[Jpn. J. Parasitol., Vol. 35, No. 1, 71-74, February 1986]

Research Note

Infection- and Migration Route of *Strongyloides pavonis* Larvae in Chicks

HISATAKE NOJIMA, MIKIO KAWANABE,
SHINICHI NODA AND ATSUO SATO

(Received for publication; August 6, 1985)

Key words: *Strongyloides pavonis*, infection route, oral infection, percutaneous infection, migration route

Since the subcutaneous migration of *Strongyloides ratti* larvae from infection site to head of rat was found by Tada *et al.* (1979) and Hattori (1981), the route other than circulation system has been paid attention for *Strongyloides* larvae in final hosts.

Sakamoto and his colleagues (1963, 1964, 1968, 1982) discovered a new species of Genus *Strongyloides* in caecum of a green peacock, and named it as *S. pavonis* (Sakamoto and Yamashita, 1970). They kindly provided us the strain for the present study. The third-stage larvae were obtained at the 7th day of incubation of chick feces containing the eggs; they were cultured on a filter paper partially submerged in water in a 15 cm petri-dish at 25°C. The larvae suspended in 1,000 ml of clean water were sieved with 8 μm milipore filter. This process helped to remove most of other contaminated microorganisms. Seven-day old white Leghorn chicks, *Gallus gallus domesticus*, were used for the infection experiment. To know natural and possible infection route of the larvae in hosts, five groups of four chicks each were individually infected with 1,000 larvae; (1) orally (operative injection) into crop, (2) orally (operative injection) into gizzard, (3) cutaneously at the left wing, (4) subcutaneously at the left femoral subcutis, or (5) intraperitoneally. Alternatively, to know migration route of the larvae in hosts, eight groups of four chicks each were infected individually with 500 larvae subcutaneously at the left femoral subcutis and killed 6-84 hr after infection. The larvae in organs or tissues were allowed to release into saline by a method of Hattori (1981); briefly, minced tissue was incubated at 37°C for 3 hr, while intestine and caecum were sliced longitudinally, reversed, and left in saline at room temperature (20-25°C) for 12 hr or more. The larvae and adults released in saline were counted.

Table 1 shows the results of worm recoveries from caecum by five different infection routes on day 7 after infection. Maximum average numbers of worms were recovered from chicks with subcutaneous and intraperitoneal infections, while minimum yield was obtained in those with cutaneous infection. When the larvae were given orally into crop and gizzard, numbers of worms recovered were found between those mentioned above. Although number of chicks is limited (4 each), these results would suggest that natural infection route of *S. pavonis* to bird hosts is oral.

As subcutaneous infection resulted in relatively constant number of worm recovered with the highest worm recovery rate among five routes, we used it in the following experiments for migration route. Table 2 shows the results of recoveries of migratory larvae.

This study was partially supported by Kodama Foundation for Research of Medical Scienses.
Department of Medical Zoology, Faculty of Medicine, Kagoshima University, Kagoshima 890, Japan.

Table 1 Recoveries of *Strongyloides pavonis* from caecum of chicks infected with 1,000 larvae by different routes

Route of infection	No. of chicks	No. of worms*	
		Average	Range
Oral infection			
Injection into crop	4	292.5	107-583
Injection into gizzard	4	157.3	0-557
Cutaneous infection			
Cutaneously at wing	4	7.5	0- 19
Other infection			
Subcutaneously at femur	4	477.8	345-667
Intraperitoneally	4	451.8	222-743

* Results obtained on day 7 after infection

Table 2 Recoveries of *Strongyloides pavonis* larvae from different organs and tissues of 4 chicks after subcutaneous infection (500 larvae into femoral subcutis)

Organ and tissue examined	Average number of larvae recovered from infected chick (hr after infection)							
	6	12	24	36	48	60	72	84
Head								
Skin & muscle	0	0	0	0	0.3	0	0	0
Cranium & brain	0	0	0	0	0	0	0	0
Neck								
Skin & muscle	0	0	0	0.3	1.5	1.8	0	0
Upper extremity								
Skin & muscle	0	0	0.5	0	0.3	0	0	0
Thorax								
Skin	0	0	0	2.0	0	0	0	0.3
Muscle	0	0	16.0	45.3	48.5	25.3	11.8	3.8
Trachea	0	0	0.3	0	0	0	0	0.3
Lung	0	1.0	2.5	5.8	1.8	11.0	6.8	0
Crop	0	0	0	0	5.3	0	0	0
Esophagus	0	0	3.0	0	0.3	0.3	0	0
Abdomen								
Skin	0	0	7.8	0	1.8	0	0	0
Muscle	0	4.3	41.3	44.5	69.0	14.8	36.0	12.3
Proventriculus	0	0	19.3	9.8	3.5	1.5	0	0
Gizzard	0	0	1.3	13.5	36.5	15.3	0.5	0
Intestine 1	0	0	4.8	5.5	8.3	7.5	5.0	0.8
Intestine 2	0	0	4.0	3.3	6.0	10.0	6.3	5.5
Caecum	0	0	0.3	48.0	62.8	132.8	155.3	212.5
Lower extremity								
Skin & muscle	17.8	28.5	1.3	1.0	1.5	0	0	0
Total	17.8	33.8	102.3	178.8	247.0	220.0	221.5	235.3

