RESEARCH NOTES

JUVENILE SNAILS AS HOSTS FOR ECHINOSTOME METACERCARIAE

Species of the trematode family Echinostomatidae have received considerable attention in the biological control of schistosomiasis by intramolluscan inter-trematode antagonism (Lim and Heyneman, 1972, In: *Advances in Parasitology*, Vol. 10, Academic Press, N.Y., pp 192-268) and parasitic castration of the first intermediate snail host (Combes, 1982, *Parasitology*, *84* : 151). More recently, penetration of large numbers of *Echinostoma liei* cercariae, moreso than localization of metacercarial cysts in the pericardial sac, has been reported as a cause of high levels of mortality in uninfected 3-8 mm *Biomphalaria glabrata* serving as second intermediate hosts (Kuris and Warren, 1980, *J. Parasit.*, *66*: 630). However, these authors recognized that under natural conditions, the high levels of cercarial penetration needed for biological control of even 3 mm snails would be unlikely to occur unless densities of snails shedding cercariae were high. Although the smallest snails used by Kuris and Warren *(op. cit.)* were 3 mm, the present study documents the suitability of recently hatched snails ($\leq$1.4 mm) as second intermediate hosts for echinostome metacercariae.

The host-parasite models used in this study were established from material collected in Egypt and maintained at the Centers for Disease Control in Atlanta. Twenty juvenile *Biomphalaria alexandrina* were maintained for 48 hours in a 150 – × 25 – mm petri dish with one adult *B. alexandrina* shedding cercariae of *E. liei*. Immediately following this exposure period, the juvenile snails were measured with the aid of an ocular micrometer and metacercarial cysts were counted in squash preparations. All 20 juveniles, which ranged from 0.8-1.4 mm in diameter, were found infected and harbored from 2 to 12 viable cysts (Table 1); viability was assessed by observation of movement of the metacercaria within the cyst. Similar findings were observed for juvenile *Bulinus truncatus* which had hatched

Table 1

Numbers of echinostome metacercarial cysts recovered from juvenile *Biomphalaria alexandrina* and *Bulinus truncatus*.

Snail Size (mm)	*B. alexandrina*		*B. truncatus*	
	No. examined	No. *E. liei* Cysts/Snail	No. examined	No. *Echinoparyphium* Cysts/Snail
0.8	1	5		
0.9	5	3, 4, 6, 6, 9	1	1
1.0	5	2, 2, 2, 3, 4	3	0, 0, 8
1.1	1	2	7	0, 0, 3, 3, 6, 7, 8
1.2	5	3, 6, 8, 9, 9	4	4, 8, 12, 16
1.3			1	2
1.4	3	2, 6, 12		

in a 150 – × 25 mm dish containing an adult *B. truncatus* shedding cercariae of a 37-spined species of *Echinoparyphium*. Twelve of 16 of these juveniles, measuring 0.9-1.3 mm in length were infected with 1 to 16 cysts (Table 1). Cercarial induced mortality in this 0.8-1.4 mm size class of snails was not determined. However, the size of the metacercarial cysts of both these species of echinostomes (150 µm in diameter) indicates that juvenile snails can support only a limited number of cysts, but these would have the potential to persist throughout the life of the snail (Nasir, 1960, *J. Parasit.*, *46* : 833), contribution to the reservior supporting the life cycle of the parasite.

The present findings and those of others suggest that echinostome cercariae are infective to essentially any size of potential second intermediate host. Accordingly, cercarial penetration of juvenile snails as a possible biological control mechanism would depend not only on high densities of snails shedding echinostome cercariae but also on any host-size preference of these cercariae in populations of snails composed of different size classes. More importantly, however, the well-documented lack of specificity of echinostome cercariae for second intermediate snail host species (*cf* Yamaguti, 1975, *A Synoptical Review of Life Histories of Digenetic Trematodes of Vertebrates*, Keigaku Publ. Co., Tokyo, 590 pp) would strongly diminish the effectiveness of these organisms in the context of biological control.

