VETERINÁRIA NOTÍCIAS

Article

Received: february, 2021; Accepted: may, 2021

# Prevalence of endo and ectoparasites in psittaciformes raised in the state of Espirito Santo

*Débora Cantarin Neiva*[1*], *Isabella Vilhena Freire Martins*[2]

**Abstract:** Birds are affected by many parasites, and at wildlife animals are less vulnerable to the changes caused by parasitism, nevertheless in captivity their vulnerability may increase by different factors, including precarious hygiene and management. Birds of the order Psittaciformes frequently live together with people, and it may causes health and environment threats. Then, the objective of the current study was to accomplish parasitological exams in captive Psittaciformes birds aiming to know their parasitological fauna, and evaluate the results with the type of management and the environment where they are, to adopt appropriate prophylaxis measures. This work was authorized by the Ethics Commission in the Use of Animals at UFES from Alegre, and by the Biodiversity Information and Authorization System (SISBIO) of ICMBio. There were analyzed 200 birds of four breedings in Espírito Santo state, being that 63 couple of cockatiels are from domestic breedings in the county of Alegre and 74 individuals of parrots from the Zoo Park da Montanha Zoo, in Marechal Floriano. The fecal samples were collected and processed by the Simple Fluctuation Centrifugal technique in parasitology lab of HOVET-UFES, and the parrots and cockatiels' feathers were analyzed in the stereomicroscope. The environment and heath aspects where the birds were living were analyzed. The obtained data were summarized by descriptive statistics. The parasites found were *Eimeria* sp., with a frequency of 9,52% and the lice *Neopsittaconirmus* sp., with frequency of 4,76% in cockatiels; *Capillaria* sp. and *Ascaridia* sp. with a frequency of 75,6 % and 39%, respectively, in parrots, which 36,5% are mixed infection (*Capillaria* sp. e *Ascaridia* sp.). It was also found the mite *Neorthydelasma* sp. with a frequency of 73,3% in mutualism with parrots. The prophylactic and control recommendations were made based on the results of this study and on the evaluation of the current situation that each bird was, showing an association of the appropriate management with the birds with the presence and diversity of parasites. This study emphasizes the need of more parasitological studies in birds of this order, since they are charismatic animals and live together harmoniously with the society.

**Keywords:** parasitism, Psittaciformes, parasitological control, health management, prophylaxis.

[1] Universidade Federal do Espírito Santo – Alegre ES. https://orcid.org/0000-0003-1816-7370
[2] Universidade Federal do Espírito Santo – Alegre ES. https://orcid.org/0000-0002-8700-3065
*Corresponding author: Rua São Geraldo, n 65, Centro, Bom Jesus do Itabapoana, RJ, CEP 28.360-000. deboranei@hotmail.com. Phone number: 22 988082214

## Introduction

Birds are affected by many species of parasites, however free-living wild birds are less susceptible to several ways of parasitism, due to the developed resistance to patogens and to the natural selection (PASSERINO, 2000). Nevetheless, the parasitic diseases in wild birds in captivity are alarming, since the conditions of parasitism increase quantitatively by flight restriction, physical contact between the birds, poor hygiene and management scenarios and stressful condition of captivity (PROCTOR, 2003). Such factors contribute to decrease the birds' immune resistance, allowing parasites to complete their cycles, triggering clinical signs in their hosts like itch, injuries and secondary infections (FREITAS et al., 2002; PROCTOR, 2003; SANTOS et al., 2015).

The nearness between humans and wild birds may impose risks to public health, since many of these species are hosts of zoonotic pathogens, being possible to severely affect the health of the people who work with these animals, such as veterinarians, biologists, zootechnicians and keepers (SIBAJA-MORALES et al., 2009). In addition, wild birds are susceptible to several diseases commonly diagnosed in poultry, like psittacosis (SANTOS et al., 2015). Among these species, stand out those belonging to the order Psittaciformes due to their frequent contact with the society. Some known members are parrots, parakeets, macaws and cockatiels, which are most commonly kept in captivity (PASSERINO, 2000).

Oftentimes, the parasitic diseases can be asymptomatic or the clinical signs unspecific, making the diagnosis difficult and requiring fecal exams and identification of ectoparasites (PASSERINO, 2000; FREITAS et al., 2002). Thus, the objective of this study was to know the endo and ectoparasites species present in breeding of birds belonging to the order Psittaciformes in two counties of Espírito Santo, besides relate the results with the type of management and the environment where the birds are, so what the owners take appropriate measures of prophylaxis.

