BIOLOGY OF LADYBIRD BEETLE *Micraspis discolors* (Fab.) (COCCINELLIDAE: COLEOPTERA)

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ABSTRACT

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The experiment was conducted at the Department of Entomology, Hajee Mohammad Danesh Science and Technology University, Dinajpur, during January to April 2007 at 21.02ºC ± 4.5 ºC (Room temperature) and 66.05 ± 0.95 % RH to observe the biology of ladybird beetle . The mean pre-oviposition period of the ladybird beetle *Micraspis discolor* was 5.1±0.48 days and the oviposition period was 40.10 ±0.46 days. The female beetles laid on an average 235.50 ±7.96 eggs and the hatching % was 83.93 ±2.11. The average incubation period was 3.1± 0.22 days and the duration of total the larval period from egg to adult was 10.76 ±1.35 days. The pre-pupal and pupal periods were 1.50 ±0.20 and 2.60± 0.21days, respectively. The mean longevity of the male and the female beetles were 40.20 ±1.0 and 47.50 ±0.82 days, respectively.

Keywords: Ladybird beetle, incubation, larval stage

INTRODUCTION

The ladybird beetles have been associated with good fortune in many myths and legends. They have been honoured through the centuries as they vernacular indicate that the term 'Lady' is in reference to biblical Mother Mary (Roache, 1960). The ladybird beetles have been known worldwide as a predator of a number of insects. They are distributed in many countries of Asia, including Bangladesh (Islam and Nasiruddin, 1978). This beetles, often called ladybug or coccinellids. They are the most commonly known of all beneficial insects. In Europe these beetles are called ladybirds (William, 2002). They are of great economic important as predaceous both in their larval and adult stages on various important crop pests such as aphids, coccids and other soft bodied insects including aphids (Hippa *et al*, 1978; Kring *et al*, 1985), while the species *M. discolor* feed on many inscet pests such as aphids, brown plant hopper, corn borer, Lepidopteron insects, mealybug, white flies (Rao *et al*, 1989; Mani, 1995). This predaceous coccinellids is also found in association with those insects infesting bean, wheat, chilli, sorghum, tobacco, cotton, maize, potato, lathyrus, soyabean, sweet potato, lentil, mustard, brinjal, groundnut, sunflower and cabbage. (Gautam *et al*, 1995; Duffieded, 1995).

Country bean (*Lablab purpureus* Linn.) is a common and popular vegetable of Bangladesh. Locally it is well known as ``Sheem`` and cultivated widely in winter season in our country. It contains 4.5% protein in pod, 25% protein in dry seed (Rashid, 1976). It also content with appreciable amount of vitamin, phosphate, calcium and sodium (Gopalan *et al*, 1982). Generally it is also known as income generating crop in our country. This crop is also important for its atmospheric nitrogen fixation (Kalra, 1979).

The aphid is one of the most destructive pests and its distribution is world wide. Bean aphid, *Aphis craccivora* Koch. attack the bean plant and other leguminous crops attacked by the nymphs and the adults of aphid cause damage by sucking the sap from the flowers, buds, pods, tender shoots and reduce the market value (Srivastava and Singh, 1986). At the time of infestation plants fail to give flowering and pods setting resulting in 20-40% yield loss (Islam, 2007).

In Bangladesh the bean growers use various insecticides to control bean aphid. Insecticidal control is not only expensive but also its residues left over the sprayed surface of the crops or in the soil and have become a matter of concern of environmental pollution. The indiscriminate use of pesticides causes phytotoxicity and destruction of beneficial organisms such as predators, parasitoids microorganisms and pollinators (Luckman and Metcalf, 1978). Global warning has cautioned us and the adverse consequences of inesticide use are always alarming and also inducing pest out break because of pest resistance. These entomological backlashes have compelled the scientists to be concerned with entomologically compatible pest management programs (Hodek, 1970).

