FACTORS AFFECTING EFFICIENCY OF NATURAL ENEMIES IN CONTROLLING ONE OF INSECTS INFESTING CITRUS

By

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B.Sc. Agric. Sc. (Entomology), Ain Shams University, 2013

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ABSTRACT

Ahmed Farag Mohamed Badr: Factors Affecting Efficiency of Natural Enemies in Controlling One of Insects Infesting Citrus. Unpublished M. Sc. Dissertation, Plant Protection Department, Faculty of Agriculture, Ain Shams University, 2019.

The present work aimed to investigate population fluctuations, annual generations, infestation rates, parasitoids and predators of the citrus flower moth, *Prays citri* Mill. on lime trees in ElQalubia Governorate throughout 2015/2016 and 2016/2017 seasons. The highest population density of *P. citri* immature stages was recorded in spring, followed by summer then winter and autumn during the two seasons. Immature stages of *P. citri* had 9, 9 and 8 annual field generations, which lasted 28-49, 22-57 and 22-69 days on flower buds, flowers and newly formed fruits, respectively during 2015/2016 and 2016/2017 seasons. The highest infestation level by *P. citri* larvae took place in spring, followed by summer then winter and autumn during the two seasons. The *Trichogramma evanescens* Westw., *Bracon brevicornis* (Wesm.), *Phanerotoma hendecasisella* Cam. and *Diadegma semiclausum* (Hell.) were surveyed parasitizing *P. citri. T. evanescens* may be a newly recorded parasitoid of *P. citri* in the world, while *D. semiclausum* is a novel record on this pest in Egypt. *T. evanescens*, *P. hendecasisella* and *D. semiclausum* are solitary endoparasitoids developing in host eggs, eggs-larvae and larvae, respectively. However, *B. brevicornis* is a gregarious ectoparasitoid on *P. citri* larvae. *T. evanescens* showed the highest parasitism of eggs in autumn (10.56%), followed by summer (3.45%) then spring (3.24%) and winter (0%). The sex ratio in *T. evanescens* was in favour of females (1:3) during 2015/2016 season. The highest parasitism of eggs by *T. evanescens* was recorded in winter (13.46%), followed by spring (7.54%) then summer and autumn (0%). The sex ratio of males to females was equal (1:1) during 2016/2017 season. *B. brevicornis* revealed the highest parasitism of larvae in winter

(5.82%), followed by summer (4.41%) then spring (2.93%) and autumn (0%). The sex ratio of males to females in *B. brevicornis* was equal (1:1) during 2015/2016 season. The highest parasitism of larvae by *B. brevicornis* was recorded in spring (6.65%), followed by summer (3.61%) then autumn and winter (0%). The sex ratio of males to females was (1:0) during 2016/2017 season. The highest parasitism of eggs-larvae by *P. hendecasisella* occurred in autumn (7.14%), followed by spring (5.67%) then summer and winter (0%). The sex ratio of males to females in *P. hendecasisella* was equal (1:1) during 2015/2016 season. Parasitism of eggs-larvae by *P. hendecasisella* was the highest (8.36%) in autumn, while it was the lowest (0%) in winter, spring and summer. The sex ratio of males to females was (1:0) during 2016/2017 season. *D. semiclausum* was not recorded from larvae during 2015/2016 season. Parasitism of larvae (3.33%) by *D. semiclausum* only occurred in spring. The sex ratio of males to females reached 0:1 during 2016/2017 season. The parasitic complex achieved parasitism rates of 43.22 and 42.95 % on field populations of *P. citri* in the first and second seasons, respectively. *Chrysoperla carnea* (Steph.), *Coccinella septempunctata* L., *Orius laevigatus* (Fieb.), *Orius albidipennis* (Reut.) and *Coccinella undecimpunctata* L. were surveyed associating with *P. citri* immature stages. The general total number of *C. carnea* (35 individuals) represented 27.1% of the predatory complex. Larvae showed the highest number in spring (12), followed by autumn (7) then summer (1) and winter (0) during 2015/2016 season. The general total number of *C. carnea* (32 individuals) constituted 27.6% of the predatory complex. The highest number of adults was recorded in spring (6), followed by autumn (4) then winter (3) and summer (0) during 2016/2017 season. *C. septempunctata* had a general total number of 33 individuals, which exhibited 25.6% of the predatory complex. Adults showed the highest number in spring (10), followed by autumn (5) then summer (2) and winter (1) during 2015/2016 season. *C. septempunctata* exhibited a general total number of 27 individuals, which recorded 23.3% of the

