Chewing lice (Psocodea, Phthiraptera: Amblycera and Ischnocera) in wild birds in Zungarococha, Iquitos (Peru)

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Abstract

Chewing lice (Psocodea, Phthiraptera: Amblycera and Ischnocera) in wild birds in Zungarococha, Iquitos (Peru). The objective of this work was to identify the species of chewing lice collected from thirty wild birds from the town of Zungarococha, Iquitos (Peru). We identified 11 specimens from a total of 36 collected. The species *Columbicola passerinae* (Wilson, 1941) presented the largest number of hosts, and *Motmotnirmus marginellus* (Nitzsch, 1874) and *Docophorus rufus* (Kellogg, 1899) presented the highest prevalence, intensity, and average abundance. This study reports 11 species of lice for the first time, and new host associations, expanding the list of host birds in Peru.

Key words: Ecology, Entomology, Ornithology, Parasitology, Phthiraptera

Resumen

Piojos masticadores (Psocodea, Phthiraptera: Amblycera e Ischnocera) en aves silvestres de Zungarococha, Iquitos (Perú). El objetivo de este trabajo fue identificar las especies de piojos masticadores recolectadas en 30 aves silvestres de la localidad de Zungarococha, Iquitos (Perú). Se identificaron 11 especies de piojos entre los 36 especímenes en total. La especie *Columbicola passerinae* (Wilson, 1941) presentó el mayor número de huéspedes y *Motmotnirmus marginellus* (Nitzsch, 1874) *y Docophorus rufus* (Kellogg, 1899) presentaron la mayor prevalencia, intensidad y abundancia media. Este estudio reporta 11 especies de piojos por primera vez y nuevas asociaciones de huéspedes, ampliando la lista de aves hospedantes en Perú.

Palabras clave: Ecología, Entomología, Ornitología, Parasitología, Phthiraptera

Resum

Polls mastegadors (Psocodea, Phthiraptera: Amblycera i Ischnocera) en ocells silvestres de Zungarococha, Iquitos (Perú). L'objectiu d'aquest treball va ser identificar les espècies de polls mastegadors recol·lectades en 30 ocells silvestres de la localitat de Zungarococha, Iquitos (Perú). Es van identificar 11 espècies de polls entre els 36 espècimens en total. L'espècie *Columbicola passerinae* (Wilson, 1941) va presentar el nombre més alt d'hostes i

Motmotnirmus marginellus (Nitzsch, 1874) i *Docophorus rufus* (Kellogg, 1899) la prevalença, intensitat i abundància mitjana més elevades. Aquest estudi registra per primera vegada 11 espècies de polls i noves associacions d'hostes i amplia la llista d'ocells hostes al Perú.

Paraules clau: Ecologia, Entomologia, Ornitologia, Parasitologia, Phthiraptera

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Introduction

Lice of the order Phthiraptera, specifically the suborders Amblycera and Ischnocera, are obligate ectoparasitic insects of birds and, to a lesser extent, mammals (Price et al., 2003). Peru has the second greatest diversity of birds in the world, with 1,892 species currently identified in its territory (Plenge, 2023). However, studies related to malophagous lice have only been carried out in 16 % of bird species, thereby limiting the information available regarding the biodiversity of these parasites in this setting (Minaya et al., 2021). The region of Loreto in the Peruvian Amazon has the greatest ornithological diversity in Peru, with the presence of 55 % of the total number of birds. It therefore provides the opportunity to study the wide biodiversity of lice not yet recorded herein (Gomez–Puerta and Cribillero, 2015; Gomez–Puerta and Luján–Vega, 2018; Minaya et al., 2021; Salinas et al., 2021). The aim of this study was to record malophagous bird lice found in the town of Zungarococha, near Iquitos in the Peruvian Amazon. We also calculated the parasitic ecological indices for each species of louse.

