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PARAGORGORHYNCHUS ASWANENSIS N.SP. (ACANTHOCEPHALA: ECHINORHYCHIDAE): AN INTESTINAL PARASITE OF SOME FISHES FROM ASWAN HIGH DAM LAKE IN UPPER EGYPT

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Key words : *Paragorgorhynchus aswanensis* n.sp. Acanthocephala - fish - Aswan High Dam Lake Egypt.

ABSTRACT

Paragorgorhynchus aswanensis n.sp. is described, both by light and scanning electron microscopy, from *Lates niloticus, Clarias lazera, Bagrus bayad, B. docmac,* and *Tetraodon fahaka,* caught from the Aswan High Dam Lake in Upper Egypt. The new species is differentited from the two other species known so far from the genus *Paragorgorhynchus.* A correlation exists between the incidence of this acanthocephalan and its intensity of infection in fish. A key is proposed to separate known species of the genus *Paragorgorhynchus.*

INTRODUCTION

Glovan, 1957 established the genus *Paragorgorhynchus* with the type species, *P. albertianus* from the intestine of *Alestes dentex, Hydrocyon forskali, Lates albertianus, Bagrus bayad* and *Schilbe mystus* from Lake Albert in tropical Africa. He included it in family Gorgorhynchidae Van Cleave and Lincicome, 1940 and order Palaeocanthocephala Meyer, 1931; becuase the male has only 4 cement glands in comparison to family Rhadinorhynchidae Travassos, 1923 where the male has 8 cement glands. Yamaguti (1963) included the same genus in order Echinorhynchidae Southwell and Macfie, 1925 and synonymised the family Gorgorhynchidae with family Rhadinorhynchidae Travassos, 1923. Yamaguti also stated that 'it seems doubtful whether the number of cement glands constitutes important taxonomic criterion by which one family can be distinguished from another". He also synonymised the sub-family Gorgorhynchinae Golvan 1960 with sub-family Rhadinorhynchinae Luhe, 1912.

Troncy, (1969) desribed another species; *P. charinensis* from the intestine of *Lates niloticus* in Chad, his description was based on females only. Later, Troncy and Vassilades (1974), described the males form the same host in Chad. Saoud and Wanas (1984) recorded the genus *Paragorgorhyunchus* in

Lates niloticus, Bagrus docomac, B. bayad, Tetraodon fahaka and *Clarias lazera* from the Aswan High Dam Lake in Egypt. Amin (1985) in his account on the classification of Phylum Acanthocephala, included the genus *Paragorgorhynchus* in Family

Rhadinorhychidae, order Echinorhynchida and Class Palaeacanthocephala. Golvan and Buron (1988) listed various hosts of fishes which are infected with members of the genus *Paragorgorhynchus.*

MATERIAL AND METHODS

Fishes were caught from the Aswan High Dam Lake in the southern part of Egypt. After examination, the helminth parasites encountered were washed in saline solution and fixed in F.A.A. (formaline-Alcohol-Acetic Acid), then stored in 70% alcohol. Some specimens were later examined as whole-mounts and stained in Aceto-carmine or Haematoxylin. Serial sections (8 μm thick) were cut and stained in Haematoxylin and eosin. In the meantime, some mature specimens were dissected to demonstrate the genital system of both male and female worms.

Specimens for Scanning Electron Microscopy (SEM) were dehydrated and dried, using the critical point technique with carbon dioxide as drying medium, and coated with gold. Drwings are made to scale with help of Camera Lucida. All measurements are in millimeters unless stated otherwise.

PARAGORGORHYNCHUS ASWANENSIS N.SP.
(Figs. 1-11)

