

EPPO Datasheet: '*Candidatus Phytoplasma fraxini*'

Last updated: 2023-07-12

IDENTITY

Preferred name: '*Candidatus Phytoplasma fraxini*'

Authority: Griffiths, Sinclair, Smart & Davis

Taxonomic position: Bacteria: Tenericutes: Mollicutes:
Acholeplasmatales: Acholeplasmataceae

Other scientific names: *Phytoplasma fraxini* Griffiths, Sinclair,
Smart & Davis

Common names: Ash yellows phytoplasma, AshY, Lilac witches'
broom phytoplasma, IWB, witches' broom of lilac, yellows of ash
[view more common names online...](#)

EU Categorization: A1 Quarantine pest (Annex II A)

EPPO Code: PHYPPFR

Notes on taxonomy and nomenclature

'*Candidatus Phytoplasma fraxini*' formerly 16SrVII group or Ash Y, is a species that contains several strains: 16SrVII-A has been reported in North America, and 16SrVII-B, 16SrVII-C, 16SrVII-D, 16SrVII-E, 16SrVII-F, and 16SrVII-G in South America. However, the strain found in the central area of Colombia 16SrVII-G, which is believed to have originated in North America, is more similar to 16SrVII-A than to the strains described in South America (Griffiths *et al.*, 1999; Barros *et al.*, 2002; Flôres *et al.*, 2015; Gajardo *et al.*, 2009; da Silva *et al.*, 2017; Franco-Lara *et al.*, 2020).

HOSTS

'*Candidatus Phytoplasma fraxini*' was initially reported in wild plants of the Oleaceae family affected with Ash yellows disease (AshY) and Lilac witches'-broom (LWB), in Canada and the United States. Susceptible species within the *Fraxinus* genus include *F. americana* (white ash), *F. angustifolia*, *F. bungeana*, *F. excelsior* (European ash), *F. latifolia*, *F. nigra* (black ash), *F. ornus* (flowering ash), *F. pennsylvanica* (green ash or red ash), *F. potamophila*, *F. profunda*, *F. quadrangulata* (blue ash), and *F. velutina* (Sinclair and Griffiths, 1994). Within the genus *Syringa*, plants of *S. x diversifolia*, *S. x henryi*, *S. x josiflexa*, *S. josikaea*, *S. julianae*, *S. komarowii*, *S. laciniata*, *S. meyeri*, *S. microphylla*, *S. nanceiana*, *S. oblata*, *S. patula*, *S. persica*, *S. x prestoniae*, *S. sweginzowii*, *S. tomentella*, *S. villosa*, *S. vulgaris* and *S. yunnanensis* have been reported as hosts (Sinclair and Griffiths, 1994; Sinclair *et al.*, 1996; Walla *et al.*, 2000).

In 2001, '*Ca. P. fraxini*' was first reported in South America, infecting diseased urban *Fraxinus uhdei* (urapan) trees in Bogotá, Colombia (Griffiths *et al.*, 2001). Evidence suggests it has moved from *F. uhdei* to other urban tree species such as *Acacia melanoxylon* (Fabaceae), *Croton* spp. (Euphorbiaceae), *Eugenia neomyrtifolia* (Myrtaceae), *Liquidambar styraciflua* (Altingiaceae), *Magnolia grandiflora* (Magnoliaceae), *Pittosporum undulatum* (Pittosporaceae), *Populus nigra* (Salicaceae), *Sambucus nigra* (Viburnaceae) and *Salix humboldtiana* (Salicaceae) and *Quercus humboldtii* (Fagaceae) (Franco-Lara and Perilla-Henao, 2014; Franco-Lara *et al.*, 2017; Franco-Lara, 2019). It also infects plants from several families in Cundinamarca, the Colombian department in which Bogotá is located. Susceptible plants include potato *Solanum tuberosum* (Solanaceae) and strawberry *Fragaria x ananassa* (Rosaceae) crops, and the grass *Cenchrus clandestinus* (Poaceae) and weeds *Amaranthus dubius* (Amaranthaceae), *Cymbalaria muralis* (Plantaginaceae), *Fumaria capreolata* (Papaveraceae), *Holcus lanatus* (Poaceae), *Gnaphalium spicatum* (Asteraceae), *Gnaphalium cheiranthifolium* (Asteraceae), *Lepidium bipinnatifidum* (Brassicaceae), *Senecio vulgaris* (Asteraceae), *Sonchus oleraceus* (Asteraceae) and *Taraxacum officinale* (Asteraceae) (Franco-Lara, 2019; Varela-Correa and Franco-Lara, 2020; Franco-Lara *et al.*, 2023).

