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CYCLOPOID COPEPODS IN DOMESTIC WATER SOURCES IN THREE VILLAGES IN AKINYELE LOCAL GOVERNMENT AREA OF OYO STATE, NIGERIA

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Abstract

The distribution and infective rates of cyclopoid copepods (the vectors of guineaworm, *Dracunculus medinensis*) in ponds was studied in 3 infected villages in Akinyele Local Government Area of Oyo state, Nigeria during the period of September 1994 to January 1996 (the peak period of guineaworm eradication activities in the country). The density of cyclopoid copepods was highest in the dry season, reaching 149.8 copepods/litre in February 1995. The abate (Temephos) application and amount of rainfall affected the cyclops in ponds. *Thermocyclops, Mesocyclops* and *Halicyclops* species of cyclops were recovered from the ponds while none was found to be infected with *D.medinensis* larvae.

Keywords: Cyclopoid Copepods, *Dracunculus medinensis*, Ponds, Abate.

Introduction

The parasite, *Dracunculus medinensis* (guineaworm) causes the disease dracunculiasis, dracontiasis or guineaworm disease. It is a disabling, painful, debilitating, water-borne helminthic disease with multiple adverse consequences on health, agriculture, school attendance, and the overall quality of life of the affected communities (Ukoli, 1984) The disease predominates among the rural communities of many developing countries whose population depend for its domestic water supply on surface water, especially stagnant ponds and water holes, shallow unprotected wells and slow flowing brooks and streams (Kale, 1977).

The vectors are various species of cyclops but only those which are predatory (Muller, 1971) and live in stagnant water with a PH of 6.0 to 6.8 (Onabamiro 1952a, 1952b) are likely to play a significant role in transmission. The guinea worm disease was targeted for elimination in several countries with the hope of global eradication before the end of the 1990s (Hopkins, 1993). Key intervention strategies to eradicate guineaworm are safe water supply, vector control using abate, health education and case management. Despite eradication efforts however, the disease remains a threat to health and hinders economic development of local communities and nations where it persists.

This study aims at identifying species of cylops found in study areas, their infection rates and densities. The study also assesses the

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effectiveness of vector control using abate in the study areas.

Materials and Methods

Study Area

The 1988 guineaworm active case search established the presence of the guineaworm disease in Oyo state in endemic proportions with the Akinyele Local Government Area (L.G.A) being one of the affected. Studies (Falode, 1992;Iyun, 1993 and Falode, 1998) have continued to confirm the presence of the disease in the L.G.A. This study was carried out in three villages, Alagba, Oyeteju and Olomitutu in this L.G.A.

Alagba village with a long experience of guineaworm disease has a population of 297 people and is located approximately on latitude 7°37' N, longitude 3°54'E. Oyeteju village with an estimated population of 45 is located on latitude 7°37'N, longitude 3°55'E. Oyeteju villagers claimed that no case of guineaworm infection had been reported in Oyeteju for 15 years until November 1994. Olomi-tutu village is located on the boundary of the L.G.A. approximately on latitude 7°43'N, on longitude 3°45'E and has a population of 215 people. No cases of guineaworm infection were reported in the village since the beginning of the guineaworm infection case searches in the L.G.A until 1993. This village is catered for by the Akinyele L.G.A. like most villages around the L.G.A. boundary.

Ponds in the study areas were sampled for the distribution and infective rates of cyclopoid copepods, which are the vectors of the guineaworm disease. Oyeteju and Olomitutu villages rely solely on ponds while Alagba has two hand-dug wells and a borehole in addition to the village pond. The ponds in the villages are shallow at the edges but deep in the middle thus making villagers wade into the pond to collect water. This allows for discharge of guineaworm larvae into the ponds if infected legs are dipped into the pond. However, the pond in Olomitutu is not as deep in the middle as those in the other two villages. It also has a larger surface area with no fringing trees.

