



Lice (Phthiraptera, Amblycera, Ischnocera) collected on the birds in the Aras basin in Iğdır Province, Türkiye with new records and new host associations

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Abstract

Chewing lice (Phthiraptera, Ischnocera and Amblycera) are permanent ectoparasites of birds and primarily feed on the feathers and scales of birds. To detect the chewing lice species found on birds in Aras basin, Iğdir, Türkiye, a total of 240 birds represented by 61 species belonging to 30 families in 13 orders were examined during the 2021 bird migration season. A total of 531 (186 females, 136 males and 209 nymphs) lice were collected from 75 individuals (31,25% of birds examined) of 26 species, 21 families and 10 orders. Thirty-one lice species (11 amblyceran and 20 ischnoceran species) in 22 genera were identified. Of these, 15 lice species were reported for the first time in Türkiye, namely *Cuculiphilus fasciatus*, *Pseudomenopon qadrii*, *Phlopterus* sp., *Ricinus serratus*, *Phlopterus picae*, *Rostrinirmus buresi*, *Sturnidoecus* sp., *Phlopterus excisus*, *Phlopterus microsomaticus*, *Phlopterus coarctatus*, *Brueelia fuscopleura*, *Sturnidoecus pastoris*, *Brueelia currucae*, *Penenirmus auritus* and *Strigiphilus tuleskovi*. In addition, new host associations were reported for the lice species *Kurodaia fulvofasciata*, *Degeeriella rufa* and *Myrsidea rustica*.

Keywords Biodiversity · Bird migration · Ectoparasite · Avian ecology · Ornithology

Introduction

Lice (Insecta, Psocodea, Phthiraptera) are ectoparasitic arthropods that feed predominantly on feathers and the skin scrapings of birds, while some of them suck blood from mammals. Traditionally, lice have been placed in the

order Phthiraptera, but some have placed lice in the order Psocodea in recent studies (ITIS 2023). There are currently four superfamily of lice, namely Anoplura, Amblycera, Ischnocera and Rhyncophthirina. Of them, Amblycera and Ischnocera (except the family Trichodectidae) species infest only birds, whereas Anoplura and Rhyncophthirina

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species infest only mammals. The superfamilies Amblycera and Ischnocera are represented by more than 4000 species, whilst the superfamilies Anoplura and Rhyncophthirina are represented approximately by 550 species (Price et al. 2003; Durden 2019).

Geographically, Türkiye is located on the main flyways of many migratory birds. The country has also vast range of climates and habitats for birds. Therefore, millions of birds visit Türkiye for roosting, breeding, and wintering every year. However, lice infesting birds are relatively poorly investigated.

In the studies conducted in Türkiye, 494 bird species have been identified so far (Kittelberger et al. 2023) and 313 of these species have been observed in the Aras River wetlands (Kittelberger et al. 2022) where this study took place. Chewing lice, feather mites and ticks, especially in their larval and nymphal stages, parasitize birds and may play a role in the transmission of some diseases to birds. Migratory birds carry many kinds of ectoparasites to the countries they visit and act as vectors for the transmission of these ectoparasites to other living organisms (Oğuz et al. 2015; Seegar et al. 1976). Chewing lice feed on the feathers and skin scrapings of birds, and sometimes disrupt the integrity of the skin and feed on leaking blood. Therefore, they can cause serious discomfort. For instance, *Piagetiella titan* living in the oral cavity of white pelicans (*Pelecanus onocrotalus*) causes erosive stomatitis (Dik 2006).

In Türkiye, more than 200 bird species were examined for lice infestations, approximately 150 bird species were found infested by lice, and the presence of more than 200 bird lice species in Türkiye has been determined (Dik et al. 2009, 2010; Dik et al. 2011a, b, c; Dik et al. 2013a, 2013b, 2013c; Dik et al. 2015; Dik et al. 2017a, b; Dik and Yamaç 2017; Dik and Kandir 2021; Dik et al. 2022; Dik et al. 2023; Eren et al. 2022; İnci et al. 2010a, b; Girişgin et al. 2013, 2022; Göz et al. 2015; Yamaç et al. 2023; Yılmaz et al. 2022).

Some studies were previously conducted on the lice infestations on birds in Kars and Iğdır Provinces of Türkiye (Dik et al. 2010; Dik et al. 2011a, c). In a study on shorebirds at Lake Kuyucuk Bird Ringing Station (43°27' N, 40°45' E; Kars Province) in 2009, where 41 individuals belonging to seven bird species in two families were examined, 36 of them were found to be infested by lice and 20 lice species were identified (Dik et al. 2010). In another study at the same station, 51 passerine birds belonging to 22 species in 10 families were examined, 11 individuals of seven bird species were found infested by lice and five lice species were identified (Dik et al. 2011c). In the last study was conducted by Dik et al. (2011a) at the Aras River Ornithological Research Station (40.078°N, 43.358°E; Iğdır Province) in 2009 and 81 birds belonging to 23 bird species in six families were examined for lice infestation.

In that study, 14 lice species reported which seven of them were reported for the first time in Türkiye.

In present study, we investigated chewing lice infestations on birds captured at the Aras River Ornithological Research Station (40.078°N, 43.358°E) in northeastern Türkiye. Here, we report three new louse–host associations for Türkiye. We also recorded the presence of 15 lice species for the first time in Türkiye.

