

Occurrence of *Laminosioptes cysticola* (Acariformes: Laminosioptidae) in *Ardea alba egretta* from the peri-urban area of Belém, Pará-Brazil

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Short title: Occurrence of *Laminosioptes cysticola* in Great Egret

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ABSTRACT

Mites of the genus *Laminosioptes* have been reported in domestic Galliformes birds and pigeons in some countries. They specifically infest the subcutaneous tissue of the host generating granulomatous lesions. In the current study, we reported the presence of *Laminosioptes cysticola* in the pectoral muscle of a specimen of Great Egret, *Ardea alba egretta*, found in the peri-urban area of Belém, Pará, Brazil. We discuss the role of this individual as vector of mites between domestic and wild birds and we recommend ornithologists and veterinaries to carry out careful observations of live and dead birds because small parasites such as the mites *L. cysticola* can easily remain undetected.

Keywords: *Laminosioptes*, *Ardea alba egretta*, mites, brazilian Amazon

1. INTRODUCTION

Mites are a large and highly diverse group of free-living, phoretic, parasitic arachnids. Parasitic mites of vertebrate animals mostly infest the skin, hair and feathers of their hosts, but there is a group that infests other tissues (Rodríguez et al. 2016). *Laminosioptes cysticola* and other species of the genus *Laminosioptes* are mites that infest the subcutaneous tissue of birds and depending on the chronicity of the infection, they can cause calcified nodules and severe lesions (Martins et al. 2010). This is particularly known for domestic species thanks to the meat quality control of birds used for human consumption (Kaliner 1970; Smith et al. 1997; Skoracki et al. 2014). In contrast, the effects and pathological lesions caused by an infection of *L. cysticola* in wild birds are poorly known.

To date, *L. cysticola* and other species of the genus *Laminosioptes* have been reported as parasites that infest wild and domestic birds such as Galliformes, Columbiformes, and Passeriformes in several countries and continents (Table 1). However, mites in wild birds are frequently unreported because their identification needs a *meticulous* collection of material, or because they cause inconspicuous injuries, or even because specific taxonomic diagnosis of recorded parasite are not performed.

The Great Egret, *Ardea alba egretta* (Gmelin, 1789), is a cosmopolitan waterbird which can adapt to urban environment (Lorenzón et al. 2012) in which the opportunity for interacting with other birds (domestic and wild) and with environments contaminated by pathogenic microorganisms is high (Oliveira et al. 2018). In the Neotropical region, specifically in São Paulo, Brazil, and Chile, the Great Egret has been reported to be parasitized by ectoparasites of the genus *Ardeacarus* (Hernandes & Pedroso 2016, Gonzalez & Palma 2021). In the present study, we record, for the first time in the region of Pará-Brazil, the occurrence of *L. cysticola* in an individual of Great Egret found in the peri-urban area of the city of Belém and, we discuss mites transmission in regard to the potential interaction between domestic and wild birds.

2. MATERIALS and METHODS

The Center for Screening and Rehabilitation of Wild Animals of the *Universidade Federal Rural da Amazônia* received an individual of Great Egret in August 2022. It was an adult 62 cm long, weighing 592 g, rescued by the Environmental Police Battalion within the urban region of Belém municipality (1°28'18.7"S 48°29'54.0"W), Pará, Brazil. Due to apathy and weakness, the bird died a few hours later. The necropsy examination began with the external evaluation of the skin alterations, feathers, mucous membranes and body orifices. Subsequently, the skin and the muscle tissue were examined. Parasites were collected along with muscle samples for histopathological examinations while, mites were processed using a 2% potassium hydroxide solution clarified with eugenol solution and placed under a light microscope (Huber & Reis 2011). This study was approved by the Animal Research Ethics Committee of the Evandro Chagas Institute and it was approved by the Animal Research Ethics Committee of the Evandro Chagas Institute (protocol 0007/2004).

3. RESULTS AND DISCUSSION

We confirmed that the individual we analyzed was a Great Egret which is distinguished from other white egrets by its yellow bill and black legs and foot, though the bill may become darker and the lower-section of the legs lighter in the breeding season (Dunning 2008). The necropsy examination showed that it was a female bird. The individual revealed a lean body state which could be due to the lack of food and dehydration suffered in the last days prior to the rescue (Electronic Supplementary Material Fig. ESM1). The bird did not show external lesions or ectoparasites on the wings. Upon skin removal and opening of the coelomic cavity, small white dots, of approximately 1–2 mm, were observed on the surface of the pectoralis muscle, close to the keel and with a coloration contrasting with that of the pectoralis muscle (Figure 1A).

