



First Egyptian record of the eye fluke (*Philophthalmus palpebrarum*) transmitted by *Melanoides tuberculata* snail and its experimental life cycle

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ABSTRACT

The present study has been recorded, for the first time, cercariae of *Philophthalmus palpebrarum* (Trematoda: *Philophthalmidae* occurring in the birds-eye) emerged from naturally infected *Melanoides tuberculata* snails collected from Giza Governorate, Egypt, and succeeded to complete its life cycle experimentally. The adult worm was extracted from the conjunctival sac of the chicken eyes after 35-40 days post experimental infection by pipetting 10-15 excysted metacercariae into each eye orbit of (1-3 days old chicks). The worms were identified as *Philophthalmus palpebrarum* based on the morphological characteristics and the comparison with the previous descriptions in the literature. They were small, the body length, 5.48 mm (4.6 - 6.1) and its width 1.60 mm (1.32 - 1.9) and the surface of the body is smooth and lacks spination. The morphological characteristics of the developmental stages, from cercariae to adults, of this eye fluke, were described. It can be concluded that this eye fluke was described as *Philophthalmus palpebrarum* and the *Melanoides tuberculata* snails emphasized as its intermediate host in natural and experimental infection for the first time in Egypt. From this study, it is recommended to pay more attention to this parasite as a zoonotic disease to avoid the risk factor of this parasite to humans.

INTRODUCTION

Philophthalmids are small trematodes of the family *Philophthalmidae* residing within the eyes of birds (Kingston, 1984). Rudolphi (1819) was the first who described a fluke found under the eyelids of birds and named it *Distoma lucipetum*. A nonspinous trematode created from the eyes of *Corvus cornix* in Egypt of the genus *Philophthalmus* for *Philophthalmus palpebrarum* (Looss, 1899). Also, Braun (1902) described *Distomum lucipetum* (Rudolphi, 1819) which has a spiny cuticle and a pharynx smaller than the oral sucker, while *P. lacrymosus* was created from *Lunis niaculipennis* in Brazil. *P. nocturnus* was described by (Looss, 1907) from birds in Egypt. Since then, over 36 species of this genus have been reported from Asia, Europe and America. *Melanoides tuberculata* snails (Müller, 1774) have been reported to be an intermediate host of several species of Eye flukes (Yamaguti, 1934; Ching, 1961; Nollen & Murray, 1978; Radev *et al.*, 2000), however the family is typified by the species, *Philophthalmus gralli*,

which known as the “oriental eye-fluke” in the Middle East, specifically the United Arab Emirates (Ismail and Saliba, 1985; Ismail and Arif, 1993), Jordan (Ismail and Issa, 1987a & b), Saudi Arabia (Kalantan *et al.*, 1998), and Israel, where only the cercaria and redia were mentioned (Farstey, 1986 and Radev *et al.*, 2000). Also, in Venezuela this species has been reported in *M. tuberculata*, from Aguasanta and Yaguaracal, Sucre State, (Diaz *et al.*, 2002). 4 species were identified in India namely *Philophthalmus* sp. by Murty (1966), *Philophthalmus anatinus* by Rao and Rao (1981), *Philophthalmus gralli* by Rezaul *et al.* (1982) and *Philophthalmus lucknowensis* by Saxena (1979, 1981, 1984, 1985, 1989).

It was recorded that both *P. palpebrarum* and *P. nocturnus* are morphologically similar to each other (Schuster, 2011) and it is even suggested that they are one species (Vassilev, 1984). However, in Israel Radev *et al.* (1999) isolated these species from *Melanopsis praemorsa* snails and formerly identified as probably belonging to *P. palpebrarum* and reevaluated as belonging to *P. lucipetus*.

In Egypt (Hassan, 1987; Khalifa *et al.*, 1997) found that the cercaria of *Philophthalmus* naturally emerged from *Cleopatra bulimoides* snail. While, Lotfy and Abo El-Hadid, 2005, succeeded in following up the life cycle of *Philophthalmus* species cercaria emerged from *Cleopatra bulimoides* snail till production of adult worm *Philophthalmus* species.

According to the original description of the adult worm only by Looss (1899 and 1907) *P. palpebrarum* and *P. nocturnus* match with the morphology of the fluke described in the present study. The present study claimed that it is the first time in Egypt that the *P. palpebrarum* and *P. nocturnus* originating in *M. tuberculata* snails.

So, the objective of the present work is to complete and describe life cycle of *Philophthalmus palpebrarum* (found by Looss 1899 and 1907) experimentally and identifying the larval stages and adults using *Melanoides tuberculata* snails and chicks.

MATERIALS AND METHODS

Snails collection: Two thousands of *Melanoides tuberculata* snails were collected from El-Mansouriya main canal, Giza Governorate, Egypt, (30°00 N, 31°10 E) using a hand net in March (2018). The snails were collected from black muddy places rich in vegetation, *Ceratophyllum demersum* and algae where oxygen content of the water was 5.7 mg/l, pH was 7.7 and the temperature was 26°C, at water depth 1.5 m. The snails were transported alive to the laboratory where they thoroughly cleaned and maintained for several weeks in aquaria with a thin substrate of sand and dechlorinated water and provided with blue green algae (*Nostoc muscarm*) for feeding. They were examined individually and successively for cercarial shedding by putting each in a well with 5 ml of dechlorinated water and exposing it to artificial light for two hours. The wells were checked for the presence of cercariae under a stereo-microscope. Cercariae liberated were pipette and examined alive after staining with vital stains (Nile Blue Sulphate and Neutral Red). Staining was performed using 10³ w/v concentration for 5 minutes at room temperature. In some cases, a few crystals of menthol were scattered on water surface to slow the motion of the cercariae to facilitate their examination. The morphological description was based on fully mature cercariae (Yousif *et al.*, 2010).

