

Millipedes (Diplopoda) in Pied flycatcher (*Ficedula hypoleuca* Pall.) nests in southern Karelia, northwestern Russia

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ABSTRACT. Only few millipede species were encountered in 2016 and 2021 in Pied flycatcher nests inside nest boxes set at a field station (60°46'N, 32°48'E) located within the subzone of middle taiga in Karelia, Russia. More species (5 vs 3) and higher abundance levels (123 vs 86) were observed in the cooler and rainy 2016 compared to the warmer and drier 2021, with the incidence of occurrence varying between ca 74% and ca 66%, respectively. The nests were dominated by *Ommatoiulus sabulosus*, while *Leptoiulus proximus* subdominated, during both years of monitoring. Together with the remaining few species of Diplopoda encountered in Pied flycatcher nests there, they can only be considered as purely opportunistic nidicoles. No obligate nidicolous in Karelian Diplopoda could be suggested, facultative nidicolous being common instead.

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KEY WORDS: myriapod, bird, nidicolous.

Многоножки-диплоподы (Diplopoda) в гнездах мухоловки-пеструшки (*Ficedula hypoleuca* Pall.) в Южной Карелии (Северо-Западная Россия)

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РЕЗЮМЕ. Лишь несколько видов диплопод отмечены в 2016 и 2021 гг. в гнездах мухоловки-пеструшки в синичниках на полевой станции (60°46'N, 32°48'E), расположенной в подзоне средней тайги в Карелии (Россия). Больше число видов (5 vs 3) и большее обилие (123 vs 86) обнаружены в более холодном и дождливом 2016 году по сравнению с более теплым и сухим 2021 годом, а встречаемость менялась соответственно с примерно 74% до около 66%. В течение обоих лет мониторинга в гнездах доминировал кивсяк *Ommatoiulus sabulosus*, тогда как кивсяк *Leptoiulus*

proximus был субдоминантом. Вместе с еще несколькими видами Diplopoda, встречающимися там в гнездах мухоловки-пеструшки, оба эти вида кивсяков можно считать чисто оппортунистическими обитателями гнезд. Обязательной нидиколии у Diplopoda Карелии нет, а вместо нее обычно факультативное обитание в гнездах птиц.

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КЛЮЧЕВЫЕ СЛОВА: многоножка, птица, нидиколия.

Introduction

Millipedes have long been recorded as symbionts in various bird nests (e.g., Schubart, 1934). Nordberg (1936) seems to have been among the first to record a *Julus* sp. from 56 nests representing five bird species in Northern Europe. A special survey of the millipedes extracted from 301 bird nests representing seven nest types and 40 bird species throughout Slovakia revealed 18 diplopod species from four orders (Tajovský *et al.*, 2001). However, no Diplopoda have been found to represent obligate nidicoles (Tajovský *et al.*, 2001; Golovatch, Kime, 2009).

As regards Russia and the adjacent parts of Ukraine, closer unidentified Diplopoda from starling (*Turdus*) nests have been recorded from the cities of Moscow and Kislovodsk (Tel'pova *et al.*, 2006; Matyukhin *et al.*, 2011). A *Polydesmus* sp. has been found in bluethroat nests in Moscow City (Matyukhin *et al.*, 2016). A *Julus* sp. has been encountered in swallow nests in Tatarstan, central-eastern Russia (Borisova, 1978). Some unidentified Polyxenida, as well as small/juvenile Polydesmida and Julida have been reported from bird nests and plumage in southern Russia by D. Krivolutsky (in litt.) (Golovatch *et al.*, 2011). Closer unidentified Julidae and a *Polydesmus* sp. have been recorded from white-necked flycatcher nests in the Kharkov Region of northeastern Ukraine (Lezhenina *et al.*, 2009; Chaplygina *et al.*, 2015).

Reliable species identifications of the millipedes revealed in various bird nests in Moscow City and its vicinities, as well as in several other

towns and regions of southern Russia have been provided only by Golovatch *et al.* (2011), altogether with eight diplopod species involved. Below is the first report of millipede diversity and abundance encountered for two years in the nests of a single bird species in a small area of a huge region in northwestern Russia.

