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MASS REARING OF *RHYNOCORIS MARGINATUS* FAB. ON LIVE AND FROZEN LARVAE OF *CORCYRA CEPHALONICA* STAINTON

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Rhynocoris marginatus (Fab.) is a predator of larvae and nymphs of many pestiferous insects for which natural enemies are not commercially available. This paper describes a containerised laboratory mass-rearing method for *R. marginatus* using refrigerated-killed larvae of *Corcyra cephalonica* Stainton (Lepidoptera: Pyralidae). Cold-killed larvae prolong the nymphal developmental period; reduce the fecundity and hatchability, net reproductive rate and pre-oviposition time. The rearing method avoids the need for live insect prey, reduce the predatory rate and labour efficient. Frozen larvae had no impact on female body weight, innate capacity for increase in number, corrected generation time, weekly multiplication and doubling time. Cold-killed *C. cephalonica* larvae provided predator oviposit latter and laid eggs for many days and also reduce the nymphal mortality. Predatory behaviour studies show that this predator predates both alive and cold-killed preys.

***Rhynocoris marginatus*, laboratory rearing, *Corcyra cephalonica*, frozen larvae, biology, fecundity, predatory behaviour, life table**

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Rhynocoris marginatus F. je predator ličinki i kukuljica mnogih štetnih kukaca za čije suzbijanje nema komercijalno raspoloživih prirodnih neprijatelja. Ovaj rad opisuje metodu laboratorijskog masovnog uzgoja koristeći smrzavanjem ubijene ličinke vrste *Corcyra cephalonica* Stainton (Lep.: Pyralidae). Hladnoćom ubijene ličinke produljuju razdoblje razvoja kukuljica, smanjuju plodnost i postotak izlaska iz jaja, neto reproduktivni omjer i vrijeme preovipozicije. Metoda izbjegava potrebu za živim domaćinom, smanjuje omjer predatorstva i radno vrijeme. Smrznute ličinke ne utječu na težinu ženki, sposobnost povećanja brojnosti, trajanje generacija, tjednu multiplikaciju i vrijeme podvostručenja populacije, produljuju vrijeme ovipozicije i smanjuju smrtnost kukuljica. Istraživanja ponašanja ukazuju da ova predatorska vrsta napada živog i hladnoćom ubijenog domaćina.

***Rhynocoris marginatus*, laboratorijski uzgoj, *Corcyra cephalonica*, smrznute ličinke, biologija, plodnost, ponašanje predatora**

Introduction

Hemipteran predators are important biological control agents of many agricultural insect pests (BIEYER and CHAUVIN, 1992, CLOUTIER and BAUDUIN, 1995, AMBROSE, 1995 and SAHAYARAJ, 2000). Of this group, reduviids are one of the least researched and most poorly understood families, although evidence in support of their potential in biological control is accumulating (SCHAEFER AND AHMAD, 1987; JAMES, 1994, AMBROSE, 1999, GRUNDY and MAELZER, 2000 and SAHAYARAJ, 2001). *Rhynocoris marginatus* (Fab.) (Reduvvidae : Hemiptera) has been reported as a biological control agent of many agricultural and forest insect pests like *Earias fabia* Stal (JOSEPH, 1959 and AMBROSE, 1988); *Dysdercus cingulatus* Fabricius and *Pectinophora demoleus* (IMMS, 1965); *Papilio demoleus* Linn., *Earia vittella* Fabricius and *Mylabris pustulata, Mylabris indica, Dysdercus cingulatus* (NAYAR *et al.,* 1976); *Componotus compressus* Fabricius and *Helicoverpa armigera* (Hubner) (AMBROSE, 1980); *Corcyra cephalonica* Stainton (BHATNAGAR *et al.,* 1983); *Earias fraterna* (Pawer *et al.,* 1986); *Achaea janata, Oxycarenus hyalinipennis* and *Pectinophora gossypiella* (KUMARASWAMI, 1991); *Amsecta albistrica, Aproarema modicella* (SAHAYARAJ, 1995) and *Spodoptera litura, Clavigralla horrens, Clavigralla gibbosa* and *Earias atomosa* (AMBROSE, 1999). Of these insects, *H.armigera* and *S. litura* are both frequent and difficult pests of groundnut (SAHAYARAJ, 1999). *R. marginatus* has been observed feeding dead *C. cephalonica* in the laboratory, can consume many prey in a single feeding (personal observation). So much effort have been made to mass rear this bug and use it as biological control agent against various insect pests.

