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International Journal of Current Research
Vol. 7, Issue, 02, pp.12635-12637, February, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

BIOLOGICAL CONTROL OF VECTOR OF COMMUNICABLE DISEASE IN CHITRAKOOT, SATNA (MP) USING LARVIVOROUS FISH, *PUNTIUS CONCHONIUS*

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ARTICLE INFO

Article History:
Received 23rd November, 2014
Received in revised form
08th December, 2014
Accepted 16th January, 2015
Published online 28th February, 2015

Key words:
Filariasis,
Japanese Encephalitis,
Culex,
Rural Health

ABSTRACT

Background and objectives: Ever increasing population and lack of adequate health care facilities, particularly for the rural masses are a matter of concern for India. The major concern of India is the spread of vector borne diseases by mosquitoes. Mosquitoes are vectors of different pathogenic organism like protozoan, nematodes and viruses. They spread diseases like malaria, filaria, chikungunya, dengue and yellow fever etc. *Culex* transmits filariasis, Japanese encephalitis, Chikungunia, Ganjam and other Encephalitis diseases in the World. *Puntius conchonius* fish was used as a biocontrol agent against larvae of *Culex*. The predation potential of *P. conchonius* against *Culex* larvae was analyzed in the presence and absence of *Hydrilla* plant.

Methods: The present experiment was designed and carried out in the laboratory of Biological Sciences, MGCGV, Chitrakoot, Satna (MP) . Fourth instars larvae of *Culex* were collected from stagnant water of natural pits, nearby university grounds (campus) and was reared in plastic cane (15-liter capacity) with unchlorinated tap water in the laboratory and was maintained at room temperature 28 ± 2^0C & pH 6.5. *P. conchonius* fish were collected from Payaswani (Mandakini) river and reared in the aquaria with tap water at same temperature and pH.

Results: The fish presented a high predation rate both in presence and in absence of aquatic weeds. Average feeding rate was 292.2 larvae / fish/day in the absence of aquatic weeds and 288.3 larvae/ fish/day in the presence of aquatic weeds in similar physico - chemical condition in the laboratory.

Interpretation and Conclusion: The maximum feeding of the fish was 587 larvae / fish in the absence of weed where as minimum were 28 larvae/ fish with *Hydrilla*. The result was statistically analyzed by student't' test. The value of t is 7.674 which is significant at P=<0.01 level.

INTRODUCTION

Environmental degradation, socio-economic decline and extreme weather patterns are contributing to changing pattern of morbidity and mortality and posing serious challenges to public health (**Sabesan and Raju, 2005**). Mosquito's larvae are found in stagnant water body like small pond, small pits, drainage water, ornamental pools, swimming pools, water coolers, riverside pits, lakes, irrigation canals and paddy fields etc (**Gosh *et al*., 2005**). Mosquitoes cause a huge medical and financial burden by spreading chikungunya, dengue, yellow fever, encephalitis, meningitis, filariasis, leprosy, malaria and Rift Valley fever etc. Mosquito consume up to 300 milliliters of blood in a day from each animal in a caribou herd, which are thought to select paths facing in to the wind to escape the swarm (**Fang, 2010**). The mosquito's larvae have been controlled by many different measures (Chemical, Physical, Community or Biological Control).

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Vector control using pesticides remains an important component of all mosquito control program worldwide. However, the persistent use of pesticides caused the development of chemically resistant sub strains and pollutes water and land resources (**Hardin Jesse *et al*., 2009**). Because of the ecosystem damaged by insecticides, there has been renewed interest in biological control techniques to complement mosquito control programs (**Jonathan and Araceli, 2010**). However, chemical control is expensive and many trained people are necessary for constant surveillance of mosquito breeding places. Physical control is also expensive and time consuming. Focusing mosquito reduction efforts on the larval stage has the advantage of controlling the vector prior to dispersal or acquisition of the diseases and interrupting the life cycle before it can cause harm. Biological control is the best method of mosquito control (**Ibarra *et al*., 2002**). Biological control of vectors is an essential and effective means for controlling transmission of several mosquito-borne diseases (**Gosh *et al*., 2005**).

