

First record of the Fiddler Crab, *Minuca osa* from the Eastern Montijo Gulf, Panama

Primer reporte del cangrejo violinista, *Minuca osa* en el oriente del golfo de Montijo, Panamá

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ABSTRACT

Minuca osa had been previously thought to be endemic to Pacific Costa Rica (Golfo Dulce). However, specimens fitting the description were sampled in April 2021 and August 2022 in two sites in the Eastern Montijo Gulf, Panama. Based on the morphological character correspondence between the specimens collected and the original species description, it can be concluded that *Minuca osa* is also present in the Eastern Montijo Gulf.

Keywords: tuberculate ridge, *Uca*, dactyl, chela, pollex



RESUMEN

Anteriormente, se pensaba que *Minuca osa* era endémica del Pacífico de Costa Rica (golfo Dulce); sin embargo, en abril 2021 y agosto 2022, se colectaron especímenes que se ajustaban a la descripción de la especie en dos sitios del oriente del golfo de Montijo, Panamá. Con base en la correspondencia de caracteres morfológicos, se concluye que *Minuca osa* también está presente en el oriente del golfo de Montijo.

Palabras clave: borde tuberculado, *Uca*, dáctilo, quela, pollex

INTRODUCTION

Fiddler crabs (Ocypodidae: *Uca* Leach, 1814) are distributed along most tropical and semitropical coastlines of the world (Rosenberg, 2020).

Research on fiddler crabs in Panama has been published on various topics, such as, functional morphology in *Petruca panamensis*, *Leptuca terpsichores* and *L. beebei* (Lim & Goh, 2021), vision in *L. stenodactylus* (see

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How *et al.* 2015), sexual selection (Dennenmoser & Christy, 2013), construction of structures (Pardo *et al.* 2020) in *L. terpsichores* and *L. beebei*, and larval ecology in *L. terpsichores* (Christy, 2003), and *L. deichmanni* (Kerr, 2015). Even though fiddler crabs are widely distributed in Panama, sampling in all the aforementioned studies was conducted exclusively at the Pacific entrance of the Panama Canal, whereas studies from other provinces are lacking.

There are currently 35 recognized fiddler crab species in Panama. On the Atlantic coast, there are seven species, distributed into three genera: *Minuca* with four species, *Uca* with two, and a single species of *Leptuca* (*L. thayeri*). In the Pacific, there are 28 species grouped into four genera, of which sixteen are in the genus *Leptuca*, six within *Uca*, five within *Minuca*, and a single species of *Petruca* (*P. panamensis*) (Rosenberg, 2014).

In the Ponuga River, Eastern Montijo Gulf, Veraguas Province, fiddler crabs were observed waving their claw in synchrony. The major claw, bright red-orange with a white tip, was the most striking feature of these fiddler crabs. A species fitting this morphological characteristic was described by Landstorfer & Schubart (2010) from the Golfo Dulce, Pacific coast of Costa Rica (Fig. 1A). The authors named the new species, *Minuca osa*, and suggested that it might be

endemic. Based on geographical proximity of Golfo Dulce and our study area, it seemed plausible that *M. osa* could also be found in Panama (Fig. 1B, C). Therefore, the objective of this study was to identify the specimens found in the Eastern Montijo Gulf and report on the possible geographical extension of *M. osa* distribution range.

MATERIALS AND METHODS

Sampling was conducted on April 27th, 2021, and August 13th and 14th, 2022 at two sites on the Eastern Montijo Gulf (Fig. 1D); the Ponuga River (07° 51' 51.3756'' N, -081° 00' 52.6248'' W) and Mata Oscura (07° 27' 29.0124'' N, -080° 55' 12.8532'' W). Fiddler crabs (n = 22) were caught by hand, rinsed, and later stored in a freezer unit. Morphological characters of interest were photographed; specimens' carapace width and length, as well as chela height and length, were measured (mean ± SD; 0.01 mm), and taxonomical keys (Landstorfer & Schubart, 2010; Crane, 2015; Shih *et al.* 2016; Rosenberg, 2020) were used for the identification of the collected material. Morphological characters between Golfo Dulce (Landstorfer & Schubart, 2010) and the Eastern Montijo Gulf were compared with the t-test.

