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Chewing Lice (Insecta: Phthiraptera) from Migratory Birds of the Curonian Spit

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Abstract—The fauna of chewing lice (Insecta: Phthiraptera) from migratory birds was studied in 2008–2009 and 2017 on the Curonian Spit, at Rybachy Biological Station of the Zoological Institute, Russian Academy of Sciences. Altogether, 35 species of chewing lice were collected off 2010 birds of 65 species. An annotated list of species is presented, including 11 species new to the Russian Federation, 29 species new to the Northwest of Russia, and 2 new host records: *Menacanthus eurysternus* from *Carduellis carduellis* and *Ricinus frenatus* from *Carduellis spinus*.

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This paper is devoted to the fauna of chewing lice (Phthiraptera: Amblycera, Ischnocera) parasitic on migratory birds flying across the Northwest of Russia (NWR), based on the material from birds captured for ringing at Rybachy Biological Station (Curonian Spit, Kaliningrad Province of Russia). The first data on the regional fauna of chewing lice were published by Golikova (1959), who studied the parasite community of birds nesting on the lakes of Kaliningrad Province. The discovered endo- and ectoparasites included 30 species from 11 genera of chewing lice parasitic on 25 species from 6 orders of aquatic birds. Besides, studies in the adjacent territories revealed 7 species from 5 genera of chewing lice parasitizing domestic and wild birds on the eastern coast of the Curonian Lagoon (Lithuanian: Kuršiu Marios) (Volkis and Panavaite, 1965). Until now, the chewing lice of migratory birds on the Curonian Spit have not been studied.

MATERIALS AND METHODS

Chewing lice were collected at Rybachy Biological Station of the Zoological Institute, Russian Academy of Sciences (ZIN RAS), in the autumn of 2008 and the spring of 2009 and 2017. Altogether, 2010 birds were examined, most of which (over 90%) belonged to the order Passeriformes (Table 1); 49 species of chewing lice were collected off 30 species of birds representing 24 genera, 17 families, and 3 orders.

During material collection in 2008 and 2009, O.O. Tolstenkov used a fumigation chamber into which the bird was placed so that only its head remained outside (Clayton and Drown, 2001). In 2017, O.D. Malyscheva collected ectoparasites only manually, recording the location of individual species of chewing lice on the host body, more exactly, on the plumage of the head, neck, body proper, and wings. No chewing lice were found directly on the host skin. The collected material (males, females, and larvae) was preserved in 70% ethanol. For species identification, 966 Canada balsam preparations were made following the technique of Palma (1978); they are now kept in the ZIN RAS collections.

Chewing lice were identified to genus using the key of Price and co-authors (2003), and to species, using various taxonomic publications (Clay and Hopkins, 1951, 1954; Eichler, 1951; Ansari, 1956a; Złotorzycka, 1964; Rheinwald, 1968; Dalgleish, 1972; Price, 1975, 1977; Conzales et al., 1980; Fedorenko, 1987; Mey, 1988; Adam, 2005; Sychra et al., 2014). Birds were identified by our colleagues at Rybachy Biological Station using the *Identification Guide to European Passerines* (Svensson, 1984); the bird taxonomy follows that of Sibley and Ahlquist (1990).

The types of host-parasite associations are classified according to the scheme of Medvedev (2002): species of chewing lice are referred to as monoxenous (known

from only one host species), oligoxenous (known from several species of hosts belonging to one genus), mesoxenous (known from several genera of hosts belonging to one family), polyxenous (known from several families of hosts belonging to one order), and euryxenous (known from hosts of different orders).

SPECIES OF CHEWING LICE PARASITIZING MIGRATORY BIRDS ON THE CURONIAN SPIT

Suborder **AMBLYCERA** Kellog

Family **Menoponidae** Mjoberg

I. Genus ***Colpocephalum*** Nitzsch, 1818

1. ***Colpocephalum inaequale*** (Burmeister, 1838)

A monoxenous parasite of black woodpecker *Dryocopus martius* L. (Price et al., 2003). A European (Central–East European) range: recorded from France (Seguy, 1944), Hungary (Balát, 1957), Romania (Bechet, 1961a; Adam et al., 2009), and Ukraine (Lunkashu, 2008). In Russia recorded from the Curonian Spit (Tolstenkov, 2009) and Leningrad Prov. (Pavlovsky, 1935). Material: 1 ♂, 4 ♀ on black woodpecker. Location not specified.

II. Genus ***Menacanthus*** Neumann, 1912

2. ***Menacanthus camelinus*** (Nitzsch [in Giebel], 1874)

An oligoxenous parasite recorded on 11 species of shrikes of the genus *Lanius* (Price et al., 2003). Probably an East European–East Asian range; known from South Korea (Gyeonggi Province) (Palma et al., 1998). The species is recorded here for the first time for NWR and Russia. Material: 2 ♀ on red-backed shrike, on body.

3. ***Menacanthus curucca*** (Schrank, 1776)

A polyxenous species parasitic on 14 species and subspecies from 2 families of passerines (Price et al., 2003). A Euro-Caucasian–Central Asian range. Recorded on the Faroe Islands (Palma and Jensen, 2005) and in Romania (Adam, 2009); within the former USSR territory, in Transcaucasia on great tit *Parus major* L. (Blagoveshtchensky, 1940) and in Tajikistan on cinereous tit *P. cinereus* Vieillot (Blagoveshtchensky, 1951b). In Russia recorded from the Curonian Spit (Kaliningrad Prov.) on garden warbler *Sylvia borin* Boddaert (Tolstenkov et al., 2009) and from Central Ciscaucasia (Tebueva, 2011). Material: 1 ♂ on garden warbler. Location not specified.