Field test is an important step in evaluating the use of natural enemies as augmented biological control agents (CLOUTIER and BAUDUIN, 1995). Field evaluation studies show that it reduced 94.9 and 92.7 per cent *S.litura* and *H.armigera* population in the groundnut field and the pod yield was also the highest in this predator released plot (1867.8 kg/ha.) than the control plot (1022.8 kg/ha.)(SAHAYARAJ, 1999). The technical feasibility of mass-rearing and release predators into field crops has been demonstrated repeatedly (HOUGH-GOLDSTEIN and WHALEN, 1993, CLOUTIER and BAUDUIN, 1995). However, the inability to mass-raring many predators of an assured quality for a competitive cost is often a major constraint for the uptake of the technology. The concept of commercial production in promoting biological control method in India was first conceived by MANJUNATH (1984). SCHAEFER (1988), COHEN (1993), AMBROSE (1995) and SAHAYARAJ (1997) felt the urgent need for evolving the strategies to mass rear the predators for their large scale release into the pest infested agro-ecosystem and to assess their bio-control potential. One of the basic

requisite for a successful biological control agent is the availability of a sound, low cost rearing and mass multiplication technique, which were not available for *R. marginatus*. Suitability of frozen larvae of *S. litura* to *Eocanthecona furcellata* (Wolff) (YASUDA and WAKAMURA, 1992), live and dead larvae of *Bombyx mori* and frozen larvae of *Psorocampa denticulate* to reduviid predators like *Apiomerus sp.* And Montina confusa (ZENUNCIO et al., 1992) and hot water - killed larvae of *Tenebrio molitor* (L.) and *Helicoverpa armigera* (Hübner) to a reduviid predator, *Pristhesancus plagipennis* (Walker) (GRUNDY et.al., 2000) were studied. The biological control aspects of *R. marginatus* on *Spodoptera litura* (Fabricius) and *Helicoverpa armigera* Hubner (SAHAYARAJ, 1999) were also studied. Recently SAHAYARAJ (2000) explained the biological control potential of *R. marginatus* on four groundnut pests under laboratory condition. The purpose of the present study was to compare the relative effectiveness of alive and cold-killed *C. cephalonica* on the development, fecundity and hatching ability and predatory behaviour of *R. marginatus*. This will provide a basis for further research focusing on its characteristic and its potential as a pest control agent in IPM strategies.

Materials and methods

Rearing of Corcyra cephalonica larva

Initial culture of *Corcyra cephalonica* (eggs) was obtained from the District Government Agricultural Office, Palayamkottai, Tamil Nadu. Jower is used as a culture of medium for *Corcyra cephalonica* in this study. This cereal is ground into small pieces of uniform size. One kilogram of Jower wheat was taken in the plastic trough having 3-litre capacity. It was fortified with crushed groundnut (200g), Yeast (5g), streptomycin (15mg) and multivitamin (500mg) (Glaxo) (SAHAYARAJ *et al.,* 2001). *C. cephalonica* eggs (0.5cc) were springled over the medium and then the trough was covered with mulin cloth firmly tightens with rubber bands. The experiment was maintained at $30 \pm 1\ ^{o}C$ temperature, $65 \pm 10\%$ relative humidity and 11L : 13D hr photoperiod. In another category, in addition to the above mentioned medium company have thyroxine powder (1g) was forfitied with the medium. Six replications were maintained for each category.

