

THE SUSCEPTIBILITY OF SOME IRANIAN SNAILS TO VARIOUS LOCAL AND FOREIGN SPECIES OF TREMATODES *

F. Arfaa*

G. H. Sahba**

J. Massoud**

ABSTRACT Studies undertaken on the susceptibility of various local snails to some of the important human and animal trematodes found in Iran have revealed that *Bulinus truncatus*, the distribution of which is restricted to the province of Khuzestan in the southwest of Iran, is the intermediate host of *Schistosoma haematobium*, *S. bovis* and *Paramphistomum microbothrium* in this area.

This snail is also susceptible to strains of *S. haematobium* from Somalia and Egypt.

It was also shown that *Lymnaea gedrosiana* is susceptible to and acts as an intermediate host of *Fasciola hepatica*, *F. gigantica* and *Ornithobilharzia turkestanicum*.

Extensive information regarding the intermediate host-para-

* This study was supported in part by the funds of the School of Public Health and Institute of Public Health Research, University of Teheran, and in part by the Public Health Research Project of the Ministry of Health and Plan Organization, and the paper was presented at the First National Conference of Parasitology, Bucharest, Romania, Oct. 1972.

* Professor of Parasitology, School of Public Health, University of Teheran, P.O. Box 1310, Teheran, Iran.

** Associate Professor of Parasitology, School of Public Health, University of Teheran.

site relationship was collected for *S. haematobium*, *S. bovis* and *O. turkestanicum*.

The degree of susceptibility of the above-mentioned snails to their proper trematodes was also investigated.

It was concluded that any effort toward the control of these two snails would result in the reduction of the prevalence of 6 important trematodes found among man and animals in the infested areas.

INTRODUCTION Human and animal infection with trematodes is one of the health problems in Iran. Of these trematodes, human infection with *Schistosoma haematobium* occurs in the province of Khuzestan, southwestern Iran(1), while the infection of livestock with *Fasciola hepatica*, *F. gigantica*, *Dicrocoelium dendriticum* and *Ornithobilharzia turkestanicum* is found in different parts of the country.

So far, the infection of sheep and cattle with *Schistosoma bovis* has been reported only from the South(2). Human distomatosis has also been reported from some parts of the country (3,4,5).

Studies on the susceptibility of various snails to these trematodes were begun in this country in 1958, and a summary of the results obtained is presented in this paper.

MATERIAL AND METHODS Of the common snails found in the southern part of Iran, *Bulinus truncatus*, *Lymnaea gedrosiana* and *Physa acuta* were exposed to the miracidia of various trematodes, namely *S. haematobium* (both local and foreign strains), *S. bovis*, *Paramphistomum* spp., *Ornithobilharzia turkestanicum*, *F. hepatica* and *F. gigantica*.

The exposed snails were checked one month after exposure and regularly thereafter for up to 3 months (according to various species) and the percentages of infection, indicating the degree of susceptibility of each species of snail, were determined.

RESULTS

1. *Schistosoma haematobium* :

It was shown that *Bulinus truncatus* from Iran is susceptible to the local strain of *S. haematobium* (1) as well as to strains from Somalia, Egypt and Iran. Susceptibility to the Iranian strains was higher among snails of two to five weeks of age than among one-week old snails, and the cercarial-incubation period was shorter in young snails than in adult ones.

Snails exposed to one miracidium shed fewer cercariae than snails exposed to two or more miracidia. Detailed information regarding the intermediate host-parasite relationship of *S. haematobium* has been published in several papers (6,7,8,9,10).

2. *S. bovis*:

It was shown that *Bulinus truncatus* is also the intermediate host of *S. bovis*(2).

It was also found that naturally-infected *Bulinus* shed the cercariae of *S. bovis* more than those of *S. haematobium* (2).

3. *Paramphistomum*:

The susceptibility of *B. truncatus* to this trematode has also been proven (12).

It was shown that the average rate of infection of *Bulinus* with the larval stage of this parasite is 5% with a maximum of 11% in the infested area (12).

4. *F. hepatica* and *F. gigantica*:

It was experimentally proven that *L. gedrosiana* acts as the intermediate host of *F. hepatica* (13) and *F. gigantica* (14).

It was shown that 33% of 155 *L. gedrosiana* exposed to the miracidia of *F. gigantica* shed cercariae(14).

In addition to the above-mentioned species, the susceptibility of *L. truncatula* to *F. hepatica*, and *L. auricularia* and *L. peregra* to *F. gigantica* in Iran has been reported by Rafyi and Eslami (15).

5. *O. turkestanicum*:

The role of *Lymnaea gedrosiana* in the transmission of this infection, which is prevalent among domestic animals, has been proven (16,17).

The natural infection of *L. gedrosiana* with this parasite has frequently been found among snails collected from the field. Exposure of this snail to various numbers of miracidia has revealed that the infection rate in snails exposed to one miracidium is much lower than in those exposed to 2 or more miracidia, and all snails exposed to 20 miracidia shed cercariae (17).

The exposure of *Physa acuta* to the miracidia of all these trematodes has revealed that this snail is refractory to all of them.

DISCUSSION AND CONCLUSION

Of 3 local snails, i.e. *B. truncatus*, *L. gedrosiana* and *Ph. acuta*, exposed to 6 species of trematodes found in man and domestic animals, two (*B. truncatus* and *L. gedrosiana*) were each found to be susceptible to 3 species of trematodes.

