FEATHER MITES (ACARIFORMES: ASTIGMATA) FROM THE BIRDS RINGED AT THE KARPAZ BIRD RINGING STATION (İSKELE, NORTH CYPRUS)

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ABSTRACT: Feather mites (Astigmata: Analgoidea and Pterolichoidea) examined in this study were collected from live birds captured and ringed in the autumn of 2024 at the Karpaz Bird Ringing Station. A total of 17 feather mite species from the families Proctophyllodidae (*Dolichodectes*—1, *Joubertophyllodes*—1, *Monojoubertia*—1, *Proctophyllodes*—10 species) and Trouessartiidae (*Trouessartia*—4 species) have been detected during the study. All of these are new records for the fauna of Cyprus. Males and females of all recorded species are illustrated in the provided photos.

KEY WORDS: Analgoidea, feather mites of Cyprus, *Proctophyllodes*, *Trouessartia*

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INTRODUCTION

Feather mites (Astigmata: Analgoidea and Pterolichoidea) are parasitic/commensal ectosymbiotic organisms living permanently on the feathers and skin of birds; they are characterized by a high level of host specificity (Gaud and Atyeo 1996; Dabert and Mironov 1999). Although there are over 2,600 identified species associated with birds, it is estimated that this number is only 15% of the current world feather mite fauna (Peterson 1975; Gaud and Atyeo 1996; Mironov 2003; Schatz *et al*. 2011; Rodrigues *et al*. 2015). Although there is sufficient information on the diversity and the number of birds in Cyprus (Charalambidou *et al*. 2016), the data on the feather mite diversity of this island is quite scanty: it includes only two reported species (Philips and Fain 1991). Considering that each bird species can host one to seven feather mites (Peterson 1975; Dabert and Mironov 1999; Valim *et al*. 2011), the feather mite fauna of Cyprus can be expected to exceed several hundred species.

Bird ringing stations, where a huge number of birds pass through the hands of researchers, allow to perform an effective investigation of regional bird fauna (Özkan *et al*. 2017); detect rare (Prünte *et al*. 2010) and migratory species (Karaardıç *et al*. 2017); investigate migration phenology and behavior (Karaardıç *et al*. 2006a, b; Erdoğan *et al*. 2008; Karaardıç 2022); and recover ectoparasitic faunas (Eren *et al*., 2025). Cyprus is an important stopover site along the Eastern European bird migration routes. This fact significantly increases the bird diversity on this Eastern Mediterranean island (Charalambidou *et al*. 2016). Although occasional short-term studies aimed at detecting avian diseases have been conducted (Kaiser *et al*. 1974), there was no station on Cyprus, where regular bird ringing studies have been carried out. In order to fill this gap and to investigate the migration ecology and behavior of birds, the Karpaz Bird Ringing Station (North Cyprus) was established in the northeast of the Dipkarpaz Island by the Taşkent Nature Park, Cyprus Wildlife Research Institute. The work of this station has started in the autumn of 2024. The aim of the present study is to report the feather mites detected on birds subjected to an ectoparasitic examination during the 2024 autumn ringing studies at the aforementioned station.

MATERIALS AND METHODS

The material for this study was collected from birds examined for the presence of ectoparasites. Mite samples were collected using blunt-tipped forceps under a stereo microscope (Leica EZ4, Wetzlar, Germany). After extraction, the samples were stored in Eppendorf tubes with 70% ethanol. In laboratory conditions, representative numbers

of mites from each sample were cleaned with lactophenol for a period of 24–48 hours at room temperature (20–24 °C), after which they were mounted using Hoyer's medium (Evans 1992). Afterwards, transparent nail polish was applied around the coverslips and glued. Permanent preparations of feather mites were identified under a light microscope (Olympus CX23, Tokyo, Japan) using previously published keys and descriptions (Mack-Firă and Cristea-Năstăsescu 1968; Atyeo and Gaud 1970, 1971; Santana 1976; Atyeo and Braasch 1966; Badek *et al*. 2008; Mironov *et al*. 2015).

All detected species were photographed with a camera integrated into the microscope (Figs. 1–9). Representative preparations of each mite species, detected on each host, have been deposited in two separate places: PAU (Pamukkale University, Faculty of Science, Department of Biology, Acarology Laboratory, Denizli, Türkiye) and the personal collection of Dr. Gökhan Eren.

RESULTS AND DISCUSSION

Cyprus, the third largest island in the Mediterranean, has many different habitat types (e.g., wetlands, forests, scrublands and agricultural lands) and is located along the migration routes of birds (the Western Palearctic–Africa route and the Balkans–Africa route). These factors have made the ornithofauna of the island diverse and rich. Over 400 bird species have been reported from Cyprus so far (Charalambidou *et al*. 2016). However, investigations of ectoparasites on the birds of Cyprus are quite scanty. Only a few studies have been conducted so far; they reported a small number of chewing lice (Clay and Hopkins 1951; Price and Beer 1963a, b; Price and Hellenthal 1998; Palma 2011; Gustafsson and Olsson 2012; Gustafsson and Bush 2017), ticks (Kaiser *et al*. 1974; Ioannou *et al*. 2009), hippoboscid flies (Bequaert 1939; Maa 1969) and two feather mites of the family Epidermoptidae (Philips and Fain 1991). The two epidermoptid feather mites, having foretic relations with the hippoboscid flies, were: *Myialges anchora* Trouessart, 1906 from the fly *Pseudolynchia canariensis* (bird host unknown; locality: Limassol); and *Promyialges pari* Fain, 1965 from the fly *Ornithophila metallica,* recorded from the common kestrel *Falco tinnunculus* (locality unknown).

During our study, feather mites were detected on 61 of the 171 examined host individuals (35.67%). The hosts included representatives of 20 species, of which 19 were passerines of 11 families (Passeriformes) and one kingfisher (Coraciiformes: Alcedinidae) (Table 1). No feather mite infestation was detected on three bird species: the kingfisher, *Alcedo attis,* and two passerines, *Sylvia borin* and *Troglodytes troglodytes*. The feather mite genera *Proctophyllodes* Robin, 1868 and *Trouessartia* Canestrini, 1899 were most diverse: they were found on 12 and 6 bird species, respectively. As a result of the identification, 17 species of feather mites have been recovered. Thirteen of them belong to the family Proctophyllodidae (14 species), and four—to the family Trouessartiidae (4 species). All feather mite species identified are new records for the feather mite fauna of Cyprus.

Family **Proctophyllodidae**. In the present study, feather mite infestations (predominantly from the family Proctophyllodidae) were detected only on the members of the order Passeriformes (Table 1). Proctophyllodidae currently includes over 500 species spread across 50 genera and two subfamilies (Proctophyllodinae and Pterodectinae), making it the largest group among all feather mites (Mironov 2009, 2019; Hernandes and Valim 2014). The feather mites of this family generally live in corridors on the ventral surfaces of the flight and tail feathers (Mironov 2019). The proctophyllodids, discussed in the present study, belong to four genera: *Dolichodectes* Park and Atyeo, 1971, *Joubertophyllodes* Atyeo and Gaud, 1971, *Monojoubertia* Radford, 1950 and *Proctophyllodes* Robin, 1868.

