

## New species and records of halacarid mites (Halacaridae: Acari) from the Black Sea

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(with 43 figures)

### Abstract

In an annotated list of halacarid species known from the Black Sea area, Bartsch (2004) mentioned 41 species. Recently another three species, one new to science and two new records, were extracted from sediment samples taken near Sinop, Turkish Black Sea coast, from 3 and 10 m depth. The new species, *Copidognathus dissimilis* sp. n., is described. The descriptions of *Camactognathus tessellatus* (Morselli & Mari, 1982) and *Copidognathus sculptus* (Police, 1909) are supplemented. *Copidognathus perforatus* Viets, 1940 is regarded as a junior synonym of *C. sculptus*. *Copidognathus dissimilis* and *Camactognathus tessellatus* were the halacarid species most abundant in the sediment samples.

**Key words:** Acari, Halacaroidea, Black Sea, Turkey, new species, descriptions, synonymy.

### Introduction

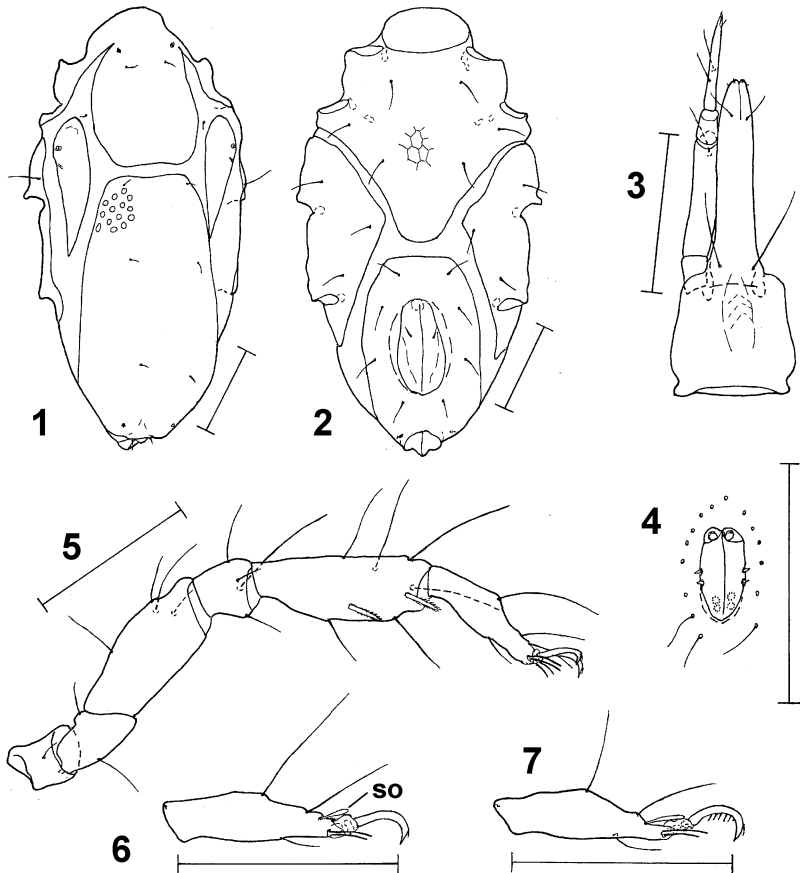
More than a century ago, Chichkoff (1907) published a first note on the Black Sea halacarid fauna; more than 3000 individuals had been examined, these belonged to a dozen species or subspecies. In the following nine decades several new halacarid records and species were published, all collected in the northern part of the Black Sea Basin (Viets 1928, Motas & Soarec 1940, Marinov 1964, Konnerth-Ionescu 1968, 1970, 1979, Petrova 1972, 1976, Bartsch 1996a, b, 1998a, b, 1999a, c, 2000, 2001). At the beginning of the 21st century records from the Turkish coast were added (Bartsch 2000, 2004). The number of species known from the Black Sea had been raised from 12 (Chichkoff 1907) to 41 (Bartsch 2004). The latter number includes six 'freshwater' species regularly found in brackish or freshwater water bodies immediately adjacent to the Black Sea Basin. The present paper presents a description of a species, new to science, and two species, previously not known from the Black Sea. It also refers to a new synonymy.

### Material and methods

The halacarid mites described in this paper are from sediment samples taken by Dr. M. Sezgin and his colleagues off Sinop, Turkish Black Sea coast, in the course of meiobenthos studies. The studies were funded by the Scientific and Technological Research Council of Turkey (TUBITAK) and the National Academy of Sciences of Ukraine

(NASU) (Project 108Y340). In monthly samples, from August 2009 through July 2010, sediment had been collected at four sites (A to D), in 3 and 10 m depth at each site. The sediment in the study area is mainly a mixture of shell remains and muddy sand. Amongst others both pontarachnid (Pešić *et al.* 2013) and halacarid mites were present. The halacarids were cleared in lactic acid and mounted in glycerine jelly. The holotype and voucher specimens are deposited in the Zoological Museum, University of Hamburg (ZMH), further slides are in the author's halacarid collection.

Abbreviations used in the descriptions are: AD, anterior dorsal plate; AE, anterior epimeral plate; *ds*-1 to *ds*-6, first to sixth pair of dorsal idiosomatic setae; GA, genitoanal plate; GO, genital opening; OC, ocular plate(s); *P*-1 to *P*-4, first to fourth palpal



**Figs 1-7.** *Camactognathus tessellatus* (Morselli & Mari). 1. idiosoma, dorsal, female; 2. idiosoma, ventral, female; 3. gnathosoma, ventral, male; 4. genital opening, male; 5. leg I, medial, male; 6. tarsus I, lateral, male (medial setae and claw excluded); 7. tarsus II, lateral, female (medial setae and claw excluded). Scale = 50 µm. (so, solenidion)

segment; *pas*, parambulacral seta(e); *PD*, posterior dorsal plate; *PE*, posterior epimeral plate(s); *pgs*, perigenital setae, numbered from anterior to posterior; *sgs*, subgenital seta(e). The legs, their segments and claws are numbered I to IV, the leg segments 1 to 6 are trochanter, basifemur, telofemur, genu, tibia, and tarsus.

