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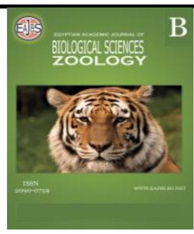

Morphological and Morphometric Characterization of Four Monogenean Parasites from Fishes of the River Nile, Qena Governorate, Egypt

Abdel-Nasser A. Hussein[1], Khalaf N. Ammar[1], Ali Mansour[1] & Kareem Morsy[2]
1-Department of Zoology, Faculty of Science, South Valley University, Qena, Egypt
2-Department of Zoology, Faculty of Science, Cairo University, Cairo, Egypt
E-mail: Hussein.ana@sci.svu.edu.eg

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ABSTRACT

Monogenea is a class constituting the ectoparasitic flukes mainly on skin and gills of fish, with greater diversity of species worldwide. In the present study, four different species of monogenean parasites were recorded; they were isolated from gills of four freshwater fish species captured from locations along the River Nile, Qena governorate, Egypt. These were *Cichlidogyrus aegypticus* from *Oreochromis niloticus* (93.33, 28/30); *Protoancylodiscoides malapteruri* from *Malapterurus electricus* (90%, 18/ 20). *Quadricanthus bagrae* from *Bagrus bajad* (30%, 15/ 50), and *Ancyrocephalus* sp. from *Mormyrus kannume* (75%, 30/ 40). The recovered parasites were described by light microscopy, where the different sclerotized parts of the haptor and copulatory organs were used as key of identification of each species. *C. aegypticus* can be differentiated by the presence of haptor with two pairs of strongly developed anchors, two long projections of the complex bar and a narrow copulatory tube with a wide basal funnel. *P. malapteruri* was characterized by the presence of broad haptor with two large dorsal and two small ventral hamuli. *Ancyrocephalus* sp. was characterized by a haptor which was not clearly demarcated from the anterior body with ventral and dorsal anchors similar in shape. *Quadriacanthus bagrae* was discriminated by possessing a complex bar with long projection at the center and two long ends, the dorsal and ventral anchors were without distinct roots. The present study represented new locality records for these species off the River Nile, Qena governorate, Egypt.

INTRODUCTION

Parasitic diseases are responsible for important economic losses in aquaculture (Osman *et al*., 2010) and however, Fish are a good source of quality protein, various diseases including parasitic infections pose a threat to fish cultivation, which is a valuable source of food and employment in developing countries Yooyen *et al*. (2006). No doubt, that fishes harbor a wide range of ecto- and endoparasites infecting the alimentary canal, liver, kidney, reproductive organs, muscles as well as gills and skin (El-Naggar & Khidr, 1988 and Yang *et al*., 2005). Ecto-parasites are the most dangerous group that causes severe mortalities (Shalaby and Ibrahim, 1988). In Egypt, there are long periods of optimum warm weather that enable external parasites for more production and cause bad effects on fish. Qena governorate lies in the southern part of Egypt; there are some factories that pouring its contents in the River Nile regions in addition to different industrial and agricultural activities. Environmental changes can make parasite populations increase or decrease. Waste water or industrial pollutants may lead to an increase in fish parasites due to a decrease in immunological defense and a lower resistance of fish to infections (Sasal *et al.*, 2007). Monogenetic trematodes of freshwater fish could be considered as one of the most prevalent diseases affecting skin and gills, which included irritation, severe destruction of the gills, impaired breathing as well as severe losses too (Sineszko and Axelrod, 1980). They are the most abundant ectoprasitic flukes of fish, with greater diversity of species occurring in tropics than in the temperate regions of the world (Rohde, 1982). They spend their entire life cycle as parasites on gills and skin of fish, hold to the fish by the use of hooks and attachment organs at the posterior end. These parasites attack fish causing massive destruction of skin and gill epithelium. Even moderate infection of these organisms on small fish may prove a fatal disease since the infection may cause the fish to stop feeding (Meyer, 1966). During a recent survey on helminth parasites infecting fresh water fish captured from a location along the River Nile, Qena governorate, Egypt, four different species of monogenean parasites were isolated and described morphologically and morphometrically by light microscopy.

MATERIALS AND METHODS

A total of one hundred and forty fish belonging to four different families were collected from October 2015 to August 2016 from commercial fishermen along the River Nile, Qena, Egypt. These were Nile tilapia *Orechromis niloticus* (Cichlidae, 30), electric catfish *Malapterurus electricus* (Malapteruridae, 20), Bayad *Bagrus bajad* (Bagridae, 50) and elephant snout fish *Mormyrus kannume* (Mormyridae, 40). In general the collected fish for examination were small and medium sized. Collected fish were transported immediately to parasitological laboratory, Zoology department, Faculty of Science, South Valley University using special tanks supplied with aeration and cooling when necessary and were kept alive in a fully prepared aquaria. Skin surface, fins and gills were then examined by naked eyes and with the help of dissecting microscope for any attached parasites, lesions or external changes. After removing operculi and exposing gill arches, each gill was removed carefully from the fish, immersed in normal saline to remove any excess gill mucus. Monogenean parasites were recovered with a Pasteur pipette using a dissecting binocular microscope. Relaxation is the first important step during examination of monogenean, parasites, without relaxation these parasites become strongly contracted and coiled thus making subsequent examination more difficult. It is necessary to allow relaxation of these collected parasites before fixation. The monogeneans were fixed in 4% formalin and the worms were washed with distilled water to remove the excess of the fixative. Worm identification was confirmed by mounting specimens on slides in drops of ammonium picrate glycerine under cover slips and examining hard parts using light microscopy. For each monogenean parasite, the sclerotized parts were measured using an ocular micrometer calibrated against a stage micrometer slide according to Gussev (1985) and Bykhovskaya-Pavlovskaya *et al.* (1962).

