THE BIOLOGICAL STUDY ON *Dolycoris baccarum* (Linnaeus) (Heteroptera: Pentatomidae) IN ERBIL –KURDISTAN REGION-IRAQ

A. M. A. Mohammed[1] B. S. Abdulla[2] N. M. Abdurrahman[3]
Assistant Professer Lecturer Assistant Professer
1,3 Department of Forestry -College of Agriculture- University Salahaddin
2. Department of Biology -College of Education- University Salahaddin
Profabed57@yahoo.com banaz.sdiq77@yahoo.com

ABSTRACT

Observations on the biology of *Dolycoris baccarum* (Linnaeus)were made under room temperature conditions (26 ± 2°C; 35 ± 10% Relative Humidity) feeding stages were fed on wheat leaves and shelled Sunflower seeds. Light and dark morphs were observed for second, third, fourth and fifth instars; short fine hairs on dorsal head, thorax and abdominal of fourth and fifth instars observed; fifth instars have black and white banded antennae. The mean periods of pre-oviposition, oviposition and post-oviposition were 7.8, 33 and 2.5 days, respectively; the averages of female and male longevity were 43.3 and 36 day respectively, and mean fecundity was 102.4 eggs per female. The barrel eggs usually deposited in masses, the mean number of egg masses and the eggs per masses were 7.2 and 14.4, respectively, the mean incubation period was 7.5days, and egg hatching percentage reached to 68.410%. An average duration of the immature stages (egg to 5th instar) was 42.5 days, and the highest mortality observed in fifth instar (40.1%).

Key words: Sloe bug, egg, nymph, mortality, developmental time

دراسة حياتية لحشرة السونة *Dolycoris baccarum* (Linnaeus) (Heteroptera:Pentatomiae) في اربيل ، اقليم كوردستان–العراق .

عبدالباسط محمدامين محمد[1] بناز صديق عبدالله[2] نشأة مولود عبدالرحمن[3]
استاذ مساعد مدرس استاذ مساعد
3,1 قسم الغابات – كلية الزراعة – جامعة صلاح الدين – اربيل 2 قسم علوم الحياة – كلية التربية – جامعة صلاح الدين – اربيل
profabed57@yahoo.com banaz.sdiq77@yahoo.com

المستخلص

سجلت ملاحظات حول حياتية *Dolycoris baccarum*(Linnaeus) تحت ظروف الغرفة (26 ± 2 م° و 35 ± 10٪الرطوبة النسبية) والتغذيه على أوراق القمح ومقشر بذور زهرة الشمس. وقد لوحظ ظهور علامات داكنه و فاتحه على الأطوارالحورية الثانية والثالثة والرابعة والخامسة.ويتميز حوريات الطور الرابع والخامس بوجود الشعيرات رفيعة على الجهة الظهرية للرأس والصدر. الطور الحورى الخامس لها قرون استشعار ذات خطوط داكنة ومضيئه. و اوضحت نتائج الدراسه ان متوسط فترات ما قبل وضع البيض و وضع بيضة وبعد وضع البيض بلغت 7.8 و 33 و 2.5 أيام على التوالي و متوسط طول العمر للاناث و للذكور البالغة والمرباةعلى القمح كانت و 43.3و36ايام على التوالي ، وكان متوسط الخصوبة 102.4 بيضة لكل أنثى. البيضة برميلية الشكل وتوضع عادة في هيئة كتل و كان متوسط عدد كتل البيض وعدد البيض في كل كتلة لكل انثى 7.2 و 14.4 على التوالي، و متوسط فترة حضانة البيض 7.5 يوما، وبلغت نسبة فقس البيض 68.410٪. و متوسط مدة المراحل الاطوارغير الناضجة (من البيض إلى الطور الخامس) 42.5 يوما، ولوحظت نسبة هلاكات عالية في الطور الخامس (40.1٪).

كلمات مفتاحيه: بق سونة، بيض، حورية، هلاكات، مدة التطور

INTRODUCTION

Stink Bugs of Pentatomidae are polyphagous insects, feeding on a wide range of plants including different families such as Leguminosae, Gramineae, Solanaceae, Compositae, and Rosacea (7). Sloe bug *D. baccarum*, like other related species such as*Aelia acuminate* (L.) and *Eurygaster integriceps*putn, This polyphagous bug causes economic damage in wheat fields, particularly in warmer regions, in addition to infest about 50 species of plants, they are well-known for their ability to produce strong smelling noxious secretions from the thoracic glands in the adults and the abdominal glands in the nymphs, the diapaus in adult stage (11). The number of generations per year of this insect was depended on the temperature and photoperiod regimes (10). It is a seed-sucking bug; they suck the sap by piercing the rostrum into the plant tissue and lower its vitality; the damage is more severe on young plants. The infested plant remains stunted in growth and present a sickly appearance. Both nymph and adult of sloe bugs cause damage by feeding on various plant parts include leaves, pods, seeds and fruits (9). Daugherty (4) Mentioned that besides sucking the sap from plants, and transmit number of viral, bacterial and fungal diseases. The aim of the present work is to study the biology of Sloe bugs *D. baccarum*.

