# THE BIOLOGY OF MICRASPIS DISCOLOR AND STUDY OF ITS PREDATION EFFICIENCY ON BLACK APHID

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**Abstract—** Biology of Micraspis discolor was studied under laboratory condition (26±2ºC, 65±3% RH) at Department of Biotechnology, Mandalay Technological University. It has been found that incubation period and total larvae period were 4.6±0.7 days and 8.5±0.5 days. The larvae passed through four instars within 8 to 9 days. The female and male longevity were 44.6±4.0 and 34.8±4.6. Moreover, predatory potential of Micraspis discolor was studied on black aphids. The result indicated that predation rate of 1st instar grub was 37.5±4.6 and 4th instar grub was 51.7±9.8. The male predation rate (51.1±16.1) and female predation rate (57.8±16.4) were observed under the same conditions. This result concluded that the females of M.discolor were higher than the males in longevity and predation rate.

**Keywords—** Biology, predatory potential, Micraspis discolour, black aphid, longevity, instar grub

## I. INTRODUCTION

Aphids are soft-bodies insects that sucks sap from plant tissues and produce honeydew that may hamper transpiration. Twenty-five percent of all plant species are infested with aphids, and though it is believed the species of aphids has followed that of plants, not all groups of plants are equally infected with these parasites. They feed on Cole crops, cucurbits, beans, peas, potatoes, tomatoes, lettuce, turnips, and spinach. Economically important aphids tend to have a wider host range e.g., green peach aphid, black bean aphid and pea aphid. Common damage symptoms are-

- cluster on flower buds, under leaves, stems
- reduce plant vigor
- produce mottling or leaf curl
- gall formation
- yellowing or speckling
- sooty mold will reduce photosynthesis.

Aphids are susceptible to many natural enemies, including aphid parasitoids or parasitic wasps, predators and entomopathogenic or insect killing fungi [4]. Entomopathogenic fungi are important natural regulators of insect populations and have potential as bio-pesticide agents against diverse insect pests in agriculture. More than 750 species of fungi are pathogenic to insects and many of them offer a great potential for the management of sucking pests. The most versatile biological control agents are entomopathogenic fungi, due to their wide host range. Applied fungi against pests that is similar to a pesticide and are called microbal biopesticides. Metarhizium anisopliae and Beauveria bassiana are characterized in respect to pathogenicity to several insects [10].

There are several natural enemies which feed on aphids. Natural enemies are lady beetle larvae, lacewings, assassin bugs, syrphid fly larvae, various wasps and spiders. Among them, lady beetle larvae consume the largest number of aphid. The ladybird beetles have been known worldwide as a predator of a number of insects. They are most useful and important members of arthropod communities in the agro-ecosystem. The majority of beetles are useful because of their predaceous nature; but some are harmful, being polyphagous [5]. 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. Occurrence of the beetles depends on prey. M. discolour is the third most common species out of the collected predatorlady in the mid country [8].

It is distributed in different areas of India, Bangladesh, Taiwan, Malaysia, Thailand, Indonesia, Philippines, China, Japan (including Ryukyu Islands) Myanmar, Pakistan and Sri- Lanka. In India, adults of M. discolor occur throughout the crop year in aphid-infested fields and then disperse to weeds. M.discolor is the most abundant species of coccinellid in rice ecosystems and touted as a biocontrol option for brown plant hopper, a key pest of rice and a series of laboratory-based influence of host species Aphis gossypii. The study of the biology of M. discolor would help to use this insect of proper biological control. So, the present study was undertaken to observe the biology and predatory capacity of M. discolor.

## II. MATERIALS AND METHODS

### *A.* Aphid Collection

The black aphid colonies were obtained from a chemical pesticide free mini vegetable farm located at the Department of Biotechnology, Mandalay Technological University. These colonies were maintained on the safflowers leaf and used as a source of test aphids in laboratory assays. under environmentally controlled conditions under photoperiod of 16:8, temperature 25 ± 1 °C and 60% RH.

