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SCANNING ELECTRON MICROSCOPY OF *CATATROPIS AEGYPTIACUS* N. SP. (TREMATODA: NOTOCOTYLIDAE) FROM NORWAY BROWN RAT, *RATTUS NORVEGICUS* (MURIDAE: *MAMMALIA*) FROM EGYPT

By

MOSTAFA M. RAMADAN, NAHED E. ABDOU, RANIA G. TAHA, AND SAHAR H. HAROUN*

Department of Biological and Geological Sciences, Faculty of Education, Ain-Shams University, Cairo, Egypt (*Correspondence: saharharoun@yahoo.com)

Abstract

Catatropis aegyptiacus n. sp. was isolated from the large intestine of 28 out of 91 rat *Rattus norvegicus*. The prevalence of infection in males is 40% and 30% in females. The infection rate was (54.54%, 36.84%,26.3% and 23.8%) in winter, fall, summer and spring respectively. The study of the new species by light and scanning electron microscopy revealed that *Catatropis aegyptiacus* n. sp. can be distinguished from all other species of the genus in having 10–11 protruded ventral glands that extend from the intestinal bifurcation level to the ovarian level, the triangular pointed spines cover the first anterior third of the body, the position of the genital pore and larger egg size. Also, the outer rim of oral sucker has unciliated sensory papillae and the tegument of the anterior dorsal surface covered with irregular ridges studded randomly with unciliated and ciliated domed-like papillae. Tegument of the body posterior half has branching and anastomosing transverse striations with small unciliated sensory papillae.

Keywords: Egypt, *Rattus norvegicus*, *Catatropis*; Trematoda; Notocotylidae.

Introduction

Catatropis was first recorded by Frölich (1789) under the name of *Fasciola verrucosa*. Zeder (1800) transferred this worm to the genus *Monostomum*, then genus *Catatropis* was established (Odhner, 1905) to distinguish monostome digeneans with ventral structures of the 'verrucosa' type from those have 3 rows of ventral gland. Lühe (1909) created the family Notocotylidae to include three monostome genera; *Notocotylus,* genus have three lateral rows of ventral glands*, Catatropis* have two lateral row of ventral glands and a median ridge and *Paramonostomum* lacks ventral glands and ridges (Schuster and Wibbelt, 2012).

Catatropis Odhner, 1905 is a cosmopolitan species recorded worldwide; Europe, Africa, Asia, Venezuela, Russia, Japan, Australia, Canada, India, Argentina, Vietnam, Pakistan, Chile, Tunisia, Bangladesh, Oceania and America (Bayssade-Dufour *et al*, 1996; Koch, 2002; Flores and Brugni, 2006; Birmani *et al*,2011; Schuster and Wibbelt, 2012; Zaman *et al*, 2016; Izrailskaia *et al*, 2019).

Gupta and Jahan (1977) in India described *C. rauschi* from a spot-billed duck but did not recognize that the species name was preoccupied by Singh (1956). Thus, Gupta and Singh (1984) erected the name and gave *C. poecylorhynchai* for *C. rauschi*. In Pakistan, the same problem occurred with Schuster and Wibbelt (2012) who named the specimens from Northern shovelers, *Anas clypeata* as *C. pakistanieses* and did not aware that this name was occupied previously by Shafi *et al*. (1982) for the specimens of rice rat *Bandicota bengalensis*.

The genus *Catatropis* infects mainly birds especially geese, chicks, ducks and snails and rarely infects mammals; only *C. morosovi* and *C. pakistanieses* recorded from rodents (Shafi *et al*, 1982; Flores and Brugni, 2003; Barton and Blair, 2005).

In Egypt, a little information about *Catatropis* infecting Egyptian birds or mammals, until Yousif, *et al.* (2011) detected this genus as a first record in experimental infected host.

The present study aimed to describe a new *Catatropis* species by light and scanning electron microscopy isolated from *Rattus norvegicus* collected from Abu-Rawash and El-Mansuria Lake, Giza, Egypt.

