

ORIBATID MITES (ORIBATEI) IN BIRD FEATHERS: PASSERIFORMES

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Abstract. The authors establish the fact of distribution of oribatid mites by birds earlier unknown from the literature. More than 1,222 individuals of 150 species of birds of different ecological groups were surveyed. 146 species of live oribatid mites were collected in bird feathers. Some oribatid mite species constantly live in bird feathers. The authors assume, that they eat not particles of bird skin, but fungi, which live on bird feathers and skin, as all oribates are micophagous.

Key words: oribatid mites, bird feathers

ORIBATID MITES IN NESTS AND FEATHERS OF CORVIDAE

Birds that have been investigated most thoroughly as possible carriers of oribatid mites are birds of the family Corvidae since they are relatively large and easily available during different seasons of the year. Two hundred and seventy-two individuals of the family Corvidae were investigated in Russia (Rostov, Moscow, Kostroma and Vladimir Provinces), Ukraine (Odessa and Kiev Provinces) and Belarus (Homel Province): Jay (*Garrulus glandarius*), Magpie (*Pica pica*), Nutcracker (*Nucifraga caryocatactes*), Jackdaw (*Corvus monedula*), Rook (*Corvus frugilegus*), Carrion Crow (*Corvus corone corone*), Hooded Crow (*Corvus corone cornix*), and Raven (*Corvus corax*). Nests of Rooks (n = 4) from the Rostov Province were investigated (January 2001). Results of the study are presented in Table 1.

It should be noted that 61 species of oribatid mites, including specimens of *Tectocephus*, *Camisia*, *Nanhermania*, *Scheloribates* and *Carabodes*, were found not only in their adult stage, but in their preimaginal stages as well (larvae and nymphs). Microarthropods were not found in feathers of 10 moulting Hooded Crows and three moulting Rooks. The most common mites in the feathers of Corvidae were: *Carabodes marginatus* (Hooded Crow, Magpie, Jackdaw and Rook); *C. areolatus* (Jay, Jackdaw, Hooded Crow); *Oppiella nova* (Jay, Hooded Crow, Raven, Jackdaw and Rook); *Liochthonius sellnicki* (Jackdaw, Rook, Hooded Crow); *Platynothrus peltifer* (Rook, Carrion Crow and Hooded Crow); *Fosseremaeus lacinatus* (Hooded Crow, Raven and Jackdaw); *Zygoribatula exilis* (Hooded Crow, Jackdaw and Rook); *Suctobelbella subcornigera*

(Jay, Hooded Crow, Raven); *Tectocephus velatus* (Hooded Crow, Nutcracker, Jackdaw, Raven, Rook and Jay). The greatest variety of species of oribatid mites was recorded in the plumage of Hooded Crow (17) and Jackdaw (14) from the Moscow Province and in the plumage of Rook (11) from the Homel Province. *Carabodes areolatus*, *Quadroppia quadricarinata* and *Tectocephus velatus* were found in the feathers of Hooded Crow from the Moscow and Rostov Provinces. Some species of oribatid mites were recorded only in single specimens of Corvidae birds. For example, *Liebstadia humerata*, *Liochthonius rufulus*, *Oppia splendens*, *Oppiella unicarinata*, *Scheloribates laevigatus* and *Steganacarus striculus* were found only in a Hooded Crow from the Moscow Province; *Oribatula tibialis* was found only in a Jay from the Kostroma Province; *Diapterobates notatus* was found only in a Raven from the Moscow Province; *Chamobates* sp., *Nanhermannia coronata*, *Neoribates roubali* and *Punctoribates punctum* were found only in a Magpie from the Homel Province; *Anachipteria latitecta* was found in a Jackdaw from the Moscow Province; *Trimalacothonrus* sp. and *Tropacarus carinatus* were found in a Rook from the Moscow Province.

Some oribatid mites found in bird feathers, including representatives of *Tectocephus*, *Camisia*, *Nanhermannia*, *Scheloribates* and *Carabodes* genera, were not only adults, but also larvae and nymphs. It has been determined that larvae and nymphs of oribatid mites dwell in the plumage of Hooded Crow, one of the most thoroughly investigated bird species, even in midwinter. In 1999, snow covered the Moscow Province at the beginning of October. Consequently, larvae and nymphs of oribatid mites that were found in the feathers of

Table 1. Composition of microarthropods in the feathers of Corvidae from Eastern Europe.

| Oribatid species | Jay | Magpie | Nut-cracker | Jackdaw | Rook | Carrion Crow | Hooded Crow | Raven | Total number of specimens |
|--|-----|--------|-------------|---------|------|--------------|-------------|-------|---------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| <i>Paleacarus hystricinus</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Hypochthonius rufulus</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Brachychthonius berlesei</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Liochchthonius sellnicki</i> | – | – | – | 1 | 1 | – | 5 | – | 7 |
| <i>Phthiracarus ligneus</i> | – | – | – | 1 | – | – | – | – | 1 |
| <i>Phthiracarus</i> sp. | – | – | – | 1 | – | – | 1 | – | 2 |
| <i>Steganacarus striculus</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Nothrus palustris</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Camisia spinifer</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Camisia</i> sp. | – | – | – | 1 | – | – | 2 | – | 3 |
| <i>Platynothrus peltifer</i> | – | – | – | – | 4 | 1 | 1 | – | 6 |
| <i>Trhypochthonius excavatus</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Trhypochthonius tectorum</i> | – | – | – | 1 | – | – | – | – | 1 |
| <i>Trimalaconothrus</i> sp. | – | – | – | – | 1 | – | – | – | 1 |
| <i>Nanhermania coronata</i> | – | 2 | – | – | – | – | 2 | – | 4 |
| <i>Poroliodes farinosus</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Belba</i> sp. | – | – | – | – | – | – | 4 | – | 4 |
| <i>Hypodamaeus riparius</i> | – | – | – | – | 1 | – | – | – | 1 |
| <i>Metabelba</i> sp. | – | – | – | 1 | – | – | – | – | 1 |
| <i>Cepheus cefeiformes</i> | – | – | – | – | 1 | – | – | – | 1 |
| <i>Fosseremaeus laciniatus</i> | – | – | – | 1 | – | – | 1 | 1 | 3 |
| <i>Eremeus hepaticus</i> | – | – | – | – | 1 | – | – | – | 1 |
| <i>Eremeus oblongus</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Furcoribala furcillata</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Xenillus discrepans</i> | – | – | – | 1 | – | – | – | – | 1 |
| <i>Carabodes areolatus</i> | 3 | – | – | 1 | – | – | 7 | – | 11 |
| <i>Carabodes marginatus</i> | – | 1 | – | 3 | 1 | – | 3 | – | 8 |
| <i>Tectocepheus velatus</i> | 1 | – | 1 | 3 | 5 | – | 19 | 1 | 30 |
| <i>Autognetha longilamellata</i> | – | – | – | 1 | – | – | – | – | 1 |
| <i>Conchogneta delacarlca</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Caleremeus monilipes</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Oppia fallax</i> v. <i>obsoleta</i> | – | – | – | 2 | – | – | 1 | – | 3 |
| <i>Oppia splendans</i> | – | – | – | – | – | – | 4 | – | 4 |
| <i>Oppia translamellata</i> | – | – | – | – | – | – | 2 | – | 2 |
| <i>Oppia unicarinata</i> | – | – | – | – | – | 1 | 7 | – | 8 |
| <i>Oppiella nova</i> | 1 | – | – | 3 | – | 1 | 8 | 1 | 14 |
| <i>Oppiella</i> sp. | – | 1 | – | – | – | – | – | – | 1 |
| <i>Quadropia quadricarinata</i> | – | – | – | – | 1 | – | 3 | – | 4 |
| <i>Suctobelba trigona</i> | – | – | – | – | 1 | – | 1 | – | 2 |
| <i>Suctobelbella baloghi</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Suctobelbella subcornigera</i> | 1 | – | – | – | – | – | 2 | 1 | 4 |
| <i>Suctobelbella</i> sp. | 1 | 1 | – | – | – | – | 3 | – | 5 |
| <i>Oribella castanea</i> | – | – | – | – | – | – | 1 | 1 | 2 |
| <i>Zygoribatula exilis</i> | – | – | – | 1 | 2 | – | 4 | – | 7 |
| <i>Protoribates lagenula</i> | – | – | – | – | – | – | 1 | – | 1 |
| <i>Scheloribates confundatus</i> | – | – | 1 | – | – | – | – | – | 1 |

Table 1 continued

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------------------------------|---|---|---|---|----|----|---|-----|----|-----|
| <i>Scheloribates laevigatus</i> | – | – | – | – | – | 1 | – | 1 | 1 | 3 |
| <i>Scheloribates latipes</i> | – | – | – | – | 1 | – | – | – | – | 1 |
| <i>Neoribates roubali</i> | – | – | 1 | – | – | – | – | – | – | 1 |
| <i>Ceratozetes cisalpinus</i> | – | – | – | – | – | 1 | – | – | – | 1 |
| <i>Diapterobates notatus</i> | – | – | – | – | – | – | – | – | 1 | 1 |
| <i>Melanozetes mollucomus</i> | – | – | – | – | – | – | – | 2 | – | 2 |
| <i>Chamobates cuspidatus</i> | – | – | – | – | – | – | – | 1 | – | 1 |
| <i>Chamobates lapidarius</i> | – | – | 1 | – | – | – | – | – | – | 1 |
| <i>Euzetes seminulum</i> | – | – | – | – | – | 1 | – | – | – | 1 |
| <i>Punctoribates punctum</i> | – | – | 1 | – | – | 1 | – | – | – | 2 |
| <i>Achipteria</i> sp. | – | – | – | – | 1 | – | – | – | – | 1 |
| <i>Parachipteria punctata</i> | – | – | – | – | 1 | 2 | – | 3 | – | 6 |
| <i>Tegoribates latirostris</i> | – | – | – | – | – | 1 | – | – | – | 1 |
| <i>Galumna lanceata</i> | – | – | – | – | – | 1 | – | – | – | 1 |
| <i>Pergalumna nervosa</i> | – | – | – | – | – | – | – | 1 | – | 1 |
| Oribatei nymphs (no determ.) | – | – | – | – | 2 | 11 | – | 20 | 5 | 38 |
| Collembola | – | – | 9 | – | – | – | – | 34 | 14 | 57 |
| Prostigmata | – | – | 2 | – | 2 | 1 | – | 35 | 8 | 48 |
| Acaridia | – | – | 1 | – | – | – | – | 1 | – | 2 |
| Gamasidae | – | – | – | – | 6 | – | – | 14 | 5 | 25 |
| Analgoidea | – | – | – | – | 2 | – | – | 34 | – | 36 |
| Mallophaga | – | – | – | – | 3 | – | – | 14 | – | 17 |
| Total number of oribatid species | | 3 | 7 | 2 | 18 | 18 | 3 | 40 | 7 | 61 |
| Number of birds | | 9 | 5 | 2 | 24 | 23 | 1 | 204 | 5 | 273 |

Hooded Crow in January and February had had to emerge from eggs laid by the mites on the skin of birds, since the life span of each stage of development (larva, protonymph, deutonymph and tritonymph) usually lasts from three to seven days. In Rooks from all the investigated geographical localities, oribatid mites in their preimaginal stages were found. This means that oribatid mites are capable of going through all the stages of their lifecycle in the plumage of birds.

