# First report of *Pseudochauhanea mexicana* (Mazocraeidea, Chauhaneidae) and *Scomberocotyle scomberomori* (Mazocraeidea, Thoracocotylidae) in *Sphyraena ensis* (Perciformes, Sphyraenidae) from the northern Peru

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**Abstract**

*First report of* Pseudochauhanea mexicana *(Mazocraeidea, Chauhaneidae) and* Scomberocotyle scomberomori *(Mazocraeidea, Thoracocotylidae) on the Mexican barracuda* Sphyraena ensis *(Perciformes, Sphyraenidae) from the northern Peru*. *Sphyraena ensis* is distributed in the Eastern Pacific from Mexico to Chile, including the Galapagos Islands. Despite the wide distribution of this fish, knowledge of the parasitic fauna of *S. ensis* is restricted to only three monogenean species. The objective of this study was to record and describe two monogenean species of *S. ensis* in northern Peru. During a parasitological study from May to October 2019, monogeneans were collected from the gills of 138 specimens of *S. ensis* from Caleta de Zorritos, Contralmirante Villar Province, Tumbes, on the north coast of Peru. Helminths were stained in carmine acetic acid, dehydrated in ethyl alcohol, diaphanized in clove oil and mounted in Canada balsam. To observe the sclerotized structures, several specimens were placed in Hoyer's medium. We identified the following monogeneans not previously reported in Peru: *Pseudochauhanea mexicana* and *Scomberocotyle scomberomori*. This is the first report of these two monogeneans in Peru, and the first report of *P. mexicana* in South America. Furthermore, *S. ensis* is reported as a new host of *S. scomberomori*.

Key words: Barracuda, Helminths, Monogeneous, Parasitology, Tumbes

**Resumen**

*Primer registro de* Pseudochauhanea mexicana *(Mazocraeidea, Chauhaneidae) y* Scomberocotyle scomberomori *(Mazocraeidea, Thoracocotylidae) en la barracuda mexicana* Sphyraena ensis *(Perciformes, Sphyraenidae) del norte de Perú*. *Sphyraena ensis* se distribuye en el Pacífico Oriental desde México hasta Chile, incluidas las islas Galápagos. A pesar de la amplia distribución de este pez, el conocimiento de la fauna parasitaria de *S. ensis* está restringido únicamente a tres especies monogéneas. El objetivo de este estudio fue registrar y describir dos especies monogéneas de *S. ensis* en el norte de Perú. Durante un estudio parasitológi-

co realizado de mayo a octubre de 2019 se recolectaron monogéneos en las branquias de 138 ejemplares de *S. ensis* de Caleta de Zorritos, provincia de Contralmirante Villar, Tumbes, en la costa norte de Perú. Los helmintos se tiñeron en ácido carmín acético, se deshidrataron en alcohol etílico, se diafanizaron en aceite de clavo y se montaron en bálsamo de Canadá. Para la observación de las estructuras esclerotizadas, algunos especímenes se colocaron en medio de Hoyer. Se identificaron los siguientes monogéneos no registrados previamente en Perú: *Pseudochauhanea mexicana* y *Scomberocotyle scomberomori*. Este es el primer registro de ambos monogéneos en Perú y el primero de *P. mexicana* en América del Sur. *S. ensis* se registra como nuevo hospedador de *S. scomberomori*.

Palabras clave: Barracuda, Helmintos, Monogéneos, Parasitología, Tumbes

**Resum**

*Primer registre de* Pseudochauhanea mexicana *(Mazocraeidea, Chauhaneidae) i* Scomberocotyle scomberomori *(Mazocraeidea, Thoracocotylidae) a la barracuda mexicana* Sphyraena ensis *(Perciformes, Sphyraenidae) del nord del Perú. Sphyraena ensis* es distribueix al Pacífic Oriental des de Mèxic fins a Xile, incloent–hi les illes Galápagos. Malgrat l'àmplia distribució d'aquest peix, el coneixement de la fauna parasitària de *S. ensis* està restringit a tres espècies monogènies. L'objectiu d'aquest estudi va ser registrar i descriure dues espècies monogènies de *S. ensis* al nord del Perú. Durant un estudi parasitològic portat a terme de maig a octubre de 2019 es van recol·lectar monogenis a les brànquies de 138 exemplars de *S. ensis* de Caleta de Zorritos, província de Contralmirante Villar, Tumbes, a la costa nord del Perú. Els helmints es van tenyir en àcid carminoacètic, es van deshidratar en alcohol etílic, es van diafanitzar en oli de clau i es van muntar en bàlsam del Canadà. Per a l'observació de les estructures esclerotitzades, alguns espècimens es van col·locar em medi de Hoyer. Es van identificar els monogenis següents no registrats prèviament al Perú: P*seudochauhanea mexicana* i *Scomberocotyle scomberomori*. Aquest és el primer registre dels dos monogenis al Perú i el primer de *P. mexicana* a Amèrica del Sud. *S. ensis* es registra com a nou hoste de *S. scomberomori*.

