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Infestation of *Ceratothripoides claratris* (Shumsher) (Thysanoptera: Thripidae) on selected food crops in Thailand

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Infestation of *Ceratothripoides claratris*, the most prevalent thrip pest species on tomatoes in Thailand was studied on eight different food crops, chili, cowpea, cucumber, egg- plant, pumpkin, tomato, water melon and yard-long bean, in an open side-wall plastic house at the campus of Asian Institute of Technology, Thailand. Percentage infested leaves and abundance of *C. claratris* on leaves of these crop species were determined at two-week intervals in three separate sampling occasions. The findings indicated that *C. claratris* has a potential to infest all the food crops tested. However, the abundance of thrips per unit leaf area and degree of infestation varied significantly. Two varieties of tomatoes, i.e., King Kong II and Luktho were found to be the most preferable food crop species for *C. claratris*. The degree of host preference of *C. claratris* was determined by the crop species, time and their combined effects.

Key words: Abundance, *Ceratothripoides claratris*, Infestation, Food crops.

1. Introduction

Ceratothripoides claratris Shumsher (Thysanoptera:Thripidae) is the predominant thrips species infesting tomatoes *Lycopersicon esculentum* Mill (Solanaceae) in Thailand. Voracious feeding by larvae and adults, and/or oviposition by female *C. claratris* damage leaves, stems and fruits (Murai et al. 2000; Rodmui 2002; Premachandra et al., 2004). In addition, it indirectly damages tomatoes by transmission of Capsicum Chlorosis Virus (CaCV) (genus *Tospovirus*, family Bunyaviridae) (Premachandra et al., 2005a). Hence, *C. claratris* causes significant yield losses on field- and greenhouse-grown tomatoes in Thailand, especially in greater Bangkok area. Previous studies indicated that *C. claratris* is particularly adapted to high temperatures frequently prevailing in tropics (Premachandra et al. 2004). Apart

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from Thailand it has been reported in India (Jangvitaya, 1993) and Malaysia (S. Okajima cited in Murai et al., 2000). Although *C. claratris* has been identified as a specialized feeder on tomatoes little is known about its host range. Jangvitaya (1993) recorded *Luffa acutangula* L. (Cucurbitaceae) and *Clitoria ternatea* L. (Fabaceae) as host plants of *C. claratris* in Thailand and this was the only published report on additional host plants of *C. claratris*. The objective of this study was to determine the level of infestation of *C. claratris* on selected food crops cultivated in Thailand. This study was conducted as a part of a larger research project aiming to develop sustainable vegetable production under protected cultivation in the humid tropics.

2. Materials and Methods

This trial was conducted in a 200m^2 open side-wall plastic house (polythene plastic, 200 micron UV-stabilized polyfilm; Ludvig Svensson, Kinna, Sweden) with an opening of 50-200 cm above the ground level, located at the campus of the Asian Institute of Technology (AIT), in Bangkok, Thailand, during September - October 2002. During the study period, the mean range of temperature and relative humidity were 26-28℃and 60-80%, respectively. Chili *Capsicum annuum* L. (Solanaceae), cowpea *Vigna sinensis* (L) Savex- Hass (Fabaceae), cucumber *Cucumis sativus* L. (Cucurbitaceae), egg plant *Solanum xanthocarpum* Schard and Wendl (Solanaceae) varieties; green and purple, pumpkin *Curcurbita moschata* (Duch.) Poir (Cucurbitaceae), tomato, *Lycopersicon esculentum* Mill (Solanaceae) varieties; King Kong II and "Luktho", water melon *Citrullus lanatus* (Cucurbitaceae) and yard-long bean *Vigna unguilulata* (L.) Walp (Fabaceae) were included for the trial. These crop species were selected based on their importance for consumption in Thailand, especially in greater Bangkok area. Twelve, three-week-old seedlings of each crop species were planted in plastic pots (30 by 25 cm) filled with a commercial growing substrate composed of clay, sand, and silt in proportions of 31, 30, and 39%, respectively, and 29% of organic matter. Plants were arranged in four rows, i.e., 30 per row, in completely randomized design. The inter-pot and inter-row distances were 60 cm and 160 cm, respectively. Irrigation and fertilization [fertilizers; [Hakaphos (N-P-K), 2.5 kg/100 l; COMPO Austria, and Bai-plus (calcium), 1.8 kg/1001; Bayer, Bangkok, Thailand]] were done seven to nine times per day (2.5 l/d) with a drip irrigation system controlled by solar light integral. Plants were supported by ropes that were fixed to the structure of the plastic house.

