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New and previously described dactylogyrid species (Monogenoidea: Polyonchoinea) and a gastrocotylinean pre-adult (Heteronchoinea) from pomacentrid and caesionid (Perciformes) fishes from Lizard Island, Great Barrier Reef, Australia

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Abstract

During a parasitological survey of perciform fishes from Lizard Island, Great Barrier Reef, Australia, we found the following gill monogenoidean species (Platyhelminthes): *Euryhaliotrema lizardi* n. sp. on *Caesio caerulaurea* Lacepède, 1801 (Caesionidae) (type host) and *Haliotrema weberii* n. sp. on *Chromis weberi* Fowler and Bean, 1928 (Pomacentridae) (type host), *Chromis amboinensis* (Bleeker, 1871), *Chromis atripectoralis* Welander and Schultz, 1951 and *Caesio teres* Seale, 1906. *Euryhaliotrema lizardi* n. sp. is characterized by having anchors with an elongated straight shaft and point as well as a vaginal canal with two loops before connecting to the seminal receptacle. *Ha. weberii* n. sp. is distinguished from other congeners by possessing a tubular male copulatory organ (MCO), partially straight. Two previously described dactylogyrids were also found: *Haliotrematoides caesionis* (Yamaguti, 1953) Kritsky, Yang and Sun 2009 on *Caesio cuning* (Bloch, 1791) and *Ca. teres* (new host record) and *Haliotrematoides patellacirrus* (Bychowsky and Nagibina, 1971) Kritsky, Yang and Sun 2009, on *Ca. cuning* (new host record). Finally, we provide the first report of a gastrocotylinean pre-adult on *Ca. teres*. We provide descriptions and illustrations of the new species and the gastrocotylinean pre-adult and include supplemental observations of *Ht. caesionis* and *Ht. patellacirrus*. The present findings expand the known spectrum of host species of *Euryhaliotrema*, *Haliotrema* and *Haliotrematoides* to include new caesionid and pomacentrid fishes.

Keywords

Monogenoidea, fish parasites, *Caesio*, *Chromis*, *Euryhaliotrema*, fusiliers, Gastrocotylinea, *Haliotrema*, *Haliotrematoides*, Indo-Pacific Ocean

Introduction

Parasites make up as much as 40% of global biodiversity and can form a large component of the biomass in a given ecosystem (Bush *et al*. 2001; Hatcher and Dunn 2011; Kuris *et al*. 2008). Despite their important role in maintaining healthy ecological communities and population dynamics (Hudson *et al*. 2006), many species have yet to be described. This is especially true in marine habitats, where most free-living organisms have not yet been examined for parasites (Rohde 2002). One exception are gill dactylogyrids (Monogenoidea) infecting coral reef fishes of the Indo-Pacific Islands, Japan, India and the Southwestern Pacific, which have been comparatively well-investigated and have the potential to provide a unique system for understanding patterns of range expansion and diversification of both hosts and parasites. For example, species of *Euryhaliotrema* (Kritsky and Boeger, 2002) Kritsky 2012, *Haliotrema* (Johnston and Tiegs, 1922) Young 1968, *Tetrancistrum* (Goto and Kikuchi, 1917)

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(= *Pseudohaliotrematoides* Yamaguti, 1953), *Pseudohaliotrema* (Yamaguti, 1953), *Glyphidohaptor* Kritsky, Galli, and Yang, 2007, and *Haliotrematoides* Kritsky, Yang and Sun, 2009, have been found infecting butterflyfishes (Chaetodontidae), rabbitfishes (Siganidae), surgeonfishes (Acanthuridae) and snappers (Lutjanidae) on coral reefs in Palau (Micronesia), Moorea (French Polynesia), Wallis (Wallis and Futuna), Heron Island and Lizard Island (Great Barrier Reef, Australia), New Caledonia, the South China Sea, Hawaii, and the Red Sea (Egypt and the Gulf of Eilat) (Kritsky and Galli 2007; Kritsky *et al*. 2007; Plaisance and Kritsky 2004). Recently, Kritsky and Diggles (2014) described two and redescribed one species of *Euryhaliotrema* Kritsky and Boeger, 2002 (Dactylogyridae) from the gills of the golden snapper *Lutjanus johnii* (Bloch, 1792) in the marine and brackish waters of Darwin, Northern Territory, Australia. Given the extraordinary diversity of fishes in the Indo-Pacific (Bellwood *et al*. 2012), more comprehensive studies of the gill parasitic fauna from a variety of hosts are needed to fully characterize their biodiversity, and provide a pathway for understanding patterns of host specificity and dispersal potential of monogenoidean ectoparasites in this region.

Here, we describe a new species of *Euryhaliotrema* and a new species of *Haliotrema* from the gills of damselfish (Pomacentridae) and fusilier (Caesionidae) hosts collected at Lizard Island, Australia, in June 2013. These specimens were recovered on three species of *Caesio* [*Caesio caerulaurea* Lacepède, 1801; *Caesio teres* (Seale, 1906) and *Caesio cuning* (Bloch, 1791) – Caesionidae] and three species of *Chromis* [*Chromis weberi* Fowler and Bean, 1928, *Chromis amboinensis* (Bleeker, 1871) and *Chromis atripectoralis* Welander and Schultz, 1951 – Pomacentridae]. In addition, we found two previously described monogenoidean species, *Haliotrematoides caesionis* (Yamaguti, 1953) Kritsky, Yang and Sun, 2009 on *Ca. cuning* and *Ca. teres*, and *Haliotrematoides patellacirrus* (Bychowsky and Nagibina, 1971) Kritsky, Yang and Sun 2009 on *Ca. cuning*. We also found a gastrocotylinean pre-adult on *Ca. teres*. We provide descriptions of the new species and gastrocotylinean pre-adult, as well as supplemental observations of *Ht. caesionis* and *Ht. patellacirrus*, and briefly discuss the host ranges of the monogenoidean species found.

