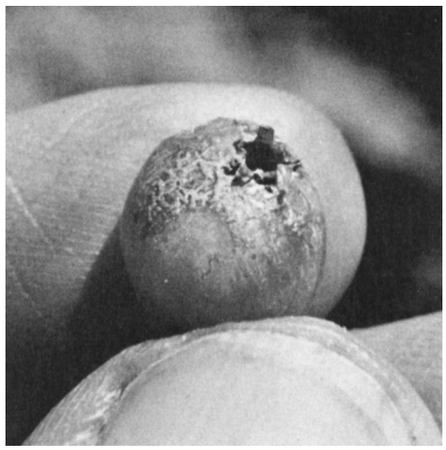
The studies reported here show that some table Thompson Seedless grapes grown in the southern San Joaquin Valley are subject to a scarring problem and this scarring may occur to some degree even when no sprays are applied to the berries. When sprays are applied during bloom and after, the degree and severity of scarring tends to increase. That scarring could be found on berries when the calyptras persisted after bloom, suggests that they play some role in the scarring injury. While the scarring is similar in its superficial nature to that caused by thrips, the pattern is different. Since thrips were not eliminated from the tests, studies during 1972 will attempt to evaluate the relationship between adhering calyptras, spray timing and thrips feeding.



Cover photo shows a Thompson Seedless berry heavily scarred at the stylar end where the calyptra is persistent (photographed June 1971).

DONALD A. LUVISI A. N. KASIMATIS

Scarring of

THOMPSON SEEDLESS TABLE GRAPES

SINCE 1945, INSECTICIDES, FUNGICIDES, nutrient sprays and growth regulators have found increasing use in the production of Thompson Seedless table grapes. As a greater number of chemicals have been applied, it has become evident that berry scarring has become more common. Recognition that certain pesticides—especially emulsifiable concentrates—applied after the berries were formed resulted in scarring injury has led to the general recommendation that only wettable powders be applied in post-bloom sprays on Thompson Seedless and other table grapes.

In the early 1960's, gibberellin sprays came into widespread use to increase the berry size of table Thompson Seedless, and in the late 1960's to achieve berry thinning. As these practices became established—during bloom for berry thinning and after bloom for increased berry size—sporadic scarring problems occurred. Studies were conducted in 1968 in which Thompson Seedless and Perlette grapes were dipped in solutions of several wetting agents at a wide range of concentrations. It was clearly demonstrated that wetting agents at high concentration could cause a ringing type of scarring pattern on Thompson Seedless and Perlette berries. The Perlette variety was judged to be more sensitive than Thompson Seedless since more severe injury occurred at the same concentration.

From 1968 through 1970, growers in the Arvin-Edison district of Kern County experienced a new type of scar-

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VIRUS AND VIRUSLIKE DISEASES OF CITRUS. Cir. 559. This circular lists the major virus and viruslike citrus diseases, based on recent research by workers in citrus-growing areas around the world. It describes symptoms and indicates possible control measures. Illustrations are included for help in identification.

Ring scarring on Thompson Seedless table grapes at harvest. This pattern can result from the use of excess wetting agent in the gibberellin sizing spray.

ring on the berries of the Thompson Seedless variety. While most of the scarring in previous years had been in a ring pattern around the stylar end of the berry, some of the rings occurred where two adjacent berries touched (photo). These ring scar patterns were generally located where the droplets of spray coalesced and collected as a large drop which on drying left a scar on sensitive berries. In contrast, the new type of scarring, aptly called sunburst or starfish by local growers, is characterized by an irregular scarring pattern somewhat in the shape of a starfish (photo). Sometimes the scarring patterns were similar in shape to those of adhering calyptras with extended petal parts (cover photo).

Three trials

In 1971, three field trials were established in Kern County to study this problem in vineyard locations with a history of scarring on the Thompson Seedless variety. Some of these vineyards have recorded scarring damage each year since 1968.

In one test, five 20-vine plots of Thompson Seedless were sprayed during bloom with a commercial type over-the-vine boom rig with the several components of a formulated gibberellin solution, and one was left unsprayed (see table 1). In each of these plots, a total of 40 flower clusters were selected according to stage of bloom development and were tagged as 0, 20, 50, 80, or 100% bloom.

At harvest time on August 3, 1971, one of the upper laterals of each of 20 clusters was clipped and judged, berry by berry, as to the presence of any scarring injury (table 1). An average berry weight was also determined.

At the same time the clusters tagged according to stage of bloom were picked and judged as a whole on the per cent of the total area covered by scarring. The data are shown in table 2.

