JURNAL
FITOPATOLOGI
INDONESIA
ISSN: 0215-7950

Volume 21, Nomor 1, Maret 2025
Halaman 1–6
DOI: 10.14692/jfi.21.1.1–6

SHORT COMMUNICATION

Identification of Polerovirus Infecting Chili Pepper in Java

Identifikasi Polerovirus yang Menginfeksi Tanaman Cabai di Jawa

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(submitted January 2025, Accepted July 2025)

ABSTRACT

Infection of polerovirus in chili peppers has been reported from various parts of the world, including Indonesia. Pepper vein yellows virus (PeVYV), a member of genus *Polerovirus* were reported infecting chili plants in Bali, Java, and Aceh during 2012 to 2020. Recently, symptoms of the polerovirus infection, such as yellowing leaves with vein thickening, were found in chili pepper crops in the Central Java Region, specifically in Brebes, Magelang, and Kulon Progo. Molecular detection by RT-PCR method using universal polerovirus primers O3R/PL4F, followed by sequence analysis, confirmed the presence of PeVYV on samples from Magelang and Kulon Progo. Furthermore, the isolates of PeVYV are identified as PeVYV-2, PeVYV-6, and PeVYV-8. These current incidences indicate the expansion of the polerovirus distribution in Indonesia.

Keywords: pepper vein yellows virus, RT-PCR, sequence analysis, vein thickening

ABSTRAK

Infeksi polerovirus pada tanaman cabai semakin banyak dilaporkan dari berbagai bagian dunia termasuk di Indonesia. Infeksi pepper vein yellows virus (PeVYV) pada tanaman cabai di Bali, Jawa, dan Aceh telah dilaporkan pada kurun waktu 2012 sampai 2020. Belum lama ini gejala infeksi polerovirus berupa daun kuning dengan penebalan tulang daun ditemukan pada pertanaman cabai di wilayah Jawa Tengah, yaitu di Brebes, Magelang dan Kulon Progo. Deteksi molekuler dengan metode RT-PCR menggunakan primer universal polerovirus O3R/PL4F yang dilanjutkan dengan analisis sekuens membuktikan adanya infeksi PeVYV dari sampel asal Magelang dan Kulon Progo. Identifikasi lebih lanjut menunjukkan bahwa isolat PeVYV tersebut ialah PeVYV-2, PeVYV-6, dan PeVYV-8. Insidensi infeksi PeVYV ini menunjukkan perluasan distribusi polerovirus di Indonesia.

Kata kunci: analisis sekuens, pepper vein yellows virus, penebalan tulang daun, RT-PCR

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Chili pepper is one of important horticultural commodities globally, including in Indonesia due to its high economic value. Pests and diseases have been known to cause problems in chili pepper production. Viral diseases have been reported to cause significant yield loss. Virus infections in chili pepper plants can result in a variety of symptoms ranging from mild to severe mosaic, wrinkled and curled leaves, chlorosis, and even stunted growth. Several viruses have been reported to infect chili pepper plants in Indonesia including tobacco mosaic virus (TMV), chili veinal mottle virus (ChiVMV), cucumber mosaic virus (CMV), potato virus y (PVY), pepper vein yellows virus (PeVYV), pepper mild mottle virus (PMMoV), and pepper yellow leaf curl virus (PYLCV) (Suastika *et al*. 2012; Damiri 2014; Selangga *et al*. 2021; Damayanti and Kurniawati 2022).

Member of genus *Polerovirus* has been known to infect chili pepper worldwide. The polerovirus species that has been reported to infect chilies in the world is PeVYV. Infection of polerovirus on chili pepper causing yellowing and rolling of leaves was reported by Murakami and Kawano (2017) in Japan. Chlorosis between leaf veins and shortened internodes were reported by Dombrovsky *et al*. (2010) on chili pepper plants in Israel. Furthermore, Tomassoli *et al.* (2016) reported yellowish leaf spot on chili pepper plant infected by polerovirus in Italy. Infections by the PeVYV on chili peppers in Indonesia were reported in Bali in 2012 (Suastika *et al.* 2012) and Aceh in 2020 (Koeda *et al.* 2020). Knierim *et al.* (2013) also found and reported polerovirus infection on chili pepper plants in Rembang, Central Java, which showing green mosaic and chlorosis of the leaves.

