Table 1.—Dead bees recovered from dead-bee traps.

Colony no.	Date (June)											
	9	10	11	12	13	14	15	16	17	18	19	20
1	553[a]	1131	707	555	598	288	190	343	189	218	310	278
2	981[a]	888	870	691	437	322	211	348	336	280	376	465
3					181[a]	183	103	310	115	60	103	126
4					190[a]	91	73	223	96	49	85	86
5						56[a]	91	155	74	44	56	40
6						83[a]	135	157	89	62	43	48
7							26[a]	105	64	44	39	46
8							43[a]	165	130	56	42	68
Rainfall (in.)	0.15		0.30						0.25	0.50		

[a] 12 hr elapsed between trap installation and 1st dead bee collection.

The plot was sprayed at 7 AM on June 9. Carbaryl was applied at the rate of 1 lb actual material/acre. The formulation was 1¼ lb of 80S (80% carbaryl, WP, sprayable) + 4 oz of 1882 Pinolene (sticker) with water to make 1 gal. The application was made with a Bell 204 B helicopter with turbo-jet engine and an output of 43 gal/min at 90 mph. The plot was sprayed in less than 25 min.

Our data (Table 1) show that colonies moved into the sprayed area suffered progressively lower daily losses than did the colonies already in the area. This fact indicates the high death rate for any given day was not due to carbaryl-contaminated pollen collected on that day alone, but that bees also died from contaminated pollen collected earlier and stored in the colony. Dead bees from the 2 original colonies recovered on the 5th and 11th days were examined. It was found that 88 and 96%, respectively, were young bees less than 48 hr old. Unfrayed wings and a full complement of body hairs indicated their age.

Dead bees were analyzed by gas chromatography. The dead bees collected from colonies 1 and 2 on the 1st, 4th, 5th, 6th, and 10th days after spray application contained 0.66, 0.52, 0.20, 0.31, and 0.23 ppm of carbaryl, respectively. A young bee gorges itself on pollen and nectar upon emergence. The fact that 88 and 96% of the workers which died 5 and 11 days after spray application were young bees supports the contention that these bees had fed on and were killed by food within the hive. This hypothesis is confirmed by the fact that they contained carbaryl in quantities known to be lethal (Morse et al. 1963).

The colonies in these experiments were returned to Ithaca on June 21, 12 days after the pesticide application, for further observation. Unbeknown to us, a nearby field of alfalfa was sprayed for alfalfa weevil at about that time, affecting the colonies and making subsequent observations meaningless. However, in earlier tests (Morse 1961) an abnormally high death rate was observed in colonies for 21 days following a single application of carbaryl.

From these data it is concluded that foraging bees in a carbaryl-sprayed area collect and store pollen containing the insecticide. While possible, the collection of contaminated nectar is improbable, because nectaries are less exposed than pollen-bearing anthers. Young bees in the colony gradually consume this pollen even after most of the foragers have been killed, prolonging the abnormal mortality period within the colony.

Our data indicate that commercially operated colonies removed from a carbaryl-spray plot during pesticide application, and returned to it 7 days later, would not suffer significant economic losses. The number of dead bees in colonies 3–8 for the dates June 15–20 (Table 1) approximates the number in colonies not affected by pesticides (Morse 1961). It appeared that there was little residual carbaryl in the spray area 5 to 7 days after spray application. Although 0.45 in. of rain fell within this time in these experiments, earlier observations on the effect of carbaryl on honey bees indicate that breakdown of carbaryl in the field, at least insofar as honey bees are concerned, is rapid, with or without the benefit of rainfall.

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The Preferences of Certain Coccinellids for Pea Aphids, Leafhoppers, and Alfalfa Weevil Larvae[1]

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Although there is considerable information published on the feeding habits of coccinellids in general (Balduf 1935, Clausen 1940, Hodek 1966, Sweetman 1958) there is apparently little published information concerning the predation of these insects on the alfalfa weevil, *Hypera postica* (Gyllenhal).

Balduf (1935) stated that the convergent lady beetle, *Hippodamia convergens* Guérin-Méneville feeds on both eggs and larvae of the alfalfa weevil. Perkes 1966[4] studied 2 additional coccinellids, *H. sinerata* var. *spuria* LeConte

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[4] R. Perkes. 1966. Biological studies of parasites and predators of the alfalfa weevil with particular reference to the affects of selected insecticides. M. S. Thesis. Utah State Univ., Logan. 57 p.

Table 1.—Host preference of coccinellids for pea aphids, leafhopper nymphs, and alfalfa weevil larvae.

