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Biology and feeding potential of Giant ladybird beetle, *Anisolemnia Dilatata* (Fab.) (Coleoptera: Coccinellidae) on Som aphids (*Aiceona* sp.) (Hemiptera: Aphididae)

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ABSTRACT: Laboratory experiments on biology and feeding efficiency of giant ladybird beetle (*Anisolemnia dilatata*) were conducted at the Department of Agricultural Entomology, UBKV, West Bengal, india in 2016. For development of beetles temperature at 24±1ºC, RH 65±2% and 16:8 L: D photoperiod was provided. The incubation period, larval period, pre-pupal, pupal and adult periods were 5.25±0.26, 11.86±0.78, 1.55±0.38 and 4.47±0.44 days, respectively. The feeding potential of *A. dilatata* was also studied on som aphid (*Aiceona* sp.). Total amount of aphids consumed by an individual *A. dilatata* during its total larval period was recorded 632.44±11.78 mg, the long life span and great predation capacity of *A. dilatata* on som aphid, *Aiceona* sp. suggested that giant ladybird beetle may perform well when released as a biological control agent against this pest.

Keywords: Giant ladybird beetle, Som aphid, biology, pedatory potential

INTRODUCTION

Som plant, *Persea bombycina* Kost is a very important host plant for rearing of muga silk worm (*Antheraea assamensis* Helfer). These plants are abundantly distributed in the north-eastern India mainly at Bhrambhaputra valley of Assam state and northern parts of West Bengal mainly Coochbehar and Jalpaiguri districts (Ghosh *et al.,* 2016). Som plants are an aromatic and evergreen tree with a height of about 20 meters when fully grown. Cultivation of som plants faces lot of problems from the insect pests attack, including muga silkworm (Singh *et al.,* 2000). One of the important pest is Som aphid (*Aiceona* sp.). Both nymphs and adults suck the saps from new flushes or tender shoots and under surface of the leaves resulting in curling of leaves. The aphid population multiplies rapidly in late spring and with increase in temperature, its population increases (Mathur and Upadhyay, 2002). The aphids secrete honey dew which facilitates growth of saprophytic fungus causing growth of 'sooty mold' on the leaves (Borgohain, 2015). Many predators feed on som aphid, and *Anisolemnia dilatata* is one of the important Coccinellid predators on som aphid.

Ladybirds are generalized predators that feed on a diverse range of foods and they are of great economic importance in biological control. Aphids are the principal food of ladybirds, whereas coccids, mites, honey dew, pollen, nectar and mildew are recorded as secondary foods (Ali and Rizvi., 2007). Biological control of aphids is an eco-friendly option to protect the plant from pests (Bellows 2001) and *A. dilatata* (Fab.) (Coleoptera: Coccinellidae) is one of the prevalent ladybird beetle predators. Giant ladybird beetles are unique among ladybird predators due to their large size and prey specialization. Information on their biology is lacking and hence present studies were conducted.

MATERIALS AND METHODS

Biology studies

The initial cultures of Coccinellid beetles were collected from som plants in the farm of the University. The Coccinellid beetles were reared on their respective prey for one generation in the laboratory. The eggs laid by the laboratory reared adults were used for studying the developmental biology, morphometric studies and assessing the feeding efficiency. The morphometric studies of the different life stages of the specimens were conducted using the Caliper-pro image analysis software supplied by Dewinter. The below methodology was adopted following Agarwala *et al.* (2003). The adult males and females of *A. dilatata* attacked *Aiceona* sp. on som plants. The collected beetles were brought to taxonomical laboratory in the Department of Agricultural Entomology. The beetles were used to establish stock culture. For development of beetles temperature at 24±1ºC, RH 65±2% and 16:8 L: D photoperiod was provided. Ten pairs of beetles were kept in Petri dishes (9.0 cm × 1.5 cm) and provided with plenty of som aphids (*Aiceona* sp.), which were collected directly from infested som plants by *Aiceona* sp. at nearby field. Females laid clusters of eggs on filter papers in the laboratory. Egg clusters were transferred to 9 cm paired Petri dishes, to avoid cannibalism and for hatching (one cluster per dish). After hatching of the eggs 20 larvae (12 h old)

Table 1. Duration of different stages of *A. dilatata* on som aphid *Aiceona* sp. in petri dishes (n=20 replicates for larval stage and adult stage)