A survey conducted in mid-2023 in several chili pepper fields in the Central Java Region, including Brebes, Magelang, and Kulon Progo, revealed dominant viral infection symptoms, such as yellow mosaic, whitish yellow mosaic, and green mosaic. Based on previous reports, symptoms associated with polerovirus involve green mosaic with thickening of leaf veins and chlorosis. Following PCR detection using universal Begomovirus primers (SPG1/SPG2) followed by sequencing, a total of eight samples were confirmed positive for PYLCV (data not shown). In a number of chili pepper fields, symptoms of leaf chlorosis with slight thickening of leaf veins resembling polerovirus infection symptoms were also observed (Figure 1).

Detection of polerovirus was carried out using reverse transcription polymerase chain reaction (RT-PCR) method with universal polerovirus primers (PL4F – 5' TGC GAC AAA TAG TTA ATG AAT ACG GT 3' and O3R – 5' GTC TAC CTA TTT BGG RTT NTG GAA 3'), which amplify the coat protein region (Corrêa *et al.* 2005). Total RNA extraction from chili pepper leaf samples was performed using a GeneJET RNA Purification Kit (Thermo-Fisher Scientific, Waltham, US). The amplification process consisted of cDNA synthesis at 45 °C for 60 minutes, followed by pre-denaturation

a b

Figure 1 Disease symptoms in chili pepper plants in Central Java associated with polerovirus infection. a, chlorosis and leaf reduction; and b, chlorosis with slight thickening of leaf veins.

at 95 °C for 1 minute, and then 35 cycles consisting of denaturation at 95 °C for 30 seconds, annealing at 50 °C for 30 seconds, elongation at 72 °C for 1 minute and one cycle of post-extension at 72 °C for 10 minutes. A specific DNA fragment of 650 bp was successfully amplified from chili pepper plant samples from Magelang and Kulon Progo (Figure 2). The amplified products were transported for purification and sequencing to First Base, Malaysia. The obtained sequencing data were then compared to sequence databases from GenBank and analyzed using the BioEdit V.7.0.5 software and MEGA 11 application. Based on the sequence analysis, the PeVYV, member of genus *Polerovirus* was identified in the chili pepper samples from Magelang and Kulon Progo. Furthermore, it was found that the homology level of PeVYV from chili pepper plants in Central Java ranged from 88.18% to 96.76% compared to the GenBank data (Figure 3). Three PeVYV sequences from chili pepper plants in Central Java have been submitted to GenBank with accession numbers

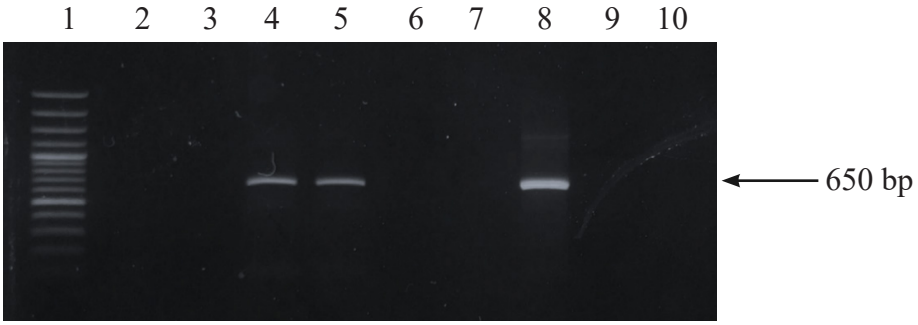

Figure 2 Visualization of DNA fragments resulting from amplification using universal polerovirus primers O3R/PL4F with a target amplicon of 650 bp. Lane 1: 100 bp DNA marker (Thermo-Fisher Scientific); lanes 2 and 3: samples from Brebes; lanes 4 and 5: samples from Magelang; lanes 6, 7, 8, and 9: samples from Kulon Progo; and lane 10: ddH2O as the negative control.

