Uluslararası Fen Araştırmalarında Yenilikçi Yaklaşımlar Dergisi
International Journal of Innovative Approaches in Science Research 2021, Vol. 5 (2), 72-83
https://doi.org/10.29329/ijiasr.2021.357.4

Original article

Diversity of Mollusc Vectors of Schistosomiasis in Miti-Murhesa Health Zone, Eastern of DRC, Kabare Territory

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Abstract

The main objective is to inventory the vectors of bilharziasis in the aquatic ecosystems of KABARE locally in Miti-Murhesa Health zone as well as other species of aquatic molluscs in order to activate the fight against this endemic disease of this region. A total of 2762 samples were collected during our investigation period in the aquatic ecosystems in Miti-Murhesa Health Zone. We carried out field work based on shellfish sampling using appropriate methods. This sampling was carried out in 12 different sites. After collect of samples, we identified the mollusc species using the indicated identification keys, counted them and compiled them in Excel software for statistical analyses using Past software. Thus, five species of aquatic molluscs were identified. These species are Biomphalaria pfeifferi, Bulinus globosus, Pisidium casernatum, B. forskalii and Lymnaea natalensis. The species Biomphalaria pfeifferi and Bilinus globosus are intermediate hosts of intestinal schistosomiasis and urinary schistosomiasis respectively; while Lymnaea natalensis is the intermediate host of fasciolosis. Depending on the frequency of species, Biomphalaria pfeifferi and Lymnaea natalensis are constant species, Bulinus globosus and Psidium casernatum are accessory species and finally B. forskalii is an accidental species.Depending on the sites prospected, one species of aquatic mollusc was abundant in the aquatic ecosystems in this area: Biomphalaria pfeifferi; three species are moderately abundant: Lymnaea natalensis, Bulinus globosus and Pisidium casernatum, and only one is rare: Tomichia ventricosa. All the prospected sites are diversified in aquatic mollusc species except the Kashekesheke site, but the 2nd tarmaque site, Mulungu River and Kamulonge sites are thus the richest sites in aquatic mollusc species of Miti-Murhesa Health zone. The presence of these species clearly shows the risk of contamination of the population of Miti-Murhesa Health zone. These intermediate hosts of bilharzia are proliferating in the aquatic ecosystems of Miti-Murhesa Health zone; it is therefore important to recommend ways to reduce this proliferation. This study provides the basis for future ecological studies of the intermediate bilharzia host molluscs in this entity.

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Keywords: Diversity, Molluscs, Schistosomiasis, Vectors, Miti-Murhesa Health zone, Kabare.

Received: 01 September 2020 * **Accepted:** 07 May 2021 * **DOI:** https://doi.org/10.29329/ijiasr.2021.357.4

INTRODUCTION

Schistosomes are endoparasites responsible for significant damage in humans. The diseases they transmit are ranked second only to malaria, especially in tropical countries where they constitute a real public health problem (WHO, 2002). They are endemic in 76 countries with 600 million people exposed and more than 200 million parasitized (Tchenté, 2006). Mortality due to bilharziasis is estimated at about 200,000 people per year (WHO, 2002; Tchenté, 2006). There are five species of schistosomes parasitizing humans (Aubry, 2010; WHO, 1991; WHO, 2004; WHO, 2012). However, only three of these species are found in Africa and especially in Democratic Republic of Congo, namely *Schistosoma haematobium*, *Schistosoma intercalatum* and *Schistosoma mansoni*. They are transmitted to humans by gastropod molluscs of the *Planorbidae* family, which is widespread in aquatic systems.

In West Africa, *Schistosoma haematobium* urinary schistosomiasis and *Schistosoma mansoni*,and *S.intercalatum* intestinal schistosomiasis are widespread (Poda J.N and coll. ,1994).The transformation of the environment by human activities (development, rice cultivation, fish farming) favours the creation of favourable deposits for the intermediate host molluscs of schistosomes that proliferate and spread to other sites and are the cause of morbidity and mortality (Steinmann and coll., 2006). This state of affairs is further aggravated by hydraulic developments and the construction of numerous small and large dams (Traoré, 2000). Schistosomiasis or bilharziosis are parasitic diseases due to trematode greens (Schistosomes) with urinary or faecal transmission transmitted by intermediate hosts called molluscs present in freshwater (Isabwe and coll., 2012).In Côte d'Ivoire, the Taabo dam lake was invaded by molluscs, creating a high risk area for the spread of *Bulinus species* and *Biomphalaria* (Tian-Bi and coll., 2011). Poda et al. (1994, 1996) in Burkina faso showed that prevalence levels increased for urinary bilharziasis from 23% overall in 1987 to 61% in Guiédougou, 40% in Niassan and 49% in traditional villages in 2000, and then to 56%, 52% and 52% respectively in 2002. As for intestinal bilharziasis, which was absent in the zone as a whole until 1987 when three cases were detected in migrants, the prevalence rates changed between 2000 and 2002 from 1% to 8% in Niassan, 7% to 23% in Di and 5% to 10% in Guiédougou.

