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Two new species of the terrestrial isopod genus *Pseudarmadillo* from Dominican amber (Amber-Collection Stuttgart: Crustacea, Isopoda, Pseudarmadillidae)

By Helmut Schmalfuss, Ludwigsburg

With 21 figures

Summary

Two new species of *Pseudarmadillo* (*P. cristatus* n. sp. and *P. tuberculatus* n. sp.) are described from Dominican amber. They are the first record of the genus from the Caribbean island of Haiti/Hispaniola, and the first fossil record of the family Pseudarmadillidae. Considerations on the systematic situation of the genus *Pseudarmadillo* are added, the genus *Delatorreia* BOONE, 1934 is considered a junior synonym of *Pseudarmadillo*. An annotated list is given of the isopod families recorded in the collection of Dominican amber in the Natural History Museum Stuttgart.

Zusammenfassung

Zwei neue Arten der Gattung *Pseudarmadillo* (*P. cristatus* n. sp. und *P. tuberculatus* n. sp.) aus Dominikanischem Bernstein werden beschrieben. Es handelt sich um den ersten Nachweis der Gattung von der karibischen Insel Haiti/Hispaniola und um den ersten Fossil-Nachweis der Familie Pseudarmadillidae. Die systematische Situation der Gattung *Pseudarmadillo* wird analysiert, die Gattung *Delatorreia* BOONE, 1934 wird mit *Pseudarmadillo* synonymisiert. In einer Liste der Isopoden-Familien, die in der Bernstein-Sammlung des Staatlichen Museums für Naturkunde Stuttgart vertreten sind, werden einige Angaben über die betreffenden Inklusen gemacht.

Contents

1. Introduction

The amber collection of the Natural History Museum Stuttgart (SMNS: Staatliches Museum für Naturkunde Stuttgart) contains two species of the terrestrial isopod genus *Pseudarmadillo* which are described and figured in the present paper. A first isopod species from Dominican amber was published previously (*Protosphaeroniscus tertiarius* n. g. n. sp., family Sphaeroniscidae, SCHMALFUSS 1980).

The age of the Dominican amber is supposed to be Oligocene or lower Miocene.

2. Material and methods

The amber inclusions presently treated are embedded in clear yellow amber, with good visibility from all sides. Drawings were made from incident light microscope after embedding the amber pieces in polyester and grinding different planes for documentation.

In contrast to insects isopods are obviously mutilated by conservation in amber. This is very probably due to the fact that the cuticle in insects is tanned by organic poly-phenole compounds, thus remaining unaffected by the chemical components of the fresh resin when the animal is trapped and embedded. On the other hand in isopods the cuticle does not undergo such organic tanning but is strengthened by calcification. The calcite in the cuticle is obviously affected by the acid components of the fresh resin. So amber isopods are never preserved in such an excellent state as insects can be. There are usually distortions of the cuticle, and in most cases setae and other cuticular structures are mutilated. In addition there is the difficulty that in isopods a species characterization needs a documentation of mouthparts and abdominal appendages, which cannot be removed and figured properly in amber fossils. So the descriptions of amber isopods are necessarily incomplete.

3. The genus *Pseudarmadillo* and its systematic situation

Type-species: *Pseudarmadillo carinulatus* SAUSSURE, 1857.

Until recently the genus *Pseudarmadillo* was placed in the family Armadillidae. In his first paper on terrestrial isopods from Cuba VANDEL (1973: 175) instituted a separate sub-family for this genus, the Pseudarmadillinae. In his second publication on Cuban isopods VANDEL (1981: 73) raises this sub-family to the family level (Pseudarmadillidae) because he considers the cephalic morphology of *Pseudarmadillo* too different to place this genus inside the family Armadillidae. I follow this contention of VANDEL 1981, separating *Pseudarmadillo* in a family of its own, apart form the Armadillidae, for several reasons:

A. The different construction of the „face" and of the telson-uropod-complex indicates a different strategy of enrollment adaptation, especially considering the internal shelter of the antennae. This means that enrollment adaptations probably have been achieved independently from those in the Armadillidae (convergence).

B. The questionable monophyly of the Armadillidae and the unknown phylogenetic relations inside the Armadillidae plead for taking out these dubious groups. This facilitates a disentangling, step by step in future piece-work, of the systematic confusion in and around the family Armadillidae.

Considering *Delatorreia* a synonym of the genus *Pseudarmadillo* (see below) the family contains only this genus for the time being. So the diagnose for the family Pseudarmadillidae coincides with that of the genus *Pseudarmadillo*.

Diagnose of the genus *Pseudarmadillo* SAUSSURE, 1857:

I. Flagellum of antenna two-jointed.
II. Primarily with lungs in all five pleopod-exopodites.
III. Uropod-protopodite flattened, wider than long.
IV. Conglobation ability.
V. Apex of telson truncated, distal part quadrangular or trapezoidal.
VI. Schisma and groove on pereon-epimera I.
VII. „Face-construction" as in *Armadillidium*, with a protruding median triangle and well-developed antennal lobes dorsolaterally of the antennal sockets.
VIII. Tuberculate structures on all tergal parts.

