



UNIVERSITY OF CALIFORNIA

Division of Agriculture and Natural Resources

<http://anrcatalog.ucdavis.edu>

Photographic Guide to Citrus Fruit Scarring

ELIZABETH E. GRAFTON-CARDWELL, UC Cooperative Extension IPM Specialist and Research Entomologist, UC Riverside; **NEIL V. O'CONNELL**, UCCE Farm Advisor, Tulare County; **CRAIG E. KALLSEN**, UCCE Farm Advisor, Kern County; and **JOSEPH G. MORSE**, Professor of Entomology and Entomologist, UC Riverside. Photography by Jack Kelly Clark, Elizabeth E. Grafton-Cardwell, Craig E. Kallsen, and Alan A. Urena.

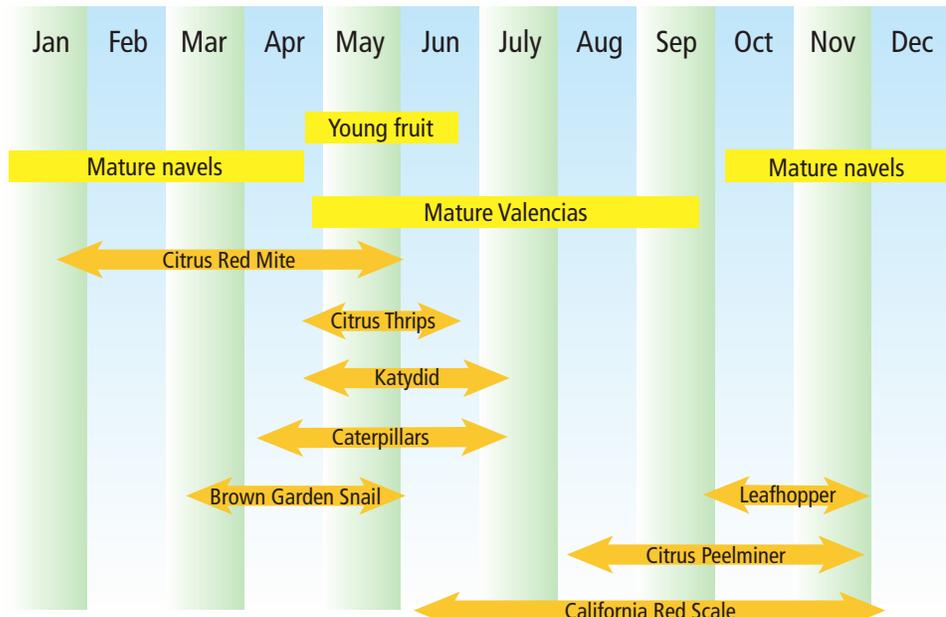
Scarring of the rind of citrus fruit can prompt packinghouse operators to downgrade the fruit from *fancy* to *choice* or even *juice*. If you as the grower can recognize the different types of scars you can differentiate between symptoms that indicate biological (e.g., insect, mite, disease, or snail), mechanical (e.g., equipment, hail, or wind rubbing), or chemical (e.g., phytotoxic burn) damage. Once you know the causal agent you can take steps to reduce injury to future crops. Orchards should be carefully

monitored when fruit are small, the stage at which damage is most likely to occur. As soon as you observe signs of damage, make an immediate search for possible sources of the damage. It is much harder to determine the cause of fruit damage toward the end of the season because the insects or other causal agents are no longer present in the orchard and many types of injuries are by then similar in appearance.



JACK KELLY CLARK

Most citrus fruit scarring occurs in spring (April through June) when fruit are first developing on the tree. The rind tissue is very tender and easily damaged at this time. If damage is severe, the fruit will often fall off of the tree, either at the time of damage or during June fruit drop. If the damage is less severe, the fruit will remain on the tree and continue to grow, and the scarring will become noticeable. Some of the more common types of fruit damage seen in citrus groves are shown on the pages that follow.



Periods of major damage from various pests to young and mature citrus fruit.



CITRUS THRIPS, *SCIRTOTHRIPS CITRI* (MOULTON) (THYSANOPTERA: THRIPIDAE)



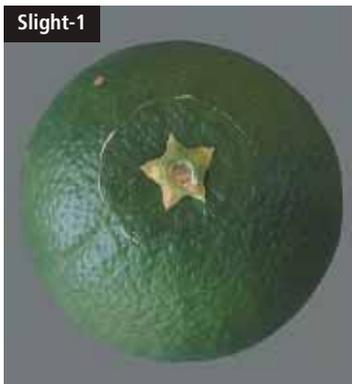
JACK KELLY CLARK



JACK KELLY CLARK

Immature citrus thrips (*left*) spend much of their time (especially when the weather is cool or overcast) under the calyx (*button*) end of the fruit. In spring, this concentrated feeding under the calyx produces a characteristic ring-shaped scar around the stem end of the fruit. The scar expands outward from the calyx as the fruit grows.

