

Halacarus longiunguis Police, 1909 (Acari: Halacaridae), a new record a century later, re-description and notes on Mediterranean *Halacarus* species

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(With 15 figures)



Abstract

Almost a century ago Police (1909) described *Halacarus longiunguis*, a species found in the Mediterranean, Golfo di Napoli, and characterized by unusual long claws. Recently individuals of that species were collected in the Golfe du Lion. The species is re-described. Notes are given on Mediterranean *Halacarus* species and eastern Atlantic species closely related to *Halacarus longiunguis*.

Key words: Acari, Halacaridae, *Halacarus*, Mediterranean, re-description, diagnoses.

Introduction

Almost a century ago, Police (1909) described six halacarid species, all collected in the Golfo di Napoli (Mediterranean), *Rhombognathus sphaerorhynchus* Police, 1909, *Halacarus longiunguis* Police, 1909, *Copidognathus magnipalpus* (Police, 1909), *Copidognathus cribosoma* (Police, 1909), *Copidognathus sculptus* (Police, 1909), and *Agauopsis spinipes* (Police, 1909).

Copidognathus magnipalpus soon proved to be wide-spread in the Mediterranean and Black Sea area (Viets 1928, 1940; Morselli 1980; Mari & Morselli 1990; Morselli & Mari 1993; Bartsch 1975, 2001). The two other *Copidognathus* species, *C. cribosoma* and *C. sculptus*, were re-described in the nineteen-eighties (Morselli & Mari 1982, 1985).

At the end of the twenties century, the status of three species was still doubtful, that of *A. spinipes*, *H. longiunguis* and *R. sphaerorhynchus*. *Agauopsis spinipes*, once tentatively attributed to the *brevipalpus* group (Bartsch 1986), seems to be a member of the *microrhyncha* or *conjuncta* group, though, according to the description (Police 1909: 437, figs 1 and 5), the number of spines on tibia I (*A. spinipes* with two spines) differs

from that known in these groups (tibia I with four or five spines). *R. sphaerorhynchus* demonstrates an overall similarity with *R. magnirostris* Trouessart, 1889 but is smaller (female 300 µm versus 390-470 µm). The most obvious characters of *H. longiunguis* are, the absence of a posterior dorsal plate, a long frontal spine, slender legs and long claws. The species obviously belongs to the *Halacarus actenos* group which is named after *Halacarus actenos* Trouessart, 1889.

Recently, J.C. Sorbe forwarded some specimens from the Mediterranean, Golfe du Lion, collected with a suprabenthic sledge at about 90 m depth. These specimens are representatives of the genus *Halacarus* and share with *H. longiunguis* the general shape of the idiosoma, the reduction of the dorsal plates, the long legs and the very long paired and median claws. The specimens, conspecific with *H. longiunguis*, are re-described.

A b b r e v i a t i o n s: *AD*, anterior dorsal plate; *AE*, anterior epimeral plate; *ds-1* to *ds-6*, pairs of dorsal setae numbered 1 to 6 from anterior backward; *GA*, genitoanal plate; *glp-1* to *glp-5*, pairs of gland pores numbered 1 to 5 from anterior backward; *GO*, genital opening; *MNHN*, Muséum National d'Histoire Naturelle, Paris; *OC*, ocular plate(s); *P-2* to *P-4*, second to fourth palpal segment; *pas*, parambulacral seta(e); *pc*, porus canaliculus; *PD*, posterior dorsal plate; *pgs*, perigenital setae; *SMF*, Senckenberg-Museum, Frankfurt am Main; *ZMH*, Zoological Museum, Hamburg. The legs, their segments and claws are numbered I to IV.

