

## Occurrence of Blackgram Viral Disease Complex in Guntur District of Andhra Pradesh

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### ABSTRACT

Roving survey was conducted to study the incidence and severity of *Mungbean yellow mosaic virus (MYMV)* and other viral diseases of blackgram during *rabi* 2020 in major blackgram growing mandals *viz.*, Cherukupalli, Amruthalur, Nizampatnam, Nagaram and Bhattiprolu of Guntur district, Andhra Pradesh. Prevalence of *MYMV* and other viral diseases were present in all surveyed fields of selected mandals. The study registered the highest overall mean incidence and severity of *MYMV* (22.08% and 30.32%) followed by leaf crinkle incidence (16.80%) and leaf curl incidence (11.65%) in Guntur district of Andhra Pradesh respectively. Of all the mandals surveyed, the highest mean *MYMV* incidence (24.05%) and severity (42.14%) was recorded in Cherukupalli mandal followed by Nizampatnam 23.78% and 39.84% and 14.58% and 17.85% in Bhattiprolu mandals. The highest mean leaf curl incidence (12.61%) was recorded in Cherukupalli mandal followed by 12.50% and 12.31% in Nizampatnam and Amruthalur mandals. The highest mean incidence of leaf crinkle disease (21.88%) was recorded in Nagaram mandal followed by 18.46% and 16.92% in Amruthalur and Cherukupalli mandals respectively.

**Keywords:** *Blackgram, Incidence and Severity, MYMV, Survey and Viral diseases.*

Blackgram or urdbean [*Vigna mungo* (L.) Hepper] is one of the major leguminous crops which is grown widely as a source of nutrition and income to billions of people in south and south east Asia (Ratnam, 2015). It is grown under mono, mixed and multiple cropping systems during *kharif*, *rabi* and *zaid* seasons under wide range of agro-ecological conditions (Srivastav *et al.*, 2012). The production of blackgram is mostly confined to Asian countries, of which, India is the largest producer followed by Myanmar and Thailand.

In India, blackgram occupies an area of 56.02 lakh ha producing 30.60 lakh tons with a productivity of 546 kg/ha (Department of Agriculture and Cooperation, GOI, 2018-19). Major blackgram growing areas in India are Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu and Uttar Pradesh accounting for about 70% of total production (Annual report, 2017). In Andhra Pradesh, blackgram occupies an area of 3.18 lakh ha, giving a total production of 3.10 lakhs tons and productivity of 977 kg/ha, respectively (Department of Agriculture and Cooperation, GOI, 2018-19). In coastal Andhra Pradesh, it fits well under rice fallow-pulse ecosystem with residual moisture after the harvest of paddy. It is an important grain legume crop with high and easily digestible protein and low flatulence contents (Salam *et al.*, 2009). It contains 24% protein, 60% carbohydrates, 4% minerals, 1.3% fat and 0.4% vitamins. It is a highly priced pulse (5-6% rich in

phosphoric acid than other pulses) and consumed in the form of 'dal' (whole or split, husked and un-husked) or perched (Prema *et al.*, 2018). This leguminous crop has inevitably marked itself as the most popular legume and can be most appropriately referred to as the "King of legume" due to its mouth-watering taste and numerous other nutritional qualities (Modgil *et al.*, 2019).

The production and productivity of this important crop is decreasing gradually due to various biotic and abiotic stresses. The crop is susceptible to many fungal, bacterial, and viral diseases from seed germination to seed production and maturity. Among them, viral diseases are considered to be the most serious constraint in blackgram cultivation that could result in 5-100% yield loss depending upon genotype and the age of the plant at which the infection occurs (Nene, 1972., Singh, 1980., Singh *et al.*, 1982., Varma *et al.*, 1992., Ghafoor *et al.*, 2000 and Rathi, 2002). Information regarding occurrence and incidence of *MYMV* in relation to other viral diseases of blackgram is inadequate. Therefore, the present investigation was carried out to find the intensity of *Mungbean yellow mosaic virus (MYMV)*, leaf curl and leaf crinkle diseases of black gram in Guntur district of Andhra Pradesh.

