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Oribatid Mites (Oribatida) Associated with Nests of Hollow-Nesting Birds, on the Example of a Model Species, the European Pied Flycatcher (*Ficedula hypoleuca*), in the Taiga Forests of the European North-East of Russia

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Abstract: The authors have obtained original material on the fauna and population structure of oribatid mites inhabiting nests of the European Pied Flycatcher (*Ficedula hypoleuca*, Passeriformes, hollow-nesting bird) on the territory of the taiga zone of the European North-East of Russia. Long-term research and the collection of nests were carried out in the green zone of Syktyvkar in 2017–2022. Observations were made for artificial nests (hollows) of a box type with a bottom area of 100 cm^2. The material of the tray was collected completely. In 135 studied nests of Pied Flycatchers, 1762 specimens were found and identified for 22 species of oribatid mites from 19 genera and 16 families. In the nests of the Pied Flycatcher, a complex of species was found that is known as an arboricolous species for this region; these are *Oribatula (Zygoribatula) propinqua*, *Oribatula (Z.) exilis*, *Trichoribates (T.) berlesei*, and *Ameronothrus oblongus*. We suggested that arboricolous species, as well as eurytopic species, can actively inhabit bird nests. Highly numerous in our collections were representatives of the Oribatulidae and Scheloribatidae families; they are *Oribatula (Z.) propinqua*, *Oribatula (Z.) exilis*, *Oribatula (O.) tibialis*, and *Scheloribates laevigatus*. Epigeic species are dominated by the species number. The fauna of oribatid mites mainly included widespread Holarctic species (54.54%).

Keywords: Oribatida; birds' nests; *Ficedula hypoleuca*; the European North-East of Russia

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1. Introduction

The nests of migratory birds are of interest as habitats for soil microarthropods, including oribatid mites [1–8]. There is information about some findings of oribatids in the feathers of migratory birds [9–11]; it has been suggested that birds carry microarthropods in their feathers thousands of kilometers away from their wintering to nesting sites, increasing the diversity of some groups of microarthropods in northern latitudes and expanding their ranges [9,12]. The nests of migratory birds in the Arctic are of increasing interest [13]. This paper is an attempt broaden understanding of this phenomenon with the example of the European Pied Flycatcher (*Ficedula hypoleuca*), a representative of small passerine birds. This species is a common model species for conducting various kinds of population studies.

Being a typical hollow-nesting species easily attracted to artificial nesting sites, the European Pied Flycatcher (*Ficedula hypoleuca*) can serve as a convenient material to study the fauna and population of microarthropods, including oribatid mites that live in nests. Pied flycatcher nests are relatively protected from the effects of weather conditions, such as precipitation and wind, and it is likely that a special microclimate for arthropods is formed in such microhabitats. Studies on the breeding biology of the Pied Flycatcher aimed at obtaining qualitative and quantitative characteristics of its nesting will provide information that will form the basis for further studying the formation patterns of the fauna and population of oribatid mites living in nests of this bird. Moreover, studies on the seasonal dynamics of microarthropod fauna in the nests of flycatchers are of particular interest as the birds leave their nests for a long time after finishing the nesting season. The main purpose of our research is to analyze the dynamics of the fauna and population of oribatid mites in the nests of the Pied Flycatcher relative to the nesting progress and life cycle of the birds in the taiga zone of the European North-East of Russia.

2. Materials and Methods

2.1. Study Region

The study region is located in the taiga zone of the European North-East of Russia within the Komi Republic, Syktyvkar (61.40° N, 50.48° E). The territory belongs to the Vychegda–Mezen district of spruce, birch, and pine forests of the middle taiga subzone and is situated on the plain. Dark coniferous spruce forests dominate in the drained interfluves. Spacious pine forests alternate with upland peats on the terraces. Significant areas are occupied by spruce-birch forests with some aspen trees [14]. The climate is moderately continental with short and cool summers and snowy and long winters. The annual air temperature amplitude is 33 °C. The warmest year month is July (the average monthly temperature is +17 °C) and the coldest year month is January (−16 °C). The mean annual air temperature is 0 °C. The number of days with a mean daily air temperature above zero is 190. The average annual precipitation is 600 mm. The average height of snow cover is 50 cm, and the duration of its occurrence is 190 days [15,16].

Nests of Pied Flycatchers were observed in the green zones of Syktyvkar, particularly in the mixed poplar–birch stands of the Kirov Park of Culture and Recreation (KP), mixed spruce–birch stands of the Michurin City Park (MP), and mixed spruce–birch forest (in the vicinity of the Radiobiological Complex of the Institute of Biology (RBC)). KP and MP plots are situated in the central city part. RBC belongs to the southwestern outskirts of the city. The total area of the studied plots was 15 hectares.

2.2. Pied Flycatcher, Distribution, Nesting Biology

The European Pied Flycatcher (*Ficedula hypoleuca*) is a representative of the flycatcher family (*Muscicapidae*) of the order of passerine birds (Passeriformes). The breeding range of the species covers Northwest Africa and a significant part of Eurasia from the Atlantic coast to the Yenisei River valley. In the north, it occurs up to the 64–70th parallel, in the south, up to the 43–56th parallel, and in Africa, up to the 35th parallel [17]. The Pied Flycatcher makes annual migrations to wintering grounds. Its wintering grounds are located in the Mediterranean and Central and North Africa [18] (Figure 1). For the territory of the European North-East of Russia, the Pied Flycatcher is a common nestling migratory species in the south and middle taiga subzones. It is few in number in the north taiga and is considered to be a rare species in the extremely north taiga subzones [19–22].

