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Mode of Attachment and Histopathological Effects of a Polyopithocotylean Monogenean Gotocotyla Secunda (Tripathi, 1956), a Gill Parasite of Scomberomorus Commerson Lacepède 1801 (the Narrow-barred Spanish Mackerel) Collected from the Mediterranean Sea near Damietta City, Egypt

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Abstract

A polyopithocotylean monogenean *Gotocotyla secunda* (Tripathi, 1956), is considered one of the negatively influencing parasitism on the gills of *Scomberomorus commerson* Lacepède 1801 inhabiting the Mediterranean Sea near Damietta City, Egypt has been investigated in this study. The light and scanning electron microscope studies revealed that the parasites attached themselves by grasping one or two tips of the secondary gill lamellae of *S. commerson* and with its elongated body located and extend at the same line to the primary gill lamellae with its head protrudes towards the tips of the primary gill lamellae. Result detects the harmful effect of *G. secunda*, that comprise of the gill lamellae, causing several damages to primary and secondary gill lamellae. These effects cause curling up, erosions, and atrophy of secondary gill lamellae, damaged central core in secondary gill lamellae, secretions of mucus, hemorrhage of blood vessels, vacuole formation and lamellar, hyperplasia of epithelial cells, necrosis of gill filaments. In addition to the secondary gill lamellae of the gill filament as well as of the neighboring gill lamellae were found to be compressed.

Keywords: Monogenea, Attachment, Histopathology, Scomberomorus commerson, Gotocotyla secunda..

Introduction

Kearn (1964) revealed that monogenean parasites attach themselves to gill's fish by means of posterior adhesive apparatus. This apparatus contains mucus glands, hooks, and clamps. The gills of *Scomberomorus commerson* Lacepède, 1800, collected from the Mediterranean Sea near Damietta City are infested with the polyopithocotylean monogenean parasite, *Gotocotyla secunda* Tripathi, 1956. Khidr (1996) made a comparative study of the attachment of monopisthocotylean monogeneans, *Cichlidogyrus halli typicus* and the monogenean *Enterogyrus cichlidarum*

parasitizing the gills and stomach of *Tilapia nilotica* inhabiting the River Nile, respectively. To our knowledge no previous detailed studies have been made on the attachment of polypithocotylean parasite, *Gotocotyla secunda* to their fish hosts.

Eissa and Hala, 1993 and Eissa, 2002, found that monogenean parasites act importance role in determining the healthy status of fish. Besides, they may act either as a primary source of disease or as secondary invaders to other infections (Eissa, 2002). The site of infection of the monogenean trematodes of fish parasites are gills and scales of fish, and may perform positively role on fish as a consequence of tissue necrosis and respiratory disorder (Dezfuli et al., 2007; Lia et al., 2007; Stroma et al., 2010).

Unfortunately, *Microcotyle pomatomi* caused mortality in *Pomatomus saltatrix* (bluefish) and striped bass (Buckel and McKown 2002). This parasite resulted a hypo-chromic anemia and decreased gill function. Besides, *Microcotyle mulgilis* caused severe losses in Greek mullet during summer (Ragias et al. 2005). To produce healthy fish farm management, Suliman et al. (2021) revealed histopathological effect by some ecto-parasites on fish gill's racker. Because of this and the unique ecosystem of Damietta governorate, the present study aimed to conduct to study the way in which *Gotocotyla secunda* attach to the gills as well as its histopathological impacts on the fish host, *Scomberomorus commerson*.

Materials and methods

Specimens of *Scomberomorus commerson* Lacepède 1801 were caught from Mediterranean Sea near Damietta city, Egypt. After killing fishes, the gills were separated and placed in a petri-dish containing sea water and searching the parasites, *Gotocotyla secunda* by using stereo-microscope.

To study the histopathological effects of monogenean parasite, the infected and uninfected gills' rackers were preserved in neutral buffered formalin (10%). According to Roberts (1978) thin sections of paraffin (5-µ thick) were made then stained with hematoxylin-eosin (H & E). Prepared mounts were observed under the microscope.

