Acta vet. scand. 1999, *40*, 351-354.

Brief Communication

A Case of Ovine Tick-Borne Fever in December in Norway

By *S. Stuen*[1], *E. Olsson Engvall*[2], *B. Brändström*[2] and *J. Slettebø*[3]

[1]Department of Sheep and Goat Research, Norwegian School of Veterinary Science, Sandnes, Norway, [2] National Veterinary Institute, Uppsala, Sweden, and [3]Stord, Norway

A 7-month-old Norwegian Pelt wether lamb was purchased from the eastern and mountainous part of southern Norway (Dovre municipality), an area free of *Ixodes ricinus* and tick-borne fever (TBF) caused by *Ehrlichia phagocytophila* (*Mehl* 1983, *Stuen* 1997), and let onto tick infested pasture for the first time on December 1, 1998. The actual pasture was on an island, Lauvøya, on the west coast of Norway (59°15′N, 5°22′E), with mostly grass and bush vegetation, where *I. ricinus* is abundant during summer time. Indigenous sheep graze on this island throughout the year, and their lambs have few disease problems. However, there has earlier been disease problems and deaths on this pasture among lambs purchased from *Ixodes* free areas.

The weather was extremely mild in late November and early December 1998, as recorded at a weather station in Skudenes only 12 km from the actual pasture (Fig. 1). On December 17 the farmer found the lamb listless and reluctant to move. It was taken indoors during the next 2 months. The lamb was anorectic and had to be fed by stomach tube for one week. A rectal temperature >41°C was observed for one day. The lamb was examined by the local veterinarian on December 22. It was still depressed, had painful and swollen fetlocks, and the right testicle was hot and swollen. The clinical diagnoses were emaciation, orchitis, polyarthritis and general infection, and the lamb was treated with vitamins, corticosteroids (Fluvet®, Leo, Denmark) and tetracyclines (Terramycin®, Pfizer) for 3 days. Two live nymphs/adults of *I. ricinus* were found on the lamb. On December 29 the lamb was still depressed, and long-acting penicillin (Penikel®, Kela Lab, Belgia) was injected 3 times (with 2 days' intervals). On January 18 the lamb was not longer depressed, ate normally, but was still reluctant to move. Blood samples were taken on that day (EDTA and serum). Haematological blood values including total and differential leucocyte counts were measured electronically (Technicon H1®, Miles Inc., USA) and a blood smear was prepared and stained with May-Grünwald Giemsa. Another serum sample was obtained on February 15. The lamb was sent to slaughterhouse the following day. No abnormal changes were observed on the carcass.

The sera were analysed for antibodies to granulocytic *Ehrlichia* by an indirect immunofluorescence antibody assay (IFA) using *E. equi* as antigen (*Artursson et al.* 1999). Crossreactivity for antibodies to different subspecies within the

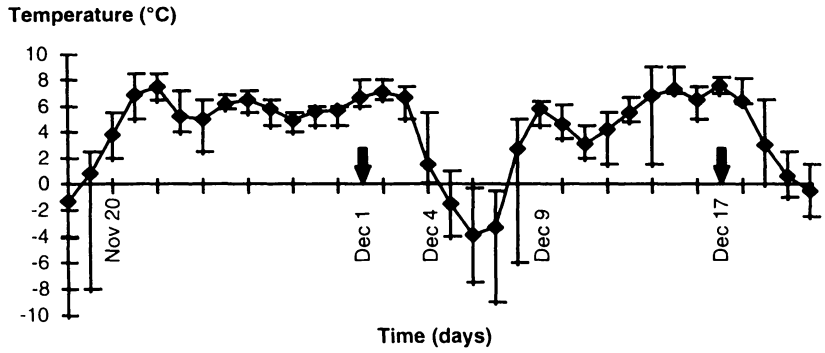

Figure 1. Average daily temperature recorded in November / December 1998 on the coast of Norway, 12 km from the actual *Ixodes ricinus* infested pasture. The daily max / min temperatures are also shown. The lamb grazed the pasture from December 1 to December 17 (see arrows).

