

A New Species of Euphausiacea, *Thysanoëssa inspinata*, from the North Pacific

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Abstract: A new species of Euphausiacea, *Thysanoëssa inspinata*, from the North Pacific is described. *Thysanoëssa inspinata* has been included in the part of the spineless form of *Thysanoëssa longipes*, but it is divided from *T. longipes* in following points.

- 1) *Thysanoëssa inspinata* has the lateral denticle in the far posterior position in the lower margin of the carapace.
- 2) The terminal process and proximal process of the male copulatory organ are nearly the same size and shorter in *T. inspinata*.
- 3) A specimen of *Thysanoëssa longipes* lacking abdominal spines which is considered to be the real spineless form is found, which has the different taxonomical character from *Thysanoëssa inspinata*. Other taxonomical points and ecological features of *Thysanoëssa inspinata* are also discussed.

1. Introduction

The spineless form of *Thysanoëssa longipes* was described by BANNER in 1949. According to BANNER, the spineless form agrees perfectly with the spined form on all characters of primary taxonomic importance except the absence of abdominal spines (BANNER, 1949). This spineless form has been described in the papers after BANNER (BODEN, JOHNSON and BRINTON, 1956; PONOMAREVA, 1957; NEMOTO, 1957; 1959; KOMAKI, 1960; BRINTON, 1962).

A clear difference in the position of the denticle of the carapace which has also taxonomical importance is already found (NEMOTO, 1957), however, the fairly close resemblances in the male copulatory organs keep myself away from the description that it is a new species. Other differences in geographical distribution, size and fragility of eyes are also found, but it has been generally accepted as a form of *Thysanoëssa longipes*.

Basing on many materials, now, I would consider that there have been some confusions about the taxonomic position of the spineless form of the *Thysanoëssa longipes* after the finding by BANNER. It is considered that the real spineless form of the *Thysanoëssa longipes*

is rather scarce, and the closely related species, which has also been considered as the spineless form of *T. longipes* is more common in the North Pacific. I think the latter spineless form is a distinct species different from *Thysanoëssa longipes*, but it has been included in the spineless form of *T. longipes* until now.

Thysanoëssa inspinata is proposed here as the name of the euphausiid.

2. Description

Thysanoëssa inspinata sp. nov. (Figs. 1 and 2)

Holotype: Female, length 18 mm: 20th August, 1955. 52-10 N, 167-52 E, Whales Research Institute station no. 79., North Pacific. 0-150 m Vertical net: Zoological Institute, Faculty of Science, University of Tokyo. Allotype: A male from the North Pacific, 21st August, 1955. 52-29 N, 164-01 E.

Description: A single lateral denticle is present in the range from 65% to 85% of the lower lateral margin of the carapace from the anterior top. Carapace produces into narrow rostrum with slight keel. Eyes are very large with a transverse constriction above the middle and very fragile. Second thoracic legs are very elongate, but usually do not exceed over the distal end of the third segment of the first antennae. Third to fifth abdominal segments have dorsal keels, but they do not

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form posterior spines. The sixth abdominal segment usually has a small spine at the dorsal end, but it is absent in a few cases.

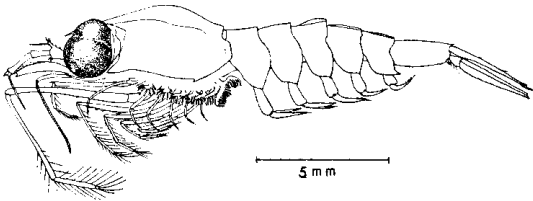


Fig. 1. *Thysanoëssa inspinata* sp. nov. adult female from 52-10 N, 167-52 E, in the North Pacific.