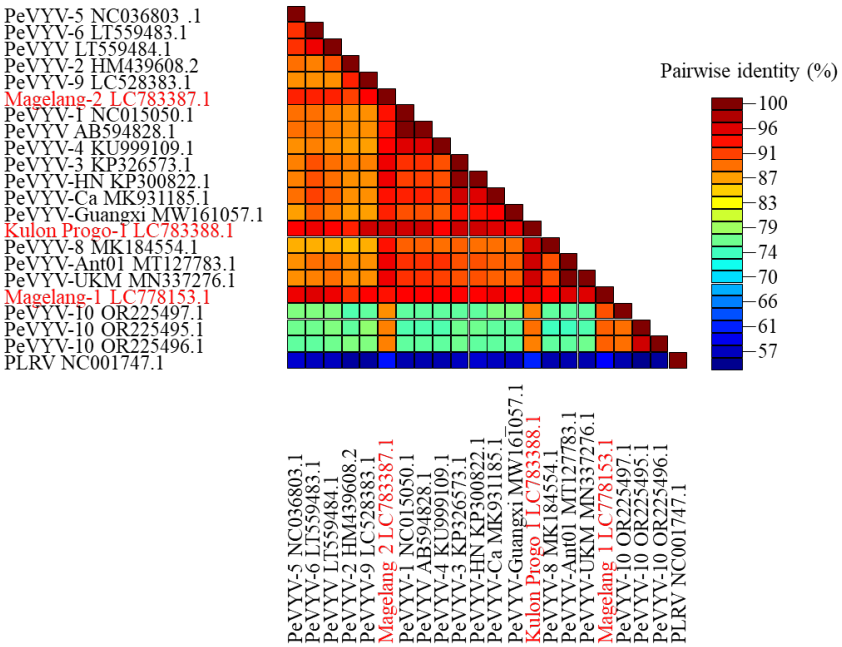

Figure 3 Pairwise identity matrix of *Pepper vein yellows virus* (PeVYV) inferred using SDT matrix in 'two-color' mode. The isolates of PeVYV from Java are indicated by red letter. The percentage of pairwise identity is visualized by the color-coded boxes. *Potato leaf roll virus* (PLRV) was used as an outgroup.

LC778153.1, LC783387.1, and LC783388.1. Subsequently, a phylogenetic tree analysis was conducted using MEGA 11. Three groups were formed in the phylogenetic tree: Magelang 1 isolate (LC778153.1) clustered together with PeVYV-6 LT559483.1 (90.59%); Magelang 2 isolate (LC7833 87.1) was closely related to PeVYV-2 HM439608.1 (93.33%); while Kulon Progo 1 isolate (LC783388.1) grouped with PeVYV-8 MK184554.1 (96.11%) (Figure 4). Therefore, it is concluded that chili pepper plants showing symptoms of chlorosis with slight leaf vein thickening are associated with polerovirus infection. PeVYV-2 and PeVYeV-6 can be said to be new discoveries and it is possible that there are still other PeVYV species that infect chili plants in Indonesia. The host range of polerovirus is known to be very wide, including cotton, cucurbits, corn, melons, chilies, potatoes, sugar cane, and wheat (Knierim *et al.* 2014; Agrofoglio *et al.* 2017; Gonçalves *et al.* 2017). There are 26 species of polerovirus and generally transmission occurs persistently by aphid vectors and can spread viruses from both the vegetative and generative phases (Bello *et al*. 2021; La Tourette *et al*. 2021). Polerovirus infection in Indonesia has been reported in cucumber plants (Adnyani 2018; Laili and Damayanti 2019; Kurnia *et al*. 2022), in addition to chili pepper plants (Suastika *et al.* 2012; Knierim *et al.* 2013; Koeda *et al.* 2020). Considering the development of polerovirus infections in the world, including in Indonesia

