New data on the grape bud beetle

Effective controls are available, but suppression may require two years

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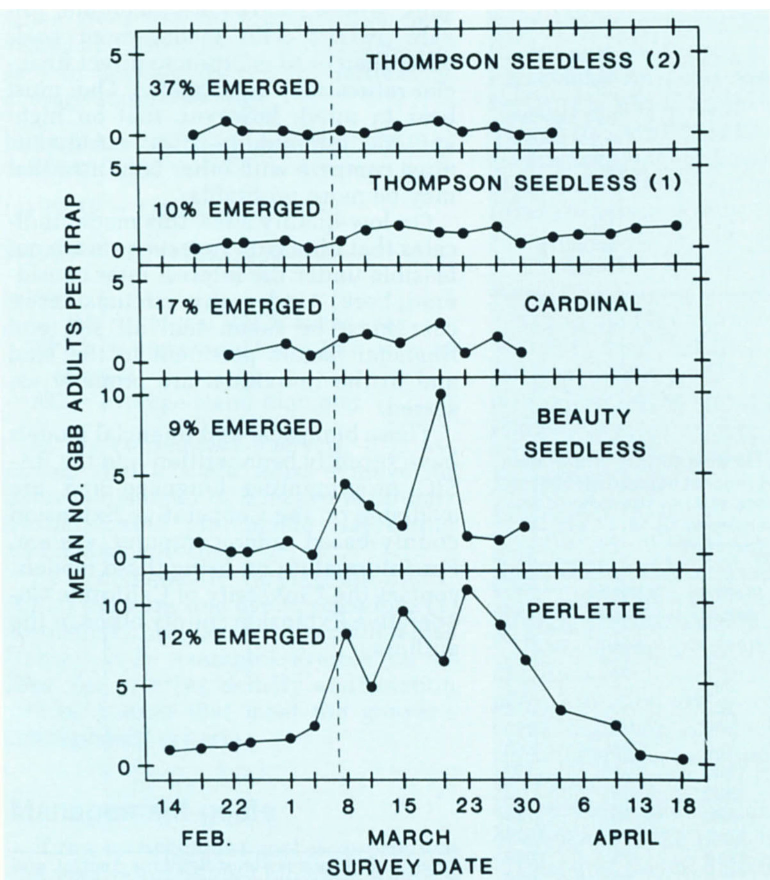
While trying to identify with an ultraviolet light beetles that had been marked with fluorescent dye, the author discovered that unmarked beetles glowed silvery-blue under UV. The discovery helped in studying the beetle's movements.



Trap catches showed peak grape bud beetle emergence in five Coachella Valley vineyards in 1983 occurred in second through fourth week of March.

The grape bud beetle, a native of southwestern North America, was first reported as a pest of grapes near Las Vegas, Nevada, in 1922, and soon after that in California's Coachella Valley. The beetle has also been found in Fresno and Sacramento counties, but it is rarely a grape pest in the Central Valley.

The adult beetles, which feed on the opening buds, have occasionally destroyed 80 percent of the crop in some Coachella Valley vineyards. Populations have increased in recent years.

The grape bud beetle, *Glyptoscelis squamulata* Crotch, has one generation per year. The yellowish eggs are laid in clusters hidden under and in cracks in the grape bark. After hatching, the larvae drop to the ground and immediately enter the soil where they feed on the grape roots. There is no information on whether larval feeding causes a loss in vine vitality.

Characteristics

In 1983, we used insect traps to monitor adult grape bud beetle emergence from the soil in five Coachella Valley vineyards: two of Thompson Seedless and one each of the Perlette, Cardinal, and Beauty Seedless varieties.

The aluminum screen emergence traps were 3 feet by 3 feet square at the base and slanted to a cone shape at the top. Ten to 15 traps per vineyard were placed in different vine rows with soil packed around the base of each one to prevent beetle escape. When the adults came out of the soil, they crawled up the wire screen and into a jar trap at the top of each cage. We removed the cages from three vineyards at the end of March because of pending grower cultural operations and decreasing beetle emergence. Otherwise, we checked all cages twice weekly and counted the beetles (see graph).