A given length of a species is that of the idiosoma, a given length of the telofemora that in dorsal aspect. Data presented with a question mark (?) are in need of verification. Rare numbers of setae are in parentheses. Drawings were done using a drawing tube. Marginal setae are illustrated either in the dorsal or ventral aspect but not in both.

When describing the ornamentation of the integument of *Copidognathus* species the terms 'ostia' and 'foveae' are used. An ostium is a part of a rosette pore. A typical rosette pore, as described and illustrated by Newell (1947: 226, fig. 205), consists of numerous canaliculi which open into a central alveolus which in turn is in contact with the exterior via a narrow ostium. Rosette pores in this typical form are within raised areolae, on the *PD* within costae; the integument in these parts is thicker than in the remainder. In species with a rather thin integument, the rosette pores are more or less reduced, there is no narrow ostium, instead the wide alveolus opens almost directly to the surface, what we see is a fovea with numerous canaliculi. To have the same denomination for homologous structures of the dorsal plates, the term ostia is used for cavities which are part of rosette pores, independent of the diameter. The term fovea means a shallow cavity, its lacks canaliculi unless otherwise indicated. On the integument of the ventral plates, gnathosoma and legs areas with typical rosette pores (with ostium and alveolus) are often weakly or not demarcated and the term 'porose fovea' is used for a shallow cavity with numerous canaliculi.

## Systematics

### *Camactognathus tessellatus* (Morselli & Mari, 1982)

Figs 1-10

*Arhodeoporus tessellatus* Morselli & Mari, 1982: 238-242, fig. 5a-c, fig. 6, ZI-ZIV.

MATERIAL EXAMINED. One female, one male (ZMH Acc. No. A15/13), 42°01'06"E, 35°08'07"N, 3 m (Station C1). Three females, six males, one deutonymph, author's collection, same collecting site, September and October 2009, March and June 2010.

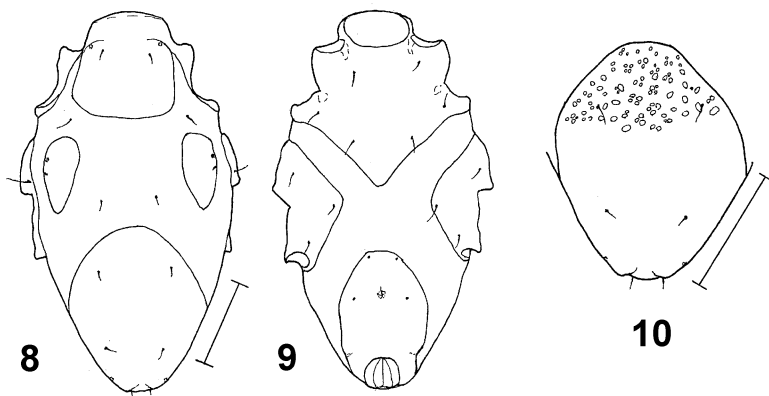
SUPPLEMENTARY DESCRIPTION. Adults. Idiosoma of female 242-245 µm long, of male 225-247 µm. Idiosoma slender, about twice as long as wide. Major parts of dorsal plates uniformly foveate and with delicate punctation. Ornamentation almost lacking in anterior parts of *AD* and *OC*. Integument between plates coarsely striated. Idiosoma with three pairs of gland pores and six pairs of dorsal idiosomatic setae (Fig. 1). Ventral plates with delicate punctation arranged in polygons. *AE* with three pairs of setae; epimeral pores lacking. Female *GA* and *AE* almost equal in length (Fig. 2). *GA* with four pairs of *pgs*. *GO* in middle of plate; distance between margin of *GO* and anterior margin of *GA* almost same as that between *GO* and basis of anal sclerites. Genital sclerites with single pair of *sgs*. Ovipositor short, not (or hardly) extending beyond anterior margin of *GO*. Genital spines obscured by genital sclerites, though basal pair and a few of apical spines shining through sclerites. Male *GA* longer than *AE*. *GO* in middle of plate; distance between margin of *GO* and anterior margin of *GA* almost same as that between *GO* and basis of anal sclerites. With 43-44 slender *pgs* arranged in

two rings around GO. Genital sclerites with three pairs of *sgs* situated at periphery of GO, not near genital slit (Fig. 4); anterior pair of *sgs* wide, leaf-like, two posterior pairs short, spur-like.

Gnathosoma long and slender, 2.4–2.6 times longer than wide (Fig. 3). Rostrum longer than gnathosomal base and extending beyond basis of *P*-4. Both pairs of maxillary setae on rostrum. *P*-2 with one dorsal seta, *P*-4 with two setae removed from segment's basis; a porus, present in several specimens, may represent a vestigial third seta.

First pair of legs longer than following legs, all legs shorter than idiosoma. Telfemora I and II about 2.4 times longer than high, telfemora III and IV about 2.1 times. Leg chaetotaxy (*pas* excluded): leg I, 1, 2, 4, 4, 8, 5; leg II, 1, 2, 3, 4, 5, 5; leg III, 1, 1, 2, 2, 5, 4; leg IV, 1, 1, 2, 3, 5, 3. Tibia I with two bipectinate ventromedial, two slender, smooth ventral, and four dorsal setae (Fig. 5). Tibiae II, III and IV each with one bipectinate ventromedial and one smooth ventral seta. Both tarsus I and II with three dorsal setae, a club-shaped solenidion in dorsolateral position, and a ventral seta (Figs 6 and 7). Tarsi I and II with pair of doubled *pas*; lateral *pas* on tarsus III spur-like, medial *pas* slender, both lateral and medial *pas* on tarsus IV spur-like. Paired claws with accessory process, claws II to IV with coarse tines.

