



Increasing the list of mammalian parasite species in Mexico: the case of the Chamela Biological Station Collection

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Biological collections are dynamic research centers that can be consulted and require curation (CONABIO 2016). These collections encompass sets of specimens, their parts, or derivatives, which collectively comprise valuable information on biodiversity (Cervantes 2016). These collections are typically maintained by various academic and non-academic institutions involved in research, teaching, training, and diffusion of biological diversity. The safekeeping of these collections is regulated by environmental legislation in the country (Hernández-Ramírez 2024). In Mexico, there are approximately 747 collections associated with 237 institutions, among which zoological collections predominate, including both invertebrate and vertebrate groups (CONABIO 2016).

The Chamela Biology Station (EBCh for its acronym in Spanish) of the Universidad Nacional Autónoma de México (UNAM), Instituto de Biología is part of the Chamela-Cuixmala Biosphere Reserve (RBChC for its acronym in Spanish), located on the Mexican Pacific coast in the municipality of La Huerta, in the state of Jalisco. In the RBChC, nearly 69 species of mammals have been recorded (Ceballos & Miranda 2000). Thirty eight taxa of ectosymbionts (parasites, commensals, and phoretics) have been reported for the EBCh, of which 30 are nominal species (one species of Myobiidae is in the process of being described), including mites, ticks, lice, fleas, and pseudoscorpions (Gómez-Rodríguez *et al.* 2015; Light *et al.* 2020; Guzmán-Cornejo *et al.* 2020). The EBCh Mammal Collection was initiated in 1981, with the most substantial augmentation of specimens occurring between 1983 and 1985. The collection was conceptualized as a reference collection, thereby serving as a comprehensive representation of the region's fauna. The specimen collection currently consists of 185 specimens, which are organized into 23 families, 50 genera, and 58 species. These specimens have been consulted by numerous researchers and students, providing support for a considerable number of research projects. As part of a research project evaluating the richness of ectoparasites associated with mammals in the EBCh, the present study aimed to increase the record of arthropods associated with mammals. This objective was based on a review of some mammals deposited in the Station's mammal collection. In October 2024, an academic field trip was conducted to the EBCh, during which the opportunity arose to examine a selection of mammal specimens deposited in this collection. The ectoparasites observed in the skins analyzed were stored in vials with 96% ethanol and labeled for subsequent review. Lice were processed for study, as the rest of the specimens were observed directly with the aid of a stereoscopic microscope (Nikon SMZ645). Taxonomic identification of ticks and flies was conducted using specialized keys, including: Guzmán-Cornejo *et al.* (2011), Skvarla & Machtinger (2019). The lice were mounted in permanent preparations, using Canada balsam, following the procedures of Kim *et al.* (1986). The preparations were then left to dry and subsequently identified using taxonomic keys (Kim *et al.* 1986). The collected parasites are deposited in the Collection of the Laboratorio de Acarología, Facultad de Ciencias, UNAM (LAFc-UNAM).

The following parasites were obtained from the mammals examined (Figure 1): **Collared Peccary, *Dicotyles tajacu* (Linnaeus) (Artiodactyla: Tayassuidae).**



FIGURE 1. A) *Dicotyles tajacu*. B-C) *Amblyomma mixtum* on *D. tajacu*. D) *Odocoileus virginianus*. E) *Solenopotes binipilosus*, anterior region of female. F) *S. binipilosus*, female. G) *S. binipilosus*, male. H) *Lipoptena mazamae* on *O. virginianus*. I) *Lipoptena mazamae*. J) *Xenomys nelsoni*. K) Anopluran egg on *X. nelsoni*. L) *Neohaematopinus* cf. *neotomae*, anterior region of female.

Acari: Ixodidae

Amblyomma mixtum (Koch)

Ticks with rounded bodies and characteristic ornamentation on the shield. Hypostome with 3/3 dentition. Internal spur of coxa IV long in males and thick, flat, and rounded in females. Coxa I with two spurs, the external one longer than the internal one, coxa II-III with a crest-shaped spur. Females have chitinous tubercles on each of the festoons; genital opening is U-shaped.

