PENTAPALPIDAE, A NEW FAMILY OF EUPODOID MITES (PROSTIGMATA: EUPODOIDEA) FROM SOUTH AFRICA

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PENTAPALPUS UNGUEMPODIUS
PENTAPALPIDAE
RHAGIDIIDAE
SOUTH AFRICA

SUMMARY: A new family of mites, Pentapalpidae, and a new genus and species, *Pentapalpus unguempodius*, are described from different soil habitats in South Africa. The Pentapalpidae are compared with the Rhagidiidae, to which they are closely related.

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AFRIQUE DU SUD

RÉSUMÉ : La nouvelle famille des Pentapalpidae est décrite des sols d'Afrique du Sud, où elle est représentée par le nouveau genre *Pentapalpus* et l'espèce *Pentapalpus unguempodius* n. sp. Les caractères du Pentapalpidae sont comparés à celles des Rhagidiidae, dont ils sont proches.

INTRODUCTION

Mites of the superfamily Eupodoidea, with five families and 43 genera, have been reported from most parts of the world, including both polar regions (BAKER, 1987; SHIBA, 1976; STRANDTMANN, 1981; ZACHARDA, 1988). Despite this, and the fact that the first descriptions of the more than 340 species of eupodoids were already published in the first half of the previous century (THOR & WILLMANN, 1941), the Eupodoidea was, until recently, still considered one of the least known taxa of prostigmatic mites. Recent comprehensive studies, including contributions to provide standardized detailed descriptions and illustrations (ZACHARDA, 1988), well illustrated information on the distinguishing morphological features of adults (BAKER, 1990) and cladistic analysis (QIN, 1996), have resolved a number of problems in the Eupodoidea.

Other than only some seventeen known species (MEYER & RYKE, 1960; Olivier & THERON, 1997a; 1997b; 1998), the Eupodoidea is poorly recorded from southern Africa. This prompted a broad study of the Eupodoidea from this region and the authors report here on the discovery of a new family, the Pentapalpidae. Since this family shows most taxonomic affinities with the Rhagidiidae, a detailed comparison of the two families is provided.

MATERIAL AND METHODS

Material collected from different soil habitats was prepared using conventional methods. Body length of specimens was measured from the posterior margin of the idiosoma to the anterior margin of the prodorsum. Body width was measured as the distance across the body at the level of setae c_2. Setal lengths

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were recorded from the setal base to the tip; curved setae were drawn and measured with a planimeter. All dimensions are given in µm. Notations for setae and the nomenclature used follow LINDQUIST & ZACHARDA (1987) and BAKER (1990). Abbreviations used in the text and figures are as follows: prodorsal setae—internal vertical (*iv*), external vertical (*ev*), trichobothria (*T*), scapular (*sc*); opisthosomal setae—internal humeral (c_1), external humeral (c_2), first dorsal (d_1), second dorsal (e_1), internal lumbar (f_1), external lumbar (f_2), internal sacral (h_1), external sacral (h_2); subcapitulum—external mala (*em*), internal mala (*im*), pharyngeal sclerite (*fs*); gnathosomal setae—basal subcapitular setae (sbc_1), apical subcapitular setae (sbc_2), adoral setae (*or*); cheliceral setae (*cha* & *chb*); palpal setae—dorsal (*d*, & d_1), lateral (*l′* & *l″*), terminal proral (*p′* & *p″*), anteroculminal (*acm*), ventral (*ba*) supracoxal (*e*); genital region—aggenital setae (*ag*), genital setae (*g*), eugenital setae (*eg*); anal region—adanal setae (*ad*), pseudanal setae (*ps*). Type material (permanently mounted slides) will be deposited in the National Collection of Arachnida, ARC-Plant Protection Research Institute, South Africa.

PENTAPALPIDAE N. FAM.

