Ecological studies on some optimum factors for rearing the pin; borer sesamia cretica in the laboratory

Ahmed Hosny Ahmed El-said Hammad

Maize is one of the important strategic cereals. Pink stem borer, Sesamia cretica Led. is of the most prevalent corn pests in Egypt, as larval stage infestation causes deterioration of plants in the seedling stage, this led to the many laboratory and field studies, which may require large numbers of any of the stages of the insect, so this work is considered as a trial for rearing the insect under investigation on a large scale.- The work outlined in this study aimed to the following points. :I-Determine the best artificial diet for rearing larvae of the insect under investigation on large scale.II-Determine the optimum larval density in rearing vial.III-Determine the best sex ratio of moths in mating cage.- All trials in this study was carried out under controlled laboratory condition of 27 ± 1 °C.I- Determine the best artificial diet for rearing larvae on large scale:The current study the possibility of targeted and efficient use of six artificial diet formulations for educational insect larvae under study and the effect of rearing this insect on different artificial diets on its biology have been studied. One of these diets was described by El-Mitwally et al, (1997) (Control diet) . Some modifications to the structure of this diet were made for the formation of five other diets. The best diets were selected by evaluating certain criteria, such as the durations of the various stages of the insect, the percentage of dead larvae, pupation, adult emergence, abnormal adults, abnormal pupae and hatching eggs, pupal weight, mean number of eggs per female, and mean number of fertile eggs per female. Sesamia cretica larvae were reared on six diets for four successive generations.The obtained results could be summarized as follows:-Egg incubation period: the results revealed that, the incubation period of egg was not affected by the larval diet, where averages were almost identical without moral differences between diets, where range of four generations was 4.8 — 4.9 days.- Larval duration: The development of larvae reared on diet TB was relatively faster (30.8 and 28.6 days) followed by diet T3 (35.5 and 34.2 days) then diet T1 (36.9 and34.8 days) for female and male larvae respectively, while was nearly similar for larvae which were reared on control, T4, T2 diets, where those averaged (40.8, 41.4 and 41.5 day/female) and (37.2, 39.0 and 39.8 day/male), respectively.-The percentage of larval mortality : The lowest percentage of dead larvae (6.6 %) was obtained when larvae were reared on diet TB followed by diet T1 (8.7 %) then diet T3 (12.5 %) then went up to (15.4 %) with diet T2 and then increased to 20.9 — 23.7 % with T4 and Control diets, respectively.- Percentage of pupation: Pupation percentage was the highest (93.4 — 91.3 %) with TB and T1 diets, decreased to (87.5 — 84.6 %) with dietsT3 ari d T2 diets and DROPped to (79.1 — 76.3 %) in the T4 and Control diets.-Pupal duration: In general, mean pupal durations in all diets and generations were nearly similar for both sexes, where the general average of the four generations ranged (9.0 — 10.6 days/female pupa) on diets Ti and T4 , respectively and (9.3 —10.6 days/male pupa) on diets TB and T4 ,respectively.- Mean weights of the pupae: In general, mean pupal weight of the females was steadily heavier than that of the males in all generations and diets. Heavier male and female pupae were obtained from larvae fed on diet TB than those from larvae fed on other diets, where mean female pupal weight of the four generations reached the highest (186.1 mg) on diet TB followedby diets Ti, T3 (180.6 — 180.3 mg), respectively, decreased to (174.6 — 173.6 mg) with T2, T4 diets,

respectively and DROPped to (148.3 mg) in the control diet. Also mean male pupal weight of the four generations reached the highest weight (134.5 mg) on diet TB followed by diets T 1 , T3 (132.5 — 131.3 mg), respectively while, decreased to (126.7, 126, 125.5 mg) with diets Control, T2, T4, respectively.- Percentage of deformed pupae: In general, percentage of deformed male pupae was higher than female in all generations and diets. The lowest percentage of deformed pupae was recorded on diet TB through all generations, for both sexes, where mean of deformation percentage for the four generations reached the lowest (0.3, 1.3 %) on diet TB followed by diet Ti (1.9, 2.4 %) then diet T3 (2.3, 3.0 %) and then diet T2 (2.7, 4.0 %) then went up to (4.8, 6.0 %) with diet T4 ,reached its highest rate (5.6, 8.8 %) with diet Control for females and males,respectively.