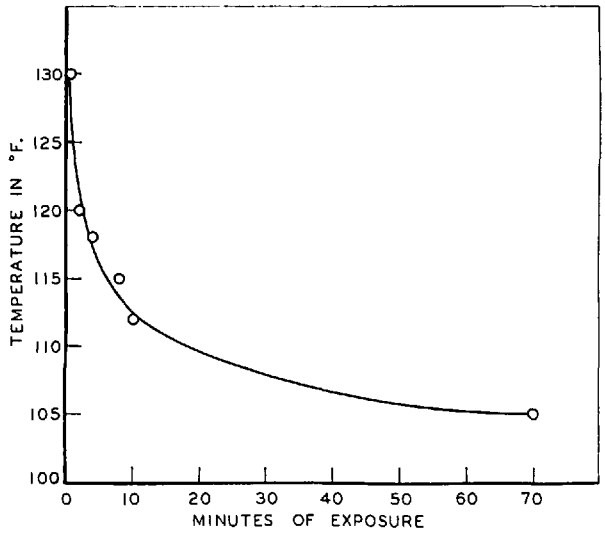

FIG. 1.—Time-temperature relationships required for elimination of third-instar European chafer larvae in hot water.

Table 1.—Mortality of the European chafer exposed to hot water.

Water Temperature, (° F.)	Exposure, (Minutes)	Per Cent Mortality				
		Eggs	First Instar Larvae	Third Instar Larvae	Pupae	Adults
112	5	26	100	4	28	54
	10	32	100	100	100	100
	20	86	100	100	100	100
	40	100	100	100	100	100
Check (64)	40	19	11	—	4	4
130	1/6	—	96	—	54	10
	1/3	—	100	—	98	83
	1/2	100	100	100	100	93
	1	100	100	100	100	100
Check (64)	2	23	13	1	0	4

metal trays and immersed in water at 112° and 130° F. for various intervals. Adults were treated in the same manner as pupae in groups of 25 males and 25 females. They were no longer sexed when it became apparent that there was no difference in their susceptibility to hot-water treatment. Each treatment was replicated twice. Controls were held at 64° for at least 20 minutes. After treatment they were placed on the surface of moist soil in trays and examined for mortality. A confirmatory reexamination was made in 24 hours.

The time of exposure necessary to obtain complete kill of third-instar larvae ranged from 30 seconds at 130° to 70 minutes at 105° F. (fig. 1). First- and third-instar larvae, pupae, and adults were killed with a 10-minute exposure at 112°, but 40 minutes at this temperature was required to destroy all the eggs. All four stages of the chafer were killed with a 1-minute exposure at 130° F. (table 1).

These results demonstrated the adequacy of submerging underground parts of plants in water at 112° for 70 minutes, or maintaining a temperature of 130° for 30 minutes in the process of steam sterilization of bulk soil as a means of eliminating all stages of the European chafer.

The insecticidal action of heat is adequate to meet certification requirements for the European chafer quarantine.

REFERENCE CITED

Fleming, Walter E., and Francis E. Baker. 1932. Hot water as an insecticide for the Japanese beetle in soil and its effect on the roots of nursery plants. U. S. Dept. Agric. Tech. Bull. **274**, 41 pp.

Distribution of the Small Rice Weevil in the United States[1]

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Sasaki (1899) pointed out the occurrence of the small sized rice weevil in Japan as being different from the rice weevil, *Sitophilis oryza*, not only in size but also in biology. He named it *Sitophilus* (*Calandra*) *oryza* var. *minor*. Takahashi (1928) described it as *S. sasakii* pointing out the differences in biology as well as morphology. The damage caused by this species and by *S. oryza* is very serious in the main parts of Japan. Some of the workers in the author's laboratory have devoted attention for about 15 years to comparative studies of these two species from several different angles of approach; namely morphology, physiology, ecology, geographical distribution, habitat segregation, and cross breeding.

From the results of our experiment (Kono, unpublished), these two species are believed to be synonymous to the large and small strains of the rice weevil, which were reported by Birch (1944) and Richards (1944) from their occurrence in Australia and England, respectively. We now have living cultures of *Sitophilus sasakii* received from Australia, Argentina, Canada, China (Formosa), Nepal, and South Africa. It is believed that this species can easily be found in these districts as a grain pest. But, we have had no previous record of distribution in the United States, excepting the recent brief report of Floyd and Newson (1957).