In Brazil, '*Ca. P. fraxini*' has been found in natural infections in the Asteraceae *Erigeron* sp. and *Vernonia brasiliensis*, and in the Apocynaceae *Catharanthus roseus* (Barros *et al.*, 2002; Montano *et al.*, 2014; Flôres *et al.*, 2015; da

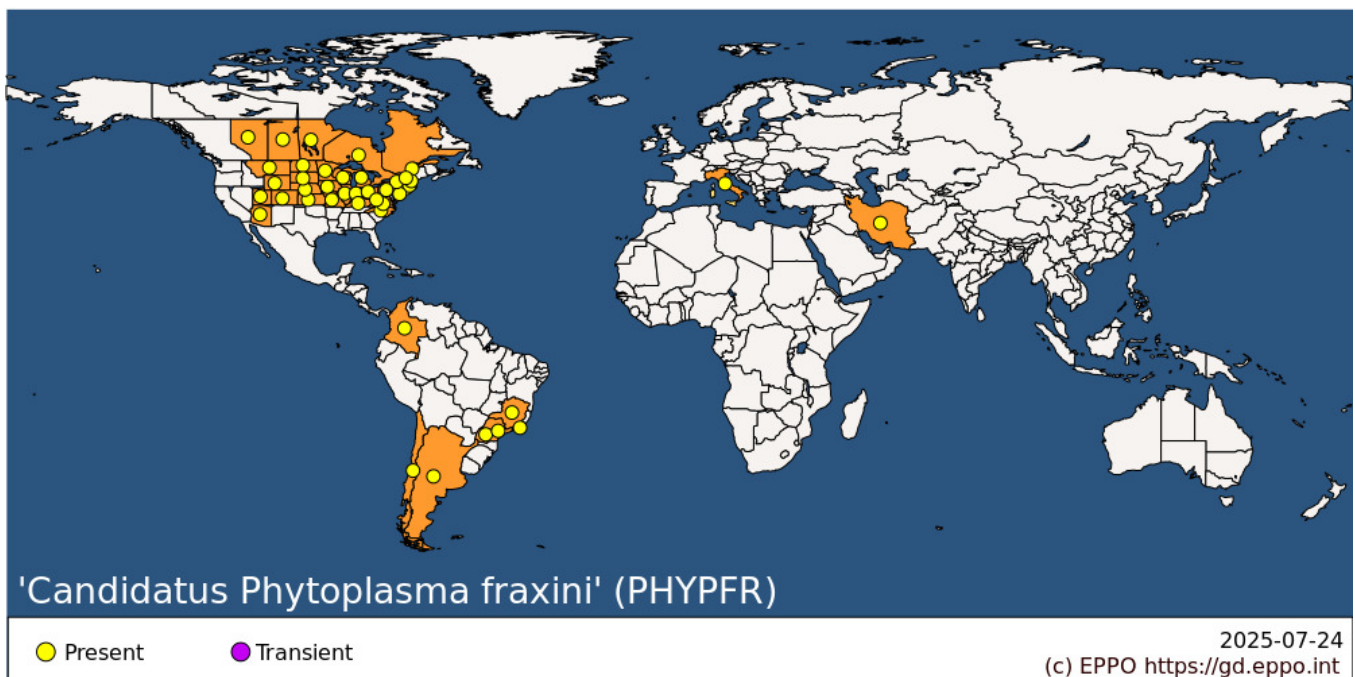
Silva *et al.*, 2017). In Argentina this bacterium is found associated with Argentinian alfalfa witches'-broom in *Medicago sativa* (Fabaceae) (Conci *et al.*, 2005), strawberry (Fernández *et al.*, 2013) and Asteraceae weeds *Artemisia annua* and *Conyza bonariensis* (Meneguzzi *et al.*, 2008). In Chile, 'Ca. P. fraxini' has been detected in vineyards infecting *Vitis vinifera* (Vitaceae), and weeds such as *Convolvulus arvensis* (Convolvulaceae), *Galega officinalis* (Fabaceae), *Gaultheria phillyreifolia* (Ericaceae), *Paeonia lactiflora* (Paeoniaceae), *Polygonum aviculare* (Polygonaceae) and *Ugni molinae* (Myrtaceae) (Fiore *et al.*, 2007; Arismendi *et al.*, 2010; Arismendi *et al.*, 2011; Gajardo *et al.*, 2009; Longone *et al.*, 2011).

