

## SOME STUDIES ON MONOGENEA INFECTIONS IN GILLS OF MARINE WATER FISHES IN EGYPT

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### ABSTRACT

The present study was conducted to investigate the prevalence of monogenetic trematodes species. Clinical signs, lesions and pathological changes appeared on diseased fishes were caught from Ezbet Elborg area (in corresponding to Mediterranean Sea), Damietta province in Egypt. From 380 marine fish samples examined, 62 (16.31%) were positive for monogenetic trematodes. According to fish species, Abu Seif (*Xiphian gladius*) was the most infected 12/50 (24%), then Loot (*Argyrosomus regius*) was 10/51 (19.6%), then Morgan (*Pagellus erythrinus*) was 25/144 (17.36%) and lastly Makarona (*Saurida undoquamis*) 15/135 (11.11%). Regarding monogenetic trematodes species were found to be most infected with more than one of monogenean species, Morgan (*Pagellus erythrinus*) 8/25 (32%) for (3) three infected monogeneans species while Loot (*Argyrosomus regius*) was infected with lowest monogenean species 2/10 (20%). Seven species of monogenetic trematodes infect the infested fish (*Diplectanum aequans*, *Macrovavitrema Caballera* and *Choriocotyle hysterocha* infected Morgan (*Pagellus erythrinus*)), (*Microcotyle chrysophrii* and *Diplectanum jerbuae* infected Makarona (*Saurida undosquamis*)), (*Pseudaxine trachuri*) infected Abu Seif (*Xiphian gladius*) and (*Diplectanum serrani*) infected Loot (*Argyrosomus regius*). Seasonally, the highest infection of monogenean was in summer 23/85 (27.06%) and lowest infection in winter 10/100 (10%), also in spring 17/93 (18.28%) and autumn 12/102 (11.76%). The clinical signs detected on infected fish include loss of appetite, scratching, excessive mucous secretion, ulcers, hemorrhage and respiratory disorders. The pathological studies revealed severe pathological lesions, the changes include hyperplasia in mucous cells, necrosis of branchial epithelium and desquamation epithelial cells due to movement of parasites causing hemorrhage, edema and inflammatory reactions. This study highlights on the prevalence of monogenetic trematodes in some marine fishes in Egypt causing high economic loss in wild marine water fish.

**Key words:** Marine, Fish, Monogenea, gills, Egypt.

### INTRODUCTION

Monogenean trematodes belong to one of the most species rich classes of fish parasites commonly found on fish gills and skin, and may lead to significant fish mortality as a consequence of tissue damage, respiratory distress and secondary bacterial and fungal infections. Many of their biological and ecological traits (Monoxeny, rapid reproduction, hermaphroditism) enable them to cause serious damage in both wild species and farmed stocks (Dezfuli *et al.*, 2007; Lia *et al.*, 2007; Stroma *et al.*, 2010). Monogeneans have high host specificity and

hence host specificity has often been used to estimate monogenean species richness as a function of fish biodiversity. Monogeneans are also very suitable for mathematical modeling in ecology (Whittington, 1998).

Monogenea is a class of Platyhelminthes parasites trematodes found mostly on external surfaces and gills of freshwater and marine fish (Whittington *et al.*, 2004). Boeger and Kritsky (2001) recognized 53 families based on morphological characters. Most of monogeneans are highly host specific (Hargis, 1955 and Lawler 1981), which aids in the specific identification of worms from a particular host.

Parasitosis by monogenean trematode *neobenedenia melleni* occurred in eight species of native marine fish held captive in the Bahamas. Clinical signs of the disease included reduced feeding, lethargy, cloudy eyes, discoloration, excessive mucous production,

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respiratory disorders and eventually death. This is the first report of *N. melleni* parasitosis in captive white grunts (*Ilaemulon pluineri*), blue-striped grunts (*H. sciurus*), and saucreye porgies (*Calamus calamus*). Tropical marine fish culture maybe constrained by *N. melleni* infections due to the pathogen's virulence and lack of host specificity (Karlw Mueller *et al.*, 1994).

The monogenean parasites of red sea fishes of the gulf of Eilat and Suez at Israel and he collected and described ten *Dactylogyridae* from gills and skin of Littoral and reef fishes (Peperna, 1992). Among monogenea, nine species were observed, *Tetrancistrum mugilis* n. sp. Showed the highest average infestation rate (15-22%), *Eichlidogyrus arthracanthus* (9.68%), *Lamellodiscus* sp (7.72%), *Diplectanum aequans* (3.0%), *D. Laubieri* (2.3%), *AL -lencotyloimami* n. sp (1.01%), *Microcotyle Chrysophrii* (48%), *Chorycotyle hysteroncha* (0.33%), then *Tareenia Suez Canali* n. sp. (0.27%) (Ezz El-Dien, 1994).