None of these characters is restricted to the genus *Pseudarmadillo*, each is present in other families or in other genera. For characters I–VI it cannot be decided, for the time being, whether their presence in other families is due to homology or to convergence, while characters VII and VIII in their specific structure are certainly synapomorphies of *Pseudarmadillo*.

The species *Delatorreia hoplites* BOONE, 1934, is considered a member of the genus *Pseudarmadillo*, possessing all diagnostic characters of this genus. The spectacular protuberances of pereon-tergite VII are an autapomorph character of the species *hoplites*, not justifying its separation in a different genus, or even in a separate family Delatorreiidae (compare VERHOEFF 1938: 253, VANDEL 1981: 74). Thus the monotypic genus *Delatorreia* BOONE, 1934 has to be taken as a junior synonym of *Pseudarmadillo*.

COLLINGE (1942) has described „*Pseudarmadillo rugosa*, sp.n." from „Zululand" (eastern Africa). Firstly, from biogeographical reasons this species does certainly not belong to the genus *Pseudarmadillo*, as VANDEL (1981: 73) has already observed. Secondly, a description of an isopod without any illustration, as it is the case with „*Pseudarmadillo rugosa*", is null and void. After such a „description" nobody will ever be able to recognize the species again („body ovate", „eyes small", „telson somewhat triangular"!), so the systematic position of „Pseudarmadillo rugosa" remains unknown even on the family level.

Including *Delatorreia hoplites* and the two fossil species herein described the genus *Pseudarmadillo* contains now seven species: *carinulatus* SAUSSURE, 1857, *gillianus* RICHARDSON, 1902, *dollfusi* RICHARDSON, 1905, *buscki* BOONE, 1934, *hoplites* (BOONE, 1934), *cristatus* n. sp. and *tuberculatus* n. sp. The species *P. welchi* BOONE, 1934 is currently considered a synonym of *P. gillianus*.

P. dollfusi is known from the Bahamas (Andros Island), the fossil species *cristatus* and *tuberculatus* have been found in amber from Haiti/Hispaniola, all the other species occur on Cuba (BOONE 1934, NAME 1936, VANDEL 1973). So the genus seems to be restricted to the northern Caribbean islands.

No detailed comparative morphological documentations are available, at the moment, to allow any safe judgments on the phylogenetic relations of *Pseudarmadillo* and thus of the family Pseudarmadillidae.

4. Descriptions of two new species of *Pseudarmadillo* from Dominican amber

Pseudarmadillo cristatus n. sp.

Figs. 1—15

Holotype: ♂ in Dominican amber from the Caribbean island of Haiti/Hispaniola, amber collection of the SMNS No. Do-2403-K-1.

Paratypes: 1. ♀ without marsupium, same data, No. Do-3881-M-1; 2.–7. Six specimens in one piece of amber, same data, No. Do-4612-B; 8. ♂, same data, No. Do-579-K; 9.–10. Two juveniles (1 mm long), same data, No. Do-457-K.

Diagnose: Comparatively small species of *Pseudarmadillo* (length about 2mm). Pereon-tergites II – VI with two lateral ribs on each side and two rows of tubercles between the ribs, a frontal one of 5 tubercles and a caudal one of 4 tubercles.

Size: Largest specimen (holotype ♂) 2.5mm long, 1.1 mm wide, probably adult, judging from the male sexual characters.

Cuticular structures (figs. 1–7, 9–11): Each pereon-tergite is equipped with two rows of lateral ribs; on tergites II – VI the dorsal part carries two transverse rows of tubercles, an anterior row of 5, and a posterior row of 4. Pereon-tergite VII lacks the anterior row of tubercles. Pereon-tergite I has 4 transverse rows of tubercles with 2, 5, 3, and 4 tubercles (lateral ribs not included). The head has an anterior row of 2 and a posterior row of 4 tubercles. Pleon-tergite III carries 6 tubercles, tergites IV and V have 4 tubercles, and on the telson there are 2 tubercles. All dorsal parts are densely covered with triangular scale-spines (figs. 10, 11) as they are described in similar shapes for many Oniscidean isopods.

Cephalon (figs. 3–5): The „face" of the cephalon has the *Armadillidium*-type construction, which is obviously a synapomorphic character of *Pseudarmadillo*, while its similarity with the genus *Armadillidium* (family Armadillidiidae)ist certainly accounted for by convergence. The frontal triangle is well-developed, with sharp outer angles, and the antennal lobes are of rather enormous size, protruding very conspicuously in a frontal direction. This construction provides a specific shelter for the antennae during conglobation. Eyes consisting of 5 ommatidia.

Pereon: Epimeron I (figs. 4, 8) with schisma and groove along the total length of the lateral margin. Epimeron II with well developed inner lobe (fig. 8). Thus epimeron II can be fixed tightly in schisma of epimeron I, and epimeron III in that of epimeron II during conglobation.

