RESEARCH PAPER

Some Biological Aspects Of *Carpocoris coreanus* Distant (Hemiptera: Pentatomidae) In Kurdistan Region-Iraq

Banaz Sedik Abdulla1, Nabel Abdulkader Moulod2, Abdulbaset M. Amin Mohammed3

1 Department of Biology - College of Education - Salahaddin University-Erbil, Kurdistan region, Iraq.
2 Department of Plant protection - College of Agriculture - Salahaddin University-Erbil, Kurdistan Region-Iraq.
3 Department of Forestry - College of Agriculture - Salahaddin University - Erbil, Kurdistan Region-Iraq.

**ABSTRACT:**
The biological study of *Carpocoris coreanus* Distant carried out in March 2011 on wild mustard *Brassica nigra* (L.) at 25 C° and 33% R.H. It has been found that the overwintered adult in the hibernated region of stink bug *C. coreanus* began their activity in March of 2011, which overwinters inside the adult stage. The mean period of pre-oviposition, oviposition and post-oviposition were reached 8.2, 34.8 and 4 days, respectively. The average of adult longevity on mustard was 37.2 days for male and 46.6 days for female. The egg is barrel, brownish when newly laid, usually deposited in masses egg mass number of *C. coreanus* in this study averaged 8 masses/female, with an average 15.7 eggs/mass. The mean incubation period was 12 days, and egg hatching ratio approached 79.4%. The nymphs completed their development within five instars, with the mean period of 6.5±0.83, 7.8±1.15, 7.3±0.66, 9.3±0.66 and 12.8±0.96 days for the 1st, 2nd, 3rd, 4th and 5th nymphal instars, respectively. It was found that stink bug *C. coreanus* has one generation per year.

**KEY WORDS:** Sunn bug, egg, nymph, developmental time.

DOI: [http://dx.doi.org/10.21271/ZJPAS.31.2.11](http://dx.doi.org/10.21271/ZJPAS.31.2.11)
ZJPAS (2019), 31(2):79-88.

**INTRODUCTION:**

Pentatomidae, is member of the order Hemiptera, suborder Hetroptera, they occur in the super family Pentatomoidea, commonly known as stink bugs, are worldwide in distribution with approximately 760 genera and 4100 described species (Schuh and Slater, 1995). The majority of economical important stink bugs belong to subfamily Pentatominae (Panizzi, 1997).

Members of this family are characterized by round or oval bodies, with five-segmented antenna, tibia bristly rather than spiny, three-segmented tarsus and scutellum that is more or less triangular in shape almost rarely covering the abdomen (Panizzi, 1997, Panizzi et al., 2000). They are called stink bugs because they discharge a strong disagreeable scent (odor), by means of their scent gland (Alston and Reding, 2003).

The stink bugs undergo incomplete metamorphosis, their eggs hatch to nymphs that develop to adults (McBrien and Millar, 1999). They have single generation annually and in almost all species the adult is the overwinter stage (Dolling, 1999). The Family is very important
from an agricultural point of view, they feed by inserting their styletes into the food source to suck up nutrients so they cause injury to plant tissue, resulting the plant wilt (Pannizzi, 1997, McBrian and Millar, 1999, Panizzi et al.,2000). Because some feed on several plant species of economic importance they are regarded as major pests. Among the more widespread species are the Dolycoris baccarum (L.) Piezodorus lituratus (Fab.), Carpocoris mediterraneus (Tam), C. Purpureipennis (Degger), Eurydema ornatum (Linnaeus), Codophila varia (Fabr.) and Aelia acuminate (Linnaeus) (Dolling, 1999, Nihataktak 1999). The aim of this work is to study some biological aspects of Carpocoris coreanus which was important for integral pest management.

**Materials and Methods**

The biological study of C. coreanus Distant was performed in the Erbil City by rearing the insects from eggs to adult inside wooden cages (30x30x60 cm) the front side made of glass and the other sides covered by mesh. The adult bugs were collected from different sites in Erbil county Kurdistan region, and transferred to wooden cages for biological study. Each couple were captured in one cage, the cage contain fresh plants of mustard Brassica nigra (L.) were placed in small tubes filled with water, (with five replication) to determine oviposition; egg incubation period; nymph development and adult life span. Young sugar beet plants, shelled sunflower seeds, moist cotton served as a source of food and water. Eggs on leaves were carefully transferred to Petri-dishes with moist filter paper and moist cotton, recorded observation daily till hatching the eggs. One day first nymphal instar remained on their egg shells, while second nymphal instar moved more freely inside the petri-dish. Fresh plants of mustard and sunflower seeds were provided every second or third day during nymphal growth period. In addition of cotton soaked in water or in 10% of honey solution, sprinkled with a small amount of yeast extract (Conradi-larsen and Somme 1973.