Nouha Kaouachi *et al.* (2010) reported that a spatial distribution study of parasite populations of gills from 540 specimens belonging to *Pagellus* genus: *Pagellus acarne*, *Pagellus erythrinus* and *Pagellus bogaraveo* (Sparidae) was realized from the eastern Algeria coastline. A preliminary description allows the distinguishing of eight parasite species belonging to two subclasses: *Monopisthocotylea* and *Polyopisthocotylea*. Rates of parasite species and parasitic indices of host species were calculated. The study findings show that parasitic populations vary depending on the site and host species within the same genus.

Morsi *et al.* (2011) recorded that *Benedenia; Capsalidae* is a genus of important oral and cutaneous fluke parasite of aquarium, cultured and marine fish. Morphological and morphometric characterization of *Benedenia sciaenae*, a monogenean parasite infecting the gills of the brown-spotted grouper fish *Epinephelus chlorostigma* were described by means of light microscopy as a first description from *Epinephelus chlorostigma*. 215 out of 290 (74.1%) fish samples were found to be infected with this ectoparasitic capsalid causing pathogenic and epizootic events.

Nisreen Mahmoud *et al.* (2014) reported that this investigation was realized between December 2012 to November 2013. A total of 400 Sea bream (*Sparusaurata*) were sampled from a private fish farm in Ezbet Elborg area, Domietta province, Egypt and were investigated in terms of monogenean parasites. The prevalence, seasonal dynamics, mean intensity as well as the histopathological influence of the detected monogeneans were estimated. The standard parasitological methods were used in the survey and yielded four monogenean species on the Sea bream

gills: *Furnestinia Echeneis* (58.59% of invaded fish), *Encotyllable spari* 32.81%, *Sparicotyle chrysophrii* 25.78% and *Choriocotyle chrysophrii* 17.19%. The total prevalence was 32% and the highest rate was recorded during summer. With the exception of *Encotyllabe spari*, the detected parasites are new records for the monogenean fauna in Egypt (new geographical record) and also Sea bream (*Sparusaurata*) is a new host record for the monogenean *Choriocotyle chrysophrii*.

The aim of this study is to investigate the effect of monogenetic trematodes on health of marine fishes.

## MATERIALS AND METHODS

A total number of 379 fishes of *Morgan* (*Pagellus erythrinus*), *Loot* (*Argyrosomus regius*), *Abu Seif* (*Xiphian gladius*) and *Makarona* (*Saurida unduquamis*) were examined for monogeneans. Fishes were collected from two areas: Ezbet El Borg area (in corresponding to Mediterranean Sea,) Damietta province and Hurghada city, red sea in Egypt.

Samples were transported in water tanks supplied with oxygen to laboratory and kept alive in aquaria filled with the same water source and examined within few hours for investigation.

- 1- **Clinically:** the clinical signs appeared on fish as movements of fish, operculum movements, skin, fins, eyes and gills colors.
- 2- **Parasitological examination:**  
**Macroscopic examination:** skin, surface, fins and gills were examined by naked eyes for detected lesions and changes due to parasitic infection according to Markewitch (1976).

**Microscopic examination:** after removing opercula and exposing gill arches, each gill was removed carefully from fish, immersed in normal saline to remove any excess gill mucus.

Monogenean parasites were recovered with a Pasteur pipette using a dissecting binocular microscope. The monogeneans were fixed in 4% formalin and the worms were washed with distilled water to remove excess fixative. Worm identification were permanent whole mount preparation, some of the fixed and flattened specimens were stained with acid carmine followed by washing in ascending concentrations of ethyl alcohol series and then cleared in clove oil, xylene and then mounted with Canada balsam. (Ergens and Dulma, 1969). The cover slid prior to being examined under a light microscope.

### 3- Histopathological examination:

The specimens from gills were fixed in 10% natural buffered formalin for routine histopathological examination. The fixed samples were washed in tap water overnight and exposed to ascending concentrations of ethanol (70, 80, 90 and 100%), cleared in xylene and embedded in paraffin. Tissue slides of sumtick sections were prepared and stained by hematoxylin and eosin (H&E). The histopathological preparation was performed according to Bancroft (1996).

## RESULTS

In this study clinical signs include lethargy, anoxia, loss of appetite and scratching Mucous secretion excess, opacity on gills and even ulcers, congestion and hemorrhages and may appear respiratory manifestations, gasping and death (Fig 1).

Out of total 380 examined samples of marine water fish include (*Morgan (Pagellus erythrinus)*, *Makarona (Saurida undoquamis)*, *Loot (Argyrosomus regius)* and *Abu Seif (Xiphian gladius)*), 62 (16.31%) were infested with monogenetic trematodes in gills. The prevalence of monogenean in different fish were the highest infestation present in *Abu Seif (Xiphian gladius)* fish (24%) while the lowest prevalence present in *Makarona (Saurida undoquamis)* (11.11%), also prevalence infestation in *Loot (Argyrosomus regius)* (19.6%) and (17.3%) in *Morgan (Pagellus erythrinus)* fish in table (2).

