

**Occurrence of *Philophthalmus gralli* Mathis and Leger, 1910
(Trematoda:Philophthalmidae) in a Desert Spring of
the United Arab Emirates**

NAIM S. ISMAIL AND ARIF M. S. ARIF

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Abstract

This is the first report on the occurrence of the adult fluke of *Philophthalmus gralli* Mathis and Leger, 1910 (Trematoda:Philophthalmidae) in the United Arab Emirates. It was found that this fluke at Al-Faydah spring near Al-Ain City utilizes the brackish water snail, *Melanoides tuberculatus*, as an intermediate host and the water goose, *Anser anser*, as a definitive natural host. The overall infection rate of *M. tuberculatus* snails with *P. gralli* cercariae in Al-Faydah spring was 30.2%. Encysted metacercariae were excysted and inoculated around the eye orbit of 1-day-old chicks. Mature flukes were recovered 32 days PI. In morphology, they were practically indistinguishable from flukes obtained from naturally infected water geese at the same locality.

Key words: *Philophthalmus*, United Arab Emirates, desert spring, Philophthalmidae, Digenea

Introduction

The eye fluke, *Philophthalmus gralli* Mathis and Leger, 1910 has been recorded from a variety of birds in Hawaii (Ching, 1961), China (Tang *et al.*, 1980; Xu, 1981), India (Srivastava and Pande, 1971), and recently from Jordan (Ismail and Issa, 1987). In its life cycle this fluke develops from a distome gymnocephalous cercaria which utilizes the freshwater prosobranch snail *Melanoides tuberculatus* as an intermediate host (Tang *et al.*, 1980). Recently, Ismail and Arif (1991) reported the occurrence of *P. gralli* cercaria in *M. tuberculatus* snails from a desert spring in the United Arab Emirates. This cercaria encysts shortly after emergence from the snail to form a philophthalmid metacercaria. The present study was thus initiated to recover the adult fluke to which this cercaria develops.

Materials and Methods

Melanoides tuberculatus snails were abundant

along the edge and the bottom of the brackish-water pool at Al-Faydah spring near Al-Ain City in the United Arab Emirates (Ismail and Arif, 1991). A total of 3700 snails were collected during the period from January 1990 to January 1991. Snails were individually placed in separate small Petri dishes containing filtered spring water, and the dishes were examined for cercariae in the following morning. Cercariae were studied alive, unstained or stained with intravital stains.

Cercariae encysted on solid subjects or on the surface of the water shortly after emergence from snails. Encysted metacercariae were placed in warm (40°C) normal saline solution (0.85%) to release the metacercarial worms (Alicata and Ching, 1960; Howell and Bearup, 1967; Nollen, 1971). Five 1-day-old chicks were bought from an indoor commercial chicken farm. Each chick was inoculated with 10 excysted metacercariae around the orbits of both eyes (Alicata and Noda, 1951; Murty, 1966). These chicks were killed 35 days after inoculation, and both eyes were examined for flukes. Recovered flukes were relaxed in cold saline solution, and examined alive or vitally stained with 0.5% neutral red. Flukes were then fixed in hot AFA solution and sub-

sequently stained with acetocarmine. Measurements and drawings of fixed and stained flukes were made with the aid of a microprojector microscope.

A group of six water geese (*Anser anser*) were taken at the water pool at Al-Faydah spring and examined for eye flukes. Both eyes of each bird were washed with normal saline solution and the eye flukes were removed from the eyes using a Pasteur pipette. The flukes were studied as described above.

Results

Cercaria and metacercaria

Of the 3700 *M. tuberculatus* snails examined, 30.2% were infected with the cercaria. Cercariae were relatively large (Figs. 1 and 2), measuring 0.50–0.82 mm long. The body proper was elongated with a slight constriction at the ventral sucker level. The tegument was thick and densely covered with fine spines. The tail was shorter than the body proper and filled with caudal bodies, and at its tip it had an adhesive organ which was composed of two pairs of glands. The ventral sucker (0.050 mm in diameter) was slightly larger than the oral sucker (0.035×0.045 mm). The

