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Feather mites (Acari: Astigmata) of the Zoobotanical State Park in Teresina, Brazil

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Original research

ABSTRACT

Feather mites are the most diverse avian ectoparasites. They mainly live on the plumage of birds, feeding on uropygial oil, and may occasionally cause skin irritation, especially on caged birds. Here we report the results of a survey of feather mites on wild birds of the Zoobotanical State Park of Teresina, Piauí, Brazil. The following mites were collected from seven bird specimens kept in the park from January to July 2017: *Pandionacarus fuscus* (Nitzsch, 1818) on the osprey (*Pandion haliaetus*); *Freyana dendrocygni* Dubinin, 1950 and *Heterobrephosceles megathrix* Peterson & Atyeo, 1977 on the white-faced whistling-duck (*Dendrocygna viduata*); *Nyctibiolichus megamerus* Atyeo, 1979 on the common potoo (*Nyctibius griseus*); *Hieracolichus hirundo* (Mégnin & Trouessart, 1884) on the harpy eagle (*Harpia harpyja*) and *Hieracolichus* sp. on the southern caracara (*Caracara plancus*). These findings increase the known ranges of the mite species, with four of them reported for the first time in Brazil.

Keywords birds; ectoparasitism; feather mites; record; captivity; *Psoroptidia*

Introduction

Feather mites (Arthropoda: Chelicerata: Arachnida: Acariformes: Astigmata) are the most diverse and abundant permanent avian ectosymbionts, associated with nearly all bird orders (Gaud and Atyeo, 1996). Most feather mites exhibit morphological adaptations to inhabit specific microhabitats on their hosts' body – flight feathers of the wings, tail, down, and contour feathers, quills and skin; some members of the Pyroglyphidae (Analloidea) also inhabit nests (Dabert and Mironov, 1999).

While a number of feather mite lineages quite certainly evolved by coevolution with their hosts, others have successfully colonized new hosts by horizontal transfer (Doña et al., 2018). Therefore, the understanding of the origin of mite-bird associations is intrinsically tied to the knowledge about bird phylogeny, ecology and behavior (Proctor and Owen, 2000). Also, mites can affect bird reproductive success and exposure them to diseases, especially in birds held in captivity (Atyeo and Gaud, 1987; Mironov, 2013; pers. obs. by FAH).

Given the exuberant diversity of birds found in the Neotropical region, it is not surprising that the study of feather mites on birds of Brazil is still incomplete, which renders a huge potential for taxonomic discoveries in this country. Researches involving these organisms,

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as well as training of students, ornithologists and parasitologists, have been improving the understanding of the ecological and biological associations of these mites with their hosts in Brazil (Roda and Farias, 2007; Pedroso and Hernandes, 2016).

The aim of this work was to investigate the feather mites associated with some wild birds of the Zoobotanical State Park of Teresina, Piauí State, Brazil.

Materials and Methods

This work was evaluated and approved by the Ethics Committee in Animal Experimentation of the Federal University of Piauí (UFPI), (protocol 242/2016). The material was collected at the Zoobotanical State Park, in an urban area of the municipality of Teresina, Piauí. The park was created in 1973 and has approximately 137 hectares, being an area designated for the protection, conservation, and researches of fauna and flora, governed by the public administration of the State Secretariat for the Environment and Water Resources of Piauí.

Feather mites were collected from wild birds held in captivity, from January to July of 2017. Mites were collected manually from the feathers using fine brushes and tweezers; a few feathers were partially cut and only one *post-mortem* bird – an osprey, *Pandion haliaetus* (Linnaeus, 1758) – was defrosted and washed for ectosymbionts. This was done by washing the bird with water and detergent (Mironov & Galloway 2002), and the resulting liquid was filtered in paper filters; the mites were collected with a fine brush from under a dissecting scope. The number of examined feathers for each bird species is shown in Table 1.

Table 1 Birds examined for feather mites at the Zoobotanical State Park, Teresina, PI, Brazil, 2017.