-Emergence of moths: Percentage of adults, emergence was the highest with diet TB than other diets through all generations, where ranged percentage of adult emergence (92.6 -89.3 %) on diets TB T1, decreased to (85.1 — 81.7 %) with dietsT3 and T2 and DROPped to (74.7 — 70.8 %) in the diets T4 and Control, respectively.-Deformed moths: In general, percentage of deformed male moths was higher than female in all generations and diets. The lowest percentage of deformed moths was recorded on diet TB through all generations, for both sexes, where the mean percentage of deformed female moths for the four generations reached the lowest (0.3 %) on diet TB, followed by diets T1, T3 and T2 (2.0, 2.2, 2.8 %, respectively) then went up to (4.2 %) with diet T4 and reached its highest rate (6.1 %) on diet Control. Also, the mean percentage of deformed male moths reached the lowest percentage (1.6 %) on TB diet, followed by diets Ti, T3 (3.3 %), then diet T2 (4.5 %), then went up to (6.1 %) with dietT4 and reached its highest rate (9.9 %) on diet Control.- Adult longevity: Female moths lived longer than the male ones, where adult longevity of female ranged (3.9 - 5.5 days) , while ranged (3.5 - 4.4 days) for male moths. The general means of adult longevity for both sexes showed that, the difference between diets was only (0.6 day), where the longevity of female moths ranging from (4.1 days) on diet T4 to (4.7 days) on diet TB and ranging from (3.7 days) on diets T2 , T4 to (4.2 days) on diets TB, T3 for male moths.- mean eggs per female: Female moths resulted from diet TB laid generally more eggs than those laid by the females of the other diets, where the mean number of eggs per female for the four generations reached the highest rate (163.2 eggs/female) decreased to (129.1 - 123.3 eggs/female) with diets T1 and T3, respectively and decreased again to (110.2 eggs/female) with diet T2 and DROPped to (9 l .8 - 89.3 eggs/female) in diets Control and T4, respectively.- Percentage of eggs hatchability: Female moths resulted from diet TB gave the highest percent of hatchability ranging (62.7 - 75.9 %) with a general mean (68.5 %) for the four generations decreased to (58.2 - 55.3 %) with diets T1 , T3 ,respectively and also to (48.1 %) with diet T2 and DROPped to (40.9 - 38.7 %) in diets T4 and Control, respectively.- Mean fertile eggs per female: Female moths resulted from diet TB laid generally more fertile eggs than obtained from other diets, where ranging between (91.2 -133.1 fertile eggs/female) with a general mean (112.2 fertile eggs/female) for the four generations decreased to (76.4 - 68.1 fertile eggs/female) with diets Ti , T3 ,respectively and less More to (53.5 fertile eggs/female) with diet T2 and DROPped to (36.7 -35.6 fertile eggs/female) in diets T4 and Control, respectively.- Total life span (T.L.S): In general, the total life span of male was shorter than female during all generations, in all diets. The mean total life span for female for the four generations was shorter (49.4 days) on diet TB, increased to (54.6 - 55.3 days) with diets T3, T1,respectively, increased more to (60.1, 60.6,60.9) in diets Control, T2 and T4, respectively. Also mean total life span for male for the four generations was shorter (46.8 days) on diet TB, increased to (52.9 — 53.3 days) with diets T1, T3, respectively, increased more to (55.7, 58.2, 58.5 days) in the diets Control, T4 and T2, respectively.-Validity of the six artificial diets could be arranged descendingly as: TB, Ti, T3, T2, T4 and Control diet.II- Determine the optimum larval density in rearing vial:This experiment was operated on the best of artificial diet, which called TB. This experiment aimed to determine the optimum of larval density which reared on constant amount of diet (10 gm. diet for each rearing glass vial).There were five treatments as follows:(Tr 1:1 larva/vial), (Tr2: 2 larvae/vial), (Tr3 :3 larvae/vial), (Tr4: 4 larvae/vial) and (Tr5: 5 larvae/vial).The pink borer; Sesamia. cretica larvae were reared for three successive generations on different treatments.The obtained results could be summarized as follows:- Egg incubation period was not affected by the larval density, where almost similar periods were obtained with no significant differences among