Re-description of *Halacarus longiunguis* Police, 1909

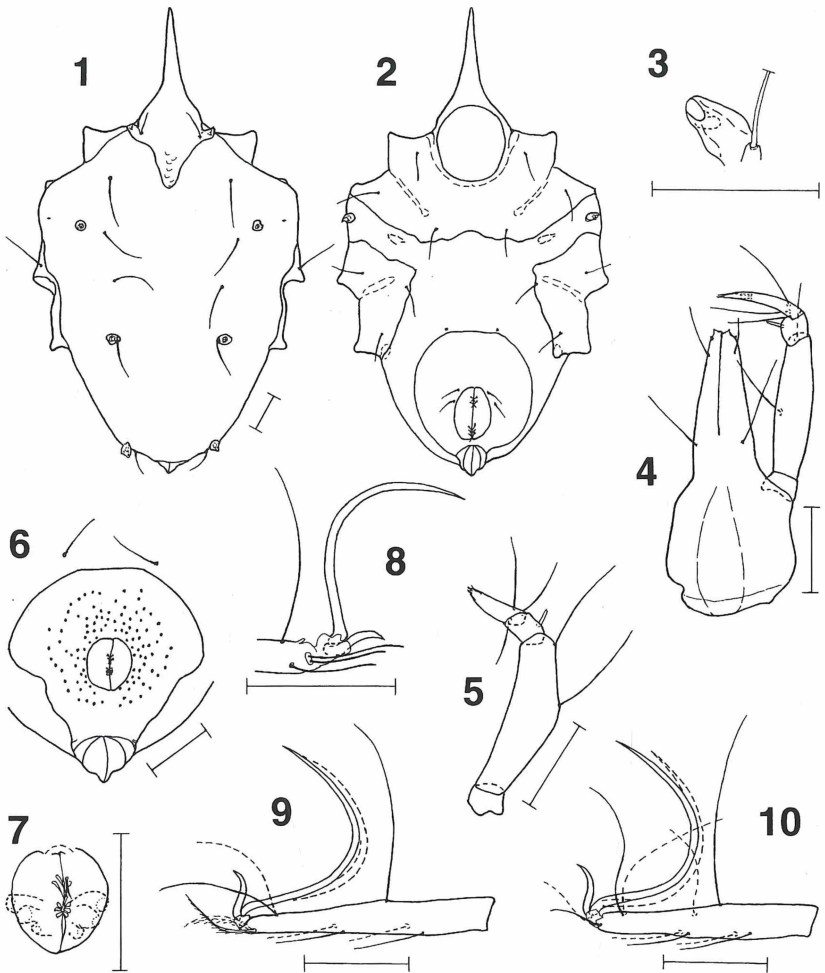
(Figs 1-15)

Halacarus longiunguis Police, 1909: 416-421, figs 27-31.

MATERIAL EXAMINED: Slides: one female, one male (ZMH, Acc. No. A24/07), one female, one male (MNHN). In ethanol: one female, one male (SMF). Further specimens in the author's collection. Mediterranean, Golfe du Lion, 42°59.36'-42°58.90'N, 3°52.61'-3°52.54'E, 94-95 m, R.V. EUROPE, Cruise Resomer2, Sample R2-S42-TS01a, near-bottom layer (0-50 cm) collected with a suprabenthic sledge, 11 April 2004, coll. J.C. Sorbe.

DESCRIPTION: F e m a l e. Length of idiosoma 572-720 µm, width 340-420 µm. Length:width ratio 1.7-1.8:1. Striated integument with parallel and irregularly maze-like ornamented cuticula, surface of dorsal and ventral plates with delicate epicuticular reticulation. *AD* with frontal spine (Fig. 1), its length about 115 µm. Posterior part of *AD* narrow. Ocular plates absent, corneae absent. *PD* absent. Pairs of *ds-1* and *glp-1* in margin of *AD*; *glp-1* situated on somewhat raised cones (Fig. 3). Following gland pores in striated integument, cones smaller than those of *glp-1*. Pair of *glp-2* in ventrolateral position, *glp-5* in marginal position. Neither ocular plate nor corneae present. Porus canaliculus immediately lateral to *glp-3*. Pairs of *ds-5* and *ds-6* immediately adjacent to *glp-4* and *glp-5*, respectively.

Shape of ventral plates as illustrated (Fig. 2). *GA* with uniform cerotegumental cover. One pair of *pgs* immediately anterior to *GA*, two



Figs 1-10. *Halacarus longiunguis* Pollice: 1 – idiosoma, dorsal, female; 2 – idiosoma, ventral, female; 3 – left *glp-1* and *ds-1*, female; 4 – gnathosoma, ventral, male; 5 – palp, lateral, male; 6 – genitoanal plate, male; 7 – genital opening, male; 8 – tip of tarsus II, medial (lateral setae and claw omitted), male; 9 – tarsus IV, medial (lateral setae and claw in broken line), male; 10 – tarsus III, medial (lateral setae and claw in broken line), male. Scale = 50 μ m.

pairs of setae close to GO. Interval between anterior margin of GO and that of GA slightly more than length of GO.

