Determination of Seasonal Activity of the Sweetpotato Whitefly (*Homoptera*: *Aleyrodidae*) and Leafhoppers (*Homoptera*: *Cicadellidae*) by Plastic Cup Traps on the Çukurova Plain, Turkey

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Abstract

Karut K., Chu C. C., Henneberry T.J., Kazak C.: **Determination of seasonal activity of the sweetpotato whitefly** (*Homoptera*: *Aleyrodidae*) **and leafhoppers** (*Homoptera*: *Cicadellidae*) **by plastic cup traps on the Çukurova Plain**, **Turkey**. Plant Protect. Sci., **41**: 8–13.

The flight activities of adult sweetpotato whitefly, *Bemisia tabaci*, and leafhoppers were monitored by plastic cup traps at Boğalı, Taşçı, Hacıali, Doğankent and Balcalı in the Çukurova Plain, Turkey, in 2001 and 2003. Activity of *B. tabaci,* expressed as numbers of adults caught in traps, was low from May to early July in both years. Numbers of *B. tabaci* caught at Tasçı were higher than at Boğalı from 10 July and 21 August in 2001. Its numbers were also higher at Doğankent than at Hacıali and Balcalı during August of 2003. The numbers of leafhopper adults caught fluctuated greatly in both years. Numbers remained low until late June, followed by gradual increases in July and August at Boğalı and Taşçı in 2001. In contrast, numbers of adults caught were higher at Hacıali, Doğankent and Balcalı from May through July in 2003, followed by lower catches during the remainder of the season. Daily minimum temperatures in July and August were positively correlated with higher trap catches of both *B. tabaci* and leafhoppers.

Keywords: sweetpotato whitefly; leafhoppers; seasonal activity; Turkey

The Çukurova Plain is one of the most important citrus and cotton growing areas of Turkey. In addition, many other cultivated crops such as fruits, corn, soybean and vegetables are grown in the area. Sweetpotato whitefly, *Bemisia tabaci* (*Gennadius*) (*Homoptera*: *Aleyrodidae*) (biotypes Q and B), and leafhoppers, *Empoasca decipiens* (Paoli) and *Asymmetresca decedens* (Paoli) (*Homoptera*: *Cicadellidae*), are important pests of many of these cultivated crops. *B. tabaci* has emerged as the most important insect pest problem in the Çukurova Plain since an initial outbreak that occurred in 1974 (Şekeroğlu *et al*. 2000). Although *B. tabaci* populations change from year to year, the insect

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remains a key pest of cotton in Çukurova. Losses occur as a result of feeding injury, transmission of disease-producing organisms, and honeydew contamination of crops. Chemical control is relied on to reduce *B. tabaci* and leafhopper numbers during the growing seasons of cotton (Şekeroğlu *et al*. 2000). After considering that sampling tools could be used to develop economic thresholds to reduce insecticide use, our objective was to evaluate plastic cup traps as such a potential sampling tool to monitor *B. tabaci* populations.

We report here on the seasonal numbers of adult *B. tabaci* and leafhoppers caught by plastic cup traps at several locations in the Çukurova Plain area of Turkey in 2001 and 2003.

MATERIALS AND METHODS

In 2001, six and four plastic cup traps (Figure 1) were installed at Boğalı and Taşçı located in the west and center of the Çukurova Plain area of Turkey, respectively. In 2003, two traps each were placed at Hacıali, Doğankent and Balcalı (Figure 2). Boğalı, Taşçı, Hacıali, Doğankent and Balcalı are approximately 20, 18, 35, 23 and 15 km distant, respectively, from the major city of Adana. For easy accessibility, the traps were located near the edges of farmland or roadways, and on banks of irrigation canals; they were fastened 1.0 m above ground to iron stakes. Numbers of adult *B. tabaci* and leafhoppers were counted and circled with an indelible pen weekly. The traps were replaced every 2 weeks. *B. tabaci* and leafhoppers were sampled

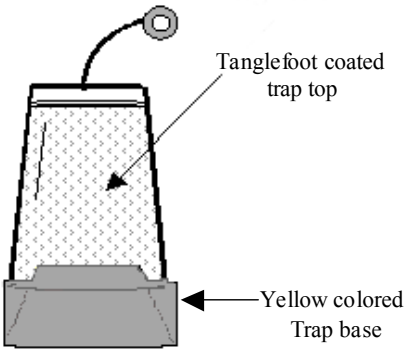

Figure 1. Plastic cup trap. The trap top is an 11 cm high 350 ml crystal clear plastic drinking cup coated by Tanglefoot® (Comet Products, Inc., Chelmsford, MA). The trap base is 4 cm high and made of yellow homopolymer polypropylene

