IRJSE International Research Journal of Science & Engineering
Int. Res. J. of Science & Engineering, 2020; Special Issue A7: 453-458 SJIF Impact Factor 6.68
ISSN: 2322-0015
RESEARCH ARTICLE **OPEN ACCESS**

Evaluation of Blue Cichild, Zebra fish and angel fish as biological control against mosquito larvae (*Culex quinquefasciatus, Aedes aegypti* & *Anopheles Stephensi*).

Thote Jayashri G*

*Research Scholar Sevadal Mahila Mahavidhyalaya, Nagpur.
Email: jayashri.thote@gmail.com

Manuscript Details
Available online on http://www.irjse.in
ISSN: 2322-0015

Editor: Dr. Arvind Chavhan

Cite this article as:
Thote Jayashri G. Evaluation of Blue Cichild, Zebra fish and angel fish as biological control against mosquito larvae (*Culex quinquefasciatus*, *Aedes aegypti* & *Anopheles Stephensi*), *Int. Res. Journal of Science & Engineering,* February, 2020, Special Issue A7 : 453-458.

ABSTRACT
In present study experiments were conducted on predation efficiency of Blue Cinchild, Zebra fish and angel fishon Three different mosquito species 1st,2nd,3rd,4th larval instar and pupa (Culex quinquefasciatus, Aedes aegypti &Anopheles Stephensi) in laboratory controlled conditions with respect to fish size, temperature and feeding time at Malaria & Filaria Department, Mahal, Nagpur Laboratory . These are efficient bio-control agent against mosquito born diseases and have been used in controlling mosquitoes. Results showed that Blue Cinchild prey consumption rate was greater at higher temperature 35°C (200±7.70), Angel fish prey consumption rate was greater at higher temperature 35°C (187.58±3.50)& Zebra Fish prey consumption rate was greater at higher temperature 35°C (118.68±2.76) and Results show that blue cichild prey consumption rate was less at low temperature 20 C (50.78±3.751), Angel fish prey consumption rate was less at low temperature. 25 C (35.96±3.78) & Zebra Fish consumption rate was less less at low temperature. 30°C (20.11±11.28). Feeding of Blue Cichild showed maximum perdition efficiency in morning time (150.56±4.56) and minimum at afternoon and evening time (60.20±3.34 and 40.50±2.24 respectively). Feeding of Angel Fish showed maximum perdition efficiency in morning time (80.20±3.89) and minimum at afternoon and evening time (30.50±4.40 and 20.70±3.470 respectively). The zebra fish showed maximum perdition efficiency in morning time (70.30±3.31) and minimum at afternoon and evening time (25.12±2.28 and 10.32±4.45 respectively). Considering the fish size in term of body weight predation rate increases with increasing body size. Blue Cinchild is more efficient biocontrol agent against mosquito larvae (C. quinquefasciatus, A. aegypti&A.Stephensi) at 35°C temperature in morning time as compared to Angel fish And Zebra Fish.

Keywords: Biological control, fish, Culex quinquefasciatus, Aedes aegypti, Anopheles Stephensi.

INTRODUCTION

In humans and mammals, some of the infectious diseases are transmitted by certain vectors like mosquitoes, flies (sand and tsetse), tics, mites and lice. Mosquitoes are the wide spread major and most common vector of different diseases including malaria, dengue, Chikungunya, JE and yellow fever [1]. The control of mosquitoes (vector for many human and animal diseases) is important for the control of these vector borne diseases. Several compounds viz, mercuric chloride, Paris Green, phenols and cresols, naphthalene [2], bordeaux mixture, rosin-fish oil soap, calcium arsenate, nicotine sulfate and dichlorodiphenyltrichloroethane (DDT), were used as conventional pesticides [3]. Paris green and petroleum oils were proven the most successfully used chemicals in larval control. The remarkable toxic and persistent effect of these insecticides is the development of insecticide resistance strains of mosquitoes[4]. The biological control is environmental friendly and not hazardous for plants, beneficial insects and humans health. For controlling pest some of the biological controlling agents were used such as parasites, parasitoids, microorganisms and predators [5]. Fresh water fish *gambusia affinis, Oreochromis mossambica, Poecilia reticulata* (Mozambique cichlid, Tilapia) was used to control mosquito [6]. *Poecilia reticulata* (guppy) has proven to be effective against all developmental stages of *Aedes spp.* [7].