The average number of beetles collected per trap differed considerably among vineyards. These differences resulted from previous infestation levels and the time of 1982 chemical treatments for grape bud beetle rather than a varietal preference by the beetles.

There was also great variation in the total number of grape bud beetles captured within rows in the same vineyard. For example, in the 40-acre Perlette vineyard, the population increased markedly from east to west. One trap on the east side collected a total of 7 grape bud beetles during the season, whereas a trap on the west side collected 132. This spotty distribution also occurred in the four other vineyards.

Peak emergence in the five vineyards was roughly during the second through the fourth week in March. Some grape growers had previously thought that many of the beetles flew from the early bud-out varieties — Perlette, Beauty Seedless, Cardinal — into Thompson Seedless and caused more damage to that variety. This does not seem to be the case. The seemingly greater number of adults in the late-budding Thompson Seedless is actually an accumulation of the long-lived beetles that have emerged over a long period rather than a convergence of the grape bud beetles on that variety.

The beetles are not active fliers. They tend to stay in vines where they emerged from the soil. When vines are vigorously shaken on warm days of March and April, many adults fall to the ground, and others fly to nearby vines. This behavior contributes to the localized and spotty distribution of grape bud beetle.

Adults begin mating almost immediately after emergence. Males are extremely aggressive. Early in the season, copulating pairs are easily seen at night or in daytime when foliage is abundant.

Laboratory data show females begin to lay eggs one to two weeks after emergence and lay one to three batches of 12 to 44 eggs each. Females need to mate only once to produce viable eggs in all batches. Females held at 70°F laid an average of 77 eggs; those held at 60°F laid an average of 158 eggs. Temperatures above 60°F also shortened female longevity.

Egg development and hatch took an average of 9, 11, 17, and 44 days at 90°, 80°, 70°, and 60°F, respectively. The average temperatures for the Coachella Valley in February and March are 58° and 62°F, respectively.

Damage

The adult beetles can cause severe fruit loss by feeding on the opening buds. They eat out the center of the bud containing immature leaves and the flower cluster primordia. They usually leave one or both lateral growing points, but these are usually sterile. Once the new shoots are an inch or so long, the beetles cause no damage.

To further determine the amount and kind of adult feeding, we placed 5, 10, or 15 beetles in 21- by 10-inch organdy cloth bags. Each bag contained a grape shoot about 18 inches long with a floral cluster. This high number of grape bud beetles per shoot has not been observed in vineyards.

Eight days later all of the beetles in the three bags were alive. The bag with 15 beetles showed about 5 percent leaf loss. No florets were damaged in any of the bags. There was a minute amount of excrement in the bags, further showing that the adult beetles fed relatively little. This small amount of leaf consumption is of no importance, considering that some leaf and shoot removal is common in the production of several table grape varieties.

The major portion of grape bud beetle emergence appears to be attuned to fruit production only in some years. In 1983 (graph), 83 to 91 percent of the adults emerged in the Perlette, Beauty Seedless, Cardinal, and the Thompson Seedless (1) vineyards after the first week in March. In the Thompson Seedless (2) vineyard, with the lowest population, 63 percent of the beetles emerged after the first week in March. This low population may not have given an accurate reading on the seasonal emergence pattern.

In 1983, the Perlette, Beauty Seedless, and Cardinal vineyards were completely budded out by March 7. The two Thompson Seedless vineyards were about 75 percent budded out on that date. These bud-out times were about two weeks earlier than in 1982, possibly because of above-normal January temperature in the Coachella Valley (averaging 5°F higher than those in 1982). A large number of vineyards were treated for grape bud beetle in 1982, but few treatments were necessary in 1983.

Adult grape bud beetles can heavily damage grapes by feeding on opening buds.

Effect of various insecticides on the grape bud beetle, Coachella Valley, 1983

Material and rate*		Mean number dead beetles per replicate†			
		Trial 1		Trial 2	
		18 hours‡	36 hours	24 hours	72 hours
	lb				
Imidan	1.25	52.7 a	81.7 a	14.1 a	17.6 a
Guthion	1.25	45.5 a	76.3 a	9.6 a	13.4 a
Diazinon	1.6	18.5 b	27.3 b	—	—
Sevin	1.6	10.3 b	16.5 b	—	—
Cygon	2.0	—	—	5.3 b	12.1 a

* Pounds active ingredient in 150 gallons water per acre applied to point of runoff with a spray gun at 200 psi.
† Values followed by the same letter are not significantly different at 95 percent confidence level.
‡ Time after treatment.