Diagnosis (based on adult female). – Small (body length *ca* 250 µm) with conspicuously short legs suggesting euedaphomorphism (ZACHARDA, 1980); epirostrum and eyes absent (eyes are reported to be present in all other members of the Eupodoidea; BAKER, 1990); idiosoma holotrichous with four pairs of prodorsal and eight pairs of opisthosomal setae; idiosomal setae small, predominantly dendriform-spinose; idiosoma without lyrifissures; genital region with four pairs of *ag*-and *g*-setae each and two pairs of *eg*-setae; coxae I–IV with 2-2-4-4 setae; trochanters I–IV with 0-1-2-1 setae; subcapitular and adoral setae (sbc_1, sbc_2, or_1 and or_2) all clearly discernable, adoral setae of unequal size; two cheliceral setae; palp five-segmented; palptarsus with two types of setae (spiculate and dendriform-spinose), lacking rhagidial and erect, spiniform solenidia; palptibia with two setae and genu with one seta; supracoxal seta (*e*) absent; tarsi I and II each with two rhagidial solenidia and a stellate famulus, all other leg segments without sensory setae; apotele of tarsi I–IV with claw-like, unrayed empodia.

Remarks. – This family is closely related to the Rhagidiidae. It can, however, be distinguished by the segmentation and chaetotaxy of the palpi, the type of idiosomal setae and the chaetotaxy of the legs and genital region.

Pentapalpus n. gen.

Etymology: Penta (Latin) five; refers to the five-segmented palpi.

Diagnosis: As for family.

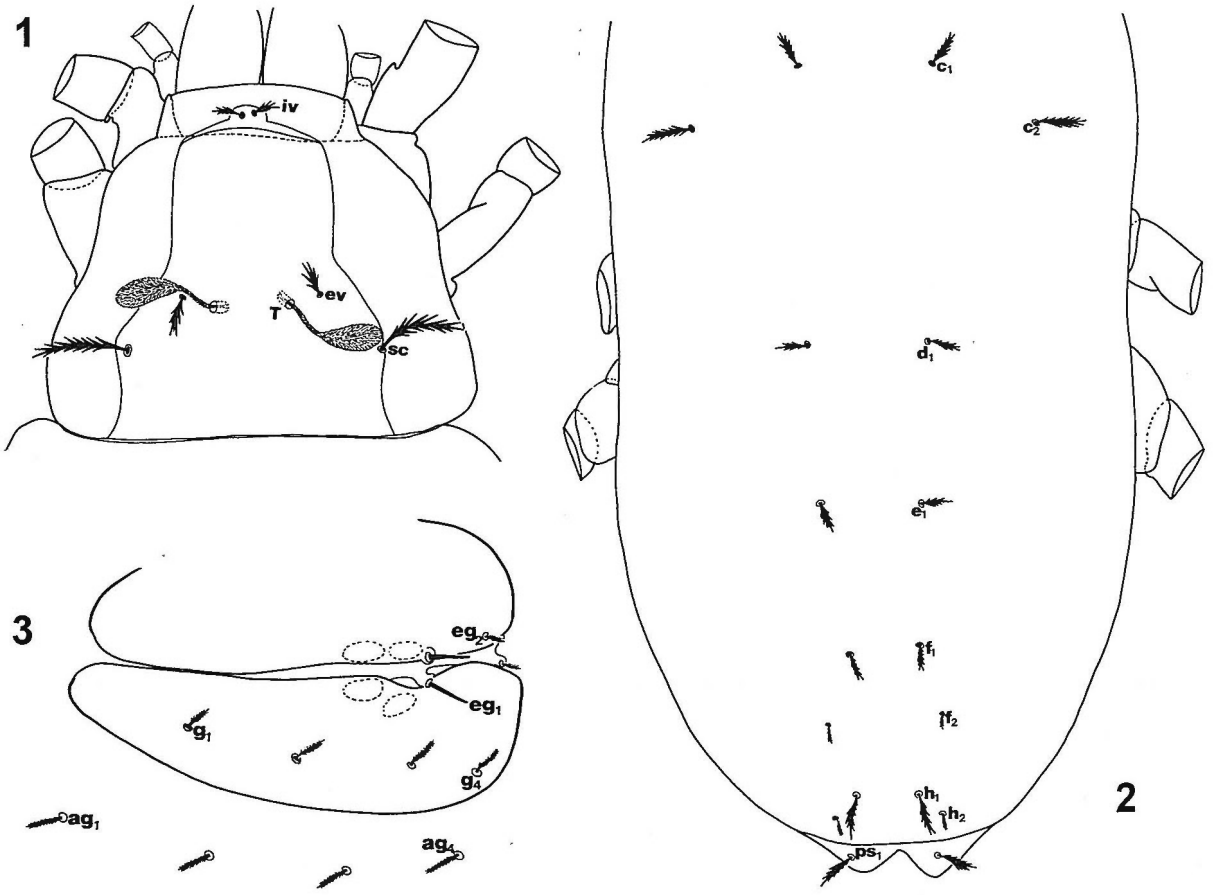
Type species: *Pentapalpus unguempodius* n. sp.

