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On a collection of stygobitic cirolanids (Isopoda: Cirolanidae) from northern Mexico, with description of a new species

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Abstract

From caves and springs in northern Mexico (Tamaulipas and Coahuila), mostly explored by diving, seven species of stygobitic and troglomorphic cirolanids were sampled: four species of *Speocirolana* Bolivar (one of them, interesting in several respects, described as new), the two known species of *Sphaerolana* Cole & Minckley, and *Cirolanides texensis* Benedict. For all six already known species, the localities are new, and additional information is provided on their morphology, variability, and relationships. With 15 described species, Mexico has a quite remarkable and varied assemblage of subterranean Cirolanidae, pointing to quite diverse marine ancestors.
Key words: Isopoda, stygobitic/troglomorphic fauna, northern Mexico, taxonomy.

Resumé

Sept espèces de cirolanides stygobies et troglomorphes ont été récoltées, surtout par plongée, dans des grottes et sources du Mexique septentrional (Tamaulipas et Coahuila): quatre espèces de *Speocirolana* Bolivar (une de celles-ci, intéressante à plusieurs points de vue, est décrite comme nouvelle), les deux espèces connues de *Sphaerolana* Cole & Minckley, et *Cirolanides texensis* Benedict. Pour toutes les six espèces déjà décrites, les localités sont nouvelles, et des informations supplémentaires sont fournies (morphologie, variabilité, parentés). Le Mexique est habité par une faune de cirolanides souterrains particulièrement riche (quinze espèces décrites) dont la diversification indique que les ancêtres marins ont été fort variés.
Mots-clés: Isopoda, faune stygobie/troglomorphe, Mexique septentrional, taxonomie.

Introduction

This is a study of the stygobitic Cirolanidae sampled in March 1997 during a blindcat collecting expedition to northern Mexico, led by the third author, the second author being a member of the team (for a full list of expedition members: see Acknowledgements).
We give detailed information on the various sampling localities and sampling methods used. In the systematic part, mention of localities will be restricted to an indispensable minimum. A topographic map showing the relative locations of the sampling sites is presented in Fig. 32. All specimens examined have been deposited either in the Zoological Museum Amsterdam or in the Royal Belgian Institute of Natural Sciences, Brussels.

Sampling sites

1. Cueva del Nacimiento del Rio Frio, Ejido El Nacimiento, Municipio Gómez Farías, Tamaulipas, Mexico; Station numbers: DAH970309-1, DAH970310-1; 9 and 10 March 1997.

The cave entrance, situated at 155 m elevation, is located in a dry channel on the mountain side immediately above the springs that give rise to Rio Frio. The small cave entrance leads about 10 m down over breakdown to a dirt floored room. From this point, a flowstone slope extends up through well-decorated passage back to the level of the entrance. About 50 m from the entrance, a large dome pit is encountered. This 12 m diameter pit drops 40 m to a deep lake. Underwater, the cave descends over breakdown to smooth walled phreatic passage at a depth of 50 m. This passage extends horizontally for about 100 m to a vertical shaft that goes up to an isolated lake with a 25 m high dome above it. No water currents were noticed.
Two homogeneous but discrete water masses were found in the cave based on *in situ* measurements of water quality taken with a Hydrolab Data Sonde 3 Multiprobe Logger. Measurements of depth, temperature, specific conductance, pH, dissolved oxygen and redox potential were taken at two second intervals over the course of the dive. The upper 40 m of the cave water column was uniform at 21.52°C, 0.43 milliSiemens/cm specific conductance, 3.4 mg/l dissolved oxygen, pH 7.76 and 361 mV redox potential. Below 41 m, temperate, specific conductance, dissolved oxygen and pH all increased slightly to 21.63°C, 0.52 mS/cm, 4.4 mg/l and 363 mV, respectively, while pH decreased slightly to 7.72. Both sets of values were significantly different from the Rio Frio springs located below the cave entrance. Spring water measured at 12 separate sites had significantly increased temperature, specific conductance, dissolved oxygen and redox potential at 23.05°C, 0.73 mS/cm, 5.4 mg/l and 380 mV, respectively, while pH decreased to 7.70. These data suggest that the

spring and cave waters are not directly connected and, considering that the spring water parameters significantly extend the depth trends observed in the cave, come from considerable depths.
Specimens of isopods were collected by hand in individual vials. The isopods were observed swimming in the water column primarily at depths below the 40 m chemocline. Also collected from the same locations within the cave were troglobitic catfish (Ictaluridae, *Prietella*), mysids, shrimp (Atyidae), gastropods and branchiobdelid worms.

2. Manantial de San Rafael de Los Castro, Municipio Ciudad Mante, Tamaulipas, Mexico; Station number: DAH970313-2; 13 March 1997.

The spring outlet is located at the southern edge of the village of San Rafael de Los Castro at an elevation of 98 m. The water surface is accessible at the bottom of a 4 m depth pit but flows under a short natural bridge before emerging permanently on the surface. From this pit, the underwater cave continues as an irregular series of small to medium sized chambers before a deep fissure extends to depths in excess of 60 m. The flow rate from the spring was very low at the time of collection.
Water quality measurements were made at two second intervals with a Hydrolab Data Sonde 3. The water mass within the cave was homogeneous at 27.3°C, 0.76 mS/cm specific conductance, 0.9 mg/l dissolved oxygen, pH 7.47, and 335 mV redox potential. These values show significantly higher temperatures and lower dissolved oxygen than Cueva del Nacimiento del Rio Frio.
Isopods were collected by hand in vials primarily from sections of the cave near the entrance at 0-15 m water depths. Also collected were troglobitic catfish (Ictaluridae, *Prietella*), shrimp (Atyidae) and amphipods.

3. Cueva La Zumbadora, Municipio La Madrid, Coahuila, Mexico; Station DAH970316-1; 16 March 1997.

Cueva La Zumbadora is located in a canyon upstream from the town of La Madrid. This cave has a waterfall not far inside that gave it the name ("humming cave"). It became accessible just a few years ago when a large gravel deposit at its mouth that reached essentially to the ceiling was dug out. Discharge has been fairly high, through a deep, narrow, serpentine channel. The cave passage sumps only 100 m or so upstream from the waterfall. A diversion structure was recently constructed above the waterfall, but was immediately abandoned when the first attempt at diversion revealed that this water continues underground to La Madrid. The waterfall roars down through a tight corkscrew passage that is partially blocked by debris. From the upstream sump, the cave was explored by divers for 150 m to a depth of 15 m, with the passage still continuing at this point.
Water quality measurements were made at the spring entrance with a Hydrolab Data Sonde 3. The cave water was measured at 24.34°C, 0.71 mS/cm specific conductance, 4.02 mg/l dissolved oxygen, pH 7.67, and 355.5 mV redox potential.
Isopods were collected by divers using individual vials in 3-10 m water depths. Snails were also collected from the cave.