## Material and methods

This project was accomplished by UFES of Alegre-ES Animal Use Ethics Committee authorization, registered under n° 031/2019, and by Biodiversity Authorization and Information System (SISBIO) of Chico Mendes Institute for Biodiversity Conservation (ICMBio) registered under n° 73950-1. The study includes 200 adults birds of the order Psittaciformes belonging to four different breedings located in two counties of Espírito Santo.

During the period from february to july of 2020, there were assessed 126 cockatiels (*Nymphicus hollandicus* (Keer, 1792)), referring to 63 couple from three domestic breedings located in Rive, district belonging to the county Alegre-ES. The first breeding had 18 couple, the second 30 couple and the third one, 15 couple kept in individual cages. The other 74 analyzed Psittaciformes were parrots housed in Marechal Floriano Zoo-ES, as macaws, parrots and parakeets. The parrots were organized in collective nurseries, being the biggest ones with more than three different species living together, and individual nurseries, smaller, with up to three individuals. In the first collective nursery, there were 14 macaws of the species *Ara ararauna* (Linnaeus, 1758), *Ara macao* (Linnaeus, 1758) and *Ara chloropterus* (Gray, 1859) living with several birds from other families, like Phasianidae and Anatidae. In the second nursery, there were around 50 parrots and parakeets of the species *Amazona aestiva*, *Amazona farinosa* (Boddaert, 1783), *Amazona rhodocorytha* (Salvadori, 1890), *Amazona amazonica* (Linnaeus, 1766), *Primolius maracana* (Vieillot, 1816), *Psittacara leucophthalmus* (Statius Muller, 1776), *Psittacula cyanocephala* (Linnaeus, 1766), *Pionus* sp., *Aratinga nenday* (Vieillot, 1823), *Amazona brasiliensis*, (Linnaeus, 1758), *Eupsittula aurea* (Gmelin, 1788) and *Aratinga* sp. In the first individual nursery there was three parrots of the species *A. aestiva*, *A. amazonica* and *A. rhodocorytha*; in the second one, a couple of *Ara chloropterus,* in the third nursery, a couple of *A. chloropterus* e *A. ararauna* and in the fourth nursery,

a male and a couple of macaws of the specie *Anodorhynchus hyacinthinus* (Table 1).

**Table 1** – Layout of the parrots' nurseries of the Marechal Floriano Zoo-ES during the study period.

| Individual nurseries | | Collective nurseries | |
|---|---|---|---|
| Nursery 1 | | Nursery 1 | |
| Species | Total of individuals | Species | Total of individuals |
| Amazona aestiva, Amazona rhodocorytha, Amazona amazonica | 3 | Ara ararauna, Ara chloropterus, Ara macao | 14 |
| Nursery 2 | | Nursery 2 | |
| Species | Total of individuals | Espécie | Total of individuals |
| Ara chloropterus | 2 | Amazona aestiva, Amazona farinosa, Amazona rhodocorytha, Amazona amazonica, Primolius maracana, Psittacara leucophthalmu, Psittacula cyanocephala, Pionus sp., Aratinga nenday, Amazona brasiliensis, Eupsittula aurea, Aratinga sp. | 50 |
| Nursery 3 | | | |
| Species | Total of individuals | | |
| Ara chloropterus, Ara ararauna | 2 | | |
| Nursery 4 | | | |
| Species | Total of individuals | | |
| Anodorhynchus hyacinthinus | 3 | | |

The assessment of presence of endoparasites was made through parasitological exam through collects of Psittaciformes feces in the breedings and nurseries. For the collects of cockatiels feces, the cages bottoms were cleaned, lined with aluminum foil and posteriorly the collects was done, totalizing 63 samples. And in the large nurseries of wild macaws, parrots and parakeets, the fresher feces was collected in the environment, only the upper side of the feces which wasn't in direct contact with the ground was collected in order to avoid contamination, with the supervision of the responsible veterinarian, and the support of aluminum foil, totalizing 41 sample (31 in

the collectives and 10 in the individuals nurseries). The collects were done in the morning period, time the birds usually defecate more often. All the cockatiels and parrots fecal samples were stored in a cooled styrofoam container and forwarded to the Parasitology Laboratory of Veterinary Hospital of Center for Agricultural Sciences and Engineering at the Federal University of Espírito Santo (HOVET-CCAE/UFES) for analysis. The technique used for the fecal exam was Conventional Centrifugal Flotation with hyper saturated sugar solution (SHEATHER, 1923), using 2 grams of each fecal sample for 15 mL of water, filtered and centrifuged twice at 2500 rpm for 10 minutes for further slides preparation without addition of dyes. The slides were read under Olympikus optical microscope in the objectives 4x, 10x and 40x, for evaluation and identification of the evolutionary shapes found and posteriorly registered by photographs and measured with support of Dino Eye camera e the Dino Capture Program.