Paraules clau: Barracuda, Helmints, Monogenis, Parasitologia, Tumbes

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## Introduction

The Mexican barracuda *Sphyraena ensis* Jordan and Gilbert, 1882 (Perciformes, Sphyraenidae) is a pelagic–neritic marine species that is distributed in the Eastern Pacific from Mexico to Chile, including the Galapagos Islands (Froese and Pauly, 2022). It inhabits depths in the range of 10 to 60 m, and can be found in sandy, muddy, coral and rocky reefs near the coast (Robertson and Allen, 2015).

Despite the importance of this species, knowledge of the parasitic fauna of *S. ensis* is restricted to only three monogenean species (Minaya et al., 2021): *Paramonaxine yamagutii* Bravo–Hollis, 1978 reported in Baja California, Isla Rasa (Bravo–Hollis, 1978a), Baja California Sur, Cabo San Lucas (Bravo–Hollis, 1978b); *Pseudochauhanea elongatus* Kritsky, Bilqees and Leiby, 1972 reported in Nayarit, San Blás, Mexico (Lamothe–Argumedo et al., 1997) and *Pseudochauhanea mexicana* Lamothe–Argumedo, 1966 reported in Guerrero, Acapulco (Lamothe–Argumedo, 1966), Jalisco, Bahía de Chamela (Pérez–Ponce De León et al., 1999) and in Nayarit, San Blás (Lamothe–Argumedo et al., 1997).

The objective of this study was to record and describe two monogenean species of *S. ensis* in northern Peru.

## Material and methods

During a parasitological study from May to October 2019, two monogenean species were removed and collected from the gills of 138 specimens of *S. ensis* from Caleta de Zorritos, Province of Contralmirante Villar, Tumbes, on the north coast of Peru (80º 40' 29" SS; 03º 40' 39" LO). For the morphological study of the parasites, the helminths were stained in carmine acetic acid and alternatively in gomori's trichrome, dehydrated in concentrations of 50 %, 70 %, 90 %, and 100 % of ethyl alcohol, diaphanized in clove oil and mounted in Canada balsam (Eiras et al., 2006; Almeida and Almeida, 2014). To observe the sclerotized structures, several specimens were placed in Hoyer's medium (Fankoua et al., 2017). Morphological measurements are presented in micrometres. The parasite specimens collected in this study are deposited in the collection of Parasitic Helminths and Allied Invertebrates–HPIA, of the Zoological Collection of the Natural History Museum of the Federico Villarreal National University–MUFV, Lima, Peru.

The fish were acquired from artisanal fishermen presenting the Artisanal Fishing certificate for natural or legal persons with the Caleta de Zorritos Fishing permit, Province of Contralmirante Villar, Tumbes, Peru, and therefore, they did not need specific authorization to obtain fish (Ministerial Resolution 409–2017–PRODUCE) or specific authorization from an ethics committee.

## Results

*Pseudochauhanea mexicana* Lamothe–Argumedo, 1966

Description

Based on 30 specimens on permanent slides: body lanceolate, slightly compressed at level of vagina and intestinal bifurcation; 4646 µm (2,325–7,300 µm) in length by 392.6 µm (230–650 µm) in maximum width at level of vitelline reservoir. Haptor without terminal anchors, asymmetrical in shape, with two lateral columns of stalked clamps, and 48–87 clamps in total distributed in 30–35 and 29–40 clamps on right and left sides, respectively. Clamps *Gastrocotyle*–type at base and apex of haptor, with those in the middle position being larger than anterior and posterior clamps, each with T–shaped middle sclerite and two pairs of marginal accessory sclerites; anterior and posterior clamps 38.1 µm (30.0–52.5 µm) long, 28 µm (15–40 µm) wide; middle clamp 46 µm (30–55 µm) long, 36 µm (25–45 µm) wide. Pair of muscular elliptical suckers at mouth level, 70 µm (40–90 µm) long, 41 µm (20–55 µm) wide. Globular pharynx 46 µm (30–70 µm) long, 36 µm (29–60 µm) wide. Esophagus 1,229 µm (950–1,600 µm) long, with numerous branches, bifurcates at level of the vaginal pore into two intestinal branches (fig. 1).

