CAVERNICOLOUS DIPLOPODA OF ROMANIA

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The study of the Diplopoda from the Romanian caves began in 1896 and, even from the first investigations made by Verhoeff, remarkable species and types of new families (*Trichopolydesmus, Anthroleucosoma*) were discovered. Later on, the pace of the investigations quickened from 1956 when Tr. Ceuca began the study of the "Biospeologica" collection and the researchers of the "Emile Racovitza" Speleological Institute began the systematic study of the Romanian caves. Up to the present, 56 species have been collected from the caves, 20 species being true troglobitic species. The authors present a list of the species found in caves and a biogeographic analysis of the troglobitic lineages.

1. INTRODUCTION

The founder of modern biospeology, EMILE RACOVITZA pointed out (1912, 1926) that taxonomy should be "an applied phylogeny" and there can be no other kind of taxonomy than that based on phylogeny and geographic repartition. Racovitza (1912) considered the species as "une colonie isolée de consanguins" ("an isolated colony of consanguines") that should be regarded as a morphological, historical and geographical entity. The closest fellow-worker of Racovitza, the French scientist RENÉ JEANNEL, argued (1942) in his vast work that biogeography should be understood as a historical science based on detailed phylogenetical studies. However, as A. VANDEL showed (1952), not all the animal groups present the same importance for the biogeographical studies. Ancient groups, with a great morphological stability, a low dispersion capacity and with narrow ecological requirements are the groups able to give the most important data. In our opinion, the Diplopoda certainly correspond to these premises.

Within the Myriapodes, the Diplopodes represent the most diversified class; it is also the class with the largest number of species. There are four classes within the Myriapodes (Diplopoda, Pauropoda, Symphyla and Chilopoda), representing terrestrial Arthropods, with mandible (Mandibulata), tracheal breathing (Tracheata), uniramous appendages (Uniramia), a large number of legs and lacking the second pair of antennas (Atelocerata). Some authors consider the Myriapoda as a superclass, a subphylum or even as a phylum, but for most of them Myriapoda is not a monophyletic group. Actually, the Chilopoda are distinct from the other classes within the Myriapodes through their maxilipedes, derived from the first pair of legs

and through the position of the genital orifices, which are situated in the posterior part of the body (Opisthogoneata), just like the Insects. The Diplopodes, Pauropodes and Symphyles have their genital orifices in the anterior part of the body (Progoneata). On the other hand, KRAUS O. and KRAUS M. (1996) regard Chilopoda as a sister-group of all the other Tracheata, named Labiophora (Progoneata + Insecta). The Diplopodes are closer to the Pauropodes because they have only two pairs of mouth parts (Dignatha), but are different by their double segments, each of them bearing two pairs of legs (diplosegments).

The Diplopodes, as an ancient group of strictly terrestrial Arthropods, with low spreading possibilities and narrow ecological requirements, represent a very valuable material for the biogeographical studies.

A. VANDEL (1969) showed that the biogeographical conclusions resulting from the study of the terrestrial isopods agree with those resulting from the study of the Diplopoda. This resemblance results from the similar way of life and spreading possibilities of the two groups, both being excelent biogeographical indicators.

2. THE DIPLOPOD FAUNA OF ROMANIA

The Diplopod fauna of Romania is relatively well-known, as a result of the papers published especially by LATZEL, DADAY, VERHOEFF, ATTEMS, LOKSA, CEUCA and TABACARU.

In the Diplopod fauna of Romania are known 162 species, belonging to 59 genera, 18 families and 7 orders. Among the orders of the Class Diplopoda found in the fauna of Europe, the fauna of Romania lacks only the order Platydesmida while the order Callipodida is represented by only two species (*Callipodella fasciata* and *Dorypetalum degenerans*); these two species mark in South-Western Romania the Northern limit of the spreading of their order.

The number of Diplopoda species found in Romania exceeds the number of species from other European countries: 51 species in Britain and Iceland (BARBER & JONES, 1996), 127 species in Switzerland (PEDROLI–CHRISTEN, 1996), 160 species in Germany (SCHUBART, 1934), 81 species in Poland (STOJALOWSKA & STAREGA, 1974), 110 species in Bulgaria (BERON, 1994), 70 species in Serbia, 59 species in Montenegro and 59 species in Macedonia (ĆURČIĆ, MAKAROV, STANKOVIĆ-JOVANOVIĆ, 2002). But, the number of Diplopoda species found in France, 282 species (Geoffroy, 1996) and in Italy, 470 species (STRASSER & MINELLI, 1984) clearly exceeds the number of species from Romania.

However, the real number of Diplopoda species living in Romania is greater than the known number since many regions are less investigated from a faunistic point of view and recent, sporadical researches led to the discovery of new species like *Stenophyllum tabacarui* Vănoaica, 2003.

Analyzing the order repartition of the Diplopodes from the Romanian fauna, we present the following table:

Order	Families	Genera	Endemisms	Species	Endemisms
Polyxenida	2	2	–	3	–
Glomerida	2	2	–	16	7
Polydesmida	3	7	3	34	15
Craspedosomida	6	17	7	40	26
Callipodida	2	2	–	2	–
Iulida	2	28	6	65	13
Polyzonida	1	1	–	2	1
Total: 7	18	59	16	162	62

In our view, the Diplopod fauna of Romania has two main features:

1. The existence of a large number of endemisms related to the Carpathian system (there are 17 endemic genera: *Trichopolydesmus, Napocodesmus, Banatodesmus, Entomobielzia, Heterobraueria, Paraporatia, Bucovinosoma, Romanosoma, Dacosoma, Anthroleucosoma, Stenophyllum, Parastenophyllum, Rumaniulus, Lamellotyphlus, Banatoiulus, Geopachyiulus* and *Micropachyiulus*. Also, the large majority of the endemic species were described from the Carpathians).

2. The existence in Southern Romania (especially in the Banat–Oltenia area and in Dobrogea) of numerous meridional elements (Mediterranean and Sub-Mediterranean) that have here their Northern limit (*Lophoproctus lucidus, Polydesmus collaris, Polydesmus renschi, Polydesmus mediterraneus valachicus, Brachydesmus troglobius, Brachydesmus polydesmoides, Brachydesmus jubatus, Melogona broelemanni, Callipodella fasciata, Dorypetalum degenerans, Leptoiulus trilineatus, Megaphyllum bosniensis, Megaphyllum transsilvanicus, Megaphyllum lictor, Pachyiulus hungaricus, Pachyiulus varius*).

On the whole, the Diplopod fauna of Romania is dominated by the Central-European elements, followed by the Sub-Mediterranean elements.

The numerous elements differentiated on the Romanian territory, that may be named Dacian elements (a name less used by the zoologists but used by the botanists from a long time) also belong to lineages with a Central-European and Mediterranean origin. The majority of these elements are endemical for Romania but there are also Dacian elements whose spreading exceeds the Romanian territory. However, the large number of Dacian elements among the Diplopoda represents one more argument for the existence of a Dacian province in the framework of the Central-European zoogeographical domain, Palearctic subregion, Holarctic region.

3. BIOGEOGRAPHICAL SIGNIFICANCE OF THE CAVERNICOLOUS DIPLOPODES

The study of the spreading of the different groups of cavernicolous invertebrates proved to be very significant for the historical biogeography research.

In 1907, EMILE RACOVITZA, in his study named «Essai sur les problèmes biospéologiques», study considered as "the birth certificate of biospeleology" (XAVIER BELES in Camacho, 1992, p. 2), says: "the old forms are not rare in the subterranean domain and they are often the relicts of a group that now has vanished from the area, but which used to have a larger repartition". But, in the same study Racovitza showed that "...we can not approach the chorological study of the cavernicoles taken as a whole; because the subterranean faunas and floras are derived faunas and floras formed by the gathering of a number of beings with very different ages, origins and immigration ages. Therefore we shall have to work out special chorologies for each homogeneous group, which will not be less interesting". (1907, p. 459).

In the analysis made by RACOVITZA (1926) on the results of the revisions published in *Biospeologica*, he considered as a first result the discovery through phylogenetical studies of a great number of "*living fossils*" and the proof for a certain number of groups, that all troglobitic species are relicts, the majority of them very ancient.

In his book "Les Fossiles vivants des cavernes", R. JEANNEL (1943) distinguishes two types of troglobionts: recent and ancient troglobionts. Jeannel regards the ancient troglobionts (named by him *fossiles vivants*) as survivors of some lineages extinct from the epigean fauna with a special phylogenetical and paleogeographical importance.

