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## First record of *Mothocya melanosticta* Schioedte and Meinert, 1884 (Isopoda: Cymothoidae) from Egyptian pinecone soldierfish with special reference to its infestation status

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**Abstract:** Cymothoidae are cosmopolitan, ubiquitous, and nonspecific parasites of fish of different biotopes causing a significant economic loss to fisheries either by killing and stunting or simply by damaging their hosts. This study represents the first record of *Mothocya melanosticta* from the Red Sea, with a new host record in *Myripristis murdjan* (pinecone soldierfish), the other resident species of the fish-parasitic isopod family Cymothoidae in Egypt. The recovered *Mothocya melanosticta* was of moderate body size (17.7 × 8.2 mm) and had a cephalon with widely truncated rostrum, short pleotelson with uropod rami not extending beyond the telson, and the presence of a small rounded protrusion ranging in size from 0.3 to 0.5 mm on the lateral side of pereonite II. The overall prevalence was 31.25% and it was only found in the branchial cavity. The monthly and seasonal variation in infestation is reported.

**Key words:** Egypt, *Mothocya melanosticta*, *Myripristis murdjan*, prevalence, Red Sea

### Introduction

Parasitic diseases in fish seriously limit aquaculture production and its economic viability. Knowledge of fish parasites, therefore, is an essential requirement for successful aquaculture.

Parasites play a pivotal role in the biology of fishes and can affect their behavior, health, and distribution (1).

Isopods are important groups of crustacean parasites of fishes with deleterious and tremendous destructive activity, causing growth retardation, emaciation, and even death of the infected fish (2,3). Cymothoid isopods are large ectoparasite groups that infest a diverse array of tropical and temperate marine and freshwater fishes worldwide (4). They are protandrous hermaphrodites with a short phase

as free-living organisms (2,5). They can be found in the buccal cavity, in the gill chamber, and externally on the body surface including the fins, or sometimes they burrow inside the host to develop in a pouch (2,4). They feed on host blood, plasma in wounds, and fish tissues, resulting in serious tissue damage due to the pressure of the parasite's body (2,6,7).

Genus *Mothocya* was described firstly by Costa (8), while Schioedte and Meinert (9) described a similar genus, *Irona*, without considering the genus *Mothocya* and according to Monod's observations (10). *Mothocya* and *Irona* represent the same genus. It is found in the Atlantic Ocean and in various areas of the Mediterranean Sea, including the Black Sea, and it mainly parasitizes the gill chamber of atherinomorph fishes of the families Hemiramphidae, Belonidae, and Atherinidae (11).

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There are still several parts of the world in which the cymothoid fauna is poorly known or even completely unknown. Therefore, the present investigation was carried out to record the common isopod parasites from *Myripristis murdjan* (pinecone soldierfish) from the Red Sea, and the prevalence, intensity, and location of isopods in the branchial cavity was examined to determine the seasonal patterns and potential impacts of the parasites on the hosts.

### Materials and methods

Specimens of *Myripristis murdjan*, the pinecone soldierfish (commercially named murjan), were obtained from El-Obour fish market, Cairo. These pinecone soldierfish were caught from the Red Sea by Egyptian fishermen. A total of 160 specimens of fish weighing approximately 150 g each were used in this study. First, a gross examination of the external surfaces, mouth, gill chambers, and fishnets were conducted at the markets, and then the fish were transported to the laboratories of the Departments of Parasitology of Kafrelsheikh University for further examination and of South Valley University for identification of the recovered isopods. The recovered parasitic isopods were removed from the gill chambers of the infected fish and a small number of males were recovered from the bottom of the barrels of fish (not used in the survey data). Their sizes were measured after they were washed in a physiological saline solution before preservation in 70% ethyl alcohol. Parasites were cleared and mounted according to the method described by

Thatcher and Carvalho (12). The parasite appendages were dissected with a needle in pure phenol for study in temporary mounts and photographs were taken with digital camera on a Leica photomicroscope. Moreover, drawings were made using a camera lucida attachment; all measurements were made in micrometers unless designated as millimeters. The recovered Isopoda specimens were morphologically identified according to the descriptions of Bruce (11).

