

Description of a new genus and a new species of Machilidae (Insecta: Microcoryphia) from Turkey

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Abstract

A new species and a new genus of Microcoryphia from Turkey are described. The new genus, named *Turquimachilis* has, as its most important distinctive feature, the presence in the male of unique parameres on the IXth urostemite, with proximal protuberances and chaetotaxy. They are different from all the other genera of the order. This alone is sufficient to allow the creation of a new genus. We add other anatomical characteristics that allow us to differentiate the new genus from the closest known genera. The type species is described.

Keywords *Turquimachilis mendesi* | new genus | new species | *Charimachilis* | Turkey

1. Introduction

Knowledge of Turkish Microcoryphia is scarce, because since Wygodzinsky (1959) no further work has been published referring to this country. The two known families of Microcoryphia are represented there. The Meinertellidae with two species of the genus *Machilinus* and the Machilidae with eight species, 3 belonging to the genus *Lepismachilis*, and *Machilis*, *Petrobius*, *Praetrigoniophthalamus*, *Charimachilis* and *Silvestrichilis* each one with one species.

The present paper reports a new genus and a new species which is particularly interesting because of its genital appendages. Principally in the male, these appendages are unique among all the known species of the whole order.

2. Material and methods

We received the specimens from the Museum of Natural History of Verona. They were collected in 1969 (one sample) and 1972 (remaining samples), all of them conserved in ethanol.

For the taxonomic study eight specimens (four of each sex) were dissected and their appendages and genitalia mounted in Hoyer's liquid. The slides were dried for a week and observed with a Leitz optical microscope. The drawings were made in a camera lucida.

For the scanning electron microscope micrographs, the specimens (one male and one female) were dehydrated in ethanol, dried in a Balzers CPD 030 critical-point dryer, and coated with gold in a Balzers MED 010 sputtering device. Specimens were subsequently examined and photographed in a Philips XL20 scanning electron microscope operated with an accelerating voltage of 10kV.

3. Results

Turquimachilis n. g.

Etymology. The genus is named by a prefix that refers to the country where it was collected (Turkey), but in Spanish (Turquia). The International Code of Zoological Nomenclature, Art. 11.3, permits this. The second part of the name corresponds to the genus *Machilis*, referring to the main genus inside the order and also to the suffix of the genus *Charimachilis*, which is the most closely related genus.

Description. Machilidae, medium size (9 mm). Scales on body and appendages. Slight pigment present only in the head and in the body, appendages without pigment. Frons and clypeus not protruding. Compound eyes large, rounded, approximately as long as wide, slightly convex. The contact line about half the length of the eye. Ocelli sole-shaped with the wider part lateral (Fig. 1). Antennae (broken) seem to be as long as the body length or a little shorter. Mandible normal, with four teeth. Maxillary palp without particularities in both sexes, the last article being conical (Figs 4 and 16). Labial palp with the third article a little broadened in both sexes, the field of sensory cones is small and placed apically (Fig. 3). Spiniform setae on the lateral margins of the thoracic tergites II and III. Legs not very strong, the first pair being more robust in both sexes. Without spiniform setae or spines on the ventral side of its articles. Coxal stylets on P II and P III (Figs 7, 8, 19 and 20). Abdominal sternites or urosternites with two pairs of eversible vesicles on II–V (Figs 9 and 21); I, VI and VII with one pair (Fig. 22). Abdominal coxites without spiniform setae. Sternites II–VII well developed forming an acute angle between the coxites. Coxal stylets on II–IX being a little longer than half of the coxite, covered with thin setae. Terminal spines of the stylets as long as half the stylet or somewhat more. Parameres only on the urosternite IX, without segmentation or only slightly segmented on its distal part (Figs 14 and 30 to 33). On its proximal part they have two lobes and specialized setae and spines (Fig. 32). Penis shorter than the paramera, the distal part longer than the proximal and with an apical aperture (Figs 13 and 30). Ovipositor of the primary type (Sturm and Bach 1993), covered by the coxites IX (Fig. 24). Gonapophysis with few divisions (less than 20) and long setae. Gonapophysis VIII ends with two somewhat rounded teeth (Figs 25 and 35). Gonapophysis IX ends with a more or less chitinized tooth (Figs 27 and 36). Caudal appendages broken, but the conserved part shows scales, piliform scales, setae and spines.

Type species: *Turquimachilis mendesi* n. sp.

