

PREDATORY AQUATIC INSECTS OF NURSERY PONDS OF MANIPUR

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(Accepted 26 March 2016)

ABSTRACT : Several fish farms of Manipur were surveyed for studying the species compositions and distribution of predatory aquatic insect fauna detrimental to pisciculture. Aquatic insects recorded in various types of fish ponds such as nursery, rearing and stocking were considered to be harmful for fish particularly in their larval stages such as spawn, fry and fingerlings. Nursery ponds designed to rear spawn of major carps were found to be invariably populated with large number of aquatic insects over greater part of year and especially during and after rains. These fish ponds are invariably heavily infested with aquatic insects found in nursery ponds are *Notonecta*, *Ranatra*, *Cybister*, *Lethocerus*, *Nepa*, *Hydrometra* and *Belostoma* are highly destructive to carp seed.

Key words : Predatory, aquatic insects, infested, nursery ponds, Manipur.

INTRODUCTION

Insects form the largest group and constitute about 70% of all known species of animals on this planet (Varshney, 1998). Although they are mainly land animal, they are widespread and adapted to varied types of environment. They also represent the only invertebrates that can fly (Voshell, 2002). Most insects are phytophagous, feeding on plant materials, while some predatory and others mycophagous. Aquatic entomology is the study of aquatic insects (Pennak, 1989). Aquatic insects have certain adaptive traits in common regardless of their taxonomic relationships, by means of which they are able to maintain themselves. Such insects are more general feeders while some species exhibit specificity in their food preferences. Food of such insects consists of either living material (microscopic and macroscopic organisms) or dead and decomposing animal and plant materials. Microscopic food items include some unicellular algae, bacteria, some fungi etc. while the macroscopic foods consist of aquatic insects, crustaceans, worms, smaller fishes etc. Some predators are also equipped with strong, opposable mouth parts for biting and chewing their preys (David and Ananthakrishnan, 2004). Aquatic insects are found to occur in various types of fish ponds such as nursery, rearing and stocking. Their larvae or nymphs are serious pests in both fresh and brackish water ponds (Merritt and Cummins, 1996) and are considered to be harmful for fish particularly of their larval stages such as spawn, fry and fingerlings. There are thirteen orders of aquatic or semi-aquatic insects (Source: Wikipedia) but the most common ones in fish

pond are Coleoptera (beetles), Homoptera (cicada), Hemiptera (bugs), Odonata (dragon flies) and Diptera (flies and mosquitoes). These fish ponds are invariably heavily infested with aquatic insects after manuring is over particularly during monsoon period. Predatory aquatic insects burgeon rapidly during preparation of pond for stocking of fry and fingerling and are responsible for taking a heavy toll of fry and fingerlings as soon as the latter are released in the pond. (Distant, 1960; Gorai and Ray Chaudhry, 1962; Tripathi and Sharaf, 1974). Many predatory aquatic insects not only directly prey upon spawn, fry and fingerlings of carps but also compete with them for their food organisms (Julka, 1965; Ganguly and Mitra, 1961). Common aquatic insects found in nursery ponds are *Notonecta*, *Ranatra*, *Cybister*, *Belostoma*, *Nepa*, and *Hydrometra* which are highly destructive to the fish fry and fingerlings.

Manipur is endowed with fisheries resources of about 56,461.15 ha. water areas in the form of lakes, seasonal and perennial swampy areas, rivers, tanks, ponds, reservoir, low lying paddy field etc. which can be developed on scientific lines of fish culture for production of increased fish yield. So far, 18,600 ha. of water areas have been brought under fish culture operation by the end of 2010-11. On the basis of the national level of production, Manipur has got a production potential of about 38,000 tonnes of fish per annum if harnessed the untapped fisheries resources through proper judicious exploitation and application of modern scientific fish culture techniques. However, the present level of annual fish production of the state is to the tune of 19,200 tonnes

as against the total requirement of about 27,500 tonnes (based on the National Nutritional Standard of 11 kgs. per capita consumption) of fish for about 25,000 lakh projected population of the state showing a shortfall of about 8,300 tonnes. At present, the shortage is partially met by importing fish from other states like Assam, West Bengal, Andhra Pradesh etc. (Annual report: Govt. of Manipur, 2012).

The most important programme implemented by the Fishery Department of Manipur is fish seed production. During 2010-11, the state could produce 124 millions of fish fingerlings till January, 2011 from both Govt. and private fish seed farms and it is expected to produce 128 millions of fish fingerlings against the target of 134 millions by the end of the year 2010 – 11 (Annual report: Govt. of Manipur, 2012). One of the main challenges related to the considerable reduction in fish fingerling production in Manipur can be attributed to the improper management of predatory insects in nursery ponds in fish farms of Manipur. Hence, an adequate knowledge of the identification, economic importance, life cycle, biodiversity, roles and taxonomic orders of aquatic insects facilitates sustainable culture fisheries management and practice.

