

Turnip mosaic virus Moves Systemically through Both Phloem and Xylem as Membrane-Associated Complexes¹

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Plant viruses move systemically in plants through the phloem. They move as virions or as ribonucleic protein complexes, although it is not clear what these complexes are made of. The approximately 10-kb RNA genome of *Turnip mosaic virus* (TuMV) encodes a membrane protein, known as 6K₂, that induces endomembrane rearrangements for the formation of viral replication factories. These factories take the form of vesicles that contain viral RNA (vRNA) and viral replication proteins. In this study, we report the presence of 6K₂-tagged vesicles containing vRNA and the vRNA-dependent RNA polymerase in phloem sieve elements and in xylem vessels. Transmission electron microscopy observations showed the presence in the xylem vessels of vRNA-containing vesicles that were associated with viral particles. Stem-girdling experiments, which leave xylem vessels intact but destroy the surrounding tissues, confirmed that TuMV could establish a systemic infection of the plant by going through xylem vessels. Phloem sieve elements and xylem vessels from *Potato virus X*-infected plants also contained lipid-associated nonencapsidated vRNA, indicating that the presence of membrane-associated ribonucleic protein complexes in the phloem and xylem may not be limited to TuMV. Collectively, these studies indicate that viral replication factories could end up in the phloem and the xylem.