The flycatcher inhabits forest stands and prefers mixed and deciduous mature and overmature forests [18]. It often inhabits artificial nesting grounds in city parks and squares. The nest is normally arranged in natural hollows of trees, in stumps, and in niches of buildings at a height of up to 15–20 m, usually at a height of 2–4 m from the very ground. The bird uses dry branches, leaves, grass blades, roots, needles, and pine and birch bark as nesting material. The nest tray in some cases does not differ from the material of the rest of the nest, and in other cases, it can be lined with very thin scales of pine bark or birch bark, and also with the hair of large mammals [18]. Adult birds are associated with the nest for about one month; this is the period of the incubation of eggs and the feeding of chicks before they leave the nest. Thus, the nest is inhabited for about 30 days. Egg laying lasts 3–11 days (usually 6–8), incubation—10–17 days (usually 12–13), and the feeding of chicks—13–18 days (usually 15–16). There are 3–11 eggs in a clutch (usually 6–8). There is one reproductive cycle per summer, but birds may re-lay eggs if the first clutches die. The departure of birds to wintering grounds begins after the end of the nesting period in late July to early August and finishes in early September [18]. Flycatchers mainly feed on insects. The birds collect them from the ground, grass, leaves, or branches or catch insects on the wing [23]. More than half of the collected insects are non-flying or poorly mobile [23–25].

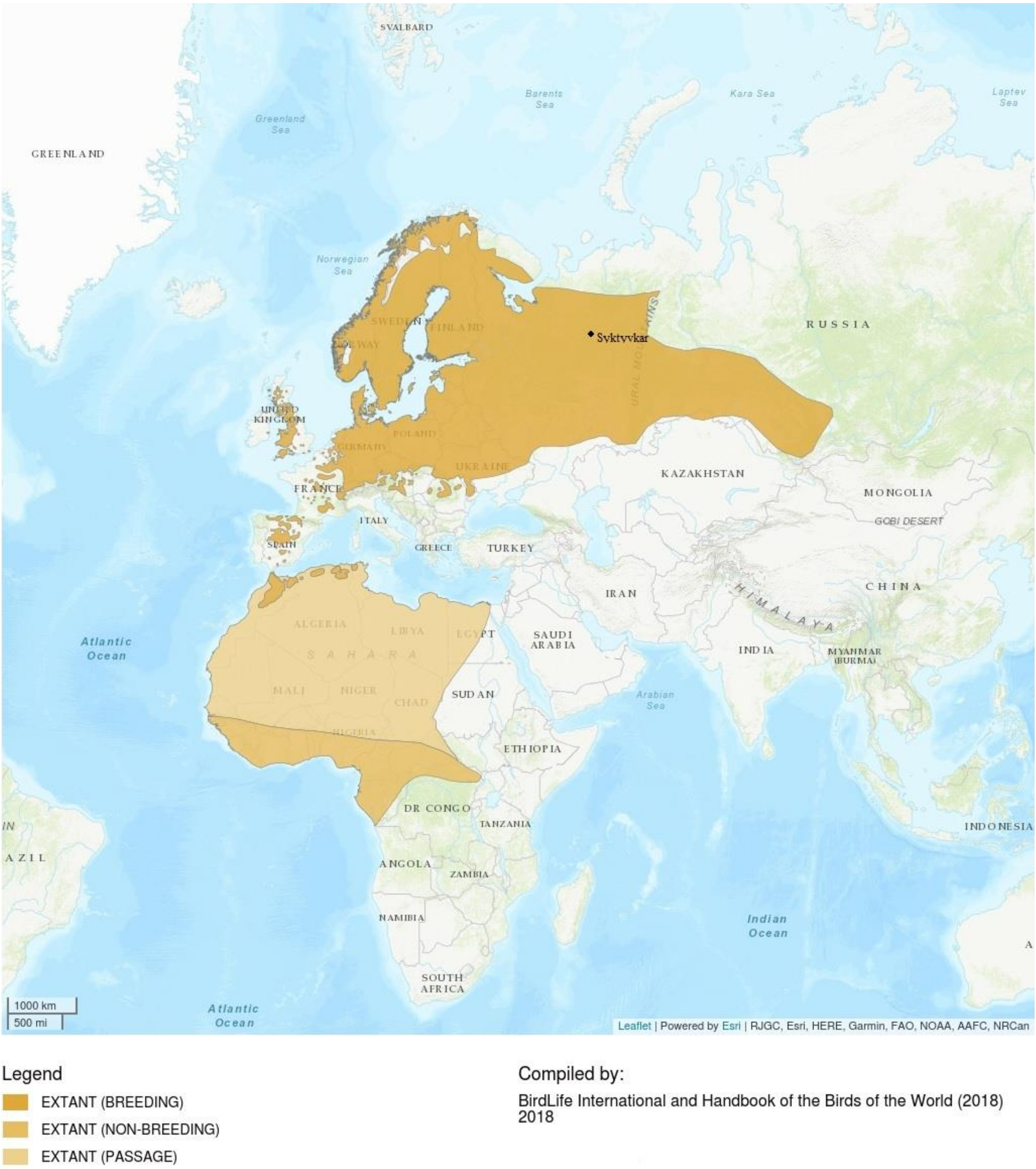

Figure 1. Distribution map of the European Pied Flycatcher according to the Red List data (https://www.iucnredlist.org, accessed: 25 January 2023).

2.3. Sampling Methods

We observed the nests located in artificial nest boxes with a bottom area of 100 cm^2 (Figure 2). About 90 artificial nests were monitored annually in the green zones of Syktyvkar, apart from 2022, when the majority of nest boxes were removed. We observed only 29 nests in 2022. The inspection of the nests was carried out once a week on the territory of the park areas and five times a week on the territory of RBC.

Figure 2. The nests of the European Pied Flycatcher at different nesting stages: (**a**) eggs, (**b**) chicks, (**c**) fledglings.

The period when the birds used nests was recorded: the time of nest construction, the beginning and the end of egg laying, the clutch size, the period of chicks' feeding, the flying-out dates of chicks, and the incubation and feeding progress. We examined the nesting material of 135 nests of the European Pied Flycatcher for the presence of oribatid mites in them.

