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# Differential Population of the Spotted Tentiform Leafminer, *Phyllonorycter* (*Lithocolletis*) *blancardella* (Fabricius) (Lepidoptera: Gracillariidae) and its Parasitoids in Middle Egypt

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## ABSTRACT

The spotted tentiform leafminer, *Phyllonorycter* (*Lithocolletis*) *blancardella* (Fab.) is considered an important pest of pome and stone fruits. This study represents *Phyllonorycter* (*Lithocolletis*) *blancardella* (Fab.) as a new record in Egypt. The population dynamics of the spotted tentiform leafminer and its parasitoids were studied during 2000 and 2001 seasons in Beni-Suif Governorate. The population increased through spring and autumn and declined during winter in the two years of study with 4-5 distinct peaks. Eleven species of hymenopterous parasitoids were reared from larvae and/ or pupae of the spotted tentiform leafminer. The dominant and sub-dominant species were; the eulophids: *Diglyphus mineus* Walker,*Diglyphus* sp., *Hemiptarsenus* sp. , *Achrysochais formosa* Westwood, *Pnigalio mediterraneus* Ferrire & Deluchi, *Sympiesis* sp. and *Tetrastichus xanthops* Ratzeburg; the encyrtids: *Holcothorax testaceipes* Ratzeburg and *Ageniaspis* sp. ; the pteromalids: *Halticoptera* sp. and the braconid, *Apanteles lautellus* Marshall. The role of parasitoids in regulating the abundance of populations of this leafminer was evaluated.

**Key Words:** *Phyllonorycter* (*Lithocolletis*) *blancardella*, Gracillariidae, Parasitoids, Population, Natural enemies and apple.

## INTRODUCTION

The spotted tentiform leafminer, *Phyllonorycter* (*Lithocolletis*) *blancardella* (Fab.) (Lepidoptera: Gracillariidae) is considered an important pest of pome and stone fruits. It mines in the leaves of apple, pear and possibly quince, causing up to 15 % damage (Dragia, 1982). Larvae of *P. blancardella* have 5 instars and change their feeding habit from sap feeding to tissue feeding at the transition from the 3rd to the 5th instar. Early-instars of *P. blancardella* are flattened and fed in the spongy mesophyll, forming a blotch mine that is visible as a light-colored area on the leaf underside. Fourth and fifth instars take on a cylindrical shape and spin silk across the upper and lower surfaces of the mine. As the silk dries it contracts, causing a wrinkling of the lower surface of the mine and a bulging of the upper surface. The fourth and fifth instars chew holes in the palsied parenchyma that are visible as translucent spots in the upper surface of the leaf and consume palsied parenchymatous tissue within the mine to make a tentiform shape and pupate within the mine. Each larva forms a single mine in which it remains until adult eclosion.

The pest is widespread and common wherever apple or crab-apple is to be found in southern and central England and Wals; more local in northern England, Scotland as far north as Stiringshire and in Ireland. Throughout Europe and as an introduction in the apple growing regions of north America and has been recorded on apple in Nova Scoti Quebec (Pottinger and LeRoux, 1971), Illinois and Missouri (Meyer, 1977), Ontario (Johnson *et al.*, 1978), northern New England, most of New York (Weires *et al.*, 1980), and Michigan (Dutcher and Howitt, 1982),

Ecology of *P. blancardella* was studied by (Pottinger and LeRoux, 1971) Nova Scoti Quebec; Maier (1983 and 1984) in Connecticut and Walgenbach *et al.*, 1990 in U.S.A.; Sato, 1991 in Japan and Cagne and Barrett, 1994 in Missouri.

Parasitism and the role of natural enemies in regulating its abundance has been reported by several authors (Viggiani, 1963; Pottinger and LeRoux, 1971; Meyer, 1977; Johnson *et al.*, 1978; Dutcher and Howitt, 1978; Weires *et al.*, 1980; Kadlubowski and Wlkaniec, 1982; Maier, 1984; Hagly, 1985; Ridgway and Mahr, 1985; Trimble, 1988; Ridgway and Mahr, 1990; Hagly and Barber,1991; Maier, 1992;Maier,1993; Casas and Meyhoefer, 1994; Cagne and Barrett, 1994; Ridgway and Mahr, 1995; Sato, 1995 ; Balazs, 1997; Olivella-Pedregal and Vogt, 1997; Bellostas *et al.*, 1998 and Bribosia, 1999).

