

OUTLINE OF RESEARCH WORK
ON
BIOLOGY AND FEEDING POTENTIAL OF LADYBIRD
BEETLE (*Cheilomenes sexmaculata* F.) ON DIFFERENT HOST



Submitted by
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OUTLINE OF RESEARCH WORK (ORW)

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3. DEGREE FOR WHICH ADMITTED : M.Sc. (Agri.)
4. YEAR OF ADMISSION : 2011-2012
5. DISCIPLINE : Agricultural Entomology
6. MAJOR FIELD : Agricultural Entomology
7. MINOR FIELD : 1.Plant Pathology
2. Agronomy
3. Agril. Statistics
- 8.TITLE OF THESIS :**BIOLOGY AND FEEDING POTENTIAL OF
LADYBIRD BEETLE (*Cheilomens
Sexmaculata* F.) ON DIFFERENT HOSTS.**

9. INTRODUCTION

Insect pests have always been a threat to agriculture productivity in India, in result the crop productivity per unit area is still far less than the potential exists or when comparison is made with the achievements of advanced agricultural countries of the world. Thus for controlling these harmful insects, different chemicals (pesticides) are applied against different insect pests (Pearson, 2004). The farmers spray toxic chemicals (pesticides) on cotton, vegetables, oilseeds and fruit crops in order to avoid the pest infestation. Due to the intensive and indiscriminate use of many pesticides poison, people suffer from many diseases, and some of these are chronic for human beings. Use of pesticides has resulted in the environmental pollution on large scale. Besides contaminating food and food products, pesticides have been accumulating in the soil, air and water to a critical stage.(Sarhad j.Agric vol.23,No,3,2007)

This calls for a safe and cheap control method. This can only be achieved by the practice of Integrated Pest Management (IPM); a pest control management which ensures environmental safety (Solangi,2004).ladybird beetle, *Coccinella spp.* is one of the most common predators, which can consume its weight in 40 aphids daily as a mature grub (larva) and as many as 53 aphids daily as an adult. Ladybird beetles have been imported to control outbreaks of aphids and scale insects.

The Ladybird beetle characterized by the mandibles having simple or bifid apices and each jaw being armed with a basal tooth. These are most important of all predators. They are active in both the larval and the adult stage and have a considerable range of prey, which includes some of the most destructive groups of insects, notably the aphids and the scale insects. The ladybird beetles are predaceous on Nymphs of cowpea aphids (*Aphis craccivora*),Nymphs of cotton mealybug (*Phenacoccus solenopsis*), Nymphs of sorghum aphids (*Rhopalosiphum maydis*), Nymphs of cotton aphids (*Aphis gossypii*), Neonate of *Helicoverpa armigera*, semilooper, Eggs of *Corcyra cephalonica* sugarcane aleyrodid, citrus psyllid, mites and sorghum stem borer, Shepard, (1998).

Keeping in view the significance of predator (ladybird beetle) for a safest control of insect pest (aphid), this study will performed with following objective to investigate it's feeding potential on different host.The findings of study will be helpful for the future research for planning the control of aphid under field conditions under agro-ecological conditions of vidarbha region.

OBJECTIVES:

- a) To study the biology of *Cheilomens sexmaculata*. F. on cow pea aphid (*Aphis craccivora*)
- b) To study the feeding potential of *Cheilomens sexmaculata* F. on different hosts.

10. REVIEW OF LITERATURE:

Pervez (2004)studied Predation potential,development, immature survival and reproduction of an aphidophagous ladybeetle, *Propylea dissecta* (Mulsant) was studied when fed on seven aphid prey, viz. *Aphis gossypii*, *Aphis craccivora*, *Lipaphis erysimi*, *Uroleucon*

compositae, *Brevicoryne brassicae*, *Rhopalosiphum maidis* and *Myzus persicae*. *A. gossypii* was most suitable and consumed by the larvae and adults of *P. dissecta*, while *M. persicae*, the least. Pre-imaginal development of *P. dissecta* was fastest (0.080 day^{-1}) when *A. gossypii* was used as prey, whilst slowest (0.061 day^{-1}) on *M. persicae*. The immature survival, adult emergence, adult male and female longevity of *P. dissecta* was maximal (i.e., 77.10 ± 0.04 and $93.21 \pm 0.79\%$, 57.10 ± 1.62 and 62.40 ± 1.93 days, respectively) on *A. gossypii* and minimal (i.e., 63.01 ± 1.87 and $81.73 \pm 1.79\%$, 42.50 ± 1.21 and 49.40 ± 2.32 days, respectively)

Khursheed et al. (2006) Studied different developmental stages of *Coccinella septempunctata* was observed that the egg, larval, pre-pupal and adult stages occupied more duration in first generation as compared to second, total larval period 16 ± 1.73 days and pupal period, 7.5 ± 0.87 days was more in first generation in contrast to second 13.5 ± 0.87 days and 6.5 ± 0.87 days, respectively. However, similar was the trend with respect to longevity of males and females. Adult stage of *Coccinella septempunctata* consumed more aphids in both generations as compared to larval. Nevertheless, when a comparison was made, between larval instars, it was observed that older larvae consume more number of aphids/day.

