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The pedipalp of *Pseudocellus pearsei* (Ricinulei, Arachnida) – ultrastructure of a multifunctional organ

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ABSTRACT

Ricinulei possess movable, slender pedipalps with small chelae. When ricinuleids walk, they occasionally touch the soil surface with the tips of their pedipalps. This behavior is similar to the exploration movements they perform with their elongated second legs. We studied the distal areas of the pedipalps of the cavernicolous Mexican species *Pseudocellus pearsei* with scanning and transmission electron microscopy. Five different surface structures are characteristic for the pedipalps: (1) slender sigmoidal setae with smooth shafts resembling gustatory terminal pore single-walled (tp-sw) sensilla; (2) conspicuous long, mechanoreceptive slit sensilla; (3) a single, short, clubbed seta inside a deep pit representing a no pore single walled (np-sw) sensillum; (4) a single pore organ containing one olfactory wall pore single-walled (wp-sw) sensillum; and (5) gustatory terminal pore sensilla in the fingers of the pedipalp chela. Additionally, the pedipalps bear sensilla which also occur on the other appendages. With this sensory equipment, the pedipalps are highly effective multimodal short range sensory organs which complement the long range sensory function of the second legs. In order to present the complete sensory equipment of all appendages of the investigated *Pseudocellus* a comparative overview is provided.

1. Introduction

The pedipalps are the second pair of arachnid appendages. One main function of those appendages is to hold and to rotate the food in front of the chelicerae during feeding (Moritz, 1993). But among the different orders, the pedipalps vary in form and also have additional functions. In Araneae, Palpigradi, Solifugae, Schizomida, many Opiliones and Acari the pedipalps are often similar to the walking legs. Some of these groups bear special modifications on their pedipalps (e.g., the copulatory apparatus of male spiders or the evertable suctorial organ of camel spiders). The Palpigradi, in fact, use their pedipalps for locomotion. Amblypygi and some Opiliones catch their prey with pedipalps which have long spines. Scorpiones, Pseudoscorpiones and Thelyphonida carry pedipalps with large forceful chelae to grasp, and in some groups also kill their prey (e.g., mechanically as in some large Scorpiones or due to poisonous glands which terminate in the fingers of the pedipalp chela as in Pseudoscorpiones), dig holes and defend themselves (Moritz, 1993).

A second main function of the arachnid pedipalps is to explore the surroundings of their mouthparts, using the pedipalps as "antennae" (Moritz, 1993). The investigation of sensilla on arachnid extremities has a long tradition (e.g., Haller, 1881; Blumenthal, 1935; Chu-Wang and Axtell, 1974; Barth and Stagl, 1976; Baker, 1985; Foelix, 1985; Alberti and Coons, 1999; Coons and Alberti, 1999; Talarico et al., 2005, 2006). But the investigation of the pedipalps and their sensory organs was focused mainly on mites and ticks (e.g., Foelix and Chu-Wang, 1972; Jackson, 1974; Jagers op Akkerhuis et al., 1985; Sridharan et al., 1998; see also Alberti and Coons, 1999; Coons and Alberti, 1999) and on scorpions (e.g., Meßlinger, 1987).

Ricinulei possess movable, slender pedipalps with tiny chelae, which they predominantly use to grasp and hold their prey (Cooke, 1967; Pollock, 1967; own observations). This supports the activities of the chelicerae and the cucullus (Cooke, 1967; Pollock, 1967). When ricinuleids walk, they occasionally touch the soil surface with the tips of their pedipalps (Beck, 1968; own observations). This behavior is similar to the exploration movements they perform with their elongated second legs (Cooke, 1967; Pollock, 1967; Beck, 1968; own observations). In order to accomplish the comparative investigations of appendage sensilla, already done for the walking legs and the chelicerae (see Talarico et al., 2005, 2006, 2007 (2008)), we studied the pedipalps of the cavernicolous Mexican species *Pseudocellus pearsei* by means of scanning as well as transmission electron microscopy.