The date of laying the first egg was calculated based on the fact that incubation began with the last laid egg [18]. The duration of the nesting cycle (or time when the birds live in the nest) was calculated as the difference between the flying-out date of chicks and the first egg-laying date. In the absence of information on the exact date of departure (although we recorded the successful completion of the nesting period), the last date of observation of the active nest was taken as the date of departure. The "period of absence of birds in the nest" was understood as a period between the last chicks' departure and the removal of the nest from the nest box. The overall success of reproduction was estimated by the ratio of the number of fledglings that flew out to the number of laid eggs. The analysis includes data on 135 collected nests of Pied Flycatchers over a six-year period (2017–11, 2018–30, 2019–31, 2020–29, 2021–29, 2022–5 nests) with a total duration of 4068 nesting days (Appendix A, Table A1). The nests were taken away from the nest boxes after the end of the nesting period, approximately 7 days after the chicks' departure. Towards the beginning of the nesting season of 2018, we sampled 11 "overwintered" nests which were places of egg laying and the rearing of offspring in 2017. Thus, these nests were collected 9–10 months later after the chicks had flown away. The material of the tray was collected completely.

2.4. Material Treatment

The invertebrates were extracted from nests using the Berlese–Tullgren thermoeclectors under 40 Watt bulbs into 96% alcohol for ten days [26]. Micropreparations were made from oribatid mites using For-Berlese liquid [26]. The oribatids were identified as species by morphological taxonomic characters using the key [27]. The taxonomy and type of global species distribution are given according to the L. Subias' classification [28]. For the analysis of the geographical distribution of species, literary sources were used [29–33] as well as others.

The classification of life forms of oribatid mites is given according to Krivolutsky [26]. The collections included varying species: inhabitants of the soil surface and upper horizons of the litter (epigeic), inhabitants of the litter layer (hemiedaphic), inhabitants of small soil holes (euedaphic), and eurybiontic and hydrobiontic species.

To compare three samples from three observation sites, these diversity indices were used: the number of taxa, the number of specimens, the Shannon index, the Menhinick index, and the Berger–Parker index. The Kruskal–Wallis test and the Mann-Whitney U test was used to determine the significance of differences. The SIMPER analysis (percentage similarity) was used to identify the species responsible for differences in the abundance of oribatids in different observation periods at different sites. The pairs of samples are compared using the Bray–Curtis measure. The calculations were carried out using the PAST 4.12b program [34]. We calculated indicators such as the number of specimens (N), dominance (D%), and the frequency of occurrence in samples (F%).

3. Results

3.1. Success of Pied Flycatcher Nesting

The start of the flycatcher's nesting period significantly varied from year to year. The earliest egg laying was recorded on 15 May, and the latest recorded eggs among repeated clutches were laid on 30 June. The duration median of the nesting cycle (distribution differs from the normal distribution) was 33 days for the entire study period. The reproduction of the Pied Flycatchers ended successfully in 101 nests (75%). The breeding success of individual pairs varied from 17 to 100%. The lowest total loss of clutches was observed in the green zone on the outskirts of the city (RBC)—6%—in contrast to the urban parks (KP, MP) where it was 30–33% (Appendix A, Table A1).

3.2. Abundance of Oribatid Mites

In the studied nests of the Pied Flycatcher, 1762 specimens of oribatid mites were found. The abundance of oribatid mites in the nests was generally low and uneven. The majority of nests counted only several specimens of oribatid mites. Only single nest boxes hosted from 60 to 80, and rarely more than 100 oribatid specimens. Some nests did not have them at all.

The "overwintered" nests of the 2017 nesting season were selected in May 2018. These nests were found for oribatid mites whose number reached 140 specimens or more per nest. The "overwintered" nests were normally inhabited by species of the Oribatulidae and Scheloribatidae families. For example, 142 specimens of oribatids of one species, *Oribatula (Zygoribatula) propinqua,* were found in nest box No. 25 (MP) on 16 May 2018; 74 specimens of *O. (Z.) propinqua* and two specimens of *Oribatula (Z.) exilis* were found in nest box No. 32 (MP). Nest box No. 21 (KP) was identified for 46 specimens of *Scheloribates (S.) laevigatus*, as well as for one specimen of *O. (Z.) propinqua* on 16 May 2018. It can be assumed that these mites successfully survived the winter in the nests of Pied Flycatchers.

The general number of oribatids in June and July of 2018 and other observation years was low compared to that in May. It continued being high in summer only in some nests dominated by the same species. Vice versa, the diversity of species increased in June and July. For example, 79 specimens of oribatid mites of five species were found in nest box No. 19 (KP) on 22 July 2020. Among them, one species, *O. (Z.) propinqua*, dominated in abundance (57.09%), and the others (*S. (S.) laevigatus, O. (Z.) exilis, Tectocepheus velatus, Graptoppia (Apograptoppia) foveolata*) were single specimens. The number of oribatids per nest normally ranged from three to ten specimens.

3.3. Taxonomic Composition and Diversity of Oribatid Mites

The examined nests of the Pied Flycatcher were found for 22 species of oribatid mites from 17 families (Table 1). The diversity of species was low. Some nests contained five or six species of oribatids, and the majority contained one or three species. The epigeic species, the so-called inhabitants of the soil surface and upper horizons of the forest litter according to the classification of life forms by D.A. Krivolutsky [21], dominated in species number. Eurybiontic species, representatives of the Oribatulidae and Scheloribatidae families, dominated in abundance. From the first family, the species *Oribatula* (*Zygoribatula*) *propinqua, Oribatula* (*Z.*) *exilis* and *Oribatula* (*O.*) *tibialis* were most common, and *Scheloribates laevigatus* from the second family. The inhabitants of shallow soil wells (euedaphic species) were rare. The greatest diversity of species was noted in nest box No. 8 (KP) on 19 July 2021 (five species), nest box No. 9 (KP) on 23 June 2021 (five species), nest box No. 9 (RBC) on 23 June 2021 (five species), and nest box No. 25 (MP) on 23 June 2021 (five species).

Table 1. Taxonomic composition of oribatid mites in the nests of the European Pied Flycatcher.

