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RESEARCH ARTICLE

New records of feather mites (Sarcoptiformes: Astigmata) from some birds in Türkiye

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ABSTRACT: Feather mites (Astigmata: Analgoidea and Pterolichoidea) are commensal ectosymbionts permanently living on avian hosts. The study was based on parasitological examination of 59 bird specimens representing 28 species from the orders Accipitriformes, Apodiformes, Columbiformes, Passeriformes, Pelecaniformes, and Strigiformes collected in Artvin, Samsun, and Sakarya, Türkiye. We recovered 18 feather mite species from the families Avenzoariidae, Eustathiidae, Gabuciniidae, Kramerellidae, Proctophyllodidae and Pterolichidae. Among them, 11 species are recorded for the first time in Türkiye: *Ardeacarus ardeae* (Canestrini, 1878), *Chauliacia securigera* (Robin, 1877), *Eustathia cultrifera* (Robin, 1877), *Gabucinia delibata* (Robin, 1877), *Kramerella aluconis* (Lönnfors, 1937), *K. lunulata* (Haller, 1878), *Michaelia heteropus* (Michael, 1881), *Neochauliacia minuscula* Gaud and Atyeo, 1967, *Proctophyllodes musicus* Vitzthum, 1922, *Pterodectes rutilus* Robin, 1877 and *Scutomegninia phalacrocoracis* Dubinin and Dubinina, 1940.

Keywords: Acari, avian parasites, bird parasites, fauna, first record.
Zoobank: https://zoobank.org/D7E54A9B-B8C4-456F-903C-C1F752225C61

INTRODUCTION

Feather mites (Acari: Astigmata) are small arthropods that live permanently as parasitic or commensal ectosymbionts on birds and can inhabit the wing, tail, and body feathers (plumicoles), cavities of feather quills (syringicoles), feather follicles and skin (dermicoles) of their hosts (Gaud and Atyeo, 1996; Dabert and Mironov, 1999; Proctor, 2003). These mites are currently arranged into two superfamilies (Analgoidea and Pterolichoidea) and altogether include over 2500 described species (Proctor and Owens, 2000; Mironov, 2016).

The effect of feather mites on birds is a phenomenon that varies between parasitism and commensalism. Up to now, studies conducted have shown that feather mites consume as a food such substances as uropygial oil, ceratinous content of rachis, skin residues, and also, by chance, spores, pollen, fungi and other organic materials stuck to feathers (Walter and Proctor, 2013). Unlike arthropods such as ticks, chiggers, chewing lice, fleas and louse flies that parasitize birds, the mouth structure of feather mites is not chewy or bloodsucking, but has a gnawing structure (Proctor and Owens, 2000).

In several past decades, the studies on feather mites in the world increased day by day, but when we look at the acarological literature, there are only a few works on feather mites in Türkiye (Eren and Açıcı, 2022). The first information about feather mites in Türkiye begins with the report of *Diplaegidia columbae* (Buchholz, 1869) (as *Megninia columbae*) and *Falculifer rostratus* (Buchholz, 1869) on the rock pigeons *Columba livia* in the book "Turkey Parasites and Parasitological Publications (In Turkish: Türkiye Parazitleri ve Parazitolojik Yayınları)" (Merdivenci, 1970). In the subsequent years, except for two studies (Gürler et al., 2013; Per and Aktaş, 2018), mostly narrow-scoped studies were conducted and only 45 feather mites have been reported so far from a small number of bird species (Eren and Açıcı, 2022; Eren et al., 2022). The aim of this study is to contribute to the knowledge on feather mite diversity in Türkiye.

MATERIALS AND METHODS

The present study is based on parasitological examination of dead bird carcasses brought to the Parasitology Department of the Faculty of Veterinary Medicine, the Ondokuz Mayıs University (Samsun, Türkiye), in 2022 (as shown in Table 1). Feather mite specimens were collected manually under a stereomicroscope using point tip tweezers and preserved in tubes with 70% ethanol. For identification, a representative number of mites from collected samples were cleared 48 hours with lactophenol (Karatepe and Karatepe, 2015) and then mounted on microscope slides in the Hoyer's medium (Evans, 1992). Although Hoyer's medium possesses cleaning properties, the well-developed integument of the mites can preclude the desired clearing. Therefore, feather mite samples can be more easily identified by clearing them with lactophenol before mounting (see also: Atyeo and Braasch, 1966; Orwig, 1967). Mite species were identified under a light microscope (Nikon Eclipse 80i, Nikon, Tokyo, Japan) using corresponding diagnostic keys and careful descriptions (Atyeo and Braasch, 1966; Atyeo and Peterson, 1967; Kwanyuen, 1973; Gaud and Atyeo, 1976, 1982; Mironov, 1989, 1990; Gaud and Barre, 1992; Valim and Hernandes, 2006; Peterson et al., 2007; Han et al., 2016;

Table 1. The identified feather mites and their hosts.

