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## Traditional healing of schistosomiasis, a neglected tropical disease in the Tonkpi region (Côte d'Ivoire)

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### Abstract

The study aims to reveal traditional knowledge in the healing of schistosomiasis in order to eventually propose an alternative treatment. A semi-structured interview with 120 Traditional Medicine Practitioners (TMP) was carried out. The TMP, mostly men (72.5%) have a good level of knowledge of the pathology. About 73% of these TMP are naturotherapists and speak mainly the local language Yacouba (90%). It is known in the local dialect by several names, the most cited of which is "Goudô-youa" which translates as "fat belly disease". The plants, with 40 species listed and divided into 26 botanical families, are mainly used in the traditional treatment of schistosomiasis. The leaves (37%) are the most organ used and the decoction (35.5%) method as the most requested method in the preparation of traditional therapy. Therefore, the medicinal drink taken orally (75%) is the most recommended mode of administration. These results constitute a valuable database for phytochemical and pharmacological research with the aim of proposing a therapeutic alternative based on plants.

**Keywords:** Traditional knowledge, medicinal plants, schistosomiasis, neglected tropical disease, ethnobotany, Tonkpi, Cote D'Ivoire

### 1. Introduction

Schistosomiasis commonly called bilharzia is one of the most prevalent parasitic diseases in the world (Zoni *et al.*, 2016) [29]. It is a water-dependent Neglected Tropical Disease (NTD) endemic to tropical and intertropical regions. It is caused by sex-separated flatworms called bilharzias or schistosomes (Adou-Bryn *et al.*, 1997) [1]. Schistosomiasis has major health and socio-economic repercussions in developing countries, where it constitutes a major public health problem (Tchunte *et al.*, 2013) [24] and poses an obstacle to achieving the Sustainable Development Goals (living good health and promote well-being). In Côte d'Ivoire, parasitological surveys results have shown that urinary and intestinal schistosomiasis remain endemic with unfavorable hygiene and sanitation conditions despite control efforts (Assare *et al.*, 2014) [3]. So far, the effective control method remains chemoprevention (CP), which consists of distributing on a large scale, at regular intervals and to the entire population, safe drugs of proven quality, alone or in combination (Aubry and Gaüzère, 2020) [4]. Praziquantel (PZQ) remains the drug recommended by the WHO in the strategy to fight against this pathology (WHO, 1985) [27]. However, evidence of emerging drug resistance and low efficacy of PZQ has been reported in Egypt and Senegal (Cioli *et al.*, 2008) [9]. Added to this are the serious adverse effects, the prolonged treatment duration and the complexity of the drug administration methods (Pink *et al.*, 2005) [20]. Therefore, to overcome all these constraints, traditional herbal medicine offers itself as a promising alternative to be explored and an asset to the poor communities affected by NTD. It is in this context that we have embarked on this research work, the objective of which was to reveal the traditional knowledge in the treatment of schistosomiasis in order to eventually propose a therapeutic alternative.

### 2. Materials and methods

#### 2.1 Study area

The study took place in the Tonkpi Region (Mountains District) located in the western part of

Côte d'Ivoire. It is made up of three health districts in alphabetical order as follows: Danané, Man and Zouan-Hounien. The selection criteria for the Tonpki Region were, among others, the high prevalence of schistosomiasis (1 to 60%) (MSHP, 2020) [18], the humidity linked to the mountain climate, the hydrography, irrigation schemes and the vegetation (Poda *et al.* 2004; Yapi *et al.*, 2014) [21, 28] that would be favorable to the contraction and spread of this neglected tropical disease.

## 2.2 Ethnobotanical surveys

A survey of Traditional Medicine Practitioners (TMP) was carried out involving 40 interviewees per Health District, i.e. a total sample, N = 120 interviewees. The selection of TMP was done using the “snowball” technique, which consists of gradually identifying new resource persons with the help of those already met (Foro *et al.*, 2012; Noy, 2008) [15, 19]. A list of the heads of the local association of traditional medicine practitioners in the region was obtained from the services of the National Program for the Promotion of Traditional Medicine (PNPMT). From this list, the first Head of the association is contacted and it is the latter who directs the research team to his peers, based on the latter's ability to treat schistosomiasis.

