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NOTE: Does *Liriomyza cicerina* Affect the Yield of Chickpeas (*Cicer arietinum*)?

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Liriomyza cicerina (Rondani, 1875) (Diptera: Agromyzidae) is an important pest on chickpea (*Cicer arietinum* L.) in some regions of Turkey. The objective of this study was to determine whether the populations of *L. cicerina* on different varieties of chickpea plants during the 2004 and 2005 production seasons affected yield in Sanliurfa province. The trials were carried out using eight different varieties of chickpea with three replicates. During each season, larval densities on leaves were assessed weekly. The *L. cicerina* larval population was lowest on four varieties for both seasons. There were very minor differences in yield among the eight varieties in the production seasons. There was no correlation found between larval density and yield loss.

KEY WORDS: *Liriomyza cicerina*; population density; chickpea varieties; Turkey.

Liriomyza (Diptera: Agromyzidae) leafminers are an important pest in vegetables, ornamentals and pulses. Both larvae and adults cause damage: larvae tunnel through the leaves and adult females puncture both upper and lower leaf surfaces to feed and lay eggs. Photosynthetic activity can also be reduced by these activities (3,5). One of the most important leafminer species on chickpea is *Liriomyza cicerina* (Rondani, 1875), the chickpea leaf fly (7). It is an oligophagous pest that feeds on plants belonging to the Fabaceae (8). Infestation of the plants is often severe and can strongly affect the vitality of the plants and reduce the amount and quality of the yield (6). Lodos (4) and Giray (2) reported that the chickpea leaf fly caused damage on chickpea in the Aegean region. Yabas and Ulubilir (9) investigated population fluctuations of chickpea leafminer (*L. cicerina*) in the Kilis and Gaziantep provinces of Turkey. According to their results, the chickpea leafminer was present throughout the vegetation period, and infestation rates were ~95% of the plants. They reported that the larvae of *L. cicerina* appeared 3–20 days after adult emergence, when the plants were 5–10 cm high. The population densities of adults and larvae reached a maximum twice in the season, once at the end of May, and again at the end of June.

Turkey ranks third in the world for chickpea production (1). The largest dam project in the Middle East and Balkans, the Southeast Anatolia, has provided irrigation water for agriculture for the last 10 years; this region is known as the GAP. Ten percent of the GAP region's agriculture is chickpea production. The objective of this study was to determine if the population densities of *L. cicerina* on different varieties of chickpea plants affected yield in the GAP region.

This study was carried out during 2004–2005 in Sanliurfa province, southeastern Turkey. Favorable climatic conditions in Sanliurfa region allow for two chickpea growing seasons per year (from January to May and from March to June). In this study, chickpea seeds were sown on March 14 and harvested on June 17 in both years. Eight different varieties of chickpea were used (see Table 1). The trial was set up as a random-

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TABLE 1. Effect of different varieties of chickpea on *Liriomyza cicerina* larval density and yield

Variety	2004		2005	
	Larvae (no. per leaf ±S.E.)	Yield (kg ha^{-1} ±S.E.)	Larvae (no. per leaf ±S.E.)	Yield (kg ha^{-1} ±S.E.)
Akcin 91	5.3±0.2 bcd[z]	4587.3±160.5 ab	4.9±0.2 bc	4994.3±7.7 b
Cagatay	5.7±0.3 d	6072.7±291.6 c	5.2±0.2 bcd	7104.5±31.9 de
Damla 89	4.6±0.2 a	5224.4±202.2 b	4.6±0.3 ab	5557.1±61.1 bc
Diyar 91	4.6±0.2 a	7316.3±186.3 d	4.3±0.2 a	7817.8± 9.4 e
Er 91	5.1±0.2 ab	6080.7±219.0 c	4.7±0.2 abc	6541.0±46.7 cd
Gökce	5.2±0.2 bc	7635.3±317.9 d	4.8±0.2 bc	7494.0±17.2 de
Gülümser	5.4±0.2 cd	5211.1±217.3 b	5.1±0.2 bcd	5870.4±34.6 bc
Uzunlu 99	5.6±0.2 cd	3951.1±110.4 a	5.5±0.3 d	3960.3±14.5 a

[z] Within columns, numbers followed by a common letter do not differ statistically at P=0.05.

ized complete block with three replications. Each plot was 9 m^2 and consisted of four rows, each 4 m long. Inter-row spacing was 0.45 m and intra-row plant spacing was 0.05 m. There was no space between the plots in any replication. Each of the eight varieties was randomly assigned to the plots. The total experiment area was 216 m^2. No insecticide treatments were applied during the production period.

The trial plots were checked weekly throughout the production period starting with the sowing of seeds. During the fourth week, when leafminer infestation occurred, and each week thereafter, ten leaves were randomly removed from each plot, brought to the laboratory, and maintained at 25±2°C and 65±5% r.h. Leaves were examined under a stereomicroscope, and live larval counts were recorded. During counting, any larva that was dark in color was taken to be dead because a greenish yellow color indicates that the larva is alive. All chickpea varieties were hand-harvested and weighed in the middle of June of each year.

Data were analyzed using two-way analysis of variance (ANOVA), and means were separated by LSD test, using SPSS 11.0 software programs. The correlation between number of leafminer larvae per leaf and yield data were analyzed. All tests were conducted at the α= 0.05 level.

The average numbers of live larvae per leaf and the yield for each year are shown in Table 1. The infestation of chickpea varieties by *L. cicerina* started in the week of 10 April in 2004 and of 12 April in 2005. As shown in the table, in both years the lowest number of larvae per leaf was recorded on Damla 89, Diyar 91 and Er 91 as compared with the other varieties (2004: P<0.05, F=2.090, df=7.781, LSD=0.425; 2005: P<0.05, F=2.090, df=7.427, LSD=0.482). The number of larvae per leaf in the Er 91 variety was not significantly different from half of the lines evaluated in both years.

The highest yield was recorded on Diyar 91 and Gökce and the lowest yield was recorded on Uzunlu 99 and Akcin 91 (2004: P<0.05, F=32.88, df=7.160; 2005: P<0.05, F=15.99, df=7.160). According to correlation analysis, the relation between larva number and yield was found to be very poor statistically (r^2=0.129 in 2004 and r^2=0.151 in 2005).

A plant is considered infested when it has larvae on the leaves and the economic threshold was considered to be two or three *L. cicerina* per leaf in 50% of the plants in a field (1). However, based on this research, that economic threshold should be reconsidered. The average yield of chickpea in the GAP region, under typical growing conditions, is 1080 kg ha^{-1}; all of the trial plots had yields higher than that and no insecticides were applied. Since Diyar 91 yields were more than six times greater than the average for the GAP region, and it supported the lowest larvae leaf miner populations, we recommend its use.

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