**Overwintering.**

To find the sites as habitat for winter hibernation, a survey was done in many places, in Erbil governorate. Many visits were performed in different time in those places. The visits were done during November 2011 to March 2012. This process included the observation of all parts of the fruit, non-fruit trees, wild plants and shrubs grow in these regions (Mohammed, 2009).

**Results and Discussions**

**1-Pre oviposition, oviposition and post oviposition periods.**

The pre-oviposition period ranged (Nihataktak 1999, Mcpherson, 1982) from March 10 to March 20/ 2011. The females started laying eggs on March 18 and continued until April 25/ 2011, the oviposition period ranged from (33 - 36) days and the post-oviposition period ranged from (3 - 5) days, with an average of 8.2, 34.8 and 4 respectively for pre-oviposition, oviposition and post oviposition periods at 25 C° and 33% R.H as shows in Table-1. Mating started in spring and eggs are laid in masses on leaves and twigs of host plants (Mcpherson, 1982). Mating is done back to back, usually begins with the male courtshiping the females, but eventually concert rating on or near the tip female abdomen this may be sufficient to stimulate the female to raise the tip of female abdomen for aedeagus insertion. If successful, copulation last for several hours, in this end to end position, and both individuals may feed during this time (Mcpherson and Mcpherson, 2000). These results agreed with that of (Hallnan et al., 1992) who mentioned that the mean of pre-oviposition period of Acrosternum marginatum reached to 10.1 ±1.31 days. Nielsen et al., (2008) found that the pre-oviposition period for Halymorpha halys (Stal.) averaged 13.35. Mohammed , (2009) indicated that the pre-oviposition period ranged between 3-6 days for the first generation of A. amygdali, but the overwintered females of the second generation have along pre-oviposition period began to lay their eggs after hibernation.
2- Adult Longevity.

The life span of adult in outdoor cages takes an average of 43.3 and 37.2 days for female and male respectively, at 25 C° and 33% R.H (Table -2). The result indicated that the females lived longer time than the male. This result nears with that of Panizzi et al., (2000) who indicated that

Table (1): Pre-oviposition, oviposition and post-oviposition periods of *C. coreanus*

Distant, in outdoor conditions in Erbil City at 25 C° and 33% R.H.

| Cage No. | Pre – oviposition period | Oviposition period | Post- oviposition period | Total days |
|----------|--------------------------|--------------------|--------------------------|------------|
|          | Dates                    | Days               | Dates                    | Days       | Dates         | Days |
| 1        | 10/3-18/3/2011           | 8                  | 19/3-23/4/2011           | 36         | 24/4-28/4/2011| 5   |
| 2        | 10/3-17/3/2011           | 7                  | 18/3-19/4/2011           | 33         | 20/4-23/4/2011| 4   |
| 3        | 10/3-20/3/2011           | 10                 | 21/3-25/4/2011           | 36         | 26/4-28/4/2011| 4   |
| 4        | 10/3-19/3/2011           | 9                  | 20/3-23/4/2011           | 35         | 24/4-26/4/2011| 3   |
| 5        | 10/3-17/3/2011           | 7                  | 18/3-20/4/2011           | 34         | 21/4-24/4/2011| 4   |
| Avg.     | 8.2                      |                    | 34.8                     | 4          |                | 47  |

Table (2): Longevity of adult *C.coreanus* Distant in outdoor conditions in Erbil city at 25 C° and 33% R.H.

| Cage No. | Female life span | Male life span |
|----------|------------------|----------------|
|          | period           | Days           | period           | Days           |
| 1        | 10/3-18/4/2011   | 43             | 10/3-19/4/2011   | 41             |
| 2        | 10/3-23/4/2011   | 44             | 10/3-14/4/2011   | 36             |
| 3        | 10/3-28/4/2011   | 40             | 10/3-5/4/2011    | 37             |
| 4        | 10/3-26/4/2011   | 45             | 10/3-28/4/2011   | 32             |
| 5        | 10/3-24/4/2011   | 44             | 10/3-10/5/2011   | 40             |
| Avg.     | 43.3             |                | 37.2             |                |
3-Female oviposition behavior.

