REPORT ON THE DANISH OCEANOGRAPHICAL EXPEDITIONS 1908—10
TO THE MEDITERRANEAN AND ADJACENT SEAS

Vol. II. Biology.

D. 3.

Decapoda-Macrura

excl. Sergestidæ.

(Penæidæ, Pasiphæidæ, Hoplophoridæ, Nematocarcinidæ, Scyllaridæ, Eryonidæ, Nephropsidæ, Appendix)

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With 27 figures and 8 charts in the text.

Published August 20, 1923.

CONTENTS.

I. INTRODUCTION

The present paper includes those families of Decapoda Macrura (excl. Sergestidæ) which occur, either as adults or larvæ, in the material in so great number of specimens as to be of interest on that account. As might be expected from the method of collecting used by the expedition, they are almost exclusively pelagic species; in some of the families, however, there are also species which live near the bottom; these are here included.

The "Thor"-expedition has moreover, taken a number of species of other families, e. g. Hippolytidæ, Pandalidæ, Palæmonidæ, Crangonidæ; the species in question have, however, here been omitted, as the number of specimens was in every case so small as to afford no fresh information of any interest, not even in respect of localities outside their area of distribution as hitherto known. (The other Decapoda — Brachyura and Anomura + Thalassinidea — are as a rule represented in the material by so few specimens of each, that these likewise could furnish no new information of any importance).

Larvæ which could be ascribed to species dealt with in the present work, or which could at least be with certainty placed as belonging to these families, have been included in their respective sections; all indeterminable larvæ, on the other hand, have been omitted. Possibly these last will be dealt with in Part II of the Decapoda, which will also include the Sergestidæ.

A few species not belonging to the families here in question, but calling for inclusion by reason of some or another feature of interest, are dealt with in an Appendix.

The implement of capture was in practically all cases the young-fish trawl, 200 (more rarely 330) cm diameter.

Save where otherwise mentioned, the animals were always measured from point of rostrum to point of telson; obviously, however, slight inaccuracies can easily occur in these measurements, when endeavouring, for instance, to straighten out a specimen whose tail is more or less bent.

The manuscript was completed in December 1919. The lack of full information as to recent literature has been sadly felt, no issue of the Zoological Record containing such having appeared since 1914. It is possible, therefore, that some work or works may have been missed.

P. S. Unfortunately, I have been unable to take into consideration the extremely important work of Bouvier, 1917, which I did not see until over a year after completion of the present work; the same applies to de Man 1920, and Sund 1920. I have, however, since added reference to these writers under the heading of the species concerned.

II. THE FAMILIES AND SPECIES

Penæidea Sp. Bate.

Penæidea Stebbing, S. Africa 1910, p. 379 (lit.).

Fam. Penæidæ Dana.

Penæidæ Bouvier 1908.
— Stebbing, S. Africa 1910, p. 379 (lit.).
— de Man 1911 and 1913.

Of this family, only 12 genera, with 18 species, are known from the area investigated by the "Thor", *Gennadas* alone (including *Amalopenæus*) having seven species, the others only one each.

The Mediterranean has no endemic species. Common to the Atlantic and the Mediterranean are 8 species (see table); the remaining 10 have not at any rate yet been found inside Gibraltar.

The depth of water is great as a rule, over 500 to 1000 m, some few may, however, be found in much shallower water, 20—50 m, (*Solenocera*, *Parapenæus*, *Penæus caramote*), one indeed, (*Sicyonia*) at only 4 m.

The species are (with the few exceptions noted above), abyssal or sub-abyssal bottom forms (for the few pelagic species see below); *Benthesicymus moratus* has even been found at depths from 2500—5450 m.

Of the species from the "Thor"-area, probably only those of the genus *Gennadas* (incl. *Amalopenæus*) and *Funchalia Woodwardii* are pelagic. *Gennadas* was

	Medit.	Atlant.	Depth of the sea (bottom forms)	Pelagic species
Benthesicymus moratus	..	(×)*	2500—5450 m	..
T[1] Gennadas elegans	×	×	..	×
— Alicei	..	(×)	..	×
T — valens	..	×	..	×
T — Tinayrei	..	×	..	×
T — similis n. sp.	..	n*	..	×
T — chiasmifera n. sp.	..	n	..	×
T — bidentata n. sp.	..	n	..	×
T Aristæomorpha foliacea	×	×	500—1300 m	..
Aristeopsis armatus var. tridens	..	(×)	750—4800 m	..
Plesiopenæus Edwardsianus	..	(×)	344—1850 m	..
Aristeus antennatus	(×)	(×)	200—1470 m	..
Haliporus (Hymenopenæus) debilis	..	(×)	500—1200 (2163) m	..
T Solenocera siphonocera	×	×	50—200 (760) m	..
T Funchalia Woodwardii	n	×	..	×
T Parapenæus longirostris	×	(×)	40—100 (500) m	..
Penæus caramote	(×)	(×)	20—100 (360) m	..
T Sicyonia sculpta	×	×	>4 m	..

[1] T indicates that the species was taken by the "Thor".
(×) - — — - — was not taken by "Thor" in the area in question.
n - — — - — is new to the area in question.

never taken at night much nearer the surface than 200 m. w, and by day only far deeper down (over 1650 m. w. especially), whereas *Funchalia* may be taken during the night very near the surface, and but little deeper during the day.

The great depth sets its mark on their external appearance; all, or nearly all, show different shades of red, with or without blue colouring matter (see especially the colour plates in BOUVIER 1908 Pl. 1—3, and notes in MURRAY and HJORT 1912 p. 669) with exception of the few living at slight depths or near the surface (for these see below). Their abyssal life, on the other hand, does not seem to affect their eyes to any great extent, though these may in some few species be grey or brown (see expecially MURRAY and HJORT 1912 p. 669); on this point, however, there is very little information to be gleaned from extant works.

Those species which live in comparatively shallow water, or near the surface, bear the stamp of their habitat accordingly; they are transparent, colourless or but faintly coloured with a reddish tinge, or only small red spots (*Solenocera*, *Funchalia*, the young *Parapenæus*), or pale yellow (adult *Parapenæus*) or spotted with brown (*Sicyonia*); only *Penæus caramote* is pale flesh-colour or reddish.

Most of the species are small to medium-sized, abt. 25—100 mm; there is, however, in the "Thor"-area, one veritable giant, to wit, *Plesiopenæus Edwardsianus*, which can attain a length of 315 mm, while *Penæus caramote* can grow to abt. 200 mm.

Gennadas lives in shoals, at any rate at times; the others are rather found singly, with exception of *Penæus caramote*, which is of direct economical importance, being an edible form.

The "Thor"-Expedition. Of the above mentioned 18 species, the "Thor" has 11, three of which are new to science, viz: *Gennadas similis*, *G. chiasmifera* and *G. bidentata*, besides some larvæ (see later on); of these 11 species, however, one, (*Aristæomorpha foliacea*) is not respresented by adult specimens, but only by larvæ.

It is characteristic of the "Thor"-expedition, that it lacks but a single one (*Gennadas Alicei*) of the 8 plankton species found in the area, while only two species of those which live on the bottom (*Solenocera* and *Sicyonia*) are represented by adult specimens, and these two, moreover, live at relatively slight depths; on the other hand, all those species living on the bottom at great depths are entirely lacking in the "Thor" material.

Genus Gennadas Bate (incl. Amalopenæus Smith).

Gennadas Bate 1881, p. 171, 191.
Amalopenæus Smith 1882, p. 86.
**Gennadas* Bouvier 1908, p. 25.
— Kemp 1909, p. 718.
— — , Indian Mus. 1910, p. 173.
Amalopenæus — , Ireland 1910, p. 13.
Gennadas — , — p. 13.
— — 1913, p. 60.
— Stebbing, Edinburgh 1914, p. 282 (lit.).

KEMP (Ireland 1910 p. 13) has shown that *Amalopenæus* should perhaps be distinguished as separate from *Gennadas*, since it lacks podobranchiæ on the pereiopoda. If we maintain *A.* as a distinct genus, it will, apart from *A. elegans* and *A. valens*, hardly contain more than the three new species noted below. I have not here separated the two genera.

Gennadas (+ *Amalopenæus*) includes at present 19 species + three new ones from the "Thor"-expedition (see below), making 22 species in all, besides some uncertain. The most important specific characters lie in the petasma and thelycum, and, as Kemp (1913 p. 60) has pointed out, several of the species are so nearly related that it is very difficult to class a ♂ with its right ♀ and *vice versa*.

We have from the "Thor"-expedition one new ♂ (*G. similis*) and two new ♀ (*G. chiasmifera*, *G. bidentata*). As these also are extraordinarily alike (save, of course in the thelycum and petasma) it is not impossible that one of the two females may belong to the existing male, but as there are distinct, albeit very small differences between ♂ and both the present ♀, I have preferred to place them as three species, leaving it to be shown in course of time, when more material is available, whether this is correct. Of the 19 species previously recorded, both sexes are known in 14 cases, only the ♂ in 4, (*G. intermedius*, *G. Kempi*, *G. præcox*, *G. Talismani*) and only the ♀ in 1 (*G. Bouvieri*). We should be fairly safe in taking it as out of the question that the two new ♀ from the "Thor"-expedition should belong to any of those species of which only the ♂ is hitherto known, and *vice versa*.

A survey of all known species, with their distribution, is given below.

1. *G. Alcocki* ♂♀ Kemp, Indian Mus. 1910, p. 174, Pl. 13 figs. 5—8. Bay of Bengal 765—1644 fms.
   — ♀ — 1913, p. 62, Pl. 7 fig. 8.

Western part of Ind. Oc., 750—0 and 800—0 fms.

2. *G. Alicei* ♂♀ Bouvier 1908, pp. 28, 30 (lit.), Pl. 1 fig. 2 (cold. fig.), Pl. 6. Trop. and subtrop. Atlantic.
— ♀ Milne-Edwards & Bouvier 1909, p. 191. West Indies, 955 fms.
— Lenz & Strunck 1914, p. 309. S. Atlantic.
(*A.*) *Alicei* Sund 1920, p. 29.
3. *G. bidentata* n. sp. ♀, see below.
4. *G. borealis* ♂♀ Rathbun 1902, p. 887 (no fig.). Kamchatka, Bering Sea, 850—1557 fms.
— ♂♀ — 1904, p. 147, figs. 88—89.
5. *G. Bouvieri* ♀ Kemp 1909, p. 726, Pl. 74 figs. 1—4, Pl. 75 figs. 6—7. Manila, N. of New Guinea, 1100—2100 fms.
— ♀ — Indian Mus. 1910, p. 179. Ceylon, 764 fms.
? *G. clavicarpus* de Man 1911, teste de Man.
6. *G. Calmani* ♂♀ Kemp 1909, p. 724, Pl. 74 figs. 5—11, Pl. 75 figs. 4—5. Japan, 345—1875 fms.
7. *Benthesicymus* (?) *carinatus* ♀ Smith 1884, p. 396, Pl. 10 figs. 6—7. 39¾° N, 71° W, 1022 fms.
Gennadas — ♂♀ Kemp, Indian Mus. 1910, p. 179, Pl. 14 figs. 4—9 (lit. and syn.). Arabian Sea, 902—930 fms.
8. *G. chiasmifera* n. sp., ♀, see below.
9. *G. clavicarpus* ♂♀ de Man, Notes from Leyden Mus., vol. 29, 1907, p. 144.
— — 1911, p. 19. Eastern Indian Oc., 0—700 to 0—2000 m.
— — 1913, Pl. 1 fig. 3 a—j, Pl. 2 fig. 3 h—k.
? *G. Bouvieri* Kemp, teste de Man 1911.
10. *G. elegans* ♂♀ Smith, see below.
11. *G. intermedius* (partim) ♂ Bate 1888, p. 343, Pl. 58, fig. 3.
— ♂ Kemp 1909, p. 723, Pl. 73 figs. 7—12, Pl. 75 fig. 3. Sierra Leone 1850 fms., Pernambuco 675 fms.
12. *G. Kempi* ♂ Stebbing, Edinburgh 1914, p. 283, Pl. 27. 39¾° S, 2½° E. 2272 fms.
13. *G. parvus* Bate, Ann. Mag. Nat. Hist. ser. 5, vol. 7, 1881, p. 192 (partim).
— — 1888, p. 340, Pl. 59 (partim).
— ♂ Kemp 1909, p. 721, Pl. 73 figs. 1—6, Pl. 75 fig. 1. Japan 2425 fms.
— ♂♀ — 1913, p. 60, Pl. 7 figs. 6—7. Indian Ocean.
not — Rathbun 1903 (1906), p. 907, p. 60 (teste Kemp, Indian Mus. 1910, p. 175).
14. *G. pasithea* de Man, Notes from Leyden Mus. vol. 29, 1907, p. 146.
— ♂♀ — 1911, p. 16. Banda Sea, 2000—0 m.
— — 1913, Pl. 1 fig. 2 a—j.
15. *G. præcox* ♂ Kemp, Indian Mus. 1910, p. 176, Pl. 13 figs. 1—4. Cape Comorin, 1053 fms.
16. *G. propinquus* ♂♀ Rathbun 1906, p. 907, fig. 61. Hawaiian Isl.
17. *G. scutatus* ♀ Bouvier 1908, p. 28, 42, Pl. 8. Between Açores and New Foundland.
— ♂ Milne-Edwards & Bouvier 1909, p. 193, figs. 10—12. Dominique, 372 fms.
— ♂ Kemp 1909, p. 727, Pl. 75 fig. 2. N. Pacific. 9½° N, 150¾° W. 2700 fms.
— subsp. *indicus* ♂ Kemp, Indian Mus. 1910, p. 178, Pl. 13 figs. 9—10. Cap Comorin, 738—1043 fms.
— ♂♀ Kemp 1913, p. 61. Desroches Atoll, 400—0 fms.
— Lenz & Strunck 1914, p. 310. Cape Verde, Ascension, W. of Capetown.
18. *G. similis* n. sp. ♂, see below.
19. *G. sordidus* ♂ Kemp, Indian Mus. 1910, p. 177, Pl. 14 figs. 1—3. N. of Laccadive Isl., NE. of Ceylon, 764—931 fms.
20. *G. Talismani* ♂ Bouvier 1906, p. 10, 12, fig. 15. Cape Verde.
— — 1908, p. 28.
— ♂ Lenz & Strunck 1914, p. 311, Pl. 18. 17½° N, 29¾° W; ¾° N, 19° W; 8¾° S, 11⅚° W; 35⅔° S, 8¼° E.
21. *G. Tinayrei* ♂♀ Bouvier, see below.
22. *G. valens* ♂♀ Smith, see below.

Doubtful species.

G. sp. ♂ Faxon 1895, p. 207. Equador, 1740 fms.
G. sp. ♀ Rathbun 1906, p. 907, fig. 62. Hawaiian Isl., 1000—1314 fms.
G. sp. ♀ Kemp 1913, p. 62, Pl. 7 fig. 9. Desroches Atoll, 750—0 fms.
G. parvus ♀ Rathbun (not Bate) (teste Kemp, Indian

Mus. 1910, p. 175) 1906, p. 907, fig. 60. Hawaii.

G. (*Amalopenæus*) *valens*? ♀ Kemp, Ireland 1910, p. 19, textfig. Ireland.

Distribution of Gennadas T. = taken by the "Thor"-Exped.	Mediteran.	Atlantic: N. of Equat.: E. of 30°W.	Atlantic: N. of Equat.: W. of 30°W.	Atlantic: S. of Equator	Indian Ocean	Between the great Ind. Isl.	Pacific
G. Alcocki	..	..	..	..	×	..	..
— Alicei	..	×	×	×	..	..	..
T. — bidentata n. sp.	..	×	..	..	..	..	..
— borealis	..	..	..	..	..	..	×
— Bouvieri	..	..	..	..	×	×	×
— Calmani	..	..	..	..	..	..	×
— carinatus	..	..	×	..	×	..	..
T. — chiasmifera n. sp.	..	×	..	..	..	..	..
— clavicarpus	..	..	..	..	..	×	..
T. — elegans	×	×	×	×	..	..	..
— intermedius	..	×	..	×	..	..	..
— Kempi	..	..	..	×	..	..	..
— parvus	..	..	..	..	×	..	×
— pasithea	..	..	..	..	..	×	..
— præcox	..	..	..	..	×	..	..
— propinquus	..	..	..	..	..	..	×
— scutatus	..	×	..	×	×	..	×
T. — similis n. sp.	..	×	..	..	..	..	..
— sordidus	..	..	..	..	×	..	..
— Talismani	..	×	..	×	..	..	..
T. — Tinayrei	..	×	×	×	..	..	..
T. — valens	..	×	×	×	..	..	..
No. of species	1	10	5	8	7	3	6

1. GENNADAS ELEGANS Smith.

Gennadas elegans Lo Bianco 1904, p. 29—31, Pl. 9 fig. 37 (cold. fig.).
— — Bouvier 1908, p. 28, 35 (lit. and syn.), Pl. 7.
Amalopenæus— Kemp, Ireland 1910, p. 14, Pl. 1.
Gennadas — Murray & Hjort 1912, p. 668.
Amalopenæus— Pesta 1918, p. 33, figs. 1—2.
— — Sund 1920, p. 27.

Mediterranean.

St. 13. > 1200 m. 39°43′ N, 17°30′ E. 19-12-1908. 65 m.w., 8^{50} pm., 60 min. 4 ♀ 16 mm. — **St. 13.** ibid. 300 m.w., 5^{35} pm., 60 min. 40 spec.: 13 ♂: 12 ♂ 19—21 mm., 1 ♂ 24 mm.; 27 ♀: 22 spec. 17—22 mm., 5 spec. 23—27 mm. — **St. 13.** ibid. 1000 m.w., 7^{05} pm., 60 min. 35 spec.: 1 spec. 14 mm.; 13 ♂: 9 spec. 20—22 mm., 4 spec. 23—25 mm.; 20 ♀ 20—25 mm, 1 ♀ 17 mm. — **St. 14.** 1125 m. 41°24′ N, 17°45′ E. 21-12-1908. 300 m.w., 6^{30} am., 60 min. 1 ♂ 24 mm., 1 ♀ 24 mm. — **St. 15.** 1000 m. 40°04′ N, 19°06′ E. 22-12-1908. 1400 m.w., hour ?, 60 min. 3 ♂ 24 mm. — **St. 24.** > 3700 m. 40°14′ N, 12°23′ E. 16-1-1909. 1600 m.w., 240 min., 11^{15} pm. 1 ♀ 25 mm. — **St. 24.** ibid. 300 m.w., 30 min., hour ?, 35 spec.: 10 ♂ 20—22 mm., 25 ♀ 17—26 mm. — **St. 29.** 1550 m. 40°47′ N, 12°55′ E. 20-1-1909. 600 m.w., 9^{30} pm., 60 min. 11 spec.: 6 ♂ 20 mm., 5 ♀: 17 (3 spec.), 21, 27 mm. — **St. 29.** ibid. 1650 m.w., 2^{15} pm., 60 min. 10 spec.: 3 ♂ 20—22 mm., 7 ♀ 16—23 mm. — **St. 31.** 1420 m. 41°44′ N, 10°52′ E. 22-1-1909. 200 m.w., 3^{15} am., 30 min. 60 spec.: 3 ♂ 18—21 mm., 57 ♀: 1 ♀ 15 mm., 56 ♀ 18—25 mm. — **St. 31.** ibid. 600 m.w., 3^{05} am., 30 min. 19 spec.: 4 ♂ 16, 16, 18, 22 mm.; 15 ♀ 16—24 mm. — **St. 31.** ibid. 1400 m.w., 1^{20} am., 60 min. 23 spec.: 5 ♂ 16—22 mm.; 18 ♀: 4 ♀ 16 mm., 14 ♀ 18—24 mm. — **St. 35.** > 2000 m. 43°36′ N, 7°36′ E. 29-1-1909. 1000 m.w., 11^{25} am., 120 min. 3 ♂ 20, 20, 23 mm. — **St. 35.** ibid. 1600 m.w., 11^{25} am., 120 min. 34 spec.: 13 ♂ 22—26 mm.; 21 ♀: 1 ♀ 20 mm., 20 ♀ 22—29 mm. — **St. 35.** ibid. 2500 m.w., 3^{45} pm., 90 min. 22 spec.: 10 ♂ 22—24 mm., 12 ♀: 3 ♀ 17—21 mm., 9 ♀ 22—28 mm. — **St. 45.** 2150 m. 37°28′ N, 8°18′ E. 6-2-1909. 300 m.w., 11^{25} pm., 30 min. 12 spec.: 3 ♂ 16—18 mm.; 9 ♀ 15—19 mm. — **St. 46.** 1930 m. 37°17′ N, 6°00′ E. 7-2-1909. 65 m.w., 30 min., 8^{20} pm. 30 spec.: 16 spec. (9) 11—13 mm., 6 spec. 14—16 mm.; 3 ♂ 18—19 mm.; 5 ♀ 17—19 mm. — **St. 46.** ibid. 300 m.w., 7^{30} pm., 30 min. 84 spec.: 29 spec. (9) 12—14 mm.; 30 ♂ 18—20 mm.; 25 ♀: 22 ♀ without ova: 1 ♀ 21 mm., 21 ♀ 15—20 mm.; 3 ♀ with ova in ovarium 20—23 mm. — **St. 46.** ibid. 600 m.w., 6^{35} pm., 30 min. 30 spec.: 8 spec. 8—12 mm., 2 spec. 14—16 mm., 11 ♂ 17—20 mm., 9 ♀ 17—22 mm. — **St. 47.** > 2000 m. 36°55′ N, 3°12′ E. 10-2-1909. 300 m.w., 11^{05} pm., 30 min. 9 spec.: 3 spec. 11—16 mm., 2 ♂ 18—19 mm., 4 ♀ 17—21 mm. — **St. 50.** > 2000 m. 37°02′ N, 1°17′ E. 12-2-1909. 600 m.w., 4^{10} am., 30 min. 60 spec.: 5 spec. 11—14 mm., 16 ♂ 17—20 mm., 39 ♀ 17—25 mm. (incl. 3 ♀ with ova in the ovarium 18—20 mm.). — **St. 50.** ibid. 1600 m.w., 5^{30} am., 60 min. 20 spec.: 4 spec. 7.5—15 mm.; 7 ♂ 19—22 mm.; 9 ♀ 18—23 mm. — **St. 51.** >2000 m. 36°27′ N, 6°27′ E. 18-2-1909. 300 m.w., 0^{50} am., 30 min. 68 spec.: 2 spec. 11—13.5 mm.; 29 ♂ 17—21 mm.; 37 ♀ 16—22 mm. — **St. 53.** > 2000 m. 36°13′ N, 1°28′ W. 18-2-1909. 2600 m.w., 5^{15} pm., 90 min. 52 spec.: 1 spec. 9 mm., 8 spec. 12—15 mm., 20 ♂ 16—21 mm., 23 ♀ 16—20 mm. — **St. 59.** 1260 m. 36°02′ N, 4°24′ W. 21-2-1909. 100 m.w., 1^{00} am., 30 min. 1 ♀ 19 mm. — **St. 59.** ibid. 500 m.w., 1^{40} am., 30 min. 22 spec.: 6 spec. 12—15 mm., 2 ♂ 20 mm.; 14 ♀ 16—24 mm. (incl. 2 with ova in the ovarium 20—22 mm.). — **St. 59.** ibid. 1200 m.w., 2^{30} am., 30 min. 41 spec.: 6 spec. 9 mm., 1 spec. 13 mm., 16 ♂ 16—22 mm., 18 ♀ (incl. 1 ♀ with ova in ovarium 24 mm.) 16—25 mm. — **St. 61.** 740 m. 35°57′ N, 5°35′ W. 21-2-1909. 600 m.w., 3^{25} pm., 60 min. 1 spec. 9 mm., 1 ♂ 20 mm. — **St. 106.** 1150 m. 36°33′ N, 2°00′ W. 25-6-1910. 1200 m.w., 0^{20} am., 60 min. 102 spec.: 8 spec. 7—10 mm., 55 spec. 11—15 mm., 12 ♂ 17—18 mm., 27 ♀ 16—25 mm. (incl. 4 ♀ with ova in the ovarium 19—20 mm.). — **St. 107.** > 2000 m. 36°13′ N, 1°28′ W. 25-6-1910. 2000 m.w., 7^{30} am., 60 min. 152 spec.: 24 spec. 7—10 mm., 45 spec. 11—15 mm., 24 ♂ 16—20 mm., 59 ♀ 16—23 mm. (incl. 1 ♀ with ova in ovarium 20 mm.). — **St. 108.** 2435 m. 36°03′ N, 0°27′ W. 26-6-1910. 2000 m.w., 0^{40} am., 60 min. 167 spec.: 34 spec. 8—11 mm.; 65 spec. 12—15 mm.; 23 ♂ 16—20 mm.; 45 ♀ 16—21 mm. (incl. 1 ♀ with ova in ovarium 21 mm.). — **St. 112.** 2700 m. 36°56′ N, 2°15′ E. 27-6-1910. 300 m.w., 0^{15} am., 30 min. 66 spec.: 47 spec. 11—15 mm., 3 spec. 8—10 mm., 5 ♂ 17—20 mm., 11 ♀ 17—18 mm. — **St. 113.** 815 m. 36°53′ N, 3°09′ E. 28-6-1910. 300 m.w.,

3^{25} am., 30 min. 2 ♀ 19—22 mm. — **St. 115.** 2800 m. 38°17′ N, 4°11′ E. 28-6-1910. 300 m.w., 11^{20} pm., 30 min. abt. 275 spec.: abt. 50 spec. 11—15 mm., abt. 75 ♂ 16—20 mm., abt. 150 ♀ 16—25 mm. — **St. 115.** ibid. 2000 m.w., 0^{30} am., 60 min. 110 spec.: abt. 20 spec. (8) 12—15 mm.; abt. 20 ♂ 16—23 mm.; abt. 70 ♀: abt. 67 ♀ 16—24 mm., 3 ♀ 25—27 mm. — **St. 116.** 2860 m. 39°27′ N, 5°26′ E. 30-6-1910. 300 m.w., 1^{40} am., 30 min. 11 spec.: 6 spec. 10—15 mm.; 5 ♀ 16—19 mm. — **St. 118.** > 2700 m. 41°00′ N, 6°43′ E. 30-6-1910. 65 m.w., 11^{35} pm., 30 min. 1 spec. 15 mm. — **St. 118.** ibid. 300 m.w., 10^{55} pm., 30 min. 86 spec.: 11 spec. 7—10 mm., abt. 20 spec. 11—15 mm.; abt. 15 ♂ 16—20 mm.; abt. 40 ♀ 16—22 mm. — **St. 120.** 2700 m. 42°31′ N, 7°41′ E. 1-7-1910. 300 m.w., 8^{50} pm., 30 min. 25 spec.: 4 spec. 15 mm.; 5 ♂ 18—22 mm.; 16 ♀: 12 ♀ 16—19 mm., 4 ♀ 24—26 mm. — **St. 122.** 1500 m. 43°50′ N, 8°34′ E. 2-7-1910. 1200 m.w., 5^{30} pm., 60 min. 5 spec.: 2 ♂ 20 mm., 2 ♀ 21—27 mm.; 1 spec. 14 mm. — **St. 129.** 3420 m. 40°05′ N, 11°31′ E. 12-7-1910. 600 m.w., 8^{00} pm., 30 min. 13 spec.: 8 spec. 15 mm., 2 ♂ 17—20 mm., 3 ♀ 16—17 mm. — **St. 129.** ibid. 1000 m.w., 4^{20} am., 60 min. 22 spec.: 2 spec. 9—11 mm., 12 spec. 12—15 mm., 1 ♂ 20 mm., 7 ♀ 16 mm. — **St. 129.** ibid. 3500 m.w., 3^{00} pm., 120 min. 31 spec.: 15 spec. 11—15 mm.; 6 ♂ abt. 20 mm., 10 ♀: 1 ♀ 25 mm., 9 ♀ 19—20 mm. — **St. 143.** 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 300 m.w., 0^{30} am., 30 min. 2 spec. 13 mm. — **St. 143.** ibid. 1000 m.w., 2^{00} am., 60 min. 2 spec.: 1 spec. 14 mm., 1 ♂ 22 mm. — **St. 144.** 3340 m. 34°31′ N, 18°40′ E. 24-7-1910. 2000 m.w., 3^{45} am., 60 min. 1 ♀ 19 mm. — **St. 144.** ibid. 4000 m.w., 6^{20} am., 60 min. 3 spec.: 1 ♂ 18 mm., 2 ♀ 20—22 mm. — **St. 147.** 960 m. 31°35′ N, 15°02′ E. 26-7-1910. 1000 m.w., 1^{10} am., 60 min. 3 spec.: 1 spec. 14 mm., 1 ♂ 19 mm., 1 ♀ 19 mm. — **St. 156.** > 3000 m. 32°31′ N, 26°51′ E. 30-7-1910. 600 m.w., 3^{00} am., 30 min. 1 ♂ 19 mm. — **St. 156.** ibid. 1000 m.w., 0^{40} am., 60 min. 2 spec.: 1 ♂ 19 mm., 1 ♀ 22 mm. — **St. 160.** >1000 m. 35°59′ N, 28°14′ E. 1-8-1910. 300 m.w., 2^{45} am., 30 min. 2 spec. 13—14 mm. — **St. 160.** ibid. 1000 m.w., 3^{15} am., 60 min. 32 spec.: 3 spec. 9—12 mm., 26 spec. 13—15 mm., 1 ♂ 20 mm., 2 ♀ 21—22 mm. — **St. 160.** ibid. 4000 m.w., 3^{30} pm., 60 min. 17 spec.: 12 spec. 9—15 mm., 2 ♂ 19 mm., 3 ♀ 21—24 mm. — **St. 163.** 1180 m. 37°52′ N, 26°22′ E. 3-8-1910. 300 m.w., 1^{05} am., 15 min. 1 spec. 15 mm. — **St. 163.** ibid. 1000 m.w., 0^{05} am., 30 min. 2 spec. 12—13 mm. — **St. 175.** 1103 m. 40°48′ N, 27°59′ E. 11-8-1910. 400 m.w., 11^{20} pm., 30 min. 16 spec.: 1 spec. 8 mm., 8 ♂ 22—23 mm., 7 ♀ 22—27 mm. — **St. 175.** ibid. 1200 m.w., 0^{25} am., 30 min. 19 spec.: 4 ♂: 3 ♂ abt. 22 mm., 1 ♂ 27 mm.; 15 ♀: 11 ♀ 21—23 mm., 4 ♀ 27—28 mm. — **St. 184.** 842 m. 38°10′ N, 22°33′ E. 17-8-1910. 1000 m.w., 2^{45} am., 30 min. 1 ♂ 23 mm., 1 ♀ 23 mm. — **St. 187.** > 2500 m. 37°54′ N, 18°02′ E. 18-8-1910. 1000 m.w., 6^{40} pm., 30 min. 1 ♂ 21 mm., 1 ♀ 21 mm. — **St. 199.** 2700 m. 39°32′ N, 10°49′ E. 28-8-1910. 300 m.w., 9^{25} pm., 20 min. 6 spec. 12—15 mm. — **St. 199.** ibid. 1000 m.w., 10^{10} pm., 30 min. 10 spec.: 8 spec. 10—15 mm., 2 ♀ 16—20 mm. — **St. 206.** 2782 m. 39°32′ N, 5°15′ E. 28-8-1910. 300 m.w., 1^{05} am., 15 min. 1 spec. 15 mm. — **St. 206.** ibid. 1000 m.w., 1^{40} am., 45 min. 35 spec.: 18 spec. 14—15 mm., 6 ♂ 16—19 mm.; 11 ♀: 8 ♀ 16—20 mm., 3 ♀ 21—25 mm. — **St. 206.** ibid. 2000 m.w., 3^{05} am., 45 min. 65 spec.: abt. 10 spec. 12—15 mm., abt. 15 ♂ 16—25 mm., abt. 40 ♀ 16—26 mm. — **St. 209.** 2131 m. 40°34′ N, 3°03′ E. 29-8-1910. 1000 m.w., 6^{00} am., 45 min. 12 spec.: 4 spec. 8—9 mm., 8 spec. 13—14 mm. — **St. 209.** ibid. 2000 m.w., 7^{25} am., 45 min. 112 spec.: abt. 12 spec. 13—15 mm.; abt. 30 ♂: 1 ♂ 25 mm., abt. 29 ♂ 16—20 mm.; abt. 70 ♀: abt. 69 ♀ 16—23 mm., 1 ♀ 29 mm. — **St. 209.** ibid., dredge, 2800 m.w., 9^{30} am., 180 min. 1 ♀ 17 mm. — **St. 218.** 2147 m. 36°54′ N, 2°57′ E. 2-9-1910. 300 m.w., 2^{45} am., 30 min. 58 spec.: 9 spec. 8—11 mm., 14 spec. 12—15 mm., 6 ♂ 16—21 mm., 29 ♀ 16—25 mm. — **St. 222.** 1950 m. 35°53′ N, 0°57′ W. 4-9-1910. 300 m.w., 11^{20} pm., 30 min. 25 spec.: 1 spec. 6 mm.; 6 ♂ abt. 18 mm.; 18 ♀ 16—23 mm. — **St. 228.** 874 m. 36°02′ N, 5°06′ W. 7-9-1910. 1200 m.w., 0^{50} am., 30 min. 31 spec.: 3 spec. 12, 15, 15 mm.; 13 ♂ 17—21 mm.; 15 ♀ 19—22 mm.

Atlantic.

St. 164. 1900—2150 m. 62°10.8′ N, 19°36′ W. 12(13)-7-1903. 1 ♂ 23 mm., 1 ♀ 25 mm. — **St. 104.** 1950 m. 62°47′ N, 15°03′ W. 24-5-1904. 1800 m.w. 1 ♂ 22 mm. — **St. 152.** 1240 m. 65°00′ N, 28°10′ W. 19-6-1904. 1000 m.w., 12 spec.: 2 ♂ 21 mm., 10 ♀: 9 spec. 21—22 mm., 1 spec. 29 mm. — **St. 180.** 2160 m. 61°34′ N, 19°05′ W. 10-7-1904. 1800 m.w. 9 spec.: 4 ♂ 21, 23, 24, 27 mm.; 5 ♀ 23, 24, 25, 25, 29 mm. — **St. 183.** > 2000 m. 61°30′ N, 17°08′ W. 11-7-1904. 1800 m.w. 33 spec.: 13 ♂: 12 spec. 23—25 mm., 1 spec. 30 mm.; 20 ♀: 17 spec. 21—27 mm., 3 spec. 31—36 mm. — **St. 63.** 1150 m. 59°49′ N, 8°58′ W. 30-5-1905. 1200 m.w. 5 spec.: 3 ♂ 22—23 mm., 2 ♀ 22 mm. — **St. 71.** 1985 m. 57°47′ N, 11°33′ W. 7-6-1905. 1500 m.w. 8 spec.: 5 ♂ abt. 23 mm., 3 ♀ 23—27 mm. — **St. 72.** 1020 m. 57°52′ N, 9°53′ W. 8-6-1905. 1500 m.w. Abt. 30 spec.: 10 spec. abt. 25 mm.: 5 ♂, 5 ♀; abt. 20 spec. 7—8 mm. — **St. 165.** 1050 m. 60°00′ N, 10°35′ W. 29-8-1905. 1000 m.w. 19 spec. 12—15 mm. — **St. 167.** 1260 m. 57°46′ N, 9°55′ W. 1-9-1905. 1500 m.w. 14 spec. 12—15 mm. — **St. 88.** 600—995 m. 48°09′ N, 8°30′ W. 20-6-1905. 300 m.w., 11^{45} pm., 240 min. 1 spec. 10 mm. — **St. 62.** 2480—2775 m. 50°25′ N, 12°44′ W. 5-6-1906. 1500 m.w., 2^{45} am., 120 min. 11 spec.: 5 ♂ abt. 22 mm., 6 ♀: 5 spec. 22—23 mm., 1 spec. 29 mm. — **St. 74.** 1245—1298 m. 49°23′ N, 12°13′ W. 10-6-1906. 2000 m.w., 6^{35} am., 60 min. 11 spec.: 7 ♂ 24—27 mm., 4 ♀ 22, 23, 23, 33 mm. — **St. 74.** ibid. 2000 m.w. (Eeldrift-seine), 1^{20} pm., 60 min. 1 ♀ 27 mm. — **St. 76.** > 2800 m. 49°27′ N, 13°33′ W. 11-6-1906. 2800 m.w., 3^{00} pm., 120 min. 4 spec.: 2 ♂ 26—29 mm., 2 ♀ 25—32 mm. — **St. 178.** 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w., 9^{05} am., 120 min. 7 spec.: 4 ♂: 25, 25, 27, 29 mm.; 3 ♀ 29, 29, 35 mm. — **St. 179.** 4000 m. 47°20′ N, 12°23′ W. 3-9-1906. 600 m.w., 0^{00} am., 120 min. 2 ♂ 26—30 mm. — **St. 180.** 4000 m. 48°19′ N, 13°53′ W. 3-9-1906. 1800 m.w., 60 min. 5^{05} pm., 6 spec.: 2 ♂ 24—27 mm.; 4 ♀: 2 ♀ 15—17 mm., 2 ♀ abt. 32 mm. — **St. 181.** 1350 m. 49°22′ N, 12°52′ W. 4-9-1906. 1800 m.w., 10^{35} am., 60 min. 4 ♀: 1 ♀ 19 mm., 3 ♀ abt. 33 mm. — **St. 190.** 4000 m. 46°30′ N, 7°00′ W. 11-9-1906. 2700 m.w., 8^{25} am., 150 min. 1 ♂ 29 mm., 1 ♀ 33 mm. — **St. 65.** 1300 m. 35°53′ N, 7°28′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 5 spec.: 1 ♂ 19 mm., 4 ♀ 17, 21, 26, 29 mm. — **St. 66.** 735 m. 36°16′ N, 6°52′ W. 25-2-1909. 300 m.w., 2^{55} am., 120 min. 2 ♀ 17—19 mm. — **St. 69.** > 3500 m. 36°13′ N, 9°48′ W. 28-2-1909. 600 m.w., 9^{00} pm., 60 min. 1 ♂ 19 mm. — **St. 69.** ibid. 3000 m.w., 6^{30} pm., 60 min. 4 spec.: 2 ♂ 19—21 mm., 2 ♀ abt. 25—30 mm. — **St. 71.** 1150 m. 39°35′ N, 9°43′ W.

4-3-1909. 1600 m.w., 4^{00} pm., 120 min. 14 spec.: 4 ♂ 21—23 mm., 10 ♀ 18—24 mm. — **St. 74.** 2000 m. 44°21′ N, 7°55′ W. 9-3-1909. 600 m.w., 0^{10} am., 60 min. 1 ♀ 33 mm.

The material contains totally 2473 spec. (580 ♂, 1164 ♀, 729 spec. 9—15 mm) from 65 stations, 96 hauls.

A. Mediterranean.

	Stations	Hauls	No. of specimens ♂	♀	Jun. 9-15mm.	total
Dec. 1908.........	3	5	30	53	1	84
Jan. 1909.........	4	10	57	161	—	218
Feb. —	8	13	140	193	98	431
June 1910.........	8	10	174	409	389	972
July —	7	12	21	43	46	110
Aug. —	8	17	68	153	114	335
Sept. —	3	3	25	62	27	114
total...	41	70	515	1074	675	2264

Depths of the sea and occurrence. Of the 41 stations where the species was taken, 12 lie in the eastern basin, the species having been taken as far in as the Adriatic and the Marmora. The remaining 29 stations lie more or less evenly distributed throughout the western basin.

The depth of sea is over abt. 850 m, especially 1000—3000 m.

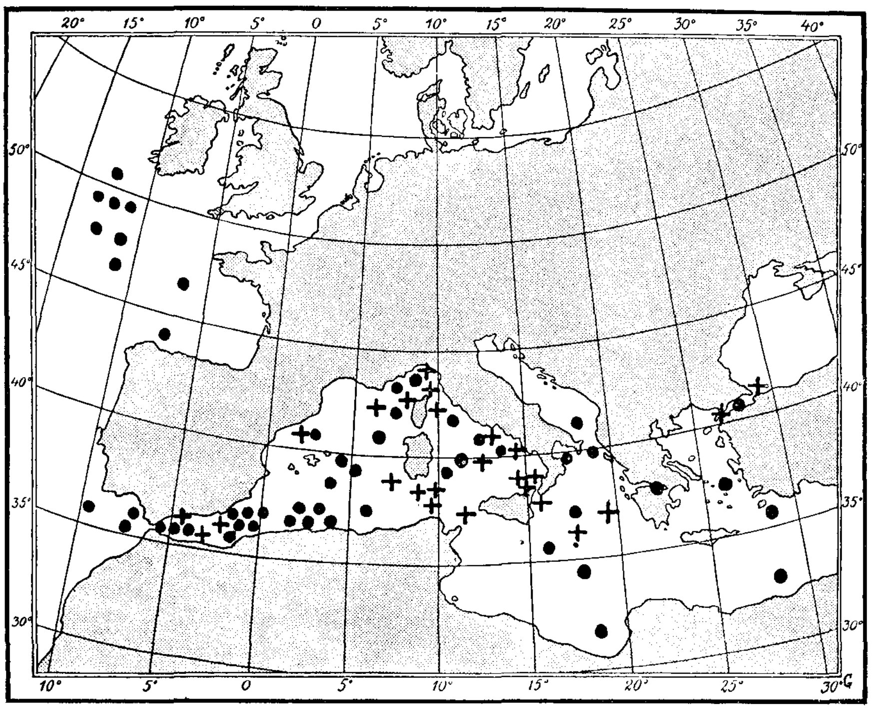

Chart 1. Gennadas elegans. ● positive stations (the stations from 1903—04 lie outside the chart to N.W.). + negative stations (> 500 m, night, > 50 m.w.) (not noted in the Atlantic).

Depths in m.	No. of stations
> 500—1000 ...	6
> 1000—2000 ...	13
> 2000—3000 ...	18
> 3000 ...	4
total...	41

Two hauls (from st. 15, 1908, and st. 24, 1909) having given total 38 spec., are omitted here, the hour being not noted (day?, night?)			No. of hauls	Duration in hours	No. of spec.	No. of spec. pr. hour
Eastern Basin	Winter	Night..	2	2	36	18
		Day...	2	2	42	21
	Summer	Night..	13	8.75	44	5
		Day...	2	2	20	10
		total...	19	14.75	142	9.6
Western Basin	Winter	Night..	16	13	494	38
		Day...	6	9	123	13.7
	Summer	Night..	22	13.25	1166	88
		Day...	5	7.75	301	38.8
		total...	49	43	2084	48.5

Taking as negative all stations where depth is over 500 m, and night hauls made with over 50 m.w. showed no specimens taken, we have in the eastern basin 3 negative stations (with an additional one in the Black Sea) as against 12 positive. The western basin has 20 negative stations scattered evenly about among the 29 positive. Thus, though we have relatively more positive stations in the eastern basin than in the western, the hauls made in the western basin gave a comparatively far larger yield, viz:

Western basin (49 hauls, 43 hours, 2084 spec.), or 42.5 spec. per haul, 48.5 per hour, while the eastern basin (19 hauls, 14.75 hours, 142 spec.) only yielded 7.5 specimens per haul, or 9.6 per hour.

The table further shows that the eastern basin in winter gave more specimens per hour than in summer, while the reverse is the case in the western basin.

Vertical occurrence.

Winter.

Night, m.w.	Hauls	Specimens	Durations of hauls in hours	No. of spec. pr. hour
65—100	3	35	2	17.5
200	1	60	0.5	120
300	4	173	2	86.5
500—600	5	142	3	47.3
1000—1200	2	76	1.5	50.7
1600	3	44	6	7.3
total...	18	530	15	35.3
Day				
[300	2	42	2	21.0][1]
600	1	2	1	2
1000	1	3	2	1.5
1650	2	44	3	14.7
2500—2600	2	74	3	24.7
total...	8	165	11	15

[1] see the text.

Night, m.w.	Spec. total	Spec. 9—15 mm.	% of spec. 9—15 mm.
65	35	22	62.9
200	60 } 233	—	0 } 17.2
300—400	173 }	40	23.9 }
500—600	142	21	14.7
1000—1200	76	8	10.5
1600	44	4	9.1

Summer.

Night, m.w.	Hauls	Specimens	Durations of hauls in hours	No. of spec. pr. hour
65	1	1	0.5	2
300—400	14	576	6.25	92.1
600	2	14	1	14
1000—1200	14	276	10.5	26.3
2000	4	343	3.75	91.5
total...	35	1210	22.0	55
Day				
1200	1	5	1	5
2000—2800	3	265	4.75	55.8
3500—4000	3	51	4	12.8
total...	7	321	9.75	32.9

Winter. 2 winter hauls (300 and 1400 m.w., total 38 spec.) cannot be included, as the time was not noted.

The 18 night hauls have a line-length of 65—1600 m.w. but the no. of specimens per hour shows that the species was taken almost exclusively with 200—1200 m.w. especially 200 m.w. In the daytime, it was taken with 300—2600 m.w., especially 1650—2600 m.w. The great number of specimens at 300 m.w. is due to a single haul (St. 13, $^{19}/_{12}$ 1908, 5.35 p. m.) which yielded 40 specimens; owing to the season, however, this should certainly be regarded as a night haul, though actually made in the afternoon (5.35 p. m.).

As regards size of the specimens, it will be seen that large and small are found evenly together; the small ones (9—15 mm) keep more particularly to the upper water layers, 65 m.w. (never taken nearer the surface than this) comparatively few being taken at the greater depth, the reverse being the case with the larger individuals.

Summer. At night, the species was taken with 65—2000 m.w but practically speaking, only with at least 300 m.w. Strangely enough, almost equal numbers per hour were taken with 300—400 m.w. and with 2000 m.w., the intermediate water layers giving far smaller numbers.

In the daytime, it was only taken with 1200—4000 m.w., especially 2000—2800 m.w. The small specimens (9—15 mm) are in summer, strangely enough, more evenly distributed among the large in regard to depth than in winter.