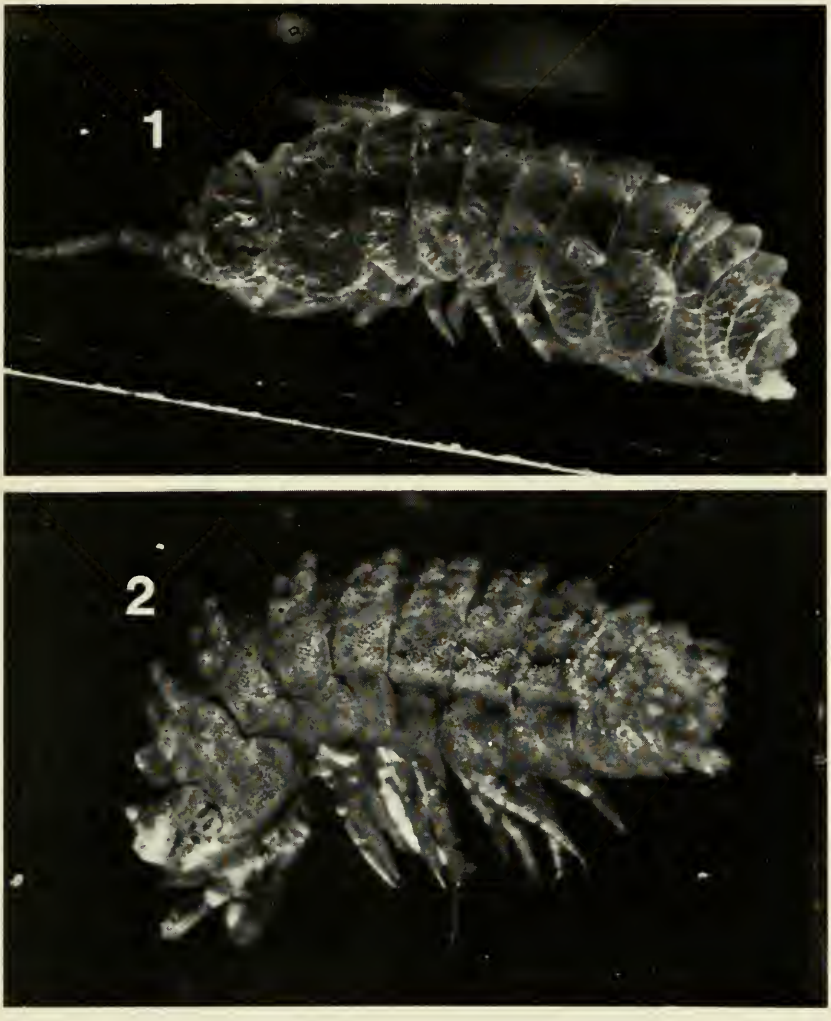
Pleon (figs. 3, 9): Posterior margin of epimeron V nearly parallel.

Telson (fig. 9): Triangular with truncated apex.

Antenna (figs. 5, 13, 14): Proximal article of flagellum about one third of distal article. As in all Oniscidean isopods the flagellum is equipped with tactile setae with pointed apex and a number of tube-like chemical sense-organs (aesthetascs) with rounded apex.

Pereopods: Short and otherwise „normal", without any sexual modifications in the ♂. Fig. 15 shows pereopod I ♂ in an oblique view.

Pleopods: The shape of the exopodites cannot be documented for technical reasons because they are covered by pereopod VII. There is no possibility to answer the question whether there are lungs or respiratory areas in the exopodites because for this the exopodites have to be removed, which cannot be done in amber fossils. It is, how-



Figs. 1–2. *Pseudarmadillo cristatus* n. sp. – 1: Lateral view of holotype ♂. – 2: Lateral view of paratype no. 1 ♀. – The differences in the height of the tuberculation can be accounted for by individual variability, and by different degrees of distortion and shrinkage after embedding in the resin. Photographs: H. LUMPE.

ever, very likely that the species had no tracheal systems, according to the small size. In a number of tracheate genera small species occur which have the air-breathing organs reduced. The distal half of endopodite I is visible (fig. 12), it is straight with pointed apex.

U r o p o d s : Exopodite well-developed, slightly surpassing tip of telson. Endopodite club-like, with truncated distal end. In the documented holotype specimen the exopodite is, in dorsal view, covered by drops of excretions of the uropod-glands (fig. 9). Because of oblique position in ventral view no reasonable drawing could be made from the ventral side.

