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Crumomyia microps sp. n. from Austria and notes on other cavernicolous Crumomyia species (Diptera: Sphaeroceridae)

J. ROHÁČEK[1] & L. PAPP[2]

[1]*Department of Entomology, Silesian Museum*
Tyršova 1, CZ–746 46 Opava, Czech Republic
e-mail: szmoprir@opanet.cz
[2]*Department of Zoology, Hungarian Natural History Museum*
H–1088 Budapest, Baross u. 13, Hungary
e-mail: lpapp@zoo.zoo.nhmus.hu

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Abstract – *Crumomyia microps* sp. n. is described from two caves situated at 2,180–2,320 m in eastern Tyrol (Karnische Alpen, Kartitsch env., Obstans caves), Austria. The species seems to belong to troglobiont flies displaying several morphological adaptations to cavernicolous life, e.g. reduction of eyes, prolongation of arista, legs and setae, and weak sclerotization and paler pigmentation of body (abdomen in particular) being particularly distinctive in comparison with its closest relative, *Crumomyia notabilis* (COLLIN, 1902). The *Crumomyia parentela* complex was re-examined and re-classified following the discovery of 5 unusual specimens in the same caves. *C. parentela cavernicola* (PAPP et ROHÁČEK, 1983) is elevated to a species rank and the specimens from Obstans caves are described as *C. cavernicola oculea* ssp. n. A key to the identification of the *C. parentela* complex is presented. A survey of *Crumomyia* species recorded from caves is given along with a discussion about the origin of troglobiont taxa. *C. tyrphophila* ROHÁČEK, 1999 is recorded from Austria. With 12 figures.

INTRODUCTION

The Holarctic genus *Crumomyia* MACQUART, 1835 belongs to the species-richest groups of the subfamily Copromyzinae. A revision of the *Crumomyia* by NORRBOM & KIM (1985) enumerated 26 species but 5 others have since been added by KUZNETZOVA (1989, 1993, 1995), viz. *Crumomyia nartshukae* KUZNETZOVA, 1989 (Russia: Sakhalin), *C. peishulensis* KUZNETZOVA, 1989 (Russia: Far East), *C. longiptera* KUZNETZOVA, 1989 (Tadzhikistan: Pamir Mts), *C. hissarica* KUZNETZOVA, 1993 (Tadzhikistan: Hissar Mts) and *C. zlobini* KUZNETZOVA, 1995 (Kamchatka), from poorly explored parts of the Palaearctic Re-

gion. Most recently, *C. tyrphophila* ROHÁČEK, 1999 has been described from peat-bogs in the Šumava Mts. (Czech Republic) which was a surprising discovery considering the fact that the genus *Crumomyia* was particularly well studied in Central Europe (cf. ROHÁČEK 1991, 1999). *C. tyrphophila* is now also known from Austria (Osttirol, Drautal, Mittewald – Kristeintal, 1500 m, 15.8.1999, 1 male, A. KOFLER leg. and coll.). Thus, 32 species of *Crumomyia* have been described to date.