For electron microscopy (SEM), specimens of monogenean *Gotocotyla secunda* were preserved in glutaraldehyde (2.5%) at 4°C then, washed several times in buffer solution and post-fixed with 1% osmium tetroxide for 2 hours. Afterwards, monogenean specimens were dehydrated in an alcohol series and acetone, dried in a critical-point dryer, gold-coated, and observed under a JSM-5910LV JEOL SEM. Ultrathin sections were contrasted and examined by using a transmission electron microscopy (TEM).

Results

The stained sections showed that the primary gill lamellae are covered with stratified squamous epithelium which is continuous over the edges and tips, but interrupted where the secondary gill lamellae project. The stratified epithelium is mainly composed of centrally nucleated cuboidal cells (Fig1A.).

The secondary gill lamellae are covered with a delicate layer of simple squamous epithelial cells. The endothelium consists of a series of loosely-packed pillar cells and outlined on each side with basement membrane. The space between pillar cells is occupied with blood capillaries. Most of the blood corpuscles are nucleated erythrocytes (Fig.1B).

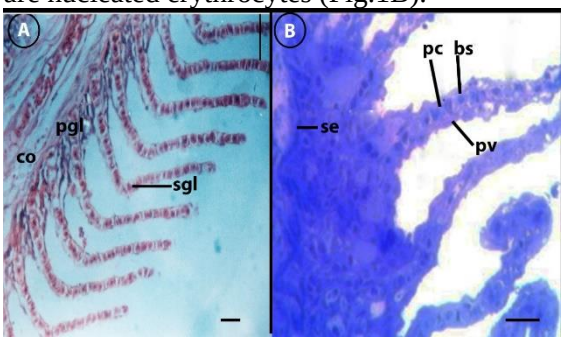

Figure (1): Photomicrographs of sections through uninfected gill filaments of *Scomberomorus commerson* stained with eosin and hematoxlyn (**A**) and toluidine blue (**B**). **A**. showing primary gill lamella (pgl), secondary gill lamella (sgl), (**B**), blood spaces (bs) pillar cell, (co), blood capillaries blood capillary, (pc), pavement cell (pv), squamous epithelium (se).

Figure 2 shows gill of *Scomberomorus commerson* Lacepède 1801 was heavily infested with *Gotocotyla secunda*. This parasite which has preoral lobe, subterminal mouth, 2 buccal suckers, small pharynx, oesophagus extends to behind level of

vaginal openings. Caeca with medial and lateral diverticula. Testes (34-37) located laterally and extend to the end of body, from anterior to ovary and at the central level from posterior to ovary. Genito intestinal duct is semi-short. The adult worm's body of *Gotocotyla* occupied with small follicular vitellaria and extend at the same level of caecum bifurcation toward the posterior end of the body. In addition, its uterus contains several eggs.

The opishaptor of *Gotocotyla* is long and narrow. At the same axis of body, two rows of clamps are located and its number are 38-42. Clamps are formed at the anterior end of worm, and enlarged in the midline of opisthaptor. These clamps consist (6-10) accessory sclerites with winged ends and 2 rows of thorns, each half of clamp with 1 pair of edge sclerites and smaller half with apical transverse sclerites (Fig.2). At the end of opisthaptor, a pair of hamuli were detected.

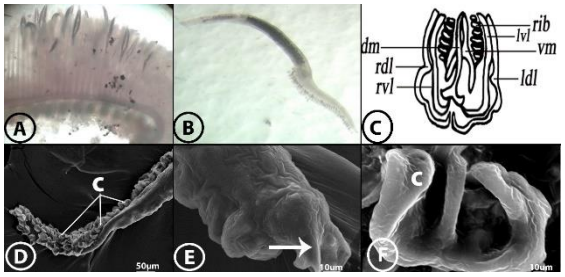

Figure (2): Photomicrographs of A, microscopic appearance *G. secunda* attached between the gill hemibranchs, of *S. commerson*. B, entire body of fresh specimen of *G. secunda*. C, Schematic hand drawings of clamp, D, SEM photograph of poserior part of the haptor. E, SEM showing anchorhook of *G. secunda* (arrow). and F, clamps (c).

