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# First description of sarcoptic mange in wild European rabbit (*Oryctolagus cuniculus*)

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**Abstract** The European wild rabbit (*Oryctolagus cuniculus*) is a keystone species in the Iberian Mediterranean ecosystems being the staple prey of protected and endangered predators. Wild rabbits were once widespread, but the introduction of two viral diseases, myxomatosis in the 1950s and the rabbit hemorrhagic disease in 1989, resulted into a dramatic decline of its populations. Sarcoptic mange is a highly contagious parasitic infection caused by *Sarcoptes scabiei*. The first cases of sarcoptic mange in a wild rabbit population are recorded from a hunting area in Majorca (Balearic Islands, Spain). Five of 32 inspected rabbits (14.7%) were affected, with similar prevalences in summer and autumn. *Sarcoptes scabiei* were obtained from the edge of the lesions of two of the rabbits. The most frequently observed lesions were small areas of alopecia and crusts in the limbs. Affected limbs presented also a marked hypertrichosis and an apparent abnormal growth of the nails. One rabbit also presented lesions around mouth and nostrils. Parasitized rabbits were in significant lower body condition than healthy ones. According to previous reports of mange epizooties in other naïve wild species that caused marked

short-term effects in their populations, this disease may pose a risk for the conservation of wild rabbit and their predators. Whether mange is endemic in rabbits from Majorca or it has been introduced is unknown. Game managers are encouraged to be aware of introducing sarcoptic mange during rabbit translocations.

**Keywords** Lagomorphs · *Oryctolagus cuniculus* · Sarcoptic mange · *Sarcoptes scabiei*

Sarcoptic mange is a highly contagious parasitic infection caused by a burrowing mite (*Sarcoptes scabiei*) in the epidermis of animals, including man (Pence and Ueckermann 2002). When introduced into a naïve population, it courses with high morbidity and mortality. For example, a mange epizooty severely affected a wild population of Spanish ibex (*Capra pyrenaica*) in Southern Spain affecting up to 81% of the population a few months after the detection of the first cases, coursing with 100% of mortality (León-Vizcaino et al. 1999) and resulting in a total reduction of 95% of the population (Fandos 1991). In Fennoscandia, a severe form of mange was introduced into the red fox (*Vulpes vulpes*) population in 1967 causing an overall decline of 50% and up to 90% of mortality in some areas (Holt and Berg 1990; Mömer 1992). Sarcoptic mange is considered to affect the abundance of many other wild species, such as the common wombat (*Vombatus ursinus*) in Australia (Skerratt et al. 1998). In Spain, scabies is known to affect diverse wild species other than ibex, such as red fox (Gortazar et al. 1998), Cantabrian chamois (*Rupicapra pyrenaica parva*; Fernández-Morán et al. 1997), roe deer (*Capreolus capreolus*; Oleaga et al. 2008a), red deer (*Cervus elaphus*; Oleaga et al. 2008b), or Barbary sheep (*Ammotragus lervia*; González-Candela et al. 2004).

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The European wild rabbit (*Oryctolagus cuniculus*) is native to the Iberian Peninsula and has been defined as a keystone species in the Iberian Mediterranean ecosystems (Delibes-Mateos et al. 2007) being the staple prey of at least 29 predators in Spain (Delibes and Hiraldo 1981). In addition, wild rabbits are economically important as small game in Spain (Angulo and Villafuerte 2003). Although rabbits were historically numerous and widespread, the introduction of two viral diseases, myxomatosis in the 1950s and the rabbit hemorrhagic disease (RHD) in 1989, resulted into a dramatic decline of its populations. Five years after the arrival of RHD, Spain's wild rabbit population was found to be half of its original level (Blanco and Villafuerte 1993); and when RHD reached Spain, rabbits suffered mortality close to 80% in most populations (Villafuerte et al. 1995; Calvete et al. 2002). Though no scientific data is available about the trends of rabbit populations in Majorca, both diseases also take place in this Island and, probably, are currently the main cause of mortality of rabbits (personal observation).

Sarcoptic mange infrequently affects domestic rabbits (e.g., Voyvoda et al. 2005; Kurtdede et al. 2007), and, to the best of my knowledge, it was never described in their wild counterparts. In the present communication, the first description of sarcoptic mange in European wild rabbits is presented.

