

Notable records of *Galictis vittata* and *Eira barbara* (Carnivora: Mustelidae) in the Northeastern Sierra of Puebla, Mexico

Registros notables de *Galictis vittata* y *Eira barbara* (Carnivora: Mustelidae) en la Sierra Nororiental de Puebla, México

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Eira barbara and *Galictis vittata* are carnivorous mammals belonging to the family Mustelidae. In Mexico, these species are listed in a risk category; however, they are among the least studied carnivorous mammals. There are scarce records and information on different aspects of the ecology of both species. The objective of this note is to report additional records of *E. barbara* and *G. vittata* in the Northeastern Sierra of Puebla. From March to May 2023, 20 camera-trap stations were installed in natural water bodies and sites where traces of wild mammals were found. Additionally, records of individuals were obtained from international databases and published articles; a map of the potential distribution of *E. barbara* and *G. vittata* in Mexico was made. With a sampling effort of 90 trap days, 2 independent records of *E. barbara* were captured in cloud forest remnants. In addition, one record of *G. vittata* was captured in a stream running through a shaded coffee plantation. There are few documented reports of the presence of these species in the state of Puebla. The records reported here were captured in cloud forest remnants with a shaded coffee plantation, considered an agricultural activity with a minor impact on biodiversity, which has probably allowed the presence of species such as *E. barbara* and *G. vittata*. The record of these species in northern Puebla suggests that this region functions as a biological corridor for them.

Key words: Biological corridor; camera trap; habitat use; shaded coffee plantation; Sierra Madre Oriental; Zapotitlán de Méndez.

Eira barbara y *Galictis vittata* son mamíferos carnívoros pertenecientes a la familia Mustelidae. En México estas especies se encuentran en alguna categoría de riesgo; sin embargo, son de los mamíferos carnívoros menos estudiados. Existen pocos registros e información sobre diferentes aspectos de la ecología de ambas especies. El objetivo de esta nota es reportar registros adicionales de *E. barbara* y *G. vittata* en la Sierra Nororiental de Puebla. De marzo a mayo de 2023 se instalaron 20 estaciones de fototrampeo en cuerpos de agua naturales y sitios donde se detectaron rastros de mamíferos silvestres. Adicionalmente, se obtuvieron registros de individuos en bases de datos internacionales y artículos publicados; además, se realizó un mapa que incluye la distribución potencial de *E. barbara* y *G. vittata* en México. Con un esfuerzo de muestreo de 90 días-trampa, se obtuvieron 2 registros independientes de *E. barbara*, en remanentes de bosque mesófilo de montaña. Además, se obtuvo un registro de *G. vittata* al interior de arroyo en un fragmento de cafetal de sombra. Existen pocos registros de la presencia de estas especies en gran parte del estado de Puebla. Los registros se obtuvieron en remanentes de bosque mesófilo de montaña con cafetal de sombra, considerada como una actividad agropecuaria con menor impacto en la biodiversidad, lo que probablemente ha permitido la presencia de especies como *E. barbara* y *G. vittata*. Su registro al norte del estado podría indicar que esta región funciona como corredor biológico para estas especies.

Palabras clave: Cafetal bajo sombra; cámara trampa; corredor biológico; Sierra Madre Oriental; uso de hábitat; Zapotitlán de Méndez.

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Mustelids comprise a diverse group of small- to medium-sized carnivores comprising 2 subfamilies, 22 genera, and 59 species (Wilson and Reeder 2005). They are widely distributed in all continents, except Antarctica and Australia, in various terrestrial and aquatic ecosystems, and even in anthropic or urban areas (Griffiths 2000; Nowak 2005; Wilson and Mittermeier 2009). They exhibit a wide range of dietary habits, ranging from omnivores to strict

carnivores (Nowak 2005). The role of these carnivores in ecosystems has also been noted, where they are seed dispersers in some cases (López-Bao et al. 2011; González-Varo et al. 2015). Mexico is home to 6 species, of which *Mustela frenata* has a wide distribution; others, like *Eira barbara*, *Galictis vittata*, *Enhydra lutris*, and the otters *Lontra annectens* and *L. canadensis*, have a more restricted distribution (Ceballos and Oliva 2005). The sea otter