Solangi et al. (2007) Conducted a field study was carried out during 2005 in Tandojam, Pakistan, to investigate the searching behaviour and feeding potential of 7-spotted ladybird beetle (*C. septempunctata*) on mustard aphid (*Lipaphis erysimi*). The aphid consumption of the 1st, 2nd, 3rd and 4th instar grubs of 7-spotted beetle was affected significantly by the host density (10, 15, 20, 25 and 30 aphids). The aphid consumed at host density of 10 was 1.1 ± 0.10 , 1.65 ± 0.96 , 1.95 ± 0.09 and 2.8 ± 0.14 in laboratory and 0.92 ± 0.09 , 1.35 ± 0.09 , 1.75 ± 0.09 and 2.55 ± 0.15 /beetle under field conditions by the 1st, 2nd, 3rd and 4th instar grubs of 7-spotted beetle, respectively.

Sattar et al. (2008) Evaluated the predatory potential and biology of seven spotted ladybird beetles (*Coccinella septempunctata* Linn.) fed on cotton aphid (*Aphis gossypii* Glover) under laboratory conditions ($26 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ R.H.). The results revealed that mean consumption of aphids per *C. septempunctata* adult was 77.8 ± 5.15 , whereas, 21.9, 55.9, 107.4 and 227.3 aphids were consumed by a single larva during 1st, 2nd, 3rd and 4th instars, respectively. A single female laid 177.0 ± 23.03 eggs during entire life period. The egg hatching was $98.3 \pm 2.79\%$ while $82.2 \pm 6.20\%$ larvae survived upto pupal stage. Total

larval and pupal duration was 18.3 ± 0.53 and 4.9 ± 0.58 days, respectively. Mean percent emergence in male and female was 36.6 ± 2.98 and 56.6 ± 4.21 , respectively. Male to female sex ratio was recorded 1:1.5.

Erika et al.(2009) Studied that predatory behavior and reproductive output of the ladybird beetle *Stethorus tridens* Gordon as function of the tomato red spider mite (TRSM), *Tetranychus evansi* Baker & Pritchard, densities was investigated in the laboratory. Adult female of *S. tridens* were isolated in cylindrical plastic arenas, containing a leaf disc of *Solanum americanum* Mill. with 5, 20, 40, 60, 80 or 100 *T. evansi* nymphs. The number of prey consumed and eggs laid were evaluated daily for ten consecutive days, starting at the oviposition. Oviposition of *S. tridens* was positively correlated with prey consumption and lower threshold prey consumption for *S. tridens* laying eggs was 16.3 mites per day. The instantaneous rate of attack (ca. discovery area) and the handling time were 0.0062 h^{-1} and 0.83 h, and 0.00254 h^{-1} and 0.78 h, respectively, for predators at the 1st- and 10th-oviposition day.

Shera et al. (2010) reported that potential impact of ladybird beetle, *Coccinella septempunctata* L. on cotton mealy bug, Tinsley and aphid, *Aphis gossypii* Glover Results revealed that aphids were slightly more preferred (53.8%) as compared to mealy bugs (46.2%) when both were exposed together to adult of *Coccinella septempunctata* in free choice test. In no choice test, when aphids and mealy bugs were fed individually to *Coccinella septempunctata*, the predation of mealy bugs was 80 per cent after 24 hours; however it increased to 84.7 per cent after 96 hours. The overall mealy bugs consumption varied from 24.0 ± 0.77 to 25.40 ± 0.98 per day. The mean number of aphids consumed the predator varied from 26.00 ± 0.81 to 28.00 ± 0.71 per day and the per cent predation was 88.7 per cent after 24 hours and it increased to 93.3 per cent after 96 hours.

Anonymous (2012) study, stage- and age-specific predatory patterns and nutritional ecology attributes of four co-occurring aphidophagous ladybirds, namely, *Coccinella septempunctata* (L.), *Coccinella transversalis* F., *Cheilomenes sexmaculata* (F.) and *Propylea dissecta* (Mulsant) on pea aphid, *Acyrtosiphon pisum* (Harris) were investigated. Despite their lower consumption rates, smaller ladybirds (*C. sexmaculata* and *P. dissecta*) and earlier instars were efficient converters of aphid prey with higher relative growth rates, over the respective larger ladybirds (*C. septempunctata* and *C. transversalis*)

and fourth instars. The consumption rates of pea aphids by the larvae increased with stage, but with a decline in the later part of the fourth instars, just prior to pupation.