Results of these tests showed, for example, that among the berries receiving no spray whatsoever, 34.5% had some level of scarring, while those sprayed with a water spray had 38.3%; he per cent of scarring increased as additional materials were added to the spray solution (table 1). When clusters were judged for the per cent of affected area, water alone is shown to have an impact, but there was not much difference when the other components were added, except for gibberellic acid. The stage of bloom development did have some effect, and there was a tendency for more scarring if spraying was done at the 50% bloom stage.

Second series

In a second series of tests, flower clusters or berry clusters were enclosed in brown paper bags during different parts of the season; therefore some clusters received part and some received all of the vineyard spray program. Table 3 gives a summary of the basic spray treatments. In this series of tests no special effort was made to eliminate tiny insects from the bagged clusters. Five treatments were made with commercial spray equipment—one series of clusters received all of the sprays applied to the field; the second series bagged before bloom received no spray during the course of the season; the third series were tagged, allowed to receive the bloom spray and then were bagged during the rest of the spray season; the fourth series were bagged during bloom but received the first and second sizing sprays of gibberellin; the last series were bagged during bloom and the first sizing spray of gib-

TABLE 1. EFFECT OF THE COMPONENTS OF SPRAY MATERIAL MADE WITH A FORMULATED GIBBERELLIN ON SURFACE SCARRING AND BERRY WEIGHT ON THOMPSON SEEDLESS GRAPES

Spray treatment	Berry Wt.,	Berries with scarring
	grams	%
Check, no spray	2.3	34.5
Water only	2.3	38.3
Water + IPA*	2.5	38.4
Water + wetting agent	2.6	43.1
Water + GA_3†	4.3	48.5
Formulated-Gib. 2% liquid	4.0	50.3

* Isopropyl alcohol
† Unformulated gibberellic acid

TABLE 2. TOTAL PER CENT SCARRED AREA ON THOMPSON SEEDLESS BERRIES SPRAYED WITH COMPONENTS OF A FORMULATED GIBBERELLIN SOLUTION AT DIFFERENT STAGES OF FLOWER DEVELOPMENT

Spray treatment	Per cent bloom development					
	0	20	50	80	100	Mean
Water	1.66	1.38	4.88	2.01	2.88	2.56
Water + IPA*	1.52	1.58	2.14	1.58	3.14	1.99
Water + wetting agent	2.41	3.13	3.52	1.56	0.56	2.24
Water + GA_3†	1.81	4.89	2.82	1.86	—	2.84
Form.-Gib. 2% liq.	1.84	3.46	3.01	2.83	5.47	3.32
Mean	1.85	2.89	3.27	1.97	3.01	

*Isopropyl alcohol
† Unformulated gibberellic acid.

TABLE 3. COMBINED DATA ON THOMPSON SEEDLESS SCARRING—THREE TRIALS KERN COUNTY—1971

Treatment	Berries scarred	Surface scarred	Area scarred	Berry weight	Degrees balling
	%	%	%	grams	
All sprays	81.4	3.15	2.63	3.97	17.7
No spray	41.4	1.99	0.94	3.17	17.8
GA_3 bloom spray	73.6	2.56	1.89	3.11	18.0
GA_3, 1st & 2nd sizing	67.4	2.65	1.80	4.09	17.0
GA_3, 2nd sizing + insecticide	57.3	2.76	1.65	3.64	17.4
LSD .05		.83	.74		.7
.01	23.0			.51	

berellin, and received the second sizing spray and an insecticide treatment for grape leafhopper control.

One hundred clusters were bagged for each treatment, with care taken that the clusters varied in their location on the vine. At harvest in early August approximately 500 bunches were harvested from each trial and graded as to the percentage of berries with scarring injury and the percentage of the surface affected. From these data, the percent of total scarred area could be estimated, as shown in table 3 where the data were combined for statistical treatment.

The fruit which received all sprays had the highest level of scarring while those covered during the spray season had the least scarring. Fruit receiving all sprays had a total area of 2.63% surface scarred, while those protected had 0.94% of the surface scarred. The other treatments which received the bloom spray, the first and second sizing, and the second sizing only were intermediate in overall surface scarring. The net result of this series again demonstrated that the addition of materials to a spray apparently increases the amount of scarring and/or the severity of scarring. Since all of the treatments had some level of scarring, other factors besides sprays may be influencing the severity and the extent of scarring damage.

An additional observation on berry sizing was made during this experiment. Table 2 shows that berries which received no direct gibberellin sprays were fairly large. It strongly suggests that considerable translocation of gibberellin occurred from the sprayed leaves and points out the value of full coverage of both foliage and fruit.

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An irregular scarring pattern on Thompson Seedless table grapes, aptly called sunburst or starfish. Note that much of the scarring is centered in the stylar area but not limited to that part of the berry.