The collection of information for this work was carried out in two stages by semi-structured interviews. First, information concerning the traditional knowledge was collected using a questionnaire addressed to Traditional Medicine Practitioners (Fah *et al.*, 2013) [14]. They were questioned about traditional knowledge and practices in the treatment of schistosomiasis. Then, the “tell and show” technique was used when administering the questionnaire. Indeed, after description and explanation of the manifestation of the diseases, images of people with symptoms contained in a photo library were shown to the TMP for visual recognition.

In addition, different plantations were visited (Cunningham, 2002) [10] for a collection of medicinal plant that was used to develop a reference herbarium. Then a photo of the plants proposed by the practitioners were taken.

When the respondent looked too old or busy, after the interview, the knowledge of a guide-interpreter made it possible to collect samples and a second visit was made to the TMP for validation of the collections according to the Diatta *et al.* (2013) [11] method.

The name of the plants often being given in the local language; the identification of the plant specimens was made by a Botanist-systematician on the ground. A confirmation of certain plant names was carried out in comparison with the herbaria of the National Floristic Center of the Félix Houphouët-Boigny University and the Swiss Center for Scientific Research.

## 2.3 Data processing and analysis

Two types of analyzes were carried out in this study, with regard to the nature of the data collected. The quantitative data collected from the questionnaire were entered using EpiData 3.1 software, then compiled using SPSS 20.0 software for coding and performing statistical analyses. On the other hand, the qualitative data focused on the perception and ethnotaxonomy attributed to the pathologies and species mentioned.

## 3. Results and discussion

### 3.1 Profile of respondents

A total of 120 TMP were interviewed, 40 practitioners per

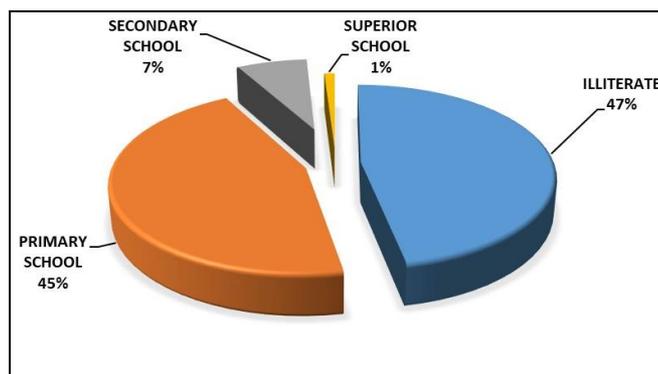
health district. The majority of respondents were men (87) that is 72.5% against 33 women about 27.5%. The higher number of men than women could be explained due to the inability of women to go to the mountainous forest to collect samples or due to their heavy occupation both field work and household chores, although they possess the same traditional knowledge.

Table 1 presents the distribution of the age groups of the respondents. Although all groups are concerned, practitioners aged between 55 and 75 are the most represented with a rate of (56.7%). Indeed, knowledge of the uses of medicinal plants and their properties is generally acquired following a long experience accumulated and transmitted from one generation to another. The experience accumulated with age is the main source of information. Above all, it has been recognized that in Africa, it is the wise ones, that is to say the aged people, who best hold traditional therapeutic knowledge (Dougnon *et al.*, 2016) [12]. Furthermore, according to Mbuyi *et al.* (2019) [17], the art of healing is age-related. The aged ones are trusted by those around them and enjoy a good reputation as healers in their living environment.

**Table 1:** Distribution of TMP according to age group

Age	Percentage (%)
[18-35 yrs]	3.3
[35-55 yrs]	37.5
[55-75 yrs]	56.7
> 75 yrs	2.5

In this health region, the majority of TMP have no educational qualification (illiterate) with a rate of 47%, followed by those with a primary school level with a rate of 45% (Figure 1). This high percentage reflects the low level of education of the local population. The majority of people surveyed (86%) inherited their skill from their parents or grandparents. This is confirmed by the work of Vwakyanakazi and Petit (2004) [26] showing that ancestral heritage remains dominant because traditional medicinal knowledge is not taught in schools, which therefore allows family or clan ties to predominate.



**Fig 1:** Spectrum of educational levels

### Ethnolinguistic structure

The Yacouba and the Toura of the Dan ethnic group were surveyed. Among these ethnic groups interviewed, the Yacouba dominates (90%).