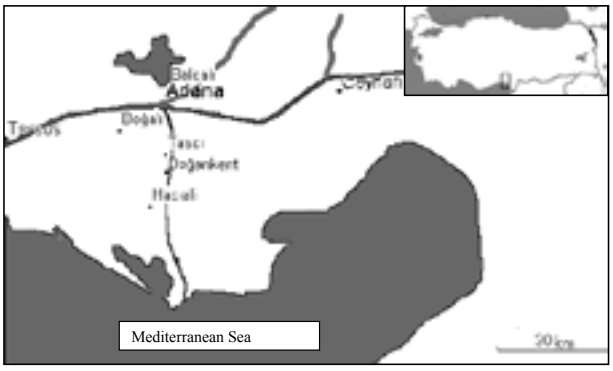

Figure 2. Plastic cup trap locations (Boğalı, Taşçı, Hacıali, Doğankent and Balcalı) for *Bemisia tabaci* and leafhopper surveys in the Çukurova Plain, Turkey, in 2001 and 2003

during the period between 5 June and 28 August in 2001 and between 15 May and 11 September in 2003.

Data analyses. Weekly adult catches were averaged for each location and the means were plotted to show seasonal *B. tabaci* and leafhopper distributions. Differences between locations were analysed using *F*- or *t*-test (Excel). In addition, correlation analyses were performed to determine the relationships between weekly trap catches of *B. tabaci* and leafhoppers, and with weekly average maximum and minimum temperatures.

RESULTS

Bemisia tabaci. At Taşçı, the numbers of adult *B. tabaci* caught in traps were low from 15 May to 17 July in 2001 (Figure 3B). The mean numbers of adults caught increased from 0 to 9.5/trap per week on 17 July and from 8 to 13/trap/week on 7 August. The mean numbers of adults caught at Boğalı were significantly lower than at Taşçı and never exceeded 3/trap/week during the season (P = 0.029, df = 10, t = 2.137) (Figure 3A).

In 2003, the numbers of *B. tabaci* adults trapped at Hacıali remained low until 17 July, followed by an increase to a peak catch of 8.0/trap/week on 24 July (Figure 3C). Likewise, the numbers of adults caught at Doğankent were low from the first sampling date to 3 July (Figure 3D). The mean numbers of adults caught increased from 0.5 to 7.5 per trap per week by 10 July and from 6.5 to 12.0 per trap/week on 14 August. At Balcalı, 2.0 *B. tabaci* per trap/week were recorded on 15 May, followed by no catches on 22 May (Figure 3E). A low peak