Materials and methods

This study was carried out to determine the lice species found in birds captured using standard mist nets for ringing at the Aras River Ornithological Research Station (Fig. 1), located near Yukarı Çıyıklı village, Tuzluca, Iğdır Province in eastern Türkiye (Kittelberger et al. 2022). A total of 240 birds belonging to 61 bird species in 42 genera in 30 families of 13 orders were examined for lice during the bird ringing season in 2021. Weight, morphometrical measurements, date and ring numbers of each bird were recorded and identified (Neate-Clegg et al. 2019). The species names of the birds were based on Gill et al. (2020) and Bird Life International (2023).

Each bird was examined for lice visually, a harmless synthetic pyrethroid insecticide (Tetramethrin + Piperonyl butoxide) was applied and then placed in a box. After 20 to 30 min, each bird was released to its natural habitat where it was captured (Fig. 2). Not only the lice seen on the birds but also the lice that fell into the box were collected with forceps and placed in a small glass tube containing 70% ethyl alcohol. Each tube was labeled with the bird name, ring number, date and location and sent to the laboratory of the Department of Parasitology, Faculty of Veterinary Medicine, Selçuk University. In the laboratory, the lice samples in the tubes were sorted under a Nikon SMZ 745 T stereo microscope, placed in 10% Potassium Hydroxide (KOH) and made transparent for 24 h. The sufficiently translucent specimens were kept in distilled water for a few hours and then kept in 70% and 99% alcohol series for one day and mounted to the slides separately with Canada balsam. After the slides were dried in an incubator at 50–60° C for 2–3 weeks, the lice were identified under a binocular light microscope (Leica DM750, Germany) with the aid of relevant literature (Balát 1958, 1981; Bechet 1961; Bush et al. 2016; Clay 1958, 1969; Dik et al. 2017a; Eichler 1952, 1953, 1986; Emerson and Johnson 1961; Gustafsson and Bush 2017; Gustafsson et al. 2018; Knechtel and Cătuneanu 1938; Mey 2020; Najer et al. 2020; Price 1974, 1977; Price et al. 2003; Rheinwald 1968; Shimada and Yoshizawa 2020; Zlotorzycza 1964, 1974).



Fig. 1 Aras River Ornithological Research Station (marked with asterisk) located in the Eastern Türkiye

Results

In this study, we examined for lice infestation 240 birds that were ringed at the in the Aras River Ornithological Research Station. A total of 531 lice (186 females, 136 males and 209 nymphs) were collected from 75 birds (31,25% prevalence) from 26 species, 21 families and 10 orders. As a result of morphological examination, lice were identified to 11 species in the superfamily Amblycera and 20 species in the superfamily Ischnocera (Table 1).

In general, birds were infested by low numbers of lice ranging from 1 to 23, but a Common starling (*Sturnus vulgaris*) specimen was heavily infested by 86 lice belonging to three species [*Brueelia nebulosa* (15♀, 19♂, 36N), *Myrsidea cucullaris* (2♀, 1♂, 7N) and *Sturnidoecus sturni* (6N)]. On the other hand, the most infested European bee-eater (*Merops apiaster*) and Common cuckoo (*Cuculus canorus*) were infested with 23 and 20 lice, respectively, whereas Bank martin (*Riparia riparia*), Sedge warbler (*Acrocephalus schoenobaenus*), Black-headed bunting (*Emberiza melanocephala*), Crested lark (*Galerida cristata*), Common rosefinch (*Carpodacus erythrinus*), Eurasian scops owl (*Otus scops*) and Syrian woodpecker (*Dendrocopos syriacus*) birds

were each infested by a single louse specimen. Co-infestations with two or three different species in a bird species were shown in Table 1.

In this study, *Pseudomenopon qadrii* (Fig. 3) from Spotted crane (*Porzana porzana*), *Ricinus serratus* (Fig. 4) from Crested lark (*G. cristata*), *Philopterus picae* (Fig. 5) from Eurasian magpie (*Pica pica*), *Rostrinirmus buresi* (Fig. 6) from Black-headed bunting (*Emberiza melanocephala*), *Philopterus excisus* (Fig. 7) and *Myrsidea rustica* (Fig. 8) from Western house-martin (*Delichon urbicum*), *Philopterus microsomaticus* (Fig. 9) from Barn swallow (*Hirundo rustica*), *Philopterus coarctatus* Fig. 10) from Lesser grey shrike (*Lanius minor*), *Brueelia fuscopleura* (Fig. 11 a, b) and *Sturnidoecus pastoris* (Fig. 12) from Rosy starling (*Pastor roseus*), *Brueelia currucae* (Fig. 13) from Lesser whitethroat (*Curruca curruca*), *Penenirmus auritus* (Fig. 14) from Syrian woodpecker (*D. syriacus*), *Strigiphilus tuleskovi* (Fig. 15) from Eurasian scops owl (*O. scops*) and *Cuculiphilus fasciatus* (Fig. 16) from Common cuckoo (*Cuculus canorus*) were detected for the first time in Türkiye. In addition, Levant sparrowhawk (*Accipiter brevipes*), Eurasian hobby (*Falco subbuteo*) and Western house-martin (*Delichon urbicum*) were reported as new host for the lice



Fig. 2 Inspection of birds and collection of lice (Photo Credits: KuzeyDoğa Society, Türkiye)

Kurodaia fulvofasciata, *Degeeriella rufa* and *Myrsidea rustica*, respectively. *Columbicola columbae* found on Eurasian sparrowhawk (*Accipiter nisus*) was evaluated as a "straggler".