Deutonymph. Length of idiosoma 220 µm. OC and PD much shorter than in adults (Fig. 8). Anterior margin of PD ovate. PD not uniformly foveate instead major part of plate ornamented with small pits, two to four pits situated adjacent and representing a fovea (Fig. 10). Number of setae on dorsum and on AE and PE same as in adults (Fig. 9). GA with two pairs of *pgs* and two pairs of minute internal acetabula. Leg chaetotaxy (*pas* excluded): leg I, 1, 2, 3, 4, 6, 5; leg II, 1, 2, 3, 4, 5, 5; leg III, 1, 1, 2, 2, 5, 4; leg IV, 1, 1, 2, 2, 5, 3. Each of tibia I to IV with one bipectinate ventromedial and one slender and smooth ventral seta.



**Figs 8–10.** *Camactognathus tessellatus* (Morselli & Mari), deutonymph. **8.** idiosoma, dorsal; **9.** idiosoma, ventral; **10.** posterior dorsal plate. Scale = 50 µm.

**DISTRIBUTION AND BIOLOGY.** *Camactognathus tessellatus* was once described on the basis of specimens from the Mediterranean (Ionian Sea, Peninsula Salentino, south-east Italy), extracted from medium coarse sand (Morselli & Mari 1982). This is the first record from the Black Sea and the first from outside the type locality. The species was found in a single locality, at 42°01'06"E, 35°08'07"N and 3 m depth (Station C1); it was one of the dominant species at this site. The sediment in this area was rather fine, but included a fraction of coarse sand (D. Ürkmez, personal communication).

*Copidognathus dissimilis* sp. n.

Figs 11-27

**MATERIAL EXAMINED.** Holotype female (ZMH), 42°01'06"E, 35°08'07"N (Station C1), 3 m, 24 December 2009 (ZMH Acc. No. A13/13). Paratype female (ZMH), collection and accession data as for holotype. One male (ZMH), 42°01'06"E, 35°08'07"N (Station C1), 3 m, 29 September 2009 (ZMH Acc. No. A14/13). Three females, two males, one protonymph, author's collection, 42°01'06"E, 35°08'07"N (Station C1), June 2009 and January 2010. One protonymph, author's collection, 42°00'53"E, 35°11'41"N (Station A2), 10 m, 30 April 2010.

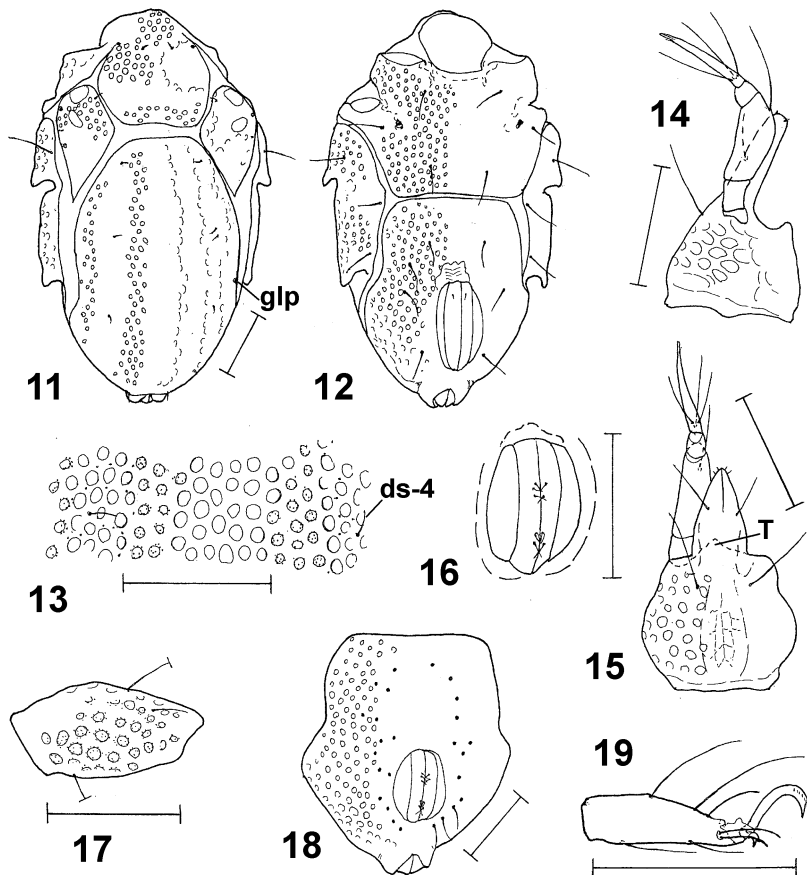
**ETYMOLOGY.** The species, though at a first glance very similar to existent Black Sea species, has a different combination of characters, hence the name *dissimilis*, derived from *dissimilis* (Latin), different.

**DIAGNOSIS.** Length of female 288-315 µm, of male 300-314 µm. Porose areolae of dorsal plates with wide ostia, each with numerous canaliculi; remainder of plates foveate. *AD* with three dome-like porose areolae and a transverse posterior areola. *PD* with two pairs of longitudinal costae. Anterior pair of gland pores on *PD* in lateral margin of plate. Ventral plates foveate and with canaliculi. Female *GA* with four (rarely three) *pgs* in either half; ovipositor short, hardly extending beyond *GO*. Male *GA* with 23-26 *pgs* arranged in a wide ring around *GO*. Spermatopositor large, extending to anterior *pgs*. Rostrum reaching to the level of seta on *P*-2. Tectum short, triangular. Female and male with two pairs of maxillary setae. Telofemur I about twice as long as high, with narrow crest-like ventral lamellae, both lateral and medial flank ornamented with porose foveae. Paired claws with accessory process, claws II to IV with minute tines.