Bird species	Bird family	Number of examined birds	Number of infected birds	Mite species
Strigiformes				
Athene noctua	Strigidae	1	1	*Kramerella lunulata*
Strix aluco		3	1	*Kramerella aluconis*
Tyto alba	Tytonidae	1	1	*Proctophyllodes troncatus**
Apodiformes				
Apus apus	Apodidae	4	2	*Chauliacia securigera* *Eustathia cultrifera* *Neochauliacia minuscula*
Charadriiformes				
Chroicocephalus ridibundus	Laridae	1	1	*Zachvatkinia larica*
Scolopax rusticola	Scolopacidae	1	1	*Proctophyllodes scolopacinus*
Pelecaniformes				
Ardea alba	Ardeidae	1	1	*Ardeacarus ardeae*
Ardea cinerea		1	1	*Scutomegninia phalacrocoracis**
Suliformes				
Phalacrocorax carbo	Phalacrocoracidae	1	1	*Michaelia heteropus*
Columbiformes				
Columba livia	Columbidae	7	2	*Diplaegidia columbae* *Falculifer rostratus*
Streptopelia decaocto		1	1	*Falculifer rostratus*
Passeriformes				
Corvus cornix	Corvidae	3	1	*Gabucinia delibata*
Delichon urbicum	Hirundinidae	1	1	*Pterodectes rutilus*
Phoenicurus ochruros	Muscicapidae	1	1	*Proctophyllodes mesocaulus*
Sylvia atricapilla	Sylviidae	1	1	*Proctophyllodes sylviae*
Turdus merula	Turdidae	2	1	*Proctophyllodes musicus*

Number (n) of examined and no infected birds: *Buteo buteo* (n: 4), *Buteo rufinus* (n: 5) and *Pernis apivorus* (n: 1) from the order Accipitriformes; *Larus michahellis* (n: 3) from the order Charadriiformes; *Ardea purpurea* (n: 1) and *Ciconia ciconia* (n: 7) from the order Pelecaniformes; *Rallus aquaticus* (n: 1) from the order Gruiformes; *Spilopelia senegalensis* (n: 1) from the order Columbiformes; *Erithacus rubecula* (n: 1), *Parus major* (n: 1), *Passer domesticus* (n: 2) and *Turdus philomelos* (n: 1) from the order Passeriformes.
*Contamination.

Negm and Hassan, 2019). Mite specimens were photographed with a microscope integrated camera (Mshot Mdx4-t, Guangzhou, China). The scale bars on all the mite images are given in as micrometers (µm). In addition, all remaining specimens of examined feather mite samples are preserved in Eppendorf tubes with 70% ethanol in the Parasitology laboratory museum where the study has been carried out.

RESULTS AND DISCUSSION

Superfamily Analgoidea Trouessart and Mégnin, 1884

Family Analgidae Trouessart and Mégnin, 1884

Subfamily Megniniinae Gaud and Atyeo, 1982

Genus *Diplaegidia* Hull, 1932

***Diplaegidia columbae* (Buchholz, 1869)**

Materials examined. 4 males and 4 females from flight feathers of the rock pigeon, *Columba livia* Gmelin, 1789 (Columbiformes: Columbidae), Artvin, Türkiye, 14 June 2022, coll. G. Eren; 4 males and 4 females from the same host species, Samsun, Türkiye, 22 February 2022, coll. M. Öztürk.

Remarks. The genus *Diplaegidia* has included seven species so far, and all of them are associated with birds of the order Columbiformes (Černý, 1975; Gaud, 1976). *Diplaegidia columbae*, which we report in this study, has been reported several times from the rock pigeons, *Columba livia*, and its domestic form, *Columba livia domestica*, in previous studies in Türkiye (Merdivenci, 1970). In addition to the studies in Türkiye, *D. columbae*, has been reported so far on birds of the genera *Columba* Linnaeus, 1758 and *Streptopelia* Bonaparte, 1855 in Africa (Gaud 1976), *Zenaida* Bonaparte, 1838 in North and South America (Goulart et al., 2011; Grossi and Proctor, 2021) and also on the *Columba livia* in Europa (Rózsa 1990). The feather mite, *D. columbae*, is a potential source of allergens for domestic pigeon breeders or people who have close contact with pigeons (Fernández-Caldas et al., 2020).

Family Avenzoariidae Oudemans, 1905

Subfamily Bonnetellinae Atyeo and Gaud, 1981

Genus *Scutomegninia* Dubinin, 1951

***Scutomegninia phalacrocoracis* Dubinin and Dubinina, 1940**

Materials examined. 1 male and 1 tritonymph from flight feathers of the grey heron, *Ardea cinerea* Linnaeus, 1758 (Pelecaniformes: Ardeidae), Samsun, Türkiye, 7 February 2022, coll. M. Öztürk (as shown in Fig. 1).

Remarks. The genus *Scutomegninia* includes fourteen described species associated with birds of the order Pelecaniformes (Anhingidae, Phalacrocoracidae, Sulidae Pelecanidae, and Threskiornithidae) (Mironov, 2000). In fact, *Scutomegninia phalacrocoracis* is associated with the great cormorant, *Phalacrocorax carbo*, and its finding on the grey heron in this study is certainly a case of accidental contamination. As a matter of fact, *S. phalacrocoracis* has been reported a few on cormorant *Phalacrocorax* hosts in African, Asia, and Europe (Atyeo and Peterson, 1967; Mironov, 1990).

Genus *Zachvatkinia* Dubinin, 1949

***Zachvatkinia larica* Mironov, 1989**

Materials examined. 2 males and 1 tritonymph from flight feathers of the black-headed gull, *Chroicocephalus ridibundus* (Linnaeus, 1766) (Charadriiformes: Laridae), Samsun, Türkiye, 1 January 2022, coll. M. Öztürk.