Myrsidea sp. (nymphs) from Common chiffchaff (*Phylloscopus collybita*) and Bank martin (*Riparia riparia*), *Philoaterus* sp. (Fig. 17) from Moustached warbler (*Acrocephalus melanopogon*) and *Sturnidoecus* sp. (nymphs) from Common rosefinch (*Carpodacus erythrinus*) were also detected for the first time in Türkiye. Because these specimens were not sufficiently transparent, some morphological characteristics of these specimens could not be seen under the microscope and therefore, they could not be identified to the species level.

Discussion

To date, more than 200 bird species have been examined for lice infestation in Türkiye. Most of the bird species in Türkiye are rare, endangered species or they require special methods to capture. Therefore, the majority of Türkiye's bird species remain unexamined for lice infestations. Previous studies conducted at bird ringing stations, such as Kuyucuk, Kars (Dik et al. 2010, 2011c), Aras, Iğdır (Dik et al. 2011a) and Cernek-Kızılırmak delta, Samsun (Açııcı et al. 2011;

Dik et al. 2015, 2017a, 2023; Eren et al. 2022), have contributed substantially to the increase in the number of lice species detected on Türkiye's avifauna. In addition, in research conducted in Afyon (Dik and Kandir 2021), Burdur (Dik et al. 2013b), Bursa (Girişgin et al. 2013, 2022), Konya and Eskişehir (Dik et al. 2011b, 2013c; Dik and Yamaç 2017) provinces, many bird species and specimens were examined for the presence of lice and many new lice species were recorded for the louse fauna of Türkiye.

In most of the studies on lice infestations in Türkiye, birds belonging to the orders Passeriformes, Accipitriformes, Columbiformes and Charadriiformes were examined. In a study conducted at the Aras River Bird Ringing Station in 2009, 81 bird specimens belonging to 23 bird species were examined, 16 birds were found to be infested with lice and 14 lice species were identified (Dik et al. 2011a). Although 240 birds belonging to 13 orders were examined in this study, most of the samples were in the order Passeriformes (203 birds). Passeriformes was followed by Piciformes and Coraciiformes, with six samples each, and Cuculiformes and Strigiformes, with four samples each. Potentially due to the small number of individuals examined, lice were not detected in Charadriiformes (*Actitis hypoleucos*, n: 1), Columbiformes (*Columba livia*, n: 1, *Streptopelia turtur*, n: 1) and Pelecaniformes (*Ixobrychus minutus*, n: 3). In this study, Common rosefinch (*C. erythrinus*), Red-rumped

Table 1 List of examined birds and their lice

Bird orders and families	Bird species	Common names of birds	E	U	I	Louse species	Total number	P	MI	MA
Accipitriformes										
Accipitridae	<i>Accipiter brevipes</i>	Levant sparrowhawk	3	2	1	<i>Kurodata fufufasciata</i> ^a	10 (5♀, 3♂, 2N)	33,3	10	3,33
	<i>Accipiter nisus</i>	Eurasian sparrowhawk	1	0	1	<i>Columbicola columbae</i> ^c	3 (3♀)	100	3	3
Caprimulgiformes										
Apodidae	<i>Apus apus</i>	Common swift	1	0	1	<i>Dennyus hirundinis</i>	3 (2♂, 1N)	100	3	3
Bucerotiformes										
Upupidae	<i>Upupa epops</i>	Eurasian hoopoe	2	0	1	<i>Menacanthus fertilis</i>	2 (2♀)	50	2	1
Charadriiformes										
Scolapacidae	<i>Actitis hypoleucos</i>	Common sandpiper	1	1	0	–	–	–	–	–
	<i>Gallinago media</i>	Great snipe	1	1	0	–	–	–	–	–
Columbiformes										
Columbidae	<i>Columba livia</i>	Rock pigeon	1	1	0	–	–	–	–	–
	<i>Streptopelia turtur</i>	European turtle-dove	1	1	0	–	–	–	–	–
Coraciiformes										
Alcedinidae	<i>Alcedo atthis</i>	Common kingfisher	2	1	1	<i>Alcedoffula alcedinis</i>	3 (2♀, 1N)	50	3	1,5
Meropidae	<i>Merops apiaster</i>	European bee-eater	4	0	4	<i>Meromenopon meropis</i>	27 (4♀, 8♂, 15N)	100	6,75	6,75
						<i>Meropsiella apiastri</i>	21 (6♀, 5♂, 10N)	100	6,75	6,75
						<i>Meropoecus meropis</i>	8 (2♀, 3♂, 3N)	75	9	6,75
Cuculiformes										
Cuculidae	<i>Cuculus canorus</i>	Common cuckoo	4	1	2	<i>Cuculiphilus fasciatus</i> ^b	7 (4♀, 3N)	50	3,5	1,75
						<i>Cuculicola latirostris</i>	15 (11♀, 4♂)	50	7,5	3,75
Falconiformes										
Falconidae	<i>Falco columbarius</i>	Merlin	1	1	0	–	–	–	–	–
	<i>Falco subbuteo</i>	Eurasian hobby	1	0	1	<i>Degeeriella rufa</i> ^a	18 (6♀, 9♂, 3N)	100	18	18
Gruiformes										
Rallidae	<i>Porzana porzana</i>	Spotted crane	1	0	1	<i>Pseudomenopon qadrii</i> ^b	9 (4♀, 4♂, 1N)	100	9	9
Passeriformes										
Acrocephalidae	<i>Acrocephalus agricola</i>	Paddyfield warbler	1	1	0	–	–	–	–	–
	<i>Acrocephalus arundinaceus</i>	Great reed warbler	28	28	0	–	–	–	–	–
	<i>Acrocephalus melanopogon</i>	Moustached warbler	2	1	1	<i>Philopterus</i> spp. ^b	1 (1♀)	50	1	0,5
	<i>Acrocephalus palustris</i>	Marsh warbler	1	1	0	–	–	–	–	–
	<i>Acrocephalus schoenobaenus</i>	Sedge warbler	24	23	1	<i>Menacanthus curuccae</i>	8 (4♀, 4 N)	4,17	8	0,33
	<i>Acrocephalus scirpaceus</i>	Common reed warbler	3	3	0	–	–	–	–	–
	<i>Iduna pallida</i>	Eastern olivaceous warbler	1	1	0	–	–	–	–	–
Alaudidae	<i>Galerida cristata</i>	Crested lark	2	0	2	<i>Ricinus serratus</i> ^b	3 (2♀, 1N)	100	1,5	1,5
Corvidae	<i>Pica pica</i>	Eurasian magpie	2	1	1	<i>Myrsidea picae</i> ^b	14 (2♀, 3♂, 9N)	50	14	7
						<i>Philopterus picae</i> ^b	3 (1♀, 2♂)	50	3	1,5