These results agree very well with Murray & Hjort 1912 p. 668; they have 292 specimens, of which 220 were taken by day at a depth of 500 to over 1500 m, especially at 750—1000 metres down; at night, 72 specimens, 150—over 1500 m down, especially at 150—1250 m. See also Bouvier 1908 p. 26. —

The colour is red with blue spots; see especially Kemp, Ireland 1910, p. 15—16; a coloured figure is given by Lo Bianco, 1904 fig. 37. Eyes brown (Murray & Hjort 1912, p. 669).

Size and propagation. The size is generally up to 24 mm, specimens of either sex can however grow to 27 mm the ♀ even to 29 mm. (Kemp 38 mm, Pesta 1918 30—40 mm, Smith 43 mm) but only a few specimens as large as this have been found. The petasma can be distinguished when the ♂ is 16 mm (Bouvier gives 14 mm); in specimens of 18 mm the petasma can be fully developed (Bouvier has 25 mm, but most of his material is from the Atlantic). Pesta, 1918, notes, strangely enough, that specimens less than 30—40 mm are not mature.

As the female lays her eggs directly into the water, not carrying them about with her for a time, it is impossible to determine the time when eggs are laid by observation of egg-bearing females. It has been found, however, that a number of them have ova in the ovary, visible through the thin skin, and were it not that part of the material is somewhat damaged as to the hinder portion of the pereion, body and tail breaking a little apart, we might certainly have found far more. Females with ova in the ovarium are (18) 20—24 mm. They were taken on the 7.—21. Feb. night, 300—1200 m.w., and 25. June, night, 1200—2000 m.w. The species thus propagates all the year round. The smallest specimens are (6) 9—10 mm.

For probable larvæ of the species see below, under *Euphema* (*armata* M.-Edw.?) p. 21.

B. Atlantic.

The material contains 209 spec. (65 ♂, 90 ♀, 54 spec. 8—15 mm.) from 24 st., 26 hauls.

The stations range from south of Iceland (1903—04) round the Irish coast (1905—06) to the Bay of Cadiz (1909).

It appears to agree in every respect with the Mediterranean, save in the fact that it does not come up quite so near the surface either day or night; and also, in attaining a somewhat larger size: ♂ 30 mm., ♀ 33 mm.

Summary.

The species keeps almost exclusively to depths of sea beyond 1000 m., especially 1000—3000 m. The "Thor" has taken it from south of Ireland to the eastern part of the Mediterranean. It is pelagic; at night it was taken especially with 200—300 m.w., by day especially 1650—2800 m.w., and there does not appear to be any perceptible difference (in the Mediterranean) in regard to season. The smaller specimens are most numerous near the upper limit of the species, the larger ones lower down. The species occurs often, at any rate, in shoals.

It is found in the Mediterranean in both basins, being, however, more numerous in the western, which agrees with the fact of its penetrating, in the Atlantic, far to the northward, as far as Iceland and Greenland. It is the only Penæid which has been met with in such high latitudes. In the Mediterranean, it probably breeds all the year round.

Distribution.

Mediterranean; Atlantic from Greenland to S. Africa.

1. Mediterranean. On the "Thor" see above. — Capri, several st.; between Capo Corso and Villafranca; Salina (Eolian Isl.) (Lo Bianco 1902, 1903, 1904). — 12 st. abt. from Valencia to Capri (Bouvier 1908). — Messina (Riggio 1901). — Southern Adria (Szütz 1915, Pesta 1918).

2. Atlantic. On the "Thor" see above. — W. Greenland 60°—65 1/2° N, 839—2000 m. w., several st. (K. Stephensen 1913). — E. Greenland 64 1/2° N, 31°—32 1/2° W, 1300—2000 m.; W, SW, S. and E. of Iceland, 582—1300 fms. (H. J. Hansen 1908). — E. America 31 3/4°—41 1/4° N, 372—2369 fms. (Smith 1882). — W and SW Ireland, several st. (Calman 1903; Kemp, Ireland 1910). — Biscaya (Kemp 1907, p. 206; Bouvier 1908, st. 1549, 1583). — Cadiz Bay (Bouvier 1908, st. 1905, 2016). — Between Europe and New Foundland (Murray and Hjort 1912, p. 669; Sund 1920, p. 27). — Several stations abt. 30°—40° N, 22°—42° W; Madeira 3 st.; 16°55′ N, 25°21 3/4′ W (Bouvier 1908). — Abt. 31° N, 40° W, closing net 1300—1500 m.; 12.3° N, 22.3° W, 0—400 m. (Ortmann 1893). — St. Lucia (W. Indies), 423 fms. (Milne-Edwards and Bouvier 1909). — 0°46′ N, 18°59′ W; 8°43′ S, 11°55′ W; 35°39′ S, 8°16′ E (Lenz & Strunck 1914). — Cape Point Lighthouse S. 83° E, 35 1/2 miles, 360 fms. (Stebbing 1918 [1919?]).

2. GENNADAS TINAYREI Bouvier.

Gennadas Tinayrei Bouvier 1908, p. 29, 48 (lit.), Pl. 1 fig. 4 (cold. fig.), Pl. 10.
— — Murray & Hjort 1912, p. 668.
Amalopenæus — Sund 1920, p. 29.

Atlantic.

St. 65. 1300 m. 35°53′ N, 7°21′ W. 24-2-1909. 1600 m.w., 0[30] pm., 120 min. 28 spec.: 13 ♂ 17—23 mm., 15 ♀ 16—22 mm. — **St. 69.** > 3500 m. 36°13′ N, 9°44′ W. 28-2-1909. 300 m.w., 11[40] pm., 30 min. 33 ♀ 18—20 mm. — **St. 69.** ibid. 600 m.w., 9[00] pm., 60 min. 4 ♂ 22—24 mm.

Colour: red (the adult; Bouvier p. 50, Pl. 1 fig. 4) or red orange (the young; Bouvier p. 50). Murray & Hjort give the colour as »coralline, bright-blue patches; eyes darkbrown, ratio of carapace to eyes 7.7.« —

The "Thor" took 65 specimens in all, (17 ♂, 48 ♀); previously, only about 50 specimens were known, (Bouvier 6, Murray & Hjort 41). The size of the "Thor" specimens is about equal for both sexes, up to 24 mm., thus not reaching the maximum hitherto known (30 mm., Bouvier).

At night, they were taken with 300—600 m.w., by day with 1600 m.w. This agrees very well with previous records; Murray and Hjort took 9 spec. by day at a depth of 500—1500 m., especially 500, but 32 at night, 50—1500 metres down, especially (24 spec.) 100—300 m. down. The 6 specimens mentioned by Bouvier were taken with 1200—3000 m.w. (daytime?).

Distribution. The species is not new to European waters, having been previously taken at 35°13′ N, 8°06′ W (Monaco St. 2016, Bouvier). The other specimens mentioned by Bouvier were taken at 39°26′ N, 31°23$^1/_2$′ W, 0—1200 m.w. (st. 2212), 37°30′ N, 22°29′ W, 0—3000 m.w. (st. 2264), 36°17′ N, 28°33′ W, 0—3000 m.w. (st. 1849), and 27°36′ N, 38°29′ W, 0—2225 m.w. (st. 2087). — Those mentioned by Murray & Hjort and Sund 1920 were all taken between Europe and New Foundland. — 11° S, 19° W (St. Helena; Lenz & Strunck 1914).

3. GENNADAS VALENS S. I. Smith.

Amalopenæus valens Smith 1884, p. 402—04, Pl. 10 fig. 2.
Gennadas — Bouvier 1908, p. 28, 44 (lit.), Pl. 1 fig. 3 (cold. fig.), Pl. 9.
— — Murray & Hjort 1912, p. 668.
?*Amalopenæus* — Kemp, Ireland 1910, p. 19, textfig.
— — Sund 1920, p. 28.

Atlantic.

St. 71. 1150 m. 39°35′ N, 9°45′ W. 4-3-1909. 1600 m.w., 4^{00} pm., 120 min. 1 ♂ 28 mm. — **St. 91.** 1225 m. 35°53′ N, 7°26′ W. 18-6-1910. 1600 m.w., 5^{25} pm., 60 min. 16 spec.: 2 spec. 15—17 mm.; 4 ♂: 25, 27, 29, 31 mm.; 10 ♀: 21, 21, 23, 23, 31, 32, 33, 34, 34, 34 mm. — **St. 231.** 1000 m. 35°56′ N, 7°16′ W. 9-9-1910. 300 m.w., 1^{15} am., 30 min. 1 ♂ 27 mm. — **St. 232.** 3700 m. 36°28′ N, 9°06′ W. 9-9-1910. 300 m.w., 10^{35} pm., 30 min. 1 ♂ 33 mm., 1 ♀ 23 mm. — **St. 232.** ibid. 1000 m.w., 10^{35} pm., 30 min. 2 ♀ 33—36 mm. — **St. 232.** ibid. 2000 m.w., 11^{45} pm., 30 min. 12 spec.: 7 spec. 16—18 mm., 3 ♂ 27, 32, 33 mm., 2 ♀ 25—37 mm. — **St. 234.** 920 m. 38°10′ N, 9°20′ W. 10-9-1910. 300 m.w., 10^{30} pm. 1 ♂ 27 mm. — **St. 234.** ibid. 1000 m.w., 11^{20} pm., 30 min. 1 ♂ 34 mm.

M.W.	No. of hauls	
	Night	Day
300	3	—
1000	2	—
1600	—	2
2000	1	—

A coloured fig. see Bouvier Pl. 1, fig. 3. Murray & Hjort 1912, p. 668 give the colour as "coralline; bright blue patches. Eyes brown. Ratio of carapace to eyes 7.8".

The "Thor" material includes 36 specimens (12 ♂, 15 ♀, 9 jun.) from 5 stations, 8 hauls, all situated in the Bay of Cadiz. The species has formerly been taken on a single occasion (Monaco St. 2016, 1905, Bouvier).

Specimens less than 20 mm. can hardly be determined as to sex. The maximal size is 34 mm. for ♂, 37 for ♀. The largest size noted in extant works is 45 mm. for ♂, 35 mm. for ♀ (Bouvier) and 48 mm. for ♀ (?, Kemp).

Depth of sea 920—3700 m.

In the daytime, it was only taken with 1600 m.w.; at night, with 300—2000 m.w., especially 300(—1000) m.w. This agrees very well with previous records. Murray & Hjort have 98 specimens taken between Europe and Newfoundland (precise locality not stated). Of these, 88 were taken at night at a depth of 500—1500 m. below surface, but the 49 were taken 100—150 m. down. The ten specimens from day hauls were taken 500—1500 m. down, especially 500—1000 (8 spec.). — Bouvier has 21 specimens, all taken (by day?) with 1000—5000 m.w.

Distribution. 37°16$^1/_2$′ N, 74°20$^1/_2$′ W, 640 fms., 1 ♂ 38 mm. (Smith 1884). — Between New Foundland and Europe, 98 spec. (Murray & Hjort; Sund 1920). — 31°38$^1/_2$′—31°43′ N, 42°38′—42°40$^1/_2$′ W, 3 st., 0—1500 to 0—3000 m.w.; 33°41′ N, 36°35′ W, to 36°46′ N, 26°41′ W, 4 st., 0—2000 to 0—3250 m.w.; 31°06′ N, 24°06$^3/_4$′ W, 0—5000 m.w.; 30°41′ N, 17°46′ W to 27°43′ N, 18°28′ W, 3 st., 0—1000 to 0—3000 m.w.; 35°13′ N, 8°05′ W, 0—1800 m.w. (Bouvier 1908). — ?SW of Ireland 50°51$^1/_2$′ N, 12°8′ W, 0—480 fms. (Kemp 1910). — 17°28′ N, 29°42′ W; 0°46′ N, 18°59′ W; 11° S, 19° W; 35°39′ S, 8°16′ E (Lenz & Strunck).

4. GENNADAS SIMILIS n. sp. (Fig. 1).

Atlantic.

St. 65. 1300 m. 35°53′ N, 7°21′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 1 ♂ 38 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 4-3-1909. 600 m.w., 6^{35} pm., 120 min. 1 ♂ 39 mm., type. — **St. 231.** 1000 m. 35°56′ N, 7°16′ W. 9-9-1909. 300 m.w., 1^{15} am., 30 min. 1 ♂ 28 mm. — **St. 232.** 3760 m. 36°28′ N, 9°05′ W. 9-9-1910. 2000 m.w., 11^{45} pm., 30 min. 2 ♂ 34—35 mm. — **St. 234.** 920 m. 38°10′ N, 9°20′ W. 10-9-1909. 300 m.w., 10^{30} pm., 30 min. 1 ♂ 36 mm.

Description of the specimen from st. 71.

Length abt. 39 mm., carapace (incl. rostrum) 11.5 mm.

There are no podobranchiæ.

The dorsal and apical tooth of the rostrum rather long. Antennary and infra-antennary angles acute; branchiostegal spine present. The distance dorsally between the cervical and post-cervical grooves of the carapace is $^1/_5$—$^1/_6$ of the distance from the postcervical groove to the hinder margin. Median carina visible throughout the length of the carapace.

In the antennulæ the second joint in the peduncle dorsally is two-thirds the length of the third joint. Antennal plate a little more than three times as long as wide; the sides are not convex.

Second joint in mandibular palp as long as the greatest width of the first joint. In second maxilla the anterior lobe of the internal lascinia is not wider at the apex than at the base and is slightly narrower than the hinder lobe of the external lascinia. The endopod bears two (three?) curved spines and is rather broad.

In the first maxillipede the third joint in the endopod is twice as long and $1^1/_2$ time as wide as the second joint. There is a little terminal (fourth) joint. The basal joint bears four stiff spines, the proximal one somewhat longer and thinner than the other three. In the second maxillipede the merus is not twice as long (total length) as broad, the width is the same in both ends, and the part beyond the insertion of carpus is abt. one fifth the entire length of the merus. Dactylus has two strong apical spines.

In p. 1 carpus has the same length as the chela, or a little more than half as long as the merus. These proportions are the same in p. 2 except that carpus is two-thirds the length of the merus. In p. 3 the merus and carpus are of the same length; the chela is a little more than half the length of the carpus, and the dactylus a trifle shorter than the palm. First joint in p. 4 evenly rounded below.

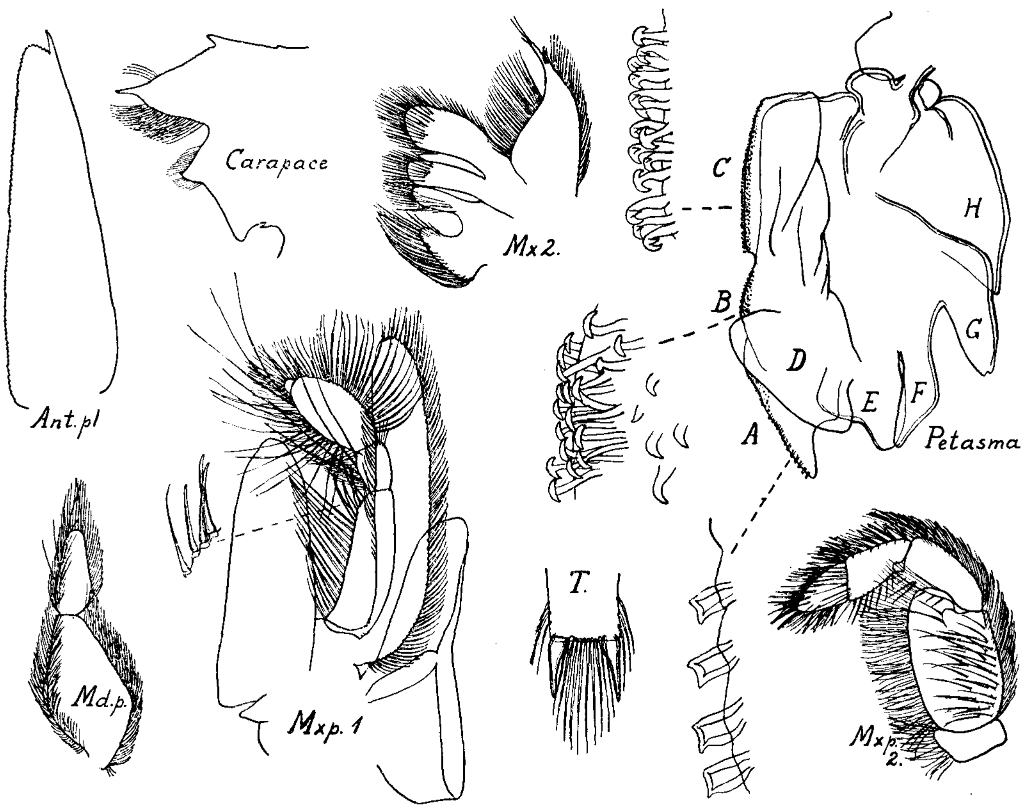

Fig. 1. Gennadas similis ♂. The setæ on the masticatory process of mxp. 1 are not drawn.

Only the sixth abdominal segment is dorsally carinate. Telson is truncate; between the two stout marginal spines it bears five pairs of plumose setæ.

The petasma is very characteristic. The median edge is longer than the other edges and ends distally in a long process with abt. 13 straight, stiff, stout spines (at A in the fig.), each of them being a little bifid in the apex. Proximally of these great spines some spines are situate, much lesser and shorter, but in very great number. At B and C in the fig. the spines are much thinner, but a little curvate and with the apex anchor-shaped, rendering it very difficult to part the two halves of the petasma from each other. At the distal part of the anterior side of petasma (this side turns toward the ventral side when the petasma lies in the natural position) is placed a lap (D in the fig.) which along with that of the other half of petasma lies between the much excavate parties of the ventral side at the basis of p. 5. The very characteristic shape of the processes E-H may be seen from the fig.

Among species hitherto described, the petasma of the present species mostly resembles that of *G. parvus* (Kemp 1909, Pl. 75, fig. 1) and *G. Alcocki* (Kemp, Indian Mus. 1910, Pl. 13, fig. 5), the lobes D—G being also found in these two species in similar form, only much smaller. On account of this similarity, I have named the present species *similis*. —

Occurrence, etc. There are altogether 6 ♂, (probably all adults) 28—39 mm. All were taken in the Bay of Cadiz; depth to bottom 920—3760 m.; taken with 300—2000 m.w. by night, with 1600 m.w. by day. No information as to colouring.

5. GENNADAS CHIASMIFERA n. sp. (Fig. 2—3).

Atlantic.

St. 65. 1300 m. 35°53′ N, 7°21′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 1 ♀ 34 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 4-3-1909. 600 m.w., 6^{35} pm., 120 min. 1 ♀ 39 mm. (carapace 12 mm.), type.

This species, extremely easy to distinguish by its thelycum, is so nearly allied to the *G. similis* ♂ above described that it might be taken for the ♀ of that species, were it not that the ♀ described below (*G. bidentata*) the ♂ of which is likewise unknown, approaches no less nearly to *G. similis*. I have therefore preferred to give each ♀ its separate name, even though one of them may later be found to be ♀ to the ♂ above noted.

Apical joint in the mandibular palp narrower. In the first maxilliped the basal joint of the endopod bears three stiff spines. The third joint only $1^1/_2$ time as long and abt. $1^1/_4$ time as broad as the second joint. In the second maxilliped (fig. 2) the merus is broader in the distal than in the proximal end; the total length is $^5/_3$ the greatest width, and the part beyond the insertion of carpus is very great, $^1/_3$ as long as the total length of the merus. Dactylus has only one strong apical spine. First joint in p. 4 has at the underedge a single, rather stout tooth.

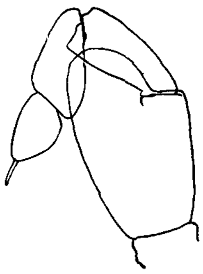

Fig. 2. Gennadas chiasmifera ♀. 2. Maxilliped (setæ omitted).

Thelycum (fig. 3) is composed anteriorly of a tongue-shaped broad process (between the two pereiopoda of third pair) with the apex turned backward, which along with the greater median process of the plate between the two pereiopoda of the fourth pair forms a hollow, very broad H or X; from this I have given it the name of *chiasmifera*. The plate between the two pereiopoda of the fourth pair is widest at the middle, very contracted toward the ends which again are somewhat broader than the narrow parties. Between the two pereiopoda of fifth pair lies a plate longer than broad, sending a tongue-shaped process toward the middle of the plate lying between the two pereiopoda of fourth pair. The posterior part of the plate is cleft into two ovular processes.

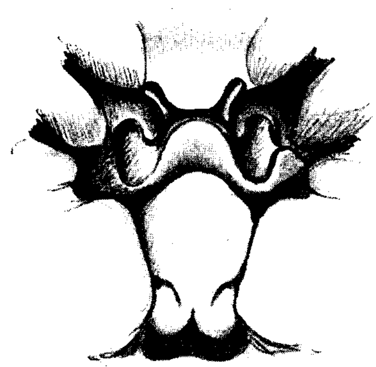

Fig. 3. Gennadas chiasmifera ♀, thelycum (St. 71, 1909, 600 m.w.)

Occurrence etc. Both specimens were taken at the Bay of Cadiz. The depth of the sea is 1150—1300 m. The vertical occurrence is: 600 m.w. (night) and 1600 m.w. (day).

6. GENNADAS BIDENTATA n. sp. (Fig. 4—5).

Atlantic.

St. 71. 1985 m. 57°47′ N, 11°33′ W. 7-6-1905. 1500 mw. 1♀ 48 mm. (carapace 15 mm.), type. — **St. 65.** 1300 m. 35°53′ N, 7°21′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 7♀ 24—27 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 4-3-1909. 600 m.w., 6^{35} pm., 120 min. 2♀ 34—39 mm.

Apart from its thelycum, this species is characterised by the two powerful teeth on the inferior margin of 1. joint in p. 4. For the rest, it is very closely allied to the above described ♂ and ♀ (*G. similis, G. chiasmifera*).

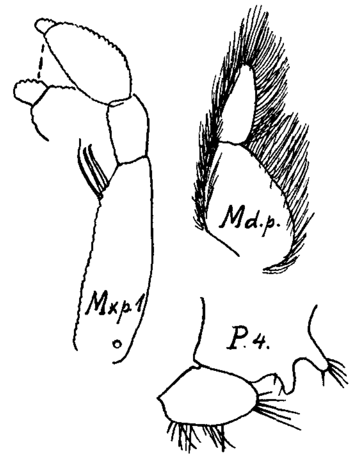

Fig. 4. Gennadas bidentata ♀. Mandibular palp, endopodite of 1. maxilliped, and 1.—2. joint of 4. pereiopod.

No podobranchiæ.

Differs from *G. similis* only in the following features:

The apical and dorsal tooth of the rostrum a little shorter. In the antennulæ the second joint in the peduncle dorsally is abt $^3/_4$ the length of the third joint. Both joints in the mandibular palp a little broader. The endopodite in second maxilla bears 4 curved spines. In the first maxilliped the basal joint of the endopodite bears 3 stiff spines. The second and third joints are as in *G. chiasmifera*, but fourth joint (the apical joint) relatively greater. The second maxilliped totally as in *G. chiasmifera*, thus somewhat differing from *G. similis*. Dactylus has one strong apical spine.

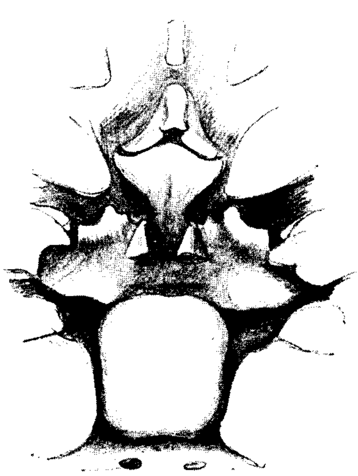

Fig. 5. Gennadas bidentata ♀, thelycum. (Fig. 71, 1905).

Both p. 1 and p. 2 are a little differing from the two above species, carpus being a little longer; in p. 1 the carpus is $^2/_3$, in p. 2 abt. $^4/_5$ the length of the merus. P. 3 as the two above species. 1. joint in p. 4 has the under edge 2 rather great teeth (hereof the specific name).

The thelycum (fig. 5) is very complicate. In the younger specimens the thelycum consists of the same principal parts, but these are lesser differentiate in details which especially applies to the fore edge of the great plate between the two pereiopoda of the fourth pair. In none of the specimens the thelycum is so highly developed in details as in the greatest specimen (fig.).

Occurrence etc. The type was found W. of N. Ireland, the other specimens in the Cadiz Bay. The depths of the sea were 1150—1985 m. At night is was taken with 600 m.w., at day with 1500—1600 m.w.

Genus Aristæomorpha Wood-Mason & Alcock.

Aristeomorpha Bouvier 1908, p. 52.
Aristæomorpha Stebbing, S. Afr. 1914, p. 24 (lit. and syn).

1. ARISTÆOMORPHA FOLIACEA Risso. (Fig. 6).

Aristeomorpha foliacea Bouvier 1908, p. 53 (lit. and syn.), Pl. 3 fig. 1 (cold. fig.), Pl. 11 figs. 1—5.
— — Sund 1920, p. 31.

Larva.

Aristeus antennatus Monticelli e Lo Bianco, Su la probabile larva di *Arist. antenn.*; Monit. Zool. Ital., Anno 13 (suppl.) Roma 1902[1] (*teste* Bouvier 1908, p. 53, 75).
— — Lo Bianco 1903, p. 184, Pl. 7 fig. 12 (cold. fig.).

Larvæ (and young stage).

Mediterranean.

St. 196. 660 m. 39°59′ N, 14°31′ E. 22-8-1910. 25 m.w., 2^{40} am., 30 min. 1 spec. 9 mm. — **St. 277.** ("Pangan"). > 3000 m. 33°20′ N, 27°30′ E. 6-4-1911. 132 m.w., 11^{35} pm., 35 min. 1 spec. 10 mm. — **St. 340.** ("Pangan"). > 2000 m. 35°50′ N, 21°30′ E. 26-8-1911. 108 m.w., 9^{00} pm., 30 min. 1 spec. 10 mm. — **St. 384.** ("Pangan"). > 3000 m. 32°50′ N, 27°10′ E. 7-11-1911. 122 m.w., 9^{00} pm., 30 min. Young stage, 9 mm.

Atlantic.

St. 376. ("Florida"). > 3500 m. 34°41′ N, 16°14′ W. 22-7-1911. 15 m.w., 8^{45} pm., 30 min. 3 spec. abt. 9 mm. — **St. 376.** ibid. 30 m.w., 8^{40} pm., 30 min. 2 spec. 7—8 mm.

Of this species which is a bottom form, living in a depth of 400—1300 m., the "Thor" has not taken the adult stage.

On the other hand the material contains some larvæ (Mysisstage) and a young stage. The length is 7—10 mm.

I have not had access to Monticelli and Lo Bianco's original description of the larva of 1902; but 1903 Lo Bianco has given a short description and a coloured figure of the larva in dorsal view. The larvæ from the "Thor" agree so well with Lo Bianco's larva that there cannot be doubt that the larvæ are identic; but a few things may be added or corrected in his description, and I give some detail figures in order to complete his habitus figure.

The rostrum has at the dorsal side 2 or (in the elder specimens) 3 teeth. A little notch is placed in the dorsal middle line of the carapace somewhat behind the rostrum. There is a spine above the eye and on the anterior under edge of the carapace; hepatic spine present. All the specimens have chelæ at p. 1—p. 3. The antennal plate

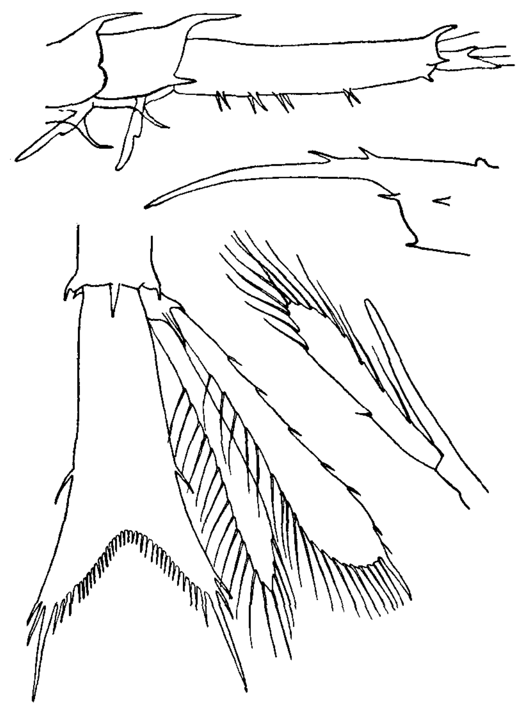

Fig. 6. Aristæomorpha foliacea, larva 9 mm ("Thor" St. 196). Rostrum, ant. 2, the last abdominal segments and caudal fan. (All drawn to the same scale).

has no apical tooth; but a spine is placed at the middle of the side edge, not at the anterior third part as in Lo Bianco's fig. The sixth abdominal segment has at its under edge 4 or (in the elder specimens) 5 pairs of spines. The telson has in the hook inside the great apical spines abt. 16 pairs of lesser spines. The peduncle of the uropods ends with two teeth; the outer ramus is rather broad toward the apex and ends in a rather long apical tooth.

The colour cannot be seen from the "Thor"-specimens; it is whitish (hyaline?) with red and orange spots (Lo Bianco's cold. fig.).

The young stage has lost all the spines at the dorsal side of the abdomen except that on the 6th segment, now very little; but all the other spines on the abdomen are present. —

The depths of the sea are 660—> 3500 m., thus much greater than the depths for the adult (400—1300 m.);

[1] I have not had access to this paper.

all the specimens were taken during the night, 15—132 m.w.

Distribution. 1. Mediterranean. Nizza, Napoli, Palermo, Messina, N. Africa 725 m., Sea of Candia 808—1242 m.; 37°53′—39°58$^1/_2$′ N, 9°27$^3/_4$′—11°56$^1/_2$′ E, 4 stations, 395—860 m. (SENNA 1903). — W. of Cape Scalambri, Sicilia, 618 m. (BOUVIER).

2. Atlantic. W. of Casablanca, Morocco, 851 m. (BOUVIER). — Bay of Cadiz, 535 m. (SUND 1920). — ?Bay of Darien (N. of Panama) (SMITH 1885).

3. Indic. ?Bay of Bengal (*A. giglioliana* WOOD-MASON?, *teste* BOUVIER 1908).

Genus Solenocera Lucas 1850.

Solenocera Bouvier 1908, p. 86.

1. SOLENOCERA SIPHONOCERA Phil.

Solenocera membranacea Bouvier 1908, p. 87 (lit. and syn.).
— *siphonocera* Kemp, Ireland 1910, p. 20 (lit. and syn.), Pl. 2.
— *membranacea* Pesta 1918, p. 36 (lit.), figs. 3—5.

The larva.

Solenocera siphonocera Monticelli & Lo Bianco 1900.*
— — — — Uova e larve di *S. s.* Monit. Zool. Ital., Anno 12, 1901, p. 205.*
— — Lo Bianco 1902, p. 437.
— — — 1903, p. 183.
— — — 1904, p. 32, figs. 39—40 (cold. figs.).
Penæus siphonocerus Williamson 1915, p. 340, figs. 8—9.

Adult stage.

St. 213. 75 m. 40°14′ N, 0°54′ E. 31-8-1910. Monaco-trawl, 6 spec., 38—abt. 75 mm.

Larvæ.

Mediterranean.

St. 98. 775 m. 35°57′ N, 5°35′ W. 23-6-1910. 65 m.w., 6^{35} pm., 15 min. 2 spec. — **St. 104.** 250 m. 36°37′ N, 2°04′ W. 24-6-1910. 65 m.w., 6^{20} pm., 30 min. Abt. 15 spec. — **St. 106.** 1150 m. 36°33′ N, 2°00′ W. 25-6-1910. 65 m.w., 2^{30} am., 30 min. 4 spec. — **St. 106.** ibid. 300 m.w., 1^{45} am., 30 min. Abt. 10 spec. — **St. 107.** 2000 m. 36°13′ N, 1°28′ W. 25-6-1910. 65 m.w., 9^{50} am., 15 min. Abt. 10 spec. — **St. 107.** ibid. 300 m.w., 9^{05} am., 30 min. 2 spec. — **St. 108.** 2435 m. 36°03′ N, 0°27′ W. 25-6-1910. 300 m.w., 10^{30} pm., 30 min. 3 Zoeæ, abt. 10 Mysis st. — **St. 108.** ibid. 2000 m.w., 0^{40} am., 60 min. 2 spec. — **St. 112.** 2700 m. 36°56′ N, 2°15′ E. 27-6-1910. 25 m.w., 1^{30} am., 15 min. 1 spec. — **St. 113.** 815 m. 36°53′ N, 3°09′ E. 28-6-1910. 300 m.w., 3^{25} am., 30 min. 4 spec. — **St. 123.** > 600 m. 44°14′ N, 8°55′ E. 3-7-1910. 25 m.w., 1^{50} am., 15 min. 7 spec. — **St. 123.** ibid. 65 m.w., 0^{55} am., 30 min. Abt. 60 spec. — **St. 124.** 86 m. 44°20′ N, 9°05′ E. 3-7-1910. 65 m.w., 3^{30} am., 90 min. Abt. 35 spec. — **St. 126.** 600—620 m. 42°43′ N, 9°50′ E. 10-7-1910. 300 m.w., 9^{30} pm., 30 min. 5 spec. — **St. 132.** 1227 m. 38°57′ N, 9°47′ E. 14-7-1910. 600 m.w., 4^{50} am., 30 min. 1 spec. — **St. 139.** 530 m. 37°57′ N, 11°54′ E. 20-7-1910. 300 m.w., 2^{35} am., 30 min. 1 spec. — **St. 143.** 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 25 m.w., 1^{20} am., 30 min. 1 spec. — **St. 143.** ibid. 300 m.w., 0^{30} am., 30 min. 2 spec. — **St. 143.** ibid. 1000 m.w., 2^{00} am., 60 min. 2 spec. — **St. 174.** 120 m. 40°54′ N, 28°53′ E. 11-8-1910. 65 m.w., 11^{50} am., 30 min. Abt. 100 spec. — **St. 175.** 1103 m. 40°48′ N, 27°59′ E. 11-8-1910. 400 m.w., 11^{20} pm., 30 min. 4 spec. — **St. 175.** ibid. 1200 m.w., 0^{25} am., 30 min. 1 spec. — **St. 176.** 560 m. 40°45′ N, 27°43′ E. 12-8-1910. 65 m.w., 4^{00} am., 30 min. Abt. 40 spec. — **St. 192.** 650 m. 38°07′ N, 15°35′ E. 20-8-1910. 600 m.w., 10^{50} pm., 30 min. 1 spec. — **St. 195.** 3160 m. 39°02′ N, 14°55′ E. 21-8-1910. 65 m.w., 6^{50} pm., 15 min. 1 spec. — **St. 206.** 2782 m. 39°32′ N, 5°15′ E. 28-8-1910. 300 m.w., 1^{05} am., 15 min. 1 spec. — **St. 209.** > 2000 m. 40°34′ N, 3°03′ E. 28-8-1910. 150 m.w., 4^{25} am., 20 min. 4 spec. — **St. 209.** ibid. 2000 m.w., 7^{25} am., 45 min. 1 spec. — **St. 210.** 775 m. 41°10′ N, 2°23′ E. 30-8-1910. 600 m.w., 3^{35} am., 30 min. 5 spec. — **St. 217.** > 2000 m. 38°01′ N, 1°48′ E. 1-9-1910. 300 m.w., 1^{40} pm., 30 min. 2 spec. — **St. 279.** 350 m. Messina-Straits. 23-2 1911. 300 m.w., 9^{30} pm., 150 min. 1 spec.

Atlantic.

St. 1. 94 m. 49°17′ N, 4°13′ W. 28-11-1908. 25 m.w., 2^{50} am, 30 min. 1 spec. — **St. 93.** 40 m. 36°17′ N, 6°17′ W. 22-6-1909. 50 m.w., 9^{20} pm., 30 min. 1 spec. — **St. 95.** 275 m. 35°57′ N, 6°00′ W. 23-6-1909. 65 m.w., 5^{50} am., 30 min. Abt. 10 spec. — **St. 96.** 190 m. 35°48′ N, 5°58′ W. 23-6-1909. 65 m.w., 9^{30} am., 30 min. 1 spec.

A. Mediterranean.

The adult stage was taken in some few specimens at one station between the Baleares and Spain.

The larvæ ("*Opisthocaris*") were taken at a number of stations from the straits of Gibraltar to Constantinople; all the specimens from the "Thor" belong to the Mysis stage except 3, being Zoeæ.

I have not had access to MONTICELLI and LO BIANCO l. c. 1900 and 1901. LO BIANCO (1902, 1904) writes that the species is pubescent during the whole of the year, and the larvæ may (at Capri) be taken the whole summer to a depth of 300 m. below surf. while they at the other seasons may also be taken at the surface. Of this species (as also of *Sicyonia*) LO BIANCO has taken the whole series of development from the ova to the young stage.

Below we shall see the results from the "Thor".

* I have not had access to this paper.

All the specimens were taken in summer (June 23. to Sept. 1.) except one spec. in Feb.

Depths of the sea and occurrence. Almost all the larvæ were taken in the western basin; only some few stations lie in the eastern basin: 2 in the Messina-Straits, 1 SE of Sicilia, 3 in the Marmora Sea.

Depths in m.	No. of stations
0— 250......	3
> 250— 500......	2
> 500—1000......	7
>1000—2000......	5
>2000—3000......	5
> 3000......	1

The depths of the sea are especially > 500—3000 m., almost only > 500—1000 m. 3 stations have depths 0—250 m., *viz.* 86, 120 and 250 m. Thus numerous larvæ were taken at depths much greater than those where the adult are most frequent (abt. 50—700 m.).

Vertical occurrence.

M.w.	Night				Day
	Hauls	Duration in hours	No. of spec.	No. of spec. pr. hour	No. of hauls
25	3	1	9	9	—
65	8	4.5	257	57.1	1
150	1	0.33	4	12	—
300— 400	9	6.25	41	6.6	2
600—2000	6	4	12	3	1
total...	27		323		4

We see that during the night most of the specimens were taken with 65 m.w., the numbers pr. hour diminishing both upward and downward.

In the day-time there were only 4 positive hauls (65—2000 m.w.).

B. Atlantic.

The larvæ were taken only at four stations: one (st. 1) in the Channel, the other outside Gibraltar. The depths of the sea were 40—275 m., the depths below surf. (night) 25—65 m.w.; day-time (1 haul): 65 m.w.

Distribution.

1. Mediterranean. The species is common especially between 60 and 200 m. (Kemp, Ireland 1910) and lives on sandy or muddy bottom (Pesta 1918). Alger, Marseille, Nizza, Genova, Napoli, Sicilia (Carus 1885). — Adria from Fiume to Otranto (Pesta 1918). — "Thor" st. 213, inside the Baleares. — 39°58′ N, 9°48′ E, 395 m. (Senna 1903). — 35°48′ N, 23°34′ E, 755 m.; 35°59′ N, 22°56′ E, 660 m.; southern Adria 7 stations 42°32¹/₄′—40°32³/₄′ N, 15°22¹/₂′—18°58′ E, 104—760 m. (Adensamer 1898). —

2. Atlantic. SW. Ireland, 8 st., 100—> 1000 m. (Calman 1896, Bouvier 1908, Kemp, Ireland 1910). — Bay of Biscay, > 400 m. (Caullery 1896). — Açores, 500 m. (Bouvier 1908). — Morocco (Milne-Edwards 1882). — Venezuela: Paria, 60 m. (Smith 1885).

Genus Funchalia Johnson.

Funchalia Bouvier 1908, p. 91 (lit. et syn.).

1. FUNCHALIA WOODWARDI Johnson.

Funchalia Woodwardi Bouvier 1908, p. 93 (lit. and syn.), Pl. 1 fig. 7 (cold. fig.), Pl. 15, Pl. 16 figs. 1—8.
— — Lenz & Strunck 1914, p. 303—06, Pl. 16, Pl. 17 figs. 1—19.
— — Murray & Hjort 1912, p. 668.
— — Sund 1920, p. 32.
Grimaldiella Richardi (postlarval stage) Bouvier 1908, p. 96, Pl. 16 figs. 9—21.

On the probable larva, see Penæid-larva No. 4 (p. 26).

Mediterranean.

St. 24. > 3700 m. 40°14′ N, 12°23′ E. 16-1-1909. 25 m.w., 10⁰⁰ pm., 30 min. 1 spec. 28 mm. — **St. 28.** 600 m. 40°53′ N, 13°43′ E. 19-1-1909. 100 m.w., 10⁰⁰ pm., 60 min. 1 spec. 42 mm. — **St. 38.** > 75 m. 40°45′ N, 9°30′ E. 31-1-1909. 25 m.w., 7¹⁰ pm., 30 min. 1 spec. 24 mm. — **St. 130.** > 3000m. 39°35′ N, 11°20′ E. 13-7-1909. 25 m.w., 0⁵⁰ am., 30 min. 1 ♀ abt. 80 mm. — **St. 132.** 1227 m. 38°57′ N, 9°47′ E. 14-7-1909. 25 m.w., 3⁰⁵ am., 30 min. 1 ♂ abt. 70 mm. — **St. 132.** ibid. 300 m.w., 3⁴⁵ am., 30 min. 1 ♂ abt. 55 mm. — **St. 144.** 3340 m. 34°31′ N, 18°40′ E. 24-7-1910. 25 m.w., 2⁰⁰ am., 30 min. 1 ♀ 45 mm. — **St. 194.** 1140 m. 38°33′ N, 15°29′ E. 21-8-1910. 1200 m.w., 6⁰⁰ am., 30 min. 1 spec. 24 mm.

Atlantic.

St. 65. 1300 m. 35°53′ N, 7°28′ W. 24-2-1909. 1600 m.w., 5³⁰ pm., 120 min. 1 ♂ 55 mm. — **St. 231.** 1000 m. 35°56′ N, 7°16′ W. 9-9-1910. 25 m.w., 0¹⁵ am., 30 min. 2 ♀ abt. 50—55 mm. — **St. 232.** 3730 m. 36°28′ N, 9°06′ W. 9-9-1910. 25 m.w., 8⁵⁰ pm., 30 min. 5 spec.: 3 ♂ abt. 50 mm., 2 ♀ abt. 45—50 mm. — **St. 232.** ibid. 300 m.w., 10³⁵ pm., 30 min. 1 ♀ 67 mm.

Of this species, the "Thor" took 17 specimens in all, to wit, in the Mediterranean, 8 specimens in 8 hauls at 7 stations, in the Atlantic, 9 specimens in 4 hauls at 3 stations.

In the Mediterranean, all the stations lie in the western basin, with the exception of a single one (St. 194) in the western part of the eastern basin; in the Atlantic, only in the Bay of Cadiz. Depth to bottom over 75—3730 m., for the most part over 1000 m. In the night hauls, nearly all specimens were taken with 25 m.w. (300—1200 m.w. at the outside); in the daytime there is a single haul with 1600 m.w. That the species is chiefly found at the surface during the night agrees with the fact that it is almost colourless, only with a faint reddish tinge (BOUVIER p. 96, Pl. 1, fig. 7; MURRAY & HJORT p. 668); larger specimens, however, may be of a more pronounced red (BOUVIER p. 96).

The "Thor" results in regard to vertical occurrence agree very well with previous records, though a single specimen has been taken with greater length of line (BOUVIER). The only great amount of material mentioned in the literature is cited by MURRAY and HJORT; it comprises 62 specimens, of which 55 taken at night at a depth of 50—1500 m., though the great majority (45 spec.) were taken at a depth of 50—150 m. In the daytime, it was taken at similar depth.

Distribution. 1. Mediterranean. New to this sea, see on the "Thor" above.

2. Atlantic. At Europe not N. of $36^1/_2$° N ("Thor"). — Between Europe and New Foundland (MURRAY & HJORT 1912; SUND 1920). — 37°28′ N, 25°53′$^1/_2$ W, 0—1000 m., 3 spec.; 36°46′ N, 26°41′ W, 0—3250 m., 2 spec.; 31°06′ N, 24°06$^3/_4$′ W, 0—5000 m., 2 spec.; 30°48′ N, 25°18$^1/_4$′ W, surf., 1 spec. (BOUVIER). — Madeira, 1 spec. (JOHNSON, *teste* BOUVIER). — W. of Canaries, surf., night 2 spec.; 30°2′ S, 14°21′ W, 10 m. below surf., 5 spec. (LENZ & STRUNCK).

Genus Parapenæus Smith.

Parapenæus Bouvier 1908, p. 101.

1. PARAPENÆUS LONGIROSTRIS Lucas = PENÆUS MEMBRANACEUS Heller.

Parapenæus longirostris Bouvier 1908, p. 102 (lit. and syn.).
— — Pesta 1918, p. 42 (on lit. and syn.), figs. 8—9.

Mediterranean.

St. 174. 120 m. 40°54′ N, 28°55′ E. 11-8-1910. Dredge. 1 spec., 70 mm.

This species, whose colour is whitish with pink spots (BOUVIER l. c., note p. 105), is a bottom-form which belongs to the sublittoral zone, 50—400 (629) m. — On the larva, see below.

Distribution. 1. Mediterranean. Alger, Cette, Nizza, Genova, Napoli, Sicilia, Palermo (CARUS 1885). — Capri; Salina (Eolian Islands) (LO BIANCO 1902, 1903, 1904). — W. of Sicilia, 224 m. (BOUVIER 1908). — Capo Carbonaro (S. E. Sardinia), 508 m.; W. of Sicilia, 400 m. (SENNA 1903). — Valencia (BOLIVAR, *teste* BOUVIER 1908). — N. of Crete, 3 stations, 287—629 m.; W. of Cyprus, 2 st., 315—390 m. (ADENSAMER 1898). — Marmora Sea ("Thor" st. 174). — Adria: Durazzo, 120 m., yellow mud, 1 spec.; not Zara and Ragusa [*Solenocera membranacea*] (PESTA 1918, p. 44—46).

2. Atlantic. From Portugal to Morocco (BOUVIER 1908). — Cadiz Bay, 535 m. (SUND 1920).

Larva and young stage.

Penæus membranaceus Monticelli & Lo Bianco, Monit. Zool. Ital., vol. 12, 1901, p. 198—200 (Mysis).
— — Lo Bianco 1902, p. 437 (young stage).
— — — 1903, p. 183 (Mysis).
— — — 1904, p. 31, fig. 38 (cold. fig., young stage).
?*Penæuslarve* Claus 1876, p. 41, Pl. 3 figs. 7—8.

