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## OVINE TOXOPLASMOSIS IN SWEDEN

By

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UGGLA, A., P. BESKOW, O. SCHWAN, N. R. BERGQUIST and T. WALLER: *Ovine toxoplasmosis in Sweden*. Acta vet. scand. 1983, 24, 113—119. — Sera from 155 ewes representing 21 different sheep flocks from the central parts of Sweden were examined for the presence of antibodies to *Toxoplasma gondii* by the indirect fluorescent-antibody test. Seropositive animals were found in 14 flocks, which corresponded to 55 % of the tested sera. Animals from the same flock were with few exceptions either all positive or all negative. Some ewes with a history of abortion a few months before blood sampling showed high titers indicating causative correlation with toxoplasmosis. These are the first verified cases of ovine toxoplasmal abortions in Sweden.

*Toxoplasma gondii*; sheep; abortion; fluorescent antibody test.

*Toxoplasma gondii* is a worldwide distributed protozoan parasite with felines as final hosts and a great variety of warm-blooded animals as possible intermediate hosts (*Jacobs 1973*). The parasite is a feared cause of congenital disease in human fetuses, however, most cases of toxoplasmosis in adults are taking a subclinical course. Humans can be infected by ingesting *Toxoplasma* oocysts from cat feces (*Hutchison et al. 1968*) or by eating raw or undercooked meat containing the tissue cyst stage of the parasite (*Jacobs et al. 1957*). Fetuses get infected by the transplacental route (*Eichenwald 1948*).

Among domestic animals sheep are known to be very susceptible to toxoplasmosis. The disease is reported as one of the main

causes of ovine abortions and stillbirths in sheep-raising countries as New Zealand (*Hartley & Marshall 1957*), Australia (*Osborne 1959*), Great Britain (*Beverley & Watson 1959*) and Norway (*Waldeland & Øverås 1958*).

In Sweden toxoplasmosis was described in wild animals such as hares and capercaillie (*Hülphers et al. 1947, Borg 1961*), but there are so far only a few reports on the disease in domestic animals (*Hansen et al. 1977, Waller & Ugglå 1982, Waller & Bergquist 1982*). Toxoplasmosis is not previously reported as a cause of abortion in ewes in Sweden, and the extent of infection in Swedish sheep flocks has not been studied before. As an introductory investigation this study was made to determine the serological status of *Toxoplasma* infection in a number of Central Swedish sheep flocks, some of them with a history of abortions among the ewes.

## MATERIAL AND METHODS

### *Animals*

A selection of 155 ewes of Swedish landrace from 21 different farms in Central Sweden and on the island of Gotland were included in the study. The number of animals tested in each flock ranged from 4 to 13. In the flocks where abortions had occurred, blood samples were taken from affected ewes as well as from ewes with normal deliveries.

### *Blood sampling*

Blood samples were collected during May-September 1981 by jugular vein puncture. Serum was prepared and stored at  $-20^{\circ}\text{C}$  until use.

### *Serologic test*

The sera were tested by the indirect fluorescent antibody technique. Sera were diluted 1:10 and subsequently in serial twofold steps. One drop from each serum dilution was added to antigen smears on microscopic slides (Bio Mérieux, Charbonnières-les-Bains, France) and was incubated at room temperature in a moist chamber for 30 min. After washing in phosphate buffered saline of pH 7.4, the smears were covered with a FITC-labelled rabbit anti-sheep IgG preparation (Dakopatts, Copenhagen, Denmark) for another 30 min. After final washing the

results were read in a Leitz Dialux fluorescence microscope at a magnification of 500x. A titer of 1:10 or higher was considered as positive.

## RESULTS

Toxoplasma-positive ewes were found in 14 of 21 examined sheep flocks (Table 1). The blood samples from 3 of these flocks (numbers 5, 6 and 20) showed very low titers. In flocks numbers 2, 11, 15, 16, 17 and 21 sera with high titers were found. These sera originated from ewes which had aborted some months before blood sampling. The frequency of abortions was generally higher in flocks where animals showed high titers than in flocks with low or no titers. No significant differences between positive

Table 1. Distribution of some reproductive disorders and immunofluorescence titers to *Toxoplasma gondii* in 21 Swedish sheep flocks.

