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First Records of the Louse *Solenopotes binipilosus* (Insecta: Phthiraptera) and the Mite *Psoroptes ovis* (Arachnida: Acari) from Wild Southern Huemul (*Hippocamelus bisulcus*)

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ABSTRACT: Two species of Phthiraptera, *Bovicola caprae* (Ischnocera: Bovicolidae) and *Solenopotes binipilosus* (Anoplura: Linognathidae), and one species of mite, *Psoroptes ovis* (Acari: Psoroptidae), were recorded on huemul (*Hippocamelus bisulcus*) in Chile. The sucking louse *S. binipilosus* and the mite *P. ovis* are reported for the first time from this host.

Key words: Acari, *Bovicola caprae*, first record, huemul, lice, mite, *Psoroptes ovis*, *Solenopotes binipilosus*.

Huemul (*Hippocamelus bisulcus*) is an endemic cervid species of southern Chile and Argentina. It is listed as endangered (IUCN, 2008) as a result of a significant decline in numbers and a reduction of its original distribution range. Possible causes of the huemul's decline are poaching, habitat destruction, predation by dogs (*Canis familiaris*), susceptibility to livestock diseases, competition with domestic animals, and the introduction of exotic species (Povilitis, 1998; Díaz and Smith-Flueck, 2000; Serret, 2001). It is considered an umbrella species (Hunter, 1996) and is one of the most vulnerable and least known cervids in the world (Smith-Flueck, 2000). The current population of huemul is about 1,000–1,500 individuals (Smith-Flueck, 2000; Serret, 2001).

Serret (2001) believes that domestic animals (e.g., cattle [*Bos taurus*], sheep [*Ovis aries*], goats [*Capra hircus*], horses [*Equus caballus*], and dogs) as well as introduced wild mammals (i.e., red deer [*Cervus elaphus*] and wild boar [*Sus*

scrofa]), may be the source of endoparasites affecting huemul deer (Díaz and Smith-Flueck, 2000). Studies of the ectoparasites of the huemul are scarce, but a goat-chewing louse *Bovicola caprae* has been reported on captive huemul from Argentina (Serret, 2001).

Between 14 June and 29 September 2007, 18 huemul (nine adult males and nine adult females) were live-captured in the vicinity of Cochrane (47°11'S, 72°29'W), Aysén District, Chile, at the Lago Cochrane National Reserve (LCNR). The LCNR was created in 1967 to protect southern beech or lenga (*Nothofagus pumilio*) forest and a population of huemul. The reserve's vegetation is classified as deciduous forest with a mosaic of shrubs and trees dominated by Antarctic beech or ñirre (*Nothofagus antarctica*), along with stands of *N. pumilio* and coihue (*Nothofagus dombeyi*). There are also old burned areas resulting from a fire that occurred in 1942–45. Much of the reserve used by huemul is dominated by steep terrain (23% of the entire area has more than a 45° slope) and flat rocky outcrops. Mean annual temperature is 7.6 C, and annual precipitation is around 805 mm. The 6,925 ha of the reserve are surrounded by a private park on the north and east sides, small sheep farms on the west side, and by Lake Cochrane and a river to the south and southeast.

The 18 huemul were captured and chemically immobilized with a combina-

tion of ketamine ($\sim 2.0 \pm 0.7$ mg/kg) and medetomidine ($\sim 0.09 \pm 0.05$ mg/kg), followed by the injection of atipamezole ($\sim 0.40 \pm 0.2$ mg/kg) as antagonist agent (P. Corti and C. Saucedo, unpubl. data). Capture was authorized by the Chile Agricultural Service. After sedation, each animal was placed over a canvas sling in a sternal position, and both flanks of the animals were visually examined for ectoparasites. Blood samples were collected, body measurements were taken, and clinical examinations were performed. Prior to their release, huemul were identified and marked with a numbered ear tag, and some were tagged with a very high frequency (VHF) radio collar. In the laboratory, ectoparasites were separated taxonomically into chewing lice, sucking lice, and mites, and sex and developmental stages (i.e., adults or nymphs) were determined using a stereomicroscope. Ectoparasites were fixed and preserved in 70% alcohol. Lice were slide-mounted in Canada balsam following the technique described by Palma (1978), and mites were cleared with Nesbitt solution for 72 hr at 55 C, dehydrated with alcohol, and slide-mounted in Berlesse mixture (Krantz, 1978). All specimens were deposited in the collection of the Zoology Department at the Universidad de Concepción, Chillán, Chile.