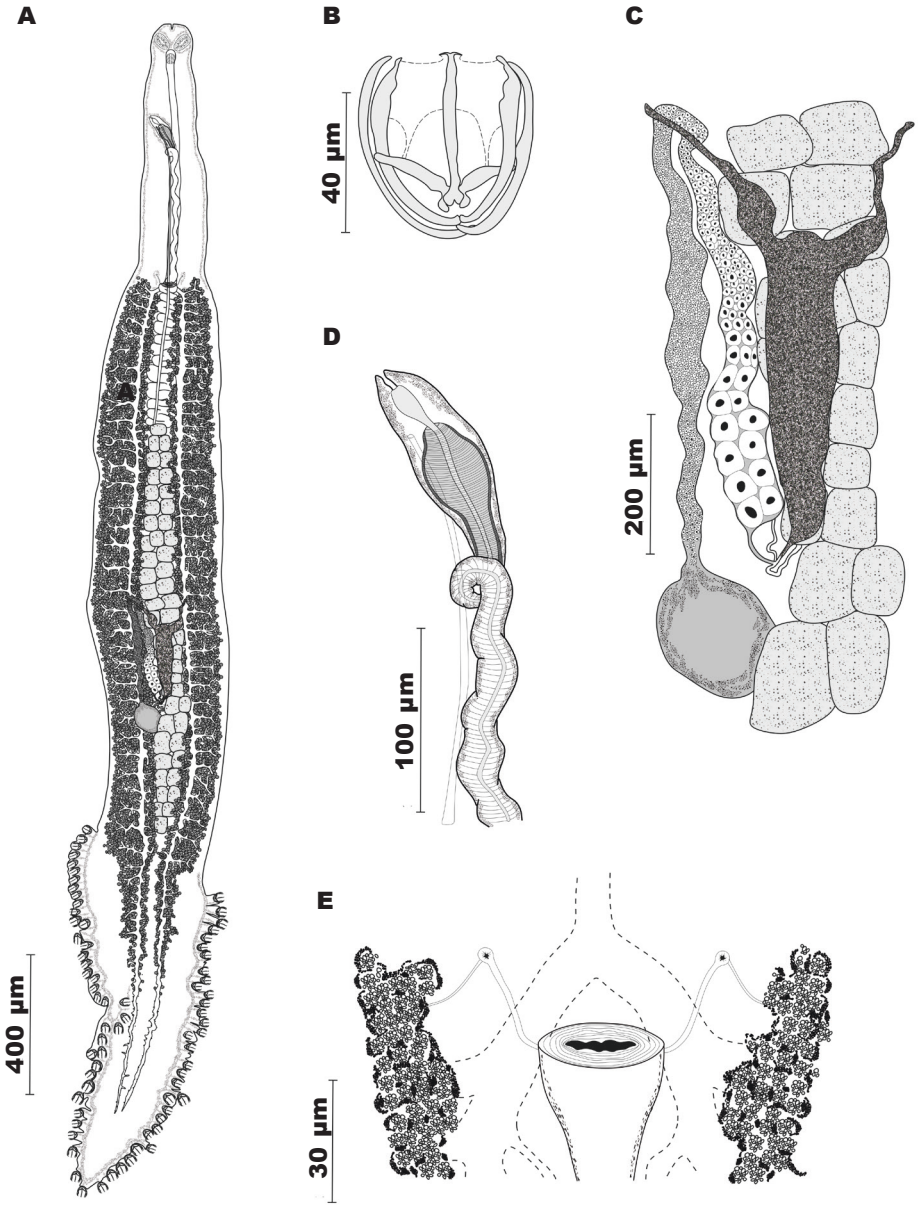


Fig. 1. *Pseudochauhanea mexicana*: A, full body, ventral view; B, gastrocotyle type clamps; C, female internal genitalia; D, cirrus sac and seminal vesicle in mid–sinistral position; E, medial vaginal pore and intestinal bifurcation.

*Fig. 1.* Pseudochauhanea mexicana*: A, cuerpo entero, visión ventral; B, pinzas tipo gastrocótilo; C, genitales internos femeninos; D, bolsa del cirro y vesícula seminal en posición medio–izquierda; E, poro vaginal medial y bifurcación intestinal.*

Male genitalia: testes rounded, intercecal, 24–50 in number, in pre, para, and post–germarium position. Cirrus bursa fusiform, asymmetrical, muscular, sinistral ventrally, unarmed, 115 µm (80–150 µm) long, opening at a distance of 365 µm (250–440 µm) from anterior margin of body. Vas deferens muscular, medial, slightly sinuous, portion proximal to cirrus strongly curved or coiled.

