First report of tobacco mosaic virus infecting *Geranium thunbergii* in Korea

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Geranium thunbergii (Family Geraniaceae) forms a component of several popular folk medicines in Asia, including a traditional antidiarrheal drug. During a survey in July 2018, viral infection-like symptoms, including mosaic, mottling, and foliage discoloration were observed on the leaves of *G. thunbergii* in a farm located in Naju, Korea. Twenty symptomatic leaves were selected and analyzed by DAS-ELISA using polyclonal antibodies against cucumber mosaic virus, pepper mottle virus, tobacco mosaic virus (TMV), and tomato mosaic virus (Agdia, Elkhart, IN, U.S.A). None of the samples reacted with any of the antisera, except with that against TMV. To further confirm TMV infection, RT-PCR was performed using TMV-specific primers designed from a highly conserved region of the coat protein (CP) gene (5'- ATGTCTTACAGTAT CACTACTCC-3' and 5'- TCAAGTTGCAGGACCAGAGG T-3') (Choi et al. 2009). PCR products of the expected size (462 bp) were amplified, and then cloned and sequenced. BLAST analysis of the primer-trimmed resulting sequence (LC417449; 436 bp) showed 99% identity with the CP gene of several TMV isolates of *Vicia faba* (AJ011933), *Capsicum annuum* (KT923121), *Solanum melongena* (AY360447), *Solanum lycopersicum* (KC007531), and *Glycine max*

(JQ895560). The virus (named TMV-Gt) caused necrotic lesions on *Nicotiana rustica* at 5 days post inoculation (dpi), whereas mild systemic mosaic symptoms were observed in *N. benthamiana*, *N. rustica*, *Physalis alkekengi*, and *N. tabacum* at 10 to 14 dpi. Symptomatic hosts tested positive for TMV by RT-PCR with the aforementioned primers. To our knowledge, this is the first report of TMV infection affecting quality of *G. thunbergii* in Korea.

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References

- Choi S-K, Yoon J-Y, Chung B-N (2009) Genome analysis and characterization of a tobacco mosaic virus isolate infecting balsam (*Impatiens balsamina*). Arch Virol 154:881–885

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