

***Thalassarachna basteri* and *T. affinis* (Acari, Halacaridae), history, characters, biology, and distribution**

ILSE BARTSCH

Forschungsinstitut Senckenberg, c/o DESY, Notkestr. 85, 22607 Hamburg, Germany. E-mail: ibartsch@senckenberg.de

Received 27 April 2015 | Accepted 4 May 2015 | Published online 7 May 2015.

Abstract

Thalassarachna basteri and *T. affinis* are known since more than a century. Though frequently found in shallow water areas, there exist only very few descriptions of their external characters. These and distinguishing characters are outlined, data of habitat, life cycle, feeding, and distribution are given. Adults and nymphs of *T. basteri* and *T. affinis* can be discriminated on the basis of the shape of the frontal spine and number of spines on leg I. *Thalassarachna basteri* is regularly found in cold-temperate and polar areas, both on the eastern and western coast of the North Atlantic whereas most records of *T. affinis* are from the warm-temperate eastern North Atlantic.

Key words: Halacaroidea, *Thalassarachna*, description, comparison, biology, distribution.

Introduction

Thalassarachna basteri (Johnston, 1836) and *T. affinis* (Trouessart, 1896) colonize shallow water substrata, tufts of multibranched algae and colonial organisms, namely hydrozoans, bryozoans, and bivalves (Mytilidae). The species are rather large-sized and abundant and can hardly escape to be noticed. The two species have been described more than a century ago. Though they are frequently mentioned in lists of species collected on the coast of the Northern Atlantic and its adjacent basins, there exist only few detailed descriptions. This paper will present the history of these species, with their different generic and specific names till they finally were called *Thalassarachna basteri* and *T. affinis*, offer descriptions and illustrations and summarize data of biology and distribution.

Material and Methods

The material described and illustrated below was collected by the author, *Thalassarachna basteri* in the Baltic and *T. affinis* in the Black Sea. The illustrations were done with a drawing tube. The legs, their segments and claws are numbered I to IV, from anterior to posterior. The leg segments are trochanter, basifemur, telofemur, genu, tibia, and tarsus. In the chaetotaxy formula of the legs the solenidia, famuli and parambulacral setae are excluded. Numbers in parentheses () indicate rarely occurring variants, those in square brackets [] inform of the quantity of a given character state.

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 setae of idiosoma, numbered from anterior to posterior; GA, genitoanal plate; glp, (pair of) gland pore(s), numbered glp-1 to glp-3, from anterior to posterior; GO, genital opening; OC, ocular plate(s); P-2 to P-4, second to fourth palpal segment; pas, parambulacral seta(e); PD, posterior

dorsal plate; PE, posterior epimeral plate(s); pgs, perigenital setae, numbered from anterior to posterior; sgs, subgenital setae.

The descriptions of the species are preceded by a list of names which have been given to these species; if proven as such, mis-identifications or mis-interpretations of the status of the species are included.

History

In 1836 Johnston published a description of a marine mite which he called *Acarus basteri*. That mite was rather large-sized, its body was coloured reddish-brown to almost black, had a light mesial line and a pair of eye spots, the legs were colourless, the two anterior pairs were directed forward, the two posterior pairs backward (Johnston 1836). The species was rather frequently found amongst corallines and filamentous algae between the tidemarks, tolerated both exposure to the air and freshwater immersion, and was often infested by protozoa (Johnston 1836). The material studied was assumedly from near Edinburgh, Scotland, North Sea. The species is now known under the name *Thalassarachna basteri* (Johnston, 1836).

Two decades later, Gosse (1855a) described and figured the two species '*Halacarus rhodostigma* (mihi)' and '*Halacarus ctenopus* (mihi)', both collected at Weymouth, England, English Channel. A type species was not designated. According to the description, figure and collecting data, the second-mentioned mite (*Halacarus ctenopus*) is conspecific with the species described by Johnston (1836). Another record of a marine mite came from the western North Atlantic Ocean, from Eastport harbor, Maine, United States. This mite, described by Packard (1871) and named *Thalassarachna Verrillii*, is according to Newell (1945) identical with *Acarus basteri*. Also *Halacarus spinifer*, described by Lohmann (1889) on the basis of specimens from the western Baltic, turned out to be synonymous with the wide-spread species nowadays called *Thalassarachna basteri*, whereas a female, collected on the coast of Murmansk and once described as *Halacarellus basteri septentrionalis* Gimbel, 1938 proved to be a typical *Thalassarachna basteri* (Bartsch 1991).

Another variety, *Halacarus spinifer* var. *affinis* Trouessart, 1896, was presented from the Mediterranean (Marseille, Villefranche-sur-Mer) (Trouessart 1896). According to the very short description, the most marked differences between this variety and *Halacarus spinifer* were the more slender shape ('faible form') of the idiosoma and the shape of the ventral setae on leg I, slender, tapering instead of stout as in the nominate species (Trouessart 1896). No details or figures were given, consequently the status was vague. The figures published in the following decades presented the dorsal aspect of the idiosoma, legs and palps of juveniles (Viets 1928a: fig. 1, 3, 1940: figs 38, 39), of adults only leg I and details of the genital region were illustrated (Makkaveeva 1966: fig. female, male; Konnerth-Ionescu 1968: fig. 1A, B, D). Another example is the mite *Halacarus istrianus* Vitzthum, 1932, described and illustrated on the basis of a deutonymph, in the meantime known to belong to the species roughly outlined by Trouessart (1896). *Halacarus spinifer* var. *affinis*, abundantly collected, was mentioned both as a subspecies, e.g. as *Halacarellus basteri affinis* Trouessart (1896) in Viets 1928a, 1940 and *Halacarus (Halacarellus) basteri affinis* in Konnerth-Ionescu 1968, or as belonging to *Halacarellus basteri*, namely in Makkaveeva (1966). In 1986, Bartsch raised *Halacarellus affinis* to species level and presented descriptions on the basis of adults from the Mediterranean and Black Sea (Bartsch 1986, 1998).

As outlined above, there exist several names for the species nowadays called *Thalassarachna basteri*. First it was placed into the genus *Acarus*, a generic name used by Linnaeus (1735) and at that time including a variety of mites. A century later, Gosse (1855a) introduced the genus *Halacarus* for mites exclusively living in the sea. The name was derived from the Greek halos, the sea and acaros, a mite (Gosse 1855a). Why don't we call this species *Halacarus basteri* as the generic name *Halacarus* Gosse, 1855 predates *Thalassarachna* Packard, 1871?

The species once described by Gosse (1855a) was characterized by a large frontal spine. In a sample from the Bermuda Islands, Lohmann (1893) found a halacarid mite with such a spine and expected it to be conspecific with the mite mentioned by Gosse, Lohmann described the mite and presented detailed figures (p. 82, 83, pl. 9: figs 2, 4, 5). In the following decades, descriptions and figures referring to *H. ctenopus* (e.g. Viets 1927; André 1946; Newell 1947, Green & MacQuitty 1987) were based either directly on the description presented by Lohmann (1893) or on specimens collected in the western part of the North Atlantic. *Halacarus ctenopus* is the type species of the genus *Halacarus* and the generic diagnosis referred to the species described by Lohmann.