For assessment of presence of ectoparasites, penaceous feather of macaws, parrots and parakeets that were in the environment were collected and kept in plastic bags, totalizing 45 feathers from the collective and 3 of 4 individual nurseries. In the cockatiels, the research of ectoparasites was done in the feathers through bird containment, and a random sampling of seven birds from each breeding, one bird per cage, totalizing 21 birds. The parasites were removed manually and stored in flasks containing etanol 70% for further identification in estereomicroscope through techniques of temporary slides mounting, with support of Lice Identification Key of Price et al., (2003) and of Feather Mites of Pedroso e Hernandes (2016).

During of feces and feathers collects, it was made a general examination of the environment where the birds were. As the number of birds per cage, the features of each nursery/cage, whether there were other species in the breeding together with the target species, and the management assessment. All the parasitological exams were done in the Parasitology Laboratory of Veterinary Hospital of Center for Agricultural Sciences and

Engineering at the Federal University of Espírito Santo (HOVET-CCAE/UFES), in the county of Alegre-ES. The frequency of each parasite presents in birds and the percentage of parasitized animals in the different places was calculated by descriptive statistics to organize e summarize the obtained dataset.

## Results and discussion

Once the cockatiels were in couples separated by cages, the collects of fecal samples was carried out each couple, instead of each individual. From 63 couples of *Nymphicus hollandicus* analyzed of domestic breedings, six samples (9,52%) presented endoparasites of class Coccidia, genus *Eimeria* (Figure 1B). From the 21 birds assessed, there was the presence of ectoparasites belonging to the order Phthiraptera, genus *Neopsittaconirmus* in one individual (4,76%) (Figure 1A).

In the first breeding analyzed, which kept in captivity 18 couples of cockatiels, two samples (11,11%) presented oocysts of *Eimeria* sp. In the second breeding, which kept 30 couples, there wasn't positive result for endoparasites. And lastly, in the third breeding, with 15 couples of cockatiels, four samples (26,66%) were positives for the presence of *Eimeria* sp. oocysts. The presence of ectoparasites was confirmed only in one bird, among the seven ones analyzed of the second breeding (14,2%), being found the chewing louse of the genus *Neopsittaconirmus* (Philopteridae) (Table 2).

**Table 2** – Frequency of endo and ectoparasites collected in cockatiels, from february to june of 2020, of the three domestic breedings in the countie of Alegre, ES.

| Breeding | Number of analyzed samples | | Number of positive samples | | Parasites | Frequency (%) |
|---|---|---|---|---|---|---|
| | endoparasites | ectoparasites | endoparasites | ectoparasites | | |
| 1º | 18 | 7 | 2 | 0 | *Eimeria* sp. | 11,11 |
| 2º | 30 | 7 | 0 | 1 | *Neopsittaconirmus* sp. | 14,2 |
| 3º | 15 | 7 | 4 | 0 | *Eimeria* sp. | 26,66 |
| TOTAL | 63 | 21 | 6 | 1 | *Eimeria* sp. | 9,52 |
| | | | | | *Neopsittaconirmus* sp. | 4,76 |

**Figure 1** – Specimens of endo and ectoparasites found in *N. hollandicus* from different breedings. A: Louse of genus *Neopsittaconirmus*, observed in an estereomicroscope. B: Oocyst of genus *Eimeria* observed in microscope, 40x magnification. Source: the author.


In all breeding sites the cages are cleaned weekly, daily water exchange and, except birds of the third breeding, the other cockatiels had already been submitted to fecal exams and to the subsequent antiparasitic control about one year before the assessment. This factor may be one of the causes of the birds of the third breeding having the highest occurrence of parasites regarding to the others. Two breedings presented positive result for genus coccidia *Eimeria* in at least one fecal sample of *N. hollandicus.* The genus of coccidia was identified through oocyst morphology and host type where it was found. Sprenger et al. (2017) also found *Eimeria* spp. in *N. hollandicus,* and it may indicate that this endoparasite is commonly found in this bird species.

The birds of the two first breedings didn't show clinical signs of any type of parasite disease. In one similar study, Oliveira et al., (2017) observed that the assessed birds seem to be healthy and didn't show clinical signs usually regarded with coccidiosis, like cachexy, diarrhea and malnutrition, even those which were parasitized. In the current study, it was observed that

the birds of the third breeding had feces with altered consistency, waterier than the normal, and this signal can be related with the presence of coccidia found in the exams, this relation was also verified by Penha et al. (2008). In this study, lice *Neopsittaconirmus* sp. were found in a couple of cockatiels in the second breeding, corroborating with the findings of Price et al., (2003).

