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First record of ereynetid mites (Acariformes: Ereynetidae) associated to the hermit crab *Coenobita compressus* (Crustacea: Paguridae) from Mexico

Primer registro de ácaros ereynétidos (Acariformes: Ereynetidae) asociados al cangrejo ermitaño *Coenobita compressus* (Crustacea: Paguridae) de México

Margarita Ojeda y José G. Palacios-Vargas

[1] Ecología y Sistemática de Microartrópodos, Departamento de Ecología y Recursos Naturales, Facultad de Ciencias, Universidad Nacional Autónoma de México. 04510 CDMX, México. margojeda@gmail.com; ORCID: https://orcid.org/0000-0001-6430-3455; troglolaphysa@hotmail.com; ORCID: https://orcid.org/0000-0001-9097-6813. * Corresponding Author: margojeda@gmail.com

ABSTRACT

Mites of the family Ereynetidae include species that inhabit terrestrial hermit crabs, such as *Ereynetes (Anereynetes) papuanus* Fain & Van Goethem, 1978 and *Ereynetes (Anereynetes) coenobitus* Hunter & Poe, 1971, associated with *Coenobita rugosus* H. Milne-Edwards, 1837 and *Coenobita clypeatus* (Fabricius, 1787), respectively. As part of a project to characterize the symbionts of hermit crabs in Mexico, field-collected specimens and those from biological collections were examined. In this work, we record for the first time to *Ereynetes (Anereynetes)* ca. *coenobitus* in *Coenobita compressus* H. Milne-Edwards, 1836 along the Mexican Pacific coast. This finding extends the known distribution of these mites both in Mexico and globally, and documents *C. compressus* as a new host species.

Keywords: Land crabs, symbiont mites, Pacific Ocean, specificity, distribution.

RESUMEN

Los ácaros de la familia Ereynetidae incluyen especies que habitan en cangrejos ermitaños terrestres, tales como, *Ereynetes (Anereynetes) papuanus* Fain & Van Goethem, 1978 y *Ereynetes (Anereynetes) coenobitus* Hunter & Poe, 1971, asociados con *Coenobita rugosus* H. Milne-Edwards, 1837 y *Coenobita clypeatus* (Fabricius, 1787), respectivamente. Como parte de un proyecto para caracterizar a los simbiontes de los cangrejos ermitaños en México, se examinaron especímenes recolectados en el campo y de colecciones biológicas. En este trabajo, registramos por primera vez a *Ereynetes (Anereynetes)* ca. *coenobitus* encontrado en *Coenobita compressus* H. Milne-Edwards, 1836, en ejemplares a lo largo de la costa del Pacífico mexicano. Este hallazgo amplía la distribución conocida de estos ácaros tanto en México como a nivel mundial, y documenta a *C. compressus* como un nuevo hospedero.

Palabras clave: Cangrejos terrestres, ácaros simbiontes, Océano Pacífico, especificidad, distribución.

The Ereynetidae Oudemans, 1931 (Acariformes) are trombidiform mites characterized by the presence of two pairs of long sensory hairs (bothridia), one pair on the anterior part of the idiosoma and the other on the posterior end of the body. These mites possess a special sensory organ on the foreleg tibia I, known as "the ereynetal organ" (Fain 1962). According to Beron (2022), the family has 35 genera and 180 species. They are free-living, saprophagous, and predatory mites associated with the upper soil layers and substrates rich in animal and plant detritus; however, a large number are symbionts (endoparasites or commensals) dwelling in the body cavities of mollusks, arthropods, and vertebrates (amphibians, birds, and mammals) (Çobanoğlu *et al.* 2020).

The family Ereynetidae has four subfamilies: Ereynetinae, Speleognathinae, Riccardoelinae and Lawrencarinae. Some species of the Ereynetinae are associated with terrestrial arthropods and gastropods; for instance, the genus *Riccardoella* Berlese, 1923 lives on the surface and within the mantle cavity of its gastropod hosts. Two species of *Ereynetes* Berlese, 1883 are associated with hermit crabs of the family Paguridae. The subgenus *Ereynetes (Anereynetes)* Fain, 1964 currently includes 12 known species from different habitats and hosts, ranging from humus, bark, and soil to a variety of insects (such as beetles and bees) and hermit crabs (Fain and Camerik 1994). Little is known about the habits of these mites; however, some species have been observed feeding on hemolymph, which is why they are con-

sidered hematophagous. *Ereynetes (Anereynetes) coenobitus* Hunter and Poe, 1971 was described from *Coenobita clypeatus* (Fabricius, 1787) in Puerto Rico, and *E. (Anereynetes) papuanus* Fain and Van Goethem, 1978 is associated with *Coenobita rugosus* H. Milne-Edwards, 1837 in New Guinea.

