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SHORT COMMUNICATION

Sarcoptic mange in two roe deer (*Capreolus capreolus*) from northern Spain

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Abstract Sarcoptic mange, a disease shared with domestic goat and sheep, affects chamois (*Rupicapra pyrenaica parva*) in northern Spain. Recent evidences suggest that mange may be emerging among deer in this region. This communication describes two cases of fatal sarcoptic mange affecting roe deer (*Capreolus capreolus*) stags in Asturias (Northern Spain) in 2006. Both animals were in poor body condition and no significant lesions other than those caused by the mites were observed. Alopecia, along with cutaneous crusts and hyperkeratosis were present in head, neck, trunk, and legs, affecting almost all the body surface. Numerous *Sarcoptes scabiei* mites were isolated from the skin. To the best of our knowledge, this is the first detailed description of fatal sarcoptic mange in European roe deer.

Keywords Asturias · Blood biochemistry · Emerging disease · Scabies

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Introduction

Sarcoptic mange, commonly referred to as scabies, is a disease affecting seven different mammalian orders, including humans. It is caused by an obligate parasitic mite of the skin, *Sarcoptes scabiei* (Linnaeus 1758), whose burrowing and feeding activity, in addition to cutaneous hypersensitivity to mite fecal antigens triggers cutaneous inflammation and pruritus, leading sometimes to excoriation, exudation, and even hemorrhage (Collebrook and Wall 2004). Severe sarcoptic mange can cause the death of the host, and is frequently reported in wild Bovidae populations throughout Europe. This is the case in the chamois (*Rupicapra rupicapra*) and the ibex (*Capra ibex*) in the Alps (e.g., Onderscheka 1982; Schaschl 2003; Rossi et al. 2007), of the Iberian ibex (*Capra pyrenaica*) in southern and eastern Spain (León Vizcaíno et al. 1999), and of the introduced Barbary sheep (*Ammotragus lervia*) in southeastern Spain (González-Candela et al. 2004). A mange epizootic mainly affecting Cantabrian chamois (*R. pyrenaica parva*) in the Cantabrian Mountains, northern Spain, was first detected in 1993 and is still expanding eastwards nowadays (Fernandez-Moran et al. 1997 and unpublished reports).

Despite the abundant literature on sarcoptic mange in European wild ungulates, information and even descriptions of clinical cases in species of deer are scarce. Sarcoptic mange has sporadically been described in the red deer (*Cervus elaphus*) in Alpine countries (e.g., Kutzer 1970; Greßmann 2001; Rossi et al. 2007; and references therein) and in Spain (León-Vizcaíno et al. 1992; Fernandez-Moran et al. 1997). A single case was reported in a fallow deer (*Dama dama*) from Spain (León-Vizcaíno et al. 1992). In the roe deer (*Capreolus capreolus*), despite being the most widely distributed cervid in Europe, the reports on sarcoptic mange are also limited. Several central European reports

comment on mange cases in roe deer (e.g., two cases reported by Kerschagl 1965 and six cases reported by Greßmann 2001, in Austria), and *Sarcoptes* mites were identified on the carcass remaining of one roe deer in the Cantabrian Mountains, Spain (Fernandez-Moran et al. 1997). In Italy, two roe deer fawns kept together with an infected alpine chamois in a wildlife rescue center developed clinical mange (Meneguz, personal communication).

Both density and geographical range of roe deer have increased during the last decades across Europe, including northern Spain (e.g., Acevedo et al. 2005). These demographic and geographic changes may increase the risk of acquiring new diseases through both increased contact rates with other species and density-dependent impact on individual fitness at higher densities. The aim of this short communication is to describe two fatal cases of sarcoptic mange in roe deer bucks in Asturias (northern Spain).

