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Leptotyphlus kovaci sp. n. (Coleoptera, Staphylinidae), a relic endogean rove beetle from Slovakia

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Sp. n. *Leptotyphlus kovaci* from Slovenský kras carst in East Slovakia is described on the base of the females found in front of the Ardovská jaskyňa cave. This species is endogeous and represents obviously a tertiary relict. It provides additional evidence that Slovenský kras was a refugial area during the glaciations. This is the first record of a member of *Leptotyphlus* from Central Europe.

Key words: Coleoptera, Staphylinidae, Leptotyphlinae, taxonomy, zoogeography, Slovenský kras carst, tertiary relic.

Introduction

Most members of Leptotyphlinae are distributed in the Mediterranean region, some occur in SE Africa, N and S America and Japan. Leptotyphlinae have usually very restricted distribution ranges (COIFFAIT, 1972; PACE, 1996). Only the parthenogenetic *Gynotyphlus perpusillus* Dodero, 1900 is widely distributed and occurs in southern parts of C Europe: Lower Austria (SCHEERTELTZ, 1959), Balaton Lake (COIFFAIT, 1972) and South Slovakia (RUSEK, 1996).

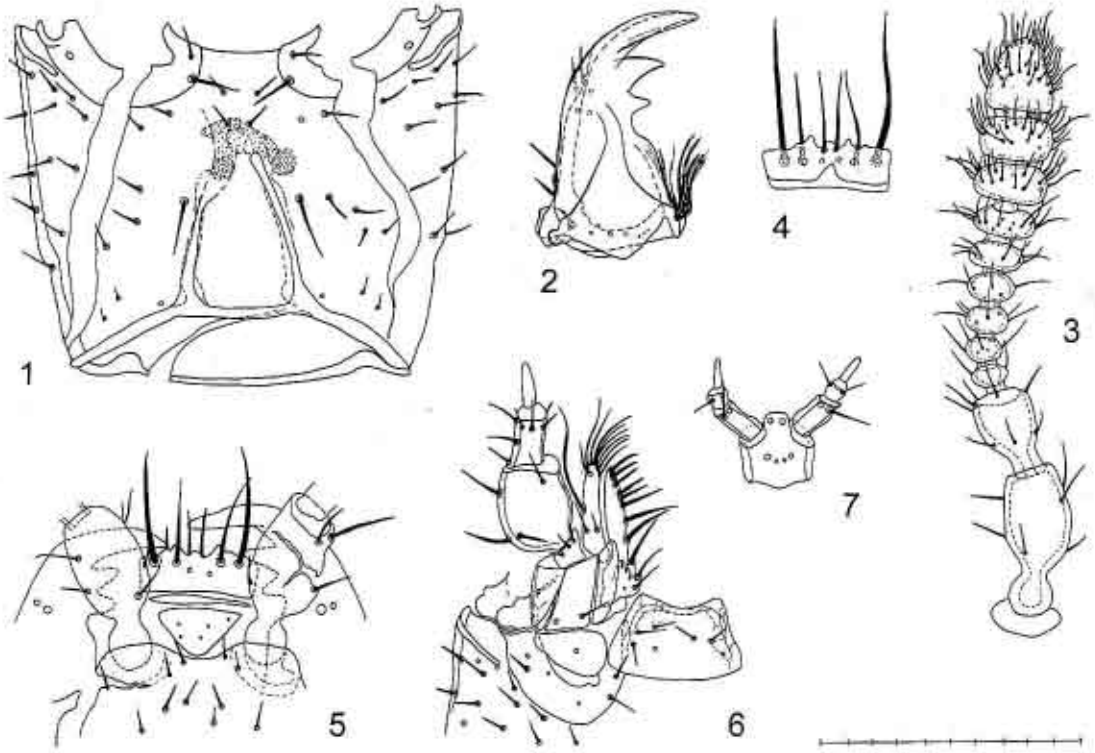
Two leptotyphlins were found on 13 June, 1997 in soil samples taken for Collembola (Ľ. Kováč leg.) in an oak-horn beam forest close to the Ardovská jaskyňa cave in Slovenský kras, E Slovakia. They possess features of *Leptotyphlus* whose representatives occur in central and western parts of the Mediterranean area (Pyrénées, Maritime Alps, Apennine peninsula, Sardinia, Corsica, Elba, Istria, North Tunisia), but cannot be assigned with any known species. The aim of this paper is to describe this new species and to show the significance of its finding from the biogeographic point of view.