Life stages	Minimum (days)	Maximum (days)	Developmental duration (days) (Mean ±S.D.)
Incubation period	5	5.5	5.25±0.26
1st instar larvae	2	2.5	2.22±0.255
2nd instar larvae	2	2.5	2.15±0.56
3rd instar larvae	1.5	2.5	2.12±0.63
4th instar larvae	4.5	6	4.92±1.25
Pre-pupal period	1	2	1.45±0.51
Pupal period	4	4.5	3.95±1.39
Total development (Period from egg to pupae)	22	25	23.13±0.90

were kept singly in paired Petri dishes (9 cm × 1.5 cm) and reared up to pupation on plenty of aphid prey. Fresh aphids were provided by weight basis every day and also the daily consumption of aphids was recorded. Rearing larvae were observed two times in a day regularly at 8 am and 6 pm until pupation. Pupae were kept undisturbed in the respective Petri dishes till the emergence of adults. It took for emergence around 4 days, 10 adult females were allowed to pair with similar aged males from stock culture and each pair was kept in each Petri dishes.

Feeding potential or efficiency study

Newly hatched larvae (20 no. of 12 h old) were kept singly in paired Petri dishes (9.0 cm × 1.5 cm) and reared till pupation on plenty of aphids. Freshly collected aphids were provided by weight basis in each Petri dish and the Petri dishes were cleaned every day during aphid supply. Developing larvae were observed two times in a day regularly at 8 am and 6 pm until pupation. Pupae were kept undisturbed in the respective Petri dishes till the emergence of adults. Aphids of each instar were weighed to nearest 0.001 mg; 1st instar = 0.216±0.07 mg, 2nd instar = 0.527±0.11 mg, 3rd instar = 0.950±0.11 mg, 4th instar = 1.29±0.09 mg and adult (<1 day old) = 1.627±0.11mg (n=30, for each stage). After emergence the adults (<12 h old) were reared on sufficient aphid food until death. Ten females were used for study of life history parameters. Similar aged males were used from the stock culture for paring with females for about 2 h at the time of food change. Development times (days) of larvae and pupae, quantity of food (aphids) consumed (mg) in every 24 h, during development of larvae was recorded for all the replicates.

RESULTS AND DISCUSSION

Biological studies of *A. dilatata*

Data on the biology of *A. dilatata* predator fed on som aphids *Aiceona* sp. is presented in Table 1. The eggs of giant ladybirds are yellow or creamy in colour and deposited in group, with their long axis perpendicular to the surface of the leaves upon which they are laid. The number of eggs laid varies considerably. Eggs are elongate-ovoid or cigar shaped. Incubation period is the duration between the eggs laying and hatching. The grub is totally different from adult. Body is elongate, depressed dorso-ventrally and well sclerotized. Head is prognathous. Mouthparts are well developed and chewing type. The larvae have three pairs of thoracic legs present. Prolegs are absent. Body colour is black in colour during 1st instar. After 1stmoulting, colour patterns of larvae changes; thorax, 3rd and 6th abdominal segments are light yellow in colour. They have several spines on their body. There are four larval stages and generally, larvae are very active. Generally, full grown grubs pupate near the point where they lived. However, pupation may also be takes place away from the living place of larvae. Sometimes, large aggregations of pupae observed on the host plant of the prey. Pupae are creamy white in colour with several black spots. Adults are larger in size, round, hemispherical and strongly convex, Bright orange in colour. Two oval spots (one on either side above scutellum) on posterior margin of pronotum and five black spots on each elytron. Adult beetles release mildly toxic chemicals when threatened, to escape from enemies.

The incubation period was 5 to 5.5 days with an average of 5.25±0.26 days. The first instar larval period ranged from 2 to 2.5 days with an average of 2.22±0.25 days; the second instar larval period varied from 2 to 2.5 days with an average of 2.15±0.56 days; the third instar larval period was observed to be 1.5 to 2.5 days with an average of 2.12±0.63 days; and the fourth instar larval period ranged from 4.5 to 6 days with an average 4.92±1.25 days. The total larval period was completed in 11 to 14 with an average 11.86±0.78 days. The pre-pupal period was observed to be 1 to 2 days with an average 1.55±0.38 days; the pupal period lasted 4 to 5.5 days with an average 4.47±0.44 days. Thus, *A. dilatata* took, 22 to 24.5 days, with an average to complete its development from eggs to pupae on *Aiceona* sp. Majumder *et al.* (2013) recorded the incubation period to be 4.12 to 5.05 days. The durations of first, second, third and fourth instars larvae of the predator to be 3.71±0.07, 3.23±0.09, 3.17±0.11 and 4.73±0.09 days, respectively. The predator took, on an average, 14.84±0.16 days to complete its larval development on *C. silvestrii*. while Agarwala *et al.* (1984) recorded 10.50 days and 13.52 days, on *C. silvestrii* and *C. lanigera* Zehntner, respectively.