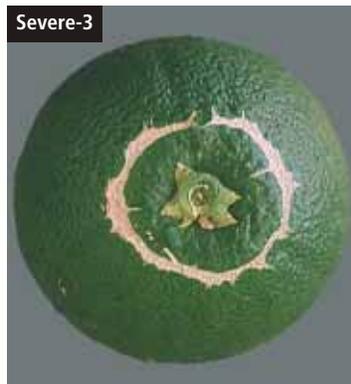
Once the fruit reach approximately 1.5" (about 4 cm) in diameter, the rind cells are not so easily damaged by citrus thrips. Adult thrips (*right*) are less important compared to immatures as a cause of fruit damage.



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

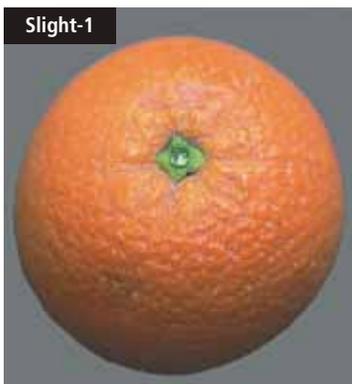


ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

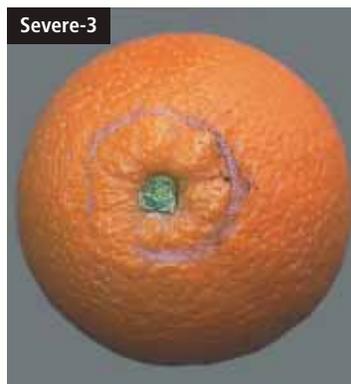
The ring may be slight (a thin circle) or severe (a thick circle, sometimes extending down the side of the fruit, or a heavy partial ring) depending upon the number of thrips, how long they have fed on the fruit, and the age of the fruit. As the fruit grows, the ring moves outward. Fruit damaged by citrus thrips generally are found at the outside of the tree canopy.



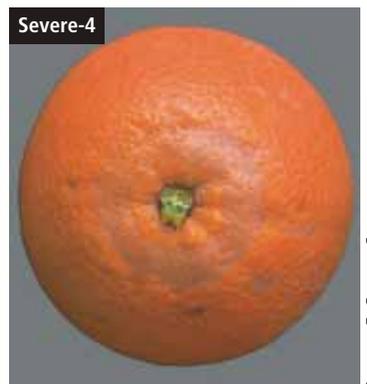
ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

In rating fruit scarring caused by citrus thrips, we use a 0-4 scale where 0 = no citrus thrips scarring, 1 = very slight scarring, 2 = slight, 3 = severe, and 4 = very severe. Levels 1 and 2 would not normally be downgraded in the packinghouse since their thrips scarring is not severe. Levels 3 and 4 would be downgraded from first to second grade.

FORKTAILED BUSH KATYDID, *SCUDDERIA FURCATA* BRUNNER VON WATTENWYL (ORTHOPTERA: TETTIGONIIDAE)



JACK KELLY CLARK

Katydid nymph.



JACK KELLY CLARK

Katydid adult.



ELIZABETH E. GRAFTON-CARDWELL

The youngest first instar katydid nymphs feed on the outer surface of citrus fruit.



ELIZABETH E. GRAFTON-CARDWELL

The older second through fourth instar nymphs have larger mouthparts and make a characteristic circular bite mark on the outside of the fruit.



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

Usually katydids take only one bite from each citrus fruit, toward the midsection. If the damaged young fruit is not aborted, the bite scar will increase in size until it is as big around as a nickel or a quarter. The scar is deeper than scars caused by citrus thrips or mechanical damage. A katydid scar often occurs on the surface of the fruit that is facing back toward the tree.

CITRUS CUTWORM, *EGIRA (XYLOMYGES) CURIALIS* GROTE (LEPIDOPTERA: NOCTUIDAE)

Early citrus cutworm instars hatch prebloom and feed on spring flush leaves.



Cutworm moth and eggs

JACK KELLY CLARK

Once flowers and fruit are available, citrus cutworm larvae will feed on them rather than on leaves. Young instars tend to feed on the surface of the fruit.



Cutworm larva

ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

Older instars may bore into the fruit or feed on the surface in a meandering pattern. The damage goes deeper than damage caused by citrus thrips. Small fruit damaged early in the season tend to fall from the tree.



ELIZABETH E. GRAFTON-CARDWELL

Most of the cutworm scarring seen in the packinghouse is superficial. When cutworm damage takes the form of a circular scar on the fruit, it can easily be confused with katydid damage.