**DESCRIPTION.** Female. Length of idiosoma 288-315 µm, of holotype 300 µm, width 192 µm. Dorsum with three spots of red eye pigment, one in anterior part of *AD* and one each on *OC*. Porose areolae of dorsal plates with wide ostia, each with numerous canaliculi; remainder of plates foveate (Fig. 13). Length of *AD* 87 µm, width 87 µm; with three dome-like porose areolae and a transverse posterior areola (Fig. 11). Anterior areola with about 20 ostia. Pair of dome-like areolae and anterior areola contiguous; pair of areolae almost meeting in midline and each areola with almost 30 ostia. Length of *OC* 87 µm, width 47 µm, with two corneae, a porose areola and one ostium (holotype) or a few ostia arranged along lateral margin. *PD* 193 µm long, 129 µm wide; with two pairs of costae, medial pair of costae two to three ostia wide (Fig. 13); ostia 3-4 µm in diameter. Lateral costae about two ostia wide.

Foveae on remainder of plate about 5-7  $\mu\text{m}$  in diameter. Dorsal setae short, delicate, first pair of setae on *AD* within anterior part of pair of dome-like areolae, second pair in anteromedial margin of *OC*, third, fourth and fifth pair on *PD*, situated lateral to medial costae, and sixth pair on anal plate.

Ventral plates covered with foveae (Fig. 12), in holotype each fovea with canaliculi, in other specimens a few foveae in median part of *GA* without canaliculi. *AE* 93  $\mu\text{m}$  long, 172  $\mu\text{m}$  wide; posterior margin truncate. *AE* with three pairs of ventral setae and pair of epimeral pores; pores 5(-6)  $\mu\text{m}$  in diameter. Length of *PE* 150  $\mu\text{m}$ ; plate with one dorsal and three ventral setae.



**Figs 11-19.** *Copidognathus dissimilis* sp. n. 11. idiosoma, dorsal, female; 12. idiosoma, ventral, female; 13. part of posterior dorsal plate level with *ds-4*, female; 14. gnathosoma, lateral, male; 15. gnathosoma, ventral, female; 16. genital opening, male; 17. telofemur I, lateral, male; 18. genitoanal plate, ventral, male; 19. tarsus I, lateral (medial setae and claw excluded), male. Scale = 50  $\mu\text{m}$ . (*ds-4*, fourth dorsal idiosomatic seta; *glp*, gland pore; *T*, tectum)

GA 157 µm long, 137 µm wide; anterior margin truncate. Plate with three and four *pgs*. GO 67 µm long. Ovipositor extending slightly beyond GO.

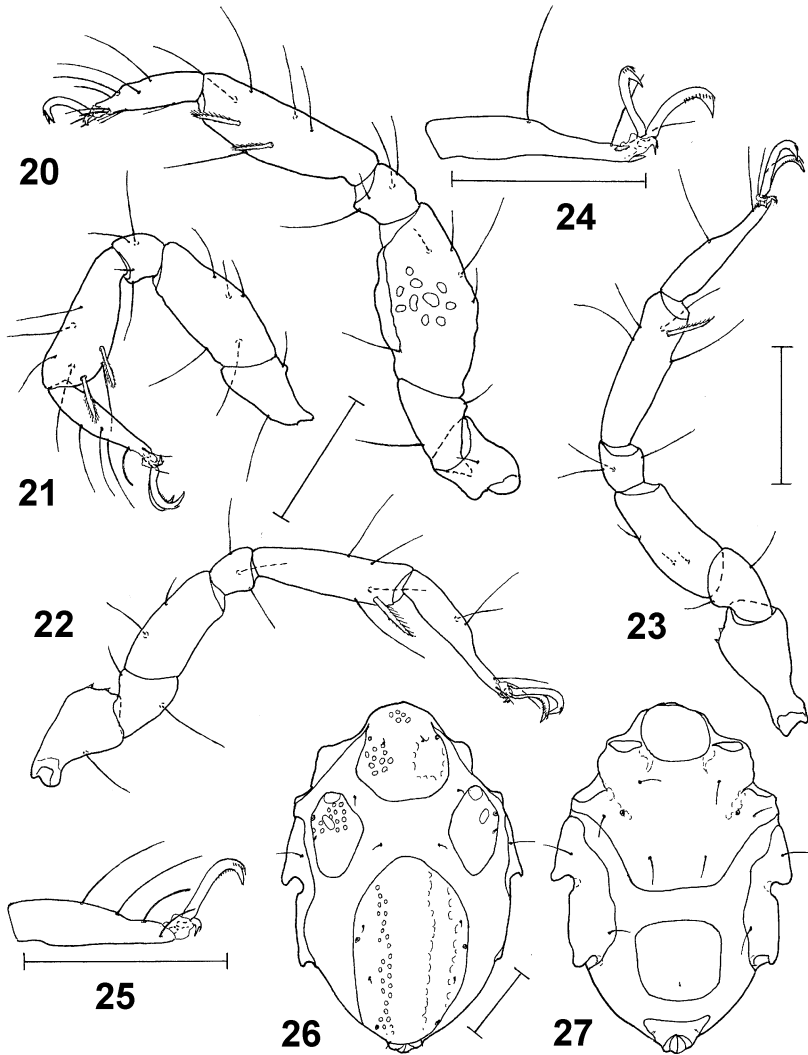
Length of gnathosoma 95 µm, width 66 µm, length:width ratio 1.4:1. Rostrum triangular and extending to level of seta on *P*-2 (cf. Figs 14 and 15). Rostral sulcus short, extending posteriad to apical pair of maxillary setae. Gnathosomal base ventrally and marginally with wide porose foveae, each including about 20 canaliculi. Tectum triangular, short, not extending beyond *P*-1 (Fig. 15).

