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Influence of Abiotic Factors and Hosts on Seasonal Dynamic of Green Lacewing, *Chrysoperla carnea* (Stephens)

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ABSTRACT

Influence of abiotic factors and hosts on population dynamics of green lacewing, *Chrysoper lacarnea* (Stephens) was studied in sunflower, *Helianthus annus* (Linn.).The maximum number of *C. carnea* population was found during mid March –mid April in the first year and mid April – mid May in the second year in sunflower crop. The maximum number of host population *viz.* egg and larva *of Helicoverpa armigera* and *Myzuspe persicae* population were found during mid March –mid April in both the year and correlation studies revealed the positive and significant correlation between larval population of *H. armigera, M. persicae* and predator *C. carnea.* While there was no significant relationship found between eggs of *H. armigera* and *C. carnea*. The *C. carnea* population on *H. annus* during both the year was positively correlated with maximum temperature and found significant, while negatively correlated with relative humidity. However, no significant correlation of *C. carnea* was found with minimum temperature in both the year.

Keywords: Seasonal abundance, *Chrysoperla carnea, Helicoverpa armigera, Myzus persicae.*

INTRODUCTION

The green lacewing, *Chrysopela carnea* (Stephens) (Chrysopidae: Neuroptera) is a major predator among the various insects. It is known to feed on various soft body pests such as aphids, eggs and larvae of lepidopterans, thrips, scale insects, mealy bugs, mites etc. and is active throughout the year in India (Anonymous, 1992). In undative release of *C. carnea* has been found effective in managing various pests of different crops such as sunflower, groundnut, tobacco and cotton (Ridgway and Murphy, 1984; Singh and Jalali, 1991). The environmental conditions play an important role for growth and development of any organisms. As *C. carnia*is an important predatory insect, therefore it was felt to study the influence of various weather parameters (temperature, relative humidity, rainfall, wind velocity and sunshine hours) and hosts *viz.H. armigera*and *Myzus persicae* population on seasonal abundance of *Chrysoper lacarnea*on sunflower crop.

MATERIALS AND METHODS

The seasonal abundance of *Chrysoper lacarnea* (Stephens) was studied on sunflower, *Helianthus annus* (Linn.) at G.B. Pant University of Agriculture and Technology, Pantnagar. To study the polpulation dynamics of *C. carnea*, sunflower field was divided into five units *i.e.* four corners and one in the center of the field. Five plants were selected at random from each unit and population of eggs, larvae and pupae of *C. carnea* were recoded weekly from nine leaves i.e. three from lower, middle and upper canopy of each plant. To count the adult population of *C. carnea*, insect collection net was swept five times in each unit and it was replicated three times. The population of eggs and larvae of *Helicoverpa armigera*, and aphid *Myzus persicae* was also observed from these at randomly selected five plants of sunflower simultaneously. Weekly observations of weather parameters like maximum and minimum temperature (^{0}C), maximum and minimum relative humidity (%), rainfall (mm), sunshine (hr), and wind velocity (km/hr) were recorded from the University Meteorological Observatory, Pantnagar. The Populations of *C. carnea* were correlated statistically with the host populations and these weather parameters using the correlation and regression analysis. The correlation was done as per the formula:

$$r_{xy} = \frac{S_{xy}}{\sqrt{S_{xy}S_{xy}}}$$

Where x, weather parameter and hosts population

y=*C. carnea* Population

Multiple regression between *C. carnea* populations and weather parameters was done as:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7$$

where y, *C. carnea* population; a, constants; b_1, b_2, b_3, b_4, b_5, b_6 and b_7 constants, regression coefficients; x_1, maximum temperature; x_2, minimum temperature; x_3, maximum relative humidity; x_4, minimum relative humidity; x_5, rainfall; x_6, wind velocity and x_7, sunshine hours.