Reduviid Predator

The populations (both the nymphal instars and adult) of *R. marginatus* were collected from two districts, namely Tirunelveli and Thoothukudi, Tamil Nadu, India during June 2000. These populations were then reared in the laboratory (temperature $29 \pm 2\ ^{o}C$; $65 \pm 10\%$ relative humidity and 11L: 13D hrs) separately in plastic containers

(500 ml capacity) on the larvae of *C. cephalonica*. Laboratory emerged first nymphal instars were used for this experiments.

Experimentation

One liter plastic containers with lids were used for rearing the predator nymphs and adults. Before introducing the predators in to the plastic boxes, blotting paper was placed in the bottom. Reference card strip of 14'9 cm size was selected and make them into zigzag pattern and placed in the container for the resting of the predator. Fourth and fifth nymphal instars of *C. cephalonica* (Lepidoptera: Pyralidae) was utilized as a prey source for *R. marginatus*. The experiment animal was divided in to two categories (i) *R. marginatus* reared on live *C. cephalonica* (AL) and (ii) *R. marginatus* reared on forzen *C. cephalonica* (FL). Fifty newly emerged first instars nymphs were released into the container and then covered with muslin cloth. Live *C. cephalorica* larvae were collected and frozen in refrigerator at 18 ^{o}C, and store in the same condition for less than 30 days. Each set of predators was fed with fourth and fifth instar *C. cephalorica* larvae. Ten replications were maintained in each category. The larvae fed upon by reduviid, turned brownish to black colour which facilitated the observations. The number of prey supplied and both the fed and unfed preys were observed daily. From the number of larvae consumed by the predators and stadial period data, the predatory rate per stadia was calculated. Observation on nymphal developmental periods, and successful adult emergence were recorded. The laboratory emerged adults from each category was grouped as five pairs separately in plastic containers (1000 ml capacity). Pre-oviposition, and oviposition periods were also recorded. The containers were carefully examined daily to record the eggs laid. Furthermore number of batches of eggs, average number of eggs laid by a female was recorded. The adults were maintained till their death and their adult longevity was also recorded. The life-tables were constructed according to the method of BIRCH'S (1948) and elaborated by SOUTHWOOD (1978). In life table statistics, the intrinsic rate of increase, net and grass reproductive rates, the survival rate (lx), finite rate of increase, weekly multiplication of predator population, doubling time and the mean number of female progeny per female (mx) stile alive at such age interval were calculated.

Predatory behaviour

In another study the predatory behaviour was observed on one day starved nymphal instars and adults of *R. marginatus* with AL and FL larvae separately. For predatory behaviour study, 24 hours old 10 predators were taken from first to fifth instarts and from adult (male and female) separately and used for this study. One first instar *R. marginatus* was introduced into plastic vials (1000 ml). After few minutes fourth and fifth instar live *C. cephalonica* larva (one each) were introduced into each box. Then

the predatory behaviour was observed for two hour continuously. In the predatory behaviour experiment, capturing and handling time were recorded for a prey. Similar procedure was followed for the remaining nymphal instarts and adults. In another experiment the predators were provided with frozen larva of *C. cephalonica* and observed the predatory behaviour.

Statistical analysis

Analysis of variance (ANOVA) was used to determine the difference between first nymphal instars and second, third, fourth and fifth nymphal instars separately for both categories. It was applied in all parameters of this study such as pre-oviposition period, total number of eggs laid and food consumption. Duncan's Multiple Range Test (DMRT) was used to separate treatment means (DANIEL, 1987). Significance was analysed at 5 per cent level. Chi-square was used to determine the statistical significance in sex ratio of adult predators.

