First report of an outbreak of the oriental eye-fluke, *Philophthalmus gralli* (Mathis & Leger 1910), in commercially reared ostriches (*Struthio camelus*) in Zimbabwe

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ABSTRACT

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A total of 17 commercially reared ostriches (*Struthio camelus*) from Msengi farm, Chinhoyi, Zimbabwe, observed with swollen eyes, severe conjunctivitis and constant lacrimation accompanied by a purulent exudate, were restrained for further clinical examination. Some of the birds were semi-blind with severe loss of body condition. When examined, tiny organisms were observed attached to the nictitating membranes and the conjuctival sacs of both eyes. The organisms were identified as *Philophthalmus gralli*, the "oriental eye-fluke" and *Melanoides tuberculata*, a prosobranch snail, was confirmed as the intermediate host through natural and experimental infection.

To the best of our knowledge this is the first record of the oriental eye-fluke infection in birds in Zimbabwe and Africa and extends its known geographical range.

Keywords: *Melanoides tuberculata*, oriental eye fluke, ostrich, *Philophthalmus gralli*, Zimbabwe

INTRODUCTION

Philophthalmids are small trematodes of the family Philophthalmidae occurring in the eye (conjuctival sac) of birds (Kingston 1984). Although several species have been reported (Yamaguti 1934; Ching 1961; Nollen & Murray 1978; Radev, Kanev & Gold 2000) the family is typified by the species, *Philophthalmus gralli*, commonly known as the "oriental eye-fluke".

Philopthalmus gralli was first described from the conjuctival sac of the domestic chicken in Hanoi, Viet Nam, by Mathis & Leger (1910). It has since been reported in chickens in Hawaii (Ching 1961), in captive-reared ostriches in Florida, USA, (Greve & Harrison 1980) and in chickens, peafowl, turkeys, ducks, and geese in Indochina and Formosa (Kingston 1984). Human infections have also been reported (Dissanaike & Bilimoria 1958; Mimori, Hirai, Kifune & Inada 1982).

The eggs or miracidia from the infected birds are eliminated from the avian host into the environment by direct contact of the eyes, nasal and oral passages with water while drinking (Alicata 1962). The freshwater snail species, *Tarebia granifera* and *Melanoides tuberculata* have been reported to be the intermediate hosts (Nollen & Murray 1978). Detailed information on the development of *P. gralli* in *T. granifera mauiensis* and the domestic chicken has been described by Alicata (1962).

The clinical signs and lesions associated with attachment of flukes to the conjuctivae are congestion

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and erosion in chickens (Kingston 1984), conjunctivitis with constant lacrimation in ostriches (Greve & Harrison 1980), redness and irritation of the eye, swelling of the semilunar fold and proliferation of papillae in the palpebral conjuctiva of man (Dissanaike & Bilimoria 1958; Mimori *et al.* 1982).

In this paper, a field outbreak of the "oriental eye-fluke", *P. gralli*, in commercially reared ostriches in Zimbabwe is described. As far as is known, this is the first report of the "oriental eye-fluke" infection in birds in Africa.

History

The first case of the eye-fluke infection was detected at Msengi Farm in Mashonaland West Province, Zimbabwe during clinical examination of an emaciated semi-blind female breeder ostrich reported by the farm attendant to have worms in the eyes. The owner of the farm indicated that the problem had commenced around April/May 2001 and only the breeders were affected. The affected birds were kept in paddocks with access to a perennial river that forms a pool in the paddocks. The owner first noticed the problem when the water level in the dam was low and only the breeder ostriches that had access to the dam were affected while other farm animals, including cattle and sheep with access to the same pool were unaffected. The affected birds showed excessive lacrimation, swollen eyelids and in some, a purulent exudate discharging from the eyes.

MATERIALS AND METHODS

Study animals

At the time of our visit, the farm was habouring 37 grower and 17 breeder ostriches kept in separate paddocks but only the latter were in a paddock with access to the dam mentioned above. Some of the birds in the paddocks were grazing along the edges of the pool as well as drinking its water. Wild birds such as Egyptian geese (*Alopochen aegyptiacus*) and white storks (*Ciconia ciconia*) were observed along the banks of the dam intermingling with the ostriches. All the ostriches on the farm were restrained and examined for the presence of the eye-fluke.

