MONITORING ADULT POPULATIONS OF TUTA ABSOLUTA IN FIELD-GROWN PROCESSING TOMATOES IN NORTHWESTERN TURKEY

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Summary

Tomatoes are one of the most important vegetable crops in Turkey. The tomato leafminer Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) has recently become a key pest of tomatoes grown in greenhouses or open fields worldwide, including Turkey, Bosnia, Montenegro, and many other countries in Europe. A field survey was conducted to monitor seasonal population fluctuation of T. absoluta adults in field-grown processing tomatoes containing three different cultivars at three locations in Yenisehir town of Bursa, northwestern Turkey in 2011. In each location, which is 2 ha in size, 4 delta type pheromone traps baited with 0.5 and 0.8 mg pheromone lures and 2 water pan traps combined with a light source and 0.5 mg pheromone lures were hung on planting stakes at an initial height of 30 cm to monitor moth populations. Moth flight activity began on 2 June and continued until 11 October. Moths showed 3 distinct flight peaks during the growing season. The maximum number of moths was recorded in October after harvest. Although more moths were caught in pheromone traps baited with 0.8 mg pheromone lures compared with those baited with 0.5 mg pheromone traps, there was no statistically significant difference. However, there were significantly fewer moths in water pan traps with a light source than those in pheromone traps. Moth captures varied significantly among tomato cultivars. The percentage of fruit damage by larvae was evaluated at harvest in September and reached 1.45% despite the insecticide sprays.

Key words: Tuta absoluta, processing tomato, monitoring, trap type, fruit damage

INTRODUCTION

Owing to its favourable climate and geography, Turkey is one of the world’s leading producers of vegetables. Tomatoes (Solanum lycopersicum L.) account for 40% of all vegetable production in Turkey with more than 11 million tons in 2011 (TUIK, 2012). Turkey ranks fourth in world tomato production after China, India and the USA. Tomatoes for fresh consumption are primarily grown in greenhouses in the Mediterranean region while industrial tomatoes are mainly grown in the open-field in the Marmara and Aegean regions. About 30 percent of tomato production is used for processing tomato products such as tomato paste, tomato juice, ketchup, and tomato puree.

However, tomato production is not problem-free. The tomato leafminer, Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae), has recently become the most damaging pest of tomatoes grown in greenhouses or open fields in the Mediterranean, Europe and North Africa (EPPO, 2005). In Turkey, T. absoluta was first reported in 2009 in Izmir (Aegean region) and Canakkale (Marmara region) provinces. The high mobility and enormous reproduction potential up to 10-12 generations per year enabled the swift spread of this multivoltine pest to all tomato growing regions of Turkey (Robredo-Junco et al. 2008). Young larvae emerging from the eggs laid by mature females can mine leaves, stems, shoots, flowers, and developing fruit (Pastrana, 2004). Later instars can attack mature fruit and may cause yield losses of up to 80-100% in tomato plantations in both greenhouses and open fields if left uncontrolled (Desneux et al. 2010; Duric et al., 2012).

The main objective of this study was to determine the presence and the population fluctuations of T. absoluta adults in industrial tomato crops grown in the open field in Bursa, northwestern Turkey in 2011. In addition, the effect of pheromone lure load, trap type and cultivar on trap catch performance was also investigated.

MATERIALS AND METHODS

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This study was carried out in the open field tomato areas at three different locations in Yenisehir town of Bursa, northwestern Turkey in 2011. All locations consisted of three tomato cultivars, namely cv. Hazal, cv. Sun 6216, and cv. 1 123. In these locations, two insecticide treatments were made with Chlorantraniliprole+Abamectin 63 SC and Emamectin Benzoate %5 SC at a rate of 80ml/100 lt water and 400 gr/ha, respectively, to control *T. absoluta* populations. In addition, Deltamethrin 2.5 EC was sprayed at 500 g/ha to manage aphids.

**Flight Monitoring**

Plastic Delta traps (Koppert, NL) baited with 0.5 and 0.8 mg pheromone lures and Ferolite® water pan traps (Russell IPM, UK) combined with a light source and 0.5 mg pheromone lures were used to monitor population fluctuations of *T. absoluta* adults. The sachets of pheromone capsules contained both the main component, (3E,8Z,11Z)-3,8,11-tetradecatrienyl acetate, and minor component, (3E,8Z)-tetradecadien-1-yl acetate, of the *T. absoluta* sex pheromone (Attygalle, et al., 1995, 1996). Soap (1% laundry detergent) was added to water traps to improve the efficacy of traps in retaining males.

Traps were placed before the start of adult flight on 1 May. As *T. absoluta* adults do not fly very high, they were hung on planting stakes at an initial height of 30 cm and then the trap height was raised to the plant height as it grows. Traps were checked daily until the first sustained fly captures occurred. Adults were counted and removed from traps once a week. Pheromone lures and trap bottoms, if needed, were changed every 6 weeks.

**Fruit sampling**

In each location, a total of 500 fruit was used for fruit sampling by selecting randomly at harvest time. Fruits were examined, and larval damage was recorded.

