Preliminary investigation on damage by *Frankliniella intonsa* to cotton in the Cukurova region of Turkey

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Abstract: Damage by *Frankliniella intonsa* (Trybom) (Thysanoptera: Thripidae) to cotton plants was investigated in field experiments in Cukurova region of Turkey. *F. intonsa* infested the cotton fields late in the season, mostly mid-August, and caused problems on cotton plants. Severe damage by thrips mainly occurred in late-planted (after beginning of June) cotton fields in Cukurova. We observed that large numbers (over 350 thrips/ flower) of thrips did not affect pollination of the flowers. Adults fed on pollen but only large numbers of adults caused damage to flowers. Heavy attacks of larvae resulted in abscission of young bolls. Shedding of young bolls was not recorded until 6-7 day after infestation but more apparent after 10 days. Shedding with 51-75 thrips/flower was 70% and increased to 80-90% with 101-150 or more thrips per flower at the 10th day in late-planted field. In this paper, symptoms of damage caused by *F. intonsa* to cotton plants are described

Introduction

Frankliniella intonsa is a flower-dwelling thrips species infesting many flowering plants belonging to different orders and families (Murai, 1988; Atakan, et al., 1999). This pest also infests cotton plants late in the season in mid-August in the Eastern Mediterranean region of Turkey (Cukurova region) (Atakan, 1998).

F. intonsa was not considered a cotton pest in previous years, but has caused serious problems recently in cotton, particular in late-planted crops (after beginning of June) in the Cukurova region (Atakan, 1998). There was no previous study on this thrips on cotton at the time, therefore cotton growers have used frequent applications of insecticides to control this pest. Chemical control is very difficult, and insecticides are inefficient or have a short-term effectiveness (5 - 7 days) on thrips populations in cotton fields in Cukurova.

As *F. intonsa* is a polyphagous species, there is limited information on its pestiferous status on cotton. Shuqiang and Rahmann (1997) reported that in some years, *F. intonsa* reached economic injury levels and caused yield losses in cotton fields located at the Yellow River in China. Leigh (1995) stated that thrips belonging to *Frankliniella* genus caused the shedding of squares and flowers sucking in particular flowers and flowering buds of cotton.

In this paper, we investigated the damage of *F. intonsa* on generative structures of cotton in field experiments and also described the damage symptoms caused by this thrips in detail.

Material and methods

The field experiments were conducted on normal and late-planted commercial cotton fields in Adana province (Cukurova).

One of the experiments was conducted in a cotton field planted in mid-May and the other experiments in a field planted in late June. Three field trials were established in the late-planted field in different time intervals due to population densities of thrips in August. All experimental fields were sprayed to control the other cotton pests prior the occurrence of thrips on cotton. After that, no chemicals were applied in any of the fields during the growing season. The population densities of other pests, mainly whitefly and lepidopterian pest were lower during the infestation of *F. intonsa* in the fields.

Because *F. intonsa* mainly prefers cotton flowers, the relationship between different population densities of thrips and damage caused by thrips were undertaken with formation of young bolls in all fields.

Thrips are more active inside of the flowers, so counting of thrips is very difficult in the fields. Therefore, we estimated the population levels of

thrips in flowers based on long-field experience. Many flowers infested by different population levels of *F. intonsa* were randomly selected and tagged. To eliminate experimental errors resulting from differences in plant phenology, we selected the plants of similar phenology stage and flowers from similar positions at the plant.

To accurately estimate the population densities of thrips, flowers were tagged at the time which mass flights of thrips occurred from red flowers (flower pollinated one day before) to white flowers (newly opened flower). Because all flowers were infested by thrips, some flowers were sprayed for thrips with imidacloprid, 350 gr/lt using a 1-liter hand pulverization. Injured and healthy young bolls were inspected at 3, 7 and 10 days after pollination of flowers.

χ-square and generalized linear logistic models (Nelder and Wedderburn,1972; Compton, 1994) were used to analyze the data. This model was adapted to SAS (1987) and effects of independed values (number of thrips and days) on shedding ratio of young bolls were assessed using χ-square test.

The entire plant was carefully examined and photographs of injured parts were taken and damage symptoms were described in detail.