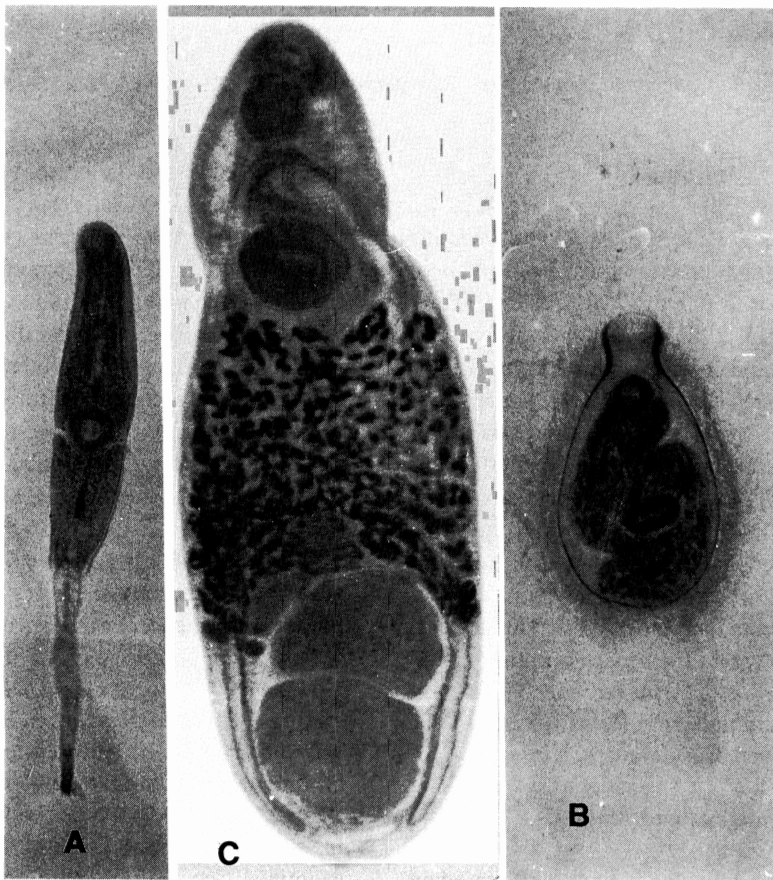


Fig. 1 Stages of *Philophthalmus gralli* from Al-Faydah spring in the United Arab Emirates. A, cercaria (0.922 mm); B, metacercaria (0.299 mm); C, mature fluke obtained experimentally from chicks (2.750 mm).

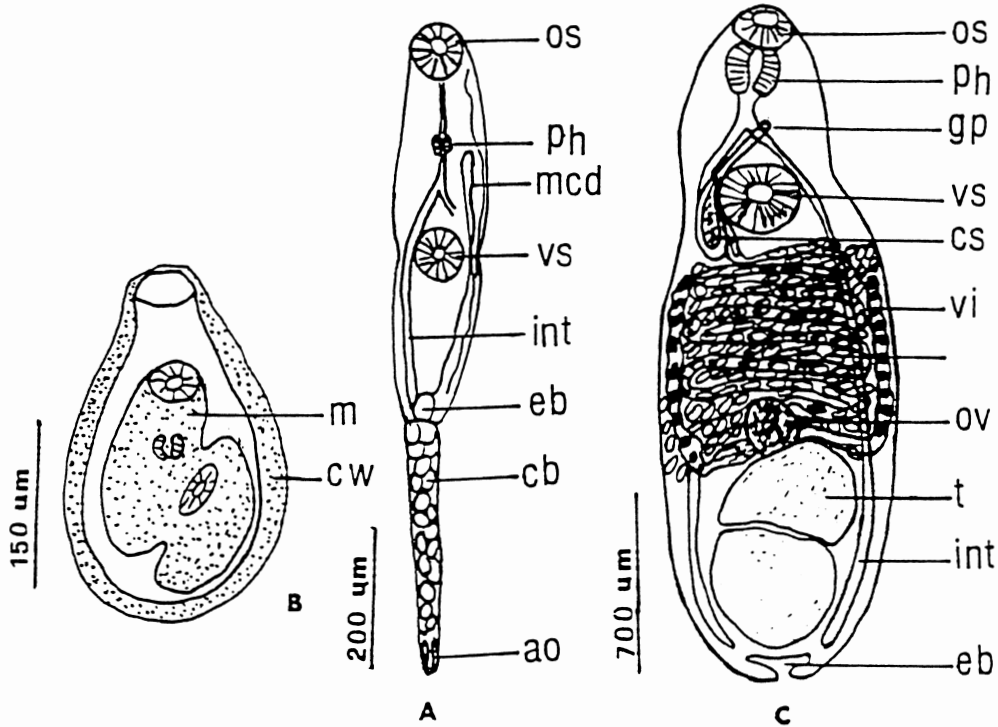


Fig. 2 Diagrams of *Philophthalmus gralli* stages from Al-Faydah spring in the United Arab Emirates. A, cercaria; B, metacercaria; C, mature fluke.

