



Six-Spotted Zigzag Ladybird Beetle and its Importance in Bio-control

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ABSTRACT

The Six-spotted Zigzag Ladybird (*Menocheilus sexmaculatus*) is the well-known species of ladybird beetle found on all over the vegetation in India. Before looking at them in a mating position, we considered color differences for different species, such as seven-spotted ladybird species, it is also a human-friendly species that acts as a biological control tool for many insect pests management for agricultural crops. Coccinellids are beneficial insects because of their predaceous nature. These insects are considered as the most economical and eco-friendly alternatives of the hazardous pesticides.

Menocheilus sexmaculatus (Fabricius, 1781), the hereditary position of this species has not been indisputably settled, as of late Slipinski (2007) utilized this name for this species. This species has been reported from many South East Asian country like India, China Australia, Japan, Java, Indonesia, Myanmar, Vietnam, Philippines, Papua New Guinea and Thailand including three South African countries including one island, namely Columbia, Ecuador and Islas Galapagos. This beetle is also reported from few parts of United Arab Emirates. This species is imported from many countries because it is natural and useful as a biological agent for the management of many pests of agricultural crops. This beetle can be found to be associated with any agricultural crop or other plants where it can get its host easily (Atwal, 1991; Bonnetta and Gordon, 1991; Gupta and Yadav, 1989).

Ladybird beetle or Ladybugs are any of approximately 5000 widely distributed species of beetles of the family coccinellidae under the order coleoptera. The name "Ladybeetle" was coined in the medieval times when the beetle was devoted to the virgin Mary and called "beetle of our lady". Ladybird beetles are hemispheric fit as a fiddle and normally 8-10 mm (0.3-0.4 inch) long (Kilgore and Doult, 1967; Lyon, 2002). They have short legs and are generally splendidly hued with dark yellow and ruddy markings. The shade of wing, number of spots on elytra and the state of spots change from species to species. The ladybird beetles are less than 1.2 cm in maximum length. They have hemispherical body, rounded above and flat below, a small head and short legs meant for walking purpose. Some of the species of ladybug are completely black in color without any color spot on the body while most of the ladybugs are red and orange color spotted with black, white and yellow color. The

larvae of ladybug also brightly colored (blue, orange, yellow, gray and blackish gray) with stripe of orange and black color (Ray, 1967; Sharma, 1975).

The underlying markings, patterns and coloration are determined by the particular species and genetics of the beetles and develop as the insect turns to maturity. Also, in many species its appearance is pre-fixed or pre-decided by the time it emerges from its pupa, though in most it may take some days for the color (melonization) of the adult beetle to mature and stabilize. Generally, the mature color (colour of mature beetles) tends to be fuller and darker than the younger ones (newly emerged beetle prior to sclerotization and melonization). They belong to holometabolous group of insects (complete metamorphosis; four stages of development viz. egg, larva, pupa and adult) and undergoes through three life stages before turning into an adult. The larval stages of these beetles are very diverse in nature as well as colour and looks quite difference from the adult beetles in shape as well as in color, shape and structure. The larvae and adult both have predacious nature and feeds upon various soft bodied insects including various types of aphids. In both the adult and the larval stage, they feed on insects, harmful to plants including many agricultural crops like mustard and potato. Predacious ladybugs feed mostly on soft bodies insects namely aphids and other scale insects. Because of the help of ladybird beetles render farmers in destroying agricultural pests, the beetle was properly regarded in the middle age as instruments of benevolent intervention by the Virgin Mary, whence the common name ladybird. There are several types of ladybird beetles found in Indian subcontinent and used as biological control agents for many insect-pests. The major species utilized in biological control are, seven spotted lay beetle, *Coccinella septempunctata*,



Transverse lady bird beetle, *Coccinella transversalis*, Vidalia beetle, *Rodolia cardinalis* and six spotted zig-zag lay bird beetle, *Menochilus sexmaculatus* are major species. The six spotted zig-zag lay bird beetle, *Menochilus sexmaculatus* is most common and widely distributed species in India and found almost on every crop, feeding on various scales. This species is polymorphic and have a total six morphological variants. The color and spots of elytra vary from one variant to another.

The zigzag (*Menochilus sexmaculatus*) beetle is widely distributed (almost worldwide) and common aphid feeding species in India, Pakistan, Borneo, Jawa Indonesia, U. K. Philippines, Islands of Bali, France, Sumatra and South Africa. Biological control measures are successfully established, because they are permanent part of food chain in their effect and have efficient capability of predation on soft bodied insect-pests. These control methods are primarily preventive but not corrective. Ladybug, *M. sexmaculatus* is an efficient predator of many aphid species, e.g. *Lipaphis erysimi* Kalt (mustard aphid), is considerably suppressed in field by this beetle. Probably the major problem is time synchronization with aphids in mustard field. Coccinellids are used as a natural enemy for almost all sucking insect-pests. The understanding of the behaviour and foraging by coccinellids in the field in relation to the crop and different prey and abundance could give knowledge about their role as a biological control agent. It could also guide for better techniques for predicting their choice and impact on prey infestations in the field. A large number of experiments on coccinellid foraging behaviour on prey have been reported. But, they were conducted in the laboratory. Predatory efficiency studies on insect predators in laboratory arenas may highlight important factors involved in the predator-prey interaction but cannot be expected to provide an adequate understanding of field interactions.

