Studies on different methods of communication in insects

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The work reported here was carried out a~ th. PlantProtection Department, ,aculty of Agriculture, llQAlhtohor.1agazig-University, Benha-branch.Selected insect for these studies were moths ot theEgyptian cottonleafworm Spodoptera littoralis (Boi84.)'{Lepidoptera: Noctuidae) is a well-known pest on cottonplants, and various vegetable crops.The main objective of these experiments was to indicatethe different methods of communication between mothsof Spodoptera l·ittoralis and some host plants. In additionto investigate the method5of communication between malesand females of the same insect.plants:-l.a.Preference to oviposition on whole plants.Some host plants (Cotton. cOlllllllOn-beanJ,ew'smallow, okra and soybean) were cultivated undersemifield conditions. Planting date, soil tlPe fe~tilizer,irrigation times and planting density were the samefor all cultivated plants. Investigated plant specieswere exposed. for the insects at two times throughoutthe experimental period, where the first and secondones were at 60 and 100 days plant ages, respectively.Not only mean number of eggs laid on each host perfemale. but also chlorophylls (a and b),total chlorophylland carotent content were calorimeticallydetermined.At 60 days plant age. soybean was the highestone in chlorophyll (a) content (723.552 -S./100 gm.fresh wt.). while cotton was the lowest one in itscontent of chlorophyll (a and b), total chlorophylland carotent. The highest average number ot eggsper female was present on soybean (197 eggs/female)Results recorded at 100 days plant age revealedthat the highest average number of eggs per temale(458.333 eggs) was oviposited on soybean plants,inspite of decrement in their content of chlorophyll(a and b), total chlorophyll and caroten content.Generally, it could be said that obvious andhighly significant increase in average egg numberlaid per female on each plant species was increasedas plants grew older, presumably due to increment inconcentration of a particular compound or c.tegoryof compounds may dominate the chemical compositionof a plant and may contribute the sensory cue thatforms the basis for oviposition preference.l.b. Preference to oviposition on host plant extractsAt the end of experimental period. leaves ofdifferent host plant were collected. dried. thenextracted by different solvents (ethanol. chloroform,and petrolium ether,) for isolating the oVipositionalstimulant. Extracts were offered for the insects ontissue papers. while control one was sprayed with asolvent.Ethanol is more efficient solvent for extractingmore active compounds which induce oviposition.Ethanolic extracts of soybean resulted in inducingthe moths to oviposit the highest average nUQber ofeggs per female (338 eggs).The highest ovipositional responses of IIIOthsofS. littoralis to extracts of soybean seem to mimictheir response to whole plant. Therefore. it couldbe concluded that a chemical composition of hostplant plays an important role in communic.tionbetween the insect and the investigated plant SpeciesDifferent levels of bilateral amputation or caat~gof males antennae, which mated with untreated fe~es.resul ted in various averages of egg -numbers pe.r female,but egg ~tching percentages were (0.000). It is evidentthat no communication or mating occurs between two sexes.The female moth easily identify about oviposition siteNerium oleander' , inspite of the presence ot t1B~papers on the bottom of cage.Singular antennectomy or covering by nitrocelluloselacquer for one antenna of males then copulated withnormal females. These females laid their e"" onNerium oleander, where egg hatching percentages wereranged (99-100%). It is obvious that mating take. placeand the female choiced its oviposition site.Different degrees of bilateral amputation or coating bynitrocellulose lacquer of female antennae then copulatedwith

