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Page(s): Page 345, Page 346, Page 347, Page 348, Page 349, Page 350, Page 351, Page 352, Page 353, Page 354, Page 355, Page 356

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**Two New Forms of Choniostomatidæ:
Copepoda Parasitic on Crustacea Malacostraca
and Ostrocooda.**

By

H. J. Hansen, D.Sc., F.M.L.S.

(Copenhagen).

With Plate 22.

DURING a stay—in August, 1902—in the house of my friend, the Rev. Canon A. M. Norman, I had the good luck to discover, in his splendid collection, a new parasitic Copepod on a couple of specimens of a rare Norwegian Amphipod. He asked me to work out the parasite, which I promised, and the result is given here.

Since the present writer, six years ago, published the book, 'The Choniostomatidæ,' Copenhagen, 1897 (4to), no species has been added to this rich and very interesting family of parasitic Copepoda, though the animals do not seem to be so rare as probably generally believed. In the preface to the book named I stated that in the course of 1895-97 I had found, "on the material brought home from the sea near Iceland and Greenland by the 'Ingolf' expedition, several new forms which cannot be included in the present treatise," and since 1897 I have accumulated additional material. During the study of the species from Canon Norman's collection I felt that a paper dealing only with that single form

would be rather meagre, but for various reasons it was impossible for me to work out the whole new material collected since 1895. Under these circumstances I resolved to embody here one very interesting form, secured on animals from New Zealand, and extending in various respects our knowledge of the family. "The Choniostomatidæ, a family of Copepoda, parasitic on Crustacea Malacostraca" is the complete title of my above-mentioned book, but the new form from New Zealand of the same family lives on a species of Ostracoda, an order of Crustacea Entomostraca. Besides, nobody has ever, as far as I know, found any Copepod parasitic on any species of Ostracoda, while on three forms belonging to this order G. O. Sars has discovered one, and Th. R. R. Stebbing a second, and G. W. Müller a third species of the Cryptoniscinæ (a sub-family of parasitic Isopoda); the two first-named authors have produced full description of the parasites, while that found by Müller was left undescribed.

The following descriptions of the two forms were written nearly in conformity to those in my earlier monograph.

Sphæronella norvegica, n. sp.

Pl. 22, figs. 1*a*—1*g*.

Female.—The specimen drawn (fig. 1*a*) and dissected measured 1.7 mm. in length, and nearly the same in breadth; the two other specimens seen are almost similar in size. The head is proportionately very small and well-defined from the trunk.

The frontal margin (fig. 1*d*) is well developed, adorned with a row of very short hairs, but the most lateral portion of the margin, towards the base of the antennulæ, is naked. The antennulæ (*a*) are long, three-jointed, with the terminal setæ very long; the third joint has, a little before the middle, an olfactory seta (*s*), which is a little shorter than the terminal ones. The antennæ (*b*) are of moderate length, three-jointed; the joints decreasing strongly in length from the first to the

third, which terminates in a seta. (In the specimen dissected the left antennæ had been lost, while the right one is shown on the left side of the figure.) The mouth is good-sized, with a broad border. The maxillulæ (*d*) with a well-developed "additional branch" (*d*¹). The maxillæ (*e*) are large; the basal joint is robust and long, with a rounded protuberance on the lower side, a little from the base and from the outer side, but without hairs, excepting the usual row along the distal margin. The maxillipeds (*f*) are long; the basal joint moderately robust without hairs; the three other joints are well marked off from each other; the terminal one is slender, and terminates in a few exceedingly fine, spiniform processes. The submedian skeleton presents two pairs of conspicuous chitinous strips; each of these is sinuate, and, besides, anteriorly bent very sharply in an acute angle, thus forming an outer short strip turning outwards and backwards; the subtriangular space between the outer set of these strips, situated near the posterior admedian angle of the maxillæ, is adorned with very long hairs, and some moderately long hairs are also found at the posterior margin of the maxillæ. Behind the maxillipeds two transverse strips are seen; rather near the middle the strips on the same half of the animal run together, forming a single strip which bends backwards and inwards, uniting itself in the middle line with the corresponding one from the other half; the front one of these transverse strips is adorned with some long hairs, and close to the posterior strip or a little removed from it some similar hairs are seen. The lateral margin of the head with a fringe of moderately long hairs. On the dorsal surface, a little behind the frontal margin, a rather small, oblong, transverse area, set with numerous very short hairs, is seen about equidistant from the middle line, and from the base of the antennula. The trunk is on the anterior half, and especially on the anterior third, set with a good number of rather conspicuous, simple, stiff hairs; on the posterior half these hairs are much less numerous, shorter, and not easily observed; the trunk-legs are exceedingly small, but one of each pair was found.

