PUBLICATION **8011**

Peach Rust Caused by *Tranzschelia discolor* in California

UNIVERSITY OF CALIFORNIA
Agriculture
and Natural Resources
http://anrcatalog.ucdavis.edu

J. E. ADASKAVEG, Associate Professor; **A. SOTO-ESTRADA,** Graduate Student; **H. FÖRSTER,** Staff Research Associate; and **D. THOMPSON,** Postgraduate Researcher, Department of Plant Pathology, UC Riverside. **J. HASEY,** Farm Advisor; and **B. T. MANJI,** Plant Pathologist/Farm Advisor, Retired, UCCE Sutter-Yuba Counties. **B. TEVIOTDALE,** UC Extension Specialist, Kearney Agricultural Research and Extension Center.

Peach rust caused by the fungus *Tranzschelia discolor* (Fuckel) Tranz. and Lit. occurs wherever peaches are grown in California. In the major production areas of the Sacramento and San Joaquin Valleys, the disease can be found almost every year from spring through autumn. In the drier San Joaquin Valley, peach rust usually occurs later in the season, and economic losses are not as great as in the Sacramento Valley. The incidence of disease in both valleys depends largely on temperature and rainfall during the growing season. Economic losses have occurred only in years with high spring rainfalls, greater than 7.5 cm (3 inches) in May and June.

Infections of leaves and young twigs are the most common symptoms, but in California, fruit infections may be a major component of the disease and result in economic losses. A high incidence of early leaf infections may cause midseason defoliation of trees and numerous fruit infections at harvest. Infected fruit are rejected or downgraded by packers or processors. On canning peaches, the sunken fruit lesions cannot be removed by peeling. Downgraded fruit are usually diverted to juicing, which results in minimal economic returns to the grower. Early and severe defoliation also may reduce yields and stimulate the production of new leaves and buds late in the growing season.

Figure 1.
Twig cankers (arrows) caused by the rust fungus *T. discolor* on a 1-yr-old peach shoot.

SYMPTOMS

Twig cankers, leaf lesions, and fruit lesions are the common symptoms of the disease on peach in California. Not all of these symptoms may develop in every growing season.

Twig cankers

Twig cankers are the first symptoms of the disease in the spring. Cankers develop after petal fall during early fruit development on 1-year-old fruiting wood (9 to 12 months old). They appear as blisters and longitudinal splits in the bark about 3 to 6 mm (⅛ to ¼ inch) long (fig. 1, arrows). The infections begin as water-soaked lesions that swell and rupture only the epidermal tissue of the twig (figs. 2 and 3). Cankers are usually found on the upper, reddish side of the twig and can be seen more easily using a 20X hand lens. A few days after emergence (3 to 7 days, depending on the temperature), the cankers, which are about 1 to 4 by 3 to 6 mm (1/25 to 1/6 by ⅛ to ¼ inch) in size, mature and produce rusty brown powdery masses of specialized spores called urediniospores (fig. 4). Urediniospores, as observed under a compound microscope (fig. 5, left side), are spiny and sharply constricted at the base. Old

