



INTEGRATIVE EVIDENCE CONFIRMS THE PRESENCE OF *AMOBIA PELOPEI* (DIPTERA: SARCOPHAGIDAE) IN SLOVAKIA

Adrián PURKART¹, Samuel KRČMÁRIK¹, Lucia GLAJŠEKOVÁ¹,
Anita IZÁKOVÁ², Vladimír JANSKÝ²

¹Comenius University Bratislava, Faculty of Natural Sciences, Department of Zoology, Mlynská dolina, Ilkovičova 6, 842 15 Bratislava, Slovakia; e-mail: purkart.adrian@gmail.com

² Slovak National Museum – Natural History Museum, Vajanského nábrežie 2, 814 36, Bratislava, Slovakia; e-mail: vladimir.jansky@snm.sk

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Abstract: The genus *Amobia* includes kleptoparasitic dipterans that develop in nests of various hymenopterans and currently includes 14 recognised taxa, four of which occur in the Palaearctic region. In Slovakia, only *A. oculata* and *A. signata* had previously been recorded. Examination of mud nests of *Sceliphron* wasps confirmed the presence of a third species, *A. pelopei*. Genetic material obtained from specimens collected at two different localities represents the first genetic data for this species. These were analysed together with published sequences, and the resulting phylogenetic tree clearly supported the distinct positions of the morphologically similar species.

Key words: kleptoparasite, *Sceliphron*, Miltogramminae, distribution, Central Europe

INTRODUCTION

Sarcophagidae, commonly known as flesh flies, comprise almost 3,000 described species worldwide (PAPE 1996, BARTÁK et al. 2019a). The family is currently divided into three subfamilies: Miltogramminae, Paramacronychiinae, and Sarcophaginae (PAPE 1996). Among them, the Miltogramminae (Diptera: Sarcophagidae) represent roughly one-fifth of global flesh fly diversity and are characterised by their predominantly parasitic lifestyle. In contrast to most flesh flies that develop in carrion, members of this subfamily are kleptoparasites of solitary wasps and bees, exploiting paralysed prey stored for the host larvae (BARTH 1908, MCCORQUODALE 1986, SPOFFORD et al. 1989, SPOFFORD & KURCZEWSKI 1990, POLIDORI et al. 2006). To date, the subfamily Miltogramminae comprises more than 40 genera and about 600 species distributed worldwide (JOHNSTON et al. 2024). Within the subfamily, the genus *Amobia* Robineau-Desvoidy, 1830 is notable for the host associations of its inquiline larvae, which primarily develop in the nests of solitary mud-daubing and potter wasps (Hymenoptera:

Sphecidae, Crabronidae; Vespidae: Eumeninae) (ITINO 1988, DOWNING 1996, COVILLE 2000, FATERYGA & KOVBLYUK 2014). The genus *Amobia* includes 14 recognised species, four of which are known from the Palaearctic Region, including *Amobia pelopei* (Rondani, 1859) – a species restricted to the western Palaearctic (VERVES & PROTSENKO 2019, JOHNSTON et al. 2020). The known distribution of *A. pelopei* includes Austria, Croatia, the Czech Republic, France, Germany, Hungary, Italy, Poland, Russia (European part), Switzerland, and Ukraine (KRČMAR et al. 2019, BARTÁK et al. 2019b).

According to the latest list of Sarcophagidae provided by VERVES & BARTÁK (2018), two species of this genus are known in Slovakia: *Amobia oculata* (Zetterstedt, 1844) and *Amobia signata* (Meigen, 1824). In this study, we present the first data on the occurrence of *Amobia pelopei* from Slovakia, gathered from the nests of mud-daubing wasps of the genus *Sceliphron*.

MATERIAL AND METHODS

The study material was obtained gradually by collecting nests of the mud-dauber wasps of the genus *Sceliphron*. These were brought to the laboratory and their contents examined. If suspicious fly pupae were found, they were transferred to simple plastic test tubes, where the hatched imagoes were preserved. The individuals were then freeze-killed and either deposited as pinned specimens or placed in 96 % ethanol. Digital photographs of flies were taken using a Canon EOS 5D Mark II camera attached to a Zeiss Axio Zoom V16 stereomicroscope. Image stacks were manually produced, combined in Zerene Stacker, and edited in Adobe Photoshop CC. The study material was determined using available identification keys and additional literary sources, mainly KURAHASHI (1974), PAPE (1987), POVOLNÝ & VERVES (1997), ŠIFNER et al. (2020), and BOGUSCH (2022). Voucher specimens are deposited at the Slovak National Museum – Natural History Museum in Bratislava.

The barcoding region of Cytochrome c oxidase subunit 1 (COI) mitochondrial gene was amplified using universal primers (FOLMER et al. 1994). Sequence was deposited in BOLD – The Barcode of Life Data Systems (RATNASINGHAM & HEBERT 2007) database under ID SKVAR001-25. Slovak sequences were combined into a dataset with available BOLD data on the genus *Amobia*. Bayesian Inference analysis was performed in MrBayes 3.2.7a (RONQUIST et al. 2012).