***Dolichodectes* (Pterodectinae)**. All species of this genus are associated with the passerine hosts of the Old World (Africa, Asia and Europe) (Park and Atyeo 1971; Constantinescu *et al*. 2018). Of the genus's 11 described species, only *D. edwardsi* (Trouessart, 1885) is widely distributed in the Old World, infesting hosts of the genera *Acrocephalus* (Acrocephalidae) and *Phylloscopus* (Phylloscopidae). *Dolichodectes hispanicus* Mironov *et al*. 2015, distributed in the Western Palearctic region, has been described from the melodious warbler, *Hippolais polyglotta* (Acrocephalidae), in Spain (Mironov *et al*. 2015; Mironov 2023a). *Dolichodectes edwardsi,* reported herein, has been found on the Cetti's warbler, *Cettia cetti,* for the first time (Fig. 1A, B).

***Joubertophyllodes* (Proctophyllodinae)**. This genus includes four species associated only with the bird families Emberizidae and Prunellidae (Atyeo and Gaud 1971). In the present study, *Joubertophyllodes modularis* was detected on its com-

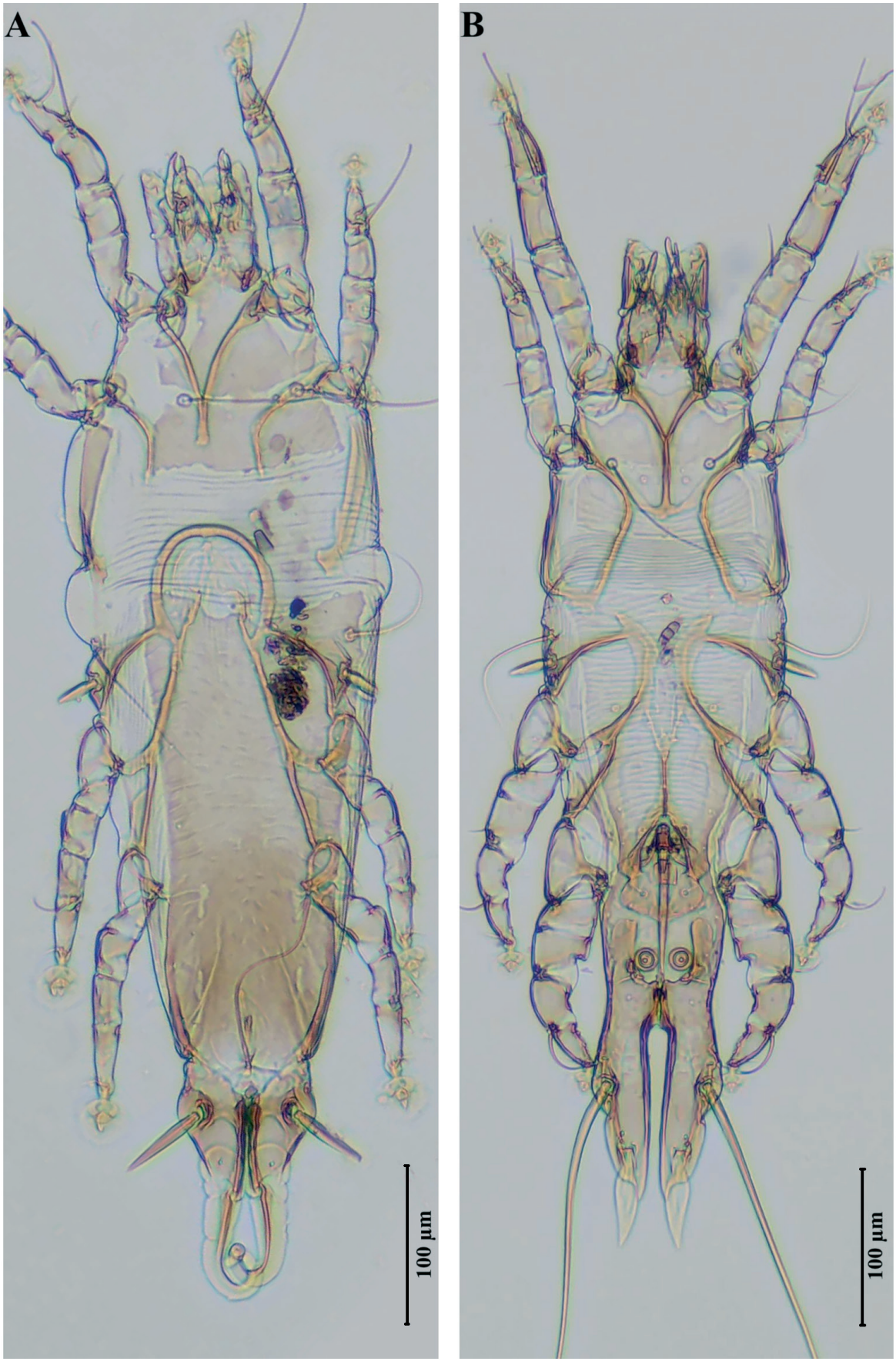

Fig. 1. *Dolichodectes edwardsi* [female (A) and male (B)].