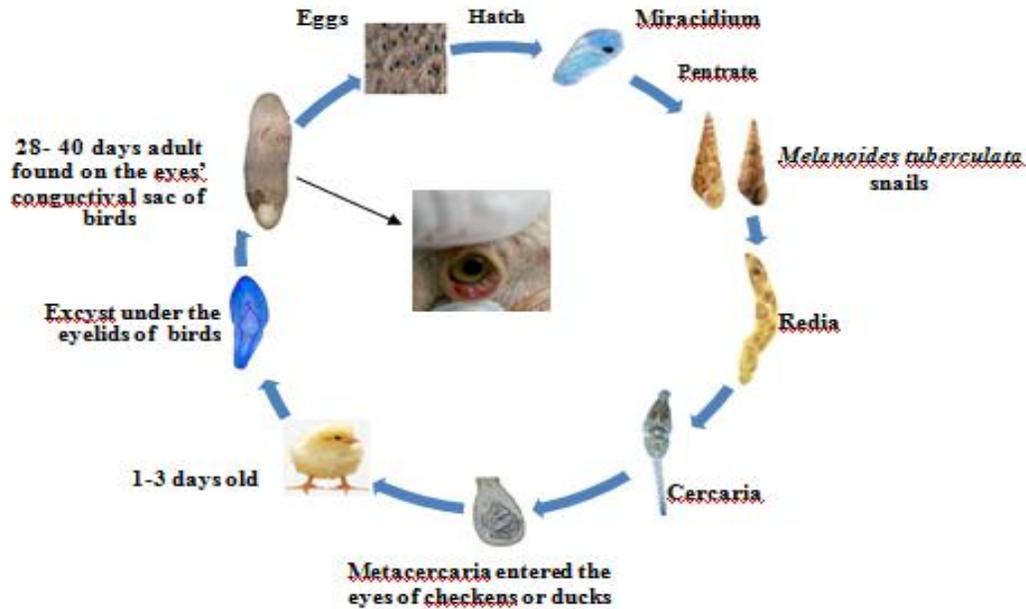
Emerged cercariae encysted within 40-60 seconds. Encysted metacercariae were excysted by their placement in saline at 37°C for several minutes (Ismail and Issa, 1987a). These excysted metacercariae were subsequently used to infect chicks. The rediae were obtained from snails by crushing the shell and isolating them out of the tissues. Rediae, Cercariae, metacercariae, excysted metacercariae and the adult worm were drawn by a light microscope using a camera Lucida and photographed by a digital camera. The means of the body and certain organs of ten for each were measured.

Infection of chicks: Chicks used in this study were 1-3 days old and experimentally infected directly by pipetting 10-15 excysted metacercariae into each eye orbit (Alicata and Ching, 1960; Howell and Bearup, 1967). Infected chicks were housed in animal house of TBRI (Theodor Bilharz Research Institute, Imbaba, Giza, Egypt) where they were provided feed and water and libitum for 40 days.

Recovery, processing and measurement of worms and eggs: The chicks were slaughtered after 35-40 days of infection and the adult flukes were carefully tested out with fine forceps from conjunctival sac of eyes. The worm relaxed, fixed, stained and mounted according to Prichard and Kruse (1982) and identified according to Yamaguti (1958); Gold *et al.* (1993) and Radev *et al.* (1999) depending on characteristic morphological features of adults.

RESULTS

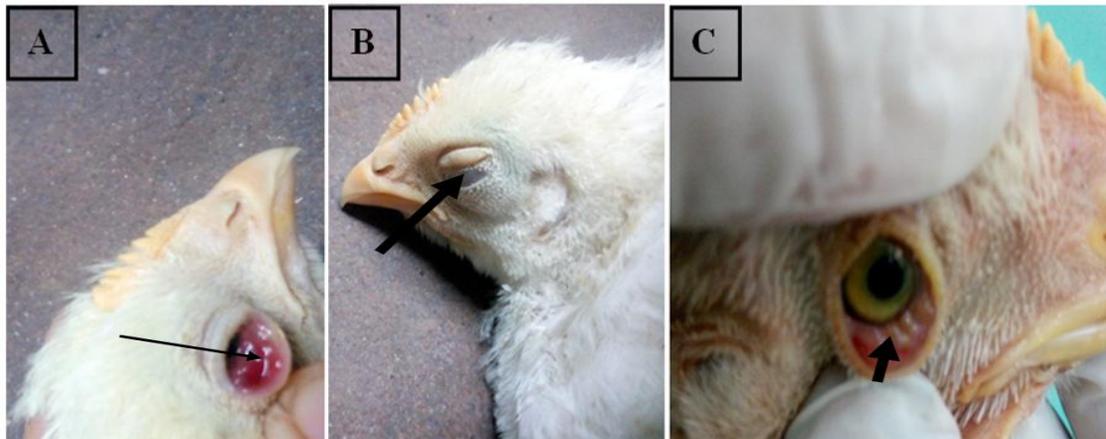
A total of 100 adult *Philophthalmus palpebrarum* were recovered from the conjunctival sac of eyes of 10 chickens after 35 day post infection (Fig. 1).



(Fig. 1): Experimental life cycle of *Philophthalmus palpebrarum* using *Melanoides tuberculata* snails and chicks.

The results of the experimental infection approximately were 100 % between chickens. The majority of the affected chickens showed severe conjunctivitis (Fig. 2A), constant lacrimation and swollen eyelids. In some, the lacrimation was accompanied by

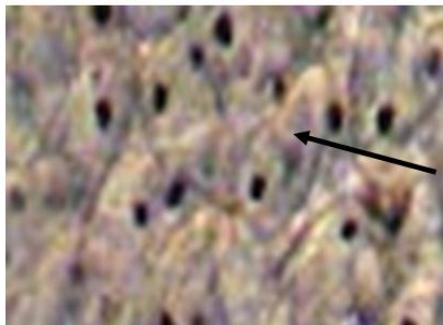
purulent exudate. Heavily infected chickens kept their eyes closed (Fig. 2B) and appeared to have lost body condition. Physical examination of the semi-blind chickens revealed numerous attached to the conjunctival sac of both eyes (Fig. 2C).