The most conspicuous difference between the specimens described by Gosse (1855a) and Lohmann (1893) is the length of the genua of legs I and II, they are shorter (Gosse 1855a: fig. 6) versus as long as (Lohmann 1893: fig. 5) the adjoining telofemora and tibia. On the basis of this difference, Lohmann (1907) proposed to split the genus *Halacarus* into two groups ('Artenkreise'), the one including all species with long genua ('*Ctenopus*-Gruppe'), the other the species with short genua ('*Balticus*-Gruppe'). For the latter group Viets (1927) established the subgenus *Halacarellus*, whereas the species with long genua remained in the genus *Halacarus*. Schulz (1933) raised *Halacarellus* in the rank of a genus. *Acarus basteri* with its short genua was now called *Halacarellus basteri* (Johnston, 1836). Newell (1945) argued that *Thalassarachna verrilli* is identical with *Acarus basteri* and consequently *Thalassarachna* should have priority over *Halacarellus*. As the type material of *T. verrilli* is no longer in existence and amongst the residues from jars with hydroids, etc. collected by Verrill no mites similar to that described by Packard were found (Newell 1945), the synonymy of *Thalassarachna verrilli* and *Acarus basteri* was not accepted by all authors and during five decades both names *Halacarellus* and *Thalassarachna* were used in parallel. In 1997, the genus with two names was splitted into the two genera *Thalassarachna*, with the type species *Acarus basteri* Johnston, 1836, and *Halacarellus*, with the type species *Halacarus balticus* Lohmann, 1889 (Bartsch 1997a). To maintain stability in the usage of the names *Halacarus* and *Halacarus ctenopus* a neotype was designated and described Bartsch (2001, 2003).

Descriptions

***Thalassarachna basteri* (Johnston, 1836)**

Figures 1A–F, 2A–J, 3.

Acarus Basteri Johnston, 1836: 353–355, fig. 51a, b.

Halacarus ctenopus, Gosse 1855a: 28–29, pl. 3, figs 1–6.

Thalassarachna Verrillii Packard, 1871: 107–109, fig. 5a–d.

Halacarus spinifer Lohmann, 1889: 343–345, pl. 7, figs 49, 50, 59, 73, pl. 8, figs 97, 99–105.

Halacarus (Halacarus) basteri, Lohmann 1901: 292

Agaue hirsuta, Trägårdh 1905: 63, figs 127, 128 (non *Agaue hirsuta* Trouessart, 1889, mis-identification)

Halacarus (Halacarellus) basteri basteri, Viets 1927: 120.

Halacarellus basteri var. *septentrionalis* Gimbel, 1938: 1–6, figs 1–12.

Halacarus (Thalassarachna) basteri, Newell 1945: 62.

Halacarus (Thalassarachna) basteri basteri, Newell 1947: 102–106, figs 143–154.

Halacarellus basteri, Kirchner 1967: 345.

Thalassarachna basteri, Straarup 1968: 264.

Halacarus basteri basteri, Kirchner 1969: 56.

Thalassarachna basteri, Green & MacQuitty 1987: 120, fig. 48A–D.

non *Halacarellus basteri*, Makkaveeva 1966: 38–44, figs.

Characters of adults. *Idiosoma*. Length of females 864–1197 μm , of males 885–1105 μm . Dorsal and ventral plates widely separated by densely striated integument. Dorsum with four plates, AD, pair of OC and PD, and three pairs of platelets; a fourth pair of platelets covered by striated integument. Anterior dorsal plate with wide, frontal spine (Fig. 1A, B), its width at the base about 60 μm , length 30 μm ; posteromarginal part of AD with delicate pores. Pair of glp-1 in margins of AD just anterior to the level of ds-1, glp-2 within striated marginal integument. Ocular plates 1.7–2.1 times longer than wide, with eye pigment and single cornea; posterior corner with gland pore and adjacent pore canaliculus. Posterior dorsal plate about quadrangular, slightly longer than wide, in ovigerous females (with striated integument dilated) reaching halfway between ds-4 and ds-5, in males PD slightly longer and extending to the level of ds-4 (Fig. 1A). Pair of ds-5 in female PD in anterior half (Fig. 1D), in male close to middle of PD. Marginal and median part of PD with faintly reticulate ornamentation and numerous minute pores, pair of longitudinal areas evenly and very delicately punctate, without reticulation (Fig. 1F).

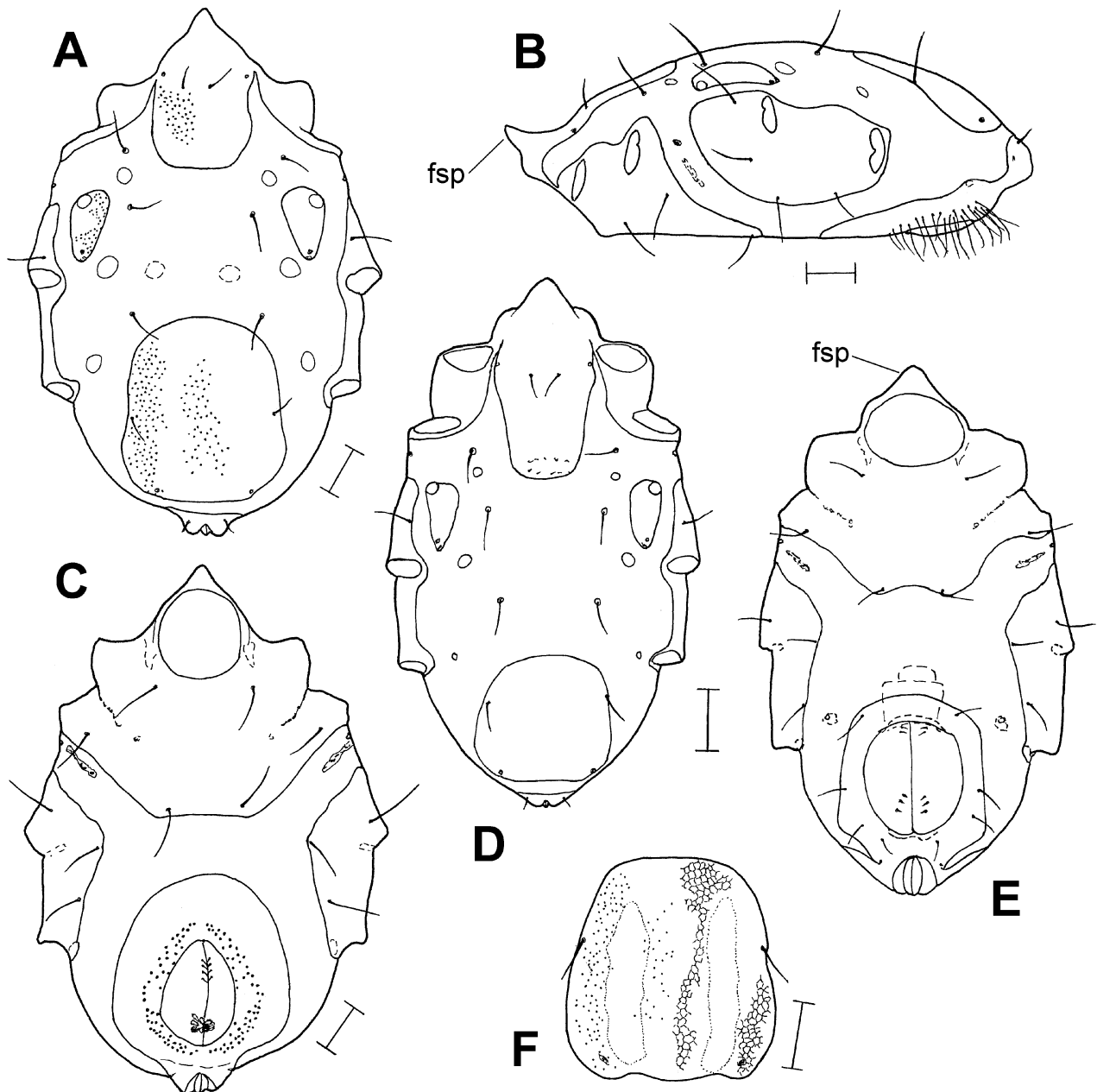


Figure 1. *Thalassarachna basteri* (Johnston, 1836). A - Idiosoma, dorsal, male. B - Idiosoma, lateral, male. C - Idiosoma, ventral, male. D - Idiosoma, dorsal, female. E - Idiosoma, ventral, female. F - PD, female (right side showing reticulate ornamentation, left side numerous pores). (fsp, frontal spine) Scale = 100 μ m.