Outside the Americas, 'Ca. P. fraxini' has been occasionally detected in Italy infecting grapevine (Zambon *et al.*, 2018) and *Hypericum perforatum* (Hypericaceae) (Bruni *et al.*, 2005), and in Iran in *Phoenix dactylifera* (Arecaceae) (Ghayeb Zamharir and Eslahi, 2019).

Experimental hosts include *C. roseus*, *Cuscuta* spp. (Convolvulaceae) (dodder), *Daucus carota* (Apiaceae), *Phaseolus vulgaris* (Fabaceae), and *Trifolium pratense* (Fabaceae) (Sinclair and Griffiths, 1996; Perilla-Henao *et al.*, 2016).

Host list: *Acacia melanoxylon*, *Amaranthus dubius*, *Artemisia annua*, *Cenchrus clandestinus*, *Convolvulus arvensis*, *Croton* sp., *Cymbalaria muralis*, *Erigeron bonariensis*, *Eugenia neomyrtifolia*, *Fragaria x ananassa*, *Fraxinus americana*, *Fraxinus angustifolia*, *Fraxinus bungeana*, *Fraxinus excelsior*, *Fraxinus latifolia*, *Fraxinus nigra*, *Fraxinus ornus*, *Fraxinus pennsylvanica*, *Fraxinus profunda*, *Fraxinus quadrangulata*, *Fraxinus sogdiana*, *Fraxinus uhdei*, *Fraxinus velutina*, *Fraxinus*, *Fumaria capreolata*, *Galega officinalis*, *Gamochaeta purpurea*, *Gaultheria phillyreifolia*, *Gnaphalium cheiranthifolium*, *Holcus lanatus*, *Hypericum perforatum*, *Lepidium bipinnatifidum*, *Liquidambar styraciflua*, *Magnolia grandiflora*, *Medicago sativa*, *Paeonia lactiflora*, *Phoenix dactylifera*, *Pittosporum undulatum*, *Polygonum aviculare*, *Populus nigra*, *Prunus* sp., *Pyrus* sp., *Quercus humboldtii*, *Salix humboldtiana*, *Sambucus nigra*, *Senecio vulgaris*, *Solanum tuberosum*, *Sonchus oleraceus*, *Syringa josikaea*, *Syringa julianae*, *Syringa komarowii*, *Syringa laciniata*, *Syringa meyeri*, *Syringa nanceiana*, *Syringa oblata*, *Syringa persica*, *Syringa pubescens* subsp. *microphylla*, *Syringa pubescens* subsp. *patula*, *Syringa tomentella* subsp. *sweginzowii*, *Syringa tomentella* subsp. *yunnanensis*, *Syringa tomentella*, *Syringa villosa*, *Syringa vulgaris*, *Syringa x diversifolia*, *Syringa x henryi*, *Syringa x josiflexa*, *Syringa x prestoniae*, *Syringa*, *Taraxacum officinale*, *Ugni molinae*, *Vernonanthura brasiliiana*, *Vitis vinifera*

