

Research Note

## Morphological Observations of the Tubule of *Theileria sergenti*

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**Key words:** *Theileria sergenti*, excretion-like phenomenon

There are many studies on the feeding mechanisms of intraerythrocytic parasites (Rudzinska and Trager, 1967; Rudzinska *et al.*, 1965; Aikawa *et al.*, 1966; Butter, 1967; Simpson *et al.*, 1967; Molyneux and Bafort, 1970; Wayne and Holbrook, 1974; Rudzinska, 1976; Schein *et al.*, 1977). However, no study has been made on excretion mechanism of them. We observed the excretion-like phenomenon by the tubule of *Theileria sergenti* in erythrocytes of cattle using transmission electronmicroscope.

The strain of *T. sergenti* was isolated from a naturally infected cattle at Shimokita field in Aomori Prefecture, Japan. This strain was maintained in splenectomized calves. As shown in Table 1, two experimental cattle (P-31, P-32) which were healthy and not infected with *T. sergenti*. They were inoculated intravenously with the blood of calves infected purely with *T. sergenti*.

Samples were collected by biopsy from the bone marrow at given time of intervals after infection. They were immediately fixed in a mixture of 2% glutaraldehyde and 2% osmium tetroxide, at pH 7.4 for 2 hours in an icebath. Thin sections were stained with uranium acetate and lead citrate and observed with a HITACHI model HU 125E electron microscope. The many parasites which had a

single tubule were observed in erythrocytes of the bone marrow.

The forms of the tubule of *T. sergenti* were divided into four types (Type I to IV). The tubule of Type I appeared within the body of parasite (Figs. 1, 2). The tubule of Type II that extended from the body of parasite at the periphery of erythrocyte was observed (Figs. 3, 4).

The tubule of Type III was touching the erythrocyte membrane (Figs. 5, 6). The tubule of Type IV appeared to dissolve the erythrocyte membrane, and to be contacted with the plasma (Figs. 7, 8). From the results of observation, there was diagramed four forms of the tubule of *T. sergenti* (Fig. 9).

Wayne and Holbrook (1974) studied the

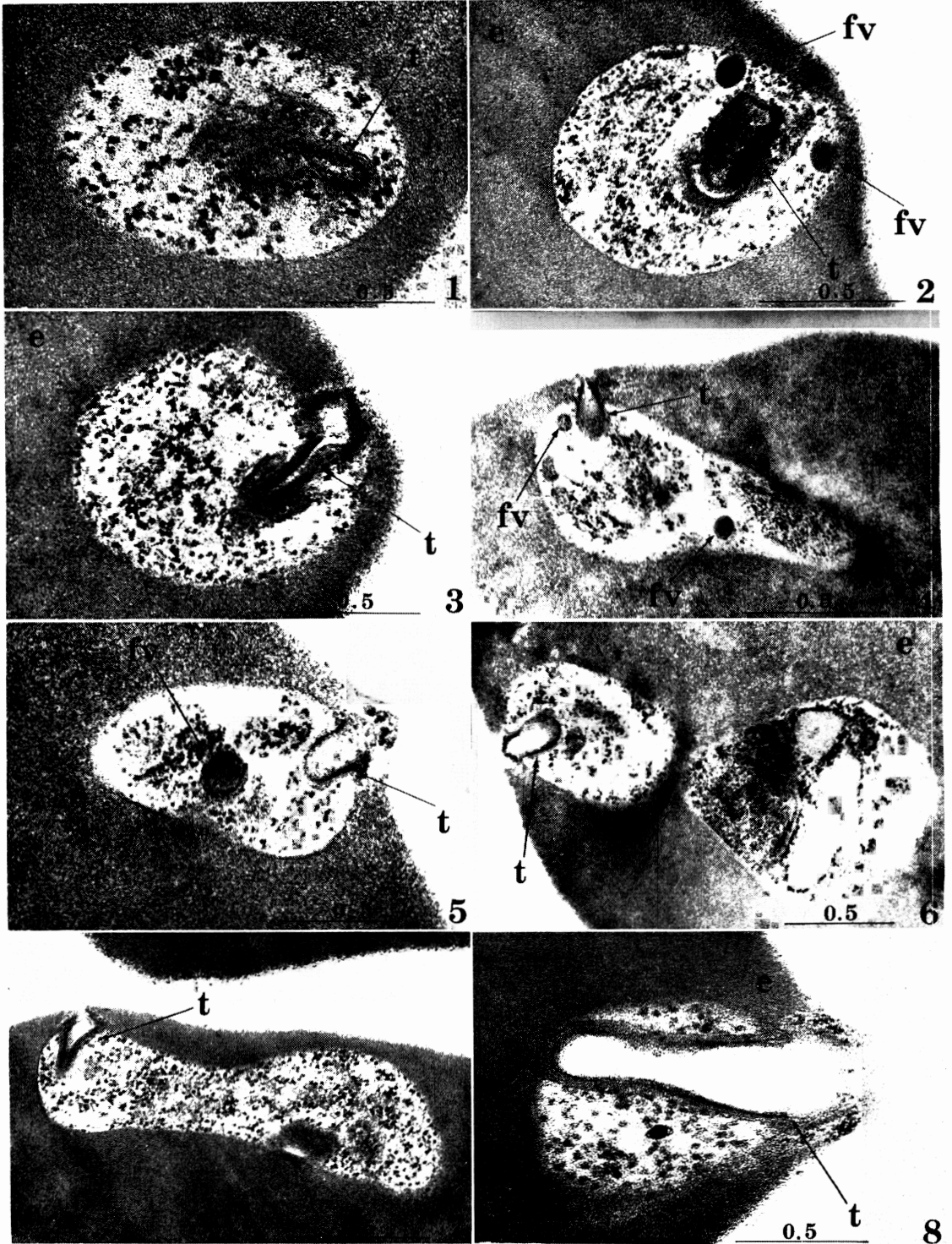
Table 1 Experimental cattle and infected blood