Parasite and snail collection for identification

Flukes were carefully removed from the eyes of the heavily infected birds, using a blunt forceps, and were stored in physiological saline before being transferred, within 2 h, to the parasitology laboratory at the Faculty of Veterinary Science, University of Zimbabwe, Harare.

A portion of the flukes was fixed in 70% alcohol. The remainder of the flukes were incubated at 37 °C for 1 h in order to induce them to lay eggs as well as the hatching of eggs so that snails could be infected with the released miracidia (Alicata 1962).

Flukes fixed in 70% alcohol were stained with aceticalum carmine according to the method described by Gibbons, Jones & Khalil (1996) and were identified according to Greve & Harrison (1980).

Using a scoop made from a kitchen sieve supported on an iron frame mounted on a 1.5 m long wooden handle, snails were sampled from the edge of the pool where ostriches frequented when drinking water. The live snails were identified according to Brown & Kristensen (1989). Shedding of the snails was induced by exposing live snails to artificial illumination for 2 h as described by Frandsen & Christensen (1984). Snails not shedding cercariae were dissected to determine whether they were infected with larval stages of *P. gralli* (Alicata 1962).

Infection of laboratory-bred *Melanoides tuberculata*

Fifteen young laboratory-bred F1 generation of *M. tuberculata* with a mean shell height of 14 mm, obtained from Blair Research Laboratory, Harare were infected by exposing them for 1 h in water containing newly emerged miracidia from the flukes, as described by Alicata (1962).

Following exposure, the snails were transferred to a 2 ℓ-capacity glass aquarium with sand and filamentous green algae. They were maintained at 27 °C in a regime of 12 h light and 12 h darkness in filtered pond water which was changed twice a week. They were fed dried lettuce and commercial trout pellets. On Day 92 and succeeding days to Day 98 post-exposure the snails were periodically observed under a dissecting microscope for the shedding of cercariae of *P. gralli* by exposing them to artificial illumination for 1 h. Surviving snails were dissected 98 days post-exposure to determine whether they were infected with larval stages of *P. gralli* (Alicata 1962).

RESULTS AND DISCUSSION

The majority of the affected birds showed severe conjunctivitis, constant lacrimation and swollen eyelids (Fig. 1). In some, the lacrimation was accom-

panied by a thick purulent exudate. Heavily infected birds kept their eyes closed and appeared to have lost body condition (Fig. 2). Seventeen breeder ostriches from the same paddock were confirmed as infected with the worms.

Physical examination of the semi-blind ostrich revealed numerous tiny organisms attached to the nictitating membrane and conjuctival sac of both eyes (Fig. 3). Preliminary examination of the specimen of the organism revealed morphological features resembling those of a digenic trematode. In fresh mounts of the parasite, non-operculated eggs, some containing fully developed miracidia, were observed in the uterus.

Both eyes of 17 breeder ostriches in the same paddock were infected with flukes. The fluke was identified as *P. gralli* (see Fig. 4) based on the following salient morphological features: strong ventral sucker with ventral sucker/oral sucker ratio of approximately 1:1.5, cirrus sac extending beyond the ventral sucker, vitelline glands tubular to follicular and occupying the majority of the distance between the anterior testis and ventral sucker and spherical testis arranged in tandem. Ching (1961) who placed great emphasis on the morphology of the vitelline gland for species determination in the genus *Philophthalmus*, described the vitellaria for *P. gralli* as "tubular with a small number of follicles". Similar vitellaria were seen in adult flukes from this outbreak.