As far as the writer is aware, the fluctuations of population density of the spotted tentiform leafminer and the role of natural enemies in regulating its abundance have not been studied yet in Egypt.

The present study was initiated to survey the parasitoids and determine the seasonal changes in the population dynamics of *P. blancardella* and the role of parasitoids in regulating its abundance in Middle Egypt.

## MATERIALS AND METHODS

The spotted tentiform leafminer, *Phyllonorycter* (*Lithocolletis*) *blancardella* (Fab.) presented here as a new record in Egypt and became in the last few years a common pest of apple and pear trees in Beni-Suif Governorate. Collected specimens of the insect pest were identified and confirmed in the British Museum (Natural History), London (by David Carter, 2000) by the Classification Research Department in the Plant Protection Res. Institute, Agric. Res. Center, Giza, Egypt.

**1-Survey of parasitoids:**

Samples of infested leaves with *P. blancardella* were randomly collected from apple orchards during the two seasons 2000 and 2001. Immediately after collection, the samples were packed in paper bags and transferred to the laboratory. These samples were enclosed in plastic jars 15 cm. diameter and 20 cm. height covered with muslin held in position by means of a rubber band and kept under preferential conditions for securing any emerging parasitoids. All emerged parasitoids were collected, sorted into species and preserved in vials containing 70% ethanol and glycerin, slide mounting of represented specimens, was conducted as well.

The parasitoid species were identified at Biological Control Res. Dept., Plant Prot. Res. Inst., Agric. Res. Center by Prof. Dr. A.R. Hamed and with assistant of keys provided by Dr. S. A. El- Serewy.

**2- Fluctuations in the population activity of *P. blanchardella*:**

The experiment was carried out in the farm of Sids Horticulture Research Station, Beni-Suef Governorate, Middle Egypt throughout 2000 and 2001seasons. The orchard was about 3 feddans, cultivated with apple, *Malus sylvestris* Mill. var. Anna (Rosacae), the trees were about 12 years and about 3 meters high. No chemical treatments were applied throughout the investigation period in the experimental orchard.

Bi-weekly samples of 100 leaves during the two seasons 2000 and 2001 were picked at random from the periphery and core of canopy at three vertical plant levels i.e. upper, middle and lower representing each of the corresponding four cardinal directions. The samples were put in paper bags and transferred to the laboratory for careful examination using stereo-microscope and accordingly different stages of the pest were detected and counted.

**3- Percentage of parasitism:**

The rates of parasitism by all species were estimated throughout the two successive years extending from January 2000 to the end of December 2001. Bi-weekly samples of 100 randomly larvae and pupae were dissected (50 individuals each). Fluctuation of percentages of parasitism on larvae and pupae were calculated.

## RESULTS AND DISCUSSION

**I-Survey of parasitoids:**

Samples of apple leaves infested with spotted tentiform leafminer, *P. blanchardella*, larvae and pupae, were collected from apple orchards during the two successive seasons, 2000 and 2001 of investigation gave rise to the following species of parasitoids:

Eleven species of hymenopterous parasitoids were recovered from larvae and/ or pupae of the pest. The dominant and sub-dominant species were; the eulophids: *Diglyphus mineus* Walker, *Diglyphus* sp., *Hemiptarsenus* sp., *Achrysochais formosa* Westwood, *Pnigalio mediterraneus* Ferrire & Deluchi, *Sympiesis* sp. and *Tetrastichus xanthops* Ratzeburg; the encyrtids: *Holcothorax testaceipes* Ratzeburg and *Ageniaspis* sp.; the pteromalid, *Halticoptera* sp. and the braconid, *Apanteles lautellus* Marshall. The above-mentioned species were recorded for the first time in Egypt during this study.

**2- Fluctuations in the population activity of *P. blancardella*:**

Data illustrated in Fig. (1) show the changes in the population density of *P. blancardella*, as indicated by the total half-monthly number of the immature stages, larvae and pupae/ 100 leaves during the two successive years 2000 and 2001. Immature stages fluctuated forming variable numbers during the period of study. The pest population reached zero level during February and March.