Types of monogenean parasites in different fish species were found to be *Diplectanum aequans*, *Macrovalvitrema coballera* and *Choriocotyle hysteroncha* in *Morgan (Pagellus erythrinus)*. *Microcotyle Chrysophrii* and *Diplectanum jerbuae* infestation in *Makarona (Saurida undoquamis)*. *Psudaxin trachuri* infestation in *Abu Seif (Xiphian gladius)*. *Diplectanum serrani* infected *Loot (Argyrosomus regius)* in table (3).

Seasonally, the prevalence of monogenetic trematodes in examined fish were the high prevalence infection in summer season (27%) and spring season (18%) but lowest seasonal prevalence was in autumn (11%) and winter (10%). table (4).

The morphological description of detected monogenea species: seven species of monogenea detected in four fish species of marine water fishes.

### Morphological description of the detected monogenean parasites in gills of examined fishes

#### Morphological description of the detected monogenean parasites in *Morgan (Pagellus erythrinus)*:

- 1) *Diplectanum aequans*. Wangener, 1857  
Subfamily: Dactylogydinae

Family: Diplectanidae

Site: gills

Fig: 2

#### Description:

A small monogenean with spined integument and measured 0.95-1.01 mm in length and 0.26-0.28 mm as maximum width. There were two pairs of eye spots, the posterior one was larger than the anterior lying in front of the large elongated pharynx which measured 0.06-0.07 by 0.06-0.08 mm. Also there were three pairs of adhesive head organs and two groups of gland cells which were ventrally located lateral to the pharynx (6-7 cells). The intestinal caeca run posteriorly without reaching the opisthaptor.

- 2) *Macrovalvitrema caballero* et Bravo Hollis, 1955

Family: Macrovalvitrematidae:

Site: gills

Fig: 3

#### Description:

Body nearly cylindrical smooth, prohaptor large, shaped like a wide goblet with two large oral suckers bottom. Opisthohaptor attached obliquely to attenuated posterior end of body proper with 8 large clamps arranged in two longitudinal groups, one group of two suckers dorsal, on the peduncle formed by prolongation of haptor, the other group ventral, each clamp guitar – shaped, with two subequal valves constricted toward middle. Each valve bears at its base a completely sclerotized transverse sclerite which articulates with lateral marginal sclerites as well as median sclerite. At the constricted part there are two more sclerites, a transverse and longitudinal, former reaching to, but not articulating with, the median sclerite, latter long, extending from basal sclerite to near distal end of valve, parallel to short above mentioned marginal sclerite which terminates in a recurved hook. One of the valves terminates in muscular, lobed membrane. At the base of one dorsal clamp is a rudimentary larval haptor provided with two pairs of hooks. Pharynx present behind prohaptor. Intestinal limbs with short lateral branches, united at anterior part of opisthohaptor into a single ramus which terminates dorsally near the posterior end of the body proper clamps are attached. Testes numerous, large, occupying postovarian median area. Genital pore behind pharynx, provided with a disc armed with radial hooks. Ovary pretesticular, in form of a shepherd's crook. Vagina large, dorsal, midway between genital disc and ovary. Viellaria extending from in front of genital disc to beyond cecalunion. parasites of marine teleosts. Type species: *M. Sinaloense Caballero et Bravo Hallis, 1955* (p 1.50, Fig 335, on gills of *Micropogonectes*, Mazatlan, Sinaloa, Oceanopacific *et al.* Norte. 1.82 mm.

- 3) *Choriocotyle hysteroncha*, Fujii, 1944  
Subfamily: choricotylineae  
Family: Diclidophoridae

Site: gills  
Fig: 4

**Description:**

It had elongated body with attenuated anterior end and it measured 2.9 – 3.4 mm length by 0.64 – 0.66 mm as maximum width. The prohaptor had one pair of suckers each was 0.54 – 0.62 mm by 0.038 – 0.096 mm. pharynx was large 0.062 – 0.077 mm by 0.077 – 0.092 mm. the genital pore was median in the region of oesophageal bifurcation and armed with six to eight hooks of 0.016 – 0.02 mm long. Testes were smooth, median post ovarian and 16-20 in number ovary was median, equatorial with pre ovarian seminal receptacle. Vitelline follicles filled most of the body from the level of genital pore till the opisthaptor. Vagina was absent. The opstthaptor measured 0.56 – 0.62 mm long with four pairs of pedunculated clamps, each of 0.16 – 0.18 mm long by 0.21 – 0.25 mm wide. There was a short terminal lappet lying between the last pair of haptoral pedicles bearing two pairs of anchors. The lamps had chitinous pieces and curved lateral bars, while their musculature was asymmetrical.

**Morphological description of the detected monogenean parasites in Abu Seif (*Xiphian gladius*):**

*Pseudaxine trachuirparona* (Perugia, 1889 and Price, 1943)

Subfamily: Dactylogyridae

Site: gills

Fig: 5

**Description:**

Body 5 – 6 mm long, 2 – 2.5 mm wide. Haptor unilateral, with a single row of clamps on its oblique lower edge, terminal lappet with one pair of anchors. Cephalic region on bearing a pair of buccal suckers. Testes numerous, post ovarian. Ovary V – shaped with unequal arms.