Materials and Methods

The specimens were collected from the large intestine of the wild rats *Rattus norvegicus* caught from Abu-Rawash and El-Mansuria Lake in Giza, Egypt. Unstained trematodes were examined to describe the pattern and distribution of ventral glands, fixed under slight cover glass pressure in 70% ethyl alcohol, stained with acetic acid alum carmine, cleared in clove oil and finally mounted in Canada balsam. Diagrams were done by camera Lucida. All measurements were given in millimeter (mm) and eggs in micrometer (µm). Specimens were identified and compared with the available literature. Specimens (Holotype and Paratypes) were deposited in the helminthes Collection, Department of Biology, Faculty of Education, Ain Shams University, Cairo.

For SEM, some worms were fixed in 2% glutraldehyde in 0.1 M sodium cacodylate buffer (pH 7.2), washed three times in the same buffer, post fixed in osmium tetroxide (O_SO_4) for 2 hrs, washed in sodium cacodylate buffer, dehydrated in ascending ethanol series, and critical point dried (Abdou *et al*, 2001). Specimens were mounted on stubs and coated with gold examined and photographed with various magnifications under by Scanning Electron Microscope, Electron Microscopic Unit, the Atomic Energy Agency, Nasr City, Egypt.

Results

Catatropis aegyptiacus n. sp. was isolated from the large intestine of 28/91(30.76%) *Rattus norvegicus* (Fig. 1:A, B, & C). Prevalence in males was 40% & 30% in females. Rate of infection varied seasonally, the highest rate was in winter (54.54%) and the lowest was in spring (23.8%), but infection rate fluctuated between 26.3% & 36.84% in summer and fall respectively

Live specimens were pale yellow-orange to red. Body elongate, flattened dorso-ventrally, slightly pointed anteriorly and rounded posteriorly. Ventero-lateral glands arranged in 2 longitudinal lateral rows; each one with 10-11 glands. A median ventral glandular ridge started from ovarian level to caecal bi-furcation anterior level. Spines covered body first third. Body was 2.38-3.12x0.9-1.2. Oral sucker terminal, measured 0.13-0.15x0.14-0.17. Oesophagus thin, measures 0.07-0.19 in length. Intestinal caeca with irregular surface composed a special shape, passed between ovary and testes and terminated just before two testes end.

Testes elongated, highly lobulated, located laterally in body posterior part. Each one extended from vitellaria posterior portion to a very short distance from body extremity. Right testis measured 0.61-0.80x0.21-0.36, left testis measured 0.56-0.81x0.23-0.38.

Genital pore median, located posterior to oral sucker, measured 0.0285 in diameter. Cirrus pouch elongated, flask-shaped structure, measured 0.50-0.84x0.10-0.64. Cirrus pouch anterior oval part contained coiled vesicula seminalis.

Ovary lobed, located between testes, measured 0.19-0.40x0.17-0.24. Mehlis' gland rosette shaped, situated above ovary; measured 0.10-0.17x0.14-0.25. Vitellaria consisted of small branched follicles extended laterally approximately from body median part to testes anterior extremity, Length of right 0.59-1.14, & left one 0.66-0.96. Uterus convoluted tubule extended between two intestinal caeca, with most proximal loop acted as a reseptaculum seminis. Eggs measured 30-40 x20-38µm. Each with two polar filaments; fully filament measured 70-130µm. Uterus distal loops contained eggs without filaments, which started to appear through following loops obviously in proximal ones, Excretory bladder Y shaped.

SEM showed body leaf like (Fig. 2: A, B, C, D, E, F, G, H, I, & J). Dorsal body surface with tegumental wrinkles; ventral one with 2 longitudinal rows of protruded spherical structures (ventral papillae or glands) ranged in number from 10 to 11 glands and occupied a considerable proportion of worm ventral surface. Confused papillae ridge in worm middle ventral surface. Ventral glands formed compact masses of secretory struc-

tures opening on tegument outer surface evaginated or protruded to outside, Oral sucker tegumental surface unciliated sensory papillae, inner rim without papillae.