As the large majority of the Diplopoda are hydrophilous and cryptophilous, it is often difficult to establish if a species is troglobitic, troglophilous or trogloxenous, as MAURIÈS (1994) pointed out. In our opinion a detailed study of the diplopod fauna from a region may lead to the discovery of the species strictly adapted to the subterranean domain, so strictly confined and without close relatives in the epigean fauna of the region. These elements are true relicts and the study of their phylogenetic affinities provides important data about the history of the group and the history of the regions fauna.

4. A BRIEF HISTORY OF THE INVESTIGATIONS CONCERNING THE CAVERNICOLOUS DIPLOPODS OF ROMANIA

1896 VERHOEFF collected and described from Peştera Hoţilor (peştera = cave) de la Băile Herculane (Räuberhöhle bei Herculesbad) the species *Polydesmus spelaeorum*; later on, Verhoeff (1925) and also Attems (1940) considered this species as a subspecies of *P. subscabratus*, but, in our opinion this was about an abnormal individual.

1897 VERHOEFF mentioned from Flintschhöhle, the following species: *Heteroporatia transsilvanicum*, *Iulus luridus*, *Gervaisia costata*; from Räuberhöhle bei Herculesbad, he mentioned *Iulus strictus*.

1898 VERHOEFF collected and described from Peştera Hoţilor de la Băile Herculane the genus *Trichopolydesmus* with the species *T. eremitis*, and later he established for this species a subfamily (1910) and a family (1941) – Trichopolydesmidae Verhoeff 1910.

1899 VERHOEFF collected and described from Peştera Mare de la Soroniţe (Tatarzy – Höhle) the genus *Anthroleucosoma* with the species *A. banaticum* for which he established the tribe Anthroleucosomini and later a subfamily (1900) and a family (1909) – Anthroleucosomidae Verhoeff 1899.

1914 BRÖLEMANN described the genus *Spelaeogervaisia* with the species *S. jonescui*, on the basis of the material collected by C.N. Ionescu, professor at the University of Iaşi, who made some speological researches in the Meridionali Carpathians.

1956 CEUCA described the genus *Spelaeoblaniulus* with the species *S. serbani* on the basis of the material collected by M. Şerban in some caves from the Apuseni Mountains.

1958 TABACARU described the troglobitic species *Gervaisia orghidani* found in a cave from the Cerna Basin and, studying the species *S. jonescui* Brölemann 1914, a species regarded by VERHOEFF (1915) as synonymous or as very close to *Gervaisia costata* Waga, 1859, he showed that this is a troglobitic species separate from *G. costata*.

1958 NEGREA and TABACARU described the species *Polydesmus oltenicus* and *P. microcomplanatus* found in caves from Oltenia and *P. dumitrescui* from a cave located in the Apuseni Mountains.

1958 CEUCA presented a study on the Diplopodes collected from Romanian caves between 1918 and 1930 (Diplopodes belonging to the Biospeologica Collection, series 7 and 8) and, taking advantage of this opportunity, he redescribed the species *Trichopolydesmus eremitis* Verhoeff, 1898.

1959 CEUCA described from the Biospeologica Collection the species *Brachydesmus jeanneli* from caves located in the Banat Mountains and *Polydesmus oltenicus* and *P. hypogeus* from caves situated in Northern Oltenia. In the same year, Ceuca, in a note, shows that *Br. jeanneli* is a subspecies of *Br. troglobius*.

1960 TABACARU described three new species of the genus *Gervaisia*: *G. racovitzai* and *G. spelaea* collected in caves from Northern Oltenia and *G. dobrogica* from Peştera Limanu (Dobrogea).

1961 CEUCA described the species *Gervaisia biharica* from Peştera Ferice (Biospeologica Collection) and the subspecies *Spelaeoblaniulus serbani unilineatus* collected by E. Cristea from Peştera Vântului (Apuseni Mountains).

1961 TABACARU and NEGREA published a revision of the genus *Polydesmus* from Romania, establishing in the same time the synonimies: *P. hypogeus* Ceuca 1959 = *Polydesmus oltenicus* Negrea et Tabacaru 1958, *P. oltenicus* Ceuca 1959 = *P. microcomplanatus* Negrea et Tabacaru 1958.

1962 STRASSER published a monographic study of the tribe Typhloiulini; with this occasion, he studied a number of specimens of *Spelaeoblaniulus serbani* Ceuca and he showed that this species belongs to the genus *Typhloiulus*.

1963 TABACARU published a study on the postembryonic development of three troglobitic species of *Gervaisia* (this paper won the "Emile Racovitza" Award of the Romanian Academy).

1964 CEUCA described the species *Anthroleucosoma (Heteranthroleucosoma) spelaea* collected in a cave from Cernişoarei Valley (Biospeologica Collection, legit by P.A. CHAPPUIS).

1964 DANCĂU and TABACARU published a zoogeographical study on the troglobitic fauna of Oltenia and Banat and mentioned numerous new locations for the troglobitic species of diplopods.

1965 TABACARU described the subspecies *Orobainosoma hungaricum orientale* who was found in many caves from Oltenia and Banat and studies its postembryonic development.

1966 TABACARU published a systematic and zoogeographic note on the diplopod fauna of Dogrogea, where he also described the troglobitic species *Apfelbeckiella dobrogica*.

1967 CEUCA described the species *Romanosoma cavernicola* based on the material collected by M. Şerban from Avenul de la Zalion (Maramureşului Mountains).

1968 TABACARU published a note on the origins and history of the repartition of the troglobitic diplopods of Romania (paper presented at the Romanian Academy Centennial – 1966).

1968 TABACARU published a monographical study on the troglobitic species of the family Anthroleucosomidae, where he also described the genus *Dacosoma* with the species *D. motasi*, and the species *Bulgarosoma ocellatum*.

1969 TABACARU published a note on the repartition of the troglobitic diplopods from the Balkanic Peninsula and the entire Carpathian chain (paper presented at the International Congress of Speleology, Lublijana, 1965).

1969 DANCĂU and TABACARU published a paper concerning the origins and the spreading of the cavernicolous fauna from the Meridionali Carpathians, quoting also the species of Diplopoda (paper presented at the International Congress of Speleology, Lublijana, 1965).

1970 TABACARU published a note (based mainly on the troglobitic species) regarding the origins of the diplopod fauna of the Carpathians (paper presented at the First International Congress of Myriapodology, Paris, 1968).

1970 TABACARU published a study on the repartition of the European troglobitic species of diplopods (Emile Racovitza Cenntenial, Bucureşti–Cluj, 1968).

1975 TABACARU described the species *Napocodesmus florentzae* collected in a cave from Northern Oltenia.

1976 TABACARU described the species *Typhloiulus mehedintzensis* found in caves from the Mehedinţi Mountains and Plateau, establishing for this species a new subgenus *Lamellotyphlus*.

1979–1983 TABACARU published a zoogeographic analysis of the Diplopoda from the South-Eastern Europe.

1980 TABACARU described the species *Trichopolydesmus jeanneli* found in caves from Banat, establishing for this species a new subgenus *Banatodesmus*.

1983 MAURIÈS considered the subgenus *Banatodesmus* Tabacaru, 1980 as a distinct genus belonging to the group that he named "Cryptodesmides trichopolydesmiformes".

1985 TABACARU described the genus *Banatoiulus* with the species *B. troglobius* based on the material collected by A. and Şt. Negrea in a cave from Banatului Mountains.

1987 ENGHOFF considerered the subgenus *Lamellotyphlus* Tabacaru, 1976 as a distinct genus belonging to the subfamily Oncoiulinae; in the same subfamily was included the genus *Banatoiulus* Tabacaru, 1985.

1989–1990 TABACARU published a revision of the genus *Trachysphaera* Heller, 1858 from the Romanian caves, where he mentioned the repartition of all the species found in caves (excepting the wide-spread species *T. costata*). He also described two new subspecies: *T. jonescui isvernae* and *T. jonescui tismanae*.

2000 ČURČIČ and MAKAROV established for the species *Bulgarosoma ocellatum* Tabacaru, 1968 the genus *Banatosoma*.

2002 MAKAROV, MITIĆ and ČURČIČ described from Serbia a new species of the genus *Lamellothyphlus* Tabacaru, 1976, regarding this genus along with *Banatoiulus* as being closer to the Typhloiulini than to the Oncoiulini.

2003 VĂNOAICA described a new species of the genus *Stenophyllum*. *S. tabacarui* collected in a small cave from Vârghişului Mountains.

5. INVENTORY OF THE DIPLOPODA FOUND IN THE ROMANIAN CAVES

Our classification uses the phylogenetic scheme proposed by ENGHOFF (1984, 1990) and takes into account the classifications made by VERHOEFF (1926–1932), ATTEMS (1926) and BRÖLEMANN (1935). Regarding the nomenclature, we used JEEKEL (1970) and HOFFMAN (1979).

