Egyptian Journal of Aquatic Research (2014) **40**, 451–458

HOSTED BY

ELSEVIER

National Institute of Oceanography and Fisheries

Egyptian Journal of Aquatic Research

http://ees.elsevier.com/ejar
www.sciencedirect.com

FULL LENGTH ARTICLE

Digenetic trematodes from siganid fish *Amphacanthus sigan* at Macady Bay, Southern Hurghada, Red Sea, Egypt

Mohey El-Din Z. Abd El-Latif [a], Tarek Abdel-Aziz Ahmed Mohammed [b,*]

[a] *Faculty of Science, South Valley Uni, Egypt*
[b] *National Institute of Oceanography and Fisheries, Red Sea Branch, Hurghada, Egypt*

Received 29 July 2014; revised 3 November 2014; accepted 3 November 2014
Available online 29 November 2014

KEYWORDS

Digenetic trematodes;
Helicometra;
Gyliauchen;
Siganid fish;
Red Sea;
Egypt

Abstract Forty fish samples of *Amphacanthus sigan* were collected from Sharm El-Naga southern Hurghada to study the parasitic infection included and present a new individual to Helicometra species using light microscope and re-describe another digenean trematode species using scanning electron microscope (SEM). Two trematode species were identified and described; *Helicometra siganus* n. sp. Nov belonging to Helicometra Odhner, 1902 (family Opecoelidae Ozaki, 1925) which is different from all the listed species in many features as having an elongated body, tapering anteriorly and larger sucker ratio; the vitellaria extended from the intestinal bifurcation to the posterior extremity of the hind-body and finally the cirrus sac and cirrus longer than the other species and extended to the midpoint of esophagus level. So, these criteria are specific and sufficient to consider it as a new species. The other species, Gyliauchen volubilis Nagaty, 1956 (Gyliauchenidae Fuki, 1929 and Ozaki, 1933) which was described before but some other constituent are not evident and appeared using the electron microscope. However, the present sample illustrated transverse striations on the body surface, the acetabulum evaginates outward, ovoid shaped and surrounded by lip-like structures and finally, the excretory pore is situated at some distance from the acetabulum at the posterior end extremity.

© 2014 National Institute of Oceanography and Fisheries. Hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/3.0/).

Introduction

Parasitic helminths of the fishes are one of the least known parts of the Red Sea fauna (Hassanine and Gibson, 2005). However, study of fish parasitology is one of the more interesting branches for many researchers all over the world especially for the marine fishes for describing the new taxa (Al-Jahdali, 2010) either for the internal or external parasites. The species of the Opecoelid genus *Helicometra* Odhner, 1902 (family Opecoelidae) are the most widespread and frequent members having many different species especially in the marine fishes of the shallow and deep-water. Sekerak and Arai (1974) reviewed the genus *Helicometra* and divided the valid species into three groups as follows: Group (a); includes species with a short cirrus sac and vitellaria follicles extending

* Corresponding author.
E-mail address: tare_mote@yahoo.com (T.A.-A.A. Mohammed).
Peer review under responsibility of National Institute of Oceanography and Fisheries.

http://dx.doi.org/10.1016/j.ejar.2014.11.001
1687-4285 © 2014 National Institute of Oceanography and Fisheries. Hosting by Elsevier B.V.
This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/3.0/).

anteriorly to the acetabular zone or the fore body; group (b); includes species with a short cirrus sac and vitellaria follicles confined to the hind body; group (c); includes species with a short fore-body and long cirrus sac extending to the hind body. Stosscich (1903) described new species from subfamily Plagioporinae, *Helicometra flava* from the intestine of *Centropristis hepatus* in Italy. Linton (1910) described two new species, *H. torta* from *Epinephelus striatus* and *H. execta* from *Chloichthys bifasciatus* in Florida. Nicoll (1910) synonymized *H. fasciatus* (Rudolphi, 1819) Odhner, 1902 with *H. pulchella*. Isaichikov (1928) described another new species *H. plovmorini* from intestine of *Lycodes agnostus* and *Aspidophoroides alriki* in Russia and transferred *Allocreadium labri* (Stosscich, 1886) Odhner, 1901 to genus *Helicometra* as *H. labri* (Stosscich, 1886) Isaichikov, 1928. Manter (1933) synonymized *H. labri* (Stosscich, 1886) Isaichikov, 1928 with *H. pulchella* (Rudolphi, 1819) Odhner, 1902. Ramadan (1986) described *Helicometra* Odhner, 1902 as *H. epinepheli* Yamaguti, 1934 from *Balistes aculeatus* and *Anampses caeruleopunctatus* as a new species from the Red Sea. *H. boseli* was collected from the intestine of *Holocentrus samara* from Hurghada, Red Sea, also Nagaty (1956) described *H. hypoditis* Yamaguti, 1934 from *Serranus (=Epinephelus)* sp. Aken'Ova et al. (2006) described new species named *Helicometra sprenti* in Australian waters. Many other studies on the trematodes of fishes had been carried out including the examination of fishes infested by helminth parasites in the Red Sea (started by Nagaty, 1930 till Ali, 2005) who revealed the existence of more than 89 trematode species were under more than 47 genera from which at least 14 species were new. Many other studies had been done on the Red Sea fish parasites by Hassanine (1995, 2005, 2007). On the other hand, Nagaty (1956) described *Gyliauchen volubilis* from the small intestine of *Amphacanthus sigan*, called "sigan" from Sharm El-Naga in Hurghada. Abdou and Heckmann (2001) studied the fine structure of *G. volubilis* Nagaty, 1956, which has segmented body and is not attached with the outer membrane of the tegument. They illustrated that, its body has two types of vesicles which are scattered in the tegumental matrix. Al-Jahdali (2012) studied the infra-population size or mating group size mostly affects some processes acting within the infra-population of *G. volubilis* Nagaty, 1956 from *Siganus*. Al-Jahdali and Hassanine (2012) studied the life cycle of *G. volubilis* Nagaty, 1956 and pointed out that this species was collected from *Siganus rivulatus* fishes of mangrove swamps at Aqaba Gulf. The current study is aimed to review the available species included in genus *Helicometra* and presents a description of the collected individual using light microscope and re-describe another digenean trematode species using scanning electron microscope (SEM). These species were collected from marine siganid fish *Amphacanthus sigan* at Macady Bay southern Hurghada.