Remarks. The genus *Zachvatkinia* currently includes eighteen species that are associated with birds belonging to the order Charadriiformes (Dromadidae, Laridae, Stercorariidae and Sternidae) and Procellariiformes (Diomedeidae, Hydrobatidae, Oceanitidae, and Procellariidae) (Negm et al., 2013). In studies conducted to date, *Zachvatkinia larica* has been reported from over 20 species and subspecies of gulls worldwide (Asia, Europe, and America) (Mironov, 1989; Han et al., 2016). In Türkiye, this mite species has been reported so far only from the yellow-legged gull, *Larus michahellis* Naumann, JF, 1840 (Eren et al., 2022).

Family Proctophyllodidae Mégnin and Trouessart, 1884

Subfamily Pterodectinae Park and Atyeo, 1971

Genus *Pterodectes* Robin, 1877

***Pterodectes rutilus* Robin, 1877**

Materials examined. 4 males from flight feathers of the common house martin, *Delichon urbicum* (Linnaeus, 1758) (Passeriformes: Hirundinidae), Samsun, Türkiye, 21 June 2022, coll. M. Öztürk (as shown in Fig. 2).

Remarks. The genus *Pterodectes* is monotypic, and its only representative, *Pterodectes rutilus*, is a cosmopolitan mite occurring on swallows (Hirundinidae) worldwide (Asia, Africa, Europe, and South America). Although this mite species most commonly occurs on the barn swallow, *Hirundo rustica* Linnaeus, 1758, in the studies conducted so far, it has also been reported on the following of hirundinids: *Atticora melanoleuca* (Wied, 1820), *D. urbicum* (Linnaeus, 1758), *H. nigrita* Gray, 1845, *Riparia riparia* (Linnaeus, 1758), *R. paludicola* (Vieillot, 1817), and *Stelgydopteryx ruficollis* (Vieillot, 1817) (Valim and Hernandes, 2008). In our study, *P. rutilus* from *D. urbicum* has been reported for the first time in Türkiye.

Subfamily Proctophyllodinae Mégnin and Trouessart, 1884

Genus *Proctophyllodes* Robin, 1877

Remarks. The genus *Proctophyllodes* with 184 described species is most species-rich genus among all feather mite families (Mironov, 2012; 2019; Pedroso and Hernandes, 2021). Mites of this genus are mainly associated with birds of the order Passeriformes, with a few species from birds of the orders Apodiformes, Charadriiformes and Piciformes (Atyeo and Braasch, 1966; Mironov and Hallan, 2022). In studies previously conducted in Türkiye, ten species of this genus, *Proctophyllodes cetti* Badek, Mironov and Dabert, 2008, *P. clavatus* Fritsch, 1961, *P. doleophyes* Gaud, 1957, *P. lusciniae* Burdejnaja and Kivganov, 2009a, *P. mesocaulus* Mac-Fira and Cristea, 1968, *P. rubeculinus* (Koch, 1941), *P. scolopacinus* Vitzthum, 1929, *P. stylifer* (Buckholz 1869), *P. sylviae* Gaud, 1957 and *P. troncatus* Mégnin, 1877, have been reported so far (Eren and Açıcı, 2022).

***Proctophyllodes mesocaulus* Mack-Fira and Cristea-Nastasescu, 1968**

Materials examined. 4 males and 4 females from flight feathers of the black redstart, *Phoenicurus ochruros* (Gmelin, 1774) (Passeriformes: Muscicapidae), Artvin, Türkiye, 21 January 2022, coll. G. Eren.

Remarks. The feather mite *Proctophyllodes mesocaulus* was previously known only from the common redstart, *Phoenicurus phoenicurus* (Linnaeus, 1758), in Europe (Romania) (Mack-Firă and Cristea-Năstăsescu, 1968; Mironov et al., 2022). The finding of *Proctophyllodes mesocaulus* on *Ph. ochruros* is a new host record for this mite.

***Proctophyllodes musicus* Vitzthum, 1922**

Materials examined. 4 males and 4 females from flight feathers of the common blackbird, *Turdus merula* Linnaeus, 1758 (Passeriformes: Turdidae), Artvin, Türkiye, 22 June 2022, coll. G. Eren (as shown in Fig. 2).

Remarks. The feather mite *Proctophyllodes musicus* is restricted to thrushes of the genus *Turdus* (Turdidae) and it has been reported from birds of this genus in Africa, Asia, and Europe (Atyeo and Braasch, 1966). *Proctophyllodes musicus* on the common blackbird, *Turdus merula*, is reported herein for the first time in Türkiye.