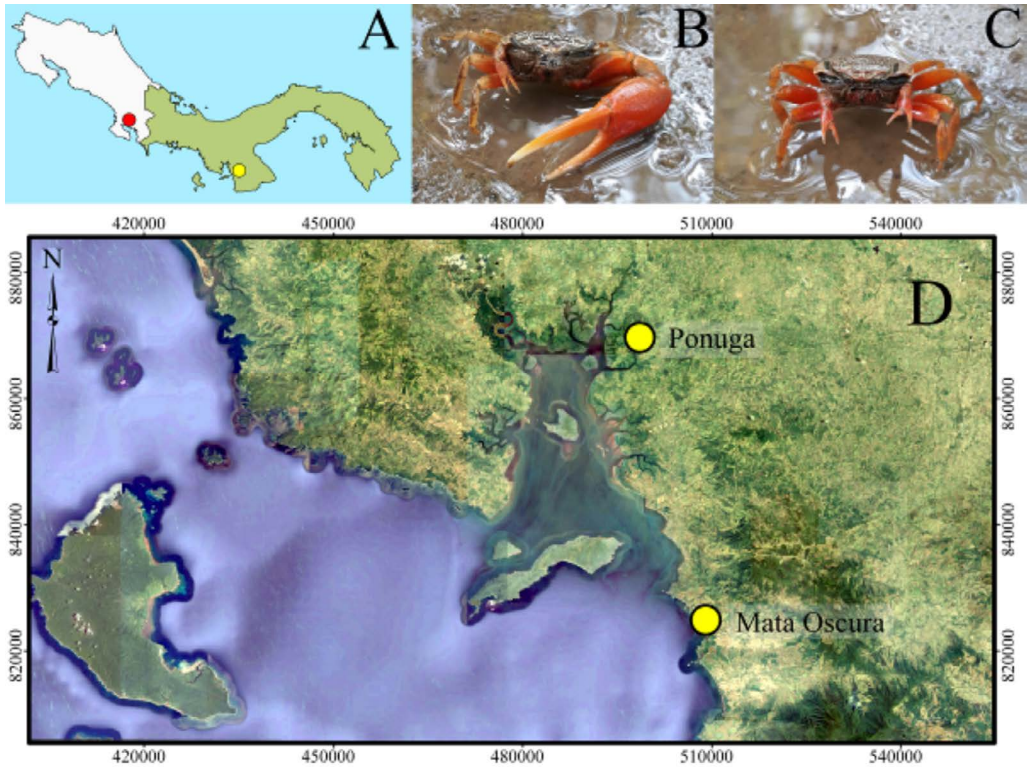


Fig. 1. Geographical context and locations of *Minuca osa* reports in the Eastern Tropical Pacific. A: sampling site (red) of the specimens in the original description of *Minuca osa* (Landstorfer & Schubart, 2010). Preliminary images of male (B) and female (C) *Minuca osa* from the Eastern Montijo Gulf. D: Ponuga (north) and Mata Oscura (south) georeferenced sampling sites (yellow); scale: 1:250,000. UTM projection (Universal Mercator Traverse - 17 N). Horizontal datum: World Geodetic System 1984 (WGS-84). Vertical datum: medium sea level of the WGS-84 geoid

Fig. 1. Contexto geográfico y ubicaciones de reportes de *Minuca osa* en el Pacífico Tropical Oriental. A: sitio de procedencia (rojo) de los especímenes en la descripción original de *Minuca osa* (Landstorfer & Schubart, 2010). Imágenes preliminares de *Minuca osa* macho (B) y hembra (C) del oriente del golfo de Montijo. D: Sitios de muestreo georeferenciados de Ponuga (norte) y Mata Oscura (sur) (amarillo); escala: 1:250,000. Proyección UTM (Universal Mercator Traverse - 17 N). Datum horizontal: Sistema Geodésico Mundial 1984 (WGS-84). Datum vertical: Nivel medio del mar del geoide WGS-84

RESULTS

Features of the genus *Minuca* were found in 22 individuals averaging 21.44 ± 2.96 mm and 14.60 ± 1.62 mm in carapace width and length, respectively; 14 were from Ponuga and eight from Mata Oscura. Specimens

were larger than those from Golfo Dulce, except in major chela height, where no difference was detected (Table 1). In general, compared to other *Minuca* species, sampled individuals from Ponuga and Mata Oscura can be considered large within the genus (Table 2).

