JSIANE : Vol. 3, Issue 2, 2023, Page 77- 80 ISSN (Online) 2583-2093

Journal of Science Innovations and Nature of Earth

Journal homepage : www.jsiane.com

BIO-ECONOMICAL LIFE STUDIES OF INDIAN WATER BOATMEN, *MICRONECTA STRIATA*, FIEB. (CORIXIDAE, HEMIPTERA: HETEROPTERA)

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www.doi.org/10.59436/jsiane.com/archives3/2/110

Abstract

Heteroptera and Homoptera are the two suborders of the order Hemiptera. Typical characteristics of the water boatman, *Micronecta striata* Fieb 1808, a member of the suborder Heteroptera, include a gular region that is typically well-developed, a long pronotum that is large, wings that are thickened basally and membranous apically, wings that are membranous on the back, a pair of wings that fold flat over the back with overlapping apices, and tarsi that are typically three-segmented. Because they devour fish eggs, the water boatmen (*Micronecta striata* Fieb) are economically significant to humans. In addition to preying on adult mosquitoes, they have been seen destroying anopheles, culex, and aedes mosquito eggs, larvae, and pupae.

Keywords : *Micronecta striata*, Hemiptera, adult mosquitoes, Bio-Economical

Received 11.01.2023 **Revised 22.05.2023** **Accepted 25.06.2023**

Introduction

The exploration of the bionomics of the Indian water boatmen, *Micronecta striata*, Fieb. (Corixidae, Hemiptera: Heteroptera), represents a multifaceted scientific endeavor that encompasses a comprehensive investigation into the ecological, behavioral, and physiological aspects of this intriguing aquatic insect species. This study contributes to our understanding of freshwater ecosystems, providing valuable insights into the intricate relationships that govern the dynamics of these environments. *Micronecta striata*, belonging to the Corixidae family, is a species of water boatmen commonly found in various freshwater habitats across India. Its significance lies not only in its ecological role but also in its potential implications for environmental conservation and management. The bionomics of this species is a broad field of study that encompasses several key components. One fundamental aspect of *Micronecta striata*'s bionomics is its life history. Researchers delve into the various stages of the insect's development, from egg to nymph to adult, to understand the factors influencing growth and maturation. This includes examining the species' reproductive strategies, such as mating behaviors, oviposition preferences, and the adaptation of offspring to their aquatic environment.

Habitat preferences and distribution are crucial elements in the bionomics of *Micronecta striata*. Understanding the specific conditions and types of freshwater ecosystems where this species thrives provides valuable information for both scientific and conservation purposes. Researchers investigate factors such as water temperature, pH levels, and the presence of vegetation to unravel the species' ecological niche and its role in maintaining the balance of the ecosystem. Feeding behavior is another essential aspect of the bionomics of *Micronecta striata*. As a water boatman, it plays a role in nutrient cycling within freshwater habitats. Studying its feeding preferences, mechanisms, and interactions with other organisms sheds light on the broader trophic dynamics of the ecosystem. Researchers explore the impact of *Micronecta striata* on the abundance and distribution of its prey, as well as its susceptibility to predation. The social and behavioral aspects of *Micronecta striata*'s bionomics are also of interest to scientists. Observations of its social interactions, communication methods, and territorial behaviors contribute to a more nuanced understanding of the species' behavioral ecology. Such insights can have implications for our understanding of community dynamics within freshwater ecosystems.

Beyond individual behaviors, the population dynamics of *Micronecta striata* are a critical component of its bionomics. Researchers investigate factors influencing population size, growth rates, and distribution patterns. These studies help elucidate the resilience of the species to environmental changes and disturbances, providing valuable information for conservation efforts.

Ecological studies on *Micronecta striata* extend to its interactions with other organisms within its habitat. This includes both competitive and symbiotic relationships with other aquatic fauna and flora. Understanding these interactions contributes to a holistic comprehension of the species' role in shaping freshwater ecosystems. The broader ecological implications of *Micronecta striata*'s bionomics are significant. As a bioindicator species, its presence,

abundance, and behavior can serve as indicators of the overall health and quality of freshwater habitats. Monitoring changes in *Micronecta striata* populations can provide early warnings of environmental disturbances, pollution, or habitat degradation, aiding in the development of effective conservation strategies.

