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Short Communication

New records and biological data of *Lolliguncula (Lolliguncula) argus* Brakoniecki & Roper, 1985 (Myopsida: Loliginidae) in the Gulf of Tehuantepec, Mexico

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ABSTRACT. The squid *Lolliguncula (Lolliguncula) argus* is a rare species, endemic to the Eastern Tropical Pacific Ocean, by their morphological characteristics could be easily confused with other species of the family Loliginidae. The distribution and meristic measures remains unclear in spite of recent work in the north part of the distribution. Eleven males and 28 females collected in artisanal fisheries and in the shrimp fishery of the Gulf of Tehuantepec were examined. These records expand species geographic distribution in the southern Mexican Pacific and morphometric and biological data are presented.

Keywords: *Lolliguncula (Lolliguncula) argus*, squid, loliginids, spermatophore, Oaxaca.

Nuevos registros y datos biológicos de *Lolliguncula (Lolliguncula) argus* Brakoniecki & Roper, 1985 (Myopsida: Loliginidae) en el Golfo de Tehuantepec, México

RESUMEN. El calamar *Lolliguncula (Lolliguncula) argus* es una especie rara, endémica del Pacífico Oriental Tropical, que por sus características morfológicas podría confundirse fácilmente con otras especies de la familia Loliginidae. La distribución y datos morfométricos aún no son claros a pesar de recientes trabajos realizados en el sector norte de su distribución. Se examinan 11 machos y 28 hembras de *L. argus*, recolectados de la pesca artesanal y en la pesquería del camarón en el Golfo de Tehuantepec. Estos registros amplían su distribución geográfica a la región sur del Pacífico mexicano y se presentan datos morfométricos y biológicos de esta especie.

Palabras clave: *Lolliguncula (Lolliguncula) argus*, calamares, loliginidos, espermatóforo, Oaxaca.

Squids from the Loliginidae family are an economically important group of neritic squids. The squids of genus *Lolliguncula* are an American species. They are small in size and occur in warm waters, shallow coastal waters and are the only cephalopods found brackish water (Vecchione *et al.*, 2005). The geographic distribution of the genus is centered in Panamá region, as most species are limited to tropical and subtropical waters off both North and South American shores. One species, *L. brevis*, is found on the Atlantic side of the Americas and the Caribbean whereas three species *L. panamensis*, *L. diomedae*, and *L. argus* occur in the Pacific Ocean (Jereb *et al.*, 2010). Presently the phylogenetic taxonomy of the Loliginidae is very con-

fusing, resulting in a number of taxonomic problems that need to be critically resolved (Cardoso & Hochberg, 2013) and complicate proper elaboration of the fisheries records. In this direction, Sales *et al.* (2014) established the phylogenetic positions of each species within the genus, except for *L. argus*, for which no sequences exist, for not having tissues available.

Lolliguncula argus is a rare species, endemic to the Eastern Pacific Ocean. A coastal species, depths range from 0-70 m; the biology and ecology of this species are unknown (Roper *et al.*, 1995). In this study new records of *L. argus* are reported from Gulf of Tehuantepec, Mexico, and some aspects of their reproduction are described *Lolliguncula argus* has been recor-

