THE FIRST MESOZOIC PSEUDOSCORPION, FROM CRETACEOUS CANADIAN AMBER

by WOLFGANG SCHAWALLER

ABSTRACT. The first Mesozoic pseudoscorpion (Arachnida, Pseudoscorpionida) from Cretaceous (Campanian) amber collected in southern Alberta, Canada, is described. The specimen is a deutonymph and belongs to the family Chernetidae, but further taxonomic assignment is impossible. Some observations and deductions on its palaeobiology are made.

PSEUDOSCORPIONS (Arachnida, Pseudoscorpionida) are extremely rare as fossils, mainly because of their small size and the weak sclerotization of their cuticle. Nearly all fossil pseudoscorpions previously described came from Tertiary ambers of various ages and provenance, and all were assigned to modern families or even genera. Recently, three extremely well-preserved fossil fragments were described from Middle Devonian sediments near Gilboa, New York (Shear *et al.* 1989), belonging to a single species of a new family. In this enormous gap in the fossil record, between Eocene (45 Ma) and Middle Devonian (380 Ma), nothing is known about the evolution of this species-rich arachnid order (Chamberlin 1931; Beier 1932*a*, 1932*b*). Here the first record of a Mesozoic pseudoscorpion is reported. It is preserved in good condition and allows morphological documentation from several sides by a special technique (Schlee and Glöckner 1978). It is embedded in Cretaceous Canadian amber, dated as Campanian, 70–85 Ma (McAlpine and Martin 1969). The fossil belongs to the Recent family Chernetidae. A further taxonomic assignment is impossible mainly because the specimen is a deutonymph: the second of four post-hatching stadia in pseudoscorpions.

McAlpine and Martin (1969) gave a general account of the Canadian amber and mentioned several arthropod inclusions. Some spiders are under examination (Selden, personal communication). Another Cretaceous amber, the Lebanese amber (Aptian or Neocomian, 110–140 Ma), has aroused considerable interest (Schlee and Dietrich 1970). It contains a few spiders (unpublished material in the amber collection of the natural History Museum, Stuttgart, Germany) and also a pseudoscorpion: Whalley (1980), in a paper on neuropteran insects from Lebanese amber, incidentally mentioned a single pseudoscorpion among spiders and mites. Nothing is shown about its location, morphology or taxonomy.

GEOLOGICAL SETTING

The amber piece with the pseudoscorpion was collected by R. Mussieux, R. Solkoski and L. Strong, staff of the Provincial Museum of Alberta, at Grassy Lake, Southern Alberta, Canada, in 1976. Precise coordinates of the site are on file at the Royal Tyrrell Museum of Palaeontology and are available to qualified investigators on request. This locality was not listed by McAlpine and Martin (1969) among more than thirty localities in Canada and Alaska, where Cretaceous amber has been found. The primary amber deposits in Canada were dated as Campanian. When undisturbed, most Canadian amber lies along bedding planes in coal or carbonaceous sediments. However, most amber particles are found in secondary positions washed ashore in rivers and lakes.

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MATERIAL AND METHODS

Preservation. The specimen is incomplete: the tibia and chela of the right pedipalp are lacking, the right pedipalp femur is somewhat damaged and the left pedipalp chela is broken in its basal part, the tips of the left tarsi I, II, IV are cut off, and the abdominal segments are wrinkled, particularly on the end of the abdomen.

From the wrinkled abdomen and because of some accompanying fungi mycelia it is concluded that the pseudoscorpion was embedded in the tree resin after death or that only the moulted cuticle was fossilized. Preservation is the same as in those amber fossils which have been heated artificially or naturally (Schlee, personal communication). Amber and its included fossils could have been heated in their primary or secondary fossil sites by different events.

Methods. The amber piece was embedded in polystyrol resin. After solidification, this amber-polystyrol-block was cut and polished under water to avoid heating. After morphological documentation under the microscope in a definitive plane, this technique was repeated for studying other views of the fossil.

DISCUSSION

Relationships

The fossil has two trichobothria laterally on the movable pedipalp finger and is therefore a deutonymph (assuming Recent conditions can be applied to the Cretaceous). A satisfactory classification of a juvenile pseudoscorpion is nearly impossible; furthermore, most of the Recent genera are fixed only by typological characters and not by synapomorphies. The fossil itself shows no unique character which would justify a new genus, so I avoid assigning this Cretaceous pseudoscorpion to a known or new genus or species.