Materials and methods

Forty fish samples were collected from the Sharm El-Naga coast southern Hurghada during summer 2011 and kept alive in aquaria. Fish samples (*Amphacanthus sigan*) were identified

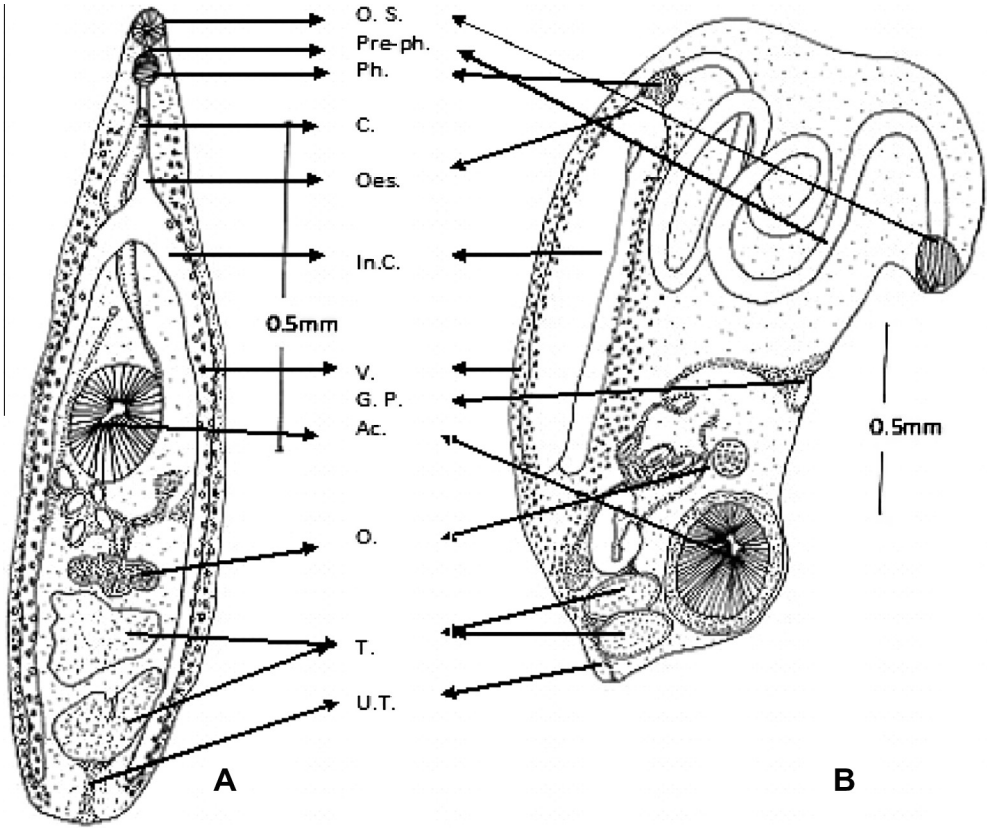

Figure 1 *Helicometra siganus* n. sp. To the left (A) and *Gyliauchen volubilis* Nagaty, 1956 (B). O. S., Oral Sucker; Pre-ph., Pre-pharynx; Ph., Pharynx; C., Cirrus; Oes., Oesophagus; In.C., Intestinal Ceaca; V., Vitellaria; G. P., Genital Pore; Ac., Acetabulum; O., Ovary; T., Testis; U.T., Urinary tube.

according to Randall (1983) and Froese and Pauly (2004). Samples were then dissected to demonstrate the intestinal trematodes. Standard parasitological techniques were used to examine the alimentary canal of the fish. Trematodes were removed from their host fishes under a dissecting microscope and observed alive under a compound microscope. Some worms were fixed in alcohol–formalin–acetic acid (AFA) under a slight cover-slip pressure and preserved in 75% ethyl alcohol. Whole-mounts were stained in aceto-acetic alum carmine; some samples were cleared in terpineol and mounted in Canada balsam.

The collected samples of parasitic trematodes were identified according to Yamaguti (1971) and some of the available recent publications (e.g., Al-Jahdali, 2012; Al-Jahdali and Hassanine, 2012; Hassanine, 2007; Hassanine and Al-Jahdali, 2007; Mohamed and Abdel-Latif, 2007). All measurements are in millimeters (mm) except eggs in μm. The collected trematodes were washed in isotonic saline solution for several times and relaxed. Each worm was carefully flattened between a slide and a cover slip, and then they were fixed in formal saline (25 formalin and 75 ml saline solutions) and alcohol–formalin acetic acid (AFA) and preserved in 70% ethyl alcohol (Hassanine, 2005) containing 5% glycerin for preventing dryness (Mohamed, 1998). Some other trematode samples were stained in aceto-acetic acid carmine (Mohamed and Abdel-Latif, 2007) then cleared in clove oil and mounted in DPX. Some other samples were preserved in cold glutaraldehyde to be scanned by the SEM at South Valley University. Reference sample specimens were preserved in the National Institute of Oceanography and Fisheries, Red Sea Branch, Hurghada.

Results and discussion

The fish *Amphacanthus sigan* was observed highly infected with several types of parasites with high number of trematodes. The present results are based on description of 17 samples of ***Helicometra*** (Fig. 1A) and 11 samples of *Gyliauchen volubilis* Nagaty (Figs. 1B and 2–5) as the following description.

