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Potentiality of *Achatina fulica* Bowdich, 1822 (Mollusca: Gastropoda) as intermediate host of the *Angiostrongylus costaricensis* Morera & Céspedes 1971

Achatina fulica Bowdich, 1822 (Mollusca: Gastropoda) como hospedeiro intermediário potencial do *Angiostrongylus costaricensis* Morera & Céspedes 1971

Omar dos Santos Carvalho[1], Horácio MS Teles[2], Ester Maria Mota[3], Cristiane Lafetá Gomes Furtado de Mendonça[1,4] e Henrique Leonel Lenzi[3]

Resumo *Exemplares de Achatina fulica foram experimentalmente infectados com larvas de Angiostrongylus costaricensis, agente etiológico da angiostrongiliase abdominal, mostrando-se susceptíveis ao parasita.* Achatina fulica *pode representar um risco para a urbanização da angiostrongilíase abdominal devido a sua alta prolificidade contínua dispersão e notável adaptação a ambientes urbanos.*

Palavras-chaves: Achatina fulica. Angiostrongylus costaricensis. *Infecção experimental. Angiostrongilíase abdominal.*

Abstract *Samples of Achatina fulica were experimentally infected with Angiostrongylus costaricensis larvae, etiological agent of abdominal angiostrongyliasis, showing that A. fulica is susceptible to the parasite.* Achatina fulica *may be a risk to urbanization of abdominal angiostrongyliasis presumably due to its high proliferation, continuous dispersion and remarkable adaptation in several Brazilian towns.*

Key-words: Achatina fulica. Angiostrongylus costaricensis. *Experimental infection. Abdominal angiostrongyliasis.*

Achatina fulica is a large generalist herbivorous and very prolific snail, samples of which can reach 10cm in length and weigh up to 100g in Brazil. This snail plays an important role in the life cycle of *Angiostrongylus cantonensis*, the etiological agents of eosinophilic meningoencephalitis, in Africa and in the pan-Pacific region[5]. Most of the reports about environmental invasions by *A. fulica* are related to urban or periurban areas as a consequence of its domestic breeding for commercial marketing as *escargots*. Professionals working in this field indicate that this mollusk has been widespread over many localities and municipalities of the Northeastern, Central-western, Southwest and South regions of Brazil.

The first report on the environmental invasion of *A. fulica,* giant or African snail, was in the municipality of Itariri, in the State of São Paulo, Brazil, in which its dispersion and possible risk of transmission of *A. costaricensis* aetiologic agent of abdominal angiostrongyliasis in the Americas[15], were remarked.

In the State of São Paulo, the presence of *A. fulica* was reported in Peruíbe, Itanhaém, Monguagá, Praia Grande, São Vicente, Santos, Guarujá, São Sebatião, Ilha Bela, Caraguatatuba, Ubatuba, along the coastline of Jacupiranga, Registro, Iporanga, Ribeira do Iguapé region, Aparecida, Guaratinguetá, Cruzeiros, Taubaté, Cachoeira Paulista, Paraíba do Sul Valley and the city of São Paulo. Also in the countryside of the State of São Paulo: Tietê, Sorocaba, Bragança Paulista, Piracaia, Nazaré Paulista, Jarinu, Mairipirã, Jundiaí, Atibaia, Votuporanga, Paulicéia, Panorama, Presidente Prudente, Bom Jesus dos Perdões, Campinas, Rio

1. Centro de Pesquisas René Rachou da Fundação Oswaldo Cruz, Belo Horizonte, MG, Brasil. 2. Superintendência de Controle de Endemias, São Paulo, SP, Brasil. 3. Departamento de Patologia do Instituto Oswaldo Cruz da Fundação Oswaldo Cruz, Rio de Janeiro, RJ, Brasil. 4. Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, MG, Brasil.
Endereço para correspondência: Dr Omar dos Santos Carvalho. Av. Augusto de Lima 1715, 30190-002 Belo Horizonte, MG, Brasil.
Fax: 55 31 3295-3115.
e-mail: omar@cpqrr.fiocruz.br
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Claro, Pedreiras, Santo André. The snail was also detected in the states of Bahia, Espírito Santo, Goiás, Minas Gerais, Pará, Paraíba, Pernambuco, Piauí, Rio de Janeiro, Rondônia, and Santa Catarina[14 17 18], as well as, in the locality of Chacao, Miranda, in Venezuela[10].