CLASS DIPLOPODA Blainville in Gervais, 1844

SUBCLASS PENICILLATA Latreille, 1827
(= Pselaphognatha Latzel, 1844)

Order Polyxenida Lucas, 1840
(= Schizocephala Verhoeff, 1926)

FAMILY POLYXENIDAE Lucas, 1840

Polyxenus lagurus (Linnaeus, 1758) – trogloxene, widespread in Europa and Northern Africa, rarely found in the caves of Dobrogea. Central Dobrogea: Peştera Cheia, Peştera Casian and Peştera Gura Dobrogei; Southern Dobrogea: Peştera de la Limanu.

FAMILY LOPHOPROCTIDAE Silvestri, 1897

Lophoproctus lucidus Chalande, 1888 – trogloxene, Mediterranean species (in Romania found only in Dobrogea, rarely found in caves).Central Dobrogea: Peştera Gura Dobrogei.

SUBCLASS CHILOGNATHA Latreille (1802–1803)

INFRACLASS PENTAZONIA Brandt, 1840
(= Opisthandria Verhoeff, 1894)

Superorder Oniscomorpha Pocock, 1887

Order Glomerida Leach, 1815
(= Plesiocerata Verhoeff, 1910)

FAMILY GLOMERIDAE Leach, 1815

Glomeris pustulata (Fabricius, 1781) – trogloxene or maybe troglophilous (frequent in the caves of Banat). Munţii Cernei: Peştera lui Adam (Avenul cu Aburi). Cazanele Mari: Peştera Gura Ponicovei. Munţii Aninei: Peştera Ponor-Uscată. The species is known from Central Europe.

FAMILY TRACHYSPHAERIDAE Strasser, 1965
(= Gervaisiidae Cook, 1895)

Trachysphaera costata (Waga, 1858) (= *Gervaisia costata* Waga, 1858) – troglophilous, spread in Central and Eastern Europe (frequent in caves all over the country). Carpaţii Orientali: Peştera Toşorog, Peşterile nr. 12, 14 (Peştera Mare de la Mereşti), 44 and 60 from Cheile Vârghişului, Carpaţii de Curbură: Peştera din Cerneadeal, Peştera Fundata. Munţii Parâng: Peştera de la Ponorici, Peştera Ponorici – Cioclovina cu Apă, Pestera-aven din Şesul Leoardei, Peştera de la Botuşi, Peştera Cetatea Bolii. Munţii Retezat: Peştera Gura Cetăţii, Peştera de la Dodoconi. Munţii

Vâlcan: Peştera Pârlazului, Peştera Cornetul Vârcanilor, Peştera Crovul cu Ferigă de la Marcoane, Peştera de la Gura Plaiului, Peştera nr. 4 from Cloşani, Peştera Cloşani, Peştera Vacilor de la Cloşani, Peşterile no. 2, 3 din Valea Motrului Sec, Peşterile no. 6, 11, 12, 15 din Valea Lupşei. Munţii Mehedinţi: Peştera din Furca Văii, Peştera de la Babie. Podişul Mehedinţi: Peştera de la Toi (Peştera din Ogaşul Peşterii; Peştera din Valea Dragoboscei), Peştera Topolniţa, Peştera Bulba, Peştera Gramei, Peştera Mare de la Balta, Peştera de la Criva. Munţii Godeanu: Peştera nr. 1 din Bazinul Cernei (Peştera nr. 1 din Ciuceava Prihodu Mare), Peştera nr. 10 din Bazinul Cernei (Peştera nr. 10 din Ciuceava Chicerii), Peştera nr. 36 din Bazinul Cernei (Peştera lui Ogaşul lui Hârţăucă), Peştera nr. 37 din Bazinul Cernei (Peştera lui Lazu Vişescu), Peştera nr. 39 din Bazinul Cernei, Peştera nr. 64 din Bazinul Cernei (P. lui Lascăr Căiniceanu), Peştera nr. 69 din Bazinul Cernei, Peşteri de la Corcoaia, Peştera no. 3 de la Prisaca Şchiopului, Peşteri de la Inelet, Peştera de la Balta Cerbului, Peştera Hoţilor de la Băile Herculane. Munţii Banatului: Peştera no. 2 de la Gura Ponicovei (Peştera din Cuina Turcului), Peştera Iasânoca, Peştera Veterani, Peştera Gaura Ponicovei, Peştera no. 2 de la Gura Ponicovei, Peştera din Cleantu Pânzei, Peştera Gaura Haiducească (Moldova Nouă), Peştera Gaura Porcariului, Peştera de la Lacul Dracului, Peştera Găurile lui Miloi, Peştera de la Valee, Peştera Socolovăţ, Peştera Bohui, Peştera de după Cârşă, Peştera Cerbului, Peştera Popovaţ, Peştera Racoviţă, Peştera cu Fereastră, Peştera Liliecilor, Peştera Stârnic, Peştera cu Oase de la Stârnic, Peştera Comarnic, Peştera Gaura Pârşului de la Capul Baciului, Peştera Gaura de la Capul Baciului, Peştera Gaura Turcului. Munţii Metaliferi: Peştera din Valea Bibarţului (Peştera din Valea Ghibarţului; Şura de Piatră). Munţii Pădurea Craiului: Peştera Seacă de la Pusta Călăţea, Peştera Vântului.

Trachysphaera schmidtii Heller, 1858 (*Gervaisia noduligera* Verhoeff, 1906) – troglophilous, Central-Southern Europe species, found in Romania only in Banat. Munţii Banatului: Peştera Gaura Haiducească (Moldova Nouă), Peştera Găurile lui Miloi I and II, Peştera Veterani. (Cazanele Mari).

Trachysphaera jonescui jonescui (Brolemann, 1914) – troglobitic, endemical in caves from Podisul Mehedinţi and the Superior Basin of Cerna. Podişul Mehedinţi: Peştera de la Vârful Înalt, Peştera de la Babie, Avenul-Peştera de la Pietre, Peştera Bulba, Peştera de la Podul Natural. Caves from the Superior Basin of Cerna Valley: Peştera de lângă Surpătură (Peştera no. 17 din Bazinul Cernei), Peştera Labirint din Ciuceava Neagră, Peşterile no. 1 (Peştera no. 1 din Ciuceava Prihodu Mare), no. 16 (Peştera no.3 din Ciuceava Prihodu Mare), no. 3 (Peştera no. 2 din Ciuceava Frasinului), no. 4 (Peştera no. 3 din Ciuceava Frasinului), no. 5 (Peştera no. 4 din Ciuceava Frasinului), no. 6 (Peştera no.5 din Ciuceava Frasinului), no. 21 (Peştera no. 6 din Ciuceava Frasinului), no. 24 (Peştera no. 9 din Ciuceava Frasinului), no. 47 (Peştera no. 12 din Ciuceava Frasinului), no. 9 (Peştera no. 3 din Ciuceava Chicerii), no. 10 (Peştera no. 4 din Ciuceava Chicerii).

T. jonescui isvernae Tabacaru, 1989 – troglobitic, endemical in Peştera Izverna.

T. jonescui tismanae Tabacaru, 1989 – troglobitic, endemical in Peştera de la Gura Plaiului and Peştera de sub Mănăstirea Tismana.

Trachysphaera orghidani (Tabacaru, 1958) – troglobitic, endemical in caves from the Middle Basin of Cernei, Munţii Mehedinţi, Munţii Vâlcan. Middle Basin of Cerna Valley: Peştera no. 1 de la Sălitrari, Peştera no. 2 de la Sălitrari, Peştera no. 2 de la Prisaca lui Şchiopu. Munţii Mehedinţi: Peştera de la Furca Vaii (Peştera da la Cracu cu Plopi), Peştera din Cornetul Văii lui Dragu, Peştera din Ogaşul Peşterii (Peştera cu Apă de la Orzeşti), Peştera Vacilor din Steiul Orzeştilor, Peşterile no. 3, 4, 5 din Steiul Orzeştilor, Peşterile no. 2, 12, 14, 16 din Valea Lupşei, Avenul din Piatra Scrisă, Peşterile no. 4, 8, 9, 10, 11 din Valea Motrului Sec, Peşterile no. 1 and no. 2 (a lui Arion Arjoc) din Sohodoalele Mici, Peştera Lazului, Peştera din Poiana Lazului (Peştera lui Mihai Arjoc), Peştera aven din Foeroaga Îngustă, Peştera cu Apa din Piatra Mare a Cloşanilor (Peştera Hoţească din Piatra Mare a Cloşanilor), Peşterile no. 2, 4, 5 (Peştera – Tunel de la Cloşani), 6, 14 (Peştera de sub Peştera – Tunel de la Cloşani), Peştera Cloşani, Peştera – aven din Cioaca Brebeneilor, Peştera Vacilor de la Cloşani. Munţii Vâlcan: Peştera de la Steiul lui Vintilă din Valea Calului (Peştera Hoţească de pe Valea Calului), Peştera din Vârful Lacului (Peştera de la Lăcău), Peştera din Cornetul Vârcanilor, Peştera Mare din Piatra Pocruia (Peştera de la Piatra Pocruii), Peştera din Dealul Ruschiului (Peştera din Poiana Ruşchiului).