Gnathosoma about 2.2 times longer than wide. Rostrum somewhat longer than gnathosomal base (Fig. 4); with two pairs of maxillary setae and two pairs of papilliform rostral setae. Two setae of *P-2* distinctly separated

(Fig. 5). *P*-3 with bluntly ending spine. *P*-4 with three basal setae.

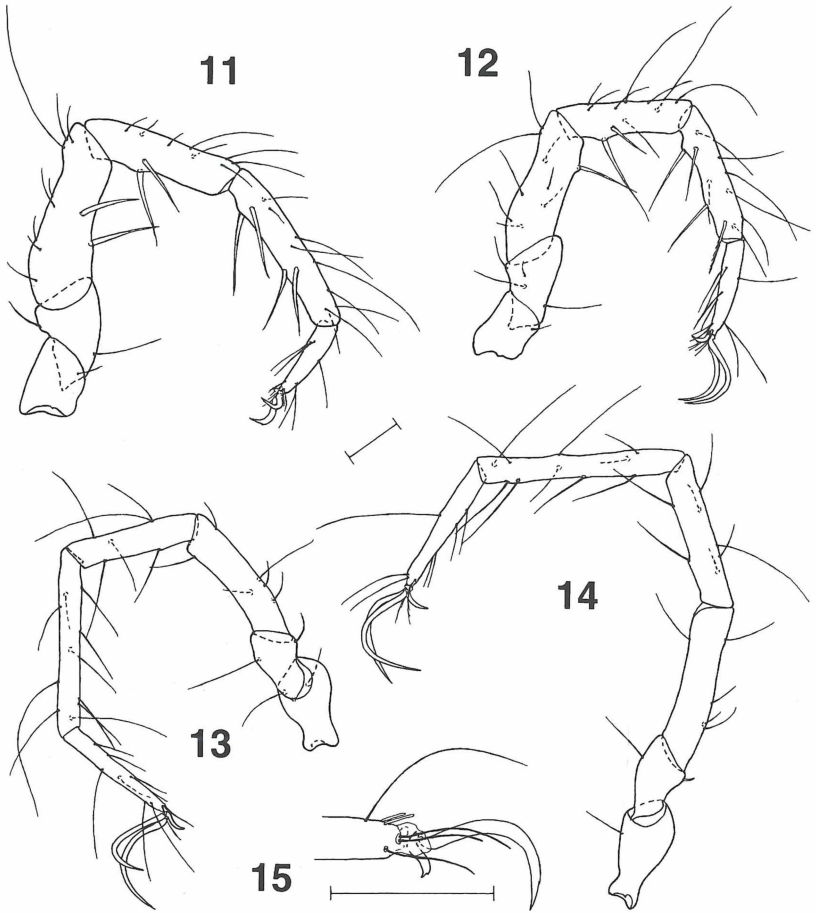
Leg I slightly longer than idiosoma, leg IV longer than leg I and longer than idiosoma. Epicuticula of all leg segments with a delicately reticulate ornamentation. Telo femora somewhat longer than genua (Figs 11-14). Telo femora II to IV 3.4, 4.5 and 4.8 times longer than high, respectively. Tibiae I and II slightly longer than these legs' genua, tibiae III and IV distinctly longer than genua. Leg chaetotaxy (female and male), from trochanter to tibia: leg I, 1, 2, 9-10, 9-10, 13; leg II, 1, 4, 9, 9-10, 12; leg III, 2, 2, 5-6, 5-6, 9-10; leg IV, 1, 2, 4-5, 5-7, 9-10. Dorsal seta on basifemur IV short. Leg I with slender, tapering ventral spines, two such spines on each of telofemur and genu and four spines on tibia. Tibiae II to IV with four bristle-like ventral setae; distomedial seta on tibia II pectinate (pecten seen only with help of oil immersion), the other setae smooth, almost equal in length. Tarsus I with three dorsal setae, digitiform solenidion and famulus, 8 and 9 μm in length (Fig. 15), two bristle-like ventral setae, pair of eupathidia and pair of doubled *pas*. Tarsus II with three dorsal setae and a minute dorsomedial solenidion, the latter 2 μm in length (Fig. 8), ventrally with four bristle-like setae, a pair of eupathidia and pair of doubled *pas*. Tarsi III (Fig. 10) and IV (Fig. 9) with four and three dorsal setae, respectively, four ventral setae and pair of *pas*. Medial *pas* on tarsus III eupathid, lateral *pas* tapering; both lateral and medial *pas* on female tarsus IV slender, tapering.