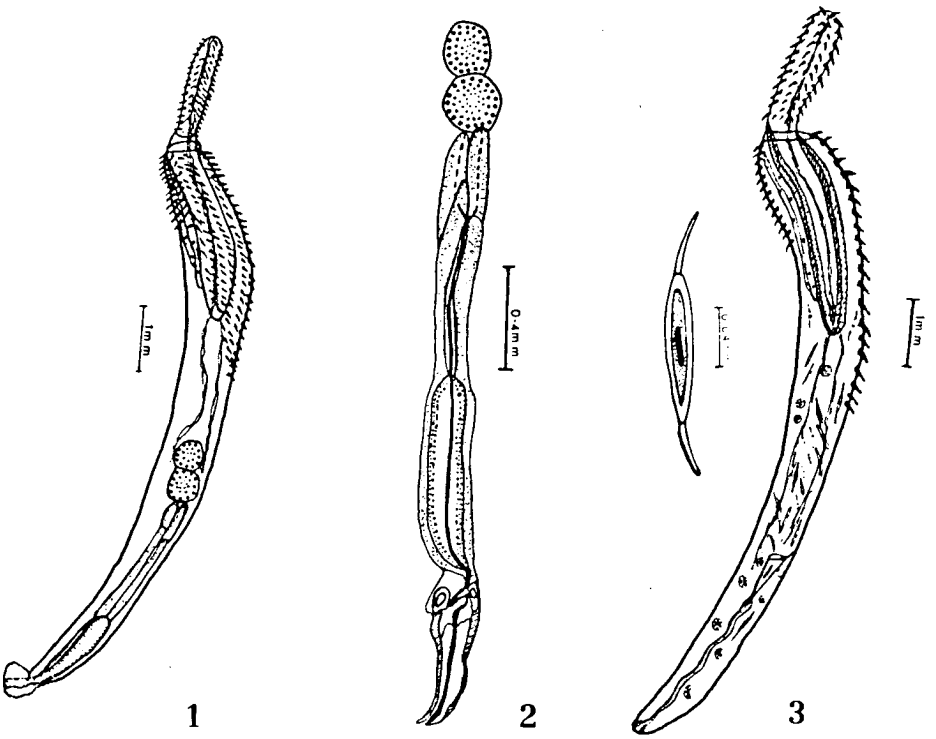
This description is based on fifty specimens (30 females and 20 males) collected from the intestine of *Lates niloticus, Clarias lazera, Bagrus bayad, B.docmac* and *Tetraodon fahaka.*

DISCRIPTION

With characters of the genus. The body is cylindrical, and elongate; the body length is 9.7–13.20 and 11–19 in males and females resepectively. The width of body at the anterior end is 0.69–1.30 in males and 0.86–1.30 in females, while the width of the body at the posterior end is 0.42–0.58 in males and 0.48–0.83 in females.

The proboscis is cylindrical and elongate and measures 1.56–1.86 x 0.32–0.41. It is provided with 8–10 circularly arranged recurved hooks surrounding the top of the probocsis. The 8–10 hooks in each circle are arranged as 3–4 hooks on the right and 3–4 hooks on the left side, and one hook at the anterior

side and one hook at the posterior side. In the middle and posterior parts of the proboscis, the circles of spines become more compact, including 16–20 spines in each circle.



Figs. 1-5 : *Paragorgorhynchus aswanensis* n. sp.
Fig. 1: Male.
Fig. 2: Male genitalia.
Fig. 3: Female and mature egg.

