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THE EFFECT OF OIL TREATMENT OF RAISINS ON NUMBERS  
OF INSECTS INFESTING RAISIN PACKAGES

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THE EFFECT OF OIL TREATMENT OF RAISINS ON NUMBERS  
OF INSECTS INFESTING RAISIN PACKAGES

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SUMMARY

Raisins with and without vegetable oil coatings were packed in standard 15-ounce cartons with cellophane overwraps and exposed to insects to determine whether the coatings would prevent or reduce insect infestation. Both oiled and unoiled raisins became infested, but after 3 months, raisins receiving the standard commercial oil treatment contained one-half to two-thirds as many insects as the unoiled raisins, and raisins with a double treatment of the oil contained one-tenth as many. Dermestid beetles were more tolerant of the oil treatments than the other stored-product insects in the test.

INTRODUCTION

A large percentage of seedless raisins are packaged as "natural raisins" (with nothing added to them). "Nectars," another large percentage, are treated with a light coating of vegetable oil to keep them from sticking together. Personnel in the raisin packaging industry received fewer complaints of insect infestation of nectar raisins than of natural raisins.

Hurlock<sup>2/</sup> has reported that oiling raisins appears to make them more susceptible to attack by merchant grain beetle but impairs breeding of Indian-meal moth. An experiment was planned to determine whether oil treatments actually did affect insect infestation of raisin packages.

PROCEDURE

One group of packaged raisins used in the test were untreated (natural) raisins. The second group (nectars) had received the standard commercial oil treatment-- a combination of hydrogenated soybean and cottonseed oils applied at a rate of 0.25 percent by weight. A third group had been treated with the same oils applied at the rate of 0.5 percent by weight, which was double the amount generally used commercially. All raisins had been dried from Thompson Seedless grapes. The packages

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<sup>2/</sup>Hurlock, E. T. Some observations on the ability of bleached, oiled and untreated sultanas to support insect infestation. J. Stored Prod. Res. 4(1):88-89. 1968.

for all the raisins were standard fold-top 15-ounce cartons with cellophane overwraps. Twenty-four packages of each type of raisins were exposed to large numbers of stored-product insects at the Stored-Product Insects Research Branch Laboratory, Fresno, Calif., beginning April 6, 1967.

Raisin packages were placed on the floor of a 12- by 12-foot exposure room containing large populations of stored-product insects. At least 15,000 insects were added each month, and it was estimated that the room contained between 60,000 and 100,000 insects at all times. A constant temperature of  $80 \pm 2^{\circ}$  F. and relative humidity of 40-45 percent was maintained.

Because it is extremely difficult to separate related species, the species in the exposure room were divided into the following four groups at time of examination:

1. Grain beetles: saw-toothed grain beetle, Oryzaephilus surinamensis (Linnaeus); and merchant grain beetle, O. mercator (Fauvel).
2. Moth: Indian-meal moth, Plodia interpunctella (Hübner).
3. Flour beetles: confused flour beetle, Tribolium confusum Jacquelin duVal; and red flour beetle, T. castaneum (Herbst).
4. Dermestids: Trogoderma variabile Ballion (= T. parabile Beal); T. glabrum (Herbst); and T. sternale (Jayne).

Because the flour beetle and moth groups never exceeded 3 percent of the total, they were grouped together in table 2.

Six cartons of each type of raisin were examined at monthly intervals for 4 months. Each carton was brushed free of insects in the exposure room and taken to the examination room. There the cellophane overwrap was removed and each carton was brushed again to remove insects between the overwrap and the carton. The contents of the carton were poured into a white enamel pan. All insects found inside the carton were counted as they were collected in an aspirator.

## RESULTS

Insects infested all of the raisins tested, and the total number of insects in the 18 cartons examined increased from month to month (table 1). However, the untreated raisins always had the most insects and the double-oiled raisins had the fewest. For the first 3 months, the nectar raisins had only one-half to one-third as many insects as the untreated raisins, and the double-oiled raisins had about one-tenth as many. After 4 months, the ratio began to level off. In the final examination, the untreated raisins averaged 1,036 insects per carton. The nectar raisins had 586, about three-fifths as many insects per carton as the untreated raisins, and the double-oiled raisins had 383, a little more than one-third as many.

TABLE 1.--Number of insects and percentage of total insects found at monthly intervals  
in 6 cartons each of oiled, double-oiled, and untreated raisins, 1967

Treatment and number and percentage of insects	First month	Second month	Third month	Fourth month
Untreated				
Number	1,109	2,455	4,478	6,214
Percentage	62	70	70	52
Oil treatment, 1 coating				
Number	542	829	1,458	3,516
Percentage	31	24	23	29
Oil treatment, 2 coatings				
Number	124	221	477	2,299
Percentage	7	6	7	19

Grain beetles were by far the largest percentage of insects found infesting the raisins (table 2). They amounted to 87 to 97 percent of insects in untreated raisins, 70 to 86 percent in the nectars, and 39 to 71 percent in the double-oiled raisins. Although the double-oiled raisins had many grain beetles, the nectars had more, and the untreated raisins had the most, at every examination.

Dermeestids were numerous in all types of raisins at every examination and were not adversely affected by the oil treatments. After the first and third months, the nectar raisins actually contained more dermeestids than the untreated raisins, and at the second and fourth examinations, they contained only slightly fewer. The number of dermeestids in the double-oiled raisins was considerably less than in the untreated raisins for the first 2 months, but at the third month it was only a little less. At the fourth month, the double-oiled raisins had more than twice as many dermeestids as the untreated raisins. In this examination, dermeestids even outnumbered the grain beetles.

Flour beetles were found in all types of raisins at all examinations, but very few were found compared with the numbers of grain beetles and dermeestids. A few moth larvae were also found in the untreated raisins each month and in the nectars at the third and fourth months' examination. Flour beetles and moth larvae comprised not more than 3 percent of the total insect count in each examination.

#### DISCUSSION

Although the oil treatments did not prevent insect infestation of the raisins, they did reduce the number of certain kinds of insects. Grain beetles were the most abundant insects in the raisins in every instance except in the double-oiled raisins at the fourth month, when they were outnumbered by dermeestids.

Although the oil treatment does make raisins less attractive to certain insects, raisin processors probably would not want to increase the amount of oil added to nectar raisins, because additional oil increases the cost and causes raisins to have an oily appearance.

The double-oiled raisins stained the cartons by the time the test was completed. This staining could be avoided by using a new type of carton with a polyethylene coating on its inside surface.

The test work showed the need for packaging that will protect both oiled and natural raisins from insect infestation. Further studies of the preference of insects for natural or nectar raisins might also be of interest.



TABLE 2.--Percentage of insects, by groups, found at monthly intervals in cartons of oiled, double-oiled, and untreated raisins, 1967

Type of insects; treatment	First month	Second month	Third month	Fourth month
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
Grain beetles				
Untreated	88	90	97	87
Oil, 1 coating	70	86	80	82
Oil, 2 coatings	69	61	71	39
Dermestids				
Untreated	12	8	3	11
Oil, 1 coating	29	12	19	18
Oil, 2 coatings	30	36	26	61
Flour beetles				
Untreated	<1	2	<1	2
Oil, 1 coating	1	2	1	<1
Oil, 2 coatings	1	3	3	<1

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