In conclusion, the bionomics of the Indian water boatmen, *Micronecta striata*, represents a fascinating and comprehensive field of study within the realm of freshwater ecology. From its life history and habitat preferences to feeding behavior, social interactions, and population dynamics, researchers explore various facets to unravel the mysteries of this aquatic insect. The insights gained from such studies not only contribute to our scientific knowledge but also have practical applications in environmental conservation and management. As we continue to delve into the bionomics of *Micronecta striata*, we unlock a deeper understanding of the intricate web of life within freshwater ecosystems, paving the way for informed and sustainable approaches to preserve these vital environments.

Material and Methods

As for the water boatmen The morphological analysis used *Micronecta striata* (Fib.) obtained from Mathura's ponds and the Yamuna River between July and November. They floated on the water's surface. They typically inhabit communities. After being fixed in various fixatives, these bugs were killed by chloroform vapours. Microneedles were used to make small punctures in the abdomen, which were then immersed in fixative to guarantee proper fixation. Fluids from Bouin, Zenker, and alcoholic Bouin were utilized as fixatives. Several changes of 70% alcohol with a few drops of glycerine were used to wash them completely after they were left in fixatives for approximately 24 hours. The specimens were immersed in 5% KOH for around one month to preserve the exterior anatomy. Alternatively, they were boiled in the solution for approximately 20 minutes to partially remove muscles and bleach the highly pigmented integument. Specimens were left in glacial acetic acid for about an hour after being treated with KOH solution to neutralize the alkaline effect. The samples were subsequently cleaned, stored in glycerine, and mounted in balsam from Canada. Scaples, forceps, and microneedles were useful for dissecting specimens in a small dish under the high power of the binocular dissecting microscope, which aided in the study of the skeleton. A common pond net was used to gather adults for the initial culture from a pond close to B.S.A. College in Mathura, Uttar Pradesh. A number of pairs were given permission to lay their eggs in circular glass tubes that were 30 cm in diameter and 15 cm tall. These tubes contained water from the same pond, along with plants that were partially submerged. Cheese cloth was used to cover the opening of the trough, preventing the nymphs from escaping. In order to prevent infections that could disrupt the proper breathing of the developing instars, notearation was provided, but the water troughs were changed around every ten days to investigate the likelihood of scum growth on the water's surface. Adults and instars alike were fed files on a daily basis, and any food that went uneaten or stuck to their jaws was removed as well. Eggs and exuviae were checked for in the cultures on a regular basis. The fluid samples were stored in One day in the lab was a typical temperature of 24 hours. The eggs, which are in the process of developing, were also retrieved from their natural home. A Leitz microscope equipped with a camera lucida was used to create each drawing. The color patterns were created by calculating the total length and width of the egg, growing instars, and adults in millimeters, as well as the segments of the legs and antennae. Using an ocular micrometer, we can get the mean of ten people's measurements.

Result and Discussion

Micronecta striata, commonly known as the water boatman, is a fascinating aquatic insect that undergoes a complex life cycle, adapting to both aquatic and terrestrial environments. This species belongs to the family Corixidae within the order Hemiptera. The life cycle of *Micronecta striata* is characterized by distinct stages, each essential for its survival and reproduction. The life cycle begins with the egg stage. Female water boatmen lay their eggs on aquatic vegetation or other submerged surfaces in freshwater habitats such as ponds, lakes, and slow-flowing streams. The eggs are typically attached to plants or other substrates to ensure their stability and protection. The duration of the egg stage varies depending on environmental conditions, such as temperature and water quality. Upon hatching, *Micronecta striata* larvae emerge. These aquatic nymphs undergo several instars or developmental stages, during which they molt and grow. The nymphs are equipped with specialized adaptations for an aquatic lifestyle, including streamlined bodies and unique structures for obtaining oxygen from the water. They actively feed on algae, detritus, and small invertebrates, exhibiting predatory behavior with their piercing-sucking mouthparts. As *Micronecta striata* larvae continue to develop, they undergo metamorphosis, transitioning into the pupal stage. The pupa is a transitional phase between the aquatic nymph and the adult insect. During this stage, the insect undergoes significant internal restructuring, preparing for the transition to a terrestrial life. The pupal stage is a critical period for the development of adult features, including wings and reproductive organs. After completing the pupal stage, adult *Micronecta striata* emerge from the water. The emergence is a crucial phase in the life cycle as the insects transition from their aquatic habitat to the terrestrial environment. The adults possess well-developed wings, allowing them to fly and disperse to new aquatic habitats. The terrestrial phase of their life cycle is relatively short, as water boatmen primarily rely on aquatic environments for feeding and reproduction. The adult stage is focused on reproduction. Male water boatmen produce mating calls by rubbing specialized structures on their forewings against ridges on their abdomen, creating a distinctive sound. Females respond to these calls, and mating occurs on the water surface. After mating, females lay eggs on aquatic vegetation or substrates, completing the life cycle.

