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Status and threat assessment of Viral Diseases in *Momordica charantia* (L.) cultivation in Eastern Uttar Pradesh, India

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Abstract

Momordicacharantia (L.) known commonly as bitter gourd or karela is an important nutrient and medicinal cucurbit growing widely in cultures of Eastern Uttar Pradesh. In recent years this crop is becoming more and more susceptible to viral diseases which cause severe yield losses and crop deterioration. The present study was undertaken to assess status and emerging threats of viral infections in bitter gourd in major cultivation zones of Eastern UP through survey carried out in different parts of Gorakhpur (Rajahi, Kauriram), Kushinagar (Duduhi, Padrauna) and Varanasi (Kashi, Jakhini). Surveys were conducted in month of February (winter), June (summer) and November–December (northeast monsoon) in six fields. Major symptomatology included yellowing, mottling, distortion, curling, small size of leaves, vein thickening and vein clearing. The disease incidence ranges from 30–40% and 500–1200 symptom bearing plants per acre. Very high population of vector (Bemisiatabaci and Myzuspersicae) have been recorded. Though molecular diagnosis (PCR/ELISA/EM) has not been carried out, symptomatology and vectorial presence indicated the possibility of infections of Begomoviruses, Potyviruses and Cucumoviruses in bitter gourd as reported in India and abroad. Comparing with earlier reports like Karnataka survey, similar disease pattern has been observed which implies increasing regional importance of viral diseases in M. charantiain need of Molecular characterization, vector surveillance and integrated viral disease management in Eastern Uttar Pradesh.

Keywords: *Momordica charantia*, bitter gourd, viral diseases, whitefly, aphid, disease incidence, Eastern Uttar Pradesh.

Introduction

Bitter gourd (*Momordica charantia* L.) is an economically important vegetable crop of the family Cucurbitaceae. It can be grown across India and is highly demanded due to its nutritional value, medicinal properties and various culinary applications[1]. Bitter gourd is a rich source of bioactive compounds, for example, charantin, polypeptide-P, vicine and momordicin which impart antidiabetic, antioxidant, anti-inflammatory and antimicrobial properties[2]. In Eastern Uttar Pradesh, particularly in the districts of Gorakhpur, Kushinagar and Varanasi, this crop is cultivated for local vegetable markets and plays a vital role in rural livelihoods. However, the productivity of bitter gourd is often greatly affected by viral diseases. Among the constraints, viral diseases are the most important diseases reported throughout the world for cucurbit crops and more than 60 viruses are known to infect cucurbits[3].

The impact of climate change leads to imergence of new strains of virus leads to adversely affect plants[4]. Whiteflies transmitted begomovirus infection on cucurbit recognized as emerging disease in various region worldwide[5]. While in India, more frequently reported viruses include Cucumber mosaic virus (CMV), Papaya ringspot virus (PRSV-W), Indian cassava mosaic virus (ICMV), Bitter gourd yellow mosaic virus (BGYMV)[6] and Tomato leaf curl New Delhi virus (ToLCNDV)[7]. Begomovirus a major group of plant virus serious threat for vegetable ecosystem across tropical and subtropical region[8]. Management of begomovirus disease in Asia and Africa can greatly affect the agriculture and leads to good production[9]. During the last two decades Geminiviridae, the second largest group of virus also caused huge economic loss[10].

A recent report from Nigeria stated for the first time MWMV infecting bitter gourd and demonstrated successful biocontrol using Trichodermaviride[11], such reports highlight the global emergence of diverse viral pathogens in *M. charantia*, underscoring the need for strengthened regional surveillance.

Eastern Uttar Pradesh lacks updated field based estimations for viral clusters and diversity in bitter gourd. Hence, the present study assesses prevalence, status, and emerging threats of viral diseases using symptom-based surveys in major cultivation zones.

Materials and Methods

Prevalence of viral diseases and vectors was surveyed in bitter gourd (*Momordica charantia*) fields at different major growing areas of Eastern Uttar Pradesh in India. Survey locations were selected in consultation with local farmers and preliminary field observations and covered two representative fields each situated in Gorakhpur (Rajahi, Kauriram), Kushinagar (Duduhi, Pudrauna) and Varanasi (Kashi, Jakhini). Fields were visited during February (winter), June (summer) and November–December (cold weather/Nor-east monsoon/Thulavarsham) to study the seasonal variation in disease expression & vector abundance. About 150–300 plants were observed per site depending upon field size and both diseased and healthy plants were assessed for virus-like symptoms and presence of vectors. Symptoms commonly recorded included yellowing, mottling, vein clearing and upward or downward curling, reduction of leaf size and distortion on infected leaves.