MATERIALS AND METHODS

Aquatic insect's identification

Several inland water bodies particularly fish farms in the different district of Manipur were surveyed for studying the species compositions and distribution of aquatic insect fauna. Insects were collected using scoop nets, soon after their capture the insects were preserved in 5% formalin in the field. The collected insects were brought to the laboratory for their identification using manuals and further investigations.

Examination of predatory activity of insects

Predatory aquatic insects, fry and fingerlings of cultivable fish species were collected from fish hatcheries and nursery ponds. Laboratory experiments were conducted in rectangular aquaria each measuring 6" x 7" x 8" to find out survival periods of both insects and fish. Five specimens of each of the insect species and fish fry and fingerlings, comprising a set, were introduced in each of these aquariums, in which water surface was covered with the required barrier. The survival periods of individual specimens in each set were recorded.

RESULTS AND DISCUSSION

Some important predatory aquatic insects

Dragonfly

Local name: Maikhumbi (nymph)

Evaluation of microbiological techniques for detection

of Methicillin.

Order: Odonata

Family: Libellulidae

Linezolid Resistance

Genus: *Acisoma*

Belsona, J. Omer, Amit Singh, Nand Lal and Rekha Chandani

Habitat of nymph: Ponds marshes and slowly moving streams.

Habitat of adult: Fast flying insect.

Characteristics: Large compound eyes with nearly 360° vision in both the nymph and adult stage. Nymphs have “lips” hinged in two places with grasping pincers on the end (Allan, 1995). Brown and green bodies allow the nymph to blend with the aquatic habitat of plants and pond bottoms, some sort of camouflage. Gills present. Water drawn into the abdomen and expelled through the gills, also propelling the nymph through the water. They have three pairs of segmented legs on upper part (thorax) of body.

Feeding habits : Nymphs are predators and feed on molluscs, other insects, crustaceans, worms, and small fish.

Damselfly

Local name: Chichribi

Order: Odonata

Suborder: Zygoptera

Family: Coenagrionidae

Genus: *Ischnura heterosticata*

Habitat of nymph: Ponds, marshes, and slow moving streams.

Habitat of adult: Aerial; fast flying insect.

Characteristics: In the same order as dragonflies and similar to dragonflies but generally smaller and more delicate. Distinguished by large compound eyes with nearly 360° vision in both the nymph and adult stage (Pennak, 1989). Nymphs have “lips” hinged in two places with grasping pincers on the end for catching prey. Three leaflike gills at the base of the abdomen obtain oxygen. Nymphs generally require 4 to 8 ppm of dissolved oxygen, O₂ for survival inside the water (Smith, 1995). Damselfly nymphs can be distinguished from dragonfly nymphs by a narrow body with three gills extending in a tripod formation at the end of body. The three pairs of legs are long and thin. Nymphs are a food source for some fish (Allan, 1995).

Feeding habits : The nymphs are voracious predators feeding on molluscs, other insects, crustaceans, worms, and small fish with the help of a flat labium, which forms the so-called mask.

Giant water bug

Local name: Naoshek

Order: Hemiptera

Family: Belostomatidae

Genus: *Lethoceros*

Species: *indicum* (Lepelletier & Serville, 1825)

Habitat of nymph & adult: Shallow water at the bottom or clinging to some aquatic plants.

Characteristics: The Giant Water Bug may reach up to 8 cm in size. They get their oxygen supply through a snorkel like breathing tube that extends to the water surface. The anterior legs are raptorial, with a modified hook for catching and holding prey and the rest two pairs are flat, long and hairy to help in swimming. They are true predators in the aquatic environment, even attacking prey that is 20 times larger in size (Thorpe and Covich, 1991). They cling to some aquatic plant with their abdominal tips in contact with the surface.

Feeding habits : Highly predaceous often feeding on fry and small fishes.

Water scorpion

Local name: Hao Naoshek

Order: Hemiptera

Family: Nepidae

Genus: *Ranatra*

Species: *varipus filiformis* Fabricius, 1794

Habitat of nymph & nymphs: Ponds and slow moving streams.

Characteristics: Look like scorpions, found clinging and crawling to the aquatic plants. Characterised by raptorial first pairs of the legs and 2 long caudal filaments held together to form a respiratory tube which maintains contact with air. They show phenomenon of 'Catalepsy' i.e. assuming a strange and rigid bizarre posture.