During the course of this study, abate (a copepodcide) was applied to village ponds by NIGEP officials, L.G.A Health officials and the researcher. Using the formular $\chi r^2 h$, the volume of water in the circular ponds in Alagba and Oyeteju villages was calculated to know the amount of Abate to be applied. About 0.1ml of Abate will treat 50 litres of water (NIGEP office, unpublished observation).

Collection and Identification of Cyclopoid Copepods

Water samples (5-litres) were collected with the aid of a gradated bucket from water sources in the study area. The copepods were recovered to determine their relative density and monthly infection rates for the period of study.

To make the samples as representative as possible of the water normally collected by the villagers, an inhabitant of each area was directed to make the collection in the manner and from the part of the pond that he/she would normally collect water for domestic use. At the pond side, the monofilament filter (pore size, 100x100 micrometers) was used to sieve the 5-litres of water collected and the cyclops on the filter were washed into a 1-litre conical flask with filtered water. Filtered water was then added to make up to 1-litre. Then 10 ml formalin was added for 5 minutes to kill the cyclops (Edungbola, 1984). After 5-minutes, the treated water was sieved again with monofilament filter, then dead cyclops were washed into specimen bottles containing filtered formalin water. The samples were then transferred to the laboratory and examined on the same day for the presence, total number and infection rates of cyclops. For identification of cyclops, specimens were observed and dissected in glycerine using a dissecting microscope. Morphological identification was done by the illustrated key of Boxshall and Braide(1991).

Results

A total of 42 (5-litre) samples were analyzed. The total number of cyclops found in 5-litre samples from the main ponds in the three infected villages during the period of study (September 1994-January 1996) and the rainfall in centimeters during the time of sample collection are shown on the Table I.

The table shows a high population of cyclopoid copepods in the dry season (September 1994 – February 1995) in the three ponds until abate was applied in Alagba and Oyeteju and before Olomitutu pond dried up. The population of cyclopoid copepods was low from March 1995 – June 1995 in Alagba and from March 1995 – May 1995 in Oyeteju when there was more rains and abate was applied. The population of cyclopoid copepods increased again in the next dry season. There was no time cyclopoid copepods were not found in Olomitutu pond when it had water. Abate was applied once to Alagba pond in February 1995. No cyclops were found in the sample taken in the month abate was applied to Alagba pond because the sample was taken after the application. So also, no Cyclops were found two months after this application.

Abate was applied two times to Oyeteju pond. Cyclops were not found in sample taken after application in the month the first abate was applied to the pond and in the sample taken a month after it. This first application was in March at the onset of the rainy season. Cyclops population was not completely wiped out in the second abate application but it was reduced. This second abate application was in July, the middle of the rains when the pond was very full.

Abate was not applied to the fish pond in Olomitutu because the quantity of water in the fish pond was too small for abate application during the dry season period.

No infected cyclops were found in all the samples. *Thermocyclops*, *Mesocyclops* and *Halicyclops* spp of the cyclopoid copepods were recovered from the ponds.

Discussion

In many studies, ponds have been identified to be the ideal source of dracunculiasis transmission (Onabamiro 1952a,b ; Scott 1960; Lyons 1972 ; Belcher *et al* 1975 ; Kale 1977 ; Edungbola 1983 ; Edungbola and Watts , 1985, 1990).

From this study, it can be assumed that the inhabitants of the study area acquire their guineaworm infection at periods of low or no rainfall when ponds are reduced in volume and there is a greater concentration of cyclopoids. This is because the transmission potential of the vectors depend solely on their density and level of infectivity, especially in stagnant ponds (Udonsi, 1987). Onabamiro (1954) found that infected cyclopoiods tended to sink to the bottom of a pond, and were thus more likely to be picked up when the water level was low.

The density of cyclopoids in Oyeteju's pond was high at the first sampling (149.8 copepods/ litre in February 1995) before Abate application because the pond had had a steady build up of cyclopoid population since it does not dry up as the villagers claimed (Falode, 1998) and it had never been subjected to any form of treatment that could affect the population dynamics of the cyclopoids. The cyclopoid population increased steadily from September 1994 (15.6 copepods/litre) to November 1994 (22.4 copepods/litre) in Olomitutu pond just before the pond dried up from December 1994 to February 1995.