Claws on tarsus I shorter than those of following tarsi; claws with delicate accessory process. Central sclerite of tarsus I with bidentate median claw. Claws on tarsi II to IV extraordinarily long and slender. Central sclerite with long median claw.

Male: Length of idiosoma 515-559 μm . Length:width ratio as in female. Dorsal aspect similar to that of female. *GA* somewhat longer than wide, widest in anterior half; with about 105 *pgs* scatteredly around *GO* and one pair in striated integument anterior to *GA* (Fig. 6). Two anterior pairs of subgenital setae tapering, three posterior pairs blunt, spur-like (Fig. 7). Interval between anterior margin of *GO* and that of *GA* about 1.2 times length of *GO*. Tarsus IV with plumose lateral and medial *pas*, 40 μm in length (Fig. 9).

REMARKS: The male in the present material is somewhat smaller than that studied by Police (1909), 515-559 μm versus 620 μm (the latter length may include the gnathosoma), the ocular plates and corneae are absent but said to be rudimentary in the material studied by Police. These 'rudimentary ocular plates' ("piastre oculari rudimentali") most likely represent the pair of *glp*-3.

The individual studied by Police was collected 1902, at a depth of 100 m, Golfo di Napoli, ca 2 km off Capo Sorrento, in a sample taken with a bottom sledge ("slitta di fondo") meant for studies of the deep water plankton ("plankton profondo") just above the ground. The present specimens are from a similar depth (94-95 m) and similar gear, a suprabenthic sledge which is used to collect the hyperbenthos (suprabenthos), the "small animals in the water layer close to the seabed" (Mees & Jones 1997). According to J. C. Sorbe (personal communication), this was the first time



Figs 11-15. *Halacarus longiunguis* Pollice, male: **11** – leg I, medial; **12** – leg II, medial; **13** – leg III, medial; **14** – leg IV, medial; **15** – tip of tarsus I, lateral (medial setae and claw omitted). Scale = 50 μ m.

he had halacarid mites in samples taken with a suprabenthic sledge, no other halacarid species were present and the halacarids were found only in areas which were inhabited by the crinoid *Leptometra phalangium* (J. Müller, 1841) (Crinoidea).

Halacarus longiunguis has unusual long and slender claws and is easily distinguished from the other species of the *H. actenos* group by these claws. Remarkable long and slender claws are not restricted to *H. longiunguis*, but present in both shallow water and deep-sea species, in marine and freshwater halacarids, examples are, *Hamohalacarus subterraneus* Walter, 1931, extracted from a cave in Lawrence County,

Indiana, US (Walter 1931), *Acarothrix longiunguis* Bartsch, 1997 and *Acarothrix umgenica* Proches, 2002, inhabitants of mangroves in the Northern Territory, Australia and KwaZulu Natal, South Africa, respectively (Bartsch 1997; Proches 2002), and *Copidognathus bruuni* Newell, 1971 and *Halacarus atlanticus* Bartsch, 1981, deep-sea species with records from the Pacific and Atlantic (Newell 1971; Bartsch 1981). Such long claws are in general expected to be correlated with a life in a soft ooze which includes fragments on which the claws may find a solid rest and hence prevent the mite from sinking into deeper layers, with reduced oxygen supply and space.

Halacarus longiunguis was taken with a suprabenthic sledge, still the mite is expected to have a benthic mode of life, on, or due to the long legs, raised above the surface of a substratum. In contrast to other meiobenthic taxa, tubellariens, nematodes, polychaetes, harpacticoids, ostracods, peracarid crustaceans, which are known to leave the sediment and enter the water column (Armonies 1988a,b; Walters 1988; Walters & Bell 1986; Macquart-Moulin 1999), nothing like that has been observed in halacarid mites. Algae-inhabiting nematodes and harpacticoids demonstrate tidal or diurnal migration and regularly leave the algal fronds, mites don't (Kolesnikova et al. 1993). Halacarid mites cannot swim (Lohmann 1889; Bartsch 2004) and there is no evidence to expect that *H. longiunguis* is able to live in the water column.

Halacarus species in the Mediterranean

Six species are at present recorded from the Mediterranean, *H. aegyptus* Viets, 1935, *H. bisulcus* Viets, 1927, *H. griseus* Bartsch, 1987, *H. longiunguis* Police, 1909, *H. rismondoi* Viets, 1940, and *H. subtilis* Viets, 1940. Their characters are outlined.

