HEALTHY FOOD SYSTEMS • HEALTHY ENVIRONMENTS • HEALTHY COMMUNITIES • HEALTHY CALIFORNIANS

University of California
Agriculture and Natural Resources
Making a Difference for California

UCCE

Kern Pistachio Notes

October 2022

Some odd observations of the 2022 harvest

During harvest this season, some of the odd issues I saw in our own U.C. pistachio trials were confirmed by the many calls I received from growers related to what they observed during their harvests. The following are the issues of concern that were most commonly reported:

1. Nuts were difficult to shake from the tree.
2. Nuts were slow to mature, especially late in the season.
3. Nuts were small.
4. Nuts did not split.
5. Lots of blanks and late-stage nut abortion.

What is not clear is what may have caused these issues. However, this season there exist plenty of possible causes to choose from and some combination of these or novel ones not listed here may have been responsible. Some of the possible causes are as follows:

1. Two days of extremely high temperatures (>95 °F in many orchards) in early April during bloom. In Kern County, these temperatures struck in the middle of the Kerman bloom period.
2. The two days of high temperatures were followed a couple of days later by freezing or near freezing temperatures. After the near-freezing temperatures remained on the cool side for pistachios for another week or so. There were many small red nuts on the trees this past May, which usually indicates some level of stress in early nut development (although there is plenty of room for more research here). We see similar nut symptoms in low-chill years.
3. In general, many mature orchards had two relatively high-yielding on-years in the alternate bearing cycle the previous two seasons. The trees may have been due for a rest. Usually, split percentage decreases in the off-year and late-season kernel abortion increases.
4. Temperatures, even for the southern San Joaquin, were unusually hot during the late nut-fill period (late August and early September) with long intervals of air temperatures above 100 °F with some record or near record high night and high daytime temperatures. Trees may not have been able to keep up with the high ET demand, or perhaps, the high day and night temperatures increased respiration or had adverse effects on plant metabolism.

Whatever the cause of this year's problems, it is somewhat of a relief that the harvest season is ending. However, I suspect that there are many orchards where the wait continues for the nuts to mature, and once mature, that they can actually be shaken from the tree.

Unusual Gopher Damage in Bearing Pistachio Trees

The pictures show unusual damage to the rootstock of some bearing pistachio trees. This damage was easy to find in this orchard. Although not caught in the act, the mounds of dirt at the base of damaged trees and the depth and diameter of the hole under the mound leaves little doubt that gophers were the cause of these large "gouges" in the tree bark. This damage is unusual in that, at least is my experience, gophers have been much more serious pests of juvenile trees than bearing trees. In young orchards, especially those newly planted and in 2nd-leaf trees, gophers chew through the trunks at crown level and kill the tree. They leave a dried up "stick" where the living tree previously existed. A single gopher can kill multiple young trees. Often, they just work down the row. Not only can they kill and damage trees directly, but the wounds they make in the below-ground parts of the tree provide easy entry for fungal organisms that cause crown rots and for mold-like, water loving pathogens such as species of *Phytophthora* that attack the cambium. Some fungal species grow slowly and can take years to kill the tree. That 12-year-old tree in the orchard that collapses suddenly from crown rot during hot weather may be the victim of gopher damage a decade ago. There should be no tolerance for gophers in a pistachio orchard. Gophers can be a bigger problem in orchards with lush cover crops and in weedy orchards. Gophers appear to prefer the roots of herbaceous plants but have no trouble adding pistachio roots to the menu. Other vertebrate pests eat pistachio bark. This list includes rabbits, ground squirrels and voles (aka meadow mice). Rabbits sit in the crotch of the tree while nibbling the bark, while ground squirrels, which are excellent climbers, can girdle entire scaffold branches and the trunk of mature pistachios. Ground squirrels, typically, unlike what we see in these pictures, will remove the entire bark and cambium down to the white wood beneath. Information on vertebrate pests associated with pistachio can be found at: Managing Vertebrates / Pistachio / Agriculture: Pest Management Guidelines / UC Statewide IPM Program (UC IPM) (ucanr.edu).