Leg I wider than following legs. Tibia and telofemur I almost equal in length and telofemur I almost twice as long as high. Telofemora II to IV 2.3 times longer than high. Lateral flank of telofemur I rather uniformly foveate, each fovea with canaliculi (cf. Fig. 17), medial flank foveate, too, but only a few foveae with canaliculi (Fig. 20). Lateral flank of telofemur II with porose foveae, medial flank (Fig. 21) and both flanks of telofemora III and IV without canaliculi and hardly foveate. Leg chaetotaxy (*pas* excluded): leg I, 1, 2, 5, 4, 7, 7; leg II, 1, 2, 5, 4, 7, 4; leg III, 1, 2, 2, 3, 5, 4; leg IV, 0, 2, 2(-3), 3, 5, 3. Trochanters III and IV with minute cuticular spines (Figs 22 and 23). Tibiae I to IV with 2, 2, 1, 1 bipectinate ventromedial setae. Tarsus I dorsally with three setae and a solenidion, 14 µm long, ventrally with three setae. Solenidion on tarsus II 14 µm long and in dorsolateral position. Tarsus III with four dorsal setae, the two basal ones situated close together. Tarsus I with pair of doubled *pas* (cf. Fig. 19), tarsus II with singlets (cf. Fig. 25), tarsus III with medial setiform and lateral spur-like *pas*, tarsus IV with pair of spur-like *pas* (cf. Fig. 24).

Tarsi end with paired claws and minute, bidentate median claw. All paired claws with accessory process. Claws I with a few tines near apex (Fig. cf. 19). Followings claws with tines at apex and halfway along shaft of claw (cf. Figs 24 and 25). Tines delicate, their length 1-2 µm.

Male. Length of idiosoma 300-314 µm. Dorsal aspect same as that of female. GA with 23-26 slender *pgs* arranged in a wide ring around GO (Fig. 18). GO smaller than in female. Each genital sclerite with four (rarely five) *sgs* (Fig. 16); three (to four) of *sgs* setiform, one spur-like. Spermatopositor large, extending beyond ring of *pgs*.

Protonymph. Length 229 µm, width 157 µm. AD with three porose areolae, no rosette pores along posterior margin (Fig. 26). Posterior angle of OC rounded. PD distinctly shorter than in adults, lateral costae lacking. Pair of *ds*-2 and *ds*-3 in striated integument. Ventral plates with porose vestigial foveae. AE with three pairs of setae and pair of epimeral pores (Fig. 27). PE with one dorsal and two ventral setae. Gnathosoma 82 µm long, 52 µm wide. Leg chaetotaxy (*pas* excluded): leg I, 1, 2, 3, 4, 5, 7; leg II, 1, 2, 3, 4, 5, 4; leg III, 1, 1, 2, 3, 5, 4; leg IV, 0, 1+2 (basi + telofemur), 3, 5, 3. Lateral flank of telofemur I with foveae and canaliculi, medial flank foveate but without canaliculi. Lateral flank of telofemur II slightly foveate, medial flank and both lateral and medial flank of telofemora III and IV without foveae. Each of tibiae I to IV with one bipectinate and one smooth and slender ventral seta.



**Figs 20-27.** *Copidognathus dissimilis* sp. n. **20.** leg I, medial, female (only foveae with canaliculi illustrated); **21.** basifemur to tarsus II, medial, female; **22.** leg III, medial, female; **23.** leg IV, medial, female; **24.** tarsus IV, medial, male; **25.** tarsus II, lateral, male (medial setae and claw excluded); **26.** idiosoma, dorsal, protonymph; **27.** idiosoma, ventral, protonymph. Scale = 50  $\mu$ m.



REMARKS. *Copidognathus dissimilis* sp. n. is similar to *C. brachystomus* Viets, 1940, *C. sculptus* and *C. ponteuxinus* Viets, 1928, all with records from the Black Sea. In its body length and outline and shape of leg I it is similar to *C. brachystomus*, but differs from the latter because of the large dome-like areolae on the AD (narrow and oblong in *C. brachystomus*), the ornamentation of the ventral plates and the gnathosomal base (in *C. brachystomus* ventral parts of plates with porose polygons and gnathosomal base with small ostia), the delicate tines on the claws (length 1–2  $\mu\text{m}$  versus 7  $\mu\text{m}$ ); and the number of maxillary setae on the male gnathosoma (two instead of three to four pairs). *Copidognathus sculptus* and *C. ponteuxinus* are larger in size, in both species the tectum extends anteriorly beyond the P-1 and the telofemur of leg I is longer than the tibia.

BIOLOGY. *Copidognathus dissimilis* sp. n. was the species most abundant in the samples collected. Most records are from 42°01'06"E, 35°08'07"N and 3 m depth (Station C1).

*Copidognathus sculptus* (Police, 1909)  
Figs 28–43

*Halacarus (Copidognathus) sculptus* Police, 1909: 480–483, figs 21–26.

