Rev. Mus. Argentino Cienc. Nat., n.s.
22(2): 219-229, 2020
ISSN 1514-5158 (impresa)
ISSN 1853-0400 (en línea)

Contributions to the knowledge of lice diversity (Phthiraptera: Amblycera and Ischnocera) in birds from Peru

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Abstract: Peru has a great diversity of birds, having more than 1870 species in its territory. However, studies on chewing lice (Phthiraptera) in birds from Peru are still limited. The objective of this study is to contribute to the knowledge of the diversity of lice in birds of Peru. The material used comes from the Zoological Collection of the Natural History Museum of the Universidad Nacional Federico Villarreal, Lima, Peru. Ten species of lice distributed in three families were identified: three species of the Menoponidae family, five species of Philopteridae and two species of Ricinidae collected from seven species of birds. This work records for the first time *Hohorstiella lata* Piaget, 1880, *Quadraceps eugrammicus* (Burmeister, 1838), *Trochiloecetes illumani* Carriker, 1960 and *Ricinus frenatus* Burmeister, 1838 in Peru; likewise, four new hosts of the order Passeriformes are registered for *Mayriphilopterus ernsti* Mey, 2004, *Threnetes leucurus* (Linnaeus, 1766) as a new host for *T. illumani* and two new hosts for *R. frenatus*; *Larus belcheri* Vigors, 1829 is also reported as a new host for *Quadraceps eugrammicus* (Burmeister, 1838) and *Austromenopon transversum* Denny, 1842.

Key words: Columbiformes, Ectoparasites, Entomology, Parasitology, Passeriformes

Resumen: Aportes al conocimiento de la diversidad de piojos (Phthiraptera: Amblycera e Ischnocera) en aves del Perú. El Perú presenta una gran diversidad de aves, teniendo más de 1870 especies en su territorio. Sin embargo, los estudios sobre malófagos (Phthiraptera) en aves del Perú son aún limitados. El presente estudio tiene por objetivo aportar al conocimiento de la diversidad de piojos en aves del Perú. El material utilizado proviene de la Colección Zoológica del Museo de Historia Natural de la Universidad Nacional Federico Villarreal, Lima, Perú. Fueron identificadas diez especies de piojos distribuidas en tres familias: tres especies de la familia Menoponidae, cinco especies de Philopteridae y dos especies de Ricinidae colectadas de siete especies de aves. Este trabajo registra por primera vez a *Hohorstiella lata* Piaget, 1880, *Quadraceps eugrammicus* (Burmeister, 1838), *Trochiloecetes illumani* Carriker, 1960 y *Ricinus frenatus* Burmeister, 1838 en el Perú; así mismo se registran cuatro nuevos hospederos del orden Passeriformes para *Mayriphilopterus ernsti* Mey, 2004, *Threnetes leucurus* (Linnaeus, 1766) como nuevo hospedero para *T. illumani* y dos nuevos hospederos para *R. frenatus;* también se reporta a *Larus belcheri* Vigors, 1829 como nuevo hospedero para *Quadraceps eugrammicus* (Burmeister, 1838) y *Austromenopon transversum* Denny, 1842.

Palabras clave: Columbiformes, Ectoparásitos, Entomología, Parasitología, Passeriformes

INTRODUCTION

Research on ectoparasites in birds involving lice, mites, fleas, ticks, and flies has been intensifying in recent years (McAllister *et al*., 2018; Hasan, 2019). The importance of the studies of ectoparasites of birds includes different aspects among which the influence that they have on their hosts stands out, as well as the conditioning that can cause the parasitic load in the behavior, feeding, reproduction and migration of the birds (Clayton *et al*., 2010; Hicks *et al*., 2018).

Chewing lice (Amblycera and Ischnocera) belonging to the order Phthiraptera are obligate and specific ectoparasites of birds and mammals (Parra-Henao *et al.*, 2011; Gomez-Puerta

& Cribillero, 2015). Lice can be highly specific to their hosts, as several species have been identified in a single host; while some species of lice have been recorded in other closely related birds (Tavera *et al*., 2019). For example, lice of the genus *Acidoproctus* Piaget, 1878, are the most common in wild birds, having a predilection for the families Anatidae and Anseranatidae (Arnold, 2006). In the same way, it is mentioned that lice of the genera *Austromenopon* Bedford 1939, *Quadraceps* Clay and Meinertzhagen, 1939, *Saemundssonia* Timmermann, 1936 and *Ciconiphilus* Bedford, 1939, are closely associated with birds of the order Charadriiformes (Figueiredo *et al*., 2010; Tavera *et al*., 2019).

The importance of the study of chewing lice in birds contemplates two points of view, which the phylogenetic that encompasses common parasites in different hosts, which confers close kinship relationships (Saavedra-Orjuela *et al.*, 2014), and the pathological one since many lice act as biological and mechanical vectors of pathogens such as rickettsia, and the direct damage they cause due to their eating and fixation behavior in different parts of the body (Parra-Henao *et al*., 2011).