This species is dedicated to our colleague and close friend Dr Luis Mendes.

Main diagnostic characters. *Turquimachilis* may be easily distinguished from all the other known genera by the form and arrangement of their male genitalia. The females could be distinguished from the closely related genus *Charimachilis* by the terminal end of the gonapophysis. Other characteristic features are the number of vesicles on the abdominal sternites and the lack of chaetotaxy in the coxites.

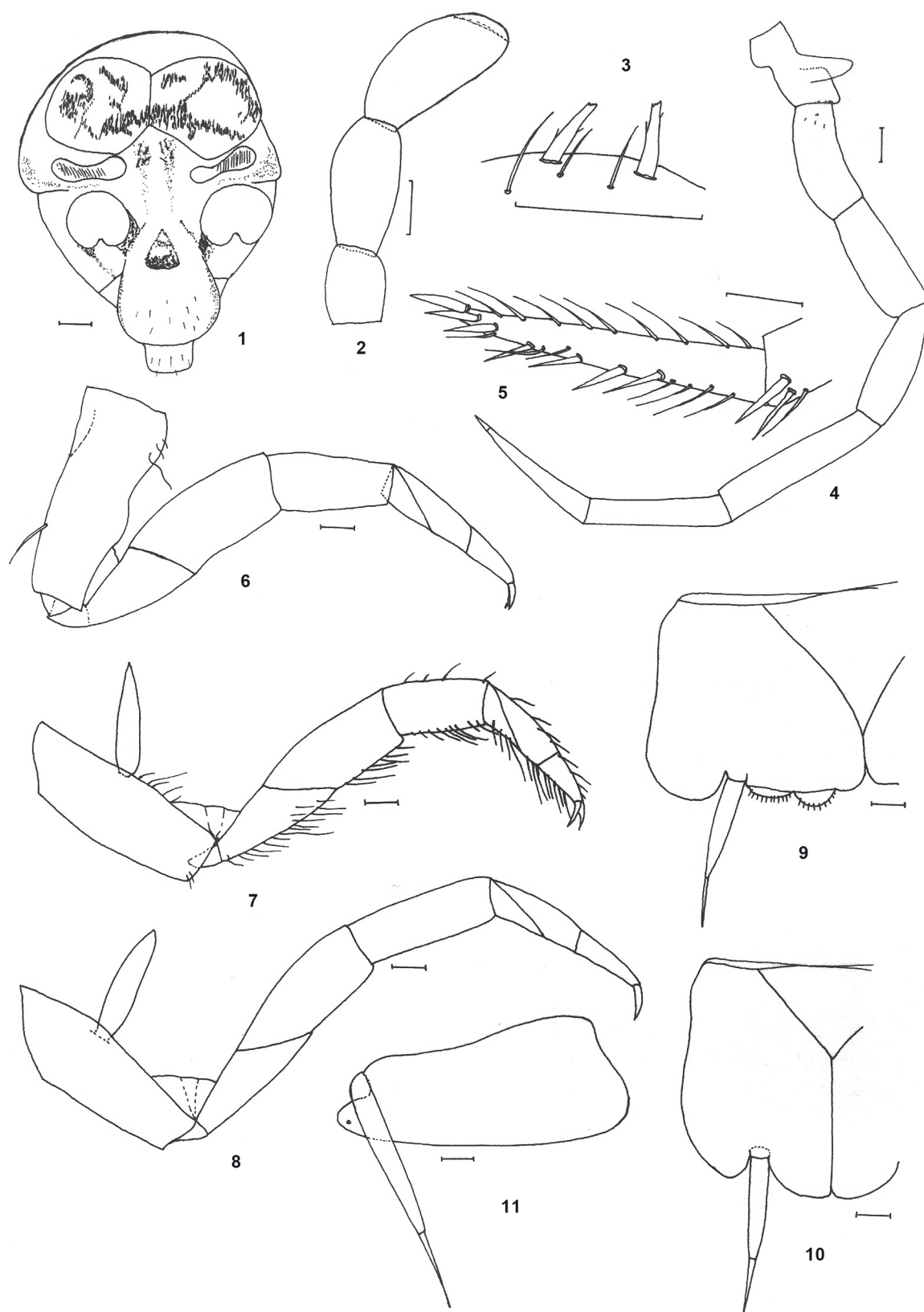
Discussion. The new genus has some characteristics common to *Charimachilis* (ocelli, terminalia and gonapophysis), but is very different, mainly regarding the unique shape of the male paramera, which has proximal protuberances with specialized setae and spines. Only one male of *Charimachilis* is described: *Ch. caucasicus* Kaplin, 1999. The shape of the paramera of *Ch. caucasicus* is very similar to those of *Charimachilis* specimens from Turkey, which we have under study. Neither the material from Turkey nor that described by Kaplin (1999) show the special features on the paramera present in *Turquimachilis*. The females are different because the VIIIth gonapophysis have no teeth on their external margin. The number of abdominal vesicles is also different (1+1 in II–VII in *Charimachilis* and 2+2 in II–V in the new genus. It is true that in some genera there are species with a variable number of abdominal vesicles, but the shape of the paramera, unique among the whole order, allows us to consider it as a new genus.