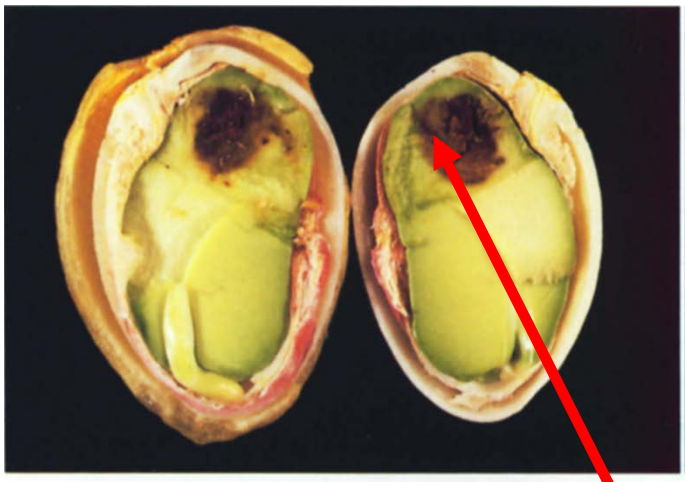
Some control options with a budget are discussed in latest Pistachio Cost of Production publication at [Sample Costs to Establish and Produce Pistachios, Low-Volume Irrigation, San Joaquin Valley South, 2020 (ucdavis.edu)]

Epicarp Lesion versus Internal Kernel Discoloration (IKD) in Pistachio

Epicarp lesion is a problem for the pistachio industry, especially the lesions caused by late season feeding of big bugs like stinkbugs and leaffooted bugs. All cultivars appear equally at risk for epicarp lesion.

ABOVE: Leaffooted nymphs on pistachio nuts near harvest.

LEFT: Rachis with nuts showing epicarp lesion.



"Less firmness at the stem end **or** base (white area in photo above) than in other parts of pistachio fruit was associated with higher percentages of epicarp lesion begun at the base (discolored area, or kernel necrosis, in photo at upper left). Another area of feeding by leaffooted bugs or stinkbugs is along the suture or split line, producing kernel necrosis and concentric rings (lower left)." Quoted text and photos from Dr. Themis Michailides – Plant Pathologist UC Davis (see link - The ‘Achilles heel’ of pistachio fruit (ucanr.edu).

Big-bug-feeding damage occurring in late August may be difficult to cull from harvested nuts and these nuts may end up in consumer packages. The picture on the left is of nuts with epicarp lesion collected during harvest in early September. The hulls and outer shell of these nuts gave little or no indication that the kernels had suffered bug damage. Stinkbug nymphal stages and adults were found in this orchard at harvest.

The two pictures above are of the same nut. The interior show obvious epicarp lesion. However, the only evidence on the outside of the kernel is the slightly sunken crater here.

Sometime in late 2020, I was made aware of a discoloration problem in kernels of the 'Golden Hills' cultivar. The picture, above, demonstrates some of the most extreme examples of the problem. The discoloration of the kernels has been named "internal kernel discoloration" (IKD). It can be present in 'Lost Hills', as well, and is rare in 'Kerman'. I have not found it in 'Gumdrop'. The cause and incidence of this problem requires further investigation. Experiments in which big bugs were excluded from nut clusters have demonstrated that it is not caused by small or big bugs (i.e. Hemipterans). No disease pathogen has been isolated from affected kernels. The effect on flavor appears to be minimal. The discoloration is located where the two "halves" of the kernel come together. The depth of discoloration into the kernel is very shallow. The discoloration emanates from the top of the kernel where the nut was attached to the rachis. As noted above in the research of Dr. Themis, the big bugs can produce concentric rings, as well, in the kernel, so it is important to separate epicarp lesion from IKD in seeking a cause.

The above picture shows typical symptoms of IKD at harvest. Approximately 1% of the sampled split nuts showed IKD in this examination.