The genital area (fig. 1 *e*) is a little broader than the head (it is not visible in fig. 1 *a*, being situated above and in front of the posterior outline of the body); it is a transverse plate with six rounded angles, but not very regularly shaped; the posterior margin of the plate is straight, about as long as the postero-lateral margin, which is longer than the antero-lateral one; the front margin is wanting, the large anterior middle portion of the area being occupied by membranous skin. The plate is adorned with a moderate number of short, stiff hairs, each originating from a conspicuous "foot," and these hairs are spread very irregularly. The genital apertures (*g*) are rather curved, and they diverge a little with their anterior third; they are placed in the penultimate fourth part of the plate, and the distance between them at the middle is somewhat shorter than the length of one of them. The caudal stylets (*st*) are situated close together, at a good distance in front of the posterior margin of the plate, a little behind the genital apertures.

Male.—The single specimen (figs. 1 *b*, 1 *f*, and 1 *g*) measures .3 mm. in length, and .213 mm. in breadth; it is thus nearly six times shorter, and between seven and eight times narrower than the female. Seen from below the head occupies a little more than one third of the length; its lateral outlines from the antennæ backwards diverge rather feebly, but where the subglobular trunk begins the lateral margins begin to diverge strongly. The frontal border has a fringe of fine hairs. The antennulæ are rather slender, of moderate length, very distinctly three-jointed; the setæ on the distal front angle of the first joint, and especially those at the apex of the third joint are long. The antennæ (*b*) are rather well developed, nearly as in the female; the basal joint is much longer than the second, which is longer than the third, the latter one is short and terminates in a rather short seta. The border of the mouth is moderately broad. The maxillulæ (*d*) have a well-developed additional branch (*d*¹). The maxillæ (*e*) are medium sized, the basal joint with a rounded protuberance on the posterior side. The submedian skeleton has a chitinous

longitudinal strip at the inner base of the maxillæ, and this strip is posteriorly scarcely produced into a free process; from the anterior part of the inner margin of this strip projects another less developed shorter strip backwards and a little inwards; no processes are found between the maxillipeds, but behind their insertions is seen a narrow, transverse strip, which, at the middle, is curved a little backwards, and behind this strip still another very narrow strip, interrupted at the middle, constitutes the limit between head and thorax. Inside the postero-interior angle of each maxilla a short transverse row of long hairs is found. The maxillipeds (*f*) consist of four distinct joints; the basal joint is rather long and slender without hairs; the fourth joint has the end obtuse, and adorned with a few fine spines. The lateral margin of the head has a row of moderately long hairs, and this row begins above the insertion of the antennula; the head has besides a short oblique, transverse, dorsal area with rather short hairs inside and a little in front of the anterior end of the insertion of each antennula (fig. 1 *g*), and a short row of hairs on the dorsal surface rather near the middle line and somewhat in advance of the thorax. The trunk is everywhere, with exception of a narrow and badly-defined transverse belt at the base on the lower surface, clothed with rather long setiform hairs, which show an interesting structure. From tiny transverse chitinous knots two or three hairs originate, and the middle one is much longer than the others; besides, the knots are arranged in short or moderately long, more or less regular, transverse, or somewhat oblique rows; the length of this clothing is about the same on all parts of the trunk and nearly as long as the diameter of the basal joint of the maxillipeds. The two pairs of trunk-legs are nearly similarly shaped, both consisting of a single truncate joint; the joint of the first pair (l^1) is somewhat longer than thick, and not as thick as that of the second pair (l^2), which is as long as thick; the joint of the first pair terminates in two setæ, one only a little shorter than the basal joint of the maxillipeds, while the other seta is about three times shorter; the joint of

the second pair with two nearly similar setæ, but its long seta is scarcely as long as that on the first pair of legs. The caudal stylets (*st*) are rather similar to the second pair of legs, each terminating in two or three setæ, the longest of which is a little shorter than the corresponding one of the legs, while the other setæ are more than half as long as the long seta.