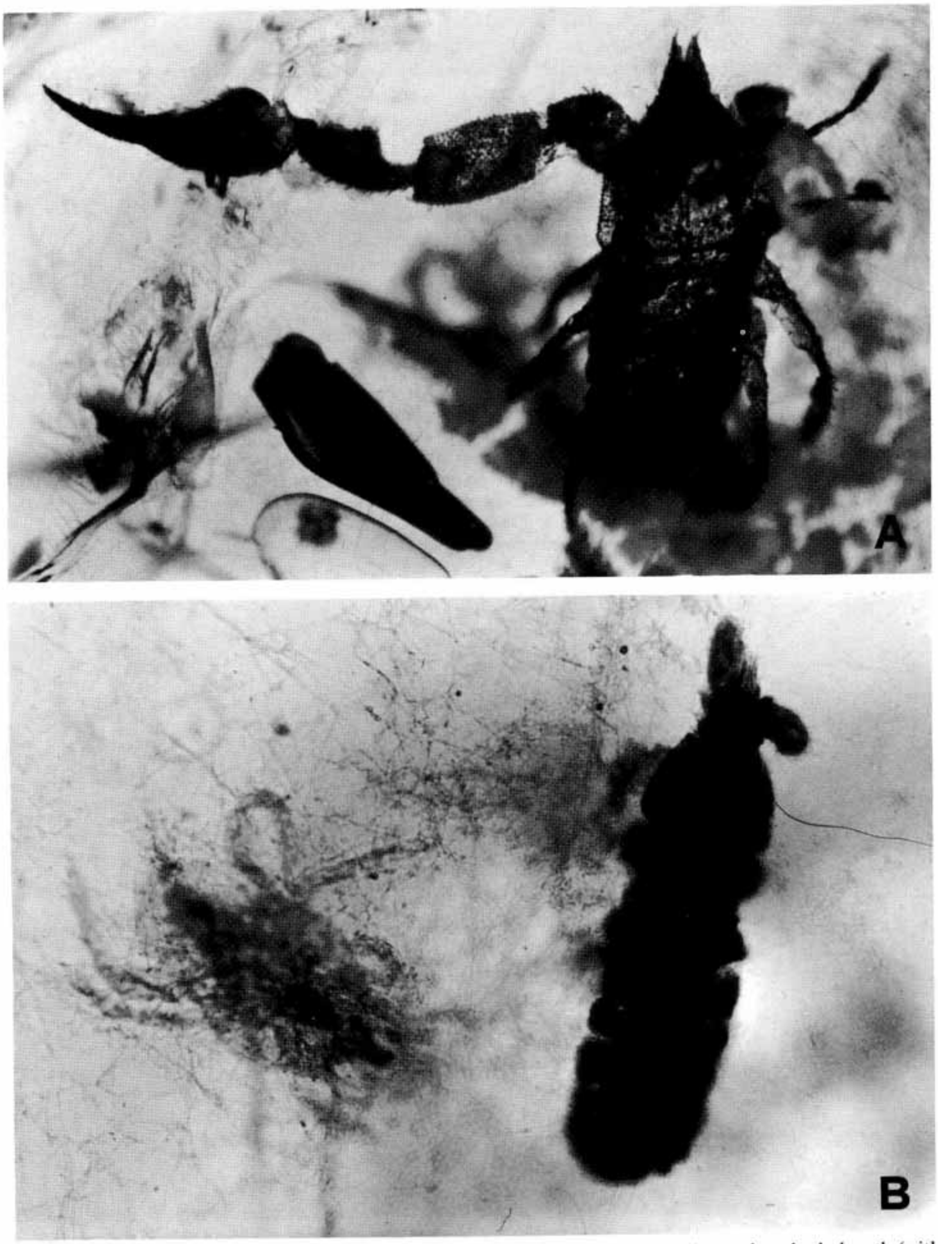
The monotarsate legs, the structure of the chelicerae and the form of the carapace point without doubt to the Cheliferoidea (Atemnidae, Chernetidae, Cheliferidae, Withiidae). The Atemnidae can be excluded here, because all members of this family have a basally inserted tactile seta on tarsus IV (this seta is clearly absent in the fossil). Most of the Cheliferidae/Withiidae have eyes on the carapace and have distinctly more slender pedipalps than has the fossil; therefore the Cretaceous specimen is placed in the remaining Chernetidae. However, Recent chernetids usually have a poisonous tooth only on the movable pedipalp finger (the fossil has such a tooth also on the fixed finger). Accessory teeth on the pedipalp fingers are sometimes absent also in Recent deutonymphs of the Chernetidae, so perhaps adults of the Cretaceous species had such teeth.

The trichobothriotaxy of the pedipalp chela of the fossil seems incomplete: in Recent deutonymphs of the Chernetidae, the fixed finger has three trichobothria laterally (Mahnert 1982). But the insertion of the trichobothria is difficult to recognize in this amber specimen and, furthermore, some fungal mycelia are impeding visibility, so this irregularity should not be weighed too heavily.

