NOTE *Parasitology*

Sarcoptic mange in captive maras: the first known outbreak and complete recovery with colony-wide acaricide treatment

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ABSTRACT. Among 16 maras housed as a colony at a zoo, 2 initially showed generalized dermal lesions on the legs, head and abdomen. Approximately 1 month later, following completion of therapy with amitraz, 6 maras in the same colony, including the 2 previously diseased animals, showed dermal lesions with severe alopecia and crusting. Sarcoptic mange was diagnosed on skin scrapings on the basis of morphological criteria. The mites were highly mobile and abundant in all cases, and no other causative agents were detected. Colony-wide treatment with ivermectin and prednisolone was administered weekly for a total of 4 treatments. After therapy was completed in all cohabitants, follow-up scrapings were negative for *Sarcoptes scabiei*. This report describes the first known outbreak of sarcoptic mange in captive maras and successful treatment with acaricides.

KEY WORDS: *Dolichotis patagonum*, ivermectin, mite infestation, Patagonian cavies, *Sarcoptes scabiei*

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Maras, also known as Patagonian cavies (*Dolichotis patagonum*), are small mammals belonging to the family Caviidae of the order Rodentia [6]. Maras are housed in captivity in zoos worldwide and are native only to Argentina. Although maras are kept at zoos, there is currently limited information on their parasitic fauna. Further, little is known on the species' vulnerability to *Sarcoptes scabiei* infestation. Therefore, this report describes the first known outbreak of sarcoptic mange in maras and subsequent colony-wide treatment with acaricides.

Since 2002, 16 maras have ranged freely as a colony at O-World Zoo (36°17′19.00″ N, 127°23′52.04″ E), Daejeon, Korea. Originally, 10 maras were introduced to the zoo from the Netherlands in 2002. Since then, the number of maras has increased to 16, and the animals appeared healthy until the reported outbreak. In September 2012, 2 maras (both females, 5 years of age) showed generalized dermal lesions: patchy alopecia on the legs, abdomen and muzzle; sparse erythematous eruptions with papules; seborrhea; lichenification; thickened skin and thick crusted lesions (Fig. 1A–1D).

To diagnose the causative agent, deep skin scrapings were collected from the skin lesions of the affected animals. Numerous mites with dorsoventrally flattened and rounded bodies, four pairs of legs and 300–500 μm body length were observed on microscopy (Fig. 2A). The mites also had sucker-like pulvilli on the long unjointed pretarsi, triangular scales and transverse ridges on the dorsum, and 3 epimeres identified as chitinous extensions of the coxae of the legs (Fig. 2C and 2D). The mites were identified as *S. scabiei* by these characteristics and known morphological criteria [2, 8]. In addition, several eggs (Fig. 2B) and mites at different developmental stages were present; other parasitic agents, such as *Demodex* spp., were not observed in the skin lesions.

To treat the sarcoptic mange, amitraz (0.025%; Greentix, Green Cross, Yongin, Korea) was topically applied by cotton swab to the infested maras every week for a total of 4 treatments. Prednisolone (2.0 m*l*, I.M.; Samu, Seoul, Korea), which is one of the steroidal anti-inflammatory drugs that suppress inflammation and whose use has risen continuously in recent years [5], was also administered to prevent secondary infection every week for a total of 4 treatments. The skin lesions disappeared within 3 weeks following treatment; however, similar skin lesions suddenly appeared in 6 different maras (1 male and 5 females; all mature, ≥3 y) including the 2 previously diseased animals approximately one month later. Skin scrapings confirmed *S. scabiei* infestation in the animals. The mites were highly mobile and abundant in all cases, and no other causative agents were detected. Therefore, the entire colony was administered with ivermectin (0.4 mg/kg, S.C.; Ivomec 1% injection, Merial, Lyon, France) and prednisolone (2.0 m*l*, I.M.; Samu) every week for a total of 4 treatments. Once the colony-wide therapy was completed, follow-up skin scrapings were negative for *S. scabiei* with no recurrence to date.