In Peru, studies of lice in birds have been addressed in recent years with the work of several researchers (Gomez-Puerta & Lujan 2018; Soto-Patiño *et al*., 2018; Tavera *et al.,* 2019, among others), who recorded new hosts and geographic range extensions for many species of lice. Despite this, there is still a significant fraction of birds that do not present any study on ectoparasites in various regions of Peru; the present study aims to contribute to the knowledge of the diversity of lice in birds from Peru.

MATERIAL AND METHODS

The specimens studied were taken from the collection of Helminths Parasites and Related Invertebrates (HPIA-ZOO) from the Zoological Collection of the Museum of Natural History of the National University Federico Villarreal (MUFV). Hosts, locations, harvest dates and collectors are mentioned in the results section.

The morphologic study of the specimens followed the methodology proposed by Palma (1978), which consisted of rinsing the specimens in a 20% Potassium hydroxide (KOH) solution for 12 h. Then the samples were kept in distilled water for 1 h, they were dehydrated in successive series of ethanol (50%, 70%, 90% and 100%), 30 min in each solution, subsequently diaphanized in Eugenol for 24 h. Finally, the samples were mounted in Balsam of Canada. The specimens were dried at 50 - 60 °C in an oven, for three weeks (Tavera *et al*., 2019).

For the morphological description of the specimens, photographs and measurements were taken using a Euromex® light microscope with ImageFocus Spanish version4 software. Measurements are shown in micrometers (μm) unless otherwise indicated in the text. For the taxonomic identification of lice, specialized keys were followed (Timmermann, 1952; Eichler, 1953; Clay, 1959; Carriker, 1960; Nelson, 1972; Price *et al*., 2003; Mey, 2004; Valim & Linardi, 2007; Martín, 2009; Naz *et al.,* 2012). The host nomenclature follows Schulenberg *et al*. (2010).

The procedures for collecting parasitic fauna in the birds was approved by resolution 2558-2018-CU-UNFV that includes the code of ethics for research at the Universidad Nacional Federico Villarreal (UNFV) and by Director's Resolution N°024-2014-SERFOR-DGGSPFFS. For the management of the parasitic fauna, the guidelines of the protection and animal welfare law of Peru were followed (Law No. 30407: Article 19). The collection of the parasitic fauna is indicated by the SERFOR (Servicio Nacional Forestal y de Fauna Silvestre) of Peru that establishes the guidelines for the scientific investigation of flora and/or wild fauna (Resolution of Executive Direction Nº060-2016 SERFOR-DE).

RESULTS

Lice species were collected from seven bird species: belcher's gull *Larus belcheri* Vigors, 1829, pale-tailed barbthroat *Threnetes leucurus* (Linnaeus, 1766), rufous-rumped foliage-gleaner *Philydor erythrocercum* (Pelzeln, 1859), grey-breasted flycatcher *Lathrotriccus griseipectus* (Lawrence, 1869), Common scale-backed antbird *Willisornis poecilinotus* (Cabanis, 1847), wedge-billed woodcreeper *Glyphorynchus spirurus* (Vieillot, 1819) and rock dove *Columba livia* (Gmelin, 1789).

Ten lice species distributed in three families are described: three species of the Menoponidae family, five species of Philopteridae and two species of Ricinidae.

Amblycera

Menoponidae Mjöberg, 1910

Austromenopon Bedford, 1939

Austromenopon transversum (Denny, 1842)

(Fig. 1A -D)