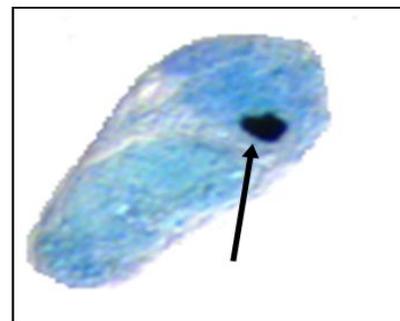
(Fig. 2): Photos of the affected chickens' eyes showing (A) severe conjunctivitis and constant lacrimation (Thin arrow), (B) Infected chickens kept their eyes closed (Thick arrow) and (C) numerous adult worms appeared attached to the conjunctival sac of both eyes (Short arrow).

Preliminary examination of the specimen of the organism revealed morphological features resembling those of a digenic trematode. In fresh mounts of the parasite; the following stages were described:

- 1. Egg:** Nonoperculate, smooth, oval, asymmetrical; pointed at one end and the other end rounded (Fig. 3). Eggs with developed miracidia occur in the final part of the uterus.
- 2. Miracidium:** Free miracidia with one black eye spot (Fig.4).The miracidium, upon release from the egg, will infect a susceptible snail host (*Melanoides tuberculata*) and internally will continue to develop into the redia where a mass of cercarial stages is enclosed within 90 days.



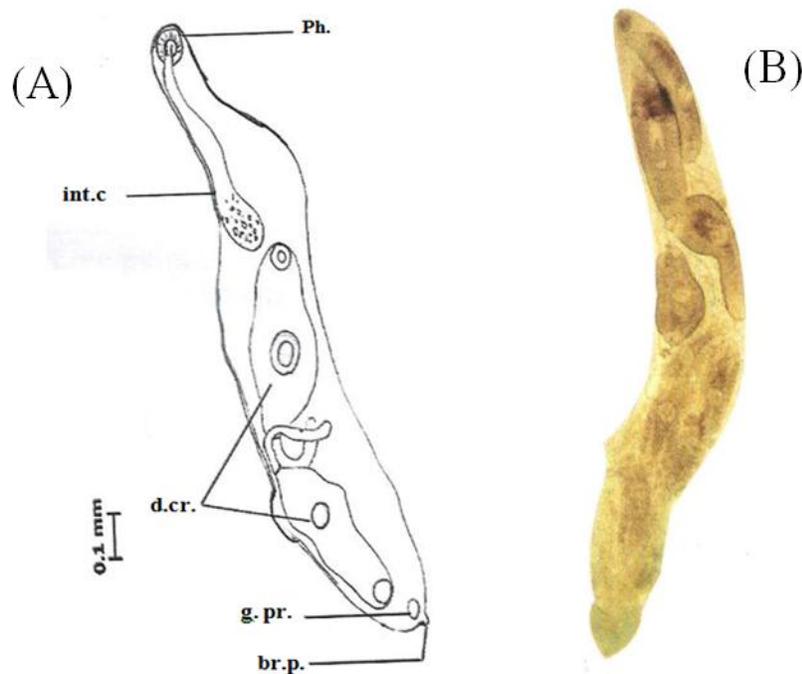
(Fig. 3): Photomicrograph of the *Philophthalmus palpebrarum* nonoperculate eggs pointed at one end and the other end rounded (Arrow) (Vital stains).



(Fig. 4): Photomicrograph of *Philophthalmus palpebrarum* miracidium with one black eye spot (Arrow) (Vital stains).

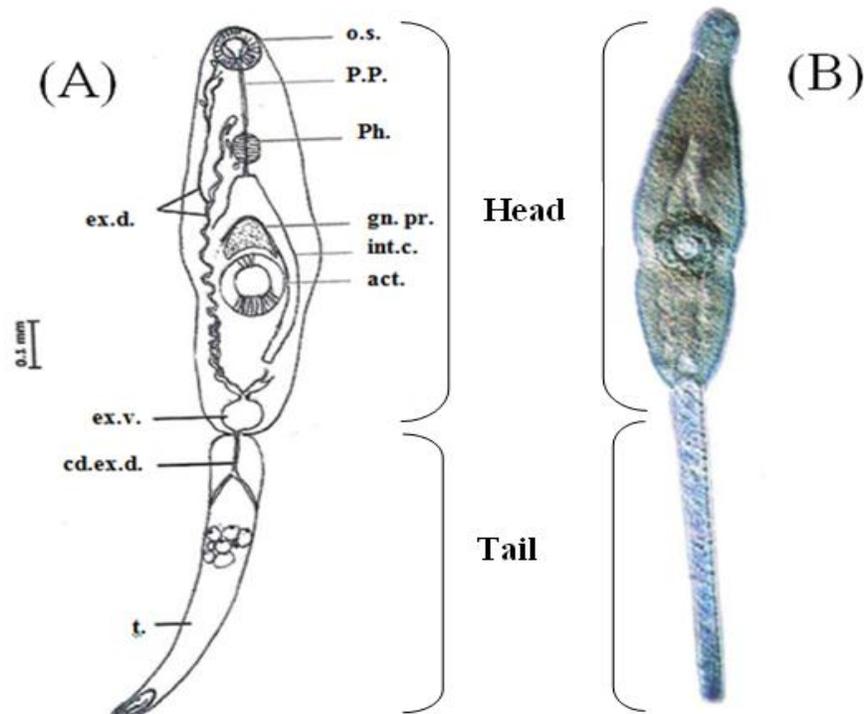
- 3. Redia** (Fig. 5): Greatly varying in size and possessing a circular pharynx and a median gut. They have a relatively small pharynx which measures 0.1mm long (0.08-

0.11) by 0.08mm wide, and a long intestinal caecum that runs to the end of the first third of the redia. Its length is 0.52 mm (0.45-0.6). The small rediae are 0.5mm (0.43-0.56) long by 0.08mm (0.045-0.13) wide. Large rediae contain 2-7 developing cercariae, several developing cercariae and germ balls. The largest redia measures 1.5mm (1.33-1.66) in length and 0.42mm (0.35-0.56) in width.