FRUITTREE LEAFROLLER, *ARCHIPS ARGYROSPILUS* (WALKER) (LEPIDOPTERA: TORTRICIDAE)

Fruittree leafrollers usually pupate by petal fall, so they seldom damage young fruit. They prefer to feed on the young, tender foliage of the spring flush.



Fruittree leafroller adult

JACK KELLY CLARK



Fruittree leafroller larva

JACK KELLY CLARK



ELIZABETH E. GRAFTON-CARDWELL

However, if mature navel or 'Valencia' oranges are present and most of the spring flush has already been consumed, leafrollers will bore into mature fruit and damage the fruit interior. Leafroller larvae leave a small circular hole in the rind the width of their body (about 1/4 inch [0.5 cm]).



ELIZABETH E. GRAFTON-CARDWELL

A leafroller larva will often form a protected feeding site by using its webbing to attach a leaf to the fruit.

**AMORBIA,
AMORBIA
CUNEANA
BUSCK
(LEPIDOPTERA:
TORTRICIDAE)**



JACK KELLY CLARK



JACK KELLY CLARK

Amorbia (also called *western avocado leafroller*) larvae are particularly prevalent in citrus orchards that neighbor avocado groves.



The amorbia larva produces webbing and lives under the sepal of the young fruit.



ALAN A. UREVA

Larvae cause circular damage at the calyx (*button*) end of the fruit similar to that caused by citrus thrips. The damage from amorbia is deeper, however, and there can be webbing at or near the site of damage. Amorbia larvae may also web leaves to mature or immature fruit and then bore into the fruit.

CITRUS PEELMINER, *MARAMARA GULOSA* GUILLEN & DAVIS (LEPIDOPTERA: GRACILLARIIDAE)



JACK KELLY CLARK



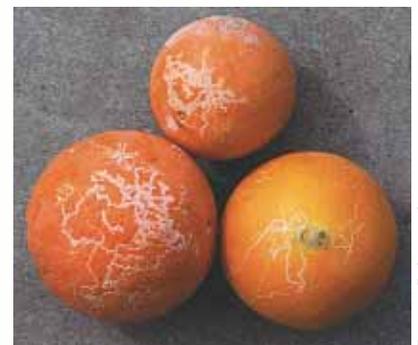
ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

The peelminer moth deposits an egg on the citrus fruit and the resulting larva bores beneath the surface leaving a long mine. Larvae may also attack green twigs.

Larvae mine just under the surface of the fruit rind.



ELIZABETH E. GRAFTON-CARDWELL

Grapefruit and smooth-skinned navels such as the 'Fukumoto' shown here are preferred hosts.

POTATO LEAFHOPPER, *EMPOASCA FABAE* (HARRIS) (HOMOPTERA: CICADELLIDAE)



JACK KELLY CLARK



JACK KELLY CLARK



ELIZABETH E. GRAFTON-CARDWELL

Leafhoppers cause fruit damage by puncturing and feeding on rind cells. The scar that forms is a small yellowish to brownish patch. Damage usually appears in late summer and fall and can easily be confused with scars from citrus thrips oviposition (egg laying).

BROWN GARDEN SNAIL, *HELIX ASPERSA* MULLER (STYLOMATTOPHORA: HELICIDAE)

Brown garden snails often damage mature fruit that is close to the ground, particularly during warm, wet winters and cool, wet springs.



JACK KELLY CLARK



ELIZABETH E. GRAFTON-CARDWELL

The damage caused by snails looks like small brown patches or white chewed areas. When fruit are damaged by snails, similarly rasped and cut leaves can usually be found nearby.

CALIFORNIA RED SCALE, *AONIDIELLA AURANTII* (MASKELL) (HOMOPTERA: DIASPIDIDAE)



ELIZABETH E. GRAFTON-CARDWELL

Heavy patches of scale lower the fruit's quality rating. As a general rule, if there are more than 10 adult female scale insects the patch will be noticeable.



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

Red scale-infested fruit before and after high-pressure washing. A "shadow" of the scale may remain after the scale insects themselves have been washed off.

CITRUS RED MITE, *PANONYCHUS CITRI* (MCGREGOR) (ACARI: TETRANYCHIDAE)



ELIZABETH E. GRAFTON-CARDWELL

Citrus red mites usually only damage leaves by stippling them. If weather conditions are right (a mild winter and a cool spring), however, red mites can build up very high numbers on the fruit and cause bleaching.



ELIZABETH E. GRAFTON-CARDWELL

Fruit at left is bleached by heavy citrus red mite feeding. Fruit at right has not been bleached.

EUROPEAN EARWIG, *FORFICULA AURICULARIA* LINNAEUS (DEMPATERA: FORFICULIDAE)



JACK KELLY CLARK

Earwigs cause occasional but often severe problems in young orchards.