From the 41 collected samples in the nurseries of Mountain Zoo Park for analysis, 31 samples (75,6%) presented positive results for endoparasites of the genus *Capillaria* (Figure 2A), and 16 positive samples (39%) of the genus *Ascaridia* (Figure 2B), being that 15 samples (36,5%) presented mixed infection (*Capillaria* sp. and *Ascaridia* sp.). It was found feather mites belonging to the genus *Neorthydelasma* (Figure 2C) in 33 of the 45 samples (73,3%).

In the first collective nursery five fecal samples were collected in the environment, and among these, three (60%) presented positive result for *Capillaria* sp. nematode egg. And of the 15 collected feathers, seven (46,6%) presented *Neorthydelasma* feather mites. In the second collective nursery there were collected 26 fecal samples, and among these, 20 samples (78%) presented positive result for *Capillaria* sp. and 13 (50%) presented *Ascaridia* sp. eggs. Of the 20 collected feathers, 16 (80%) were infested by the mite *Neorthydelasma* sp. The first individual nursery showed mixed infection of *Capillaria* sp. and *Ascaridia* sp. in only one collected sample, while in the other samples the occurring parasite was only *Capillaria* sp. In the second nursery with a couple of *A. chloropterus*, both samples showed mixed infection of *Capillaria* sp. and *Ascaridia* sp. In the third nursery, there was positive result for *Capillaria* sp. in both collected samples. It wasn't made ectoparasites assessment in these nurseries due to the absent of feathers in the environment for collects. Finally, in the fourth nursery, Only the sample referent to the lonely male presented infection by *Capillaria* sp., and the mite *Neorthydelasma* sp. was present in all of the 10 collected feathers in the

environment. The obtained data in the individual and collective nurseries of the zoo are represented in the tables 3 and 4.

**Table 3** – Frequency of endoparasites in parrots analyzed in april 2020, in the collective and individual nurseries of Mountain Zoo Park, located in the county of Marechal Floriano, ES.

| Individual nursery | N° of samples | N° of positive samples | Endoparasites | Frequency (%) |
|---|---|---|---|---|
| Nursery 1 | 3 | 3 | *Capillaria* sp. | 100 |
| | | 1 | *Ascaridia sp.* | 33,3 |
| Nursery 2 | 2 | 2 | *Capillaria* sp. | 100 |
| | | | *Ascaridia* sp. | 100 |
| Nursery 3 | 2 | 2 | *Capillaria* sp. | 100 |
| Nursery 4 | 3 | 1 | *Capillaria* sp. | 100 |
| Collective nursery | N° of samples | N° of positive samples | Endoparasites | |
| Nursery 1 | 5 | 3 | *Capillaria* sp. | 60 |
| Nursery 2 | 26 | 20 | *Capillaria* sp. | 76,9 |
| | | 13 | *Ascaridia* sp. | 50 |
| TOTAL | 41 | 31 | *Capillaria sp.* | 75,6 |
| | | 16 | *Ascaridia sp.* | 39 |

