

BIOLOGICAL CONTROL AGENTS OF CYCLOPOID COPEPOD, VECTOR OF DRACUNCULIASIS: LABORATORY EXPERIENCE.

¹Adeyeba O.A., ²Sridhar, M.K.C., ³Fagbemi B.O., ⁴Kale O.O.

¹Department of Medical Microbiology and Parasitology, Ladoké Akintola University of Technology, P.M.B. 4400, Osogbo Nigeria.

²Department of Preventive and Social Medicine, University of Ibadan Nigeria.

³Department of Vet. Microbiology and Parasitology, University of Ibadan, Ibadan Nigeria.

In order to determine the predating capability of some indigenous fishes to Nigeria on cyclopoid copepods, the vector of *Dracunculus medinensis*, species of three genera of fishes were fed experimentally with *Cyclops* in the presence or absence of alternate food substances as described in the text.

The study revealed that indigenous fishes like *Hemicromis fasciatus*; *barbus occidentalis*, *Tilapia nilotica* and *T galilea* were identified as very effective indigenous biological control agent of *Cyclops*-the vector of dracunculiasis. The benefits of rearing these fishes in village ponds are highlighted. It is believed that there would be no longer cases of resurgence of dracunculiasis in areas where transmission has been broken when the biological agents are used in concert with filtration method.

INTRODUCTION

Dracunculiasis is primarily a rural problem where there is no supply of portable water, and this account for the relative obscurity of the disease. Until recently the disease had a very high prevalence and scope with the devastating effect on the productivity of the affected.

The efforts of both government agencies and non-governmental organization like Global 2000, UNICEF and Gowon Foundation combining many approaches has yielded some positive results. In fact many countries of the world have eradicated the disease. The combined approach involving health education and distribution of water filters in the endemic villages have reduced the cases in many villages. Since Nigeria has seen a dramatic decrease in reported 98% reduction cases between 1992 and 1997(1), there has been resurgence of cases in some areas in Nigeria where disease was eradicated.

The use of chemicals advocated from some quarters (2) has not brought much success either. Therefore there is need for a search for an alternative model for control, which should be indigenous and should not require much in terms of foreign exchange. Where other approaches have failed it is thought germane that biological method of control could serve as alternative model for control. Since the use of certain small fishes *Gambusia* Species, *Barbus* Species and *Rasbora doniconius* a biological control agent worked in India (3,4), it could also work in Nigeria as well. The need to search for new biological control agents has become more urgent in view of the fact that most areas where there is frequent resurgence of dracunculiasis after the international target dates for

eradication has expire are yet to enjoy potable water. The communities still rely on untreated streams and ponds, which have a large population of the vector cyclopoid copepods for there water needs. Therefore it has become imperative to search for new-bio-control agents to act in synergy with the filtration programme in eradicating the disease in the country. This study was stimulated by an observation made at an endemic village in Oyo State, Nigeria, which indicate a low *Cyclops* count in ponds where certain fishes were found in large number.

This study therefore reports the effect of some indigenous fishes as biological control agents of vector of dracunculiasis under laboratory conditions.

MATERIALS AND METHODS

This study was conducted with pond water collected from an endemic village near Ibadan, capital of Oyo State, Nigeria.

Samples of pond water were periodically collected and filtered through a plankton net made up of monofilamentous nylon gauze with mesh size 75um attached to a plastic tube. Adult and nauplii stages of different species of *Cyclops* retained on the filter and collected in the tube were transferred to a glass container, their number were counted under the low power objective of a compound microscope and use in the laboratory experiments. The dominant species in this part of Nigeria were shown by Sridhar and Kale (5) to be: *Thermocyclops neglectus decipiens*, *T. crassus*, *Afrocyclops gibroni*, *Mesocyclops major*, *Tropocyclops prasinus*, *Microcyclops varicans*, *thermocyclops species*, *cryptocyclops linjanticus* and *tropocyclops onabamiroi*.