*Copidognathus perforatus* Viets, 1940: 48–52, figs 85–90 (**new synonymy**)

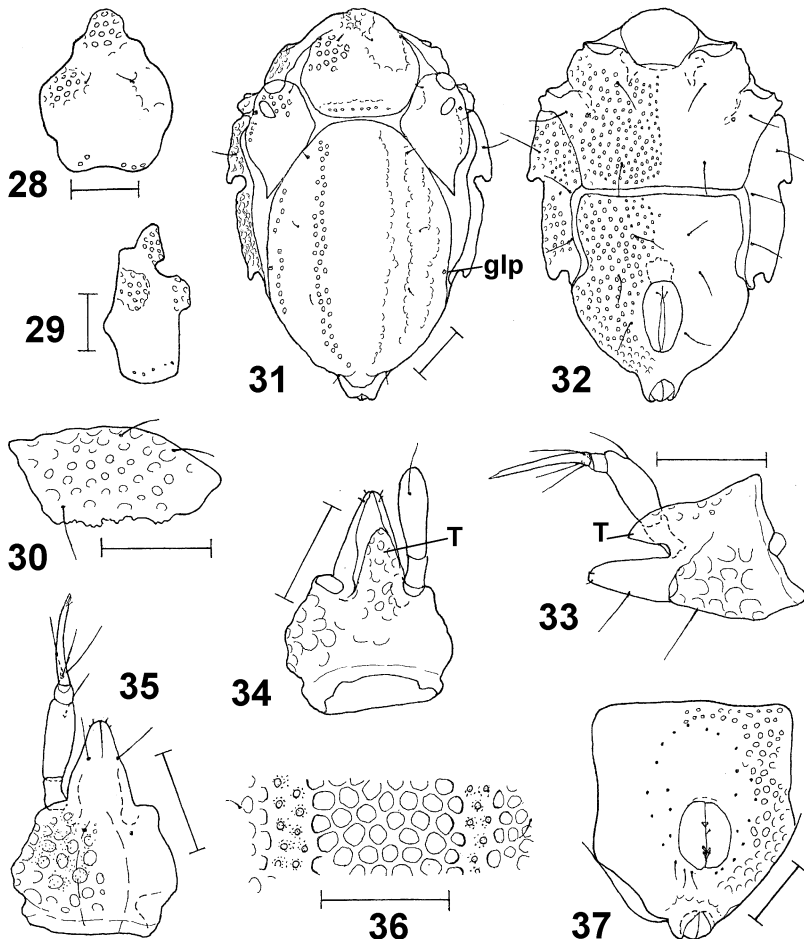
MATERIAL EXAMINED. One male (ZMH Acc. No. A15/13), 42°01'03"E, 35°08'14"N (Station C2), 10 m; two females, author's collection, 42°00'57"E, 35°10'03"N (Station B2), 10 m, December 2009.

SUPPLEMENTARY DESCRIPTION. Length of females 356 and 380  $\mu\text{m}$ , of male 325  $\mu\text{m}$ . Dorsum with spots of brown-red eye pigment beneath AD and OC. Dorsal plates with distinctly raised porose areolae with rosette pores; integument outside porose areolae foveate (Fig. 36). AD with three dome-like areolae, paired areolae distinctly separated (by about three foveae), each with 13–15 rosette pores. A few rosette pores in line along posterior margin of AD (Fig. 31). OC with about eight rosette pores between corneae and one to three rosette pores along lateral margin. PD with pair of medial costae, about two rosette pores wide, and pair of lateral costae. On PD ostia of rosette pores 3–4  $\mu\text{m}$ , foveae 6–8  $\mu\text{m}$  in diameter. Anal cone elongate. Pair of ds-1 in anterior margin of dome-like areolae; ds-2 in anteromedial margin of OC and ds-3 to ds-5 on PD lateral to medial costae, ds-6 at basis of anal cone. First pair of gland pores in anterolateral margin of dome-like areolae, second pair on OC lateral to posterior cornea, PD with pair of gland pores in lateral margin at the level of insertion of leg IV. Posterior pair of gland pores obscured by rosette pores.

Ventral plates with rosette pores; in median parts of AE and GA these pores either smaller than in lateral parts or reduced to minute foveae (without canaliculi). Pair of small epimeral pores on AE about 3  $\mu\text{m}$  in diameter. Female GA with three pairs of pgs (Fig. 32). Distance between anterior margin of GO and that of GA 1.3 times length of GO. Ovipositor extending halfway between the level of pairs of pgs-1 and pgs-2. Male with 26 slender

*pgs*, arranged in a ring (Fig. 37). Spermatopositor large, extending antieriad to ring of *pgs*.

Gnathosoma short, 1.3 times longer than wide. Basis with wide foveae (5–8  $\mu\text{m}$  in diameter) and numerous canaliculi. Rostrum shorter than gnathosomal base, extending antieriad to the level of seta on *P*-2 (Figs 34 and 35).



**Figs 28–37.** *Copidognathus sculptus* (Police). **28.** anterior dorsal plate, dorsal, female; **29.** anterior dorsal plate, dorsolateral, female; **30.** telson, medial, female; **31.** idiosoma, dorsal, female; **32.** idiosoma, ventral, female; **33.** gnathosoma, lateral, female; **34.** gnathosoma, dorsal, female; **35.** gnathosoma, ventral, female; **36.** part of posterior dorsal plate level with *ds*-4, female; **37.** genitoanal plate, ventral, male. Scale = 50  $\mu\text{m}$ . (Figs 28–30, specimens from the Adriatic Sea labelled *Copidognathus perforatus*, Collection Viets, Zoological Museum, University Hamburg). (glp, gland pore; T, tectum)

Rostrum slightly widened at its base. Tectum stout, spiniform, distinctly extending beyond basis of *P*-2 (Figs 33 and 34). Both female and male with two pairs of maxillary setae.