Prevalence and intensity are herein used in accordance with the recommendations of Margolis et al. (13). The data were analyzed considering the entire studied period as well as the period separated into 4 distinct seasons of the studied years: winter (rainy season from January to March), spring (from April to June), summer (from July to September), and autumn (from October to December).

### Results

The recovered parasitic isopods from *Myripristis murdjan* were identified as *Mothocya melanosticta*.

#### Survey results

**Prevalence:** 31.3% (50/160).

With the exception of October and November, the monthly prevalence showed slightly marked variations throughout the year. The lowest percentage occurred in November (7.6%) and the highest in September (57.1%) and May (46.2%), while for all other months the prevalence varied from 25% to 40% (Figures 1 and 2).

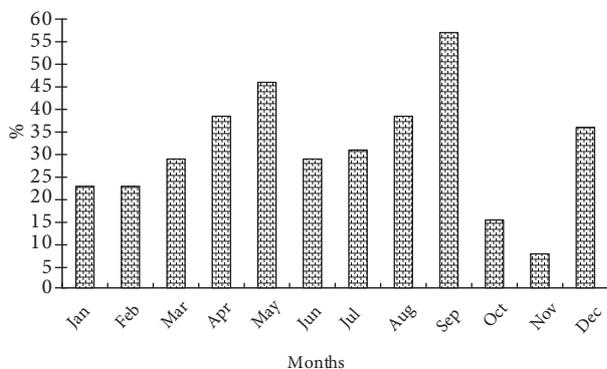


Figure 1. Monthly variation of adult female *Mothocya melanosticta* prevalence on *Myripristis murdjan* from Red Sea.

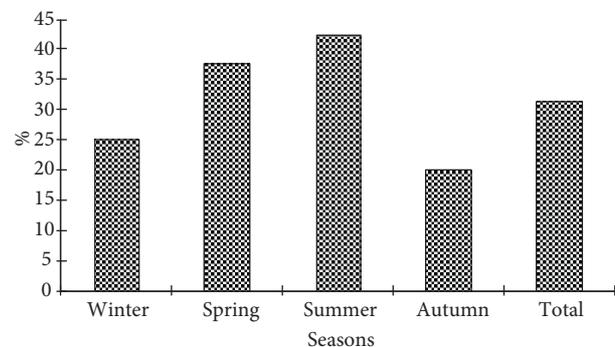


Figure 2. Seasonal variation of adult female *Mothocya melanosticta* prevalence on *Myripristis murdjan* from Red Sea.

**Intensity:** 64 parasites in 50 infected fish = 1.28.

**Locality:** Red Sea, Egypt.

**Site:** Branchial cavity.

A total of 64 parasites were recovered from the host branchial cavity; 50 parasites were found in the left branchial cavity and 14 parasites in the right. Infected *Myripristis murdjan* usually carried parasites in 1 branchial cavity; 36 (22.5%) specimens carried 1 parasite, while 14 (8.75%) carried 2 parasites, 1 in each branchial cavity. Moreover, in all cases a female was found in the branchial cavity, and a small number of males were collected from the barrels of fish (3 males/summer season; perhaps the male departs and dies after impregnating the female). In all cases, female isopods were attached to the anteroventral portion of the host's gill chambers. Parasites' heads were always directed toward the host's ventral side. The parasite's body was bent to the left when it occupied the left branchial cavity or to the right when it occupied the right branchial cavity. The parasite was attached to

the internal wall of the branchial operculum with its claw-like pereopods. The affected operculum did not show any obvious effects compared to noninfected ones. As the parasite grew, there was an increase in the amount of mechanical damage done to the gill, such as moderate bleeding and extensive destruction of gill filaments, which in turn reduced the host's metabolic capacity (gross observation). The parasite is illustrated in Figures 3A–3F, 4A–4H, and 5A–5E.