4. ***Menacanthus eurysternus*** (Burmeister, 1838)

A euryxenous parasite recorded on 176 species and subspecies of birds from 35 families of the orders Passeriformes and Piciformes (Price et al., 2003). A European–West Siberian range: recorded from the Faroe Islands (Palma and Jensen, 2005), Czech Republic (Sychra et al., 2011), Poland (Złotorzycka, 1965), Bulgaria (Tuleshkov, 1960), Moldova (Lunkashu, 2008), and Romania (Adam and Sandor, 2004; Adam et al., 2009). In Russia recorded from Volgograd Prov. (Chernobai, 1969), Yakutia (Stepanova, 2016), and West Siberia (Blagoveshtchensky, 1948, 1951a). Material: 10 ♂, 14 ♀, 8 L on 3 ind. of common blackbird *Turdus merula* L.; 2 ♂, 5 ♀, 3 L on 2 ind. of song thrush *T. philomelos* Brehm; 1 ♀ on European goldfinch *Carduelis carduelis* L.; recorded for the first time on the latter host. Location not specified.

5. ***Menacanthus sinuatus*** (Burmeister, 1838)

An oligoxenous species parasitic on 8 species and subspecies of tits (Price et al., 2003). A European (West–Central European) range: recorded from the Faroe Islands (Palma and Jensen, 2005), Czech Republic (Sychra et al., 2011), Romania (Adam et al., 2009), Western Ukraine and Moldova on great tit and willow tit (Lunkashu, 2008). The species is recorded here for the first time for NWR and Russia. Material: 2 ♂, 1 ♀ on 2 ind. of great tit. Location not specified.

In addition, several specimens of chewing lice of the genus *Menacanthu*s could not be identified to species: 1 L from goldcrest *Regulus regulus* L., 1 ♀ from brambling *Fringilla montifringilla* L., and 1 ♀ from willow warbler *Phylloscopus trochilus* L. Some specimens collected from great tit (3 ♂, 5 ♀) and blue tit (6 ♀) did not match the diagnostic characters of *Menacanthus sinuatus*, the specific parasite of these hosts. In particular, these chewing lice differed in a larger body, a greater number of setae, and the shape of microstructures on the cervical plate.

III. Genus ***Myrsidea*** Waterston, 1915

6. ***Myrsidea quadrimaculata*** (Carriker, 1902)

A monoxenous parasite of red crossbill *Loxia curvirostra* (Schrank) (Price et al., 2003). A European (Central European) range: recorded from Czech Republic (Sychra et al., 2011) and Romania (Adam and Sandor, 2005). In Russia recorded from the Curonian Spit (Tolstenkov, 2009). Material: 1 ♂, 2 ♀, 1 L on red crossbill. Location not specified.

Table 1. Distribution of species of chewing lice over the orders and families of migratory birds

Families of birds	Number of species of birds	Families of chewing lice			Number of species of chewing lice
		Menoponidae	Philopteridae	Ricinidae	
Order Passeriformes					
Corvidae	2		4		4
Emberizidae	2		2		2
Fringillidae	5	2	4	2	8
Muscicapidae	1		1	1	2
Paridae	2	1	1		2
Regulidae	1		1	1	2
Sylviidae	1	1			1
Troglodytidae	1		1		1
Turdidae	2		2	1	3
Order Accipitriformes					
Accipitridae	1		1		1
Order Piciformes					
Picidae	2	1	1		2
Total	20	5	18	5	28

7. ***Myrsidea rustica*** (Giebel, 1874)

A mesoxenous species parasitic on swallows and martins; in particular, in Eurasia recorded on barn swallow *Hirundo rustica* L., and also on the South African cliff swallow *H. spilodera* Sundevall, welcome swallow *H. tahitica neoxena* Gould (Price et al., 2003), common house martin *Delichon urbicum* (L., 1758), red-rumped swallow *Hirundo daurica* (L., 1771), and wire-tailed swallow *H. smithii* Leach, 1818 (Malcomson, 1960). A Holarctic (Euro-Caucasian–North American) range. Recorded from North America (Malcomson, 1960); from Eurasia: the Faroe Islands (Palma and Jensen, 2005), Spain (Soler-Cruz et al., 1989), France, Great Britain (Thompson, 1961), Poland (Złotorzycka, 1964), Czech Republic, Slovakia (Balát, 1977), Ukraine (Lunkashu, 1969; Fedorenko, 1972b), Moldova (Tebueva, 2011), Romania (Bechet, 1961b), Bulgaria (Tebueva, 2011), and Azerbaijan (Mustafaeva, 1972). In Tajikistan found on wire-tailed and red-rumped swallows (Blagoveshtchensky, 1951b). In Russia collected in the northwest of European Russia (Peterhof) on common house martin (Dogiel and Navtsevich, 1936), and also in the Middle Volga basin (Volga-Kama Reserve) (Akhmetzyanova, 1977); collected on barn swallow in Central Ciscaucasia (Lyakhova, 2008). Material: 3 ♂, 3 ♀ from 6 ind. of barn swallow, on body.

