EUTYPA DIEBACK OF APRICOT AND GRAPE IN CALIFORNIA

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EUTYPA DIEBACK OF APRICOT AND GRAPE IN CALIFORNIA

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Introduction

This disease, first described as "gummosis" of apricot trees and "dying arm" of grapevines in Australia, is now known to be an important problem throughout temperate apricot and grape growing areas of the world. Recognized in California apricot orchards in the early 1960's, it was detected in vineyards 10 years later. Initially called "Cytosporina dieback" on apricots in California because the imperfect (asexual) fungus stage was readily associated with affected apricot trees, it is now designated "Eutypa dieback" after the perfect (sexual) fruiting stage of the fungus, *Eutypa armeniacae*. The perfect stage is frequently present in diseased orchards and vineyards in higher rainfall districts, such as those close to San Francisco Bay. The most severe damage is generally found in mature trees and vines. One or more limbs of trees or arms of vines may be lost and, if the disease is not arrested, the entire tree or vine may eventually die.

It is probable that Eutypa dieback has been present in California for many years and has only recently been properly identified, especially in grapes. In fact, studies in northeastern America earlier this century mistakenly attributed "dead-arm" symptoms on grapes to another fungus. On apricots the disease was commonly mistaken earlier for bacterial canker, a widespread disease of apricot and other fruit trees.

Economic losses due to Eutypa dieback may be minor under good growing conditions where diseased branches or arms are removed and quickly replaced. The most damaging effects are seen where infection has occurred at a large pruning wound on the main structural framework of the tree or vine; for example, an infection in the crotch of the trunk of a 2- to 3-year-old apricot tree can lead to gummosis, cankering, and premature collapse of large portions of or even the entire tree several years later, just when heavy fruit bearing begins. Removal of such infections is often impossible. On vines, the most severe infections are often seen where large pruning wounds have been made on the trunks during retraining. Over-all, the greatest loss seems to be in decreased productivity and shortened economic orchard or vineyard life.

The marked increase in incidence of this disease in vineyards in recent years probably can be attributed to several things: accurate identification of the disease formerly attributed to various causes, too little attention given to removal of infected vine parts, and greater use of sprinkler irrigation in cooler grape areas (which favors development of infective spores of the fungus).

In California, the *Eutypa* fungus attacks most of the commonly grown varieties of apricot and grape. While abandoned apricot orchards in some parts of the San Francisco Bay Area are a known source of infectious spores for other orchards and vineyards, old apricot orchards are not the sole culprit. Additional hosts include species of *Ceanothus*, or "California lilac," that grow in home gardens as well as in the wild and become infected if heavily pruned. Choke cherries are another host in California. In other parts of the world the fungus is reported to exist on dead wood of an even wider range of woody perennial trees and shrubs, and this suggests that infectious spores may originate from a number of different sources in California as well.

Recognizing Eutypa Dieback

On apricot trees

Sudden collapse of individual branches during mid- to late-summer is the most obvious symptom. Leaves and shoots often wilt rapidly and dry on the tree, standing out like dessicated "flags," and the dry brown leaves often remain until the following winter (Fig. 1). Branches sometimes become weak with chlorotic leaves as flow of sap is gradually cut off.

The *Eutypa* fungus is a wound parasite, and infection by airborne spores usually occurs through fresh pruning wounds. The disease does not occur on unpruned apricot trees, or on those damaged by harvester or cultivation equipment. Visible cankers develop around an infected pruning wound for 12 months or so, and the branch eventually dies, although final limb collapse may not occur until months or years after the canker is formed. Externally, the cankered bark is usually darkened, depressed, and malformed, often with cracking and gumming (Fig. 2).

Primary infection occurs in the woody or water-conducting tissues (xylem) which discolors light-tan to dark-brown; this is easily seen when the limb is removed and split lengthwise. Discoloration of the inner wood may extend for a considerable distance above or below the margin of a bark canker. As the infection grows older, the wood becomes drier, more brittle, and breaks readily. This characteristic can provide a useful guide in diagnosis: branches which have been extensively invaded are easily broken off. Leaves on badly-affected branches sometimes are cupped and marginally scorched.