RESULTS

Ninety Out of 140 Fish Were Found Infected with Monogenean Parasites:

93.33% in *O. niloticus* (28/30), 30% in *B. bajad* (5/50), 90% in *M. electricus* (18/20) and 75% in *M. kannume* (30/40). The recovered parasites were examined by light microscopy, it was revealed that the monogenean parasites isolated belong to four different species.

Cichlidogyrus aegypticus Ergens, 1981 (Table 1, Figs. 1-8)**:**

(Dactylogyridea, Ancyrocephalidae)

Diagnosis: The body was elongated with a total length of 0.500-0.550 mm and the maximum width was 0.082-0.135 mm. The attachment part had three pairs of cephalic glands. Two pairs of eyes were present on the dorsal body region anterior to the pharynx arranged as two posterior eyes with crystalline lenses and two small inconstant anterior eyes. The muscular pharynx was located behind the margin of the posterior pair of eyes. The mouth was subterminal, found ventrally between the two pairs of eyes and delayed behind the muscular pharynx to simple intestinal branches which united posteriorly near the margin of the haptor. The haptor was delicate, with two pairs of strongly developed anchors. The total length of the ventral anchor was 0.033-0.036 mm, the shaft length was 0.024-0.027 mm, its inner root length was 0.018-0.023 mm, the outer root length was 0.009-0.014 mm and the point length was 0.011-0.015 mm. The ventral anchor was attached to a V-shaped bar, which had a number of teeth-like projections on the inner margin. The total length of this bar was 0.040-0.045 mm and its width was 0.004-0.006 mm. The total length of the dorsal anchor was 0.028-0.032. The shaft length was 0.020-0.023 mm, the inner root length was 0.012-0.015 mm, the outer root length was 0.007-0.011 mm and the point length was 0.011-0.016 mm. The second pair of anchors was attached to a complex bar which consisted of three articulated pieces; the central piece was slightly bent and measured 0.042-0.047 mm in length and its width was 0.004-0.009 mm. The two pieces were attached to the complex bar with a long appendage measured 0.016-0.025 mm in length. The copulatory tube was found as a narrow tube with a wide basal funnel and its basic portion was branched acting as a supporting portion. The copulatory complex was 0.060-0.078 mm in length and it had an accessory piece.

Taxonomic summary:

Host: *O. niloticus*

Locality: River Nile, Qena, Egypt.

Infection site: gills.

Prevalence: 93.33% (28/30).

Material deposited in: Zoology department, Faculty of Science, South Valley University.

Table (1): Comparison between the measurements (mm) of *Cichlidogyrus aegypticus* in the present study and some of the previously described species.

Aspect	*C. aegypticus* Ergens, 1981	*C. aegypticus* Bayoumy, 1996	*C. aegypticus* Present study
Total body length	-	0.800-0.840	0.500-0.550
Maximum body width	-	0.180-0.200	0.082-0.135
First pair of anchors			
a) Total length	0.029-0.031	0.030-0.032	0.033-0.036
b) Shaft length	0.025-0.026	0.025-0.028	0.024-0.027
c) Inner root length	0.011-0.012	0.005-0.010	0.018-0.023
d) Outer root length	0.004-0.006	-	0.009-0.014
e) point length	0.010-0.012	0.005-0.006	0.011-0.015
Connecting bar			
a) Total length	0.055-0.064	0.050-0.070	0.040-0.045
b) Width	0.004-0.005	0.003-0.005	0.004-0.006
Second pair of anchors			
a) Total length	0.024-0.025	0.023-0.027	0.028-0.032
b) Shaft length	0.020-0.021	0.020-0.023	0.020-0.023
c) Inner root length	0.009-0.010	0.006-0.009	0.012-0.015
d) Outer root length	0.004-0.005	0.004-0.006	0.007-0.011
e) point length	0.007-0.009	0.006-0.009	0.011-0.016
Complex bar			
a) Total length	0.031-0.038	0.038-0.043	0.042-0.047
b) Width	-	0.004-0.009	0.004-0.009
c) Appendage length	0.015-0.018	0.017-0.020	0.016-0.025
Copulatory organ			
Copulatory complex	0.044-0.045	0.035-0.043	0.060-0.078

Protoancylodiscoides malapteruri Charles *et al.* 1997 (Table 2, Figs. 9-16)
(Dactylogyridea, Ancyrocephalidae)

Diagnosis: The adult worm length was 0.794-0.798 mm and the maximum body width was 0.114-0.117mm. There were two unequal pairs of eyes located anterior to the pharynx. The posterior pair was located close to each other and larger than the anterior one. The muscular pharynx was located behind the margin of the posterior pair of eyes. The haptor was broad. Two large dorsal hamuli and two small ventral ones were present. The ventral hamuli measured 0.026-0.029 mm in length, the shaft length was 0.021-0.026 mm, the inner root length was 0.010-0.014 mm, the outer root length was 0.003-0.004 mm and the point length was 0.008-0.010 mm. The ventral hamulus was attached to V-shaped bar, with two lateral parts measured 0.035-0.039 mm in length and 0.004-0.006 mm in width. The total length of the dorsal hamulus was 0.068-0.070 mm. The shaft length was 0.060-0.063 mm, the inner root length is 0.018-0.020 mm, the outer root length was 0.005-0.006 mm and the point length was 0.015-0.019 mm. The second pair of anchors was attached to a complex bar (dorsal bar) which expanded at each end with a sharp appendage, the total length of this bar was 0.043-0.047 mm and 0.010-0.013 mm in width, each lateral appendage measured 0.005-0.007 mm long. The important structure characterizing this species was the copulatory organ which was composed of two main parts; the penis which was a long narrow tube measured 0.034-0.037 mm long and a complex coiled vagina with two ends, one end was the seminal receptacle and the other end was in the form of a funnel structure and measured 0.033-0.037 mm in length. Large larval hooklets were present.

