

ARTÍCULO:

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(Pseudoscorpiones: Neobisiidae):
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Remarks on the genus *Roncocreagris*
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Roncocreagris Mahnert**

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Abstract:

The subspecies of *Roncocreagris galeonuda* Beier have been examined and new characteristics for their separation are considered. The chelal microsetae pattern and the shape of coxa I are shown to provide good diagnostic characters for these taxa, which are here elevated to specific rank. Remarks on the genus *Roncocreagris* and its relationships with other genera are also given.

Key words: Pseudoscorpions, Neobisiidae, *Roncocreagris*, *Roncocreagris galeonuda*, microsetae.

Taxonomy: *Roncocreagris galeonuda* (Beier, 1955), stat. nov., *Roncocreagris clavata* (Beier, 1955), stat. nov., *Roncocreagris robustior* (Beier, 1959), stat. nov.

**Sobre el status de las subspecies de *Roncocreagris galeonuda*
(Pseudoscorpiones: Neobisiidae): importancia de la disposición de las
microsedas de la pinza. Observaciones sobre el género *Roncocreagris*
Mahnert**

Resumen:

Se han examinado las subspecies de *Roncocreagris galeonuda* Beier y se han considerado nuevos caracteres. La variación en la disposición de las microsedas de la pinza y en el aspecto de la coxa I han resultado definitivas para establecer buenas diagnósticos de las subspecies de *R. galeonuda* que son propuestas para ser elevadas a categoría de especie. Se ofrecen también observaciones sobre el género *Roncocreagris* y su posición con otros géneros afines.

Palabras Clave: Pseudoscorpiones, Neobisiidae, *Roncocreagris*, *Roncocreagris galeonuda*, microsedas.

Taxonomía: *Roncocreagris galeonuda* (Beier, 1955), stat. nov., *Roncocreagris clavata* (Beier, 1955), stat. nov., *Roncocreagris robustior* (Beier, 1959), stat. nov.

Introduction

The European representatives of the family Neobisiidae comprise two subfamilies: Neobisiinae, with eight genera, and Microcreagrinae, with only three genera (Harvey, 1991; 2007).

The subfamily Microcreagrinae can be distinguished from Neobisiinae by: A) presence of a hyaline galea (reduced to a sclerotic knob in Neobisiinae); B) chelal trichobothrium *ist* usually in sub-basal position (Harvey, 1992); C) in European species, at least sternites six and seven carry two discal setae.

The three European genera of Microcreagrinae are *Acanthocreagris* Mahnert, *Insulocreagris* Ćurčić and *Roncocreagris* Mahnert (Harvey, 2007). *Acanthocreagris* and *Roncocreagris* were established by Mahnert (1974) for two well-defined groups of species that had traditionally been included in the previously poorly known Eurasian *Microcreagris* "complex". *Insulocreagris* is a troglobitic genus created by Ćurčić (1987), with only two known species from Croatia and Bosnia-Herzegovina (Harvey, 1991; 2007). These three genera can be distinguished by the form and chaetotaxy of the male genital area and by the presence or absence of spiniform setae on palpal trochanter (Ćurčić, 1987).

Mahnert (1974, 1976) transferred all the *Microcreagris* species of the Iberian Peninsula to the newly created genera *Acanthocreagris* and *Roncocreagris*. Seventeen species and two subspecies are known for the genus *Roncocreagris* (Mahnert, 1976; Ćurčić & Legg, 1990; Judson, 1992; Zaragoza, 2000; 2002; 2003; 2007), of which six species are strictly cave-dwelling and the rest are epigeic (Table I). The distribution of *Roncocreagris* species is restricted to the Iberian Peninsula (Portugal, Spain), with the sole exception of *Roncocreagris cambridgei* (L. Koch, 1873), which is a widespread species also known from France, Great Britain, Ireland and doubtfully Algeria (Gardini, 2000; Harvey, 1991).

Research by the author on type and recently collected material of some species of *Roncocreagris* has allowed an evaluation of the position of the genus within European Neobisiidae after considering some characteristics that had not been previously used. Special attention was paid to the *Roncocreagris galeonuda* "complex", a group of three subspecies with slight taxonomic differences and a disjunct distribution in the case of *Roncocreagris galeonuda galeonuda* Beier, 1955 (Fig. 1). The study of the chelal microsetae pattern allows more reliable diagnoses of these taxa.

Material and Methods

Microscopical examination was carried out with a ZEISS AXIOLAB light microscope, which was also used for photographs. SEM photographs were taken with JEOL JSM-840 and HITACHI S-3000N microscopes. The Helicon Focus 4.03 program, which combines focused areas from several images, was used to improve photographs taken with light microscope, followed by slight retouching with the Adobe Photoshop 4.0 program.

EXAMINED SPECIMENS

Material received on loan from the Naturhistorisches Museum Wien, with the following original labels by Max Beier:

Microcreagris cantabrica (slide). "Type" Puente Viesgo (Santander), 24.08.1957

Microcreagris cantabrica distinguenda (slides). "Typus" Monte de Santoña, Santoña, 18.08.1957. Umg. Oñate, Guipuzcoa, 23.08.1957

Microcreagris clavata. "Typen" Bosque de Muniellos, n.o. Sierra de Ancares, 30.08.1952. "Paratypen" Sierra de Ancares, Agulleiro b. Pyornedo, 24.07.1952

Microcreagris galeonuda. "Typen" Sierra de Ancares, Agulleiro by Pyornedo, 24.07.1952. "Paratypen" Monte Reres, Asturien, 09.09.1952. "Paratypen" Picos de Europa, Umbg. Peña Santa, 04.09.1952

Microcreagris galeonuda robustior. Villaviciosa bei Oviedo, 27.8.57. El Tito b. Aviles, 24.07.1952

Microcreagris iberica. "Paratypen" El Pardo bei Madrid, 09.02.1951: 4♂. "Paratypen" El Pardo, 09.02.1951: 2♂, 3♀.

Microcreagris iberica andalusica (slides). Sierra Nevada, 1600m, 10.09.1959. "Typen" Cinca de Pino, Andalusien, Sevilla, 21.02.1951

Microcreagris portugalsensis (slides). "Typen" Portugal, Paços de Ferreira, 1950: 3♀.

Microcreagris pycta. San Saturnino, El Ferrol-Vivero, 15.08.1957: 3♂, 1♀

Microcreagris roncooides. "Typen" Portomouro nordl. Santiago de Compostela, 1952. "Paratypen" Pontevedra, 09.07.1952

Other material examined (including unpublished data): *Roncocreagris aurouxi* Zaragoza. Holotype, Cueva La Lastrilla, Samano, Cantabria, Spain.

Roncocreagris beieri Mahnert. Carvalheira, Portugal, 1999.

Roncocreagris galeonuda galeonuda (Beier). Sierra de Ancares, Cervantes, Lugo, Spain, 13.09.1999.