Results and Discussion

We observed that extremely higher numbers (over 350 thrips/per flower) of *F. intonsa* did not affect the pollination of flowers. Flowers turned to young bolls in about two days following the pollination. Adult thrips were found always on flowers. In addition to flowers, larvae also feed on fresh leaves and bolls. The feeding activity of larvae on bolls and additionally, oviposition of adults into flower parts resulted in main shedding of young bolls.

Boll shedding

Experiment 1

Flowers bearing 51-75 and 76-100 thrips have different effect on abscission of young boll compared with flowers infested by lower population densities (1-25 and 26-50 thrips/ flower) at third day in normal cultivated cotton field (Fig. 1). χ-square test indicated that different population densities of thrips had important effect on abscission of young bolls which newly formed from infested flowers by thrips ($\chi^2_{1\ 0.05}$ = 3.841 ,$\chi^2_{1\ 0.01}$= 6.635). Although shedding ratios were increased depending on increasing population densities of thrips, differences in percentage of abscised bolls among the groups including different population densities of thrips were reduced due to occurrence of higher physiological abscission in groups non infested by thrips and have lower population densities of thrips at the tenth day.

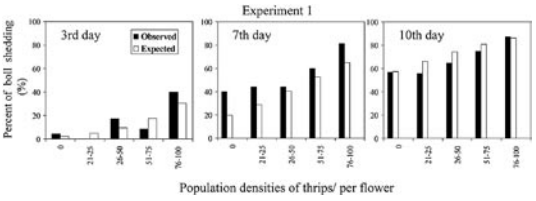

Fig. 1. Shedding ratios of young bolls caused by different population densities of *Frankliniella intonsa* in normal planted cotton field in Cukurova region.

Experiment 2

There were no recorded any abscission of young boll at third day of thrips infestation in this experiment and others. Abscission caused by 76 and more thrips was higher and ranged between 64 % and 81 % at the seventh day (Fig. 2). Evident differences in percentage of abscised bolls were recorded by 51-75 and more thrips/ flower at tenth day. Proportions of abscised bolls were not differ among the groups including 101-150 thrips and over thrips / flower at tenth day.

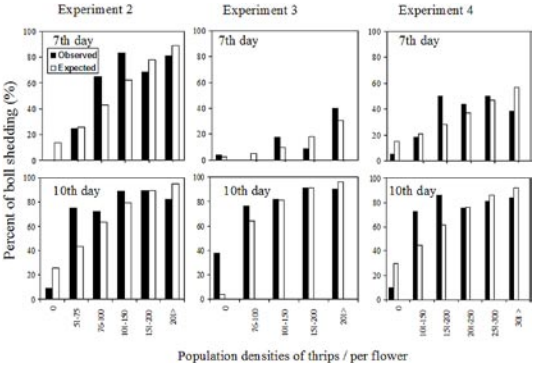

Fig. 2. Shedding ratios of young bolls caused by different population densities of *Frankliniella intonsa* in late planted cotton field in Cukurova region.

Experiment 3

In this field experiment which had higher population densities of thrips compared the that of previous, the first abscission of bolls occurred at the seventh day and percentage of abscised bolls caused by over 200 thrips/ flower differed as much as 40 % from others (Fig. 2). Abscission by 76-100 and over thrips/ flower were more conspicuous compared to that of the control group with bearing no thrips. Most bolls were shed by 150-200 and over 201 thrips/ flower and proportions of abscission were very similar with 91 and 90 %, respectively.

Experiment 4

The percentage of abscised bolls with 151-200 and over thrips/ flower were conspicuous and similar at seventh day (Fig. 2). The ratio of abscised bolls from non infested flowers was only 9.52 %. Abscission were increased due to increasing population densities over 101-150 thrips/ flower at tenth day.

Damage on leaf and boll

Adults of *F. intonsa* were always found on flowers, feeding on pollen. Pollen is an important food energy source for adult flower thrips (Trichilo and Leigh, 1988; Murai, 1988). Adults laid eggs into tissues of flowering organs. Atakan and Özgür (1999) stated that adult *F. intonsa* mostly oviposited into bracts of flower and therefore the possibility damaging the ovary during oviposition is low. Large number of adults caused feeding damages on petals. Scarred petals were shrank and then fully closed due to greater numbers of adults. Graves et al. (1987) reported that the primary activity of *Frankliniella occidentalis* (Pergande) seemed to be pollen feeding but when extremely large numbers of thrips were presented, infested flowers were not fully open. The color of heavy infested flowers turned into dirty yellow one day after pollination.