Ovisacs.—The ovisacs belonging to two females differed little in size, while those of a third female differed considerably from each other, but that was to a certain degree due to the different stage of development of their contents. The two ovisacs figured (fig. 1 *c*) give the average size of them as compared with the female (fig. 1 *a*) and the male (fig. 1 *b*), all being drawn with the same degree of enlargement; the large one of these ovisacs measures nearly .7 mm. in diameter. The ovisacs are generally subglobular, sometimes irregularly flattened from pressure; each contains a rather high number of eggs.

Larva and Post-larval Development.—Unknown.

Habitat.—Among several specimens of *Rhachotropis leucophthalmus*, G. O. Sars, secured by Canon A. M. Norman in Thronhjemsfjord (Norway) from a depth of 250—300 fathoms, I found two adult females with this parasite. In one marsupium I found one female, one male and twelve ovisacs, the latter ones all adhering to each other; in the other marsupium was one female with six free ovisacs. The single male was very dirty, and, hoping to get some fine specimens, I applied myself to Prof. G. O. Sars, who, with his usual courtesy, lent me his whole material of that rare Amphipod for inspection. I found only one infested specimen, with one female, eight free ovisacs, but no male. (I succeeded afterwards in cleaning the male rather well with two brushes, each consisting of one short and fine hair fixed in a small stick).

Remarks.—The male is large in proportion to the same sex in most other species of *Sphæronella*, and it is much larger than one of the eggs; by the shape of the legs and

the length of the seta on these appendages and on the caudal stylets it differs considerably from all other forms hitherto known. Furthermore, I have not observed the existence of two hairy areas in front and two transverse rows of hairs more backwards on the upper surface of the head in the male of any other species. The structure of the hairs on the trunk is rather similar to that met with in *Sph. Giardii*, H. J. H. The female is, as usual, less characteristic than the male, but presents yet some distinguishing features: in most other species the trunk is almost totally naked; in no other female I observed two hairy areas on the upper surface of the head behind the frontal margin, and the distribution of hairs on the lower surface of the head is rather similar to that in *Sph. intermedia*, H. J. H., but differing from most other species; the shape of the submedian skeleton and of the transverse strips just in front of the trunk was not observed in any other form.

Sphæronellopsis, n. gen.

Female.—The body is more or less ovate. The head is rather large, well defined from the trunk. The frontal border is at most feebly developed, while the lateral margins are wanting. The antennulæ are small, two-jointed; the antennæ wanting. The mouth of moderate size; its border is narrow. The maxillulæ are well developed, with a good-sized additional branch. The maxillæ are rather small, but normally shaped. The maxillipeds consist of only three joints: the basal one is short, but very thick, inflated; the second joint, which certainly is formed by the complete fusion of two joints, is rather short; the terminal joint is nearly rudimentary. The trunk has two quite rudimentary pairs of legs, each consisting of a joint with one terminal seta. The genital area is well developed, situated on the posterior surface of the body, nearly as long as broad; the genital apertures are situated as in *Sphæronella* rather

near each other and in the posterior part of the area, but from its anterior (lower) portion a broad, low protuberance (fig. 2 *g, p*) is directed downwards, the lower rounded or rather truncate end of which protrudes freely and conceals the anterior (lower) margin of the area itself and a small portion of the skin in advance of that area. The receptacula seminis (fig. 2 *g, r*) are very long, slender, sausage-shaped, and very curved, situated beneath the middle of the area, and their entrances, which could not be distinguished with certainty, must be rather near the genital apertures. The caudal stylets (fig. 2 *g, st*) are completely fused with each other in nearly their whole length.

Male.—Unknown.

Ovisacs.—As in *Sphæronella*, and deposited freely.

Larva and Post-larval Development.—Unknown.

Habitat.—The upper posterior space between the shells of Ostracoda, hitherto found only at New Zealand.