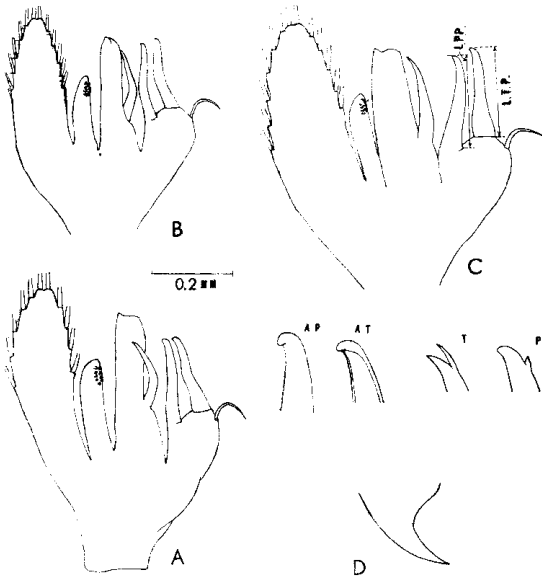


Fig. 2. A-C. Male copulatory organ of *Thysanoëssa inspinata* sp. nov. L.T.P.-Measuring position of the terminal process, L.P.P.-Measuring position of length of the proximal process. AP-The top of the proximal process of a specimen. T-Terminal process. P-Proximal process of a specimen. D. Preanal spine.

In the female, the two distal segments of the first antennal peduncle are rather slender. The third segment is a little longer than the second. In the male, third segment in some specimens a little longer than the second but do not in other specimens. The first segment is thick and bears about 7 setae and 1 spine in the outer distal margin. About 7 setae in

the middle of the first segment of the female. A rather long seta in the inner margin of the distal end of the first segment in antennae. Antennular peduncles show only slight sexual differences.

The terminal process of the male copulatory organ is rather broad and about the same length with the proximal process. The space between the terminal and proximal processes is very narrow and the slope from the terminal process to the proximal process is gentle. Both the terminal and proximal processes are taper and in the blunt top but sometimes they bear small protrusions as illustrated. The spine shaped process is curved and small. The lateral process is sometimes curved in the middle or rather straight in other cases. The length of the adult male is 15 to 16 mm, and the female 16 to 18 mm.

3. Discussion

The first taxonomic character to discriminate *Thysanoëssa inspinata* from *T. longipes* is the position of the lateral denticle in the lower margin of the carapace. According to BANNER (1949), the spineless forms agree with the spined forms on all characters of primary taxonomic importance. He considers also the lateral denticle of the carapace, but he describes that the position is not different from *Thysanoëssa longipes*. After the BANNER'S description, BODEN, JOHNSON and BRINTON (1955), NEMOTO (1957) and KOMAKI (1960) draw the figures of the spineless form of *Thysanoëssa longipes* in their discussion which clearly show the lateral denticle of the lower margin of the carapace in the far posterior position of the carapace.

HANSEN (1911) states the denticle of the carapace is in the middle of the lateral margin of the carapace in *Thysanoëssa longipes*, and uses the positions of the denticle for the taxonomic importance in *Thysanoëssa raschii*, *T. gregaria*, *T. parve* and *T. longipes*. But BANNER (1949) describes that the lateral margin of the carapace bears a small denticle on its posterior half, and KOMAKI (1960) describes that a well developed lateral denticle is at the middle or near the posterior margin of the

carapace as the taxonomic descriptions on *Thysanoëssa longipes*. These descriptions clearly show that *Thysanoëssa longipes* treated by them includes *T. inspinata* as the same position with *T. longipes* taxonomically.

The positions of the lateral denticle in the carapace are illustrated in the ratios, anterior top to the denticle: length of the lateral margin of the carapace in Fig. 3. The positions of the denticle shown as the percentage do not overlap each other, and *Thysanoëssa longipes* is consistently distinguished from *T. inspinata*. The positions are already clear in the younger stage of the development from 7 mm in length. It is already shown that 7mm *T. longipes* has the lateral denticle in the middle of the lateral margin of the carapace (NEMOTO, 1957). The position of the lateral denticle of the younger stage of *T. longipes* is at somewhat posterior position than the fully developed adults. As shown in Fig. 3, the younger *T. longipes* by 14 mm has the denticle posterior than the adults. There is no sexual difference in the position of denticle in *T. longipes*.