Our observations have revealed unambiguously that oribatid mites, as well as other microarthropod groups (including collembolans), are constant inhabitants of bird feathers. Our studies carried out in 1998–2001 revealed that oribatid mites are constantly found in the plumage of a great variety of birds belonging to different ecological and taxonomic groups. A great number of immature oribatid mites (larvae and nymphs) were found in the feathers of birds as well (such species as *Trhypochthonius tectorum*, *Tectocephus velatus*, *Diapterobates notatus* and *Carabodes marginatus* were especially frequent). Larvae and nymphs of the above-mentioned species can be found even in the midwinter.

Hence we may conclude that some species of oribatid mites are constant inhabitants of bird feathers. Our research data have also revealed that oribatid mites can reproduce in the plumage of Corvidae birds. This can be said without doubt about *Tectocephus velatus*.

Large and old nests of a great number of Corvidae birds (Hooded Crow, Magpie, Rook and Raven) that were built many years ago include soil, which occurs in them during the process of building. Such an environment turns out to be a very attractive habitat for oribatid mites. Data on oribatid mites inhabiting Corvidae nests are presented in Table 2.

Table 2 shows that Corvidae nests are inhabited by oribatid mites, which are more numerous and diverse than oribatid mites inhabiting nests of any other bird species (Krivolutsky & Lebedeva 1999; Lebedeva *et al.* 1998, 1999). Distribution of oribatid mites in Corvidae nests is extremely irregular. For instance, the number of oribatid mites in most nests of Hooded Crow varies from one to two specimens a nest. However, over 275 oribatid mites belonging to 35 species were found in a nest of Hooded Crow in Moscow.

Table 2. Composition of oribatid mites and other microarthropods in Corvidae nests (+ – 1–10 specimens, ++ – 11–20 specimens, +++ >20 specimens).

| Microarthropods | Hooded Crow | Magpie | Raven | Jay | Rook |
|--|-------------|--------|-------|-----|------|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Number of nests | 10 | 11 | 1 | 1 | 4 |
| Prostigmata | ++ | + | – | – | – |
| Gamasida | + | + | – | – | – |
| Acaridia | ++ | + | – | – | – |
| Scutacaridae | – | + | – | – | – |
| Collembola | + | + | – | – | – |
| Oribatid imagos | – | – | – | – | – |
| <i>Palaeacarus histicinus</i> | + | – | – | – | – |
| <i>Eniochthonius minutissimus</i> | – | – | – | – | + |
| <i>Hypochthonius rufulus</i> | – | + | – | – | – |
| <i>Cosmochthonius lanatus</i> | – | – | – | – | + |
| <i>Brachychthonius berlesei</i> | – | – | – | – | + |
| <i>Liochthonius sellnicki</i> | + | – | – | – | – |
| <i>Liochthonius</i> sp. | + | – | – | – | – |
| <i>Phthiracarus globosus</i> | – | + | – | – | – |
| <i>Phthiracarus lentulus</i> | – | + | – | – | – |
| <i>Phthiracarus ligneus</i> | + | + | – | – | – |
| <i>Phthiracarus</i> sp. | + | + | – | + | – |
| <i>Steganacarus applicatus</i> | + | – | – | – | – |
| <i>Steganacarus striculus</i> | + | – | – | – | + |
| <i>Steganacarus</i> sp. | + | – | – | – | – |
| <i>Tropacarus carinatus</i> | + | +++ | – | + | – |
| <i>Oribotritia loricata</i> | – | – | – | – | + |
| <i>Heminothrus paolianus</i> | – | – | – | – | + |
| <i>Platynothrus peltifer</i> | – | + | – | – | – |
| <i>Trhypochthonius tectorum</i> | + | + | – | – | – |
| <i>Malaconothrus egregius</i> | + | – | – | – | + |
| <i>Nanhermannia coronata</i> | – | – | – | – | + |
| <i>Licnodamaeus undulatus</i> | + | – | – | – | – |
| <i>Belba sellnicki</i> | + | – | – | – | – |
| <i>Belba verrucosa</i> | – | + | – | – | – |
| <i>Fosseremaeus lacinatus</i> | + | – | – | – | – |
| <i>Eremobelba geographica</i> | – | + | – | – | – |
| <i>Eremaeus oblongus</i> | + | – | – | – | – |
| <i>Adoristes ovatus</i> | – | – | – | + | + |
| <i>Ceratoppia bipilis</i> | + | – | – | – | – |
| <i>Carabodes areolatus</i> | + | + | – | – | + |
| <i>Carabodes labyrinthicus</i> | – | – | – | – | + |
| <i>Carabodes marginatus</i> | + | + | – | – | – |
| <i>Tectocephus velatus</i> | +++ | ++ | – | + | + |
| <i>Autogneta</i> sp. | – | – | – | – | + |
| <i>Concogneta delacarlica</i> | – | – | – | – | + |
| <i>Caleremaeus monilipes</i> | – | – | – | – | + |
| <i>Epimerella</i> sp. | – | – | – | – | + |
| <i>Oppia fallax</i> v. <i>obsoleta</i> | + | + | – | – | + |
| <i>Oppia minus</i> | – | + | – | – | – |

Table 2 continued

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|-----|-----|---|---|----|
| <i>Oppia ornata</i> | – | – | – | – | + |
| <i>Oppia splendens</i> | + | + | + | – | – |
| <i>Oppia</i> sp. | + | – | – | – | + |
| <i>Oppiella neerlandica</i> | – | +++ | – | – | – |
| <i>Oppiella nova</i> | +++ | ++ | – | – | – |
| <i>Oppiella unicarinata</i> | +++ | – | – | – | – |
| <i>Quadroppia quadricarinata</i> | ++ | + | – | – | + |
| <i>Suctobelba trigona</i> | + | + | – | – | – |
| <i>Suctobelbella sybcornigera</i> | – | – | – | – | + |
| <i>Suctobelbella</i> sp. | +++ | + | – | – | – |
| <i>Micreremaeus brevipes</i> | – | + | – | – | – |
| <i>Peloribates longipilosus</i> | – | + | – | – | – |
| <i>Oribatula tibialis</i> | + | + | – | – | – |
| <i>Zygoribatula exarata</i> | – | + | – | – | – |
| <i>Zygoribatula exilis</i> | + | + | – | + | – |
| <i>Liebstadia similis</i> | – | + | – | – | – |
| <i>Scheloribates laevigatus</i> | + | + | – | – | + |
| <i>Scheloribates latipes</i> | – | + | – | – | – |
| <i>Ceratozetes gracilis</i> | – | + | – | – | – |
| <i>Ceratozetes mediocris</i> | – | + | – | – | – |
| <i>Diapterobates notatus</i> | – | + | + | – | – |
| <i>Melanozetes mollicomus</i> | – | – | – | – | + |
| <i>Trichoribates trimaculatus</i> | + | + | – | – | + |
| <i>Chamobates cuspidatus</i> | + | – | – | – | – |
| <i>Chamobates lapidarius</i> | – | + | – | – | – |
| <i>Minunthozetes pseudofusiger</i> | – | + | – | – | – |
| <i>Minunthozetes semirufus</i> | – | + | – | – | – |
| <i>Mycobates parmeliae</i> | – | – | – | – | + |
| <i>Eupelops</i> sp. | + | + | – | – | – |
| <i>Punctoribates punctum</i> | – | + | – | – | + |
| <i>Oribatella berlesei</i> | + | – | – | – | – |
| <i>Oribatella calcarata</i> | + | – | – | – | – |
| <i>Anachipteria latitecta</i> | – | – | – | – | + |
| Larvae | – | – | – | – | – |
| Oribatei (no determ.) | ++ | ++ | – | – | – |
| <i>Camisia</i> sp. | – | – | – | – | + |
| Nymphs | – | – | – | – | – |
| <i>Nothrus palustris</i> | + | – | – | – | – |
| <i>Camisia biurus</i> | + | – | – | – | – |
| <i>Camisia segnis</i> | + | – | – | – | – |
| <i>Poroliodes farinosus</i> | – | + | – | – | + |
| <i>Belba</i> sp. | + | + | – | – | – |
| <i>Metabelba pulverrulenta</i> | + | + | – | – | – |
| Damaeidae | + | – | + | – | – |
| <i>Ceratoppia bipilis</i> | + | – | – | – | – |
| <i>Diapterobates notatus</i> | – | + | + | – | – |
| Total number of species of mite imagos and nymphs | 42 | 41 | 3 | 5 | 28 |

In total, 79 species of oribatid mites were found in Corvidae nests. Most of them are of great interest from the faunistic point of view. Such are *Steganacarus applicatus* found for the first time in the territory of Russia and *Peloribates longipilosus*, *Eremobelba geographica*, *Zygoribatula exarata* and *Licnodamaeus undulatus*, which are very rare in the European part of Russia. *Palaeacarus histricinus*, quite a rare and extremely primitive species, was found in the nests and plumage of Corvidae for the first time. Some species (*Nothrus palustris*, *Poroliodes farinosus*, *Camisia segnis*, *C. biurus* and *Ceratoppia bipilis*) were found in the nests of birds only in the nymphal form. Nymphs of other species, especially *Tectocephus velatus*, *Carabodes* sp., *Metabelba* sp., *Belba* sp. and *Diapterobates notatus*, were customary. This fact demonstrates that these species not only inhabit Corvidae nests, but they can also reproduce in them. *Carabodes areolatus*, *Oppia fallax* v. *obsoleta*, *Quadroppia quadricarinata* and *Scheloribates laevigatus* were found in a great number of nests of Hooded Crow, Magpie and Rook; *Oppia splendens* prevailed in the nests of Hooded Crow, Magpie and Raven; *Phthiracarus* sp. and *Zygoribatula exilis* dominated in the nests built by Hooded Crow, Magpie and Jay; *Tectocephus velatus* was frequently found in the nests of Hooded Crow, Magpie, Jay and Rook.