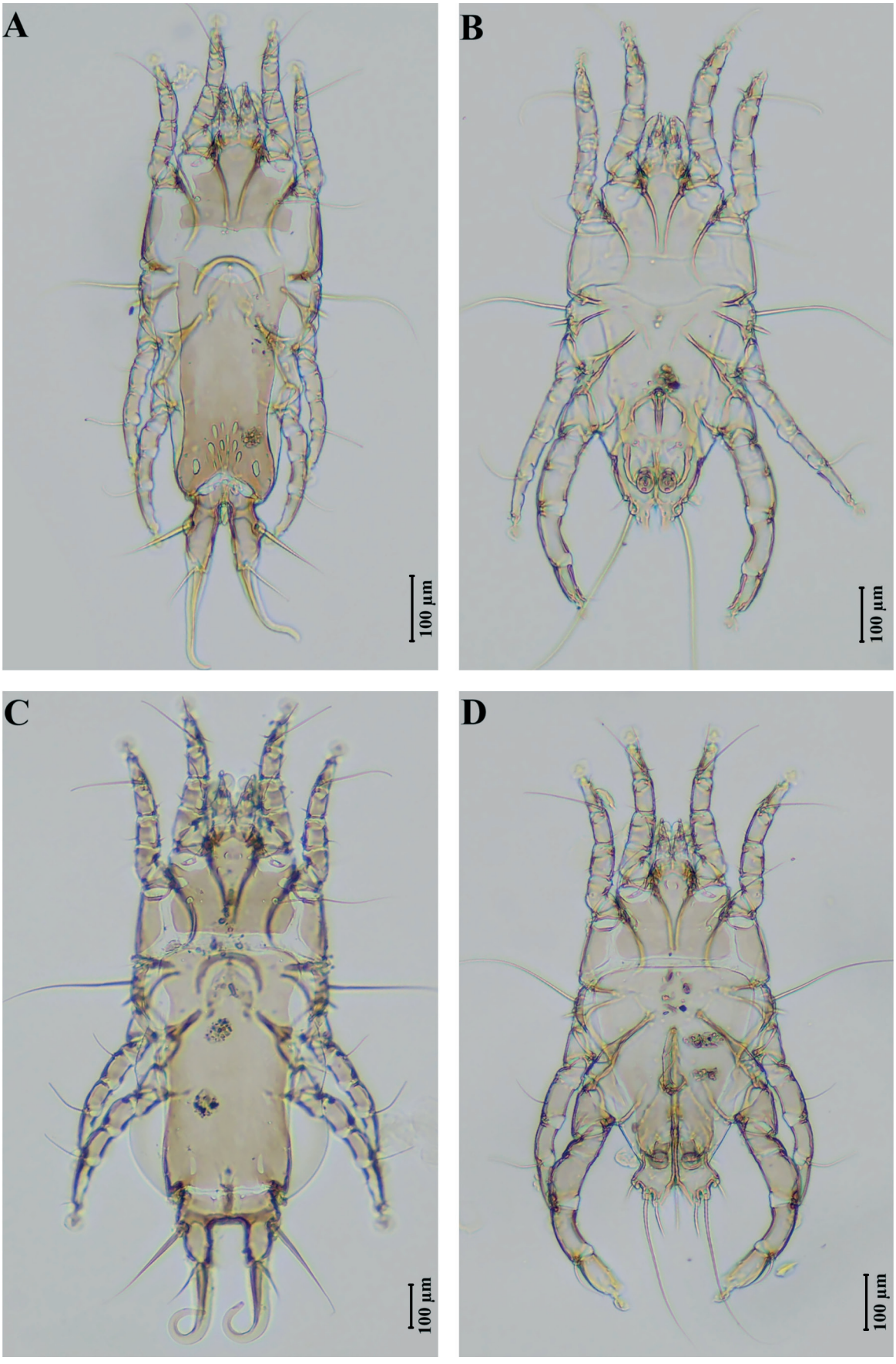

Fig. 2. *Joubertophyllodes modularis* [female (A) and male (B)] and *Monojoubertia microphylla* [female (C) and male (D)].

mon hosts, the dunnock (*Prunella modularis*) and the little bunting (*Emberiza pusilla*) (Fig. 2A, B). In previous studies, *J. modularis* has also been reported from *P. modularis* and various *Emberiza* species in the Palearctic region (Atyeo and Gaud 1971; Manilla *et al*. 1994; Mironov 1996; Kolarova and Mitov 2008; Gürler *et al*. 2013).

***Monojoubertia* (Proctophyllodinae)**. This genus includes 10 species, associated with passeerine hosts of the families Dicaeidae, Fringillidae, Emberizidae, Muscicapidae and Nectariniidae (Atyeo 1967; Atyeo and Gaud 1970; Atyeo 1971). In the Palearctic region, two species of this genus are widely distributed: *Monojoubertia microphylla* (Mégnin, 1877) on the common chaffinch (*Fringilla coelebs*) and *M. hemiphylla* (Robin, 1877) on the brambling (*Fringilla montifringilla*) (Manilla *et al*. 1994; Kolarova and Mitov 2008; Eren *et al*. 2022; Mironov *et al*. 2023). In addition to its type host, *M. microphylla*—recovered in this study from the chaffinch (Fig. 2C, D)—has also been reported from the hawfinch (*Coccothraustes coccothraustes*) in Russia (Mironov *et al*. 2023) and from the African chaffinch (*Fringilla spodiogenys*) in Morocco (Atyeo and Gaud 1970).

***Proctophyllodes* (Proctophyllodinae)**. This genus, containing over 170 described species, is not only the largest in the family Proctophyllodidae but also among all feather mites. It is mostly associated with the birds of the order Passeriformes (Atyeo and Braasch 1966; Mironov 2012; Klimov *et al*. 2017). Members of the genus *Proctophyllodes* are generally monoxenous (associated with a single host) or oligoxenous (associated with phylogenetically close hosts) (Mironov 2019).

Proctophyllodes caulifer (Fig. 3A, B) is a feather mite species specific to the bluethroat (*Luscinia svecica*) (Atyeo and Braasch 1966). Previous studies have documented its presence on the same host in several countries across the Palearctic region, including Bulgaria, France, the Netherlands and Russia (Atyeo and Braasch 1966; Kolarova and Mitov 2008; Mironov *et al*. 2023; Siepel *et al*. 2023).

Proctophyllodes clavatus (Fig. 3C, D) is a mite related to the birds belonging to the genera *Acrocephalus* and *Locustella* (Acrocephalidae); *Phylloscopus* (Phylloscopidae); and *Curruca* and *Sylvia* (Sylviidae). It is distributed across the Palearctic region (Fritsch 1961; Atyeo and Braasch 1966; Rojas *et al*. 1993; Behnke *et al*. 1995; Moodi *et al*. 2014; Per and Aktaş 2018; Mironov *et al*. 2023). In the present study, *Proctophyllodes clavatus*, detected on the lesser whitethroat (*Curruca curruca*) and Sardinian warbler (*Curruca melanocephala*) (Sylviidae), represents a new record for Cyprus.

Proctophyllodes cetti (Fig. 4A, B) was first described based on specimens collected from Cetti's warbler (*Cettia cetti*) in Kazakhstan (Badek *et al*. 2008), and it has subsequently been reported from the same host species in European Russia and Türkiye (Gürler *et al*. 2013; Mironov *et al*. 2023).

Proctophyllodes cotyledon (Fig. 4C, D), occurring on birds of the genera *Enicurus, Copsychus, Muscicapa, Myiomela, Phoenicurus, Saxicola* and *Tarsiger* (Muscicapidae); *Rhipidura* (Rhipiduridae); and *Cyanoderma* (Timaliidae) has been reported from many countries in Europe and Africa (Atyeo and Braasch 1966; Rojas *et al*. 1993; Kolarova and Mitov 2008). Given its broad host diversity and cosmopolitan distribution, *Proctophyllodes cotyledon* is most likely a complex of closely related or cryptic species. In the present study, *P. cotyledon* is reported from the black redstart, *Phoenicurus ochruros*, one of its common hosts in Europe (Mironov 1996), and from a new host, the European stonechat, *Saxicola rubicola.*

Proctophyllodes doleophyes (Fig. 5A, B) is a polyxenous mite that has been reported from the muscicapids of the genera *Ficedula* (Muscicapidae), *Phylloscopus* (Phylloscopidae) and *Hippolais* (Acrocephalidae). It is distributed throughout the Palearctic region (Atyeo and Braasch 1966; Rojas *et al*. 1993; Kolarova and Mitov 2008; Mironov *et al*. 2023; Eren *et al*. 2025). In this study, *Proctophyllodes doleophyes* was detected on the common chiffchaff (*Phylloscopus collybita*).

Proctophyllodes mesocaulus (Fig. 5C, D) was first described from Romania, from the common redstart, *Phoenicurus phoenicurus* (Mack-Firă and Cristea-Năstăsescu 1968). In the following years, it has also been reported from the same host in Russia (Mironov *et al*. 2023) and from the black redstart, *Ph. ochruros* in Türkiye (Eren *et al*. 2023).

Proctophyllodes musicus (Fig. 6A, B) is restricted to thrushes of the genus *Turdus* (Turdidae). It is distributed on these hosts in Africa, Asia, Europe and the Americas (Atyeo and Braasch 1966; Manilla *et al*. 1994; Galloway *et al*. 2014; Eren *et al*. 2023; Mironov *et al*. 2023; Eren *et al*. 2025). In the present study, this species was recorded from two species of thrushes, *Turdus merula* and *T. philomelos*.