Female genitalia: germarium sinistral, located in middle third of body, first portion compact from which arising ascending portion of 592 µm (506–666 µm) long, followed by loop and then descending portion of similar length. Mehlis' gland positioned between germarium and testes. Uterus in midline of body, ventral, empties into genital atrium. Vaginal opening mid–ventral, 25 µm (22–30 µm) wide, located at level of the intestinal bifurcation, at distance of 1234 µm (1000–1690 µm) from anterior end of body. Vitellarium extend from intestinal bifurcation parallel to intestine and enter anterior third of haptor, Vitellarium field length 2605 µm (1300–5300 µm); vitelline reservoir Y–shaped. Egg elongate, operculate, 180 µm (150–250 µm) long, 44 µm (25–60 µm) wide, with filaments at both poles.

Host: *Sphyraena ensis* Jordan and Gilbert, 1882.

Site of infection: gill filaments.

Location: Caleta de Zorritos, Province of Contralmirante Villar, Tumbes, north coast of Peru. (80º 40' 29" LS; 03º 40' 39" LO).

Material examined: MUFV–ZOO: HPIA 196 A–P.

*Scomberocotyle scomberomori* (Koratha, 1955) Hargis, 1956

Description

Based on three specimens on permanent slides: body elongate to lanceolate, 6,500–7,625 µm in length, 250–305 µm maximum width at level of vitelline reservoir. Pair of oral suckers 37–67 µm long, 37–82 µm wide, each sucker with anterior hollow protrusion as pseudo–sucker. Mouth subterminal; pharynx ovoid, 47–62 µm long, 27 µm wide. Esophagus unbranched, 1,181–1,386 µm long. Haptor asymmetrical, 2,200–2,800 µm long, 650–780 µm wide, armed with 93–101 stalked clamps distributed in two columns, 35–43 dextral and 58 sinistral. Clamps *Gastrocotyle*–type, dissimilar in size, with the middle position clamps being larger, 90–100 µm long, 65–67 µm wide. Clamp with J–shaped median sclerite the dorsal part is short and forked at its posterior end, the ventral part is thickened at its base and forked at its opposite end.; two pairs of marginal sclerites, 5–7 muscular striations between J–shaped median sclerite and marginal sclerites. Hamuli 22–25 µm in length (fig. 2).

Male genitalia: testes ovoid, 23–28 in number, intercecal, post–germarium, enter up to anterior third of haptor. Cirrus 150–187 µm long, 55–62 µm wide, armed with two types of spines: first type anterior, 14–18 µm long continuing towards back by another type posterior; needle–like spines, 27–35 µm in length. Vas deferens sinuous, slender, continuous anterior to cirrus.

Female genitalia: germarium elongated, centrally positioned with ascending and descending portion from 605–780 µm long. Vagina with four lateral and anterior sclerotized accessory pieces, sclerotized accessory pieces 30–37 µm in length. Vitellarium extends from intestinal bifurcation parallel to intestine to start of haptor without entering it; Vitellarium field length 3532 to 4162 µm; Vitelline reservoir Y–shaped. Eggs elongate, operculate, 187–195 µm long, 57–62 µm wide, with filaments at both poles.

Host: *Sphyraena ensis* Jordan and Gilbert, 1882

Site of infection: gill filaments.

Location: Caleta de Zorritos, Province of Contralmirante Villar, Tumbes, north coast of Peru (80º 40' 29" LS; 03º 40' 39" LO).

Material examined: MUFV–ZOO: HPIA 198 A, B.