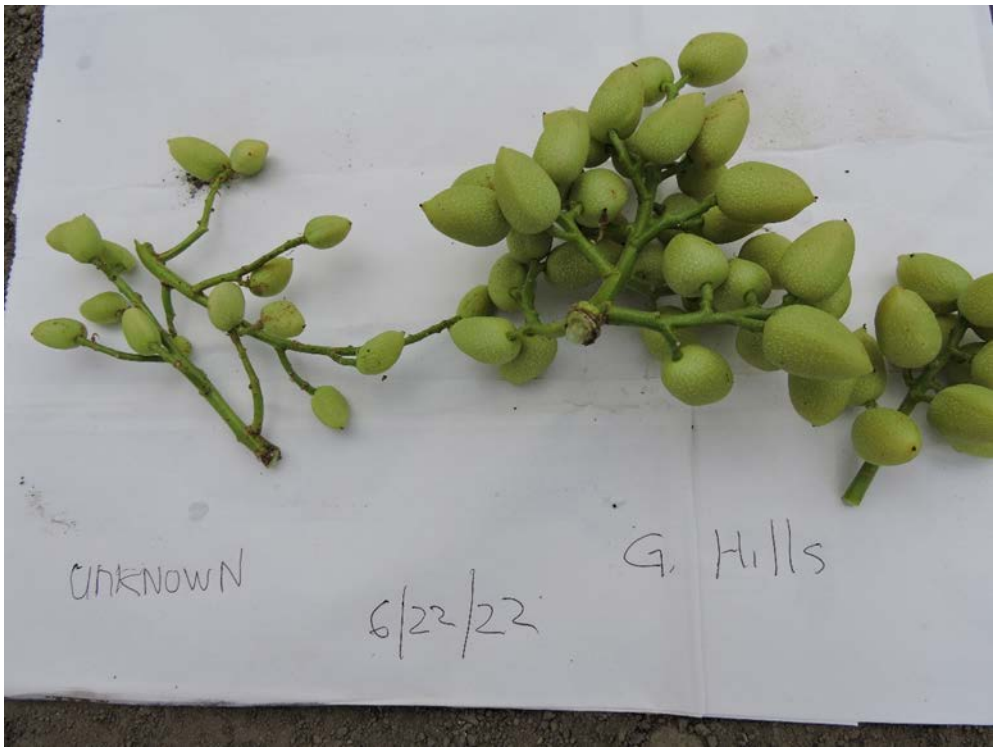
There appears to be increasing interest on the part of the USDA to call nuts with IKD a “cull”. If so, it is not clear how the industry will be able to separate IKD nuts from unaffected nuts. The same is likely true for late-season big-bug damage.

Unfortunately, the increased scrutiny that IKD is bringing to internal kernel quality is going to focus more attention on late stage big-bug kernel damage. In the past, since late-season big bug damage was often not visible in nut-quality grading, there was little feedback from the processors that late-season stinkbug and leaffooted bug pesticide treatments may have been justified. However, as increased attention focuses on the interior kernel, the importance of controlling late-season infestations of the big bugs becomes obvious.

“Off-type” Golden Hills Trees Found in Some Orchards. A Bud Sport is Suspected.

For a number of years, growers have been bringing to my attention what appears to be trees that originated from a “sport mutation” in their orchards. Buds may mutate spontaneously and some of the most valuable varieties of our cultivated tree species have originated in this way. For example, navel orange originated from a bud sport. For the purposes of this article, I am assuming that what appears to be off-type trees seen in some orchards are, indeed, the result of propagation of a bud sport. However, proving that these trees are bud sports is not easy to do and is outside my area of expertise. Please consider this article a “heads up” for those collecting budwood for future orchards.

