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Effect of Population Density on Fecundity of *Chrysoperla Carnea* (Neuroptera: Chrysopidae) Under Laboratory Conditions.

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Abstract: The reproductive potential of *Chrysoperla Spp.* has been examined by a number of researchers and reported that population density of insects in rearing cages play a major role for their mass production of adult green lacewings. Therefore, an experiment was conducted for efficient and quality production of the generalist predator, *Chrysoperla carnea* (Stephen) with respect to laboratory rearing programme. Different population densities i.e. (5, 10, 15 and 20) were paired in glass chimneys of 1750 cm^3 to determine the effect of adult density of *C. carnea* on its biology. Studies revealed that five pairs (male and female) of adults produced maximum mean number of eggs (1797.0±76.05) while highest hatching (1452.8±44.55), pupae recovered (1196.8±49.10) and adult emergence (838.2±42.14). Whereas, minimum number of egg laying (814.25± 121.83), hatching (655.25±105.13), number of pupae (506.0± 97.23) and adult emergence (268.0±44.50) was recorded in treatment when 20 pairs were confined. The lower percentage of deformed adults (19.82±1.03) was recorded at 5 pairs density followed by 10 (28.0±0.91) and 15 (35.3±0.64) pairs. Maximum deformed adult percentage (42.25± 0.47) was observed in treatment where 20 pairs were confined. Therefore, findings of this study suggested that five pairs adult density of *C. carnea* in particular given space was the best among all treatments.

Keywords: *C. carnea*, deformed adults, Fecundity, population density

1. INTRODUCTION

Chrysoperla carnea (Stephens) (Neuroptera; Chrysopidae), a generalist predator for soft bodied insect pests of agricultural crops and is an important element of biological control (Nadeem *et al*, 2012). In Pakistan it is being mass reared and released successfully for the management of insect pests of different crops (Sattar and Abro, 2011). Commonly the success of biological control by an increase number of released natural enemies against insect pests in the field depends on an economically efficient mass-rearing. (Syed *et al.,* 2008). Developmental duration and survival rate of *C. carnea* are influenced by temperature, relative humidity, photoperiod, food quality and quantity (Adane and Gautam, 2002).

Despite the provision of ideal laboratory conditions, insect colonies show signs of abnormal development, reduced fertility and increased mortality due to high population in rearing cages. (Peters and Barbosa 1977; Clarke and McKenzie 1992; Hoffman and Woods 2001). According to the study of Simpson *et al.* (1999) are usually observed as a result of increased intraspecific competition for limited food, but increased close contact rate within the species can influence development and behavior in insects as observed in *Schistocerca gregaria.* To identify such potential stress for developmental and behavioral response of insects can facilitate the strategy of rearing environments that avoid possible confusing effects in investigations using laboratory populations. In order to establish laboratory colonies of *C.carnea* for the large scale production different developmental methods are necessary for current rearing system (Tauber *et al*. 2000). Adults population density in rearing cages has an important influence in the fecundity and fertility of *C. carnea*

Therefore, objective of the current research was to investigate the effect of different population densities on some biological aspects of *C. carnea* under laboratory conditions for quality production in the mass rearing colony.

2. MATERIALS AND METHODS

Study was conducted to evaluate the effect of population density on fecundity of *Chrysoperla carnea* at 26±2°C, 65±5% R.H and 8L: 16 D Photoperiod in the biological control laboratory of Nuclear Institute of Agriculture, Tandojam. Newly emerged adults were placed individually in glass chimneys (its glass apparatus used for adult rearing in lab.) along with adult diet containing nulure (protein) 4ml , sugar 5 g, honey 1g, brewer yeast 2 g and water 20 ml, respectively. After four days, virgin adults were paired in glass chimneys (1750 cm^3). Four different density regimes i-e, 5, 10, 15, 20 pairs per chimney were used as a treatment with four replications. The chimneys were covered with black colour muslin cloth piece. Diet was provided on hard paper cards (5mm x 6mm) in droplets and water was provided with wet cotton impregnated in glass vials. The eggs laid by individual females of each treatment were checked daily and the eggs laid on cover or on the inner side of the chimneys were harvested with razor. Observations on the fecundity,

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Table.1. Effect of adult *C. carnea* population densities on egg laying, hatching, number of pupae and adult emergence

Population density	Fecundity (Mean ± SE)	Fertility (Mean ± SE)	No. of pupae (Mean ± SE)	Adult emergence (Mean ± SE)
5 pair	1797.0 ± 76.05a	1452.8 ± 44.55a	1196.8 ± 49.10a	838.2 ± 42.14a
10 pair	1397.0 ± 96.115b	1179.0 ± 75.45b	991.7 ± 75.45b	608.5 ± 58.59-b
15 pair	1110.0 ± 42.15-c	923.75 ± 35.43c	767.7 ± 10.26c	428.2 ± 10.66c
20pair	814.25 ± 121.83d	655.25 ± 105.13d	506.0 ± 97.23d	268.0 ± 44.50d