Atlantic.

St. 376 ("Florida"). > 3500 m. 34°41′ N, 16°14′ W. 22-7-1911. 15 m.w., 8^{45} am., 30 min. 4 spec. 10—12 mm. — **St. 377** ("Florida"). > 4300 m. 31°23′ N, 18°08′ W. 23-7-1911. 15 m.w., 8^{05} pm., 30 min. 4 spec. 10—16 mm.

The present larva, which in addition to the rostrum and caudal spines is characterised by an enormous outer ramus in the urop., agrees well with CLAUS' fig. save for the presence of a distinct hepatic spine.

The smallest specimens are abt. 10 mm. Even at this stage, all five pairs of pereiopoda are indicated, but greatly decreasing in size toward the hinder part. No true chelæ on p. 1—3. Pleopoda quite small, but cleft. The largest specimens (16 mm.) answer to the stage shown in Claus' figure. The caudal fan is uniform throughout all stages.

Literature and determinations. While the young stage has been well portrayed and comparatively well described (vide supra, under Literature), this cannot be said of the larva. The only real description is given (without figure) by MONTICELLI and LO BIANCO l. c. 1901, and this is not particularly good. It ends, however, with the statement that the mysis stage greatly resembles ("mostra molta rassomiglianze con") the undetermined larva described and figured by CLAUS l. c.

As the larvæ taken by the "Thor" are identical with that described by CLAUS, there is thus a certain probability of their being really those of *Parapenæus longirostris*.

The young stages of *Parapenæus longirostris* (10—40 mm.) live as a rule in the cloaca of *Pyrosoma*, very rarely free-swimming, and are hyaline, whitish with yellow spots (Lo Bianco 1902, 1904 fig. 38, col. fig.). The older specimens are pale yellow (PESTA 1918).

Distribution. (Of CLAUS' larva) Atlantic, precise locality not stated, up to 16 mm. long (CLAUS). Indian Ocean 27°—29° S, $62^1/_2$°—$65^1/_2$° E, CASPERSEN 1869, 1 spec. (The specimen in our Zool. Museum)

Genus Sicyonia M.-Edw.

Sicyonia Milne-Edwards 1830, p. 339.
Eusicyonia Stebbing, S. Afr. 1914, p. 25 (lit. and sgn.).

1. SICYONIA SCULPTA M.-Edw.

Adult stage.

Cancer carinatus Olivier, Zool. Adriat., Pl. 3 fig. 2 (*teste* HELLER 1863).
Sicyonia sculpta H. Milne-Edwards 1830, p. 339, Pl. 9 fig. 1—8.
— — Heller 1863, p. 291 (lit. and syn.).
— — Bate 1888, p. 294, Pl. 43 fig. 1.
— *carinata* Pesta 1918, p. 47 (lit. and syn.), figs. 10—12.
non— — H. Milne-Edwards 1830, p. 344, non *S. c.* Sp. Bate 1883 (*teste* DE MAN 1911, p. 111).

Larval development.

Sicyonia sculpta Monticelli & Lo Bianco 1900.[1]
— — Lo Bianco 1902, p. 436, 438.
— — — 1904, p. 29, 31.

Mediterranean.

St. 17. 19 m. 37°49′ N, 23°27′ E. 30-12-1908. Dredge. 1 spec. 23 mm.

This species which (like the genus, to which it belongs) differs from the other Penæids in its strong sculpture, is a bottom form; it lives in rather shallow water, 4 m. and downwards, between algæ and stones or at sandy bottom with *Zostera* (PESTA l. c.). The body is spotted with brown (PESTA).

[1] I have not had access to this paper.

Larval development. GRAEFFE (Arb. Zool. Inst. Wien, Bd. 13, 1900, p. 65) states that the spawning time is May—June, perhaps also the autumn; but PESTA (1918, p. 49) cannot find a confirmation of this neither in the literature nor in the material.

I have not had access to MONTICELLI and LO BIANCO's original description of the larva 1900; figures of the larva do not seem to exist. LO BIANCO (1902—1904) says only that the larva very much resembles that of *Gennadas elegans* (the larvæ of *Amalopenæus elegans* "erinnern . . in ihren Gesammthabitus sehr an diejenigen von *Sicyonia sculpta*"), and that the whole series of development from ova to the Mysis-stage may be found in the plankton at Naples.

Distribution. 1. Mediterranean. The species does not seem to be very common in the Mediterranean, but is found at several localities. Messina (RIGGIO 1905, p. 18). — Naples (LO BIANCO l. c.). — Mers-el-Kebir, Alger, Bone; Genova; Isola Maddalena; Naples; Sicilia: Palermo, Messina, Catania; Reggio di Calabria (CARUS 1885). — Adria: Trieste, Lesina, Naples, Messina (specimens in Zool. Museum). — Several localities in the Adriatic (see PESTA 1918). — Gulf of Aegina ("Thor" st. 17).

2. Atlantic. Cap Verde; Senegambia (PESTA 1918).

On the Development of the Penæidæ.

The development of the *Penæidæ* is altogether somewhat indifferently known (see WILLIAMSON 1915 p. 335). The larvæ are known by having chelæ on the three anterior pairs of pereiopoda.

Of the species from the "Thor" area, there are only the following species whose development is at all known, and all these are found in the Mediterranean.

Gennada elegans, see below [Penæidlarva No. 1], p. 21.
Aristeomorpha foliacea (=*Aristeus antennatus* Mont. & Lo B.), see p. 15.
Solenocera siphonocera (p. 16).
Funchalia Woodwardii (postlarval stage, p. 17).
Parapenæus longirostris (p. 18).
Penæus caramote (young stage: P. MAYER, Mitt. Zool. Stat. Neapel vol. 1, 1878, p. 49—51).
Sicyonia sculpta (p. 19).

Of the species from the "Thor" area, the determination appears to be absolutely certain only in the case of *Solenocera*, this being the only species in which the development is known from the egg to the young.

The same applies, it is true, also to *Gennadas elegans*, but the only extant description is not particularly good, and is not accompanied by any figure, so that the larvæ can hardly be recognised with any degree of certainty from this. It is possibly identical with the larva called *Euphema armata* (vide infra, Penæid larvæ No. 1).

Parapenæus longirostris has been hatched out by MONTICELLI and LO BIANCO, who managed to keep it alive through several stages; the transition from the Mysis stage to the young, however, they did not succeed in obtaining. In regard to this, the same applies as in the case of *Gennadas elegans*: the description of the larva is not accompanied by any figure. See also under *Parapenæus longirostris* (supra, p. 18).

In addition to these, there are also known larvæ which are referred to *Aristeomorpha foliacea* and *Sicyonia sculpta*; the reason for attributing the first larva to the species in question is not apparent from the description, whereas in the case of *Sicyonia*, we have the entire development from egg to Mysis.

The larva of *Sicyonia* shows, "in its total habitus, a great resemblance" to those of *Gennadas elegans* (LO BIANCO 1904 p. 29), no other description is given, nor any figure; I have not, however, had access to MONTICELLI's and LO BIANCO's original description of 1901, so that I do not known whether the larva is there more fully described.

Quite apart from the fact that the determinations in literature of several of the larvæ are perhaps not always certain, the works in question (or at least those I have been able to consult) do not always give a sufficiently good description to enable one to recognise a larva.

The Penæide larvæ above mentioned (determined or undetermined) are, as far as I can see, the only ones mentioned in literature from the area covered by the "Thor".

"Thor" Expedition. The material from the "Thor" includes larvæ (and some young stages) of 6 *Penæidæ* in all. Of these, *Aristeomorpha foliacea* and *Solenocera* can with certainty be referred to the extant descriptions and figures. The larvæ of *Parapenæus longirostris* (vide supra p. 18) is perhaps rightly determined, and 2 can with a fair degree of certainty be referred to larvæ already described which have not been ascribed to any definite adult species, viz. *Euphema* (*armata*?) and *E.* (*polyacantha*?) (Larvæ Nos. 1—2). There remain 2 (Larvæ Nos. 3—4) which are altogether new to science, but which can nevertheless be determined with some degree of certainty.

Three of these larvæ (Nos. 1, 3 and 4) were found in the Mediterranean, the corresponding adult forms must therefore be sought for among the 8 species known from that sea.

Of these 8 species, we have good descriptions of the larvæ only in the case of two; viz. *Aristeomorpha foliacea* and *Solenocera*, larvæ of both these species were taken by the "Thor" and are noted together with the adults. Of the remaining 6 species, the larvæ of 3, (*Aristeus antennatus*, *Funchalia Woodwardii*, *Penæus caramote*) have never been described, and in 3 cases (*Gennadas elegans*, *Parapenæus longirostris* and *Sicyonia sculpta*) only described in such a manner (and without figure) that they are hardly to be recognised with certainty. (An attempt has been made, however, to refer one of the larvæ to *Parapenæus*). The three undetermined larvæ taken by the "Thor" in the Mediterranean must thus belong to three of the last mentioned six species: ÷ *Parapenæus*; an andeavour is made in the following to determine them.

Larva No. 1. (*Euphema* [*armata*?]) was found in great numbers both in the Mediterranean and the Atlantic and must thus belong to a species common in both seas; this would hardly apply to any other than *Gennadas elegans*. The question then is: does it answer to the description of the larva of this species?

Unfortunately, the original description of *Gennadas elegans* larva (MONTICELLI and LO BIANCO 1900) was not available for reference, so that I only know the description from WILLIAMSON's account of the same (1915 p. 343—44) which is not clear in all points, besides lacking figures. It is here stated that Zoea has "kräftige dorsale Stackeln nach dem Abdominalsegment", which is hard to understand. For the rest, the description might agree fairly well with CLAUS' figure (CLAUS 1876, Pl. 3, fig. 2) of *Euphema armata*, to which W. refers; but whether this is really the larva in question it is hard to decide with certainty. The mysis-stages (and there are no others in the "Thor" material) are said to be furnished with "four long anterior spines on the sides of the thick median point" (= rostrum). This might perhaps fit, as there is both a supra-ocular spine and a spine on the lower anterior margin of the carapace. The zoea stages are said to have small spines on the sides of 4 and 5 caudal segment; the "Thor" has no zoea stages, but the mentioned spines are not found in the "Thor" material, which consists exclusively of mysis stages, and we cannot see from WILLIAMSON's text whether they are also present in the mysis.

It is impossible, then, to determine with certainty whether the larva from the "Thor" belongs to *Gennadas elegans*, though much would appear to indicate that this is the case.

According to LO BIANCO 1904, p. 29, the larva of *Gennadas elegans* should be very similar to that of

Sicyonia sculpta; it is therefore not impossible that the larva belongs to this species, though on the other hand its great frequency would seem to contradict this.

Larva No. 4. probably belongs to *Funchalia Woodwardii*; in the two oldest specimens, the telson is alltogether similar in form, and in the arrangement of spines on the posterior margin, to that of the postlarval specimens (see Bouvier 1908, Pl. 16 fig. 21) while the presence of an hepatic spine also renders it likely that it belongs to a species having this spine in the adult stages. On the other hand, it must be pointed out that md. even in the largest specimen, has no approximation to the elongated form found even in the young stages.

Larva No. 3. If the above observation are correct, there remain then the following Mediterranean species having larvæ unknown: *Aristeus antennatus, Penæus caramote* (and *Sicyonia sculpta*), and Larva No. 3 must probably belong to one of these; *Sicyonia*, however, is probably out of the question (vide supra under Larva No. 1). Which of these species it does belong to can hardly be determined at the moment, though it seems most likely that it should be *Penæus caramote*, owing to the comparatively numerous teeth on the upper margin of the rostrum, for the adult *Aristeus antennatus* has only three such teeth, whereas *Penæus caramote* has 10 or thereabouts. On the other hand, the hepatic spine is lacking, both in the larva and in *Aristeus*, while it is present in *Penæus*.

Larva No. 2 *(Euphema [polyacantha?])* This larva was only taken in the Atlantic, not in the Mediterranean; it is therefore probable, if not certain, that it belongs to a species only found in the Atlantic. There is, however, no description of a larva belonging to any of the 10 species only found in the Atlantic, and the larva from the "Thor" does not seem to present any characters offering any particular indication to aid in the determination. If, however, the observations in the foregoing are correct, and Larva No. 1 (*Euphema* [*armata?*]) should properly be ascribed to one of the *Gennadas* species, there may be reason to believe that *Euphema* (*polyacantha?*) is the larva of one of the *Gennadas* species which do not penetrate into the Mediterranean, since I take it for granted that *Euphema* can be maintained as a genus, though it does not, it is true, comprise any adult forms, but only larvæ.

Euphema M.-Edw.
(Penæid-larvæ Nos. 1—2).

Euphema H. Milne-Edwards 1837, p. 420.
— Ortmann 1894, p. 76.

Penæid-larva No. 1. (Fig. 7).
Euphema (armata M.-Edw.?) = ?larva of Gennadas elegans Smith
(see p. 20).

?*Euphema armata* H. Milne-Edwards 1837, p. 421.
Penæus-Larve Claus 1876, p. 41—43 (partim), Pl. 3 fig. 6, figs. 1, 3—5?, not fig. 2.
?*Aristæus-larva* Bate 1888, p. 239, Pl. 47 fig. 2.
?*Euphema armata* Ortmann 1893, p. 76.
?*Amalopenæus elegans, larva* Monticelli & Lo Bianco 1900.[1]
? — — — Lo Bianco 1902, p. 435.
? — — — — 1904, p. 29.
? — — — Williamson 1915, p. 343.

Mediterranean.

St. 11. > 3700 m. 36°57′ N, 18°16′ E. 16-12-1908. 25 m.w., 60 min., 4^{00} am. 3 spec. 4, 4, 6 mm. — **St. 35.** 200 m.w., 6^{40} am., 60 min. 1 spec. 6 mm. — **St. 40.** 235 m. 39°10′ N, 9°40′ E. 1-2-1909. 65 m.w., 9^{30} pm., 30 min. 1 spec. 8 mm. — **St. 43.** > 2000 m. 38°14′ N, 8°42′ E. 3-2-1909. 65 m.w., 6^{15} am., 30 min. Abt. 60 spec. 4—7 mm. — **St. 53.** 2600 m.w., 5^{15} pm., 90 min. 1 spec. 7 mm. — **St. 55.** 75 m. 36°46′ N, 2°18′ W. 19-2-1909. 25 m.w., 6^{30} am., 60 min. 3 spec. 8 mm. — **St. 99.** 750 m. 36°02′ N, 5°16′ W. 24-6-1910. 65 m.w., 0^{10} am., 15 min. 1 spec. 6 mm. — **St. 99.** ibid. 300 m.w., 11^{25} pm., 30 min. 3 spec. 4—6 mm. — **St. 105.** 20 m. 36°43′ N, 2°08′ W. 24-6-1910. 40 m.w., 7^{45} pm., 15 min. 3 spec. 4—7 mm. — **St. 106.** 300 m.w., 1^{45} am., 30 min. 10 spec. abt. 7 mm. — **St. 106.** ibid. 1200 m.w., 0^{20} am., 60 min. 1 spec. 8 mm. — **St. 107.** 65 m.w., 9^{50} am., 15 min. Abt. 100 spec. 5—7 mm. — **St. 107.** ibid. 300 m.w., 9^{05} am., 30 min. 14 spec. 4—7 mm. — **St. 107.** ibid. 2000 m.w., 7^{30} am., 60 min. 2 spec. 7—8 mm. — **St. 108.** 65 m.w., 11^{15} pm., 30 min. 2 spec. 5—7 mm. — **St. 108.** ibid. 300 m.w., 10^{30} pm., 30 min. Abt. 50 spec. 4—7 mm. — **St. 108.** ibid. 2000 m.w., 0^{40} am., 60 min. 9 spec. 7—8 mm. — **St. 113.** 300 m.w., 3^{25} am., 30 min. Abt. 30 spec. 4—8 mm. — **St. 115.** 300 m.w., 11^{20} pm., 30 min. 5 spec. 7 mm. — **St. 115.** ibid. 2000 m.w., 0^{30} am., 60 min. 1 spec. 6 mm. — **St. 118.** 65 m.w., 11^{35} pm., 30 min. 2 spec. abt. 7 mm. — **St. 276** ("Pangan"). > 3000 m. 36°30′ N, 19°20′ E. 4—4—1911. — 132 m.w., 11^{55} pm., 35 min. 4 spec. 5—7 mm. — **St. 278.** 230 m. 38°11.5′ N, 15°37.5′ E. 22-2-1911. 15 m.w., 3^{20} pm., 120 min. Abt. 50 spec. 4—7 mm. — **St. 279.** 350 m. (= St. 279). 23-2-1911. 30 m.w., 9^{30} pm., 150 min. Abt. 30 spec. 5—7 mm. — **St. 280.** 230 m. (= St. 278). 25-2-1911. 15 m.w., 7^{20} pm., 120 min. Abt. 30 spec. 5—7 mm. — **St. 281.** 200 m. 38°13′ N, 15°36.5′ E. 1-3-1911. 10 m.w., 5^{55} pm., 60 min. 6 spec. 3—7 mm. — **St. 281.** ibid. 30 m.w., 4^{45} pm., 60 min. 18 spec. 3—6 mm. — **St. 281.** ibid. 40 m.w., 7^{10} pm., 60 min. Abt. 30 spec. 6—7 mm. — **St. 281.** ibid. 40 m.w., 8^{50} pm., 30 min. Abt. 30 spec. 4—7 mm. — **St. 282.** 200 m. 38°12′ N, 15°37′ E. 9-3-1911. 40 m.w., 3^{30} am., 90 min. Abt. 40 spec. 4—7 mm. — **St. 282.** ibid. 40 m.w., 7^{00} pm., 90 min. Abt. 50 spec. 4—7 mm. — **St. 282.** ibid. 40 m.w., 8^{45} pm., 90 min. Abt. 60 spec. 5—7 mm. — **St. 282.** ibid. 40 m.w., 10^{30} pm., 90 min. Abt. 60 spec. 5—7 mm. — **St. 283.** 200 m. (= St. 282).

[1] I have not had access to this paper.

12-3-1911. 40 m.w., 9^{30} pm., 180 min. Abt. 60 spec. 5—7 mm. — **St. 698** ("Pangan"). > 200 m. 37°20′ N, 9°25′ E. 25-2-1913. 5^{00} am. 5 spec. 4—8 mm. — **St. 729** ("Nordboen"). 200 m. 41°00′ N, 17°44′ E. 14-4-1913. 4 spec. 4—8 mm. — **St. 730** ("Nordboen"). 2000 m. 38°36′ N, 13°37′ E. 16-4-1913. 2^{00} pm. 5 spec. 6—7 mm.

Atlantic.

St. 72. 1020 m. 57°52′ N, 9°53′ W, 8-6-1905. 1500 m.w. 10 spec. 6—8 mm. — **St. 376** ("Florida"). > 3500 m. 34°41′ N, 16°14′ W. 22-7-1911. 15 m.w., 8^{45} pm., 30 min. Abt. 500 spec. (10 ccm.) 4—9 mm. — **St. 377** ("Florida"). > 4300 m. 31°23′ N 18°08′ W. 23-7-1911. 15 m.w., 8^{05} pm., 30 min. Abt. 2000 spec. (35 ccm.) 4—9 mm. — **St. 382** ("Florida"). > 1100 m. 34°31′ N, 16°24′ W. 23-10-1911. 22 m.w., 6^{35} pm., 30 min. 2 spec. 7—8 mm. — **St. 399** ("Ingolf"). > 2600 m. 34°23′ N, 15°31′ W. 26-10-1911. 56 m.w., 9^{40} pm., 30 min. 4 spec. 5 mm.

The "Thor" material contains numerous larvæ of a type which are at any rate identical with the larvæ whose telson is shown by Claus l. c. in fig. 6. It is possibly also the same larva of which Claus has shown some appendages in figs. 1, 3—5. But it is hardly identical with Claus' fig. 2, for if this figure be correct, then the caudal spines, especially on 3.—6. caudal segment, are longer than those on the specimen of the corresponding stage in the "Thor" material, and the telson also seems too markedly bifid. Another circumstance which suggests that the larvæ mentioned by Claus are not all of the same species, is the maximal size he himself indicates: 11 mm., as the largest specimens from the "Thor" are only 8 (9) mm., though they are at exactly the same stage of development as the largest mentioned by Claus (we have, however, in our Museum a very few specimens of the same species of 10—12 mm.).

That the larva mentioned by Claus really comprises at least two species is rendered more probable by the fact that I have recognised what I believe to be specimens of both among the material at our Museum. Of the large form with deeply cleft telson and relatively long spines on the dorsal side of the tail, there are in our Museum abt. 10 specimens from 34°50′ S, 41°30′ E, Andrea leg. 1864, length abt. 10—12 mm. The pleopoda are bifid and large, the telson cleft for $^1/_3$-$^1/_4$ of its total length; in the cleft there are four pairs of long ciliate setæ, and on the outside 2 pairs of shorter spines, besides one pair of spines midway along the exterior margin of the telson.

All the remaining old material in our Museum, as also the entire material from the "Thor", plainly comprises only the smaller species, which has shorter spines on the dorsal side of the tail, with telson in the older stages very slightly cleft.

This smaller species, of which we have specimens of (3.5) 4—8 (9) mm., may, in the various stages (all mysis stages) be characterised as follows:

Total length 3.5 mm. (only very few specimens). P. 4—5 not indicated. Forward-pointing hook on either side of 1—3 abdominal segments, largest on the two first. Spines on dorsal side of 3—5 caudal segments rather long, almost as long as the segments. The telson has midway on either side a small spine, and is cleft for abt. $^1/_3$rd of its total length (excluding apical spines). Each branch of the telson has six spines at the point, the apical spine being much longer and heavier than the others. This stage answers to Claus, Pl. 3 fig. 6. —

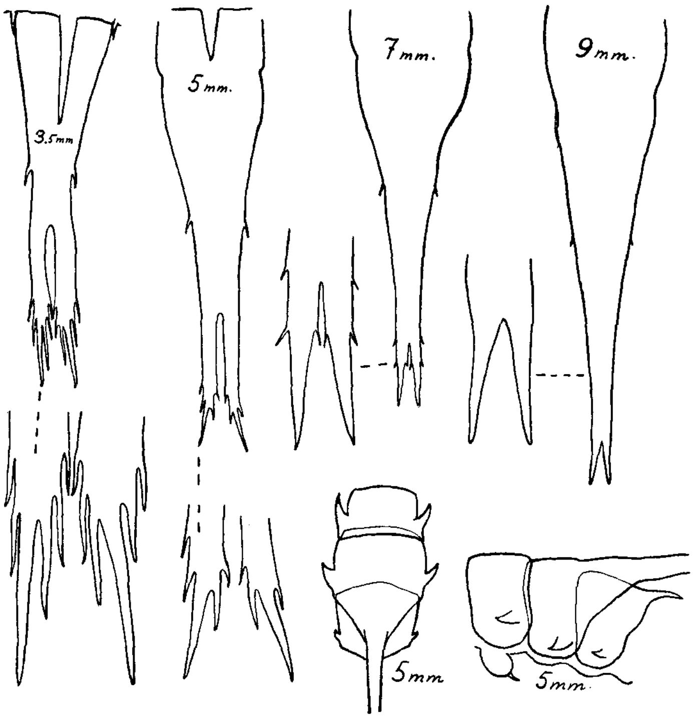

Fig. 7. Euphema (armata?), the larva of ? Gennadas elegans. Telson of specimens 3.5—9 mm. Below to the right 1.—3. abdominal segment of a specimen 5 mm. long, dorsal and side view.

Total length 5 mm. P. 4 in length as the other pereiopoda, P. 5 length as peduncle in p. 4. Plp. 1, which in the foregoing stage was shaped like a small sphere, has not assumed an ovular shape. Still no trace of plp. 2—5. Spine on dorsal side of 3—5 caudal segment now only half the length of the segments; spine on 6. joint in length as the foregoing ones. Cleft of telson only abt. $^1/_4$ total length (excl. apical spine). On the inner side of either branch of the telson there are only two spines inside the apical spine (formerly 3). There may often be one spine more on the one side than on the other.

Total length 6 mm. P. 5 half as long as p. 4; plp. 2—5 indicated as small processes. Spine on side of 3. caudal segment has disappeared. Telson has same no. of teeth as in the foregoing stage, but the cleft runs only $^1/_9$th of the way in. —

Total length 7 mm. P. 1—3 with indication of chela. P. 5 not much shorter than p. 4, but endopodite in p. 4 somewhat shorter than in p. 1—3. Plp. 2—5 bifid, but very small. Spines on dorsal side of abdomen shorter than before. Telson approximately as in foregoing stage, but the cleft still smaller, only abt. $^1/_{16}$ total length of telson (excl. apical spine); only one pair of spines on inner side of cleft. Apical spines much heavier than the other spines; or rather, these spines are considerably weaker than in the younger stages. —

Total length 9 mm. Same stage (but hardly same species) as CLAUS' Pl. 3 fig. 2, but differs especially in having the teeth on the back much shorter, and much smaller cleft in the telson. CLAUS' specimen is 11 mm.; the largest of the "Thor" — specimens are 9 mm. The spines on the side of 1—2 caudal segments are not indicated in CLAUS' figure. — P. 1—3 with distinct chela, p. 4—5 almost equal in length to p. 1—3. Plp. 2—5 large and bifid. Cleft of telson amounts now to abt. $^1/_{12}$ of telson's total length, the apical spine now running into one with the remaining part of the sides of the cleft; the other spines have altogether disappeared with the exception of the one situate about midway on either side of the telson.

The few specimens of the same species which are larger, (10—12 mm.) and are found in the old and hitherto undetermined material of our Museum, do not differ in any respect from the larges specimens of the "Thor" collection.

Colour. The labels on some of the specimens in our Museum, from 30° S, 96° E and 29°10′ S, 96°20′ E, read "blue when alive".

For the determination see supra p. 20

Synonymy. It is doubtful whether the above list of synonyms (which, save for the reference to *Gennadas* (*Amalopenæus*) *elegans*, is taken from ORTMANN 1893) comprises a single species or several. It is likely that the larva mentioned and described by BATE is identical with the one from the "Thor", as the spines on the dorsal side are not particularly long. More doubtful is the case of the larva described by MILNE-EDWARDS; ORTMANN gives no description at all.

The material includes abt. 3200 specimens from 29 stations, 42 hauls.

A. Mediterranean.

	Stations	Hauls	Specimens
Dec. 1908	1	1	3
Jan. 1909	1	1	1
Feb. —	4	4	65
June 1910	8	15	181
Feb. 1911	3	3	110
March —	3	9	284
April —	1	1	4
Feb. 1913	1	1	5
April —	2	2	9
total...	24	37	662

The larvæ were thus taken in Dec., Jan.—Apl., and June; they were not found in the hottest summer months. The size affords no aid to determining any particular time for hatching out.

Of the 24 stations where the larva was found, 5 are in the eastern basin, but only in its western part (including the Adriatic), the remainder in the western basin (see chart 2).

Depths in m.	No. of stations
0—500	11
> 500—1000	2
> 1000—2000	2
> 2000—3000	7
> 3000	2
total...	24

Nearly half the stations where the larva was found had a depth of less than 500 m., one indeed only 20 m., which undoubtedly agrees with the fact that the larvæ are found comparatively near the surface.

Vertical occurrence. In winter (19 hauls in all) practically all the specimens were taken with 10—40 m.w or 65 at the outside, and there is hardly any difference between day and night. In summer, on the other hand,

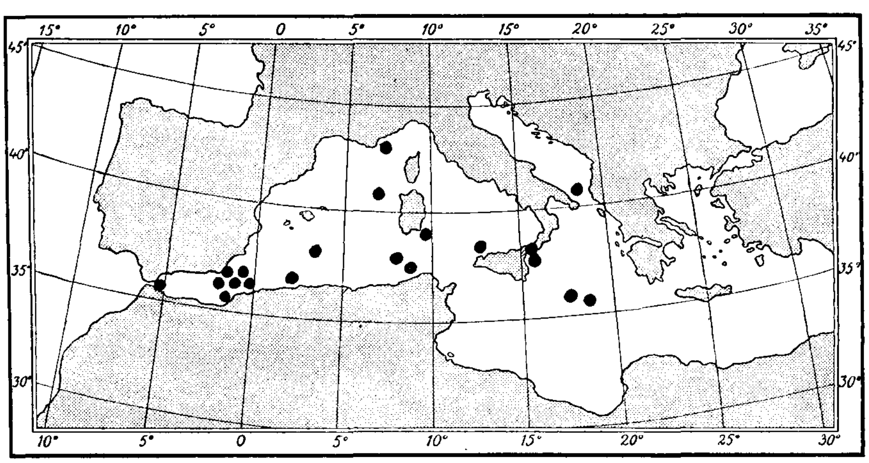

Chart 2. Euphema (ar mata?).
The stations in the Atlantic lie outside the chart.

the depth seems to be greater, night at least 40 m.w., especially 300 m.w.; the three day hauls are not enough to judge from.

B. Atlantic.

We have about 2500 specimens from 5 stations, 5 hauls. One station is situate west of Ireland, the other SW of the Bay of Cadiz. Though the material comprises a very great number of specimens, the hauls are still too few to judge by, but there seems to be no difference compared with conditions in the Mediterranean, save for the fact that nearly all the specimens were taken in the hottest period of summer (July).

Distribution.

1. Mediterranean, see above. — "Mediterranean" (CLAUS).

2. Atlantic. On the "Thor" see above. — Our Zoological Museum possesses specimens from the following localities: 37°30′ N, 52°13′ W, ANDREA 1867, 1 spec.; 40°13′ N, 13°35′ W, ANDREA 1862, 2 spec.; 33°6′ N, 25°30′ W, ANDREA 1862, 1 spec.; 33° N, 47° W, "Galatea"-Exped., 2 spec.; 30° N, 19° W, HYGOM 1853, 1 spec.; 27°11′ N, 88°52′ W, to 29°39′ N, 88°45′ W, "Galatea"-Exped., 1 spec.; 23°2$^3/_4$′ N, 31°48′ W, MATHIESEN 1848, 1 spec.; 22° N, 20′ W, HYGOM, 1 spec.; 29°0′ S, 37°23′ W, WARMING 1866, 1 spec.; 13° N, 27° W, KRØYER, abt. 35 spec.; 31°16′ S, 24°20′ W, ANDREA 1869, 1 spec. —

ORTMANN mentions the species from the following localities: Sargasso Sea 10 st. 31.6° N, 60.2° W, to 19.9° N, 27.2° W; N. Equatorial Current 3 st. 18.9° N, 26.4° W, to 10.2° N, 22.2° W, and 12° N, 40.3° W; S. Equatorial Current 5 st. 0.1° N, 15.2° W, to 5.1° S, 14.1° W, 6.9° S, 23.4° W, 5.7° S, 26.5° W, 3 st. 4.1° S, 14.6° W, to 7.5° S, 20.3° W, 3.8° S, 32.6° W, and 2.4° S, 36.4° W; Guinea Current 5.9° N, 20.3° W, and 9.4° N, 41.9° W. When the depth is noted, it is surf. to 0—400 m.

"Atlantic" (CLAUS). — 5°28′ N, 14°38′ W (BATE). — "Southern Atlantic" (MILNE-EDWARDS).

3. Indic. 25° S, 61° E, STRANDGAARD, 1 spec.; 27°—29° S, 62$^1/_2$°—65$^1/_2$° E, CASPERSEN 1869, 4 spec.; 33°30′ S, 89°30′ E, ANDREA 1870, 1 spec.; 30° S, 96° E, ANDREA 1870, 1 spec.; 29°40′ S, 96°20′ E, ANDREA 1870, 3 spec.; 27°30′ S, 98°—99°10′ E, ANDREA 1870, 6 spec. (Spec. in our Zool. Museum).

4. Pacific. Hongkong, Dr. MAYER, 2 spec. (in our Zool. Mus.).

Penæid-larva No. 2.
Euphema (polyacantha Ortm.?) (Fig. 8), Larva of Gennadas sp.? (see above, p. 21).

?*Aristeus* (?), *Megalopa*, Bate 1888, p. 241, Pl. 47 fig. 1.
?*Euphema polyacantha* Ortmann 1894, p. 77.
?*Penæus? sp.*, *Aristeus* Williamson 1915, p. 340, fig. 7.

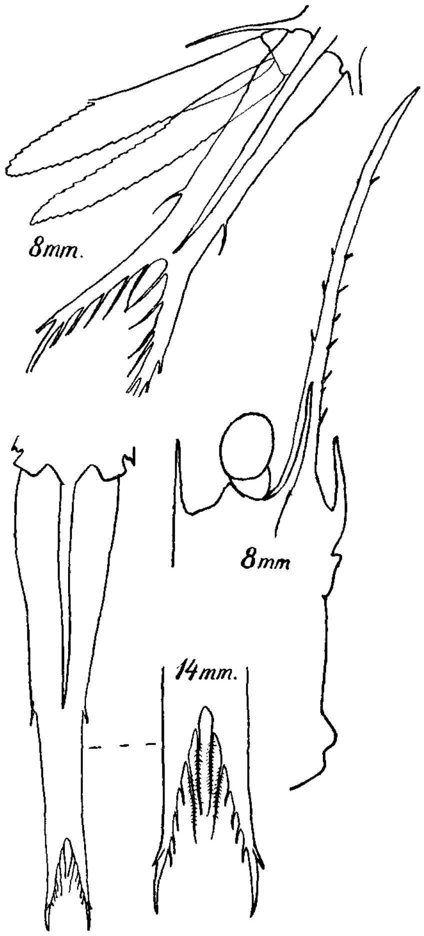

Fig. 8. Euphema (polyacantha?). Carapace and caudal fan of a specimen 8 mm. long, and telson of a specimen 14 mm. long.

St. 66. 735 m. 36°16′ N, 6°52′ W. 25-2-1909. 1200 m.w., 8^{30} am., 120 min. 1 spec. — **St. 69.** > 3500 m. 36°13′ N, 9°48′ W. 28-2-1909. 65 m.w., 10^{45} pm., 30 min. 2 spec. — **St. 69.** ibid. 300 m.w., 11^{40} pm., 30 min. 5 spec.

These larvæ have been referred, albeit with some doubt, to *Euphema polyacantha*. They agree with ORTMANN's description in having a long spine and a process at root of the rostrum (BATE does not mention the long spine), but differ both from BATE and ORTMANN in having a pair of long, outward pointing spines laterally on the 1.—3. abdominal segments of the same shape, but even larger than shown in *E.* (*armata?* fig. 7) and also in having long spines on the hindmost lateral corners of the 4—6. abdominal segments (these spines have, however, mostly disappeared in the largest specimens); besides lacking the spine which Bate places midway on the lower margin of the 6. abdominal segment, and by having a process midway above the posterior margin of the carapace. All the spines mentioned, (except the lateral spines on the 6. abdominal segment) are found both in large and small specimens, but are relatively larger in the small ones. The same applies to the rostrum (which in the smallest individuals is abt. $1^1/_2$ times as long as the carapace ex. rostrum) not, however, to the spines on the dorsal side of the tail, which are relatively of equal length in all the present specimens.

In the smallest specimens (8 mm.) there is an indication of chela in p. 1—p. 3. P. 4—p. 5 are somewhat smaller than p. 3. Plp. 1 is swollen out as in *E. armata*, plp. 2—5 are small, hardly bifid warts. Telson cleft for abt. $^1/_3$ its total length (ex. apical spines); in the cleft are 5 or 6 pairs of spines, and 1 or 2 pairs outside, besides a pair of lateral spines a little proximal to the inner end of the cleft. (The point of the telson is somewhat damaged in all specimens, so that the no. of spines cannot be stated exactly).

The largest specimen (14 mm.) is at the same stage of development as regards its appendages as Bate Pl. 47 fig. 1. Cleft of telson only abt. $^1/_5$ of its total length (incl. apical spines). In the cleft are 6 pairs of spines, of which the two proximal pairs are pennate setæ and much longer than the others.

Distribution. Atlantic, between Cape Verde and Azores, April 29., 1876, 1 spec. (Bate). — Guinea Current 9.4° N, 41.9° W, 0—400 m., 1 spec. (Ortmann).

Penæid-larva No. 3 (Fig. 9). (Larva of Penæus caramote? or Aristeus antennatus, see above p. 21.)

Mediterranean.

St. 189. 1683 m. 37°44′ N, 15°55′ E. 19-8-1910. 1000 m.w., 9^{30} am., 30 min. 1 spec. abt. 10 mm. — **St. 339** ("Pangan"). > 2000 m. 40°30′ N, 3°10′ E. 20-8-1911. 28 m.w., 3^{00} am., 30 min. 4 spec. abt. 7 mm.

This larva is characterised by its rostrum, which has on the upper margin 3—8 teeth, according to age, but none on the under side, and by its tail, which has no dorsal spines except a very small one on the 6th caudal segment, apart from the telson, which is truncate.

The rostrum (reckoned from the ocular sinus) is $^1/_2$—$^2/_3$ as long as the carapace ex. rostrum; it is nearly straight, compressed and powerful, and has on the upper margin 3—8 teeth, according to age, none on the under margin. There is a supra-ocular tooth, otherwise no teeth on the fore margin of the carapace. Tail very powerful, 6. joint much compressed, equal in length to the four preceding ones together. Tail altogether without dorsal spines, save for a single short one on the posterior margin of the 6. segment. Telson almost of uniform breadth throughout, and cut off almost straight at the point, with six pairs of short spines on the posterior margin

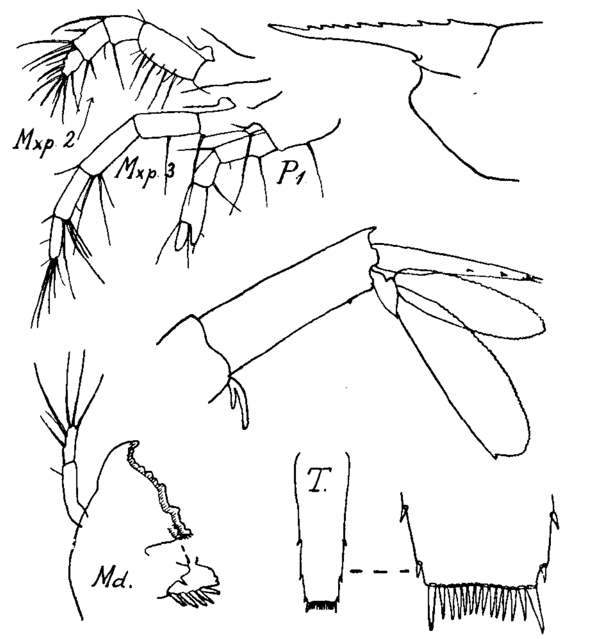

Fig. 9. Penæid-larva No. 3. Rostrum, mandible, 2.—3. maxilliped, 1. pereiopod, caudal fan, and telson.

and one larger one at each corner; 3 spines on either side. Urop. large and powerful, outer ramus abt. $1^1/_2$ times as long as the telson.

Eyes very large. As regards the oral parts, (which have been dissected out from the large specimen) there is nothing particular to remark. Md. has a two-jointed palpa and abt. 6 spines in the proximal portion of the masticatory part, mx. 1—2 and mxp. 1 correspond fairly accurately to Claus 1876 Pl. 3 fig. 3—5. Even the smaller specimens have a chela on p. 1—3. P. 4—5 developed in all specimens, but even in the largest specimen somewhat smaller than p. 1—3. In the smallest specimen, plp. are only small protuberances; in the largest one they are bifid, but not yet very large. In none of the specimens had plp. 1 the swollen shape found in *Euphema* (see Claus 1876, Pl. 3, fig. 1—2).

Distribution. The Zoological Museum has a specimen at the same stage as the largest from the "Thor" recorded as from "Atlantic 33°—36° N, PETERSEN ded., 1857" and measuring abt. 11 mm.

Penæid-larva No. 4 (Fig. 10). (Larva of Funchalia Woodwardii?, see above p. 21).

Mediterranean.

St. 143. 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 300 m.w., 0^{30} am., 30 min. 1 spec. 12 mm. — **St. 175.** 1103 m. 40°48′ N, 27°59′ E. 11-8-1910. 400 m.w., 11^{20} pm., 30 min. 1 spec. abt. 16 mm. (rostrum lost). — **St. 175.** ibid. 1200 m.w., 0^{25} am., 30 min. 1 spec. 7.5 mm.

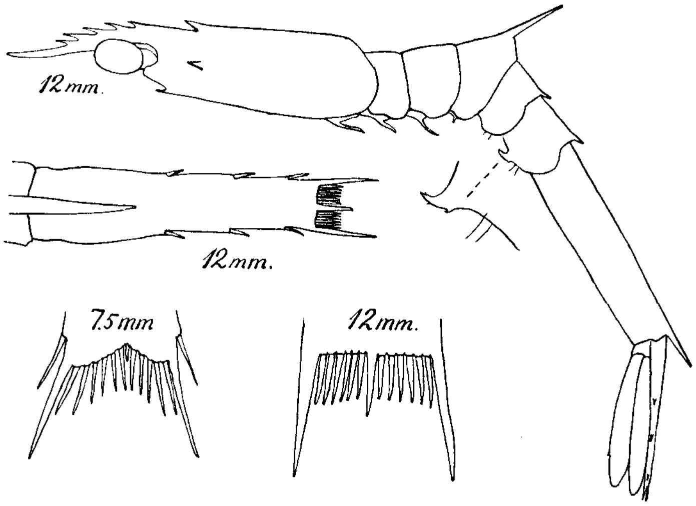

Fig. 10. Penæid-larva No. 4. A larva of 12 mm. length and its telson; apex of telson of a larva 7.5 mm. long.

This larva is characterised especially by the dentate upper part of the rostrum, by the spines on dorsal side of 3—6. abdominal segments (largest on the third), by the hook formation in the inferior margin of the epimeral part of 5. abdominal segment, and by the long, soft, filiform process midway below the posterior part of the pereion and the two anterior abdominal segments. The specimen of 12 mm. is the best preserved, and the following description is therefore taken from this; the other specimens are later compared therewith.

Rostrum somewhat over half the length of the carapace ex. rostrum, rather powerful, with 5 teeth on the upper side, besides one a little in rear of the base. No teeth on the lower margin. No supra-ocular tooth; there is, however, a tooth on the lower anterior corner of the carapace, and there is an hepatic spine. The tail has a rather long spine on the dorsal side (not posterior margin) of 3. caudal segment, and on the posterior margin of 6. segment, and one quite short one on the 4—5. segment. Midway along the ventral side of the hinder part of the pereion and on the 1.—2. caudal segment there is a fairly large, but soft, filiform process; a very small one also on the 3. segment. The inferior lateral margin of the 5. caudal segment forms a hook. Telson of almost equal breadth throughout, cut off straight at the rear, and with three pairs of lateral spines. The posterior margin has at each corner, and also in the middle, a fairly large spine, not articulate; between the middle spine and each of those at the corners there are six shorter, articulate spines.

Distinct chela on p. 1—p. 3; p. 4—p. 5 in length as p. 3. Pleopoda bifid, inner ramus however only quite short; some few natatory setæ present. Plp. 1 of same shape as the rest, not swollen.

The small specimen, (7.5 mm.) differs in having only 3 + 1 spines above the rostrum; behind the hindmost there is a wart in on the carapace. In p. 1—p. 3 there are distinct though very small chelæ, but p. 4—p. 5 are of same size as p. 3. Pleopoda very small, hardly bifid. Telson as in the older specimen save in having the posterior margin slightly notched (see fig.); no large median spine, but six pairs of articulated spines, one of the midmost being much smaller than the rest, this, however, seems to be accidental.

The largest specimen (16 mm.) has lost almost the whole of the rostrum, so the number of teeth cannot be given. Chelæ so far developed as to have apparently a true movable digit. Pleopoda have natatory setæ on both rami. Telson with 5 pairs of spines between the corner and median spines.

Caridea.

Fam. Pasiphæidæ Dana.

Pasiphæidæ Dana 1852, p. 532, 536.
* — Stebbing, Edinburgh 1914, p. 293 (lit. and key to the genera).
— Pesta 1918, p. 62 (lit.).
— de Man 1920, p. 1 (list of all genera and species).

The family of the *Pasiphæidæ* is represented in the "Thor" area (S. of abt. 50° N) by two genera, the *Pasiphaë* and the *Parapasiphaë*, with 3 (4) and 2 species respectively. To these must be added 2 species, *Dantecia caudani* CAULLERY (CAULLERY 1896, p. 372, pl. 14, figs. 1—11) and *Psathyrocaris fragilis* WOOD-MASON var.

atlantica CAULLERY (ibid. p. 374, Pl. 14, figs. 12—15) one specimen of each being taken in the Bay of Biscay, at 1710 and 800 m. respectively and mentioned by CAULLERY l. c. but hardly met with again since then.

The genus *Parapasiphaë* has, besides the well-known species *P. sulcatifrons,* mentioned below, also a species *P. Grimaldi* COUTIÈRE (COUTIÈRE 1911, p. 157) of which two specimens were taken off the coast of Portugal at 36°—45° N, 11° W; the specific diagnosis is extremely brief, and runs as follows: "*P. G.* reproduit sauf des différences tres légères, l'espèce de l'Océan Indien, *P. latirostris* ALCOCK. Mais elle ne possède pas de palpe mandibulaire, annulant ainsi la valeur d'un caractère considéré comme fondamental entre les genres *Pasiphaë* et *Parapasiphaë*."

According to CARUS (1885 p. 482) a mysterious species is described from Naples, *Pasiphaë neapolitana* HOPE, Ann. Accad. Aspir. Nat. vol. 4, p. 131. It is "affinis *P. Savignyi*" (= *P. sivado*) but can hardly be determined from the description. As, however, we know with certainty from the Mediterranean only *Pasiphaë multidentata* and *P. sivado*, it is probably identical with one of these (here disregarding PESTA's highly improbable record of *P. principalis* from the Adriatic (PESTA 1918, p. 67); see under *P. multidentata* below).