Results

Nymphs supplied with an AL throughout development had a mean developmental period of 41.00 $\pm$ 0.2 days, which was significantly shorter ($P < 0$ 0.05) than those nymphs reared on the FL (48.66 $\pm$ 1.6 days). Among the five instars, the shortest instar was the second except the FL fed instars, and the longest was the fifth instar (Table 1). Nymphal mortality within type of the prey was higher during the early developmental stages, which suggested that cannibalistic behaviour (observed usually among older instars) was not the primary cause of mortality. Moreover, type of larvae had significant impacts ($P < 0,05$) on the mean total nymphal mortality of the predator (18.2 and 7.8 per cent for AL and FL, respectively). Male biased sex ratio was observed in *R. marginatus,* which were reared on AL and FL (0.418 and 0.459). Chi square test shows that the result is significanct between male and female sex ratio of these two categories. Irrespective of the larval nature both in the AL and FL categories, the male predators lived longer than the females. Both the male (141.91$\pm$ 10.87) and female (123.5 $\pm$ 13.5 days) of test individuals fed with AL had the longest adult longevity. A significant difference was present between goups reared on AL and FL respectively ($P < 0.05$). Similarly statistical significance ($P < 0.05$) was observed between male and female adult longevities.

Reproduction of *R. marginatus* is summarized in table 2. The shortest pre-oviposition period was observed among the females fed with the AL (20.4 $\pm$ 1.01 days) than the FL category (29.8 $\pm$ 2.2 days). Furthermore, the AL fed group had relatively longer life span and had shorter pre-oviposition period (Table 2). The highest fecundity

(266.5 ± 80.77 eggs/female) was recorded among the females fed with AL than FL (235.5 ± 80.77 eggs/female). More number of batches of eggs (6.8 ± 2.15), highest average number of eggs per batch (39.1 ± 4.75), and maximum number of eggs per batch (71.2 ± 3.18) were recorded among the females fed with AL (Table 2). The maximum number of nymphs emerged from the *R. marginatus* in AL (77.1%) than FL (68.69%).

Table 1. Influence of live (AL) and frozen (FL) *C. cephalonica* larvae on the developmental period of *R. marginatus*

Life stages	AL	FL
First Instar	7.24 ± 0.18[a]	8.4 ± 0.39[a]
Second Instar	4.58 ± 0.15[a]	8.94 ± 0.68[b]
Third Instar	5.96 ± 0.15[a]	7.45 ± 0.72[b]
Fourth Instar	9.49 ± 0.12[a]	6.12 ± 0.71[b]
Fifth Instar	11.25 ± 0.45[a]	11.82 ± 1.43[a]
Total period	41.00 ± 0.22[a]	48.66 ± 1.57[b]

Values followed by same letters between the column are not statistically significant at 5 % by DMRT

The number of larvae consumed by a *R. marginatus* during its immature stage is shown in figure 1. The total predatory rate was maximum and minimum in AL (49.63) and FL (43.56) respectively. All the nymphal instars of *R. marginatus* except first instars fed on FL had lowest predatory rate. Similarly, all instars of the predators except the fifth instar fed on frozen larva had highest prey consumption. The heaviest adult was observed in the test individuals fed with AL (154.6 ± 7.37mg) than FL (151.5 ± 7.91mg).

Table 2. Alive (AL) and frozen (FL) *C. cephalonica* larvae on the fecundity and hatchability of *R. marginatus* ($\bar{X}$ ± S.E)

Parameteres	AL	FL
Pre-oviposition period (in days)	20.4 ± 1.0[a]	29.8 ± 2.2[b]
Number of batches of eggs laid /Female	6.8 ± 2.2[a]	6.1 ± 1.9[a]
Total number of eggs laid/Female	266.5 ± 84.2[a]	235.5 ± 7.4[b]
Average number of egg/batch	39.19 ± 4.8[a]	38.60 ± 4.9[a]
Minimum number of egg/batch	14.66 ± 4.63[a]	10.1 ± 3.2[b]
Maximum number of egg/batc	71.2 ± 3.2[a]	61.2 ± 2.7[b]
Hatching percentage	87.15[a]	68.69[b]
Post oviposition period (in days)	27.5 ± 2.01[a]	16.0 ± 5.1[b] .

