

# Infection Degree of Major Five Viruses for Commercial Nursery Trees in Apple Cultivars 'Hongro' or 'Fuji'

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## Abstract

In apple trees, the multiple infection of viruses and a viroid causes farmer's economic losses, such as yield and quality decrease of fruits. Therefore, we analyzed the commercial nursery trees of main apple cultivars to confirm the infection degree with RT-PCR technique. The RT-PCR analysis for each nursery tree performed dividedly into scion and root zone.

For apple cultivars of 'Hongro' lines, the scion analysis resulted that both ACLSV and ASGV were infected by 100%. ASPV was infected by 81.3%. ApMV and ASSVd showed no amplification bands on the all samples. Whereas, the root analysis showed that infection ratio of ACLSV, ASGV, and ASPV were 87.5, 100, and 81.3% as well as that of ApMV and ASSVd were 12.5 and 6.3%, respectively.

For apple cultivars of 'Fuji' lines, the scion analysis resulted that each infection ratio of ACLSV, ASGV, and ASPV were 86.7, 100, and 86.7%, showing no infection of both ApMV and ASSVd. On the other hand, the root analysis showed that ACLSV, ASGV, ASPV, ApMV, and ASSVd were infected by 86.7, 93.3, 93.3, 6.7, 0%, respectively.

In conclusion, our results indicate that most of commercial apple nursery trees was multiple-infected by at least 2~3 viruses, such as ACLSV, ASGV, ASPV.

**Additional key words:** ACLSV, ASGV, ASPV, ApMV, ASSVd

## Materials & Methods

- The used apple cultivars were 'Hongro' and 'Fuji' of 1-year-old tree, included bud mutation cultivars such as 'Mishima Fuji', 'Myanma Fuji', and 'Miyabi Fuji'.
- The nursery trees was collected to 16 manufacturers (A~D, Chungbuk 4; E, Chungnam 1; F, Jeonbuk 1; G~P, Gyeongbuk 10)
- The samples were analyzed into GeneAll Biotechnology Co., Ltd. (Seoul, Korea) with technical supporting from RDA Genebank (<http://genebank.rda.go.kr>) to check if infected or not against 4 viruses (ACLSV, *Apple chlorotic leaf spot virus*; ASGV, *Apple stem grooving virus*; ASPV, *Apple stem pitting virus*; ApMV, *Apple mosaic virus*) and 1 viroid (ASSVd, *Apple scar skin viroid*)
- The band intensity by RT-PCR analysis was assorted into three groups (+, ++, +++) under visual distinction

## Results

**Table 1.** The infection degree of each virus for scions in nursery trees of an apple cultivar 'Hongro'

ID	ACLSV	ApMV	ASPV	ASGV	ASSVd
A	+++	-	++	+++	-
B	+	-	-	+	-
C	+	-	-	+	-
D	+++	-	++	+++	-
E	++	-	+++	+++	-
F	+++	-	++	+++	-
G	+	-	-	+++	-
H	+++	-	+++	+++	-
I	+	-	++	+++	-
J	+	-	++	+++	-
K	+++	-	+++	+++	-
L	+++	-	++	+++	-
M	+++	-	+++	+++	-
N	+	-	+++	+++	-
O	+++	-	++	+++	-
P	++	-	++	+++	-

-, no amplification; +, weak; ++, intermediate; +++, strong.

## Acknowledgement

Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry and Fisheries (IPEF) through (Agri-Bioindustry Technology Development Program), funded by Ministry of Agriculture, Food and Rural Affairs (MAFRA) (grant No. 315003-05-2-HD060)

**Table 2.** The infection degree of each virus for roots in nursery trees of an apple cultivar 'Hongro'

ID	ACLSV	ApMV	ASPV	ASGV	ASSVd
A	+	-	+	+++	-
B	+	-	-	+	-
C	+	-	-	-	-
D	++	-	-	-	-
E	+++	-	-	+++	-
F	++	-	+	+	-
G	+	-	-	-	+++
H	+++	-	-	+++	+++
I	-	+	+	+	++
J	+	-	-	+	++
K	+++	-	-	+++	+++
L	+++	+	+	+++	-
M	++	-	+	++	-
N	-	-	++	+++	+
O	+++	-	++	++	-
P	+++	-	++	++	+++

-, no amplification; +, weak; ++, intermediate; +++, strong.

**Table 3.** The infection degree of each virus for scions in nursery trees of apple cultivars 'Fuji' and the bud mutations

ID	ACLSV	ApMV	ASPV	ASGV	ASSVd
A	-	-	+	+++	-
B	+	-	-	+++	-
C	+++	-	+++	+++	-
D	++	-	+	+++	-
E	+	-	+++	+++	-
F	+++	-	+++	+++	-
G	+++	-	++	+++	-
H	+++	-	+++	+++	-
I	nt	nt	nt	nt	nt
J	+	-	+	+	-
K	+++	-	+++	+++	-
L	+++	-	+	+++	-
M	+	-	+++	+++	-
N	-	-	-	+	-
O	+	-	++	+++	-
P	+++	-	++	+++	-

-, no amplification; +, weak; ++, intermediate; +++, strong.

nt, not tested owing to no production.

**Table 4.** The infection degree of each virus for roots in nursery trees of apple cultivar 'Fuji' and the bud mutations

ID	ACLSV	ApMV	ASPV	ASGV	ASSVd
A	++	-	+	++	-
B	-	-	-	+++	-
C	+++	-	++	+++	-
D	+++	-	+	+++	-
E	+++	-	++	+++	-
F	+++	-	+	+++	-
G	++	+	+	+++	-
H	++	-	+	+++	-
I	nt	nt	nt	nt	nt
J	-	-	+	-	-
K	+++	-	++	+++	-
L	+++	-	+	+++	-
M	+	-	+	+++	-
N	+++	-	++	+++	-
O	+++	-	+	+++	-
P	++	-	+	+++	-

-, no amplification; +, weak; ++, intermediate; +++, strong.

nt, not tested owing to no production.

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