During the past year, the author made a trip to the United States of America and to Canada, and had occasion to examine some preserved specimens of the rice weevil at several points in these countries. By examination of the morphological characters, especially of the pattern of the sculpture on the pronotum, some specimens of *S. sasakii* were found with those of *S. oryza* in the following collections: Chicago Natural History Museum, Chicago, Dr. Timberlake's collection in the Department of Biological Control, Citrus Experiment Station, Riverside, California, and Royal Ontario Museum, Toronto University. The following are the localities from which the specimens of *S. sasakii* were collected:

Honolulu, Hawaii (1924)
Lake Lucy, Florida (1925)
Wyandotte County, Kansas (1919)
Yolo, California (1896)
Winnipeg, Canada (1930)

A living culture of the weevil population thought to be *S. oryza* and which has been reared under laboratory conditions at the Department of Entomology, University of California at Riverside was brought to the author's laboratory and upon careful study of its biology and morphology was found to be the small rice weevil. We also know that the small rice weevil has frequently been found, as well as the rice weevil, in rice imported from the Southern United States to Japan. These results would seem to indicate fairly wide distribution of the small rice weevil, *S. sasakii*, in the United States, sharing the same habitat with the rice weevil, *S. oryza*.

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to examine their insect collections when he visited them; also to Dr. D. L. Lindgren, who furnished the author a living culture of this weevil.

REFERENCES CITED

Birch, L. C. 1944. Two strains of *Calendra oryzae*. Australian Jour. Exptl. Biol. Med. Sci. **22**: 271–5.

Floyd, E. H., and L. D. Newson. 1957. Evidence of the occurrence of sibling species of rice weevils in the southern United States. (Abs.) Bull. Ent. Soc. Amer. **3**: 22.

Richards, O. W. 1944. The two strains of the rice weevil, *Calandra oryzae*. Trans. Roy. Ent. Soc. London **94**: 187–200.

Sasaki, C. 1899. Insects injurious to agricultural crops. (Japanese). Tokyo.

Takahashi, S. 1928. Insects injurious to field crops. (Japanese). Tokyo.

Persistence of Residues of Neotran on and in Mature Lemons and Oranges[1]

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Bis(*p*-chlorophenoxy)methane (Neotran) proved in laboratory and field studies by Jeppson in 1947 and 1951 to be very toxic to all stages (including eggs) of the citrus red mite, *Panonychus citri* (McG.), and its toxic effect persisted for several weeks after application to foliage and fruits. It was therefore of interest to establish magnitudes of residues on and in lemons and oranges as required by Public Law 518 (Miller Amendment). Residue data obtained by the total organic chloride combustion method described by Gunther & Blinn in 1955 on mature lemons and mature navel oranges are presented as a degradation study of Neotran. It is a characteristic of the total-chloride method that residue results represent maximum possible residues of this acaricide.

METHODS AND MATERIALS.—On November 26, 1956, mature lemon trees were sprayed with 20 ounces of 40% wettable powder per 100 gallons of finished spray mixture. Applications were made as conventional sprays, using a high-pressure reciprocating pump and manually operated spray guns. Final sprays were applied at the rate of approximately 1500 gallons per acre. On February 6, 1957, mature navel orange trees were sprayed with the same spray formulation at the rate of 2000 gallons per acre.

Mature fruit samples of both lemons and oranges were taken prior to the spray application and 1, 2, 4, 8, 16, and 37 days after treating the lemons, and 1, 2, 5, 9, 19, and 33 days after treating the oranges. Two fruits were picked from each quadrant of each of six trees in each plot, and the resulting 48 fruits were processed as a unit. Replicates were processed separately.

The unwashed fruits were peeled, and 1-pound subsamples of the minced peel were processed with petroleum ether as described by Gunther & Blinn (1955). Aliquots of the stripping solutions were washed free of inorganic chloride then assayed by the standardized combustion technique for total organic chloride.

