

Molecular identification of tapeworms in rodents and possible final hosts supports the resurrection of species *Mesocestoides melesi*

Anna Bajer^{1*}, Mohammed Alsarraf^{1*}, Dorota Dwużnik¹,
Ewa J. Mierzejewska¹, Marta Kołodziej-Sobocińska²,
Jolanta Behnke-Borowczyk³, Łukasz Banasiak⁴, Maciej Grzybek⁵,
Katarzyna Tołkacz¹, Natalia Kartawik³, Łukasz Stańczak⁶,
Patrycja Opalińska⁶, Małgorzata Krokowska-Paluszak⁶,
Grzegorz Górecki⁶, Mustafa Alsarraf¹, Jerzy M. Behnke⁷

¹ Department of Parasitology, Faculty of Biology, University of Warsaw, Warsaw, Poland; ² Mammal Research Institute, Polish Academy of Sciences, Stoczek 1c, 17-230 Białowieża; ³ Department of Molecular Phylogenetics and Evolution, Faculty of Biology, University of Warsaw, Warsaw, Poland; ⁴ Department of Forest Phytopathology, Faculty of Forestry, Poznań University of Life Sciences, Poznań, Poland; ⁵ Department of Game Management and Forest Protection, Faculty of Forestry, Poznań University of Life Sciences, Poznań, Poland; ⁶ Department of Tropical Parasitology, Medical University of Gdańsk, Powstania Styczniowego 9 B, 81-519 Gdynia, Poland; ⁷ School of Life Sciences, University of Nottingham, University Park, Nottingham, NG7 2RD, UK

* these authors contributed equally

INTRODUCTION. Rodents constitute an important part of the diet of many carnivore species. This predator–prey food chain is exploited by helminth parasites, such as cestodes, whose larval stages develop in rodents and then mature to the adult stage in predators. The role of rodents as obligatory intermediate or paratenic hosts of tapeworms exploiting this route of transmission is therefore indispensable in enabling the completion of their life cycles.

AIMS. The main aim of our study was to use molecular techniques for identification of, and comparison between, cestode species recovered from both intermediate and final hosts: sylvatic rodents, red foxes and other final hosts, with a particular focus on the genus *Mesocestoides*.

MATERIALS AND METHODS. Larval cestodes were obtained during our long-term studies on rodent helminth communities in Mazury Lake District in NE Poland in 2000-2018. Cestode larvae/cysts were collected from body cavities or internal organs (liver) during autopsy. Adult tapeworms were derived from nine red foxes, three badgers and one lynx. Parasites were primarily identified based on morphological features. PCR amplification, sequencing and phylogenetic analyses were conducted employing three genetic markers: 18S rDNA, mitochondrial (mt) 12S rDNA and mt cytochrome oxidase subunit I (COI) gene fragment.

RESULTS. Altogether 19 *Mesocestoides* samples were analyzed, including 13 samples of adult tapeworms from final hosts (9 foxes, 3 badgers, 1 lynx) and six larval samples from rodents (4 from bank voles, 2 from yellow-necked mice). Phylogenetic analyses revealed three well-supported trees of similar topology. In each case the *Mesocestoides* samples formed two separate

clades. The majority of sequences/samples including all isolates from foxes, lynx isolate and two isolates from rodents grouped with sequences known to be those of *Mesocestoides litteratus*. However, four isolates from rodents from Mazury Lake District and all three isolates from badgers from the same area created a separate clade, distant from all known species or genotypes available in the GenBank database, but most similar to North American *M. corti*/*M. vogae*. This clade may represent *Mesocestoides melesi*, the species first described in 1985 from the Eurasian badger *Meles meles*. Molecular analysis allowed the identification of *Taenia crassiceps*, *Hydatigera kamiyali* and *Cladotaenia globifera* among larvae derived from rodents.

CONCLUSIONS. Molecular and phylogenetic analyses support the resurrection of *M. melesi* as a valid species and our data represent the first record of the larvae of this species in rodents. To the best of our knowledge this is the first report on *H. kamiyali* occurrence in rodents from Poland.

ACKNOWLEDGEMENTS. The study was partially supported by National Science Centre (NCN) Sonata Bis grant no. 2014/14/E/NZ7/00153.