Life Stages:

The adult beetles lay eggs on the upper surface of leaves in clusters which contain about 45-70 egg. Eggs appear to be pale to bright yellow in colour, turned into dark yellow before hatching. The size of the eggs varies from 0.87 to 1.21 mm with an average of 1.02 ± 0.04 mm. Eggs look like tiny cylinders and gives a bright appearance. Eggs hatch in 2-3 day after egg laying. The incubation period is highly depending upon the host

type on which the species feeds. Hatching percentage of eggs is varying from 70-85 per cent (Shanmugapriya, et. al., 2017).

The larvae (Grubs) are dark black or blackish-grey to brown in colour with yellowish patches on dorsal side. The young grubs of *C. sexmaculatus* appears to be dull black with long legs, body tapering to the hind end as it grows older, white spots appeared and the full-grown larvae were black with yellow and white blotches. When the eggs hatched into grubs it undergoes metamorphosis three times with four larval instars to become a full-grown grub and then it enters the pupal stage. After the growing upto full grown larvae, larvae stop eating and become dull and pupate. Pupation takes place on the leaf; the larva undergoes pupation by fixing itself by the tail. When grubs pupate, they turn dark brown in colour attached itself either on upper or lower surface or sometimes even on stems. Black spots were established symmetrically on the segments of fully formed pupae (Rajamohan and Jayaraj, 1974; Singh and Sharma, 2010).

The adult of Six Spotted Zig-Zag Ladybug shows a total number 6 colour variants (Agarwala et. al., 2000; Rope, 1989; Subramaniam, 1924). The adult beetles were oval in shape, elongated and moderately convex from dorsal side. Elytra had six black macular including two zig-zag lines in colour, enclosing hind pair of wings. Some other forms have whole black elytra as shown in below Fig 1. Abdomen and eyes are appearing to yellow in colour. Male and female adult beetles can be differentiated on the basis of body size and structure of external genitalia. The last abdominal segment was entire or notched to some degrees in males and it was narrow or evenly rounded or medially divided or rounded in case of females (Sureja, 1991).



Fig 1. Six Spotted Zig-Zag Lad Bird Beetle



Effective Against: Aphidophagous, also feeds on psyllids, whiteflies, mealybugs, tingids, leaf- and plant hoppers, mites, and early instar lepidopteran larvae.

Aleyrodidae of Order Hemiptera: contains mostly false flies known as whitefly and as a host it may include *Aleurodicus dispersus* (Russell), *Aleurolobus barodensis* (Maskell) and *Bemisia tabaci* (Gennadius).

Lophopidae: Tropical South America and Asia is the home for family lophopidae, a family of fulgoroid plant-hoppers. Most family members are distinguished by the fact that the face is longer than wide with at least two lateral ridges. The hind tibia of this family can bear few spines (2 to 3 spines). Lateral ocelli are available underneath the compound eye and marginally front of it. The wings are broad and flat, and the wings have numerous patterns. The nymph has two long tails and numerous members of this family have slightly flat front tibiae. This may include *Pyrillaperpusilla* (Walker).

Aphidoidea: *Aphis fabae* (Scopoli), *Aphis craccivora* (Koch), *Aphis gossypii* (Glover), *Aphis pomi*, *Aphis nerii*, *Brevicoryne brassicae* (Linnaeus), *Capitophorus himalayensis*, *Ceratovacuna lanigera* (Zehntner), *Myzus persicae*, *Liosomaphisatra*, *Melanaphis sacchari*, *Myzus nicotianae*, *Pemphigus napaeus* (Buckton), *Pentalonia nigronervosa* (Coquerel), *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum nymphaea* (Linnaeus), *Rhopalosiphum padi* (Linnaeus) and *Toxoptera citricida*.

Cicadellidae: *Empoasca kerri*, *Amritodus atkinsoni* (Lethierry), *Amrasca biguttula*, *Exitianus indicus* and *Nephrotettix nigropictus* (Stal).

Coccoidea: *Drosicha mangiferae*, *Maconellicoccus hirsutus* and *Phoenicococcus marlatti*.

Delphacidae: *Peregrinus maidis* (Ashmead), *Nilaparvata lugens* (Stal) and *Sogatella furcifera*.

Crambidae: *Chilopartellus* (Swinhoe) and many other pests from several families are known to be the host of this lady beetle.

The predation of aphids is directly related with the age of beetles as results of bonnet and Gordon the predation is expanded with the age of the beetles and arrived at its apex (32.2 aphids/day/beetle) in 22nd day old males and

22nd day old females (35.0 aphids/day/beetle). The females ate up fundamentally a bigger number of aphids than males. It could, subsequently, be derived that feeding behavior is essentially higher on account of females than males. These beetles are found to be more active during a little cold weather in mustard and wheat agro-ecosystems. These beetles are found to more effective against mustard aphid.

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