Terrestrial hermit crabs represent a complex biocenosis where various symbiont species occupy specific sites and niches that provide them with the conditions for their survival. Crabs act as hosts, establishing a variety of symbiotic relationships due to their typical behavior of inhabiting empty gastropod shells, which they use as shelter or settlement space (Conover 1979; Williams and McDermott 2004; Wright and Jones 2006). A wide variety of symbionts have been documented attaching to, boring into, or living freely in the lumen of the shells that house these crabs, as well as on some body parts, gills, and body setae. Approximately 130 of the 850 known species of hermit crabs have been associated with about 1,500 symbiont species across nine phyla (Williams y McDermott 2004; McDermott *et al.* 2010). Among the least studied groups of invertebrates are mites and springtails (Palacios-Vargas *et al*. 2026), with little known about the biology of these commensal species on hermit crabs. The first contributions to the knowledge of symbiont mites on hermit crabs were made by André (1937), who reported three species of Mesostigmata mites: *Androgamasus conchylidae* (André, 1937), *Aspidilaelaps pagurophilus* (André, 1937), and *Physalozercon paguroxemus* (André, 1937) Mesostigmata mites associated with *Coenobita* sp. from an island in Oceania. Vitzthum (1937) mentioned an astigmatine, *Caloglyphus birgophilus* Vitzthum, 1937, and the tryginaspid (Mesostigmata) *Vitzthumegistus latronis* (Vitzthum, 1937) from the crab *Birgus latro* (Linnaeus, 1767). Among the most recognized mites, due to their association and specialized morphology for this environment, are the astigmatines *Ewingia coenobitae* Pearse, 1929, *Askinasia aethiopicus* Junker, 1970, and *Hoogstraalacarus tiwensis* Junker, 1970 (McDermott *et al.* 2010; Palacios-Vargas 2007).

Coenobita compressus H. Milne-Edwards, 1836 possesses eyes that are more oval-shaped and thicker when compared to the round, dot-shaped eyes of the Caribbean hermit crab, *C. clypeatus*. Its major cheliped features four or five small ridges on the upper part, and the tips of the second pair of walking legs are darker than the proximal segments. The abdomen of this species is notably short and robust. *C. compressus* exhibits a wide range of colorations, typically appearing in tan tones, though bright yellow, dark grey, or orange individuals occur, sometimes with blue or green tints on the body or the inner surface of the legs (Ball and Haig 1974). When selecting a shell, they show a preference for those with wide, round apertures (Abrams 1978; Guillén 1993; Osorno *et al.* 2005). Native to the Americas, these hermit crabs inhabit the Pacific seashore from Mexico to Chile, gathering primarily around tidal pools and high-tide zones. This species has adapted to coastal environments, requiring access to seawater in captivity to facilitate salt metabolism and maintain gill moisture; failure to provide access to seawater (natural or artificial) results in mortality. As scavengers, they consume seaweed, carrion, and other detritus found along the shoreline (Thacker 1996; Thacker 1998).

As part of a project aimed at understanding symbionts, such as mites and springtails, associated with hermit crabs in Mexico, both live specimens from the field and preserved specimens from collections were examined. The material included Collembola and Acari; among the latter, several adult and nymphs´s specimens belonging to the family Ereynetidae were mounted, identified, and conferred to *Ereynetes (Anereynetes)* ca. *coenobitus*.

MATERIALS AND METHODS

The study of hermit crabs was conducted using both live and preserved material. Fresh specimens were obtained from the offshore area on the coast of Jalisco State, Mexico (20° 31 ‘38.51”N 105° 17’ 22”W). Locations for the preserved material included sites near the southern border of Oaxaca State (Bahía Puerto Escondido, 15°51’43”N 97°04’18”W) (Fig. 1). During field sampling, symbiotic animals were washed from the hermit crabs (*Coenobita compressus*). Washes were conducted through a fine gauze using a 5% ethanol solution. To study the associated fauna from the Crustacean Collection of the Institute of Biology (CNCR, IBUNAM), which were preserved in 75% ethanol, each organism was carefully examined under a microscope to extract its symbionts.

All material will be deposited in Colección de ácaros y colémbolos del Laboratorio de Ecología y Sistemática de Microartrópodos (LESM).

RESULTS

Trombidiformes: **Prostigmata**

Superfamily: Tydeoidea

Family: Ereynetidae Oudemans, 1931

Diagnosis: Idiosoma with 7-11 setae in dorsal, lateral, and caudal positions. Includes a pair of posterodorsal bothridial sensilla.