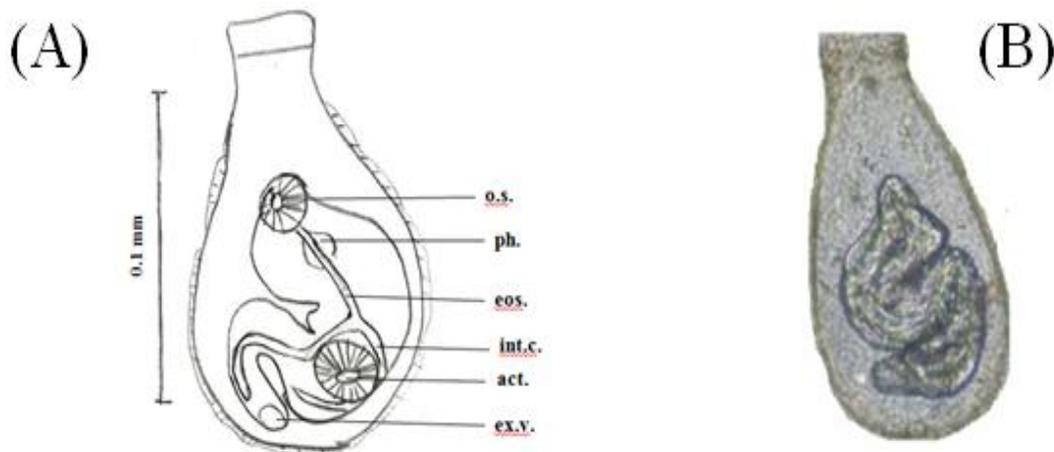
(Fig. 5): *Philophthalmus palpebrarum* redia. (A) Camera lucida drawing and (B) photomicrograph of the redia showing birth pore (br.p), developing cercariae (d.cr.), genital primordium (gn.pr.), intestinal caeca (int.c) and pharynx (ph.) (Vital stains).

4. Cercaria (Fig. 6): Gymnocephalus type, develop in elongated rediae. The body is relatively large elongate and usually displays a slight constriction posterior to the level of the acetabulum and its L x W 0.8 (0.61-0.9) x 0.15 (0.14- 0.2) mm. The oral sucker is smaller and subterminal than the acetabulum. The gut starts with a mouth that leads into a long prepharynx 0.15mm (0.12-0.21) then to a muscular pharynx, its L x W 0.04 (0.04-0.046) x 0.055 (0.043-0.06) mm, lies at the end of the anterior third of the body. The pharynx leads to oesophagus which bifurcates into two intestinal caeca. The caeca extend posteriorly till the excretory vesicle. The excretory ducts unit to open in front of a round excretory vesicle. The genital primordium is triangular and lies anterior to the acetabulum between the intestinal caeca. The tail is 0.65 mm (0.55-0.79) long 0.1mm (0.08-0.14) wide, slender and terminates with an adhesive organ. Freshly emerged cercariae are not active swimmers. Swimming occurs by undulation of the body with the tail forming "S" shape. The cercariae released from the snail and they encysts rapidly within 40-60 seconds, it may encyst on the pipette or bottom of petry dish to infective metacercariae. Cyst wall is composed of a double layer. The inner layer is closely enveloping the metacercaria which assumes a characteristic flask shape.



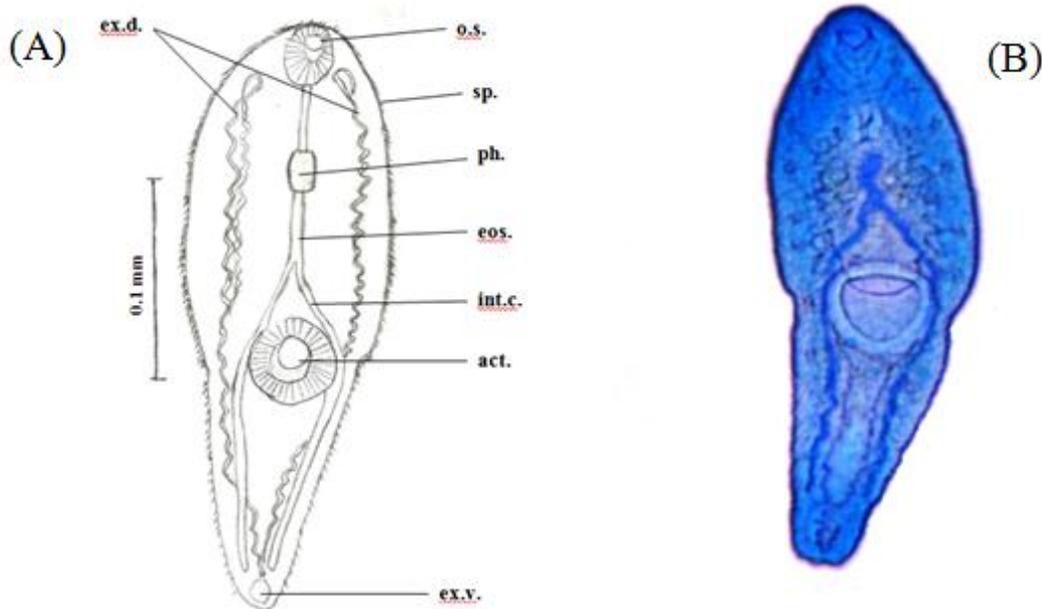
(Fig. 6): *Philophthalmus palpebrarum* gymnocephalous cercaria (A) Camera lucida drawing and (B) Photomicrograph of the cercaria showing acetabulum (act.), caudal excretory duct (cd.ex.d.), excretory duct (ex.d.), excretory vesicle (ex.v.), genital primordium (gn.pr.), intestinal caeca (int.c.), oral sucker (o.s.), prepharynx (p.p.), pharynx (ph.) and tail (t.) (Vital stains).

