

SUMMARY

SOME PHYSIOLOGICAL STUDIES ON THE METHODS OF  
COMMUNICATION IN INSECT

This work considered as a trial to know the cotton leafworm moth behaviour, consequently understanding the communication system of this insect . So, the morphological and electrophysiological evidence of antenna odor chemoreceptors were studied . Chapter I contains the introduction and review of literature for essential recent work in the field of chemical communication .

Chapter II deals with the scanning electron microscope and electroantennogram methods which are used in the present work . It also, contains full description for the techniques of rearing of S.littoralis, glass microelectrodes, and the coating of the metal electrode .

Chapter III concerns the obtained results and is divided into two main parts .

I. Identification and distribution of sensilla on S.littoralis antennae by scanning electron microscope.

The first 5 proximal segments of the flagellum have scales present on nearly all surfaces, while on the higher segments, scales are restricted on the dorsal surface . The ventral and lateral surface

are covered with a network of micro-ridges among which most antennal sensilla are located . The only evident sensilla present under the scales were sensilla squamiformia .

Eight types of sensilla are localized on the antenna . These are, three morphological types of sensilla trichodea I,II,&III which can be easily distinguished by their dimensions and curvature . Small chemoreceptor pegs are characterized by the cone-shaped sensory structures . Sensilla chaetica are present on all segments of flagellar antenna and divided into two types I & II. Sensilla squamiformia occur under the scales, bedded in a socket . Sensilla auricillica are concave, small and thin-walled, it is ear-shaped in outline . Sensilla styloconica recognized by its reticulated base, a relatively smooth stalk, and a conical extremity . Sensilla basiconica a short peg is characterized by a blunt tip. Sensilla coeloconica there are two morphological types of these sensilla I & II (pig like sensillar apparatus recessed in a cuticular pit ) .

2. Determination of the main functions of some sensilla by electroantennogram technique .

The obtained data could be summarized under the following topics :

## 2.1. Effect of NaCl on the recorded electroantennogram.

The S.littoralis moth's activity is low in both NaCl concentrations of 0.5 and 3.0 M . These concentrations may be used if one wants to study the effect of other agents on the EAG of sensillum . The 3.0 M NaCl was chosen in this work since it is the best stimulator and good conductor which used for studying the effect of sex pheromone and odor chemical substances on sensilla .

## 2.2. Effect of KCl on the recorded electroantennogram .

Similar general trend of response to those obtained by using NaCl . Also, the response of sensillum trichodeum is higher than the response of small chemoreceptor peg, while the difference in response is always slight and insignificant .

## 2.3. Effect of $\text{CaCl}_2$ on the recorded electroantennogram.

Generally  $\text{CaCl}_2$  appeared of much less stimulating activity at the tested concentrations compared with that obtained by using NaCl and KCl . The frequencies and amplitudes of the EAG recorded from the two sensilla (trichodeum and small chemoreceptor peg) one can notice that they have the same form of change .

#### 2.4. Comparison between the effect of NaCl, KCl & CaCl<sub>2</sub>

On the EAG of antennal sensilla of S.littoralis. The least activity of the sensillum trichodeum was recorded by using calcium chloride solution, while the highest activity occurred with sodium chloride solution. Other while, at higher concentration of the KCl and CaCl<sub>2</sub> the amplitudes of the EAG became much higher than those obtained by using the same concentrations of NaCl.

#### 2.5. Effect of the attractant female sex pheromone on S.littoralis male moth.

Sensilla trichodea of male antennae was very sensitive to sex pheromone, while in female this sensillum did not respond during passing a current of sex pheromone.

Small chemoreceptor pegs were not stimulated by passing the sex pheromone odor neither in male nor in female antennae.

By using sodium chloride solution as a conductor, the highest response of sensillum trichodeum to sex pheromone was induced at NaCl concentration of 3.0 M. The increase in concentration of sex pheromone between 1 and 5 mg was not accompanied with increase in response.

2.6. Effect of the odor chemical substances on both sexes of S.littoralis .

Sensilla trichodea on the antennae of female S.littoralis were found sensitive to amyl acetate as chemical stimuli . While in male antennae sensilla trichodea did not respond to it .

On the other hand, small chemoreceptor pegs in both male and female were sensitive to amyl acetate as chemical stimuli .

Also, sensilla trichodea and small chemoreceptor pegs in female were sensitive to ethyl butyrate as chemical stimuli .

2.7. Effect of sound on sensillum chaeticum on the antennae of both sexes of S.littoralis .

Sensillum chaeticum responded to mechanical sounds and no differences occur between female and male .

Chapter IV concerns the discussion and conclusion :

This chapter shows that the electroantennogram technique could be considered as method for the determination of the functions of sensilla .

The functions of three types of sensilla in both sexes were detected as follows :

(A) In the male moths of S.littoralis, sensilla trichodea type I act as site receptor for the female sex pheromone . However, in female these sensilla function as olfactory receptor for the odor from chemical substances such as amyl acetate and ethyl butyrate . This result may consider sensilla trichodea in female associated with the location of a suitable oviposition site by gravid female .

(B) In both sexes of S.littoralis sensilla small chemoreceptor pegs function as site olfactory receptor for the odor of chemical substances, such as amyl acetate and ethyl butyrate .

(C) In both sexes of S.littoralis, sensilla chaetica are concerned with mechanoreception .

(D) From the result of the theoretical study, it was found that the number of neurons which is expected to innervate the small chemoreceptor peg is about 50 times greater than that needed for the sensillum trichodeum.