



A STUDY OF THE PREVALENCE OF ECTO AND ENDO PARASITES OF NILE RAT *Arvicanthis niloticus* DISMAREST (1822) IN RURAL AREAS OF BENUE STATE, NIGERIA FOR SUCCESSFUL DOMESTICATION OF THE SPECIES

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ABSTRACT

*This study examined the type and abundance of Ecto and Endo parasites of Nile rat (*Arvicanthis niloticus*) in rural areas of Benue State. A total of 400 rats (average of 100 for each location) were systematically captured from the wild in four locations namely, Makurdi, Gwer West, Guma and Kwande Local Government Areas (L.G.A) of Benue State for the entire studies on the captive rearing of Nile rats. However, only 10 % of the captured rats from each location were subjected to parasite isolation procedures in accordance with standard methods. The number of each parasite isolated and identified from each location were recorded and documented as findings of the study. Results revealed that four ecto parasites (Lice, Termite, Soft Tick and Hard Tick) were prevalent in all the locations considered. Similarly, three endo parasites (Hook Worm, Tape Worm and Myosin) were isolated from the rats in all locations. In general Lice (17%) and Tick (13%) were observed to be dominant ecto parasite for each location, while Tape worm (21%) and Myosin (7%) were observed to be the dominant endo parasites of feral Nile rats in the study area. For successful and healthy domestication of the Nile rats, the present study concludes that adequate attention must be given towards the control of both the ecto and endo parasites of captive reared Nile rats.*

Keywords: Nile rats, Ecto parasite, Endo parasite, prevalence, wild, Benue state.

INTRODUCTION

Arvicanthis niloticus other names are African grass rat, Nile rat, Younguh (Tiv) and Emo (Yoruba). These animals live in burrows, they require some defense of ground cover such as short bushes, trees, rocks or termite mounds, under which they may nest. A variety of African habitat, including day savannah, sub desert, coastal sand, open woodlands, grasslands and cultivated areas, provide such protection. Exact altitudinal data not requested, but *Arvicanthis niloticus* are not known to exist at high

altitudes, they are basically tropical and terrestrial animals (Refinetti, 2004). The Nile rat (*Arvicanthis niloticus*) is a common rodent species in Benue and, in particular the most common detected along the cultivated areas and River banks. The extinction of species resulting from human activities throughout the world, have caused great concerns in the scientific community and among the general public (Houston, 1995).. The quest for domestication of any wild species require a thorough check on the eminent outbreak of zoonotic diseases (Viral,

bacteria and parasitic) in such practice as well as the potential for impediment of growth and development of the species in captivity at the instance of undetected/uncontrolled parasitic infections. This entails that parasites, viruses and bacteria associated with such species must be identified and analysed with certainty to pave way for such domestication efforts, otherwise such practitioners may be attempting to cause more harm than good. Recently, a few studies performed on a laboratory scale have provided useful information for domestication of the Nile rat (Bolsinger *et al.*, 2014; Subramanian *et al.*, 2018) but not much is known about the parasites, viruses and bacteria associated with the wild Nile rats.

The study of the parasites of Nile rats (*Arvicanthis niloticus*) and its prevalence in rural areas is a necessary preliminary step toward achieving procedures for domestication. This if done will help to provide information and knowledge that will enable its effective rearing in captivity. In essence, this will go a long way to preserving the species and as well increase protein availability for man and his animals (Ityavyar *et al.*, 2011). The thrust of the current study therefore, is to determine the type and prevalence rate of both ecto and endo parasites of freshly captured (from the wild) Nile rats from selected locations in Benue State, Nigeria.