Birds	EB	IB	EF	Feather mites
<i>Pandion haliaetus</i> (Accipitriformes: Pandionidae)	1	1	12	<i>Pandionacarus fuscus</i> * (Avenzoariidae)
<i>Harpia harpyja</i> (Accipitriformes: Accipitridae)	1	1	2	<i>Hieracoliclus hirundo</i> ** (Gabuciniidae)
<i>Caracara plancus</i> (Falconiformes: Falconidae)	2	2	8	<i>Hieracoliclus</i> sp. ** (Gabuciniidae)
<i>Dendrocygna viduata</i> (Anseriformes: Anatidae)	5	2	17	<i>Freyana dendrocygni</i> * (Freyanidae) <i>Heterobrephosceles megathrix</i> * (Alloptidae)
<i>Nyctibius griseus</i> (Nyctibiiformes: Nyctibiidae)	2	1	5	<i>Nyctibioliclus megamerus</i> * (Pterolichidae)
Total	11	7	44	

Legend: EB – number of examined birds; IB – number of infested birds; EF – number of examined feathers for each bird specimen; *First record of the mite species in Brazil; **species recorded in a new locality in Brazil.

After collecting, the mites were counted and stored in vials with 70% ethanol, labeled with locality, date and host. The sorting was done in the Laboratory of Parasitology of the Department of Parasitology and Microbiology of UFPI, and the material was sent to FAH for mounting and identification. Mites were mounted in slides with Hoyer's medium, and subsequently analyzed and photographed on a Leica DM3000 microscope equipped with a DFC295 digital camera. Debris surrounding the specimens were digitally removed using Adobe Photoshop CS6. Voucher specimens were deposited at the Acari collection of the Universidade Federal de Santa Catarina. The classification of birds follows BirdLife International (2018).

Results

All examined bird species were shown to harbor feather mites. We found feather mites on 7 of the 11 bird specimens that we examined. The following mite species were recovered from their respective hosts: *Pandionacarus fuscus* (Nitzsch, 1818) (Avenzoariidae) from the osprey *Pandion haliaetus* (Pandionidae); *Freyana dendrocygni* Dubinin, 1950 (Freyanidae) and *Heterobrephosceles megathrix* Peterson & Atyeo, 1977 (Alloptidae) on the white-faced whistling duck (*Dendrocygna viduata*) (Linnaeus, 1766) (Anatidae); *Nyctibiolichus megamerus* Atyeo, 1979 (Pterolichidae) on the common potoo (*Nyctibius griseus*) (Gmelin, 1789) (Nyctibiidae); *Hieracoliclus hirundo* (Mégnin & Trouessart, 1884) on the harpy eagle (*Harpia harpyja*) (Linnaeus, 1758) (Accipitridae), and *Hieracoliclus* sp. (Gabuciniidae) on the southern caracara (*Caracara plancus*) (Miller, 1777) (Falconidae) (Table 1).

Discussion

Besides reporting feather mites for the first time from the Northern Brazilian state of Piauí, this study also reports four species for the first time in Brazil, and two mites constitute new locality records. *Pandionacarus fuscus* (Figure 1), one of the largest feather mites at about 1.2–1.3 mm in length, and commonly associated with the osprey (Miller *et al.*, 1997; Philips, 2000), was recently reported on a toucan – *Ramphastos citreolaemus* Gould, 1844 (Piciformes: Ramphastidae) – in Colombia (Parra-Henao *et al.*, 2011), that is definitely a contamination. The osprey is a worldwide distributed bird, including in several parts of Brazil (BirdLife International, 2016), and we herein report *Pandionacarus fuscus* for the first time in this country.

Dendrocygna viduata was reported as a host of *Freyana dendrocygni* (Figure 2), along with *D. javanica*, *D. arcuata*, *D. eytoni*, and *D. bicolor* (McDaniel *et al.*, 1966). Mites of this genus are normally associated with aquatic birds of the family Anatidae (ducks, geese, swans) (Dubinin, 1950; Aksin, 2007). There are records of the mite *Heterobrephosceles megathrix* (Figures 3A–C) from lesser whistling ducks in Malaysia and Thailand, and white-faced whistling ducks in Uganda (Peterson and Atyeo, 1977). Gaud (1952: 87) reported undetermined alloptid females on the latter host, but he asserted that the absence of males could not allow a reliable identification of the genus. The females of *H. megathrix* remained unknown until this date, and were found herein for the first time. *Freyana dendrocygni* and *Heterobrephosceles megathrix*, both found on *Dendrocygna viduata*, are recorded for the first time in Brazil.