different treatments, where the general mean of egg incubation period for the three generations ranged (5.2 — 5.3 days).- The larval duration of male was shorter than female through all generations and treatments. The general mean of female larvae period for the three generations ranged from (32.6 days) with treatment Tr3 to (35.5 days) with treatment Tr5, while ranged from (30.8 days) with treatment Tr2 to (34.3 days) with treatment Tr5 for male.- Larval death increased as larvae density in rearing vial increased, where the average of the larval death percentage for three generations reached the highest (69.7 %) with treatment Tr5, decreased to (56.8 %) with treatments Tr4 , then decreasedmore to (41.7 %) Tr3 and reached the lowest (9.0 — 5.0 %) with treatments Tr2 and Trl, respectively.- The pupation decreased clearly by increased larval density in rearing vial, where the mean of the pupation percentage for three generations, reached the highest (95.0 %) with treatment Tr 1, followed by treatment Tr2 (91.0 %), decreased to (58.3 %) with Tr3 , decreased more to (43.2 %) with treatment Tr4 and reached to the lowest rate (30.3) in the treatment Tr5.- Mean pupal durations in all generations and treatments were nearly similar and recorded (11.3 — 10.7 days) and (10.1 —10.8 days) for female and male pupae, respectively in the last generation.- Generally, the pupal weights of both sexes were significantly reduced by increased larval density. However, there is no significant different between mean pupal weights for the larvae which reared on Tr 1 &Tr2 treatments during the first and second generations for both sexes and also were no significant different between mean female pupae weights for the larvae which reared on Trl&. Tr2 treatments during the third generation. The general mean pupal weight of three generations for both sexes reached the highest (185.4 mg/female, 136.0 mg/male) with treatment Tr 1, followed by Tr2 (180.4 mg/female, 135.4 mg/male), decreased to (157.4 mg/female, 126.1 mg/male) with treatment Tr3, more decreased to (141.0 mg/female, 118.7 mg/male) with treatment Tr4 and DROPped to (133.2 mg/female, 113.9 mg/male) in the treatment Tr5.- Deformed pupae increased clearly by increased larval density, where the average of the deformed pupae (totality for both sexes) percentage for three generations reached the lowest (1.0 %) with treatment Tr 1, followed by Tr2 (4.6 %), increased to (18.1 %) with treatment Tr3, increased more to (29.1 %) and reached the highest (35.5 %) with treatment Tr5.-The cannibalism phenomenon did not recorded in the treatments Tr 1 and Tr2, while the rate of 3 larvae/ vial (Tr3)11caused cannibalism ranged between 1 and 2.4 % with a general mean (1.5 %), increased to (4.8 %) with treatment Tr4 and reached the highest (7.8 %) with treatment Tr5.- Adult emergence percentage was the highest with Treatment Tr 1 than other treatments through all generations, where the mean percentage of adult emergence for three generations, reached the highest (94.0 %) with treatment Tr 1, followed by treatment Tr2 (86.8 %), decreased to (46.9 %) with treatment Tr3 , decreased more to (28.8 %) with treatment Tr4 and reached to the lowest rate (17.3 %) in the treatment Tr5.- Generally, percentage of deformed the male moths was highest than female in all generations and treatments, Deformed moths increased clearly by increased larval density, where the average of the deformed female moths percentage for three generations reached the lowest (0.0 %) with treatment Trl, followed by Tr2 (1.6 %), increased to (11.3 %) with treatment Tr3, increased more to (18.9 %) with treatment Tr4 and reached the highest (29.6 %) with treatment Tr5.Also mean deformed male moths percentage for three generations reached the lowest (0.7 %) with treatment Tr 1 , followed by Tr2 (2.7 %), increased to (14.1 %) with treatment Tr3, increased more to (24.0 %) with treatment Tr4 and reached the highest (32.4 %) with treatment Tr5.- Female moths lived longer relatively than male ones. Mean periods of female moths for three generation reached the longest (5.2 - 4.8 days) with treatments Tr5 and Tr2,espectively then decreased to (3.8 - 3.7 days) with other treatments . Also for male moths reached the longest (4.4 - 4.3 days) with treatments Tr 1 and Tr2, respectively then decreased to (3.4 - 3.3 days) with other treatments.- Generally, the mean number of laying eggs per female was affected by larval rearing density in a negative correlation. The mean number of eggs/female for three generations reached the highest rate (142.9 eggs/female) with treatment Tr 1, followed by treatment Tr2 (136.6 eggs/female), decreased to (113.8eggs/female) with treatment Tr3, decreased more to (75.2 eggs/female) with treatment Tr4 and reached the lowest (65.4 eggs/female) with treatment Tr5.- The moth fecundity decreased as the number of rearing larvae per vial increased , where the average of hatchability eggs for three generations could be descendingly arranged as followed: 68.5, 65.9, 39.4, 29.5 and 22.9 % for the five treatments (Tr 1 — Tr5),