Mode of attachment of Gotocotyla secunda Tripathi, 1956

Observations with the light and SEM photomicrograph show that *G. secunda* attaches itself by its clamps to the tips of the secondary gill lamellae of *Scomberomorus commerson* and its elongated body with its head protrudes project at the same line of the gill lamellae (Figs.3, 4A). Clamps of the parasite was observed to grasp two secondary gill lamellae in each clamp (Fig, 4B). gill cellular residues were observed inside the clamp (Fig. 5)

Histopathological changes

Histopathological effects were observed, revealed severe damage in construction of the primary and secondary gill lamellae, fusion of secondary gill lamellae (Fig. 6), adhesion of secondary lamellae (Figs. 7), destructed in the central core of secondary gill lamellae (Fig.6), a lot of chloride cells (Fig. 8) erosions , atrophy of secondary lamellae (Fig. 9), hyperplasia of epithelial cells (Fig. 8), necrosis of gill filaments (Fig. 6), mucus secretion (Fig.10), and the secondary gill lamellae of the gill filament as well as of the neighboring gill lamellae were found to be compressed (Fig. 11). Hemorrhage of blood vessels (Fig. 7), vacuole formation (Fig. 8) and lamellar clubbing (Fig.4).

Figure (3): Light microscope photomicrograph showing *G. secunda* attaches itself by its clamps to the tips of the secondary gill lamellae and its elongated body lies parallel to the primary gill lamellae and its head projects free towards the tips of the primary gill lamellae. c, clamp, h, haptor, p, parasite. sgl, secondary gill lamellae.

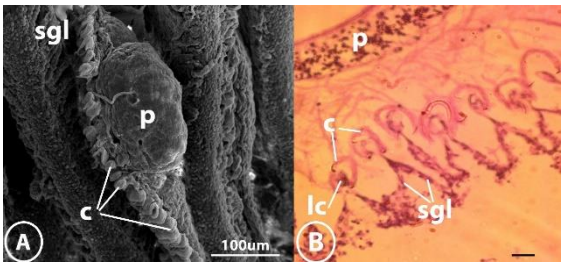

Figure (4): Microscopic appearance of *G. secunda* worm showing in A scanned micrograph of a parasite (p) attached to gill filament. B shows clearly clamps capturing the tips of two adjacent secondary gill lamellae. c, clamp. Lc, lamellar clubbing, p, parasite, sgl, secondary gill lamellae note host tissues inside the clamps. Note that clamps grasp lamellar tips, one or two lamellae being inserted into them.

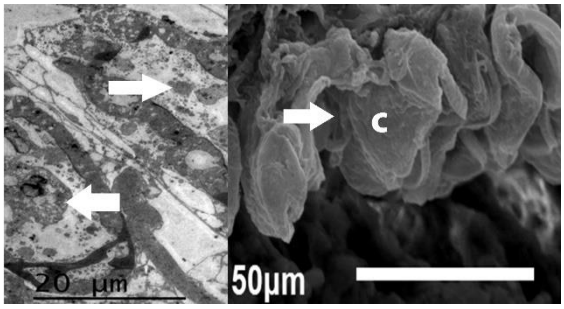

Figure (5): Photomicrographs of shows c, clamp, gill cellular residue inside the clamp (thick arrow).

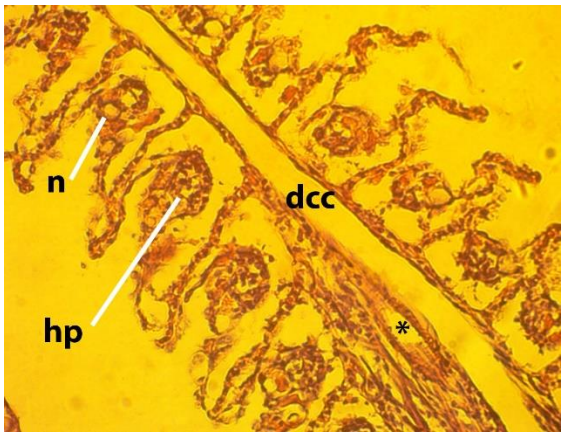

Figure (6): Photomicrographs of showing dcc, destruction of central core, hp, hyperplasia of host tissues inside parasite clamps, n, necrosis, and degeneration (star) associated with parasite.