Ereynetes Berlese, 1883 One or two mid-dorsal plates presenting a striated pattern of evenly spaced lines. One pair of eyes and two pairs of genital sensory organs present. Tibia I with ereynetal organ present.

Ereynetes (Anereynetes). Fain, 1964 With one or two mid-dorsal plates showing a striated pattern of evenly spaced lines. Eyes absent. Two pairs of genital sensory organs (genital acetabula). Ereynetal organ of type B present. The famulus is clearly located outside the vestibule and is attached to a common seta (seta 1), which emerges from the same alveolus, making the seta almost imperceptible. This type B is found only in certain Ereynetinae, specifically within the genera *Riccardoella* and *Ereynetes (Anereynetes)* (Fain and Camerik, 1994).

Ereynetes (Anereynetes) ca. *coenobitus*
Hunter and Poe, 1971
(Figs. 2–4)

Material. One female, two males. México: Guerrero; Copala, Playa Casa de la Piedra. ex *Coenobita compressus* CNCR 4421. 28-V-1985, unknown col. One male, México: Michoacán; Lázaro Cárdenas, Caleta de Campos. ex *Coenobita compressus* CNCR 3461. 31-XII-1983, unknown col. One Protonymph, México: Oaxaca; Bahía Puerto Escondido. CNCR 3029. 10-IX-1983, unknown col. Three males, one female. Jalisco; Puerto Vallarta, Playa Los Arcos de Mismaloya. ex *Coenobita compressus*, Martínez-Pérez, C. col. 4-IV-2024. All materials are deposited in the mite collection of LESM.

Diagnosis. One or two mid-dorsal plates at the anterior part of the idiosoma, presenting a striated pattern of evenly spaced lines. Eyes absent; two pairs of genital sensory organs present. Ereynetal organ type B present (Fig. 2). **Gnathosoma.** Pedipalps are relatively short with three segments. Palptarsus with three short, barbed setae and a solenidium. Chelicerae long basal segment is strongly enlarged. **Idiosoma dorsum.** Eyes absent. The cuticle is very finely striated and punctuated. Propodosomal shield well-sclerotized with a pattern of sclerotized subcuticular lines forming an H-shaped figure and a fine striated cuticle. The shield is always more distinct in mature, more well-sclerotized adult specimens than in young specimens, where it is generally hard to recognize. Anterior sensilla (*sci*) with fine, short barbs. Dorsal setae with strong barbules. Sensilla is more sparsely barbed than body setae (Fig. 3). **Venter.** Coxae and other leg segments with irregular lines. Epimeres strong with setae on each. Three pairs of intercoxal setae. Genital opening is surrounded by ten pairs of strong barbed setae (Fig. 4); the two posterior pairs are situated on the border of the genital shield and are nearly three times longer than the rest. Two pairs of genital sensory organs. **Male:** Venter as in female except for the genital area; three pairs of very small setae of similar size arising from within the genital opening; genital structure curved, forming a T-shaped structure; genital suckers more distinct than in female. **Legs:** With some subcutaneous sclerotization; tarsus I with a sensory pit-like structure on the dorsal surface; tibia I with an ereynetal organ, bulbous portion asymmetrical in shape (Fig. 2).

DISCUSSION

Ereynetes (Anereynetes) coenobitus was originally described from *C. clypeatus* in Puerto Rico. In Mexico, this species has been found associated with the land hermit crab *Coenobita clypeatus*, distributed along the country ‘s east coast, Gulf of Mexico and the Caribbean Sea (Palacios-Vargas 2007).

The morphological analysis of our specimens shows a close similarity to the species described in association with *C. clypeatus*; however, some morphological features especially the number, arrangement, shape, and size of the male genital setae differ from what is mentioned in the original description, which was only briefly described and illustrated. We found some differences mainly concerning the male described by Hunter and Poe. Some of the setae in the genital area are longer. The presence of two pairs of internal (vestibular) genital cusps in all our specimens compared to three pairs in *E. (A.) coenobitus.* Shorter cheliceral digits; shorter palps and longer femur I.

There is a degree of specificity between these two taxa. The findings on various *Coenobita compressus* specimens on the western coast of Mexico (Pacific Ocean) and the presence of the ereynetid *E. (A.) coenobitus* represents a new record that extends the known distribution of the mite to another host and another region of the world.

The results of this study provide information that can be used to highlight the specificity between crab species and ereynetid mites. This will be confirmed once we determine whether it is a new mite species. Known species of this genus are reported specifically with one crab species, suggesting a high probability that the record found in *C. compressus* represents a new species.