Materials and methods

Two cases of severe sarcoptic mange affecting roe deer males where reported in Asturias (northern Spain) in April and August 2006. The first one occurred on 21/04/2006 when a sick adult roe deer buck was observed in the Piloña regional hunting preserve (Asturias, northern Spain, 30T 307337/4801084 UTM). When approached by the observers, the animal showed an extreme weakness and made no attempt to escape. Blood was collected from the jugular vein in plain tubes, a fecal sample was taken from the rectum, and visible ticks were collected. Thereafter, the animal was sedated with xylazine (Rompun, Bayer) and humanely euthanized with embutramide and mebezonium (T-61, Intervet). The carcass was weighed, measured, and taken to the laboratory for a complete necropsy. Skin samples of 5×5 cm^2 were taken from the edges of the lesions, including both healthy and altered tissues, processed in a 10% KOH solution for 60 min at 37°C and examined under a light microscope. Mites were identified according to Wall and Shearer (1997). Additional skin sections were resected and fixed in 10% buffered formalin for paraffin embedding and routine histopathology (hematoxylin–eosine). No other samples were fixed in formalin. Blood serum obtained after coagulation was frozen and submitted for serum biochemistry. This analysis included nine parameters (creatinine, urea UV, albumin, magnesium, phosphorus, calcium arsenazo, total protein, cholesterol, and glucose) and was performed using an A25-BioSystems (Biosimex SA) biochemical automatic analyzer.

In the second case, the animal was found dead on a path of the Caso regional hunting preserve (30T 313692/4780706 UTM) on 17/08/06. During the first examination, visible ticks and a fecal sample were collected, and after recording measurements and weight, the carcass was taken to the laboratory. The necropsy was made according to the protocol followed in the previous case, paying special attention to any alteration in connection with the cause of death. Skin samples where taken and processed for both histological and parasitological examination, and blood was obtained from the thoracic cavity. Different organ samples (kidney, duodenum, myocardium, lung, liver, spleen) were taken for histopathology.

Results

The first animal was not completely emaciated and had a body weight of 20 kg, for a head and body length of 96 cm. The poor condition was confirmed by the complete absence of kidney fat. No significant traumatic injuries were observed. Alopecia, along with cutaneous crusts and hyperkeratosis were present in head, neck, trunk, and legs, affecting almost all the body surface (Fig. 1). A general lymphadenitis, more evident in the cervical lymph nodes, was noted. All other organs appeared normal. The animal exhibited a crusting dermatitis characterized by the presence of large number of mites that were isolated from skin samples. They were identified as *S. scabiei*, including both adults and larvae. Histological examination of skin sections revealed hyperkeratosis with intracorneal tunnels where mites demonstrated. The hair follicles were clogged with keratin. The epidermis was hyperplastic with prominent rete ridge formations. The dermis presented an inflammatory infiltrate consisting of lymphocytes, neutrophiles, and macrophages (Fig. 2). Eosinophils were rarely seen. Dermal lesions also included variable vasodilatation; vessels in the superficial dermis were congested, and there was a

Fig. 1 Mangy roe deer stag (case 1) with visible alopecia and skin crusts

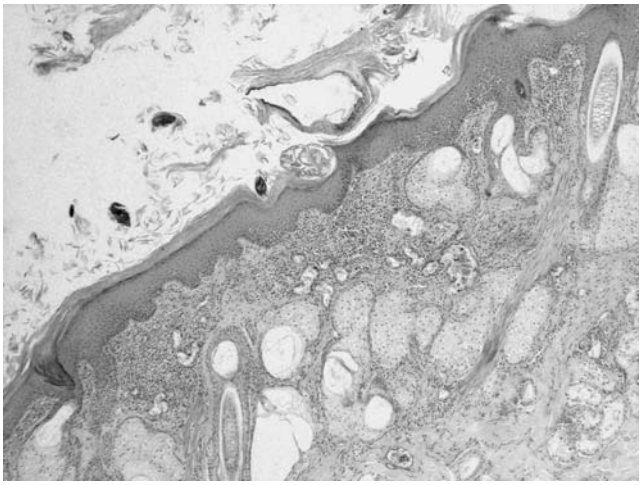

Fig. 2 Skin section of roe deer stag 1 showing hyperkeratosis, intracorneal tunnels with mites, and inflammatory infiltrate (H&E stained, ×400)