There is a wide variety of mollusks involved in the transmission of *A. costaricensis,* detected in several states of the Southeast and South regions of Brazil. Its transmission is mainly associated with slugs from the family Veronicellidae. The most important species are *Sarasinula plebeius* in Central America, *Phyllocaulis variegatus*[3] and *S. linguaeformis*[6], in Brazil. Other snails such as *Limax maximus*, *L. flavus*, *Bradybaena similaris*[4], *Belocaulus angustipes*[3], *P. soleiformis*, *Helix aspersa*[16] and *Deroceras laeve*[11] were also reported with natural infections. On the other hand, the literature records a great variety of mollusk species experimentally infected with *Angiostrongylus costaricensis*, thus showing to be highly non-specific to the intermediate host. In fact, other terrestrial and aquatic mollusks, experimentally infected, such as *Veronicella occidentalis*[9], *S. marginata*[7], *P. boraceiensis*[1], mollusks from the genus *Megalobulimus*[3] and the planorbids *Biomphalaria tenagophila* and *B. glabrata*[8] were also susceptible to *A. costaricensis*, allowing the parasite to develop and eliminate L_3.

The aim of this study was to test the experimental susceptibility of *A. fulica* to *A. costaricensis* infection. To do so 37 mollusks from the municipality of São Vicente (23s57/46w23) were divided into eight groups (Table 1) and after two months of quarantine, individually exposed to circular lettuce pieces covered with healthy mouse feces and 100ml of a concentrate containing L_1. The snails were sacrificed (Table 1) at different times of infection, and the shells were broken in order to have their soft parts exposed and their viscera discarded. The fibromuscular layer of the body was digested[19] and transferred to a Baerman's funnel. The sediment was gathered into a watch glass and larvae were counted under a stereomicroscope. Viable L_3 were divided into groups of 30 specimens and orally inoculated into three *Sigmodon hispidus* for later identification of adult worms.

Table 1 - Groups of Achatina fulica *infected with* L_1 Angiostrongylus costaricensis *and mean number of* L_3 *eliminated after digestion, according to Wallace and Rosen (1969).*

Group	Number of L_1 (exposure)	Number of snails	Days after exposure	Positive snails	Number of L_3 after digestion
I	1.000	8	34	0	0
II	3.296	5	35	0	0
		3	45	0	0
III	3.296	5	50	2	28
					300
IV	4.400	1	42	0	0
V	4.580	4	52	2	3
					3
VI	4.860	5	54	4	3
					200
					300
					1.000
VII	5.180	1	21	1	4
		1	60	1	400
VIII	13.662	4	39	2	4
					5

Two groups were used as controls: Three infected *S. marginata* snails for each *A. fulica* group (positive control), and three non-infected *A. fulica* snails for mortality control.

Out of 37 snails examined, 12 (32%) eliminated *A. costaricensis* L_3; 7 showed less than 30; and 5 more than 200 L_3 (Table 1). All *S. marginata* controls became infected and all the three non-infected *A. fulica* remained alive up to the end of the experiments. The three *S. hispidus* infected with L_3 (from infected *A. fulica*) eliminated *A. costaricensis* L_1 in the feces 28 days after infection.

Five *A. fulica* snails were individually infected with 4860 larvae, then sacrificed at 54 days after infection, and fixed in Carson's Formalin-Millonig[2]. Serial cross-sections were stained with hematoxylin and eosin, and observed under brightfield microscopy. Only two *A. fulica* snails presented well organized granulomas (encapsulation process) in the fibromuscular layer, without evidence of larvae inside of them, similar to those noticed in *S. marginata*[12].

The experiments with *A. fulica* showed that this snail is susceptible to *A. costaricensis* infection, requiring, however, high levels of larval exposure. Although only 32% of the samples were found to be positive, the parasite burden in 42% of the snails ranged from 200 to 1000 L_3.

Due to the extensive and continued dissemination of these snails all over the Brazilian territory, *A. fulica* could be an additional risk of new abdominal angiostrongylosis clinical cases. After checking its susceptibility, this possibility is high in urban environments, where the mollusk has shown a great capacity of adaptation and survival. The non-specificity of the parasite for intermediate hosts, the great reproductive capacity and rapid dispersion of *A. fulica*, as well as the possibility that the prevalence of abdominal angiostrongylosis could be underestimated (Fauza et al 1990) are determinant factors for a possible *A. costaricensis* urbanization.

This is a preliminary study, and as such another will be carried out with further and more properly designed experiments.

The scope of this work was not to describe a new host, but to afford considerable evidence of the risk to public health related to the fact that *A. fulica* may play an important role as a transmitter of angiostrongylosis. Additionally, this paper attempted to answer various questions of the population in general, ecologists and health professionals.

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