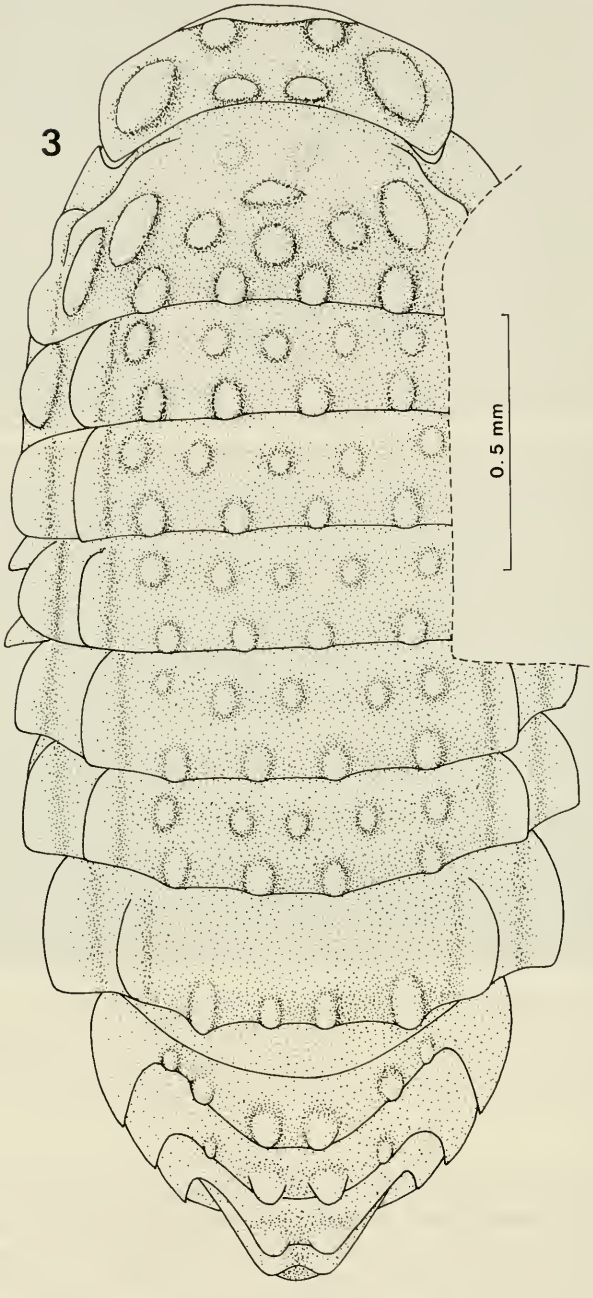
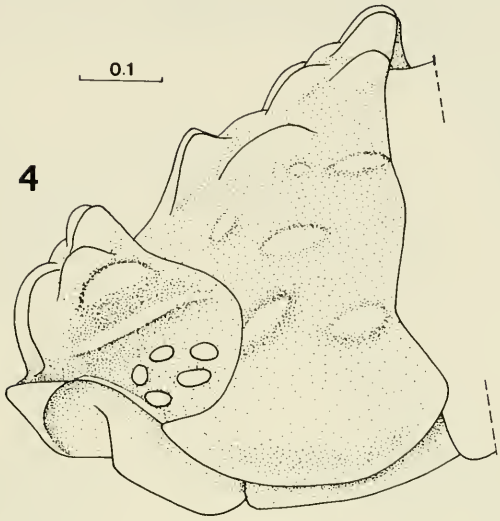
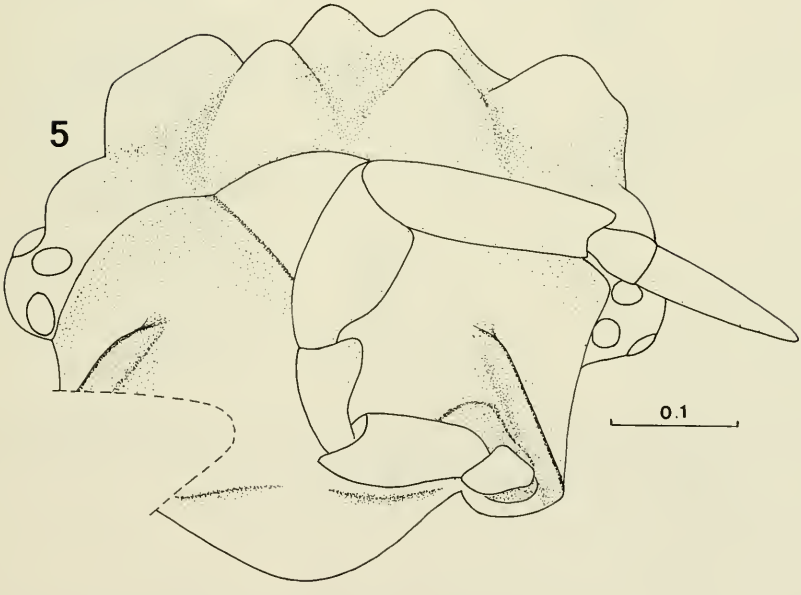
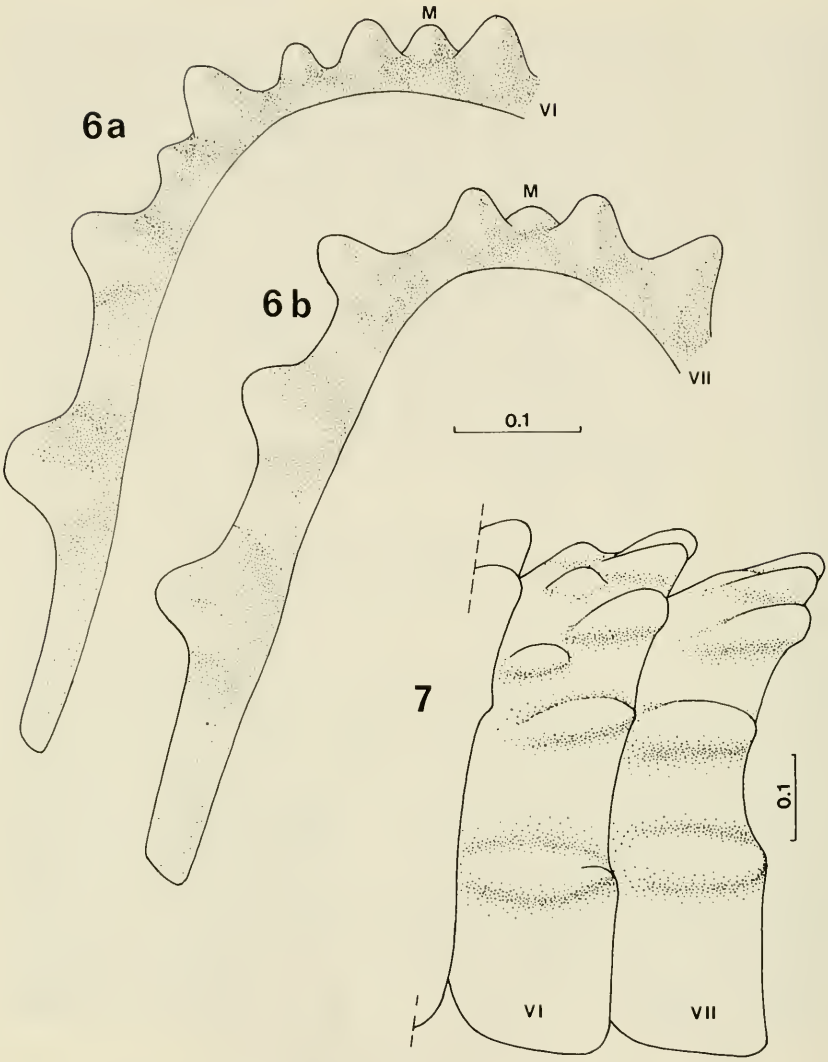


