

# BIOLOGICAL CONTROL OF VECTOR OF COMMUNICABLE DISEASE IN SIDHI (MP) USING LARVIVOROUS FISH, *GAMBUSIA AFFINIS*

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**Abstract-** In India, malaria had been considered predominantly a problem of rural areas and the activities of the National Anti-Malaria Programme (NAMP) were largely rural oriented. While in cities with over 40,000 populations, malaria control activities were expected to be implemented by the local bodies. 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 affinis* fish was used as a bio control agent against larvae of *Culex*. The predation potential of *Gambusia affinis* against *Culex* larvae was analyzed in the presence & absence of *Hydrilla* plant. The present experiment was designed and carried out in the laboratory of Biological Sciences, Govt. S.G.S. P.G. College, Sidhi (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 chlorinated tap water in the laboratory and was maintained at room temperature  $28 \pm 2^{\circ}\text{C}$  & pH 6.5. *Gambusia affinis* fish were collected from Sone 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.

**KEYWORD:-** Filariasis, Japanese encephalitis, *Culex*, Rural health

## I. INTRODUCTION-

In India, malaria had been considered predominantly a problem of rural areas and the activities of the National Anti-Malaria Programme (NAMP) were largely rural oriented. While in cities with over 40,000 populations, malaria control activities were expected to be implemented by the local bodies (Hati, A.K, 1997). At present there is an alarming situation due to the rising trend in mosquito-borne diseases in urban areas. The escalation in the incidence of these diseases is closely related to unplanned urbanization, increase in water storage practices resulting in the creation of favourable habitats for vector proliferation, development of commerce and industrialization, and influx of labour from rural to urban areas Bang, (Y.H. Kudsen, 1985, A.B. and Sloof, R., 1992). In urban agglomeration, both man-made and natural habitats provide ideal conditions conducive for the proliferation of mosquito vectors. As a consequence, malaria and dengue have emerged as major health problems in several urban areas. The use of insecticides/ larvicides over the years is responsible for the development of resistance against these chemicals in mosquitoes and has rendered them ineffective in many places. Thus, there is an urgent need to review and strengthen the on-going urban malaria control programme with appropriate

technologies so as to reduce the reliance on chemical insecticides and preserve them for emergency situations.

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 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). 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 biological control agent against *Culex* larvae.

## II. MATERIAL AND METHODS–

### Collection and maintenance of fish and prey organisms

Water of natural pits nearby college campus and was reared in plastic trough with unchlorinated tap water in the laboratory at room temperature  $28 \pm 2^{\circ}\text{C}$  & pH 6.5. Fourth instars larvae were identified and used for the experiments. In the same season, *Gambusia affinis* fish were collected from Sone river near Sidhi District and reared in glass aquaria with tap water at room temperature  $28 \pm 2^{\circ}\text{C}$  & 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 The usefulness of larvivorous fishes especially the *Gambusia* and *Poecilia* (guppy) in mosquito control operations in different situations has been proved globally 4-10. In India, uses of larvivorous fishes constitute one of the important components of the Urban Malaria Scheme (UMS) and this has been incorporated in the Malaria Action Plan of the NAMPII. It has also been incorporated as an important component of the selective vector control strategy in the Enhanced Malaria Control Project (EMCP) launched in 1998 with World Bank support in the tribal areas of Madhya Pradesh and other parts of the country.

The different instars of *Culex* larvae were collected from stagnant analyzed using student 't' test. The value of 't' is verified at  $P < 0.01$  level.

### III. RESULT AND DISSCUSSION-

The result indicated that *Gambusia affinis* fish has high larvorous 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. 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 biological 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).

**Table -1 Larvorous potential of *Gambusia affinis***

Experimental week	Feeding capacity of fish in absence of <i>Hydrilla</i> (average larvae/fish /day)	Feeding capacity of fish in presence of <i>Hydrilla</i> (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

### IV. CONCLUSION: -

Larvorous fishes are an excellent option in controlling the breeding of malaria and dengue vectors in a variety of mosquito breeding habitats. But, this can be achieved only after following a systematic approach towards developing an operational larvorous fish network and infrastructure in the form of adequate fish resources, and a fully equipped and trained staff under the Rural and Urban Malaria Scheme. Experience of the development of larvorous fish network for mosquito control in Sidhi district demonstrated the feasibility of using larvorous fishes and proved that this can play an important role in mosquito control in rural areas provided a systematic and

planned approach is applied. This strategy would be helpful in controlling the reemergence of certain vector-borne diseases, particularly in urban areas and will reduce the dependence on insecticides. It is concluded that *Gambusia affinis* fish is better biological control 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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