Values followed by same letters between rows are not statistically significant at 5 % by DMRT

The data on age specific fecundity and the life table parameters of the predator *R. marginatus* are presented in the table. The results indicate that both the survival and the female birth of *R. marginatus* varied when reared on *C. cephalonica* in two different conditions (AL and FL). The highest survival and the female birth were noted on *R. marginatus* fed with AL. The schedules of survival for female (lx) were gradually decreased when the predator grew older. The net reproductive rate (R_o) of *R. marginatus* fed with AL was higher (205.48) than on FL (156.7). The intrinsic rate of population increase (r_m) was higher on AL and more or less similar in FL also. The mean length of generation was shorter on FL (84.95). The doubling time was more or less similar on AL and FL (table 3). The present study has showed that *R. marginatus* can develop and reproduce on both AL and also on FL. Shorter developmental time, pre-oviposition period, and heaviest adults, highest hatching percentage was observed on AL. This group also had maximum egg production and hatchability. Hence thyroxin can be incorporated in the *C. cephalonica* rearing medium. Similarly FL also makes an ideal pray for the mass rearing of *R. marginatus*. Hence, FL will be useful tools for mass rearing of reduviids.

Table 3. Influence of live (AL) and frozen (FL) larvae of *C. cephalonica* on the life table parameters of *R. marginatus*

Demographic Parameters	AL	FL
Net reproductive rate ($R_o = \in lx.mx$)	205.48	156.7
Mean length of a generation $T_C = \in lx.mx$)	90.43	84.95
Innate capacity for increase in numbers ($r_c = \log_e R_o/T_c$)	0.058	0.059
Corrected r_m ($r_m = \in C^{7-mx}.\ lxmx$)	0.069	0.067
Corrected generation time ($T = \log_e R_o/r_m$	77.17	75.43
Finite rate of increases in numbers ($\lambda = e^{rm}$)	1.07	1.06
Rate of weekly multiplication (RWM) of the population (e^{rm7})	7.49	7.48
Doubling time (Dt) days ($\log e^2/r_m$)	10.13	10.41

The morphometric data show the maximum head (0.44 and 0.15 mm for length and width respectively), thorax (0.98 and 0.52 mm for length and width respectively) and abdominal length (0.81 and 0.49 mm for length and width respectively) are observed in *R. marginatus* fed with AL. This was reduced in FL category *R. marginatus* head (0.43 and 0.15 mm for length and width respectively), thorax (0.97 and 0.46 mm for length and width respectively) and abdominal length (0.78 and 0.47 mm for length and width respectively). However, the statistical analysis showed that AL was significant to the FL. As observed for the various parts of the body the total body length of AL was longer (1.79 cm) than the FL (1.68 cm).