Title 1	Life Forms	Distribution	N	D%	F%
Trhypochthoniidae Willmann, 1931					
Trhypochthonius tectorum s. str. (Berlese, 1896)	hemiedaphic	Semi-cosmopolitan	4	0.23	1.54
Crotoniidae Thorell, 1876					
Heminothrus (Platynothrus) peltifer s. str. (Koch, 1839)	hemiedaphic	Semi-cosmopolitan	2	0.11	1.54
Damaeidae (Berlese, 1896)					
Damaeus (Epidamaeus) bituberculatus (Kulczynski, 1902)	epigeic	Palearctic	30	1.7	9.23
Liacaridae Sellnick, 1928					
Adoristes (A.) ovatus (Koch, 1839)	epigeic	Holarctic	3	0.17	1.54
Oppiidae (Sellnick, 1937)					
Dissorhina ornata s. str. (Oudemans, 1900)	euedaphic	Holarctic	31	1.77	6.15
Graptoppia (Apograptoppia) foveolata (Paoli, 1908)	euedaphic	Holarctic	17	0.96	4.61
Suctobelbidae Jacot, 1938					
Suctobelbella (S.) acutidens sarekensis (Forsslund, 1941)	euedaphic	Holarctic	2	0.11	1.54
Carabodidae Koch, 1843					
Carabodes (C.) subarcticus Trägårdh, 1902	epigeic	Palearctic	8	0.45	3.08
Tectocepheidae (Grandjean, 1954)					
Tectocepheus velatus (Michael, 1880)	eurybiontic	Cosmopolitan	13	0.74	3.08
Ameronothridae Vitzthum, 1943					
Ameronothrus oblongus Sitnikova, 1975	hydrobiontic	Holarctic	1	0.06	1.54

Table 1. *Cont.*

Title 1	Life Forms	Distribution	N	D%	F%
Ceratozetidae Jacot, 1925					
Melanozetes mollicomus (Koch, 1839)	epigeic	Holarctic	9	0.51	3.08
Sphaerozetes piriformis (Nicolet, 1855)	epigeic	Palearctic	3	0.17	1.54
Trichoribates (T.) berlesei (Jacot, 1929)	epigeic	Holarctic	4	0.23	4.61
Chamobatidae Thor, 1937					
Chamobates (C.) pusillus (Berlese, 1895)	epigeic	Holarctic	7	0.40	4.61
Humerobatidae Grandjean, 1971					
Diapterobates oblongus (L. Koch, 1879)	epigeic	Palearctic	9	0.51	6.15
Diapterobates humeralis (Hermann, 1804)	epigeic	Holarctic	7	0.40	3.08
Oribatulidae Thor, 1929					
Oribatula (Oribatula) tibialis (Nicolet, 1855)	eurybiontic	Holarctic	21	1.19	7.69
Oribatula (Zygoribatula) exilis (Nicolet, 1855)	eurybiontic	Holarctic	76	4.31	9.23
Oribatula (Z.) propinqua (Oudemans, 1902)	eurybiontic	Palearctic	1006	57.09	41.53
Scheloribatidae Grandjean, 1933					
Scheloribates (S.) laevigatus (Koch, 1835)	eurybiontic	Semi-cosmopolitan	487	27.64	30.77
Parakalummidae Grandjean, 1936					
Neoribates (N.) aurantiacus (Oudemans, 1914)	epigeic	Holarctic	15	0.85	3.08
Galumnidae Jacot, 1925					
Pergalumna (P.) willmanni (Zachvatkin, 1953)	epigeic	Palearctic	7	0.40	4.61
Total			1762	100	

Note. N number of specimens; D% dominance; F% frequency of occurrence in samples.

We compared (Kruskal-Wallis test) three observation sites: Kirov Park, Michurin City Park, and RBC in terms of such diversity indices as: the number of taxa, the number of specimens, the Shannon Index, the Menhinick Index, and the Berger–Parker Index; there were no significant differences between the three sites in these indicators revealed, with the exception of the number of specimens indicator (Kruskal-Wallis test, $p = 0.038$): the abundance of individuals in RBC was statistically significant less than in the Kirov Park (Mann-Whitney test, Z = 2.44, $p = 0.016$) (Figure 3).