Key to letterings of figures

ao: Adhesive organ
 cb: Caudal body
 cs: Cirrus sac
 cw: Cyst wall
 eb: Excretory bladder
 eg: Egg
 gp: Genital pore
 int: Intestine

m: Metacercaria
 mcd: Main collecting duct
 os: Oral sucker
 ov: Ovary
 ph: Pharynx
 t: Testis
 vi: Vitellaria
 vs: Ventral sucker

digestive system was fully developed and consisted of a mouth, prepharynx, muscular pharynx, an esophagus, and two intestinal caeca the last of which ran posteriorly to the region of the excretory bladder. The excretory system consisted of a globose bladder and two main collecting ducts, the latter of which extended anteriorly to the region of the pharynx, where they recurred and received the anterior and posterior primary tubules at the ventral sucker region. Then, two pairs of secondary tubules ran

forward and backward.

Cercariae encysted shortly after emergence from snails. Metacercariae were pear-shaped and measured 0.28–0.32 by 0.16–0.17 mm (Figs. 1 and 2). The cyst wall was relatively thick and measured 0.017 mm.

Adult of experimental infection

Adult flukes were found in the outer region of the nictitating membrane under the eye lids of the experimentally infected chicks (Figs. 1 and 2).

Measurements of these flukes are shown in Table 1. The tegument of them was smooth except for around the ventral sucker where the remnant spines were seen. The terminal oral sucker was smaller than the ventral sucker, and the ratio of their transverse diameters was 1:1.3. The digestive system consisted of a subterminal mouth, short prepharynx, muscular pharynx, an esophagus, and intestinal caeca which ran posteriorly to the end of the body. The two testes were tandem and located in the posterior third of the body. The cirrus sac was located lateral and posterior to the ventral sucker. The seminal vesicle, in the posterior part of the cirrus sac, led into an ejaculatory duct which opened in the genital pore. The globular ovary was located in front of the

anterior testis. The Mehlis' gland, ootype, and the proximal portion of the uterus were seen posterior to the ovary. The uterus occupied the body from the testes to short of the ventral sucker. The vitellaria were extracaecal and tubular, and occupied about 80% of the distance from the margin of the anterior testis to the posterior border of the ventral sucker. The excretory bladder (0.21 mm wide) opened to outside through a terminal excretory pore. It received two main collecting ducts which ran intracaecally up to the region of the ventral sucker where they became extracaecal and ran up to the level of the pharynx.

Table 1 Comparison between *Philophthalmus gralli* mature flukes obtained experimentally and those obtained from a natural host. Measurements (in mm) were made on at least 10 stained flukes. Figures in parenthesis are the mean \pm standard deviation

	Flukes from experimental host	Flukes from natural host
Length	2.24–2.98 (2.78 \pm 0.28)	2.70–3.68 (3.14 \pm 0.35)
Width	0.74–1.16 (0.94 \pm 0.12)	0.60–1.16 (0.82 \pm 0.17)
Ventral sucker (diam.)	0.35–0.39 (0.37 \pm 0.02)	0.36–0.55 (0.45 \pm 0.06)
Oral sucker length \times width	0.21–0.25 \times 0.25–0.33 (0.23 \pm 0.01 \times 0.28 \pm 0.04)	0.23–0.29 \times 0.29–0.40 (0.26 \pm 0.02 \times 0.34 \pm 0.04)
Anterior testis	0.19–0.40 \times 0.29–0.61 (0.33 \pm 0.07 \times 0.50 \pm 0.09)	0.27–0.53 \times 0.29–0.60 (0.32 \pm 0.09 \times 0.39 \pm 0.09)
Posterior testis	0.20–0.47 \times 0.31–0.60 (0.36 \pm 0.09 \times 0.50 \pm 0.09)	0.27–0.47 \times 0.31–0.56 (0.31 \pm 0.06 \times 0.39 \pm 0.07)
Ovary	0.17–0.27 \times 0.20–0.24 (0.24 \pm 0.02 \times 0.24 \pm 0.02)	0.19–0.35 \times 0.12–0.28 (0.23 \pm 0.04 \times 0.21 \pm 0.04)
Ovary:testis ratio*	1:2.08	1:1.88
Cirrus sac length	0.42–0.76 (0.61 \pm 0.18)	0.43–0.83 (0.65 \pm 0.21)

* ratio of the transverse diameter of the ovary to testis.

