

Peach Rust (*Transchelia* spp.)¹

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Introduction

Peach rust is a fungal disease commonly caused by *Transchelia discolor* (Fuckel) (Adaskaveg et al. 2000) that attacks plants in the genus *Prunus*, including peach, nectarine, almond, plum, apricot, and cherry. In the southeastern United States, the fungus is most common in peach orchards during the summer and fall. Peach rust severity depends on the climatic conditions (temperature and rainfall), hosts (peach cultivars), and geographic location. The disease is spread by airborne spores, which depend on moisture for infection. Where warm temperatures and high rainfall occur, severe peach rust infections usually result. Florida's summer rainfall provides favorable conditions for peach rust development. All currently available peach cultivars in Florida are susceptible to the disease. Management practices such as sanitation, scouting for disease, and fungicide applications before harvest help reduce the adverse impacts of this disease.

In temperate climates, peach rust fungi present four spore stages: urediniospores, teliospores, basidiospores, and aeciospores (Cummins and Hiratsuka 1983); however, the disease is mainly a management concern in high rainfall years (Soto-Estrada et al. 2005). In contrast, in subtropical growing regions, urediniospores are the main type of inoculum of peach rust. Peach rust is considered an important foliar disease in both tropical and subtropical climates every year due to high temperature and humidity (Alves et al. 2014)



Figure 1. Peach leaf rust symptoms showing small yellow necrotic areas on the surface on the left (axial side) and rust-colored fungal spores on the underside on the right (abaxial side).

Credits: Mercy Olmstead

Ecologically, rust is considered a biotroph, which requires living host tissue for survival. Peach rust symptoms mainly occur on the leaves of peach trees (Figure 1), where multiple disease cycles occur during a growing season. Occasionally, young twigs or fruit can be infected through stomata (Soto-Estrada et al. 2005). Orchards with severe symptoms can suffer significant economic losses due to premature defoliation. In addition, early budbreak in late autumn and induction of early budburst and bloom may reduce the cropping potential for the subsequent season up to 45% in severe cases (Adaskaveg et al. 2000; Alves and May-De Mio 2008).

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Leaf Symptoms

Leaf lesions are the most common symptoms of peach rust observed in Florida. Symptoms initiate as pale, chlorotic spots on both leaf surfaces during spring. Leaf lesions continue forming bright yellow and angular lesions (Figure 2). Lesions develop through the summer and into the fall, turning into mature lesions with necrotic yellow halos (Adaskaveg et al. 2000). Lesions on the lower leaf surface develop rust-brown spore masses (Figure 2) similar to those observed on twig cankers. Late in the growing season, leaf lesions may turn dark brown, reddish-to-black as they produce overwintering structures (Adaskaveg et al. 2000). Severe early-season infections can produce premature defoliation, reduced yields, and fruit infections at harvest (Adaskaveg et al. 2012). In Florida, defoliation is the main concern because it reduces yields in the following year. Under the microscope, peach rust urediniospores can be observed showing specific ornamentation (Figure 3).

Disease symptoms may resemble damage caused by other fungal pathogens and insects, so it is important to confirm the diagnosis of rust by sending a plant sample to the [UF/IFAS Plant Diagnostic Center in Gainesville \(PDC-GNV\)](#) to be tested for rust spores.