MATERIAL AND METHODS

The rearing procedure used in the study was obtained from the method described by (14). The adults of sloe bug were collected from different fields in the Erbil Proven Kurdistan regions. To conduct the biological studies the culture of sloe bugs were reared under room temperature and humidity condition (26 ± 2°C; 35 ± 10%) April 2014. Males and females in the ratio of 2:1 were kept in wooden cage (40x40x60cm), the front side made of glass and the other sides covered by mesh for aeration (with five replication). Eggs and first instars were kept in petri dishes with moistened cotton inside the wooden cage. From the second instar to adults, the insects were reared inside wooden cages, and relative humidity was supplied in moistened cotton, a bunch of wheat leaves were placed in a small tube filled with water and shelled Sunflower seeds were used as food from the second instar to the adult stages, the food and moistened cotton were replaced every three days to maintain a clean rearing environment. Means of periods related to oviposition, number of eggs per mass, total number of eggs per female, longevity of the adult female, and male, duration of egg incubation, hatching percentage, immature development time, and mortality of *D. baccarum* were recorded under room condition. Data on immature were obtained with daily observations after oviposition. Mean of stage specific mortality of eggs and each nymphal stage was calculated (18). Statistical analysis was performed by using standard error (SE).

RESULTS AND DISCUSSION

Number of eggs per female, eggs incubation and Hatching.

The eggs are barrel shaped and reticulate sculptured with a pseudoperculum apically, they are laid in mass and arranged regularly in rows and which firmly stuck together and glued vertically to the host by sticky secretion from the accessory gland(Fig.1), egg masses collected from leaf underside (55%), leaf upper side (10%), stem (14%) and cage wall (21%), the eggs are brown in color and become light brown after hatching, the egg burster is well developed and T-shaped is present beneath the pseudoperculum. The mean (±SE) of pre-oviposition period was 7.8±0.19 (range 6-9 days), oveposition period was 33±0.30 (range 31-38 days), and post oviposition period was 2.5±0.21(range 1-2 days) (Table1). In another study of (1) found these parameters for *Carpocoris coreanus* Distant were 8.2, 34.8 and 4 days respectively for pre-oviposition, oveposition and post oviposition periods at 25 C^{o} and 33% R.H. The total mean number of eggs (±SE) oviposited per female was 102.6±8.9 or the mean number of **(**egg masses and the eggs per masses) was 7.2±1.17 (range 6-9 masses)and14.4±0.72 (range 12-16 eggs per masses),respectively (Table 1 and Fig.1). Pentatomidae usually have seven ovarioles in each ovary (13), which seems to be the case of *D. baccarum*,despite the fixed number of ovarioles among pentatomids, the number of eggs per mass can be strongly influenced by the oviposition strategy of each species. The oviposition strategy can be defined as the most frequent

number of eggs per mass, which is relatively constant within stink bugs species (6) Matesco *et al*., (8) Recorded that each female of *Chinavia longicorialis* (Breddin) laid an average of 5.8 ± 3.86 egg mass and 103.8 ± 91.78 eggs and with a marked peak at 17.7 ± 7.38 eggs per egg mass. The median longevities of females and males (±SE) measured under room conditions was 43.3±3.6 days (range 40-45) and 36.0±2.4 days (range 34-38) respectively (Table 1). The result indicated that the females lived longer time than the male. This result close to that of Halnan *et al.*,(5) who indicated that the female of *Acrosternum marginatum* lived mean of 44.4 ± 2.84 days. (15) Found that the female and male adults of painted bug *Bagrada cruciferarum* survived for 25.9 and 20.9 during April, respectively.

Figure 1. *D. baccarum*egg mass (40X).

Table 1.Reproductive parameters for female of D. *baccarum* under room conditions (26 ± 2°C; 35 ± 10%).

Biological periods	Mean ±SE
Preoviposition period (day)	7.8±0.19
Oviposition period (day)	33±0.30
postoviposition period (day)	2.5±0.21
Number of egg masses per female	9.0±0.17
Number of eggs per masses	14.4±0.72
Total no. of eggs per female	102.6±8. 9
Hatching percent	68.4±4.10
Longevity of adult female (day)	43.3±3.6
Longevity of adult male (day)	36.0±2.4

Lifetime fecundity of sloe bugs ranged from 84.6 to115.5 eggs per female, the median fecundity was 102.6 eggs per female. The mean of incubation period (±SE) was 7.5±1.55 (range 6-9) days (Table 2). Shafi *et al*., (14) stated that the incubation period of *D. indicus* Stal ranged from 3 to 6 days. Egg hatching begins with peristaltic contraction of the body of the hatched nymph from the posterior to anterior which forces the blunt sclerotized tooth of the egg burster, against the anterior pole of the eggs. During hatching the pseudo operculum is lifted and smoothly detached from the remainder of the egg shell (2). The hatched nymph through the caused foramen pushes its head after the widening the preformation by using the legs crawls gradually to get rid of egg shell leaving it as an empty sac, hatching process lasts about 20-50 minutes. The percentage of egg hatching reached to an average of 68.4±4.10 eggs (range 60.6-80.9) (Table1). In a similar study of (1) on *C. coreanus*whoindicated that the percentage of hatching ranged from 66.6 %to 88.8% with the average 79.4. The mean mortality percent (±SE)of this stage was31.6 ± 1.25 (Table 2).