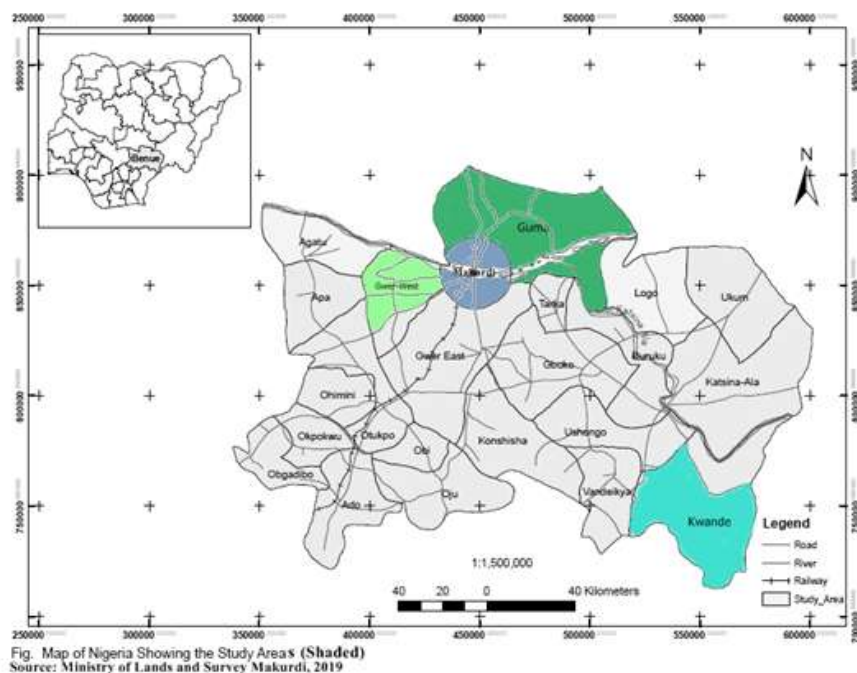
MATERIALS AND METHODS

Study Area

Benue State was created on 3rd February, 1976. It was carved out of the so called Middle Belt Region

of Nigeria. It has a land mass of 32,511 Km². It is the seventh largest and most populous state in Nigeria. The state lies between Longitude 6° - 10° East and Latitude 6° - 8°North. The state lies mostly within the lower Benue from the South-eastern borderlands to the Cross River plains. The River Benue is the major geographical feature from which the state derives its name. The River Kastina Ala is the most important tributary of the Benue River. The Benue and her tributaries have lowered the state high plains and deposited alluvial soil in the trough. This forms the bulk of farmland that is the pride of the state. Benue state has the greatest stretch of the system in Nigeria with over 100 natural ponds and lakes. During the peak of the rainy season, the river is navigable up to Garoua in the Republic of Cameroon.

The state is located in the Southern Guinea Savanna which is the transition belt between the Grassland Savanna in the North and the Tropical Rain Forest in the South. Vegetation cover of the state is majorly that of giant grasses (Elephant grass) with tree species such as *Vetellaria paradox*, *Parkia biglobosa*, *Prosopis africana*, *Vitex doniana*, *Khaya senegalensis* etc (Ityavyar *et al.*, 2011). The major wild animals commonly found in the state include Monkeys (*Cercopithecus ascanius*), Hedgesogs (*Atelerix albiventris*), Nile Rats (*Arvicanthis niloticus*), Squirrel (*Xerus erythropus*), Rabbit (*Poelagus ascanius*), wild dog (*Canis simensis*), Antelope (*Neotragus pgymacus*), Crocodile (*Crocodylus niloticus*) and Grasscutter (*Thyonomyswinderianus*).



Sampling and Experimental Procedures

The experiment was setup in the Animal House of the Department of Wildlife and Range Management, University of Agriculture, Makurdi, Benue State, Nigeria. All laboratory procedures were undertaken at the central laboratory of the college of Veterinary Medicine, Federal University of Agriculture, Makurdi.

Nile rat (*Arvicanthus niloticus*) were collected from the wild at Makurdi (derived savannah), Gwer-west (wood land), Guma (wood land and savannah) and Kwande (wood land), all in Benue State Nigeria in November and December, 2017. Local hunters in these areas were recruited for the rat collection using various local devised traps. A total of four hundred rats were collected during the period.

After capturing 10% from each of the four Local Governments were selected for parasites evaluation. Ascocide powder ectoraid was applied on the whole body of the selected rats to weaken the attached ecto parasites for collection using a brush. Checks were carefully made under the ears and all over the body on each rat for the presence of ecto parasites. A tooth brush was used to comb each rat and this was repeated several times on glass surface to ensure that all the parasites were completely

removed and according to the method of Fagi and El-Rayah (2009).