For disease assessment, the visual scoring of the severity of symptoms on a scale of 0–5 (0 = no visible symptoms, 1 = very mild, 2 = mild, 3 = moderate, 4 = severe, and 5 = very severe plant distortion and mosaic intensity) was recorded. Both data of incidence and severity were collected from randomly selected plants in the field. Leaf samples showing clear virus-like symptoms along with a few symptomless leaves were randomly collected while walking diagonally across the field. The disease incidence (DI) was calculated as:

DI (%) = (Number of infected plants / Total number of plants scored) × 100.

The vulnerability index (VI) was calculated based on visual severity classes using the standard formula:

$$VI = (0n_0 + 1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5) \times 100 / [n_t (nc - 1)],$$

Where: n_0–n_5 is the number of plants in the severity classes of 0–5, n_t is the total number of plants scored, and nc is the number of severity categories.

A total of 1400 plants were visually evaluated in all surveyed fields out of which 515 had viral symptoms. In all sites, the severity class included 925 symptomless, 40 very mild, 82 mild, 65 moderate, 184 severe and 104 very severe. Though molecular confirmation was not performed using the PCR, ELISA or electron microscopy, the total observations in the field gave a good basis for estimation for symptom based virus incidence/ severity and vulnerability.

Results and Discussion

Disease Incidence- Across all fields, 30–40% viral disease incidence was recorded. Fields with one acre area had approximately 500–1200 symptomatic plants.

Disease Incidence Across Surveyed Fields**:** DI varied among the six fields of Eastern UP (Fig.1). Higher DI was recorded in Kauriram (55%) followed by Jakhini (45%) and Rajahi (40%), indicating higher viral pressure in Gorakhpur and Varanasi district. Moderate DI was recorded in Kashi (30%) and Padrauna (26.67%), whereas the lowest DI was recorded in Duduhi (22%). District wise pooled incidence revealed Gorakhpur (45%) had highest DI followed by Varanasi (37.5%) and Kushinagar (23.75%). Overall mean DI among all fields was 36.79%, indicating higher viral pressure in bitter gourd cultivation areas of Eastern UP.