Family **Ricinidae** Neumann

IV. Genus ***Ricinus*** De Geer, 1778

8. ***Ricinus elongatus*** (Olfers, 1816)

A polyxenous species parasitic on 11 species of birds from 4 passerine families, mostly on Turdidae (Price et al., 2003). A Euro-Caucasian range: recorded on the Faroe Islands (Palma and Jensen, 2005); in Czech Republic on mistle thrush *Turdus viscivorus* L. (Valan et al., 2016); in Romania (Adam et al., 2009) and Lithuania on common blackbird (Volskis and Panavaite, 1965). In Russia recorded from Central Ciscaucasia (Tebueva, 2011) and the Middle Volga basin (Volga-Kama Reserve), on song thrush *T. philomelos* and redwing *T. iliacus* L. (Akhmetzyanova, 1977). The species is recorded here for the first time for NWR. Material: 4 ♀, 4 L on 3 ind. of common blackbird. Location not specified.

9. ***Ricinus frenatus*** (Burmeister, 1838)

An oligoxenous species parasitic on ruby-crowned kinglet *Regulus calendula* L., common firecrest *R. ignicapillus* Temminck, and goldcrest *R. regulus* L. (Price et al., 2003). A European (West European) range; recorded on the Faroe Islands (Palma and Jensen, 2005). The species is recorded here for the first

time for NWR and Russia. Material: 5 ♂, 27 ♀, 6 L on 4 ind. of goldcrest; collected for the first time from Eurasian siskin. Location not specified.

10. ***Ricinus fringillae*** (De Geer, 1778)

A polyxenous species parasitic on 47 species from 8 families of passerine birds (Price et al., 2003). A European range; recorded from the Faroe Islands (Palma and Jensen, 2005), Czech Republic (Sychra et al., 2011), Romania (Adam et al., 2009), Moldova, and Ukraine (Lunkashu, 2008). In Russia known from Volga-Kama Reserve, on common chaffinch *Fringilla coelebs* L., yellowhammer *Emberiza citrinella* L., and greenfinch *Carduelis chloris* L. (Akhmetzyanova, 1977); in Yakutia on common redpoll *Acanthis flammea* L. (Stepanova, 2016). The species is recorded here for the first time for NWR. Material: 1 ♂, 4 ♀ on 3 ind. of common chaffinch, 1 ♀ on yellowhammer. Location not specified.

11. ***Ricinus rubeculae*** (Schrank, 1776)

A polyxenous species parasitic on 14 species from 4 families of passerine birds (Price et al., 2003). A European range; recorded from the Faroe Islands (Palma and Jensen, 2005), France (Seguy, 1944), Poland (Złotorzycka, 1965), Hungary (Balát, 1952), Romania (Negru, 1958), and Ukraine (Lunkashu, 2008). In Russia recorded from the Middle Volga basin (Volga-Kama Reserve) (Akhmetzyanova, 1977). The species is recorded here for the first time for NWR. Material: 1 ♂, 2 ♀, 1 L on European robin *Erithacus rubecula* L. Location not specified.

In addition, 1 ♂, 4 ♀, and 3L of the genus *Ricinus* which could not be identified to species were found on tawny pipit *Anthus campestris* L.

Suborder **ISCHNOCERA** Kellog

Family **Philopteridae** Burmeister

V. Genus ***Brueelia*** Keler, 1936

12. ***Brueelia glandarii*** (Denny, 1842)

A monoxenous parasite of common jay *Garrulus glandarius* L. (Price et al., 2003). A European (Central-East European–Caucasian–Central Asian) range: France (Seguy, 1944), Poland (Złotorzycka, 1964), Romania (Lunkashu, 2008), Bulgaria (Tuleshkov, 1960), Belarus (Chaikovsky, 2010), Ukraine, Moldova (Lunkashu, 2008), Georgia (Bauer, 1941), Azerbaijan (Blagoveshtchensky, 1940), and Transcaucasia (Blagoveshtchensky, 1940). In Russia recorded from Central Ciscaucasia (Akhmetzyanova and Khokhlov, 1986b; Lyakhova, 2005, 2006; Tebueva, 2011) and Yakutia (Stepanova, 2009, 2016). The species is recorded here for the first time for NWR. Material: 14 ♂, 7 ♀, 12 L on 4 ind. of common jay. Location not specified.

13. ***Brueelia merulensis*** (Denny, 1842)

A monoxenous parasite of common blackbird *T. merula* L. (Price et al., 2003). A European range: the Faroe Islands (Palma and Jensen, 2005), Czech Republic (Sychra et al., 2011), Romania (Adam and Sandor, 2004; Adam et al., 2009), Moldova, and Ukraine (Lunkashu, 2008). In Russia recorded from the Middle Volga basin (Volga-Kama Reserve) (Akhmetzyanova, 1977). The species is recorded here for the first time for NWR. Material: 44 ♂, 116 ♀, 56 L on 7 ind. of *T. merula*. Location not specified.

14. ***Brueelia olivacea*** (Burmeister, 1838)

A monoxenous parasite of spotted nutcracker *Nucifraga caryocatactes* L. (Price et al., 2003). A European range; in Russia recorded from Yakutia (Stepanova, 2016). The species is recorded here for the first time for NWR. Material: 7 ♂, 4 ♀, 3 L on spotted nutcracker. Location not specified.

15. ***Brueelia turdinulae*** (Ansari, 1956)

A monoxenous parasite of song thrush *T. philomelos* L. (Price et al., 2003). A European (West-East European) range; found on the Faroe Islands (Palma and Jensen, 2005). The species is recorded here for the first time for NWR and Russia. Material: 3 ♂, 10 ♀, 4 L on 3 ind. of song thrush, on body.