Material and methods

The study was performed at the university campus of the Faculty of Biological Sciences of the National University of the Peruvian Amazon (UTM 681268.421 E 9574643.113 N) in the district of San Juan Bautista, province of Maynas in Loreto Peru (fig. 1). As part of the project 'Monitoring bird populations' in the Department of Loreto directed by the Loreto Bird Observatory (LBO), five monitoring stations were set up for the temporary capture of birds from July to September 2019. Bird capture was performed using 12 mist nets of 12 m x 2.6 m x 36 mm mesh diameter. During the capture days, the captured birds were transported in cloth bags to the data–recording site within the shortest time possible. The birds were identified following Schulenberg (2010). The birds were kept separate between searches to avoid cross–contamination, and the bags were discarded after use. A thorough

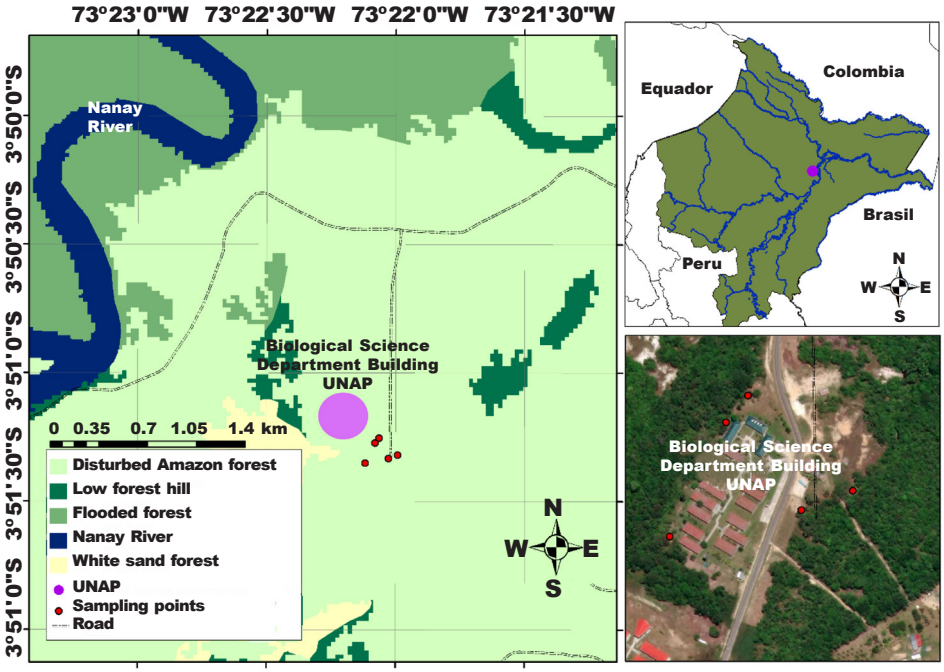

Fig. 1. Geographic location of the campus of the Faculty of Biological Sciences of the University of the Peruvian Amazon (UNAP), in the town of Zungarococha (Iquitos), in the Peruvian Amazon, and the sampling stations.

Fig 1. Ubicación geográfica del campus de la Facultad de Ciencias Biológicas de la Universidad de la Amazonía Peruana (UNAP) en la localidad de Zungarococha (Iquitos), y las estaciones de muestreo.

search of the condition of the plumage was carried out in each bird in various parts of the body (head, back, chest, wing and tail). If ectoparasites were found, the lice were collected using entomological tweezers and brushes with a fine tip. The lice were preserved in vials with 70 % ethanol, clearly labeled for subsequent preparation and identification.

Each louse specimen was rinsed in 10 % potassium hydroxide solution. The specimens were then mounted on Canada Balsam (Palma, 1978). Taxonomic identification at the genus level was based on the dichotomous keys of Price et al. (2003). For identification at the species level, we used the specialized keys of Price (1977), Wiseman (1963, 1966), Kellogg and Mann (1912), Valim and Palma (2012), Stafford (1943), Cicchino (1986), Clayton and Price (1999), Gustafsson and Bush (2017). The specimens of lice species were deposited in the Collection of Parasitic Helminths and Related Invertebrates of the Museum of Natural History of the National University Federico Villarreal, Lima, Peru.

The authors declare that the study followed established ethical guidelines. Authorization for this research and scientific collection of wildlife was issued by the National Forestry and Wildlife Service (AUT–TFS–2018–52). Likewise, a temporary collection permit was requested from the authorities at the Faculty of Biological Sciences during the sampling periods. To ensure the well–being of the birds the authors declare they followed the protocols based on the North American Banding Council's (2001).