Pentapalpus unguempodius n. sp.
(Figs 1–12)

Female (Fig. 1–12). – Dorsal integument smooth, without any ornamentation or folds; posterior extremity appears bilobed; idiosomal setae predominantly dendriform, spinose.

Dorsal idiosoma. – Prodorsum (Fig. 1) approximately rectangular, with truncate anterior margin partially overhanging the gnathosoma; naso semicircular, base flattened and extending laterally; sensory area well-developed, present from tips of lateral extensions of naso to sejugal groove; with four pairs of prodorsal setae, all but *iv* situated on sensory area; *iv* (7 µm: 6.5–8), situated centrally on naso, not associated with distinct bothria; *ev* (8 µm: 7–9); *T* (25 µm: 23–27) densely spiculate, with large clavate terminal section, situated more or less in line with *ev*; *sc* (19 µm: 18–20) always slightly arched, situated well posterior to *T*, close to lateral margins of sensory area.

Opisthosoma (Fig. 2) with eight pairs of dendriform-spinose setae; c_1 (7 µm: 6.5–8) situated anterior to, and much more centrally than, c_2 (10 µm: 9–10.5); d_1 (6 µm: 5.5–6.5) well anterior to, and longitudinally in line with, e_1 (6 µm: 5–6.5); f_1 (6 µm: 5–6.5) anterior to, and moderately more central than f_2, which is very small (3 µm: 2–4) and delicate; h_1