respectively.- In general, the mean number of fertile eggs per female was affected by larval rearing density in a negative correlation. The mean number of fertile eggs/female for three generations reached the highest rate (98.0 fertile eggs/female) with treatment Tr 1, followed by treatment Tr2 (90.0 fertile eggs/female), decreased to (44.9 fertile eggs/female) with treatment Tr3, decreased more to (22.3 fertile eggs/female) with treatment Tr4 and reached the lowest rate (15.1 fertile eggs/female) with treatment Tr5.- The female moths resulted from rearing on 2 larvae/vial treatment (Tr2) laid the highest number of fertile eggs per generation in all generations comparing with those of the other treatments, where the mean number of fertile eggs/generation for three generations reached the highest rate (5644 fertile eggs/generation) followed by treatment Tr 1 (4526 fertile eggs/generation), decreased to (2198 fertile eggs/generation) with treatment Tr3, decreased more to (814 fertile eggs/generation) with treatment Tr4 and reached the lowest rate (455 fertile eggs/generation) with treatment Tr5.- Mean total life span for female for three generations reached the shorter life cycle (51.9 days) with treatment Tr3, followed by Tr2 (53.0 days) while was (54.4, 54.8, 55.3 days) with treatments Tr 1, Tr4, Tr5, respectively. However mean total life span for male for three generations reached the shorter life cycle (50.0 — 50.3 days) with treatments Tr2 and Tr3, respectively while was (51.7, 52.2, 53.4 days) with treatments Tr1, Tr4, Tr5, respectively.- Validity of the five larval density treatments could be arranged descendingly as: Tr2, Tr 1, Tr3, Tr4 and Tr5 treatment.III- Determine the best sex ratio of moths in mating cage:This experiment was operated on the best of artificial diet (TB), this aimed to determine the optimum number of males and females moths in mating cage to obtain the greater number of viable fertile eggs per female.In this experiment seven treatments were employed as follows:Tml:(4 females paired with 7 males moths),Tm2:(4 females paired with 8 males moths),Tm3:(3 females paired with 5 males moths),Tm4:(1 female paired with 3 males moths),Tm5:(2 females paired with 3 males moths),Tm6: (2 females paired with 2 males moths) and Tm7:(1 female paired with 1 male moths). The pink borer; Sesamia. cretica larvae were reared for three successive generations on different treatments of sex ratio.The obtained results could be summarized as follows:- Mean eggs per female: Overall, the number of female eggs increase in the number of male and female moths with the exception of treatment Tm4:(1 female paired with 3 males moths). , treatments Tm2 and Tml gave the highest number of eggs with slight or no significant differences between them. Their average eggs number per female for the three generations was (154.5 - 152.7 eggs/female) with treatments Tml and Tm2, respectively , decreased to (126.8 — 120.4 eggs/female) with treatments Tm3 and Tm4, respectively, more decreased to (110.6 eggs/female) with treatment Tm6 and reached the lowest rate (90.3 eggs/female) with treatment Tm7.- Percentage off eggs hatchability: Female moths resulted from treatment Tml gave the highest percent of hatchability ranging (71.8 — 75.4 %) with a general mean (73.7 %) for the three generations , decreased to (66.4, 63.9 %) with treatments Tm2 and Tm4, respectively , decreased more to (60.1- 56.5 %) with treatments Tm3 and Tm5, respectively, less more (51.9 %) with treatment Tm6 and DROPped to (41.0 %) with treatment Tm7.- Mean fertile eggs per female: Female moths resulted from treatment Tml laid generally more fertile eggs than obtained from other treatment, where ranging between (107.7 -115.4 fertile eggs/female) with a general mean (112.6 fertile eggs/female) for the four generations, followed by treatment Tm2 (102.5 fertile eggs/female), decreased to (77.0 — 76.2 fertile eggs/female) with treatments Tm4 and Tm3 ,respectively ,less More to (67.2 fertile eggs/female) with treatment Tm5, and DROPped to (57.4 fertile eggs/female) with treatment Tm6, whilereached the lowest rate (37.1 fertile eggs/female) with treatment Tm7.