Materials and Methods

Fish and parasites

Fishes were collected by divers on SCUBA using either a monofilament barrier net (10 mm stretch mesh) and hand nets, or microspears from continuous reef habitats in the Lizard Island lagoon (14°41´35.0″S, 145°27´46.0″E). Fish species were identified using Randall *et al*. (1997). Live individuals were transferred to aerated buckets separated by species to prevent cross-infection among hosts, and transported to the laboratory facilities at the Lizard Island Research Station (LIRS) within 90 min of capture. There, species were kept in separate flow-through aquaria at ambient water temperature (23–24°C) until pithing and dissection. Speared fish were pithed immediately upon capture and placed in individual plastic bags containing seawater and kept on ice until examination. The gills of each fish were removed and placed in Petri dishes containing seawater and examined for parasites under a dissecting microscope. Portions of the gills of fish infected with monogenoids were removed and placed in vials containing hot (60°C) 5% formalin (2% formaldehyde) solution for relaxation and fixation of attached helminths. The vials were labelled, shaken vigorously for 15–30 s, and subsequently shipped to the Instituto EPOMEX (Autonomous University of Campeche, Mexico) for further examination. In Mexico, parasites were picked from the sediments or gill lamellae with a fine probe and dissecting microscope at low-magnification. The collection methods and preparation of monogenoids follow techniques described in Mendoza-Franco *et al*. (2013). Illustrations were made with the aid of a drawing tube, using a Leica microscope DM50 with Nomarski interference contrast. Measurements (in micrometers) represent straight-line distances between extreme points of the structures and are expressed as the mean followed by the range and number of specimens measured (n) in parentheses. Description of the distribution of hook pairs in the gastrocotylineans follows Kritsky *et al*. (2011). The direction of the coil (when present) of the copulatory organ (i.e., counterclockwise *vs*. clockwise) was determined using the procedure suggested by Kritsky *et al*. (1985). Type and voucher specimens were deposited in the Queensland Museum, Brisbane, Australia (QM) and the Colección Nacional de Helmintos (CNHE), Institute of Biology, National Autonomous University of Mexico, Mexico, as indicated in the descriptions below. The study was approved by the Great Barrier Reef Marine Park Authority (G11/33857.1) and the Australian National University Animal Experimentation Ethics Committee (B.EEG.03.10, A2011/021).

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Results

Identification of fish hosts and parasites

All caesionid (*Ca. caerulaurea*, *Ca. teres* and *Ca. cuning*) and pomacentrid (*Cr. weberi*, *Cr. amboinensis* and *Cr. atripec-*

Table I. Occurrence of monogenoideans (Platyhelminthes) on caesionid and pomacentrid fishes from Lizard Island, Great Barrier Reef, Australia

Host (specimens collected)	Parasite				
	***Euryhaliotrema lizardi* n. sp.**	***Haliotrema weberii* n. sp.**	**Gastrocotylinean in a pre-adult stage**	***Haliotrematoides caesionis***	***Haliotrematoides patellacirrus***
Caesio caerulaurea (3)	+	–	–	–	–
Caesio cunning (4)	–	–	–	+	+
Caesio teres (3)	–	+	+	+	–
Chromis amboinensis (7)	–	+	–	–	–
Chromis atripectoralis (5)	–	+	–	–	–
Chromis weberi (9)	–	+	–	–	–

toralis) host species examined contained monogenoids (Table I). A total of four monogenoidean species (i.e., *Euryhaliotrema lizardi* n. sp., *Ha. weberii* n. sp., *Ht. caesionis* and *Ht. patellacirrus*) were identified, three of which were found infecting *Ca. teres* (*E. lizardi* n. sp. was restricted to *Ca. caerulaurea*). *Ha. weberii* n. sp. had a wide host spectrum and was found on four host species (*Ca. teres*, *Cr. amboinensis*, *Cr. atripectoralis* and *Cr. weberi*). The gastrocotylinean pre-adult was only found on the caesionid *Ca. teres*.

Morphology of monogenoideans

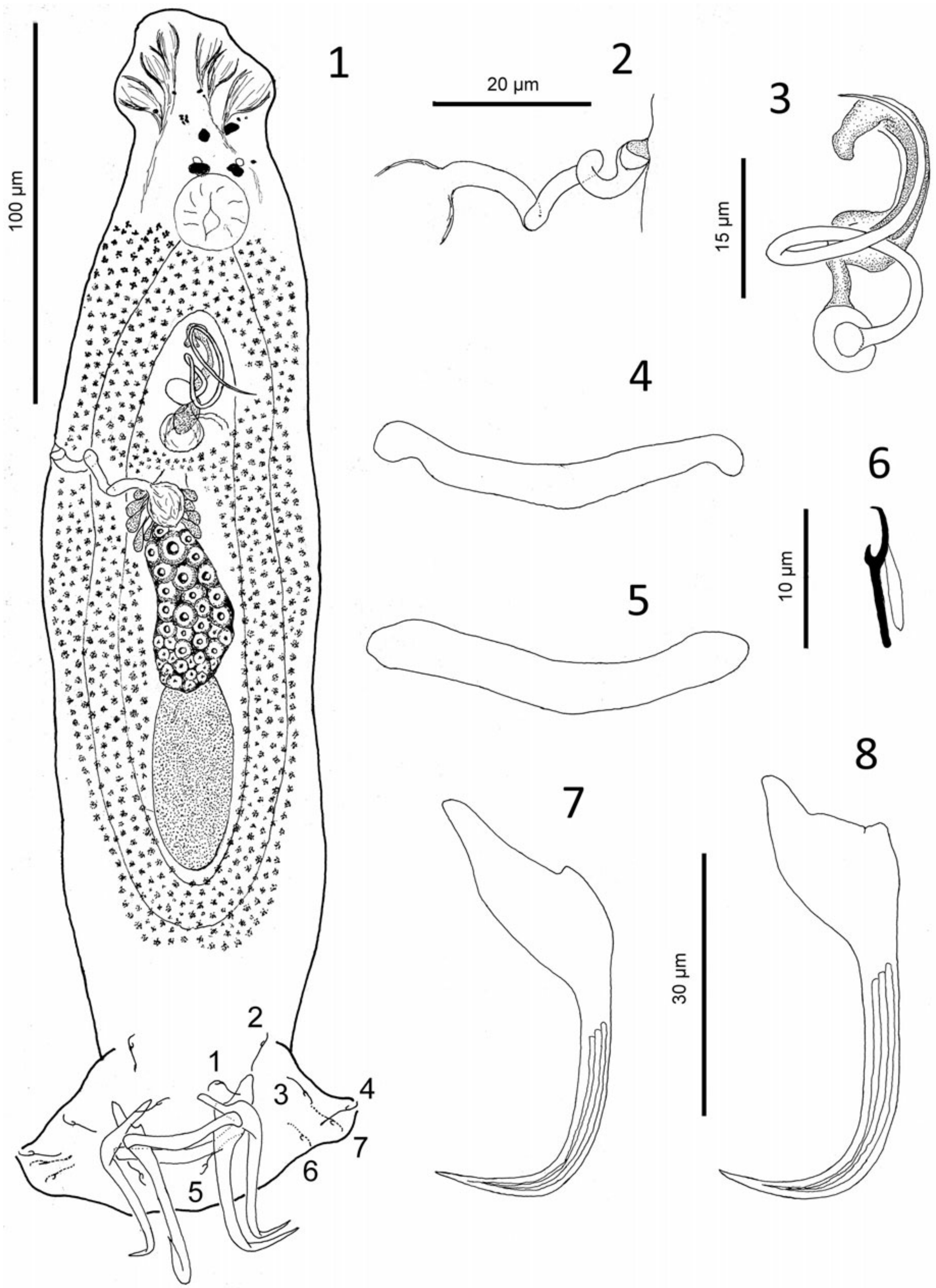
Class Monogenoidea Bychowsky, 1937
Subclass Polyonchoinea Bychowsky, 1937
Order Dactylogyridea Bychowsky, 1937
Dactylogyridae Bychowsky, 1933