In total, the small white dots on the pectoralis muscle contained 58 mites of the order Acarina that were morphological compatible with *L. cysticola* (Acariformes: Laminosioptidae; Vizioli, 1868). The mites had an average length of 856 μm and an average width of 294 μm (N = 10 specimens). The specimens exhibited a small elongated body, flattened dorso-ventrally, with the gnathosoma much wider than longer. They had short chelicerae, short legs with sclerotized apodeme, and an oval-shaped opisthosoma with two long setae at the posterior end. Additionally, tarsi II and III had setae, while tarsi IV had long setae (Figure 1B). We therefore identified our specimens as *L. cysticola*, which was previously reported as a parasite of the subcutaneous tissue of Galliformes domestic birds and Passeriformes (Table 1).

The histopathology of the pectoral muscle around the keel and marginal fascia showed the presence of many oval-to-elongated pseudocysts, with cavities of up to 400 μm in diameter which contained several mites characterized by a chitinous exoskeleton and refringent. The pseudocysts did not induce reactions in the host's muscle, and mites were intact without evidence of degeneration (Figure 1C). In this study, no mineralized or granulomatous lesions were observed in the musculature of the host (Smith et al. 1996). Mineralized lesions are typically associated with chronic infestation induced by mites death. Lesions caused by *L. cysticola* are known to be significant in domestic birds because they can lead to muscle injuries and have the potential to cause hypersensitivity in humans through the consumption of infected birds (Martins et al. 2010).

Kaliner (1970) reported that, during hyper-infestation in domestic birds, *L. cysticola* can invade vital organs, such as the liver, kidneys, intestines, trachea, esophagus, air sacs, serosa of the abdominal viscera, reproductive tracts, and peripheral nerves, forming mineralized nodules. These subcutaneous nodules can be confused with tuberculoid lesions or with *Cytodites nudus*, which is a mite species that infests the air sacs and other internal organs of domestic birds and pheasants (Herpich et al. 2012). The life cycle of *L. cysticola* is not fully understood, except that, females lay embryonated eggs that develop in the deep tissues of the host (Tavakkoli et al. 2018).

Arce et al. (2020) reported cross-infestation of the mite *Ornithonyssus sylviarum* between wild and domestic birds likely due to their proximity to farms in Santa Fe, Argentina. In our study area, the Great Egret is often observed in proximity of peri-urban areas or of domestic animals (Gomes et al. 2009). Furthermore, *L. cysticola* in Brazil have been already found in the domestic *Gallus gallus* (Table 1) which may have represented the source of *L. cysticola*.

Overall, parasitic mites in wild birds remain an important proportion of arthropods diversity that requires further study, as infestation cycles are still poorly understood. We recommend ornithologists and veterinaries

from rehabilitation centers to carry out careful observations of birds in their hands and accurate necropsy, respectively to avoid small parasites such as the *L. cysticola* remain undetected.

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Ethics statement

The authors confirm that the ethical policies of the journal. The research was approved by the the Animal Research Ethics Committee of the Evandro Chagas Institute (protocol 0007/2004).

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Early view

Figure 1. A) Macroscopic photograph of the pectoral muscle of the *A. a. egretta* at the keel region with surface-adhered specimens of *L. cysticola* (arrow). B) Microscopic photo of the female adult specimen of *L. cysticola* in the ventral view showing detailed morphology: quelicera (q); gnathosoma; apodeme (a); long bristles (d5); long seta on tarsi IV (s4), (scale bar = 200 μ m). C) Histopathological section of the *L. cysticola* pseudocyst in the pectoral muscle showing detailed cross-sections of the mite (arrow) (scale bar = 200 μ m)