During acclimatization deworm at recommended dose was applied to the rats through the water saved during feeding. Their faecal samples were collected for analysis and identification of void endo parasites. This was done by direct microscopic examination and faecal flotation technique. Examination of different tissues, blood, bone marrow and live smears were prepared then investigated for the presence of parasites. Intestinal organs (digestive tract, heart, liver and kidney) were examined in normal saline under a microscope. The heart was cut open and examined. Intestine was opened longitudinally and examined.

RESULTS

Endo and Ecto Parasites Isolated from the Captured Nile Rats

The type and quantity of the endo and ecto parasites isolated from the Nile rats caught from different locations in the study area are presented in Figures 1 and 2, respectively. Plates 1 and 2 also show the isolated Ecto and Endo Parasites respectively in the study area. Freshly captured feral Nile rats from four locations (Makurdi, Gwer-West, Guma and Kwande LGA) in the study area were assessed for

the purpose of isolating and identifying the ecto and endo parasites associated with the species.

Four major ecto-parasites (Tick, Termite, Lice and Fleas) were isolated from the bodies of the freshly caught Nile rats and identified (Fig. 1). Tick was the predominant ecto-parasites isolated from the Nile rats brought from Makurdi and Gwer-West LGA, while lice was predominantly found on the bodies of Nile rats brought from Kwande and Guma L.G.A. Fleas and Termites were observed to be the least common ecto parasites found on Nile rats from all the locations considered.

On the other hand, three major endo-parasites (Tapeworm, Worm and Hookworm) were found in the bodies of Nile rats in most of the locations covered in this study. Tape worm was observed to

be the dominant endo-parasite in all the locations, while hook worm was the least endo parasites isolated from Nile rats brought from all the studied locations (Fig. 2). The hook worm which is commonly found in domestic animals was isolated from the rats caught in Makurdi, Gwer-West and Kwande, while the rats brought from Guma were observed not to be associated with hook worm. This observation shows that, Nile rats from Guma are less likely to have interacted with human and other domestic animals as compared to the rats from the other locations, hence the absence of hookworm in their bodies. It could also be inferred that the feral Nile rats from Guma L.G.A appear to be safer for human consumption as compared to those from the other locations studied.