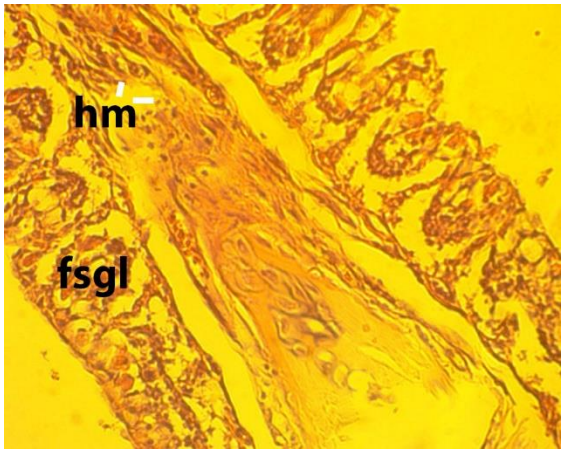

Figure (7): Photomicrographs of showing severe epithelial hyperplasia with total fusion of the secondary lamellae (fsgl) and. Hm, Hemorhage in secondary gill lamellae.

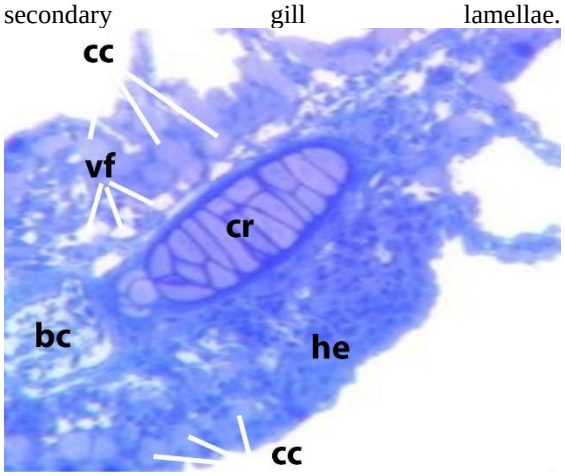

Figure (8): Photomicrographs of showing blood capillary (bc), a lot of chloride cells (cc), main blood vessel (mbv), cartilage (cr) he, hyper-plasia of epithelial cells and vacuole formation (vf).

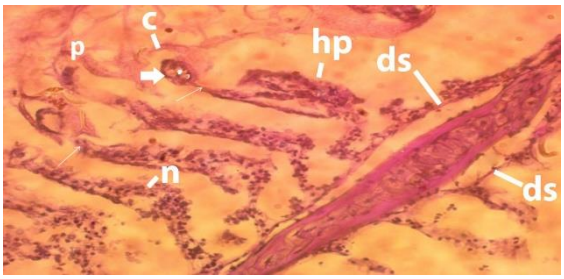

Figure (9): Photomicrographs of showing c,clamps of *G. secunda* (P), ds, desquamation of gill lamellae, hp, hyperplasia, host tissues inside parasite clamps, n, necrosis, tissue erosion of secondary gill lamellae (thin arrows), and gill cellular residue inside the clamp, (thick arrow).

Discussion

Kearn, 1964 revealed that uses the adaptive organ for parasitism of the monogenean parasites of fishes; posterior adhesive apparatus consisting of glands, hooks, and suckers.

In this study, the mode of attachment of the blood feeding polyopithocotylean monogenean, *Gotocotyla secunda* to the gills of *Scomberomorus commerson* have been studied in detail. The light and scanning electron microscope observations revealed that the parasites attached themselves by grasping one or two tips of the secondary gill lamellae of *S. commerson* and with its elongated body with its head projects at the same line to the primary gill racker.

The attitude of attachment of a relatively large polyopithocotylean monogean *G. secunda* to the gills of *S. commerson* with clamps upstream is relation to the host's gill-ventilating current and the shape of the rest of the body follows the course of water flow through the gill in the preset study is found to minimize the threat of dislodgement of the parasite, since the water currents through the gill rarely falter (Kearn, 2014).