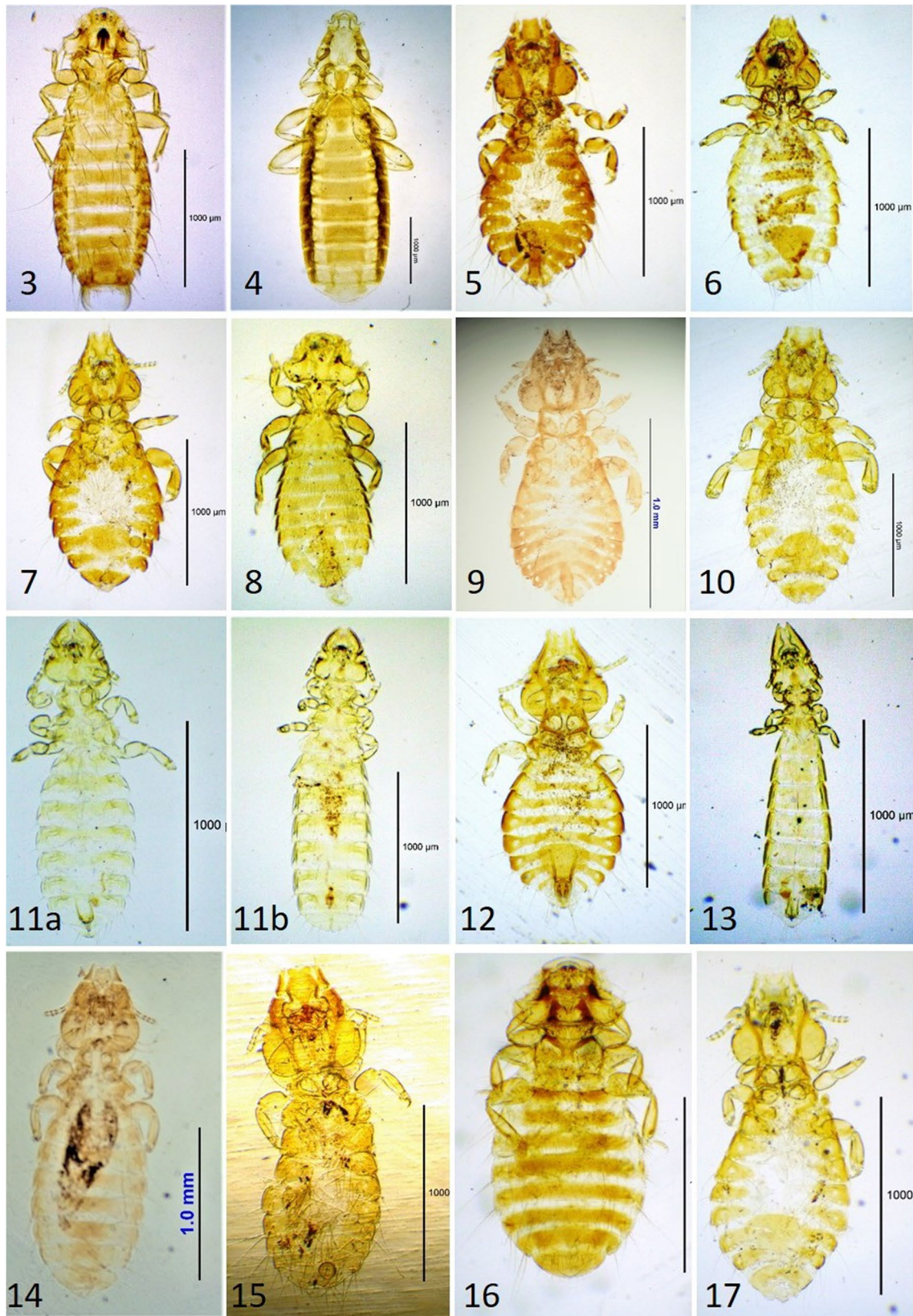
Table 1 (continued)