As above mentioned, there are hardly more than 2 species known from the Mediterranean (almost exclusively the western basin) to wit, *P. multidentata* and *P. sivado* (but no species of *Parapasiphaë*); both these two species were taken by the "Thor" at a considerable number of places, and are found at night almost exclusively in the upper water layers, 10—300 m.w., though by day they live considerably deeper down. They are glassy clear, almost colourless, and rather firm-skinned. Both are likewise found in the northern Atlantic.

Besides these two, we also find in the "Thor" area of the North Atlantic, the two above-mentioned species of *Parapasiphaë* and *Pasiphaë principalis* (but hardly *P. tarda*) but these keep, even at night, rather far down (*Parap. sulcatifrons* was at any rate not taken by the "Thor" higher up than with 1500 m.w.) and they are red and rather soft (except *P. tarda* in specimens of more than abt. 80—100 mm.).

The development is not known, but as *Parap. sulcatifrons* has very large eggs, it has doubtless a very abbreviated larval development.

Genus **Pasiphaë** (Savigny) Krøyer.

Pasiphæa Savigny, Mém. sur les Animaux sans vertèbres 1816, p. 50, note.
Pasiphaë Kröyer 1845, p. 453.
— Bate 1888, p. 863.
Phyë Wood Mason 1893, p. 164.
Pasiphæa Sund 1912.
— Pesta 1918, p. 63.
— de Man 1920, p. 1 (list of all species), 5.

Save for the easily recognisable *P. sivado*, the other North-Atlantic species have been the subject of much misunderstanding, being alternately conjoined or separated into several species.

Briefly, the facts are as follows: The American species *P. princeps* has been found in the Northern Pacific and at Equador (see RATHBUN 1904, p. 23—24) and in the northern Atlantic only off the American coast: 3°9′ N, 82°8′ W, 1132 fms. 1 spec. (FAXON 1895) and 32°27$^1/_2$′ N, 77°20$^1/_2$′ W, (RATHBUN 1904, p. 24) to 37°59$^1/_2$—39°39$^3/_4$′ N, 71°35$^1/_4$′—73°48$^1/_2$′ W, 444—693 fms. 5 spec. (SMITH 1882, 1885 [1886]). For the difference compared with *P. principalis* see SUND 1912, p. 11—12.

The remaining species, on the other hand, which were originally established under several different names comprising several synonyms, were later united in a single species "*P. tarda* Kr." until KEMP, 1910 divided this into two; viz. "*P. tarda* Kr." (= *P. multidentata* Esmark) and "*P. princeps* Smith" (= *P. principalis* Sund + ?*P. tarda* Kr.). In my work on the Decapods of the "Tjalfe" 1912 I furnished reasons for uniting the mentioned species in one. True, this result was not correct, but it is explained by the fact that *P. multidentata* and *P. tarda*, in contrast to *P. principalis*, have the same shaped carina on the 6. caudal segment, so that I did not distinguish between even the largest specimens of one and the other; and *P. tarda* and *P. principalis*, as is also evident from SUND's description, are certainly not to be distinguished one from another in specimens less than abt. 60 mm. (according to may own material, this limit should indeed be raised to abt. 75 mm.).

Shortly after the appearance of my work, SUND (SUND 1912) explained that there were 5 species in the North Atlantic, viz. besides *P. sivado* and *P. princeps* Smith, also *P. multidentata* Esmark, *P. tarda* Kr. and *P. principalis* Sund. SUND gives (l. c. p. 3—4) a list of determinations of the European species; for the difference between *P. principalis* and the species *P. princeps*, which latter is probably exclusively American, see l. c. p. 11—12.

As the "Thor" has yielded a not inconsiderable quantity of material (chiefly, however, belonging to a single one of the species here in question) I have, in addition to going through the "Thor" material, also carried out a new revision of all the older material in our Museum, both from the Northern Atlantic and from Denmark (mentioned by H. J. HANSEN 1908, p. 78; K. STEPHENSEN 1910, p. 289 and 1912 ("Tjalfe") p. 65). As the starting point of this revision I have taken a number of specimens determined by O. SUND during a stay in Copenhagen in July 1912. Unfortunately, I was away in Greenland at the time, so that there was no opportunity of discussing the matter verbally with him.

And here I may state at once that this fresh revision on the whole confirms the main result of SUND's examination, viz. that there are in Europe three species besides *P. sivado*; my material, however, does not bear out all the details quoted by him, and as will be seen from what now follows, his list of determinations for the species (l. c. p. 3—4) can only be used for larger specimens and is by no means applicable to specimens of all sizes, the specific characters being only developed with increasing age.

P. multidentata. The best specific character the 7—12 spines on the base of P. 2 can only be used for determining large specimens, over abt. 50 mm., smaller individuals have only a smaller number of spines, or none at all, and can thus in this respect be confused with *P. tarda* and *P. principalis*. Specimens with a total length of less than 50 mm. or thereabouts can, according to Sund's text, (p. 11) and figures (SUND, fig. 5—7; from the text, the left column in the three figures should be *P. multidentata*, the right *P. principalis*) be distinguished from the two other European species, even when no more than 14—20 mm. (carapace 4—6 mm.). That the species is easily distinguishable at a relatively small size is undoubtedly partly due to the fact that the species is altogether smaller in size than the two others; ♀ with ova may be met with right down to 57—60 mm. (carapace 17—18 mm.).

According to the material I have myself examined, *P. multidentata* can not always be distinguished with certainty from the other species before reaching a total length of abt. 30—35 mm.; in smaller specimens (20—30 mm.) the antennal plate may be shaped as in SUND's fig. of this species, while the outer ramus in the urop. is shaped as in the other species, or both may have an intermediate form, not coinciding exactly with either of the species. The rostrum, again is not altogether serviceable as a means of determination with such small individuals.

When the species has attained a size of abt. 50 mm., it has — a point not mentioned in the literature — the carina of the 6. abdominal segment shaped as in *P. tarda* Kr. (K. STEPHENSEN: "Tjalfe" 1912, fig. 1 p. 68). The fact that this keel is of the same shape in the two mentioned species was the principal reason for my — incorrectly — uniting them as one species in my work on the Malacostraca of the "Tjalfe".

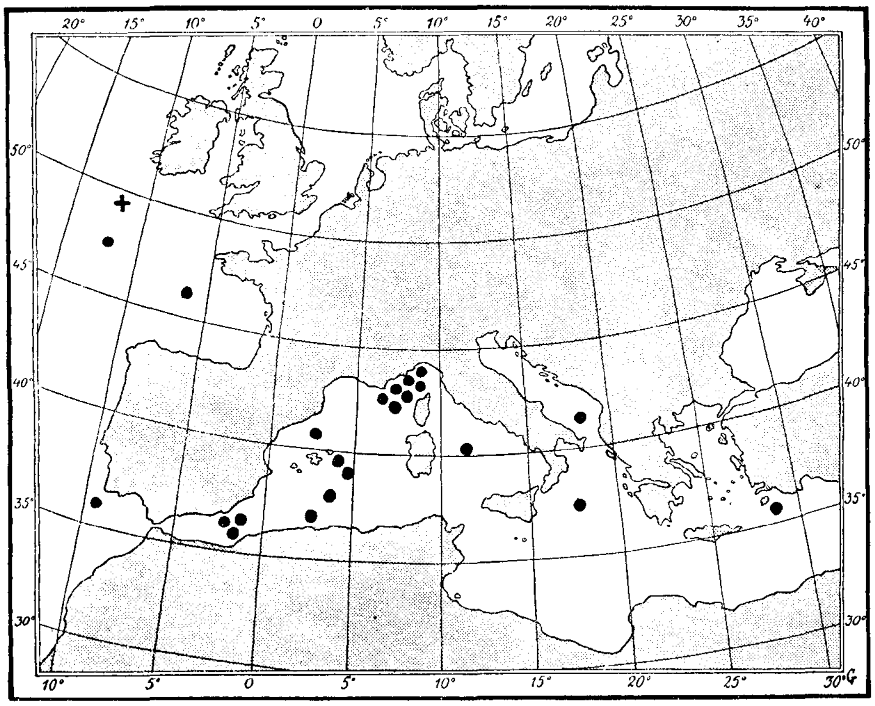

Chart 3. Pasiphaë. • P. multidentata. + P. principalis.

P. principalis and P. tarda are far more difficult to distinguish one from the other, save in the case of large specimens. SUND gives some lists of localities (SUND 1912, p. 13, 16) with measurements of the specimens there found. We find here, it is true, specimens with a carapace no larger than 5 or 11 mm. length (*P. principalis*); but he himself states (p. 12) that he would not venture to determine with any certainty specimens having the carapace less than 20 mm., answering to a total length of abt. 60 mm. Where he does give a determination of smaller individuals, it is only such as were taken together with larger specimens which were determinable themselves with certainty. (SUND, p. 12, 17).

From the material at my disposal it appears that in seeking to distinguish between these two species we have hardly more than two good characters (and even these can only be used with specimens over 60—75 mm.) viz. the rostrum (Sund fig. 9) and the keel on the 6. abdominal segment (K. Stephensen "Tjalfe" 1912 fig. 1).

1. PASIPHAË MULTIDENTATA Esmark
(Chart 3, partim).

Pasiphæa multidentata Sund 1912, p. 3, 4—5 (lit. and syn.), fig. 1 (distribution), figs. 2—4, p. 6—11, figs. 5—7 (the left series of detail figures).
Pasiphaë tarda Kemp 1910, p. 39—43, Pl. 4 fig. 8—11.
? — (*Phye*) *sicula* Riggio 1895—96, p. 7—13, Pl. 1 fig. 2.
?*Pasiphæa principalis* Pesta 1918, p. 67, fig. 21.

Mediterranean.

St. 14. 1125 m. 41°24′ N, 17°45′ E. 21-12-1908. 300 m.w., 6^{30} am., 60 min. 1 ♀ 49 mm. — **St. 14.** ibid. 1000 m.w., 8^{20} am., 90 min. 2 spec.: 1 spec. 34 mm., 1 ♀ 61 mm. — **St. 34.** > 2000 m. 43°27′ N, 8°16′ E. 23-1-1909. 200 m.w., 6^{35} am., 30 min. 1 jun. 11 mm. — **St. 35.** > 2000 m. 43°36′ N, 7°36′ E. 29-1-1909. 200 m.w., 6^{40} pm., 60 min. 1 ♀ 60 mm. — **St. 36.** > 2000 m. 42°49′ N, 6°54′ E. 30-1-1909. 300 m.w., 6^{50} am., 60 min. 2 spec. 30—43 mm. — **St. 53.** > 2000 m. 36°13′ N, 1°28′ W. 18-2-1909. 2600 m.w., 5^{15} pm., 90 min. 2 spec. 18 mm. — **St. 107.** > 2000 m. 36°13′ N, 1°28′ W. 25-6-1910. 2000 m.w., 7^{30} am., 60 min. 5 spec.: 11.5, 20, 23, 39, 46 mm. — **St. 108.** > 2435 m. 36°03′ N, 0°27′ W. 26-6-1910. 2000 m.w., 0^{40} am., 60 min. 10 spec.: 5 spec. 16—21 mm., 5 spec. 31—41 mm. — **St. 112.** 2700 m. 36°56′ N, 2°15′ E. 27-6-1910. 300 m.w., 0^{15} am., 30 min. 2 spec. 26—34 mm. — **St. 115.** 2800 m. 38°17′ N, 4°11′ E. 28-6-1910. 300 m.w., 11^{20} pm., 30 min. 1 spec. 36 mm. — **St. 115.** ibid. 2000 m.w., 0^{30} am., 60 min. 1 spec. 32 mm. — **St. 116.** 2860 m. 39°27′ N, 5°26′ E. 30-6-1910. 300 m.w., 1^{40} am., 30 min. 4 spec. 24—32 mm. — **St. 120.** 2700 m. 42°31′ N, 7°41′ E. 1-7-1910. 300 m.w., 8^{50} pm., 30 min. 3 spec.: 30, 34, 44 mm. — **St. 122.** > 1500 m. 43°50′ N, 8°34′ E. 2-7-1910. 1200 m.w., 5^{30} pm., 60 min. 4 spec.: 3 spec. 22, 27, 39 mm.; 1 ♀ 107 mm. (Carapace 33 mm.). — **St. 123.** > 600 m. 44°14′ N, 8°55′ E. 3-7-1910. 300 m.w., 0^{05} am, 30 min. 1 spec. 39 min. — **St. 125.** 1082 m. 43°57′ N, 9°13′ E. 9-7-1910. 300 m.w., 9^{45} pm., 30 min. 2 spec. 43—46 mm. — **St. 129.** 3420 m. 40°05′ N, 11°31′ E. 12-7-1910. 3500 m.w., 3^{00} pm., 120 min. 1 spec. 29 mm. — **St. 160.** 2980 m. 35°59′ N, 28°14′ E. 1-8-1910. 4000 m.w., 3^{30} pm., 60 min. 1 spec. 31 mm. — **St. 187.** > 2500 m. 37°54′ N, 18°02′ E. 18-8-1910. 1000 m.w., 6^{40} pm., 30 min. 1 spec. 34 mm. — **St. 206.** 2782 m. 39°32′ N, 5°15′ E. 28-8-1910. 1000 m.w., 1^{40} am, 45 min. 3 spec.: 32, 46, 48 mm. — **St. 206.** ibid. 2000 m.w., 3^{05} am, 45 min. 1 spec. 47 mm. — **St. 209.** > 2000 m. 40°34′ N, 3°03′ E. 29-8-1910. 2000 m.w., 7^{25} am, 45 min. 1 spec. 30 mm.

Atlantic.

St. 3. 280 m. 58°52′ N, 4°18′ E. 30-4-1903. 3 spec. 34, 43, 57 mm. — **St. 152.** 1240 m. 60°00′ N, 28°10′ W. 19-6-1904. 1000 m.w. 1 spec. 32 mm. — **St. 285.** Depth ?. 62°49′ N 18°46′ W. 1-9-1904. 100 m.w. 1 ♀ 76 mm. — **St. 61.** 963 m. 61°11′ N, 11°00′ W. 28-5-1904. 900 m.w., 60 min. 1 ♀ with ova 102 mm. — **St. 179.** 4000 m. 47°20′ N, 12°25′ W. 3-9-1906. 1800 m.w., 3^{40} am, 120 min. 1 spec. 41 mm. — **St. 76.** 1800 m. 47°01′ N, 5°48′ W. 10-3-1909. 1600 m.w., 2^{40} pm., 60 min. 1 spec. 27 mm. — **St. 232.** 3700 m. 36°28′ N, 9°06′ W. 9-9-1910. 1000 m.w., 10^{35} pm., 30 min. 1 spec. 37 mm.

On the determination of the species, etc., see above p. 28. The material comprises 59 specimens (52 spec. 11—48 mm., 7 ♀ 49—107 mm.) from 26 stations, 29 hauls; almost the whole of the material was taken in the Mediterranean.

A. Mediterranean.

The material comprises 50 specimens, (46 of 11—48 mm., 4 ♀ 49—107 mm.) from 19 stations, 22 hauls, taken both winter and summer.

Depths of the sea and occurrence. (Chart 3). The depth to bottom was over 600—3420 m. especially over 2000—3000 m. The stations lie distributed throughout the whole of the Mediterranean; only 3 however, lie in the eastern basin; 1 in the southern Adriatic, 1 between Sicily and Greece, and one at the entrance to the Ægean.

Depths in m.	No. of stations
500—1000	1
> 1000—2000	3
> 2000—3000	14
> 3000	1

As all the specimens not altogether small (over abt. 30 mm.) and also the great majority of the still smaller ones could be referred with certainty to this species, there can be no doubt but that the remaining very small specimens belong to the same. As, therefore, the whole of the "Thor" material from the Mediterranean does not include a single specimen which can be ascribed to any other species, it is extremely probable that the specimens previously recorded from the Mediterranean (Lo Bianco 1903, and Pesta 1916) as *P. tarda* are in reality specimens of *P. multidentata*. Riggio has (l. c. 1895—96) described a new species, *P. sicula*, from a single large ♀, (124 mm., carapace 46.5 mm.) from Augusta, between Catania and Sicarusa. This specimen also (the "species" has never been met with since) would seem to be referable to the same species. In all probability, then, there should be in the Mediterranean, apart from the easily distinguishable *P. sivado* — no other species than *P. multidentata*.

Pesta (1918 p. 67) mentions some specimens from the Adriatic as belonging to "*P. principalis* Sund", partly, it would seem, collected by himself, and partly previously determined by ADENSAMER (1898 p. 626) as *P. sivado*. As these, however, are small specimens (30 mm. total length) so that PESTA himself is not certain in his determination, it seems to me most likely that it is really *P. multidentata*, since — apart from the easily distinguishable *P. sivado* — adult specimens of no other species appear to have been found in the Mediterranean.

M. w.	No. of hauls			
	Winter		Summer	
	Night	Day	Night	Day
200— 300	1	3	6	—
900—1200	—	1	2	1
2000—4000	—	1	3	4

Vertical occurrence. Upper limit both day and night lies abt. 200 m.w. In both summer and winter it is taken at night especially with 200—300 m.w. In the daytime, on the other hand, it is taken in winter chiefly with 200—300 m.w. and in summer for the most part with 2000—4000 m.w., not nearer the surface than 1000 m.w.

This species seems to live nearer the surface than *P. tarda* and *P. principalis*. This agrees with the fact of its being a glassy clear, colourless form (SUND 1912 p. 5) for which reason it is called "Glasræke" (glass-shrimp) in Norway. LO BIANCO (1903) however, gives its colour ("*P. tarda*") somewhat otherwise: adult specimens semi-transparent with small red spots. Margin of uropoda and of telson, base and distal part of pereiopoda red. Besides the red spots, there are red bands at the base of the pleopoda. — A fact pointing in the same direction is that its skin is much firmer than in the two other species, which, in specimens of less than ant. 75 mm. is very soft; this applies at any rate to all the specimens at my disposal, and can hardly be altogether due to preservation.

Size and propagation. Nearly all the specimens are comparatively small, 11—49 mm.; only three are larger, viz. 60, 61 and 107 mm. (carapace 33 mm.) and these three are all ♀. RIGGIO's sole type-specimen of *P. sicula* which should probably be referred to this species, is also a ♀, and even larger: 124 mm., carapace 46.5 mm.

Females with ova have probably never been found in the Mediterranean.

B. Atlantic.

We have only 9 specimens, from seven hauls at seven stations. Localities: Danmark Strait (St. 152, 1904), between the Færöes and Iceland (St. 61 and 285, 1904), SW of Norway (St. 3, 1903), Bay of Biscay (St. 179, 1906 and St. 176, 1909) and Bay of Cadiz (St. 232, 1910). — The three first-mentioned are noted by H. J. HANSEN 1908 under *P. tarda*.

In addition to this material, we have in our museum several hundred specimens of this species from the Skagerak (*P. tarda*, K. STEPHENSEN 1909 [1910] p. 287; this materiall really includes also some true *P. tarda* Kr. and possibly a few *P. principalis*). The measurements for females with ova in this Danish material are as follows:

Length of carapace in mm[1] ..	17	18	19	20	21	22	23	24	25
Total length in mm	57—59	59—63	59—65	64—70	72—74	69—75	75—78	—	82—84
No. of ♀ with ova..........	2	8	7	4	2	6	2	—	2

[1] from ocular sinus to hind edge of the carapace.

These dimensions are somewhat smaller than those given by SUND (1912, p. 4) but it is likely that some difference obtains according to locality, and SUND does not state where his specimens were procured.

Apart from the above-mentioned large ♀ from the Mediterranean, ("Thor" St. 122, 1910, 107 mm.) we have in our museum only a single large ♀ (with ova) viz. that from the "Thor" St. 61, 1904, (W. of the Færöes: total length 102 mm., carapace ex. rostrum 30 mm., incl. rostrum 33 mm.).

Distribution.

Mediterranean, especially Western Basin; North Atlantic; Gulf of Maine, S. E. of Greenland; between the Færöes and Iceland; West coast of Europe from Tromsö to Cadiz Bay. —

1. Mediterranean. On the "Thor" see above. — Between Capo Corso and Villafranca, 2000 m.w., daytime closing net, 1 spec.; Capri, 1200—2000 m.w., daytime, and closing net 300 and 400 m.w., daytime, > 4 spec.; Salina (Eolian Isl.), 2500 m.w., daytime, 3 spec. (*P. tarda*, LO BIANCO 1903, p. 185). — Augusta

between Siracusa and Catania, 1 spec. (*P. sicula*, Riggio 1895—96). — ?Adriatic (*P. principalis*, Pesta 1918, p. 67).

2. Atlantic. On the "Thor" see above. — Gulf of Maine, 2 localities, 140—175 fms., several spec. (*P. tarda*, Smith 1879). — S. E. Greenland 58°08′ N, 39°24′ W, 500 m.w. ("Tjalfe" st. 15), 2 spec. 34—59 mm. (O. Sund determ.; *P. tarda* K. Stephensen, "Tjalfe" 1912 (1913), p. 66). — S. of the Færöes (Sund 1912, p. 5). — Norway from Malangen (Tromsö) to Skagerak and Christianiafjord (Sund 1912, p. 5). — Almost all the specimens from the Skagerak determined by myself as *P. tarda* (1910, p. 289) belong to *P. multidentata*; the localities are: Skagerak without special localities, several hundred spec.; 58°20′ N, 9°00′ E, 30-6-1907, 350 m., trawl ("Thor" st. 15), 2 spec. abt. 65 mm.; 58°05′ N, 8°24′ E, 23-6-1907, 490 m., 300 m.w., ("Thor" st. 1), 3 spec. abt. 50—60 mm.; North sea at Uggerby, 1 spec. abt. 60 m.w. (Sund determ.); 57°52′ N, 8°1′ E, 6-9-1905 520 m., 300 or 65 m.w., 3 spec. abt. 50—60 mm. ("Thor" st. 173) (Sund determ.); ibid. 300 m.w., 1 spec. abt. 40 mm. (Sund determ.), and 1 spec. abt. 35 mm.; 42 miles N. W. 3/4 N. of Hirshals, 9-10-1904, 640 m. ("Thor" st. 273), 2 spec. 30—35 mm. — S. W. Ireland, 370—411 fms. 1 spec. (Kemp 1910). — ?36°—45° N, 11° W, 3 spec. (*P. tarda*, Coutière 1911, p. 157, is evidently *P. mult.*, but not *P. principalis*, as this species ("*P. princeps*") is specially mentioned by Coutière and *P. tarda* is never found so far to the south).

2. PASIPHAË PRINCIPALIS Sund.
(Chart 3, partim [p. 28]).

Pasiphæa principalis Sund 1912, p. 4, 6—17, fig. 1 (distribution), figs. 2—4, figs. 5—7 (the right series of figures), fig. 9, a—f; lit. and syn.

?non— — Pesta 1918, p. 67 (= ?*P. multidentata*, see this species above p. 29).

Atlantic.

St. 99. 872—970 m. 61°15′ N, 9°35′ W. 22-5-1904. 700—1700 m.w. 24 spec. 24—51 mm. (O. Sund determ.). — **St. 63.** 1150 m. 59°49′ N, 8°58′ W. 30-5-1905. 1200 m.w. 1 spec. 103 mm. (O. Sund determ.). — **St. 74.** 1220 m. 49°23′ N, 12°13′ W. 9-6-1906. 2500 m.w., ell drift-seine. 2 spec. 70—76 mm.

On determination etc. see above p. 28; differences from *P. princeps* Smith see Sund, p. 11—12.

Distribution. Davis Straits 63°54′ N, 53°15′ W, 8-6-1909, 988—1400 m. ("Tjalfe" st. 429; O. Sund determ.; by myself ("Tjalfe" 1912 (1913), p. 66 determined as *P. tarda*) 1 spec. 61 mm., carapace 20 mm.). — 65°14′ N, 55°42′ W, 420 fms. ("Ingolf" st. 28; Sund determ.; by H. J. Hansen ("Ingolf" 1908, p. 78) determined as *P. tarda*). — ?S. W. of Iceland 61°44′ N, 27°00′ W, 485 fms. ("Ingolf" st. 81; 1 spec. 37 mm. (Carapace 11 mm.); by Sund determined as "possibly *P. principalis*"; by H. J. Hansen "Ingolf" 1908, p. 78, determined as *P. tarda*). — S. of the Færöes, "Thor" st. 99, 1904, and st. 63, 1905, see above. — S. of the Færöes, "Michael Sars", see Sund 1912, p. 13. — Norway from Lofoten to Sognefjord (Sund 1912, p. 13). — S. W. Ireland: "Thor" st. 74, 1906 (see above), and Sund 1912, p. 13. — 36°—45° N, 11° W, 2 spec. (*P. princeps*, Coutière 1911, p. 157). — North side of Bay of Biscay 48°7′ N, 8°13′ W, 246 fms., 1 spec. 69 mm. (*P. princeps* Kemp, "Huxley" 1910, p. 410).

3. PASIPHAË TARDA Kr.

Pasiphæa tarda Sund 1912, p. 4, fig. 1 (distribution), figs. 2—4, p. 8—9, 12, 14—17, fig. 8, fig. 9, g—n; lit. and syn. Pl. 1—3.

Atlantic.

St. 3. 280 m. 58°52′ N, 4°18′ E. 30-4-1903. 1 spec. 89 mm. (O. Sund determ.).

On determination etc. see above p. 28.

Distribution. Davis Straits, Danmark Straits, Jan Mayen, S. Greenland (see Sund 1912, p. 16). — ?Bredefjord (S. W. Greenland), 26-8-1912, 800 m.w., several spec., total length 11—41 mm. (K. Stephensen 1916, p. 270). — The two localities at W. Greenland in Sund's chart (1912, fig. 1) are situated too far to the north; should be 65°14′ N and 64°14′ N ("Ingolf" st. 28, "Tjalfe" st. 407—08). — N. of Jan Mayen 73°—73°30 1/2′ N, 2°—2°50′ W, 3 localities, 1500—0 and 3000—0 m., 4 spec. (Ohlin 1901). — Skagerak, see Sund 1912, p. 16. The greatest Danish specimen is about 140 mm., (not 150 mm., as given by K. Stephensen 1910, p. 289), carapace abt. 47 mm., but is very defective: rostrum lost, carapace broken, etc. — Was never found in the "Thor"-area S. of 50° N.

4. PASIPHAË SIVADO Risso. (Chart 4, figs. 11—14).

Alpheus sivado Risso 1816, p. 93, Pl. 3 fig. 4.

Pasiphæa — Heller 1863, p. 243, Pl. 8 fig. 4—6 (lit. and syn.).

— — Alcock 1901, p. 51 (lit. and syn.).

— — Investigator 1892—1907, Crustacea, Pl. 3 fig. 6.

Pasiphaë — Kemp 1910, p. 37, Pl. 4 fig. 12.

Pasiphæa — Pesta 1918, p. 64 (lit.), textfigs. 19—20.

Mediterranean.

St. 10. > 2100 m. 37°21′ N, 16°45′ E. 15-12-1908. 65 m.w., 6^{10} am, 60 min. 2 spec. 34—37 mm. — **St. 10.** ibid. 600 m.w., 3^{45} pm., 60 min. 3 spec.: 2 jun. 12—17 mm., 1 ♂ 53 mm. — **St. 12.** 1060 m. 39°34′ N, 17°17′ E. 19-12-1908. 1000 m.w., 2^{15} pm., 45 min. 2 spec. 17—23 mm. — **St. 13.** > 1200 m. 39°43′ N, 17°30′ E. 19-12-1908. 65 m.w., 8^{50} pm., 60 min. 4 spec. 22, 23, 28, 29 mm. — **St. 14.** 1125 m. 41°24′ N, 17°45′ E. 21-12-1908. 65 m.w., 5^{00} am, 60 min. 3 ♀ (1 with ova 54 mm.) 50—54 mm. — **St. 14.** ibid. 300 m.w., 6^{30} am, 60 min. 1 spec. 42 mm. — **St. 14.** ibid. 1000 m.w., 8^{20} am, 90 min. 1 spec. 34 mm. — **St. 26.** 560 m. 40°41′ N, 13°59′ E. 19-1-1909. 65 m.w., 0^{55} am, 60 min. 2 spec.: 37—48 mm. — **St. 26.** ibid. 300 m.w., 6^{40} am, 180 min. 1 spec. 27 mm. — **St. 27.** 90 m. 40°58′ N, 13°59′ E. 20-1-1909. 25 m.w., 2^{30} am, 180 min. 4 spec.: 1 ♂ 55 mm., 3 ♀ with ova (one of them [53 mm.] with ova also in the ovarium) 53, 60, 60 mm. — **St. 27.** ibid. 65 m.w., 6^{00} am, 120 min. 24 spec.: 11 ♂ (47 mm. [2 spec.], 50, 51, 54 [3 spec.], 56 [2 spec.], 57, 60 mm.), 13 ♀ (2 without ova 46—47 mm., 11 with ova: 50, 51 [2 spec.], 52, 54 [3 spec.], 55 [2 spec.], 56, 62 mm.; 3 of these ♀ have ova also in the ovarium: 52, 54, 54 mm.). — **St. 28.** 600 m. 40°53′ N, 13°43′ E. 19-1-1909. 65 m.w., 11^{50} pm., 120 min. 17 ♀: 2 without ova 46—52 mm., 15 with ova (48, 53 [3 spec.], 54 [2 spec.], 55 [2 spec.], 56, 57, 59, 60 [2 spec.], 61, 63 mm.; of these ♀ 3 spec. have ova also in the ovarium [53, 54, 60 mm.] 1 only in the ovarium [48 mm.]). — **St. 28.** ibid. 1100 m.w., 5^{00} pm., 60 min. 1 spec. 25 mm. — **St. 35.** > 2000 m. 43°36′ N, 7°36′ E. 29-1-1909. 25 m.w., 9^{10} pm., 60 min. 1 ♀ 53 mm. — **St. 35.** ibid. 100 m.w., 7^{55} pm., 60 min. 4 spec.: 2 jun. 29 mm., 1 ♂ 54 mm., 1 ♀ with ova 49 mm. — **St. 35.** ibid. 200 m.w., 6^{40} pm., 60 min. 2 spec. 23—33 mm. — **St. 38.** 105 m. 40°45′ N, 9°50′ E. 31-1-1909. 150 m.w., 8^{20} pm., 30 min. 3 spec. jun. 10, 14, 17 mm. — **St. 47.** > 2000 m. 36°55′ N, 3°12′ E. 10-2-1909. 65 m.w., 10^{20} pm., 30 min. 1 spec. 28 mm. — **St. 61.** 740 m. 35°57′ N, 5°35′ W. 21-2-1909. 600 m.w., 3^{25} pm., 60 min. 3 spec.: 9, 20, 23 mm. — **St. 108.** > 2435 m. 36°03′ N, 0°27′ W. 26-6-1910. 2000 m.w., 0^{40} am, 60 min. 1 spec. 18 mm. — **St. 118.** > 2700 m. 41°00′ N, 6°43′ E. 1-7-1910. 25 m.w., 0^{20} am, 15 min. 2 spec. 30—39 mm. — **St. 118.** ibid. 65 m.w., 11^{35} pm., 30 min. 1 spec. 44 mm. — **St. 122.** > 1500 m. 43°50′ N, 8°34′ E. 2-7-1910. 1200 m.w., 5^{30} pm., 60 min. 4 spec.: 22, 28, 31, 36 mm — **St. 123.** > 600 m. 44°14′ N, 8°55′ E. 3-7-1910. 25 mw., 1^{50} am., 15 min. 21 spec.: 1 ♀ 56 mm, 20 spec. 29—42 mm. (29—31 mm. [5 spec.], 33 [2 spec.], 35 [2 spec.], 37—40 [9 spec.] 42 mm. [2 spec.]). — **St. 123.** ibid. 65 m.w., 0^{55} am, 30 min. 68 spec. 7—47 mm. (7—8 mm. [5 spec.], 10 [4 spec.], 11—15 [14 spec.], 17—18 [10 spec.], 19—20 [5 spec.], 21, 23—25 [7 spec.], 27—30 [7 spec.], 33—35 [6 spec.], 37, 39 [2 spec.], 41, 42, 45—47 mm. [5 spec.]. — **St. 123.** ibid. 300 m.w., 0^{05} am, 30 min. 4 spec.: 10, 13, 18, 31 mm. — **St. 125.** 1082 m. 43°54′ N, 9°13′ E. 9-7-1910. 25 m.w., 10^{30} pm., 30 min. 82 spec.: 4 ♂ 51, 52, 55, 57 mm.; 4 ♀: 1 with ova 62 mm., 3 without ova 53, 58, 61 mm.; 74 spec. 13—50 mm. (13 mm., 23 [2 spec.], 30, 31 [2 spec.], 32—33 [12 spec.], 34—35 [7 spec], 36, 37, 38—40 [8 spec.], 41—43 [11 spec.], 44—45 [14 spec.], 46 [5 spec.], 47—49 [5 spec.], 50 mm. [4 spec.]). — **St. 125.** ibid. 300 m.w., 9^{45} pm., 30 min. 5 spec.: 42, 44, 45, 47, 50 mm. — **St. 126.** 600—620 m. 42°43′ N, 9°50′ E. 10-7-1910. 25 m.w., 10^{10} pm., 30 min. 10 spec. 23—37 mm. — **St. 133.** 600 m. 38°18′ N, 9°59′ E. 14-7-1910. 300 m.w., 10^{15} pm., 30 min. 1 ♀ 64 mm. — **St. 133.** ibid. 600 m.w., 9^{20} pm., 30 min. 1 ♂ 49 mm. — **St. 138.** 820 m. 37°37′ N, 11°25′ E. 19-7-1910. 300 m.w., 9^{10} pm., 30 min. 2 spec. 35—41 mm. — **St. 138.** ibid. 25 m.w., 9^{50} pm., 30 min. 1 spec. 39 mm. — **St. 138.** ibid. 1000 m.w., 7^{40} pm., 60 min. 5 spec.: 2 ♂ 64—75 mm., 3 ♀ 48, 54, 69 mm. — **St. 139.** 530 m. 37°57′ N, 11°54′ E. 20-7-1910. 300 m.w., 2^{35} am, 30 min. 1 spec. 42 mm. — **St. 163.** 1180 m. 37°52′ N, 26°22′ E. 3-8-1910. 300 m.w., 1^{05} am, 15 min. 1 spec. 39 mm. — **St. 175.** 1103 m. 40°48′ N, 27°54′ E. 11-8-1910. 100 m.w, 10^{45} pm., 15 min. 4 spec.: 22, 29, 31, 33 mm. — **St. 175.** ibid. 400 m.w., 11^{20} pm. 30 min. 2 spec. 23—40 mm. — **St. 175.** ibid. 1200 m.w., 0^{25} am, 30 min. 1 spec. 15 mm. — **St. 184.** 850 m. 38°10′ N, 22°35′ E. 17-8-1910. 10 m.w., 1^{50} am, 15 min. 2 spec. 24—38 mm. — **St. 190.** 360 m. 37°51′ N, 15°19′ E. 19-8-1910. 25 m.w., 8^{15} pm., 15 min. 6 spec.: 8, 10, 22, 22, 32, 33 mm. — **St. 192.** 620 m. 38°07′ N, 15°35′ E. 20-8-1910. 25 m.w., 9^{40} pm., 15 min. 1 spec. 26 mm. — **St. 192.** ibid. 600 m.w., 10^{50} pm., 30 min. 2 spec. 29—34 mm. — **St. 209.** > 2000 m. 40°34′ N, 3°03′ E. 29-8-1910. 2000 m.w., 7^{25} am, 45 min. 1 spec. 42 mm. – On the shore at Faro, Messina, 20-3-1911. 1 mutilated spec. 56 mm.

Atlantic.

St. 90. 1012—830 m. 47°47′ N, 8°00′ W. 21-5-1905. 500 m.w., 7^{30} pm., 120 min. 4 spec.: 24, 30, 38, 43 mm. — **St. 167.** 800 m. 57°46′ N, 9°55′ W. 31-8-1905. 65 m.w., 1 spec. 15 mm. — **St. 36.** 1140 m. 44°21′ N, 2°31′ W. 10-5-1906. 300 m.w., 2^{55} am, 120 min. 8 spec.: 6 spec. 42—47 mm., 1 ♂ 63 mm., 1 ♀ 53 mm. — **St. 36.** ibid. 800 m.w., 9^{05} am, 120 min. 6 spec.: 1 ♀ with ova 70 mm., 2 ♀ without ova 53—57 mm., 3 spec. 32, 33, 47 mm. — **St. 36.** ibid. 1250 m.w., 5^{55} am, 120 min. 1 ♂ 60 mm., 1 ♀ 54 mm. — **St. 37.** 1400 m. 44°01′ N, 2°49′ W. 10-5-1909. 300 m.w., 7^{05} pm., 120 min. 33 spec.: 5 spec. 26—38 mm., 7 ♂ 57—68 mm., 4 ♀ with ova 57, 60, 65, 67 mm., 17 ♀ without ova 53—66 mm. — **St. 42.** 348 m. 43°31′ N, 2°13′ W. 15-5-1906. 70 m.w., 10^{30} am, 60 min. 1 spec. 29 mm. — **St. 43.** 1030—1290 m. 43°37′ N, 2°08′ W. 16-5-1906. 600 m.w., 5^{20} am, 120 min. 14 spec.: 7 spec. 28—34 mm., 3 spec. 40—44 mm., 1 ♂ 62 mm., 1 ♀ with ova 63 mm., 2 ♀ without ova 53—56 mm. — **St. 43.** ibid. 250 m.w., 2^{45} am, 120 min. 1 ♂ 70 mm. — **St. 47.** 1015 m. 45°00′ N, 2°57′ W. 17-5-1906. 300 m.w., 2^{25} pm., 120 min. 6 spec.: 5 spec. 13—18 mm., 1 spec. 28 mm. — **St. 168.** 470 m. 51°30′ N, 11°37′ W. 26-8-1906. 300 m.w., 11^{55} pm., 300 min. 3 ♀ 45, 57, 58 mm. — **St. 175.** 1520 m. 51°11′ N, 11°41′ W. 30-8-1906. 300 m.w., hour? 1 ♀ 75 mm. — **St. 185.** 640 m. 51°56′ N, 11°55′ W. 7-9-1906. 600 m.w., 10^{00} am, 60 min. 1 ♀ 72 mm. — **St. 188.** 490 m. 48°12′ N, 8°52′ W. 9-91906. 65 m.w., 30 min., 11^{00} pm., 1 ♀ 52 mm. — **St. 65.** 1300 m. 35°53′ N, 7°26′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 1 spec. 25 mm. — **St. 66.** 735 m. 36°16′ N, 6°52′ W. 25-2-1909. 65 m.w., 1^{45} am, 60 min. 8 spec.: 5 spec. 16, 19, 33, 35, 48 mm.; 3 ♀ 52, 52, 57 mm. — **St. 66.** ibid. 300 m.w., 2^{55} am, 120 min. 8 spec.: 3 jun. 16, 39, 47 mm.; 5 ♀ with ova 56, 57, 59, 66, 71 mm. (the spec. 66 mm. has ova only in the ovarium). — **St. 66.** ibid. 600 m.w., 5^{15} am, 120 min. 6 spec.: 4 spec. 17, 21, 25, 41 mm.; 1 ♂ 61 mm., 1 ♀ 65 mm.

— **St. 66.** ibid. 1200 m.w., 8^{30} pm., 120 min. 2 spec. 25—41 mm. — **St. 68.** 550 m. 36°39′ N, 7°21′ W. 27-2-1909. 65 m.w., 7^{00} pm., 15 min. 1 spec. 40 mm. — **St. 68.** ibid. 800 m.w., 5^{55} pm., 45 min. 13 spec.: 12 spec. 18, 28, 32, 32, 33, 37, 40, 41, 42, 43, 45, 47 mm.; 1 ♀ 54 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 5-3-1909. 25 m.w., 0^{05} am, 30 min. 0.12 liter. 586 spec. 13—33 mm., most of them (208 spec.) 18—20 mm.: (13—15 mm. [19 spec.], 16—17 [57 spec.], 18 [68 spec.], 19 [69 spec.], 20 [71 spec.], 21—25 [222 spec.], 26—27 [45 spec.], 28—30 [28 spec.], 31—33 mm. [7 spec.]). — **St. 71.** ibid. 65 m.w., 10^{50} pm., 60 min. 22 spec. 14—33 mm. (14 mm., 16—19 [11 spec], 27—30 [7 spec.], 31—33 mm. [3 spec.]). — **St. 71.** ibid. 300 m.w., 8^{40} pm., 120 min. 0.6 liter. 174 spec.: 54 spec. 13—50 mm. (incl. 3 ♀ with ova 48, 48, 50 mm.), 120 spec. 51—69 mm. (13 mm. [1 spec.], 16—20 [10 spec.], 21—25 [15 spec.], 26—30 [17 spec.], 32 mm., 42—43 [4 spec.], 47—50 mm. [6 spec.]. — 48 ♂ 52—69 mm.: 52 mm. [2 spec.], 54 [2 spec.], 56—58 [4 spec.], 59 [8 spec.], 60—63 [20 spec.], 64—65 [6 spec.], 66—69 mm. [6 spec.]. — 28 ♀ without ova 51—65 mm.: 51—52 mm. [4 spec.], 54—55 [2 spec.], 56 [6 spec.], 58 [3 spec.], 59—60 [6 spec.], 61—62 [5 spec.], 65 mm. [2 spec]. — 44 ♀ with ova 52—67 mm. [of which 4 have ova only in the ovarium: 54, 55, 61, 64 mm.]: 52 mm., 53—54 [4 spec.], 55—58 [15 spec]. 59—60 [6 spec.], 61 [6 spec.], 62—64 [7 spec.], 66—67 mm. [5 spec.]). — **St. 71.** ibid. 600 m.w., 6^{35} pm., 120 min. 55 spec.: 34 spec. 14—50 mm. incl. 1 ♀ with ova 50 mm., 7 ♂ 60—64 mm. 14 ♀ 51—67 mm. (14—15 mm. [2 spec.], 16—17 [4 spec.], 19—20 [5 spec.], 21—25 [5 spec.], 26 [2 spec.], 28—29 [4 spec.], 34, 36, 37, 38, 40 [2 spec.], 43, 45 [4 spec.], 50 mm. [1 ♀ with ova]. — 7 ♂: 60 mm. [5 spec.], 62, 64 mm. — 4 ♀ without ova 58, 59, 65, 67 mm. — 10 ♀ with ova: 51, 53, 54, 55 [3 spec.], 56 [2 spec.], 59, 62 mm.). — **St. 71.** ibid. 1600 m.w., 4^{00} pm., 120 min. 129 spec.: 116 spec. 10—47 mm., 7 ♂ 51—66 mm., 6 ♀ 51—63 mm. — (10—12 mm. [13 spec.], 13—15 [35 spec.], 16 [18 spec.], 17—18 [20 spec.], 19—20 [13 spec.], 21, 23—27 [8 spec.], 38, 41, 42, 43, 44 [2 spec.], 45, 47 mm. — 7 ♂: 51, 60, 61, 62, 64, 65, 66 mm. — 2 ♀ with ova 51—68 mm., 4 ♀ without ova 55, 57, 60, 63 mm.). — **St. 74.** > 2000 m. 44°21′ N, 7°55′ W. 9-3-1909. 600 m.w., 0^{10} am, 60 min. 2 spec. 26 mm. — **St. 74.** ibid. 65 m.w., 1^{30} am, 60 min. 2 spec., 17—22 mm. — **St. 76.** 1000 m. 47°01′ N, 5°48′ W. 10-3-1909. 25 m.w., 7^{15} pm., 30 min. 0.4 liter, 115 spec.: 48 spec. 27—50 mm., 21 ♂ 51—65 mm., 33 ♀ without ova 51—60 mm., 13 ♀ with ova 55—67 mm. (27—28 mm. [5 spec.], 29, 30, 32—33 [4 spec.], 34, 36, 38—40 [7 spec.], 41, 42, 43—45 [8 spec.], 46—47 [4 spec.], 48—50 mm. [14 spec.]. — 21 ♂: 51—52 mm. [3 spec.], 53—54 [5 spec.], 55 [2 spec.], 57 [4 spec.], 60 [3 spec.], 62, 63 [2 spec.], 65 mm. — 33 ♀ without ova: 51 mm. [4 spec.], 52 [7 spec.], 53 [3 spec.], 54 [5 spec.], 55 [5 spec.], 56—58 [6 spec.], 59, 60 mm. [2 spec.]. — 13 ♀ with ova: 6 have ova only in the ovarium: 55, 57 [2 spec.], 58, 60, 67 mm., 7 have ova only under the abdomen: 55 [2 spec.], 58, 59, 64 66, 67 mm.). — **St. 76.** ibid. 65 m.w., 6^{05} pm., 60 min. 32 spec.: 22 spec. 23—50 mm., 5 ♂ 52—58 mm., 5 ♀ 52—62 mm. (23, 26, 28, 30 (4 spec.], 33 [3 spec.], 34, 35 [2 spec.], 37, 38, 41, 46 [2 spec.], 48 [2 spec.]. 50 mm. [2 spec.]. — 5 ♂: 52, 53, 54, 57, 58 mm. — 4 ♀ without ova: 52 [2 spec.], 57, 62 mm., 1 ♀ with ova 58 mm.). — **St. 76.** ibid. 300 m.w., 11^{30} am, 60 min. 17 spec. 11—15 mm. — **St. 76.** ibid. 600 m.w., 1^{15} pm., 60 min. 75 spec. 9—29 mm. (9—10 mm. [5 spec.], 11 [6 spec.], 12—13 [26 spec.], 14—15 [18 spec.], 16—17 [8 spec.], 18 [2 spec.], 19, 20, 21 [4 spec.], 22, 23, 26, 29 mm.). — **St. 76.** ibid. 1600 m.w., 2^{40} pm., 60 min. 27 spec.: 8 spec. 21—37 mm., 2 spec. 41—48 mm.; 8 ♂: 53, 57, 61, 63, 66 (2 spec.), 67, 70 mm.; 9 ♀: 3 without ova 58—60 mm., 6 ♀ with ova: 57, 60, 61 (3 spec.), 64 mm. — **St. 77.** 100 m. 48°43′ N, 4°45′ W. 11-3-1909. 65 m.w., 3^{15} pm., 30 min. 1 spec. 10 mm. — **St. 80.** > 4000 m. 46°17′ N, 7°31′ W. 13-6-1910. 25 m.w., 10^{45} pm., 15 min. 1 spec. 28 mm. — **St. 80.** ibid. 65 m.w., 10^{00} pm., 30 min. 2 spec. 33—34 mm. — **St. 80.** ibid. 300 m.w., 10^{05} pm., 30 min. 20 spec.: 1 spec. 23 mm., 19 spec. 33—45 mm. — **St. 81.** 2140 m. 41°32′ N 9°32′ W. 15-6-1910. 500 m.w., 4^{50} pm., 30 min. 8 spec. 33—47 mm. — **St. 91.** 1225 m. 35°53′ N, 7°26′ W. 18-6-1910. 1600 m.w., 5^{25} pm., 60 min. 1 spec. 31 mm. — **St. 92.** > 500 m. 36°16′ N, 6°50′ W. 19-6-1910. 65 m.w., 3^{40} am, 30 min. 18 spec.: 17 spec. 24—34 mm., 1 spec. 41 mm. — **St. 231.** 1000 m. 35°56′ N, 7°16′ W. 9-9-1910. 300 m.w., 1^{15} pm., 30 min. 1 ♀ 60 mm. — **St. 233.** 658 m. 36°49′ N, 9°15′ W. 10-9-1910. 25 m.w., 5^{05} am, 15 min. 6 spec., 37—40 mm. — **St. 234.** 920 m. 38°10′ N, 9°20′ W. 10-9-1910. 25 m.w., 9^{45} pm., 30 min. 0.7 liter = 415 spec.: 6 ♂, 26 ♀, 383 spec. 32—50 mm. (32—33 mm. [3 spec.], 34—35 [16 spec.], 36 [24 spec.], 37 [31 spec.], 38 [38 spec.], 39—40 [91 spec.], 41 [36 spec.], 42 [24 spec.], 43 [31 spec.], 44 [26 spec.], 45 [17 spec.], 46 [11 spec.], 47 [8 spec.], 48 [13 spec.], 49—50 [16 spec.] — 6 ♂: 51, 51, 53, 54, 54, 70 mm. — 26 ♀ (none with ova) 51, 52 [4 spec.], 53 [3 spec.], 54 [5 spec.], 55 [6 spec.], 58 [2 spec.]). — **St. 234.** ibid. 300 m.w., 10^{30} pm., 30 min. 22 spec. 3 ♂ 52, 56, 58 mm. — 6 ♀: 1 with ova 60 mm., 5 without ova 51, 56, 57, 58, 59 mm. — 13 spec. 33—48 mm.: 33 mm., 35 [3 spec.], 37, 38, 39—40 [4 spec.], 44, 47, 48 mm. — **St. 234.** ibid. 1000 m.w., 11^{20} pm., 30 min. 11 spec.: 4 spec. 38—40 mm., 4 spec. 48—50 mm.; 1 ♂ 69 mm., 2 ♀ with ova in the ovarium 56—60 mm. — **St. 240.** 2500 m. 44°30′ N. 8°16′ W. 15-9-1910. 300 m.w., 9^{00} pm., 15 min. 1 ♀ with ova in ovarium 63 mm. — **St. 242.** 4941 m. 46°19′ N, 6°48′ W. 16-9-1910. 65 m.w., 10^{55} pm., 30 min. 3 spec.: 33, 35, 40 mm. — **St. 244.** 960 m. 47°08′ N, 6°08′ W. 17-9-1910. 1000 m.w., 10^{25} am, 30 min. 5 spec.: 12, 13, 14, 30, 37 mm. — **St. 245.** > 460 m. 47°14′ N, 6°12′ W. 17-9-1910. 65 m.w., 9^{55} pm., 15 min. 0.6 liter = 208 spec.: 124 spec. 18—50 mm., 16 ♂ 55—69 mm., 68 ♀ 51—68 mm. (18 mm., 21, 22 [3 spec.], 25, 26—27 [4 spec.], 28, 29 [3 spec.], 30, 32 [3 spec]., 33 [4 spec.], 34 [2 spec.], 35 [5 spec.], 36—37 [6 spec.], 38, 39—40 [6 spec.], 41 [5 spec.], 42—43 [18 spec.], 44 [4 spec.], 45 [10 spec.], 46 [4 spec.], 47—48 [21 spec.], 49 [9 spec.], 50 [11 spec.]). — 16 ♂: 55, 56, 57, 58, 60 [3 spec.], 62 [5 spec.], 63, 64, 68, 69 mm. — 50 ♀ without ova: 51 [3 spec.], 52, 53 [2 spec.], 54—55 [6 spec.], 56 [4 spec.], 57 [7 spec.], 58, 59—60 [6 spec.], 61 [7 spec.], 62 [3 spec.], 64 [4 spec.], 65 [3 spec.], 67 [2 spec.], 68 mm. — 18 ♀ with ova: 6 with ova only in the ovarium: 60 [2 spec.], 61 [3 spec.], 64 mm.; 1 with ova both in the ovarium and on the abdomen: 66 mm.; 11 with ova only on the abdomen: 62, 63 [2 spec.], 65, 66 [2 spec.], 67, 68 [3 spec.], 69 mm.). — **St. 245.** ibid. 150 m.w., 15 min., 8^{55} pm. 21 spec.: 2 spec. 21—28 mm., 5 spec. 37—46 mm.; 4 ♂: 58, 59, 60, 64 mm.; 1 ♀ with ova only in the ovarium 63 mm.; 9 ♀ without ova: 57 [2 spec.], 58, 59, 60 [2 spec.], 62 [2 spec.], 63 mm. — **St. 245.** ibid. 400 m.w., 5^{15} pm., 120 min. 0.7 liter = 268 spec.: 134 spec. 15—50 mm., 41 ♂

