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PENETRATION OF *SCHISTOSOMA MANSONI* MIRACIDIA IN ABNORMAL HOSTS

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SUMMARY

Observations on the behavior of the miracidia of *Schistosoma mansoni* toward the larvae of *Phyllomedusa* sp were made. Miracidia attack the tadpoles penetrating through their skin. Cross sections of the infected larvae showed one miracidium attached to the skin of the tadpole and two other miracidia located beneath the epidermis of the frog's larvae.

INTRODUCTION

Conflicts of opinion on the means by which the miracidia of the trematodes find their intermediate hosts show that the problem is still open to question.

LEIPER & ATKINSON [8], LUTZ [9], FAUST [5], BARLOW [2], BRUMPT [3], KLOETZEL [7] and WRIGHT [13] are among those who believe in some kind of attraction exercised upon trematode miracidia by their snail hosts. On the opposite field, i.e., denying any kind of attraction or, at least, convinced that phenomenon has not yet been unequivocally demonstrated are MATTES [11], GRIFFITHS [6], MALEK [10], SWALES [12], BARBOSA [1] and, very recently, CHERNIN & DUNAVAN [4].

As demonstrated by BARBOSA [1] miracidia of *S. mansoni* penetrate in snails belonging to the families *Physidae* and *Ampullariidae*. The species used in those experiments were respectively *Physa rivalis* Maton & Rackett and *Pomacea dolioides* Reeve. The snails were exposed individually to the miracidia of *S. mansoni*. Sections of the anterior part of the exposed snails revealed that all the penetrating larvae were destroyed and surrounded by extensive cellular reaction. Another experiment demonstrated that when one resistant species of the above mentioned families was exposed to *S. mansoni* larvae simultaneously with a high susceptible strain of *A. glabratus*, miracidia penetrate in both species apparently in equal number. BARBOSA [1] has also stated that miracidia of *S. mansoni* are able to penetrate tadpoles.

MATERIAL AND METHODS

For the present study five specimens of young larvae of the frog *Phyllomedusa sp* were exposed to large unrecorded number of miracidia of *S. mansoni* for two hours. Miracidia were obtained from a human source. The tadpoles were kept individually in water in small vials for six hours. The temperature of the water was 25°C. Immediately after the exposure time the tadpoles were fixed in Bouin's fluid by direct immersion. Serial cross sections of the intere body of the tadpoles were made and stained with hematoxilin-eosin.

RESULTS

Observations were made during the exposure period. Miracidia were seen attacking eagerly the tadpoles, fixing on any part of their skin and attempting penetration. However, abrupt movements of the tadpoles usually threw away the just attached mira-

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cidia. According to these observations very few miracidia succeeded in penetrating the skin of the frog's young larvae.

Careful examination of the cross sections of the tadpoles showed only four miracidia which had penetrated. Figures 1 to 3 show three aspects of the penetration of the miracidia.

The epidermis (Ep.) of the young larvae of *Phyllomedusa sp* consists two layers. The outermost (c.e.) and thinner of these two layers is composed of one row of flattened cells bearing deeply stained elongated nuclei. The innermost (c.i.) and thicker of the two layers consists of rounded and irregularly distributed cells. These cells bear less compact and rounded nuclei. Under the epidermis a line of pigmented cells (c.p.) is seen.

Figure 1 shows one miracidium attached to the skin of the tadpole. The epidermis is destroyed around the site of fixation of the miracidium. The external layer of the epidermis almost disappeared. Some cells of the internal layer have pyknotic nuclei.

Figures 2 and 3 show other advanced stages of the penetration of the miracidia of *S. mansoni*. In Figure 2 penetration of the miracidium was still incomplete.

Figure 3 shows the miracidium placed under the external layer of the epidermis. The cells of the internal layer of the epidermis are disorderly arranged and some of the nuclei are pyknotic.

The fate of the miracidia which penetrate the skin of tadpoles is still unknown.