**Morphological description of the detected monogenean parasites in Makarona (*Saurida undquamis*):**

*Microcotyle Chrysophrii* (Von Beneden and Hesse, 1863)

Subfamily: microcotylinae

Family: microcotylidae

Site: gills

Fig: 6

**Description:**

It has lanceolated body of 4.70 – 4.90 mm length and 0.50 – 0.56 mm as maximum width at the middle of the worm. Anteriorly, there were a pair of buccal suckers each has a septum and numbers of minute spines. The muscular pharynx was spherical measuring 0.038 – 0.044 mm by 0.044 – 0.048 and

away by 0.076 – 0.082 mm from the anterior margin of the worm, following by the oesophagus with two lateral diverticula. The intestinal caeca bifurcated anterior to the genital atrium and extended posteriorly with inner and outer diverticula till reaching about the level of the haptor. Testes were ovoid, numerous, vary in numbers (12-18) lying in posterior mid region of the body each measured 0.076 – 0.093 by 0.07 – 0.08 mm. the muscular copulatory organ was ovoid in shape. Genital atrium measured 0.10 – 0.12 by 0.12 – 0.13 mm armed with 32 – 38 spines with pointed curved tips, four of them located centrally. The length of spines was 0.18 – 0.51 mm. ovary was pretesticular and v shaped and its extremities directed backward, the genito-intestinal canal cross the ovary. Vitellaria were follicular and coextensive with intestine. The opisthaptor was triangle in profile and bordering with a row of numerous (65-70) pairs of small clamps of uniform structure. No terminal anchors or marginal hooklets were present.

*Diplectanum jebuae* (Bychowsky, 1933)

Subfamily: Ancyrocephallinae

Family: Dactylogyridae

Site: gills

Fig: 7

**Description:**

Flukes of small size. Head region not clearly demarcated. Head organs 3-4 pairs. Eyes 2 pairs. Cephalic gland cells in two groups. Pharynx oval in shape, muscular. Oesophagus very short. Intestinal crura extending posteriorly up to a little behind the testis. Opisthaptor consists of two lateral transverse bars, one median transvers bar, two pairs of anchors and dorsal and ventral squamodiscs. Each squamodiscs with 18-20 rows of arc – shaped lamellae. Each lamella best with samm know like outgrowths, projecting downwards. Marginal hooklets 4-5 pairs present. Ovary median, rounded to oval and pretesticular. Vitellaria well developed, occupying most of the available space in the post bifurcal zone. Testis single, median, rounded to spherical and post ovarian. Vas deferens, short and narrow forming seminal vesicle. Cirrus tubular and bipartite with an accessory piece. Genital pore rounded and post bifurcal. Prostate glands seen at the base of seminal vesicle, scattered irregularly. Body length including opisthaptor 0.775 – 0.821 mm. width across the ovarian region 0.17-0.201 mm. pharynx 0.048-0.056 x 0.56-0.060 mm. opisthaptor 0.142 – 0.144 mm wide. Squamodisc 0.06-0.065 x 0.088 – 0.090 mm wide. Median transverse bar 0.06 – 0.080 mm wide. Dorsal anchors length 0.032 – 0.036 mm. ventral anchor length 0.04 – 0.052 mm. marginal hooklet length 0.01 mm. ovary 0.032 – 0.040 x 0.060 – 0.080 mm. testis 0.080 x 0.048 – 0.068 mm. cirrus width 0.11 – 0.125 mm.

### Morphological description of the detected monogenean parasites in *Loot* (*Argyrosomus regius*):

*Diplectanum serrani* (Yamaguti, 1952)

Site: gills

Fig: 8

#### Description:

Body elongated lanceolate, with haptor well-marked off, 0.45 – 0.66 mm in length, 0.1 – 0.14 mm in maximum width at or near level of genital pore or ovary and testis. Posterior part of body covered dorsal hook 33-54  $\mu$  long from end of ventral root to height of curve of blade, rosal root nodular; ventral hook 42 – 49  $\mu$  long from end of dorsal root to height of curve of blade, ventral root nearly as long as dorsal one, but more attenuated distally; connecting rod 48 – 54  $\mu$  long, swollen at inner end; central bar 75 – 90  $\mu$  long by 12 – 20  $\mu$  wide, blunt-pointed at both ends. Marginal hooklet 8 – 9  $\mu$  long. Squamodisc 39 – 45  $\mu$  long by 33 – 42  $\mu$  wide, consisting of 9 – 11 concentric rows of scales.

Head triangular or trapezoidal, 48 – 70  $\mu$  wide at base, with three pairs of swollen sticky gland ducts on each side. Two pairs of eye spots in front of pharynx. Sticky glands well developed on either side of eye spots and pharynx. Pharynx 27 – 33x21 – 27. Esophagus very short, ceca extending some distance further back of testis and terminating blindly.