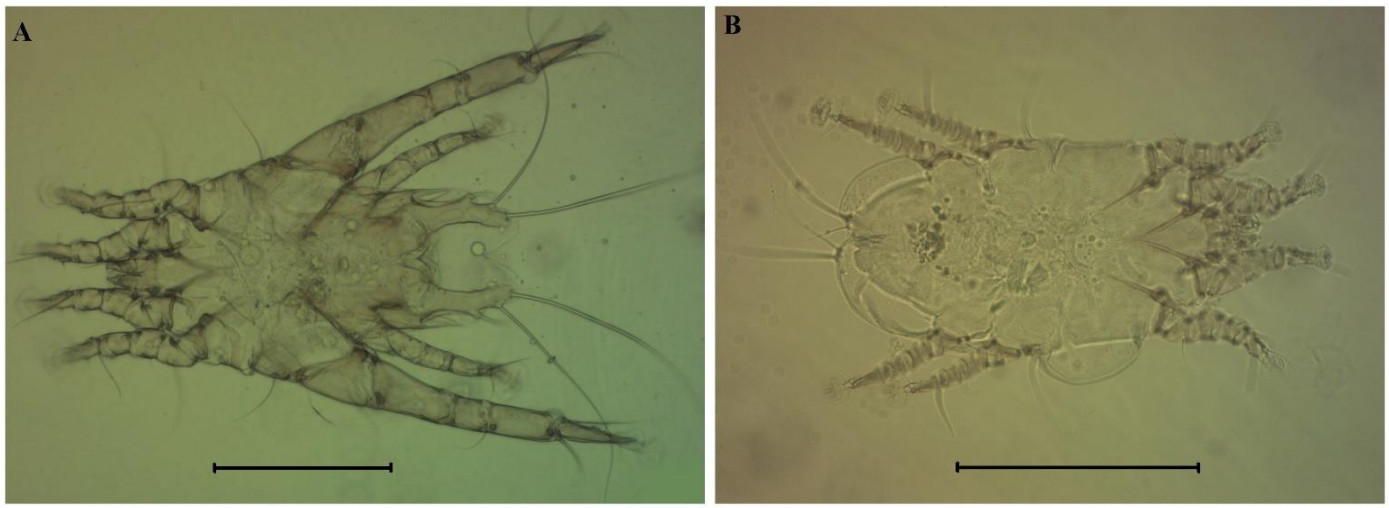

Figure 1. *Scutomegninia phalacrocoracis*—**A.** Male, **B.** Tritonymph (scale bars: 200).

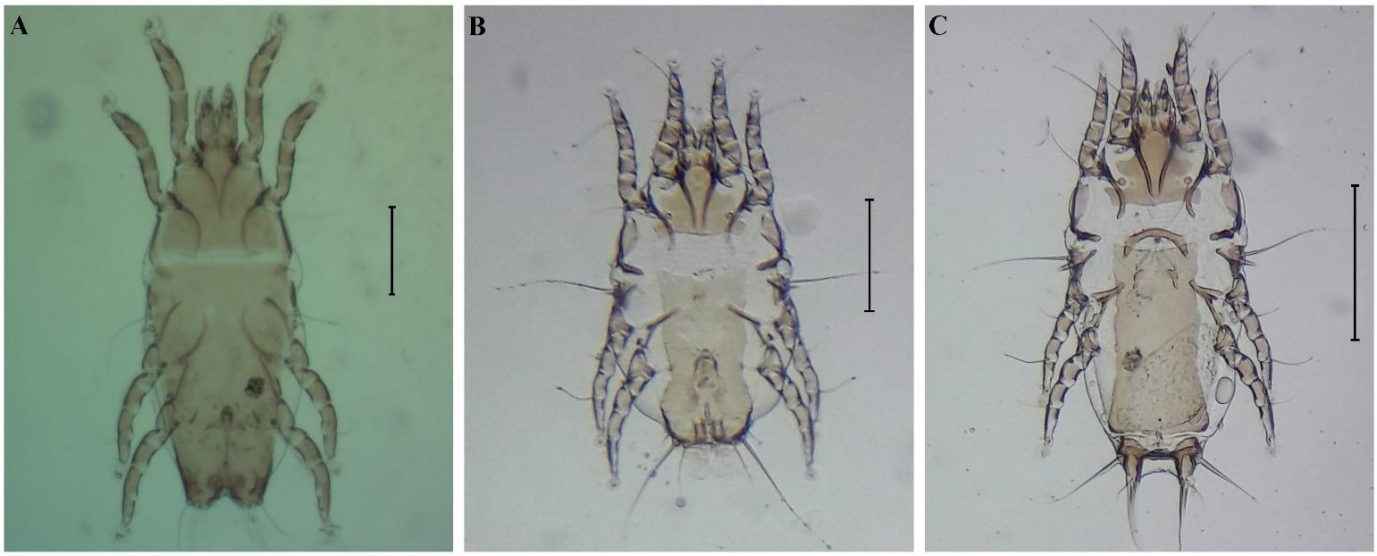

Figure 2. Mites of the family Proctophyllodidae—**A.** *Pterodectes rutilus*, male (scale bar: 100), **B-C.** *Proctophyllodes musicus*, male (scale bar: 200) and female (scale bar: 100).

***Proctophyllodes scolopacinus* (Koch, 1842)**

Materials examined. 4 males and 4 females adult from flight feathers the Eurasian woodcock, *Scolopax rusticola* Linnaeus, 1758 (Charadriiformes: Scolopacidae), Samsun, Türkiye, 27 January 2022, coll. M. Öztürk.

Remarks. The feather mite *Proctophyllodes scolopacinus* is associated with the Eurasian woodcock, *S. rusticola*, in Europe and Asia, and the American woodcock, *Scolopax minor*, in North America and (Atyeo and Braasch, 1966). In studies previously conducted in Türkiye, *P. scolopacinus* from the Eurasian woodcock, *S. rusticola* has been reported (Gürler et al., 2013).

***Proctophyllodes sylviae* Gaud, 1957**

Materials examined. 4 males and 4 females from flight feathers of the Eurasian blackcap, *Sylvia atricapilla*; (Passeriformes: Sylviidae), Samsun, Türkiye, 30 May 2022, coll. M. Öztürk.

