Article available at http://www.parasite-journal.org or http://dx.doi.org/10.1051/parasite/1998054379

NEW SITES OF *BULINUS TRUNCATUS* AND INDIGENOUS CASES OF URINARY SCHISTOSOMIASIS IN JORDAN

ARBAJI A.*, AMR Z.S.**, ABBAS A.A.***, AL-ORAN R.****, AL-KHARABSHEH S.***** & AL-MELHIM W.N.**

Summary :

Thirty-two autochthonous cases of *Schistosoma haematobium* are reported from Ghore As-Safi, Karak lowlands, Jordan. All infected persons were males (9-46 years-old). New unusual breeding sites for *Bulinus truncatus* are discovered. The past and current distribution of the snail intermediate host is given.

KEY WORDS : *Bulinus truncatus*, schistosomiasis, Jordan.

Résumé : NOUVEAUX SITES DE *BULINUS TRUNCATUS* ET CAS AUTOCHTONES DE SCHISTOSOMIASE URINAIRE EN JORDANIE

Trente-deux observations d'infections autochtones à Schistosoma haematobium *sont rapportés de Ghore As-Safi, dans la région de Karak en Jordanie. Les personnes infectées sont toutes des hommes, âgés de 9 à 46 ans;* Bulinus truncatus *est découvert dans de nouveaux sites, inhabituels. La distribution ancienne et actuelle de cet hôte intermédiaire est précisée.*

MOTS CLÉS : Bulinus truncatus, *schistosomiase, Jordanie.*

Jordan was considered a schistosomiasis-free country (Abdel Azim & Gismann, 1956). There has been a continuous influx of foreign labor originating from schistosomiasis endemic countries, especially from Egypt, into Jordan. Many of these workers are employed in agriculture in the most schistosomiasis receptive areas in the country.

The first indigenous case of *Schistosoma haematobium* infection was reported in 1975 in the Jordan Valley (Saliba *et al.*, 1976). During the period 1984-1995, a total of 60 cases of urinary schistosomosis were reported among Jordanians from Tafila Governorate and the Jordan Valley (Saliba *et al.*, 1986; Ministry of Health records).

In 1980-1983, a national survey was organized to study the freshwater snails of Jordan, which resulted in reporting more than 15 breeding sites of *Bulinus truncatus* (Burch *et al*, 1985). Subsequently, the surveillance team of the Ministry of Health reported additional 45 sites in the Jordan Valley and along the Yarmouk River (Malaria, schistosomiasis and Zoonotic Diseases Division, Unpublished report).

Within the past forty years, Jordan has witnessed rapid changes in its environment, including habitat modification due to agricultural expansion along the Rift Valley and the Eastern Desert. Water extraction, changes in watercourses, and construction of dams and irrigation canals has drastically affected the distribution of freshwater snails.

The present study reports on discovery of new sites of *B. truncatus* that lead to detection of 32 autochthonous cases of *S. haematobium* in Ghore As-Safi, Karak low lands.

MATERIALS AND METHODS

SAMPLING FRESHWATER BODIES FOR THE PRESENCE OF *BULINUS TRUNCATUS*

Freshwater bodies (streams, ponds, pools, etc.) in different localities in Jordan were inspected for the presence of *B. truncatus*. Snails were collected either manually from underneath rocks, floating vegetation, submerged objects (plastic sheets and containers) or around the edges.

URINE COLLECTING AND EXAMINING FOR THE PRESENCE OF *SCHISTOSOMA HAEMATOBIUM* OVA

Collected urine specimens were kept in plastic tubes. Specimens were then centrifuged at 2,000 rpm for ten minutes. The sediment was aspirated by a Pasteur

* Malaria, Schistosomes and Zoonotic Diseases Division, Ministry of Health. Amman, Jordan.
** Department of Biology, Jordan University of Science & Technology. P.O. Box 3030. Irbid, Jordan.
*** Faculty of Medicine, The University of Jordan.
**** Department of Biology, Mutah University. Mutah, Jordan.
***** Disease Control Directorate, Ministry of Health. Amman, Jordan.
Correspondence: Zuhair S. Amr. e-mail: amrz@just.edu.jo

pipette onto glass slides and examined under the microscope.

