Short Note

Galemys, 38: xx-, 2026
ISSN 1137-8700
e-ISSN 2254-8408
DOI: 10.7325/Galemys.2026.N8

First record of a flea *Pulex irritans* on Iberian ibex, *Capra pyrenaica*

Primera cita de una pulga *Pulex irritans* en la cabra montés, *Capra pyrenaica*

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The Iberian ibex *Capra pyrenaica* Schinz, 1838 is a medium-sized dimorphic wild ungulate inhabiting diverse mountain ranges in Spain, North of Portugal and French Pyrenees (García-González *et al*. 2022). Its parasitofauna has been profusely studied and a number of micro and macroparasites infecting this host species have been reported during last decades (Cordero del Campillo *et al*. 1994, Pérez *et al*. 2006, Espinosa *et al*. 2017). With regards to ectoparasites, 4 mites, 9 ticks and 2 lice species have been reported as ectoparasites of the Iberian ibex (Valldeperes *et al*. 2023), and the co-infection patterns between them have been analyzed (Carvalho *et al*. 2016, Fernández-Muñoz *et al*. 2023). Sarcoptic mange, caused by the mite *Sarcoptes scabiei* is of particular relevance because it persists as an endemic disease in affected populations, such as that of ibex inhabiting the Sierra Nevada Natural Space (SNNS), southern Spain (Pérez *et al*. 2022).

Sierra Nevada is a massif located within the Baetic System, near the Mediterranean Sea which harbours the highest summits of the Iberian Peninsula. Despite its general climate is Mediterranean, the mountain morphology gives it the characteristics of a continental climate. Biogeographically, five of the six thermotypes defined for the Mediterranean region appear in Sierra Nevada, from the thermomediterranean in the lowest and driest areas of the east to the cryoromediterranean in the highest peaks (Rivas-Martínez 1987). The mean precipitation gives rise to a dry and subhumid ombrotype, although exceptions appear due to extreme drought (eastern part) and to areas with mean precipitation of more than 1,000 mm/year. Topographically, the area is heterogeneous, with strong climatic contrasts between the sunny, dry south-facing slopes and the shaded, wetter north-facing slopes. As a major diversity hotspot in the Mediterranean region, Sierra Nevada has unique ecosystems with many endemic species.

Within the context of a management plan devoted to monitor and control sarcoptic mange and ibex density as well, in November 2018, an adult male Iberian ibex (*Capra pyrenaica*) with severe mange in the consolidation and chronic stages (Espinosa *et al*. 2017) (eg, lesions affecting ≥ 50% of the skin surface) from SNNS was chemically immobilized with a mixture of ketamine (3 mg/kg) and xylazine (3 mg/kg) (Casas-Díaz *et al*. 2011), and then euthanized with T-61 Intervet® (combination of embutramide and mebezonium iodide) at a dose of 1 mL/1.5 kg. This protocol complies with the Spanish and Andalusian laws regarding bioethics and animal welfare (ref. 21/03/2022/048). Several skin pieces were removed and placed in 14 cm diameter Petri dishes for live mites collection (Pérez *et al*. 2024) (Figs. 1 and 2). At the first mite count, we noticed the presence of a single flea specimen. It was fixed in 70% ethanol, The specimen was cleared in a 5% KOH solution during several hours and then dehydrated in increasing ethanol concentrations (80%, 90%, 96%, 5 min each) and, finally, absolute ethanol during 10 minutes. It was transferred to xylene and clove essence for several seconds and mounted in Canada balsam. For its identification we used the keys by Beaucournu & Lunay (1990).

The flea was identified as an adult *Pulex irritans* female (Figs. 3 and 4). This flea species, commonly known as the human flea, has a cosmopolitan distribution and parasitizes a wide variety of hosts, including birds, rodents, carnivores, livestock and

Figure 1. Aspect of the skin (hindlimb) of a mangy adult male Iberian ibex.