Results

A total of 30 birds were captured, classified in 11 families, 15 genera, and 16 species. Of these, seven birds of seven different species among Columbiformes, Coracciiformes, Cuculiformes and Passeriformes presented some type of lice. Thirty–six individuals of lice were collected, distributed in 11 species. Table 1 shows the parasitological indices (prevalence, abundance and average intensity) of the birds evaluated. The infestation is specific for each of the bird species evaluated.

The infected bird species belonging to the orders Columbiformes, Coracciiformes and Cuculiformes were the reddish dove *Columbina talpacoti* Temminck, 1810, the Amazonian clockmaker *Momotus momota* Linnaeus, 1766 and the smooth–billed woodpecker *Crotophaga ani* Linnaeus, 1758.The species of the order Passeriformes were the yellow–backed chieftain *Cacicus cela* Linnaeus, 1758, the short–crested tuft *Myiarchus ferox* Gmelin, 1789, the black–billed thrush *Turdus ignobilis* Linnaeus, 1766 and the bienteveo grande *Pitangus sulphuratus* Linnaeus, 1766.

Table 1 shows that Philopteridae presented a greater richness and number of host species (seven parasitic species hosted on six species of wild birds) than Menoponidae (with four parasitic species hosted on four species of wild birds) and Ricinidae (one species parasite hosted in a species of wild bird). *C. passerinae* (Menoponidae) had the highest number of hosts (two parasitized hosts) while the rest of the species of Philopteridae, Menoponidae and Ricinidae were only found on a single host. Likewise, *Motmotnirmus marginellus* and *D. rufus* presented the highest prevalence, intensity and average abundance of infestation, in *M. ferox*, and, *M. momota*, respectively (fig. 2, 3).

Table 2 shows the sex and morphological measurements of each species of chewing louse, expressed in millimeters (mm). The parameters measured were chosen because of their relevance to support the taxonomic identity of a species. These parameters are mentioned in all the literature in which lice species are described.

Discussion

Our results suggest that *Columbicola passerinae* was the least specific ectoparasite, parasitizing the host *C. ani* (Cuculiforme) and *Columbina talapacoti* (Columbiforme). Although many of the *Columbicola* species are specific to a single genus, species, and even several genera of hosts, these are exclusive parasites of birds of the order Columbiformes, as indicated by Price et al. (2003) and Adams et al. (2005). However, as in *C. passerinae* of this study, there are species that have been recorded in non–columbiformes hosts, such as *C. columbae* (Piaget, 1885), and lice of the 'angustus' group collected in non–columbiformes populations; these are probably not true parasites of these birds and are possibly the result of phoretic dispersal in hippoboscid flies (Johnson et al., 2002). According to Adams et al. (2005), although there is no evidence that phoretic dispersal can lead to establishment on a different host species, it is worth remembering that Keirans (1975) recorded more than 400 cases of lice attached to hypoboscids. Despite the above, this finding should be considered accidental and not as true evidence of new hosts for *C. passerinae*, at least until there is a sufficient number of individuals infesting more than one individual of *Crotophaga ani*.

In our study, *Motmotnirmus marginellus* and *Docophorus rufus* were the species with the highest prevalence, intensity and mean abundance of infection in the hosts *M. momota* and *M. ferox*, respectively. This finding is consistent with the comparison made by Tavera et al. (2019), where these species were considered 'core species', according to the definition of Bush and Holmes (1986). The latter considered that parasitic species with a prevalence greater than 40 % are classified as central species that interact with the host frequently enough to achieve an equilibrium. According to Mey and Barker

Table 1. Chewing lice species collected from seven species of wild birds from Iquitos, Loreto, in the Amazon of Peru, and their respective parasite–ecological indices: P%, percentage of prevalence; nB, number of birds; nBP, number of parasitized birds; nP, total number of parasites; MI, mean intensity of infestation; MA, mean abundance of infestation; CD, collection deposition code MUFV–ZOO; * new record for the country; ** new country and host registration; *** considered accidental.

