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Outbreaks of philophthalmiasis in ostriches (*Struthio camelus*) in Northeast Brazil[1]

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ABSTRACT.- Silva R.A.F., Alves R.C., Soares Y.G.S., Ferreira J.S., Olinda R.G., Santos L.J.M., Galiza G.J.N. & Dantas A.F.M. 2023. **Outbreaks of philophthalmiasis in ostriches (*Struthio camelus*) in Northeast Brazil**. *Pesquisa Veterinária Brasileira 43:e07146, 2023*. Laboratório de Patologia Animal, Hospital Veterinário, Centro de Saúde e Tecnologia Rural, Universidade Federal de Campina Grande, Campus de Patos, Avenida Universitária s/n, Bairro Santa Cecília, Patos, PB 58708-110, Brazil. E-mail: ggaliza@yahoo.com

This study discusses the epidemiological, clinical, and pathological characteristics of two outbreaks of ocular infection in ostriches (*Struthio camelus*) caused by the trematode *Philophthalmus* sp. The outbreaks occurred in the states of Ceará and Rio Grande do Norte in Northeast Brazil. Ostrich farming was categorized as semi-intensive farming with free access to the weir and river. The clinical symptoms for infection included nictitating membrane inflammation, epiphora (tearing), eyelid edema, ocular congestion, eyeball destruction, emaciation, and death, and the infection period ranged from 8 to 16 months. Macroscopically, thickening of the eyelids and conjunctiva were observed, with orange parasites infestation. Histologically, the lesions were characterized as lymphoplasmacytic and heterophilic, multifocal to coalescing, moderate, chronic conjunctivitis associated with hyperplasia and ectasia of the Harderian gland, and numerous parasites. The parasites were oval and flattened with an oral suction cup, acetabulum, and thick cuticle containing spicules. The diagnosis of philophthalmiasis was based on epidemiological, clinical, and pathological findings associated with the morphological characteristics of the parasites present in the conjunctival sacs which were similar to the trematode *Philophthalmus* sp. Philophthalmiasis can occur in ostriches raised on urban and rural properties in Northeastern Brazil, probably associated with the contact of birds with contaminated water, and is characterized by severe conjunctivitis that can result in the loss of the eyeball and death of the animals.

INDEX TERMS: Philophthalmiasis, birds, ostriches, *Struthio camelus*, conjunctivitis, ocular parasites, trematode *Philophthalmus* spp., Brazil.

RESUMO.- [**Surtos de filoftalmíase em avestruzes (*Struthio camelus*) no Nordeste do Brasil.**] Descrevem-se as características epidemiológicas, clínicas e patológicas de dois surtos de infecção ocular pelo trematódeo *Philophthalmus* sp. em avestruzes ocorridos nos estados do Ceará e Rio Grande do Norte no Nordeste do Brasil. As propriedades tinham em comum, a criação semi-intensiva e livre acesso a açude e rio. Os sinais clínicos incluíam protrusão da membrana nictante, lacrimejamento, edema palpebral, congestão ocular, destruição do globo ocular, emagrecimento e morte. A evolução clínica variou de oito a 16 meses. Macroscopicamente, observou-se espessamento das pálpebras e conjuntivas associado a numerosas estruturas parasitárias alaranjadas. No segundo surto, as lesões eram mais graves e consistiam em perda do globo ocular direito e anexos. Histologicamente, as lesões caracterizavam-se por conjuntivite linfoplasmocítica e heterofílica, multifocal a coalescente, moderada, crônica associada a hiperplasia e ectasia da glândula de Harderian e numerosas estruturas parasitárias. Os parasitas eram ovalados, achatados com ventosa oral e acetábulo e cutícula

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espessa contendo espículas. O diagnóstico de filoftalmíase foi realizado com base nos achados epidemiológicos, clínicos e patológicos associadas as características morfológicas dos parasitas presentes nos sacos conjuntivais compatíveis com o trematódeo *Philophthalmus* sp. A filoftalmíase pode ocorrer em avestruzes criados em propriedades urbanas e rurais no Nordeste do Brasil, provavelmente associado ao contato das aves com água contaminada e caracteriza-se por quadros de conjuntivite grave que pode resultar com a perda do globo ocular e morte dos animais.

TERMOS DE INDEXAÇÃO: Filoftalmíase, aves, avestruzes, *Struthio camelus*, conjuntivite, parasitas oculares, trematódeo *Philophthalmus* spp., Brasil.