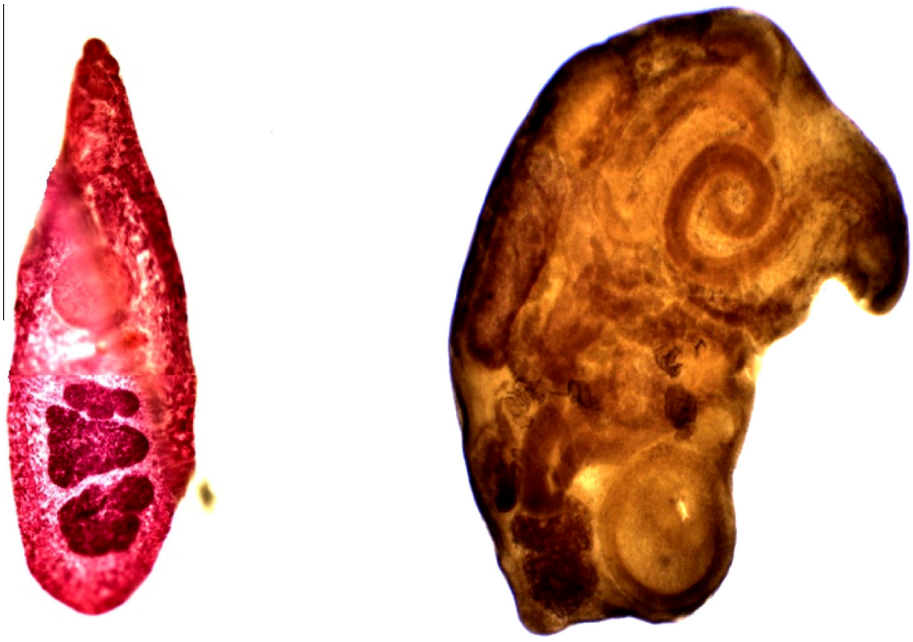

Figure 2 Photography of *Helicometra siganus* n. sp. (to left) and *Gyliauchen volubilis* Nagaty, 1956 (right).

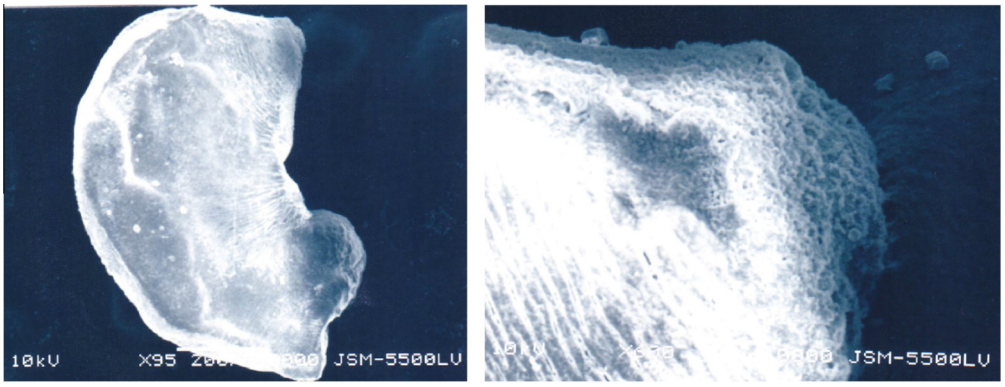

Figure 3 Scanning electron microscope illustrated the whole length of the fluke *Gyliauchen volubilis* Nagaty, 1956 to left side and enlarged part of the oral sucker to right.

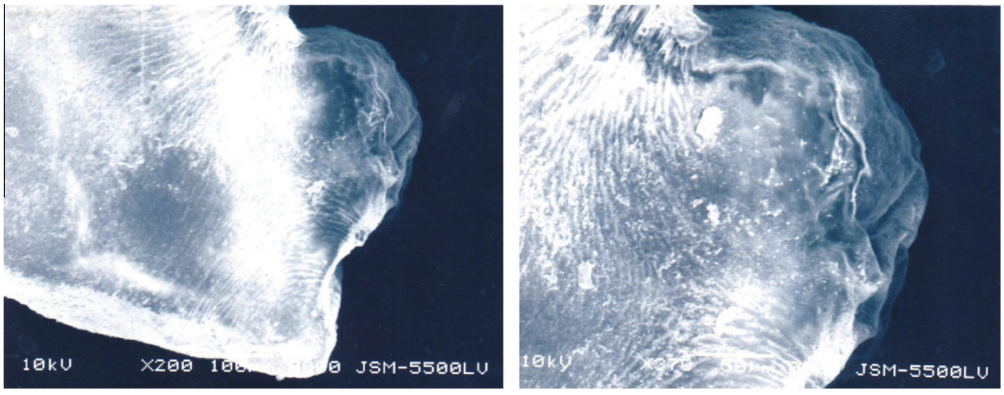

Figure 4 The posterior part of the fluke using SEM (left side) and enlarged part of the acetabulum.

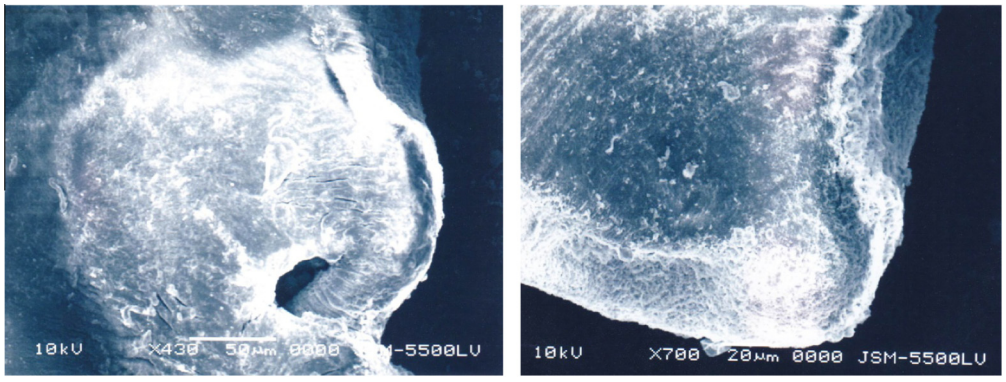

Figure 5 The genital pore of *Gyliauchen volubilis* (left) and the excretory pore (right) appeared by SEM.