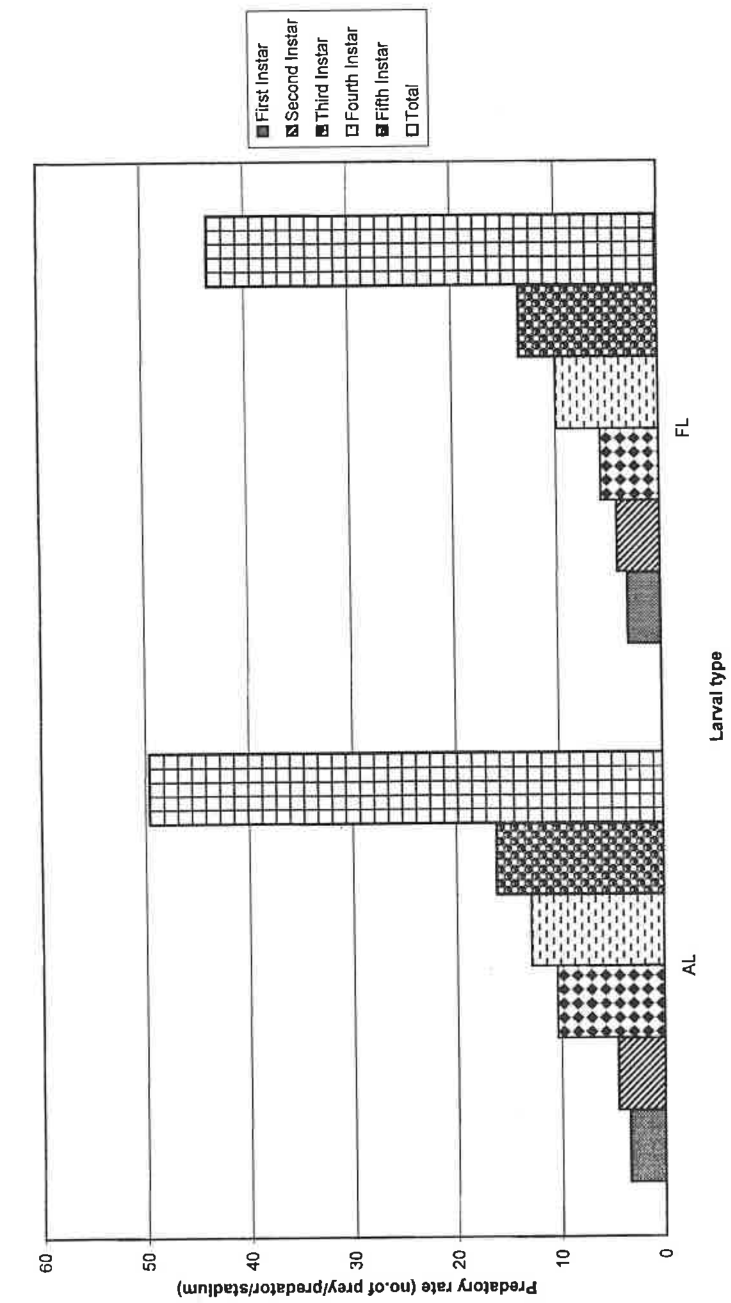

Fig. 1. Alive (AL) and frozen (FL) *C.cephalonica* larvae on the predatory rate of *R.marginatus*

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Under natural and laboratory condition, *R. marginatus* feed on many agricultural and forest pests. Predatory behaviour of *R. marginatus* is observed in sequencial patterns as follows: arousal – approach – pounching – rostral probings – paralysing the prey – piercing and sucking and post predatory behaviour. In the capturing response, the early nymphal instars took less time when they are provided with AL (18.45, 17.21 and 13.80 seconds for first, second and thirst instars respectively), than the FL (37.7,30.16, and 29.8 seconds for first, second and third instars respectively) and the data were statistically significant ($P < 0.05$). The time was further reduced in the fourth, fifth instars and adults when they were provided with AL and FL. After the third instar the capturing time was lesser in FL than the AL. However they were statistically insignificant. Among the adults, female took less time for capturing than the male. From this observation we conclude that it is feasible to use the frozen larva for fouth and fifth instars and adults respectively. Weight was not differed significantly from the AL (154. 6 mg/adult) to FL (151.5 mg/adult).

