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Analysis of the clinical profile of macrorabdiosis cases: a retrospective study

Análise do perfil clínico de casos de macrorabdiose: um estudo retrospectivo

Guilherme Augusto Marietto Gonçalves[1], Alexandre Alberto Tonin[2]

Abstract: Macrorabdiosis is a disease caused by the bacillary fungus *Macrorhabdus ornithogaster* that colonizes the avian gastrointestinal tract. It has a tropism for the proventriculus, causing gastritis and, consequently, high mortality due to the occurrence of the so-called "wasting syndrome". This study analyzed the case distribution of species affected by macrorabdiosis and the clinical presentation of *Macrorhabdus ornithogaster* infections. Based on the data, it was concluded that young *Psittaciform birds* are more frequently affected by macrorabdiosis, with *Nymphicus hollandicus* being the species of highest prevalence during the study period. It was also observed that wasting, in association with vomiting, is the most common clinical sign in young birds, while adult birds more frequently present with subclinical infections. These results highlight the importance of screening for *M. ornithogaster* contamination, as early diagnosis is critical for successful therapeutic outcomes in animals showing clinical signs.

Keywords: *Macrorhabdus*, mycology, gastrology, animal health, avian pathology

Resumo: A macrorabdiose é uma doença causada pelo fungo bacilar *Macrorhabdus ornitogaster* que coloniza o trato gastrointestinal aviário, com tropismo de infecção ao proventrículo, causando gastrite e assim alta mortalidade devido à ocorrência da chamada síndrome do emagrecimento progressivo. O presente estudo analisou a casuística das espécies acometidas por macrorabidiose e o padrão clínico de casos de infecção por *Macrorhabdus ornitogaster*. Conforme os dados, concluímos que aves Psittaciformes jovens foram as mais afetadas por macrorabidiose e a espécie *Nymphicus hollandicus* a de maior prevalência no período estudado. Observou-se também que emagrecimento em associação com vômito é o sinal clínico mais comum

observado em aves jovens, enquanto aves adultas apresentam infecções subclínicas com maior frequência. Estes resultados evidenciam reforçando a importância da investigação da contaminação por *M. ornitogaster*, uma vez que o diagnóstico precoce é importante para o sucesso terapêutico em animais com sinais clínicos.

Palavras-chave: *Macrorhabdus*, micologia, gastrologia, sanidade animal, patologia aviária.

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Autor para correspondência. E-mail: gmarietto@gmail.com
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[1]. Médico Veterinário e Biólogo, Prof., PhD., Ms C., Bac., Lic.; Universidade do Contestado - UnC, Mafra, SC, Brazil; gmarietto@gmail.com
[2]. Médico Veterinário, Prof., PhD., Ms C., Bac.; Universidade Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil; aat.tonin@gmail.com

Introduction

Macrorabdiosis, commonly known as "megabacteriosis," is a disease caused by the bacillary fungus *Macrorhabdus ornithogaster*. It belongs to the phylum Ascomycota, class Saccharomycetes, and order Saccharomycetales, but its taxonomic classification, at the family level, remains undefined. For a long time, the agent was mistaken for a bacterium. It is a pathogenic agent of the avian gastrointestinal tract with a specific infection tropism for the proventriculus, causing gastritis and consequent high mortality, due to the occurrence of so-called "wasting syndrome," which causes significant morbidity in large-scale breeding operations. The disease has been described in birds of the orders Psittaciformes, Passeriformes, Piciformes, Galliformes, Columbiformes, and Struthioniformes (TOMASZEWSKY et al., 2003; MARTINS et al., 2006; PHALEN, 2014; MARIETTO-GONÇALVES, 2020; HAMIAN et al., 2023).

Infection with *M. ornithogaster* disrupts the gut microbiota and increases susceptibility to co-infections with other pathogens, as well as exacerbates pre-existing conditions (OZMEN et al., 2013; PÜSTOW e KRAUTWALD-JUNGHANNS, 2017; ROBINO et al., 2019). The clinical signs of the disease are non-specific and may include lethargy, diarrhea, hyporexia, ruffled feathers, undigested food in the feces (or fecal undigested food), and regurgitation, as well as sudden death (MARIETTO-GONÇALVES, 2020).

For a long time, the *in vivo* diagnosis of macrorabdiosis was restricted to the analysis of Gram-stained fecal smears. However, the intermittent shedding of the agent makes this technique unreliable due to its low sensitivity (HOLLWARTH e PRIETO, 2025).

Recent studies have demonstrated that detection by molecular methods, primarily the Polymerase Chain Reaction (PCR), is far more accurate. Fecal smear analysis should therefore be used only as a screening tool (SULLIVAN et al., 2017; KANNO e MATSUMOTO, 2023).