Till date nobody has done the study on blue cinchild, Zebra Fish And Angel Fish for biological control of mosquitoes for malaria and dengue diseases. Keeping in view the importance of blue cinchild, Zebra Fish And Angel Fish as an effective biological control agent against different species of mosquito, the present study was designed to investigate the larval predation efficacy of blue cinchild, Zebra Fish And Angel Fish as a biological control agent against three mosquito species *Culex quinquefasciatus* and *Aedes aegypti* and *Anopheles* 1^{st} ,2^{nd} ,3^{rd} ,4^{th} larval instar and pupa, under laboratory controlled conditions. Some of the parameters like fish size, temperature and feeding time of blue cichlid, Zebra Fish And Angel Fish were also recorded.

METHODOLOGY

Mosquito larvae used in present study were collected from ponds located in Nagpur Urban Area. The mosquito larvae collection was carried out by dipping a small size net into the pond and transferred into beaker filled with tap water (Okorie, 2010) [8]. Morphometery of thirty larvae from each species was conducted. Each larva was individually placed on a slide and added a drop of 70% ethyl alcohol. Total length of body and length and width of siphon tube of larvae were measured under 40X power of light microscope. The larvae counting was performed within 1 hour. The counted 500 larvae were transferred into the 3 Aquarium where 3 types of fishes were introduced.

The three types of fishes Blue Cinchild, Angel Fish & Zebra Fish were collected from Aquarium shops of Nagpur city. In each treatment a known number of mosquitoes were offered and number of larvae consumed by fishes was recorded. Total numbers of larval consumption in 1 hr of duration were noted carefully, the noting was done after 20 minutes. The experiment was carried out in day time and observation was taken in morning, afternoon and in evening [9].

RESULTS AND DISCUSSION

1. **Predation Efficiency of Fishs (Blue Cinchild, Zebra fish & Angel fish)**

On the size basedinvestigation of mosquito larval consumptions for that Angel fish (4 cm), Zebra fish (5 cm) & Blue Cinchild (6 cm) was taken.Duration of the experiment showed that blue cinchild fish consumed (200.50 ±7.70,) Angel Fish consumed (187.78±5.58) & Zebra fish consumed (118.6±3.70). (figure 1).

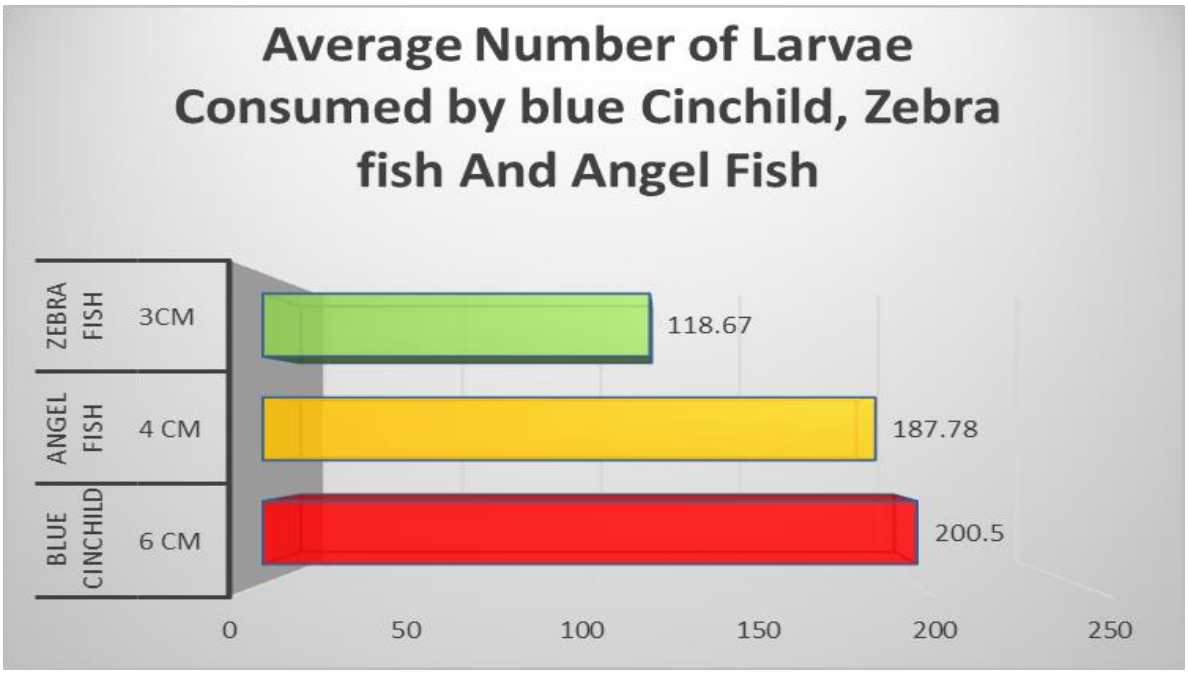
2. **Predation Efficiency of Blue cinchild, Angel fish & Zebra Fish at Water Temperatures**