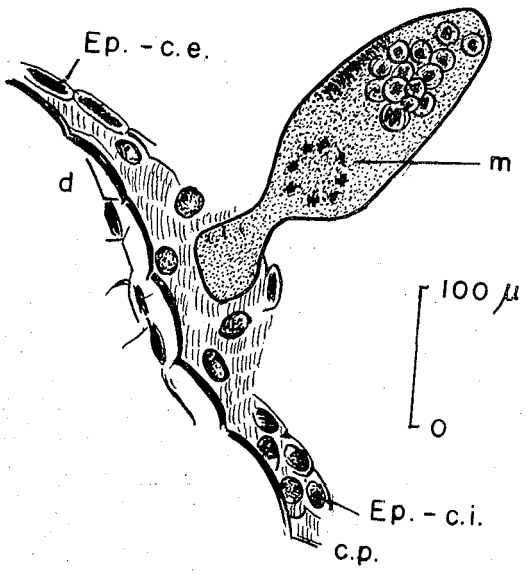

Fig. 1 — Drawings taken from three cross sections of the tadpole of *Phyllomedusa* sp infected with miracidia of *Schistosoma mansoni*. Symbols used for the figures as follow: c.p., pigment cells; Ep., epidermis, c.e. outermost layer and c.i. innermost layer; m, miracidium. Miracidium is attached to the skin of the tadpole

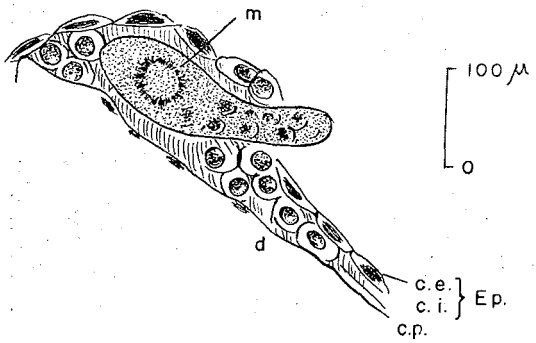

Fig. 2 — Miracidia are seen in more advanced stages of penetration

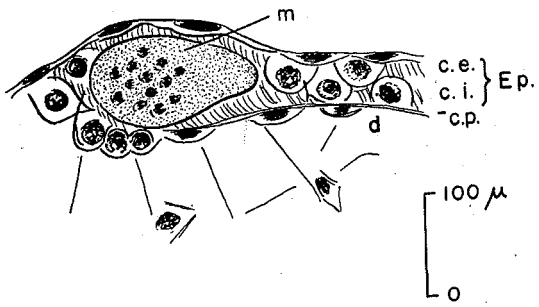

Fig. 3 — Miracidia are seen in more advanced stages of penetration

DISCUSSION AND CONCLUSIONS

Although arguments regarding an alleged attraction exercised upon schistosome miracidia have been presented by several workers (LEIPER & ATKINSON [8], LUTZ [9], FAUST [5], BARLOW [2], BRUMPT [3], KLOETZEL [7] and WRIGHT [13]) the experience obtained in this laboratory does not support the opinion that miracidia of *S. mansoni* are attracted at a distance by their hosts. However this question cannot be simplified by placing the problem in two extremes. Some sort of attraction may exist but probably only when the miracidia get at a short distance from the snail. When the larvae come in the vicinity of the snails they are probably stimulated an then the host is attacked. This is just what is usually called penetrating tropism, a phenomenon which is common to many other parasitic forms. And so, in such a case, the expression "miracidial attraction" is absolutely unnecessary.

Recently CHERNIN & DUNAVAN [4] studying the host-parasite dispension, state: "We find nothing in our own observations to support the hypothesis that "attraction" occurs, nor do the experiments and rationalizations which have been published in support of it seem entirely convincing".*

Miracidia of *S. mansoni* attack and penetrate different species of fresh-water snails as well as tadpoles. According to the data presented in this paper and other experiments by different workers (MALEK [10], BARBOSA [1]), penetrating tropism is inespecific, i.e., when the larvae come to the immediate proximity of snail or other fresh-water animal, they are probably stimulated and penetration is attempted.

ACKNOWLEDGMENTS

I am indebted to Dr. C. Wright through whom the frog's tadpoles were determined in the British Museum (Natural History) as probably *Phyllomedusa rhodei.*

* In that paper (CHERNIN & DUNAVAN [4]) I am quoted (BARBOSA [1]) among those who support the views that miracidia are attracted by the snails. However, in my paper, which was published in Portuguese a completely different opinion is expressed. In the English summary of that paper is written: "Any type of the so-called miracidal attraction can be excluded".

RESUMO

Penetração de miracídios de Schistosoma mansoni *em hospedeiros acidentais*

Neste trabalho são feitas observações sôbre o comportamento dos miracídios de *Schistosoma mansoni* em presença dos girinos de *Phyllomedusa sp.* Os miracídios foram vistos atacando e penetrando o tegumento dos girinos. Cortes transversais dos girinos infetados mostraram um miracídio fixado ao tegumento de uma larva do anfíbio e dois situados logo abaixo da epiderme de outros girinos.

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