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Research Paper

Determination of the best timing for control application against cotton leaf worm using remote sensing and geographical information techniques

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Abstract Knowledge of the larval-age distribution in the field is important for prediction purpose and timing of insecticide applications for insect pest management. This studies acts by calculating the average of thermal units in degree-days (dd's). The average of thermal units required for completion of generation is 544.98, 640.63 and 599.66 degrees-days (°C) as calculated from air temperatures derived from thermograph and satellite images, and soil temperatures from satellite images, respectively, considering 9.89 °C as a developmental threshold. These were higher than the estimated value of dd's based on laboratory data (524.27 degrees-days (°C)). There was a difference between degree days obtained from air temperatures derived from satellite images and thermograph by 59.2 dd's, this value represented only about 2.85 days. In order to improve the predictability, a factor was estimated between them which is 0.81, 0.96 and 0.87 in case of thermograph, soil and air temperature that derived from satellite images so the predicted stages was highly improved. Egg hatching was estimated to be 80% complete by ≈80.45 dd's. At 174.85 DD, mostly all larvae in the field experiment were from the first to third instars. The presence of more mature larvae (fourth

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to sixth instars) was not noticed until 197.59 dd's. These data indicate that, the best timing for control application against *Spodoptera littoralis* would be at 174.85–197.59 dd's.

The results are important for quick prediction purposes, control timing and also as valuable tools used in an integrated control program for managing *S. littoralis* in Egypt.

1. Introduction

The Egyptian economy has traditionally relied heavily on the agriculture sector as a source of growth and support for the non-agricultural sector. Cotton has traditionally been the most important fiber crop in Egypt as well as the leading agricultural export crop. One of the major obstacles facing the production of more crop and food for Egypt's fast-growing population is the damage effects caused by pests, especially the cotton leafworm, *Spodoptera littoralis* (Boisd.).

S. littoralis, also known as Egyptian Cotton Leafworm is native to Africa and Israel and widely found in both Africa and the Mediterranean Europe. It is considered a pest of national concern and may result in quarantine and/or regulatory actions if detected. It is a pest on vegetables, fruits, flowers and other crops (http://wiki.bugwood.org).

Pests prediction, are major problems in the different climatic regions in Egypt. Early prediction of insects is urgent to help the farmers to avoid heavy sprays of pesticides and take the necessary actions to restrict dangerous infestations. These practices require real time weather data covering the country.

Development of insect is temperature dependent; and each organism requires a specific measure of heat accumulation between lower and upper developmental thresholds to complete development. Applications of developmental thresholds and rates in the form of phenological models are often used in agricultural IPM programs to predict and manipulate pest population dynamics in the field under consideration. The lower threshold (t_0) and the degree days of generation of *S. littoralis* are 9.89 °C and 524.27, respectively (Yones et al., 2008).

For the vast majority of economically important insect pest species, the information necessary for precisely predicting dormancy, development, and reproduction in the field is still scarce (Tauber and Tauber, 1973; Tauber et al., 1986).

The main objective of the current study is

1. The early prediction of insects to help the farmers to avoid heavy sprays of pesticides and take the necessary actions to restrict dangerous infestations.
2. To determine the larval-age distribution in the field for cotton leaf worm.
3. Estimate a factor to enhance the predictability.

Finally, it is hoped that, the findings achieved in this study will help in future studies related to this subject; and will get better understanding and illustrate how these findings could be used through IPM programs against the major cotton insect pests in Egypt. It should be emphasized that, a complete IPM program develops slowly, usually through a step-by-step procedure and that full significance of the program emerges slowly as well.

2. Methodology

This study was conducted during 2006 in Ezbet Shalaqan, located in El-Kanatir El-Khairia, Al-Qalyubiya Governorate, Egypt (30°12′45″N, 031°08′02″E) shown in Fig. 1. Egg masses of the cotton leafworm, *S. littoralis*, were obtained from the

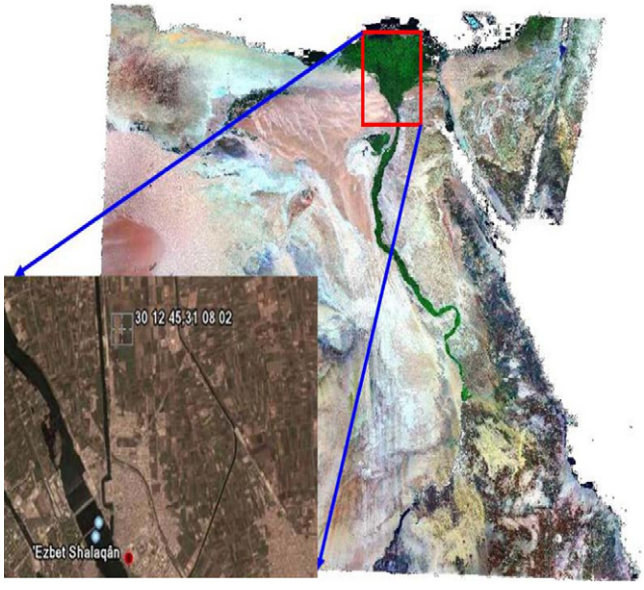

Figure 1 Ezbet Shalaqan, Al-Qalyubiya Governorate; Egypt.

Figure 2 Rearing technique under field conditions of Ezbet Shalaqan, Al-Qalyubiya Governorate.