Taxonomic summary:

Host: *M. electricus*

Locality: River Nile, Qena, Egypt.

Infection site: gills.

Prevalence: 90% (18/20).

Material deposited in: Zoology department, Faculty of Science, South Valley University.

Table (2): Comparison between the measurements (mm) of *Protoancylodiscoides malapteruri* in the present study and some of the previously described species.

Aspect	*P. chrysichthes* Paperna, 1969	*P. mansourensis* El-Naggar, 1987	*P. malapteruri* Charles *et al.*, 1997	*P. malapteruri* Present study
Total body length	0.400-0.500	0.710-1.000	0.590-0.780	0.794-0.798
Maximum body width	-	0.142-0.261	0.135-0.160	0.114-0.117
First pair of hamuli				
a) Total length	0.040-0.060	0.039-0.047	0.024-0.029	0.026-0.029
b) Shaft length	-	-	0.018-0.021	0.021-0.026
c) Inner root length	-	0.016-0.019	0.011-0.014	0.010-0.014
d) Outer root length	0.001-0.002	0.003-0.004	0.003-0.005	0.003-0.004
e) point length	-	0.019-0.024	0.013-0.017	0.008-0.010
Connecting bar				
a) Total length	-	0.038-0.043	0.050-0.065	0.035-0.039
b) Width	-	-	0.002-0.004	0.004-0.006
Second pair of hamuli				
a) Total length	0.040-0.050	0.031-0.093	0.058-0.064	0.068-0.070
b) Shaft length	-	-	0.048-0.052	0.060-0.063
c) Inner root length	0.020-0.030	0.025-0.032	0.021-0.024	0.018-0.020
d) Outer root length	0.003-0.005	0.004-0.005	0.003-0.004	0.005-0.006
e) point length		0.022-0.025	0.019-0.022	0.015-0.019
Complex bar				
a) Total length	0.030-0.040	0.040-0.048	0.034-0.038	0.043-0.047
b) Width	-	-	0.004-0.006	0.010-0.013
c) Appendage length	-	-	-	0.005-0.007
Copulatory organ				
Penis length	-	0.030-0.034	0.065-0.085	0.034-0.037
Vagina length	-	0.011-0.014	-	0.033-0.03٧

Quadriacanthus bagrae Paperna, 1979 (Table 3, Figs. 17-24)
(Dactylogyridea, Ancyrocephalidae)

Diagnosis: The total body length measured 0.570-0.575 mm, while the maximum width was 0.070-0.075 mm at the anterior trunk. Four pairs of cephalic glands and poorly developed cephalic lobes were found in the prohaptor. Two pairs of eyes were present on the dorsal body region anterior to the pharynx; there were two large posterior eyes with crystalline lenses and two small inconstant anterior eyes. Accessory pigment granules were observed in cephalic region at anterior trunk. The haptor was subhexagonal with two pairs of anchors strongly developed. The total length of ventral anchor was 0.020-0.026 mm, its shaft length was 0.019-0.022 mm, the anchor base length was 0.005-0.007 mm and the point length was 0.004-0.008 mm. The ventral anchor was attached to the V-shaped bar with a total length of 0.03-0.05 mm and 0.004-0.007 mm in width. The total length of dorsal anchor was 0.026-0.031 mm. The shaft length was 0.027-0.030 mm, the anchor base length was 0.011-0.013 mm and the point length was 0.008-0.010 mm. The dorsal anchor was attached to a complex bar (dorsal bar) with a total length of 0.046-0.050 mm, 0.009-0.014 mm in width and had an appendage 0.010-0.017 mm long, consisting of a posterior bilobed knob and a sclerite process. The copulatory tube (the penis) was 0.019-0.022 mm in length.

Taxonomic summary:
Host: *B. bajad*
Locality: River Nile, Qena, Egypt.
Infection site: gills.
Prevalence: 30% (5/50).
Material deposited in: Zoology department, Faculty of Science, South Valley University.

Table (3): Comparison between the measurements (mm) of *Quadriacanthus bagrae* in the present study and some of the previously described species.

Aspect	*Q. kobiensis* Ha Ky, 1968	*Q. clariadis* Paperna, 1961	*Q. bagrae* Paperna, 1979	*Q. bagrae* Present study
Total body length	0.260-0.400	0.160-0.230	0.260-0.365	0.570-0.575
Maximum body width	0.080-0.105	0.070-0.095	0.065-0.095	0.070-0.075
First pair of anchors				
a) Total length	0.022-0.028	0.022-0.026	0.024-0.029	0.020-0.026
b) Shaft length	-	-	-	0.019-0.022
c) anchor base length	0.012-0.016	0.009-0.011	0.007-0.010	0.005-0.007
e) point length	-	-	-	0.004-0.008
Connecting bar				
a) Total length	0.036-0.043	0.040-0.046	0.048-0.054	0.03-0.05
b) Width	-	-	-	0.004-0.007
Second pair of anchors				
a) Total length	0.024-0.030	0.036-0.042	0.030-0.034	0.026-0.031
b) Shaft length	-	-	-	0.027-0.030
c) anchor base length	0.013-0.017	0.009-0.012	0.010-0.013	0.011-0.013
d) point length	-	-	-	0.008-0.010
Complex bar				
a) Total length	0.045-0.052	0.042-0.054	0.040-0.058	0.046-0.050
b) Width	-	-	-	0.009-0.014
c) Appendage length	0.026-0.039	0.009-0.014	0.013-0.019	0.010-0.01٧
Copulatory organ				
Copulatory complex	0.017-0.018	0.018-0.022	-	0.019-0.022