54—74 mm., 93 ♀ 51—73 mm. (15—17 mm. [7 spec.], 18—19 [6 spec.], 20 [8 spec.], 21 [6 spec.], 22 [4 spec.], 23—24 [5 spec.], 25 [4 spec.], 26 [2 spec.], 27 [6 spec.], 28 [3 spec.], 29 [5 spec.], 30 [2 spec.], 31 [4 spec.], 32, 33, 34 [3 spec.], 35—39 [5 spec.], 40 [2 spec.], 41, 42 [3 spec.], 43 [12 spec.], 44 [3 spec.], 45—46 [9 spec.], 47 [2 spec.], 48 [9 spec.], 49 [4 spec.], 50 mm. [17 spec.], — 41 ♂: 54, 56, 57 [2 spec.], 58, 59 [2 spec.], 60 [5 spec.], 61—62 [5 spec.], 63, 64—65 [5 spec.], 66, 67 [4 spec.], 68 [2 spec.], 69, 70 [3 spec.], 71—72 [4 spec.], 73, 74 mm. — 38 ♀ without ova: 51, 52 [2 spec.], 53, 54 [3 spec.], 56 [3 spec.], 57 [5 spec.], 58—59 [4 spec.], 61—62 [6 spec.], 63 [2 spec.], 64—65 [8 spec.], 66, 67, 70, 71 mm. — 55 ♀ with ova: 26 with ova only in the ovarium: 59, 60, 61—62 [6 spec.], 63—64 [11 spec.], 65—67 [6 spec.], 68 mm.; 3 ♀ with ova both in the ovarium and on the abdomen: 60, 64, 70 mm.; 26 ♀ with ova only on the abdomen: 55, 61 [2 spec.], 63 [3 spec.], 64 [2 spec.], 65 [4 spec.], 66 [3 spec.], 67 [2 spec.], 68, 69 [5 spec.], 70, 71, 72 [2 spec.], 73 mm.).

The material contains totally 2672 spec. (197 ♂ > 50 mm., 442 ♀ > 50 mm., 2033 spec. 10—50 mm.) from 55 stations, 95 hauls.

Variation (Mediterranean and Atlantic). (Fig. 11).

In seeking for characters to show how far specimens from the Mediterranean differ from those from the Atlantic or not, I found that the spines on the inferior margin of the merus in p. 1—p. 2 really exhibit such a difference, though it is not always possible to tell, by counting the spines on any specimen at hazard, from which region it came.

The basis of p. 1—p. 2 always terminates in a single spine; the ischium is smooth on the lower margin, but the merus has a varying no. of spines. In order to be sure that the no. of spines did not vary with the age of the specimen, I have only examined specimens of 50 mm. or over, (total length). In the Mediterranean material, I examined all specimens of this size having the two mentioned pairs of legs undamaged; there were 62 such specimens in all. From the Atlantic, I selected a number of specimens from those stations which had yielded the greatest number of large individuals, viz. St. 71 (5-3-1909, 39°35′ N, 138 spec.), St. 76 (10-3-1909, 47°01′ N, 76 spec.) and St. 245 (17-9-1910, 47°14′ N, 127 spec.) In choosing these particular stations, I had also the advantage of having one station N. of 40°, both spring and autumn, and also one station S. of 40° N (spring; no other station had given a greater no. of large specimens). If any seasonal or local difference existed, (as a result of migration or from similar causes) it would then appear.

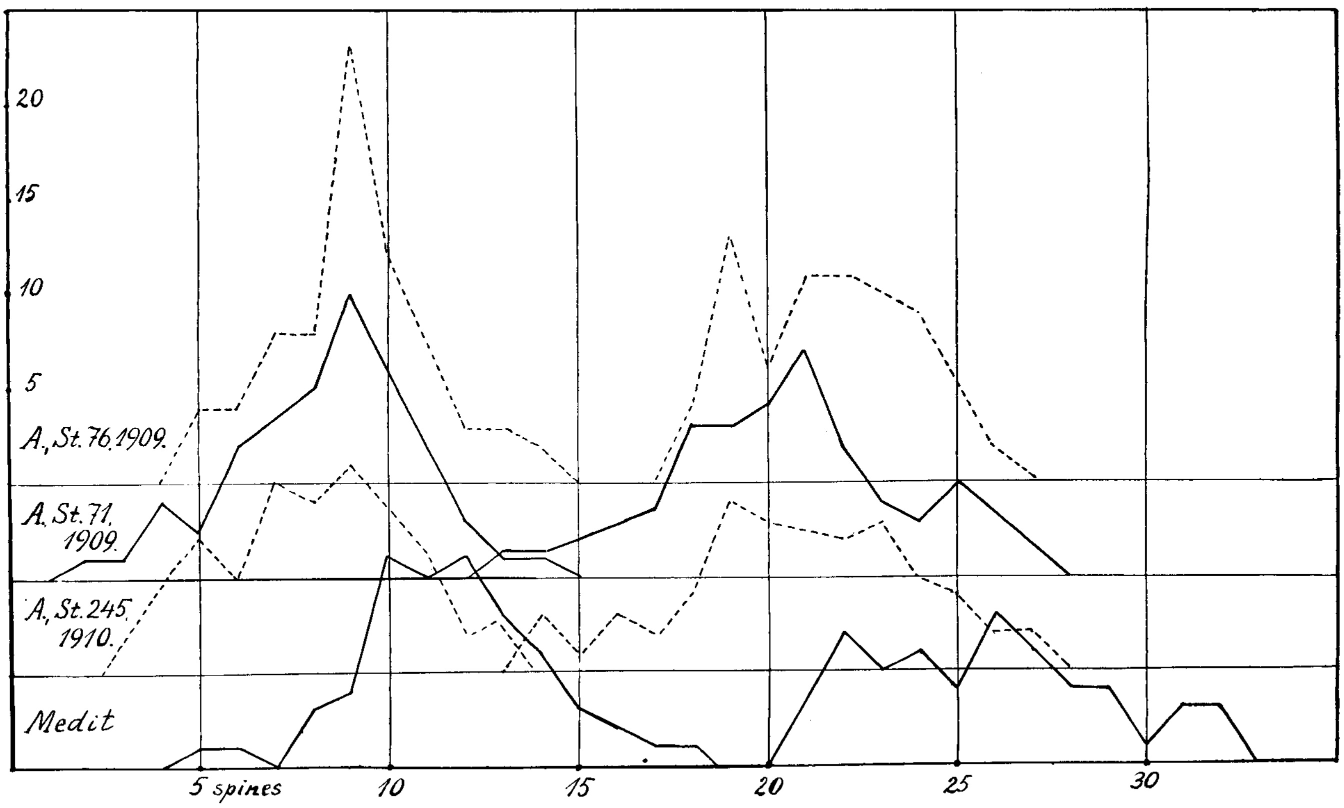

Fig. 11. Pasiphaë sivado. Number of spines on the underedge of the merus of the two pereiopods of 1. pair (to the left) and 2. pair (to the right) in the Atlantic (A) at 3 different stations and in the Mediterranean (Medit.). The Stations 71 and 245 have given twice as many specimens as noted.

As it proved, however, these three Atlantic stations agreed very well together, in contrast to the Mediterranean, which presented an entirely different appearance.

	No. of specimens			
	Medit.	Atlantic		
		St. 71	St. 76	St. 245
Total no. of specimens	62	138	76	127
The two p. 1 have equal no. of spines	22	49	22	41
The two p. 2 have equal no. of spines	22	44	17	32
These characters combined	4	14	6	10

From this it will be seen that only abt. 30% have the same no. of spines on the two p. 1; a somewhat smaller percentage (abt. 20—25%) have the same no. of spines on both p. 2, not 10% have these two characters combined.

In most cases (abt. 40% of all specimens) one leg on the one side has 1 spine more than the corresponding leg on the other side, more rarely (abt. 15%) they differ by 2, still more rarely again the difference may be 3 or 4; the greatest difference noted was 7, one specimen from St. 71 having 3 spines on the one p. 2 and 10 on the other. In this respect, the same principle seems to apply to p. 1 and p. 2.

The absolute limits for no. of spines on the merus of p. 1 and p. 2 in a single specimen are 10 and 51; these, however, are unique exceptions. The 10 is thus obtained: the two p. 1 have no spines, the two p. 2, 4 and 6 respectively (St. 71, 1909). The 51 case (a specimen from the Mediterranean) had 7 on each of the two p. 1, and 18 and 19 respectively on p. 2. A single specimen (also from the Mediterranean) has 50 spines in all. Otherwise, the figures lie between these limits, and it can be stated as a rule that the more spines there are on p. 1, the more there will also be on p. 2; this also appears from the fig. 11).

As shown in fig. 11, the specimens from the Atlantic differ from those of Mediterranean origin in regard to no. of spines. The majority of the Mediterranean specimens have, on both p. 1 together, 10—12 spines, whereas the figure for material from the three Atlantic stations above noted is 9; in the case of p. 2, the figures are 22—26 and 19—21 (23) respectively. It will thus be seen that while the three Atlantic stations, albeit differing in regard to season and locality, are in excellent agreement on this point, the Mediterranean material is different.

A. Mediterranean.

The material contains 308 spec. (18 ♂ > 50 mm., 39 ♀ > 50 mm., 251 spec. 10—50 mm.) from 26 stations, 44 hauls.

	Stations	Hauls	No. of specimens			
			♂ > 50 mm.	♀ > 50 mm.	Spec. 10-50 mm.	total
Dec. 1908...	4	7	1	2	13	16
Jan. 1909...	5	10	10	29	19	58
Feb. — ...	2	2	—	—	4	4
June 1910...	1	1	—	—	1	1
July — ...	8	15	7	8	194	209
Aug. — ...	6	9	—	—	20	20
total...	26	44	18	39	251	308

Depth of sea and occurrence. The relatively greater part of the stations are 500—1000 m. deep, but it has been taken at stations down to abt. 3000 m. Three stations show a depth to bottom of less than 500 m., viz. 90, 105 and 360 m.

Depths in m.	No. of stations
0—500	3
> 500—1000	10
> 1000—2000	7
> 2000—3000	6
> 3000	—
total...	26

It will be seen from Chart 4, that it is distributed throughout the whole of the Mediterranean with the exception of the southern part of the eastern basin; it goes right up into the Marmora, and in the southern portion of the Adriatic, but there are more stations in the western than in the eastern basin. It is not so numerous, however, as in the Atlantic: 44 hauls yielded 308 specimens (or 7 per haul) against 51 hauls giving 2376 specimens (45 per haul) in the Atlantic.

It does not appear to thrive equally well in both basins. The eastern gave 36 specimens in 16 hauls (2.3 per haul) and showed no difference as between summer and winter. The western, on the other hand, yielded 272 specimens in 28 hauls (9.8 per haul) with a rather marked difference according to season: summer 16 hauls, 210 spec., (13.1 per haul), winter 12 hauls only 63 spec. (5.2 per haul).

In the night hauls, practically all specimens, both large and small, summer and winter were taken with 65—100 m.w.; hardly any were taken outside these limits.

In the daytime, it was taken during winter with

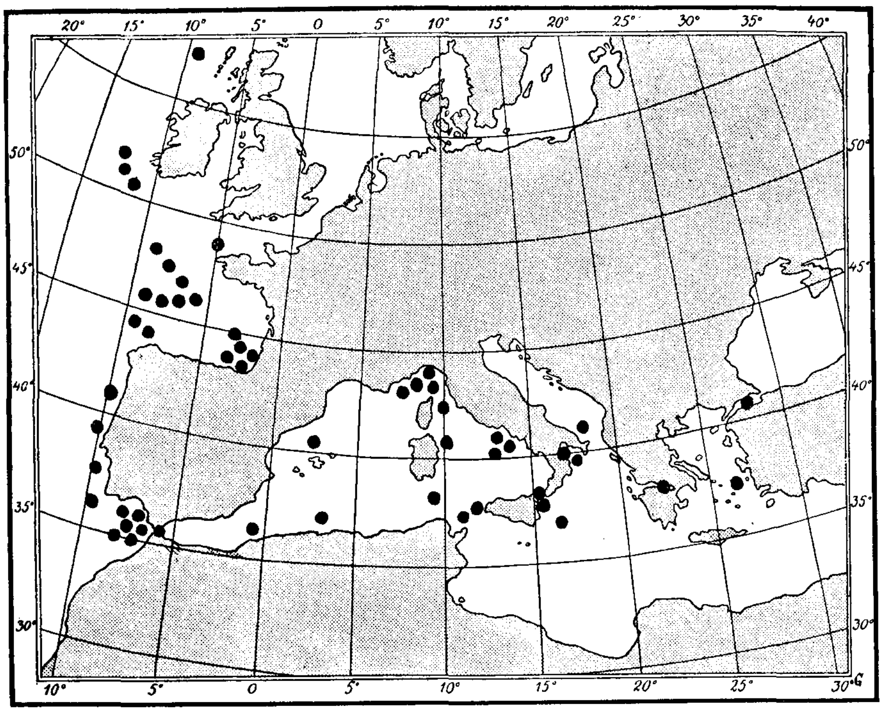

Chart 4. Pasiphaë sivado.

65—1100 m.w., and in summer (only 2 hauls in all, 5 specimens) with 1200—2000 m.w.

Shoals may occur, but almost exclusively in summer. The occurrence of shoals is always caused by the presence of a great number of small individuals; shoals are never composed exclusively of adult specimens (over 50 mm.). That the shoals are only met with in summer is doubtless due to the fact that the whole process of spawning takes place, practically speaking, only in winter (*vide infra*) so that at this season — (save for newly hatched specimens, which are not found in the "Thor" material) only large specimens would be met with, and these, as mentioned, do not form shoals. The largest no. of specimens from a single haul (of 30 minutes) was 82.

Size and propagation. Among specimens over 50 mm., there are twice as many ♀ as ♂ (39 and 18) but the sizes for the two sexes are about the same, as a rule not more than 64 mm., though we have a single ♀ of 69, and a single ♂ of 75 mm.

Females with ova are practically speaking only met with in winter (Dec.—Feb.); at this season, a total of 31 ♀ over 50 mm. was taken, and of these only 3 (52—54 mm) were without ova, all the remaining 28 ♀ (51—63 mm.) with ova, either in the ovarium (where they are very easily discernible, showing through the skin) or under the abdomen, or both together. (The material also includes 3 smaller ♀ with ova, viz. one of 48 mm. with ova in the ovarium, and 2, of 49 and 50 mm., with ova under the abdomen). It is thus seen that all females over 54 mm., besides several of the smaller ones, have ova. It will further be noticed that it is only the smaller ♀, (52—54 mm., with a single individual of 60 mm.) which have ova both in the ovary and under the abdomen; it would seem, then, that the largest ones lay their eggs first, the smaller coming on a little later (as in the Atlantic, see fig. 13).

In summer, on the other hand, 8 ♀ over 50 mm. were taken in all, of which only one had ova.

We may thus take it for granted that the spawning takes place only in winter. Nevertheless, owing to the small number of specimens, we have not succeeded in determining the age and growth of the individuals. Despite endeavours to range them in order of size, it is impossible to say with certainty whether the egg-bearing individuals are 1 or 2 years old; probably, however, the majority of these are only 1 year old, since we can doubtless take it for granted that they agree in this respect with those from the Atlantic S. of 40° N (*vide infra*). It seems, nevertheless, not impossible that some few may be older, for we have in the "Thor" material one or two of especially large size (1 ♀ 69 mm., 1 ♂ 75 mm.) taken in summer; these would probably be $1^1/_2$ years old.

B. Atlantic.

The material contains 2364 spec. (179 ♂ > 50 mm., 403 ♀ > 50 mm., 1782 spec. 10—50 mm.), from 29 stations, 51 hauls.

♀, Mediterranean, Winter

Length in mm	51	52	53	54	55	56	57	58	59	60	61	62	63	total
Without ova	—	1	1	1	—	..	..	..	..	..	..	..	..	3
Ova both in the ovar. and on the abdom.	—	1	2	3	—	..	..	..	—	1	—	..	..	7
Ova only on the abdomen	2	—	2	3	4	2	1	—	1	3	1	1	1	21

	Stations	Hauls	No. of specimens			
			♂ > 50 mm.	♀ > 50 mm.	spec. 10—50 mm.	total
May 1905........	1	1	—	—	4	4
Aug. —	1	1	—	—	1	1
May 1906........	5	8	11	29	31	71
Aug. —	2	2	—	3	1	4
Sept. —	2	2	—	2	—	2
Feb. 1909........	3	7	1	10	28	39
Mar. —.........	4	13	96	152	989[1]	1237
June 1910	4	6	—	—	50	50
Sept. —	7	11	71	207	678	956
total...	29	51	179	403	1782	2364

[1] including 4 ♀ with ova 48—50 mm.

Depth of sea and occurrence. Depth of sea generally 500—2000 m.; the 5 stations with depth to bottom less than 500 m. were as follows: 100, 348, over 460, 470 and 490 m.

Depth in m.	No. of stations
0— 500	5
> 500—1000	10
> 1000—2000	9
> 2000—3000	3
> 3000—4000	—
> 4000	2

Taken by the "Thor" from the Bay of Cadiz up to N. of Ireland; 5 stations situate far up in the Bay of Biscay, one at the mouth of the Channel.

Vertical occurrence. 1. N. of 40° N. The hauls here did not on the whole yield any great number of specimens, and the results can therefore not be taken as very reliable. For the night hauls in summer, 214 out of a total 355 specimens were taken with 65—70 m.w.; this depth, then, is the most frequent. Only 1 spec. was taken nearer the surface (25 m.w.) and only 2 with over 600 m.w. In winter (night) on the other hand, 115 out of 151 were taken with only 25 m.w. In the day-time, most were taken with 250—400 m.w. (summer) and 600 m.w. (winter) at both seasons, however, some few were taken with 65 m.w.

Kemp (Ireland 1910 p. 39) seems to take it for granted that the species is a bottom form, though he states that specimens less than 30 mm. can be met with "in midwater, and less commonly at the surface". That he is not correct in thus presuming it to live on the bottom is evident from the fact that practically all the hauls from the "Thor" were made with a length of line reaching only a fraction of the distance to bottom at the stations concerned.

The specimens appear to be distributed evenly, irrespective of size, throughout the area within which the species is at all frequent (see list of localities, especially St. 76, 1909 and St. 245, 1910); St. 76, 1909 indeed, shows that large specimens can at night be met with close to the surface (25 m.w.) in great numbers.

2. S. of 40° N. In the first place, the material from this area is far greater than that from the northern waters, and further, a couple of stations — and one especially, (St. 71, 5-3-1909) yielded a very large number of specimens. (See fig. 12). Night hauls from this station with 25 m.w. yielded 586 specimens of 13—33 mm. of which 208 were only 18—20 mm. With 65 m.w. only a few specimens were taken, but similar in size, whereas 300 m.w. gave, in addition to a number of small ones, 119 specimens over 50 mm. Females with ova were never found at all nearer the surface. St. 234 (10-9-1910) which, it is true, yielded nothing under 30 mm., supplements the results from the first-mentioned station in showing that larger specimens (30 to over 60 mm.) may occur in the autumn, as contrasted with March, near the surface, while, as in March, most of the larger specimens (over 50 mm.) keep to a depth answering to 300 m.w.

At night, in both spring and autumn, 25 m.w. seems to give the depth yielding relatively greatest nos. of specimens; depths over 300 m.w. yielded only very few.

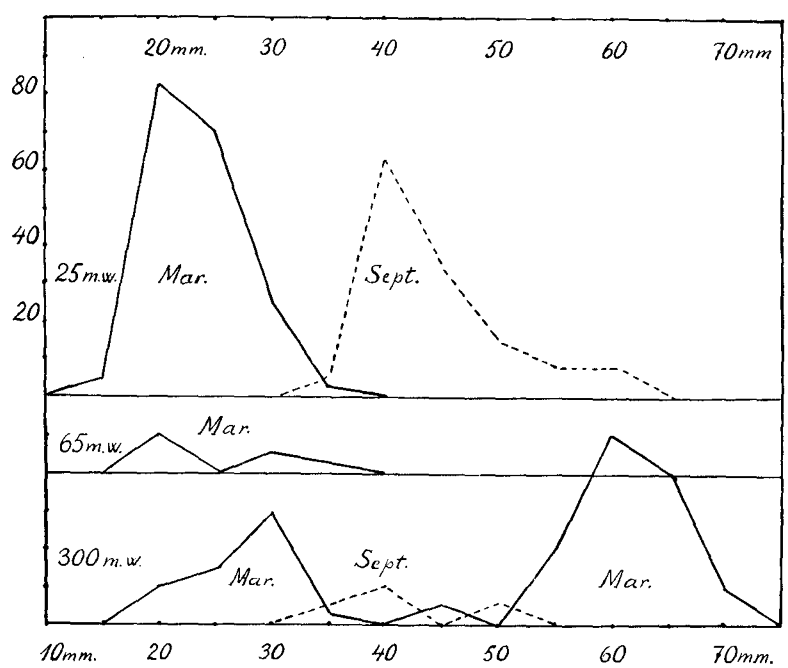

Fig. 12. Pasiphaë sivado. Sizes of specimens taken at night with 25, 65 and 300 m.w. in the Atlantic S. of 40° N. in March (St. 71, 5-3-1909) and Sept. (St. 234, 10-9-1910). (St. 71, 25 m.w., has given twice as many specimens as noted).

In the daytime, some specimens were taken with 300—1600 m.w.

Shoals are quite frequently met with, and may be found both in summer and winter both S. and N. of 40° N, but not N. of 50° N, where four hauls (summer) yielded only 1 specimen.

The 51 hauls yielded 2364 specimens, or abt. 46 per haul. Several hauls showed a very large yield, abt. 0.5 litre or even more in the course of 30 minutes. The greatest number of individuals is 586 (30 minutes) but most of the specimens in the larger hauls are small, under 50 mm.

Greatest average no. of specimens per haul is found S. of 40° N, where 7 summer hauls showed an average of abt. 67 specimens, while 12 winter hauls gave each abt. 84 specimens. Between 40° and 50° N, we have 20 summer hauls, giving an average of 31 spec., and 8 winter hauls, with very similar average, viz. abt. 34. It is thus far more numerous in the Atlantic than in the Mediterranean.

Size and propagation. The size of the ova is 1 × 0.8 mm. Balss (1914, p. 20) gives the dimensions as 1 × 1.44 mm. for a ♀ from Japan.

As almost the entire yield of larger specimens (over 50 mm.) is derived from 4 stations (St. 71 and 76 1909, St. 234 and 245 1910) the following observations are based exclusively on the results from these 4 stations.

The yield of specimens over 50 mm. amounted to 167 ♂, 357 ♀, i. e. fully twice as many ♀ as ♂, and this proportion is also found more or less for the separate stations (as in the Mediterranean); the greatest difference is seen at St. 234 (34 ♀, 10 ♂). The two sexes appear to be altogether alike in regard to size; the largest specimens are 73—74 mm. Relatively, however, there are more ♂ than ♀ among the largest specimens, (70—74 mm.) viz. 11 ♂, 8 ♀. According to the literature, the size may go up to abt. 100 mm (4 ins. Henderson, Proc. & Trans. Nat. Hist. Soc. Glasgow, vol. 1, 1886).

Propagation. Females with ova were found both N. and S. of 40° N.

The survey in fig. 13 (St. 245, 1910) shows that females with ova are found for the most part among the largest specimens; from the list of localities (especially stations 76, 1909, and 245, 1910) it will be seen, not only that specimens with ova are mostly larger than those without, but also that the smallest females with ova often have these only in the ovary, not under the abdomen, while those with all the ova under the abdomen are often the largest individuals from the station concerned. (As in the Mediterranean). It would seem then, that the ♀ grow several mm. while bearing the ova (in the ovary or under the abdomen) which again suggests that the egg take some considerable time to hatch out.

Spawning period. N. of 40° N, ♀ were found in the months of March, May and Sept. Kemp, (Ireland 1910) states (p. 7) that females with ova are found in Jan., Feb. and March (locality not stated) and in May off the coast of Ireland. In his list of Irish localities, however, (p. 38—39) he gives only a few finds from 1.—18. May. In the "Thor" material, we have, save for St. 76 and 245 in the northern area, only found very few females, and the fact that the few hauls made at all outside the months allready mentioned (March, May, September) did not yield females with ova therefore affords no proof that the species in these waters does not also spawn in the summer proper.

Station 76 (1909) and St. 245 (1910) yielded nearly

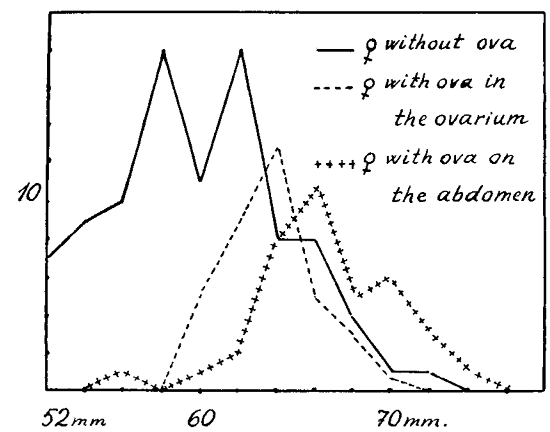

Fig. 13. Sizes of Pasiphaë sivado from St. 245, 19-9-1910. (4 of the ♀ with ova in the ovarium had also ova on the abdomen).

all the ♀ taken anywhere N. of 40° N, and it will therefore suffice to keep to these two stations. St. 76 (10-3-1909) gave 60 ♀ over 50 mm. of which 20 with ova, or 33 %. St. 245 (17-9-1910) gave 171 ♀ over 50 mm.; 74 with ova, or 43 %. These figures alone suggest that the summer (or more correctly, the latter part of the summer) is more usual as a spawning season than the spring, even though the extant information otherwise shows that the species can spawn at almost any season.

In order if possible to ascertain by other means the commonest period of spawning (and the age) curves have been drawn showing size of individuals from these two stations (fig. 14). St. 76 (March) shows a maximum of individuals 15 and 55 mm., while St. 245 (Sept.) has two maxima at 50 and 65 mm. separated by a minimum at 55 mm. While realising that the true state of things may be obscured by the fact that the species can practically speaking propagate at any season, these curves can nevertheless admit of no other explanation than that the specimens of 15 mm. (March) and 50 mm. (Sept.) commenced their existence in summer (or late summer) of the previous year, whereas the two maxima of 55 mm. (March) and 65 mm. (Sept.) apply to individuals of $1^1/_2$ and $2^1/_2$ years old respectively. The existence at the same point (55 mm.) of a minimum for specimens taken in September and maximum for specimens taken in March seems to suggest that the foregoing is correct. That the animals grow more during summer than in

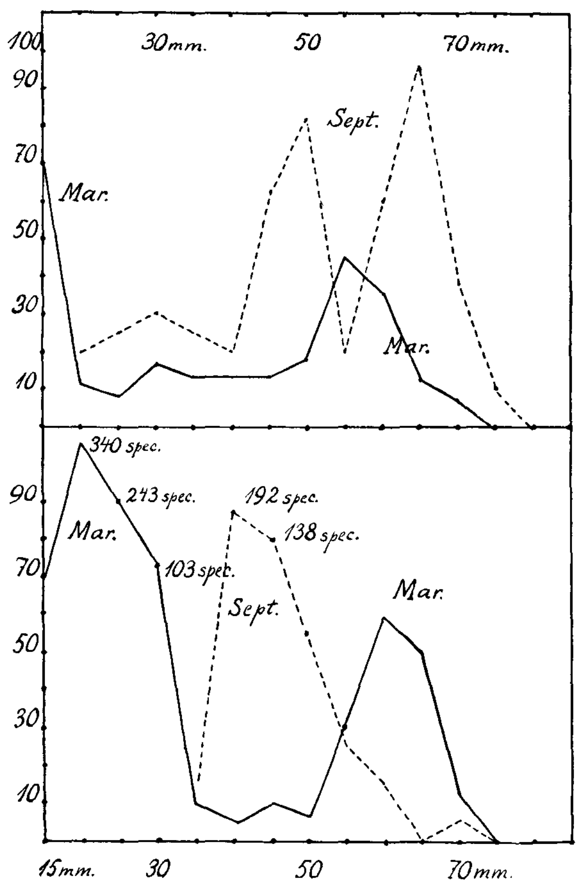

Fig. 14. Pasiphaë sivado. Sizes of specimens N. of 40° N. (above) in March (St. 76, 1909) and Sept. (St. 245, 1909) — and S. of 40° N. (below) in March (St. 71, 1909) and Sept. (St. 234, 1910).

winter seems evident from the position of the March maximum (55 mm.) which shows — always presuming the foregoing to be correct — that the specimens only grew 5 mm. since Sept. of the previous year, (viz. from 50 to 55) whereas in the following summer they will grow 10 mm. (from 55 to 65 mm.).

As females with ova are at least 55 mm., and for the most part considerably larger, they must then be 2 years old before spawning.

S. of 40° N we find a much simpler state of affairs. Spawning takes place practically speaking only in winter (or at any rate early spring) i. e. as in the Mediterranean. The following observations are based solely on results from the two largest stations in this area, St. 71 (5-3-1909) and St. 234 (10-9-1910). In March (St. 71) we have 92 ♀ over 50 mm. of which 56 with ova (+ 4 spec. 48—50 mm) i. e. abt. 60 %. In September (St. 234) on the other hand, 31 ♀ were taken without ova, and only 3 with; (at all other stations, in the summer half of the year [the "Thor" has only stations for September] no ♀ with ova were taken at all). The curves for the southern area are therefore much easier to understand than those for the northern waters; we have in March, maxima at 20 and 60 mm., in Sept. at 40 mm. Those specimens which measured 20 mm. in March must naturally have been hatched out some months earlier (some few females with ova have indeed been found in February, but not in other months during the winter half-year). As there are uniform intervals between the three maxima (20—40—60 mm.) it is thus evident that the species here, in contrast to the northern area, grows at an equal rate both summer and winter. This again gives a more rapid rate of growth on the whole (specimens of abt. 1 year old measure 60 mm. as against 50 farther north), so that females with ova would hardly be more than 1 year old and much smaller than in the northern waters (Station 71 alone yielded 16 ♀ with ova, 50—56 mm., whereas in the northern area, the two largest stations above mentioned gave no females with ova at less that 55 mm., and only 4 specimens in all of sizes from 55—56 mm.). These results also appear to agree well with what is noted for the Mediterranean.

Summary.

Individuals in the Mediterranean differ from those found in the Atlantic in having somewhat larger no. of spines on the lower margin of the merus in p. 1 and p. 2.

The species lives pelagically over great depths of sea. At night, it is taken more especially from the surface down to 100 m., which agrees with its colouring: glassy clear with red spots (Kemp, Ireland 1910 p. 38). The smaller specimens live as a rule nearer the surface, the large ones often deeper down (as far as 300 m.w.) but females with ova may be met with at the surface both in the Atlantic and the Mediterranean. Females with ova are as a rule over 50 mm. Spawning time N. of 40° N is probably the summer half of the year especially; south of this latitude, and also in the Mediterranean, almost exclusively the winter half. Growth is far more rapid in the southern waters than farther north; maturity

(over 50 mm. total length) is attained, in the southern area and in the Mediterranean, after one year, in the northern area after two years. The females seem to carry their eggs for some considerable time, and increase in size, not inconsiderably, during the period. Larval development is unknown; the smallest known specimens (8—10 mm.) are of the same shape as the adults. Shoals may occur, but consist for the greater part always of small individuals.

Distribution.

Mediterranean, especially western basin; west coast of Europe from S. W. Norway to Gibraltar; Indian Ocean (Bay of Bengal, Red Sea); Pacific: Japan.

1. Mediterranean. On the "Thor" see above. — Villafranca, Nizza, Genova, Corsica, Isola Maddalena; Greece: Sapienza, Astros, Naxos (Carus 1885, p. 481). — Nizza (Ortmann 1891). — Messina, ?Catania (Riggio 1905). — Adriatic, in the southern deep parties (Pesta 1918, but not Adensamer 1898, see Pesta l. c. p. 64, 67). — Capri 1000—2000 m.w., and 110 m.w., closing net (daytime); between Monaco and Villafranca 2000 m.w.; on the shore at Faro (Messina); several spec. (Lo Bianco 1902, 1903 (p. 185), 1904 (p. 28, fig. 37).)

2. Atlantic. West coast of Europe from S. W. Norway to Gibraltar, but not the North Sea and the English Channel. The northern limit cannot be given with certainty; but it is at all events not found as far to the North as Lofoten (Appellöf 1906, p. 188); and it occurs scarcely at Bergen (Appellöf 1906, p. 116). On the other hand it is found at Mosterhavn N. of Stavanger (Sund 1912, p. 17). By G. O. Sars (1882, p. 49) it is given from Christianiafjord and "several localities at the West coast." Also Sund (1912, p. 17) mentions several specimens from Christianiafjord. In Skagerak are found a few specimens (K. Stephensen, 1910, p. 288), even at Bohuslän (Lagerberg 1908, p. 8—9). It is abundant W. of Scotland and is found in the Bristol Channel, S. W. Ireland, Bay of Biscay and at Portugal (see Kemp 1910, p. 38). — On the "Thor" see above. — 36°—45° N, 11° W, 50 spec. (Coutière 1911, p. 157). It is scarcely found S. of Cadiz Bay.

Adensamer (1898, p. 626) states its being mentioned from Iceland by Thomson. This must be due to an error, for the species is never found as far to the west, not even at the Færoes, and I have not been able to find the citation. Should Iceland be a misprint for Ireland?

3. Indian Ocean. Andaman Sea, 200 fms.; Bay of Bengal 200—350 fms.; several spec., one ♀ with ova, carapace 14 mm. (Alcock 1901). — Red Sea, 8 localities, taken pelagically or with dredge, 650—910 m., several spec. (Balss 1915, p. 17).

4. Pacific. Boshiu, Japan, 1 ♀ with ova, 70 mm. (Balss 1914, p. 20).

Genus Parapasiphaë Smith.

Parapasiphaë Smith 1884, p. 383.
Parapasiphæa Alcock 1901, p. 64.
Parapasiphaë Stebbing, Edinburgh 1914, p. 294.
— de Man 1920, p. 3 (list of species).

1. PARAPASIPHAË SULCATIFRONS Smith.

Parapasiphaë sulcatifrons Smith 1884, p. 384, Pl. 5 fig. 1, Pl. 6 fig. 1—7.
— — — 1886, p. 683.
— — H. J. Hansen 1908, p. 79.
— — Kemp 1910, p. 47, Pl. 5.

Atlantic.

St. 180. 2160 m. 61°31′ N, 19°05′ W. 10-7-1904. 1800 m.w. 9 spec. 16—35 mm. — **St. 183.** > 2000 m. 61°30′ N, 17°08′ W. 11-7-1904. 1800 m.w. 15 spec. 16—32 mm. (but one spec. 45 mm.). — **St. 57.** 1985 m. 57°47′ N, 11°33′ W. 7-6-1905. 1500 m.w. 1 spec. 37 mm. — **St. 62.** 2480—2775 m. 50°25′ N, 12°44′ W. 5-6-1906. 1500 m.w., 2^{45} am, 120 min. 2 spec. 29—33 mm. — **St. 74.** 1170 m. 40°23′ N, 12°13′ W. 9-6-1906. 2000 m.w., (Eel drift-seine), 1^{20} pm., 60 min. 1 spec. 33 mm. — **St. 74.** ibid. 1245—1298 m. 10-6-1906. 2000 m.w., 6^{35} am, 60 min. 7 spec. 19—29 mm. — **St. 74.** ibid. 1220 m. 9-6-1906. 2500 m.w., (Eel drift-seine), 9^{50} pm., 60 min. 2 spec., 33—35 mm. — **St. 76.** > 2600 m. 49°27′ N, 13°33′ W. 11-6-1906. 2800 m.w., 3^{00} pm., 120 min. 3 spec. 9—15 mm. — **St. 178.** > 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w. 9^{05} am, 120 min. 5 spec. 23—42 mm. — **St. 179.** > 4000 m. 47°20′ N, 12°23′ W. 3-9-1906. 1800 m.w., hour? 4 spec. 23—31 mm. — **St. 180.** 4000 m. 48°19′ N, 13°53′ W. 3-9-1906. 1800 m.w., 5^{05} pm., 60 min. 2 spec. 16—37 mm. — **St. 181.** 1850 m. 49°22′ N, 12°52′ W. 4-9-1906. 1800 m.w., 10^{35} am, 60 min. 3 spec. 22—40 mm. — **St. 190.** > 4000 m. 46°30′ N, 7°00′ W. 11-9-1906. 2700 m.w., 8^{25} am, 150 min. 6 spec.: 1 ♀ with ova 45 mm.; 5 spec. 18, 21, 24, 37, 55 mm. — **St. 189.** 3500 m. 47°27′ N, 7°55′ W. 10-9-1906. 1800 m.w., 0^{20} pm., 60 min. 2 spec. 10—14 mm. — **St. 65.** 1300 m. 35°53′ N, 7°21′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 1 spec. 27 mm. — **St. 69.** > 3500 m. 36°13′ N, 9°44′ W. 28-2-1909. 3000 m.w., 6^{30} pm., 60 min. 1 spec. 38 mm. — **St. 75.** > 4000 m. 45°37′ N, 7°03′ W. 9-3-1909. 4300 m.w., 1^{45} pm., 120 min. 1 spec. 65 mm.

The material contains 65 spec. from 15 st., 17 hauls.

Depths of the sea and occurrence. The depth is always > 1000 m., in half-part of the stations > 3000 m.

The stations lie between S. Iceland and the Cadiz

Bay, especially at S. W. Ireland, where it was known from several localities (Kemp 1910).

Vertical occurrence. That the species is pelagic is shown beyond doubt by the fact that the length of wire is almost always considerably less than the depth to bottom.

Depth in m.	No. of stations
0—1000	—
> 1000—2000	4
> 2000—3000	4
> 3000	7

It has only been taken with 1500—4300 m.w.: at night, 1500—3000 m.w., and by day almost exclusively with 1800—2000 m.w.

This agrees very well with the material from the "Michael Sars" (Murray & Hjort 1912, p. 668); out

M. wire	No. of hauls		
	Night	Day	Night? or day?
1500—1600..........	1	1	1
1800—2000..........	—	6	3
2500—3000..........	2	2	—
4300..........	—	1	—

of a total of 150 specimens, 125 were taken by day, and 25 at night, both night and day at a depth of 500—1500 m. below surface (at night, however, also one specimen at over 1500 m.). During the night, they seem to be evenly distributed throughout this range; in the daytime, on the other hand, there appears to be an optimum at 1000 m. The species is thus decidedly a deep-water form, which is also borne out by its appearance; colouring red (Kemp 1910, p. 49), eyes reddish crimson (Kemp 1910) or dark brown (Murray & Hjort 1912, p. 668), ova red (Murray & Hjort) and skin rather soft, this last particularly in the larger specimens.

Size and propagation. Most of the specimens are rather small, abt. 16—35 mm. Only a few are essentially larger: 45 and 55 mm. (St. 190, 1906), 65 mm. (St. 75, 1909). The largest specimens in our museum are 74 mm. (Davis Straits "Tjalfe" Exped.), 75 mm. (S. of Iceland, "Ingolf" St. 191). The largest specimen mentioned in literature is 83 mm. (one of Smith's type specimens).

Only a single ♀ was found with ova; it was 45 mm., and taken at St. 190, 11-9-1906, 2700 m.w. It had abt. 25 eggs, measuring 1.5 × 2.5 mm. This is a considerably smaller size than stated in the literature: 3 × 3.7 mm. (Kemp 1910), 4 × 5 mm. (Smith 1884) while the shape, also, is more oblong.

Distribution. America, several localities 35°12′10″—41°53′ N, 65°21′50″—74°57′15″ W, 516—2949 fms. (Smith 1884 and 1886). — Davis Straits, 4 stations 63°13′ — 64°35′ N, 900—1500 m.w., and E. of S. Greenland (1 st.) 60°07′ N, 48°26′ W, 2000 m.w., totally 22 spec. (K. Stephensen "Tjalfe" 1912). — W. and S. of Iceland, 3 st., 2160—abt. 2300 m., 1800 m.w., 25 spec. (H. J. Hansen 1908; the two stations S. of Iceland are st. 180 and 183 (1904) from the "Thor"). — S. W. Ireland, very abundant (Kemp 1910). — On the "Thor" see above. — 36°—45° N, 11° W, 7 spec. (Coutière 1911). — Cape Point E. N. E. 36 miles (Cape Colony), 660 fms. (Stebbing 1914, p. 33).

Fam. **Hoplophoridæ** Kingsley.

