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Populations of Alfalfa Weevils (Coleoptera: Curculionidae) and Aphids (Homoptera: Aphididae) on Different Alfalfa Cultivars

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Abstract: Populations of alfalfa weevil, *Hypera variabilis* (Gyllenhal) (Coleoptera: Curculionidae) and aphids were evaluated on 12 alfalfa, *Medicago sativa* L. cultivars in 2002 and 2003. The cultivars used included MA-324, MA-414, MA-525, P-5693, Gara, Desica, Kayseri, Hemedan, Prosementi, Bilensoy, Prista and Elci. There were no significant differences among the weevil populations on different alfalfa cultivars in any of the years. Aphids were more abundant ($p<0.05$) on Kayseri cultivar in both years, on Bilensoy only in 2002 and on MA-324, Hemedan and Elci in 2003. Under the current pest pressure and ecological conditions, MA-324, MA-414, MA-525, Desica and Elci cultivars that provided higher ($p<0.05$) yields than most of the cultivars seemed more promising in forage production.

Key words: Alfalfa, *Hypera variabilis*, aphids, cultivar, yield, resistance

Introduction

Alfalfa is an increasingly important pasture legume for a wide range of livestock. It provides high yield, forage quality and adapts to wide climatic and soil conditions (Van Keuren and Matches, 1988). Alfalfa is attacked by a great number of insect species that cause considerable damage and reduce forage yield. Alfalfa weevil is one of the most important pests that consumes foliage severely and leaves only leaf veins unfed (Yakhontov, 1974). Some aphid species remove plant sap and cause considerable damage on crop (Manglitz and Ratcliffe, 1988). A number of resistant alfalfa cultivars have been developed against pea aphid, *Acyrtosiphon pisum* Harris and the spotted alfalfa aphid, *Therioaphis maculata* Buckton whereas only limited success has been accomplished in development of resistant cultivars against alfalfa weevil (Sorensen *et al*., 1988). Recent studies have focused mostly on potato leafhopper, *Empoasca fabae* Harris resistant alfalfa cultivars that were released by several seed companies in 1997 (Hansen *et al*., 2002; Lefko *et al*., 2000 a and b; Sulc *et al*., 2001, 2004). This study aimed to generate preliminary data on populations of alfalfa weevil and aphids as well as yields of different cultivars in Van, Turkey ecological conditions in order to select proper alfalfa cultivar(s) in pest management context in relation to resistance as well as sustainable forage production.

Materials and Methods

The experiment was conducted in a private field, east of Yuzuncu Yil University Campus in Van, Turkey in 2002 and 2003. The soil was sandy clay loam. The field was cultivated and treatment plots were sown with a rate of 20 kg alfalfa seed ha^{-1} on 30 cm row spacing on 23 April 2001. The field

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received 30 kg ha^{-1} N and 80 kg ha^{-1} P at planting and additional 80 kg ha^{-1} P in October 2002. The experiment was a complete randomized block design with thirty six 9 m^{-2} plots, involving twelve cultivar treatments, each replicated three times. A 1.5 m buffer gap was left between plots. Plots were irrigated every 20-25 days. No pesticides were applied to the plots. The cultivars used included MA-324, MA-525, Ma-414, P-5693, Desica, Kayseri, Hemedan, Prosementi, Bilensoy, Prista, Elci and Gara.

Alfalfa weevil larvae and aphids were sampled once a week using a sweep-net (10 sweeps per plot) from the first week of May to the first cut (Mid-June). The weevils and aphids were counted in the field and released into the same plots from they were removed. Yield data were obtained from the first cut by removing stands in 4.8 m^{-2} (4 × 1.2 m) area in each plot. Two rows from opposite sites of the plots and 0.5 m of the other sites were removed in advance to avoid edge effect. Samples were weighed and 500 g of each sample was placed in an oven kept at 78 °C until constant dry weight was obtained. Dry weight values were converted to harvest values (kg da^{-1}) to indicate forage yield. Hay yields of alfalfa cultivars were calculated using dry weight rate and fresh herbage yield. Data on the numbers of pest taxa and yield were analyzed by a two-way ANOVA and group means were separated by Duncan's Multiple Range Test at $p = 0.05$.

Results

Populations of alfalfa weevils varied significantly between the 2 years of study ($F = 11.15$, $df = 1, 438$, $p<0.01$). However, there were no differences in the weevil numbers among the treatments ($F = 0.85$, $df = 11, 438$, $p = 0.592$) (Table 1) and there was no significant interaction between years and cultivars ($F = 0.23$, $df = 11, 438$, $p = 0.995$). The trend in the data indicated that cultivars such as MA-324, MA-414, MA-525 and Desica sustained relatively lower numbers of alfalfa weevils than the other cultivars did.

