INSECT ECTOPARASITES FROM WILD PASSERINE BIRDS IN THE CZECH REPUBLIC

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Summary:

Wild passerine birds (Passeriformes) from northeastern part of the Czech Republic were examined for ectoparasites. Three species of louse-flies of the genus *Ornithomya* (Diptera: Hippoboscidae), two species of fleas of the genera *Ceratophyllus* and *Dasypsyllus* (Siphonaptera: Ceratophyllidae), and 15 species of chewing lice belonging to the genera *Myrsidea*, *Menacanthus* (Phthiraptera: Menoponidae), *Brueelia*, *Penenirmus*, *Philopterus* (Phthiraptera: Philopteridae) were found on 82 birds of 23 species. New chewing louse-host records are *Hippolais icterina* for *Menacanthus currucae*; *Motacilla cinerea* for *Menacanthus pusillus*; *Turdus philomelos* and *Motacilla cinerea* for *Brueelia merulensis*; and *Sylvia atricapilla* for *Menacanthus eurysternus*. *Brueelia neoatricapillae* is cited for the first time for the Czech Republic. Parasitological parameters such as prevalence, intensity and abundance are also discussed.

KEY WORDS : chewing lice, Phthiraptera, flea, Siphonoptera, louse-fly, Hippoboscidae, Passeriformes, post-breeding migration.

Résumé : LES INSECTES ECTOPARASITES DES PASSEREAUX SAUVAGES EN RÉPUBLIQUE TCHÈQUE

Nous avons examiné la faune ectoparasite des oiseaux passériformes sauvages dans la partie nord-est de la République Tchèque. Sur 82 spécimens d'oiseaux appartennant à 23 espèces, nous avons récolté trois espèces de mouches-araignées du genre Ornithomya *(Diptera: Hippoboscidae), deux espèces de puces des genres* Ceratophyllus *et* Dasypsyllus *(Siphonaptera: Ceratophyllidae) et 15 espèces de mallophages appartennant aux genres* Myrsidea, Menacanthus *(Phthiraptera: Menoponidae),* Brueelia, Penenirmus *et* Philopterus *(Phthiraptera: Philopteridae). Nous avons révélé les nouvelles associations hôte-parasite suivantes:* Hippolais icterina *pour* Menacanthus currucae*;* Motacilla cinerea *pour* Menacanthus pusillus*;* Turdus philomelos *et* Motacilla cinerea *pour* Brueelia merulensis*;* Sylvia atricapilla *pour* Menacanthus eurysternus. *En outre, nous rapportons* Brueelia neoatricapillae *pour la première fois en République Tchèque. Nous discutons aussi des paramètres parasitologiques, comme la prévalence, l'intensité et l'abondance.*

MOTS CLÉS : *Mallophages, Phthiraptera, puces, Siphonaptera, mouches-araignées, Hippoboscidae, Passériformes, migration.*

Chewing lice (Insecta: Phthiraptera) are among the less studied insect groups in the Czech Republic. As a result of several faunistic surveys (Balát, 1952, 1953, 1977, 1981a,b) carried out during the period 1950-1992, the species of chewing lice from many bird species occurring in the Czech Republic were collected and studied. There are 403 species of birds in the Czech Republic (Vavřík, 2004), and 381 of them (95 %) are known as hosts of 735 species of chewing lice (Price *et al.*, 2003). According to Balát (1977), 361 species of those lice (49 %) have been recorded in the Czech Republic. Therefore, there is still a great number of bird lice to be found in that country.

Species of fleas and their relationships with different birds are well known in the Czech Republic (Rosický, 1957). Species of louse-flies are also well known, but only relatively scarce data on the relationships of these flies with different hosts are available from the Czech Republic (see Chalupský & Povolný, 1983; Krištofík, 1998).

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The aims of this paper are: 1) to present new data on the species richness and distribution of insect ectoparasites found on some passerine birds in the Czech Republic; 2) to include information on their prevalence, intensity and abundance.