5. Metacercaria: Body size 0.15 mm (0.13 - 0.1) in length, and 0.07 mm (0.06-0.08) in width (Fig. 7). The metacercarial cyst wall is composed of several layers. The inner layers closely enveloping the metacercaria assume a characteristic flask shape, whereas the outer layer is irregular and distant from the inner layers. This encysted metacercaria could be excysted if induced excystation by placing it in saline at 37-39 C°. This excysted metacercaria is infective to the final host.



(Fig. 7): *Philophthalmus palpebrarum* metacercaria (A) Camera lucida drawing and (B) Photomicrograph of the metacercaria showing acetabulum (act.), esophagus (eos.), excretory vesicle (ex.v.), intestinal caeca (int.c.), oral sucker (o.s.) and pharynx (ph.) (Vital stains).

6. Excysted metacercaria (Fig. 8): It measures 0.27 mm (0.21- 0.29) in length and 0.08 mm (0.065-0.089) in maximum width. The body is elongated, spinose and the preacetabular region is wider than the postacetabular region. The suckers are more developed than in the cercaria. The spines appear to be fine spines on the border of anterior portion of body and more prominent and abundant in the postacetabular regions.



(Fig. 8): *Philophthalmus palpebrarum* excysted metacercaria (Infective stage). (A) Camera lucida drawing and (B) Photomicrograph of the metacercaria showing acetabulum (act.), esophagus (eos.), excretory duct (ex.d.), excretory vesicle (ex.v.), intestinal caeca (int.c.), oral sucker (o.s.), pharynx (ph.) and spines (sp.) (Vital stains).

7. Adult worm (Fig. 9): The body of the worm was fusiform. Body length, 5.48 mm (4.6 - 6.1) and its width 1.60 mm (1.32 - 1.9). The surface of the body is smooth and lacks spination.

Oral sucker is subterminal, with width greater than length, 410 (310-480) x 490 (320-620) μm .

Acetabulum is in anterior third of the body, 570 μm (500- 620) in length, and 530 μm (480-580) in width.

Pharynx is in direct connection to the oral sucker. Intestinal bifurcation is closer to the caudal end of the pharynx than to the anterior margin of the acetabulum. The size of pharynx is closer to oral sucker size; 400 μm (300-480) x 440 (320-510). The main excretory duct extends up to the level of pharynx.

The esophagus is very short and bifurcates anteriorly to the acetabulum. The genital opening is situated in front of the intestinal bifurcation, left of the esophagus.

Intestinal caecum is simple narrow nearly reaching the level of the caudal margin of the second testis.

Cirrus sac is left of the acetabulum and always distinctly projecting and not extend beyond the acetabulum. The basis of the cirrus sac is situated in the anterior third of the body. The seminal vesicle is found at the posterior part of the cirrus sac at a level starting at the center of the acetabulum.

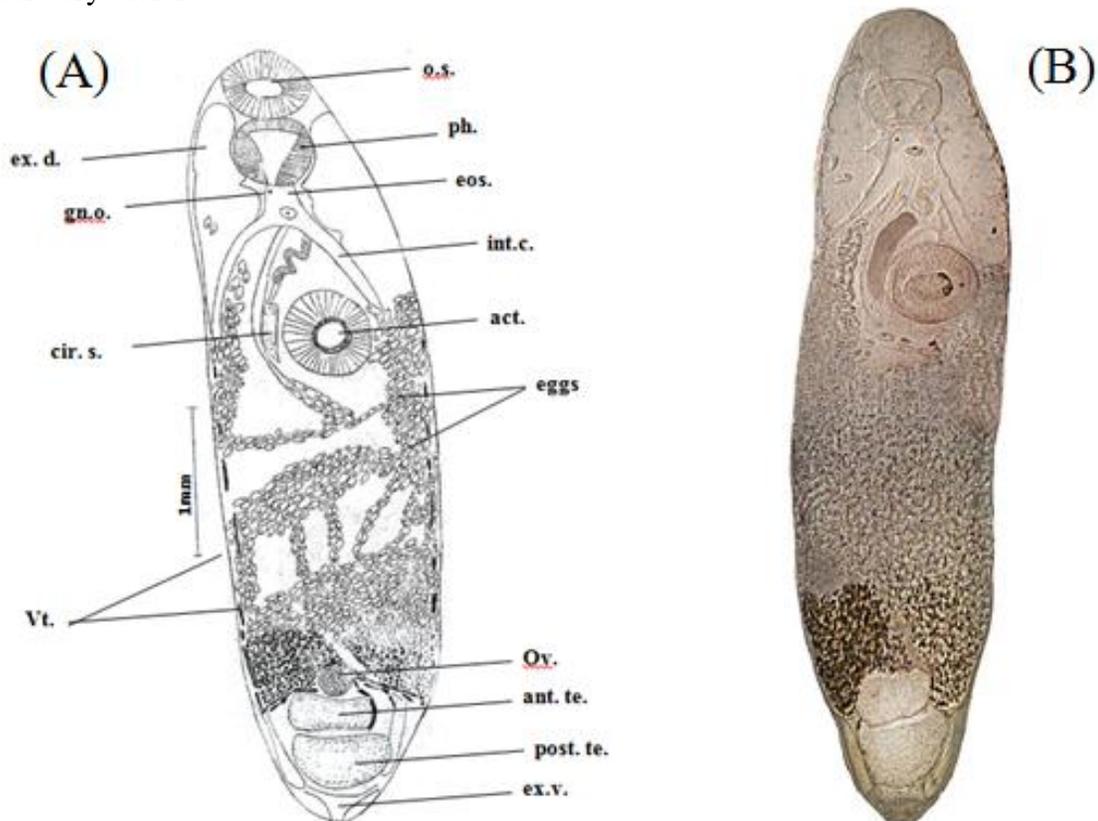
Vitellaria are interrupted in 2 lateral rows of 5 to 6 roads follicles. They start in the posterior first third of the body at a distinct distance to the cirrus sac and extend to the level of the anterior testes.