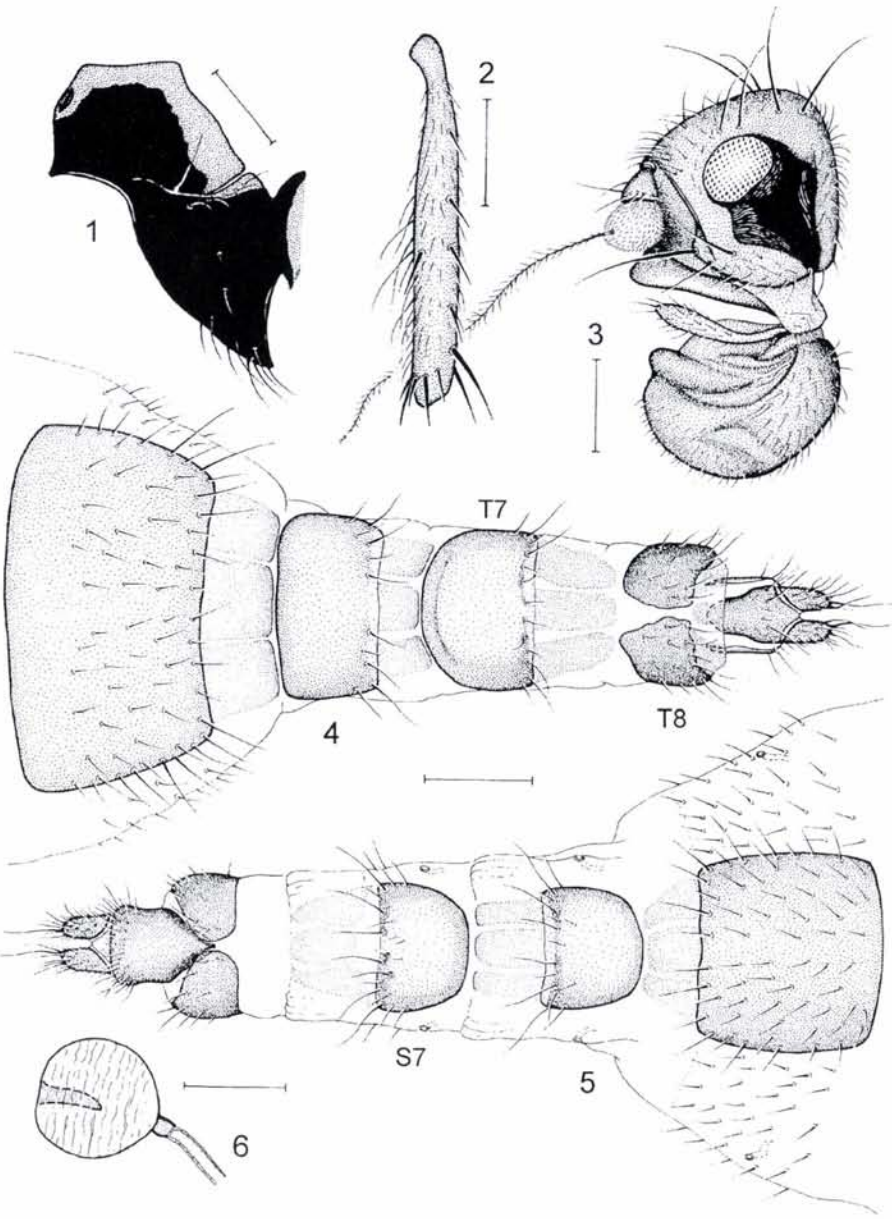
A further new species was unexpectedly found among flies collected in Obstans caves in the eastern Tyrol (Austria), kindly presented to us by Dr. ALOIS KOFLER (Lienz, Austria). A number of *Crumomyia* species are known to live in caves (cf. PAPP & PLACHTER 1976; PAPP 1979, 1982; PAPP & ROHÁČEK 1983; ROHÁČEK 1991; ROHÁČEK & KOŠEL 1993) but most of them do not belong to the troglobiont category as they also (or preferably) occur outside caves, usually in various shaded and cold habitats such as burrows of small mammals, deep gulleys, rocky ravines and slots, mine galleries, etc. However, a few of them (see also discussion below) are only known from caves and because they are morphologically modified due to the cavernicolous way of life, are considered true troglobionts. The new species (described below) also seems to be a member of this group.

Crumomyia microps sp. n.
(Figs 1–8, 11–12)

Type material – Holotype male and 5 males 6 females paratypes: Austria: Osttirol, Karnische Alpen, Obstans Tropfsteinhöhle, 2320 m, 7.9.1997–20.9.1998, Kahlen et Egger leg. One paratype: Austria: Osttirol, Karnische Alpen, Obstanser Eishöhle, 2180 m, 7.9.1997–15.9.1999, Kahlen leg. Holotype and part of paratypes are deposited in the Hungarian Natural History Museum, Budapest (Hungary), remaining paratypes in the Silesian Museum, Opava (Czech Republic) and in the collection of Dr. ALOIS KOFLER, Lienz (Austria). All specimens were dried from alcohol and pinned or glued on cards. Abdomens of several paratypes were removed, cleared and/or dissected and preserved in plastic tubes with glycerine pinned below respective specimens. Note: some paratypes are provided with slightly different text on locality labels [e.g. "Kartitsch Umgeb.", "Obstans Höhle B.F.", "lg. Kahlen"] but all have the same date and altitude.

Etymology: The species is named according to its reduced eyes, the most striking feature distinguishing it from the closely related *Crumomyia notabilis* (COLLIN, 1902).

Description – Male. Total body length 3.77–4.17 mm (specimens dried from alcohol); general colour dark to blackish brown; most of body with relatively sparse brownish grey microtomentum. Head (Fig. 3) about as long as high, with voluminous mouthparts being almost as large as the head proper. Frons wide because of reduced eyes, largely microtomentose, only small spots laterally to ocellar triangle, a very narrow (lanceolate in shape) frontal triangle, small posterior part of orbit, anterior margin of frons and frontal lunule with reduced microtomentum or bare and shining. Anterior fourth to third of frons distinctly paler (ochreous or reddish brown). Face (prefrons) blackish