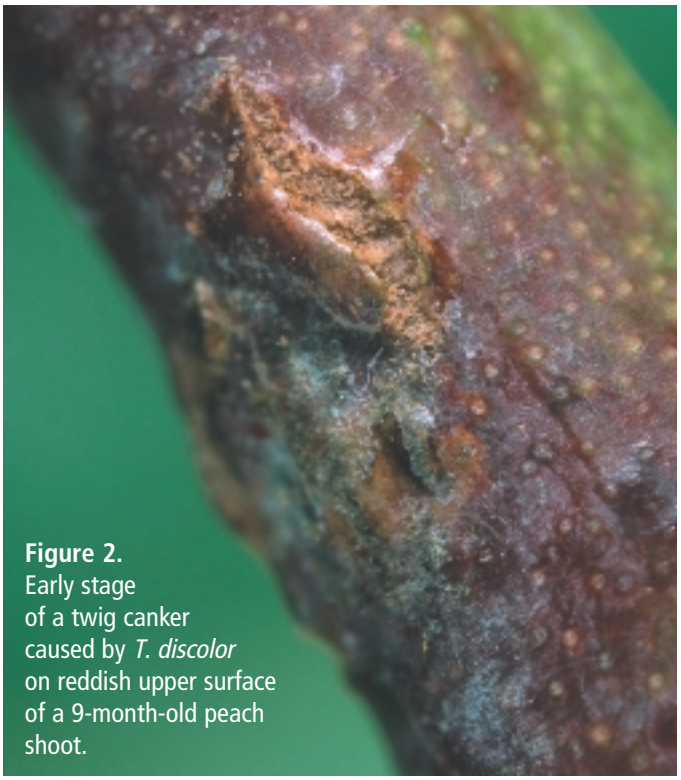

Figure 2.
Early stage of a twig canker caused by *T. discolor* on reddish upper surface of a 9-month-old peach shoot.

Figure 3.
Twig canker caused by *T. discolor* on reddish upper surface of a 9-month-old peach shoot.

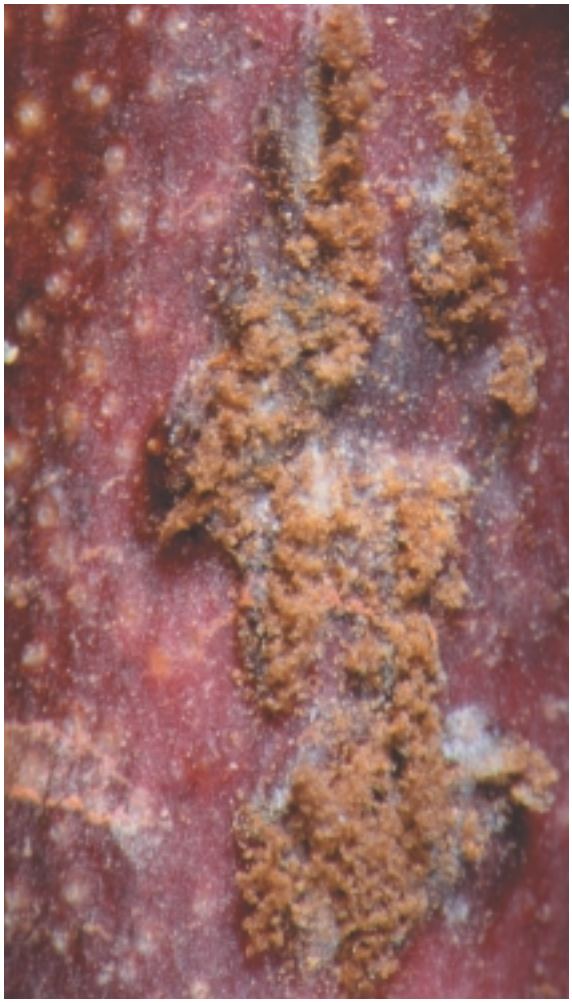

Figure 4.
Early stage of a twig canker caused by *T. discolor* on reddish upper surface of a 9-month-old peach shoot.