In a column mean followed by same letter are not significantly different at $P < 0.05$ SE

fertility of eggs, pupae recovered, adult emergence and deformed adults were recorded on daily basis. The CRD experimental design were used for experimentation

DATA ANALYSIS:

The data of all tested parameters was analyzed by the Statistical software Statistix® Version 8.1, Analytical Software. (Steel *et al*. 1997)

3. RESULTS

The results of the experiment are presented in **(Table-1).** The fecundity and fertility was significantly higher in the treatment where 5 pairs were confined in glass chimneys. Whereas, with more number of pupal recovery and adult emergence which is followed by 10 and 15 pairs. However, significantly least fecundity, fertility, number of pupal recovery and adult emergence was observed in the treatment where 20 pairs were confined in glass chimneys. The minimum deformed adult's percentage (%) was also recorded at 5 pairs density was confined in glass chimneys followed by 10 and 15 pairs. Whereas, maximum deformed adult percentage (%) were recorded at 20 pairs **(Fig. 1).**

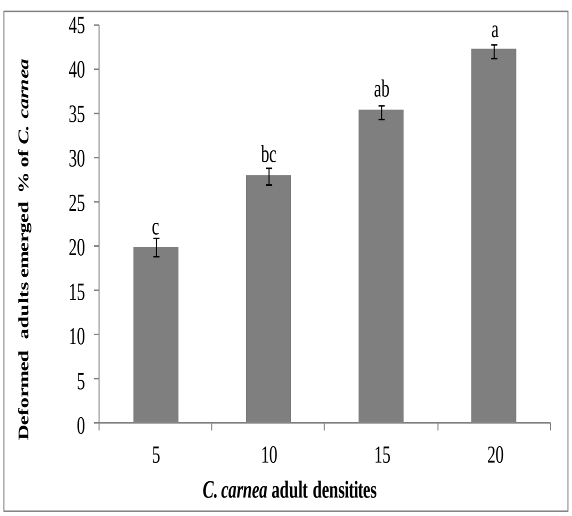

Fig. 1: Deformed adult emergence % of *C. carnea* on different population densities.

4. DISCUSSION

In this study population densities of *C. carnea* adults significantly affected the egg production, hatching, number of pupae, adult emergence and deformed adults. The maximum production parameters observed when 5 pairs were confined in chimneys as compared to other pairs i.e, 10, 15 and 20. These results are in accordance with Carvalho *et al.,* 2002 they observed that one couple per rearing unit showed the greatest fecundity (520±26.0 eggs/female) while increasing the number of couple in rearing units resulted in the decline of total oviposition capacity (270.0±103.0 eggs/female) when seven couples were cramped in the rearing unit. Samos-Petersen *et al.* 1989 described that the increased adult population in rearing cages reduced the oviposition period which ultimately affected the egg production. According to Peters and Barbosa 1977; Clarke and McKenzie 1992; Hoffman and Woods 2001 high densities of insects in rearing cages often show signs of abnormal or retarded development, reduced fertility and increased mortality rates. Singh 1977; Stone & Sims 1992 carried out a study on larval rearing of *E. kuehniella* in laboratory and observed that fecundity and fertility of *E. kuehniella* adults significantly decreased with the increasing larval density. The insects reared under the density of 100 larvae can still produce adults of the highest fecundity and fertility. Vanda Helena *et al.* (2006) investigated the effect of population density on different stages of flower *Orius insidiosus* in the laboratory and observed that the 100 eggs density was suitable for rearing of immature stage of *O. insidiosus* in both petri dishes and glass jars. For adult rearing 400 adults per container was the most suitable with the highest number of eggs laid per female in glass jars. And further suggested that with increasing in adult population in container may decrease the fecundity and fertility of the predator. Van den Meiracker (1999) conducted laboratory studies to observe the impact of adult population density i.e, 1-8 pairs of O. *insidiosus* in 1000 ml container and detected a decrease 19% in female fecundity when they were reared at a density of 8 pairs, as compare to one pair per 1000 ml container. Karelin *et al*., (1989) reported the best fecundity and fertility in 30 couples of adults rearing cage (2062cm^3), and observed reduction on 25th day and suggested the destruction of adult rearing cages over 25 days. Carvalho *et al.*, (1996), observed the population density, feeding, temperature, relative humidity and photoperiod effect the reproductive capacity of adults of *Chrysoperla externa* and *Ch. Mediterranea* the in the mass rearing system. The suitable adult stage density of Ch*rysoperla mediterranea* is important for evaluation of main biological parameters for laboratory rearing and time for the expiry of adults (Finney 1948, 1950, Morrison and Ridgway 1976, Nunez 1988, Ribeiro *et al*. 1993).

5. CONCLUSION AND RECOMMENDATION

On the basis of findings of the study it is concluded and suggested that the overall developmental performance of *C. carnea* with special reference to fecundity decreased with the increase in adult density in rearing cages. Therefore, adults reared at 5 pairs density/chimney is recommended to produce a satisfactory quality of this predator.

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