GEOGRAPHICAL DISTRIBUTION



EPPO Region: Italy (mainland)

Asia: Iran, Islamic Republic of

North America: Canada (Alberta, Manitoba, Ontario, Québec, Saskatchewan), United States of America (Arizona, Colorado, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Minnesota, Missouri,

Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, South Dakota, Utah, Vermont, Virginia, West Virginia, Wisconsin, Wyoming)

South America: Argentina, Brazil (Minas Gerais, Parana, Rio de Janeiro, Sao Paulo), Chile, Colombia

BIOLOGY

The epidemiology of ‘*Ca. P. fraxini*’ associated diseases has been described in detail for Bogotá and surrounding areas of Cundinamarca, in Colombia. In this area, ‘*Ca. P. fraxini*’ is usually present in mixed infections with ‘*Candidatus Phytoplasma asteris*’ related strains (Franco-Lara and Perilla-Henao, 2014; Perilla-Henao *et al.*, 2016; Franco-Lara, 2019; Franco-Lara *et al.*, 2020; Franco-Lara *et al.*, 2023). At least two insect vectors are present in this area, *Amplicephalus funzaensis* and *Exitianus atratus* (both Hemiptera: Cicadellidae) (Perilla-Henao *et al.*, 2016). These are polyphagous insect species that transmit both phytoplasmas and reproduce in the widespread grass species *C. clandestinus*. Other Cicadellidae species within the Deltocephalinae and Typhlocybinae are known to become infected with phytoplasmas but their ability to transmit these has not been tested (Perilla-Henao *et al.*, 2016; Lamilla *et al.*, 2022). *C. clandestinus* is an asymptomatic host of both ‘*Ca. P. fraxini*’ and ‘*Ca. P. asteris*’ and hosts not only *A. funzaensis* and *E. atratus*, but also other potential insect vectors.

Potential insect vectors in Canada include *Graminella nigrifrons* (Hemiptera: Cicadellidae) (Arocha-Rosete *et al.*, 2011) and *Paraphlepsius irroratus* (Hemiptera: Cicadellidae) and spittlebug *Philaenus spumarius* (Hemiptera: Cercopidae) (Matteoni and Sinclair, 1988). In the United States, *Scaphoideus* spp. and *Colladonus clitellarius* (Hemiptera: Cicadellidae) (Hill and Sinclair, 2000) have both been detected as infected with phytoplasmas. In Chile, *Paratanus exitiosus* (Hemiptera: Cicadellidae) (Longone *et al.*, 2011) is a potential insect vector of ‘*Ca. P. fraxini*’.

DETECTION AND IDENTIFICATION

Symptoms

Symptoms vary between species, but some general features are observed. In susceptible taxa, Ash yellows and Lilac witches’-brooms are characterized by slow growth, loss of vitality, dieback (dead branches) and sometimes, early death of the plant. Other symptoms on trees species include light green or chlorotic foliage, witches’-brooms (proliferation of axilar shoots from one point that results in broom-like appearance), tufted foliage (branches with slow twig growth and short internodes that cause foliage to appear bunched), epicormic shoots (abnormal and disorderly proliferation of shoots that emerge from the trunk or branches), small leaves (leaves that never reach the normal leaf size), deliquescent branching (loss of apical dominance), abnormally elongated or shortened branches) which produce a deformation of the normal architecture of the tree crowns (Sinclair and Griffiths, 1994; Sinclair *et al.*, 1996; Franco-Lara and Perilla-Henao, 2014; Lamilla *et al.*, 2022).

