

A NEW GENUS AND SPECIES OF BUTHIDAE (SCORPIONES) FROM THE HIGH MOUNTAINS OF MOROCCO, NORTH-WESTERN AFRICA

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Abstract: A remarkable scorpion, which represents a new buthid genus and species, is herein described from the southern slopes of the high mountains of the Moroccan Atlas, north-western Africa. This new genus is closely related to *Cicileus* Vachon 1948 and *Leiurus* Ehremerberg 1828, but exhibits some strikingly unique characters. This new genus is very interesting from a biogeographic point of view, because it seems to represent a geographical vicariant of both *Cicileus* and *Leiurus*, as well as an isolated mountain-dwelling relict.

Key words: Scorpiones, Buthidae, taxonomy, new genus, new species, Africa, Morocco.

Un género y especie nuevos de Buthidae (Scorpiones) de las montañas altas de Marruecos, África noroccidental.

Resumen: En la presente contribución se describe un notable escorpión bútido procedente de la vertiente sur de las montañas altas del Atlas marroquí (África noroccidental), el cual representa un género y especie nuevos. Este nuevo género está estrechamente relacionado con *Cicileus* Vachon 1948 y *Leiurus* Ehremerberg 1828, pero exhibe ciertos caracteres llamativamente únicos. Este género nuevo es muy interesante desde un punto de vista biogeográfico, pues parece representar un vicariante geográfico de *Cicileus* y *Leiurus*, así como un relicto montano aislado.

Palabras clave: Scorpiones, Buthidae, taxonomía, nuevo género, nueva especie, África, Marruecos.

Taxonomy / Taxonomía: *Cicileiurus monticola* new genus, new species.

Introduction

The scorpion fauna of North Africa is among the most diverse in the world especially that of west Sahara and Moroccan Atlas, where three families and 15 genera have been recorded so far (Vachon, 1952; Fet *et al.*, 2000; Lourenço, 2001), but such a remarkable diversity is widely dominated by Buthidae, a family which accounts for 13 of these genera: *Androctonus* Ehremerberg 1828, *Buthacus* Birula 1908, *Butheoloides* Hirst 1925, *Buthiscus* Birula 1905, *Buthus* Leach 1815, *Cicileus* Vachon 1948, *Compsobuthus* Vachon 1949, *Hottentotta* Birula 1908, *Leiurus* Ehremerberg 1828, *Lissothus* Vachon 1948, *Microbuthus* Kraepelin 1898, *Orthochirus* Karsch 1891, and *Pseudolissothus* Lourenço 2001.

Even though the vast Saharan plain have been moderately well sampled at least along its major travel routes, the mountains of Moroccan Atlas remain very poorly prospected and the few collecting efforts which have been undertaken there have revealed not only high diversity rates, but also the interesting finding that its scorpion fauna includes some genera such as *Butheoloides* and *Hottentotta*, which in general are not well-adapted to aridity and thus exhibit their highest diversity in the more southern, mesic to moist Sub-Saharan Africa. This fact puts in evidence that the Moroccan populations of these genera represent true relicts which have subsisted on the altitude-moderated climate of these impressive mountain ranges, and points to the possibility that such ecological isolation may also have prompted deeper differentiation processes eventually leading to the evolution of endemic genera, which still remain undiscovered due to the lack of adequate sampling.

This promissory hypothesis was recently confirmed when the study of a single adult female scorpion collected at

an altitude of about 2000 m in the southern slopes of the Great Atlas range, revealed it to represent a remarkable new genus and species of Buthidae, apparently a geographic vicariant of both *Cicileus* and *Leiurus*.

Material and methods

Specimens were studied, measured and illustrated under a ZEISS Stemi 2000-C dissecting stereomicroscope, equipped with a line-scale ocular micrometer and a CANON PowerShot A620 digital camera. The high-resolution color pictures were slightly processed with Adobe Photoshop® 8.0 (only to optimize light and contrast); those of the pedipalp segments were used as templates over which the trichobothrial pattern was illustrated using Corel Draw® 12.0 drawing tools. Nomenclature and mensuration follow Stahnke (1970), except for trichobothrial pattern (Vachon, 1974), sternum classification (Soleglad & Fet, 2003), and metasomal carinae terminology (Francke, 1977).