*Tabla 1. Especies de piojos masticadores recolectadas en siete especies de aves silvestres procedentes de Iquitos, Loreto, en la Amazonía de Perú, y sus respectivos índices parásito–ecológicos: P%, porcentaje de prevalencia; nB, número de aves; nBP, número de aves parasitadas; nP, número total de parásitos; MI, intensidad media de la infestación; MA, abundancia media de la infestación; CD, código de depósito de la colección MUFV–ZOO; * nuevo registro en el país; ** nuevo registro de país y hospedador; *** considerado accidental.*

Species	Hosts	P%	nB	nBP	nP	MI	MA	CD
Menoponidae								
*Osborniella crotophagae**	*Crotophaga ani*	67	3	2	7	3.5	2.33	HPIA–221
*Menacanthus tyranni***	*Pitangus sulphuratus*	100	1	1	2	2	2.00	HPIA–222
Myrsidea sp.	*Cacicus cela*	100	1	1	1	1	1.00	HPIA–223
	Turdus ignobilis	13	7	1	3	3	0.38	HPIA–224
Ricinidae								
*Ricinus arcuatus***	*Pitangus sulphuratus*	100	1	1	2	2	2.00	HPIA–225
Philopteridae								
*Columbicola passerinae**	*Columbina talpacoti*	50	2	1	2	2	1.00	HPIA–226
	*Crotophaga ani****	33	3	1	1	1	0.03	HPIA–227
*Bizarrifrons picturatus**	*Cacicus cela*	100	1	1	3	3	3.00	HPIA–228
*Brueelia cela**	*Cacicus cela*	100	2	2	2	1	1.00	HPIA–229
*Brueelia magellanica***	*Turdus ignobilis*	13	7	1	1	1	0.13	HPIA–230
Brueelia sp.	*Turdus ignobilis*	13	7	1	1	1	0.13	HPIA–231
*Motmotnirmus marginellus**	*Momotus momota*	100	1	1	5	5	5.00	HPIA–232
*Docophorus rufus***	*Myiarchus ferox*	100	1	1	6	6	6.00	HPIA–233