Testis oval, 35 – 63x 24 – 42  $\mu$ , situated at about midbody. Vas deferens narrow, running forward along uterus on its sinistrodorsal side, forming a small fusiform vesicular seminalis; ductus ejaculatorius very

narrow, looped in front of vesicular seminalis; muscular bulbus ejaculatorius as observed in *D. epinepheli* Yamaguti, 1938 has not been detected. Copulatory organ 60 – 70  $\mu$  long, consisting of a reniform, chitinous structure, which is divided into four compartments, and whose posterior end is produced into a styliform process, and a fine tubular cirrus proper, whose end is usually more or less winding. The thin-walled muscular sheath enclosing the cirrus proper runs arcuately toward the genital pore and opens along with the uterus. Genital pore ventral to posterior end of prostatic reservoir. Latter elongate sacular, 30 – 40x 15 – 22  $\mu$ , along right side of reniform portion of copulatory organ, into which it opens at the anterior end. Prostate cells extending in dorsal are between copulatory organs and ovary, though not illustrated in the figure.

Ovary 30 – 58x24 – 50  $\mu$ , turning round right cecum, with the attenuated distal portion ventral to the anterior end of the main part, which lies immediately anterodorsal to the testis. The uterus, receiving the shell gland and the seminal receptacle at the very beginning, is provided with fine circular muscle fibers and runs a little obliquely forward. No mature eggs observed. Vagina short cylindrical, opening in left submedian line a little behind genital pore, chitinized at its posterior somewhat swollen part, from which the winding half-chitinized vaginal duct is continued backward. The straight posterior portion of the vaginal duct is however no more chitinous and forms a small receptaculum seminis at its posterior end. Vitelline follicles extending from pharynx to cecal ends.

**Table 1:** Size and length of different types of examined fishes.

Type of examined fish	Length (cm)	Weight (gm)	number
<i>Morgan</i> ( <i>Pagellus erythrinus</i> )	10 – 12 cm	13 – 15 cm	144
<i>Makarona</i> ( <i>Saurida unduquamis</i> )	11 – 13 cm	10 – 12 cm	135
<i>Loot</i> ( <i>Argyrosomus regius</i> )	70 – 75 cm	1000 – 1500 cm	51
<i>Abu Seif</i> ( <i>Xiphian gladius</i> )	100 – 120 cm	1000 – 1500 cm	50

**Table 2:** Prevalence of monogenean parasites in different species of marine fishes.

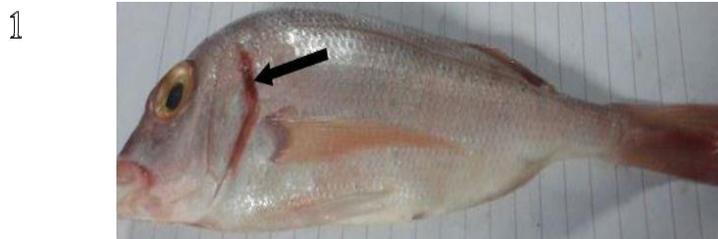
Fish species	No. of exam. Fish	No. of infe. Fish	% of inf. Fish
<i>Pagellus eryrhinus</i>	144	25	17.36
<i>Makarona</i> ( <i>Saurida unduquamis</i> )	135	15	11.11
<i>Loot</i> ( <i>Argyrosomus regius</i> )	51	10	19.60
<i>Abu Seif</i> ( <i>Xiphian gladius</i> )	50	12	24
<b>Total</b>	380	62	16.31

**Table 3:** Types of monogenean parasites in different infested fish species.

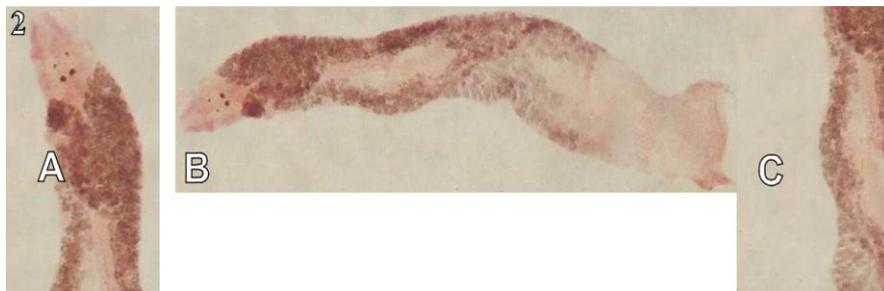
Fish species	Parasites species
<i>Morgan (Pagellus erythrinus)</i>	<ul style="list-style-type: none"> <li>▪ <i>Diplectanum aequans</i></li> <li>▪ <i>Macrovalvitrema coballera</i></li> <li>▪ <i>Choriocotyle hysteroncha</i></li> </ul>
<i>Makarona (Saurida undoquamis)</i>	<ul style="list-style-type: none"> <li>▪ <i>Microcotyle Chrysophrii</i></li> <li>▪ <i>Diplectanum Jerbuae</i></li> </ul>
<i>Abu Seif (Xiphian gladius)</i>	<ul style="list-style-type: none"> <li>▪ <i>Pseudoxine trachuri</i></li> </ul>
<i>Loot (Argyrosomus regius)</i>	<ul style="list-style-type: none"> <li>▪ <i>Diplectanum serrani</i></li> </ul>