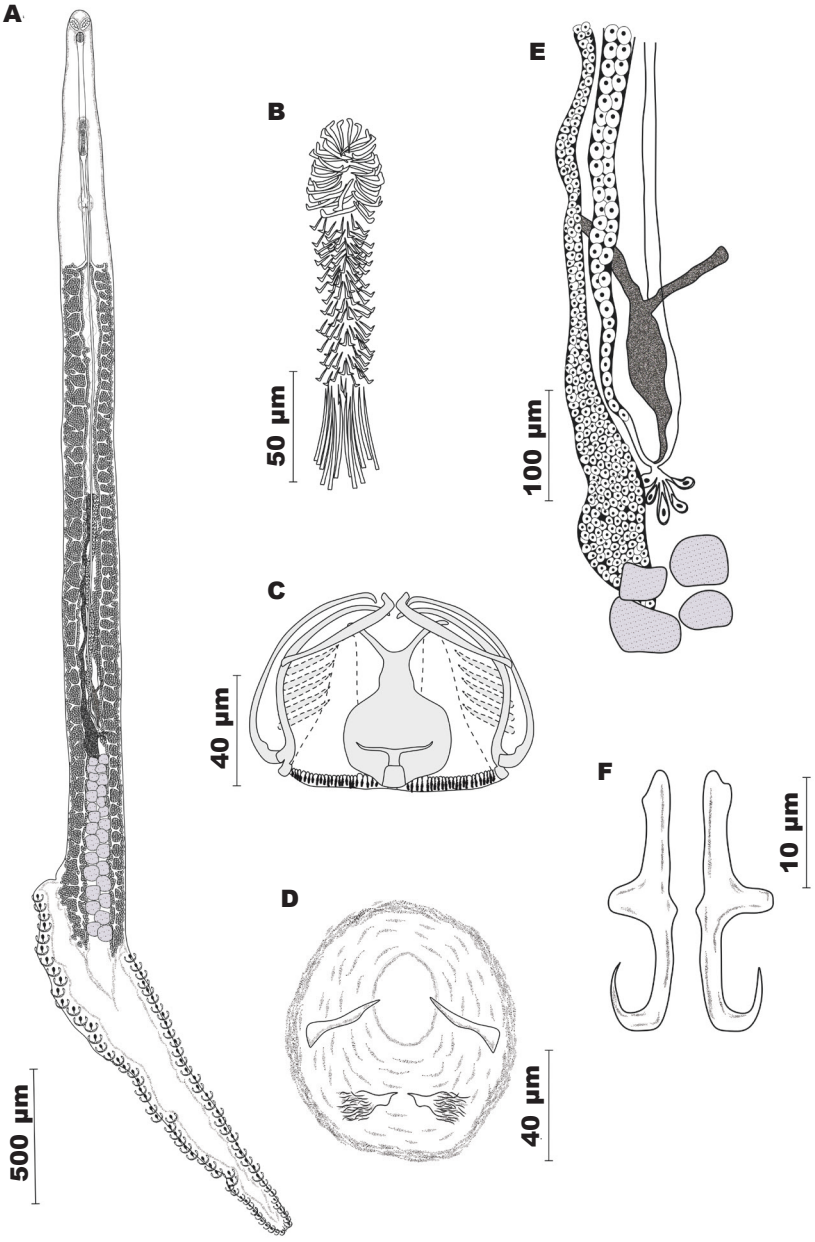


Fig. 2. *Scomberocotyle scomberomori*: A, full body ventral view; B, cirrus armed with spines; C, gastrocotyle type forceps; D, sclerotized vagina and accessories; E, female internal genitalia; F, anchors.

*Fig. 2.* Scomberocotyle scomberomori*: A, cuerpo entero, visión ventral; B, cirro provisto de espinas; C, fórceps tipo gastrocótilo; D, vagina esclerotizada y accesorios; E, genitales internos de la hembra; F, garfios.*

## Discussion

*Pseudochauhanea mexicana*

The specimens evaluated in this study were identified as *Pseudochauhanea mexicana* based on the description of Lamothe–Argumedo (1966). This species differs from its congeners by the number of testes, and the size, and the number of clamps: *P. mexicana* is differentiated from *Pseudochauhanea elongata* Kritsky, Biqees and Leiby, 1972 by the number of testes, being 24–50 in *P. mexicana* vs. 70 in *P. elongata* (Kritsky et al., 1972) and the size of the clamps which are larger in *P. elongata* (72–93 µm; 64–90 µm: Kritsky et al., 1972) than in *P. mexicana* (30–55 µm; 25–45 µm); *P. mexicana* differs from *P. elegans* Fuentes–Zambrano, 1997 by the number of clamps in the haptor, being higher in *P. mexicana* (30–35 and 29–40) compared to *P. elegans* (23–29 and 22–28: Fuentes–Zambrano, 1997). In addition, the geographical distribution of *P. elegans* is only reported in the Atlantic. The differences between *P. mexicana* and *P. sphyraenae* Yamaguti, 1965 are described by Lamothe–Argumedo (1966), although some of the differences reported by the author should not be considered due to the morphological plasticity that individuals present (body size and shape of the haptor). Nonetheless, *P. mexicana* and *P. sphyraenae* can be differentiated by the number of testicles, being 24–50 and 70–100 (Yamaguti, 1965), respectively. The morphometric comparisons are shown in table 1 with *Pseudochauhanea* species recorded in South and Central America in greater detail.