In order to determine the predating capability of indigenous species in western Nigeria, the following species of fishes obtained from the Oyo State Fishery Department at Agodi Station in Ibadan were used for

* Corresponding Author

the experiment *Hemicromis fasciatus*, *barbus occidentalis*, *Tilapia nilotica* and *T. galilea*.

The physical characteristics of the pond in these experiment was determined as described by Adeyeba (6) before the commencement of the experiment in order to ascertain the prevailing ecological character.

Samples of pond water were collected and filtered as described earlier on, into each 15 liters plastic aquarium containing 10 liters of Cyclops free pond water and 16,000 active Cyclops were introduced 10 active young five of the same species *H fasciatus* *N. occidentalis* and *Tilapia* species. The experiment was done in replicate with a control tank, which contained only pond water and Cyclops but no fish. The experiment was maintained at room temperature (26-28°C). The Cyclops counts were record over a period of hours and days. The Cyclops density per unit time was determined in the system and expressed in percentage.

In another experiment, alternate food was provided for the fish in order to assess the predating effectiveness of the fish on the Cyclops in the presence of alternate food. Into each 15 liter capacity aquarium containing 10 liters of Cyclops free pond water, 16,000 active Cyclops and 10 active fish of the same specie were introduced 4 gramme of fish meal as an alternate food supply to Cyclops meal. The experiment was carried out in replicate with a control aquarium that contained only pond water, Cyclops and fish meal but no fish. The experiment was similarly maintained at room temperature (26-28°C) and observed over a period of hours and days. The Cyclops density per unit was

determined and expressed in percentage.

RESULTS

Effect of predating fishes on Cyclops:- The result of the experiment involving *H. fasciatus* is shown in Figure 1. Data indicate that these relatively big fishes of about 4cm long reduced the Cyclops population by 50% in 60 hours and by 75%, 90% in 72 hours and 84 hours respectively. The Cyclops counts in the control bank did not drop throughout the duration of the experiment.

Figure 2 shows the result of the experiment involving the *Tilapia* species. Data indicate that Cyclops count dropped by 45% and 90% in 4 days and 9 days respectively when the fish were kept on pure Cyclops diet whereas the fish caused a drop in Cyclops population by 33% and 84% in 4 days and 9 days respectively when there was an alternate food supply, there was no drop in Cyclops count in the control bank. This result shows that the presence of alternate food supply had very little influence on the feeding habit of fish on Cyclops.

The result of the experiment involving *barbus occidentalis* is shown in figure 3. The result shows *B. occidentalis* reduced the population of Cyclops by 48% and 90% in 3 days and 6 days respectively when there was no alternate food supply in the medium whereas there was a drop of 38 percent and 52 percent in Cyclops count when there was an alternate food supply. There was no drop in Cyclops count in the control bank. *Barbus* lived longer than 3 weeks the experiment lasted.