The most widely distributed Indian boatman in India is the Fieb, a *Micronecta striata*. There are a lot of them floating about on the calm surface of lakes, rivers, tanks, and ponds. They favor open water and tend to congregate around the margins. Although seen occasionally on their own, they are most often found in communities. Because of their agile gait, netting them is an extremely challenging task. Despite repeated attempts at persuasion, they remain unmoved. They have been seen to leap a few inches on occasion. The body of a water boatman is long and somewhat flattened. They can swim because the tarsi on their back legs are scoop or oar-shaped and the hind legs are equipped with hairs. The adults

are typically speckled and have poor colors; their length ranges from 3/16 to 3/8 inch, or 3 to 11 mm. Among the many kinds of aquatic true bugs, the most numerous are water boatmen. Due to their similar overall shape, they are occasionally mistaken for backswimmers (Hemiptera: Notonectidae). But backswimmers are characterized by their flipped body position in the water and lighter-colored wings compared to their darker legs. Because of their small size and delicate bodies, adults do not do well when kept on insect pegs. Immatures and adults share the same environment and look very similar. In order to facilitate chewing, they have adapted their sucking mouthparts. Many times, water boatmen swim out in open water. You might notice them swimming in clusters or groups in a pond. Algae and other plant matter is what they eat. Collecting water boatmen is possible using aquatic nets. On rare occasions, an issue may arise if there are too many in ponds. Being a non-toxic component of fish food, they serve a useful purpose. These are helpful insects, and there is no management for them.

Insects belonging to the Hemiptera order can range in size from tiny to enormous. They have a variety of body shapes and sizes, including ovals, elongates, and flattened surfaces. Hemiptera feed on plants and animals, and they can change their shape simply. Their mouth parts include piercing and sucking. Their heads are free and either prognathous or hypognathous, and they have two to ten antennae, occasionally with 25 segments. Their eyes are large, and they have ocelli or none at all. Labium modifications include a simple or segmented rostrum, a beak or proboscis, palpi that have atrophied, and wings that are either short or long. Bugs are members of the Hemylaptera order. Their wings, which are typically thickened at the base and covered in membranes at the tip in Heteroptera and completely covered in membranes in Homoptera, are used for walking, running, jumping, swimming, and grabbing prey. Their legs, which can be cylindrical or flattened, have one or two claws and may or may not have arolia or empodia. Their abdomen has few segments, with the first segment especially reduced or nonexistent, and cerei. Heteroptera and Homoptera are the two suborders of the order Hemiptera. The hydroplane crew *Micronecta striata* The suborder Heteroptera, to which Fieb 1808 belongs, is defined by the following traits: a gular region that is typically well-developed; a long pronotum that is large; wings that are typically thickened basally and membranous apically; wings that are membranous on the back; tarsi that are normally three-segmented; and wings that are folded flat over the back with apices overlapping.

