ISOPODA: SPHAEROMATIDAE

B. SKET*

All troglobitic sphaeromatids (Sphaeromatidae Richardson, 1905) belong to the rather uniform group Monolistrini Hansen, 1905 within the subfamily Cassidininae Iverson, 1982. The phyletic relations of Monolistrini to an epigean (marine) taxon have not been elucidated satisfactorily. All Monolistrini are completely pigmentless and eyeless, and found only in freshwaters. 37 taxa of the species and subspecies categories have been recognized (and mostly described) until now, while some additional ones have yet to be studied properly. A remarkable increase in their number is unlikely.

Some other representatives of the overwhelmingly marine family Sphaeromatidae inhabit freshwaters (the crenobiotic *Thermosphaeroma* spp. mostly in hot springs of Mexico and Texas, some *Gnorimosphaeroma* spp., some euryhaline *Sphaeroma* spp. and some other euryhaline species in coastal habitats), but they all seem to be true epigean animals with no tendency towards colonization of hypogean habitats.

Belonging to a family of such a pronounced marine character, the Monolistrini have often been considered as one of the most typical groups of "marine relicts in cave waters". Nevertheless, more recent studies have shown that at least the species and subspecies of the "eastern group" *(Monolistra)* must have differentiated mostly in epigean prekarstic fresh waters. Their distribution areas are clearly bound to hydrographic systems as they are supposed to have existed before karstification (Sket 1970b).

The separation of the Monolistrini into two genera *(Monolistra* and *Caecosphaeroma)* has good morphological and zoogeographical grounds. The division of *Caecosphaeroma* into two subgenera is presently not necessary, but acceptable. The eastern group is, on the contrary, composed of several subgroups which could be given the rank of genus. Only for practical purposes (females would then not be always determinable to a genus) have they been given only a subgenus rank within the genus *Monolistra.*

Both genera are distinguished by a different degree of pleotelson integration. The subgenera are characterized by the presence or absence of (uniramous) uropods as well as by differences in the sexual differentiation of pereiopods. The most obvious character of some taxa is the presence of tergal sculpture, which may reach the shape of long spines.

All *Monolistra* (s.l.) spp. have developed at least a slight sexual dimorphism in the shape of pereiopods. In most species there is a praecopula in which the animals may persist up to 2 months. Such a praecopula has never been observed in *Pseudomonolistra* and *Microlistra* spp. (and is hard to imagine in spinose species!). The female carries about 10 fertilized eggs in its external marsupium; they are white in *Caecosphaeroma* and bluish-green in *Monolistra* s.l. The marsupial development lasts about 12 months (in *Caecosphaeroma:* Daum, 1954) and the animals may reach their final lengths (mostly 10-20 mm) after some years. The animals living permanently in stagnant water may grow twice longer than in runnung water. As the intermoult periods exceed a year (Daum, 1954), the thick dorsal cuticula may occasionally be either covered by limestone, blackened (by manganese?), or inhabited by different sessile Ciliata. On a single specimen of *M. spinosissima,* 7 species of Ciliata Peritricha along with 2 of Suctoria have been found (Hadži, 1940). On their setae and softer cuticula, the Monolistrini are quite regularly infested by some Ciliata, mostly Peritricha *(Lagenophrys monolistrae* on pleopods e.g.), as well as by the minute commensal Ostracods *Sphaeromicola* spp. (see chapter Ostracoda in the present book).

The Monolistrini, the only subterranean Sphaeromatidae, inhabit only waters of southern Europe. The genus *Caecosphaeroma* is limited in its distribution to NE and SW France. The very diverse genus *Monolistra* is spread generally along the Dinaride and Italo-Dinaride Systems, from Crna Gora (Montenegro) to the Swiss Alps.

Monolistrini are predominantly detritus-feeders; however, some species must be able to scratch the epilithal film. They move very slowly on the clayey or rocky substratum and roll themselves into a ball when disturbed. Nevertheless the stronger cohabitant amphipods *(Niphargus longiflagellum* e.g.) are able to feed on them (biting through the strongest parts of their cuticula!).

Their habitats are mostly karstic phreatic waters, subterranean streams (also sinking rivers), and residual cave "lakes". Some of them seem to be bound to clean water (some representatives of the sg. *Microlistra* e.g.) and thus are to a greater degree endangered by growing pollution in karstic areas.