**Table 4:** Seasonal prevalence of monogenean parasites in examined fishes.

Season	No. of exam	No. of infested fish	% of inf. Fish
Winter	100	10	10
Spring	93	17	18.28
Summer	85	23	27.06
Autumn	102	12	11.76
Total	380	62	67.1

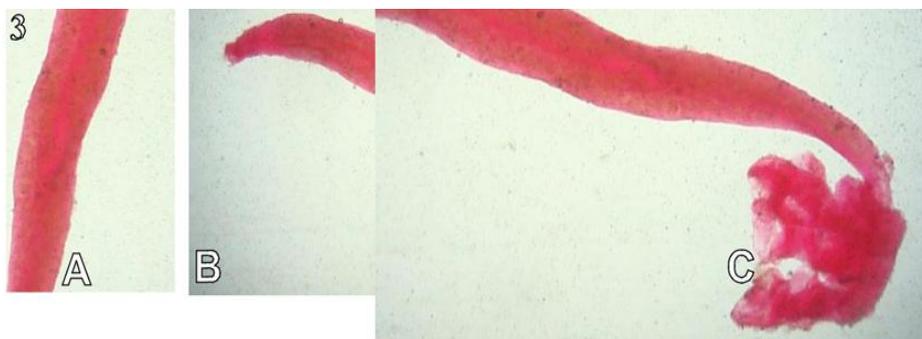


**Fig. (1):** *Pagellus erythrinus* infected with *Diplectanum aequans* in gills



**Fig. (2):** *Diplectanum aequans*

A) The prohaptor; two pairs of eye spots, large elongated pharynx. B) *Diplectanum aequans*, full view. C) The opisthaptor; 3-7 pairs of small marginal hooklets, two pairs of Hamuli.



**Fig. (3):** *Macrovalvitrema coballera*

A) The prohaptor; wide goblet with two large oral suckers. B) *Macrovalvitrema coballera*, full view. C) The opisthaptor; 8 large clamps, one group of two suckers dorsally.



**Fig. (4):** Choriocotyle hysteroncha

A) The prohaptor; one pair of suckers, large pharynx. B) Choriocotyle hysteroncha, full view. C) The opisthaptor; four pairs of clamps.



**Fig. (5):** Psendaxine trachuri

A) The prohaptor; a pair of buccal suckers. B) Psendaxine trachuri, full view. C) The opisthaptor; single row of clamps on its oblique lower edge, terminal lappet with one pair of anchors.



**Fig. (6):** Microcotyle chrysophrii

A) The prohaptor; a pair of buccal suckers, minute spines, muscular pharynx. B) Microcotyle chrysophrii, full view. C) The opisthaptor; triangular in profile with a row of numerous small clamps.



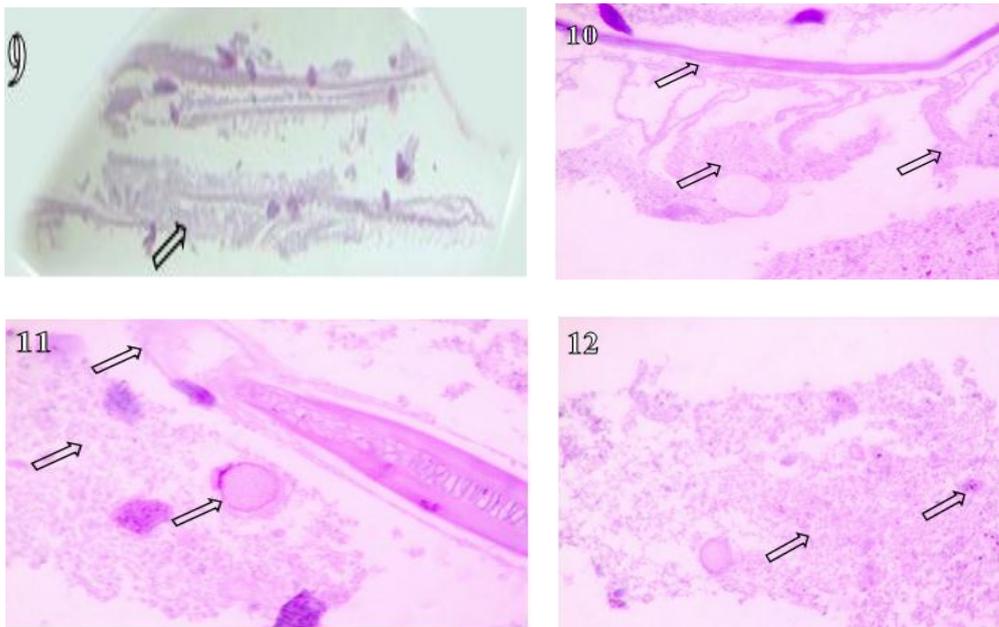
**Fig. (7):** Diplectanum Jerbuae

A) The prohaptor; 3 pairs of head organs, 2 pairs of eyes, cephalic gland cells, oval pharynx. B) Psendaxine trachuri, full view. C) The opisthaptor; two lateral transverse bars, one median transverse bar, two pairs of anchors, dorsal and ventral squamodiscs.



