

## Effect of Artificial Diets on the Development of Immature Stages of *Chrysoperla Carnea* (Stephens) under Laboratory Conditions

UMAIR QURESHI

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

ASLAM BUKERO

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

FIDA HUSSAIN MAGSI

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

ZAKIR ALI BHUTTO

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

ZULFIQAR ALI UJJAN

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

ABID ALI SOOMRO

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

ASRAR MOHI-UD-DIN KASHMIRI

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

MAQSOOD AHMED CHANDIO

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

NAVEED ALI CHANNA

Department of Entomology, Sindh Agriculture University  
Tandojam, Sindh, Pakistan

### Abstract:

*Study was conducted to determine the effect of artificial diets on the development of immature stages of *Chrysoperla carnea* (stephens) under laboratory conditions during 2015 at Temperature  $26\pm 2$  and Relative humidity  $65\pm 5$  % in the Bio-control laboratory of*

*Entomology Department, FCPT, SAU, Tandojam. The artificial diets from jelly of different flavors were prepared. Five treatments i.e. T<sub>1</sub> = Mango jelly, T<sub>2</sub> = Banana Jelly, T<sub>3</sub> = Pudding T<sub>4</sub> = Mix jelly (Banana jelly 10 g+3 g egg whitish+3g Yeast+80 ml water) and T<sub>5</sub> = Control (eggs of *S. cerealella*). The result presented that first instar larvae of *C. carnea* survived on different artificial diets in plastic tube as well as glass tube. Maximum larval development was recorded  $12.08 \pm 1.08$  and  $10.5 \pm 1.11$  days reared in plastic and glass tube on diet D<sub>4</sub>, followed by diets D<sub>1</sub>, D<sub>2</sub> and D<sub>3</sub>, respectively. The third instar larva not survived longer in both plastic and glass tube. Similarly minimum development time was observed  $8.6 \pm 0.56$  and  $8.5 \pm 0.76$  days reared in plastic and glass tube on diet D<sub>5</sub> (control), whereas, the pupal period was seen  $1.8 \pm 0.77$  and  $5.3 \pm 1.33$  days reared in plastic and glass tube on same diet. The results further revealed that when second instar larvae of *C. carnea* reared on artificial diets in plastic and glass tube it indicated the maximum larval development was recorded  $13.10 \pm 1.03$  and  $10.2 \pm 1.12$  days reared on diet D<sub>4</sub>, followed by diets D<sub>4</sub>, D<sub>1</sub> and D<sub>3</sub>, respectively. Similarly, third instar larvae not lined more in both plastic and glass tube and not transformed into subsequent stage.*

**Key words:** *Chrysoperla carnea*, artificial diets, development, temperature, humidity.

## INTRODUCTION

The common green lacewing, *Chrysoperla carnea* (Stephens) Order "Neuroptera" is predator of soft bodied insects. A group of insect having soft bodies, two pairs of similar wings (roof like) along with abdomen and biting mouth parts consisted in this order. A large colony of aphids in the tropics found rarely. Five hundred aphids may demolish by one larva in life, there is no doubt that in natural control of homopterous pests they play major role [2]. Lacewing species are broad habitation and 1200 species are known worldwide. Among these the common species are: *Chrysoperla carnea* (Stephens), *C. plorabunda* (Fitch), *C.*

*rufilabris* (Burmeister), *C. mediterranea* (Hölzel), *C. oculata* (Say), *C. johnsoni* (Henry , Wells and Pupedis), *C. adamsi* (Henry, Wells and Pupedis), *C. nigricornis*, *C. downesi* (Smith), *C. lucasina* (Lacroix), *C. comanche* (Banks), *C. Formosa* (Brauer), *C. pallens* (Rambur), *C. mohave* (Banks), *C. scelestes* (Banks). *Chrysoperla* spp. *C. lacciperda* (Kimmins) Especially *C. carnea* and *C. rufilabris*, by producers and suppliers these are sold commercially [1] provided for controlling the arthropods insect pest.