Now a day, Integrated Pest Management (IPM) is well known to entomologists, where all suitable pest control techniques are being used to find ecologically sound and environmentally safe ways of pest control. Biological control should be regarded as the backbone of any IPM program and about 90% of all potential pests are already under biological control (Debach and Rosen, 1991). The biological control is one of the most effective means of achieving insect control (Pedigo, 2004). The vegetable growers use less insecticide or avoid insecticides in

developed countries. In recent years, pest control particularly for aphids has been revolutionized by the application of predators and parasitoids in those countries (Bari and Sardar, 1998). The coccinellid beetles are considered to be a great economic importance in agro-ecosystem through their successful employed in the biological control of many injurious insect (Agarwala *et al*, 1988).

In our country most of the farmers are not well acquainted with grubs and pupae of the lady birds. They are accustomed to use insecticide indiscriminately without monitoring the pest population above the Economic Threshold Level (ETL) as well as consulting experts of this line. Its adverse side effects have already caused threat to a great extent to human being, beneficial predators. Our poor farmers are becoming poorer and crops vulnerable to attack and disease. In this aspect exploration of predators like *M. discolor* in Bangladesh may play a vital role as part of IPM Programme.

The study of the biology of *M. discolor* would help to use this insect of proper biological control. But reviews of biology of *M. discolor* is limited and environmental conditions of Dinajpur are different from other areas of the country. So, the present study was undertaken to observe the biology of *M. discolor*

MATERIALS AND METHODS

The experiment was conducted at the laboratory of the Department of Entomology, Hajee Mohammad Danesh Science and Techonolgy University (HSTU), Dinajpur, during the period of January to April 2007. All the experiment were completed at 21.02^0C $\pm$ 4.5^0C (Room temperature) and 66.05 $\pm$ 0.95 % RH.

Collection and mass culture

A culture of large number of larvae and adult predator of *Micrapis discolor* was established in the laboratory in order to supply necessary insects for the experiment. For this reason, some males and females of the *Micrapis discolor* were collected by sweep net from the unsprayed horticulture field and were confined in petridishes. Bean aphids were also collected daily with infested bean leaves, stems, twigs and inflorescences from the same unsprayed field and supplied as food. These beetles were sexed and paired in petridishes (6.0 x1.0 cm). The bottom of the petridishes was covered with blotting paper (Whitman filter paper no 1). After hatching of eggs, the grubs were transffered to several medium sized petridishes (11cm diameter) and reared on bean aphids. The emerged adults were sexed and confined in pairs in the petridishes and fed on bean aphids. Egg masses were collected and reared as above and continued for several times for obtaining large number of larvae and adult predators.

Study of Biology

Egg laid by each female during 24 hours were counted and kept in separate petridish to determine the total number of eggs laid per female and also hatching period including hatching percentage (%) of eggs were recorded. After hatching of eggs young larvae were then transfered individually in pertridishes (6.0 $\times$ 1.0 cm), containing blotting paper at the bottom. Fresh bean shoots infested with aphids were placed in each petridish to provide food for the larvae every morning. The larvae were observed twice daily at 12 hrs interval until pupation. The number of instars and period of each instar were recorded. The pupae were kept undisturbed in the respective petridishes until the emergence of adult. At the same time the pupal period was recorded. Ten replications were used in this case.

Statistical analysis

The Data were analyzed by Analysis of Variance (ANOVA) and the mean values were separated by Duncan's Multiple Range Test (DMRT). All analyses were performed using SPSS, version 12.01 (SPSS, Chicago, IL, USA).

RESULTS AND DISCUSSIONS

Pre-oviposition

The time between the date of adult emergence and the first egg deposition was considered as pre-oviposition period. The pre-ovipositon period of *M. discolor* was 3 to 7 days with an average of 5. 10 ± 0.48 days (Table 1)). Agarwala *et al* (1988) observed that the pre-oviposition period was 6 to 10.33 days on *A. craccivora at* 16-26^0C. Prodhan *et al* (1995) studied that the pre-oviposition preiod of *M. discolo*r was 3 to 7 days, which is simillar to the present findings.

Ovipostion

Oviposition period was the duration between first and last egg laying. The ovipostion period in the present study was 38 to 43 days. (Table 1) and the mean ovipositon period was 40.10 ± 0.46 days. Prodhan *et al* (1995)

reported that the period of *M. discolor* lasted from 35 to 42 days using *A. craccivora* as food, which is similar to the present observation.