### MATERIAL AND METHODS

A roving survey was carried out during *rabi* 2020 to assess the incidence and severity of viral diseases in major blackgram growing mandals of

Guntur district of Andhra Pradesh. Relying on crop statistics of preceding year, five mandals were chosen for survey. In each mandal two villages and in each village, two fields were surveyed at random when the crop was at 45 DAS. In each field, five number of one square meter area was selected. Four from each of the four corners, leaving the border rows and other at the center to record the incidence and severity of viral diseases of blackgram. Diagnosis of the disease in the field was based on symptoms on the plants. Data on incidence of leaf curl, leaf crinkle and yellow mosaic virus diseases was recorded and per cent disease incidence for each virus disease was calculated by using the following formula:

$$\text{Per cent disease incidence (PDI)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

*MYMV* severity was assessed mandal-wise by following disease rating scale given by Alice and Nadarajan (2007) (Table 1).

**Table 1. Disease rating scale for *MYMV* (1-9 scale)**

Scale	Description
1	No visible symptom on leaves or very minute yellow specks on leaves.
2	Small yellow specks with restricted spread covering 0.1-5% leaf area.
3	Yellow mottling of leaves covering 5.1-10% leaf area.
4	Yellow mottling of leaves covering 10.1-15% leaf area.
5	Yellow mottling and discoloration of 15.1-30% leaf area.
6	Yellow discoloration of 30.1 to 50% leaf area.
7	Pronounced yellow mottling and discoloration of leaves and pods, reduction in leaf size and stunting of plants covering 50.1-75% foliage.
8	Severe yellow discoloration of leaves covering 75.1 to 90% of foliage, stunting of plants and reduction in pod size.
9	Severe yellow discoloration of leaves covering above 90.1% of foliage of plant, stunting of plants and no pod formation.

The per cent disease index (PDI) was computed from the given scale by using the following formula (Wheeler, 1969).

$$\text{PDI} = \frac{\text{Sum of all the numerical ratings}}{\text{Number of observations} \times \text{Maximum disease grade}} \times 100$$

Besides incidence and severity, other information like name of the variety, age of the crop, area sown, surrounding and preceding crop *etc.*, were also collected.

## RESULTS AND DISCUSSION

### Disease symptoms under natural field conditions *MYMV*

*Mungbean yellow mosaic virus (MYMV)* produced typical yellow mosaic symptoms on young leaves in the form of yellow, diffused, round spots scattered on the leaf lamina followed by bright yellow patches on leaves interspersed with green areas or complete yellowing and stunting of the plant. The infected leaves turned necrotic and the diseased plants usually matured late with relatively few flowers and pods. The pods were stunted and mostly remained immature but whenever seeds are formed, they were small in size. These symptoms are in agreement with the descriptions made in earlier reports of Nene (1972), Rathi (2002), Ratnam (2015), Singh *et al.* (1980) and Singh *et al.* (2002) (Plate 2).

### Leaf curl

Leaf curl symptoms initially appeared on the youngest leaves as chlorotic patches around some lateral veins and veinlets. Veinal necrosis occurred resulting in downward curling and twisting of leaves. Diseased plants show reddish-brown discoloration on the under surface of the leaf which also extended to the petiole. Early infected plants showed stunted growth due to reduced internodal length and death due to bud necrosis, late season infection was manifested with veinal necrosis and the observations are in agreement with the descriptions of Nene (1972), Bhat *et al.* (2001), Prasadarao *et al.* (2003), Thein *et al.* (2003) and Ratnam (2015) (Plate 3).

### Leaf crinkle

*Urdbean leaf crinkle virus* caused systemic infection in blackgram with initial recognizable symptoms being noticed at three weeks after sowing. Under natural field conditions third trifoliate leaf was characterized by increased leaf size with chlorotic symptoms. A week after initial symptoms, the typical leaf crinkle appeared more conspicuously and affected plants showed delayed flowering. Later, the infected plant produced large number of small sized flower buds with poor pod setting. In severe cases, the sepals became thick, greener and covered half or all of the buds giving bushy appearance to the inflorescence.

Similar observations were described by Nene (1968), Williams *et al.* (1968), Bindra (1971), Khatri *et al.* (1971), Kolte and Nene (1979), Subbarao (1984), Bashir *et al.* (2006) and Ratnam (2015) (Plate 4).