The evaluation only considers the species registered in America, so *Pseudochauhanea macrorchis* Zhang et al., 2001 was not considered because it is geographically restricted to the China Sea (Zhang et al., 2001).

*Scomberocotyle scomberomori*

The genus *Scomberocotyle* Hargis, 1956 is a monotypic genus, established by Hargis (1956) for *Heteraxine scomberomori* Koratha, 1955. Its body is elongate, gradually narrowing anteriorly; haptor asymmetrical, with two unequal rows of 75 to 125 clamps; clamps gastrocotylid; cirrus armed with two types of spines; vagina bearing two pairs of sclerotised hook–like structures (Hargis, 1956; Hayward and Rohde, 1999). Table 2 shows the comparison of the measurements of *S. scomberomori* in different hosts. This table includes the measurements of the most taxonomically important structures of the monogenean recovered from *Scomberomorus cavalla* (Cuvier, 1829) and *S. maculatus* (Mitchell, 1815) from Florida, Texas, United States published by Hargis, 1956. Also included are the measurements recorded and published by Hayward and Rohde (1999), which review the genus *Scomberocotyle*, providing new data for diagnosis based on the review of recovered specimens of five fish species of *Scomberomorus* Lacepède, 1801 America and Africa.

Specimens of *S. scomberomori* in thr present study are similar in size and shape to those described by Hargis, 1956, with both cases being larger specimens in all the structures analyzed than those reported by Hayward and Rohde (1999) in which all the specimens were smaller (except those of *S. cavalla*). The number of clamps, which is often important to separate species of the same genus, was lower than that reported by Hargis (1956) but overlapped with the ranges described by Hayward and Rohde (1999). The number of testes, which is also of similar importance to clamps, was also slightly higher in previous studies than in the present study. Hayward and Rohde (1999) reported that the size of this monogenean varies widely for each host species, from 1575 µm in *Scomberomorus tritor* to 8,095 µm in *Scomberomorus maculatus* (see table 1 of Hayward and Rohde, 1999). This demonstrates the high morphological plasticity of *S. scomberomori* in terms of its body length, so it should not be considered as a criterion to differentiate this species from its peers.

Table 1. Morphometric comparison of the *Pseudochauhanea* specimens collected in this study with the *Pseudochauhanea* species recorded in the Neotropics: P, *Pseudochauhanea;* S, *Sphyraena.*

*Tabla 1. Comparación morfométrica de los especímenes de* Pseudochauhanea *recolectados en este estudio con las especies de* Pseudochauhanea *registradas en el Neotrópico: P,* Pseudochauhanea*; S,* Sphyraena.

| **Characteristic** | ***P. mexicana*** | ***P. mexicana*** | ***P. elongata*** | ***P. sphyraenae*** | ***P. elongata*** |
|---|---|---|---|---|---|
| Host | *S. ensis* | *S. ensis* | *Labeo rohita* | *S. barracuda* | *S. barracuda* |
| Nº specimens | n = 30 | | n = 14 | n = 5 | n = 6 |
| Locality | Peru | Mexico | Pakistan, Mexico | Hawaii | Venezuela |
| Ocean | Pacific | Pacific, Atlantic | Indian, Pacific | Atlantic | Atlantic |
| Reference | Present study | Lamothe–Argumedo (1966) | Kritsky et al. (1972) | Yamaguti (1965) | Fuentes–Zambrano (1997) |
| Whole body length (µm) | 4,646 (2,325–7,300) | 2,093–3,992 | 11,700 (8,500–15,000) | 4,450–5,800 | 1,900–2,250 |
| Max. body width (µm) | 393 (230–650) | 434–595 | 810 (500–1,000) | 320–1,400 | 252–280 |
| Length of suckers (µm) | 70 (40–90) | 60–90 | 114 (98–131) | 72–112 | 34–37 |
| Width of suckers (µm) | 41 (20–55) | 32–37 | 69 (53–79) | 37–60 | 20–24 |
| Pharynx length (µm) | 46 (30–70) | 37–45 | 56 (53–62) | 37–58 | 25–32 |
| Length of the esophagus (µm) | 1,229 (950–1,600) | 418–550 | -- | 830–2,000 | 432–594 |
| Haptor length (µm) | 1,325 (660–1,750) | -- | 2,970 (2,020–4,400) | -- | 450–486 |
| Width haptor | 445 (250–700) | -- | 788 (583–968) | -- | -- |
| Length of clamp (middle) (µm) | 46 (30–55) | 37–45 | 86 (72–93) | -- | 26–36 |
| Width of clamp (middle) (µm) | 36 (25–45) | 33–37 | 75 (64–90) | -- | 27–34 |
| N° of clamps | 48–87 | 39–67 | -- | 58–87 | -- |
| N° of clamps (right side) | 30–35 | 25–35 | 35–50 | 28–50 | 23–29 |
| N° of clamps (left side) | 29–40 | 20–32 | 29–61 | 25–37 | 22–28 |
| N° of testes | 24–50 | 22–27 | 75 | 70–100 | 23–35 |
| Cirrus sac length (µm) | 114 (80–150) | 80–97 | 135 (121–157) | 90–160 | 47 |
| Distance from cirrus to anterior end (µm) | 365 (250–440) | -- | -- | 360–840 | -- |
| Ovary length (µm) | 592 (506–666) | -- | 1,120 (990–1,320) | 860–1,400 | 486–517 |
| Vagina width (µm) | 25 (22–30) | 26–37 | -- | -- | -- |
| Distance from vagina to anterior end (µm) | 1,234 (1,000–1,690) | -- | -- | -- | 522–648 |
| Egg length (µm) | 180 (150–250) | 209–213 | -- | 220–230 | -- |
| Egg width (µm) | 44 (25–60) | 42–48 | -- | 40 | -- |