Trachysphaera racovitzai (Tabacaru, 1860) – troglobitic, endemical for caves from Bistriţa – Stogu karstic region (Munţii Căpăţânii). Munţii Căpăţânii: Peşterile no. 1, 2, 3 from Cheile Comarnici, Peştera Liliecilor de la Mănăstirea Bistriţa.

Trachysphaera spelaea (Tabacaru, 1960) – troglobitic, endemical for caves from the Polovragi – Cernădie karstic region from Munţii Parâng and Munţii Căpăţânii: Peştera Muierii de la Baia de Fier from Cheile Gălbenului and Peştera de la Polovragi from Cheile Oltetului.

Trachysphaera dobrogica (Tabacaru, 1960) – troglobitic, endemical in caves from the South-Eastern Dobrogea: Peştera de la Limanu, Peştera Hoţilor de la Mangalia.

Trachysphaera bihariça (Ceuca, 1961) – troglobitic, endemical in Peştera de la Perice (Munţii Bihorului).

INFRACLASS HELMINTHOMORPHA Pocock, 1887
(= Proterandria Verhoeff, 1894)

Subterclass Colobognatha Brandt, 1834

Order Polyzoniida Gervais, 1844

FAMILY POLYZONIIDAE Gervais, 1844

Polyzonium germanicum Brandt, 1837 – trogloxene, widespread in Europe, found in Banat in Peştera din Cariera Nouă.

Subterclass Eugnatha Attems, 1898

Superorder Merocheta Cook, 1895
(= Proterospermophora, Verhoeff, 1913)

Order Polydesmida Leach, 1815

Suborder Paradoxosomatidea Hoffman, 1967

FAMILY PARADOXOSOMATIDAE Daday, 1889
(= Strongylosomatidae Cook, 1895)

Strongylosoma stigmatosum (Eickwald, 1830) (= *S. pallipes* Karlinski, 1883) – trogloxene, maybe troglophilous, widespread in Europe, often found in caves from Banat. Munţii Banatului: Peştera cu Apă de sub Socolovaţ, Peştera din Drumul Prolazului, Peştera Comarnic, Peştera Gaura de la Capul Baciului, Peştera Gaura Pârşului de la Capul Baciului. Carpaţii Orientali: Peştera no. 30 de la Cheile Vârghişului.

Strongylosoma jaqueti Verhoeff, 1898 – troglophilous, endemic for Romania; found in a drill nearby Peştera de la Movile.

Suborder Polydesmidea Leach, 1815

Superfamily Polydesmoidea Leach, 1815

FAMILY POLYDESMIDAE Leach, 1815

Polydesmus (Polydesmus) complanatus (Linnaeus, 1761) – trogloxene, widespread in Central and Northern Europe, often found in caves from Munţii Banatului (Peştera Gaura Pârşului de la Capul Baciului, Peştera Gaura Pârşului, Peştera Padina lui Matei) and Carpaţii Meridionali (Peştera de la Gura Cetăţii).

Polydesmus (Polydesmus) montanus Daday, 1889 – troglophilous, spread along the Carpathian chain, frequently found in numerous populations in caves from Munţii Apuseni (Peştera de la Vadul Crişului, Peştera Cugliş) and Carpaţii Orientali (Peştera din Valea cu Paşi, Peşterile no. 7, 18, 33, 35 din Cheile Vârghişului)

Polydesmus (Polydesmus) microcomplanatus Negrea et Tabacaru, 1958 (= *Polydesmus oltenicus* Ceuca, 1959) – probably troglobitic, endemical in caves from Northern Oltenia. Munţii Vâlcan: Peştera Laptelui din Cheile Runcului, Peştera II de la Mănăstirea Tismana.

Polydesmus (Nomarchus) subscabratus Latzel, 1884 (=*Polydesmus banaticus* Daday, 1889; *P. spelaeorum* Verhoeff, 1896) – trogloxene, spread in Serbia and South – Western Romania, found in caves from Banat and Northern Oltenia. Munţii Vâlcan: Peştera Picuel. Munţii Cernei: Peştera Hoţilor de la Băile Herculane. Munţii Mehedinţi: Peştera Mare de la Soronişte. Munţii Banatului:

Peştera de la Voinicovăţ, Peştera Socolovăţ (Mostnic), Peştera Gaura Haiducească de laMoldova Nouă.

Polydesmus (Nomarchus) schaessburgensis Verhoeff, 1889 – trogloxene, spread in Romania, Sebia and Southern Hungary. Found in Peştera Gura Cetăţii (Munţii Retezat).

Polydesmus (Nomarchus) renschi Schubart, 1934 – trogloxene, spread only in Romania and Bulgaria; found in caves from Oltenia: Peştera nr. 2 from Cloşani, Peştera nr. 9 and 12 from Valea Lupşei.

Polydesmus (Spanobrachium) collaris C. L. Koch, 1847 – trogloxene, spread in Central Europe and the Balcanic Peninsula, found in caves from Munţii Banatului: Peştera Gaura Cornii, Peştera Mică de la Lacul Dracului, Peştera de la Izvorul Înfundat.

Polydesmus (Spanobrachium) oltenicus Negrea et Tabacaru, 1958 (= *Polydesmus hypogeus* Ceuca, 1959) – troglobitic, endemical in caves from Oltenia: Munţii Vâlcan: Peştera din Vârful Lacului (Peştera de la Lăcău. Munţii Mehedinţi: Peştera Cloşani, Peştera Vacilor de la Cloşani, Peştera de la Crovul cu Apă (Avenul din Poteca). Podişul Mehedinţi: Peştera de la Varful Înalt. Munţii Godeanu: Peştera Babei din Ciuceava Chicerii.

Polydesmus (Spanobrachium) dumitrescui Negrea et Tabacaru, 1958 – probably troglophilous. Endemical in Munţii Pădurea Craiului: Peştera Igriţa.

Brachydesmus (Brachydesmus) troglobius Daday, 1889 (= *Brachydesmus jeanneli* Ceuca, 1959) – troglophilous, spread in Serbia, Slovenia and Croatia; in Romania found only in Banat; frequent in caves from Munţii Banatului: Peştera Românesti, Peştera lui Clemente, Peştera no. 2 de la Gura Ponicovei, Peştera de la Veterani, Peştera Stârnic, Peştera cu Oase de la Stârnic, Peştera Buhui, Peştera Comarnic, Peştera Popovăţ, Peştera Racoviţă, Peştera de după Cârşă, Peştera Vraşka, Peştera no. 6 din Cureaciţa.

Brachydesmus (Stylobrachydesmus) polydesmoides Verhoeff, 1895, trogloxene, spread in Serbia, Montenegro and Bulgaria. Munţii Banatului: Peştera Mică de langă Peştera lui Vât.

Brachydesmus (Stylobrachydesmus) daday frondicola Verhoeff, 1898, troglophilous, known from Bulgaria and Romania: in Peştera de la Crovul cu Apă (Peştera Mică de sub Varful Inalt) from Oltenia (Podişul Mehedinţi).

Brachydesmus (Lophobrachydesmus) jubatus Attems, 1907 – trogloxene, known from Crimeea and Dobrogea, found in Peştera Hoţilor from the shore of Limanu Lake (Mangalia), also in a drill nearby Peştera de la Movile.

Brachydesmus (Eubrachydesmus) superus Latzel, 1884 – troglophilous, widespread in Europe, found in one cave from Munţii Apuseni: Peştera de la Gălăşeni.

Superfamily Trichopolydesmoidea Verhoeff, 1910

FAMILY TRICHOPOLYDESMIDAE Verhoeff, 1910

Trichopolydesmus eremitis Verhoeff, 1898 – troglobitic, endemical in caves from Valea Cernei and Northern Oltenia (Munţii Mehedinţi). Valea Cernei: Peştera nr. 40 de la Ineleţ, Peştera Hoţilor de la Băile Herculane. Munţii Mehedinţi: Peştera Cicioara, Peştera Cornetul Vârcanilor, Peştera Cloşani, Peştera Vacilor de la Cloşani, Peştera din Poiana Lazului (Peştera lui Mihai Arjoc).

Banatodesmus jeanneli Tabacaru, 1980 – troglobitic, endemical in caves from Munţii Banatului: Peştera de la Lacul Dracului, Peştera Haiducească de la Moldova Nouă.