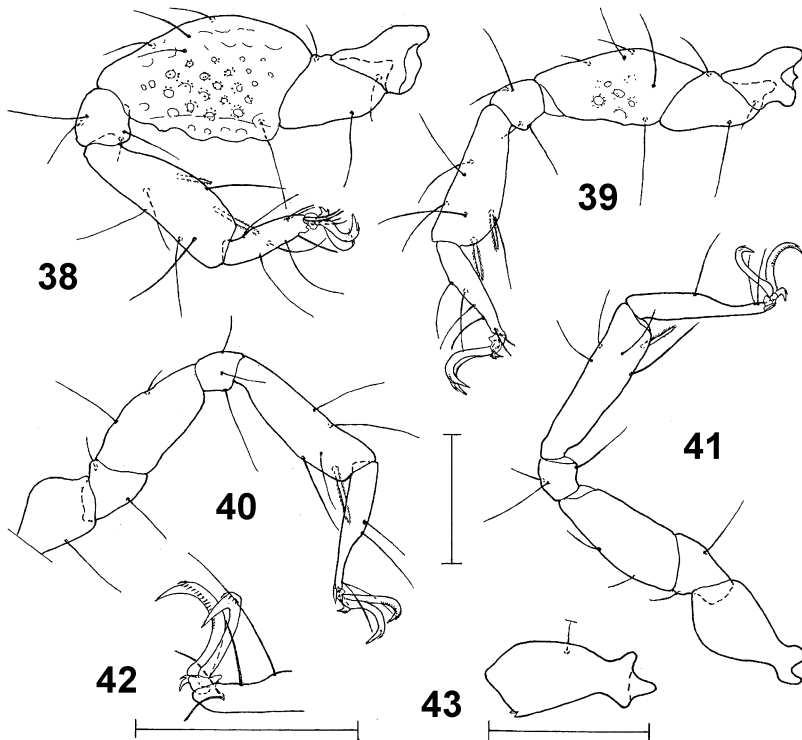
Leg I wider than the other legs. Telo femur I ventrally with narrow, lobate (four lobes) lamella (Fig. 38). Length of telofemur I 1.7 times the height; both medial and lateral flank with foveae and canaliculi. Length of telofemur II 2.1-2.3 times the height, ventral margin almost truncate; lateral flank with a few ostia and canaliculi (Fig. 39), medial flank with delicate foveae. In some individuals trochanters III (Fig. 43) and IV with delicate cuticular spurs, in others this apical part rounded and only slightly protruding conelets present. Telo femora III and IV without marked ornamentation and lamellae, their length 2.3-2.4 times the height (Figs 40 and 41). Tibiae I to IV with 2, 2, 1, 1 bipectinate ventral setae. Claws on tarsi II to IV (Fig. 42) with delicate tines, their length 1-2  $\mu\text{m}$ .

REMARKS. *Copidognathus sculptus* was described by Police (1909) on the basis of an individual from a plankton sample taken in the Golfo di Napoli (Tyrrhenian Sea), but, as mentioned by Police (1909), the species is certainly benthic and not pelagic. The length of that individual, with the gnathosoma included, was 430  $\mu\text{m}$ . Morselli & Mari (1985) extracted two specimens from sediment samples taken near Piombino (Tyrrhenian Sea) in 16 and 35 m depth. A species from the Adriatic Sea, by Viets (1940) described under the name *Copidognathus perforatus*, is similar to *C. sculptus*. Both species have a stout tectum and almost the same ornamentation of the dorsal and ventral plates, the gnathosoma and the telofemora I and II. According to Viets (1940: p. 48), differences between the specimens from the Adriatic Sea and the individual described by Police (1909) are in the shape of the OC, AE and GA. These differences seem to be negligible; the illustrations published by Police are somewhat schematic and in the material from the Adriatic Sea the ornamentation and length ratios proved to vary. Along the posterior margin of the AD some specimens have rosette pores, others not; the lateral costae of the PD are reduced to just a few rosette pores (cf. Viets, 1940: fig. 85) or distinctly present. The anterior areola on the AD is often markedly raised and extends beyond the margin of the plate (Figs 28 and 29). The lateral lamella on telofemur I generally bears four ventral lobes, but in one individual the margin is coarsely dentate (Fig. 30), length ratios of telofemur I varied between 1.8 and 2.2, those of telofemur II between 2.0 and 2.5. The length of females from the Adriatic Sea is 350-420  $\mu\text{m}$ , that of males 352-387  $\mu\text{m}$ . All these specimens are expected to belong to a single species, to *C. sculptus*.

Another similar-looking specimen, a female, extracted from 36.5 m depth off the coast of Romania, was by Konnerth-Ionescu (1968) identified as *Copidognathus perforatus*. Unfortunately the gnathosoma is lacking. The length of the female is 395  $\mu\text{m}$ ; the AD is characterized by the pair of wide porose areolae, contiguous in the median (Konnerth-Ionescu, 1968: fig. 4). Such wide areolae are present in *Copidognathus dissimilis* and *C. ponteuxinus* but not in *C. sculptus*; the length of *C. dissimilis* is 288-315  $\mu\text{m}$ , that of *C. ponteuxinus* 371-401  $\mu\text{m}$ , accordingly the individual from Romania may be conspecific with *C. ponteuxinus*. The most marked difference between *C. sculptus* and *C. ponteuxinus* is in the gnathosoma, the tectum of *C. sculptus*

has a long stout spine that extends beyond the *P*-1 whereas in *C. ponteuxinus* that spine is short and only slightly extends beyond the *P*-1 (cf. Bartsch 2001: figs 63, 64).