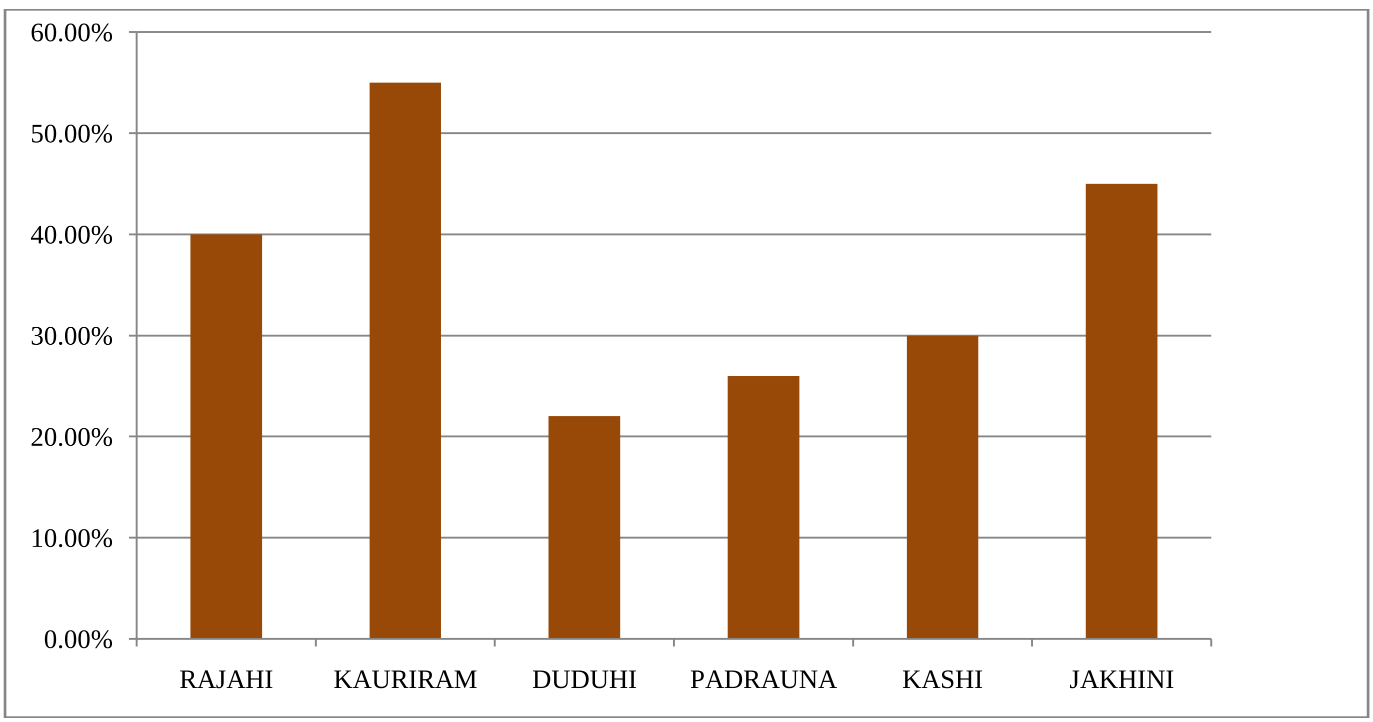

Figure-1: Disease Incidence (DI), in *Momordica charantia* L. in Eastern UP, India.

Table-1: Disease Incidence (DI) in Momordica charantia in Eastern Uttar Pradesh.

District	Village (Field)	Total Plants Observed	Infected Plants	Disease Incidence (DI%)
Gorakhpur	Rajahi	400	160	40
Gorakhpur	Kauriram	200	110	55
Total		600	270	45
Kushinagar	Duduhi	250	55	22
Kushinagar	Padrauna	150	40	26
Total		400	95	23
Varanasi	Kashi	200	60	30
Varanasi	Jakhini	200	90	45
Total		400	150	37.5

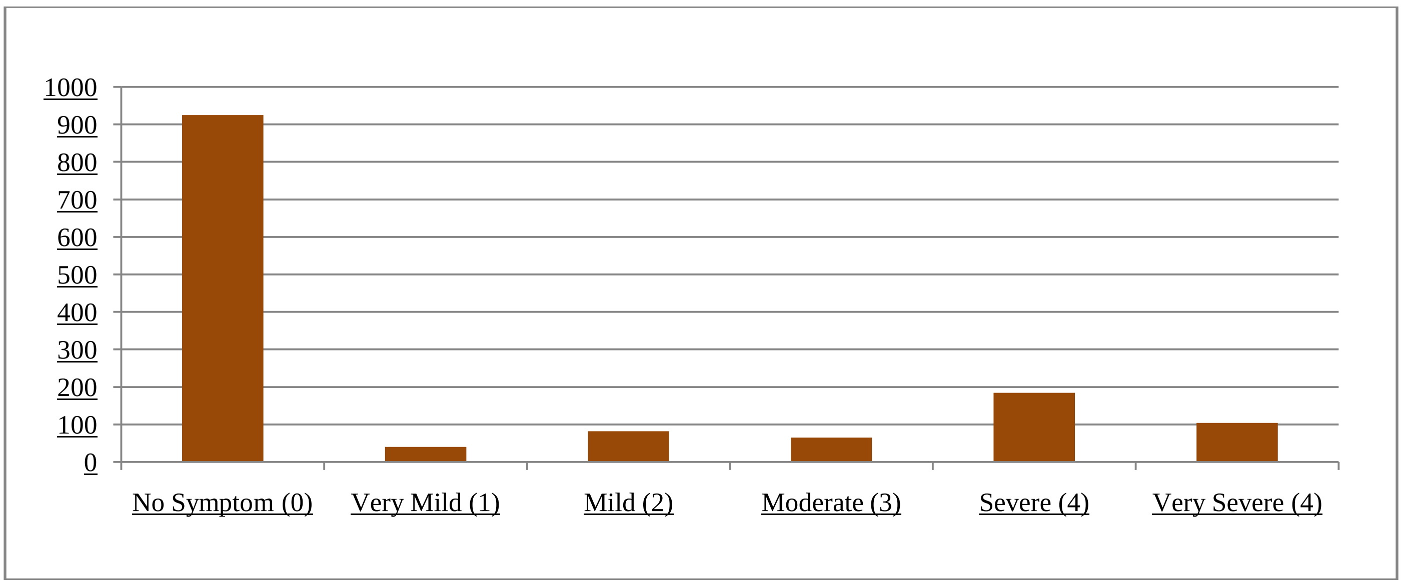

Figure-2: Symptom Severity Distribution (All Fields Combined).

