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Determination of the infection densities of mudfish *Eustrongylides* in *Clarias gariepinus* and *C. anguillaris* from Bida floodplain of Nigeria

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ABSTRACT The infection densities of *Eustrongylides africanus* larvae were analysed according to the season, sex and distribution. Its prevalence, intensity and abundance was 26.5 ± 15.4%, 2.1 ± 0.9 and 0.7 ± 0.5 worms per fish, respectively for the wet season and the dry season had 32.9 ± 5.4%, 2.5 ± 0.4 and 0.9 ± 0.2 worms per fish, respectively. These incidences increased greatly during the dry season, being higher in the females than the males for both seasons of the year. Its lifecycle is complex and indirect with fish as intermediate, reservoir (alternative) or final (definitive) hosts. However, this is the first report and record of the incidence and lifecycle of infections with larvae of *Eustrongylides africanus* in free catches freshwater mudfish *Clarias* from Bida floodplain of Nigeria. @*JASEM*

The occurrences of helminth parasites in fishes have been extensively studied in various water bodies in Nigeria. Some works included those done on the River Niger at Shagunu; River Niger at Kainji Reservoir, Benue and Ogun Rivers; on the Coast of Lagos; on the Cross River estuary; on the Niger Delta Area; on the Lake Chad; from Zaria (Aken'ova, 1999; Auta *et al*., 1999); on the Imo River; from the Anambra River Basin (Ezenwaji and Ilozumba, 1992); Ile-Ife; from the Jos Plateau (Anosike *et al*., 1992; Omoregie *et al*., 1995); on the Opi Lake; on the River Kaduna (Emere, 2000) and on the Kandole Shela Stream in Sokoto. Based on these criteria (morphological, anatomical and colour description) as well as on ecological data over ten species of *Clarias* have been identified in West Africa (Sydenham, 1980). No studies, however, have been made concerning the quantitative assessment of worm burdens in free catches *Clarias* from Bida floodplain of Nigeria. This study was undertaken to determine the infection densities of *Eustrongylides africanus* larvae in *Clarias* from Bida floodplain, according to season and sex, for the first time.

MATERIALS AND METHODS

The study covered an area located between longitude 5° 45' to 6° 15'E and latitude 8° 30' to 9° 10'N within the southern Guinea Savannah zone of Nigeria (Areola *et al*., 1992). 2700 *Clarias* of different sizes, sexes, lengths and weights randomly selected were 5-10% of the catches from four sampled locations (Doko, Dokoji, Fokpo and Dutsu) in the Bida floodplain. They were handled in humane manner, thoroughly examined and dissected to recover helminth larvae, for direct numerical count using a tally counter, and the sites of infection recorded at NIFFR Fish Health Diagnostic Laboratory. Its prevalence, intensity and abundance were determined for sex and seasons of the year as described by Margolis *et al.* (1982).

RESULTS AND DISCUSSIONS

The prevalence of *E. africanus* larvae infection in C*larias* from Bida floodplain is shown in Figure 1. The males' prevalence of 33.7% in January decreased to 26% in June, and increased to its peak of 33% in July followed by sharp fall to lowest value of 5.4% in October with a sharp rise to 27.7% in December. The females' prevalence of 42.4% in January decreased to 27.3% in April followed by a sharp rise to its peak of 50.2% in June, also with a sharp fall to its lowest value of 8.0% in October later by a sharp rise to 32.6% in December. The prevalence for the total sampled of 39.6% in January decreased to 26.7% in April followed by a sharp rise to its peak of 41.9% in June followed by a sharp fall to its lowest value of 7.1% in October later by a sharp rise to 31.1% in December. Both the females and total sampled had their peaks in June while the males had their peak in July. The trend of prevalence

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is about the same for the males, females and total sampled since all of them had falls in April and October. The intensity of *Eustrongylides africanus* larvae in C*larias* of Bida floodplain is shown on Fig 2. The males intensity of 1.5 larvae per infected fish increased to 2.3 in April followed as sharp fall to 1.0 in June with characteristic rises and falls between July and to 1.3 in December.