INTRODUCTION

Philophthalmus spp. are trematodes that parasitize the eyeball and affect the conjunctival sacs of several species of Galliformes, Anseriformes, and mammals (Radev et al. 2006, Verocai et al. 2009, Church et al. 2013, Rojas et al. 2013), including humans (Dissanaike & Bilimoria 1958, Rajapakse et al. 2009). Reports from natural (Mukaratirwa et al. 2005) and experimental (Diaz et al. 2002) infections have demonstrated the potential of trematodes to cause eye illnesses. *Philophthalmus gralli* is the most common infectious species causing conjunctivitis (Pinto et al. 2005).

Clinically infected animals may suffer from eye swelling, congestion, and continuous epiphora (tearing) accompanied by purulent exudate that can lead to loss of vision and poor body condition (Mukaratirwa et al. 2005, Church et al. 2013, Rojas et al. 2013). Philophthalmiasis in ostriches has been reported as both isolated cases and outbreaks in the United States of America (Greve & Harrison 1980), Zimbabwe (Mukaratirwa et al. 2005), and Brazil (Verocai et al. 2009). However, the clinicopathological characteristics of *P. gralli* infections in the country, especially in the Northeast region, are unknown. Thus, this study aimed to evaluate the epidemiological, clinical, and pathological characteristics of two outbreaks of ocular infection by the trematode *Philophthalmus* sp. in ostriches in Ceará and the Rio Grande do Norte, Northeast Brazil.

MATERIALS AND METHODS

Three ostrich heads were collected, fixed in 10% buffered formalin and sent to the Animal Pathology Laboratory of the "Universidade Federal de Campina Grande" (UFCG) for anatomopathological examination. The ostriches had a history of severe ocular clinical signs with two different properties. Epidemiological data and clinical signs were obtained from veterinarians. Tissue fragments were routinely processed for histological analysis and stained with hematoxylin and eosin (HE). Samples were collected from the conjunctival sac and nictitating membrane and placed in a fixative solution (alcohol, formaldehyde, and acetic acid; AFA) for morphological characterization and parasite identification.

RESULTS

The first ocular infection outbreak occurred on a rural property located in the municipality of Caucaia (3°44′4″ South, 38°39′23″ West). The herd comprised three adult ostriches reared in a semi-intensive system, fed with a balanced commercial ration, and with access to a pond. Of these birds, two birds aged three years – one male and one female – died after suffering protrusion of the nictitating membrane, epiphora, eyelid edema, bilateral ocular congestion (Fig.1), and weight loss over a clinical course of eight months. The second outbreak occurred in the municipality of Mossoró (5°11′17″ South, 37°20′39″ West) on a property located in an urban area close to the Açu-Mossoró river. The ostriches were reared in a semi-intensive system. A four-year-old female bird suffered from unilateral ocular clinical changes that consisted of epiphora, congestion, eyelid edema, and purulent secretion leading to loss of the right eyeball and a progressive weight loss over ~16 months. As a therapeutic, a single dose of levamisole was administered intraocularly to all animals. However, the ostriches did not respond to the treatment and died.

Macroscopically, the infected animals had thick eyelids and conjunctivae during the first outbreak. The nictitating membrane protrusion was associated with numerous small, flat, and orange parasites attached to the surface and measuring ~5mm (Fig.2 and 3, respectively). During the second outbreak, the lesions were more severe and led to the loss of the right eyeball and adnexa, replaced by projections of epithelial tissues covered by crusts (Fig.4).

Histologically, the lesions were similar in all cases and affected the conjunctival sac and the nictitating membrane. The changes were characterized by lymphoplasmacytic and heterophilic, multifocal to coalescing, moderate, chronic conjunctivitis associated with hyperplasia and ectasia of the Harderian gland (Fig.5), and numerous parasites. Hyperplasia of the Harderian gland was observed in the conjunctiva, where conjunctiva was surrounded by a moderate interstitial inflammatory infiltrate composed of lymphocytes, plasma cells, and heterophils, sometimes in the lumen of the ectasia glands, in the own blade, and around vessels. On the epithelial surface, there were multiple parasites in the longitudinal and transverse sections associated with the papillary projections of the epithelium (Fig.6 and 7). In other parts of the conjunctiva, there were multifocal to coalescing inflammatory infiltrates composed of intraepithelial heterophiles associated with epithelial hyperplasia.

Morphologically, the parasites presented as oval, flattened structures with a thick eosinophilic cuticle containing spicules and oral and ventral suction cups (acetabulum) (Fig.6 and 7). The pseudocoelom in the parasites allowed protection and cushioning to the digestive and reproductive systems, pharynx, intestinal cecum, testes, and uterus (Fig.7 and 8). The morphological characteristics of the parasites observed in these outbreaks were comparable to those of the trematode *Philophthalmus* sp.