Fig. 3. *Pseudarmadillo cristatus* n. sp., holotype ♂, dorsal view. Right pereon-epimeres I–V are not visible in dorsal view.





Figs. 4–5. *Pseudarmadillo cristatus* n. sp., paratype no. 1 ♀ – 4: Head and pereon-tergite I, lateral view. – 5: Head, frontal view. – Scale in mm.

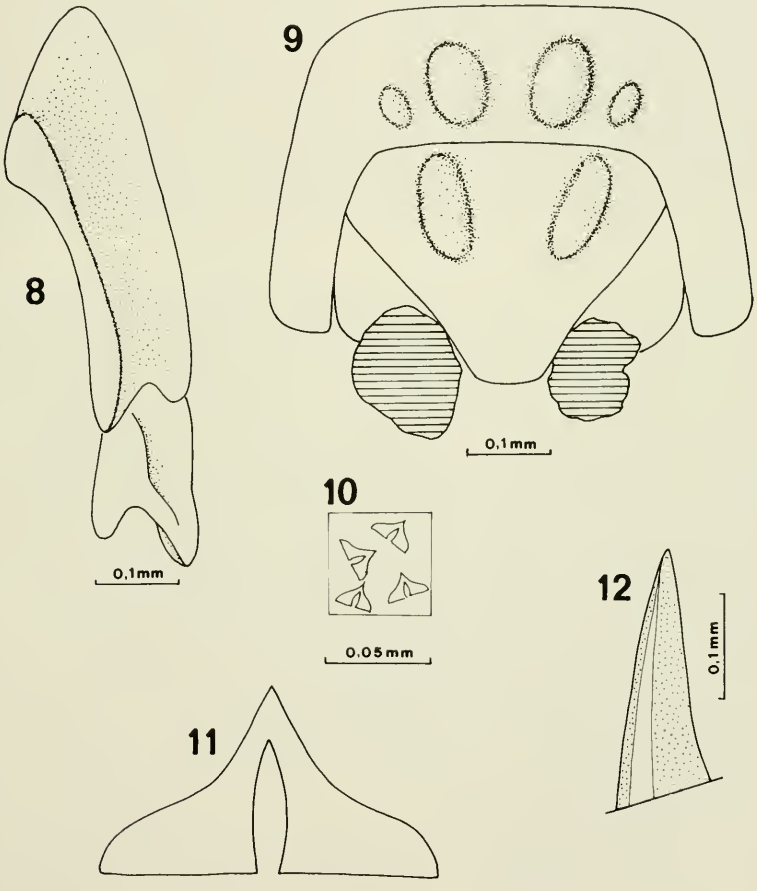


Figs. 6–7. *Pseudarmadillo cristatus* n. sp., paratype no. 1 ♀ – 6: Pereon-tergites VI (a) and VII (b) in caudal view; M = asymmetrical medial tubercle. – 7: Pereon-tergites VI and VII in lateral view. – Scale in mm.

