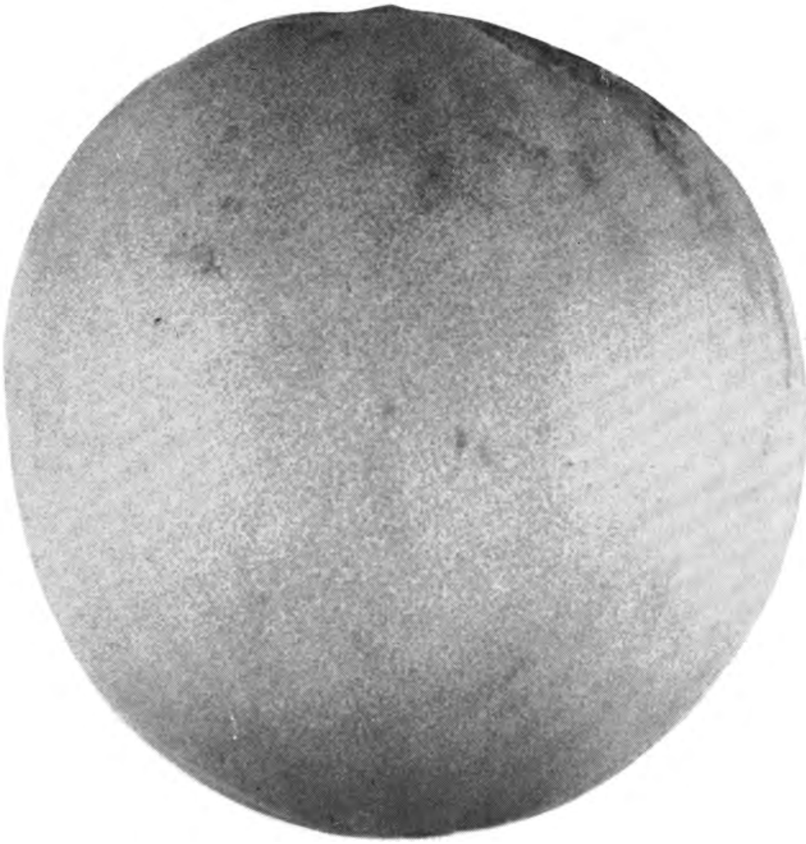


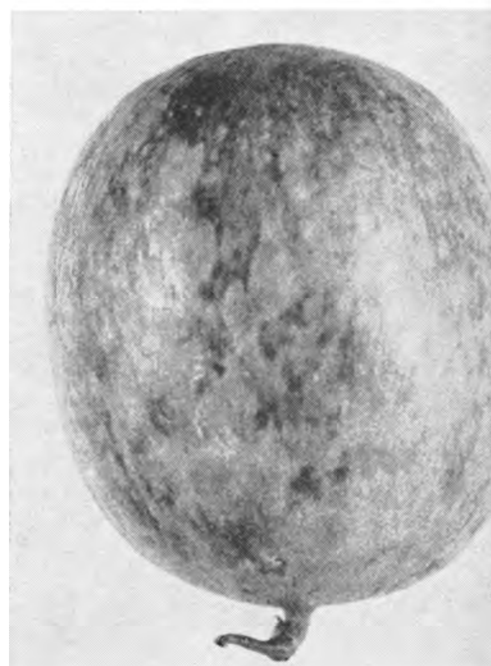
Sunken Mott

R. M. DAVIS, JR. • G. E. MAY • A. R. SPURR •

The fruit defect, sunken mottle, is a major proble
is an insect-borne malady, apparently caused b
study. In recent years it has caused losses of abo
County. It has been especially severe on late-pla
and control of the insect vector and any host pla
be a breeding program for mosaic-resistant lines

(1) Normal Honey Dew melon fruit (above) with a smooth surface except for minor blemishes.

(2) Fruit affected with sunken mottle (right). Note the irregular, depressed areas which at this stage are not discolored.



(3) Fruit with sunken mottle (below) showing that some of the affected areas have darkened. Superficial tissue in these areas is necrotic and light brown.

A SURFACE DEFECT OF HONEY DEW melons first attracted attention as a problem in western Stanislaus County in 1958. It was not serious again until 1963, and in 1964 it resulted in stopping shipment of melons. A similar disorder occurs in Kern and Yolo counties. The blemish was at first attributed to such causes as ultraviolet radiation, excessive humidity, or excessive soil moisture. The symptoms sometimes seemed to be coupled with early fall rains.