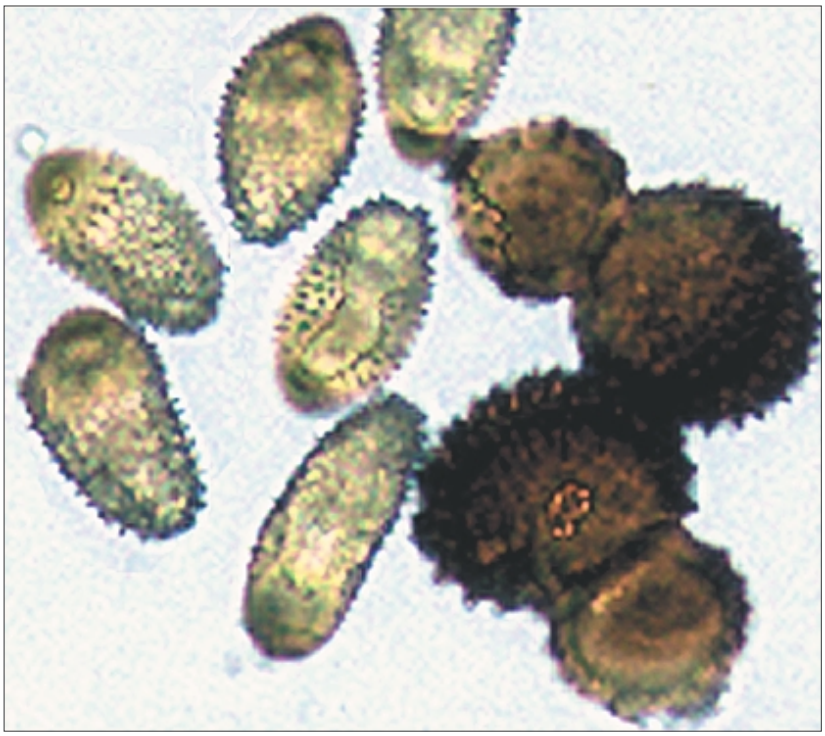

Figure 5.
Light micrograph of urediniospores (left) and teliospores (right) of *T. discolor*. The one-celled urediniospores are 15 to 23 by 28 to 44 micrometers in size; the two-celled teliospores are 18 to 27 by 30 to 39 micrometers in size.

Figure 6.
Nonsporulating twig cankers (arrows) caused by *T. discolor* on a 1.5-yr-old peach shoot.

Figure 7.
Close-up of an old twig canker with no fungal sporulation on a 1.5 yr-old peach shoot.

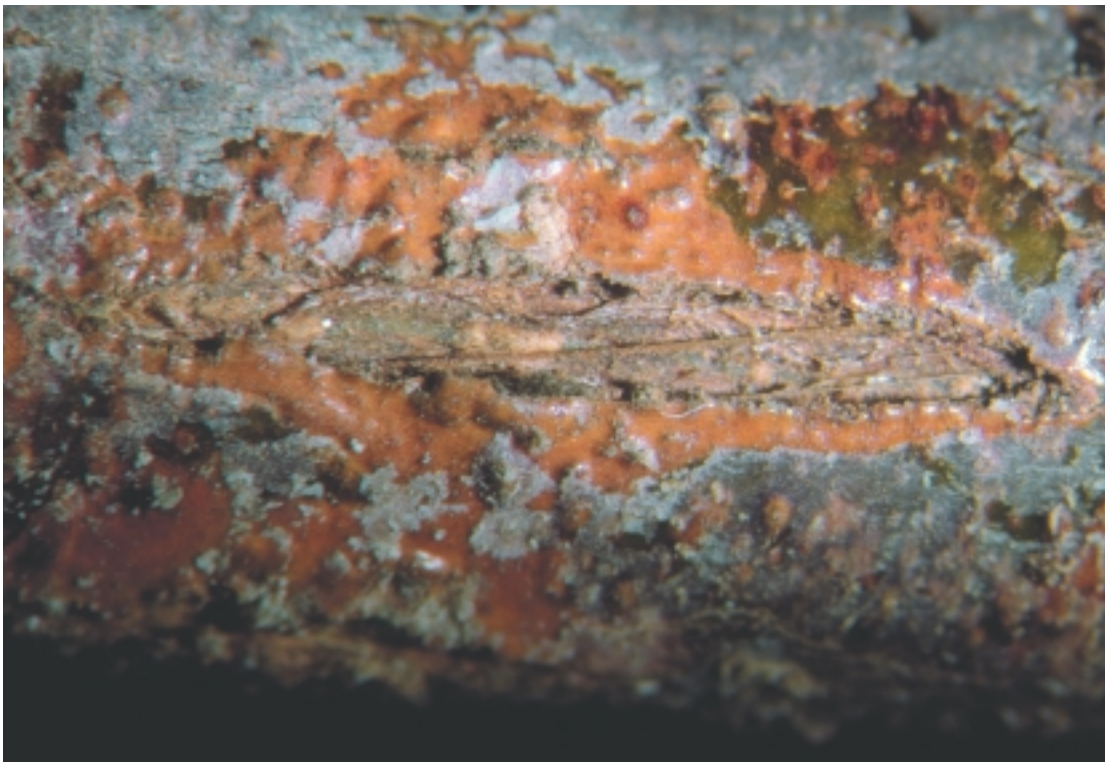

Figure 8.
Close-up of a healing twig canker on a 2-yr-old peach shoot with secondary branch growth.