In the Democratic Republic of Congo, recent studies on this subject are very localized and the current mapping is therefore out of date (Baluku and all., 2000). Intestinal bilharziasis in *Schistosoma mansoni* is widespread in the Democratic Republic of Congo, particularly in the Ruzizi plain and along the Kivu Lake (WHO, 1987, Baluku and coll., 2000). However, schistosomiasis with *Schistosoma haematobium* is localized in certain areas of the country (Gillet and Wolfs, 1954).

In Katana Health Zone, cases of schistosomiasis with *Schistosoma mansoni* and *Schistosoma haematobium* had already been reported, and the foci of infestation are Kivu Lake, constructed marshes, streams and fish ponds (Baluku and all.2000). Parasitological studies conducted in the region show that the rate of schistosomiasis infestation in *Schistosoma mansoni* is as high as 8% in some villages. However, no cases of schistosomiasis in *Schistosoma haematobium* were found during the study period (Baluku and coll., 2000).

However, the endemicity of intestinal and urinary schistosomiasis in the Miti-Murhesa Health Zone in recent years has become a cause for concern and this is justified by the movement of human populations, which has led to the suspicion of increased transmission and an extension of the outbreak of *Schistosoma mansoni* on the one hand and the outbreak of *Schistosoma haematobium* on the other in this groupement (Olivier et al., 1998; Bagalwa and Baluku, 1997). In this Health zone, there is an important aquatic system that hosts intermediate of bilharziosis and these aquatic ecosystems constitute a favourable biotope for the survival and development of the intermediate hosts of bilharziosis. The aim of our study is to inventory the vectors of bilharziasis in aquatic ecosystems in Miti-Murhesa Health-Zone as well as other aquatic mollusc species in order to activate the fight against this endemic disease in this region.