On the other hand, *Thysanoëssa inspinata* has the denticle in the position ranging 65% to 85% of the carapace as shown in Fig. 3. As a general consideration, the lateral denticle in the carapace is situated at the posterior position in the Furcilia stages of euphausiids as stated above. *Thysanoëssa inspinata* is considered to come from *T. longipes* relatives as the neoteny phenomenon. The relative

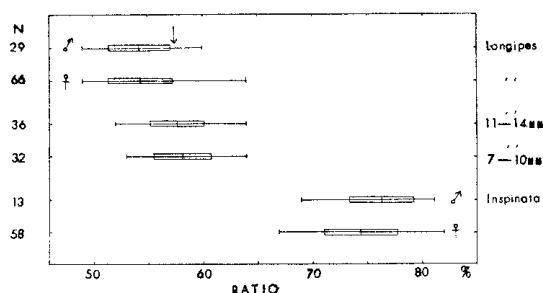


Fig. 3. Ratios, length from the anterior top to the lateral denticle: length of the lateral margin of the carapace. Means, range of variations and two standard deviations are illustrated.

growth of the length from the anterior top to the lateral denticle (denticle length) for the length of the lateral margin of the carapace (carapace length) is given in Fig. 5. The allometry lines of *Thysanoëssa longipes* and *Thysanoëssa inspinata* are clearly different. The growth constant is 1.19 in *Thysanoëssa inspinata* and the constant for *T. longipes* is less than 1.0. The constant is 0.998 for specimens less than 14 mm and 0.973 for specimens more than 16 mm in body length. The slight difference between the former and the latter may be due to the change of the growth. Of course further detailed examination will find more complicated critical points in their development, this critical point is standing on the point where the abdominal spines of *T. longipes* begin to develop. These allometry

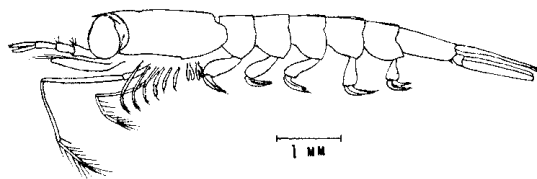


Fig. 4. The 7 mm *Thysanoëssa longipes*. Notice the position of lateral denticle in the carapace.

lines, if they are prolonged as they are, will cross at 1.5 mm in carapace length, in which *T. longipes* finish their furcilia stages in general.

HANSEN (1911) also describes the denticle on the lower margin of the carapace of *Nematoscelis* species shows some geographical variations. But in that case, variations are the matters of the presence, not the variations of the position of the presence. I notice some specimens of *Thysanoëssa gregaria* lack completely the lateral denticles in their lateral margins of the carapace, but none of *T. gregaria* shows the variation of position of the denticle if it is present.

The male copulatory organ has been used as the most important taxonomical character in euphausiids. Male copulatory organs of *Thysanoëssa longipes* are illustrated in Fig. 6. The difference between *T. longipes* and *T.*

inspinata is not so clear in the shape of those processes at a glance. But the copulatory organ of *T. inspinata* is different from that of *T. longipes* in following points.

- 1) Both the terminal and proximal processes are shorter and broad in the base for the length.
- 2) The space between the terminal and proximal processes is narrower in *inspinata* than in *longipes*.
- 3) The terminal process is the same length as the proximal process in *inspinata*, but the terminal process is shorter than the proximal process in *longipes*.
- 4) The slope between the terminal and proximal processes is gentle in *inspinata* but rather sharp in *longipes* as illustrated in Figs. 2 and 6.