MATERIALS AND METHODS

STUDY AREAS

Fieldwork was carried out in two localities in the north-eastern part of the Czech Republic, near the city of Nový Jičín. First, collections were made in reed beds around the ponds of Bartošovice (49° 40' N, 18° 03' E) at an elevation about 240 m above sea level. The second collection locality, 13 km distant from the first, was in a forest aisle adjacent to pasture located in the Sub-Beskidian Hills, near Čerťák (49° 34' N, 17° 59' E) at an elevation of about 400 m above sea level.

METHODS

Birds were examined during the season of post-breeding migrations, in the following periods: 24-31 July

Bird species	Prev.	Ectoparasite family/species	♂	♀	Imm.
Family Motacillidae					
Motacilla cinerea Tunstall, 1771	2/4	H/*Ornithomya avicularia* (Linnaeus, 1758)	2	7	
	1/4	H/*Ornithomya fringillina* Curtis, 1836		1	
	1/4	C/*Dasypsyllus gallinulae* (Dale, 1878)		1	
	2/4	M/*Menacanthus pusillus* (Nitzsch, 1866)**		2	16
	1/4	P/*Brueelia merulensis* (Denny, 1842)**	1	1	
Family Hirundinidae					
Hirundo rustica Linnaeus, 1758	3/3	H/*Ornithomya biloba* Dufour, 1827	1	3	
	2/3	P/*Brueelia domestica* (Kellogg & Chapman, 1899)	2	2	2
Riparia riparia (Linnaeus, 1758)	1/1	H/*Ornithomya biloba* Dufour, 1827		1	
	1/1	C/*Ceratophyllus garei* Rothschild, 1902		1	
Family Sylviidae					
Acrocephalus arundinaceus (Linnaeus, 1758)	4/18	H/*Ornithomya avicularia* (Linnaeus, 1758)		4	
Acrocephalus palustris (Bechstein, 1798)	1/9	H/*Ornithomya fringillina* Curtis, 1836	1	2	
	1/9	M/*Menacanthus currucae* (Schrank, 1776)	2	4	22
Acrocephalus scirpaceus (Hermann, 1804)	1/8	H/*Ornithomya fringillina* Curtis, 1836		1	
Acrocephalus schoenobaenus (Linnaeus, 1758)	1/14	M/*Menacanthus* sp.			4
Hippolais icterina (Vieillot, 1817)	1/1	M/*Menacanthus curuccae* (Schrank, 1776)**		2	
Locustella luscinioides (Savi, 1824)	1/2	M/*Menacanthus obrteli* Balát, 1981[1]	5	9	17
	1/2	P/*Brueelia locustellae* Fedorenko, 1975	6	3	2
Phylloscopus trochilus (Linnaeus, 1758)	1/1	M/*Menacanthus agilis* (Nitzsch, 1866)		1	
Sylvia atricapilla (Linnaeus, 1758)	3/78	H/*Ornithomya avicularia* (Linnaeus, 1758)		5	
	3/78	H/*Ornithomya fringillina* Curtis, 1836	1	3	
	1/78	M/*Menacanthus curuccae* (Schrank, 1776)		1	
	3/78	M/*Menacanthus eurysternus* (Burmeister, 1838)**		3	3
	2/78	M/*Myrsidea sylviae* Sychra & Literák, 2008		1	
	1/78	P/*Brueelia neoatricapillae* Price, Hellenthal, Palma, 2003		1	
	1/78	P/*Brueelia tovornikae* (Balát, 1981)		1	
Family Prunellidae					
Prunella modularis (Linnaeus, 1758)	2/10	H/*Ornithomya avicularia* (Linnaeus, 1758)	1	2	
	1/10	H/*Ornithomya fringillina* Curtis, 1836		1	
Family Muscicapidae					
Erithacus rubecula (Linnaeus, 1758)	5/15	H/*Ornithomya fringillina* Curtis, 1836	3	2	
Family Turdidae					
Turdus merula (Linnaeus, 1758)	4/12	H/*Ornithomya avicularia* (Linnaeus, 1758)	1	3	
	3/12	M/*Menacanthus eurysternus* (Burmeister, 1838)		4	6
	7/12	P/*Brueelia merulensis* (Denny, 1842)	15	18	
	1/12	P/*Philopterus turdi* (Denny, 1842)		3	1
Turdus philomelos Brehm, C. L., 1831	5/15	H/*Ornithomya avicularia* (Linnaeus, 1758)		6	
	5/15	P/*Brueelia merulensis* (Denny, 1842)**	2	7	
Family Troglodytidae					
Troglodytes troglodytes (Linnaeus, 1758)	1/7	H/*Ornithomya fringillina* Curtis, 1836		1	
	2/7	P/*Penenirmus albiventris* (Scopoli, 1763)			23
Family Laniidae					
Lanius collurio Linnaeus, 1758	1/8	H/*Ornithomya avicularia* (Linnaeus, 1758)		2	
	7/8	M/*Menacanthus camelinus* (Nitzsch, 1874)	18	38	22
Family Paridae					
Parus caeruleus (Linnaeus, 1758)	1/1	H/*Ornithomya avicularia* (Linnaeus, 1758)		1	
Parus major (Linnaeus, 1758)	2/7	H/*Ornithomya fringillina* Curtis, 1836		2	
Parus montanus (Conrad von Baldenstein, 1827)	1/7	H/*Ornithomya fringillina* Curtis, 1836		1	
Family Certhiidae					
Certhia familiaris (Linnaeus, 1758)	1/4	H/*Ornithomya fringillina* Curtis, 1836	1		
Family Fringilidae					
Pyrrhula pyrrhula (Linnaeus, 1758)	1/3	P/*Brueelia pyrrhularum* Eichler, 1954	2	7	
Family Emberizidae					
Emberiza schoeniclus (Linnaeus, 1758)	1/3	H/*Ornithomya fringillina* Curtis, 1836	1		