The female's IXth gonapophysis is also related to *Catamachilis*, however the two genera are quite distant because the latter genus has 1+1 abdominal vesicles in abdominal sternites I–VII, the form of the ocelli are very different (rounded and submedian) and it has stylets only on the third pair of legs. Gonapophysis IX is also related to *Promesomachilis*, but it is very different regarding the position and shape of the ocelli and the paramera of the male.

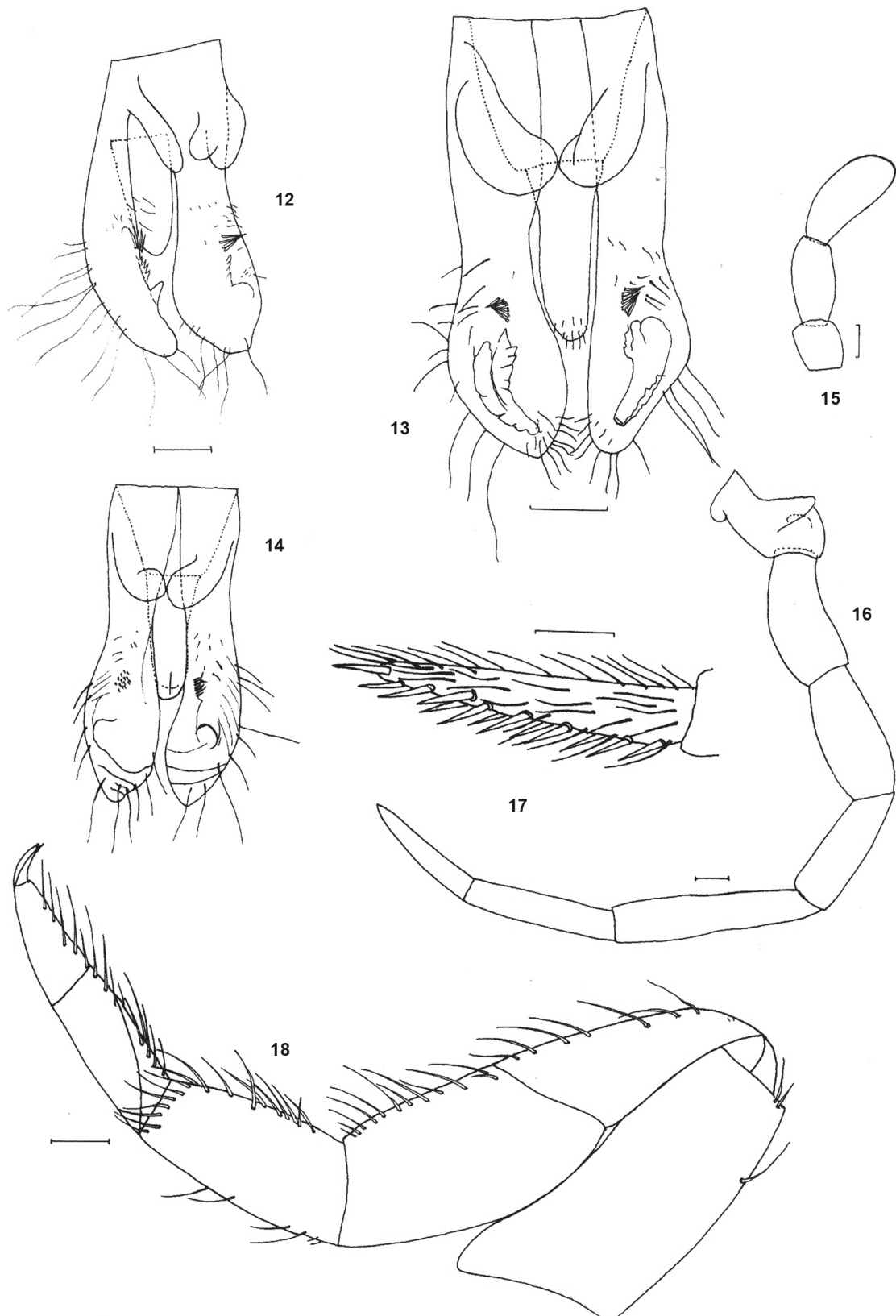
Turquimachilis mendesi n. sp.