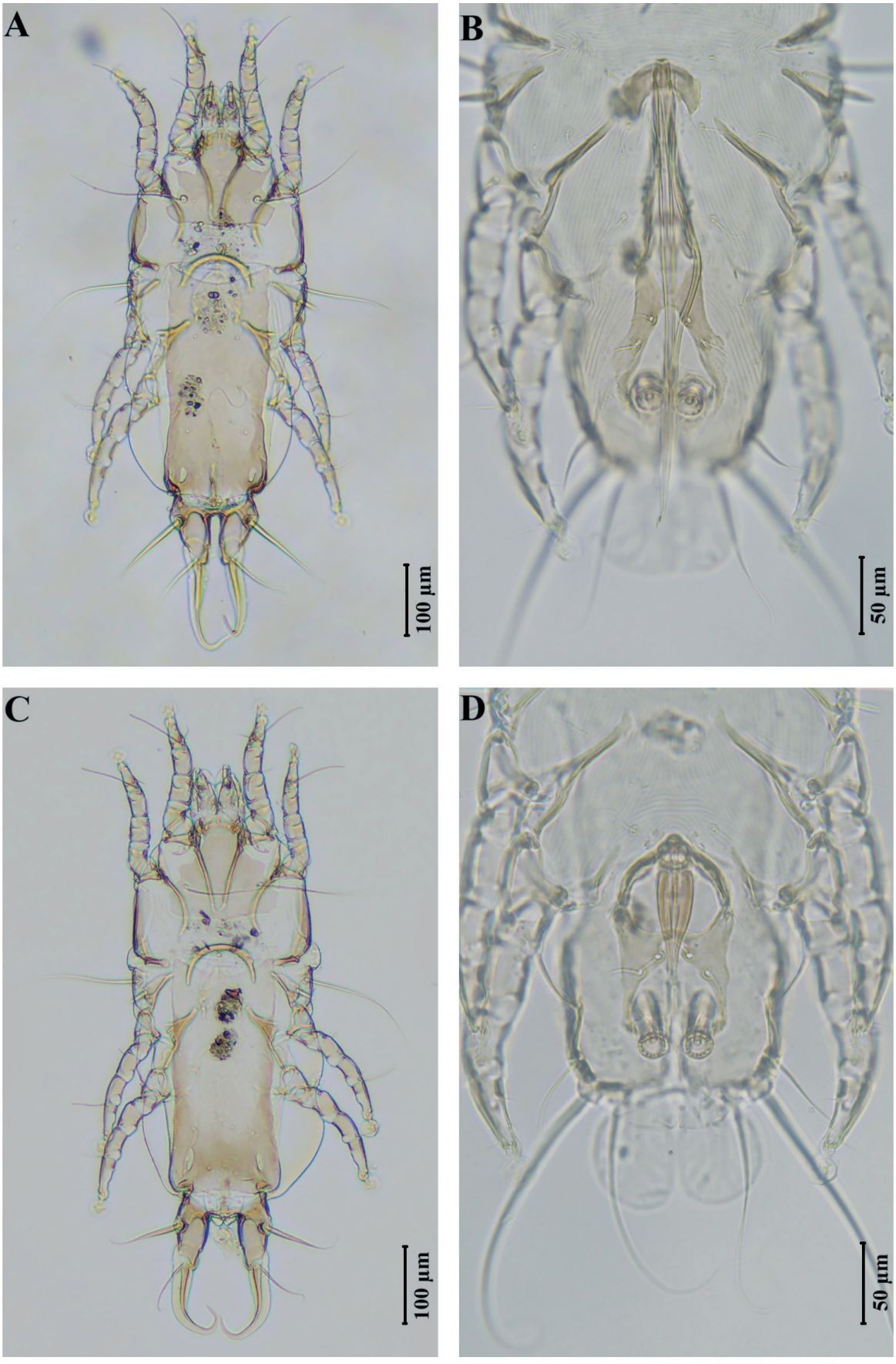

Fig. 3. *Proctophyllodes caulifer* [female (A) and male (B)] and *P. clavatus* [female (C) and male (D)].

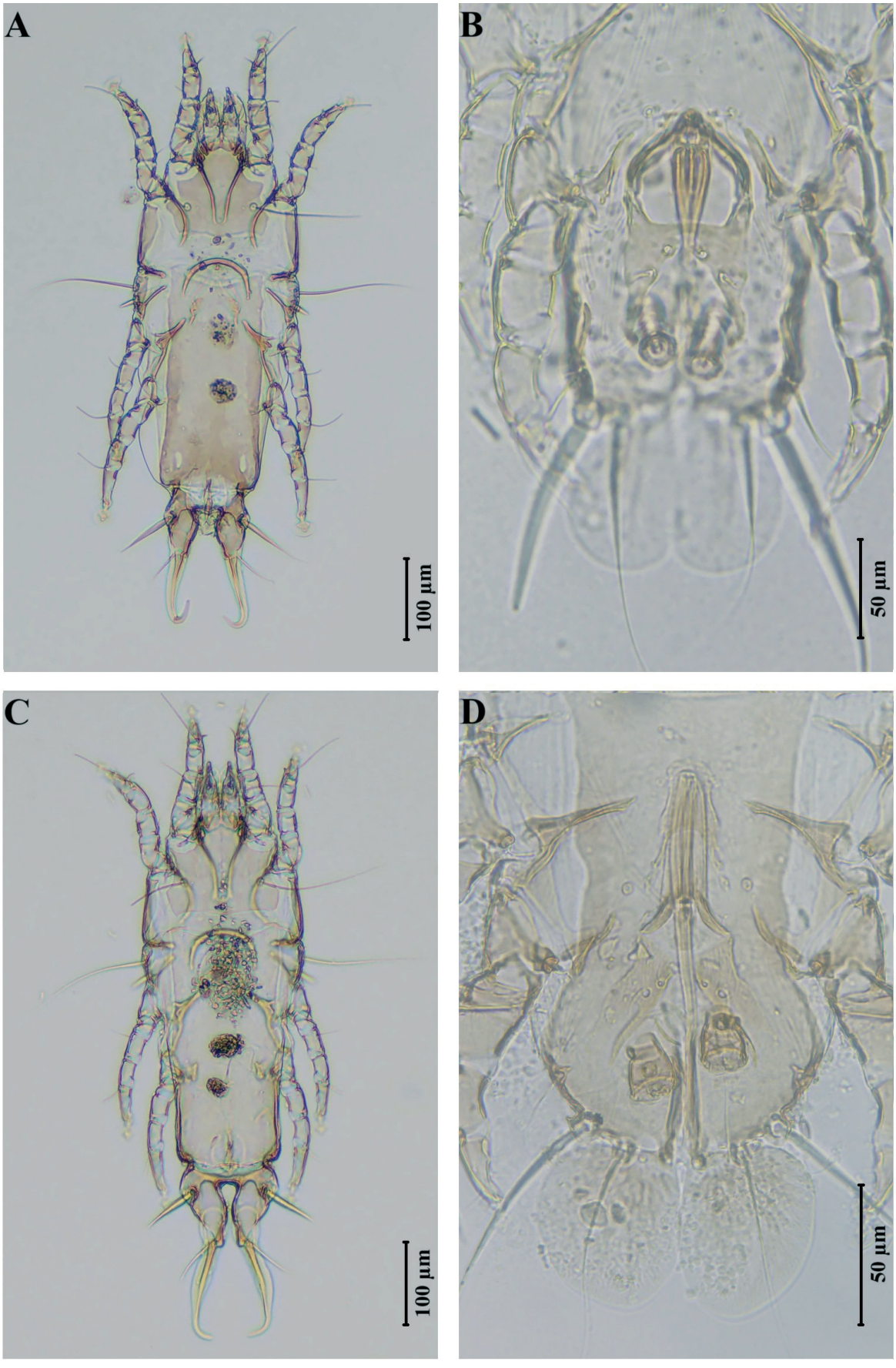

Fig. 4. *Proctophyllodes cetti* [female (A) and male (B)] and *P. cotyledon* [female (C) and male (D)].