Biological control of mosquito larvae has been managed by vertebrate predators. Many larvivorous fish like as *Gambusia affinis, Aphanius disper*, *Aplocheilus panchax*, *Colisa fasciatus, Chanda nama, Macropodus cupanus, Xenentodon cancila* Guppy and *Puntius ticto* etc. are used as biocontrol agent (**Chandra *et al*., 2008**). In different regions of the world, indigenous fish have been used for mosquito control. Most of these indigenous larvivorous fish provided dual benefits i.e. reducing mosquito populations and indirectly augmenting the aquaculture economics. The predatory performance of the indigenous larvivorous fish is better than insect predators (**Bhattacharjee *et al*., 2009 and Chandra and Brahman, 2009**). The larvivorous potential of cypriniformes fish was calculated both in the presence and absence of aquatic weeds (**Chatterjee *et al*., 2001**). In this contest, the present study has been designed to assess the efficacy of indigenous fish *P. conchonius* as biocontrol agent against *Culex* larvae.

MATERIALS AND METHODS

Collection and maintenance of fish and prey organisms

The different instars of *Culex* larvae were collected from stagnant water of natural pits near by university campus and was reared in plastic trough with unchlorinated tap water in the laboratory at room temperature 28 $\pm$ 2^{0}C and pH 6.5.

Fourth instars larvae were identified and used for the experiments. In the same season, *P. conchonius* fish were collected from Payaswani (Mandakini) river and reared in glass aquaria with tap water at room temperature 28 $\pm$ 2^{0}C and pH 6.5 in the laboratory. In all experiments the individual fish was starved for a period of 24 h before introduction in the experimental trough. The medium size fish (average size 5.3 cm and weight 3.1 gm) were used in the present experiments. The rate of predation potential of *Culex* larvae by fish was assessed both in the presence and in absence of aquatic weeds. The feeding capacity of the fish was observed in plastic trough (50 cm diam). The number of mosquito larvae consumed by fishes was recorded at every 24 hours. The result was statistically analyzed using student't' test. The value of 't' is verified at P=<0.01 level.

RESULTS AND DISCUSSION

Puntius conchonius is used as biocontrol agent against mosquito larvae first time in India. The result indicated that *P. conchonius* fish has high larvivorous potential Table 1. The fish presented a high predation rate both in presence and in absence of aquatic weeds. The weed, *Hydrilla* did not affect feeding potential of the fishes.

In the absence of *Hydrilla* the maximum consumption was 586 larvae/ fish /day & minimum 30 larvae/ fish /day and in the presence of *Hydrilla* the maximum consumption was 581 larvae/ fish /day and minimum was 28.1 larvae/ fish /day. The average feeding 292.2 larvae / fish/day in the absence of aquatic weeds and 288.3 larvae/ fish/day in the presence of aquatic weeds was recorded. Although *P. conchonius* eats leaves of *Hydrilla* plant in natural environment, yet it also consumes mosquito larvae. The results obtained from our experiments clearly indicate that differences of the consumption rate of fish, *P. conchonius* of immature mosquitoes was minor both in the presence and absence of aquatic weed plants. The result was statistically analyzed using student't' test. The value of't' is 7.674 which is significant at P=<0.01 level. The result of the present work concord with cypriniformes fishes as biocontrol agent (**Chatterjee and Chandra, 1997**). in which 76.3 larvae/day were consumed with aquatic vegetation where as 87.1 larvae /day without vegetation. *Xenentodon cancila* fish was used as bio-control agent against fourth instars larvae of *Anopheles sabpictus*, *Culex quinquefasciatus* and *Armegeres subalbatus* and reported that this fish consumed 28 larvae of *Culex quinquefasciatus* /day (**Chandra and Brahman, 2009; Chandra and Chatterjee, 1996).** The feeding potential of *Gambusia affinis* against *Culex quinquefasciatus* was reported 51/larvae/day (**Chatterjee and Chandra, 1997**).

Table 1. Larvivorous potential of *P. conchonius*

Experimental week	Feeding capacity of fish in absence of *Hydrilla* (average larvae/fish /day)	Feeding capacity of fish in presence of *Hydrilla* (average larvae/fish /day)
I	29.67	28.10
II	99.10	92.67
III	190.00	185.00
IV	295.60	292.66
V	373.60	367.68
VI	476.00	471.23
VII	586.60	581.00

Three air-breathing fish were used as predators on *Culex quinquefasciatus* larvae and found that 1000 to 1200 larvae/day were consumed by these fish (**Bhattacharjee *et al*., 2009**). It is concluded that *P. conchonius* fish is better biocontrol agent for *Culex* mosquito larvae than *Xenentodon cancila* and *Gambusia affinis*. Thus, this fish would be used for vector control program strategy in endemic rural area.

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