Leptotyphlus (s. str.) *kovaci* sp. n.

Description. Body length: 1.39–1.42 mm, body width 0.17–0.18 mm (two specimens measured). Body shape as of other congeners.

Head capsule (Figs 1, 5): rhomboid, moderately enlarging forwards, in basal third slightly neck-like narrowed. Two convergent dark gular sutures reaching approximately up to the second third of head length. Complex tentorium visible behind them. Antennae inserted above mandibles on strong antennal protuberances. Chaetotaxy irregular, two larger setae situated at mid-length on ventral side and at inner margin on mandible insertion. Two rather small setae situated ventrally in an oblique line at both hind angles.

Mandibles (Fig. 2): external margin almost straight in basal part, curved from middle part up to apex. Two setae situated on dorsal side near



Figs 1–7. *Leptotyphlus kovaci* sp. n.: 1 – head capsule ventrally; 2 – right mandible ventrally; 3 – right antenna; 4 – labrum ventrally; 5 – head fore part with antennae basis, clypeus and labrum; 6 – mentum and right maxilla with palpus; 7 – labium with labial palpi. Scale 0.1/0.01 mm.

basis and three setae in middle outer margin. Two large pores situated in a transversal line, approximately at level of premolar tooth (Fig. 5). Inner margin with three teeth, retinaculum larger than premolar tooth, between basal part and premolar tooth a wide rhomboid incision. Basal part of internal margin straight. Mandibular penicilium rich, inserted at basis and attending to margin of rhomboid incision. Ventral side of mandible strongly thickened forming a triangular plane with anterior tip, reaching incision between retinaculum and premolar tooth and turning to outer margin. The outer corner thickened basal part of mandible forming a third ball joint. Lacinia apparently absent (possibly in both specimens broken or not distinguishable).

Antennae (Fig. 3) 0.29 mm long, 11-segmented. Scape and pedicel large and thick, scape twice as long as pedicel, segments 3–7 much narrower, but becoming gradually thicker, almost fluently passing to segments 8–11, forming a distinctive oval club. Proximal part of last segment club-shaped. Scape and pedicel with two rings of 3–4 setae. Segments 3–8 with one setal ring, number of setae increasing from segment 3 to 6 proportionally to increased segmental width. Second setal ring indicated in segment 8. Segments 9–10 with two setal rings. Segment 11 with wide strip of setae in its middle and dense group of setae at apex.

Labrum (Figs 4, 5): wide, almost rectangular, with 5 teeth on anterior margin. Central tooth situated in middle of deep, approximately semicircular incision between two large teeth, and about half as long as these teeth. Additionally two small teeth situated on outer side. Four large setae inserted at anterior margin of labral dorsal side, lateral ones about one third longer and stronger, then central setae. One small asymmetrical seta inserted posterior right small lateral tooth in one of examined females. One small seta inserted at lateral margins, one shifted slightly to left anterior corner, right one situated just posterior centre of lateral side. Two medium sized setae inserted on ventral side. Two pores situated slightly asymmetrically on centre of labrum. Labral basal mar-

gin strongly thickened ventrally with asymmetrical tooth-like process in the middle.

Mentum (Fig. 6): wide rhomboid, lateral sides converging anteriorly, angles rounded, apical margin concave. Transversal row of 7 irregularly situated setae in mid-length. Lateral and fore margin thickened, with irregular meshes.