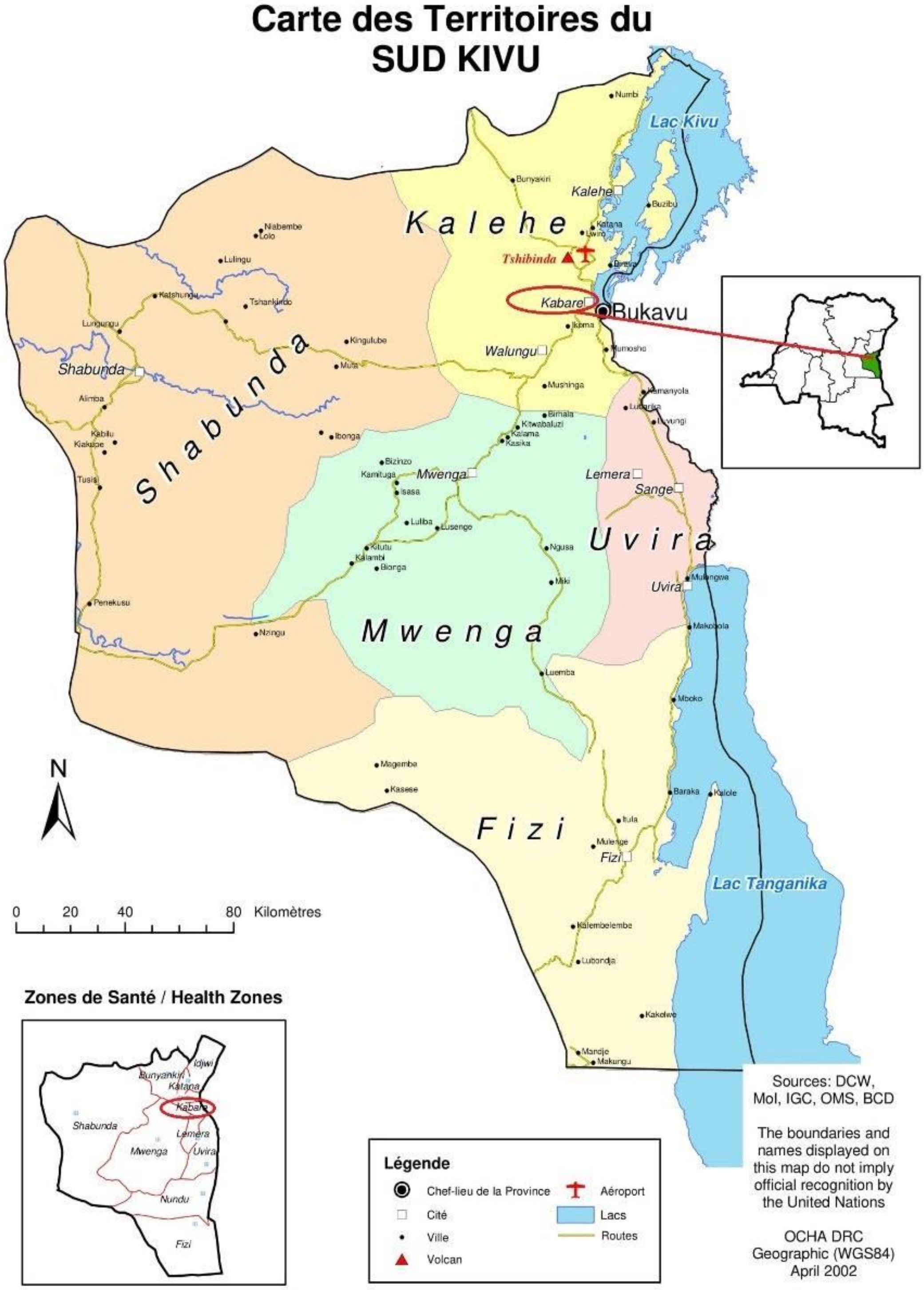
MATERIALS AND METHODS

Description of the site of study

The health zone of Miti-Murhesa is located in the province of South Kivu in RDcongo and has a temperate mountain climate, it serves a population of 278,372 inhabitants. It spans three groups including: the Bugorhe, Miti and Mudaka groups.

It is limited:

