

THE EXPERIMENTAL TRANSMISSION OF THEILERIA OVIS BY RHIPICEPHALUS
EVERTSI.

B. C. JANSEN AND W. O. NEITZ, Onderstepoort Laboratory.

INTRODUCTION.

Theileria ovis Rodhain, 1916 (= *Gonderia ovis* Sergent, Parrot and Hilbert, 1922, = *Theileria recondita* Lestoquard, 1929) was placed in the genus *Theileria* by Lestoquard in 1929. The revision in the nomenclature was justified because he had demonstrated that the administration of cultures Paratyphoid B into five splenectomized sheep harbouring *Th. ovis* provoked the development of Koch's bodies. This appears to be the only record where schizonts have been observed in sheep harbouring *Th. ovis*. Rastegaieff (1934, 1935, 1936, 1937) concludes from his experiments that *Rhipicephalus bursa* Canestrini and Fanzago, 1877, *Dermacentor silvarum* Alenev, 1931, and *Ornithodoros lahorensis* Neumann, 1908, are the vectors of *Th. ovis*. No mention is made by him of the occurrence of schizonts in his experimental animals.

Th. ovis was first recorded in South Africa by De Kock and Quinlan (1926) in splenectomized sheep. Since then this parasite has been encountered quite often in experimental sheep at Onderstepoort. Very little is known about its distribution and no information is available in the literature about its biological transmission in South Africa.

EXPERIMENTAL OBSERVATIONS.

The wide distribution of various species of ticks and the sporadic occurrence of *Th. ovis* in sheep clearly indicated the importance of using known susceptible animals for biological transmission experiments. The splenectomy of sheep and the careful examination of blood smears of such animals for at least six weeks after the operation was considered to be the only reliable method of ascertaining whether or not they harboured a latent infection. For this purpose 22 weaned lambs were obtained from the Veterinary Laboratory at Ermelo. After their arrival they were maintained under tick-free conditions. Splenectomy of these animals showed that five harboured a latent infection of *Th. ovis*, while one relapsed to *Th. ovis*, *Anaplasma ovis* Lestoquard, 1924, and *Eperythrozoon ovis* Neitz, Alexander, and Du Toit, 1934. This result proved to be satisfactory, because it offered several active *Th. ovis* carriers for the infection of ticks and a fairly large number of susceptible sheep for the transmission work.

The common occurrence of larvae, nymphae and adults of the two host tick *Rhipicephalus evertsi* Neumann, 1897, on sheep suggested this species as a possible vector. For the experimental work the larvae of *Rh. evertsi* reared at the laboratory were used. They were fed on the ears of the above-mentioned *Th. ovis* carriers, being controlled by suitable ear bags according to the method described by Neitz (1937). During the course of these experiments a certain amount of difficulty was experienced with the feeding of the larvae. Sometimes they would die within 24 to 48 hours after infestation or alternatively they would produce a marked oedema and suppuration of the ears. Despite these difficulties it was

EXPERIMENTAL TRANSMISSION OF THEILERIA OVIS.

possible to feed an adequate number of ticks for the transmission work. The details of this work are mentioned in the appended Table I. The ticks were allowed to moult and starved for periods varying from 40 to 82 days before infesting the sheep.

The adult ticks were fed on the six sheep mentioned in the subjoined Table II. On five sheep both females and males fed, while on the sixth animal males only attached. The females detached after periods varying from seven to nine days and the males were destroyed a day or two later. All the sheep showed a febrile reaction which commenced eight to 13 days after the tick infestation and continued for periods varying from four to 16 days.

Palpation of the parotid lymphatic glands draining the ears on which the ticks had fed showed a moderate swelling for a period of one week. Smears prepared from the swollen lymphatic glands exhibited an increased lymphocyte and a moderate increased histiocyte count for a week. After a prolonged examination Koch's bodies in rare numbers were demonstrated in four sheep, including the one on which male ticks only had attached. The schizonts were seen on the 14th and/or the 16th day and in one sheep also on the 17th day after the tick infestation. The haematropic forms of *Th. ovis* appeared on the 17th to 23rd day and were demonstrable for more than two months. The maximum erythrocytic infection was never more than three per cent. A variable degree of anaemia developed in all the sheep. Regenerative anaemic changes were observed five to 18 days after the first appearance of *Th. ovis* and persisted for periods varying from one to five weeks. The sheep did not exhibit any other clinical symptoms.

CONCLUSIONS.

1. The transmission of *Th. ovis* by the two host tick *Rh. evertsi* was successful in six susceptible splenectomized sheep.
2. *Th. ovis* was picked up by the larvae and nymphae and transmitted by the ensuing adults.
3. Koch's bodies were demonstrated in rare numbers in the parotid lymphatic glands of four sheep.
4. The reaction in all the sheep was accompanied by an increased lymphocyte production in the parotid lymphatic glands, a fever and a relatively mild anaemia.
5. These results once more confirm the observations of Lestoquard (1929) that Koch's bodies form a part of the *Th. ovis* life-cycle.

TABLE I.
Feeding of Rh. evertsi on Th. ovis Carriers.

Sheep No.	Infested with Larvae Batch No.	Attached for.	No. of Nymphae Collected; Batch No.	Period of Moulting.	Adults Fed on Sheep.	Refer to.
81453.....	1977B	Days. 16-19	8; 1977Ba	Days. 22	81473	Table 2.
81456.....	1978D	16-21	34; 1978Da	22	81468	Table 2.
81494.....	1980B	16-21	43; 1980Ba	22	81460 81172	Table 2. Table 2.
81484.....	1992A	16-19	22; 1992Aa	22	81466	Table 2.
81214.....	1992B	15-18	12; 1992Ba	18	81869	Table 2.

