

Evaluation of indigenous molluscicides in water against schistosomiasis vectors

B. MAKANGA¹, A. MONKIEDGE² AND C. J. OBBO¹

1 Zoology Department, Makerere University
P.O.Box 7062
Kampala, Uganda.

2 Institute of Medical Research and Study of Medical Plants (C.E.P.M.)
P.O. Box 11878 Yaounde, Cameroon.

ABSTRACT

Seven varieties of indigenous *Phytolacca dodecandra* L'Herrit (Phytolaccaceae) were field-tried for molluscicidal potency. Varieties (U96) and (U95) collected from Kabarole and Kabale respectively were the most potent with LD90 equal to 2.54 and 6.46 mg.l⁻¹ respectively. Water bodies ranging between 4,770 and 347,510 litres in Kibimba rice fields were treated with up to 50mg.l⁻¹. Snails kills were monitored every three months and 92 - 100% mortality rates were realized.

HPLC fingerprints revealed the two *P. dodecandra* varieties to contain highest concentration of the active principle, oleanglycotoxin- A or lemmatoxin- A.

INTRODUCTION

It was reported from Entebbe Peninsula that out of 358 migrants, 144 were infected with *Schistosoma mansoni* (ODONGO-AGINYA and MUGISA, 1987). The snail vectors in the peninsula were reported to be *Biomphalaria choanophala* and *B. pfeifferi*. Four years later, LAKWO and ODONGO-AGINYA (1991) reported higher

snail infection in Kitubulu than in Bugonga area and Nakiwogo.

The snail surveys of 1992 at several sites on the shore of Lake Victoria, Fig.1, (Nakiwogo Pier, Kigungu, Botanical Gardens, Bugonga and Fisheries Training Institute (FTI), did not reveal any significant numbers of *Biomphalaria* spp., the vectors of *S. mansoni*. It was only from the

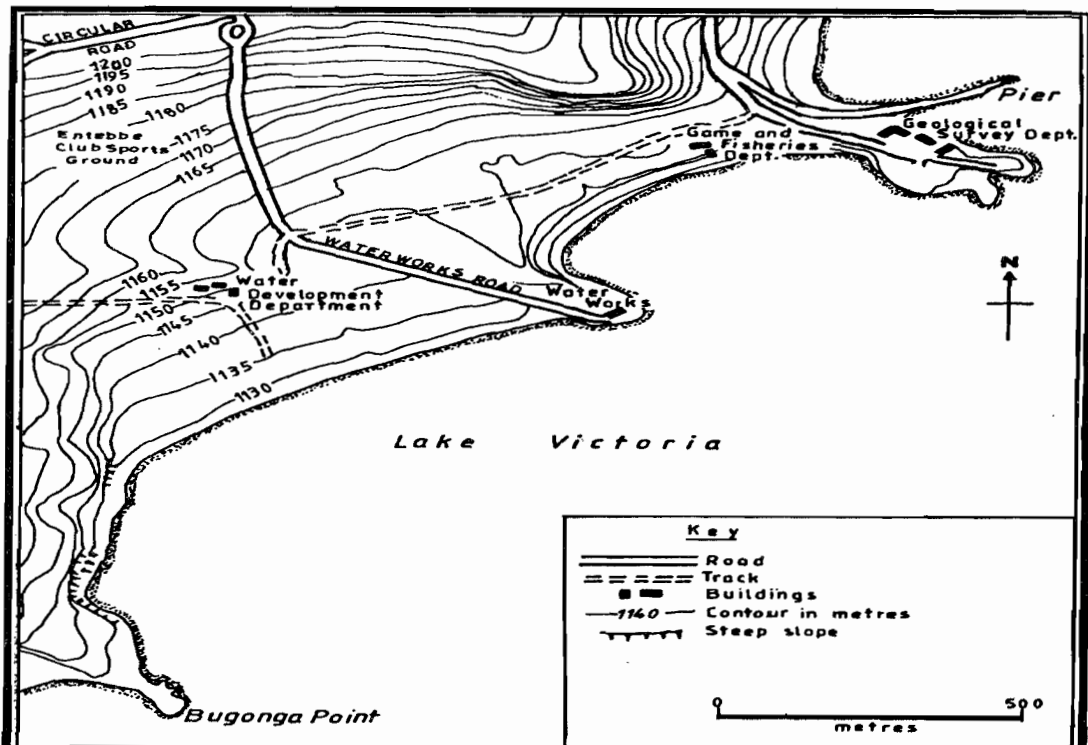


Fig.1. Entebbe Peninsula - Showing sites along the lake shore where snail survey was carried out.