cankers 5 to 10 by 10 to 15 mm (⅕ to ⅖ by ⅖ to ⅗ inch) in size are observed by the middle to the end of the growing season. Cankers on branches that are 1.5 to 2 years old may persist in the following growing season (figs. 6–8) until bark formation occurs. Old cankers no longer contain viable spores.

Twig cankers on peach may be confused with hail damage or large lenticels (specialized host structures facilitating gas exchange to the internal twig tissues after bark formation). Positive identification of rust cankers depends on observing the rusty brown spores of the fungus developing in the canker (see fig. 4).

Figure 9.
Leaf symptoms of rust on peach.

Leaf lesions

Leaf lesions (figs. 9, 11–13) usually develop after cankers form in the spring (late April to June) and may continue to develop through the summer and into the fall. Defoliation may result during epidemics, when numerous infections occur on individual leaves. The first diseased leaves observed in the spring are usually in the immediate proximity of twig cankers (fig. 10, arrow). Initially, lesions develop as pale yellowish-green spots visible on both leaf surfaces. As the disease progresses, the lesions become bright yellow and angular (see figs. 11 and 12). With age, they become necrotic in the center (see fig. 10). On the lower leaf surface, numerous spore pustules (uredinia) can be differentiated in individual lesions at higher magnification (fig. 14). Lower-leaf lesions become rusty brown due to the production of powdery masses of urediniospores (see figs. 13–14). At the end of the growing season, leaf lesions may turn dark brown to black as they produce two-celled teliospores (see fig. 5, right side). Lower-leaf lesions caused by the rust fungus cannot be confused with any other leaf spot because of their angular shape, small size, and rusty brown appearance.

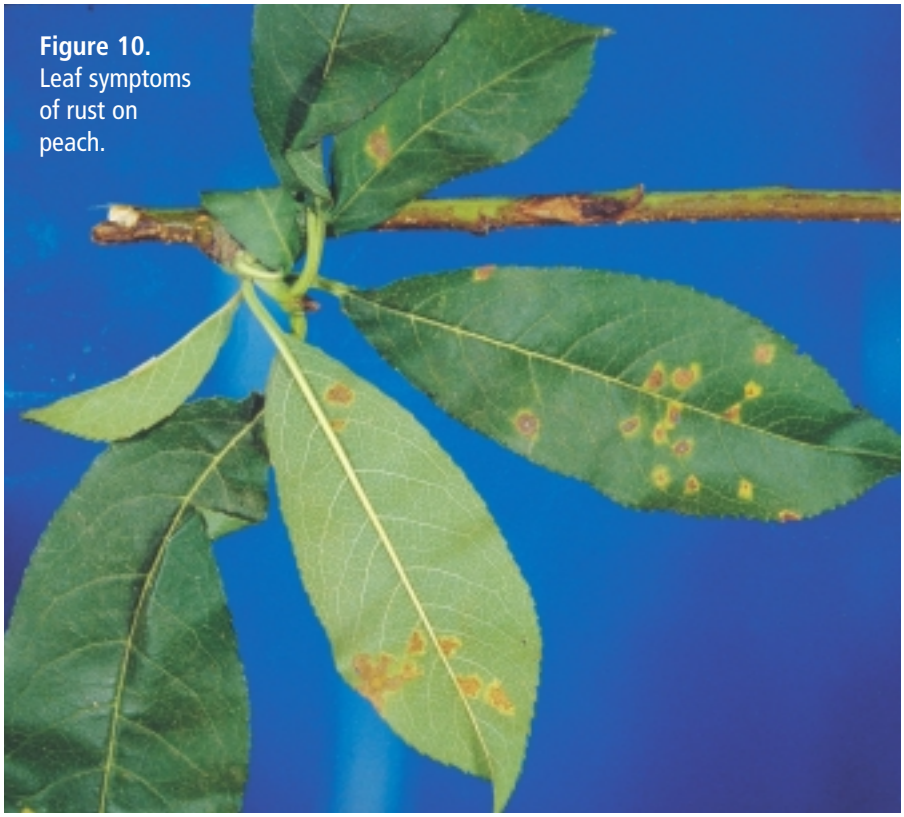

Figure 10.
Leaf symptoms of rust on peach.