Remarks. The feather mite *Proctophyllodes sylviae* is associated with the Eurasian blackcap, *Sylvia atricapilla*, in Europa and Africa (Gaud, 1957; Atyeo and Braasch, 1966). In studies previously conducted in Türkiye, *P. sylviae* from the common reed warbler *Acrocephalus scirpaceus*, the Cetti's warbler *Cettia cetti*, the common chiffchaff *Phylloscopus collybita*, the Eurasian blackcap *Sylvia atricapilla*, the garden warbler *S. borin*, the common whitethroat *S. communis*, the lesser whitethroat *S. curruca*, and the Sardinian warbler *S. melanocephala* has been reported (Gürler et al., 2013; Per and Aktaş, 2018).

***Proctophyllodes troncatus* Robin, 1877**

Materials examined. 1 male and 1 tritonymph from flight feathers the barn owl, *Tyto alba* (Strigiformes: Tytonidae), Samsun, Türkiye, 1 January 2022, coll. by M. Öztürk.

Remarks. The feather mite *Proctophyllodes troncatus* is associated with the sparrows of the genus *Passer* (Passeridae) in worldwide (Europa, Asia, Africa, and America) (Atyeo and Braasch, 1966; Gaud and Atyeo, 1976), and the finding on the barn owl, *Tyto alba*, in this study is most probably a case of contamination most probabaly caused by the interaction between prey and predator. In studies previously conducted in Türkiye, *P.*

troncatus from the house sparrow *Passer domesticus* and the Spanish sparrow *P. hispaniolensis* has been reported (Gürler et al., 2013).

Superfamily Pterolichoidea Trouessart and Mégnin, 1984

Family Eustathiidae Oudemans, 1905

Remarks. The family Eustathiidae is restricted to swifts (Apodiformes: Apodidae and Hemiprocnidae). Up to now, this family has included 63 described species in 16 genera (Kwanyuen, 1973; Peterson et al., 1980). In studies conducted so far, three aforementioned eusththiid species, *Eustathia cultrifera*, *Chauliacia securigera*, *Neochauliacia minuscula*, and also *Thysanocercus cypseli* (Canestrini and Berlese, 1881) (Analgoidea: Thysanocercidae) are known to be common on *Apus apus* (Kwanyuen, 1973; Peterson et al., 1980; Gaud and Peterson, 1987).

Genus *Chauliacia* Oudemans, 1905

***Chauliacia securigera* (Robin, 1877)**

Materials examined. 2 males from flight feathers of the common swift, *Apus apus* (Linnaeus, 1758) (Apodiformes: Apodidae), Samsun, Türkiye, 10 May 2022, coll. M. Öztürk (as shown in Fig. 3).

Remarks. The genus *Chauliacia* includes six described species associated with birds of the order Apodiformes in the Old World (Europe, Africa, and Asia) and the New World (North America and South America). In the previous studies conducted in world, *C. securigera* has been reported on the common swift *Apus apus*, the white-rumped swift *A. caffer*, the Horus swift *A. horus*, the Pacific swift *A. pacificus*, the pallid swift *A. pallidus*, the plain swift *A. unicolor*, and the African palm swift *Cypsiurus parvus* (Kwanyuen, 1973; Peterson et al., 1980). In the present study, three eustathiid species detected on *A. apus*, are new records for feather mite fauna in Türkiye.

Genus *Eustathia* Oudemans, 1905

***Eustathia cultrifera* (Robin, 1877)**

Materials examined. 2 males from flight feathers of the common swift, *Apus apus* (Linnaeus, 1758) (Apodiformes: Apodidae), Samsun, Türkiye, 10 May 2022, coll. M. Öztürk (as shown in Fig. 3).

Remarks. The genus *Eustathia* includes nine described species associated with birds of the order Apodiformes in the Old World (Europe, Africa, and Asia) and the New World (North America and South America). In the previous studies conducted in world, *Eustathia cultrifera* has been reported on the African black swift *Apus barbatus*, the common swift *Apus apus*, the little swift *A. affinis*, the white-rumped swift *A. cafferhas*, the Horus swift *A. horus*, the Pacific swift *A. pacificus*, and alpine swift *Tachymarptis* (*Apus*) *melba* been reported (Kwanyuen, 1973; Peterson et al., 1980).

Genus: *Neochauliacia* Gaud & Atyeo, 1967

***Neochauliacia minuscula* Gaud and Atyeo, 1967**

Materials examined. 2 males from flight feathers of the common swift, *Apus apus* (Linnaeus, 1758) (Apodiformes: Apodidae), Samsun, Türkiye, 10 May 2022, coll. M. Öztürk (as shown in Fig. 3).

Remarks. The genus *Neochauliacia* includes sixteen described species associated with birds of the order Apodiformes in the Old World (Europe, Africa, and Asia) and the New World (North America and South America). In the previous studies conducted in world, *N. minuscula* has been reported on the common swift *Apus apus*, the African black swift *A. barbatus*, the pallid swift *A. pallidusthe*, and alpine swift *Tachymarptis* (*Apus*) *melba* has been reported (Kwanyuen, 1973; Peterson et al., 1980).

Family Falculiferidae Oudemans, 1905

Genus *Falculifer* Railliet, 1896

***Falculifer rostratus* (Buchholz, 1869)**

Materials examined. 4 males and 4 females from flight feathers of the rock pigeon *Columba livia* Gmelin, 1789 (Columbiformes: Columbidae), Artvin, Türkiye, 14 June 2022, coll. G. Eren; 2 males and 2 females from the same host species, Samsun, Türkiye, 22 February 2022, coll. M. Öztürk; 4 males and 4 females from flight feathers of the Eurasian collared dove, *Streptopelia decaocto* (Frivaldszky, 1838) (Columbiformes: Columbidae), Sakarya, Türkiye, 20 July 2022, coll. G. Eren.