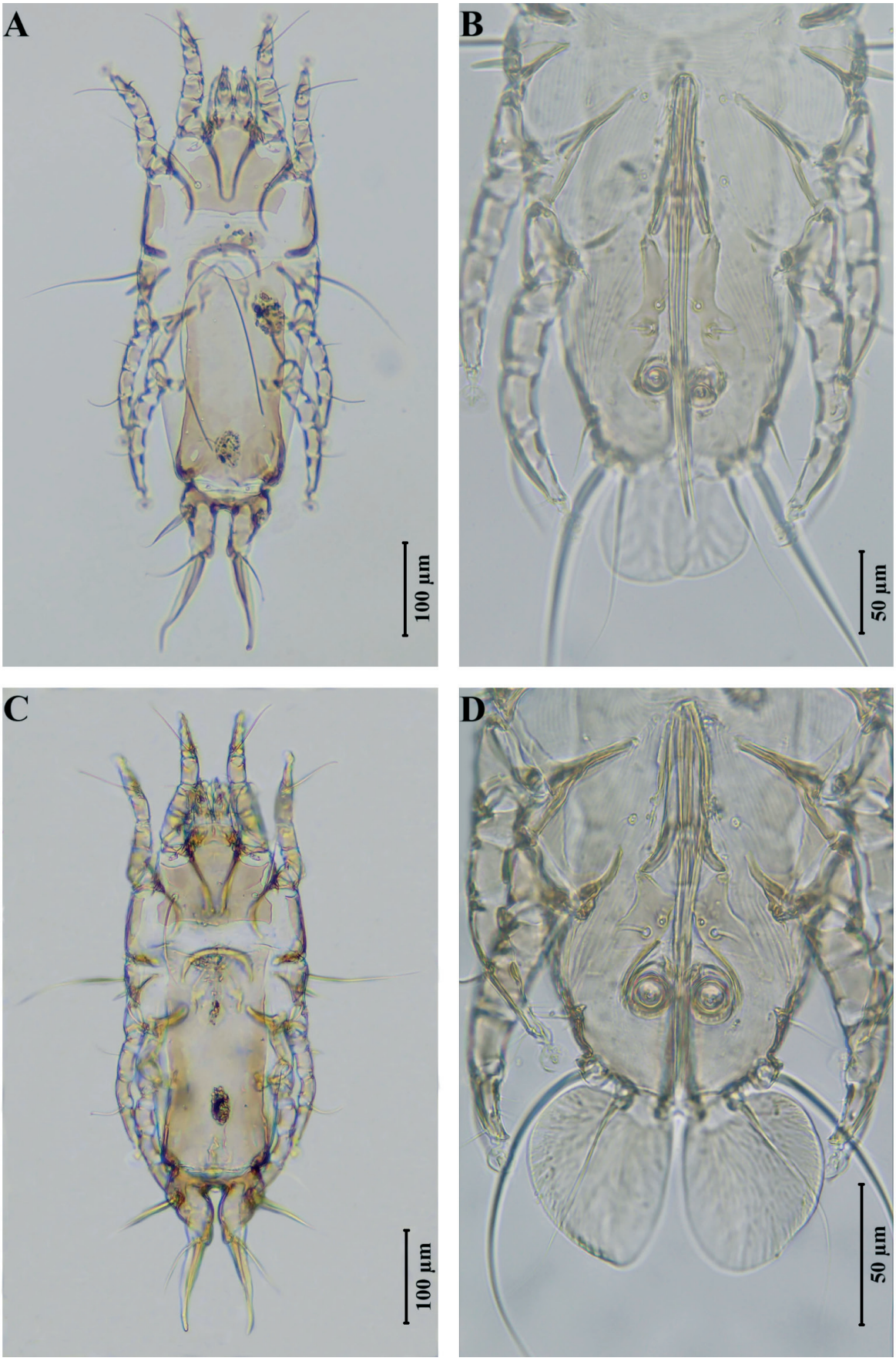

Fig. 5. *Proctophyllodes doleophyes* [female (A) and male (B)] and *P. mesocaulus* [female (C) and male (D)].

Proctophyllodes rubeculinus (Fig. 6C, D) is a monoxenous mite restricted to the European robin, *Erithacus rubecula* (Muscicapidae), and has been reported from various parts of the Palearctic region, including Bulgaria, England, France, Russia, the Netherlands, Spain and Türkiye (Atyeo and Braasch 1966; Rojas *et al*. 1993; Kolarova and Mitov 2008; Mironov *et al*. 2023; Siepel *et al*. 2023; Eren *et al*. 2025).

Proctophyllodes sylviae (Fig. 7A, B) is a mite associated with the Eurasian blackcap (*Sylvia atricapilla*) and the Sardinian warbler (*Curruca melanocephala*). It has been reported from several Palearctic countries, including Bulgaria, Morocco, Russia, Saudi Arabia, Spain and Türkiye (Atyeo and Braasch 1966; Rojas *et al*. 1993; Kolarova and Mitov 2008; Negm *et al*. 2019; Mironov *et al*. 2023; Eren *et al*. 2025). In the present study, it was found on its type host, *S. atricapilla*.

Proctophyllodes troncatus (Fig. 7C, D) is restricted to the sparrows of the genus *Passer* (Passeridae) (Atyeo and Braasch 1966). In the present study, *P. troncatus* was recorded from the house sparrow (*Passer domesticus*). This species has previously been reported from sparrows belonging to the *Passer* genus in Europe, Asia, Africa and the Americas (Braasch 1965; Atyeo and Braasch 1966; Gaud and Atyeo 1976; Behnke *et al*. 1995; Byers and Proctor 2013; Gürler *et al*. 2013; Eren *et al*. 2023; Mironov *et al*. 2023; Siepel *et al*. 2023).

Family **Trouessartiidae**, the second family of feather mites identified in the present study, is also a numerous group, with over 217 species spread across 11 genera (Orwig 1967; Santana 1976; Atyeo and Peterson 1977; Gaud 1993; Wang and Proctor 2015; Dabert and Bąkowski 2019; Constantinescu *et al*. 2023; Dmitryukov and Mironov 2023; Mironov 2023b; Mironov *et al*. 2023; Constantinescu *et al*. 2024; Mironov and Heleno 2025). Members of this family are mainly associated with the birds of the order Passeriformes, but there are also species associated with non-passerine avian hosts (Gaud and Atyeo 1996; Mironov 2022). In this group, unlike in other feather mite families, adult and tritonymph stages are usually located on the dorsal surface of the contour feathers devoid of corridors, while larval and protonymph stages are located on the vanes of the contour feathers (Mironov *et al*. 2023).