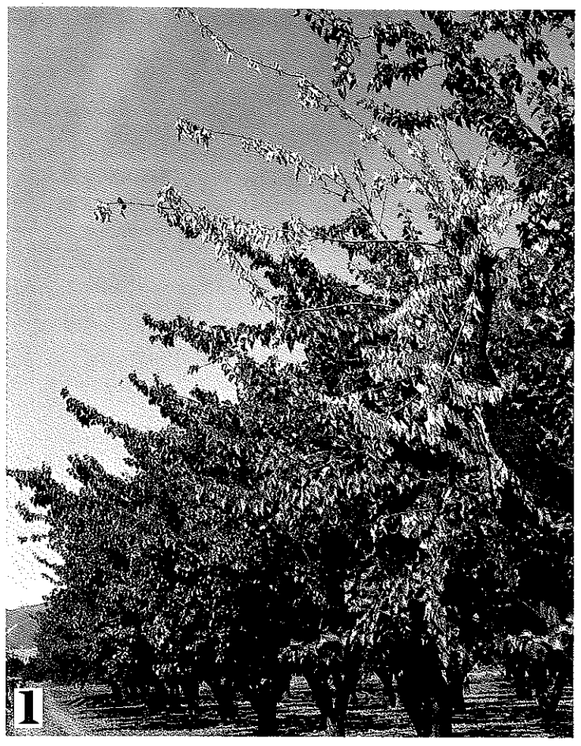
On grapevines

The symptoms of Eutypa dieback are best seen in spring, when normal grapevine shoots are 10 to 15 inches (25 to 38 cm) long, just ahead of the period of rapid shoot growth. Affected vines, distributed at random throughout the vineyard, show individual weak and stunted shoots with shortened internodes. These shoots contrast strikingly with healthy ones alongside (Fig. 3). Leaves on affected shoots at first are small, chlorotic, and misshapen, sometimes cupped, distorted, and marginally necrotic with small areas of dead interveinal tissue. Later in the season they take on a tattered and scorched appearance. Many of the flowers shell off, and the flower clusters often dry before blooming. On other clusters the set may be poor so that the clusters have numerous shot berries and are straggly in appearance. If the shoots are only mildly affected, the tattered leaves appear on just the first few nodes and subsequent growth is normal.

The disease appears first in one or two spurs and spreads in following seasons to adjacent spurs and arms, eventually killing the arm or cordon branches. Shoots developing from below an affected arm are quite healthy at first but show symptoms in subsequent seasons. Unless a major portion of the vine's structural framework is involved, by midsummer the affected shoots usually are covered by normal overgrowth from the healthy portion of the vine. It is common to find one side of the vine dead while the other side appears healthy (Fig. 4). When the whole vine has been killed or is severely affected by Eutypa dieback, strong suckers often develop from the still healthy root system. Complete collapse and death of vines or arms in summer — as occurs in apricot trees — is uncommon for grapevines; once shoots have emerged they usually grow through summer and die the next winter. Eutypa dieback disease is not generally found in vines younger than 5 to 6 years, and is seen most frequently in vineyards established for 10 years or more.

An important diagnostic symptom of the disease in grapevines too is the formation of pruning wound cankers. These dead areas surrounding large old pruning wounds take several growing seasons to develop, and often can only be found by removing the rough outer bark (Fig. 5). They are frequently located adjacent to the affected spurs and, unlike apricot trees, there is no gumming. In advanced cases, the wood around an unhealed wound assumes a ridged and flattened appearance so that the trunk or cordon may be twisted and malformed. Older cankers show a marginal zonation, indicating successive annual attempts of the vine to overgrow the necrotic area.

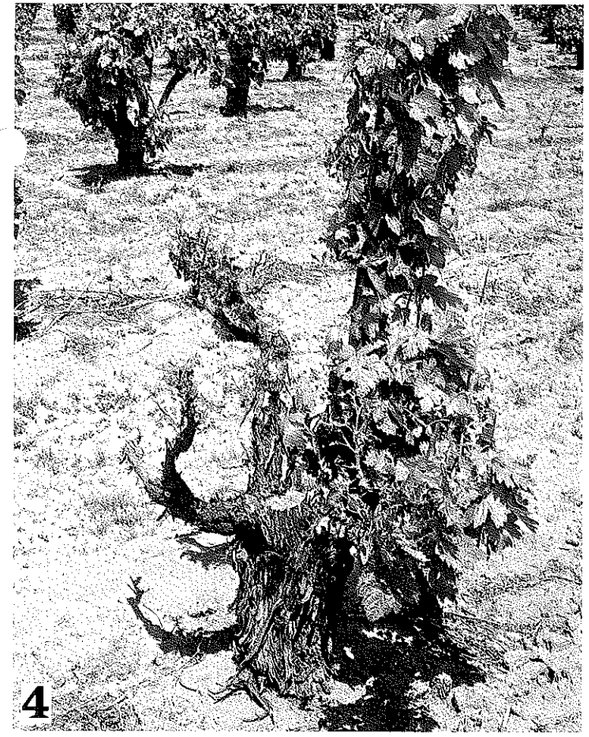
Trunk cankers on vines can be quite long, and a cross section through the canker often reveals only a narrow strip of live wood. In its early stages, a canker in cross section appears as a wedge-shaped darkened area coming to a point in the center of the arm or trunk (Fig. 6). Streaks or flecks of darkened tissue in the live wood above the canker are characteristic.