Ventral plates uniformly punctate. AE with three pairs of ventral setae; PE with one dorsal and three ventral setae. Female GA slightly extending beyond large genital foramen; distance from anterior margin of GA to that of GO about 0.2 times of length of GO. GO mostly surrounded by three or four pairs of pgs, rarely five, six or even seven setae on either side of GO. Genital sclerites both anteriorly and posteriorly with two (to three) pairs of minute setae. Ovipositor extending beyond genital plate (Fig. 1E). Male genitoanal plate larger than that of female; interval between anterior margin of GA and of GO about 0.6 of length of GO (Fig. 1C). Genital foramen surrounded by approximately 110 perigenital setae (Fig. 1C); genital sclerites with 8–10 pairs of stout setae and two pairs of spurs. Female and male with three pairs of large internal genital acetabula.

Gnathosoma 1.5–1.7 times longer than wide. Tectum truncate (Fig. 2A). Rostrum shorter than gnathosomal base, extending to end of P-2. Integument of gnathosomal base delicately punctate. Basal pair of maxillary

setae at the basis of the rostrum, apical pair in posterior third. Palps almost cylindrical, P-3 with medial spine (Fig. 2B). Three setae in basal whorl of P-4 slightly unequal in size. P-4 ending with two setulae and two spurs. Lateral surface of cheliceral basis faintly foveate (Fig. 2D). Cheliceral claw with about 25 minute tines (Fig. 2C). Setae at the basis of the rostrum, apical pair in posterior third. Palps almost cylindrical, P-3 with medial spine (Fig. 2B). Three setae in basal whorl of P-4 slightly unequal in size. P-4 ending with two setulae and two spurs. Lateral surface of cheliceral basis faintly foveate (Fig. 2D). Cheliceral claw with about 25 minute tines (Fig. 2C).

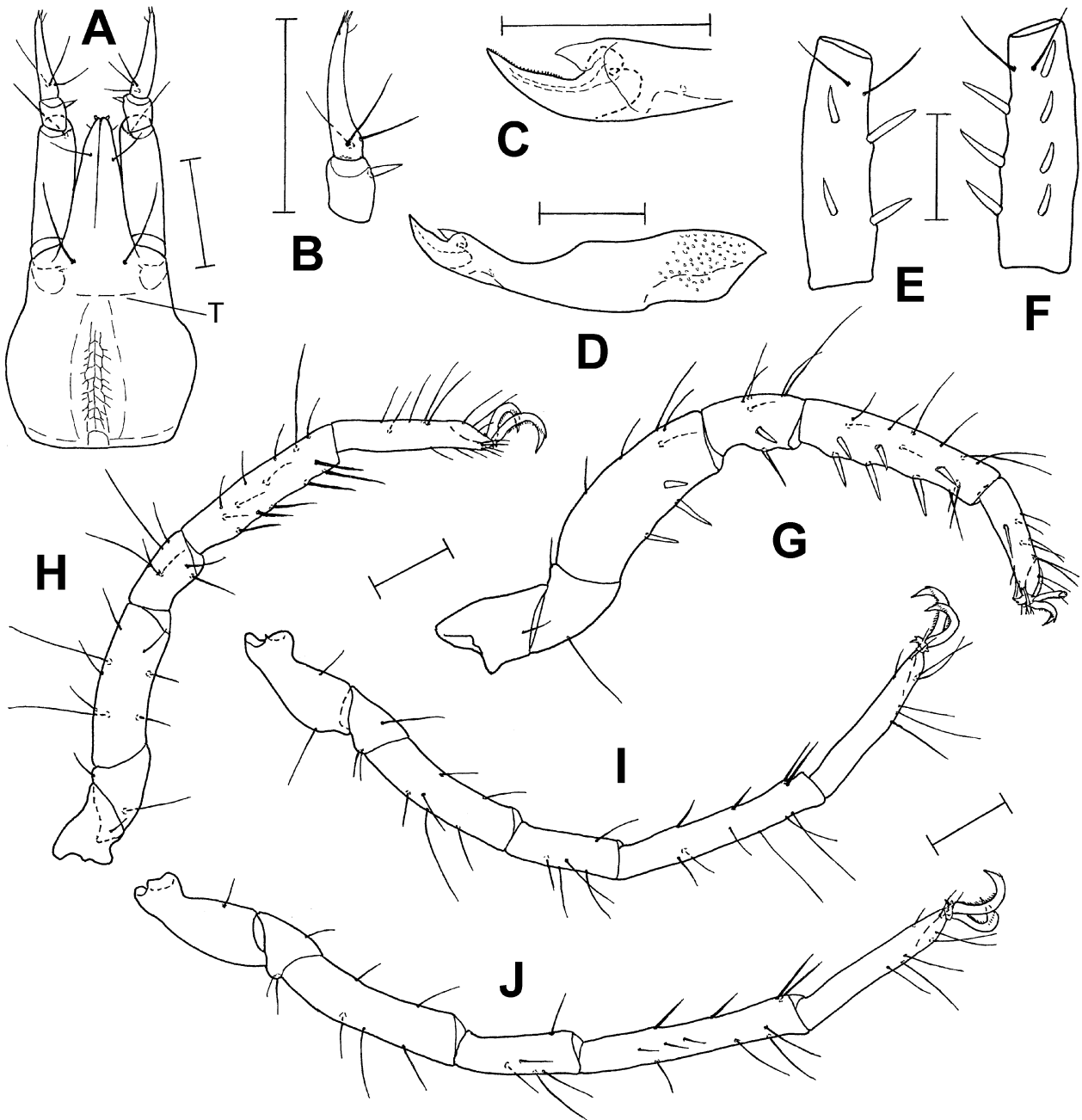


Figure 2. *Thalassarachna basteri* (Johnston, 1836), female. A - Gnathosoma, ventral. B - Third and fourth segment of palp, ventral. C - Tip of chelicera, lateral. D - Chelicera, lateral. E. Left tibia I, ventral. F - Right tibia I, ventral. G - Leg I, medial. H - Leg II, medial. I - Leg III, lateral. J - Leg IV, lateral. (T, tectum) Scale = 100 μ m.

Legs. Two anterior pairs distinctly, two posterior pairs of legs slightly shorter than idiosoma. Number of setae on leg segments variable (Table 1). Leg I with conspicuous ventral spines; 35–70 μ m long, at their basis almost 10 μ m wide; telofemur I with three such spines; in general tibia I ventrally with three pairs of spines and anterior pair of setae (Fig. 2G), rarely, as in female illustrated (Fig. 2E, F), with four or seven spines in addition to anterior pair of slender setae. Following tibiae with bristle-like ventral setae but no spines (Fig. 2H–J). Tarsus I with eight (rarely seven) dorsal setae, a short dorsolateral solenidion, a ventral

spine, six to seven (rarely less) ventral eupathid setae, and a pair of doubled (rarely tripled) parambulacral setae. Claws on tarsus I shorter than on following tarsi; claws on tarsi II to IV with J-shaped pecten with numerous tines.

Colour. Integument almost transparent. Dorsum with three black eye spots. Gut content red-brown with dark spots (Fig. 3); colour highly depending on food items. In general a narrow, white bar present.



Figure 3. *Thalassarachna basteri* (Johnston, 1836) from northern Norway, Gamvik. (Photo: Roy Erling Wrånes).

Characters of juveniles. Length of deutonymph 654–794 μm , of protonymph 452–654 μm , of larva 384–440 μm . Outline of dorsal plates similar to plates of adults, though PD distinctly smaller. AD always with large frontal spine. Telfemora I to IV of deuto-, protonymph and larva with 2, 1, 0 spines, genua with 1, 1, 0 and tibiae with 4(–3), 2, 0 spines, respectively. Deutonymphal tarsi I to IV with 6, 6, 4(–3), 4 dorsal setae, protonymphal tarsi with 4(–3), 4, 3, 3 and larval tarsi I to III with 3, 3, 3 dorsal setae.

***Thalassarachna affinis* (Trouessart, 1896)**

Figures 4A–F, 5A–D

Halacarus spinifer affinis Trouessart, 1896: 253.

Halacarus basteri var. *affinis*, Lohmann 1901: 292.

Halacarus (Halacarellus) basteri affinis, Viets 1927: 120.