Remarks. The genus *Falculifer* includes ten described species associated with birds of the order Columbiformes in the Old World (Europe, Africa, and Asia) and the New World (North America, South America, and the West Indies) (Trouessart, 1898; Gaud, 1976; Gaud and Atyeo, 1976; Gaud and Barré, 1992). In the previous studies conducted in Türkiye, *Falculifer rostratus* has been reported on the rock pigeons, *Columba livia*, and its domestic form, *C. l. domestica* (Eren and Açıcı, 2022). The Eurasian collared dove *Streptopelia decaocto* is a new host record for *Falculifer rostratus* in Türkiye, although formerly it was reported from doves *Streptopelia* spp. and pigeons *Columba* spp. in the Africa (Egypt and Morocco), America (Brazil, Chile, and United States of America), Asia (China, India, Korea, and Russia), Europe (Bulgaria, France, Greece and Italy) (Gaud and Atyeo, 1976).

Family Freyanidae Dubinin, 1953

Subfamily Michaelichinae Gaud and Mouchet, 1959

Genus *Michaelia* Trouessart, 1884

***Michaelia heteropus* (Michael, 1881)**

Materials examined. 2 males and 2 females from flight feathers of the great cormorant, *Phalacrocorax carbo* (Linnaeus, 1758) (Pelecaniformes: Phalacrocoracidae), Samsun, Türkiye, 19 January 2022, coll. M. Öztürk (as shown in Fig. 4).

Remarks. The genus *Michaelia* includes five described species, and all of them are associated with

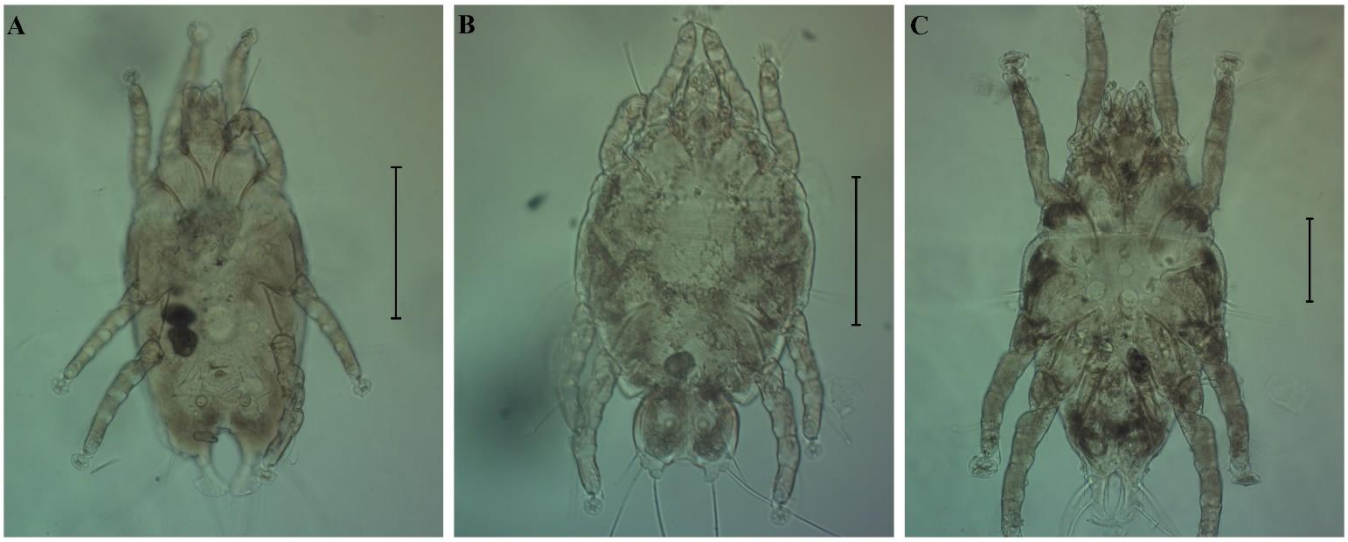

Figure 3. Mites of the family Eustathiidae—**A.** *Chauliacia securigera*, male, **B.** *Neochauliacia minuscula*, male, C. *Eustathia cultrifera*, male (scale bars: 100).