Table 1. Morphological character comparisons (mm) between *Minuca osa* specimens collected in the Eastern Montijo Gulf (Panama) and those noted in the original species description by Landstorfer and Schubart (2010) at Golfo Dulce (Costa Rica). EMG: Eastern Montijo Gulf. GD: Golfo Dulce. CW: carapace width. CL: carapace length. QH: major chela height. QL: major chela length

Tabla 1. Comparaciones de caracteres morfológicos (mm) entre especímenes de *Minuca osa* colectados en el oriente del golfo de Montijo (Panamá) y aquellos en la descripción original de la especie por Landstorfer y Schubart (2010) en golfo Dulce (Costa Rica). EMG: Oriente del golfo de Montijo. GD: golfo Dulce. CW: ancho del caparazón. CL: longitud del caparazón. QH: altura de la quela mayor; QL: longitud de la quela mayor

Variable by site	<i>n</i>	Mean± SD	Min.	Max.	<i>t</i> -value; d. f.	<i>P</i>
EMG-CW	22	21.44 ± 2.96	12.66	25.98	4.21; 18	0.001
GD-CW	12	16.22 ± 3.70	9.28	21.10		
EMG-CL	22	14.60 ± 1.62	11.10	17.89	4.01; 15	0.001
GD-CL	12	11.32 ± 2.57	6.12	14.70		
EMG-QH	22	11.04 ± 2.34	4.09	14.66	1.55; 13	0.146
GD-QH	7	9.76 ± 1.76	7.83	11.90		
EMG-QL	22	30.27 ± 7.80	7.13	42.23	2.31; 18	0.033
GD-QL	8	24.41 ± 5.42	18.32	31.05		
EMG-Front	22	7.47 ± 1.04	4.42	9.09	3.85; 13	0.002
GD-Front	10	5.59 ± 1.37	3.11	7.17		

Table 2. Carapace width differences between *Minuca osa* from the Eastern Montijo Gulf (mean = 21.44 mm), Golfo Dulce (Pacific Costa Rica) and other *Minuca* species reported in Panama
 Tabla 2. Diferencias en ancho de caparazón entre especímenes de *Minuca osa* del oriente del golfo de Montijo (media = 21.44 mm), golfo Dulce (Costa Rica) y otras especies del género *Minuca* reportadas en Panamá

Realm distribution	Species	Carapace Mean \pm SD	Mean difference	Range	Location	References
Eastern Tropical Pacific	<i>Minuca osa</i>	16.22 \pm 3.70	5.22	9.28 - 21.11	Golfo Dulce, Costa Rica	Landstorfer & Schubart (2010)
	<i>Minuca argillicola</i>	10.63 \pm 1.55	10.81	8.5 - 12.2	Diablo Creek, Panama	
	<i>Minuca brevifrons</i>	23.11 \pm 3.67	-1.67	16.8 - 28	Parida Island, Chiriquí; Rodman, Panamá; Iglesias River, Darién	
	<i>Minuca ecuadoriensis</i>	11.85 \pm 5.33	9.59	7.35 - 25	Diablo Creek, Panamá; Garachiné, Darién	Crane (1975); Rosenberg (2000)
	<i>Minuca galapagensis</i>	20.11 \pm 2.00	1.33	14.20 - 22.1	Rodman, Panamá	
	<i>Minuca herradurensis</i>	16.48 \pm 5.87	4.96	7.5 - 23	Diablo Creek, Rodman & Taboguilla Island, Panamá	
Western Atlantic	<i>Minuca vocator</i>	11.80 \pm 6.96	9.64	17.80 - 36.1	Canal Zone & Colón	Crane (1975); Rosenberg (2000); Koch <i>et al.</i> (2005)
	<i>Minuca burgersi</i>	11.40 \pm 3.27	10.04	2.8 - 22.2	Canal Zone, Colón & Bocas del Toro	Crane (1975); Jones (1980); Rosenberg (2000); Benetti & Negreiros-Franozo (2003); Juarrero de Várona & Ortiz (2003)