The histopathological lesions which were observed in this study include compression of the gill lamellae, several damages to primary and secondary gill lamellae. These effects cause curling up the secondary gill lamellae, and damaged its central core. Furthermore, mucus secretion, and hemorrhage of blood vessels, vacuole formation and lamellar, were observed in gill filaments. Besides, the secondary gill lamellae of the gill filament as well as of the neighboring gill lamellae were found to be compressed. Morgan

and Tovell (1973) detected that the immune response of fish after infecting polyopithocotylean monogean, these responses include hyperplasia of epithelial cells and destructed of some secondary lamella. Moreover, the lamellar fusion could also be a protection device so that vulnerable gill surface areas are being covered (Modu et al, 2012).

The present study finding, the abundant chloride cells might be a response to the ion regulatory challenge and may induce by the gill's epithelial injuries provoked by the parasite. The proliferation of chloride cell of gill is a common response of fish to enhance the ion transporting capacity of the gill (Sakuragi et al. 2003**;** Benli et al. 2008). This result agrees with Ramudu and Dash (2015), observing mucus cells in the gills of *Epinephelus coioides* infested with *Dactylogyrus* spp. Ramudu and Dash (2015) and Jithendran et al. (2005) reported that gill response to the parasites with abnormal production of mucus and due to this hyper-trophy of the mucus cells after infecting the gill of Carps and *Epinephelus tauvina* with monogenean parasite. In addition, Bu and Seng (1997) detected that high prevalence of gill monogeneans causes sever necrosis, erosion of gill filament, and loss of respiratory surface area.

Histopathological effects were observed in the present study by infestation of polyopithocotylean monogenean *G. secunda* to the gills of *S.commerson* could negatively effect on the function of the fish's gills.

References

Benli, A. C. K., Koksal, G. and Özkul, A. (2008). Sublethal ammonia exposure of Nile tilapia (*Oreochromis niloticus* L.): effects on gill, liver and kidney histology. Chemosphere, 72: 1355–1358.

Bu, S. S. H. and Seng, L. T. (1997). The histopathology of sleepy grouper disease. AAHRI Newsletter Article, 6: (2).

Buckel, J. A. and McKown., K. (2002). Competition between juvenile striped bass and bluefish: resource partitioning and growth rate. Marine Ecology Progress Series, 234: 191–204.

Dezfuli, B. S., Giari, L., Simoni, E., Menegatti, R., Shinn, A. P. and Menera, M. (2007). Gill histopathology of cultural European seabass, *Dicentrarchus labrax* (L.), infected with *Oiplectunum aequans* (Wagener 1857) Diesing 1958 (Diplectanidae: Monogenea). Parasitology Research, 100: 707-713.

Eissa, 1.A.M. and Hala, M.F. (1993) Studies on yellow grub disease in Nile Bolti. Beni- Suef, Vet. Med. Res. III (1): 96-107.

Eissa, I.A.M. (2002) Parasitic fish diseases in Egypt. Dar El- Nahdda ElArabia Publishing, Cairo, Egypt.

Suliman, E. M., Osman, H. A. and Al-Deghayem, W. A. (2021). Histopathological changes induced by ectoparasites on gills and skin of *Oreochromis niloticus* (Burchell 1822) in fishponds, Journal of Applied Biology & Biotechnology, 9(1): 68-74.

Jithendran, K. P., Vijayan, K. K., Alavandi, S. V. and Kailasam, M. (2005). *Benedeniae pinepheli* (Yamaguti 1937), A Monogenean Parasite in Captive Broodstock of Grouper, Epinephelus tauvina (Forskal). Asian fisheries Science, 18: 121-126.

Kearn, G. C. (1964). The attachment of the monoenean *Entobdella soleae* to the skin of the common sole. Parasitology, 54: 327-335.

Kearn, G. C. (2014) Some Aspects of the Biology of Monogenean (Platyhelminth) Parasites of Marine and Freshwater Fishes. Oceanography. 2: 117. doi:10.4172/2332-2632.1000117

Khidr, A. A. (1996). A comparative study of the attachment of the monogenean gill-parasite *Cichlidogyrus halli typicus and* the monogenean stomach parasite *Enterogyrus cichlidarum* from *Tilapia nilotica* of the River Nile. **J. Egypt Ger. Soc. Zool. 21, 107-120.**

Lia, R. P., Zizzo, N., Tinelli, A., Lionetti, A., Cantacessi, C. and Oranto, D. (2007). Mass mortality in wild greater amberjack (Serioladumerili) infected by *Zeuxapta Seriolac* (Monogenea: Heteraxinidae) in the Iranian sea. Bulletin Association of Fish Parasites, 27(3): 108- 111.