Bird orders and families	Bird species	Common names of birds	E	U	I	Louse species	Total number	P	MI	MA
Emberizidae	<i>Emberiza calandra</i>	Corn bunting	3	3	0	–	–	–	–	–
	<i>Emberiza melanocephala</i>	Black-headed bunting	2	1	1	<i>Rostririrmus buresi</i> ^b	1 (1♀)	50	1	0,5
Fringillidae	<i>Carpodacus erythrinus</i>	Common rosefinch	1	0	1	<i>Sturnidoecus</i> spp. ^b	1 (1N)	100	1	1
Hirundinidae	<i>Cecropis daurica</i>	Red-rumped swallow	1	1	0	–	–	–	–	–
	<i>Delichon urbicum</i>	Western house-martin	2	1	1	<i>Philopterus excisus</i> ^b	3 (3♀)	50	3	1,5
	<i>Hirundo rustica</i>	Barn swallow	49	10	7	<i>Myrsidea rustica</i> ^a	1 (1♂)	50	1	0,5
					38	<i>Acronirmus gracilis</i>	43 (23♀, 13♂, 7N)	14,3	6,14	0,87
					1	<i>Myrsidea rustica</i>	178 (60♀, 39♂, 79N)	77,6	4,68	3,63
					1	<i>Philopterus microsomaticus</i> ^b	1 (1♀)	2,04	1	0,02
Laniidae	<i>Riparia riparia</i>	Bank martin	4	3	1	<i>Myrsidea</i> spp. ^a	1 (1N)	25	1	0,25
	<i>Lanius collurio</i>	Red-backed shrike	3	3	0	–	–	–	–	–
	<i>Lanius minor</i>	Lesser grey shrike	3	2	1	<i>Philopterus coarctatus</i> ^b	5 (5♀)	33,3	5	1,66
Locustellidae	<i>Locustella fluviatilis</i>	River warbler	1	1	0	–	–	–	–	–
Motacillidae	<i>Motacilla alba</i>	White wagtail	2	2	0	–	–	–	–	–
	<i>Motacilla flava</i>	Western yellow wagtail	2	2	0	–	–	–	–	–
Muscicapidae	<i>Cercotrichas galactotes</i>	Rufous-tailed scrub-robin	3	3	0	–	–	–	–	–
	<i>Ficedula hypoleuca</i>	European pied flycatcher	1	1	0	–	–	–	–	–
	<i>Ficedula semitorquata</i>	Semicollared flycatcher	1	1	0	–	–	–	–	–
	<i>Luscinia luscinia</i>	Thrush nightingale	3	3	0	–	–	–	–	–
	<i>Luscinia megarhynchos</i>	Common nightingale	3	3	0	–	–	–	–	–
	<i>Luscinia svecica</i>	Bluethroat	2	2	0	–	–	–	–	–
	<i>Oenanthe isabellina</i>	Isabelline wheatear	1	1	0	–	–	–	–	–
	<i>Phoenicurus phoenicurus</i>	Common redstart	11	11	0	–	–	–	–	–
	<i>Saxicola rubetra</i>	Whinchat	1	1	0	–	–	–	–	–
Oriolidae	<i>Oriolus oriolus</i>	Eurasian golden oriole	2	0	2	<i>Maculinirmus mundus</i>	9 (3♀, 2♂, 4N)	100	4,5	4,5
Passeridae	<i>Passer domesticus</i>	House sparrow	1	1	0	–	–	–	–	–
	<i>Passer hispaniolensis</i>	Spanish sparrow	3	3	0	–	–	–	–	–
	<i>Passer montanus</i>	Eurasian tree sparrow	1	1	0	–	–	–	–	–
Phylloscopidae	<i>Phylloscopus collybita</i>	Common chiffchaff	7	5	2	<i>Myrsidea</i> spp. ^a	4 (1♀, 3N)	28,6	2	0,57
	<i>Phylloscopus sindianus lorenzii</i>	Mountaim chiffchaff	5	5	0	–	–	–	–	–
	<i>Phylloscopus trochilus</i>	Willow warbler	6	6	0	–	–	–	–	–
Remizidae	<i>Remiz pendulinus</i>	Eurasian penduline-tit	1	1	0	–	–	–	–	–

Table 1 (continued)