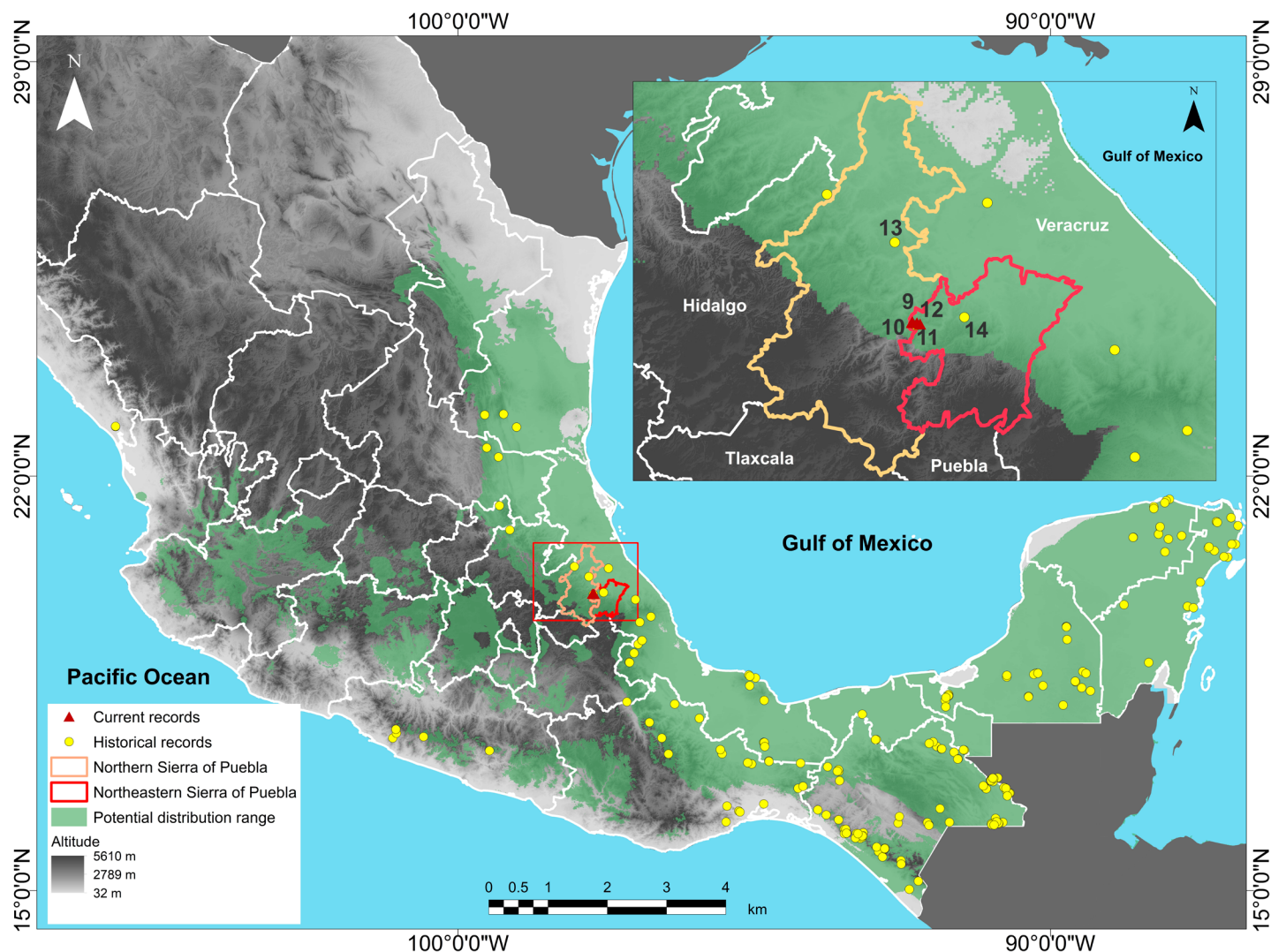


Figure 1. Potential distribution and records of *Eira barbara* in Mexico. Historical records (GIBIF 2024, Nagy-Reis et al. 2020) are indicated by yellow circles. The red triangles correspond to current records in the Northeastern Sierra of Puebla obtained with camera traps. Zapotitlán de Méndez (9, 10, 11, 12), Zihuateutla (13), San Miguel Tizapán (14).