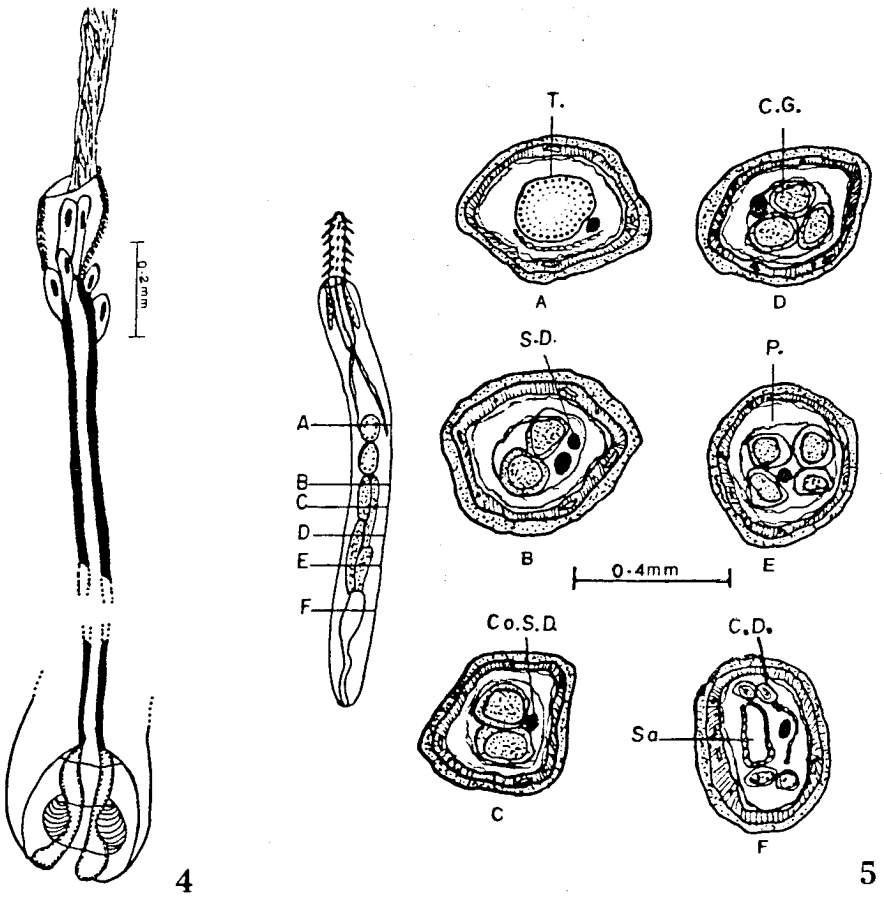


Fig. 4: Female genitalia.

Fig. 5: (A-F) Diagramatic serial cross sections through the posteior region of male.

C.G. - cement gland.

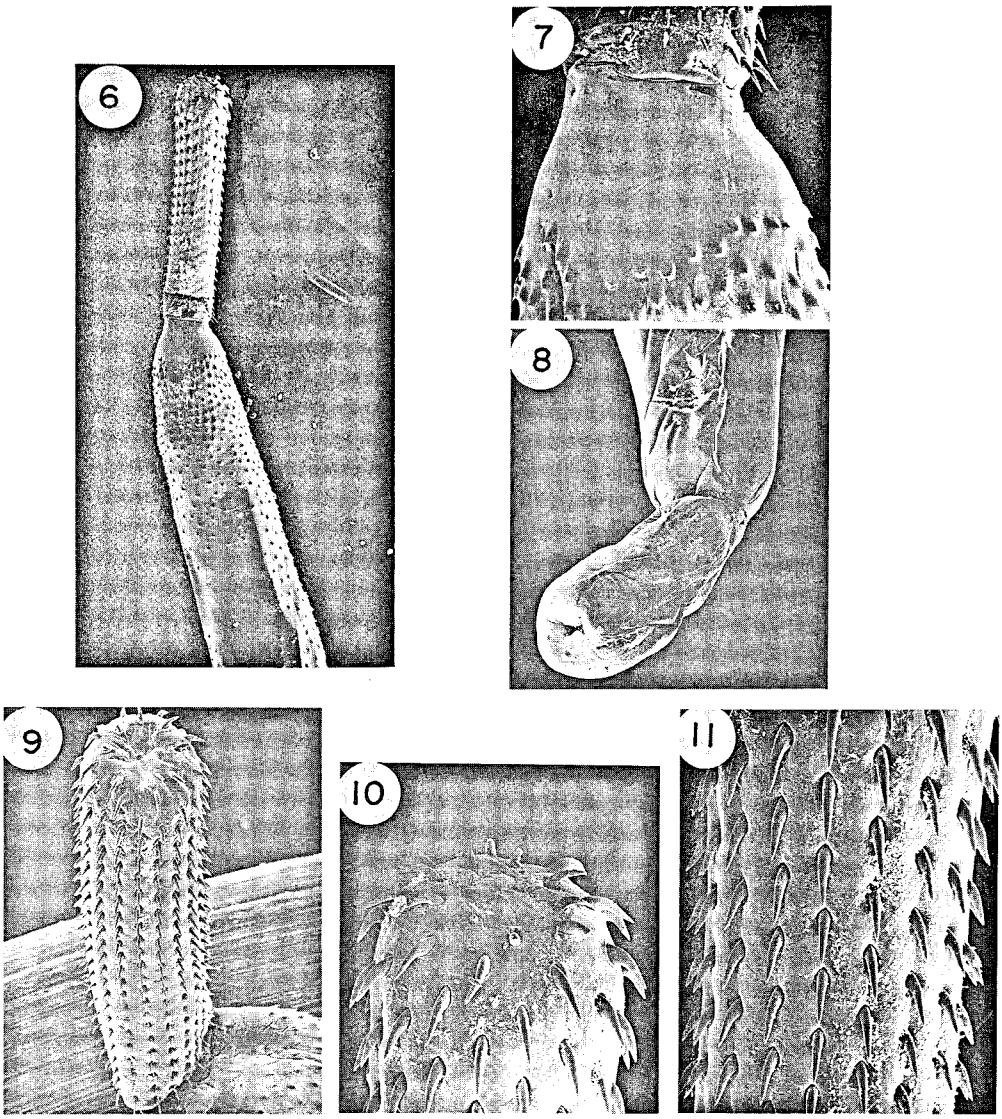
Co.S. D - Common sperm duct.