16. ***Brueelia domestica*** (Kellog & Chapman, 1899)

A monoxenous parasite of barn swallow *Hirundo rustica* L. (Price et al., 2003). A European (West-East European) range; found on the Faroe Islands (Palma, 2005). The species is recorded here for the first time for NWR and Russia. Material: 1 ♂, 4 ♀, 5 L on 3 ind. of barn swallow, on back.

17. ***Brueelia gracilis*** (Burmeister, 1838)

A monoxenous parasite of common house martin *Delichon urbica* L. (Price et al., 2003). A European (West-East European) range; found on the Faroe Islands (Palma, 2005). In Russia recorded from

Volga-Kama Reserve (Akhmetzyanova, 1977). The species is recorded here for the first time for NWR. Material: 5 ♀, 1 L on 4 ind. of common house martin, on body.

18. ***Brueelia chrysomitris*** Blagoveshtchensky, 1940

A monoxenous parasite of siskin (Price et al., 2003). A European–Central Asian range; found in Azerbaijan (Blagoveshtchensky, 1940b). The species is recorded here for the first time for NWR and Russia. Material: 4 ♂, 4 ♀, 1 L on 3 ind. of siskin, on body under wings.

19. ***Brueelia amsel*** (Eichler, 1951)

An oligoxenous species parasitic on common blackbird. A European range; found in Spain on song thrush (Soler-Cruz et al., 1989). In Russia recorded in Central Ciscaucasia on common blackbird (Vasyukova and Komarov, 1997). The species is recorded here for the first time for NWR. Material: 4 ♂, 4 ♀, 1 L from common blackbird. Location not specified.

In addition, some other specimens of the genus *Brueelia* were collected which could not be identified to species. They probably include a species new to science. In particular, 1 ♀ was collected from willow warbler, 1 ♀ from great tit, 1 ♂ from blue tit, 1 ♂ from spotted nutcracker, and 1 ♀ from Eurasian blackcap *Sylvia atricapilla* L.

VI. Genus ***Degeeriella*** Neumann, 1906

20. ***Degeeriella nisus*** (Giebel, 1866)

An oligoxenous species parasitic on sparrow hawk *Accipiter nisus* L. and sharp-shinned hawk *A. striatus* Vieillot (Price et al., 2003). A European range; known from the Faroe Islands (Palma and Jensen, 2005). The species is recorded here for the first time for NWR and Russia. Material: 7 ♂, 21 ♀, 1 L on sparrow hawk. Location not specified.

In addition, 1 ♀ of the genus *Degeeriella* was found on siskin.

VII. Genus ***Penenirmus*** Clay et Meinertzhagen, 1938

21. ***Penenirmus albiventris*** (Scopoli, 1763)

An oligoxenous species parasitic on Eurasian wren *Troglodytes troglodytes* L. and house wren *T. aedon* Vieillot (Price et al., 2003). A South American–European–Caucasian–Central Asian range; found on the Faroe Islands (Palma and Jensen, 2005), in Peru on house wren (Sychra et al., 2014), in Czech Republic and Slovakia (Sychra et al., 2014), Hungary (Balát, 1957), Romania (Negru, 1958), Moldova, Ukraine (Lunkashu, 2008), Azerbaijan (Blagoveshtchensky, 1940b, 1951b), and Tajikistan (Blagoveshtchensky, 1951b). In Russia recorded from Central Ciscaucasia (Vasyukova and Komarov, 1997). The species is recorded here for the first time for NWR. Material: 4 ♂, 1 ♀, 4 L on 5 ind. of *T. troglodytes* L. Location not specified.

22. ***Penenirmus serrilimbus*** (Burmeister, 1838)

An oligoxenous species parasitic on red-throated wryneck *Jynx ruficollis* Wagler and Eurasian wryneck *J. torquilla* L. (Price et al., 2003). A European–Middle Eastern–South Asian range: the Faroe Islands (Palma and Jensen, 2005), Spain, Great Britain, Czechoslovakia, Afghanistan, Pakistan, India, and Thailand (Dalgleish, 1972). In Russia recorded from Volga-Kama Reserve (Akhmetzyanova, 1977). The species is recorded here for the first time for NWR. Material: 8 ♂, 11 ♀, 34 L on Eurasian wryneck, on neck.

In addition, 1 L of the genus *Penenirmus* was found on black woodpecker *D. martius* L. and 1 ♀, on long-tailed tit *Aegithalos caudatus* L.

VIII. Genus ***Philopterus*** Nitzsch, 1818

23. ***Philopterus citrinella*** (Schrank, 1776)

A polyxenous species parasitic on passerines: yellowhammer, greenfinch, and common bullfinch (Price et al., 2003). A European range: the British Isles (Clay and Hopkins, 1954), France, Saxony, Hungary, Yugoslavia, Estonia (Balát, 1957), Germany (May, 1980), Czech Republic (Sychra et al., 2011), Czechoslovakia (Balát, 1977), Poland (Złotorzycka and Lutińska, 1976), Finland (Eichler and Hackman, 1973), Romania (Adam and Sandor, 2004; Lunkashu, 2008; Adam et al., 2009), Bulgaria (Tuleshkov, 1962, 1964), Ukraine, and Moldova (Lunkashu, 2008). In Russia recorded from Volga-Kama Reserve (Akhmetzyanova, 1977). Located on the head and neck plumage (Fedorenko, 1987). The species is recorded here for the first time for NWR. Material: 14 ♂, 6 ♀, 24 L on 3 ind. of yellowhammer *E. citrinella* L., 1758, on head and neck.