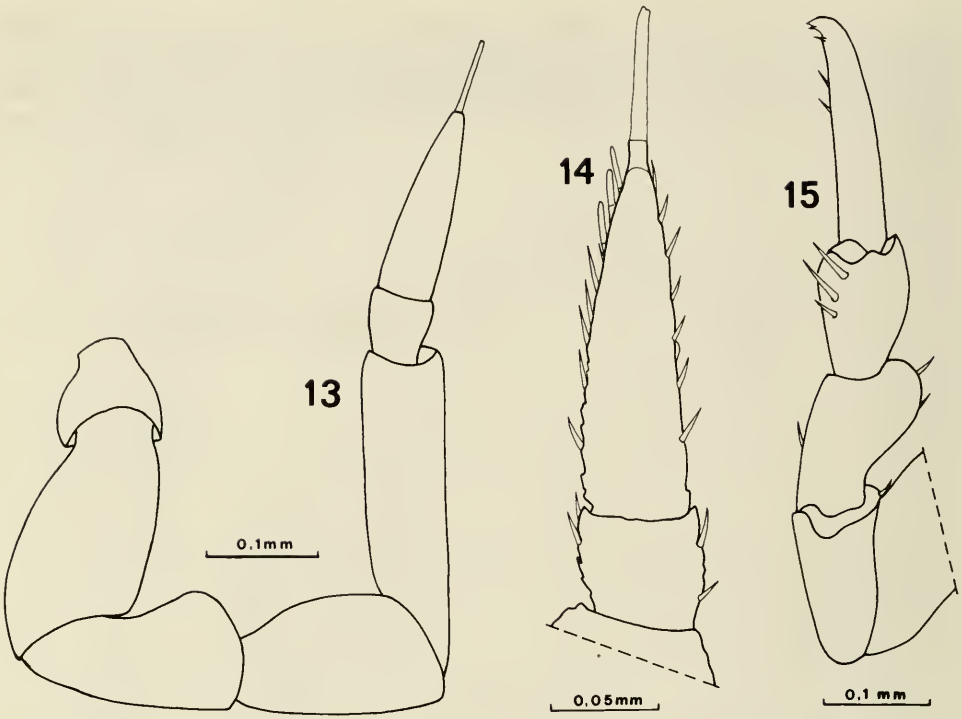
Relationships: The scanty descriptions of the other species of *Pseudarmadillo* do not allow any conclusions on the phyletic relations inside the genus.

Ecology: Small size and specific pattern of tergal tuberculation indicate an endogean way of life (compare SCHMALFUSS 1977). The fact that the animals had eyes and were trapped together with many epigean insects in rather big pieces of amber (one is 100 x 60 x 30 mm) shows, however, that they were also appearing on the surface. In tropical rain forest tuberculated endogean isopods are nearly completely absent, per-

haps because of the fastness of organic decomposition which prevents the formation of humus-layers (compare SCHMALFUSS 1977: 165). This agrees with the findings in other groups from Dominican amber indicating a hot and – at least seasonally – dry rather than a permanently humid climate at the time of embedding of the amber fossils.



Figs. 8–12. *Pseudarmadillo cristatus* n. sp., holotype ♂. – 8: Pereon-tergites I and II, ventral view of grooved epimeres. 9: Pleon-tergite V, telson and uropods from dorsally; barred blotches are obviously secretions from uropod-glands, covering the uropod-exopodites. – 10: Scale-spines on tergites. – 11: Scale-spine enlarged. – 12: Visible tip of pleopod-endopodite I.



Figs. 13–15. *Pseudarmadillo cristatus* n. sp., holotype ♂. – 13: Antenna. – 14: Flagellum of antenna, with tactile setae and aesthetascs. – 15: Pereopod I in oblique view.