Incubation

Incubation period was the duration between the dates of egg laying and hatching. The incubation period was 2 to 4 days with an average of 3.10 ± 0.22 days (Table 1). Islam and Nasiruddin (1978) observed that the incubation period of *M. discolor* was 2 days on cotton aphid. However, Ngammuang (1987) and Prodhan *et al* (1995) reported that it was 2 and 3 days respectively using bean aphids as host. These results seem to be close with the present observation.

Table 1. Duration of different stages of *M. discolor* as noted in the study

Different stages	Duration of days		Mean ± SE
	Minimum	Maximum	
Pre-oviposition period	3	7	5.10 ± 0.48
Oviposition Period	38	43	40.10 ± 0.46
Incubation period	2	4	3.10 ± 0.22
Total larval period	8.8	14	10.76 ± 0.47
Pre-pupal period	1	2	1.50 ± 0.20
Pupal period	2	4	2.60 ± 0.21
Total developmental period from egg to adult	12.5	25	17.96 ± 1.35
Longevity of adult			
Male	35	45	40.20 ± 1.00
Female	45	53	47.50 ± 0.82
Average longevity of the beetle			43.85 ± 0.91

Duration of larval stages

The total larval period (1st instar to 4th instar) was 10.76 ± 0.47 days (Table 1). Nasiruddin and Islam (1979) observed that the total period of *M. discolor* was 11.8 to 12.5 days, which is higher than the present findings. Prodhan *et al* (1995) observed that the total larval period of *M. discolor* varied from 7 to 9 days on bean aphid. This result was lower than the present study. However, Sakurai *et al* (1991) reported that the quality of food and environmental factors like temperature, humidity also play an important role on different aspects of the biology of coccinellid beetles. So, this variation may be due to the quality of food and environmental factors like temperature and humidity.

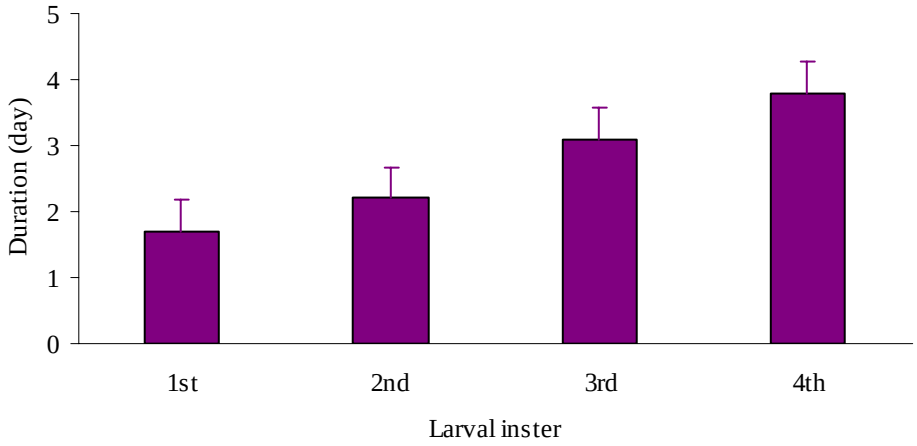

Figure 1. Duration (mean ± SE) of different larval instars of *M. discolor* reared on bean aphid.

First instar

The newly hatched larval period was 1 to 3 days and on an average of 1.71 ± 0.20 days (Figure 1). Prodhan et al (1995) reported that this period of *M. discolor* was 2 to 3 days using bean aphid as a host. This result supported to the present observation.

Second instar

The results of the duration of the 2nd instar varied from 1.50 to 3 days and the mean duration was 2.20± 0.16 days (Figure 1). Nasiruddin and Islam (1979) found that the duration of the 2nd instar larvae of *M. discolor* was 2.4 to 3.1 days on different aphid, which is comparatively similar to the results of the present findings. Prodhan *et al* (1995) found that the duration of 2nd instar of *M. discolor* varied from 1 to 2 days using bean aphid using cabbage aphid as a host.