The greatest diversity of species was found in the nests of Hooded Crow (37) and Magpie (41) from the Moscow Province and in the nests of Rook (28) from the Rostov Province. The most common species of oribatid mites found in the nests of Hooded Crow in both provinces were *Carabodes marginatus*, *Oppia* sp., *Palaeacarus histricinus*, *Suctobelbella* sp. and *Trichoribates trimaculatus*. *Carabodes areolatus*, *C. marginatus*, *Minunthozetes pseudofusiger*, *Tectocephus velatus* and *Tropacarus carinatus* were found in the nests of Magpie in two provinces. Some species of oribatid mites were found only in single Corvidae nests. Thus, *Belba sellnicki*, *Camisia biurus*, *C. segnis*, *Ceratoppia bipilis* and *Chamobates cuspidatus* were found only in a nest of Hooded Crow in the Moscow Province.

Interestingly, reproduction of oribatid mites was absent in Corvidae nests collected on the eastern bank of the Don River in the environs of Rostov-on-Don at the end of October. Only single nymphs in their last stage of development (tritonymphs) were present there. Since they are capable of wandering around by themselves, they, quite possibly, had penetrated the nests from soil in spite of the fact that the nests were built at the height of 7–13 m from the ground. Heavily pigmented surface inhabitants of the soil (epifauna) were clearly dominant there, with the prevalence of mites of the genera *Tropacarus*, *Eupelops*, *Carabodes* and *Trichoribates*, and the

nymphs of the genera *Poroliodes* and *Ceratoppia*. All these mites were capable of climbing to the tops of trees by themselves in search of food (they, especially in wet weather, feed on microscopic fungi and algae) and of inhabiting Corvidae nests since dampness in these nests was relatively steady. The faunistic findings from these nests are very interesting: *Palaeacarus histricinus*, a new species for the Rostov Province; a species of the genus *Liochthonius* sp., which is very rare in the nests of birds; and some other species, such as a species of the genus *Steganacarus* sp., which had never been found in Russia before. The determination of the latter species should be specified. In addition to the oribatid mites, other soil invertebrates (arachnids, Prostigmata, Gamasidae, collembolans, Diptera larvae, fleas and even earthworms (*Dendrobaena octaedra*) were found in Corvidae nests. It should be noted that quite a diverse fauna of collembolans (*Collembola*) was found in 20% of investigated birds. In most cases, their abundance was 1–2 specimens a bird, but in some cases it made 5–6 or even 14 (in a Raven) specimens a bird. Generally, however, collembolans were small in numbers (mostly single specimens), and they were less numerous and less diverse than mites. This may be related to their lower resistance to desiccation, which is periodically unavoidable for the inhabitants of nests situated in trees at the height of 5–12 m over the surface of soil.

The following common species of oribatid mites were found in the nests of Hooded Crow from the Moscow Province: *Carabodes areolatus*, *Fosseremaeus lacinatus*, *Liochthonius sellnicki*, *Oppia splendens*, *Oppiella nova*, *O. unicarinata*, *Palaeacarus histricinus*, *Quadroppia quadricarinata*, *Scheloribates laevigatus*, *S. latipes*, *Steganacarus striculus*, *Suctobelba trigona*, *Tectocephus velatus* and *Zygoribatula exilis*. *Carabodes marginatus* were found both in the feathers and nests of Hooded Crow in the Rostov Province.

In all likelihood, oribatid mites penetrate the plumage of birds from the surface of soil or the nests abundantly inhabited by these mites, as it is shown in this study. In our opinion, the data obtained during our research are of great importance both for the biogeography of oribatid mites themselves and biogeography of birds, vectors of mites, as distinctive biomarkers of their geographical populations and passage routes.

Thus, the diverse and numerous fauna of oribatid mites inhabiting the plumage and nests of Corvidae birds has been investigated in the territory of Russia for the first time. However, the current study requires a continuation. To all appearance, Corvidae birds play an important role in the geographical distribution of oribatid mites in the European part of Russia and in accumulation of more southerly species in this region.

ORIBATID MITES IN THE PLUMAGE OF OTHER PASSERIFORMES

Small Passeriformes make up the main avian fauna in all the regions of the European part of Russia. However, there was a majority of specimens in some populations of Passeriformes (including Starling (*Sturnus vulgaris*), some species of swallows and warblers, House Sparrow (*Passer domesticus*), etc.) that did not contain any oribatid mites in their feathers. This was a serious problem hindering our research since it was very difficult for us to obtain large representative series of birds. Nevertheless, it has been determined that oribatid mites are quite numerous in the plumage and nests of many Passeriformes (Lebedeva *et al.* 1998, 1999; Krivolutsky *et al.* 2001a, b). In total, 950 specimens belonging to 63 species of Passeriformes were investigated. Tree Sparrow (*Passer montanus*) and House Sparrow were investigated especially thoroughly (about 300 specimens containing 55 species of oribatid mites of the first species and over 100 specimens containing 23 species of oribatid mites of the latter one). Oribatid mites were found in 57 species of small Passeriformes: Barn Swallow (*Hirundo rustica*), Horned Lark (*Eremophila alpestris*), Woodlark (*Lullula arborea*), Tree Pipit (*Anthus trivialis*), Meadow Pipit (*Anthus pratensis*), Yellow Wagtail (*Motacilla flava*), White Wagtail (*Motacilla alba*), Penduline Tit (*Remiz*

pendulinus), Red-backed Shrike (*Lanius collurio*), Golden Oriole (*Oriolus oriolus*), Starling, Waxwing (*Bombycilla garrulus*), Wren (*Troglodytes troglodytes*), Dunnock (*Prunella modularis*), Savi's Warbler (*Locustella luscinioides*), Sedge Warbler (*Acrocephalus schoenobaenus*), Blyth's Reed Warbler (*Acrocephalus dumetorum*), Marsh Warbler (*Acrocephalus palustris*), Moustached Warbler (*Acrocephalus melanopogon*), Icterine Warbler (*Hippolais icterina*), Blackcap (*Sylvia atricapilla*), Whitethroat (*Sylvia communis*), Lesser Whitethroat (*Sylvia curruca*), Willow Warbler (*Phylloscopus trochilus*), Chiffchaff (*Phylloscopus collybita*), Goldcrest (*Regulus regulus*), Pied Flycatcher (*Ficedula hypoleuca*), Red-breasted Flycatcher (*Ficedula parva*), Spotted Flycatcher (*Muscicapa striata*), Whinchat (*Saxicola rubetra*), Wheatear (*Oenanthe oenanthe*), Black Redstart (*Phoenicurus ochruros*), Thrush Nightingale (*Luscinia luscinia*), Bluethroat (*Luscinia svecica*), Robin (*Erithacus rubecula*), Fieldfare (*Turdus pilaris*), Blackbird (*Turdus merula*), Song Thrush (*Turdus philomelos*), Bearded Reedling (*Panurus biarmicus*), Long-tailed Tit (*Aegithalos caudatus*), Willow Tit (*Parus montanus*), Blue Tit (*Parus caeruleus*), Great Tit (*Parus major*), Treecreeper (*Certhia familiaris*), House Sparrow, Tree Sparrow, Chaffinch (*Fringilla coelebs*), Greenfinch (*Carduelis chloris*), Goldfinch (*Carduelis carduelis*), Linnet (*Carduelis cannabina*), Redpoll (*Carduelis*

Table 3. Oribatid mites in the plumage of some Passeriformes.

| Oribatid mite species | Starling | Goldcrest | Great Tit | Robin | Chaffinch | Total |
|-----------------------------------|----------|-----------|-----------|-------|-----------|-------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Number of birds | 64 | 5 | 60 | 73 | 61 | 263 |
| <i>Palaeacarus hystricinus</i> | – | 2 | 2 | – | – | 4 |
| <i>Eniochthonius minutissimus</i> | 2 | – | – | 1 | – | 3 |
| <i>Hypochthonius rufulus</i> | – | 1 | – | – | 1 | 2 |
| <i>Liochthonius sellnicki</i> | – | – | – | – | 1 | 1 |
| <i>Phthiracarus piger</i> | – | – | – | 1 | – | 1 |
| <i>Phthiracarus</i> sp. | – | – | 2 | – | – | 2 |
| <i>Steganacarus applicatum</i> | – | – | – | 1 | – | 1 |
| <i>Steganacarus striculus</i> | 1 | – | – | 1 | – | 2 |
| <i>Tropacarus carinatus</i> | – | – | 1 | 1 | – | 2 |
| <i>Tropacarus pulcherrimus</i> | – | – | – | 1 | – | 1 |
| <i>Oribotritia loricata</i> | – | – | – | – | 2 | 2 |
| <i>Nothrus biciliatus</i> | – | – | 1 | – | – | 1 |
| <i>Camisia spinifer</i> | – | – | 2 | – | – | 2 |
| <i>Camisia</i> sp. | – | – | 1 | 1 | – | 2 |
| <i>Platynothrus peltifer</i> | 1 | – | 1 | – | 1 | 3 |
| <i>Platynothrus thori</i> | – | – | – | – | 2 | 2 |
| <i>Trhypochthonius tectorum</i> | – | – | 1 | 2 | 1 | 4 |

