

Distribution of *Eukoenenia spelaea* (Peyerimhoff, 1902) (Arachnida, Palpigradida) in the Western Carpathians with remarks on its biology and behaviour

LUBOMÍR KOVÁČ, ANDREJ MOCK, PETER LUPTÁČIK & JOSÉ G. PALACIOS-VARGAS

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Presently the only palpigrade recorded from the Western Carpathians is *Eukoenenia spelaea* (Peyerimhoff, 1902). This species was originally detected in caves of the Hungarian part of the Slovak-Aggtelek Karst. Later, cave palpigrades were recorded in the same mountain range in Slovakia. Our new data expands the distribution of *E. spelaea* to cover the central parts of the Western Carpathians. A surprising discovery of these peculiar arachnids was from Demänovská Cave system (Low Tatras) and Važecká Cave (Kozie Chrbty Mts.), both situated at the latitude of roughly 49° N. These represent the northernmost known localities of palpigrades. The discovery of these animals in the Demänovská Cave system confirms the hypothesis that Pleistocene mountain glaciations in Central Europe did not completely extinguish the local subterranean fauna.

The dense population of *E. spelaea* in the Ardovská Cave (Slovak Aggtelek Karst) is very promising for collecting, permitting laboratory observations and culturing. Preliminary investigations suggest that animals may survive in laboratory conditions for a long time. Feeding has not been observed. Strong sensitivity of palpigrades to excess of heat is well documented.

Keywords: Zoogeography, biospeleology, Palpigradida, behaviour, Western Carpathians.

Lubomír Kováč, Department of Zoology, Institute of Biology and Ecology, Faculty of Sciences, University of P.J.Šafárik, Moyzesova 16, SK-041 54 Košice and Institute of Zoology, Slovak Academy of Sciences, Löfflerova 10, SK-040 01 Košice, Slovakia. E-mail: kovaclu@science.upjs.sk

Andrej Mock, Peter Luptáčík, Department of Zoology and Ecology, Faculty of Sciences, University of P.J.Šafárik, Moyzesova 11, SK-041 57 Košice, Slovakia.

José G. Palacios-Vargas, Laboratorio de Ecología y Sistemática de Microartrópodos, Departamento de Biología, Facultad de Ciencias, UNAM, 04510 México D. F., Mexico.

Introduction

Palpigrades are minute, blind, enigmatic arachnids with numerous ancestral character states, e.g. three-segmented chelicerae, segmented prosoma, leg-like pedipalps, antenniform first legs and a multisegmented flagellum. The phylogenetic position of this

group within Arachnida is still unsettled. They live primarily in tropical soils and in Europe inhabit only subterranean environments (Condé, 1996).

Eukoenenia spelaea (Peyerimhoff, 1902) (Fig. 1 - 3) is a palpigrade species documented from the Alps, Western Carpathians and Dinaric mountains. Because of unclear