- in North by: the Katana Health zone
- -In South by: the Kabare Health Zone
- -Est by: BUNYAKIRI Health Zone
- West by: Bunyakiri Health Zone Note that the main activities of the population are: agriculture, animal husbandry, fishing, trade.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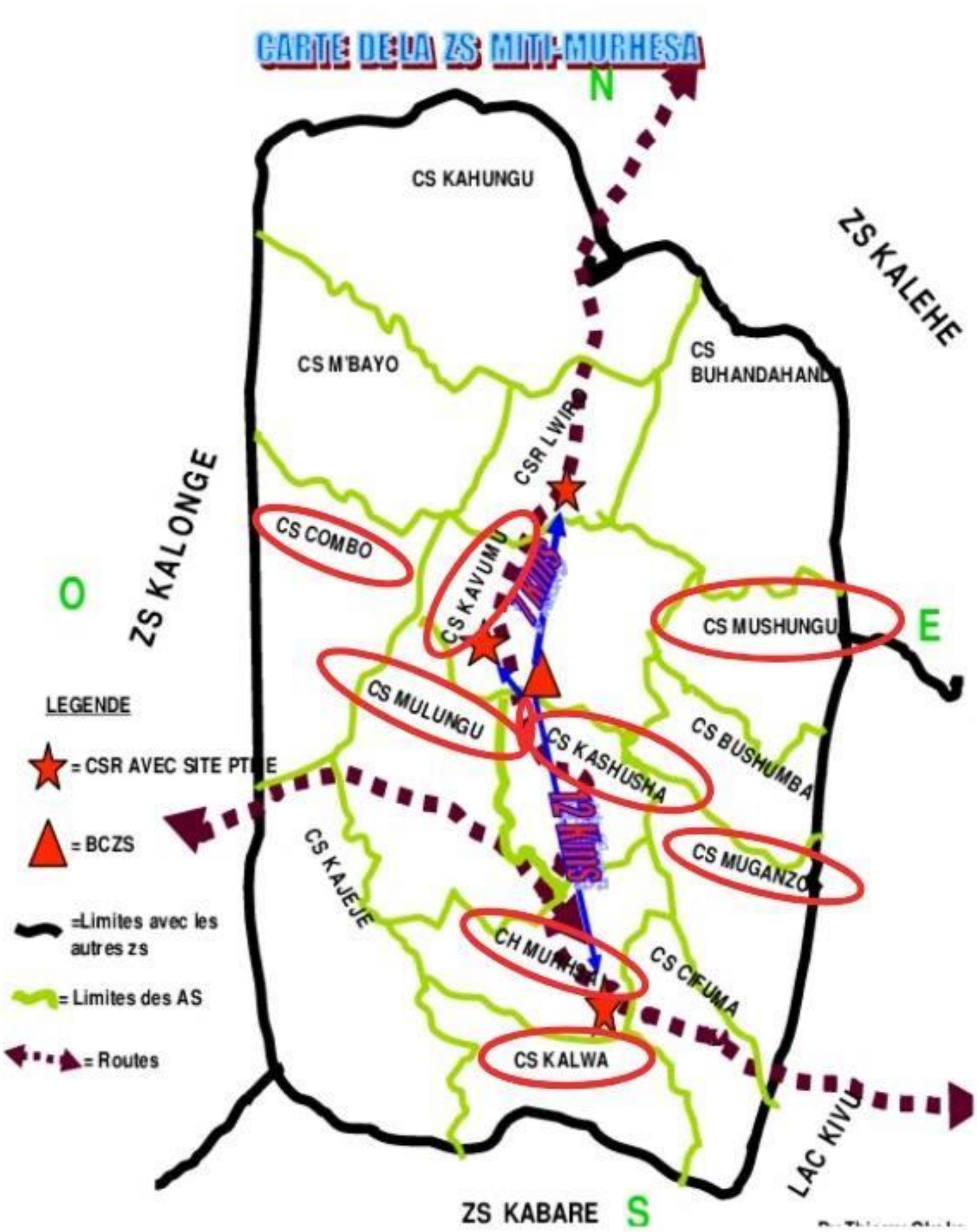

Sampling of aquatic molluscs

The sampling period ran from July 2016 to June 2017 and samples were taken monthly from a total of 6 sampling sites. Shellfish sampling was done using the standardized collecting time unit method (Olivier and Scheiderman, 1956). A total of 2762 individuals were collected during our period of investigation in the aquatic ecosystems of the Miti-Murhesa Healthzone, and we conducted field work based on shellfish sampling using appropriate methods. The harvesting time per person was set at 10 minutes per site. Molluscs were collected using a 2 mm small-mesh muddy net hung on an iron bar with a circular opening of 50 cm in diameter fitted with a 1.5 m wooden handle. Those found were counted by species and the environmental factors of each site were noted on the sampling sheets for each site. The determination of molluscs was carried out in the laboratory of ISTM/Bukavu and in the laboratory of Plant Physiology and Applied Microbiology of UOB-Bukavu, following the determination key of Mandhl-Barth (1988) and Brown (1980).

Analysis of the results

To analyze our results, the following parameters were used:

- Frequency

The frequency of molluscs in the sampling was calculated by the following formula:n/Nx100

- Abundance

Abundance will be determined according to the number of species and individuals caught per site and as a function of time (Dash, 1995)

- Specific diversity

The specific diversity at different sites is calculated by the diversity index or Shannon Weaver index as given by Fowler and al. (2000). This index was determined by the Past software.

- Similarity

To judge the similarity of molluscs caught from one site to another, we calculated the similarity coefficient (QS) of Sorensen (1948) in Bachelier (1963). This similarity was determined by the software Past.

- Specific richness

The species richness will be calculated as the number of taxa in a sample, this was done for each taxa (order) in each site by counting the number of mollusc species caught in that site (Dash, 1995).

DISCUSSION

The taxonomic distribution of the aquatic molluscs in Miti-Murhesa Health Zones.