**Fig. (8):** Diplectanum Serrani

**A)** The prohaptor; triangular head, three pairs of gland ducts, two pairs of eye spots, marginal hooklet, squamodisc. **B)** Pseudaxine trachuri, full view. **C)** The opisthaptor; dorsal hook, ventral root of curved blade, nodular dorsal root.



**Fig. (9):** hyperplasia, fusion and necrosis of gill filaments of gill, pagellus erythrinus infected with *Diplectanum aequans*

**Fig. (10):** Dilated branchial vessels and hyperplasia of gill lamellae due to infection with monogenean parasites with large number

**Fig. (11):** The edematous fluid together with inflammatory cells and dilation of branchial blood vessels

**Fig. (12):** Large number of mononuclear cells infiltration due to infection with monogenetic trematodes

#### **Histopathological results:**

The histopathological examination revealed hyperplasia of epithelium of gill filaments, inflammatory reactions, hemorrhage, destruction of gill tissues due to attachment of monogenean parasites with gill filaments by anchors. The infested gills show diffuse degeneration and necrosis in the filament epithelial tissues and dilated blood vessels. The parasites were easily detected in affected gills caused circumscribed area at sites of parasitic attachment. (Fig. 9).

The lesions contain mucous cells, hyperplasia, complete necrosis of branchial epithelium, hemorrhage, edema and desquamated epithelial cells were also observed. (Fig. 10).

The parasitic feeding on lamellar tissue were caused inflammatory reactions and fusion of secondary lamellae and proliferation of gill filaments caused mortality in infested fish. (Fig. 11) The gills were infiltrated with large number of eosinophilic granular cells due to monogenean infestation. (Fig. 12)

#### **DISCUSSION**

In the present study contribute important information on the parasite fauna of some species of salt water fish from Ezbet Elborg areas, Domietta province (corresponding to Mediterranean Sea) and Hurgada city, Red Sea in Egypt. The monogenean parasites were isolated from the gills of *Morgan (Pagellus erythrinus)* and identified as *Diplectanum aequans*,

*Macrovalvitrema coballera* and *Choriocotyle hysteroncha*. Monogenean parasites were isolated from gills of *Makarona (Saurida undoquamis)* and identified as *Microcotyle Chrysophrii* and *Diplectanum jerbuae*. Monogenean parasites were isolated from *Abu Seif (Xiphiangladius)* and identified as *pseudaxine trachuri*. Also monogenean parasites were isolated from *Loot (Argyrosomus regius)* and identified as *Diplectanum serrani*. The morphological characteristics studied by light microscope.

The prevalence of monogenean parasites in *Morgan (Pagellus erythrinus)* was 17.36 this result agreed with (Nouha Kaouachi *et al.*, 2010). The average infestation monogenean parasites in *Makarona (Saurida undoquamis)* was 26% these results not agreed with (Aida A. El Massry and Olfat, Mahdy, 1997).

While the average infestation in *Abu Seif (Xiphian gladius)* was 25%, this result agreed with (Malticucci *et al.*, 2005) were reported the number species identified in the Mediterranean appears to be lower than these reported in Atlantic, on the other hand, the parasite fauna of the Mediterranean population to be represented mainly by specialist species such as the monogeneans *Tristoma* species. The monogenean parasites prevalence of *Loot (Argyrosomus regius)* were low (20%) these result agreed with (Merellaet *et al.*, 2009) were reported that two different batches of meager *Loot (Argyrosomus regius)* were stocked in the same floating cage located in north eastern Sardinia (western Mediterranean Sea). In total is 65 specimens meagre of both stocks were sampled for parasitological analysis present only 1 species of parasite, the microcotylid monogenean *Sciaenacotyle panceri*, was found on the gills of caged meagre.

Seasonally the monogenean parasites prevalence high in summer (27.6%) and spring (18.28%) but low in autumn (11.76%) and winter (10%) these results agreed with (Nisreen Mahmoud *et al.*, 2014) were reported that the highest rate of infestation was recorded during summer (49%) while the lowest was during winter (19%). Regarding the monogenean worms and their morphological status it was noticed that, *Diplectanum aequans* (Wagener 1857, Diesing 1858) were collected from *Morgan (Pagellus erythrinus)* these result which agreed with Nisreen Mahmoud (1994). Concerning with *Macrovalvitrema coballera* were infested *Morgan (Pagellus erythrinus)* was morphological similar to those described by Yamaguti (1963). The presence of *Choriocotyle hysteroncha* in *Morgan (Pagellus erythrinus)* collected from Mediterranean Sea water were recorded by Fuji (1944) and Kohn *et al.* (1984). This result disagreed Nisreen Mahmoud (1994) were reported *Choriocotyle hysteroncha* in *Parusauratus* collected from Suez Canal water. Morphologically it agreed with of materials of Kohn *et al.* (1984) and