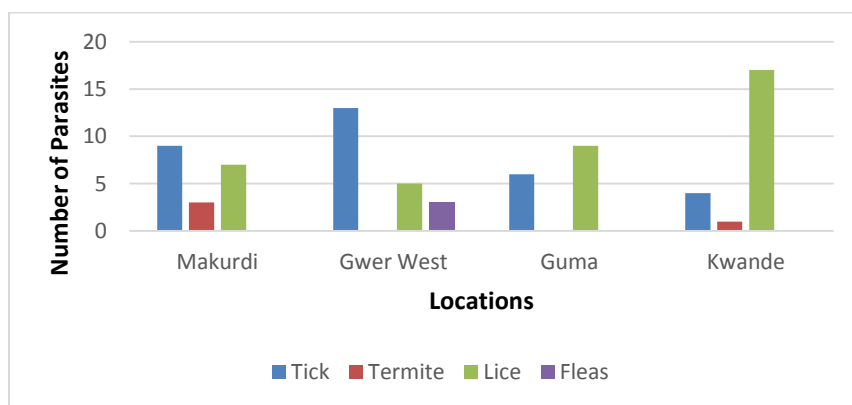


Figure 1: Ecto Parasites Isolated from the Captive Nile Rats

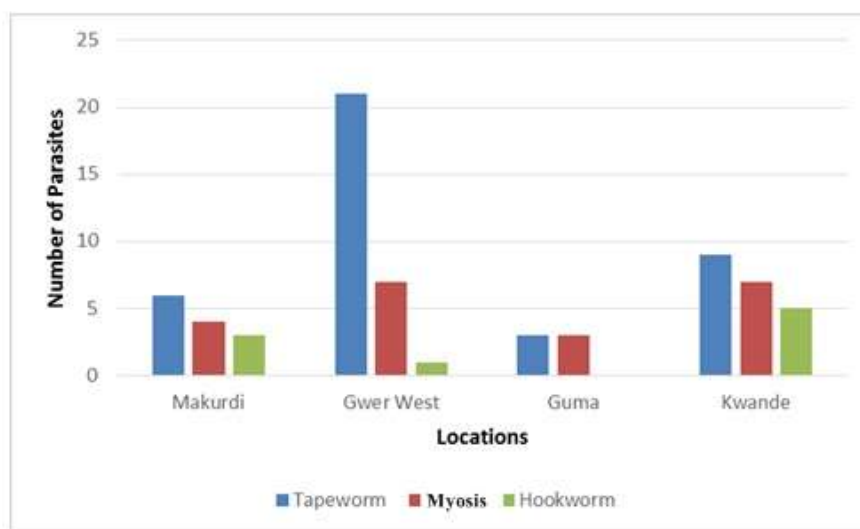





Figure 2: Endo Parasites Isolated from the Captive Nile Rats

	<p style="text-align: center;">A</p> <p>Kingdom - Animalia Phylum - Arthropoda Class - Insecta Order - Mallophaga</p>
	<p style="text-align: center;">B</p> <p>Kingdom - Animalia Phylum - Arthropoda Class - Insecta Order - Isoptera Family - Hodotermitidae</p>
	<p style="text-align: center;">C</p> <p>Kingdom - Animalia Phylum - Arthropoda Class - Arachnida Order - Ascari Family - Ixodida</p>

