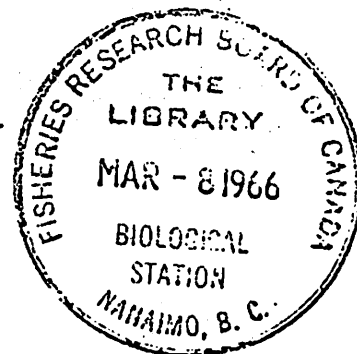


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FILES IUS

A study of the crabs of Kamchatka, also the isopods, the entomostracans, and the microscopic phosphorescent marine Cancelli with an Appendix concerning the mites and ticks of Kamchatka

By Tilesius

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On the cover, last section, title of the study in question:

Study concerning the Crabs of Kamchatka, the Onisci and the Entomostracean phosphorescent minute crabs of microscopic size. (Cancelli), with an Annexe, showing the Acari and Ricini of Kamchatka.

Written by Tilesius

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VIII

The Entomostraceans

Caligus

Table VIIIth, Figures Nos. 1, 2, 3, 4, 5, 6.

Characteristics of this Genus.

Two (?) setaceous antennae, eight or ten (?) legs, two marginal eyes, with one-piece carapace.

O.F. Mueller Entomostr. page 129.

Their carapace is shielded, the fish-dwelling parasitic insets of this Genus belong to the Branchiopodal (legs issuing from the gills) Entomostracean (division, of Crustaceans beset with simple body structure), it may be stated that by their shield-like carapace they are related to the Limuli, but by the occurrence of their ovaries on a pair of elongated tubules (pp) they are also similar to the Lerneae. The eyes and the marginal nostrils (or sensory growths) are distal, (ll Fig. Nos. 1 and 3a) perceptible by microscope only, and they are joined to the base of the lateral and very short antennae or cirrhi (tendrils, thread-like, flexible appendages).

The name of Caligus was given to this Genus by Mueller, on account of their dark colored eyes, and Monoculus (one-eyed) by Linneus, respectively.

There is no head, but only a shield which, on account of the legs joined beneath, (subnect) one might call it with more reason a chest. The chest, (if you adopt this name) from this part is wider than the abdomen, and not quite orbicular. (not quite round shaped) The abdomen and cauda differ from one another in many respects. These insects adhere to the fish externally remaining fixed between the scales and since the Oriental Ocean abounds with Salmon and fish of the Trout family, these insects might also be found in abundance on their vectors.

These species are diversified, following the warmer or colder climatic conditions where they are actually distributed. Accordingly, I saw different species, namely, some dwelling on the Salmon of Kamchatka, and again others on the Coryphaenae and the Squali of Brazil. They cling so tightly to the Salmon that even with a sharp scalpel it is difficult to loosen and remove them, and once removed, assuredly, they change place with fast steps on the scaly surface of the fish's body.

The running motion of this species is performed really fast, and by alternative interruption of their locomotion while advancing on the body surface of fish, and in the water itself as well, they move upwards also with speed, and then turn and fall downwards. They are attached to the scales of fish with niple-like suctional glands; producing a vacuum, and besides, being also provided with marginal notched processes, by means of which they

adhere to the less smooth parts of the body surface.

Caligus Curtus (Short Caligus)

Table VIIIth Fig. Nos. 1 and 2.

Caligus, with shorter body, and cauda split on two, with one piece carapace.

O.F. Mueller Entomost. t. XXI

One-eyed, foliaceous (consisting of thin layers) Linn. Fauna of Sweden	2044
One-eyed, living on fishes " " "	2045
Two-eyed, living on fishes, Study on the Zoology of Denmark	2408
Two-eyed, living on fishes, O. Fabricius, Fauna of Groenland	239

Pediculus Pleuronectis and Aselli Baster (Please refer to the next short study 2. page 137, Table 7, Fig. Nos. 9 - 10)

Flinderlaus, Schriften der Berliner

Nat. Forsch; (Writings of the Nature Researcher of Berlin) Issue No. 3, page 44, Table 1, Fig. Nos. 4, 5, 6.

Slightly depressed, membranous body over slightly convex, below concave (Fig. No. 2)

Carapace or shield is orbicular, emarginated in front, (aA) lunated (crescent-shaped) at the rear circled with inward-bent margin and fine notches,

Abdomen (b) which is small, and short consisting of two unequal segments, of which the anterior one is wider, emarginated on both sides, the rear one is longer, truncated (b) and terminated by an elongated cauda.

