Garden Lupin (*Lupinus polyphyllus*) Is a New Natural Host of Lily Symptomless Virus in Korea

Sung-Woong Kim,¹ Hyo-Jeong Lee,¹ Hong-Sup Kim,² and Rae-Dong Jeong^{1,†}

¹ Department of Applied Biology, Institute of Environmentally Friendly Agriculture, Chonnam National University, Gwangju 61185, Republic of Korea

² Dongbu Office, Korea Seed & Variety Service, Pyeongchang 219-66, Republic of Korea

Funding: This work was supported by Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry, and Fisheries (IPET) through Ministry of Agriculture, Food and Rural Affairs (MAFRA) (321105-03-1-WT011). Plant Dis. 106:2003, 2022; published online as <https://doi.org/10.1094/PDIS-09-21-2108-PDN>. Accepted for publication 11 January 2022.

Lupinus polyphyllus (Fabaceae), commonly known as garden lupin, is cultivated for commercial, private, and gardening purposes in many countries in Europe, North America, and Asia (Ramula and Kalske 2020). No previous studies have reported viruses infecting *L. polyphyllus* in the Republic of Korea. In May 2021, virus-like symptoms such as stunting, chlorotic striping, and mosaic were observed on the leaves of *L. polyphyllus* at the Suncheonman National Garden in Suncheon, South Korea; the disease incidence was estimated to be between 10 and 20%. These symptoms were similar to those observed in lily plants infected by lily symptomless virus (LSV) (Flores et al. 2019; Singh et al. 2005). Several different species of *Lilium*, including lilies, were grown in the same garden with *L. polyphyllus* on the adjacent block. Only carlavirus-like filamentous particles (approximately 610 to 700 nm in length and 12 to 15 nm in diameter) were observed using transmission electron microscopy in negatively stained extracts from five symptomatic samples. To further investigate the causative virus, a total of 20 symptomatic leaves were collected from 20 different *L. polyphyllus* plants and tested by DAS-ELISA using polyclonal antibodies against viruses infecting plants from the *Lilium* genus, including Arabis mosaic virus, cucumber mosaic virus, LSV, lily mottle virus, and Plantago asiatica mosaic virus (Agdia, Elkhart,

IN, U.S.A.). Commercial positive and negative controls and extract from healthy *L. polyphyllus* tissue were included in each ELISA. The serological analyses showed that all symptomatic samples were positive only for LSV and not for other viruses. To further confirm LSV infection, total RNA was extracted from 10 ELISA-positive plants and two healthy *L. polyphyllus* plants (negative control) using the Clear-S Total RNA extraction kit (InVirusTech Co., Gwangju, Korea). RT-PCRs were performed using LSV coat protein (CP) specific primers, LSV1 (5'-CACATATGCAATCAAGACCAGCAC-3') and LSV2 (5'-GAGGATCCTCATCCATTATTGCGTATC-3'), that were designed to amplify an 876-nt fragment of the CP gene (Lim et al. 2009). A DNA fragment of the expected size was amplified from only the 10 symptomatic leaves. Three amplified RT-PCR products were cloned into the pGEM-T Easy Vector (Promega, Madison, WI) and sequenced. The sequences obtained from each amplicon showed 100% sequence identity; a single representative sequence was deposited to GenBank (LC649240). Pairwise nucleotide sequence analysis revealed that this LSV isolate LP2 had 99% nucleotide and 100% amino acid identity with *Lilium longiflorum* LSV isolate from South Korea (JX962776). To fulfill Koch's postulates, sap from an LSV-positive *L. polyphyllus* plant was inoculated on 10 young, healthy *L. polyphyllus* plants. At 14 days postinoculation, all the inoculated plants showed typical symptoms of LSV infection, such as mild vein-clearing and mosaic (Asjes 2000). The LSV infection in the inoculated plants was confirmed by RT-PCR using the aforementioned primers and sequencing of the 876-nt amplicons. To the best of our knowledge, this is the first report of LSV naturally infecting *L. polyphyllus* in the Republic of Korea. LSV could negatively impact the quality of *L. polyphyllus* and trade. Thus, it is important to investigate the extent of its distribution in South Korea and how it can be effectively managed.

References:

- Asjes, C. J. 2000. Virus Res. 71:23.
- Flores, F., et al. 2019. Microbiol. Resour. Announc. 8:e00368.
- Lim, J. H., et al. 2009. J. Microbiol. 45:251.
- Ramula, S., and Kalske, A. 2020. Ecol. Evol. 10:13742.
- Singh, A. K., et al. 2005. Plant Pathol. 54:255.

The author(s) declare no conflict of interest.

Keywords: garden lupin, lily symptomless virus, viral disease

[†]Indicates the corresponding author.
Rae-Dong Jeong; jraed2@jnu.ac.kr