Pier that 14 *B. pfeifferi* were collected. When screened for *S. mansoni* cercariae, they were negative.

The vector for *S. haematobium*, *Bulinus globosus*, was found at all the sites surveyed except at F.T.I. None of the screened *B. globosus*, was positive for the urinary schistosomiasis parasite, *S. haematobium*.

It was concluded that with time, *Biomphalaria* spp. in Entebbe Peninsula had declined tremendously to give new hopes of the disappearance of gastro-intestinal schistosomiasis along the shores of L. Victoria in this area. *Bulinus globosus*, however, poses a big threat of urino-genital schistosomiasis as migrants frequent the shore and urinate therein.

Of the 1309 inhabitants of Kibimba Rice Scheme, 258 were found infected with *S. mansoni*. Infection varied from light to moderate (100 - 500 eggs per gram of faeces). Most heavy infections were seen in the age groups 5-9 and 10 - 19 years (36 and 44% respectively).

Therefore *Phytolacca* trials were redirected to Kibimba from Entebbe Peninsula because many *Biomphalaria* snails screened were positive for *S. mansoni* cercariae unlike those from the Peninsula.

MATERIALS AND METHODS

Semi-ripe berries of four *P. dodecandra* varieties were collected from wild-growing plants, in Gulu (U93), Rakai (U94), Kabale (U95) and Kabarole (Fort-Portal) (U96). They were dried in the shade. A grain miller was used to get a fine powder of each variety.

Ten grams of each variety was sent to the Royal Danish School of Pharmacy, Denmark, for HPLC finger prints.

Laboratory toxicity evaluation was done in order to determine LD50 and LD90 of each variety. Only the water extracts were used. Cold extraction was allowed to proceed for 24 hours.

Faecal samples were collected from school-going boys and girls at Nainala Quarters, Labour Line Quarter, Kasobere, Bubusi, Mahoma, Kibimba Quarter, Kibimba Nursery and Kibimba Primary

School. Egg counts were done at the Institute of Public Health, Makerere University Medical School.

RESULTS

Table 1 summarizes the LD50 and LD90 of *Phytolacca* varieties against *Biomphalaria* snails.

Table 1. LD 50 and LD 90 of five *Phytolacca* varieties.

Variety	Serial No.	LD50 mg ^l -1	LD90 mg ^l -1
Ethiopian	E44	2.64	3.53
Fort Portal	U96	1.88	2.54
*Rakai	U94	2.73	3.47
Kabale	U95	4.67	6.46
Gulu	U93	5.11	6.56

* Collected from one site only.

Fig. 1 shows some of the sites along the shores of Lake Victoria where snail survey was done.

Figure 2 shows the HPLC finger prints for (five) *Phytolacca* varieties. This includes variety E44 from the Institute of Pathobiology, Addis Ababa, Ethiopia. The peak heights correspond to the relative quantity of lemmatoxin in each sample. Judging from the origins of the varieties, altitude, temperature and soil conditions seem to influence the composition of the toxins.

Table 2 summarizes the results of the first field *Phytolacca* trials at Kibimba Rice fields. Assessment of toxicity was followed by counting numbers of snails still alive 24 hours after application of the water extract of *Phytolacca*. The results show that indigenous *Phytolacca* berry extracts could be used effectively to control the schistosomiasis vectors and curtail schistomiasis transmission.