1. Leaves and shoots of affected apricot branches often wilt rapidly and dry on the tree during mid- to late-summer.

2. A pruning wound canker on apricot is usually darkened and malformed, often with cracking and gumming.

3. Severely-affected grapevine in early summer shows individual weak and stunted shoots with shortened internodes. These shoots contrast strikingly with healthy ones alongside.

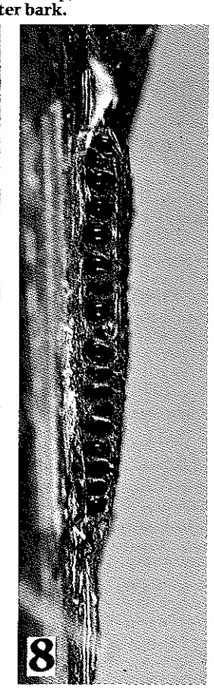


4. It is common to find one side of a grapevine dead while the other side appears healthy.

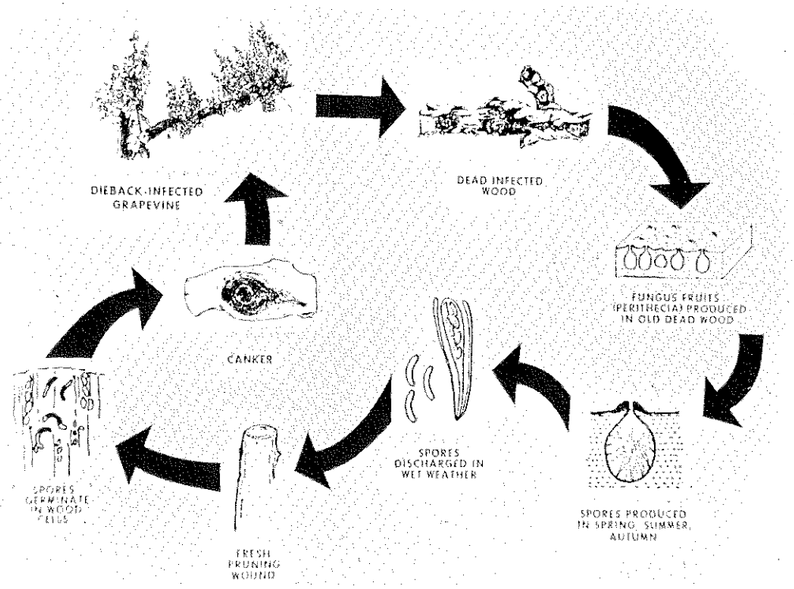
5. Pruning wound cankers on grapevines are not as obvious as on apricot trees. These dead areas surrounding large, old pruning wounds take several growing seasons to develop, and often can only be found by removing the rough outer bark.

6. Grapevine canker in cross section, showing wedge-shaped darkened area; flecks of darkened tissue in the live wood around the canker are also often found.

7. In higher rainfall districts, spore-bearing wood is often found on the lower trunk of previously infected trees or vines, especially on the shaded side.



8. A sharp blade can be used on the blackened crust of wood to expose the *Eutypa* fruiting bodies holding the spores.



9. Disease cycle of Eutypa dieback fungus on grapes. On apricots, the cycle is similar, except that portions of the tree often collapse suddenly rather than exhibiting a gradual dieback.

How Does the Disease Spread?

The fungus comes in contact with pruning wounds as a result of aerial movement of infective spores (ascospores) produced by the fungus on old, diseased dead wood.

Eutypa dieback does not spread by pruning tools, so it is not necessary to disinfect shears or saw after making a cut. Once an apricot limb or a grapevine arm has been killed by the disease, it takes 2 or more years before perithecia (fruiting bodies) containing spores are produced on old, infected host tissue (mainly the exposed wood) and then only under conditions of high moisture. In southern Australia, where the disease has been studied in more detail, it is thought that formation of *Eutypa* fruiting bodies is rare in regions where the mean annual rainfall is less than 12 inches (300 mm). In California, perithecia have not been found anywhere in the San Joaquin Valley, where annual rainfall varies from approximately 5 to 15 inches (125 to 380 mm), and summers are always hot and dry. But perithecia, which are renewed each year, are comparatively easy to locate in the cooler, higher rainfall areas near the coast. These fruiting bodies discharge spores during rain, with greatest numbers in the fall (October) and spring (April). Spores are discharged only during and soon after a rainfall of at least 0.05 inch (1.25 mm). There is now substantial evidence that viable spores may be carried for distances of at least 40 miles (64 km) from the San Francisco Bay Area to infect trees and vines in the more arid regions of the San Joaquin Valley where spores are not known to be produced.