Nyctibiolichus megamerus (Figure 3D), one of the two known species of the genus *Nyctibiolichus* Atyeo, was described from *Nyctibius griseus* in Panama and Jamaica (Aty eo, 1979). Up to this date, this mite had not been reported from hosts or countries other than those in the original publication. In our study, only a few females and immatures, and no males of this mite were recovered, that can be due to the low number of feathers collected. Despite about 25 caprimulgid species occurring in Brazil, feather mites had been previously reported from only three host species in that country, which suggests the existence of a number of undescribed taxa (Mironov and Fain, 2003; Enout *et al.*, 2012; Hernandes, 2014; Pedroso and Hernandes, 2016).

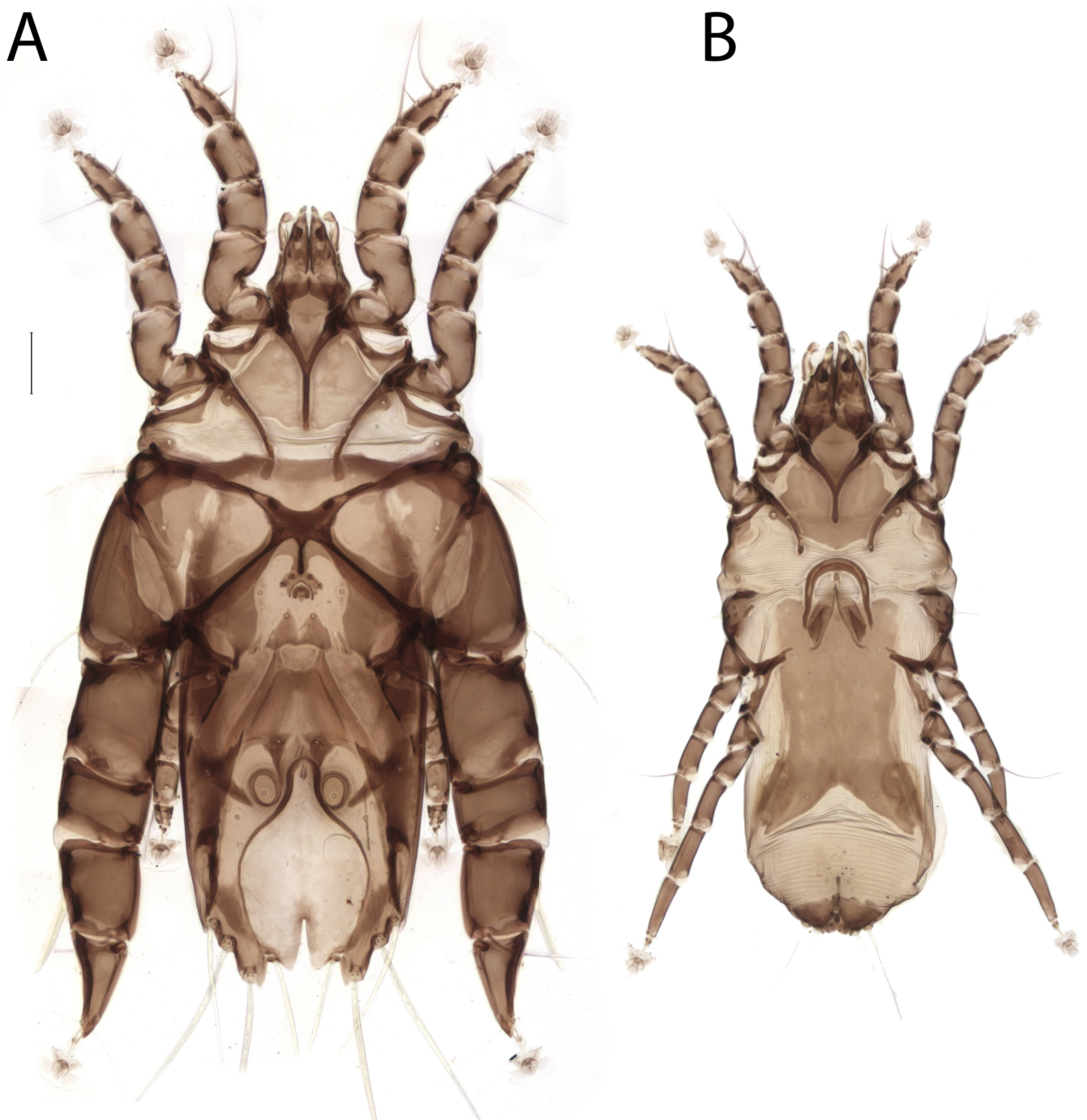


Figure 1 *Pandionacarus fuscus* found on the osprey (*Pandion haliaetus*): A – male; B – female. Scalebar A, B = 100 μ m.

