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Control of Schistosomiasis through Reduction of its Intermediate Host: Biological and Chemical Strategies

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EDITORIAL

Schistosomiasis is a severe widespread neglected tropical parasitic disease and is considered the second most prevalent tropical disease in the world after malaria. This disease needs an intermediate host to develop its infective stage [1]. Estimates show that at least 206.4 million people are infected with Schistosomiasis from 78 countries in 2016. Intestinal schistosomiasis is caused by Schistosoma mansoni and is transmitted by the freshwater snails of *Biomphalaria* genus, which are the intermediate hosts [2].

Several strategies have been used to control schistosomiasis through controlling the intermediate host. Snail control is based on the elimination or reduction of its population density below a certain critical threshold will lead to reduce the transmission [3]. This was achieved by:

Biological control

Biological control involves usage of other organisms or some medicinal plants that have a molluscicidal activity to affect the snail density. Several species can be used including bacteria, fungi, protozoa, amphibia, fish and birds have been considered as potential competitors or predators. Also, the planorbid snail *Helisoma duryi* was proved to be refractory to infection with Schistosoma mansoni and *S. haematobium* and possess the ability to replace and took over the role of *B. alexandrina* and *B. truncatus* but not as transmitter of schistosomes [4].

Using medicinal plants as molluscicide is a promising choice for controlling *B. alexandrina* snails, as they are cheaper, safer and having a high level of degradability [5]. The bioactive molecules in these medicinal plants are saponins, lectins and volatile oils [6]. Recent studies indicated that some medicinal plants like *Moringa oleifera* [2], *Panicum repens, Solanum nigrum, A. arvensis, Sesbania sesban, Haplophyllum tuberculatum* expressed high molluscicidal activity against Schistosome intermediate snails [7]. Piper species (*Piper diospyrifolium, P. cumanense* and *P. gaudichaudianum*) are candidate alternatives to control the transmission of schistosomiasis due to their benzoic acid derivative and three flavokawains [8].

Chemical control

Controlling of snail populations with chemical molluscicides was used since 1920, by using Copper compounds (copper sulfate: $CuSO_4$) as a killing agent of Australorbis galabratus snails, the intermediate host of *S. mansoni*. Also, Niclosamide (Bayluscide) proved to have an efficient molluscicidal effect against various types of snails at a concentration from 0.2 to 1 ppm but [9] stated that this pesticide accumulated in the muscles of fishes and are not destroyed by freezing or cooking of the fishes and considered as teratogenic material.

Also, Insecticides like the chlorinated hydrocarbon and the organophosphorus insecticides, Fungicides like Isoprothiolane and herbicides like glyphosate isopropylammonium, butralin and Pendimethalin [10] were also proved to have a molluscicidal effect.

These manufactured molluscicides are an imperative part of the incorporated schistosomiasis control programs [10], but because they have high cost and being poisonous to creatures of land and water [11], have stimulated interest to find suitable molluscicides that did not affect the non-target organisms [12,13] (Figure 1).

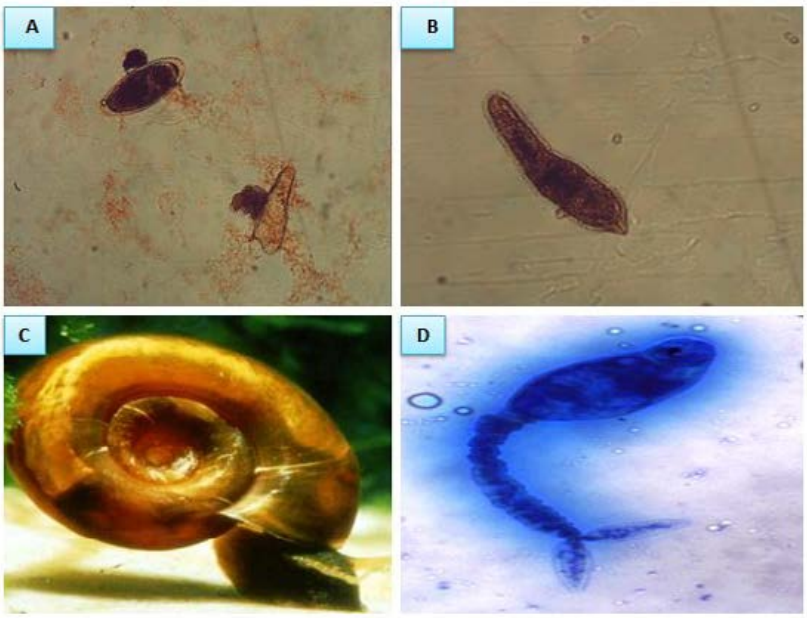

Figure 1: Photographs of (A) Eggs of *Schistosoma mansoni* and miracidia will hatch, (B) Miracidia released in water, (C) *Biomphalaria alexandrina* snails, (D) Cercaria of *Schistosoma mansoni*

CONFLICT OF INTEREST

All authors declare that there is no conflict of interest.

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