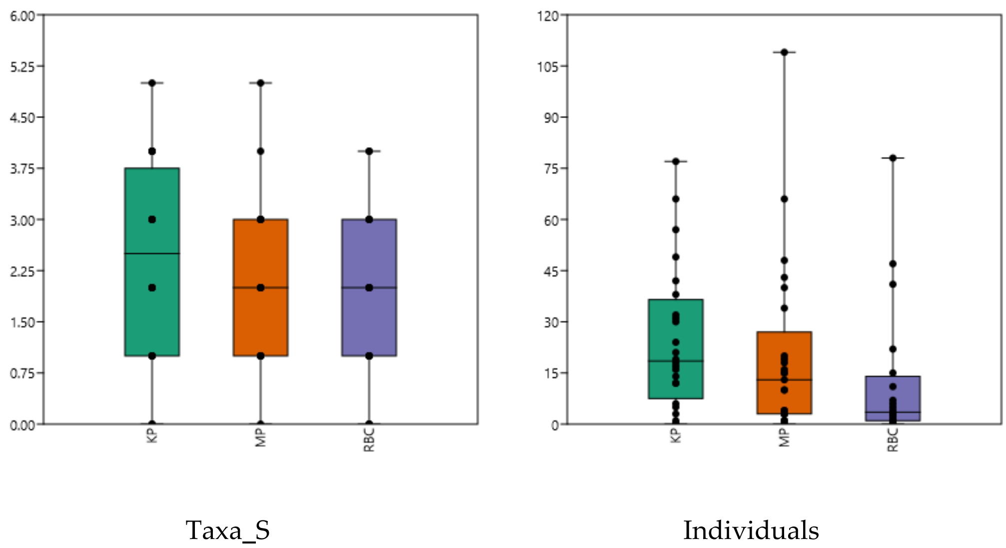

Figure 3. *Cont.*

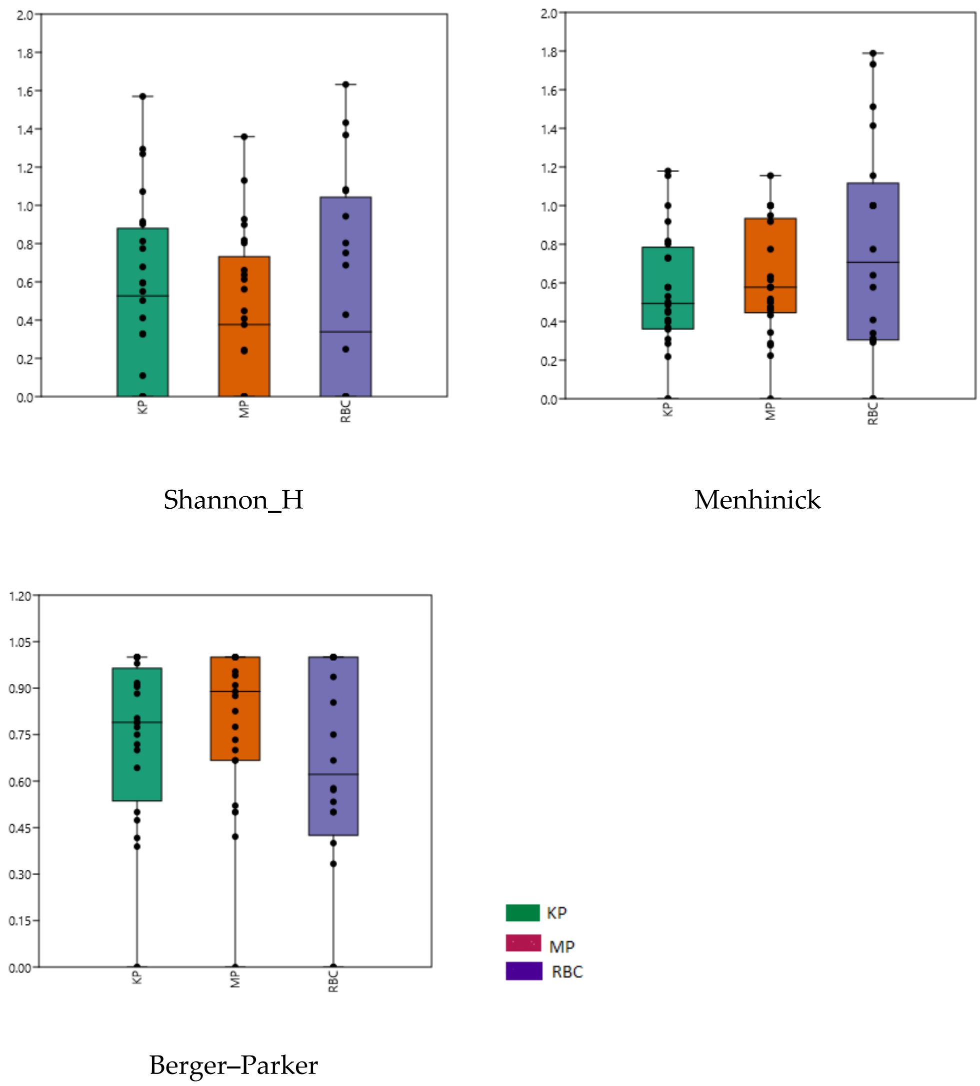

Figure 3. Comparison of three sites samples (KP—Kirov Park, MP—Michurin City Park, RBC—the Radiobiological Complex) by diversity indices, based on the results of 2018-2022 (excluding overwintered nests 2017).

4. Discussion

4.1. Taxonomic Composition

The SIMPER analysis (similarity percentage) revealed two significant species that determined the differences in the number of oribatid mites in different observation periods; these were the species *Oribatula (Z.) propinqua* and *Scheloribates (S.) laevigatus*. When comparing the number of oribatid mites at the RBC site, significant differences were revealed in overwintered nests collected before the arrival of birds (in May to early June 2018) not yet inhabited by birds, and nests collected in the summer, when they were already populated by birds. In the overwintered nests that were inhabited by birds in 2017, the number of oribatid mites was significantly higher (Mann-Whitney test, Z = 2.2, p = 0.028) (Figure 4).

The *Oribatula (Zygoribatula) propinqua* species was earlier found by us in epiphytic lichens of coniferous forests of the European North-East [35]. This species was recorded exclusively in epiphytes. It dominated in abundance in the *Hypogimnia physodes* thallus in pine forests and was rare in spruce forests. The species was not found in the soil. We included this species in the ecological group of arboreal dominant species [35]. The eurytopic species *Scheloribates (S.) laevigatus* was often found in both ground and epiphytic lichens [35,36]. The *Oribatula (Z.) exilis*, *Melanozetes mollicomus*, and *Trichoribates (T.) berlesei* species also inhabited epiphytic lichens [36].

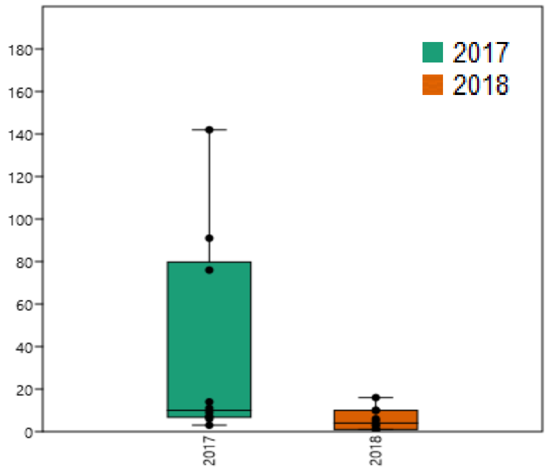

Figure 4. The number of oribatid mites in the RBC site in different months of observation in 2018 (2017—overwintered nests, 2018—nests collected in summer).

Some species rare in Pied Flycatcher nests have also been noted as arboreal species.