The example of the species which are not predacious in adults stage is *C. carnea*, while in some species adults are predators, larval stage is predatory stage [3]. *C. carnea* larvae are commonly known as social predator and also known as aphid lion, generally *C. carnea* eats 100-600 aphids [6]. Lacewing adults generally feed on nectar juice, pollen and honeydew of aphids. Adults of *C. carnea* have pale green to golden or copper-colored eyes about 12-20 mm long antennae. Adults having delicate body, pale green wings which are transparent. *C. carnea* has special characteristics of fluttering flights and mostly they are active at evening and night time [8]. Adults may fly 3 to 4 hours having strong flight urge. Eggs are oval shaped laid singly at the tip of silken stalks, initially pale green, turned grey in 2-3 days. Eggs hatch after 6-7 days. Larvae are active, having three instars, grey or brownish, with well-developed legs. At the time of prey lacewing sucks the body fluid of prey with the help of pincers. Larvae of lacewing grow from less than 1 mm to 6-8 mm. Third mature instar of larvae moves round in silken cocoon in hidden places and pupates inside the cocoons. Lacewing adults emerge in 8 to 10 days. There are two to several generations in a year [10]. Green lacewing, *Chrysoperla carnea* (Stephens) (Chrysopidae: Neuroptera) is considered as predator of soft bodied insects mostly aphid species. Larva of this predator feed on insect eggs, arthropods including mealy bugs, jassids, and caterpillars. It is

used as Bio-control agent [7]. In America and Europe it is mass reared on broad scale as Bio-control agent. Predaceous larvae feed prey through sucking body fluids by sickle shaped mouth parts. Rearing of predator on insect is quite expensive. Therefore, the need of efforts to develop synthesis diets for *Chrysoperla*.

## **MATERIALS AND METHODS**

The present study was conducted in the Bio-Control Research laboratory, Department of Entomology, Faculty of crop Protection, Sindh Agriculture University, Tandojam to determine the effect of artificial diets on the development of immature stages of *Chrysoperla carnea* (stephens) under laboratory conditions during 2015 at Temperature  $26\pm 2$  and Relative humidity  $65\pm 5$  %. In this experiment we find out most suitable artificial diet for mass rearing of immature stage and development period of *C. carnea*.

In this experiment the materials used i.e. Glass vials, Plastic vials, Beaker, Measuring cylinder, Weight machine, scissor, Hole needle, Camel hair brush, Lobster, Jelly of different flavors, Eggs, Yeast and Electric boiler. The larvae of *Chrysoperla carnea* were obtained from the stock culture of biocontrol laboratory of the Entomology Department. The experiment was Completely Randomized Design (CRD) with ten replications. The artificial diets from jelly of different flavors were prepared according to their prescribed procedure and formulas. Five treatments i.e.  $T_1$  = Mango jelly,  $T_2$  = Banana Jelly,  $T_3$  = Pudding  $T_4$  = Mix jelly (Banana jelly 10 g+3 g egg whitish+3g Yeast+80 ml water) and  $T_5$  = Control (eggs of *S. cerealella*). Each larval instar 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> were released in the ten plastic tubes and ten glass vials separately and reared on different jelly diets as well as natural diets (eggs of *S. cerealella*). The diets were changed after 24 hrs. The

experiment was conducted at  $26\pm 2^{\circ}\text{C}$  and  $60\pm 5\%$  RH as reported Ashfaq *et al.*, (2002). The observation was taken daily on the development period and survivor % age of *C. carnea* larvae. The collected data was subjected for statistical analysis by using (Statistix. 8.1) software.

## RESULTS

The result presented in Table 1 indicated that first instar of *C. carnea* survived on different artificial diets in plastic tube as well as glass tube. The first instar lived  $3.4 \pm 1.06$  days followed by  $3.7 \pm 1.11$  and  $4.2 \pm 1.18$  days second and third instar larvae reared on diet D<sub>1</sub> in plastic tube. Similarly, the same cohorts was reared on same diet in glass tube it showed that the first instar survived  $3.5 \pm 1.08$  days followed by  $3.4 \pm 1.06$  and  $2.3 \pm 0.88$  days second and third instar larvae, respectively. The third instar no lived longer in both plastic and glass tube and not reached into subsequent pupal stage. The results further showed that the first instar larvae survived  $3.2 \pm 1.08$  days followed by second and third instars  $5.1 \pm 1.06$  and  $0.8 \pm 0.05$  days, respectively, when larvae fed with diet D<sub>2</sub> in plastic tube. In glass tube rearing it was observed that the first instar lived  $3.2 \pm 1.03$  days followed by  $4.6 \pm 1.24$  and  $1.1 \pm 0.61$  days second and third instar larvae, respectively, reared on D<sub>2</sub> diet. The third instar was not survived in both plastic and glass tube and not transform into pupal stage. The results indicated that the first and second instar larvae lived  $4.7 \pm 1.25$  and  $2.2 \pm 0.86$  days, respectively, when larvae fed with diet D<sub>3</sub> in plastic tube. The first and second instar larvae survived  $3.5 \pm 1.08$  and  $1.8 \pm 0.77$ , respectively, on D<sub>3</sub> diet. In this diet second instar not transformed into next subsequent stages in plastic as well as glass tubes. The results further revealed that the first instar larvae of *C. carnea* survived  $3.6 \pm 1.10$  days followed by second and third instars  $7.0 \pm 1.53$  and  $2.2 \pm 0.86$  days, respectively,