4. El Potrero 1, Municipio Melchor Múzquiz, Coahuila, Mexico; Station DAH970318-1; 18 March 1997.

El Potrero 1, located just outside the of town Melchor Múzquiz at ca. 600 m a.s.l., is the type locality for the blind catfish *Prietella phreatophila*. The site is the natural opening of a crack at the base of the mountains, but is now covered by steel doors and highly modified by installation of a submersible pump. This pump runs continuously and supplies water for a mining company. The crack narrows quickly as it descends near vertically. Water level varies by at least 8 m. Underwater, the fissure was explored by divers to a depth of 15 m before becoming too tight.
Water quality measurements were made at the pool surface with a Hydrolab Data Sonde 3. The cave water was measured at 31.12°C, 0.72 mS/cm specific conductance, 1.58 mg/l dissolved oxygen, pH 7.73, and 345.8 mV redox potential.
Isopods were collected by divers in individual vials from 1-8 m water depths. Snails were also collected from the cave.

5. El Potrero 2, Municipio Melchor Múzquiz, Coahuila, Mexico; Station DAH970320-1; 20 March 1997.

El Potrero 2 is a natural cave located across the road from El Potrero I. The entrance is covered by a steel plate with access through a trap door to a 4 m long by 2 m wide pool. At the far side of this shallow pool, a crack continues underwater for more than 100 m reaching depths of 5 m.
Water quality measurements were made throughout the submerged cave passage with a Hydrolab Data Sonde 3. At the surface, the cave water was measured at 29.15°C, 0.72 mS/cm specific conductance, 3.48 mg/l dissolved oxygen, pH 7.92, and 344.18 mV redox potential. Below 4 m, temperature, dissolved oxygen and pH decreased to 28.25°C, 1.76 mg/l and 7.79, respectively, while specific conductance and redox potential were little changed.
Isopods were collected by divers using individual vials from 1-4 m water depths. Snails were also collected from the cave.

6. Sotano de Amezcua, Municipio Ciudad Acuña, Coahuila, Mexico; Station DAH970325-1; 25 March 1997.

Sotano de Amezcua is located northwest of Ciudad Acuña. The entrance consists of a 70 m vertical drop from the bottom of a funnel-shaped collapse structure. A small stream at the bottom of this shaft continues for 30 m upstream to a sump, while downstream a crawl over

cobbles in a snaking channel ends in another sump. The cave obviously floods dramatically after heavy rains as evidenced by the flood line on the walls. The upstream sump was explored by divers and found to connect to additional air-filled passage that again sumped.
Isopods were collected by divers from the upstream sump with individual vials from 1-4 m water depths. Amphipods were also collected from the cave.

Systematic part

Genus *Speocirolana* Bolivar y Pieltain, 1950

First described as subgenus of *Cirolana* Leach, this was elevated to generic rank by Bowman (1964). Presently seven species are assigned to *Speocirolana*, six inhabiting various zones of Mexico and only one known from outside this country but near to its borders, i.e., from southern Texas; these species - the Texas one excepted - and their distribution and habitats are listed in Botosaneanu, Bruce & Notenboom (1986). The character considered in various publications as shared by all species and justifying the genus, is the presence of three pairs of prehensile pereiopods with long dactyli, followed by 4 pairs of ambulatory ones with short dactyli. But it should be added that there are other shared characters apparently demonstrating the monophyly of *Speocirolana*, for instance the all-important structure of the pleon (only 3 well-developed segments with projecting tips of epimera, a 4th one less developed and with concealed tips, the 5th one being very small but still well seen dorsally), and the telson devoid of marginal spines or setae. Moreover, the remarkable proliferation of species, all troglomorphic, on a relatively restricted territory, could be an additional argument for monophyly.
In the collection here studied, four species of *Speocirolana* - one of them new - were found.

Speocirolana bolivari Rioja, 1953

MATERIAL EXAMINED

Mexico, Tamaulipas, Municipio Gómez Farías, Ejido El Nacimiento, Cueva del Nacimiento del Rio Frio, 9 and 10 March 1997: 4 males measuring slightly more than 3 cm, 2.9 cm, 2.8 cm, and 2.2 cm, respectively, and 3 females measuring 3.3 cm, 3.2 cm and ca 2.8 cm, respectively (none with oostegites).

Speocirolana pelaezi Bolivar y Pieltain, 1950

MATERIAL EXAMINED

Same locality as for *S. bolivari*, 10 March 1997: 1 male measuring ca. 1.5 cm.

These two species are possibly rather closely related. Rioja (1953) and Bowman (1981) have summarized the characters enabling distinction of *bolivari* and *pelaezi*; some of these characters are really conclusive: relative length of AII, setation of articles 2 and 3 of the maxilliped palpus, complete or incomplete bipartition of pleopod III exopodite, setation/lack of setation of pleopods IV and V exopodites, as well as shape of the telson (although the characteristic shape of the telson of *bolivari* can be sometimes modified by an emargination of the distal margin); whereas other characters are less conclusive, difficult to use (shape of lamina frontalis), or variable (spines on internal margin of uropodal exopodite; ratio length/width of articles in the terminal 1/3 of the AII flagellum - in most of our specimens the situation being intermediate between that considered by Rioja (1953) as characteristic for *bolivari* or, respectively, for *pelaezi*.

Although both species are known from Tamaulipas (localities additional to those in the papers by Bolivar and by Rioja are listed in Reddell & Mitchell, 1971a, 1971b), Cueva del Nacimiento del Rio Frio is a new locality for them. Coexistence in the same locality of the two species was already known, and this is an additional case. Our material confirms the opinion that *pelaezi* is far less abundant than *bolivari*. In samples with *S. bolivari*, ectoparasitic worms (Branchiobdellidae or Hystriobdellidae) were found.