Morphological characters of the genus found in sampled specimens include: H-like depression in the cardiac-mesogastric region, carapace width to front ratio of approximately 35% (wide front; Fig. 2A), with long anterolateral margins curving inwards (Fig. 2A, D), small suborbital crenulations increasing towards outer angle (Fig. 2B), narrow gape minor chelipeds with small serrations (Fig. 2C), and two postero-lateral striae in the carapace (Fig. 2D).

A total of 16 males and six females exhibited traits that fit the description of *Minuca osa*. Specifically, segments of the pleon were not fused, carapace surface with small pits; no pubescence or setae on carapace (Fig. 2A, D). There was pile with few long setae in the ambulatories dorsal margin of the carpus and propodus, in agreement with that reported for *M. osa* (Fig. 2E). The dorsal margins of ambulatory meri in males had a soft dorsal tuberculate ridge (Fig. 2F); dactyls of ambulatory legs have three distinct rows of short setae (Fig. 2G). In males, the external surface and dorsal edge of the manus was tuberculate, with a minuscule hollow space, proximal to the predactylar groove. Tubers in the major chela diminished on lower manus and were minuscule on pollex and dactyl (Fig. 2H). The pollex was curved upwards at the tip; both, the pollex and dactyl were flattened. The dactyl was longer than the pollex and was curved at approx. 90° downward at tip (Fig. 2H, K,

M). The pollex showed three rows of tubercles, and one large carina beyond the midpoint (Fig. 2I). There was one large subdistal tooth at the gape mid-row of the pollex, forming three distinct tubercles (white) on the tip (Fig. 2J, K, M). The dactyl had three to four larger tubercles (Fig. 2K, M). The inner surface of the manus had a ridge of dense tubercles lining the margin of the carpal cavity, warping in direction to the palm with tubercles growing in size and ending in a patch in the central section of the manus, almost connecting to the oblique tuberculate edge (Fig. 2L). The ventral manus tuberculate ridge was oblique with a high apex, sloping into pollex ventral surface. This ridge had distinctive tubercles decreasing in size towards the pollex with increased irregularity. The pollex and manus articulation had a deep sulcus which ran between the pollex ventral margin and two predactylar tuberculate ridges; the nearest was divergent and curled into the inner dorsal tuberculate ridge of the pollex (Fig. 2L, M). The carpal surface (dorsal) of major chelipeds bearded four to five sharp tubers, and the merus showed numerous sharp tubercles on the dorsal edge (Fig. 2N). The gonopod had two flanges and a thumb; the posterior flange was longer than the anterior. The genital pore and flanges were covered by extension of the shaft. Setae were on the opposite side of the flanges, on thumb and tip of gonopod (Fig. 2O).

