Received: 8 October 2022 | Accepted: 6 February 2023

DOI: 10.1002/ndr2.12157

New Disease Reports Open Access BSPP WILEY

NEW DISEASE REPORT

# First report of a begomovirus infecting *Ocimum kilimandscharicum* in India

**S. Sinha** | **A. Samad**

Plant Pathology Department, CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, Uttar Pradesh, India

**Correspondence**
A. Samad, Plant Pathology Department, CSIR-Central Institute of Medicinal and Aromatic Plants, P.O. CIMAP, Lucknow 226015, Uttar Pradesh, India
Email: samad_cimap@yahoo.co.in

**KEYWORDS**
Medicinal Plant, Virus, Characterization

*Ocimum* kilimandscharicum, commonly known as Camphor basil, is a perennial evergreen shrub in the family Lamiaceae. Its essential oil possesses a wide range of pharmacological properties with anti-malarial, antioxidant, anti-microbial, and wound healing attributes (Soni *et al.*, 2012). During a survey in February 2020, an infestation of white-flies and viral symptoms, including leaf mottling, yellowing, mosaic, curling and deformation (Fig. 1), were observed on the leaves of *O. kilimandscharicum* in the experimental fields of the CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, India. The disease was observed in patches of plants in different parts of the field (an area of c. 80 $m^2$ in total) and disease incidence was estimated to be approximately 20%.

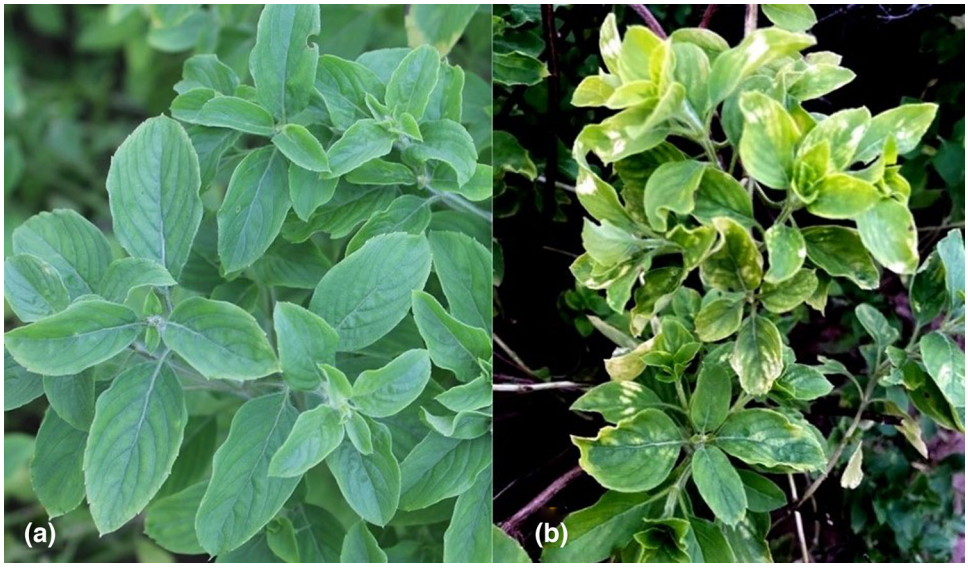



**FIGURE 1** A. Healthy plants in the field. B. Naturally infected leaves of *Ocimum kilimandscharicum* exhibiting mottling, yellowing, mosaic and deformed leaves.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.
© 2023 The Authors. *New Disease Reports* published by British Society for Plant Pathology and John Wiley & Sons.

New Disease Reports
Open Access

**TABLE 1** List of begomoviruses, including their acronyms and GenBanlk accession numbers, used for phylogenetic analysis (ICTV-approved virus species are in bold)