Eggs are barrel-shaped with a detachable cap (pseudoperculum), dull brownish color when freshly laid, then changed to light color and laid in masses, closely packed in four irregular rows (Fig.1-A). There are differences in the number of mass and the number of eggs per mass which are laid by each female. These results confirmed with that of Southwood, (1956) who pointed that the Pentatomide eggs, always oviposited in clusters, they are characterized by their shapes (barrel and cylindrical or spherical), and variable degree of chorion ornamentation and with Javahery, (1994) mentioned that the eggs of C. coreanus are barrel-shaped, brownish and laid in masses of 14 eggs in four rows. From the data obtained in the (Table -3) number of masses ranged between (5-10) mass, with an average of 8 masses average number of eggs per mass ranged from (14 -17.2) eggs at 25 Cº and 33% R.H which firmly stuck together and adhere to the host by a sticky secretion from the accessory glands, with a total of (86 - 148) eggs per female.

Eggs are laid in various parts of host particularly on the lower surface of leaves and the wall of the petri dish. These results agreed with Mcpherson, (1982) who indicated that the eggs are laid in masses on various exposed parts of the plant, particularly on leaves, and fixed by sticky secretion. Also with Todd, (1989) who suggested that the southern stink bugs laid eggs under surface of leaves. And with Candan and Suludere, (1999) who reported that each female of C. pudicus generally deposited 14 barrel-shaped eggs in a mass. Stink bug eggs are deposited on host plants in polygonal masses. Each mass may contain several to more than 70 barrel-shaped eggs that are tightly packed in rows (Bunddy and Mcpherson, 2000). Mcpherson and Mcpherson, (2000) reported that the green stinkbug Nezara viridula deposited lemon yellow to pea green eggs in loosely uniform rows, each egg masses have been consisting of a maximum of 40 to 69 eggs. In another biological study, Panizzie et al., (2000) found that Piezoros lituratus eggs are barrel-shaped, blackish color with two circles of white or creams band. Bernon, (2000) observed that the stink bug Acrosternum hilare always laid egg masses on underside of leaves, not near the leaf margin. Matesco et al., (2007) found that each female of Chinavia pengue (Roston) laid an average of 15.9±4.18 egg mass and 218.8 ±48.69 eggs with a marked peak at 14 eggs per egg mass. Mohammed, (2009) observed that the female of A. amygdali laid its eggs in masses usually 14 eggs per each mass.

Eggs hatching.

(Table -4) shows that the mass contains an average of 15 eggs, and takes an average 12 days of incubation period at 25 Cº and 33% R.H the percentage of hatching ranged from 66.6 to 88.8% with the average 79.4% at 25 Cº and 33% R.H. Eggs were found in both of plant parts and the wall of the petri-dish. Hatching begin 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. Egg bursters of C. coreanus are T-shaped and dark color as shows in (Photo.1-B). The egg burster is a median sclerotized area of the embryonic cuticle that is present in 35 species of pentatomomidea (Javahery 1994). These results agreed with Southwood, (1956) who pointed that the pentatominae egg-burster is well