when larvae reared on diet D<sub>4</sub> in plastic tube. Similarly, the larval instars reared in glass tube displayed that the first instar survived  $3.7 \pm 1.11$  days followed by second and third instar larvae  $6.2 \pm 1.44$  and  $0.6 \pm 0.45$  days, respectively, when fed with D<sub>4</sub> diet. The third instar

**Table 1 Mean development time (days) of first instar of *C. carnea* on different diets.**

Diets	Life stages	Plastic tube	Glass tube
D <sub>1</sub>	1 <sup>st</sup> instar	3.4±1.06	3.5±1.08
	2 <sup>nd</sup> instar	3.7±1.11	3.4±1.06
	3 <sup>rd</sup> instar	4.2±1.18	2.3±0.88
	Pupa	0±0.00	0±0.00
D <sub>2</sub>	1 <sup>st</sup> instar	3.2±1.08	3.2±1.03
	2 <sup>nd</sup> instar	5.1±1.06	4.6±1.24
	3 <sup>rd</sup> instar	0.8±0.88	1.1±0.61
	Pupa	0±0.00	0±0.00
D <sub>3</sub>	1 <sup>st</sup> instar	4.7±1.25	3.50±1.08
	2 <sup>nd</sup> instar	2.2±0.86	1.80±0.77
	3 <sup>rd</sup> instar	0±0.00	0.00±0.00
	Pupa	0±0.00	0.00±0.00
D <sub>4</sub>	1 <sup>st</sup> instar	3.6±1.18	3.7±1.11
	2 <sup>nd</sup> instar	7±1.53	6.2±1.44
	3 <sup>rd</sup> instar	2.2±0.86	0.6±0.45
	Pupa	0±0.00	0±0.00
D <sub>5</sub> (control)	1 <sup>st</sup> instar	2.5±0.91	2.8±0.97
	2 <sup>nd</sup> instar	2.3±0.88	3.4±1.06
	3 <sup>rd</sup> instar	3.8±1.13	2.3±0.88
	Pupa	1.8±0.77	5.3±1.33

was not survived more cause death in both plastic and glass tube. The results further indicated that the first instar larvae survived  $2.5 \pm 0.91$  days followed by second  $2.3 \pm 0.88$ , third instar  $3.8 \pm 1.13$  and pupa  $1.8 \pm 0.77$  days, respectively, reared on diet D<sub>5</sub> in plastic tube. Similarly, glass tube rearing showed the survival of first instar  $2.8 \pm 0.97$  days followed by second instar  $3.4 \pm 1.06$ , third instar  $2.3 \pm 0.88$  and pupa lived  $5.3 \pm 1.33$  days when larvae fed with diet D<sub>5</sub>. It was found that in the 1<sup>st</sup> instar larval instar survival on artificial diets displayed

that the longest development was recorded in the artificial diet D<sub>4</sub> followed by D<sub>1</sub>, D<sub>2</sub> and D<sub>3</sub>, respectively. Whereas, the lowest development was observed on diet D<sub>5</sub> (Control). The larval instar lived longer in the plastic tube and shortest in the glass tube on all diets, whereas, pupa lived longer in glass tube as compare to plastic tube reared on D<sub>5</sub> (Control). The analysis of the results showed that there is significant difference in the development period of larval instars and pupal stages when reared on different diets ( $P < 0.05$ ).