#### Systematic section

*Mothocya melanosticta* Schioedte and Meinert, 1884

Figures 3–5.

*Irona cypselurus* Avdeev (14): 33, Figure 3.

*Mothocya melanosticta* Bruce (11): 1131, Figures 23, 24.

**Type host:** Flying fish (*Cypselurus nigripinnis*, *C. spilanoreptus*, *Parexocoetus brachypterus*, and unidentified *Cypselurus* sp.), Bruce (11).

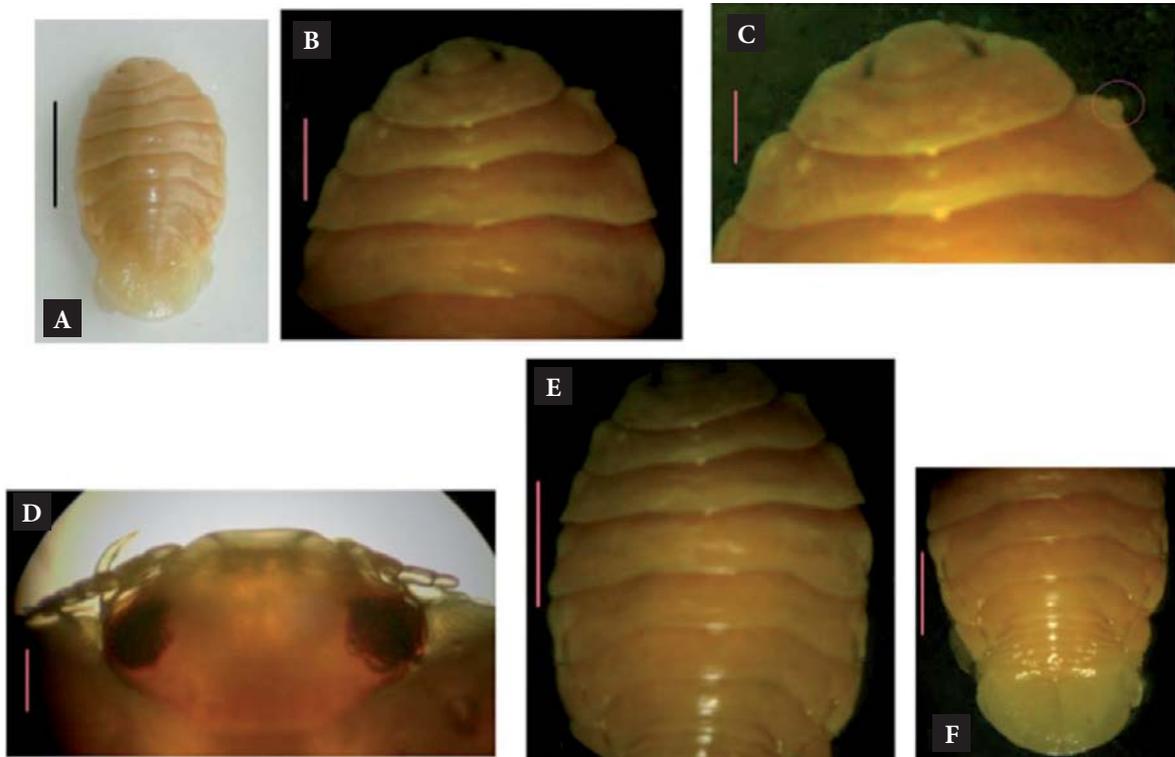


Figure 3. *Mothocya melanosticta* (scale = 10 mm): A) adult nonovigerous female; B) cephalon and first pereon segments; C) second pereon segment with a small protrusion (circle); D) head region showing antenna, antennules, and eyes; E) pereon; F) pleon and pleotelson.

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**New host (this paper):** *Myripristis murdjan* (Forsskål 1775).