During the first season of investigation (2000), the pest had four peaks representing overlapping generations per year. The first peak representing the 1st generation appeared on 25th May

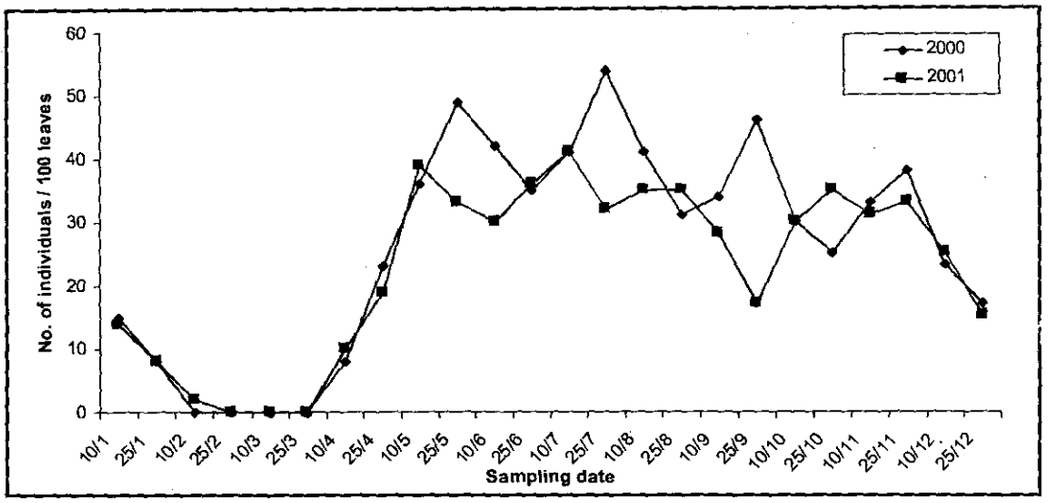


Fig. (1): Fluctuation in the half-monthly number of *P. blanchardella* (immature stages / 100 leave at Beni-Suif Governorate during 2000\2001 seasons.

(49 individuals/100 leaves). The second peak was on 25th July (52 individuals/100 leaves). The third peak was observed on 25th September (46 individuals/100 leaves). The fourth peak was recorded on 25th November (38 individuals/100 leaves).

Collected data for 2001 apple season are illustrated in Fig. (1). Five peaks have been observed in the year; the peaks occurred on 10th May, 10th July, 25th August, 25th October and 10th December represented by 39, 41, 45, 35 and 25 individuals/100 leaves, respectively.

Obtained results are in agreement with the results of Maier (1984) who recorded that the seasonal abundance in pheromone traps of the spotted tentiform leafminer showed 3-4 peaks. Also agree with the results of Walgenbuch et al. (1990) who stated that trapping data indicated that *P. blancardella* completed 4 and partial 5th generations per season in North and South Carolina and Georgia (USA). Cagne and Barrett, 1994 in Missouri revealed 4 distinct periods of adult leafminer (spring emergence and 3 summer) each year, producing 4 generations (3 complete summer and a partial 4th [fall over wintering] generation).

**3-: The role of parasitoids as mortality factor:**

Fig. (2) shows that during the first season (2000), percentage of parasitism had five peaks on *P. blanchardella* larvae and pupae appearing on Jan. 25th , June 10th , July 25th , October 10th and December10th. The respective percentages of these peaks were, 8, 36, 40, 53 and 31 %, respectively. During the second season (2001), percentage of parasitism ranged between 0 - 49 %. Six peaks were recorded. The first peak was recorded on 25th May, 2001 (39%), the second and the highest peak (49 %) was observed