### **Rearing of second instar larva of *Chrysoperla carnea* on different diets.**

The result depicted in Table 2 displayed the development period of second instar larva of *C. carnea* reared on different artificial diets in plastic and glass tube. The second instar larva lived  $3.8 \pm 1.13$  and third instar  $6.80 \pm 2.37$  days reared on diet D<sub>1</sub> in plastic tube. Similarly, the in glass tube it showed that the second and third larval instars lived  $3.2 \pm 1.39$  and  $5.2 \pm 1.70$  days, respectively, reared on D<sub>1</sub> diet. The third instar not transformed into subsequent next stage in both plastic and glass tube. The results further indicated that the second instar larvae lived  $5.8 \pm 1.39$  days and third instar  $7.3 \pm 1.70$  days reared on diet D<sub>2</sub> in plastic tube. In glass tube rearing it was observed that the second instar lived  $4.3 \pm 1.20$  days and third instar larva was observed  $5.9 \pm 1.14$  days reared on D<sub>2</sub> diet. The third instar was not survived in both plastic and glass tube and not transform into pupal stage. Furthermore, it was observed that

**Table 2 Mean development time (days) of second instar larvae of *C. carnea* on different diets.**

Diets	Life stages	Plastic tube	Glass tube
D <sub>1</sub>	2 <sup>nd</sup> instar	3.80±1.13	3.2±1.39
	3 <sup>rd</sup> instar	6.80±2.37	5.2±1.70
	Pupa	0.00±0.00	0.0±0.00
D <sub>2</sub>	2 <sup>nd</sup> instar	5.80±1.39	4.30±1.20
	3 <sup>rd</sup> instar	7.30±1.70	5.90±1.14
	Pupa	0.00±0.00	0.00±0.00
D <sub>3</sub>	2 <sup>nd</sup> instar	4.20±1.60	3.45±1.02
	3 <sup>rd</sup> instar	3.70±1.11	2.63±0.60
	Pupa	0.00±0.00	0.00±0.00
D <sub>4</sub>	2 <sup>nd</sup> instar	6.3±1.20	5.4±1.21
	3 <sup>rd</sup> instar	4.2±1.48	3.8±1.68
	Pupa	0±0.00	0±0.00
D <sub>5</sub> (control)	2 <sup>nd</sup> instar	3.4±1.21	4.1±1.17
	3 <sup>rd</sup> instar	4.8±1.26	3.1±1.06
	Pupa	3.3±0.88	4.7±1.25

second and third instar larvae lived  $4.2 \pm 1.60$  and  $3.7 \pm 1.11$  days, respectively, when larvae fed with diet D<sub>3</sub> in plastic tube. In the plastic tube showed that the second instar larvae lived  $3.45 \pm 1.02$  and third instar larva  $2.63 \pm 0.61$  reared on diet D<sub>3</sub>. The same observation was recorded that the third instar not transformed into next subsequent stages in plastic as well as glass tubes. The results displayed that the second and third instars survived  $6.3 \pm 1.20$  and  $4.2 \pm 1.48$  days, respectively, fed on diet D<sub>4</sub> in plastic tube. In glass tube rearing the second and third instar larvae lived  $5.4 \pm 1.21$  and  $3.8 \pm 1.68$  days, respectively, larvae reared on D<sub>4</sub> diet. The third instar was not transformed into next subsequent stage of *C. carnea*. The results further depicted that second instar larva lived  $3.4 \pm 1.21$  and third instar  $4.8 \pm 1.26$  and pupa lived  $3.3 \pm 0.88$  days, respectively, when fed with diet D<sub>5</sub> in plastic tube. Similarly, the larvae reared into glass tube showed the second instar lived  $4.1 \pm 1.17$  days, third instar  $3.1 \pm 1.06$  and pupa lived  $4.7 \pm 1.25$  days when larvae reared on diet D<sub>5</sub>. It was observed that in the 2<sup>nd</sup> instar larval survival was displayed the maximum

development period on the artificial diet D<sub>2</sub> followed by D<sub>4</sub>, D<sub>1</sub> and D<sub>3</sub>, respectively. However, the lowest development was recorded on diet D<sub>5</sub> (Control). The maximum development was seen in the plastic tube and minimum in the glass tube fed on all artificial diets. Therefore, pupal stage survived longest in glass tube and lowest in plastic tube on diet D<sub>5</sub> (Control). The analysis of variance of present results indicated that there is development period of larval instars and pupal stages significantly different when fed with different diets ( $P < 0.05$ ).