Adult of natural infection

Flukes were found in the eyes of 4 out of the 6 water geese examined. Measurements of 10 mature flukes recovered from geese are shown in Table 1. The body was 2.70–3.68 mm long and 0.60–1.16 mm wide. The ventral sucker was 0.36–0.55 mm in diameter. The ratio of the transverse diameter of the ovary to that of the testis was 1:1.88.

Discussion

The morphological features of mature *Philophthalmus* flukes obtained experimentally from the eyes of chicks and those from the natural host indicate that they are same species and belong to *P. gralli*. They have basically tubular extracaecal vitellaria which occupied about 80% of the distance between the anterior testis and the posterior border of the ventral sucker, and the ratio of the transverse diameter of the ovary to that of the testes was similar to that reported for *P. gralli* (1:2.0) (Ching, 1961). In addition the tail of the cercaria obtained in the present study was shorter than the body proper as those described for *P. gralli*. The flukes obtained experimentally were slightly shorter and their testes were slightly larger than those recovered from the natural host. Such variations in the body dimensions and the reproductive organs of *P. gralli* due to age and type of host were also reported by Ching (1961) and Srivastava and Pande (1971).

The infection rate of the 3700 *M. tuberculatus* snails collected from Al-Faydah spring during this study was relatively high (30.2%). Similarly, Xu (1981) found that 34.0% of *M. tuberculatus* snails in Southern China were infected with *P. gralli* cercaria. Lower infection rates of *M. tuberculatus* with *P. gralli* cercaria (1.0 to 3.6%) were reported from Azraq Oasis, Jordan (Ismail and Issa, 1987; Ismail and Saliba, 1985). The relative abundance of the water geese at the Al-Faydah spring may have contributed to this relatively high infection rates of *M. tuberculatus*.

References

- 1) Alicata, J. E. and Ching, H. L. (1960): On the infection of birds and mammals with the cercaria and metacercaria of the eye fluke, *Philophthalmus*. J. Parasitol., 46 (Suppl.), 16.
- 2) Alicata, J. E. and Noda, K. (1959): The life history of a species of *Philophthalmus*, an eye fluke of birds in the Hawaiian Islands. J. Parasitol., 45 (Suppl.), 22.
- 3) Ching, H. L. (1961): The development and morphological variation of *Philophthalmus gralli* Mathis and Leger, 1910, with a comparison of species of *Philophthalmus* Looss, 1899. Proc. Helminthol. Soc. Wash., 28, 130–138.
- 4) Howell, M. J. and Bearup, A. J. (1967): The life histories of two bird trematodes of the family Philophthalmidae. Proc. Linn. Soc. N.S.W., 92, 182–194.
- 5) Ismail, N. S. and Arif, A. M. S. (1991): Larval trematodes of *Melanoides tuberculatus* (Müller, 1774) (Gastropoda: Prosobranchia) in a brackish spring, United Arab Emirates. Jpn. J. Parasitol., 40, 157–169.
- 6) Ismail, N. S. and Issa, I. M. (1987): Life cycle of *Philophthalmus gralli* (Mathis and Leger, 1910) (Trematoda: Philophthalmidae) in Azraq Oasis, Jordan. Jpn. J. Parasitol., 36, 53–62.
- 7) Ismail, N. S. and Saliba, E. K. (1985): Studies on larval stages of digenetic trematodes of *Melanoides tuberculata* (Müller) snails from Azraq Oasis, Jordan. Riv. Parasitol., 46, 263–271.
- 8) Murty, A. S. (1966): Experimental demonstration of the life cycle of *Philophthalmus* sp. (Trematoda: Philophthalmidae). Curr. Sci., 36, 366–367.
- 9) Nollen, P. M. (1971): Studies on growth and infection of *Philophthalmus megalurus* (Cort, 1914) (Trematoda) in chicks. J. Parasitol., 57, 261–266.
- 10) Srivastava, S. C. and Pande, B. P. (1971): The eye-fluke *Philophthalmus gralli* Mathis & Leger, 1910, in two anatid hosts with remarks on the genus. Indian J. Anim. Sci., 41, 740–743.
- 11) Tang, Z.-z., Tang, C.-t., Chen, Q.-q., Lin, X.-m., Weng, Y.-l. and He, Y.-c. (1980): Studies on philophthalmosis of domestic fowls in Fujian. Acta Zool. Sinica, 26, 232–242.
- 12) Xu, P.-r. (1981): On the epidemiology of *Philophthalmus* of domestic fowls in Guangdong Province. J. South China Agric. Coll., 2, 19–27.