***B.*** **Rearing**

Prasitoids free aphids were reared on free-pesticide safflower leaf and placed on small plastic cup containing 15% agar gel under photoperiod of 16:8, temperature 25 ± 1 °C and 60% RH.

***C.*** **Collection of Predators**

The predators were collected from the upper mini farm and paddy fields in Patheingyi Township, Mandalay Division, Myanmar.

**D. Rearing of Micraspis discolor**

The collected predators were reared in the long and wide plastic bottles under 26±2ºC and 65% relative humidity. They were fed 10% honey cotton ball and filled with syringe once a day. The bottle was sealed with gauze. The bottom was covered with blotting paper.

**E . Predation Capacity of Micraspis discolor**

*i.* Predation capacity of 1st instar and 4th instar grub Micraspis discolor

For determination of efficiency of six 1st insta and six 4th instar grubs were kept in each of 12 small plastic insect rearing cups. Aphids were supplied at the rate of ten aphids per day per beetle on bean leaf. The number of aphids consumed by predators was recorded after 24 hours feeding.

ii. Predation capacity of adult Micraspis discolor

For determination of efficiency of predators nine male and nine female predators were kept in each of 18 small plastic insect rearing cups. Aphids were supplied at the rate of ten aphids per day per beetle on bean leaf. The number of aphids consumed by predators was recorded after 24 hours feeding.

## III. RESULTS AND DISCUSSIONS

***A.*** **Aphid Description**

Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Hemiptera
Family: Aphididae
Genus: Aphis
Species: fabae

These insects can be recognized by its pear-like shape, a pair of cornicles at the posterior end of the abdomen and fairly long antennae; winged forms can usually be recognized by the relative size of the front and hind wings.

**Fig 1. Aphid colonies on safflower plant and parasitoid free aphid colony**

**B. Identification of Predator Beetle (Micraspis discolor)**

Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Celeoptera
Family: Coccinellida
Genus: Micraspis
Species: discolor

Effects of temperature levels 26±2°C and 65% relative humidity used on the life cycle and developmental stages of the ladybird beetle M. discolor were showed in table 1.

**Incubation period**

Female laid 4-10eggs per day in a cluster under blotting paper. Within a cluster the eggs remained unattached to each other. Eggs were about 1.03 mm long and 0.38 mm wide, elongate, oval, smooth, bright yellow and shiny surface. Mean incubation period was 4.6±0.7 days. Before hatching, the eggshell turned to pale brown to black eye spot.

**Total Larval Period**

Larval period has four larval instars. The 1st instar was greynish brown, flatten, elongate, soft-bodies and 1.42mm long and 0.33 wide.The final 4th instar was white in back longer than other instars and more feeding capacity (table 2). The total larvae period was 8.5±0.5 days. The minimum and maximum period of total larvae periods were 8 and 9 days. The total larval period of M. discolor varied from 7 to 9 days on bean aphid so this result was similar the present study. 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.

**Pupa**

The pupa period was 3.6±0.7 days. It was reddish in color and short pupa stage. The female pupa are longer than male. At the beginning of this stage the full-grown larva stopped feeding, they became stout and thick. The maximum pupa period was 4 and the minimum pupa period was 2 days.

Adult

The adult beetle of M. discolor was oval, flat beneath, convex in shape and red in color, with small head party concealed by pronotum. Elytra covered the abdomen on resting position, margins of elytra formed a joint median black streak in the mid- dorsal line. Male was usually smaller (about 3.60 mm long and 2.80 mm wide) than female. The beetles were cannibalistic in habit. The longevity of adult was measured from adult emergence to death. Longevity of female was longer than the male. The mean female longevity was 44.6±4.0 and the mean male was just 34.8±4.6 days. Although aphid is usual prey for M

discolor, other finding observed that the predator can survive and reproduce on brown plant hopper.