Oplophoridæ Kingsley 1878, p. 68.
Ephyrinæ Smith 1882, p. 66.
Miersiidæ — 1886, p. 667.
Acanthephyridæ Bate 1888, p. 481, 927.
Miersiidæ Stebbing 1905, p. 104 (lit. and syn.).
Hoplophoridæ Kemp 1906, p. 3.
— — 1910, p. 35, 55.
Oplophoridæ Stebbing 1910, p. 394.
Hoplophoridæ de Man 1920, p. 41 (with list of all genera and species).

From the "Thor" area, there are in all 6 genera known, with 17 (?18) species, of which the "Thor" has 5 genera with 9 species (2 as new to science, viz. *Systellaspis densispina* and *Ephyrina bifida*).

A single species, *Acanthephyra pulchra*, seems to be endemic to the Mediterranean; it was not taken by the "Thor". All the other species are found in the Atlantic (or there and in other oceans) and only 1 of these, *Acanthephyra multispina*, has also been found in the Mediterranean. There are thus in the Mediterranean only 2 species, which is doubtless due to the fact that the others, being deep-sea forms (a term which, indeed, also applies to the two Mediterranean species) cannot endure the high temperature in the deeper water layers of the Mediterranean. It is remarkable that the one species (*Systellaspis debilis*) which was most frequently taken comparatively near the surface, stops outside Gibraltar without passing in through the strait.

The depths to bottom are always very great, generally 1000 metres or over.

A single species is almost arctic (*Hymenodora glacialis*) and thus only just touches the "Thor" area (coast of Ireland). Another species, also, *Acanthephyra multispina*, occurs in at any rate very rarely S. of S.W. Ireland, and it is remarkable that this species in particular should also be met with in the Mediterranean.

The two mentioned northern species, whose European limit of occurrence, or at any rate of occurrence in any considerable numbers, lies abt. 50° N, have each a southern substitute form, closely allied to and often confused with it, viz. *Acanthephyra multispina* — *A. purpurea*, and *Hymenodora glacialis* — *H. gracilis.*

The only species which appear to be common are *Acanthephyra purpurea*, *A. multispina*, *Systellaspis debilis* and *Hymenodora glacialis*; specimens of *Acanthephyra pulchra* and *Hymenodora gracilis,* however, are also fairly numerous. The mentioned species are probably also the only ones which can occur in shoals.

Only exceptionally are these species taken as near the surface as with 300 m.w. (— *Systellaspis debilis* can, however, be taken at night with 65 m.w.) for the most part, indeed, they are taken with 1000 m.w. or more even at night, and their appearance is in accordance with this. Where the colour is known, it is always dark red (see especially KEMP 1910 under the separate species) save in a single instance, (*Hymenodora gracilis*) where it is orange. The eyes, strangely enough, seem mostly to be black, but can also be brown (*Hymenodora gracilis*) or whitish with a faint golden tinge (*H. glacialis*). The genus *Hymenodora* takes its name from the softness of its integument. A single species has luminous organs (*Systellaspis debilis*).

Although the adults, then, are bathypelagic, the larvæ can, at any rate occasionally, (*Acanthephyra multispina, A. purpurea*?) be met with comparatively near the surface, being taken, indeed, with 65 m.w. (day and night). Some have very large ova (the genera *Systellaspis* and *Hymenodora*), which suggests a very abbreviated larval development. Save in very few cases (*Acanthephyra multispina, A. purpurea, Systellaspis debilis*) nothing is otherwise known as to the larval development.

A list of all the species found in the "Thor" area is given below.

Hoplophorus Grimaldi Coutière, Comptes Rendus, Paris, 17. April 1905.
— — — 1905, p. 1—5, fig. 1,1-9.
— — Lenz u. Strunck 1914, p. 328—29, Pl. 22.

(32°18′ N, 23°58′ W, 0—2000 m., 1 spec. (COUTIÈRE). — 31°21′ S, 14°02′ W, 10 m., night, several spec. (LENZ u. STRUNCK).)

T.[1] *Acanthephyra purpurea* M.-Edw., see below p. 44.
T. *A. multispina* (Coutière) Sund, see below p. 44.

[1] T indicates that the species was taken by the "Thor".

A. pulchra A. Milne-Edwards, Diagnose d'un Crustacé Macroure nouveau de la Méditerranée. Acanthephyra pulchra n. sp. — Bull. Soc. Zool. France, vol. 15, 1890, p. 163.
— Prince de Monaco, Comptes Rendus Paris, tome 110, 1890, p. 1170.
— Riggio 1895, and 1896, p. 244, Pl. 1, fig. 1.
— Adensamer 1898, p. 625.
— Senna 1903, p. 296, Pl. 13.
— Kemp 1906, p. 23.

(Monaco, 1650 m., 33 spec. (Prince de Monaco 1890, MILNE-EDWARDS 1890). — 41°$24^2/_3$′ N, 7°$43^1/_2$′ E, 2836—2809 m., 1 spec.; 39°$40^2/_3$′ N, 9°$54^1/_4$′ E, 1553 m., 1 spec.; 40°$44^2/_3$′ N, 11°22′ E, 2390—2188 m., 1 spec. (SENNA 1903). — Augusta (between Catania and Siracusa) (200 m.?) (RIGGIO 1896). — Between Crete and Africa: 33°$11^1/_3$′ N, 22°53′ E, 1765 m.; 33°4′ N, 21°$15^2/_3$′ E, 1770 m.; 36°15′ N, 21°7′ E; 34°45′ N, 24°23′ E, 1274 m.; totally 16 spec. (ADENSAMER 1898; A. enumerates still one station (st. 95), but this is not to be found in his list of localities).)

A. microphthalma Smith 1885, p. 502.
- — — 1886, p. 668, Pl. 124 fig. 3.
- longidens Bate 1888, p. 735, Pl. 124 fig. 4.
- microphthalma Wood-Mason & Alcock 1891, p. 361.
- — Alcock 1901, p. 80.
- — Kemp 1906, p. 24.

(37°23′ N, 63°8′ W, 2620 fms., 2 spec.; 36°$16^1/_2$′ N, 68°21′ W, 2571 fms., 4 spec. (SMITH 1885, SMITH 1886). — 36°—45° N, 11° W, 1 spec. (COUTIÈRE 1911). — Bay of Bengal 1748 fms., 2 spec. (ALCOCK 1901, WOOD-MASON & ALCOCK 1891). — Philippine Islands 2°55′ N, 124°53′ E, 2150 fms., 1 ♂ (BATE 1888).)

A. brevirostris Smith (nec Bate) 1885, p. 504.
- — — 1886, p. 670, Pl. 14 fig. 2, Pl. 15 fig. 2—8, Pl. 16 fig. 1, 6.
- duplex Bate 1888, p. 843, Pl. 136 fig. 3.
- brevirostris Faxon 1895, p. 167.
- — Kemp 1906, 0. 24.

(37°12′20″ N, 69°39′ W, 2949 fms., 3 spec.; 39°22′ N, 68°34′30″ W, 1683 fms., 1 spec.; 37°50′ N, 73°03′50″ W, 1395 fms., 1 spec.; 37°23′ N, 63°08′ W, 2630 fms., 1 spec. (SMITH 1885, SMITH 1886). — 36°—45° N, 11° W, 4 spec. (COUTIÈRE 1911). — 1°7′ N, 81°4′ W, 1 spec. (FAXON 1895). — 46°16′ S, 48°27′ E, Marion Isl., 1600 fms., 1 spec. (BATE).)

?*A. Batei* Faxon.
- brevirostris Bate 1888, p. 751, Pl. 126 fig. 5.

A. Batei Faxon 1895, p. 167.
- — H. J. Hansen 1908, p. 77, Pl. 4 fig. 2a.
- — Kemp 1906, p. 24.

(61°30′ N, 17°08′ W, 1800 m.w., 1 spec. (H. J. Hansen 1908). — 36°—45° N, 11° W, 1 spec. (Coutière 1911, p. 157: "*A. parvirostris* Bate nec Smith"; this should perhaps be a misprint for *A. brevirostris* Bate nec Smith, = *A. Batei* Faxon). — 1°22′ N, 26°36′ W, 1500 m. (Bate 1888).)

T. *Systellaspis debilis* M.-Edw., see below p. 54.
T. *S. densispina* n. sp., see below p. 57.
S. echinurus Coutière 1911, p. 158.
(36°—45° N, 11° W, 1 spec. (Coutière).)
T. *Ephyrina bifida* n. sp., see below p. 58.
E. Hoskyni Wood-Mason, see below under *E. bifida* p. 58.
T. *E. Benedicti* Smith, see below p. 59.
T. *Hymenodora glacialis* Buchh., see below p. 59.
T. *H. gracilis* Smith, see below p. 60.
H. mollis Smith.
Meningodora mollis Smith 1882, p. 74, Pl. 11 fig. 8—9, Pl. 12 fig. 5—9.
Hymenodora — Bate 1888, p. 841, Pl. 135 fig. 5.

(34°28′25″ N, 75°22′50″ W, 1632 fms., 1 ♀ (Smith 1882). — 36°—45° N, 11° W, 20 spec. (Coutière 1911, p. 157). — 8°37′ S, 34°28′ W (Pernambuco), 675 fms., 1 ♀ (Bate 1888).)

T. *Notostomus atlanticus* Lenz u. Strunck, see below p. 60.
N. elegans A. Milne-Edwards 1881, p. 8.
— — 1883, Pl. 33.

(36°—45° N, 11° W, 1 spec. (Coutière 1911, p. 157). — 24°36′ N, 84°05′ W, 955 fms. (Milne-Edwards 1881).)

Genera **Acanthephyra** M.-Edw. and **Systellaspis** Bate.

*1. *Acanthephyra* (partim) Kemp 1906, p. 3 (lit. and syn.); list of species p. 20—23, key to the species p. 23—24.
— de Man 1920, p. 43 (list of species), 53.
2. *Systellaspis* Bate 1888, p. 757.
— Coutière 1905, p. 5—7.
— de Man 1920, p. 43 (list of species), 50.

Acanthephyra was established by Milne-Edwards in 1881. Bate (1888, p. 757) separated out *Systellaspis* in order to include *S. lanceocaudata* n. sp. and the previously established *Acanthephyra debilis* M.-Edw. but this genus has not since been maintained by other writers than Coutière, de Man Sund.

For a definition of *Systellaspis* see Bate 1888, but more particularly Coutière 1905. To the generic differences noted by Coutière may perhaps be added the external sex difference; the species mentioned below, at any rate, exhibit some considerable difference in this respect.

The sex difference in *A. purpurea* with regard to plp. 1—plp. 2 has been mentioned already by Smith 1882 p. 69—70, which is here quoted with some few additions.

In ♂ the outer ramus in plp. 1 is like that of the succeeding pleopoda. The inner ramus is a broad oval lamella, abt. a third as long as the outer ramus, with both margins setigerous and the inner thickened end bearing a slender stylet (Smith 1882, Pl. 11 fig. 7; Coutière 1905, fig. 4, 8). The inner ramus of plp. 2 has the same shape as the outer ramus, but bears the two stylets characteristic of the male; these stylets are respectively $^1/_4$ and $^1/_2$ as long as the inner ramus.

In the ♀ the inner ramus of plp. 1 is a very small lamella, abt. $^1/_5$ as long as the outer ramus, nearly 4 times as long as broad and furnished with very long and slender setæ. In plp. 2 the inner ramus is of the same shape as the outer ramus, but a little shorter, and provided with only one stylet, abt. $^1/_5$ as long as the inner ramus.

In *A. multispina* the sex difference is as in *A. purpurea*.

In *Systellaspis debilis* the sex difference is not so strongly marked. In ♂ (Smith 1882, p. 72, Pl. 11 fig. 4b-c) the inner ramus in plp. 1 is a little more than a third as long as the slender normal outer ramus, fully three times as long as broad, ciliated along the outer edge, the inner edge straight and projecting slightly dorsally, but without a stylet as in *A. purpurea*. The inner ramus of plp. 2 bears the usual two stylets, but the secondary stylet, specially characteristic of the male, is very short, abt. $^2/_5$ as long as the outer (Smith: $^1/_5$ as long in an immature ♂, 44 mm.).

In ♀ plp. 1 is abt. as in *A. purpurea*, but the inner ramus a little longer; plp. 2 as in *A. purp.* —

Kemp 1906, p. 20—24 gives a bibliography and list of determination for all species of *A.* (incl. *Syst.*) then known. With the prolonged terminal section of the telson as an easily distinguishable character for *Systellaspis*, this genus should include *S. debilis* M.-Edw., *S. lanceocaudatus* Bate, *S. affinis* Faxon and *S. cristata* Faxon; later, *S. echinurus* Coutière (1911, p. 158) was established, and the "Thor" has taken a new species, *S. densispina*. Of the genus *Acanthephyra* sens. strict. the only one later established is *A. multispina* (Coutière) Sund, *vide infra*.

Acanthephyra purpurea M.-Edw. sens. str. and A. multispina (Coutière) Sund.

(Chart 5, fig. 15).

1. *A. purpurea* M.-Edw. sens. str.

Acanthephyra purpurea A. Milne-Edwards 1881, p. 935.
— — — 1882, p. 37.
— — — 1883, Pl. 33.
Miersia Agassizi Smith 1882, p. 67, Pl. 11 fig. 5—7, Pl. 12 fig. 1—4.
Acanthephyra — — 1884, (partim) p. 372, (not the fig.).
— *purpurea* Bate 1888, p. 733, Pl. 124 fig. 3 (teste KEMP 1906, p. 11).
— *sica* (partim) — p. 739, Pl. 125 fig. 1 (teste KEMP 1906, p. 11).
— *Agassizi* Faxon 1895, p. 161.
— *Batei* Stebbing 1905, p. 107, Pl. 24 B.
— *purpurea* Coutière 1905, p. 10 fig. 4.
— *parva paucidens* Coutière ibid. p. 15, fig. 5, 3.
— *purpurea* Coutière 1906, p. 12, fig. 5, 6, 7 A-B, 7 E.
* — — (partim) Kemp 1906, p. 4, 23 (lit. and syn.), (Pl. 2 fig. 1-3?).
— — (partim) Kemp 1910, p. 56.
* — — Murray & Hjort 1912, p. 585, 622—24, 668, 720, Pl. 3 fig. 2 (col. fig.).
— *purpureus* Stebbing 1915, p. 96.
— *purpurea* (partim) de Man 1920, p. 43.

For literature on larvæ and development see below p. 47.

2. *A. multispina* (Coutière) Sund.

Acanthephyra Agassizi Smith 1884, p. 372 (partim), Pl. 8 fig. 1 (the fig. is *A. multispina*, not *A. purpurea*).
— *sica* (partim) Bate 1888, p. 739, Pl. 125 fig. 1 (teste KEMP 1906, p. 11).
Acanthephyra acanthitelsonis Bate 1888, p. 745, Pl. 125 fig. 3.
— *purpurea* Caullery 1896, p. 375.
— *Agassizi* var. *mediterranea* Riggio 1900, p. 20.
— *rectirostris* Riggio, Mon. Zool. Ital. 1900, p. 20.
Acanthephyra rectirostris Lo Bianco 1903, p. 186.
— *purpurea* — ibid. p. 185.
— *rectirostris* Riggio 1905, p. 40, Pl. 3 fig. 1—17.
— *purpurea* var. *mediterranea* Riggio 1905, p. 35, Pl. 2 fig. 12-15, Pl. 3 fig. 18.
— *Haeckeli* Thiele 1905, p. 466.
— *rectirostris* — p. 467.
— *purpurea* var. *multispina* Coutière 1905, p. 10.
— *parva multidens* Coutière 1905, p. 15, fig. 5, 1—2.
— — — + *A. purpurea* var. *multispina* Coutière 1906, p. 18, fig. 7 C-D.
* — *purpurea* (partim) Kemp 1906, p. 4, 23 (lit. and syn.), Pl. 1, (Pl. 2 fig. 1—3?).
— — H. J. Hansen 1908, p. 75 (all the specimens from the "Ingolf" and the "Thor").
— — (almost exclusively) Kemp 1910, p. 56.
* — *multispina* Sund, in Murray & Hjort 1912, p. 585, 622—24, 668, 720, Pl. 3 fig. 1 (col. fig.).
— *purpurea* Pesta 1912, p. 995—98, 1 textfig.
— — var. *multispina* A. v. Szüts 1915, p. 433—36.
— — Pesta 1918, p. 71 (lit.), textfig. 22.
— — (partim) de Man 1920, p. 45.

For literature on larvæ and development see below p. 47.

3. *A. purpurea* M.-Edw. or *A. multispina* (Coutière) Sund?

- *Agassizi* Smith 1886, p. 667, Pl. 15 fig. 1, 6, 7, Pl. 16 fig. 2.
- *purpurea* Ortmann 1893, p. 43.

On this literature see p. 45. —

The two species are very closely related; the only sure distinctive feature seems to be that *A. purpurea* has 3—5, generally 4 pairs of dorso-lateral spines on the telson, whereas *A. multispina* has 6—11 pairs, or even more (COUTIÈRE 1905, p. 10—11). For its relation to the other species of the genus see Kemp 1906 p. 4—16, 23, where the literature and the synonymy are dealt with.

The species *multispina* was established by Coutière in 1905 as a variety of *A. purpurea*, and by Sund 1912 as an independent species. Having thus only comparatively recently been separated from *A. purpurea*, which was established in 1881, it is not always possible to be sure from references in the literature which species is meant; from the manner in which the above lists are compiled, however, there can be no doubt but that the individuals in every case are referred to the proper species. A further explanation is given below.

Literature.

1. A. purpurea.

From Milne-Edwards' description 1881—82 it cannot be seen whether it is *A. purp.* or *A. mult.*; the specific characters, on the other hand, seem clearly indicated in his figures 1883 (no copy of this work exists in this country) as representing the individual described by him in 1881—82 (teste Kemp 1906, p. 5); in any case, Coutière (1905, p. 10) refers the mentioned figure to the species with 4 pairs of spines on the telson. — *A. Agassizi* Smith 1884 includes both species.

All Bate's specimens from the "Challenger" of "*A. purpurea*" and nearly all his specimens of *A. sica* belong to the present species (Kemp 1906, p. 11.)

In the following literature, the species appears without difficulty from the separate descriptions or figures: Smith 1882, Faxon 1895, Stebbing 1905, and all later writers.

2. A. multispina.

Some few of Bate's specimens ("Challenger" Exp.) of *A. sica* belong to the previous species (Kemp 1906, p. 11). — *A. Agassizi* Smith 1884 comprises both species, but his figure is *A. multispina.*

Lo Bianco 1903 gives no description from which the species can be arrived at; the determination, however, is hardly doubtful, as only *A. multispina* has been found in the Mediterranean.

Thiele 1905 I have been unable to consult; but according to Kemp 1906, p. 5, there can be no doubt but that his species in the present work are correctly placed.

In the following works, the species appears with certainty from the description or figure: *A. acanthitelsonis* Bate 1888, Caullery 1895, Riggio 1900 and 1905. The same applies to all later works.

Variation etc.

From Kemp 1906, p. 12, the following characteristics are most liable to variation.

1. Proportional length of rostrum.
2. Rostral formula.
3. Presence or absence of a spine on the posterior margin of 4th abdominal segment.
4. Comparative length of the telson.
5. Number of dorso-lateral spines on telson.

1. The rostrum, which in the larva is shorter than the eye, grows longer and longer with increasing age, (Coutière 1906, p. 16—19, fig. 6 A-F, fig. 7B-C). In specimens with total length (from point of rostrum to point of telson) 30—40 mm. for *A. purpurea*, 40—50 mm. for

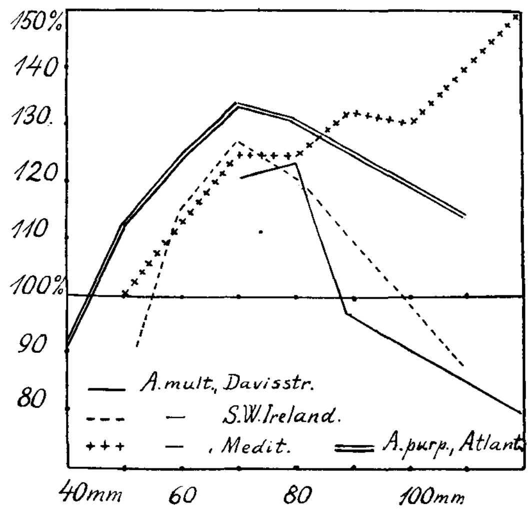

Fig. 15. Acanthephyra multispina and A. purpurea. Length of rostrum[1] in percent in proportion to the carapace (the figures 40—100 mm. indicate the total length of the body).

A. multispina, the rostrum has attained the same length as the carapace, and continues growing thenceforward, but in different degree in the two species. In order to demonstrate this growth, I have in addition to most of the specimens of *A. multispina* from the "Thor" (71 from S. W. Ireland, 40 Mediterranean) also examined 45 specimens from Davis Straits ("Tjalfe" Exp.), and 80 of *A. purpurea* from the "Thor". The result appears in the figure here given (Fig. 15).

From this it will be seen that the specimens of *A. multispina* from Davis Str. and S. W. Ireland, are almost alike: the rostrum is relatively longest in spec. of abt. 70—80 mm. (Davis Str.) or 60—70 (S. W. Ireland) then noticeably decreasing in proportion to the carapace; at a total length of 100 or 90 mm., the rostrum is equal in length to the carapace, and then decreases further in length. In the Mediterranean, the species, at

[1] measured from the eye, as shown by Kemp 1906, textfig. 1 p. 9.

a length of up to 70—80 mm. is exactly as in the Atlantic, in this respect, but instead of then decreasing in length, the rostrum here, in the larger specimens, grows longer and longer, until, in spec. of over 110 mm. we find it half as long again as the carapace itself.

Riggio (1905, p. 36) points out that two specimens from Messina should be ranked as a special variety, var. *mediterranea*, falling, in regard to the rostrum, between the typical Atlantic species (he is here mixing up *A. purp.* and *A. mult.*) and *A. sanguinea* (from the Indian Ocean) where the rostrum is somewhat longer. He does not give any further explanation of this point, but the observation is, as we see, fully confirmed by the extensive material from the "Thor".

The only description in the literature which is accompanied by measurements from the Mediterranean (13 spec.) is Szüts 1915; on reckoning from this the proportion between rostrum and carapace we arrive at exactly similar results to those above noted from the "Thor".

A. purpurea is earlier than *A. multispina* in attaining a length of rostrum equal to the carapace; (at a total length of abt. 40 mm. as against abt. 50 mm.); otherwise, up to a length of abt. 70 mm., the species appears to follow the same lines as *A. multispina*. Thereafter, the rostrum certainly decreases in size, but even in the largest specimens, it is still longer than the carapace.

2. Rostral formula.

(Teeth on the upper and under edge of rostrum).

Rostral formula	No. of specimens			
	A. multispina			A. purpurea
	Davis Str.	S.W. Ireland	Medit.	Atlantic (Bay of Cadiz)
$^{5}/_{2}$	..	..	1	—
$^{5}/_{3}$	—	..	1	—
$^{6}/_{3}$	2	..	—	1
$^{8}/_{4}$	3	..	..	—
$^{9}/_{4}$	1	2	..	—
$^{7}/_{5}$	1	3	—	1
$^{8}/_{5}$	14	27	3	21
$^{9}/_{5}$	18	24	7	14
$^{10}/_{5}$	2	7	4	1
$^{7}/_{6}$	—	—	—	1
$^{8}/_{6}$	1	5	2	8
$^{9}/_{6}$	3	5	14	26
$^{10}/_{6}$	—	7	4	4
$^{11}/_{6}$	..	—	2	—
$^{8}/_{7}$	..	..	—	1
$^{9}/_{7}$	..	..	—	1
$^{10}/_{7}$	..	..	3	—

From this it will be seen that in *A. multispina*, the rostral formula varies between $^{5}/_{2}$ and $^{10}/_{7}$. For the Atlantic, the limits lie between $^{6}/_{3}$ and $^{10}/_{6}$; it will be seen that both in Davis Str. and from S. W. Ireland the figures most frequently occurring are the same, viz. $^{8}/_{5}$ and $^{9}/_{5}$; in the Mediterranean, on the other hand the most frequent figure is $^{9}/_{6}$.

In the literature, the rostral formula for the Atlantic is given as 8—9 above, rarely 7, below 5, rarely 6, very rarely 4 (Coutière 1905, p. 11); this agrees exactly with the "Thor". Kemp 1906, p. 12, gives the formula for "*A. purpurea*" (he notes 1910, p. 57 that practically speaking, only *A. multispina* is found off the coast of Ireland) off the Irish coast as between $^{5}/_{3}$ and $^{9}/_{6}$; but he does not state which figures were the most frequent.

From the Mediterranean, we have only very few records of any service in this respect; only Pesta 1912 and Szüts have more than very few specimens (7 and 13 respectively). Of these 20 spec. 11 have $^{9}/_{6}$ rostral teeth, 4 have $^{10}/_{6}$, the remaining figures are $^{8}/_{4}$ (1 spec.) $^{9}/_{5}$ (1 spec.) $^{10}/_{5}$ (1 spec.) and $^{8}/_{6}$ (2 spec.); these figures likewise agree well with the "Thor".

For *A. purpurea*, the figures lie between $^{6}/_{3}$ and $^{9}/_{7}$; by far the most frequent, however, are $^{9}/_{6}$ and $^{8}/_{5}$, next in order $^{9}/_{5}$; the other figures are far more rarely found. According to Coutière 1905, p. 11, the figures should be the same as in *A. multispina*, which agrees very well if we take the outer limits only. Otherwise, the figures of most frequent occurrence answer to *A. multispina* in the Mediterranean, and the two next in frequency to *A. mult.* in the Atlantic.

In both species, there are as a rule 3 teeth on the upper margin inside the innermost tooth on the lower.

3. Spines on posterior margin of 4. abdominal segment are probably found in all specimens of *A. multispina*, but seem to be lacking in all specimens of *A. purpurea*.

4. Length of telson in proportion to outer ramus in urop. In *A. purpurea*, the telson is always shorter than the uropoda. The only exception I know of is that of a few specimens from the Indian Ocean, mentioned by Kemp (1913, p. 64—65) where the "telson extends noticeably beyond the uropods". As these specimens have 4—5 pairs of telson spines, there can thus after all be no doubt as to the determination.

In *A. multispina*, on the other hand, the telson should be longer than the uropoda (Coutière 1905, p. 10) this, however, is by no means always the case. In the Mediterranean, indeed, it is the exception; long telson is only found in 5 large specimens (100—120 mm.). In the Atlantic, the telson is longer than the uropoda, in a large number, abt. 30, specimens over abt. 90 mm., possibly more specimens had long telson, but a number have the tip broken off. In all specimens of less than abt. 90 mm., the telson is equal to or shorter than the up. The long telson is thus only a specific character for specimens over 90 mm., and not even then for all. All specimens from Davis Straits on the other hand ("Tjalfe" Exp., 67—123 mm.) have long telson.

5. No. of dorso-lateral spines on the telson. Of *A. purpurea*, 3 spec. (St. 234, 1910, 300 m.w. 2 spec. and ibid. 1000 m.w. 1 spec.) have 5 pairs of spines, all the rest 4 pairs. KEMP (1906, p. 13) says that 3 pairs are found, but this is not the case with the specimens from the "Thor".

In *A. multispina*, on the other hand, the figure varies, 6—15 pairs (KEMP 1906, p. 13). Often the number is not the same on both sides; the difference may in a few rare instances amount to 2, somewhat more often 1.

A. multispina (Dorso-lateral spines on telson).

No. of spines	No. of specimens		
	Davis Str.	S. W. Ireland	Mediterr.
6—7[1]	..	..	3
6—8	..	..	1
7 × 2	—	—	6
7—8	2	3	13
7—9	2	2	—
8 × 2	3	10	14
8—9	6	14	3
8—10	1	1	—
9 × 2	10	15	2
9—10	10	13	—
9—11	2	1	..
10 × 2	5	15	..
11 × 2	1	—	..
13 × 2	—	1	..

[1] 6—7 : 6 on one side, 7 on the other, etc.

The figures, which, like the rostral formula, do not appear to depend on the size of the individual, vary between 6 on the one side, seven on the other, and 13 on both sides (in the table, this is shown as 6—7 and 13 × 2 respectively). In the Atlantic, the figures lie between 7—8 and 13 × 2. It will be seen that the figures of most frequent occurrence are not altogether the same for Davis Str. and S. W. Ireland. Of the Davis Str. specimens, most had 9 × 2 or 9—10, the Irish ones 9 ×2, 10 ×2, 8—9, 9—10 and 8 ×2; other figures very rare. In the Mediterranean, the figures are lower, lying between 6—7 and 9 × 2, mostly 7—8 and 8 × 2, but 7 × 2 is not altogether rare.

As a summary of the above, it appears that *A. multispina* from the Medinterranean differs in several respects from the Atlantic form, while in the Atlantic, there is very little difference between specimens from S. W. Ireland and those from Greenland; both forms, however, vary within certain limits, so that it is impossible to say of any given specimen whether it is from the Mediterranean or the Atlantic.

For *A. multispina*, the most important variations within the mentioned area are then as follows: In the Atlantic, the rostrum decreases in length when the individuals attain a total length of over 60—80 mm., whereas in the Medinterranean, it continues to grow, also relatively, all their life. The rostrum has somewhat fewer teeth in the Atlantic than in the Medinterranean ($^8/_5$ or $^9/_5$ as aginst $^9/_6$). In regard to the telson, on the other hand, the reverse is the case.

Development of A. purpurea and A. multispina. The youngest larvæ described (with eyes longer than the rostrum and cornea thicker than the eye-stalks) measure from eye to point of telson 5.6—13.4 mm. (KEMP 1907, p. 206—12, pl. 14). They are referred by KEMP to *A. purpurea*, but KEMP does not distinguish *A. purpurea* from *A. multisp.* and from the locality (Bay of Biscay) it cannot be determined with certainty which species it really is, though *A. multispina* would seem more likely.

A somewhat older stage, 12.9 mm. *Hoplocaricyphys similis* COUTIÈRE (1907; p. 7—10 text-fig. 1) has been ascribed by HJORT ("Naturen" 1911, p. 95) and SUND (MURRAY & HJORT 1912, p. 622) to *A. multispina*.

The post-larval, or parva-stage, is known first and foremost from the fact that the eyes are smaller in diameter than the eye-stalks. It is described by COUTIÈRE (1905, p. 15—18 text-fig. 5, *Acanthephyra parva*; 1907, p. 13—15 text-fig. 5) and KEMP (1907, p. 210—11, Pl. 14 fig. 14, 24; Pl. 15 fig. 1). It differs from the adult chiefly in the above-mentioned shape of the eye, and in the much shorter rostrum (equal in length to or somewhat shorter than the eye). The size is abt. 10.5—25 mm. This stage can, according to no. of spines on the telson, be clearly divided between the two species (COUTIÈRE 1905): *A. parva multidens* = *A. multispina*, *A. parva paucidens* = *A. purpurea*.

A brief report of the above mentioned, with some figures, is given by WILLIAMSON 1915, p. 360—61; but the two species are lumped together without any attempt at distinguishing what pertains to the separate species.

For changes taking place with age in the larger individuals, see COUTIÈRE 1906, p. 15—20, fig. 6—7 and the present work, supra, p. 45.

The parva-stage can, then, be determined as to species, and the specimens belonging to this (they are very few) in the "Thor" material have therefore been noted in the locality lists together with older specimens of the respective species. In the case of the larvæ, on the other hand, no such determination can be made, and these are accordingly placed in a list by themselves. Nevertheless it is beyond doubt that at any rate the great bulk of the larvæ belong to *A. multispina*, since they were found in the Mediterranean, where only this species has been met with; and in the case of the larvæ from the two localities in the Atlantic, the determination, would also, from the position (S. W. of Ireland and W. of Brittany) seem to be beyond doubt, as practically speaking, only *A. multispina* has been found in these waters.

Even though the larvæ in themselves are hardly determinable, there is thus, from the localitiy, hardly room for doubt as to their being referred to the proper species. The size, (incl. rostrum) is 9—15 mm., and they agree entirely with the description given by Kemp (1907).

1. ACANTHEPHYRA PURPUREA M.-Edw. sens. str.

Literature see p. 44, 45; morphological characters and variation see p. 45; development and larvæ see p. 47.

Atlantic.

St. 76. > 2600 m. 49°27′ N, 13°33′ W. 11-6-1906. 2800 m.w., 9[45] pm., 1 ♂ 85 mm. — **St. 74.** 1220 m. 49°23′ N, 12°13′ W. 9-6-1906. 9[50] pm., 2500 m.w. 1 ♂ 95 mm. — **St. 65.** 1300 m. 35°53′ N, 7°26′ W. 24-2-1909. 1600 m.w., 0[30] pm., 120 min. 46 spec.: 14—26 mm. (31 spec.), 28—31 mm. (4 spec.), 35—39 mm. (4 spec.), 2 ♂ 43—51 mm. 5 ♀ 41, 43 (2 spec.), 46, 54 mm. — **St. 69.** > 3500 m. 36°13′ N, 9°44′ W. 28-2-1909. 600 m.w., 9[00] pm., 60 min. 28 spec.: 13 ♂: 39, 45, 60 (3 spec.), 65, 70, 72, 81, 83, 85 (2 spec.), 97 mm.; 9 ♀ without ova 37, 43, 55 (? mm.; rostrum lost), 67, 85, 87 (2 spec.), 90, 91 mm.; 6 ♀ with ova 75 (2 spec.), 82, 83 (2 spec.), 89 mm. (the eyes are visible in most of the ova). — **St. 69.** ibid. 3000 m.w., 6[30] pm., (y. 330), 60 min. 10 spec.: 1 parva-st. 21 mm., 1 jun. 25 mm., 3 ♂ 40, 90, 91 mm.; 5 ♀ 39, 58, 78, > 83 mm. (apex of rostrum lost; ♀ with ova), 97 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 4-3-1909. 600 m.w., 6[35] pm., 120 min. 20 spec.: 6 ♂ 77, 80 (2 spec.), 87, 91, 105 mm. 14 ♀ 36, 50, 61, 68 (3 spec.), 69, 73, 74, 75, 78, 79, 86, 87 mm. (the last one with ova). — **St. 71.** ibid. 1600 m.w., 4[00] pm., 120 min. 12 spec.: 4 sex indet. 28 mm. (2 spec.), 32, 41 mm.; 5 ♂ 55, 63, 71, 83 mm. (2 spec.); 3 ♀ 41 mm. (2 spec.), 71 mm. (♀ with ova; the eyes are visible). — **St. 80.** > 4000 m. 46°17′ N, 7°31′ W. 15-6-1910. 300 m.w., 10[05] pm., 30 min. 5 spec.: 2 ♂ 61, 68 mm.; 3 ♀ 49, 53, 60 mm. — **St. 91.** 1225 m. 35°53′ N, 7°26′ W. 18-6-1910. 1600 m.w., 5[25] pm., 60 min. 13 spec.: 3 parva-st. 12, 16, 16 mm.; 3 ♂ 35, 37, 39 mm.; 5 ♀ 30, 34, 47, 74 mm. (2 spec.); 2 spec. jun. 24—29 mm. — **St. 231.** 1000 m. 35°50′ N, 7°16′ W. 9-9-1910. 300 m.w., 1[15] am, 30 min. 5 spec.: 3 jun. 28, 29 mm. (2 spec.); 1 ♂ 63 mm.; 1 ♀ 35 mm. — **St. 231.** ibid. 1200 m.w., 2[15] am, 30 min. 4 spec.: 2 ♂ 43—51 mm., 2 ♀ 45—83 mm. (the greater one with ova). — **St. 232.** 3700 m. 36°28′ N, 9°00′ W. 9-9-1910. 300 m.w., 10[35] pm., 30 min. 2 ♀ 67—76 mm. — **St. 232.** ibid. 1000 m.w., 10[35] pm., 30 min. 3 spec.: 1 ♂ 43 mm., 2 ♀ with ova 76—88 mm. — **St. 232.** ibid. 2000 m.w., 11[45] pm., 30 min. 4 spec.: 3 ♂ 57, 68, 79 mm.; 1 ♀ with ova 79 mm. — **St. 234.** 920 m. 38°10′ N, 9°20′ W. 10-9-1910. 300 m.w., 10[30] pm., 30 min. 6 spec.: 1 ♂ 55 mm. 5 ♀: 45, 50, 67 (with ova), 76, 87 mm. (with ova). — **St. 234.** ibid. 1000 m.w., 11[20] pm., 30 min. 8 spec.: 1 jun. 38 mm.; 2 ♂ 48—58 min.; 5 ♀ 67, 70, 75, 79, 98 mm. (the three last with ova).

The material contains 169 spec. (46 ♂, 58 ♀, 65 spec. < 45 mm.), from 10 stations, 16 hauls.

Depth of sea and occurrence. Chart 5, p. 51). The depth to bottom is 920—over 4000 m.

Depth in m.	No. of stations
0—1000	2
> 1000—2000	4
> 2000—3000	1
> 3000	3

Two stations lie S.W. of Ireland, 1 in the Bay of Biscay, 7 between the Strait of Gibraltar and 40° N. Only 3 st. (1906, st. 74 and 76; 1909, st. 69) are common to this and *A. multispina*.

From this, then, it is seen that the species has a more southerly distribution than *A. multispina*, which was not met with in the "Thor" area south of the Bay of Biscay; this result also agrees very well with Kemp 1910, according to which only *A. multispina* is at all generally found off W. S. Ireland, very rarely *A. purpurea*.

The species has never been met with in the Mediterranean.

M. w.	Night			
	Specimens	Hauls	Duration of hauls in hours	Specimens per hour
300	18	3	2	9
600	48	2	3	16
1000—1200	15	3	1.5	10
2000—3000	16	3	?	?
	Day			
1600	81	3	5	16.2

Vertical occurrence. It has never been taken nearer the surface than 300 m.w. and as it was never taken in night hauls with lengths of line between 1200 and 2000 m.w., the yield of the deeper hauls was possibly captured during hauling in.

At night, we have nearly as many specimens per hour with 300 and with 1000—1200 m.w., considerably more with 600 m.w., which, strangely enough, gave about the same number as day hauls with 1600 m.w., the only depth at which the species was taken during the day.

The "Michael Sars" expedition (MURRAY & HJORT 1912, p. 622—24, 668) has 437 specimens of the species, 195 taken by day at a depth of 100—1500 m., and 242 at night from the same depths (also 8 specimens, however, from deeper than 1500 m.). Nearly all the day specimens, (viz. 179 out of a total of 195) were taken in water layers between 500 and 1000 m. below the surface, which agrees well with the "Thor". At night, on the other hand the "Michael Sars" has the greater proportion of spec. (102) at 150 m. depth, far fewer in the other water layers, which does not agree so well with the "Thor".

The "Thor" material thus agrees with what is stated by MURRAY & HJORT l. c., that the species in the Atlantic lives higher up than *A. multispina*, whose maximum both day and night ("Thor") lies about 1500—1900 m.w.; the site of this maximum, however, is not the same in both expeditions.

The individuals of the different size groups do not seem to prefer any particular depth during winter within the above mentioned limits; the position is more definite in summer, where the material, small though it is, appears to show that the smaller specimens are found nearer the surface than the large ones. Females with ova do not seem to prefer any particular depth, but were found at all depths where the species was taken at all.

Shoals may occur, the greatest no. in a single haul (60 min.) is 28 specimens. In contrast to *A. multispina*, the shoals may be formed by comparatively large individuals, not essentially by the small ones; one haul of 120 minutes duration, however, yielding 46 specimens, has mostly small specimens, (31 measuring only 14—26 m.).

Size, propagation etc. Of the specimens examined as to sex, (size over abt. 45 mm.) there were 46 ♂, 58 ♀ (for sex differences see supra p. 43) the ♀ are thus somewhat more numerous than the ♂.

Size of ♂ up to 95 mm., only two are larger, the largest 105 mm. At what size the ♂ attains maturity cannot be stated, none were found with spermatophores, as was the case with *A. multispina*.

The ♀ is somewhat smaller, especially up to 90 mm., only three were larger (up to 98 mm.). The largest ♀ without ova was 97 mm. The 17 ♀ with ova measured 67—90 mm.; only one larger (98 mm.).

Females with ova were found at all depths and at the following seasons: 28. Feb., 4. April, 9.—10. Sept. i.e. not at midsummer; this, however, may be accidental.

Distribution. Disregarding the literature where *A. purpurea* cannot be distinguished from *A. multispina*, (these localities will be dealt with later on, p. 54) the distribution can be stated as follows: In the Mediterranean, it has never been found. The northern limit in the Atlantic lies, on the American side abt. 41° N, on the European abt. 40° N, very rarely farther north (up to 50° N). S. of 40° N, it thus takes the place of *A. multispina*, which is most numerous north of that limit. Many specimens were taken between 40° N and the equator. South of the equator, only few specimens have been taken, only between the point of S. Africa and abt. 25°—35° S. In the Indian Ocean, 3 stations between the southern extremity of India proper and Madagascar. In the Pacific, 3 finds in New Zealand waters, 1 S. of Japan, and 2 S. of Panama.

A specified list of localities is given below.

1. Atlantic. 41°23′15″ N, 65°51′25″ W, 810 fms.; 33°19′ N, 76°12′30″ W, 457 fms.; 31°41′ N, 74°35′ W, 1047 fms. (SMITH 1882, p. 67). — *A. Agassizi* SMITH 1884 comprises both *A. purpurea* and *A. multispina* ("telson . . . armed with five to twelve pairs of stout dorsal aculei . . ."); the specimens were taken at 27 localities 30°22′50″—42°02′ N, 68°16′—74°37′15″ W, 389—2949 fms. — 437 spec. between New Foundland and W. Europe, without special localities (MURRAY & HJORT 1912, p. 668). — S. W. Ireland, a few spec. (KEMP 1910, p. 57). — 34°51′ N, 68°30′ W, 2675 fms.; 32°41′ N, 36°6′ W, 1675 fms.; 25°49′ N, 20°12′ W, 1675 fms. (*A. purpurea* BATE 1888, p. 733, teste KEMP 1906, p. 11). — 36°46′ N, 26°41′ W, 0—3250 m.; 37°08′ N, 28°28$^1/_2$′ W, 0—1000 and 0—1500 m.; 35°44′ N, 11°52′ W, 0—1000 m.; 32°18′ N, 23°58′ W, 0—2000 m.; 31°46′ N, 25°00′ W, 0—3000 m.; 31°06′ N, 24°06$^3/_4$′ W, 0—5000 m.; 30°41′ N, 17°46′ W, 0—2500 m.; 27° 43′ N, 18°28′ W, 0—3000 m. (COUTIÈRE 1905, p. 10). — 28°42′ N, 34°33′ W, 3000 m.; 20°41′ N, 31°53′ W, 3000 m.; 17°28′ N, 29°42′ W, 3000 m.; 5°27′ N, 21°41′ W, 1500 m.; 0°46′ N, 18°59′ W, 3000 m.; 0°6′ S, 18°18′ W, 800 m.; 24°55′ S, 1°14′ W, 1500 m.; 32°8′ S, 8°28′ W, 1000 m., night; 35°10′ S, 2°33′ E, 3000 m.; 35°39′ S, 8°16′ E, 3000 m. ("*Acanth. purpurea*" LENZ u. STRUNCK 1914, p. 326—27). Most of these spec. are *A. purp.* sens. str., but a few (from what localities?) are *A. multispina* ("telson . . . mit vier bis fünf, selten mit sechs Stachelpaaren besetzt"). — Cape Point Lighthouse (Cape State), S. 83° E, distant 35$^1/_2$ miles, from a depth of 658 m. (*A. Batei*, STEBBING 1905). — Cape Point N. E. by E. $^1/_4$ E. 40 miles, 800—900 fms. 1 spec. (STEBBING 1915).

2. Indian Ocean. 4°16′ S, 71°53′ E, 1200—0 fms.; 10°27′ S, 51°17′ E, 1000—0 fms.; 4 miles N. W. of Desroche's Atoll (Amirante), 750—0 fms. (Kemp 1907).

3. Pacific. S. of Japan 26°29′ N, 137°57′ E, Off New Zealand 40°28′ S, 177°43′ E, and 37°34′ S, 179°22′ E; Kermandec Isl. 29°45′ S, 178°11′ W (*A. sica* Bate 1888, p. 739, teste Kemp 1906, p. 11). — S. of Panama 7°21′ N, 79°2′ W, 1832 fms., and 1°7′ N, 80°21′ W, 1573 fms. (Faxon 1895).

2. ACANTHEPHYRA MULTISPINA (Coutière) Sund.

Literature see p. 44; morphological characters and variation p. 45; development and larvæ p. 47.

Non-larval stages:

Mediterranean.