Maxillae (Fig. 6): cardo wide, triangular, with rounded angles, one seta in middle. Stipes twice as long as wide, elongate rhomboid, with two setae at basal angles (one broken). Palpifer approximately twice as long as wide at apex, with one seta at mid-length of outer margin. Lacinia finger-shaped, with row of 9–10 strong spines at inner side, decreasing in length towards apex. Three very short setae situated obliquely at strongly increased basal part. Galea rifle-stock-shaped, apical margin obliquely truncated and bearing 8–9 setae. Long strong seta at external margin at mid-length and two short setae in basal third.

Maxillar palpi (Fig 6): four-segmented. Segment 1 small, irregularly cylindrical, outer side shorter than internal. Segment 2 large, strongly thickened, asymmetrical, outer side semi-globular, inner side almost straight or slightly convex. Two large setae inserted on basal third of outer side, three setae situated along apical margin (one broken), approximately in middle third. Segment 3 cylindrical, about twice as long as wide, inserted asymmetrically at outer side of segment 2. One seta situated at outer side at basis, one at middle, and setal ring at apical margin. Segment 4 needle-like, slightly conical, with rounded apex, without setae.

Labium and labial palpi (Fig. 7): labium wide, ventral anterior margin with large quadratic process rounded at angles and bearing two pores at apical margin. Two small pores situated at labial centre, two large pores situated at sides and shifted slightly anteriorly. Segment 1 of labial palpi cylindrical, twice as long as wide, with somewhat irregularly shaped sides. Two large setae inserted ventrally at apex. Segment 2 narrower, slightly wider than long, with two setae at apex. Segment 3 narrow, slightly conical, with rounded apex.

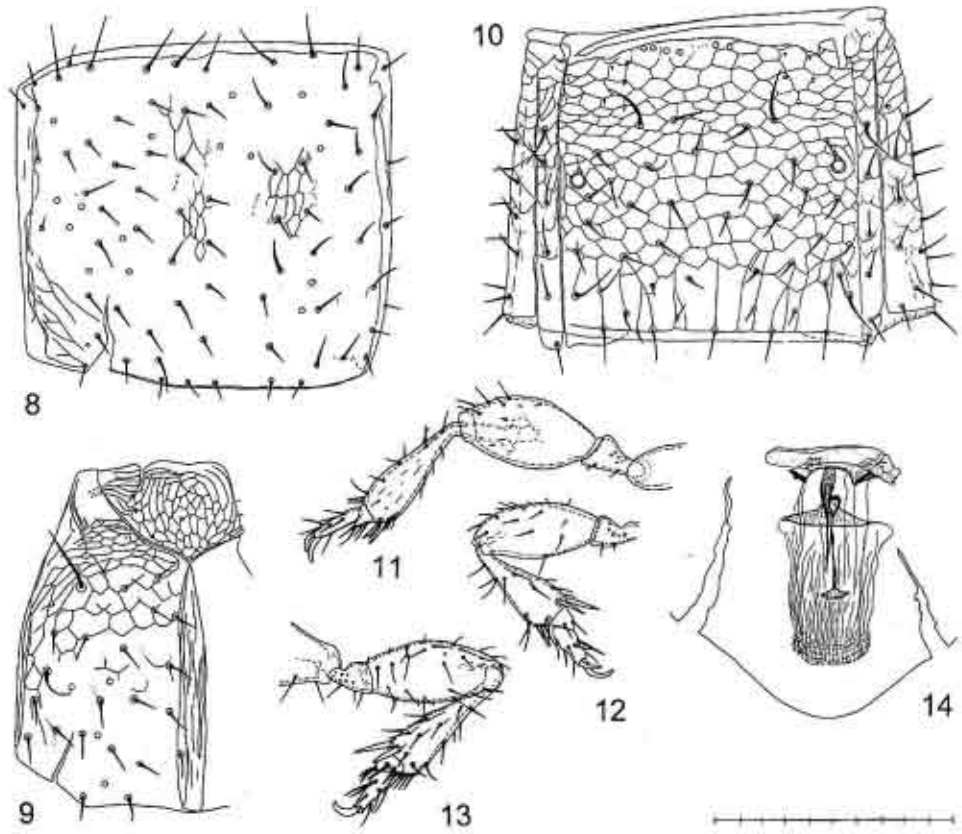
Pronotum (Fig. 8): slightly wider than long, with rounded angles. Disc flat with two shallow admesal impressions marked by microsculpture consisting of very fine longitudinal meshes. Chaetotaxy mostly irregular, row of long setae along anterior margin. Microsculpture absent from disc except for very fine irregular meshes visible only in the right posterior angle, and in admesal impressions.