E. phagocytophila genogroup is considered to be high (*Dumler et al.* 1995, *Nicholson et al.* 1997, *Pusterla et al.* 1997). The titres to *E. equi* were 1/160 ($\log_{10}$ = 2.2) and 1/40 ($\log_{10}$ = 1.6) on January 18 and February 15, respectively. A titre of 1.6 ($\log_{10}$ reciprocal of 1:40) or higher was regarded as positive. The serum samples were also tested for antibodies to *Borrelia afzelii* according to *Artursson et al.* (1999), with negative results. Unfortunately, blood samples had not been collected during the acute phase of the disease.

The haematological values in the peripheral blood were within the normal range and the absolute number of neutrophils was 0.82×10^9 cells/l. Neutropenia ($<0.7 \times 10^9$ cells/l), which is a consistent feature of infection with *E. phagocytophila* and may extend over 2 to 3 weeks, was not observed. However, in the present case the blood sample was obtained one month after the acute disease.

Four hundred neutrophils were examined on the blood smear, but *Ehrlichia* inclusions were not observed. A nested PCR analysis for detection of granulocytic *Ehrlichia* was also performed according to *Egenvall et al.* (2000) on the EDTA blood sample, but with negative result. The parasitaemia is most prominent during the first weeks of a TBF infection, but inclusions may occasionally be found in the peripheral blood for months after the initial infection (*Stuen et al.* 1998). However, the lamb had been treated with tetracycline, which is efficient against *E. phagocytophila* (*Brodie et al.* 1988). The clinical symptoms indicated a severe infection, most probably a serious bacterial infection such as pyaemia/septicaemia. The lamb would probably have died without treatment. The serological results indicated infection with *E. phagocytophila,* with declining titre values in the 2 samples, taken 28 days apart. The titre level observed in January is in accordance with an earlier experimental trial, where the mean titre to *E. equi* in TBF infected lambs was 2.5 ± 0.21, six weeks after inoculation with *E. phagocytophila* infected blood (*Stuen et al.* 1998). The antibody titre to *E. phagocytophila* may last for several months in untreated lambs.

Serological investigation in Norway indicates that *E. phagocytophila* infection is prevalent in tick populations (*Stuen,* unpublished results). In UK uplands, the probability that sheep will

acquire TBF infection on *Ixodes* infested pasture has been estimated to be nearly 100% (*Ogden et al.* 1998). The transmission of TBF may occur with very light tick infestation; in an earlier observation only 2 female ticks were required to transmit the disease (*MacLeod & Gordon* 1933). Secondary infections are also very common in tick-borne fever infected animals, such as pyaemia and septicaemia caused by *Staphylococcus aureus* and *Pasteurella hemolytica (trehalosi),* respectively (*Brodie et al.* 1986, *Stuen* 1996). In one study at least 92% of the lambs that died of TBF had a secondary infection (*Stuen,* unpublished results).

Questing ticks in December is far out of season for *I. ricinus* activity in Norway, where the normal season is from April to October (*Mehl,* unpublished observations). Earlier investigations in Wales and Northern England indicate that the commencement of tick activity is initiated when the weekly average maximum daily air temperature exceeds 7 °C (*MacLeod* 1936). In Ireland the activation temperature for adults and nymphs ranges from an air temperature of 6.8-7.1 °C, or a soil temperature in the previous week of 4.3-4.75 °C (*Gray* 1984). The daily air temperature near the actual pasture indicates that *I. ricinus* may have shown questing activity in late November (Fig. 1). The temperatures of the first 2 days of December were not below 6.0°C. According to an earlier study, *I. ricinus* infestation of sheep was not observed when the air temperature was below 5.5 °C (*MacLeod* 1932).

The lamb had not been exposed to ticks before December, and the positive titre against granulocytic *Ehrlichia* indicates that the lamb was infected with *Ehrlichia* on the actual pasture. In an earlier study including 506 cases of TBF in sheep, 99.4% were diagnosed in the period from April to October, with most cases in medio May to medio June (49.4%), and the latest date TBF was diagnosed was on November 11 (*Stuen* 1997). Only once earlier has a verified tick-borne fever infection been documented during the winter in Norway; i.e. in one ewe that aborted in February 1958 (*Øverås* 1959).