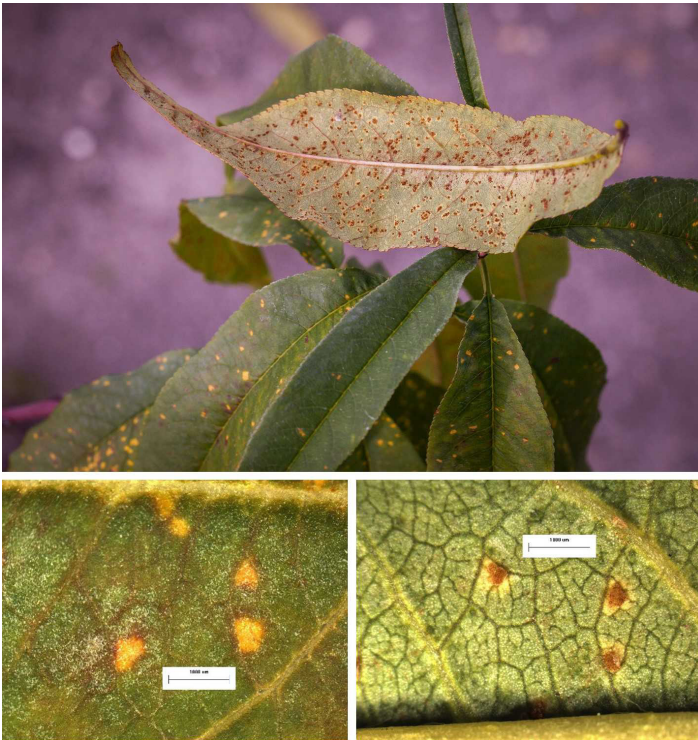


Figure 2. Peach rust leaf symptoms (top), magnified pictures showing small yellow chlorotic areas on leaf top side (left) and rust-colored fungal spores on the leaf underside (right).
Credits: M. Borden

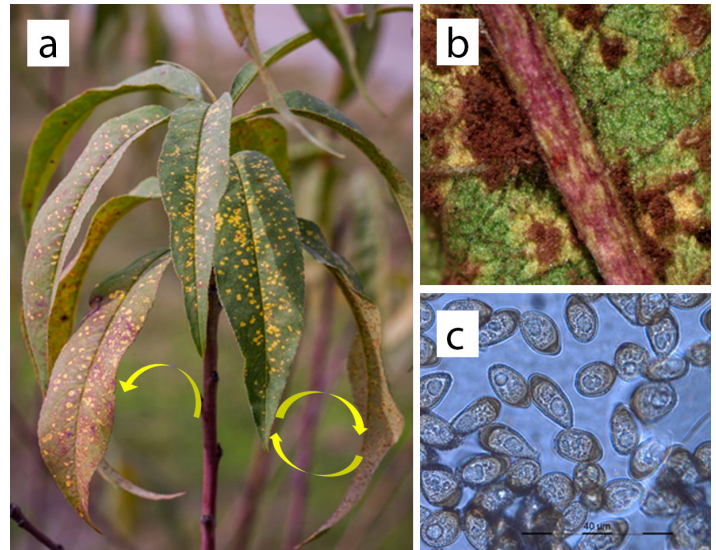


Figure 3. Peach rust (*Transchelia* spp.) cycle in Florida: a) infected leaves or twigs from previous season serve as primary inoculum; b) rust pustules under the leaves produce urediniospores that reinfest leaves; and c) urediniospores pictured under the microscope.
Credits: Image adapted from photos by the UF/IFAS Plant Diagnostic Center

Shoot Symptoms

Symptoms on young stems start as water-soaked lesions, which develop into splits with uredinia (flacks) formation. Twig cankers appear as blisters, with splits measuring up to ¼-inch long usually visible on the upper side of the twig (Figure 4; Adaskaveg et al. 2000). After the twig lesions emerge, rusty brown, powdery masses of spores (urediniospores) are produced in the cankers. However, in Florida, twig cankers are not common.

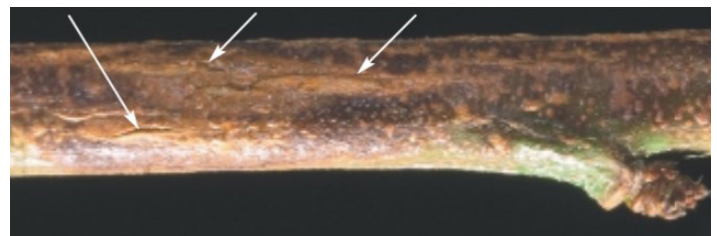


Figure 4. Twig cankers (arrows) caused by the rust fungus *T. discolor* on a one-year-old peach branch.
Credits: Adaskaveg et al. 2000

Fruit Symptoms

Fruit lesions may develop during the growing season following leaf symptoms; however, fruit lesions are not often observed in Florida because our varieties are early maturing. If later-maturing varieties are grown, fruit lesions may be observed. On immature, yellow, or green fruit, lesions first develop as small, brownish spots (about 0.1 inch diameter) with green halos (Figure 5). When the fruit



Figure 5. Typical fruit lesions on mature fruit, which is atypical for peach production in Florida.
Credits: Jack Kelly Clark; reproduced by permission from University of California Statewide IPM Program, © 2002 by Regents, University of California.

matures and develops darker skin color (blush), these lesion halos become greenish-yellow. The lesions are sunken and extend several millimeters into the fruit (Adaskaveg et al. 2012). Numerous infections may develop on each fruit, and these can lead to secondary infections by other fungal species and cause fruit decay.