### **Rearing of third instar larva of *Chrysoperla carnea* on different diets.**

The result described in Table 3 showed that the development time of third instar larvae of *C. carnea* fed with artificial diets in plastic as well as glass tube. The results indicated that third instar larvae lived  $7.8 \pm 1.81$  days after that it transform successfully into next subsequent stage pupa lived  $3.0 \pm 0.82$  days when fed with diet D<sub>1</sub> in plastic tube. However, the third larval instars lived  $5.8 \pm 2.24$  and pupa survived  $2.6 \pm 0.63$  days, reared on D<sub>1</sub> diet in glass tube. The results of present study indicated that the third instar larvae lived  $8.4 \pm 2.48$  days reared on diet D<sub>2</sub> in plastic tube. Whereas, the glass tube rearing showed that third instar larva survived  $7.7 \pm 1.60$  days fed with diet D<sub>2</sub> diet. The third instar was not survived further in both plastic and glass tube and not transform into pupal stage. Moreover, it was observed that third instar larvae survived  $7.1 \pm 1.76$  and pupa lived  $2.5 \pm 0.71$  days, when larvae reared on diet D<sub>3</sub> in plastic tube. In the glass tube reared third instar larvae lived  $6.12 \pm 1.97$  days and pupa showed  $1.97 \pm 0.55$  fed with diet D<sub>3</sub>. The results further revealed that third instar larvae lived  $6.6 \pm 1.88$  and pupae developed adult after  $3.2 \pm 0.63$  days when fed with diet D<sub>4</sub> in plastic tube. The similar diet was provided in glass tube third instar larvae survived  $5.1 \pm 1.83$  days on D<sub>4</sub> diet. The third instar larva was not transformed

into subsequent stage. The results depicted that third instar lived  $5.4 \pm 1.34$  and pupa lived  $2.5 \pm 0.91$  days reared on diet D<sub>5</sub> in plastic tube. In the glass tube rearing it displayed that third instar lived  $4.7 \pm 1.25$  and pupa  $5.1 \pm 1.30$  days when fed on diet D<sub>5</sub>. The findings of present result indicated the 3<sup>rd</sup> instar larval lived longer when fed with artificial diet D<sub>2</sub> followed by D<sub>1</sub>, D<sub>3</sub> and D<sub>4</sub>, respectively. Therefore, the lowest development time was observed on diet D<sub>5</sub> (Control). Furthermore, it was also defined that plastic tube reared larvae passed maximum time in development as compare to glass tube on all artificial diets. The analysis of variance showed that there is significant difference in the larval and pupal development when reared on different diets ( $P < 0.05$ ).

**Table 3 Mean development time (days) of third instar larvae of *C. carnea* on different diets.**

Diets	Life stages	Plastic tube	Glass tube
D <sub>1</sub>	3 <sup>rd</sup> instar	7.80±1.81	5.8±2.24
	Pupa	3.00±0.82	2.6±0.63
D <sub>2</sub>	3 <sup>rd</sup> instar	8.40±2.48	7.70±1.60
	Pupa	0.00±0.00	0.00±0.00
D <sub>3</sub>	3 <sup>rd</sup> instar	7.10±1.76	6.12±1.97
	Pupa	2.50±0.71	1.97±0.55
D <sub>4</sub>	3 <sup>rd</sup> instar	6.60±1.88	5.10±1.83
	Pupa	3.20±0.63	0.00±0.00
D <sub>5</sub> (control)	3 <sup>rd</sup> instar	5.4±1.34	4.7±1.25
	Pupa	2.5±0.91	5.1±1.30

### **Survival percentage of first instar larva of *Chrysoperla carnea* on different diets.**

The result further revealed that Fig.1 indicated that in first instar larval development period the highest survivor % was recorded in the first instar (90.0%), second instar (82.0%), third instar (78.0%) and pupa (75.0%) in plastic tube rearing on D<sub>5</sub> (control), whereas, in glass tube rearing on same diet this showed that survivor % of first instar (95.0%), second instar (85.0%), third instar (81.0%) and pupa (76.0%). In all artificial

diets showed that maximum survivor % of larvae of *C. carnea* was obtained in first instar followed by second and third instar, respectively. Third instar not survivor more and found unable to transform in the subsequent stage.