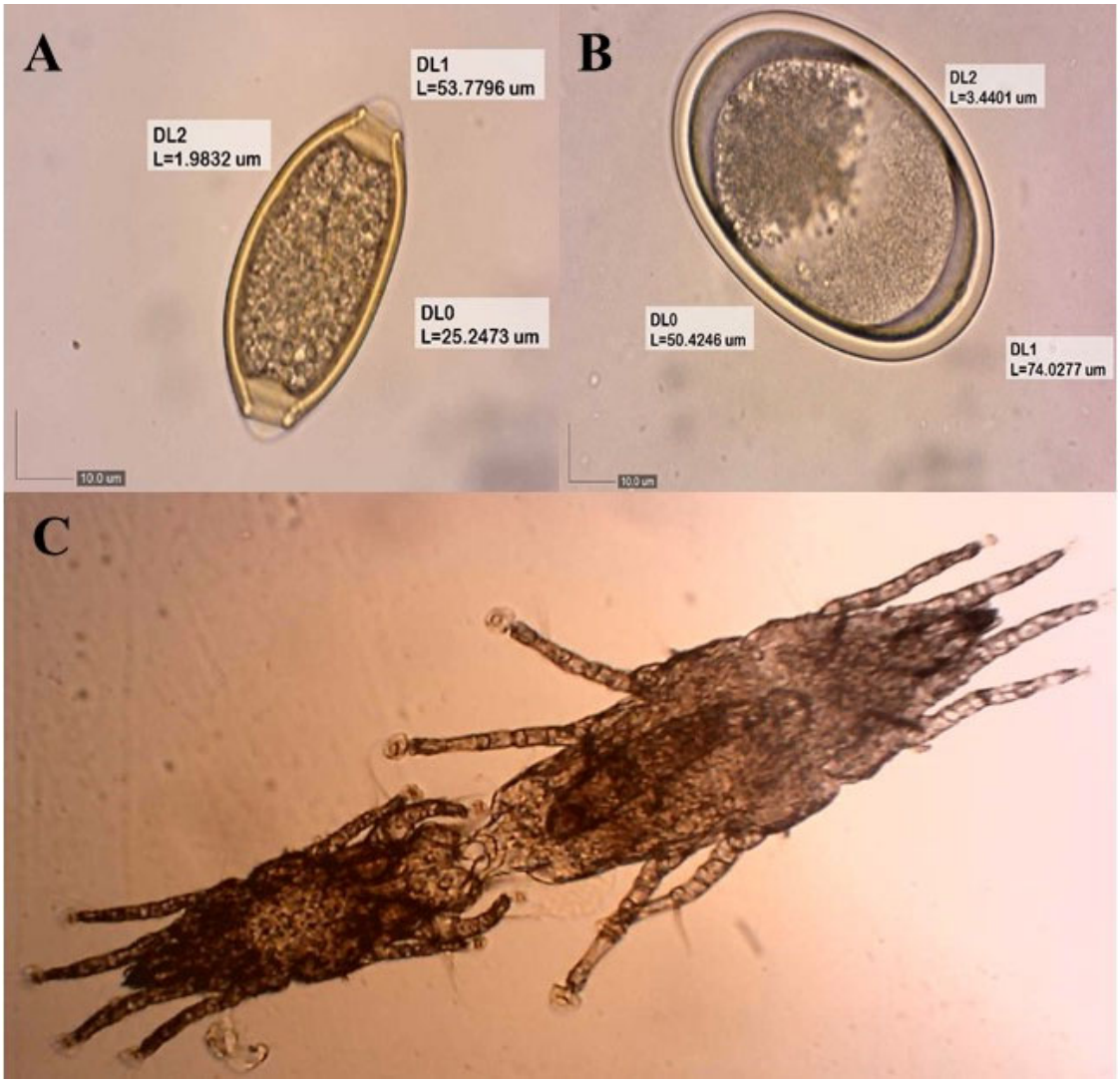
**Tabela 4** – Frequency of feather mite *Neorthydelasma* sp., in the collective and individual nurseries of parrots of Mountain Zoo Park, located in the county Macheral Floriano, ES.

| Individual nurseries | N° of feathers | N° of affected feathers | Frequency (%) |
|---|---|---|---|
| Nursery 4 | 10 | 10 | 100 |
| Collective nurserie | | | |
| Nursery 1 | 15 | 7 | 46,6 |
| Nursery 2 | 20 | 16 | 80 |
| TOTAL | 45 | 33 | 73,3 |

Valim, Hernandes and Proctor (2011) found 3 species of the genus *Neorthydelasma* in Psittaciformes, like *N. dilatata* in *Diopsittaca nobilis* (Linnaeus, 1758), *N. forficiventris* in *Pionites leucogaster* (Kuhl, 1820) and *N. ulocerca* in *A. chloropterus*. The mite found in high occurrence in the collected

feathers in the current study can be explained by the fact that its transmission occurs through physical contact between the birds of the same species, or even of the same family, increasing its proliferation. Since the mite *Neorthydelasma* sp. was found in the ventral surface, near the birds' feather racket, and the collected feathers didn't show damages, it may be considered a mite that acts in mutualism with the birds when feeding on the oil secreted by the uropigial gland, avoiding bacterial proliferation (Blanco et al., 1997).

**Figure 2** – Specimens of endoparasites and feather mites found in parrots kept in nurseries of zoo at Marechal Floriano, ES. A: Egg of *Capillaria* sp., 40x magnification and its respective measures. B: Egg of *Ascaridia* sp., 40x magnification and its respective measures. C: Copulation of *Neorthydelasma* sp., 10x magnification. Source: the author.



Passerino (2000), when performing parasitological exams obtained positive results of *Ascaridia* sp., *Heterakis* sp., Strongylidea and *Capillaria* sp. in parrots like *A. aestiva*, *A. chloropterus* and *Pionopsitta pileata* (Scopoli, 1769). Among these parasites, *Capillaria* sp. was the most frequent (91,30%) in all methods. Santos et al. (2015) made parasitological exams in birds at the Wild Animal Screening Center (WASC) of Pernambuco, and registered a prevalence of 44,2% of gastrointestinal parasites in Psittaciformes, being *Capillaria* sp. the most prevalent. The results of the cited studies above coincide with the results of the present study, which *Capillaria* sp. was the gastrointestinal parasite most found in the exams done in the parrots of the Mountain Zoo Park, with the total frequency of 77,5%.

