Egypt. J. Agric. Res., 80 (3), 2002.

MONITORING THE CHANGES IN THE SEASONAL ACTIVITY OF CITRUS LEAFMINER *PHYLLOCNISTIS CITRELLA* MOTHS IN THREE DIFFERENT AGROECOSYSTEMS

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(Manuscript received October 2001)

Abstract

Ecological studies of citrus leaf miner (CLM) *Phyllocnistis citrella* were carried out in citrus orchards at three different Agro-ecosystems namely Qalyoubia, Sharkia and Beni-Sweif for three successive years 1996, 1997 and 1998. For Qalyoubia Governorate CLM, infestation started to appear in new shoots as early as mid April, 1996 and three weeks later for both 1997 and 1998 (i.e. May 5th). The CLM infestation disappeared during the 1st half of December. Seven field generations were completed during citrus flushing periods. For Sharkia Governorate, the main period of activity was extended between the 2nd week of May and the last week of December, thus demonstrating 9 generations. Thus for Beni-Sweif Governorate, however, young citrus trees the infestation high figures revealed possibly all the year round. Samples were picked comparatively and 10 annual generations were recorded in navel organ leaves. Navel orange was the most preferendum species for citrus CLM infestation and the most susceptible compared with other citrus varieties throughout the three successive years. Lime variety ranked second, while mandarin variety was the least.

Key words: *Phyllocnistis citrella*, Ecology, Population dynamics, Field generation, Susceptibility

INTRODUCTION

The micro-lepidopterous citrus leafminer *Phyllocnistis citrella*, (CLM) larvae cause considerable damage to tender citrus leaves as they feed in mines and subsequently twisted and curled leaves are observed. The larval infestation retard growth of newly citrus trees, thus reducing the yield.

CLM larvae inhabit eastern and southern parts of Asia (weerawut, 1990) and widely distributed where citrus orchards are grown. In Asia, Australia (Beattie, 1993), USA (Florida) (Pena *et al.* 1996), Sudan (Badawy, 1967), Saudi Arabia (Ayoub, 1960), Yamen (Ba-Angood, 1978) and Egypt (Abd El Aziz, 1996). In temperate and subtropical regions where Egypt is located citrus production is obviously high.

In Egypt, lime (*Citrus aurantifolia* Chrstm) and Willow (*Salik stetrasperma* Roxb.) (secondary host) offer together a good chance for CLM survivors to persist almostly allover the year. The new shoots of citrus, occur in late February and March, most escape from CLM infestation owing to the unfavorable temperature, thus keeping its population density below the equilibrium position level.

The present investigation was constructed to evaluate the changes in the population density of CLM. The triangular relationship between infestation and the corresponding physical factors and yield was considered.

MATERIALS AND METHODS

Selected citrus orchards cultivated with citurs species namely baladi lime, (*Citrus aurantifolia* Christm) navel orange (*C. sinensis* Osbeck); mandarin baladi, (*C. reticulata* Blanco) and valencia orange, (*C. sinensis Osbeck*) were chosen for the present investigation. The selected trees were 20 years old at Kaha (Qalyubyia Governorate), while at Sharkia and Beni Sweif Governorates quite younger trees (i.e. 6 years old) were closen.. Field trials were carried out during three successive citrus growing seasons (1996, 1997 and 1998). Weekly samples of 20 tender branches were picked at random and transferred to the laboratory in plastic bags for inspection. Number of CLM larvae inside 20 infested leaves was counted to study the infestation susceptibility. The approximated number of CLM generations was estimated based on the weekly number of moths. The population density of CLM larvae and the number of larval generations were estimated according to Audemard and Millaire (1975) and Jacob (1977) method.

The relative susceptibility of four citrus species namely, lime baladi, navel orange, baladi mandarin and orange valencia was evaluated for *Ph. citrella* infestation at Qalyubyia Governorate during 1996, 1997 and 1998. CLM infestation levels were determined in young 100 leaves picked at random for each of the tested four species.

Samples were transferred to the laboratory and CLM stages were counted.

RESULTS AND DISCUSSION

Data graphically illustrated in Fig. 1, 2 and 3 show the changes in the population density of CLM based on the weekly number of larvae/60 citrus leaves/week from selected citrus orchards at representative three different agro-ecosystems; (Qalyubyia, Beni-Sweif and Sharkyia Governorates) during three successive years (1996, 1997 and 1998).