Halacarellus basteri affinis, Viets 1928a: 49, 50, fig. 1–3.

Halacarus istrianus Vitzthum, 1932: 691–697, figs 1–5.

Halacarus (Halacarellus) basteri var. *affinis*, Sokolov 1952: 81, 82, fig. 31: 1–3.

Halacarellus basteri, Makkaveeva 1966: 38–44, figs.

Halacarellus affinis, Bartsch 1986: 247–249, figs 1–8.

Thalassarachna affinis, Bartsch 1997a: 1229.

The identity of the Black Sea records of *Thalassarachna hexacantha* (Viets, 1927) from Bulgaria, Varna, and *Thalassarachna longipes* (Trouessart, 1888) from Ukraine, Odessa Bay (Caspers 1951; Vorobyeva & Yaroshenko 1982) is in need of verification. At the time the specimens were identified, the knowledge of *T. affinis* was meagre.

Characters of adults. *Idiosoma.* Length of female 600–774 μm , of male 568–710 μm . Dorsal plates uniformly and delicately punctate, lateral areas with minute scattered pores. Plates separated by wide areas of densely striated integument. AD longer than wide; posterior margin arched, anterior margin with minute frontal spinelet, length of spinelet 5–8 μm , its width 15–22 μm , i.e. one-fifth or less than width of AD. OC oblong, 2.2–2.5 times longer than wide, with large cornea in anterolateral part. PD oblong, longer and wider than AD and about 1.3 times longer than wide. Female PD not reaching the level of ds-4 (Fig. 4A), male PD extending to or slightly beyond the level of ds-4. Pairs of ds-1 and ds-5 on AD and PD, respectively, ds-2 to ds-4 on minute sclerites in striated integument, ds-6 short, on anal plate. Internal platelets between each OC and AD and OC and PD covered by striated integument. Pair of glp-1 in lateral margin of AD level with insertion of leg I, glp-2 within marginal integument between legs II and III, glp-3 in posterior corner of OC, immediately anterior to pore canaliculus; fourth pair in posterior part of PD.

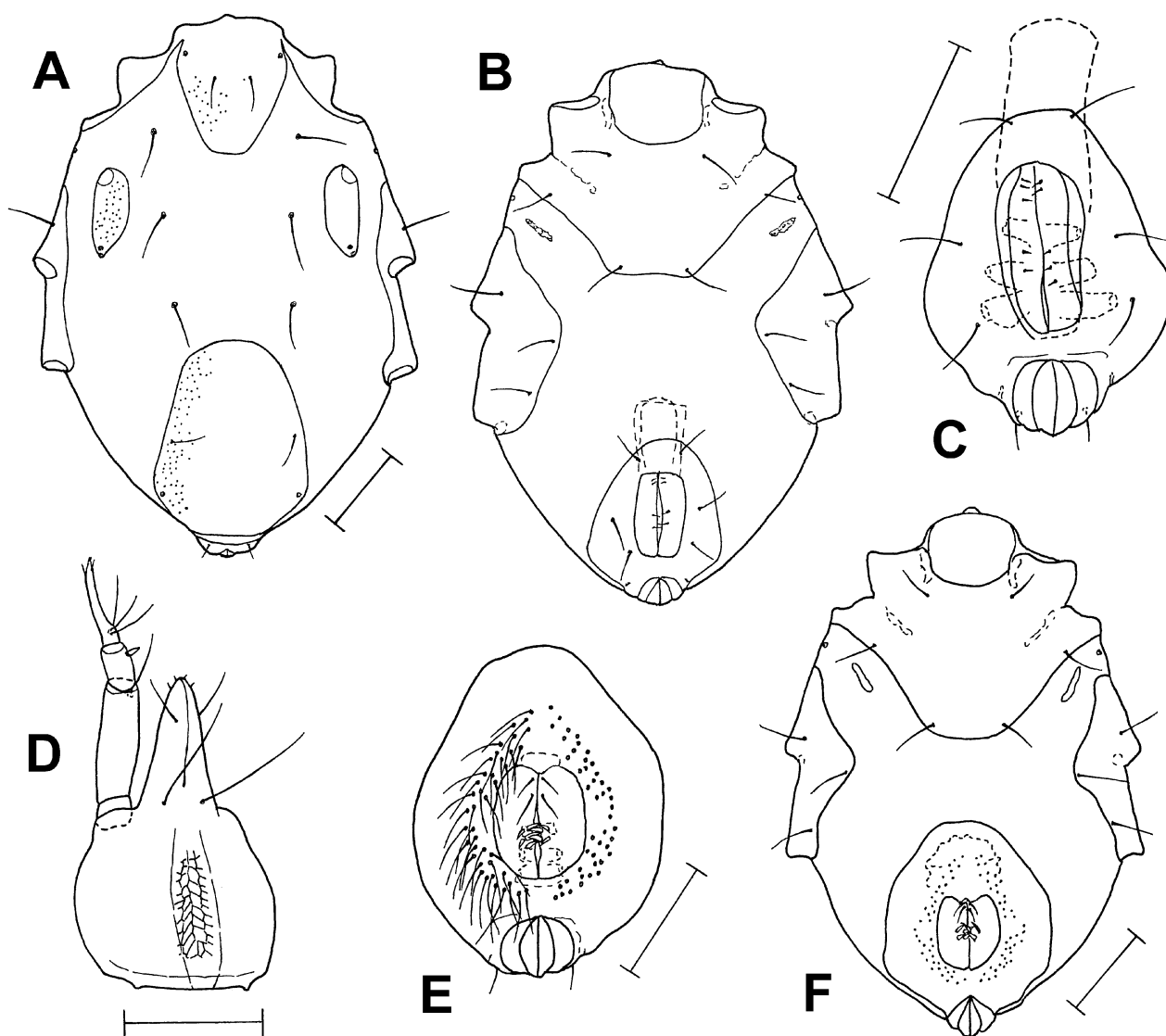


Figure 4. *Thalassarachna affinis* (Trouessart, 1896). A - Idiosoma, dorsal, female. B - Idiosoma, ventral, female. C - Genitoanal plate, female. D - Gnathosoma, ventral, male. E - Genitoanal plate, male. F - Idiosoma, ventral, male. Scale = 100 μm .

Ventral plates uniformly and delicately punctate. AE with three pairs of ventral setae; PE with one dorsal and three ventral setae. Female GA with three pairs of perigenital setae (Fig. 4C), anterior pair near anterior margin of GA. Length of GO half that of GA; interval between anterior margin of GA and that of GO distinctly less than half length of GO. Two (to three) pairs of sgs in anterior part of genital sclerites, two (to three) pairs in the middle part. Genital acetabula large, tube-like, three pairs present (Fig. 4C). Ovipositor at rest extending beyond anterior margin of GA. Male GA ovate; interval between anterior margin of GA and GO equalling length of GO (Fig. 4E); approximately 90 perigenital setae densely arranged around GO. Each of male genital sclerites with about six sgs. Genital acetabula smaller than in female.

Gnathosoma. Length 1.4–1.6 times the width. Tectum truncate. Rostrum slender, triangular (Fig. 4D), shorter than gnathosomal base, extending to end of P-2. Basal pair of maxillary setae within basis, apical pair in posterior third of rostrum. Palps almost cylindrical, P-3 with short, medial spine.

Legs. Leg IV about as long as idiosoma, preceding legs shorter. Telfemora slender. Number of setae on telfemora, genu and tibiae highly variable (Table 1), none of setae long and spiniform (Fig. 5A–D). Tibia I to IV with 8, (6–)7(–8), 3(–4), 3(–4) ventral setae. On tibia I one (Fig. 5A) to two of ventromedial setae short and spur-like, all other ventral setae on tibia I and following tibiae bristle-like, tapering (in a Mediterranean specimen all eight ventral setae tapering, none spur-like). Tarsus I with eight (rarely 9) dorsal setae, dorsolateral solenidion, one ventromedial seta, approximately seven eupathidia, and pair of tripled parambulacral setae. Tarsus II with eight dorsal setae, dorsomedial solenidion and almost 10 ventral eupathidia (pas included). Tarsi III and IV generally with six dorsal setae, and one, rarely zero or two, ventral setae; tip of these tarsi each with pair of single pas.