Cauda (dd) is joined to the trunk of the abdomen in a suspended way (b) seemingly pedicellate, (pedicellatus - being attached by a small stalk-like structure - pedicel) it is dilated in the middle and the apex is split into two diverging ridged filaments, one of them at the tip is ornated with three setae. (Fig. No. 2 dd)

On the inferior part (Fig. No. 2) at the middle point, all along the body, runs an alimentary canal (n) which at the upper part opens with a mouth-like suctorial nipple (n) besides, five pairs of legs are joined to the sides, which are well fitted with claws, that help it to adhere to the scales of fish, and they are provided with comb-like setae, similar to those legs observed on the Tritons.

From the abdomen, or if you like to call it, from the intermediate segment, protrude two even filaments (ee) (which were wrongly called antennae by Linnaeus, Baster and Fabricius of Kilon). They are longer, than the body itself (cc) and look like ovaries. On certain species the occurrence of a single ovary is observable only, on other species both are wanting; their locomotion is performed by jerking and shaking the body violently always holding up the cauda, when moving, and according to my observation the motion itself is achieved through a sort of respiratory mechanism.

The Brasil variety differs by its pectinate antennae (finely toothed as a comb). Many of them I have collected on the Coryphaena Hippurus, off the shores of the Frio Promontory, namely on the 12th and 14th days of December of the year 1803, the other varieties of the same species roaming in the waters of Kamchatka, distinguishable by its very simple and short antennae, and I have captured most of them in quite a great number, between 13 and 23 of the month of August.

O.F. Mueller has seen specimens which had adhered to *Gadus Merlangus* and kept some in water, not refreshed, for twenty four hours, and they have shown so much tenacity in preserving life that they survived that period of time.

O. Fabricius happened to find the same species on the *Pleuronectes* but indeed, their form showed just a few differences, finding them so related to other known individuals that even by means of an autopsy one could not exactly extricate characteristics suggesting a different species.

I do not dispute at all the existence of several species of these parasitic insects, although I did not have sufficient time myself to submit them to a thorough observation by microscope and to establish definite distinction among species, but I came to the conclusion that the *Caligus productus* (Elongated *Caligus*) held by Mueller as a distinct species, is not, but simply that they are the female individuals of the *Caligus Curtus* (Short *Caligus*) and I hold this opinion after having observed the reproductive copulation of these insects; indeed for several days I kept observing short and elongated caligi united, and in a way indeed that the thorax of the elongated individual was affixed to the short individual's cauda; (Fig. No. 6) nevertheless, ^{for} this female individual, which is named by Mueller "elongated" I would keep the name given by Mueller with a specification as such:

Caligus productus (in accordance with my remarks, in my opinion, it is the female of the *Caligus Curtus*)

Fig. Nos. 3 and 4

Caligus, with elongated body, with imbricated (overlapping evenly as fish scales) four-piece cauda. O.F. Mueller, Entomotr. p. 132, Table XXI, Fig. Nos. 3 and 4.

Two-eyed salmon-dwelling species, O. Fabr. Fauna of Greenland p. 264, Hemorlaus, Writings of the Friends of Nature of Berlin I. p. 56. t. 3. Fig. 17.

The stature of the animal is larger and longer than the previous species, with a golden-yellowish colour. Fig. Nos. 3 and 4.

The shield or if you like, the carapace is round-shaped and oblong as well, (Fig. No. 3) convex on the upper part and concave beneath (Fig. No. 4) as was seen in the previous species, and emarginated. The edge is crenulated with very fine hairlike outgrowths; the front part is irregularly truncated and on both side there is a minute tuftlike growth; or if you like, a short small antenna with setae, and supported by underlying lentilshaped tubercule. The shield's cavity contains various organs and by two transversal tendons it is divided into three areas; the anterior part consists of various glands, two feet, armed with claws, and a rostellum turned backwards in the middle (d), as seen on the cimici.

In the middle area, a pair of larger legs are located; both are armed with two hooklike claws, also here are two larger visible glands or you might also call them cotyledones (two lobes with close contact) (Fig. No. 4).

The middle part of the posterior area is occupied by a ciliated lamina (h) which is joined to the body at the base, (of the lamina) by twin tubercules (ii) and in a dilating process, extends over the margin of the clypeus, (shield) the latter is covered by four natatorial or branchial legs.

The abdomen is narrower than the chest, and twice as long as the back; at the base it is covered by an irregularly shaped rectangular lamina which at the apex is split (upwards) up to the middle part, (ef) just beneath this, two corrugated laminae (bf) stretch lengthwise, becoming eroded at the apex; they are distal from the medium of the back; the latter imitates joints of wings, the former simulates elytrea (elytreum meaning a leathery, tough, wing-like process) this insect by these features shows affinity with the coleopteri, as by the rostellum it is related to the hemipteri, as well, it has, therefore, been assigned to the class of the apteri; on the lower part of the body two oblong, longer lamellae extend; (Fig. No. 3) beneath these, lies a blunt, prominulous (prominent in position) lobe.