Thus, only one specimen of *Ameronothrus oblongus* was found in nest box No. 26 (MP) on 13 May 2018. We earlier found it in epiphytic lichens, and it was not recorded in any other habitats and was included in the group of a few arboreal species [35].

Representatives of the Ameronothrus genus known as hydrobiontic littoral species have previously been recorded in bird nests. For example, *Ameronothrus lineatus* (Thorell, 1871) was found in nests of Common Eider, Glaucous Gull, and Black-legged Kittiwake on the Svalbard archipelago [12]. This species (*A. lineatus*) was identified in the nest of Common Eider in the north of the European part of Russia (the Murmansk region) [37].

Arboricolous species could possibly actively inhabit artificial nests of the Pied Flycatcher. The eurytopic species *Scheloribates (S.) laevigatus* and *Tectocepheus velatus* occupy various habitats and also could actively inhabit nest boxes. According to S.V. Shakhab [37], the oribatid species *Tectocepheus velatus*, *Oribatula tibialis*, and *Scheloribates laevigatus*, being eurybiontic species according to the D.A. Krivolutsky system [26], dominated in abundance in bird nests in the European part of Russia.

We believe that oribatid mites can enter the nests of the Pied Flycatcher within the nest-building material the birds collect mainly from the soil surface. This conclusion relies on the fact that the majority of oribatid mite species found in the nests are common to the taiga forests of the European North. These species are predominantly inhabitants of the soil surface and the upper horizons of the forest litter (*Damaeus (Epidamaeus) bituberculatus*, *Carabodes (C.) subarcticus*, *Chamobates (C.) pusillus*, *Neoribates (N.) aurantiacus* et al.). Therefore, it is very likely to capture them with pieces of litter, bark, or lichens.

However, it is also possible that some species could have been transferred by birds in feathers from the southern regions where they winter, as well as from stopping places (for feeding and resting) during the migration period, since some of the oribatid mites species (*Pergalumna (P.) willmanni*, *Diapterobates oblongus*), found in the nests of the Pied Flycatcher, are rare in the taiga zone. It is known that arthropods, including oribatid mites, have been found in the feathers of migratory birds [9–11].

Some species found in nests of the Pied Flycatcher including eurybiontic species, populated nests of small mammals. They are *Heminothrus (P.) peltifer* (as *Platynothrus peltifer*), *Dissorhina ornata* (as *Oppia ornata*), *Suctobelbella* (S.) *acutidens sarekensis* (as *Suctobelbella sarekensis*), *T. velatus*, *Oribatula tribialis*, *Scheloribates laevigatus*, and *Chamobates* (C.) *pusillus* (as *Chamobates borealis*) [38]. *Dissorhina (Oppia) ornata*, *Oribatula tibialis*, and *Tectocepheus* *velatus* inhabited nests of waterfowl and semiaquatic birds in the water ecosystems of the Sea of Azov; *T. velatus* was among the two dominants [39].

Some species found in the nests of the European Pied Flycatcher were previously identified in the nests of passerine birds (Passeriformes). For example, the eurytopic species of *Tectocepheus velatus, Oribatula (Z.) exilis, and Scheloribates (S.) laevigatus* were found in the nests of Lapland Bunting on the Vaigach island [6]. Five species from the Crotonioidea superfamily, including two species of the *Heminothrus* genus as *H. peltifer* and *H. longisetosus* (Crotoniidae family) were identified in the nests of the ground-nesting Wood Warbler *Phylloscopus sibilatrix* in Poland [7]. Some oribatid specimens could possibly have been brought to the nests by birds in feathers from the places of migration stops (for feeding and rest) during the flight back home in the spring.

4.2. Zoogeographic Structure of Fauna and Distribution of Species

The zoogeographic structure of fauna was dominated by widespread Holarctic species (12 species, 54.54%). Cosmopolitans and semi-cosmopolitans were also present (four species, 18.18%). Palearctic species accounted for 27.27% (six species). The majority of oribatid species found in nests are common representatives of taiga forests of the European North. They are *Carabodes (C.) subarcticus, Neoribates (N.) aurantiacus, Oribatula (O.) tibialis*, and other species widely distributed in the Arctic–Boreal zone [29,32,33,35,40].

Some species we found are rare for northern latitudes. For example, Subias [28] characterizes the species *Pergalumna (P.) willmanni* (Zachvatkin, 1953) as a Palearctic (European: less common in the north, and southwest of Siberia) species. In the European part of Russia, the species is known to inhabit coniferous–deciduous forests, forest-steppe, and steppe [26,29,30]. In the taiga zone of the northeastern part of European Russia, the *Ameronothrus oblongus* species was previously noted only in epiphytic lichens as a single specimens [35,36]. The *Oribatula (Zygoribatula) propinqua* species was highly abundant in our samples and was previously among the dominating species in epiphytes of spruce and pine forests [35]. It also is not widely distributed in the North.

5. Conclusions

In total, 135 nests of the European Pied Flycatcher were identified for 1762 specimens of oribatid mites of 22 species. Highly common and numerous in our collections were the *Oribatula (Zygoribatula) propinqua (family Oribatulidae)* and *Scheloribates (S.) laevigatus (Scheloribatidae)* species. Rare were the *Heminothrus (P.) peltifer, Ameronothrus oblongus, Sphaerozetes piriformis,* and *Diapterobates oblongus* species. They were only found as single specimens.

In the nests of Pied Flycatchers, a complex of species that were previously known as arboricolous for the study region, such as *Oribatula (Zygoribatula) propinqua, Oribatula (Zygoribatula) exilis, Trichoribates (T.) berlesei,* and *Ameronothrus oblongus*, was found. We assume that arboricolous, as well as eurytopic, species (*Scheloribates (S.) laevigatus*, *Oribatula (O.) tibialis*), can actively populate bird nests. It is also possible that some species of oribatids that are rare in the taiga zone (such as *Pergalumna (P.) willmanni, Diapterobates oblongus*) could have been brought by birds in their plumage from more southern regions. The findings of numerous oribatid specimens in the "overwintered" nests suggest that they can last over winter in a nest without a nest owner.