Table 3 continued

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------------------------------------|----|----|----|----|----|----|
| <i>Malaconothrus egregius</i> | 2 | – | 1 | – | – | 3 |
| <i>Nanhermannia coronata</i> | 1 | – | 1 | 1 | 1 | 4 |
| <i>Gymnodamaeus bicostatus</i> | – | – | – | – | 1 | 1 |
| <i>Licnodamaeus pulcherrimus</i> | – | 1 | – | – | – | 1 |
| <i>Belba corynopus</i> | – | – | – | – | 1 | 1 |
| <i>Metabelba</i> sp. | – | – | – | – | 1 | 1 |
| <i>Eremaeus oblongus</i> | – | – | 1 | 2 | – | 3 |
| <i>Adoristes ovatus</i> | – | 1 | – | – | – | 1 |
| <i>Xenillus clypeator</i> | – | – | – | – | 1 | 1 |
| <i>Carabodes areolatus</i> | – | – | 2 | – | 1 | 3 |
| <i>Carabodes forsslundi</i> | – | 2 | – | – | – | 2 |
| <i>Carabodes labyrinthicus</i> | – | – | – | 5 | – | 5 |
| <i>Tectocepheus velatus</i> | 5 | 2 | 2 | 3 | 4 | 16 |
| <i>Autogneta tragardhi</i> | – | 1 | – | – | – | 1 |
| <i>Concogneta delacarllica</i> | – | – | – | 1 | – | 1 |
| <i>Caleremaeus monilipes</i> | 1 | – | – | – | – | 1 |
| <i>Multioppia</i> sp. | – | – | – | – | 1 | 1 |
| <i>Multioppia glabra</i> | – | 1 | – | – | 1 | 1 |
| <i>Oppia fallax</i> | – | 3 | – | 1 | – | 4 |
| <i>Oppia splendens</i> | – | – | 1 | – | – | 1 |
| <i>Oppia translamellata</i> | – | – | – | – | 2 | 2 |
| <i>Oppia unicarinata</i> | – | – | 2 | – | – | 2 |
| <i>Oppiella nova</i> | 2 | – | 4 | 4 | 3 | 13 |
| <i>Quadroppia quadricarinata</i> | – | 1 | – | – | 2 | 3 |
| <i>Suctobelba trigona</i> | – | – | – | 1 | 1 | 2 |
| <i>Suctobelbella acutidens</i> | 2 | – | 1 | 2 | 2 | 7 |
| <i>Suctobelbella falcata</i> | – | – | – | – | 1 | 1 |
| <i>Suctobelbella subgornigera</i> | – | – | – | – | 1 | 1 |
| <i>Oribella castanea</i> | – | – | 1 | – | – | 1 |
| <i>Scutovertex minutus</i> | – | – | – | – | 1 | 1 |
| <i>Lucoppia lucorum</i> | – | – | – | – | 1 | 1 |
| <i>Liebstadia similis</i> | – | 1 | – | – | – | 1 |
| <i>Scheloribates laevigatus</i> | – | – | – | – | 1 | 1 |
| <i>Scheloribates latipes</i> | – | – | – | – | 1 | 1 |
| <i>Neoribates aurantiacus</i> | – | – | 1 | – | – | 1 |
| <i>Sphaerozetes piriformes</i> | – | – | – | 1 | – | 1 |
| <i>Trichoribates trimaculatus</i> | – | – | – | – | 1 | 1 |
| <i>Chamobates cuspidatus</i> | 1 | – | – | – | – | 1 |
| <i>Chamobates spinosus</i> | 1 | – | – | – | – | 1 |
| <i>Chamobates lapidarius</i> | – | – | – | 1 | – | 1 |
| <i>Chamobates schuetzi</i> | – | – | – | 1 | – | 1 |
| <i>Minunthozetes pseudofusiger</i> | 2 | 1 | 1 | – | 1 | 5 |
| <i>Punctoribates astrachanicus</i> | – | – | – | – | 1 | 1 |
| <i>Punctoribates punctum</i> | 1 | – | 2 | – | 2 | 5 |
| <i>Achipteria coleoptrata</i> | – | – | 1 | – | – | 1 |
| <i>Parachipteria punctata</i> | – | 1 | 1 | 5 | 1 | 8 |
| <i>Lepidozetes singularis</i> | – | – | 1 | 1 | 1 | 3 |
| <i>Galumna</i> sp. | – | – | – | – | 1 | 1 |
| Total number of oribatid mite species | 13 | 13 | 25 | 22 | 34 | 65 |

flammea), Common Rosefinch (*Carpodonus erythrinus*), Hawfinch (*Coccothraustes coccothraustes*), Corn Bunting (*Miliaria calandra*), Yellowhammer (*Emberiza citrinella*) and Reed Bunting (*Emberiza schoeniclus*). Most of the above-mentioned species were collected in several specimens. However, the remaining 24 species were obtained only as single specimens. Therefore, we may only draw attention to the fact of the presence of oribatid mites in their plumage, but we are not able to determine composition of their fauna and peculiarities of its ecology. More complete collections of specimens in different regions of the European part of Russia and in different years have been done only for five species: Starling, Goldcrest, Great Tit, Chaffinch and Robin. Results of their studies are presented in Table 3.

Analysis of the list of oribatid mite species presented in Table 3 demonstrates that the most common species of large and middle-sized oribatid mites penetrate the plumage of Passeriformes in their nesting and residing sites. We did not reveal any distinct dominance of any oribatid mite species. However, *Oppiella nova*, *Suctobelbella acutidens*, *Tectocephus velatus* and *Minunthozetes pseudofusiger*, the most common soil inhabitants, were distributed all over the European part of Russia. Species of large oribatid mites (*Galumna*, *Neoribates*, *Achipteria*, *Trichoribates*, *Steganacarus* and *Tropacarus*) were found singly; *Platynothrus*, *Nothrus* and *Camisia* were found only in nymphal stages. Out of the species mentioned in Table 3 (in total, 65 species), about one third (24 species) inhabit small soil apertures (*Oppia*, *Suctobelbella*, *Autogneta*, *Licnodamaeus*, etc.) and they prevail in numbers. This material contains a series of interesting findings: *Palaecarus histricinus*, *Platynothrus thori*, *Belba corynopus*, *Gymnodamaeus bicostatus*, *Multioppia* sp., *Xenillus clypeator*, *Luoppia lucorum*, *Caleremaeus monilipes*, *Punctoribates astrachanicus*, and *Steganacarus applicatum*, which are very rare or they have not been recorded before in the plumage of birds, or they have been found far to the north of their main soil habitats.

Here we present findings of oribatid mites from some Passeriformes, which are not mentioned in Table 3. Thus, *Oppia maritima* and *Tectocephus velatus* were found in the feathers of Horned Lark (n = 1); *Suctobelbella* sp. – in the feathers of Tree Pipit (n = 2); *Tropacarus pulcherrimus* – in the feathers of Yellow Wagtail (n = 1); *Oppiella nova*, *Tectocephus velatus* (larvae of these oribatid mites) – in the feathers of White Wagtail (n = 4); *Nothrus silvestris*, *Trhypochthonius tectorum*, *Carabodes areolatus*, *Tectocephus velatus*, *Zygoribatula exilis*, *Parachipteria punctata* – in the feathers of Red-backed Shrike (n = 5); *Brachychthonius berlessei*, *Camisia* sp., *Tectocephus velatus*, *Oppia* sp., *Oppiella*

nova – in the feathers of Golden Oriole (n = 3); *Platynothrus peltifer*, *Trhypochthonius tectorum*, *Hermannia granulata*, *Scutovertex minutus*, *Achipteria coleoptrata* – in the feathers of Waxwing (n = 2); *Oppia splendens* in the feathers of Wren (n = 2); *Poroliodes farinosus*, *Oribella paoli*, *Tectocephus velatus* – in the feathers of Sedge Warbler (n = 1); *Carabodes marginatus*, *Oppia minus* – in the feathers of Marsh Warbler (n = 3); *Phthiracarus* sp., *Tropacarus carinatus*, *Nanhermannia coronata*, *Carabodes areolatus*, *Oppia splendens*, *Oppiella nova* – in the feathers of Icterine Warbler (n = 2); *Liochthonius sellnicki*, *Nothrus silvestris*, *Nanhermannia coronata*, *Metabelba pulverulenta*, *Tectocephus velatus*, *Oppia falax*, *O. splendens*, *Ramusella furcata*, *Oribella paoli*, *Fuscozetes fuscipes*, *Trichoribates trimaculatus*, *Eupelops* sp. – in the feathers of Blackcap (n = 4); *Steganacarus striculus*, *Malaconothrus egregius*, *Tectocephus velatus*, *Oppiella nova* – in the feathers of Whitethroat (n = 2); *Ceratozetes gracilis* – in the feathers of Lesser Whitethroat (n = 1); *Platynothrus peltifer*, *Tectocephus velatus*, *Liebstadia similes* – in the feathers of Red-breasted Flycatcher (n = 2); *Adoristes ovatus*, *Carabodes areolatus*, *Tectocephus velatus*, *Liebstadia similes*, *Minunthozetes pseudofusiger* – in the feathers of Whinchat (n = 3); *Carabodes labyrinthicus*, *Oppiella nova*, *Quadroppia quadricarinata* – in the feathers of Wheatear (n = 2); *Suctobelba trigona* – in the feathers of Thrush Nightingale (n = 1); *Hypochthonius rufulus*, *Phthiracarus borealis*, *P. globisus*, *P. logneus*, *P. nitens*, *Platynothrus peltifer*, *Hermannia* sp., *Carabodes areolatus*, *C. marginatus*, *Tectocephus velatus*, *Oppiella nova*, *Ameronothrus* sp., *Neoribates aurantiacus*, *Chamobates lapidaries*, *Minunthozetes semirufus*, *Achipteria coleoptrata*, *A. nitens* – in the feathers of Bluethroat (n = 13); *Camisia borealis*, *C. horrida*, *Tectocephus velatus*, *Oppia* sp. – in the feathers of Fieldfare (n = 4); *Liochthonius sellnicki*, *Sellnickochthonius zelawaiensis*, *Suctobelbella hammeri*, *Punctoribates punctum* – in the feathers of Blackbird (n = 2); *Tectocephus velatus*, *Oppia splendens* – in the feathers of Song Thrush (n = 2); *Tectocephus velatus*, *Oppiella nova*, *Chamobates cuspidatus*, nymphs of oribatid mites – in the feathers of Bearded Reedling (n = 23); *Eremaeus oblongus*, *Tectocephus velatus*, *Oppiella nova*, *Suctobelbella* sp., *Liebstadia similes* – in the feathers of Blue Tit (n = 25); *Oppia* sp. – in the feathers of Treecreeper; *Palaecarus hystricinus*, *Hypochthonius rufulus*, *Steganacarus striculus*, *Epidamaeus kamaensis*, *Eremobelba geographica*, *Tectocephus velatus*, *Conchogneta delacarlca*, *Oppiella nova*, *Oribatula tibialis*, *Chamobates* sp., *Minunthozetes pseudofusiger* – in the feathers of Greenfinch

(n = 5); *Adoristes poppei*, *Tectocephus velatus*, *Oppia ornata*, *Zygoribatula exilis*, *Melanozetes mollicomus* – in the feathers of Goldfinch (n = 9); *Trichoribates trimaculatus* – in the feathers of Linnet (n = 2); *Nothrus* sp., *Hermannia gibba*, *Oppia falax*, *Oppiella nova*, *Minunthozetes pseudofusiger* – in the feathers of Redpoll (n = 4); *Hermannia* sp., *Tectocephus velatus* – in the feathers of Common Rosefinch (n = 2); *Neoribates aurantiacus* – in the feathers of Hawfinch (n = 1); *Tectocephus velatus*, *Oppia translamellata*, *Oppia* sp., *Suctobelbella acutidens*, *S. hammeri*, *Chamobates caucasicus* – in the feathers of Corn Bunting (n = 4); *Hypochthonius rufulus*, *Steganacarus striculus*, *Tectocephus velatus*, *Oppiella nova*, *Suctobelbella* sp. – in the feathers of Yellowhammer (n = 13); *Paleacarus hystricinus*, *Conchogneta delacarlica*, *Oppia splendens*, *Ceratozetes parvulus* – in the feathers of Reed Bunting (n = 3).