At both sides of the lobe, the twin folioles of the cauda catch the sight, the superior one is fixed and complete (smooth, not notched) (n) the inferior one is pendulous (attached in a movable way) and denticulated (o) upon both sides two filaments (one each side) or if you like, ovaries recline), which are three times longer than the body itself (ll) and they extend from beneath the lobe.

The abdomen (or stomach) at the base is provided with four small lamellae arranged in a transversal series, out of which the intermediate ones are rounded off and plain; the distal, lateral ones are folded like a fan, or if you like, are foveated. Finally, below this series, four oblong laminae, equal in length, stretch out; the middle of the stomach is hollow (sunken) and bare, carinated (keeled) in the centre. Next to both sides of the keel, a glandule protrudes (mm) and beneath and over the glandules a twin cauda is affixed (one foliole beneath, the other above) made up of a pair of folioles; the superior one is oblong (nn) and suited for sitting upon; the inferior one is fan-shaped ciliated at the apex, the same is pedicellated also and supported underneath at the base. The folioles and the lamellae are mobile.

This minute animal was first collected from the skin of the Squali, where the illustrious Herbst first observed their presence from which they took the name of Femorlaus, but afterwards the same species was also found on the Salmon.

I hardly believe that the caudal filaments (ll Fig. No. 3 and pp. Fig. No. 4) which are three times longer than the body itself, are made to serve as ovaries, and I really do not think that these "tubules" were similar to those filaments seen on the Lerneae; for these setae are very fine, equal in diameter and blunt at the tip, and the structure of their tissue seems to be made up of fibrous-muscular cells, in short, not even by means of a magnifying glass could I detect any vestigial remnants of ovaries on those so called "tubes", but only I found some rudiments of segmentation. In my opinion, the research work on the National History of these minute animals is not completed yet; it may even be rightly stated it has scarcely started, and with this in mind, let me add to the knowledge of these animals by representing hereafter some various forms of Monoculi (captured by collectors on Coryphaenae and Squali of Brazil) made available for examination in Figures Nos. 5 and 6. Especially, Monoculi were found in countless numbers, in an translator: in anatomy sessile means attached directly by its base.5

position, clinging to labrum and theradii, and to the membranous gills-covering part of the carapace (Branchiostegae) of the Hippuridis Coryphaena, some of them having been united in an act of procreative copulation (as shown in Fig. No. 6) some others alone, minor in size, perhaps young ones, all displaying so much diversity and mutability in form and colour, and such rich varieties in form and colour of their body structure, that it seems reasonable to think that they are individuals of the Cyclops species, transmuting or transforming themselves from the stage of Nauplius * through some kind of methamorphoses. More certitude will be acquired with more time and study.

* Footnote to page 361

The Nauplius has been first demonstrated and described by Mueller, as a distinct species; this view has been repeatedly reevaluated by Jurin of Geneva, and afterwards by Rambrodrius (Supplements to the Natural History of the Genus of Monoculi, Halle, Volume 4, published in 1805, page 5) and he concluded, on the basis of all methamorphoses he observed, that there is no distinct species but the one and the same species of Cyclops, goes through various stages of methamorphosis; accordingly, the Nauplii are not distinct species, but individuals of Cyclopeses in transformation. Please refer to Fabricius, Supplements to Systemathical Entomology, 1798, page 306.

Text continues:

I made a sketch, however, in Figure No. 5, in order to demonstrate a species or a variety of the Monoculi, or if you like of the Caligi, which I collected from the fishes of Kamchatka, because I found that its cauda at the apex is rarely forked (uncinulate) and bears double, ciliated antennae; I intend to continue to record such occurrences, so that I may be able to examine the re-occurrence of always similarly constructed (analogous ?) parts of the body.

I have previously collected this kind of crustacean insect in quite a great number from the body of the Brazilian Squali (on the 12th and 14th days of the month of December, in 1803) having found them built in somewhat minor size, and whether they form exactly the same species, I am not prepared to adopt such an opinion, for at that time I was first and foremost very occupied and tied up by examining and making thorough-going research on other matters of Natural Science, which appealed to me with more importance, and in fact, were dearer to me (dealing with the globar, brachial, cochineal (red dyed) Crab, which colours and gives sometimes a blood coloured tone to the frigid waters of the Brazilian Archipelago, etc.) on account of this, I could not manage to submit to observations using a microscope, but a few specimens of small Entomostraceans. (Entomostraca pusilla).

Nevertheless, one thing at least has been revealed to me, through my observations, namely, that all Monoculi collected from different kinds of fish and in a great number, displayed so wide variations in colour, size and form and the structure of parts of their bodies varied to such an extent that they might be considered as distinct species, or, as a matter of fact, diversified individuals as well, or as undergoing in one of the repetative evolutions of several metamorphoses, and again, the short and long Caligi (the latter held by Mueller as such) are only going to merge to a sole and unique species,

by the effects of the law of Nature itself, having been found these different individuals in acts of copulation; during my observations made in Kamchatka, which confirms such an opinion.

