BIOLOGICAL CONTROL OF VECTOR OF COMMUNICABLE DISEASE IN PAWAI, PANNA MP USING LARVIVOROUS FISH, *GAMBUSIA*

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ABSTRACT: 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 transmitted filariasis, Japanese encephalitis, Chikungunia, Ganjam and other Encephalitis diseases in the World. The Gambusia fish was used as a biocontrol agent against larvae of Culex. The predation potential of Gambusia conchonius against Culex larvae was analyzed in the presence & absence of Hydrilla plant. The present experiment was designed and carried out in the laboratory of Govt. College Pawai Panna (MP) in 2015. 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+ 20C & pH 6.5. Gambusia fish were collected from Ken River and reared in the aquaria with tap water at same temperature and pH. 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. The maximum feeding of the fish was 587 larvae / fish in the absence of weed, minimum was 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.

KEYWORDS: Filariasis, Japanese encephalitis, Culex, Rural health.

INTRODUCTION

Environmental degradation, socio-economic decline and extreme weather patterns are contributing to changing pattern of morbidity and mortality & posing serious challenges to public health (Sabesan & 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. (Ghosh *et al*., 2005).

The life cycle of mosquito is completed in four stages: egg, larva, pupa & adult . Male mosquito feed only flower nectar but female mosquito sucks the animal blood for the development of eggs. Mosquitoes cause a huge medical and financial burden by spreading chikungunya, dengue, yellow fever, encephalitis, meningitis, filariasis, leprosy, malaria & 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). 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 & land resources (Hardin *et al*., 2009). Because of the ecosystem damaged by insecticides, there has been renewed interest in biological control techniques to complement mosquito control programs (Matias & Adrias, 2010). However, chemical control is expensive and many trained people are necessary for constant surveillance of mosquito breeding places. Physical control is also expensive & 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 & 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* and Guppy etc. are used asbiocontrol 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). The larvivorous potential of cypriniformes fish was calculated both the presence & absence of aquatic weeds (Chatterjee *et al*., 2001). In this contest, the present study has been designed to assess the efficacy of indigenous fish *Gambusia affinis* as bio-control agent against *Culex* larvae.

MATERIALS & METHODS

Collection and maintenance of fish and prey organisms

The different instars of *Culex* larvae were collected from stagnant water of natural pits nearby university campus and was reared in plastic trough with unchlorinated tap water in the laboratory at room temperature 28 ± 2^{0}C & pH 6.5. Fourth instars larvae were identified and used for the experiments. In the same season, *Gambusia affinis* fish were collected from Ken river Panna and reared in glass aquaria with tap water at room temperature 28 ± 2^{0}C & pH 6.5 in the laboratory. In all experiments the individual's 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.) was 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 (size 1.5'x 1.5' x 0.5'). 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.

RESULT & DISCUSSION

The result indicated that *Gambusia affinis* 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 & 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 *Gambusia affinis* eats leaves of *Hydrilla* plant in natural environment, yet it also consumes mosquito larvae.

Table -1 Larvivorous potential of *Gambusia affinis*

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

The results obtained from our experiments clearly indicated that differences of the consumption rate of fish, *Gambusia affinis* of immature mosquitoes was minor both the presence & 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 Chatterjee (2001) with cypriniformes fishes as bio-control agent and he reported that 76.3 larvae/day were consumed with aquatic vegetation whereas 87.1 larvae /day without vegetation. Chandra & Chatterjee (1996) used *Xenentodon cancila* fish as bio-control agent against fourth instars larvae of *Anopheles sabpictus*, *Culex quinquefasciatus* & *Armegeres subalbatus* and reported that this fish consumed 28 larvae of *Culex quinquefasciatus* /day. Chatterjee and Chandra (1997) studied the feeding potential of *Gambusia affinis* against *Culex quinquefasciatus* and found that it consumed 51 larvae/day. 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).

CONCLUSION:

It is concluded that *Gambusia affinis* fish is better biocontrol agent for *Culex* mosquito larvae than *Xenentodon cancila* and *Pintus ticto*. Thus, this fish would be used for vector control program strategy in endemic rural area.

REFERENCES

1. Bhattacharjee, I.; G. Aditya and G. Chandra, 2009. Laboratory and field assessment of the potential of larvivorous, air – breathing fishes as predators of Culicine mosquitoes . *Biological control* 49:126-133.
2. Chandra, G. ; I. Bhattacharjee, S. N. Chatterjee and A. Gosh, 2008. Mosquito control by larvivorous fish . *Indian J Med Res*. 127:13-27.
3. Chandra, G. and S.N. Chatterjee, 1996. Laboratory Trials on the feeding pattern of *Anopheles subpictus*, *Culex quinquefaciatus* and *Armegeres subalbatus* larvae by *Xenetodon cancila* fry. *Environment & Ecology* 14(1): 173-174.
4. Chatterjee, S. N., A. Ghosh and G. Chandra, 2001. Larvivorous potential of some Cypriniformes fishes. *Trans. Zool. Soc. Eastern India* 5(2): 83-84.
5. Chatterjee, S. N., and G. Chandra, 1997. Laboratory trials on the feeding pattern of *Anopheles subpictus*, *Culex quinquefaciatus* and *Armigeres subalbatus* larvae by *Gambusia affinis. Sci. & Cult.* 63(1-2):51-52.
6. Fang, J., 2010. A world without mosquitoes. *Nature* 466: 432-434.
7. Gosh, A., S. Mandal, I. Bhattacharjee and G. Chandra, 2005. Biological control of vector mosquitoes by some common exotic fish predators. *Turk J. Biol*. 29: 167-171.
8. Hardin, Jesse A., and Fatimah L.C. Jackson, 2009. Applications of natural products in the control of mosquito –transmitted diseases. *American Journal of Biotechnology* 8(25): 7373-7378.
9. Ibarra J. A. Martinez, Y. Grant Guillen; J. I. Arredondo, Jimenez and M. H., Rodriguez, Lopez, 2002. Indigenous fish species for the control of *Aedes aegypti* in water storage tank in Southern Mexico. *Biocontrol* (47): 481-486.
10. Matias, Jonathan R. and Araceli Q. Adrias, 2010. The use of annual killifish in the biocontrol of the aquatic stages of mosquitoes in temporary bodies of fresh water: a potential new tool in vector control. *Parasites and Vectors* 3(46):1-9.
11. Sabesan, S. and KHK. Raju, 2005. GIS for rural health and sustainable development in India with special references to vector borne diseases. *Current Science* 88(11):1749-1752.