predatory complex during 2016/2017 season. The general total number of *O. laevigatus* (28 individuals) represented 21.7% of the predatory complex. The highest number of adults was reported in spring (11), followed by autumn (5) then winter (3) and summer (0) during 2015/2016 season**.** The general total number of *O. laevigatus* (24 individuals) constituted 20.7% of the predatory complex. Adults revealed the highest number in spring (11), followed by autumn (3) then winter and summer (0) during 2016/2017 season. *O. albidipennis* showed a general total number of 21 individuals, which revealed 16.3% of the predatory complex during 2015/2016 season. *O. albidipennis* had a general total number of 19 individuals, which exhibited 16.4% of the predatory complex. Nymphs showed the highest number in spring (5), followed by autumn (3) then winter (1) and summer (0) during 2016/2017 season. The general total number of *C. undecimpunctata* (12 individuals) expressed 9.3% of the predatory complex during 2015/2016 season. *C. undecimpunctata* exhibited a general total number of 14 individuals, which constituted 12.1% of the predatory complex during 2016/2017 season.

Key words: *Prays citri*, population fluctuations, annual generations, infestation rates, parasitoids, predators, lime trees.

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INTRODUCTION

The citrus flower moth, *Prays citri* Mill. (Lep.: Hyponomeutidae) is an economically important pest infesting different species and varieties of citrus in several continents **(Anonymous, 1982; Silva *et al.*, 2006; Toth *et al.*, 2009; Conti and Fisicaro, 2015)**. Lime, lemon, sweet orange and navel orange were more susceptible host plants to the pest infestation, while grapefruit, sour orange and mandarine were more resistant ones **(Shehata, 1982; Ibrahim and Shahateh, 1984; Abo-Sheaesha, 1987and 1994; Abd El-Kareim *et al.*, 2017)**. Volatile oils in citrus flowers contain different chemical compounds having odors, which stimulate or inhibit females to lay eggs on susceptible or resistant plants, respectively **(El-Sayed *et al.*, 1994)**.

In Egypt, **Abd El-Kader and Zaklama (1967)** first recorded existence of *P. citri* on lime flowers in Alexandria Governorate. Afterwards, this pest infested many other citrus trees in several Governorates of the Nile Delta **(Shehata, 1982; Abo-Sheaesha, 1987; Abd El-Kareim *et al.*, 2017)**. Seasonal changes of *P. citri* larvae were investigated on lime trees **(Shehata, 1982; Abo-Sheaesha, 1987)**. *P. citri* had nine annual generations on lime trees **(Abd El-Kader and Zaklama, 1967; Abo-Sheaesha, 1987)**. However, it had 11 generations a year on lime trees **(Shehata, 1982)**.

P. citri larvae feed on flower buds, flowers, newly formed fruits, leaves and shoots of lemon and lime trees **(Liotta and Mineo, 1962; Shehata, 1982; Abo- Sheaesha, 1987; Mineo, 1993; Carimi *et al.*, 2000; EFSA, 2008)**. The larvae preferably feed on reproductive organs and interior petals of lemon flowers. They also attack mesocarps and seeds of newly formed fruits causing premature fruit dropping **(Liotta and Mineo, 1962)**. *P. citri* larvae bore beneath rinds of different citrus fruits forming galls, which remain open at tips for destructively invasive fungi **(Garcia, 1939)**. The heavy infestation of *P. citri* caused 30-40% loss of citron crop