24. ***Philopterus crassipes*** (Burmeister, 1838)

A mesoxenous species parasitic on 7 species from 4 genera of Corvidae (Price et al., 2003). A Central European–Siberian–East Asian range: France (Seguy, 1944), Czechoslovakia (Balát, 1977), Poland (Złotorzycka, 1955, 1964, 1977), Hungary (Rékási, 1973), Romania (Bechet, 1961b; Adam and Sandor, 2005), Bulgaria (Balát, 1958; Tuleshkov, 1960), Finland (Eichler and Hackman, 1973; Złotorzycka and Lutińska, 1975), and Ukraine (Kistyakivskii, 1926; Lunkashu, 2008). In Russia recorded from Volga-Kama Reserve (Akhmetzyanova, 1977), Yakutia (Stepanova, 2016), Irkutsk Prov. (Fedorenko and Sonin, 1983), and Khabarovsk Terr. (Fedorenko and Volkov, 1977b). The species is recorded here for the first time for NWR. Material: 1 ♂, 1 ♀, 14 L on spotted nutcracker. Location was not specified in our material but *Ph. crassipes* is known to occur on the head and neck plumage (Fedorenko, 1987).

25. ***Philopterus curvirostrae*** (Schrank, 1776)

A monoxenous parasite of red crossbill *Loxia curvirostra* L. (Fedorenko, 1987). A North American–European range: North America (Malcomson, 1960; Emerson, 1972), the Faroe Islands (Palma and Jensen, 2005), England (Clay and Hopkins, 1954), Poland (Clay and Hopkins, 1954; Złotorzycka, 1964, 1977; Złotorzycka and Lutińska, 1976), Czech Republic (Sychra et al., 2011), Romania (Bechet, 1961b; Adam and Sandor, 2005), Bulgaria (Tuleshkov, 1974), Finland (Eichler and Hackman, 1973), Estonia (Clay and Hopkins, 1954), and Ukraine (Rovno Prov.) (Fedorenko, 1975a, 1977). In Russia recorded from Volga-Kama Reserve (Fedorenko, 1987) and Irkutsk Prov. (Fedorenko and Sonin, 1983). The species is recorded here for the first time for NWR. Material: 12 ♂, 22 ♀, 36 L on 5 ind. of red crossbill.

26. ***Philopterus fortunatus*** (Złotorzycka, 1964)

A monoxenous parasite of common chaffinch (Price et al., 2003). A Central European–Caucasian range: Poland (Złotorzycka, 1964; Złotorzycka and Lutińska, 1976), Moravia (Balát, 1977), Finland (Eichler and Hackman, 1973), Belarus (Emelyanova, 1981), Moldova (Shumilo and Lunkashu, 1972; Lunkashu, 2008), Ukraine (Lunkashu, 2008): Chernovtsy (Lunkashu, 1969), Kiev, Zhitomir, Chernigov, Rovno, Nikolaev, Kharkov, Transcarpathian, Volyn (Fedorenko, 1977), Lvov, Ivano-Frankovsk (Kharambura, 1978) provinces. In Russia recorded from Volga-Kama Reserve (Akhmetzyanova, 1977) and Central Ciscaucasia (Vasyukova and Komarov, 1977). The species is recorded here for the first time for NWR. Material: 34 ♂, 36 ♀, 113 L on 15 ind. of common chaffinch, on head and neck. This location of *Ph. fortunatus* was noted earlier (Fedorenko, 1987).

27. ***Philopterus garruli*** Boisduval et Lacordaire, 1835

A monoxenous parasite of common jay (Price et al., 2003). A Central-East European–Central Asian range: France (Seguy, 1944), Switzerland (Bouvier, 1963), Czechoslovakia (Balát, 1977), Poland (Złotorzycka, 1955, 1964, 1977; Złotorzycka and Lutińska, 1975), Hungary (Schäfer, 1963), Romania (Bechet, 1961b; Negru, 1962), Bulgaria (Balát, 1958; Tuleshkov, 1960, 1962, 1970, 1974), Finland (Eichler and Hackman, 1973; Złotorzycka and Lutińska, 1975), Latvia (Grinbergs, 1940), Ukraine (Lunkashu, 2008): Chernovtsy Prov. (Lunkashu, 1969) and Ukrainian Carpathians (Chvak and Kharambura, 1972); Moldova (Shumilo and Bechet, 1963; Lunkashu, 2008), Georgia (Bauer, 1941), Azerbaijan (Blagoveshtchensky, 1940). In Russia recorded from Central Ciscaucasia (Akhmetzyanova and Khokhlov, 1986; Lyakhova, 2005, 2006) and Volga-Kama Reserve (Akhmetzyanova, 1977). The species is recorded here for the first time for NWR. Material: 12 ♂, 15 ♀, 19 L on common jay. Location was not specified in our material but *Ph. garruli* is known to occur on the head and neck plumage (Fedorenko, 1987).

28. ***Philopterus hercynicus*** (Mey, 1988)

A monoxenous parasite of blue tit *P. caeruleus* (Price et al., 2003). A European range. The species is recorded here for the first time for NWR and Russia. Material: 6 ♀, 11 L on 2 ind. of blue tit. Location not specified.