Scutellum (Fig. 9): wide, only slightly narrower than pronotum, subtriangular, sides convex in basal three quarters, slightly concave near moderately acute apex. Surface with irregular meshes becoming elongately rounded laterally. Three minute pores with almost invisible short setae at lateral sides of scutellum in both specimens. One larger pore situated near scutellar centre in one specimen.

Elytra (Fig. 9): each elytron about 1.5 times as long as wide at apex. Basal margin very narrow, humeral part lays below plan of most elytron surface. Outer margin in basal half oblique, in apical half parallel sided. Apical margin obliquely truncate in external two fifths, slightly concave in internal three fifths. Outer hind angles rounded. Setae approximately equidistant forming irregular, slightly oblique, transverse rows. One much larger seta situated in apical third near outer margin. Elytral surface smooth in humeral part. Sloping posthumeral part with strong microsculpture consisting of mostly transverse meshes forming rounded belt, running from lateral margin towards sutural basis. Mesh becoming pentagonal or hexagonal with rounded apical angles. Microsculpture evanescent approximately at mid-length, absent from apical third.

Abdominal segments 1–5 (Fig. 10) transverse, (L/W 0.78–0.85), slightly enlarged posteriorly. Tergites bordered by raised lateral margins. Tergal surface with microsculpture predominantly hexagonal, slightly transversal in anterior third, almost isodiametric in middle, and mostly longitudinal in posterior third. Transverse row of four large setae at anterior margins, numerous smaller setae scattered irregularly over entire surface. Six small pores situated at centre of basis. Two large stigmata situated in mid-length near lateral sides.

Abdominal segments 6–7 (genital segments sensu PACE 1996) (Figs 15, 16) much wider than segments 1–5 (0.19 mm), elongate elipsoid (L/W 1.15). Apical margin of tergite 6 transversally truncate, slightly convex. Lateral margins of tergite 6 with distinctly longitudinal microsculpture. Central part of tergite 6 with hexagonal microsculpture, meshes isodiametric at basis and on sides, elongate in middle, becoming inconspicuous in apical third. Four pores situated at centre of basis and two large stigmata in basal third, at lateral sides. Chaetotaxy consisting of a transversal row of four strong bristles situated in basal quarter, two strong marginal bristles in apical third, two pairs of very strong curved bristles in apical angles and small setae scattered approximately equidistantly over the entire surface. Intervals between setae increasing in apical third. Sternite 6 ellipsoid