Bird orders and families	Bird species	Common names of birds	E	U	I	Louse species	Total number	P	MI	MA
Sturnidae	<i>Pastor roseus</i>	Rosy starling	5	3	1	<i>Brueelia fuscopleura</i> ^b	16 (4♀, 10♂, 2N)	20	16	3,2
	<i>Sturnus vulgaris</i>	Common starling	2	1	1	<i>Sturnidoecus pastoris</i> ^b <i>Brueelia nebulosa</i> <i>Myrsidea cucullaris</i> <i>Sturnidoecus sturni</i>	5 (1♀, 2♂, 2N) 70 (15♀, 19♂, 36N) 10 (2♀, 1♂, 7N) 6 (6N)	40	2,5	1
Sylviidae	<i>Sylvia atricapilla</i>	Eurasian blackcap	1	1	0	—	—	—	—	—
	<i>Curruca curruca</i>	Lesser whitethroat	4	3	1	<i>Brueelia currucae</i> ^b	10 (4♀, 6♂)	25	10	2,5
	<i>Curruca mystacea</i>	Menetries's warbler	1	1	0	—	—	—	—	—
	<i>Troglodytes troglodytes</i>	Eurasian wren	1	1	0	—	—	—	—	—
Piciformes										
Picidae	<i>Dendrocopos syriacus</i>	Syrian woodpecker	6	4	2	<i>Penenirmus auritus</i> ^b	2 (2♀)	33,3	1	0,33
Pelecaniformes										
Ardeidae	<i>Ixobrychus minutus</i>	Little bittern	3	3	0	—	—	—	—	—
Strigiformes										
Strigidae	<i>Otus scops</i>	Eurasian scops owl	4	3	1	<i>Strigiphilus tuleskovi</i> ^b	10 (2♀, 8 N)	25	10	2,5
Total			240	168	75		531 (186♀, 136♂, 209N)	31,3	7,08	2,21

N Nymph; ^a New louse–host association for Türkiye; ^b First record in Türkiye; ^c Straggler; E: Examined bird number; U: Uninfested bird number; I: Infested bird number; P: (%) Prevalence (number of birds parasitized/number of birds examinedx100); MI: mean intensity (number of individuals of a particular chewing louse species on infested hosts); MA: mean abundance (number of individuals of a particular chewing louse species on examined birds)



◀**Fig. 3-17** 3. *Pseudomenopon qadrii*—female, 4. *Ricinus serratus*—female, 5. *Philoaterus picae*—male, 6. *Rostrinirmus buresi*—female, 7. *Philoaterus excisus*—female, 8. *Myrsidea rustica*—male, 9. *Philoaterus microsomaticus*—male, 10. *Philoaterus coarctatus*—female, 11. *Brueelia fuscopleura* (a) male (b) female, 12. *Sturnidoecus pastoris*—male, 13. *Brueelia currucae*—male, 14. *Penenirmus auritus*—female, 15. *Sturnidoecus tuleskovi*—female, 16. *Cuculiphilus fasciatus*—female, 17. *Philoaterus* sp.—female

swallow (*Cecropis daurica*), Rufous-tailed scrub-robin (*Cercotrichas galactotes*), Common nightingale (*Luscinia megarhynchos*), Paddyfield warbler (*Acrocephalus agricola*), Eurasian penduline-tit (*Remiz pendulinus*) and Rosy starling (*P. roseus*) were examined for lice for the first time in Türkiye. Among these birds, *Sturnidoecus* spp. found in Common rosefinch (*C. erythrinus*) *Bru. fuscopleura* and *Stu. pastoris* found in Rosy starling (*P. roseus*) were recorded for the first time in Türkiye, while lice were not detected in other species.

In a previous study (Dik et al. 2011a), 14 lice species were detected on birds in the Aras River Bird Ringing Station, but in the present study, 31 lice species (11 Amblyceran species in eight genera and 20 Ischnoceran species in 14 genera) were detected. In parallel with Dik et al. (2011a), most lice (17 species) were found on passerine birds. In addition, some specimens of the genus *Myrsidea* collected from Bank martin (*Riparia riparia*) and Common chiffchaff (*Phylloscopus collybita*) and several nymphal *Sturnidoecus* specimens collected from Common rosefinch (*Carpodacus erythrinus*) could not be identified to the species level. Unlike the previous study conducted by Dik et al. (2011a), some new bird species were examined for the lice infestations, and 15 lice species were reported for the first time in Türkiye.

Ricinus serratus from Crested lark (*Galerida cristata*) and *Phi. coarctatus* from Lesser grey shrike (*Lanus minor*) were reported for the first time (Çoban et al. 2021). Of these species, *Ric. serratus* was later recorded from Eurasian skylark (*Alauda ervensis*) and *Phi. coarctatus* was recorded for the second time from Lesser grey shrike (*Lan. minor*) (Yılmaz et al. 2022). In the present study, *Kurodaia fulvofasciata* from Levant sparrowhawk (*Accipiter brevipes*), *Deg. rufa* from Eurasian hobby (*Falco subuteo*), *Myrsidea* sp. from Common chiffchaff (*P. collybita*) and Bank martin (*R. riparia*) are reported for the first time from these bird species in Türkiye. *Columbicola columbae* detected in Eurasian sparrowhawk (*Accipiter nisus*) was probably transmitted from a pigeon it hunted and was therefore considered a "straggler".