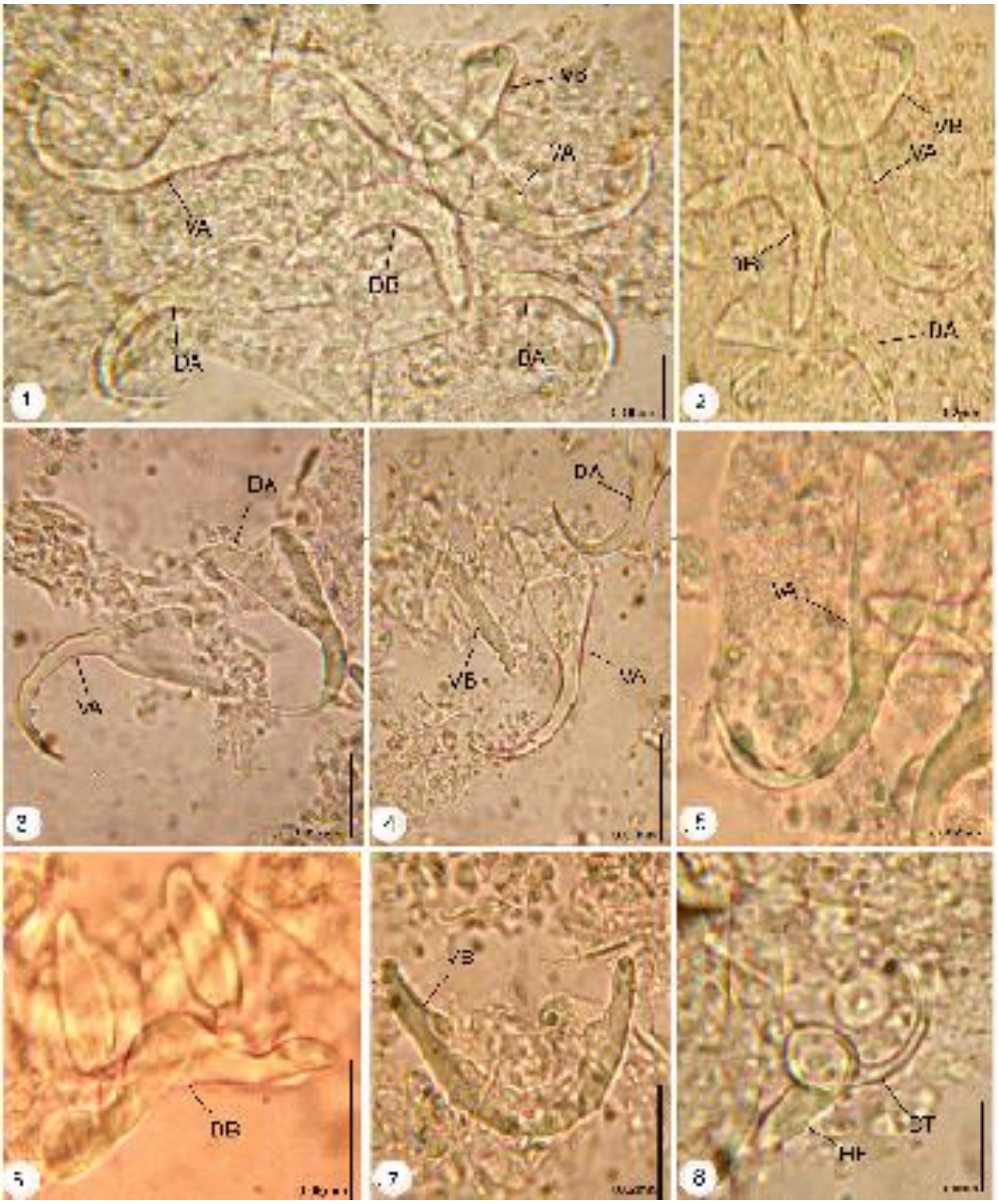
***Ancyrocephalus* sp.** Creplin, 1839 (Table 4, Figs. 25-31)
(Dactylogyridea, Ancyrocephalidae)

Diagnosis: The body was 0.535-0.539 mm long and the maximum body width measured 0.120-0.123 mm. The width of the haptor was 0.077-0.080 mm. In the anterior region, three pairs of cephalic glands were present; also there were two unequal pairs of eyes located anterior to the pharynx. The posterior pair was larger than the anterior ones. The haptor was delicate with two pairs of similar anchors. The ventral anchor measured 0.029-0.034 mm in length, its shaft length was 0.024-0.029 mm, the inner root length was 0.010-0.015 mm, the outer root length was 0.005-0.008 mm and the point length was 0.006-0.01 mm. The ventral anchors were attached to the ventral bar, which was enlarged in the center and pointed at the ends; its total length was 0.059-0.064 mm and 0.009-0.014 mm in width. The total length of dorsal anchor was 0.028-0.033 mm. The shaft length was 0.021-0.028 mm, the inner root length was 0.010-0.015 mm, the outer root length was 0.004-0.007 mm and the point length was 0.011-0.017 mm. The second pair of anchor was attached to the dorsal bar which was simple and pointed at both ends. The total length of this bar was 0.036-0.040 mm long and 0.006-0.009 mm wide. The copulatory organ consisted of a copulatory tube 0.050-0.057 mm long. The accessory piece was not observed.