The blemishes appear as large, slightly sunken areas on the melon surface. In Stanislaus County where it is usual to plant a succession of fields from April until early July, the blemish generally occurs only in fields planted after June 20 and harvested after September 10.

Observations recorded from a number of fields during an investigation started in 1965 showed many blemishes, particularly after harvest, and some were obviously due to sunburn. The sunken blemish became so abundant after September 10 that shipment of melons was again stopped. Contrary to early reports, the depressed or distorted areas were not necessarily associated with brown discoloration before harvest, nor were the affected areas more frequent on the upper than on the lower surfaces. This defect was named "sunken mottle" (photos 2 and 3). The depressed areas did not differ greatly in color from more nearly normal non-depressed areas, but were somewhat more blue-green in hue and shinier. Repeated observations revealed that shiny, channel-like areas on small fruits were the forerunners of sunken mottle. The more or less colorless spots of sunken mottle turned to an olive-brown color a day or two after the fruit was picked (see photo 3).

Observation showed that the occurrence and intensity of sunken mottle were asso-

e of Honey Dew Melons

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facing Honey Dew growers in the Central Valley. It
Watermelon mosaic virus, type 2, according to this
one-third of the Honey Dew acreage in Stanislaus
ed fields. Control of the virus requires knowledge
. The best long-term solution to the problem may
Honey Dew melons.

(4) Fruit with measles-type symptoms (left), a possible variation of sunken mottle. The large lightly discolored blotch in the central area of the fruit involves a complex of symptoms including sunburn.

(5) A young fruit (below) showing severe early sunken mottle symptoms. Though not too evident in the photo the leaves showed severe mosaic-type symptoms.

ciated with leaf symptons of a mosaic virus infection. In early plantings there were no virus symptoms and no sunken mottle. Later plantings sometimes had mosaic symptoms on young leaves when fruits were mature, but the fruits were not blemished. On still later plantings, however, the plants showed mosaic symptoms while the fruits were still small—less than 20 days old—and such fruits later developed sunken mottle as they matured. Plants which appeared to have been infected while very young, were either barren or had fruits that were small and distorted (photo 5).

The appearance of the Honey Dew melon fields in western Stanislaus County suggested that plantings were infected over the entire area during a comparatively brief period. During this period some plantings were near harvest, others were in intermediate stages of fruit production, and others were in the seedling stage. Brown or green discoloration occasionally occurred along with sunken mottle on unpicked fruits. Although sometimes more conspicuous than sunken mottle alone, these were secondary features caused by such factors as sunburn, excessive soil moisture, or possibly other plant diseases.

In September, 1965, stem cuttings were taken from a field with both leaf mosaic symptoms and sunken mottle on the fruits. Strains of cucumber, watermelon, and squash mosaic viruses were isolated from the material. Ten of 40 diseased cuttings were rooted and grown throughout the winter in gallon cans of sterilized soil protected from contamination from outside sources. By means of hand pollination, a fruit was set on each of four plants. These fruits were similar to those on plants that had been infected while young in commercial fields. All showed severe sunken mottle with the slight blue-green discoloration in the depressed areas—barely distinguishable from the more nearly normal color of the non-depressed areas.

In 1966, the hypothesis that sunken mottle is inseparably associated with a mosaic virus infection carried by insects was tested. A field experiment was designed to compare plants and fruits grown in insect-proof cages with those growing in surrounding fields. Three cheesecloth cages were placed in each of three widely separated commercial fields of late-planted Honey Dew melons before seedlings emerged. Small hives of bees were put in each cage for three weeks during the period of most abundant flowering. One cage in each field was elevated for the three-week period to permit natural insect visitation.

Severe mosaic infection and fruit blemishes appeared after September 10 in all three fields and in the area as a whole. Sunken mottle on the fruits was again correlated with the variations in leaf symptoms between fields and within fields. The virus was identified as watermelon mosaic virus, type 2. The chief vector is probably the green peach aphid. No mosaic symptoms or sunken mottle were observed inside the cages, including those which were elevated for a 3-week period. The explanation of the latter must lie in the timing of insect flights, or in the age of the plants when exposed to infection, or in a combination of both. The greenhouse experiment with stem cuttings (as mentioned) and caging experiments with cantaloupes will not support a contention that the altered physical environment within the cages suppresses mosaic leaf symptoms and sunken mottle of the fruit. In the fields in which cages were placed, unprotected melons which set earliest did not have sunken mottle; those fruits which were set later were badly affected; intermediate melons developed the blemish known as measles (photo 4). No measles appeared on melons in the screen cages.