Palaeobiology

Two further fossils are embedded in the same piece of amber (Text-fig. 1B), a mite and a juvenile insect larva or a collembolan. They are, together with the pseudoscorpion, members of the same Cretaceous biocoenosis, and not of a caenocoenosis as in other fossil sites apart from amber. These accompanying animal groups are typical inhabitants of Recent pseudoscorpion biotopes.

The fossil has a galea on its chelicera which proves that spinning behaviour existed in pseudoscorpions during the Cretaceous. So, the present deutonymph very probably spun a silken moulting chamber. Spinning activity of pseudoscorpions is already known from the Middle Devonian (Shear *et al.* 1989). Recent pseudoscorpions spin not only moulting chambers but also capsules for their eggs and for hibernation. The Cretaceous pseudoscorpion was able to groom itself



TEXT-FIG. 1. A, chernetid pseudoscorpion (deutonymph) from Cretaceous Canadian amber; body length (with chelicerae), 1·35 mm. B, mite (left) and juvenile insect larva or collembolan (right) from the same piece of amber as the pseudoscorpion; body length of the mite about 0·4 mm.

by the cheliceral serrulae. The animal, as a predator, used poison in grasping its prey, shown by the palpal venom teeth. The situation of the palpal trichobothria point to the same mode of orientation as in Recent species. The granulate cuticle (as in most of the Recent Chernetidae and Cheliferidae) may suggest a drier biotope; possibly this Cretaceous species lived in or under the bark of the tree which produced the amber.

SYSTEMATIC PALAEONTOLOGY

Order PSEUDOSCORPIONIDA Banks, 1895
Family CHERNETIDAE Chamberlin, 1931
chernetid gen. et sp. indet.

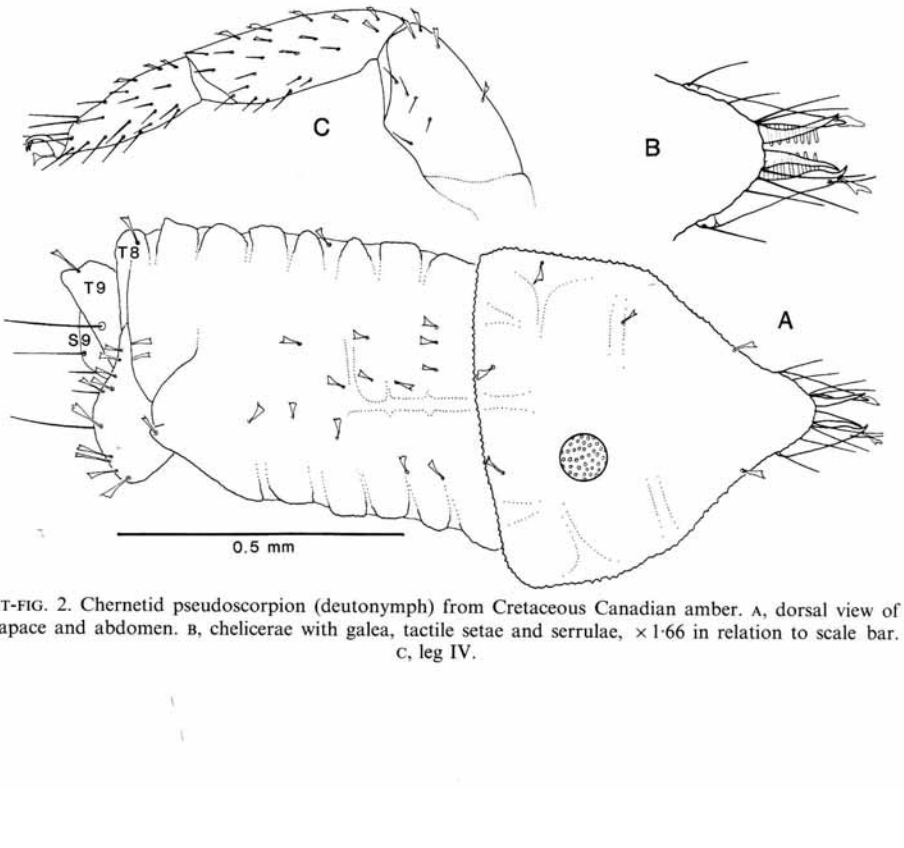
Text-figs 1–3

Material. A single specimen in Cretaceous Canadian amber from Grassy Lake, Alberta. Deposited in Tyrrell Museum of Palaeontology, Drumheller, Alberta, Canada.