Five species of aquatic molluscs have been inventoried in the Miti group, which is our study area; of which: Biomphalaria pfeifferi (Krauss, 1948), Bulinus globosus (Morelet, 1866), Lymnaea natalensis (Krauss, 1948), Pisidium casernatum (Poli, 1791) and B. forskalii (Ehrenberg, 1831). They belong to two classes (Gasteropoda and Bivalvia), two subclasses, that of Pulmonata and the other of Bivalvia, and four families (Planorbidae, Bulinidae, Lymnaeidae and Sphaerida). The species Biomphalaria pfeifferi and Bulinus globosus are intermediate hosts of schistosomiasis with Schistosoma mansoni and Schistosoma haematobium, respectively (Baluku, 1990) and Lymnaea natalensis is the intermediate host of fasciolosis by Fasciola hepatica and Fasciola gigantica (Baluku, 1990). These same species have already been identified in East of DRC, in Katana Healthzone and its surroundings (Baluku, 1987; Bagalwa et al., 2009; Batumike et al., 2014 and Ndegeyi et al...), 2014); these authors point out that it is these species, Biomphalaria pfeifferi and Bulinus globosus, that are intermediate hosts of Schistosoma mansoni and Schistosoma haematobium, respectively; but also Lymnaea natalensis is the intermediate host of fasciolosis in Fasciola hepatica and Fasciola gigantica (Bagalwa et al., 2009).

Individuals collected by site and aquatic mollusc species

A total of 2762 aquatic molluscs were collected during our period of studies. The species *Biomphalaria pfeifferi* presented a higher score of 1001 individuals, followed by *Lymnae natalensis* (670 individuals), *Pisidium casernatum* (600 individuals); *Bulinus globosus* (481 individuals) and in last position *B. forskalii* (10 individuals). At all sites with *Biomphalaria pfeifferi*, *Lymnae natalensis* and *Bulinus globosus*; the number of individuals is always high for *Biomphalaria pfeifferi* and lower for *Bulinus globosus* (Baluku, 1990; Poda et al., 1994). In terms of sites, Mulungu Creek presented the highest score (1078 individuals), followed by 2nd Tarmaque Site (405 individuals) and finally, the Kashekesheke site, where only 5 individuals were collected.

Frequency of aquatic mollusc species collected in the Miti grouping.

According to the frequency of species, *Biomphalaria pfeifferi* and *Lymnaea natalensis* have an identical and highest frequency (83.3%); these species are said to be constant especially as their frequency is higher than 50% (Dajoz, 1985) followed by *Bulinus globosus* and *Pisidium casernatum* also have identical frequencies (41. 7%). These species are said to be incidental, especially as their frequency is less than 50% and greater than 25% (Dajoz, 1985) and finally *B. forskalii* has a frequency of 8.3% and is said to be accidental because its frequency is less than 25% (Dajoz, 1985).

Abundance of collected in aquatic mollusc species.

Depending on the sites visited, one species of aquatic mollusc was abundant in Miti-Murhesa Health zone, *Biomphalaria pfeifferi*; three species are moderately abundant, *Lymnaea natalensis*, *Bulinus globosus* and *Pisidium casernatum*, and only one is rare, *B. forskalii*. The abundance of these species has already been reported in Ituri and Katana region (Pilsbry and Bequaert, 1927; Baluku, 1987).

Specific diversity

The specific diversity results found from the Shannon-Weaver diversity index show that the site (Mulungu Creek) is the most diverse in aquatic mollusc species, followed by the Kamulonge site, 2e tarmaque site, the CISIRHA 2 site while the Kashekesheke site is the least diverse in aquatic mollusc species. Figure 4 clearly shows the level of diversity of aquatic mollusc species by surveyed site. However, the specific diversity of these sites is due to their ecological characteristics; these sites are clear (without shading), with sandy-clay bottom, shallow water, weak water current and abundant dead vegetation as Baluku (1987) showed that a clear site, with sandy-clay bottom, shallow water and weak water current is a focus for development of intermediate hosts of bilharziosis, while a deep site with strong water current is not favourable for these intermediate hosts of bilharziosis; This is what we found for the Kashekesheke site, which is why it is not diversified.

Similarity

The similarity results show that there is a large positive correlation between all sites for aquatic mollusc species. This similarity is justified by the similarity of the ecological characteristics of the sites and especially that they are in the same environment. The similarity of the sites in the same environment has been shown to be very high.