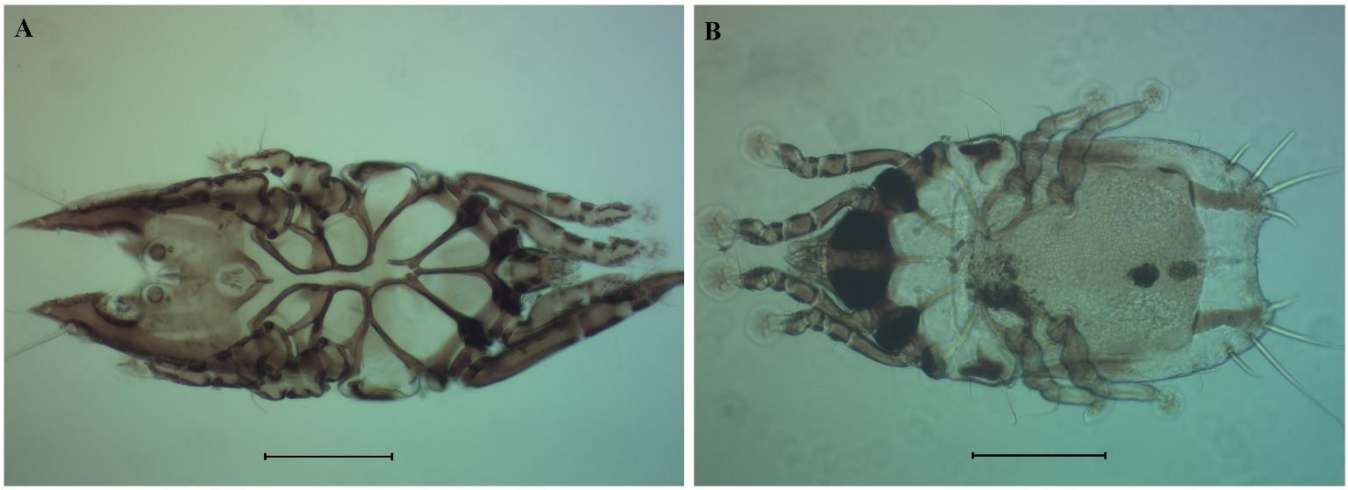

Figure 4. *Michaelia heteropus*—**A.** Male, **B.** Female (scale bars: 200).

cormorants (Phalacrocoracidae) in Africa, America, Asia, and Europe (Dubinin, 1953; Gaud and Atyeo, 1982; Hernandes et al., 2016). In the present study, *Michaelia heteropus* on the great cormorant, *Phalacrocorax carbo*, is reported for the first time in Türkiye.

Family Gabuciniidae Atyeo and Gaud, 1975

Genus *Gabucinia* Oudemans, 1905

***Gabucinia delibata* (Robin, 1877)**

Materials examined. 1 female and 1 tritonymph from flight feathers of the hooded crow, *Corvus cornix* Linnaeus, 1758 (Passeriformes: Corvidae), Samsun, Türkiye, 22 February 2022, coll. M. Öztürk (as shown in Fig. 5).

Remarks. All three presently known species of the genus *Gabucinia* —*Gabucinia delibata* (Robin, 1877), *G. gladiscapulata* Gaud, 1960 and *G. neotropica* Hernandes, 2020— are associated with crows Corvidae (Passeriformes) (Mironov et al., 2014). *Gabucinia delibata*, has been reported so far on hosts belonging to the genera *Corvus*, *Coloeus*, and *Pica* across the Holarctic region (Negm and Hassan, 2019; Hernandes, 2020); in the present study, it is reported on the hooded crow, *Corvus cornix*, for the first time in Türkiye.

Family Kramerellidae Gaud and Mouchet, 1961

Genus *Kramerella* Trouessart, 1916

***Kramerella aluconis* (Lönnfors, 1937)**

Materials examined. 3 males and 3 females from flight feathers of the tawny owl, *Strix aluco* Linnaeus, 1758 (Strigiformes: Strigidae), Artvin, Türkiye, 22 March 2022, coll. G. Eren (as shown in Fig. 6).

***Kramerella lunulata* (Haller, 1878)**

Materials examined. 1 male and 1 tritonymph from flight feathers of the little owl, *Athene noctua* (Scopoli, 1769) (Strigiformes: Strigidae), Samsun, Türkiye, 20 February 2022, coll. M. Öztürk (as shown in Fig. 6).

Remarks. The genus *Kramerella* currently includes 10 species associated with birds of the orders Strigiformes

Figure 5. *Gabucinia delibata*—**A.** Female, **B.** Tritonymph (scale bars: 100).

Figure 6. *Kramerella* species—**A-B.** *Kramerella aluconis*, male and female, **C.** *Kramerella lunulata*, male (scale bars: 100).

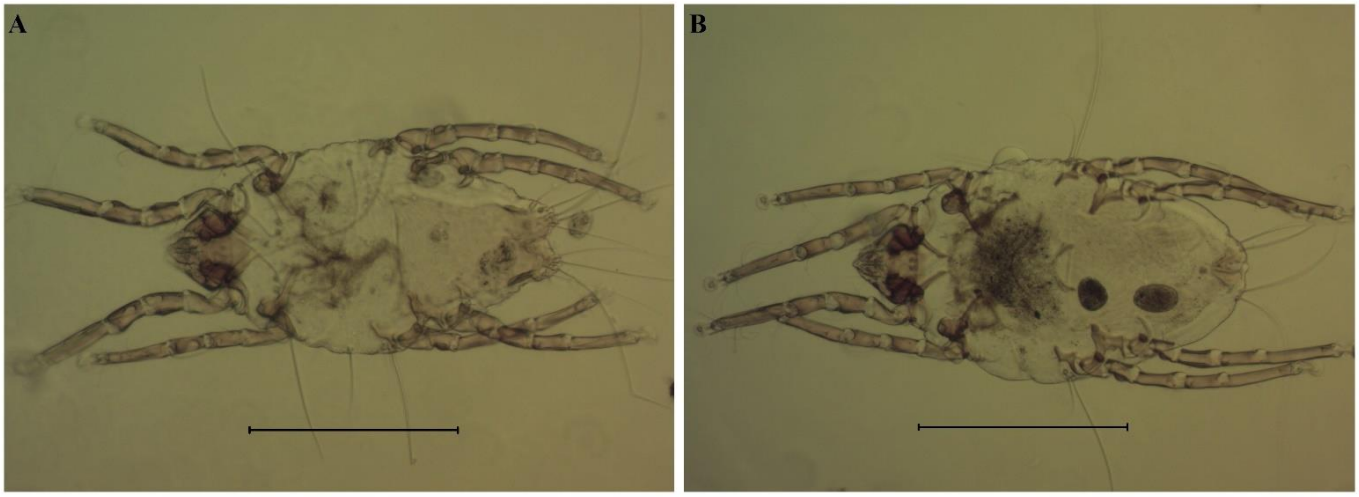

Figure 7. *Ardeacarus ardeae*—**A-B.** Male and female (scale bars: 200).