St. 13. > 1200 m. 39°43′ N, 17°30′ E. 19-12-1908. 1000 m.w., 60 min., 2^{15} pm. 1 ♂ 81 mm. — **St. 24.** > 3700 m. 40°14′ N, 12°23′ E. 16-1-1909. 300 m.w., 30 min., 9^{10} pm., 1 ♂ 63 mm. — **St. 24.** ibid. 1600 m.w., 30 min., 11^{15} pm., 2 spec. 16—23 mm. — **St. 29.** 1530 m. 40°47′ N, 12°59′ E. 20-1-1909. 1650 m.w., 2^{15} pm., 60 min. 3 spec.: 18—21 mm.; 1 ♀ 96 mm. — **St. 31.** 1420 m. 41°44′ N, 10°52′ E. 22-1-1909. 1400 m.w., 1^{20} am, 60 min. 1 ♂ 98 mm. — **St. 31.** ibid. 600 m.w., 3^{05} am, 30 min. 1 (♀?) 46 mm. — **St. 35.** >2000 m. 43°36′ N, 7°36′ E. 29-1-1909, 1000 m.w., 11^{25} pm., 120 min. 1 spec. 39 mm. — **St. 35.** ibid. 1600 m.w., 11^{25} am, 120 min. 1 jun. 31 mm., 1 ♀ 53 mm. — **St. 45.** 2150 m. 37°28′ N, 8°18′ E. 6-2-1909. 300 m.w., 11^{25} pm., 30 min. 3 spec.: 1 jun. 31 mm., 1 ♀ 40 mm., 1 ♂ 56 mm. — **St. 46.** 1930 m. 37°17′ N, 6°00′ E. 7-2-1909. 65 m.w., 8^{25} pm., 30 min. 1 jun. 28 min. — **St. 46.** ibid. 600 m.w., 6^{25} pm., 30 min. 1 ♀ 107 mm. — **St. 50.** > 2000 m. 37°02′ N, 1°17′ E. 17-2-1909. 1600 m.w., 5^{30} am, 60 min. 2 ♀ 95—112 mm.; the greater one has ova in which the eyes are visible. — **St. 53.** > 2000 m. 36°13′ N, 1°28′ W. 18-2-1909. 2600 m.w. (Y. 330), 5^{15} pm., 90 min. 3 ♂ with spermatophores 104 mm. (?, telson lost), abt. 120, > 112 mm.; 1 ♂ 96 mm. (?, telson broken). — **St. 51.** > 2000 m. 36°27′ N, 0°37′ W. 18-2-1909. 300 m.w., 0^{50} am, 30 min. 1 ♀ 53 mm. — **St. 106.** 1150 m. 36°33′ N, 2°00′ W. 25-6-1910. 1200 m.w., 0^{20} am, 60 min. 1 ♂ 53 mm. — **St. 107.** > 2000 m. 36°12′ N, 1°28′ W. 26-6-1910. 2000 m.w., 7^{30} am., 60 min. 1 ♂ 88 mm. — **St. 108.** 2435 m. 36°03′ N, 0°27′ W. 26-6-1910. 2000 m.w., 0^{40} am, 60 min. 2 spec. 15—24 mm. — **St. 112.** 2700 m. 36°56′ N, 2°15′ E. 27-6-1910. 300 m.w., 0^{15} am, 30 min. 3 spec.: 1 jun. 28 mm., 2 ♀ 56—63 mm. — **St. 113.** 815 m. 36°53′ N, 3°09′ E. 28-6-1910. 300 m.w., 3^{25} am, 30 min. 3 spec.: 2 ♂ 62—74 mm., 1 ♀ 65 mm. — **St. 115.** 2800 m. 38°17′ N, 4°11′ E. 29-6-1910. 300 m.w., 11^{20} pm., 30 min. 3 spec.: 44—46 mm. — **St. 115.** ibid. 2000 m.w., 0^{30} am, 60 min. 6 spec.: 5 jun. 15, 21, 27, 29, 32 mm.; 1 ♂ 90 mm. — **St. 116.** 2860 m. 39°27′ N, 5°26′ E. 30-6-1910. 300 m.w., 1^{40} am, 30 min. 1 spec. 43 mm. — **St. 118.** > 2700 m. 41°00′ N, 6°43′ E. 30-6-1910. 300 m.w., 10^{55} pm., 30 min. 2 spec. (♂, ♀) 56 mm. — **St. 120.** 2700 m. 42°31′ N, 7°41′ E. 1-7-1910. 300 m.w., 8^{50} pm., 30 min. 1 ♀ 76 mm. — **St. 122.** 1285 m. 43°50′ N, 8°54′ E. 2-7-1910. 1200 m.w., 5^{30} am, 30 min. 4 spec.: 3 ♂ 54, abt. 80, 93 mm.; 1 ♀ with ova 117 mm. — **St. 129.** 3420 m. 40°05′ N, 11°31′ E. 12-7-1910. 600 m.w., 8^{00} pm., 30 min. 1 ♀ 82 mm. — **St. 143.** 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 1000 m.w., 2^{00} am, 60 min. 3 ♂ 73, 80, 95 mm. — **St. 160.** > 1000 m. 35°59′ N, 28°14′ E. 1-8-1910. 300 m.w., 2^{45} am, 30 min. 1 ♀ 50 mm. — **St. 160.** ibid. 1000 m.w., 3^{35} am, 60 min. 2 ♀ 69—88 mm. — **St. 206.** 2182 m. 39°32′ N, 5°15′ E. 28-8-1910. 1000 m.w., 1^{40} am, 45 min. 2 ♂ 103—112 mm. — **St. 209.** > 2000 m. 40°34′ N, 3°03′ E. 29-8-1910. 2000 m.w., 7^{25} am, 45 min. 2 spec. 24—32 mm. — **St. 218.** 2147 m. 36°54′ N, 2°57′ E. 2-9-1910. 300 m.w., 2^{45} am, 30 min. 1 ♂ 55 mm.

Atlantic.

St. 104. 1950 m. 62°47′ N, 15°05′ W. 24-5-1904. 1500 m.w. 1 ♀ 62 mm. — **St. 152.** 1240 m. 65°00′ N, 28°10′ W. 19-7-1904. 800 & 1000 m.w., 1 ♀ 61 mm., 1 ♂ 81 mm. — **St. 180.** 2160 m. 61°34′ N, 19°05′ W. 10-7-1904. 1800 m.w. 2 jun. 30—39 mm.; 1 ♀ 68 mm., 1 ♂ 72 mm. — **St. 183.** 61°30′ N, 17°18′ W. 11-7-1904. 1900 m.w. 8 spec. 31—35 mm. — **St. 71.** 1985 m. 57°47′ N, 11°33′ W. 7-6-1905. 1500 m.w. 2 jun. 28—33 mm.; 1 ♂ 46 mm., 1 ♀ 109 mm. — **St. 72.** 1020 m. 57°52′ N, 9°55′ W. 8-6-1905. 1500 m.w. 2 ♀ 78—89 mm. — **St. 88.** 600—993 m. 48°09′ N, 8°30′ W. 20-6-1905. 300 m.w., 8^{45} pm., 120 min. 11 spec.: 4 ♂: 48, 50, 55, 76 mm.; 7 ♀: 50, 52, 53 (3 spec.), 59 mm. (2 spec.) — **St. 90.** 740—1600 m. 47°47′ N, 8°00′ W. 21 (22)-6-1905. 300 m.w., 2^{15} am., 120 min. 8 spec.: 3 ♂ 54, 56, 57 mm.; 5 ♀: 50 (2 spec.), 52, 54, 76 mm. — **St. 36.** 1125—1050 m. 44°21′ N, 2°37′ W. 10-5-1906. 1250 m.w., 5^{55} am, 120 min. 5 ♀ 69, 80, 82, 84, 95 mm. — **St. 62.** 2480—2775 m. 50°25′ N, 12°44′ W. 5-6-1906. 1500 m.w., 2^{45} am, 120 min. 30 spec.: 25, 28, 30—33 (8 spec.), 34, 35 (4 spec.), 43 (2 spec.), 47 mm.; 7 ♂: 68, 73, 77, 79 (2 spec.), 89, 107 mm.; 5 ♀ 55, 78, 79, 81, 83 mm. — **St. 63.** 2140 m. 49°27′ N, 13°22′ W. 5-6-1906. 300 m.w. (Y. 330), 5^{30} pm., 120 min. 1 ♀ 103 mm. — **St 74.** 1245—1298 m. 49°23′ N, 12°13′ W. 10-6-1906. 2000 m.w. (Y. 330), 6^{35} am, 60 min. 7 spec.: 29, 32, 34, 36, 39, 44 mm.; 1 ♀ abt. 83 mm. (rostrum broken). — **St. 74.** ibid. 1170 m. 2000 m.w. (Eel drift-seine), 1^{20} pm., 60 min. 5 spec.: 1 ♂ 81 mm.; 4 ♀: 84, 101, 105, 110 mm. (?, apex of telson lost). — **St. 74.** ibid. 1220 m. 2500 m.w. (Eel drift-seine), 9^{50} pm., 60 min. 4 spec.: 2 ♂ 79—abt. 90 mm. (?, apex of telson lost); 2 ♀ 58—96 mm. — **St. 75.** 1520 m. 49°20′ N, 12°39′ W. 10-6-1906. 2800 m.w. (Eel drift-seine), hour? 2 ♂: > 90 mm. (apex of telson lost), 96 mm. — **St. 76.** > 2600 m. 49°27′ N, 13°33′ W. 11-6-1906. 2800 m.w., 3^{00} pm., 120 min. 10 spec.: 33 (2 spec.), 34, 41, 42, 48 mm.; 1 ♂: 76 mm., 3 ♀: 97, 105, 106 mm. — **St. 80.** 1140 m. 51°34′ N, 11°50′ W. 16-6-1906. 1200 m.w. 6^{30} pm., 120 min. 9 spec.: 39, 40, 42, 45 mm.; 2 ♂: 77—80 mm.; 3 ♀: 54, 84, 95 mm. (the last one with ova). — **St. 178.** > 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w., 9^{05} am., 120 min. 17 spec.: 30, 31, 33 (2 spec.), 37 (2 spec.); 39—41 (4 spec.), 42, 44, 46, 49 mm.; 1 ♂ 57 mm., 2 ♀ 87—88 mm. — **St. 179.** > 4000 m. 47°20′ N, 13°23′ W. 3-9-1906. 1800 m.w. 3^{40} am., 120 min. 3 spec.: 1 jun. 43 mm., 1 ♂ 106 m., 1 ♀ 110 mm. — **St. 180.** > 4000 **m.** 48°19′ N, 13°53′ W. 3-9-1906. 1800 m.w., 5^{05} pm., 60 min. 6 spec.: 38 (2 spec.), 39, 45, 46, 47 mm. — **St. 181.** 1350 m. 49°22′ N, 12°52′ W. 4-9-1906. 1800 m.w., 10^{35} am., 60 min. 9 spec.:

14, 15, 16, 18, 41, 43 mm.; 3 ♀ 51, 57 mm. (2 spec.). — **St. 190.** > 4000 m. 46°30′ N, 7°00′ W. 11-9-1906. 2700 m.w., 8^{25} am., 150 min. 6 spec.: 3 ♂ 48, 92, 105 mm.; 3 ♀ 54, 88, 110 mm. — **St. 69.** > 3500 m. 36°13′ N, 9°44′ W. 28-2-1909. 3000 m.w., 6^{30} pm., 60 min. 1 ♀ with ova (the eyes are visible) > 104 mm. (apex of rostrum lost). — **St. 75.** > 4000 m. 45°37′ N, 7°03′ W. 9-3-1909. 300 mw., 7^{45} pm., 60 min. 1 ♀ 80 mm. — **St. 75.** ibid. 600 m.w., 6^{30} pm., 60 min. 5 spec.: 1 ♂ 70 mm.; 4 ♀: 68, 83, 86, 93 mm. (the last one with ova). — **St. 75.** ibid. 4300 m.w., 1^{45} pm., 120 min. 7 spec.: 4 ♂: 62, 90, 100, abt. 110 mm. (rostrum lost); 3 ♀: 64, 95, 117 mm. (the 2 last with ova). — **St. 240.** 2500 m. 44°34′ N, 8°16′ W. 15-9-1910. 1000 m.w., 9^{40} pm., 30 min. 1 ♂ 65 mm., 1 ♀ 57 mm. — **St. 242.** 4941 m. 46°19′ N, 6°48′ W. 16-9-1910. 4350 m.w., 7^{00} pm., 60 min. 1 ♀ 94 mm.

Larvæ (on determination see above p. 47):

Mediterranean.

St. 58. 85 m. 36°36′ N, 4°24′ W. 20-2-1909. 65 m.w., 3^{00} pm., 30 min. 3 larvæ 9, 12, 12 mm. — **St. 107.** > 2000 m. 36°13′ N, 1°28′ W. 25-6-1910. 300 m.w., 9^{05} pm., 30 min. 3 larvæ 12, 12, 15 mm. — **St. 108.** > 2435 m. 36°03′ N, 0°27′ W. 26-6-1910. 2000 m.w., 0^{40} am., 60 min. 1 larva 11 mm. — **St. 113.** 815 m. 36°53′ N, 3°09′ E. 28-6-1910. 300 m.w., 3^{25} am. 30 min. 2 larvæ 15 mm. — **St. 115.** 2800 m. 38°17′ N, 4°11′ E. 29-6-1910. 2000 m.w., 0^{30} am., 60 min. 2 larvæ 12—15 mm. — **St. 118.** > 2700 m. 41°00′ N, 6°43′ E. 30-6-1910. 65 m.w., 11^{35} pm., 30 min. 1 larva 10 mm. — **St. 118.** ibid. 300 m.w., 5^{55} pm., 30 min. 5 larvæ 11, 15, 15, 15, 15 mm. — **St. 129.** 3420 m. 40°05′ N, 11°31′ E. 12-7-1910. 300 m.w., 3^{40} am., 30 min. 1 larva 14 mm. — **St. 132.** 1227 m. 38°57′ N, 9°47′ E. 14-7-1910. 600 m.w., 4^{50} am., 30 min. 2 larvæ 6—14 mm. — **St. 133.** 600 m. 38°18′ N, 9°59′ E. 14-7-1910. 300 m.w., 10^{15} pm., 30 min. 2 larvæ 10—15 mm. — **St. 133.** ibid. 600 m.w., 9^{30} pm., 30 min. 1 larva 14 mm. — **St. 137.** 175—195 m. 37°17′ N, 10°56′ E. 19-7-1910. 250 m.w., 9^{05} am., 30 min. 1 larva 14 mm. — **St. 143.** 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 300 m.w., 0^{30} am., 30 min. 1 larva 15 mm. — **St. 199.** 2700 m. 39°32′ N, 10° 49′ E. 28-8-1910. 300 m.w., 9^{25} pm., 20 min. 1 larva 12 mm. — **St. 199.** ibid. 1000 m.w., 10^{10} pm., 30 min. 1 larva 13 mm. — **St. 206.** 2782 m. 39°32′ N, 5°15′ E. 28-8-1910. 300 m.w., 1^{05} am., 15 min. 2 larvæ 12—15 mm. — **St. 210.** 775 m. 41°10′ N, 2°23′ E. 30-8-1910. 600 m.w., 3^{35} am., 30 min. 1 larva 14 mm.

Atlantic.

St. 88. 600—995 m. 48°09′ N, 8°30′ W. 20-6-1905. 300 m.w. 8^{45} pm., 240 min. 11 larvæ 10—15 mm. — **St. 66.** > 4000 m. 48° 43′ N, 15°17′ W. 6-6-1906. 400 m.w., 2^{15} pm., 60 min. 3 larvæ 15 mm.

The material comprises 277 spec. (55 ♂, 72 ♀, 106 spec. (non larvæ) < abt. 50 mm., 44 larvæ (determination see p. 47), from 57 stations, 72 hauls.

A. Mediterranean.

The material contains 63 spec. (23 ♂, 14 ♀, 26 spec. < 50 mm.), from 26 stations, 32 hauls. Besides the "Thor" has taken 30 larvæ (see above p. 51) from 14 st., 17 hauls; at 8 of these 14 stations also non-larvæ were taken.

Depths of the sea and occurrence. (Chart 5).

The depth to bottom is very great, especially 1000-3000 m. The non-larval stages have only one station less than 1000 m. (viz. 815 m.). The larvæ can, on the other hand, be met with at very much shallower places, which agrees with the fact of their keeping closer to the surface: 5 stations showed a depth to bottom of less than 1000 m., viz. 85, 175—195, 600, 775 and 815 m.

Depths in m.	No. of stations	
	Non-larvæ	Larvæ
0— 500......	—	2
> 500—1000......	1	3
> 1000—2000......	8	2
> 2000—3000......	15	7
> 3000......	2	1

The stations lie more or less evenly distributed throughout the western basin; only 3 lie in the eastern, and one of them even east of Crete. Larvæ were only found at 1 station in the eastern basin (St. 143, S. E. of Sicily).

Such information as the literature affords with regard to distribution in the Mediterranean is given below. In some cases it cannot be seen whether *A. purpurea* or

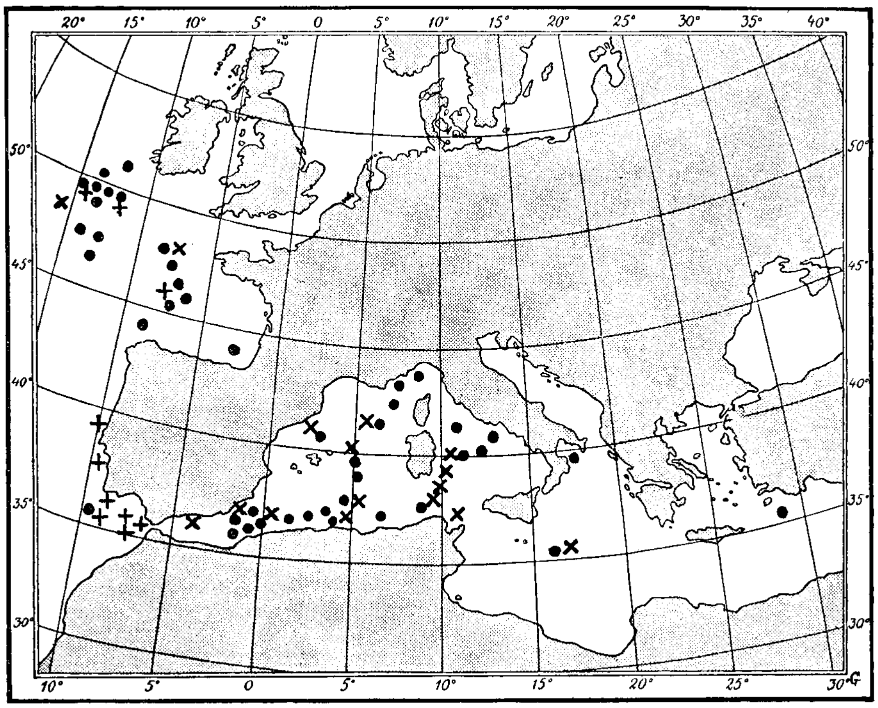

Chart 5. Acanthephyra. • A. multispina, adult or postembryonal stages. × same species, larvæ. + A. purpurea.

A. multispina is meant (Lo Bianco 1903, Pesta 1918); but since the true *A. purpurea* has never been recorded from the Mediterranean, there can be no doubt that all records from this water refer to *A. multispina*. In all other cases it is evident that *A. multispina* is really meant.

42°53′ N, 8°22′ E, 0—2000 m. (*A. purp.* var. *mult.*, Coutière 1905, p. 10). — Between Capo Corso and Monaco, 2000 m.w. (*A. purp.*); Capri 2400 m.w., 1 spec., and Salina, Eolian Isl., 2500 m.w., 1 spec. (*A. rectirostris*?, Lo Bianco 1903, p. 185—86). — Messina (*A. purp.* var. *medit.*, 2 spec.; *A. rectirostris*, 4 spec.; Riggio 1900 and 1905). — Messina, 1 spec. and 48°8.7′ N, 17°40.6′ E (Adria), 600—900 m., 7 spec. ("*A. purp.*", Pesta 1912, p. 995—98). — S. Adria (*A. purp.*, Pesta 1918). — Pelagosa-Gravosa (Adria), 300—1100 m., 18 spec. (*A. purp.* var. *mult.*, Szüts 1915, p. 433—36).

Vertical occurrence.

M. w.	Non-larvæ				Larvæ			
	Night		Day		Night		Day	
	Hauls	Spec.	Hauls	Spec.	Hauls	Spec.	Hauls	Spec.
65	1	1	—	—	1	1	1	3
200—300	11	20	—	—	6	9	3	9
600	3	3	—	—	3	4	—	—
1000—1200	6	13	1	1	1	1	—	—
1400—2600	5	13	5	12	2	3	—	—
total	26	50	6	13	13	18	4	12

There appears to be no difference between summer and winter.

Only 3 specimens (2 larvæ, 1 spec. of 28 mm.) were taken with 65 m.w. (night and day); the other non-larval stages were never found nearer the surface at night than with 300 m.w., and by day considerably deeper (over 1000 m.w.). The greatest length of line was 2600 m.w., the most frequent depth (night) seems to be 300—1200 m.w.

It will be seen that the larvæ prefer the upper water layers both day and night, especially 250—300 m.w., the other individuals, however, do not appear to show any preference for a particular depth within the limits noted, as was the case in the Atlantic (*vide infra*).

Shoals do not occur; the max. of specimens taken in a single haul was 6.

Size and propagation etc. For sex differences *vide supra*. p. 43.

Of specimens over 50 mm., there are only 23 ♂, 14 ♀. Both sexes grow to about the same size, 120 mm. (♂) and 117 (♀), and similarly, we find in the different size groups approximately equal nos. of either sex.

Ova were found only in the two largest ♀, 112 and 117 mm.; all the others lacking ova. The two ♀ with ova were taken on the 18. Feb. and 2. July; it would seem then, as if the species propagated all the year round. Three ♂ with spermatophores outside the genital apertures were found (St. 53, 18-2-1909, 2600 m.w.); the sizes of the specimens were 104—120 mm. Larvæ were found both winter and summer, though certainly more numerous in summer; this, however, is doubtless due here to the fact that we had most stations at that season.

B. Atlantic.

	Stations	Hauls	Specimens (non-larvæ)		
			♂	♀	< 50 mm.
May 1904	1	1	—	1	—
July —	3	3	2	2	10
June 1905	4	4	5	11	8
May 1906	1	1	—	5	—
June —	6	8	15	19	34
Sept. —	5	5	4	9	28
Feb. 1909	1	1	—	1	—
Mar. —	1	3	5	8	—
Sept. 1910	2	2	1	2	—
total	24	28	32	58	80

The material contains 170 spec. (non-larvæ) (32 ♂, 58 ♀, 80 spec. < abt. 50 mm.) from 24 st., 28 hauls, and 14 larvæ from 2 st., 2 hauls.

Depth of the sea and occurrence. The depth is nearly always over 1000 m.; only 1 st. is of slighter depth (600—993 m.) and at this one, both larvæ and older individuals were found.

Non-larval stages	
Depth in m.	No. of stations[1]
500—1000	1
> 1000—2000	10
> 2000—3000	5
> 3000	7

[1] The depth was at a single station (st. 183, 1904) not noted.

All stations lie between S.W. Ireland and the base of the Bay of Biscay. Only three stations are common to this and *A. purpurea* (1906, st. 74 and 76, 1909, st. 69).

Vertical occurrence.

M. w.	Non-larval stages								
	Night				Day				
	Hauls	Spec.	Duration of hauls in hours	No. of spec. pr. hour	Hauls	Spec.	Duration of hauls in hours	No. of spec. pr. hour	Night? or Day? No. of hauls
300— 400	3	20	5	4	1	1	2	0.5	—
500— 800	1	5	1	5	—	—	—	—	1
1000—1200	3	16	4.5	3.6	—	—	—	—	—
1500—1900	2	33	4	8.3	3	32	4	8	5
> 1900	3	6	3	2	5	35	8.5	4.1	1

Larvæ occur only relatively near the surface, but were only taken in two hauls, 300 m.w. night, 400 m.w., day. They may, however, be met with even nearer the surface: 50 fms. (KEMP 1910, p. 57) otherwise, the depth according to the literature is more especially 50—150 m. (MURRAY & HJORT 1912, p. 622—24), 0—100 fms. (KEMP 1907, p. 211).

The parva stage, on the other hand, lives much deeper down. The "Thor" has only 5 specimens, taken both day and night with 1500—1900 m.w., i. e. at same depth as the older ones. According to the literature, this stage occurs at 500—400 fms. and 750—500 fms. (KEMP 1907, p. 211) and 800—465 fms. (KEMP 1910, p. 57—58).

The older stages were taken at night in 12 hauls, 300 to over 1900 m.w. relatively greatest no. per hour with 1500—1900 m.w. In the daytime, it was taken practically speaking only with over 1500 m.w., relatively most frequent with 1500—1900 m.w.

According to MURRAY & HJORT (1912, p. 668) the "Michael Sars" took in all 232 spec. in the Atlantic, 209 by day and 23 at night, in both cases only at a depth of 500—1500 m. By day it was most numerous at a depth of 1000—1500 m. which agrees well with the "Thor" but at the same time, the "Thor" results show that the species can occur much nearer the surface.

The collections mentioned by KEMP 1910 from S. W. Ireland show (by day?) a similar but somewhat slighter depth than the "Thor" and the "Michael Sars"; save for a single haul with 50 fms. w. especially 500—700 fms.w. There seems to be, according to the "Thor", a slight tendency among the older specimens to keep lowest of all; one spec. of 103 mm., however, was taken by day with only 300 m.w. (St. 63, 1906).

Shoals can occur, but are not frequently met with; by far the greatest no. in one haul (120 min.) was 30. When more than a very few specimens are taken in one haul, most of them are nearly always small, under abt. 50 mm., of the largest specimens, only a few are ever found in each haul.

Size and propagation. Of specimens over 50 mm., there were 32 ♂, 58 ♀.

Size of both sexes about the same, up to 110 mm. (a single ♀ however, 117 mm.) but in the higher size-groups (over 80 mm.) there are relatively somewhat more ♀ than ♂ (31 and 12 respectively) considering that the material contains nearly twice as many ♀ as ♂.

Only 5 females with ova in all (sizes: 93, 95, 95, over 104, 117 mm.) taken a night with 600, 1200 and 3000 m.w., and by day with 4300 m.w. Dates: 28. Feb., 9. March and 16. July (KEMP 1910, p. 7 gives only Feb.).

Only 3 ♂ had spermatophores outside the genital aperture. Sizes, 81, 92 and 105 mm.; taken 9. June and 11. Sept. with 2000 and 2700 m.w. We have, however, in our museum, from the "Tjalfe" exped. (S. W. Greenland) out of a total of 31 ♂, no fewer than 20 with spermatophores; sizes, 90—121 mm., length of wire 1500—2000 m.w.

Distribution. Disregarding the literature where it cannot be seen whether this species or *A. purpurea* is meant, (these localities will be treated later on, p. 54) the distribution may be given as follows: 1. Mediterranean; western basin especially. 2. Atlantic. The northern limit here lies about Davis Str. (abt. 64° N), W., S.W. and S. of Iceland and S. W. of the Færoes. On the American side it has been taken at a few places abt. 40° N; on the European side the southern limit of great frequency lies in the Bay of Biscay (very numerous off S.W. Ireland). Roughly speaking, then, we can note it as most numerous between 64° and 40° N; south of this limit it can occur, at any rate as far as the equator, possibly even in the southern part of the Atlantic (abt. 25°—40° S) but this is uncertain. It seems then to take the place of *A. purpurea* N. of abt. 40° N. 3. In the Pacific it has been found at two places, S. of Australia and off the coast of New Zealand. In the Indian Ocean it has never been found.

Specified list of localities is given below.

1. Mediterranean, see above p. 51—52.

2. Atlantic. All the specimens from the "Ingolf"-Exped., mentioned by H. J. HANSEN 1908 as *A. purpurea*, are in reality *A. multispina*; the localities are Davis Straits 63°30′ N (1 st.), W., S. W. and S. of Iceland (5 st.). — S. W. Greenland, 4 localities 60°07′—64°06′ N, 1185—2000 m.w. (*A. purpurea*, K. STEPHENSEN "Tjalfe" 1912). — 41°10′ N, 66°2′ W, 1259 fms., WANDEL leg., 1 spec. (in our Zool. Mus.). — Martha's Vineyard 39°12′ N, 72°3$^1/_2$′ W, 707 fms., 2 spec. (U. S. Fish. Comm. st. 2235, in our Zool. Mus.). — *A. Agassizi* SMITH 1884 comprises both *A. purpurea* and *A. multispina*; see *A. purpurea* p. 45. — 232 spec.; 500—1500 m. below surf., between New Foundland and Europe (no special localities; MURRAY & HJORT 1912, p. 668). — S. W. Ireland, very common (KEMP 1910). — 44°39′ N, 4°30′ W, 800 m.w., 3 spec. (*A. purpurea*, CAULLERY 1896). — Bay of Biscay 0—100 fms., 1 ♂ ad 81 mm. (KEMP 1907). — 46°15′ N, 7°09′ W, 0—3000 m.; 47°36′ N, 7°38′ W, 1490 m.; 36°17′ N, 28°53′ W, 0—3000 m.; 32°18′ N, 23°58′ W, 0—2000 m. (COUTIÈRE 1905). — 1°47′ N, 24°26′ W, 1850 fms., 1 ♂, trawled; 1°22′ N, 26°36′ W, 1500 fms., 1 ♂, trawled (*A. acanthitelsonis* BATE 1888). — 0°46′ N,

18°59′ W, 3000 m., several spec. (*A. purp.* var. *acanthitelsonis*, LENZ & STRUNCK 1914; also some of their localities for "*A. purpurea*", see *A. purpurea* p. 49).

3. Pacific. 40°28′ S, 177°43′ E, 1100 fms., 1 spec., trawled, bottom temp. 37.2° F; 47°25′ S, 130°22′ E, 2150 fms., 2 ♂, trawled, bottom temp. 34.5° F. (*A. sica* BATE 1888, teste KEMP 1906, p. 11).

Acanthephyra purpurea or A. multispina (se above p. 44).

(References to literature from which the species cannot be determined.).

1. Atlantic. 36°16½′—39°46½′ N, 68°21′—73°09′ W, 578—2574 fms., 26 spec. from 19 localities (SMITH 1886, *A. Agassizi*). — Abt. 10° N, 22° W, 0—400 m., 1 ♀, and abt. 6° N, 20° W, 4000 m., trawl, 1 ♀ (*A. purp.*, ORTMANN 1893). — 36°—45° N, 11° W, 100 spec. (COUTIÈRE 1911, *A. purp.*). — N. of Falkland Isl. 42°32′ S, 56°29′ W, 1 spec. (*A. sica*, BATE 1888, teste KEMP 1906, p. 11; telson broken).

2. Pacific. Between Australia and Salomon Isl., 1 spec. (*A. sica*, BATE 1888, teste KEMP 1906, p. 11; telson broken).

3. SYSTELLASPIS DEBILIS M.-Edw. (Chart 6, fig. 16).

Acanthephyra debilis A. Milne-Edwards 1881, p. 13.
— — — 1883, Pl. 33, fig. 2.
Miersia gracilis Smith 1882, p. 70, Pl. 11 fig. 4.
Systellaspis debilis + *S. Bouvieri* Coutière 1905, p. 5 fig. 2, p. 8 fig. 3.
**Acanthephyra* — Kemp 1906, p. 16 (lit. and syn.), p. 23, Pl. 2 fig. 4—7.
Systellaspis — Coutière 1906, p. 1—12, fig. 1—4.
Acanthephyra gracilis H. J. Hansen 1908, p. 76.
— *debilis* Kemp 1910, p. 59, Pl. 6 fig. 1—15.
Systellaspis — Murray & Hjort 1912, p. 668, Pl. 3 fig. 3 (cold. fig.).
Acanthephyra — Williamson 1915, p. 358, figs. 35—38 (development).
Systellaspis — var. *indica* de Man 1920, p. 51, Pl. 6 figs. 11—11 f. (with lit.).

Atlantic.

St. 81. 960—1420 m. 51°32′ N, 12°03′ W, 13(14)-6-1905. 300 m.w., 7^{35} am., 120 min. 2 spec.: 29—35 mm. — **St. 88.** 600—995 m. 48°09′ N, 8°30′ W. 20-6-1905. 300 m.w., 8^{45} pm., 120 min. 4 spec.: 28 (2 spec.), 30, 31 mm. — **St. 90.** 740—1600 m. 47°47′ N, 8°00′ W. 21(22)-6-1905. 300 m.w., 2^{15} am., 120 min. 1 ♀ 67 mm. — **St. 90.** 1012—830 m. ibid. 500 m.w., 7^{30} pm., 120 min., 5 spec.: 19 (2 spec.), 23, 29, 35(?) mm. — **St. 93.** 1230—1350 m. 49°25′ N, 12°20′ W. 24-6-1905. 300 m.w., 3^{30} pm., 60 min. 6 spec.: 22, 38, 43 mm.; 1 ♂ 58 mm.; 2 ♀ 52—68 mm. — **St. 93.** ibid. 200 m.w., 1^{15} am., 120 min. 2 ♀ 43—53 mm. — **St. 36.** 1140 m. 44°21′ N, 2°31′ W. 10-5-1906. 300 m.w., 2^{55} am., 120 min. 2 ♂ 48—58 mm. — **St. 36.** ibid. 1035 m. 800 m.w., 9^{05} am., 120 min. 22 spec.: 15 jun.: 16, 21, 25—27 (4 spec.), 32 (2 spec.), 38, 40, 41 (2 spec.), 43, 45, 50(?) mm.; 2 ♀: 56—68 mm., 5 ♂: 60, 66, 70, 71, 80 mm. — **St. 36.** ibid. 1250 m.w., 5^{55} am., 120 min. 3 spec.: 40, 44, 48 mm. — **St. 46.** 1360 m. 44°37′ N, 2°17′ W. 17-5-1906. 300 m.w., 1^{45} am., 120 min. 6 spec.: 3 jun.: 18, 24, 39 mm.; 3 ♂: 57, 65, 74 mm. — **St. 52.** 1860—1910 m. 48°42′ N, 12°20′ W. 21-5-1906. 300 m.w., 0^{25} am., 120 min. 1 ♂ 56 mm. — **St. 62.** 2480—2775 m. 50°25′ N, 12°44′ W. 5-6-1906. 1500 m.w., 2^{45} am., 120 min. 1 spec. 28 mm. — **St. 67.** > 4000 m. 48°29′ N, 14°15′ W. 7-6-1906. 1700 m.w. 5^{00} am., 120 min. 1 ♂(?) 50 mm., 1 ♂ 70 mm. — **St. 75.** 1520 m. 49°20′ N, 12°39′ W. 11-6-1906. 800 m.w., 1^{50} am., 120 min. 1 ♂ 81 mm., 1 ♀ with ova 81 mm. — **St. 75.** ibid. 1500 m.w., 4^{30} am., 120 min. 1 ♂ 80 mm. — **St. 76.** > 2600 m. 49°27′ N, 13°33′ W. 11-6-1906. 2800 m.w., hour?. 1 jun. 21 mm. — **St. 88.** 1880 m. 55°05′ N, 12°20′ W. 23-6-1906. 300 m.w., 120 min. 1 ♀ 59 mm. — **St. 89.** 1600 m. 55°45′ N, 9°35′ W. 23-6-1906. 200 m.w., 120 min. 1 ♀(?) 48 mm. — **St. 176.** 1125 m. 49°31′ N, 11°51′ W. 31-8-1906. 300 m.w., 120 min., 9^{30} pm. 5 spec.: 3 ♂: 75, 78, 83 mm., 1 ♀(?) 50 mm, 1 ♀ with ova 78 mm. — **St. 178.** > 3000 m. 48°04′ N, 12°40′ W. 2-9-1906. 300 m.w., 120 min., 3^{15} am. 16 spec.: 2 spec. 40 mm., 5 ♂: 52, 56, 61, 72—80 mm., 9 ♀: 50, 53, 54, 61, 68 (2 spec.), 73, 75 mm. (2 spec., with ova). — **St. 178.** ibid. 1800 m.w., 9^{05} am., 120 min. 1 spec. 33 mm. — **St. 179.** > 4000 m. 47°20′ N, 13°23′ W. 3-9-1906. 1800 m.w., 120 min., 3^{40} am., 8 spec.: 2 spec. 35—47 mm., 2 ♂: 53—58 mm., 4 ♀: 49, 53, 60, 61 mm. — **St. 180.** > 4000 m. 48°19′ N, 13°53′ W. 3-9-1906. 1800 m.w., 60 min., 5^{05} pm. 15 spec.: 22 (2 spec.), 32, 35 (2 spec.), 40 (2 spec.), 43, 45 (2 spec.), 2 ♂: 55—58 mm., 3 ♀: 59 (2 spec.) 65 mm. — **St. 181.** 1350 m. 49°22′ N, 12°52′ W. 4-9-1906. 1800 m.w., 60 min., 10^{30} am. 1 spec. 37 mm. — **St. 182.** 2200 m. 50°11′ N, 12°05′ W. 4-9-1906. 600 m.w., 60 min., 6^{45} pm. 1 ♀ 61 mm. — **St. 190.** > 4000 m. 46°30′ N, 7°00′ W. 11-9-1906. 300 m.w., 120 min., 3^{00} am. 6 spec.: 3 ♂: 65, 67, 75 mm.; 3 ♀: 73 (2 spec.), 75 mm. (with ova; rostrum abnormous, only 10 mm.). — **St. 65.** 1300 m. 35°53′ N, 7°26′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 6 spec.: 3 spec. 35, 42, 46 mm., 2 ♂: 53—85 mm., 1 ♀ with ova 77 mm. — **St. 66.** 735 m. 36°16′ N, 6°52′ W. 25-2-1909. 300 m.w., 2^{55} am., 120 min. 50 spec.: 18, 22, 25, 30 mm. (3 spec.), 33, 35 mm. (3 spec.), 37 mm. (2 spec.), 39 mm. (4 spec.), 41, 43 mm. (3 spec.), 46, 48—49 mm. (4 spec.); 14 ♂: 53—63 mm; 13 ♀: 3 ♀ 50—53 mm., 9 ♀ 57—65 mm. — **St. 66.** ibid. 600 m.w., 5^{15} am., 120 min. 41 spec.: 17—23 mm. (7 spec.), 26—29 (4 spec.), 31—34 (8 spec.), 35—39 (13 spec.), 43—49 (6 spec.); 3 ♂: 55, 58, 63 mm. — **St. 69.** > 3500 m. 36°13′ N, 7°48′ W. 28-2-1909. 300 m.w., 11^{40} pm., 30 min. 1 spec. 25 mm. — **St. 69.** ibid. 600 m.w., 9^{00} pm., 60 min. 1 ♂ 70 mm., 1 ♀ 62 mm. — **St. 69.** ibid. 3000 m.w., 6^{30} pm., 60 min. 1 spec. 32 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 4-3-1909. 300 m.w., 8^{40} pm., 120 min. 31 spec.: 20 ♂: 51, 56, 58 (5 spec.), 60 (3 spec.), 61, 63, 65 (4 spec.), 66, 67, 70, 77 mm.; 11 ♀: 44, 48, 50, 57 (2 spec.), 59, 62 (3 spec.), 66 (2 spec.). — **St. 71.** ibid. 600 m.w., 6^{25} pm., 120 min. 43 spec.: 22 spec. 16—21 mm.; 7 ♂: 52, 56, 59, 68, 69, 73 mm. (2 spec.); 14 ♀: 4 without ova 63 (3 spec.), 68 mm., 10 with ova: 75 (2 spec.), 78—81 (7 spec.), 87 mm. — **St. 71.** ibid. 1600 m.w.,

4^{00} pm., 120 min. 5 spec.: 3 ♂: 61, 62, 73 mm.; 2 ♀ with ova 71—76 mm. — **St. 75.** > 4000 m. 45°37′ N, 7°03′ W. 9-3-1909. 300 m.w., 7^{45} pm., 60 min. 1 ♂ 54 mm. — **St. 75.** ibid. 600 m.w., 6^{30} pm., 60 min. 5 spec.: 2 spec. 29—31 mm., 2 ♂ 65—75 mm., 1 ♀ 54 mm.— **St. 75.** ibid. 4300 m.w. (Y. 330), 1^{45} pm., 120 min. 1 ♂ 71 mm. — **St. 76.** 1800 m. 47°01′ N, 5°48′ W. 10-3-1909. 1600 m.w., 2^{40} pm., 60 min. 1 spec. 13 mm. — **St. 80.** > 4000 m. 46°17′ N, 7°31′ W. 13-6-1910. 300 m.w., 10^{45} pm., 30 min. 1 ♂ 68 mm. — **St. 81.** 2140 m. 41°32′ N, 9°32′ W. 15-6-1910. 300 m.w., 4^{00} pm., 30 min. 20 spec.: 22 (5 spec.), 27 (3 spec.), 28—30 (9 spec.), 34, 37 mm. (2 spec.). — **St. 89.** 1310 m. 36°28′ N, 8°22′ W. 1000 m.w., 4^{10} am., 30 min. 8 spec.: 24, 28 (2 spec.), 29, 38 (2 spec.), 44, 47 mm. — **St. 89.** ibid. 1800 m.w., hour? 1 spec. 17 mm. — **St. 91.** 1225 m. 35°53′ N, 7°26′ W. 18-6-1910. 1600 m.w., 5^{25} pm., 60 min. 19 spec.: 14—17 (4 spec.), 20, 38, 39, 40, 41, 42 mm., 5 ♂: 62, 64, 66, 69, 70 mm.; 4 ♀: 3 without ova 48, 58, 62 mm.; 1 with ova 72 mm. — **St. 231.** > 950 m. 35°50′ N, 7°16′ W. 9-9-1910. 300 m.w., 1^{15} am., 30 min. 8 spec.: 3 spec. 22, 41, 46 mm.; 1 ♂ 70 mm.; 4 ♀: 1 without ova 53 mm., 3 with ova 64 mm. — **St. 231.** ibid. 1200 m.w., 2^{15} am., 30 min. 2 spec.: 1 ♂ 63 mm., 1 ♀(?) 46 mm. — **St. 232.** 3700 m. 36°28′ N, 9°00′ W. 9-9-1910. 300 m.w., 10^{35} pm., 30 min. 3 ♀ with ova 71, 80, 87 mm. — **St. 232.** ibid. 2000 m.w., 11^{45} pm., 30 min. 2 spec.: 1 spec. 38 mm., 1 ♀ with ova 77 mm. — **St. 234.** 920 m. 38°10′ N, 9°20′ W. 10-9-1910. 300 m.w., 10^{30} pm., 30 min. 19 spec.: 7 ♂: 54, 56, 61, 64 (2 spec.), 66 mm. (2 spec.); 5 ♀: 36, 46, 50, 56, 60 mm.; 7 ♀ with ova: 66, 68, 70, 72 (2 spec.), 73, 76 mm. — **St. 234.** ibid. 1000 m.w., 11^{20} pm., 30 min. 2 ♀ with ova: 66—73 mm. — **St. 240.** 2500 m. 44°34′ N, 8°16′ W. 15-9-1910. 300 m.w., 9^{00} pm., 15 min. 5 spec.: 30, 37, 39, 45; 74 mm (♂). — **St. 240.** ibid. 1000 m.w., 9^{40} pm., 30 min. 1 spec. 20 mm. — **St. 245.** 330 m. 47°14′ N, 6°02′ W. 17-9-1910. 65 m.w., 9^{55} pm., 15 min. 3 spec.: 40, 47, 62 mm (♂). — **St. 245.** ibid. 400 m.w., 5^{15} pm., 120 min. 38 spec.: 6 jun. 37, 40 (2 spec.), 45, 46, 50 mm.; 21 ♂: 58, 60, 64 (2 spec.), 69 (5 spec.), 71, 73, 75 (3 spec.), 82 (5 spec.), 85, 87 mm.; 11 ♀: 8 without ova 53, 57, 61, 64 (2 spec.), 65, 74, 83 mm., 3 with ova 75, 79 mm (2 spec.).

On the development see COUTIÈRE 1905 and 1906 and WILLIAMSON; on the eyes: especially COUTIÈRE 1906; on the luminous organs: COUTIÈRE 1906 and KEMP 1905 (1906) and 1908 (1910).

Atlantic.

The material contains 398 spec. (117 ♂, 98 ♀, 183 jun. [< abt. 50 mm.]), from 35 stations, 54 hauls, all situated in the Atlantic between W. Ireland and the Bay of Cadiz. The species is not known from the Mediterranean.

	No. of stations	No. of hauls	No. of specimens ♂	♀	jun. (< abt. 50 mm.)
June 1905	4	6	—	5	14
May 1906	3	5	11	2	21
June —	6	7	4	3	2
Aug. —	1	1	3	2	—
Sept. —	6	7	9	20	19
Feb. 1909	3	6	20	15	46
Mar. —	3	7	32	18	25
June 1910	4	5	6	4	39
Sept. —	5	10	32	29	17
total...	35	54	117	98	183

Depths of the sea and occurrence (Chart 6). Only one st. has a depth of 330 m.; the other > 500 m., most of them > 1000 m. All these stations are situated from W. Ireland to the Bay of Cadiz, several in the Bay of Biscay. The species was known from all these seas except from the Bay of Cadiz (see below under Distribution).

Depths in m.	No. of stations
330	1
500—1000	5
> 1000—2000	16
> 2000—3000	5
> 3000	8
total...	35

Vertical occurrence.

M. w.	Night: No. of hauls	No. of specimens	Duration in hours	No. pr. hour	No. of hauls: Day	Day? or Night?
65..........	1	3	1/4	12	—	—
200.........	1	2	2	1	—	1
300— 400..	17	160	24 3/4	6.5	4	1
500— 800..	7	99	11	9	1	—
1000—1250..	5	16	4	4	—	—
1400—2000..	5	14	6 1/2	2.1	7	1
2800—4000..	1	1	1	1	1	1
total...	37				13	4

At night, there were most hauls with 300 m.w., but highest average of spec. per haul with 500—800 m.w. The nos. of individuals decrease upward and down; the fact that the only haul with 65 m.w. (duration 15 min.) yielded 3 spec. i. e. 12 per hour must doubtless be accidental.

In the daytime, it was taken especially with 1400—2000 m.w., but there are 4 hauls with 300—400 m.w. not taken nearer the surface than this. (Both KEMP 1908 (1910) and MURRAY & HJORT (Depths of the Ocean 1912, p. 668) however, note a few specimens taken by day quite close to the surface; so also KEMP 1907).

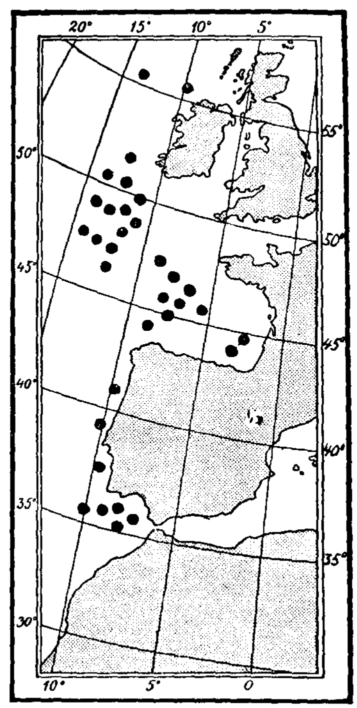

Chart 6. Systellaspis debilis. Positive stations.

On endeavouring to separate out the hauls according to season, geographical area (N. or S. of 40° N) and size of specimens, it was found that the species keeps to the same depth at all seasons and throughout the whole area, while the individuals are evenly distributed between the limits noted, without regard to size.