untreated males. These treat menta resulted in fertileeggs laid on tissue papers. inspite of the presence ofNerium oleander.Singular cutting or coating for one antenna of femalemoth then mated with untreated male. These treatmentsindicated that communication takes place. where the femalelaid fertile eggs on Nerium oleander inspite of the presenceof tissue papers on the bottom of the cage.Generally. it could be summarized that the coating of,~tennae with nitrocellulose lacquer found to be eqUivalentto amputation in male and female moths of S. littoralis.Eventually. it could be concluded that male antennaeand its sensillar structures together play or considered asa physical appartus responsible about the choic. or egglaying place.3.Some morphological studies on the antennae and its sensillaof S. littoralis moth.3.a. Light microscopy investigation.Mean diameter and mean length were meaeured pereach flageller segment of the 401h. terminal flagellumsegments of both male and female III,Qths.Alao,surface area and volume were calculated tor thesesegments.The average length of the first flagellum segmentof male was the longest of all in both ~xes.Averages surface area and volume per each segment inboth sexes were gradually increased from the apex ofan tenna to the base un til it reached the maximum atthe 361h. segment, then began in decrement. Also,increment in male was higher than in female.J.b.Scanning electron microscopy studies (SEM).Scanning electron micrographs of the &l:1tennaeof ~. 11 ttoralis show that the most sensi11a arefound on the ventral and lateral surfaces of theflagellum with the dorsal surface covered by overlappingscales are similar to those on the scape andpedicel.113-All sensillar structures occur on the reticulatedarea of S. littoralis antennae are sensilla auricillica,sensilla trichodae (type 1, type 2 and type 3), sensillastyloconica, small chemoreceptor pegs, sensilla chaetica,sensilla coeloconica and sensilla squamiformia.Sexual dimorphism is mainly restricted in: Sensillaauricillica have a mean length of 9.8 U in males, meanlength of 7.9 U in females. Sensilla trichodae (typel,1, type 2 and type 3) are shorter on the female than onthe male antennae. The average lengthes of type I, type2 and type 3 were (43.2 ,16.17 and 9.8 U in respectively)in males, while in females were (31.6,16.6 and 9.6 U,respectively). The apical subsegment of the femaleantennae bears no sensilla styloconica, while in maleit bears more than one. Only three small chemorecepterpegs were found on the narrowed tip of termjnaJ subsegmentof the female antenna, while there are more thanfive on the male antenna. The terminal se~nt of theantenna bears many of the sensilla chaetica, where 10and 12 hairs were found in the apical subsegment infemale and male, respectively.J.b. Histological studies using transmission electronmicroscopy (TEM).Transmission electron microscopy sections in .theantennae of both male and. female mot.hs-of S. littoraliswere made in attempt to determine the.histoloQ and the ,innervation pattern of some sensory receptors. Ofparticular interest the sensilla which were know torespond to the sex pheromone (sensilla trichodae,sensilla chaetica and antennal sensory cone).The antennal lumen in both sexes consists of alarge haemocoel containing the paired antennal nerves.one trachea and one thin-walled blood vessel. Patbodie s are often found in the haelllOcoel. Therefore.it could be said that the contents of the antennallumen indicated no sexual dimorphisa betw.en two sexes.Around the whole surface of ’the antenna, there arebranched and un branched projections originate from theantennal cuticle. According to the literature, thedescription of these projections had not be.n reportedpreviously. The name of wavy shape proJ.~tionf(hairs) was given for them according to their shape.The dermal glands are situated just belO1J t:be basmentmembrane of the epide:r:mallayer. Eacb de1’/l¥J>l 4- ~de upof 1 to 4 large closely associated cells. P.~n& throughthe centre of these cells is a semicircular cuticular canalending in a small bulb. These glands were bore noticeablein males than females of S. littoralis moth.The hypodermal gland is closely associate4with maleantennal sensory cone and the cell body of the gland sharethe cuticular invagination of the sensillum which is one ofthe main characters of this type of .glands. The openingof this gland is cone-shaped with a ridge of cuticle ·extendingalong one side. Specialized enveloping hypodermal cellwas found in one of the lateral side of sensillum trichodumtype A. According to the literature, no reference showedthe presence of the hypodermal cell in any order, also inLepidoptera.There is no sexual dimorphism in the fine structure oftriehoid type A sensillum, sensillum chaet 1cum and antennalsensory cone on male or female antennae of ~. li ttoralismoth.4. Ultrasonic waves and its role in communication betweenthe two sexes of S. littoralis moths.The effect of different treatments ot ultrasonicwaves on S. littoralis moth fecundity, hatc~:ilitypercent and sterelity by making different

copulationsbetween treated and untreated males and females.Both males and females were received the same dose ofultrasonic waves including, power (20 in db.) and frequency(2 in MHz) for 30 minutes as exposure time,was the best ofall for reducing insect fecundity (350 eggs/f~le) andincreasing the percent of sterelity (71. 2~5 %) in additionto reduce the egg hatching percent (93.625 %).Treatment of both male and female by similar conditionsof power (50 db) and frequency (2 MHz) for a period of 30minutes, resulted in the lowest of egg hatchability (92 %)and percent of sterelity (69.064 %).Exposing the femaleonly for these . for_ these condi tions then copula tedwith untreated male resulted in high percent ot sterelity(41. 337 %) than case in which male were treated by thesame previous dose then copulated with untreated female(sterelity % = 23.031).-Previously mentioned results leading us to postulatethat ultrasonic waves not prevent communication betweenmales and females of ~. littoralis moths, but reduced insectfe.cundity, lowered percentage of egg hatching and raisedthe sterelity percent.