The cyclopoid population of Alagba pond was probably affected by control measures. The Alagba pond prior to abate application had been treated on a number of occassions with chloride of lime. This could be the reason why there is no marked difference in the population of cyclopoids in the rainy or dry season.

No infected cyclopoids were found in this study probably due to the low infection rate in the human population at this period (Falode, 1998), which may also be due to the control measures in place. The absence of infection in cyclopoid population during the time of study could also probably be due to the usually low percentage infection of cyclopoids in nature (Onabamiro, 1951). Other studies on guineaworm transmission by Onabamiro (1951), Kale (1977) and Nwosu *et al* (1982) had indicated that guineaworm disease has its peak transmission occurring during the dry season in areas where people depended on pond water for drinking purposes.

The cyclopoid copepods found in the study area were of 3 different genera. Those identified to the species level were *Thermocyclops decipiens* found in Alagba and Oyeteju ponds and *Halicyclops korodiensis* found in Olomi-tutu pond. *Mesocyclops* spp of cyclopoids were also found in the Oyeteju pond. It was observed from this study that the Abate application to ponds wiped out or reduced the cyclopoid population. The second application of Abate to Oyeteju pond was not as effective as its first application when cyclopoids were completely wiped out for some weeks. The rains affected this second application of Abate to Oyeteju pond since the pond was filled up soon after the application. The Abate effectively controlled the species of cyclops found in Alagba and Oyeteju ponds in its first application for 2-3 months at 1ml of Abate to 500 litres of water. The Abate however was applied late in the dry season instead of at its onset and it was not applied on several occasions and consistently as in the work of Lyons (1972) to ensure there are no cyclops for transmission in the dry season. The health officials lacked the expertise to monitor the cyclopoid population to know effectiveness of application and when to repeat application for total removal of cyclops from pond water. The available abate supplied to the L.G.A by NIGEP used for treatment had expired (The abate was manufactured in January 1992 and had an expiry date of 1st January 1994 and was used on the pond as from February 1995). The effect of its expiration was not studied.

The Olomitutu pond was not treated being a seasonal pond, very little water was left in it in the dry season before it dried up.

Conclusion

Since none of the cyclopoid copepods recovered from all the ponds in the study area was found to be infected with guineaworm larvae, it is concluded that there has been a significant reduction in the pollution of water sources by infected persons. This is attributed to a drastic reduction in the human reservoir of infection and reduced water contact by active cases. This is expected because of eradication activities at the time of this study. However, to completely and speedily eradicate the guineaworm disease, it is necessary that control measures are properly carried out to avoid lapses as seen in this study where for vector control, expired abate was used and was not properly applied.

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Table. I

Number of Cyclopoid Copepods Per 5 Litre of Water Sample
Collected Between September 1994 – January 1996

Mth/ Year	Sept. 94	Oct. 94	Nov. 94	Dec. 94	Jan. 95	Feb 95	Mar. 95	Apr. 95	May 95	June 95	July 95	Aug. 95	Sept. 95	Oct. 95	Nov. 95	Dec. 95	Jan. 96	Species of cyclopoid copepods recovered
Rainfall (cm)	25.02	26.97	1.58	0.0	0.0	0.1	14.3	17.37	20.86	14.62	21.13	15.79	21.03	14.0	3.63	0.74	0.16	
Water Sources	Total No of cyclopoid copepods (5 Litre sample)*																	
Alagba Pond	39	169	104	84	98	0+	0	0	30	42	220	170	143	83	112	53	91	*Themocyclops decipiens*
Oyeteju pond	ND	ND	ND	ND	ND	749	0	0	62	165	210-	25	69	181	74	190	213	*Themocyclops decipiens Mesocyclops spps*
Olomi tutu pond	78	89	112	Dry	Dry	Dry	19	Dry	Dry	56	110	160	84	120	153	80	86	*Halicyclops korodiensis*

*All Stages of Cyclopoid copepods
+ Month of Abate application
- Abate applied after taking sample
ND Not done

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