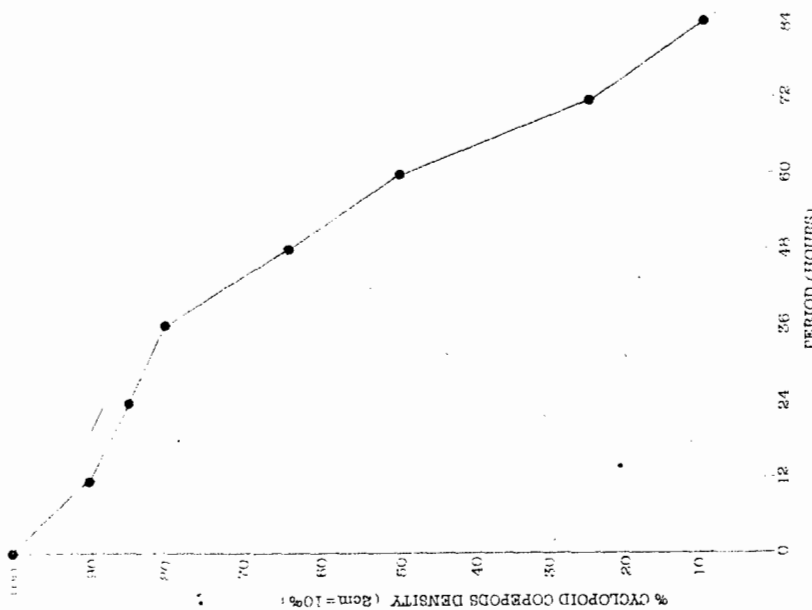


FIG. 1: EFFECT OF PREDATING FISH (*Hemicromis fasciatus*) ON CYCLOPOID DENSITY IN POND WATER UNDER LABORATORY CONDITION. (2cm - 12hrs.)

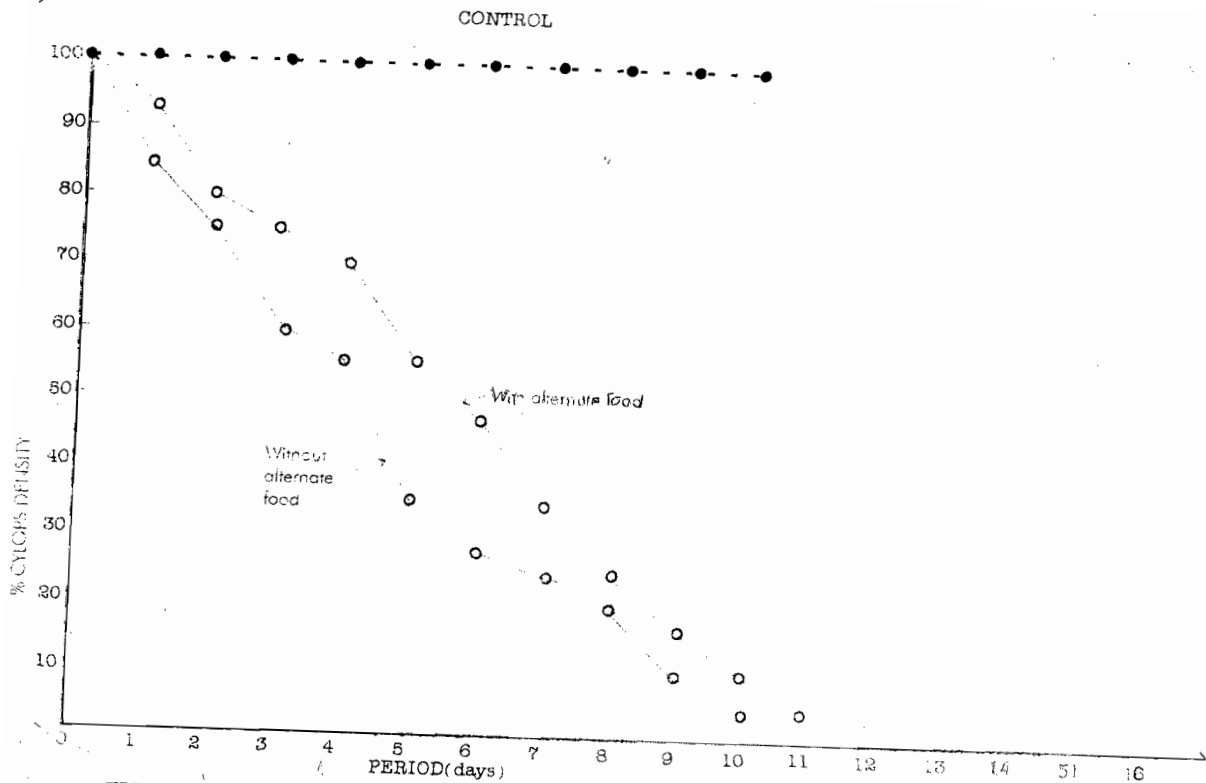


FIG. 2 : EFFECT OF PREDATING FISH (*Tilapia nilotica* x *T. galilea*) ON CYCLOPS DENSITY IN POND WATER UNDER LABORATORY CONDITION.

