

Original Research Article

<https://doi.org/10.20546/ijcmas.2025.1411.025>

Survey-Based Assessment of Urdbean Leaf Crinkle Disease Infection in Black Gram Fields of Andhra Pradesh, India

Shaik Haseena Banu^{1*}, M. Reddi Kumar², V. Venkataravanappa³,
R. Sarada Jayalakshmi Devi⁴, L. Prasanthi⁵ and G. Rama Rao⁶

¹Department of Plant Pathology, ARS, Podalakur / Acharya N.G. Ranga Agricultural University, Lam, Guntur, India

²Department of Plant Pathology, ARS, Perumallapalle / Acharya N.G. Ranga Agricultural University, Lam, Guntur, India

³Department of Plant Pathology, ICAR-IIHR, Bangalore, India

⁴Hon'ble Vice -Chancellor, Acharya N.G Ranga Agricultural University, Lam, Guntur, India

⁵Department of Genetics & Plant Breeding/SMGR Agricultural College, Udayagiri/ Acharya N.G. Ranga Agricultural University, Lam, Guntur, India

⁶Department of Physiology, Agricultural College, Pulivendula / Acharya N.G. Ranga Agricultural University, Lam, Guntur, India

*Corresponding author

ABSTRACT

Keywords

Urdbean; Leaf crinkle disease; Roving survey; Percent disease incidence; Vector association; ULCV; Cultivar susceptibility.

Article Info

Received:
22 September 2025
Accepted:
30 October 2025
Available Online:
10 November 2025

Urdbean Leaf Crinkle Disease (ULCD) is one of the most economically important viral diseases in urdbean (*Vigna mungo* L.), adversely affecting both seed yield and quality. A roving survey was undertaken during Rabi 2024–25 across major urdbean-growing districts of Andhra Pradesh to determine the incidence of ULCD and to document associated insect vectors. Observations were recorded from multiple villages across Annamaiah, Bapatla, Guntur, Kadapa, Krishna, Palnadu and SPSR Nellore districts. The percent disease incidence (PDI) varied widely among districts, cultivars and growth stages, ranging from 2.0% to 30.0%. The highest incidence (30.0%) was recorded in cultivar PU-31 at the pod formation stage in Kadapa district, followed by PU-37 and PU-38 (20.0–25.0%). In contrast, comparatively lower incidence (2.0–9.5%) was observed in cultivars LBG-932, LBG-904, TBG-104 and Kota Urd-3. The frequent occurrence of whiteflies, aphids and thrips in infected fields suggests their likely involvement in ULCD transmission. The observed incidence range agrees with earlier reports from Maharashtra and Tamil Nadu, confirming the widespread susceptibility of currently cultivated varieties. The findings highlight the urgent need for resistant genotype development, certified seed use and vector management strategies to minimize disease spread under field conditions.

Introduction

Black gram (*Vigna mungo* L. Hepper) is an economically important pulse crop widely cultivated in the semi-arid and subtropical regions of Asia. It belongs to the family Leguminosae and is popularly known by various local names such as urd, mash, urid, and urad. India serves as the primary centre of origin for this crop, while Central Asia is regarded as the secondary centre. Black gram constitutes a rich source of dietary protein and forms an integral part of the human diet in South Asia. However, its productivity is often constrained by several biotic stresses, particularly those caused by fungal, bacterial, and viral pathogens. Among the viral diseases, Urdbean Leaf Crinkle Disease (ULCD), incited by Urdbean Leaf Crinkle Virus (ULCV), is considered one of the most devastating, leading to substantial yield and quality losses. The disease was first documented from Delhi by Nariani (1960) and subsequently by Williams *et al.*, (1968); however, the precise etiology of the causal agent still remains unresolved. Infected plants typically exhibit severe crinkling, puckering, curling, and malformation of leaves and floral structures (Bindra, 1971). The virus is primarily transmitted through infected seed (Narayanasamy and Jaganathan, 1975; Kanimozhi *et al.*, 2009), infected sap (Biswas *et al.*, 2012), and insect vectors (Sravika *et al.*, 2018), while transmission through soil has not been observed (Beniwal *et al.*, 1983). Considerable yield reductions associated with ULCD have been reported by several researchers (Beniwal and Chaubey, 1979; Kadian, 1982; Bashir *et al.*, 1991; Kadian, 1994; Sharma *et al.*, 2007; Kanimozhi *et al.*, 2009). In Andhra Pradesh, black gram is grown over an estimated area of 2.75 lakh hectares, producing 3.53 lakh tonnes with an average productivity of 1284 kg ha⁻¹ during 2024-25. (Black gram Outlook, April 2025, Agricultural Market Intelligence Centre, PJTAU). In view of the economic significance of the crop and the widespread prevalence of the disease, the present investigation was undertaken to record the incidence of leaf crinkle disease in major urdbean-growing districts of Andhrapradesh.