### Disease incidence

A total of ten villages were surveyed over five major blackgram mandals of Guntur district of Andhra Pradesh for the incidence and severity of all the viral diseases in different major blackgram growing regions of Guntur district (Table 2). Comparative incidence of all the viral diseases in different villages of Guntur district were presented in Figure 1.

### MYMV

The overall mean incidence and severity of *MYMV* in Guntur district of Andhra Pradesh surveyed was 22.08% and 30.32% respectively (Table 2 & Fig. 1).

The lowest *MYMV* incidence and severity of 12.99% and 25.96% was recorded in Cherukupalli village and mandal, whereas, the highest incidence and severity of 44.53% and 65.15% was recorded in Muthupalle village of Nizampatnam mandal. Of all the mandals surveyed, the highest mean incidence (24.05%) and severity (42.14%) was recorded in Cherukupalli mandal followed by 23.78% and 39.84% in Nizampatnam and 14.58% and 17.85% in Bhattiprolu mandals

Salam *et al.* (2011) reported higher incidence of *MYMV* in different districts of Karnataka *viz.*, Bidar (22.64%) and Kalaburgi (17.6%) districts followed by Haveri (9.52%), Dharwad (7.05%) and Gadag (2.61%). Survey carried out by Ratnam (2015) during *rabi* 2013-14 revealed the incidence and severity of *MYMV* ranged from 4.00 to 36.00% and 1.78 to 38.22% in Guntur district in blackgram. In the present study, the overall disease incidence of *MYMV* on blackgram ranged from 12.99 to 44.53% and 25.96 to 65.15% in Guntur district of blackgram. The results are also in agreement with findings of Obaiyah *et al.* (2013), Prasanthi *et al.* (2013), Shamim and Pandey (2014), Panduranga *et al.* (2012) Manjunath *et al.* (2013) and Prasad *et al.* (2015).

### Leaf curl

Survey carried out in five mandals revealed the overall mean of incidence of 11.65% leaf curl disease in Guntur district of Andhra Pradesh (Table 2 & Fig. 1). The lowest leaf curl incidence of 7.34% was recorded in Padamatipalem village of Bhattiprolu mandal, whereas the highest incidence of 15.33% was recorded in Amruthalur village and mandal. Of all the mandals surveyed, the highest mean incidence (12.61%) was recorded in Cherukupalli mandal

followed by 12.50% and 12.31% in Nizampatnam and Amruthalur mandals, respectively.

During early days, Amin *et al.* (1985) reported 5-40 per cent of leaf curl disease on greengram and blackgram in farmers fields during 1979 in Nalgonda district of A. P. Survey carried out in the major blackgram growing areas of Guntur district of A. P. revealed 7.21- 10.71% of leaf curl incidence during *kharif* 1991-93 (Sreenivasulu, 1994).

Krishnaveni (1998) surveyed major blackgram growing areas of A. P. for the leaf curl incidence during 1991 and 1992 *kharif* and *rabi* seasons and noted incidence of leaf curl from 39.00-43.60% in Chittoor district, 4.90-35.90% in Guntur district and 2.50-30.90% in Ranga Reddy district. Leaf curl incidence on urdbean in Guntur, Krishna and Prakasam districts was in the range of 10.04 to 11.98% during *rabi* 2001-02 and from 2.92 to 5.73% in rice fallows of Guntur and Krishna districts (Prasadarao *et al.*, 2003). Survey conducted by Ratnam (2015) during *rabi* 2013-14 revealed the incidence of leaf curl ranging from 6-18% in Guntur district.

### Leaf crinkle

The overall mean per cent disease incidence of blackgram leaf crinkle in five mandals of Guntur district was 16.80% (Table 2 & Fig. 1). However, the lowest leaf crinkle incidence of 7.96% was observed in Vemavaram village of Bhattiprolu mandal, whereas the highest incidence of 27.99% was recorded in Karankivaripalem village of Nagaram mandal. Among all the mandals surveyed, the highest mean incidence (21.88%) was recorded in Nagaram mandal followed by 18.46% and 16.92% in Amruthalur and Cherukupalli mandals, respectively.