RESULTS AND DISCUSSION

SW Slovakia: Chorvátsky Grob, Čierna Voda (48.22386 N, 17.23579 E, 133 m a. s. l., DFS 7769) 10.5.2022, *Amobia pelopei*, two specimens, leg. V. Janský, det. V. Janský & A. Purkart; collected from a nest of *Sceliphron curvatum* (F. Smith, 1870).

W Slovakia: Tovarníky (48.57151 N, 18.14664 E, 186 m a. s. l., DFS 7474), 13.7.2022, *Amobia pelopei*, three specimens, leg. E. Sečanský, det. V. Janský & A. Purkart; collected from a nest of *Sceliphron curvatum*.

SW Slovakia: Bratislava-Staré Mesto (48.14071 N, 17.09773 E, 145 m a. s. l., DFS 7868), 27.7.2023, *Amobia pelopei*, five specimens (Fig. 1), leg. V. Janský, det. V. Janský, Z. Kejval & A. Purkart; collected from a nest of *Sceliphron caementarium* (Drury, 1773); sequence ID in BOLD database HMYZ363-24.

SW Slovakia: Chorvátsky Grob, Čierna Voda (48.22386 N, 17.23579 E, 133 m a. s. l., DFS 7769), 16.6.2023, *Amobia pelopei*, seven specimens, leg. V. Janský, det. V. Janský & A. Purkart; collected from a nest of *Sceliphron caementarium*.



Fig. 1. Dorsal view of *Amobia pelopei* from Slovakia (scale = one millimetre).

SW Slovakia: Bratislava-Rača (48.21699 N, 17.16584 E, 145 m a. s. l., DFS 7769), 12.8.2025, *Amobia pelopei*, one specimen, leg. A. Purkart, det. V. Janský & A. Purkart; collected from a nest of *Sceliphron caementarium*; sequence ID in BOLD database SKVAR001-25.

The fly samples were identified using available literature; additional genetic material was obtained from two samples. One of them had already been published in the BOLD database in 2024 under the code HMYZ363-24 – the sample in this record was re-examined and morphologically confirmed as *Amobia pelopei*.

Two sequences from Slovakia represent a single haplotype (100 % identity). They were assigned BIN (Barcode Index Number) BOLD:AGC3275. Sequences are the first molecular data for the species, and they seem to form a well-separated haplotype group, with a p-distance to the nearest neighbour haplotype group is 4.7 %. The nearest neighbour haplotype group is BOLD:ABV1181, consisting of Canadian samples identified only to the family level; based on its phylogenetic position among other *Amobia* spp., we presume it corresponds to some species of the genus *Amobia*.

COI sequences alone do not allow for reliable interpretation of the phylogenetic position of *A. pelopei*. Its grouping in the presented tree is not statistically supported (Fig. 2), and the sequences exhibit affinity to both Canadian *Amobia* sp. and Australian samples of *Amobia auriceps* (Baranov, 1935) and *Amobia serpenta* Johnston, Wallman, Dowton, Szpila & Pape, 2020.

