Reactions of Alfalfa Varieties to Pea Aphids in the Field and Greenhouse


Damage to alfalfa, Medicago sativa L., caused by pea aphids, Acyrthosiphon pisum (Harris), may be more extensive than generally realized. Losses of alfalfa hay production from pea aphids was estimated at 4.1% representing an annual loss of over 30 million dollars in the United States according to a 1944 survey (2). Alfalfa acreage has doubled since 1944 and present losses may be correspondingly higher.

Although pea aphid injury to alfalfa is not always conspicuous, sporadic heavy infestations may destroy an entire spring crop of alfalfa. Widespread outbreaks of pea aphids were reported in Kansas in 1921 (14) and in 1934 (13). Pea aphid damage in 1959 resulted in nearly the total loss of an estimated half of the state's first crop of alfalfa. Actual yield losses sustained during a serious pea aphid infestation at the Ft. Hays Branch Station were demonstrated by increases in hay yields of 151% through insecticidal control (7).

The importance of pea aphid injury to alfalfa has been oversharded since 1954 by the more obvious injury caused by spotted alfalfa aphids, Therioaphis maculata (Buckton). However, because of recent successes in developing varieties with resistance to spotted alfalfa aphids (9, 10, 17), resistant selection (P-42) had developed to these growth stages. In Manhattan trials, seedling stunting was determined by counting seedlings with unifoliate leaves when nearly all the seedlings of the resistant selection (P-42) had developed to these growth stages. Field-collected aphids and aphids reared on broadbeans (Vicia sativa L.) in the greenhouse were used in the trials at Hays and Manhattan, respectively. One replication of uninfested selections in each trial at Hays served as checks. Since variances of seedling infestations and aphid damage in the uninfested controls developed to the unifoliate- to trifoliate-leaf stage, the percentages of infested seedlings that had developed to these growth stages were recorded.

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In a second-year alfalfa variety trial, seedlings were infested only once with pea aphids. Injury was determined from the average reduction in top-growth weights of 6-weeks-old surviving seedlings after infestation in the cotyledon stage relative to 3 replications of uninfested seedlings.

Field experiments—Aphid populations on alfalfa varieties and varietal reactions to natural field infestations of pea aphids were studied.

MATERIALS AND METHODS

Greenhouse experiments—Seedling alfalfa varieties and strains were evaluated for reactions to pea aphid infestations in 5 separate trials. Trials were conducted during April, May, and June at Hays and during September, October, and November at Manhattan under natural day lengths. Greenhouse temperatures averaged 70°, but wide fluctuations were common.

In each field survival trial, 50 seeds of each variety or strain were planted in rows 2 inches apart and 6 inches long in 12-20 inch flats. Six replications of 17 entries were seeded in each of 2 trials at Hays. Two trials including entries of 4 replications each were seeded at Manhattan. After determining seedling emergence in the cotyledon stage about 5 days after planting, each of the 2 trials at Hays of seedlings was infested with 50 cc. of aphids. Seedlings were reinfested 3 times at 4-day intervals. Screen cages confined aphids on the seedlings in each flat. Field-collected aphids and aphids reared on broadbeans (Vicia sativa L.) in the greenhouse were used in the trials at Hays and Manhattan, respectively. One replication of uninfested selections in each trial at Hays served as checks. Since variances of seedling infestations and aphid damage in the uninfested controls developed to the unifoliate- to trifoliate-leaf stage, the percentages of infested seedlings that had developed to these growth stages were recorded. In 6 Manhattan trials, seedling stunting was determined by counting seedlings with unifoliate leaves when nearly all the seedlings of the resistant selection (P-42) had developed to these growth stages.

A preliminary assay rated for aphid infestation at the Ft. Hays Branch Station were demonstrated by increases in hay yields of 151% through insecticidal control (7).

Since a knowledge of sources of pea aphid resistance is needed to inaugurate breeding programs, seedling alfalfa varieties and strains were surveyed for resistance in greenhouse trials with pea aphid populations occurring on alfalfa varieties and varietal reactions to natural field infestations of pea aphids were studied.

Analyses—The wide ranges in values expressed as percentages in the seedling survival trials necessitated angular transformation for analysis of variance. Since variances of percentage survival data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted. Average within-trial variance estimates were computed for each trial and the data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted. Average within-trial variance estimates were computed for each trial and the data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted. Average within-trial variance estimates were computed for each trial and the data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted. Average within-trial variance estimates were computed for each trial and the data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted. Average within-trial variance estimates were computed for each trial and the data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted. Average within-trial variance estimates were computed for each trial and the data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted. Average within-trial variance estimates were computed for each trial and the data from separate trials in the greenhouse were not homogeneous, a combined analysis of variance was not attempted.