AGRO PRODUCTIVIDAD

Colegio de Postgraduados

Tricholiperus lipeuroides (Mégnin 1884) in *Mazama temama* (Kerr 1792): first case report in Mexico

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ABSTRACT

Objective: To identify the taxonomy of lice of the family Trichodectidae present in a captive population of *M. temama*.

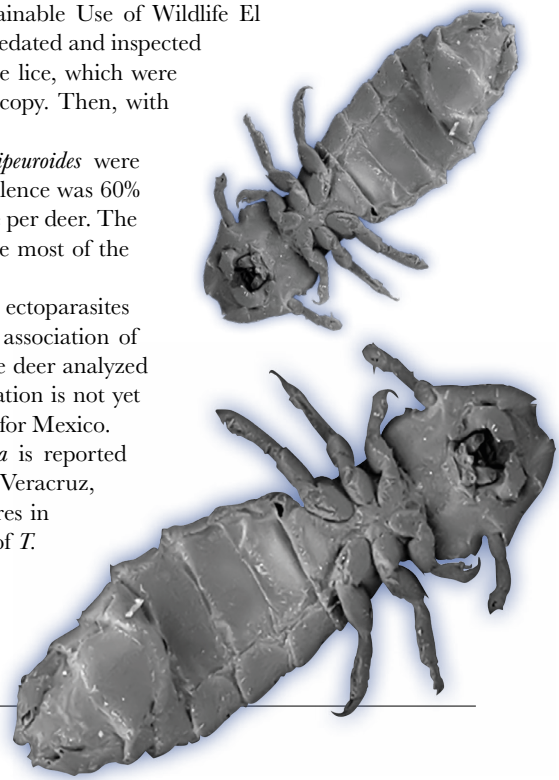
Methodology: Lice were collected from 15 red brocket (Temazate) deer (*M. temama*) in captivity at the Unit for the Conservation, Management and Sustainable Use of Wildlife El Pochote, Ixtaczoquiltan, Veracruz, Mexico. The deer were sedated and inspected in the ventral and inguinal zone, ears and tail to collect the lice, which were observed with bright field microscopy and electron microscopy. Then, with the use of taxonomic keys, lice were identified up to species.

Results: A total of 155 lice identified as *Tricholiperus lipeuroides* were collected in 8 females and 7 males of *M. temama*. The prevalence was 60% (9 out of 15 deer had lice) at an average abundance of 10 lice per deer. The inguinal and ventral zone were the areas of the body where most of the collected lice were detected.

Implications: This study expands the knowledge about ectoparasites in *M. temama* in captivity, recording for the first time the association of the chewing louse *T. lipeuroides* with this species of deer. The deer analyzed did not present clinical signs such as hair loss. This information is not yet reported in other studies; there are no previous case reports for Mexico.

Conclusions: The presence of *T. lipeuroides* in *M. temama* is reported for the first time in the UMA El Pochote, Ixtaczoquitlán, Veracruz, Mexico. Since *M. temama* shares some areas of the enclosures in the UMA with *O. virginianus*, the Temazate became a host of *T. lipeuroides*.

Keywords: ectoparasite, louse, red brocket (Temazate) deer, UMA.



Citation: Mora-Collado, N., Romero-Salas, D., Serna-Lagunes, R., Cruz-Romero, A., Sánchez-Montes, S., Leyva-Ovalle, O. R., González-Hernández, M., & Tapia-Maruri, D. (2022). *Tricholiperus lipeuroides* (Mégnin 1884) in *Mazama temama* (Kerr 1792): first case report in Mexico. *Agro Productividad*. https://doi.org/10.32854/agrop.v15i10.2281

Academic Editors: Jorge Cadena Iñiguez and Libia Iris Trejo Téllez

Received: May 22, 2022.
Accepted: September 18, 2022.
Published on-line: November 15, 2022.

Agro Productividad, 15(10). October. 2022. pp: 139-144.

