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## Evaluation Population Density of *Tetranychus urticae* Koch on Cotton Fields Planted Nearby Dirt and Asphalt Roads

N. Demirel and F. Çabuk

Department of Plant Protection, Faculty of Agriculture,  
Mustafa Kemal University, 31034, Antakya, Hatay, Turkey

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**Abstract:** The two spotted spider mite (TSSM), *Tetranychus urticae* Koch (Acari: Tetranychidae), is one of the most important pests on the cotton crop in Hatay region of Turkey. A two-year study was conducted between 2006 and 2007 to evaluate the population density of TSSM on cotton fields planted by dirt and asphalt roads. In 2006, the cotton plants nearby dirt roads had 1.72, 1.75, 4.04 and 2.65 times higher TSSM population than the cotton plants nearby asphalt roads in the four sampling dates, respectively. In 2007, the cotton plants nearby dirt roads had 5.54 and 10.64 times higher TSSM population than cotton plants nearby asphalt roads in two sampling dates, respectively. Consequently, the population densities of the TSSM were 1.79 and 13.86 times higher on the cotton plants nearby dirt roads than cotton plants nearby asphalt roads in 2006 and 2007, respectively. It is thought, the dusty conditions may bring about increasing population of TSSM on cotton plants.

**Key words:** Two spotted spider mite, *Tetranychus urticae* Koch, cotton, Hatay region

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### INTRODUCTION

Cotton, *Gossypium hirsutum* L., is one of the most significant industrial crops, approximately planted 1,280,090 hectares and yielded 3,390,999 tons in Turkey (Anonymous, 2004). The two spotted spider mite (TSSM), *Tetranychus urticae* Koch, is about 0.5 mm long with an oval shaped body which varies in color from greenish-yellow to brown and red-orange (Osborne *et al.*, 1999; Wilkerson *et al.*, 2005). There are generally two large black spots one on either side of the body (Wilkerson *et al.*, 2005).

Two spotted spider mite causes significant injuries on cultivated plants (Wilkerson *et al.*, 2005). Plants are affected in several ways from TSSM attack. The direct effects results in stippling, webbing, defoliation, leaf burring and plants death during severe TSSM outbreaks. The indirect effects of mite feeding may include decreased photosynthesis and transpiration.

Population density of TSSM can be affected by different environmental conditions (Guerena and Sullivan, 2003). Temperature (Thomas, 2001), dry weather (Helle and Sabelis, 1985), dusty conditions (Guerena and Sullivan, 2003) and humidity (Sabelis, 1981) are some of the environmental conditions that influence the survival, development time and reproduction of TSSM. The purpose of this study was to evaluate the population density of TSSM on cotton crops planted by dirt and asphalt roads in Hatay region of Turkey.

### MATERIALS AND METHODS

A two-year study was conducted between 2006 and 2007 to evaluate the population density of TSSM on cotton fields planted by dirt and asphalt roads in Hatay region of Turkey. A hundred and

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**Corresponding Author:** N. Demirel, Department of Plant Protection, Faculty of Agriculture, Mustafa Kemal University, 31034, Antakya, Hatay, Turkey Fax: 90(326)2455832

four cotton fields were sampled during the study. In 2006, fifty-two cotton fields were sampled; twenty-five of them were located by dirt roads and twenty-seven of them were located by asphalt roads. In 2007, fifty-two cotton fields also were sampled. Sixteen of them were located nearby dirt roads and thirty-six of them were located nearby asphalt roads. In 2006, samples were taken on 9th, 19th, 31st of August, 2nd, 14th of September. In 2007, samples were taken 1st and 11th of September. Twenty-five leaves were randomly taken from each of the sampling fields. The leaves were replaced in paper bags and then refrigerated in laboratory to keep them fresh. A total of 2600 cotton leaves were sampled in both years. Each of the leaves was examined under stereo microscope and all stages of two spotted spider mite (except their eggs) were counted. Data were analyzed by analysis of variance (ANOVA) using the SAS software and means were separated using the Student-Newman-Keuls (SNK) Tests ( $p < 0.05$ ) (SAS, 1998).

## RESULTS AND DISCUSSION

Results of the two-year study showed that in 2006, the population densities of TSSM were significantly higher on cotton plants nearby dirt roads than cotton plants nearby asphalt roads in four sampling dates ( $F = 4.99$ ,  $df = 7, 192$ ,  $p = 0.0001$ ;  $F = 10.90$ ,  $df = 7, 192$ ,  $p = 0.0001$ ;  $F = 5.31$ ,  $df = 23, 576$ ,  $p = 0.0001$ ;  $F = 2.92$ ,  $df = 7, 192$ ,  $p = 0.006$ , respectively) (Table 1-4). Therefore, the cotton plants nearby dirt roads had 1.72, 1.75, 4.04 and 2.65 times higher the TSSM population than the cotton plants nearby asphalt roads in the four sampling dates. However, the population density of TSSM were not significantly different at the last sampling date ( $F = 0.28$ ,  $df = 3, 96$ ,  $p = 0.84$ ) (Table 5).