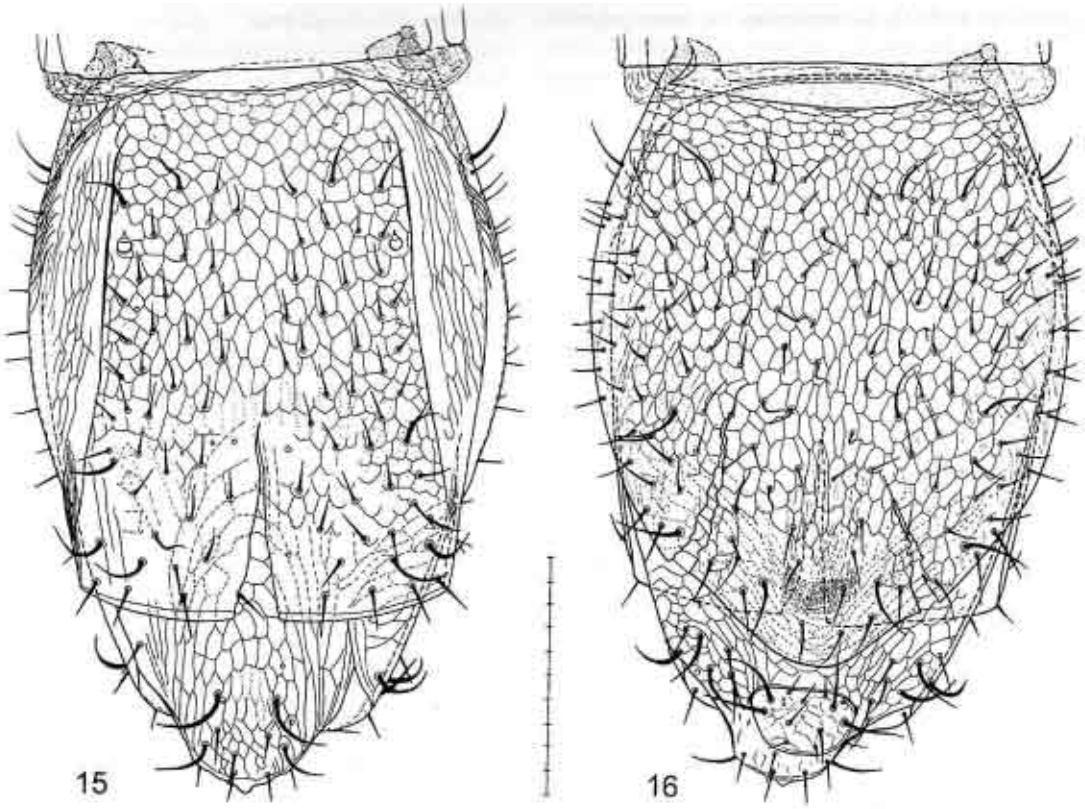


Figs 8–14. *Leptotyphlus kovaci* sp. n.: 8 – pronotum; 9 – scutellum and left elytron; 10 – abdominal segment 4 dorsally; 11 – fore leg; 12 – middle leg; 13 – hind leg; 14 – female genitalia with posterior margin of abdominal segment 6 in dorsal view. Scale 0.1/0.01 mm.

(L/W 1.26), lateral sides before apex slightly concave. Microsculpture hexagonal, almost isodiametric at basis and along lateral margins, longitudinal in middle, elongate in apical quarter. Chaetotaxy consisting of four strong bristles forming transverse row near basis and two pairs of strong bristles situated in apical half near lateral margins. Other setae dense, scattered about equidistantly scattered over entire surface.

Segment 7 almost entirely inside segment 6, with narrow exposed apical part (0.08 mm at apical margins of tergite 6, ca. 0.04 mm at apex), with microsculpture strongly longitudinal on sides, elongate hexagonal meshes in middle. Two pairs of strong, curved bristles situated before apex. Five small setae inserted between bristles. Lateral parts of sternite 7 with strong, distinct bristles near apical angles. Apex of tergite 7 runs in a small semicircular process. Sternite 7 much wider than tergite 7 (0.12–0.13 m). Microsculpture elongate hexagonal, longer axis of meshes runs mostly parallel to margins. Two pairs of strong curved bristles situated near apical angles. Genital plate transversal, narrowed posteriorly, with widely rounded angles. Two pairs of strong bristles inserted in basal angles, two slightly irregular, longitudinal rows of three small setae in middle.

Fore legs (Fig. 11): trochanters triangular, twice as long as wide, narrowed near basis, dilated to apical margin, with rounded anterior angles, six pores on middle concave part and two setae on ventral side. Femora almost ellipsoid, (L/W 2.00), with five setae in dorsal apical part and four small setae in anterior third. Middle of inner lateral side with inconspicuous, irregular, approximately hexagonal meshes. Tibiae as long as femora, moderately enlarged club-like at apex (0.018 mm wide). Row of four small setae in basal half of ventral edge. Comb of three spines situated on dorsal side of apex. Two large terminal thorns



Figs 15, 16. *Leptotyphlus kovaci* sp. n.: 15 – abdominal segments 6 and 7 dorsally; 16 – abdominal segments 6 and 7 ventrally. Scale 0.1/0.01 mm.

inserted ventrally at apex. One or 2 medium sized setae situated at dorsal edge, two terminal spines at apex. Segment 1 short, triangular, with rounded angles, 4 ventro-apical setae. Segment 2 twice as long as ventral side of segment 1, with three dorsal setae and two lateral setae. Claws about half as long as segment 2.

