CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

Candidatus Phytoplasma ziziphi Jung et al. 2003

jujube witches' broom disease

Kingdom: Bacteria, Phylum: Tenericutes,
Class: Mollicutes, Order: Acholeplasmatales,
Family: Acholeplasmataceae

Pest Rating: A

Comment Period: 07/30/2026 through 09/13/2026

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from *Candidatus* Phytoplasma ziziphi is described herein, and a permanent rating is proposed.

History & Status:

Background:

In 1967, Doi et al. observed mollicutes in the phloem of plants exhibiting yellows and witch's broom symptoms. Initially called mycoplasma-like organisms, their name was later changed to phytoplasmas. Phytoplasmas are phloem-limited pleomorphic bacteria lacking a cell wall. They are mainly transmitted by leafhoppers, but they can also be moved with plant propagative materials. They cause yellowing symptoms by clogging sieve tubes of the phloem tissue and interfering with the transportation of photosynthate out of the leaves. They can also produce biologically active toxic substances, causing death of the leaves, inflorescences, and vegetative buds of their hosts. Species descriptions of bacteria belonging to the class Mollicutes typically require an accompanying culture of the organism. However, because phytoplasmas are very difficult to isolate in culture and maintain in vitro, lineages within this group are generally referred to as '*Candidatus* Phytoplasma species' (Davis and Sinclair, 1998). Phytoplasmas are classified into subgroups based on RFLP analysis of their 16S rDNA segment (F2nR2 fragment) using a defined set of 17 restriction enzymes (Lee et al., 1998). The phytoplasma groups

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delineated using this classification scheme are consistent with 16S rRNA gene phylogeny (Zhao et al., 2009).

Candidatus Phytoplasma ziziphi belongs to the elm yellows phytoplasma group (16SrV). This group contains several related but biologically distinct phytoplasmas associated mainly with diseases of woody plants, including elm yellows, flavescence dorée of grapevine, alder yellows, rubus stunt, cherry lethal yellows, peach yellows, and jujube witches' broom. *Candidatus* Phytoplasma ulmi, the elm yellows phytoplasma, belongs to subgroup 16SrV-A, whereas *Ca.* Phytoplasma ziziphi is placed in subgroup 16SrV-B. Therefore, records identified only as "elm yellows group," "16SrV," or "16SrV-related" should not be treated as confirmed records of *Ca.* Phytoplasma ziziphi unless subgroup, sequence, or strain-level evidence supports that identification (Lee et al. 2004; EPPO, 2026).

Jujube witches' broom disease has been known in China since at least the twentieth century and is one of the most serious diseases of jujube. The disease is associated with *Ca.* Phytoplasma ziziphi and is referred to in China as "Zaofeng" disease. Symptomatic trees show abnormal shoot proliferation and floral abnormalities, and affected trees may suffer yield loss, fruit quality decline, gradual decline, and death within several years (Guo et al. 2023). The principal risk pathway is infected propagative material, particularly asymptomatic plants, root suckers, seedlings, and grafted plants. Local spread would depend on vectors.

Hosts: The primary host is jujube, *Ziziphus jujuba* (Jung et al., 2003). Other reported hosts include several fruit, ornamental, and herbaceous plants. EPPO lists *Amaranthus retroflexus*, *Camellia* sp., *Cichorium intybus, Diospyros kaki, Euonymus bungeanus, Hovenia tomentella, Ipomoea batatas, Malus* sp., *Phragmites australis, Prunus armeniaca, Prunus avium, Prunus cerasifera, Prunus persica, Prunus salicina,* and *Salix babylonica* as hosts or associated hosts (EPPO, 2026). *Prunus, Malus, Diospyros, Ipomoea batatas*, and ornamental hosts are relevant to California risk, but records involving "related strains" or subgroup-level identifications only should be flagged as weaker unless sequence identity and strain placement are clear.

Symptoms: Symptoms associated with *Ca.* Phytoplasma ziziphi and related strains vary by host but commonly include small leaves, yellowing, leaf curling or rolling, shortened internodes, witches' broom, shoot proliferation, phyllody, virescence, stunting, decline, and dieback. On jujube, typical symptoms include witches' broom, proliferation of shoots and small leaves, dense root suckers, lack of winter defoliation, elongated peduncles, phyllody, deformed fruit or failure to fruit, decline, and death within three to five years (Chen et al. 2022; Xue et al. 2020; Zhao et al. 2019). Similar foliar, floral, fruit, and decline symptoms have been reported on peach, apricot, apple, Japanese plum, persimmon, honey locust, cherry, and Chinese cherry, including fruit drop, delayed fruit maturity, reduced fruit quality, stem fasciation, floral virescence, failure of fruit set, abnormal fruit development, branch death, and tree decline or death (Han et al. 2021; Li et al. 2014a; Wang et al. 2018).