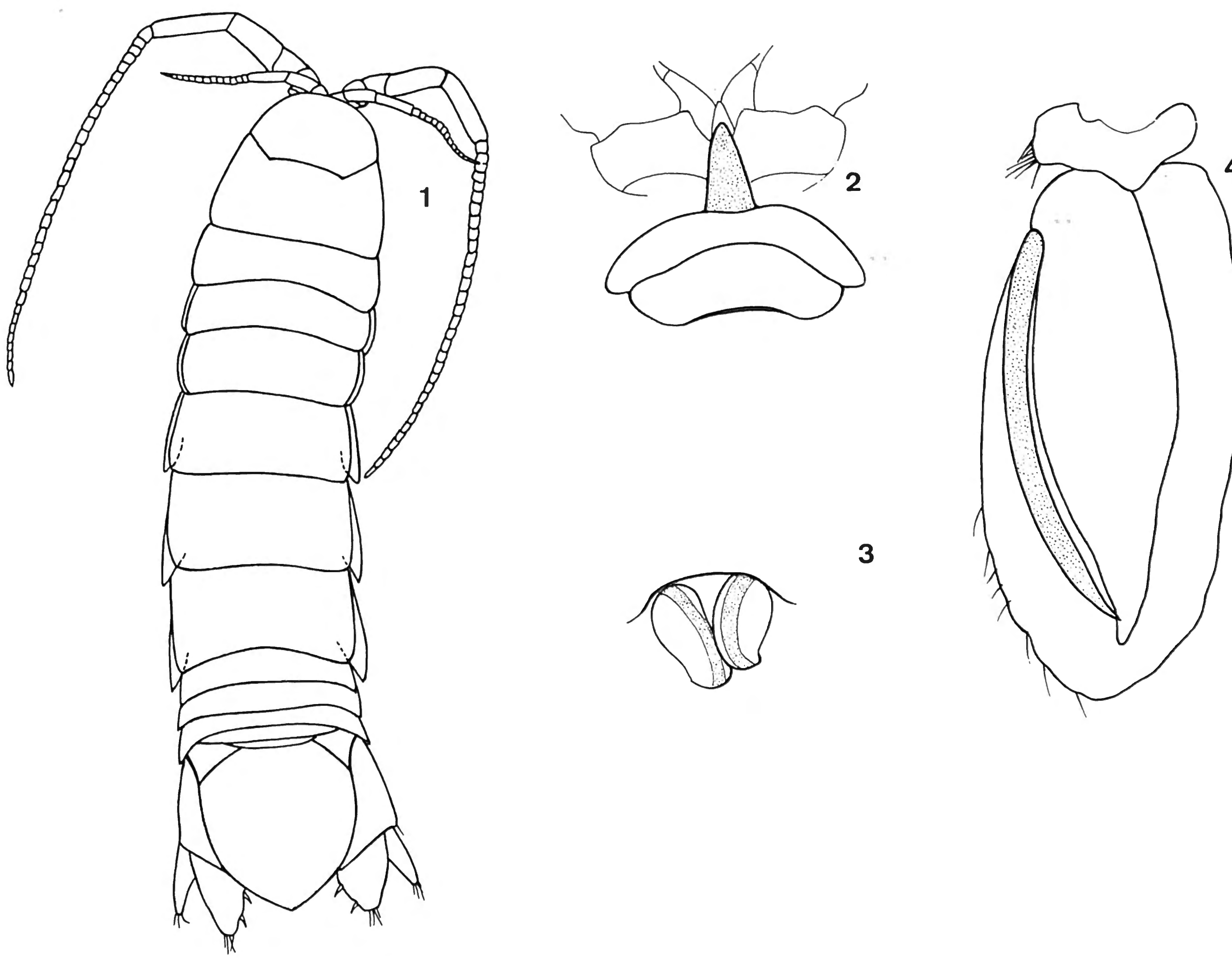
Speocirolana thermydronis Cole & Minckley, 1966
Figs. 1- 4

MATERIAL EXAMINED

Mexico, Coahuila, Municipio Melchor Múzquiz, El Potrero 1, 18 March 1997: 1 male measuring 1.4 cm. Same, but El Potrero 2, 20 March 1997: 1 female without oostegites, in bad condition, measuring ca. 2 cm (ratio length/maximum width: at least 4.3).

The original description of this species was made from a single female measuring 1.5 cm caught in a habitat associated in some way to thermal springs from a locality in Coahuila. In Minckley & Cole (1968) there is much interesting additional morphological and ecological information on this species, based on a large number of specimens from two other localities situated not far from the first one. El Potrero 1 and El Potrero 2 are new localities.

Although the male was never fully described and illustrated, there is in Minckley & Cole (1968) some information on it (without illustration); and in Bowman (1992: fig.4f) a description and a drawing - with details - of the male uropod; in these publications no mention is made of presence of spines on the uropodal rami, the same being true for the original description prepared from a



Figs. 1-4. – *Speocirolana thermydronis* COLE & MINCKLEY, male. 1. Habitus. 2. Lamina frontalis and clypeo-labrum, ventral. 3. The penial papillae, in slightly different positions. 4. Right pleopod II.

female; this is rather surprising because in our specimen there are well-developed spines on the internal margin of the uropodal endopodite (bilaterally 2 in the male - fig. 1 -, 3 on the left and 2 on the right endopodite in the female).

We illustrate here the habitus, lamina frontalis + clypeus + labrum, the genital papillae, and pleopod II of our male specimen.

Speocirolana zumbadora n. sp.
Figs. 5-25

MATERIAL EXAMINED

Mexico, Coahuila, Municipio La Madrid, La Zumbadora, 17 March 1997: 1 female (holotype; deposited in the Zoological Museum, Amsterdam. This specimen measures 1.75 cm and has no oostegites. It is generally in good condition but with some mutilated appendages (left AII flagellum, possibly also tip of right AII flagellum, endopodite of left uropod) and some appendages (coxopodite of right uropod, endopodite of pleopod IV) look like having been bitten by a predator.

DESCRIPTION OF FEMALE

The body is fusiform, the maximum width being attained by the VIth pereionite; ratio length/maximum width: ca. 3.5. Head posteriorly with three edges, the lateral ones concave; antero-laterally with two shoulders (well distinct also ventrally: fig. 7), medially trilobed; no rostrum. Lamina frontalis strong, slightly widening towards the rounded apex; clypeus rather broad, its obtuse apices not reaching posterior margin of labrum; labrum slightly emarginate posteriorly.
Epimeres of pereion I not visible dorsally, those of pereions II-III very indistinct, in strong contrast with those of pereions IV-VII. The structure of the pleon is that typical for *Speocirolana*. Telson shield-like, maximal

width in its middle, then margins gently converging towards a rounded apex. On telson (fig. 5) two pairs - one smaller, one larger - of roughly rounded formations were found which were interpreted by the first author as possibly being statocysts; but having examined the specimen at our request, Prof. J.W. WÄGELE concluded that they cannot be statocysts because of their irregular, asymmetrical distribution on the pleotelson and the apparent absence of sensory elements, and that they may be calcareous spherules.

AI could reach, if completely stretched, the posterior limit of pereion I; peduncle slightly shorter than flagellum; well-developed apical part of the 3rd peduncular article - looking like a 1st flagellar article; flagellum with 13

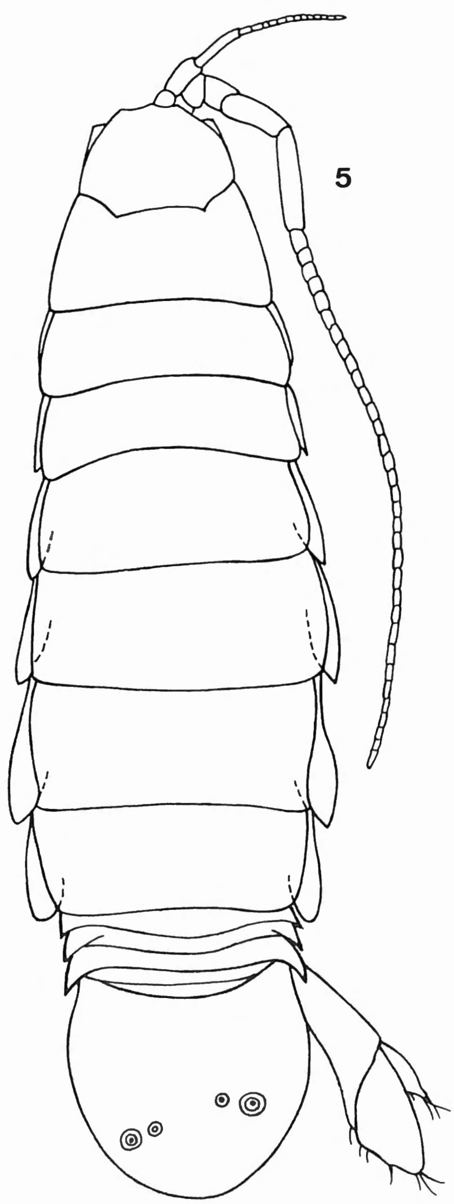


Fig. 5. – *Speocirolana zumbadora* n. sp., habitus of female holotype.

articles (2nd longest of all, 3rd shortest of all), articles 4-12 each with one esthetasc.