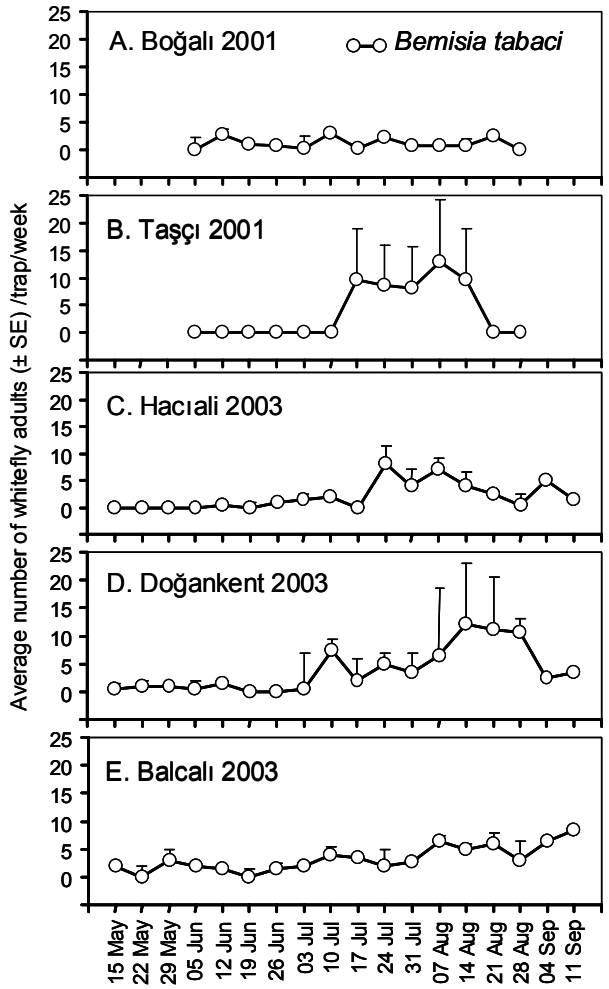

Figure 3. Seasonal mean numbers of *Bemisia tabaci* adults caught in plastic cup traps at Boğalı and Taşçı in 2001, and at Hacıali, Doğankent and Balcalı in 2003, in the Çukurova Plain, Turkey

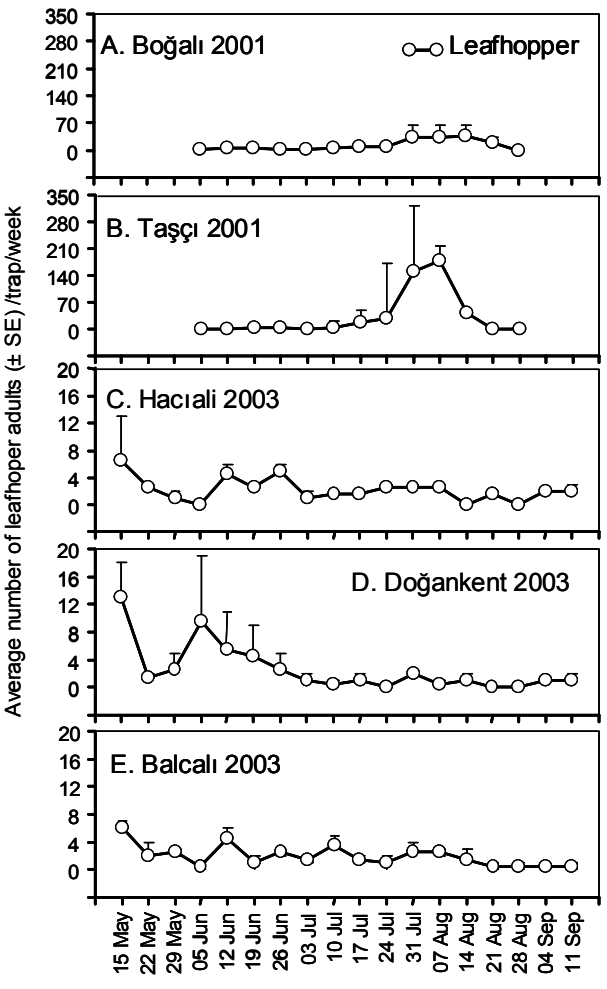

Figure 4. Seasonal mean numbers of leafhopper adults caught in plastic cup traps at Boğalı and Taşçı in 2001, and at Hacıali, Doğankent and Balcalı in 2003, in the Çukurova Plain, Turkey

catch of 3.0/trap/week occurred on 29 May, after which the mean numbers of adults caught fluctuated between 0 and 8.5/trap/week throughout the season. *B. tabaci* activity seemed to be higher at Doğankent than Hacıali and Balcalı during 14 to 28 August in 2003. However, no significant differences were observed between the sites (P = 0.371, df = 2, 15, F = 1.06) (Figures 3C–E).

The higher catches of adult *B. tabaci* from 1 July to 31 August at Taşçı in 2001, and at Hacıali, Doğankent and Balcalı in 2003 occurred when both maximum and minimum air temperatures were high (Figures 3 and 5). The correlations between weekly catches of *B. tabaci* and higher minimum temperature were stronger than for higher maximum temperature (Table 1). The significant correlations ($P < 0.05$) indicates positive relationships between weekly trap catches of *B. tabaci* and high minimum temperature at Taşçı 2001, Hacıali 2003 and Doğankent 2003.

Leafhoppers. The majority of trapped leafhoppers were *Empoasca decipiens* and *Asymmetresca decedens*. In 2001, the numbers of leafhopper adults caught remained low until 24 July (7.8/trap/week), increased between 31 July and 14 August (35 to 18/ trap/week), and decreased on the last sampling date at Boğalı (Figure 4A). Likewise, numbers trapped at Taşçı remained low until 24 July (30 per trap/week), followed by a gradual increase to peak with catches of 149/trap/week and 179/trap/week on 31 July and 7 August, respectively (P = 0.036, df = 1, t = 8.61) (Figure 4B).