Remarks.—Unfortunately only the female and the ovisacs of one species are known, while the male is unknown. The female is similar and closely allied to the rich genus *Sphæronella*, but differs in the following features: the fusion of the caudal stylets, the genital area being furnished with a large protuberance, and the sausage-shaped, strongly curved receptacula seminis. Besides, the habitation of the parasite on Ostracoda is a most remarkable feature.

Sphæronellopsis littoralis, n. sp.

Pl. 22, figs. 2*a*—2*g*.

Female.—The largest specimen (fig. 2 *b*), which scarcely had begun to deposit ovisacs, measured .57 mm. in length to the end of the projecting mouth and .41 mm. in breadth, but the body was rather depressed; another similarly depressed female (fig. 2 *a*), found together with eight ovisacs and with a much smaller half evacuated female, measured .48 in length

and .4 mm. in breadth, but in this specimen the mouth turns essentially downwards. The head is sharply defined from the thorax, broader than long, without lateral borders. The antennulæ (fig. 2 *e*) are small, two-jointed, the second joint not well defined, as long as or shorter than the first, with an olfactory seta (*s*) nearly longer than the whole antennula, and besides with two, three, or four acute, somewhat shorter setæ. The maxillæ (*e*) have no protuberance or hairs on the rather slender basal joint; the second joint is thick at the base. The maxillipeds (*f*) are rather anomalous; the basal joint is short, but exceedingly thick, only very little longer than thick, with the admedian margin concave and the outer side strongly vaulted; a transverse row of short hairs is seen on the inner part of the lower side on its proximal half, and a similar and little longer row at the distal margin near the articulating membrane. The second joint is rather short, and not completely regularly shaped; the third joint is shaped nearly as a short thick claw inserted on the anterior surface of the second joint near its end. The submedian skeleton is not very strongly developed, without processes. Head and thorax without hairs. The genital area (fig. 2 *g*) is about half as broad as the base of the head, nearly as long as broad, with the outline almost circular, but somewhat emarginate behind; the protuberance (*p*) mentioned in the diagnosis of the genus is well chitinised, especially the lateral parts of its proximal half, but the lateral part of the area itself is less chitinised, and the portion in the main covering the muscle of each half, is rather thin-skinned. The protuberance is distally either rounded or truncate, with the angles rounded. The genital apertures (*g*) are long, strongly curved, their most anterior (lower) portion is nearly parallel, and the distance between them is here slightly more than one half of their length, while the distance between their opposite ends is about two and a half times longer than one of them. The whole area is naked. The muscles (*m*) to the antero-lateral half of the frame of each aperture are directed somewhat outwards and essentially forwards. The sausage-

shaped, strongly sinuate receptacula (*r*) are situated at the admedian margin of the muscles; on the figure the two receptacula are very differently curved; they were drawn in the position observed, but I believe that the receptaculum on the left half of the figure is the normal one. The caudal stylets (*st*) are fused with each other, together a little broader than long, more or less incise behind, and from the end of each half originates a comparatively strong seta which is from two to almost three times longer than the stylets; these are inserted on the posterior (upper) margin itself of the chitinised area.

Male.—Unknown.

Ovisacs.—They differ very considerably in size, and are subglobular, shortly ovate or somewhat flattened. I have figured, with the same degree of enlargement, one of the smallest (fig. 2 *c*) and one of the largest (fig. 2 *d*) ovisacs together with the largest of the two females found together with them; the greatest dimension of the smallest ovisac is .2 mm., of the largest one .27 mm. The eggs are proportionately large, in one of the smallest ovisacs about eight or nine, in a large one between twenty and thirty.

Larva and Post-larval Development.—Unknown.