Pseudarmadillo tuberculatus n. sp.
Figs. 16–21

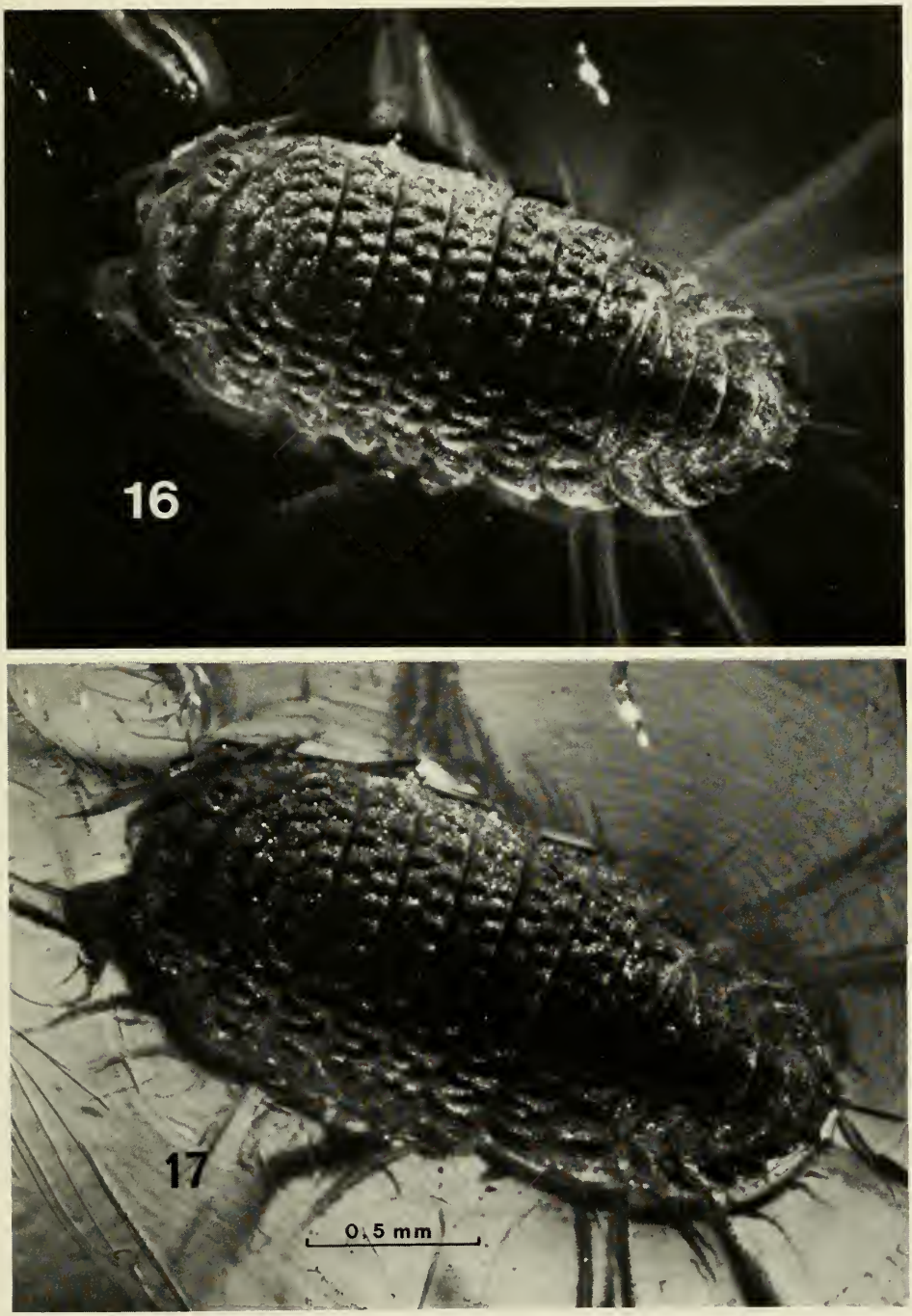
Holotype: ♂ in Dominican amber from the Caribbean island of Haiti/Hispaniola, amber collection of SMNS No. Do-4157-M-1.

Paratypes: 1. ♀ without marsupium, same data, No. Do-4156-M-1; 2.–3. Two specimens in one piece of amber, same data, No. Do-3349-M.

Diagnose: As for *P. cristatus* n. sp., but pereon-tergites II–VI with only one lateral rib on each side and an anterior row of 11 and a posterior row of 10 tubercles in-between.

Size: Largest specimen (paratype 3) 3.5 mm long, 1.5 mm wide; holotype ♂ 2.2 mm long, 1.0 mm wide.

Cuticular structures (figs. 16–18): Each pereon-tergite with one lateral rib on each side. Tergites II–VI with two rows of tubercles, an anterior row of 11 and a posterior row of 10. Tergite I as tergites II–VI and additional 7 tubercles on protergite. Tergite VII with only 4 pronounced posterior tubercles between the lateral ribs. Cephalon with diffuse tuberculation. Pleon-tergite V with two medial tubercles, telson with two tubercles at its base. All dorsal parts covered with triangular scale-spines as in *P. cristatus*.



Figs. 16–17. *Pseudarmadillo tuberculatus* n. sp., holotype ♂, dorsal views. Photographs: H. LUMPE.

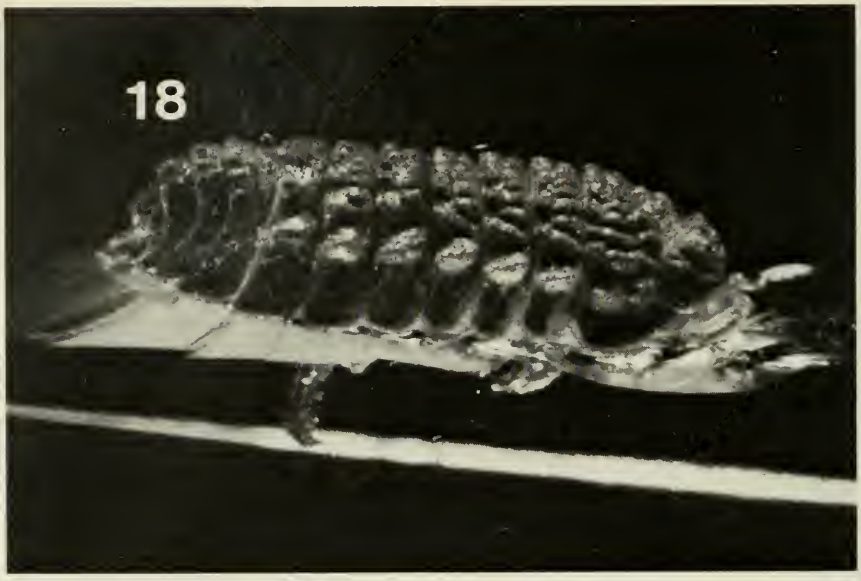


Fig. 18. *Pseudarmadillo tuberculatus* n. sp., holotype ♂, lateral view. Photograph: H. LUMPE.