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Appendix A

Table A1. Life cycle phases and nesting progress of the European Pied Flycatcher in the green zones of Syktyvkar for 2017–2022 (MP—the Michurin Park, KP—the Kirov Park, RBC—the Radiobiological Complex.

Nest-Box Number	Nest-Box Location Place	Nesting Start (Date)	Nesting End (Date)	Period the Birds Are in Nest, Days	Period the Birds Are Out of Nest, Days	Breeding Progress (%)	Sampling (Date)
5	MP	13 June 2017	13 July 2017	30	307	100	16 May 2018
18	MP	27 June 2017	4 August 2017	38	285	100	16 May 2018
25	MP	11 June 2017	13 July 2017	32	307	100	16 May 2018
26	MP	10 June 2017	26 June 2017	16	324	0	16 May 2018
32	MP	10 June 2017	13 July 2017	33	307	50	16 May 2018
5	KP	30 June 2017	4 August 2017	35	285	43	16 May 2018
9	KP	11 June 2017	23 June 2017	12	285	0	16 May 2018
17	KP	12 June 2017	20 July 2017	38	300	100	16 May 2018
29	KP	11 June 2017	23 June 2017	12	327	0	16 May 2018
31	КП	10 June 2017	13 July 2017	33	307	57	16 May 2018
б/н	KP	27 June 2017	4 August 2017	38	285	100	16 May 2018
3	MP	13 June 2018	13 July 2018	30	7	100	13 July 2018
4	MP	21 May 2018	23 June 2018	33	13	86	6 July 2018
7	MP	3 June 2018	6 July 2018	33	7	100	13 July 2018
11	MP	26 May 2018	29 June 2018	34	7	86	6 July 2018
12	MP	25 May 2018	15 June 2018	21	21	0	6 July 2018
15	MP	13 June 2018	13 July 2018	30	7	83	13 July 2018
19	MP	25 May 2018	29 June 2018	35	13	71	6 July 2018
22	MP	25 May 2018	29 June 2018	35	13	43	6 July 2018
26	MP	25 May 2018	15 June 2018	21	21	0	6 July 2018
30	MP	12 June 2018	22 June 2018	10	14	0	6 July 2018
32	MP	31 May 2018	06 July 2018	36	7	100	13 July 2018
3	KP	22 June 2018	13 July 2018	21	19	0	1 August 2018
5	KP	20 May 2018	13 June 2018	24	7	0	20 July 2018
9	KP	11 June 2018	12 July 2018	31	7	83	20 July 2018
17	KP	25 May 2018	29 June 2018	35	7	43	6 July 2018
18	KP	29 June 2018	6 July 2018	7	14	0	20 July 2018
19	KP	21 June 2018	29 June 2018	8	21	0	20 July 2018
23	KP	18 June 2018	20 July 2018	32	7	100	20 July 2018
24	KP	1 June 2018	6 July 2018	35	13	100	6 July 2018
28	KP	24 May 2018	29 June 2018	36	7	100	6 July 2018
29	KP	5 June 2018	6 July 2018	31	7	100	20 July 2018
30	KP	26 May 2018	29 June 2018	34	13	57	6 July 2018
38	KP	31 May 2018	29 June 2018	29	7	86	6 July 2018
41	KP	13 June 2018	22 June 2018	9	6	0	1 August 2018
45	KP	25 May 2018	29 June 2018	35	7	86	6 July 2018
8	RBC	8 June 2018	12 July 2018	34	1	86	13 July 2018
10	RBC	20 May 2018	29 June 2018	40	0	71	2 July 2018
11	RBC	4 June 2018	12 July 2018	38	0	100	12 July 2018
13	RBC	29 May 2018	6 July 2018	38	0	83	6 July 2018
15	RBC	21 May 2018	2 July 2018	42	0	100	3 July 2018