DISCUSSION

The diagnosis of philophthalmiasis was based on epidemiological, clinical, and pathological findings associated with the morphology of the parasites in the conjunctival sacs, similar to the trematode *Philophthalmus* sp. During the outbreak of philophthalmiasis in Minas Gerais, the birds were acquired from Northeast Brazil months before developing clinical symptoms. This suggests that infection by *Philophthalmus* sp. may be endemic to this region (Verocai et al. 2009). Several studies have identified the occurrence of *Philophthalmus gralii* and *Philophthalmus aylacostoma* parasitizing on snails (Onaca et al. 2019, Pulido-Murillo et al. 2022).

Philophthalmus sp. requires two hosts for survival: the adult parasite is found in birds that are the definitive host, and the larval form is found in snails (*Melanoides tuberculata, Aylacostoma chloroticum*, and *Aylacostoma tuberculatum*) that are the intermediate host (Pinto & Melo 2010, Chalkowski et al. 2021, Pulido-Murillo et al. 2022). The infected bird lays mature eggs in the water. The parasite releases the fully developed ciliated miracidia, penetrating the snail through direct contact with the eyes, nasal, and oral cavities. The miracidia develop into reins, giving rise to cercariae and metacercariae, which enter the definitive host via direct or oral contact (Alicata 1962). In the present study, it was impossible to detect the presence of snails on the properties. Thus it is likely that the birds had access to contaminated water reservoirs that led to the infection of the animals.

The presence of parasites in the conjunctiva and the nictitating membrane is associated with the appearance of clinical signs. It is the most common disease occurrence described in the literature (Mukaratirwa et al. 2005, Verocai et al. 2009, Church et al. 2013). Chronic infections occur sporadically and are characterized by the destruction of the eyeball and its attachments (Rojas et al. 2013). This suggests a prolonged evolution time through the non-treatment of animals or their permanence in risky places (Mukaratirwa et al. 2005). In Brazil, only one study has described the occurrence of the parasites as an outbreak in ostriches (Verocai et al. 2009). However, outbreaks with similar clinicopathological features have been described in other domestic and wild waterfowl species, including muskrats and mallard ducks, African geese, moorhens (Assis et al. 2022), ducklings, red-footed ducks (Muniz-Pereira & Amato 1993), and capybaras (Pinto et al. 2005).

The ocular histopathological findings associated with the presence of parasites are essential for the diagnosis (Church et al. 2013). Findings included marked hyperplasia of the bulbar and palpebral conjunctival mucosa; inflammatory infiltrate in the submucosa; and several specimens of *Philophthalmus* sp. on the surface of the conjunctival mucosa (Pinto et al. 2005). In chronic evolution, ocular tissue is lost and is replaced by fibrous connective tissue (Rojas et al. 2013).

Fig.1-4. Philophthalmiasis in ostriches. (**1**) Infected bird showing tearing of the right eye with eyelid swelling and congested protruding nictitating membrane. (**2**) Numerous parasitic structures adhered to the mucosa of the nictitating membrane (arrow). (**3**) Parasitic specimens were removed and placed on gauze and were characterized by small, flat, orange-colored structures. (**4**) Animal with loss of the right eyeball and adnexa, replaced by projections of epithelial tissue covered by crusts.