It is of interest that *B. truncatus* is a species found only in one province of Iran, and thus the distribution of *S. haematobium* and *S. bovis* is restricted to this province.

Since other snails found in other parts of the country may also act as intermediate hosts of *Paramphistomum* spp., these parasites may have a wider distribution.

It should be noted that, although the natural infection of

B. truncatus with the larval stage of *Paramphistomum* has been found to be higher than that of *S. haematobium* and *S. bovis*, it cannot be concluded that *Bulinus* is more susceptible to *Paramphistomum*, since other factors such as the higher contamination of infested water with the faeces of infected animals might be the main reason.

It is interesting to note that *L. gedrosiana* has a wide distribution throughout various parts of the country while *F. gigantica* is found mostly in the South and *F. hepatica* in the North.

Because of this type of distribution, it is not surprising to find more human cases of *F. hepatica* infection in the northern areas.

The susceptibility of various domestic and laboratory animals to *O. turkestanicum* found during these investigations (16) and by Massoud and Nelson (17) is of great interest.

The most important finding of this investigation is the fact that the application of control measures for the destruction of *B. truncatus* and *L. gedrosiana* in Iran will result in the reduction of infection of 6 species of important trematodes in this country.

Such a reduction in the prevalence of *S. bovis*, from 20.8% before mollusciciding to 0.8% afterwards, has been achieved as a result of bilharziasis control in Iran (18).

REFERENCES

1. Arfaa, F., Bijan, H. and Farahmandian, I. (1967). Present status of urinary bilharziasis in Iran. *Trans. Roy. Soc. Trop. Med. Hyg.* 61 :358-367.
2. Arfaa, F., Sabbaghian, H. and Bijan, H. (1965)a). Studies on *Schistosoma bovis* in Iran. *Trans. Roy. Soc. Trop. Med. Hyg.* 59:681-683.
3. Sohrabi, A.K. (1969). Human cases of distomatosis found in the Caspian Sea area. Paper presented at the 3rd Veterinary Congress of Iran (in Persian).
4. Mohsenin, H. and Ebrahimi, M.A. (1969). Human fascioliasis in Iran, report of a case with *Fasciola hepatica* in biliary ducts, *bull. Path. Exot.* 62:871-874.
5. Farid, H. (1971). Human infection with *Fasciola hepatica* and *Dicrocoelium dendriticum* in Isfahan area, central Iran. *J. Parasit.* 57:160.
6. Chu, K.Y., Massoud, J. and Sabbaghian, H. (1966a) Host-parasite relationship of *Bulinus truncatus* and *Schistosoma haematobium* in Iran 1- Effect of the age of *B. truncatus* on the development of *S. haematobium*. *Bull. Wld. Hlth. Org.* 34:113-119.
7. Chu, K.Y., Sabbaghian, H. and Massoud, J. (1966b). Host-

- parasite relationship of *Bulinus truncatus* and *Schistosoma haematobium* in Iran. 2- Effect of exposure dosage of miracidia on the biology of the snail host and the development of the parasites. Bull. Wld. Hlth. Org. 34:121-131.
8. Chu, K.Y., Massoud, J. and Sabbaghian, H. (1966c). Host-parasite relationship of *Bulinus truncatus* and *Schistosoma haematobium* in Iran. 3- Effect of water temperature on the ability of miracidia to infect snails. Bull. Wld. Hlth. Org. 34:131-133.
 9. Chu, K.Y., Massoud, J. and Sabbaghian, H. (1966d). Host-parasite relationship of *Bulinus truncatus* and *Schistosoma haematobium* in Iran. 4- Effect of month of infection on cercarial-incubation periods of *S. haematobium* and *S. bovis*. Bull. Wld. Hlth. Org. 34:135-140.
 10. Chu, K.Y., Massoud, J. and Arfaa, F. (1968) Distribution and ecology of *Bulinus truncatus* in Iran. Bull. Wld. Hlth. Org. 39:607-637.
 11. Arfaa, F. (1962). A study on *Paramphistomum microbothrium* in Khuzestan, S.W. Iran. Annales de Parasit. Humaine et Comparee 37:549-555.
 12. Arfaa, F., Movafagh, K. and Mahdavi, M. (1969). *Lymnaea gedrosiana*, an intermediate host of *Fasciola hepatica* in Iran. J. Parasit. 55:134-135.
 13. Sabha, G.H., Arfaa, F., Farahmandian, I. and Jalali, H. (1972). Studies on Fascioliasis in Khuzestan, S.W. Iran. J. Parasit. 58:712-716.
 14. Rafyi, A. and Eslami, H. (1971). Etat actuel de nos connaissances sur les Fascioloses en Iran. Cah. Med. Vet. 40:277-281.
 15. Arfaa, F., Sabbaghian, H. and Ali Dawood, H. (1965b) Studies on *Ornithobilharzia turkestanicum* (Skrjabin, 1913) Price, 1929, in Iran. Ann Parasit. Hum. Compar. 40:45-50.
 16. Massoud, J. (1971). Observations on *Ornithobilharzia turkestanicum* and *Schistosoma bovis* in Iran. Thesis for Ph.D degree from London School of Hyg. and Trop. Med., London University.
 17. Massoud, J. and Nelson, N.G. (1972). A new approach for assessing snail control measures where human and animal schistosomes are transmitted by the same intermediate host. Trans. Roy. Soc. Trop. Med. and Hyg. 66:191.