Middle legs (Fig. 12): trochanters twice as long as wide, narrowed near basis, with 5 pores on dorsal and lateral sides and two small ventral setae. Femora elongately ovoid, narrower than profemora (L/W 2.33), with two longitudinal rows of three and two setae in mid-length of lateral sides, one seta on mid-length of posterior margin, group of ten setae at apical half of anterior margin. Tibiae notably enlarged at apex (width 0.028 mm), with two large terminal thorns inserted ventrally at apex, comb of three long spines at outer apical edge, one dorso-basal seta, a ring of four setae in basal third, two pairs of ventro-apical setae, two dorso-apical setae, and one seta in small apical incision on inner side. Tarsal segment 1 short, triangular, with two apical setae, one dorso-basal seta, a ring of five setae in mid-length and one seta dorso-apical and ventro-apical seta. Segment 2 thicker and shorter than that of pro- and metatarsi, twice as long as ventral side of segment 1, with one dorso-basal seta, a ring of five setae in mid-length and one dorso-apical and ventro-apical seta. External claw longer than internal, almost as long as segment 2.

Hind legs (Fig. 13): trochanters twice as long as wide, narrowed near basis, with 7 pores on ventral and lateral sides, and three small ventral setae. Femora elongately ovoid (L/W 2.11), as wide as mesofemora. Small setae in two longitudinal rows at dorsal and ventral margins more or less evenly distributed along entire length. Tibia moderately enlarged at apex (width 0.019 mm), with two large terminal thorns inserted ventrally at apex end and a comb of five strong spines inserted dorsally. Two transversal rows of three ventro-apical setae. Series of five setae situated more or less equidistantly along dorsal margin. Tarsal segment 1 short, tri-

angular, with three ventro-apical setae, segment 2 twice as long as ventral side of segment 1, with three dorsal setae, one lateral seta and two ventral setae.

Genitalia (Fig. 14, dorsal view): sternite 6 with two large transverse, complex sclerites situated in middle near apical margin. Basal segment asymmetrical with short, irregular process left of middle, irregularly enlarged at right side. Below, a long, dark, irregular sclerotised spicule runs axially backwards. Apical sclerite triangular, obtuse angled, situated under this spicule, approximately at its mid-length. Its obtuse angle oriented towards base. Above it, a needle-like sclerite with bulb-headed basis and flat axe-like apex runs axially backwards, parallel to the irregular spicule. Wide longitudinally frilled cylindrical membranous bag running from both transversal sclerites backwards. Four transverse frills along apical margin.

Male unknown. In spite of a very enhanced collecting effort in the type locality in growing seasons of 1998 and 1999 no other specimens of *L. kovaci* sp. n. had been caught.

Material examined

Types:

L. kovaci sp. n.: **holotype** 1 female, **paratype** 1 female, from E Slovakia, at entrance of the Ardovská jaskyňa cave (48°31′ N, 20°25′ E, altitude 317 m, moderate southwestern slope, soil type rendzina, humus type mul, substrate lime stone skeleton, soil depth 5–30 cm, in cracks still deeper), near Ardovo village, soil samples taken from depth of 15 cm in a *Corneto-Querceto acerosum* forest on 13 June, 1997 and extracted in an intensive termoeclector, Ľ. Kováč leg., Slovak National Museum in Bratislava. Both specimens were clarified in KOH and mounted in liquido de Swan.

Other material:

Leptotyphlus uccellinensis Pace, 1978, Paratypes, Toscana, 1 male, Mti. Uccellina, 22 June 1977, R. Pace leg., 1 male, 1 female, Mti. Uccellina, 4 July 1977, R. Pace leg.