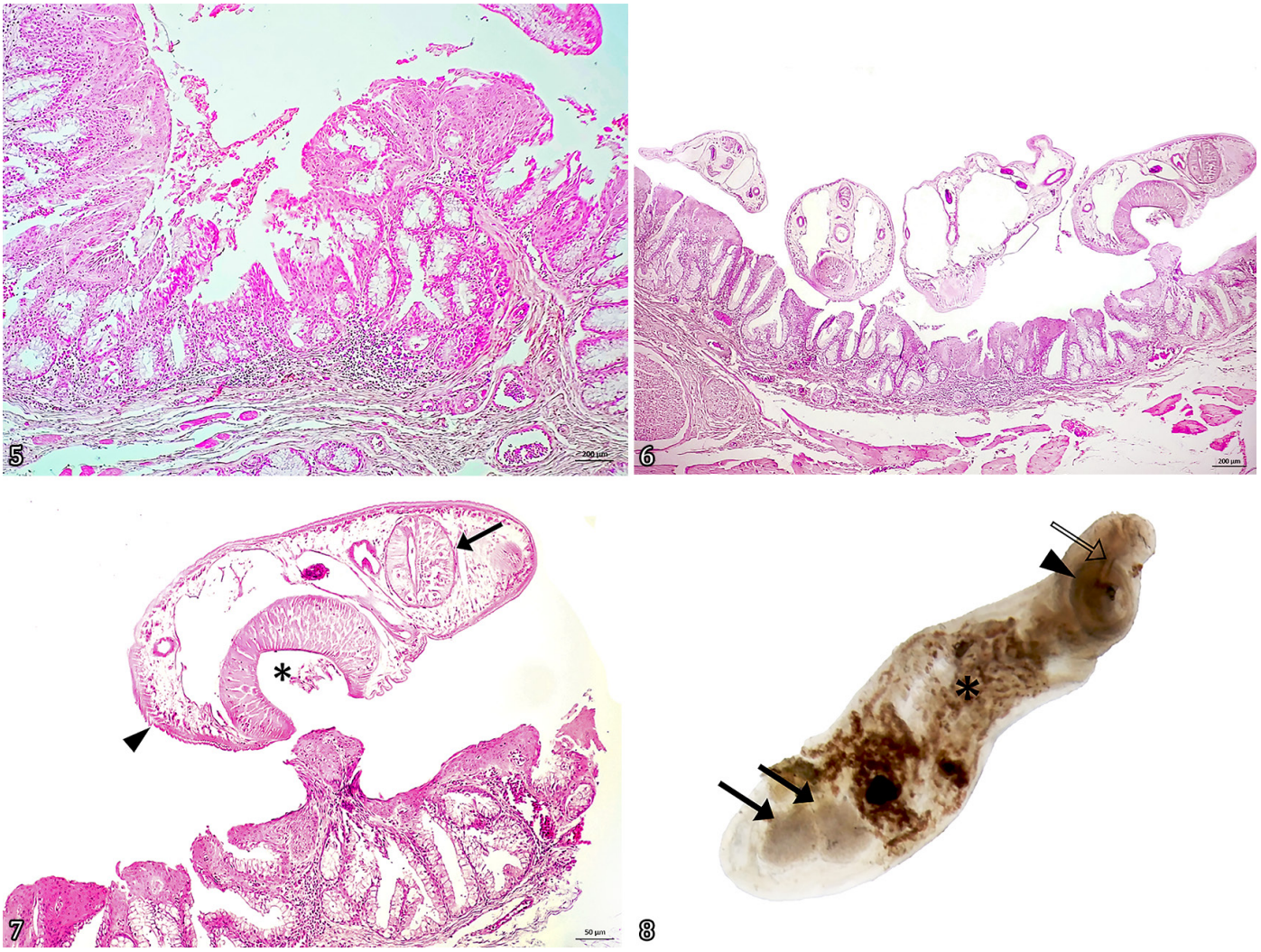

Fig.5-8. Philophthalmiasis in ostriches. (**5**) Ocular conjunctiva. Epithelial and Harderian's gland hyperplasia associated with lymphoplasmacytic and heterophilic inflammatory infiltrate is observed. HE, bar = 200µm. (**6**) Ocular conjunctiva. Multiple parasites in longitudinal and transverse sections associated with papillary projections of the epithelium. HE, bar = 200µm. (**7**) Close-up image showing the parasite attached to an epithelial projection of the conjunctiva containing eosinophilic cuticle with spicules (arrowhead) and oral (arrow) and ventral (acetabulum) suction cups (asterisk). HE, bar = 50µm. (**8**) Identification of *Philophthalmus* sp. Morphological features of an adult parasite in fixative solution including pharynx (hollow arrow), acetabulum (arrowhead), two circular testes (arrows), and uterus (asterisk).

One study compared the effects of parenteral doramectin and closantel with topical levamisole in treating *P. gralli*-infected ostriches. We obtained a positive response only in levamisole-treated birds (Mukaratirwa et al. 2008). However, the administration of single-dose levamisole was not an effective treatment. Manual removal of parasites from the conjunctival mucosa is recommended, as is the use of praziquantel (Church et al. 2013). In addition, control measures such as periodic deworming and restriction of contact in at-risk areas are indispensable management actions, considering the importance of parasitism as a public health problem due to the risk of infection in humans (Waikagul et al. 2006, Rojas et al. 2013, Chalkowski et al. 2021, Assis et al. 2022).

CONCLUSION

It is concluded that philophthalmiasis occurs in ostriches raised in urban and rural properties in Northeast Brazil, probably associated with the contact of birds with contaminated water, and is characterized by conjunctivitis that can result in the loss of the eyeball and death of the ostriches.

Conflict of interest declaration. The authors declare that they have no conflicts of interest. The authors are solely responsible for the content and writing of this manuscript.

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