No. of cattle	P-31	P-32
Species of cattle	Holstein	Holstein
Age (month)	10	8
Body weight	180kg	180kg
Sex	♂	♀
Days after infection	90-120	20-30
Infection rate*	60-110	50-100
Hb (g/dl)	4.9-4.2	5.2-4.6
Ht (%) Infectious rate*	21-10	25-22
Species of <i>Theileria</i>	<i>T. sergenti</i>	<i>T. sergenti</i>

\* Infection rate of *T. sergenti* in 1,000 erythrocytes.

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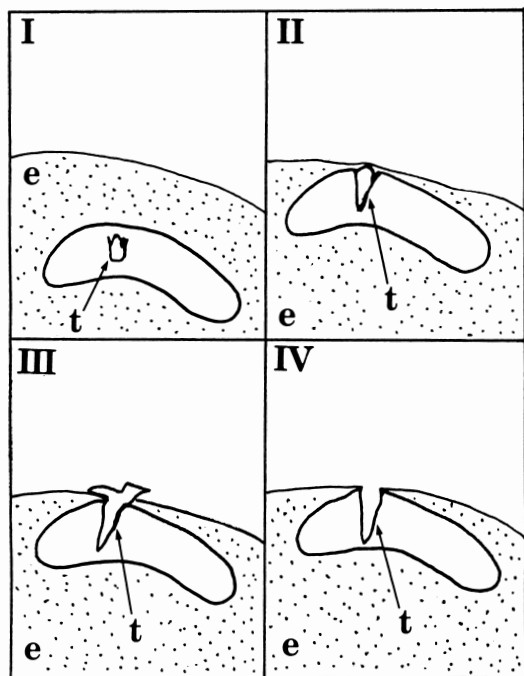


Fig. 9 Diagrammatic representation of the various forms in excretion-like phenomenon by the tubule (t) of *Theileria sergenti*.

e: erythrocyte t: tubule

feeding mechanisms of *Babesia equi* and described the tubular probably functions in the uptake of nutrients. The present authors (1979) reported the isolation and characterization of *Theileria* antigen, and the serum from cattle infected severely with *T. sergenti* revealed higher the passive hemagglutination (PHA) titer. From this report, it may be considered that the excretion material of *T. ser-*

*genti* had specific antigenicity for PHA reaction.

In our study, it is difficult to decide the function of the tubule of *T. sergenti*. However, the tubule was often observed in the multiplication stage of parasite. Therefore, the parasite probably seems to have excretion-like phenomenon by the tubule.

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Figs. 1-8 The ultrastructural morphology of the parasites in erythrocyte in the cattle bone marrow.

Figs. 1, 2 The parasite has a tubule within its body. Two food vacuoles (fv) are observed.

Figs. 3, 4 A tubule (t) is extended from the body of parasite to be the periphery of the erythrocyte. Nucleus (n) and food vacuole (fv) are observed. Fig. 3 ( $\times 52,000$ ), Fig. 4 ( $\times 36,000$ )

Fig. 5 Excretory-like material is touching the membrane of the erythrocyte is present. A food vacuole is observed in parasite. ( $\times 60,000$ )

Fig. 6 A tubule (t) is touching the membrane of the erythrocyte. ( $\times 38,000$ )

Fig. 7 The erythrocyte membrane is dissolved by a tubule (t). ( $\times 38,000$ )

Fig. 8 A tubule (t) opening into plasma from the parasite body is observed. Opening from of a tubule (t) is slightly expanded. ( $\times 51,000$ ) e: erythrocyte fv: food vacuole t: tubule

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## 短 報

### *Theileria sergenti* の小管の形態学的観察

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牛赤血球内 *T. sergenti* の小管について観察を行なった。小管は、虫体体側に位置し、虫体の細胞質内 (Type I)、細胞質より伸び寄生赤血球辺縁 (Type II)、赤血球膜に接し (Type III)、さらに血球膜を貫通し血漿内に開

口する (Type IV) およそ四つの形に分けられた。

これら小管の機能については、排泄様作用を有しているものと考えられた。