### Level of knowledge of schistosomiasis

The results of the study revealed that all of the respondents have a good knowledge of schistosomiasis. Among them, 71.7% recognize the pathology and other associated symptoms, while 28.3% recognize only one symptom

(swelling or bloating of the stomach). These results are justified by various names of schistosomiasis in different languages. About 77% of TMP claim to treat children more often than adults. About 98.8% recognize that schistosomiasis is transmitted via a vector found in water and the main area of transmission remains the river as shown in figure 2. This figure shows a group of children bathing in a river at Danané (risk factor for contracting schistosomiasis). Indeed, according to Uniting to Combat NTDs (2016) [25], schistosomiasis (also called bilharziasis) is a disease that develops when a person comes into contact with water contaminated by small freshwater snails carrying the parasites responsible for the disease, which penetrates the skin and moves through the body. The disease mainly affects the urinary and intestinal system, causing a chronic poor state of health that can lead in some cases to death.



Fig 2: Group of children bathing in a river

### Traditional Medicine Practitioners Profession in the Tonkpi region

TMP are essentially naturotherapists (73%) and phytotherapists (12.5%). Among the remaining 14.5%, some practice other occupation for living, which tends to demonstrate that the art of healing alone is not enough to ensure the survival of traditional healers, as indicated by Mbuyi *et al.* (2019) [17]. Table 2 presents the different occupations of TMP.

Table 2: Different occupations of TMP of Tonkpi

Occupation	Percentage (%)
Naturotherapist	73
Phytotherapist	12.5
Farmer	5
Traditional healer	3
Traditional practitioner/Naturotherapist	2.5
Herbalist/Naturotherapist	1
Housewife	1
Psychotraditherapist	1
Fortune teller/Healer/Naturotherapist	1

### 3.2 Knowledge of medicinal plants

About 40 species of medicinal plants are used in the traditional treatment of schistosomiasis and are divided into 26 botanical families. The Fabaceae (16.5%) and Solanaceae (11.3%) are the most dominant families. The dominance of the Fabaceae could be explained by the grouping, with the phylogenetic classification, of three subfamilies, the Mimosoideae, the Caesalpinioideae and the Faboideae or Papilionoideae, into a single family: the Fabaceae (APG III, 2009; Chase and Reveal, 2009) [2, 8].

The leaves (37%), the trunk bark (21%) followed by the roots (18%) are the most used organs in the preparation of

traditional therapeutic recipes (Figure 3). The high frequency of use of leaves can be explained by the ease and quickness of cutting the leaves and bark, but also by the fact that the leaves are the site of photosynthesis and the storage of secondary metabolites responsible for the properties of the plant (Bigendako-Polygenis and Lejoly, 1990; Bitsindou, 1986; Diatta *et al.*, 2013) [6, 7, 11]. About 90% of the various organs are harvested in the forest rather than in the immediate environment (10%).

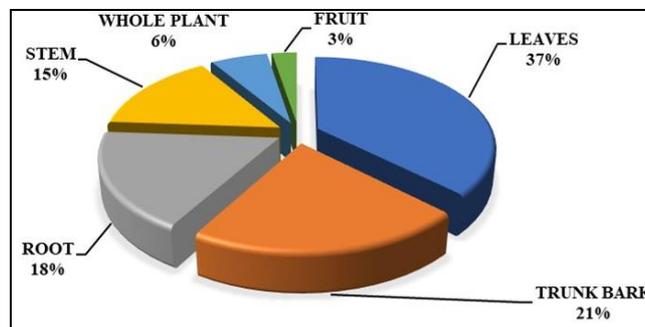


Fig 3: Spectrum of organs used

In addition to plants, a fungus has been identified in the treatment of schistosomiasis (Figure 4). This species is called *Daldinia concentrica* (Xylariaceae). Several studies including those of Thangaraj *et al.* (2017) [23] revealed the therapeutic use of *Daldinia concentrica* by the tribes of Sirumalai Hills (India).



Fig 4: *Daldinia concentrica* (Xylariaceae)

The decoction (35.5) is the most commonly used mode of preparation (Figure 5). Next comes grinding (26.2%) which consists of grinding or crushing herbal drugs. The predominance of the decoction could be explained by the fact that it makes it possible to extract the most active ingredients and also to attenuate or cancel the toxic effect of certain therapeutic recipes (Bene *et al.*, 2016; Salhi *et al.*, 2010) [5, 22]. In addition, the decoction obtained helps to warm the body. Medicated recipes are 98.8% prepared with water. Indeed, this solvent, having the ability to extract a large group of phytochemicals, is more easily accepted by all, unlike alcohol-based recipes (1.2%). The alcohol could be either palm wine or the traditional liquor commonly called "Koutoukou". About 96% of the organs are used fresh.