Similarly, in 2007, the population densities of TSSM were significantly higher on cotton plants nearby dirt roads than cotton plants nearby asphalt roads in two sampling dates ( $F = 19.41$ ,  $df = 21$ ,

Table 1: Evaluation population density of *Tetranychus urticae* on cotton crops in Hatay in 2006

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>	
	9 August	
NDR	9.28±1.77 <sup>a</sup>	
NDR	8.24±1.10 <sup>ab</sup>	
NDR	5.64±0.74 <sup>bc</sup>	
NAR	5.28±0.12 <sup>bc</sup>	
NAR	3.84±0.71 <sup>c</sup>	
NDR	3.76±0.83 <sup>c</sup>	
NAR	3.44±0.88 <sup>c</sup>	
NAR	3.12±0.53 <sup>c</sup>	

<sup>w</sup>Means followed by the same letter(s) in a column do not differ significantly ( $p < 0.05$ , SNK). <sup>y</sup>NDR (nearby dirt road) and NAR (nearby asphalt road)

Table 2: Evaluation population density of *Tetranychus urticae* on cotton crops in Hatay in 2006

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>	
	9 August	
NDR	9.84±1.26 <sup>a</sup>	
NDR	5.00±0.82 <sup>b</sup>	
NDR	3.52±0.57 <sup>b</sup>	
NAR	3.52±0.54 <sup>b</sup>	
NDR	3.36±0.61 <sup>b</sup>	
NAR	3.24±0.52 <sup>b</sup>	
NAR	2.92±0.52 <sup>b</sup>	
NAR	2.72±0.54 <sup>b</sup>	

<sup>w</sup>Means followed by the same letter(s) in a column do not differ significantly ( $p < 0.05$ , SNK). <sup>y</sup>NDR (nearby dirt road) and NAR (nearby asphalt road)

Table 3: Evaluation population density of *Tetranychus urticae* on cotton crops in Hatay in 2006

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>
	31 August
NDR	1.84±0.50 <sup>a</sup>
NDR	1.48±0.44 <sup>ab</sup>
NDR	1.12±0.38 <sup>bc</sup>
NDR	1.04±0.36 <sup>bcd</sup>
NAR	0.88±0.28 <sup>cd</sup>
NDR	0.64±0.24 <sup>def</sup>
NDR	0.64±0.30 <sup>def</sup>
NDR	0.44±0.22 <sup>def</sup>
NAR	0.40±0.21 <sup>def</sup>
NAR	0.28±0.15 <sup>def</sup>
NDR	0.32±0.16 <sup>def</sup>
NAR	0.12±0.88 <sup>f</sup>
NDR	0.12±0.09 <sup>f</sup>
NAR	0.08±0.08 <sup>f</sup>
NDR	0.08±0.08 <sup>f</sup>
NAR	0.05±0.05 <sup>f</sup>
NAR	0.05±0.05 <sup>f</sup>
NAR	0.05±0.05 <sup>f</sup>
NDR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>

<sup>w</sup>Means followed by the same letter(s) in a column do not differ significantly (p<0.05, SNK). <sup>w</sup>NDR (nearby dirt road) and NAR (nearby asphalt road)

Table 4: Evaluation population density of *Tetranychus urticae* on cotton crops in Hatay in 2006

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>
	2 September
NDR	1.12±0.43 <sup>a</sup>
NDR	1.12±0.40 <sup>a</sup>
NAR	0.68±0.35 <sup>ab</sup>
NDR	0.52±0.27 <sup>ab</sup>
NAR	0.24±0.18 <sup>b</sup>
NAR	0.12±0.12 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NDR	0.00±0.00 <sup>b</sup>

<sup>w</sup>Means followed by the same letter(s) in a column do not differ significantly (p<0.05, SNK). <sup>w</sup>NDR (nearby dirt road) and NAR (nearby asphalt road)

Table 5: Evaluation population density of *Tetranychus urticae* on cotton crops in Hatay in 2006

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>
	14 September
NDR	1.60±0.21 <sup>a</sup>
NDR	1.52±0.42 <sup>a</sup>
NAR	1.32±0.36 <sup>a</sup>
NAR	1.12±0.38 <sup>a</sup>

<sup>w</sup>Means followed by the same letter(s) in a column do not differ significantly (p<0.05, SNK). <sup>w</sup>NDR (nearby dirt road) and NAR (nearby asphalt road)

528, p = 0.0001; F = 4.16, df = 29, 720, p = 0.0001, respectively) (Table 6, 7). The cotton plants nearby dirt roads had 5.54 and 10.64 times higher the TSSM population than the cotton plants nearby asphalt roads in the two sampling dates.