To determine other possible causes of sunken mottle, many types of observations were again made on a larger number of fields in 1966—including consideration of soil moisture, disorders of roots, stems, and leaves, and damage by such insects as leaf miners and leafhoppers. None of these conditions except leaf mosaic symptoms was correlated with sunken mottle.

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CHEMICAL ATTRACTANTS *for Navel Orangeworm Moths*

D. W. PRICE · J. A. MAZRIMAS

F. M. SUMMERS

THE NAVEL ORANGEWORM, *Paramyelois transitella* (Walker), is a sporadic pest of almonds in California. Crop damage caused by this pest tends to increase and persist at an economically significant level for a few years in a particular locality, and then to drop to a low, chronic level for an indefinite period. The factors causing these changes in infestation are not known. Since this moth does not attack an almond crop until the nuts begin to ripen, the grower usually does not appreciate the extent of its damage until harvesting begins. A system to detect and assess changes in the pest population would enable growers to adjust harvest operations, if necessary, to minimize damage; for example, to harvest and fumigate susceptible soft-shell varieties as early as possible. These studies were to determine the value of chemical attractants in a detection program.

An effective insecticidal control program for this pest has not yet been developed. The larvae remain protected throughout their development within a single nut, and individuals in various stages of development may be found concurrently in an infested orchard. There are no periodic worm broods or moth flights. The overwintering and spring populations occur at low densities, and are maintained by the few unharvested almonds remaining in the trees from the previous season. The new crop becomes susceptible to attack when the hulls of maturing almonds split, in mid-July. The crop is attacked, therefore, immediately before and during

TABLE 1. NAVEL ORANGEWORM MOTHS AND TOTAL LEPIDOPTERA CAPTURED IN TRAPS BAITED WITH THREE SELECTED CHEMICAL ATTRACTANTS—SEPTEMBER 1–3, 1966

Chemical	Total navel orangeworm moths captured							Total Lepidoptera
Repl.	1	2	3	4	5	Total	Females	
							%	
Unbaited check	3	5	1	0	1	10	90.0	14
3–Bromopropyl phenyl ether	15	12	6	18	14	65	84.6	89
Phenyl ether	46	25	40	22	29	162	85.2	213
Phenyl propionate	123	79	44	62	57	365	87.1	482

TABLE 2. NAVEL ORANGEWORM MOTHS AND TOTAL LEPIDOPTERA CAPTURED IN TRAPS BAITED WITH FOUR SELECTED ATTRACTANTS—SEPTEMBER 2–6, 1966

Chemical	Total navel orangeworm moths captured						Total Lepidoptera
Repl.	1	2	3	4	Total	Females	
						%	
Unbaited check	3	2	2	0	7	100.0	13
Phenyl-n-propyl ether.......	3	2	5	5	15	80.0	31
DL-a-methyl-benzyl alcohol	29	34	18	26	107	80.4	155
Ethyl phenylacetate	49	23	28	32	132	76.5	154
Phenyl-2-propanone	56	72	49	44	221	62.0	275

TABLE 3. NAVEL ORANGEWORM MOTHS AND TOTAL LEPIDOPTERA CAPTURED IN TRAPS BAITED WITH PHENYL ISO-BUTYRATE AND THREE OF ITS ISOMERS—SEPTEMBER 15–19, 1966.

Chemical	Total navel orangeworm moths captured							Total Lepidoptera
Repl.	1	2	3	4	5	Total	Females	
							%	
Unbaited Check	0	0	3	1	1	5	100.0	10
2-Phenylethyl acetate	1	0	3	0	1	5	100.0	18
Benzyl propionate	3	5	5	1	2	16	87.5	52
Ethyl phenylacetate	4	7	6	15	23	55	81.8	76
Phenyl iso-butyrate	22	11	21	27	12	93	89.2	129

TABLE 4. NAVEL ORANGEWORM MOTHS AND TOTAL LEPIDOPTERA CAPTURED IN TRAPS WITH THREE RELATED PHENYL ESTERS—SEPTEMBER 23–26, 1966.

Chemical	Total navel orangeworm moths captured					Total Lepidoptera
Repl.	1	2	3	Total	Females	
					%	
Unbaited check	0	2	0	2	100.0	2
Phenyl acetate	9	5	2	16	100.0	29
Phenyl iso-butyrate	8	7	14	29	96.6	50
Phenyl propionate	37	21	16	74	95.9	125