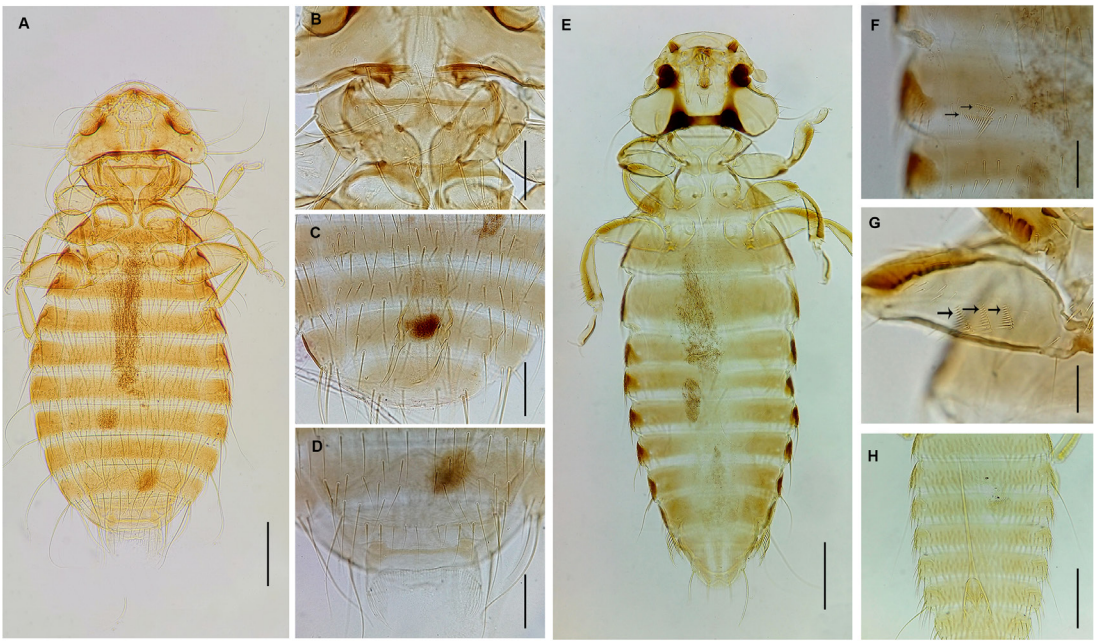

Fig. 1. A-D. *Austromenopon transversum,* A. Whole body (female), dorsal view (200 μm), B. Lunar form of the prothorax (100 μm), C. Male reproductive system (50 μm), D. Vulvar segment of female with presence of short mushrooms like structures (50 μm). E-H. *Colpocephalum turbiratum,* E. Whole body (female), dorsal view (200 μm), F. Two rows of short mushrooms in the ventral area of the abdominal sternite III (arrows) (50 μm), G. Three rows of short mushrooms on the femur of the third pair of legs (Arrows) (50 μm), H. Male reproductive system (200 μm).

Material studied: MUFV: ZOO-HPIA:161.
Host: *Larus belcheri*, Peru: Lima: Ventanilla, 11°52´15" S, 77°9´30" W, 21-23.ix.2017, Naupay A.
Description: Based on 4 individuals (1 male, 3 female). Prothorax in the lunar form, prothoracic marginal setae do not reach the metathorax, long prothoracic dorsal setae (males), a lateral long seta, starting from the second segment of the abdomen; margin of the subgenital plate in the female is transverse and presents short setae. **Male**: Total body length 1194 (n = 1); head length 237; length of prothorax 158, length of pterothorax 245; abdomen length 543, abdomen width 497. **Female**: Total body length 1665 (1642–1677, n = 3); head length 251 (232–264), head width 506 (498 - 513); prothorax length 217 (197–229), pterothorax length 273 (267 –279); abdomen length 966 (926–1024), abdomen width 719 (685 - 748).
Comment: *Austromenopon transversum* was first reported in Peru parasitizing *Larus modestus* Tschudi, 1843 (Dale, 1970) and in Chile it is reported in hosts of the family Laridae (González-Acuña *et al*., 2006), but not including *L. belcheri*. Likewise, Price *et al.* (2003) and Smith *et al.* (2020) have reported *A. tranversum* in different species of the genus *Larus* but not in *L. belcheri*, so this would be the first report of *A. transversum* parasitizing *L. belcheri*.

Colpocephalum Nitzsch, 1818
Colpocephalum turbinatum Denny, 1842
(Fig. 1E-H)

Material studied: MUFV: ZOO-HPIA:157.
Host: *Columba livia*, Peru: Lima: Cercado de Lima, 12°2´43" S, 77°1´45" W, 02-03.ix.2017, Naupay, A.
Description: Based on 7 individuals (4 males, 3 females). The species is characterized by presenting two rows of short setae in the ventral part of the abdominal sternum III and three rows of short spiny setae in the ventral part of the III femur. Females have a "W" shaped anal plate. **Male**: Total body length 1542(1431 –1797, n = 4); head length 270 (243 –287), head width 440 (424 –469); prothorax length 142 (115 –167), pterothorax length 259 (132 –363); abdomen length 871 (797 –985), abdomen width 476 (426 –585). **Female**: Total body length 1741 (1713 –1762, n = 3); head length 283 (266 –294), head width 459 (447 –467); prothorax length 157 (152 –159), pterothorax length 266 (233 –286); abdo-

men length 1057 (974 –1100), abdomen width 580 (552 - 617).

Comment: *Colpocephalum turbinatum* is considered a generalist species since it has been reported parasitizing different orders of birds, such as Columbiformes, Falconiformes, Accipitriformes, Ciconiformes and Galliformes by various authors in different countries (Martín, 2006; Parra-Henao *et al.*, 2011; Adly *et al*., 2019). This species has been recorded for the first time in Peru in the study of Dale (1970) parasitizing *C. livia*, this relationship coincides with our study where the association is also observed.

Hohorstiella Eichler, 1940
Hohorstiella lata (Piaget, 1880)
(Fig. 2A -D)

Material studied: MUFV: ZOO-HPIA:158.

Host: *Columba livia*, Peru: Lima: Cercado de Lima, 12°2´43" S, 77°1´45" W, 02-03.ix.2017, Naupay, A.

Description: Based on three adult females. Head wider than long, with a pair of spines on the ventral part, abdomen oblong, antenna of two segments, the first segment with a marked lobe and the second small and rounded, abdominal sternite IV-V with thin brush-shaped seta; broad vulvar margin with long and short fine mushrooms like structures. Total body length 2048 (2051 –2454, n = 3); head length 393 (366 –417), head width 670 (662 –675); length of the prothorax 227 (209 –256), length of the pterothorax 386 (330 –417); abdomen length 1258 (1115 –1371), abdomen width 1151 (1079 –1235).

Comment: The association of *Columba livia* and *Hohorstiella lata* found in this study coincides with that reported by Quiguango (2015) in Ecuador, by Cortés *et al.* (2016) in Colombia and in the same way in Brazil (Amaral *et al*., 2017). In Peru, *H. lata* has not been registered in previous works, so this study would be the first to report this ectoparasite within the diversity of chewing lice for the country.