Body surface first anterior third ventrally covered with overlapped spines, directed backward, triangle in shape with pointed ends. Tegument of anterior body dorsal surface covered with irregular ridges. Unciliated and ciliated domed-like papillae scattered irregularly, Body tegument posterior half branched and anastomosing transverse striations with small unciliated sensory papillae.

Taxonomy:

Catatropis aegyptiacus n. sp.
Host: *Rattus norvegicus* Berkenhout, 1769
Site: large intestine
Locality: Nile Delta, Abu-Rawash and El-Mansuria Lake, Giza Governorate, Egypt.
Etymology: The specific name referred to Egypt, the type locality.

Discussion

Odhner (1905) described genus *Catatropis* for the first time from anseriformes collected from Sweden. Genus distinguished from *Notocotylus* Diesing, 1839 (Famliy: Notocotylidae) in having a median ventral ridge and everted two lateral rows of ventral glands or papaillae while *Notocotylus* genus have 3 rows of ventral glands without median ridge. Ventral glands arrangement was of generic diagnosis as well as, their number and the genital pore position (Mackinnon, 1982).

Schuster and Wibbelt (2012) reported that genus *Catatropis* included 17 species and 3 species were added by Izrailskaia *et al*. (2019). So, the genus *Catatropis* included 20 valid species, and the present *Catatropis aegyptiacus* is new species.

In the present *C. aegyptiacus*, genital pore was situated directly posterior to oral sucker as in *C. indicus, C. pricei, C. harwoodi, C. chinensis, C. misrai, C. poecyclorhynchai, C. pakistane- nsis* and C. vietnamensis. But, in all other *Catatropis* species the genital pore opens just posteriorly to the intestinal caeca bifurcation. In the present *C. aegyptiacus*, number of ventral papillae in each lateral row was 10-11. This distinguished *C. aegyptiacus* from *C. orientalis, C. harwoodi, C. poecylorhynchai, C. joyeuxi, C. lagunae* and *C. vietnamensis* having up to 9 ventral papillae and from *C. verrucosa, C. liara, C. indicus, C. cygni, C. morosovi, C. chinensis* and *C. misrai* having more than 12 ventral papillae.

The present *C. aegyptiacus* was nearly close to *C. pakistanensis* with 9-10 ventral glands, but disagreed in the tegumental spicules pattern where in *C. pakistanensis* spines cover all ventral surface and dorsal surface anterior half, while in *C. aegyptiacus* spines cover only the worm first third of ventral surface. Also, the present *C. aegyptiacus* disagreed with *C. vietnamensis* whose scale-like spines covered the ventral surface anterior half and extension of ventral ridge to the internal seminal vesicle level to the ovary of end. Moreover, the present *C. aegyptiacus* differed from *C. indicus* and *C. misrai* in the absence of tegumental spines. The *C. aegyptiacus* testes were lobed but entire in *C. pricei*. However, the present *C. aegyptiacus* was in harmony with *C. pakistanieses*, in the cuticular spines distribution in the first third of the body but differed in the ventral glands number and genital pore position, as in *C. pakistanieses*, the number of ventral glands was 12 and genital pore was posterior to intestinal bifurcation.

On the other hand, ventral papillae number in each row was more or less similar with *C. hatcheri* (10-12) and *C. chilinae* (9-11), but disagreed with both in the genital pore position and eggs in *C. chilinae* have one or two filaments at one pole, while the eggs in *C. aegyptiacus* have one filaments at each pole.

In the present *C. aegyptiacus*, eggs were (30-40×20-38µm), larger than in *C. hatcheri* (22-24×11-13µm), *C. liara* (18×10µm), *C. charadrii* (18×14µm), *C. cygni* (19-21 ×12-14µm), *C. indicus* (17-20×8-10µm), *C. pricei* (17-20×10-11µm), *C. harwodii* (18× 11µm), *C. lagunae* (20×10µm) *C. orientalis* (24-26µm), *C. morosovi* (25-29µm), *C. chilinae* (24-29×12-14) & *C. verrucosa* (25-30)

after (Flores and Brugni, 2003; 2006).