Discussion

Mass culturing predatory heteroptera for augmentative release has been used for species from pentatomidae (DECLERCQ AND DEGHEELE, 1992, HOUGH-GOLDSTEIN and WHALEN, 1993, CLOUTIER and BAUDIN, 1995) and reduviids (SAHAYARAJ, 1995, AMBROSE, 1999 and GRUNDY *et al.*, 2000). However, the mass culture of this predator poses numerous challenges like the cost of maintaining large insect-prey cultures and the risk of prey shortage due to disease or facility mismanagement. Furthermore, mass rearing of reduviids, the major constraint for success was cannibolism, which caused high mortality during mass rearing and selecting moving objects. Combination of these difficulties was responsible for the limited number of successful mass rearing programs for reduviids. Nature of prey influenced the mean developemental time and percentage mortality of the nymphs and the mean adult body weight of the eclosed male and female insects. When *R. marginatus* reared with live prey, nymphs can developed quickly when we compared to the dead prey. This mean developmental period was higher than that observed by the other researchers (AMBROSE et al., 1990 and GEORGE, 1999). LAKKUNDI (1989), VENNISON and AMBROSE (1989), SAHAYARAJ (1991) and KUMARASWAMI (1991) reported that generally in reduviids the shortest and the longest stadium were the second and fifth instars respectively. SAHAYARAJ (1995) reported that the total developmental period of *R .marginatus* was the 38.82 days when reared on *S. litura* larvae. The total nymphal period was reduced from isolated rearing (70.47 days) to group rearing (61.13 days) in *Acanthaspis pedestris* Stål (SAHAYARAJ, 1991). Similar result was obtained in *Catopsila crocale* (MATHAVAN and NAMBIRAJAN, 1976) and also in a reduviid, *Coranus soosai* (AMBROSE and JENOBA, 1988). In both the prey type, the sex ratio was male biased. AMBROSE (1980) stated that the members of Harpactorinae were female biased. Similar, result has been reported for other reduviids (SAHAYARAJ, 1995; AMBROSE and SAHAYARAJ, 1991). Hence to understand the sex ratio of *R. marginatus* further studies were essential. This rearing technique is unique in that nymphs are reared together in small container while being supplied with dead prey larvae of a same size. This made the mass rearing of *R. marginatus* feasible and inexpensive in contrast to previous techniques used for *Reduvius, Zelus,* and *Apiomerus*, which were reliant on different-sized live prey for nymphs reared in individual cells (RYCKMAN and RYCKMAN, 1966). The production of insects without the provision of water fountains, which are often necessary for other predatory heteroptera (COHEN, 1985; ZANUNCIO et al., 1992; DECLERCQ et al., 1995), also made rearing more efficient while eliminating a potential site for pathogen transfer and disease outbreak.

YASUDA and WAKAMURA (1992) repored that *E. furcellata* (Wolff) fed on live and frozen larva of *S. litura* had no significant difference on adult longevity. Further they added that, both the male and female reared on frozen larvae were significantly smaller than those reared on live prey. Notably, test individuals which recorded longer stadial period fed on the FL showed the lower adult weight and vice versa.

The longest pre-oviposition period was observed among the females, which were fed once in 4 days (AMBROSE *et al.,* 1990). The FL fed group had relatively lower consumption rate. *R. marginatus* have longer pre-oviposition period when fed with *C. cephalonica* than *S. litura* and *E. vitella* (GEORGE, 1999). Later (GEORGE, 2000b) he observed that *C. cephalonica* reduced the pre-oviposition period in *Rhynocoris fuscipes* (Fabricius) than *S. litura* and *Earias vittella* Fab. larvae. Studies have indicated that the fertility of predator could vary based on the type of host larvae provided. In *A. pedestris* it was recorded to be 19.36 (SAHAYARAJ, 1991) where in *R. marginatus* the net reproductive rate was 48.2 days on *S.litura* (GEORGE, 1999) and 33.4 days on *C. cephalonica* (GEORGE, 2000a) respectively. YASUDA and WAKAMURA (1992) recorded, more number of egg masses per female, maximum eggs per egg mass and also the total number of eggs per female in *E. furcellata* reared on alive *S. litura* larvae. Futher more, they added that frozen larvae may be a good diet for containers rearing of *E. furcellata.* Similar result was also observed in this study. The adults reared on cold-killed larvae were not generally smaller than those feeding on live larvae, however the reproductive rates were significantly different. This indicates that cold-killed larvae were suitable for *R. marginatus.* The production of insects with a high adult body weight was important because increased body weight is often corre-

lated with increased fecundity for many insect species, including predatory pentatomids (EVANS, 1982) and reduviids (GRUNDY et.al., 2000). Similarly the body size was also in favour of AL than the FL category, but they were not statistically insignificant. This might be due to the minimum number of prey consumed by the AL category *R. marginatus* (136.8 preys/adult) than the FL category (122.5 preys/adult).