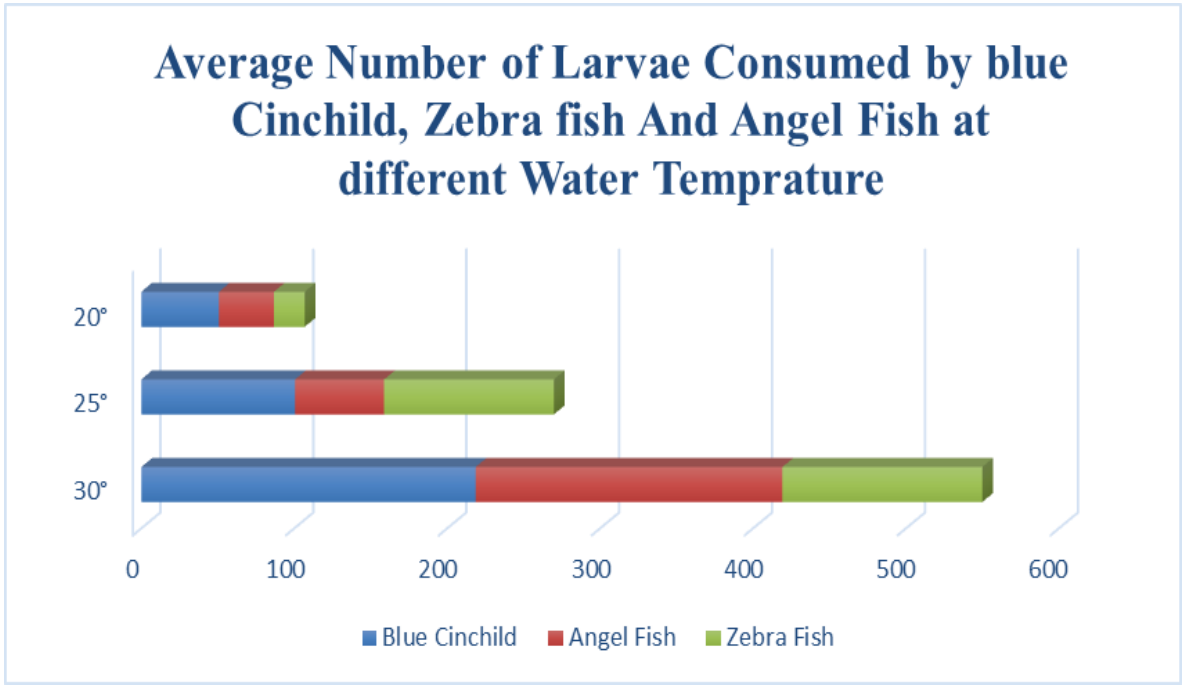
The temperature based studies of fishes was at 35°C Blue cinchild consumed average mosquito larvae (218.60±4.58), Angel fish (200.58±3.50) & Zebra Fish (130.68±2.76) which decreased at 30°C to Blue cinchild (100.60±4.71), Angel Fish (110.96±2.87) & Zebra Fish(58.20±3.21) and further decreased to at