Family:	Opecoelidae Ozaki, 1925, emend. (Syn. Coitocoecidae Ozaki, 1929) Podocotylidae Dollfus, 1960.
Sub-Family:	Plagioporinae Manter, 1942.
Genus:	Helicometra Odhner, 1902 (syn. Laqborchis Lühe Stossich, 1902)
Species:	***Helicometra siganus* sp. Nov.** (Figs. 1A and 2)

The body is elongated, tapering anteriorly, aspinose and rounded posteriorly, its length is ranging between 1.59–1.65 mm by 0.44–0.61 mm width (Fig. 1A). The oral sucker is small and rounded in shape and located at the anterior terminal, with ventral aperture. The oral sucker diameter is varied between 0.11 mm and 0.13 mm at maximum. The acetabulum is rounded to oval in shape, located at the end of anterior half of the body, measuring 0.25 mm length by 0.31 mm width. The pre-pharynx is not distinguished and a muscular well developed pharynx was observed and measuring 0.05×0.08 mm. The esophagus is cylindrical not so long, measuring 0.11 mm length. It bifurcates in the middle of the anterior half of the body into two long and cylindrical intestinal caeca, running blindly to the posterior extremity of the body. The testes are paired, diagonal, with irregular shape and located in the posterior half near the end of the body. The anterior testis measures 0.27 mm length by 0.11 mm. width, while the posterior testis measures 0.165 mm length by 0.32 mm width. The ovary is irregular in shape, located pre-testicular mass and measures 0.25 mm length by 0.18 mm width. Cirrus pouch is less developed, while the cirrus is well developed, located between the ventral sucker and intestinal bifurcation, opening before the intestinal bifurcation and measures 0.27 mm length. The vitellaria are small follicules and numerous in numbers, running in two parallel rows along the sides of the body, from the level before the intestinal bifurcation to the posterior extremity of the body. The uterus is convoluted and extending from pre-ovarian to the level of the acetabulum, containing eggs. Eggs are rounded, embryonated, yellow in color, very large in size with a polar filament and measure 0.065 mm length by 0.041 mm width. The excretory vesicles are short tubular with I-shaped and open at the extremity posterior end of the body. There are many different species described and included within the genus *Helicometra* (Odhner, 1902), where most of the collected and described species are listed in Tables 1 and 2 and collected from marine fishes. Reversat et al. (1989) showed that the genus *Helicometra* consists neither a complex of strictly specific species nor a single very polymorphous species with broad specificity. Indeed, the existence of at least three species is shown with different degrees of specificity for their final hosts of fishes (teleosts).

The present species is closely related to *Helicometra* (Odhner, 1902) due to the general characters and morphology which related to most of the illustrated species

Table 1 *Helicometra* species with a short cirrus sac and vitellaria follicles extending anteriorly to the acetabular zone or the fore body.

Characters	*H. pulchella* (Rudolphi, 1819) Odhner, 1902	*H. pulvomornini* Isaichikov, 1928	*H. grandora* Manter, 1954	*H. indica* Agrawal, 1964	*H. borneoensis*, Fischthal and Kuntz, 1965	*H. kylitrema*, Pritchard, 1966	*H. paracirrhiti*, Pritchard, 1966	*H. gomphosi*, Yamagoti, 1970	*H. robinsorum*, Overstreet & Martin, 1974	*H. filamentosa*, Madhavi, 1975	*H. pulchella* (Rudolphi, 1819) Odhner, 1902; Ali (2005)	*H. equilata* (Manter, 1933) Siddiqi & Cable, 1960	*H. pteroisi* (Gupta, 1956) Siddiqi & Cable, 1960	*H. spiniferi* n. sp. (Ali, 2005)
Body length	0.41–4.7	1.48–2.14	2.48–3.74	3.23	2.25	2.41–3.07	1.64–1.71	0.6–0.8	1.59–2.99	1.84	2.8–3.85	0.87–1.86	4.2–4.5	2.34–3.22
Fore body/ total body length	1/5–2/5	1/3	1/4–13	1/4	1/4	2/5	1/4	1/3	1/5–1/3	5/8	1/3	1/5	1/5	1/5
Oral sucker	0.07–0.29	0.18–0.32	0.38–0.48	0.31	0.22	0.38–0.45	0.17–0.18	0.08–0.09	0.19–0.26	0.2	0.23–0.31	0.09–0.12	0.16–0.22	0.23–0.31
Acetabulum	0.10–0.48	0.26–0.42	0.32–0.41	0.35	0.29	0.45–0.56	0.22	0.11–0.12	0.35–0.51	0.28	0.36–0.48	0.11–0.19	0.17–0.36	0.36–0.48
Sucker ratio	1: 1.0–2.4	1:1.13–1.15	1:0.8–0.9	1:1.1	1:1.5	1:1.2–1.4	1:1.2	1:1.3–1.4	1:1.7–2.1	1:1.4	1:1.54–1.56	1:1.2–1.6	1:1.1–1.5	1:1.54–1.56
Testes shape	Lobed or unlobed	Deeply idented	Lobed	Lobed	With wavy border	Lobed	Unlobed	Unlobed	Lobed	Unlobed	Lobed	Lobed	Lobed	Lobed
Extension of cirrus sac	To posterior border of acetabulum	To posterior border of acetabulum	To mid-acetabular level	To a short distance behind the acetabulum	To posterior border of acetabulum	To mid-acetabular level	To a short distance behind the acetabulum	To the posterior border of acetabulum	To a short distance behind the acetabulum	Overlapping the anterior third of acetabulum	To near posterior border of acetabulum	To mid-way between acetabulum and ovary	To mid-way between acetabulum and ovary	To the level of ovary
Ovary shape	Lobed	Lobed	Lobed	Lobed	Unlobed	Lobed	Lobed	Unlobed, reniform	Lobed	Lobed	Lobed	Tetra-lobed	Multi lobed	Multi lobed
Extension of vitelline follicles	From anterior border of acetabulum to the level of pharynx	To mid-acetabular level	From anterior border of acetabulum to level of cecal bifurcation	To a short distance behind the acetabulum	8 pairs of lateral clusters extending longitudinally around each cecum	From the level of acetabulum to the middle of the forebody	From anterior border of acetabulum to level of cecal bifurcation	From anterior border of acetabulum to level of esophagus	To the anterior border of acetabulum	To cecal bifurcation	To cecal bifurcation	To posterior border of acetabulum	To cecal bifurcation	To cecal bifurcation
Egg length (μm)	30–100	67–72	68–84	80–120	46–53	50–58	35–42	40–49	44–74	51	33–38	45–56	38–41	30–35
Egg width (μm)	11–42 μm	27–36	26–34	25–30	26–33	26–34	21–25	23–39	22–35	27	22–26	24–27	19–26	22–25

(All measurements are expressed in mm except eggs in μm).