Table A1. *Cont.*

Nest-Box Number	Nest-Box Location Place	Nesting Start (Date)	Nesting End (Date)	Period the Birds Are in Nest, Days	Period the Birds Are Out of Nest, Days	Breeding Progress (%)	Sampling (Date)
2	MP	31 May 2019	4 July 2019	34	7	43	11 July 2019
4	MP	16 May 2019	21 June 2019	36	7	86	28 June 2019
9	MP	30 May 2019	4 July 2019	35	8	88	11 July 2019
14	MP	1 June 2019	4 July 2019	33	13	17	11 July 2019
19	MP	22 May 2019	6 June 2019	15	7	0	13 June 2019
29	MP	20 May 2019	22 June 2019	33	7	50	28 June 2019
32	MP	17 May 2019	7 June 2019	21	7	0	13 June 2019
1	KP	1 June 2019	4 July 2019	33	7	71	11 July 2019
3	KP	24 June 2019	25 July 2019	31	7	20	25 July 2019
6	KP	16 May 2019	22 June 2019	37	7	67	28 June 2019
9	KP	28 June 2019	25 July 2019	27	4	25	29 July 2019
18	KP	16 May 2019	22 June 2019	37	7	70	28 June 2019
19	KP	6 June 2019	13 July 2019	37	7	89	19 July 2019
20	KP	24 May 2019	1 June 2019	8	7	0	6 June 2019
23	KP	27 May 2019	28 June 2019	32	7	63	4 July 2019
24	KP	27 May 2019	28 June 2019	32	7	0	4 July 2019
28	KP	16 May 2019	31 May 2019	15	13	0	13 June 2019
29	KP	15 May 2019	22 June 2019	38	7	88	28 June 2019
37	KP	5 June 2019	4 July 2019	29	7	43	4 July 2019
38	KP	6 June 2019	11 July 2019	35	7	100	11 July 2019
45	KP	16 May 2019	20 June 2019	35	8	100	28 June 2019
2	RBC	30 May 2019	8 July 2019	39	0	86	8 July 2019
4	RBC	3 June 2019	8 July 2019	35	0	71	8 July 2019
8	RBC	14 June 2019	17 July 2019	33	12	100	29 July 2019
9	RBC	16 June 2019	4 July 2019	18	4	56	8 July 2019
11	RBC	15 May 2019	28 May 2019	13	5	0	5 June 2019
12	RBC	16 June 2019	20 June 2019	4	11	0	1 July 2019
13	RBC	30 May 2019	1 July 2019	32	8	83	9 July 2019
14	RBC	30 May 2019	4 July 2019	35	1	67	9 July 2019
15	RBC	9 June 2019	14 July 2019	35	15	83	29 July 2019
2	MP	19 May 2020	23 June 2020	35	7	71	23 June 2020
4	MP	31 May 2020	30 June 2020	30	7	86	7 July 2020
12	MP	20 May 2020	23 June 2020	34	7	71	30 June 2020
17	MP	12 June 2020	14 July 2020	32	7	60	22 July 2020
18	MP	29 June 2020	30 June 2020	1	7	0	30 June 2020
19	MP	20 May 2020	23 June 2020	34	7	71	30 June 2020
25	MP	20 May 2020	23 June 2020	34	7	63	30 June 2020
28	MP	24 May 2020	23 June 2020	30	7	0	23 June 2020
31	MP	11 June 2020	14 July 2020	33	7	67	14 July 2020
33	MP	29 May 2020	17 June 2020	19	7	0	23 June 2020
1	KP	19 May 2020	23 June 2020	35	7	71	30 June 2020
3	KP	22 May 2020	23 June 2020	32	7	0	23 June 2020
8	KP	21 May 2020	23 June 2020	33	7	0	23 June 2020
9	KP	27 May 2020	23 June 2020	27	7	29	7 July 2020
14	KP	21 May 2020	30 June 2020	40	7	0	30 June 2020
19	KP	9 June 2020	7 July 2020	28	15	20	22 July 2020
23	KP	29 May 2020	14 July 2020	46	8	0	22 July 2020
24	KP	23 May 2020	23 June 2020	31	7	0	23 June 2020
28	KP	6 June 2020	8 July 2020	32	7	33	14 July 2020
29	KP	18 May 2020	23 June 2020	36	7	100	23 June 2020
41	KP	13 June 2020	22 July 2020	39	7	0	28 July 2020
43	KP	28 May 2020	1 July 2020	34	7	100	7 July 2020
2	RBC	23 May 2020	29 June 2020	37	7	86	30 June 2020
5	RBC	27 May 2020	30 June 2020	34	0	86	30 June 2020
6	RBC	28 May 2020	30 June 2020	33	3	71	3 July 2020
8	RBC	24 May 2020	29 June 2020	36	1	75	30 June 2020
10	RBC	28 May 2020	30 June 2020	33	3	83	3 July 2020
12	RBC	15 May 2020	22 June 2020	38	0	100	22 June 2020
13	RBC	23 May 2020	26 June 2020	34	0	100	26 June 2020
15	RBC	9 June 2020	14 July 2020	35	0	83	14 July 2020

Table A1. *Cont.*

Nest-Box Number	Nest-Box Location Place	Nesting Start (Date)	Nesting End (Date)	Period the Birds Are in Nest, Days	Period the Birds Are Out of Nest, Days	Breeding Progress (%)	Sampling (Date)
4	MP	11 June 2021	12 July 2021	31	7	100	12 July 2021
5	MP	22 May 2021	1 June 2021	10	7	0	7 June 2021
10	MP	20 May 2021	14 June 2021	25	15	100	29 June 2021
14	MP	21 May 2021	23 June 2021	33	6	63	29 June 2021
18	MP	9 June 2021	12 July 2021	33	7	100	12 July 2021
21	MP	25 May 2021	29 June 2021	35	6	89	5 July 2021
25	MP	2 June 2021	14 June 2021	12	9	0	23 June 2021
28	MP	25 May 2021	29 June 2021	35	7	86	29 June 2021
30	MP	6 June 2021	29 June 2021	23	7	0	5 July 2021
32	MP	17 May 2021	17 May 2021	0	20	0	23 June 2021
3	KP	19 May 2021	23 June 2021	35	7	100	23 June 2021
8	KP	11 June 2021	12 July 2021	31	7	80	19 July 2021
9	KP	19 May 2021	23 June 2021	35	9	100	23 June 2021
14	KP	17 May 2021	23 June 2021	37	9	86	23 June 2021
19	KP	25 May 2021	29 June 2021	35	6	83	29 June 2021
20	KP	10 June 2021	12 July 2021	32	7	100	12 July 2021
23	KP	20 May 2021	23 June 2021	34	9	100	29 June 2021
28	KP	28 May 2021	29 June 2021	32	6	100	5 July 2021
29	KP	19 May 2021	23 June 2021	35	9	100	23 June 2021
31	KP	30 May 2021	1 July 2021	32	6	0	7 June 2021
43	KP	17 May 2021	17 May 2021	0	29	0	14 June 2021
45	KP	21 May 2021	1 July 2021	41	6	0	7 June 2021
1	RBC	18 May 2021	23 June 2021	36	1	86	24 June 2021
4	RBC	17 May 2021	24 June 2021	38	0	100	24 June 2021
8	RBC	1 June 2021	30 June 2021	29	4	83	2 July 2021
9	RBC	18 May 2021	24 June 2021	37	0	100	24 June 2021
11	RBC	10 June 2021	12 July 2021	32	3	75	14 July 2021
12	RBC	17 May 2021	21 June 2021	35	0	86	21 June 2021
15	RBC	18 May 2021	21 June 2021	34	3	67	21 June 2021
2	RBC	4 June 2022	7 July 2022	33	0	100	8 July 2022
8	RBC	29 May 2022	30 June 2021	32	3	83	4 July 2022
11	RBC	2 June 2022	5 July 2022	33	2	86	7 July 2022
12	RBC	5 June 2022	7 July 2022	32	1	100	11 July 2022
14	RBC	30 May 2022	4 July 2022	35	4	100	4 July 2022

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