Control of the grapeleaf skeletonizer

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Carefully timed chemical applications will control the destructive skeletonizer gradually spreading through California vineyards.

Larvae of the western grapeleaf skeletonizer (GLS), *Harrisina brillians*, defoliate grapevines and sometime damage fruit and induce bunch rot. Hairs on the larvae (caterpillars) also sting field workers when they brush against the larvae, causing skin welts.

The skeletonizer was first found in California near San Diego in 1941 and in a short time became a serious pest in the county's commercial vineyards. By 1943, crop loss in some San Diego vineyards reached 90 percent, with an average of 40 to 60 percent. Despite statewide eradication attempts, the pest had spread by 1975 to central and northern California commercial and backyard vineyards and wild grapes. Ornamental hosts of GLS are Virginia creeper and Boston ivy.

Description

GLS adults are a conspicuous bluish black to greenish black color and about 5/8 inch long, with a wing span of about 1 to 1 1/3 inches.

Pale yellow or whitish eggs about 1/60 inch wide and 1/40 inch long are laid on the undersides of leaves in flat clusters with the eggs separated slightly from one another. There may be 300 or more eggs in a cluster, but the average is 96.

In commercial vineyards, the eggs of the first generation are laid mostly on the inner mature basal leaves under the vine canopy. Eggs of the second and third generations are almost always laid on the leaves of the outside shoots.

All eggs in a cluster hatch at about the same time. After completing each of the first three instars, or developmental stages, larvae move away from the feeding site, often to another leaf and sometimes to the stems, to molt in a group.

In five stages (instars) the larvae grow from about 1/16 inch to 5/8 inch long. The fully grown larva spins a grayish white cocoon and pupates in the trash around the base of the vine or under loose bark.

Injury to grapevines

Larvae of the first three and sometimes early fourth stages feed side by side in conspicuous, orderly rows on the undersides of leaves, consuming all but the veins and upper cuticle. Just a few of the larger, fourth- and fifth-stage larvae can skeletonize an entire leaf, leaving only the larger veins.

Second and third generations have defoliated entire vineyards in the central San Joaquin Valley. Defoliation weakens the vines and leads to overall vine deterioration. Heavy defoliation also can cause fruit sunburn and quality loss.

When GLS populations are high, the older larvae feed on fruit once they have consumed most of the foliage. Damage to the berry skin leads to bunch rot, which usually destroys the entire cluster.

Seasonal development

Skeletonizers overwinter in the pupal stage. Emergence, mating, and egg-laying of the first-generation adults occur in the spring after the flush of new shoots and leaves on grapevines.

In San Diego County, first-generation adults emerge during late April through mid-May, and the eggs of this generation hatch in about 16 days. Second-generation adults emerge from about mid-July to late July. Eggs of this generation hatch about 10 days after egg-laying, or from late July into early August. Most pupae of this generation become dormant, but a few adults emerge and initiate a partial third generation.

In the warmer San Joaquin Valley, there are three complete generations per year (table 1). All third-generation larvae overwinter as pupae. Adults appear in the spring; egg-laying occurs first in urban areas, then in commercial vineyards, and later in wild grapes.

Monitoring

GLS populations are monitored by counting the number of adults flying during 1 minute between two stakes in two vine rows, 25 feet apart. A count of 20 or more in the 25-foot zones in all parts of the vineyard indicates that defoliation will be severe enough to cause 100 percent fruit loss. Counts of 6 to 7 adults suggest that widespread leaf damage will occur.

The greatest flight activity is usually near the ground between vine rows during the morning, decreasing considerably by mid-afternoon, and nearly ceasing by late afternoon. Cloudy conditions reduce flight activity.

If surveys are made after adults have died, three to four egg batches or young GLS larval colonies per shoot will also cause complete crop loss.

Infestations usually begin on the end vines and along border rows as adults migrate in after defoliating vines in other areas. The infestation then spreads and continues in the vineyard, because adult GLS tend to remain in the area of their larval development.

Vineyards should be monitored closely for leaf damage and defoliation just before harvest. Even moderate populations of mature larvae may pose hazards to pickers.

Natural control

In San Diego County, GLS has been markedly suppressed by a parasitic wasp, *Apanteles harrisinae*, and fly, *Sturmia harrisinae*, imported from Mexico and Arizona in the 1950s, and a naturally occurring granulosis virus disease that attacks the larvae. However, damage sometimes occurs on backyard vines and in commercial vineyards.