Materials and Methods

In Andhra Pradesh, Urdbean is cultivated during three distinct seasons *Summer*, *Kharif*, and *Rabi* apart from rice fallows in certain districts. To assess the prevalence of leaf crinkle disease and the associated insect vectors, an intensive roving survey was carried out across major

Urdbean-growing districts of the state, namely Annamaiah, Bapatla, Guntur, Kadapa, Krishna, Nellore, and Palnadu, during the *Rabi*, 2024–25. In each selected village, two fields were surveyed, and within each field, ten quadrats of 10 m² area were randomly chosen for recording disease incidence. The percent disease incidence (PDI) was calculated based on the number of infected plants and the total number of plants observed using the following formula:

$$\text{Disease incidence (PDI \%)} = \frac{\text{Number of diseased plants}}{\text{Total number of plants observed}} \times 100$$

During the survey, relevant information regarding the varieties grown and stage of the crop is also documented.

Results and Discussion

A roving survey conducted during *Rabi*, 2024–25 revealed that ULCD was prevalent in all surveyed districts of Andhra Pradesh. The disease incidence varied markedly across cultivars and growth stages. The infected plants exhibited characteristic symptoms such as severe leaf crinkling, puckering, malformation of auxiliary buds, stunted growth, and poor pod set (Fig. 1).

The incidence of ULCD ranged from 2.0% to 30.0% across surveyed locations. The highest disease incidence was recorded in Kadapa district, particularly in Tadigotla village, where cultivar PU-31 showed 30.0% incidence at pod formation stage. The cultivars PU-31, PU-37, and PU-38 consistently showed higher susceptibility, recording 20.0–30.0% across villages of Kadapa district.

In contrast, lower levels of infection were observed in Bapatla, Palnadu, and SPSR Nellore districts, where cultivars such as LBG-932, LBG-904, TBG-104, and Kota Urd-3 showed minimum incidence (2.0–9.5%) depending on growth stage (Table.1)

The cultivars LBG-645, LBG-648, LBG-752, LBG-904, LBG-932, LBG-954, PU-31, PU-37, PU-38, PU-39, TBG-104, VBN-8 and Kota Urd-3 were commonly grown. The presence of whiteflies, aphids, flea beetles and Thrips was observed during the survey, suggesting their role in disease transmission.

The varietal reaction to the disease revealed clear differences among the evaluated black gram genotypes.

Table.1 Incidence of Urdbean leaf crinkle disease (ULCD) during Rabi, 2024-25

S. No	District	Mandal	Villages	GPS Coordinates	Cultivar	Stage of the crop	Percent Disease incidence
2.	Bapatla	Bapatla	Bapatla	N15.9039° E80.4671°	LBG 904	Pod initiation	6.2
			Ipurupalem	N15.8512° E80.3840°	TBG 104	Flowering	8.6
			Stuvartpuram	N15.8667° ; E80.4062°	LBG 752	Pod development	9.5
3.	Guntur	Tadikonda	Lam	N16.3693° E80.4271°	LBG 648	Vegetative	13.6
			Tadikonda	N16.4171° E80.4532°	LBG 752	Vegetative to flowering	11.5
		Mangalagitri	Kaza	N16.3906° E80.5425°	LBG 904	Vegetative to flowering	13.2
4.	Kadapa	Kamalapuram	Sambatur	N14.6415° E 78.6431°	PU-31	Flowering	25.0
			Nallingayapalli-	N14.5963° E78.5916°	PU-37	Flowering	25.0
			Peddacheppali	N14.5734° E78.6512°	PU-38	Vegetative	20.0
		Muddanur	Chintakunta	N14.7834° E78.7030°	VBN-8	Vegetative	5.0
		Sambepalle	Motagatla	N14.1414° E78.7373°	PU-37	Flowering to pod formation	15.0
		(Chinthakomma dinne)	Tadigotla	N14.4810° E78.7562°	PU-31	Pod formation stage	30.0
		Mydukur	Mydukur	N14.7265° E78.7321°	PU-38	Pod formation stage	25.0
		Badvel	Badvel	N14.7305° E78.0597°	PU-31	Pod formation stage	15.0
		Proddutur	Proddutur	N14.7526° E78.5541°	PU-31	Pod formation stage	15.0
5.	Krishna	Pedana	Pedana	N16.2579° E81.1444°	LBG 752	Vegetative	23.02
			Nandigama	N16.7392° E80.3143°	LBG 752	Pod development	12.27
					TBG 104	Pod development	13.0
					Seed mix	Pod development	15.0
			Nadupuru	N16.2808°	LBG 752	Pod initiation	19.24

