



## Theileriosis in River Nile State, Northern Sudan

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### Introduction:

In River Nile State, Sudan (Fig. 1), tropical theileriosis caused by *Theileria annulata* and malignant ovine theileriosis caused by *T. lestoquardi* are the most prevalent and pathogenic tick-borne diseases among cattle and sheep, respectively (ElGhali and ElHussein, 1995). Tropical theileriosis was concluded to reduce the expected profitability by 29% of gross profit in a cross-bred dairy farm in the State (Gamal and ElHussein, 2003).

There is a wide diversity of tick populations characterized in River Nile State including the described proven field vector of *T. annulata* and *T. lestoquardi*, *Hyalomma anatomicum*. In spite of intensive research on theileriosis, only little and fragmented work has been done to study various aspects of tropical theileriosis transmissibility and susceptibility.

### Objectives:

- To investigate ability of selected ixodid tick species to transmit *T. annulata*.
- To investigate infectivity of *T. annulata* to sheep and *T. lestoquardi* to cattle under laboratory conditions.
- To estimate the natural prevalence of *T. lestoquardi* in cattle and *T. annulata* in sheep in the state.
- To optimize a molecular tool (PCR) for detection of *T. lestoquardi* and *T. annulata* in Sudan.

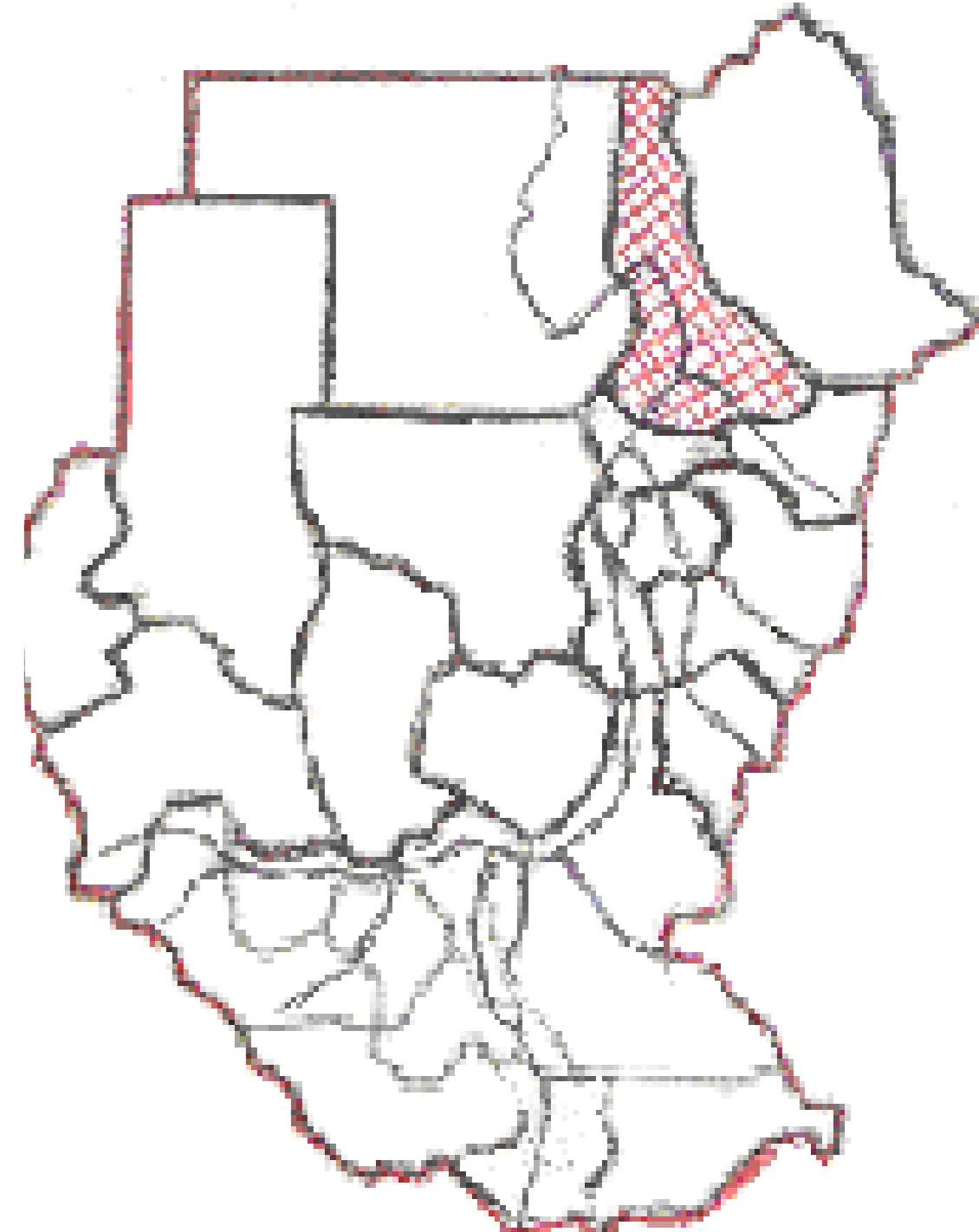


Fig. 1: River Nile State, Sudan

### Materials and Methods:

- H. dromedarii* and *H. marginatum rufipes* were used to transmit tropical theileriosis to 6 naive calves through nymphal adult feeding according to Bailey (1960).
- H. anatomicum* ticks were used to transmit tropical theileriosis to 3 naive sheep and malignant ovine theileriosis to 3 calves.
- All infections were confirmed by IFA serological test, PCR, in addition to regular microscopic examination and close monitoring of experimental animals.
- A molecular surveillance was conducted in sheep using *T. annulata* specific primers and in cattle using *T. lestoquardi* specific primers (Bakheit *et al.*, 2006, Kirvar *et al.*, 1998).