P. - Pseudocoel.

S.D. - sperm duct.

Sa. - Saefftigen's pouch.

T. - testis



Figs. 6-11 *P. aswanensis* n. sp. SEM preparations

Fig. 6: Proboscis and anterior half of body.
Fig. 7: Presoma.
Fig. 8: Posterior end of male with protruded bursa.
Fig. 9: Proboscis.
Fig. 10: Apex of proboscis.
Fig. 11: Middle part of proboscis.

The number of hooks per one longitudinal row ranges from 24–26 hooks. The distance between two successive hooks at insertion is 60–80 um in males and 70–80 um in females, while the distance between two alternate hooks is 40–60 um and 50 um in males and females respectively. The posterior hooks are smaller than the anterior ones; the free portion of the anterior hooks measures 50–70 x 20–40 μm in males and 30–60 x 10–30 um in females, whereas the free portion of posterior hooks measures 10–20 um in width.

The anterior hooks are more recurved posteriorly than the posterior ones. All the anterior hookse are provided with backwardly directed and oval–shaped roots, measuring 50–80 um in length but the basal hooks are rootless.

The retractor or invertor muscles of proboscis, extend through the wall of proboscis receptacle to terminate on the walll of the trunk near the anterior testes in males and the uterine bell in females.

The neck is short, cylinderical; 0.12–0.21 x 0.27–0.49. It is separated from the trunk by the tegumental fold, which encircle the base of neck to form the tegumental ring.

The proboscis receptacle is cylindrical, elongate, double-walled, measuring 2.67–3.0 x 0.41 – 0.62 in males and 2.60–3.64 x 0.52–0.77 in females. The cerebral ganglion is postequatorial. Two lateral nerve trunks arise from the cerebral ganglion and pass through the muscular wall of the proboscis receptacle.

The histology of presoma body wall is similar to that of the trunk except that it is much thinner. The two lemnisci are cylindrical and shorter than proboscis receptacle. In males, the ventral lemniscus is slightly longer than that the dorsal one; the former measures 2.0–2.6 x 0.10–0.17 while the latter is 1.19–2.50 x 0.10–0.17 but in females they measure 2.20–2.79 x 0.11–0.16 and 2.1–2.3 x 0.10–0.16 respectively. The two lemnisci are supplied by small vessels of the lacunar system and small nuclei variable in number and arrangement. The lemnisci and proboscis receptacle are encircled by groups of muscles known as receptacle protrusors and compressors of the leminsci.

The trunk is cylindrical, circular in cross section, elongated, inflated and spined at its anterior third. The trunk spines are minute and cone-shaped, arranged in a regular circular pattern at the anterior third of trunk, then extend ventrally to reach the level of the bottom of receptacle. They extend ventrally about 2.6–4.6 in males and 3.12–4.48 in females and dorsally for 0.78–1.30 and 0.64–1.56 in males and females respectively. 14–17 rows of spines extend on the dorsal side while 43–51 rows extend on the ventral side. The trunk spines measure 13–34 x 5–12 um and 10–22 x 8–14 in males and females respectively.

Ligament sac ruptures in mature males. Testes lie at posterior half of the body. They are contiguous with the anterior testis partly over-lapping the posterior one, it is slightly larger than the latter and measures 0.34–0.71 x 0.27–0.56 while the posterior one measures 0.35–0.63 x 0.28–0.43. The distance between the anterior testis and the proboscis receptacle measures 0.5–3.04. The common sperm duct is inserted between the four cement glands.

There are four elongated tubular tandem cement glands, lying behind the posterior testis. The four cement glands are syncytial and contain numerous small spherical fragmented nuclei. The first pair touches the posterior testis, they measure 1.0-2.4 x 0.10-0.30. One gland of the second pair is longer than the other. The third cement galnd measures 0.96-1.97 x 0.13-0.30 while the corresponding figures for the fourth are 0.95-1.90 x 0.13-0.30. The four cement glands extend posteriorly to give four ducts which open separately in the bursa. No cement reservoir or vesicula seminalis were observed.