Transmission: Phytoplasmas reside in phloem sieve cells of infected plants and can be transmitted from infected plants to healthy ones through phloem-feeding insects, mainly leafhoppers, planthoppers, and psyllids. They are not seed-transmitted. They can be graft-transmitted but are not transmitted by mechanical contact such as pruning (Davis and Sinclair, 1998). Phytoplasmas are fastidious: there is no

indication that any phytoplasma can survive outside of its host, and no pure phytoplasma culture has been established in any medium thus far.

Jujube witches' broom phytoplasma is transmitted by leafhoppers. The best-documented vector is *Hishimonus sellatus*, which was reported to transmit the disease agent experimentally from diseased to healthy jujube seedlings (La and Woo, 1980). *Hishimonus hamatus* has also been reported as a vector associated with jujube witches' broom phytoplasma in China, and recent work has examined how infection alters jujube leaf metabolites and affects feeding behavior of *H. hamatus* (Liu et al. 2023). Other leafhoppers reported in association with transmission of jujube witches' broom disease include *Hishimonoides chinensis, Hishimonoides aurifascialis*, and *Typhlocyba* sp., but they are considered putative vectors (USDA CAPS, 2023). *Hishimonus* is not known to be in California (CDFA PDR database, 2026).

Damage Potential: Candidatus Phytoplasma ziziphi has high damage potential on jujube and potentially important damage potential on other fruit and ornamental hosts. In jujube, infected trees may show witches' broom, phyllody, reduced fruit quality, yield loss, decline, and death within several years (Guo et al., 2023). Chen et al. (2022) stated that jujube witches' broom disease can result in total losses in yield and fruit quality, although this statement should be interpreted in the context of severe disease conditions and susceptible hosts.

USDA CAPS (2023) reports damage on multiple hosts, including yield losses of 20 to 50 percent and rapid death after infection in apricot, failure of infected sweet cherry flowers to set fruit, decline and death of infected peach trees, shriveled and prematurely dropped peach fruit, and infection in young apple trees. Some of these records are based on foreign reports and should not be directly extrapolated to California without considering climate, host cultivars, vector presence, and production systems.

In California, the damage concern would be high because susceptible or potentially susceptible hosts include jujube, *Prunus* spp., *Malus* spp., and ornamental or landscape hosts. Damage potential depends strongly on whether competent vectors are present or introduced, whether infected propagative material enters production systems, and whether host records based on related strains are confirmed as *Ca.* Phytoplasma ziziphi in the strict sense.

Worldwide Distribution: China, India, Italy, Japan, Republic of Korea (EPPO, 2026)

Official Control: *Candidatus* Phytoplasma ziziphi is on the EPPO's A1 list for Switzerland and a quarantine pest in the European Union (EPPO, 2026). It is on the USDA PCIT's Harmful Organisms list for Albania, Antarctica, and the European Union (USDA, 2026).

California Distribution: none

California Interceptions: none

The risk that *Ca.* Phytoplasma ziziphi would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** *Ca.* Phytoplasma ziziphi is reported from regions with climates that include major fruit-growing areas in California, and USDA CAPS (2023) states that it may establish in USDA Plant Hardiness Zones 4 to 11. Jujube is adapted to the southern and southwestern United States, and California has extensive production of *Prunus* and *Malus* hosts that are included in reported host records or related-strain records.

   Evaluate if the pest would have suitable hosts and climate to establish in California.

   Score: **2**
   - Low (1) Not likely to establish in California; or likely to establish in very limited areas.
   - Medium (2) may be able to be established in a larger but limited part of California.
   - High (3) likely to establish a widespread distribution in California.

2) **Known Pest Host Range:** The strongest host association is with *Ziziphus jujuba*, but EPPO lists additional hosts across several genera and families, including *Amaranthus, Camellia, Cichorium, Diospyros, Euonymus, Hovenia, Ipomoea, Malus, Phragmites, Prunus,* and *Salix* (EPPO, 2026). Some non-jujube records are less certain because they involve *Ca.* Phytoplasma ziziphi-related strains or subgroup-level identification.

   Evaluate the host range of the pest.

   Score: 3
   - Low (1) has a very limited host range.
   - Medium (2) has a moderate host range.
   - High (3) has a wide host range.