Roncocreagris galeonuda clavata (Beier). Suarbol, León, Spain, 12.12.1999.

Roncocreagris iglesiasae Zaragoza. Holotype, Cueva les Xianes, La Piñera, Asturias, Spain.

Roncocreagris lucensis Zaragoza. Holotype, Cova do Santalla, Santalla, Lugo, Spain.

Roncocreagris roncooides (Beier). Cabeça, Portugal, 03.1999.

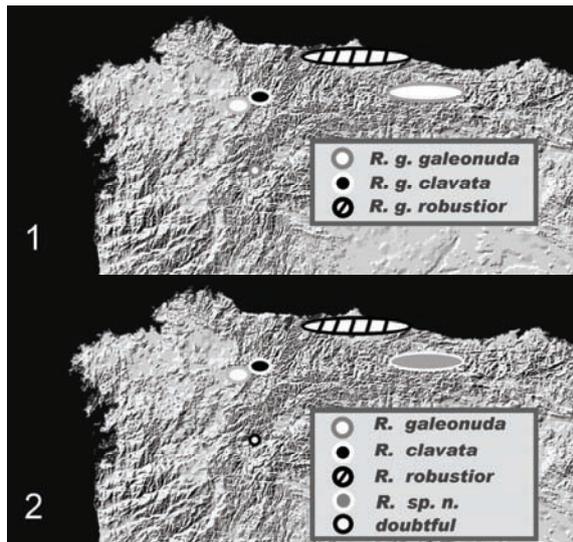
Roncocreagris salgadoi Zaragoza. Holotype, Paratype, Cova do Eixe, Mercurín, Lugo, Spain.

Roncocreagris sp. n. Hayedo de Saja, Puerto de Palombera, Cantabria, Spain, 12.1999.

Results

Roncocreagris galeonuda SUBSPECIES

Beier (1955, 1959) described a new species of the genus *Microcreagris* Balzan with four new subspecies from northwestern Spain: *M. galeonuda galeonuda* Beier,



Figs 1-2. 1. Prior distribution in the Northwest of Spain of the subspecies of *Roncocreagris galeonuda*. 2. Present distribution of the *Roncocreagris* species of *galeonuda* group in the Northwest of Spain.

1955, *M. galeonuda clavata* Beier, 1955, *M. galeonuda nana* Beier, 1959 and *M. galeonuda robustior* Beier, 1959. Mahnert (1974, 1976) transferred *galeonuda* and its subspecies to *Roncocreagris* Mahnert, 1974. Judson (1992) later elevated *R. galeonuda nana* to species rank, transferred it to the genus *Occitanobisium* Heurtault, 1978, and also suggested that *R. galeonuda robustior* was probably a distinct species.

Following the Catalogue of Zaragoza (2007), *R. galeonuda galeonuda* has been recorded in Spain, from Sierra de los Ancares (Lugo), Peña Trevinca (Orense) and Picos de Europa (Asturias, Cantabria) and in Portugal, from Faro (Algarve). *R. galeonuda clavata* is known from Bosque de Muniellos (Asturias) and Sierra de Ancares (Lugo). *R. galeonuda robustior* is known from Asturias, on the coast (Fig. 1).

Taxonomic differences between the three remaining subspecies of *R. galeonuda* were established by Beier (1955, 1959, 1963) and adopted by Mahnert (1976) in his key. The main difference was the presence or absence of granulation on the palpal trochanter. However, re-examination of the type specimens of the three taxa shows that granulation occurs, to varying degrees, on the trochanter of all of them. The position of trichobothrium *ist* relative to trichobothria *ib* and *it* was also used by Beier to distinguish the subspecies, but variation again occurs within all three taxa.

Because of the variability of these characters, the geographical overlap between some taxa and the disjunct distribution of *R. galeonuda galeonuda*, the real status of the subspecies of *R. galeonuda* needs to be reconsidered.

Recent observations by the author have revealed that the microsetae pattern between trichobothria *ib* and *isb* of the palpal chela is different for each taxon and that additional differences can be seen in the shape of the anterior and medial process of coxa I. These new

characteristics, allow better definitions of the subspecies of *R. galeonuda*, resulting in taxonomic changes given in the Conclusions below.

CHELAL MICROSETAE PATTERN

One of the most important European pseudoscorpion experts, Max Beier, gave primacy to the study of the morphometry of the palp, and the relative positions of trichobothria for separating species within genera of Neobisiidae. This has resulted in some confusion in identification of closely related species. In contrast, modern chelonethology tends to an integral study of the animal.

The chelal microsetae pattern has only occasionally been used as a taxonomic character. Gardini (1981, 1983) redescribed *Roncus lubricus* L. Koch, 1873, and found that the presence of a microsetae group basal of trichobothria *eb/esb* was distinctive for that species. This characteristic allowed him to conclude that this species, previously considered widespread in West and Middle Europe, was in reality restricted to England, northern France and Belgium. Records from elsewhere were therefore considered to belong to undetermined or misidentified taxa. Gardini & Rizzerio used this characteristic as a primary discriminant in their published keys on *Roncus* Italian fauna (1985, 1986). Another case of chelal microsetae pattern in Neobisiidae was studied by Henderickx & Zaragoza (2005). *Roncus judsoni* Henderickx & Zaragoza, 2005 was named as new species after detailed comparison with *Roncus duboscqi* Vachon, 1937, both species coming from the Spanish and French Pyrenees. The morphometry of these closely related species shows only slight differences, but the chaetotaxy of microsetae between trichobothria *eb/esb* provided a definitive means to separate the taxa. *R. judsoni* presents an increased microsetae number, with about 10 microsetae, whereas *R. duboscqi* has only 4 microsetae at most. Harvey (1993) used the number of microsetae in a group just distal of trichobothrium *ib* to separate species of the genus *Hya* J.C. Chamberlin (Hyidae).

Examination of the *R. galeonuda* subspecies has revealed that up to three different groups of microsetae can be distinguished in the dorsal side of the chela, between trichobothria *ib* and *isb* (Fig. 3):

- First group are curved or angular pseudomicrosetae on the dorsoexternal side of the finger (Em). The dorsoexternal setae are named "pseudomicrosetae" because they are slightly longer and thicker than the microsetae of the other two groups.
- Second group are microsetae on the midline of the finger (Mm).
- Third group are microsetae on the dorsointernal side of the finger (Im).

The microsetae pattern for the *R. galeonuda* specimens recorded from the Picos de Europa zone, between the Spanish regions of Asturias and Cantabria, present

all three of these groups of microsetae. The presence or absence of some of these microsetae groups and their different combination are always constant for each taxon in *R. galeonuda* group and helps to distinguish between them.