Small releases of parasites have been made in the Central Valley, but there is no

TABLE 1. Occurrence of Various Stages of the Western Grapeleaf Skeletonizer in Central San Joaquin Valley Commercial Vineyards*

	Adults	Eggs	Larvae
First generation	Late April to mid-May	Late April to mid-late May	Early May to late June
Second generation	Late June to early July	Late June to mid-July	July to mid-August
Third generation	Late August to early September	Late August to mid-September	September October

*Data were collected in Tulare County; time periods may change slightly for warmer or cooler areas.

TABLE 3. Effect of Various Insecticides on Western Grapeleaf Skeletonizer (GLS), Second Test, Tulare County, 1979

	Percentage control of GLS after:†		
Material and rate*	1 day	5 days	12 days
Kryocide, 8 lb	—	92	99
Dipel, 1 lb	—	90	94
Sevin, 1 lb	99	100	100
Lannate, 0.7 lb	99	100	100
Dibrom, 0.5 lb	99	100	100
Dimilin, 4 oz	—	83	100
Check (GLS/vine)	112	102	78

*Amount active ingredient per acre
†Percentage control based on average number of GLS per vine in comparison with untreated vines.

TABLE 2. Effect of Various Insecticides on Western Grapeleaf Skeletonizer (GLS), First Test, Tulare County, 1979

		Number of GLS larvae per vine and percentage control (in parenthesis)†							
		1 day	5 days	8 days		14 days		21 days	
Material and rate*	Pretreatment GLS/vine	1st-5th instar	1st-5th instar	1st instar	2nd-5th instar	1st instar	2nd-5th instar	1st instar	2nd-5th instar
Kryocide, 8 lb	99	—	61 (38)	10**	2 (88)	6**	1 (93)	0	1 (99)
Dipel, 1 lb	98	—	70 (29)	0	20 (80)	0	20 (80)	0	10 (90)
Lannate, 0.7 lb	80	0 (100)	0 (100)	0	0 (100)	95**	0 (0)	46**	61 (0)
Dimilin, 2 oz	104	—	60 (42)	17**	0 (84)	6**	0 (94)	0	0 (100)

*Amount active ingredient per acre
†Percentage control based on the pretreatment count of GLS per vine.
**Indicates new egg hatch.

evidence that they have become established. In northern California the parasitic fly has been established only in Siskiyou and Shasta counties, where grapes are not commercially important.

Chemical control tests

Two field trials were conducted in one vineyard on first-year Thompson Seedless grapes near Visalia, which GLS had invaded from severely defoliated wild grapes on nearby river banks. Moths were laying eggs in the test plots in early August, a time when adults are absent in commercial vineyards not near wild grapes.

The chemicals were applied by hand sprayer to each vine to the point of runoff at the rate of 200 gallons per acre in both trials. A randomized block design was used.

In the first test, each treatment was applied to 10 vines on July 25 (table 2). There were no untreated vines. GLS larvae were counted on each vine before treatment: 82 percent were in the first to third larval stages, and 18 percent in the fourth. A few egg batches were present.

One day after treatment, Lannate gave 100 percent control. Kryocide, Dipel, and Dimilin are slower acting, so the GLS were not counted in those plots at that time.

Five days after treatment, Kryocide, Dipel, and Dimilin gave 38, 29, and 42 percent control, respectively. Kryocide and Dipel markedly reduced leaf feeding before the larvae died.

Eight days after treatment, Kryocide and Dimilin gave excellent control of all GLS larvae present when the vines were sprayed. However, new egg hatches from moths invading the vineyard reduced control. Dipel gave only 80 percent control, possibly because of inadequate spray coverage on the undersides of leaves near the ground on these first-year grapevines.

Lannate did not control new egg hatches 14 days after treatment, because it has a residual activity of a day or less. Kryocide and Dimilin, long-residual materials, kept newly hatching larvae under control. Dipel is ratner short-lived, and control remained at about 80 percent. For some reason, no eggs were laid in the Dipel-treated vines until a large moth flight occurred in early September.

After 21 days, control in Kryocide and Dimilin plots was essentially 100 percent. Forty-two days after treatment, none of the materials suppressed the newly hatching larvae.

In the second test, each chemical was applied to 15 vines on September 26 (table 3), and 15 were left untreated. Before treatment 65 percent of the GLS larvae on the 105 vines were first to third instars, and 35 percent fourth and fifth instars. The early instars resulted from the third-generation moth flight from wild grapes.