In herbaceous plants such as potato, symptoms include leaf yellowing and curling, leaves with purple margins, excessive shoot proliferation and abnormally short or long internodes and leaves with altered shape and development (Varela-Correa and Franco-Lara, 2020; Franco-Lara *et al.*, 2023). Infected strawberry plants show symptoms such as virescence, achenes’ hypertrophy and phyllody development that prevent the normal fruit formation (Perilla-Henao and Franco-Lara, 2012; Fernandez *et al.*, 2013). In infected grapevines, symptoms vary with the plant variety; however, yellowing, downward rolling of leaves and leaf vein reddening are commonly observed (Gajardo *et al.*, 2009). Alfalfa plants infected with *Ca. P. fraxini*’ can become stunted and develop small leaves, excessive shoot proliferation and flower abnormalities, although some plants are almost asymptomatic (Conci *et al.*, 2005). In plants of infected *Erigeron* sp., *Conyza bonariensis*, *Gaultheria phillyreifolia* and *Ugni molinae*, the main symptom is the formation of witches’-brooms, while in *Paeonia lactiflora*, plant malformation, necrosis, leaf rolling and flower virescence and flower bud drying are observed (Barros *et al.*, 2002; Meneguzzi *et al.*, 2008; Arismendi *et al.*, 2011). Some infected plants, such as the kikuyu grass *C. clandestinus* are completely asymptomatic (Franco-Lara, 2019).

Morphology

Electronic microscopy observations have shown the presence of pleomorphic translucent bodies of about 1 µm in the sieve tube elements or companion cells of infected potato plants and Andean oak (*Q. humboldtii*) trees infected with ‘*Ca*

. *P. fraxini*'. These bodies were not observed in tissues other than the phloem. Using electronic microscopy, they were indistinguishable from other phytoplasmas (Lamilla *et al.*, 2021; Franco Lara *et al.*, 2023).

Detection and inspection methods

Symptoms are important evidence of the occurrence of phytoplasmas; however, their presence should be confirmed by molecular methods. The most common method of detection is amplification of the 16S rRNA gene by PCR techniques. A commonly used method is detection of the 16S rRNA gene by nested PCR using universal primers for phytoplasmas (Bertaccini *et al.*, 2019; Lee *et al.*, 1993; Gundersen & Lee; 2006), followed by RFLP analysis or sequencing of the amplicon (Lee *et al.*, 1998; Zhao *et al.*, 2009). Real-time PCR methods have also been developed to detect '*Ca. P. fraxini*' with universal primers (Christensen *et al.*, 2004; Satta *et al.*, 2017).

PATHWAYS FOR MOVEMENT

'*Ca. P. fraxini*' is transmitted locally by insect vectors. Long distance spread of the pathogen can be caused by movement of infected material such as stem cuttings or seed-tubers. Grafting of infected material is also a possible pathway for phytoplasmas movement. There is no evidence of '*Ca. P.* dispersal by seeds.

PEST SIGNIFICANCE

Economic impact

Several of the '*Ca. P. fraxini*' susceptible species are tree or bushes of ornamental and ecological value in wild and urban forests. In these cases, the economic impact of the disease is mainly due to the negative impact on ecosystem services and loss of trees. Direct economic impact can occur in timber trees as well as in crops such as potato, strawberry, alfalfa, and grapevine, although the economic losses have not been estimated.

Control

Currently there are no curative methods against phytoplasma diseases, and resistance or tolerance to these pathogens is rare. Classical approaches include roguing, and insecticide treatments can be used against vectors, although these measures do not eliminate completely the source of inoculum. Integrated pest management strategies can be designed but require knowledge of the particularities of each pathosystem such as the susceptibility of the plant hosts, the insect vectors involved and their feeding habits. In economically important systems, symptoms and insect vector appearance should be permanently monitored to take further management decisions. For instance, tubers obtained from potato fields infected with phytoplasmas should not be used as seed-tubers for future planting seasons. Infected plants should not be used as propagating or grafting materials. Elimination of infected weeds is recommended, but it is not a definitive control measure. Using phytoplasma-free planting material should be a priority and molecular tests to confirm the absence of phytoplasmas in them is recommended.

Phytosanitary risk

'*Ca. P. fraxini*' can infect plants in many botanical families. As with other phytoplasmas, its host range is more dependent on the feeding habits of the insect vectors than on the susceptibility of the plant hosts. The phytosanitary risk of '*Ca. P. fraxini*' relates to its ability to infect woody and herbaceous plants, but so far it has not been associated with any devastating disease.