Figure 2. Iberian ibex skin pieces removed for mite (*Sarcoptes scabiei*) extraction, where an adult flea was found.

humans among other host species (Graz 1999, Zurita *et al.* 2019). In Spain, this flea has been found parasitizing swine, domestic goat, sheep, dog, cat, brown rat *Rattus norvegicus* (Berkenhout, 1769), badger *Meles meles* (Linnaeus, 1758), brown bear *Ursus arctos* Linnaeus, 1758, roe deer *Capreolus capreolus* (Linnaeus, 1758), Iberian hare *Lepus granatensis* Rosenhauer, 1856, rabbit *Oryctolagus cuniculus* (Linnaeus, 1758), wolf *Canis lupus* Linnaeus, 1758 and red fox *Vulpes vulpes* (Linnaeus, 1758) (Cordero del Campillo *et al.* 1994). As many other species belonging to family Pulicidae, *P. irritans* is an ectoparasite of medical and veterinary importance (Durden & Hinkle 2019). A recent study involving domestic and peridomestic hosts in Spain reported *P. irritans* as carrier of pathogen agents such as *Wolbachia* sp. Hertig & Wolbach, 1924, *Bartonella* spp. Barton, 1905 and *Yersinia pestis* (Yersin, 1894) (Zurita *et al.* 2024). The human flea has also a significant role as intermediate host of the tapeworm *Dipylidium caninum* Linnaeus, 1758 (Durden & Hinkle 2019). However, the health and epidemiological implications of these pathogens within the framework of the present study must be approached with extreme caution. To begin with, none of these infectious agents are specific to or typical of wild ruminants, as they are predominantly associated with carnivores, rodents, or peridomestic animals. Consequently, while it is important to acknowledge the vector potential

of *P. irritans* in general terms, there is currently no evidence to suggest that flea-borne pathogens pose a tangible sanitary threat to the Iberian ibex population. In fact, our finding agrees with those reported in several studies carried out in northern Africa. Only four *P. irritans* specimens were found in one out of 12,130 sheep sampled in Libya (Kaal *et al.* 2006) and the prevalence of flea infection in domestic goat and sheep in Algeria (mainly due to a number of siphonapteran species other than *P. irritans*) reached values as low as 3.54% and 2.02%, respectively (Sidhoum *et al.* 2023).

Figure 3. *Pulex irritans*. Adult female. Scale bar: 200 µm.

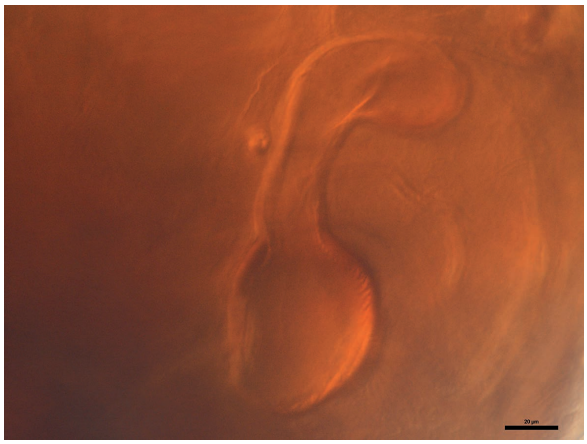

Figure 4. *Pulex irritans*. Adult female. Spermatheca. Scale bar: 20 µm.

To the best of our knowledge, this is the first report of a flea parasitizing Iberian ibex. In fact, this is the only flea specimen found after sampling systematically more than 1,250 whole ibex skins, from both dead (n= 530) and alive (n= 720) animals during the period 1999-2026. So, the prevalence of flea infestations in this host population is expected to be very small (< 0.08%; the Wilson Score Method gives an 95% CI: 0; 0.0045) (Wilson 1927), even assuming the ability of these ectoparasites to leave their hosts. Due to the extremely small sample size, we are not able to track the source of this infestation nor to conduct research on pathogens transmitted by the vector.

Although the discovery of *Pulex irritans* on an Iberian ibex constitutes a novel and remarkable addition to the known ectoparasitofauna of this wild ungulate, the epidemiological significance of this finding must be interpreted with caution. Given that only a single female flea specimen was recovered from a comprehensive screening of more than 1,250 host skins, our results yield an extremely low estimated prevalence. This statistical scarcity strongly suggests that the recorded infestation represents an accidental or highly infrequent event rather than a stable host-parasite association. Unlike carnivores, rodents, or domestic livestock, which frequently utilize dens, burrows, or confined shelters where flea pupae can accumulate and emerge, the open-habitat mountain ecology of the Iberian ibex typically limits its exposure to such microenvironments. Consequently, while this record broadens the documented host range of *P. irritans*, it should be considered an occasional spillover event -likely facilitated by the severe, debilitated state of the mangy individual- rather than evidence of a consolidated or established ectoparasitic pattern in this wild ruminant population.

Acknowledgements

This study was supported by the Junta de Andalucía (PAIDI RNM 118 group), and the Jaén University (actions 1b and R1).

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Submitted: 15 April 2026
Accepted: 23 August 2026

Associate editor was Francisco Ruiz Fons