AII could reach, if completely stretched, the middle of pereion VII. Four setae at the end of the 5th peduncular article are plumose. Flagellum of 33 articles (maybe slightly more).

Mandibulae with row of setulae in the middle of the mandibular body; molar process with row of very fine, sharp points, without setulae basad from this row.

Mx I: lateral lobe with 12, mostly shortly ciliate spines; endite with 6 setae of similar length.

Mx II: internal lobe with some 13-14 very dissimilar setae, the larger ones plumose in their distal part; middle lobe with 5, external lobe with 3 setae.

Mxp: epipodite glabrous: the structure of the sympodite is probably like illustrated (fig.13); masticatory lobe rectangular, bilaterally with 5 apically inserted plumose setae, and with only one retinaculum; most of the setae on articles 2-5 of the palpus are as strong as those of the masticatory lobe, although they were not so illustrated (they are shortly ciliate); in the disto-external angle of palp segments 3 and 4, a single ciliate seta.

Like in all *Speocirolana*, pereiopods I-III haptorial (I - especially propodus - more robust than II and III), and IV-VII ambulatory, the contrast between these two groups being impressive, and resulting not only from the different shape of, i.e., the propodi, but also from the strongly differing dactyli (long, swinging, in I-III, very strongly shortened in IV-VII). Unguis in all pereiopods with well-developed additional unguis ("secondary spine"). The armature of spines is poor on all pereiopods, although the number of spines slightly augments from I to VII; on the propodial palm 2 spines on pereiopod I, 3 on pereiopods II and III; setae are almost absent (of course, there are marginal setulae).

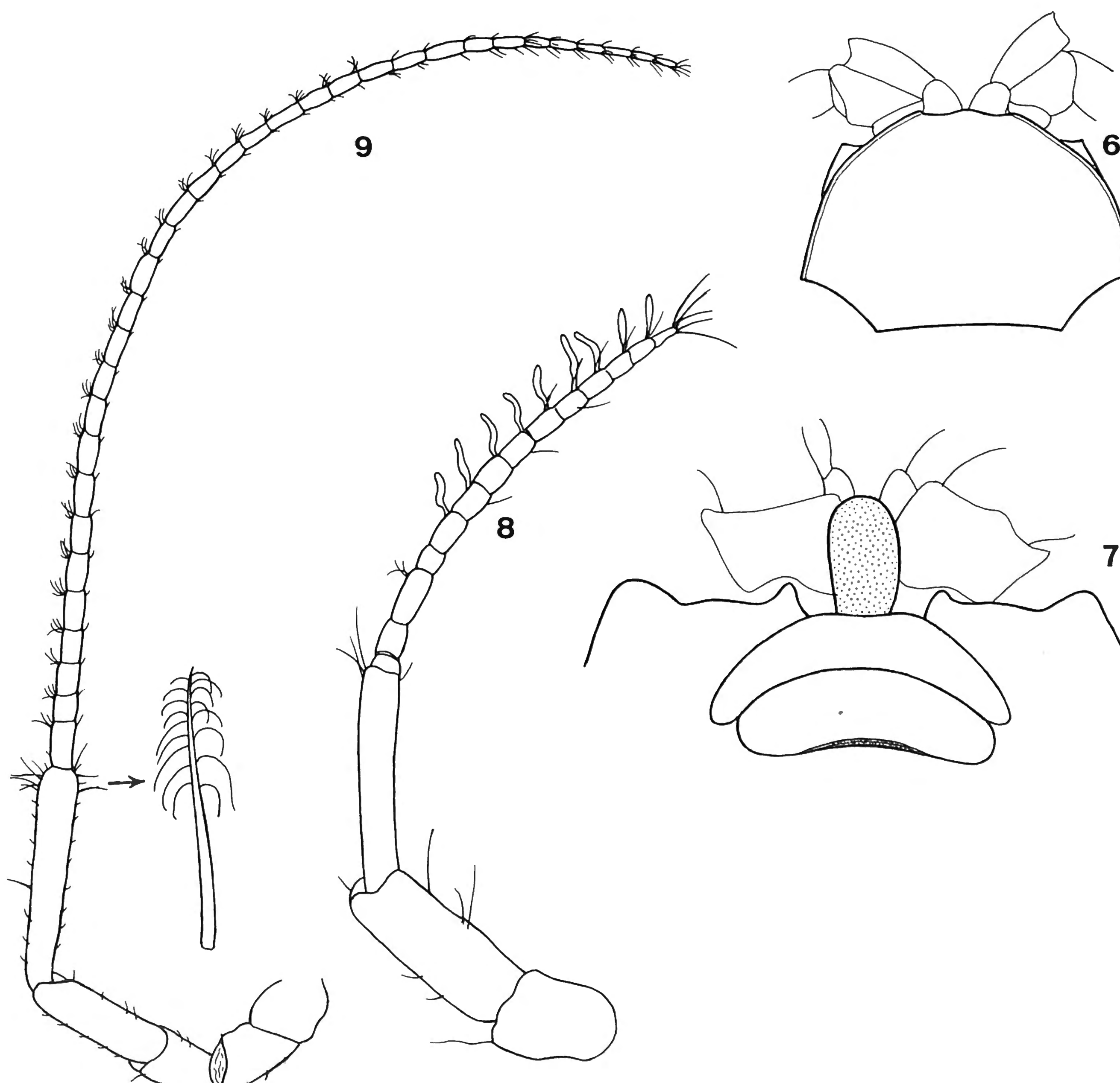
Rami of pleopods I and II more slender than those of pleopods III-V, all membranous. Protopodites (especially I-III) relatively small, wider than long, those of I-III on internal margin with rich armament of coupling hooks and setae (none seen on protopodites IV and V). Exopodites III-V distinctly and completely bipartite. Endopodites glabrous; distally on exopodites I-III very short and relatively few finely ciliate marginal setae; these are even fewer on III than on I and II, and reduced to only 3 medio-distally on IV and V (there are quite a few very small setae along the external margin of the basal part of the exopodites III and IV).

Uropods of about the same length as the telson - anyway, not distinctly overrunning it; coxopodite slender, with very slender spine in its very moderately produced internal angle, and a pair of spines in the external angle; exopodite ovoid, slender, endopodite strongly developed, broadly triangular, almost two times as long as the exopodite; there are 4 spines on the internal margin of the endopodites, one of them subapical, and not far from the apex of the exopodite one spine on each margin; the setation is very scarce, reduced to a tuft of apical setae on both rami.