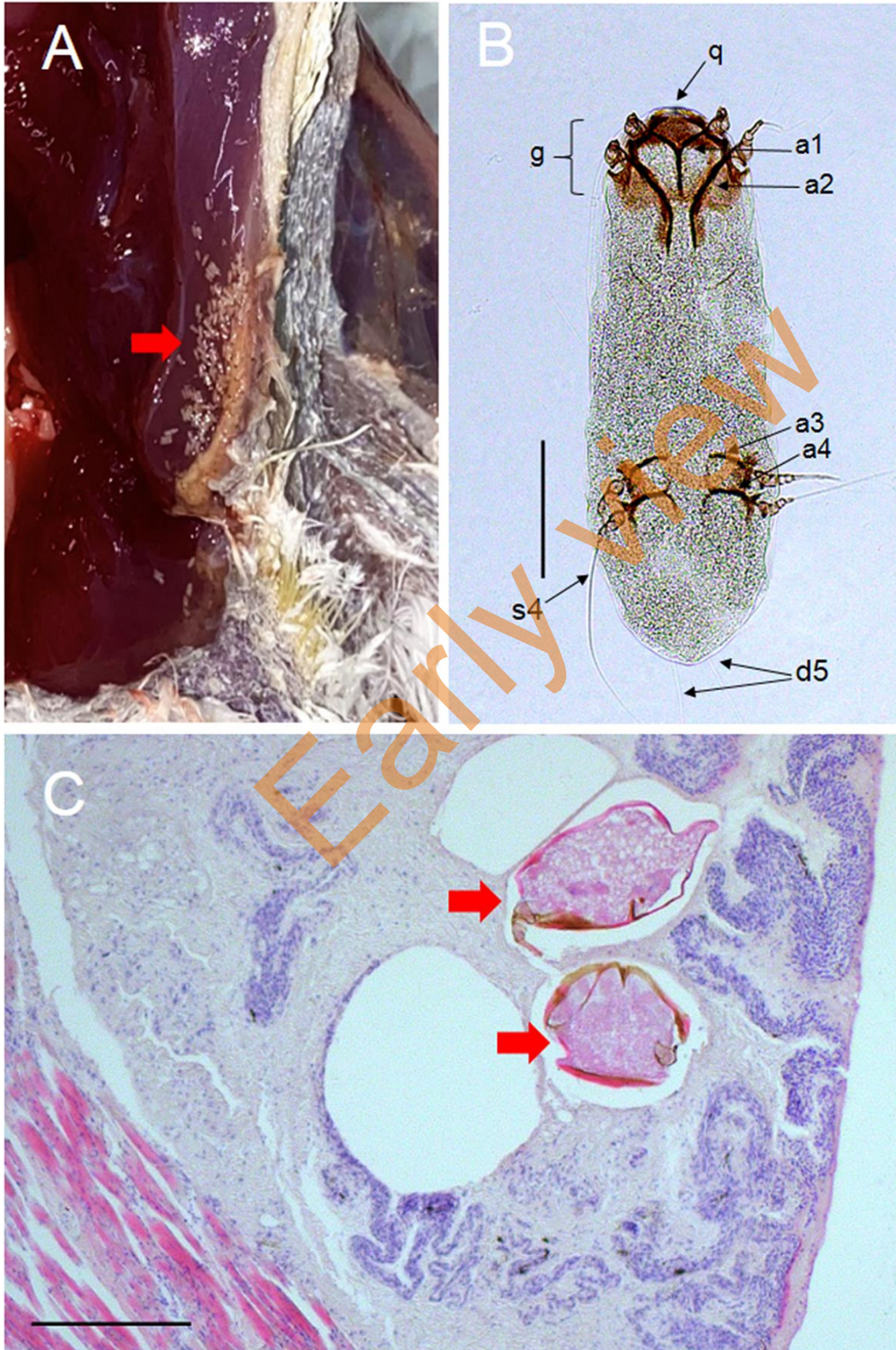


Table 1. Records of *Laminosioptes* mites in wild and domestic birds in different geographical areas of the world. Subgenera names are reported in parenthesis.

Host	Mite species	Country	Reference	
Columbiformes:				
<i>Columbigallina minuta</i>	<i>L. (Columbietta) collaris</i>	Belgium	Fain (1981)	
<i>Columba livia</i>	<i>L. cysticola</i>	Chile	Toro et al. (1999)	
Galliformes:				
<i>Gallus gallus</i>	<i>L. cysticola</i>	Germany	Dietrich (1925)	
	<i>L. cysticola</i>	Argentina	Roveda & Ringuelet (1947)	
	<i>L. cysticola</i>	USA	Lindquist & Belding (1949)	
	<i>L. cysticola</i>	Australia	Seddon (1951)	
	<i>L. cysticola</i>	USA	Cassidy & Ketter (1964)	
	<i>L. (Laminosioptes) cysticola</i>	Belgium	Fain (1981)	
	<i>L. cysticola</i>	Iran	Kaliner (1970)	
	<i>L. cysticola</i>	Mexico	Soriano-Vargas et al. (2010)	
	<i>L. cysticola</i>	Brazil	Martins et al. (2010)	
	<i>L. cysticola</i>	Brazil	Herpich et al. (2012)	
	<i>L. cysticola</i>	Iran	Tavakkoli et al. (2018)	
	<i>L. cysticola</i>	England	Grista et al. (2022)	
	<i>Meleagris gallopavo</i>	<i>L. cysticola</i>	Kenya	Kaliner (1970)
		<i>L. cysticola</i>	USA	Smith et al. (1996)
<i>Pternistis afer</i>	<i>L. (Laminosioptes) cysticola</i>	Rwanda	Fain (1981)	
Passeriformes:				
<i>Molothrus ater</i>	<i>L. cysticola</i>	USA	Stewart (1963)	
<i>Coccothraustes migratorius</i>	<i>L. (Passeriella) reticulata</i>	Belgium	Fain (1981)	
Pelecaniformes:				
<i>Ardea alba egretta</i>	<i>L. cysticola</i>	Iran	Hosseini et al. (2009)	
Psittaciformes:				
<i>Myiopsitta monachus</i>	<i>L. (Psittaciella) myiopsittae</i>	Belgium	Fain (1981)	