Conclusion

Vectors of bilharzia are proliferating in the aquatic ecosystems of Miti-Murhesa Health zone; it is therefore important to recommend ways to reduce this proliferation to public health authorities. This study provides the basis for future ecological studies and infectious diseases controle en l'occurrence water-born diseases of the intermediate bilharzia host molluscs in this entity and others parasitics infections.

REFERENCES

1. WHO, 2002. Prevention and control of schistosomiasis and soil-transmitted helminthiasis. Report of a WHO Expert Committee. WHO Technical Report Series No. 912. WHO, Geneva.
2. WHO, 2004. Schistosomiasis and soil-transmitted helminthiasis: prevention and control, Report of an expert committee, Technical report series, Geneva; 912
3. WHO, 2012. Schistosomiasis (Bilharzia). World Health Organization, Geneva, January 2012. Aide-Mémoire, no 115, 4p.
4. Tchuenté T.L.A., 2006. The fight against schistosomiasis: challenge and perspectives for the 21st century. Bull Soc Pathol Exot, 99, 5, 372-376.
5. WHO, 1991. Tropical diseases: research progress 1989-1990. UNDP / World Bank Report, Geneva, 135p.
6. Aubry P., 2010. Schistosomiasis or bilharzias: News 2010. Méd.Trop., 7p.
7. Poda J.N., Sellin B., Sawadogo L., Sanago S., 1994. Spatial distribution of potential intermediate host molluscs of schistosomes and their biotopes in Burkina-Faso. Bulletin of liaison of the organization of coordination and cooperation for the fight against the great endemics. 14th year, No101, 32p.
8. Poda J. N., Sawadogo L. L., Sellin B., Sanogo S., 1996. Population dynamics of Bulinus truncatus rohlfsi clessin in the Dyoro dam in the Sudanian Zone of Burkina faso ''. African Agronomy VIII, 1, pp 61 - 6.
9. Dupont D., 1984. Chronic diarrhea: Schistosomes. Institute of Parasitology and Medical Mycology, Croix Rousse Hospital, 27p.
10. Isabwe A., Ruberanziza E., Mupfasoni D., Ruxin J., Clerinx J. and White P.T., 2012. Potential for transmission of schistosomiasis in kayonza district. Rwandan Medical Review 69 (2): 14-19.

11. Tian-Bi T Y.-N., N'Guessan A.N., Coulibaly M.Y. and N'Goran K. E., 2011. Variability of Bulinus truncatus - Schistosoma haematobium interaction across three generations of molluscs: epidemiological implications. Journal of Applied Biosciences 48: 3284– 3292.
12. Steinmann P., Keiser J., Tanner M. and Utzinger J., 2006. Schistosomiasis and water resources development: systematic review, Meta analysis and estimates of people at risk. Lancet Infections diseases 6 (7): 411-425.
13. Bagalwa M., Baluku B., 1997. Distribution of intermediate host molluscs of human schistosomiasis in Katana, South Kivu, East Zaire. Med Too. 57, 369 - 372.
14. Baluku B., 1990. Spatio-temporal distribution of schistosoma mansoni bilharzia in the Ruzizi plain (eastern Zaire). Revue des Sciences Naturelles V1, 1-10.
15. Baluku B., Bagalwa M., 2000. Problems posed by bilharziasis in the Democratic Republic of Congo. Cahiers du CERPRU, 14, 58 - 60.
16. Baluku B., Bagalwa M., Bisimwa B. 2000. Parasitological survey on shistosomiasis caused by Schistosoma mansoni in Katana, Democratic Republic of Congo. Med. Too much. 60: 163 - 166.
17. Baluku B., Josens G., Loreau M., 1987. The diet of Biomphalaria pfeifferi (Gastropoda, Planorbidae) in Eastern Zaire. Zool Review., Afr., 101,272-282.
18. Baluku B., Loreau M., 1989. Comparative study of the population dynamics of Biomphalaria pfeifferi (Gasteropoda, Planorbidae) in two rivers of eastern Zaire. Rev. Zool., Afr., 103, 311-325.
19. Gillet J. and Wolfs J., 1954. Human schistosomiasis in Belgian Congo and Rwanda-Urundi, Bull OMS, 10, 315-419.
20. Olivier G., Brutus L., Cot M., 1998. Intestinal schistosomiasis caused by Schistosoma mansoni in Madagascar: Extension and focus of the endemic. Octeac, B.P 288 Yaoundé, Cameroon.
21. OMS, 1987. Atlas de la schistosomiase. Presse Universitaire de Bordeaux éd. ; Genève, 171-182.
22. Olivier L. et Scheiderman M., A., 1956. Method of estimation of the density of aquatic snail population. Exp. Parasitol., 5, pp 109-117.
23. Mandhl-Barth G., 1962. Key to the identification of East and Central African freshwater snails of medical and veterinary importance Bull. Wld. Hlth. Org, pp 135-150.
24. Brown S. D., 1980. Freshwater snails of Africa and their medical importance. Taylor and Francis, London 487p.
25. Brown S.D., Freshwater Snails of Africa and their medical importance. Taylor Francis, 609p, 1994.
26. Dash M.C., 1995, Fundamentals of ecology, School of life science, Sambalpur University, Jyoti vihar, Orissa, Tata McGraw-Hill Publishing Company Limited, New Delhi, 203-204 pp.
27. Majaliwa J.G.M., Bashwira S., Tenywa M., Kansiime F., 2012. An overview of pollution loading into Lake Kivu basin. Third RUFORUM Biennial Meeting 24 - 28 September 2012, Entebbe, Uganda, 861 – 868.
28. Ravaoalimalala V.E., Ramaniraka V.L., Rabarijaona L.P., Ravoniarimbinina P, Migliani R., 2002. Situation épidémiologique actuelle des bilharzioses dans la plaine d'Antananarivo. Arch Inst Pasteur de Madagascar; 68, 1, 2, 63-67.