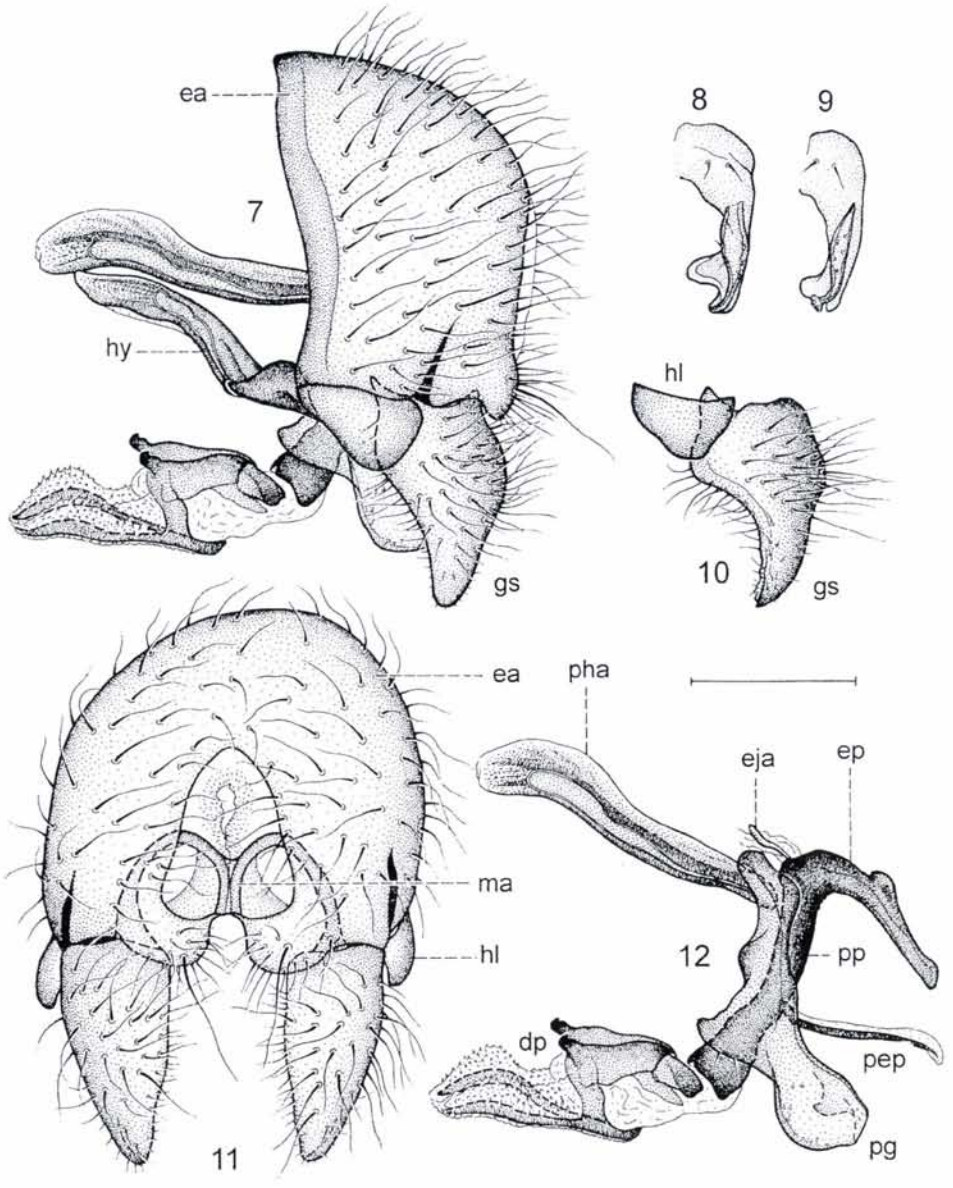
Figs 1–6. *Crumomyia microps* sp. n., paratype male (1–3) and paratype female (4–6). 1 = mesopleuron and sternopleuron laterally (microtomentose areas dotted), 2 = male mid tibia anteriorly, 3 = head laterally (microtomentose areas dotted), 4 = female postabdomen with 5th segment dorsally, 5 = dtto ventrally, 6 = spermatheca. – Scales: Fig 6 = 0.1 mm, others = 0.3 mm. Abbreviations: S – sternum, T – tergum

brown, with relatively deep antennal concavities, sparsely microtomentose. Parafacialia brown, glossy blackish brown margined. Frontal lunule pale brown, largely bare and shining. Vibrissal angle reddish to ochreous brown, microtomentose. Gena as high as or slightly higher than longest eye diameter, pale greyish brown microtomentose except for a large bare shining area below eye being distinctly finely furrowed (see Fig. 3). Occiput and postgena dark brown and entirely microtomentose. Cephalic chaetotaxy: all macrosetae relatively thin; no true postverticals (only small postocellar setulae); outer and inner verticals long and subequal to ocellars in length; 2 subequal (or posterior slightly longer) closely arising exclinate orbitals; 6–7 fine interfrontals becoming longer anteriorly; numerous additional setulae between orbits and interfrontalia (longest situated at anterior frontal margin) and a series of small exclinate or reclinate setulae on orbits and in front of eye; vibrissa long, subvibrissa about one-third of its length; genal seta well developed, long; peristomal setulae fine and, like postoculars, numerous, the latter covering unarranged most of postgena. Eye strongly reduced (Fig. 3), relatively flat, oval; its longest (oblique) diameter about 1.5 times as long as shortest. Antenna dark brown, with paler scape and 1st flagellomere; pedicel conical and relatively long; 1st flagellomere rounded and laterally somewhat compressed. Arista long, about 4 times as long as antenna, with long cilia.