Larvae and nymphs of oribatid mites were found in the feathers of Barn Swallow, Woodlark, Meadow Pipit, Penduline Tit, Dunnock, Savi's Warbler, Blyth's Reed Warbler, Willow Warbler, Chiffchaff, Pied Flycatcher, Spotted Flycatcher, Black Redstart, Long-tailed Tit, Willow Tit and Goldfinch.

House and Tree Sparrows together with Corvidae make the basic part of the avian fauna of towns and cities of Russia, Ukraine and Belarus. The fact that oribatid mites (as well as other microarthropods) constantly inhabit feathers of sparrows has not been revealed until now in spite of the abundant research material on the arthropod fauna of these birds and publication of several studies (Yliencko 1976; Noskov *et al.* 1981). Oribatid mites were found in the feathers of House and Tree Sparrows: *Hypochthonius rufulus*, *Eniochthonius minutissimus*, *Liochthonius sellnicki*, *Nothrus* sp. (immature form), *Camisia* sp. (immature form), *Heminothrus targionii*, *Platynothrus peltifer*, *Malaconothrus egregius*, *Trhypochthonius tectorum*, *Nanhermannia coronata*, *Hermannia gibba*, *Hermannia* sp. (preimaginal form), *Damaeus* sp. (immature form), *Epidamaeus kamaensis*, *Metabelba* sp., *Eremaeus oblongus*, *Xenillus tegeocranus*, *Pirropia* sp. (possibly a new species), *Carabodes areolatus*, *C. marginatus*, *C. labyrinthicus*, *Tectocephus velatus*, *T. kuhnelti*, *Caleremaeus monilipes*, *Banksinoma lanceolata*, *Suctobelbella hammeri*, *S. subcornigera*, *S. acutidens*, *Suctobelbella* sp., *Oppia falax*, *O. neerlandica*, *O. splendens*, *O. minus*, *O. ornata*, *O. translamellata*, *Oppia* sp., *Oppiella nova*, *Quadroppia quadricarinata*, *Autogneta willmani*, *A. longilamellata*, *Fosseremaeus laciniatus*, *Scutovertex minutus*, and *Licnodamaeus pulcherrimus*. The study material has revealed that assemblages of oribatid mites in the plumage of sparrows consists of a great

number of species, and if oribatid mites are absent in 40% of birds, some single specimens contain from eight to 10 species of oribatid mites in their feathers. Fauna of oribatid mites in the feathers of Tree Sparrow is beyond comparison richer quantitatively and more diverse than the fauna of oribatid mites in House Sparrow. Meanwhile, the fauna of oribatid mites collected from the feathers of House Sparrow is more diverse. The mites, however, were collected in the suburbs of Moscow, Homel and Odessa where sparrows build their nests beyond the building systems of towns, mostly in the territories of cattle farms. Some species of oribatid mites live and reproduce in the feathers of sparrows constantly: *Oppiella nova*, *Tectocephus velatus*, *Platynothrus peltifer*, *Eremaeus oblongus* and *Heminothrus paolianus*. It should be noted that larvae and nymphs of oribatid mites of the genera *Camisia*, *Nothrus*, *Damaeus* and *Hermannia* have been repeatedly found in the plumage of sparrows. However, adult representatives of these large oribatid mites of epifauna have not been found in their feathers.

Oribatid mites inhabiting feathers of sparrows fall into the ecological group of hemi-edaphon, litter and hydrophilous species (*Liochthonius*, *Trhypochthonius*, *Malaconothrus*, *Hypochthonius*). They are extremely small in numbers and accidental, as well as representatives of epifauna.

Oribatid fauna of sparrows differs greatly enough from the fauna of oribatid mites of waterbirds and Corvidae. This can be explained by the peculiarities of their nest building and dwelling environment. Our collections of oribatid mites contain specimens of several rare species (*Caleremaeus monilipes*, *Hermannia gibba* and *Chamobates lapidaries*), and two species (*Latilamellobates* sp. and *Pyrrropia* sp.) of this collection are obviously new for science. *Oppia bicarinata* and *Licneremaeus licnophorus*, oribatid species that had not been recorded anywhere in tundra before, were found in a nest of House Sparrow in Dalnye Zelentsy Settlement (Eastern Murman).

In the plumage of most of Passerines, there were no oribatid mites at all. However, some single specimens of the following species were found: *Oppiella unicarinata*, *Carabodes areolatus*, *C. marginatus*, *Eremaeus oblongus*, *Tectocephus velatus*, *Camisia segnis*, *Fosseremaeus laciniatus*, *Trhypochthonius tectorum* and *Suctobelbella* sp. All of them are common species in the Temperate Zone of Russia. The number of interesting species is small: *Sphaerozetes tricuspis* (Tree Pipit), *Mycobates* sp. (Chiffchaff), *Tectocephus knullei* (Bluethroat), *Oribella paoli* (Sedge Warbler), *Oppia minus* (House Sparrow).

Apparently, nests of Passeriformes are the main source of oribatid mites found in their feathers, especially during the period of incubation and rearing nestlings. In to-

tal, we investigated nests of 39 Passeriformes collected mostly in the environs of Moscow, Rostov-on-Don, Odessa, Gelenjyk, Stary Oskol and Tver. Some data were published (Shakhab & Lebedeva 1996; Lebedeva *et al.* 1998, 1999), and they comprised records of 26 oribatid species in the nests of White Wagtail; 12 oribatid species in the nests of Song Thrush; five oribatid species in the nests of Bearded Reedling; seven oribatid species in the nests of Dunnock, etc. During our studies, we found 20

species of oribatid mites in the nests of House Sparrow (including *Haplochthonius simplex*, a rare species found in Odessa) and 17 species of oribatid mites in the nests of Tree Sparrow. We revealed a general tendency that the most diverse population of soil microarthropods occurs in the nests built on the ground or near the ground. Table 4 presents data on the oribatid fauna inhabiting nests of some common bird species. The data vary qualitatively due to different seasons of the year.

Table 4. Oribatid mites in the nests of some Passeriformes.

| Oribatid species | Barn Swallow | White Wagtail | Dunnock | Great Reed Warbler (<i>Acrocephalus arundinaceus</i>) | Reed Warbler (<i>Acrocephalus scirpaceus</i>) | Moustached Warbler | Pied Flycatcher | Robin | Bluetthroat | Great Tit | Penduline Tit | Chaffinch |
|---------------------------------|--------------|---------------|---------|--|--|--------------------|-----------------|-------|-------------|-----------|---------------|-----------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Number of nests | 4 | 1 | 1 | 4 | 14 | 1 | 7 | 3 | 11 | 4 | 2 | 13 |
| <i>Hypochthonius rufulus</i> | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Liochthonius sellnicki</i> | - | + | - | - | - | - | - | - | + | - | - | + |
| <i>Liochthonius</i> sp. | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Phthiracarus</i> sp. | - | + | - | - | - | - | + | - | + | - | - | + |
| <i>Steganacarus striculus</i> | - | + | - | - | - | - | - | - | - | - | - | + |
| <i>Tropacarus carinatus</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Euphthiracarus</i> sp. | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Oribotritia decumana</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Camisia</i> sp. | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Platynothrus peltifer</i> | - | + | - | - | - | - | - | + | - | - | - | - |
| <i>Trhypochthonius tectorum</i> | - | + | - | - | - | - | - | - | - | - | - | + |
| <i>Malaconothrus</i> sp. | - | + | - | - | - | - | - | - | - | - | + | - |
| <i>Trimalaconothrus glaber</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Nanhermannia coronata</i> | - | - | - | - | - | - | - | - | - | + | - | - |
| <i>Hermannia scabra</i> | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Hermannia reticulata</i> | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Hermannia granulata</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Poroliodes farinosus</i> | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Licnodamaeus undulatus</i> | - | - | - | - | - | - | - | - | - | + | - | - |
| <i>Belba</i> sp. | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Belba corynopus</i> | + | - | - | - | - | - | - | - | + | - | - | - |
| <i>Metabelba</i> sp. | - | + | - | - | - | - | + | - | - | - | - | - |
| <i>Cepheus cepheiformis</i> | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Eremobelba geographica</i> | - | - | - | - | - | - | + | - | - | - | - | - |
| <i>Eremaeus oblongus</i> | - | + | - | - | - | - | - | - | + | - | - | - |
| <i>Eremaeus</i> sp. | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Adoristes ovatus</i> | - | - | - | - | - | - | + | - | - | - | - | + |