Euryhaliotrema lizardi n. sp. (Figs 1–8)

Type host: Blue and gold fusilier *Caesio caerulaurea* Lacepède, 1801 (Perciformes: Caesionidae).
Type locality: Lizard Island, Great Barrier Reef, Queensland, Australia.
Type material: Holotype, QM- G235401; 30 paratypes, QM-G235402-235431, CNHE-10265.
Etymology: This species is named for the study area from which it was collected.
Description: Body 303 (218–380; n = 22) long, fusiform; greatest width 71 (45–103; n = 17) usually near mid-length of trunk. Terminal cephalic lobe rounded, bilateral lobes moderately developed; three pairs of head organs; cephalic glands indistinct. Eyespots four; each posterior eye with lens; members of anterior pair slightly closer together, smaller than those of posterior pair; accessory chromatic granules subovate, small, few to absent in cephalic region. Pharynx subspherical, 21 (18–25; n = 19) in diameter. Peduncle tapered posteriorly; haptor 78 (67–90; n = 27) wide, subhexagonal, with bilateral lobes containing hook pairs 3, 4, 6 and 7 (see Figure 1). Anchors similar; each with tapered superficial root, poorly differentiated deep root, elongate and straight shaft and point extending to near the level of the superficial root tip; shaft and point with longitudinal superficial grooves. Ventral anchor 47 (46–51; n = 8) long; base 20 (20–21; n = 3) wide; dorsal anchor 49 (42–52; n = 8) long; base 17 (15–18; n = 6) wide. Ventral bar 17 (30–47; n = 28) long, with ends directed posteriorly; dorsal bar 37 (32–50; n = 24) long, slightly curved, rod-shaped, slightly expanded at mid-length. Hook 11 (10–12; n = 10) long, with uniform shank, upright acute thumb and recurved point; FH loop about shank length. Male copulatory organ (MCO) a counterclockwise coil with approximately 1.5 rings and bulbous base; copulatory complex 28 (20–41; n = 18) long, containing an MCO articulated by an articulation process to an accessory piece. Accessory piece distally recurved. Gonads slightly overlapping; testis dorsal to germarium 46 (28–60; n = 10) long, 22 (17–32; n = 4) wide. Proximal portion of vas deferens not observed; seminal vesicle spherical; prostatic reservoir small, sigmoid, lies dorsal to seminal vesicle. Germarium 33 (25–40; n = 10) long, 17 (15–20; n = 8) wide, pyriform; oviduct, oötype and uterus not observed. Mehlis' gland-cells well developed, in body mid-line dorsal to large seminal receptacle. Vaginal pore dextromarginal within small indentation of tegumental surface; vaginal canal with distal loop (of one ring) followed by a sigmoid portion before entering the seminal receptacle situated anterior to germarium. Vitellarium in form of dense follicles in lateral fields, coextensive with intestinal caeca, confluent anterior to Mehlis' gland and posterior to gonads. Egg not observed.

Remarks

Placement of this new species in *Euryhaliotrema* is based on agreement with the emended diagnosis provided by Kritsky (2012): species with a bulbous or funnel-shaped base on the copulatory organ; tandem or slightly overlapping gonads (germarium pretesticular); a coiled MCO with counterclockwise rings; an accessory piece, when present, serving as guide for distal portion of MCO; a dextral vaginal aperture; and 14 hooks, each with an upright thumb and a slender shank composed of one subunit. Species of *Euryhaliotrema* (from both freshwater and marine environments) have been reported from six perciform families: the Ambassidae, Chaetodontidae, Haemulidae, Lutjanidae Sciaenidae and Sparidae. Thirty-six



Figs 1–8. *Euryhaliotrema lizardi* n. sp. on *Caesio caerulaurea*. **1** – composite, whole mount, ventral view, **2** – vagina, dorsal view, **3** – male genital complex, ventral view, **4** – ventral bar, **5** – dorsal bar, **6** – hook, **7**– ventral anchor, **8**– dorsal anchor. Scale bars: 1 = 100 µm; 2 = 20 µm; 3 = 15 µm; 4–5, 7–8 = 30 µm; 6 = 10 µm