Thorax dark to blackish brown, dorsally completely (including scutellum) though sparsely greyish brown microtomentose. Pleural parts of thorax with microtomentose pattern most resembling that of *Crumomyia glabrifrons* (MEIGEN, 1830). Propleuron microtomentose only posterodorsally. Mesopleuron (anepisternum) largely bare and lustrous, only dorsally and posteriorly with microtomentose marginal band (Fig. 1); sternopleuron (katepisternum) bare and glabrous except for small microtomentose areas at posterodorsal corner and posterior margin. Pteropleuron (anepimeron), the distinctly protruding metapleuron (laterotergite) and most of hypopleuron (meron) greyish brown microtomentose. Thoracic chaetotaxy: all macrosetae long but thin; 2 humerals (external very long, internal small); 2 notopleurals (anterior longer than posterior); 1 short supra-alar and 1 very long postalar; 1 long presutural (posthumeral); 3 (1+2) relatively weak dorsocentrals; 4 irregular rows of sparse and fine acrostichal setulae; 2 very long scutellars (basal only slightly shorter than apical); propleuron finely setulose; mesopleuron without setae; sternopleuron with 4–5 fine setulae at dorsal margin, more strongly setulose in its ventral third (Fig. 1).

Legs relatively long and slender, brown to dark brown, with paler knees or entire tibiae and tarsi. All femora and tibiae finely densely setulose with macrosetae as follows. Fore femur somewhat thickened, with longer but hair-like setae in posteroventral and posterodorsal rows. Mid femur, except the usual preapical setae, with numerous hair-like sinuate setae ventrally. Hind femur with a row of 5–6 dorsal (or anterodorsal) setae and several longer setae also in anteroventral row, the middle of which is usually longest. Fore tibia simply haired, with 1 short dorsopreapical seta and ventroapical brush of dense golden setulae. Mid tibia (Fig. 2), with usual subapical crown of setae, 5–6 anterodorsal (relatively short) setae along its entire length, 1 distinct anteroventral seta below middle, 1 posteroventral seta in apical fourth and ventrally with a number of long fine sinuate hairs. Hind tibia with the usual dorsopreapical seta, 1 long but thin anteroventral seta in apical two-fifths and 2 apical spurs (the anterior short, the ventral strong, curved, about as long as tibial width). Both fore and hind basitarsus with a small backish ventroapical hook well developed, hind basitarsus and 2nd hind tarsal segment with dense ventral brush of golden hairs.

Wing slightly to distincly shortened but with normal venation; membrane and veins unicolorous pale brown, only small areas along ta (R-M) and tp (dM-Cu) somewhat darkened. Venation tending to some variation due to wing length reduction (one male with ta lacking in one wing, another male with ta doubled in one wing, apical portion of M often shortened) but discal cell always long and narrow, with ta situated in its basal fourth to third. Wing measurements: length 2.58–3.62 mm, width 0.89–1.27 mm, C-index (Cs2 : Cs3) = 4.10–5.42, ta-tp : tp (R-M\dM-Cu : dM-Cu) = 3.70–4.60. Haltere dirty yellow, knob usually darker than stem.



Figs 7–12. *Crumomyia microps* sp. n. (7, 8, 11–12) and *C. notabilis* (COLLIN) (9, 10). 7 = male genitalia laterally, 8 = postgonite anteriorly, 9 = dtto (*C. notabilis*), 10 = gonostylus and lateral part of hypandrium laterally (*C. notabilis*), 11 = male genitalia caudally, 12 = aedeagal complex laterally. – Scale = 0.3 mm. Abbreviations: dp – distiphallus, ea – epandrium, eja – ejacapodeme, ep – epiphallus, gs – gonostylus, hl – hypandrial lobe, hy – hypandrium, ma – medandrium, pep – pre-epiphallus, pg – postgonite, pha – phallapodeme, pp – phallophore

Abdomen with relatively weakly sclerotized preabdominal sclerites. Terga broad, sparsely greyish brown microtomentose, with fine setulae being longest at lateral margins. Preabdominal sterna somewhat broader than in female, densely finely setulose as also is pleural membrane. 5th sternum unmodified. Postabdominal sclerites well sclerotized, dark brown pigmented; 6th and 7th sterna strongly asymmetrical and fused together. 8th sternum relatively long, less asymmetrical, dorsally strongly convex and less densely microtomentose or partly bare.

Genitalia (Figs 7, 11) large and heavily sclerotized. Epandrium strongly convex, with the usual ventral lateral cleft (Fig. 7) and densely uniformly haired, without strikingly longer setae (in contrast to that of *C. notabilis*). Cerci distinct though fused with epandrium (Fig. 11) but medially separate (subanal plate reduced between cerci), each with 1 long sinuous hair-like seta and a number of fine setulae. Anal fissure subtriangular, relatively small. Medandrium (= intraepandrial sclerite) well developed (Fig. 11). Gonostylus (Fig. 7) convex posterolaterally, strongly tapered apically but its apex rounded (in contrast to that of *C. notabilis* – cf. Fig. 10) and covered by dense and long hair-like setae. Hypandrium (Fig. 7) with expanded convex lobes of lateral arms and robust anteromedial apodeme. Aedeagal complex (Fig. 12) of the *C. notabilis*-group type, closely resembling that of *C. notabilis* but differing as follows. Phallapodeme with small dorsal keel; phallophore with epiphallus more strongly curved ventrally and pre-epiphallus arising more distally; distiphallus with differently formed (less acute) and smaller paired dorsal hooks; postgonite with larger internal tooth being situated more proximally (Fig. 8) than that of *C. notabilis* (Fig. 9). Ejacapodeme very small and slender, situated in posterodorsal opening of phallophore (Fig. 12).

