

found attacking green cabbage. These additional species are listed below.

Striped flea beetle, *Phyllotreta vittata discodens* Weise

Harlequin bug, *Murgantia histrionica* (Hahn)

The Aphid *Pemphigus populi-transversus* Riley

Fall armyworm, *Laphygma frugiperda* (A. & S.)

Garden webworm, *Loxostege similalis* (Guen.)

Yellow-striped armyworm, *Prodenia ornithogalli* Guen.

Onion thrips, *Thrips tabaci* Lind.

Southern fire ant, *Solenopsis xyloni* McCook

Salt-marsh caterpillar, *Estigmene acrea* (Drury)

Field cricket, *Achetia assimilis* F.

Cotton aphid, *Aphis gossypii* Glov.

Pale-striped flea beetle, *Systema blanda* Melsh.

White-lined sphinx, *Celerio lineata* (F.)

The arctiid *Epantheria deflorata* (F.)

#### LITERATURE CITED

- Harrison, P. K., and Ross W. Brubaker. 1943. The relative abundance of cabbage caterpillars on cole crops grown under similar conditions. *JOUR. ECON. ENT.* 36: 589-92.

## Detrimental Effect of Rotenone on *Rodolia cardinalis*

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The vernalia *Rodolia cardinalis*, has for years been acknowledged as one of the classical examples of a successful entomophagous insect. Its host, the cottony-cushion scale, *Icerya purchasi*, is generally kept at a very low population density by vernalia in California, although the scale is rather uniformly distributed throughout the citrus areas. Occasionally, however, heavy infestations of cottony-cushion scale develop on citrus concurrent with the absence, for one reason or another, of vernalia. This condition was noted, during the 1920's, to coincide with arsenical spray applications to citrus. DDT appeared to be causing the same condition during 1946. This led to the initiation of studies concerning the effect of insecticides on the cottony-cushion scale-vedalia complex.

Severe infestations of cottony cushion scale developed in a considerable number of citrus groves during 1946 following DDT applications, especially in Tulare County. The distribution of cottony-cushion scale in certain experimental groves made it appear, however, as if materials other than DDT might possibly be producing similar effects. One grove, for instance, which the writer followed in detail during 1946 showed a build-up and a fairly heavy infestation of cottony-cushion scale by August 1946. Vernalia was just getting started at this time. This grove had no DDT but received an application of an oil spray containing rotenone in April.

With these field observations as a background, as well as Haug & Peterson's (1938) laboratory work showing derris to be toxic to *Hippodamia*, preliminary toxicity tests were run to obtain further data on the effect of rotenone against vernalia. Leaves were obtained from an experimental plot in a navel orange grove in Tulare County carrying a spray deposit of cube (0.95 lbs. cube root (5 per cent rotenone) in 1.5 gallons kerosene plus 0.3 lbs. blood spreader per 100 gallons water). This spray was

applied August 7, 1946, and the leaves were picked August 21, a weathering period of 14 days with daily temperatures ranging to 90°F. or above. Vernalia pupae were obtained from the field and the emerged adults of comparable ages tested for contact toxicity by confining them in petri dishes with the sprayed leaves. Checks using untreated leaves were run. Food and water were supplied. The results are given in Table 1.

Table 1.—Total per cent mortality over a period of days of *Rodolia cardinalis* adults confined in petri dishes with cube sprayed leaves and with untreated leaves.

DAYS	CUBE	CHECK
	(2 REPLICATES— 25 ADULTS)	(3 REPLICATES— 35 ADULTS)
	<i>Per cent</i>	<i>Per cent</i>
1	12	3
2	48	11
3	76	23
4	100	26

Although mortality from rotenone was not unexpected, the above results obtained from leaves weathered during two weeks of high summer temperature were indeed striking, and indicate the possibility that because of adverse effects on vernalia populations, rotenone as well as DDT (unpublished data) may be potentially dangerous when applied to citrus trees bearing incipient infestations of cottony-cushion scale, especially when two or more applications are made during the season or when used before or after DDT applications. Further studies are planned on the timing of applications, types of formulations and other factors in order to reduce to a minimum the possible harmful effects of rotenone, DDT, and perhaps other materials, on vernalia populations.—10-12-46.

#### LITERATURE CITED

- Haug, G. W. and Alvah Peterson. 1938. The effect of insecticides on a beneficial coccinellid, *Hippodamia convergens* Guer. *JOUR. ECON. ENT.* 31(1): 87-92.

## Spittle Insect Damage to Alfalfa and Red Clover

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Infestations of spittle insects (Cercopidae) were observed in abnormally large numbers on alfalfa and red clover during 1944 and 1945 in Wisconsin. Carrots, peas, strawberries, and some other crops were also infested with both nymphs and adults. In certain fields of alfalfa and clover in Sheboygan County, one semicircular sweep of a 14-inch insect net caught about 100 adult spittle insects. Insect damage was apparent even in fields with heavy plant stands.

Careful observations of such infested fields of both alfalfa and clover revealed dwarfed, rosetted, blossom-blasted, and necrotic conditions of many plants (Fig. 1). The injured areas of the plants harbored a

<sup>1</sup> Approved by the Director of the Wisconsin Agricultural Experiment Station.