29. ***Philopterus rapax*** (Złotorzycka, 1964)

A monoxenous parasite of brambling *F. montifringilla* L. (Price et al., 2003). A North American–Euro-Siberian range: North America (Emerson, 1972), the Faroe Islands (Palma and Jensen, 2005); Czechoslovakia (Złotorzycka and Lutińska, 1976; Balát, 1977), Poland (Złotorzycka, 1964, 1977; Złotorzycka and Lutińska, 1976), Romania (Rékási and Kiss, 1980), Finland (Eichler and Hackman, 1973), Turkmenia, and

Ukraine (Rovno Prov.) (Fedorenko, 1987). In Russia recorded from Volga-Kama Reserve (Akhmetzyanova, 1977) and Yakutia (Fedorenko, 1987). The species is recorded here for the first time for NWR. Material: 15 ♂, 5 ♀, 24 L on 5 ind. of brambling. Location not specified.

30. ***Philopterus reguli*** (Denny, 1842)

A monoxenous parasite of goldcrest (Price et al., 2003). A European range: the Faroe Islands (Palma and Jensen, 2005); France (Seguy, 1944), Poland (Złotorzycka, 1964; Złotorzycka and Lutińska, 1976), Hungary (Rékási, 1973), Moravia (Balát, 1977), Romania (Bechet, 1961b; Adam and Sandor, 2004), Bulgaria (Balát, 1958), and Finland (Eichler and Hackman, 1973). The species is recorded here for the first time for NWR and Russia. Material: 13 ♂, 10 ♀, 40 L on 4 ind. of goldcrest. Location not specified.

31. ***Philopterus residuus*** (Złotorzycka, 1964)

A monoxenous parasite of common reed bunting *Emberiza schoeniclus* L. (Price et al., 2003). A European (Central-East European) range: Moravia and Slovakia (Balát, 1977), Poland (Złotorzycka, 1964), Hungary (Rékási, 1973), Finland (Eichler and Hackman, 1973), Ukraine (Kherson Prov.) (Fedorenko, 1978), Turkmenia (Fedorenko, 1987). In Russia recorded from Volga-Kama Reserve (Akhmetzyanova, 1977). The species is recorded here for the first time for NWR. Material: 5 ♂, 5 ♀, 22 L on 2 ind. of reed bunting. Location not specified.

32. ***Philopterus rubeculae*** (Denny, 1842)

A monoxenous parasite of European robin *Erithacus rubecula* L. (Price et al., 2003). A European (North-Central-East European) range: France (Seguy, 1944), Poland (Złotorzycka and Lutińska, 1976; Złotorzycka, 1977), and Finland (Eichler and Hackman, 1973). The species is recorded here for the first time for NWR and Russia. Material: 1 ♂ on European robin. Location not specified.

33. ***Philopterus linariae*** (Piaget, 1885)

A monoxenous parasite of common redpoll *Acanthis flammea* L. A European (West-Central European)–Siberian range: the Faroe Islands (Palma and Jensen, 2005); Moravia (Balát, 1977), Poland (Złotorzycka, 1964; Złotorzycka and Lutińska, 1976), and Finland (Eichler and Hackman, 1973). In Russia recorded from Yakutia (Fedorenko, 1987; Stepanova, 2016). The species is recorded here for the first time for NWR. Material: 10 ♂, 12 ♀, 49 L on 8 ind. of redpoll, on head and neck.

34. ***Philopterus excisus*** Nitzsch, 1818

A mesoxenous species parasitic on common house martin *Delichon urbica* L. and the South African cliff-swallow *Hirundo spilodera* Sundevall (Price et al., 2003), and also on barn swallow *Hirundo rustica* and sand martin *Riparia riparia* L. A European–Central Asian–West Siberian range: France (Seguy, 1944), Scotland, Sweden, France, Morocco, the British Isles (Clay and Hopkins, 1960), Finland (Eichler and Hackman, 1973), Bulgaria (Tuleshkov, 1974), Poland (Złotorzycka, 1977), Iraq (Abul-hab, 1980), Moldova (Shumilo, 1966; Shumilo and Lunkashu, 1972), Ukraine: Kiev and Crimean provinces (Fedorenko, 1972a, 1977), Cherkassy Prov. (Fedorenko, 1987). In Russia recorded from Peterhof (Dogiel and Navtsevich, 1936) and Volga-Kama Reserve (Akhmetzyanova, 1977).

Records on *Hirundo rustica* L.: Romania (Negru, 1958; Bechet, 1961b), Bulgaria (Balát, 1958; Tuleshkov, 1962, 1974), the British Isles (Thompson, 1961), Poland (Złotorzycka, 1964, 1977), Spain (Guivara Benitez et al., 1981), Tajikistan (Blagoveshtchensky, 1951b), Azerbaijan (Mustafaeva, 1972; Mustafaeva and Gadzhiev, 1972), Moldova (Shumilo and Lunkashu, 1972), Kopet Dagh foothills (Fedorenko et al., 1975), Ukraine: Kiev Prov. (Kistyakivskii, 1926), Chernovtsy Prov. (Lunkashu, 1969), Kiev, Vinnitsa, Odessa, Kherson, and Crimean provinces (Fedorenko, 1972a, 1977). In Russia: Baraba Lakes (Blagoveshtchensky, 1948), the Volga delta (Dubinina and Kulakova, 1960), Volga-Kama Reserve (Akhmetzyanova, 1977), and Peterhof (Dogiel and Navtsevich, 1936).