Identification of the chewing lice as *Bovicola caprae* (Ischnocera: Bovicoliidae) was based on size, antennal shape, chaetotaxy, thorax shape, and genitalia, following Werneck (1936, 1948, 1950). The sucking lice were identified as *Solenopotes binipilosus* (Anoplura: Linognathidae) following Ferris (1932). Identification of the mites as *Psoroptes ovis* (Acari: Psoroptidae) was based on previously published descriptions (Sweatman, 1958; Sanders et al., 2000; Pegler et al., 2005).

Five (27%) of the 18 huemul were infested with ectoparasites. Two (11%) animals carried adult *B. caprae*, and two (11%) carried *S. binipilosus*; one presented both louse species. Four (22%) huemul were affected by *P. ovis*, but two of them

showed heavy infestations, causing skin damage manifested by redness, thickening, and desquamation. A single animal was coinfecting with all three species of ectoparasites. Negative animals had no evidence of skin damage due to the ectoparasites, which are easily recognized on affected individuals. Lice were located mainly on the head, thighs, loins, and lateral sides of the trunk of the animals. The mites were mainly found on the back.

The small total number of both louse species (chewing and sucking lice) found ($n=23$) in this study was presumably due to the relative low density, small group size, and scattered distribution of huemul in the area (Corti, 2008). Low host numbers, scattered distribution, and small group size are mechanisms that reduce the probability of parasite infestations (Lohele, 1995).

Lice are highly specialized obligate ectoparasites of mammals and birds (Johnson and Clayton, 2003). The primary host of *B. caprae* is the domestic goat (including goats in Chile; Tagle, 1966), and infestations have been reported from dead captive huemul in Argentina (Serret, 2001) and Chile (Povilitis, 1998). Because several developmental stages (nymphs, males and female) were found on the huemul sampled in the present study, we conclude that this louse species is now established on wild huemul, and detected infestations were not the result of contact with domestic goats. Goats have been suggested as a potential source of an infestation of *B. caprae* in captive pudu (*Pudu puda*; González-Acuña et al., 2004), but we believe that the current infestations are a result of introduction via domestic goats and a successful host-switch (see Paterson and Gray, 1997; Paterson et al., 1999, 2003). Other cervid species are not known to be parasitized by *B. caprae* (Price et al., 2003).

The present report of *S. binipilosus* from huemul constitutes a new host record. This parasite has been recorded from three species of deer in South America, including *Mazama gouazoubira*, *Mazama americana*

(Castro and Cicchino, 1998), and pudu (González-Acuña et al., 2004), and has been associated with disease. Because of the low number of specimens collected during this study (two females), the significance of this new host record is unknown, and additional studies that include goats and other mammalian hosts are needed to fully understand its host range.

Psoroptes mites are a major cause of psoroptic mange in domestic and wild ungulates, causing livestock welfare problems and economic losses in many areas of the world (Van den Broek and Huntley, 2003). Several species of the genus *Psoroptes*, which are all currently considered junior synonyms of *P. ovis* (Zahler et al., 2000 [*P. equi*]; Wall and Kolbe, 2006 [*P. ovis*]), have been described and recorded from different species of wild herbivores, such as European bison (*Bison bonasus*; Kadulski et al., 1996), Wapiti (*Cervus canadensis*; Zahler et al., 2000), and African buffalo (*Syncerus caffer*) in Kenya (Sweatman et al., 1969). This is the first record of *P. ovis* in huemul, and as with *B. caprae*, the significance of these infestations to huemul conservation is unclear and deserves additional study.

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