According to Nene (1970), blackgram leaf crinkle virus (*BLCV*) was not as widespread as yellow mosaic virus in U.P. Subbarao (1984) conducted a similar survey in Guntur district of A. P. during *kharif* and *rabi* in 1982-83 and reported that the blackgram crop suffers seriously from *MYMV* and *BLCV*. Vijaykumar (1993) observed the incidence of *ULCV* disease ranging from 1.15 to 4.52% in Guntur district of A.P. during *kharif* 1993 and also revealed that the incidence of *ULCV* as high during *rabi* (1.25-7.52%) as compared to *kharif* (1.15-4.52%) and rice fallows (1.10-2.52%). The occurrence of *ULCV* under field conditions was also noticed by Vijaykumar and Subbarao (1994) from Guntur district of A.P. Survey conducted by Ratnam (2015) during *rabi* 2013-14 in three major blackgram mandals of Guntur district of A. P. revealed leaf crinkle incidence ranging from 11-25%.

During survey, it was also observed that the blackgram crop suffers more seriously from *MYMV*

**Table 2. Survey on the incidence of Blackgram viral diseases in Guntur district of A. P. during *rabi* 2019-20**

S. No.	Name of the District	Name of the Mandal	Name of the Village	Area (In acres)	Variety of the crop	Stage of the crop	Mean (%) Disease Incidence			Mean <i>MYMV</i> Severity	Preceding / Surrounding crops
							Leaf Curl	Leaf Crinkle	<i>MYMV</i>		
1	Guntur	Cherukupalli	Cherukupalli	1.5	LBG 752	Flowering	12.33	20.33	24.66	42.03	Rice / Maize
2				1	LBG 752	Vegetative	9.86	13.19	12.99	25.96	Rice / Maize
			Village Mean				11.09	16.76	18.82	34.00	
3			Arumbaka	4	LBG 752	Pod filling	13.66	18.66	30.44	58.39	Rice / Maize
4				2	LBG 752	Vegetative	14.61	15.53	28.09	42.2	Rice / Groundnut
			Village Mean				14.13	17.09	29.26	50.29	
		Mandal Mean				12.61	16.92	24.05	42.14		
5		Amruthalur	Panchalavaram	1.5	PU 31	Pod filling	10.33	15.99	27.59	35.28	Rice / Maize
6				1	LBG 752	Early Flowering	10.6	15.42	23.59	28.68	Rice / Greengram
			Village Mean				10.46	15.7	25.59	31.98	
7			Amruthalur	3	PU 31	Flowering	15.33	26.33	18.66	36.96	Rice / Maize
8				2.5	LBG 752	Pod filling	12.99	16.13	16.36	27.04	Rice / Maize
			Village Mean				14.16	21.23	17.51	32.02	
		Mandal Mean				12.31	18.46	21.55	31.99		
9		Nizampatnam	Kuchinapudi	2	LBG 752	Flowering	13.66	17.33	14.33	36.79	Rice / Maize
10				2	PU 31	Early Flowering	13.36	15.33	16.06	31.44	Rice / Maize
			Village Mean				13.51	16.33	15.19	34.12	
11			Muthupalle	1	LBG 623	Pre-Harvesting	14.66	18.66	44.53	65.15	Rice / Maize
12				2	LBG 752	Early Flowering	8.33	15.26	20.21	28.68	Rice / Maize
			Village Mean				11.49	16.96	32.37	46.92	
	Mandal Mean				12.5	16.64	23.78	39.84			
13	Nagaram	Karankivaripalem	1	PU 31	Flowering	10.99	27.99	14.33	36.12	Rice / Sorghum	
14			1.5	LBG 752	Vegetative	9.06	21.95	18.23	32.54	Rice / Maize	
		Village Mean				10.02	24.97	16.28	34.31		
15		Nagaram	4	LBG 752	Pod filling	9.66	19.66	19.33	45.41	Rice / Greengram	
16			2.5	LBG 752	Pod filling	12.32	17.95	21.49	37.17	Rice / Maize	
		Village Mean				10.99	18.8	20.41	41.29		
	Mandal Mean				10.5	21.88	18.34	37.17			
17	Bhattiprolu	Vemavaram	1	PU 31	Pod filling	9.33	7.96	16.99	35.1	Rice / Maize	
18			1.5	PU 31	Pre-Harvesting	12.66	9.48	14.82	29.34	Rice / Maize	
		Village Mean				10.99	8.73	15.9	32.21		
19		Padamatipalem	1	LBG 752	Pod filling	7.34	9.33	33.86	49.14	Rice / Greengram	
20			2.5	LBG 752	Flowering	10.33	13.61	25.07	37.01	Rice / Maize	
		Village Mean				8.83	11.47	29.46	43.07		
	Mandal Mean				9.91	10.1	22.68	37.63			
	District Mean				11.65	16.8	22.08	30.32			