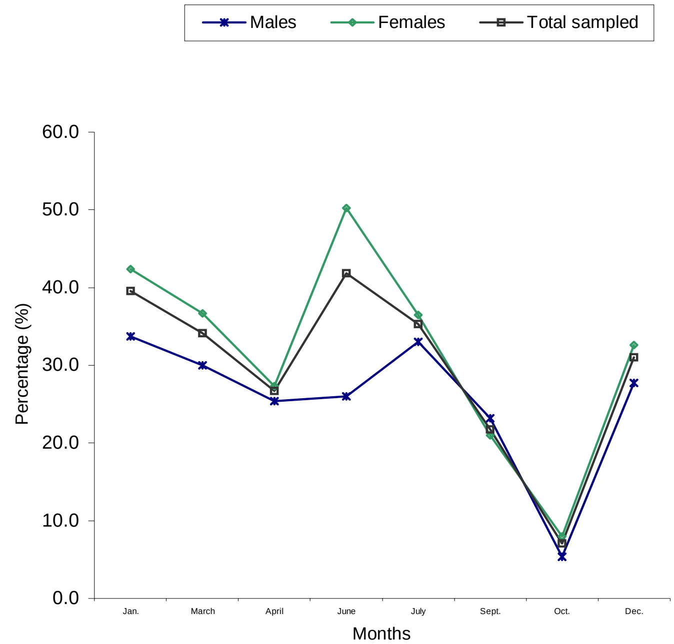


Figure 1: Prevalence of *Eustrongylides africanus* larvae in *Clarias* from Bida floodplain of Nigeria.

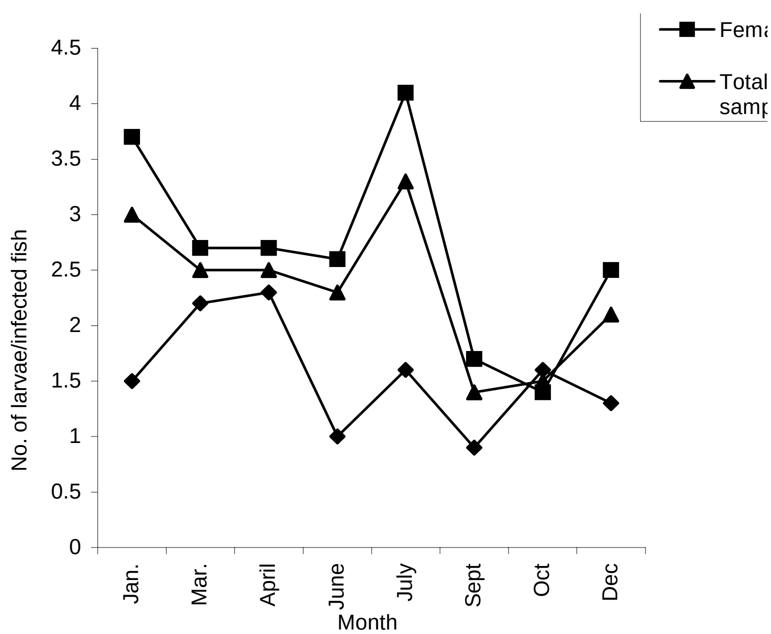


Figure. 2: Intensity of *Eustrongylides africanus* larvae in *Clarias* from Bida floodplain of Nigeria.

The females' intensity of 3.7 larvae per fish gradually decreased between March and June to 2.6 followed a sharp rise to its peak of 4.1 in July also followed by a sharp fall to 1.4 in October and later by a sharp rise to 2.5 in December. The intensity for the total sampled of 3.0 larvae per fish in January gradually decreased between May and April to 2.7 followed by a gradual rise to its peak of 3.5 in July with a sharp fall to its lowest value of 1.4 in September and followed by a rise to 2.1 in December. All of them had peaks and falls in July and September, respectively. The trends of intensity are about the same for the females and total sampled but contrarily for the males. The abundance of *Eustrongylides africanus* larvae infection in C*larias* from Bida floodplain is shown in Figure 3. The males' abundance of 0.5 per sampled fish in January increased to its highest peak of 0.7 in March, decreased to 0.3 in June and rose to 0.5 in July followed by a fall to its lowest value of 0.1 in October and later rose to 0.4 in December. The females' abundance of 1.6 larvae per sampled fish in January decreased sharply to 0.7 in April, rose sharply to 1.5 in July, fell sharply to 0.1 in October and later rose sharply to 0.8 in December. The abundance for the total sampled of 1.2 larvae per sampled fish in January fell sharply to 0.7 in April, rose sharply to 1.2 in July and fell sharply to 0.1 in October and later rose sharply to 0.7 in December. All of them had peaks in July and falls in October. The trends of abundance are about same for the females and total sampled but contrarily for the males.