(*Enhydra lutris*), which inhabits the coasts of Baja California, is virtually extinct (Gallo-Reynoso 2013).

Eira barbara (Tayra) is a Neotropical mustelid distributed from the coasts of central Mexico to northern Argentina (Presley 2000; Larivière and Jennings 2009). It is considered an opportunistic omnivore, observed to consume a wide variety of fruits, small vertebrates, and invertebrates (Álvarez del Toro 1991; Presley 2000; Soley and Alvarado-Díaz 2011). It shows semi-arboreal habits, using both terrestrial and arboreal substrates for displacement (Álvarez del Toro 1991). This species is active day and night, with peak activity periods during the early morning and evening hours (Villafañe-Trujillo et al. 2021). In Mexico, there are records of *E. barbara* in the states of Yucatán (Hernández-Hernández et al. 2019), Quintana Roo (Chávez 2005), Chiapas (Espinosa-Medinilla et al. 2018), Guerrero (Ruiz-Gutiérrez et al. 2017), Oaxaca (Espinosa-Lucas et al. 2015), Veracruz (Ríos-Solís et al. 2021), Hidalgo (García et al. 2016), Puebla (Ramírez-Pulido et al. 2005), Querétaro (López-González and Aceves 2007), Tamaulipas (Chávez 2005), and Sinaloa (Ruiz-Gutiérrez et al.

2017; Figure 1). It is one of the carnivore mammals with a wide distribution in tropical forests; however, these ecosystems are undergoing the greatest loss of vegetation cover related to changes in land use (Mendoza et al. 2023).

Galictis vittata (Grisson) is a solitary species, mainly diurnal, although it can be active at night (Sunquist et al. 1989; Yensen and Tarifa 2003). It has a carnivorous diet, including rodents, birds, amphibians, reptiles, and fish (Bisbal 1986; Sunquist et al. 1989; Roemer et al. 2009; Hidalgo-Mihart et al. 2018). It thrives in the proximity of water bodies, such as rivers and streams, where it usually swims; although it can climb, it usually forages on the ground (Álvarez del Toro 1991). The Grison is distributed from central-eastern and southeastern Mexico down through Central America to southern Brazil, Bolivia, and northern Argentina (Yensen and Tarifa 2003; Bornholdt et al. 2013; Jiménez-Alvarado et al. 2016). *G. vittata* is considered a species with low-density and stable populations (Arita et al. 1990; Cuarón et al. 2016), and its conservation status is uncertain (De la Torre et al. 2009; Hernández-Sánchez et al. 2017).