Table 2. Morphometric comparison of *Scomberocotyle scomberomori* specimens reported in America.

*Tabla 2. Comparación morfométrica de los especímenes de* Scomberocotyle scomberomori *registrados en América.*

| | ***Sphyraena*** | ***Scomberomorus*** | | | | |
|---|---|---|---|---|---|---|
| **Characteristic** | ***ensis*** | ***cavalla, maculatus*** | ***cavalla*** | ***concolor*** | ***maculatus*** | ***sierra*** |
| Locality | Tumbes, Peru | Florida, Texas; USA | Brasil; Colombia El Potrero, | Sonora, Mexico | Florida, USA; Sontecomapan, Mexico | Buenavista, Colombia; El Salvador; Sonora, Mexico; Punta Chame, Panama |
| Reference | Presente estúdio | Hargis (1965) | Hayward and Rohde (1999) | Hayward and Rohde (1999) | Hayward and Rohde (1999) | Hayward and Rohde (1999) |
| Nº specimens | 3 | 5 | 1 | 1 | 1 | 14 |
| Whole body length (µm) | 6,500–7,625 | 5,500–6,500 | 6,100 | 2,760 | 2,840 | 1,990–4,035 |
| Max. body width (µm) | 250–305 | 500–700 | -- | -- | -- | -- |
| Length of suckers (µm) | 67.5–37.5 | 73–76 | -- | -- | -- | -- |
| Width of suckers (µm) | 37.5–82.5 | 47–58 | -- | -- | -- | -- |
| Length haptor (µm) | 2,200–2,800 | 2,200–2,400 | 3,000 | 1,110 | 1,725 | 1,020–2,070 |
| N° of clamps | 93–101 | 134 | 156 | 57 | 84 | 65–114 |
| N° of clamps (right side) | 35–43 | 50 | 65 | 25 | 26 | 24–39 |
| N° of clamps (left side) | 58 | 84 | 91 | 32 | 58 | 41–75 |
| Length of clamp (middle) (µm) | 90–100 | 88–95 | 103 | 76 | 94 | 69–91 |
| Width of clamp (middle) (µm) | 65–67.5 | 43–68 | -- | -- | -- | -- |
| Hamuli length (µm) | 22.5–25 | 30 | 26–30 | 28 | 28–29 | 18–22 |
| Pharynx length (µm) | 47.5–62.5 | 55–67 | -- | -- | -- | -- |
| Pharynx width (µm) | 27.5–27.5 | 40–42 | -- | -- | -- | -- |
| N° of testes | 23–28 | 27–38 | 25–40 | -- | -- | -- |
| Cirrus sac length (µm) | 150–187.5 | 110–140 | -- | -- | -- | -- |
| Length of the anterior spines of the cirrus (µm) | 14–18 | 12–16 | 10–12 | 8–11 | 13 | 8–15 |
| Length of the posterior spines of the cirrus (µm) | 27.5–35 | 61–85 | 78 | -- | 56 | 53–70 |
| Length of vagina spines (µm) | 30–37.5 | -- | 37–39 | -- | 22–23 | 23–38 |
| Egg length (µm) | 187.5–195 | 94–182 | -- | -- | -- | -- |
| Egg width (µm) | 57.5–62.5 | 41–55 | -- | -- | -- | -- |

## Conclusion

This study reports two species of monogeneans *Pseudochauhanea mexicana* and *Scomberocotyle scomberomori* from gills of *S. ensis* in Peru and provides a morphological description. The former species is a new record from South America, including Peru, and the latter is represented as a new host record from *S. ensis* and new to Peru.

