

Sarcoptic mange in red deer from Spain: Improved surveillance or disease emergence?

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Received 13 December 2007; received in revised form 28 February 2008; accepted 4 March 2008

Abstract

Concern about emerging diseases has risen in recent years, and multihost situations have become increasingly relevant for wildlife management and conservation. We present data on Asturias, northern Spain, where 80 mangy red deer (*Cervus elaphus*) have been found since the beginning of the epizootic in chamois (*Rupicapra pyrenaica parva*) in 1993. We combine field and necropsy data with the results of a serosurvey using an in-house ELISA test to evaluate if deer mange due to *Sarcoptes scabiei* is an emerging disease in this area. The mean number of deer mange cases per year was 5, with a maximum of 16. No significant relationship was detected between monthly temperatures, rainfall or number of days with snow cover and the annual number of sarcoptic mange cases in red deer. Only 4 mangy red deer (5%) were detected outside the limits of scabietic chamois distribution during the same year, and all were less than 2500 m away from that limit. The longest distance reported between two consecutive mangy deer locations was 18 km. Mange cases were significantly more frequent in stags than in hinds and in adults than in juvenile deer. The time of the first mange detection in chamois in each sector, year with minimum number of chamois recorded, year with maximum chamois population decline rate and chamois density offered no significant correlation with red deer mange cases appearance moment and frequency. In the mange affected area, ELISA testing of 327 blood samples from hunter-harvested deer without obvious mange-compatible lesions revealed only 4 seropositive animals. All 83 sera from hunting preserves without clinical cases yielded negative ELISA results. According to these epidemiological data mange does not seem to threaten red deer populations in Asturias. However, continued monitoring of deer health and ELISA testing for sarcoptic mange is advisable.

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Keywords: *Cervus elaphus*; Emerging disease; Monitoring; Scabies; Shared disease

1. Introduction

Concern about emerging diseases has risen in recent years, and multihost situations have become increasingly relevant for wildlife management and conservation (Gortázar et al., 2007). Sarcoptic mange is a highly

contagious skin disease affecting seven different mammalian orders, including humans (Arlian, 1989). The etiological agent is an obligate parasitic mite of the skin, *Sarcoptes scabiei* (Linnaeus 1758), that causes skin inflammation, pruritus, and usually cutaneous hypersensitivity leading sometimes to excoriation, exudation and even haemorrhage (Collebrook and Wall, 2004). As a consequence of physiological alterations in skin and different organs (Arlian et al., 1990) the host often becomes dehydrated and ema-

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ciated, and can finally succumb to the infestation (Pence and Ueckerman, 2002).

In many animal species, the prevalence of scabies is very high and often causes death if it is untreated (Brotowijoyo, 1987; Kemp et al., 2002). It is an important disease in cattle, pigs, sheep and goats worldwide, with many economical implications in prophylaxis and treatment (Alonso de Vega et al., 1998; Rehbein et al., 2003; Tarigan and Huntley, 2005; Menzano et al., 2007). Sarcoptic mange seems to show more dramatic effects in wildlife, severely affecting the population dynamics of different species (Mörner, 1992; Balestrieri et al., 2006). This parasitic disease has frequently been reported in wild Bovidae populations throughout Europe: chamois (*Rupicapra rupicapra*) and ibex (*Capra ibex*) in the Alps (e.g. Onderscheka, 1982; Schaschl, 2003; Rossi et al., 2007), Iberian ibex (*Capra pyrenaica*) in southern and eastern Spain (Leon Vizcaino et al., 1999), and the introduced Barbary sheep (*Ammotragus lervia*) in south-eastern Spain (González-Candela et al., 2004). A mange epizootic mainly affecting Southern chamois (*Rupicapra pyrenaica parva*) in the Cantabrian Mountains, northern Spain, was first detected in 1993 and is still expanding eastwards today (Fernández-Moran et al., 1997). Since the onset of the outbreak until 2006 a total of 1515 mangy chamois have been detected in Asturias.

The Iberian red deer (*Cervus elaphus hispanicus*) populations are increasing during recent years (Gortázar et al., 2000). In Asturias, northern Spain, the last autochthonous red deer were hunted in the first decade of 20th century, but red deer were successfully reintroduced between 1955 and 1974 with animals from the remaining indigenous populations in Central Spain (Nores and Vázquez, 1987; Pérez et al., 1998; Acevedo, 2006).

Sarcoptic mange transmission has been documented from chamois to red deer, roe deer (*Capreolus capreolus*) and Alpine ibex by Kutzer (1966), and from Iberian ibex to red deer, fallow deer (*Dama dama*) and mouflon (*Ovis aries musimon*) by Leon Vizcaino (Leon Vizcaino et al., 1992). Sarcoptic mange has sporadically been described in red deer in European countries, usually as sporadic cases (Boch and Schneidawind, 1988; Rossi et al., 2007). Outbreaks with more than 4 red deer affected by sarcoptic mange have only been described in Austria (Kutzer, 1966; Köhler, 1970; Großmann, 2001) and in Spain during the sarcoptic mange epizootic affecting Iberian ibex in the Cazorla Natural Park since 1987 (Leon Vizcaino et al., 1992).

During the last decade an increasing number of mangy red deer have been observed in south eastern Asturias

(Cantabrian Mountains, Northern Spain). Although other cervid species, such as roe deer, have been affected in the same area (Oleaga et al., 2008), the number of mangy red deer found since the beginning of the epizootic in chamois (1993) in Asturias, and the small area where all these cases were reported prompted a study of the known cases. The aim of this paper is to compile this information and use an in house ELISA test to establish if sarcoptic mange is an emerging disease in deer.

2. Material and methods

2.1. Study area

The Principality of Asturias is a 10,603 km² autonomous region located in the North of the Iberian Peninsula, including the central part of the Cantabrian mountain chain. This area includes 17 public game reserves. These reserves have a total surface area of 2110 km² and contain most of the red deer and chamois ranges in the region (Fig. 1).

One of these 17 reserves is the Regional Game Reserve of Caso (43° 06'N, 005° 15'W; number 10 in Fig. 1), that covers 307 km² and is located in south-western Asturias. This is the core area of the deer mange cases reported herein. It is surrounded by the game reserves of Aller (223 km², number 9) and Sobrescobio (67 km², number 17) to the West, Piloña (54 km², number 11) to the North and Ponga (205 km², number 13) to the East, and by the province of León to the South. The relief is mountainous, with altitudes ranging from 800 to 2100 m, and the landscape is the typical of the Orocantabrian region, basically composed of forests (39%, mainly deciduous woods), shrubs (39%) and meadows (16%).

This region is included in the Eastern nucleus of the Cantabrian chamois distribution area in Asturias and houses other ungulate species including roe deer, red deer and wild boar (*Sus scrofa*); there can also be found large populations of red fox (*Vulpes vulpes*), beech marten (*Martes martes*), stone marten (*Martes foina*), badger (*Meles meles*) and wolf (*Canis lupus*), all of them listed among the hosts of *S. scabiei* in Europe (Todd et al., 1981; Bornstein et al., 2001; Domínguez et al., in press). Cattle are also abundant in the studied area, sharing pasture with wild ruminants, whereas the presence of sheep and goats is almost anecdotal.

2.2. Monitoring of chamois and red deer

As a consequence of the chamois sarcoptic mange outbreak detected in 1993, the distribution area of this

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