Beetle detection

The adults become active at night a little more than an hour after sundown. During February and early March on the early-budding varieties, the beetles crawl up the trunk or along the arms and vine supports to feed on the opening buds and small shoots on the spurs. They follow this same nighttime activity pattern on Thompson Seedless, even though this variety may not have reached bud-break time. During the day on all grape varieties, the adults hide under the bark or in cracks of the wooden stakes and crossarms and in the trash at the base of the trunk. As the new shoots elongate and leaves develop, a greater number of beetles remain hidden within the foliage during the day.

It is difficult to detect adults at night with a flashlight, because the beetles blend in with the color of the bark, spurs, canes, and vine supports. Through very unusual circumstances, we found that grape bud beetle adults

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Grape bud beetle (cont'd)

naturally glow a bright silver-blue under ultraviolet light, and they can be counted on a vine in a few seconds for population monitoring at bud-out time. Dead beetles also glow, as do dried water droplets containing the fungicide Bayleton. Once the vines are covered with foliage, it is nearly impossible to determine the number of beetles present.

Control

We conducted two chemical trials in 1983. The first test, on March 31, compared Guthion (azinphosmethyl), Imidan (phosmet), Diazinon, and Sevin (carbaryl). The insecticides were applied at night, after winds ceased. Each treatment consisted of four replicates of five vines each in a randomized block design.

The second test, on April 12, evaluated Cygon (dimethoate), Guthion, and Imidan applied in the morning in calm weather. Eight replicates with five vines each were used per treatment in the same design as in the first trial.

At the time of treatment, the upper portion of the vines was covered with foliage. The actual or relative number of beetles hidden beneath the bark, in cracks in the vine stakes and crossarms, or in the heavy foliage could not be determined by any practical method.

Examination before treatment showed only an occasional dead beetle on the ground in the test areas. This did not change in untreated vines during the tests, and the extremely low number had no bearing on results shown in the table. The relative effectiveness of each insecticide was based on the number of dead beetles beneath treated

Adult beetles lay eggs in and under cracks in grape bark. Larvae drop to ground after hatching and enter soil, where they feed on roots.

vines following application. Dead beetles were not removed; thus, the counts are cumulative.

In the first test, we counted dead beetles at 18 and 36 hours after treatment. In the second test, the counts were 24 and 72 hours after treatment. After the second count in both trials, severe wind storms covered up or blew away the dead beetles, making additional counts meaningless.

In the first test, Imidan and Guthion were statistically equivalent in grape bud beetle kill, and both gave significantly better control than Diazinon or Sevin. In the second trial, Cygon was statistically equal to Imidan and Guthion by the 72-hour counts.

Emergence data in the graph as well as observations of the beetle in untreated vines indicate that Imidan, Guthion, and Cygon gave very good control. However, we are unable to estimate percent killed because of problems in sampling grape bud beetles on the vines at the time the tests were conducted.

Imidan has a five-day worker reentry time, whereas Guthion has a 21-day reentry. Imidan is also less hazardous to applicators. Cygon has been used to control thrips and can be effective in a cleanup after most of the beetles have emerged in the spring; to avoid a visible deposit on the berries, Cygon should not be applied after grapes reach a diameter of ¼ inch.

Conclusions

At present there are no biological control agents known that suppress grape bud beetle adults and eggs above ground or larvae in the soil.

The key features to damage and control are clearly related to the beetle's minimal flight activity, which causes spotty distribution, and the time of adult emergence from the soil in relation to bud-out time of different grape varieties. A chemical to enhance early bud break might suppress the problem for a few years, but meanwhile, the beetle would most likely increase in number with more adults emerging in February. We are also concerned about the larvae feeding on the grape roots.

Our research indicates that, when beetles are present in high numbers, a chemical application at around peak emergence eliminates adults and reduces egg-laying. In view of the long beetle emergence period and its egg-laying habits, suppression of grape bud beetle may require a two-year program.

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