

California Pest Rating Proposal for
***Trametes versicolor* (Linnaeus: Fries.) Pilát 1920 [1921]**
turkey tails

Current Pest Rating: C

Proposed Pest Rating: C

Kingdom: Fungi, Phylum Basidiomycota

Class: Agaricomycotina, Subclass: Agaricomycetes

Order: Polyporales, Family: Polyporaceae

Comment Period: 8/10/2020 through 9/24/2020

Initiating Event:

On August 9, 2019, USDA-APHIS published a list of “Native and Naturalized Plant Pests Permitted by Regulation”. Interstate movement of these plant pests is no longer federally regulated within the 48 contiguous United States. There are 49 plant pathogens (bacteria, fungi, viruses, and nematodes) on this list. California may choose to continue to regulate movement of some or all these pathogens into and within the state. In order to assess the needs and potential requirements to issue a state permit, a formal risk analysis for *Trametes versicolor* is given herein and a permanent pest rating is proposed.

History & Status:

Background:

Trametes versicolor has also been known as *Coriolus versicolor* and *Polyporus versicolor*. It is a polyporus basidiomycete distributed worldwide. It is commonly saprobic but is opportunistically pathogenic, causing papery bark, weak bud unions, dieback, and white rot. It is widely distributed on hardwoods and conifers; one of the most common species in North American forests. White-rot fungi play an important ecological role in delignification (breaking down wood) through the production of ligninolytic extracellular oxidative enzymes. It has the capability to degrade the lignin, hemicellulose, and cellulose. The decayed wood is left white and fibrous in texture (Abdel-Hamid et al., 2013).

The species epithet means 'of several colors'. This reflects the variability of the color on the cap of the fruiting body; it can be gray, yellow, buff, brown, cinnamon, and reddish brown. The polypore is "zonate" with sharply contrasting concentric zones of color, and the surface of the cap is fuzzy or velvety. Because the shape and multiple colors are reminiscent of a wild tom turkey's fanned tail, *T. versicolor* is commonly called "turkey tail".

Trametes versicolor is used in Chinese medicine with the following purported benefits: to prevent and treat cancer, to reduce the side effects of chemotherapy, to stimulate the immune system, to treat infections, and to reduce the side effects of radiation therapy (Cui and Christi, 2003). Fungi with a high enzymatic activity and substrate affinity have industrial chemical applications. Laccase from *T. versicolor* has been purified and characterized and is highly active in degrading polycyclic aromatic hydrocarbons (Han et al., 2005). The laccase also has applications for detoxification and improvement of the fermentation of wood hydrolysates to produce products such as fuel ethanol (Jönsson et al., 1998). Sludge from wastewater that has been treated in a fungal slurry reactor with *T. versicolor* showed reduced concentrations of pharmaceuticals, UV-filters, and brominated flame retardants (Rodríguez-Rodríguez et al., 2012).

Hosts: Hundreds of species of woody angiosperm and gymnosperm trees and shrubs are reported hosts (Farr and Rossman, 2020). California detections have been on fruit trees including stone fruit, pome fruit, guava, avocado, and olives, on conifers including cypress, pine, spruce, and redwood, and on hardwood trees including alder, birch, madrone, oak, and willow,

Symptoms and signs: Decayed wood is the primary symptom for detecting wood-rotting fungi. The polypore fruiting bodies of *T. versicolor* can be found growing in dense, overlapping clusters or rosettes on logs and stumps, occasionally on living trees. They are perennial and can be found year-round. The cap is 2–8 cm across, 1–4 cm deep, 1–2 mm thick, plano-convex to flat, circular, semicircular, fan-shaped, bracket-shaped, or kidney-shaped, often fused with other caps, flexible when fresh, and densely hairy or velvety. It often has alternating zones of texture, with concentric zones of white, gray, brown, cinnamon, orangish, and reddish brown (but highly variable in color and sometimes with other shades, including blue, green, and orange). The pore surface is whitish to pale brownish, does not bruise, and has 3–6 or more tiny pores per mm and tubes up to 1.5 mm deep. The flesh is insubstantial and whitish, except for a very thin black line (in cross-section) separating the cap surface from the flesh, which is tough and leathery (Kuo, 2017).

Papery bark of apple is a disease is caused by *T. versicolor* and is characterized by a white rot of wood, gummosis at lesions, papery bark that peels away from the trunk, dieback, and occasionally death of young trees (Adaskaveg and Ogawa, 1990).

Transmission: Basidiospores are carried by wind from the basidiocarps to wounds, stumps or stubs of new trees. The mycelium invades the wood and spreads within and along the trunks. Infected wood discolors and rots and infection spreads outward and along the axis of the tree. Sporophores form near the point of entry or in cankers along the trunk. The fungus overwinters as mycelium in disease or dead trees and stumps (Agrios, 2005).

Damage Potential: White rotters such as *T. versicolor* break down lignin and cellulose leaving the rotted wood feeling moist, soft, spongy, or stringy and appear white or yellow. Mycelia extensively colonize the woody tissues and fruiting bodies form on the outside of the bark. Fungi that cause white rots also cause the production of zone lines in wood, sometimes called spalted wood (Agrios, 2005). This partially rotted wood is sometimes desirable for woodworking. Direct effects of wood decay were observed as breakage of scaffold branches during fruit production, resulting from loss of wood strength, and uprooting of trees, weakened from root decay, during wind-storms or mechanical harvesting. Infected trees die, lose structural integrity, and fall (Adaskaveg and Ogawa, 1990).

