Strawberry Phytoplasma Diseases

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

Phytoplasma Diseases of Strawberry

'Candidatus Phytoplasma asteris', Green petal disease of strawberry
'Candidatus Phytoplasma australiense', Lethal decline disease and Green petal disease of strawberry
'Candidatus Phytoplasma fragariae' Strawberry yellows disease
'*Candidatus* Phytoplasma hispanicum', Strawberry green petal and Strawberry multiplier disease

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

All phytoplasmas associated with diseases in strawberry all are able to infect other crops, including several of the national clean plant network crops

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

Each of the phytoplasmas causes a greening of the petals and or yellowing of the leaves. In many cases, some of the achenes on the fruit form leaves (fruit phyllody) symptomology caused by multiple phytoplasmas (Jomantiene et al., 2002). Phyllody symptoms are not seen with other pathogens except for tomato ringspot virus in 'Rainier', but can be a result of herbicide damage or excess chilling of transplants in storage (Bolda and Koike, 2015). Leaves on the plants may develop a reddening or chlorosis. In some cases there is witches' brooming (Harrison et al., 2007; Jomantiene et al., 2002) which canbe caused by multiple phytoplasmas (Jomantiene et al., 2002). The phytoplasmas that infect strawberry are not evenly distributed around the world, but at least one has been reported from each continent strawberry is grown other that Africa

d. Geographic distribution:

'Ca. Phytoplasma asteris' is present in the Americas, Europe and Asia but has not been reported from Australasia. 'Ca. Phytoplasma australiense has been reported to be widespread in Australasia and there is a single report from Israel. 'Ca. Phytoplasma fragariae' has been reported in Europe. '*Candidatus* Phytoplasma hispanicum' has been reported IN the Americas.

e. Means of spread: Phytoplasmas are all vectored by leafhoppers.
'Candidatus Phytoplasma asteris' is transmitted by *Aphrodes bicincta, Macrosteles fascifrons, Euscelis lineolata and E. plebejus.*
'Candidatus Phytoplasma australiense' is transmitted by *Aphrodes bicincta*
'Candidatus Phytoplasma fragarie' Strawberry yellows disease
'*Candidatus* Phytoplasma hispanicum', Strawberry green petal and Strawberry multiplier disease

f. Recognized diagnostic tests with cited references:

Diagnosis is by generic phytoplasma PCR (Smart et al., 1996) or real-time PCR (Satta et al., 2017).

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

Phytoplasmas are phloem-limited pathogens, therefore petiole and midrib tissue should be collected from plants. If there are symptoms it is best to collect from symptomatic tissues.

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

Control is best targeted during nursery production if the nursery is located in an area where there is inoculum and vectors present (Bertaccini and Duduk, 2009; Kumari et al., 2019). In fruit production fields control measures should not be necessary if starting with certified plants.

i. References

Bertaccini, A. and Duduk, B. 2009. Phytoplasma and phytoplasma disease: a review of recent research. Phytopathologia Mediterranea 48:355-378.

Bolda, M. and Koike, S. 2015. Phyllody on strawberry. https://ucanr.edu

Harrison, N.A., Legard, D.E., DiBonito, R. and Richardson, P.A. 1997. Detection and differentiation of phytoplasmas associated with diseases of strawberry in Florida. Plant Disease 81:230.

Kumari, S., Nagendran, K.,Rai, A.B., Singh, B., Rao, G.P. and Bertaccini, A. 2019. Global status of phytoplasma diseases in vegetable crops. Frontier in Microbiology doi.org/10.3389/fmicb.2019.01349

Padovan, A., Gibb, K. and Persley, D. 2001. Association of '*Candidatus* Phytoplasma australiense' with green petal and lethal yellows disease in strawberry. Plant Pathology 49:362-369.

Pérez-López, E. and Dumonceaux, T.J. 2016. Detection and identification of the heterogeneous novel subgroup 16SrXIII-(A/I)I phytoplasma associated with strawberry green petal disease and Mexican periwinkle virescence. International Journal of Systemic and Evolutionary Microbiology 66:4406-4415.

Satta, E., Nanni, I.M., Contaldo, N., Collina, M., Poveda, J.B., Ramírez, A.S. and Bertaccini, A. 2017. General phytoplasma detection by a q-PCR method using mycoplasma primers. Molecular and Cellular Probes 35:1-7.

Smart, C.D., Schneider, B., Blomquist, C.L., Guerra, L.J., Harrison, N.A., Ahrens, U., Lorenz, K.-H., Seemüller, E. and Kirkpatrick, B.C. 1996. Applied and Environmental Microbiology 62:2988-2993.

Valiunas D., Staniulis, J. and Davis, R.E. 2006. ‘Candidatus Phytoplasma fragariae’, a novel phytoplasma taxon discovered in yellows diseased strawberry, Fragaria x ananassa. International Journal of Systematic and Evolutionary Microbiology 56, 27–281.

Names of reviewers: Ioannis E. Tzanetakis

Date of last update: August 2024