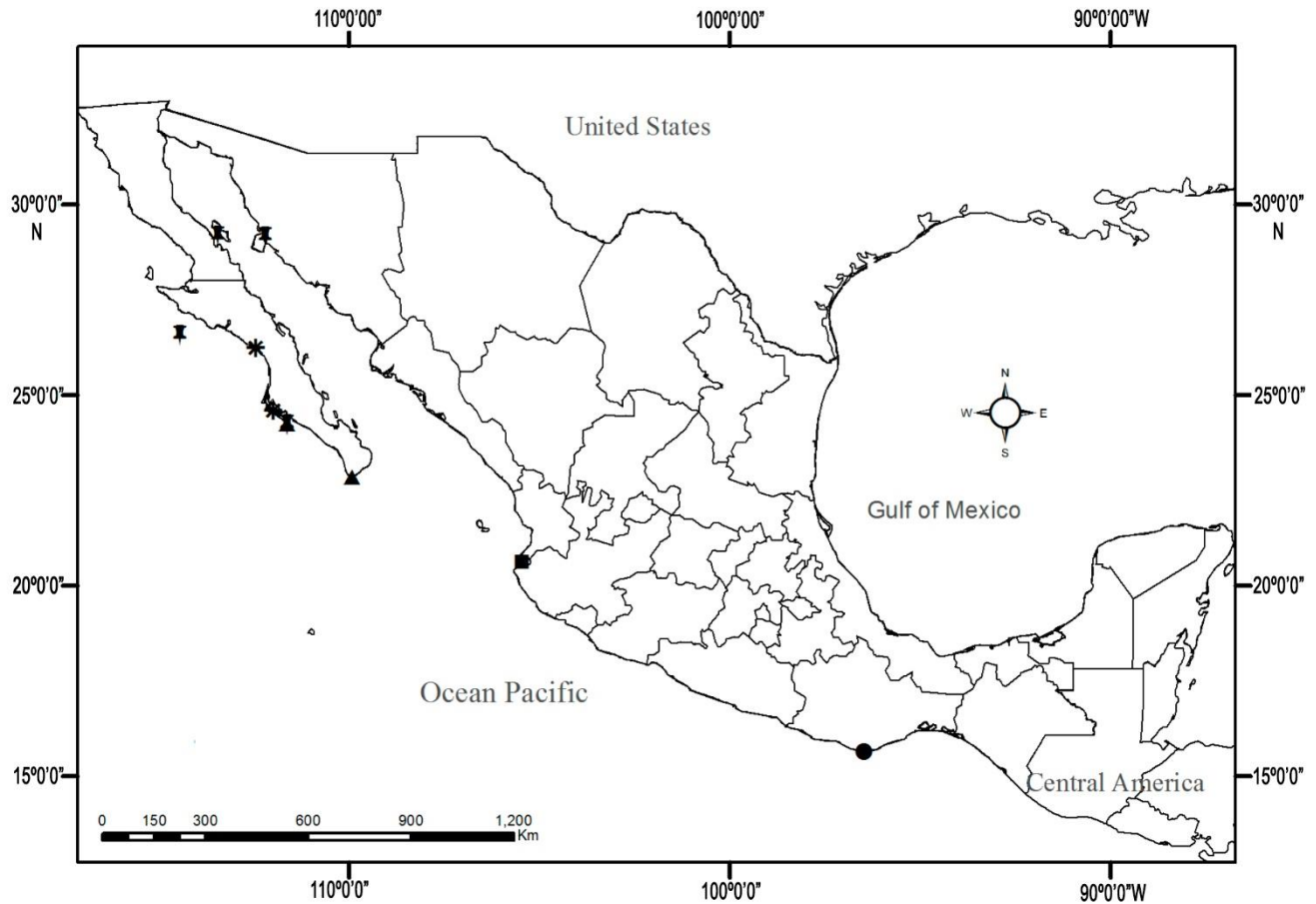


Figure 1. The location of sampling points off the Pacific coasts of Mexico and in the Gulf of California. (●) Present study; (▲) Santa Barbara Museum of Natural History (SBMNH); (■) Los Angeles County Natural History Museum (LACNHM); (*) Scripps Institute of Oceanography SIOPIC-B; (▼) Granados-Amores *et al.* (2014).

ded from off the west coast of Baja California Sur and Gulf of California (Granados-Amores *et al.*, 2013), La Plata Island, Ecuador (Brakoniecki, 1986) and Peru (Cardoso & Hochberg, 2013). The present records is based on 13 females and 11 males collected as by-catch in fished artisanal in March 2014 front Puerto Angel Bahía, Oaxaca ($15^{\circ}39.91'N$, $96^{\circ}29.45'W$), and 15 females captured incidentally in shrimp fisheries in 2006 off Chipehua Bay ($16^{\circ}10'N$, $95^{\circ}21'W$), in the Gulf of Tehuantepec (Fig. 1).

Specimens were identified according to Brakoniecki & Roper (1985). The measurements (mm) were taken from each individual using caliper (0.01 mm nearest). Measurements and indices used in the work are as defined by Roper & Voss (1983): mantle length (ML); mantle width index (MWI); fin length index (FLI); fin width index (FWI); index arm I length (AILI); index arm II length (AILII); index arm III length (AILIII); index arm IV length (AILIV) and hectocotylyzed arm length index (HcLI) (Tabla 1). Hard structures were observed: beak, radula and gladius. Spermatophores

and spermatangias were cleared with trypsin and then transferred to glycerol (Vecchione, 1991).

