Cherry Leaf Roll Virus

a. Virus/pathogen name, including accepted acronyms and synonyms

Cherry leaf roll virus, CLRV - Genus *Nepovirus*, Subfamily *Comovirinae*, Family *Secoviridae*, Order *Picornavirales*.
Synonyms - Elm mosaic, Golden elderberry mosaic

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

Known natural hosts include a broad range of trees, shrubs, and herbaceous hosts. Some important crop hosts are apple (*Malus domestica*), elderberry (*Sambucus* spp.), grapevine (*Vitis* spp.), kiwifruit (*Actinidia chinensis*), pecan (*Carya illinoensis*), plantain (*Plantago major*), potato, olive (*Olea europaea*), raspberry (*Rubus* spp.), red currant, rhubarb (*Rheum rhabarbarum*), stone fruits (*Prunus* spp.), and *Vaccinium* spp., walnut (*Juglans* spp.) (Bargen *et al.* 2012; Borja & Pons 1992; Jones & Wood 1978; Werner *et al.* 1997, Woo *et al.* 2013).
Other hosts: ash (*Fraxinus* spp.), beech (*Fagus* spp.), birch (*Betula* spp.), flowering dogwood (*Cornus florida*), dock (*Rumex* spp.), elm (*Ulmus* spp.), hornbeam, hydrangea (*Hydrangea macrophylla*), *Rhamnus* spp., and spindle tree (*Euonymus europaeus*).
Experimental hosts include: *Chenopodium amaranticolor*, *Chenopodium quinoa*, *Nicotiana benthamiana, N. clevelandii, N. occidentalis, N. tabacum, Cucumis sativus, Phaseolus vulgaris.*

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

Symptoms vary widely based on host species, cultivar and virus strain. CLRV commonly causes foliar symptoms such as mosaic, chlorotic or yellow ring patterns or ringspots, yellow vein netting and yellow spotting (Büttner et al., 2011). Other common symptoms include leaf rolling, general decline, and dieback. In many hosts, symptoms disappear or are reduced in the summer. In raspberry, reported symptoms include stunting, chlorosis and mottling on the leaves, as well as irregular development (Cropley & Tomlinson, 1971; Ormerod, 1972, 1975; Jones & Wood 1978).
As with many nepoviruses, there could be a hypersensitive reaction at the union of the graft that creates the characteristic necrotic black line around the tree that results in die-back. The tree would sucker from the rootstock, and eventually the scion would die. In cherry, symptoms include leaf rolling, delayed flowering, late ripening, smaller fruit, and poor fruit color that can be unmarketable. Early leaf drop and failure of buds to develop can leave the tree with a sparse canopy and blind wood. CLRV is one of the causes of virus-induced cherry decline, which occurs when infected with multiple viruses.

d. Geographic distribution:

CLRV was first described in England in sweet cherry (Posnette & Cropley 1955; Cropley 1960; Cropley 1961). Since then, CLRV is distributed globally, but not limited to, Australia (Woo *et al.*

2012), Chile (Herrera and Madariaga 2001), Czech Republic (Cieślińska 2020), Germany (von Bargen *et al.* 2012), Italy (Ferretti *et al.* 2017), Finland (Jalkanen *et al.* 2007), Spain, United Kingdom, New Zealand (Jones and Wood 1978), and Syria (Al-Chaabi and Ismaeil 2009). In the United States, CLRV has been reported in Arkansas (Larsen *et al.* 1990), California (Rowhani and Mircetich 1988), Oregon (Lutes and Pscheidt 2018), South Carolina (Reddick *et al.* 2007), and Washington (Eastwell and Howell 2010).

e. Means of spread:

CLRV is naturally transmitted by pollen and seed. Through pollen transmission, CLRV has a high potential to spread across areas and to hosts of different species/genera. CLRV can also be spread by grafting or mechanical means. Unlike other nepoviruses, there is not strong evidence of transmission by nematodes.

f. Recognized diagnostic tests with cited references:

RT-PCR recommended as it is most sensitive for detection (Werner *et al.* 1997; Borja & Pons 1992, Kumari 2009; Lebas *et al*., 2016)
Double antibody sandwich enzyme-linked immunosorbent assays (DAS-ELISA) tests are available commercially (Lebas *et al*. 2016). Inconsistent distribution of the virus within hosts may make this test ineffective in some cases. ELISAs can specify between different strains of CLRV such as cherry or walnut (Jones and Murant 1971; Rowhani *et al*., 1985).
Dot-blot hybridization test have been found to be effective (Borja *et al*. 1995; Massalski and Cooper 1986)

Biological indexing on indicator plants is typical for clean plant certification.

g. Sampling recommendations for each pathogen including timing and tissue to be sampled

Tissue sampling is recommended during spring-early summer, this period is reported as the most conducive to virus isolation (Srecko et al., 1980). Young leaves/leaf buds, inflorescences, cortical tissue of young twigs, or single seeds can be sampled for detection. CLRV distribution and titer can vary wildly both by season and host, symptomatic tissue should be targeted for the best chance of detection.

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

The planting of material derived from virus-tested elite stock should be the first line of defense against this pathogen. Other management strategies are specific to the host:
Monitor orchard for blackline symptoms in late summer/early fall, quickly remove any affected trees. In affected areas, consider own-rooted trees that can escape the disease. The transmission of CLRV by pollen makes its spread in crops difficult to control except by the use of plants immune or resistant to infection.

i. References

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