Najer et al. (2020) collected some lice samples from *A. melanopogon* and identified them as *Phi.acrocephalus*. Najer et al., (2020) also gave a redescription of *Phi.acrocephalus*, but Mey (2020) stated that the samples of *Phi.acrocephalus* collected from *A. melanopogon* by Najer et al. (2020) were probably an unnamed species. In our study, the

female *Philoaterus* sample collected from *A. melanopogon* was measured with a head length of 0.48 mm, head width of 0.46 mm, head index: 1.04, preantennal length 0.23 mm, preantennal width 0.32 mm, postantennal length 0.20 mm, prothoracic width 0.28 mm, pterothoracic width 0.42 mm, abdominal length 0.99 mm, abdominal width 0.72 mm and total length 1.71 mm. Because the female sample was too translucent, some morphological features key to identification, such as dorsal and genital plates, particularly abdominal chaetotaxy (the length of the setae could not be evaluated because most of them were shed), could not be examined. The total length of our sample is greater than that reported by Carriker (1949) for *Phi.acrocephalus*. The structure of the head, the ratio of length and width, slight convexity of the preantennal region, the frons, the dorsal anterior plate (DAP) slightly concave anteriorly and convex laterally, the lengths of the preantennal and the postantennal region are similar to those reported by Najer et al. (2020). However, we observed that the ocular setae and postocular setae were shorter than the marginal temporal setae, and the length of the thoracic setae was different from the drawing of Najer et al. (2020). Therefore, we concluded that this species is different from the species described as *Phi.acrocephalus* by Carriker (1949) and Najer et al. (2020), as stated by Mey (2020).

Philoaterus coarctatus was described by Scopoli (1763) as *Pediculus coarctatus* from Red-backed shrike (*Lanius collurio*). Fedorenko (1973) described *Philoaterus magnus* from Lesser grey shrike (*L. minor*). Zlotorzycza (1964) reported that *Docophorus coarctatus coarctatus* was detected on Red-backed shrike (*L. colluro*) and *Docophorus coarctatus fuscicollis* in Great grey shrike (*Lanius excubitor*). Price et al. (2003) reported that the genus *Docophorus* is a synonym of the genus *Philoaterus* and also *Phi. magnus* is a synonym of *Phi. coarctatus*. Price et al. (2003) also highlighted that the hosts of *Phi. coarctatus* are Red-backed shrike, Great grey shrike and Lesser grey shrike. In this study, five female *Philoaterus* samples were collected from Lesser grey shrike and all of them were identified as *Phi. coarctatus*, which is the first report the louse species in Türkiye.

Pediculus hirundinis was described by Schrank (1803) from Western house-martin (*Delichon urbicum*), but he did not provide detailed information on this species. Nitzsch (1818) used the name *Phi. excisus* [= *Philoaterus (Docophorus) excifus*] for this species. He also stated that the hosts of this species were Barn swallow (*Hirundo rustica*) and Western house-martin. Piaget (1871) described *Docophorus hirundinis* and stated that the hosts of this species were Barn swallow and Western house-martin. Zlotorzycza (1964) and Emerson (1972) stated that the host of *Phi. excisus* (= *Cypseloecus excisus*) is Western house-martin, while the host of *Phi. microsomaticus* Tandan 1955 (= *Docophorus hirundinis*, *Cypseloecus hirundinis*) is Barn swallow. In

this study, three female (♀) *Philopterus* samples collected from Western house-martin were identified as *Phi. excisus* and one male (♂) *Philopterus* sample collected from Barn swallow was identified as *Phi. microsomaticus*. The morphological characteristics and measurements of these species were found to be compatible with those of Clay and Hopkins (1960) and Tandan (1955), respectively. With this study, the presence of *Phi. excisus* and *Phi. microsomaticus* species in Türkiye was reported for the first time.

In Türkiye, *Brueelia domestica* was previously reported (Açıcı et al. 2011) from Barn swallow. Gustafsson and Bush (2017) reported that this species is a synonym of *Acronirmus gracilis* (Burmeister, 1838), that the main host of this species is Western house-martin; but that it is seen in many other Hirundinidae species, including Barn swallow. Therefore, in this study, *Brueelia*-complex samples collected from Barn swallow were identified as *Acr. gracilis*.

We collected 5♀ and 5♂ *Brueelia currucae* from two *C. curruca*. This is the first report of *Bru. currucae* in Türkiye. The morphological characteristics of our specimens were similar to *Bru. currucae* described by Bechet (1961).

