

## INTRODUCTION

In Egypt, cotton is an important crop that cultivated mainly for fibers in industry and seeds for oil which is of great value (Kamal, 1951a).

The annual cultivated areas with cotton were more than one million feddans. During the present decade, these areas were decreased steadily from year to another. In 1985 cotton season, the cultivated areas were 1081009 feddans yielded 7344768 metric tons (Kentars) of cotton seeds while in 1995 season, these areas decreased, to 762002 feddans yielded only 540358 metric tons of cotton seeds (Youssef, 1997).

Unfortunately, the plant is attacked by many insect and mite species which are reported to attack all parts of the plant and during the whole period of the growing season (Kamal, 1951 a). One of the most important cotton pests, is the cotton leafworm, *Spodoptera littoralis* (Boisduval). The insect is active almost all the year round and polyphagous, feeding on many field and vegetable crops, ornamental, plants and weeds (Kamal, 1951 b). Cotton cultivations also suffer from infestation with the pink bollworm, *Pectinophora gossypiella* (Saunders) and the spiny bollworm, *Earias insulana* (Boisd.). Bollworms feed mainly on cotton bolls and seeds, causing a decrease in quantity and quality of the cotton production.

For the last 25 years, insecticides were widely used in Egypt. About 30000 metric tons of pesticides are imported every year, mainly to control both the cotton leafworm and the bollworms. The recent annual cost of these pesticides reached more than 150 million U.S. dollars. This indiscriminate use of

pesticides led to environmental pollution and toxicity of mammals and beneficial organisms (El-Sebae 1981). Effect of pesticides on beneficial organisms is represented by the destruction of predators and parasitoids; for example, parasitism percentage in the cotton leafworm, *Spodoptera littoralis* (Boisd.), was as high as 75 % before the extensive use of pesticides (1934 - 1941), while it reached 1.9 -6.2 % during the period 1968 - 1977 (Attiah, 1977). Also, due to the destruction of large portion of natural enemies by pesticides an upset in the natural balance occurred in the favor of what previously known as secondary pests (Hafez, 1960; Fayad and Ibrahim 1980; Shalaby *et al.*, 1983 a & b and Kares *et al.*, 1988).

Newsom (1974) reported that both pests and beneficial species respond in a similar manner to exposure to toxic chemicals, however, beneficial populations (Mc Pherson *et al.* 1976) are more severely effected due to the results of the two selective factors: toxicity of the chemical plus decrease of an adequate host food source.

From these points of view, appears the necessity of minimizing the quantity of pesticides used to a minimum in I P M programs in which different control methods might be applied.

It has been indicated by several authors that the number of predators in cotton fields gradually increase during growth season to reach their peak during the first week of July (Hafez *et al.*, 1977; Fayad & Ibrahim, 1980; Ibrahim & Fayad, 1980 a & b and Shalaby *et al* 1983 a & b).

This study was carried out aiming to find convenient control measures against the cotton leafworm and bollworms and to avoid as far as possible the extensive use of chemical insecticides and instead designing an integrated programme using a bioinsecticide, chemical insecticide, Insect Growth Regulator, plant extract and pheromone trap and the hymenopterous endoparasite, *Microplitis rufiventris* Kok. In order to reach this goal, laboratory and field studies were attempted.

The laboratory studies were to determine the effect of the bioinsecticide (Xentari), the chemical insecticide (Baythroid), Insect Growth Regulator (Mimic) and a combination of different Xentari concentrations with  $LC_{10}$  level of Baythroid or Mimic (to determine the potential and the additional effects of the chemical or I.G.R. insecticide) on healthy *S. littoralis* larvae and those parasitized by *M. rufiventris*. This study may be considered of special importance in determining the insecticide of higher efficacy on the target pests (cotton leafworm and bollworms) and of lower efficiency on the beneficial parasitoid.

The field applications were conducted to study the impact of using either the insecticides recommended for controlling the cotton leafworm and bollworms or bacterial preparation (Xentari), I.G.R. (Mimic), plant extract *Clerodendron inerme* and sex-pheromone trap on the populations of the most dominant entomophagous insects in cotton fields, and consequently the rate of damage with each of the mentioned pests.