per cluster in untreated vines during bloom.

The results of the Calmeria trial are shown in tables 4 and 5. The bagging trial indicated that less than one-third of the halo spotting occurred up to the 70% bloom stage, and that most of the damage occurred in the week between the 70% bloom stage and the post-shatter stage with berries at 4 to 6 mm diameter.

The insecticide trial showed that about half of the damage occurred between 70% bloom and the 4 to 6 mm berry diameter stage, with the other half about equally divided before and after those stages. A significant amount of spotting occurred after the berries had reached the 4 to 6 mm diameter stage. Thrips counts averaged 20 adults per cluster during the bloom period.

Considering both varieties and the results of both the bagging and insecticide trials, it appeared that the halo spotting occurs both during the bloom period and the post-bloom period up until about the shatter stage or slightly beyond. In the Italias, two sprays were required to reduce halo spotting to low levels, one applied when bloom begins, and one a week later. In the Calmerias, one treatment applied in the late bloom stage was sufficient to keep damage at an acceptable level for this variety.

Cygon produced no phytotoxicity, or excessive visible residue, even with four sprays. This insecticide was used under an experimental registration for the 1972 season.

FLOWER THRIPS NYMPHS INVOLVED IN SCARRING OF THOMPSON SEEDLESS GRAPES

FRED JENSEN · DON LUVISI

TRIALS CONDUCTED in Kern County Thompson Seedless vineyards in 1972 showed that flower thrips nymphs, feeding under persisting caps (calyptras), are associated with the sunburst or starfish scars which have proved troublesome in recent years. The gibberellin sprays used in producing table Thompsons, accentuate this damage.

During the 1971 season, the effects of the gibberellin sprays were investigated. All sprays including water only, increased the scarring. The gibberellin thinning sprays, applied during bloom, increased the scarring more than did the berry-enlarging sprays applied after the completion of shatter. However, even unsprayed fruit showed some scarring. These results indicated that while the gibberellin sprays accentuated the scarring, they were probably not the primary cause.

TABLE 1. EFFECT OF EXPOSURE TIME ON AMOUNT OF THOMPSON SEEDLESS BERRY SCARRING

Date bagged	Stage	Area scarred	
		Vineyard 1*	Vineyard 2†
		%	
Not bagged	—	10	1.2
May 10	End of bloom	1.2	.057
May 17	Shatter completed	1.6	.047
May 24	Berries 6–9 mm	6.6	.96

*Vineyard 1:
Bloom spray - May 8
First sizing spray - May 16
Second Sizing spray - May 24
†Vineyard 2:
Bloom spray - None
First sizing spray – May 16
Second sizing spray - May 24

TABLE 2. EFFECT OF PROTECTING CLUSTERS FROM THRIPS BY BAGGING ON AMOUNT OF BERRY SCARRING

Period protected from thrips by bagging	Area scarred	
	Vineyard 1	Vineyard 2
	%	
Not protected	8.1	1.5
Protected all season	.50	.083
Bloom only	3.6	2.1
After bloom for remainder of season	2.1	.88

Early scarring

It was known that the scarring occurred early in the development of the berry, that berries in the vineyards which showed severe scarring had persistent calyptras, and that in many instances, the area of the berry scarred showed a pattern similar to that covered by the persistent cap or adhering flower parts (i.e., stamens).

The grape flower has petals fused at the top which make up the calyptra. The calyptra becomes detached at the base and is shed as a cap. Sometimes however, the cap fails to fall off. It persists or sticks for a week or two until the growth of the berry forces it off. The caps usually stick at the tip of the berry as shown in the photo but they may also persist on the side in an area stretching from the base of the berry to the tip. Occassionally the caps may shed normally but the stamens persist.

During the 1972 season, the possible role of western flower thrips, *Frankliniella occidentalis* (Perg.), was investigated.

Bagging trials

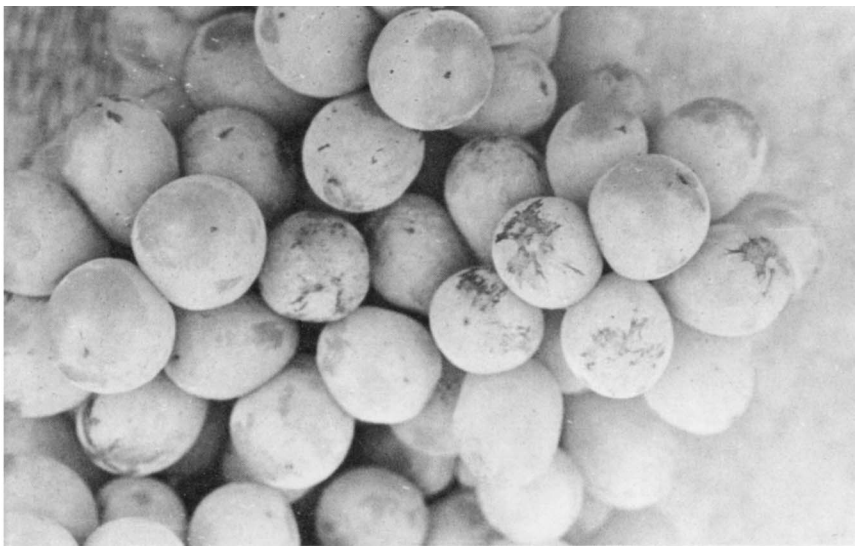
Grape clusters were exposed to or protected from the flower thrips for certain periods during the bloom and early berry growth periods when the scarring was thought to occur. This exposure or protection was controlled by bagging the clusters. The bags contained a small piece of plastic impregnated with the insecticide DDVP to kill any thrips infesting the cluster when bagged, or any nymphs that might hatch from eggs already laid in the clusters, and from any thrips that might gain entrance to the bags.

