Mini Review

Open Access Journal of
Biomedical Science
ISSN: 2690-487X

Aqueous Extracts: An Alternative in the Control of the Intermediate Host of Schistosomiasis

Keyla Nunes Farias Gomes[1,2]*, José Augusto Albuquerque dos Santos[2] and Robson Xavier Faria[1,3]

[1]*Universidade Federal Fluminense-Programa de Pós-graduação em Ciências e Biotecnologia, Instituto de Biologia, Campus Valonguinho, Brasil*

[2]*Laboratório de Avaliação e Promoção da Saúde Ambiental, Instituto Oswaldo Cruz, Brasil*

[3]*Laboratório de Toxoplasmose e outras Protozooses, Instituto Oswaldo Cruz, Brasil*

ABSTRACT

Schistosomiasis is a parasitic disease caused by worms of the genus Schistosoma. Some substances are used to control the intermediate host, being a strategy to prevent the risk of infection and re-infection of the disease. According to the WHO, the recommended substance is Niclosamide; however, it presents toxicity in non-target organisms. Aqueous extracts are being increasingly studied as a potential molluscicide in combating schistosomiasis. The aqueous extract of *Moringa oleifera* flowers was used to evaluate the molluscicidal activity in *Biomphalaria glabrata*. This extract caused lethality in adult molluscs, obtaining a lethal concentration 50 = 2.37 mg/mL. In the second aqueous extract, fruits of the species Randia nilotica were used on molluscs of the species *Biomphalaria pfeifferi* and *Bulinus truncatus*. These extracts showed molluscicidal activity on both molluscs used in the experiments. In the third aqueous extract, they used leaves of the species *Anagallis arvensis* to test the molluscicidal action on molluscs of the species *Biomphalaria alexandrina*. It was possible to obtain lethal concentrations, with lethal concentration 50 = 37.9 mg/L and lethal concentration 90 = 48.3 mg/L. In the fourth aqueous extract, they used the seeds of the species *Moringa oleifera* to evaluate the molluscicidal activity in molluscs of the genus Bulinus. These seeds showed molluscicidal action, but they were not in accordance with what is recommended by the WHO. According to the experiments carried out with aqueous extracts, it can be seen that there are many studies using these methodologies as a form of control for schistosomiasis. Some criteria are essential to obtain a low-cost aqueous extract. It is essential to emphasize that this methodology could be used by the government to control the intermediate host of schistosomiasis in less favored areas, where the population itself would have access to inputs using accessible technological resources.

KEYWORDS: Schistosomiasis; Natural products; Aqueous extracts; Molluscicide activity; Molluscs

INTRODUCTION

Schistosomiasis is a parasitic disease caused by worms of the genus Schistosoma Matos et al. [1]. According to the World Health Organization (WHO) more than 250 million people are infected in 76 countries, resulting in about 200 thousand deaths per year Pereira et al. [2].

Some substances are used to control the intermediate host may interrupt the parasite's life cycle, being a strategy to prevent the risk of infection or reinfection in the definitive host Pereira et al. [2]. Copper-derived compounds have been used due to their molluscicidal action on adult mollusks and embryos. However, these compounds are absorbed by soil and organic materials, causing contamination Matos et al. [1]. The substance recommended by the WHO is Niclosamide. However, this substance has high cost

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Address for correspondence: Keyla Nunes Farias Gomes, Universidade Federal Fluminense-Programa de Pós-graduação em Ciências e Biotecnologia, Instituto de Biologia, Campus Valonguinho, Brasil

Received: July 02, 2021 **Published:** July 12, 2021

How to cite this article: Keyla Nunes Farias , José AAdosS, Robson Xavier Faria. Aqueous Extracts: An Alternative in the Control of the Intermediate Host of Schistosomiasis. 2021- 4(3) OAJBS.ID.000302. **DOI:** 10.38125/OAJBS.000302

and toxicity in non-target organisms, such as fish and amphibians Matos et al. [1]; SÁ et al. [3].

Aqueous extracts are studied and described as a potential molluscicide to combat schistosomiasis disease Pereira et al. [2]. Most plants are easy to grow, have high profitability, and are widely distributed, making them cheaper, safer and with a high level of degradation Ibrahim [4]. Given this scenario, the aqueous extract has become an economical alternative, being a possible government method for the less favored populations to prevent this neglected disease.