Lepotyphlus meriensis, Coiffait, 1959, male, 1 female, Liguria, Isola Buena, 22 June 1976, R. Pace leg.

Leptotyphlus tyrrhenicus Dodero, 1908, Toscana, Monte Argentario, 10 September 1972, R. Pace leg.

Habitat. Thermophilous oak-maple forest with *Cornus mas* in undergrowth (group of geobiocoens *Corneto Quercetum acerosum*, Zlatník 1976), at the entrance of the Ardovská jaskyňa (DFS 7488) near the village of Ardovo in Silická planina plain. The site is situated on a steep slope of Ardovská dolina valley at 320 m a.s.l. The growing period lasts about 225 days, the annual energetic input reaches 460–781 kJ.year^{-1}, the south, southwestern and southeastern winds strongly (60%) prevail (MAZÚR, 1980).

This habitat type is similar to that given by PACE (1996) for *L. devillei*.

Derivatio nominis. The species is named in honour of the outstanding Slovak collembologist Ľubomír Kováč from Košice, who provided the material.

Systematic position. *L. kovaci* sp. n. belongs to the subgenus *Leptotyphlus* s. str., group *L. tyrrhenicus* because of the most similar labrum form and female genitalia.

Differential diagnosis. *L. kovaci* sp. n. differs from its congeners by the labrum, labium and female genitalia. According to the five-teeth denticulate anterior margin of labrum, *L. kovaci* sp. n. is most similar to *L. meriensis* Coiffait, 1959, *L. uccellinensis* Pace, 1978, *L. vicus* Coiffait, 1959, but similar denticulation of the labrum anterior margin can be found in *L. calcatogius* Coiffait, 1959, *L. devillei* Coiffait, 1957, *L. elbanus* Pace, 1980 and *L. senensis* Pace, 1978. In addition, the general shape of the labrum (only the L/W proportion and backwards convergent lateral sides) is similar to *L. sbordonii* Pace, 1991, *L. meriensis* and *L. remensis* Pace, 1981.

The labium of *L. kovaci* is characteristic by the presence of a slightly rounded lobe in middle of basal edge. In *L. tyrrhenius* Dodero, 1908, the central part of the basal labial margin runs into a narrow, sharp and almost triangular process, in *L. meriensis* in an almost semicircular lobe, and in *L. uccellinesis* it is straight. A more or less anchor-shaped structure of female genital armature, observed in *L. kovaci* sp. n., occurs in *L. tyrrhenius* *L. meriensis*, *L. unccellinensis*, but the most similar one can be found in *L. devillei*.

Zoogeography. The isolated distributional range of *L. kovaci* sp. n. suggests two hypotheses. First, the real distribution range of *Leptotyphlus*, and likely of all Leptotyphlinae, may be larger and less disjunct than supposed. This hypothesis is supported by recent discoveries of Leptotyphlinae in Alaska, California, Florida, Chile, SE Africa and Japan (PACE, 1996) remote from the apparent distribution centre of Leptotyphlinae in Mediterranean basin. This assumption is indirectly supported by two indices:

a. collecting of Leptotyphlinae requires different methods than usually used by coleopterists.

It is symptomatic that collembologists discovered Leptotyphlinae in Slovakia, similarly as an acarologist discovered the first specimens of the endogean *Thinobius korbeli* Löbl et Rychlík, 1994 (LÖBL & RYCHLÍK, 1994).

b. Besides obvious ecological and zoogeographical reasons, the large number of Leptotyphylinae discovered in western Mediterranean may also result from a great attention traditionally paid to the study of endogean invertebrates in these areas.

Accordingly, findings of Leptotyphlinae might be expected in other places after application of appropriate collection methods.