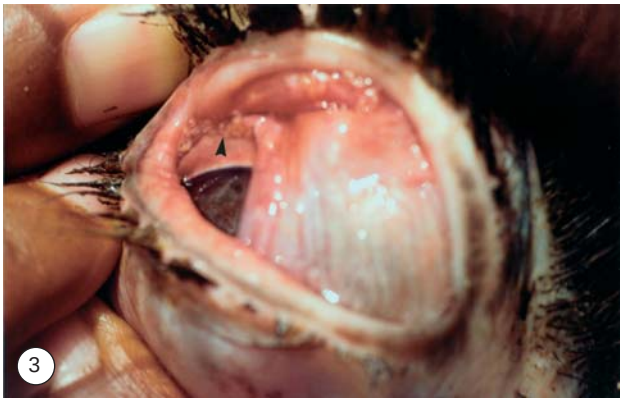

FIG. 1 Emaciated and semi-blind ostrich with eyes infected with *Philophthalmus gralli*

FIG. 2 Swollen eyelids due to heavy infection with *Philophthalmus gralli*

FIG. 3 *Philophthalmus gralli* (arrow) attached to the conjuctival sac of an ostrich eye

FIG. 4 Adult *Philophthalmus gralli* from the eye of an ostrich. X 3.2. Cirrus extends beyond the ventral sucker (A), strong ventral sucker with ventral sucker/oral sucker ratio approximately 1:1.5, vitelline glands tubular to follicular (B) and spherical testis arranged in tandem (C)

TABLE 1 Prevalence of *Philopthalmus gralli* in field and laboratory-bred *Melanoides tuberculata*

Source of *Melanoides tuberculata*	No. of snails collected*/infected§	No. shedding *P. gralli* cercariae	No. with larval stages of *P. gralli*	Prevalence of infection (%)
Field	45*	0	11	24.4
Laboratory-bred	15§	6	9	100

Live snails collected from the edges of the pool were identified as *M. tuberculata*, which has been reported as a natural intermediate host of *P. gralli* (Nollen & Murray 1978). A few empty shells were identified as those of *Bulinus globosus*.

Results of natural and experimental infection of *M. tuberculata* with *P. gralli* are shown in Table 1. Eleven out of 20 *M. tuberculata* collected from the field had daughter rediae, granddaughter rediae and well developed cercariae compatible with those of *P. gralli* as described by Alicata (1962). No snails from this group were shedding cercariae. Six of the 15 snails kept in the laboratory released *P. gralli* cercariae and the remaining nine had larval stages, giving a 100 % infection rate in the experimentally infected laboratory-bred group of snails.

According to Kingston (1984), the genus *Philophthalmus*, apart from *P. gralli*, comprises several other species reported from Asia, the former USSR, USA and Europe but not from Africa. This is the first reported outbreak of the "oriental eye fluke", *P. gralli*, in Zimbabwe and Africa as far as is known by the authors and extends the known geographical range of *P. gralli*.

Cases of ocular infection of captive-reared ostriches with *P. gralli* in Florida, USA have been reported by Greve & Harrison (1980) and the clinical signs observed were similar to those observed in this outbreak. The origin of the infection reported by Greve & Harrison (1980) was never established, although it was presumed that the fluke was introduced either through importation of birds for exhibit in a Texas zoo (Nollen & Murray 1978) or through wild migratory birds in an area where the freshwater snail intermediate hosts, *T. granifera* and *M. tuberculata*, were present (Greve & Harrison 1980). Information gathered from the present outbreak seems to indicate that the introduction of *P. gralli* in Zimbabwe was through wild migratory birds, possibly white stork. The storks were observed at the locality together with the ostriches in the presence of an ideal biotope for the breeding of the natural intermediate host snail, *M. tuberculata*. The local aquatic wild birds, especially the Egyptian geese, commonly frequenting the locality might have played a role in maintaining the cycle and ostriches might have become infected accidentally whilst grazing or drinking water contaminated with *P. gralli* metacercariae.

It is highly unlikely that the fluke was introduced into Zimbabwe through importation of ostriches as Zimbabwe does not generally import live ostriches and those on the farm on which the outbreak occurred were acquired locally. The possibility of the fluke spreading in Zimbabwe depends on the availability of the intermediate host snail, a stable biotope where the intermediate host snails can breed, and also direct contact of the final host with the snail biotope infected with metacercariae.

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