R. g. galeonuda from Sierra de los Ancares presents the schema Em+Im (Figs 5, 6, 19) that is also present in *R. g. robustior* (Fig. 4) and in other *Roncocreagris* species not considered here: A) presence of the dorsoexternal curved pseudomicrosetae and of the dorsointernal microsetae groups, B) absence of the midline microsetae group (seldom one microseta level with *isb*). Number of curved pseudomicrosetae are 3 in *R. g. galeonuda* and 2-3 in *R. g. robustior*, dorsointernal microsetae are 2-3 in the former and 1-2 in the latter.

R. g. clavata also has only two groups: 2-3 dorsoexternal curved pseudomicrosetae and 4-6 midline microsetae; dorsointernal microsetae are absent and the schema is Em+Mm (Figs 7, 8, 21).

Specimens from Picos de Europa present a different pattern to those described above: all three microsetae groups are present (schema Em+Mm+Im) (Figs 3, 9, 10, 23). Dorsoexternal pseudomicrosetae number is 2-3, midline microsetae have an increased number of 5-8, and there are 2-3 dorsointernal microsetae. These specimens and *R. g. clavata* show some differences to *R. g. galeonuda* and *R. g. robustior* with respect to the position of the dorsoexternal pseudomicrosetae between: the distal third pseudomicroseta (when present) is clearly basal of trichobothrium *isb*, whereas in the latter two subspecies it is level with *isb*. The shape of the dorsoexternal microsetae is also different with respect to *R. g. galeonuda* and *R. g. robustior*, in which they are more angular than curved, at about 75-90° (Fig. 25). It is not infrequent that an additional angular microsetae is present distal of trichobothrium *isb* and clearly separated from the area considered.

Some other examined epigeal species of *Roncocreagris* present the schema Em+Mm+Im, but midline microsetae are represented by a lone distal microseta and in other species the schema is only Em+Im. It seems that the loss of one microsetae group (Mm or Im) is apomorphic for some species. In the *R. galeonuda* group the taxon can be recognized from tritonymphs in the case of *R. g. clavata* and specimens from Picos de Europa.

COXA I: ANTERIOR AND MEDIAL PROCESS

Additional observations have been carried out during this study on the shape of the anterior and medial process of coxa I in the *R. galeonuda* subspecies and significant differences have been found.

R. g. galeonuda from Sierra de los Ancares presents median anterior corner rounded and obtusely angled, anterior process is short and broad (Figs 11, 12, 20). In *R. g. clavata* median anterior corner forms a right angle and the anterior process is directed forwards, well developed and may have some apical denticles (Figs 13, 14, 22). In *R. g. robustior* the medial process is a pronounced elevated tubercle and the anterior process is oblique, long and very sharp (Fig. 18). Specimens from

Picos de Europa have the medial process rounded and slightly elevated, while the anterior process is oblique, broad and apically moderately rounded or with apical denticles (Figs 15, 16, 24).

Discussion

Taking the new characteristics into account has contributed to a better diagnosis of the *R. galeonuda* subspecies and it has allowed the unambiguous identification of specimens from different areas. As a result, *R. g. galeonuda* is now seen to be restricted to the area of Sierra de los Ancares (eastern Galicia), *R. g. clavata* to Bosque de Muniellos (western Asturias region) and *R. g. robustior* to northern Asturias. The specimens from sites around Picos de Europa (eastern Asturias) that were previously assigned to *R. g. galeonuda* prove instead to belong to a new, undescribed species. Records of *R. g. galeonuda* in Peña Trevinca (Orense) and particularly from the Algarve region of South Portugal must now be considered doubtful, since the *Roncocreagris* taxa in the North of Spain seem to be restricted to well defined areas. The revised distributions of the *R. galeonuda* "complex" as result of the present work are shown in Fig. 2.

REMARKS ON THE GENUS *RONCOCREAGRIS*

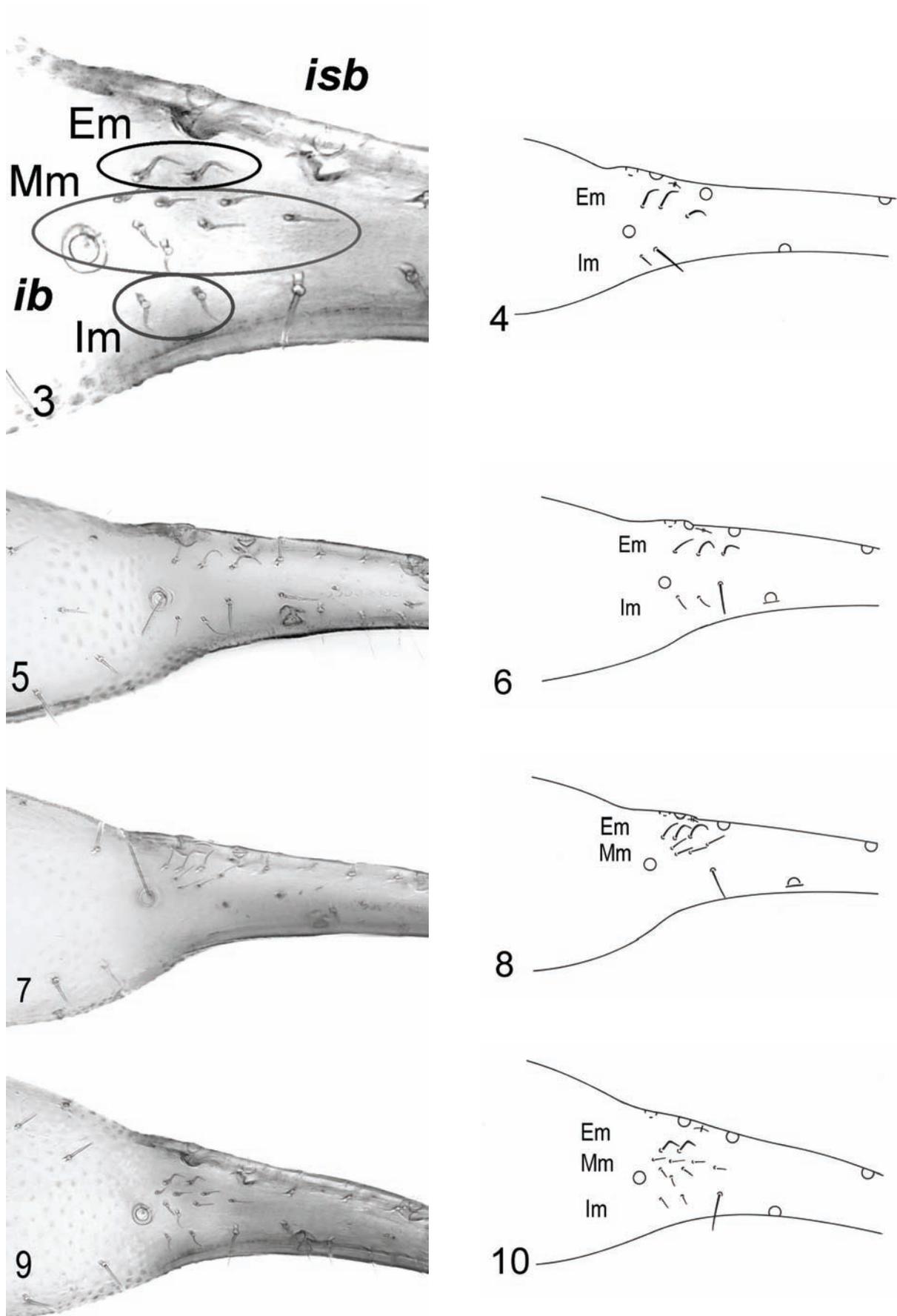
The diagnosis of the genus *Roncocreagris* was established by Mahnert (1974; 1976) and complemented by Gardini (1982; 1998), Ćurčić (1987), Ćurčić & Legg (1990) and Judson (1992). The main characteristics are as follows:

- One pair of eyes (epigeal species).
- Galea well developed or reduced to a hyaline tubercle.
- Sternites VI and VII with two discal setae.
- Sternite III of the male ungrooved, with 1-2 pairs of setae on each side of the midline and a posterior setal row.
- Palpal trochanter without spiniform setae.
- Cheliceral flagellum with all blades pinnate, close together and not dilated at its base (Fig. 17)
- Leg IV telotarsus with tactile seta in basal position, ratio 0.22-0.38.

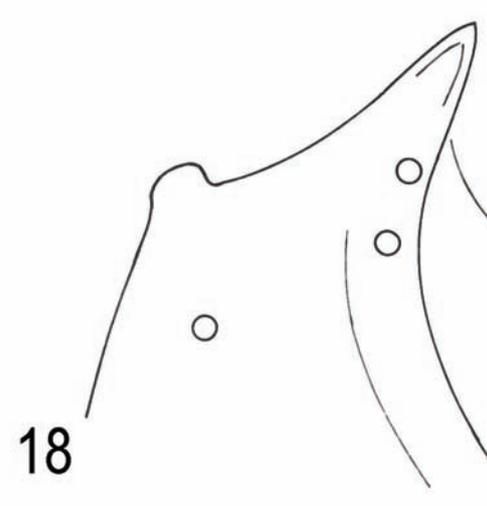
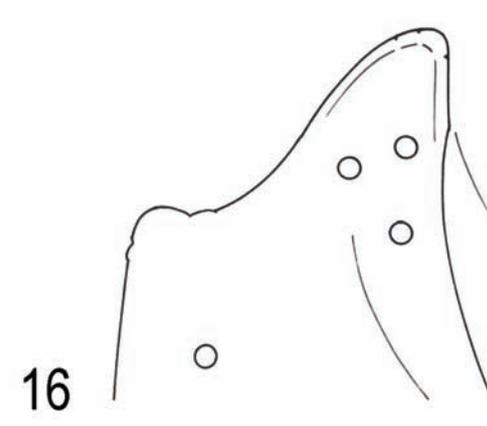
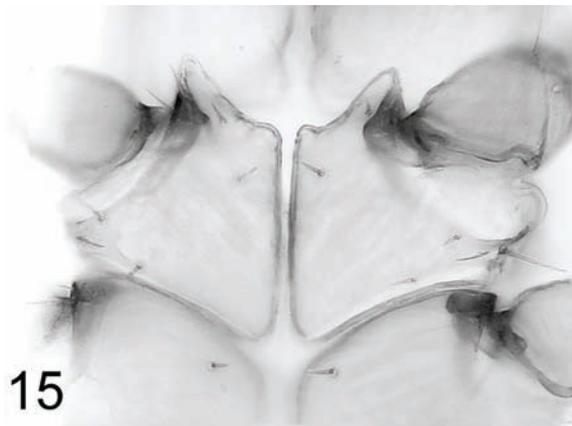
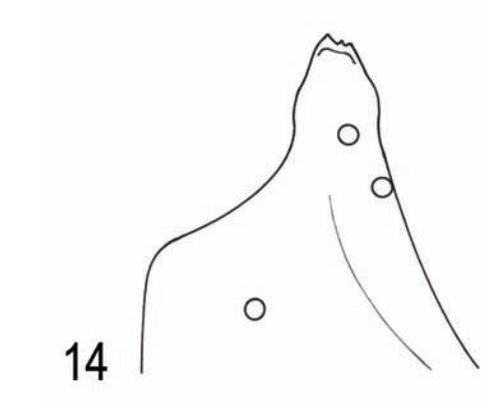
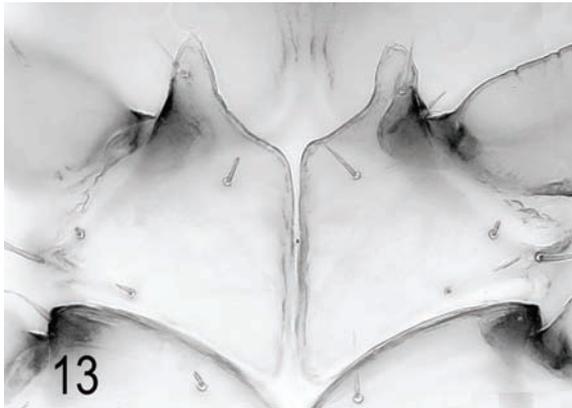
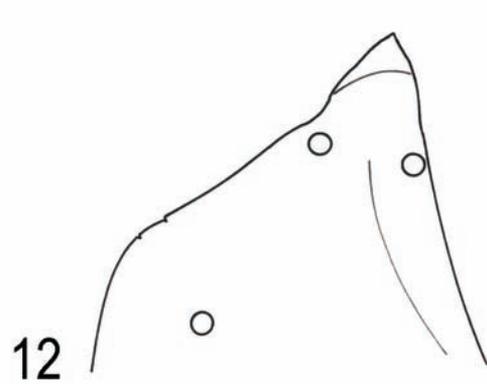
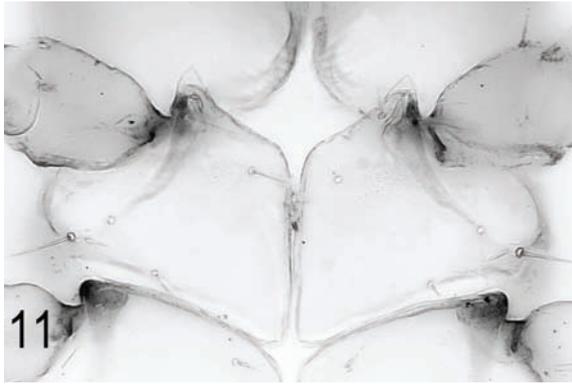
After the analysis of type and recently collected material of 15 *Roncocreagris* taxa, new characteristics are added to the diagnosis: leg IV tibia tactile seta ratio, distal opening of palpal patella and relative position of trichobothrium *ist*.