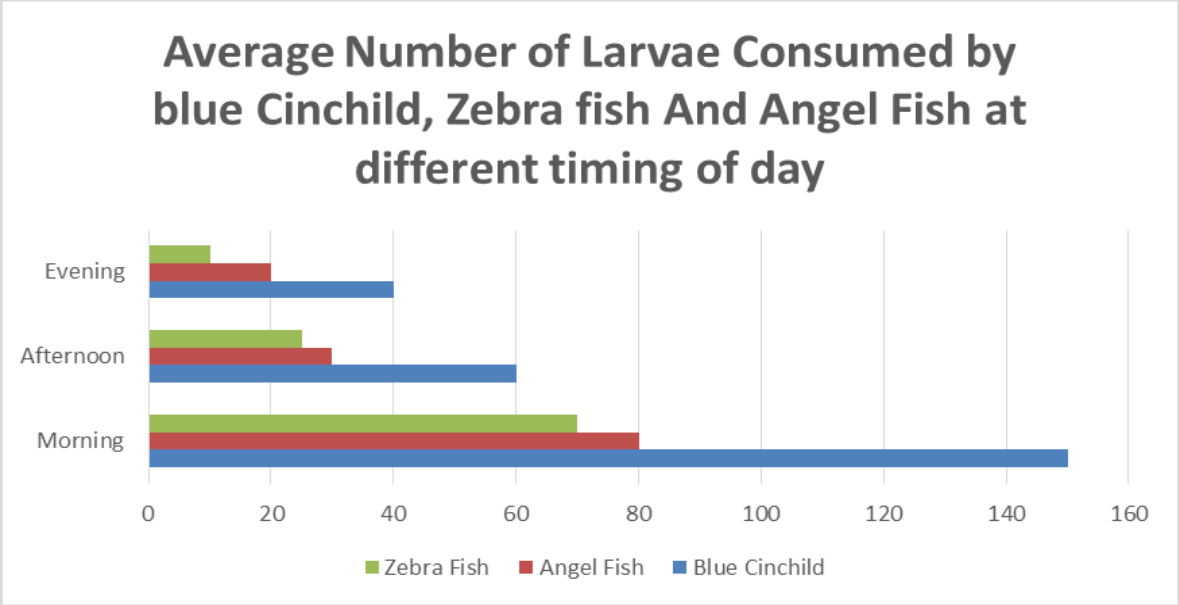
25°C Blue cinchild (50.78±3.751), Angel Fish (35.96±3.78) & Zebra Fish(20.11±2.28).(figure 2).

Consumption of Mosquito Larvae at Different Timing of Day

The investigation of mosquito larval consumptions based on timing of the day showed that Blue Cinchild, Angel Fish & Zebra Fish consumed higher number of larvae at morning time and afternoon(150.56±4.56) (60.20±3.24) & (40.50±2.24) at evening time (figure 3) while angel fish consumed (80.20±2.89) larvae at morning time and lower to (30.50±4.40) and (20.70±3.70) at afternoon and evening time respectively and Zebra fish consumed at morning (7.30±3.31) at afternoon (25.12±2.28) and at evening (10.32±4.45).(figure 3).