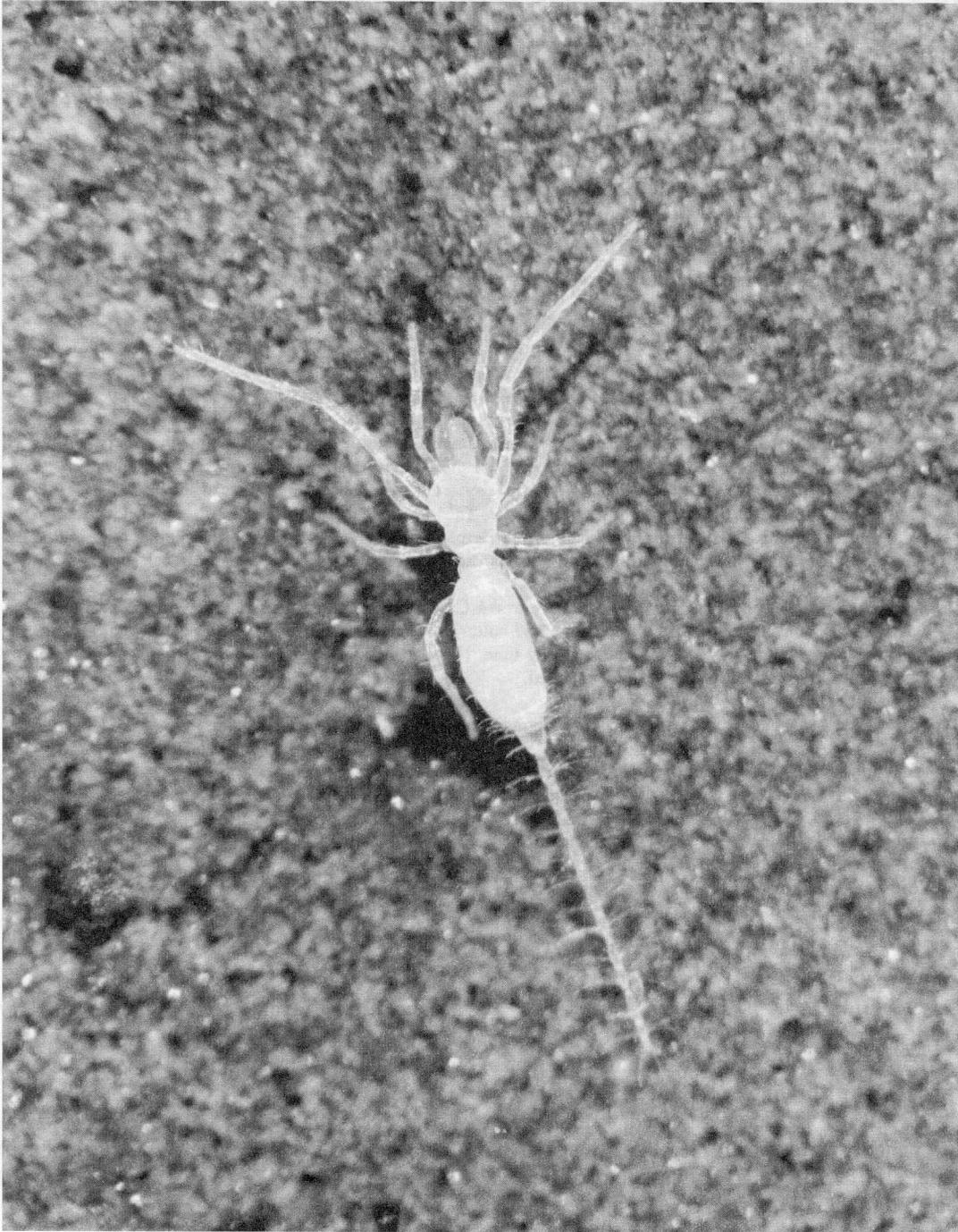


Fig. 1. Habitus of *Eukoenia spelaea* (Peyerimhoff, 1902) from the Ardovská Cave. Body size without appendages 1.5 mm. G. Csizsmárová and L. Kováč phot. (magnification 27 x).

subspecies taxonomy we use the term „*E. spelaea* complex“. This is the only palpi grade recorded in the Western Carpathians to date. The species was firstly detected in three caves in the Hungarian part of the Slovak-Aggtelek Karst (Szalay, 1956; Loksa, 1961; Bajomi, 1969; Dózsa-Farkas and Loksa, 1970). Later, and not surprisingly, cave palpi grades were recorded in Slovakia within the same mountain range (Kováč, 1999).

Distribution

Our new records expand the range of *E. spelaea* to include the central parts of the Western Carpathians (Fig. 4). Surprisingly, we found palpi grades in the Demänovská Valley (Low Tatras) which was in close contact with mountain glaciers during the Pleistocene. Demänovská Slobody Cave and Važecká Cave are the northernmost known localities of the entire order Palpi grade. Within the Western Carpathians palpi grades have been detected from following mountain regions (1-4) all from underground localities (* - unpublished records, S - Slovakia, H - Hungary):

(1) Low Tatras

* Demänovská Slobody Cave, section „Zázračné siene - Čarovná chodba“, 1 female on the surface of a water pool, 11.5.2000, leg. I. Hudec; „Mramorové riečište“, 1 juvenile on rotten wood, 11.5.2000, leg. P. Luptáčik (both in coll. L. Kováč)

(2) Kozie Chrbty Mts.

* Važecká Cave, „Jazierková sieň“, 1 female on the surface of a water pool, 17.5.2001, leg. P. Luptáčik (in coll. L. Kováč)

(3) Čierna Hora Mts.