The affected hunting area is located in the southeastern part of Majorca Island (39°24' N, 3° 12' E). According to the local hunter's association, translocated or farm-reared wild rabbits were never released in this area though rabbits

from the peninsular Spain are released in many other hunting areas in Majorca. Hunters denounced the presence of a disease in rabbits that was the cause of a marked decrease of the rabbit populations and hunting bags. According to hunters, found-dead rabbits were tiny and presented long hair on the feet (so called "hairy feet disease"). In July 12 and 13 and in November 4 and 8, 2008, I visited the affected area and collected 32 hunted rabbits (18 in summer and 14 in autumn) that were carefully inspected for external lesions and necropsied. Body condition was subjectively assessed by valuating internal fat depots and assigning a score from 1 (total absence of fat) to 5 (rather fatty animal). Skin samples from each rabbit with lesions were taken from the edges of the lesions, processed in a 10% KOH solution for 60 min at 37°C and examined using a microscope.

Five of the analyzed rabbits (14.7%) presented lesions that were confirmed by hunters as the typical lesions of "hairy feet disease". Prevalence was similar in rabbits sampled in summer (16.6%) and in autumn (14.2%). The affected rabbits were two adult females, two adult males, and one young male. These lesions consisted in areas of alopecia (always <5 cm) and crusts mainly in the hind limbs, as seen in four of the cases. The fifth rabbit presented, in addition, lesions in the forelimbs and around the mouth and nostrils. In this rabbit, the hypertrichosis in finger and toes was evident, the rabbit presenting long hair around the crusts in the limbs, up to cover the nails, which presented an abnormal growth (Fig. 1). The distribution of

**Fig. 1** Lesions of sarcoptic mange in wild European rabbits. **a** Lesions in head and forelimbs, **b** details of the lesions around nostrils and mouth, **c** lesions in hindlimbs, **d** detail of the lesions in toes, and **e** mite obtained from a mangy rabbit



the lesions is similar to that reported in domestic rabbits (e.g., Rosell et al. 2000; Voyvoda et al. 2005) though in the present case, lesions were not observed in ears or tail. Hypertrichosis or abnormal growth of nails has not been noted in domestic rabbit (Rosell et al. 2000) or in other wild species (Pence and Ueckermann 2002). This abnormal growth of hair and nails may be due to an absence of wearing due to a reduction of rabbit movements.

Skin examination revealed the presence of *S. scabiei* in two of the cases (Fig. 1). Mangy rabbits presented lower body condition (mean  $2.0 \pm 1.2$ ) than those not affected ( $3.2 \pm 1.2$ ; Mann–Whitney U test,  $z=2.01$ ,  $p<0.01$ ). It is well known that sarcoptic mange is a wasting disease (León-Vizcaíno et al. 1999) and causes cachexia in parasitized rabbits (Rosell et al. 2000). Thus, affected wild rabbits probably lose their flight ability, increasing rabbit vulnerability to predation. In fact, the most severely affected rabbit was observed by the author of this communication just before being shot, showing evident movement problems.

Whether the sarcoptic mange is endemic in the rabbit from Majorca or it has been introduced with released rabbits, is unknown. Though no rabbits were released in the study area, rabbits from the Iberian Peninsula are released in other areas of Majorca and the other islands of the Balearic archipelago.

According to Pence and Ueckermann (2002), sarcoptic mange generally does not affect long-term population dynamics. However, if a population of European wild rabbit is naïve to this parasite, mortality can be high and short-term effects can be devastating as observed in other species (Mörner 1992; León-Vizcaíno et al. 1999). In addition, in domestic rabbits, mange decreases the fitness of the affected rabbits (Rosell et al. 2000). An increased mortality and an impaired reproduction may have catastrophic consequences not only for the wild rabbit populations but also for the populations of predators which depend on this prey, such as the endangered Iberian lynx (*Lynx pardinus*) or the Imperial eagle (*Aquila adalberti*) in the peninsular Spain. Ongoing epidemiological, histo-pathological, and serological research is under performance to identify the variant of *S. scabiei* involved (which could be *Sarcoptes scabiei* var. *cuniculi*), the potential origin of the disease, and its current distribution along the Balearic Islands.

Game managers are encouraged to be aware of introducing sarcoptic mange in naïve populations during translocations, which is a frequent technique for wild rabbit management (Moreno et al. 2004), and to conduct adequate quarantine protocols.

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