Material studied: Turkey, Ilgazdaggeci, Passo, 1775 m, 17.VII.1972, Osella leg. 1 ♂ holotype, 1 ♀ allotype, 1 ♂ + 5 ♀♀ paratypes. - Ilgazdaggeci, 1800 m, 6.VII.1972, 7 ♂♂ + 9 ♀♀ (paratypoids), Osella leg. - Ilgazdaggeci, Kastamenu, 1800–1900 m, 30.V.1969, 1 ♂. Osella leg. - Ilgazdaggeci, 2200–2300 m, 9.VII.1972, 1 ♀, Osella leg. - Ilgazdaggeci, 2200–2300 m, 8.VII.1972, 1 ♀, Osella leg. All the specimens are deposited in the Museum of Natural History of Verona (Italy), except 2 paratypes, 1 male and 1 female that are in the collection of the University of Córdoba.

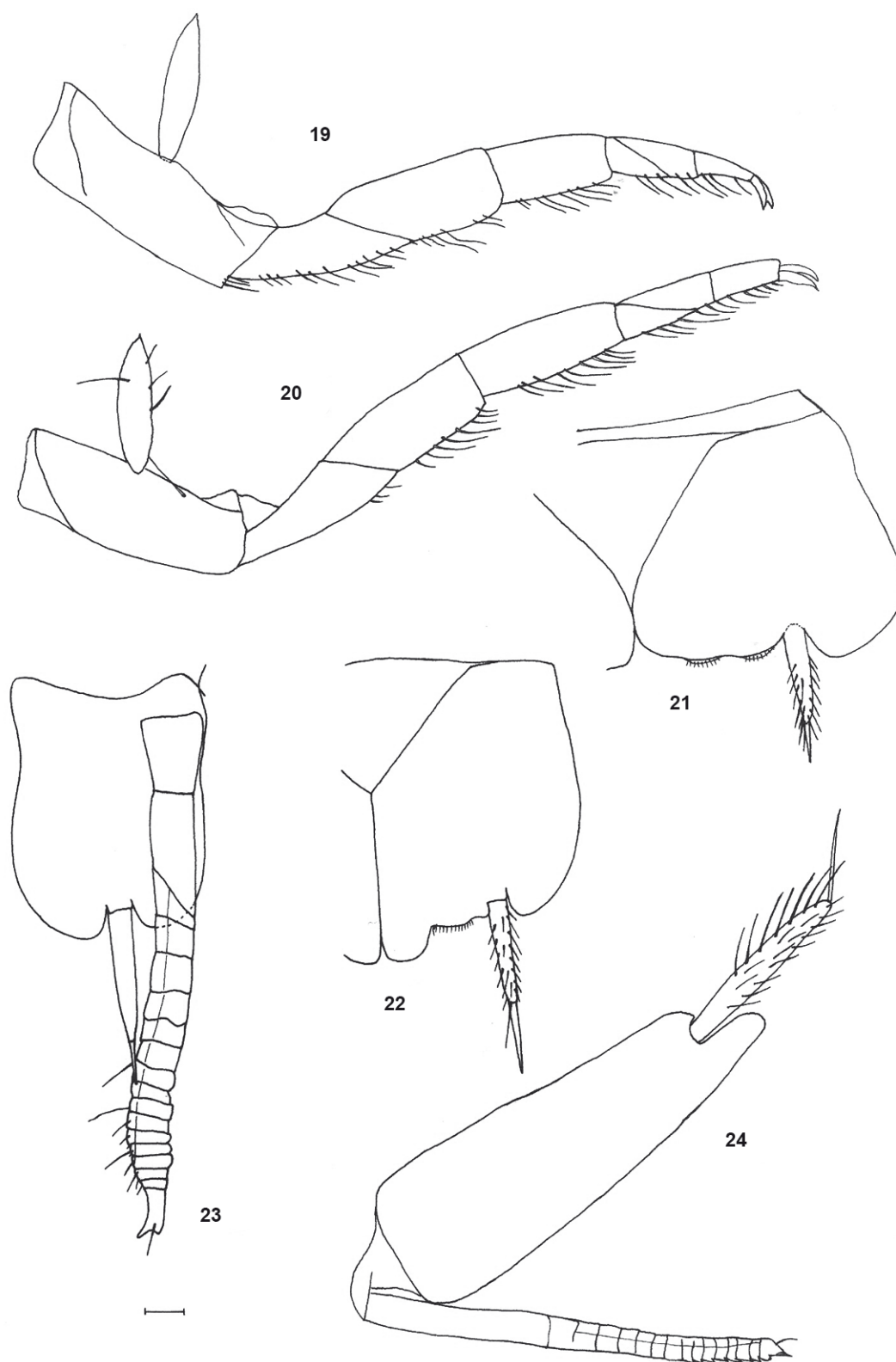
Description of the male holotype. Body length: 8.5 mm, length of antennae (broken): 4 mm; length of paracercus (broken): 2 mm; length of the cerci (broken): 1.5 mm.