LEG IV TIBIA TACTILE SETA

Roncocreagris species present a tactile seta on the tibia of leg IV, positioned in the basal half of the article (ratio less than 0.50) (Fig. 26). This position is constant for all the epigeal *Roncocreagris* specimens examined (cave-dwelling species present some long setae) and differs from that of the other two European Microcreagrinae genera. Compared with the European Neobisiiidae genera (Table II) and attending to this characteristic,



Figs 3-10. Chelal microsetae pattern, light microscope photographs and schemas: **3, 9, 10.** *Roncocreagris* sp. n. **4.** *Roncocreagris robustior*. **5, 6.** *Roncocreagris galeonuda*. **7, 8.** *Roncocreagris clavata*.



Roncocreagris coincides with *Neobisium* J.C. Chamberlin and other genera related to the latter. This represents a significant difference in relation to the other two genera in the subfamily Microcreagrinae, as well as to *Balkanoroncus* Čurčić and *Roncus* L. Koch.

Basal position of the tibial TS in *Roncocreagris* was mentioned by Mahnert (1974, 1976), Čurčić & Legg (1990) and Judson (1992) in their species descriptions, but it was not expressly mentioned as a diagnostic feature of the genus. Tibial tactile seta position is revealed to be constant in the vast majority of the species for each genus in Neobisiidae and represents a good additional characteristic for separating genera, although it has not been employed in this way previously. Present knowledge on this matter is not yet enough to draw phylogenetic conclusions, but this deserves to be studied.

DISTAL OPENING OF PALPAL PATELLA

It is known that distal opening of palpal patella, which receives the patella-chela articulation, may be more or less oblique in Neobisiidae. In epigeal European neobisiids, for instance, in *Roncus* distal opening is only moderately oblique and do not present significative variation between species but in *Neobisium* it is markedly oblique; in this latter genus, ratio between the length of this parameter and the length of the inner margin of the patella (as defined by Gabbutt & Vachon, 1965) is sometimes used to distinguish species [Beier had previously used the relative length of the patellar notch in his keys of the species of *Neobisium* (f.i. 1932, 1963)]. In nymphal stages of *Roncus* distal opening of palpal patella is more wide and oblique respect to the club than in adults (f.i. as illustrated in Gabbutt & Vachon, 1967; Gardini & Benelli, 1991; own observations); if it could have philogenetic implications would be worthy to be studied.

In *Roncocreagris galeonuda* subspecies the palpal patella has a pronounced oblique distal opening. This was illustrated and mentioned by Beier (1955). It does not significantly occur in all species of the genus and this difference, combined with the presence/absence of a well developed galea and variation of the position of the two setae on sternites VI-VII, clearly discal or only subdiscal, reveals that *Roncocreagris* is a diverse genus and that some species groups might be recognized (Čurčić & Legg, 1990; Zaragoza, 2000).

The relative length of the distal opening of palpal patella of *Acanthocreagris* species has not been mentioned in descriptions and the drawings do not reflect it as widely oblique but only moderately (own observations), it represents another difference between *Roncocreagris* and *Acanthocreagris*. In *Insulocreagris*, as usually occurs with specialized troglitic neobisiids, this characteristic is not noticeable.

Comparison of the main characteristics between the genera *Acanthocreagris* and *Insulocreagris* on one hand and *Roncocreagris* on the other reveals significant differences between the three genera and suggests that they are phylogenetically far apart (Table III).

Mahnert (1974) pointed out similarities between genera *Roncus* and *Roncocreagris*. For Čurčić (1986a, b), *Roncocreagris* might represent a transitional form between the genera *Neobisium* and *Roncus*. *Roncocreagris* shares with *Roncus* the presence of only one pair of eyes, the flagellum shape (Fig. 17) and the subbasal position of trichobothrium *ist*; with *Neobisium* it shares the position of the tactile seta of the tibia of leg IV and the oblique distal opening of palpal patella (*R. galeonuda* species group) (Table IV).

Conclusions

The results of the present study confirm the importance of the chelal microsetae pattern for the definition of species within the Neobisiidae (Gardini 1981, 1983; Henderickx & Zaragoza, 2005). Concerning the microsetae pattern observed in *R. galeonuda* related species, the following points are noteworthy:

- Position on the dorsal side of the chela, since previous observations had been made on the lateral-external side.
- Different groups of microsetae can be distinguished by their constant position.
- Setae with different shape occur, as is the case for the curved or angular pseudomicrosetae.