Three different Types of fishes Blue cinchild, Angel Fish & Zebra Fish predated on undifferentiated 1st ,2nd ,3rd ,4th larval instar and pupa of three mosquito species C. quinquefasciatus, A. aegypti and A. Stephensi It was observed that in the beginning of study the Blue cinchild, Angel Fish & Zebra Fish larvae consumption of mosquito species were greater and consumption reduced with time interval. It was further observed that consumption rate of larvae is depends upon size of fish. Contrary to our study [12] reported that predation declines significantly as size of fish increases. The rate of larval consumption was proportional and dependent to fish size [13]. All the three fishes were also predated on undifferentiated larvae of *C. quinquefasciatus*, *A. aegypti* and *A. Stephensi* consumed them. Although, the consumption efficiency of Zebra Fish was comparatively lesser than blue cinchild and angel fish. In line to our study [12] predation declines significantly as size of fish increases[12]. The fish size is directly proportional to is rate of larvae consumption [13]. The number of prey consumed varies with the difference in body size. This means that prey consumption increases with body size [14]. This result also supports by finding by [15] who report that the efficacy as predator depends on its weight and sex. [15] used three different fish species as predators against *Aedes aegypti* larvae and found that the larger fish are more effective predators, and female guppies are more capable to eradicate *Aedes aegypti* larvae than male guppies. Therefore, larger fish eat more mosquito larvae than smaller fish do [9]. Daily feeding patterns were size-dependent. The largest fish fed at a relatively constant level through the day, medium-sized fish fed in a pattern similar to that described above for the population and small fish fed most at first and last light. These differences were due probably to the effect of competitive interactions upon fish of different sizes. It was observed that the larval consumption of Blue Cinchild was higher to zebra fish and angel fish at all the temperatures during the whole intervals of the study. The consumption was highest at 35°C that progressively reduced significantly for all the time durations at 30°C and 25°C respectively. However, the zebra fish consumption was significantly reduced compared to blue cinchild and angel fish. As the water temperature fluctuates in which the mosquito breeds from time to time the evaluation of the predatory efficiency of this fish in different temperature is naturally essential. However, it must be mentioned that [16], reported the feeding behavior of other larvicidal fishes such as G. affinis, P. reticulata and A. lineatus to be in direct response to water temperature. The increase in temperature causes enhanced fish activity and metabolism that leads in the increased feeding activity said by [17-18]. A positive correlation of the consumption rate of the guppy with that of the water temperature was observed. At the higher temperature ranges, both the male and female guppy fish consumed higher number of mosquito larvae [19]. Similar findings were also observed by other workers [20]. Therefore, one of the reasons that fish enhance its feeding may be linked to the increase in temperature. The predation efficiency was found minimized at low

temperature of 25°C. It increases to higher numbers of larvae as the temperature rises to 30°C and then further increased to the considerably highest larvae numbers at 35°C. The finding that the amount of food were consumed by the fishes generally an increase with rising temperature till an optimum is reached is supported by the works of [21-22]. It was also noted that the predatory efficiencies of Aplocheilus panchax was higher than that reported for other larvivorous fishes like Gambusia affinis by [21] at 20°C (12.6 larvae), 25°C (16.1 larvae) and 30°C (20.5 larvae). The predatory efficiency of *O. niloticusus* is higher than that reported for *G. affinis* in tropical waters, at 20°C (12.6 larvae per individual), 25°C (16.0 larvae per individual) and 30°C (20.5 larvae per individual), but is lower than that reported by (Jacob et al., 1982) [12] in A. lineatus at 22.5°C, 27.5°C and 32°C (47.3, 61.2 and 67.7 larvae per individual). It was also evident from the results that all three fish species (blue cinchild, angel fish & Zebra Fish) of devour more larvae in the morning times compared to evening times. In conjunction to our results, the feeding pattern for the fish in an earlier study that highest levels of feeding activity in the early morning and late evening. Differences between our and other studies may be due to variation in climate, season or life-history stage. These results are in consistent to the earlier studies that a nocturnal depression in feeding was observed and the fish ceased feeding in the evening without commencing feeding again until 5 a.m. or later when it is getting quite light. The feeding activity increased in intensity throughout the morning but often slackens off during mid-day. Parr fish species usually have another period of active feeding in the evening. There were similar observations to our study that in a semi natural stream were carried out during the day and night comparing diet and seasonal differences in behavior between fish and the fish were found to be foraging at surprisingly low light levels. It also showed a feeding depression during the hours of darkness, with fish feeding in lower intensity light during the evening rather than during the early morning hours. Some studies reported a daily appetite rhythm, with an early-morning peak after a slow start at first light, a trough in the early afternoon, and a second peak in the late afternoon/early evening. It was assumed previously that the afternoon drop in appetite found in these studies was a response to higher light levels at this time of day.

CONCLUSION

All three Blue cinchild, Angel fish & zebra fish species are more efficient biological control agent against mosquito larval instar and pupal stage of (C. quinquefasciatus, A. aegypti & A. Stephensi) at 35°C temperature in morning time. The numbers of parameters like fish size, different temperature and different feeding time also showed the maximum result on blue cinchild, angel fish & zebra fish. On the basis of above parameters blue cinchild, angel fish & zebra fish species are recommended as biological control agent against mosquito larvae and mosquito borne diseases.

Conflicts of interest: The authors stated that no conflicts of interest.