For Qalyubyia Governorate the initial infestation stared at mid-April 1996, but the 1st week of May 1997 and 1998 seasons. The reliable infestation levels were observed during the 1st week of May. The weekly number of larvae increased gradually forming the first peak during the first half of May 1996 and June for both 1997 and 1998. The population density fluctuated around the equilibrium position during the following months. Down (-) up (+) and disappeared during the 1st half of December. The data illustrated in Fig. (1) for 1996 indicate that *Ph. citrella* completed 7 distinct successive peaks between mid April and mid December. The most obvious peaks were commonly occurred during May, June, August and September with moderate size. In general, it could be concluded that CLM underwent 7 larval field generations (peaks) during the whole season of activity, Fig. 1.

As for Beni Sweif Governorate CLM infestation was first observed as early as the third week of March 1996 in a scarcely numbers (20 larvae/60 leaves) and increased afterwards forming a distinct peak during the third week of April. The population density fluctuated forming a number of peaks during the whole investigated period from March to December 1997 and 1998. The larval infestation persisted for a fairly long period during the three tested years, Fig. 2. The population density during winter months was quite low and increased obviously forming a distinct three peaks representing three generations from April to June. During July 1997 and 1998, moderate peaks were achieved during spring months. Also 7 generations were estimated from March to December 1996, 1997 and 1998.

At Sharkyia Governorate, the data illustrated in Fig. 3 revealed that the main period of activity extended (one month less) between May and December. It appeared that autumn months harboured the highest infestation densities i.e. 788, 663 and 535

larvae during September, October and November, respectively. In general, the population density during 1996 dominated that of 1997.

The integration of the data illustrated in Fig. 1, 2 and 3 for the changes in the weekly number of larvae counted/60 leaves showed that the initial infestation was detected one month earlier at Beni Sweif. At Sharkia and Qalyubyia, CLM commenced one month later. This may be due to weather conditions.

These results were in harmony with the findings of, Clausen (1931) in Southern of Japan. Pandy and Pandy (1964) in India and Huang *et al.* (1989) in China reported that CLM had 6-10 generations each year. Badawy (1967) found that the CLM infestation in Sudan started by the end of March, thus reaching a peak during the dry summer months. The population then declined gradually reaching low level during December and January were negligible infestation with very few larvae succeeded to complete their development. Batra and Sandhuy (1981) in India concluded that CLM completed two distinct periods of activity coinciding with the spring and autumn new flushes. Bhumannavar and Singh (1983) in India indicated that CLM was active throughout the year with four peaks of population on Coorg mandarin and nine peaks on Rangpur lime. Wilson (1991) in Australia stated that citrus leaf flushes occurred throughout the year with peaks and troughs occurring simultaneously between varieties. Knapp *et al.* (1995) in Florida reported that spring flushes were least damaged, while summer and autumn flushes suffered much due to cumulative build up of CLM populations. Pena *et al.* (1996) in Florida reported that the presence of CLM immature stages increased in successive generations during summer and early fall and declined during winter season. Abo-Sheasha (1997) in Egypt mentioned that CLM population was changed by changes either in weather conditions, in the abundance of food supply or in the number of natural enemies.

Relative Susceptibility of Citrus Varieties to CLM Infestations

Field trails revealed that navel orange variety harboured the highest level of infestation 351 CLM larvae/month/sample. Lime, mandarin and valencia varieties showed less infestation 250, 210 and 202 CLM larvae/month/sample, respectively.