Halacarus aegyptus Viets, 1935

DIAGNOSIS (according to the holotype and Viets 1935): Length of female 460 µm. Pair of *ds-1* posterior to *glp-1*. *OC* with cornea, *glp-3* and *pc*. *PD* slender, triangular. Pair of *glp-4* in striated integument. Female *GA* with pair of crescent cerotegumental areas. Anterior pair of *pgs* on *GA*, plate extending beyond this pair of setae. Distance from anterior margin of *GO* to that of *GA* 1.2 times length of *GO*. Gnathosoma about 2.3 times longer than wide. Basal seta on *P-2* at 0.6 (from basal to distal and relative to length of palpal segment). Tibiae I to IV with four spiniform or bristle-like ventral setae, setae on tibia II dissimilar in size and shape; distomedial seta coarsely bipectinate, proximomedial one small and slender. Tarsi III and IV without ventral setae. Claws with accessory process; pectines of tarsi II and III with numerous distinct tines along shaft of claw.

Halacarus bisulcus Viets, 1927

DIAGNOSIS (according to Viets 1927; Green & MacQuitty 1987; Bartsch 1980 and specimens in the author's halacarid collection): Length of female 435-610 µm, of male 425-450 µm. Posterior margin of *AD* broadly

rounded. *OC* small; *pc* in posterolateral edge of *OC* or just outside *OC*. *PD* present, short, not extending to level with *glp-4* in neither female nor male. Pair of *ds-1* posterior to *glp-1*. Pairs of *glp-3* and *glp-4* within striated integument. Female *GA* with pair of crescent cerotegumental areas; anterior pair of *pgs* on *GA*; *GA* extending beyond this pair of setae. Distance from *GO* to anterior margin of female *GA* almost same as length of *GO*. Male *GA* ovate, distance between anterior margin of *GO* to that of *GA* 1.7 times length of *GO*; almost 40 *pgs* close around *GO* and three to four pairs of outlying setae. Gnathosoma 1.6-1.7 times longer than wide. Basal seta on *P-2* in mid-segmental position. Epicuticula on legs with parallel striae. All tibiae with four spiniform or bristle-like ventral setae; these setae on tibia II dissimilar in shape. Tarsus II with pair of ventral eupathidia but no bristle-like setae. Tarsi III and IV without ventral setae. Claw pectines of tarsi II and III with numerous distinct tines.

Halacarus griseus Bartsch, 1987

DIAGNOSIS (according to Bartsch 1987): Length of female 914-1025 μm , of male 790-884 μm . *OC* small, hardly larger than cornea, *pc* in striated integument. *PD* absent. Pair of *ds-1* slightly anterior to *glp-1*; *glp-3* and *glp-4* in striated integument. Female *GA* with uniform cerotegumental cover; anterior pair of *pgs* in striated integument distinctly anterior to *GA*. Male *GA* with about 90 *pgs* around *GO*, one pair of *pgs* in striated integument anterior to *GA*. Gnathosoma 2.5 times longer than wide. Both setae on *P-2* in apical fourth of segment. All tibiae with four spiniform or bristle-like ventral setae; distomedial seta on tibia II coarsely bipectinate. Tarsus II with four bristlelike ventral setae and pair of eupathidia; tarsi III and IV each with four ventral setae. Claws robust, each with accessory process but no pecten.

Halacarus longiunguis Police, 1909

DIAGNOSIS (according to above given re-description): Length of female 572-720 μm , of male 515-559 μm . *OC* and *PD* absent. Pair of *ds-1* almost level with *glp-1*. Pairs of *pc*, *glp-3* and *glp-4* in striated integument. Female *GA* with uniform cerotegumental cover; anterior pair of *pgs* in striated integument adjacent to *GA*. Male *GA* with about 100 *pgs* around *GO*, one pair of setae immediately anterior to *GA*. Gnathosoma about 2.2 times longer than wide. Basal seta on *P-2* in almost mid-segmental position. Epicuticula on striated integument maze-like, on legs delicately reticulate. All tibiae with four spiniform or bristle-like ventral setae; distomedial seta on tibia II pectinate. Tarsus II with four bristlelike ventral setae and pair of eupathidia; tarsi III and IV each with four ventral setae. Claws on tarsus I with accessory process, claws on tarsi III to IV very long, slender and smooth; median claw long.