**Color:** Yellowish brown with sparsely scattered small punctuating dots of brownish pigment mainly on head, abdomen, and pleotelson.

**Size:** Ovigerous female 16–22 mm (mean: 17.7 mm), nonovigerous female 14.0–17.0 mm (mean: 13.2 mm) in total length. Body of the adult female is weakly twisted to one side at pereonites III and IV (Figure 3A and Figures 4A and 4B).

**Description:** Based on 10 females and 3 mature males.

**Female:**

#### Cephalon and appendages

The cephalon (Figure 3D and Figure 4C) is deeply immersed in pereonite I, its posterior margin is straight, and the rostrum is scarcely produced and widely truncated. Eyes are large, dorsolaterally

situated, and separated from one another by a distance equal to about 0.6 to 0.8 times the width of cephalon. Antennules (Figure 4D) are larger at 8.9 mm, are more robust, and are composed of 8 articles, while the antenna (Figure 4E) is shorter at 8.2 mm and is composed of 9 articles with the bases of both slightly separated. Mouthparts are set strongly toward the anterior of the cephalon, and the maxilla medial lobe is narrow with 2 recurved spines and 3 on the lateral lobe. The mandible (Figure 4F) has an acute incisor and rounded molar process; mandibular palp extends beyond the mandible, of 3 articles with the terminal article much shorter; all 3 articles without setae, while the maxillules (Figure 4G) are slender with 1 broad and 3 slender spines.

#### Pereon and appendages

The pereon (Figures 3B and 3E) is composed of 7 segments with the maximum width at pereonites V and VI. A small rounded protrusion (Figure 3C), the