Ricinidae Neumann, 1890
Ricinus De Geer, 1778
Ricinus frenatus Burmeister, 1838
(Fig. 2E-2H)

Material studied: MUFV: ZOO-HPIA:151 and (MUFV: ZOO-HPIA:152.

Hosts: *Philydor erythrocercum*, Peru: Huanuco: Puerto Inca 9°36'49.32''S, 74°56'8.16" W, 18-22. iii.2018, Cipriano, S.; *Lathrotriccus griseipectus,* Peru: Huanuco: Puerto Inca 9°36'49''S, 74°56'8"W, 18-22.iii.2018. Cipriano, S.

Description: Based on 3 individuals (females). Head convex in shape. This species differs from the other *Ricinus* species by presenting the end of the mandibular lobes (left and right) of similar size, slightly ovoid sclerites, labium with 14 pairs of setae, seta a1 as long as the pa series. Total body length 4500 (4462 - 4552, n = 3); head length 977 (971-986), head width 762 (754-767); prothorax length 477 (467 - 492), pterothorax length 632 (556 - 689); abdomen length 2414 (2378 - 2443), abdomen width 1193 (1171 - 1214).

Comment: The genus *Ricinus* has been reported in the study by Soto-Patiño *et al*. (2018) parasitizing species from different families of the order Passeriformes found in Peru. In this study we report for the first time *R. frenatus* in Peru and two new hosts: *P. erythrocercum* and *L. griseipectus*.

Trochiloecetes Paine & Mann, 1913
Trochiloecetes illumani Carriker, 1960
(Fig. 3A -D)

Material studied: MUFV: ZOO-HPIA:153.

Host: *Threnetes leucurus,* Peru: Huanuco: Puerto Inca 9°36'49'' S, 74°56'8" W, 18-22. iii.2018, Cipriano, S.

Description: Based on 5 individuals (1 male, 4 female). Short and wide head, concave fronts (430). It has a thin transverse frontal carina and is made up of two narrow bands across the occipital region, thinner prothorax and pterothorax carina, slightly thickened longer jaws, very thick lateral carina and abdominal joints. **Male**: Total body length (2059, n = 1); head length 500, head width 609; prothorax length 302, pterothorax length 300; abdomen length 957, abdomen width 1047. **Female**: Total body length 2372 (2209 - 2455, n = 4); head length 528 (501 - 556), head width 650 (647 - 652); prothorax length 337 (326 - 350), pterothorax length 338 (248 –390); abdomen length 1172 (1063 - 1246), abdomen width 1095 (1006 - 1145).

Comment: The genus *Trochiloecetes* has been reported parasitizing different species of birds of the Trochilidae family in Brazil (Roda & Farias, 1999), Argentina (Abrahamovich *et al*., 2006) and in Peru by Soto-Patiño *et al.* (2018). Additionally, Carriker (1960) reported the genus for the first time in Peru in the host *Threnetes leucurus*, the latter association coincides with our study. Therefore *T. illumani* is reported as a new ectoparasite for Peru, and the Bardud Hermit (*T. leucurus*) as a new host for this species.