Female. Head, thorax, legs and wing as in male except differences mentioned below. Total body length 4.76–5.24 mm. Fore femur more slender; mid femur and tibia without ventral sinuate hairs. Fore and hind basitarsus lacking small ventroapical hook. Wing measurements: length 3.09–3.26 mm, width 1.19–1.27 mm, C-index = 5.47–5.80, ta-tp : tp = 4.06–4.52.

Abdomen. Preabdominal terga similar to those of male, 3rd–6th tergum relatively weakly sclerotized, brown to pale brown; syntergum 1+2 longest, darkest and most sclerotized preabdominal sclerite. Preabdominal sterna pale brown and narrower than in male. Setosity of postabdomen similar as in male.

Postabdomen telescopically retractable, much narrower than preabdomen (Figs 4–5). Sclerites of 6th and 7th segment weakly sclerotized and pale pigmented, darkest along margins and bases of setae. These sclerites and also those of 5th segment and 8th tergum provided with 3 posterior tongue-shaped secondary sclerotizations of intersegmentary membrane. 6th tergum broader than 6th sternum (Figs 4–5), the later anteriorly rounded and both with fine setulae at posterior margin only. 7th tergum also larger than 7th sternum although both similar in shape. 8th tergum dark and heavily sclerotized and dorsomedially divided into two plates; its setulae scatered on entire disc. 8th sternum also dark and medially divided but distinctly shorter (Fig. 5) than 8th tergum. 10th tergum small, and strikingly narrow, elongately pentagonal but somewhat tapered anteriorly, dark pigmented, with 1 long and (usually) 3 short pairs of setulae dorsally. 10th sternum also dark and well sclerotized, broader than 10th tergum, convex ventrally and acutelly narrowed anteromedially, with numerous fine hairs at posterior margin. Spermathecae (1+1) ball-shaped (Fig. 6), with dense and fine superficial striae, internally with a long straight apodeme opposite the duct opening, the latter being provided with distinct though short external collar. Cerci relatively short, darkly pigmented, with usual set of hair-like setae (Figs 4–5).

Discussion – The new species is a member of the *Crumomyia notabilis*-group sensu NORRBOM & KIM (1985). Judging from the highly similar male genitalia it is the closest relative of *Crumomyia notabilis* (COLLIN, 1902) and, consequently, its sister-species. Other closely allied species undoubtedly are: *C. absoloni* (BEZZI, 1914), *C. rohaceki* NORRBOM et KIM, 1985 and *C. zuskai* (ROHÁČEK, 1976). All these species share similar microtomentose pattern on gena, similar construction of distiphallus with a pair of small dorsal hooks and postgonite with simple lateral outline but with internal tooth or lobe. Interestingly, all these species can live also (if not only) in caves. In addition, *C. hungarica* (DUDA, 1938) should also be taken into consideration although its membership in the above assemblage is not certain because the species is only known from the female holotype (see PAPP 1979). Owing to strongly reduced eyes, *C. microps* sp. n. externally most resembles the cavernicolous species *C. absoloni* and *C. hungarica*. However, both these species differ from *C. microps* sp. n. in having strongly shortened wings (cf. PAPP 1979, Figs 5, 6), not to mention different gonostylus (apically pointed), postgonite (apically somewhat notched) and female 8th tergum (medially undivided) of *C. absoloni* (cf. NORRBOM & KIM 1985, Figs 121, 122, 124) and only one orbital seta, enlarged prescutellar dorsocentral seta and pale legs of *C. hungarica*. As noted above, the closest ally of *C. microps* sp. n., viz. *C. notabilis*, has very similar male genitalia but differs in a number of external features, e.g. in having darker (almost black) body, shorter and thicker macrosetae on head and thorax, shorter cilia on arista, usually additional setulae on scutellum, shorter and thicker legs, darker clouded cross-veins, heavily sclerotized preabdominal terga and, most distinctly, large eyes (cf. NORRBOM & KIM 1985, Fig. 127) and mesopleural microtomentose pattern restricted to dorsal marginal area (see ROHÁČEK 1976, Fig. 2). However, the validity of *C. microps* sp. n. can also be supported by several characters of the male and female terminalia, particularly by the epandrium without enlarged setae, apically rounded gonostylus (Fig. 7), strongly bent epiphallus, smaller paired hooks on distiphallus (all on Fig. 12) and larger inner tooth of postgonite (Fig. 8) and by the medially divided 8th female tergum.