Nisreen Mahmoud *et al.* (2014). *Microcotyle Chrysophrii* (Beneden and Hesse, 1863) was collected from *Makarona (Saurida undoquamis)* from Mediterranean Sea and morphologically which agreed with Nisreen Mahmoud *et al.* (2014). *Diplectanum jerbuae* (Bychowsky 1933) was obtained from gills of *Makarona (Saurida undoquamis)*. Such recorded among the marine fishes could attributed in the workers' opinion and according to Gupta *et al.* (1974) that this species was also found on the gills of *Therapon jerbuae* (Forsk.). *Diplectanum serrani* in *Loot (Argyrosomus regius)* collected from Mediterranean Sea. Morphologically, it agreed with materials of Yamaguti (1952).

The histopathological study revealed that *Morgan (Pagellus erythrinus)* infested with *Diplectanum aequans* showed proliferative bronchitis characterized by large number of mononuclear cells infiltration together with fusion and adhesion between the gills lamellae, lamellar edema was noticed where the interlamellar spaces revealed accumulation of edematous fluid together with inflammatory cells and dilation of branchial blood vessels. The proliferation and adhesion between gill lamellae attribute to mechanical injury of infested parasite and the edematous fluid together with inflammatory cells and dilation blood vessels indicates the chemical toxins released from parasite. Therefore, the tissue reaction in our study may be resulted from the defense mechanism of the host against monogenean parasites. These results were agreed with the findings of Paperna (1991), Eid (1997), Abd El-Rhim (1998) and Floravanti *et al.* (2006).

The infestation with monogenean parasites showed characteristic eggs or larvae embedded in the bronchial tissue, this result was in parallel with the finding of Whittington (1990) and Nisreen Mahmoud *et al.* (2014). Also, the gills were infiltrated with large number of eosinophilic granular cells (EGC) and degranulation of some cells. However, the role of EGC in defense mechanism still obscure, these results agreed with Roberts (1978) and Rawia Adawy (2000).

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## بعض الدراسات على الإصابة بديدان المونوجينيا التي تصيب خياشيم أسماك المياه المالحة في مصر

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لقد تم فحص عدد (٣٨٠) سمكة من أسماك الماء المالح وتشمل أسماك المرجان، أبو سيف، اللوت، المكرونة) لدراسة مدى تأثير الإصابة بديدان التريماتودا أحادية العائل (المونوجينيا) ولقد تم جمع الأسماك من عزبة البرج بمحافظة دمياط من مياه البحر الأبيض المتوسط في مصر وقد أثبتت النتائج أن أهم الأعراض الإكلينيكية والصفات التشريحية التي تم ملاحظتها على الأسماك المصابة كانت تشمل احتقان في الخياشيم مع زيادة إفراز السائل المخاطي على الخياشيم المصابة بالديدان وحيدة العائل (المونوجينيا) مع ضعف في شهية الأسماك وظهور مشاكل تنفسية على الأسماك المصابة وكانت نسبة الإصابة بين ٣٨٠ من الأسماك المجمعة التي تم فحصها (١٦.٣١%) إيجابياً. لقد أوضحت الدراسة وجود سبعة (٧) أنواع مختلفة من ديدان المونوجينيا في مصر وكانت تلك الأنواع ديبليكتانم إكوانس، ماكروأوفالتريما كوبلايرا، كوريوكوتيل هاليسترونكا في أسماك المرجان بنسبة (١٧.٣٦%) ووجد ماكروكوتيل كوريوفري، ديبلاكتانم جريبي بنسبة (١١.١١%) في أسماك المكرونة وأيضاً وجد سيداكسين تراكيبوري بنسبة (٢٤%) في أسماك أبو سيف وتم عزل ديبليكتانم سيراني في أسماك اللوت بنسبة (١٩.٦٠%) وكانت أعلى نسبة إصابة بديدان وحيدة العائل (المونوجينيا) في أسماك أبو سيف (٢٤%) أما أقل نسبة إصابة كانت (١١.١١%) في أسماك المكرونة. ولوحظ أن نسبة الإصابة بديدان وحيدة العائل مرتفعة في موسم الصيف والربيع (٢٧%) و (١٨%) على التوالي وكانت نسبة الإصابة منخفضة في موسم الخريف والشتاء (١١%) و (١٠%) على التوالي. تبين وجود تغيرات باثولوجية واضحة في أنسجة خياشيم الأسماك المصابة بالديدان وحيدة العائل (المونوجينيا) في أسماك المرجان. هذه الدراسة تسلط الضوء على نسبة الإصابة من أنواع الديدان وحيدة العائل (المونوجينيا) المختلفة في أسماك الماء المالح في البحر الأبيض المتوسط في مصر وتفيد هذه النتائج الجديدة والحديثة في مقاومة هذا المرض.