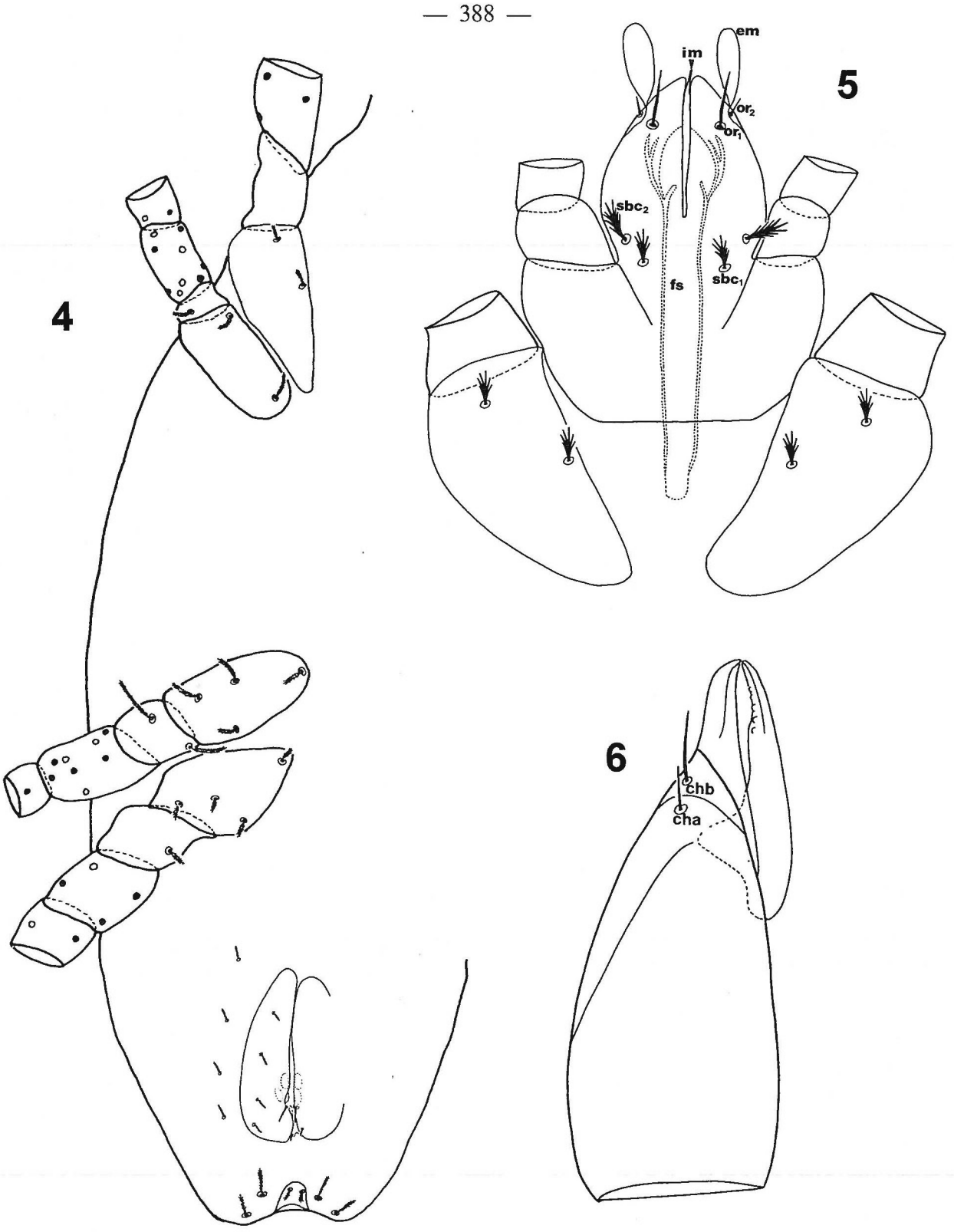


FIGS. 1–3: *Pentapalpus unguempodius* ♀.
1. — Prodorsum. 2. — Opisthosoma, dorsal view. 3. — Genital region.

(9 µm: 8–10) and h_2 (4 µm: 3.5–4) near bilobed posterior margin of idiosoma.

Ventral idiosoma. – Genital region (Figs. 3 & 4) with four pairs of *ag*- and four pairs of *g*-setae, all homomorphic dendriform-spinose, *g*-setae arranged evenly in line, nearer to the free margins of the relatively large, kidney-shaped genital flaps; genital atrium with two pairs of heteromorphic *eg*-setae, eg_1 simple to very weakly serrate, eg_2 much smaller, prominently spinose; anal opening (Fig. 4) subterminal, with one pair of adanal setae (*ad*) and three pairs of pseudanals, ps_1 situated dorsally (Fig. 2).

Gnathosoma. – Subcapitulum moderately slender, oval; lateral lips rounded, with prominent internal and external malae (Fig. 5); external malae (*em*) very large, soft, lobe-like structures situated a fair distance from the terminal extremity of lateral lips, just anterior to or_2; internal malae (*im*) delicate and needle-like, much closer to terminal extremities of lateral lips than *em*; subcapitular setae both strong, dendriform-spinose, sbc_1 inserted more medially on the ventral surface of the subcapitulum than sbc_2, sbc_2 slightly longer than sbc_1; adoral setae nude, with or_1 conspicuously larger than or_2; pharyngeal sclerite (*fs*) with finger-like projections towards median fissure of subcapitulum; chelicerae (Fig. 6) large and robust, fixed digit well developed, only moderately curved, slightly furcate terminally, edentate, movable digit with small rounded teeth on inner distal margin; two nude setae (*cha* and *chb*) situated on proximal third of fixed chela, *cha* inserted distad of articulation of movable



FIGS. 4–6: *Pentapalpus unguempodius* ♀.