Revised material: 7 ♀♀, 14 ♂♂, 16 NN, ex *D. tajacu* (= *Tayassu tajacu sonorensis*) (no. 141), junio 1992, Colección EBCh, Jalisco, México, G. Sánchez. LAFC000501.

White-tailed deer, *Odocoileus virginianus* (Zimmermann) (Artiodactyla: Cervidae)

Diptera: Hippoboscidae

***Lipoptena mazamae* Rondani**

Diptera with short spiniform setae on the ventral surface of the thorax. Wings short, flat, and transparent. Anterior coxa without a posterodorsal retrograde spur. Tibia 1 with an apical spine-shaped spur. Eyes as long as wide. Male with one tergite, female with two tergites.

Revised material: 11 ♀♀, 11 ♂♂, ex 1 ♀ juvenile *O. virginianus* (no. 444), 8 mayo 1986, Colección EBCh, Jalisco, México, G. Ceballos. LAFC-D01.

Phthiraptera: Anoplura

Linognathidae

***Solenopotes binipilosus* (Fahrenholz)**

Small head, as long as the thorax; segments 4 and 5 of antennae without sensoria. Pentagonal sternal thoracic plate. Abdominal spiracles not on tubercles.

Revised material: 68 ♀♀, 33 ♂♂, 43 NN ex 1 ♀ juvenile *O. virginianus* (no. 444), 8 mayo 1986, Colección EBCh, Jalisco, México, G. Ceballos. LAFC-P34.

Magdalena rat, *Xenomys nelsoni* Merriam (Rodentia: Cricetidae)

Phthiraptera: Anoplura

Polyplacidae

***Neohaematopinus* cf. *neotomae* Ferris**

Head as long as wide, basal antennal segment with moderately thick silk and distant from the posteroapical angle; front legs smaller than the second and third pairs of legs. Thoracic sternal plate with concave posterior margin. Abdomen with sternal and tergite plates on all segments and with paratergites on segments 2 to 8.

Revised material: 1 ♀, ex *X. nelsoni* (no. 99), 12 marzo 1983, Colección EBCh, Jalisco, México, G. Sánchez. LAFC-P35.

This study found four species of parasites recovered from four mammals in the EBCh Mammal Collection. All represent new records for the hosts analyzed. Apart from *A. mixtum*, all these species represent new records for the locality, while the louse *S. binipilosus* constitutes a new record for Mexico. This contributes to an augmentation of the extant knowledge concerning ectosymbionts associated with mammals in the reserve, encompassing now 41 taxa and 31 nominal species (Gómez-Rodríguez *et al.* 2015; Light *et al.* 2020; Guzmán-Cornejo *et al.* 2020; this study).

The tick *A. mixtum* is the most widespread species of the genus *Amblyomma* in Mexico (Guzmán-Cornejo *et al.* 2023); in the EBCh, it has been collected in association with two species of wild hosts: *Didelphis virginiana* and *Nasua narica*, which are highly mobile vertebrates, a characteristic shared with *D. tajacu*. The hippoboscid *L. mazamae* is hematophagous and is distributed throughout North, Central, and South America (Dibo *et al.* 2023). It has been documented to parasitize various species of deer, including *O. virginianus* (Kern 2003; Dibo *et al.* 2023). Regarding the sucking lice, the first species, *S. binipilosus*, has been observed parasitizing *O. virginianus* and species of the genus *Mazama*. This louse species is found in North and South America (Kim *et al.* 1986). The second species, *Neohaematopinus* cf. *neotomae*, represents the second documented instance of Anoplura [in addition to *Hoplopleura hirsuta* Ferris] that parasitizes *X. nelsoni*, a rodent species endemic to the tropical Pacific coast of Mexico (Ceballos & Miranda 2000). The genus *Neohaematopinus* comprises species of lice that primarily parasitize squirrels. However, certain species, such as *N. neotomae*, parasitize Cricetidae of the genera *Neotoma* and *Hodomys* (Kim *et al.* 1986). Notably, *Hodomys alleni* has been designated as a sister species of *X. nelsoni* (Bradley *et al.*, 2022).