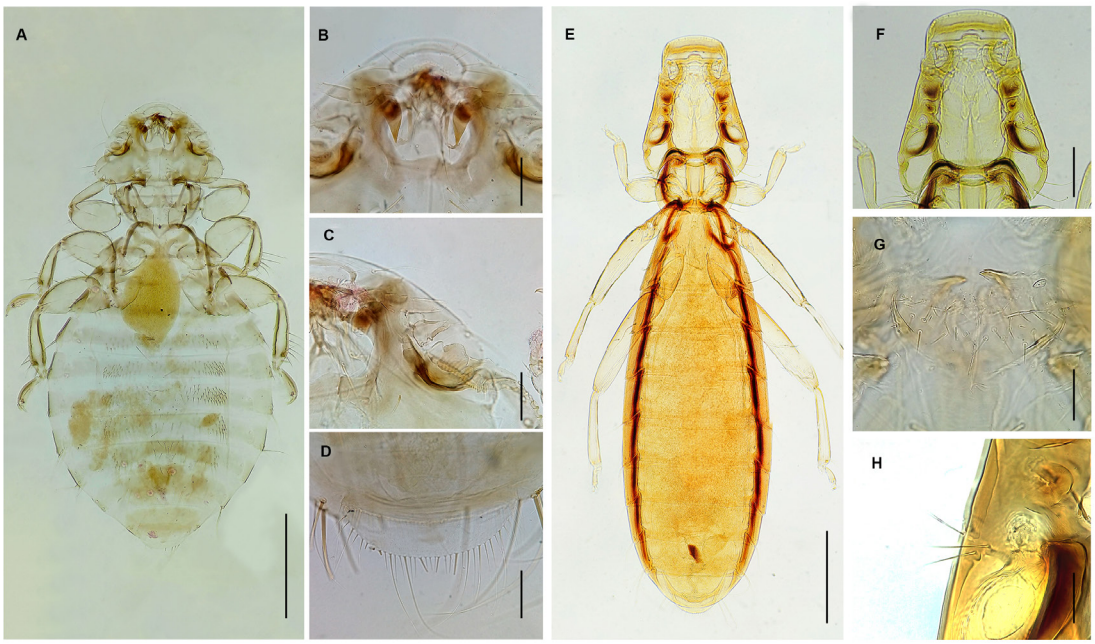

Fig. 2. A-D. *Hohorstiella lata,* A. Whole body (female) (500 µm). B. Pair of spines on the ventral head (100 µm), C. Two-segment antenna, the first segment with a marked lobe (50 µm), D. Vulvar segment of female with long and short mushrooms like structures (50 µm). E-H. *Ricinus frenatus,* E. Whole body (female) (500 µm), F. Convex head shape (200 µm), G. Labium with 14 pairs of mushrooms and jaw lobes of almost equal sizes (20 µm), H. Seta a1 as long as the "pa" series (20 µm).

Ischnocera
Philopteridae Burmeister, 1838
Campanulotes Kéler, 1939
Campanulotes compar (Burmeister, 1838)
(Fig. 3E-H)

Material studied: MUFV: ZOO-HPIA:156.
Host: *Columba livia,* Peru: Lima: Cercado de Lima, 12°2´43" S, 77°1´45" W, 02-03.ix.2017, Naupay, A.
Description: Based on 6 individuals (3 males, 2 females). Antenna with four segments, the first segment, longer than the others. Acute temples, IX male abdominal segment presents a slightly bilobed plate provided with setae at each lobar end and a pair of contiguous lateral sclerites. Vulvar margin (female) bordered by rows of tiny mushroom like structures. Rounded clipeal border and slightly elongated pre-antennal region. **Male**: Total body length 1123 (1078 –1156, n = 3); head length 353 (343 –359), head width 366 (354 –376); prothorax length 108 (86 –133), pterothorax length 158 (136 –176); abdomen length 497 (474 –519), abdomen width 555 (477 –680). **Female**: Total body length 1376 (1365 –1387, n = 2); head length 398 (397 –399), head width 401 (393 –409); prothorax length 119 (109 - 128), pterothorax length 200 (186 –214); abdomen length 609 (479 –697), abdomen width 512 (438 –558).
Comment: *Campanulotes compar* is an ectoparasite that has been reported in *Gallus gallus domesticus* in Brazil (Ferreira *et al*., 2013) and in columbiform birds such as the common dove *C. livia* in Chile by González *et al*. (2004), in the same way in Ecuador by Quiguango (2015), the same relationship was reported by Dale (1970) for the first time in Peru, thus coinciding with our study.

Columbicola Ewing, 1929
Columbicola columbae (Linnaeus, 1758)
(Fig. 4A -D)

Material studied: MUFV: ZOO-HPIA:159.
Host: *Columba livia,* Peru: Lima: Cercado de Lima, 12°2´43" S, 77°1´45" W, 02-03.ix.2017, Naupay, A.
Description: Based on 7 individuals (5 males, 2 females). The species of this genus are characterized by having an elongated and thin body. Likewise, they present a clear sexual dimorphism based on the antennas, the males present the third segment of the antenna (proximal seg-

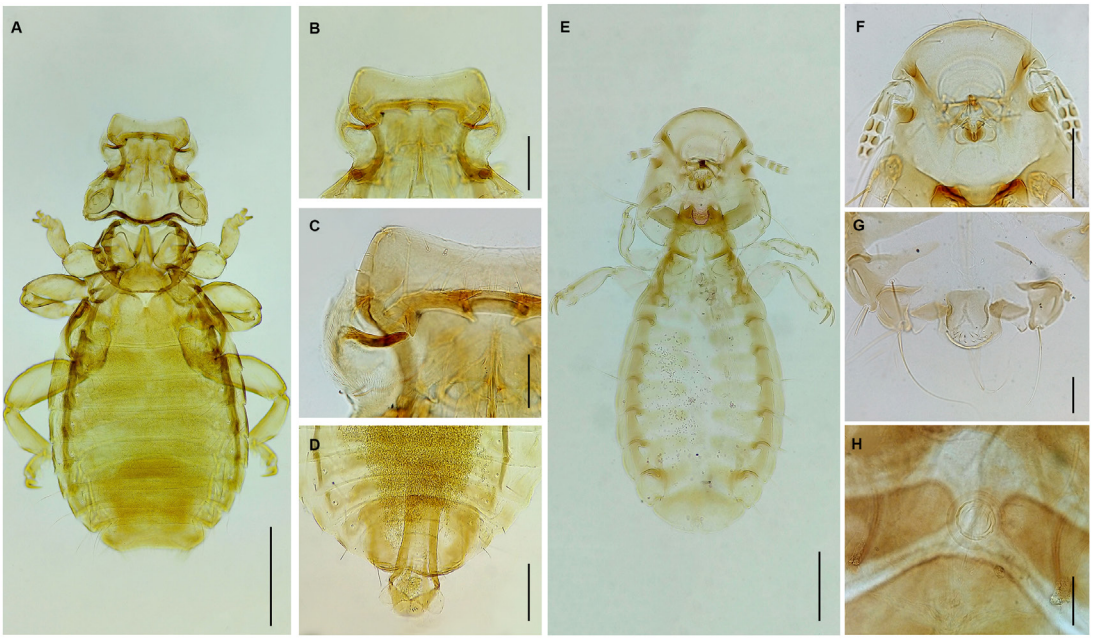

Fig. 3. A-D. *Trochiloecetes illumani,* A. Whole body (female), dorsal view (500 μm), B. Concave fronts (200 μm), C. Two-band thin cross front carina (100 μm), D. Male reproductive system (200 μm). E-H. *Campanulotes compar,* E. Whole body (female) (200 μm), F. Antenna in 4 segments, the first segment, longer (100 μm), G. Male reproductive apparatus in two lobes, provided with short mushrooms at each end (100 μm), H. Female genital pore (50 μm).