Table 4 continued

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-----------------------------------|---|----|---|---|---|---|----|----|----|----|----|----|
| <i>Xenillus tegeocranus</i> | - | - | - | - | - | - | + | - | - | - | - | - |
| <i>Caratoppia bipilis</i> | - | - | + | - | - | - | - | - | - | - | - | - |
| <i>Ceratoppia quadridentata</i> | - | - | - | - | - | - | + | - | - | - | - | - |
| <i>Carabodes areolatus</i> | - | + | + | - | - | - | + | - | - | - | - | + |
| <i>Carabodes labyrinthicus</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Carabodes marginatus</i> | - | + | - | - | + | + | - | - | - | - | - | - |
| <i>Odontocepheus elongatus</i> | - | - | - | - | - | - | + | - | - | - | - | - |
| <i>Tectocepheus velatus</i> | + | + | - | - | + | - | - | + | + | + | - | + |
| <i>Autogneta longilamellata</i> | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Oppia falax</i> | - | - | - | - | - | - | + | - | - | - | - | - |
| <i>Oppia minus</i> | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Oppia ornata</i> | - | - | - | - | - | - | - | + | - | - | - | + |
| <i>Oppia splendens</i> | - | - | - | - | + | - | - | - | - | - | - | - |
| <i>Oppia translamellata</i> | + | - | - | - | + | - | - | - | - | - | - | - |
| <i>Oppia unicarinata</i> | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Oppiella nova</i> | + | + | + | - | - | - | + | + | + | - | - | + |
| <i>Quadroppia quadricarinata</i> | - | - | - | + | - | - | - | - | - | - | - | - |
| <i>Suctobelba trigona</i> | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Suctobelbella acutidens</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Suctobelbella forsslundi</i> | - | - | - | - | - | - | - | + | - | - | - | - |
| <i>Suctobelbella hummery</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Suctobelbella perforata</i> | + | - | - | - | - | - | - | + | - | - | - | - |
| <i>Suctobelbella sp.</i> | - | - | - | + | + | - | - | - | + | - | - | - |
| <i>Cymbaeremaeus cymba</i> | - | - | - | - | - | - | - | - | - | + | - | - |
| <i>Scutovertex minutus</i> | - | - | - | - | - | - | - | - | + | - | - | + |
| <i>Lucoppia lucorum</i> | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Oribatula tibialis</i> | - | - | - | - | - | - | - | - | - | + | - | + |
| <i>Zygoribatula cognata</i> | + | - | - | - | - | - | - | - | - | - | - | + |
| <i>Zygoribatula exilis</i> | - | - | - | - | - | - | + | - | + | - | - | + |
| <i>Liebstadia humerata</i> | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Liebstadia similis</i> | - | + | - | - | - | - | - | + | - | - | - | + |
| <i>Protoribates capucinus</i> | - | - | - | - | - | - | - | - | - | + | - | - |
| <i>Scheloribates laevigatus</i> | - | - | + | + | - | - | + | + | + | - | - | - |
| <i>Scheloribates latipes</i> | + | + | + | - | - | - | - | + | - | - | - | + |
| <i>Scheloribates pallidulus</i> | - | - | - | - | - | - | + | - | - | - | - | - |
| <i>Neoribates aurantiacus</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Diapterobates notatus</i> | + | - | - | - | - | - | - | + | + | - | - | - |
| <i>Trichoribates trimaculatus</i> | - | - | - | - | - | - | - | - | - | + | - | - |
| <i>Chamobates cuspidatus</i> | - | - | - | - | - | - | - | - | - | + | - | - |
| <i>Chamobates lapidarius</i> | - | - | - | - | - | - | - | - | + | - | - | - |
| <i>Chamobates sp.</i> | - | - | - | - | - | - | - | - | - | - | - | + |
| <i>Punctoribates punctum</i> | - | + | - | - | - | - | - | - | + | - | - | - |
| <i>Peloptulus phaenotus</i> | - | - | - | - | - | - | + | - | - | + | - | - |
| <i>Parachipteria punctata</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Liacarus caracinus</i> | - | - | - | + | - | - | - | - | - | - | - | - |
| <i>Galumna sp.</i> | + | - | - | - | - | - | - | - | - | - | - | - |
| <i>Pergalumna nervosa</i> | - | + | - | - | - | - | - | - | - | - | - | - |
| <i>Sphaerobates gratus</i> | - | - | - | - | - | - | - | - | + | + | - | - |
| Total number of oribatid species | 9 | 26 | 5 | 4 | 5 | 1 | 14 | 10 | 23 | 10 | 1 | 23 |

As we see, arboricolous oribatid species (*Cymbaeremaeus*, *Hermannia*, *Belba*, *Eremobelba*, *Odontopheus*, *Poroliodes*, *Scutovertex*, *Cepheus*, etc.), which are absent or rarely found in bird feathers, prevail in the nests of birds.

Some species of oribatid mites were found in all their stages of development, which means that they reproduce in the nests of birds and pass there through all the stages of their life cycle. Thus, *Caratoppia bipilis*, *Carabodes areolatus* and *Scheloribates latipes* were recorded in a nest of Dunnock, whereas oribatid mites in their preimaginal stages were absent in a nest of White Wagtail, all species – migrants. Diversity of oribatid mites is higher in the nests of White Wagtail.

Oribatid mites *Tropacarus carinatus*, *Steganacarus striculus*, *Oribotritia decumana* and *Euphthiracarus* sp. are much more abundant in the nests of White Wagtail than in soil communities of Central Russia, for example, in the Moscow Province. *Tropacarus carinatus*, which is dominant in the nests of this species, is not numerous in soils of the Moscow Province. *Oppia nova*, *Tectocephus velatus*, *Scheloribates latipes*, *Pergalumna nervosa*, *Parachipteria punctata*, *Steganacarus striculus*, *Phthiracarus* sp. and *Caratoppia bipilis* were found by us in the nests of openly nesting bird species from the Moscow Province (Lebedeva *et al.* 1998).

Oribatid mites characteristic of the nests of other bird species (nesting openly above the ground and in tree cavities) were not found in the nests built above the water in the Rostov Province (Shakhab & Lebedeva 1996). However, *Quadroppia quadridentata* was found in the nests of Fieldfare and Song Thrush in the Moscow Province (Lebedeva *et al.* 1998). *Carabodes marginatus* was found in a nest of White Wagtail from the Vladimir Province.

Diversity of microarthropods in the nests of Bearded Reedling and warblers was very poor, although quite peculiar: Gamasida and Trombidiidae, spiders, and collembolans actually were absent. Prostigmata (Scutacaridae, Nanorchestes and Tarsonemidae) oribatid mites in their preimaginal stages are capable of phoresy, i.e. of being carried by insects. Thus, they could get into the nests together with insects that fell prey to birds inhabiting those nests. All the investigated oribatid mites were mesophytic and in no way related to water. These species are found in moss on the shores of water bodies and, most probably, they get into nests with building material. However, it should be noted that moss was found in the nests of birds built in the Rostov Province. The nests were built of the inflorescences of canes and of fiberised leaves of reed mice. Bearded Reedling builds nests of vegetable fluff and moulted feathers of Coot

(*Fulica atra*). The absence of a contact with soil during the period of collection of nest building material and bedding elements determined the poorness of the nidicolous fauna in waterbirds. Dwelling above the water did not allow common pedogenic forms inhabiting their nests.

CONCLUSIONS

Our studies carried out in 1997–2002 revealed for the first time that oribatid mites are constantly found in the feathers of birds (we investigated 146 bird species) belonging to different taxonomic and ecological groups. Most of them reproduce there, what can be said for sure about such species as *Hypochthonius rufulus*, *Tectocephus velatus*, *Scheloribates laevigatus*, *Palaeacarus hystricinus* and *Trhypochthonius tectorum*. In all probability, oribatid mites penetrate the plumage of birds from the bedding of the soil covering or from the nests abundantly inhabited by these mites. In our opinion, the data obtained are of great interest not only for biogeography of the oribatid mites themselves, but also for biogeography of birds, carriers of the mites, as distinct biomarkers of their geographical populations and migratory routes. In particular, we recorded cases of dispersing of oribatid mites by birds beyond the boundaries of their ranges: *Hermannia reticulata* was brought from the northern part of Europe to the Krasnodar Province by Mute Swan (*Cygnus olor*) and *Sphaerochthonius splendidus* (a Mediterranean species) to Belarus by Corncrake (*Crex crex*). To all appearance, species composition of oribatid mites in the feathers of birds during their seasonal migrations, especially on the boundaries of biogeographical regions and provinces and also in islands, especially those of the Arctic Ocean, deserves special studies. Ecology of oribatid mites inhabiting bird feathers is still obscure, but since they are microphages, we may assume that they feed not only and mostly on the scales of skin, but, most probably, on fungi that dwell on bird feathers and skin (Krivolutsky & Lebedeva 1999).

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**ORIBATIDINĖS ERKĖS (ORIBATEI, ACARIFORMES)
PAUKŠČIŲ PLUNKSNOSĖ: ŽIVIRBLINIAI**

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SANTRAUKA

Autoriai nustatė, kad oribatidines erkes (Oribatei) platiną paukščiai. Oribatidinių erkių plitimo per paukščius atvejai anksčiau literatūroje aprašyti nebuvo. Iš 150 paukščių rūšių, priklausančių skirtingoms ekologinėms grupėms, buvo ištirti 1,222 individai. 146 rūšys gyvų oribatidinių erkių buvo aptiktos paukščių plunksnose. Kai kurios šių erkių rūšys paukščių plunksnose gyvena nuolat. Autorių nuomone, oribatidinės erkės minta ne paukščių odos dalelytėmis, bet grybeliu, kuris veisiasi ant paukščių plunksnų ir odos.

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Annex I. List of oribatid mites found in bird feathers