In conclusion, the present case indicates that mild climate during wintertime may activate ticks in northern areas where ticks normally have a diapause, and that movements of animals from *Ixodes* free pastures to tick infested pasture accordingly may cause serious disease problems throughout the whole year. This is an important factor to consider in endemic areas, when rebuilding new flocks with animals lacking immunity to existing pathogens.

References

Artursson K, Gunnarsson A, Wikström U-B, Olsson Engvall E: A serological and clinical follow-up in horses with confirmed equine granulocytic ehrlichiosis. Equine Vet. J., 1999. 31, 473-477.

Brodie TA, Holmes PH, Urquhart GM: Some aspects of tick-borne diseases of British sheep. Vet. Rec. 1986, *118,* 415-418.

Brodie TA, Holmes PH, Urquhart GM: Prophylactic use of long-acting tetracycline against tick-borne fever *(Cytoecetes phagocytophila)* in sheep. Vet. Rec. 1988, *122,* 43-44.

Dumler JS, Asanovich KM, Bakken JS, Richter P, Kimsey R, Madigan JE: Serologic cross-reactions among *Ehrlichia equi, Ehrlichia phagocytophila* and human granulocytic ehrlichia. J. Clin. Microbiol. 1995, *33,* 1098-1103.

Egenvall A, Lilliehöök I, Bjoersdorff A, Olsson Engvall E, Karlstam E, Artursson K, Heldtander M, Gunnarsson A: Persistence of ehrlichia infection in dogs inoculated with granulocytic ehrlichia. Vet. Rec. 2000. In press

Gray JS: Studies on the dynamic of active populations of the sheep tick, *Ixodes ricinus:* L. in Co. Wicklow; Ireland. Acarology 1984, *25,* 167-178.

Macleod J: The bionomics of *Ixodes ricinus* L., the "sheep tick"of Scotland. Parasitology 1932, *24,* 382-400.

Macleod J: Ixodes ricinus in relation to its physical environment. IV. An analysis of ecological complexes controlling distribution and activities. Parasitology 1936, *28,* 295-319.

Macleod J, Gordon WS: Studies in tick-borne fever of sheep. Parasitology 1933, *25,* 273-283.

Mehl R: The distribution and host relations of Norwegian ticks (Acari, Ixodides). Fauna Nor. Serie B 1983, *30,* 46-51.

Nicholson WL, Comer JA, Sumner JW, Gingrich-Baker C, Coughlin RT, Magnarelli LA, Olson JG, Childs JE: An indirect immunofluorescence assay using a cell culture-derived antigen for detection of antibodies to the agent of human granulocytic ehrlichiosis. J. Clin. Microbiol. 1997, *35,* 1510-1516.

Ogden NH, Woldehiwet Z, Hart CA: Granulocytic ehrlichiosis: an emerging or rediscovered tick-borne disease? J. Med. Micro. 1998, *47,* 475-482.

Pusterla N, Wolfensberger C, Gerber-Bretscher R, Lutz H: Comparison of indirect immunofluorescence for *Ehrlichia phagocytophila* and *Ehrlichia equi* in horses. Equine Vet. J. 1997, *29,* 490-492.

Stuen S: Tick-borne fever (TBF) and secondary infections in sheep. In: Kazár J, Toman R. (eds.): Rickettsiae and rickettsial diseases, Veda, Bratislava, 1996, 347-349.

Stuen S: The distribution of tick-borne fever (TBF) in Norway (in Norwegian). Norsk Vet.-T. 1997, *109,* 83-87.

Stuen S, Olsson Engvall E, Artursson K: Persistence of *Ehrlichia phagocytophila* infection in lambs in relation to clinical parameters and antibody responses. Vet. Rec. 1998, *143,* 553-555.

Øverås J: Tick-borne fever (sjodogg) as a cause of abortion in ewe (in Norwegian). Nord. Vet. med. 1959, *11,* 475-482.

(Received August 1, 1999; accepted September 27, 1999)

Reprints may be obtained from: S. Stuen, Department of Sheep and Goat Research, Norwegian School of Veterinary Science, Kyrkjev. 332/334, N-4325 Sandnes, Norway. E-mail: Snorre.Stuen@veths.no, tel: +47 51 60 35 10, fax: +47 51 60 35 09.