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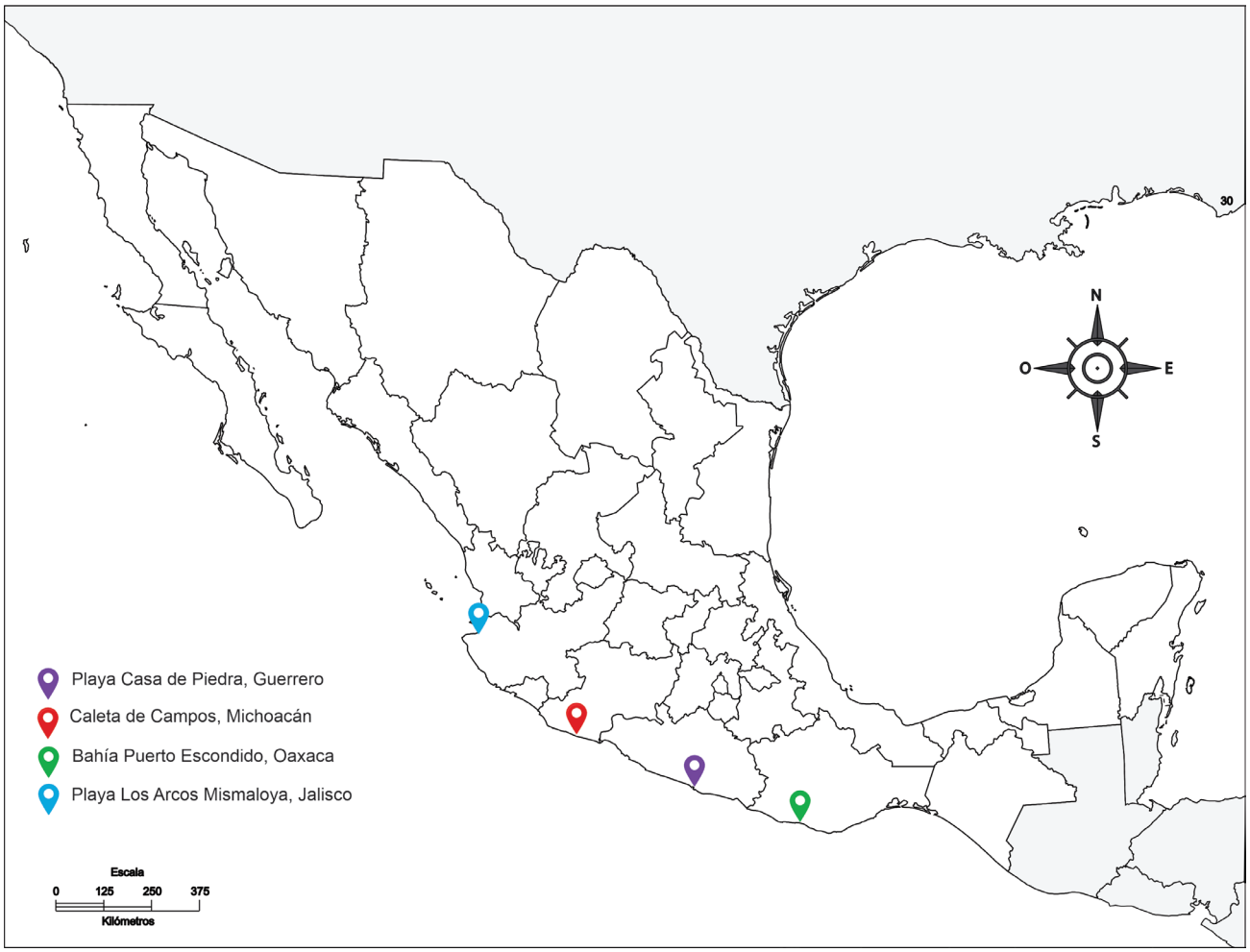
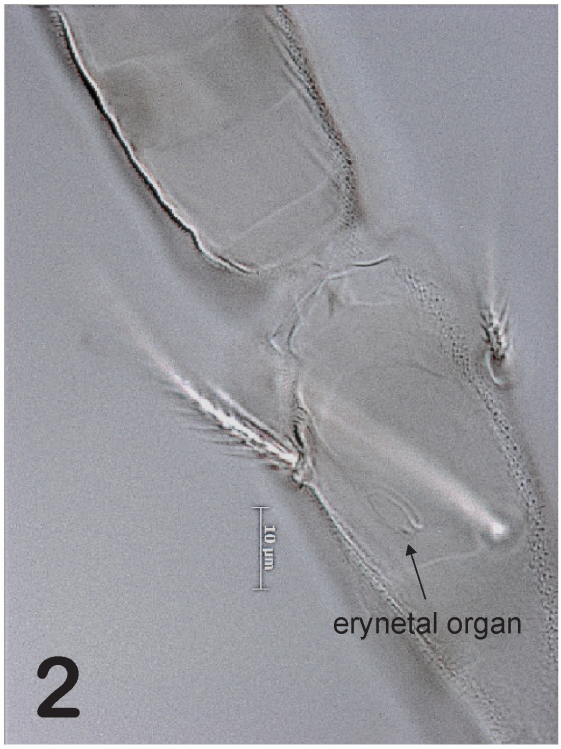