Halacarus rismondoi Viets, 1940

DIAGNOSIS (according to type material and Viets 1940): Length of female 456-487 μm , of male 388-429 μm . Epicuticula on plates, gnathosoma and legs with striae in parallel and fingerprint-like arrangement. *OC* with

cornea and *pc*. Pair of *ds-1* posterior to *glp-1*. Pairs of *glp-3* and *glp-4* within striated integument. *PD* present, in male extending to level of *glp-4*, in female halfway between *glp-4* and *glp-5*. Female *GA* with pair of crescent cerotegumental areas; anterior pair of *pgs* on *GA*, close to anterior margin; distance from *GO* to anterior margin of *GA* equalling 0.6 times length of *GO*. Male *GA* longer, interval between anterior margin of *GO* and *GA* equalling 1.7 times length of *GO*; with almost 40 *pgs* in a ring close to *GO* and four pairs outlying. Spermatopositor small, extending beyond *GO* by 0.7 times length of *GO*. Gnathosoma 2.2 times longer than wide. Basal seta on *P-2* in mid-segmental position. Tibiae I to IV with four spiniform or bristle-like ventral setae; setae on tibia II dissimilar in length and shape; distomedial seta coarsely bipectinate, basomedial seta short and slender. Tarsi III and IV without ventral setae. All paired claws with accessory process; claw pectines of tarsi II and III with numerous distinct tines along shaft of claw.

Halacarus subtilis Viets, 1940

DIAGNOSIS (according to type material and Viets 1940): Length of female 437 μm , of male 370-434 μm . Epicuticula with delicate striae. Pair of *ds-1* posterior to *glp-1*. *OC* with cornea, *pc* and *glp-3* and extending beyond level of *glp-3*. *PD* with reticulate ornamentation; in both female and male including *glp-4*. Female *PD* extending somewhat or distinctly beyond *glp-4*, that anterior part equalling 0.32-0.38 times length of *PD*. Male *PD* extending to level of *ds-4*, part beyond *glp-4* equalling 0.43-0.44 times length of *PD*. Female *GA* extending beyond anterior pair of *pgs*, plate with pair of crescent cerotegument. Basal seta on *P-2* at 0.6 (from basal to distal and relative to length of palpal segment). Interval between anterior margin of *GO* and that of *GA* equalling 0.8 times length of *GO*. Male *GA* large, interval between anterior margin of *GO* to that of *GA* 2.1-2.4 times length of *GO*. Almost 30 *pgs* close around *GO* and five to six pairs of outlying setae. Gnathosoma 2.2 times longer than wide. Basal seta on *P-2* at 0.6 (from basal to distal and relative to length of palpal segment). All tibiae with four spiniform or bristle-like ventral setae; distomedial seta on tibia II bipectinate. Tarsi III and IV each with four ventral setae. All paired claws with accessory process.

Halacarus aegyptus, *H. bisulcus*, *H. rismondoi*, and *H. subtilis* have a *PD*, the female *GA* bears crescent cerotegumental areas, and the tarsi III and IV lack ventral setae. The species can be separated by the size of the dorsal plates *OC* and *PD* and the position of the gland pores relative to these plates, the length of the *GA*, and the length of the gnathosoma. In contrast to these four species the *PD* of both *H. griseus* and *H. longiunguis* is reduced, the female *GA* has a uniform cerotegumental cover, and tarsi III and IV bear four ventral setae.

Both *H. longiunguis* and *H. griseus* can be attributed to the *actenos* group. Four species of this group are recorded from the Northern Atlantic, *H. actenos*, *H. leptopus* Bartsch, 2002, *H. longiunguis* and *H. griseus*. The species share the characters: *PD* absent in both female and male, *OC* small or absent, pair of *ds-1* slightly anterior to or about level with *glp-1*; uniformly sculptured female *GA* with one pair of *pgs* anterior to *GA* and

two pairs of *pgs* adjacent to *GO*, male *GA* only slightly longer than wide and with one pair of *pgs* anterior to plate and about 70-100 *pgs* scatteredly around *GO*; distomedial seta on tibia II pectinate, four bristle-like ventral setae on tarsi II, III and IV, claws with or without accessory process, tines, if present, on accessory process but not on shaft of claw.