Feeding habits : Highly predaceous often feeding on fry and small fishes.

Water stick insects

Local name: Esing Mi

Order: Hemiptera

Family: Nepidae

Genus: *Laccotrephus*

Species: *rubber* (Ramesh Kumar, 2004)

Habitat of nymph & nymphs : Ponds and slow moving streams.

Characteristics : Similar as above in case of *Ranatra* but the whole body is comparatively broader. They are commonly called water scorpions for their superficial resemblance to scorpions, because of their raptorial forelegs and the presence of a long slender process at the posterior end of the abdomen, resembling a tail, sometimes called needle bugs or water stick insects as they are more slender than *Nepa*. Respiration in the adult is effected by means of the caudal process, which consists of a pair of half-tubes capable of being locked together to form a siphon by which air is conducted to the tracheae at the apex of the abdomen when the tip of the tube is thrust above the surface of the water. In immature forms, the siphon is often underdeveloped and respiration takes place through six pairs of abdominal spiracles.

Feeding habits : Feed primarily on invertebrates, but occasionally take small fish or tadpoles.

Water boatman

Local name: Long Khajing

Order: Hemiptera

Family: Corixidae

Genus: *Corixa*

Species: *punctata* Illiger, 1807

Habitat of nymph & adult : Ponds, streams and intertidal marshes.

Characteristics : Water Boatmen have middle and hind legs covered with long swimming hairs. They eat decaying matter as well as other animals. Many species are tolerant of pollution and can live in oxygen-poor environments. Atmospheric oxygen is trapped as an air bubble (or plastron) beneath microscopic hairs (Merritt and Cummins, 1996). Found in shallow waters at the bottom or clinging to the aquatic plant with their abdominal tips in contact with the surface. The anterior legs are raptorial and rest two pairs are flat, long and hairy to help in swimming. The forelegs have only one flat tarsal segment with bristle to sweep debris, algae, protozoa and microscopic organisms towards mouth. Body is covered with thin air bubbles continuously below their wings.

Feeding habits : Highly predacious, often feeding voraciously on fry and small fishes.

Common Backswimmer

Local name: Long Khajing

Order: Hemiptera

Family: Notonectidae

Genus: *Notonecta*

Species: *glauca* Linnaeus, 1758

Habitat of nymph & adult : Ponds, running water of streams and intertidal marshes.

Characteristics : Backswimmers have middle and hind legs covered with long swimming hairs like water boatman but swim on their back. Three pair of legs used in swimming keeping the ventral surface towards the skylight. In resting position, they lie on their backs while the tip of the abdomen is kept contact with atmosphere.

Feeding habits : Voracious feeders, attacking fry of fishes

Water Bug

Local name: Konjeng kokphai

Order: Hemiptera

Family: Belostomatidae

Genus: *Diplonychus*

Species: *rusticus* Fabricius, 1871

Habitat of nymph & adult: Shallow water.

Characteristics: The aquatic bug uses primarily the “sit and wait” strategy for pursuing and attacking its prey from the submerged objects. However, sometimes, it also searches actively for prey. After a successful encounter, the predator grasps the prey with its pro- and mesothoracic legs. The aquatic bug has a great ability to make successful attacks because of its strength and tenacity. While feeding, it can capture another prey item and reserve it to eat later. The beak is introduced into the prey through the soft parts of its body and extracts the liquefied contents. The dead remain of the prey is discarded and the predator hunts for next prey.

Feeding habits : It prefers mostly the living prey of medium size category but choose mainly dead individual in the large size classes.

Predaceous Driving Beetle

Local name: Tengbi

Order: Coleoptera

Family: Dytiscidae

Genus: *Cybister*

Species: *tripunctatus* (Olivier, 1795)

Habitat of nymph & adult: Both adults and larvae are aquatic in freshwater lakes, dams, riverine pools.

Characteristics: Body oval, elliptical or circular, tapering at the ends. Elytra are shiny, glossy with a yellow border around the body. with different colour pattern, striated and smooth. Antennae long filiform. The first pair

of legs is rubbed against abdomen and elytra to make stridulating sounds. Hind legs are fringed with hairs as an adaptation for swimming. Adults and larvae touch the surface film for water by abdominal trip to contact air for respiration.

Feeding habits : Adults and larvae are predatory.

Water Scavenger Beetles

Local Name. Tharaikokpi

Order: Coleoptera

Family: Hydrophilidae

Genus: *Hydrophilus*

Species: *triangulari* Say, 1823

Habitat of larvae & adult: Shallow ponds with abundant vegetation, ponds and streams.