Records on *Riparia riparia* L.: Bulgaria (Balát, 1958), Czechoslovakia (Balát, 1966), Poland (Złotorzycka, 1977), Moldova (Shumilo and Lunkashu, 1972), Belarus (Emelyanova, 1981), Ukraine: Kiev Prov. (Kistyakivskii, 1926), Chernovtsy Prov. (Shumilo and Lunkashu, 1972), Donetsk, Kherson, and Crimean provinces (Fedorenko, 1977). In Russia: Baraba Lakes (Blagoveshtchensky, 1948), Volga-Kama Reserve (Akhmetzyanova, 1977). Our material: 14 ♂, 7 ♀, 29 L on 8 ind. of common house martin, on head and neck.

35. ***Philopterus picae*** (Denny, 1842)

An oligoxenous species parasitic on yellow-billed magpie *Pica nuttalli* Audubon and common magpie *P. pica* (L.) (Price et al., 2003). An East European–Central Asian range: Turkmenia (Fedorenko, 1983), Ukraine (Fedorenko, 1987). The species is recorded here for the first time for NWR and Russia. Material: 8 ♂, 10 ♀, 14 L on common magpie, on head. This location of *Ph. picae* was also recorded earlier (Fedorenko, 1987).

In addition, 83 ♂, 100 ♀, and 207 L of the genus *Philopterus* were collected from 56 ind. of siskin *Carduelis spinus* (L.). Chewing lice of this genus found on siskin were earlier reported in the literature as *Philopterus sp.* (Palma, 2005); they probably belong to a species new to science. Besides, specimens of *Philopterus* sp. 1 and *Ph.* sp. 2 were collected from song thrush and common blackbird, though in insufficient numbers for correct identification.

DISCUSSION

At present, 76 species from 26 genera of chewing lice are known in the Northwest of Russia (Dogiel and Navtsevich, 1936; Blagoveshtchensky, 1940; Golikova, 1959; Grebenyuk and Kasiev, 1964; Alieva, 1970; Kasiev, 1971; Fedorenko, 1987; Tolstenkov et al., 2009; Tebueva, 2011; Stepanova, 2016). Our collections from migratory birds of the Curonian Spit comprised 35 species from 8 genera of chewing lice belonging to the families Menoponidae (24 species of 3 genera), Ricinidae (4 species of 1 genus), and Philopteridae (7 species of 4 genera). Of these, 12 species were recorded for the first time for the territory of Russia; they belonged to 5 genera: *Menacanthus* (*M. camelinus*), *Philopterus* (*Ph. hercynicus*, *Ph. rubeculae*, *Ph. regul*, *Ph. picae*), *Brueelia* (*B. turdinulae*, *B. olivacea*, *B. domestica*, *B. gracilis*, *B. chrysomytris*), *Ricinus* (*R. frenatus*), and *Degeeriella* (*D. nisus*). Besides, 29 species were recorded for the first time for the Northwest of Russia. *Menacanthus eurysternus* was for the first time collected from the goldfinch, and *Ricinus frenatus*, from the siskin.

In addition, 83 females and 100 males of chewing lice probably belonging to a new species of the genus *Philopterus* were collected off the siskin. Previously chewing lice were recorded on this host only on the Faroe Islands but they were not identified to species, either (Palma, 2005).

Over 90% of the examined birds belonged to the order Passeriformes (Table 1). Of them, the family Fringillidae was represented by the greatest number of species (5), from which 8 species of chewing lice of all the 3 families were collected. The families Corvidae, Emberizidae, Paridae, and Turdidae were less diverse in our material, each family being represented by 2 species; from 2 to 4 species of chewing lice were collected from hosts of each family. Besides, one species of birds from each of the orders Piciformes and Accipitriformes was examined, and specific parasites were collected from these hosts.

The distribution of many species of chewing lice remains to be clarified. The species collected by us are known from a varying number (from 1 to 22) of geographic records from particular countries or regions. Such records are the most numerous (22) for *Philopterus excisus* which parasitizes 2 species of swallows. One of its hosts, the common house martin *Delichon urbica* (L.), has a vast European–Asian–African range; the other, *Hirundo spilodera* Sundevall, is distributed in South Africa. However, the chewing louse *Ph. excisus* is presently known only from the West and Central Palaearctic. Thus, according to the available data, its range may be assigned to the European–Central Asian–West Siberian type.

The distribution of several more species of chewing lice can be characterized based on numerous records. One of them, *Philopterus garruli*, a monoxenous parasite of the common jay, is known from 17 records, and its range may be described as Central-East European–Central Asian. The polyxenous parasite *Ph. citrinella*, found on 3 species of hosts from 3 genera, is widely distributed in Europe and known from 16 records. *Myrsidea rustica*, known from 18 records, is a mesoxenous parasite of 6 species of birds from 2 genera. The range of *M. rustica* may be characterized as European–Caucasian–North American.

The other species of chewing lice present in our material have from 1 to 13 geographic records, so that their ranges can be only preliminarily classified. According to the available data, the highest diversity of range types (6) is observed among chewing lice of the family Philopteridae (Table 2), which is represented by the greatest number of species in our collections. In the family Menoponidae, 7 species are characterized by 4 range types. The family Ricinidae is represented by only 4 species, mostly with European ranges. On the whole, most (18 out of 35) species of chewing lice parasitic on migratory birds are distrib-

Table 2. Distribution of species of chewing lice parasitizing migratory birds on the Curonian spit, by range types and host specificity