Indeed, most plants are found in the practitioner's environment and therefore not necessary to keep them for long unless the plant has become rare to find and sometimes far from the user. However, in some cases, preparations require dried plant organs (4%). In major cities, for example, most drugs are generally sold in dried form.

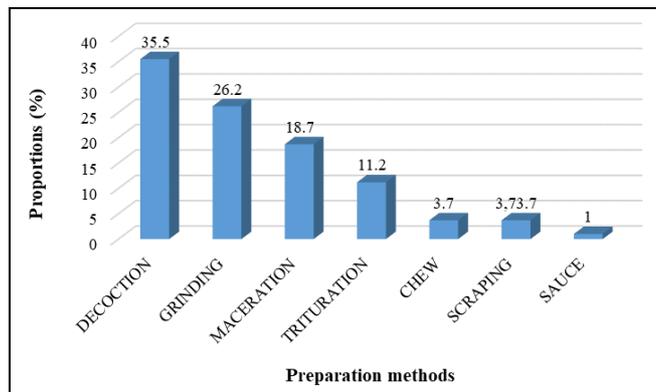


Fig 5: Histograms of traditional medicine preparation methods

Four administration routes were recorded (Figure 6). It appears that the oral route (75%) is the most used in the healing of schistosomiasis. This result is similar to that of Kadri *et al.* (2018) [16] whose study focused on the ethnobotanical study of some medicinal plants in a hyper-arid region of southwestern Algeria

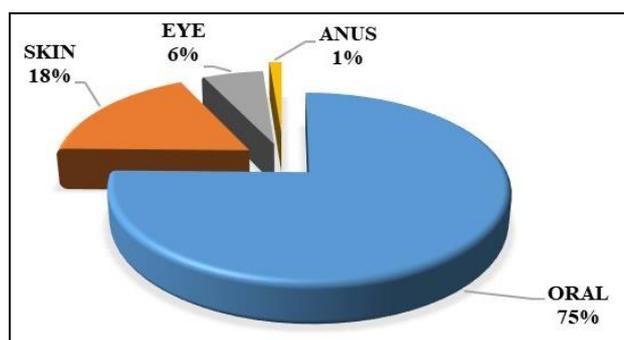


Fig 6: Spectrum of traditional recipe administration routes

### 3.3 Main symptoms of schistosomiasis

The main symptoms recognized by the practitioners interviewed are swelling or bloating of the stomach (33%), the presence of blood in the urine (23%), itching (17%), pain during urinating (12%) and fever (10%). Other symptoms represent a smaller proportion (5%).

### 3.4 Ethnotaxonomy of schistosomiasis in the Tonkpi region

In the Tonkpi region, the Yacoubas designate schistosomiasis by various terms, the main one being "Goudô-youa" (65%). This first name is composed of two terms "Goudô" which means "big belly" and "youa" which means "disease" in this language. Which could mean "fat belly disease". Just like the previous one, the other names are related to the different symptoms observed. This is the case of "Plouguignon", "Sôhò; Wê-sanhan or Woueyantin", "Yohoun" and "Goudô-tin" which designate respectively "big belly disease", "bloating", "pissed blood", "itching of the body", "big red belly".

In Toura, schistosomiasis is referred to as "Gué" and "Tanhan" to mean respectively "banana" and "growth problem" respectively.

### 3.5 Associations: plants, ingredients (adjuvants) and excipients

Medicinal recipes are prepared from mainly herbal drugs. In this study, monospecific recipes (95%) predominate. Moreover, this predominance is to the advantage of patients. Indeed, associations of plants, poorly matched, are sometimes dangerous. In Africa, about 30% of fatal accidents are due to the use of mixtures (El-Said *et al.*, 1969) [13]. It should be noted, all the same that practitioners involve in medicinal preparations, very often add other plants (multi-specific recipes, i.e. 5%), ingredients or adjuvants to make the recipe more effective and excipients to facilitate the shaping of the traditional medicine. In Tonkpi, the black termite mound or "Zênêkpô" (in Yacouba) is often added to the treatment of schistosomiasis which can play both an excipient and an adjuvant role. When this ingredient is part of the therapeutic recipe, the dermal route is used (application on the stomach). This is also the case of "white kaolin" or white clay or "Yôpouh" (Yacouba). An adjuvant by the name of *Xylopi aethiopica* (Dunal) A. Rich. (Annonaceae) or Guinea pepper or "Zohoga" (Yacouba) is in great demand in traditional medicine.