| | | |
|--|--|--|
| Family PALAEACARIDAE Grandjean, 1932 | | |
| 1. | <i>Paleacarus hystricinus</i> Trägårdh, 1932 | Hooded Crow, Goldcrest, Great Tit, Greenfinch, Reed Bunting |
| Family ENIOCHTHONIIDAE Grandjean, 1947 | | |
| 2. | <i>Eniochthonius minutissimus</i> (Berlese, 1903) | Starling, Robin |
| Family HYPOCHTHONIIDAE Berlese, 1910 | | |
| 3. | <i>Hypochthonius rufulus</i> C.L. Koch, 1835 | Hooded Crow, Goldcrest, Bluethroat, House Sparrow, Tree Sparrow, Chaffinch, Greenfinch, Yellowhammer |
| Family BRACHYCHTHONIIDAE Balogh, 1943 | | |
| 4. | <i>Brachychthonius berlessei</i> Willmann, 1928 | Golden Oriole, Hooded Crow |
| 5. | <i>Liochthonius sellnicki</i> (Thor, 1930) | Jackdaw, Rook, Hooded Crow, Blackcap, Blackbird, Tree Sparrow, Chaffinch |
| 6. | <i>Sellnickochthonius zelawaiensis</i> (Krivolutsky, 1965) | Blackbird |
| Family PHTHIRACARIDAE Perty, 1841 | | |
| 7. | <i>Phthiracarus borealis</i> (Trägårdh, 1910) | Bluethroat |
| 8. | <i>Phthiracarus globosus</i> (C.L. Koch, 1841) | Bluethroat |
| 9. | <i>Phthiracarus ligneus</i> Willmann, 1931 | Jackdaw, Bluethroat, Tree Sparrow |
| 10. | <i>Phthiracarus nitens</i> (Nicolet, 1855) | Bluethroat |
| 11. | <i>Phthiracarus piger</i> (Scopoli, 1763) | Robin |
| 12. | <i>Phthiracarus</i> sp. Perty, 1841 | Jackdaw, Hooded Crow, Icterine Warbler, Great Tit, Tree Sparrow |
| 13. | <i>Steganacarus applicatus</i> (Sellnick, 1920) | Robin |
| 14. | <i>Steganacarus striculus</i> C.L. Koch, 1836 | Starling, Hooded Crow, Robin, Tree Sparrow, Greenfinch, Yellowhammer |
| 15. | <i>Tropacarus carinatus</i> (C.L. Koch, 1844) | House Sparrow, Icterine Warbler, Whitethroat, Robin, Great Tit |
| 16. | <i>Tropacarus pulcherrimus</i> Berlese, 1885 | Yellow Wagtail, Robin |
| Family EUPHTHIRACARIDAE Jacot, 1930 | | |
| 17. | <i>Rhysotritia duplicata</i> (Grandjean, 1953) | Tree Sparrow |
| Family ORIBOTRITIIDAE Grandjean, 1954 | | |
| 18. | <i>Oribotritia loricata</i> Rathke, 1799 | Chaffinch |
| Family NOTHRIDAE Berlese, 1896 | | |
| 19. | <i>Nothrus biciliatus</i> C.L. Koch, 1841 | Great Tit |
| 20. | <i>Nothrus palustris</i> C.L. Koch, 1839 | Hooded Crow, House Sparrow |
| 21. | <i>Nothrus silvestris</i> Nicolet, 1855 | Red-backed Shrike, Blackcap |
| 22. | <i>Nothrus</i> sp. C.L. Koch, 1839 | Tree Sparrow, Redpoll |
| Family CAMISIIDAE Oudemans, 1900 | | |
| 23. | <i>Camisia borealis</i> (Thorell, 1872) | Fieldfare |
| 24. | <i>Camisia horrida</i> (Hermann, 1804) | Fieldfare |
| 25. | <i>Camisia spinifer</i> (C.L. Koch, 1835) | Hooded Crow, Great Tit |
| 26. | <i>Camisia</i> sp. von Heyden, 1826 | Golden Oriole, Jackdaw, Hooded Crow, Robin, Great Tit, Tree Sparrow |
| 27. | <i>Heminothrus paolianus</i> (Berlese, 1913) | Tree Sparrow |
| 28. | <i>Platynothrus peltifer</i> (C.L. Koch, 1939) | Golden Oriole, Starling, Rook, Carrion Crow, Hooded Crow, Red-breasted Flycatcher, Bluethroat, Great Tit, House Sparrow, Tree Sparrow, Chaffinch |

Annex I continued

| | | |
|---|--|--|
| 29. | <i>Platynothrhus thori</i> (Berlese, 1904) | Chaffinch |
| Family TRHYPOCHTHONIIDAE Willmann, 1931 | | |
| 30. | <i>Trhypochthoniellus excavatus</i> (Willmann, 1919) | Hooded Crow |
| 31. | <i>Trhypochthonius tectorum</i> (Berlese, 1896) | Red-backed Shrike, Golden Oriole, Jackdaw, Robin, Great Tit, House Sparrow, Tree Sparrow, Chaffinch |
| Family MALACONOTHRIDAE Berlese, 1916 | | |
| 32. | <i>Malaconothrus egregius</i> Berlese, 1904 | Starling, Whitethroat, Great Tit, House Sparrow, Tree Sparrow |
| 33. | <i>Trimalaconothrus</i> sp. Berlese, 1916 | Rook |
| Family NANHERMANNIIDAE Sellnick, 1928 | | |
| 34. | <i>Nanhermannia coronata</i> Berlese, 1913 | Starling, Magpie, Hooded Crow, Icterine Warbler, Blackcap, Robin, Great Tit, Tree Sparrow, Chaffinch |
| 35. | <i>Nanhermannia nana</i> (Nicolet, 1855) | House Sparrow |
| Family HERMANNIIDAE Sellnick, 1928 | | |
| 36. | <i>Hermannia gibba</i> (C.L. Koch, 1839) | Common Rosefinch |
| 37. | <i>Hermannia</i> sp. Nicolet, 1855 | Bluethroat, Common Rosefinch |
| Family HERMANNIELLIDAE Grandjean, 1934 | | |
| 38. | <i>Hermanniella granulata</i> (Nicolet, 1855) | Waxwing |
| Family LIODIDAE Grandjean, 1954 | | |
| 39. | <i>Poroliodes farinosus</i> (C.L. Koch, 1839) | Hooded Crow, Sedge Warbler |
| Family GYMNODAMAEIDAE Grandjean, 1954 | | |
| 40. | <i>Gymnodamaeus bicostatus</i> (C.L. Koch, 1835) | Chaffinch |
| Family LICHNODAMAEIDAE Grandjean, 1954 | | |
| 41. | <i>Licnodamaeus pulcherrimus</i> (Paoli, 1908) | Goldcrest, Tree Sparrow |
| Family DAMAEIDAE Berlese, 1896 | | |
| 42. | <i>Belba</i> sp. Heyden, 1826 | Hooded Crow |
| 43. | <i>Belba corynopus</i> (Hermann, 1804) | Chaffinch |
| 44. | <i>Epidamaeus kamaensis</i> (Sellnick, 1925) | Tree Sparrow, Greenfinch |
| 45. | <i>Hypodamaeus riparius</i> (Nicolet, 1855) | Jackdaw |
| 46. | <i>Metabelba</i> sp. Grandjean, 1936 | Jackdaw, Tree Sparrow, Chaffinch |
| 47. | <i>Metabelba pulverulenta</i> (C.L. Koch, 1839) | Blackcap |
| Family CEPHEIDAE Berlese, 1896 | | |
| 48. | <i>Cepheus cepheiformis</i> (Nicolet, 1855) | Rook |
| Family DAMAEOLIDAE Grandjean, 1954 | | |
| 49. | <i>Fosseremaeus laciniatus</i> (Berlese, 1905) | Jackdaw, Hooded Crow, Raven, Tree Sparrow |
| 50. | <i>Eremobelba geographica</i> Berlese, 1908 | Greenfinch |
| Family EREMAEIDAE Sellnick, 1928 | | |
| 51. | <i>Eremaeus hepaticus</i> C.L. Koch, 1835 | Rook |
| 52. | <i>Eremaeus oblongus</i> (C.L. Koch, 1835) | Hooded Crow, Robin, Blue Tit, Great Tit, Tree Sparrow |
| Family ASTEGISTIDAE Balogh, 1961 | | |
| 53. | <i>Furcoribula furcillata</i> (Nordenskiöld, 1901) | Hooded Crow |
| Family LIACARIDAE Sellnick, 1928 | | |
| 54. | <i>Adoristes ovatus</i> (C.L. Koch, 1839) | Goldcrest, Whinchat, Goldfinch |
| 55. | <i>Adoristes poppei</i> (Oudemans, 1906) | House Sparrow |
| 56. | <i>Liacarus</i> sp. Michael, 1898 | Tree Sparrow |

Annex I continued

| Family PELOPPIDAE Balogh, 1943 | |
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| 57. | <i>Pyrropia</i> sp. Hammer, 1955 Tree Sparrow |
| Family XENILLIDAE Woolley et Higgins, 1966 | |
| 58. | <i>Xenillus clypeator</i> Robinaeu-Desvoidy, 1839 Chaffinch |
| 59. | <i>Xenillus discrepans</i> Grandjean, 1937 Jackdaw |
| 60. | <i>Xenillus tegeocranus</i> Hermann, 1804 Tree Sparrow |
| Family CARABODIDAE C.L. Koch, 1837 | |
| 61. | <i>Carabodes areolatus</i> Berlese, 1916 Red-backed Shrike, Jay, Jackdaw, Hooded Crow, Icterine Warbler, Whinchat, Bluethroat, Great Tit, Tree Sparrow, Chaffinch |
| 62. | <i>Carabodes forsslundi</i> Sellnick, 1953 Goldcrest |
| 63. | <i>Carabodes labyrinthicus</i> (Michael, 1879) Wheatear, Robin, Tree Sparrow |
| 64. | <i>Carabodes marginatus</i> (Michael, 1884) Magpie, Jackdaw, Rook, Hooded Crow, Marsh Warbler, Bluethroat, Tree Sparrow |
| Family TECTOCEPHEIDAE Grandjean, 1954 | |
| 65. | <i>Tectocepheus knullei</i> Vanek, 1960 House Sparrow |
| 66. | <i>Tectocepheus velatus</i> (Michael, 1880) Horned Lark, White Wagtail, Red-backed Shrike, Golden Oriole, Starling, Jay, Nutcracker, Jackdaw, Rook, Hooded Crow, Raven, Sedge Warbler, Blackcap, Whitethroat, Goldcrest, Red-breasted Flycatcher, Whinchat, Robin, Bluethroat, Fieldfare, Song Thrush, Bearded Reedling, Blue Tit, Great Tit, House Sparrow, Tree Sparrow, Chaffinch, Greenfinch, Goldfinch, Common Rosefinch, Corn Bunting, Yellowhammer |
| Family AUTOGNETIDAE Grandjean, 1960 | |
| 67. | <i>Autogneta longilamellata</i> (Michael, 1885) Jackdaw, Tree Sparrow |
| 68. | <i>Autogneta tragardi</i> Forsslund, 1947 Goldcrest |
| 69. | <i>Autogneta willmanni</i> (Dyrdowska, 1929) Tree Sparrow |
| 70. | <i>Conchogneta delacarlca</i> (Forsslund, 1947) Hooded Crow, Robin, Yellowhammer, Reed Bunting |
| Family CALEREMAEIDAE Grandjean, 1965 | |
| 71. | <i>Caleremaeus monilipes</i> (Michael, 1882) Starling, Hooded Crow |
| Family OPPIDAE Grandjean, 1954 | |
| 72. | <i>Multioppia glabra</i> (Mihelčič, 1955) Goldcrest, Chaffinch |
| 73. | <i>Multioppia</i> sp. Hammer, 1961 Chaffinch |
| 74. | <i>Oppia falax</i> (Paoli, 1908) Jackdaw, Hooded Crow, Blackcap, Goldcrest, Robin, Tree Sparrow, Redpoll |
| 75. | <i>Oppia maritima</i> Willmann, 1929 Horned Lark |
| 76. | <i>Oppia minus</i> (Paoli, 1908) Marsh Warbler, House Sparrow, Tree Sparrow |
| 77. | <i>Oppia neerlandica</i> (Oudemans, 1900) Tree Sparrow |
| 78. | <i>Oppia ornata</i> (Oudemans, 1900) Goldfinch |
| 79. | <i>Oppia splendens</i> (C.L. Koch, 1840) Hooded Crow, Wren, Icterine Warbler, Blackcap, Song Thrush, Great Tit, House Sparrow, Yellowhammer, Reed Bunting |
| 80. | <i>Oppia translamellata</i> (Willmann, 1923) Hooded Crow, House Sparrow, Tree Sparrow, Chaffinch, Corn Bunting |
| 81. | <i>Oppia unicarinata</i> (Paoli, 1908) Carrion Crow, Hooded Crow, Great Tit, Tree Sparrow |