Third instar

The result indicated that the duration of the 3rd instar larvae lasted from 2 to 4 days. The mean duration of 3rd instar larvae was 3.10±0.17 (Fig. 1). Nasiruddin and Islam (1979) found that the duration of the 3rd instar larvae of *M. discolor* varied from 3.1 to 3.8 days on maize, bean and chilli aphids as host. This result supported to the present observation.

Fourth instar

Observation made on the larval duration of the 4th instar larvae on an average 3.75±0.19 days with minimum of 3 days and maximum of 5 days (Figure 1). Prodhan *et al* (1995) reported that the duration of final instar larvae of *M. discolor* was 3 days. Nasiruddin and Islam (1979) found that the duration of the 4th instar larvae of *M. discolor* varied from 3.8 to 4.2 days on maize, bean, and chilli aphids. This duration was within the range of present findings.

Pupal period

The pupal period was 2 to 4 days with an average 2.60 ± 0.21 days (Table 1). Nagammuang (1987) recorded that the mean pupal duration of *M. discolor* was 3.43 ± 0.57 days when larvae reared on *A. craccivora*. Different findings revealed that the pupal period of coccinellid beetles varied with the differnces of food and it was correlated with the temperature (Sakurai *et al* 1991).

Facundity and haching rate

The number of eggs laid per female were 190 to 270 with an average 235.50 ± 7.96. The mean hatching percentage were 83.93 ± 2.11 (Table 2). Ngammuang (1987) reported that the number of eggs deposited per female of *M. discolor* was 181.07 ± 66.37 on *A. craccivora*, and 70.15% eggs were hatched. Prodhan *et al* (1995) observed that the facundity of female varied form 200-300 eggs with mean of 270.5 and with average 70.15% eggs were hatched. These results seem to be close with the present findings.

Table 2: Fecundity and hatching rate of *M. discolor* as observed in the study

No of observation	No. of egg laid	No. of egg hatched	% of egg hatching
1	228	205	71.18
2	196	181	92.35
3	242	210	86.78
4	250	208	83.20
5	242	220	90.91
6	222	193	86.94
7	255	211	82.75
8	260	191	73.46
9	190	170	89.47
10	270	222	82.22
Mean± SE	235.50 ± 7.96	201.10± 5.08	83.93 ± 2.11

Adult Longevity

The longevity of adult beetles was counted from the emergence of the adult to its death. The longevity of the male beetles varied from 35 to 45 days with an average of 40.20±1.00 days. Whereas, the longevity of the female beetles varied from 45 to 53 days with an average of 47.50 ±0.82 days. The average longevity of the beetle (male and female) were 43.85±0.91 days (Table 1). It showed that the longevity of the male beetle was shorter than the female. But there were no significant differences. Samal and Misra (1985) reported that the adult of *M. discolor* lived for 24 to 40 days in September- November. This result was near similar to the present study. Ngammuang (1987) found that the longevity of male and female were 37.8 ±15.24 and 59.53 ± 23.53

days when fed on *A. craccivora*, in the laboratory at temperature of 28 ± 2 ^{0}C with 74% RH. These results are also close to the present observation.

REFERENCES

Agarwala, B. K., S. Das & M. Senchowdhuri. 1988. Biology and food relation of *Micraspis discolor* (F.) an aphidophagous coccinellid in India. *J. Aphidology.* 2 (1-2): 7-17

Bari, M. N. & M. A. Sardar. 1998. Control strategy of bean aphid with predator, *Menochilus sexmaculatus* (F.) and insecticides. *Bangladesh J. of entomol.* 8 (1&2): 21-29

Debach, P. & D. Rosen 1991. Biological control by natural enemies. McMillan com. New York, London. 5: 97 - 112

Duffieded, S. J. 1995. Corp-specific difference in the seasonal abundance of four major predatory groups on sorghum and short-duration pigeon pea Intl. Chikpea and Pigeon pea Newsl. 2: 74-76

Gopalan, C., B.Y. Ramsastri & S. C. Balasubramanium. 1982. Nutritive values of Indian foods. Nat. Inst. Nutrition, ICMR, Hyderabad. 78 p

Gautam, R. D., S. Chander, V. K. Sharma & R. Singh. 1995. Aphids infesting safflower, their predatory complex and effect on oil content. *Ann. Plant Prot. Sci.* 3: 27-30

Hodek, I. 1970. Coccinellids and the modern pest management. *Bioscience,* 20: 543-552.