* Priepasťová Cave in the Humenec Mt., middle part of the cave (approximately 15 m from the entrance), 1 male under leather glove, 23.6.2000, leg. A. Mock (in coll. L. Kováč)

(4) Slovak-Aggtelek Karst

Ardovská Cave (S)

-“Vstupná chodba“, 1 male, 4 females, 1 juvenile and 7 individuals (sex not determined yet), extracted from bottom sediment, 23.4., 13.6., 4.9., 30.10.1997, 5.3., 8.7.1998 and 11.5.1999, leg. L. Kováč (in coll. B. Condé, Nancy and O. Kraus, Hamburg)

- section „Vstupná chodba - Hlavná chodba“, 19 males, 17 females, 5 juveniles and 2 damaged individuals, collected by visual searching on rotten wood, under stones and on the surface of water pools, 11.5., 1.7., 4.10.1999, 8.9., 1.11.2000 and 8.3.2001, leg. J. G. Palacios-Vargas, A. Mock, L. Kováč and P. Luptáčik (in coll. L. Kováč and J. Král, Prague)

Domica-Baradla Cave System (S-H)

- 2 ex., 1968, leg. K. Dózsa-Farkas (Dózsa-Farkas and Loksa, 1970)

- section „Kvetnica - Kaňon“, 1 male and 1 female, on rotten wood, 3.10.2001, leg. P. Luptáčik and A. Mock

Szabadság Cave (H)

- 170-190 m from the entrance, 1 male and 1 female collected from clay sediment on the bank of an underground stream, 23.10.1955, leg. J. Vágvölgyi (Szalay, 1956)

- 25-300 m from the entrance, 9 individuals, Barber traps with ethylenglycol, 3.9.1958 - 12.3.1959, leg. I. Loksa (Loksa, 1961)

* Magas Tetői Barlang (H)

- 60 m from the entrance, 1 male, 6.3.2001, leg. R. Mlejnek (in coll. L. Kováč)

Meteor Cave (H)

-3 ex., Barber traps with ethyleneglycol, leg. D. Bajomi (Bajomi 1969)

* Jasovská jaskyňa (S)

- „Blatistý dóm“, 1 juvenile on rotten wood, 24.11.2000, leg. A. Mock (in coll. L. Kováč)

Central European records of palpi grades are very scattered. The occurrence of *E. spelaea* at numerous underground sites of the Western Carpathians suggests that it may occur over much of this region. In contrast, palpi grades are not found in the subterranean



Fig. 2. Habitus of *Eukoenenia spelaea* (Peyerimhoff, 1902) from the Ardovská Cave. G. Csizsmárová and L. Kováč phot. (magnification 50 x).

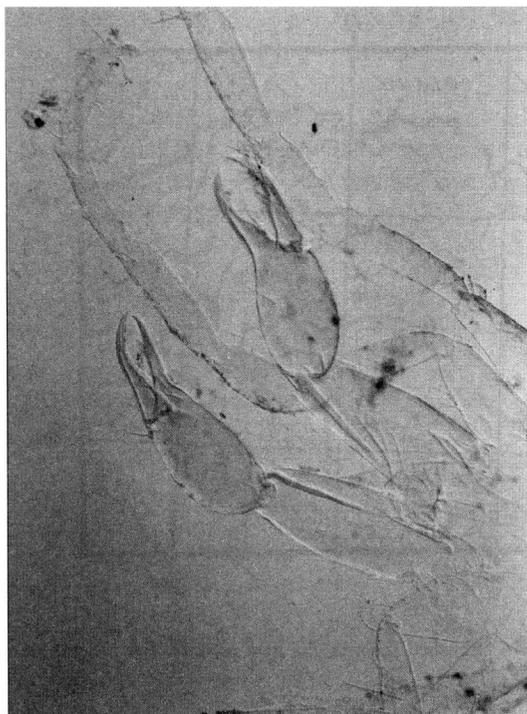


Fig. 3. Detail of chelicerae and pedipalps of *E. spelaea*. G. Csizsmárová and L. Kováč phot. (magnification 800 x).

ecosystems of northern mountain ranges, e.g. Tatra Mts. and Pieniny, as recent explorations of the cave fauna suggest (Kováč and Mock, 1999; and unpublished data).

The surprising detection of a juvenile of the *E. spelaea - austriaca* complex in Pleistocene Danube gravel accumulations right in the Vienna City center (Christian, 1998), sheds new light to the geographical distribution of palpigrades. Thus, palpigrade populations inhabiting subterranean habitats of different karstic areas are probably not truly isolated, but probably communicate via the „Milieu Souterrain Superficiel“. It is still unclear, if the populations have survived „in situ“ as Tertiary relicts, or have slowly dispersed through new areas during suitable climatic periods and retreating to hypogean habitats when

conditions are harsher. Further biospeleological observations in different underground habitats and microhabitats and the use of additional collecting techniques are necessary to resolve this question.