Earlier, Majumdar *et al.* (2013) recorded pre-pupal and pupal periods to be 2.13±0.03 and 6.58±0.10 days, respectively. They also found that insect took 28.30±0.25 days, to complete its development from eggs to pupae on *C. silvestrii.*

Table 2. Biomass (mg) of som aphids consumed by larvae and adult female of *A. dilatata* at each developmental stage (n =20)

Larval instars	Aphid consumed in each stage (mg) (Mean± S.D.) n=20
First instar	43.49±5.40
Second instar	51.26±3.06
Third instar	126.18±3.69
Fourth instar	411.50±5.47
Total larval	**632.44±11.78**
Adult (1st 7 days)	
1st day	115.98±8.88
2nd day	139.24±3.01
3rd day	176.835±4.96
4th day	232.98±9.62
5th day	297.23±8.50
6th day	341.55±7.32
7th day	379.05±2.16
Total 1st seven days	**1682.89±20.26**

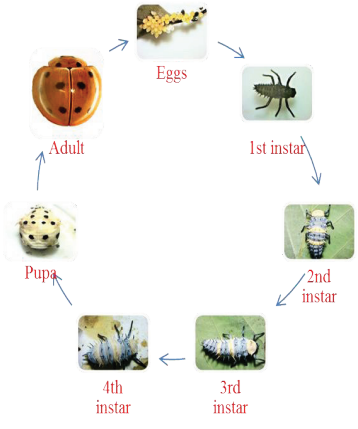

Fig.2. Developmental stages of *A. Dilatata*

Feeding potential study

Predation efficiency depends on the searching capacity of the beetle, the surrounding environment and also their size. Both larvae and adults of *A. dilatata* fed on *Aiceona* sp. voraciously but their consumption rate varied. They fed both in the day and night, but mainly at day time.

The predation efficiency of larvae increased with the increase in size of instars, minimum rate of aphids were fed by first instar, 43.49±5.40 mg and maximum rate was fourth instar 411.50±5.47 mg. Total amount of aphids consumed by an individual *A. dilatata* during its total larval period was recorded 632.44±11.78 mg (Table 2).

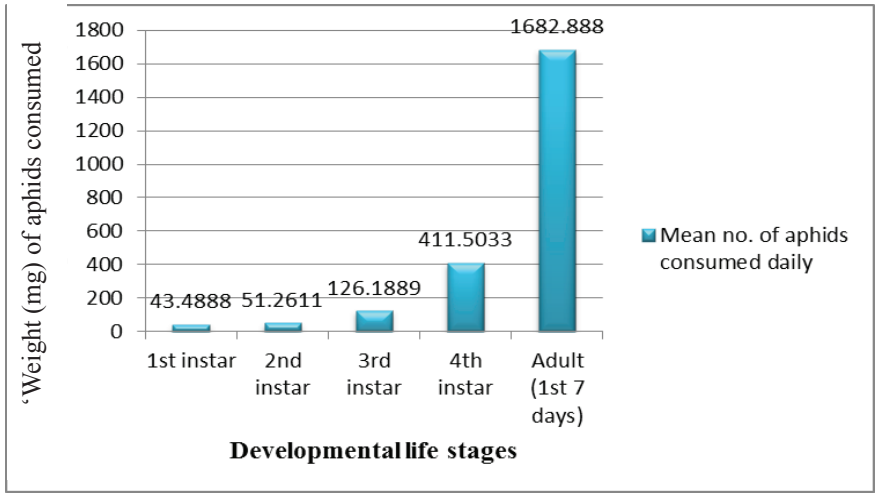

Fig. 1. Biology and feeding potential study of *A. dilatata* on som aphids

Fourth instar larvae were found to be more voracious and consumed more (411.50±5.47 mg) than the earlier instar larval stages.

CONCLUSION

The biology of giant ladybird beetle (*A. dilatata*) was studied. This species had long life span compared to other species. Different life stages of *A. dilatata* durations (days) were also mentioned. The incubation period, larval period, pre-pupal and pupal periods were 5.25±0.26, 11.86±0.78, 1.55±0.38 and 4.47±0.44 days, respectively.

The feeding potential of *A. dilatata* was also studied on som aphid (*Aiceona* sp.). Total amount of aphids consumed by an individual *A. dilatata* during its total larval period was recorded 632.44±11.78 mg so, the long life span and great predation capacity of *A. dilatata* on som aphid, *Aiceona* sp. suggested that giant ladybird beetle may perform well when released as a biological control agent against this pest.

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