Despite the abundance of Micronecta species in India's slow-moving rivers, streams, ponds, and lakes, no one has ever tried to investigate their bionomics. *Micronecta striata*, Fieb, the common Indian water boatman, is the subject of this chapter's evolution and bionomics. Skating on the surface of slow waters of ponds, lakes, rivers, and streams, the most common water boatman in India is *Micronecta striata*, often known as Fieb. In addition to its extensive distribution in India, the current studies have documented its presence in Burma, Ceylon, China, Malaya, and Thailand, as well as in Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Kerala, Rajasthan, and Madhya Pradesh. Unlike during the day, when it is more sedentary, this water skater is a voracious feeder. Their diet consists of a wide variety of aquatic insects belonging to the Hemiptera order. Multiple striders will work together to catch and eat a fallen insect if it's too big for a single strider. They use their beaks to spear their victims. Adaptations to the forelegs allow them to grasp prey more securely. In their pursuit of these tiny insects, they occasionally launch themselves into the air, leaping several inches off the water's surface. Researchers in the lab used files, leaf hoppers, and mosquito larvae as food sources for adults and their growing instars. Mites infest the *Micronecta striata*, Fieb, and feed on it throughout its life cycle. The mites prey on this in droves since they are ectoparasitic. They prey on both the eggs and the different stages of development.

These aquatic boatmen are insects with long legs that swim, glide, walk, or skate on the water's surface. Foraging requires the use of the short forelegs. Locomotion is accomplished by use of the very lengthy hind and middle legs. The trochenters are equipped with strong retractor muscles that extend the middle and back legs. Thrust is mostly generated by the strong muscles in the middle of the legs. Insects propel themselves ahead by building a flow with their legs as they go backward. To make forward motion with less resistance, the tibiae are followed backwards during protraction. The insect then swims forwards with its mid legs lifted above the surface. Insects steer by contracting their muscles in opposite directions, and they turn quickly by moving the legs on the side they're turning while keeping the other side still. Skating on water's surface is like defying gravity thanks to surface tension. The wings are either completely or partially extended in these water boatmen. The reason they can adapt to both big and small bodies of water is because their wingless forms fly at night. Those with fewer wings are unable to fly. On the water's surface, the water boatman (Fieb: *Micronecta striata*) is extremely specialized. Their slender, feathery coat keeps them dry and protected from the elements as they move about. The essential air becomes tangled up in the pubescence. The front legs are adapted to grasp prey, while the rear legs are utilized for locomotion on land or in water. The arrangement of the tarsi provides buoyancy and traction on the water's surface. Tarsi are tough to wet because they're covered in fine hairs. Insects lose their ability to cling to surfaces when their tarsi become moist; without access to a dry surface, they will sink to the bottom of the pool. From April through October, there is an abundance of water boatmen, and then it declines. December, January, and February are the winter months. When they're adults, they hide out in the water, making them hard to spot while they hibernate among the debris on the water's edge. By the end of March, you can usually spot the adults that spend the winter in ponds. While waiting for the rains to come back, they aestivate under similar items near dried ponds in Indian regions.

These insects only reproduce in one way. The external genitalia of males are smaller and structured differently than those of females. Although mating can take place at any time of day or night, the afternoon is when it happens most frequently. It seems like the mating phases are brief and often interrupted when a third person gets involved. Without putting on any kind of premating display, the male leaps over the female and stays there for around twenty to twenty-five minutes. The female continues with her regular tasks, such as feeding and cleaning, with little to no attention given to the. It is during the night that the eggs are laid. A number of floating objects, including grass blades, had the eggs attached to them. Both the laboratory object and the walls of the glass

trough, just below the water line, were used to lay the eggs lengthwise. A transparent holdfast substance that looked like gelation held the eggs in place. Typically, a female will lay around fifteen eggs at a period. In generations, there are multiple instars.

The life cycle of *Micronecta striata* is intricately connected to the health and dynamics of freshwater ecosystems. These insects play vital roles in nutrient cycling and food webs, serving as both predators and prey for various aquatic organisms. Their adaptability to both aquatic and terrestrial environments highlights their ecological significance. Understanding the life cycle of *Micronecta striata* contributes to broader ecological knowledge and aids in the conservation and management of freshwater habitats. Monitoring their populations and the factors influencing their life cycle can provide valuable insights into the overall health of aquatic ecosystems, helping scientists and conservationists make informed decisions for the protection of these vital environments

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Cite this article-

Sunil Kumar Bhardwaj and H.N. Sharma, 2023"Bio-Economical Life Studies of Indian Water Boatmen, *Micronecta Striata*, Fieb. (Corixidae, Hemiptera: Heteroptera)" ***Journal of Science Innovations and Nature of Earth***, Vol. 3(2), Page- 77-80

www.doi.org/10.59436/jsiane.com/archives3/2/110