4. — Opisthosoma, ventral view. 5. — Subcapitulum. 6. — Chelicera, dorsolateral view.

digit, tip reaching beyond insertion of *chb*; palpi (Fig. 7) with five free articles (tarsus, tibia, genu, femur and trochanter), distal margin of tarsus rounded; tarsus with seven setae of two different types (*d* large, densely spiculate; *l′* small, spiculate; *l″* dendriform-spinose; *ba* spiculate; *p′* and *p″* slightly curved, densely spiculate; *acm* dendriform-spinose), without rhagidial or erect, spiniform solenidia; tibia with two spiculate setae (*d* and *l″*); genu with one spiculate seta (d_1).

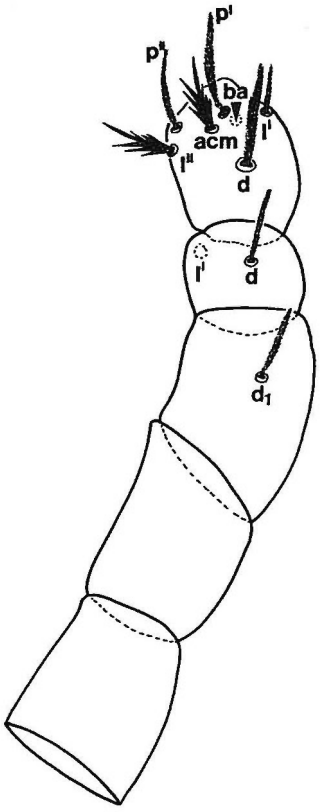


FIG. 7: *Pentapalpus unguempodius* ♀, palp, dorsal view.

Legs. – All legs shorter than body, with leg I (not longer than 130 μm) and leg II (not longer than 80 μm) being the longest and shortest, respectively; tarsi I–IV each with a small, naked, claw-like empodium (Fig. 12) at the base of two prominently rayed claws; supracoxal seta of coxa I absent; femur I slightly divided (Fig. 8), femur IV divided (Fig. 11); leg chaetotaxy of legs I–IV (with solenidia and famuli, ε, in parentheses) as follows (Figs. 4 & 8–11): tarsi 18(2 + ε)-12(2 + ε)-11-10; tibiae 7-5-4-4; genua 7-5-5-6; femora 10-9-8-6; trochanters 0-1-2-1; coxae 2-2-4-4; rhagidial organ of tarsus I (Fig. 8) with 2 parallel, L-type rhagidial solenidia, in separate depressions, and a large, lateral, stellate famulus; rhagidial organ of tarsus II (Fig. 9) with two L-type rhagidial solenidia, more or less in tandem (proximal solenidion slightly more lateral than distal solenidion), in separate depressions, and a small, median, stellate famulus; famulus I is prominently stalked, as in the genus *Shibaia* (ZACHARDA, 1980), and branched, as in *Caleupodes reticulatus* (BAKER, 1987).