Ovary is more or less median in front of the anterior testes, circular to slightly oval 200 (180-250) x 220 (180-220) μm . The oviduct is directed posteriorly to form the ootype. Uterine seminal receptacle, ootype, and proximal part of the uterus are situated between ovary and anterior testes.

Testes are at the posterior end of the body, tandem, very close to each other, variable in shape, unlobed; anterior testes 260 (200-290) x 590 (500-590) μm ; posterior testes slightly larger, 340 (300- 340) x 700 (680-720) μm

Uterine coils extensive are occupying the whole width of body from testes almost to the acetabulum. Uterine coils can go back behind the junction of the vitellarial tubes of one site of the body reaching the midlevel of anterior testes.

Excretory vesicle is small Y shaped, located at the posterior end of the body. Two excretory duct extend along both sides of the worm till pharynx level and drain in excretory vesicle.



(Fig. 9): *Philophthalmus palpebrarum* adult worm. (A) Camera lucida drawing and (B) Photomicrograph of the adult worm showing acetabulum (act.), anterior testes (ant.te.), cirrus sac (cir.s.), esophagus (eos.), excretory duct (ex.d.), excretory vesicle (ex.v.), genital opening (gn.o.), intestinal caeca (int.c.), oral sucker (o.s.), ovary (ov.), Pharynx (Ph.), posterior testes (post.te.) and vitellaria (vt.) (Vital stains).

Further dimensional and observational data are summarized in Table (1), which also provides available data by other authors in Middle East. As can be seen from Table (1) some of our observational data with those of other investigators, especially

P. palpebrarum and *P. nocturnus*, but there are numerous divergencies, the more important of which are the following: The snail intermediate host, location of the adult worm, the worm size and Spination.

Table (1): Comparison between the data from published references and the present study about the Philophthalmid (eye fluke).

Species Data	<i>P. hegneri</i> (Penner & Fried, 1963)	<i>P. lucipetus</i> (Rudolphi, 1819)		<i>P. distomatosa</i> (Looss, 1899)	<i>Philophthalmus</i> sp. (Lotfy & Hadid, 2005)	<i>P. gralli</i> (Mathis & Iegér, 1910)		<i>P. lachrymosus</i> (Braun, 1902)	<i>P. aweerensis</i> (Schuster, 2011)	<i>P. palpebrarum</i> (Looss, 1907)	<i>P. nocturnus</i> (Looss, 1907)	Present work
	(Abdul-Salam et al., 2004)	(Kanev et al., 1993)	(Radev et al., 1999)	(Radev et al., 2000)	(Lotfy & Hadid, 2005)	(Pinto & Melo, 2010)	(Diaz et al., 2002)	(Pinto et al., 2005)	(Schuster, 2011)	(Gold et al., 1993)	(Ghosh & Chakrabarti, 2002)	
Country	Kuwait	Austria	Israel	Israel	Egypt	Brazil	Venezuela	Brazil	Emirates	India, Egypt & Israel	India & Egypt	Egypt
Intermediate host	<i>Cerithium scobridium</i>	<i>Fagotia acicularis</i>	<i>Melanopsis praemorsa</i>	<i>Melanoides tuberculata</i>	<i>Cleopatra bulimoides</i>	<i>Melanoides tuberculata</i>	<i>Melanoides tuberculata</i>	<i>Melanoides tuberculata</i>	<i>Melanoides tuberculata</i>	<i>Melanopsis praemorsa</i>	—	<i>Melanoides tuberculata</i>
Location of the adult worm	In the ocular orbit	Pre adult in eye cavity in human	Inner side of nictitating membrane	Nictitating membrane	Nictitating membrane	Nictitating membrane	Nictitating membrane	Palpebral conjunctiva of mammal	In the conjunctival sac	1-Under eyelids of bird in Cairo (Looss, 1901) 2- Nictitating membrane of chicks (Gold et al., 1993)	In the conjunctival sac	In the conjunctival sac
Tegument	—	Spine	Spine	Spine	—	—	Spine	—	Aspinose	Aspinose	Aspinose	Aspinose
L X W (mm)	1.8 x 0.58	3.5 - 4.5 x 0.20 - 0.70	4.85 x 1.26	2.60 x 0.9	4.37 x 0.86	3.61 x 1.02	2.6 - 3.4 x 0.5 - 1	3.73 x 1.08	5.5 x 1.5	4.40 - 4.90 x 1.20 - 1.50	5.20 - 5.80 x 1.2 - 1.9	5.48 x 1.60
O. s. L X W (µm)	200 x 230	350 x 320	332 x 421	242 x 291	350 x 290	330 x 401	237 - 297 x 287 - 378	260 x 300	460 x 327	450 - 540	300 - 420 x 480 - 500	410 x 490
Act. L X W (µm)	340 x 350	550 - 540	550 x 540	386 x 386	430 x 470	514 x 514	388 - 544 x 404 - 505	670 x 700	653 x 604	670 - 770	650 - 750 x 600 - 700	570 x 530
Ph. L X W (µm)	220 x 210	250 x 280	3338 x 348	247 x 224	260 x 300	299 x 339	227 - 323 x 227 - 333	200 x 110	376 x 302	320 - 420	350 - 400 x 470 - 525	400 x 440
Ov. L X W (µm)	120 x 110	280	250	171 x 193	260	237 x 266	126 - 222 x 151 - 252	190 x 210	214 x 240	380 - 580	200 - 250 x 220 - 270	200 x 220
Ant. te. L X W (µm)	150 x 190	450 x 510	504 x 566	286 x 438	370 x 620	222 x 403	272 - 378 x 424 - 530	230 x 370	534 x 698	450 - 900	475 - 675 x 700 - 925	260 x 590
Post. te. L X W (µm)	160 x 180	450 x 540	568 x 543	301 x 449	340 x 500	216 x 351	272 - 464 x 404 - 505	280 x 360	513 x 627	380 - 770	425 - 625 x 725 - 925	340 x 700