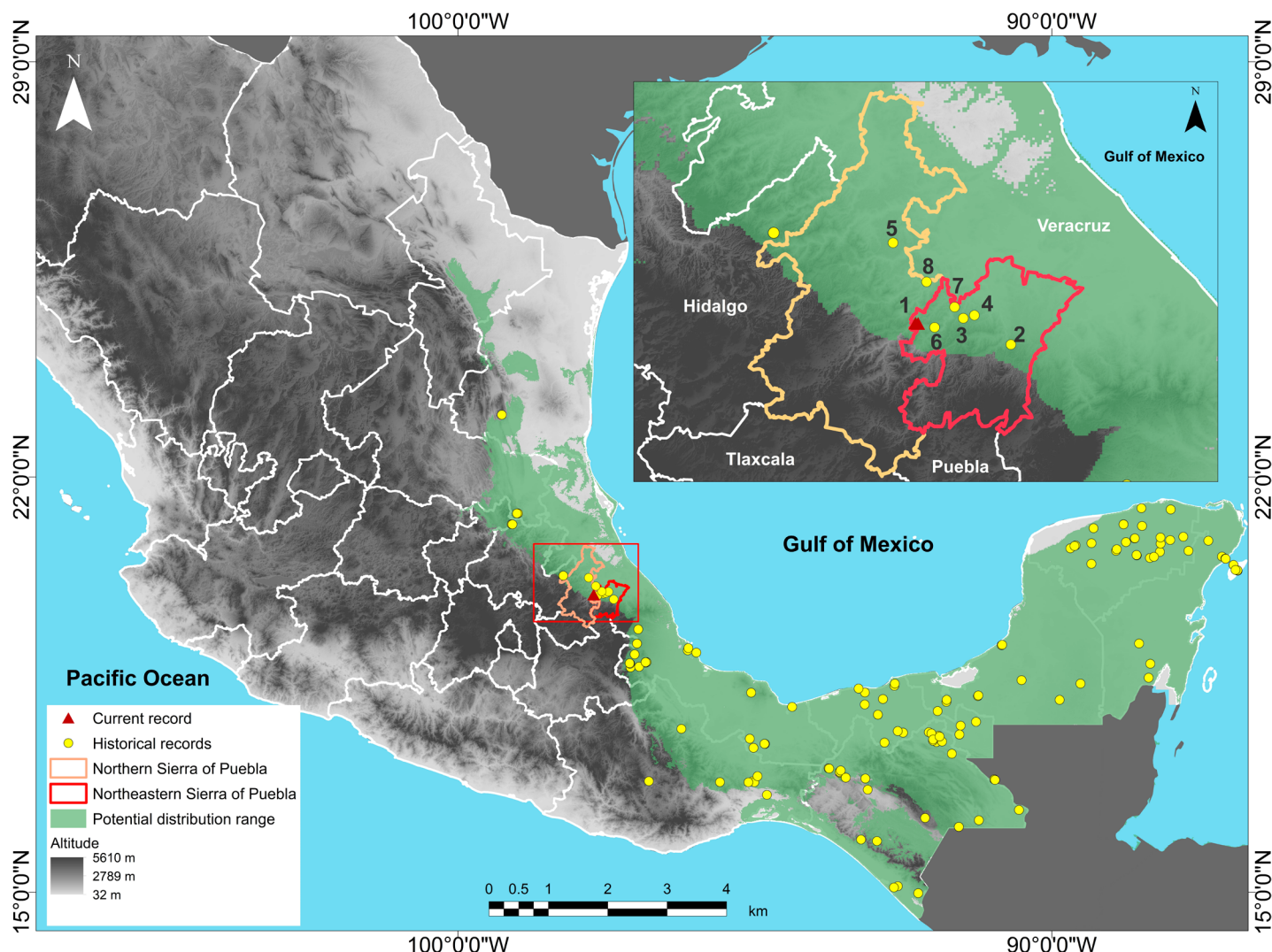


Figure 2. Potential distribution and records of *Galictis vittata* in Mexico. Historical records (GIBIF 2024, Nagy-Reis et al. 2020) are indicated by yellow circles. The red triangles correspond to current records in the Northeastern Sierra of Puebla obtained with camera traps. Zapotitlán de Méndez (1), Hueyapan (2), San Miguel Tizacapan (3), San Andrés Tizacapan (4), Zihuateutla (5), Tuxtla (6), Tuzamapan (7), Jopala (8).

In Mexico, *G. vittata* has been recorded on the eastern slopes of the states of Tamaulipas (Contreras-Días et al. 2020), Hidalgo (Mejenes-López et al. 2010), Veracruz (Gallina and González-Romero 2018), Puebla (Lucas-Juárez et al. 2021; Hernández-Hernández et al. 2022); southward to Oaxaca (Espinosa-Lucas et al. 2015), Chiapas (De la Torre et al. 2009), Tabasco (García-Morales and Díez de Bonilla-Cervantes 2021), Campeche (Contreras-Moreno et al. 2023), Yucatán (Sosa-Escalante et al. 2013), and Quintana Roo (Chávez-León 1987; Figure 2). This species has been recorded mainly in tropical evergreen, sub-evergreen, and sub-deciduous forests, and occasionally in mountain cloud forests (Gallina et al. 1996; De la Torre et al. 2009; Pérez-Solano et al. 2018). It has also been recorded in localities with secondary or modified vegetation (Hernández-Hernández et al. 2022; Sánchez-Brenes and Monge 2022), and even in urban and suburban areas (Contreras-Días et al. 2020; García-Morales and Díez de Bonilla-Cervantes 2021).