Colour. Similar to that of *T. basteri*.

Table 1. Number of setae of trochanter to tibia I to IV and dorsal setae of tarsus I to IV of adults. The quantity of each character state is given in square brackets []. d, dorsal.

Thalassarachna basteri (5 females, 5 males) from the Baltic.

Segment	1	2	3	4	5	6d
Leg I	1[20]	2[20]	7[1],8[17],9[2]	6[2],7[17],8[1]	11[1],13[1],15[1],16[2],17[13],18[2]	7[1],8[19]
Leg II	1[20]	2[20]	7[2],8[18]	5[1],6[2],7[17]	15[6],16[12],17[2]	7[3],8[17]
Leg III	2[20]	3[13],4[7]	4[1],6[15],7[2],8[2]	4[1],5[14],6[5]	5[1],9[2],10[16],12[1]	4[1],5[18],6[1]
Leg IV	1[18],2[2]	3[18],4[2]	5[12],6[8]	4[1],5[19]	9[3],10[16],11[1]	5[20]

Thalassarachna affinis (5 females, 5 males) from the Black Sea.

Segment	1	2	3	4	5	6d
Leg I	1[20]	2[20]	6[1],7[7],8[12]	6[3],7[17]	16[4],17[16]	7[1],8[19]
Leg II	1[20]	2[20]	7[9],8[8],9[2],10[1]	6[2],7[17],8[1]	14[6],15[11],16[3],	8[20]
Leg III	2[17],3[3]	3[1],4[16],5[1],6[2]	4[2],5[17],7[1]	4[2],5[16],7[1],8[1]	8[10],9[7],10[2],11[1]	5[4],6[16]
Leg IV	1[20]	3[20]	3[2],5[7],4[11]	4[3],5[15],6[2]	7[1],8[15],9[4]	5[1],6[6],7[13]

Thalassarachna affinis (1 male) from the Mediterranean.

Segment	1	2	3	4	5	6d
Leg I	1[2]	2[2]	7[1],9[1]	7[2]	17[2]	8[2]
Leg II	1[2]	2[2]	5[1],7[1]	5[1],7[1]	12[1],16[1]	7[1],8[1]
Leg III	2[1]	3[2]	3[1],5[1]	4[1],5[1]	8[1],9[1]	6[2]
Leg IV	1[2]	3[2]	5[2]	5[2]	9[2]	6[2]

Thalassarachna litoralis (2 females) from the English Channel.

Segment	1	2	3	4	5	6d
Leg I	1[4]	2[4]	7[1],8[3]	5[1],6[1],7[2]	16[1],17[3]	8[4]
Leg II	1[4]	2[2],3[2]	4[1],6[1],7[2]	5[2],6[1],7[1]	9[1],12[1],13[1],14[1]	7[2],8[2]
Leg III	2[4]	3[4]	3[2],4[2]	3[2],5[2]	7[2],8[2]	5[4]
Leg IV	1[4]	3[4]	4[2],5[2]	3[2],4[2]	7[2],8[2]	5[3],6[1]

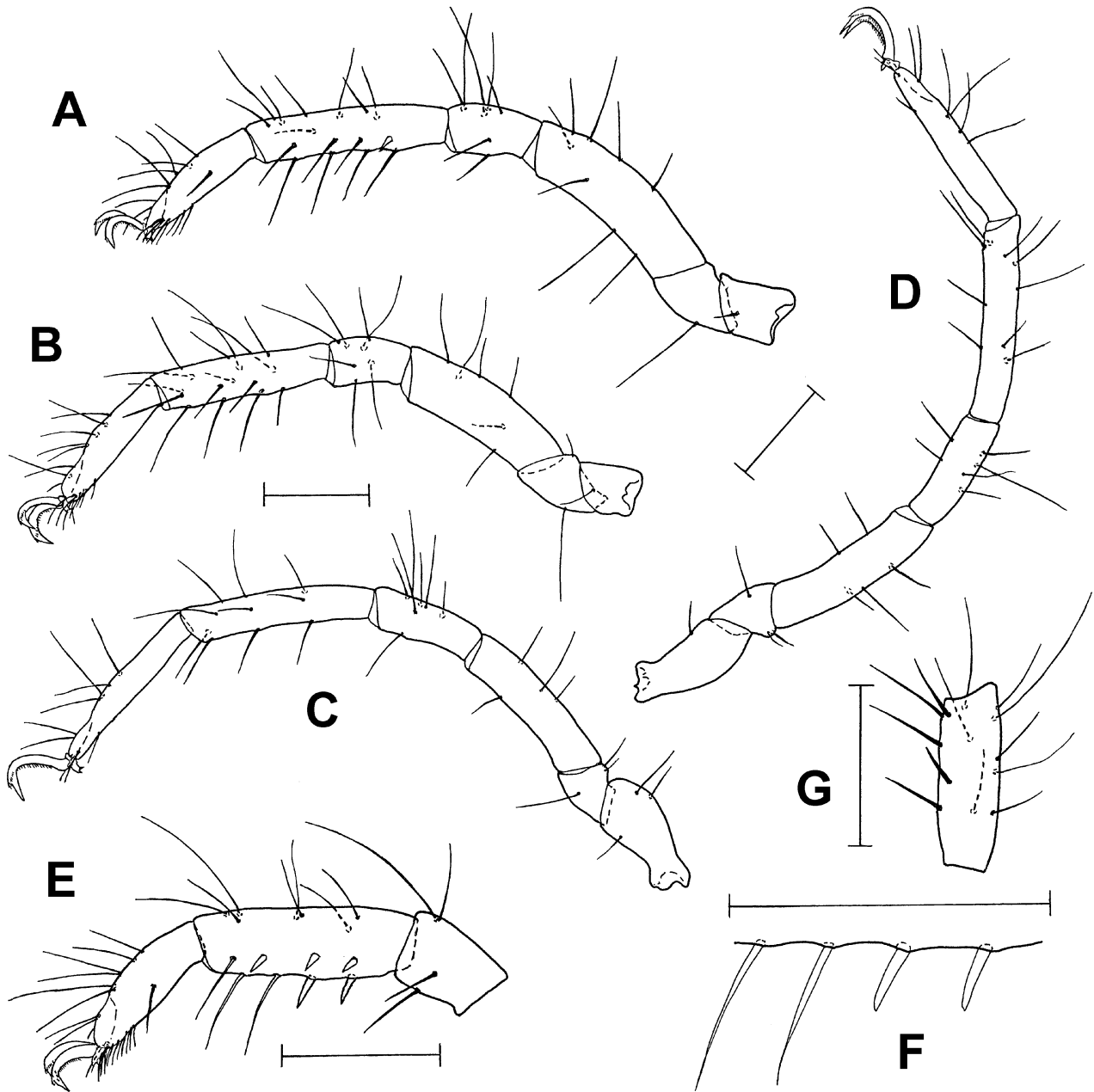


Figure 5. *Thalassarachna affinis* (Trouessart, 1896) and *T. littoralis* (Bartsch, 1976). A–D - *Thalassarachna affinis*, female. A - Leg I, medial. B - Leg II, medial. C - Leg III, lateral. D - Leg IV, lateral. E–G - *Thalassarachna littoralis*, female. E - Genu to tarsus I, medial. F - Ventral margin of tibia I. G - Tibia II, medial. Scale = 100 μm .

Characters of juveniles. Length of deutonymph 600–653 μm , of protonymph 378–446 μm , of larva 345 μm . Outline of dorsal plates similar to that of plates of adults, though PD distinctly shorter. Frontal spine on AD present but minute. Tibia I of deutonymph with six (three pairs) ventral setae, one (rarely two) of setae spur-like; tibia I of protonymph with four ventral setae, one (rarely none) of ventral setae spur-like. Deutonymphal tarsi I to IV with 6, 6, 4, 4 dorsal setae, protonymphal tarsi with 4, 4, 3(–4), 3 dorsal setae.