ment) wider and more robust compared to the female that has it in the form of a brush and the vulvar segment of the female in two lobes (Eichler, 1953). **Male**: Total body length 2642 (2409 –2749, n = 5); head length 545 (525 –561), head width 274 (266 –279); prothorax length 144 (128 - 173), pterothorax length 304 (271 –350); abdomen length 1649 (1361 –1773), abdomen width 371 (350 –411). **Female**: Total body length 2445 (2247 - 2643, n = 2); head length 536 (503 - 569), head width 273 (267 - 278); prothorax length 134 (123-144), pterothorax length 279 (275-282); length of abdomen 1497 (1318 - 1676), width of abdomen 351 (331 - 371).

Comment: *Columbicola columbae* is a cosmopolitan ectoparasite common in pigeons, and whose specific association has been reported in Peru (Naupay *et al*., 2015; Castro *et al.,* 2017), Colombia (Pérez *et al*., 2015), Brazil (De Oliveira *et al*., 2000), Chile (González *et al*., 2004) to name a few, thus coinciding with our results.

Mayriphilopterus Mey, 2004
Mayriphilopterus ernsti Mey, 2004
(Fig. 4E-H)

Material studied: Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 10-15.v.2018, Cipriano, S. (MUFV:ZOO-HPIA:154); Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 10-15.v.2018, Cipriano, S. (MUFV:ZOO-HPIA:155); Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 10-15.v.2018, Cipriano, S. (MUFV:ZOO-HPIA:163); Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 10-15.v.2018, Cipriano, S. (MUFV:ZOO-HPIA:164).

Hosts: *Philydor erythrocercum*, Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 18-22.iii.2018, Cipriano, S.; *Lathrotriccus griseipectus*, Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 18-22.iii.2018, Cipriano, S.*; Willisornis poecilinotus*, Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 18-22.iii.2018, Cipriano, S.; *Glyphorynchus spirurus,* Peru: Huanuco: Puerto Inca 9°36’49’’S, 74°56’8”W, 18-22.iii.2018, Cipriano, S.

Description: Based on 4 individuals (1 male, 3 female). It is characterized by the absence of a functional conus; trabecula well developed. Clypeus with hyaline membrane without marginal sclerotization. Presence of 4 pairs of spatulate mushrooms like structures in the clipped hyaline membrane, the latter being the most distinctive character. **Male**: Total body length 1764 (n = 1); head length 607, head width 597; length of prothorax 213, length of pterothorax 232; abdomen length 712, abdomen width 535. **Female**:

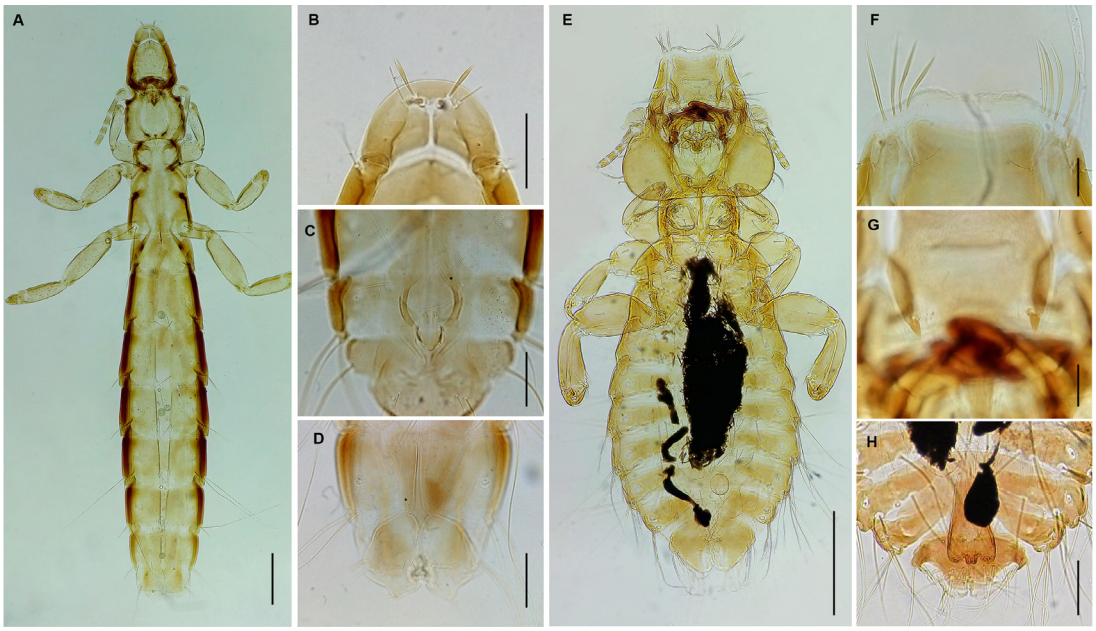

Fig. 4. A-D. *Columbicola columbae* A. Whole body (female) (200 µm), B. Brush Mushroom (50 µm), C. Male reproductive system (100 µm), D. Vulvar segment of female in two lobes (100 µm). E-H. *Mayriphilopterus ernsti* E. Whole body (female), ventral view (400 µm). F. Four spatula mushrooms on each side of the fronts (50 µm), G. Strong thorns (50 µm), H. Male copulatory organ (200 µm).