In older diseased vineyards (in the Napa Valley for example), spore-bearing wood is often located on the lower trunk of previously infected dead vines, especially if the remaining "stump" is shaded from direct sunlight. This also applies in older apricot orchards of the Suisun or other coastal valleys (Fig. 7). A blackened crust appears as the perithecial layer matures. With a very sharp knife one can cut through the blackened wood to confirm presence of perithecial cavities holding the ascospores (Fig. 8).

Pruning wounds usually lose their susceptibility to infection about 2 to 4 weeks after pruning, although duration of pruning-wound susceptibility depends on the time of the year: apricot wounds are more susceptible in autumn than near bud break in spring, and grape pruning wounds are likewise more susceptible early in the dormant season. Figure 9 shows the disease cycle on grapes.

Managing the Disease

Because of the diversity of host species which provide spores for infection, eradication of the disease source is not feasible. However, individual growers can reduce risk by eliminating infected wood of grape, apricot, or other known hosts in the vicinity — especially in higher rainfall areas.

Apricot trees

Nonpruning offers one alternative for apricots, since pruning wounds are necessary for infection, but this approach is usually only practical in home orchards. In training vigorously growing, 1- to 3-year-old apricot trees, it is customary to make large pruning wounds on the trunk and basic framework of the developing tree. These injuries frequently become infected with *Eutypa* if wounds are made in rainy weather between fall and spring. The resultant cankers, which may not become evident until the tree is 3 to 5 years old, are almost impossible to remove by surgery. For this reason, train young trees in the growing season, wherever possible. Leaving lateral branches long, rather than shortening them back too far will also help reduce the number of pruning cuts and subsequent infection, and will give a larger tree earlier in life. This method also lends itself better to July-August pruning.

During summer in California there is almost no risk of infection because in most years these months are virtually rainfree, and studies have shown that even if rain does fall at that time there are few *Eutypa* spores being spread in the air. However, by late September-October, when leaves start dropping from the trees, the spores are abundant, and infection potential is greatest during early rains. For the same reason, mechanical topping of orchard trees is also best completed in August-early September, well ahead of the rainy season (topping machines do not spread the disease).

Studies of apricot orchards have shown that rain-discharged ascospores follow a regular seasonal cycle. Highest numbers of spores are found when rain falls in the autumn, and again in spring, with relatively low numbers between early November and late December. Long-term data suggest that the safest time to carry out routine dormant pruning operations of established apricot trees is between November 15 and December 15; however, do not start dormant pruning until a fall rain of at least 0.25 inch (6.25 mm) has occurred — this will ensure that the large spore potential which builds up by autumn will have been discharged.

Grapevines

With grapes, late spring is a good time to locate and remove portions of diseased vines, before they are masked by the growth of vigorous adjacent shoots. In California, diminishing risk of rain at that time also decreases the chance of spore dispersal and reinfection, although arm or cordon removal has to be done with care, often with a series of successive saw cuts. The final saw cut must show completely healthy tissue and no evidence of a pie-shaped sector of dead wood extending inward from the canker surface. (Pruning tools are not a means of spreading the disease.)

Where surgery has been neglected and the tree or vine framework has become extensively involved, it is almost impossible to cut back to healthy wood. In this case if a grapevine, for example, is weakened to the point that strong suckers are emerging from the lower trunk, the best alternative may be to cut out the dead trunk and rebuild the frame from one of these suckers. Bear in mind that this cutting presents further opportunity for infection; thus the wound should be protected.

In commercial apricot orchards it is common practice to chain-saw dieback-affected limbs and remove them from the orchard in late summer; in vineyards, it is necessary to flag sites for arm or cordon removal when symptoms are obvious in May. Later in the season, the diseased portions may be masked by adjacent healthy growth. If at all possible, make such cuts in dry weather and use a reliable wound protectant. The systemic fungicide Benlate is now registered as a wound paint to protect against Eutypa dieback on apricot trees and on grapevines; it is used at the rate of 1/5 lb/gallon water. Some growers apply this fungicide mixture directly to large cuts with a small hand-held atomizer; it can also be applied with a paint brush. (This high a rate is too expensive to apply with regular spray equipment.) Routine fungicide sprays applied to orchards and vineyards are ineffective; likewise, applications of latex paint and other wound dressings on pruning cuts have not proved to be very successful against Eutypa dieback.

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Recommendations are based on the best information currently available, and treatments based on them should not leave residues exceeding the tolerance established for any particular chemical. Confine chemicals to the area being treated. THE GROWER IS LEGALLY RESPONSIBLE for residues on his crops as well as for problems caused by drift from his property to other properties or crops.

Consult your County Agricultural Commissioner for correct methods of disposing of leftover spray material and empty containers. **Never burn pesticide containers.**

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