Clusters protected for the whole season had very low amounts of scarring, those not protected at all had the greatest amount of scarring (tables 1 and 2). The clusters protected from thrips during the bloom period only had a fairly high amount of scarring, while those protected

TABLE 3. OBSERVATIONS AND THRIPS COUNTS IN A VINEYARD WITH A HISTORY OF BERRY SCARRING

Date	No. thrips per cluster		Comments
	Nymphs	Adults	
May 3	0	8.7	Early bloom, caps sticking
May 9	18.7	23.2	95% bloom stage, largest berries to 3 mm, most caps sticking, not many nymphs except with the most developed berries.
May 16	184.	4.4	At shatter stage, berries 3–5 mm. Many caps still sticking on tops and sides of berries. Heaviest nymphal populations in clusters just ready to shatter. If past shatter, have lower nymphal population but nymphs are larger. Some scarring evident.
May 23	9.95	0.90	Berries 6–8 mm, many scars evident.
May 30	—	—	Berries 8–10 mm, scarring easily visible, some caps still sticking — usually scarring underneath. Fruit too large to check for thrips population.

Persistent cap at the tip of a small grape berry.



A grape cluster showing berry scarring of the sunburst or starfish type produced by flower thrips nymphs feeding under persistent caps.

from the end of the bloom through shatter had a fairly low amount of scarring.

Observations

The observations of the thrips populations explained why the berries not protected during the post-bloom stage were the most subject to scarring. The adult flower thrips are attracted to the blooming clusters. Maximum counts of flower thrips adults are usually obtained when about 50% of the caps have shed. The females lay their eggs in the clusters, some in the berries and probably some in the stem structure. The nymphs begin to appear toward the latter stages of bloom, reach a peak around the shatter stage and then decline to low levels shortly thereafter.

Thrips nymphs were found in equal amounts in clusters with or without persistent caps. On berries with persistent caps, nymphs were found underneath the caps which offered protected feeding sites. The scarring pattern which ultimately developed on the berries was associated with the area of the cap in contact with the berry. Without persistent caps or other flower parts, little or no scarring resulted. Thrips counts and observations made in one vineyard are given in table 3.

The sprays during this period apparently stimulated scar tissue development on the surface of the berries, damaged by the rasping type of feeding of the thrips nymphs. Observation during 1972 confirmed the 1971 finding that the bloom-time gibberellin thinning sprays accentuated the scarring more than did the shatter-period berry enlarging sprays. Apparently the stimulus of gibberellin on scar tissue development is greater during the very early stage of berry growth than after shatter even though the later gibberellin sprays have more influence on berry size than do the bloom sprays.

Insecticide treatment

Dimethoate (Cygon) was applied in one vineyard for thrips control since it was known to have given excellent control in other fruits. It was used to determine whether a reduction of nymphs population would result in lesser amounts of scarring in comparison with fruit not protected from thrips. Table 4 shows that single applications of dimethoate on either of two dates or a double application, reduced the amount of scarring as compared with unprotected vines. In this unreplicated trial, the late single treatment appeared slightly better than the single early treatment, with the double treatment superior to either of the single treatments.

All treatments were commercially satisfactory. The area of the berry scarred is a product of the percentage of berries in a cluster with scars, times the percentage of the surface covered by the scarring on the affected berries, divided by 100. Scarring is not considered to cause serious fruit cullage until the area scarred reaches a figure of 3 or above.

The berry scarring of table Thompson Seedless is produced by flower thrips nymphs rasping the berries under persistent caps or other flower parts. The gibberellin sprays accentuate this damage, probably by both stimulating the production of scar tissue and by the growth of the berry which increases the visibility of the scar. The bloom sprays accentuate this damage more than do the sizing sprays. The damage can be greatly reduced by controlling the thrips nymphs population from the late bloom stage through the shatter stage. Eliminating the bloom thinning sprays also reduces the amount of scarring.

Why the caps of other flower parts sometimes persist, rather than falling off normally, is not known.

TABLE 4. EFFECT OF CYGON SPRAYS ON FLOWER THRIPS POPULATIONS AND AMOUNT OF SCARRING

Date treated*	Date sampled†								Area of berry
	May 3		May 9		May 16		May 23		July 19
	Ny	Ad	Ny	Ad	Ny	Ad	Ny	Ad	scarred
1. None	0.0	9.1	12.0	12.0	46.8	4.8	3.7	1.5	5.11
2. Single, Apr. 29	0.0	1.4	2.6	0.0	3.6	5.6	1.3	2.1	1.19
3. Single, May 9	—	—	—	—	0.0	.85	0.0	.93	.794
4. Double, Apr. 29 & May 9	—	—	—	—	0.5	1.7	0.0	1.0	.394

* (4 lbs. of Cygon 25W applied per acre each treatment)
Apr. 29—Early bloom.
May 3—70% bloom, erratic, many caps sticking.
May 9—100% + bloom, no shatter, berries 1–3 mm diam.
May 16—70% shatter completed, berries 4–5 mm diam., very few caps still sticking, little scarring evident.
May 23—Berries 6–8 mm, scarring evident.

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