Euryhaliotrema are known from lutjanids (a family closely related to the Caesionidae, Near *et al*. 2013) worldwide (Kritsky *et al*. 2009; Kritsky 2012; Kritsky and Diggles 2014). *Euryhaliotrema lizardi* n. sp. is the only member of its genus recorded from a caesionid, *Ca. caerulaurea*. *Euryhaliotrema lizardi* n. sp. resembles *Euryhaliotrema atlantica* Kritsky and Boeger, 2002 on *Paralonchurus brasiliensis* (Sciaenidae) from Paraná, Brazil and *Euryhaliotrema cardinale* Kritsky and Justine, 2012 found on Dory snapper, *Lutjanus fulviflamma* (Forsskål) from Récif de Crouy, Nouméa, New Caledonia and Heron Island, Great Barrier Reef, Australia and found on *Lutjanus ehrenbergii* from Nabq Bay, Ras Mohammed National Park (South Sinai, Red Sea). These three monogenoidean species share the following features: accessory piece distally curved (present in *E. lizardi* n. sp. and *E. atlantica*), poorly differentiated deep root of ventral and dorsal anchors (present in *E. lizardi* n. sp., *E atlantica* and *E. cardinale*), vaginal canal with distal loops (present in *E. lizardi* n. sp., *E. atlantica* and *E. cardinale*). *Euryhaliotrema lizardi* n. sp. differs from the two latter species in that it lacks a protruding bulb at the vaginal aperture (present in *E. atlantica*) and by having ventral anchors with an elongate, straight shaft and point (curved short shaft in *E. atlantica* and curved shaft in *E. cardinale*) (Kritsky and Boeger 2002; Kritsky 2012).

***Haliotrema weberii* n. sp.** (Figs 9–15)

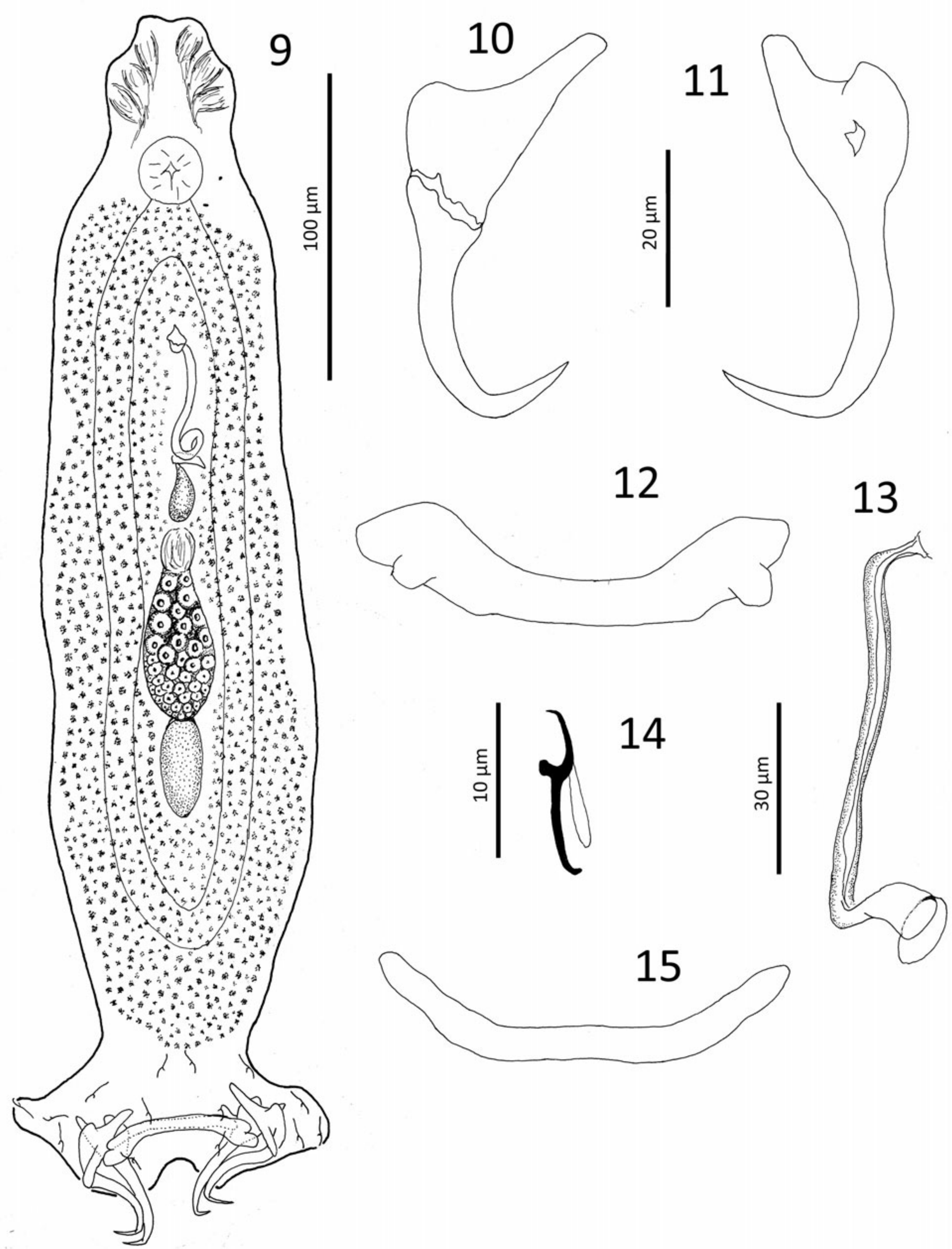
Type host: Weber´s chromis *Chromis weberi* Fowler and Bean, 1928 (Perciformes: Pomacentridae – Damselfishes).
Type locality: Lizard Island, Great Barrier Reef, Queensland, Australia.
Other hosts: *Chromis amboinensis* (Bleeker, 1871), *Chromis atripectoralis* Welander and Schultz, 1951 and *Caesio teres* Seale, 1906 (see Table I).
Type material: Holotype, QM- G235432; 11 paratypes, QM- G235433-235443; 29 vouchers from *Cr. amboinensis*, *Cr. atripectoralis* and *Ca. teres*, QM- G235444-235450, G235451-235465 and G235466-235469, respectively, CNHE-10266.
Etymology: *Haliotrema weberii* n. sp. is named after its host fish species.
Description: Body 396 (310–495; n = 9) long, fusiform; greatest width 100 (65–127; n = 9) usually near mid-length of trunk. Terminal cephalic lobe poorly developed, bilateral lobes poorly developed; three pairs of head organs; cephalic glands indistinct. Eyespots absent; accessory chromatic granules small, ovate to spherical, uncommon in cephalic region. Pharynx subspherical, 21 (20–22; n = 6) in diameter. Peduncle tapered posteriorly; haptor 89 (75–100; n = 8) wide, with bilaterally paired lobes. Ventral anchor 50 (49–52; n = 3) long, base/shaft junction hinged, inconspicuous deep root, elongate superficial root, curved shaft; base 23 (21–27; n = 5) wide. Dorsal anchor 48 (45–50; n = 12) long, perforated, short rounded deep root, elongate superficial root; base 19 (17–22; n = 4) wide. Ventral bar 50 (46–56; n = 10) long, slightly arced on its midportion with bilateral oblong posterior prominences. Dorsal bar 52 (47–58; n = 10) long, rod-shaped with ends directed anteriorly. Hooks 10–11 (n = 11) long, all similar, with protruding and terminally rounded thumb, delicate point, shank comprising one subunit; FH loop about 80% shank length. MCO 46 (38–55; n = 8) long, a straight tube portion, twisted near funnel-shaped base; accessory piece absent. Gonads overlapping; testis dorsal to germarium 25 (20–30; n = 5) long, 16 (11–22; n = 5) wide. Proximal and distal (seminal vesicle) portion of vas deferens not observed; prostatic reservoir small, pyriform. Germarium 53 (47–70; n = 7) long, 26 (20–33; n = 7) wide, ovate; oviduct, oötype and uterus not observed. Vagina inconspicuous, apparently unsclerotised; seminal receptacle anterior to germarium. Vitellarium dense; follicles coextensive with intestinal caeca; lateral fields confluent anterior to copulatory complex and germarium and posterior to gonads. Egg not observed.