Table 2 A comparison between the present species and other species of *Helicometra*.

Characters	*H. boseli* Nagaty, 1956	*H. nasae* Nagaty and Aal, 1962	*H. cociellae* Hassanine, 1995	*Helicometra* sp. (Mohamed 1998)	*Helicometra hurghadus* sp. nov. (Mohamed and Abdel-Latif, 2007)	*H. hypoditis* (Yamaguti, 1934) Nagaty, 1956	*H. hypoditis* Yamaguti, 1934 (Mohamed 1998)	*H. hypoditis* Yamaguti,1934 (Mohamed and Abdel-Latif, 2007)	The present study
Body length	0.27–4.09	3.15–6.3	3.56–4.53	1.42	1.52–1.61	2.16–2.3	0.97–1.59	1.48–1.58	(1.59–1.65) ± 0.025
Body width	0.39–0.99	0.48–0.5	0.44–0.66	0.49	0.46–0.52	1.21–1.01	0.35–0.64	0.43–0.48	(0.44–0.61) ± 0.079
Oral sucker	0.193–0.22	0.18–0.24 × 0.20–0.30	0.18–0.25 × 0.17–0.22	0.11–0.13 × 0.18–0.20	0.095–0.099 × 0.11–0.13	0.21–0.25	0.08–0.13 × 0.14–0.15	0.12 × 0.13	0.11 ± 0.01 × 0.13 ± 0.01
Acetabulum	0.23–0.36	0.21–0.35 × 0.23–0.35	0.23–0.30 × 0.22–0.33	0.22–0.20 × 0.15–0.14	0.21–0.23 × 0.17–0.18	0.33	0.14–0.20 × 0.21–0.22	0.21 × 0.17	0.25 ± 0.01 × 0.31 ± 0.01
Sucker ratio	01:01.4	–	–	01:02	01:03.3	01:01.4	1: 1.48–1.6	1:1.42–1.75	1:5.4
Anterior testis	–	–	0.29–0.44 × 0.26–0.36	0.13 × 0.26	0.195 × 0.214	0.29 × 0.52–0.59	0.08–0.15 × 0.11–0.29	0.106 × 0.213	0.11 ± 0.01 × 0.27 ± 0.01
Posterior testis	–	–	0.32–0.47 × .25–0.38	0.14 × 0.24	0.149 × 0.149	–	0.11–0.20 × 0.15–0.29	0.15 × 0.194	0.165 ± 0.25 × 0.32 ± 0.13
Ovary	–	–	0.14–0.25 × 0.14–0.17	0.13 × 0.20	0.11 × 0.227	0.16 × 0.24	0.07–0.18 × 0.08–0.25	0.10–0.11 × 0.20–0.21	0.18 ± 0.01 × 0.25 ± 0.01
Vitellaria	From acetabulum to posterior end	From acetabulum to posterior end	From acetabulum to posterior end	From the pharynx to the body end	From the intestinal bifurctation to the body end	From pharynx level to the posterior end	From pharynx level to the posterior end	From the intestinal bifurcation to the posterior end	Before the intestinal bifurcation to the body posterior end
Egg length	0.05	0.05	0.040–0.052	0.052	0.26–0.286	0.040–0.060	0.067	0.046 x	0.065 ± 0.001
Egg width	0.035	0.03	0.026–0.033	0.029	0.162–0.156	0.030–0.040	0.033	0.035	0.041 ± 0.001
Hosts	Holocentrus samara	–	–	*Epinephalus summana*	*Lethrinus mahsena* and ***Epinephalus summana***	*Serranus* sp.	*Thalassoma* sp. & *Cheilinus* sp.	*Cheilinus fasciatus*, *Epinephalus summana* and *Thalassoma klunzingeri*.	*Amphacanthus sigan*

(All measurements are expressed in mm).

in Tables 1 and 2. On the other hand, Yamaguti (1971) separated the genus *Helicometra* into subgenera as follows: Subgenus *Helicometra* (*Helicometra*) Odhner, 1902 in which, the vitellaria are extended to fore- and hind-body and subgenus *Helicometra* (*Metahelicometra*) Yamaguti, 1971, in which vitellaria are commencing at pre-ovarian level. Sekerak and Arai (1974) reviewed the genus *Helicometra* and divided the valid species into three groups as follows: Group (a) which includes species with a short cirrus sac and vitellaria follicles extending anteriorly to the acetabular zone or the fore body; group (b) that includes species with a short cirrus sac and vitellaria follicles confined to the hind body; group (c) that includes species with a short fore-body and long cirrus sac extending to the hind body. On the other hand, Hassanine (2007) revised the proposed groups into four groups including all species of *Helicometra* possessing a terminal, infundibuliform oral sucker. These groups are re-described as follows:

- Group I includes: Species having a sub-terminal oral sucker, a short cirrus sac with a posterior-most extent lightly posterior to the ventral sucker, and vitelline follicles extending into the region of ventral sucker or into the fore-body such as: *H. fasciata* (Rudolphi, 1819) Odhner, 1902 (type species) [synonyms: *H. pulchella* (Rudolphi, 1819) Odhner, 1902, *H. sinuate* (Rudolphi, 1819) Odhner, 1902, *H. mutabilis* Stossich, 1902 (Stosscich, 1903), *H. flava* Stosscich, 1903, *H. gobii* Stossich, 1883; *H. labri* (Stosscich, 1886) Isaichikov, 1928, *H. epinepheli* Yamaguti, 1934, *H. hypodytis* Yamaguti, 1934, *H. markewitschi* Pogorel.tseva, 1954, *H. dochmosorchis* Manter and Pritchard, 1960, *H. marmoratae* Nagaty and Abdel-Aal, 1962, and more than 15 species of the same characters.
- Group II includes: Species having a sub-terminal oral sucker, a short cirrus sac with a posterior most extending to the ventral sucker, and vitelline follicles to the hind-body: *H. torta* Linton, 1910 (synonym: *H. pretiosa* Bravo-Hollis and Manter, 1957), *H. tenuifolia* Woolcock, 1935 (synonym: *H. neosebastodis* Crowcroft, 1947), *H. bassensis* Woolcock, 1935 and *H. sprenti* Aken.Ova, Cribb and Bray, 2006.
- Group III includes: Species having a sub-terminal oral sucker, a distinctly short fore-body, and a long cirrus sac extending far into the hind-body: *H. equilata* (Manter, 1933) and *H. rectisaccus* (Fischthal and Kuntz, 1964a,b) Fischthal and Kuntz, 1965], *H. pteroisi* Gupta, 1956 and Fischthal and Kuntz, 1965 (synonym: *Stenopera pteroisi* Gupta, 1956) and *H. interrupta* Hassanine, 2005.
- Group IV includes: Species having a terminal, infundibuliform oral sucker: *H. insolita* Polyansky, 1955 [synonym: *Neohelicometra insolita* Polyansky, 1955 (Sekerak and Arai, 1974)], *H. antarcticae* Holloway and Bier, 1968 [synonym: *Neohelicometra antarcticae* Holloway and Bier, 1968 (Sekerak and Arai, 1974)], *H. pleurogrammi* Baeva, 1968 (Sekerak and Arai, 1974) [synonyms: *Allostenopera pleurogrammi* Baeva, 1968, *Helicometra pugetensis* Schell, 1973 and *Neohelicometra pleurogrammi* Baeva, 1968 (Sekerak and Arai, 1974)], *H. sebastis* (Sekerak and Arai, 1974) Bray, 1979 (synonym: *Neohelicometra sebastis* Sekerak and Arai, 1974), *H. rakusai* Zidzitowiecki, 1997, *H. pisanoae* Zdzitowiecki, 1998 and *H. dalianensis* Li, Qiu and Zhang, 1989 and Cribb, 2005 (synonym: *Neohelicometra dalianensis* Li, Qiu and Zhang, 1989).

The present sample *Helicometra siganus* sp. nov. agrees typically and related with the concepts of group IV of genus *Helicometra*, and similar to its mentioned species in containing short fore-body and a long cirrus sac which extent posteriorly to the ventral sucker, but differs significantly from them in having a distinctly obvious pharynx, a distinct esophagus, a very large sucker ratio where the oral sucker reached 1/5 of the ventral sucker, and small vitelline follicles less clustered and arranged in two lateral rows on each side of the body. The vitelline follicles grouped into small clusters are only known in *H. borneoensis* (group I). However, the new species differs from each of the known species of different groups in several other characteristics such as having a larger and elongated fore-body nearly reached about 1/4 of the total length, a cirrus sac extending posterior to about 1/2 the body at distance of the ventral sucker and not reach to the ovary. The vitelline follicles are terminating anteriorly at level of a middle part of the esophagus before the intestinal bifurcation (vs. at the same level of the cirrus opening). It could resemble *H. interrupta* but differentiated from it in having a longer fore-body representing 1/4 of the body length, vitelline follicles terminating anteriorly at the level of the midpoint of the esophagus and before the intestinal bifurcation. Moreover, the present species is characterized by having big sucker ratio, having larger egg sizes (65 μ vs. sizes of 40–28.33 μ). From the point of view of these differences, the present sample is considered as a new species. Generally, five species of *Helicometra* are so far known from the Red Sea fishes: *H. fasciata* [described as *H. hypodytis* Yamaguti, 1934 by Nagaty (1956), as *H. epinepheli* Yamaguti, 1934 by Ramadan (1986) and as *H. marmoratae* Nagaty and Abdel-Aal, 1962 by Nagaty and Abdel-Aal, 1962], *H. equilata* [described as *H. boseli* Nagaty, 1956 by Nagaty (1956)], *H. nasae* Nagaty and Abdel-Aal (1962), *H. interrupta* Hassanine 2005 and *H. aegyptense* [described by Hassanine (2007)].

So, and from the listed Tables 1 and 2 of different species of *Helicometra* we can conclude that, the present sample differs from all the listed species in many features, where the species is unique in having the following characters: **1-** The body was elongated and tapering anteriorly; **2-** The sucker ratio (anterior: posterior) was larger (1/5 of the body) than all listed species in Tables 1 and 2; **3-** The vitellaria extended from the beginning of intestinal bifurcation to the posterior extremity of the hind-body; **4-** The cirrus sac and cirrus were longer than the other species and extended to the midpoint of esophagus level. So, these characters are specific and sufficient to consider it as a new species, and proposed the name *H. siganus*, where the specific name *siganus* refers to the scientific name of *Siganus* fish from which it was collected.

Family:	Gyliauchenidae Fuki, 1929 and Ozaki, 1933
Genus:	*Gyliauchen* Nicoll, 1915
Species:	*Gyliauchen volubilis* Nagaty, 1956

Abdou and Heckmann (2001) studied the fine structure of *Gyliauchen volubilis* Nagaty, 1956, which illustrated, a segmented body, which is not attached with the outer membrane of the tegument. They illustrated that, its body has two types of vesicles which are scattered in the tegumental matrix. There are two layers of subtegumental myofibers, circular and longi-

tudinal. The circular muscle myofibers are grouped into bundles whereas the longitudinal myofibers are densely distributed adjacent to the circular fibers. Numerous polygonal structures whose function has not yet been determined are located beneath the muscle layers. Hassanine and Al-Jahdali (2007) collected *Gyliauchen volubilis* Nagaty, 1956 from of *Siganus rivulatus* (Siganidae) with a relatively high prevalence. They placed the Gyliauchenidae Fukui, 1929 close to the Lepocreadiidae Odhner, 1905. The larval forms of this trematode were found in the gonads and digestive gland of *Clypeomorus clypeomorus*.