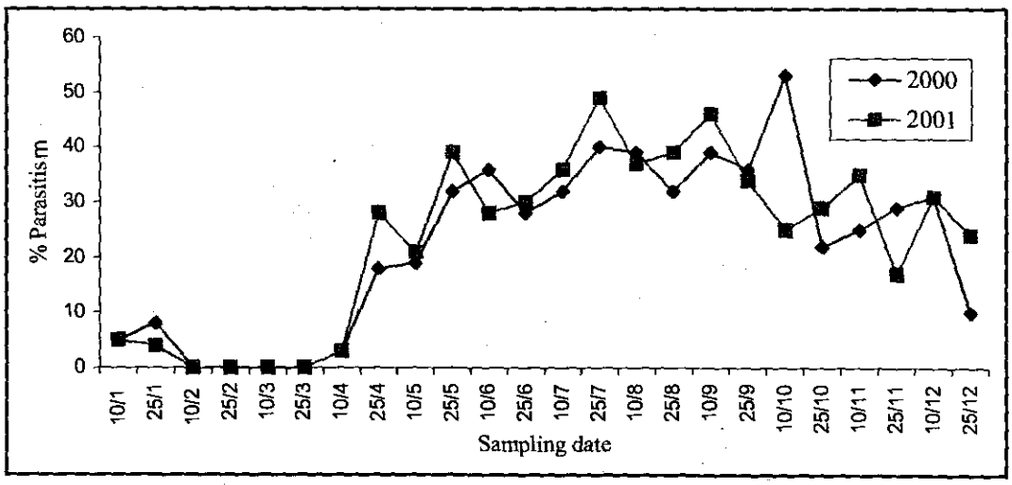


Fig. (2): Half-monthly percentages of parasitism among *P.blanchardella* infesting apple at Beni-Suif Governorate during 2000 and 2001 seasons (Based on 100 dissected larva and pupae)

on 25th July, the third (46%) during the second week of September, 2001, the fourth peak (35%) was

observed on 10th November and the six one was recorded in 10th December.

In this respect, Kadlubowski and Wlkaniec (1982), recorded 10 species of parasitoids and mentioned that, the dominant ones were *Ageniaspis testaceipes* (*Holcothorax testaceipes*) and *Apanteles circumscriptus*. They also, mentioned that total parasitism over the 4 years of the study averaged 43 %. The highest rate of parasitism occurred in the first generation of the pest and amounted 72 % in 1979. Dragia (1982) in Romania, stated that the parasitoids of *P. blancardella* were *Cirrosplus sericeicornis, S. gordius, Chrysocharis niveipes* (*Achrysocharoids niveipes* and *Apantelis flavolimbatus* (*A. circumscriptus*), which together caused 92 % parasitism of the larvae and 73.45 % of the pupae. Olivella-Pedregal and Vogt (1997) reported that total parasitism of *P. blancardella* by Chalcidoids and Ichneumonoids ranged from 10 to 29%.

Since 11 species of hymenopterous parasitoids were reared from larvae and pupae of *P. blancardella* during the course of this study, close parasitic relationship between these different species of parasitoids and the insect pest, as a host, has to be established during some years. Therefore, I assume that, *P. blancardella* is existed in Egypt since years ago but it hasn't got enough attention to be studied before.


## ACKNOWLEDGMENTS

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## ***Phyllonoryccter (= Lethocolletis) blancardella*** الاختلافات العددية لصانعة أنفاق أوراق التفاح
## (Fabricius) (Lepidoptera: Gracillariidae) وطفيلياتها في منطقة مصر الوسطى

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أجريت دراسة حقلية في بستان تفاح صنف أنا بمزرعة محطة بحوث البساتين بسدس بمحافظة بنىسويف، وتم تقدير التذبذبات الموسمية ونسبة التطفل لصانعة أنفاق أوراق التفاح في موسمى ٢٠٠٠ و٢٠٠١ والحشرة كانت متواجدة طوال العام ماعدا شهرى فبراير ومارس لتساقط الأوراق فى شهر فبراير وتم تحديد ٤-٥ قمم للتعداد وازداد تعداد الحشره من ابريل وحتى ديسمبر. وقد تم حصر إحدى عشر نوعا من الطفيليات والتي خرجت من يرقات وعذارى صانعة أنفاق أوراق التفاح او كانت داخلها وهى *Diglyphus mineus* Walker,*Diglyphus* sp., *Hemiptarsenus* sp. , *Achrysochais formosa* Westwood, *Pnigalio mediterraneus* Ferrire & Deluchi, *Sympiesis* sp. , *Tetrastichus xanthops* Ratzeburg; the encyrtids *Holcothorax testaceipes* Ratzeburg and *Ageniaspis* sp.; the pteromalid *Halticoptera* sp., and the braconid *Apanteles lautellus* *Marshall*، وقد تم تقويم دور هذه الطفيليات كعامل موت طبيعي للآفة.