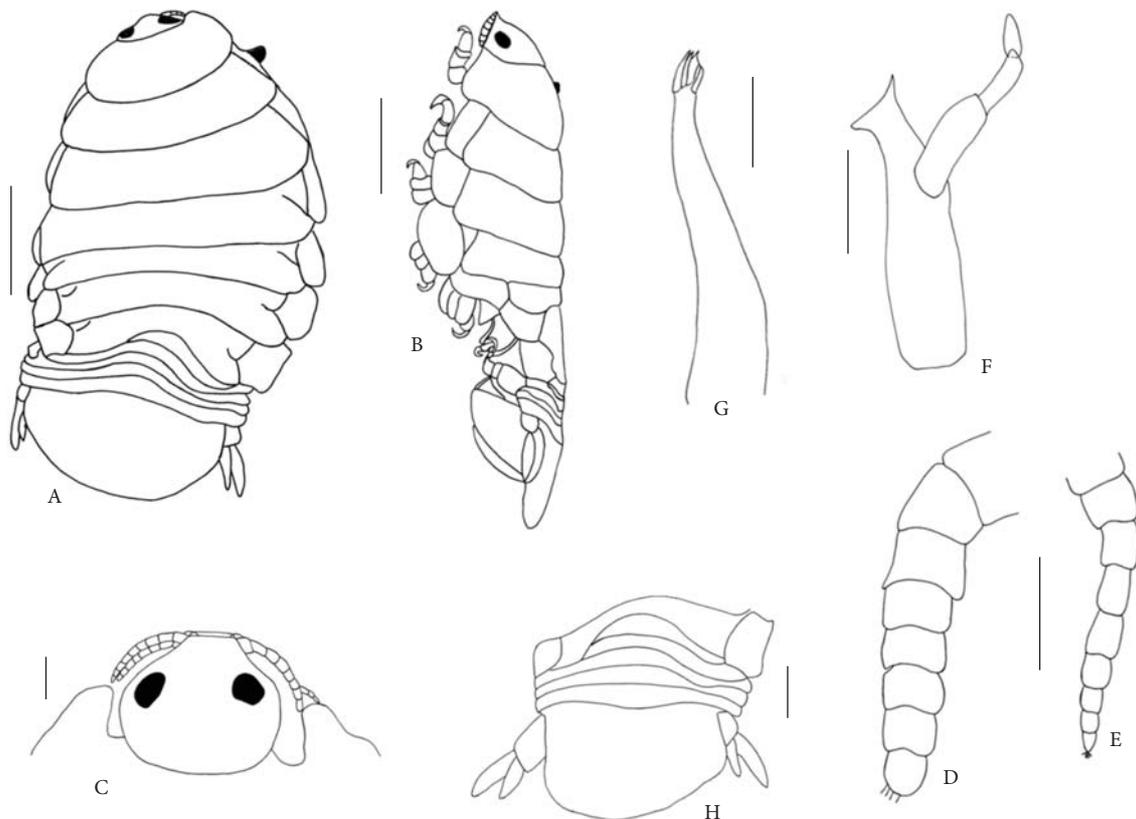


Figure 4. Line drawing of *Mothocya melanosticta* (scale = 3 mm): A) adult nonovigerous female dorsal view, B) adult nonovigerous female lateral view, C) cephalon, D) antennules, E) antenna, F) mandible, G) maxillule, H) female pleon and pleotelson.

size of hazelnut fruit (0.3–0.5 mm), was present on the lateral side of pereonite II (new criterion). Anterior margin of pereonite I is recessed to accommodate the cephalon. Coxae of pereonites II, III, IV, and V are about 1.5 times longer than wide and are not produced beyond the posterior margin of all segments, while the coxae of pereonite VII are about 0.9 times longer than wide, their posterior margin is straight, lateral margin concave and better produced, especially on the concave side. Posterior margin of pereonite VII is deeply recessed to accommodate the pleon. Pereopods are robust, never flattened, and similar except for pereopods IV, V, VI, and VII, which are slightly larger and longer than pereopods I–III and all without carina. The bases of pereopods I (Figure 5C), II, and III are 1.3 times longer than wide, and the posterior margin is convex. Ischium is about half as long as the bases and longer than the total lengths of merus and carpus. Propodus is more long than wide, and palm is straight. Dactylus is strongly curved and is longer than propodus.

### Pleon and appendages

Pleon (Figure 3F and Figure 5A) is composed of 5 visible segments and is equal to the width of pereonite V, slightly wider at pleonite V than at pleonite IV. Pleonite I is completely overlapped laterally by pereonite VII, while the lateral margins of pleonites II and III are partly overlapped and pleonites IV and V are completely uncovered. Pleotelson (Figure 3F and Figure 4H) is short, about one-fifth wider than long; its anterior margin is narrower than pleonite V. Uropod (Figure 5B) peduncle is short (1.7 times longer than wide), and the lateral margin is obviously convex. The rami are short and do not extend beyond the posterior margin of pleotelson; exopod is longer than endopod, and both rami taper to a narrow apex.

**Male:** See Figure 5D.

The male is morphologically similar to the female in the structure of the antenna, antennules, and mouthparts, and it differs principally in the cephalon, which is slightly truncated with folded rostrum;