Taxonomic Remarks

The most marked differences between adult *Thalassarachna basteri* and *T. affinis* are:

(1) the frontal spine. In adult *T. basteri* the spine is wide, about 30 μm long, at the basis 60 μm wide, slightly raised upward (lateral aspect). A prominent frontal spine is present also in nymphs and larvae. That spine in *T. affinis* is a short process on the anterior margin of the AD, rarely more than 10 μm long and 25 μm wide. In the juveniles the spine is still shorter.

(2) the shape of the PD. The PD of adult and juvenile *T. basteri* is only slightly longer than wide, in *T. affinis* about 1.3 times longer than wide.

(3) the ventral setae on leg I. In adults of *T. basteri* several of the ventral setae are long and spiniform, from telofemur to tibia most commonly three, one and six spines are present, respectively (Table 2). In *T. affinis* the ventral setae on telofemur and genu are slender, evenly tapering, on the tibia (none to) one or two of the ventromedial setae are spur-like. Deuto- and protonymphs of *T. basteri* have four (rarely three) ventral spines on tibia I, protonymphs two spines, respectively, deuto- and protonymphs of *T. affinis* one (rarely two) and one (rarely zero) spurs. Larvae of both species have bristle-like setae but neither spines nor spurs.

Thalassarachna hexacantha and *T. longipes*, with the above mentioned unverified records from the Black Sea (Caspers 1951; Vorobyeva & Yaroshenko 1979), bear a pair of ventral setae in the striated integument whereas in *T. affinis* and *T. basteri* this pair of setae is on the PE. In addition to this, *T. longipes* is characterized by its enlarged anal valves which extend beyond the anal sclerites.

Thalassarachna litoralis (Bartsch, 1976), known from Brittany, France (Bartsch 1976), is a species similar to *T. affinis* and its status not clear (cf. Bartsch 1998, 2009). When *T. litoralis* was described, no detailed information of adult *T. affinis* was available and a careful comparison hence not possible. The holotype female (housed in the Zoological Museum, Hamburg) and a second female (in the author's collection) have an idiosomal length of 710 and 793 μm . Marked differences between *T. litoralis* and *T. affinis* are in the number and shape of the setae on the legs. On tibia I both species bear eight ventral setae, but in *T. litoralis* three of the ventromedial setae and one or two of the ventrolateral setae are short, spiniform (Fig. 5E, F), in *T. affinis* one or two, rarely none, of the ventromedial setae are spur-like, all other setae are long, slender, evenly tapering. *Thalassarachna litoralis* has four to six ventral setae on tibia II, the ventrolateral setae are slender (Fig. 5G), the basal one of the ventromedial setae is shorter and slightly wider than the other setae, in *T. affinis* there are mostly seven ventral setae, all tapering and increasing in length from the segment's basis onward (Fig. 5B). Tibiae III and IV of *T. litoralis* bear two to three ventral setae and tarsus I doubled parambulacral setae, tibiae III and IV of *T. affinis* in general three ventral setae and tarsus I parambulacral triplets. At present *T. litoralis* and *T. affinis* are expected to represent two species.

Table 2. Numbers of spur-like or spiniform setae on the leg segments telofemur, genu and tibia I of *Thalassarachna affinis* (from the Black Sea), *T. basteri* (from the Baltic), and *T. litoralis* (from the English Channel, France). The quantity of each state is given in square brackets [].

	telofemur	genu	tibia
<i>T. affinis</i>	0[20]	0[20]	1[19],2[1]
<i>T. basteri</i>	3[20]	1[20]	4[2],6[17],7[1]
<i>T. litoralis</i>	0[4]	0[4]	4[2],5[2]

Habitat

Thalassarachna species are exclusively benthic, as halacarids in general they cannot swim. *Thalassarachna affinis* and *T. basteri* have been extracted from a variety of substrates which include a system of microcavernes, from colonial hydroids, bryozoans, byssus filaments of bivalve molluscs (Mytilidae), and tubes of serpulid polychaetes, from mats of green, brown and red algae, the haptera of *Laminaria* sp. (Phaeophyta), but also amongst sediment rich in debris. Juveniles and adults live in the same habitat, though juveniles are often more wide-spread than adults and are found in niches not occupied by the large-sized adults (Bartsch 2004a). The species are regularly found from the lower intertidal zone down to depths of at least 100 m. Presently deepest record of *T. basteri* is 105 m, of *T. affinis* 150 m. The two species may be abundant, 1800 individuals/m² at 3–6 ‰ are mentioned by Purasjoki (1947), 1600 individuals/kg *Cystoseira* sp. (Phaeophyta) by Makkaveeva (1966). Most records of *T. affinis* and *T. basteri* are from a salinity range of 10–32 ‰, *T. basteri* is still present in fairly large numbers in diluted seawater at 3–5 ‰, e.g. in the Gulf of Bothnia (Finland) and Matsalu Bay (Estonia) (Purasjoki 1947; Järvekülg 1965), and *T. affinis* was extracted from nearshore spring-water and slightly saline pools (Vitzthum 1932; Petrova 1973).

Feeding

Thalassarachna basteri is predaceous, preying on oligochaetes, polychaetes, small crustaceans, other halacarids and even its eggs (Lohmann 1889, 1893; Kirchner 1969; Bartsch 1974). The prey is captured with

the first pair of legs, the spines prevent an escape, the chelicerae, which can move to and fro within the rostral trough, pierce and cut the prey's integument and internal organs. After pre-oral digestion, the body content of the prey is sucked up (Kirchner 1969). *Thalassarachna affinis* is expected to have similar food items, though, in contrast to *T. basteri*, leg I bears bristle- or spur-like setae rather than spines (cf. Figs. 2G and 5A)

Reproduction

The two *Thalassarachna* species run through one larval and two nymphal stages until the adults, females and males, moult. Males produce elaborate spermatophores which include the sperm sac; the spermatophores are deposited on the substratum inhabited (Kirchner 1967, 1969). Females pick up the sperm sac. The eggs are stuck into the surface of the substratum.

Both *T. affinis* and *T. basteri* have a univoltine highly synchronized reproduction. In respect to *T. affinis*, Trouessart (1896) mentioned that adults were present only in winter time. More detailed data were presented by Makkaveeva (1966) who studied populations from the Black Sea. In the winter (January) only adults were found, females dominated the population, they were ovigerous, with 8–10 eggs per individual. The first juveniles appeared in February. In June and July only a few adults were present and the females held, if at all, just a single egg; the halacarid population was dominated by the nymphs which numerically hold almost 90 %. In October the first adults of the new generation had hatched and in October and November 25 % of the population were adults; in several of the females eggs were visible.

Detailed studies of the live cycle of *T. basteri* had been published by Lohmann (1893), Kirchner (1969) and Bartsch (1972). In populations from the Baltic Sea, eggs were deposited in early spring which in May and beginning of June hatched into larvae; a month later protonymphs appeared, and in August through October the deutonymphal stage dominated. Adults were present from beginning of November to end of May, they overwintered but died after reproduction in spring. In most of the months females numerically dominated over males and females had a longer life-span than males (Kirchner 1969; Bartsch 1972). Up to 15 eggs per female had been observed (Kirchner 1969); moribund females still contained one to three eggs.

Epizoans

Johnston (1836) already mentioned 'it [*Acarus basteri*] is much infested with infusory animalicus' and Gosse (1855b) found a peritrich ciliate (*Vorticella*) and several suctorians (Acinetidae) on this halacarid species. The above mentioned *T. litoralis* was infested with *Thecacineteta*, eight individuals fixed to marginal parts of the halacarid body. The loricae, 72–85 µm in length, 45–47 µm in diameter, are annulated with 22–24 horizontal ribs, the stalk is almost as long as the lorica, the slightly ovate macronucleus about 12 µm in length, and the more than 20 tentacles are arranged in a single bundle. Most likely it is a *Thecacineteta calix* (Schröder, 1907) which is a cosmopolitan species found on a variety of taxa (Chatterjee et al. 2014).

