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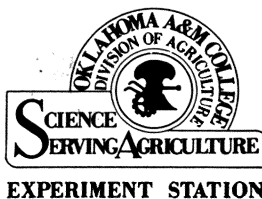
Spotted Alfalfa Aphid

A PROGRESS REPORT

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BULLETIN
NO. B-469

MAY, 1956



On The Cover

The nymph and two adult forms of the aphid are shown on the cover.

All are damaging to alfalfa.

Research to date has established:

- Characteristics and habits important to the control of the spotted alfalfa aphid.
- Type and extent of damage to alfalfa that can be expected.
- Control Measures:

Malathion will give satisfactory and reasonably safe control if applied as a water emulsion spray at the rate of 2 to 14 gallons per acre containing 0.5 (ground equipment) to 0.75 (aerial equipment) pound actual chemical per acre. *Malathion is a poisonous chemical and must be handled with care. Applications to alfalfa grown for hay should not be made less than 7 days before harvest. One spray application should provide protection for 15 days or more during periods favorable to the aphids.*

Spray applications with ethyl or methyl parathion at the rate of 0.25 pound actual toxicant per acre will give control similar to that obtainable with malathion, however, hazards of handling and from crop residues are greater.

Predators are important to aphid control in light and declining infestations. However, they are unable to cope effectively with heavy infestations.

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Research on The Spotted Alfalfa Aphid

A Progress Report

By

G. A. Bieberdorf and D. E. Bryan

The spotted alfalfa aphid, *Therioaphis maculata* (Buckton), formerly called the yellow clover aphid, *Therioaphis (Myzocallis) trifolii* (Monell), was first reported doing damage to alfalfa in the United States in the spring of 1954. Following the discovery of this aphid in New Mexico in February, 1954, it soon appeared in California and by July of that year was doing damage in Oklahoma as far east as Stillwater.

By March, 1955, the numbers of this aphid assumed outbreak proportions and alfalfa in south central Oklahoma began to show severe damage. This situation continued spreading over the whole State, until May, when aphid populations dropped to sub-economic levels following heavy rains. Relatively little damage was reported until February 1956, due, apparently, to summer drouth and low fall temperatures. The aphids over-wintered successfully and their injurious activities were extensive during the first part of 1956.

The Oklahoma Experiment Station initiated a study to establish control measures when the aphid appeared in this State in 1954. Little was known about the insect and control recommendations were non-existent at that time. The initial steps were aimed at determining the characteristics and habits of the aphid which could be used as a basis for establishing control. Research in 1955 and 1956 has been related to chemical and biological control. This bulletin reports results of research to date.

Appearance and Life History

When mature, the spotted alfalfa aphid is a soft-bodied, oval-shaped insect approximately one-sixteenth of an inch in length. The body color, when viewed without the aid of magnification, appears yellowish-brown due to the presence of several rows of brown spots on the upper side of the body. These spots are arranged in eight rows more or less parallel to the long axis of the body. Transversely, the spots appear as parallel lateral bands arranged segmentally. Each spot bears

a spine which is wider at the tip than at the base. The antennae are held along the lateral part of the upper body surface when at rest and are extended when in motion. The sucking mouthparts characteristically lie between the bases of the front legs when the insect is not feeding.

The life history of this aphid is similar to that of other aphids in warmer regions. Both winged and unwinged forms may occur throughout the year, however, the winged ones attain their greatest numbers in the late spring and early summer. The females produce young without mating during most, if not all, of the year.

The immature aphids or nymphs have the same general appearance as the adults except for coloration. In this respect the nymphs are lighter in color, the brownish tint not being as well developed as in the adults. Depending upon the temperature, the nymphs require from one to four weeks to reach maturity.

In Oklahoma, the spotted alfalfa aphids spend the winter in both the unwinged adult and immature stages on or around the alfalfa crowns. During this period, feeding and movement are limited by warmth and moisture. While temperatures as low as 10°F. restrict aphid activities, and cause the death of those not protected by the crown or debris, sufficient numbers remain to begin infestations as the season progresses.

Data for two years indicate that first-year alfalfa plants support only small aphid populations early in the spring. This is due, possibly, to the inability of the aphids to survive the winter as well on young plants as on older plants of which the plant crowns are better developed. Consequently, young alfalfa makes rapid growth early which tends to conceal later infestation and delay evidence of damage. This indicates that all alfalfa is subject to infestation ultimately.

Host Plants

The host range of the spotted alfalfa aphid is apparently restricted to a relatively few members of the legume family. Alfalfa *Medicago sativa*, bur clover, *Medicago hispida*, and medic, *Medicago lupulina*, are the preferred hosts as far as presently known. Most clovers belonging to the genus *Melilotus* are not generally suitable hosts, for example, Hubam clover, *Melilotus alba annua*, is not known to be attacked. Most clovers belonging to the genus *Trifolium* are poor hosts as are the vetches, birdfoot trefoil, and sesbania (Dickson et al., 1955).