The Northeastern Sierra of Puebla is located in the transition zone of two physiographic units, the Sierra Madre

Oriental and the Trans-Mexican Volcanic Belt. This region is covered by mountain cloud forests and tropical forests that contribute to its being considered one of the most important areas Puebla in terms of its mammal composition (CONABIO 2011). This area has recorded 17 species of carnivorous mammals (Ramírez-Bravo and Hernández-Santín 2016), considered key drivers of ecosystem dynamics (Servín 2013). Two of these species are worth mentioning: *G. vittata*, a species listed as threatened in the Mexican legislation, and *E. barbara*, listed as Endangered of Extinction (SEMARNAT 2010), due to destruction and fragmentation of their habitat as a result of conversion to agricultural land, livestock raising, and urban development (Oliveira 2009).

Galictis vittata and *E. barbara* are among the least studied carnivorous mammals in Mexico. There is insufficient information available on the ecology, distribution, and conservation status of both species in the country and at a global level (López-González and Aceves-Lara 2007; Hidalgo-Mihart et al. 2018; González-



Figure 3. Photographic records of *Eira barbara* (a, b) and *Galictis vittata* (c, d) in the Northeastern Sierra of Puebla, Mexico.

[Maya et al. 2019](#)). Since the presence of *E. barbara* and *G. vittata* was first documented in Puebla in Coxcatlán de Osorio and Zihuateutla, respectively ([Ramírez-Pulido et al. 2005](#)), records for this state have been scarce. For all the above, the objective of this study was to contribute to the knowledge about the presence of *G. vittata* and *E. barbara* in the Northeastern Sierra of Puebla, Mexico.

This study was carried out in the municipality of Zapotitlán de Méndez, in the Northeastern Sierra of Puebla (19°58'10" to 20°01'36" N; 97°38'36" to 97°44'24" W). The climate is temperate humid, with a mean annual temperature of 22 °C and a mean annual precipitation of 2750 mm ([INEGI 2005](#)). The local landscape comprises cloud forests at high altitudes and ravines; fragments of medium sub-evergreen forest and pine-oak forest are also present. These vegetation types are within a matrix of anthropic uses that include mainly coffee plantations and induced pastures ([Evangalista-Oliva et al. 2010](#)).

Systematic sampling with camera traps was carried out from March to May 2023. In each of 10 stations, a Stealth Cam camera trap (model STC-BT16) was randomly installed at 30 cm to 40 cm above the ground in sites where traces (footprints, excreta, trails) of wild mammals were found. The distance between stations was 1 km to avoid leaving large gaps unsampled. Camera traps remained in operation 24 hours a day and were set to capture one photograph and one 30-second video per event, recording the date and time of each event. A record from a trap station was considered independent when the time between two

consecutive photograph records exceeded 60 minutes ([Tobler et al. 2008](#); [Srbek-Araujo and García Chiarello 2005](#)). Camera traps were installed in shaded coffee plantations with remnants of mountain cloud forest.

A map was made that illustrates the potential distribution of *E. barbara* and *G. vittata* ([Lavariega and Briones-Salas 2019a, b](#)), the records of the National Biodiversity Information System ([CONABIO 2020](#)), the Global Biodiversity Information Facility ([GBIF 2024](#)), and the Neotropical Carnivores database ([Nagy-Reis et al. 2020](#)), as well as records published in the state of Puebla, to overlap them with the photographic records obtained in this study.

Two independent photographic records of *E. barbara* were captured with a sampling effort of 90 trap-days. These records correspond to adult females, determined by the absence of testicles. Additionally, individuals were identified based on the fur coloration showing the characteristic disruptive pattern, where the nape and head are lighter-colored than the rest of the body ([Presley 2000](#); [Matos 2018](#)). The first record was captured on 24 March 2023 at 14:12 hr, at coordinates 20°0'8.93" N and 97°42'51.60" W, at 835 m (Figure 3a). The second record was captured on 2 April 2023 at 06:53 hr, at coordinates 20°0'40.84" N and 97°42'51.60" W, at 1011 m (Figure 3b). Both records were obtained in remnants of mountain cloud forest within a matrix of shaded coffee plantations. One photographic record of an adult of *G. vittata* was also captured on 15 April 2023 at 15:50 hr, at coordinates 20°0'43.64" N and 97°43'10.86" W, at 840 m in the town of Zapotitlán de Méndez, in a stream running

Table 1. Geographic location of the records (IDs) of *Galictis vittata* and *Eira barbara* in Puebla, Mexico. The new records provided in this study are shown in bold.