INTRODUCTION

Chewing lice of the genus *Tricholipeurus*, belonging to the family Trichodectidae, have a paurometabolous life cycle based on three stages: egg, nymph (three stages: N1, N2 and N3) and adult (Mégnin, 1884). These lice measure between 0.8 and 11 mm. Females have an elongated and thin subgenital lobe and are 20% larger than males, which have a reduced head, in the middle part a superficial concave hollow is formed, with thin antennae with three segments and with a claw in each tarsus (Marshall, 1981). Information on the lice-host relationship and the reporting of lice in new hosts (Johnson *et al.*, 2018; Song *et al.*, 2019), as in wild deer (Artiodactyla: Cervidae) or in captivity, is essential information to maintain the health conditions of cervids (Romero-Castañón *et al.*, 2008).

The red Temazate deer, *Mazama temama* (Kerr 1792) is a deer native to the Neotropical region, in which a wide range of pathogens and diseases have been identified (Barbanti *et al.*, 2008). This species is distributed in the central region of Veracruz, Mexico, where environmental conditions prevail for the development of its populations (Ceballos, 2010), such as humid zones and areas of dense vegetation of tropical forests (Serna-Lagunes *et al.*, 2014). However, this species faces conservation problems related to illegal hunting (Salazar-Ortiz *et al.*, 2020), habitat fragmentation (Macario-Cueyactle *et al.*, 2019) and loss of genetic diversity due to geographical isolation (Serna-Lagunes *et al.*, 2021). For this reason, the Management Units for the Conservation and Sustainable Use of Wildlife (UMA) are an *ex situ* strategy for the conservation and management of wild populations of M. temama and their study is important to guarantee the integral health of the species (SEMARNAT, 2008).

Studies on the lice-host relationship in *M. temama* in UMA have been addressed by describing the presence of their endoparasites (Salmorán-Gómez *et al.*, 2019). However, to date, the relationship of the presence of lice of the Trichodectidae family in this species of cervid has not been reported or studied, which is important to guarantee the health of the deer in the UMA. Therefore, the objective of the study was to identify the presence and richness of lice of the family Trichodectidae present in a captive population of *M. temama*.

MATERIALS AND METHODS

In the UMA El Pochote (SEMARNAT code: UMA-IN-CR-0122-VER/og) located in the municipality of Ixtaczoquitlán, Veracruz, Mexico (18° 45' and 18° 57' N; 96° 58' and 97° 06' W). During February to December 2020, seven males (46%, three juveniles and four adults) and eight females (54%; three juveniles and five adults) of *M. temama* were anesthetized. An intramuscular injection of Zelazol® (REG. SAGARPA Q-1196-009) at a dose of 5 mg kg^{-1} (Tilethamine base 50 mg, Zolazepam base 50 mg, and 57.7 mg mannitol per mL) and as an antagonist Tolazoline hydrochloride (2 mg kg^{-1}) intramuscular. It is worth mentioning that the deer were managed under the ethical criteria indicated in the Mexican Standard NOM-051-ZOO-1995 (DOF, 1996) and NOM-062-ZOO-1999 (DOF, 1998).

Each deer was inspected between the hair in the ventral and inguinal area, the ears and the tail, where the detected lice were removed with stainless steel fine-tipped tweezers (Aven®, USA) and placed in polyethylene tubes with 70% ethanol labeled with

the collection data. For the taxonomic identification of the lice, these were mounted on slides and brightfield micrographs were obtained with a Carl Zeiss compound microscope, 10X and 40X in the Optical Microscopy Laboratory of the Faculty of Biological and Agricultural Sciences of the Universidad Veracruzana. For the identification of the species, morphological characters were analyzed based on the taxonomic keys of Price and Graham (1997) and Price *et al.* (2003).

In addition, some specimens were selected to obtain micrographs with Environmental Scanning Electron Microscope (ESEM). For this, the samples were mounted on aluminum stubs (filaments) adhered on a double-sided carbon conductive tape and a retro-dispersed electron detector in 20 kV and 20 Pa of pressure. The heels were directly observed, and the images were captured at a magnification 200X and 1000X in a Carl Microscope Zeiss model EVO LS10 (Munich, Germany) and stored in TIFF format (2048×1536 px). The Laser Scanning Confocal Microscopy (CLSM) technique was also performed; the samples were mounted on glass slides to be observed in lambda mode in parallel. A sequence of images was obtained at laser wavelengths of 405 nm, 488 nm, 561 nm, and 640 nm (4% capacity) in a Carl Zeiss A microscope model LSM 800 (Munich, Germany) (Delgado-Núñez *et al.*, 2020).