Ayres et al. (2016) performed fecal exams in four species of Psittaciformes, and the endoparasites responsible for the infections were *Ascaridia* sp., *Capillaria* sp. and *Heterakis* sp., being the first one, more frequent (65,62%). While in the current study, the genus *Ascaridia* was the second most frequent (40%), the eggs were identified as of *Ascaridia* sp. because of the egg and shell thickness, which although the great similarity with eggs of *Heterakis* sp., it has the shell thicker (MELO et al., 2019) and is the most found in Psittaciformes (BARROS et al., 2002).

The zoo which samples were obtained for the current study is located near the city Marechal Floriano, enabling the ecosystem to be frequented by domestic and synanthropic animals, from surrounding urban and suburban environment, like pigeons, sparrows and other birds, mice, rats, skunks and wandering cats. Passerino (2000) affirms that pigeons can act as vectors, being responsible for the infection in birds in captivity, since it can be parasitized by *Capillaria* spp. This interaction with external birds can be one of the reasons of the high occurrence of this helminth in the analyzed birds. Invertebrates like annelids can act as carrier hosts (MELO et al., 2019), and they can be present in the nurseries lawns, even with the weekly cleaning of the premises. As individual nurseries have less space for birds, there is more

contact with the floor, and this means of infection can be more frequent compared to the collective nurseries.

Usually an ideal captivity from birds needs a comfortable environment, quiet, with enough space to fly, with good quality food available, environmental enrichment like suspended perches, intending to decrease the captivity stress, and concomitantly avoid the birds contact with the ground of the nurseries, place where the feces are, and consequently, most parasitic infection site. More over, vacination are needed in new born birds, 45-day quarantine and parasitological exam in the newly arrived birds before (BRUNO E ALBUQUERQUE, 2008) are factors that influence the maintenance of the population of these animals and work as prophylactics measures against parasites dissemination.

Sibaja-Morales et al. (2009) clarify that the parasitological control must be done through basic hygiene measures like cages and nurseries systematic desinfection using fire broom for destroying eggs and oocysts, besides the remove of impurities and invertebrates in the ground, being viable measures to avoid reinfections. Depending on the parasite, the environment kept dry and clean during three weeks usually is enough for the lost of egg (MELO et al., 2019). These measures are essential for the animal well-being, decreasing the stress of these birds and making their immune system more resilient to the diseases caused by the parasites found. Moreover, the parasitism is something usual in wild animas, and in the nature doesn't cause so much clinical harms compared to the life in captivity, due to the developed resilience to the pathogens and to the natural selection, besides the fact that they are not restricted to only one place, as stated by Passerino (2000).

## Conclusion

The parasitological profile of the Psittaciformes analyzed is composed by protozoa of genus *Eimeria*, and lice belonging to the genus

*Neopsittaconirmus* in cockatiels, and by nematodes *Capillaria* sp. and *Ascaridia* sp. in macaws, parrots and parakeets. The parrots act in mutualism with the feather mite *Neorthydelasma* sp. The obtained results show a great association with the birds management and the presence and diversity of the parasites found. Thus, it is emphasized the need of preventive and parasitological control care, besides the achievement of more parasitological studies in birds of this order, since they are charismatics animals and coexist in harmony with society.

**Acknowledgments**

To the owners of the cockatiel breedings, to the responsible ones for Mountain Zoo Park, and to the Federal University of Espirito Santo.

***

## Prevalência de endo e ectoparasitos em psittaciformes criados no estado do Espírito Santo

**Resumo:** As aves são acometidas por diversos parasitos e, na natureza são menos suscetíveis às alterações causadas pelo parasitismo, todavia em cativeiros a susceptibilidade às infecções e infestações pode aumentar por diversos fatores, como por higiene e manejo precários. As aves da ordem Psittaciformes possuem um convívio frequente com pessoas, podendo impor riscos ambientais e sanitários. Assim, o objetivo do presente estudo foi conhecer as espécies de endo e ectoparasitos presentes em criações de aves pertencentes a ordem Psittaciformes em dois municípios do Espírito Santo, além de relacionar os resultados com o tipo de manejo e ambiente em que as aves se encontram, para que os proprietários adotem medidas adequadas de profilaxia. Este trabalho foi autorizado pela Comissão de Ética no Uso de Animais da UFES de Alegre, e pelo Sistema de Autorização e Informação em Biodiversidade (SISBIO) do ICMBio. Foram analisadas 200 aves de quatro criações no estado do Espírito Santo, sendo 63 casais de calopsitas de criações domésticas no município de Alegre e 74 indivíduos de espécies de psitacídeos do Zoológico Zoo Park da Montanha, em Marechal Floriano. As fezes foram recolhidas e processadas pela técnica de Centrífugo Flutuação Simples no laboratório de Parasitologia do HOVET-UFES, e as penas e penugens das calopsitas e psitacídeos foram analisadas em estereomicroscópio. Foram analisados o ambiente e os aspectos sanitários aos quais as aves eram submetidas. Os dados obtidos foram sumarizados