Biology – All but one type specimens of *C. microps* sp. n. were found in an Alpine stalactite cave during a-year period (precise dates of collection unknown) at unusually high altitude (2,320 m). The flies occurred here in community with *Crumomyia cavernicola oculea* ssp. n. (described below), which was probably caught in the entrance zone of the cave, and the very rare – cavernicolous but not troglobiont – *Eccoptomera sanmartini* CZERNY, 1924 (described from San Martino di Castrozza and known only from gr. du Lichen, Onnion, Haute-Savoie, see PAPP 1982). One paratype was found in a nearby ice cave at an altitude of 2,180 m.

Distribution – Hitherto, the species is only known from the Obstans caves in the Karnische Alpen Mts (Austria).

TAXONOMY OF THE CRUMOMYIA PARENTELA COMPLEX

Two females and three males of a *Crumomyia* species found in the Obstans caves are externally highly similar to the montane *Crumomyia parentela alpicola* (ROHÁČEK in TROGER et ROHÁČEK 1980) but proved to have somewhat different genitalia, resembling those of *C. parentela cavernicola* (PAPP et ROHÁČEK, 1983). A female *Crumomyia parentela alpicola* found also in the Obstans cave (Austria: Osttirol, Karnische Alpen, Obstans Tropfsteinhöhle, 2320 m, 20.9.1998–15.9.1999, Kahlen leg., in coll. A. KOFLER, Lienz) confirms our presupposition that both *C. parentela* and *C. cavernicola* occur sympatrically in the Karnischen Alpen and have therefore be treated as separate species. The female examined has postabdomen with characteristically long, anteriorly incised but medially undivided 8th sternum. It was captured in the same cave as three males of *C. cavernicola oculea* ssp. n. (described below). This fact initiated a more thorough comparative study of all taxa belonging to the *C. parentela* complex, which resulted in finding that the differences in genitalic structures are invariable and enable us to split this complex of subspecies into two groups which are classified here as separate species. Each of these species include two subspecies: one troglobiont with strongly reduced eyes, narrowed thorax and prolonged legs, and the other free-living (or at most troglophilous) one with eyes, thorax and legs normal (for a classification of cave dwelling flies see below). The taxonomical results can be summarized as follows:

Crumomyia parentela (SÉGUY, 1963)
- ssp. *parentela* (SÉGUY, 1963) – a troglophilous subspecies known from two caves in Serbia (see NORRBOM & KIM 1985).
- ssp. *alpicola* (ROHÁČEK in TROGER et ROHÁČEK, 1980) – a montane subspecies widespread in Alps and Carpathians, also known from caves in Slovakia (see ROHÁČEK 1991).

Crumomyia cavernicola (PAPP et ROHÁČEK, 1983), stat. n.
- ssp. *cavernicola* (PAPP et ROHÁČEK, 1983) – a troglobiont subspecies described from St. Vincent cave in France.
- ssp. *oculea* ssp. n. – a troglophilous subspecies from Obstans caves in Austria. It supposedly also occurs outside the caves and can thus be expected elsewhere in Alps. For diagnosis and type material see below.

A KEY TO THE CRUMOMYIA PARENTELA COMPLEX

1 Male gonostylus longer, narrower and ventrally more acute; hypandrial apodeme as long as or longer than phallapodeme (cf. TROGER & ROHÁČEK 1980: Fig. 12; NORRBOM & KIM 1985: Figs 76–77); female postabdomen with 8th tergum dorsomedially undivided (NORRBOM & KIM 1985: Fig 79)
C. parentela (SÉGUY, 1963) ... 2

– Male gonostylus broader, ventrally rounded (cf. PAPP & ROHÁČEK 1983: Fig. 12); hypandrial apodeme distinctly shorter than phallapodeme (about two-thirds of the latter); female postabdomen with 8th tergum dorsomedially divided (cf. PAPP & ROHÁČEK 1983: Fig. 9)
C. cavernicola (PAPP et ROHÁČEK, 1983) ... 3

2 Eye small, its longest diameter about 0.9–1.0 times as long as smallest genal height. Gonostylus narrower (NORRBOM & KIM 1985: Fig. 76), legs long and slender *C. parentela parentela* (SÉGUY, 1963)

– Eye distinctly larger, its longest diameter about 1.7–2.0 times as long as smallest genal height. Gonostylus more broadened in distal half (cf. TROGER & ROHÁČEK 1980: Fig. 12), legs normal
C. parentela alpicola (ROHÁČEK in TROGER et ROHÁČEK, 1980)

3 Eye reduced, small, its diameter about 1.2 times as long as smallest genal height; thoracic spiracle reduced (PAPP & ROHÁČEK 1983: Fig. 11), legs elongate, thorax narrowed
C. cavernicola cavernicola (PAPP et ROHÁČEK, 1983)

– Eye larger, its diameter about 1.7–1.9 times as long as smallest genal height; thorax, thoracic spiracle and legs normal *C. cavernicola oculea* ssp. n.

Crumomyia cavernicola oculea ssp. n.