Figures 1–11. *Turquimachilis mendesi* n.g., n.sp., male. (1) Head, frontal view, (2) Outline of the labial palp, (3) Sensory connules of the 3rd article of the labial palp, (4) Outline of the maxillary palp, (5) Last article of the maxillary palp, (6) Outline of the fore leg, (7) Ditto, mid leg, (8) Ditto, hind leg, (9) Outline of the Vth abdominal sternite, (10) Ditto, of the VIIIth, (11) Ditto, of the IXth. Scale bars = 0.1 mm.



Figures 12–18. *Turquimachilis mendesi* n. g., n. sp., male. (12) Parameres and penis, (13) Ditto (1800 m height), (14) Ditto (1800–1900 m height). *Turquimachilis mendesi* n. g., n. sp., female. (15) Outline of the labial palp, (16) Ditto, of the maxillary palp, (17) Last article of the maxillary palp, (18) Outline of the foreleg. Scale bars = 0.1 mm.



Figures 19–24. *Turquimachilis mendesi* n. g. n. sp., female. (19) Outline of the mid leg, (20) Ditto, hind leg, (21) Vth abdominal sternite, (22) Ditto, of the VIIth, (23) Abdominal sternite VIII and gonapophysis, (24) Ditto, IXth. Scale bars = 0.1 mm.

Pattern of the scales unknown. Pigment only detectable in the head, the rest nearly completely depigmented.

Head (Fig. 1) with diffuse pigment on frons, genae and base of the antennae, darker around the median ocelli. A few short setae in frons, clypeus and labrum. Frons not protruding. Compound eyes rounded with spots of dark pigment over a grey colour (possible artefact of the alcohol); ratio contact line/length: 0.5; length/width: 0.95. Paired ocelli sole-shaped.

Antennae broken, scape strong. The antennal chains appear to have 10 annuli with a row of setae longer than the annuli, short setae, small sensorial sensilla and sensilla in shape of rosette (in German: Rosettenförmige Sensillen) (Fig. 29).

Maxillary palp thin, without pigment, covered with normal setae, hyaline spines in the last three articles: 2/10/8. Last article conical with the terminal spine longer than the previous pair (Figs 4 and 5).

Labial palp (Figs 2 and 3) with the last article slightly widened in their apex and with a field of sensory cones that are longer than the surrounding setae. These cones have 1–2 setae along their length and at the top have 8–10 little teeth.

Legs with coxal stylets in the second and third pairs. The first pair is more robust than the others. The chaetotaxy has no special features and there are not special setae or spines. Only femur I shows a macrochaeta (Figs 6 to 8).

In the urosternites, the sternites are well developed, forming an acute angle between the coxites, these have no spiniform setae except in coxite IX, which presents only one (Fig. 11). Coxites I, VI and VII have one pair of abdominal vesicles, II–V with two pairs (Fig. 9). Coxite VIII is longer in its medial part (Fig. 10). Stylets covered by setae and ending with a spine longer than the neighbouring hyaline setae. Ratios length of stylet (without spine) / coxite: V = 0.48; VIII = 0.51; IX = 0.53. Ratio spine / stylet (without spine): V = 0.49; VIII = 0.51; IX = 0.46.