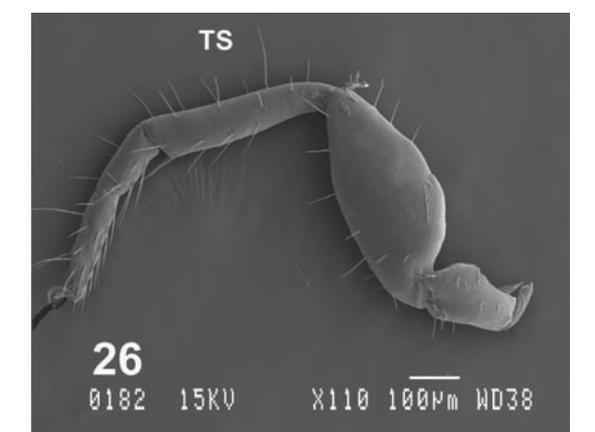
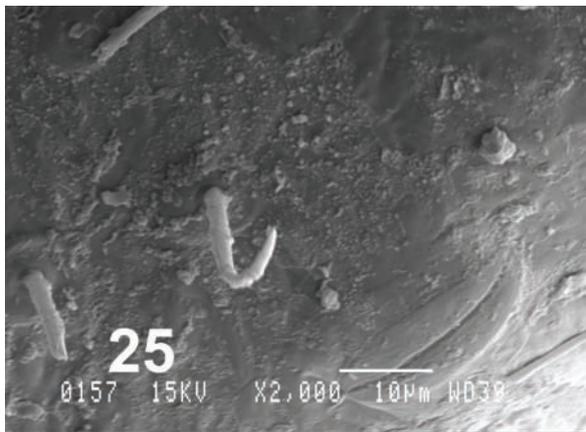
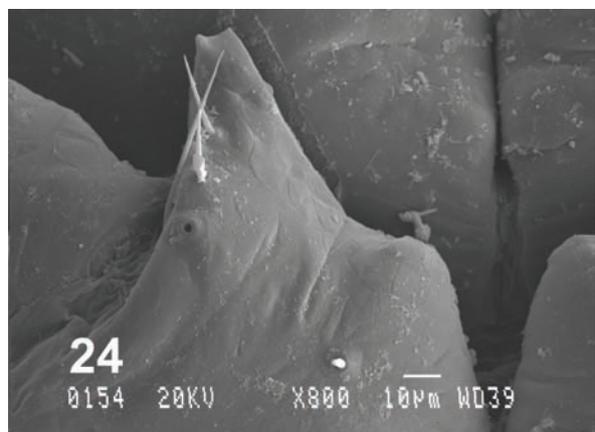
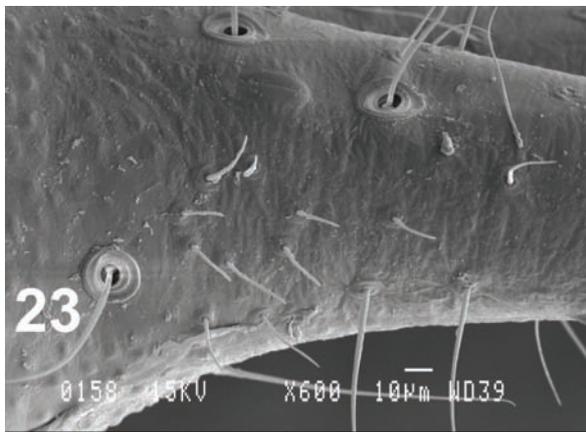
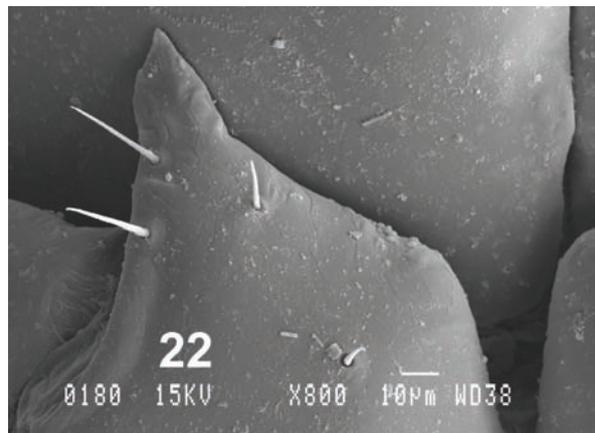
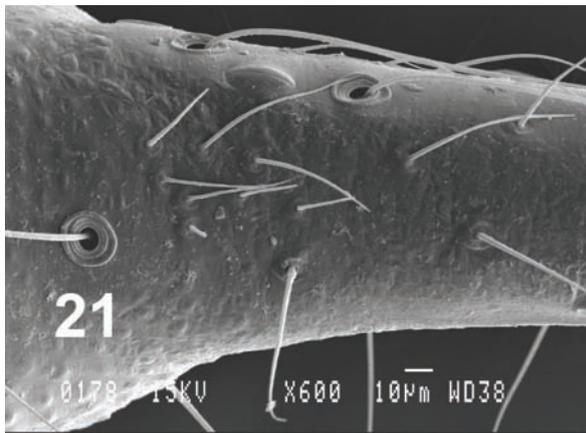
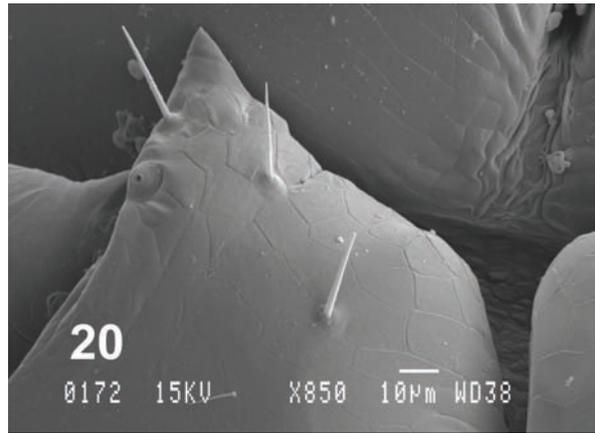
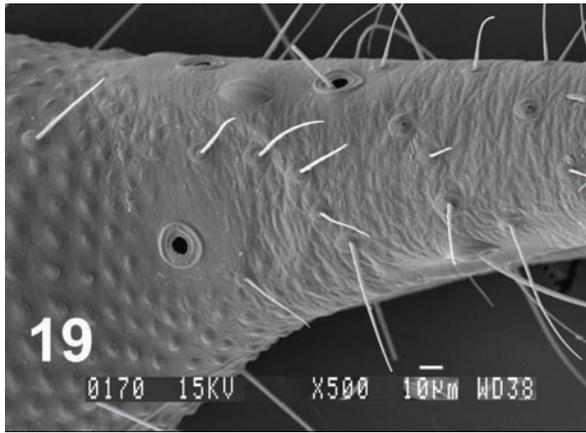
The presence of "groups" of microsetae on the palpal chela suggests that they act as "sensory fields" and their presence is usually constant. Definition of the sensory fields in Neobisiidae will be very important in future, since differences in their positions have been shown to be of great help in taxonomy.

Description of the different pattern of the chelal microsetae and the shape of the processes of coxa I, added to the traditional morphometric data from Beier's descriptions (1955, 1959) are, in my opinion, sufficient arguments to propose the elevation of all the *R. galeonuda* subspecies to full specific rank:

- *Roncocreagris galeonuda* (Beier, 1955), new status
- *Roncocreagris clavata* (Beier, 1955), new status
- *Roncocreagris robustior* (Beier, 1959), new status

The types of these species will be redescribed in full elsewhere.

Figs 11-16, 18. Coxa I anterior and medial process, light microscope photographs and schemas: **11, 12.** *Roncocreagris galeonuda*. **13, 14.** *Roncocreagris clavata*. **15, 16.** *Roncocreagris* sp. n. **18.** *Roncocreagris robustior*. Fig. 17. Flagellum blades in *Roncocreagris roncooides*, light microscope photograph.



At least in Europe, the division between the subfamilies Neobisiinae and Microcreagrinae (Harvey, 1992) is not very convincing. Harvey (2007) presumably includes *Balkanoroncus* in the Neobisiinae because it lacks a hyaline galea, but Ćurčić (1987) and Gardini (1982, 1998) placed this genus very close phylogenetically to the Microcreagrinae genera. Even in *Roncus*, in the nymphal stages, the spinneret is represented by a low convex "hyaline tubercle" that sometimes is also conserved in adults [as defined in Gabbutt & Vachon, 1967, also own observations, in contrast to the spinneret of *Neobisium* that is defined as a "sclerotic tubercle" (Gabbutt & Vachon, 1965; Gabbutt, 1965)]. The position of trichobothrium *ist* also varies in each Microcreagrinae genus: sub-distal in *Insulocreagris*, medial in *Acanthocreagris*, sub-basal in *Roncocreagris*. It implies that a best definition of the Neobisiidae subfamilies in Europe should be done.

After the observations mentioned herein, the following characteristics are added to the diagnosis of the genus *Roncocreagris*:

- Leg IV tibia tactile seta in basal position.
- Palpal patella with oblique distal opening, more (*galeonuda* group) or less pronounced.
- Trichobothrium *ist* in sub-basal position.