Determination of natural infection in *Bulinus truncatus*

A total of 195 *B. truncatus* snails were checked for infection. Snails were collected from irrigation pools in Ghore As-Safi where infected persons had previous contact with water. Shedding was performed as described in Amr *et al.* (1988).

RESULTS

Distribution of *Bulinus truncatus* in Jordan

Since 1975 and until the present, a total of 60 sites were identified in four Governorates (Ministry of Health Records). Most of the known populations were concentrated along the Jordan Valley and the Yarmouk River (Balqa and Irbid Governorates), other major sites includes Zarqa River, King Talal Dam and Jarash Roman Pools (Zarqa and Jarash Governorates). Additional site in the southeastern desert was found to harbor the snail (Aqaba Governorates). Figure 1 shows the past and current distribution of *B. truncatus* in Jordan.

New sites for *Bulinus truncatus*

During the summer and winter of 1996, several field trips were made covering many permanent and temporary water bodies in Jordan. Breeding populations of *B. truncatus* were found in four additional new sites.

Ad-Disah

This new site is located to the south-east of Jordan (29° 37' N 35° 33' E). The site is a permanent pool fed from an artesian well with thick vegetation of *Typha* and *Tamarix*.

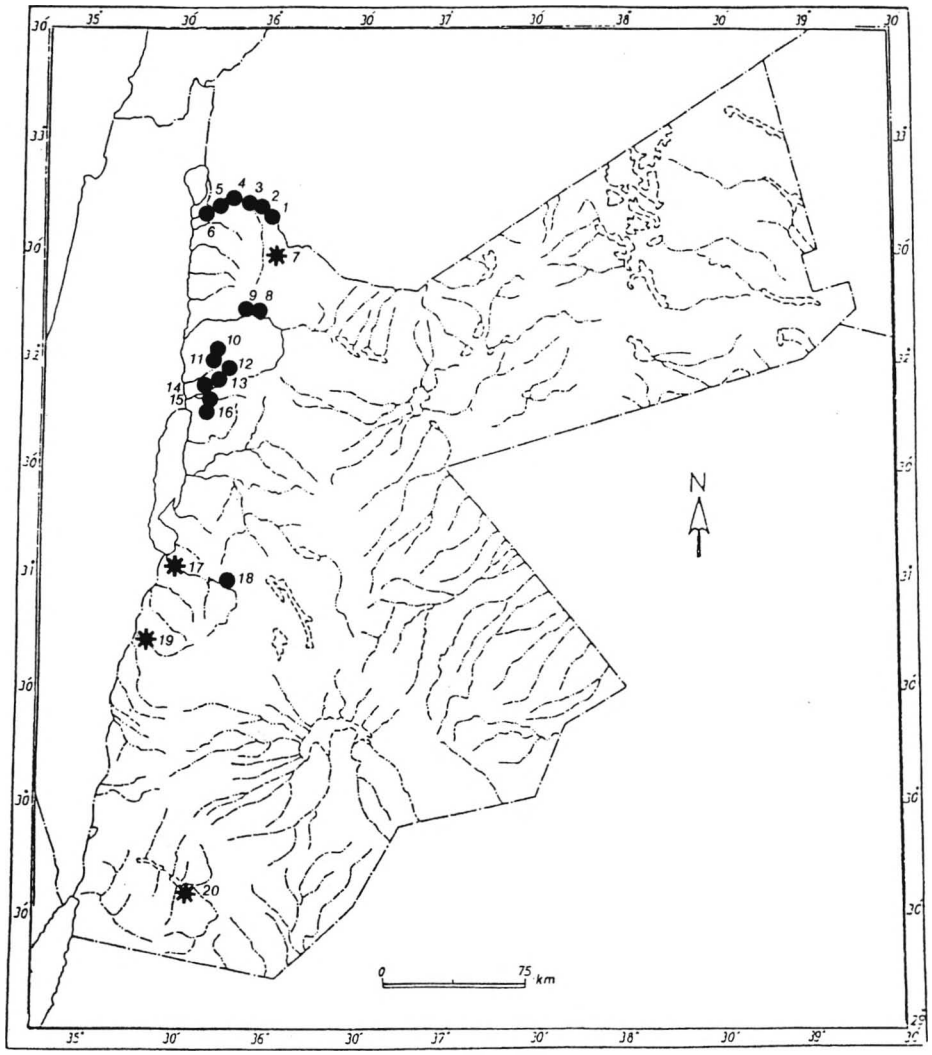

Fig. 1. – The past and current distribution of *Bulinus truncatus* in the major water bodies. Solid circles • indicate previously reported site. Stars * indicated newly discovered sites.