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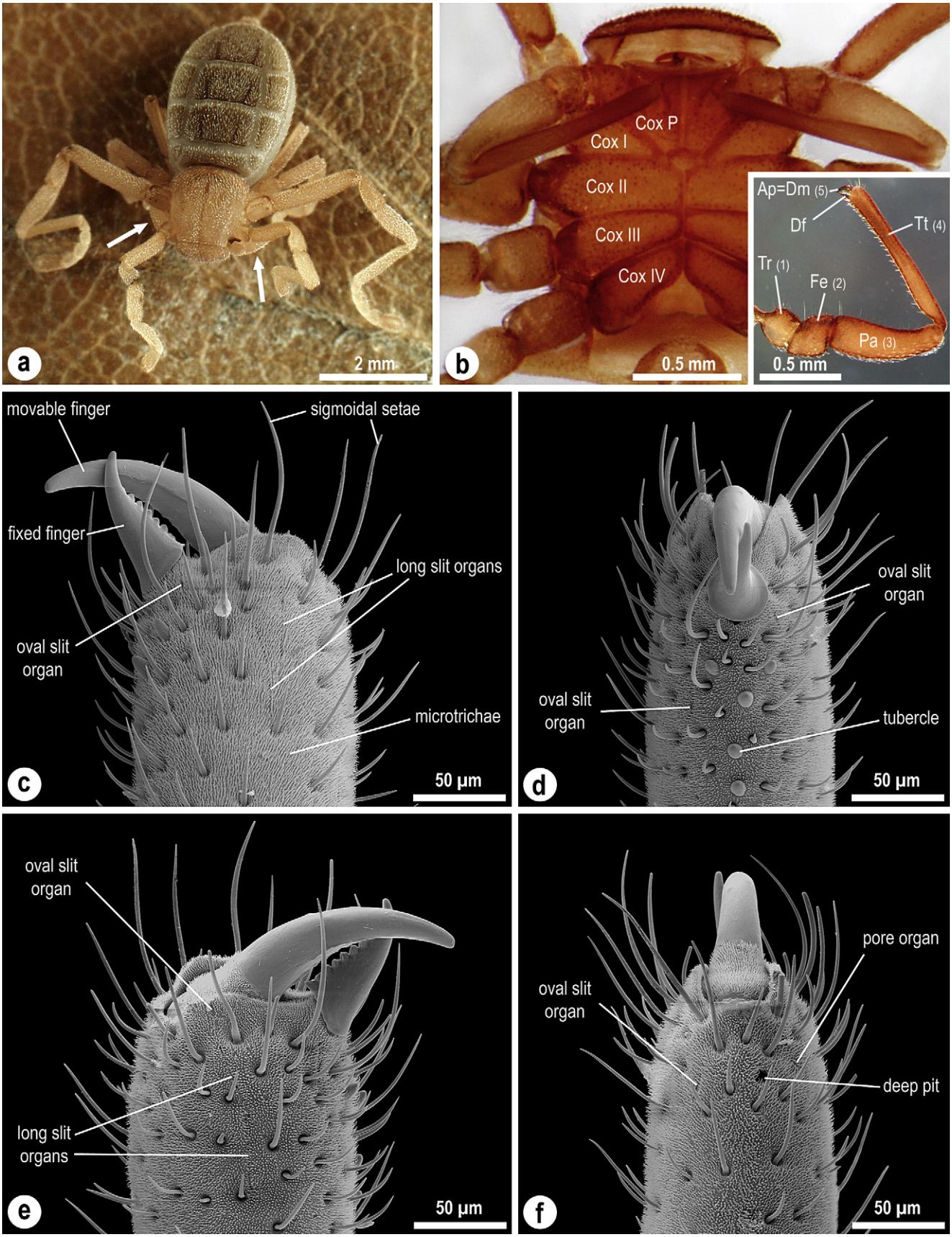

Fig. 1. The pedipalps of *Pseudocellus pearsei*. (a) Dorsal view of a tritonymph. The pedipalps are hardly visible (arrows). (b) Ventral view of the prosoma of an adult male. The pedipalps are folded and their chelae are held close to the pedipalp coxae. The inset shows the right pedipalp (dorsal view) of an adult female. Segments named after van der Hammen (1989) and Shultz (1990). (c)–(f) SEM. (c) Ventral view of the apical region of the left pedipalp of an adult female showing the small chela. The smaller fixed finger bears several conical teeth on its inner edge. The surface of the tibio-tarsus is covered with small microtrichia. Note two long slit organs and the long sigmoidal setae surrounding the chela. (d) Retrolateral view of the same pedipalp. Below the fixed finger conical tubercles are present. (e) Dorsal view of that pedipalp. The longer movable finger crosses the fixed finger dorsally. Also on this side the two long slit organs are present. (f) Lateral view of that pedipalp showing the deep pit and the hardly visible opening of the pore organ. Abbreviations: Ap, apotele; Cox I–IV, coxae of walking legs; Cox P, coxa of pedipalp; Df, digitus fixus (fixed finger); Dm, digitus mobilis (movable finger); Fe, femur; Pa, patella; Tr, trochanter; Tt, tibio-tarsus.