The adult echinostomes are intestinal parasites of birds and mammals. Human infections are rare, usually accidental and of little clinical importance (Carney *et al.*, 1980, *Trop. Geogr. Med.*, *32* : 101). Infection, which results from ingestion of metacercarial cysts, is more prevalent in human populations whose diet includes raw or improperly cooked molluscs (Lie and Virik, 1963, *J. Trop. Med. Hyg.*, *66* : 77; Carney, *et al.*, *op. cit.;* Radomyos, 1982, *Southeast Asian J. Trop. Med. Publ. Hlth.*, *13* : 265). However, juvenile snails, containing even limited numbers of metacercarial cysts, could serve as a source of food contamination. Such juveniles may be easily overlooked, especially on leafy vegetables, and inadvertently consumed transmitting those echinostomes which use snails as second intermediate hosts.

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EXPERIMENTAL INFECTION OF *PARAGONIMUS HETEROTREMUS* METACERCARIAE TO THE MONGOLIAN GERBILS *(MERIONES UNGUICULATUS)*

P. heterotremus is a medically important lung fluke in Thailand. It is commonly found in both natural and experimentally infected cats and dogs. Vajrasthira and Radomyos (1966, *J. Med. Ass. Thailand*, *49* : 968) reported that the long-tailed monkey *(Macaca irus)* was susceptible to induced *P. heterotremus* infection, while *Bandicota indica* and albino rats were not susceptible. Vajrasthira (1969, *In :* Proceedings 4th Southeast Asian Seminar on Parasitology and Tropical Medicine, Schistosomiasis and other snail-transmitted Helminthiasis, p. 299-304) reported that the rabbit was also one of the experimental definitive hosts.

Further studies were carried out to find laboratory experimental definitive hosts. Four gerbils, each was infected with 5, 5, 3 and 2 metacercariae of *P. heterotremus*, and first, second, third and fourth gerbil died on the day 30, 54, 29 and 90 respectively. Autopsies were performed on each animal; two immature worms were found in the liver and thoracic cavity of the first gerbil; 5 mature worms were found in the lung and thoracic cavity of the second gerbil; one immature worm was found in the thoracic muscle of the third gerbil and two mature worms were found in the lung of the fourth gerbil; these two worms contained numerous eggs in the uteri and the worms measured 8.5-9.35 mm in length and 5.00-5.35 mm in width (pressed and fixed specimen). This finding indicate that the gerbil is a susceptible laboratory experimental definitive host of *P. heterotremus*.

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EXPERIMENTAL INFECTION OF FIVE SPECIES OF *ONCOMELANIA* WITH *PARAGONIMUS HETEROTREMUS*

P. heterotremus, the causative agent of human paragonimiasis in Thailand was originally reported in China by Chen and Hsia (1964, *Zhongshan Daxue Xuebao*, *2* : 236). A similar fluke was described by Chung *et al.*, (1964, *Chin. Med. J.*, *83* : 641) under a different name, *P. tuanshanensis*, although, both flukes are identical. The natural first intermediate hosts of *P. tuanshanensis (P. heterotremus)* in China are the *Tricula* snails, *Tricula gregoriana* Annandale, and laboratory infection of *Tricula humida* Heude reared with the miracidia has been successful. In Thailand, the snail hosts of *P. heterotremus* in nature are still unknown. Thus studies were carried out to observe the susceptibility of *Oncomelani* spp.

Five species of *Oncomelania* snails, the intermediate host of *Schistosoma japonicum* were experimentally infected with *P. heterotremus* miracidia. Ten weeks after exposure, rediae and corcariae were observed in all species of *Oncomelania* snails: *O. nosophora*, *O. formosana*, *O. chuii*, *O. quadrasi* and *O. hupensis* with different levels of susceptibility. This finding indicate that *Oncomelania* spp. could be used as laboratory experimental intermediate host of *P. heterotremus* in Thailand.