### Table (3): Oviposition behavior of C. coreans Distant in outdoor conditions in Erbil City at 25 Cº and 33% R.H.

| Cage No. | Egg Masses | Avg. No. Eggs per mass | Total eggs |
|----------|------------|------------------------|------------|
| 1        | 7          | 16±1.3                 | 112        |
| 2        | 5          | 17.2±0.16              | 86         |
| 3        | 10         | 14.8±0.91              | 148        |
| 4        | 10         | 14.0±0.77              | 140        |
| 5        | 8          | 16.5±0.72              | 132        |
| Avg.     | 8          | 15.7                   | 123        |
marked and T-shaped. Also with Puchkoval, (1961) who indicated that the inverted T-shaped egg burster found in eggs of various species of pentatomoidea such as Sciocoris sulcaus, Bagrada stolata, Palomena prasina and Pentatoma rufipers; other species like D. baccarum and Piezodorus lituratus have Y-shaped egg burster. Candan and Suludere, (1999) in their studies on the external morphology of C. pudics eggs founded that the T-shaped egg bursters are dark and sclerotized. The incubation period of A. hilari eggs takes (10 – 15) days (Bensebbane, 1981). Javahery, (1994) indicated that the incubation period takes 14 to15 days of C. fuscispinus eggs in the field. N. viridula eggs require 6 days of incubation at 33 Cº (Mcpherson and Mcpherson, 2000). According to Mohammed, (2009) the mean incubation period for A. amygdali eggs on the apricot tree was 3.5 days at 36.05 Cº and 31% R.H.

Saruhan et al., (2010) in their biological studies on the development of Palomena prasina, showed the incubation period and hatching ratio were 5.47 days and 90.7 %, respectively at 28 Cº.

| Eggs masses No. | No. of eggs/masses | Incubation period (Days) | Hatching % |
|----------------|---------------------|--------------------------|------------|
| 1              | 18                  | 14                       | 88.8       |
| 2              | 14                  | 10                       | 78.5       |
| 3              | 16                  | 12                       | 66.6       |
| 4              | 15                  | 12                       | 76.9       |
| 5              | 13                  | 10                       | 78.9       |
| 6              | 14                  | 14                       | 87.5       |
| Avg.           | 15                  | 12                       | 79.4       |

Table (4): Number of eggs per mass, incubation period and hatching percent of C. coreanus Distant in outdoor conditions in Erbil City at 25 Cº and 33% R.H. .

Figure (1): Egg masses of C. coreanus Distant (A) New laid eggs; (B) Hatched eggs.
5- Nymphal development.
Data in the (Table-5) shows the nymphal stages specific development rate. The mean duration in day of 1st, 2nd, 3rd, 4th and 5th instars was 6.5 ± 0.83, 7.8 ± 1.15, 7.3 ± 0.66, and 9.3 ± 0.66 and 12.8 ± 0.96 days, respectively. Nymphal development takes 42.7 days at 25 C° and 33% R.H.

R.H. Nymphs of C. coreanus hatch from the eggs and pass through five instars before becoming adults. First nymphal instar (Figure.2-A), aggregated and remain clustered around egg masses until molting to the second instar and remain inactive without feeding, feeding activity begins during the second instar, and generally a quire food by puncturing plant tissues with their piercing sucking mouthparts and removing cell content, as the bugs pass through the remaining instars (Figure. 2-A, B, C, D, E and F) until change occurs in the marking, patterns, and number of punctures, setae and development of the wing pads (Panizzi 1997). Wing pads are distinctive in the fourth and fifth instar, that they can be used to distinguish these instars from each other and from younger instar (Mcpherson and Mcpherson, 2000). Aggregation is believed to occur as a defensive strategy against predator uptake of symbionts from the eggs, or for improved humidity control and is believed to development time (26,11,27 and 13) . Dolling (1991) suggested they stay clustered on the remains of the egg-mass, ingesting the symbiotic bacteria that the female smeared on the eggs as she laid them. This result agreed with Todd , (1989) who suggested that the first instar nymph enclose within five days, and remain aggregated on or near the egg mass without feeding, then the nymph begin to disperse slightly and feed after the first molt, but aggregation may continue through the third molt, this nymphal aggregation up to the fourth instars may provide a measure of protection from predator. Conradi- Larsen and Somme , (1973) recorded that the development from egg to adult of D. baccarum at 21 C° takes 48 to 52 days. Nymphal development from 1st to 5th instars in C. fuscispinus takes 45 days (Javahery, 1994). Gyeitshen et al., (2005) indicated that the brown marmored stink bug Halys dentatus (F.) has five nymphal instars, and each stages lasts approximately one week, depending upon temperature. mentioned that the period of the five nymphal instar of A. amygdali lasted a mean period of 4.0, 7.7, 7.8, 8.7 and 9.3 days for the 1st, 2nd, 3rd, 4th and 5th nymphal instars, respectively.