Method of Injury and Damage to Alfalfa

Both young and adult aphids are highly injurious to most commercial varieties of alfalfa. These insects, by means of their sucking mouthparts, withdraw the fluid contents of the plant cells thereby reducing the vigor and consequently retarding the growth of the plant. There is good evidence also, that these insects inject a toxic substance into the plant while feeding. Continued infestation by large numbers of these aphids almost invariably results in the death of the plant, especially when soil moisture is scarce. As feeding becomes more intense the normal green color characteristic of vigorous alfalfa gives way to yellowing and finally browning of the leaves. At the same time the whole plant becomes less erect as the stems begin to droop (Figure 1).

The presence of aphids on the ground beneath disturbed plants and small drops of honeydew on the leaves are early evidence of infestation. Later signs are the large number of cast skins and the darkening of ground beneath heavily infested plants due to honeydew deposition. The stickiness of the honeydew often creates problems in harvesting. Mowers and rakes may become unusable unless washed periodically and baling equipment can become unmanageable.

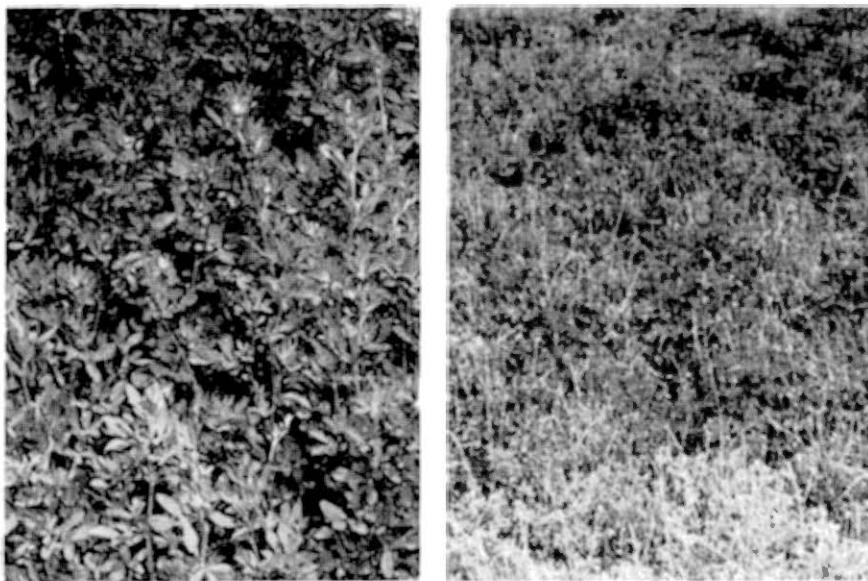


Figure 1.—Alfalfa plants before and after damage. Note stemminess and lack of leaves on plants at the right. Damaged plants usually wilt, turn yellowish-brown in color, and show obvious lack of vigor.

Early infestations in a given field are distributed unevenly. Yellow, then brown areas first appear in scattered locations, but these finally merge as the infestation progresses. In Oklahoma, alfalfa often suffers from drouth during the spring months and aphid infestation seems to accentuate the usual spotted appearance of fields under these conditions.

Control

Chemical

During 1955 and 1956 chemical control tests were conducted with thirteen insecticides at several dosage levels.

Heavily infested fields of Oklahoma common alfalfa were divided into sufficient one-quarter acre blocks to provide four replicates of each treatment. Infestation counts were taken by counting the numbers of aphids per square unit of surface as provided by the fork sampling method (Henderson, 1956). (See Figure 2). All chemical applications were made at the rate of eight gallons of finished spray per acre by means of experimental ground equipment.



Figure 2.—Accurate sampling is important. This sampling fork allows determination of plant population changes which indicate necessity of spraying.

The spotted alfalfa aphid appears to be very susceptible to most of the organic phosphate insecticides and to several chlorinated hydrocarbon insecticides. The initial kill obtained with each compound tested was generally satisfactory except for lindane, nicotine, and AC 528¹ for which the data have been omitted in this publication. Speed of action of chemicals for control in this case is less important than the lasting qualities of the compounds due to the constant reinfestation of alfalfa from untreated fields outside of the control area.

All materials tested were used initially at 0.25 pound actual toxicant per acre with the exception of malathion which was used at 0.5 pound actual (Table I). Later work involved dosages of one half the concentrations given above but the data here are not conclusive because the aphid populations declined sharply in the experimental plots as a result of predator action and plant deterioration (Table II).

Systox at 0.25 pound actual toxicant per acre showed the greatest residual effect with 143 aphids per square inch of sampling surface 20 days after treatment. Malathion at twice the dosage gave slower kill but showed promising consistency in residual action (Table I). From these data it would appear that alfalfa subjected to comparable aphid populations would need treatment approximately every 15 days with even the best material tested, at least in the absence of other factors detrimental to the survival of the aphids.

¹Hercules Powder Company experimental compound.

Table I.—Comparison of the effectiveness of several insecticides against the spotted alfalfa aphid, *Therioaphis maculata* (Buckton) expressed as mean numbers of aphids in all replicates for the time intervals indicated. Stillwater, Oklahoma, April 7-28, 1955.