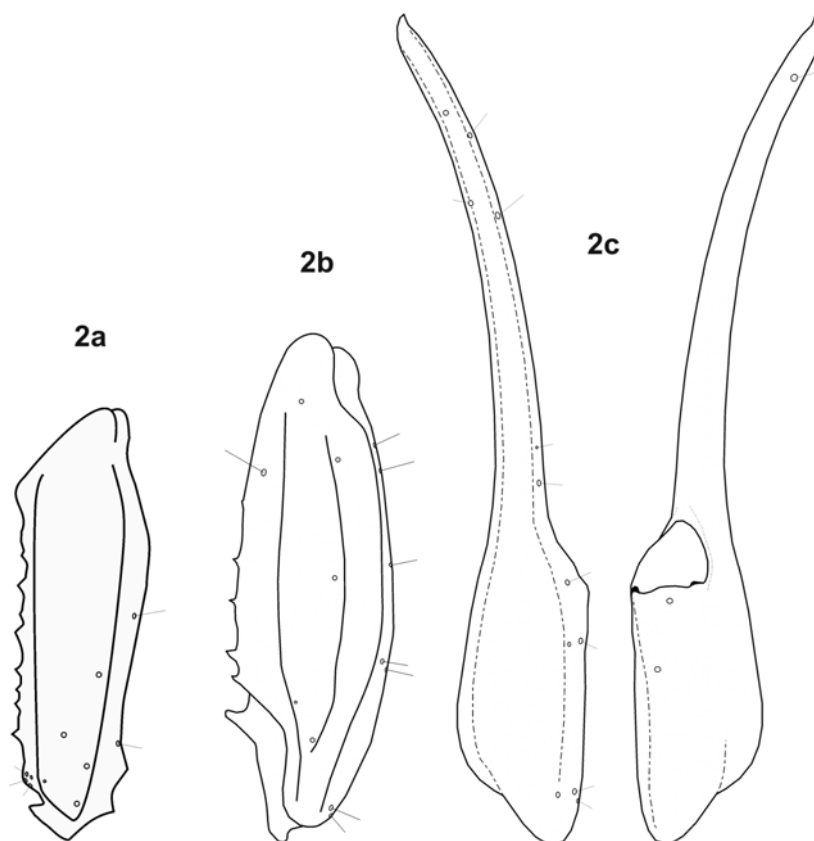
Systematics

Cicileiurus, new genus

Figures 1-3; table I

DIAGNOSIS: Adults of moderately small size (female 46 mm). Trichobothrial pattern A-β orthobothriotaxic, with trichobothria *db*, *dt*, *est* and *et* displaced to the distal third of the finger. Tibial spurs well developed in legs III-IV; leg tarsi not modified, ventral aspect of tarsomere II in all legs with a single median row of 4-8 spiniform setae. Pectines large, with well developed fulcrum. Pedipalps very slender, movable finger 2.6 times longer than underhand; dentate

Fig. 2. Female holotype of *Cicileiurus monticola* gen.n., sp.n., diagrammatic view of pedipalp showing trichobothrial pattern: **a)** femur; **b)** patella; **c)** chela.



margin of fingers with 12-13 rows of granules; movable finger with four distal granules proximal to terminal denticle. Cheliceral fingers each with two ventral denticles, dorsal dentition typical for Buthidae. Carapace strongly carinate and with complete set of eyes, in lateral view with its anterior half moderately raised; lateral-ocular, central-lateral and posterior-median keels fused in a lyre-shaped configuration. Tergites I-VI with five well developed carinae. Stigmata long, slit-like. Metasoma moderately slender, without any special features (i.e., flared segments, hirsute or punctate tegument) except segments I-IV with ventrosubmedian keels distally lobate and fused in U-configuration; ventrolateral keels of segment V with a few denticulate teeth; telson elongated, without subaculear tubercle.

TYPE SPECIES: *Cicileiurus monticola* gen.n., sp.n.

ETYMOLOGY: Combination of the generic names *Cicileus* and *Leiurus*; it alludes to the close relationship existing among these three scorpion genera and is masculine in gender.

AFFINITIES: According to the subdivision of Buthidae carried out by Fet *et al.* (2005) on the basis of trichobothrial patterns, *Cicileiurus* gen.n. is undoubtedly a member of the "Buthus" group: pattern A- β , patella with trichobothrium d_3 located above dorso-median carina. On morphological and geographical grounds it is most closely related to *Cicileus* and *Leiurus*, the former with two disjunct species in the mountains of southeast Algeria and north Niger, and the latter with three parapatric species in lowlands of North Africa and the Middle East. In fact, apart from those characters in common with many other Saharo-Sindian buthid genera (trichobothrial pattern, eye number, cheliceral and

pedipalpal finger dentition, structure of the pectines and shape of stigmata), *Cicileiurus* gen.n. shows a very interesting combination of important features which are diagnostic for the two genera mentioned above: the small size, pedipalps and metasoma attenuation and arrangement of fixed finger trichobothria of *Cicileus*, plus the color pattern and carinae structure of the carapace, tergites and metasomal segment V of *Leiurus*.