Multiple regressions between *C. carnea* populations and hosts populations were done as:

$$y = a + b_1x_1 + b_2x_2$$

where y, *C. carnea* population; a, constants; b_1, *Helicoverpa armigera* population and b_2, aphids, *Myzus persicae* population (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

To study the seasonal abundance and hosts predator interaction of the *C. carnea* with *H. armigera* and *M. persicae* observations taken from first week of February to last week of

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Junein sunflower crop in the first year. The eggs of *C. carnea* were starts to appear in the field during 7th standard week (12Februry -18 Februry) and reached at it's peak during 17th standard week(23April -29April) (Table 1).The number of eggs was quite high during mid April, which was in accordance with Mannan *et al.* (1995); and Sengonca *et al.* (1994) who reported that oviposition of *C. carnea* was quite high during mid March to mid April in sunflower crop.

The larvae and pupae of *H. armigera* started to appear from12th standard week (19March-25March).The adults of *C. carnea* observed from the 11th standard week (12March- 18March). The maximum number of larval and adult population was observed in 18th standard week (30April-6May).The maximum number of pupal population was observed in 16th standard week (16April-22April).The highest populations of eggs of *H. armigera* and *M. persicae* were found during13th standard week (26March-1April).The maximum numbers of larvae of *H. armigera* were found in 17th standard week(23April-29April).There was a good correlation found between the larval population of *H. armigera* and total population of *C. carnea*.

The correlation coefficient between predator*C. carnea* and *H. armigera*was positive and significant (r = 0.940). However no significant correlation was found with larva of *H. armigera* and *Myzus persicae*(*r* = 0.264, 0.440 respectively.)(Table3). It was observed that during March-April, the peak period of *H. armigera* and aphid infestation coincided with peak period of predator population. These observations were in accordance with the findings of Mahmoud *et al.*(1981) who reported a positive correlation between aphid populations and their predators. Similarly, Ghavami and Ozgur (1992) reported that *C. carnea* population increased in relation to pest populations. Mannan *et al.* (1995) reported that all the life stages of the predator were found throughout the year except during fourth week of February, second week of August and fourth week of September. The highest aphid population was recorded during March and April and the correlation studies revealed the positive correlation between population of aphid and predator which were highly significant.

The correlation between maximum temperature and *C. carnea* population was positive and significant (r = 0.452) (Table 4).

Table 4: Correlation coefficient between weather parameters and *Chrysoperla carnea* population on sunflower during 2008 and 2009

Weather Parameters	Correlation coefficient 2008	2009
Maximum temperature (^{0}C)	0.452*	0.500*
Minimum temperature (^{0}C)	0.220	0.361
Maximum relative humidity (%)	-0.842*	- 0.520*
Minimum relative humidity (%)	-0.619*	- 0.636*
Rainfall (mm)	-0.086	- 0.333
Wind velocity (km/hr)	0.237	- 0.201
Sunshine (hrs)	0.059	0.529*

**P*=0.05

Though, there was significant negative correlation between maximum and minimum relative humidity and predator population (r = -0.842, r = -0.619 respectively). However no significant relationship was observed with minimum temperature, wind velocity and sunshine (r = 0.22, 0.237 and 0.059 respectively) (Table 4). These observations were in accordance with the finding of Cardoso *et al.* (2003), who has reported that the Chrysopids predator were recorded mostly during the summer, possibly influenced by temperature and Swaminathan *et al.*(2003) reported that the population of *C. carnea* was higher during winter than summer.

The cumulative regression coefficient between *C. carnea* and host population during 2008 was positive (R^2=83.406) (Table 5).

Table 5: Cumulative regression coefficients between host population and *Chrysoperla carnea* population on sunflower during 2009

Host population	2008 b	2008 R^2	2009 b	2009 R^2
X 1 (Eggs of *Helicoverpa armigera)*	2.85		10.72	
X 2 (Larvae of *Helicoverpa armigera)*	105.30	83.406	69.44	83.281
X 3 (Aphid, *Myzus persicae)*	-7.15		-42.17	

The cumulative regression equation between *C carnea* and host population was Y= -150.97+2.85X1+105.30X2-7.15X3. The cumulative regression coefficient between *C. carnea* and weather factors during 2008 was positive (R^2=83.72) (Table 6).