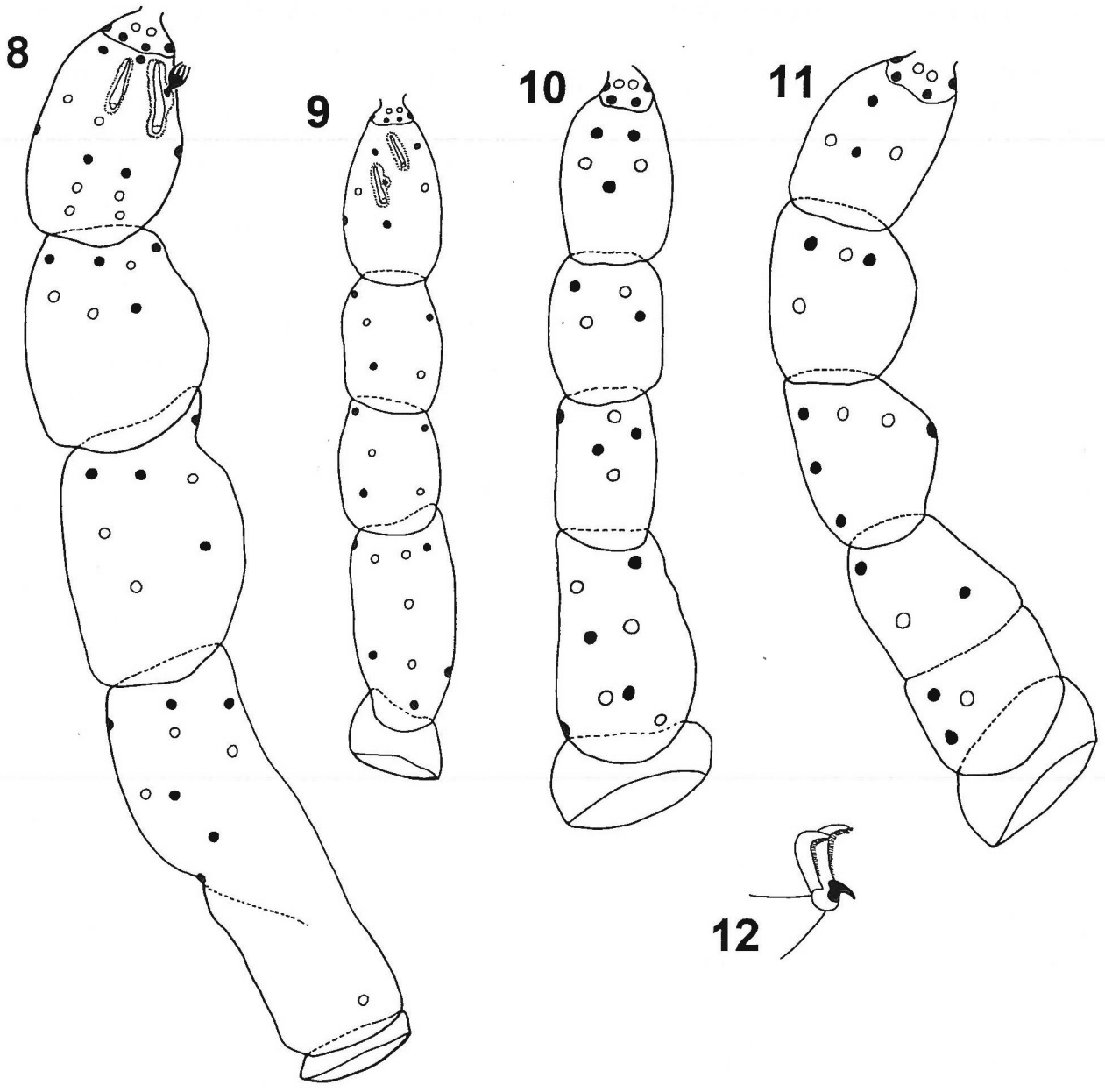
Material examined. – Holotype ♀, SOUTH AFRICA: Eastern Cape Province, soil, Summerstrand, Port Elizabeth 33.58S 25.38E, J. M. VENTER, 10 Nov. 1977; Paratypes: 3 ♀, same data as holotype; 3 ♀, soil under *Acacia karroo*, Northern Province, Warm Baths 24.53S 28.16E, P. A. S. OLIVIER, 6 Nov. 1983; 1 ♀, soil covered with *Pennisetum clandestinum* under *Salix babylonica*, Mpumalanga, Middelburg 25.25S 29.28E, P. A. S. OLIVIER, 29 Dec. 1983; 1 ♀, soil under *Solanum* sp., KwaZulu-Natal, Newcastle 27.45S 29.55E, P. A. S. OLIVIER, 29 Dec. 1983.

Etymology. – *unguis* (L), claw; refers to clawed empodium.