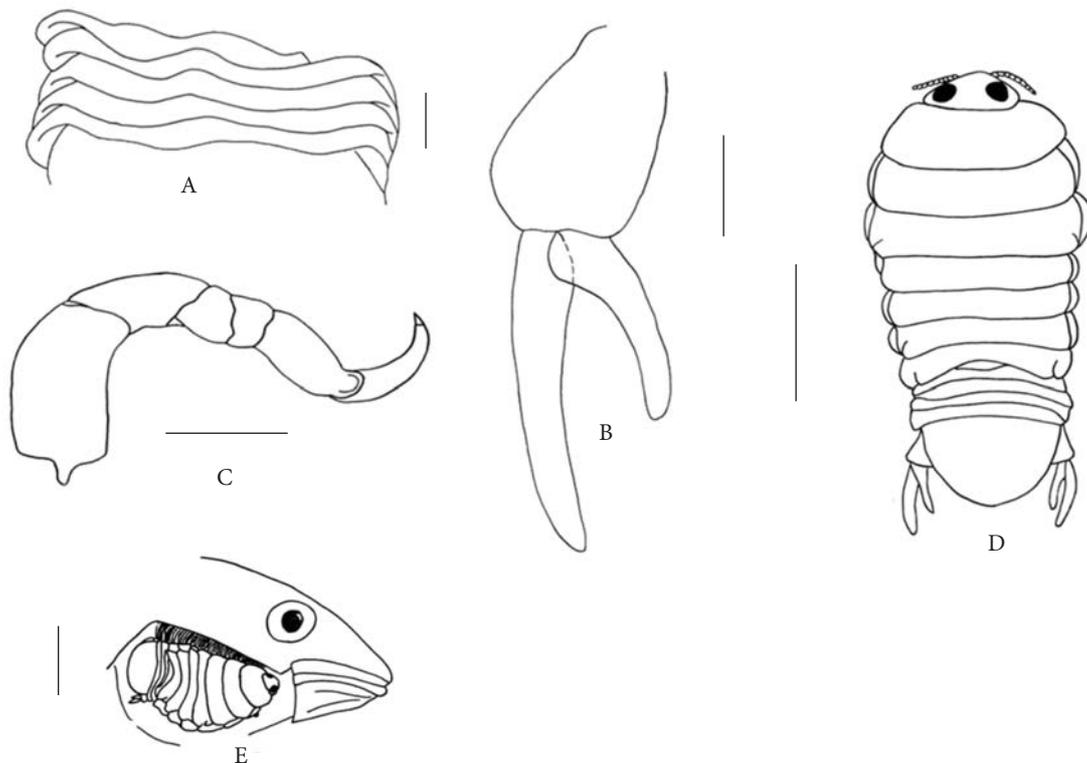


Figure 5. Line drawing of *Mothocya melanosticta* (scale = 3 mm): A) female pleon segments, B) uropods, C) pereopod I, D) adult male, E) female of *Mothocya melanosticta* in branchial cavity of *M. murdjan*. A part of the gill cover has been removed to expose the isopod and gill filaments (scale = 2 mm).

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uropods are longer with exopod proportionally longer, about 1.9 times length of endopod and both rami with bluntly rounded apices. Pleotelson is in the form of a shield and pleonites are almost equal in width.

## Discussion

Cymothoid fauna is poorly known in many regions of the world and some groups remain completely undescribed. This was the situation in the Red Sea, particularly in Egypt, as there is scanty information about fish-associated isopods.

With respect to prevalence, the overall prevalence of *M. melanosticta* on *Myripristis murdjan* in the Red Sea, Egypt, was 31.3%. This prevalence might be a secondary impact of the migration of exotic fish species from the Mediterranean Sea to the Red Sea through the Suez Canal. Variations in the prevalence of parasitism were observed in different periods of the year, and the peaks in the monthly distribution of prevalence corresponded to the recruitment of the newborn parasites. They showed an increase during the dry season (spring and summer, at 37.5% and 42.5%, respectively) and a decrease during the rainy season (autumn and winter, at 20% and 25%, respectively). During the summer months, the percentage prevalence increased, indicating that the parasite takes advantage of favorable conditions (temperature, productivity, presence of hosts) for reproduction. The decrease in prevalence during November and December may be attributed to natural mortality. The unusual high level of infection together with the presence of infection throughout the year suggests that the *Myripristis murdjan* is an appropriate host for *Mothocya melanosticta*.

Isopods from the genus *Mothocya* have not been previously reported on members of the family Holocentridae. Despite that, Bruce (11) found that *Mothocya melanosticta* was recorded from the flying fishes (*Cypselurus nigripinnis*, *C. spilanocephalus*, *Parexocoetus brachypterus*, and an unidentified *Cypselurus* sp.). *Mothocya melanosticta* is thus the first species of this genus known to occur on members of the order Beryciformes (16), but is probably the only species that parasitizes Beryciformes.