Geographical distribution

Records of the genus *Thalassarachna* are at present restricted to northern seas. The genus is abundant in the North Atlantic and its adjacent basins (Barents Sea, White Sea, Baltic, Mediterranean, Black Sea), a single record is from the western part of the Northern Pacific (Makarova 1978; Bartsch 2009). At present 16 species are known (Bartsch 2009; Bartsch & Rybakova 2015). Records of the two species *T. affinis* and *T. basteri* are from the northern Atlantic and the Arctic. The most northerly records are from Greenland, Northern Norway (Gamvik) and the Barents Sea (Trägårdh 1905; Viets 1928b; Sokolov 1952; Nikitina 2013; unpublished record), the most southerly from the Mediterranean (Trouessart 1996; Viets 1940; Bartsch 1998; Durucan & Boyaci 2014). Records of the genus are from the lower tidal zone to deep sea basins (Bartsch 2009).

The species most wide-spread is *Thalassarachna basteri*. It has been taken on the coasts of North America, from Connecticut (US) to Quebec (Canada), and Europe, from Spain to Nowaya Zemlya (Newell 1945, 1947; Viets 1928b; Sokolov 1952; Bartsch 1997b; Riesgo et al. 2010). Obviously it is a species of the temperate and Arctic region. A record from the Mediterranean is that of a single deutonymph which had been extracted from sediment between rhizomes of *Posidonia* sp., collected in September 1995 by T. Wittling in 6 m depth via SCUBA-diving in the Tyrrhenian Sea, near the island Giglio, in a bay which is opening to the northeast. The sample, preserved in ethanol, had been taken to Hamburg (Germany), there washed over a 100 µm sieve and the residue in the sieve scanned for halacarid mites. Contamination in the laboratory is unlikely as no material from the North Atlantic, North Sea or Baltic had been studied neither at

that time, nor in the preceding months. As there are no previous records of this species from the Mediterranean (cf. Viets 1940; Mari & Morselli 1990), it is likely to expect that the species is a neozoan in the Mediterranean, introduced by Man.

Records of *Thalassarachna affinis* are at present restricted to the eastern part of the North Atlantic, most are from the Mediterranean and Black Sea (Trouessart 1896; André 1928; Viets 1928a, 1940; Bartsch 1986, 2004b). Pugh & King (1985) mentioned a single individual of *T. affinis* (*Halacarellus basteri* v. *affinis*) from Great Britain (Bristol Channel, Wales). The individual may be a *T. litoralis*. According to a recent re-examination of unidentified juveniles mentioned by Bartsch (1985), several of these *Thalassarachna* juveniles, collected in the Irish Sea, most likely are representatives of *T. litoralis*, and consequently we can expect that species to occur in the Bristol Channel, too. Independent of the status of that specimen from Great Britain, *T. affinis* seems to be a species of warm-temperate areas.

Acknowledgements

Thanks are due to S. Toussaint for loan of the holotype *Thalassarachna litoralis*, Dipl. Biol. T. Wittling for collecting mites in the Tyrrhenian Sea, and Roy Erling Wrånes for sending me the photo of the *Thalassarachna basteri* party from the Slettnes Biological Research Station in Gamvik, Norway.

References

- André, M. (1928) Contribution à l'étude des Halacariens des environs de Monaco. *Bulletin de l'Institut Oceanographique de Monaco*, 511, 1–15.
- André, M. (1946) Halacariens marins. *Faune de France*, 46, 152 pp.
- Bartsch, I. (1972) Ein Beitrag zur Systematik, Biologie und Ökologie der Halacaridae (Acari) aus dem Litoral der Nord- und Ostsee. I. Systematik und Biologie. *Abhandlungen und Verhandlungen des Naturwissenschaftlichen Vereins zu Hamburg, Neue Folge*, 16, 155–230.
- Bartsch, I. (1974) Ein Beitrag zur Systematik, Biologie und Ökologie der Halacaridae (Acari) aus dem Litoral der Nord- und Ostsee. II. Ökologische Analyse der Halacaridenfauna. *Abhandlungen und Verhandlungen des Naturwissenschaftlichen Vereins zu Hamburg, Neue Folge*, 17, 9–53.
- Bartsch, I. (1976) Zur Systematik und Verbreitung der *Halacarellus*-Arten (Halacaridae, Acari) an der Bretagne-Küste. *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg*, 5, 97–109.
- Bartsch, I. (1985) Halacaridae (Acari) from the Strangford Narrows and the Irish Sea. *Proceedings of the Royal Irish Academy, Section B*, 85, 21–35.
- Bartsch, I. (1986) *Halacarellus affinis* (Halacaridae, Acari), eine Wiederbeschreibung. *Acarologia*, 27, 247–250.
- Bartsch, I. (1991) On the identity of some North Atlantic halacarid species (Acari). *Journal of Natural History*, 25, 1339–1353.
- Bartsch, I. (1997a) *Thalassarachna* and *Halacarellus* (Halacaridae: Acari): two separate genera. *Journal of Natural History*, 31, 1223–1236.
- Bartsch, I. (1997b) *Copidognathus biodomus* (Halacaridae: Acari), a new species from eastern Canada. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 94, 153–159.
- Bartsch, I. (1998) Halacarinae (Acari, Halacaroidae) from the northwestern Black Sea: A review. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 95, 143–178.
- Bartsch, I. (2001) *Halacarus* Gosse, 1855, *H. ctenopus* Gosse, 1855 and *Thalassarachna* Packard, 1871 (Arachnida, Acari): proposed conservation of usage of the name by designation of a neotype for *H. ctenopus*. *Bulletin of zoological Nomenclature*, 58, 202–205.
- Bartsch, I. (2003) *Halacarus ctenopus* Gosse, 1855 (Acari, Halacaridae), description of the neotype. *Acarologia*, 43, 23–28.
- Bartsch, I. (2004a) Geographical and ecological distribution of marine halacarid genera and species (Acari: Halacaridae). *Experimental and Applied Acarology*, 34, 37–58.
- Bartsch, I. (2004b) The Black Sea halacarid fauna (Halacaridae: Acari): faunal comparison with the Mediterranean, Eastern North Atlantic, North Sea and Baltic and reflection on its origin. *Mitteilungen aus dem Museum für Naturkunde in Berlin, Zoologische Reihe*, 80, 143–158.