Records of *H. actenos* are from the Cape Verde Islands to Ireland, of *H. leptopus* from the Great Meteor Seamount (Green & MacQuitty 1987; Bartsch 2002), of *H. longiunguis* and *H. griseus* from the Mediterranean. According to Newell (1947), *H. actenos* is also present in Florida, but those specimens are smaller and the identification should be verified. *Halacarus longiunguis* is easily identified because it has very long and slender claws. *H. leptopus* and *H. griseus* are slender forms, their telofemora III and IV are almost or even more than four times longer than wide, *H. actenos* is more robust, the telofemora III and IV 2.6 and 2.8 times longer than high (according to specimens from northern France), the known length of females is 750-870 μm , that of males 555-670 μm (Trouessart 1889; Bartsch 1980). *Halacarus leptopus* and *H. griseus* differ in the size (560-650 μm versus 790-1025 μm), the shape of the frontal spine (more slender in *H. leptopus*), the shape of gnathosoma and palps (gnathosoma 2.3 times longer than wide versus almost 2.6 times, and palps almost four and six times longer than wide, respectively).

Zusammenfassung

Vor fast 100 Jahren wurde vor der Westküste Italiens eine *Halacarus* Art gefunden, die durch ungewöhnlich lange Krallen gekennzeichnet war und von Police (1909) unter dem Namen *Halacarus longiunguis* beschrieben wurde. Die Art, nun wiedergefunden, wurde erneut beschrieben. In einer kurzen Übersicht werden die *Halacarus* Arten des Mittelmeeres und die mit *Halacarus longiunguis* nah verwandten Arten aus dem Ostatlantik dargestellt.

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References

- Armonies, W., 1988a: Active emergence of meiofauna from intertidal sediment. – Mar. Ecol. Prog. Ser., **43**: 151-159. Oldendorf/Luhe.
- Armonies, W., 1988b: Hydrodynamic factors affecting behaviour of intertidal meiobenthos. – Ophelia, **28**: 183-193. Helsingör.
- Bartsch, I., 1975: Beitrag zur Halacaridenfauna des Eulitorals bei Banyuls-sur-Mer (Mittelmeer) (Halacaridae, Acari). – Mitt. hamb. zool. Mus. Inst., **72**: 137-155. Hamburg.
- Bartsch, I., 1980: Halacaridae (Acari) aus der Bucht von Morlaix (Bretagne). – Acarologia, **21**: 34-45. Paris.

- Bartsch, I., 1981: Fünf neue Arten der Gattung *Halacarus* (Acari, Halacaridae) aus dem Atlantik. – Zool. Scr., **10**: 203-215. Stockholm.
- Bartsch, I., 1986: Zur Gattung *Agauopsis* (Acari, Halacaridae), Beschreibung zweier neuer Arten und Übersicht über Verwandtschaftsgruppen. – Zool. Scr., **15**: 165-174. Oslo.
- Bartsch, I., 1987: *Halacarus griseus* sp. n., eine Halacaride (Acari) aus dem Mittelmeer. – Entomol. Mitt. zool. Mus. Hamburg, **9**: 75-79. Hamburg.
- Bartsch, I., 1997: Copidognathinae (Halacaridae, Acari) from Northern Australia; description of four new species. – In: Hanley, J.R., Caswell, G., Megirian, D. & Larson, H.K. (eds), Proceedings of the Sixth International Marine Biological Workshop. The marine flora and fauna of Darwin Harbour, Northern Territory, Australia, 231-243. Museum & Art Gallery of the Northern Territory. Darwin.
- Bartsch, I., 2001: Black Sea Copidognathinae (Arachnida: Acari: Halacaridae): A review. – Mitt. Mus. Natkd. Berl., Zool. Reihe **77**: 247-275. Berlin.
- Bartsch, I., 2002: Halacarids from the Great Meteor Seamount (Northeastern Atlantic). Description of new species of the genera *Agauopsis*, *Atelopsalis* and *Halacarus* and redescription of *H. spiniger* Bartsch (Arachnida: Acari: Halacaridae). – Mitt. hamb. zool. Mus. Inst., **99**: 29-45. Hamburg.
- Bartsch, I., 2004: Geographical and ecological distribution of marine halacarid genera and species. – Exp. Appl. Acarol., **34**: 37-58. Dordrecht.
- Green, J. & MacQuitty, M., 1987: Halacarid Mites. – Synop. Br. Fauna, (NS) **36**: 178 pp. Leiden.
- Kolesnikova, E.A, Povchun, A.S & Serenko, I.V., 1993: Migration of meiobenthos in the coastal zone of the Black Sea – Gidrobiol. Zh., **29** (6): 36-45. Kiev. (In Russian, English Summary)
- Lohmann, H., 1889: Die Unterfamilie der Halacaridae Murr. und die Meeresmilben der Ostsee. – Zool. Jb. Syst., **4**: 269-408. Jena.
- Macquart-Moulin, C., 1999: Diel vertical migration and endogenous swimming rhythm in *Asterope mariae* (Baird) and *Philomedes interpuncta* (Baird) (Crustacea, Ostracoda, Cypridinidae). – J. Plankton Res., **21**: 1891-1910. Oxford.
- Mari, M. & Morselli, I., 1990: Idracnelle ed alacaride (Acari) di una prateria *Posidonia oceanica* (L.) delile dell'isola d'Ischia. – Atti tosc. Sci. nat. Mem. (B), **96**: 243-256. Pisa.
- Mees, J. & Jones, M.B., 1997. The hyperbenthos. – Oceanogr. Mar. Biol. Annu. Rev., **35**: 221-255. London.
- Morselli, I., 1980: Su tre Acari prostigmati di acque salmastre dell'alto Adriatico. – Atti tosc. Sci. nat. Mem. (B), **87**: 181-195. Pisa.
- Morselli, I. & Mari, M., 1982: Alacaride (Acari, Prostigmata) di fondi sabbiosi della costa Ionica del Salento. – Atti tosc. Sci. nat. Mem. (B), **88**: 229-247. Pisa.