In addition, specimens from Oaxaca were compared with the type specimens of *L. argus* housed in the Los Angeles County Natural History Museum (LACNHM); California Academy Sciences (CAS), Scripps Institute of Oceanography; Pelagic Collection (SIOPIC-B). Voucher specimens of identified organisms were selected and deposited in the Collection of the Cephalopods at Universidad del Mar (CEPHA-0143), located at Puerto Angel, Oaxaca, Mexico.

Lolliguncula argus is characterized by mantle short, bluntly pointed posteriorly; fins small, nearly elliptical in outline; length about 25% of mantle length; tentacles short, compressed; buccal suckers absent; arm suckers with about five blunt teeth on distal margin of sucker rings; distinct manus and dactylus present but carpus absent (Brakoniecki & Roper, 1985). The morphological and biometrical features of the specimens collected in Gulf of Tehuantepec correspond to those of *L. argus* (Tabla 1, Fig. 2).

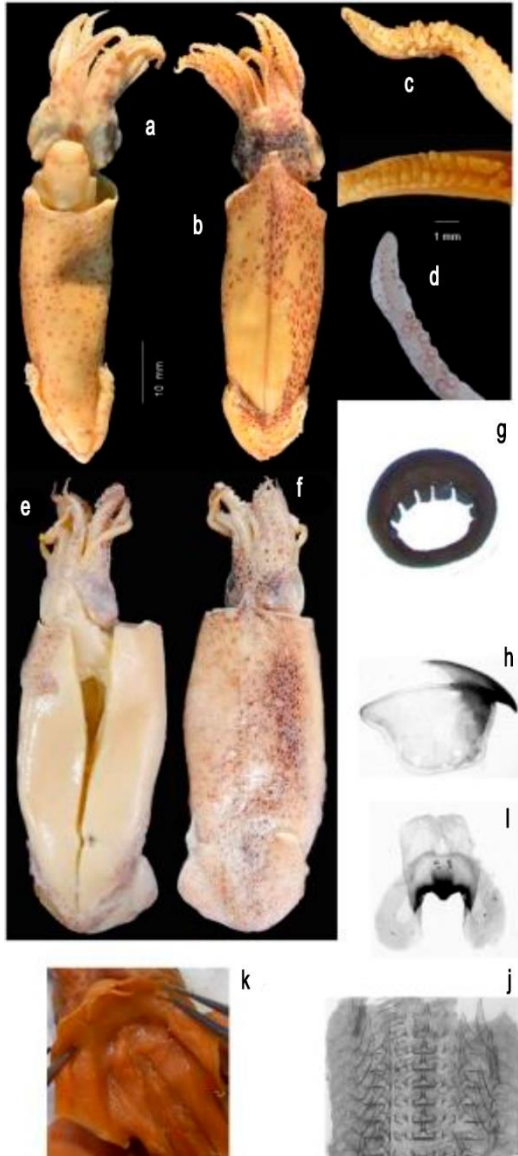


Figure 2. *Lolliguncula (Lolliguncula) argus*. a) Male (38 mm ML), ventral view, b) dorsal view, c) hectocotylus, d) tentacular club; e) Female (52.4 mm ML), ventral view, f) dorsal view, g) sucker from right arm III, h) upper beak, i) lower beak, j) radula, k) funnel valve.

The analyzed specimens are 11 males in juvenile stage and mature with sizes from 26 to 38.7 mm ML; 28 are females mature (16 mated), with sizes from 28.5 to 78.4 ML. Mated females had spermatangia inserted in the muscles of the inner mantle at the basis of the left gill in the vicinity of the oviduct aperture (Fig. 3a). Spermatophores were long and thin. The cement body was long and slender, occupying approximately 1/3 of the spermatophores total length (Fig. 3c). Mature males of *L. argus* have smaller sizes than females such as it has been observed in other loliginids species (see