Fruit symptoms may resemble damage caused by stink bugs, so it is important to confirm the diagnosis of rust by sending a plant sample to the [UF/IFAS Plant Diagnostic Center in Gainesville \(PDC-GNV\)](#) to be tested for rust spores.

Disease Cycle

The life cycle of *Tranzchelia discolor*, the causal agent of peach rust, includes multiple spore stages that develop from sexual or asexual reproduction. The spore stages are urediniospores, teliospores, basidiospores, and aeciospores (Adaskaveg et al. 2000). Sexual and asexual cycles are non-exclusive and occur under specific conditions. Peach rust starts when moisture from precipitation or irrigation splashes the spores onto nearby leaves (Figure 5).

In a sexual life cycle, infected peach leaves can produce teliospores, which may overwinter on a peach tree until the next the growing season. If so, teliospores can germinate to produce basidiospores, which are capable of infecting alternate hosts, the identity of which are unknown in Florida. In California, *Anemone coronaria* (poppy anemone) has been identified as an alternate host of peach rust where basidiospores are infective and aecio spores are formed. Then, aecio spores can infect peach trees and continue the cycle. Aeciospores can reinfest a peach tree and produce rust lesions with urediniospores in the spring (Adaskaveg et al. 2000).

In the asexual cycle, infected leaf tissue erupts, producing a rust pustule under the leaf. A single rust pustule on the leaf can produce thousands of urediniospores, which can reinfest peach leaves in favorable conditions.

In subtropical conditions, urediniospores overwinter in twig cankers and pustules under the leaves, producing the primary inoculum for infection in the next growing season (Alves et al. 2015)

The *T. discolor* cycle between peach and poppy anemone, an alternate host, starts with aeciospore infecting peach leaves and twigs. Urediniospores move from twig to leaf and from leaf to fruit. Late in the season, other urediniospores on leaf develop teliospores, which overwinter and produce basidiospores. Basidiospores can infect the alternate host. Finally, aeciospores are produced on poppy anemone, which restarts the cycle of infecting peach leaves and twigs (Adaskaveg et al. 2000).

Management

Peach rust phytosanitary management uses fungicide applications in spring (Ellis et al. 2002). This practice increases the risk of developing resistance rust biotypes. Therefore, fungicides should be tank-mixed or rotated according to the specific product labels to reduce the risk of fungicide resistance. See Table 1 for additional product, rate, and timing information. More severe infections in the previous year result in several fungicide applications through the growing season. Fungicide efficacy controlling

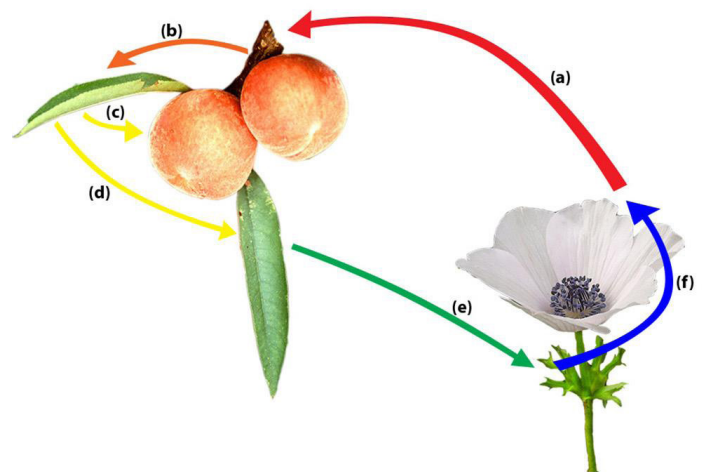


Figure 6. Path of *T. discolor* between peach and poppy anemone, an alternate host: a) aeciospore infects peach twig; b) urediniospores move from twig to leaf; c) urediniospores move from leaf to fruit; d) other urediniospores on leaf develop teliospores, which are overwintering structures; e) overwintering structures produce basidiospores, which infect the alternate host; and f) aeciospores are produced on poppy anemone, which restart the cycle.
Credits: Image adapted from photos by M. Knight and Z. Evenor

rust outbreaks are affected by many factors, such as the source of inoculum, the cultivar, weather, tree spacing, and cultural management (Nesi et al. 2014; Kowata et al. 2011).