Napocodesmus florentzae Tabacaru, 1975 – troglobitic, endemical only in Peştera cu Două Uşi (Valea Suşita Verde, Munţii Vâlcan).

Superorder Coelocheta Cook, 1895
(= Nematophora Verhoeff, 1913)

Order Craspedosomatida Gray, 1843
(= Chordeumatida Kock, 1847, Hoffman, 1979,
Ascospermophora Verhoeff, 1900)

Suborder Craspedosomatidea Gray, 1843

Superfamily Craspedosomatoidea Gray, 1843

FAMILY CRASPEDOSOMATIDAE GRAY, 1843

Dyocerasoma (Xylomicrodon) lignivorum (Verhoeff, 1899) (= *Polymicrodon lignivorum* Verhoeff, 1899) – trogloxene, described from South – Western Romania and, also, found in ex – Yugoslavia. Munţii Banatului: Peştera Comarnic.

Superfamily Neotractosomatoides Hoffman, 1979

FAMILY MASTIGOROPHOROPHYLLIDAE Verhoeff, 1899

Mastigona transsylvanica Verhoeff, 1897 (= *Heteroporatia transsylvanicum* Verhoeff, 1897) – troglexene, known from Bulgaria and Romania. Quoted by Verhoeff (1897) from Flintschhöhle (= Peştera din Cerneadeal).

Superfamily Haaseoidea Attems, 1899

FAMILY HAASEIDAE Attems, 1899
(= Orobainosomidae, Verhoeff, 1899)

Haasea (Brachybainosoma) hungaricum orientale Tabacaru, 1965 – troglophilous, endemical in caves from Oltenia and Banat. Munţii Banatului: Peştera Gaura Cornii, Avenul de la Cantonul Pin, Peştera de la Izvorul Înfundat, Peştera Gaura

Haiducească de la Moldova Nouă, Peştera de la Izvorul Înfundat, Peştera Gaura Comii. Munţii Vâlcan: Peştera no. 1 din Bazinul Cernei (P. no. 1 din Ciuceava Prihodul Mare), Peştera Labirint din Ciuceava Neagră (Peştera no. 26 din Bazinul Cemei, Peştera lui Fănică Argintaru), Avenul din Piarta Scrisă (Masivul Gorganul), Avenul de la Jgheab (Masivul Gorganul). Munţii Mehedinţi: Peştera Vacilor de la Cloşani, Avenul Mare din Foeroaga Îngustă, Avenul nr. 2 din Sohodoalele Mici, Avenul Cracul cu Plopi – Obarşia Cloşani, Avenul din Furca Văii – Obarşia Cloşani, Avenul Gaura Porcului (M. Gorgani), P. cu Gheaţă (M. Gorgani), Peştera de la Cazărmi, Peştera de sub Plaiul Gorganului. Platoul Mehedinţi: Peştera Topolniţa, Peştera de la Râpa Vânătă, Peştera de la Petri.

Romanosoma cavernicola Ceuca, 1967 – troglobitic. Endemical in Munţii Rodnei: Avenul de la Zalion.

Romanosoma? birtei Ceuca, 1967 – only one immature male found in Pestera de la Izvorul Tauşoarelor from Munţii Rodnei.

Superfamily Brannerioidea Cook, 1896

FAMILY ANTHROLEUCOSOMATIDAE Verhoeff, 1899

Anthroleucosoma (Anthroleucosoma) banaticum Verhoeff, 1899 – troglobitic, endemic for the Romanian fauna. Munţii Mehedinţi: Peştera – aven din Foeroaga Îngustă, Peştera Mare de la Soronişte.

Anthroleucosoma (Heteranthroleucosoma) spelaea Ceuca, 1964 – troglobitic, endemical in Peştera de la Piatra Arsă a Cernişoarei – (N/9 Biospeologica nr. 1350).

Dacosoma motasi Tabacaru, 1967 – troglobitic, endemical in caves from Munţii Căpăţânii: Peştera Arnăuţilor, Peştera Stogu (Peştera nr. 1 din Cheile Comarnicelor), Peştera no. 2 din Cheile Comarnicelor (Peştera Neterminată), Peştera no. 3 din Cheile Comarnicelor (Peştera Labirintul Mare din Valea Cheii).

Banatosoma ocellatum (Tabacaru, 1967) – troglobitic, endemical in caves from Banat. Munţii Banatului: Peştera Buhui, Peştera Cuptoare, Peştera Ponor-Plopa, Peştera Ponor-Uscată.

Order Callipodida Bollman, 1893

Suborder Schizopetalidea Verhoeff, 1909

FAMILY SCHIZOPETALIDAE Verhoeff, 1909

Callipodella fasciata (Latzel, 1882) – trogloxene, spread in the Balcanic Peninsula, in our country only in Banat (Peştera Veterani).

Superorder Diplocheta Cook, 1895
(= Opistospermophora Verhoeff, 1900, Juliformia Attems, 1926)

Order Julida Leach, 1814 (= Symphyognatha Verhoeff, 1910)

Superfamily Blaniuloidea C.L. Koch, 1847

FAMILY BLANIULIDAE Koch, 1847

Nopoiulus kochii (Gervais, 1847) (=*Nopoiulus venustus* Meinert, 1868) – troglophilous, widespread in Europe, Anatolia and introduced on other continents. In Romania, found in a few caves in numerous populations. Munţii Vâlcan: Peştera Fuşteica. Podişul Mehedinţi: Peştera Femeii de la Cireşu (Topolniţa). Munţii Banatului: Peştera Stârnic, Peştera Gaura cu Muscă (numerous populations on animal dejections), also found in a drill nearby Peştera de la Movile (Southern Dobrogea).

Superfamily Juloidea Leach, 1814

FAMILY JULIDAE Leach, 1814

Stenophyllum tabacarui Vănoaica, 2003 – trogloxene, endemic species for the Romanian fauna, found only in a small cave from Vârghişului Keys.

Ophyiulus fallax (Meinert, 1868) – trogloxene, widespread in Europe, found in three caves from Banat: Peştera din Cariera Nouă, Peştera Stârnic, Peştera cu Urzici.

Typhloiulus (Typhloiulus) strictus (Latzel, 1882) – endogeous and troglophilous species known from Bulgaria, Serbia and from Carpatii Meridionali. Munţii Retezat: Peştera de la Gura Cetăţii. Munţii Sebeşului: Peştera Cetatea Bolii. Munţii Mehedinţi: Peştera Cloşani. Munţii Cernei: Peştera de la Ineleţ, Peştera Hoţilor de la Băile Herculane. Munţii Banatului: Peştera Veterani, Peştera Gaura Haiducească de la Moldova Nouă, Peştera din Cariera Nouă.

Typhloiulus (Spelaeoblaniulus) serbani (Ceuca, 1956) (= *Spelaeoblaniulus serbani* Ceuca, 1956) – troglobitic, endemical in caves from Munţii Apuseni: Avenul 1 Mai de la Scărişoara (Avenul din Şesuri), Avenul Lumea Pierdută de la Padiş, Peştera de la Poiana Ponorului Văii Tringheştilor, Peştera Neagră de la Padiş.

Typhloiulus (Spelaeoblaniulus) serbani unilineatus (Ceuca,1961) – troglobitic, endemical in Peştera Vântului Şuncuiuş.

Lamellotyphlus mehedintzensis (Tabacaru, 1976) – troglobitic, endemical in caves from Valea Cernei, Munţii Mehedinţi and Platoul Mehedinţi: Peştera – Aven din Cioaca cu Brebenei, Peştera Topolniţa, Peştera no. 62 from Bazinul Cernei, Peştera Gaura Ungurului.

Banatoiulus troglobius Tabacaru, 1985 – troglobitic, endemical in Peştera Zamoniţa from Munţii Banatului (Munţii Almaj).

Apfelbeckiella dobrogica Tabacaru, 1966 – troglobitic, endemical in caves from Dobrogea: Peştera de la Casian, Peştera de la Movile.

Megaphyllum transsylvanicus (Verhoeff, 1897) (= *Chromatoiulus transsylvanicus* Verhoeff, 1897) – trogloxene, spread in Romania and the Balcanic Peninsula, sometimes found in caves: Peştera Topliţei (Munţii Metaliferi), exploatation gallery Iazovnic.

Megaphyllum platyurus (Latzel, 1884) (= *Chromatoiulus platyurus* Latzel, 1884) – trogloxene, spread in Romania and Sebia, found sometimes in caves. Munţii Mehedinţi: at the entrance of Peştera Cloşani. Munţii Banatului: Peştera Gaura din Cioaca Birtului.

Allajulus boleti (C.L. Koch, 1947) (= *Cylindroiulus boleti* C.L. Koch, 1947) – trogloxene, spread in Central Europe and Balkanic Peninsula. Sometimes found in caves.