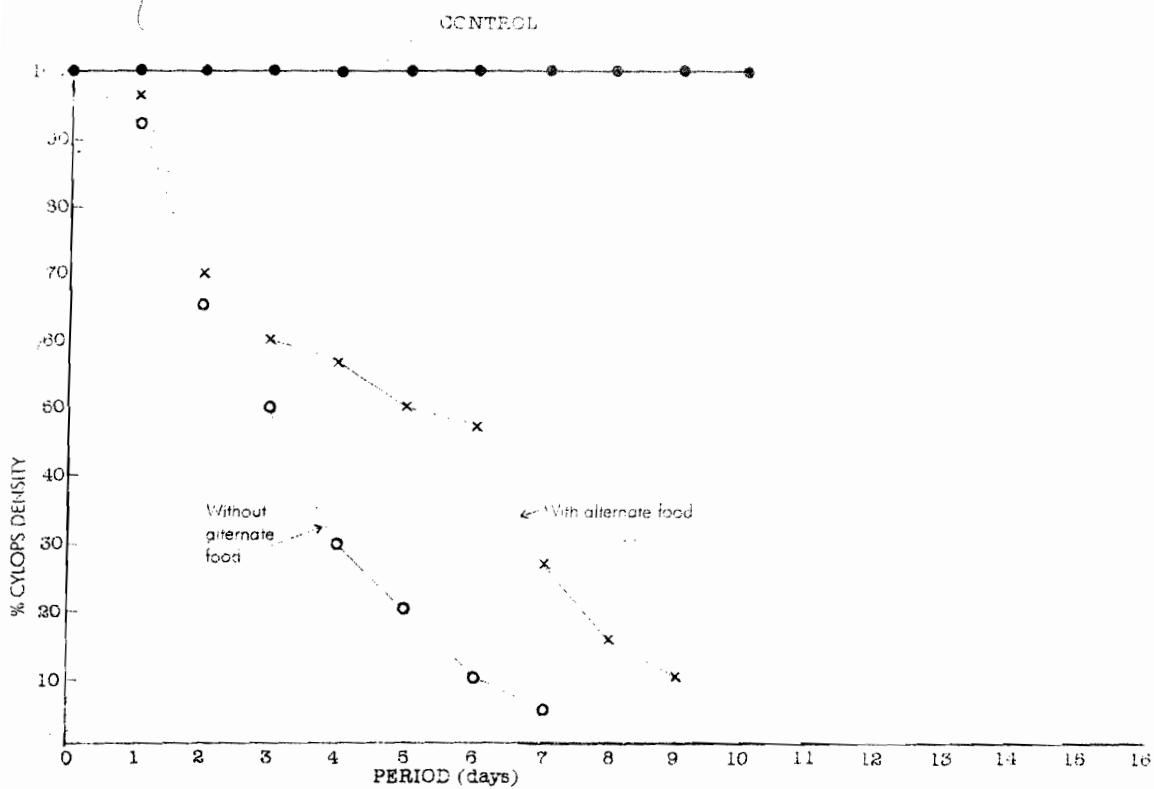


FIG. 3 : EFFECT OF PREDATING FISH (*Barbus occidentalis*) ON CYCLOPS DENSITY IN POND WATER UNDER LABORATORY CONDITION.

DISCUSSIONS

The observations reported here seem to be applicable in the control of dracunculiasis in the tropical areas. In most of these areas the ponds are seasonal, with excess water in raining season, which gradually recede and finally dry up.

This present study has shown that certain fishes are efficient biological control agents of the vector of dracunculiasis. Earlier on successful field experiment using small fishes (*Gambusia*, *Barbus* species and *Rasbora doniconius*) reported in India by some workers (3,4) agree with the present findings. This is significant in the sense that for the first time there has been a report of indigenous species of fishes that could serve as biological control agents of cyclopoid copepods in Nigeria.