Material and methods

Millipedes were captured in the nests of the Pied flycatcher (*Ficedula hypoleuca*) in 2016 and 2021 at the Mayachino Field Station of the Institute of Biology, Karelian Research Centre of the Russian Academy of Sciences (60°46'N, 32°48'E). The station is located at the southeastern coast of Lake Ladoga, Olonets District, Republic of Karelia, within the subzone of middle taiga. The birds bred in standard-sized wooden nest boxes set up at a height of 1.7 m in forests typical of the area, mainly in mature pine or mixed pine and birch woodlands of varying age, as well as spruce and pine forests and black alder stands. The area of observation totaled ca 10 sq. km. A detailed description of the study area is available elsewhere (Artemyev, 2008).

Entire individual bird nests were removed from the nest boxes during the second half of June, 1–5 days after the fledglings had left the nest. Then the nests were hermetically packed in two plastic bags and kept for two weeks in a cool place to finally be transported to Moscow. In both 2016 and 2021, the nest boxes were set in similar habitats, but only a few nest boxes remained the same in 2021.

The two collecting seasons differed considerably in weather conditions. The June of 2016

was cool and rainy, its mean air temperature amounting to only 13.7 °C (vs 14.7 °C for many-year long observations in 1980–2021), and the monthly precipitations to 90 mm (vs 58.7 mm). In contrast, the June of 2021 was hot and dry, its mean air temperature amounting to 19 °C, and precipitations to 40 mm, these mostly received as strong showers in the last 10 days of the month. During the removal of the nests from the nest boxes, these measures averaged 18.2 °C and 37 mm in 2016, vs 22.3 °C and 36 mm in 2021.

When in the lab in Moscow, the nests were unpacked and subjected to thermal extraction using Berlese-Tullgren thermo-electors until complete desiccation, and then hand-sorted for macrofauna. The debris, including dry and mostly badly fragmented Diplopoda, were fixed in 75% ethanol, examined and identified under an МБС-1 stereo microscope.

Altogether, 46 Pied flycatcher nests were examined for Diplopoda in 2016, vs 48 in 2021.

Results

According to Palmén (1949, 1988), eastern Fennoscandia within both Finland and Karelia, Russia supports 24 species of Diplopoda representing 17 genera, six families and four orders. Of them, only five or three species have been encountered in pied flycatcher nests in 2016 and 2021, respectively (Tables 1 and 2). Altogether, the following six millipede species have been recorded: *Polydesmus denticulatus* C.L. Koch, 1847 (family Polydesmidae, order Polydesmida), *Proteroiulus fuscus* (Am Stein, 1857) (family Blaniulidae, order Julida), *Leptoiulus proximus* (Němec, 1896), *Megaphyllum sjelandicum* (Meinert, 1868), *Ommatoiulus sabulosus* (Linnaeus, 1758) (all family Julidae, order Julida), and *Polyzonium germanicum* Brandt, 1837 (family Polyzoniidae, order Polyzoniida). Most of these millipedes are very widely distributed and common in European Russia, the taiga belt in particular, being forest floor-dwellers (Schubart, 1934; Lokshina, 1969). Only *Proteroiulus fuscus* is a subcorticolous species strongly inclined to dwelling under the bark of pine trees

(Schubart, 1934; Palmén, 1949, 1988).

As of the 46 Pied flycatcher nests examined for Diplopoda in 2016 as many as 12 contained no millipedes, vs 48 and 16 in 2021, respectively (Tables 1 and 2), the incidence of occurrence amounted to ca 74% and ca 66%, respectively. In other words, regardless of the collecting season being cooler and rainy or warmer and drier, most of the nest boxes were populated by millipedes. However, it is clear that more species (5 vs 3) and higher abundance levels (123 vs 86) were observed in 2016 compared to 2021. This agrees well with the common wisdom that the Diplopoda is a generally meso- to hygrophilous class of soil macrofauna.

Moreover, as direct observations at Mayachino show, millipedes were encountered throughout the season, from May to July, not only in bird nests, but also in empty nest boxes. Diplopods tend to climb the trees and populate the nest boxes in a humid weather, often occurring in empty nest boxes already in the early spring, just after snow melting on the ground and before the soil drying up, as well as in summer after and/or during a rain. No obligate nidicolity in Karelian Diplopoda is thus possible to imply, facultative nidicolity being common instead.