One day after treatment, Sevin, Lannate, and Dibrom gave 99 percent control. Five days after treatment, Kryocide, Dipel, and Dimilin gave 92, 90, and 83 percent control, respectively. At 12 days, control was essentially 100 percent in all treatments, except for Dipel, which gave 94 percent control.

Summary

Vineyards with an uncontrolled GLS population in the fall will have a more widespread and devastating problem recurring the following spring. The key to chemical control is good underleaf coverage, because the young larvae feed almost entirely on the undersides of the leaves.

Kryocide has a long residual action. A single treatment in vineyards not near wild grapes generally gives season-long control. Skeletonizer sprays can also be timed with control of the omnivorous leaf roller. Dibrom, which has been used for late-season leafhopper control on table grapes, will also eliminate GLS that sting field workers. Sevin gave excellent GLS control, but it can cause a spider mite problem. More than one treatment with Dipel may be required.

Dimilin is not registered for use on grapes. It is an insect-growth-regulating chemical that kills GLS larvae when they molt from one instar to another. It has potential in integrated pest management programs, because it appears to be nontoxic to natural enemies.

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Photos by Jack Kelly Clark.

Male and female GLS moths are about the same size, but male's antennae are larger. Adults mate one to three days after emerging.

Moths lay eggs in large clusters on undersides of grape leaves one to four days after adults have emerged from cocoons.

Newly hatched larvae, about 1/16 inch long, feed on underside of grape leaf, leaving characteristic white spot on upper surface.

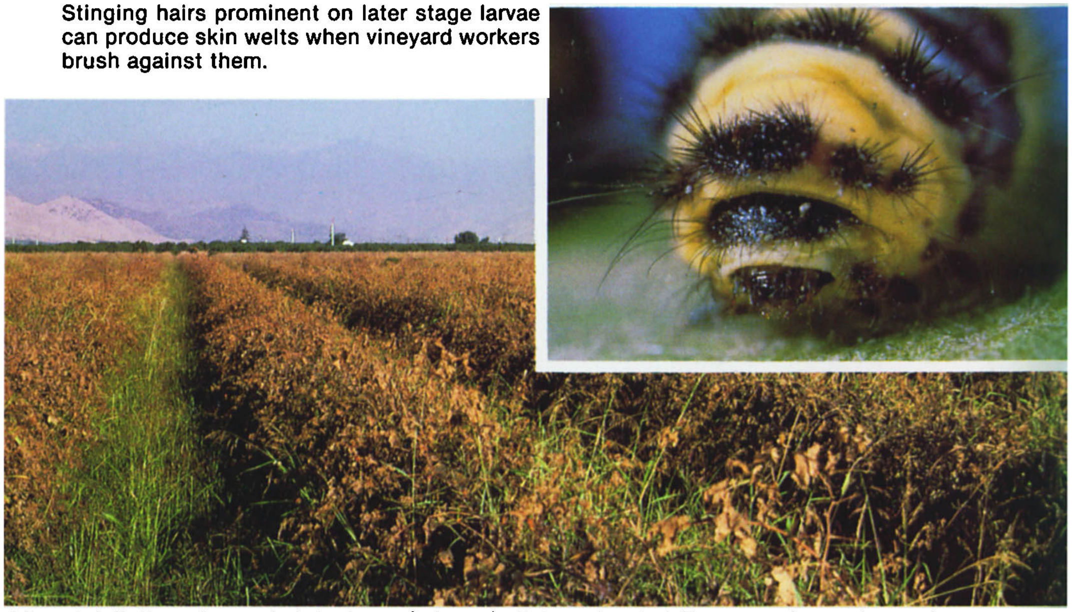
Larvae feed as a group into early fourth stage, then separate. Third-stage larvae (1/4 inch long) develop seven distinctive body rings.

Fourth- and fifth-stage larvae are brightly colored. By fifth (last) stage they are about 5/8 inch long.

Typical damage of first-generation GLS. Second- to early fourth-stage larvae feed on lower vine leaves in spring or early summer.

Early fourth- and all fifth-stage larvae feed separately and skeletonize the entire leaf, sparing only the large veins.

Stinging hairs prominent on later stage larvae can produce skin welts when vineyard workers brush against them.



After defoliating vines, skeletonizers fed on fruit in untreated Emperor vineyard, causing bunch rot. Entire crop was lost.

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Nutsedge competes with dry-bean plants in untreated plot on left. A layer of herbicide controlled the emerging weeds on right.