Table 1.—Neotran residues expressed as parts per million on and in field-treated lemons and navel oranges.[a]

	Lemons				Oranges			
	Peel[b]		Pulp[c]		Peel[d]		Pulp[e]	
Elapsed Days	Rep. 1	Rep. 2	Rep. 1	Rep. 2	Rep. 1	Rep. 2	Rep. 1	Rep. 2
0[f]	0.2	—	—	—	0.0	—	—	—
1	14.1	15.2	—	—	14.8	11.4	—	—
2	15.6	15.2	0.0	0.0	12.5	12.2	0.0	0.4
4	14.8	14.4	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—
8	12.2	10.6	—	—	12.9	—	—	—
9	—	—	—	—	11.0	10.6	—	—
16	9.9	10.0	0.0	0.0	—	—	—	—
19	—	—	—	—	9.1	10.8	0.0	0.0
33	—	—	—	—	6.8	8.4	0.2	0.4
37	9.5	8.7	0.0	0.0	—	—	—	—

[a] Infrared analysis of Neotran shows that soluble material is bis(*p*-chlorophenoxy) methane and accounts for 40±5% of the wettable powder formulation (Dow Chemical Company personal communication).

[b] Mature lemons have 30.0±8.5% peel from 632 measurements. Values corrected for recovery (97% from 12 samples fortified at 3.8 p.p.m.) and for average background from untreated control samples (0.2 p.p.m.).

[c] Edible portion of fruit. Values corrected for recovery (91% from three samples fortified at 3.0 p.p.m.) and for average background from untreated control samples (0.3 p.p.m.).

[d] Navel oranges have 22.1±7.3% peel from 567 measurements. Values corrected for recovery (89% from 11 samples fortified at 3.8 p.p.m.) and for average background from untreated control samples (0.2 p.p.m.).

[e] Edible portion of fruit. Values corrected for recovery (116% from three samples fortified at 3.0 p.p.m.) and for average background from untreated control samples (0.3 p.p.m.).

[f] Pretreatment samples.

RESULTS.—Residue values in peel and pulp of field-treated lemons and navel oranges are presented as parts per million of apparent Neotran in table 1.

DISCUSSION.—Previous residue studies for many insecticides and acaricides on and in citrus fruits have shown persistence half-life values in the range of 17 to more than 100 days (Gunther & Blinn 1955, 1956). Data herein presented, when plotted as a log curve of persistence, demonstrate that Neotran residues have a half-life of 30 days for lemons and 39 days for oranges.

REFERENCES CITED

Gunther, F. A., and R. C. Blinn. 1955. "Analysis of Insecticides and Acaricides." Interscience Publishers, New York-London.

Gunther, F. A., and R. C. Blinn. 1956. Persisting insecticide residues in plant materials. Ann. Rev. Ent. **1**: 167–80.

Jeppson, L. R. 1947. Di(4,chlorophenoxy)-methane for control of citrus red mite. Jour. Econ. Ent. **39**(6): 813.

Jeppson, L. R. 1951. Bis-(*p*-chlorophenoxy)-methane in relation to the control of citrus red mite and other mites injurious to citrus in California. Jour. Econ. Ent. **44**(3): 328–37.

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Toxicity of DDT in Oil and in Acetone to Adult DDT-Resistant House Flies[1]

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When oil was used as a solvent for DDT instead of acetone, Busvine (1951) found less difference in tolerance to DDT between a susceptible and a resistant strain of house flies (*Musca domestica* L.). A susceptible strain tested by Barker and Rawhy (1957) had a higher regression coefficient of mortality on dosage for DDT in Risella oil than for DDT in acetone. Extrapolation of the log-dosage-probit lines suggests a point of intersection at high mortalities above which oil would be a more effective solvent than acetone. They did find that 0.8 μg. of DDT in oil killed flies of a strain that tolerated the same dosage in acetone. Hoskins and Gordon (1956) suggested that application of DDT in oil increases the accessibility of DDT and gives a more homogeneous response. This would be indicated by an increase in the slope of the log-dosage-probit line.

To discover a point of intersection of the log-dosage-probit lines, a moderately resistant strain (LDD) of 2- to 3-day-old

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