Annex I continued

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| 82. | <i>Oppia</i> sp. C.L. Koch, 1836 | Golden Oriole, Fieldfare, House Sparrow, Tree Sparrow, Corn Bunting |
| 83. | <i>Oppiella nova</i> (Oudemans, 1902) | White Wagtail, Golden Oriole, Starling, Jay, Jackdaw, Carrion Crow, Hooded Crow, Raven, Icterine Warbler, Whitethroat, Wheatear, Robin, Bluethroat, Bearded Reedling, Blue Tit, Great Tit, Treecreeper, House Sparrow, Tree Sparrow, Chaffinch, Greenfinch, Redpoll, Yellowhammer |
| 84. | <i>Oppiella</i> sp. Jacot, 1937 | Magpie |
| 85. | <i>Ramusella furcata</i> (Willmann, 1928) | Blackcap |
| Family QUADROPIIDAE Balogh, 1983 | | |
| 86. | <i>Quadroppia quadricarinata</i> (Michael, 1885) | Rook, Hooded Crow, Goldcrest, Wheatear, Tree Sparrow, Chaffinch |
| Family SUCTOBELBIDAE Jacot, 1938 | | |
| 87. | <i>Suctobelba trigona</i> (Michael, 1888) | Rook, Hooded Crow, Robin, Thrush Nightingale, Chaffinch |
| 88. | <i>Suctobelbella acutidens</i> (Forsslund, 1941) | Starling, Robin, Great Tit, House Sparrow, Tree Sparrow, Chaffinch, Corn Bunting |
| 89. | <i>Suctobelbella baloghi</i> (Forsslund, 1958) | Hooded Crow |
| 90. | <i>Suctobelbella falcata</i> (Forsslund, 1941) | Chaffinch |
| 91. | <i>Suctobelbella hammeri</i> (Krivolutsky, 1966) | Blackbird, Corn Bunting |
| 92. | <i>Suctobelbella perforata</i> (Strenzke, 1950) | House Sparrow |
| 93. | <i>Suctobelbella subcornigera</i> (Forsslund, 1941) | Jay, Hooded Crow, Raven, House Sparrow, Chaffinch |
| 94. | <i>Suctobelbella</i> sp. Jacot, 1937 | Tree Pipit, Jay, Magpie, Hooded Crow, Blue Tit, House Sparrow, Tree Sparrow, Yellowhammer |
| Family THYRISOMIDAE Grandjean, 1954 | | |
| 95. | <i>Banksinoma lanceolata</i> (Michael, 1885) | Tree Sparrow |
| 96. | <i>Oribella castanea</i> (Hermann, 1804) | Hooded Crow, Raven, Great Tit |
| 97. | <i>Oribella paoli</i> Oudemans, 1913 | Sedge Warbler, Blackcap |
| Family AMERONOTHRIDAE Willmann, 1931 | | |
| 98. | <i>Ameronothrus</i> sp. Berlese, 1896 | Bluethroat |
| Family SCUTOVERTICIDAE Grandjean, 1954 | | |
| 99. | <i>Scutovertex minutus</i> (C.L. Koch, 1836) | Waxwing, House Sparrow, Tree Sparrow, Chaffinch |
| Family ORIBATULIDAE Thor, 1929 | | |
| 100. | <i>Lucoppia lucorum</i> (C.L. Koch, 1840) | Chaffinch |
| 101. | <i>Oribatula tibialis</i> (Nicolet, 1855) | Greenfinch |
| 102. | <i>Zygoribatula exilis</i> (Nicolet, 1855) | Red-backed Shrike, Magpie, Rook, Hooded Crow, Tree Sparrow, Goldfinch |
| Family PROTORIBATIDAE J. Balogh et P. Balogh, 1884 | | |
| 103. | <i>Liebstadia similis</i> (Michael, 1888) | Goldcrest, Red-breasted Flycatcher, Whinchat, Blue Tit, Tree Sparrow |
| 104. | <i>Protoribates capucinus</i> (Berlese, 1908) | Tree Sparrow |
| 105. | <i>Protoribates lagenula</i> (Berlese, 1908) | Hooded Crow |
| Family SCHELORIBATIDAE Grandjean, 1953 | | |
| 106. | <i>Scheloribates confundatus</i> Sellnick, 1928 | Nutcracker |
| 107. | <i>Scheloribates laevigatus</i> (C.L. Koch, 1835) | Rook, Hooded Crow, Raven, Tree Sparrow, Chaffinch |
| 108. | <i>Scheloribates latipes</i> (C.L. Koch, 1844) | Rook, Chaffinch |

Annex I continued

| Family PARAKALUMMIDAE Grandjean, 1936 | |
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| 109. <i>Neoribates aurantiacus</i> (Oudemans, 1914) | Bluethroat, Hawfinch |
| 110. <i>Neoribates roubali</i> (Berlese, 1910) | Magpie, Great Tit |
| Family CERATOZERIDAE Jacot, 1925 | |
| 111. <i>Ceratozetes cisalpinus</i> Berlese, 1908 | Rook |
| 112. <i>Ceratozetes gracilis</i> (Michael, 1884) | Lesser Whitethroat |
| 113. <i>Ceratozetes parvulus</i> (Sellnick, 1922) | Reed Bunting |
| 114. <i>Diapterobates notatus</i> (Thorell, 1871) | Raven, Tree Sparrow |
| 115. <i>Fuscozetes fuscipes</i> (C.L. Koch, 1844) | Blackcap, Tree Sparrow |
| 116. <i>Fuscozetes</i> sp. Sellnick, 1928 | Tree Sparrow |
| 117. <i>Melanozetes mollicomus</i> (C.L. Koch, 1839) | Hooded Crow, Tree Sparrow, Goldfinch |
| 118. <i>Sphaerozetes piriformes</i> (Nicolet, 1855) | Robin |
| 119. <i>Trichoribates trimaculatus</i> (C.L. Koch, 1835) | Blackcap, House Sparrow, Chaffinch, Linnet |
| Family CHAMOBATIDAE Thor, 1938 | |
| 120. <i>Chamobates caucasicus</i> Shaldybina, 1969 | Corn Bunting |
| 121. <i>Chamobates cuspidatus</i> (Michael, 1884) | Starling, Hooded Crow, Bearded Reedling, Tree Sparrow |
| 122. <i>Chamobates lapidarius</i> (Lucas, 1849) | Magpie, Robin, Bluethroat |
| 123. <i>Chamobates schuetzi</i> (Oudemans, 1902) | Robin |
| 124. <i>Chamobates spinosus</i> Sellnick, 1928 | Starling |
| 125. <i>Chamobates</i> sp. Hull, 1916 | Tree Sparrow, Greenfinch |
| Family EUZETIDAE Grandjean, 1954 | |
| 126. <i>Euzetes seminulum</i> (Müller, 1776) | Rook |
| Family MYCOBATIDAE Grandjean, 1954 | |
| 127. <i>Minunthozetes pseudofusiger</i> (Schweizer, 1922) | Starling, Goldcrest, Whinchat, Great Tit, Tree Sparrow, Chaffinch, Greenfinch, Redpoll |
| 128. <i>Minunthozetes semirufus</i> (C.L. Koch, 1835) | Bluethroat |
| 129. <i>Punctoribates astrachanicus</i> Shaldybina, 1973 | Chaffinch |
| 130. <i>Punctoribates punctum</i> (C.L. Koch, 1839) | Starling, Magpie, Rook, Blackbird, Great Tit, House Sparrow, Chaffinch |
| Family PHENOPELOPIDAE Petrunkevitch, 1955 | |
| 131. <i>Eupelops torulosus</i> (C.L. Koch, 1836) | House Sparrow |
| 132. <i>Eupelops</i> sp. Ewing, 1917 | Blackcap |
| 133. <i>Peloptulus phaenotus</i> (C.L. Koch, 1844) | House Sparrow |
| Family ORIBATELLIDAE Jacot, 1925 | |
| 134. <i>Latilamellobates</i> sp. Shaldybina, 1971 | Tree Sparrow |
| 135. <i>Oribatella berlesei</i> (Michael, 1898) | Tree Sparrow |
| 136. <i>Oribatella quadricornuta</i> (Michael, 1880) | Tree Sparrow |
| Family ACHIPTERIIDAE Thor, 1929 | |
| 137. <i>Achipteria coleoptrata</i> (Linneus, 1758) | Waxwing, Bluethroat, Great Tit |
| 138. <i>Achipteria</i> sp. Berlese, 1885 | Jackdaw, Tree Sparrow |
| 139. <i>Parachipteria nitens</i> Hamman, 1952 | Bluethroat, Tree Sparrow |
| 140. <i>Parachipteria punctata</i> (Nicolet, 1855) | Red-backed Shrike, Jackdaw, Rook, Hooded Crow, Goldcrest, Robin, Great Tit, Chaffinch, Tree Sparrow |
| Family TEGORIBATIDAE Grandjean, 1954 | |
| 141. <i>Lepidozetes singularis</i> Berlese, 1910 | Robin, Great Tit, Chaffinch |
| 142. <i>Tegoribates latirostris</i> (C.L. Koch, 1844) | Rook |

Annex I continued

Family GALUMNIDAE Jacot, 1925

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| 143. <i>Galumna lanceata</i> Oudemans, 1900 | Rook |
| 144. <i>Galumna</i> sp. Heyden, 1928 | Chaffinch |
| 145. <i>Pergalumna nervosa</i> (Berlese, 1914) | Hooded Crow, Tree Sparrow |
| 146. Nymphs of Oribatei mites | Barn Swallow, Woodlark, Meadow Pipit, White Wagtail, Penduline Tit, Dunnock, Savi's Warbler, Blyth's Reed Warbler, Willow Warbler, Chiffchaff, Pied Flycatcher, Spotted Flycatcher, Black Redstart, Bearded Reedling, Long-tailed Tit, Willow Tit, Goldfinch |
