RESEARCH COMMUNICATION

Schistosoma mattheei—an ovum containing twin miracidia

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ABSTRACT

VAN RENSBURG, L.J. & VAN WYK, J.A. 2003. *Schistosoma mattheei*—an ovum containing twin miracidia. *Onderstepoort Journal of Veterinary Research*, 70:69–71

A large *Schistosoma mattheei* ovum containing two miracidia was recovered from a squash preparation of the liver of an experimentally infected hamster. When observed, the miracidia were motile and facing in opposite directions.

Keywords: Abnormal ovum, hamster, *Schistosoma mattheei*, twin miracidia

INTRODUCTION

Abnormal worm development has been described in a large variety of worm species and their developmental stages, but they usually comprise only a small percentage of each population concerned.

While examining squash preparations of the livers of experimentally infected hamsters for *Schistosoma mattheei* not removed by perfusion, a large ovum containing two miracidia was encountered.

METHOD AND DESCRIPTION OF OVUM

A population of *S. mattheei* that had been maintained by serial passage in sheep in the laboratory for about 5 years was used in a trial to test the infectivity of cercariae for hamsters at different times after having emerged from *Bulinus (Physopsis)* spp. (Van Wyk, unpublished observations 1973). The young adult hamsters were exposed by submerging their hindquarters in bottles, each containing approximately 100 cercariae in water, and were sacrificed for worm recovery after 50 days. After perfusion to recover *S. mattheei* that developed (Duvall & De Witt 1967) the livers of the hamsters were squashed in turn between two glass plates and examined for worms with the aid of a stereoscopic dissection microscope.

The ovum shown in Fig. 1 was conspicuous because of its unusually large size. On closer examination it was seen to contain two fully-developed miracidia, which were active within the ovum, and facing in opposite directions.

Unfortunately the ovum was lost when an attempt was made to recover it from the squash preparation for further examination. Therefore, it was not possible to ascertain whether the miracidia were able to hatch and infect the intermediate host, *Bulinus* (*Physopsis*) spp.

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Accepted for publication 21 November 2002—Editor

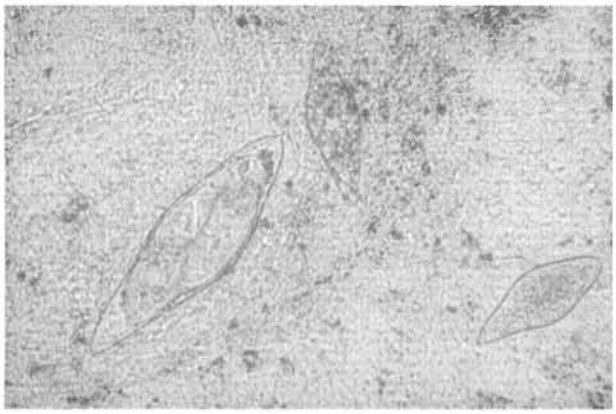

FIG. 1 Twin miracidia in a *S. mattheei* ovum from the liver of a hamster, together with some abnormally small ova

RESULTS AND DISCUSSION

The ovum containing the twin miracidia is depicted in Fig. 1, together with two abnormally small, dark ova, such as are often encountered in the livers of animals infected with *S. mattheei* (Van Wyk, personal observation 1970).

This appears to be the first report of a *S. mattheei* ovum containing more than one miracidium. In size, the ovum was in the upper ranges of normality for the species, being approximately 260 µm in length, by 75 µm in breadth, compared to a range of 170–280 x 72–84 µm reported for *S. mattheei* (Soulsby 1982) and a length of 152–220 µm for "normal looking" ova from the livers of infected sheep and cattle (Van Wyk, personal observation 1982). The smallest ovum in Fig. 1 measured 130 x 50 mm.

Janer (1941) described a pair of miracidia of *Schistosoma mansoni* in an ovum stated to be of normal size, and Dias & Ribeiro (1980) described similar miracidia in an ovum, the length of which is in the upper limits of that of normal ova of that species (Beaver, Jung & Cupp 1984) and the breadth only slightly above the normal.