Accordingly, I should have described several specimens of these small Entomostraceans of microscopic size, new and phosphorescent ones which, in fact, previously have been already represented and made known by illustrations of the illustrious Herbst and by others as well, and since their specimens have shown a larger size and a close similarity in form to those observed by me, for this reason, it was thought proper not to demonstrate them here. But I might mention concerning them, however, that, viewed in natural size, they displayed somewhat larger capitulum (enlarged part on the tip of the antennae) than the Acimulae (this denomination was not found in any Nomenclature) and their form, inspected by the naked eye, has shown a not quite lineolate shape, which is called comma.

These microscopic, hardly lineolate minute Crabs, hardly visible by the naked eye, are nevertheless dispersed in the waters of the Ocean in an incredibly great number, agitated by the waves, diffusing phosphorescent sparks, fairly lentilshaped in form, three-times larger than themselves, and sometimes propelling out from the boiling waves of the Ocean, scattered all around, resembling tiny sparks. I have scrutinized hundreds of these diversified phosphorescent marine insect by means of a microscope, and from the most different angles, and always realized that these minute Crabs (Cancelli) are smaller than the sparks emitted by them; that is why the minute Crabs (?) (Translator's note: it seems here that there is a hiatus in the logic of the sentence, and not clarified by the tenor of the next statement, between brackets, which read as follows:

(but, by no means the Medusae, of which just recently the British MacCartney* has remarked they produce the most common light phenomena of the Sea) (* See on page 363, the relative footnote, quoted in English) and should I seek in earnest to find the cause of the light effects, emanated by the Medusae, and the other animals, namely Beroë, eggshaped and gelatinous, having eight ciliated sides, paddling and jerking, and their effects and that of the Salpae as well; I would not always find the same explanation and unique cause of various light phenomena observed in various regions of the Seas (2nd footnote at the bottom of page 364 *)

(See the explications in Tables XXI and XXII of Volume IV, concerning the travel of Krusenstern and a study on the phosphorescent (luminous) marine animals).

Yet, if I concur with the observation that rays of light of waves, which are so commonly found and so widespread in the northern seas, but as to the light phenomena of the minute Crabs, indeed, it could very easily be distinguished from other light effects experienced, for the latter, always emit sparks towards the rear, and they seem to throw off sparks (scintillas) on the top of the waves, because these sparks are produced by the agitating minute animals in making very quick motions and especially by the convulsive motion of the cauda, peculiar to the Crustaceans, or, by such muscular motion, a sort of irritated quick respiration is suscitated. These minute Crabs (Cancelli) there is no doubt about it, exhale a sort of fluid, composed by a hydrogen-

phosphorated compound, which when it comes into contact with the surrounding atmosphere, produces some sort of ray of light.

These minute Crabs, of which several specimens are represented in the collection of illustrations, (in Table Nos. 21 and 22) related to the book, written about the trip around the world, made by Krusenstern) it should be noted, they are all Macruori, that is to say, they belong to the order of Astacoidei only, and the Brachiuri (Krabben) or Carcinodes, in whatever great number they have been caught, none of them were ever found phosphorescent.

Most genera, among all the phosphorescent minute Crabs which were discovered, were the Arthrocephala podophtalmo - macrophtalma malacostraca polypoda, and branchio-gastra, with a skin hardly crustaceous, but more often provided with a gelatinous cover, most of these minute phosphorescent Crabs were composed of hardly perceptible vestigial segments, and noted by large or distinguished by pedicellate eyes (eyes attached to the body part by a small stalk-like structure (pedicel)) and provided with pairs of legs, extending from a common base and ornated, as a rule, all over with shaggy, tuft-like growth (penicellatus) out of which (the legs) now the anterior ones, now the posterior ones are longer, and on the posterior ones, very often the function of open gills may be noted, in addition, they are related to the genera of Penaeus, Palaemon, Crago, Squilla, Mysis, Phromine, Thalitrus and Zoe^u; moreover, these Entomostraceans similarly to the Cyclopes or if you like to call them, the Nauplii, they also emit the most splendid light, taken from the oriental sea, (where these minute animals breed) by a piece of cloth, and as long as I kept them in a glass container, refilled and changed continuously with fresh sea waters, they remained luminous.

A specimen belonging to the order of the Nauplius, known also as Cyclops, represented here by Figures Nos. 7 and 8 respectively; bearing reversed claws and coloured by a deep-blue (cerulean) shade, collected by me from the Sea of Kamchatka, the above is represented in its natural size and enlarged by microscope, as well, and in Figure No. 9, I completed the pictures by a sketch of a minor roseate Tenia Inermis.

END