29. Roux J.F., Ravaoalimalala V.E., Rakoto L., Bisier P., Andriamahefazafy B., Rabeson D., Esterre Ph., 1994. Bases de réflexion et grandes lignes du Programme National de Lutte contre les Bilharzioses à Madagascar. Arch Inst Pasteur Madagascar; 61 : 58-61.
30. Ndiaga T. et Diallo A., 2010. Intégration de la Biodiversité d'eau douce dans le processus de développement en Afrique. Module de formation des formateurs sur les mollusques d'eau douce africain ; Gambie, 44p.
31. Mouthon and Daufresne, 2010. Long-term changes in mollusk communities of the Ognon River (France) over a 30-year period ", Fundamental and Applied Limnology, 178 (1): 67-79.
32. WHO, 2012. Schistosomiasis (Bilharzia). World Health Organization, Geneva, Aide-Mémoire, n ° 115, 4p.
33. Ernould JC. 2000. Importance of human behavior in the transmission of Schistosomiasis. In "CHIPPAUX JP (Ed) - The fight against Schistosomiasis in West Africa". IRD éd., Paris, Colloque; pp 31-41.
34. Fain A., 1952. Contribution to the study of larval faunas of trematodes in the Belgian Congo and especially of the fluke Schistosoma mansoni. Memory Royal Belgian Colonial Institute, 22, 311p.
35. Sow S., de Vlas S.J., Polman K., Gryseels B., 2003. Hygienic practices and risks of surface water contamination by Schistosome eggs: the case of an infected village in northern Senegal. Bull Soc Pathol Exot .; 96, 12-4.
36. Barreto M.L., 1991. Geographical and socio-economic factors relating to the distribution of S. mansoni in an urban area of North-East Brazil. Bull. WHO, 69, 93-102.
37. Benyoussef A., 1973. Health, migration and Urbanization. Bull. WHO, 49, 517-537.
38. Batumike C, Bagalwa M, Ndegeyi K, Baluku B., Bahizire K., 2014. Contribution to the inventory and ecology of species of freshwater molluscs from small rivers in Lwiro and its surroundings, eastern DR Congo , International Journal of Innovation and Applied Studies, 7, 1,298-308.
39. Bagalwa M., Baluku B., Mushayuma N., 2009. Distribution of molluscs in Lake Kivu and their medical importance. Special issue, CRSN- Lwiro, pp 14 - 21.
43. Pilsbry H. A. and Bequaert J., 1927. The aquatic mollusks of the Belgian Congo, with a geographical and ecological account of Congo malacology. Bull. Ann. Mus. Nat Hist., 53, pp 69 - 602.
44. Dajoz, R. 1985. Precise ecology. Ed Bordas, Paris, 505p.
45. Fowler J., Cohen L. and Jarvis P., 2000, practical statistics for field Biology, second edition, John Wikey & Sons, 259 p.