- Bartsch, I. (2009) Checklist of marine and freshwater halacarid mite genera and species (Halacaridae: Acari) with notes on synonyms, habitats, distribution and descriptions of the taxa. *Zootaxa*, 1998, 1–170.
- Bartsch, I. & Rybakova, E. (2015) Halacaridae (Arachnida: Acari) from Lost City, the Mid-Atlantic Ridge, description of new species. *Cahiers de Biologie marine*, 56, 177–193.
- Caspers, H. (1951) Quantitative Untersuchungen über die Bodentierwelt des Schwarzen Meeres im bulgarischen Küstenbereich. *Archiv für Hydrobiologie*, 45, 1–192.
- Chatterjee, T., Fernandez-Leborans, G. & Marshall, D.J. (2014) New records of ciliate epibionts (Ciliophora: Suctorea) from Brunei Darussalam. *Marine Biodiversity Records*, 70, e87, 1–4.
- Durucan, F. & Boyacı, Y.Ö. (2014) First record of *Thalassarachna affinis* Trouessart, 1896 (Acari: Halacaridae) from the Marmara Sea, Istanbul. 2.2: 199–200. In: Kapisir, K., Apostolidis, C., Baldaconi, R., Başusta, N., Bilecenoglu, M., Bitar, G., Bobori, D.C., Boyacı, Y.Ö., Dimitriadis, C., Djurović, M., Dulčić, J., Durucan, F., Gerovasileiou, V., Gökoğlu, M., Koutsoubas, D., Lefkadiou, E., Lipej, L., Marković, O., Mavrič, B., Özvarol, Y., Pesic, V., Petriki, O., Siapatis, A., Sini, M., Tibullo, D., Tiralongo, F. (Eds). *New Mediterranean Biodiversity Records (April, 2014)*. *Mediterranean Marine Science*, 15 (1), pp. 198–212.
- Gimbel, O. (1938) Eine neue Halacaridenvarietät von der Murmanküste. *Zoologischer Anzeiger*, 122, 1–7.
- Gosse, P.H. (1855a) Notes on some new or little-known marine animals (II). *Annals and Magazine of Natural History, Series 2*, 16 (91), 27–36.
- Gosse, P.H. (1855b) Notes on some new or little-known marine animals (III). *Annals and Magazine of Natural History, Series 2*, 16 (91), 305–313.
- Green, J. & MacQuitty, M. (1987) Halacarid Mites. *Synopses of the British Fauna, New Series*, 36, 178 pp.
- Järvekülg, A. (1965) Mere- ja riimveeselgrootue levikupiiridest Matsalu Lahes. *Eesti NSV Teaduste Akademia Toimitted (Ivestija Akademii Nauk Estonskoi SSR, Serija Biologičeskaja)*, 14 (3), 362–365 (with Russian and German summary)
- Johnston, G. (1836) Illustrations in British zoology. *Magazine of Natural History*, 9 (63), 353–357.
- Kirchner, W.-P. (1967) Spermatophoren bei Halacariden (Acarina). *Naturwissenschaften*, 54, 345–346.
- Kirchner, W.-P. (1969) Zur Biologie und Ökologie von *Halacarus basteri* Johnson 1836 (Acari, Trombidiformes). *Oecologia (Berlin)*, 3, 56–69.
- Konnerth-Ionescu, A. (1968) Contribution à l'étude des halacarides du littoral roumain. *Travaux du Muséum d'Histoire Naturelle Grigore Antipa*, 8, 375–379.
- Linnaeus, C. (1735) *Systema naturae, sive regna tria naturae systematice proposita per classes, ordines, genera & species*. Lugduni Batavorum Theodorum Haak 14 pp.
- Lohmann, H. (1889) Die Unterfamilie der Halacaridae Murr. und die Meeresmilben der Ostsee. *Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere*, 4, 269–408.
- Lohmann, H. (1893) Die Halacarinen der Plankton-Expedition. *Ergebnisse der Plankton-Expedition der Humboldt Stiftung*, 2. G. a, 11–95.
- Lohmann, H. (1901) Halacaridae. *Das Tierreich*, 13, 273–305.
- Lohmann, H. (1907) Die Meeresmilben der Deutschen Südpolar-Expedition 1901-1903. *Deutsche Südpolar-Expedition 1901–1903*, 9, 361–413. G. Fischer, Jena.
- Makarova, N.G. (1978) [Marine mites (Acarina, Halacaridae) from the intertidal zone of the Gulf of Anadyr (Bering Sea).] In: Kussakin, O.G. (Ed.), *The intertidal zone of the Bering Sea and south-eastern Kamchatka*. Publishing House Nauka, Moscow, pp. 131–149. (In Russian, with English summary)
- Makkaveeva, E.B. (1966) K biologii *Halacarellus basteri* (Johnston) v Černom More. In: *Rapsredelnie bentosa i biologiya donnih zivotnih v juznah moryah*. Akademia Nauk Ukrainskoi SSSR. Kiev, pp. 38–45.
- Mari, M. & Morselli, I. (1990) Idrachnelle ed alacaridi (Acari) di una prateria di *Posidonia oceanica* (L.) delile dell'isola d'Ischia. *Atti della Societa Toscana di Scienze Naturali, Memorie, Serie B*, 96, 243–256.
- Newell, I. M. (1945) The status of *Thalassarachna verilli* Packard 1871, *Halacarus* Gosse 1855, and *Copidognathus* Trouessart, 1888 (Acari Halacaridae). *Transactions of the American Microscopical Society*, 64, 58–62.
- Newell, I. M. (1947) A systematic and ecological study of the Halacaridae of eastern North America. *Bulletin of the Bingham Oceanographic Collection*, 10, 1–232.

- Nikitina, M.P. (2013) Sezonnaja dinamika čislennosti i žiznennye morskikh klešči litoralnih fykoidov v okrestnostjah BBS. *Moskovskii Gosudarstvennii universitet imeni M.B. Lomonosova. Biologičeskii fakultet*, 207–210, Table 1.
- Packard, A.C. (1871) On insects inhabiting salt water. *American Journal of Science*, 3, 100–110.
- Petrova, A. (1973) On halacarid migration into freshwaters. In: Daniel, M. & Rosicky, B. (Eds), *Proceedings of the 3rd International Congress of Acarology, Prague, 1971*. S. Junk, Den Haag, pp. 169–171.
- Pugh, P.J.A. & King, P.E. (1985) Vertical distribution and substrate association of the British Halacaridae. *Journal of Natural History*, 19, 961–968.
- Purasjoki, K.J. (1947) Quantitative Untersuchungen über die Mikrofauna des Meeresbodens in der Umgebung der Zoologischen Station Tvärminne an der Südküste Finnlands. *Commentationes biologicae*, 9 (14), 1–24.
- Riesgo, A., Pérez-Portela, R. & Arroyo, N.L. (2010) Halacarid mites (Acari: Halacaridae) associated with a North Atlantic subtidal population of the kelp *Laminaria ochroleuca*. *Journal of Natural History*, 44 (11), 651–667.
- Schröder, O. (1907) Die Infusorien der Deutschen Südpolar-Expedition 1901–1903. *Deutsche Südpolar-Expedition 1901–1903*, 9, 351–360. G. Fischer, Jena.
- Schulz, E. (1933) Zur Halacaridenfauna der Kieler Bucht. *Schriften des Naturwissenschaftlichen Vereins für Schleswig-Holstein*; 20, 96–105.
- Sokolov, I.I. (1952) Vodjanye klešči. II. Halacarae. *Fauna SSSR*, 5, Izdatelstvo Akademii NAUK SSSR, Moskva, Leningrad, 201 pp.
- Straarup, J.-O. (1968) On the life cycles of halacarids (Acari) from the Öresund. *Ophelia*, 5, 255–271.
- Trägårdh, I. (1905) Monographie der arktischen Acariden. *Fauna Arctica*, 6, 1–78.
- Trouessart, E.L. (1888) Note sur les acariens marins recueillis par M. Giard au laboratoire maritime de Wimereux. *Comptes Rendus de l'Académie des Sciences, Paris*, 107, 753–755.
- Trouessart, E. (1889) Sur les acariens marins des côtes de France. *Comptes Rendus de l'Académie des Sciences, Paris*, 108, 1178–1181.
- Trouessart, E. (1896) Description d'espèces nouvelles d'acariens marins. *Bulletin de la Société Entomologique de France*, 1896, 250–253.
- Viets, K. (1927) Die Halacaridae der Nordsee. *Zeitschrift für Wissenschaftliche Zoologie*, 130, 83–173.
- Viets, K. (1928a) Wassermilben aus dem Schwarzen Meer, dem Kaspischen Meer und dem Aral-See. *Abhandlungen. Naturwissenschaftlicher Verein zu Bremen*, 27, 47–80.
- Viets, K. (1928b) Halacaridae von der Murman-Küste, aus dem Weissen Meer und von Nowaja-Semlja. *Issledovanja Morei SSSR*, 6, 81–88.
- Viets, K. (1940) Meeresmilben aus der Adria (Halacaridae und Hydrachnellae, Acari). *Archiv für Naturgeschichte, (Neue Folge)* 9, 1–135.
- Vitzthum, H. (1932) Acarinen aus dem Karst (Excel. Oribatei). *Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere*, 63, 681–700.
- Vorobyeva, L.V. & Yaroshenko, N.A. (1979) [Halacaridae of the north-western part of the Black Sea.] *Gidrobiologičeskii Zhurnal (Kiev)*, 15 (6), 29–33. (In Russian with English summary)