3) **Pest Reproductive Potential:** *Ca.* Phytoplasma ziziphi is transmitted by leafhopper vectors and by grafting or movement of infected propagative material. *Hishimonus hamatus* and *H. sellatus* are known vectors, and infected plants for planting, including asymptomatic material, root suckers, seedlings, and grafted material, are important long-distance pathways. The pathogen can move systemically in plants, persist in infected propagative material, and spread locally by vectors where competent vectors are present**.**

   Evaluate the natural and artificial dispersal potential of the pest.

   Score: 3
   - Low (1) does not have high reproductive or dispersal potential.
   - Medium (2) has either high reproductive or dispersal potential.
   - High (3) has both high reproduction and dispersal potential.

4) **Economic Impact:** *Candidatus* Phytoplasma ziziphi can cause serious disease in jujube, including yield loss, fruit quality reduction, decline, and tree death. There are reports of significant damage in other

fruit hosts, including apricot, cherry, peach, apple, and plum, although some of these records should be treated cautiously because they could involve related strains. If introduced into California production systems with susceptible hosts and competent vectors, the pathogen could reduce yield, fruit quality, nursery stock value, and marketability.

Evaluate the economic impact of the pest on California using the criteria below.

Economic Impact: A, B, E.

A. The pest could lower crop yield.
B. The pest could lower crop value (including increasing crop production costs).
C. The pest could trigger the loss of markets (including quarantines).
D. The pest could negatively change normal cultural practices.
E. The pest can vector, or is vectored, by another pestiferous organism.
F. The organism is injurious or poisonous to agriculturally important animals.
G. The organism can interfere with the delivery or supply of water for agricultural uses.

Economic Impact Score: 3
- Low (1) causes 0 or 1 of these impacts.
- Medium (2) causes 2 of these impacts.
- High (3) causes 3 or more of these impacts.

5) Environmental Impact: No strong evidence was found that *Ca.* Phytoplasma ziziphi would directly affect rare native plants or cause major ecosystem-level disruption in California. However, the reported host range includes ornamental and landscape trees, and phytoplasma management could increase vector control activities in nurseries, orchards, and ornamental plantings.

Evaluate the environmental impact of the pest on California using the criteria below.

Environmental Impact: E

A. The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes.
B. The pest could directly affect threatened or endangered species.
C. The pest could impact threatened or endangered species by disrupting critical habitats.
D. The pest could trigger additional official or private treatment programs.
E. The pest significantly impacts cultural practices, home/urban gardening, or ornamental plantings.

Environmental Impact Score: 2
- Low (1) causes none of the above to occur.
- Medium (2) causes one of the above to occur.
- High (3) causes two or more of the above to occur.

Consequences of Introduction to California for *Ca.* Phytoplasma ziziphi*:* High

Add up the total score and include it here. **13**
-Low = 5-8 points
-Medium = 9-12 points
-High = 13-15 points

6) **Post-Entry Distribution and Survey Information**: Evaluate the known distribution in California. Only official records identified by a taxonomic expert and supported by voucher specimens deposited in natural history collections should be considered. Pest incursions that have been eradicated, are under eradication or have been delimited with no further detections should not be included.

Evaluation is 'Not established'.

Score: 0
-Not established (0) Pest never detected in California or known only from incursions.
-Low (-1) Pest has a localized distribution in California or is established in one suitable climate/host area (region).
-Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.
-High (-3) Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.

7) **The final score is** the consequences of the introduction score minus the post-entry distribution and survey information score: (Score)

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information* ***= 13***

Uncertainty:

The largest uncertainty is the non-jujube host range. *Ziziphus jujuba* is the strongest and primary host, but several other host records involve *Candidatus* Phytoplasma ziziphi-related strains, subgroup 16SrV-B detections, or disease-note records. Vector uncertainty is also important. There are known vectors, and additional documented or putative vectors. As of yet unidentified vectors may already be established in California.

Conclusion and Rating Justification:

Based on the evidence provided above, the proposed rating for *Candidatus* Phytoplasma ziziphi **is A.**

References:

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Responsible Party:

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***Comment Period: 07/30/2026 through 09/13/2026**

***NOTE:**

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at permits[@]cdfa.ca.gov.

Comment Format:

- Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

  Example Comment:

  Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to "Climate/Host Interaction" here.]

- Posted comments will not be able to be viewed immediately.
- Comments may not be posted if they:

  Contain inappropriate language which is not germane to the pest rating proposal;

Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;

Violates agency regulations prohibiting sexual harassment or other forms of discrimination;

Violates agency regulations prohibiting workplace violence, including threats.

- Comments may be edited prior to posting to ensure they are entirely germane.
- Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.

Pest Rating: A