Notes on the biology and behaviour

We lack any knowledge of the food, reproduction and behaviour of Palpigradida. It is rather difficult to collect them without damage and keep them alive for long (Condé, 1996). However, the abundant population of *E. spelaea* in the Ardovská Cave (Slovak - Aggtelek Karst) should allow further ecological and biological observations. The fact that several specimens from our sampling in March 2001 survived four weeks under laboratory conditions, one of them even over three months is promising. Palpigrades were kept in a refrigerator, in a plastic box with moistened plaster of Paris charcoal bottom. Crumbs of rendzina soil were carefully added to create shelter for palpigrades. Unfortunately even though possible food, several nematodes extracted from garden soil (Baermann funnel), numerous juveniles of the collembolan *Folsomia candida* (Willem, 1902) and the oribatid mite *Scheloribates pallidulus* (C.L. Koch, 1841) were offered no feeding was observed.

We did observe that both in their natural habitat and in the laboratory they move quickly with the flagellum kept in horizontal position. During short stops they lift the flagellum vertically, and occasionally also turn body around. The first pair of legs is often raised just as in Schizomida, Uropygi or Protura. They exhibit very frequently preening of limbs, a common behaviour in all Arachnida (Savory, 1977). During this action, they pass the long fore legs through robust pincers, the two terminal segments of the chelicerae. Cleaning of the antenniform legs is important because of the trichobothrial on these limbs.

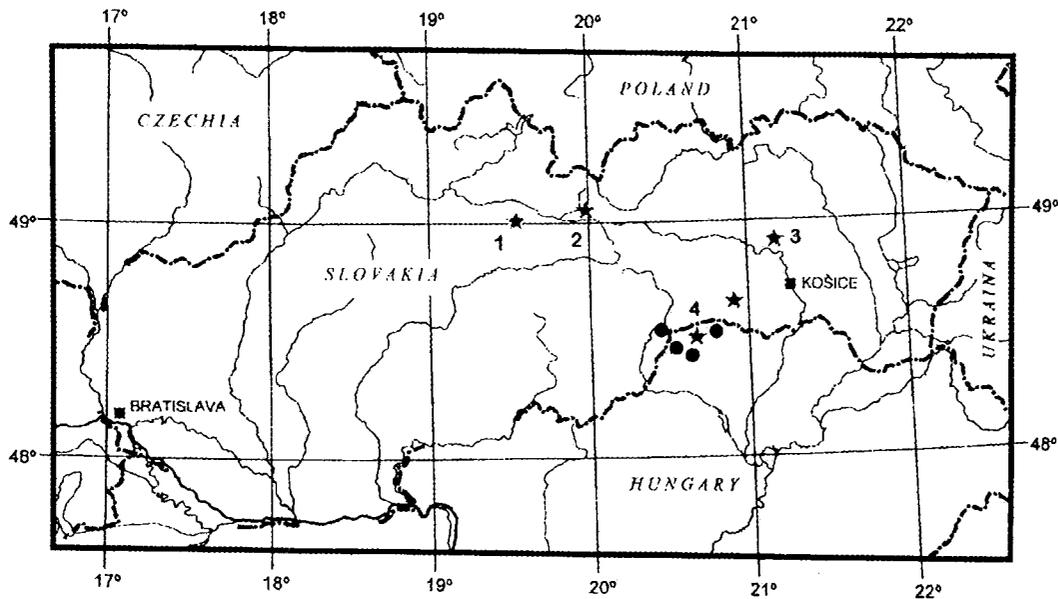


Fig. 4. Records of *E. spelaea* in the Western Carpathians, ● - published records, * - new records. For orographic regions (1-4) see text.

Ar dovská Cave has stable physical conditions with a temperature of $+10.8^{\circ}\text{C}$ and approximately 97% relative humidity (Droppa, 1961). The cave habitat offers marked stenohygryc and stenothermic conditions. Palpigrades are extremely sensitive to heat. When approaching the hand of the collector, they immediately turn back to escape from the source. When an animal is forced to drop in the palm of the collector's hand, it begins to twist and jump as if in pain. Cleaning of fore legs is repeated more frequently, when the palpigrade is exposed for a short time to room temperature or to the halogen lamp of the dissecting microscope. A similar habit is well-known in harvestmen, when exposed to temperatures above their optimum (Savory, 1977).

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