Fig. 2: Fingerprints of the Ugandan Endod varieties compared to type E 44 from Ethiopia

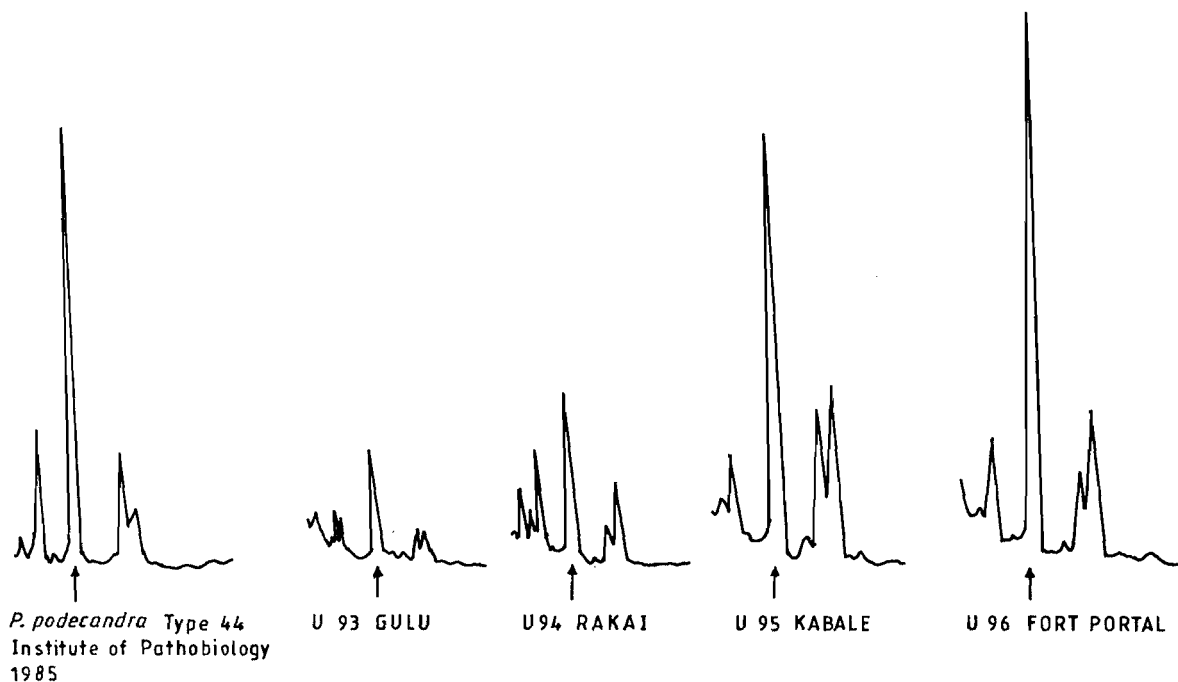


Fig. 2. Fingerprints of the Uganda Endod varieties compared to type E 44 from Ethiopia.

Table 2. Toxicity of *Phytolacca* varieties U95 and U96 in Kibimba Rice Fields.

Site No.	Volume of water (m ³)	Weight of <i>Phytolacca</i> (kg)	Snails alive after 24 hrs.
1	27	1.35	0
1°	74	3.70	0
2	05	0.25	1
7	35	1.75	0
8	10	0.50	0
9	31	1.55	0
10	05	0.15	1

Table 3. Toxicity of *Phytolacca* varieties U95 and U96 in Kibimba Rice Fields three months from the first application.

Site No.	Volume of water (m ³)	Weight of <i>Phytolacca</i> (kg)	Snails alive After 24 hrs.
1°	105.25	5.30	0
1	347.51	17.40	0
2	4.77	0.2	0
3	24.95	1.25	0

Figure 3 shows the southern part of Kibimba Rice Scheme where the different sites for *Phytolacca* trials are located. Water flows from Lake towards site 10, gives off tributaries 3, 10, 8 and crosses the main road towards the North. This study was limited to the southern part of the Rice Scheme.

Table 3 shows the result of *Phytolacca* trials three months after the first trials.