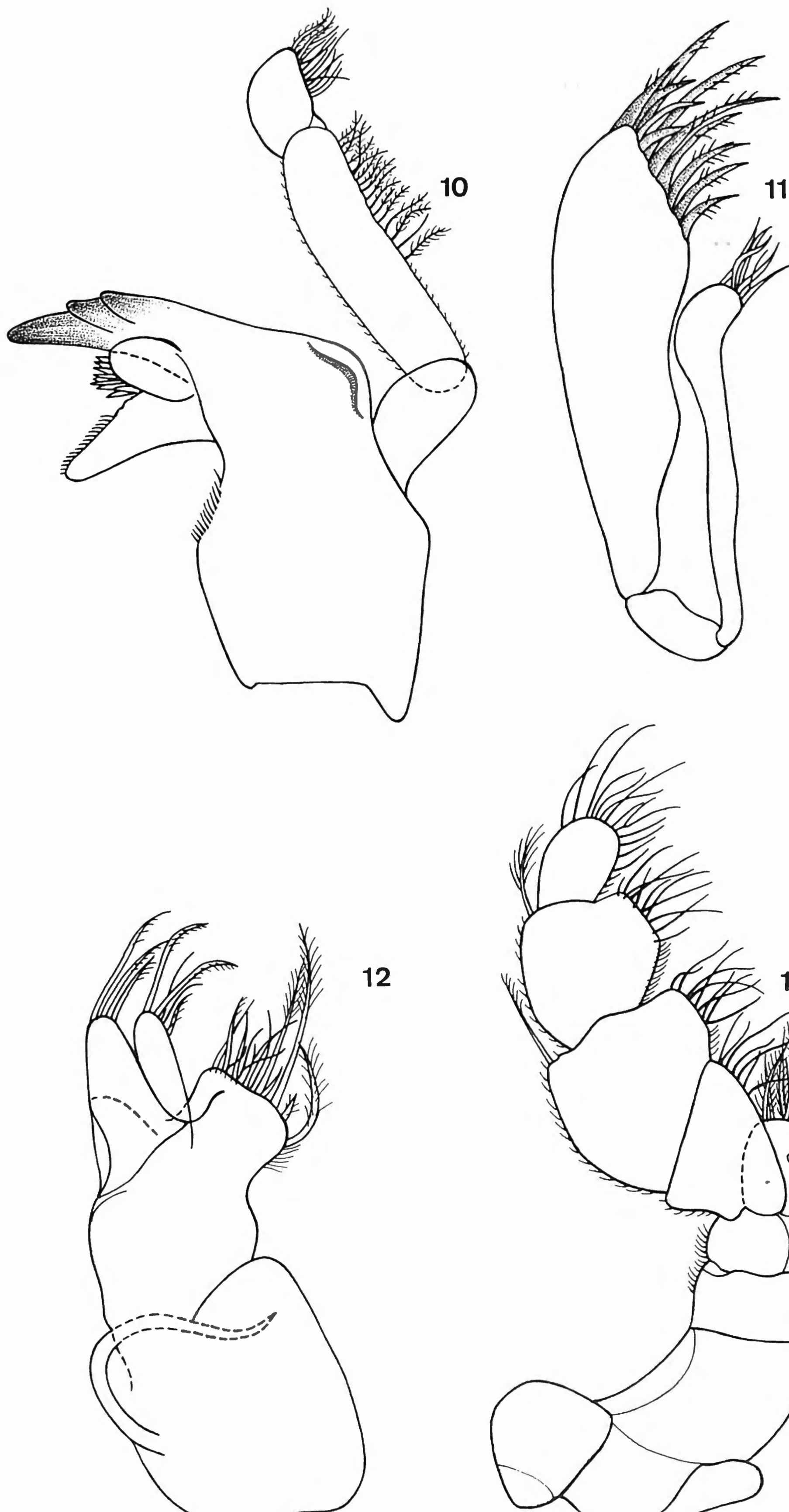
AFFINITIES; DISTINCTIVE CHARACTERS OF THE NEW SPECIES

Discovering the possible affinities of *S. zumbadora* n. sp. is not an easy problem. We first thought that it is more closely related to *S. thermydronis*, and also to *S. hardeni* (BOWMAN 1972, notes differences between these two and the other described species of the genus); and, indeed, there are several significant characters shared by these three species. But, in fact, there are other characters shared with each of the other described species of *Speocirolana* (publications not yet referred to, and containing descriptions: BOWMAN, 1981; CONTRERAS-BALDERAS & PURATA-VELARDE, 1981); to give only one example: the cephalon of the new species strongly resembles that of *S. bolivari* (see fig. 2 in RIOJA, 1953).

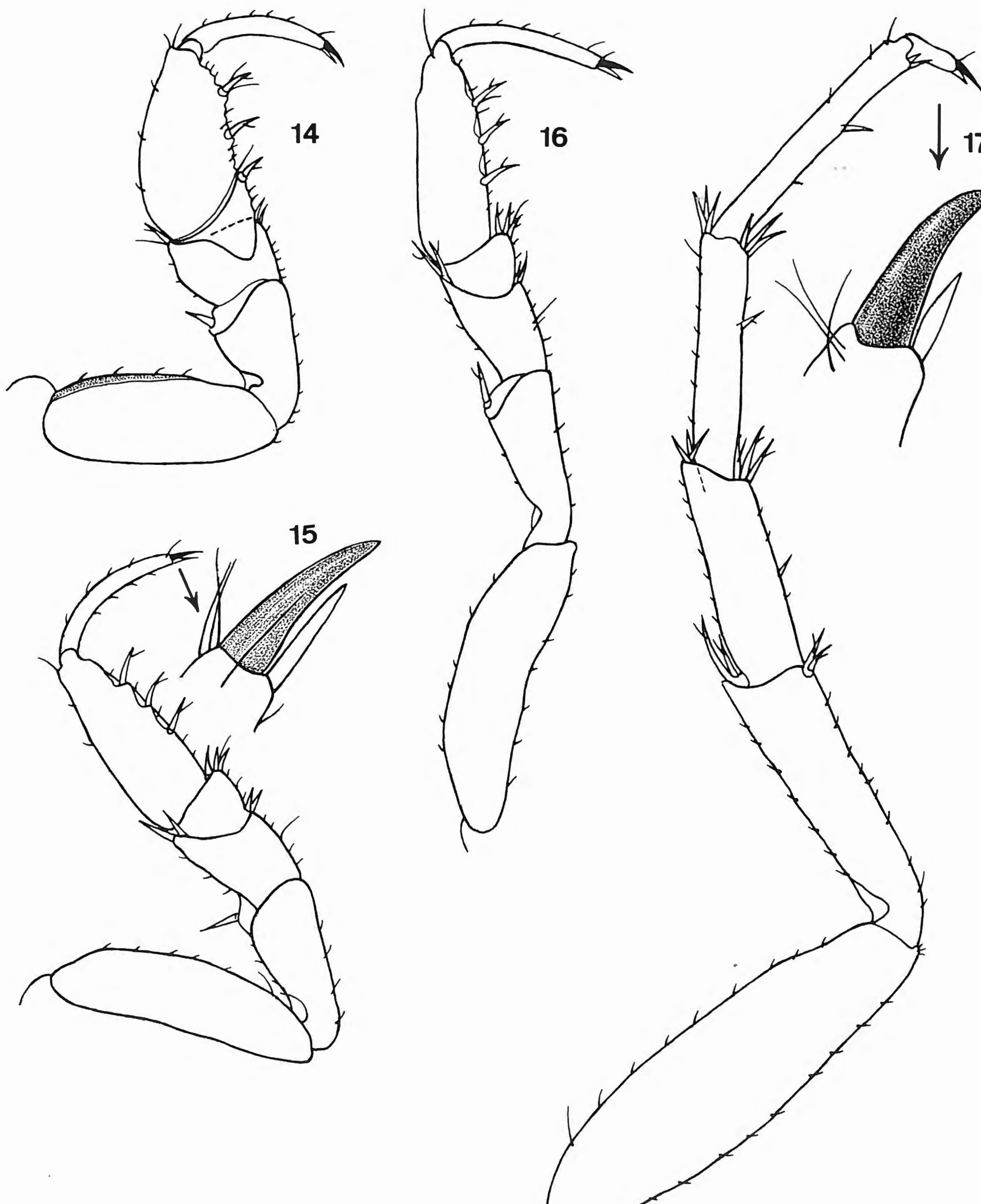
Pending a - for the time being premature - revision of the genus, here are the most important characters whose combination allows the easy distinction of the new species: size intermediate between that of largest and of smallest *Speocirolana*; body fusiform, *S. zumbadora* being, nevertheless, one of the most slender species; cephalon with complex, characteristic outline, not simply rounded anteriorly; lamina frontalis strong, apically broadly rounded; telson distally rounded; maxilliped with a single retinaculum on masticatory lobe (this character maybe variable); pereiopods IV-VII with extremely short dactyli (only about 1/3 of the length of those of pereiopods I-III); pleopods with completely bipartite exopodite, all