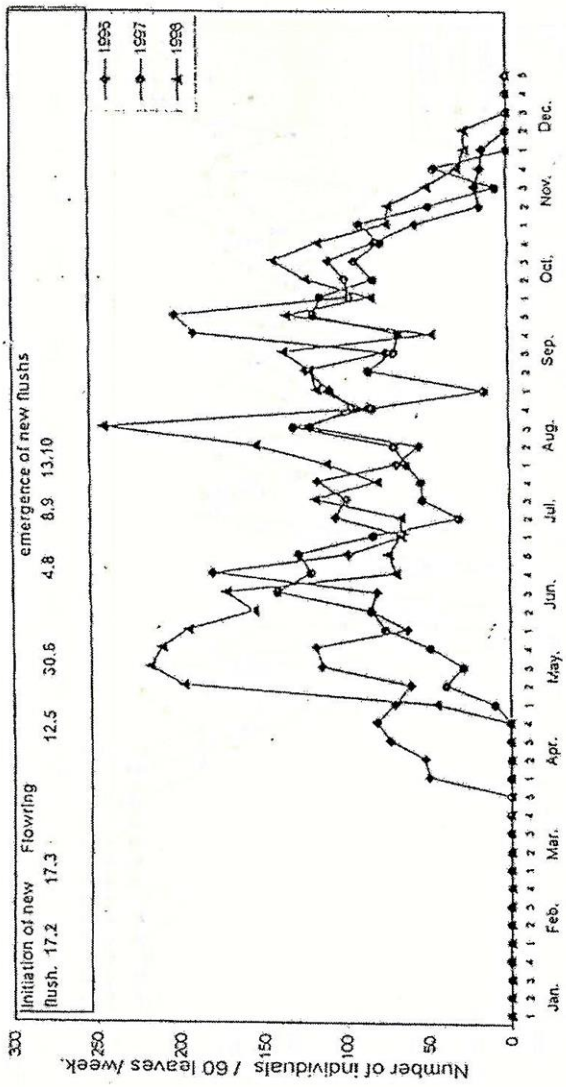

Fig. 1. Population dynamics of *Ph. citrella* at Qalyubiya Governorate during three successive years (1996, 1997 & 1998).

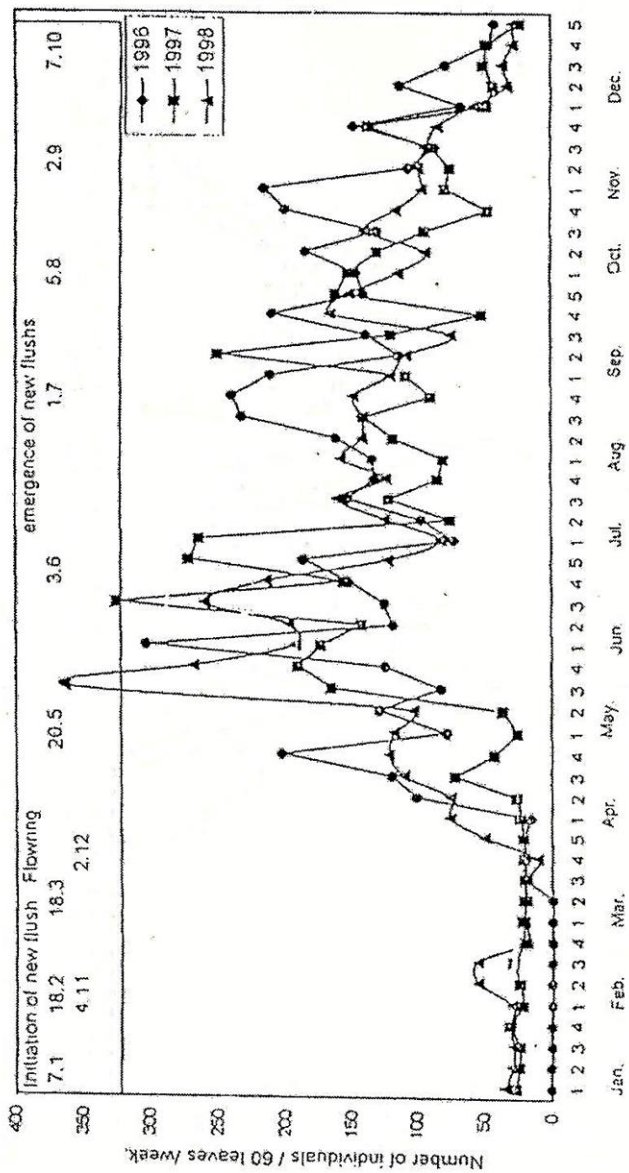

Fig. 2. Population dynamics of *Ph. citrella* at Beni-Sueif Governorate during three successive years (1996, 1997 & 1998).