In this context, this study analyzed the case series of species affected by macrorabdiosis and the clinical presentation of *Macrorhabdus ornithogaster* infections diagnosed by molecular techniques between 2015 and 2025 at Doc.Bird – Avian, Exotic, and Wildlife Medicine Consulting, located in Botucatu, São Paulo, Brazil.

Material and methods

This study was divided in three phases. The first phase involved a file review, in order to identify completed cases with a history of digestive disorders. The search was based on the key clinical signs of vomiting, diarrhea, and/or wasting. All analyzed cases represented captive birds kept in various environments, including private households (pets), zoos, or production systems, encompassing both exotic and native species. In the second phase, the selected cases were, then, screened for those that had received a confirmed diagnosis of *M. ornithogaster* infection. Finally, in the third stage, data were collected regarding the following parameters: the affected species; whether birds were asymptomatic (with no apparent clinical signs) or symptomatic; age, categorized as young (considered sexually immature birds) or mature; and the clinical symptoms observed—vomiting, diarrhea, and wasting (either isolated or in combination).

The diagnosis of macrorabdiosis in all cases was confirmed using the PCR technique. For this purpose, fecal samples, oropharyngeal swabs, or cloacal swabs were collected, and DNA was extracted for analysis. The samples were diluted 10-fold with physiological saline solution, and 400 µL of the fecal suspension were used for genomic DNA extraction. The extracted DNA was eluted with 50 µL of TE buffer. The real-time PCR assay was conducted using TB Green® Premix Ex Taq™ II (TaKaRa, Shiga, Japan). The reaction mixture consisted of 10 µL of TB Green® Premix Ex Taq™ II, 0.4 µL of

each primer (10 µM), 2 µL of genomic DNA, and nuclease-free water for a total reaction volume of 20 µL. The primer sequences targeting the 18S ribosomal RNA gene of *M. ornithogaster* were: forward, 5'-ggacttatattactagtcagatgg-3' and reverse, 5'-caatacgcctgctttgaacactc-3'.

Amplification was performed according to Tomaszewski et al. (2003), starting with an initial denaturation at 95 °C for 10 seconds, followed by 40 cycles of denaturation at 95 °C for 5 seconds, and a combined annealing/extension step at 58 °C for 30 seconds. Finally, a melting curve analysis was performed to determine the melting temperature of the amplification products. For the collected data, prevalence and incidence rates were calculated for the investigated period, where:

Period prevalence = (Number of existing cases within the date range / size of the population analyzed during that period) x 100.

Incidence rate = Number of cases / population at risk x population size

A base population size of 100,000 was pre-established.

Results and discussion

During the study period, out of a total of 4,516 records reviewed, 1,303 cases were found with a history of wasting, vomiting, and/or diarrhea, representing 28.85% of potential compatible cases. Upon investigation of these 1,303 cases, 322 were diagnosed with the presence of *M. ornithogaster* in the sick birds.

This represents a prevalence of 70 cases per 1,000 and an annual incidence rate of 14.5. Of the total cases of *M. ornithogaster* infection, all were identified in species belonging to the orders Passeriformes and Psittaciformes. Among these, 83.3% (278 cases) were species from the order Psittaciformes, and 13.7% (44 cases) were from the order passeriformes (Table 1).

Overall, macrorabdiosis was identified in 34 different species. The highest number of cases was in *Nymphicus hollandicus* (54.35%), followed by *Melopsittacus undulatus* (6.53%), *Amazona aestiva* (5.29%), *Serinus canaria* (4.37%), and *Agapornis roseicollis* (3.12%).

The remaining species showed low positivity rates. These findings are consistent with the literature (Martins et al., 2006; Phalen, 2014; Marietto-Gonçalves, 2020), which reports that *N. hollandicus*, *M. undulatus*, and *S. canaria* are commonly affected species.

Survey data addressing the case rates in *A. aestiva* and *A. roseicollis* were not found for comparison.

These findings likely reflect the fact that their significant case numbers are a result of these being commonly kept as pet birds in Brazil, particularly *N. hollandicus*.

Table 1. Prevalence of bird species infected with *Macrorhabdus ornithogaster* from June 2015 to June 2025.