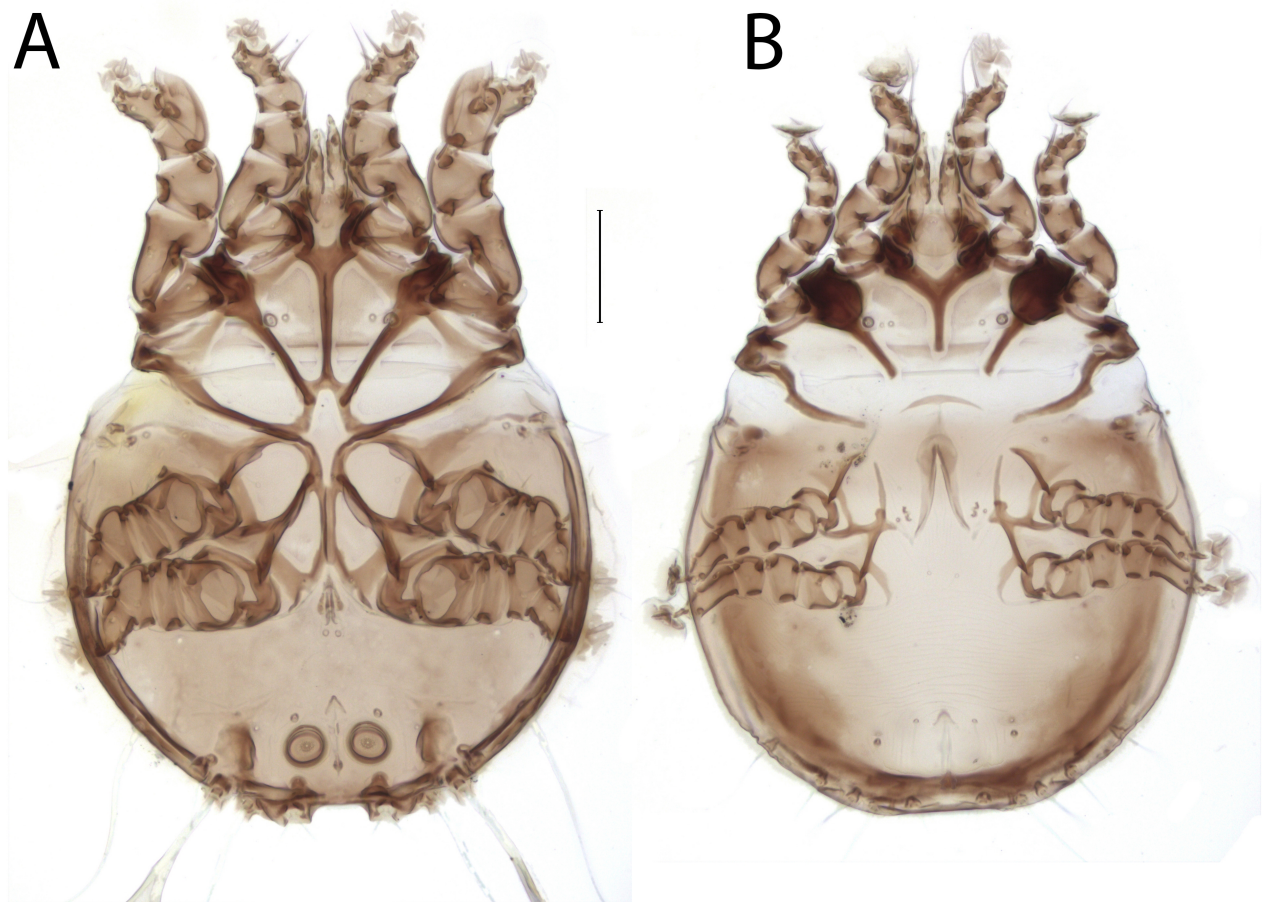


Figure 2 *Freyana dendrocygni* found on the white-faced whistling duck (*Dendrocygna viduata*): A – male, B – female. Scalebar A–B = 100 μm .

The genus *Hieracolichus* includes nine described species primarily associated with birds of the family Accipitridae (Accipitriformes) (Gaud and Atyeo, 1974; Mironov *et al.*, 2007). Nevertheless, a few studies (Barreto *et al.*, 2012; Pereira, 2015, present study) indicate that this genus is also associated with falcons (Falconiformes), which are presently considered to be distant relatives to hawks and eagles (Prum *et al.*, 2015).

Feather mites studied from birds held in captivity can constitute an important resource for understanding patterns of bird-mite associations. For instance, they can help to confirm poorly known associations. Until recently, *Hieracolichus hirundo* (Figure 4) was represented only by a few specimens in a single slide at the Museum National d’Histoire Naturelle, Paris. Based on those and also on freshly collected specimens from a harpy eagle in captivity, this species was recently redescribed (Hernandes, 2017a).

However, a caveat must be made to unsuspecting students or researchers studying feather mites from birds held in captivity: it is not uncommon to recover unnatural mite-bird associations, because birds can acquire mites from other birds held in the same or neighboring cages. Thus, rheas – *Rhea americana* (Linnaeus, 1758) (Rheiformes: Rheidae) – were once reported as hosts of the same mite species commonly associated with ostriches – *Struthio camelus* (Linnaeus, 1758) (Struthioniformes: Struthionidae) (Méglin and Trouessart, 1884; André, 1960), and flamingos (Phoenicopteriformes: Phoenicopteridae) may eventually show mites commonly found on ducks (Anseriformes: Anatidae) (pers. obs. by FAH). These are obvious contaminations.