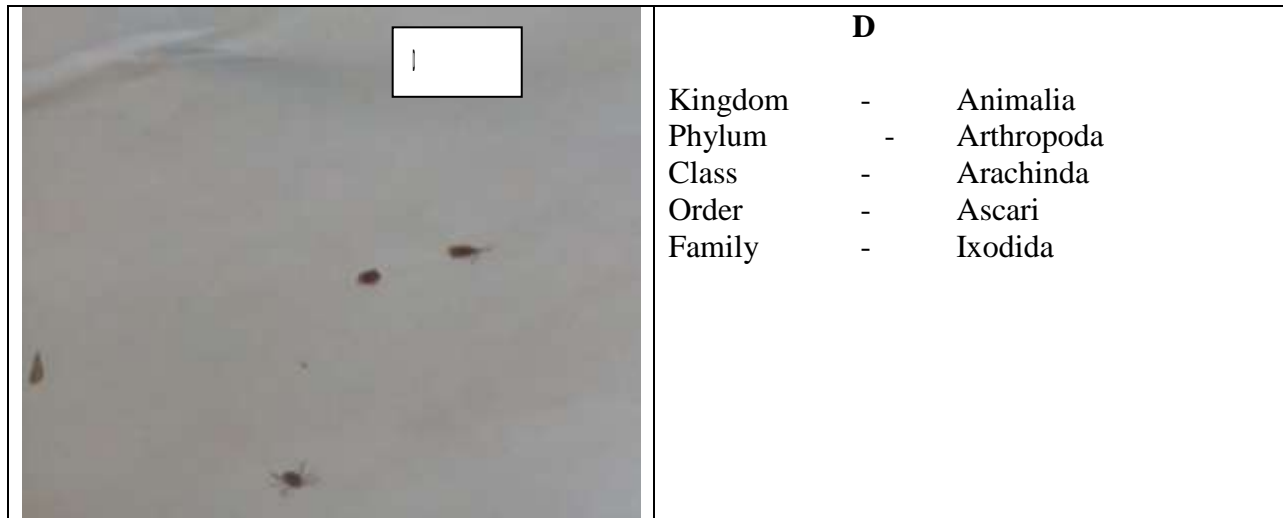
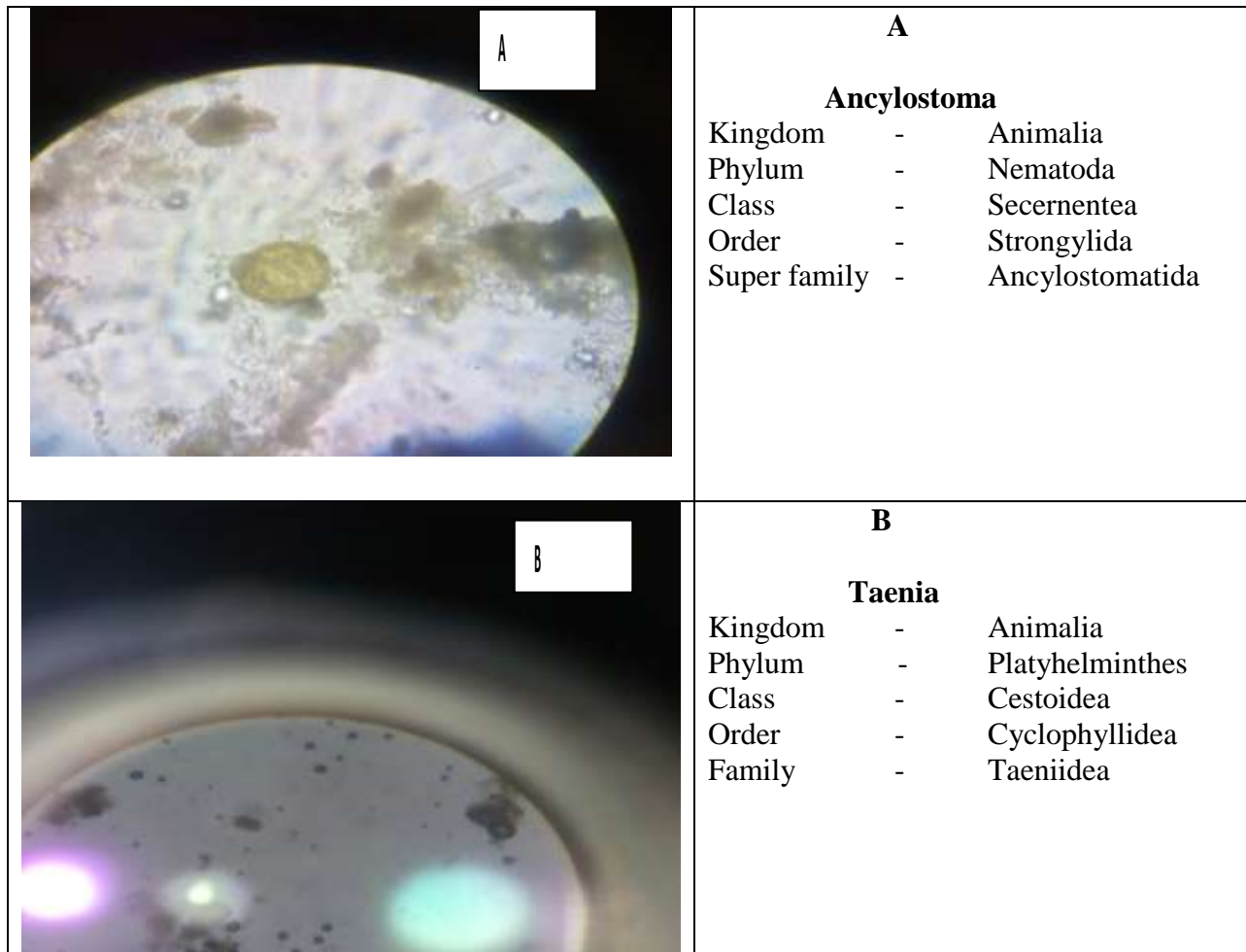


Plate 1: Ecto Parasites isolated from the studied Nile rats (A) Lice, (B) Termite, (C) Soft Tick and (D) Hard Tick