## References

Almeida, A. S., Almeida, K. S. S., 2014. Sobre variações na técnica de tricrômico de gomori para estudo de helmintos da classe Monogenoidea e família Dactylogyridae. *Biológicas Saúde*, 4: 12: 1–7, Doi: 10.25242/8868412201415

Bravo–Hollis, M., 1978a. Helmintos de peces del Pacífico mexicano XXXIII. Monogéneos del Golfo de Cortés, Baja California. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 49: 1–9.

Bravo–Hollis, M., 1978b. Monogéneos de la Colección Winter I. Sobre seis especies de la superfamilia Microcotyloidea Unnithan, 1957. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 49: 11–18.

Eiras, J., Takemoto, R., Pavanelli, G., 2006. *Métodos de estudo e técnicas laboratoriais em parasitologia de peixes*. Eduem, Maringa.

Fankoua, S. O., Bitja Nyom, A. R., Bilong Bilong, C. F., Pariselle, A., 2017. Influence of preservative and mounting media on the size and shape of monogenean sclerites. *Parasitology research*, 116: 2277–2281, Doi: 10.1007/s00436-017-5534-7

Froese, R., Pauly, D., 2022. *FishBase*. World Wide Web electronic publication www.fishbase.org [Accessed on 25 april 2022].

Fuentes–Zambrano, J. L., 1997. *Neohexostoma mochimae* n. sp. y *Pseudochauhanea elegans* n. sp. Monogenea) dos nuevas especies de parásitos de peces de la Bahıa de Mochima, Venezuela. *Boletín del Instituto Oceanográfico de Venezuela*, 36: 45–52.

Hargis Jr., W. J., 1956. Monogenetic trematodes of Gulf of Mexico fishes. Part XII. The family Gastrocotylidae Price. *Bulletin of Marine Science*, 6: 28–43.

Hayward, C. J., Rohde, K., 1999. Revision of the monogenean subfamily Neothoracocotylinae Lebedev, 1969 (Polyopisthocotylea: Thoracocotylidae). *Systematic Parasitology*, 44: 183–191. Doi: 10.1023/A:1006240814286

Kritsky, D. C., Bilquees, F. M., Leiby, P. D., 1972. Studies on Monogenea of Pakistan. I. *Pseudochauhanea elongatus* sp. n. (Gastrocotylidae: Gastrocotylinae) from the gills of *Labeo rohita* (Ham.). *Proceedings of the Helminthological Society of Washington*, 39: 231–233.

Lamothe–Argumedo, R., 1966. Monogéneos de peces I. Descripción de *Pseudochauhanea mexicana* n.sp. (Gastrocotylidae) parásito de *Sphyraena ensis* Jordan and Evermann. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 37: 129–134.

Lamothe–Argumedo, R., García–Prieto, L., Osorio–Sarabia, D., Pérez–Ponce De León, G., 1997. *Catálogo de la Colección Nacional de Helmintos. Instituto de Biología*, Universidad Nacional Autónoma de México y Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México City.

Minaya, D., Ferre, D., Garcia, M., Alvariño, L., Iannacone, J., 2021. Community of macroparasites of the Pacific barracuda *Sphyraena ensis* Jordan and Gilbert, 1882 (Perciformes, Sphyraenidae) from the north coast of Peru. *Arxius de Miscel·lània Zoològica*, 19: 273–287, Doi: 10.32800/amz.2021.19.0273

Pérez–Ponce De León, G., García–Prieto, L., Mendoza–Garfias, B., León–Règagnon, V., Pulido–Flores, G., Aranda–Cruz, C., García–Vargas, F., 1999. *Listados Faunísticos de México IX. Biodiversidad de Helmintos parásitos de peces marinos y estuarinos de la*

*Bahía de Chamela, Jalisco*. Instituto de Biología. Universidad Nacional Autónoma de México, Mexico City.

Robertson, D. R., Allen, G. R., 2015. Shorefishes of the Tropical Eastern Pacific Online Information System. Version 2.0. Available online at: https://obis.org/dataset/0e1d55f3-c7dc-4355-a81f-e48a96795329. Smithsonian Tropical Research Institute, Balboa, Panamá.

Yamaguti, S., 1965. New monogenetic trematodes from Hawaiian fishes, I. *Pacific Science*, 19: 55–95.

Zhang, J. Y., Yang, T. B., Liu, L., 2001. *Monogeneans of Chinese marine fishes*. Agriculture Press, Beijing.