Order/Specie	Cases	Prevalence
Psittaciformes	**278**	**83,30%**
Agapornis fisherii	3	0,93%
Agapornis personata	8	2,48%
Agapornis roseicollis	10	3,12%
Amazona aestiva	17	5,29%
Amazona amazonica	5	1,55%
Amazona vinacea	1	0,31%
Anodorhyncus hyacinthinus	3	0,93%
Ara ararauna	2	0,61%
Aratinga aurea	1	0,31%
Brotogeris tirica	1	0,31%
Cacatua alba	6	1,86%
Cacatua mollucensis	1	0,31%
Cyanoramphus novaezelandiae	1	0,31%
Forpus coelestis	1	0,31%
Forpus xanthopterygius	1	0,31%
Guaruba guarouba	4	1,24%
Melopsittacus undulattus	21	6,53%
Neopsephotus bourkii	1	0,31%
Nymphicus hollandicus	175	54,35%
Psephotus haematonotus	1	0,31%
Psittacara leucophthalmus	8	2,48%
Psittacula alexandri	1	0,31%
Psittacula krameri	6	1,86%
Passeriformes	**44**	**13,70%**
Chloebia gouldiae	1	0,31%
Cyanocompsa brissonii	2	0,62%
Lonchura oryzivora	1	0,31%
Lonchura striata	1	0,31%
Saltator similis	6	1,86%
Serinus canaria	14	4,37%
Serinus mozambicus	1	0,31%
Sporophila angolensis	6	1,86%
Sporophila bouvreuil	2	0,62%
Sporophila caerulescens	8	2,48%
Sporophila maximiliani	2	0,62%
Total	**322**	**100%**

The accuracy in detecting the pathogen is also attributed to the use of molecular techniques, which provide greater sensitivity and specificity when compared to conventional fecal smear methods commonly employed (SULLIVAN et al., 2017). An analysis of clinical sign occurrences revealed a predominance in Psittaciform patients, accounting for 86.3% of cases. Among these, 66.2% (184 out of 278) were symptomatic cases. In contrast, 72.7% of affected Passeriform patients presented with no apparent disease (Table 2).

Table 2. Prevalence of cases among the studied avian orders and presence of clinical signs.

Family	Cases	Asymptomatics	Symptomatics
Passeriformes	44 (13,7%)	32 (72,7%)	12 (27,3%)
Psittaciformes	278 (86,3%)	94 (33,8%)	184 (66,2%)
Total	**322 (100%)**	**126 (39%)**	**196 (61%)**

Regarding the age distribution, 55.27% of the total cases were in young birds. When analyzing the symptom/age relationship, it was observed that 75.51% of symptomatic patients were young birds, while 76.19% of asymptomatic patients were mature adults (Table 3).

Table 3. Prevalence of clinical signs by age group in the analyzed patients.

Clinical situation	Cases	Young[a]	Mature[b]
Symptomatic birds	196 (61%)	158 (75,51%)	38 (24,49%)
Asymptomatic birds	126 (39%)	30 (23,81%)	96 (76,19%)
Total	**322 (100%)**	**178 (55,27%)**	**144 (44,73%)**

a. Young patient: Birds of an age known to be below sexual maturity.
b. Mature patient: Birds of an age known to be above the age of sexual maturity or with years of captive history.

BLAGOJEVIĆ et al. (2024) also observed in their study that asymptomatic infection with *M. ornithogaster* is common. Furthermore, Lanzarot et al. (2013) had previously reported that asymptomatic birds continuously shed the pathogen, meaning they act as reservoirs and contribute to its spread within flocks.

An analysis of the main clinical signs observed in the cases revealed that 44.4% presented with the combination of vomiting and wasting. Of these, 83.9% occurred in young birds.

In contrast, the primary clinical sign found in mature birds was wasting, present in 15 out of 38 cases (Table 4). In conclusion, the data indicates that young Psittaciform birds are more susceptible to macrorabdiosis, with the species *Nymphicus hollandicus* showing the highest prevalence during the study period. It was also observed that the combination of wasting and vomiting is the most common clinical presentation in young birds, whereas adult birds more frequently present with subclinical infections.

Table 4. Prevalence of the most common clinical signs according to bird age.

Chief Complaint	Cases	Young[a]	Mature[b]
Vomiting	43 (21,9%)	37 (86,05%)	6 (13,95%)
Diarrhea	25 (12,7%)	23 (92%)	2 (7%)
Wasting	35 (17,8%)	20 (57,14%)	15 (42,86%)
Wasting and Vomiting	87 (44,4%)	73 (83,9%)	14 (16,1%)
Wasting and Diarrhea	4 (2,1%)	3 (75%)	1 (25%)
Vomiting and Diarrhea	2 (1,1%)	2 (100%)	0
Total	**196 (100%)**	**158 (75,51%)**	**38 (24,49%)**

a. Young patient: Birds of an age known to be below sexual maturity.
b. Mature patient: Birds of an age known to be above the age of sexual maturity or with years of captive history.

These findings underscore the importance of screening for *M. ornithogaster*, as early diagnosis is critical for a successful therapeutic outcome in symptomatic animals.

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