Larvae actively fed on fresh tissues of bolls. Ovaries of injured young bolls were shrank and wrinkled. Brownish areas on tip of ovarium were more conspicuous and longitudinal stripes sometimes covered the epidermal layer. Wounded and brown-colored ovaries were dried (Fig. 3 a-b). Calyx and bracts of bolls were also scarred. Injured and absolutely dried young bolls stayed on branch for times. This feature of damage was specific to *F. intonsa*. Larvae also scarred matured bolls. At first, bolls were oiled and had brownish appearance and later damaged tissues were subsequently turned to brownished hard tissues (Fig. 3 c). Injured bolls were not developed and opened early (Fig. 3 d).

Larval feeding caused discoloration on surrounding area of petiole and main vein of leaves. Infested leaves were silvery and of brown color (Fig. 3 e-f). These symptoms were similar to that caused by early season thrips damage. Reed and Reinecke (1990) based on microscopic observation reported that feeding of *F. occidentalis* depleted the leaf cells of cotton. Heavy infested leaves were slightly curved to inside and crisped.

Severe infestation of plants by *F. intonsa* resulted in less number boll formation on plant in late-planted cotton. After infestation of thrips ceased plants recovered and started to produce bolls on upper layer.

Larvae emerged from boll tissues and feed on the bolls is related to adult population. As a matter of fact, considerable damage to leaves and bolls caused by larvae were recorded only after heavy infestation of adult thrips to flowers.

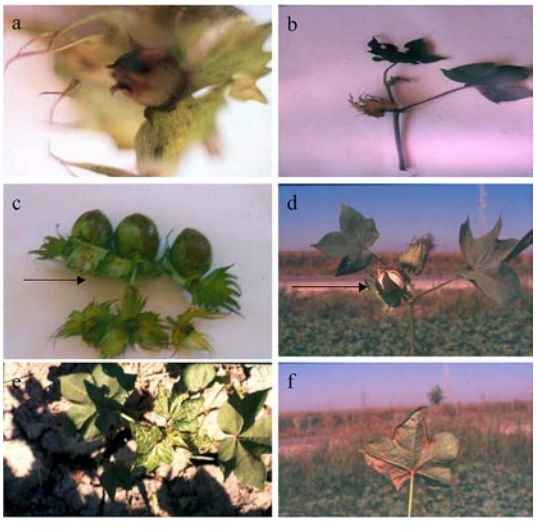

Fig.3. Damage caused by *Frankliniella intonsa* on different structures of cotton plant.

a-b) young boll, c) maturated bolls, d) early opened boll. e-f) leaves.

In particular, flower thrips cause problems in late-planted cotton fields in Cukurova. Plants have enough bolls to be returned the yields in normal planted cotton fields during the infestation of thrips. Because the numbers of flower are low in normal planted cotton, *F. intonsa* from surrounding vegetation move to flowers in less numbers. This situation shows as if higher adult population attacked the flowers. At result, farmers spray the fields for thrips. The bolls existed during the infestation of thrips need long period to be matured, because ofthe unfavorable climatic conditions. These young bolls have no contribution to cotton yield and anyway most of them were also shed naturally in normal planted cotton fields. We can suggest that using chemicals to control the flower thrips on normal planted cotton fields is needless because, (i) plants have enough bolls to recover and produce sufficient yield and (ii) number of flower exposed to thrips infestations is low and most bolls will mature.

Plants in late-planted cotton have many flowers and a only few bolls and thus, are more sensitive to thrips attack. It is therefore necessary to take control measures when population density of flower thrips exceeds 51-75 thrips/ flower in Cukurova region of Turkey.

Acknowledgements

We thank Dr. T. Momol and Dr. F. E. Funderburk (University of Florida Nort Florida Research and Education Center Institute of Food and Agricultural Sciences) for reviewing the manuscript.

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