Mastozoological collections constitute an additional source of information regarding symbiotic fauna. Parasitic arthropods, for instance, possess diagnostic characteristics such as the presence of a chitin cuticle, which enables their preservation in mammalian skins over extended periods of time. These collections can also provide valuable past and present information on many parasites and ectosymbionts that have generally been neglected, and many of which have not yet been recorded in certain areas or simply have not been discovered. For instance, Hromada & Klimovičová (2015) described ten novel species of feather mites and a new genus from avian specimens deposited at the Saris Bardejov

Museum in Slovakia. Similarly, the review of specimens from collections, which may contain specimens from different stages of their life cycle, would allow for further exploration of aspects of the parasite-host relationship. For instance, in the context of ticks, these organisms have the potential to offer insights into the mammals utilized at each stage of their development (Darrigrán 2012; Galbreath *et al.* 2019).

Mammal collections may contain unique specimens that are difficult to collect and/or specimens that may currently be classified as endangered, making field study complicated, as government procedures for their capture and study are limited. This issue is further exacerbated by the prevalence of insecurity in many regions, which hinders unobstructed access to new sites that could be investigated (Herrera-Mares *et al.* 2022).

It is imperative to persist in the examination of the remaining specimens in the collection to acquire novel records. In the RBChC, a substantial number of mammalian species (approximately 57) have yet to be studied in the context of their ectosymbionts, which are organisms that must be incorporated into the inventory of species inhabiting the Reserve and contributing to the planet's biological diversity (Darrigrán 2012).