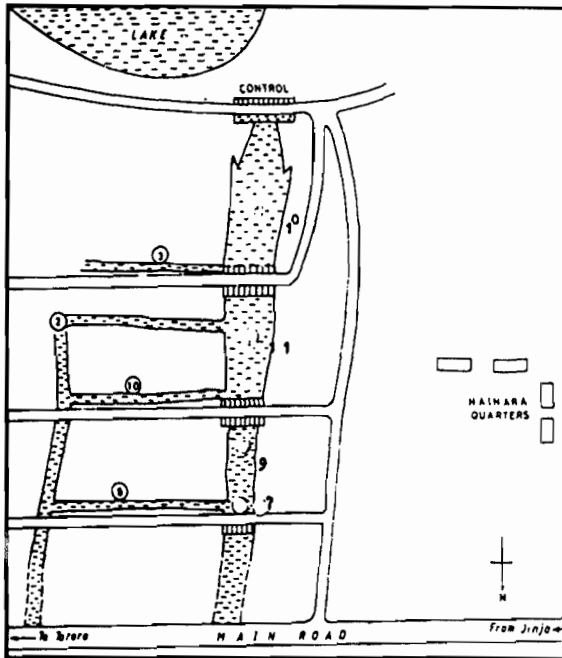


Fig. 3. The Southern part of Kibimba Rice Scheme.

DISCUSSION

Our findings in Entebbe Peninsula about the snail vectors for gastro-intestinal schistosomiasis, revealed that the vectors present cannot pose a very serious risk of the disease. Similarly, the cleanliness of urinal bilharzia vectors is another sign of relief. Intestinal schistosomiasis was a big worry more than two decades ago. PRENTICE, PANESAR and COLES, 1970; PRENTICE, 1972). The use of *Phytolacca*, (Endod in Ethiopia), for the control of schistosomiasis dates back to 1964 (LEMA, 1965; 1972). The potential use of Plant Molluscicides against Bilharzia was reviewed a decade ago in a meeting of the UNDP, World Bank/WHO Special Programme for Research and Training in Tropical Diseases Scientific Working Group on Plant Molluscicides (MOTT, 1987). It was felt that there was need to assess not only the molluscicidal effects but also the ecotoxicity of the plant under test to non target organisms and also the user.

LAMBERT *et al.* (1991) were commissioned by IDRC to undertake a comprehensive toxicological study of *Phytolacca* or Endod. Their findings were that the plant was not dangerous to the user with the exception of slight irritation of the eyes and nose. The plant was found to kill the water fleas, *Daphnia* and related organisms. Juvenile fish were also found to be affected. Algae, on the other hand, suffered slightly.

Our observations in Kibimba Rice fields also showed that fish fry would get intoxicated at the beginning of the applications; but as water continued to flow, they would recover to normality.

The 100% snail kills observed makes us advocate for the use of *Phytolacca dodecandra* against schistosomiasis vectors wherever they occur.

ACKNOWLEDGEMENTS

We are grateful to Dr. Aklilu, the UNICEF Country representative, for financial support and provision of Endod variety E44. Dr. Lemmisch of the Royal Danish School of Pharmacy, Denmark is acknowledged for the HPLC fingerprints. Our gratitude goes to the Town Clerk of Entebbe for permission to conduct snail surveys in the peninsula. We recognize the co-operation and assistance of RC Chairmen in Kibimba and all the workers.

REFERENCES

- Lema, A., (1965). A preliminary report on the the molluscicidal property of Endod (*Phytolacca dodecandra*) Ethiopia Med. J. 3, 187-190.
- Lema, A., (1972). Report concerning studies on the Molluscicidal Properties of Endod (*P. dodecandra*). Project LSU-8972, Stanford Research Institute, Menlo CA.
- Lambert, J.D.H. *et al* (1991). Endod: Safety Evaluation of Plant Molluscicide. *Regulatory Toxicol & Pharmacol* 14. 189-201.4.
- Lakwo, T. L. & E.I. Odongo-Aginya, (1991). The intensity of *Schistosoma mansoni* in the Fishing village of Bugonga and Kitubulu in Entebbe Peninsula, Uganda. *E. Afr. Med. J.*, 68 (5), 372 - 377.
- Mott, K.E. (1987). *Plant Molluscicides*. Wiley, Chichester, England.
- Odong-Aginya, E. I. & C. Mugisha, (1987). The Prevalence of *Schistosoma mansoni* in migrants from endemic areas living in the Entebbe Peninsula, Uganda, *E. Afr. Med. J.*, 6 (9) 571 - 579.
- Prentice, M.A., T.S. Panesar and G.S. Coles (1970). Transmission of *Schistosoma mansoni* in a large body of water. *Ann. trop. Med. Parasit.*, 64 (3), 339 - 348.
- Prentice, M.A., (1972). Distribution prevalence and transmission of Schistosomiasis in Uganda. *Ug. Med. J.* 1, 5.