Characteristics : Body with short and clubbed antennae concealed below the head. Hind legs are flattened and moved alternatively for swimming but usually they crawl on aquatic vegetation. To obtain oxygen while diving inside the water, the beetle carries air bubble or film under the elytra. Adult females have structures resembling the spinnerets of spiders to make pouches of their eggs.

Feeding habits : The adults are omnivores, consuming detritus materials; while the larvae are known to be predacious eating mosquito larvae and fish fry in stock management ponds.

Aquatic insects which occur in various types of fish ponds such as nursery, rearing and stocking often prove to be harmful to the fish at their larval stages such as spawn, fry and fingerlings. Of the various different insect predators causing damage to the fish populations in nursery pond, the most common ones include beetles, bugs, dragonfly, and damselflies nymphs. The larvae of dragonfly and damselflies are well equipped with well developed labium that is quite extended to capture and hold the fish fingerling. Similarly, most water bugs have well developed piercing and sucking mouth parts and forms such as giant water bugs and water scorpions have raptorial fore legs which are adapted for grasping prey in pincer like manner. Among beetles, predaceous forms include diving beetle (*Cybister confusus* Sharp, 1882), water scavenger beetle (*Sternolophus rufipus* Solier, 1834) and whirling beetle (*Gyrinus* sp.). Aquatic bugs are also highly predatory. Back swimmers (*Anisops bouvieri* Kirkaldy, 1704) appear in swarms in manured ponds during rainy season and cause heavy damage to the fish spawn. Other predatory members of this group generally include water scorpion {*Laccotraphes griseus* (Gúerin-Méneville, 1844)}, giant water bug {*Lethoceros*

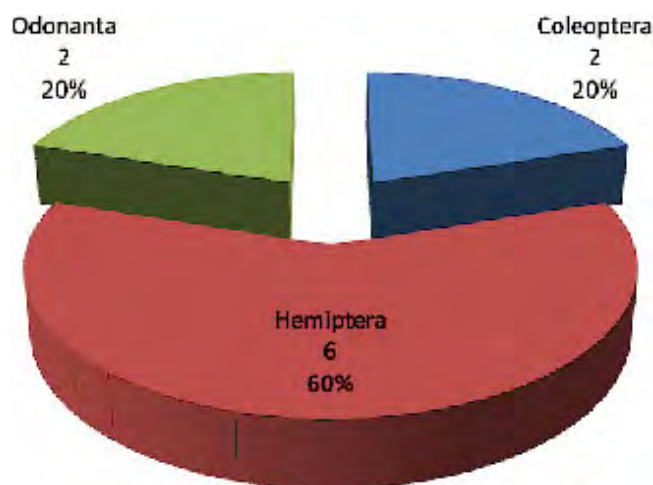


Fig. 1 : Order wise analysis of aquatic insects which infect nursery ponds.

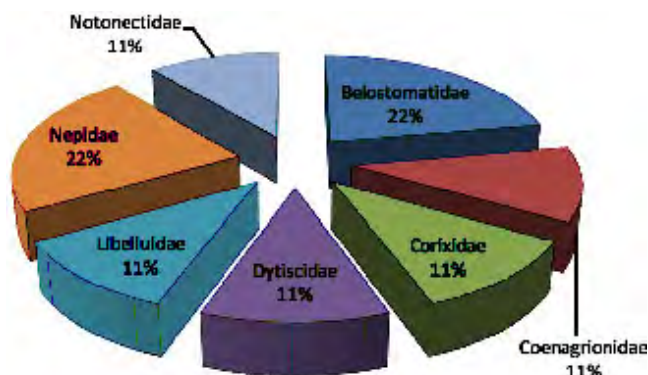


Fig. 2 : Family wise analysis of aquatic insects which infect the nursery ponds.

indicum (Lepeletier & Serville, 1825)} and water stick insect (*Ranatra filiformis* Fabricius, 1794). Similarly, Dragonfly nymphs are also highly predaceous on carp spawn. Considering the above effects, proper management of the nursery pond quite is essential for stocking carp spawn. Order wise analysis of aquatic insects which infect nursery ponds hemiptera mainly cause the maximum destruction followed by Odonata and Coleoptera (Fig. 1). Family wise analysis of aquatic insects which infect the nursery ponds Belostomatidae and Nepidae mainly causes maximum destruction and the remaining families, Coenagrionidae, Corixidae, Dytiscidae, Libellulidae and Notonectidae were almost equal in their destruction activity in the nursery ponds (Fig. 2).

ACKNOWLEDGEMENT

The authors are thankful to the Department of Biotechnology, New Delhi for providing financial support and working facilities to the Institutional level Biotech Hub, Manipur College, Imphal.

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