Roncocreagris is a well defined genus with some primitive characteristics, f.i. the form of the flagellum. It seems to have evolved separately from the rest of the european Microcreagrinae, probably due to the isolation of the Iberian Peninsula since the oldest Palaeocene. The great expansion and diversification of this genus in the Iberian Peninsula, particularly in the Northwest, suggests that may have originated in that geographical region. Only one widespread species, *Roncocreagris cambridgei* (L. Koch, 1873), is known outside that area. The presence of highly cave-dwelling species only at the same area where epigeal species inhabit (apart from *R. cambridgei*), hence without an isolated relictual distribution, lend conviction to the argument.

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Figs. 19, 21, 23. Chelal microsetae pattern, SEM photographs: **19.** *Roncocreagris galeonuda*. **21.** *Roncocreagris clavata*. **23.** *Roncocreagris* sp. n. Fig. **25.** Angular subexternal pseudomicrosetae in *Roncocreagris* sp. n. **Figs 20, 22, 24.** Coxa I anterior and medial process, SEM photographs: **20.** *Roncocreagris galeonuda*. **22.** *Roncocreagris clavata*. **24.** *Roncocreagris* sp. n. Fig. **26.** Leg IV in *Roncocreagris clavata*, TS: tibial tactile seta, SEM photograph.

References

- BEIER, M., 1932. Pseudoscorpionidea I. Subord. Chthoniinea et Neobisiinea. *Tierreich* **57**: i-xx, 1-258.
- BEIER, M., 1955. Neue Beiträge zur Kenntnis der iberischen Pseudoscorpioniden-Fauna. *Eos*, Madrid, **31**: 87-122.
- BEIER, M., 1959. Ergänzungen zur iberischen Pseudoscorpioniden-Fauna. *Eos*, Madrid, **35**: 113-131.
- BEIER, M., 1963. Ordnung Pseudoscorpionidea (Afterscorpione). En: *Bestimmungsbücher zur Bodenfauna Europas*, Vol. **1** Akademie-Verlag, Berlin.
- ĆURČIĆ, B.P.M., 1986a. On the taxonomy and biogeography of *Microcreagris* related genera in Eurasia (Neobisiidae, Pseudoscorpiones). *Mémoires de la Société Royale Belge d'Entomologie*, **33**: 75-79.
- ĆURČIĆ, B.P.M., 1986b. Taxonomy and geographic distribution of some *Microcreagris*-related genera (Neobisiidae, Pseudoscorpiones). En: *Actas X Congreso Internacional de Aracnología*, Jaca. Vol. **1**: 321-326.
- ĆURČIĆ, B.P.M., 1987. *Insulocreagris*, a new genus of pseudoscorpions from the Balkan Peninsula (Pseudoscorpiones, Neobisiidae). *Revue Arachnologique*, **7**: 47-57.
- ĆURČIĆ, B.P.M. & LEGG, G., 1990. On the identity of some taxa assigned to the genus *Roncocreagris* Mahner (Neobisiidae, Pseudoscorpiones). *Prirodoslovná Istraživanja* **60**, Acta Biologica, Zagreb, **15**: 8-25.
- GABBUTT, P.D., (1965). The external morphology of two pseudoscorpions *Neobisium carpenteri* and *Neobisium maritimum*. *Proceedings of the Zoological Society of London*, **145**: 359-386.
- GABBUTT, P.D. & VACHON, M., 1965. The external morphology and life history of the pseudoscorpion *Neobisium muscorum*. *Proceedings of the Zoological Society of London*, **145**: 335-358.
- GABBUTT, P.D. & VACHON, M., 1967. The external morphology and life history of the pseudoscorpion *Roncus lubricus*. *Journal of Zoology*, London, **153**: 475-498.
- GARDINI, G., 1981. *Roncus caralitanus* n. sp. della Sardegna meridionale (Pseudoscorpionida Neobisiidae) (Pseudoscorpioni d'Italia XIII). *Bollettino della Società Entomologica Italiana*, **113**: 129-135.
- GARDINI, G., 1982. *Balkanoroncus baldensis* n. sp. delle Prealpi Venete (Pseudoscorpionida, Neobisiidae) (Pseudoscorpioni d'Italia XIV). *Bollettino del Museo Civico di Storia Naturale*, Verona, **9**: 161-173.
- GARDINI, G., 1983. Redescription of *Roncus lubricus* L. Koch, 1873, type species of the genus *Roncus* L. Koch, 1873 (Pseudoscorpionida, Neobisiidae). *Revue Arachnologique*, **4**: 151-155.
- GARDINI, G., 1998. Il genere *Acanthocreagris* in Italia (Pseudoscorpionida, Neobisiidae). *Fragmenta Entomologica*, Roma, **30**: 1-73.
- GARDINI, G., 2000. Catalogo degli Pseudoscorpioni d'Italia. *Fragmenta Entomologica*, Roma, **32** (Suppl.): 1-181.
- GARDINI, G. & BENELLI, R., 1991. The external morphology of the pseudoscorpion *Roncus andreinii*. *Journal of Zoology*, London, **223**: 27-48.
- GARDINI, G. & RIZZERIO, R., 1985. Materiali per una revisione del genere *Roncus* L. Koch, 1873. I. Ridescrizione dei tipi di alcune specie italiane non cavernicole (Pseudoscorpionida, Neobisiidae). *Fragmenta Entomologica*, **18**: 47-79.
- GARDINI, G. & RIZZERIO, R., 1986. Materiali per una revisione del genere *Roncus* L. Koch, 1873. II. Ridescrizione dei tipi delle specie parablothroidi alpine e appenniniche. *Fragmenta Entomologica*, **19**: 1-56.
- HARVEY, M.S., 1991. *Catalogue of the Pseudoscorpionida*. Manchester University Press, Manchester.
- HARVEY, M.S., 1992. The phylogeny and systematics of the Pseudoscorpionida (Chelicerata: Arachnida). *Invertebrate Taxonomy*, **6**: 1373-1435.
- HARVEY, M.S., 1993. The Systematic of the Hyidae (Pseudoscorpionida: Neobisiidae). *Invertebrate Taxonomy*, **7**: 1-32.
- HARVEY, M.S. (ED.). 2007. Pseudoscorpiones, de Geer. *Fauna europaea*, version 1.1, <http://www.faunaeur.org>
- HENDERICKX, H. & ZARAGOZA, J.A., 2005. Notes on *Roncus* (Pseudoscorpiones: Neobisiidae) from the Eastern Pyrenees: new synonymy and description of a new species. *Revista Ibérica de Aracnología*, **11**: 47-59.
- HEURTAULT, J., 1977. *Occitanobisium coiffaiti* n. gen. n. sp. de Pseudoscorpions (Arachnides, Neobisiidae, Neobisiinae) du département de l'Hérault, France. *Bulletin du Muséum National d'Histoire Naturelle*, Paris, (3) **497** (Zool. 346): 1121-1134.
- JUDSON, M.L.I., 1992. *Roncocreagris murphyorum* n. sp. and *Occitanobisium nanum* (Beier) n. comb. (Neobisiidae) from Iberia, with notes on the sternal glands of pseudoscorpions (Chelonethi). *Bulletin of the British Arachnological Society*, **9**: 26-30.
- MAHNERT, V., 1974. *Acanthocreagris* nov. gen. mit Bemerkungen zur Gattung *Microcreagris* (Pseudoscorpiones, Neobisiidae) (Über griechische Pseudoscorpione IV). *Revue Suisse de Zoologie*, **81**: 845-885.
- MAHNERT, V., 1976. Zur Kenntnis der Gattungen *Acanthocreagris* und *Roncocreagris* (Arachnida, Pseudoscorpiones, Neobisiidae). *Revue Suisse de Zoologie*, **83**: 193-214.
- ZARAGOZA, J.A., 2000. Pseudoscorpiones cavernícolas de Asturias, Cantabria y País Vasco (Arachnida). *Mediterranea, Serie de Estudios Biológicos*, **17**: 5-17.
- ZARAGOZA, J.A., 2002. Dos nuevos *Roncocreagris* cavernícolas de Galicia (Arachnida, Pseudoscorpiones, Neobisiidae). *Revista Ibérica de Aracnología*, **5**: 91-98.
- ZARAGOZA, J.A., 2003. *Roncocreagris iglesiasae*, nueva especie cavernícola de Asturias (Arachnida, Pseudoscorpiones, Neobisiidae). *Revista Ibérica de Aracnología*, **7**: 89-94.
- ZARAGOZA, J.A., 2007. Catálogo de los pseudoescorpiones de la Península Ibérica e Islas Baleares (Arachnida: Pseudoscorpiones). *Revista Ibérica de Aracnología*, **13** (06-2006): 3-91.