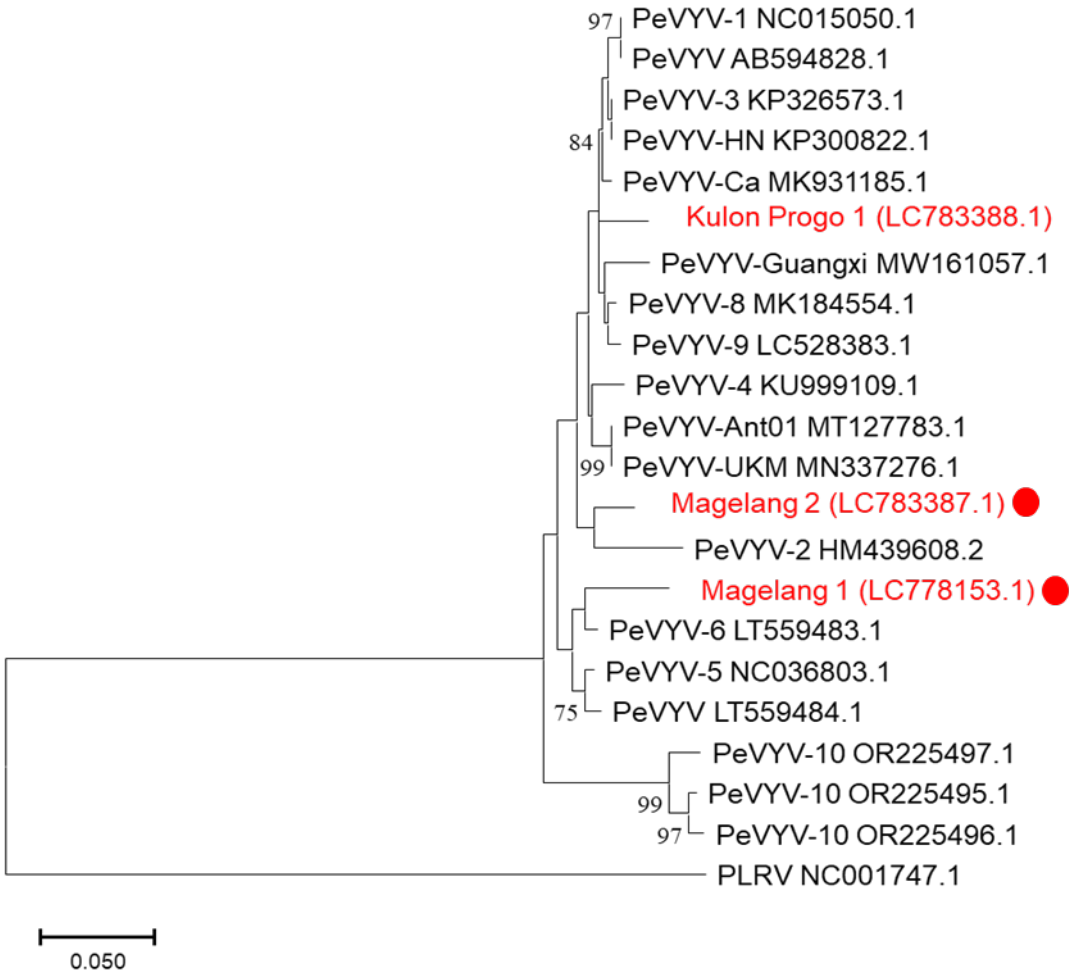

Figure 4 A phylogenetic tree shows the relationship between *Pepper vein yellows virus* (PeVYV) isolates from Java and isolates from other countries. This phylogenetic tree was constructed using the Maximum-Likelihood method in MEGA 11. The PeVYV isolates from this study consist of Magelang 1 (LC778153.1), Magelang 2 (LC783387.1), and Kulon Progo 1 (LC783388.1). The PLRV NC001747.1 was used as outgroup.

which is increasingly widespread, efforts are needed to inhibit it. Identifying polerovirus to the species level and studying its virulence can support strategies to control the diseases it causes.

ACKNOWLEDGMENTS

This research was funded through a Master's Thesis Research grant No. 102/E5/PG.02.00.PL/2023 of the Ministry of Education, Culture, Research and Technology-Republic of Indonesia and ACIAR Project-SLAM/2018/145.

DAFTAR PUSTAKA

Adnyani NNP. 2018. Deteksi *Pepper vein yellows virus* yang berasosiasi dengan penyakit yellow vein banding pada tanaman mentimun di Tabanan-Bali. DwijenAGRO. 8(2):80–85. DOI: https://doi.org/10.46650/dwijenagro.8.2.654.80-85.

Agrofoglio YC, Delfosse VC, Casse MF, Hopp HE, Kresic IB, Distéfano AJ. 2017. Identification of a new cotton disease by an atypical Cotton leafroll dwarf virus in Argentina. Phytopathology. 107(3):369–376. DOI: https://doi.org/10.1094/PHYTO-09-16-0349-R.

Bello VH, Ghosh S, Krause-Sakate R, Ghanim M. 2021. Competitive interactions between whitefly- and aphid-transmitted *Polerovirus*es within the plant host and the insect vectors. Phytopathology. 111(6): 1042–1050. DOI: https://doi.org/10.1094/PHYTO-08-20-0369-R.