PHYTOSANITARY MEASURES

In the case of trees and crops, phytoplasma-free planting material should be used and, where appropriate should have been produced in the framework of a certification scheme. It may also be recommended that plants for planting originate from pest-free places of production.

REFERENCES

- Arismendi N, Andrade N, Riegel R & Carrillo R (2010) Presence of a phytoplasma associated with witches' broom disease in *Ugni molinae* Turcz. and *Gaultheria phillyreifolia* (Pers.) Sleumer determined by DAPI, PCR, and DNA sequencing. *Chilean Journal of Agricultural Research* **70**, 26-33.
- Arismendi N, Gonzalez F, Zamorano A, Andrade N, Pino AM & Fiore N (2011) Molecular identification of 'Candidatus Phytoplasma fraxini' in murta and peony in Chile. *Bulletin of Insectology* **64**(Supplement), S95-S96.
- Arocha-Rosete Y, Kent P, Agrawal V, Hunt D, Hamilton A, Bertaccini A, Scott J, Crosby W & Michelutti R (2011) Identification of *Graminella nigrifrons* as a potential vector for phytoplasmas affecting *Prunus* and *Pyrus* species in Canada. *Canadian Journal of Plant Pathology* **33**, 465-474.
- Bertaccini A, Paltrinieri S & Contaldo N (2019) Standard detection protocol: PCR and RFLP analyses based on 16S rRNA gene. In *Phytoplasmas: Methods and Protocols, Methods in Molecular Biology* (eds Musetti R & Pagliari L), volume 1875, pp. 83-95. Springer Science+Business Media, LLC, New York, USA.
- Barros TS, Davis RE, Resende RO & Dally EL (2002) Erigeron witches'-broom phytoplasma in Brazil represents new subgroup VII-B in 16S rRNA gene group VII, the ash yellows phytoplasma group. *Plant Disease* **86**, 1142-1148.
- Bruni R, Pellati F, Bellardi MG, Benvenuti S, Paltrinieri S, Bertaccini A & Bianchi A (2005) Herbal drug quality and phytochemical composition of *Hypericum perforatum* L. affected by ash yellows phytoplasma infection. *Journal of Agricultural and Food Chemistry* **53**, 964-968.
- Christensen NM, Nicolaisen M, Hansen M & Schulz A (2004) Distribution of phytoplasmas in infected plants as revealed by real-time PCR and bioimaging. *Molecular Plant-Microbe Interactions* **17**, 1175-1184.
- Conci L, Meneguzzi N, Galdeano E, Torres L, Nome C & Nome S (2005) Detection and molecular characterisation of an alfalfa phytoplasma in Argentina that represents a new subgroup in the 16S rDNA ash yellows group ('Candidatus Phytoplasma fraxini'). *European Journal of Plant Pathology* **113**, 255-265.
- da Silva Fugita J M, Pereira TBC, Banzato TC, Kitajima EW, da Souto ER & Bedendo IP (2017) Molecular characterization of a phytoplasma affiliated with the 16SrVII group representative of the novel 16SrVII-F subgroup. *International Journal of Systematic and Evolutionary Microbiology* **67**, 3122-3126.
- Fernández F D, Conci VC, Kirschbaum DS & Conci LR (2013) Molecular characterization of a phytoplasma of the ash yellows group occurring in strawberry (*Fragaria x ananassa* Duch.) plants in Argentina. *European Journal of Plant Pathology* **135**, 1-4.
- Fiore N, Prodan S, Paltrinieri S, Gajardo A, Botti S, Pino A M, Montealegre J & Bertaccini A (2007) Molecular characterization of phytoplasmas in Chilean grapevines. *Bulletin of Insectology* **60**, 331.
- Flôres D, Amaral Mello APDO, Pereira TBC, Rezende JAM & Bedendo IP (2015) A novel subgroup 16SrVII-D phytoplasma identified in association with erigeron witches' broom. *International Journal of Systematic and Evolutionary Microbiology* **65**, 2761-2765.
- Franco-Lara L (2019) Epidemiological aspects of phytoplasma diseases in a tropical country. *Phytopathogenic Mollicutes* **9**, 45-46.
- Franco-Lara L, Contaldo N, Mejia JF, Paltrinieri S, Duduk B & Bertaccini (2017) Detection and identification of phytoplasmas associated with declining *Liquidambar styraciflua* trees in Colombia. *Tropical Plant Pathology* **42**, 352-361.
- Franco-Lara L, García JA, Bernal YE & Rodríguez RA (2020) Diversity of the 'Candidatus Phytoplasma asteris' and 'Candidatus Phytoplasma fraxini' isolates that infect urban trees in Bogotá, Colombia. *International Journal of Systematic and Evolutionary Microbiology* **70**, 6508-6517.