The numbers of aphids on alfalfa plants differed significantly between the 2 years ($F=17.59$, $df=1, 438$, $p<0.01$) and also among the cultivars ($F=3.063$, $df=11, 438$, $p<0.01$) (Table 1); no significant interaction occurred between years and treatments ($F=0.187$, $df=11, 438$, $p=998$). Aphid populations were significantly larger ($p<0.05$) on Kayseri and Bilensoy cultivars in 2002 and on Kayseri, MA-324, Hemedan and Elci in 2003 than those on the other cultivars. Also, in 2003, the numbers of aphids were higher on MA-324, Hemedan and Elci cultivars than those on Kayseri cultivar.

Table 1: Numbers of alfalfa weevils and aphids (number/ 10 sweeps) and alfalfa forage yield (kg/da) in response to cultivar differences

	Alfalfa weevils		Aphids		Forage yield (kg da^{-1})	
Cultivars	2002	2003	2002	2003	2002	2003
MA-525	13.60±2.61 a	17.67±2.89 a	20.85±4.93 b	8.50±1.65 c	893.90±16.89 a	910.60±27.84 a
MA-324	13.61±2.95 a	21.89±3.74 a	31.81±6.71 b	24.56±6.50 a	901.27±30.41 a	894.13±11.99 ab
Desica	13.62±2.66 a	18.67±3.27 a	19.71±3.99 b	13.33±2.44 c	933.87±24.08 a	912.20±34.53 a
MA-414	14.33±2.71 a	18.94±3.56 a	24.29±5.12 b	13.17±3.54 c	941.47±31.15 a	907.46±20.07 a
Kayseri	14.43±3.18 a	22.83±6.88 a	35.92±7.45 a	23.78±5.74 b	801.43±54.81 abc	800.56±20.68 d
Hemedan	14.95±3.20 a	23.33±4.49 a	33.86±7.59 b	27.33±4.97 a	835.03±18.05 ab	811.20±15.91 cd
Prosementi	16.10±3.54 a	19.39±3.34 a	15.81±4.29 b	9.22±1.55 c	765.53±30.52 abc	781.50±6.83 d
Bilensoy	16.10±3.97 a	24.83±5.93 a	37.76±7.87 a	22.11±5.75 c	812.20±102.36 ab	882.40±36.00 abc
Prista	17.48±4.01 a	26.00±3.95 a	24.76±5.23 b	18.22±4.14 c	622.47±142.31 c	779.46±27.41 d
Elci	18.81±4.08 a	20.50±3.51 a	30.29±5.67 b	24.88±5.35 a	873.50±23.84 a	876.53±23.41 abc
Gara	18.84±3.59 a	20.78±4.39 a	21.90±4.43 b	12.94±3.39 c	682.20±24.24 bc	704.16±27.60 e
P-5693	23.44±4.32 a	26.50±6.59 a	25.83±3.78 b	16.50±4.62 c	812.10±12.98 ab	833.00±19.17 bcd

(in a column, values indicated with different letters are significantly different at $p<0.05$)

Forage yield did not differ between years ($F = 1.04$, $df = 1, 44$, $p = 0.313$) but differed among cultivars ($F = 6.61$, $df = 11, 44$, $p<0.01$); there was no significant interaction between years and cultivars ($F = 0.701$, $df = 1, 48$, $p = 0.731$). In general, MA-324, MA-414, MA-525, Desica and Elci provided better ($p<0.05$) yields than the other cultivars in both 2002 and 2003, while Gara and Prista cultivars had the lowest yields.

Discussion

Resistance in alfalfa can be in forms of antixenosis (Moellenbeck and Quisenberry, 1992) antibiosis, non-preference, and tolerance (Sorensen *et al*., 1988). In a previous study with a different set of Turkish alfalfa cultivars including Kayseri cultivar, commonly grown in Central and Eastern Turkey were screened for antibiosis and feeding non-preference. None of the cultivars was found as promising source of genes in these regards (Ratcliffe and Elgin, 1990). Although, the lack of significant differences with respect to alfalfa weevil populations on different cultivars indicated that there was no significant sign of resistance attributable to cultivar differences in this study, consistently higher yields provided by MA-324, MA-414, MA-525, Desica and Elci cultivars but relatively smaller alfalfa weevil populations that they (except Elci) sustained might indicate some forms of resistance at some levels. In general, aphid populations did not show any pattern. However, significantly higher aphid numbers on Kayseri cultivar in both years indicate that this cultivar might require specific attention in alfalfa production areas where alfalfa aphids are serious problem.

Alfalfa is an increasingly important crop for animal feeding in organic agriculture. Even moderate level of resistance with support of other acceptable techniques could be utilized as a mean of pest control in organic context. Clearly, our preliminary results indicated that under the current pest pressure and ecological conditions, MA-324, MA-414, MA-525, Desica and Elci cultivars might better fit to alfalfa production in the area.

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