Toxicological and biological studies on the effect of some insecticidal agents on the prouduction and release of pheromones by the rust-red flour beetle، tribilium castaneum

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The present study aimed to evaluate the biological effect of someinsect growth regulators (Atabron) as a chitin synthesis inhibitor and(Admiral) as a juvenile hormone analogue, against 4th larval instar and pupalstage of Tribolium castaneum, to determine their toxicity. The effect ofsublethal doses LC50 were used to investigate some of the factors influencingsex pheromone production and perception by T. castaneum. The structure ofthe male and female antennae and different types of sensillae were examinedby using the scanning electron microscope before and after treatment.„« Toxicological studies:-Both tested compounds significantly induced larval, pupal & adultmortalities, which were concentration dependant.All the treated larvae as 4th larval instar showed a high sensitivity toboth tested IGRs more than pupal stage, female pupae were more sensitivethan male after treatment by both compounds and also, Atabron was themore toxic than Admiral except after female pupal stage treatment.„« Morphological abnormalities:-„h Larval instars:Treatment of the 4th larval instar and pupal stage with the tested IGRsinduced some morphological abnormalities in larval stages, larval- pupalintermediates were also recorded.SUMMARYSUMMARY273„h Pupal stage:Pupae with different degrees of morphogenic malformations such aspupae with C- shape & pupae with shortened body were recorded, as well aspupal- adult intermediate.„h Adult stage:Some emerged adults have various degrees of malformations. Adultswere completely free but possessed crumpled and incomplete formation ofwings and constricted adults were also recorded.„« Biological studies:-Fourth larval instar and pupal stage of T. castaneum were treated withdifferent concentrations of the tested IGRi¦s, and some biological -aspects ofthe treated larval and pupal stages as well as their sub sequentdevelopmental stages were determined.Both tested IGRi¦s significantly increased the larval and pupaldurations. On the other hand decrease the percentages of adult emergence,fecundity, fertility of the eggs produced by the adult.„« Pheromone production and perception by treated and untreatedbeetles:-Treated and untreated rust-red flour beetles, T. castaneum secretedtwo kinds of pheromones. The first pheromone called an aggregationpheromone was secreted by males which was stimulated and attracted

bothsexes while, second pheromone called sex pheromone was secreted byfemales which was excited and attracted males more than females, althoughSUMMARY274production and perception of pheromone by untreated beetles weresignificantly higher than production and perception of pheromone by treatedone.„« Effect of solvent on pheromone extraction from treated anduntreated beetles:-According to the potency of solvents tried in the extraction ofpheromone, the tested solvents could be arranged descendingly in thefollowing manner: Hexane, diethylether, acetone and chloroform.Consequently, hexane was used throughout the present study.„« Effect of pheromone concentration on treated and untreated maleresponse:-The treated and untreated male response to sex pheromone increasedwith the increase of pheromone titers (0.1, 0.2, 0.3, 0.5, 0.8 & 0.9 femaleequivalents), although response by untreated males were significantly higherthan response by treated one.„« Factors influencing sex pheromone production and perception bytreated and untreated beetles:-I-Day time:-Through studying the effect of LC50 (1.2ppm of Atabron, 2.4ppm ofAdmiral after treatment 4th larval instar, 12.6ppm of Admiral after treatmentmale pupae and 7.1ppm of the later compound after treatment female pupae)on production and perception adult beetles through different periods ofphotophase and scotophase, it was found that times of production andperception of pheromone by untreated beetles were significantly higher thanSUMMARY275times of production and perception of pheromone by treated one. Also, thetime of highest production and perception of pheromone by untreated beetlesat three o’ clock, while the time of highest production and perception ofpheromone by treated beetles at one o’ clock. On the other hand, bytreatment of pupal stage by (10.6ppm of Atabron for males and 8.3ppm ofthe same compound for females), it was found that the time of highestproduction and perception of pheromone by untreated beetles was similar tothe time of highest production and perception of pheromone by treated oneat three o’ clock.II-Age:-Through studying the effect of LC50 (1.2ppm of Atabron, 2.4ppm ofAdmiral after treatment 4th larval instar, 12.6ppm of Admiral after treatmentmale pupae and 7.1ppm of the later compound after treatment female pupae)on production and perception adult beetles through different ages, it wasfound that the production and perception of pheromone by untreated beetleswere significantly higher than production and perception of pheromone bytreated one at the same ages. Also, the age of highest production andperception of pheromone by untreated beetles was 4- 6 day old, while theage of highest production and perception of pheromone by treated beetleswas 8-10 day old. On the other hand, by treatment of pupal stage by(10.6ppm of Atabron for males and 8.3ppm of the same compound forfemales), it was found that the age of the highest production and perceptionof pheromone by untreated beetles was similar to the age of the highestproduction and perception of pheromone by treated one at age from 4-6 daysold.SUMMARY276It was observed that production and perception of pheromone bytreated and untreated beetles decreased with the youngest sexes then start toincrease until reach to peak and then decreased another time with theincreasing of age until beetles reach to fourteen day old.III-Hunger:-The pheromone titer produced by treated and untreated females andthe level of treated and untreated male response were at maximum whenboth sexes were well fed. The

reverse occurred when both sexes werehungry. Intermediate levels of pheromone production and male responsewere obtained when one sex was fed and other was left hungry, althoughproduction and perception of pheromone by untreated fed or unfed beetleswere significantly higher than production and perception of pheromone bytreated fed or unfed one.IV-Temperature:-Low temperature (15 ¢XC) adversely influenced sex pheromoneproduction by treated and untreated beetles. As the rearing temperatureincreased, the pheromone production also increased to reach its maximumtiter at (30 ¢XC). At a rearing temperature (40 ¢XC), the pheromone productionstarted to decrease again, but the difference was not significant from that at(30 ¢XC). None of the rearing temperatures (15- 40 ¢XC) tested could inhibitpheromone production, although production and perception of pheromoneby untreated beetles rearing at different temperatures (15- 40 ¢XC) weresignificantly higher than production and perception of pheromone by -treatedone rearing at different temperatures (15- 40 ¢XC).SUMMARY277V Mating:-Mating did not lower or inhibit treated and untreated femalepheromone production, although production and perception of pheromoneby untreated virgin and mated beetles were significantly higher thanproduction and perception of pheromone by treated virgin and mated one.„« The external morphology of treated & untreated male and femaleantennae:-Scanning electron microscopy of the antennae of T. castaneumwas used to compare external structure and number of sensillaepresent on antennae of treated & untreated male and female for theassessment of physical apparatus responsible for sex pheromonedetection.Seven main types of sensillae are located on the antennae ofuntreated males of rust-red flour beetles; include sensillae trichodeaType I (T1), sensillae trichodea Type I (T2), sensillae trichodeaType I (T3), sensillae chaetica, sensillae bohm, sensillae basiconicaand sensillae campaniform, while there are only three types ofTrichodea (T1, T2 & T3) on the antennae of untreated female.The study revealed that LC50 of Atabron and Admiral causedthe formation of abnormal antennae and effected the number anddistribution of the sensillae of both male and female.