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

Earwigs can climb the trunk of a tree and feed on foliage and young fruit.

CHEMICAL DAMAGE (PHYTOTOXICITY)



ELIZABETH E. GRAFTON-CARDWELL



JACK KELLY CLARK

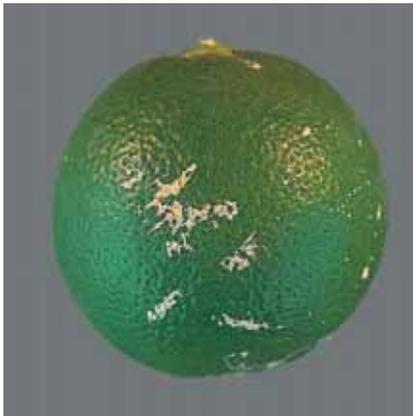


ELIZABETH E. GRAFTON-CARDWELL

Some chemicals, oils, and fertilizers can cause chemical burn or phytotoxicity, particularly when the fruit is small and tender. Usually, if it is going to appear, such damage is evident on the fruit 3 to 4 days after treatment. The pattern of damage looks like a splash and usually occurs on the side of the fruit facing away from the tree.

Lorsban (chlorpyrifos) insecticide applied to trees from January through March can cause ridges to develop on the new crop of fruit that develops later in the season.

PHYSICAL DAMAGE: EQUIPMENT



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

Equipment such as spray rigs that are driven down the row often can cause scratches or marks on green fruit. Fruit damaged by field equipment are always on the side of the tree facing the driving area.

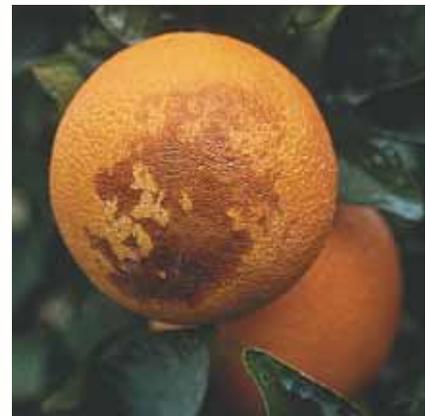
PHYSICAL DAMAGE: WIND/BRANCH RUBBING



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

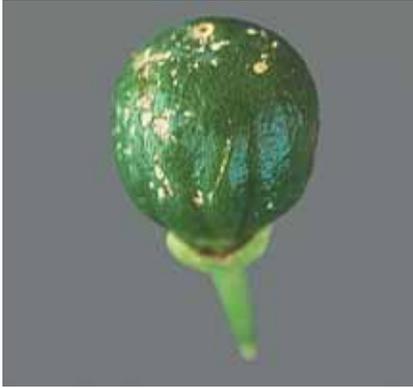


CRAIG E. KALLSEN

Wind may cause fruit to rub against branches, twigs, or leaves, causing scratches and scars to develop. Unlike insect damage scars, this type of scar is usually superficial and the shape or pattern of the scar may suggest the source of the abrasion.

High winds that blow dust and sand against fruit may cause abrasions.

PHYSICAL DAMAGE: HAIL



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL



ELIZABETH E. GRAFTON-CARDWELL

Hail damage occurs only infrequently. It looks very much like equipment damage except that it can be found on areas of the tree that farm equipment does not touch. The scars look like small pits and strikes on the fruit. Often the leaves are shredded, with some leaf fragments found on the ground near the tree a short time after the hail storm.

FOR MORE INFORMATION

You'll find detailed information on many aspects of citrus production and pest management in these titles and in other publications, slide sets, CD-ROMs, and videos from UC ANR:

Integrated Pest Management for Citrus, publication 3303

Decollate Snails for Control of Brown Garden Snails in Southern California Citrus Groves, publication 21384

Stages of the Cottony Cushion Scale (Icerya purchasi) and its Natural Enemy, the Vedalia Beetle (Rodolia cardinalis), publication 8051

To order these products, 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, CD-ROMs, and videos from

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

Telephone: (800) 994-8849 or (510) 642-2431

FAX: (510) 643-5470

E-mail inquiries: danrcs@ucdavis.edu

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

Publication 8090

© 2003 by the Regents of the University of California, Division of Agriculture and Natural Resources. All rights reserved.

The University of California prohibits discrimination against or harassment of any person employed by or seeking employment with the University on the basis of race, color, national origin, religion, sex, physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (special disabled veteran, Vietnam-era veteran or any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized).

University Policy is intended to be consistent with the provisions of applicable State and Federal laws.



Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 300 Lakeside Drive, 6th Floor, Oakland, CA 94612-3550 (510) 987-0096. For information about obtaining this publication, call (800) 994-8849. For downloading information, call (530) 754-5112.

10/03-WJC/CR