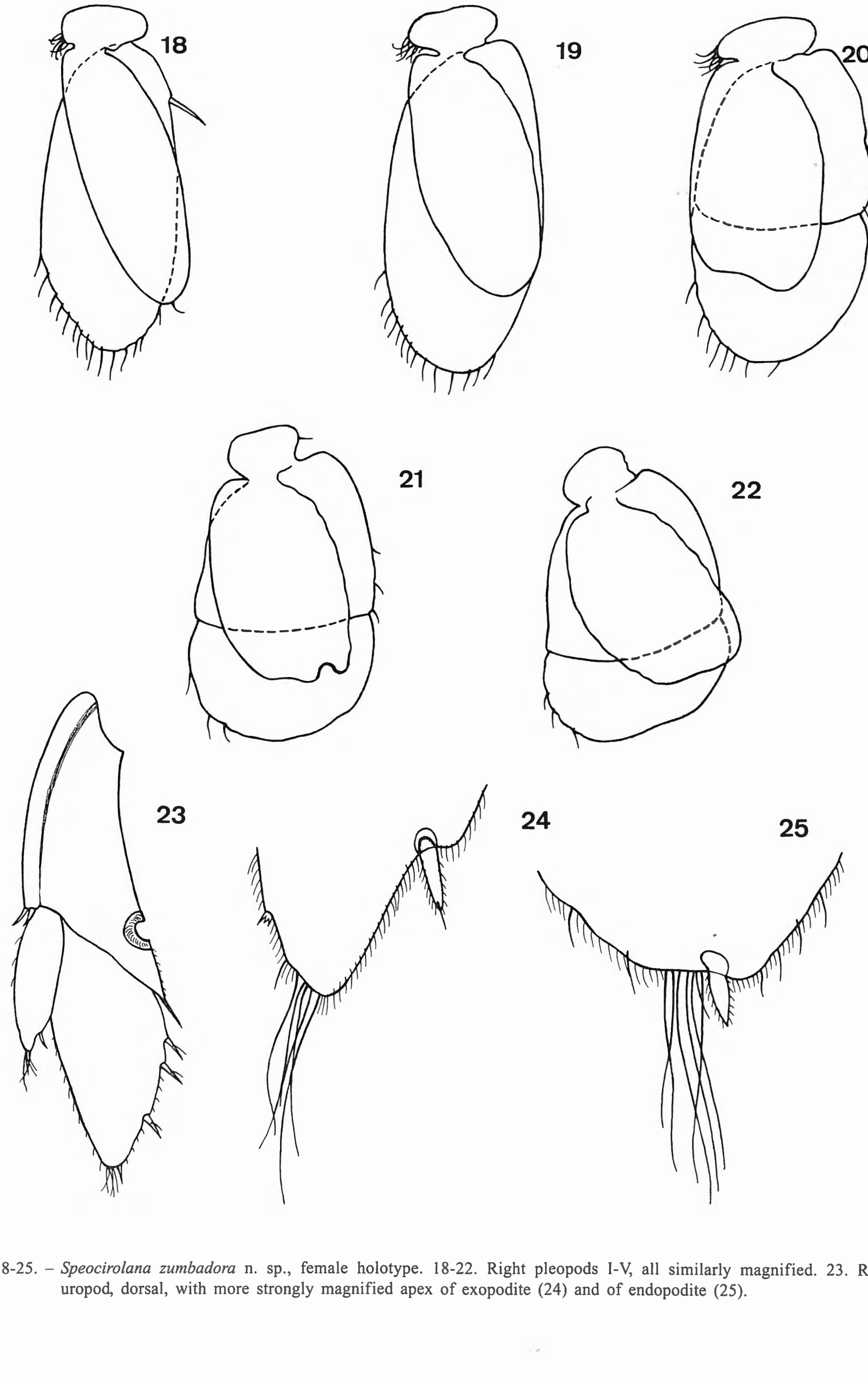
Figs. 6-9. – *Speocirolana zumbadora* n. sp., female holotype. 6. Cephalon. 7. Lamina frontalis and clypeo-labrum, ventral ("shoulders" of cephalon also represented). 8. AI. 9. AII. Various magnifications.



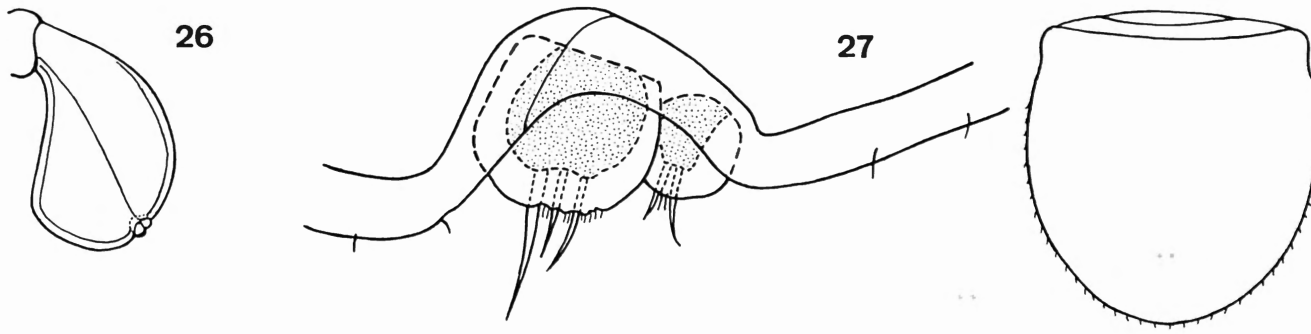
Figs. 10-13. – *Speocirolana zumbadora* n. sp., female holotype. 10. Right mdb. 11. Right mx I. 12. Right mx II. 13. Right mxp. (11 & 12 more strongly magnified than 10 & 13).