por estatística descritiva. Os parasitos encontrados foram *Eimeria* sp., com 9,52% de frequência e o piolho *Neopsittaconirmus* sp., com 4,76% de frequência em calopsitas, *Capillaria* sp. e *Ascaridia* sp, com 75,6 % e 39% de frequência, respectivamente, em psitacídeos, e destes, 36,5% são de infecção mista (*Capillaria* sp. e *Ascaridia* sp.). Foi encontrado também o ácaro *Neorthydelasma* sp.com a frequência de 73,3% em mutualismo com psitacídeos. As recomendações de profilaxia e de controle foram feitas baseadas nos resultados deste estudo e na avaliação da situação atual em que cada ave se encontrava, apresentando uma associação dos manejos adequados para com as aves com a presença e diversidade de parasitos. Este estudo enfatiza a necessidade de mais estudos parasitológicos em aves desta ordem, visto que são animais carismáticos e que convivem com a sociedade em harmonia.
**Palavras-chave:** parasitismo, Psittaciformes, controle parasitológico, manejo sanitário, profilaxia.

***

## References

AYRES, M.C.C.; PEIXOTO, M.S.R.; DA SILVA, W.B.; GOMES, D.M.; NUNES, O.C.; BORGES, K.B.; DE MORAES NETO, M.A.; DE ALMEIDA, M.A.O. Ocorrência de parasitos gastrintestinais em Psitacídeos, mantidos em Parques Ecológicos na região metropolitana de Salvador, Bahia. **Revista Brasileira de Medicina Veterinária**, Salvador, v. 38, n. 2, p. 133-136, 2016. Disponível em: http://rbmv.org/index.php/BJVM/article/view/225. Acesso em: 12 jul. 2020.

BARROS, L.A.; FEDULLO, L.P.L.; ALMEIDA, F.M.; PINTO, R.M. First case report of Ascaridia hermaphrodita (Froelich, 1789) Railliet & Henry, 1914 (Nematoda Ascaridoidea) in the Brazilian hyacinth macaw, Anodorhynchus hyacinthinus (Latham, 1790) Spix, 1824 (Aves, Psitacidae). **Revista Brasileira de Ciências Veterinárias**, Rio de Janeiro, v. 9, n. 2, p. 114-115, 2002. DOI: https://doi.org/10.4322/rbcv.2015.242. Disponível em: http://doi.editoracubo.com.br/10.4322/rbcv.2015.242. Acesso em: 2 abr. 2020.

BLANCO, G.; TELLA, J. L.; POTTI, J. Feather mites on group-living red-billed choughs: a non-parasitic interaction? **Journal of Avian Biology**, Copenhagen, v.

28, n. 3, p. 197–206, 1997. DOI: https://doi.org/10.2307/3676970. Disponível em: https://www.jstor.org/stable/3676970?seq=1. Acesso em: 3 jul. 2020.

BRUNO, S.F.; ALBUQUERQUE, D.D.A. Ocorrência e tratamento de sarna knemidocóptica (Knemidokoptes sp.) em aves de companhia atendidas na Faculdade de Veterinária da Universidade Federal Fluminense, RJ. **Ciência Rural**, Santa Maria, v. 38, n. 5, p. 1472-1475, 2008. DOI: https://doi.org/10.1590/S0103-84782008000500046

FREITAS, M.F.L.; OLIVEIRA, J.B.; CAVALCANTI, M.D.B.; LEITE, A.S.; MAGALHÃES, V.S.; OLIVEIRA, R.A.; SOBRINO, A.E. Parásitos gastrointestinales de aves silvestres en cautiverio en el estado de Pernambuco, Brasil. **Parasitologia Latinoamericana**, Pernambuco, v. 57, n. 1-2, p. 50 - 54, 2002. DOI: https://doi.org/10.4067/S0717-77122002000100012

MELO, Y.J.O.; OGLIARI, K.; FERRAZ, H.T.; OLIVEIRA, R.A.; AGUIAR, P.T.B. Ovos de helmintos encontrados em fezes de aves silvestres. **Enciclopédia Biosfera, Centro Científico Conhecer**, Goiânia, v. 16, n. 29, p. 1129, 2019. DOI: https://doi.org/10.18677/EnciBio_2019A94. Disponível em: https://www.conhecer.org.br/enciclop/2019a/agrar/ovos.pdf. Acesso em: 5 mar. 2020.