Control measures must be started before rust symptoms are severe, and multiple applications of fungicides with different modes of action may be required to achieve acceptable disease control. Preventive treatments of Bordeaux and sulfocalcic mixtures at the beginning of the season can help to reduce the initial inoculum (Citadin et al. 2010). Peach rust fungicide application usually starts after the trees leaf out; however, management for peach rust can be combined with peach scab control. Specific fungicides can be effective for both diseases (Table 1). Scouting the peach orchard for early symptoms helps detect the disease early in the season. High relative humidity and leaf wetness favor rust development; therefore, irrigation schedules and sprinkler direction should be managed to reduce wetting of the foliage (Rouse and Roberts 2000).

Treatment with sulfur can be effective and acceptable for use in an organically certified crop. However, sulfur applications at high temperatures (>90°F) can cause burning symptoms on leaves. Sterol-inhibiting fungicides (Fungicide Resistance Action Committee [FRAC] Code 3 below) are systemic options that are efficacious and generally more expensive than sulfur (Rouse and Roberts 2000). Products listed in Table 1 with active ingredients in the quinone outside inhibitor (QoI) (FRAC Group 11) and succinate dehydrogenase inhibitors (SDHI) FRAC Group 7) have the greatest potential efficacy.

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Table 1. Suggested fungicide options organized by efficacy for peach rust management, their application rates, effectiveness, re-entry intervals (REI) and pre-harvest intervals (PHI) (data adapted from Rouse and Roberts 2000; and Horton et al. 2015).

Material	FRAC Code (2015)	Rate/Acre	Effectiveness ^z	REI/PHI	Remarks
sulfur	M2	18 lbs./100 gal	++	24 hrs./0 days	
Chlorothalnil					
Bravo Weather Stik	M5	3–4 pts.	+++	12 hrs./do not apply after shuck split	<p>Chlorothalnil provides 14–21 days of scab control. Chlorothalnil is not labeled for use after shuck split, but can be used after harvest.</p> <p>Chlorothalnil and captan are severe eye irritants. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided:</p> <ol style="list-style-type: none"> At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site. Workers must be informed, in a manner they can understand: <ul style="list-style-type: none"> that residues in the treated area may be highly irritating to their eyes. that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. how to operate the eyeflush container.
Bravo Ultrex WDG		2.8–3.8 lbs.			
Equus 720 or ECHO 720		3–4 pts.			
Captan					
Captan 50W	M4	4–6 lbs.	+++	24 hrs./0 days	
Captan 80WDG		2.5–3.75 lbs.			
Captan 4L		2–3 qts.			
Azoxystrobin					
Abound	11	9.0–15.5 fl. ozs.	++++	4 hrs./0 days	
Tebuconazole					
Tebuzol 45DF	3	4 oz.	++	12 hrs./0 days	<p>For peaches only, 9.0–15.5 fl. ozs. can be used for scab control. For scab, begin applications at petal fall and continue at 7–14 day intervals per label. Do not apply more than two sequential applications of Group 11 fungicides before alternation with a fungicide that</p>
Orius 20AQ		10.75–17.2 oz.			
Tebuconazole plus trifloxystrobin					
Adament 50 WG	3 + 11	4–8 oz.	+++	12 hrs./24 hrs.	
Fenbuconazole					
Indar	3	2 oz.	++	12 hrs./0 days	

Difenoconazole plus cyprodinil					
Inspire Super	3 + 9	16–20 fl. oz.	+++	12 hrs/0 days	
Pristine	11 + 7	10.5–14.5 oz	++++	12 hrs/0 days	
QoI/SDHI mix: pyraclostrobin plus fluxapyroxad					
Merivon Xemium	11 + 7	4–6.7 fl oz	++++	12 hrs/0 days	Under certain conditions, mixtures of Merivon Xemium with adjuvants, additives and/or other products may cause crop injury, particularly to fruit within two weeks of harvest. DO NOT use Merivon Xemium with: <ul style="list-style-type: none"> • Emulsifiable concentrate (EC) or solvent-based formulation products. • Crop oil concentrate (COC), methylated seed oil (MSO) adjuvants.
penthiopyrad					
Fontelis	7	14–20 fl oz	++	12 hrs/0 days	

²Effectiveness ratings range from +, slightly effective, to +++++, highly effective. The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication do not signify our approval to the exclusion of other products of suitable composition. All chemicals should be used in accordance with directions on the manufacturer's label.