Balát (1958) described *Penenirmus buresi* from Black-headed bunting (*Emberiza melanocephala*) and Ortolan bunting (*Emberiza hortulana*), but he did not give detailed information about this species. Gustafsson and Bush (2017) moved this species to the genus *Rostrinirmus*. In a previous study, a nymphal specimen of *Penenirmus* was collected from *E. melanocephala* in Türkiye (Dik et al. 2015), but it was not identified to the species level. In the present study, we collected a female specimen of *Rostrinirmus buresi* on Black-headed bunting. This is the first report of *Ros. buresi* in Türkiye. Our specimen was slightly larger (1.77 mm) than the specimens of Balát (1958), but other morphological characters were compatible with Balát's specimens. In the same study, Balát (1958) described a new louse species, namely *Str. tuleskovi*, from Eurasian scops owl (*O. scops*), and reported *Stu. pastoris* and *Bru. fuscopleura* on Rosy starling (*P. roseus*). *Brueelia fuscopleura* (= *Degeeriella cruciata fuscopleura*) was described on *P. roseus* by Blagoveshtchensky (1951), while *Brueelia gulabitylar* was described on *P. roseus* by Ansari (1955), but neither of them provided sufficient information about this lice species nor any drawings or pictures. Gustafsson and Bush (2017) highlighted that *Bru. gulabitylar* was inseparable from *Bru. fuscopleura* based on their original descriptions. Therefore, they suggested that *Bru. gulabitylar* was a junior synonym of *Bru. fuscopleura*. In this study, we reported *Stu. pastoris* and *Bru. fuscopleura* in Türkiye for the first time.

Myrsidea rustica was originally described by Giebel (1874) under the name *Menopon rusticum* from Barn swallow. Conci (1942) redescribed *Myr. rustica* and emphasized that no difference was observed between the measurements

and chaetotaxy of the samples collected from Barn swallow and Western house-martin. Malysheva et al. (2018), citing some sources, also reported that *Myr. rustica* was observed in Western house-martin. In the present study, we collected *Phi. excisus* and *Myr. rustica* on Western house-martin. *Philopterus excisus* is reported for the first time in Türkiye, while Western house-martin is new host association for *Myr. rustica* in Türkiye.

Penenirmus auritus is a cosmopolitan species seen in many birds in the order Piciformes and has been reported from many woodpecker species (Price et al. 2003). This species has also been found in Syrian woodpecker (*Den. syriacus*) (Eichler 1953; Emerson and Johnson 1961; Diakou et al. 2017; Malysheva et al. 2018). Girişgin et al. (2022) could not detect louse infestation on Syrian woodpeckers in Bursa region. In this study, *Pen. auritus* (2♀) were detected on two of the six examined *D. syriacus*. To the best of our knowledge, the presence of *Pen. auritus* was detected for the first time in Türkiye with this study.

In previous studies, *Cuculicola latirostris* (Burmeister) and *Cuculoecus latifrons* were detected in Common cuckoo (*C. canorus*) in Türkiye (Açıcı et al. 2011; Dik et al. 2015). In the present study, *Cuc. latirostris* and *Cuculiphilus fasciatus* were collected on Common cuckoo, and *Cuc. fasciatus* was reported in Türkiye for the first time in this study.

Consequently, a total of 240 birds represented by 61 species belonging to 30 families in 13 orders were examined during the bird migration season in 2021. Seventy-two (30%) of 240 birds were found infested by lice. Thirty lice species belong to 11 amblyceran and 20 ischnoceran species represented in 22 genera were identified. With the current study, *Cuc. fasciatus* from Common cuckoo, *Pse. qadrii* from Spotted crane, *Philopterus* spp. from Moustached warbler, *Ric. serratus* from Crested lark, *Phi. picae* from Eurasian magpie, *Ros. buresi* from Black-headed bunting, *Sturnidoecus* spp. from Common rosefinch, *Phi. excisus* and *Myr. rustica* from Western house-martin, *Phi. microsomaticus* from Barn swallow, *Phi. coarctatus* from Lesser grey shrike, *Bru. fuscopleura* and *Stu. pastoris* from Rosy starling, *Bru. currucae* from Lesser whitethroat, *Pen. auritus* from Syrian woodpecker, and *Str. tuleskovi* from Eurasian scops owl were identified for the first time in Türkiye. On the other hand, *Kur. fulvofasciata* from the Levant sparrowhawk, *Deg. rufa* from Eurasian hobby, *Myrsidea* sp. from Common chiffchaff and Bank swallow were reported for the first time in Türkiye.

Although several studies have been conducted in Türkiye, more than half of the avifauna of Türkiye has not yet been examined for lice infestations. Therefore, we have no information on the lice host associations of many birds of Türkiye. To determine the exact lice fauna of Türkiye, we recommend that focused studies should be conducted on the poorly studied bird species.

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Author contribution B.D., A.Ç., Ç.H.Ş., M.A.K. and E.Ç. conceived and designed the study; Ç.H.Ş. obtained the funding for field research and directed the ornithological field work for specimen collection; A.Ç., B.Ç., E.Ç. M.A.K. and Ç.H.Ş. collected the data; B.D., A.Ç. E.Ç. and A.K. processed and prepared data for analysis; B.D., A.Ç. E.Ç. and A.K. analyzed the data; B.D., A.Ç. E.Ç. and A.K. prepared figures; B.D., A.Ç. E.Ç. and A.K. wrote the manuscript; B.D., A.Ç., A.K. and Ç.H.Ş. revised and corrected the manuscript. All authors read and approved the final manuscript.

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Data availability Not applicable.

Declarations

Ethical Approval Field ornithological research and bird ringing were conducted with the permission of Türkiye's Ministry of Agriculture and Forestry, General Directorate of Nature Conservation and National Parks (Permission number: E-21264211–288.04–2480918). Ethical Principles in Animal Research permission was approved by the Kafkas University Animal Ethical Committee (permit number KAÜ-HADYEK/2021–100).

Consent to participate and consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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