Prev. = prevalence = number of birds parasitized/number of birds examined, C = Ceratophyllidae, H = Hippoboscidae, M = Menoponidae, P = Philopteridae, ** = new host-louse record.
[1] Sychra *et al.*, 2008.

Table I. – List of hosts and their insect ectoparasites.

	Insect ectoparasites	Louse-flies	Chewing lice
Prevalence (%) (n = 262)[1]	31.3	17.2	15.3
Mean intensity (range)	4.2 (82)[2] (1-38)	1.4 (45)[2] (1-3)	7.0 (40)[2] (1-38)
Mean abundance (n = 262)[1]	1.3	0.2	1.1
Richness (range) (n = 36)[3]	1.2 (0-7)	0.6 (0-2)	0.6 (0-5)
Percentage males	–	19.7 (61)[4]	33.3 (162)[4]
Percentage adults	–	–	42.1 (280)[5]

[1] = number of birds examined, [2] = number of birds parasitized, [3] = number of host species, [4] = number of adults, [5] = number of aged lice.

Table II. – Parasitological parameters of insect ectoparasites collected from wild passerine birds in the Czech Republic.

2004 (Bartošovice) and from 29 July to 24 September 2005 (Čerťák). At these sites, an ornitological mist-netting and ringing project was carried out. Every individual bird was identified, sexed and aged using Hromádko *et al.* (1992, 1993, 1998) and Svensson *et al.* (1999). Insect ectoparasites were collected by visual examination and using the fumigation chamber method with visual search of the head (Clayton & Drown, 2001). Ectoparasites were fixed in 70 % ethanol. Chewing lice and fleas were subsequently slide-mounted in Canada balsam as permanent slides, following the technique in Palma (1978), for proper identification.

Identification of the lice was based on papers by Price (1977) and Zlotorzycka (1976, 1977). The nomenclature of the lice follows Price *et al.* (2003). Identification of the louse-flies and fleas was based on papers by Chvála (1980) and Rosický (1957). The taxonomy of the birds follows Dickinson (2003).