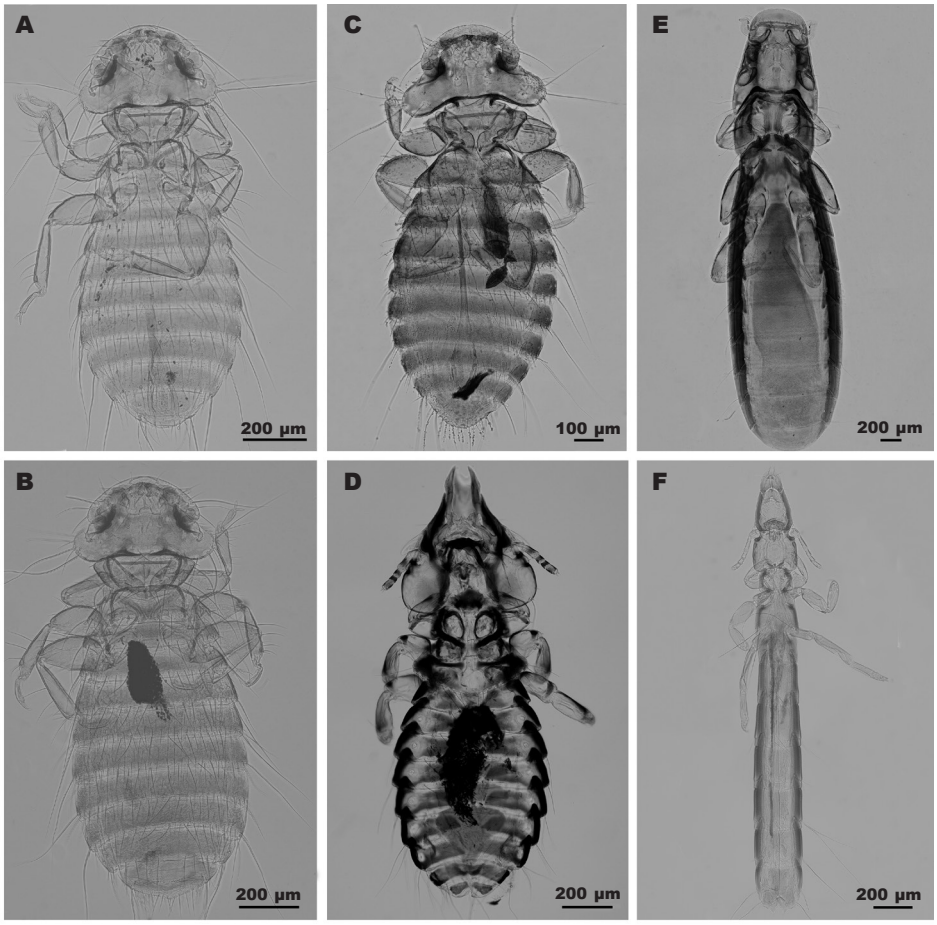

Fig. 2. Chewing lice collected from wild birds from Iquitos, Loreto, in the Amazon of Peru: A, *Menacanthus tyranni*, male of *Pitangus sulphuratus*; B, *Menacanthus tyranni*, female of *Pitangus sulphuratus*; C, *Osborniella crotophagae,* male of *Crotophaga ani*; D, *Bizarrifrons picturatus*, female of *Cacicus cela*; E, *Ricinus arcuatus,* female of *Pitangus sulphuratus*; F, *Columbicola passerinae*, female of *Columbina talpacoti*.

Fig. 2. Piojos masticadores recolectados de aves silvestres de Iquitos, Loreto en la Amazonía del Perú: A, Menacanthus tyranni*, macho de* Pitangus sulphuratus*; B,* Menacanthus tyranni*, hembra de* Pitangus sulphuratus*; C,* Osborniella crotophagae*, macho de* Crotophaga ani*; D,* Bizarrifrons picturatus*, hembra de* Cacicus cela*; E,* Ricinus arcuatus*, hembra de* Pitangus sulphuratus*; F,* Columbicola passerinae*, hembra de* Columbina talpacoti*.*