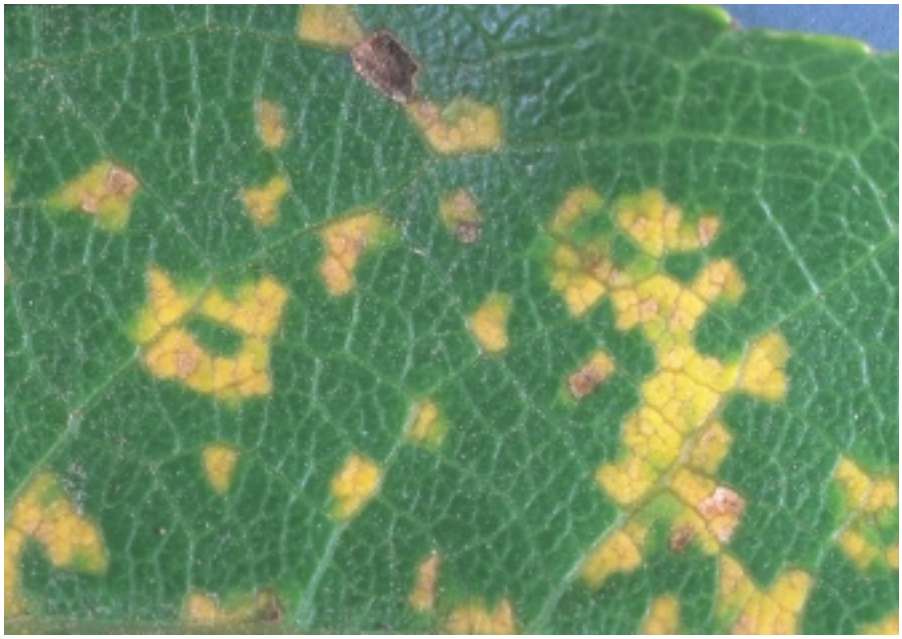

Figure 12.
Close-up of angular yellow rust lesions on upper surface of a peach leaf.

Figure 11.
Numerous yellow angular rust lesions on upper surface of a peach leaf.

Figure 13.
Rust symptoms on lower surface of a peach leaf.

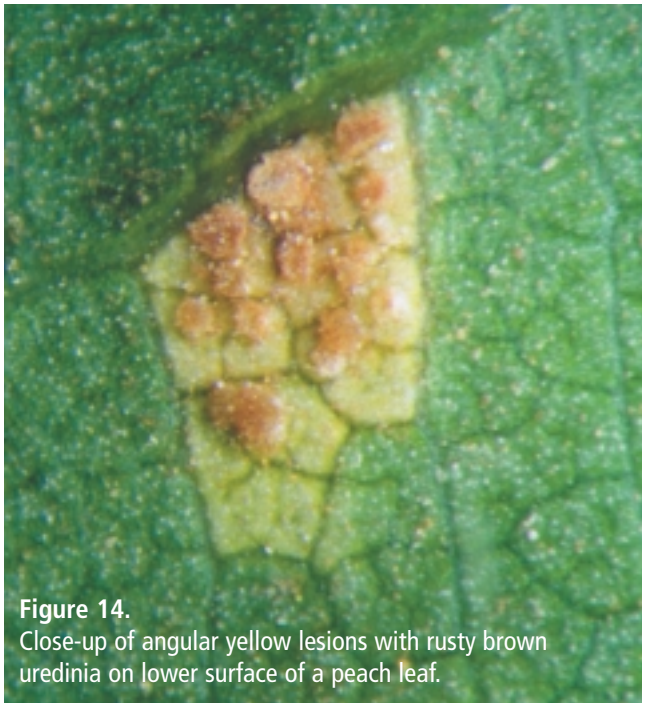

Figure 14.
Close-up of angular yellow lesions with rusty brown uredinia on lower surface of a peach leaf.