| Instars | No. of nymph | Nymphal period( days) |
|---------|--------------|-----------------------|
|         |              | Range                 | Average               |
| 1st     | 20           | 5-7                   | 6.5±0.83              |
| 2nd     | 19           | 6-9                   | 7.8±1.15              |
| 3rd     | 17           | 6-8                   | 7.3±0.66              |
| 4th     | 14           | 8-10                  | 9.3±0.66              |
| 5th     | 12           | 12-14                 | 12.8±0.96             |
| Total   | 82           | 37-48                 | 42.7                  |
Figure (2): Nymphal instars of *C. coreanus* Distant (A) first nymphal instar (B) First nymphal instar aggregation (C) Second nymphal instar (D) Third nymphal instar (E) Fourth nymphal instar (F) Fifth nymphal instar.
Figure (3): *C. coreanus* Distant adult stage (A) Male (B) Female.
6 - Overwintering

Field observation indicated that the *C. coreanus* overwinter in adult stage and has only one generation per year. They hide under many wild plants and debris through aestivation and hibernation, it has been found that aestivation spend underneath the plants like *Astragalus russelli*, *Thymbra vlugris* (Thyme), also under, the falling leaves of *Quercus aegiliops* L. and *Pistacia atlantica*. These plants grow naturally on the top of the mountains at different altitudes, generally higher than 1900 meters they do not exist in mountain side or at the base, and in addition to providing shelter to adult they protect the insect from critical conditions of temperature, relative humidity, wind, sunlight and natural enemies. Stink bugs move from wild host plants to cultivated field crops coincides with seed development stages of the hosts, then become active in the spring, and have been observed as early in March. Kobayashi, (1972) suggested that *D. baccarum* has a bivoltine life cycle in. Jones and Sullivan, (1981) reported winter mortality levels and spring emergence pattern among several hemipterans from various overwintering habitats. Adult species of *Carpocoris* enter aestivation on the mountain summit and then they resume their movement from the top to the mountain sides toward to the base of the mountain for overwintering. They hide under fallen leaves and rocks for months, this migration perform by the insects to protect itself against the winter condition. Javahery, (1994) indicated that *C. fuscispinus* migrate to higher altitudes during early summer and returns to the breeding areas during the following spring. Overwintered adults appear in the field during April to May and feed on green shoots, leaves and stems. Yousif, (1995) found that the stink bug *A. amygdali* spend the winter in adult stage from the 4th week of November 1993 till the end of April 1994. Mcpherson and Mcpherso, (2000) indicated that the brown stink bugs are bivoltin, while green stink bugs have been reported as both univoltin and bivoltin depending upon its geographical location. Mohammed, (2002) reported that the stink bug *D. baccarum* used Safeen Mountain in Erbil governorate for hibernation. Bernon, (2004) observed adults of stink bug *H. halys* were leaving overwintering sites at the end of April near the Rodale tree farm site, and not observed on host plants at the monitoring site until late May. Mehmet and Ozlem, (2005) reported that prediapauing adults of *D. baccarum* and *P. lituratus* spend the summer in fields, while diapausing individual spend the winter in overwintering localities under stones and wild plants. Adults of *D. baccarum* started reproduction soon after adult emergence under long-day condition while they entered diapause under short-day condition (Nakamura and Numata, 2006).

References:

Alston, D. G. and Reding, M. E. (2003). Cat-Facing insects (Lygus bugs, stink bugs and box elder bugs) on tree fruits. Extension entomology, department of biology. London, UT 84322. Uton state university.

Bernon, G. (2004). Biolog of Halyomorpha halys, the Brown Marmorated stink bug (BMSB). Final report –U.S Dep. Agric. APHIS CPHST http://cphst.aphis.usda.gov/docs/Bernonfinal report T3P01.

Bensebbane, C.G. (1981). Les punaises des bles en. Algeric. Bull. OEPP, 71: 33-38.

Bunddy, C. S. and McPherson, R. M. (2000). Morphological examination of stink bugs (Heteroptera: Pentatomidae) eggs on cotton and soybean with a key to genera. Ann. Entomol. Soc. Am., 93:616-624.

Candan, S. and Suludere, Z. (1999). External morphology of eggs of *Carpocoris pudicus* (Poda, 1761) (Heteroptera: Pentatomidae). J. Entomol. Soc. Res., 1(2):21-26.