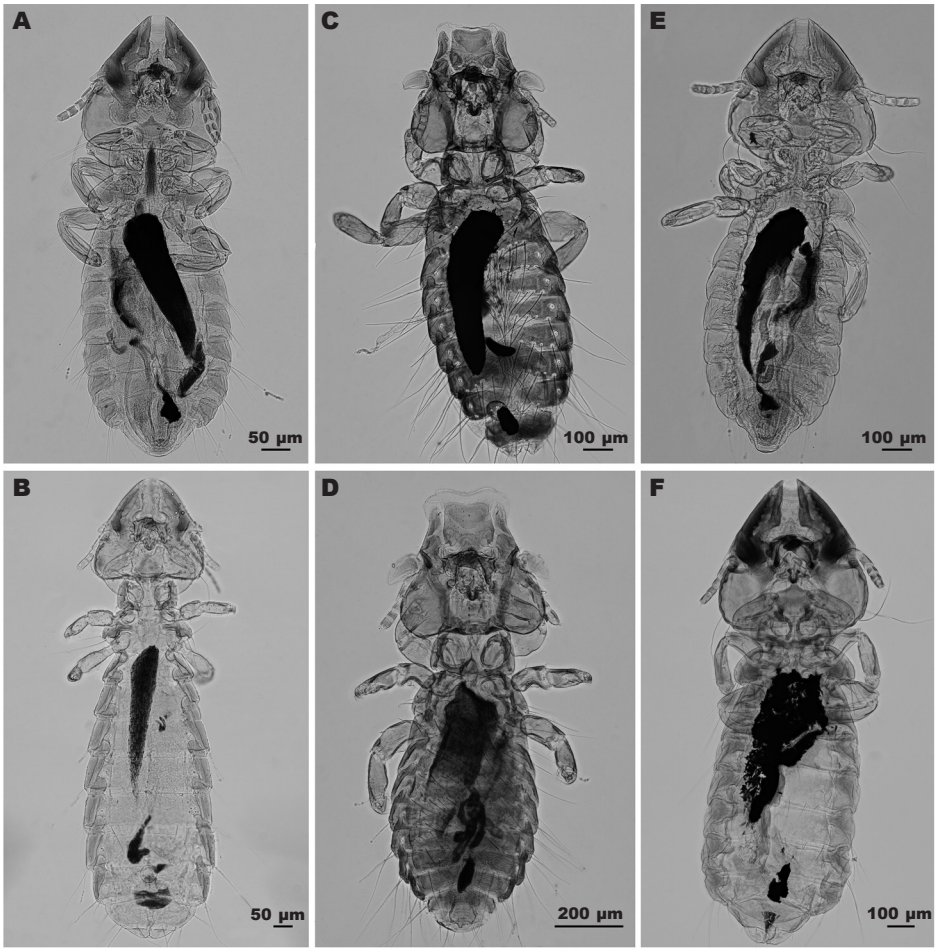

Fig. 3. Chewing lice collected from wild birds from Iquitos, Loreto, in the Amazon of Peru: A, *Brueelia cela,* male of *Cacicus cela*; B, *Brueelia magellanica,* female of *Turdus ignobilis*; C, *Docophorus rufus,* female of *Myarchus ferox*; D, *Docophorus rufus,* male of *Myarchus ferox*; E, *Motmotnirmus marginellus,* male of *Momotus momota*; F, *Motmotnirmus marginellus,* female of *Momotus momota*.

Fig. 3. Piojos masticadores recolectados de aves silvestres de Iquitos, Loreto en la Amazonía del Perú: A, Brueelia cela*, macho de* Cacicus cela*; B,* Brueelia magellanica*, hembra de* Turdus ignobilis*; C,* Docophorus rufus*, hembra de* Myarchus ferox*; D,* Docophorus rufus*, macho de* Myarchus ferox*; E,* Motmotnirmus marginellus*, macho de* Momotus momota*; F,* Motmotnirmus marginellus*, hembra de* Momotus momota*.*

Table 2. Morphometric measurements of nine species of lice collected from wild birds in Iquitos, Loreto, Peruvian Amazon: ACT, head width at temple level; AG, genitalia width; AM, maximum width; AMN, metanotum width; AO, occipital width; APA, preantennal width; APD, dorsoanterior plate width; APN, pronotum width; APO, preocular width; APT, width of pterothorax; AT, width of thorax; COW, inner width of large circular opening in basal apodeme; LA, length of abdomen; LAn, length of antenna; LC, length of head; LEA, length of scape; LES, length of sclerite of genital sac; LG, length of genitalia, LMF, length of metafemur; LMT, length of metatibia; LPA, median length of anterior plate; LPN, length of pronotum; LPO, preocular length; LPT, pterothorax length; LT, total leng.

Tabla 2. Medidas morfométricas de nueve especies de piojos recolectadas en aves silvestres en Iquitos, Loreto, Amazonía peruana: ACT, ancho de la cabeza a nivel de la sien; AG, ancho de los genitales; AM, ancho máximo; AMN, ancho del metanoto; AO, ancho occipital; APA, ancho preantenal; APD, ancho de la placa dorsoanterior; APN, ancho del pronoto; APO, ancho preocular; APT, ancho del pterotórax; AT, ancho del tórax; COW, ancho interior de la gran abertura circular del apodema basal; LA, longitud del abdomen; LAn, longitud de la antena; LC, longitud de la cabeza; LEA, longitud del escapo; LES, longitud del esclerito del saco genital; LG, longitud de los genitales; LMF, longitud del metafémur; LMT, longitud de la metatibia; LPA, longitud media de la placa anterior; LPN, longitud del pronoto; LPO, longitud del preocelo; LPT, longitud del pterotórax; LT, longitud total.