Figure 15.
Rust lesions on mature, yellow fruit developing as brownish spots with green halos.

Fruit lesions

Fruit lesions may develop during the growing season after leaf symptoms. They first develop as brownish spots with green halos on mature, yellow fruit (fig. 15). When fruit redden, lesion halos become greenish-yellow (fig. 16). In cross-section, the lesions are depressed and extend several millimeters into the fruit (fig. 17). Numerous infections may develop on each fruit, and these can lead to secondary infections by other fungi such as species of *Monilinia*, *Colletotrichum*, *Alternaria*, and *Cladosporium*, resulting in fruit decay (fig. 18, top left and right fruits).

PATHOGEN AND EPIDEMIOLOGY

Tranzschelia discolor is a fungal pathogen that attacks plants of the genus *Prunus,* including almond, apricot, cherry, peach, nectarine, plum, and prune. It is most common, however, on almond, peach, and prune. The fungus can be separated by special forms, or *formae speciales* (f. sp.), based on the host where it is found. These forms are *T. discolor* f. sp. *persicae* on peach, *T. discolor* f. sp. *dulcis* on almond, and *T. discolor* f. sp. *domesticae* on prune. Although cross-infection of forms among *Prunus* spp. occurs (e.g., the pathogen from almond infecting peach), symptom expression is usually delayed, lesions are fewer in number, and fungal sporulation is reduced.

Tranzschelia discolor has multiple spore stages (macrocyclic) that develop on two different hosts (heteroecious). The only alternate host that has been reported for the peach rust fungus in California is *Anemone coronaria* (Ranunculaceae). The spore stages are urediniospores, teliospores, basidiospores, and aeciospores. Only urediniospores and teliospores are found on *Prunus* spp. (see fig. 5). For peach rust, the single-celled, rusty brown urediniospores are produced on peach and can re-infect peach. This secondary infection and subsequent spore production and reinfection causes economic damage on peach. The dark brown teliospores that develop on peach late in the season cannot reinfect peach. After overwintering, the teliospores germinate and produce basidiospores that in turn infect the alternate host, *A. coronaria.* Aeciospores that are produced on *A. coronaria* infect only *Prunus* spp., and the resulting infection produces the first cycle of urediniospores in the spring. In California, aeciospores have been experimentally shown to infect almond, apricot, peach, and prune, but the *A. coronaria* host is rare where stone fruit crops are grown. *Anemone* spp. are therefore not considered inoculum sources for initial spring infections of peach rust in California.

Figure 16.
Rust lesions on mature reddish fruit developing as brownish spots with yellow halos.