Table-2: Symptom Severity Distribution (All Fields Combined).

Severity Class	Description	No. of Plants
0	No symptom	925
1	Very mild	40
2	Mild	82
3	Moderate	65
4	Severe	184
5	Very severe	104

Calculated Vulnerability Index (VI)**:** VI = $(0n_0 + 1n_1 + 2n_2 + 3n_3+4n_4+5n_5)\times100/[n_t(n\_c-1)]$,
Where: nt = total plants = sum of n0…n5 = 1400. Compute weighted sum:
0×925 = 0
1×40 = 40
2×82 = 164
3×65 = 195
4×184 = 736
5×104 = 520
Sum = 40 + 164 + 195 + 736 + 520 = 1655
Now VI=1655×100 /1400×5 =165500/7000= 23.642857…
Rounded to two decimals: VI = 23.64%

Symptom Severity Distribution: Symptom severity on surveyed plant counts exhibited wide variation (Figure-2). Total 925 plants without any symptoms (severity class 0), whereas 475 plants were found having different levels of symptom expression. Among the symptomatic classes, highest number of plants were in severity class 4 (184 plants) and class 5 (104 plants), indicating highest number of plants with severe to very severe viral symptoms were observed. Vulnerability Index (VI) based upon severity distribution is found to be 23.64%, indicating a moderate vulnerability status of the bitter gourd plants in survey fields. i. Plants level DI ranged from 22.00% (Duduhi) to 55.00% (Kauriram), maximum fields show moderate incidence (30–45%). ii. District wise pooled DI: Gorakhpur highest (45.00%), Kushi nagar lowest (23.75%). iii. District wise (6 fields) DI = 36.79%. iv. Vulnerability Index for the entire surveyed population = 23.64%, indicating moderate vulnerability distribution as the number of plants in severe/very severe category (n4 + n5 = 288 plants) were high in number.

Discussion: The present study revealed significant viral disease pressure in bitter gourd crop in our surveyed places in Eastern Uttar Pradesh. Field-wise DI ranged from 22.00-55.00% indicating the uneven distribution of virus but moderate-to-high infection levels in all the districts. Highest DI was recorded in Kauriram 55%. It may be attributed to the local environment couple with continuous cultivation of cucurbits that may favour more vector activity and virus transmission. Similarly, DI was also higher in Jakhini 45% and Rajahi 40% of Gorakhpur and Varanasi district, respectively, which indicates that Gorakhpur and Varanasi district has higher viral stress than Kushi nagar district. Similarly, when pooled district wise these patterns re-emerged with highest disease incidence in Gorakhpur 45% followed by Varanasi 37.5%. Lower DI in Kushi nagar 23.75% may be due to field sanitation, cropping pattern or local vector density. Overall mean DI 36.79% indicated that the viral pathogens are emerging threat to bitter gourd productivity in Eastern UP.

Symptom severity analysis revealed that although majority of plants were asymptomatic, symptomatic categories were more towards ‘severe’ (n4 = 184) and ‘very severe’ (n5 = 104) categories. This indicates that a substantial part of the population showed advanced symptoms like mosaic, curling, severe leaf distortion and stunted growth. The VI (23.64%) falls in the moderate category with a concern that nearly one third of the symptomatic plants showed severe to very severe reaction. VI value was in tandem with the severity of symptoms observed, and it seems that the bitter gourd fields of Eastern UP are heading towards a high-risk epidemic phase if vector control measures are not taken timely.

The constant presence of white fly (Bemisia tabaci) and aphids (Myzus persicae) is a key pathway of transmission of important cucurbit infecting viruses that are Begomoviruses, Potyviruses and Cucumoviruses. Similar trend was reported in Karnataka where heavy whitefly infestation correlated with the incidence of BGYMV and ToLCNDV[12]. Similarly, Etim and Okon reported the same symptomology in Nigeria showing the global emergence of various viral complexes associated with *M. charantia.*

The findings from this study reinforces the need for molecular characterization and vector surveillance with integrated disease management strategies in eastern part of Uttar Pradesh. Since we did not perform PCR, ELISA and EM, hence future work must include identification of the virus at genomic level to verify which viral species or strain complex is present in the region.

Comparison with Karnataka Study: The symptomology observed in this study is similar to Naik et al.[12] in Karnataka where they observed mosaic, curling and yellowing symptoms with high population of B. tabaci. Hence this could be widely spread begomovirus and potyvirus infection at least in India.
Potential viral agents are: i. Begomovirus: BGYMV, ToLCNDV, ii. Potyvirus: PRSV-W, ZYMV, iii. Cucumovirus: CMV.