In this plastic house, plants were naturally colonized by *C. claratris*. Previous studies confirmed that *C. claratris* is the predominant thrips species in the greenhouses at the AIT campus (Premachandra et al., 2004). Thrips palmi Karny (Thysanoptera: Thripidae) also occurs in fields and greenhouses in the greater Bangkok area, though in very low numbers. Three separate sampling occasions were performed in two-week time intervals commencing from 14 days post-planting of the crop species in the plastic house. At each sampling, three plants were selected at random from each food crop species and the total number of leaves and the number of thrips-infested leaves, i.e., thrips-feeding damage (e.g. leaves showing scars and necrosis), were recorded. In addition, at each sampling date, three fully expanded non-senescent thrips-infested leaves were picked at random from three randomly selected plants of each food crop species by pulling them into self-sealing plastic bags. Thereafter, the sealed bags were transported to the laboratory and were washed three times for 10 s in a plastic box (159 cm) containing 250 ml of 70% ethanol. Subsequently, the thrips-containing solution was poured into a conical fask (200 ml), shook thoroughly, and stored for 30 min for settling. Thereafter, the supernatant was gently decanted to 50 ml, the remaining suspension was poured onto a counting plate, and the thrips, i.e., both adults and larvae, were counted under a stereomicroscope. Total leaf area of sampled leaves was recorded using a leaf area meter (LI-3100 area meter, LI-COR. Inc, Nebraska, USA). Percentage infested leaves per crop (i.e., percentage infestation) and abundance of thrips per unit leaf area (i.e., cm^2) were calculated with respect to each food crop species.

Data on thrips abundance and percentage infested leaves were subjected log transformation and arcsine transformation, respectively, prior to the statistical analysis. Two factorial ANOVA was performed to compare the abundance of thrips and percentage infested leaves among the different plant species using PROC GLM (SAS Institute 1999). When the analysis of variance yielded significant F values, means were compared using the least significant difference (LSD) multiple range test. Whenever significant interactions were observed between two factors, i.e., food crop species and sampling occasion, treatment means of one factor were compared at each level of the other factor. In contrast, no significant interactions were found means of the level of the one factor were compared irrespective of the levels of the other factor. All analyses were performed at 5% significance level using SAS statistical package (SAS institute, 1999).

3. Results and Discussion

The mean abundance of *C. claratris* per cm^2 leaf area varied significantly among the different food crop species (F = 21.70; df = 9, 60; P < 0.0001) and sampling occasions (F =18.16; df = 2, 60; P < 0.0001). In addition, significant interactions were detected between the food crop species and the sampling occasions (crop species*sampling occasion: F = 6.12; df = 18, 60; P < 0.0001). Hence, thrips abundance on each food crop species was compared with each of the sampling occasion. The highest *C. claratris* abundance per cm^2 was recorded on tomato-King Kong II followed by tomato-Luktho and water melon on the second sampling occasion, but was not significantly different. The thrips abundance was significantly lower (P < 0.05) on chili, cowpea and yard-long bean on all the three sampling dates. In general, in the first sampling, highest number of thrips was recorded on cucumber and water melon while in the second and third sampling highest thrips abundance was detected on two tomato varieties.

Percentage infested leaves also differed significantly among the different crops species (F =23.49; df = 9, 60; P < 0.0001) over three sampling occasions (F = 29.81; df = 9, 60; P < 0.0001). Moreover, significant interactions were detected between the crops species and sampling occasions (crop species*sampling occasion: F = 4.73; df = 18, 60; P < 0.0001). Hundred percent of the leaf infestation was detected on

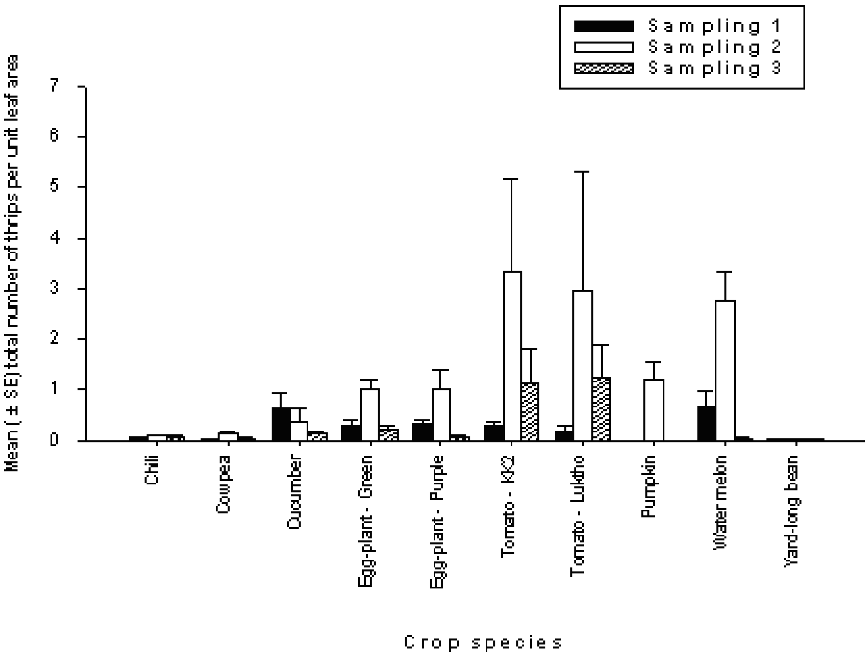

Figure 1 Total number of *C. claratris* (mean (± SE) per unit leaf area (cm^2) on different food crops at three sampling occasions).

cucumber, both varieties of tomato, water melon and yard-long bean. The lowest leaf infestation was found on chili (Figure 2). Only on cucumber maximum leaf infestation, i.e., 100% was detected at all the sampling occasions.