In the current study, the only genus of Trouessartiidae, which was recorded, was *Trouessartia* Canestrini, 1899. This is the most numerous genus in the family (with approximately 150 species). It is also the second most populous genus among all feather mite genera (Mironov 2022; Mironov and Galloway 2019; Mironov and Chandler 2020). The genus *Trouessartia* is mostly composed of monoxenous species, although it also includes oligoxenous species.

Trouessartia bifurcata (Fig. 8A, B) is an oligoxenous species, primarily associated with the species of the genus *Acrocephalus* (Acrocephalidae) and *Sylvia atricapilla* (Sylviidae) in the Palearctic region (Santana 1976; Burdejnaja and Kivganov 2009; Kolarova 2021; Mironov *et al*. 2023; Siepel *et al*. 2023). It has also been reported from *Cettia cetti* (Cettiidae) in Türkiye (Per and Aktaş 2018). In the present study, *T. bifurcata* was recorded from three bird species belonging to different families: *Acrocephalus melanopogon* (Acrocephalidae), *Phoenicurus ochruros* (Muscicapidae) and *Sylvia atricapilla* (Sylviidae) (Table 1). Given that this mite is primarily associated with the birds of the genera *Acrocephalus* (Acrocephalidae) and *Sylvia* (Sylviidae) (Santana 1976), its finding on only one of the nine examined individuals of *P. ochruros* is questionable and, apparently, represents a case of an accidental contamination.

Trouessartia inexpectata (Fig. 8C, D), another oligoxenous species of *Trouessartia* that we identified, was found on *Phylloscopus collybita* (Phylloscopidae) and *Curruca melanocephala* (Sylviidae). In previous studies, this species has been reported from *S. atricapilla*, *C. melanocephala* (Sylviidae) and *P. collybita* (Phylloscopidae) in the Palearctic region (Algeria, Italy, Morocco and Türkiye) (Santana 1976; Manilla *et al*. 1994; Per and Aktaş 2018).

Trouessartia mironovi (Fig. 9A) was first described from the moustached warbler, *Acrocephalus melanopogon* (Acrocephalidae), in Romania (Constantinescu *et al*. 2013), and it has since been reported only once, from the same host in Bulgaria (Kolarova 2021). In our study, it was found on the same bird host and, apparently, it is a monoxenous species.

Trouessartia rubecula (Fig. 9B, C) is associated with the European robin, *Erithacus rubecula* (Muscicapidae), and was first described from Poland (Jabłońska 1968; Santana 1976). In subsequent years, it has been reported multiple times from the same host, mainly in the Western Palearctic region (Rojas *et al*. 1993; Mironov 2022; Mironov *et al*. 2023; Siepel *et al*. 2023; Eren *et al*. 2025). This

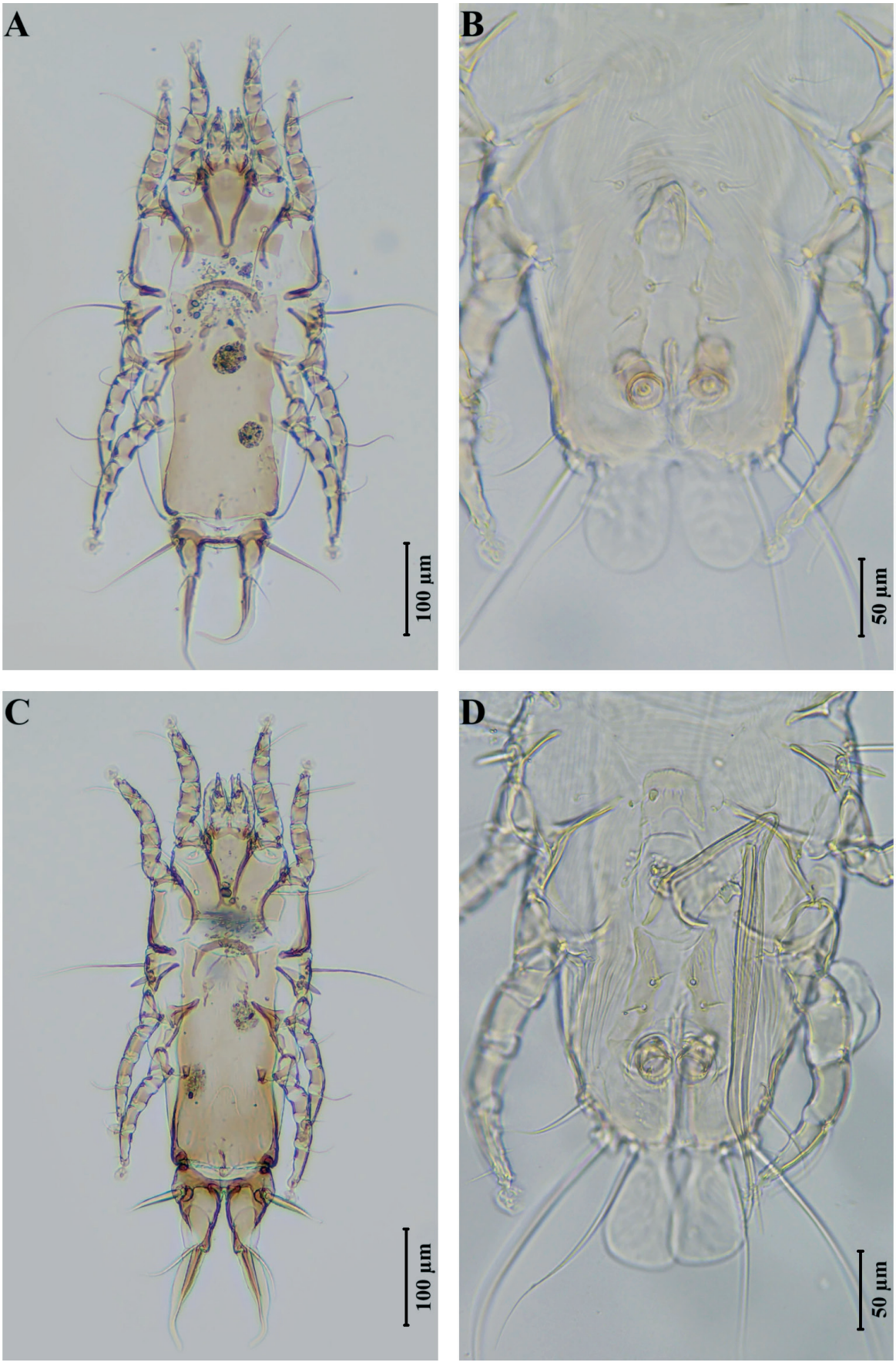

Fig. 6. *Proctophyllodes musicus* [female (A) and male (B)] and *P. rubeculinus* [female (C) and male (D)].