- Franco-Lara L, Varela-Correa CA, Guerrero-Carranza GP & Quintero-Vargas JC (2023) Association of phytoplasmas with a new disease of potato crops in Cundinamarca, Colombia. *Crop Protection* **163**, 106-123.
- Franco-Lara L & Perilla-Henao LM (2014) Phytoplasma diseases in trees of Bogotá, Colombia: a serious risk for urban trees and Crops. In: Bertaccini A (ed) *Phytoplasmas and Phytoplasma Disease Management: How to Reduce Their Economic Impact*, 1 ed. Bologna: IPWG – COST, pp. 90–100.
- Gajardo A, Fiore, N, Prodan S, Paltrinieri S, Botti S, Pino AM, Zamorano A, Montealegre J & Bertaccini A (2009) Phytoplasmas associated with grapevine yellows disease in Chile. *Plant Disease* **93**, 789-796.
- Ghayeb Zamharir M & Eslahi MR (2019) Molecular study of two distinct phytoplasma species associated with streak yellows of date palm in Iran. *Journal of Phytopathology* **167**, 19-25.
- Griffiths HM, Boa ER & Filgueira JJ (2001) Ash yellows disease of *Fraxinus chinensis* in Colombia. *Phytopathology* **91**, S32-S33.
- Griffiths HM, Sinclair WA, Smart CD & Davis RE (1999) The phytoplasma associated with ash yellows and lilac witches'-broom: '*Candidatus* Phytoplasma fraxini'. *International Journal of Systematic and Evolutionary Microbiology* **49**, 1605-1614.
- Gundersen DE & Lee IM (1996) Ultrasensitive detection of phytoplasmas by nested-PCR assays using two universal primer pairs. *Phytopathologia Mediterranea* **35**, 144-151.
- Hill GT & Sinclair WA (2000) Taxa of leafhoppers carrying phytoplasmas at sites of ash yellows occurrence in New York State. *Plant Disease* **84**, 134-138.
- Lamilla J, Solano CJ & Franco-Lara L (2022) Epidemiological characterization of a disease associated with phytoplasmas in Andean oak, *Quercus humboldtii* Bonpland, in Bogotá—Colombia. *Forest Pathology* **52**, e12730.
- Lee IM, Hammond RW, Davis RE & Gundersen DE (1993) Universal amplification and analysis of pathogen 16S rDNA for classification and identification of mycoplasmalike organisms. *Phytopathology* **83**, 834-842.
- Lee IM, Gundersen-Rindal DE, Davis RE & Bartoszyk IM (1998) Revised classification scheme of phytoplasmas based on RFLP analyses of 16S rRNA and ribosomal protein gene sequences. *International Journal of Systematic Bacteriology* **48**, 1153-1169.
- Longone V, Gonzalez F, Zamorano A, Pino AM, Araya J, Diaz V, Paltrinieri S, Calari A, Bertaccini A, Picciau L, Alma A & Fiore N (2011) Epidemiological aspects of phytoplasmas in Chilean grapevines. *Bulletin of Insectology* **64** (Supplement), S91-S92.
- Matteoni JA & Sinclair WA (1988) Elm yellows and ash yellows. Tree mycoplasmas and mycoplasma diseases. 19-31. University of Alberta. Press.
- Meneguzzi NG, Torres LE, Galdeano E, Guzmán FA, Nome SF & Conci LR (2008) Molecular characterization of a phytoplasma of the ash yellows group (16Sr VII-B) occurring in *Artemisia annua* and *Conyza bonariensis* weeds. *AgriScientia* **21**, 7-15.
- Montano HG, Bertaccini A, Pimentel JP, Paltrinieri S & Contaldo N (2014) Erigeron (*Conyza bonariensis*), a host of '*Candidatus* Phytoplasma fraxini'-related strain in Brazil. *Phytopathogenic Mollicutes* **4**, 72-76.
- Olivier CY, Lowery DT & Stobbs LW (2009) Phytoplasma diseases and their relationships with insect and plant hosts in Canadian horticultural and field crops. *The Canadian Entomologist* **141**, 425-462.
- Perilla LM, Franco-Lara L (2012) Phytoplasmas of group 16SrI associated with strawberry (*Fragaria x ananassa*) in Colombia. 22nd International Conference on Virus and Other Graft Transmission Diseases of Fruit Crops. *Petria* **22**, 342.