Allajulus luridus (C.L. Koch, 1874) (= *Cylindroiulus luridus* (C.L. Koch, 1874) – trogloxene, spread in Central Europa and ex-Yugoslavia. Sometimes found in caves: Peştera de la Tecuri (Munţii Sebeşului).

Enantiulus nanum (Latzal, 1884) (= *Leptophyllum nanum* Latzel, 1884) – trogloxene, widespread in Europe, found in a cave from Banat: Peştera Stârnic.

Unciger foetidus (C.L. Koch, 1838) – trogloxene, widespread in Europe, found in Peştera Cetatea Bolii (Munţii Sebeşului).

6. REMARKS ON THE ROMANIAN TROGLOBITIC DIPLOPODA

The inventory of the Romanian cavernicolous Diplopoda, shows that 20 species out of the 56 above mentioned are strictly troglobitic and, at the same time, they are endemic for the respective caves. They belong to the orders Glomerida, Polydesmida, Craspedosomatida and Julida.

As EMILE RACOVITZA, RENÉ JEANNEL, ALBERT VANDEL, the classics of biospeology argued, any biogeographical analysis should rely on a complete knowledge of the material from a taxonomic point of view. Also, this is the premise of historic, cladistic biogeography. This is the reason why one of the authors (I.T.), beginning his study of the cavernicolous Diplopoda at the suggestion of the regretted biospeologist TRAIAN ORGHIDAN, sought to study as minutely as possible from a taxonomic point of view the lineages of Romanian Diplopoda with troglobitic and endogeous representatives: Trachysphaeridae (1958, 1960, 1963, 1986–88, 1989–90), Trichoplydesmidae (1975, 1980), Anthroleucosomidae (1968), Typhloiulini (1976, 1985), Pachyiulini (1966, 1978).

The order Glomerida comprises in Romania troglobitic species only from the genus *Trachysphaera* Heller, 1858 (= *Gervaisia* Waga, 1858, nom. preocc.,

Gervaisicus Chamberlin, 1962), which, in our opinion (Tabacaru, 1986), belongs to a distinct family, the Trachysphaeridae Strasser, 1965 (Strasser, 1965, p. 13, Tabacaru, 1966, p. 341, by the replacement according to the Zoological Nomenclature Code of the name Gervaisiidae Cook, 1895, Silvestri, 1896, Verhoeff, 1912). This genus comprises over 40 species spread from the Cantabric Mountains and the Pyrenees to Anatolia, the Caucasus Mountains and the Elbruz Mountains (Northern Iran). The genus has an essentially Mediterranean spreading, only the species *T. lobata* (Ribaut, 1954) was found more northward in France and the Island of Wight from the English Channel and the species *T. costata* (Waga, 1857), *T. gibula* (Latzel, 1884) and *T. acutula* (Latzel, 1884), spread in Central Europe up to Germany and Poland.

The spreading of the *Trachysphaera* species is linked to the limestone regions. The majority of the species are endogeous, lapidicolous, while some are frequently troglophilous (*T. costata*, *T. lobata*, *T. schmidtii*) or even troglobitic: *T. ribauti* (Condé et Demange, 1961) from the Spanish Pyrenees, the species *T. fabbri* (Verhoeff, 1929), *T. agazzi* (Strasser, 1959) and *T. gasparoi* Strasser, 1981 from the Frioul-Venice region, *T. lakatnicensis* Tabacaru, 1979 from the Balkan Mountains, the species *T. fragilis* Golovatch, 1976, *T. solida* Golovatch, 1976 and *T. minuta* Golovatch, 1978 from the Caucasus Mountains and 6 species described from Romania, respectively *T. jonescui* (Brölemann, 1914), *T. orghidani* (Tabacaru, 1958), *T. racovitzai* (Tabacaru, 1960), *T. spelaea* (Tabacaru, 1960), all four from the Meridionali Carpathians, West of the Olt Valley, *T. biharica* (Ceuca, 1961) from the Bihor Mountains and *T. dobrogica* (Tabacaru, 1960) from Southern Dobrogea.

In Romania, the troglobitic representatives of the order Polydesmida are a species of *Polydesmus* and three species belonging to the remarkable family Trichopolydesmidae. The genus *Polydesmus* Latreille, 1802–1803 is widespread in the whole Palearctic and has a very big number of species. In Romania were found 22 species of *Polydesmus* among which 9 species were collected in caves but only *P. oltenicus* Negrea & Tabacaru, 1958 is a strictly troglobitic species spread in Oltenia (the Mehedinți Mountains and Plateau). The closely related genus *Brachydesmus* Heller, 1858 (synonymous with *Polydesmus* after Hoffman, 1979), with numerous species spread in the Mediterranean region, has in Romania 4 species among which, only one, *B. troglobius* Daday, 1889 is troglophilous and frequent in caves from the Banat Mountains.

The family Trichopolydesmidae Verhoeff, 1910, is enclosed in the suprafamily Trichopolydesmoidea Verhoeff, 1910 (established by Hoffman, 1979) that comprises numerous representatives especially in tropical America. As it was defined by TABACARU (1975, 1980) and by MAURIÈS (1981, 1983), the family Trichopolydesmidae includes the following European genera: *Trichopolydesmus* Verhoeff, 1898, *Bacillidesmus* Attems, 1898, *Haplocookia* Brölemann, 1915, *Cottodesmus* Verhoeff, 1936, *Galliocookia* Ribaut, 1955, *Verhoeffodesmus* Strasser,

1959, *Napocodesmus* Ceuca, 1974, *Ingurtidorgius* Strasser, 1974, *Banatodesmus* Tabacaru, 1980, *Occitanocookia* Mauriès, 1981 and *Caucasodesmus* Golovatch, 1985. As has been stated (VERHOEFF, 1941, TABACARU, 1968, 1970, MAURIÈS, 1983, 1994) these genera are veritable relics of a Tertiary tropical fauna. In Romania, the family Trichopolydesmidae is represented in caves from the Meridionali Carpathians by the genus *Trichopolydesmus* with its sole species *T. eremitis* Verhoeff, 1898 and the species *Napocodesmus florentzae* Tabacaru, 1975, and in the caves from the Banat Mountains by the genus *Banatodesmus* Tabacaru, 1980 with its sole species *B. jeanneli* (Tabacaru, 1980). We should notice that the affiliation of the species *N. florentzae* to the genus *Napocodesmus* is not certain taking into account that this genus was established only on female exemplaries found in the garden of the Biology Faculty from Cluj and it is very possible that this is not an autochthonous species but a species imported along with some plants.

The order Craspedosomatida has in Romania troglobitic representatives from two families: Haaseidae Attems, 1899 (= Orobainosomidae Verhoeff, 1899) and Anthroleucosomatidae Verhoeff, 1899. The Haaseidae family is represented in many caves from the Banat Mountains, Cerna Valley and Mehedinți Mountains and Plateau by a subspecies, *Haasea (Brachybainosoma) hungaricum orientale* (Tabacaru, 1965), of the species *H. (B.) hungaricum* (Verhoeff, 1928), known only from Southern Hungary from Abaliget Cave (Mecsek Mountains). From the same family was described the endemic genus *Romanosoma* Ceuca, 1967 with 4 species, among which one is troglobitic, *R. cavernicola* Ceuca, 1967, found in a sinkhole from Rodnei Mountains (Eastern Carpathians). It is probably the northernmost troglobitic diplopod found but the origin and the affinities of the genus are difficult to establish.