### Results:

- Both *H. dromedarii* and *H. marginatum rufipes* transmitted tropical theileriosis to naive calves resulting in an onset of clinical disease including: fever (40-41.1°C), enlargement of superficial lymph nodes, decrease in appetite and respiratory manifestations. Schizonts and piroplasms were detected in the two animal groups intermittently. Drop in PCV values was noticed in all calves. Anti-*T. annulata* antibodies were detected in all animals starting from day 14 post infection (Fig. 2) and the expected band appeared on PCR in all animals.
- All sheep (3/3) became infected with *T. annulata* resulting in onset of clinical theileriosis including slight elevation in body temperature, enlargement of one or both prescapular lymph nodes and respiratory distress. Two animals showed both erythrocytic and lymphocytic *Theileria* stages, while only schizonts were detectable in the third animal. Anti-*T. annulata* antibodies were detectable in two animals starting from day 21 post infection and the expected PCR band was demonstrated for all animals (Fig. 3). On the other hand, transmission of *T. lestoquardi* to cattle revealed apparent clinical picture in two (2/3) calves exposed to the infection, with increased body temperature, marked enlargement of both prescapular lymph nodes (Fig. 4), respiratory manifestations: cough, nasal discharge and rales. Piroplasms and schizonts were detected in blood and lymph node biopsy smears respectively taken from one animal. Another animal only showed lymphocytic stage, while no parasitic stage was detected in the third animal. PCV showed no significant difference ( $P>0.05$ ) post infection in all animals. Anti-*T. lestoquardi* specific antibodies were detected firstly on day 16 and day 36 in two animals while no antibodies were detected in the non-affected animal. PCR bands of the expected size could be shown for the two infected animals (Fig. 5).
- PCR surveillance on natural infectivity of *T. lestoquardi* in cattle and *T. annulata* in sheep revealed that eight out of 105 (7.7%) sheep showed specific bands of *T. annulata* (Tab. 1) and three out of 112 (2.7%) cattle showed *T. lestoquardi* infection (Tab. 2).

Location	No. of sampled animals	No. of positives	Percentage of positives
Atbara Food Security Scheme	37	4	10.8
Fadlab / Um attur	35	2	5.7
Eddamer Town	33	2	6.1
Total	105	8	7.7

Table 1: Molecular surveillance of *T. annulata* in sheep

Location	No. of sampled animals	No. of positives	Percentage of positives
Atbara Food Security Scheme	39	2	5.1
Fadlab / Um attur	37	1	2.7
Eddamer town	36	0	0
Total	112	3	2.7