Perilla?Henao L, Wilson MR & Franco?Lara L (2016) Leafhoppers *Exitianus atratus* and *Amplipcephalus funzaensis* transmit phytoplasmas of groups 16SrI and 16Sr VII in Colombia. *Plant Pathology* **65**, 1200-1209.

Satta E, Nanni IM, Contaldo N, Collina M, Poveda JB, Ramírez AS & Bertaccini A (2017) General phytoplasma detection by a q-PCR method using mycoplasma primers. *Molecular and Cellular Probes* **35**, 1-7.

Sinclair WA & Griffiths HM (1994) Ash yellows and its relationship to dieback and decline of ash. *Annual Review of Phytopathology* **32**, 49-60.

Sinclair WA, Griffiths HM & Davis RE (1996) Ash yellows and lilac witches'-broom: phytoplasma diseases of concern in forestry and horticulture. *Plant Disease* **80**, 468-475.

Varela-Correa CA & Franco-Lara L (2020) First report of a '*Candidatus Phytoplasma fraxini*'-related strain associated with potato in Colombia. *Plant Disease* **104**, 2720-2720.

Walla JA, Jacobi WR, Tisserat NA, Harrell MO, Ball JJ, Neill GB, Reynard DA, Guo YH & Spiegel L (2000) Condition of green ash, incidence of ash yellows phytoplasmas, and their association in the Great Plains and Rocky Mountain regions of North America. *Plant Disease* **84**, 268-274.

Zambon Y, Canel A, Bertaccini A & Contaldo N (2018) Molecular diversity of phytoplasmas associated with grapevine yellows disease in north-eastern Italy. *Phytopathology* **108**, 206-214.

Zhao Y, Wei W, Lee M, Shao J, Suo X & Davis RE (2009) Construction of an interactive online phytoplasma classification tool, iPhyClassifier, and its application in analysis of the peach X-disease phytoplasma group (16SrIII). *International Journal of Systematic and Evolutionary Microbiology* **59**, 2582-2593.

Zunnoon?Khan S, Arocha?Rosete Y, Scott J, Crosby W, Bertaccini A & Michelutti R (2010) First report of '*Candidatus Phytoplasma fraxini*' (group 16SrVII phytoplasma) associated with a peach disease in Canada. *Plant Pathology* **59**, 1162.

ACKNOWLEDGEMENTS

This datasheet was prepared in 2023 by Liliana Franco-Lara [Universidad Militar Nueva Granada, Bogotá, Colombia]. Her valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2025) '*Candidatus Phytoplasma fraxini*'. EPPO datasheets on pests recommended for regulation. Available online. <https://gd.eppo.int>

Datasheet history

This datasheet was first published online in 2023. It is maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', 'Hosts', and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.



Co-funded by the
European Union