Some physiological studies on the methods of communication in insects

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This work considered as a trial to know the cotton leafworm moth behaviogr, consqunetlyunderstanding the communication system of this insect •So, the morphological and electrophysiological evidenceof antenna odor chemoreceptors were studied •Chapter I contains the introduction and review ofliterature for essential recent work in the field ofchemical communication •Chapter II deals with the scanning electronmicroscope and electroantennogram methods which areused in the present work • It also, contains fulldescription for the techniques of rearing of.§.littoralis, glass microelectrodes,and the:coating of themetel electrode •Chapter III concerns the obtained resultsand is divided into two main parts •I. Identification and distribution of sensilla onS.littoralis antennae by scanning electron microscope.The first 5 proximal segments of theflagellum have scales present on nearly all surfaces,while on the higher segments, scales are restricted onthe dorsal surface • The ventral and lateral surfaceare! covered with a network of micro-ridges amongwhi~h most antennal sensilla are located The onlyevipent sensilla present under the scales were sensillasq~amiformia •Eight types of sensilla are localized on the antenna •These are, three morphological types of sensillatrichodea 1,11,&111 which can be easily distinguished bytheir dimensions and curvature • Small chemoreceptorpegs are characterized by the cone-shaped sensorystructures • Sensilla chaetica are present on allsegments of flagellar antenna and divided into twotypes I & II. Sensilla squamiformia occur under thescales, bedded in a socket • Sensilla auricillica areconcave, small and thin-walled, it is ear-shaped inoutline. Sensilla styloconica recognized by itsreticulated base, a relatively smooth stalk, anda conical extremity. Sensilla basiconica a short pegis characterized by a blunt tip. Sensilla coeloconicathere are two morphological types of these sensillaI & II (pig like sensillar apparatus recessed ina cuticular pit) •2. betermination of the main functions of some sensillapy electroantennogram technique • !The I obtained data could be summarized under the I!fol~owing topics :2.1. Effect of NaCl on the recorded electroantennogram.The S.littoralis moth,s activity is low inboth NaCl concentrations of 0.5 and J.O M . Theseconcentrations may be used if one wants to study theeffect of other agents on the EAG of sensillum •The 3.0 M NaCl was chosen in this work since it isthe best stimulator and good conductor which used forstud1ng the effect of sex pheromone and odor chemical Isubstances on sensilla •2.2. Effect of KCI on the recorded electroantennograrn •Similar general trend of response to thoseobtained by using NaCl • Also, the response of sensillumtr~chodeum is higher than the response of smallchemoreceptor peg, while the difference in response isalways slight and insignificant •2.’. Effect of CaC12 on the recorded electroantennogram.Generally CaG12 appeared of much lessst~mulating activity at the tested concentrationscompared with that obtained by using NaGI and KGl •Th¢ frequencies and amplitudes of the EAG recordedfr~m the two sensilla (trichodeum and small chemoreceptorpe$) one can notice that they have the same form ofch~e •2~4. Comparison between the effect of Nael, KCl & caC12On the EAG of antennal sensilla of S.littoralis~T~e least activity of the sensillum trichodeum was~¢corded by using dalcium chloride solution, whilethe highest activity occured with sodium chloridesolution. Other while, at higher concentration of theKCl and CaCl2 the amplitudes of the EAG became muchhigher than those obtained by using the same concentrations of NaCI •2.5. Effect of the attractant female sex pheromone on-S.littoralis male moth.Sensilla trichodea of male antennae was verysensitive to sex

pheromone, while in female thissensillum did not respond during passing a currentof sex pheromone •Small chemoreceptor pegs were not stimulatedby passing the sex pheromone odor neither in male norin female antennaeBy using sodium chloride solution as a conductor, thehighest response of sensillum trichodeum to sexpheromone was induced at NaCI concentration of 3.0 M •The increase in concentration of sex pheromonebetween I and 5 mg was not accompanied with increasein response •2.6. Effect of the odor chemical substances OD bothsexes of S.littoralis •Sensilla trichodea on the antennae of female§.littoralis were found sentitive to amyl acetate asc~emical stimuli • While in male antennae sensillat~ichodea did not respond to it -. j _.o~ the other hand, small chemoreceptor pegs in bothmale and female were sentitive to amyl acetate aschemical stimuli •Also, sensilla trichodea and small chemoreceptor pegsin female were sentitive to ethyl butyrate aschemical stimuli •2.7. Effect of sound on sensillurn chaeticurn on theantennae of both sexes of S.littoralis •Sensillum chaeticum responded to mechanicalsounds and no differences occur between female and male •Chapter IV concerns the discussion andconclusion :This chapter shows that -the electroantennogramtechnique could be considered as. method ~or thedetermination of the functions of sensilla •The functions of three types of sensilla in bothsexes were detected as follows :(A) In the male moths of S.littoralis, sensillatrichodea type I act as site receptor for the femalesex pheromone • However, in female these sensillafunction as olfactory receptor for the odor fromchemical substances such as amyl acetate and ethylbutyrate. This result may consider sensilla trichodeain female associated with the location of a suitableoviposition site by gravid female.(B) In both sexes of S.littoralis sensilla smallchemoreceptor pegs function as site olfactoryreceptor for the odor of chemical substances, such asamyl acetate and ethyl butyrate •(C) In both sexes of S.littoralis, sensilla chaeticaare concerned with mechanoreception.(D) from the result of the theoretical study, it wasfound that the number of neurons which is expecte~ toinnervate the small chemoreceptor peg is about 50 timesgreater than that needed for the sensillum trichodeum.