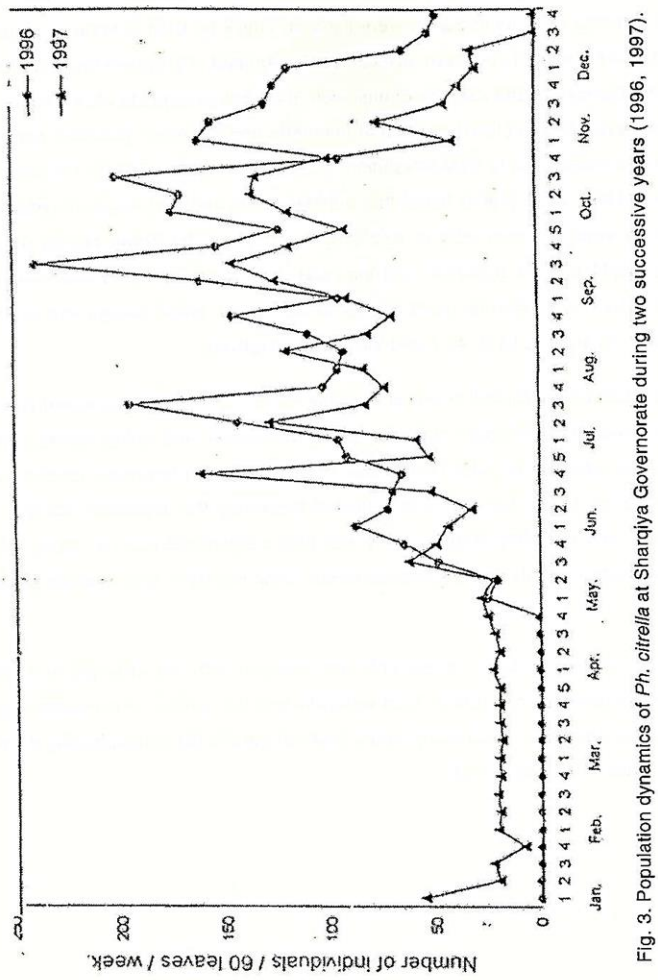

Fig. 3. Population dynamics of *Ph. citrella* at Sharqiya Governorate during two successive years (1996, 1997).

These results are in agreement with the findings of Badawy (1967) who found that all varieties of citrus in Sudan were liable to attack by CLM in spite of grapefruit and lime acid seemed to be more susceptible. Ba-Angood (1978) confirmed the former results that grapefruit and valencia orange were the most susceptible while sour orange were the least. Wilson (1991) found that mandarin and wheeney grapefruit appear to be the least susceptible to CLM infestation, while March's grapefruit was the most susceptible. Zhange *et al.* (1994) found that mandarin was the most resistant, while lime and lemon were the least. Abd El Aziz (1996) concluded that navel orange was the most susceptible, while mandarin was the least. Abo Sheasha (1997) determined the percent of CLM infestation on navel orange, sweet orange, baladi orange and mandarin in 1996 as 69.4, 57.6, 51.9, 48.7 and 24.1 %, respectively.

It could be concluded, however, that the infestation density expressed as number of larvae/sample increased obviously during the summer and spring months and the new flushes suffer greatly CLM infestations in summer. The unfavorable weather conditions prevailing during winter months affected negatively the population density. The abundance and suitability of food supply also play a significant role i.e., navel orange and lime, harbour the highest infestation levels, while mandarin and valencia were the least.

The agro-ecosystems components are changed with the changes in physical components (weather conditions), food suitability and the number of corresponding related natural enemies. These components seem to govern the corresponding changes in the population density of CLM.

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رصد التغيرات فى النشاط الموسمى لفراشة ناخرة أوراق الموالح فى ثلاث أنظمة بيئية مختلفة

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أجريت الدراسة البيئية للنشاط الموسمى لفراشة ناخرة أوراق الموالح فى ثلاث مناطق بيئية مختلفة وذلك لمدة ثلاث سنوات متتالية (١٩٩٦-١٩٩٨) فى محافظات القليوبية والشرقية وبنى سويف.

ومن رصد النتائج المتحصل عليها فى كل من المحافظات الثلاثة وجد أن الإصابة فى محافظة القليوبية بدأت منتصف ابريل عام ١٩٩٦أما فى عامى ١٩٩٧، ١٩٩٨ بدأت الاصابة فى الأسبوع الأول من مايو واختفت تماما فى الاسبوع الاول من ديسمبر وطوال اشهر الشتاء أعطت هذه الدراسة لمحافظة القليوبية سبعة أجيال. أما فى محافظة الشرقية كانت الإصابة الفعلية متماثلة مع القليوبية حيث بدأت من الاسبوع الثانى من مايو حتى ديسمبر بزيادة جيلين عن القليوبية بإجمالي تسعة أجيال خلال العام. أما فى محافظة بنى سويف فقد أعطت النتائج عشرة أجيال متداخلة وبكثافة عددية مؤكدة مع تقلبات النشاط الموسمى تمثل عشرة قمم توضح وجود عشرة أجيال لجاميع الفراشات على مدار العام فى محافظة بنى سويف والتى تعتبر من أكثر المناطق البيئية ملائمة بأخذ الحرارة المرتفعة فى الاعتبار والملائمة الغذائية فى الأشجار صغيرة السن.