They made an ecological study to illustrate the prevalence of digenetic species. Al-Jahdali (2012) studied the infra-population size or mating group size mostly affects some processes acting within the infra-population of *Gyliauchen volubilis* Nagaty, 1956 from *Siganus rivulatus* and were found distributed in a well-defined fundamental niche. He illustrated that, the large flukes tend to have shrivelled-up seminal receptacles and assume the role of sperm donors, inseminating multiple smaller flukes and rarely if ever pair with a worm of equal size.

The present fluke is closely related to *Gyliauchen volubilis* Nagaty, 1956 (Figs. 1B and 2) which was collected previously from *Siganus rivulatus* by many authors starting from Nagaty (1956) and ended by Al-Jahdali (2012, 2013) and Al-Jahdali and Hassanine (2012). The same parasite was collected from the small intestine of siganid fish *Amphacanthus sigan*, where the fluke body has a conical shape, fleshy, tapering anteriorly, convex dorsally, concave ventrally, with small tapered end like protuberance posterio-dorsal to acetabulum. Fully mature specimen is 1.81 mm long and 0.80 mm width with smooth cuticle. The oral sucker is embedded in parenchyma, pyriform and is 0.13×0.15 mm. Acetabulum is located at the posterior end of the body, more or less spherical or rounded in shape with a size of 0.29×0.31 mm. The mouth is narrow and sub-ventral. Prepharynx is very long, convoluted and occupying most of the anterior part of the body. Direction of the coils of prepharynx is in two levels, the ventral most resembling a reversed letter C, followed by a more dorsal counter clockwise C-shaped loop which is followed by an inverted U coil. Pharynx is overlapped ventrally by dorsal most coil of prepharynx, close to intestinal bifurcation. Posterior boarded of pharynx is at about mid-body level or slightly sub-median. The intestinal caeca are short, broad and ending just anterior to gonads at about junction of the 3rd and 4th quarters of the body length. The two testes are spheroid to oval, smooth with sizes reached 0.24×0.13 mm for the anterior one and 0.25×0.13 mm for the posterior one, where they are situated in posterior fourth of the body length, dorsal to acetabulum. Vesicula seminalis external is well developed. Cirrus sac is pyriform, prostate gland is large cluster of cells outside and posterior to cirrus sac. The genital pore is in a median position with a short distance posterior to the mid-body level. The ovary is rounded or spheroid just above the acetabulum and reached a size of 0.13×0.10 mm. Seminal receptacle and Mehli's gland are near the ovary. Vitelline glands are well developed, extending from the level of intestinal bifurcation anteriorly to a level in front of the testis. Uterus is short with few coils, between ovary and the intestinal ceaca and contains few eggs. The egg is large ovoid in shape and reached to 91–98 μm length and 55–59 μm width. Excretory vesicle is small, pyriform and extends anterior to posterior boundary of testes. The genital opening is well developed and opens externally at the middle of the fluke approximately.

Scanning electron microscope study shows that the body of the parasite is c-like shaped with strong cuticle and divided into two parts; the anterior part is broad in which the oral sucker is situated (Fig. 3), while at the posterior part the acetabulum is located (Fig. 4). Moreover, the genital pore is situated at the beginning of the second part of the fluke (Fig. 5). The tegument of the body is bending on it self ventrally and appeared as if it is segmented. The oral sucker is ovoid shaped and protrudes dorsally. The opening of oral sucker is oval in shape and surrounded by a transverse striated tegument. The genital pore opening evaginates outwards like a papilla, oval in shape and situates behind the oral sucker directly. There are transverse striations on the body surface. The acetabulum evaginates outward, ovoid shaped and surrounded by lip-like structures. The excretory pore is situated at a distance from the acetabulum at the posterior end extremity (Fig. 5). Finally, from the above description and the illustrated figures and plates, it is pointed out that the collected sample is the same *Gyliauchen volubilis* Nagaty, 1956 which described by several authors such as; Nagaty (1956), Abdou and Heckmann (2001), Al-Jahdali (2012, 2013) and Al-Jahdali and Hassanine (2012).

Finally, the presence of these two parasites with a large number in the intestinal canal affect the health of mentioned fish economically and may transferred to human by hazardous and consequently affect the human health.

References

Abdou, N., Heckmann, R.A., 2001. Fine structural studies on the intestinal trematode, *Gyliauchen volubilis* Nagaty 1956 from fish *Siganus luridus* in the Red Sea, Egypt. J. Egypt. Soc. Parasitol. 31 (1), 281–294.

Aken'Ova, T.O.L., Cribb, T.H., Bray, R.A., 2006. *Helicometra* Odhner, 1902 (Digenea: Opecoelidae) in Australian waters: problems of species identification and a description of *H. Sprenti* n. Sp. Syst. Parasitol. 63, 17–27.

Ali, H.A.M., 2005. Biological and Taxonomical Studies on the Parasites of Some Economic Families in the Red Sea (Ph.D. thesis). Marine Science Dept. Fac. Sci. Suez Canal Uni. p. 425.

Al-Jahdali, M.O., 2010. Helminth parasites from Red Sea fishes: *Neowardula brayi* gen. Nov., sp. Nov. (Trematoda: Mesometridae Poche, 1926) and *Sclerocollum saudii* sp. Nov. (Acanthocephala: Cavisomidae Meyer, 1932). Zootaxa 2681, 57–65.

Al-Jahdali, M.O., 2012. Infrapopulations of *Gyliauchen volubilis* Nagaty, 1956 (Trematoda: Gyliauchenidae) in the rabbitfish *Siganus rivulatus* (Teleostei: Siganidae) from the Saudi coast of the Red Sea. Parasite 19 (3), 227–238.

Al-Jahdali, M.O., 2013. New intestinal trematodes from siganid fishes off the Saudi coast of the red sea. Acta Zool. Acad. Sci. Hung. 59 (1), 3–12.

Al-Jahdali, M.O., Hassanine, R.M.E., 2012. The life cycle of *Gyliauchen volubilis* Nagaty, 1956 (Digenea: Gyliauchenidae) from the Red Sea. J. Helminthol. 86 (2), 165–172. http://dx.doi.org/10.1017/S0022149X11000186.