11. METHODOLOGY:

11.1. Procurement of different host:

a) *Cheilomens sexmaculata* :

To obtain the eggs of *Cheilomens sexmaculata* throughout the experimental period, rearing will be carried out in the laboratory. Egg, larvae and adults of *Cheilomens sexmaculata* will be collected from their natural habitats during the spring months from plants already infested with aphids in fields and gardens.

b) Procurement of host from different crops:

The different hosts like cowpea aphids, sorghum aphids, Cotton aphid mealy bug spp. will be collected from field. The larvae/pupae of *Helicoverpa armigera* (Hub.), and semilooper will be collected and reared in the laboratory to get F1 population and then the neonate larvae will be used for treatments.

11.2. Experimental Details:

The studies on predatory potential of *Cheilomens sexmaculata* F. on different hosts will be carried out in the biocontrol laboratory.

- a) Design of experiment : C.R.D.
- b) Number of replications : 3
- c) Number of treatments : 7

11.2.1 Details of treatments:

- T1 - Cowpea aphids (*Aphis craccivora*)
- T2 - Sorghum aphids (*Rhopalosiphum maydis*)
- T3 - Cotton aphids spp. (*Aphis gossypii*)
- T4 - Mealy bug spp.
- T5 - Neonate of *Helicoverpa armigera*
- T6 - Neonate of Semi looper (*Chrysodeixis acuta*)
- T7 - Eggs of *Corcyra cephalonica*

a) Biology of *Cheilomens sexmaculata* on Cow aphid(*Aphis craccivora*)

The adults of the predator ladybird beetle, *Cheilomens sexmaculata* will collect from the field of Entomology Department, College of Agriculture, Nagpur. The stock culture was prepared in laboratory under controlled conditions ($26\pm 2^{\circ}\text{C}$ and $65\pm 5\%$ R.H.) Single pair of the newly emerged virgin adults of *Cheilomens sexmaculata* will placed in petridish and fed with counted number of insects as different treatments. The top of the petridish were covered with muslin cloth, 10% honey solution and water will also placed in petridish for adult feeding. Damp cotton wool was placed on the top of the cover, to ensure humidity. Eggs laid by female on the walls of petridish were removed daily, counted and transferred in petri dishes. Ten eggs per treatments will observed in three replications for percent hatching and incubation period will recorded. After hatching, the grub will collected with a fine point camel hair brush and placed in new petridish. In three replications ten grub each will be observed for grub and pupal duration (days). Each grub instar will be provided with a known number of aphids, The numbers of aphids was increased daily and as the larvae entered to next instar. Ten pupae per replicate will be kept in three replications to record the data on longevity and fecundity of *Cheilomens sexmaculata* female.

• Biological observations:

The biological observation will be taken on the basis of following parameters:

1. Incubation period
2. Larval period
3. Pupal period
4. Adult longevity
5. Preoviposition period
6. Fecundity

b) Feeding potential:

The grubs of first, second, third and fourth instars of *Coccinell spp.* were obtained from the culture maintained the laboratory for experimentation. Each grub of respective instar was provided with 50 aphids, neonate of noctuide in mealy bug and eggs of *Corcyra* in petridishes. The experiment in each case was replicated three times. The consumption of aphids was recorded daily (by counting unconsumed aphids) and continued till grub entered into the next development stage. The record of dead aphids (beetle injured) in each petridish was also maintained.

13.LITERATURE CITED:

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12. FACILITIES REQUIRED AND THEIR AVAILABILITY:

For conducting experiment rearing room, factitious host (*Corcyracephalonica*), eggs of, thermometer, goggles, petri plates, glass plastic vials, cages, black album papers, weighing balance, formaldehyde, crushed sorghum grain, muslin cloth etc. will be required.

All these materials will be made available by Entomology section, College of Agriculture, Nagpur.

14. PLACE OF RESEARCH WORK:

The work will be carried out in the laboratory of Entomology section, College of Agriculture, Nagpur.

Date:

Signature of student

Place: Nagpur

(Gujar Swapnil Vilasrao)

RECOMMENDED BY ADVISORY COMMITTEE

The ORW prepared by the student was presented before the Advisory Committee on dated..... and Advisory Committee approves the same.

1. Chairman Dr. A. K. Sadawarte -----
2. Member Dr. R. W. Gawande -----
3. Member Mr. P. N. Dawane -----
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RECOMMENDED

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