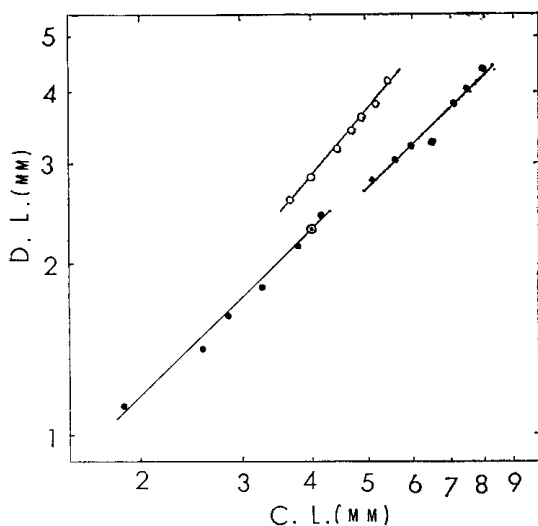


Fig. 5. Comparison of the relative growths of denticle length for carapace lateral margin length between *Thysanoëssa longipes* and *T. inspinata* in the North Pacific. Closed circle-*T. longipes*, open circle-*T. inspinata*. C.L.-Length of the lateral margin of the carapace. D.L.-Length from the top to the lateral denticle of the carapace.

The former illustrations of copulatory organs fairly coincide with above points except the slope in one figure (NEMOTO, 1957: Fig. 7 A). But the figure clearly shows that specimen is not in natural stretch.

The relative growth of the proximal process for the terminal process is shown in Fig. 7, which indicates the clear different allometry lines. The growth constant is 0.933 for *T. inspinata*, and 1.069 for *T. longipes*. The measurement for this study is made in natural stretch and by microscope with built-in micrometer.

The ends of both the terminal process and proximal process are blunt. In the full grown adult of *Thysanoëssa longipes*, the small protrusion are usually observed as illustrated in Fig. 6. The terminal and proximal processes usually have these protrusions in full grown stage, but I notice rather few cases of having protrusion in the lateral process. The full developed protrusion is the proximal process is given in D in Fig. 6.

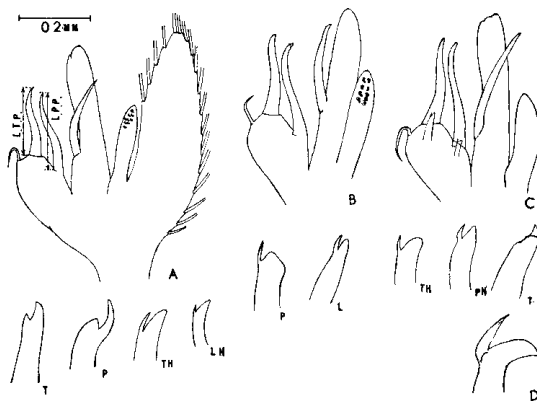


Fig. 6. Male copulatory organ of *Thysanoëssa longipes*. T-The top of the terminal process. P-The top of the proximal process. L-The top of the lateral process. TH-The hidden terminal process. PH-The hidden proximal process. D-The top of the fully developed proximal process.

On the other hand, the terminal and proximal processes of *T. inspinata* lack these protrusions in many specimens, however, sometimes they bear clear protrusions as illustrated in Fig. 2.

There is a case like that of *T. inspinata* and *T. longipes* in other euphausiids.

The copulatory organs of *Thysanopoda subaequalis* are closely related to that of *T. aequalis* (BODEN and BRINTON, 1957).

But BODEN and BRINTON (1957) use the difference in the frontal plate and third legs as well as the geographical distributions to divide above two species.

Among many specimens examined, the real spineless form of *Thysanoëssa longipes* is found in the collection, in 49-52 N, 158-54 E, 1956. This specimen's body length is about 14 mm, the shape of the copulatory organ and the lateral denticle of which are illustrated in Fig. 8, with the arrow in Fig. 3 and open circle with dott in Figs. 5 and 7.

These characters are those of *T. longipes* and clearly different from *T. inspinata*. The keel of the third abdominal segment slightly protruded posteriorly, but other many specimens collected in the same position and same time have well developed abdominal spines and larger body length. Fourth to Sixth abdominal segments of this real spineless form lack the spines.