Parameres only in the IXth urostemite. The paramera show no annuli except in some specimens, where they are very weak and irregularly annulated (Figs 14 and 30). At its basal part there is a protrusion like two rounded apophyses that are touching in the medial part (Fig. 31). In the internal part it has a concavity where there is a little protuberance similar to teeth and, over them, a brush of small spines (Figs 32 and 33). The distal part has short setae and in the apical and dorsal part ciliary setae which are not very abundant. The paramera are not subparallel, because they are broad basally, and then narrower (in the concave region), finally the last part broad and ending rounded. The penis, somewhat shorter than the paramera and with setae in the distal part, has not any particularity. Aperture apical without specialized setae. Ratio basal part / terminal part = 1.48 (Figs 12 to 14).

Terminalia broken. In one specimen (not the holotypus), the cercus ends with two terminal spines, one of them smaller.

Description of the female allotype. Body length: 9 mm; antennae length (broken): 2 mm; paracercus (broken): 5mm; cercus (broken): 2.5 mm. Pattern of scales unknown.

Pigmentation of the head and particularities as in the male. Ratio of compound eyes: contact line/length: 0.48; length/width: 0.90.

Antennae as in the male.

Maxillary palp long and with normal chaetotaxy. The last article conical. Number of hyaline spines on the last three articles: 6 / 0–12 / 9–10 (Figs 16 and 17).

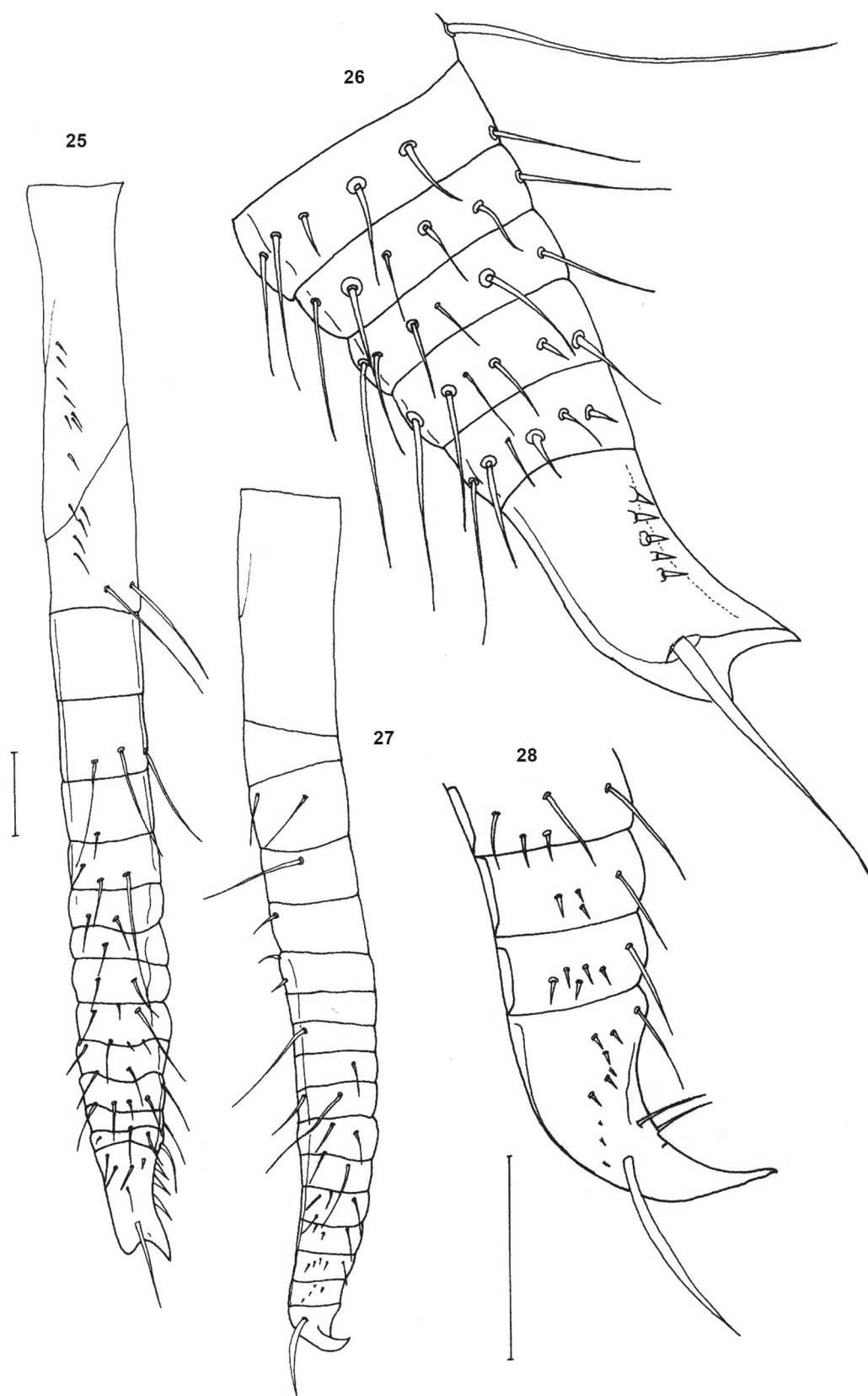
Labial palp less robust than in the male, the third article slightly widened in their distal part and with few sensory cones (Fig. 15).