Table 1. Relationships between plastic cup trap catches of *Bemisia tabaci* and leafhoppers and maximum and minimum temperature in Boğalı (2001), Taşçı (2001), Hacıali (2003), Doğankent (2003) and Balcalı (2003), Turkey

Location	*B. tabaci*				Leafhopper			
	Max. temp.		Min. temp.		Max. temp.		Min. temp.	
	r^2	*P*	r^2	*P*	r^2	*P*	r^2	*P*
Boğalı	0.0000	0.9600	0.01	0.720	0.40	0.020*	0.54	0.003*
Taşçı	0.3000	0.0500	0.61	0.001*	0.16	0.1700	0.41	0.017*
Hacıali	0.2900	0.010*	0.43	0.002*	0.02	0.5400	0.05	0.3600
Doğankent	0.3400	0.010*	0.40	0.004*	0.11	0.1600	0.44	0.002*
Balcalı	0.0800	0.2500	0.18	0.0700	0.01	0.7700	0.06	0.3100

Max. temp. – maximum temperature; Min. temp. – minimum temperature
*statistically significant relationship at $P \leq 0.05$

In 2003, 13 adult leafhoppers/trap/wk were recorded on 15 May, followed by lower catches on 22 May and an increase to a peak catch of 9.5/trap per week on 5 June at Doğankent (Figure 4D). The numbers caught thereafter averaged below 5.5/trap/week from 19 June to 11 September. At Hacıali and Balcalı, the mean numbers of adult leafhoppers caught on 15 May were 6.5 and 6.0 per trap/week, respectively, and thus were lower than at Doğankent. The numbers caught thereafter remained low from 3 July to 11 September. At all three locations the numbers of leafhoppers caught were higher on 15 May and 3 July of 2003 compared with 2001 (Figures 4C, 4D, 4E).

Similar to *B. tabaci*, the correlation between weekly leafhopper trap catches and minimum temperature were higher than for maximum temperature. The correlations were higher at Boğalı and Taşçı in 2001, and at Doğankent in 2003 compared with Hacıali and Balcalı (Table 1).

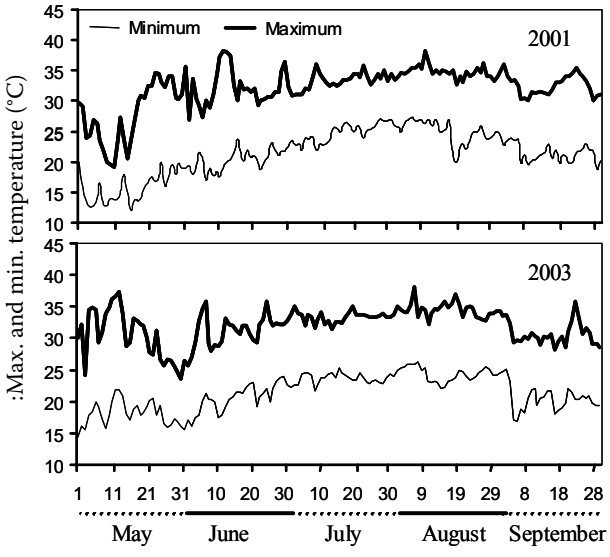

Figure 5. Daily maximum and minimum temperature in 2001 and 2003 in the Çukurova Plain, Turkey (data were obtained from the Turkish State Meteorological Service)

DISCUSSION

Trap catches of *B. tabaci* were low at Boğalı throughout the 2001 season. There, the traps were surrounded with corn and cotton fields. Generally, insecticides were applied that kept the *B. tabaci* population at low levels and prevented their migration between fields. In 2001, catches of *B. tabaci* at Taşçı increased suddenly on 17 July and remained high until the end of August, probably because the traps were close to untreated soybean fields which were infested with *B. tabaci*. Chu *et al.* (2001) had reported that in the Imperial Valley, California, USA, traps placed between insecticide treated and untreated cotton fields caught more *B. tabaci* adults than traps placed between insecticide treated cotton and Bermuda grass or fallow fields. This suggests an effect of *B. tabaci* infested untreated cotton on the numbers caught in the traps.