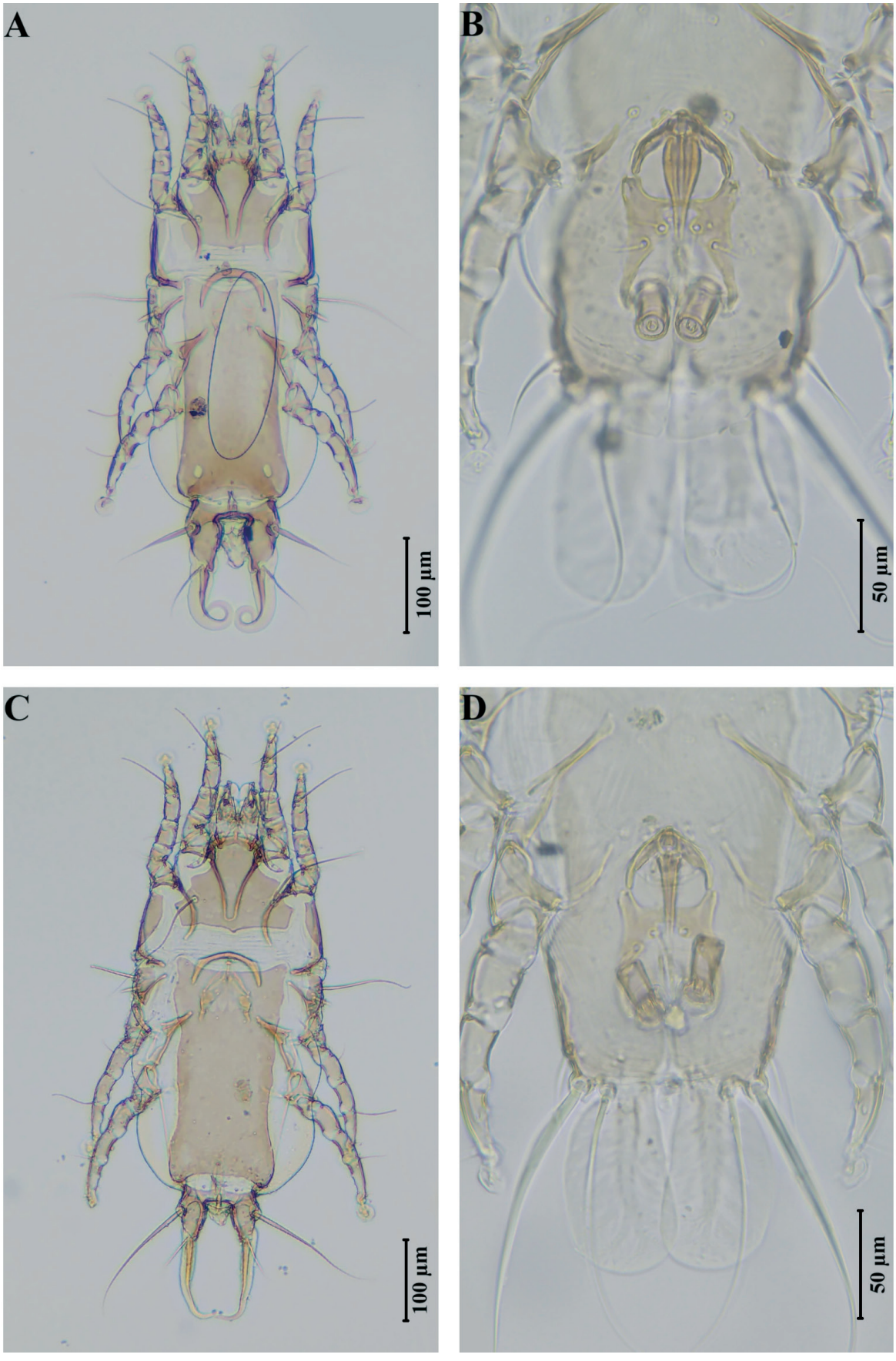

Fig. 7. *Proctophyllodes sylviae* [female (A) and male (B)] and *P. troncatus* [female (C) and male (D)].

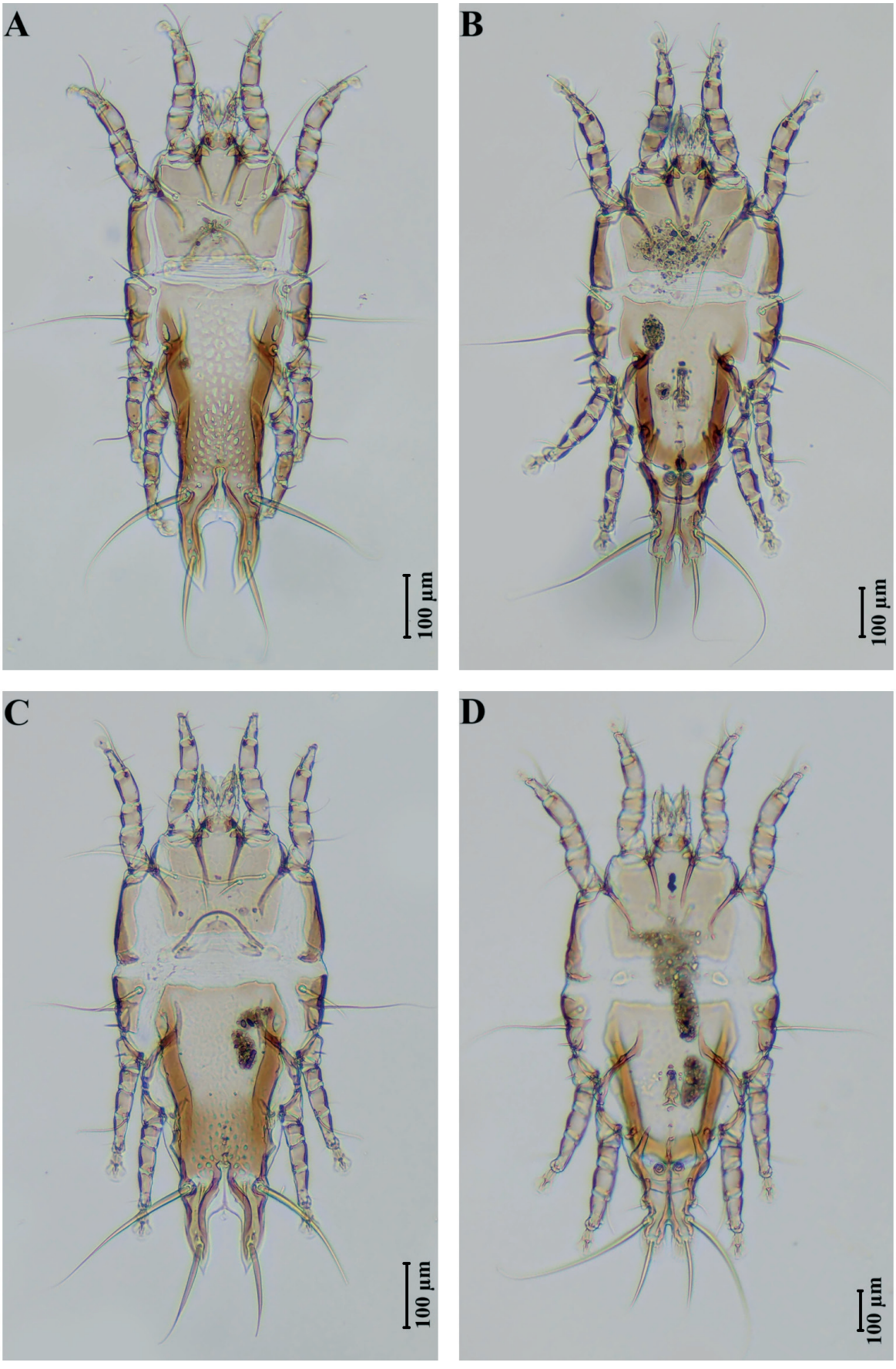

Fig. 8. *Trouessartia bifurcata* [female (A) and male (B)] and *T. inexpectata* [female (C) and male (D)].