Legs as in the male and also with a macrochaeta in femur I (Figs 18 to 20). Urocoxites without spiniform setae (Figs 21 and 22). Ratio stylet (without spine) / coxite: II–V = 0.38–0.43; VIII = 0.66–0.8; IX = 0.45. Ratio spine / stylet (without spine): V = 0.49–0.65; VIII = 0.30–0.42; IX = 0.48.

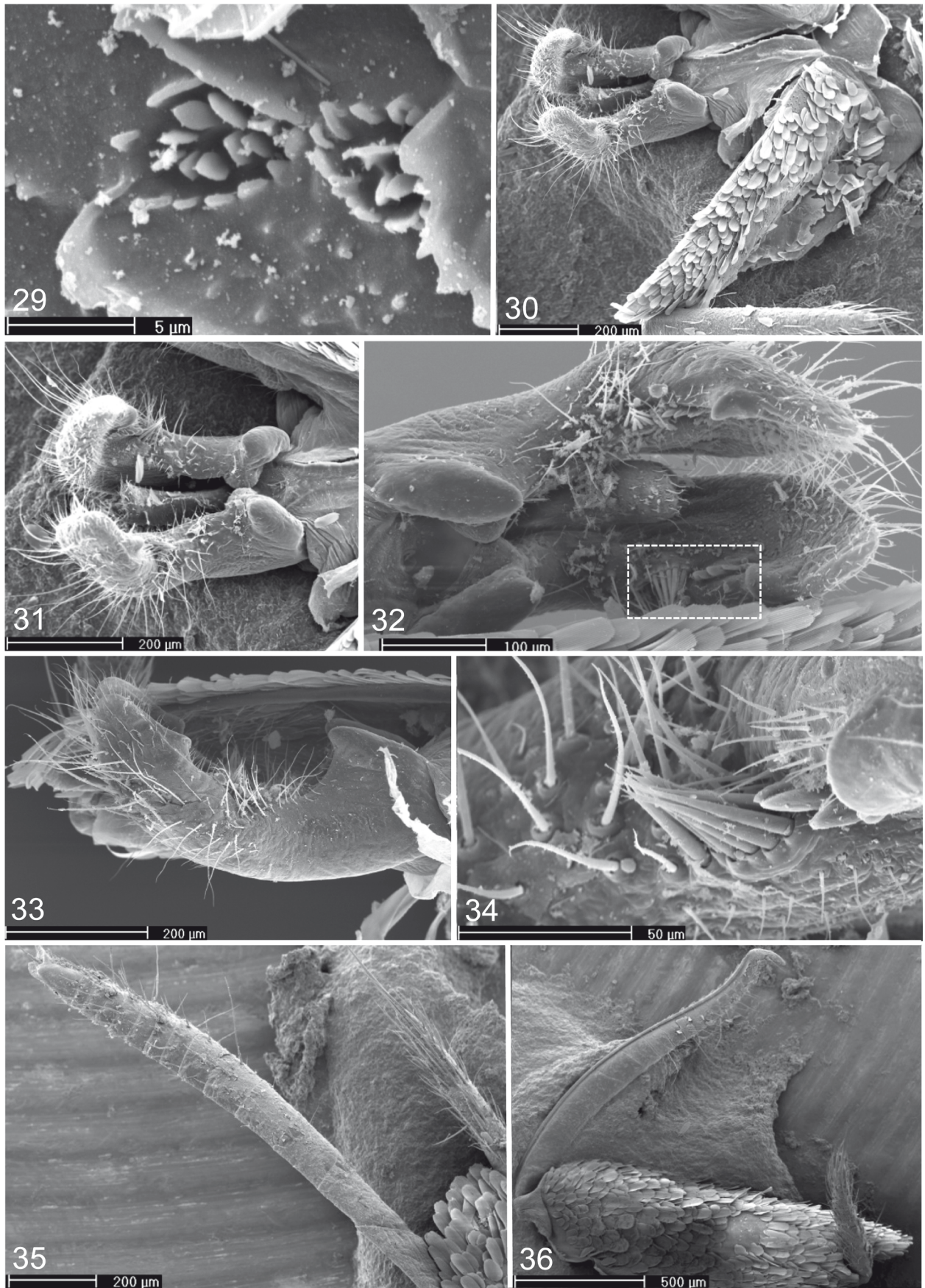
Ovipositor of the primary type covered by the IX coxites, stout. Gonapophysis VIII with 15–16 divisions (Figs 23 and 35). The end shows two small spine-like lobules and between them there is subterminal seta a little longer than the last division, this has sensory spines and 2–3 setae. The remaining divisions have a row of setae, some of which, principally in their internal and external parts, are long and ciliary. The basal division has no setae (Figs 25, 26 and 36). Gonapophysis IX with 15–16 divisions ending with a somewhat curved apical spine at its end and with a subterminal seta longer than the spine (Fig. 24). This division presents further a group of tiny sensory spines, which are also present in the following 4–6 divisions, but their number decreases towards the base. These divisions also have 2–3 setae, those of the external part being longer. The two most basal divisions lack chaetotaxy (Figs 27 and 28).