| S.No. | Name | Acronym | Accession No. |
|---|---|---|---|
| 1. | ***Ageratum enation virus*** **[India:Lucknow: 2012]** | **AgEV-Ind:Lko** | **JQ911765** |
| 2. | ***Allamanda leaf mottle distortion virus*** **[India:West Bengal: 2012]** | **AllLMDV-Ind:WB** | **KC202818** |
| 3. | ***Bhendi yellow vein Haryana virus*** **[India: Haryana: 2019** | **BhYVHV-Ind:Har** | **FJ561298** |
| 4. | ***Catharanthus yellow mosaic virus*** **[Pakistan:Lahore: 2011]** | **CYMV-PK** | **HE580234** |
| 5. | ***Chilli leaf curl virus*** **[India:Amritsar: 2009]** | **ChLCV-Ind:Asr** | **GU136803** |
| 6. | ***Clerodendron yellow mosaic virus*** **[India: 2007]** | **ClYMV-Ind** | **EF408037** |
| 7. | *Cotton leaf curl Allahabad virus* [India:Karnal:OY77: 2005] | CLCuAlV-Ind:Kar | GU112081 |
| 8. | ***Crassocephalum yellow vein virus*** **[China: Yunnan: 2019** | **CrYVV-Chi:Yun** | **MK622789** |
| 9. | ***Croton yellow vein mosaic virus*** **[Pakistan:Lahore: 2006]** | **CYVMV-Pak** | **FN678906** |
| 10. | *Euphorbia leaf curl virus Fujian* [China: 2006] | EuLCuV-Chi | FJ487911 |
| 11. | *Kenaf leaf curl virus* [ China: Yunnan: 2010 | KeLCV-Chi:Yun | HM448898 |
| 12. | *Loofa yellow mosaic virus* [VietNam: 2003] | LYMV-VNam | AF509739 |
| 13. | ***Melon yellow mosaic virus*** **[Thailand: 2019]** | **MeYMV-Th** | **MH665365** |
| 14. | ***Papaya leaf curl virus*** **[India: New Delhi: 2009]** | **PaLCV-Ind:Del** | **DQ629103** |
| 15. | ***Pedilanthus leaf curl virus*** **[Pakistan:Multan: 2004]** | **PedLCV-Pak** | **AM712436** |
| 16. | *Pumpkin yellow mosaic Malaysia virus* [Malaysia: Negeri Sambilan: 2007] | PYMMV-Mal: Nes | EF19794 |
| 17. | ***Squash leaf curl China virus*** **[India: Delhi: 2012]** | **SLCCV-Ind:Del** | **JN587811** |
| 18. | ***Stachytarpheta leaf curl virus*** **China:Hainan: 2003]** | **StaLCuV-Chi** | **AJ564742** |
| 19. | *Syndrella yellow vein clearing virus* [India: 2012 | SyYVCV-Ind | KX363443 |
| 20. | ***Tomato leaf curl New Delhi virus*** **[India:Kanpur: 2014]** | **ToLCNDV -Ind:Kan** | **KM190927** |
| 21. | ***Tomato leaf curl New Delhi virus*** **[India:Lucknow: 2022]** | **ToLCNDV** | **OP589304** |
| 22. | ***Tomato leaf curl New Delhi virus*** **[India:Varanasi: 2015]** | **ToLCNDV-Ind:Vns** | **KY780207** |
| 23. | ***Tomato leaf curl New Delhi virus*** **[India:New Delhi: 2015]** | **ToLCNDV-Ind:Del** | **KY780201** |
| 24. | ***Tomato leaf curl New Delhi virus*** **[India:Varanasi: 2015]** | **ToLCNDV-Ind:Vns** | **MH475912** |
| 25. | ***Tomato leaf curl New Delhi virus*** **[India:Haryana: 2007]** | **ToLCNDV-Ind:Har** | **FN645905** |
| 26. | ***Tomato leaf curl Karnataka virus*** **[India: Karnataka: 2019]** | **ToLCKV-Ind:Kar** | **KF551585** |