Families of chewing lice	Mesoxenous	Monoxenous	Oligoxenous	Polyxenous	Euryxenous	Total
European ranges						
Menoponidae		2	1			3
Philopteridae		9	2	1		12
Ricinidae			1	2		3
Euro-Caucasian ranges						
Philopteridae		2	1			3
Ricinidae				1		1
Euro-Siberian ranges						
Menoponidae				1	1	2
Philopteridae	1	3	1			5
Euro-Asian ranges						
Philopteridae	1		1			2
Euro-Turanian ranges						
Philopteridae		2				2
Palaearctic–Neotropical ranges						
Philopteridae	1		1			2
Total	3	18	8	5	1	35

uted in Europe, including 6 species of the genus *Brueelia*, 5 of the genus *Philopterus*, 3 of the genus *Ricinus*, and 1 species of each of the genera *Degeeriella*, *Colpocephalum*, *Menacanthus*, and *Myrsidea*. Among the European ranges, 3 species of chewing lice have West-East European ranges, 2 species have West European ranges, 2 species have Central-East European ranges, and 1 species is characterized by each of the West-Central European, North-Central-East European, and Central European ranges.

The European species of chewing lice have various host associations. Most of them (11 species) are monoxenous parasites, in particular *Myrsidea quadrimaculata*, *Colpocephalum inaequale*, *Brueelia merulensis*, *B. turdinulae*, *B. olivacea*, *B. domestica*, *B. gracilis*, *Philopterus rubeculae*, *Ph. hercynicus*, *Ph. reguli*, and *Ph. residuus*. Of them, *Ph. reguli*, *Ph. hercynicus*, *Ph. rubeculae*, and *Ph. residuus* mainly occur on the head plumage. Such species as *Brueelia merulensis*, *B. olivacea*, *B. turdinulae*, *B. domestica*, *B. gracilis*, *Colpocephalum inaequale*, and *Myrsidea quadrimaculata* parasitize passerine birds from different genera. Four species (*Degeeriella nisus*, *Ricinus frenatus*, *B. amsel*, and *Menacanthus sinuatus*) are oligoxenous parasites while other 3 species (*Ricinus fringillae*, *R. rubeculae*, and *Philopterus citrinella*) are polyxenous parasites.

Among the chewing lice with European ranges, 7 species have the Euro-Siberian type of distribution, 4 species have the Euro-Caucasian type, 2 species, the Euro-Asian type, and 2 species, the Euro-Turanian type.

The Euro-Siberian range type is characteristic of 7 species from 4 genera. Of these, *Menacanthus curucca* is polyxenous, *Penenirmus serrilimbus* is oligoxenous, *Philopterus crassipes* is mesoxenous, and *M. eurysternus* is euryxenous. Such species as *Philopterus garruli*, *Ph. linariae*, and *Brueelia glandarii* may be regarded as monoxenous ectoparasites.

The chewing lice collected by us also include some species with Euro-Caucasian ranges. Of them, *Ricinus elongatus* is polyxenous, *Philopterus picae* is oligoxenous, and *Ph. fortunatus* and *Brueelia chrysomitris* are monoxenous parasites. Two more species, *Philopterus curvirostra* and *Ph. rapax*, have Euro-Turanian ranges; both show narrow host specificity. *Menacanthus camelinus* and *Philopterus excisus* have wider, Euro-Asian ranges; the former is oligoxenous and the latter, mesoxenous.

Table 3. The number of species of chewing lice with different types of host specificity and location on the host plumage

Genera of chewing lice	Head and neck	Body	Unknown location	Host specificity
Family Menoponidae				
Menacanthus		1		oligoxenous
Myrsidea		1		mesoxenous
Family Philopteridae				
Brueelia		4	1	monoxenous
Philopterus	2		1	monoxenous
	1			oligoxenous
	1			mesoxenous
	1			polyxenous
Penenirmus	1		1	oligoxenous
Family Ricinidae				
Ricinus			1	polyxenous
Total	6	6	4	

Two species, *Peninirmus albiventris* and *Myrsidea rustica*, have very wide ranges of the Palaearctic–Neotropical type. Of them, *P. albiventris* is oligoxenous while *M. rustica* is mesoxenous.

The monoxenous type of parasitism is most frequently recorded: in 18 species of chewing lice from 4 genera and 2 families (Table 2). Monoxenous parasites prevail in the family Philopteridae (16 species). Most of the narrow specific parasites in this family belong to the genera *Philopterus* and *Brueelia* (9 and 7 species, respectively). At the same time, this family includes a considerable number of species (5) with the oligoxenous type of parasitism. All the five types of host associations are represented in the family Menoponidae; in particular, *Myrsidea rustica* is mesoxenous, *M. quadrimaculata* and *Colpocephalum inaequale* are monoxenous, *Menacanthus sinuatus* and *Menacanthus camelinus* are oligoxenous, *M. curucca* is polyxenous, and *M. eurysternus* is euryxenous. Only polyxenous and oligoxenous parasites were recorded in the family Ricinidae: 3 and 1 species, respectively.

Thus, monoxenous species of chewing lice prevail in the family Philopteridae, which was represented by 23 species and 4 genera in our collections (Table 3). These chewing lice are not very mobile and mainly occur on the head and neck of their hosts, i.e., in places least available for self-grooming. The family Ricinidae was represented in our material by only 4 species characterized by broad host associations, mainly of the polyxenous type. Chewing lice of this family are the largest, reaching 4–5 mm in body length; they are also the most mobile and actively move over the whole host body except its head.

The taxonomic diversity of the family Menoponidae in our material was intermediate between Philopteridae and Ricinidae. All the 5 types of host associations can be observed in the 7 recorded species of Menoponidae. It should be noted that chewing lice of this family also actively move over the whole host body except its head.

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