	Species ID	Latitude	Longitude	Municipality	Type of evidence	Source
1	<i>G. vittata</i>	20° 0' 43.64" N	97° 43' 10.86" W	Zapotitlán de Méndez	Photograph	This study
2	<i>G. vittata</i>	19° 56' 9.2" N	97° 22' 43.36" W	Hueyapan	Photograph	Hernández-Hernández <i>et al.</i> 2022
3	<i>G. vittata</i>	20° 1' 46.83" N	97° 32' 55.55" W	San Miguel Tizacapan, Cuetzalan	Interview	Hernández-Reyes <i>et al.</i> 2017
4	<i>G. vittata</i>	20° 2' 25.92" N	97° 30' 33.37" W	San Andrés Tizacapan, Cuetzalan	Interview	Hernández-Reyes <i>et al.</i> 2017
5	<i>G. vittata</i>	20° 18' 0" N	97° 47' 60" W	Zihuateutla	Museum	Ramírez-Pulido <i>et al.</i> 2005
6	<i>G. vittata</i>	19° 59' 49.4" N	97° 39' 51.5" W	Tuxtla, Zapotitlán de Méndez	Direct observation	Lucas-Juárez <i>et al.</i> 2021
7	<i>G. vittata</i>	20° 4' 12" N	97° 34' 48" W	Tuzamapan	Direct observation	Ramírez-Bravo and Hernández-Santín 2016
8	<i>G. vittata</i>	20° 9' 36" N	97° 40' 48" W	Jopala	Direct observation	Ramírez-Bravo and Hernández-Santín 2016
9	<i>E. barbara</i>	20° 0' 40.84" N	97° 42' 51.60" W	Zapotitlán de Méndez	Photograph	This study
10	<i>E. barbara</i>	20° 0' 8.93" N	97° 42' 51.60" W	Zapotitlán de Méndez	Photograph	This study
11	<i>E. barbara</i>	20° 0' 43.64" N	97° 43' 10.8" W	Zapotitlán de Méndez	Photograph	This study
12	<i>E. barbara</i>	20° 0' 8.93" N	97° 42' 51.6" W	Zapotitlán de Méndez	Interview	Ramírez-Bravo 2011
13	<i>E. barbara</i>	20° 18' 0" N	97° 47' 24" W	Zihuateutla	Photograph	Ramírez-Bravo 2011
14	<i>E. barbara</i>	20° 1' 53.36" N	97° 32' 26.6" W	San Miguel Tizacapan, Cuetzalan	Photograph	Hernández-Reyes <i>et al.</i> 2017
15	<i>E. barbara</i>	18° 11' 8.02" N	97° 8' 48.01" W	Coxcatlán de Osorio	Direct observation	Ramírez-Pulido <i>et al.</i> 2005

across a shaded-coffee plantation. The photographic shot does not allow determining the sex (Figure 3c, d), but it shows the coloration pattern of the species, i.e., blackish marbled gray on the back, in addition to small limbs and a short tail (Álvarez-Castañeda and González-Ruiz 2017).

Eira barbara is included in the lists of mammals for the state of Puebla (Ramírez-Pulido et al. 2005; Ramírez-Bravo 2011); however, there are few documented reports of its presence in a large part of the state (Table 1). In the Northern Sierra of Puebla, Ramírez-Bravo (2011) documented the presence of *E. barbara* in fragments of tropical vegetation in the municipality of Zihuateutla. Although its presence in this region of Puebla had not been confirmed recently, this study documented *E. barbara* in a fragment of cloud forest surrounded by shaded coffee plantations.

It has been observed that *E. barbara* occurs mainly in areas with primary vegetation or, at least, with a similar structure, although it is also found in landscapes modified by anthropic activities (Dotta and Verdade 2011; Timo et al. 2014), including agroforestry plantations (Soley and Alvarado-Díaz 2011). However, when landscape complexity is reduced, such as in coffee plantations without tree strata or when human disturbance increases, arboreal and scansorial mammals such as *E. barbara* can be negatively affected (Gallina et al. 1996; Naughton-Treves et al. 2003; Cassano et al. 2014).