Conradi-larsen, E. and Somme, L. (1973). Note on the biology of Dolyceoris baccarum L. (Heteroptera: Pentatomidae) Nor. Entomol. Tidsskr. 20:245-247.

Dolling, W. R. (1991). The Hemiptera. Oxford: Oxford University press 274pp.

Gyeltschen, J.; Bernon, G. and Hodes, A. (2005). Brown marmorated stink bug Halyomorpha halys Stal (Insecta: Hemiptera: Pentatomidae). Florida Cooperative Extension service.Unvercity of Floridae.p.

Hallnan, G. J., Morales, C. G. and Dugue, M. C. (1992). Biology of Acrosternum marginatum (Heteroptera:
Pentatomidae) on common bean. Florida Entomologist, 75(2): 190-197.

Jawahery, M. (1994). Development of eggs in some true bugs (Hemiptera-Heteroptera). Part 1, Pentatomiodea. Can. Entomol., 126: 401-433.

Jones, W. A. and Sullivan, M. J. (1981). Overwintering habits, spring emergence patterns and winter mortality of some South Carolina Hemiptera. Environ. Entomol., 10: 409-414.

Kobayashi, T. (1972). Biology of insect pests of soybean and their control. JARQ., 6 (4):212-218.

Matesco, V. C.; Schwertner, C. F. and Grazia, J. (2007). Morphology of the immature and Biology of Chinavia pengue (Rolston) (Hemiptera: Pentatomiodea). Revista Brasileira de Entomologia, 51(1): 93-100.

McBrien, H. L. and Millar, J. G. (1999). Phytophagous bugs. In: Hardy, J. and Minks, A. K (Eds) Pheromones of non-lepidopteran insects associated with agricultural plants. CABI International. Wallingford. Oxon OX10 8DE, UK.: 277-304.

McPherson, J. E. (1982). The pentatomidea (Hemiptera) of North America with emphasis on the found of Illinois. Southern Illinois Univ. press. Carbondale and Edwardsville – 240pp.

McPherson, J. E. and McPherson, R. M. (2000). Stink bugs of economic importance in America North of Mexico. CRC Press II.C. 474 pp. In Scheafer, C. W. and Panizzi, A. R., (eds) Heteroptera of Economic Importance. Boca Raton: CRC Press, 828pp.

Nihataktak, M. F. (1999). Taxonomic and faunistic studies of the fauna Pentatomidae (Heteroptera) in the region of Erdin. Tr. J. Zool., 23(2): 377-395.

Panizzi, A. R. (1997). Wild host of pentatomids: Ecological significance and role in their pest status on crops. Ann. Rev. Entomol., 42: 99-122.

Pannizi, A. R.; McPherson, J. E.; James, D. G.; Jawahery, M. and McPherson, R. M. (2000). Stink bugs (pentatomidae). 421-474 pp. In Scheafer, C. W. and Panizzi, A. R., (eds) Heteroptera of Economic Importance. Boca Raton: CRC Press, 828pp.

Puchkoval, L.V. (1961). The eggs of Hemiptera VI. Pentatomoidea; 2. Pentatomiidae and Plataspidae. Rev. Entomol., 40:131-141.

Sarukhan, I.; Tuncer, C. and Akca, I. (2010). Development of green shield bug Palomena prasina L. (Heteroptera: Pentatomiidae) in different temperature. Zemdiobyste - Agriculture, 97(1): 55-60.

Schuh, R. T and Slater, J. A. (1995). True bugs of the world (Hemiptera: Heteroptera). Classification and Natural History. Ithaca and London: Cornell University press Xii 349pp.

Singii, H. and Malik, V. S. (1993). Biology of painted bug Bagrada cruciferarum. Indian. J. Agric. Sci., 63(10):672-674.

Southwood, T. R. E. (1956). The structure of the eggs of the terrestrial Heteroptera and its relationship to the classification of the group. Trans. R. Entomol. Soc. Lond., 108:163-221.

Todd, J.W. (1989). Ecology and behavior of Nezara viridula. Ann. Rev. Entomol., 34:274-292.

Yousif, A. H. (1995). Ecological and Biologica Istudies of the Fruit tree bark bug Apodiphus amygdali (Germar) (Hemiptera: Pentatomidae).M.Sc. Thesis University of Bagdad, Iraq.46pp.