1. Ghadir Abu-Zeid
2. Zur Al-Khbeinah
3. Zur Al-Nasaireh
4. Tallat Khalid ben Al-Walid
5. Mahatat Iklid
6. Zur Al-Klea
7. Ar Ramtha
8. Jarash - The Roman pools
9. Jarash
10. Ghawr Kabid
11. El-Karamah
12. Ash Shunah
13. Wadi Batus & Al-Kufren Dam
14. Al-Kufren
15. Rama Wadi
16. Zur Shasha'a
17. Ghore As-Safi
18. Burbaytah Hammamat
19. Wadi Abu Dubana
20. Ad-Disah

Ar Ramtha

This new location (32° 34' N 360 00' E) is a small mud dam constructed at the Jordan University of Science and Technology campus to hold rain water for irrigation. Aquatic vegetation such as *Typha* is restricted to the dams' wall.

Ghore As-Safi

Ghore As-Safi is an agricultural area situated along the southern end of the Dead Sea (31° 02' N 35° 28' E). Irrigation ponds are very common and fed from Wadi Al-Hasa. Of 172 ponds examined, 59 (34.7%) were found infested with *B. truncatus* at different stages of development. The population of Ghore As-Safi is about 15,000 inhabitants, mostly engaged in agriculture.

Wadi Abu Dubana

This site is a permanent water body that stretches from the east to the northwest of Wadi Araba (30° 42' N 35° 17' E). Lush vegetation of *Typha* and other reeds are common.

All new sites were sprayed using niclosamide (1 ppm).

Urine examination results

After the discovery of the above-mentioned breeding sites for *B. truncatus*, an extensive urine examination campaign among the Egyptian workers employed in these areas was undertaken. One Jordanian living in Ghore As-Safi indicated that he discharged bloody urine. Subsequently, mass urine collection and examination were undertaken in this area. At Ghore As-Safi, a total of 5,637 urine samples were examined for the presence of *S. haematobium* ova (Table I). Thirteen male school students (0.34 %), 19 male farmers (all Jordanians) and 17 foreign workers (all Egyptian males) were found to be infected. Male school students under 16 and males aged 16-27 years-old constituted 37.5 % and 46.9 % of infected persons respectively. Female school students were not found to be infected.

A total of 349 and 65 samples were collected from Egyptian workers at Al-Disah and Ar-Ramtha with infection rates of 7.5 and 7.7 % respectively.

Category	No of samples examined	No of infected persons	% of infection
School students	3819	13	0.34
Jordanian farmers	1559	19	1.22
Foreign workers	259	17	6.56

Table I. – Infection rates among different population categories in Ghore As-Safi.

All infected persons were treated immediately using praziquantel (40 mg/kg as a single dose).

Natural infection in *Bulinus truncatus*

All snails examined for the presence of cercaria were negative.

DISCUSSION

Remarkable changes of water utilization patterns are continuing to occur in Jordan, this is exemplified by water extraction from the underground aquifers in remote and arid environments in the Eastern Desert and Wadi Rum area to meet the demand for the expanding modern agriculture and drinking water. Several major changes have occurred within the past two decades including construction of dams in different parts of the kingdom (Karamah and King Talal Dam), and changes in watercourses of natural waterbodies, will allow the dispersal and range expansion of several freshwater snails into newly suitable habitats. Indeed, one of these dams, King Talal Dam, was the most heavily infested site for *B. truncatus*. Similar findings were reported by Tiemersma *et al* (1997) in Morocco due to construction of modern surface irrigation schemes.

Most of the agricultural irrigation systems in the Jordan Valley and many parts of Jordan depend on the dripping system, where water ponds (Plastic, cemented or mud) are constructed to pump water. Such ponds hold water all-year-round and offers a suitable breeding sites for the intermediate host snail.