### 3.6 Dosage and duration of treatment

Traditional therapies are mainly taken once a day (46.4%) and until recovery (85.6%).

### 4. Conclusion

This study shows that schistosomiasis is well known by the TMP of Tonkpi. Medicinal plants are mainly used in the traditional treatment of schistosomiasis. About 40 medicinal species have been identified in the treatment of pathology. The leaves are the organs most widely used in the preparation of traditional therapeutic recipes. The decoction and oral administration, is the most common method of preparation and administration route respectively. Traditional knowledge in the treatment of schistosomiasis has been revealed and the data collected constitutes a database for biological studies which will eventually make it possible to propose a therapeutic alternative based on plants.

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### 6. References

1. Adou-Bryn KD, Allah-Kouadio E, Penali LK, Ouhon J, Kone M. Prévalence des porteurs d'oeufs de *schistosoma haematobium* chez des patients hématuriques en Côte d'Ivoire. Médecine d'Afrique Noire. 1997;44(8/9):440-443.
2. APG III. The Angiosperm Phylogeny Group, « An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III », Botanical Journal of the Linnean

- Society. 2009;161(2):105-121.
3. Assare RK, Knopp S, N'guessan NA, Yapi A, Tian-Bi Y-NT, Yao PK *et al.* Sustaining control of schistosomiasis mansoni in moderate endemicity areas in western Côte d'Ivoire: a SCORE study protocol. *BMC Public Health*. 2014;14:1290-1301.
  4. Aubry P, Gaüzère BA. *Maladies tropicales négligées – Actualités*. Médecine tropicale, Centre René Labusquière, Institut de Médecine Tropicale, Université de Bordeaux, 33076 Bordeaux, France, 2020, 7p.
  5. Bene K, Camara D, Fofie N'GBY, Kanga Y, Yapi AB, Yapo YC, *et al.* Étude ethnobotanique des plantes médicinales utilisées dans le Département de Transua, District du Zanzan (Côte d'Ivoire) *Journal of Animal & Plant Sciences*. 2016;27(2):4230-4250.
  6. Bigendako-Polygenis MJ, Lejoly J. *La pharmacopée traditionnelle au Burundi*. Pesticides et médicaments en santé animale, Presses universitaires Namur, Burundi, 1990, pp 425-442.
  7. Bitsindou M. Enquête sur la phytothérapie traditionnelle à Kindamba et Odzala (Congo) et analyse de convergence d'usage des plantes médicinales en Afrique centrale. *Mem. Doc (inéd.)*, Univ. Libre de Bruxelles, 1986, 482p.
  8. Chase MW, Reveal JL. «A phylogenetic classification of the land plants to accompany APG III», *Botanical Journal of the Linnean Society*. 2009;161:122-127.
  9. Cioli D, Valle C, Angelucci F, Miele AE. Will new antischistosomal drugs finally emerge? *Trends in Parasitology*. 2008;24:379-382.
  10. Cunningham AB. *Applied ethnobotany: People, wild plant use and conservation*. People and Conservation Manuel, Earth scan publications Ltd, United States of America, 2002, 300p.
  11. Diatta CD, Gueye M, Akpo LE. Les plantes médicinales utilisées contre les dermatoses dans la pharmacopée Baïnouk de Djibonker, région de Ziguinchor (Sénégal). *Journal of Applied Biosciences*. 2013;70:5599-5607.
  12. Dougnon TV, Attakpa E, Bankolé H, Hounmanou YMG, Dèhou R, Agbankpè J, *et al.* Etude ethnobotanique des plantes médicinales utilisées contre une maladie cutanée contagieuse: La gale humaine au Sud-Bénin. *Revue CAMES: Série Pharmacopée et médecine traditionnelle africaine*. 2016 ;18(1):16-22.
  13. El-Said F, Sofowora E, Malcolm A, Hoffer A. An investigation into the efficacy of *Ocimum gratissimum* L. (Lamiaceae) as used in Nigeria native medicine. *Planta Medica*. 1969;17:150-165.