Of the miracidial twinning reported to date in *S. mansoni*, some of the larvae were partially fused (Hoffman & Janer, 1936; Janer 1941), while in others they were separate. It was also shown that two pairs of fused miracidia, and one of the four pairs of separate twins, were able to hatch and swim in water. The only pair of fused miracidia placed "... in close apposition to..." an *Australorbis glabratum* [*Biomphalaria glabrata*] snail (that was afterwards penetrated by normal miracidia), the pair paid no attention to the snail, despite having come into contact with it quite frequently during a period of more than 15 min (Hoffman & Janer 1936). Short (1952) described four ova of *Schistosomatium douthitti*, containing two oocytes each, and five (all from unisexual infections) containing twin miracidia. Other ova contained "abortive or teratic" embryos, some of which consisted of more or less spherical groups of cells. Two of these eggs containing immature embryos were "about average in size", but the three containing two mature miracidia each, were "noticeably larger than most of the eggs which contained only one." As reported by Short (1952), some miracidia that hatched in squash preparations of fresh tissues were irregular in form, e.g. "small ciliated spindle-shaped forms", with atypical internal structure and activity. The cilia of a number of the miracidia appeared to be confined to certain areas, being only a small patch in some.

As discussed by Kuntz (1948), the cause of twinning of schistosome larval forms is unknown, but this phenomenon can probably be expected to occur in all multicellular fauna and flora that develop by cell division from a single-celled zygote. Growth-producing stimuli at critical stages in the development may be responsible (Kuntz 1948). This probably also applies to the present case, since there were no special conditions that could have offered an explanation for the twin miracidia observed. On the other hand, some factors and possible causes associated with abnormal ova of schistosomes and other helminths have been described. Machado, Da Silva & Pellegrino (1970) and Bennett & Gianutsos (1978) described abnormal ova of *S. mansoni* (from white mice treated with thiosinamine, disulfiram or diethyldithiocarbamate), with abnormalities such as distorted or deformed shells. Bruijning (1968) described a twin ovum of *S. mansoni* comprising an almost normal ovum (as regards size, general shape and contents) that was connected by a thin stalk to a grossly abnormal, smaller one, possibly due to an abnormally functioning sexual organ. This record was from a mouse that had been treated shortly before with an unidentified compound. Gamal-Eddin & Aboul-Atta (1979) reported "spineless eggs [of *S. mansoni*] and [ones] with semi-formed spines" from mice vaccinated with hepatopancreas antigen from *Biomphalaria alexandrina* snails infected with this worm species. Other compounds reported to be responsible for the development of abnormal ova are thiourea, allyl thiourea and ethylene thiourea in *Schistosoma japonicum* (Ho & Yang 1974) and nicarbazin in both *S. japonicum* and *S. mansoni* (Reyes, Glidewell & Hillyer 1975). *In vitro* cultivation or maintenance has also been shown to give

rise to abnormalities in the formation of ova of various schistosome species, e.g. ova about half the normal size, each with a small and blunt lateral spine and apparently lacking a germinal disc (Basch 1981; Basch & Basch 1982; Irie, Tanaka & Yasuraoka 1987; Wang & Zhou 1987). Furthermore, abnormally small ova are routinely found in the perfusate of livers and lungs of animals infected with *S. mattheei* (Fig. 1; Van Wyk, personal observations 1970).

Abnormal ova and/or miracidia have also been described in other worm genera, including Nematoda as well as Trematoda. Bednarz & Lucka (1979) and Bielecki (1979) ascribed abnormal miracidia of *Fasciola hepatica* to centrifugation of ova at various stages of development and Bergstrom & Werner (1977) regularly obtained abnormal ova of *Trichostrongylus colubriformis* and *Nematodirus spathiger* when these worms commenced egg laying 15 d after infection of the host. Similarly, Lagrange (1960) found abnormal egg-like structures sometimes associated with the commencement of egg-laying by *S. mansoni*, before the appearance of normal eggs. These structures, varying greatly in size and shape, were recovered from the uteri of *S. mansoni* females, as well as from the livers and, rarely, the intestines of mice.

ACKNOWLEDGEMENTS

We are very grateful to Mr Tonie du Bruyn for his patience and his vigorous attempts for perfection during the microscopic photographic sessions.

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