REFERENCES

1. Pant CP, Rishikesh N, Bang YH, Smith A. Progress in malaria vector control. Bull. WHO, 1981; 59(3):325-333.
2. Gratz NGR, Malaria Pal. vector control: larviciding. In: Wernsdorfer, W. H., McGregor, I. (Eds.) Malaria: Principles and practice of malariology. Edinburgh, UK: Churchill Livingstone. 1988, 1213-1226.
3. Raghavendra K, Barik TK, Niranjan BPR, Sharma P, Dash AP. Malaria vector control: From past to future. Parasitol. Res., 2011; 108(4):757-79.
4. Brown AW. Laboratory studies on behaviouristic resistance of anopheles albimanus in Panama. Bull. WHO. 1958; 19:1053-1061.
5. Sarwar M. Proposals for the Control of Principal Dengue Fever Virus Transmitter Aedes aegypti (innaeus) Mosquito (Diptera: Culicidae). J Ecol. Environ. Sci. 2014; 2(2):24-28.
6. Walker KA. A Review of control methods for African Malaria Vectors. Activity Report 108. Agency for international Development Washington WA, USA, 2002.
7. Chandra G, Bhattacharjee I, Chatterjee SN, Ghosh A. Mosquito control by larvivorous fish. Indian J Med. Res., 2008; 127:13-27.
8. Saleeza SNR, Norma-Rashid Y, Sofian-Azirun M. Guppies as predators of common mosquito larvae

in Malaysia. Southeast Asian J Trop. Med. Public Health. 2014; 45(2):299-308.
9. Jacob SS, Nair NB, Balasubramanian NK. Influence of certain environmental factors on the predatory efficiency of the larvicidal fish Aplocheiluslineatus (Cuv. &Val.). ArchivffirHydrobiol. 1982; 93:341-351.
10. Pamplona LGC, Lima JWO, Cunha CL, Santana EWP. Avaliação do ImpactonaInfestação por Aedes aegypti emtanques de cimento no município de Canindé, Ceará, Brasil, após a utilização do peixe Betta splendenscomoalternativa de controlebiológico, 2004.
11. Manna B, Aditya G, Banerjee S. Vulnerability of the mosquito `larvae to the guppies (Poecilia reticulata) in the presence of alternative preys. J Vector Borne Dis. 2008; 45:200-206.
12. Cavalcanti Pontes LPRJ, Regazzi AC. Efficacy of fish as predators of Aedes aegypti larvae, under laboratory conditions. Rev. SaúdePública. 2007; 41:638-44.
13. Maglio VJ, Rosen DE. Changing preference for substrate colour by reproductively active mosquito-fish Gambusia afJinis (Baird &Girad) (Poeciliidae, Atheriniformes). Amer. Mus. 1969, 2397:1-39.
14. Elliott JM. The growth rate of brown trout (Salmo trutta L.) fed on maximum rations. J Anita. Ecol., 1975; 44:805-821.
15. Rozin P, Mayer J. Regulation of food intake in the goldfish. Amer. J Physiol., 1961; 201:968-974. 16.
16. Elias M, Saidullslam M, Kabir MH, Rahman MK. Biological control of mosquito larvae by Guppy fish. Bangladesh Med. Res. Council Bull., 1995; 21(2):81-86.
17. Ahmed T, Bhuiyan MKR, Khuda M. Observations' on the larvivorous efficiency of Poecilia reticulata Rosen and Bailey (CyprinodontiformesCyprinidontidae). Bangladesh J Zool. 1985; 13(1):712.
18. Brett JR. Satiation time, appetite or maximum food intake (Onychorhynchusnerke). J Fish Rev. Board Can., 1971, 409-475.
19. Gerald VM. The effect of temperature on the consumption, absorption and conversion of food in Ophiocephalus punctatus Bloch. Hydrobiologia. 1976; 49:87-93.
20. Reddy SR. Mosquito control through larvlvorous predators. Ph.D. thesis, University of Bangalore, India. 1973, 287.
21. Hoar WS. Diurnal variations in feeding activity of young salmon and trout. Journal of the Fisheries Research Board of Canada. 1942; 6:90-101. 25.
22. Valdimarsson SK, Metcalfe NB. Is the level of aggression and dispersion in territorial fish dependent on light intensity. Anim. Behav. 2011; 61(6):1143-1149.