This method of using biological control agents if employed, may save money for the country. Of all the species of fishes used in this experiment *Barbus occidentalis*, was the most enduring fish, followed by *Tilapia nilotica* and *T. galilea* as they were able to withstand the adverse laboratory conditions which let *Hemicromis fasciatus* dead within 4 days. Despite the inadequate facility for aeration in the course of the experiment *Barbus* and *Tilapia* species survived as long as the experiment lasted, and even beyond. Besides, these species were observed to be preponderant in ponds in this part of the country (6). This is an indication that these small fishes would be invaluable tools of biological control in the field, their natural ecological environment. *Hemicromis fasciatus*, though a very voracious predator of *Cyclops* could not be regarded as a good experimental model animal as it could not withstand the laboratory stress. Besides, it was discovered that the fish did not only prey on cyclopoid copepods but predate also on the other small fishes like *Tilapia* within the same enclosure, a situation that does not augur well for the other mates in the ecosystem that expected to be more efficient bio-control agents.

Tilapia fish could be safely regarded as the most reliable of all the indigenous fishes in villages Southwestern Nigeria. The fish could also endure to a large extent, the adverse conditions occasioned by prolonged dry season. It has been demonstrated that the presence of alternate food supply in the ecosystem had very little negative effect on the predating ability of *Barbus* and *Tilapia* fishes on cyclopoid copepods. This further supports the adoption of fish as biological control agents of *Cyclops*.

Although field trials have not yet been undertaken the prospect of success is very bright. It was discovered from an unpublished observation that those ponds in fishes were more preponderant had lower density of cyclopoid copepods than others in some villages Southwestern part of the country. In addition, it was observed that the level of acceptability of presence of fishes in drinking water supply is very high among all the house heads interviewed [Adeyeba- unpublished observation]. In fact, the fishes

are given maximum protection possible by the villagers through legislation against fishing in ponds that are designated for drinking. It is a general belief of the Yoruba nation (occupiers of South-western Nigeria) that the presence of fishes in pond water meant for drinking is an indicator or index of fitness of water for drinking. The water is believed to be free of all undesirable elements such as poison, etc.

In addition, fishing activities in the pond is strictly forbidden because of the belief that water might go dry as a result.

Although certain fishes had been recommended for biological control in India (3,4), no other report has been published elsewhere. Hence it is believed that this report has made a landmark in the search for new biological control agents of vector of dracunculiasis in Nigeria. Particularly at this time of economic reconstruction in this country, indigenous bio-control agents could be adopted, as an alternative to the expensive imported chemicals used for water treatment with little success in the country.

In view of the identification of some indigenous fishes like *Hemicromis occidentalis*, *barbus fasciatus*, *Tilapia nilotica* and *T. galilea* as biological control agents of dracunculiasis it would be commendable to encourage the rearing of such fishes in the village pond. This is expected to compliment the use of filter synergistically in the control and eventually eradication of dracunculiasis in the country where sporadic resurgence of cases occur in areas where the disease had been contained. Besides, there is an additional benefit of protein supplement to the community with good management.

REFERENCES

1. World Health Organization: Eradicating Guinea worm Disease: The last painful steps. WHO/CTD/DRA/98.11 1998 p.8
2. Mc McCullough, P.S. Cyclopoid copepods: Their role in the transmission and control of dracunculiasis: in "opportunities for control of dracunculiasis. Report of workshop, Washington DC, 1982, p. 46.
3. Moorthy, V.M. and Sweet, W.C.: A biological method for control of dracontiasis. *India Med. Gazz.* 1936, 11: 565-568.
4. Gideon, P.W.: Experiment in the control of guinea worm infections in step wells by means of carnivorous fish, *Rasbora doniconius* and chlorogen (abstract). Proceeding of 28th Indian Science Congress, 19942 p. 225.
5. Sridhar, M.K.C. and kale, O.O.: Some observations on the control of guinea worm in Oyo State. Proceeding of the first National Conference on dracunculiasis in Nigeria. 1985, p. 136-140.
6. Adeyeba, O.A.: Epidemiological studies on dracunculiasis in Oyo State, Nigeria. PhD Thesis, University of Ibadan, Nigeria. 1995.