The ornamentations of sensory papillae, spines, folds, pits, grooves and various shapes of ridges were of tegument of trematode general characters (Schmidt and Roberts, 2000). In the present *C. aegypticus*, the first anterior third of was covered with triangular pointed spines as those in other flukes as *Anchitrema sangiuneum* and *Prosthodendrium prosthodendrium urna* (Ammar *et al*, 2003), *Acanthotrema felis* (Sohn *et al*, 2003) and *Stictodora fuscatum* (Abdul-Salam *et al*, 2000). These spines are used for abrasion of the intestinal host for feeding and anchorage.

In the *C. aegypticus,* oral sucker rim was devoid of tegumental spines as in *Macroorchis spinulosus* (Hong *et al*, 2004) and *Leucochloridium* sp. (Bakke, 1976). The latter author suggested that the absence of spines on the suckers' rim indicated the necessity for a smooth seal against the host mucosa. But, the oral sucker outer rim has unciliated sensory papillae. This agreed with *Catatropis indicus* and *Allogenarchopsis bareilliensis*, where papillae played important role in the feeding (Lee *et al*, 1987) and sucking as well as acted as tango-rheo-or mechanoreceptive (Gupta *et al*, 2017)

The present *C. aegyptiacus* was distinguished by ventral glands that secreted proteolytic enzymes (Harwood, 1939). Martin (1956) found that the median ventral ridge was formed of unicellular glands for adhesion in host caecal mucosa. The present *C. aegypticus* has a high number of sensory papillae on the tegumental body posterior part, which played an important role in the fluke physiological and metabolic functions (Sohn *et al*, 2003). The dorsal body tegumental wrinkles surface was similar to the *Allogenarchopsis* tegument encircled by tegu- mental folds or ridges causing body flexure and oral sucker movement (Abdou *et al*, 2001). Tegumentary ridges caused by contraction waves of the fluke internal musculature (Otubanjo, 1985).

Conclusion

Catatropis aegyptiacus has the following features: ventral glands (10-11) extend from the intestinal bifurcation level to ovarian level and the spines cover the first body anterior third, the genital pore position and larger egg size recommended *C. aegyptiacus* as new Egyptian species and new host record.

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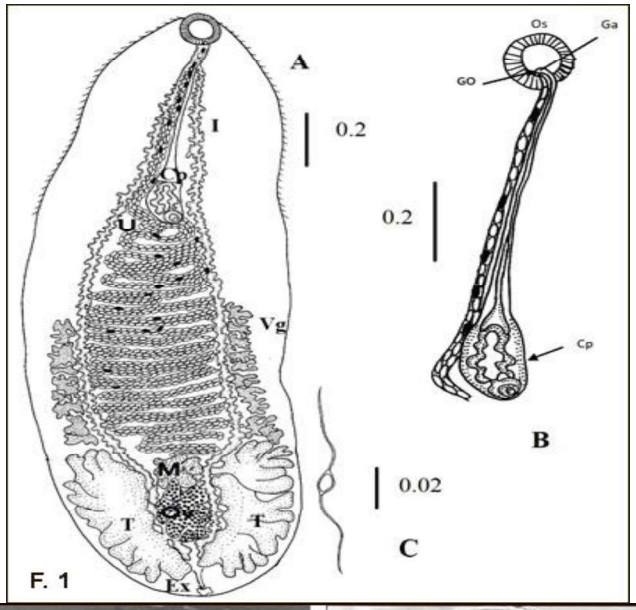
Explanation of figures

Fig. 1: Light Microscope Drawing of *Catatropis aegyptiacus* n.sp. A- Adult worms (I, intestine; Cp, cirrus pouch; T, testis; ov, ovary; u, uterus; M, Mehlis gland; vg, vitelline gland; Ex, excretory pore) B-Terminal genitalia (os, oral sucker; Ga, genital atrium; Go, genital opening); C-Eggs.