Type material – Holotype male, Austria: Osttirol, Karnische Alpen, Obstans Tropfsteinhöhle, 2320 m, 7.9.1997–20.9.1998, Kahlen et Egger leg. (Hungarian Natural History Museum, Budapest). One paratype male, same data but labelled: "Osttirol, Austria, Kartitsch Umgeb., Obstans Höhle BF., 2320 m, leg. Kahlen, 7.9.1997–20.9.1998" (coll. Dr. A. KOFLER, Lienz). Both with genitalia dissected, cleared and preserved in plastic tubes in glycerine pinned below specimens. One paratype male, Austria: Osttirol, Karnische Alpen, Obstans Tropfsteinhöhle, 2320 m, 20.9.1998–15.9.1999,

Kahlen leg. (coll. Silesian Museum, Opava); 2 female paratypes, Austria: Osttirol, Karnische Alpen, Obstanser Eishöhle, 2180 m, 7.9.1997–15.9.1999, Kahlen leg. (coll. A. KOFLER and Silesian Museum, Opava).

Etymology – The new subspecies is named according to large eyes (oculeus = big-eyed).

Diagnosis – Male. Body length about 3.8–4.0 mm; general colour dark brown to black. Head with chaetotaxy and microtomentose pattern as described for *C. parentela* (cf. NORRBOM & KIM 1985). Gena relatively high but eye not reduced; its longest diameter 1.7–1.9 times as long as shortest genal height. Aristal cilia slightly longer than in *C. p. alpicola*. Mesopleuron with a narrow microtomentose band along dorsal margin, otherwise bare, thus pleura as in other taxa of the *C. parentela* complex. Thoracic spiracle normal, not reduced. Legs as in *C. p. alpicola*, normal in length and with similar chaetotaxy. Wing not reduced (length 3.7–3.8 mm, width 1.4–1.5 mm), with cross-veins slightly infuscated. Abdomen with sclerites of normal size. Male genitalia as in *C. cavernicola cavernicola* (see PAPP & ROHÁČEK 1983, Figs 12–14), thus with shorter, distally more dilated and rounded gonostylus, short hypandrial apodeme and anterior apical lobe of postgonite narrower than in *C. parentela*.

Female. Postabdominal sclerites very similar to those of *C. cavernicola cavernicola* (cf. PAPP & ROHÁČEK 1983, Fig. 9); the relatively short and dorsomedially divided 8th sternum is the most diagnostic feature distinguishing female of *C. cavernicola* from the female of the sympatric (see above !) *C. parentela alpicola*.

Discussion – The new subspecies is here recorded from both caves near Obstan. It is externally hardly distinguishable from *C. parentela alpicola*; however, it can be easily separated from the latter by the features in the genitalia. *C. cavernicola*, originally described as a subspecies of *C. parentela,* is elevated here to a species level because the above described *C. cavernicola oculea* ssp. n. occurs sympatrically with *C. parentela alpicola* in the Alps (also records of the latter from the Hohe Tauern Mts. are not far from the type locality of the new subspecies) and the comparison of their genitalia revealed distinct differences between these taxa. Nevertheless, both species (*C. parentela* and *C. cavernicola*) are very closely related, and have to be splitted not very long ago.

In contrast to the nominate subspecies (*C. c. cavernicola*) the new subspecies *C. c. oculea* is morphologically unmodified despite the fact it was discovered in a cave, and, therefore, it cannot be treated as a troglobiont. It probably also live free in alpine zone of the Alps and can be classified at most as a troglophilous species, like *C. parentela alpicola* occuring besides mountains also in caves in Carpathians (Slovakia).

THE CAVERNICOLOUS SPECIES OF CRUMOMYIA: A SUMMARY OF PRESENT KNOWLEDGE AND DISCUSSION OF THE ORIGIN OF TROGLOBIONT TAXA

Sphaeroceridae are regular components of the cavernicolous fly fauna. However, most of species recorded from caves belong to the so-called "parietal fauna" which is composed of animals living in entrance zones of caves and only temporarily penetrating deeper inside caves. Nevertheless, a few species are able to inhabit deep, aphotic passages of caves and spend all their life there. The former group is formed by species originating from outside and living in caves only temporarily, occurring here either by chance (trogloxenous species) or visiting caves because of convenient conditions during the season (e.g. psychrophilous species in summer) – these are classified as hemitroglophilous species. In the latter group, forming the residental cave community, two subgroups, differing by their origin, can be recognized: (1) troglobiont (or true cavernicolous) species which evolved in consequence of their adaptation and specialization to cavernicolous way of life and are unable to live elsewhere, and (2) troglophilous species which besides caves also occupy other subterranean or even terricolous habitats, such as burrows of mammals, underground nests of social insects or deep layers of soil. Troglophilous species can migrate from and to caves but, in contrast to hemitroglophilous species of the entrance zone community, they can complete all their life-history within the cave habitat and live in caves also during winter. Species of Sphaeroceridae occur in all the above-discussed groups of cave-dwelling insects.