Treatment	Dosage in pounds actual chemical per acre	Aphids per square inch of sampling area				
		Before Treatment	3 days	7 days	12 days	20 days
Systox	0.25	404	4	9	61	143
Malathion	0.50	306	15	13	81	176
Methyl parathion	0.25	243	2	13	107	244
Chlorthion	0.25	180	3	10	87	267
Diazinon	0.25	230	2	11	84	282
3911 ¹	0.25	238	3	11	95	323
Ethyl parathion	0.25	222	3	10	114	352
12008 ¹	0.25	188	6	12	118	377
Check	water	231	366	237	427	61 ²

¹ American Cyanamid Company experimental compounds

² Plants destroyed or otherwise made unsuitable for aphids by preceding weeks of heavy infestations.

Table II.—Comparison of the effectiveness of several insecticides against the spotted alfalfa aphid, *Therioaphis maculata* (Buckton) expressed as mean numbers of aphids in all replicates for the time intervals indicated. Stillwater, Oklahoma, April 16-28, 1955.

Trea ment	Dosage in pounds actual chemical per acre	Aphids per square inch of sampling area			
		Before Treatment	2 days	6 days	12 days
Systox	0.125	537	10	42	24
Malathion	0.25	678	14	57	97
Methyl parathion	0.125	631	17	47	45
Chlorthion	0.125	709	12	27	13
Diazinon	0.125	681	4	25	12
3911	0.125	619	23	30	10
Ethyl parathion	0.125	467	10	35	9
12008	0.125	594	41	40	45
Endrin	0.25	760	14	22	23
Check	Water	762	403	231	8 ¹

¹ Plants destroyed or otherwise made unsuitable for aphids by preceding weeks of heavy infestation.

Other tests have also shown the effectiveness of such experimental organic phosphate materials as compounds 8305¹ and R-1303² which at 0.25 pound actual per acre compare favorably with presently recommended materials.

Biological

Biological control of the spotted alfalfa aphid is constantly in progress. Larval and adult ladybird beetles are the most numerous and probably the most important aphid predators in alfalfa fields. Both stages contribute spectacularly in light or waning infestations, but do not appear to be able to cope with severe aphid outbreaks in time to save crop or stand. Other insects preying upon these aphids in Oklahoma are big-eyed bugs, *Geocoris* sp.; lacewings, *Chrysopa* sp.; minute pirate bugs, *Orius* sp.; damsel bugs, *Nabis*, spp.; and *Syrphid* flies. All of these species are general feeders, even to the point of cannibalism.

Early in 1956 minute parasitic wasps, whose only hosts are the spotted alfalfa aphids and which were originally collected in the Mediterranean region were obtained through the cooperation of the United States Department of Agriculture, Entomology Research Branch. The parasites were released and observed to determine their adaptability to Oklahoma conditions. Recoveries have been made at this early date of one species. Much remains to be done on this facet of the control problem before it will be possible to determine the advisability of going into the production of parasitic biological control agents.

¹Carbide and Carbon Chemicals Company experimental compound.

²Stauffer Chemical Company experimental compound.



Figure 3.—Resistant and non-resistant alfalfa plants growing side by side. Resistant plant (left) shows little damage although some aphids were observed on the plant. Resistant plants offer hope for future control.

Plant Resistance

Certain alfalfa varieties have shown more resistance to spotted alfalfa aphid attack than the present commercial varieties (Figure 3). For example, the variety Lahontan, although an unproven variety under Oklahoma conditions, may prove to be a source of resistance factors for future breeding work. Another possible source of resistant plants is the alfalfa nursery at the Oklahoma Agricultural Experiment Station which contains varieties from the Far East and Middle East, the native home of the spotted alfalfa aphid.

The aphid densities on approximately 100 varieties are being sampled regularly to determine the population trends which may indicate resistance. To date sampling records and estimates of damage have shown several foreign introductions to the nursery of interest from the standpoint of resistance to aphid attack. Narrow-leaved, pasture type plants support smaller numbers of aphids and show less damage than the broad-leaved, forage types under conditions of severe field infestations.

Summary

The spotted alfalfa aphid, a recently introduced pest threatens the alfalfa industry in Oklahoma. The Oklahoma Experiment Station initiated research in 1954 to determine the characteristics and habits of this insect as they apply to control, the type and extent of injury and the measures necessary to reduce infestations. In all, thirteen insecticides have been tested to determine their efficiency as regards initial and residual control. Aphid parasites have been introduced to the State and evaluation of these is now in progress. Studies of alfalfa varieties showing resistance to aphid attack are being continued.

Literature Cited

- Dickson, R. C., Edward F. Laird Jr., and George R. Pesho.
1955. The spotted alfalfa aphid (yellow clover aphid on alfalfa).
Hilgardia 24 (5) :93-118.
- Henderson, Charles F.
1956. A sampling fork for estimating populations of small arthropods. U. S. Dept. Agr. ARS Pamphlet 33-18. 7pp.