

Helminths of tits *Cyanistes caeruleus* (L., 1758) and *Parus major* (L., 1758) (Passeriformes, Paridae) in northern Poland

Isabella Rząd^{1,2}, Anna Okulewicz³, Rusłan Sałamatin^{4,5},
Magdalena Szenejko^{1,2}, Remigiusz Panicz⁶, Jarosław Nowakowski⁷,
Agata Stapf-Skiba⁸, Przemysław Śmietana^{1,2}

¹ Department of Ecology and Environmental Protection, Institute for Research on Biodiversity, Faculty of Biology, University of Szczecin, Wąska 13, 71-415 Szczecin, Poland; ² Molecular Biology and Biotechnology Centre, University of Szczecin, Wąska 13, 71-415 Szczecin, Poland; ³ Department of Parasitology, Institute of Genetics and Microbiology, University of Wrocław, Przybyszewskiego 63/67, 51-148 Wrocław, Poland; ⁴ Department of General Biology and Parasitology, Medical University of Warsaw, Chałubińskiego 5, 02-004 Warsaw, Poland; ⁵ Department of Parasitology and Vector-Borne Diseases, National Institute of Public Health – National Institute of Hygiene, Chocimska 24, 00-791 Warsaw, Poland; ⁶ Department of Meat Sciences, West Pomeranian University of Technology, Kazimierza Królewicza 4, 71-550 Szczecin, Poland; ⁷ Bird Migration Research Station, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland; ⁸ University School of Physical Education in Poznań, Faculty of Physical Culture in Gorzów Wielkopolski, Department of Biology, Morphological and Health Sciences, Estkowskiego Str. 13, 66-400 Gorzów Wielkopolski, Poland

The Eurasian blue tit *Cyanistes caeruleus* (L., 1758) and the great tit *Parus major* (L., 1758) (Passeriformes, Paridae) are common birds in Europe whose helminths are little known in Poland. Tit populations in Poland are partially migratory, which means that some blue tits and great tits of the local population remain for the winter near their breeding grounds, while others migrate to wintering grounds. The great tits and Eurasian blue tits that migrate in the autumn over the Polish Baltic coast occupy similar breeding grounds. As the migration route passes through north-eastern Poland, Kaliningrad Oblast (Russia), western and central Lithuania, Latvia, Estonia, and the Leningrad Oblast, both species can play a significant role in the transmission of parasites between ecosystems on their migration route. Helminths occurring in juvenile birds undertaking autumn migration for the first time will represent the local fauna of parasites present on the host breeding grounds. In adult birds, infection may occur in both the breeding grounds and the wintering grounds, which in both species include north-western Poland, northern Germany, the Netherlands and Belgium, and for the great tit, north-eastern France as well. For this reason the parasite fauna of adult birds may be mixed.

In the years 2008–2012, during the autumn migration of *C. caeruleus* and *P. major*, helminths were obtained from 67 Eurasian blue tits and 166 great tits in northern Poland. During the analyses the tapeworm *Anonchotaena globata* (von Linstow, 1879) was found for the first time in Poland. In addition, the Eurasian blue tit was identified as a new host in Poland for *Monosertum parinum* (Dujardin, 1845), *Cardiofilaria pavlovskyi* Ström, 1937, and *Diplotriaeana henryi* Blanc,

1919, while the great tit was found to be a new host for *Urogonimus macrostomus* (Rudolphi, 1802), *Anonchotaena globata*, *Monosertum parinum* and *Diplotriaena obtusa* (Rudolphi, 1802). Genetic analysis was used to identify trematode species of the genera *Leucochloridium* and *Urogonimus* for which species identification based on morphological features was inconclusive. The genetic diversity of trematodes *L. paradoxum* Carus, 1835 was additionally shown to be characterized by more haplotypes and lower haplotype and nucleotide variation than *U. macrostomus*.

The structure of the component community and infracommunity of helminths, as defined by the Simpson, Berger-Parker and Brillouin indices, as well as the prevalence, intensity of infection and abundance of individual groups and species of helminths in the host population, showed little variation between parasites of Eurasian blue and great tit. Statistically significant differences between the Eurasian blue and great tit were found for the prevalence of infection with helminths, mainly by *L. paradoxum* (6.0% of Eurasian blue tits vs. 16.9% of great tits), and for abundance of helminths (6.0 vs. 11.3, respectively). The different feeding grounds of the species are crucial for understanding these differences. Both species share the same clear tendency of infection with nematodes *C. pavlovskyi*, which had the highest prevalence among all confirmed helminths (32.8% of Eurasian blue tits and 43.4% of great tits), with low intensity of infection (on average 2.1 in the Eurasian blue tits, in a range of 1–6, and 2.6 in the great tit, in a range of 1–9). There were no significant differences between the parameters of infection of females and males of either species of tit.