The muscular Saefftingen's pouch is elongated, club-shaped, measuring 0.92-1.46 x 0.26-0.38, and extends posteriorly to continue with the bursal cap. No definite penis is observed in whole mount preparations, in dissected male specimens or in sectios.

The ejaculatory system includes the strong muscular bursa and bursal cap. The evaginated bursa measures 0.35-0.41 x 0.39-0.45. The body wall of bursa has a few small nulcei which measure 0.02 in diameter. The bursal cap measures 0.26 in diameter, it is swollen anteriorly and gives a pair of muscular pockets. The invaginated bursa and bursal cap measure 0.92-1.28 x 0.26-0.34. The posterior part of male genital system is enclosed by a genital sheet, which continues with ligament sac and terminate on the bursal cap. The genital pore is terminal.

In the mature female, the ligament sac extends from the base of proboscis receptacle and proceeds posteriorly to enter the uterine bell. Ovarian balls, measure 50-90 x 40-80 μm. The ligament sac ruptures upon maturation.

The uterine bell lies 3.02-4.68 from posterior end of the proboscis receptacle. It measures 0.4-0.8 x 0.1-0.2. The uterus proper is a simple elongated tube composed of an outer muscular layer and an inner syncytial plasmatic layer, it measures 1.69-2.69 x 0.07-0.23. The vagina is enclosed by strong muscles which form the strong sphincter. The vagina measures 0.18-0.27 x 0.16-0.24. The female genital opening is terminal.

The mature eggs are elongated and spindle-shaped measuring 165-225 μm x 17-18 μm with two polar prolongations. The immature eggs are without polar prolongations and measure 70-90 μm in length.

DISCUSSION

The material described above evidently belongs to the genus *Paragorgorhynchus* Golvan, 1957 which includes two species besides *P. aswanensis* n. sp. It resembles *P. albertianus* Golvan, 1957 but can differentiated by the number of longitudinal rows of proboscis hooks which are 16-18 in *P. albertianus* but 16-20 in *P. aswanensis* n. sp. The two species also differ in the number of hooks on each row, being 30-34 in *P. albertianus* and 24-26 in *P. aswanensis.* The ventral and dorsal hooks of proboscis in the *P. aswanensis* are similar in length and size, but are markedly dissimilar dorso-ventrally in *P. albertianus.* Cement glands are three times longer in *P. aswanensis* than in *P. albertianus.* They are arranged at two levels in *P. alberitanus,* but at three levels in *P. aswanensis.* The number of anterior trunk spines ranges from 30-40 rows in *P. albertianus* compared with 43-51 in *P. aswanensis.*

P. aswanensis n.sp. has also slight differences in the body and organs

and in number of hooks per each longitudianl row. However, the number of longitudinal rows of hooks are 16-20 in *P. aswanensis,* and 16-18 in *P. chariensis.* Moreover, th eggs are shorter and thinner in *P. aswanensis,* measuring 0.165-0.225 x 0.018 while in *P. chariensis* they are 0.33 x 0.025. The same is also true for the length of embryos which are 0.07-0.09 in *P. aswanensis* n. sp., but 0.20-0.22 in *P. chariensis.* The trunk spines are arraged in 12 rows on the on the dorsal side and 55 rows on ventral side in the *P. chariensis* but are 14-17 and 43-51, respectively in *P. aswanensis.*

P. aswanensis n.sp. has also slight differences in the body and organs

measurements, as compared to the other two species (Table 1).

Host : *Lates niloticus, Clarias lazara, Bagrus bayad, B. docmac* and *Tetraodon fahaka.*
Location : Intestine
Locality : Aswan High Dam Lake, Egypt.
Types : Deposited in Helminthological collection, Department of Zoology, Ain Shams University, Egypt and Internatiional Institute of Parasitology, St. Albans, England.

CORRELATION BETWEEN INCIDENCE OF*PARAGORGORHYNCHUS* IN FISH, AND INTENSITY OF INFECTION.