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References

- Bradley, R.D., Edwards, C.W., Lindsey, L.L., Bateman, J.R., Cajimat, M.N., Milazzo, M.L., Fulhorst, C.F., Matocq, M.D. & Mauldin, M.R. (2022) Reevaluation of the phylogenetic relationships among Neotomini rodents (*Hodomys*, *Neotoma* and *Xenomys*) and comments on the woodrat classification. *Journal of Mammalogy*, 103, 1221–1236.
<https://doi.org/10.1093/jmammal/gyac031>
- Ceballos, G. & Miranda, A. (2000) *Guía de campo de los mamíferos de la costa de Jalisco, México*. Fundación Ecológica de Cuixmala, A.C. Instituto de Ecología/Instituto de Biología, Universidad Nacional Autónoma de México, La Huerta, México, 502 pp.
- Cervantes, R.F.A. (2016) Uso y mantenimiento de Colecciones biológicas, IB, UNAM. *Revista Digital Universitaria*, 17, 1–11.
- CONABIO. (2016) Colecciones Biológicas Científicas en México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Available from: www.biodiversidad.gob.mx/especies/colecciones (accessed 9 June 2025)
- Darrigrán, G. (2012) Las colecciones biológicas: ¿para qué? *Boletín Biológica*, 23, 28–31.
- Dibo, N., Yang, Y., Wu, X. & Meng, F. (2023) A brief review on deer keds of the genus *Lipoptena* (Diptera: Hippoboscidae). *Veterinary parasitology*, 313, 109850.
<https://doi.org/10.1016/j.vetpar.2022.109850>
- Galbreath, K.E., Hoberg, E.P., Cook, J.A., Armién, B., Bell, K.C., Campbell, M.L., Dunnun, J.L., Dursahinhan, A.T., Eckerlin, R.P., Gardner, S.L., Greiman, S.E., Heikki Henttonen, H., Agustín-Jiménez, F., Koehler, A.V.A., Nyamsuren, B., Tkach, V.V., Torres-Pérez, F. & Hope, A.G. (2019) Building an integrated infrastructure for exploring biodiversity: field collections and archives of mammals and parasites. *Journal of Mammalogy*, 100, 382–393.
<https://doi.org/10.1093/jmammal/gyz048>
- Gómez-Rodríguez, R.A., Gutiérrez-Granados, G., Montiel-Parra, G. & Rodríguez-Moreno, A. (2015) Diversity and coexistence of ectoparasites in small rodents in a tropical dry forest. *Biotropica*, 47, 484–490.
<https://doi.org/10.1111/btp.12229>
- Guzmán Cornejo, C., Robbins, R.G., Guglielmo, A.A., Montiel Parra, G. & Pérez, T.M. (2011) The *Amblyomma* (Acari: Ixodida: Ixodidae) of Mexico: identification keys, distribution and hosts. *Zootaxa*, 2998 (1), 16–38.
<https://doi.org/10.11646/zootaxa.2998.1.2>
- Guzmán-Cornejo, C., Herrera-Mares, A., Ugalde-Medina, A., López-Pérez, A.M., Del Castillo-Martínez, L., Acosta-Gutiérrez, R., Cabrera-Garrido, M. & Morales-Malacara, J.B. (2020) Arthropods associated with mammals. Their importance as part of the richness in a Biosphere Reserve in Mexico. *Journal of Medical Entomology*, 57, 780–787.
<https://doi.org/10.1093/jme/tjz237>
- Guzmán-Cornejo, C., Herrera-Mares, A., Paredes-León, R. & García-Prieto, L. (2023) Actualización de la Riqueza de garrapatas de los géneros *Ixodes* y *Amblyomma* (Ixodida: Ixodidae) en México. *Dugesiana*, 30, 163–176.
<https://doi.org/10.32870/dugesiana.v30i2.7303>
- Hernández-Ramírez, A.M. (2024) Las colecciones biológicas científicas en México. *Elementos*, 136, 7–12.
- Herrera-Mares, A., Guzmán-Cornejo, C., García-Prieto, L., Rebollo-Hernández, A., León-Paniagua, L., Del Castillo-Martínez, L., Montiel-Parra, G. & Ríos-Sais, G. (2022) Acari (Parasitiformes and Acariformes) from Mexico: analysis of their geographical and host distribution in Rodentia (Cricetidae). *Journal of Medical Entomology*, 59, 1880–1890.
<https://doi.org/10.1093/jme/tjac135>

- Hromada, M. & Klimovičová, M. (2015) From dusty collections to descriptions of new species—birds in Sarisske Museum Bardejov as valuable source for investigating mite biodiversity. *Acta Universitatis Prešovensis, Folia Oecologica*, 7, 98–108.
- Kern Jr., W.J. (2003) *Neotropical deer ked or Neotropical deer louse fly, Liptoptena mazamae Rondani (Insecta: Diptera: Hippoboscidae)*. Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. ENY 686. University of Florida, Gainesville, Florida, 3 pp.
- Kim, K.C., Pratt, H.D. & Stojanovich, C.J. (1986) *The sucking lice of North America. An illustrated manual for identification*. Pennsylvania State University Press, University Park, Pennsylvania, 241 pp.
- Light, J.E., Durden, L.A., OConnor, B.M., Preisser, W.C., Acosta, R. & Eckerlin, R.P. (2020) Checklist of ectoparasites of cricetid and heteromyid rodents in Mexico. *Therya*, 11, 79–136.
<https://doi.org/10.12933/therya-20-785>
- Skvarla, M.J. & Machtinger, E.T. (2019) Deer keds (Diptera: Hippoboscidae: *Liptoptena* and *Neoliptoptena*) in the United States and Canada: new state and county records, pathogen records, and an illustrated key to species. *Journal of Medical Entomology*, 56, 744–760.
<https://doi.org/10.1093/jme/tjy238>