Trametes versicolor causes chronic disease in fruit orchards that reduces yields, causes a slow decline of trees over years, and may be difficult to recognize and assess. Although it is influenced by environmental and host factors, tree decline is often attributed solely to environmental stresses, nutritional deficiencies, or other more obvious pest problems rather than to the pathological consequences of this fungus (Adaskaveg and Ogawa, 1990). In olive orchards in California, Úrbez-Torres et al. (2013), found that *T. versicolor* has the ability to cause twig and branch dieback.

Worldwide Distribution: Cosmopolitan

Official Control: None

California Distribution: Records in multiple counties

California Interceptions: None

The risk *Trametes versicolor* would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** This pathogen is widely distributed in multiple climates in California.

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

Score: 3

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

- 2) Known Pest Host Range:**

The host range of *T. versicolor* is extremely large on woody hosts, both conifers and hardwoods.

Evaluate the host range of the pest.

Score: 3

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

3) Pest Reproductive Potential:

Trametes versicolor spreads with windborne spores and needs wounds or natural openings to attack a new host. There are no vectors.

Evaluate the natural and artificial dispersal potential of the pest.

Score: 2

- 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:

Trametes versicolor can damage tree trunks and branches causing yield loss for fruit, tree decline for ornamentals or lumber, and very occasionally tree death.

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

Economic Impact: A

A. The pest could lower crop yield.

- B. The pest could lower crop value (includes increasing crop production costs).
- C. The pest could trigger the loss of markets (includes 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: 1

- **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:

With a primary ecological role as white-rotting decay fungus, *T. versicolor* is generally beneficial to forest ecosystems. However, it also acts as a wound pathogen capable of colonizing sapwood of trees stressed by water shortage, sunburn, freeze damage, or wounding, and causing disease over a large host range.

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.
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- 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 *Trametes versicolor*: Medium

Add up the total score and include it here. **11**

-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 'high'. *Trametes versicolor* is widespread in California.

Score: -3

-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 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 = 8*

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Trametes versicolor* is C.

References:

Adaskaveg, J.E., and Ogawa, J.M. 1990. Wood decay pathology of fruit and nut trees in California. Pl. Dis. 74: 341-352

Abdel-Hamid, A. M., Solbiati, J. O. and Cann, I. K., 2013. Insights into lignin degradation and its potential industrial applications. In *Advances in Applied Microbiology* (Vol. 82, pp. 1-28). Academic Press.

Agrios, G. N. 2005. *Plant Pathology*, 5th Edition. Elsevier Academic Press. 922 pg

CABI Crop Production Compendium 2020. *Trametes versicolor*. <https://www.cabi.org/cpc/datasheet/15432> Accessed 7/7/2020

Cui, J. and Chisti, Y. 2003. Polysaccharopeptides of *Coriolus versicolor*: physiological activity, uses, and production. *Biotechnol Adv.* 2003 Apr;21(2):109-22. Review.

EPPO Global Database. 2020. <https://gd.eppo.int/taxon/CORLVE>. Accessed 7/8/2020

Farr, D.F., and Rossman, A.Y. *Fungal Databases*, U.S. National Fungus Collections, ARS, USDA. Retrieved July 8, 2020 from <https://nt.ars-grin.gov/fungaldatabases/>

French, A. M. 1989. *California plant disease host index*. CA Division of Plant Industry. 2nd Ed. 394 pg

Han, M. J., Choi, H. T. and Song, H. G. 2005. Purification and characterization of laccase from the white rot fungus *Trametes versicolor*. *The Journal of Microbiology*, 43(6), pp.555-560.

Jönsson, L. J., Palmqvist, E., Nilvebrant, N. O. and Hahn-Hägerdal, B. 1998. Detoxification of wood hydrolysates with laccase and peroxidase from the white-rot fungus *Trametes versicolor*. *Applied microbiology and biotechnology*, 49(6), pp.691-697.

Kuo, M. 2017. *Trametes versicolor*. Retrieved from the MushroomExpert.Com Web site: http://www.mushroomexpert.com/trametes_versicolor.html Accessed 7/15/2020

Rodríguez-Rodríguez, C. E., Barón, E., Gago-Ferrero, P., Jelić, A., Llorca, M., Farré, M., Díaz-Cruz, M. S., Eljarrat, E., Petrović, M., Caminal, G. and Barceló, D., 2012. Removal of pharmaceuticals, polybrominated flame retardants and UV-filters from sludge by the fungus *Trametes versicolor* in bioslurry reactor. *Journal of hazardous materials*, 233, pp.235-243.

Úrbez-Torres, J. R., Peduto, F., Vossen, P. M., Krueger, W. H. and Gubler, W. D., 2013. Olive twig and branch dieback: etiology, incidence, and distribution in California. *Plant Disease*, 97(2), pp.231-244.

Responsible Party:

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***Comment Period: 8/10/2020 through 9/24/2020**

*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](mailto: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.
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- ❖ Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.
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Proposed Pest Rating: C