Only 17.8 and 28.5 larvae in average were released from infection site (lower extremity) 6 and 12 hr after infection, respectively. A similar phenomenon was first found for *S. ransomi* larvae by Stone *et al.* (1967) and for *S. ratti* by Katz (1969) as "quiescent state" which occurred 24 hr after percutaneous infection. Recently, Hattori (1981) transplanted the skin obtained from infection site, 6 hr after infection with *S. ratti* on the abdomen of the recipient rat, and confirmed the presence of the larvae at the site. As shown in Table 2, the larvae did not accumulate in any organ but distributed evenly from neck to lower extremity 24-48 hr after infection. Then, the larvae began to accumulate to caecum. Larvae appeared simultaneously in various parts of digestive canal, although relative large number of larvae were found in proventriculus. At hours 60-84, most larvae reached caecum, although some larvae were still found in trunk. There was no evidence that the larvae accumulated in the lung during their migration, as we failed to detect more than 11 larvae from lung during the observation period of 84 hr.

It was suggested that the larvae distribute evenly in trunk including lung, and then penetrate into intestine and eventually reach the caecum of the host.

We wish to thank Drs. H. Sawa and R. Miyawaki for their help, medical students of Kagoshima University at that time.

References

1) Hattori, Y. (1981): Migration of *Strongyloides ratti* in rats. Jpn. J. Parasitol., 30, 597-607 (in Japanese).
2) Katz, F. F. (1969): *Strongyloides ratti* (nematoda) in newborn offspring of inoculated rats. Proc. Pennsylvania Acad. Sci., 43, 221-225.
3) Sakamoto, T. (1968): Avian *Strongyloides* and strongyloidiasis. Shiyu (J. Grad. Ass. Dep. Vet. Med., Kagoshima Univ.), No. 10, 14-24 (in Japanese).
4) Sakamoto, T. (1982): Studies on Strongyloidiasis of the peacock. IV. Observations on pathogenicity of *Strongyloides pavonis* Sakamoto et Yamashita, 1970 for various birds. Mem. Fac. Agr. Kagoshima Univ., 18, 115-125.
5) Sakamoto, T. and Takahashi, H. (1963): Studies on *Strongyloides* of peacock. Jpn. J. Parasitol., 12, 296 (in Japanese).
6) Sakamoto, T., Takahashi, H. and Nakamata, M. (1964): Studies on strongyloidiasis of the peacock I. The anthelmitic action of phenothiazine, kamala and dithiazanine iodide against parasites in the peacock, Jpn. J. Vet. Res., 12, 39-46.
7) Sakamoto, T. and Yamashita, J. (1970): Studies on strongyloidiasis of the pecaock. II. *Strongyloides pavonis* n. sp. (nematoda: Strongyloididae) from the green peafowl *Pavo muticus* Linnaeus. Jpn. J. Vet. Res., 18, 163-171.
8) Stone, W. M. and Simpson, C. F. (1967): Larval distribution and histopathology of experimental *Strongyloides ransomi* infection in young swine. Can. J. Comp. Med. Vet. Sci., 31, 197-202.
9) Tada, I. Mimori, T. and Nakai, M. (1979): Migration route of *Strongyloides ratti* in albino rats. Jpn. J. Parasitol., 28, 219-227.

短　報

ヒヨコにおけるクジャク桿虫の感染経路と体内移行経路

野島尚武　川辺幹生　野田伸一　佐藤淳夫
（鹿児島大学医学部医動物学教室）

クジャク桿虫の３期幼虫をヒヨコに５種の感染法（①嗉嚢注入法，②砂嚢注入法，③翼下経皮感染法，④大腿皮下注入法，⑤腹腔内注入法）にて接種し，７日目に盲腸からの虫体回収率を比較した．その結果回収率は④⑤①②③の順に回収率が低下し，実験的には体内注入法が有利だが，自然界では本虫は経皮感染よりも経口感染が主であると考えられた．又，大腿皮下注入感染後，時間毎に部位別に虫体回収を行い，本虫のヒヨコでの体内移行は接種後体幹に分散し，特定器官に集中することなく，やがて消化管に侵入し盲腸に最終寄生することが分った．