A summary of older data dealing with Sphaeroceridae living in caves can be found in the catalogue of cavernicolous fauna by WOLF (1934–1938) and a review of additional papers dealing with European taxa are presented by ROHÁČEK & KOŠEL (1993). Our discussion is, however, restricted only to species of the genus *Crumomyia*, a number of which are known to live in caves and form important components of all the above diagnosed groups. The following summary of *Crumomyia* species recorded from caves are based on papers by WOLF (1934–1938), PAPP & PLACHTER (1976), PAPP (1978, 1979, 1982), PAPP & ROHÁČEK (1983), NORRBOM & KIM (1985), ROHÁČEK (1991), ROHÁČEK & KOŠEL (1993) which also contain revised data from older papers and the new knowledge added in the present paper.

(1) Trogloxenous species
C. fimetaria (MEIGEN, 1830).

(2) Hemitroglophilous species
C. glabrifrons (MEIGEN, 1830)
C. nigra (MEIGEN, 1830)
C. nitida (MEIGEN, 1830)
C. notabilis (COLLIN, 1902)
C. pruinosa (RICHARDS, 1932)
C. rohaceki NORRBOM et KIM, 1985
C. roserii (RONDANI, 1880)
C. zuskai (ROHÁČEK, 1976)

(3) Troglophilous species
C. cavernicola oculea ssp. n.
C. parentela alpicola (ROHÁČEK, 1980)
C. setitibialis (SPULER, 1925)

(4) Troglobiont species
Crumomyia absoloni (BEZZI, 1914) – Mušica ponor cave nr. Bašic; cave nr. Avtovac (NE Hercegovina)
C. glacialis gallica (PAPP et ROHÁČEK, 1983) – St. Vincent cave in Mélan (France)
C. hungarica (DUDA, 1938) – an unknown cave in Bihar (= Bihor, Roumania)
C. microps sp. n. – Obstans cave in the Karnische Alpen (Austria)
C. parentela parentela (SÉGUY, 1963) – Šepla Maja Hajne cave nr. Sjenica; a cave nr. Strajevac (Serbia)
C. cavernicola cavernicola (PAPP et ROHÁČEK, 1983) – St. Vincent cave in Mélan (France)

As mentioned above, the two last groups (3, 4) contain species which are stable inhabitants of caves, i.e. they live in caves also during winter. The more important troglobiont group includes at present six taxa of *Crumomyia*. Except *C. microps* sp. n. (described here) all were classified in this group already by MATILE (1994). Besides the fact that these taxa are only known from caves (mostly from a single cave, except *C. absoloni* and *C. parentela parentela* which were recorded from two caves), all share several features which apparently evolved as a result of a long-time life in deep zones of caves. These morphological modifications include e.g. reduction of eyes, prolongation of arista, legs and setae, weak sclerotization

and pale pigmetation of body (abdomen in particular), reduction of thorax (in consequence of reduction of wing muscles), narrowed thoracic spiracle, and, in some cases (very distinctly in *C. absoloni* and *C. hungarica*) also shortened wings and halteres. Interestingly, the medially divided female 8th tergum was found in three species of this group (*C. microps, C. glacialis gallica, C. cavernicola cavernicola*) although this character is otherwise unknown in other (properly described) species of the genus. The scenario of evolution of troglobiont *Crumomyia* taxa was outlined by PAPP & ROHÁČEK (1983): they apparently evolved from ancestral, strictly psychrophilous but free-living species which had been widespread in Central (and possibly also South) Europe during Pleistocene Ice Ages. These species were unable to tolerate climatic changes of warm and dry interglacial and/or postglacial periods and, therefore, their populations were restricted to refugial habitats with acceptable climatic conditions, such as high mountains and caves. While montane free populations continued to live similarly as in the past, those hidden in caves had to adapt to conditions of this extreme habitat (complete darkness, stable low temperature, high humidity), which resulted in their morphological modifications.

The changes of less affected parts of body (e.g. the male genitalia) were relatively slow; thus, we are able to recognize ancestral species (or their less modified descendants) even now. Taxa which apparently evolved later, perhaps in the postglacial period, are so little different in this respect that we consider them only subspecies. Thus, *C. glacialis gallica* is a cavernicolous subspecies derived from ancestor of the high montane *C. glacialis glacialis*; similarly *C. parentela parentela* and *C. cavernicola cavernicola* are cavernicolous populations whose free-living subspecies *C. parentela alpicola* and *C. cavernicola oculea* ssp. n. are known to occur in high mountains of the Alpine and/or Carpathian (*C. p. alpicola* only) ranges but also (!) secondarily as troglophilous species in some caves where they penetrated only recently. The new species, *C. microps*, is clearly a derivative of an ancestor of *C. notabilis*, a common psychrophilous species occurring in North and Central Europe, but, in contrast to the above-discussed cases, *C. microps* had to live in caves for a much longer period (from last interglacial period ?), considering the number of differences from the free-living sister species. Also *C. absoloni* seems to be derived from an ancestor similar to *C. notabilis*, possibly the same or closely related to that of *C. microps* sp. n. If this is true, *C. absoloni* more strongly diverged from the free-living ancestral type and was possibly branched off earlier than *C. microps*. Only the ancestral species of *C. hungarica* remains a mystery because the male of this species is unknown.

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