Hippa, H., S. D. Kepeken & T. Laine. 1978. On the feeding biology of *Coccinella hieroglyphica* L. (Coleoptera: Coccinellidae). *Kevo-subaretitic Ras. Station* 14, 18-20

Islam, M. A. & M. Nasiruddin. 1978. Life history and feeding habit of *Verania discolor* (f.) *Bangladesh J. Biol. Sci.* 6 & 7 (I): 48-49

Islam, M. H. 2007. Biology and predation efficiency of lady bird beetle *Menochilus sexmaculatus* (F.) M. S. (Entomology) Thesis, Department of Entomology, HSTU, Dinajpur. 2p

Kalra, V. K. 1979. Integrated control of the pest complex of mustard. Ph.D. Thesis submitted to the Dept. of Entomology, Haryana Agril. Univ. Hisar, India.

Kring, T. J., F. E. Gilstrap & G. J. Michels. 1985. Role of indegenous coccinellid in regulating green bugs (Homoptera: Aphididae) on Texas grain sorghum. *J econ. Ent.* 78 (1): 269-273

Luckman, W. H. & *R.* L. Metcalf. 1978. The pest management concept. In: *Introduction to Insect Pest Management*. John Willey & Sons, New York. pp. 3–35

Mani, M. 1995. Studies of natural enemies of wax scale *Drepanococcus chiton* (Green) on ber and guava. *Entomol.* 20: 55-58

Nasiruddin, M. & M. A. Islam. 1979. *Verania discolor* F. (Coleoptera: Cocinellidae) an effective predator on different species of aphid. *Bangladesh J*. 2001. 6 (1): 69-71

Ngammuang, Pa-Nan. 1987. Study on the coccinellidae, *Micraspis discolor* (F.) (Coleoptera: Coccinellidae) and its role as biological control agent. Bankok (Tailand). 64

Prodhan, N. Z. H., M. A. Haque, A. B. Khan & A. K. M. M. Rahman. 1995. Biology of *M. discolor*. F. (Coleoptera: Coccinellidae) and its susceptibility to two insecticides. *Bangladesh J. Ent.* 5 (1-2): 11-17

Pedigo, L. P. 2004. Entomology and Pest Management. Prentice-Hall of India Pvt. Ltd. New Delhi-1100.

Roache, L. C. 1960. Ladybug, Ladybug, Ladybug: What's a Name? Coleopt. Bull., 14: 21-25

Rashid, M. M. 1976. Bangladesher Sabji. Bangla Academy, Dhaka, Bangladesh. pp. 313-323

Rao, N. V., A. S. Reddy & K. T. Rao. 1989. Natural enemies of cotton white fly *Bemesia tabaci.* Gunnandius in relation to host population and weather factors. *J. Bio. Control.* 3: 10-12

Samal, P. & B. C. Misra. 1985. Morphology and biology of the coccinellid beetle *Verania discolor fab*. (Coleoptera: Coccinellidae) a predator on rice brown plant hopper *Nilaparvata lugens* (stal). Oryza 22 (1): 58 - 60

Srivastava, K. M. N. & L. N. Singh. 1986. A review of the pest complex of Kharif pulses in U.P. *PANS 28* (3): 333-355

Sakurai, H., N. Yoshida, C. Kobayashi & S. Taheda. 1991. Effect of temperature and day length on oviposition and growth of lady bird bettle, *Coccinella septumpunctata* Res. Bull. of the faculty of Agri. Gifu University. 56: 45- 50

William. F. L. 2002. Lady beetle. Ohio State University Extension Fact Sheet, Horticulture and Crop Science. Division of Wildlife, 2021 Coffey Rd. Columbus, Ohio-43210-1086