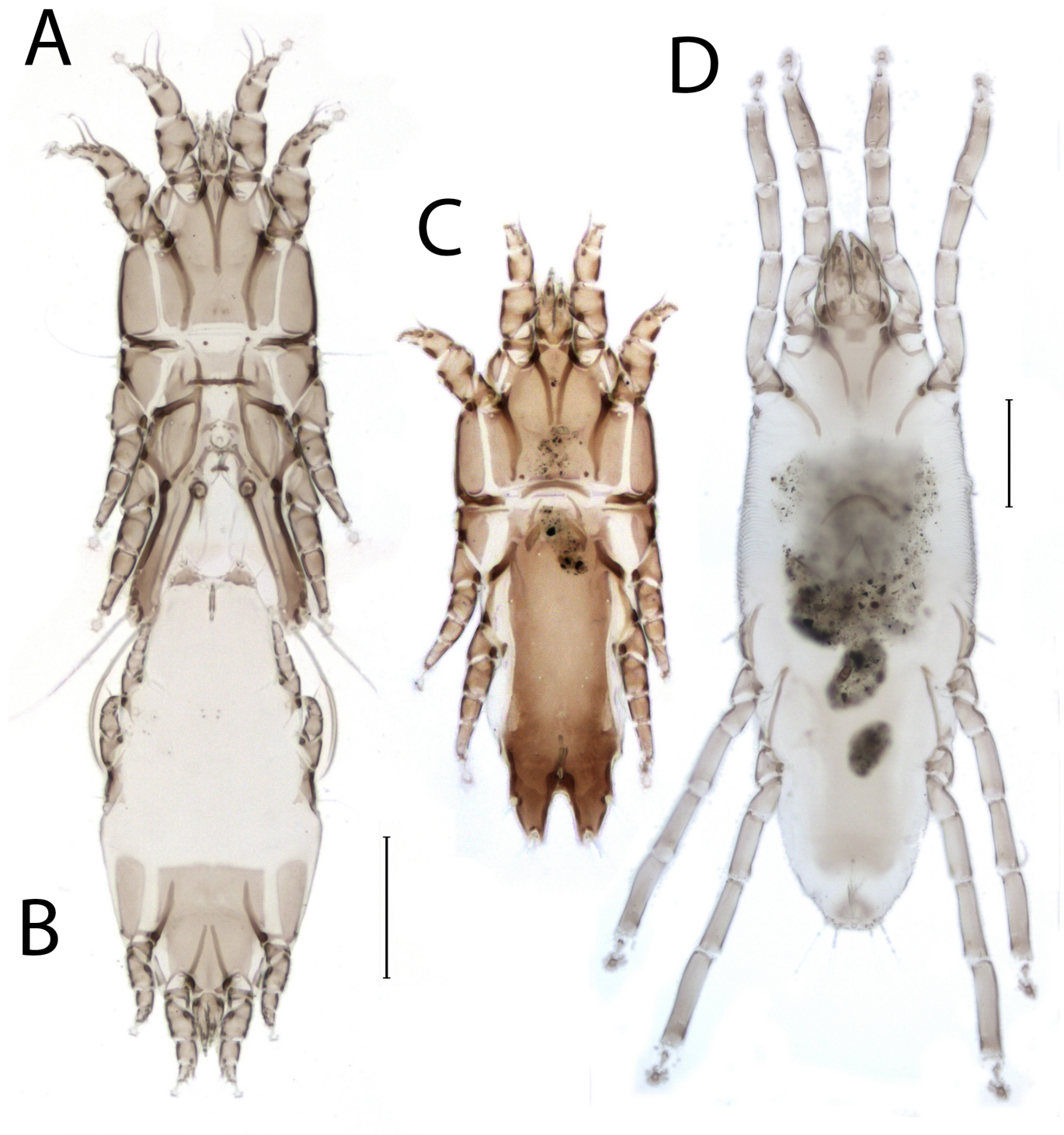


Figure 3 *Heterobrephosceles megathrix* (A–C) found on the white-faced whistling duck (*Dendrocygna viduata*): A – male, B – tritonymph (A and B attached in a precopulatory guarding position), C – female; *Nyctibiolichus megamerus* (D) found on the common potoo *Nyctibius griseus*: D – female. Scalebar A-D = 100 μ m.