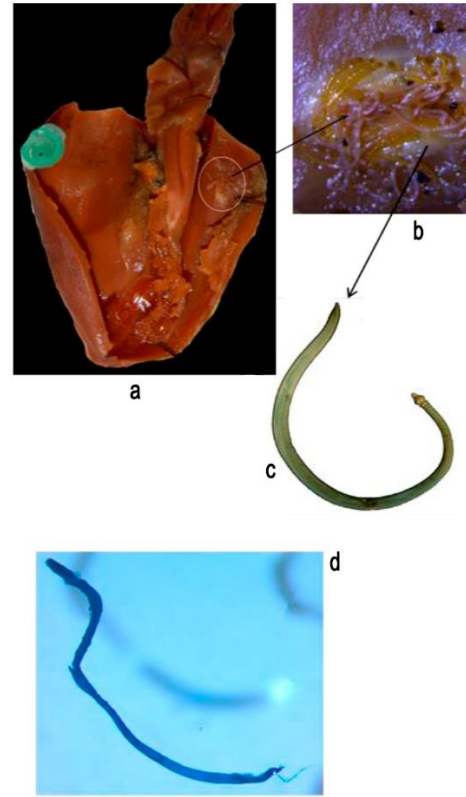


Figure 3. *Lolliguncula (Lolliguncula) argus*. a-b) Spermatangias inserted in the inner mantle wall of a female, c) spermatangia, d) spermatophore.

Jackson, 2004; Arizmendi-Rodríguez *et al.*, 2012). Most of the stomachs were empty and those that contained food, presented highly digested prey items. Only three squid males contained identifiable prey items that were identified as sardine, *Harengula thrissina*. This study presents new records of maximum ML of 78.4 mm for females, respect to that 60.8 mm ML reported by Granados-Amores *et al.* (2013).

In Mexico, loliginids are commonly fished artisanally and also caught as bycatch in trawl fisheries for shrimp (Hernández-Vázquez, 1987; Alejo-Plata *et al.*, 2001) and commercialized locally. In most cases loliginids that appear in trawls are not identified to species level, due to existing taxonomic confusion, which prevents any reliable distribution patterns. Lack of previous records of *L. argus* in Mexico can be an answer for the existing similarity within species from Loliginidae family with distribution in Tropical Eastern Pacific (Granados *et al.*, 2013).

Although the Gulf of Tehuantepec may fall within the known distribution range of the other species of Loliginidae, *L. panamensis* and *L. diomedae* (Alejo-Plata *et al.*, 2001; Alejo-Plata, 2002), *L. argus* is consi-

Table 1. Measurements and indices of bodily proportions of *Lolliguncula (Lolliguncula) argus*. ML: mantle length, MWI: mantle width index, FLI: fin length index, FWI: fin width index, AILI: index arm I length, AILII: index arm II length, AILIII: index arm III length, AILIV: index arm IV length, and HcLI: hectocotylized arm length index.

Character	Females	Males
Number of individuals	28	11
ML (mm)	56.8 (28.5-78.4)	32.7 (26.0-38.7)
MWI	37.6 (30.2-44.3)	35.3 (30.3-43.1)
FLI	34.2 (22.4-38.7)	24.5 (22.3-27.3)
FWI	40.9 (29.3-53.3)	37.0 (31.9-40.7)
IALI	23.1 (11.6-37.7)	22.0 (13.8-30.0)
IALII	32.0 (18.2-41.0)	34.4 (25.0-44.7)
IALIII	39.9 (24.2-56.1)	41.9 (33.1-55.4)
IALIV	38.5 (23.3-51.7)	44.8 (25.7-55.4)
HcLI		25.7 (25.7-63.9)

dered distinct from this species. *L. argus* is characterized by its small size at maturity, and it is the only known myopsid to have its primary hectocotylization on the right ventral arm (Brakoniecki & Roper, 1985). Both ventral arms in male *L. diomedea* are modified, the hectocotylus is modified along the entire arm; *L. panamensis* has hectocotylized the left ventral arm. The hectocotylus is a valuable taxonomic character that can be used to separate species (Brakoniecki, 1986). The funnel valve of *L. argus* observed was narrow with a pair of folds on its lateral sections that ended at the patches level, different from other loliginids (see Granados-Amores *et al.*, 2014). Analyzed squids included juvenile males and mature stages; as well as mature and mated females. This indicates that the Gulf of Tehuantepec is a reproduction area of *L. argus*.

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