Sarcoptic mange, caused by the burrowing mite *S. scabiei*, is a re-emerging zoonotic disease that threatens animals and humans globally, with an estimated 300 million people affected worldwide [1]. Numerous epidemiological studies of scabies have been reported in various human, wild animal and domestic animal populations [3, 4]; nevertheless, there are no known reports describing *S. scabiei* infestation in

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Fig. 1. Gross appearance of dermal lesions in maras (*Dolichotis patagonum*) housed in a colony at a zoo before and after treatment. Skin lesions were observed on the legs (A, arrows; D), muzzle (B) and abdomen (C) of multiple animals.

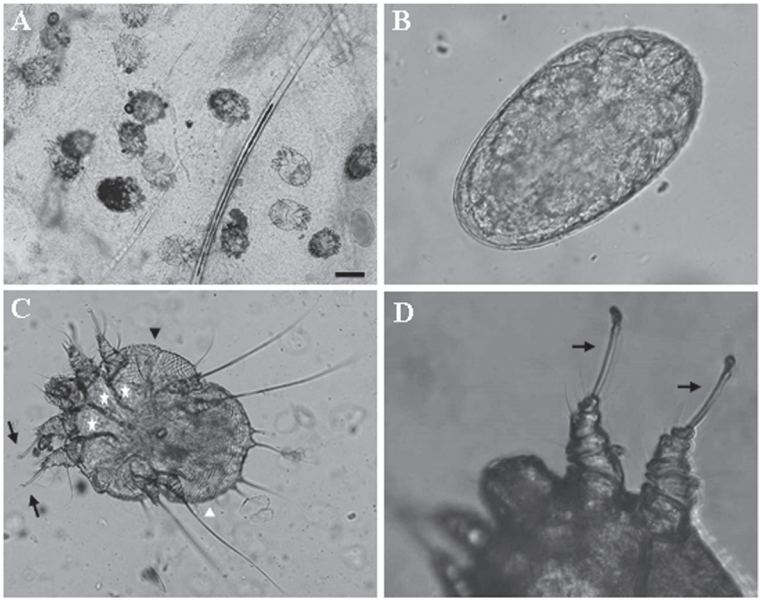

Fig. 2. Diagnosis of sarcoptic mange from the dermal lesions of maras. (A) Numerous scabies mites measuring 300–500 μm in body length were microscopically diagnosed in skin lesions following deep skin scrapings. Bar=300 μm. (B) A larvated egg of a scabies mite. (C, D) *Sarcoptes scabiei* with its characteristic dorsoventrally flattened and rounded body, four pairs of legs, sucker-like pulvilli on long unjointed pretarsi (arrows), triangular scales (black arrowhead) and transverse ridges (white arrowhead) on the dorsum, and three epimeres (asterisks), which are chitinous extensions of the coxae of the legs.

maras anywhere in the world.

Scabies mites induce a highly contagious pruritic skin disease typified by erythematous macules, papules, crusts and alopecia grossly. Because the scabies mites are transmitted to new hosts by direct contact, early diagnosis and aggressive treatment of the diseased animals are crucial for outbreak control. The presence of parasites in any ecosystem generates complex parasite webs within the system, and it is through these interactions that parasites may move from one host to another [7]. The heavy infestation of *S. scabiei* in zoo maras described in the present report highlights the need to develop prophylactic interventions for zoo animals.

Occurrence of sarcoptic mange in this mara colony might be explained by the following reasons. First, the causative agent might have remained dormant on some of the maras and been reactivated by captivity-induced stress or some other stressful condition. Second, regardless of periodical disinfection at the zoo, mites infested on other animals (such as rodents or stray cats) might have been transmitted to the maras. Third, mites infested on zoo animals might have been transmitted to the maras. Last, although unlikely, mites infested on zookeepers or veterinarians might have been transmitted to the animals.

In this study, we report the first known outbreak of sarcoptic mange in maras housed at a zoo and complete recovery using colony-wide treatment with ivermectin (0.4 mg/kg, S.C.; Ivomec 1% injection, Merial) and prednisolone (2.0 m*l*, I.M.; Samu). It is worth noting that colony-wide therapy is a requisite for complete eradication of sarcoptic mange without recurrence. In addition, maras can now be considered another natural host for the scabies mites, a finding not altogether surprising. It is also important that zoo workers include sarcoptic mange in the differential list for maras exhibiting pruritus and alopecia.

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