	Osborniella crotophagae		***Menacanthus tyranni***		***Ricinus arcuatus***		***Columbicola passerinae***		***Bizarrifrons picturatus***		***Brueelia cela***		***Brueelia magellanica***		***Motmotnirmus marginellus***		***Docophorus rufus***	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
LT	1.24–1.29	–	1.29	1.44	–	4.18	1.76–1.77	2.26	1.26	1.69–1.75	1.75	–	–	1.56	1.52–1.64	1.74	1.30–1.49	1.64
AM	0.51–0.64	–	0.53	0.61	–	1.17	0.21	0.25	0.36	0.46–0.65	0.59	–	–	0.47	0.49–0.53	0.58	0.51	0.54
LAn	0.10–	–	0.11	0.09	–	2.4	0.26	0.26	–	0.22	0.94	–	–	0.96	0.23	0.21	0.19	0.19
APA	0.37	–	0.31	0.32	–	–	0.18	–	–	–	0.45	–	–	–	–	–	–	–
APD	–	–	–	–	–	–	0.11	0.13	0.10	0.10–0.11	–	–	–	0.059	–	–	0.15	0.16
LPD	–	–	–	–	–	–	0.07–0.075	0.09	–	–	–	–	–	0.035	–	–	0.22	0.23
LEA	0.03	–	0.023	0.014	–	–	0.095–0.10	0.45	–	0.05	0.05	–	–	0.047	0.063	0.055	0.043	0.054
LA	0.94	–	0.73	0.86	–	0.56	0.95	1.34	–	0.83	0.96	–	–	0.97	0.87	0.95	0.68	0.91
LPO	–	–	–	–	–	–	–	–	0.24	0.28–0.29	–	–	–	–	–	–	–	–
APO	–	–	0.37	0.39	–	–	–	–	0.32	0.37–0.38	–	–	–	0.29	–	–	–	–
ACT	0.54–0.55	–	0.46	0.50	–	0.78	0.22–0.23	0.24	0.40	0.56–0.60	0.57	–	–	0.39	0.50–0.55	0.55	0.45	0.48
LC	0.24–0.27	–	0.26	0.26	–	0.80	0.46–0.48	0.54	0.48	0.60–0.62	0.55	–	–	0.34	0.49–0.51	0.54	0.45	0.49
LPN	0.15	–	0.14	0.15	–	0.54	0.14	0.14	–	0.20	0.17	–	–	0.12	0.15	0.15	0.16	0.19
APN	0.35–0.38	–	0.32	0.35	–	0.85	0.17–0.18	0.19	0.22	0.33–0.34	0.33	–	–	0.22	0.29–0.31	0.33	0.26	0.27
AMN	0.44–0.495	–	0.40	0.48	–	–	0.22–0.23	0.24	0.30	0.44–0.48	0.49	–	–	–	–	–	–	–
LPT	–	–	–	–	–	–	0.35	0.39	–	0.22	0.17	–	–	0.16	0.15	0.17	0.18	0.21
APT	–	–	–	–	–	–	0.22	0.23	–	0.47	0.48	–	–	0.33	0.43–0.47	0.46	0.39	0.42
LMF	0.19–0.22	–	0.18	0.22	–	0.65	0.25	0.23	–	0.17	0.17	–	–	0.11	0.16	0.17	0.2	0.19
LMT	0.19–0.22	–	0.21	0.23	–	0.48	0.16	0.18	–	0.18	0.20	–	–	–	0.2	0.2	0.21	0.2
LG	0.53–0.71	–	0.43	–	–	–	0.1	–	–	–	0.2	–	–	–	0.23	–	0.22	–
AG	0.09–0.11	–	0.08	–	–	–	0.08	–	–	–	0.1	–	–	–	0.075	–	0.08	–
COW	–	–	–	–	–	–	0.055–0.06	–	–	–	–	–	–	–	–	–	–	–
LES	–	–	0.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

(2014), *Motmotnirmus* species are parasitic species occurring in birds of the Momotidae family, unlike *Docophorus*, which have been recorded parasitizing multiple orders of birds (Guerin–Méneville and Percheron, 1835).

In relation to the richness of the reported Phthiraptera families, the Philopteridae family was of note as the most abundant, showing the highest number of parasitic species. This result is similar to findings in studies carried out in Brazil (Gomes et al., 2014), Peru (Tavera et al., 2019), and Colombia–Peru (Soto–Patiño et al., 2018). It is known that the greatest richness of species of lice that parasitize birds are those that belong to the family Philopteridae, which is 162 % more diverse than Menoponidae (see table 1 of Price et al., 2003) worldwide, so it is expected that this advantage on the part of the Philopteridae is maintained in areas such as the Neotropics.

Conclusion

According to the list of malophagous lice species recorded in Peru by Minaya et al. (2021), it can be inferred that the malophagous lice species identified in the present study constitute new records for the Department of Loreto and for Peru. Table 1 records nine new species for Peru and four new hosts. The results obtained from the collection of malophagous lice in Zungarococha, Iquitos, Loreto, constitute a significant contribution to the knowledge of chewing lice in Peruvian Amazonian birds, highlighting 11 new reports.

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