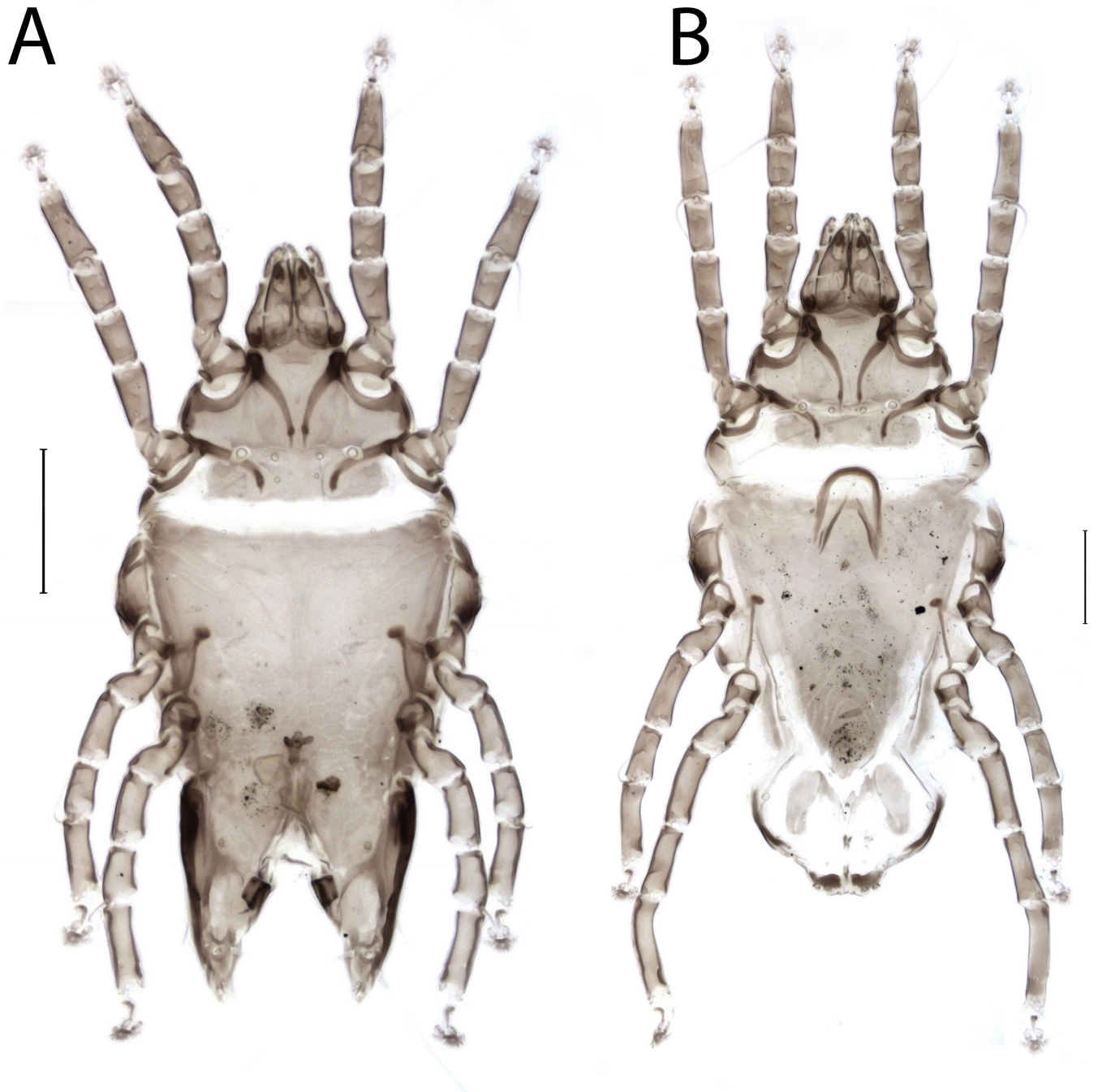


Figure 4 *Hieracolicus hirundo* found on the harpy eagle (*Harpia harpyja*): A – male; B – female. Scalebar A-B = 100 μ m.

All mites reported herein, however, are natural associates of their respective hosts, for they have been originally reported from the same hosts in other localities. This fact may help to reinforce the knowledge about these mite-bird associations. Mironov *et al.* (2018) demonstrated that feather mites may persist on a host in captivity for more than 40 years after being captured from the wild, even after undergoing through antiparasitic treatments. Likewise, cockatiels, *Nymphicus hollandicus* (Kerr, 1792) (Psittaciformes: Cacatuidae), bred and kept in captivity for decades in Brazil – and often treated for parasites in pet stores, were also shown to contain feather mites from its place of origin, Australia (Hernandes, 2017b).

The studies on feather mites collected from birds kept in captivity are still very scarce in Brazil (Valim *et al.*, 2006; Pereira *et al.*, 2018). We hope to stimulate further studies since valuable results may be obtained from these birds, including confirmation of parasite-host associations, discovery of new species, recollecting of rare species, new records and hosts, information on microhabitats, and also provide a better understanding on epidemiological case studies.

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