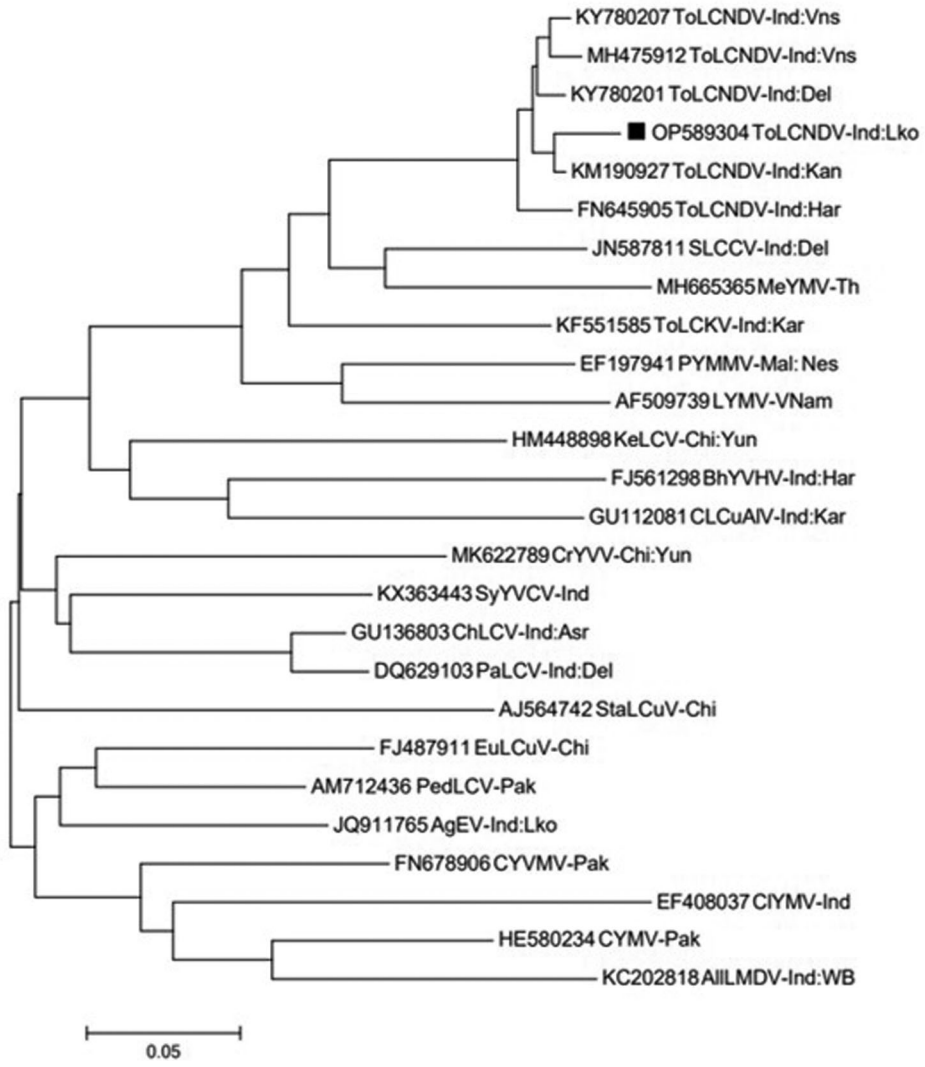



**FIGURE 2** Phylogenetic tree of nucleotide DNA-A sequences of selected begomovirus isolates (Table 1) showing the relationship of the isolate infecting *Ocimum kilimandscharicum* (OP589304) with other species in the genus. The tree was constructed by the neighbor joining tree method using MEGA 7.0

The disease was not transmissible via mechanical inoculation with sap obtained from infected leaf tissues to *O. kilimandscharicum*, *Nicotiana benthamiana* or *N. glutinosa*. Eighteen samples (13 diseased and five asymptomatic) were collected from different locations of the field and total genomic DNA was isolated. PCR was done using begomovirus coat protein gene-specific primers (Hallan *et al.*, 1998). All 13 diseased samples yielded an amplicon of c. 770 bp while no amplification was observed from the five asymptomatic samples. The positive samples were subjected to PCR using two sets of overlapping primers K1F/K1R and K2F/K2R for complete genomic characterisation of the DNA-A segment (Kumar *et al.*, 2011). The samples yielded amplicons of c. 1,200 bp and 1,700 bp, respectively. The PCR products were cloned and sequenced. BlastN analysis revealed 97.6% identity with the DNA-A segment of *Tomato leaf curl New Delhi virus* (ToLCNDV) from lentil isolated in Kanpur, India (Naimuddin *et al.*, 2016). The sequence was submitted to GenBank (Accession no. OP589304). Phylogenetic analysis was performed with different begomovirus isolates (Table 1) using MEGA 7 software (Tamura *et al.* 2004). The isolate in the current study and ToLCNDV ex lentil share a common ancestor and fall in the same clade (Fig. 2).

Ongoing increases in the incidence of begomovirus infection in economically important crops are becoming a major concern globally. To the best of our knowledge this is the first record of a begomovirus infecting *O.* kilimandscharicum. Camphor basil is commonly grown in kitchen gardens and commercial fields, and infected plants may serve as a virus reservoir for other hosts, therefore, management strategies are required.

## ACKNOWLEDGMENTS

We are thankful to the Director, CIMAP, Lucknow for the necessary facilities and DST-New Delhi for INSPIRE-SRF to Soumya Sinha.

## ORCID

*A. Samad* https://orcid.org/0000-0002-9392-4549

## REFERENCES

Hallan, V., Saxena, S. and Singh, B.P. (1998) *Ageratum*, *Croton* and *Malvastrum* harbour geminiviruses: evidence through PCR amplification. *World Journal of Microbiology and Biotechnology*, 14, 931–932. https://doi.org/10.1023/A:1008833208973

Kumar, Y., Hallan, V. and Zaidi, A.A. (2011) Chilli leaf curl Palampur virus is a distinct begomovirus species associated with a betasatellite. *Plant Pathology*, 60, 1040–1047. https://doi.org/10.1111/j.1365-3059.2011.02475.x

Naimuddin, K., Akram, M. and Agnihotri, A.K. (2016) Molecular characterization of a first begomovirus associated with lentil (*Lens culinaris*) from India. *Acta Virologica*, 60, 217–223. https://doi.org/10.4149/av_2016_03_217

Soni, N., Gill, D., Sagar, B.S., Raheja, S. and Agrawal, S. (2012) *Ocimum kilimandscharicum*: A systematic review. *Journal of Drug Delivery and Therapeutics*, 2, 45–52. https://doi.org/10.22270/jddt.v2i3.169

Tamura, K., Masatoshi, N. and Kumar, S. (2004) *Prospects for inferring very large phylogenies by using the neighbor-joining method*. Proceedings of the National Academy of Sciences of the United States of America, 101, 11030–11035. https://doi.org/10.1073/pnas.0404206101

**How to cite this article:** Sinha, S. & Samad, A. (2023) First report of a begomovirus infecting *Ocimum kilimandscharicum* in India. *New Disease Reports*, 47, e12157. https://doi.org/10.1002/ndr2.12157