DISCUSSION

As mentioned above, the family Pentapalpidae is related to the Rhagidiidae. However, the combination of a five-segmented palp and subequal adoral setae seem to be sufficient to distinguish the Pentapalpidae from the latter. In the four-segmented palpi of the Rhagidiidae, and in fact all other Eupodoidea (QIN, 1996), it is accepted that a femorogenu is formed by the fusion of the respective segments, rather than being a tibiotarsus (BOOTH *et al.*, 1985; LINDQUIST & ZACHARDA, 1987; BAKER, 1990). In the five-segmented palp of the Pentapalpidae, the normal free articles (tarsus through trochanter) are present. The palpi are more robust (as in the Penthaleidae) and relatively short, only just exceeding the subcapitular apex in length.

The palpal tarsus, in different genera of rhagidiids, bears nine, ten or complements of six to fourteen setae (all setae of similar shape) and a dorsal spini-



FIGS. 8–12: *Pentapalpus unguempodius* ♀.
8. — Leg I. 9. — Leg II. 10. — Leg III. 11. — Leg IV. 12. — Claw and empodium, tarsus I.

form solenidion, which may occasionally be rhagidiform (BAKER, 1990). The Pentapalpidae display only seven setae, represented by two distinct types (Fig. 7), and lack rhagidial solenidia and/or erect, spiniform solenidia on the palpal tarsus. Generally, species of the Eupodoidea bear at least two setae on the femorogenu (QIN, 1996). In the Pentapalpidae, however, a single seta is found on the genu, with the femur completely devoid of setae. The presence of a minute supracoxal seta (*e*), situated laterally just above the articulation of the palpal trochanter, is thought to be a general feature in Rhagidiidae (ZACHARDA, 1980). However, even in lateral view, *e* could not be detected in *P. unguempodius*.

In the Pentapalpidae, both the adoral setae are clearly discernable but, unlike those of Rhagidiidae, they are of unequal size, with or_2 being much smaller. The rhagidiid *Hammenia macrostella* Zacharda bears only a single pair of adoral setae.

Five to six (exceptionally seven) pairs of homomorphic eugenital setae are common in females of the Rhagidiidae (ZACHARDA, 1980), while in the Pentapalpidae only two pairs (heteromorphic in both shape and size) are found.

The presence of an apotele with a relatively small, claw-like, sclerotized and unrayed empodium in the Pentapalpidae, is unique within the Eupodoidea. In the Rhagidiidae, the apotele consists of two lateral claws, sometimes with a minute clawlet or basal spur, and one prominently ciliated empodium. The empodium is usually large, soft and pad-like. The conspicuously short legs also separate this family from the rhagidiids. Both leg I and IV seem to be constantly longer than the body in the Rhagidiidae. This is also true for a number of other eupodoid species (QIN, 1996) with the extreme of lengths displayed in the genus *Linopodes* (Eupodidae).

A number of pronounced differences are to be found in the leg chaetotaxy. In species of Rhagidiidae, tarsus I bears from three to twelve rhagidial solenidia and tarsus II may have from three to seven (ZACHARDA, 1980), as compared with only two solenidia each on tarsi I and II in the Pentapalpidae. The stellate famulus of tarsus II in the Pentapalpidae is also different from the spiniform famulus of the Rhagidiidae. Rhagidial solenidia on tibiae I and II (sometimes also III and IV), genua I–III and tarsus III are present only in the Rhagidiidae. Erect spiniform solenidia on tibiae I–IV and genua I–III, found in the Rhagidiidae, are also lacking in the Pentapalpidae.

The coxal chaetotaxy seems to be a variable feature in species of Rhagidiidae, with coxae I and II constantly bearing three and one seta respectively, but coxae III and IV mostly display from three to eight setae each. In *Rhagidia gelida*, coxa III displays from six to eleven setae (ZACHARDA, 1980). This differs in the Pentapalpidae, with coxae I and II bearing two setae each and coxae III and IV four setae each (Fig. 4). The only other eupodoid with two setae on coxa I is *Benoinyssus najae* (QIN, 1996: OLIVIER & THERON 1997b).

The absence of opisthosomal lyrifissures in the Pentapalpidae may also prove to be a valuable feature. In rhagidiids there are usually three pairs dorsally and one pair ventrally.

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