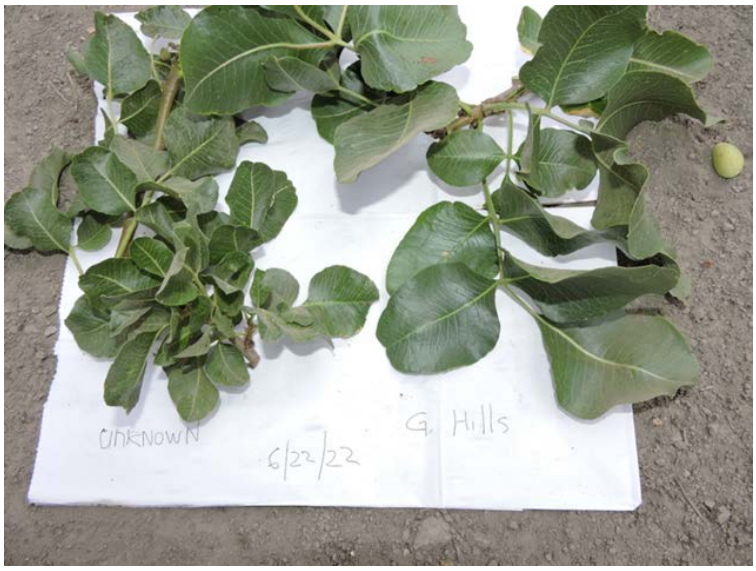
Unfortunately, this off-type tree present in ‘Golden Hills’ orchards is unsuitable for horticultural use. This sport, based on current observations, appears to produce small yields of very small nuts that will likely pass through the 30/64 inch screen when harvest quality is evaluated at the processing plant. Many of these small nuts are blank, as well. The picture below demonstrates the difference in nut size seen in an orchard on June 22, 2022, between the unknown sport (on the left) and a “normal” tree (on the right). Nuts should be full size at the end of June and shell hardening is occurring at this time.



Usually, in the orchards I have visited, four or five of these sport trees are found lined up in a single row, as if they came from the same bud stick. Sometimes there is a “normal-looking” male tree separating the sport trees in the row. The observation that the male tree is unaffected, suggests that the affected female sport trees on each side came from the same bud stick. There may be a number of locations within an orchard where the sport trees are found, all, again, lined up in an interval along a single tree-row. More recently, longer rows of these trees have been observed, suggesting that the budder had multiple sticks of affected budwood.

Differences in canopy growth are noted in these trees. The age of the trees appears to effect symptoms. Juvenile trees demonstrate long shoot growth with ragged, misshapen leaves and leaflets as in the two photos below.

Also, this kind of growth is present in the upper canopy shoots of trees just coming into bearing (beginning in fifth leaf). In addition, in trees just coming into bearing, lower areas of the canopy on older shoots may demonstrate "bunchy" growth as shown in the shoot on the left in the photo below.



In general, identifying this specific sport in an orchard of trees is not easy before they come into bearing. Poor yields of small nuts are the major identifying characteristics.

The similarities in growth between affected and non-affected non-bearing trees is demonstrated in the photo below. The affected trees are in the row on the right (note painted rings on the trunk) and "normal" trees in the row on the left.

In an attempt to define where the sport originated, sample leaves of the affected trees were sent to Dr. Dangl, at the UC Davis Foundation of Plant Services - Foundation Plant Services (ucdavis.edu). Dr. Dangl has a protocol for genetically identifying and separating the major pistachio varieties and rootstocks. However, this protocol will not determine if a tree is a sport or not. His results showed that the affected trees were 'Golden Hills''. If we assume then, that these trees are sports, then the logical conclusion is that these trees are a sport of Golden Hills', which explains how something like this ended up in a pistachio orchard in the first place.

Pistachio trees take a long time from planting to when they begin to produce nuts. Understandably, growers are hesitant to remove a tree and replace it without sound evidence. Minor difference in canopy growth are not usually enough to warrant tree removal. For this reason, affected trees may remain in an orchard for a long time. Typically, in the pistachio industry, budwood for new orchards comes from existing commercial orchards, and usually from non-bearing third or fourth-leaf trees. If the trees shown in the above picture were used as sources of budwood for other orchards, it is not difficult to imagine how this sport was and could be spread far and wide, with the severity of occurrence among orchards and within a given future orchard, increasing with time. It is not possible that the sports in this orchard mutated in this orchard. The original mutation, undoubtedly, occurred many years ago in an orchard far away and has since traveled through budding. Fortunately, pistachio does not appear to mutate as commonly as navel orange but even a single sport can be a problem,

especially considering the number of pistachio trees that have been propagated in the past decade. The existence of even the possibility of bud mutations should emphasize the importance of care in budwood selection for future orchards.

Craig Kallsen, Pistachios/Subtropical Horticulture Advisor
cekallsen@ucdavis.edu or 661-868-6221