The family Anthroleucosomatidae presents a particular zoogeographic interest. It is widespread in the Mediterranean region from Southern France to the European Turkey (Bosphorus) and the Caucasus; the southernmost point of its spreading is the island of Crete and the northernmost is in the Meridional Carpathians. The family has troglobitic representatives only in the Eastern Balkanic Peninsula (Bulgaria and Serbia) and in South-Western Romania. In Romania, the spreading of the family Anthroleucosomatidae does not excced in the North, the Mureş Corridor and in the East, the Olt Valley. Bulgaria has the greatest number of representatives of the Anthroleucosomatidae, respectively 5 genera with 12 species among which 10 are troglobitic; in Serbia was found a sole genus with 5 species, all of them being troglobitic. In Romania are known only troglobitic species and namely from the Meridionali Carpathians between Olt Valley and the Timiş-Cerna Corridor, the genus *Anthroleucosoma* Verhoeff, 1899 with two species, *A. (A.) banaticum* Verhoeff, 1899 and *A. (Heteranthroleucosoma) spelaeum* Ceuca, 1964, and the genus *Dacosoma* Tabacaru, 1968 with its sole species *D. motasi* Tabacaru, 1968, while in the Banat Mountains, the genus *Banatosoma*

Ćurčić & Makarov, 2000 with a sole known species *B. ocellatum* (Tabacaru, 1968). In our opinion, two phyletic lineages may be distinguished: the *Anamastigona* lineage (to which belong the genera *Anthroleucosoma* and *Dacosoma*) and the *Bulgarosoma* lineage. The genus *Bulgarosoma* Verhoeff, 1926, as defined by us (TABACARU, 1968), was split by ĆURČIĆ & MAKAROV (2000) into five genera: *Bulgarosoma* Verhoeff, 1926, *Troglodicus* Gulička, 1967, *Serbosoma* Ćurčić & Makarov, 2000, *Banatosoma* Ćurčić & Makarov, 2000 and *Rhodoposoma* Ćurčić & Makarov, 2000. But, all these genera have in common (TABACARU, 1968) the presence at the anterior gonopods of a posteriorly placed, median, uneven process (syncoxit) anteriorly prolonged with a structure named by VERHOEFF triangulum. Apically, the median process presents an anchor-shaped head (*Bulgarosoma*, *Serbosoma*, *Banatosoma*) or a narrow blade (*Troglodicus*, *Rhodoposoma*). In our opinion, the diagnose of these genera and the understanding of the relationships between them still needs comparative, morphological studies. The triangulum is clearly visible if only the syncoxit is examined rostrally (in Fig. 2 of ĆURČIĆ & MAKAROV, only at *B. bureschi*, *B. ocellatum* and *T. meridionalis*). It is obvious the rectangular lobe considered as characteristic for *Rhodoposoma* represents the posterior parts of the telopodites that leave between them an opening named by Strasser "window" (STRASSER, 1973, Abb. 19 fe – Fenster) while the triangulum is visible if only we examine the syngonopodite on the anterior side (Abb. 18, im – deieckiger Schuppe).

In the European fauna, the order Julida comprises numerous troglobitic representatives from the families Blaniulidae and Julidae but, as has been noted (TABACARU, 1968, 1970, 1976; MAURIES, 1994) the troglobitic Blaniulidae dominate around the occidental basin of the Mediterranean Sea hence on the remains of the Tyrrhenian dryland while the troglobitic Julidae dominate the Eastern Mediterranean region hence on the remains of the Egeida. In the Balkanic Peninsula are well represented the troglobitic Julidae belonging to the tribes Typhloiulini and Pachyiulini, tribes that have in Romania the northern limit of their spreading.

The tribe Typhloiulini comprises blind, generally depigmented, cavernicolous or edaphicolous Julidae spread from South-Eastern France (the French Maritime Alps) to Bulgaria, northward to the Salzburg Alps and Apuseni Mountains and southward to Sicily and the Peloponnesus. The genus *Typhloiulus* Latzel, 1884, with many species, and other seven genera, with one or more species (*Leptotyphloiulus* Verhoeff, 1899, *Trogloiulus* Manfredi, 1931, *Buchneria* Verhoeff, 1941, *Serboiulus* Strasser, 1962, *Alpityphlus* Strasser, 1967, *Lamellotyphlus* Tabacaru, 1976, *Banatoiulus* Tabacaru, 1985) are regarded as belonging to this tribe (STRASSER, 1962; HOFFMAN, 1979; TABACARU, 1976, 1985, 1992). Exclusively from caves are known the genera *Trogloiulus, Serboiulus,*

Alpityphlus, Lamellotyphlus, Banatoiulus and from the genus *Typhloiulus* the subgenera *Stygiiulus* Verhoeff, 1929, *Inversotyphlus* Strasser, 1962, *Attemsotyphlus*

Strasser, 1962, *Spelaeoblaniulus* Ceuca, 1956 as well as some species from the subgenus *Typhloiulus* s.str. There were contradictory opinions concerning the definition and the composition of the *Typhloiulus* subgenera (VERHOEFF, 1930; ATTEMS, 1959; STRASSER, 1962). STRASSER (1962), in his monographic study dedicated to the tribe Typhloiulini, remarked the great differences in the structure of the gonopodes between the different genera reunited in the tribe Typhloiulini and argued that this tribe does not represent a phylogenetic unity and it can not be considered a subfamily as ATTEMS (1959) argued. In fact, there are in this tribe gonopods with coxal piece and with phylacum (*Leptotyphloiulus*) and gonopods without coxal piece and without phylacum (all the other genera), gonopods without flagellum (*Trogloiulus, Serboiulus)* and gonopods with flagellum (all the other genera). Taking into account all these differences, MAURIÈS, GOLOVATCH and STOEV (1997) synonymied the tribe Typhloiulini with the tribe Leptoiulini, an opinion we do not share. Moreover, from the point of view of the nomenclature, the Typhloiulini Verhoeff, 1930 can not be synonymied with Leptoiulini Lohmander, 1936. In our opinion, excluding the genus *Leptotyphloiulus*, the tribe Typhloiulini may be defined by the absence of the coxal piece and the absence of the phylacum (also, see READ, 1990). It is worth mentioning that Strasser remarked a particularity found at the gonopods of almost all species of *Typhloiulus* and, namely, the presence of a fringed lamella placed between the mesomerit and opisthomerit. This lamella is either free or fused with the opisthomerit or represents the bond between the mesomerit and the opisthomerit (*T. strictus*). Initially, taking into account the presence of this lamella, we described *Lamellotyphlus* as a subgenus of *Typhloiulus* and regarded the new genus *Banatoiulus* as belonging to the tribe Typhloiulini. However, ENGHOFF (1987) showed that *Lamellotyphlus* should be regarded as an independent genus. In the opinion of Enghoff, both *Lamellotyphlus* and *Banatoiulus* should be considered as belonging to the tribe Leucogeorgiini Verhoeff, 1930 comprised in the subfamily Oncoiulinae. More recently, MAKAROV, MITIĆ and ĆURČIĆ (2002) consider these two genera as belonging to the tribe Typhloiulini.

In Romania, from the tribe Typhloiulini, are known 5 species, among which 3 are troglobitic. Thus, were found the species *Typhloiulus (T.) strictus* (Latzel, 1982), the type species of this genus, a big, edaphicolous and troglophilous species also spread in Serbia and Bulgaria; *Typhloiulus (Spelaeoblaniulus) motasi* Tabacaru et Gava, 1992, a small, edaphicolous species found only in the hills region, south of the Meridional Carpathians. The troglobitic species *Typhloiulus (Spelaeoblaniulus) serbani* (Ceuca, 1956) was described from caves of the Bihor Mountains while the subspecies *T. (S.) serbani unilineatus* (Ceuca, 1961) was described from caves of the Pădurea Craiului Mountains. From some caves found at the western end of the Meridionali Carpathians (the Mehedinți Mountains and Plateau) is known the troglobitic species *Lamellotyphlus mehedintzensis* (Tabacaru, 1976); the second

species of the genus *Lamellotyphlus* Tabacaru, 1976 was described recently from a cave from Serbia (MAKAROV, MITIĆ and ĆURČIĆ, 2002). From a cave found in the Banatului Mountains was described the troglobitic, small-sized *Banatoiulus troglobius* Tabacaru, 1985 that belongs to a remarkable endemic genus.

The tribe Pachyiulini comprises numerous genera and presents a vast Palearctic spreading from the Canary Islands to Japan (TABACARU, 1979) but the majority of the species are known from the Mediterranean region. The tribe comprises edaphicolous, large sized forms and troglobitic or endogeous, thin and small sized forms. The genera *Mesoiulus* Berlese, 1886, *Baskoiulus* Verhoeff, 1938 and *Apfelbeckiella* Verhoeff, 1901, contain troglobitic species.

The tribe Pachyiulini is represented in Romania by 6 species belonging to 4 genera; a sole species is troglobitic. Thus, the genus *Pachyiulus* Berlese, 1883, spread especially in the East-Mediterranean region, is represented in Romania by two big-sized, intensely pigmentated species, *P.hungaricus* (Karsch, 1881) being the biggest diplopod from Romania. The other three genera are represented by small-sized, thin, depigmentated species with reduced or absent ocelli. It is the case of the genus *Apfelbeckiella* Verhoeff, 1901 (sin. *Bulgaroiulus* Verhoeff, 1928) and two genera endemic for the Romanian fauna: *Geopachyiulus* Verhoeff, 1899 with two species, namely *G. nematodes* (Latzel, 1884) and *G. negreai* Tabacaru, 1978 and *Micropachyiulus* Verhoeff, 1899 with a sole species *M. paucioculatus* Verhoeff, 1899. There are different opinions concerning the sistematic position of the genus *Apfelbeckiella*: Verhoeff regards it as belonging to the separate tribe, Apfelbeckiellini Verhoeff, 1909, while ATTEMS (1926) considers it as belonging to the tribe Paectophyllini Verhoeff, 1910. The genus is known by 7 endogeous and cavernicolous species found exclusively in the east of the Balcanic Peninsula (the European part of Turkey, Bulgaria, Dobrogea). The northernmost species, *A. dobrogica* Tabacaru, 1966 (found in caves from Central and South Dobrogea) is very closely morphologic to the species from Bulgaria: *A.trnowensis*, *A. deliormana*, *A. rhodopina* and *A. golemanskyi*; for this reason, these taxa are regarded sometimes as subspecies of *A. trnowensis* (Verhoeff, 1928).