				E81.1334 ^o			
					TBG 104	Pod intiation	13.65
Gudivaada	Billapadu			N16.4125 ^o E80.9974 ^o	LBG 645	Pod initiation	6.241
				N16.2060 ^o E80.5942 ^o	LBG 904	Flowering	21.26
				N16.4035 ^o E80.9484 ^o	LBG 645	Pod development	18.43
Gudlavalleru	Kowthuram			N16.3084 ^o E81.0565 ^o	LBG 752	Pod development	5.16
				N16.3130 ^o E81.0720 ^o	Kommathudu	Pod development	12.21
Ghantasala	Chutturpu			N16.1698 ^o E80.9451 ^o	LBG 752	Flowering	5.26
				N16.1360 ^o E80.9830 ^o	LBG 645	Flowering to pod initiation	2.34
				N16.7780 ^o E80.2995 ^o	LBG 752	Pod development	5.15
Challapalli	Vakkalagadda			N16.1202 ^o E80.9287 ^o	Kota urd 3	Flowering to Pod Initiation	4.56
Mopidevi	Pedaprolu			N16.0845 ^o E80.9200 ^o	LBG 645	Flowering to pod initiation	5.62
					LBG 752	Flowering to pod initiation	7.5
					LBG 932	Flowering to pod initiation	4.2
					Kota Urd 3	Flowering to pod initiation	8.0
					Nandini	Flowering to pod initiation	9.5
Pamaru	Komaravolu			N16.0751 ^o E80.9194 ^o	LBG 752	Pod development	3.15
Pamaru	Komaravolu			N16.4035 ^o E80.9485 ^o	LBG 648	Pod Initiation	9.25
Pamaru	Pamaru			N16.3229 ^o E80.9610 ^o	LBG-752	Pod development	11.26
Pamaru	Addada			N16.2129 ^o E80.5908 ^o	LBG 752	Pod development	8.32
Pamaru	Komaravolu			N16.4035 ^o E80.9485 ^o	LBG 648	Pod Initiation	9.25
Movva	Pedapudi			N16.6418 ^o E81.0388 ^o	LBG 752	Flowering to pod initiation	6.26
Movva	Kuchipudi			N16.2542 ^o E80.9180 ^o	TBG 104	Flowering to pod initiation	11.51
	Movva			N16.1863 ^o E80.9089 ^o	PU 31	Flowering to pod initiation	5.24

	Palnaadu	Narsarao peta	Narsarao peta	N16.2359 ^o E80.0496 ^o	LBG 752	Flowering	5.26
			Mulakaluru	N16.2729 ^o E80.0707 ^o	LBG 645	Flowering to pod initiation	2.34
			Madala	N16.3825 E80.1373 ^o	LBG 752	Pod development	5.15
	SPSR Nellore	Atmakuru	Gouravaram	N14.5961 ^o E79.3747 ^o	LBG-904	Vegetative stage	4.2
			Gamparla paadu	N14.3030 ^o E79.7272 ^o	VBN-8	Vegetative stage	8.5
			Erram reddy palli	N14.4245 ^o E80.1587 ^o	VBN-8	Vegetative stage	5.2
			Peddireddy palli	N15.0693 ^o E79.2881 ^o	VBN-8	Vegetative to flowering stage	6.0
		Chejarla	Adurapalli	N14.3831 ^o E79.5094 ^o	VBN-8	Pod development stage	9.0
					PU-39	Pod development stage	15.0
			Chittaluru	N14.4674 ^o E79.5948 ^o	VBN-8	Vegetative stage	5.0
			Kaluvai	N14.5000 ^o E79.4167 ^o	PU-31	Pod development Stage	5.0
		Marripaadu	Nandavaram	N14.6995 ^o E79.4644 ^o	LBG -932	Vegetative stage	3.2
			Kothalampaadu	N14.4796 ^o E79.3054 ^o	LBG-904	Vegetative stage	2.0
			Bheemavaram	N15.1343 ^o E79.9579 ^o	LBG-932	Flowering stage	2.0
			PN Palli	N14.5642 ^o E79.6632 ^o	TBG-104	Vegetative stage to flowering stage	5.0
			Ayyavaaripalem	N14.0998 ^o E79.9169 ^o	VBN-8	Vegetative stage	10.0
			Inakurthi	N14.3348 ^o E79.7007 ^o	Tbg-104	Flowering stage	5.0
			Lingampalli	N14.3796 ^o E79.7214 ^o	LBG-954	Flowering stage	8.0
			Podalakur	N14.3848 ^o E79.7327 ^o	PU-31	Vegetative stage	3.6
			Prabhagiripatnam	N14.4572 ^o E79.7480 ^o	VBN-8	Flowering stage	10.0
			Venkatapalem	N14.3167 ^o E79.9167 ^o	TBG-104	Flowering stage	2.0