Table I
List of known species of the genus *Roncocreagris* Mahnert.

Species	Distribution	Biology
<i>Roncocreagris andalusica</i> (Beier, 1952)	S-Spain	Epigean
<i>Roncocreagris aurouxi</i> Zaragoza, 2000	N-Spain	Epigean
<i>Roncocreagris beieri</i> Mahnert, 1976	Portugal	Epigean
<i>Roncocreagris blothroides</i> (Beier, 1962)	C-Portugal	Cave-dwelling
<i>Roncocreagris cambridgei</i> (L. Koch, 1873)	Algeria, Great Britain, France, Ireland, Italy, Portugal, Spain	Cave-dwelling
<i>Roncocreagris cantabrica</i> (Beier, 1959)	N-Spain	Epigean
<i>Roncocreagris cavernicola</i> (Vachon, 1946)	C-Portugal	Cave-dwelling
<i>Roncocreagris distinguenda</i> (Beier, 1959)	N-Spain	Epigean
<i>Roncocreagris galeonuda galeonuda</i> (Beier, 1955)	N-Spain	Epigean
<i>Roncocreagris galeonuda clavata</i> (Beier, 1955)	N-Spain	Epigean
<i>Roncocreagris galeonuda robustior</i> (Beier, 1959)	N-Spain	Epigean
<i>Roncocreagris iberica</i> (Beier, 1952)	C-Spain	Epigean
<i>Roncocreagris iglesiasae</i> Zaragoza, 2003	N-Spain	Cave-dwelling
<i>Roncocreagris lucensis</i> Zaragoza, 2002	N-Spain	Cave-dwelling
<i>Roncocreagris murphyorum</i> Judson, 1992	N-Portugal	Epigean
<i>Roncocreagris portugalensis</i> (Beier, 1952)	N-Portugal, N-Spain	Epigean
<i>Roncocreagris pycta</i> (Beier, 1959)	N-Spain	Epigean
<i>Roncocreagris roncooides</i> (Beier, 1955)	N-Spain, C-Portugal	Epigean
<i>Roncocreagris salgadoi</i> Zaragoza, 2002	N-Spain	Cave-dwelling

Table II.

Position of Leg IV tibia tactile seta in the european genera of Neobisiidae. ¹Basal in epigean species, cavernicolous forms sometimes present several long setae. ²Heurtault (1977) and Judson (1992) illustrated the tactile seta as being near the middle of the article. ³Personal observations. ⁴No data in literature.

European Neobisiidae genera	Distal	Basal
<i>Acanthocreagris</i>	X	
<i>Balkanoroncus</i>	X	
<i>Insulocreagris</i>	X	
<i>Microbisium</i>		X
<i>Neobisium</i>		X ¹
<i>Occitanobisium</i>		X ²
<i>Paedobisium</i>		X ³
<i>Protoneobisium</i>		X
<i>Roncobisium</i>		X ^{4(?)}
<i>Roncocreagris</i>		X
<i>Roncus</i>	X	

Table III.

Comparison of the main characteristics of the Microcreagrinae european genera. ¹Only known cave-dwelling species. ²Reduced to a convex hyaline tubercle in some species groups (f.i. *Roncocreagris galeonuda*).

Characteristics Subfamily Microcreagrinae	<i>Acanthocreagris</i>	<i>Insulocreagris</i>	<i>Roncocreagris</i>
One pair of eyes (epigean species)			X
Two pairs of eyes (epigean species)	X	X ¹⁽²⁾	
Flagellum with all blades pinnate			X
Flagellum with only 2-5 distal blades pinnate	X	X	
Galea present ²	X	X	X
Discal setae only on sternites VI-VII			X
Discal setae on sternites VI-VIII	X	X	
Palp trochanter with spiniform setae	X	X	
Tactile seta ratio tibia IV +0.50	X	X	
Tactile seta ratio tibia IV -0.50			X

Table IV.

Comparison of the main characteristics of the genera *Neobisium*, *Roncocreagris* and *Roncus*. ¹In nymph stages and sometimes in adults of *Roncus* species a low convex hyaline tubercle is present. ²In some *Roncocreagris* groups (f.i. *galeonuda*)

Characteristics genera <i>Neobisium</i>, <i>Roncocreagris</i>, <i>Roncus</i>	<i>Neobisium</i>	<i>Roncocreagris</i>	<i>Roncus</i>
One pair of eyes (epigean species)		X	X
Two pairs of eyes (epigean species)	X		
Flagellum with all blades pinnate		X	X
Flagellum with only distal blades pinnate	X		
Galea present		X	X ¹
Discal setae on sternites VI-VII		X	
Tactile seta ratio tibia IV +0.50			X
Tactile seta ratio tibia IV -0.50	X	X	
Distal opening of palpal patella moderately oblique			X
Distal opening of palpal patella markedly oblique	X	X ²	
Trichobothrium <i>ist</i> usually distal	X		
Trichobothrium <i>ist</i> usually basal		X	X