Second, *L. kovaci* sp. n. represents hypothetically a preglacial relic. This assumption is based on the following indices. The area of Slovenský kras lay at the northern coasts of Paratethys and was never completely overflowed. The position of the Tethys and Paratethys northern coasts in the period from middle to superior Miocene (CAVAZZUTI, 1989; DĚDINA, 1929; RÖGL & STEININGER, 1983) could *Leptotyphlus* allow to expand along them from the area of its distribution centre in Tyrrhenia – the present-day West Mediteranean (the present north-western coast of the Mediterranean Sea is almost identical with the north-western coasts of Tethys) to the East and penetrate the area of Slovenský kras. At the same time, the temporal withdrawal of the narrow belt linking the western parts of Paratethys and Tethys could have enabled Leptotyphlinae expand in Dinarids and Egeida. The changes in the eastern parts of Tethys and Paratethys might explain the great difference in the species richness of Leptotyphlinae between the western and eastern parts of the Mediterranean basin. This way of spreading of *Leptotyphlus* to Slovenský kras seems to be more probable than its later spreading from the area of present-day Italy and Istria. This is also supported by the later development of the Carpathian basin (KORMÁNY, 1978). After withdrawal of Tethys, a large Croat-Slavonian lake spread out in South Pannonia during Pliocene. This lake was supplied by ancestors of some recent rivers (Sáva, Drava, Mura, Danube, March, Váh, Nitra, Ipeľ) whose lower streams flowed almost exactly from the North to South. Later, during the Quaternary, the pre-Danube river bed was gradually shifting to the East and, together with the pre-Tisza river, an enormous deposing activity and forming an extensive and unstable system of temporary arms and lakes continued (their remnants are the Neusiedler See, Balaton lake and the remnants of the Danube inland delta). All these processes represented a strong ecological barrier for expansion of the leptotyphlines preferring clay soils, fissured rocks, carstic habitats and Mediterranean-type climate.

The minimal energetic needs of Leptotyphlinae and cryptic habitat might increase the chance of their populations to survive cold periods in a protected refuge which was about 150 km from the limit of maximum glaciation (HOLDHAUS, 1954).

If *L. kovaci* sp. n. is really a terciary relic, its finding supports the hypothesis (LOŽEK, 1994) that the refuge role of Slovenský kras during the glaciation was similar to that of the refuges in Balkan.

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Biologia, Bratislava, **55**/2: 158, 2000 **BOOK REVIEW**

KAPELLER, K. & STRAKELE, H. 1999. Cytomorfológia. Učebnica pre lekárske fakulty. [Cytomorphology. Textbook for students of medicine.] Osveta, Martin, 2nd Ed., 238 pp.

After the successful first edition (in 1990) which was shortly run out and the demand for next edition from medical and biological practice, K. Kapeller decided to publish a second, updated version of the textbook. Unfortunately, the co-author H. Strakele was not able to participate because of his sudden decease.

I should like comment that the textbook is written on high-quality coated paper. This contributed to higher quality of the drawings and micrographs whose number increased to 166 in comparison with the previous edition. K. Kapeller, an excellent expert in ultrastructure of the nervous system cells, enriched the second edition by new knowledge on the intermediary filaments and their function, the glial cells and their membrane skeleton.

The textbook is arranged into 10 main chapters. The first chapter deals with the cell as a basic unit of all organisms and its general morphology. The following chapters describe biomembranes, their structure and function as well as the relationships of cell membranes to immunological processes. The next chapter deals with the cell nucleus, its structure and function during the cell reproduction, its metabolism and genetic processes.

Extensive and useful is the chapter on the basic components of cytoplasm, cell organelles, cytoskeleton, cell inclusions and hyaloplasma, described from both morphological and functional aspects. A separate chapter is dedicated to surface structures of the cell, cell communication and functions during various life stages. The textbook is addressed not only to students of the first-year courses, but also to all students of medicine and physicians. That is why the authors included at the end of the textbook two chapters on cell pathology, especially changes in the morphology of cancer cells.

The authors explain the importance and function of all cell components from cytophysiological, cytochemical and cytopathological points of view.

The textbook will be available to students of medicine, pharmacy and biology and can be helpful for biologists, pathologists and cytologists. "Cytomorphology" is a contribution to the professional literature in medical and biological sciences in Slovakia.

Gustáv ČATÁR