Remarks

This new species was allocated to *Haliotrema* (s.l.) on the basis of the generic diagnoses provided by Young (1968) and Plaisance *et al*. (2004). From Young's (1968) generic diagnosis and based on examination of original descriptions of other species of *Haliotrema* in Vala *et al*. (1982), Klassen (1993), Kritsky and Stephens (2001), Plaisance *et al*. (2004), Guevara *et al*. (2005), Sun *et al*. (2007), Sun *et al*. (2011), Dang *et al*. (2010) and Mendoza-Franco and Violante-González (2011), *Ha. weberii* n. sp. most closely resembles *Haliotrema angelopterum* Plaisance, Bouamer and Morand, 2004 from *Chaetodon ornatissimus* and *Haliotrema aurigae* (Yamaguti, 1968) Plaisance, Bouamer and Morand, 2004 from *Chaetodon lunula* on coral reefs of the Indo-West Pacific islands of Moorea (French Polynesia) and Palau (Micronesia), respectively (Plaisance *et al*. 2004) based on the morphology of the dorsal and ventral anchor/bar complexes. *Ha. weberii* n. sp. differs from the two aforementioned monogenoidean species by possessing a straight tube of the MCO (twisted near funnel shaped-base) without an accessory piece (MCO a bent tube near trapezoidal-shaped base with a filamentous accessory piece inserted on it in *Ha. angelopterum* and *Ha. aurigae*) (see Plaisance *et al*. 2004). The present finding represents the second report describing new species of *Haliotrema* on a host species of *Chromis* (the first report was that of Yamaguti [1968] followed by Mildred and Marion [1969] for *Ha. brotulae* Yamaguti, 1968, *Ha. chromidis* Yamaguti, 1968 and *Ha. pterophallus* Yamaguti, 1968 on *Cr. ovalis* (Steindachner, 1900) and *Cr. verater* [Jordan and Metz, 1912]).

Haliotrematoides caesionis (Yamaguti, 1953) Kritsky, Yang and Sun 2009

Hosts: Redbelly yellowtail fusilier *Caesio cuning* (Bloch, 1791) (Perciformes: Caesionidae) and *Caesio teres* Seale, 1906 (see Table I).



Figs 9–15. *Haliotrema weberii* n. sp. on *Chromis weberi*. **9**– composite, whole mount, ventral view, **10**– ventral anchor, **11**– dorsal anchor, **12**– ventral bar, **13**– male genital complex, ventral view, **14**– hook, **15**– dorsal bar. Scale bars: 9 = 100 µm; 10–12, 15 = 20 µm; 13 = 30 µm; 14 = 10 µm

Locality: Lizard Island, Great Barrier Reef, Queensland, Australia.
Specimens deposited: 14 reference specimens from *Ca. cuning*, QM- G235472-235485, CNHE-10263; 8 reference specimens from *Ca. teres*, QM- G235486-235493, CNHE-10264.

Supplemental observations (measurements based on 18 specimens from *Ca. cuning*): Body 545 (340–690; n = 12) long; greatest width 95 (66–115; n = 12). Haptor 77 (68–82; n = 9) wide. Pharynx 35 (32–40; n = 8) wide. MCO 48 (38–55; n = 14) long. Ventral anchor 61 (60–65; n = 8) long; dorsal anchor 56 (54–59; n = 10) long. Ventral bar 37 (36–40; n = 5) long; dorsal bar 28 (25–36; n = 8) long. Hook 12 (11–12; n = 6) long. Germarium 68 (55–80; n = 5) long, 25 (22–27; n = 3) wide; testis 81 (47–100; n = 13) long, 56 (37–70; n = 11) wide.