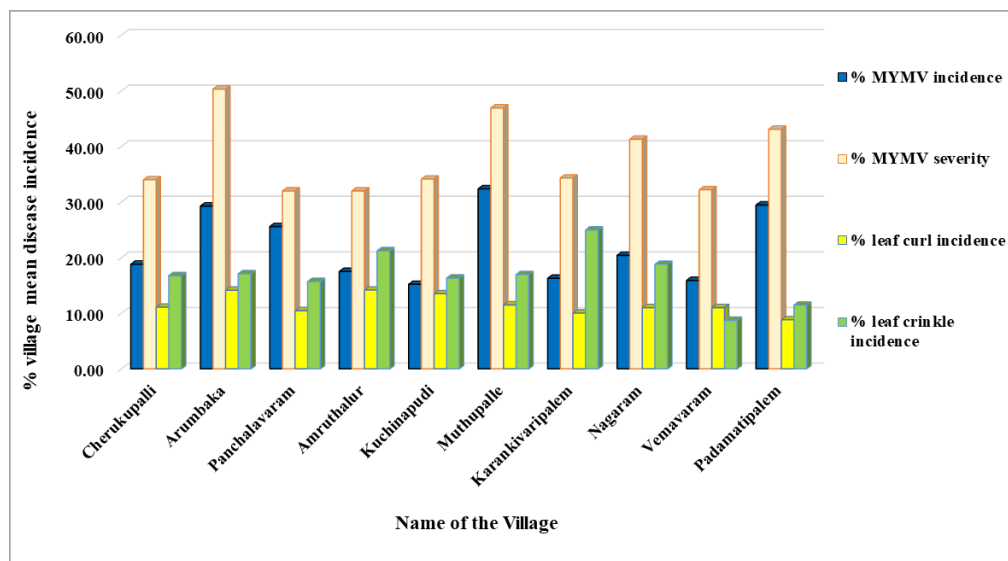
**Fig. 1 Comparative incidence of all viral diseases in different villages of Guntur district of A. P. during *rabi* 2019-20**



Plate 1. Showing the healthy blackgram leaves



Plate 2. Showing the typical symptoms of MYMV disease



Plate 3. Showing the typical symptoms of Leafcurl disease



Plate 4. Showing the typical symptoms of Leaf crinkle disease

incidence than leaf curl and leaf crinkle viral disease. The blackgram variety “LBG 752” was occupied to an extent of 70% in all these surveyed mandals. Even though, the similar variety was grown in the maximum surveyed fields, the variation in incidence of viral diseases among the surveyed fields can be ascribed due to different prevailing cropping systems, differences in sowing time, varied environmental conditions, establishment of different weed flora which acts alternate hosts for virus and non- adoption of recommended management practices by the farmers *etc.*

### CONCLUSION

During *rabi* 2019-20, viral disease incidence was observed in all mandals of Guntur district surveyed. The Overall MYMV mean incidence and severity was high in MYMV (22.08% and 30.32%). After MYMV incidence, leaf crinkle incidence (16.80%) and leaf curl incidence (11.65%) dominated out of all the five mandals surveyed. The highest per cent of 44.53% and 65.15% incidence and severity of MYMV respectively was recorded in Muthupalle village of Nizampatnam mandal. However, leaf curl incidence of 15.33% was observed in Amruthalur village and mandal and the leaf crinkle incidence (27.99%) in Karankivaripalem village of Nagaram mandal was observed.

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