It is evident that female fishes are more frequently infected with parasites than the males from the findings of this study. This observation agreed well with the findings of Mhaisen *et al*. (1988) that female fishes were generally more liable than males to infections with cestode, nematode, acanthocephalan, crustacean and copepod parasites. The mean prevalence, intensity and abundance of *Eustrongylides africanus* larvae in *Clarias* for the dry season is higher than the wet season of the year. Fishes are susceptible to heavy infestation with parasites mainly in the early rain when fishes are weakened by hibernation (a state of exhaustion). Larger fishes are heavily parasites than smaller ones. The intensity and prevalence of parasites infection increases with increasing length, size and age of the fish host. And that the food amount contained in the intermediate host of the parasite might cause the increase in infection level.

Eustrongylides species have complex, indirect life cycle (Yanong, 2002) with fish as intermediate, paratenic (alternative) or final (definitive) hosts. Where the fish is the intermediate host, the nematode eggs/larvae enter an invertebrate or a fish intermediate host prior to being eaten by or entering the final host. The final host (which contains the reproductive adult stage of the nematode may be a piscivorous (fish – eating) fish, mammal, amphibian, reptile or bird. Where the nematode has the ability to survive in "alternative" organisms, known as "paratenic" or reservoir hosts, which are not required for completion of the life cycle, but they can contain infective nematode life stages and be a source of infection. They can be fish, worms or other aquatic organisms that can eat the nematode eggs/larvae. Where the fish is the final host, the nematode eggs/larvae enter an aquatic invertebrate intermediate host such as a copepod, annelid worm or insect larva prior to being eaten by or entering the final host fish. The eggs of all *Eustrongylides* species are very tough and can easily survive for some time in fishponds. At about 77^{0}F, it can take anytime from 3 – 4 1/2 months from the time fish become infected. This means that, after sterilization of ponds, if fish – eating birds do infect the ponds with *Eustrongylides* eggs, the producer may not see a problem until harvesting the fish, 3 – 4 months later, as this is approximately the time required for the eggs to hatch and become the L3 stage which infects the fish. After this 3 – 4 months period, fish raised on ponds with a population of fish – eating birds have a greater chance of becoming infected as the number of nematode increase overtime. Adults are found in fish – eating birds, the eggs are shed by the aquatic birds into ponds, where they develop into a life stage that is consumed by an oligochaetes or annelid worms where it develops further into a third large stage "L3" which can infect fish when eaten. Once the annelid worms containing the L3 stages is eaten by a fish and digested, the nematodes migrate (within the fish) into the body cavity and, frequency, over the external surface of internal organs such as the liver. Some recent studies, however, suggest that *E. ignotus*, commonly found in mosquito fish, which is a close relative of *Eustrongylides africanus*, may be able to complete its life cycle without the need for a tubifex worm (Coyner *et al*., 2002). The first intermediate hosts are oligochaetes or annelid worms (Shah-Fischer and Say, 1989). Complementary (reservoir, alternate, paratenic) hosts are fish, where encysted larvae are found. The death of the host might stimulate the nematodes to emerge from their cysts, migrate through the body wall to the surface of their dead host and may survive for over 24hrs when a dampened condition exists. The specimens of fourth stage of *Eustrongylides* species were morphologically consistent with materials described by Lichtenfels and Pilitt (1986). Adult *Eustrongylides africanus* (Jaegerskiold, 1909), the only species so far reported from Africa was found

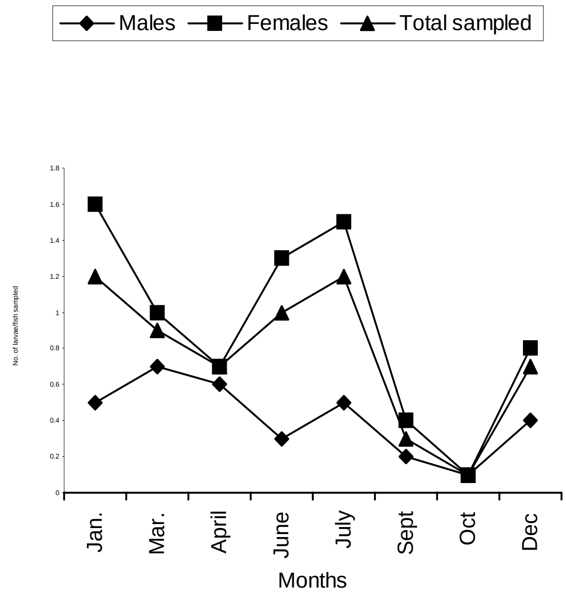
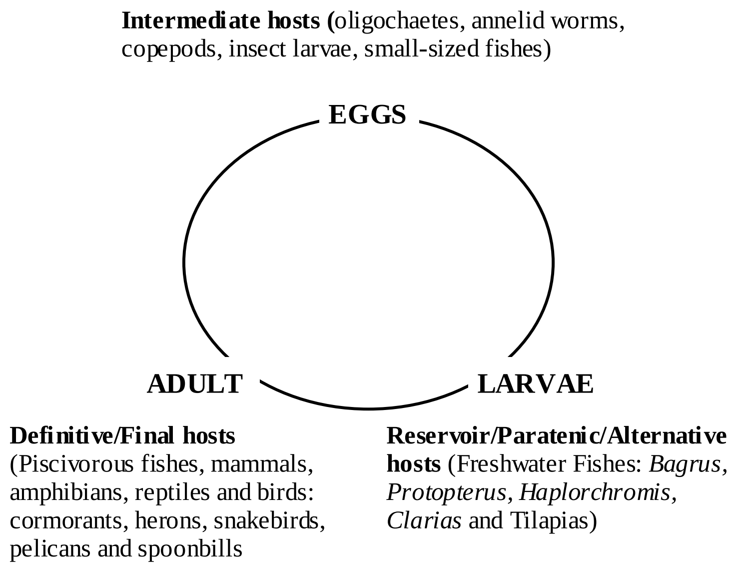