This ambiguity might be argued as a reason to unite them all into a single genus, but such a hypothesis can be refuted at once by the presence in *Cicileiurus* gen.n. of two remarkable characters which fairly support its distinction as a separate genus: the single row of spiniform setae present on the ventral aspect of tarsomere II in all legs, and the raised anterior half of the carapace. Amongst all remaining Buthidae, the first character is present only in the Irano-Turkmenian endemic *Kraepelinia* Vachon 1974, which does not show any close relationship to *Cicileiurus* gen.n., and the second feature is exclusive of the Arabian endemic *Apistobuthus* Finnegan 1932, which indeed appears to be related to this new genus, but not as close as both *Cicileus* and *Leiurus* evidently are.

Additional characters which easily distinguish *Cicileiurus* gen.n. from its two closest relatives are as follow: **1) *Cicileus*:** carapace with no keels fused in a lyre-shaped configuration, and without posterior-lateral keels; tergites with only three keels; metasomal segments I-IV with ventro-submedian keels distally not lobate nor fused in U-configuration. **1) *Leiurus*:** large scorpions, 65-100 mm in total length; pedipalps and metasoma conspicuously less attenuated, specially the telson vesicle, which is distinctly globular; trichobothria *db*, *dt*, *est* and *et* located more basally on the fixed finger.