Fischthal, J.H., Kuntz, R.E., 1964a. Digenetic trematodes of fishes from Palawan Island, Philippines. Part III. Families Hemiuridae and Lepocreadiidae. Proc. Helminthol. Soc. Wash. 31, 109–120.

Fischthal, J.H., Kuntz, R.E., 1964b. Digenetic trematodes of fishes from North Borneo (Malaysia). Part III. Families Hemiuridae and Lepocreadiidae. Proc. Helminthol. Soc. Wash. 32, 63–71.

Froese, R., Pauly, D., 2004. FishBase (2004/2009). World Wide Web electronic publication. <www.fishbase.org>, version 04/2009.

Hassanine, R.M.E., 1995. Taxonomic and Biological Studies on Some Parasitic Helminth of Certain Fish Species from the Coasts of

SOUTHERN SINAI (Red Sea) (Ph. D. thesis). Mar. Sci. Dept. F. Sci. Suez Canal Uni. p. 374.

Hassanine, R.M.E., 2005. Trematodes from the Red Sea fishes: *Gibsonius aegyptensis* gen. Nov., sp. Nov. (Lepocreadiidae Odhner, 1905) and *Helicometra interrupta* sp. Nov. (Opecoelidae Ozaki, 1925). Acta Parasitol. 50 (4), 276–280.

Hassanine, R.M.E., 2007. Trematodes from Red Sea fishes: on the validity of *Helicometra marmoratae* Nagaty and Abdel-Aal, 1962 and the description of *H. Aegyptense* sp. Nov. (Opecoelidae Ozaki, 1925). Acta Parasitol. 52 (1), 18–23. http://dx.doi.org/10.2478/s11686-007-0004-5.

Hassanine, R.M., Al-Jahdali, M.O., 2007. Ecological comments on the intestinal helminths of the rabbitfish *Siganus rivulatus* (Teleostei, Siganidae) from the northern Red Sea. Acta Parasitol. 52, 278–285. http://dx.doi.org/10.2478/s11686-007-0030-3.

Hassanine, R.M., Gibson, D.I., 2005. Trematodes of Red Sea fishes: *Hexangium brayi* n. Sp. (Angiodictyidae Looss, 1902) and *Siphodera aegyptensis* n. Sp. (Cryptogonimidae Ward, 1917), with a review of their genera. Syst. Parasitol. 61, 215–222. http://dx.doi.org/10.1007/s11230-005-3168-0.

Isaichikov, I.M., 1928. Information on some parasitic worms of the vertebrates of Russian arctic. Trudy Morsk. Nauchn. Inst. 3, 5–79.

Linton, E., 1910. Helminth Fauna of the Dry Tortugas. II. Trematodes. Carnegie Instit.Wash. Publ., Pap. Tortugas Lab 4 (1), 11–98.

Manter, H.W., 1933. The genus *Helicometra* and related trematodes from Tortugas, Florida. Carnegie Instit. Wash. Publ. Tortugas lab. 28 (11), 167–182.

Mohamed, T.A.A., 1998. Studies on Certain Parasites of Some Fishes from the Red Sea (M.Sc. thesis). F. Sci. South Valley Uni. p. 181.

Mohamed, T.A., Abdel-Latif, M., 2007. On some trematodes from certain coral reef fishes off Hurghada, Red Sea, Egypt. Afr. J. Biol. Sci. 3 (2), 61–74.

Nagaty, H.F., 1930. A new Anaporrhutine termatode genus and species *Nagmia yorkei*, with a review of the classification of the subfamily. Ann. Trop. Med. Parasitol. 24, 97–108.

Nagaty, H.F., 1956. Trematodes of fishes from the Red Sea. Part 7. On two Gylauchenids and three Allocreadoids, including four new species. J. Parasitol. 42, 523–527.

Nagaty, H.F., Abdel Aal, T.M., 1962. Trematodes of fishes from the Red Sea. Part 16. On three new species of *Hamacreadium* (Family Allocreadiidae). J. Arab Vet. Med. Assoc. 22, 301–305.

Nicoll, W., 1910. Mitteilungen Zu kenntins der Distomen. Parasitology 3, 322–359.

Odhner, T., 1902. Mitteilungen Zu kenntins der Distomen. J. Zb1. Bakt. I. Orig. 31, 56–69.

Ramadan, M.M., 1986. Trematodes of the genus *Helicometra* Odhner, 1902 (Opecoelidae) and *Apharyngogylauchen* Yamaguti, 1942 (Gylaychenidae) from the Red Sea fishes. Jpn. J. Parasitol. 35 (6), 483–490.

Randall, J.E., 1983. Red sea reef fishes. IMMEL Publishing, 20 Barkely street, Barkely square, London, p. 192.

Reversat, J., Renaud, F., Maillard, C., 1989. Biology of parasite populations: the differential specificity of the genus *Helicometra* Odhner, 1902 (Trematoda: Opecoelidae) in the mediterranean sea demonstrated by enzyme electrophoresis. Int. J. Parasitol. 19 (8), 885–890.

Rudolphi, C.A., 1819. Entozoorum synopsis cui accedunt mentissa duplexet inndices Locupletissimi. Berolini 1, 1–811.

Sekerak, A.D., Arai, H.P., 1974. A revision of *Helicometra* Odhner, 1902 and related genera (Trematoda: Opecoelidae), including a description of *Neohelicometra sebastis* n. Sp.. Can. J. Zool. 52, 707–738.

Stosscich, M., 1886. Brani di helmintolgia tergestinae serie iii. Boll. Soc. Adriat. Sci. Nat. 10, 90–96.

Stosscich, M., 1903. Una nuova speciedi helicmetra odhner. Arch. Parasit. 7, 373–376.

Yamaguti, S., 1934. Studies on the helminth fauna of Japan. Part 2. Trematodes of fishes. Jpn. J. Zool. 5 (3), 249–541.

Yamaguti, S., 1971. Synopsis of Digenetic Trematodes of Vertebrates. Keigaku Publishing Co, Tokyo.