Overall, the population densities of TSSM were significantly higher on cotton plants nearby dirt roads than cotton plants nearby asphalt roads in 2006 and 2007 (F = 32.534, df = 1, 1298, p = 0.0001;

Table 6: Evaluation population density of *Tetranychus urticae* on cotton crops in Hatay in 2007

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>
	1 September
NDR	32.88±4.59 <sup>a</sup>
NDR	21.60±3.24 <sup>b</sup>
NDR	11.52±5.12 <sup>c</sup>
NDR	8.00±2.91 <sup>cd</sup>
NDR	6.48±1.46 <sup>cd</sup>
NAR	5.36±2.44 <sup>def</sup>
NAR	3.40±1.07 <sup>def</sup>
NAR	3.12±0.83 <sup>def</sup>
NAR	1.12±0.72 <sup>ef</sup>
NAR	0.48±0.96 <sup>f</sup>
NAR	0.32±0.18 <sup>f</sup>
NDR	0.20±0.10 <sup>f</sup>
NAR	0.20±0.08 <sup>f</sup>
NAR	0.16±0.07 <sup>f</sup>
NAR	0.12±0.09 <sup>f</sup>
NAR	0.12±0.09 <sup>f</sup>
NAR	0.08±0.06 <sup>f</sup>
NAR	0.04±0.04 <sup>f</sup>
NAR	0.04±0.04 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>
NAR	0.00±0.00 <sup>f</sup>

<sup>y</sup>Means followed by the same letter(s) in a column do not differ significantly ( $p < 0.05$ , SNK). <sup>w</sup>NDR (nearby dirt road) and NAR (nearby asphalt road)

Table 7: Evaluation population density of *Tetranychus urticae* on cotton crops in Hatay in 2007

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>
	11 September
NDR	7.56±3.93 <sup>a</sup>
NDR	6.04±1.95 <sup>a</sup>
NDR	5.00±2.54 <sup>a</sup>
NAR	0.76±0.50 <sup>b</sup>
NAR	0.36±0.18 <sup>b</sup>
NAR	0.28±0.12 <sup>b</sup>
NDR	0.16±0.74 <sup>b</sup>
NDR	0.12±0.09 <sup>b</sup>
NDR	0.12±0.09 <sup>b</sup>
NAR	0.12±0.09 <sup>b</sup>
NAR	0.12±0.09 <sup>b</sup>
NDR	0.08±0.06 <sup>b</sup>
NDR	0.08±0.06 <sup>b</sup>
NAR	0.04±0.04 <sup>b</sup>
NAR	0.04±0.04 <sup>b</sup>
NAR	0.04±0.04 <sup>b</sup>
NAR	0.04±0.04 <sup>b</sup>
NDR	0.00±0.00 <sup>b</sup>
NDR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>
NAR	0.00±0.00 <sup>b</sup>

<sup>y</sup>Means followed by the same letter(s) in a column do not differ significantly ( $p < 0.05$ , SNK). <sup>w</sup>NDR (nearby dirt road) and NAR (nearby asphalt road).

Table 8: Evaluation of population densities of *T. urticae* on cotton crops in Hatay region in 2006-07

Places <sup>w</sup>	No. <i>T. urticae</i> (Mean±SE)/25 leaves <sup>y</sup>	
	2006 <sup>z</sup>	2007 <sup>z</sup>
NDR	2.48±1.70 <sup>a</sup>	6.24±0.75 <sup>a</sup>
NAR	1.38±0.10 <sup>b</sup>	0.45±0.09 <sup>b</sup>

<sup>w</sup>Means followed by the same letter(s) in a column do not differ significantly ( $p < 0.05$ , SNK). <sup>w</sup>NDR (nearby dirt road) and NAR (nearby asphalt road). <sup>z</sup>2006 (sampling dates; 9, 19, 31-August and 2, 14-September) <sup>z</sup>2007 (sampling dates; 1, 11-September)

F = 126.662, df = 1, 1298, p = 0.0001, respectively) (Table 8). Consequently, the cotton plants nearby dirt roads had 1.79 and 13.86 times higher the TSSM population than the cotton plants nearby asphalt roads in both years.

The development of TSSM population density might vary with different conditions; temperature (Van de Vrie *et al.*, 1972; Mitchell, 1973; Sabelis, 1981; Helle and Sabelis, 1985; Thomas, 2001), humidity (Sabelis, 1981), host plant, leaf age (Karban and Carey, 1984), hot and dry weather (Helle and Sabelis, 1985), dusty conditions (Flint, 1998; Guerena and Sullivan, 2003) and high level of nitrogen (Mattson, 1980). The current study also indicated that the dusty conditions resulted in higher TSSM population on the cotton plants. The reason might be due to natural enemies of TSSM populations in dusty conditions as has been previously reported by Flint (1998) and Guerena and Sullivan (2003) observed that keeping down dust along road sides decreased population densities of TSSM on cotton fields. In conclusion, the cotton plants nearby dirt roads had significantly higher TSSM population than the cotton plants nearby asphalt roads in Hatay region of Turkey.

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