Remarks

This species was originally placed in *Haliotrema* by Yamaguti (1953) based on specimens collected on *Ca. cuning* from Macassar, Indonesia and later transferred to *Haliotrematoides* by Kritsky *et al*. (2009) based on examination of specimens collected from the same host species around Heron Island, Great Barrier Reef, Australia. The morphology (i.e., base of the dorsal anchor is perforated and the MCO comprises a small saucer-shaped base and delicate coiled tubular shaft appearing G-shaped) and measurements of the present specimens found on *Ca. cuning* and *Ca. teres* (parasite specimens not measured) fit well with those of *Ht. caesionis* provided by Kritsky *et al*. (2009). Species of *Haliotrematoides* (i.e., *Ht. caesionis*) mainly differ from species of *Euryhaliotrema* by having dorsal anchors with perforated bases, a copulatory complex lacking an accessory piece, hook pairs 1, 2 and 3 on the ventral surface of the peduncle (pairs 2, 3 may extend anteriorly on the trunk to the level of the testis) and hook pair 7 on the dorsal surface of the peduncle (these characteristics are absent in *Euryhaliotrema*, i.e., *E. lizardi* n. sp.; see Kritsky *et al*. 2009, present study). Lizard Island is a new locality record for *Ht. caesionis.*

Haliotrematoides patellacirrus (Bychowsky and Nagibina, 1971) Kritsky, Yang and Sun, 2009

Host: Redbelly yellowtail fusilier *Caesio cuning* (Bloch, 1791) (Perciformes: Caesionidae- fusiliers)
Locality: Lizard Island, Great Barrier Reef, Queensland, Australia.
Specimens deposited: 3 reference specimens, QM- G235494-235496.

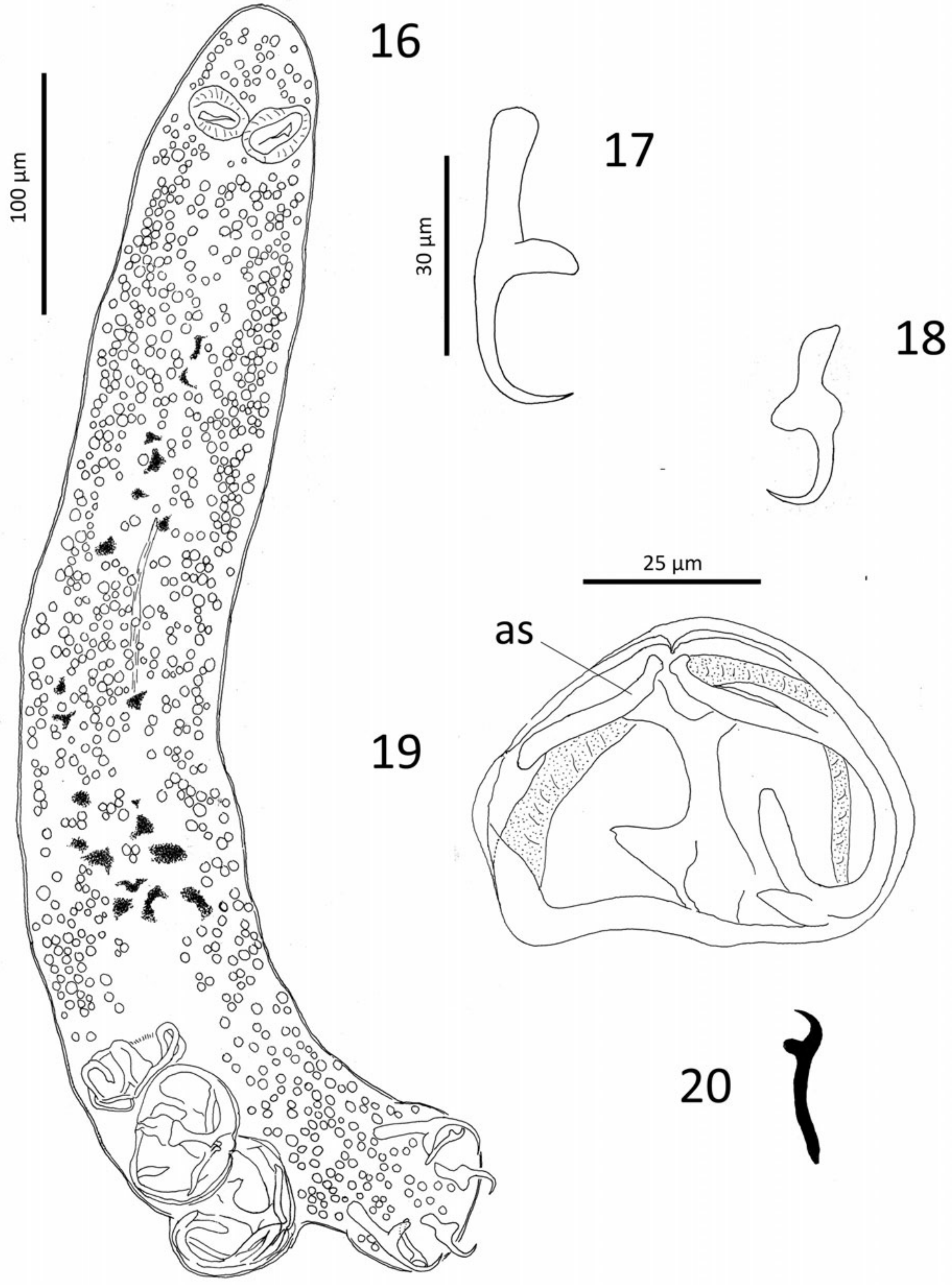
Supplemental observations (measurements based on 3 specimens): Body 340–390 long; greatest width 100–105. Haptor 85 (77–90; n = 3) wide. MCO 55 (45–66; n = 3) long. Ventral anchor 47 (45–50; n = 6) long; dorsal anchor 50 (50–51; n = 6) long. Ventral bar 31 (n = 2) long; dorsal bar 35–41 long. Hook 12 (11–12; n = 5) long. Testis 40 long, 33 wide.