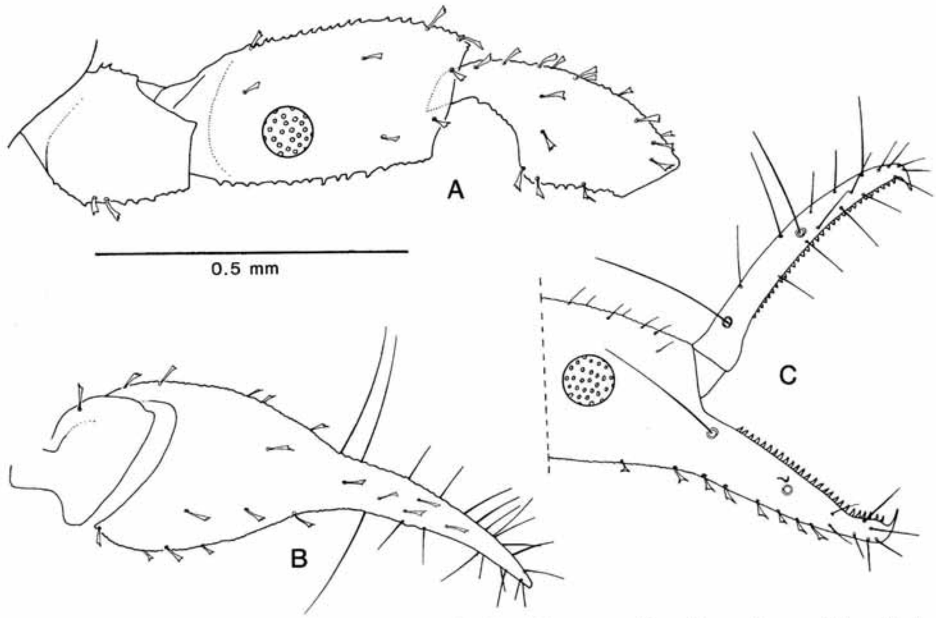
Description. Body length (with chelicerae) 1·35 mm. Cuticle of the body and of the appendages with granules. Carapace without eyes lenses and without eyes spots. Maximal width: 0·59 mm, median length: 0·58 mm. Carapace strongly narrowed in front, surface with two weak cross-furrows and basally with three short longitudinal furrows. Surface with uniform granulation and with irregularly inserted dentate bristles.

Abdomen with ten visible segments. At least the first tergites separated medially. Last tergite with two long tactile setae, tergites otherwise with dentate bristles (as on carapace). Number and position of all tergite bristles and details of the sternites not determinable.

Chelicerae have fixed and movable fingers without inner teeth. Movable finger with galea distally, its detailed



TEXT-FIG. 2. Chernetid pseudoscorpion (deutonymph) from Cretaceous Canadian amber. A, dorsal view of carapace and abdomen. B, chelicerae with galea, tactile setae and serrulae, × 1·66 in relation to scale bar. C, leg IV.



TEXT-FIG. 3. Chernetid pseudoscorpion (deutonymph) from Cretaceous Canadian amber. A, left pedipalp trochanter, femur and tibia from dorsal view. B, left pedipalp chela from dorsal view. C, left pedipalp fingers from lateral view with teeth and recognizable trichobothriotaxy.

structure not visible. Basis of chelicera with at least four setae, their insertions covered by carapace. Movable finger with subgaleal seta distally. Serrula exterior with at least seven lamellae, structure of the serrula interior and of the flagellum not determinable.

Pedipalps: femur 0·49 mm long and 0·24 mm wide, tibia 0·38 mm and 0·19 mm, and chela 0·83 mm and 0·28 mm. Granulation on medial and lateral side of femur and tibia distinct, not so prominent on the chela and very faint towards the tip of the fingers. Surface with dentate bristles irregularly inserted, fingers with acute bristles distally. Trichobothriotaxy cannot be completely documented: movable finger with two trichobothria laterally (deutonymph), fixed finger with one trichobothrium laterally near basis and probably with a further trichobothrium in the middle; trichobothria on the medial side not visible. Fixed finger with twenty-six uniform and acute teeth, movable finger with thirty; both fingers with a distinct poisonous tooth; no accessory teeth.

All legs monotarsate. Tibia I 0·27 mm, tarsus I with claws 0·35 mm, tibia IV 0·43 mm, tarsus IV with claws 0·37 mm long. Tarsus I not modified; all claws simple, not dentate. Bristles on tibia and tarsus laterally dentate, medially acute; subterminal seta simple, acute; tibia and tarsus without tactile seta. Details of the coxae not visible without grinding away the legs.

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WOLFGANG SCHAWALLER
Staatliches Museum fur Naturkunde
Rosenstein 1, D-7000 Stuttgart 1
Germany

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