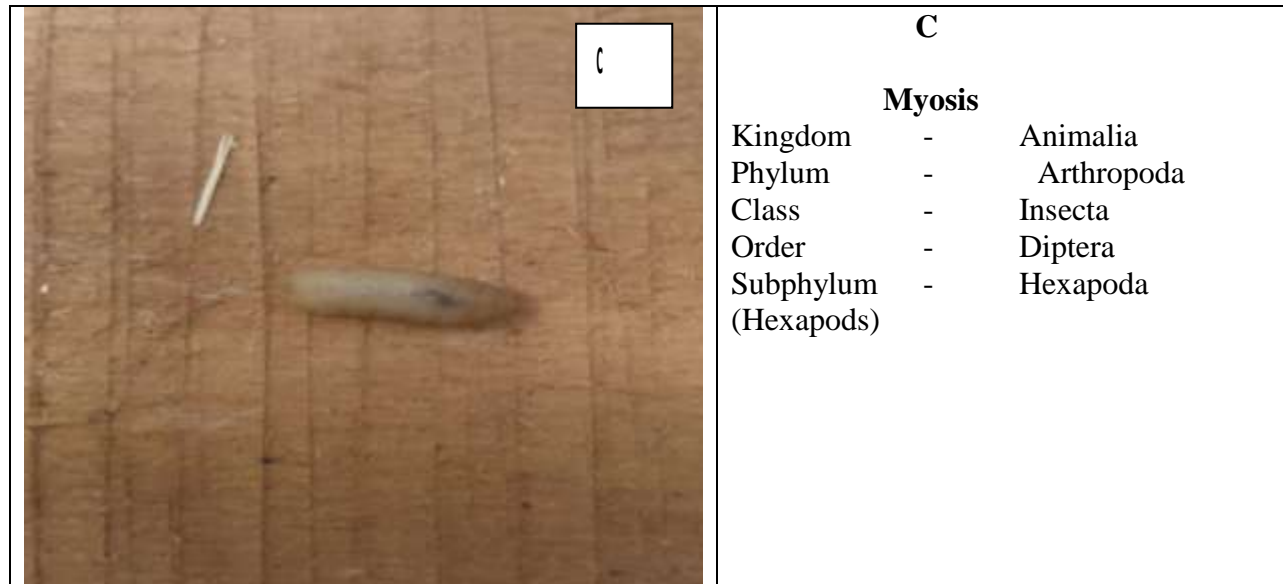


Plate 2: Endo Parasites isolated from the studied Nile Rats: (A) Hook worm, (B) Tape worm and (C) Myosis (Worm)

DISCUSSION

The Nile rats like other vertebrates was found to harbour both endoparasites and ectoparasites such as lice, soft tick, hard tick, termites, hookworm, tapeworm and myosis infection. Rodents serve as hosts to the immature stages of many of the tick species; furthermore, rodent burrows could provide a more suitable microhabitat of higher humidity and buffered temperature extremes for Ixodid ticks (Logan *et al.*, 1993). Infection of *A. niloticus* with Cestode endo parasites according to Fagi and El-Rayah (2009) could be due to the presence of richer insect and other arthropod fauna in the environment of the rat. Previous reports have also shown that the natural populations of Nile grass rats in Africa harbour various parasites including fleas (Schwan, 1993), worms (Arafa and Massoud, 1990; Imbert-Establet *et al.*, 1997) and bacteria (Godeluck *et al.*, 1994).

Several detrimental effects including histological damages, reductions in growth, health and meat quality of reared animals could result from parasitic infection. Parasitic associations in animals have been reported to act as stressor, stimulating the primary stages of stress and affecting the haematocrit. According to Martins *et al.*, (2004), parasitism reduces the red blood cells, haemoglobin and haematocrit.

Thus, parasites have the potential to cause anaemia in infected animals. Similarly, elevation of white blood cells as recorded by Faraz *et al.*, (2016) was associated with the response of cellular immune system to parasitic infection. These white blood cells play a great role during infestation by stimulating the haemopoietic tissues and the immune system by producing antibodies and chemical substances working as defense against infection (Lebelo *et al.*, 2001).

CONCLUSIONS AND RECOMMENDATION

Four (4) ecto-parasites and three (3) endo parasites were predominantly isolated and identified from the body of the feral Nile rats brought in from different location (Makurdi, Guma, Gwer-West and Kwande L.G.A) of the study area. The ecto-parasites identified were; Tick, Termite, Lice and Fleas with the Tick found to be the dominant parasite on the body of Nile rats from all the locations.

While the endo-parasites found were; Tapeworm, Worm and Hookworm. The most common endo-parasite in all the location was the Tapeworm, while the Hookworm was the least observed. Hookworms, which are zoonotic parasites were found with rats from Makurdi, Kwande and Gwer –West but was not found in rats from Guma, indicating that the Nile rats from Guma were more hygienic for human consumption as compared to the others.