The aqueous extract of the flowers of the *Moringa oleifera* of the Moringaceae family was used to evaluate the molluscicidal activity in *Biomphalaria glabrata*. An evaluation was realized to discover the possible compounds in the aqueous extract of the flower. In this investigation, alkaloids, tannins, saponins, steroids, and triterpenes were found. The B. glabrata mollusks were exposed to the aqueous extract for 24 h. It was possible to calculate the lethal concentration 50, being 2.37 mg/mL in the results. Lethal concentration 90 has not been calculated. According to the observed results, the aqueous extract of the flower of *M. oleifera* caused lethality for adult mollusks of the species *B. glabrata* and delayed the development of their embryos. However, in the toxicity test performed with Artemia salina, it was possible to notice that this extract is possibly toxic to non-target organisms Rocha-Filho [5].

Ebodi [6] used fruits of *Randia nilotica*, a plant located in Western Sudan, in their aqueous extract. Different dilutions were performed to test the molluscicidal activity against the species *Biomphalaria pfeifferi* and *Bulinus truncatus*. Filtered and unfiltered extracts were prepared for evaluating the molluscicidal action in the 24 h period.

The filtered extract on *Biomphalaria pfeifferi* obtained a lethal concentration of 50 and 90, with 53.33 ppm and 97.95 ppm, respectively. The LC50 = 46.24 ppm and CL90 = 85.31 ppm were obtained in the unfiltered extract. The effect of the filtered aqueous extract in *Bulinus truncatus* was 46.56 ppm for the lethal concentration 50 and 84.33 ppm for the lethal concentration 90. The unfiltered aqueous extract obtained CL50 = 39.63 ppm and CL90 = 67.61 ppm. According to the results obtained, it can be concluded that the unfiltered aqueous extract was more potent than the filtered extract.

This effect may be related to the debris contained in the unfiltered extract continuously in contact with the snails. The *Randia nilotica* species has a wide distribution and needs a simple application to be used by the population itself.

Ebodi [6] used the leaves of the species *Anagallis arvensis* to make the aqueous extract and test the molluscicidal action on mollusks of the species *Biomphalaria alexandrina*. It was possible to obtain lethal concentrations 50 and 90, namely: 37.9 mg/L and 48.3 mg/L, respectively. It can be observed that the lethal concentrations are following the recommended by the World Health Organization (WHO), being equal to or less than 100 ppm for crude extracts. This aqueous extract of *A. arvensis* caused changes in biological, hormonal and histopathological aspects in mollusk *B. alexandrina*.

Nnamdi et al. [7] used the seeds of the species *Moringa oleifera* to evaluate the molluscicidal activity of mollusks of the genus Bulinus. The mollusks were exposed for 24 h in the aqueous extract of the seeds of *M. oleifera*. According to the results obtained with mollusks of the genus Bulinus collected in the Senatorial Omogho zone, it was possible to obtain lethal concentrations 50 and 90, 436.5 ppm, and 794.3 ppm, respectively. Thus, the aqueous extract of the seeds of *M. oleifera* is not following the value recommended by the WHO.

Among the works mentioned earlier, it is possible to verify the lack of recommendations in the methodologies used for the preparation of aqueous extracts. There are distinct methodologies reported, such as infusion, decoction, maceration, where these can be filtered or not. The lack of standardization difficulties the methodologies comparison to study a possible extract with a molluscicidal potential.

CONCLUSION

According to the experiments carried out with aqueous extracts, it can be observed that many studies are using these methodologies as a form of control for schistosomiasis disease. Interestingly, the plant part used to interfere in extracts mechanism to inhibit the embryo development or lethality in different mollusks species. Previous research is necessary to know the plant species that is intended to be used, as it needs to be easy to cultivate, widely distributed, and has a good development during the year. It is suggested to use the leaves so as not to eliminate the specimen. These criteria are essential to obtain an aqueous extract at a low cost, reducing the difficulty of use. Considering the points covered, the use of natural products, in the form of aqueous extracts, can be a way to obtain a possible compound with a molluscicidal action that is effective and with low toxicity for non-target organisms. It is essential to point out that this methodology could be used in a governmental way to control the intermediate host of schistosomiasis in less favored areas, where the population itself would have easier access to inputs using accessible technological resources.

ACKNOWLEDGMENT

To the Graduate Program in Science and Biotechnology (PPBI) - Fluminense Federal University (UFF).

To the Laboratory for Assessment and Promotion of Environmental Health (LAPSA) - Instituto Oswaldo Cruz (FIOCRUZ). Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - CAPES.

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