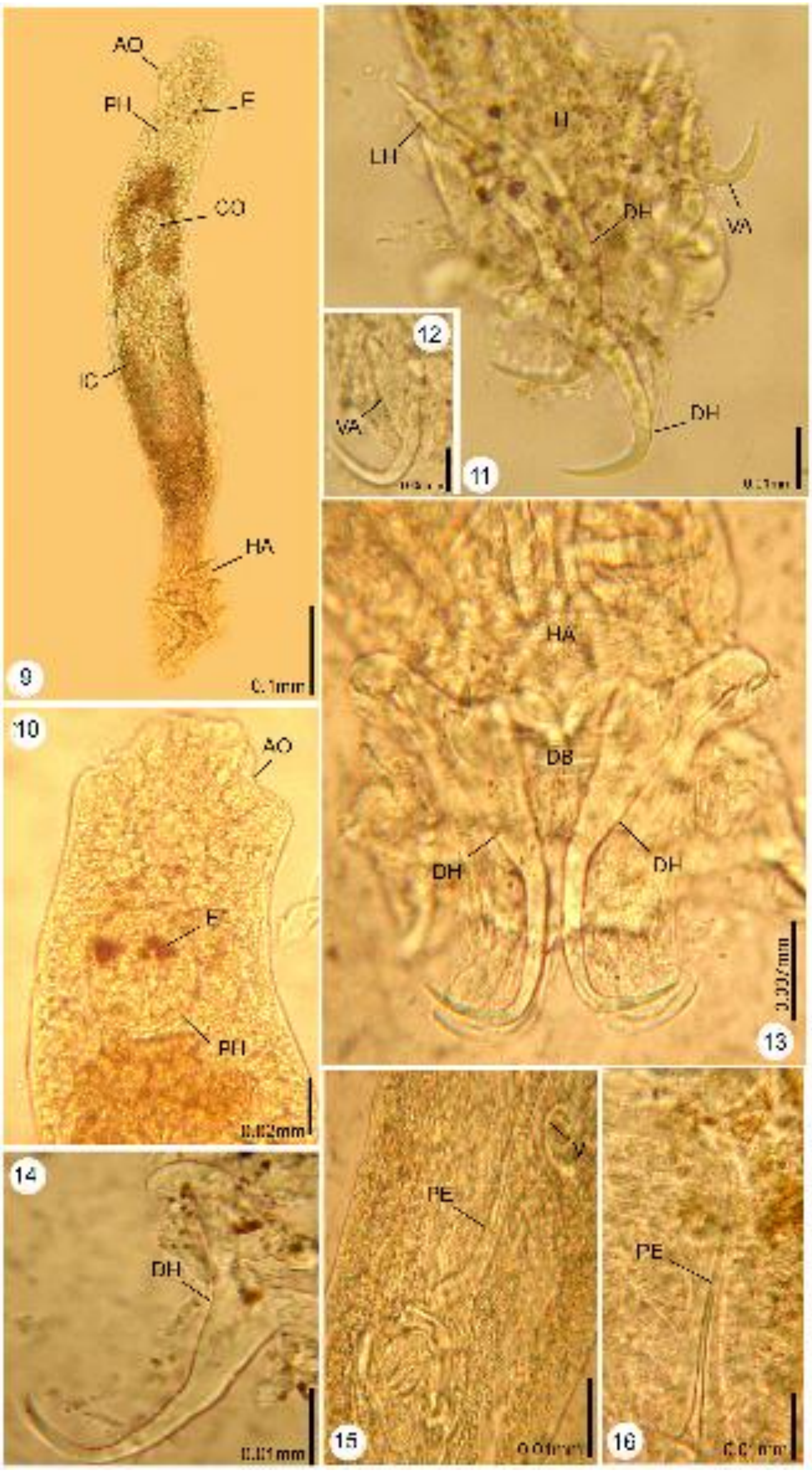
Taxonomic summary:
Host: *M. kannume*
Locality: River Nile, Qena, Egypt.
Infection site: gills.
Prevalence: 75% (30/40).
Material deposited: Zoology department, Faculty of Science, South Valley University.

Table (4): Comparison between the measurements (mm) of *Ancyrocephalus* sp. in the present study and some previously described species.