Total body length 2513 (2403 - 2586, n = 3); head length 693 (676-715), head width 704 (698-710); prothorax length 272 (254-307), pterothorax length 324 (308-351); abdomen length 1224 (1165-1279), abdomen width 837 (796-883).
Comment: *Mayriphilopterus ernsti* was discovered and described for the first time by Mey (2004) in *Monasa morphoeus peruana* Sclater, 1856 in the province of Victoria, Río Pachitea, Peru. Our study expands the host list for *M. ernsti* with species of the order Passeriformes: *Philydor erythrocercum*, *Lathrotriccus griseipectus*, *Willisornis poecilinotus*, and *Glyphorynchus spirurus*.

Quadraceps Clay & Meinertzhagen, 1939
Quadraceps eugrammicus (Burmeister, 1838)
(Fig. 5A -D)

Material studied: MUFV: ZOO-HPIA:162.
Host: *Larus belcheri,* Peru: Lima: Ventanilla, 11°52´15”S, 77°9´30”W, 21-23.ix.2017. Naupay A.
Description: Based on 5 individuals (4 males, 1 female). The antennae present in the last two segments a darker coloration than the rest of the segments. The contours of the temples form an acute angle. The edge of the head has dark pigmentation, except for the frontal area. It has a long mushroom that grows from the edge of the temple. Abdominal segments have transverse dark brown spots; Dark coloration that extends to the entire proximal part of the basal plate (Timmermann, 1952). **Male**: Total body length 1763 (1708 –1794, n = 4); head length 505 (469–543), head width 363 (357 –367); prothorax length 129 (102–141), pterothorax length 190 (175–207); abdomen length 933 (907–974), abdomen width 421 (424–472). **Female**: Total body length 2907 (n=1), head length 527, head width 365. Prothorax length 108, pterothorax length 186. Abdomen length 1176, abdomen width 460.
Comment: The genus *Quadraceps* was first reported in Peru by Carriker (1950), finding the congeneric species *Quadraceps burhinoides* Carriker, 1950 in hosts of the family Charadriidae, from Paramonga and later by Gomez-Puerta & Lujan-Vega (2018) in Surco, Lima. In our study, we reported for the first time on *Q. eugrammicus* in Peru and *L. belcheri* as a new host for this species.

Saemundssonia Timmermann, 1936
Saemundssonia (Saemundssonia) lari (O. Fabricius, 1780)
(Fig. 5E-H)