Act.: acetabulum, Ant.te.: anterior testes, O.s.: Oral sucker, Ov.: Ovary, Ph.: Pharynx, Post.te.: Posterior testes.

DISCUSSION

The present work succeeded to complete, describe life cycle of *Philophthalmus palpebrarum* (found by **Looss 1899 and 1907**) experimentally and identifying the larval stages and adults using *Melanoides tuberculata* snails and chicks for the first time in Egypt. The identification of the obtained worm was made depending on its main characteristics. It characterized by absence of spines on the tegument, the pharynx of the same size of the oral sucker and the body is widest at the level of the acetabulum, short cirrus sac not exceed the posterior margin of the acetabulum, genital pore below the pharynx, Vitellaria are interrupted and start in the posterior first third of the body at a distinct distance to the cirrus sac and extend to the level of the anterior testes and the adult worm found in the eye cavity (conjunctival sac) of chicks. This is in full accord with the description given by **Looss (1899 and 1907)** of the adult worm of *P. palpebrarum* and *P. nocturnus*, respectively, recovered from the eyes of Hooded Crow, Yellow Billed Kite and Little Owl in Egypt, while this description of both flukes in Europe were attributed to *P. lucipetus* (**Kanev *et al.*, 1993; Radev *et al.*, 1999 and Radev *et al.*, 2000**). **Vassilev (1984)** suggested that both *P. palpebrarum* and *P. nocturnus* are belonging to the same species. However, in *P. palpebrarum* the vitellaria reach the level of the posterior margin of the acetabulum, but in the fluke described here the vitellaria interrupted below the acetabulum region. *P. nocturnus* (**Looss, 1907**) has a similar morphology to *P. palpebrarum* (**Vassilev, 1984 and Schuster, 2011**) and differs mainly in a uterus extending extra-caecally and the presence of eye spot in the miracidia and these features are compatible with the fluke described here.

Looss (1899 and 1907) recorded 3 species of *Philophthalmus* in Egypt (*P. distomatosa*, *P. palpebrarum* and *P. nocturnus*). The only the cercaria of *P. distomatosa* naturally emerged from *Cleopatra bulinoides* snails were recorded. While, the adult worm of *P. palpebrarum* and *P. nocturnus* were described from Hooded Crow and Yellow Billed Kite and Little Owl, respectively.

In the present work the eye fluke (*P. palpebrarum*) originating from *Melanoides tuberculata* snails. While, **Gold *et al.* (1993)** recorded *P. palpebrarum* from *M. praemosa* in Israel. The freshwater snail *Melanoides tuberculata* (**Müller, 1774**) is known to be the intermediate host of several species of eye fluke. Eye flukes originating in *M. tuberculata* have been identified as *P. gralli* in the Middle East, specifically the United Arab Emirates (**Ismail and Saliba, 1985; Ismail and Arif, 1993**), Jordan (**Ismail and Issa 1987a & b**), Saudi Arabia (**Kalantan *et al.*, 1998**), and Israel (**Farstey, 1986**), where only the cercaria and redia were mentioned. It has also been found in India under the synonyms *Philophthalmus lucknowensis* and *Philophthalmus anatinus* (**Nollen and Kanev, 1995**). Also **Radev *et al.* (1999)** recorded *P. lucipetus* in Israel that was considered an European species in the past. While, in Egypt *P. distomatosa* was first known by its larval stage, Cercaria *distomatosa* and its adult worm was experimentally grown and described by **Radev *et al.* (2000)**. Also, has been found Venezuela (**Diaz *et al.*, 2002**), Brazil (**Verocai *et al.*, 2009**) and in Zimbabwe (**Mukaratirwa *et al.*, 2005**). All these mentioned species in the Middle East region have freshwater snails of the family Thiariidae (*Melanopsis praemosa*, *M. tuberculata*, *Cleopatra bulinoides*, and *Tarebria granifora*) as intermediate hosts. *P. hegeneri* is the only representative of

Philophthalmus in Arabia developing in a marine snail (*Cerithium scabridum*) which was found in Kuwait (**Abdul-Salam et al., 2004**).

In Egypt, the cercaria of *Philophthalmus* was reported to be naturally emerged from *Cleopatra bulimoides* snail by **Hassan (1987) and Khalifa et al. (1997)**. While, **Lotfy and Abo El-Hadid, 2005**, succeeded in following up the life cycle of *Philophthalmus* species cercaria emerged from *Cleopatra bulimoides* snail till production of adult worm *Philophthalmus* species, which, can be excluded due to some striking differences from the fluke described here (extracted from the nictitating membrane of eyes and large in size).

P. distomatosa (**Looss, 1899**) also can be excluded due to the pharynx is smaller, the presence of spines around the acetabulum, vitellaria extending beyond the basis of the cirrus sac, and much smaller body size,

Also *P. gralli* (**Mathis & légér, 1910**) does not match with the morphology of the fluke described here. Because of the presence of diverticula in the caeca, lobed testes, the presence of spines in the tegument of *P. gralli*. and the longe vitellaria that sometimes reach the basis of the cirrus sac

Differences between the fluke described here and *P. lucipetus* (**Rudolphi, 1819**) consist in the presence of spination at least in some specimens, different shapes of oral sucker and pharynx. The genital pore in *P. lucipetus* was located between the bifurcation of the caeca and the anterior margin of the ventral sucker or at the level of the bifurcation, while in the fluke of the present study the genital opening is situated in front of the intestinal bifurcation, left of the esophagus.