This was the first study on infestation of *C. claratris* on different food crops. Our results indicated that all the food crops tested in this trial could act as potential hosts for *C. claratris*. However, these food crops differed in their suitability as hosts for *C. claratris*. The degree of host preference of *C. claratris* was determined by the crop species, time and their combined effects. The higher abundance per unit leaf area coupled with 100% leaf infestation on two tomato varieties indicated that tomatoes were good host plants for *C. claratris*. Conversely, chili was not considered as a suitable host plant for *C. claratris*. Rosenthal and Berenbaum (1991) indicated that differences in host plant preferences of a particular pest species depends on differences in food quality determined by the level of primary and secondary plant metabolites. It has also been shown that many plants contain secondary substances that deter feeding and oviposition in phytophagous insects (Gupta and Thorsteinson,1960). Previous research work indicated that natural infestation by *C. claratris* commenced one week post-planting of tomatoes in the greenhouses at the AIT campus. After invasion the prevailing microclimatic conditions (i.e., high temperatures and relative humidity) inside the plastic house provided favorable conditions for growth and reproduction of this thrips species (Premachandra et al., 2004).

The higher thrips abundance of *C. claratris* on tomatoes, eggplants, pumpkin and water melon on the second sampling occasion could most probably be associated

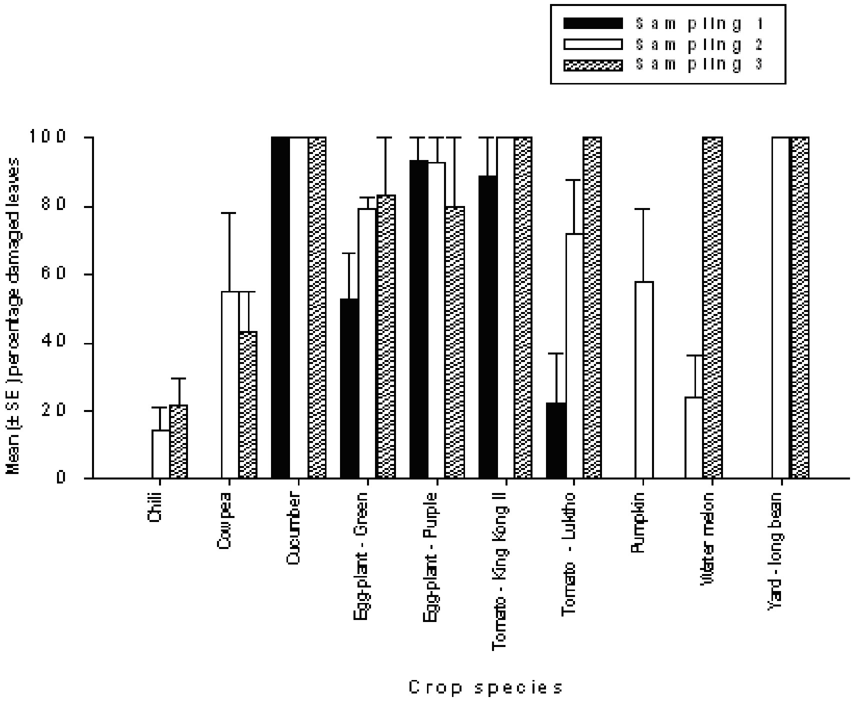

Figure 2 Mean (± SE) percentage leaf infestation of *C. claratris* on different food crops at three sampling occasions.

with their reproduction on these food plants after invasion. It was also reported that the abundance of *C. claratris* on tomatoes started to decline five weeks post-planting tomatoes in the greenhouse at AIT campus (Premachandra et al., 2005b) due to deterioration of leaves caused by voracious feeding of the thrips adults and larvae, corroborating findings of the current study. Though 100% infestation was found on cucumber, water melon and yard-long bean the thrips abundance was substantially low. This implies these food plants were preferable for feeding, but not for reproduction for *C. claratris* which act as the main factor for rapid increase in thrips population. However, in this study, the degree of damage on leaves was not estimated in this study. In conclusion, our study added ten additional host plants for the host range of *C. claratris* implying *C. claratris* has a broad host range. This information is important for manipulating of plant species in crop rotations.

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