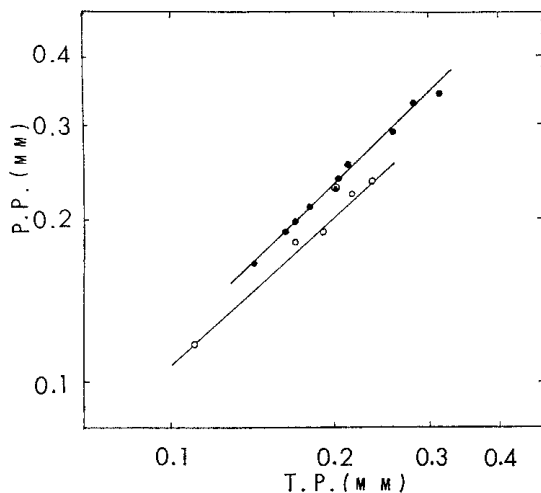


Fig. 7. Comparison of the relative growths between *Thysanoëssa longipes* and *T. inspinata* in the male copulatory organ. Closed circle-*T. longipes*. Open circle-*T. inspinata*. T.P.-Length of the terminal process, P.P.-Length of the proximal process.

The copulatory organ is not fully developed, but far more developed than other specimens in these body size of 14 mm and 15 mm in *T. longipes*. In other specimens of *T. longipes* of these sizes, the male copulatory organs are

only slightly developed. Thus this specimen is considered as the real spineless form of *T. longipes*, the most part of the taxonomic characters of which agree with the BANNER'S description.

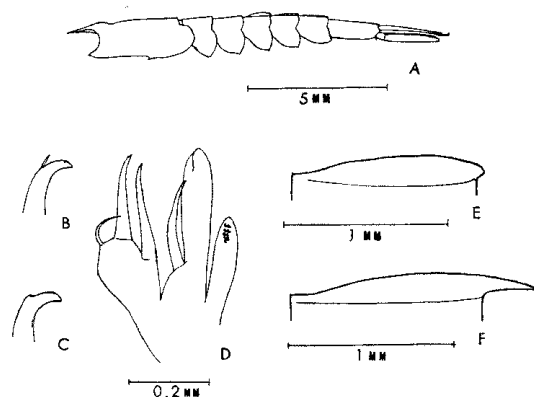


Fig. 8. The real spineless form of *Thysanoëssa longipes* 14 mm long. A-The carapace and abdominal segments of the specimen. B-The top of terminal process of male copulatory organ. C-The top of proximal process. D-Copulatory organ. E-Third segment with slight spine. F-Well developed spines in abdominal segments in other specimens of *T. longipes* caught it the same position, 20 mm long.

The development of the abdominal keel of the young *T. longipes* is illustrated in Fig. 9.

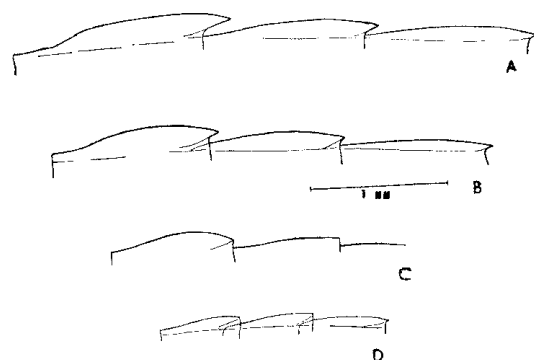


Fig. 9. Keel and undeveloped spines of the immature specimens of *Thysanoëssa longipes*. A-17 mm with developed spine in 3rd segment. B-14 mm with well developed keel. C-12 mm with no spine. D-11 mm with small spine in 5th segment.

The abdominal keel and spines develop with that of the body. Some protruded keel is already observed in 11 mm specimen in fifth segment. But the spines are observed usually in 14 mm specimens or more developed ones in general. The spined form of *T. longipes* have spines in fourth, fifth and sixth abdominal segments as well.