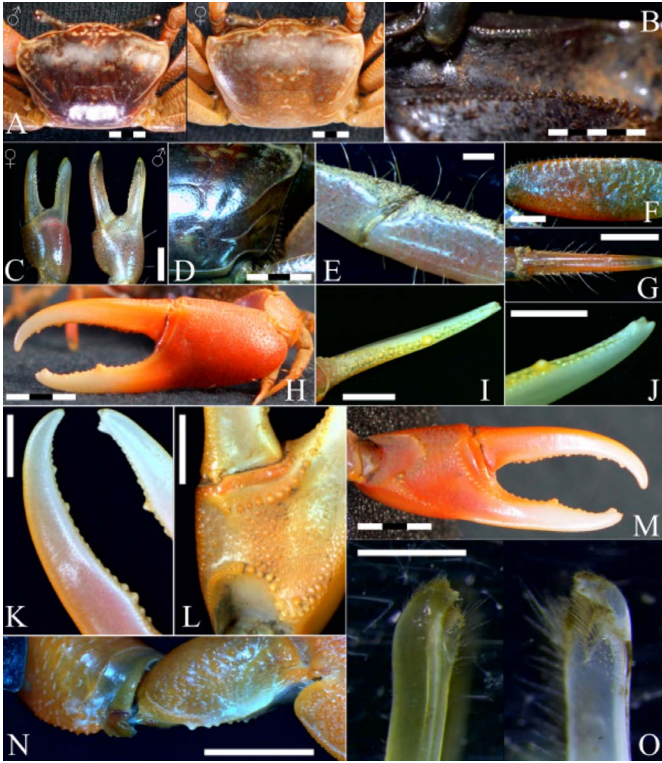


Fig. 2. *Minuca osa* diagnostic features from the Eastern Montijo Gulf, Veraguas, Panama. A: carapace. B: orbital cavity. C: minor chelipeds, left female (outer side); right male (inner surface). D: carapace striae. E: pubescence in carpus and propodus of ambulatories. F: ambulatory merus tuberculate ridge. G: ambulatories dactylus setae rows. H: major chela. I: pollex tubercle rows and large carina beyond midpoint. J: large tubercles at pollex tip. K: dactyl edge tubercles. L-M: manus, palm, and pollex tubercular ridges. N: large chela carpus and merus tubercles. O: right gonopod, anterolateral (left) and posteromesial (right). (Scale bar: A, D, I-L, N = 5 mm; B, C, F, G = 2 mm; H, M = 10 mm; E = 0.5 mm; O = 0.2 mm)

and pollex tubercular ridges. N: large chela carpus and merus tubercles. O: right gonopod, anterolateral (left) and posteromesial (right). (Scale bar: A, D, I-L, N = 5 mm; B, C, F, G = 2 mm; H, M = 10 mm; E = 0.5 mm; O = 0.2 mm)

Fig. 2. Características diagnósticas de *Minuca osa* del oriente del golfo de Montijo, Veraguas, Panamá. A: caparazón. B: cavidad orbital. C: quelípedos menores, izquierda es hembra (exterior); derecha es macho (interior). D: estriás de caparazón. E: pubescencia y setas en carpio y propodio de ambulatorios. F: borde tubercular en mero ambulatorio. G: setas en dactilo ambulatorio. H: chela mayor. I: filas de tubérculos del pollex y carina grande, más allá del punto medio. J: tubérculos en punta del pollex. K: borde prensil del dactilo tuberculado. L-M: crestas tuberculares del manus, palma y pollex. N: tubérculos en carpio y mero de chela mayor. O: gonopodio derecho, anterolateral (izq.) y posteromesial (der.). (Barras de escala: A, D, I-L, N = 5 mm; B, C, F, G = 2 mm; H, M = 10 mm; E = 0.5 mm; O = 0.2mm)

DISCUSSION

Minuca burgersi, *M. vocator*, and *M. ecuadoriensis* are morphologically similar to *M. osa* (Landstorfer & Schubart, 2010; Rosenberg, 2020); however, *M. burgersi* and *M. vocator* are only distributed in the Western Atlantic, while *M. ecuadoriensis* is only found in the Eastern Pacific (Masunari *et al.* 2020; Rosenberg, 2020). Furthermore, *M. burgersi* also differs from our specimens in that the oblique tuberculate ridge on the major palm has small tubercles (not a single row); tubercle ridge does not diminish distally on outer pollex (Crane, 2015; Shih *et al.* 2016). In *Minuca vocator* and *M. ecuadoriensis*, the carapace as well as the ambulatories on all segments have a profuse pile (except dactyls) in an irregular pattern (see Masunari *et al.* 2020), while our specimens had no such pile. In *M. ecuadoriensis*, the oblique ridge in the major palm has a very low apex; tubercles are small and irregular, sometimes vestigial or absent. In contrast, the apex in *M. osa* is high and tubercles are large (Landstorfer & Schubart, 2010; Crane, 2015); all of our specimens showed the latter. Considering its behavior and coloration, *M. osa* is a conspicuous fiddler crab species; thus, it is unclear why it was not been identified other than in Golfo Dulce (Landstorfer & Schubart, 2010) prior to this report. Based on the

morphological differences between *M. osa*, *M. burgersi*, *M. vocator*, and *M. ecuadoriensis*, it can be concluded that *M. osa* is also present in the Eastern Montijo Gulf, Panama.

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