The record of *G. vittata* in a stream coincides with other observations of this species reported by Gallina et al. (1996) and Sáenz-Bolaños et al. (2009). These authors point out that *G. vittata* thrives on the edges of dense forests, preferably near water bodies such as rivers or streams, although it has also been observed in areas with secondary and managed vegetation (De la Torre et al. 2009; Lucas-Juárez et al. 2021;

Sánchez-Brenes and Monge 2022). In the Northeastern Sierra of Puebla, the presence of Grison has been reported in shaded coffee plantations in the Tecolutla River basin (Ramírez-Pulido et al. 2005; Ramírez-Bravo and Hernández-Santín 2016; Hernández-Reyes et al. 2017; Lucas-Juárez et al. 2021; Hernández-Hernández et al. 2022; Table 1).

Some studies have been carried out that analyzed population density (Hernández-Sánchez et al. 2017), diversity (Hernández-Hernández and Chávez 2021), and diet (Hidalgo-Mihart et al. 2018), which include few records of *G. vittata*; in other studies of diversity and activity patterns, this species was not recorded in conserved areas (Ortiz-Lozada et al. 2017; Ríos-Solís et al. 2021). In this sense, it is considered that anthropic factors such as habitat destruction and collision with vehicles can affect their populations (Escobar-Lasso and Guzmán-Hernández 2013; Salcedo-Rivera et al. 2020; García-Morales and Díez de Bonilla-Cervantes 2021). However, García-Morales and Díez de Bonilla-Cervantes (2021) point out that *G. vittata* is highly adaptable to modified environments and has the potential to maintain breeding populations in urban areas.

This study recorded *G. vittata* and *E. barbara* in fragments of mountain cloud forest surrounded by shaded coffee plantations. It has been pointed out that diversified shaded coffee plantations are a habitat that may have less impact on biodiversity compared to other activities such as livestock raising and rainfed or permanent cultivation (Greenberg et al. 1997; Cruz-Lara et al. 2004), which has probably allowed the presence of threatened species such as *G. vittata* and *E. barbara* in the Northeastern Sierra of Puebla (Ramírez-Pulido et al. 2005; Ramírez-Bravo and Hernández-Santín 2016). In this region, shaded coffee plantations are the predominant

livelihood in the agricultural sector ([Evangelista-Oliva et al. 2010](#)). In this regard, components with buffer capacity, such as shaded coffee plantations, have corridors and vegetation fragments with significant inner habitat areas ([Gallina et al. 1996](#)), which should be prioritized in conservation strategies because they could serve as core reserves and maintain functional connectivity of the study area. However, additional studies are needed to determine whether these species can persist in highly anthropized environments ([García-Morales and Diez de Bonilla-Cervantes 2021](#)).

The records of *E. barbara* and *G. vittata* in the Northeastern Sierra of Puebla are relevant because they allow for determining the continuity of their distribution in the Sierra Madre Oriental. Their record in the north of the state could indicate that this region functions as a biological corridor between vegetation remnants in eastern and southeastern Mexico, including the Sierra Negra in Oaxaca and Veracruz. This area was also identified as essential for the dispersal of other carnivore species ([Grigione et al. 2009](#); [Ramírez-Bravo et al. 2010](#); [Hernández-Flores et al. 2013](#); [Dueñas-López et al. 2015](#)). Additionally, the records of *G. vittata* and *E. barbara* in the Northeastern Sierra of Puebla provide relevant information to advance a better understanding of the distribution of populations of these species.

Acknowledgments

This study was carried out thanks to the UNAM-PAPIIT Program IA206221. We thank H. Rojas Luis and J. Rodríguez Vázquez for their support in the fieldwork. María Elena Sánchez-Salazar translated the manuscript into English.

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Associated Editor: Jorge Ayala Berdón.

Submitted: November 8, 2024; Reviewed: February 12, 2025.

Accepted: March 16, 2025; Published on line: June 23, 2025.