The images were taken at 20X and 40X magnification with the Apochromatic Plan, 1.3 numerical aperture and 1 Airy Unit (AU) of pinhole aperture at a 2048×2048 px resolution in TIFF format, using a coupled HD camera (AxioCam, Carl Zeiss, Model 305, color, Göttingen, Germany). The images were handled using the ZEN 2.6 Zeiss Blue editing software (Delgado-Núñez *et al.*, 2020). Frequency analyses were performed to describe the sex ratio of the collected lice, and to describe the proportion of lice collected regarding the sex and age category of the sampled deer.

RESULTS AND DISCUSSION

The lice collected in *Mazama temama* were identified as *Tricholipeurus lipeuroides* (Mégnin, 1884). The lice presented morphological structures that coincided with the characteristics described in the taxonomic key such as the head wider than the prothorax, the jaw under the head, a nail in each tarsus, filiform antennae and divided into three segments. In the males, also it was observed an enlarged basal segment (Figure 1).

The morphological identification structures obtained by electron microscopy (Figure 2), allowed to observe details of the shape, texture, and surface of the lice such as the jaw, silks (hairs), legs with claws, and reproductive organs. These characteristics corresponded to the taxonomic identification of the species of chewing louse *T. lipeuroides*, a new ectoparasite recorded in the red brocket (Temazate) deer, *M. temama*.

A total of 155 chewing lice were collected just in the groin and ventral zone of *M. temama*. Out of the 15 *M. temama* deer evaluated, only nine presented lice, this is equivalent to a prevalence of 60%. Of those nine deer with lice, five males had 105 lice equivalent to 68%, and four females 50 lice, which corresponded to 32%. According to the age category of deer, adults had a higher proportion of lice 77%, compared to juvenile deer, 33%.

This study reports for the first time the presence of the chewing louse *T. lipeuroides* in *M. temama* in captivity conditions in Veracruz, Mexico, as *M. temama* has not been reported in

Figure 1. *Tricholipeurus lipeuroides* female: a) head; (b) abdomen; male: c) abdomen; (d) head.