predominantly mononuclear cell perivascular infiltrate. No obvious lesions were observed in the sebaceous or sweat glands. Microscopic inspection of the underlying muscle revealed the presence of occasional *Sarcocystis*. Other parasitological findings included a myasis under the burr of both antlers, nine ticks of the genus *Ixodes*, and four lungworms of the genus *Dictyocaulus*. Biochemical results were 0.72 mg/dl creatinine, 74.51 mg/dl urea, 30.56 g/l albumine, 2.40 mg/dl magnesium, 10.13 mg/dl phosphorus, 7.59 mg/dl calcium, 72.66 g/l total protein, 69.07 mg/dl cholesterol, and 9.18 mg/dl glucose.

The second roe deer was in a worse body condition, with a weight of only 19.5 kg for a length of 120 cm. Neither kidney nor coronary fat was observed. Small injuries around the snout, probably caused by a fox or a small dog before death, were observed. No other significant alteration was appreciated. As in the first animal, there was a general alopecia affecting about 60% of the body surface, characterized by hyperkeratosis and cutaneous crusts in head, neck, and trunk. Isolation and identification of mites provided the same results as in the other case. Only four adult ticks were found in the first examination; however, nine larvae were recovered during necropsy. Eleven nematodes of the genus *Dictyocaulus* were found in the bronchioli. Two *Sarcocystis* cysts were observed on the myocardial surface, but no more parasites were isolated in the other organs. As in the first case, a general lymphadenitis was evident. Histopathologic examination of the skin sections revealed hyperkeratosis and mites inside intracorneal tunnels, and lymphocytes, neutrophiles and macrophages appeared as an inflammatory infiltrate in dermis. No significant alteration, other than renal congestion, was observed.

Discussion

Even if the availability of data for the first buck's biochemical results comparison is limited, these results show slightly elevated urea and low creatinine and glucose levels (Stubbe et al. 1975; Haenichen and Barth 1978; Ursache et al. 1980; Volmer and Herzog 1995). This can suggest a loss of muscular mass due to chronic disease, a renal disorder, or a consequence of the persistent stress situation caused by scabies. The lack of formalin-preserved kidney samples in case 1 prevented a complete histopathology. In case 2, only renal congestion was observed in kidney histology.

To the best of our knowledge, this is the first detailed description of fatal sarcoptic mange in free-living European roe deer. The large proportion of affected skin, with inflammation and probably secondary infections, along with the poor body condition of both deer and the absence of significant traumas or organic alterations, strongly indicates that the death was due to the sarcoptic mange in the second animal, and it would also have been fatal in the first case in a short time. This extreme weakness, which can course with anorexia, has been suggested to trigger the death in severe mange cases (Cordero del Campillo and Rojo Vázquez 1999). The loss of a large part of a vital organ such as the skin may explain the fatal course of the described cases (Kerschagl 1965).

The first clinical case was detected only 4 km north of a chamois population, where the first mange cases were reported in 1994. Nonetheless, chamois populations in the area are monitored, and a recovery trend is evident since 2002 (Quirós, personal communication). No mange cases have been observed in chamois from this area since 2002. There were also no reports on mangy domestic animals in this area.

In contrast, in the area where the second mangy roe deer was found (21 km southeast of the first one), the chamois population is still affected by mange, and cases of red deer (*Cervus elaphus*) mange were observed in previous years.

Because cases of mange are extremely rare in roe deer, the occurrence of these two cases during the last months in Asturias (northern Spain) may suggest some kind of variation in sarcoptic mange epidemiology. Careful wildlife disease surveillance will allow evaluating whether these cases were sporadic, or whether this was the first sign of a disease emerging in Spanish deer.

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