Figs. 2: Scanning Electron Micrographs of *Catatropis aegyptiacus* n.sp.: A: Dorsal view of *Catatropis aegyptiacus* sp. n. showed tegumental wrinkles and oral sucker (Os). Bar=100 µm. B: Ventral surface of the worm showing the ventral glands (Vg). Bar=50 µm. C: Posterior part of the ventral surface of fluke showed protruded ventral glands (Vg). Bar=50 µm. D: High magnification of oral sucker show showed outer rim with unciliated sensory papillae (Arrows). Bar=10 µm. E: Top view of oral sucker (Os) showed mouth opening (Mo) with smooth tegument around it. Bar=10 µm. F: High magnification of anterior ventral tegumental body surface showed spines (S). Bar=5 µm. G: High magnification of the anterior dorsal tegumental body surface showed irregular ridges. Bar=10 µm. H: Enlarged view of ciliated and unciliated domed papillae (Astons) and tegumental minute structures (Arrows). Bar=1 µm. I: A high magnification of posterior tegumental body surface showed longitudinal striations. Bar=10 µm. J: Enlarged view of the posterior tegumental body surface showed distributed unciliated small sensory papillae (Astons). Bar=5 µm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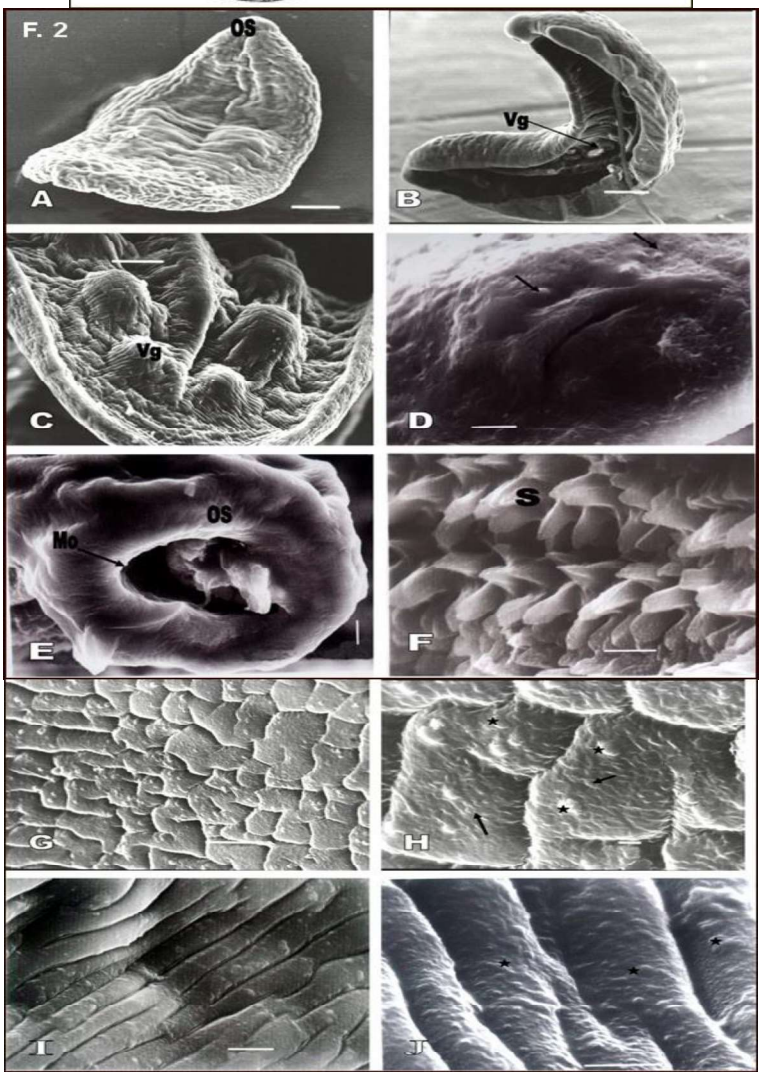
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