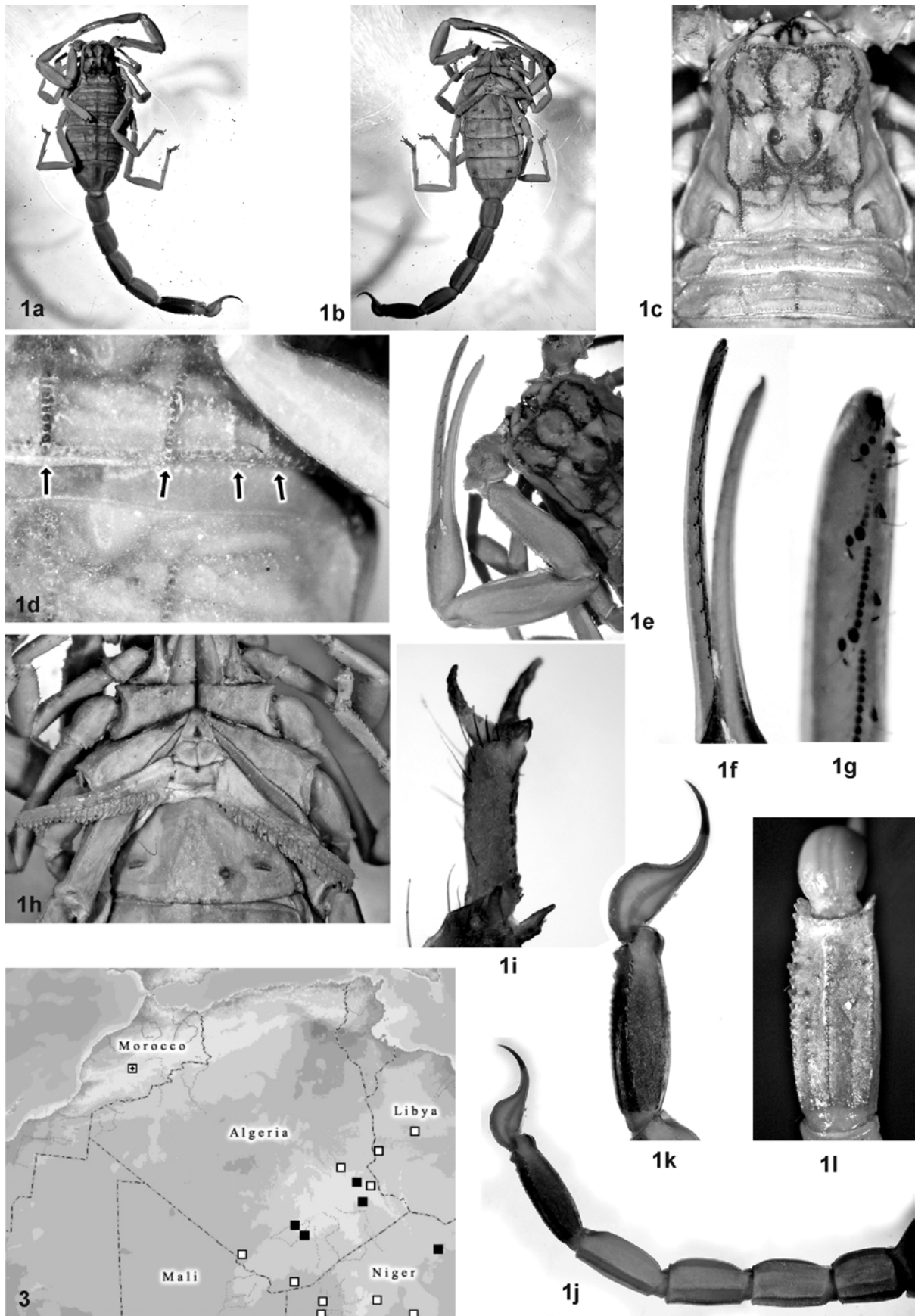


Fig. 1. Female holotype of *Cicileiurus monticola* gen.n., sp.n.: **a)** entire dorsal view; **b)** entire ventral view; **c)** carapace and tergites I-II; **d)** right half of tergite V, with arrows showing the seven longitudinal carinae (median keel on top left); **e)** left pedipalp, dorsal view; **f)** left movable finger, dorsal view; **g)** close-up of left movable finger tip, dorsal view; **h)** sternopectinal region; **i)** tarsomere II of right leg IV, ventrolateral view; **j)** metasoma, lateral view; **k)** metasomal segment V and telson, lateral view; **l)** metasomal segment V and telson, ventral view.

Fig. 3. Type locality of *Cicileiurus monticola* gen.n., sp.n. (⊕), compared to the known distribution inside the mapped area of the genera *Cicileus* (■) and *Leiurus* (□), modified from Vachon (1952), Lourenço (1999) and Lourenço *et al.* (2006).

***Cicileiurus monticola*, new genus, new species**

Figures 1-3; table I

HOLOTYPE: adult ♀ (in author's collection, catalogue number Sco-0346): MOROCCO: ATLAS MOUNTAINS: southern slopes of Great Atlas: between Talemdout and Toufrine; 2000 m a.s.l.; November 28th, 2004; H. el-Berouda. **Note:** Collecting and designation labels accompanying the holotype originally written in Spanish, but transcribed here in English only for coherence purposes.

DIAGNOSIS: As for the genus (see above).

DISTRIBUTION: Known only from the type locality, located above 2000 m on the southern slopes of the Atlas Mountains, central Morocco (fig. 3).

ETIMOLOGY: The name is an indeclinable Latin adjective in apposition, which literally means "mountain-dweller" and alludes to the habitat of this remarkable scorpion.

DESCRIPTION (based on the adult female holotype): **Coloration** (fig. 1) basically light reddish brown, almost without contrasting dark markings and somewhat paler over chelicerae, pedipalps and legs. Chelicerae pale, only with teeth blackish. Carapace with all carinae heavily spotted with blackish brown, and some irregular blackish spots symmetrically disposed behind the median eyes. Metasomal segments III-IV pale, only with ventrosubmedian keels outlined in black; segment V blackish with its apical one-fifth yellowish; telson pale brown, with the distal half of the aculeus blackish. Venter pale brown, pectines yellowish. **Carapace** (fig. 1c) trapezoidal, wider than long, in lateral view with the anterior half moderately raised; anterior margin straight, with setation not discernible due to broken setae; median eyes large and separated by almost twice its diameter; five pairs of lateral eyes; all keels very strong and coarsely granulose, lateral-ocular, central-lateral and posterior-median keels fused in a lyre-shaped configuration; intercarinal spaces very finely and densely granular. **Tergites** (fig. 1a, d) I-VI with five well developed longitudinal carinae (the outermost pair progressively weakens backwards), and with a weak additional lateral pair in IV-VI; intercarinal spaces very finely and densely granular. **Chelicerae** (fig. 1c) tegument smooth and shiny; both fingers with dorsal dentition typical of Buthidae and with two ventral denticles each. **Pedipalps** (fig. 1e-g) very slender and almost bare; trichobothrial pattern (fig. 2) A-β orthobothriotaxic, with patellar *d*₃ located above dorso-median carina and digital *db*, *dt*, *est* and *et* displaced to the distal third of the fixed finger; femur and patella with standard number of carinae, moderately costate to granulose on femur, weakly costate to subgranulose on patella, intercarinal spaces very minutely granulose to smooth; chela elongate (movable finger 2.6 times longer than underhand) and narrower than patella, hand basically acarinate, intercarinal spaces smooth to coriaceous, fingers without basal lobe/notch combination, each with 12-13 principal rows of granules flanked by internal and external accessory granules, fixed and movable fingers each with claw-like tip, the latter with four granules proximal to terminal denticle. **Sternum** (fig. 1h) *type 1*, subtriangular, longer than wide, with the median depression very deep. **Genital operculum** (fig. 1h) paraboloid, with the two valves free along entire midline. **Pectines** (fig. 1h)