The following parasitological parameters are evaluated in this paper: 1) Richness is the number of species of ectoparasites on a host taxon; 2) Host specificity is the range of host taxa infested by a given ectoparasite taxon; 3) Dominance is number of individuals of a parasite species as a percentage of the total number of individuals collected from examined birds; 4) Prevalence is the proportion of the members of a taxon infested with ectoparasites; 5) Mean intensity is number of individuals of a particular ectoparasite species on infested hosts; 6) Mean abundance is number of individuals of a particular ectoparasite species on examined birds (Marshall, 1981; Bush *et al.*, 1997).

RESULTS

A total of 262 individuals of 36 bird species belonging to the passerine families Motacillidae, Hirundinidae, Sylviidae, Prunellidae, Turdidae, Muscicapidae, Troglodytidae, Laniidae, Paridae, Certhiidae, Sittidae, Fringilidae and Emberizidae were examined in Bartošovice (2004) and Čerťák (2005) during the post-breeding migration. Eighty two birds (31 %, n = 262) of 23 species were parasitized with three species of louse-flies of the genus *Ornithomya* Latreille, two species of fleas in the genera *Ceratophyllus* Curtis and *Dasypsyllus* Baker, and 15 species of chewing lice of the genera *Myrsidea* Waterston, *Menacanthus* Neumann, *Brueelia* Kéler, *Penenirmus* Clay and Meinertzhagen and *Philopterus* Nitzsch (see Table I). Young birds were the most parasitized hosts (85 %, n = 82). The average number of ectoparasite species was 1.2 on individual bird species. Most birds were parasitized with only one species of ectoparasite. Fewer birds were either parasitized with two species of lice (five cases), or with the louse-fly *O. avicularia* and one species of chewing louse (*B. merulensis,* three cases). The highest number of insect ectoparasite species was found on *Sylvia atricapilla* and *Motacilla cinerea* Tunstall (Table I). Mean species richness, mean intensity and prevalence are given in Table II. The mean host specificity score for louse-flies and chewing lice was 7.3 (range 2-12) and 1.3 (range 1-3), respectively. The following dominance was found for five genera of lice: *Menacanthus* (64 %), *Brueelia* (26 %), *Penenirmus* (8 %), *Philopterus* (1.5 %) and *Myrsidea* (0.5 %, n = 280). The overall sex ratio of lice was female-biased (108 females against 54 males; $\chi^2 = 18$, $P < 0.001$). The overall age ratio of lice was adult-biased (162 adults against 118 immatures; $\chi^2 = 6.91$, $P < 0.01$).

DISCUSSION

In the course of this study, ecological and parasitological characteristics were evaluated for small passerine birds during their post-breeding migration in the central Europe.

The time of the year when the sampling was carried out is the best period for collecting louse-flies, since adult flies occur mainly during the period July - September (Chalupský & Povolný, 1983). Considering their high mobility, the collection of louse-flies from birds doesn't predict their total abundance in a given locality. Louse-flies of the genus *Ornithomya* are not host specific as they usually feed on an array of unrelated hosts. From the records published in Chalupský & Povolný (1983) and Krištofík (1998), we report the following new host records for the Czech Republic: *Pru-*

nella modularis and *Sylvia atricapilla* for *O. avicularia*; *Parus montanus*, *Troglodytes troglodytes*, *Certhia familiaris*, *Phylloscopus trochilus* and *Motacilla cinerea* for *O. fringillina*.

Finding fleas on the bodies of birds is usually accidental. Both species of fleas recorded in this paper have been commonly found on the same hosts by Rosický (1957).

The prevalence and intensity of ectoparasites, especially chewing lice, recorded in the present study are considerably lower than those recorded in similar surveys by Wheeler & Threlfall (1986) and Clayton *et al.* (1992). One possible explanation for the low number of lice found in this study could be methodological differences. While Clayton *et al.* (1992) collected lice from dead birds we examined live birds using the fumigation chamber method. Clayton & Drown (2001) showed that this method could give reasonably accurate predictors of total abundance. However, in the case of data sets restricted to birds with relatively small infestations, it would explain only 45-55 % of variation in the total abundance. The expected value of overall abundance of lice calculated by that method is still lower than those recorded by Wheeler & Threlfall (1986) and Clayton *et al.* (1992). On the other hand, the overall proportion of males as well as adult lice were similar to that reported by those authors.

