

winter when the animal experiences very low environmental temperature. The reverse is found true in summer. These observations are parallel with the results obtained in the present experiment after artificial exposure to different day lengths and varying temperatures.

The effect of temperature on physiology of this lizard is mediated either directly or indirectly through thyroid gland. In fact, thyroid hormones are well known for their involvement in physiology of reptiles<sup>2,11,12</sup>. However, the effects of thyroid hormones were observed only around 30°C. High levels of circulating thyroid hormones have also been reported in *C. versicolor* during winter. These observations lead the author to assume that the effect of temperature in this lizard is a direct one. However, further research is required to know in detail the mode of action of temperature in the physiology of reptiles.

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### PROTECTION AGAINST *PLASMODIUM BERGHEI* IN RATS BY IMMUNIZATION WITH ADULT WORM HOMOGENATE OF *SETARIA CERVI*

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SUCCESSFUL vaccination against *Plasmodium berghei* has been achieved by using antigens prepared from sporozoite, asexual blood or gametocyte stages of the plasmodial life cycle<sup>1</sup>. Vaccination with non-protozoal agents has been reported to protect mice non-specifically against *P. yoelii* and *P. vinkei*<sup>2,3</sup>. This paper presents the results of experiments in which the albino rats were immunized with a homogenate of adult male and female worms of *Setaria cervi*, bovine filariid worm, before challenging them with  $1 \times 10^6$  parasitized RBC of *P. berghei*.

Male inbred albino rats, 4-5 week old, were first immunized with *S. cervi* homogenate. The homogenate was prepared according to earlier studies<sup>4</sup>. The homogenate was emulsified with an equal volume of Freund's incomplete adjuvant. Sensitizing injections were given intraperitoneally on one or two occasions seven days apart. Control injections were made using a saline adjuvant emulsion.

Rats were challenged with a lethal dose of  $1 \times 10^6$  parasitized RBC of *P. berghei* intraperitoneally 15 days after the last sensitizing injection. The results were expressed as the proportion of rats surviving 60 days after challenge. The mortality data were analyzed by application of  $\chi^2$  test with Yate's correction (1 tail) method.

Hundred per cent mortality was observed in non-immunized rats with a challenge dose of *P. berghei*. Immunization with homogenate of female worms appeared to be more protective than the male homogenate. The pooled data reveal that the survival of female homogenate-treated rats 31/60 (51.67%) was significantly greater ( $P < 0.05$ ) than the male homogenate-treated rats 21/60 (35.0). The

**Table 1** Effect of *S. cervi* homogenate on the level of protection against *P. berghei* in rats

Antigen for sensitization mg rat	No. of injections	No. survivors/No. Challenged		Control
		Male homogenate	Female homogenate	
0.1	1	0/6	1/6	0/4
0.1	2	1/6	1/6	0/5
0.2	1	1/6	1/6	0/5
0.2	2	1/6	2/6	0/5
0.5	1	2/6	3/6	0/5
0.5	2	3/6	4/6	0/5
1.0	1	3/6	4/6	0/5
1.0	2	3/6	4/6	0/5
2.0	1	3/6	5/6	0/5
2.0	2	4/6	6/6	0/5

lower dose of female homogenate-treated rats was found to induce only 16.67% protection while the higher dose provided 100% protection (table 1). The proportion of rats surviving with lethal challenge increased with repeated injections of male and female homogenates. The pooled numbers of survivors were 30% and 46.67% with two doses of homogenate of male and female respectively (table 1) ( $P < 0.05$ ). Since female worms contained microfilariae, it was the mixture of both adult worm and microfilarial antigen. A similar situation was observed in *Dirofilaria immitis*-infected dogs, *Litomosoides carinii*-infected cotton-rats and *Dipetalonema viteae*-infected hamsters, in which the infection was suppressed dramatically in animals immunized with homogenate from gravid females<sup>5-7</sup>.

Thus the level of protection induced by vaccination varied with the male and female homogenate, antigen dose and number of immunizing injections.

It is clear from this study that rats can be protected fully from virulent *P. berghei* challenge by vaccination with female homogenate of *S. cervi*.

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## ECOLOGICAL CONSIDERATION IN THE CONTROL OF FISH DISEASE

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AN infection of black grub disease caused by the metacercaria of digenetic trematodes of the genus *Diplostomum* spp. was observed in the nursery ponds maintained at this farm, in which 2.7 lakh fry of *Cyprinus carpio* was stocked in March 1981. Again during July and August 1981, fry of *Catla catla*, *Labeo rohita*, *Cirrhina mrigala* and *Hypophthalmichthys molitrix* stocked in the nursery ponds were infected with black grub.

The fish farm (latitude 29° 43'N, longitude 76° 58'E, altitude at 245 m above sea level) received its water supply from the Western Jamuna Canal which runs by the side of the farm. The farm had a thick population of various types of trees viz. *Eucalyptus* sp. (Safeda), *Dalbergia sisoo* (Shisham), *Acacia arabica* (Kikar), *Melia azadirachta* (Neem), *Ficus religiosa* (Pipal), *Cordia obliqua* (Lasura), *Eugenia jambolina* (Jaman), *Mangifera indica* (Mango), *Zizyphus Jujuba* (Ber). They were the nestling grounds of the fish-eating birds, *Ardeola grayii* (Sykes), *Ardea* sp. and Kingfisher *Alcedo atthis*. The number of nests actually counted were 223 and were observed mainly on 'safeda' 'shisham' and 'kikar' trees. The pond had a population of molluscs viz. *Vivipara bengalensis*, *Planorbis* sp and *Lymnaea* sp.

The fry and fingerlings of all the species *op. cit.* were infected with black cysts distributed all over the body and located in the muscles just beneath the skin. Even the eyes and the body cavity were infected. The cysts were oval in shape and black in colour. The number of cysts ranged from 3 to 41. Their diameter ranged between 1.0 and 1.52 mm. On opening the cysts, metacercaria of digenetic trematode belonging to the genus *Diplostomum* sp. were observed. The length of the cercaria ranged