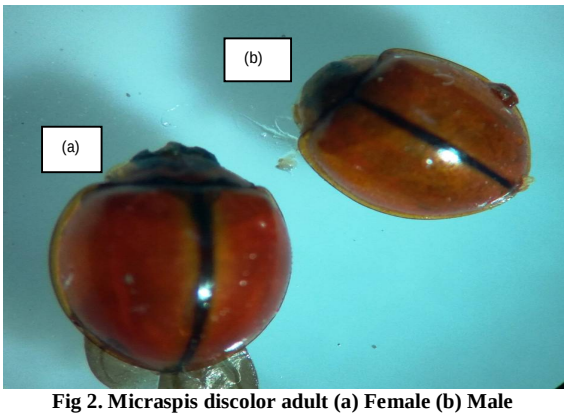


**Fig 2. Micraspis discolor adult (a) Female (b) Male**

**TABLE I. DURATION OF DIFFEERENT STAGES OF MICRASPIS DISCOLOR**

| Different Stages | Duration of days | | |
|---|---|---|---|
| | Minimum | Maximum | Mean ± SD |
| Incubation period | 4 | 6 | 4.6±0.7 |
| Total larval period | 8 | 9 | 8.5±0.5 |
| Pupal period | 2 | 4 | 3.6±0.7 |
| Longevity of adult | | | |
| Male | 30 | 41 | 34.8±4.6 |
| Female | 38 | 50 | 44.6±4.0 |

## C. Predation Capacity of Micraspis discolour

i. Predation capacity of 1st instar and 4th instar grub Micraspis discolor

The predation capacity of larvae was determined by cou nting the total number of aphids consumed by each larvae instar. The result presented by Table 2 indicated that the feeding rate increased gradually from the 1st instar to the 3rd instar grubs and sharply increased in the final instar. The consumption of prey by the 1st instar grub was 37.5±4.6% and the 4th instar grub consumption rate was 51.7±9.8%. The 4th instar required the bigger amount of food than the previous instars, longer duration and food deposition for pupa period.

ii. Predation capacity of adult Micraspis discolor

Predation capacity of both male and female beetles was studied. It was found that the female beetles consumed more aphids than the male beetles. The range of female and male consumption rate were 57.8±16.4 % and 51.1±16% respectively. Rahman (1990) reported that the feeding rate of M. discolor larvae on the first day after hatching ranged between 2 and 7 on cotton aphids with an average of 5.2. From the second day the average rate of consumption gradually increased to 26.8 on the 9th day after which feeding rates dropped sharply. Each larva of this beetle consumed with an average of 131.6 aphids in total larval period. The adult consumed 21.0 aphids during her first day and the rate gradually increased up to 9th day (86.4) aphids. There were great variation among the previous results and present study, which might be due the different species of prey.

TABLE II. DEVELOPMENT PERIOD AND PREDATORY RATE OF MICRASPIS DISCOLOR

| Life stages of *M. discolor* | Average percentage of prey consumption |
|---|---|
| | Black aphid |
| 1st instar grub | 37.5±4.6 |
| 4th instar grub | 51.7±9.8 |
| Male | 51.1±16.1 |
| Female | 57.8±16.4 |

## CONCLUSION

Rearing growth and development of M. Discolor, the cycle of this species was prolonged at 26±2ºC. The 4th instar feeding capacity of M. discolor larvae was higher than other instar grubs and female feeding capacity was also greater than male rate. The data from this work also provided further evidence that the predator could be considered as a potential natural enemy for the biological control of aphids. Finally, it is conclude that knowing the all behavioral style and biology of M. discolor can be helpful in enhancing its population in lab and it can be applied in fields for pest control as. M. discolor indicates its feeding against Aphis. fabae, they can be used as potential biocontrol agent after field experiments for the management of black bean aphid.

## ACKNOWLEDGMENT

The author would like to express her thanks to Dr. Myo Nyunt, Rector, Mandalay Technological University, for his kindness, helpful, permission and suggestion for completion of this paper. The author also express her thank to Dr. Myo Myint, Professor and Head, Department of Biotechnology, Mandalay Technological University. The author would like to extend deepest gratitude to her supervisor and co-supervisor for their advice, suggestion and guidance.

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