Table 2: Molecular surveillance of *T. lestoquardi* in cattle

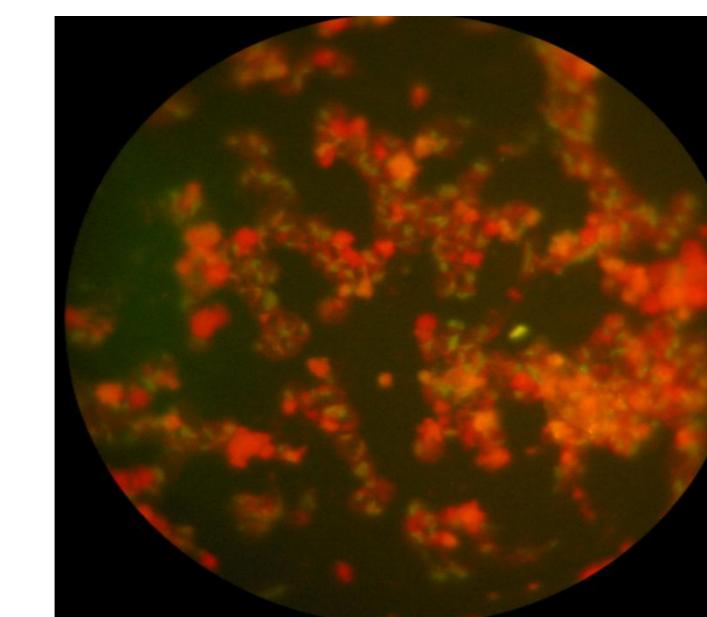


Fig. 2: Fluorescent emission reflecting *T. annulata* antibodies in a calf infected through adult *H. m. rufipes*

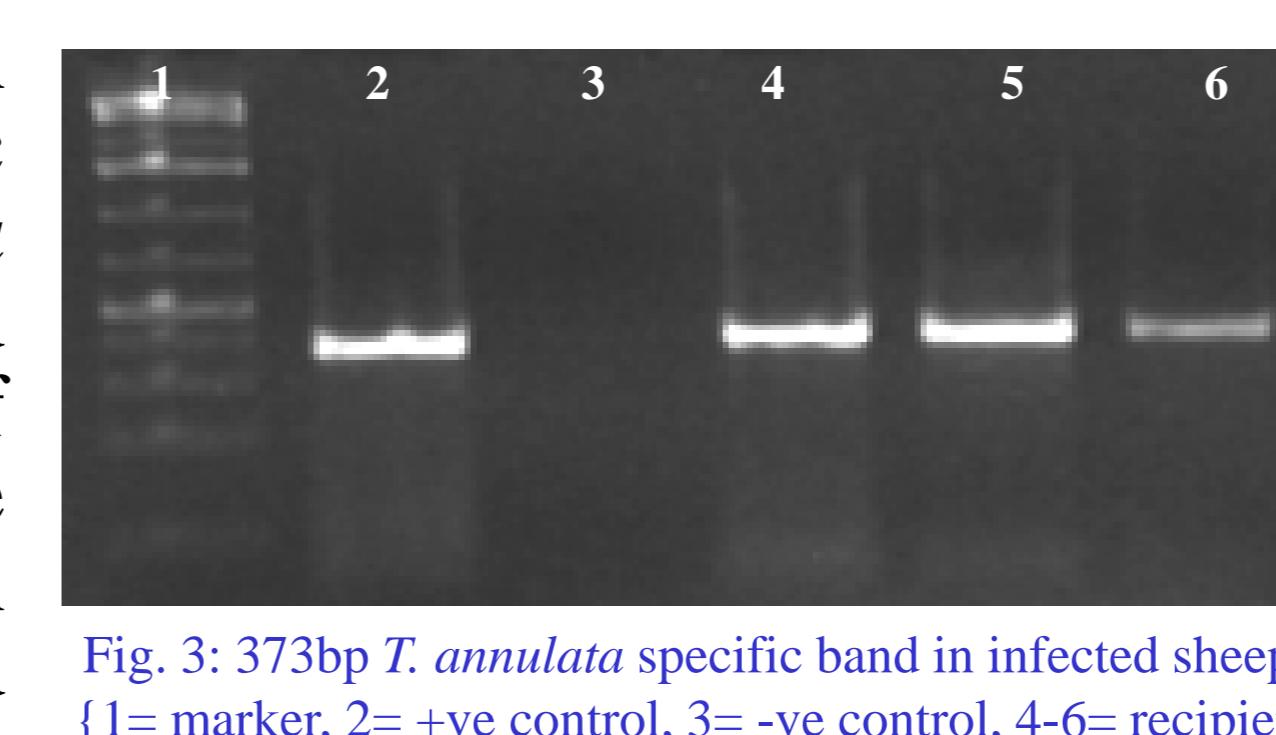


Fig. 3: 373bp *T. annulata* specific band in infected sheep. {1= marker, 2= +ve control, 3= -ve control, 4-6= recipient sheep}