Also from the Julida, is worth mentioning from the Movile Cave (Southern Dobrogea) the southernmost presence of the Blaniulid *Archiboreoiulus*, with a Boreo-Alpine spreading (but the material is still under study).

*

As our data show, the troglobitic Diplopoda from the Romanian fauna have here the northernmost limit of the spreading of their phyletic lineages (see Fig. 1, lineages 1, 2 and 8). Troglobitic species were found in Central and Southern Dobrogea, in the Apuseni Mountains, Banatului Mountains and in the Meridional Carpathians only west of the Olt Valley.

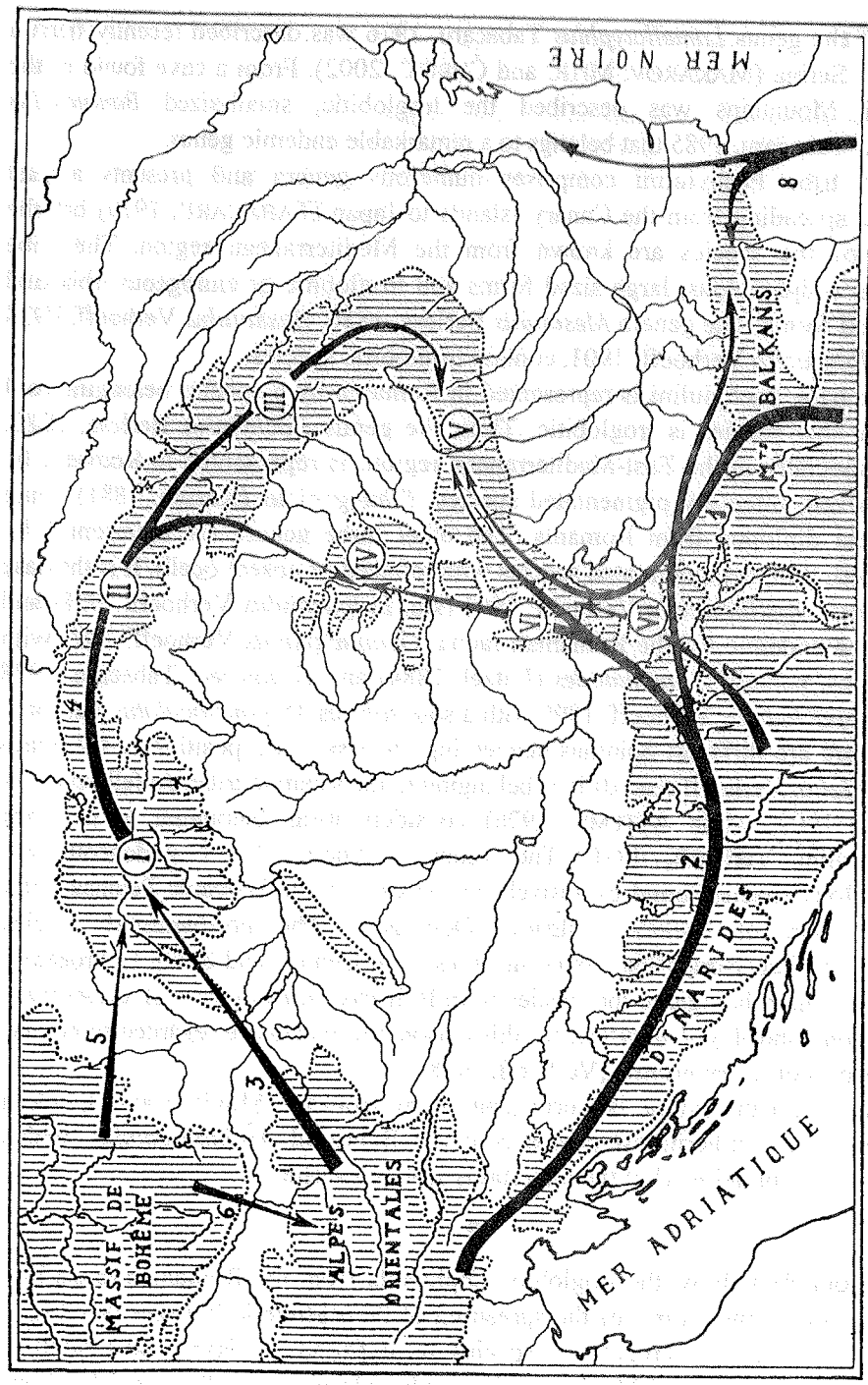

Fig. 1 – Probable migration of the Diplopoda lineages after Tabacaru, 1969: I – Northern Carpathians; II – Eastern Beskides; III – Eastern Carpathians; IV – Bihor Mountains; V – Southern Carpathians; VI – Banat Mountains; VII – South – Danube Carpathians; lineages with troglobitic representatives: 1 – Anthroleucosomidae; 2 – Typhloiulini; 8 – Pachyiulini (*Apfelbeckiella*).

There are only two strictly troglobitic Diplopoda species in Dobrogea: the Glomerid *Trachysphaera dobrogica* and the Iulid *Apfelbeckiella dobrogica*. Among the Diplopoda found in the caves of Apuseni Mountains, strictly troglobitic are the Glomerid *Trachysphaera biharica* and the Iulid *Typhloiulus serbani*. In the Meridionali Carpathians, between the Timiş – Cerna Corridor and Olt Valley, were found the Glomerids *Trachysphaera jonescui, T. orghidani, T. spelaea* and *T. racovitzai*, the Polydesmids *Polydesmus oltenicus*, *Trichoplydesmus eremitis* and *Napocodesmus florentzae*, the Craspedosomids *Anthroleucosoma banaticum, Anthroleucosoma spelaea* and *Dacosoma motasi* and the Iulid *Lamellotyphlus mehedintzensis*. West of the Timiş-Cerna Corridor, in the caves of the Banat Mountains, the troglobitic Diplopoda are represented by the Craspedomid *Banatosoma ocellatum* and the Iulid *Banatoiulus troglobius*.

All the troglobitic Diplopoda from Romania belong to lineages with a Southern, Mediterranean or East-Mediterranean spreading, excepting the troglobitic species of *Archiboreoiulus* from Peştera de la Movile (Southern Dobrogea) with a Boreo-Alpine origin and the troglobitic species of *Romanosoma* with an Alpine origin.

The majority of the troglobitic Diplopoda from Romania come from southern lineages that migrated northward under favorable paleogeographic conditions but following climatic changes they remained only as subterranean relicts. Their study, in correlation with investigations on troglobitic relicts from other groups, allows reconstitutions of the paleogeographic links and, especially, emphasize the importance of some biogeographic barriers: the Mureş Corridor, the Olt Valley, Timiş-Cerna Corridor (JEANNEL, 1931, 1942, 1943; DANCĂU & TABACARU, 1964, 1969; TABACARU, 1968, 1969, 1970, 1970; DECU & NEGREA, 1969).

ACKNOWLEDGMENTS. One of the authors (I.T.) warmly thanks those who, for nearly half a century, collected for him Diplopoda from the caves: Drs. L. Botoşăneanu, A. and Şt. Negrea, V. Decu, A. Burghele-Bălăcescu, D. Danielopol, I. Juvara-Balş, M. Gruia, V. Javorschi, V. Ilie and V. Gheorghiu. We keep a very grateful memory to Prof. Tr. Orghidan, Prof. M. Dumitrescu and also to our friends D. Dancău, I. Căpuşe and E. Şerban. We are very grateful to those who helped us with the diplopodological references: the regretted diplopodologist and speleologist Dr.h.c. Karl Strasser and Drs. G. Mauermaer (Zoologische Staatssammlung München), J. Gruber and V. Stagl (Naturhistorisches Museum Wien), B. Hauser (Muséum d'Histoire Naturelle, Genève), J.-J. Geoffroy, J.-P. Mauriès and M. Nguyen Duy-Jacquemin (Muséum National d'Histoire Naturelle Paris – editors of the "Bulletin du Centre International de Myriapodologie").

The authors are grateful to the Romanian Academy for the Grant No. 79/2003–2004 which allowed us to pursue our researches concerning the Romanian cave Diplopoda.

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