Remarks

This species was transferred from *Haliotrema* to *Haliotrematoides* by Kritsky *et al*. (2009) based on specimens found on six species of *Lutjanus* [*Lutjanus russellii* (Bleeker), *Lutjanus fulviflamma* (Forsskål) (type host), *Lutjanus fulvus* (Forster), *Lutjanus quinquelineatus* (Bloch), *Lutjanus ehrenbergii* (Peters) and *Lutjanus vitta* (Quoy and Gaimard)] from La RégniPre, Nouméa, New Caledonia; Heron Island, Great Barrier Reef, Australia; Récif Crouy, Nouméa, New Caledonia; Nabq Bay, Ras Mohammed National Park (South Sinai, Red Sea), Egypt; and Baie des Citrons, Nouméa, New Caledonia. The present specimens did not differ significantly from those presented in the redescription of *Ht. patellacirus* from *L. russellii* by Kritsky *et al*. (2009) based on the morphology of the MCO which has a proximal platter-shaped base; ventral and dorsal anchors, each with elongate superficial roots (dorsal anchor with inconspicuous or absent deep root); a shaft slightly narrowed distally; a straight recurved point with delicate superficial grooves; and similar measurements of the sclerotized structures. *Ht. patellacirus* is known to occur on lutjanids but is reported for the first time on a caesionid host in the present study. It is added to two other described and/or reported species of *Haliotrematoides* on these hosts. The other two species known to occur on caesionids are *Ht. caesionis* from *Ca. cuning* and *Ht. isolens* Kritsky, Yang and Sun, 2009 found on *Pterocaesio marri* Schultz from Heron Island, Great Barrier Reef, Australia (Kritsky *et al*. 2009; present study). Lizard Island is a new locality record for *Ht. patellacirus.*

Subclass Heteronchoinea Boeger and Kritsky 2001
Infrasubclass Oligonchoinea Bychowsky, 1937
Order Mazocraeidea Bychowsky, 1937
Suborder Gastrocotylinea Lebedev, 1972
Gastrocotylinean in a pre-adult stage (Figs 16–20)

Host: Yellow and blueback fusilier *Caesio teres* Seale, 1906 (Perciformes: Caesionidae- fusiliers)
Locality: Lizard Island, Great Barrier Reef, Queensland, Australia.
Deposition of material: Reference specimen, QM- G235470.
Description (based on a single specimen): Body proper elongate, fusiform; subterminal prohaptoral suckers. Haptor with three unilateral clamps, each with a medial sclerite and paired anterolateral and posterolateral sclerites. Anterior and posterior pairs of ventral anchors; anterior anchors with well-developed superficial roots perpendicular to the longitudinal axis of the anchor, straight shaft and short point; posterior anchors with flattened deep roots and short rounded superficial roots, evenly curved shaft and point. A bilateral pair of usually morphologically distinct hooks situated ventrally near the posterolateral margin of the haptor. Details of the internal



Figs 16–20. Gastrocotylinean pre–adult on *Caesio teres*. **16**– whole mount, ventral view, **17**– anterior anchor, **18**– posterior anchor, **19**– clamp, **20**– hook. Scale bars: 16 = 100 µm; 17–18, 20 = 30; 19 = 25 µm. **as** = additional sclerite

anatomy (i.e., gland ducts and masses, intestine, etc.) could not be determined.

Remarks

Kritsky *et al*. (2011) described two post-oncomiracidial forms (each subdivided in two morphotypes) of the suborder Gastrocotylinea from the gills of flyingfish (Exocoetidae), snapper (Lutjanidae), dolphinfish (Coryphaenidae), and amberjack (Carangidae) from the Gulf of Mexico near Mississippi and Florida (Western Atlantic). In the present study, a new gastrocotylinean post-oncomiracidial form was collected from the gills of *Ca. teres*. This new form is characterized by having three clamps (at least one of them with accessory sclerites [see "as″ in Figure 19], a characteristic of the "gastrocotylid" clamp- see figure 3 in Justine *et al*. 2013) on one side of the haptor (clamps absent in the forms described by Kritsky *et al*. 2011) and by lacking four bilateral pairs of hooks directed ventrally and positioned along the lateral haptoral margin (present in the forms described by Kritsky *et al*. 2011). Considering that the number of clamps may depend on the age of the larval specimen (see Abu 2009), the present form may represent an older larval stage in which hooks have been lost and clamps have begun to form. The present finding represents the first report of a gastrocotylinean pre-adult on a caesionid host species.

Discussion

We found evidence that some congeneric species of Monogenoidea can be present on hosts of different families. For example, we found *Ha. weberii* n. sp. on *Ca. teres* (Caesionidae) and on three species of Pomacentridae. We also found *Ht. patellacirrus*, which is known to occur on six species of lutjanids and on the caesionid *Ca. cunning*. The host range observed in *Ht. patellacirrus* is perhaps not surprising as its two host fish families (i.e., Caesionidae and Lutjanidae) co-occur in the Indo-Pacific and are closely related phylogenetically (see page 49 in Kritsky *et al*. 2009; Near *et al*. 2013). In our study, a gastrocotylinean pre-adult was found only on the caesionid *Ca. teres*.