Fig. 4: Enlarged lymph node of a calf infected with *T. lestoquardi*

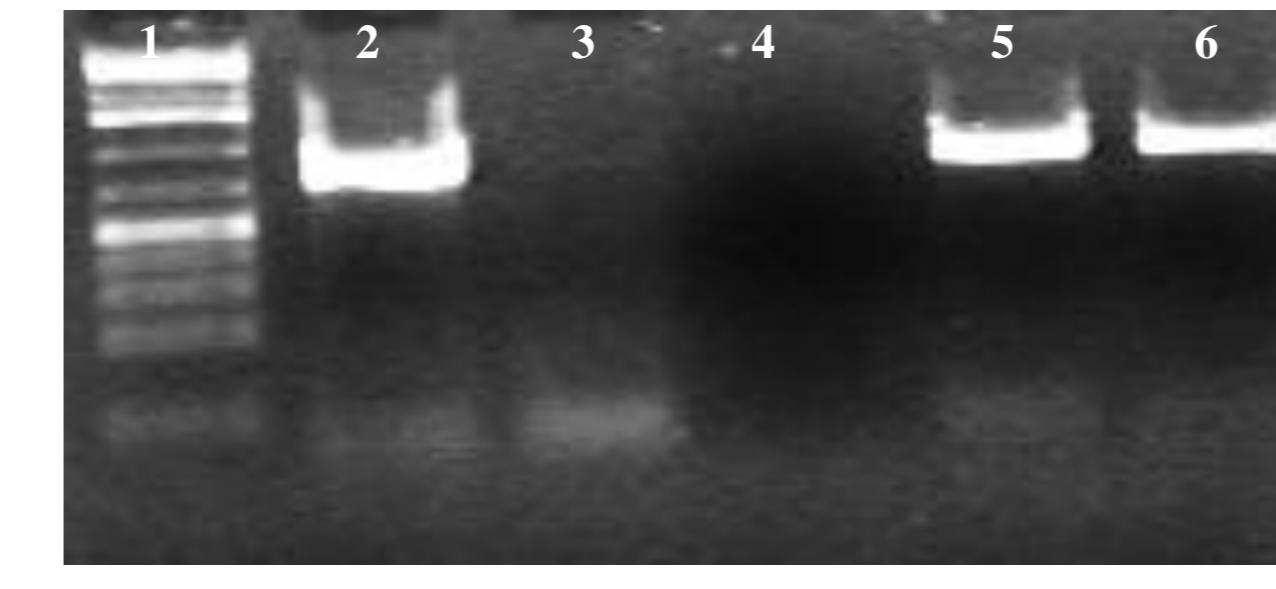


Fig. 5: 730 bp *T. lestoquardi* specific band in infected sheep. {1= marker, 2= +ve control, 3= -ve control, 4-6= recipient cattle}



Bailey method for tick feeding



[www.nhc.ed.ac.uk](http://www.nhc.ed.ac.uk)  
*H. dromedarii*



<http://webpages.lincoln.ac.uk>  
*H. marginatum*

### Discussion:

The study confirmed that *T. annulata* is transmitted by *H. dromedarii* and *H. marginatum rufipes*. Secondly, it was shown that *T. lestoquardi* could infect cattle, and *T. annulata* could infect sheep, the latter having been previously shown. These findings were demonstrated by the tick transmission studies as well as through the field surveillance of the parasites in both animal species. Although trials revealed positive results as assessed by different means, experimental transmission is not a conclusive evidence for the transmission in the field but reflects the possibility of such a transmission to occur. Our results are in contrast to Leemans *et al.* (1999a, 1999b) where only a slight enlargement of lymph nodes in calves infected with *T. lestoquardi* sporozoites stabilite was noticed and neither piroplasms nor schizonts were detectable in all six calves used. This difference in reaction is possibly related to differences in virulence between the *T. lestoquardi* strains used. The *T. lestoquardi* strain used in this study is known to be highly pathogenic (ElGhali and ElHussein, 1995).

### References:

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