Figure3: Abundance of *Eustrongylides africanus* larvae in *Clarias* from Bida floodplain of Nigeria.

and described only from the proventriculus and stomach walls of the female cormorants *Phalacrocorax africanus* (Gmelin) and in a wide diversity of other aquatic fish-eating birds (definite hosts). *Eustrongylides* are known from a diversity of fishes, mammals, amphibians, reptiles and birds (Hoffmann, 1999) and their relatively great abundance suggests they are common in the habitats where fish forage. But exceptionally rare parasites of carnivorous mammals associated with riparian or lacustrine habitats. The prevalence recorded in this study may indicate that larvae are particularly abundant in fishes and amphibians available to Rivers Kaduna and Niger and other tributaries supplying water to Bida floodplain; consistent with the potential that humans could be exposed to infection.

All evidences indicated that the larva is *Eustrongylides africanus* and that a wide diversity of aquatic fish-eating birds, which are extremely numerous along the floodplain serve as final hosts with tilapias their predominant food. Adult *Bagrus* and *Clarias* are too large to be eaten by aquatic fish-eating birds or any other potential hosts of *Eustrongylides*. The infection to the final host is apparently transmitted mainly or exclusively through tilapias. *Bagrus* and *Clarias* apparently become infected with larval *Eustrongylides* by ingesting infected tilapias a dominant food item in their diets. The ability of *Eustrongylides* larvae to re-establish in a new intermediate host was experimentally demonstrated with *E. ignotus*. Adult *E. africanus* are apparently not particularly host specific since they have been reported from several species of aquatic birds widely distributed on the African continent, e.g. cormorants *Phalacrocorax africanus* (Gmelin), herons *Ardea goliath* (Cretzschmer), snake birds *Anhinga rufa* (Lacepede), pelicans *Pelecanus rufescens* (Gmelin) and spoon bill *Platalea leucordia* (Linnaeus) (Jaegerskiold, 1909). *Eustrongylides* species can be found within the body cavity, encapsulated on the liver and other organs, but outside the intestinal tract of fish. Eustrongylid nematodes can affect a number of different species, including yellow perch, pumpkin seed, mummichug, guppies, gar, danios and angelfish. Affected fish typically have bloated abdomens (dropsy), as the nematodes frequently migrate into body cavity and can be quite large. Eustrongylids are typically very long, coiled and red (due to the presence of haemoglobin) and an infected fish often has more than one nematode in its body cavity. If a feeder fish containing *Eustrongylides* species are fed to other fish, the nematode can migrate out of the feeder fish and into the muscles or other organs of the fish that just consumed them. After migrating into the muscle, this nematode can cause lesions that look superficially similar to a grub. Infection would tend to build up in already infected environment due to re-infected as this worm is viviparous and since contact with other infected fish could be less in the river with the large volume of water than in the floodplains or fish ponds with smaller water volume. The differences in size of nematode larvae might have



* First report and record of host and helminth larvae in Nigeria.

Figure 4: Life cycle for *Eustrongylides africanus* larvae in freshwater fishes (Compiled from Shah—Fisher and Say, 1989; Paperna, 1996; Khalil, 1999; *Ibiwoye *et al*.,2000 and Yanong, 2002).

resulted from the differences in the site of infection. Most piscivorous birds are unlikely to find *Clarias* easy to handle because of its pectoral spines so encystment of this larva on *Clarias* might prove to be a dead – end in most cases.

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