Our study describes *E. lizardi* n. sp. found on the caesionid host *Ca. caerulaurea* (new host family for a species of *Euryhaliotrema*) and *Ha. weberii* n. sp. found on the pomacentrid host *Cr. weberi*. We also report *Ht. caesionis* from *Ca. cuning* and *Ca. teres* (new host record) and *Ht. patellacirrus* from *Ca. cuning* (new host record) (see Table I). Some of these dactylogyrids appear to parasitize a wide range of hosts: *Ha. weberii* n. sp. was found to occur on four host species from two phylogenetically distinct families (Pomacentridae and Caesionidae – Near *et al*., 2013) sampled here [*Cr. weberi* (type host), *Cr. amboinensis*, *Cr. atripectoralis* and *Ca. teres*]. *Ht. patellacirrus* was known to occur on six host species of Lutjanidae (*L. russellii*, *L. fulviflamma*, *L. fulvus*, *L. quinquelineatus*, *L. ehrenbergii*, *L. vitta* from New Caledonia, Australia and Egypt) (Kritsky *et al*. 2009). Our study now adds a new host species for *Ht. patellacirrus*: the caesionid *Ca. cuning*. This finding suggests that the host specificity of dactylogyrids might be related, in part, to the diversity of host species in the family or closely related families. For example, a wide host range has been observed in species of *Haliotrema*: *Ha. angelopterum* is known to parasitize seven species of *Chaetodon* Linnaeus, 1758 [Chaetodontidae: *C. ornatissimus* Cuvier, 1831 (type host), *C. auriga* Forsskål, 1775, *C. lunula* Lacepède, 1802, *C. vagabundus* Linnaeus, 1758, and *C. citrinellus* Cuvier, 1831 from Moorea (French Polynesia) and *C. kleinii* Bloch, 1790, *C. ornatissimus* and *C. reticulatus* Cuvier, 1831 from Palau (Micronesia)]; similarly, *Ha. aurigae* infects 10 species of *Chaetodon* (*C. auriga*, *C. citrinellus*, *C. vagabundus* and *H. chrysostomus* from Palau, Moorea, Wallis, New Caledonia, Heron Island and Lizard Island; *C. ephippium* Cuvier, 1831 and *C. lunulatus* Quoy and Gaimard, 1825 from Moorea, Wallis, Heron Island and Lizard Island; *C. kleinii* from Wallis, Heron Island and Lizard Island; *C. lunula* from Palau, Wallis and Moorea; *C. ornatissimus* from Palau, Moorea, Wallis and Heron Island and *C. reticulatus* and *C. trifascialis* Quoy and Gaimard, 1825 from Palau) (see Plaisance *et al*. 2004). This host flexibility is likely an important factor mediating the broad distribution of these parasites. These observations suggest that the dispersal range (i.e., distance from which a species can move from an existing population) of these dactylogyrids is potentially quite extensive given the large geographical range over which specimens of closely related species have been collected (Indo-Pacific), and the broad distributions of their hosts. Despite broad geographical distributions having been documented for some dactylogyrids, there are no reports of any Indo-Pacific dactylogyrid species that range into the Western Atlantic even though their potential hosts (i.e., Lutjanidae and Sparidae) occur in tropical marine waters in both of these areas (Kritsky *et al*. 2009). The morphological divergence between species of *Euryhaliotrema* from the Indo-Pacific region versus those from the western hemisphere is generally greater (much older than 3.2 mya) than what is observed in the amphiamerican clades (= geminate species pairs), i.e., in the waters off southern North America (Kritsky 2012). Nevertheless, some authors have suggested geminate relationships among species of *Euryhaliotrema* occurring in these two regions. For example, *E. diplops* Kritsky, Yang and Justine, 2012 in Kritsky (2012) and *E. cryptophallus* Kritsky and Yang 2012 in Kritsky (2012) infecting the Indo-Pacific lutjanid *L. argentimaculats* (New Caledonia and China) more closely resemble *E. fastigatum* (Zhukov, 1976) Kritsky and Boeger, 2002 from the western Atlantic (Gulf of Mexico) than they do to other co-occurring congeners. In our study, *E. lizardi* n. sp. from Australia resembles *E. atlantica* from Brazil. While convergence cannot be discounted, the morphological similarities among these monogenoids suggest that host switching by monogenoids between various lutjanid species occurred before populations were isolated by the rise of the isthmus of Panama [i.e., during an early Miocene diversification of an Indo-Pacific lutjanine lineage that dispersed into the western Atlantic via the Panamanian Gateway (Gold *et al*. 2011)].

Until now, none of the six caesionid and pomacentrid species examined in our study have been described as hosts of any adult gastrocotylinean species. A possible explanation for the absence of such records might be that these hosts are decoys rather than regular hosts of gastrocotylinean species. Decoy hosts are thought to dilute the susceptible fish-host population by intercepting infective larvae (oncomiracidia) and decreasing the abundance of these parasites on their typical hosts (Kritsky *et al*. 2011). For example, these latter authors suggest that exocoetids, lutjanids, coryphaenids and carangids from the Gulf of Mexico in Mississippi and Florida may be acting as decoy hosts for the gastrocotylinean post-oncomiracidia forms found in their gills. However, in contrast to the early-stage forms typically found on decoy hosts, the pre-adult stage gastrocotylinean found on *Ca. teres* in the present study appears to be developing on this host. This suggests that *Ca. teres* may in fact be a true rather than a decoy host for this gastrocotylinean species.

Parasites are essential, yet often overlooked components of healthy ecosystems (Hudson *et al*. 2006). Given the sheer biomass and diversity of parasites in natural systems (Hatcher and Dunn 2011; Kuris *et al*. 2008) and the broad suite of effects they can have on hosts performance and behavior (Barber *et al*. 2000; Binning *et al*. in press), it is imperative that researchers consider the role that parasites play in the community dynamics of natural ecosystems. This can only be done after most of the parasite fauna in a given environment are collected and described. Morphological descriptions are essential for understanding patterns of biological diversification in helminth parasites and should be complemented by molecular studies whenever possible to help resolve phylogenies and strengthen biological inventory databases. Currently, there are insufficient molecular data to revise *Haliotrema* (s.l.). Therefore, our placement of *H. weberii* n. sp. in this genus is based on a morphological comparison with congeneric species and is provisional until a complete revision of *Haliotrema* is carried out. Importantly, our results add to the growing number of new parasite species described from fish hosts in the Indo-Pacific, a hotspot for fish biodiversity (Bellwood *et al*. 2012).

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