Another possible explanation for the relatively low number of lice found in this study could be the time of the year when the sampling was carried out. Unlike louse-flies, populations of chewing lice decrease during the period July-September (Ash, 1960; Price *et al.*, 2003). Most passerines moult during their post-breeding period (Hromádko *et al.*, 1992, 1993, 1998), and moulting may have been the key factor in reducing the louse populations of the birds deloused during this study (Kettle, 1983; Doyle *et al.*, 2005). The very low prevalence of lice (1.3-3.8 %) on *Sylvia atricapilla*, a host with the highest number of individuals examined and the highest species richness (see Table I), was surprising. However, the overall prevalence of lice on this host was 9 % (n = 78), with a similar prevalence (9.5 %, n = 179; or 4.9 %, n = 61) recorded by Pérez-Tris *et al.* (2002) and Frenzel (2006), respectively. Four species of lice have been recorded from *S. atricapilla* by Price *et al.* (2003). One of the five species of lice collected from *S. atricapilla* from the Czech Republic and reported in this paper is cited for the first time for this host.

Myrsidea sylviae was described recently (Sychra & Literák, 2008) with *S. atricapilla* as a type host.

Myrsidea is the most speciose menoponid genus parasitizing mainly passerines. In their world checklist, Price *et al.* (2003) recognized 207 species of the genus *Myrsidea* including 197 parasitic species on 267 species of passerine birds from 34 families. A further 65 new species of this genus have been described since the publication of that checklist (see Price & Dalgleish, 2007). In this regard, it is interesting to point out that hitherto no other species of *Myrsidea* had been described from such a diverse and widespread passerine group as the Sylviidae.

If *Myrsidea* species are an example of highly host-specific lice, species of the genus *Menacanthus*, on the other hand, are found on a broader range of closely related hosts, usually belonging to a single family. Our findings corroborate that host-louse distribution pattern, extending the host range for several species. *Menacanthus pusillus*, previously known from several motacillid hosts, has now been found for the first time on *Motacilla cinerea*, while *Menacanthus currucae*, parasitic on several sylviid hosts, has now been found on *Hippolais icterina* for the first time. A further new host, *Sylvia atricapilla*, is also listed here for *Menacanthus eurysternus*, a louse species recorded from an extremely large number of hosts (Price *et al.*, 2003).

Like *Myrsidea*, chewing lice of the genus *Brueelia* are also highly host-specific. All currently recognized species of *Brueelia* are restricted to one or, much less often, a few host species (Price *et al.*, 2003). This fact is interesting if we consider that several species of *Brueelia* are known to use other arthropods, especially louse-flies of the family Hippoboscidae, to colonize new hosts in a process called phoresis (Keirans, 1975). This type of louse transport is largely non-host specific. In their DNA-based analysis of co-evolutionary relationships, Johnson *et al.* (2002) found that the phylogeny of some species of the louse genus *Brueelia* does not reflect that of their hosts. The reasons given by the authors are phoresis and the chewing lice ability to adapt to new hosts. Our finding of *B. merulensis* on *T. philomelos*, a louse primarily known from *Turdus merula*, may be an example of such a scenario. This is the first record of *B. merulensis* from *T. philomelos*. Because *B. merulensis* has been found on five birds, the possibility that they were accidental stragglers can be ruled out. In addition, *B. merulensis* has often been reported from hippoboscids (*e.g.* Ash & Monk, 1959; Walter, 1989). Since *Turdus merula* and *T. philomelos* are sympatric, a host-switch of *B. merulensis* from the former host onto the latter is possible.

A similar explanation may be given for our record of one female *B. merulensis* from *Motacilla cinerea*. Because that was the first bird we examined, we can safely assume that it was not a contaminant from another of the birds we examined. Also, we collected from that same bird one *Ornithomya avicularia* with another female of *B. merulensis* attached to its abdomen. The question remains whether *B. merulensis* could survive on *Motacilla cinerea*, which is not only unrelated to thrushes, but also has different body proportions. In any case, our findings are clear evidence that phoresis is taking place in our study area.

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