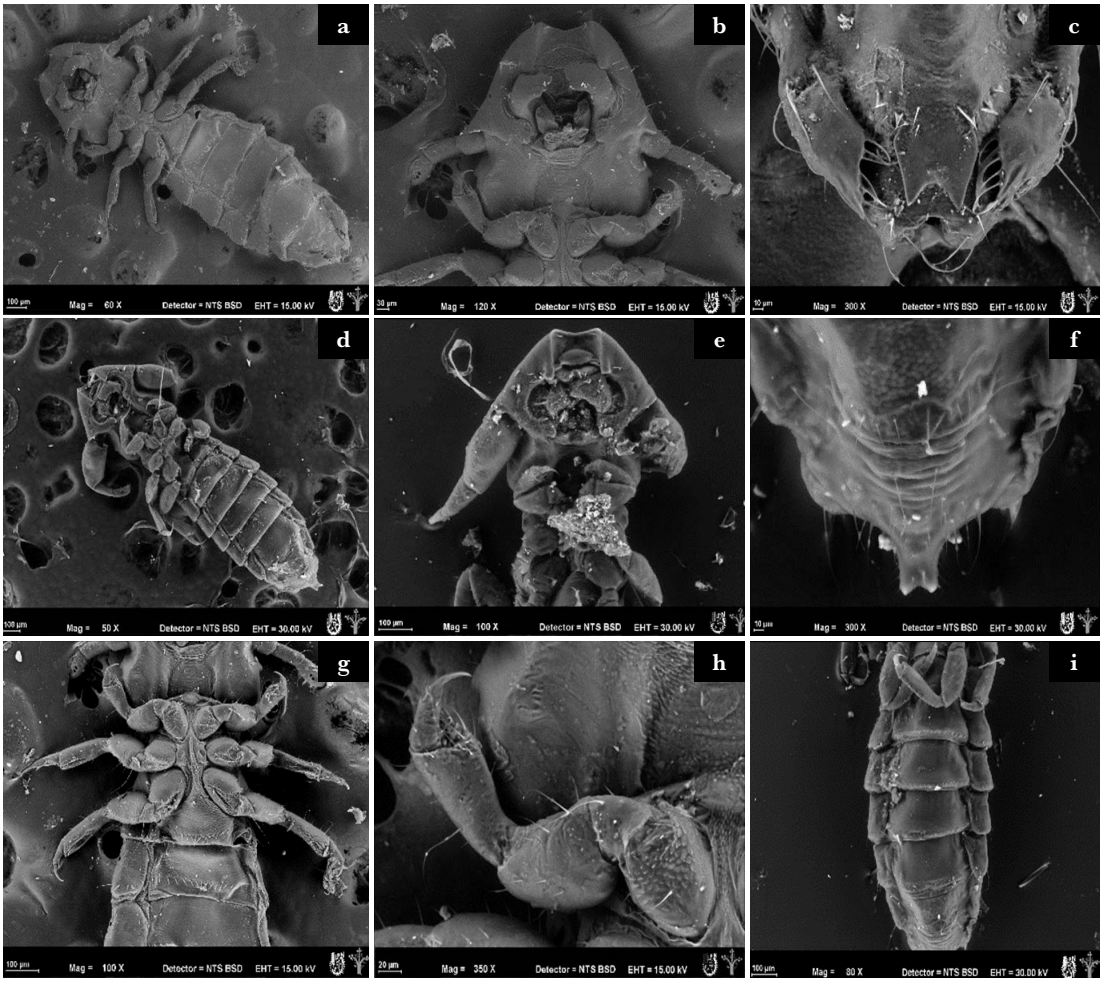


Figure 2. Female: a) ventral view, b) head-jaw, c) genitalia; male: d) ventral view, e) head-antennae, f) genitalia, g) thorax, h) leg-nail, i) abdominal segments.

other studies as a new host of *T. lipeuroides*. Due to the conditions of management, control of parasites and diseases, and the movement of deer to different management pens within the same UMA El Pochote, this could promote exchanges of *T. lipeuroides* to *M. temama* (Salmorán-Gómez *et al.*, 2019).

In other countries, the presence of *T. lipeuroides* has been reported in white-tailed deer fawns (*O. virginianus*) in Canada (Colwell *et al.*, 2008) and in four white-tailed deer in the Virgin Islands National Park, USA (Mertins *et al.*, 2017). However, for Mexico, the first report of *T. lipeuroides* was in Mexican white-tailed deer (*O. virginianus mexicanus*; Sánchez-Montes *et al.*, 2018) and for Veracruz white-tailed deer (*O. virginianus veraecrucis*; Estrada-Souza *et al.*, 2020), but this is the first case report of *T. lipeuroides* in *M. temama* for Mexico.

In other studies, with black-tailed deer (*O. hemionus columbianus*) it was found that some species of chewing lice can affect the health of deer when the diet does not meet their nutritional needs. Because the immune system does not act properly and causes diseases such as hair loss syndrome (Foreyt *et al.*, 2004). However, in the Temazate deer evaluated in this study, those signs were not present; thus, a constant monitoring of the integral health of the temazates would guarantee the viable management of the population in the UMA El Pochote.

The chewing louse *T. lipeuroides* has been considered an ectoparasite specific to its host (Strickland *et al.*, 1981). However, factors that influence presence such as age and sex of the deer, should be evaluated in future studies to determine the parasite-host relationship (Forrester *et al.*, 1996).

CONCLUSIONS

The presence of *Tricholipeurus lipeuroides* in *Mazama temama* is reported for the first time to our knowledge at the UMA El Pochote, Ixtaczoquitlán, Veracruz, Mexico. Although chewing lice are present in red brocket (Temazate) deer, these latter do not present any clinical signs of disease such as hair loss. It is possible that by sharing some areas of the enclosures and management pens of the UMA El Pochote with *O. virginianus*, the Temazate deer became an incidental host of *T. lipeuroides*; sometimes in the UMA El Pochote other deer are received by exchange, donation or seizing. The greater number of lice was found in males of Temazate deer than in females. This finding suggests implementing studies on the influence of sex, age, and reproductive condition of the host on the presence of chewing lice. Since the gravid females of *M. temama* that were evaluated in this study did not present lice.

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