With regard to the site, the parasite seems to prefer to infect the left branchial chamber (78.1%) over the right chamber (21.9%). Similar results were reported

by Bello et al. (15) in Italy, in a study of *Mothocya epimerica* populations from the Lesina Lagoon (57.1% in the left branchial chamber and 42.9% in the right) and Venice (70.5% in the left chamber and 29.5% in the right), which showed a statistically significant difference in the parasite's preference. The authors attributed this preference to genetic or environmental differences.

The gill-infesting isopods were treated in detail by Bruce (11) in a revision of *Mothocya* species that included material from non-Beloniformes host families. The morphological details of Egyptian specimens are similar to those provided by Bruce (10). In addition, new diagnostic criteria were found, such as cephalon with widely truncated rostrum, large eyes, mandible with acute incisor and rounded molar process, and mandibular palp extending beyond the mandible with 3 articles with the terminal article much shorter and all 3 articles without setae. Furthermore, the presence of a small, rounded protrusion the size of hazelnut fruit (0.3–0.5 mm) on the lateral side of pereonite II is another criterion. The pleotelson is furthermore short with uropod rami not extending beyond the telson; these features have never been described previously and can therefore be considered diagnostic and specific for this species parasitizing the soldierfish. Egyptian specimens, on the other hand, can be readily distinguished from the common Mediterranean *Mothocya* species (*Mothocya epimerica*) with the latter being characterized by having a cephalon with a narrowly rounded point rostrum and posterolateral margins of posterior coxae that are rounded with weakly sinuate lateral margins, as described by Bruce (11). The differences between the populations of *M. melanosticta* and closely related *Mothocya* species are summarized in the Table.

*Mothocya melanosticta* was the only metazoan parasite observed in the branchial cavity of *Myripristis murdjan* and it was recorded for the first time from the Red Sea, Egypt. *Myripristis murdjan*, the pinecone soldierfish, is a new host record for this parasite in this study.

## Acknowledgments

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Table. Differences between *Mothocya melanosticta* and other *Mothocya* species.

	<i>Mothocya melanosticta</i>	<i>Mothocya sajori</i>	<i>Mothocya ihi</i>
Host	Previously from flying fish and <i>Myripristis murdjan</i> (new host, this paper)	<i>Hyporhamphus sajori</i>	<i>Hyporhamphus ihi</i>
Cephalon	With rostrum widely truncated	With rostrum weakly produced	With distinct rostral process
Eyes	Large	Moderate, about 0.5 times width of cephalon	Large, about 0.70 times width of cephalon
Body	Widest at pereonites V and VI	With dorsum convex, widest at pereonite IV	With dorsum strongly vaulted, about 3 times longer than wide; longitudinal apex of dorsum asymmetrical
Pereonite VII	Posterior margin deeply recessed	Same	Pleon largely free of pereonite VII
Coxae	Posterior margin straight, lateral margin concave, posterolateral angle acute	Narrow, lateral margins usually concave	Broad
Uropods extending beyond pleotelson	No	Yes	Yes
Pleotelson	Short (wider than long)	With indistinct longitudinal median ridge; lateral margins abruptly indented prior to meeting pleonite V; posterior margin broadly rounded	About 0.7 times as long as wide, lateral margins converging slightly to broad subtruncate apex
Pleopods V lobe	Large	Same	Distinctly larger
Uropod rami	Tapering to narrow apex	Broad, bluntly rounded	Bluntly rounded
Remarks	Presence of a small rounded protrusion on the lateral side of the pereonite II; hazel nut-sized (diagnostic)	Maxilla with 2 spines each on medial and lateral lobe, respectively; maxilliped article 3 with 3 large recurved terminal spines and 2 recurved spines on proximal posterior surface (10)	Pleopods 2 to 5 endopods with well-developed proximomedial lobe, pleopods III to V endopod proximomedial lobes well developed, pleopods 1 to 3 have peduncle medial margin with coupling hooks and seta (10)

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