Dogiel *et al* (1964) stated... "when a parasite occurs in more than one host, it is almost always possible to observe that in one of them it is most frequent, grows to the largest size, reaches maturity most rapidly produces the greatest number of egg and, generally appears to be best adapted to the conditions in it. Although present also in other hosts, the parasite is, in them, less common

Table 1

Comparison between the three species of the genus Paragorgorhynchus Golvan, 1957.

Character	*P.albertianus* Male	Golvan, 1957 Female	*P.chariensis* Male	Troncy, 1969 Female	Male	*P.aswanensis* n.sp Female
Body length	8	10	9.5	10-11	9.70-13.20	11-9
Body width	0.7	1	1	1.10	0.42-1.30	0.83-1.30
Proboscis	1.5 x 0.4	1.5 x 0.4	1.85 x 0.35	1.35 x 0.26	1.50-1.80 x 34-0.4	1.50-1.80 x 0.30-0.40
Number of longitudinal rows of proboscis hooks	16-18	16-18	16	16–18	16-20	16-20
Number of hooks/row	30-40	30-40	26	24-26	24-26	24-26
Neck	0.1 in length	0.1 in length	–	0.15	0.12-0.21 x 0.27-0.49	–
Proboscis receptacle	2.5 in length	2.8 in length	2.8 in length	2.8 in length	2.67-3 x 0.41-0.61	2.60-3.0 x 0.50-0.70
Lemniscis	1.8 in length	1.8 in length	1.1 in length	Not observed	1.19-2.60 x 0.10-0.17	2.10-2 x 0.10-0.16
Trunk Spines	Very small (0.04) (0.04)	with 30-45 raws	–	0.40-0.05 long 10-55 rows	V. 14-17 rows D. 43-51 rows	–
Testis	Spherical	–	0.54 x 0.40	–	0.34 x 0.56	–
Cement glands	Short (0.5 length	–	–	–	Elongated	–
Saefftigen's pouch	0.8 in length	–	–	–	0.92-1.4x 0.2-0.30	–
Uterine Bell	–	–	–	0.24 x 0.20	–	0.40–0, 80 x 0.10-0.20
Mature eggs	Not present	–	–	0.33 x 0.03	–	165-225 x 17-18μm
Embryo	–	–	–	0.20-0.22 x 0.02	–	70-80 μm diameter
Hosts	*Alestes dentex* *Hydrocyon forskalii* *Lates albertianus* *Bagrus bayad* Schilbe mystus		*Lates niloticus*		*Lates niloticus* *Clarias lazera* *Bagrus bayad* *B. docmac* Tetraodon fahaka	
Habitat	Intestine		Intestine		Intestine	
Locality	Lake Albert		Chad		Aswan High Dam Lake, Egypt	

and less abundant; its growth is related and it is exposed to considerable resistance by the host... In other host, the parasite occurs very rarely and as a rule develops in them only with difficulty. Dogiel *et al* (1964) referred to these three groups as the main, secondary, and accidental hosts, respectively."

Saoud and Ramadan (1984) studied the correlation between the incidence of certain helminthes and intensity of infection in fishes from the Red Sea. They observed that the highest incidence of trematodes in a fish was correlated with the heaviest worm load in that fish. Moreover, they postulated that the population strength of susceptible fish species determined the role of the species in the maintenance of the life cycle of corresponding parasites in nature.

In the present study, a significant correlation exists between the incidence of *P. aswanensis* in fish and the intensity of infection. The highest incidence of *P. aswanensis* in a fish is associated with the heaviest worm load in that fish. *P. aswnensis* was recorded in five species of fish, the highest incidence (95%) was in *Lates niloticus*, while its incidence was much lower in *Bagrus docmac, Tetraodon fahaka, B. bayad,* and *Clarias lazera* being 13.3, 12.9, 11.1 and 10% respectively (Table 2). It is also significant to note that the highest incidence of this acanthocaphalan is associated with the highest intensity of infection (Table 2). Moreover, it is observed that the size of worms collected from *Lates niloticus* is larger in comparison with those collected from other hosts. It is thus evident that *L. niloticus* is the main host of *P. aswanensis* at the Aswan High Dam Lake.

Table 2

Correlation between incidence of *P. aswanensis* and intensity of infection in fish.

Hosts	Infection Incidence %	No. of Worms per Fish
Lates niloticus	95.0	87–200
Bagrus docmac	13.3	4–15
Tetraodon Fahaka	12.9	9–22
Bagrus bayad	11.1	4–15
Clarias lazera	10	4–7

KEY FOR PARAGORGORHYNCHUS SPP.