Terminalia broken.

Discussion. All the criteria we have given for the genus apply to the species. We mention again that is the only species known of the entire order Microcoryphia that presents male parameres that are so modified. Sturm & Bach (1993) and Sturm & Machida (2001) have pointed out the singularity of this paramera. Regarding the gonapophysis of the female, we agree with Sturm and Machida (opus cit.) that the closest genus is *Charimachilis*. The female of *Charimachilis* has, as in the new species, less than 20 divisions in its gonapophysis (the lowest number inside the Machilidae). The new species has a different number of abdominal vesicles



Figures 25–28. *Turquimachilis mendesi* n. g., n. sp., female. (25) VIIIth gonapophysis, (26) Apical divisions of the VIIIth gonapophysis, (27) IXth gonapophysis, (28) Apical divisions of the IXth gonapophysis. Scale bars = 0.1 mm.



(2 pairs in II–V) and teeth in the last article of the VIIIth gonapophysis, lacking the teeth that are normally found in *Charimachilis*. Nevertheless the new species shares this particularity with *Ch. palaestinensis* Wygodzinsky, 1939.

We agree with Sturm and Machida (opus cit.) that *Turquimachilis* could be placed into the *incerta sedis* group together with *Charimachilis*, both genera being different palaeoforms from the ancestral group of Machilidae and Meinertellidae. *Turquimachilis* has primitive characteristics and, at the same time, some derived features which are totally original leading us to think that their evolution has been independent.

Surely, with the study of more material, these two genera should be put into a family of their own, agreeing in this aspect with the criteria of Sturm and Machida (opus cit.). The authors attempted molecular studies of both genera in order to clarify this hypothesis, but due to the age of the material no results could be obtained.

4. Acknowledgements

The authors are deeply grateful to Giuseppe Osella, from the Museum Civico of Natural History of Verona (Italy), who many years ago sent us a loan for study that has allowed us to describe this interesting genus of Microcoryphia.

5. References

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Figures 29–36. *Turquimachilis mendesi* n. g., n. sp., male. (29) Sensilla in shape of rosette, (30) Coxite IX with penis and paramera, (31) Penis and paramera showing its apophysis touching in its medial part, (32) Detail of paramera, marked the brush of spines that are shown also in Figs 34, 33; Protuberance and concavity of the paramera, (34) Sensilla and brush of spines on the paramera. *Turquimachilis mendesi* n.g, n.sp., female. (35) Whole gonapophysis VIII, (36) Ditto IX.