**Data analysis**

The experiment was conducted in a Randomized plot design. Statistical analysis was carried out using analysis of variance (ANOVA) (Sall et al. 2007). If there were significant interaction effects, LSMEANS comparisons were used to identify these effects. Data are presented as mean cumulative moth catches per trap, but based on inspection of plots of residuals trap counts were transformed using \[\text{square root (x+1)}\] prior to ANOVA. Fisher's Protected LSD test was used to compare treatment means (\(P = 0.05\)).

**RESULTS AND DISCUSSION**

**Moth emergence and activity**

Seasonal flight activity of the *T. absoluta* adults in Yenisehir town of Bursa province in 2011 is given in Figure 1. The first male moths were captured on 2 June. However, average moth catches per trap remained low during June. Trap counts suddenly increased at the beginning of July, coinciding with the onset of tomato ripening. There were significant differences among weeks in terms of moth catches (\(F= 5.8; \text{df} = 19, 520; P < 0.01\)). Chermiti and Abbes (2012) also recorded an increasing trap catch pattern in industrial tomato crops grown in the open field in Tunisia, where peak moth catches of 47 moths/trap/week occurred on 23 June. As can be seen in Fig 1, *T. absoluta* had 3 flight peaks on 21 July, 1 September and 4 October, respectively, with peak moth catches of 25 moths/trap/week in the third flight period. On the other hand, Hrncic and Radonjic (2012) captured the maximum number of moths either in greenhouses or open field areas from the end of July to the beginning of August in Montenegro. The variation in peak moth emergence periods among countries may be explained by the cultivar differences as well as the varying climatic conditions.

Our results indicate a relatively low presence of the pest during the whole monitoring period as previously observed by Chermiti and Abbes (2012) in field-grown processing tomatoes.
Moth captures varied significantly among tomato cultivars suggesting that there may be a preference by *T. absoluta* populations for a particular industrial tomato cultivar (*F* = 9.2; df = 2, 537; *P* < 0.01). The highest cumulative moth catch occurred on Hazal cultivar with a total of 315 moths followed by Sun 6216 (89 moths) and I 123 (85 moths) cultivars (Figure 2).

Significant differences were found between trap types in terms of moth catch (*F* = 21.9; df = 2, 537; *P* < 0.01). Figure 3 clearly shows that the cumulative moth catch on the plastic delta type traps baited either with 0.5 (223 moths) or 0.8 mg pheromone (242 moths) were significantly higher than that of the water pan traps combined with a light source and 0.5 mg pheromone lure (24 moths). In contrast to this finding, Hrnčic and Radonjic (2012) captured significantly more moths in water pan traps combined with a light source than those in delta traps baited only with pheromone under greenhouse conditions.

Although more moths were caught in pheromone traps baited with 0.8 mg pheromone lures compared with those baited with 0.5 mg pheromone traps, there was no statistically significant difference. Chermiti and Abbes (2012) found that pheromone traps baited with 0.8 mg lure attracted more males than pheromone traps baited with 0.5 mg lure. However, our results are in agreement with Ferrara et al. (2001) who also did not find a higher efficiency in traps baited with a greater pheromone load.
Monitoring adult populations of *Tuta absoluta* in field-grown processing tomatoes in northwestern Turkey

Fig. 3. Seasonal cumulative moth catch on different trap types baited either with 0.5 or 0.8 mg pheromone load.

Maintenance of the water pan traps combined with a light source, which uses a specific wavelength to attract moths, in open-field tomato areas was particularly difficult because water in the trap was quickly evaporated in a period of 3-4 days during July and August. This result is similar to that of Chermiti and Abbes (2012) who complained about the difficulty of finding a nearby water supply in open-field tomato crops to refill the traps that lost almost all of its water content due to high temperatures in June.

The percentage of fruit damage by *Tuta* larvae was evaluated at harvest in September and reached 1.45% in all tomato cultivars despite the insecticide sprays.

**CONCLUSIONS**

As a result of this study, the presence and seasonal flight activity of *T. absoluta* adults was determined in the open field tomato areas in Yenisehir town of Bursa, northwestern Turkey in 2011. The first male moths were captured on 2 June. Trap counts suddenly increased in the beginning of July, coinciding with the onset of tomato ripening. Moth catches significantly varied among weeks. *T. absoluta* had 3 flight peaks on 21 July, 1 September and 4 October, respectively, with peak moth catches of 25 moths/trap/week in the third flight period. Moth captures were significantly different among tomato cultivars suggesting that there may be a preference by *T. absoluta* populations for Hazal cultivar over other cultivars. Yet, no significant difference was found among cultivars in terms of fruit damage. Pheromone load did not have any significant effect on the trap catch performance of delta type traps. The cumulative moth catch on delta type traps baited either with 0.5 or 0.8 mg pheromone were significantly higher than that of the water pan traps combined with a light source and 0.5 mg pheromone lure. The lower efficiency of the water pan traps may be due to the evaporation of water during hot summer months.

**REFERENCES**