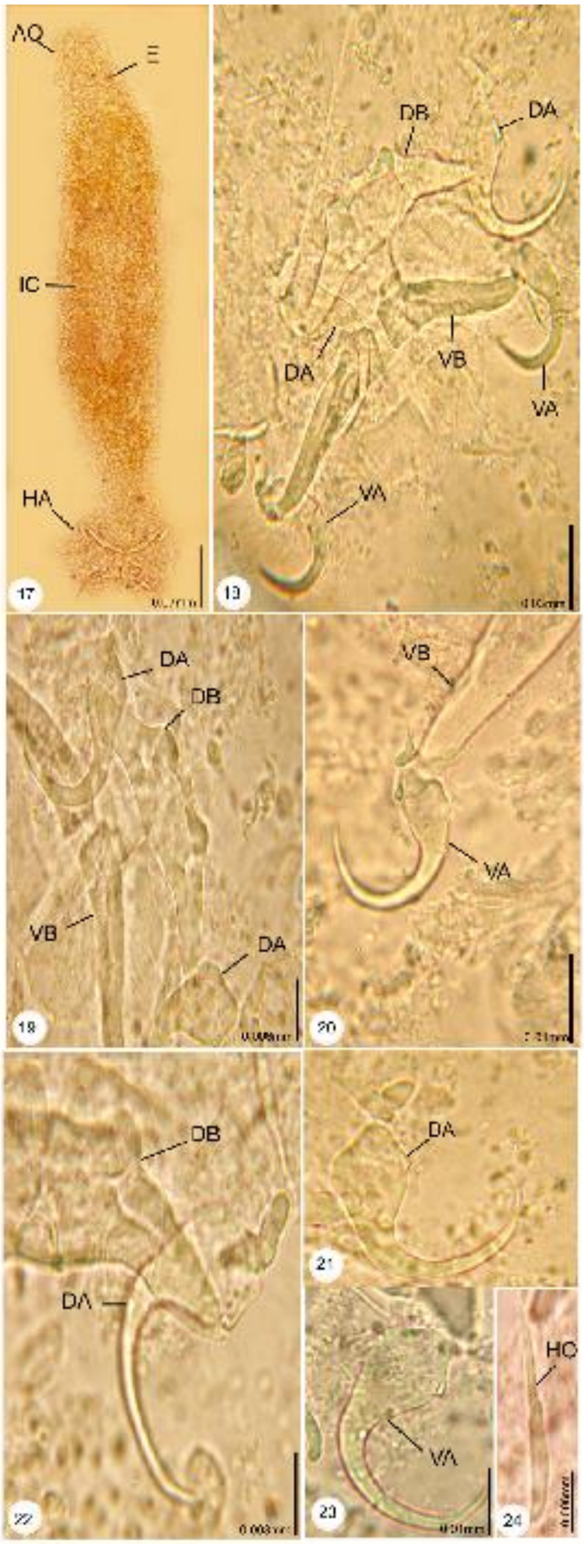
Aspect	*Ancyrocephalus parvus* Linton, 1940	*Ancyrocephalus cornutus* Ernest *et al.*, 1972	*Ancyrocephalus* sp. Present study
Total body length	0.506-1.005	0.420-0.579	0.535-0.539
Maximum body width	0.204-0.396	0.103-0.147	0.120-0.123
Haptor width	0.070-0.198	0.079-0.117	0.077-0.080
First pair of anchors (Ventral anchors)			
a) Total length	0.017-0.018	0.024-0.027	0.029-0.034
b) Shaft length	-	-	0.024-0.029
c) Inner root length	-	-	0.010-0.015
d) Outer root length	-	-	0.005-0.008
e) point length	0.004-0.005	0.004-0.006	0.006-0.01٠
Connecting bar			
a) Total length	0.024-0.029	0.037-0.044	0.059-0.064
b) Width	0.002-0.003	0.002-0.004	0.009-0.01٤
Second pair of anchors (Dorsal anchors)			
a) Total length	0.013-0.015	0.018-0.022	0.028-0.033
b) Shaft length	-	-	0.021-0.028
c) Inner root length	-	-	0.010-0.015
d) Outer root length	-	-	0.004-0.007
e) point length	0.003-0.004	0.003-0.005	0.011-0.01٧
Complex bar			
a) Total length	0.022-0.026	0.029-0.035	0.036-0.040
b) Width	0.002-0.003	0.002-0.003	0.006-0.00٩
Copulatory organ			
Copulatory tube	0.068-0.097	0.024-0.026	0.050-0.05٧