LIST OF TABLES AND FIGURES

Table 1. Total number of individuals collected by site and by species

	Species				
Station(Site)	*Biomphalaria pfeifferi*	*Bulinus globosus*	*Lymnae natalensis*	*Pisidium casernatum*	Total
Langa/Kabuga	23	0	34	0	57
Langa ADI-Kivu	45	0	29	0	74
Langa aeroport	79	0	43	0	122
2nd Tarmaque site	54	75	39	237	405
Pont Nyamunyunye	0	74	32	0	106
Cisirha 1	59	0	24	0	83
Cisirha 2	97	30	15	0	142
Source Kaminyambwe	65	0	0	179	244
Cirehe	263	0	24	0	287
Mulungu River	279	265	376	158	1078
Kamulonge	37	47	54	21	159
Kashekesheke	0	0	0	5	5
Total	1001	481	670	600	2762

Table 2. Frequency of Aquatic Mollusc Species collected.

Species	**%**	**Characteristics**
Biomphalaria pfeifferi	83.3	Constant species
Bulinus globosus	50	Accessory species
Lymnae natalensis	83.3	Constant species
Pisidium casernatum	41.7	Accessory species

Table 3. Abundance of collected aquatic mollusc species.

Species	**Abundance (in %)**	**Caracteristics**
Biomphalaria pfeifferi	36.2	Abundant species
Bulinus globosus	17.4	Medium abundant species
Lymnae natalensis	24.3	Medium abundant species
Pisidium casernatum	21.7	Medium abundant species
B. forskalii	0.4	Medium abundant species
Total	100	

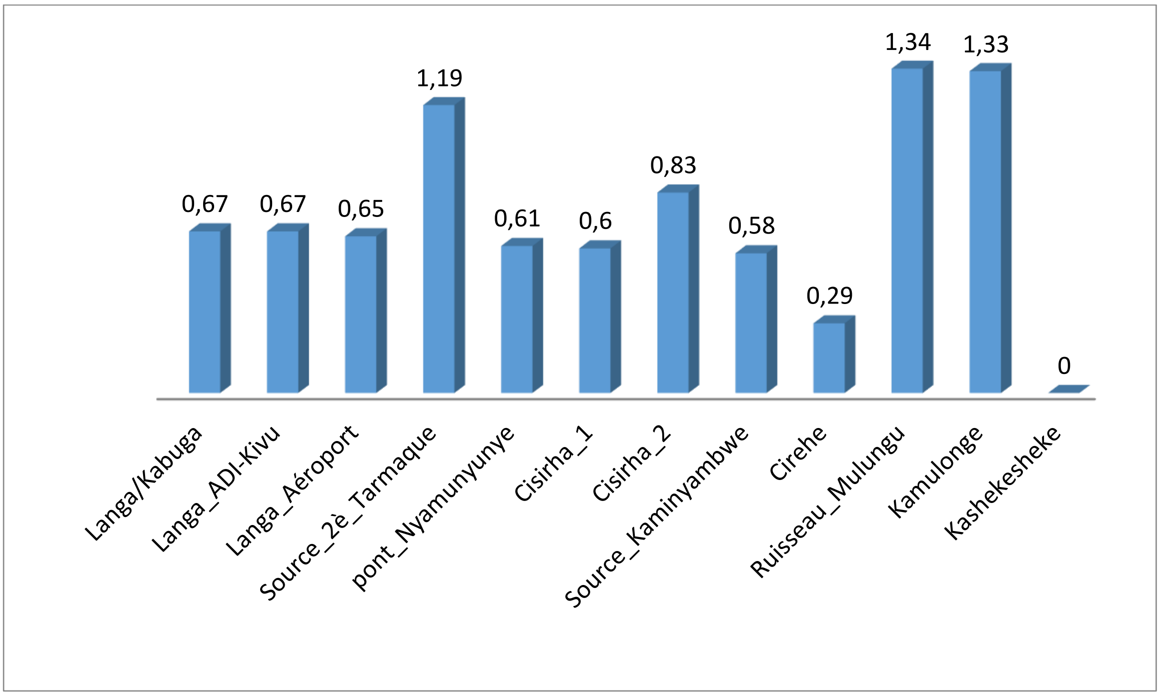

Figure 1. Shannon-Weaver specific diversity index of aquatic mollusc species.