Continuous surveillance of permanent water bodies should be continued to reveal new breeding sites for the snail vector. The number of discovered sites increased enormously after the initial discovery of the snail in the Jordan Valley in 1975, reaching 60 in 1997. Also, a data-base covering all water bodies should be established. Monitoring newly constructed dams and other irrigation schemes must be implemented in collaboration with the involved authorities (Jordan Valley authority, Ministry of Planning, etc.).

It is noteworthy to indicate that tap water reaches up to 95 % of villages and houses are served with modest latrines. Due to the presence of these services, behavioral and social patterns of water contact in areas where the intermediate host snail is abundant are not practiced on a large scale such as washing clothes, utensils, and animals, bathing and swimming, urination and defecation and taking water for domestic use. In Egypt and Iraq, such activities are practiced in many villages due to the absence of municipal services (Abdel-Wahab, 1982). Social customs and tradition

forbid females from pathing or swimming in open water. This may explain the absence of infection among females.

A mobile unit for active case detection is stationed in the Jordan Valley. Tasks of this unit include laboratory diagnosis for urine samples and treatment of infected persons using praziquantel (40 mg/kg as a single dose). However, urine sample collecting at ports of entry should be enforced.

In addition, health education through the media should be addressed and promoted. Further investigation into man-water contact patterns is needed if the disease is to be controlled effectively. In the Jordan Valley, sanitary practices remain poor without adequate disposal of human excreta and development of sewage systems, to avoid contact of urine with the freshwater habitats.

Chemical control seems not to affect the populations of the snail intermediate host. Since 1981, the King Talal Dam is undergoing chemical control on irregular basis, and the snails re-appeared several times. Additionally, the high cost of molluscicides and the ill-effects they inflect on fish farms may hinder the efforts. In an area like Ghore As-Safi, with extensive ponds and ditches, it is advisable to resort to biological control. Our initial laboratory studies showed that *Bacillus thuringiensis* isolated from different soil samples in Jordan has an effect on the viability of *B. truncatus* egg masses. Other control alternatives should be investigated in especially large water bodies (fishes as *Gambusia affinis,* other predatory snails as *Marisa cornuarietis* and other bacterial agents).

ACKNOWLEDGEMENTS

We would like to extend our thanks to the staff of Malaria, Schistosomes and Zoonotic Diseases Division, Ministry of Health, Amman, Jordan. This work was supported in part by the Higher Council of Science & Technology/Badia Development and Research Project (Animal Biodiversity). We are grateful for the continuous support of Eng. Mohamed Shahbaz, Director of the Badia Development and Research Project.

REFERENCES

ABDEL AZIM M. & GISMANN A. A bilharziasis survey in southwestern Asia. Covering Iraq, Israel, Jordan, Lebanon, Saudi Arabia, and Syria: 1950-51. *Bulletin of the World Health Organization,* 1956, *14,* 403-456.

ABDEL-WAHAB M. Schistosomiasis in Egypt. CRC Press, Inc. Boca Raton, 1982, 234 pp.

AMR Z.S., BRUCE J.I. & SALIBA E.K. Susceptibility of *Bulinus truncatus* from Jordan to Three African Strains of *Schistosoma hematobium. Japanese Journal of Parasitology,* 1988, *37,* 36-43.

BURCH J.B. Handbook on Schistosomiasis and Other Snail-mediated Diseases in Jordan. Published at The University of Michigan, Ann Arbor, Michigan, U.S.A., 1985, 224 pp.

SALIBA E.K., ABDEL-HAFEZ S.K. & TAWFEEK M.R. Schistosomiasis in Jordan: An unwelcomed guest. *Parasitology Today,* 1986, *2,* 91-93.

SALIBA E.K., MASAIDEH A. & RIDA TAWFEEK M. First record of *Bulinus truncatus* (Audouin) in Jordan. *Annals of Tropical Medicine and Parasitology,* 1976, *70,* 369-370.

TIEMERSMA E.W., HAFID S., BOELEE E., KHALLAAYOUNE K. & GRYSEELS B. Detection of urinary schistosomiasis in a low prevalence region. *Transaction of the Royal Society of Tropical Medicine and Parasitology,* 1997, *91,* 285-286.

Reçu le 23 septembre 1997
Accepté le 25 juin 1998