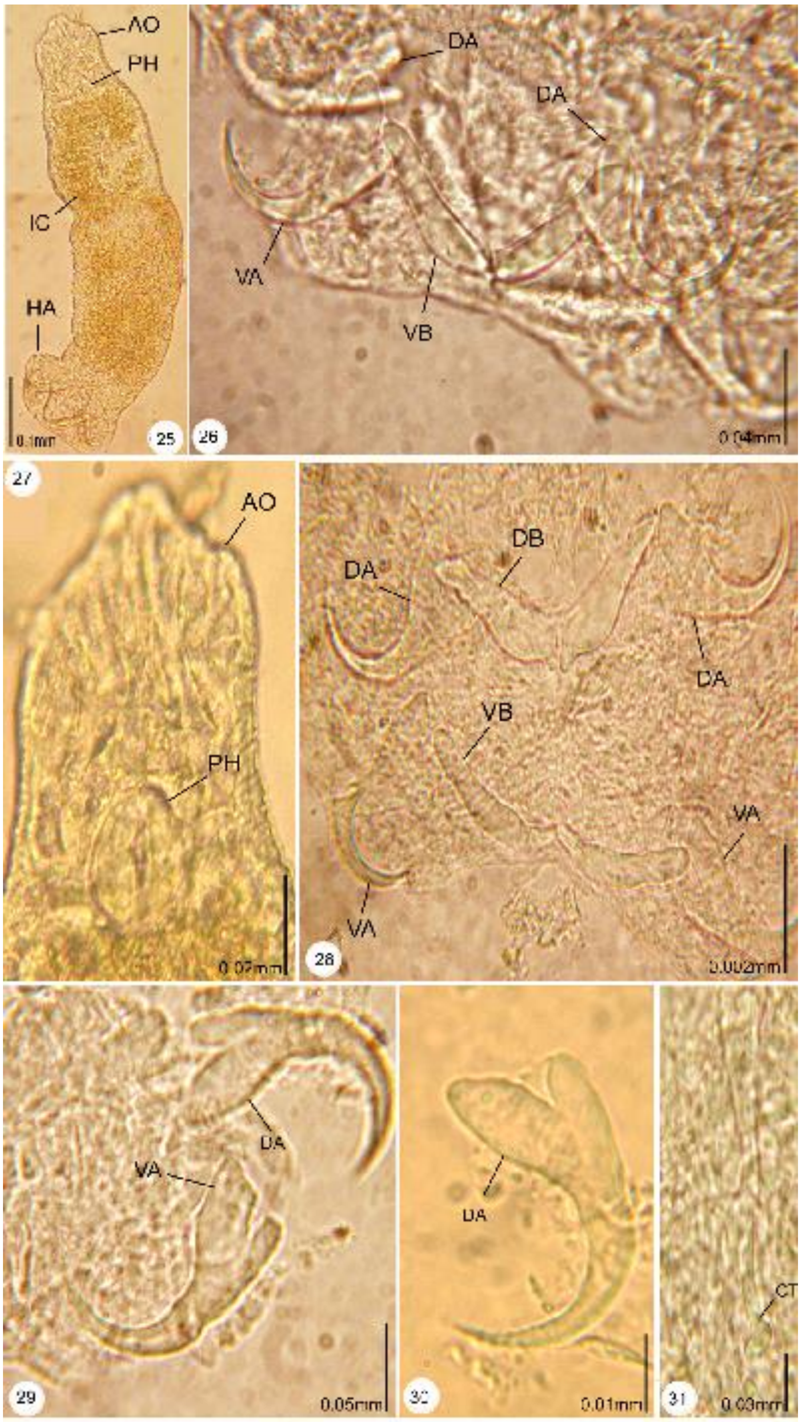
Figs. (1-8): Photomicrographs of *Cichlidogyrus aegypticus* infecting *Oreochromis niloticus* showing high magnifications of: (1-7) The sclerotized parts of the haptor which consists of two bars, the dorsal bar (DB) and the ventral bar (VB), the two pairs of anchors, the dorsal anchor (DA) and the ventral anchor (VA);, the dorsal bar (DB) and the ventral bar (VA). (8) The copulatory complex which consists of a copulatory tube (CT) and a supporting accessory piece called heel (HE).



Figs. (9-16): Photomicrographs of *Protoancylodiscoides malapteruri* infecting *Malapterurus electricus* (9) Whole mount preparation of the adult worm showing its anterior attachment organ (AO), two pairs of eyes (E), copulatory organ (CO), intestinal caeca (IC) and haptor (HA). (10-16) High magnifications of: (10) The anterior attachment organ of the worm (AO) with eyes (E) and pharynx (PH). (11-15) The sclerotized parts of the haptor (HA) showing two pairs of hamuli (H), one pair of large dorsal hamuli (DH) and one pair of small ventral hamuli, large larval hooklets (LH), dorsal bar (DB) and ventral anchor (VA). (16) The copulatory organ which consists of long penis (PE) and vagina (V).



Figs. (17-24): Photomicrographs of *Quadriacanthus bagrae* infecting *Bagrus bajad.* (17) Whole mount preparation of the adult worm showing its anterior attachment organ (AO), Eyes (E), intestinal caeca (IC) and haptor (HA) region. (18-24) High magnifications of the sclerotized parts of the haptor which consists of two bars, a dorsal bar (DB) and a ventral bar (VB), two pairs of anchors, dorsal anchors (DA) and ventral anchors (VA), dorsal bar (DA) and ventral bar (VB), hooklet (HO).



Figs. (25-31): Photomicrographs of *Ancyrocephalus* sp. infecting *Mormyrus kannume*. (25) Whole mount preparation of the adult worm showing its anterior attachment organ (AO), pharynx (PH), intestinal caeca (IC) and haptor (HA). (26-31) High magnifications of: (26) The anterior part of the worm showing its anterior attachment organ (AO) and the pharynx (PH). (27-30) Haptor elements including two bars, a dorsal bar (DB) and a ventral bar (VB), two pairs of anchors, two dorsal anchors (DA) and two ventral anchors (VA). (31) The copulatory tube (CT).

DISCUSSION

Cichlidogyrus aegypticus Ergens, 1981:

C. aegypticus was obtained in the present study from the gills of *O. niloticus*. The same parasite species had been reported previously by Ergens (1981) and Bayoumy (1996). Table (1) shows measurements of *C. aegypticus* in the present study and those previously described. The total body length and the maximum body width obtained in the present study were measured, which were not recorded by Ergens (1981), while they were smaller than that recorded by Bayoumy (1996). The measurements of the first pair of anchors and the second pair of anchors in the present study were larger than those recorded by Ergens (1981) and Bayoumy (1996). The total length of the ventral bar was relatively smaller than those recorded by Ergens (1981) and Bayoumy (1996), but its width was equal to those recorded by Ergens (1981) and Bayoumy (1996). Furthermore, measurements of the complex bar of the present parasite were relatively larger in length than that recorded by Ergens (1981), but they were relatively equal to that obtained by Bayoumy (1996). Width of this bar and the appendage length were relatively equal to those recorded by Ergens (1981) and Bayoumy (1996). The copulatory organ in the present study was larger than those recorded by Ergens (1981) and Bayoumy (1996). From the morphological and morphometric comparison, it was concluded that the present parasite had most of the characteristics of *C. aegypticus* as described by Ergens (1981) and Bayoumy (1996). Ergens (1981) and Bayoumy (1996) recorded this parasite from the gills of *Tilapia zilli* but in the present study, *O. niloticus* was considered as a new host for *C. aegypticus* Ergens, 1981.