The following key is proposed to separate the three species known so far from the genus *Paragorgorhynchus* Golvan, 1957.

1. Cement glands are elongated and arranged at three levels.
   ..... *P. aswanensis* n. sp.
   Cement glands are elongated and arranged at two levels 2
2. Longitudinal proboscis hooks rows has 30-34 hooks each, ...
   ..... *P. albertianus* Golvan, 1957.
   Longitudinal proboscis hooks rows, with 24-26 hooks each,
   ..... *P. chariensis Troncy 1969.*

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REFERENCES

Amin, O. 1985. Classification In: Crompton, D.W.T. and Nickol, B.B. (Eds.). Biology of The Acanthocephala. Cambridge: Cambridge University Press, 27-72.

Dogiel, V.A., Polyanski, Yu.I. andKheisin, E.M. 1964. General Parasitology. (In Russian: Translation by Z. Kabata). pp. 1-516. Oliver and Boyd, Edinburgh.

Golvan, Y. J. 1957. Acanthocephala des poissons. Exploration Hydrobiologique des lacs Kivu, Edouard et Albert. Res. Sci., 3, 55-64.

Golvan, Y.J. 1960. Le phylum des Acanthocephala. Troisieme note, la class des Palaeocanthcephala (Meyer, 1930). Ann. Parasit. Hum. Comp., 35, 76-386.

Golvan, Y.J. and I.Buron 1988. Les hotes des Acanthocephales, II-less hotes definitifs. I, Poissons. Ibidem. 63, 349-375.

Luhe, M. 1912. Zur Kenntnis der Acanthocephalen. Zool. Jahrb. 15, 271-306.

Meyer, A. 1931. New Acanthocephalen dem Berliner Museum. Bergrundung eines neuen Acanthocephalensystems auf Grund einer untersuchung der Berliner Sammlung Ibidem. 62, 53-108.

Saoud, M.F.A. and M.M. Ramadan, 1983. Studies on Digenetic Trematodes of some red Sea Fish I. General survey. Qatar Univ. Sci. Bull. 5, 141-167.

_____, and **M.Q.A. Wanas, 1984.** A Qualitative and quantitative survey on the helminth parasites of fishes from the Aswan High Dam Lake in Egypt. Ibidem., 4, 129-142.

Southwell, T. and J.W.S. Macfie, 1925. On a collection of Acanthocepala in the Liverpool School of Tropical Medicine. Parasitolology, 19, 141-184.

Travassos, L. 1923. Informacoes sobra a fauna helminthologica de Mattco Grosso. Folha. Med. 4, 12.

Troncy, P.M. 1969. A contribution to the study of helminths in Africa mainly Chad. Bull. Mus. Natn. Hist. Paris, 4, 1487-1511.

_____, and **G. Vassiliades, 1974.** Acanthocephala Parasitic in African fish. Bull. Ints. F.A.N., 36, 902-910.

Van Cleave, H.J. and D.R. Limcicome, 1940. A reconsideration of the Acanthocephala family Rhadinorhynchidae, J. Parasit. 26, 75-81.

Yamaguti, S. 1963. Systems Helminthum, Vol. 5, Acanthocephala, pp. 1-423. New York and London, Wiley Interscience.

باراجورجورهينكس أسوانينسس
الرأسشوكيات
طفيل الأمعاء لبعض الأسماك من بحيرة السد العالي
بأسوان في مصر العليا

محمد فتحي عبد الفتاح سعود و محمد قاسم عادل ونس

وصف المؤلفان نوعاً جديداً من الرأسشوكيات ، وهو باراجورجورهينكس أسوانينسس ، وذلك في ضوء الفحص بالميكروسكوبي الضوئي والالكتروني الماسح . ولقد سُجل الطفيل في عدد من العوائل الجديدة من الأسماك ببحيرة السد العالي بأسوان . وقد تمت مناقشة أهم الاختلافات المميزة للنوع الجديد بالمقارنة معها النوعين السابقين ، كما وضعها مفتاح للتعرف والتفرقة بين الأنواع المختلفة للطفيل ، وتم مناقشة العلاقة بين معدل الاصابة وشدة الاصابة بالطيفل في العوائل المختلفة وبيان أهمية تلك العلاقة في دراسة ظاهرة إنتشار الطفيل في أكثر من عائل .