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A CASE REPORT OF SPINAL CYSTICERCOSIS

Human infection with larvae of *Taenia solium* have been reported from various parts of the world as well as Thailand. Generally, the sites of infection are subcutaneous tissues, muscles, eye, thyroid gland and brain (Faust *et al.*, 1970, Craig and Faust's *Clinical Parasitology*, 8th ed. Lea & Febiger, Phil; Patharangkura *et al.*, 1980, *Southeast Asiau J.Trop. Med. Pub. Hlth.*, *11* : 532). The spinal cord is rarely involved (Singh *et al.*, 1966, *Brit. Med. J.*, *2* : 684), but there have been 40 reported cases of spinal cysticercosis (Akigu-

chi *et al.*, 1977, *Rinsho Shinkeigaku, 17* : 520). A case of intramedullary spinal cord tumour diagnosed on clinical and myelographic evidence is presented herein.

A 35-year-old Thai female, a resident of Bangkok gave a history of abdominal pain of 2 months duration. She has been treated for peptic ulcer without improvement. She complained of numbness of the left leg 4 days prior to coming to Siriraj Hospital. The numbness had increased but she was able to walk. Both extremeties were numb, the left leg up to the knees and the right up to ankle joint. One day before admission to the hospital, she was unable to move her left leg, and she also had retention of urine.

On examination the patient looked well-nourished and healthy, temperature 37°C, pulse rate 80/min, B.P. 120/70 mm Hg. No abnormalities were detected in respiratory, cardiovascular or alimentary systems. Central nervous system was normal, motor and sensory function normal in upper extremities. In the affected area there was loss of sensation up to 10th thoracic on both sides, flaccid monoplegia of left leg. Others were negative anal reflex and incontinence of urine. Results of routine laboratory findings were unremarkable, hematocrit reading 42%; white cell count 8400/c.mm with 75% neutrophils, 23% lymphocytes and 2% eosinophils. The results of urinalysis and faecal examinations were normal. Cerebro-spinal fluid cell count was 72/ml, mostly RBC, protein 56 mg%, sugar 33 mg%, chloride 116 mEq/l. Roentgenogram of the thoracic and lumbar column showed no destruction of the spine, but thoracic myelogram revealed complete block at the level of 11th thoracic, suggesting intramedullary tumour of the spinal cord. With the patient under general anesthesia, laminectomy of the T10-L1 was performed. There was bulging of the spinal cord at T10 segment. A vertical incision was made on the prominent part of the bulge, disclosing a whitish cyst. The cyst was sent for pathological and parasitological identification: The cyst was round, 9 mm in diameter, glistening white in colour with a dense opaque part. On incision and pressing the cyst, an invaginated scolex was extracted. The scolex was quadrate and had four cupped suckers with rostellar hooks at its apical end, (Fig. 1-2). The cyst was identified as *Cysticercus cellulosae*. Three days post-operation

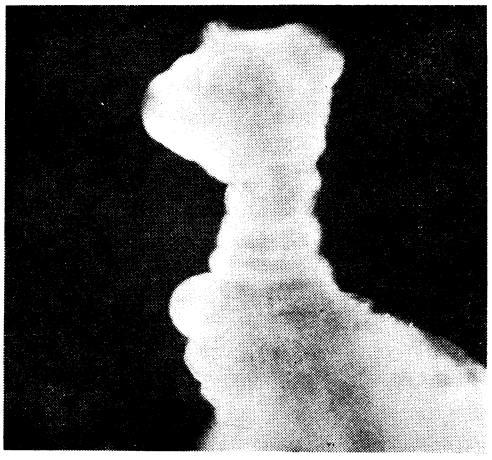

Fig. 1—*Cysticercus cellulosae* from a spinal cyst.

Fig. 2—Scolex with four suckers and rostellar hooklets.

the urinary system became normal, the patient was able to move her left leg with return of sensations, and 15 days later she could walk with the aid of a walking stick. On follow-up of the patient one month later, she was able to walk normally without any aid.

Thus the present case final diagnosis was an intramedullary spinal cysticercosis. A review of spinal cysticercosis by Akiguchi *et al.*, (1977, *ibid*) showed that out of 40 cases of spinal cysticercosis, 24 cases were intramedullary spinal cysticercosis. However, spinal cysticercosis is a rare cause of flaccid monoplegia, and is likely to be missed unless the *Cysticercus* is found at surgery, or calcification of the cyst is found on routine examination. In parts of the world where *Taenia solium* larval infections are common, one should consider spinal cysticercosis in the differential diagnosis of spinal cord tumours.

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