Protoancylodiscoides malapteruri Charles *et al.* 1997 **:**

In the present study, *P. malapteruri* was obtained from the gills of *M. electricus* and interestingly the same species was reported from the same host by Charles *et al.* (1997) from Cameron. There were other two species of *Protoancylodiscoides*; *P. mansourensis* obtained from the Nile catfish *Chrysichthysauratus* from Damietta Branch of the River Nile by El-Naggar (1987) and *P. chrysichthes* from *Ch. nigrodigitatus* (Paperna, 1969). Table (2) shows intraspecific variations between the measurements of *P. malapteruri* in the present work and those previously described. The total body length in the present study was larger than those reported by Paperna (1969) and Charles *et al.* (1997), while it coincided with that reported by El-Naggar (1987). Moreover, the maximum body width was smaller than those reported by El-Naggar (1987) and Charles *et al.* (1997). Measurements of the total length of the first pair of hamuli in the present investigation coincided with those reported by Charles *et al.* (1997), while they were smaller than those reported by Paperna (1969) and El-Naggar (1987). Measurements of the total length of the second pair of hamuli (present study) were larger than those reported by Paperna (1969), El-Naggar (1987) and Charles *et al.* (1997). Also, the penis length was coinciding with that reported by El-Naggar (1987), but it was smaller than that reported by Charles *et al.* (1997). The vagina length was larger than that reported by El-Naggar (1987). So, the present parasite had most of the morphological characteristics of the shape and structure of the sclerotized parts similar to those reported by Charles *et al.* (1997), but differed in the location of study and some of the measurements. In conclusion, the present parasite may be classified as *P. malapteruri*. Charles *et al.* (1997) reported *P. malapteruri* from Cameron but in the current study, Qena govrnorate from Egypt was considered as a new locality for *Protoancylodiscoides malapteruri*.

Quadriacanthus bagrae Paperna, 1979 (Table 3, Figs. 17-24):

The parasite *Q. bagrae* was obtained in the present study from the gills of *B. bajad*. Previously, *Q. bagrae* was reported by Paperna (1979) from *B. bajad*. Other species of *Quadriacanthus* were previously reported as: *Q. clariadis* from *Cl. gariepinus* Lake Galilee, Israel (Paperna, 1960 and 1961), *Q. kobiensis*, Ha Ky, 1968 from *Cl. fuscus* Linnaeus, 1758 in Vietnam (Tripathi *et al.*, 2007), and *Quadriacanthus* species from catfishes (Teleostei: Siluriformes) in eastern Africa (Francová *et al.*, 2017). Intraspecific variations between the measurements of *Q. bagrae* in the present work and those registered previously were shown in Table (3). The total body length in the present parasite was relatively larger than those of *Q. bagrae* (Paperna, 1979), *Q. clariadis* (Paperna, 1961) and *Q. kobiensis* (Ha Ky, 1968). Moreover, the maximum body width was smaller than *Q. kobiensis* (Ha Ky, 1968) while it coincided with those in *Q. bagrae* (Paperna, 1979) and *Q. clariadis* (Paperna, 1961). The total length of the first pair of anchors in the present investigation coincided with those of the other compared species, while the anchor base length was smaller. The total length of the second pair of anchors (present study) coincided to those recorded for *Q. kobiensis* (Ha Ky, 1968) and *Q. bagrae* (Paperna, 1979), while it was smaller than that recorded for *Q. clariadis* (Paperna, 1961). Meanwhile, the total length of the connecting (ventral) bar coincided relatively with those of all compared species. Furthermore, the total length of the complex (dorsal) bar was relatively equal to those in the other species and the appendage length in the present investigation was equal to those in all other species except in *Q. kobiensis* (Ha Ky, 1968). The copulatory complex in this study was similar to those reported by the previous studies. The present parasite was similar in the shape and measurements of the sclerotized parts to *Q. bagrae* described previously by Paperna (1979). Therefore, the present parasite might be classified as *Q. bagrae*.

***Ancyrocephalus* sp.:**

Ancyrocephalus sp. was obtained in the present study from the gills of *Mo. kannume*. This genus had been reported from previous studies: *A. cornutus* (Ernest *et al.*, 1972) and *A. parvus* (Linton, 1940) from *Strongylura marina*, Alabama and Florida. The ventral bar was straight with slightly expanded ends. The dorsal bar was with gentle posterior bend in the mid region and its ends were expanded. The copulatory tube took a fish-hook shape and the accessory piece was elongated with abruptly curved end. Intraspecific variations between the measurements of *Ancyrocephalus* sp. in the present work and those registered previously were shown in Table (4). The total body length and the maximum body width in the present study were relatively equal to those of species previously described by Ernest *et al.* (1972) and smaller than species previously described by Linton (1940). The haptor width was smaller than species previously described by Ernest *et al.* (1972) and Linton (1940). Morphologically, the present parasite had most of the characteristics of genus *Ancyrocephalus* but with more or less different measurements. In the present study, this genus was recorded for the first time from the River Nile at Qena governorate, Egypt.

Conclusion

The present study described four different monogenean species from River Nile fish hosts at Qena governorate, Egypt. Depending on reports of increasing water pollution, further studies should be undertaken to find the relation between pollution of Nile water and parasites infecting freshwater fish in Egypt.

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