Both second legs of *Thysanoëssa longipes* and *T. inspinata* are fragile. And I have not examined many specimens of second legs, but it is considered that the legs of *T. inspinata* are shorter than *T. longipes*. The fully grown female *T. inspinata* has the second leg which is not beyond the distal end of the third segment of the first antennae. Male *T. inspinata* also shows the shorter second leg from the illustrations by BODEN, JOHNSON and BRINTON (1955), NEMOTO (1957) and KOMAKI (1960), which also do not exceed the third segment of the antennae.

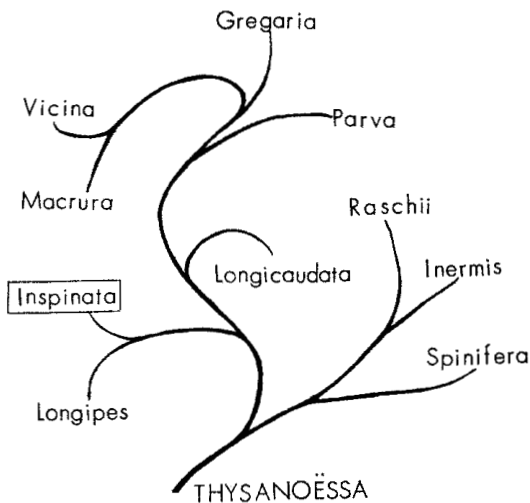


Fig. 10. Schematic dendrogram of the *Thysanoëssa* group and taxonomic position of *Thysanoëssa inspinata* sp. nov.

MARUKAWA's figure of *T. longipes* does not show this character, however, his illustration is not so accurate to consider the length of legs from his illustration (MARUKAWA, 1928: Fig. 19). I will check this point again in further examination on many specimens.

The eyes of *T. inspinata* is very large (BANNER, 1949), and larger than *T. longipes*

in comparison between them.

From the above stated characters of *Thysanoëssa inspinata*, the dendrogram of the *Thysanoëssa* group and taxonomic position of *T. inspinata* are illustrated in Fig 10. This schema is only a preliminary one and I hope to compile more detailed and perfect dendrogram of the euphausiids groups in due course.

There are some differences in sexual conditions between *Thysanoëssa longipes* and *T. inspinata*. The fertilized female specimens of *T. longipes*, such as spermatophores being inserted into the thelycum or eggs fully developed, are found in June in the waters off Kamchatka peninsula and the south waters of Aleutian Islands. *T. inspinata* is, on the other hand, copulating in August in the south waters in the Aleutian Islands, but *T. longipes* in the same locality do not show the reproducing character (NEMOTO, 1957). Other materials also prove that *T. longipes* is often not full mature when *T. inspinata* is copulating or vice versa.

The size of the spermatophore is about 0.53 mm × 0.33 mm in *T. inspinata* and 0.72 mm × 0.48 mm in *T. longipes*.

It has been observed that the spineless form of *Thysanoëssa longipes* is distributing in somewhat warmer waters. BODEN, JOHNSON and BRINTON (1955) report the spineless form (the illustration by them is *T. inspinata*) distributes southern waters of the North Pacific as south as about 40°N. KOMAKI (1960) and BRINTON (1962) state the same results in the recent publications.

The most southern occurrences of *Thysanoëssa longipes* in the Pacific in the stomach content of baleen whales reach 40°N too, but it occurs in the colder season of the year. Usually it has been found more abundantly in the northern waters along Kurile Islands or adjacent waters to Aleutian Islands (NEMOTO, 1962). The distributions of these two species in the Pacific are fully discussed by BRINTON (1962). PONOMAREVA (1957) described the spineless form of *T. longipes* in the Japan Sea in the southern region, but KOMAKI and MATSUE (1958) find none of the

spineless form of *T. longipes*. The occurrence of *T. inspinata* in the Okhotsk Sea has not been observed in the stomach contents of the baleen whales too (NEMOTO, 1959).

The difference in the vertical distributions for these two species is suggested by NEMOTO (1962), however, the clear tendency has not been observed (BRINTON, 1962). The possible correlation between the length of the second legs and the vertical distribution will be discussed again in due course.

Acknowledgements

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