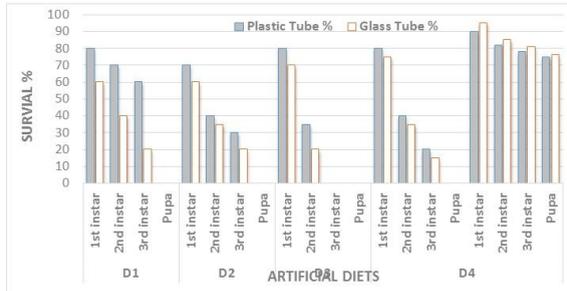
### **Survival percentage of second instar larva of *Chrysoperla carnea* on different diets.**

The result presented Fig.2 displayed that in second instar larval development period, the highest survivor % was observed the second instar (85.0%), third instar (80.0%) and pupa (76.0%) in plastic tube fed on diet D<sub>5</sub> (control), while, in glass tube rearing on same diet it indicated that survivor % of second instar (80.0%), third instar (74.0%) and pupa (72.0%). The results further revealed that the maximum survivor % of larvae of *C. carnea* was found in second and third instar when fed with artificial diets. This study also showed that third instar not survived more to transform into next subsequent stage.

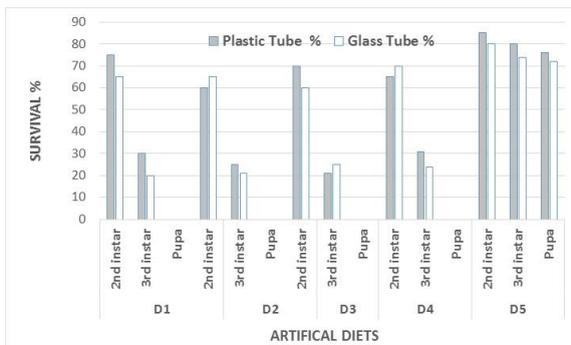
### **Survival percentage of third instar larva of *Chrysoperla carnea* on different diets.**

The result described in Fig. 3 displayed that during the development of third instar larval, the highest survivor % was found in third instar (90.0%) and pupa (86.0%) in plastic tube when larvae reared on diet D<sub>5</sub> (control), while, in glass tube rearing on same diet this showed that survivor % of third instar (88.0%) and pupa (81.0%). Furthermore, it was observed that the maximum survivor % of third instar larvae of *C. carnea* was found when reared on artificial diets. However, maximum survival % of pupa was recorded on diet D<sub>1</sub> followed by D<sub>3</sub> and D<sub>4</sub>, respectively. Therefore third instar reared on diet D<sub>2</sub> was not to transform into next stage.

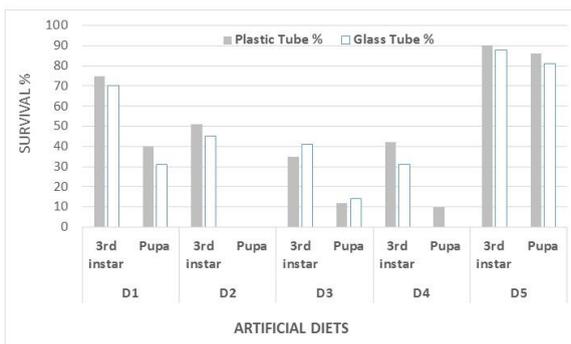
**Fig. 1 Survival percentage of first instar larvae of *C. carnea* reared on artificial diets**