Figure 1. Collection sites for crabs and their associated ereynetid mites.



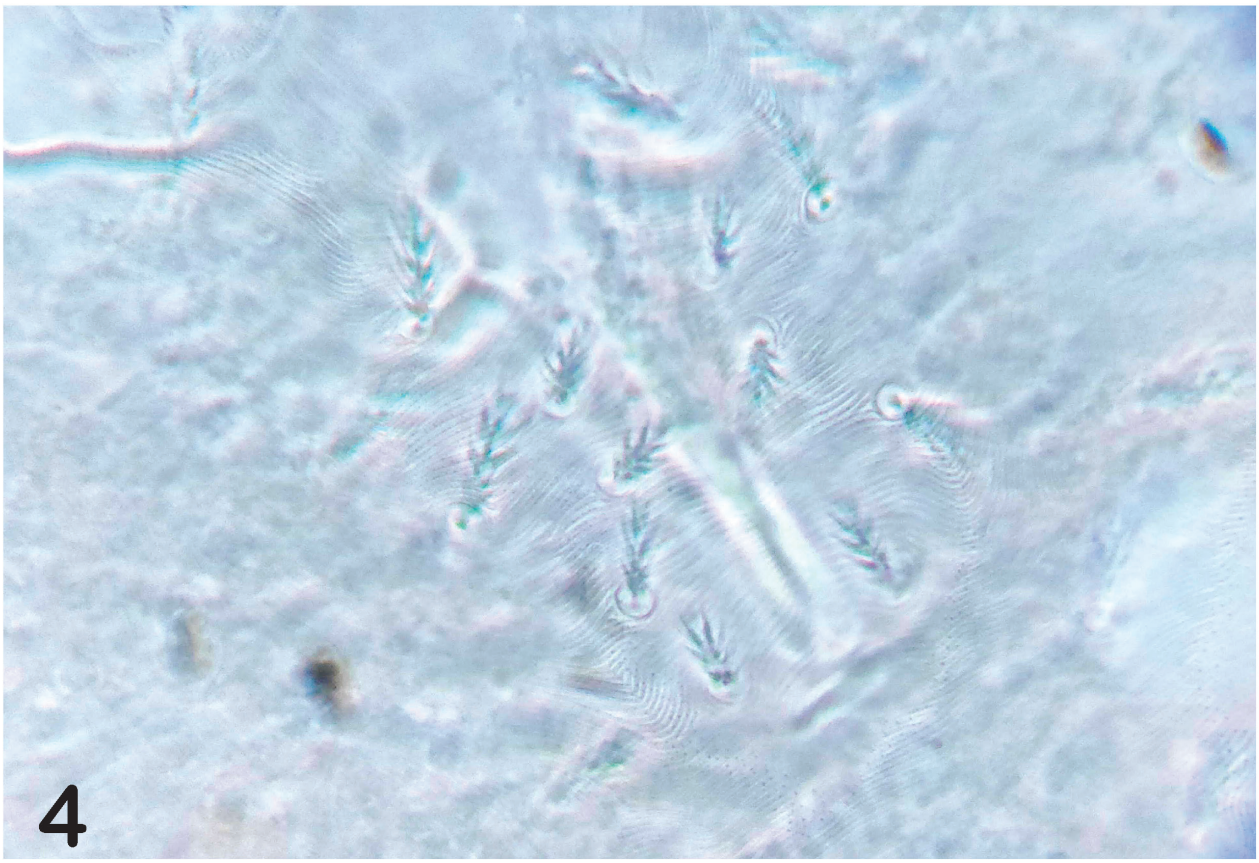


Figure 2. Photograph showing the ereynetal organ type B of *Ereynetes (Anereynetes)* ca. *coenobitus* Figura 3. Detail of Propodosomal plate of *Ereynetes (Anereynetes)* ca. *coenobitus.* Figure 4. *Ereynetes (Anereynetes)* ca. *coenobitus* female genital region .