(Dubinin, 1953; Gaud, 1980; Gaud and Atyeo, 1996; Černý and Wiesner, 1992). In the previous studies in Africa and Eurasia, *Kramerella aluconis* was found on *Strix aluco*, and *K. lunulata* was formally reported from several owl species, *Athene noctua* (Scopoli, 1769), *Bubo lacteus* (Temminck, 1820), *Otus scops* (Linnaeus, 1758), and *Tyto alba* (Scopoli, 1769), as was summarized by Philips (2000). However, all subspecies, formerly recognized in *K. lunulata* and restricted to particular genera of owls (Dubinin, 1953), at present are considered full species (Gaud, 1980). Therefore, the reports of *K. lunulata* on hosts other than owls of the genus *Athene*, quite probabaly represent

records of other *Kramerella* species. *Kramerella aluconis* on *S. aluco* and *K. lunulata* on its type host, *A. noctua*, are reported herein for the first time in Türkiye.

Family Pterolichidae Trouessart and Mégnin, 1884

Subfamily Ardeacarinae Gaud, 1981

Genus *Ardeacarus* Dubinin, 1951

***Ardeacarus ardeae* (Canestrini, 1878)**

Materials examined. 1 male and 1 female from flight feathers of the great egret, *Ardea alba* Linnaeus, 1758 (Pelecaniformes: Ardeidae), Samsun, Türkiye, 2 February 2022, coll. M. Öztürk (as shown in Fig. 7).

Remarks. The genus *Ardeacarus* includes only one species, *Ardeacarus ardeae*, having a cosmopolitan distribution (Africa, Asia, Europe, and America), has been reported so far on herons of the genera *Ardea*, *Bubulcus*, *Butorides*, *Egretta*, *Ixobrychus*, and *Nycticorax* (Pelecaniformes: Ardeidae) (Dubinin, 1956; Černý, 1967; Gaud, 1981; Han et al., 2016). *Ardeacarus ardeae* on the great egret, *Ardea alba*, is reported herein for the first time in Türkiye.

Considering the investigations of the feather mite fauna conducted in Türkiye, it is remarkable that these studies were mainly carried out in coastal provinces of the Black sea, especially Samsun province (Gürler et al., 2013; Per and Aktaş, 2018). Other countries bordering the Black Sea seem to have similar ornithofauna with Türkiye according to checklists provided by the Avibase - World Bird Database (Lepage, 2022), and therefore it would not be wrong to predict that the feather mites faunas of the countries around the Black Sea will also show similarity. The studies carried out so far in these countries reported: about 300 feather mite species in entire Russia and the former USSR (Dubinin, 1953; 1956; Mironov, 1996; Mironov et al., 2022), including 146 species from only passerines in the coastal areas of Russian Black sea (Mironov et al., 2022); over 160 species in Ukraine (Burdejnaja and Kivganov, 2009a-c; 2011a,b; Kivganov and Chernichko, 2007; 2009a,b; 2012); over 150 species in Bulgaria (Kolarova, 2015; Kolarova and Ilieva, 2021), over 30 species in Romania (Constantinescu et al., 2013), and only 2 feather mites in Georgia/Sakartvelo (Bauer, 1939). The diversity of feather mite fauna in Türkiye, including to date 56 species in 34 genera and 15 families, takes the fourth places among the countries having a coast to the Black Sea (Eren and Açıcı, 2022; Eren et al., 2022; present study). De facto, when is compared the number of bird species in ornithoofaunas of the relevant countries according to the eBird database (2022), Türkiye places the second, with 496 bird species (versus Russia: 690; Bulgaria: 389; Georgia: 361; Ukraine: 361; Romania: 324). The main reason for the relatively low number of recovered feather mite fauna in Türkiye, comparing to the richness of its ornithofauna, is the incomparably limited number of parasitological studies of avian hosts conducted in this country. Although the first feather mite report in Türkiye dates back to the 1970s, the number of studies conducted in the past 50 years does not exceed a dozen. With this study, which is a continuation of the feather mite fauna studies in Türkiye, we aimed to contribute to ornitho-parasitological investigations.

Authors' contributions

Gökhan Eren: Conceptualization (supporting), data curation (supporting), formal analysis (lead), visualization (supporting), writing - original draft. **Mehmet Öztürk:** Investigation (equal), writing - review & editing (equal). **Sergey V. Mironov:** Conceptualization (lead), data curation (lead), formal analysis (supporting), investigation (equal), methodology, visualization (lead), supervision, writing - review & editing (equal). **Hatice Özlem Nisbet:** Investigation (equal), writing - review & editing (equal). **Mustafa Açıcı:** Investigation (equal), writing - review & editing (equal).

Statement of ethics approval

Ethical approval is not required as the study material consists of parasite samples collected from dead birds brought to the Parasitology Laboratory, Department of Parasitology, Faculty of Veterinary Medicine, Ondokuz Mayıs University, Samsun, Türkiye.

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Conflict of interest

No potential conflict of interest was reported by the authors.

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