Peach rosette mosaic virus

a. Virus/pathogen name, including accepted acronyms and synonyms
Peach rosette mosaic virus (PRMV), *Nepovirus* (Genus), Comovirinae (Subfamily), *Secoviridae* (Family) (Thompson et al., 2017).
Peach rosette mosaic disease
Rosette Mosaic Virus
PRMV was also found to cause "decline" or "degeneration" disease in grapevine (Dias and Cation, 1976)

b. Host range, including resistance or tolerance within the crop hosts, alternate hosts

Stone fruit including, Peach, Prune, Plum (Klos, 1976), Grapevine *Vitis labrusca* (Ramsdell and Myers, 1974) and Blueberry (Martin and Tzanetakis, 2018; Ramsdell and Gillett, 1981).

Weed species – Curly dock plant (*Rumex crispus* -single plant), Carolina horsenettle (*Solanum carolinense*) common dandelion (*Taraxacum officinale*), all of which were symptomless (Ramsdell and Myers, 1978)

A sap transmission study showed symptoms in a number of Chenopodiaceae sps, particularily *C. quinoa*; mottle, leaf deformities, shoot tip distortion, epinasty, with little variation throughout the year. (Dias and Cation, 1976). Other plant species such as *Nicotiana tabacum* and *Lycopersicum esculum* showed symptoms however these were transient or changed with environment conditions (Dias and Cation, 1976). C. quinoa is often used as a bioassay.

c. Symptoms on crop host including varietal differences with images of symptoms when available

Stone fruit – may show leaf distortion, internode shortening which leads to rosetting, chlorotic mottling of early leaves, darker leaves, delayed foliation (Klos, 1976)

Blueberry – Uneven leaf distribution, malformed leaves; spoon (Berkley cultivar) or elongated/crescent (Jersey cultivar) leaves. Non-uniformly distributed over the plant (Ramsdell and Gillett, 1981)

Grapevine – Stunted vines, umbrella-like appearance of canes due to crooked growth. Leaves puckered, asymmetric, shortening of internodes, frequently mottled with flattened petiolar sinuses. Crop loss due to irregular size, irregular ripening and berry shelling. Eventual death of the cane (Ramsdell and Myers, 1978, 1974; Stobbs, 1996)

d. Geographic distribution:

PRMV has a limited distribution. It has been identified in a small number of fields in the Great lakes area of North America – Ontario (Stobbs, 1996), Michigan (Allen et al., 1982; Dias and Cation, 1976; Lammers et al., 1999; Ramsdell and Gillett, 1981) and also in the Northeast and Midwest regions of USA (Martin and Tzanetakis, 2018).

In Egypt there has been a single report of PRMV in peach trees, detected with serological tests, EM and PCR, although no sequence information is available (Kheder et al., 2004). Almond trees in Turkey have also tested positive with ELISA for PRMV (Azerý and Çýçek, 1997). In Poland there has also been a single report, however, the ELISA reads were weak, and no further PRMV in the region has been reported (Paduch-Cichal et al., 2011)

e. Means of spread:
Nematodes (including *Xiphinema* and *Longidorus*) (Allen et al., 1984, 1982). PRMV is also seed transmissible in grapevine, dandelion and *C. quinoa* (Dias and Cation, 1976; Ramsdell and Myers, 1978)

f. Recognized diagnostic tests with cited references:

RT-PCR with primers designed to amplify a region within both RNA 1 and RNA 2 molecules (Ho et al., 2018).

Buffer described by Martin and Bristlow (Martin and Bristow, 1988) can be used along with PRMV ELISA kit which is commercially available (Martin and Tzanetakis, 2018).

g. Sampling recommendations for each pathogen including timing and tissue to be sampled
Young, fully developed leaf tissue collected early in the season

h. Management strategies for the pathogen and the vector(s) of the pathogen

Not growing susceptible plants in soil where PRMV has been present. Soil Fumigation to reduce nematode numbers. Eliminate weeds that are susceptible to the virus Grown in a system separate to the nematode vectors such as soilless media or potted plants separated from the ground.

Allen, W.R., Schagen, J.G.V., Ebsary, B.A., 1984. Comparative transmission of the peach rosette mosaic virus by Ontario populations of Longidorus diadecturus and Xiphinema americanum (Nematoda:Longidoridae). Can. J. Plant Pathol. 6, 29–32. https://doi.org/10.1080/07060668409501587

Allen, W.R., Van Schagen, J.G., Eveleigh, E.S., 1982. Transmission of peach rosette mosaic virus to peach, grape, and cucumber by Longidorus diadecturus obtained from diseased orchards in Ontario. Can. J. Plant Pathol. 4, 16–18.