Habitat.—Years ago I discovered this species in three specimens of the Ostrocod *Sarsiella hispida*, Brady, from Akaroa Harbour (New Zealand), six fathoms. In two specimens I found only a female without ovisacs, in the third specimen one rather large female, one very small, half evacuated female, and eight ovisacs. Between several hundreds of *Sarsiella Hanseni*, Brady, from Lyttleton Harbour (New Zealand), one to five fathoms, I found a good number of *Sarsiella hispida*, Brady, and two of these infested, in one specimen a female without ovisacs, in the other one very small female with nine ovisacs. The parasite, surrounded by its ovisacs, is placed in the posterior upper half of the space between the shells, essentially above the posterior half of the body of the Ostracod; some of the ovisacs were also found within the hollow pro-

tuberances projecting from the upper postero-lateral angles of the shell in that species of *Sarsiella*. I looked in vain for males. It is interesting that while several infested specimens of *S. hispida* were discovered, I did not find the parasite on any specimen of *S. Hanseni*, which was taken together with the other form, but was much more abundant, and I have inspected a good number of the latter species. Prof. G. S. Brady established both species of Ostracoda on material from the Copenhagen Museum.

Remarks.—The rich material of both species of *Sarsiella* was procured to our Museum in the following way. I wrote an instruction to H. Suter, Esq., how he should deal with the bottom material and send it to us preserved in spirit; in sieved mud received from him I found a good number of tolerably preserved specimens of these Ostracoda and of numerous other Crustacea, many of which were new to science. The above-described parasite must be rather easy to secure by zoologists living in New Zealand or staying there during some time. I will exhort these colleagues to take up the investigation and look for males and stages of development. I suppose that if my own material had been somewhat better preserved or still richer I should have been able to find these tiny animals, which probably were fallen out before my inspection. My earlier monograph of the family gives full information on the mode of proceeding applied by me in order to find and deal with such minute forms without damaging them. I am inclined to believe that several species of Ostracoda inhabiting other places in the world are infested with hitherto unknown species of *Sphæroneelloides*. Our knowledge of parasitic Copepoda is still in its infancy, and numerous interesting, even startling, discoveries in this field are to be done by zoologists in the future.

EXPLANATION OF PLATE 22,

Illustrating Mr. H. J. Hansen's paper on "Two New Forms of Choniostomatidæ."

FIG. 1.—*Sphæronella norvegica*, n. sp.

FIG. 1 *a*.—Female, from below. $\times 28$. l^1 , leg of the first pair; l^2 , leg of the second pair.

FIG. 1 *b*.—Male, from below. $\times 28$.

FIG. 1 *c*.—Two ovisacs. $\times 28$.

FIG. 1 *d*.—Head of the female, from below. $\times 322$. *a*. Antennula. *b*. Antenna. *c*. Mandible. *d*. Maxillula. d^1 . Additional branch of the maxillula. *e*. Maxilla. *f*. Maxilliped. *s*. Olfactory seta on the last joint of the antennula.

FIG. 1 *e*.—Genital area of the female. $\times 182$. *g*. Genital aperture. *m*. Muscle to the outer strip of the frame around the aperture. *r*. Receptaculum seminis indicated with dotted outline, as seen through the skin (the other receptaculum is omitted). *st*. Caudal stylet.

FIG. 1 *f*.—Male, from below. $\times 170$. *b*. Antenna. *d*. Maxillula. d^1 . Additional branch of the maxillula. *e*. Maxilla. *f*. Maxilliped. l^1 . Leg of first pair. l^2 . Leg of second pair. *st*. Caudal stylet.

FIG. 1 *g*.—Head of the same male, from the side. $\times 222$. The lettering as in Fig. 1 *f*.

FIG. 2.—*Sphæronellopsis littoralis*, n. gen., n. sp.

FIG. 2 *a*.—Female, from below. $\times 71$. *g*. Genital area.

FIG. 2 *b*.—Large female, with the head directed forward. $\times 71$. Of the trunk-legs, only those on the right side of the figure are shown.

FIG. 2 *c*.—Small ovisac. $\times 71$.

FIG. 2 *d*.—Large ovisac. $\times 71$.

FIG. 2 *e*.—Head of a female, from below. $\times 240$. The lettering has the same significance as on Fig. 1 *d*.

FIG. 2 *f*.—Anterior part of the head of the female represented in Fig. 2 *b*, showing the border of the mouth and the maxillulæ, with their three branches or setiform processes. $\times 285$.

FIG. 2 *g*.—Genital area of a female. $\times 325$. *g*. Genital aperture. *m*. Muscle opening that aperture. *p*. Anterior (lower) end of the large protuberance, met with only in this genus. *r*. Receptaculum seminis. *st*. Caudal stylets fused with each other.