Increasing trap catches of *B. tabaci* in July indicate dispersing populations that continued in August. Özgür *et al.* (1989), using yellow sticky cards to monitor *B. tabaci* in Çukurova, reported

that most of the *B. tabaci* population overwintered in the foothills on *Cistus* spp. which are the main winter hosts. Dispersal into cultivated crop areas began in April. They also reported a low population density until the end of July in cotton and other crops. Thereafter, large numbers of adults occurred in August and September in the Çukurova Plain area.

Temperature is an important factor that influences *B. tabaci* development and dispersal (Coudriet *et al*. 1986; Isaacs & Byrne 1998). Chu *et al*. (2001) had found that peak trap catches of adult *B. tabaci* (= *B. argentifolii*) occurred during July, August and September when average air temperatures were 29°C or higher in the Palo Verde Valley, California. In our recent studies in Turkey, the adult *B. tabaci* trap catches increased with increased average daily minimum temperatures from 16.4 to 19.7°C (Sekeroğlu *et al*. 2002).

Similar to trap catches of *B. tabaci*, the higher numbers of adult leafhoppers in catches at Taşçı than in those at Boğalı in 2001 suggest that insecticides applied to crops at Boğalı reduced leafhopper populations compared to Taşçı where crops were untreated. The mean numbers of adults caught were higher in 2001 at Taşçı and Boğalı than in 2003 at Hacıali, Doğankent and Balcalı. Also, the peak catches in July of 2001 did not occur in 2003. In 2003, we began monitoring the populations earlier than in 2001 for which year early season catches were thus not available for comparison.

Kersting *et al*. (1996) found 40 leafhopper species in a young citrus orchard in Turkey using suction traps. They reported that the most common species were *A. decedens, E. decipiens*, *Cicadulina bipunctella* Matsumura, *Balclutha hebe* (Kirkaldy) and *B. punctata* (Fabricius). They also found that most leafhopper species increased flight activity from May through mid-September. Our results with leafhopper catches in plastic cup traps indicated a similar flight activity distribution as was observed in their study. Numbers of adults caught were high during July and August in 2001 and during May and July in 2003.

The use of plastic cup traps may be an option for surveys of leafhopper species in Turkey. The plastic cup traps are much cheaper and less labor-demanding compared with yellow sticky card traps.

We conclude that the plastic cup traps measured changes that occurred in populations of the sweetpotato whitefly, *B. tabaci,* and of the leafhoppers *A. decedens* and *E. decipiens* that appeared to be related to yearly variation and insecticide use. The results suggest that the traps may be useful to monitor populations and also to develop treatment thresholds. The use of treatment thresholds is an important part of Integrated Pest Management strategies to conserve natural enemies and reduce crop production costs.

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Abstrakt

Karut K., Chu C. C., Henneberry T. J., Kazak C. (2005): KARUT K., CHU C. C., HENNEBERRY T. J., KAZAK C. (2005): **Stanovení sezonní aktivity molice bavlníkové (***Homoptera***:** *Aleyrodidae***) a křísků (***Homoptera***:** *Cicadellidae***) v oblasti Çukorova, Turecko, pomocí plastových nádobových pastí**. Plant Protect. Sci., **41**: 8–13.

V roce 2001 a 2003 byly pomocí plastových nádobových pastí monitorovány letové aktivity dospělců molice bavlníkové, a křísků v oblasti Çukorova, Turecko, na lokalitách Boğalı, Taşci, Hacıiali, Doğankent a Balkalı. Aktivita *B. tabaci*, vyjádřená počtem dospělců zachycených v pastích, byla v obou letech od května do začátku července nízká. Množství *B. tabaci* zachycené v roce 2001 od 10. července do 21. srpna v Taşci bylo vyšší než v Boğalı. Během srpna 2003 bylo jejich množství rovněž vyšší v lokalitě Doğankent než Hacıiali a Boğalı. Množství zachycených dospělců křísů v obou letech značně kolísalo. V roce 2001 zůstalo jejich množství na lokalitách Boğalı a Taşci až do konce června nízké a v červenci a srpnu následoval postupný vzestup. Naproti tomu množství dospělců zachycených v průběhu května až července 2003 bylo vyšší v lokalitách Hacıiali, Doğankent a Boğalı a do konce vegetace zůstalo nižší. Denní minimální teploty v červenci a v srpnu pozitivně korelovaly s vyšším počtem zachycených dospělců jak *B. tabaci*, tak i křísků.

Klíčová slova: molice bavlníková; křísi; sezonní aktivita; Turecko

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