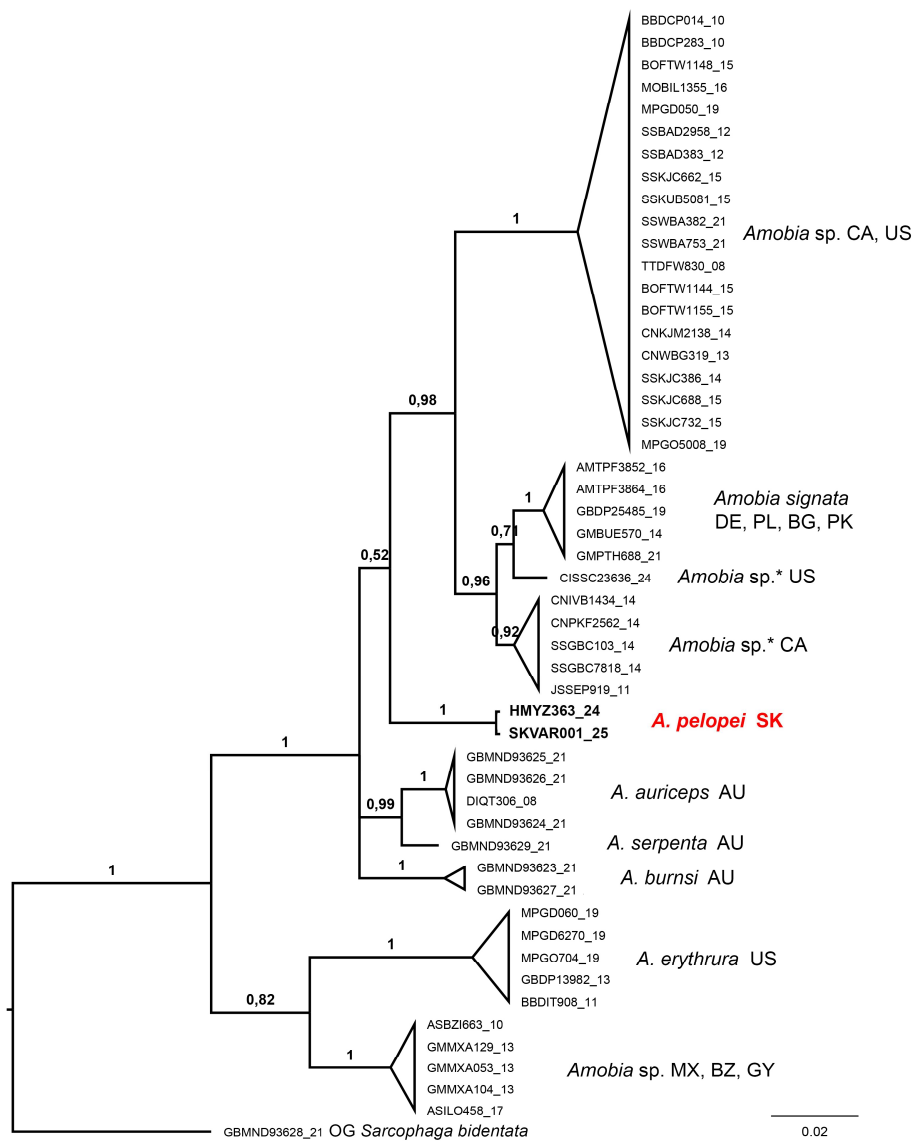


Fig. 2. Phylogenetic tree of *Amobia* based on COI 5P sequences. Values above branches – posterior probability. * – sequences only labeled to family / subfamily level (Sarcophagidae/Miltogramminae), assumed *Amobia* spp.

In the past, some authors considered *A. auriceps*, originally described from Sri Lanka, a synonym of *A. pelopei* (KURAHASHI 1974). JOHNSTON et al. (2020) refuted their conspecificity, and apart from revising morphological differences, provided barcode references for Australian species, stating that the validity of these two species can be further confirmed once sequences of *A. pelopei* are available. We provide the first molecular data on *A. pelopei* and support the conclusions of JOHNSTON et al. (2020), the two species are well separated with a p-distance over 5 % (Fig. 2). In agreement with the phylogeny of JOHNSTON et al. (2020), *A. auriceps* is supported as the sister species of *A. serpenta*.

In addition to morphological and genetic differences, species of *Amobia* living in Slovakia also differ in their bionomics. *Amobia oculata* has the broadest host range and, as a generalist, is typically found throughout the Holarctic-Oriental region. It lives as a kleptoparasite in nests of *Sceliphron* spp., *Trypoxylon figulus* (Linnaeus, 1758), or *Symmorphus bifasciatus* (Linnaeus, 1761) (VERVES & PROTSENKO, 2019, 2021, VERVES et al. 2018). In contrast, the Palaearctic species *Amobia signata* parasitizes the nests of potter wasps of the species *S. bifasciatus*, *Discoelius zonalis* (Panzer, 1801), and even the crabronids of the genus *Trypoxylon* Latreille, 1796 (VERVES & PROTSENKO 2021, VICENS et al. 2022). In the case of *Amobia pelopei*, the list of host species is more complex. According to recent literature, it can be classified among the species that most significantly specialize in parasitizing the nests of the genus *Sceliphron*, and rarely occurs in other host species (MEIKLEJOHN et al. 2013, FATERYGA & KOVBLYUK 2014). Similarly, some sources also mention several Asian species as hosts, which are likely misidentifications of *Amobia* (KURAHASHI 1974, DANG & NGUYEN 2019, JOHNSTON et al. 2020).

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SÚHRN

Do rodu *Amobia* zaraďujeme kleptoparazitické dvojkrídlovce vyvíjajúce sa v hniezdach rôznych druhov blanokrídlovcov. V súčasnosti pozostáva zo 14 druhov, z ktorých štyri sa vyskytujú v palearktiskej oblasti. Na území Slovenska boli dosiaľ rozoznávané dva druhy: *Amobia oculata* a *A. signata*. Postupným zberom a následným skúmaním obsahu hlinených hniezd kutaviek rodu *Sceliphron* bol získaný študijný materiál, z ktorého bol potvrdený výskyt tretieho zástupcu rodu *Amobia* – *A. pelopei*. Okrem územia Slovenska je výskyt tohto druhu známy aj z okolitých štátov. Z dvoch jedincov pochádzajúcich z rôznych lokalít bol získaný aj genetický materiál, na základe ktorého bol vytvorený fylogenetický strom z dosiaľ publikovaných sekvencií rodu *Amobia*. Ten potvrdil odlišnú pozíciu dvoch morfológicky veľmi podobných druhov *A. pelopei* a *A. auriceps*.