Corrêa RL, Silva TF, Simões-Araújo JL, Barroso PAV, Vidal MS, Vaslin MFS. 2005. Molecular characterization of a virus from the family Luteoviridae associated with cotton blue disease. Archives of Virology. 150(7):1357–1367. DOI: https://doi.org/10.1007/s00705-004-0475-8.

Damayanti TA, Kurniawati F. 2022. Pepper mild mottle virus infection in cayenne and sweet pepper in Indonesia. Australasian Plant Disease Notes. 17(4):1–3. DOI: https://doi.org/10.1007/s13314-022-00451-5.

Damiri N. 2014. Mixed viral infection and growth stage on chilli (*Capsicum annuum* L.) production. Pertanika Journal of Tropical Agricultural Science. 37(2): 275–283.

Dombrovsky A, Glanz E, Perlsman M, Lachman O, Antignus Y. 2010. Characterization of Pepper yellow leaf curl virus, a tentative new *Polerovirus* species causing a yellowing disease of pepper. Phytoparasitica. 38(5):477–486. DOI: http://dx.doi.org/10.1007/s12600-010-0120-x.

Gonçalves MC, Godinho M, Alves-Freitas DMT, Varsani A, Ribeiro SG. 2017. First report of *Maize yellow mosaic virus* infecting maize in Brazil. Plant Disease. 101(12):2156. DOI: https://doi.org/10.1094/PDIS-06-17-0885-PDN.

Knierim D, Tsai WS, Kenyon L. 2013. Analysis of sequences from field samples reveals the presence of the recently described *Pepper vein yellows virus* (genus *Polerovirus*) in six additional countries. Archives of Virology. 158(6):1337–1341. DOI: https://doi.org/10.1007/s00705-012-1598-y.

Knierim D, Tsai WS. Maiss E. Kenyon L. 2014. Molecular diversity of *Polerovirus*es infecting cucurbit crops in four countries reveals the presence of members of six distinct species. Archives of Virology. 159(1):1459–1465. DOI: https://doi.org/10.1007/s00705-013-1939-5.

Koeda S, Homma K, Kamitani M, Nagano AJ, Taniguchi M, Pohan N, Kesumawati E. 2020. Pepper vein yellows virus 9: a novel *Polerovirus* isolated from chili pepper in Indonesia. Archives of Virology. 165(12):3017–3021. DOI: https://doi.org/10.1007/s00705-020-04838-6.

Kurnia TD, Purwantoro AP, Sulandari S, Basunanda P, Setiawan AB, Fatmawati Y, Andika IP. 2022. Molecular and morpho-physiological identification of yellow leaf curl disease of cucumber in Salatiga, Indonesia. Biodiversitas. 23(3):1466–1474.

DOI: http://dx.doi.org/10.13057/biodiv/d230334.

Laili NU, Damayanti TA. 2019. Deteksi virus pada tanaman mentimun di Jawa Barat. Agrivigor. 12(1):8–15. DOI: http://dx.doi.org/10.21107/agrovigor.v12i1.5089.

LaTourrette K, Holste NM, Garcia-Ruiz H. 2021. *Polerovirus* genomic variation. Virus Evolution. 7(2):1–18. DOI: https://doi.org/10.1093/ve/veab102.

Murakami R, Kawano S. 2017. A natural host and diversity of *Pepper vein yellows virus* in Japan. Japan Agricultural Research. 51(1):59–68. DOI: https://doi.org/10.6090/jarq.51.59.

Selangga DGW, Wiyono S, Susila AD, Hidayat SH. 2021. Distribusi dan identifikasi *Pepper yellow leaf curl indonesia virus* yang menginfeksi tanaman cabai di Pulau Bali. Jurnal Fitopatologi Indonesia. 17(6): 217–224. DOI: https://doi.org/10.14692/jfi.17.6. 217–224.

Suastika G, Hartono S, Nyana IDN, Natsuaki T. 2012. Laporan pertama tentang infeksi *Polerovirus* pada tanaman cabai di daerah Bali, Indonesia. Jurnal Fitopatologi Indonesia. 8(5):151–154. DOI: https://doi.org/10.14692/jfi.8.5.151.

Tomassoli L, Manglli A, Ahmad A, Tiberini A, Barba M. 2016. First report of *Pepper vein yellows virus* infecting chilli pepper (*Capsicum* spp.) in Italy. New Disease Reports. 33:22–22. DOI: https://doi.org/10.5197/j.2044-0588.2016.033.022.