Cephalon: As in *P. cristatus*, eyes likewise with 5 ommatids.

Pereon: Same construction as in *P. cristatus*, the groove on epimeron I wider and more bulky (fig. 19).

Pleon and telson: As in *P. cristatus*.

Antenna and pereopods: As in *P. cristatus*.

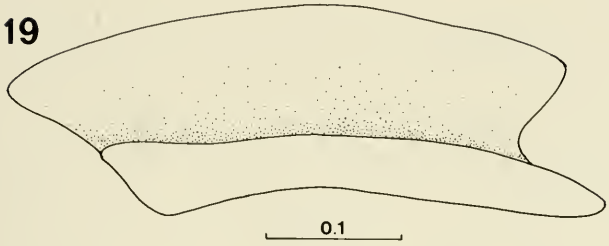
Pleopods: The proximal parts of pleopod I are visible in the holotype ♂ and shown in fig. 20.

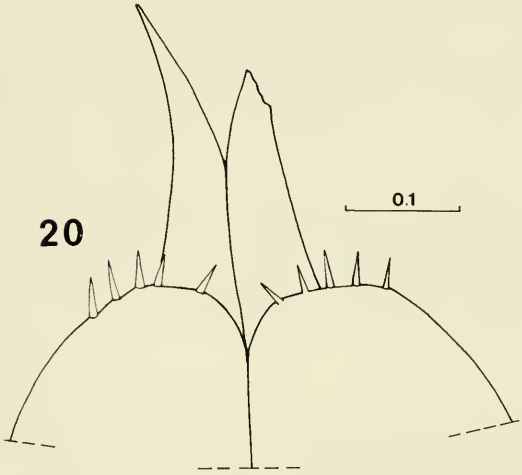
Uropods (fig. 21): Well-developed exopodite, endopodite with apex rounded, not truncated.

5. Isopod families in Dominican amber of the Stuttgart collection

Family Styloniscidae or Trichoniscidae: In the SMNS collection there is one inclusion of a juvenile specimen (♀ 1.4 mm long) belonging to one of these two families. The animal has pointed tubercles on the dorsal parts. An identification even concerning the family is possible only by detached male pleopods, therefore no closer determination can be made at the moment (Do-122-K).

Family Philosciidae: Ten inclusions (Do-3348-M, Do-3315-M, Do-3382-M, Do-3331-M, Do-700-K, Do-1910-B, Do-3868-M, Do-496-K, Do-389-K, Do-430-K). Generic identifications in this family are possible only by detached mouthparts and male pleopods. Additionally, although this family provides the highest number of isopod species in any tropical terrestrial biotope, the Caribbean Philosciidae are practically unknown. So no comparisons with Recent material are yet possible, which would perhaps enable at least a generic identification of part of the amber material.





Figs. 19–20. *Pseudarmadillo tuberculatus* n. sp., holotype ♂. – 19: Ventral view on groove and schisma of pereon-epimere I. – 20: Visible parts of pleopods I. – Scale in mm.

Family Sphaeroniscidae: One species known and described by SCHMALFUSS 1980 (*Protosphaeroniscus tertiarius*). In addition to the four type-specimens of this species, four more specimens are in the SMNS collection (Do-2989-E, Do-3239-M, Do-3352-M, Do-457-K) which belong to the genus *Protosphaeroniscus* and probably to the described species. A safe specific ascription is not possible because the specimens are heavily mutilated.

Family Platyarthridae: Four inclusions belonging to the genus *Trichorhina* (Do-457-K: 2 specimens, Do-120-K, Do-388-K) will be described in a subsequent publication.

Family Pseudarmadillidae: Two species described in the present paper (*Pseudarmadillo cristatus* and *P. tuberculatus*).

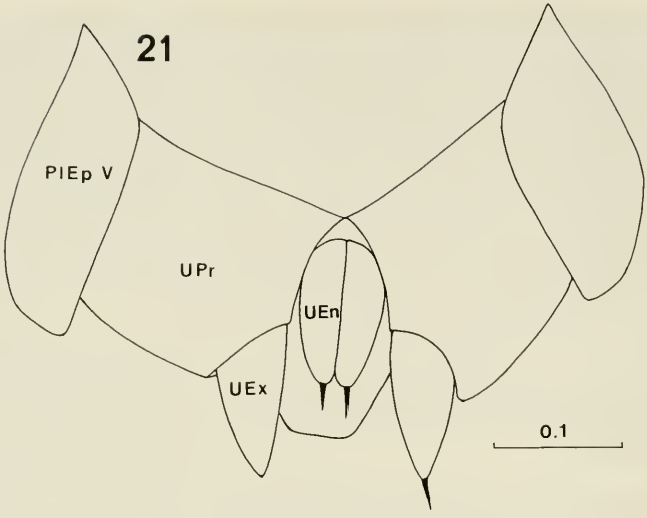


Fig. 21. *Pseudarmadillo tuberculatus* n. sp., holotype ♂, ventral view of uropods (heavily distorted). – Scale in mm.
PlEp V = pleon-epimere V, UPr = uropod-protopodite, UEx = uropod-exopodite, UEn = uropod-endopodite.

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