The marine *P. hegneri* (**Penner & Fried, 1963**) can be also excluded due to some striking differences in the morphology (smaller size, spines at the tegument, and short follicular vitellaria) and the intermediate host is *Cerithium scobriddum*.

In Israel the eye fluke that was correspond in their morphology most likely with *P. palpebrarum* which raised by **Gold et al. (1993)** has striking difference from the current worm of the present study (the intermediate host is *M. praemosa* and short cirrus pouch the basis of which does not reach the posterior margin of the acetabulum).

P. aweerensis of UAE (**Schuster, 2011**) excluded also due to the cirrus sac always exceed the posterior margin to acetabulum, anterior testes larger than the posterior, and the oral sucker larger than the pharynx.

Moreover, the present results indicated that the cercaria has long pre pharynx. Similar results were obtained by **Lotfy and Abo El-Hadid, 2005 & Pinto and Melo, 2010** for *Philophthalmus* species in Egypt and *P. gralli* in Brazil, respectively. On contrary the prepharynx of cercaria may absent or short such in *P. lucipetus* in Austria (**Kanev et al., 1993**); *P. lucipetus* in Israel (**Radev et al., 1999**) and *P. distomatosa* in Israel (**Radev et al., 2000**).

The present study also showed that the spines were not detected by us on any of our mature or immature specimens, except the excysted metacercaria is spinose, appears with fine spines on the border of anterior portion of the body, are more prominent and abundant in the postacetabular regions. These results agree with the studies of **Gold et al. (1993)**; **Ghosh & Chakrabarti (2002)** and **Schuster (2011)** on *P. palpebrarum*, *P. nocturnus* and *P. aweerensis*, respectively. Whereas their presence on *P. gralli* has been reported by **Ching (1961)**, **McDonald (1981)** and **Ismail and Issa (1987b)**.

The Eye flukes occur naturally in a wide variety of birds but accidentally were found in mammals and man (Zoonosis) as well (Pinto and Milo, 2010; Schuster, 2011 and Sapp *et al.*, 2019). Moreover, Lang *et al.*, 1993; Kanev *et al.*, 1993 & Nollen and Kanev, 1995 reported cases of human infection and conjunctivitis in eyes due to infection with *P. palpebrarum*; *P. lucipetus* and *P. lachrymosus*, respectively. Recently, a unique pattern of granulomatous anterior uveitis in rural children swimming in El-Fayoum, Egypt, was attributed to a waterborne helminthic infection (Nadar *et al.*, 2017). Where 56 eyes of 54 patients had small granulomas (<3 mm) with active AC inflammation, while 47 eyes showed larger nodules and/or a retrocorneal vascularized post inflammatory membrane. Inactive scarred lesions were noted in 11 patients. Ocular structural complications including cataract, glaucomatous optic atrophy, corectopia, phthisis, and extensive scarring in the AC were documented in a total of 29 eyes. Polymerase chain reaction detected the presence of digenic trematode DNA in 6 out of 14 excised nodules.

Finally it can be concluded that *Philophthalmus palpebrarum* originating from *Melanoides tuberculata* snails for the first time in Egypt. This indicates the need for more study of this parasite and an environmental investigation to further identify the risk factors for this problematic pathogen and outline the best management and possible preventive measures in the given endemic areas.

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ARABIC SUMMARY

التسجيل المصرى الاول لدودة العين *Philophthalmus palpebrarum* المنتقل من قوقع
Melanoides tuberculata ودورة حياته المعملية.

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سجلت هذه الدراسه لأول مره سركاريا لطفيل *Philophthalmus palpebrarum* (وهو من Trematoda وينتمى للعائلة Philophthalmidae التي تحدث في أعين الطيور) والتي ظهرت فى قواقع *Melanoides tuberculata* المعدها طبيعيا والتي تم تجميعها من (محافظة الجيزه ،مصر) و نجحت ايضا هذه الدراسه فى استكمال دورة حياة هذا الطفيل معمليا. تم استنباط الدودة البالغة من الملتحمه فى عيني الدجاج بعد ٣٥-٤٠ يومًا من العدوى المعملية عن طريق وضع حوالى ١٠-١٥ ميتاسركاريا فى كل عين من عيون الدجاج الصغير والذى يتراوح عمره بين يوم وثلاثة أيام. تم التعرف على الديدان على أنها *Philophthalmus palpebrarum* بناءً على الخصائص المورفولوجية والمقارنة مع الأوصاف فى الأبحاث السابقة. حيث أظهرت النتائج أنها دوده صغيرة ، وطول جسمها ٥.٤٨ ملم (٤.٦ - ٦.١) وعرضها ١.٦٠ ملم (١.٣٢ - ١.٩) و سطح الجسم أملس ويفتقر إلى الأشواك. وتم وصف الخصائص المورفولوجية للأطوار المختلفه، من السركاريا إلى الدوده البالغه لهذا الطفيل محل الدراسه. وفى ضوء هذه النتائج نستخلص ان هذه الدوده التي تحدث فى العين تم التعرف علي انها طفيل *Philophthalmus palpebrarum* وقد تم التأكد من أن قواقع *Melanoides tuberculata* هى العائل الوسيط لدورة حياة هذا الطفيل طبيعيا ومعمليا لأول مرة فى مصر من خلال هذه الدراسه. ولذلك من خلال هذه الدراسه يوصى بالمزيد من الإهتمام لهذا الطفيل لتجنب مخاطر إنتقاله للإنسان.