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All of the described taxa can be determined using the following literature.

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KEY REFERENCES

Daum, J., 1954. Zur Biologie einer Isopodenart unterirdischer Gewässer: Caecosphaeroma (Vireia) burgundum Dollfus. — Ann. Univ. Saraviensis, 3 (1-2): 104-159.

Deeleman-Reinhold, C.L., 1971. Deux Monolistrini nouveaux (Crustacea, Isopoda) des eaux souterraines de Croatie. — Int. J. Speleol., 3 (3-4): 205-213, 2 pl.

Hubault, E., 1934. Etude faunistique d'eaux souterraines à la lisière septentrionale du Bassin d'Aquitanie. — Bull. biol. France Belgique, 68: 59-76, pl. 5-7.

Iverson, E.W., 1982. Revision of the Isopod family Sphaeromatidae (Crustacea: Isopoda: Flabellifera) I. Subfamily names with diagnoses and key. J. Crust. Biol., 2 (2): 248-254.

Racovitza, E.G., 1910. Sphéromiens (Première série) et revision des Monolistrini (Isopodes sphéromiens). — Arch. Zool. Exp. Gen., 5e ser., 4: 625-758.

Sket, B., 1964. Östliche Gruppe der Monolistrini, I. — Int. J. Speleol., 1: 163-189.

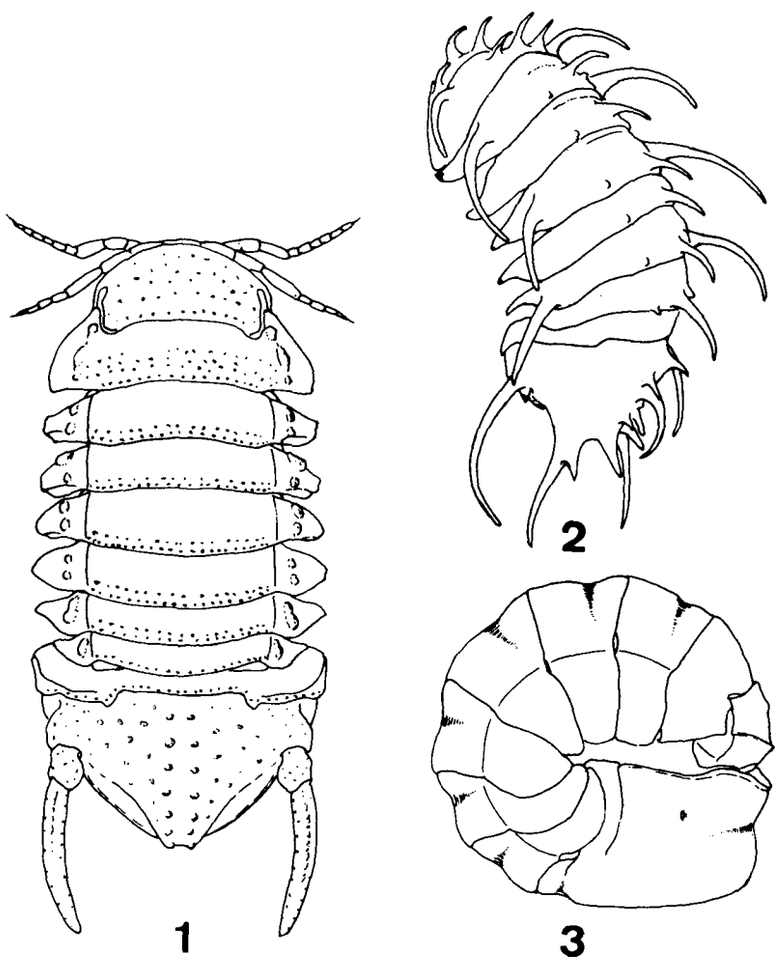
—, 1965. Östliche Gruppe der Monolistrini, II. — Int. J. Speleol., 1: 249-267.

—, 1970. Presenetljive novosti v jamski favni Bosanske Krajine (Surprising novelties in the cave fauna of Bosanska Krajina). — Naše jame (Ljubljana), 11: 93-100.