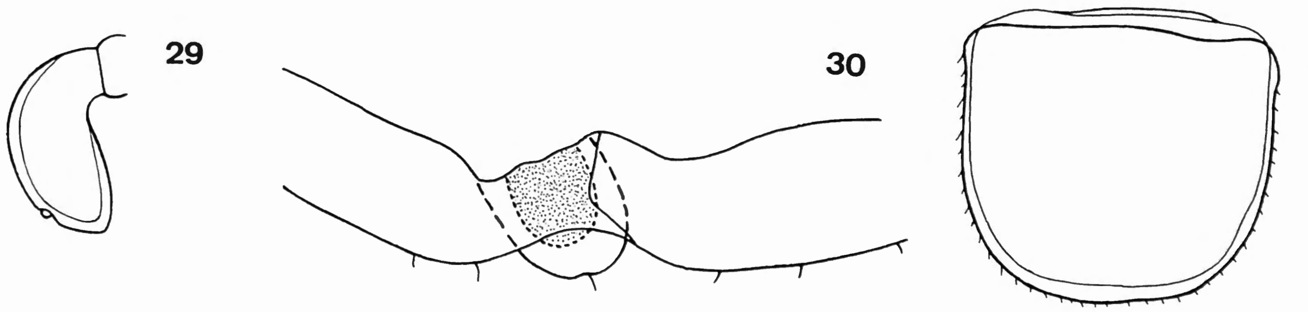


Figs. 14-17. – *Speocirolana zumbadora* n. sp., female holotype, right pereiopods I, II, III, and VII (all similarly magnified; details of unguis more strongly magnified).



Figs. 18-25. – *Speocirolana zumbadora* n. sp., female holotype. 18-22. Right pleopods I-V, all similarly magnified. 23. Right uropod, dorsal, with more strongly magnified apex of exopodite (24) and of endopodite (25).





Figs. 26-28. – *Sphaerolana affinis* COLE & MINCKLEY, male, similarly magnified left uropod, ventral (26) and pleotelson (28), and strongly magnified apex of uropod (27).

Figs. 29-31. – *Sphaerolana interstitialis* COLE & MINCKLEY, female, similarly magnified right uropod, ventral (29) and pleotelson (31), and strongly magnified apex of uropod (30).

endopodites glabrous; uropods not overrunning telson, exopodite much shorter and narrower than the strong, triangular endopodite, both rami armed with marginal spines.

Genus *Sphaerolana* COLE & MINCKLEY, 1970

This very remarkable genus of stygobitic Cirolanidae was erected for two closely related species from various springs in Coahuila; sometimes sympatrically found, these are characterized, i.e., by their ability to roll into a ball and by the extraordinarily reduced rami of their uropods. A third species, *S. karenae*, was later described by RODRIGUEZ-ALMARAZ & BOWMAN (1995) from two localities in the state of Nuevo Leon.

The two species from Coahuila are represented in the collection studied by us. Examination of these specimens allows some considerations about the value of characters considered in various publications (COLE & MINCKLEY, 1970; COLE, 1984; RODRIGUEZ-ALMARAZ & BOWMAN, 1995) as allowing distinction of the various species.

The following characters seem to be of no, of little, or of difficult use (variable, not clearly distinctive...): body size; length of AII; shape of median margin of pleopod I exopodite; number of pleonites demarcated dorsally (RODRIGUEZ-ALMARAZ & BOWMAN, 1995, state that there are two such segments in *S. affinis* and *S. interstitialis*, and three in *S. karenae*; observation of our specimens - see figs. 28 and 31 - allows us to conclude that there is no true difference: besides the first two well-developed pleonites, there are two others, welded to the telson and much less developed, the last one becoming sometimes visible dorsally. An excellent character allowing distinction of the three species, is offered by the telson (shape, proportions). The structure of the uropods is abundantly different in *S. affinis* and *S. interstitialis* (figs. 26-27 and 29-30), but very similar in *S. affinis* and *S. karenae*, where the only difference seems to be in the setation of the endopodite (compare fig. 16 in RODRIGUEZ-ALMARAZ & BOWMAN, 1995, with our fig. 27).

Sphaerolana affinis COLE & MINCKLEY, 1970
Figs. 26-28

MATERIAL EXAMINED

Mexico, Coahuila, Municipio La Madrid, La Zumbadora, 17 March 1997: 1 female with oostegites[1], measuring 0.9 cm; 4 males measuring 1 cm, 1.1 cm, 1.2 cm, and 1.3 cm, respectively; and one small manca specimen. This locality is new for *S. affinis*.

[1] In BOTOSANEANU, BRUCE & NOTENBOOM (1986) an incorrect statement was made that "...ovigerous females or females with brood plates or pouches were apparently never found in subterranean species" [of Cirolanidae]. This was not true, females with oostegites having been already described in *Skotobaena* FERRARA & MONOD, 1972. And - present paper - females of *Sphaerolana* with oostegites or ovigerous are frequently caught, this being possibly valid also for *Cirolanides*.

Sphaerolana interstitialis COLE & MINCKLEY, 1970
Figs. 29-31

MATERIAL EXAMINED

Mexico, Tamaulipas, Municipio Ciudad Mante, Manantial de San Rafael de Los Castro, 12 March 1997: 1 male measuring 0.46 cm; 1 female without oostegites, 0.45 cm; 1 female with oostegites, 0.6 cm; and 2 females with oostegites and 5 and respectively 7 large, yellow eggs (0.6 and 0.62 cm).

As shown by our drawings, *S. interstitialis* differs from *S. affinis* in the telson slightly truncate, with a distinct "hem", and with maximal width slightly exceeding the maximal length; in the more slender uropod propodite; and especially in the still more extraordinarily reduced uropods, with one of the rami (which?) absent.

The locality is not only new but also considerably (ca. 550 km!) distant from the localities in Coahuila.

Cirolanides texensis BENEDICT, 1896

MATERIAL EXAMINED

Mexico, Coahuila, Municipio Ciudad Acuña, Sotano de Amezcua, 25 March 1997: 1 female with oostegites.
This species frequently found in caves and phreatic water of south-central Texas (southern limits of Edwards Plateau) is here for the first time recorded from Mexico, but the locality is just on the border with Texas. The specimen perfectly matches the re-description in BOWMAN (1964).