Azerý, T., Çýçek, Y., 1997. Detection of virus diseases affecting almond nursery trees in Western Anatolia (Turkey). EPPO Bull. 27, 547–550.
Çağlayan, K., Gazel, M., 2016. Current Status of Virus Diseases in Highbush Blueberries in Turkey. Adv Biochem Biotechnol 109.
Dias, H.F., Cation, D., 1976. The characterization of a virus responsible for peach rosette mosaic and grape decline in Michigan. Can. J. Bot. 54, 1228–1239. https://doi.org/10.1139/b76-133
García, M.L., Dal Bó, E., da Graça, J.V., Gago-Zachert, S., Hammond, J., Moreno, P., Natsuaki, T., Pallás, V., Navarro, J.A., Reyes, C.A., 2017. ICTV Virus Taxonomy Profile: Ophioviridae. J. Gen. Virol. 98, 1161.
Gauthier, N.W., Polashock, J., Veetil, T.T., Martin, R.R., Beale, J., 2014. First Report of Blueberry Mosaic Disease Caused by Blueberry mosaic associated virus in Kentucky. Plant Dis. 99, 421–421. https://doi.org/10.1094/PDIS-09-14-0946-PDN
Hildebrand, E.M., 1958. Masked virus infection in plants. Annu. Rev. Microbiol. 12, 441–468.
Ho, T., Harris, A., Katsiani, A., Khadgi, A., Schilder, A., Tzanetakis, I.E., 2018. Genome sequence and detection of peach rosette mosaic virus. J. Virol. Methods 254, 8–12. https://doi.org/10.1016/j.jviromet.2018.01.004
Isogai, M., Matsuhashi, Y., Suzuki, K., Yashima, S., Watanabe, M., Yoshikawa, N., 2016. Occurrence of blueberry mosaic associated virus in highbush blueberry trees with blueberry mosaic disease in Japan. J. Gen. Plant Pathol. 82, 177–179.
Jevremović, D., Paunović, S., Leposavić, A., 2016. Incidence of viruses in highbush blueberry (Vaccinium corymbosum L.) in Serbia. Pestic. Fitomedicina 31, 45–50.
Kheder, A.., Ibrahim, A.., Mazyad, H.., 2004. Isolation and characterization of Peach Rosette Mosaic Virus (PRMV) in Egypt. Egypt. J Virol 1, 259–272.
Klos, E.J., 1976. Rosette mosaic. US Dep. Agric. Agric. Handb. 437.
Lammers, A.H., Allison, R.F., Ramsdell, D.C., 1999. Cloning and sequencing of peach rosette mosaic virus RNA1. Virus Res. 65, 57–73. https://doi.org/10.1016/s0168-1702(99)00104-5
Martin, R.R., Bristow, P.R., 1988. A carlavirus associated with blueberry scorch disease. Phytopathology 78, 1636–1640.
Martin, R.R., Polashock, J.J., Tzanetakis, I.E., 2012. New and emerging viruses of blueberry and cranberry. Viruses 4, 2831–2852.
Martin, R.R., Tzanetakis, I.E., 2018. High Risk Blueberry Viruses by Region in North America; Implications for Certification, Nurseries, and Fruit Production. Viruses 10, 342. https://doi.org/10.3390/v10070342
Paduch-Cichal, E., Kalinowska, E., Chodorska, M., Sala-Rejczak, K., Nowak, B., 2011. Detection and identification of viruses of highbush blueberry and cranberry using serological elisa test and PCR technique. Acta Sci. Pol.-Hortorum Cultus 10, 201–215.
Ramsdell, D.C., Gillett, J.M., 1981. Peach Rosette Mosaic Virus in Highbush Blueberry. Plant Dis. 65, 757–758.
Ramsdell, D.C., Myers, R.L., 1978. Epidemiology of peach rosette mosaic virus in a Concord grape vineyard. Phytopathology 68, 447–450. https://doi.org/10.1094/Phyto-68-447
Ramsdell, D.C., Myers, R.L., 1974. Peach rosette mosaic virus, symptomatology and nematodes associated with grapevine ‘degeneration’in Michigan. Phytopathology 64, 1174–1178.
Ramsdell, D.C., Stretch, A.W., 1987. Blueberry mosaic. Agric. Handb.-U. S. Dep. Agric. Comb. For. Pest Res. Dev. Program USA.

Shands, A.C., Crandall, S.G., Miles, T.D., 2017. First Report of the Ability of Olpidium virulentus to Vector Blueberry Mosaic Associated Virus (BlMaV) on Southern Highbush Blueberry in California. Plant Dis. 101, 1683. https://doi.org/10.1094/PDIS-02-17-0201-PDN

Stobbs, L.W., 1996. Occurrence of Peach Rosette Mosaic Virus on Grapevine in Southern Ontario. Plant Dis. 80, 105. https://doi.org/10.1094/pd-80-0105c

Thekke-Veetil, T., Ho, T., Keller, K.E., Martin, R.R., Tzanetakis, I.E., 2014. A new ophiovirus is associated with blueberry mosaic disease. Virus Res. 189, 92–96. https://doi.org/10.1016/j.virusres.2014.05.019

Thekke-Veetil, T., Polashock, J.J., Marn, M.V., Plesko, I.M., Schilder, A.C., Keller, K.E., Martin, R.R., Tzanetakis, I.E., 2015. Population structure of blueberry mosaic associated virus: Evidence of reassortment in geographically distinct isolates. Virus Res. 201, 79–84.

Thekke-Veetil, T., Tzanetakis, I.E., 2017. Development of reliable detection assays for blueberry mosaic- and blackberry vein banding- associated viruses based on their population structures. J. Virol. Methods 248, 191–194. https://doi.org/10.1016/j.jviromet.2017.07.014

Thompson, J.R., Dasgupta, I., Fuchs, M., Iwanami, T., Karasev, A.V., Petrzik, K., Sanfaçon, H., Tzanetakis, I., van der Vlugt, R., Wetzel, T., 2017. ICTV virus taxonomy profile: Secoviridae. J. Gen. Virol. 98, 529.

Varney, E.H., 1957. Mosaic and shoestring, virus diseases of cultivated blueberry in New Jersey.

j. Names of reviewers: Ioannis E. Tzanetakis, Robert R. Martin,

k. Date of last update: March 2019