—, 1970b. Über Struktur und Herkunft der unterirdischen Fauna Jugoslawiens. Biol. vestn. (Ljubljana), 18: 69-78.

—, 1982. Some news about the subgenus Microlistra (Isopoda, Sphaeromatidae) in subterranean waters of Yugoslavia. — Biol. vestn. (Ljubljana), 30 (1): 143-154.

Stoch, F., 1984. Su una nuova "Monolistra (Crustacea, Isopoda)" delle acque sotterranee del Friuli e osservazioni sulla distribuzione dei Monolistrini nell'Italia nordorientale. — Atti Mus. civ. stor. nat. Trieste, 36 (1): 61-67.



1: *M. (Monolistra) caeca absoloni;* 2: *M. (Microlistra) spinosissima;* 3: *C. (Vireia) burgundum burgundum.* (1 and 3 redrawn from Racovitza 1910; 2 redrawn from Sket 1971).

	Monolistra Gerstaecker, 1856		
	sg. **Pseudomonolistra** Hubault, 1937		
1	bosnica Sket, 1970	I 7d: cave Dabarska pećina (near Sanski Most, 45 km WSW of Banja Luka)	C
2	hercegoviniensis hercegoviniensis Absolon, 1916	I 7d: cave Vjetrenica (Zavala, 25 km NNW of Dubrovnik)	C
3	hercegoviniensis atypica Sket, 1965	I 7c: cave Dragića pećina (Maljkovo, 35 km N of Split)	C
4	hercegoviniensis brevipes Sket, 1965	I 7c: some localities on the line Gračac (Lika) — Cetina spring	C, T
5	hercegoviniensis ornata S. Karaman, 1953	I 7d: cave Dejanova pećina (Bileća, 35 km NE of Dubrovnik)	C
	undefined taxa	I 7c: near Vrgorac; I 7d: near Vitina, and Dabarsko polje	
	sg. **Monolistra** Gerstaecker, 1856		
6	caeca caeca Gerstaecker, 1856	I 7a / I 7c: some localities 30-110 km SE of Ljubljana	C, B, T
7	caeca absoloni Racovitza, 1910	I 7a: some localities 10-20 km S to SW of Ljubljana	T, C
8	caeca intermedia Sket, 1964	I 7a (ca 25 km SE of Ljubljana): cave Želimeljska jama; and Šumnik (Vel. Lašče)	C, T
9	caeca julium (Feruglio, 1904)	I 5a: some caves near Nimis, Lusevera, and Pulfero (ca. 25 km N and NE of Udine) I 7a: cave Smoganica (Most na Soči); and cave Podloška jama (Grgar, 70 km W of Ljubljana)	A C
10	caeca meridionalis Deeleman, 1971	I 7c: some localities ca. 70 km SW — 90 km SSW of Zagreb	C
11	monstruosa Sket, 1970	I 7d: cave Majdan, Lušci polje (60 km W of Banja Luka)	C
	undefined taxa	I 7d: some localities on the line Prijedor — Travnik, and Bregava spring (Stolac)	T
	sg. **Typhlosphaeroma** Racovitza, 1910		
12	bericum bericum (Fabiani, 1901)	I 5a: many localities in Colli Berici (S of Vicenza) and in Verona — Vicenza — Monti Lessini	A
13	bericum hadzii Sket, 1964	I 7b: cave Škulja Sitnice (Žudetići, 30 km NNE Rovinj), and ? Plomin (45 km E of Rovinj)	C