OLIVEIRA, P.S.; FERREIRA, M.A.; SILVA, L.M.; RODRIGUES, M.B.; CARDOZO, S.V.; BERTO, B.P. Diversity and distribution of coccidia of wild birds in an Atlantic forest fragment area in southeastern Brazil. **Brazilian Journal of Veterinary Parasitology**, Jaboticabal, v. 26, n. 4, p. 457-464, 2017. DOI: https://doi.org/10.1590/s1984-29612017063. Disponível em: https://www.scielo.sa.cr/pdf/rbt/v59n3/a26v59n3.pdf. Acesso em 22 fev. 2020.

PASSERINO, A.S.M. **Levantamento da fauna helmintológica em Psittacidae**. 2000. 116 f. Dissertação (Mestrado em Ciências Veterinárias) – Universidade Federal do Paraná, Curitiba, PR, 2000.

PEDROSO, L.G.A.; HERNANDES, F.A. New records of feather mites (Acariformes: Astigmata) from non-passerine birds (Aves) in Brazil. **CheckList**, São Paulo, v. 12, n. 6, p. 1-25, 2016. DOI: https://doi.org/10.15560/12.6.2000. Disponível em: https://checklist.pensoft.net/article/19602/. Acesso em 4 ago. 2020.

PENHA, G.A.; SUZUKI, E.Y.; UEDA, F.S.; BOCARDO, M.; PERES PEREIRA, R.E. Coccidiose Aviária. **Revista Científica Eletrônica de Medicina Veterinária**, v. 6, n. 11, 2008. Disponível em: http://faef.revista.inf.br/imagens_arquivos/arquivos_destaque/SYeao0yvEk4rvMI_2013-6-14-14-38-51.pdf. Acesso em: 4 ago. 2020.

PRICE. R.D.; HELLENTHAL, R.A.; PALMA, R.L.; JOHNSON, K.P.; CLAYTON, D.H. **The chewing lice: world checklist and biological overview**. Illinois: Natural History Survey Special Publication 24, 2003.

PROCTOR H.C. Feather mites (ACARI: ASTIGMATA): Ecology, Behavior, and Evolution. **Annual Review of Entomology**, v. 48, n. 1, p. 185–209, 2003. DOI: https://doi.org/10.1146/annurev.ento.48.091801.112725.

SANTOS, P.M.S.; SILVA, S.G.N.; FONSECA, C.F.; OLIVEIRA, J.B. Parasitos de aves e mamíferos silvestres em cativeiro no estado de Pernambuco. **Pesquisa Veterinária Brasileira**, Rio de Janeiro, v. 35, n. 9, p. 788-794, 2015. DOI: https://doi.org/10.1590/S0100-736X2015000900004. Disponível em: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-736X2015000900788&lng=pt&tlng=pt. Acesso em 11 ago. 2020.

SHEATHER, AL. The detection of intestinal protozoa and mange parasites by a floatation technique. **Journal of Pathology and Therapy**, v. 36, n.4, p. 266-275, 1923.

SIBAJA-MORALES, K.D.; OLIVEIRA, J.B.; ROCHA, A. E. J.; HERNÁNDES-GAMBOA, J.; PRENDAS-GAMBOA, J.; ARROYO-MURILLO, F.; SANDÍ, J.; NUÑEZ, Y.; BALDI, M. Gastrointestinal parasites and ectoparasites of Bradypus

variegatus and Choloepus hoffmanni sloths in captivity from Costa Rica. **Journal of Zoo and Wildlife Medicine**, v. 40, n. 1, p. 86-90, 2009. DOI: https://doi.org/10.1638/2008-0036.1.

SPRENGER, L.K.; YOSHITANI, U.Y.; BUZATTI, A.; MOLENTO, M.B. Occurrence of gastrointestinal parasites in wild animals in State of Paraná, Brazil. **Anais da Academia Brasileira de Ciências**, v. 90, n. 1, p. 231-238, 2017. DOI: https://doi.org/10.1590/0001-3765201720150030. Disponível em: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0001-37652018000100231&lng=en&tlng=en. Acesso em: 9 jul. 2020.

VALIM, M.P.; HERNANDES, F.A.; PROCTOR, H.C. Feather mites of Brazil (Acari: Astigmata: Analgoidea and Pterolichoidea). **International Journal of Acarology**, v. 37 n. 4, p. 293-324, 2011. DOI: https://doi.org/10.1080/01647954.2010.519719.