TABLE II.
Transmission of *Th. ovis* by the Adults of *Rh. evertsi*.

Sheep No.	Infested with Adults, Batch No.	Attached for.	No. of Ticks Collected.	Incubation Period.	Duration of Fever.	Changes in the Left (= L1) and the Right (= R1) Parotid Lymphatic Glands.	Koch's Bodies Seen on.	<i>Th. ovis</i> in Erythrocytes Seen on.	Changes in the Peripheral Blood.
81473	1977Ba1. Placed on left ear.	Only males attached.	6 males destroyed on the 8th day.	13 days.	6 days. 105-105.6°F.	L1 moderately swollen for 1 week. Increased lymphocyte production. R1 not swollen.	14th day after tick infestation in L1.	23rd day after tick infestation.	Mild anaemia. Erythrocyte count not below 6.6 million per cmm. Anisocytosis, basophilia and polychromasia seen 5 days after first appearance of <i>Th. ovis</i> and persisted for 14 days.
81468	1978Da1. Placed on both ears.	7 to 8 days.	8 females. An equal number of males destroyed.	9 days.	8 days. 105-105.6°F.	L1 moderately swollen for 1 week. Increased lymphocyte production. R1 slightly swollen. No smears examined.	14th and 16th day after tick infestation in L1.	17th day after tick infestation.	Mild anaemia. Erythrocyte count not done. Anisocytosis, basophilia, polychromasia and Jolly bodies seen 11 days after first appearance of <i>Th. ovis</i> and persisted for about 30 days.
81460	1980Ba1. Placed on both ears.	8 to 9 days.	8 females. An equal number of males destroyed.	9 days.	4 days. 104-105°F.	L1 and R1 moderately swollen for one week. Increased lymphocyte production in both glands.	Not seen.	17th day after tick infestation.	Anaemia. Erythrocyte count not below 3.44 million per cmm. Anisocytosis, basophilia, polychromasia and Jolly bodies seen 14 days after first appearance of <i>Th. ovis</i> and persisted for about 5 weeks.
81172	1980Ba2. Placed on left ear.	8 to 9 days.	2 females. Several males destroyed.	9 days.	4 days. 104-105°F.	L1 swollen for about one week. Increased lymphocyte production. R2 not swollen and no smears examined.	Not seen.	17 days after tick infestation.	Mild anaemia. Erythrocyte count not below 6.3 million per cmm. Anisocytosis, basophilia and polychromasia seen 18 days after first appearance of <i>Th. ovis</i> and persisted for 7 days.
81466	1992Aa1. Placed on both ears.	7 to 8 days.	9 females. Equal number of males destroyed.	9 days.	7 days. 106-106.6°F.	L1 and R1 swollen for about a week. Increased lymphocyte production in both glands.	16th day after tick infestation in R1.	19th day after tick infestation.	Mild anaemia. Erythrocyte count not below 5.62 million per cmm. Anisocytosis, basophilia, polychromasia and Jolly bodies seen 11 days after first appearance of <i>Th. ovis</i> and persisted for 21 days.
81869	1992Ab1. Placed on left ear.	8 to 9 days.	4 females. Several males destroyed.	9 days.	16 days. 105-105.8°F.	L1 swollen for about a week. Increased lymphocyte production. R1 not swollen.	14th, 16th and 17th day after tick infestation in L1.	17th day after tick infestation.	Anaemia. Erythrocyte count not below 4.30 million per cmm. Anisocytosis, basophilia, polychromasia and Jolly bodies appeared 11 days after first appearance of <i>Th. ovis</i> and persisted for 14 days.

EXPERIMENTAL TRANSMISSION OF THEILERIA OVIS.

LITERATURE.

- DE KOCK, G. AND QUINLAN, J. B. (1926). The appearance of *Gonderia ovis* in the blood of splenectomized sheep. *11th and 12th Repts. Dir. Vet. Educ. and Research, South Africa*, pp. 255-258.
- LESTOQUARD, F. (1929). Quoted by Du Toit, P. J. (1930). Theileriasis. *Eleventh International Veterinary Congress, London, 1930*.
- NEITZ, W. O. (1937). The transmission of heartwater to and from blesbuck. (*Damaliscus albifrons*) by means of the bont tick (*Amblyomma hebraeum*). *Onderstepoort Jnl.*, Vol. 9, No. 1, pp. 37-46.
- RASTEGAIEFF, E. F. (1934). Zur Frage der Schaffiroplasmosen in Azerbaidschau (Transkaukasien). *Arch. f. Tierheilkunde*, Vol. 67, pp. 176-185.
- RASTEGAIEFF, E. F. (1935). Un nouveau vecteur dans la transmission des hémoparasites des animaux domestiques *Ornithodoros lahorensis*, Neumann 1908. *Ann. Inst. Pasteur.*, Vol. 54, pp. 250-258.
- RASTEGAIEFF, E. (1936). *Ornithodoros lahorensis*, Neumann 1908, vecteur des hémoparasites du mouton *Anaplasma ovis* et *Theileria récondita*. *Bull. Soc. Path. Exot.*, Vol. 24, pp. 732-733.
- RASTEGAIEFF, E. (1937). *Dermacentor silvarum*, vecteur des hémoparasites du mouton: *Anaplasma ovis* et *Theileria récondita*. *Bull. Soc. Path. Exot.*, Vol. 30, pp. 479-480.