14	bericum ssp.	I 7b: some localities in the northern part of Istra Peninsula	C, T, springs in flysch
15	boldorii boldorii Brian, 1931	I 5a: some localities NW of Brescia (Botticino, Iseo, Lumezzana, Neboli)	A
16	boldorii bergomas Arcangeli, 1935	I 5a: cave Grotta del Salto (Valle Imagna); cave Büs del Boter (Caprino Bergamasco, WNW of Bergamo)	A
17	boldorii ssp.	I 5a: cave Büs della Fous (6 km N of Meduno, 40 km NW of Udine)	C
17a	lavalensis Stoch, 1984	I 5a: Grotta di La Val (Clauzetto, ca 30 km NW of Udine)	A
18	matjasici Sket, 1964	I 7d: cave Obod (Fatničko polje, 45 km NNE of Dubrovnik)	C
19	pavani Arcangeli, 1941	I 5a: some localities between Como (Erba) and Lugano (Italy — Switzerland) I 5a: Moščenice (= Moschenizze), springs; springs in Lago di Pietrarossa (near Monfalcone, ca 25 km NW of Trieste)	A T
20	racovitzai racovitzai Strouhal, 1928	I 7a: many localities W, SW, and S of Ljubljana (up to borders of district); I 7c: cave at Kupa Spring (in NW).	C, T, B, D C
21	racovitzai conopyge Sket, 1964	I 7a (SE corner of district): cave Stubica (Bojanci); and cave Bezgovka (Desinec)	C
22	racovitzai karamani Sket, 1959	I 7a: many localities in the Krka system, ESE of Ljubljana (except for area of "23"); near Anže (Brestanica, 40 km WNW of Zagreb)	C, T
23	racovitzai pseudoberica Sket, 1964	I 7a: cave Jama v Luknji (Novo Mesto), cave Globočica (Kostanjevica, 25 km ENE of Novo Mesto), cave Mokriška jama (Brežice)	C
	undefined taxa	I 7c: some localities in the NE corner of the district; I 7d: opposite to "I 7c"; I 7f: along the upper reach of Zeta River	C, T
	sg. **Microlistra** Racovitza, 1929		
24	bolei bolei Sket, 1960	I 7a: cave Stolbe (Črnomelj, 70 km SE of Ljubljana)	C
25	bolei brevispinosa Sket, 1982	I 7a: cave Jama v kamnolomu (Vinica, 90 km SE of Ljubljana)	C
26	calopyge Sket, 1982	I 7a: Kronovo (Novo Mesto, 60 km WSW of Ljubljana)	I (artesian carstic water from drillings, slightly thermal 16-18°C)
27	pretneri pretneri Sket, 1964	I 7c: cave Pećina kod Vrane (90 km NW of Split)	C

28	pretneri spinulosa Sket, 1965	I 7c: some localities near Šibenik, Knin, and Žegar (along Krka and Zrmanja rivers); Punta Križa in southern part of Cres Island)	C, T
29	schottlaenderi Stammer, 1930	I 5a: Moščenice (= Moschenizze), springs; springs in Lago di Pietrarossa (near Monfalcone, ca 25 km NW Trieste-Trst)	T
30	sketi (Deeleman, 1971)	I 7c: cave near Pećina selo (Ličko Lešće, 125 km SSW of Zagreb)	C
31	spinosa (Racovitza, 1929)	I 7a: some localities 25-45 km SE of Ljubljana (upper Krka system)	T
32	spinosissima (Racovitza, 1929)	I 7a: some localities near Vrhnika and Planina (20-30 km SW of Ljubljana, Ljubljanica system)	C, D, T
	sg. **Monolistrella** Sket, 1964		
33	velkovrhi Sket, 1960	I 7a: cave Jama v Luknji (Novo Mesto) and cave Stolbe (Črnomelj); I 7c: cave Vrlovka (Kamanje, near Ozalj), and cave Kukuruzovićeva pećina (Vaganac, near Rakovica)	C
	Caecosphaeroma Dollfus, 1896		
	sg. **Caecosphaeroma** Dollfus, 1896		
34	virei Dollfus, 1896	I 4 (in Jura Franche): Grotte de Baume-les-Messieurs (Dept. Jura), Grotte des Faux Monnayeurs (Mouthiers, Dept. Doubs), and Grotte de Sous-Roche and Trou des Voleurs (Poncin, Dept. Ain)	A
	sg. **Vireia** Viré, 1903		
35	burgundum burgundum Dollfus, 1898	I 4: in NW parts (up to Dept. Saône-et-Loire in S); II 3: along NW part of boundary to "I 4", from Dept. Yonne in SW to fr.-belg.-lux. frontiers in NE	A, T, I
36	burgundum rupisfucaldi Hubault, 1934	II 3: some localities in SW parts (Depts. Lot, Deux-Sèvres, Dordogne, Charente)	A, T

NOTE

17 & 17a: both taxa seem to be at least conspecific.