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A study on the influence of certain eco–physiological factors on predation efficiency of *Aplocheilus panchax*

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Abstract

Mosquitoes are the vectors of serious vector borne diseases, causing millions of deaths every year. Vector control using agents of chemical origin, continues to be practiced in the control of vector borne diseases. However, due to some drawbacks including lack of selectivity, environmental contamination and emergence and spread of vector resistance, development of natural product for vector control has been a priority in this area. Malaria, dengue fever, yellow fever, chikungunya, filariasis are some common examples of vector borne diseases. Fishes may be alternative sources of mosquito control agents. In the present study a representative larvicidal fish, *Aplocheilus panchax* has been chosen and an attempt has been made to predict the course of predation processes on the basis of certain environmental factors. The study revealed that predation efficiency is dependent on the eco-physiological factors such as temperature, illumination, fish size and to a certain extent the hydrogen ion concentration. It is obvious on the basis of predatory capacity, *Aplocheilus panchax* deserves an important role in the control of mosquito larvae.

Keywords: Larvivorous, predation, biological agents, *Aplocheilus panchax* etc.

1. Introduction

Organisms usually respond to the environment as a whole rather than to single factors as environmental factors interact among themselves to mitigate the effect of a given factor [5]. For assessing larvivorous fishes as the best biological control agents of mosquito larvae, it is important to elucidate how the environmental factors affect the predation processes on the basis of temperature, pH and light. The basic scheme of assessing the effect of environmental factors on the time course of predation was suggested by [6]. The most controlling factor in an environment is its temperature. However, in tropics temperature does not vary over a wide range. The present investigation observed the effect of environmental factors on the predatory capacity of representative larvicidal fish, *Aplocheilus panchax*. It revealed that larval control is further advantageous in that it produce a more effective check in mosquito population by attempting to exterminate the vector in an earlier stages of its life history.

2. Materials and methods

In the present study the fishes after being acclimated to laboratory condition in aquarium tanks filled with well water at a temperature of 27.5 °C, a pH of 7.1 and oxygen at near air saturation were utilized. The fishes were fed once a day on *Culex* larvae (reared in lab) for a period of 90 minutes. After being used to a regular feeding schedule, the fishes were divided into 15 each and acclimated to the desired environmental conditions. The range of temperature and pH was experimented with that which might be encountered in the habitats into which the fishes were introduced [8]. The effect of light on feeding was determined by allowing the fishes to predate under both light and dark conditions. Since predation is greatly modified by environmental factors, all factors except the one dealt with were constant to elucidate the influence of each factor separately.

All tests were carried out separately with medium sized fishes of *Aplocheilus panchax*.

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Prior to the investigation, the fishes were starved for a period of 24 hours. Each was then fed for nine periods of ten minutes duration each, following Mathavan [7]. Larvae offered at the beginning of each feeding period were removed at the end with minimum disturbance to the fish. Each test was repeated and the results were analysed.



Fig 1: *Aplocheilichthys panchax*

3. Results and Discussion

Influence of temperature

Table 1: Effect of temperature on the predatory efficiency of *Aplocheilichthys panchax*

Temperature	Predation rate(larvae)
22.5 °C	30.5
27.5 °C	45.3
32.5 °C	60.2

The results (Table 1) revealed that temperature is an overriding stimulus regulating predatory efficiency at the various chosen temperature. The rate of predation (30.5 larvae) is minimized at low temperature of 22.5 °C. It increases to 45.3 larvae as the temperature rises to 27.5 °C and then to 60.2 at 32 °C. The findings that the amount of food eaten by the fishes generally increases with rising temperature till an optimum is reached is supported by the works of [3] and [4]. It was also noted that the predatory efficiencies of *Aplocheilichthys panchax* was higher than that reported for other larvivorous fishes like *Gambusia affinis* by [3] at 20 °C (12.6 larvae), 25 °C (16.1 larvae) and 30 °C (20.5 larvae). Since the temperature of the aquatic units in which the mosquito breeds fluctuates from time to time the evaluation of the predatory efficiency of this fish in different temperature is naturally essential.

Influence of light

Table 2: Effect of illumination on the predatory efficiency of *Aplocheilichthys panchax*

Condition	Predation rate
Light	95 larvae
Dark	80 larvae

It was found that the degree of light influences feeding there being a highly significant differences between predation efficiencies under light and dark conditions. Predation efficiency (Table 2) under conditions of light (95 larvae) was higher than that under conditions of darkness

(80 larvae). [2] claims that visual feeders cease to feed once the light intensity falls below a threshold value. In *Aplocheilichthys panchax* the feeding intensity is lowered under conditions of darkness. The fact that tank feeding under dark conditions exists is an indication of the larvivorous potential of this fish in covered wells. It was also noted that predatory efficiency of this fish was higher than that reported by [3] in other larvivorous fishes like *Gambusia affinis* feeding conditions of light (17.4 larvae) and darkness (15.8 larvae).

Influence of pH

Table 3: Effect of pH on predatory efficiency of *Aplocheilichthys panchax*

pH	Predatory efficiency(larvae)
5.5	45.2
6.5	22.5
7.5	49.3

Although no regular alternation in predation efficiencies is discernible in *Aplocheilichthys panchax*, the predation rate (table 3) is maximally elevated at pH 5.5(45.2 larvae) but is depressed at pH (22.5 larvae) respectively. Owing to the lack of literature, the influence of pH on feeding cannot be fully discussed. However, the maximum feeding in pH 7.5 is probably due to the fact this is close to the pH of water (7.1) in which the fishes were acclimatized. This is supported by the findings of [1] that the largest fish crops were found in waters on the alkaline side of neutrality between pH 7 and 8.

4. Conclusion

In the present study an attempt have been made for predicting the course of predation processes on the basis of certain environmental factors. The elucidation of the degree to which environmental factors affect predation reveals that predatory efficiency is dependent on many measurable variables of the prey predator system including temperature, illumination, fish size and to a certain extent hydrogen ion concentration. In conclusion, the manner in which predatory efficiencies are altered by numerous eco-physiological factors of the habitat permits an evaluation of the suitability of introducing the fishes into specific habitats. Thus this study on *Aplocheilichthys panchax*, proved the larvicidal efficiency of it and holds good promise as an effective biological agent to control the population of mosquito larvae.

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