- Morselli, I. & Mari, M., 1985: Ricerche sugli alacaridi della coste livornesi. IV. Osservazioni su alcune specie raccolte su fondi sabbiosi della zona di Piombino. – Atti tosc. Sci. nat. Mem. (B), **91**: 201-220. Pisa.
- Morselli, I. & Mari, M., 1993: Alacaridi (Acari, Actinedida) di formazioni coralligene dell'infralitorale Laziale (Italia Centrale). – Atti tosc. Sci. nat. Mem. (B), **99**: 115-123. Pisa.
- Newell, I.M., 1947: A systematic and ecological study of the Halacaridae of eastern North America. – Bull. Bingham oceanogr. Coll., **10**: 1-232. New Haven, Connecticut.
- Newell, I.M., 1971: Halacaridae (Acari) collected during cruise 17 of the R/V Anton Bruun, in the southeastern Pacific Ocean. – Anton Bruun Rep., **40**: 58 pp. Galveston.
- Police, G., 1909. Alcune nuove specie di Halacaridae del Golfo di Napoli. – Archo zool. ital., Napoli, **3**: 409-443. Neapel.
- Proches, S., 2002: New species of Copidognathinae (Acari: Halacaridae) from southern Africa. – J. nat. Hist., **36**: 999-1007. London.
- Trouessart, E.L., 1889: Revue synoptique de la famille des Halacaridae. – Bull. scient. Fr. Belg., sér. 3, **20**: 225-251. Paris.
- Viets, K., 1927: Die Halacaridae der Nordsee. – Z. wiss. Zool., **130**: 83-173. Leipzig.
- Viets, K., 1928: Wassermilben aus dem Schwarzen Meer, dem Kaspischen Meer und dem Aral-See. – Abh. naturw. Ver. Bremen, **27**: 47-80. Bremen.
- Viets, K., 1935: IV. Some marine mites from Alexandria. – The Fishery Grounds near Alexandria. Fishery Research Directorate Coastguard and Fisheries Service, 1-4. Cairo.
- Viets, K., 1940: Meeresmilben aus der Adria (Halacaridae und Hydrachnellae, Acari). – Arch. Naturgesch. (N.F.), **9**: 1-135. Berlin.
- Walter, C., 1931: Arachnides halacariens. Biospeologica LVI. Campagne spéologique de C. Bolivar et R. Jeannel dans l'Amérique du Nord (1928). – Arch. zool. expér. gén., **71**: 375-381. Paris.
- Walters, K., 1988: Diel vertical migration of sediment-associated meiofauna in subtropical sand and seagrass habitats. – J. exp. mar. Biol. Ecol., **117**: 169-186. Amsterdam.
- Walters, K. & Bell, S.S., 1986: Diel patterns of active vertical migration in seagrass meiofauna. – Mar. Ecol. Prog. Ser., **34**: 95-103. Oldendorf/Luhe.

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