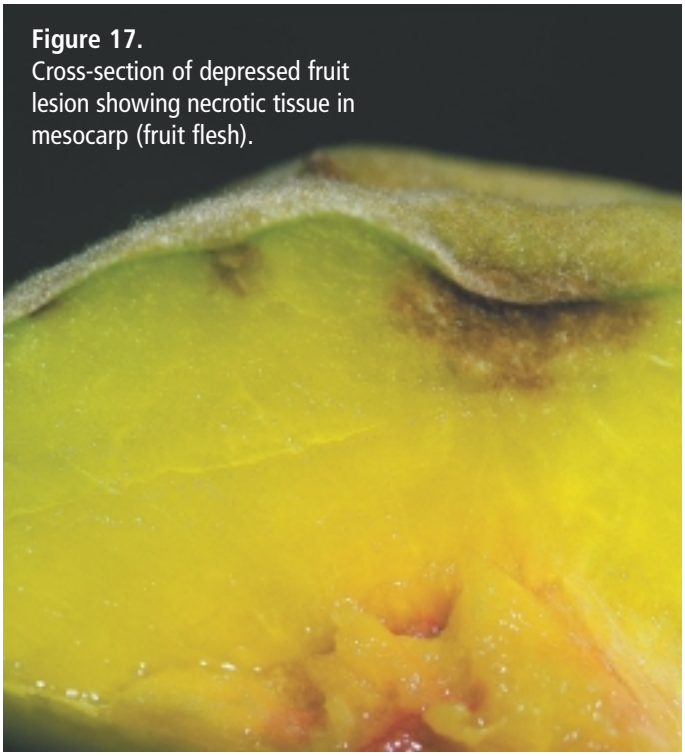

Figure 17.
Cross-section of depressed fruit lesion showing necrotic tissue in mesocarp (fruit flesh).

Figure 18.
Numerous rust lesions and secondary infections of peach fruit.

Urediniospores contaminating peach twigs and buds also cannot be the initial inoculum sources because these spores are generally short-lived and do not survive during host dormancy. Instead, the fungus probably overwinters as mycelia in fruit wood infections from the previous summer and fall. In the spring these infections most likely become the twig cankers that are the source of primary inoculum each year. Urediniospores from twig cankers then infect nearby leaves, more spores are produced in the leaf lesions (secondary inoculum), and under favorable environmental conditions, the disease becomes epidemic due to repeated infections of leaves and fruit. Urediniospores are disseminated by wind. Rainfall and higher wind velocity result in increased numbers of airborne spores.

Because urediniospores germinate over a wide temperature range, from 5° to 30°C (41° to 86°F) with an optimal temperature of 10° to 25°C (50° to 77°F), the availability of viable spores (inoculum) and wetness are major factors for determining infection periods. Leaf and twig infections can occur over a wide range of wetness periods (12 to 36 hours) and temperatures (15° to 25°C [59° to 77°F]). In controlled experiments the optimal wetness duration and temperature for infection was 18 to 36 hours at 15° to 20°C (59° to 68°F). Additionally, the incubation period needed for visible leaf symptoms to develop, after an infection, is 8 to 10 days, whereas the incubation period for twig symptoms is 4 to 6 weeks at 20°C (68°F). The wetness and temperature conditions for fruit infection and symptom expression are not known.

SUMMARY

Our current knowledge about the development of peach rust epidemics in California indicates that high rainfalls (greater than 7.5 cm [3 inches] in May and June) and a high incidence of twig cankers in the spring favor high levels of leaf and fruit infections in the early and middle portion of the growing season. Furthermore, peach rust epidemics on leaves in the fall have been correlated with a high incidence of twig cankers in the following spring. Wetness periods, leaf infections, and twig cankers are the critical components of the disease cycle for forecasting peach rust in California.

FOR MORE INFORMATION

You will find more information on peach rust in the peach guideline in *UC IPM Pest Management Guidelines* (ANR Publication 3339), available at UCCE county offices or from the IPM website at http://www.ipm.ucdavis.edu. For a detailed summary of the disease and for further information on peach production, see *Integrated Pest Management for Stone Fruits* (ANR Publication 3389) and *Peaches, Plums, and Nectarines: Growing and Handling for the Fresh Market* (ANR Publication 3331). See also *Postharvest Handling of California Stone Fruits* (ANR Slide Set 97/102) and *Stone Fruit Bloom Stages* (ANR Slide Set 99/103).

To order these publications, visit our online catalog at http://anrcatalog.ucdavis.edu. You can also place orders by mail, phone, or FAX, or request a printed catalog of publications, slide sets, and videos from

University of California
Agriculture and Natural Resources
Communication Services
6701 San Pablo Avenue, 2nd Floor
Oakland, CA 94608-1239

Telephone: 1-800-994-8849 or (510) 642-2431, FAX: (530) 643-5470
e-mail inquiries: danrcs@ucdavis.edu

An electronic version of this publication is available on the ANR Communication Services website at http://anrcatalog.ucdavis.edu.

This publication was funded in part with a grant from the Cling Peach Advisory Board of California.

Publication 8011

11/00-SB/VFG

ISBN 978-1-60107-191-0