Flock number	Flock size (Number of ewes)	Number of samples	Ewes with abortion (percentage)	Barren ewes (percentage)	Stillborn lambs (percentage)	Titers												
						< 1:10	1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1280	1:2560			
1	83	10	12	12	17	2		3	3	1	1							
2	205	13	1	12	8						3	7	1	2				
3	63	9	0	0	3	1		1	1	2	3	1						
4	39	5	0	0	3	5												
5	24	4	0	0	1	1	1	2										
6	36	5	0	0	0	1	3	1										
7	29	5	0	0	5	5												
8	21	5	0	23	18	5												
9	53	5	0	4	3	5												
10	33	5	0	0	5	5												
11	99	10	5	2	1				1	1	3	3	1					1
12	256	10	1	9	4	1		4	1	1	1	2						
13	98	10	0	3	4	1	1	4	1	3								
14	198	10	0	0	7	10												
15	80	5	1	8	2					1		1	2	1				
16	77	11	11	1	4				6	3		1	1					
17	54	7	11	14	5						1	3	3					
18	87	10	9	2	7				2	2	6							
19	143	6	2	15	3	6												
20	62	6	0	20	2	4	1	1										
21	39	4	17	0	2							2		1	1			

and negative flocks were seen regarding barren ewes or stillborn lambs. Of the 155 samples examined 103 or 66 % showed an immunofluorescence titer of 1:10 or higher.

## DISCUSSION

Sheep farming in Sweden is a relatively small industry with a breeding stock of only about 170,000 animals according to official statistics for 1981. According to the farmers own reports to the *Swedish Sheep Recordings* (1981) the total frequency of abortions was as low as 0.1 % of all lambing ewes, barren ewes comprised 1.5 % and the incidence of stillbirths was 2.9 % of all lambs born. However, the actual figures are evidently higher, and in individual flocks abortions can reach troublesome proportions. *Campylobacter*, *Listeria* and *Chlamydia* are well known ovine abortive agents in Sweden, but like the situation in e.g. Great Britain (*Linklater* 1979) most cases of post-mortem examined aborted lambs will get no definite laboratory diagnosis. Despite characteristic pathological lesions (*Beverley et al.* 1972) *Toxoplasma* infection is very rarely diagnosed in sheep in Sweden (*Gunnarsson et al.* 1972, *Nilsson* 1982).

In the present material very high *Toxoplasma*-titers have been encountered in ewes which had aborted some months earlier. Although no post-mortem examinations of fetuses or membranes were made in these cases it seems nevertheless obvious that these abortions were caused by infections with *Toxoplasma gondii*. This opinion is in accordance with judgements made by *Calamel* (1982) for the interpretation of *Toxoplasma* serology in sheep. However, it is difficult to explain why *Toxoplasma* induced abortions in ewes in Sweden obviously do not reach the same proportions as in the neighbouring country Norway, where an estimated 80 % of abortions in sheep were due to toxoplasmosis (*Waldeland* 1978).

Of the sera tested in this study 66 % were positive to *Toxoplasma*. This can be compared with results from similar studies in England where 89.5 % of animals tested were seropositive (*Beverley & Watson* 1961), Denmark 61 % (*Work* 1967), Norway 46 % (*Waldeland* 1967) and the USA 24 % of animals tested (*Riemann et al.* 1977). However, the prevalence may vary strongly in the same country from one locality to another (*Feldman & Miller* 1956).

An interesting observation in the present material is the fact that animals examined in the flocks were with few exceptions either all positive or all negative to *Toxoplasma* serology. The epidemiology of *Toxoplasma gondii* in sheep flocks is in many ways still obscure. *Beverley et al.* (1975) noted that ovine abortions due to toxoplasmosis are common in areas where possible contact between sheep and cats is very remote. A horizontal spread of the infection has been discussed (*Sharman et al.* 1972) and this opinion is supported by the observation that toxoplasma abortions can be prevented by presenting ewes to an infected flock before mating and pregnancy (*Beverley & Watson* 1971). Whether the infections in the present cases are due to ingested oocysts from cat feces has not been proved. Cats were found on all farms except on number 13.

Meat producing animals act as a reservoir of *Toxoplasma* which may be transmitted to man. It is evident that *Toxoplasma* infections among sheep are common also in Sweden. The prevalence of the infection in other regions of the country and in other meat animals is at present under study.

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#### SAMMANFATTNING

##### *Toxoplasmos hos får i Sverige.*

Sera från 155 tackor från 21 olika fårbesättningar i Mellansverige och på Gotland har undersökts med indirekt immunofluorescens teknik avseende förekomst av antikroppar mot *Toxoplasma gondii*. Seropositiva djur hittades i 14 besättningar, vilket motsvarar 55 % av de undersökta djuren. Undersökta tackor från samma besättning var med få undantag antingen alla positiva eller alla negativa. Några av tackorna som tidigare under året aborterat visade höga titrar mot *Toxoplasma*. Dessa aborter har uppenbarligen orsakats av toxoplasmos, som tidigare inte fastställts som abortorsak hos får i Sverige.

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