large and narrow, extending slightly beyond the coxa/trochanter articulation; pectinal tooth count 28/28; basal plate much wider than long, anterior margin deeply incised in the middle, posterior margin straight. **Legs** (fig. 1a-b, i) very long and slender; tarsi not modified (without flattened segments, bristlecombs, or asymmetric ungues), ventral aspect of tarsomere II with a single median row of 4-8 short spiniform setae distally bifurcate (this implies three distal pairs of setae in legs I, and only one in II-IV). **Sternites** (fig. 1b, h) smooth, III slightly depressed around pectines, IV-VII with two pairs of smooth longitudinal keels; stigmata long, slit-like. **Metasoma** (figs. 1a-b, j-l): moderately slender and practically bare; number of keels per segment: I-II (10), III-IV (8), V (5), lateral-inframedian keel complete on I but present only on distal half of II, and as a distal remnant on III; remaining keels well developed in all segments, subcrenulate to crenulate and without special features except for the ventrosubmedians on I-IV (distally raised and fused in U-configuration) and ventrolaterals on V (sharply serrate and with a few denticulate lobes), laterodistal lobes of anal arch with three blunt lobate granules; intercarinal spaces coriaceous. Telson elongated; vesicle oval, with tegument basically smooth and with no trace of subaculear tubercle; aculeus very long and sharp, gently curved.

COMMENTS: No ecological information other than altitude is available for this scorpion, but it shows some morphological features which suggest it to be lithophilous or at least lapidicolous (Prendini, 2001, 2005): the overall attenuated appearance and the armature of its legs, with short, spiniform setae and a tarsal grasp formed by the elongate median claw and the well curved ungues.

Table I. Measurements (in millimeters) of the type of *Cicileiurus monticola* gen.n., sp.n. Abbreviations: length (L), width (W), posterior in carapace), depth (H).

Measurements	♀ holotype
Carapace	L / W 5.2 / 5.8
Mesosoma	L 12.8
Tergite VII	L / W 3.6 / 5.4
Metasoma	L 27.9
Segment I	L / W 3.5 / 2.8
Segment II	L / W 4.0 / 2.5
Segment III	L / W 4.1 / 2.3
Segment IV	L / W 5.0 / 2.2
Segment V	L / W 5.8 / 2.3
Telson	L 5.5
Vesicle	L / W / H 2.5 / 1.8 / 1.6
Aculeus	L 3.0
Pedipalp	L 20.6
Femur	L / W 5.0 / 1.5
Patella	L / W 5.9 / 1.9
Chela	L 9.7
Hand	L / W / H 2.7 / 1.4 / 1.5
Movable finger	L 7.0
Total	L 45.9

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Paleoentomología

Boletín de la SEA, nº 16 (volumen monográfico), 1996. 2ª edición 1997. 206 pp., 12 euros.

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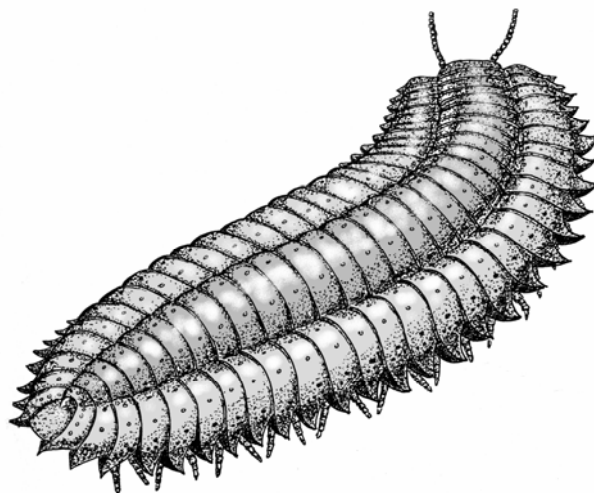


Fig. Reconstrucción hipotética de un artropleúrido (*Arthropleura* sp.), 'miriápodo' gigante de posición sistemática incierta, con una longitud superior a 1,5 m y una anchura de unos 45 cm (Carbonífero) (de Melic & Grustán, nº 12).