*Copidognathus sculptus* and the above mentioned *C. brachystomus*, *C. dissimilis* and *C. ponteuxinus* share numerous characters, i.e., the shape and ornamentation of the dorsal and ventral plates; the red or brown-red eye pigment; the arrangement of the dorsal setae in relation to the plates and porose areolae; a pair of gland pores in the lateral margin of the *PD* at the level of insertion of leg IV; the short ovipositor that only slightly extends beyond the *GO*; the arrangement of male *pgs* in a wide ring around the *GO*; the large spermatopositor that extends to or beyond the anterior *pgs*; the porose foveae on the telofemur I; a bipectinate ventromedial seta on the tibia IV. From the Mediterranean and eastern Atlantic Ocean another two species are mentioned which have a similar character combination, *C. rhodostigma* (Gosse, 1855) and *C. rondus* Bartsch, 1979. *Copidognathus tectirostris* Bartsch, 1979 may have to be added to these species; its *PD* has a pair of gland pores in the lateral margin at about the level of insertions of legs IV.



**Figs 38-43.** *Copidognathus sculptus* (Police). 38. leg I, lateral, female; 39. leg II, lateral, female; 40. leg III, lateral, female; 41. leg IV, lateral, female; 42. tip of tarsus II, medial, female; 43. trochanter III, dorsal, male. Scale = 50  $\mu$ m.

In general, *Copidognathus* species predominantly found in a salinity range between 5 and 28 S‰, hence brackish water species, have a weaker ornamentation than closely related marine species (Bartsch 1996a, 1999b). In many marine species the areolae with rosette pores are distinctly raised (integument thick), small ostia end at the surface but the canaliculi do not reach the surface of the integument, in contrast, in closely related brackish water species these areolae are only slightly raised, the ostia are shallow pits, the canaliculi reach or almost reach the surface and their number is increased. The different texture of the integument in marine and brackish water *Copidognathus* populations is expected to be species-specific and not just to represent the range of intraspecific ecotypes.

**DISTRIBUTION AND BIOLOGY.** Black Sea (new record) and Mediterranean (Adriatic Sea, Tyrrhenian Sea, Golfe du Lion (Bartsch 2009). Most records are from sandy deposits and 5-40 m depth.

### The Black Sea halacarid fauna

The present day Mediterranean and Black Sea once were parts of the Tethys (Adams 1981), and we can expect that about 20 million years ago both, the Proto-Mediterranean and Paratethys, had an almost identical halacarid fauna. The connection between the water bodies ended 15-14 million years ago (Hsü *et al.* 1977). Due to rise of the Alps, rivers of central Europe and Asia emptied into the Paratethys resulting in a salinity decrease. In the Late Mio- and Pliocene, the Paratethys was a vast system of fresh and brackish water lakes and channels that extended northward to Vienna and eastward included the Aral Sea (Fink 1966, Adams 1981). In the Pleistocene, a connection between the Mediterranean and Black Sea was established and interrupted again (Hsü 1978, Adams 1981, Görür *et al.* 1997); finally, at the beginning of the Holocene, 9000-7000 years ago, the Black Sea was flooded again by saline Mediterranean water (Deuser 1974, Görür *et al.* 1997, Ryan *et al.* 1997, Demirbag *et al.* 1999). Halacarid mites are known to withstand extreme amplitudes in their environment and tolerate a wide salinity range (Bartsch 1974), still the majority of the epigean Paratethyan halacarid species assumedly did not survive the refreshing of their environment, partly because the substratum (algae, colonial organisms) inhabited disappeared, and hence the syn-ecological structure, the shelter and food-web, partly because of competitive inferiority in an environment with new competitors (Bartsch 2004). A few species certainly survived the refreshing and got adapted to the new environment, but their offsprings nowadays are not found in the Black Sea Proper but in ponds, limans and rivers adjacent to or far away from the Black Sea (Bartsch 2004, Bartsch & Gerecke 2011). Accordingly, the majority of the present-day epifaunal halacarid species in the Black Sea are Mediterranean emigrants (Bartsch 2004).

Noteworthy is that four of the ten *Copidognathus* species known from the Black Sea basin seem to be closely related, viz. *C. brachystomus*, *C. dissimilis* sp. n., *C. ponteuxinus*, and *C. sculptus*, in addition, two of these species (*C. dissimilis* sp. n., *C. ponteuxinus*) have no records from the Mediterranean. In the Mediterranean five species of this *Copidognathus* group

are known (*C. brachystomus*, *C. rhodostigma*, *C. rondus*, *C. sculptus*, and *C. tectirostris*), but 27 *Copidognathus* species in all (Bartsch 2009). One may speculate that the present day Black Sea halacarid fauna includes both Holocene and Pleistocene Mediterranean emigrants and the latter speciated when the connection to the Mediterranean was interrupted and the Black Sea became brackish to fresh. *Copidognathus dissimilis* sp. n. and *C. ponteuxinus* may be the offsprings of such Pleistocene colonizers and *C. brachystomus* and *C. sculptus* be Holocene immigrants.

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### Zusammenfassung

Aus dem Schwarzen Meer waren bisher 41 Halacariden-Arten genannt worden (Bartsch 2004). Sediment, entnommen vor der türkischen Küste in 3 und 10 m Tiefe, enthielt drei bisher aus diesem Meer unbekannte Arten, eine neue Art, *Copidognathus dissimilis* sp. n., und zwei Neufunde, und zwar die bisher aus dem Mittelmeer gemeldeten Arten *Camactognathus tessellatus* (Morselli & Mari, 1982) und *Copidognathus sculptus* (Police, 1909). *Copidognathus dissimilis* n. sp. wurde beschrieben, die Art-Beschreibungen der zwei Neufunde ergänzt. Ein Vergleich von aus dem Mittelmeer genannten Arten ergab, daß *Copidognathus perforatus* Viets, 1940 *C. sculptus* zuzuordnen ist. *Copidognathus dissimilis* sp. n. und *Camactognathus tessellatus* waren die zwei häufigsten Halacaridenarten in den Sedimentproben.

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