AMBROSE (1999) concluded that reduviid predators only capture alive and moving preys and spend significantly longer periods. Similarly wolf spider prefer moving than the non-moving prey (PERSONS and UETZ, 1998). However, GRUNDY et.al., 2000 mass reared *Pristhesancus plagipennis* (Walker) with both the alive and heat-killed preys. *R. marginatus* predates both the alive and cold-killed preys. However, the predatory acts like approach and capturing were slow when the predator was provided with cold-killed *C. cephalonica.* The early nymphal instars prefer the AL than the FL. However, they consumed less number of FL than the AL. AMBROSE and KUMARASWAMI (1993) and Lakkundi (1989) reported that the feeding rate was higher in immature stages of reduviid than their adults. In contrast, *Rhinocoris bicolor* (PARKER, 1969) early nymphal instars attack very large or active insects. Usually the females are more efficient predators than the males exhibiting comparatively quicker predatory acts (AMBROSE, 1997; GEORGE *et al.,* 1998). According to the type of prey, the arousal and approaching behaviour was varied (AMBROSE and SUBBURASU, 1988). Arousal response is indicated by the unusual posture involving tibial juxtaposition followed by erect posture and extension of antennae towards the direction of the prey (AMBROSE *et al.* 1993). Similar kind of behaviour was observed when the predator was provided with both AL and FL category preys. Adults capture cold-killed preys quickly than the alive preys. Out hypothesis that reduced activity in the presence of live *C. cephalonica* increases survival (adult longevity) is supported by the large difference in survival between cold-killed *C. cephalonica* in the rearing containers. The alarm pheromones are generally released only by mechanical damage of the prey during a predation event. We expressed that even in non-mechanical damage the prey release chemical cuse to attract the predator. But several studies indicated that reduviids visual senses and vibration detection organs are particularly sensitive to movement cuse (AMBROSE et.al., 1988, 1993 and 1994). JOSEPH (1959) used *Corcyra* larvae as food for the reduviid bugs by releasing them on filter paper in the rearing container. We also used the same technique, but the persistant problems of webbing by *C. cephalonica* larvae in the rearing containers that lead to poor feeding accessibility as well as their entanglement and consequent death of predators as well as to avoid the feeding by those host larvae on the reduviid bugs. In turn, the reduviids in got the web caught and starved. Often, these problems were of cannibalism amongst the *C. cephalonica* larvae, making them unavailable for predators. Hence, highest total nymphal mortality was observed in the AL fed category. Furthermore, some larvae escaped through the muslin cover, thus making it difficult for quantitative studies. These kinds of problems were not observed when the reduviid was provided with cold-killed *Corcyra* larvae.

The purposes of the present study were to develop an adequate rearing method for *R. marginatus* and to determine its developmental period and fecundity when rearing the bug on the cold-killed larvae of *C. cephalonica* in the laboratory successfully. Our experiments demonstrate that *R. marginatus* nymphs and adults have the capacity to consumed large number of the cold-killed immature stages of *C. cephalonica*. The developmental time, nymphal and adult survival, size and weight of the adults, fecundity and hatchability, predatory behaviour and predatory rate in relation to that of its prey nature appeared to the major factor determining success in the rearing. Such observations suggest that cold-killed larvae of *C. cephalonica* can be used for rearing this predator The study will provide a basis for the further research focusing on its characteristics and its potential as a pest control agent in IPM.

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