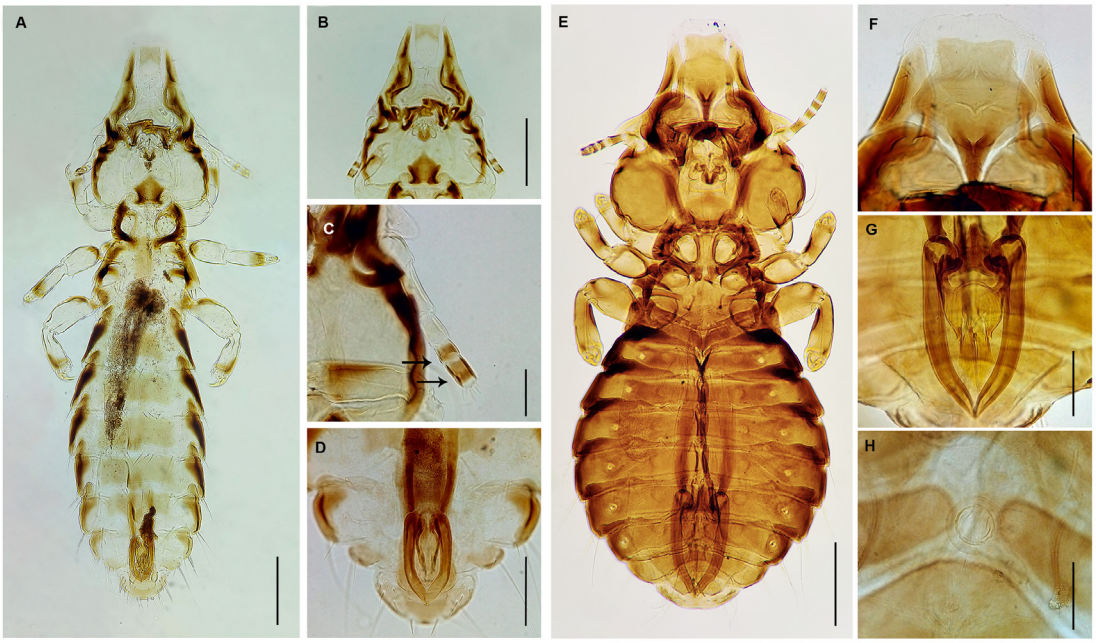

Fig. 5. **A-D.** *Quadraceps eugrammicus,* A. Whole body (male) (200 μm), B. Dark coloration around the edge of the head (200 μm), C. Last two segments of the antenna, presents dark coloration (50 μm), D. Male reproductive system (100 μm). E-H. *Saemundssonia lari,* E. Whole body (male), dorsal view (200 μm). F. Triangular sclerite with dark coloration at the tip (100 μm), G. Male reproductive system (100 μm), H. Female genital pore (50 μm).

Material studied: MUFV: ZOO-HPIA:160.
Host: *Larus belcheri,* Peru: Lima: Ventanilla, 11°52´15.352" S, 77°9´30.283" W, 21-23.ix.2017, Naupay A.
Description: Based on 5 individuals (3 males, 2 females). It has a strong coloration throughout the body. Temples not very widened. The width of the head is equal to or slightly less than the length of the head. The posterior appendage of the clipeal dorsal plate clearly composed of two parts: a conical and colored part, followed by a lighter prolongation that ends in a sharp shape and with a dark coloration. **Male**: Total body length 1725 (1619–1817, n = 3); head length 579 (555–594), head width 593 (589–599); prothorax length 158 (140–171), pterothorax length 219 (200–246); abdomen length 813 (765–853), abdomen width 814 (805–820). **Female**: Total body length 2052 (2051–2052, n = 2); head length 629 (607–651), head width 659 (657–660); prothorax length 161 (158–163), pterothorax length 239 (216–262); abdomen length 1068 (1065–1071), abdomen width 1031 (1027–1034).
Comment: This species was recorded in Chile in hosts of the family Laridae by González-Acuña *et al.* (2006). In Peru it has been previously reported in *Leucophaeus atricilla*, from Atocongo, Lima, and in *Larus belcheri* from Pisco, Ica (Dale, 1970). Additionally, Gomez-Puerta & Cribillero (2015) reported *S. lari* in *Larus pipixcan* in the Province of Huaral, Lima. Therefore, the ecto-parasite-host relationship found in this study coincides with what has already been reported.

DISCUSSION

Peru has a great diversity of birds, with approximately 1870 species (Plenge, 2020). However, the number of bird species evaluated for the study of chewing lice is still low (Gomez-Puerta & Cribillero, 2015), despite the importance of these studies because of the effects of parasites like lice in birds. These parasites have direct pathological effects (hyperkeratosis and damage to feathers), and indirect effects such as negative sexual selection for parasitized birds (Lopez *et al*., 2008; Liebana *et al*., 2011; Moreno-Rueda & Hoi, 2012).

Among the results of this investigation, we report the species *Q. eugrammicus*, *S. lari* and *A. transversum* parasitizing the Peruvian seagull *Larus belcheri* (Charadriiformes). These three species of lice have been recorded in birds of the Laridae family in Chile, the Galapagos Islands, and Mexico (Emerson, 1972; González-Acuña *et*

al., 2006; Palma & Peck, 2013), but only *S. lari* was previously reported in *L. belcheri* (Dale, 1970). Birds of the genus *Larus* are highly prone to the transmission of ectoparasites due to the close relationship between their species, sharing spaces in their habitat, nesting and feeding (Gómez & González, 2010; Lenzi, 2011), which could generate contagion between species.

We also report two taxa of lice in the family Ricinidae, the genera *Trochiloecetes* and *Ricinus*, although both genera belong to the same family, they parasitize different orders of birds. In our study we report for the first-time *T. illumani* parasitizing *T. leucurus*. In the case of *Ricinus frenatus*, Valan *et al*. (2016) reported this species in association with different birds of the order Passerifomes. These results agree with the ones published by Soto-Patiño *et al*. (2018), who report the *Ricinus* genus in multiple Passerifomes birds.

Four species of ectoparasites were identified in the common pigeon *Columba livia*. This host bird has been studied in Brazil by Amaral *et al*. (2017) who reported the same species of ectoparasites in their study. In Peru, different authors have reported the same association of ectoparasites with the host, found in *C. columbae* (Naupay *et al*., 2015; Castro *et al.,* 2017), *C. turbiratum* and *C. compar* (Dale, 1970), however, it was not previously reported for *H. lata*. The diversity of ectoparasites in *C. livia* could be attributed to the fact that this species has a close interaction with domestic and wild birds, in addition to being located in different parts of the city, which can generate a cross contagion (Begum & Sehrin, 2011).

CONCLUSION

Our results show important contributions to the diversity of chewing lice in birds of Peru, including four new reports of lice for the country. Likewise, new associations were found, expanding the list of hosts for four species of chewing lice. This work highlights the need to investigate parasites in birds that do not present previous studies on ectoparasites since these birds are likely to harbor new species for Peru and science.

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Doi: 10.22179/REVMACN.22.697

Recibido: 19-VII-2020
Aceptado: 23-X-2020