Conclusion

A moderately high incidence (30–40%) of viral diseases was observed in bitter gourd fields of Gorakhpur, Kushinagar and Varanasi. On the basis of vector population and typical field symptoms, viral diseases seem to be the most important emerging threat to the bitter gourd crop of Eastern UP.. The moderate Vulnerability Index suggests that a significant portion of crop is in high risk to cause severe infection in favourable environmental and vector prevalent conditions. Although molecular diagnosis was not performed in the present study, based on symptoms and in situ observations, Begomoviruses, Potyviruses and Cucumoviruses are likely to be involved, which are usually implicated in cucurbit viral disease complexes in India. Thus, a comprehensive molecular analysis is needed to precisely determine the virus species and strain diversity. This will facilitate the development of location-specific management strategy. To control adoption of integrated approach needs to be followed such as vector monitoring and management, crop rotation, use of healthy seeds and resistant varieties, and use of eco-friendly biocontrol options. Farmer awareness needs to be increased by conducting various training programs and regular surveillance to diagnose the viruses in early stage and try to contain the outbreak. This study is a baseline for future work.

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References

1. Saad, D. Y., Soliman, M. M., Baiomy, A. A., Yassin, M. H., & El-Sawy, H. B. (2017). Effects of Karela (bitter melon; *Momordicacharantia*) on genes of lipids and carbohydrates metabolism in experimental hypercholesterolemia: Biochemical, molecular and histopathological study. *BMC Complementary and Alternative Medicine*, 17, *A*rticle 319.
2. Shubha AS, Devaraju, Sharavati MB, Srinivasa V, Kantharaj Y, Ravi CS, Angadi A, Yallesh Kumar HS and Ahmed S. (2018). Medicinal and nutritional importance of bitter melon (Momordicacharantia L.): A review article. *Journal of Pharmacognosy and Phytochemistry*. SP3:297–300.
3. Nama CP, Lal J, Ranawat JS and Meena RK (2016). Diseases of cucurbits and their management. *Marumegh,* 1(2), 8–15.
4. Erayya, Sarkhel, S., Managanvi, K., Kumar, S., &Alipatra, A. (2023). Emerging diseases of vegetables due to changing climate. In *Advances in research on vegetable production under a changing climate* (Vol. 2, pp. 323–340).
5. Pradeep, R. K. M., Jeyaraj, G., & Krishnan, N. (2026). Unveiling the diversity of begomoviruses infecting weed hosts in vegetable ecosystems. *Indian Phytopathology*.
6. Rajinimala N, Rabindran R and Ramaiah M. (2009). Detection of Bittergourd yellow mosaic virus (BGYMV) in bitter gourd through Triple Antibody Sandwitch (TAS) ELISA and Polymerase Chain Reaction (PCR). *Archives of Phytopathology and Plant Protection*. 42(8), 804–814.
7. Tiwari AK, Sharma P, Khan S, Snehi SK, Raj SK and Rao GP. (2010). Molecular detection and identification of Tomato leaf curl New Delhi virus isolate causing yellow mosaic disease in bitter gourd. *Medicinal Plants*, 2(2), 117–123.
8. Balsak, S. C. (2025). Investigation of virus and viroid diseases in cucurbits. *YüzüncüYıl Üniversitesi Tarım Bilimleri Dergisi, Yuzuncu Yil University Journal of Agricultural Sciences*, 35(2).
9. Kumar, S., Srivastava, A., Kumari, A., & Raj, R. (2017). Begomovirus disease management measures, now and then. In *Begomoviruses, Occurrence and management in Asia and Africa* (pp. 71–92).
10. Varma, A., & Malathi, V. G. (2003). Emerging geminivirus problems: A serious threat to crop production. *Annals of Applied Biology,* 142(2), 145–164.
11. Etim D. O. and Okon N. I. (2021). Molecular characterization of virus infecting Momordicacharantia Linn and application of Trichodermaviride as biocontrol agent. *Annual Research & Review in Biology*, 36(12), 51–58.
12. Naik SO, Kannan GS, Venkataravanappa V and Chakravarthy AK (2019). Incidence of whiteflies and viral diseases of bitter gourd in Southern Karnataka. *International Journal of Current Microbiology and Applied Sciences*. 8(5), 927–937.