Some final remarks

With 15 species described to this day, Mexico has a most extraordinary assemblage of stygobitic and troglomorphic cirolanids. It is certain that several others will be discovered especially in zones not yet, or insufficiently, explored by biospeleologists. All these are obviously of

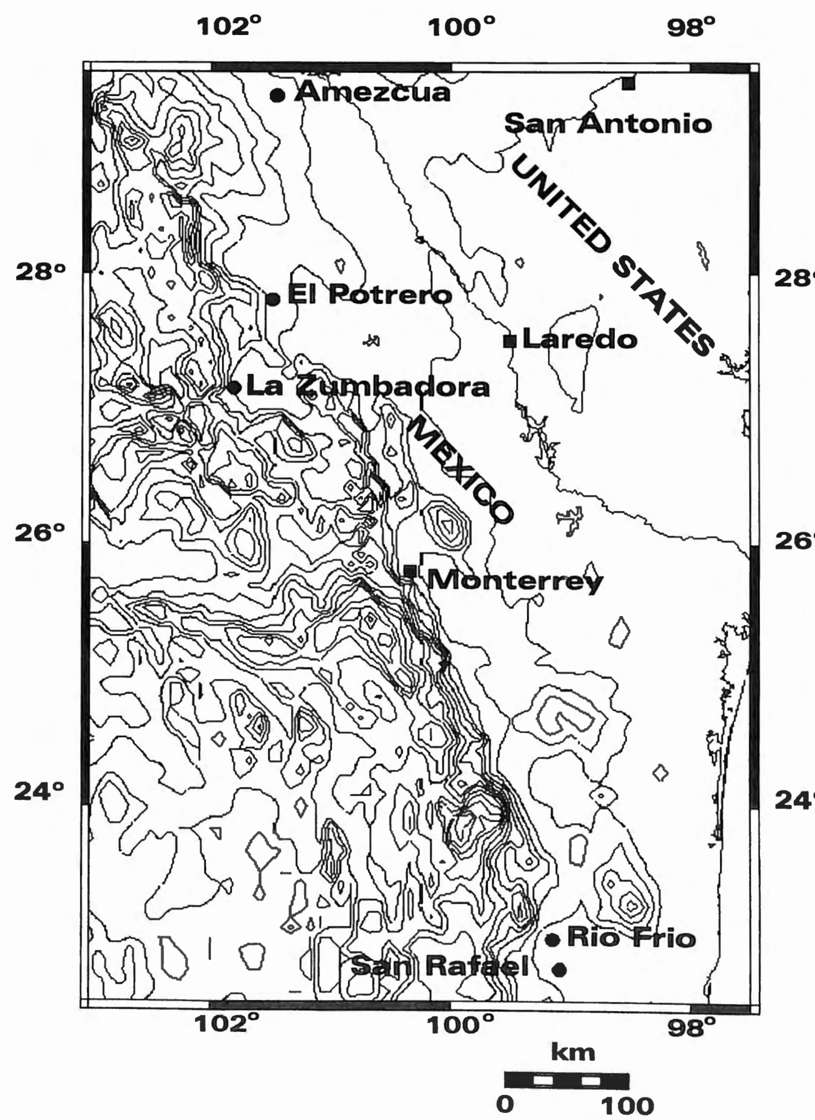


Fig. 32. –Topographic map of northern Mexico and part of Texas showing the relative locations of the collecting sites reported in this paper. The map was created with GMT (The Generic Mapping Tools) on the Internet at: <http://www.aquarius.geomar.de/omc/omc_intro.html>

marine origin. In several papers (COLE & MINCKLEY, 1966, 1970) interesting speculation was published on possible time and place of origin for Mexican stygobitic Cirolanidae, mainly based on evidence supplied by paleogeography. One striking fact is the great diversity of these cirolanids, pointing to quite diverse marine ancestors. The question is: will it be possible, by thorough analysis of all available evidence, to discover something really making sense about these ancestors? It is more probable that, in this case too ". . . the subterranean, often convergent evolution of characters might obscure the phylogenetic relationships between marine epigean and stygobiont taxa"(GALASSI, 1997: 284).

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References

BOLIVAR Y PIELTAIN, C., 1950. Estudio de una *Cirolana* cavernicola nueva de la region de Valles, San Luis Potosi, México. *Ciencia* (México), 10: 211-218.

BOTOSANEANU, L., BRUCE, N. & NOTENBOOM, J., 1986. Isopoda: Cirolanidae. In: BOTOSANEANU, L. (Ed.), Stygofauna Mundi, E.J. Brill, Leiden: 412-422.

BOWMAN, T.E., 1964. *Antrolana lira*, a new genus and species of troglobitic cirolanid isopod from Madison Cave, Virginia. *International Journal of Speleology*, 1(1-2): 229-236, plates 50-57.

BOWMAN, T.E., 1981. *Speocirolana pubens* and *S. endeca*, new troglobitic isopod crustaceans from Mexico (Flabellifera: Cirolanidae). *Association of Mexican Cave Studies Bulletin*, 8: 13-23.

BOWMAN, T.E., 1992. Two subterranean aquatic isopod crustaceans new to Texas: *Mexistenasellus coahuila* (COLE and MINCKLEY, 1972) (Asellota: Stenasellidae) and *Speocirolana hardeni*, new species (Flabellifera: Cirolanidae). *Texas Memorial Museum Speleological Monographs*, 3: 23-30.

COLE, G.A., 1984. Crustacea from the bolson of Cuatro Cienegas, Coahuila, Mexico. *Journal of the Arizona-Nevada Academy of Science*, 19: 3-12.

COLE, G.A. & MINCKLEY, W.L., 1966. *Speocirolana thermydronis*, a new species of cirolanid isopod crustacean from Central Coahuila, México. *Tulane Studies in Zoology*, 13: 17-22.

COLE, G.A. & MINCKLEY, W.L., 1970. *Sphaerolana*, a new genus of cirolanid isopod from northern México, with description of two new species. *The South-Western Naturalist*, 15(1): 71-81.

CONTRERAS-BALDERAS, S. & PURATA-VELARDE, D.C., 1981. *Speocirolana guerrai* sp. nov., Cirolanido troglobio anoptalmo de la Cueva de la Chorrera, Linares, Nuevo León, México (Crustacea: Isopoda). *Association of Mexican Cave Studies Bulletin*, 8: 1-12.

GALASSI, D.M.P., 1997. The genus *Pseudectinosoma* KUNZ, 1935: an update, and description of *Pseudectinosoma kunzi* sp.n. from Italy (Crustacea: Copepoda: Ectinosomatidae). *Archiv für Hydrobiologie*, 139(2): 277-287.

MINCKLEY, W.L. & COLE, G.A., 1968. *Speocirolana thermydronis* (Crustacea: Isopoda) from North-East Mexico, re-discovery, habitat, and supplemental description. *Tulane Studies in Zoology and Botany*, 15(1): 2-4.

REDDELL, J.R. & MITCHELL, R.W., 1971a. A checklist of the cave fauna of Mexico. I. Sierra de El Abra, Tamaulipas and San Luis Potosi. *Association for Mexican Cave Studies Bulletin*, 4: 137-176.

REDDELL, J.R. & MITCHELL, R.W., 1971b. A checklist of the cave fauna of Mexico. II. Sierra de Guatemala, Tamaulipas. *Association for Mexican Cave Studies Bulletin*, 4: 181-215.

RIOJA, E., 1953. Observaciones sobre los cirolanidos cavernicolas de Mexico (Crustaceos, Isopodos). *Annales del Instituto de Biologia de México*, 24(1): 147-170.

RODRIGUEZ-ALMARAZ, G.A. & BOWMAN, T.E., 1995. *Sphaerolana karenae*, a new species of hypogean isopod crustacean from Nueva Leon, Mexico. *Proceedings of the Biological Society of Washington*, 108(2): 207-211.

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