Table 6: Cumulative regression coefficients between weather parameters and *Chrysoperla carnea* population on sunflower during 2009

Weather Parameters	2008 b	2008 R^2	2009 b	2009 R^2
X_1(Maximum temperature)(^{0}C)	-0.016		0.004	
X_2(Minimum temperature) (^{0}C)	-0.155		0.34	
X_3(Maximum relative humidity) (%)	0.046		-0.046	
X_4(Minimum relative humidity) (%)	-0.114	83.729	0.053	90.840
X_5(Rainfall) (mm)	-0.083		0.013	
X_6(Wind velocity) (km/hr)	-0.043		-0.073	
X_7 (Sunshine) (hrs)	-0.116		0.075	

In the second year 2009 observation on interaction of the *C. carnea* with *H. armigera* and *M. persicae* were taken from first week of February2009 in sunflower crop till the last week of June. The eggs of *C. carnea* first appear in 9th standard week(26Februry-4March) and gradually increased and reached at it's peak in 19thstandard week (07May-13 May) (Table 2). Then the egg population of *C. carnea* gradually decreased from 20th standard week (14May-20May) to 26th

standard week (25Jun-1Jul). The larval and pupal population of *C. carnea* first appear in 12th standard week (19March-25March), increased gradually and reached at it's peak in 18th standard week (30April-6 May) and pupal population in 17th standard week (23April-29April). The adult population of *C. carnea* first appear in 11th standard week(12March-18March) and reached at it's peak in 17th standard week (23 April-29April). Therefore, results revealed that maximum larval, pupal and adult population of *C. carnea* was found in the month of April, which is similar to the previous year results.

The egg population of *H. armigera* first appear in 7th standard week (12 Februry-18Februry) gradually increased and reached at it's peak in 15th standard week (09April-15April) .Then the egg population gradually decreased from 16th standard week (16April-22April) to 20th standard week (14May-20May).

There were no eggs found in 21st and 22nd standard week of May and month of June.The first larval population of *H. armigera* was found in 7th standard week (12Februry-18Februry), gradually increased and reached at it's peak in 19th standard week (7May-13May). Then the larval population of *H. armigera* gradually decreased from 20th standard week (14May-20May) to 25th standard week (18June -24June). There was no larval population found in 26th standard week (25June -1July). The *M. persicae* population was found throughout the season and it's peak was found in 15th standard week (09April-15April).

Thus results revealed that the highest number of host population was found in the month of April which was very well synchronized with the population of predator *C. carnea.*

The correlation coefficient between predator *C. carnea* and *H. armigera* was positive and significant (r = 0.939). However non significant correlation of *C. carnea* was found with larva of *H. armigera* and *Myzus persicae* (*r* = 0.246, 0.603 respectively)in the year 2009 (Table3).

Table 3: Correlation coefficient between host population and *Chrysoperla carnea* population on sunflower during 2008 and 2009

Host population	Correlation coefficient	
	2008	2009
Eggs of *Helicoverpa armigera*	0.264	0.246
Larvae of *Helicoverpa armigera*	0.940*	0.939*
Aphid, *Myzus persicae*	0.440	0.603*

*P =0.05

The correlation coefficient between *C. carnea* and weather factors during 2009 was positive and significantfor maximum temperature and sunshine(r= 0.500 and 0.529 respectively), negative and significant for maximum relative humidity and minimum relative humidity (r= -0.520 and -0.636 respectively). However, no significant relationship was found with minimum temperature, rainfall and wind velocity (r=0.361, -0.33 and -0.201 respectively).The cumulative regression coefficient between *C carnea* and host population during 2009 was positive (R^2=83.281) (Table 5). The cumulative regression equation between *C. carnea* and host population was Y= 11.49+10.72X1+69.44X2-42.17X3. The cumulative regression coefficient between *C.carnea* and weather factors during 2009 was positive (R^2=90.84) (Table 6). It may be concluded that, the predator, *C. carnea* is available throughout the crop season. The egg laying was maximum during mid March- mid May and host population is coincided with the predator population, which was positively correlated with maximum temperature.

CONCLUSION

Thus, it may be concluded that weather condition play an important role in seasonal incidence and activity of pest population and as well as their predator population. The predator population increases with the increasing temperature and decreasing relative humidity from March to April and at the same time larval, pupal and adult population of *C. carnea*is increases. Therefore, application of insecticide for the control of *H. armigera* and Aphis in the month of March and April should very be carefully and considering the predator population in the field.

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