Although few studies have experimented the captive rearing of Nile rats as model in the laboratory, there is still a dearth of information on the domestication and farming of the Nile rats in literature. Based on the findings of the current study, it is therefore

recommended that proper attention be placed on the control of both the endo and ecto parasites of the Nile rat in captivity if a successful and healthy domestication of the specie is to be achieved.

REFERENCES

- Arafa, M. A. and Massoud, M. M. (1990). Natural *Schistosoma mansoni* infection in *Arvicanthis niloticus* in Ismailia, Egypt. *Journal of Egyptian Society of Parasitology* 20(2), 775–778
- Bolsinger, J.; Pronczuk, A.; Sambanthamurthi, R.; Hayes, K.C. (2014). Anti-Diabetic Effects of Palm Fruit Juice in the Nile Rat (*Arvicanthis niloticus*). *Journal of Nutritional Science*, 3(5): 1 – 11
- Fagir, D. M. and El-Rayah E. 2009. Parasites of the Nile rat in rural and urban regions of Sudan. *Integrative Zoology* 4: 179–187
- Faraz, P., Safoura, A., Hossein, K. and Hossein M.P. 2016. Parasitic infection alters haematology and immunity parameters of common carp, *Cyprinus carpio*, Linnaeus, 1758. *Journal of Parasitic Diseases* 40(4):1540–1543
- Godeluck, B., Duplantier, J.M., Ba, K. and Trape, J.F. (1994). A longitudinal Survey of *Borrelia crocidurae* prevalence in rodents and insectivores in Senegal. *American Journal of Tropical Medicine and Hygiene* 50(2), 165–168
- Houston, A.M (1995). Biological Diversity: The Coexistence of Species on Changing Landscapes, Cambridge University Press New York. Pg. 681.
- Imbert-Establet, D., Mone, H. Tchuem-Tchuente, L.A. and Jourdane, J. (1997). Permissiveness of two African wild rodents, *Mastomys huberti* and *Arvicanthis niloticus*, to *Schistosoma intercalatum*: epidemiological consequences. *Parasitological Resources* 83(6), 569–573
- Ityavyar, J. A., Inah, E.J. and Akosim, C. (2011). Assessment of captive management of Nile Crocodile (*Crocodylus niloticus*) in three towns of Benue State, Nigeria. *Journal of Research in Forestry and Wildlife Environment* 3(2): 12- 23.
- Lebelo, S.L., Saunders, D.K. and Crawford, T.G. (2001). Observations on blood viscosity in striped bass, *Morone saxatilis* (Walbaum) associated with fish hatchery conditions. *Kansas Academy of Science* 104:183–194
- Logan, T.M., Wilson, M.L. and Cornet, J.P. (1993). Association of ticks (Acari: Ixodoidea) with rodent burrows in Northern Senegal. *Journal of Medical Entomology* 30: 799–801
- Martins, M.L., Tavares-Dias, M., Fujimoto, R.Y., Onaka, E.M. and Nomura, D.T. (2004). Haematological alterations of *Leporinus macrocephalus* (Osteichthyes: Anostomidae) naturally infected by *Goezia leporini* (Nematoda: Anisakidae) in fish pond. *Brazilian Journal of Animal Science* 56:640–646
- Refinetti, R. (2004). The Nile Rat as a laboratory Animal. *Lab Animal*, 33(9) 54-57.
- Schwan, T.G. (1993). Sex ratio and phoretic mites of fleas (Siphonaptera: Pulicidae and Hystrichopsyllidae) on the Nile grass rat (*Arvicanthis niloticus*) in Kenya. *Journal of Medical Entomology* 30(1), 122–135
- Subramaniam, A., Landstrom, M., Luu, A. and Hayes, K. C. (2018). The Nile Rat (*Arvicanthis niloticus*) as a Superior Carbohydrate-Sensitive Model for Type 2 Diabetes Mellitus (T2DM). *Nutrients* 10, 235; doi:10.3390/nu10020235.