**Fig. 2 Survival percentage of second instar larvae of *C. carnea* reared on artificial diets**



**Fig. 3 Survival percentage of third instar larvae of *C. carnea* reared on artificial diets**



## DISCUSSION

The findings of present study indicated that 1<sup>st</sup> instar larval instar rearing on artificial diets displayed that the longest development was recorded in the artificial diet D<sub>4</sub> followed by D<sub>1</sub>, D<sub>2</sub> and D<sub>3</sub>, respectively. Whereas, the lowest development was observed on diet D<sub>5</sub> (Control). The larval instar lived longer in the plastic tube and shortest in the glass tube on all diets, whereas, pupa lived longer in glass tube as compare to plastic tube reared on D<sub>5</sub> (Control). The results further revealed that in the 2<sup>nd</sup> instar larval survival was displayed the maximum development period on the artificial diet D<sub>2</sub> followed by D<sub>4</sub>, D<sub>1</sub> and D<sub>3</sub>, respectively. However, the lowest development was recorded on diet D<sub>5</sub> (Control). The maximum development was seen in the plastic tube and minimum in the glass tube fed on all artificial diets. Therefore, pupal stage survived longest in glass tube and lowest in plastic tube on diet D<sub>5</sub> (Control). The findings of present result indicated the 3<sup>rd</sup> instar larval lived longer when fed with artificial diet D<sub>2</sub> followed by D<sub>1</sub>, D<sub>3</sub> and D<sub>4</sub>, respectively. Therefore, the lowest development time was observed on diet D<sub>5</sub> (Control). Furthermore, it was also defined that plastic tube reared larvae passed maximum time in development as compare to glass tube on all artificial diets. The result further depicted that the highest survivor % was recorded in the first, second, third instar and pupa reared in plastic and glass tube on diet D<sub>5</sub> (control). The maximum survivor % of larvae of *C. carnea* was obtained in first instar followed by second and third instar, respectively reared on artificial diets, while third instar not survivor more and found unable to transform in the subsequent stage. Furthermore, it was observed that the maximum survivor % of third instar larvae of *C. carnea* was found when reared on artificial diets. However, maximum survival % of pupa was recorded on diet D<sub>1</sub> followed by D<sub>3</sub> and D<sub>4</sub>, respectively. Therefore third instar

reared on diet D<sub>2</sub> was not to transform into next stage. The findings of present study have more or less conformity with those of [9] reared 10 generations on larval semi-synthetic diets containing egg yolk (32.3%), honey (16.1%), soybeans hydrolyzed powder (1.3%), water (38.7%), yeast extract (1.3%), petroleum jelly (0.7%) and paraffin wax (9.6%). Larval developmental period was recorded longer on semi-synthetic diet than on *C. cephalonica* eggs. There were two different means of *C. carnea* reared on semi-synthetic diet and *C. cephalonica* eggs were 56.7 and 82.5%, respectively. As *C. carnea* was developed, food consumption was also increased. First larval stage of *C. carnea* fed more on *Aphis gossypii* nymph, sterilized eggs of *C. cephalonica* than on *H. armigera* 54.05, 53.90 and 43.05, respectively. [4] evaluated the different biological parameters on adult diet of *C. carnea*. (A) pollen grains + honey distilled water, (B) honey distilled water, (C) royal jelly and pollen grains + honey distilled water and (D) royal jelly + honey distilled water. The overall results of egg hatching, larval survival rate, pupal survival rate, adult emergence and overall developmental period from egg to adult (89.3%, 92.6%, 95.1%, 98.1% and 77%) were observed in treatment (D), respectively. Pre-ovipositional period, long-ovipositional period and shortest total development duration (3.6, 14, and 19.3 days) were recorded on treatment (D), respectively. Highest values of net reproductive rate, intrinsic rate of natural increase, and finite rate of increase were also recorded on treatment (D). [5] reported that *Crysoperla* is predator of soft bodied insect pests. Therefore, *C. carnea* was reared on artificial diets to compare with natural diets. *Aphis craccivora* and eggs of *Corcyra cephalonica* were used as artificial diet. Artificial diets having some composition were used, in diet 1 (eggs and ginger) and in diet 2 (chemical antimicrobials and egg yolk). The predator population was significantly higher in diet 1, as compare to diet 2. On diet 2

higher pupal period was observed. In the head capsule and in body length there were no significant. IN the third instar body length was higher with diet of *C. cephalonica* eggs. Whereas, the emergence % of adult no difference were found in both diets. Therefore, diet 1 is suggested for rearing due to significantly higher population.

## CONCLUSION

First and second larval instars of *C. carnea* were survived separately on artificial diets in less numbers but after third instar it was not transformed into subsequent stage. Third instar larvae were successfully reared on artificial diets and transformed into pupation only reared on D<sub>1</sub>, D<sub>3</sub> and D<sub>4</sub>, respectively. The highest survival % of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and pupae were recorded when reared on diet D<sub>5</sub> (control) as compare to artificial diets. The larval instars lived shorter when reared in glass tube as compared to plastic tube.

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