Modu, B.M. ; Saiful, M. ; Kartini, M. ; Zaleha Kasim, I; Marina Hassan and Shaharom-Harrison, F.M. (2012) Effects of Water Quality and Monogenean Parasite in the Gills of Freshwater Catfish, *Hemibagrus nemurus* Valenciennes 1840, Current Research Journal of Biological Sciences. 4(3): 242-246, Morgan, M. and Tovell, P.W.A. (1973). The Structure of the gills of the trout (Salmo gairdneri). Zellforch Mikrosk Anat, 142: 147-162.

Ragias, V., Athanassopoulou, F. and Sinis, A. (2005). Parasites of the Mugilidae spp. reared under semi-intensive and intensive conditions in Greece. Bulletin of the European Association of Fish Pathologists, 25: 107–115.

Ramudu, K.R., and Dash, G. (2015) Histopathological alterations in the vital organs of Indian Major Carps with parasitic infestation in fish farms West Bengal, India. Drug

Development and Therapeutics. 6(1):38-43.

Roberts RJ. (1978) Fish Pathology. London. Bailliere Tindall.

Sakuragi, M. M., Sanches, J. R. and Fernandes M. N. (2003). Gill chloride proliferation and respiratory responses to hypoxia of the neotropical erythrinid fish *Hoplias malabaricus*. Journal of Comparative Physiology,173: 309–317.

Strona, G., Stefoni, F. and Galli, P. (2010). Monogeneidean parasites of Italian marine fish and updated checklist. Italian Journal of Zoology,77(4): 419-437.

Suliman, E. M., Osman, H. A. and Al-Deghayem, W. A. (2021). Histopathological changes induced by ectoparasites on gills and skin of *Oreochromis niloticus* (Burchell 1822) in fishponds, Journal of Applied Biology & Biotechnology, 9(1): 68-74.

Tripathi, Y. R. (1956). Studies on the parasites of Indian fishes. IV. Trematoda: Monogenea, Microcotylidae. Records of the Zoological Survey of India, 52(24): 231-247.

الملخص العربي

عنوان البحث: طريقة الالتصاق والتأثيرات التشريحية المرضية لطفيلي Gotocotyla secunda بولى أوبيثوكوتيل (Tripathi, 1956)، وهو طفيل خيشومي Scomberomorus commerson (Lacepède 1801) (اسماك الماكريل الإسباني ضيق الشريط) تم جمعه من البحر الأبيض المتوسط بالقرب من مدينة دمياط، مصر

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يعتبر طفيلى Gotocotyla secunda (Tripathi, 1956) البولي اوبيثوكوتيل واحدة من الديدان المتطفلة ذات التأثير الإيجابي على خياشيم اسماك الماكريل الإسباني ضيق الشريط Scomberomorus commerson القاطنة البحر الأبيض المتوسط بالقرب من مدينة دمياط، مصر. وقد أظهر الفحص الدراسات بالمجهر الضوئي والمجهر الإلكتروني الماسح أن الطفيليات تلتصق بواسطة الخطاطيف عن طريق الإمساك بطرف أو طرفين من صفائح الخياشيم الثانوية للأسماك S. commerson وجسمها الممدود مواز لصفائح الخياشيم الأولية ورأسها يتجه نحو أطراف الصفيحة الأولية الخيشومية. تكتشف نتائجنا التأثير الضار لطفيل G. secunda، على صفائح الخياشيم، مسببا العديد من الأضرار لصفائح الخياشيم الأولية والثانوية. ومن ضمن هذه التأثيرات تجعدًا وتآكلًا وضمورًا واندماجًا في صفائح الخياشيم الثانوية، وتلف القلب المركزي في صفائح الخياشيم الثانوية، وإفرازات مخاطية، ونزيف الأوعية الدموية، وتكوين الفجوات والصفائح، وتضخم الخلايا الظهارية. بالإضافة إلى تاثيرات فى الصفائح الخيشومية الثانوية و خيوط الخياشيم وكذلك الصفائح الخيشومية المجاورة تبين أنها مضغوطة.