Apparently, the most common and abundant millipede to crawl into nest boxes at Mayachino is invariably *Ommatoiulus sabulosus*, followed by the subdominant *Leptoiulus proximus* (Tables 1 and 2). Together with the remaining few species of Diplopoda encountered in bird nests there, they can be considered as purely opportunistic nidicoles.

Compliance with ethical standards

CONFLICTS OF INTEREST: The authors declare that they have no conflicts of interest.

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Table 1. Diplopoda species and number of specimens encountered in Pied flycatcher nests at Mayachino in 2016.

Табл. 1. Виды Diplopoda и количество экземпляров, отмеченные в гнездах мухоловки-пеструшки близ Маячино в 2016 г.

No. of nests containing Diplopoda	Nest no. in the field	<i>Ommatoiulus sabulosus</i>	<i>Leptoiulus proximus</i>	<i>Megaphyllum sjaelandicum</i>	<i>Proteroiulus fuscus</i>	<i>Polyzonium germanicum</i>
1	1	2	–	–	–	–
2	2	6	–	–	–	–
3	3	3	–	–	–	–
4	4	–	5	–	–	–
5	6	1	–	2	–	–
6	7	8	–	–	–	–
7	9	4	–	–	–	–
8	11	2	–	–	–	–
9	14	–	–	–	2	–
10	15	3	–	–	–	–
11	16	2	–	–	–	–
12	19	1	–	–	–	–
13	20	–	–	1	–	–
14	22	1	4	–	–	–
15	25	6	–	–	–	1
16	26	5	4	–	–	–
17	27	4	–	–	–	–
18	28	2	–	–	–	–
19	31	7	–	–	–	–
20	10	6	–	–	1	–
21	0-9	–	–	–	3	–
22	0-11	2	–	–	–	–
23	0-27	–	–	–	1	–
24	0-28	–	–	–	1	–
25	10/3	1	–	–	–	–
26	3/18	3	–	3	–	–
27	Д-41	1	2	–	–	–
28	Д-62	1	–	–	1	–
29	Б-9	4	–	–	1	–
30	Б-40	6	–	–	–	–
31	Б-51Б	2	–	–	–	–
32	Б-53Б	3	–	–	–	–
33	Б-53М	4	–	–	–	–
34	Б-60	1	–	–	–	–
Altogether		91 ex.	15 ex.	6 ex.	10 ex.	1 ex.

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Table 2. Diplopoda species and number of specimens encountered in Pied flycatcher nests at Mayachino in 2021.

Табл. 2. Виды Diplopoda и количество экземпляров, отмеченные в гнездах мухоловки-пеструшки близ Маячино в 2021 г.

No. of nests containing Diplopoda	Nest no. in the field	<i>Ommatoiulus sabulosus</i>	<i>Leptoiulus proximus</i>	<i>Polydesmus denticulatus</i>
1	М-31	–	5	–
2	0-28	–	1	–
3	М-54	3	–	–
4	М-71	–	2	–
5	Л-10	1	–	1
6	П-10	3	–	–
7	М-10	1	–	–
8	М-51	1	2	1
9	Б53-М	2	–	–
10	М-3	1	–	–
11	А-7	–	1	–
12	М-61	–	1	–
13	М-58Н	–	2	–
14	Б-17	2	–	–
15	М-62	–	3	–
16	Б-37Б	3	–	1
17	Б-76	2	–	–
18	Б-41	4	–	–
19	М-12	2	1	–
20	М-36-А	3	–	–
21	Д-53	1	–	–
22	Б-77	3	–	–
23	Б-35-Б	4	–	–
24	М-36-Б	2	–	–
25	Б-42	2	–	–
26	М-58БР	2	–	–
27	М-8	2	–	–
28	1-VIII	4	–	–
29	М-14	3	–	–
30	Б-38,	3	–	–
31	М-48	3	–	–
32	Б-53Б	3	–	–
Altogether		61 ex.	22 ex.	3 ex.

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