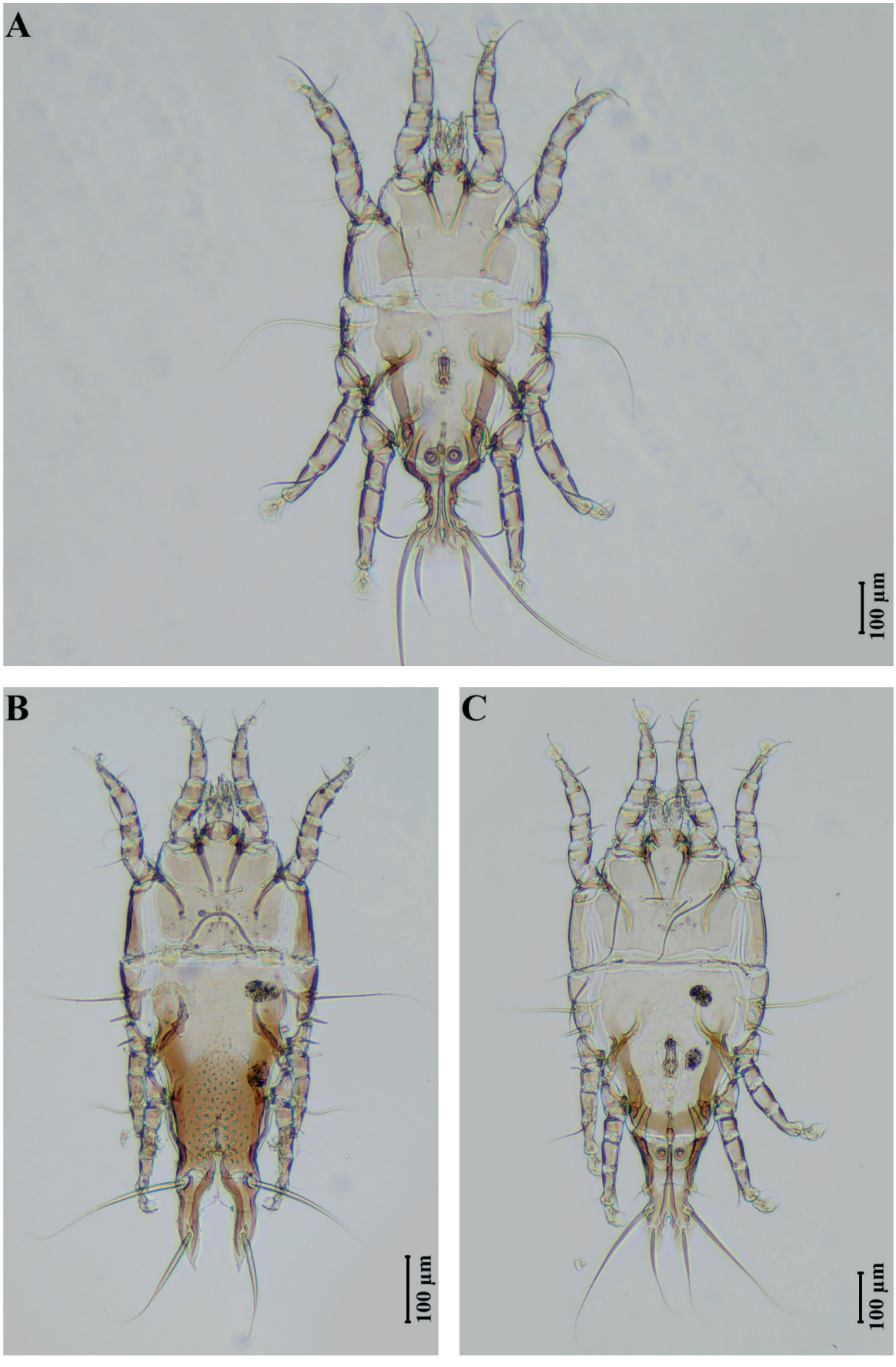

Fig. 9. *Trouessartia mironovi* [male (A)] and *T. rubecula* [female (B) and male (C)].

mite species, occurring exclusively on the robin, presents an example of monoxenous association.

The present article is the first comprehensive preliminary study of the feather mite fauna associated with the birds living on and migrating through Cyprus. We suggest continuing this investigation in both the spring and autumn ringing periods in subsequent years.

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Table 1.
Birds examined and feather mites detected during the study.

Birds (Order, family and species)	**Birds (examined/infested)**	**Feather mite species**
Coraciiformes		
Alcedinidae		
Alcedo atthis	(1/0)	—
Passeriformes		
Acrocephalidae		
Acrocephalus melanopogon	(3/2)	*Trouessartia mironovi* Constantinescu, 2013
“	(3/1)	*Trouessartia bifurcata* (Trouessart, 1884)
Cettiidae		
Cettia cetti	(2/1)	*Dolichodectes edwardsi* (Trouessart, 1885)
“	(2/1)	*Proctophyllodes cetti* Badek, Mironov and Dabert, 2008
Emberizidae		
Emberiza pusilla	(1/1)	*Joubertophyllodes modularis* (Berlese, 1894)
Fringillidae		
Fringilla coelebs	(2/2)	*Monojoubertia microphylla* (Mégnin, 1877)
Muscicapidae		
Erithacus rubecula	(37/4)	*Proctophyllodes rubeculinus* (Koch, 1941)
“	(37/3)	*Trouessartia rubecula* Jablonska, 1968
Luscinia svecica	(3/3)	*Proctophyllodes caulifer* Trouessart, 1886
Phoenicurus ochruros	(9/6)	*Proctophyllodes cotyledon* Trouessart, 1899
“	(9/1)	*Trouessartia bifurcata* (Trouessart, 1884)
Phoenicurus phoenicurus	(1/1)	*Proctophyllodes mesocaulus* Mac-Fira & Cristea, 1968
Saxicola rubicola	(16/2)	*Proctophyllodes cotyledon* Trouessart, 1899
Passeridae		
Passer domesticus	(1/1)	*Proctophyllodes troncatus* Robin, 1877
Phylloscopidae		
Phylloscopus collybita	(45/5)	*Proctophyllodes doleophyes* Gaud, 1957
“	(45/1)	*Trouessartia inexpectata* Gaud, 1957
Prunellidae		
Prunella modularis	(2/1)	*Joubertophyllodes modularis* (Berlese, 1894)
Sylviidae		
Curruca curruca	(1/1)	*Proctophyllodes clavatus* Fritsch, 1961
Curruca melanocephala	(15/6)	*Proctophyllodes clavatus* Fritsch, 1961
“	(15/4)	*Trouessartia inexpectata* Gaud, 1957
Sylvia atricapilla	(20/14)	*Proctophyllodes sylviae* Gaud, 1957
“	(20/1)	*Trouessartia rubecula* Jablonska, 1968*
“	(20/4)	*Trouessartia bifurcata* (Trouessart, 1884)
Sylvia borin	(1/0)	—
Troglodytidae		
Troglodytes troglodytes	(2/0)	—
Turdidae		
Turdus merula	(3/2)	*Proctophyllodes musicus* Vitzthum, 1922
Turdus philomelos	(21/1)	“

*probable contamination.