Figure.1 Field symptoms of Urdbean Leaf Crinkle Disease



A. Severe leaf crinkling and puckering.



B. Floral malformation

PU-31, PU-37 and PU-38 recorded the highest disease incidence (15.0–30.0%) and were categorized as highly susceptible. LBG-752, LBG-645 and TBG-104 exhibited moderate levels of infection (8.0–18.0%), placing them under the moderately susceptible group. In contrast, LBG-932, LBG-904 and Kota Urd-3 showed comparatively lower disease incidence (2.0–9.5%) and were considered relatively tolerant.

The present roving survey clearly demonstrated that Urdbean Leaf Crinkle Disease (ULCD) is prevalent across all major Urdbean-growing districts of Andhra Pradesh with disease incidence ranging from 2.0% to 30.0% depending upon the location, cultivar and crop growth stage. The highest incidence was observed in Kadapa district, particularly in PU-31, PU-37 and PU-38 cultivars, where the incidence ranged between 20.0–30.0% during flowering to pod formation stages, indicating high varietal susceptibility under field conditions. In contrast, lower ULCD incidence (2.0–9.5%) was noticed in cultivars such as LBG-932, LBG-904, TBG-104 and Kota Urd-3, suggesting their comparatively better tolerance.

The overall range of disease incidence recorded in Andhra Pradesh (2.0–30.0%) in the present study is

consistent with the incidence range (0–30%) reported from Jalna district of Maharashtra during *Kharif*, 2021 (Bansode, S.B. *et al.*, 2023). Similar variation in disease pressure across regions has been attributed to variation in seed health status, climatic conditions, cropping season, and vector population dynamics. Further, the present results are also in agreement with the roving survey conducted in Tamil Nadu, where all cultivated black gram varieties were found susceptible, and the percent disease incidence ranged from 11.80% to 33.50% across districts (Priyanga, T *et al.*, 2020). In that study, T-9 and VBN-8 recorded high susceptibility, whereas VBN-5 and CO-6 exhibited relatively lower incidence. The similarity in disease expression and cultivar response between Tamil Nadu and Andhra Pradesh clearly indicates that ULCD is widely distributed and cultivar susceptibility is consistent across different agro-climatic regions.

Reports from Uttar Pradesh have documented much higher incidence levels (28–85%) under natural field conditions, with yield losses reaching up to 91% over successive cropping seasons (Biswas *et al.*, 2012). These findings, together with the present survey, highlight the epidemic potential of ULCD if susceptible cultivars continue to dominate farmer fields.

The frequent occurrence of whiteflies, aphids and thrips in infected fields during flowering to pod formation stages in our survey further supports earlier findings that ULCD is efficiently transmitted through insect vectors, in addition to infected seed transmission (Narayanasamy and Jaganathan, 1975; Sravika *et al.*, 2018).

In conclusion, the present study demonstrates that ULCD is widely prevalent in the major urdbean-growing regions of Andhra Pradesh, with disease incidence varying across districts and cultivars. Cultivars PU-31, PU-37 and PU-38 exhibited high susceptibility, while LBG-932, LBG-904 and TBG-104 showed relatively better tolerance under field conditions. The frequent presence of whiteflies, aphids and thrips in affected fields indicates their probable role in the natural spread of the disease. The findings are in close agreement with earlier reports from Maharashtra and Tamil Nadu, confirming that no currently cultivated urdbean variety possesses stable resistance to ULCD. Therefore, integrated disease management strategies emphasizing use of virus-free certified seed, vector monitoring and control, and identification and promotion of resistant genotypes are essential for reducing disease impact and improving crop productivity.

Author Contributions

Shaik Haseena Banu: Investigation, formal analysis, writing—original draft. M. Reddi Kumar: Validation, methodology, writing—reviewing. V. Venkataravanappa:—Formal analysis, writing—review and editing. R. Sarada Jayalakshmi Devi: Investigation, writing—reviewing. L. Prasanthi: Resources, investigation writing—reviewing. G. Rama Rao: Validation, formal analysis, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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How to cite this article:

Shaik Haseena Banu, Reddi Kumar M., Venkataravanappa V., Sarada Jayalakshmi Devi R., Prasanthi L. and Rama Rao G. 2025. Survey-Based Assessment of Urdbean Leaf Crinkle Disease Infection in Black Gram Fields of Andhra Pradesh, India. *Int.J.Curr.Microbiol.App.Sci*. 14(11): 251-258. doi: <https://doi.org/10.20546/ijcmas.2025.1411.025>