  14. Fah L, Klotoé JR, Dougnon V, Koudokpon H, Fanou VBA, Dandjesso C, *et al.* Étude ethnobotanique des plantes utilisées dans le traitement du diabète chez les femmes enceintes à Cotonou et Abomey-Calavi (Bénin). *Journal of Animal & Plant Sciences*. 2013;18(1):2647-2658.
  15. Foro A, Champagne F, Denis J-L. L'approche multisectionnelle du programme VIH/sida en Haïti : une revue critique des acteurs impliqués dans sa gouvernance, *Revue Pratiques et Organisation des Soins*. 2012;43:131-141.
  16. Kadri Y, Moussaoui A, Benmebarek A. Étude ethnobotanique de quelques plantes médicinales dans une région hyper aride du Sud-ouest Algérien « Cas du Touat dans la wilaya d'Adrar ». *Journal of Animal & Plant Sciences*. 2018;36(2):5844-5857.
  17. Mbuyi KS, Kalunga MR, Kalonda ME, Cimanga CCB, Numbi WIE, Kahumba BJ, *et al.* Aperçu ethnobotanique de plantes réputées antipaludéennes utilisées dans la ville de Lubumbashi et ses environs, dans le Haut-Katanga en RD Congo. *Ethnopharmacologia*. 2019;61:75-84.
  18. MSHP. Ministère de la santé et de la lutte contre le sida. *Plan directeur national de lutte contre les maladies tropicales négligées de Côte d'Ivoire 2016-2020*. Abidjan, Côte d'Ivoire, 2020, 141p.
  19. Noy C. Sampling knowledge: the hermeneutics of snowball sampling in qualitative research. *International Journal of Social Research Methodology*. 2008;11(4):327-44.
  20. Pink R, Hudson A, Mouriès M-A, Bendig M. Opportunities and Challenges in Antiparasitic Drug Discovery. *Nature Reviews Drug Discovery*. 2005;4:727-740.
  21. Poda JN, Traore A, Sondo BK. L'endémie bilharzienne au Burkina Faso. *Bulletin de la Société de Pathologie Exotique*. 2004;97(1):47-52.
  22. Salhi S, Fadli M, Zidane L, Douira A. Études floristique et ethnobotanique des plantes médicinales de la ville de Kénitra (Maroc). *Lazaroa*. 2010;31:133-146.
  23. Thangaraj R, Raj S, Renganathan K. Wound healing effect of king alferd's mushroom (*Daldinia concentrica*) used by tribes of Sirumalai hills, Tamilnadu, India. *International Journal of Pharmacy and Pharmaceutical Sciences*. 2017;(9)7:162-164.
  24. Tchunte TLA, Noumedem CD, Ngassam P, Kenfack CM, Gipwe NF, Dankoni E, *et al.* Mapping of schistosomiasis and soil-transmitted helminthiasis in the regions of Littoral, North-West, South and South-West Cameroon and recommendations for treatment. *BMC Infectious Diseases*. 2013;13:602-614.
  25. *Uniting to Combat NTDs*. La Côte d'Ivoire et les maladies tropicales négligées. Taux de couverture des traitements de masse pour les mtn, 2016, 12p.
  26. Vwakyankazi M, Petit P. Bunganga ya mici: guérisseurs et plantes médicinales à Lubumbashi : rapport des recherches effectuées durant la douzième session des travaux de l'Observatoire, octobre 2003-mars 2004, Université de Lubumbashi, Lubumbashi, Observatoire du changement urbain, Coopération universitaire au développement, 2004, 125p.
  27. WHO. The control of schistosomiasis: report of a WHO expert committee. *WHO Technical Report Series*. 1985;728:1-114.
  28. Yapi G, Traore FD, Coulibaly D, Tia E. Etude contributive à la connaissance des populations de simulies dans la commune de Bouaflé, Centre-Ouest de la Côte d'Ivoire. *International Journal of Biological and Chemical Sciences*. 2014;8(6):2540-2551.
  29. Zoni AC, Catalá L, Ault SK. Schistosomiasis Prevalence and Intensity of Infection in Latin America and the Caribbean Countries, 1942-2014: A Systematic Review in the Context of a Regional Elimination Goal. *PLOS Neglected Tropical Diseases*. 2016;10(3):1-22.