			Host Insects								
			No. pea aphids			No. alfalfa weevil larvae			No. leaf-hoppers nymphs		
				Eaten			Eaten			Eaten	
Coccinellid	Stage	No. replicates	Intro-duced	3 hr	24 hr	Intro-duced	3 hr	24 hr	Intro-duced	3 hr	24 hr
Coleomegilla maculata	Adult	4	15	10	15	12	5	11	12	0	0
	Larva	2	6	3	6	6	2	4	6	0	0
Coccinella novemnotata	Adult	4	12	7	12	12	0	3	12	1	1
	Larva	2				6	0	2	6	3	5
C. transversoguttata	Adult	4	12	7	12	12	0	3	12	0	1
C. trifasciata	Adult	4	12	8	12	12	0	3	12	1	10
Hippodamia convergens	Adult	4	12	11	12	12	0	2	12	0	0
	Larva	2	12	4	6	12	0	0	12	0	0
H. parenthesis	Adult	4	12	8	12	12	0	3	12	0	0

and *Coccinella novemnotata* Herbst. He found that the larval stages of the former species and both larvae and adults of the latter preyed on alfalfa weevil larvae.

METHODS AND MATERIALS.—During the summer of 1967, some preliminary experiments were conducted in Massachusetts to determine the role of certain coccinellids in the control of some of the insect pests of alfalfa including alfalfa weevil larvae; pea aphids, *Acyrthosiphon pisum* (Harris); and nymphal leafhoppers of several species. The species of coccinellids were *Coleomegilla maculata* De Geer; *Coccinella novemnotata; C. transversoguttata* Faldermann; the transverse lady beetle, *C. trifasciata* L.; *Hippodamia convergens;* and *H. parenthesis* (Say).

Several methods of determining host preference were investigated. In one, the weevil larvae, pea aphids, and nymphal leafhoppers were placed in a vial into which the coccinellid was introduced. The mouth of the vial was closed with cotton. A 2nd technique involved placing the test insects together with a sprig of alfalfa in a ½-pint cardboard container. Most of the lid of the container was replaced by nylon. In a 3rd test, a cardboard ring was placed in an enamel pan and a glass cylinder was placed over the ring. Three partitions of cardboard were erected between the outer wall of the ring and the inner wall of the cylinder, dividing the area into 3 equal parts. Aphids, leafhoppers, and alfalfa weevil larvae were introduced into separate compartments, and a coccinellid was released into the center of the ring. In this way, it was theorized that a choice could be made by the prey.

All these methods provided some preliminary information on host preference of the coccinellids but failed to give conditions approximating those encountered in the field. Hence a 4th and final technique was developed which appeared to be superior. In this a cut sprig of alfalfa was inserted through a small hole in a piece of cardboard into a petri dish containing water. A glass chimney was placed over the alfalfa. A minimum of 3 each of pea aphids, nymphal leafhoppers, and alfalfa weevil larvae were introduced into the chimney and 1 coccinellid was added; at least 2 replicates were included for each species of lady beetle. Observations were made immediately, at 3 and 24 hr.

RESULTS.—Some of the data obtained are condensed and presented in Table 1. Both the larvae and adults of *Coleomegilla maculata* appear to prefer aphids but will feed on alfalfa weevil larvae. They preferred 2nd- and 3rd- and 3rd- and 4th-instar larvae, respectively. *Coccinella novemnotata* adults preferred aphids to alfalfa weevil larvae and to leafhopper nymphs. In the absence of pea aphids larvae of this beetle did feed on nymphal leafhoppers and alfalfa larvae, preferring the former. Adults of *C. transversoguttata* preferred aphids to alfalfa weevil larvae; leafhoppers were least attractive. Adults of *C. trifasciata* preferred aphids; leafhopper nymphs were a 2nd choice, with alfalfa weevil larvae being the least attractive.

H. convergens adults preferred aphids but if starved would feed on alfalfa weevil larvae. The younger instars were preferred. Larvae of this beetle did not feed readily on either alfalfa weevil larvae or on leafhopper nymphs. *H. parenthesis* adults preferred aphids but would feed on 2nd-instar alfalfa weevil larvae. Fourth-instar larvae were avoided.

CONCLUSIONS.—From the 6 species of coccinellids studied it is obvious that aphids were preferred to alfalfa weevil larvae. Second-instar weevil larvae were preferred to those of later instars. Leafhopper nymphs were avoided by both larval and adult *Coleomegilla maculata* and *H. convergens* and by adult *H. parenthesis.*

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Hymenopterous Parasitism in the Little House Fly[1]

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An ichneumoid, *Stilpnus,* sp., and a pteromalid, *Muscidifurax raptor* Girault and Sanders, were found to parasitize puparia of the little house fly, *Fannia canicularis* (L.), collected during a fly-control study in 1964 near Ontario in southern California by Loomis et al. (1968). Because quantitative parasitism data are few for these

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