Biology of Nymphal instars

The sloe bugs have five nymphal instars before coming adults. The nymphal instars are different on the basis of body structure. (17)Velasco and Walter Stated that stink bugs *Nezara viridula* develop through five nymphal instars.

Ist instar:

Body round and strongly convex, on eclosion the nymph were pale yellow, but darkened after 1-2h to mottled brown and yellow color (Fig.2). The newly hatched nymph remains inactive and aggregated around the empty egg for approximately 1 day. Feeding does not occur during this stage, later they become active. Mean development time (±SE) and mortality percent (±SE) of first instars were 5.0± 0.90 days and 8.8 ± 5.10 % respectively (Table 2).

Figure 2. First nymphal instar of *D. baccarum* (40X)

2nd instar: Body round and convex, dark morph resembles first instar except an white sub median areas of abdomen and a series of brown maculae dorsally on the abdomen (Fig.3). Feeding starts from this stage. Mean development time (±SE) and mean mortality percent (±SE) of the second instars were 6.0± 1.28 days and 14.7 ± 8.91% respectively (Table 2).

Figure 3. Second nymphal instar of *D. baccarum* (20X)

3rd instar: Body oval and less convex than first and second instar, light morph, general color mostly light brown, except the dark brown maculae on thorax and abdomen, with punctures on dorsal head, thorax and abdomen (Fig.4). Mean development time (±SE) and mortality percent (±SE) of the third instars were 6.5± 1.35 days and 25.3 ± 10.72 % respectively (Table 2).

Figure 4. Third nymphal instar of *D. baccarum* (20X)

4th instar: Body less oval than third instar, general color mostly brown, except the dark maculae on thorax and abdomen, with punctures and short fine hairs on dorsal head, thorax and abdomen, mesothorax wing pads developed; metathorax wing pads undeveloped; metasternal scent glands ostiole with peritreme and evaporatoria slightly developed; sexes not differentiated (Fig.5). Mean development time (±SE) and mean mortality percent (±SE) of the fourth instars were 8.0± 1.63 days and 32.5± 11.62 % respectively (Table 2).

Figure 5. Fourth nymphal instar of *D. baccarum* (20X)

5th instar: Body oval resembles fourth instar except in having, darker morph, and general color mostly dark brown; darker maculae on thorax and abdomen, densely punctuate with small hairs, however it is distinctly hairy, especially underneath, this is always a useful distinguishing character; characteristically

have black and white banded antennae; meso and meta thorax wing pads well developed never extending beyond middle of abdomen; scutellum broadly triangular; metasternal scent glands ostiole with peritreme and evaporatoria developed (Fig.6). Abdomen with connexiva developed; male and female external genitalic structures indistinctly differentiated. Mean development time (±SE) and mean mortality percent (±SE) of the fifth instars were 9.5± 1.98 days and 40.1 ± 13.39 % respectively (Table 2).

Figure 6.Fifth nymphal instar of *D. baccarum* (X).

Table 2. Duration (in days) of egg incubation and nymphal stages of D. baccarum reared under room conditions.

Stage	Duration (Day) (mean ± SD)	Range (Day)	Mortality (%) (mean ± SD)	Range (%)
Egg	**7.5± 1.55**	**6-9**	**31.6 ± 1.25**	**29-33**
Instars				
1st	**5.0± 0.90**	**4-6**	**8.8 ± 5.10**	**8-9**
2nd	**6.0± 1.28**	**5-8**	**14.7 ± 8.91**	**13-16**
3rd	**6.5± 1.35**	**5-7**	**25.3 ± 10.72**	**24-27**
4th	**8.0± 1.63**	**7-9**	**32.5± 11.62**	**31-34**
5th	**9.5± 1.98**	**8-11**	**40.1 ± 13.39**	**38-42**
Egg to adult	**42.5**	**35-50**		

Usually, nymphs of sloe bugs show an increase in mortality rates as in its duration, with higher values during the fifth instar (Table 2), in which the quality and quantity of food are important due to the storage of nutrients for the final moulting and adult activities, as flight and reproduction (12). The high mortality also observed from second to fifth instar (82.4%) in *C. longicorialis*reared on green beans (*Phaseolus vulgaris* L.) (8). Mean developmental time from egg to adult instar in our study reached to 42.5 days (table2), were very similar to the results of previous researchers who found that the average duration of immature stages (egg to adult) was 41.1 days at 24 ± 1 C° and 70 ± 10% R.H. From the second instar on, quality and quantity of food resources have great influence on immature performance of *Nezara virdula* (16). in another study of Conradi-larsen and Somme(3) on the same species of our study recorded 48 to 52 days (egg to adult) at 21C°; but in the species *D. indicus* under laboratory conditions reached 23-30 days (14); from first to fifth instars in *C. fuscispinus* takes 45 days (6) and for *C. coreanus* takes 42 days (1).

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