Murray & Hjort l. c. p. 668 record 264 spec. taken by the "Michael Sars" exped., 170 at night, 94 by day. At night, 57 spec. were taken at a depth of 100 m., 74 at 150 m.; the "Thor" maximum, then, lies somewhat deeper. In the day time, the "Michael Sars" took 16 spec. at 150 m, 20 at 300 and 29 at 500 m. depth; the remaining specimens were distributed, a few in each depth.

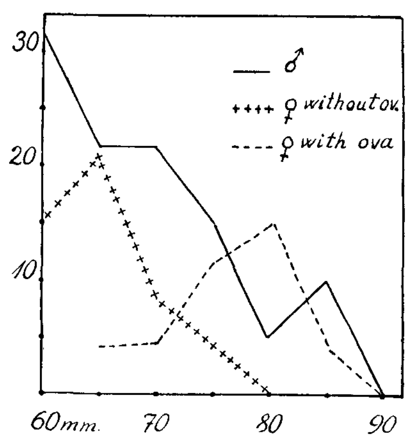

Fig. 16. Sizes of Systellaspis debilis.

Shoals can occur, though each haul as a rule only contains a few specimens; hauls of a couple of hours' duration, however, may bring up 41—50 spec. The large numbers are almost always chiefly composed of small specimens; of large ones, each haul has generally only a few.

Size and propagation. For sex difference in the pleopoda *vide supra* p. 43. Another method of determing sex is to examine a triangular process situate on the ventral side behind the 5. pair of legs, with its point turned forward; in the male, it is about as long as broad, reaching only to the posterior margin or at the outside, to face the middle of the genital aperture (which last, by the way, is not always easily discernible) or abt. $^1/_6$—$^1/_8$ of the distance to p. 4. In the ♀ on the other hand, the progress in question is nearly six times as long as it is broad at the base, and can reach as far as p. 4.

Of specimens determined as to sex (over abt. 50 mm.) there were somewhat more ♂ than ♀, 117 and 98 respectively.

Taking the specimens over 55 mm., we have altogether 104 ♂ and 87 ♀ (50 without ova, 37 with). The largest individuals of both sexes are 87 mm. (1 ♂, 2 ♀) (Fig. 16). Male and female then grow to equal size, though there are somewhat more ♂ than ♀ over 80 mm. It will be seen that nearly all the largest ♀ have ova, which suggests either that they only spawn once, or that they do not grow to any degree after the first spawning.

The female attains maturity at a smaller size than the male; in some few specimens (54, 58, 60, 63, 63, 70 mm.; St. 93, 1905, 300 m.w.; st. 36 1906) 800 m.w., st. 66, 1909, 300 m.w., st. 231 1910, 1200 m.w., a couple of spermatophores are discernible outside the genital aperture. In a considerable number of specimens of like size, the spermatophores can be seen through the skin, situate inside the vas deferens.

South of 40° N, at any rate, females with ova have been found at nearly all seasons when the species was taken at all; we have 30 ♀ from Feb., March, June and Sept. North of 40° N, 70 ♀ with ova were found in those months in which collections were made; June, August, September. Females with ova are evenly distributed throughout the water layers where the species is found.

Distribution.

1. Atlantic. Especially N. Atlantic from S. Iceland to Bahama Islands and Canarian Islands. — S. of Iceland 62°47′ N, 15°03′ W, 1950 m., 1500 m.w. (H. J. Hansen 1908). — 36°5$^1/_2$′ N, 69°51$^3/_4$′ W, 2512 fms, 1 ♀ ovig. (Smith 1885 [1887]). — 34°28′25″ N, 75°22′50″ W, 1632 fms, 1 spec. (Smith 1882). — Bahama Channel, 500 fms. (Milne-Edwards 1881). — Old Bahama Channel, 428 fms., 1 spec. (Faxon, Bull. Mus. Comp. Zool. vol. 30, 1896, p. 163). — N. Atlantic, 264 spec. (Murray & Hjort 1912). — W. and S. W. Ireland, several spec. (Kemp 1905 [1906] and 1908 [1910]). — Bay of Biscay, surf. — 25 m., 1 ♂ 67 mm. (Kemp 1907). — 36°46′ N, 26°41′ W, 0—3250 m., 3 spec. (Coutière 1905). — 39°26′ N, 42°40′ W, 0—2000 m.; 38°04′ N, 26°07$^1/_2$′ W, 0—3000 m.; 37°17′ N, 19°10′ W, 0—3000 m.; 33°41′ N, 36°55′ W, 0—3000 m.; 33°07′ N, 15°49′ W, 0—1000 m.; 31°42′ N, 42°40′ W, 0—2000 m.; 31°38′30″ N, 42°38′ W, 0—2000 m. (Coutière 1906). — 36°—45° N, 11° W, 200 spec. (Coutière, 1911, p. 157). — 28°42′ N, 34°33′ W, 3000 m.; 17°28′ N, 29°42′ W, 3000 m.; 35°39′ S, 8°16′ W, 3000 m. (Lenz u. Strunck, 1914, p. 327).

2. Pacific. Kauai Islands (Hawaiian Isl.), 478—453 fms., 1 spec. (Rathbun 1906, p. 922).

4. SYSTELLASPIS DENSISPINA n. sp. (Fig. 17).

St. 190. > 4000 m. 46°30′ N, 7°00′ W. 11-9-1906. 2700 m.w., 8^{25} am, 150 min. 1 ♀ 89 mm.

Rostrum abt. 8 mm. (the outermost apex is lost), carapace without rostrum 19 mm. (measured as shown by Kemp 1906, textfig. 1).

Carapace somewhat compressed, not carinate dorsally. Rostrum $^2/_5$ as long as the carapace, straight, triangular seen from the side, laterally compressed, continued on the carapace with a carina somewhat shorter than the rostrum itself. The outermost apex is lost. On the dorsal edge 11 teeth, of which 4 on the carapace; ventrally 3 teeth. The branchiostegal spine prominent, directed forward and a little outward; it has a little, blunt carina. The eyes are not much wider than the eye-stalks, pyriform, with a rather great tubercle at the inner (median) side. The eye-colour is black.

Antennal scale is a little more than $^2/_3$ as long as the carapace (13.5 to 19 mm.), 4 times as long as broad, with a little apical spine.

An exopod at all the pereiopoda. P. 3—p. 4 of equal length, abt. $1^1/_2$ time as long as p. 5; when stretched forward they pass the apex of the antennal scale.

The median angle of the antero-lateral margin of epimeral parts of the first abdominal segment is blunt, of the same shape as in *S. debilis* (Kemp 1906, Pl. 2 fig. 4).

No dorsal carina on the abdomen except on the third segment which has a long stout dorsal spine. 4.—5th segments have a very little dorsal spine, but no such is found in the 6th segment. The form of the hind edge of the epimeral parts of these segments may be seen from my fig., note especially the incision and tooth at the lower hind edge of segment 5. Segment 6 is twice as long as segm. 5 (respectively 15 and 8 mm.).

The telson is a trifle longer than 6th segment, 17 mm. It has about the same form as in *S. debilis* (Kemp 1906, Pl. 2 fig. 7), but is somewhat more slender. The apex is tongue-shaped with 8—9 spines at each side; the outer most part is damaged. Laterally of the base of the apex are a pair of spines, half as long as the apex. The distal two thirds of the telson are densely trimmed with spines in two rows (— from this the specific name *densispina* —): the one at the ventral edge, the other row a little more dorsally. Between the spines in the lower row some fine setæ may be seen.

Outer ramus of the uropoda is of abt. the same length as the telson, inner ramus somewhat shorter.

On colour or luminous organs no information can be given.

Affinities. In the shape of the rostrum, it resembles at a first glance *A. curtirostris*, but is easily distinguished from this species inter alia by the long p. 3—p. 4 (in *A. curt.* equal in length to p. 5) by the much longer spine on 3. abdominal segment and the close arrangement of spines on the telson (*A. curt.* has 9—10 pairs of sub-marginal spines + 5 pairs of somewhat longer apical spines) as also by the fact that the telson terminates in a tongue-shaped end section.

This species is perhaps identical with *S. echinurus* Coutière (1911, p. 158) but the description of this latter

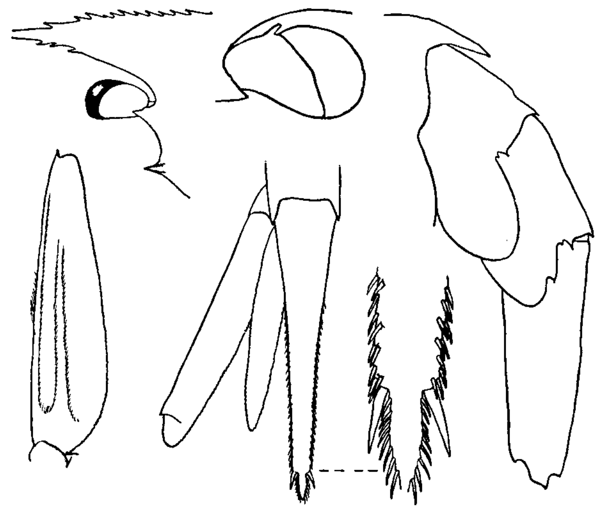

Fig. 17. Systellaspis densispina. Rostrum, eye (the right one, seen partly from the dorsal side, partly from the lateral side), antennal plate, the last abdominal segments, and caudal fan.

is so brief that there are in reality only two specific characters (the others are generic characters) viz. "son rostre est court" and the specific name "*echinurus*" which, however, is not justified by the text. Both these characters would, it is true, apply to the "Thor" spec. while the locality also is the same, (36°—45° N, 11° W); this is, however, too slight a foundation to warrant out classing them as identical.

That it belongs to the genus *Systellaspis*, not *Acanthephyra*, is altogether beyond doubt, especially from the large, tongue-shaped terminal section of the telson.

Genus **Ephyrina** Smith.

Ephyrina Smith 1885, p. 68.
Tropiocaris (partim) Bate 1888, p. 834.
Ephyrina Alcock 1901, p. 83.

Of the genus *Ephyrina*, only 2 species are hitherto known, and these two are closely allied: *E. Hoskyni* Wood-Mason, and *E. Benedicti* Smith, both described and figured by Kemp 1910, p. 68—72, Pl. 7, where also the literature is noted. They are chiefly distinguished one from the other by the shape of the rostrum, and by the lack (*E. Hoskyni*) or presence (*E. Benedicti*) of a spine on the 3. caudal segment. These characters, however, seem to apply only to large specimens, over abt. 50 mm. Kemp 1910, describes a small specimen, 24 mm., which he refers to *E. Benedicti* from the rostrum, but it lacks the tooth on the 3. caudal segment; Kemp considers that the lack of this tooth is due to the youth of the specimen.

This genus is represented in the "Thor" material by 3 small specimens of *E. Benedicti*, besides a large specimen which is certainly nearly related to the two known species, but should nevertheless probably be taken as the type of a new species.

1. EPHYRINA BIFIDA n. sp. (Fig. 18).

St. 75. 4000 m. 45°37′ N, 7°03′ W. 9-3-1909. 4300 m.w., 1^{45} pm., 120 min. 1 ♂ > 101 mm.

The specimen here in question is highly defective; it lacks the flagellum in both pairs of antennæ, and also the tip of the antennal plate, as well as p. 4—p. 5 and the point of the telson and of the outer ramus in the uropoda. The similarity to the two known species is, apart from what is stated above, so striking that there is no occasion to give a description of the entire animal.

Rostrum 5 mm., carapace 27 mm., abdomen (from anterior margin of 1. abdominal segment) 66 mm.

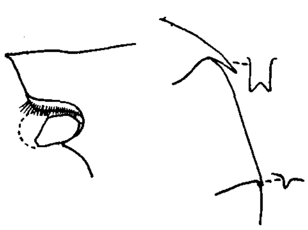

Fig. 18. Ephyrina bifida. Rostrum and eye, and dorsal teeth of 3.—4. abdominal segment.

The rostrum is of the same shape as in Kemp's spec. of *E. Hoskyni* (Kemp 1910, Pl. 7 fig. 1) save that there is a small apical point, and the length is somewhat greater, reaching probably to about the extreme end of the cornea of the eye, but this cannot be stated exactly, as the outermost part of the eye is altogether destroyed. On the inferior margin of the rostrum, there is a furrow on either side, each apparently designed to accomodate one eye; the very thin upright partition between these furrows is furnished with bristles. This formation in the inferior margin of the rostrum is not described in any of the other species. The eyes are very badly damaged, but seem to have been shorter and heavier than in the other species.

Dorsal side of abdominal segments evenly rounded. The 3. segment is drawn out dorsally into a horizontal, plate-like process, bifid for the last third of its length (hence the specific name) and abt. $^1/_3$ the length of the segment in question; the edges are very slightly upturned. No such process is found in the other species; in *E. Hoskyni*, there are indeed no teeth on the caudal segments, while *E. Benedicti* has a single on the 3. caudal segment, at any rate in the two largest known specimens (56—57 mm.) and also in 2 spec. from the "Thor" (see below) of 27 and 33 mm. A single small tooth is found on the back of the 4. caudal segment; nothing of this sort is known at all in the other species. Kemp (1910, p. 71) presumes that both rostrum and teeth on 3. caudal segment are subject to variation, but we know very little of the species here concerned. Only 7 specimens in all of *E. Hoskyni* are known, 8 of *E. Benedicti*. (Besides the spec. mentioned by Kemp 1910, we have, besides the 3 spec. from the "Thor", of *E.Benedicti*, also a further 3 spec. — 1 of *E. Hoskyni*, 2 of *E. Benedicti* — mentioned without further description by Coutière 1911, p. 157).

It is surely quite out of the question that the present spec. should be identical with *E. Hoskyni*, for the largest specimens of this species described in literature (87—110 mm.) are of the same size as the spec. from the "Thor" and differ, then, in lacking altogether the tooth or process on the 3. caudal segment. On the other hand, it is not quite impossible that the "Thor" spec. might be *E. Benedicti*. Only 3 specimens of this species have been described, (apart from the 3 mentioned below from the "Thor"), and these are at the outside barely half the size of the "Thor" spec. 24 mm. (Kemp), 20—33 mm. ("Thor"), 56 mm. (Smith) and 57 mm. (Bate). The two smallest of these specimens have no tooth at all on the 3. caudal segment, the others, however, have one, but it is not bifid. Though it is hardly impossible that a single tooth, in the case of smaller specimens, might be found bifid in one of about double the size, it still seems to me best for the time being to maintain the "Thor" spec. as a distinct species.

Telson slightly longer than 6. caudal segment (over 16 mm., as against 14.5 mm.) but lacking the tip; the preserved portion has 6 pairs of lateral spines.

That the specimen is a male is seen from the inner ramus of up. 1, which is of similar shape to that of *Acanthephyra purpurea* (see p. 43) but the stylet is quite short.

2. EPHYRINA BENEDICTI Smith (Fig. 19).

Ephyrina Benedicti Smith 1884, p. 506, no fig.
— — — 1886, p. 674, Pl. 14 fig. 3, Pl. 16 fig. 4.
Tropiocaris planipes Bate 1888, p. 835, Pl. 136 fig. 1.
Ephyrina Benedicti Kemp 1910, p. 71, Pl. 7 fig. 7.

St. 76. > 2600 m. 49°27′ N, 13°33′ W. 11-6-1906. 2800 m.w., 3^{00} pm., 120 min. 3 spec.: abt. 20, 27, 33 mm.

Though the determination of the smallest specimen is, owing to its size, not quite certain, I have, from the presence of the tooth on the 3. caudal segment,

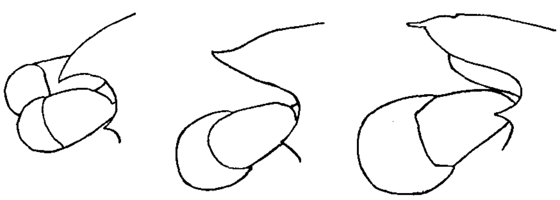

Fig. 19. Ephyrina Benedicti (St. 76, 1906). Rostrum and eye of specimens 20, 27 and 35 mm. in length respectively.

no hesitation in the case of the two larger ones. The smallest specimen hitherto described is probably 24 mm., and lacks the tooth mentioned (Kemp 1910).

The largest spec. from the "Thor" has a distinct tooth on the 3. caudal segment; the rostrum reaches only to the middle of the cornea. The remarkable shape of the rostrum (see fig. 19) is due to the fact that the animal is still soft after moult; on either side of the lower margin there is, as in *E. bifida*, a furrow for partial accomodation of the eyes. The middle specimen has only a very small tooth on 3. caudal segment; the rostrum here reaches to the commencement of the cornea. The smallest specimen has the rostrum markedly bent outward; it hardly reaches as far as the cornea. No tooth on 3. caudal segment, and the 4. segment in p. 3, p. 4 is considerably narrower than in the larger spec.

A curious feature is the change which takes place in the eye as the animal increases in size. In the smallest spec., the cornea is not much larger on the lateral than on the median side, and the diameter is only slightly greater than that of the stalk. This stage seems to answer to that shown by Kemp (1910 fig. 7). On the two larger specimens, the diameter of the cornea is much larger than that of the stalk, and the obliquity of the cornea is also greater, the median side reaching farther down the stalk than the lateral.

In all three specimens, the lateral side of the cornea is (in spirits) light grey in contrast to the whole remaining part, which is a blackish brown.

Distribution. 1. Atlantic. 40°26′40″ N, 67°5′15′ W, 959 fms., 1 spec. (Smith). — 50°28′ N, 11°39′ W, 0—700 fms. w., 1 spec. (Kemp). — 36°—45° N, 11° W, 2 spec. (Coutière 1911, p. 157).

2. Pacific. 26°29′ N, 137°57′ E, 2425 fms., 1 spec. (Bate).

Genus Hymenodora G. O. Sars.

Hymenodora G. O. Sars 1877, p. 340.
— — Norske Nordhavs-Exp. 1885, p. 35.
— (partim) Bate 1888, p. 838.
— de Man 1920, p. 46 (list of species).

1. HYMENODORA GLACIALIS Buchh.

(non H. gracilis Smith).

Pasiphaë glacialis Buchholz 1874, p. 279 Pl. 1 fig. 2.
Hymenodora — G. O. Sars 1877, No. 24.
* — — — 1885, p. 37, 275, Pl. 4.
— — Smith 1886, p. 678, Pl. 15 fig. 3, 10, Pl. 16 fig. 5.
— — (partim) Faxon 1895, p. 169.
— — Rathbun 1904, p. 27.
— — H. J. Hansen 1908, p. 79.
— — (partim) Kemp 1910, p. 72 Pl. 8.
non — — Lenz u. Strunck 1914, p. 331.

St. 164. 1900—2150 m. 62°10′ N, 19°36′ W. 12(13)-7-1903. 1 spec. 47 mm.

This specimen is rather small in comparison with the maximal sizes noted in the literature: 68 mm. (H. J. Hansen 1908), 83 mm. (Sars 1885).

A female from the "Ingolf" exped. (locality?) abt. 56 mm., has ova, these measuring abt. 2 × 2.5 mm. The ova, abt. 30 in number, form a compact mass; the separate ova do not appear to be arranged in any regular order (cf. *H. gracilis*, infra). A fig. in Sars (1885, Pl. 4 fig. 2, copied by Kemp 1910, Pl. 8 fig. 1) shows a far greater number of ova. From the measurements given, the animal itself is 58 mm.; the ova of the same dimensions as in the spec. from the "Ingolf".

Colour an intense red, the eyes with a faint golden sheen. (Grieg 1914, p. 19).

Distribution. This species is often combined with *H. gracilis* (infra No. 2) so that we cannot always see from the literature whether one or the other is meant. The distribution, however, would seem to be as follows:

1. Atlantic. The species is bathypelagic and lives at great depths, over 1000 m. below the surface; as a

rule with negative temp. Its principal area seems to be the Norwegian Sea, whence it is recorded by numerous writers, for the rest, it is found N. of a line drawn thus: E. America 37°12$^1/_3$′ N, 69°36′ W, 2949 fms. (Smith 1886 p. 678 = Smith 1882, p. 502 partim) then S. Iceland 62° N, ("Thor" st. 164, 1903) Færoe Channel abt. 60° N, (Norman 1882, p. 684) and S. W. Ireland (Kemp 1910, p. 73: "the podobranch on the second maxilleped . . . in many cases is totally absent" which is precisely the distinguishing character of this species in contrast to *H. gracilis*). From localities south of this boundary line it has hardly been noted with certainty, being apparently here represented by *H. gracilis.* A more detailed list of localities is given in H. J. Hansen 1908, p. 79, 80 and Rathbun 1904, p. 27; since when some further finds have been added from the waters off S.W. Norway (Wollebæk 1908, p. 73, and Grieg 1914, p. 19) — (Kemp 1907, see *H. gracilis*).

2. Pacific. The following localities: Bering Sea S. of Pribylof Is. 1401 fms. and E. of Prince of Wales Is. Alaska 1569 fms. (Rathbun 1904, p. 27) probably refer to this species.

On the other hand, Faxon 1895, p. 168 notes some specimens from the following 4 localities considerably farther south: Gulf of California 25°29$^1/_2$′ N, 109°48′ W, 1218 fms. and 27°34′ N, 110°53$^2/_3$′ W, 905 fms.; S.W. of Panama 7°21′ N, 79°2′ W, 1832 fms. and W. of Ecuador 1°7′ N, 84° 4′ W, 1740 fms. These localities are noted again by Rathbun 1904, but despite the fact that H. J. Hansen (1908, p. 80) takes it for granted that the determination is correct, it is nevertheless evident from Faxon's text that at any rate 25°29$^1/_2$′ N, gave both *H. glacialis* and *H. gracilis,* and that 7°21′ N, gave only *H. glacialis* (Faxon states nothing as to the spec. from the two other localities) On geographical grounds however, it seems very doubtful whether the true *H. glacialis* would be found in these localities; it would be of importance to have the specimens subjected to revision.

2. HYMENODORA GRACILIS Smith.

Hymenodora gracilis Smith 1886, p. 681, Pl. 12 fig. 6.
— *glacialis* (partim) Faxon 1895, p. 168.
— — (partim) Kemp 1910, p. 72.
— — Lenz & Strunck 1914, p. 331—34, texfig. 5.
— *gracilis* Murray & Hjort 1912 p. 668.

Atlantic.

St. 76. > 2800 m. 49°27′ N, 13°33′ W. 11-6-1906. 2800 m.w., 9^{45} pm., 30 min. 28 spec.: 3 spec. abt 10 mm., 24 spec. 15—30 mm., 1 ♀ with ova 34 mm. — **St. 190.** >4000m. 46°30′ N, 7°00′ W. 11-9-1906. 2700 m.w., 8^{25} am., 150 min. 5 spec. (1 ♀ with ova 35 mm.), 34—38 mm. — **St. 75.** >4000m. 45°37′ N, 7°03′ W. 9-3-1909. 4300 m.w., 1^{45} pm., 120 min. 3 spec.: 42, 47, 57 mm.

From the shape of the rostrum, the determination is altogether certain, and confusion with *H. glacialis* is out of the question.

The species is generally confused with *H. glacialis,* to which it is closely allied; it may be distinguished, however, *inter alia*, by the very long rostrum, and in having a podobranch on the second maxilliped. It seems to be smaller, max. 57 mm. ("Thor" st. 75, 1909) the largest specimen mentioned in lit. is 55 mm. (Smith 1886) Females with ova are 34—35 mm. ("Thor") as against 58 mm. for *H. glacialis* (Sars 1885, pl. 4 fig. 2).

The colour, too is different, being here orange, with brown eyes (Murray & Hjort 1912, p. 668).

One station (St. 76, 1906) lies S. W. of Ireland, the two others (St. 190, 1906 and St. 75, 1909) are in the Bay of Biscay. Depth to bottom very great, over 2800—over 4000 m. length of wire 2700—4300 m.w. In one haul at any rate it was certainly taken pelagically (St. 190) the length of line being considerably less than the depth to bottom.

Shoals can occur: St. 76 gave 28 in a single haul. A female of 38 mm. from st. 76, 1906 had ova. Compared with the size of the animal itself, the eggs are enormous: 2 × 2.5 mm. Though it can be seen that none have fallen off, the ova are only 7 in number, and placed in a particular manner, filling the space in the curve of the body. On either side, immediately under the belly, there is 1 egg between plp. 1—2 and plp. 2—3, making 4 in all. Behind and outside the interval between the two hindmost eggs there is another single one touching the ventral side. Of the two remaining eggs, one is placed ventrally to the interval between the four above mentioned, in front; the last one is placed in front of, but ventrally to, the interval between the two foremost "paired" eggs. — A female from St. 190 also had ova, but had lost most of them, only 2 remaining.

Distribution. 1. Atlantic. There can be no doubt that this species takes the place of *H. glacialis* S. of the line noted under that species, there being, however, a mixed area at the boundaries, at any rate as regards E. America and S. W. Ireland. In the Norwegian sea it is not found.

The distribution can be stated as follows: E. America 10 spec. from 9 localities 35°45$^1/_2$′—40°26$^2/_3$′ N, 67°05$^1/_4$′—74°31$^1/_2$′ W, 861—2949 fms. (Smith 1886, p. 681 = 1882, p. 502 partim). For S. W. Ireland and the Bay of Biscay see "Thor" supra. — W. of Ireland both species are found, specimens being noted both with and without podobranch on the 2. mxp. (KEMP 1910, p. 73). — KEMP 1907, p. 213, mentions some macerated fragments from the Bay of Biscay 2000—15000 fms. which he with a (?) refers to *H. glacialis*; owing to the locality, there can hardly be any doubt that they are in reality *H gracilis.*

The only material of any extent recorded in the literature was taken by the "Michael Sars" between Europe and Newfoundland (precise locality not stated; see MURRAY & HJORT 1912, p. 668). It includes in all 221 spec. taken both day and night at a depth of from 750 to over 1500 m.; in the daytime, it was found almost exclusively at 1000—1500 m. (151 out of a total, 160 spec.); at night at the same depths, most numerous however, at 1500 m. below the surface.

Much farther south it has only been taken at 5°27′ N, 21°41′ W, 800 m., 1 spec. 31 mm. (LENZ & STRUNCK 1914).

2. Pacific. FAXON 1895 see under *H. glacialis.*

Genus **Notostomus** M.-Edw.

Notostomus A. Milne-Edwards 1881, p. 7.
— — 1883[1], Pl. 19, 40.
— Smith 1884, p. 377.
— — 1886, p. 676.
— Bate 1888, p. 824.
— Faxon Bull. Mus. Comp. Zool. 24, 1893, p. 207.
— — 1895, p. 170.
* — Kemp 1913, p. 65 (key to the species).
— Lenz u. Strunck 1914, p. 330.
— de Man 1920, p. 46 (list of species).

MURRAY and HJORT 1912, p. 585—86 mention that 13 species are known representing in total 15 specimens; but that the "Michael Sars"-Exped. has 19 specimens representing 5 species, of which 4 new to science; fig. 425 (p. 586) is a new species.

KEMP 1913, p. 66 gives a key to the species; later on a new species is described (*N. atlanticus* Lenz & Strunck see below).

The species are:

1. *N. elegans* Milne-Edwards 1881, p. 8.
   - — — 1883.
   - — Coutière 1911, p. 157.
2. *N. gibbosus* Milne-Edwards 1881, p. 7.
   - — — 1883.
3. *N. vescus* Smith 1886, p. 676 (no fig.).
4. *N. robustus* Smith 1884, p. 377, Pl. 7 fig. 2.
   - — — 1886, p. 676, Pl. 12 fig. 5.
5. *N. patentissimus* Bate 1888, p. 826, Pl. 133 fig. 1-2.
6. - *Murrayi* — p. 829, Pl. 134 fig. 3.
7. *N. longirostris* — p. 833, Pl. 135 fig. 4.
8. *N. perlatus* — p. 831, Pl. 124 fig. 2.
   =?*N. brevirostris* — p. 832, Pl. 134 fig. 4 (teste KEMP 1913, p. 65).
   N. perlatus Kemp 1913, p. 66, Pl. 7 fig. 10.
9. *N. Japonicus* Bate 1888, p. 830, Pl. 135 fig. 1.
10. *N. Westergreni* Faxon 1893, p. 208.
    - — — 1895, p. 171, Pl. F (cold. fig.).
    - — Stebbing 1910, p. 110.
11. *N. fragilis* Faxon 1893, p. 207.
    - — — 1895, p. 170, Pl. 44 fig. 2.
12. *N. atlanticus* Lenz u. Strunck 1914, see below.

?13. *N. corallinus* Milne-Edwards 1883, Pl. 32. ("Does not seem to be correctly referred to this genus" [KEMP 1913, p. 66]).

[1] I have not had access to this paper.

1. NOTOSTOMUS ATLANTICUS Lenz u. Strunck. (Fig. 20).

Notostomus atlanticus Lenz u. Strunck 1914, p. 330—31 (no fig.).

St. 69. > 3500 m. 36°13′ N, 9°44′ W. 28-2-1909. 3000 m.w., 6^{30} pm., 60 min. 1 ♂ > 107 mm.

Despite the fact that the rostrum is minus its tip, it must evidently have been very long; the portion preserved (from base of the eye-socket) is itself more than half the length of the carapace. Besides the point of the rostrum, most of the flagellum of the antennæ is missing, as also the point of the telson; otherwise, the specimen is extremely well preserved.

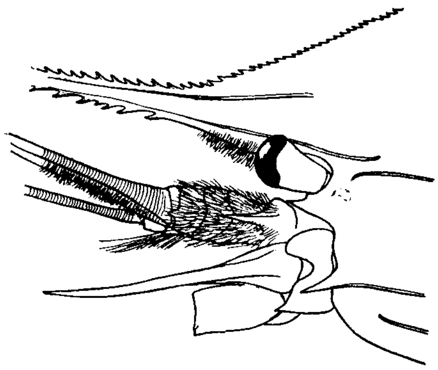

Fig. 20. Notostomus atlanticus.

Measurements: rostrum over 20 mm. (apex lost). Carapace (from the eye to the hind edge) 36 mm. Height of carapace 25 mm. Abdomen + telson over 55 mm. telson over 15 mm. (apex of telson lost).

According to KEMP's key to the species (KEMP 1913, p. 67) the species must be determined as belonging to the group comprising *N. patentissimus*, *N. Westergreni* and *N. longirostris*; since Kemp's writing of this, however, a new species has been added, namely *N. atlanticus*.

The specimen from the "Thor", however, has a character which would certainly seem to be of great importance, in the lateral carina on either side of the rostrum between the dorsal carina and the two ventral ones, which run out to the post-orbital carina. Such lateral carina is probably found only in *N. Westergreni* and *N. atlanticus*. According to Kemp's "key", the present specimen might belong to *N. Westergreni*, this, however, is out of the question, from the fact that the longitudinal carina between the post-orbital and post-antennal carina in *N. Westergreni* lies abt. midway between the two carinæ, whereas in our specimen here it is decidedly nearer the post-orbital, which agrees with *N. longirostris* (indeed, the position and shape of the carinæ on the carapace are altogether as in *A. longirostris* [Bate 1888, Pl. 135 fig. 4]).

It remains then, only to compare it with *N. atlanticus*, and there can be no doubt that it is identical with this species; Lenz & Strunck's description (they give no figure) might, save for the missing parts and the measurements (Thor's specimen is the largest) equally well apply to the "Thor" specimen.

Distribution. 20°41′ N, 31°53′ W, 3000 m.w. 1 spec. 91 mm. (Lenz & Strunck).

Fam. Nematocarcinidæ Bate.

Nematocarcinidæ Sp. Bate 1888, p. 481, 927.
— Alcock 1901, p. 85.
— Stebbing, Edinburgh 1914, p. 296 (synonymy).
— de Man 1920, p. 72.

From the "Thor"-area are only known the species mentioned below.

Genus Nematocarcinus M.-Edw.

Nematocarcinus A. Milne-Edwards 1881, p. 14.
— Alcock 1901, p. 86.
— Kemp 1910, p. 76 (lit. and syn.).
— Stebbing, Edinburgh 1914, p. 297 (with lit. and syn.).
— — S. Africa 1914, p. 43.
— Balss, 1914, p. 22.
— de Man 1920, p. 74 (list of species).

NEMATOCARCINUS ENSIFER Smith.

Nematocarcinus ensifer Kemp 1910, p. 75 (lit. and syn.).

NEMATOCARCINUS EXILIS Bate.

Stochasmus exilis Bate 1888, p. 822, Pl. 132, fig. 14.
Nematocarcinus exilis Calman 1896, p. 7.
— — H. J. Hansen 1908, p. 74.
— *ensifer* var. *exilis* Kemp 1910, p. 75, Pl. 9.
— — — — Lenz & Strunck 1914, p. 330.

On the variety *N. ensifer* (S. I. Smith) var. *producta* Bate see de Man 1920, p. 76 (lit.), Pl. 8 fig. 18, 18 a.

On the larva see below.

Atlantic.

St. 93. 1330—1440 m. 49°25′ N, 12°20′ W. 25-6-1905. 2700 m.w. (Shrimp trawl), 7^{45} am., 120 min. 3 ♀. — **St. 74.** 1220 m. 49°23′ N, 12°13′ W. 9-6-1906. 2500 m.w. (Eel drift-seine), 9^{50} pm., 60 min. 16 spec.: 4 ♂, 12 ♀. — **St. 75.** 1520 m. 49°20′ N, 12°39′ W. 10-6-1906. 2800 m.w. (Eel drift-seine), hour?, 90 min. 61 spec.: 30 ♂, 31 ♀. — **St. 178.** 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w., 9^{05} am., 120 min. 13 spec.: 6 ♂, 7 ♀.

All specimens belong to *N. exilis*, not *N. ensifer*.

The material comprises 93 specimens (40 ♂, 53 ♀) from 4 hauls at 4 stations. All the stations are situate S. W. of Ireland. Depth to bottom 1220—1520 m., disregarding a single station with 4000 m. at which the length of wire out was only 1800; there is no doubt, however, but that the net must have passed bottom at one spot with comparatively slight depth, as the species is undoubtedly not pelagic, but lives on the bottom. A similar instance, albeit less pronounced, is mentioned by Kemp 1910: soundings 800 fms. midwater trawl 750—800 fms. wire.

The ♂ is somewhat smaller than the ♀: 60—70 mm. (one ♂ however, 75 mm.) while the ♀ are 75—80 mm. No females with ova were found. For the larvæ see below.

Distribution of *N. exilis* and *N. ensifer*. In their extreme forms, the two species are well distinguished; there are, however, intermediate forms, whose proper place may be difficult to determine,

In eastern American waters, probably only *N. ensifer* is found, and off S. W. Ireland only *N. exilis* (these are the two localities from which most specimens were taken, and both have yielded extremely large numbers). From this one might suppose that *N. ensifer* was a west-Atlantic form, and the other east-Atlantic. In the Mediterranean, probably both species are found; but if the records in the literature are correct, *N. exilis* is limited to the western basin, while *N. ensifer* is only found in the eastern; a point which is not without interest, since it would seem that only *N. exilis* is found in the eastern Atlantic, and apparently only *N. ensifer* is found in the Indian Ocean. The material at present available is, however, too slight to serve as basis for reliable results.

For further information, see list of localities below.

A. N. exilis.

1. Mediterranean. 41°14²/₃′ N, 8°18′ E, 2145 m., 1 spec.; 40°24³/₄′ N, 7°43¹/₂′ E, 2836—2809 m., several spec.; 38°38′ N, 9°47′ E, 1600 m., 2 spec.; 39°20¹/₂′ N, 13°10²/₃′ E, 3624 m., 3 spec. (SENNA 1903, *N. ensiferus*; but from the measures for the rostrum it is evident that all the specimens are in reality *N. exilis*).

2. Atlantic. S. W. and S. of Iceland, 7 stations, 695—1128 fms., several spec. (H. J. HANSEN 1908). — S. W. Ireland, several spec. (CALMAN 1896, KEMP 1910). — ?Bay of Biscay, *N. ensifer*, CAULLERY 1896. C. mentions "*N. ensifer*" from 3 stations in the Bay of Biscay (46°28′ N, 7° W, 1710 m.; 44°47′ N, 4°33′ W, 1200 m.; 44°39′ N, 4°30′ W, 650 m.). Our Zool. Mus. possesses one (very defective) spec. from one of these localities, and it may be determined as an intermediate form between the two species. — 30°38′ N, 18°5′ W, depth?, 1 spec. (BATE 1888). — 12°11′ S, 6°16′ W, 2000 m., 1 spec. (LENZ & STRUNCK 1914).

B. N. ensifer.

1. Mediterranean. 33°4′ N, 21°15²/₃′ E, 1770 m.; 35°26′ N, 23°18′ E, 2525 m.; 35°59′ N, 25°8′ E, 1838 m.; 34°42′ N, 25°14′ E, 1503 m. (ADENSAMER 1898).

2. Atlantic. E. America 31°41′—41°33¹/₄′ N, 65°51¹/₂′—74°35′ W, 588—2033 fms., several loc., several spec. (SMITH 1882, 1884, 1886). —? Biscaya (CAULLERY 1896, see *N. exilis*). —

3. Indian Oc. Arabian Sea, 5 stations, 824—1200 fms.; Bay of Bengal, 1310 fms. (*N. tenuipes*, ALCOCK 1901).

4. Pacific. 35°11′ N, 139°28′ E, 345 fms., 6 spec.; 34°7′ N, 138°0′ E, 565 fms., 6 spec.; 2°33′ S, 144°4′ E, 1070 fms., 1 spec. (BATE 1888). — 6 stations at Hawaii, 293—1314 m. (RATHBUN 1906, p. 926). — Pacific coasts of America, 19 stations between 0°36′ S and 27°34′ N, 660—1879 fms., several spec.; the typical form is found 0°36′ S to 7°5¹/₂′ N; the specimens from 16°33′ N to 27°34′ N belong to a somewhat obvious race, intermediate forms are found in intermediate localities (FAXON 1895, p. 156).

Larva of ?Nematocarcinus exilis Bate or ?N. ensifer Smith.

Larva allied to *Caricyphus* Sp. Bate, Kemp 1907, p. 213, Pl. 15, fig. 2—8. *Nematocarcinus* sp. juv. (nom. incert.) Kemp 1910, p. 81.

Mediterranean (c. = length of carapace).

St. 115. 2800 m. 38°17′ N, 4°11′ E. 28-6-1910. 300 m.w., 11²⁰ pm., 30 min. 1 spec., c. 6 mm. — **St. 115.** ibid. 2000 m.w., 0³⁰ am., 60 min. 1 spec., c. 9.5 mm. — **St. 116.** 2860 m. 39°27′ N, 5°26′ E. 30-6-1910. 65 m.w., 2²⁰ am., 30 min. 1 spec., c. 4.5 mm. — **St. 116.** ibid. 300 m.w., 1⁴⁰ am., 30 min. 2 spec., c. 5—6.5 mm. — **St. 116.** ibid. 300 m.w., 4⁰⁵ pm., 30 min. 1 spec., c. 6 mm. — **St. 118.** > 2700 m. 41°00′ N. 6°43′ E. 30-6-1910. 65 m.w., 11³⁵ pm., 30 min. 2 spec., c. 5.5—7 mm. — **St. 118.** ibid. 300 m.w., 10³⁵ pm., 30 min. 2 spec., c. 6—7 mm. — **St. 129.** 3430 m. 40°05′ N, 11°31′ E. 12-7-1910. 300 m.w., 3⁴⁰ am., 30 min. 1 spec., c. 11 mm. — **St. 131.** 915 m. 38°36′ N, 11°00′ E. 13-7-1910. 300 m.w., 10³⁵ am., 30 min. 2 spec., c. 8—10 mm. — **St. 131.** ibid. 1000 m.w., 11⁴⁰ am., 60 min. 1 spec., c. 9 mm. — **St. 132.** 1227 m. 38°57′ N, 9°47′ E. 14-7-1910. 300 m.w., 3⁴⁵ am., 30 min. 1 spec., c. 8 mm. — **St. 133.** 600 m. 38°18′ N, 9°59′ E. 14-7-1910. 600 m.w., 9³⁰ pm., 30 min. 1 spec., c. 8 mm. — **St. 143.** 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 300 m.w., 0³⁰ am., 30 min. 1 spec., c. 11 mm. — **St. 204.** > 1000 m. 38°52′ N, 7°43′ E. 27-8-1910. 65 m.w., 4³⁰ am., 15 min. 1 spec., c. 5 mm. — **St. 207.** 2131 m. 40°34′ N, 3°03′ E. 29-8-1910. 1000 m.w., 6⁰⁰ am., 45 min. 2 spec. 3.5—8 mm. — **St. 276.** ("Pangan") > 3000 m. 36°30′ N, 19°20′ E. 4-4-1911. 132 m.w., 11⁵⁵ pm., 35 min. 40 spec., c. 3.5—8.5 mm.

Atlantic.

St. 167. 1160—1300 m. 51°25′ N, 11°50′ W. 26-8-1906. 200 m.w., 10³⁰ am., 120 min. 3 spec. c. 10 mm. — **St. 173.** 390 m. 51°31′ N, 11°37′ W. 30-8-1906. 200 mw., 60 min., 8¹⁵ am., 1 spec., c. 13 mm.

The only certain fact at present known about the development of *Nematocarcinus* is that KEMP 1910 (p. 79 Pl. 9 fig. 9—10) gives a brief description and figure of a Zoea picked out from the ovum. Size is not stated, but since he gives (p. 78) the size of a mature egg as 1.1 × 0.67 mm., the newly hatched larva can hardly be much over 2 mm. long. Shortly before (1907) he had described and figured an older larva from the Bay of Biscay, 15—25 mm., which he referred, in 1910, with some uncertainty, to *Nematocarcinus, inter alia* on account of the branchial formula. Though certainly not of great importance, it might perhaps be further pointed out that the larva taken from the egg has long rostrum and rather pronounced "elbow" on the 3. caudal segment, as in the case as the larger larva, which after all to some extent confirms the presumed relationship between the two.

The larvæ taken by the "Thor" agree entirely with KEMP's description and fig. (KEMP 1910) save for such differences as are due to dissimilarity in size. KEMP's larvæ have a total length of 15—33 mm.; those from the "Thor" on the other hand 10—40 (owing to the marked elbow in the 3. caudal segment, the length can hardly be measured with absolute accuracy, and I have therefore measured the carapace, the length of which is noted in the above list of localities; the carapace, however, seems to be very nearly $^1/_3$ total length.)

Without dissection, the only age differences I have been able to observe were as follows: In the smallest spec., (carap. = 3.5 mm.) p. 5 is entirely lacking; caudal fan already present. When c. is 6 mm., p. 5 is still quite diminutive; pleopoda not yet indicated. When c. is 6.5 mm., p. 5 is somewhat larger, pleopoda indicated, but still quite small, not bifid. Spec. with carapace from abt. 8—9 mm. answer to KEMP's figure. When c. is 11 mm., the pleopoda are considerably larger, but as a rule without natatory setæ; in one specimen, the rostrum is equal in length to the carapace minus rostrum. When c. is 13 mm., natatory setæ have appeared at the point of the pleopoda.

All specimens have exopods on p. 1—4. Eyes (in spirits) pale grey, colourless.

The "Thor" has 63 specimens, of which 59 in the Mediterranean, only 4 in the Atlantic. The 2 Atlantic stations are both S.W. Ireland, all Mediterranean stations in the western basin except 2, which lie between Sicily and Greece. Depth at one station only 390 m., otherwise much greater, as a rule over 1000 m.

Vertical occurrence. At night, it was taken almost exclusively with 65—300 m.w. never nearer the surface, and only 3 times deeper still. In the daytime it keeps practically speaking only to a depth answering to 200—300 m.w. All the larvæ were from end July to end August, save for a shoal of 40 spec. taken in the Mediterranean 4. April.

M. w.	No. of hauls	
	Night	Day
65	3	—
132—200	1	2
300	6	2
600	1	—
1000—1200	2	1

For KEMP's larvæ, the following data are given: Bay of Biscay 50—100 fms. w. (date?) 4 spec. 15—25 mm. (KEMP 1907) S.W. Ireland 80—750 fms. w. 5. Aug—12. Sept. 14 spec. 25—35 mm.

There seems to be no direct relation between vertical occurrence and size, or date and size. As a rule, each haul contained only 1—2 spec., only one haul giving 40 spec.

Palinura (Eryonidea + Scyllaridea).

Eryonidea de Haan.

Eryonidea Stebbing 1910, p. 377 (lit.).

This group comprises only a single family, the *Eryonidæ*, with 4 genera (*Eryoneicus, Polycheles, Stereomastis, Willemoësia*) all of which were found within the "Thor" area. DE MAN 1916, p. 4—6, gives a list of all genera and species.

Depth to bottom great, over 500—1000 m. often even far more than this, up to 4000 m. (see DE MAN 1916, p. 4—6).

The three genera are bottom forms with firm, brittle skin, the fourth (*Eryoneicus*) on the other hand, is bathypelagic with at any rate generally soft skin.

Their deep-sea life is apparent in their external appearance. Eyes colourless and can hardly function; the first established species of the family, *Polycheles typhlops* HELLER 1862, takes its specific name from this fact.

The colour can only be stated in some few cases. *Polycheles sculptus pacificus* is pale rose purple and bluish white, the setæ yellow (see FAXON 1895, p. 123, Pl. C., fig. 1 [col. fig.]) and *Eryoneicus coecus pacificus* is purplish red, the branchial regions livid (FAXON ibid., p. 115, Pl. B., fig. 2 [col. fig.]). ALCOCK 1901 gives the colour for some species of *Polycheles, Willemoësia* and *Eryoneicus*; it is pink or milky white, in *Eryoneicus* also with or without a touch of brown or white. Excellent coloured figures of several species are given by BOUVIER 1917, Pls. 2—4, 7.

Nothing is known as to propagation. SUND (1915) has revived the old hypothesis according to which *Eryoneicus* is taken to be the larval or juvenile form of *Polycheles* (+ *Stereomastis*) which was at once strongly contradicted by BOUVIER (1915). SELBIE (1914, p. 40, Pl. 4, figs. 6—9) describes a mysis stage of *Eryoneicus* sp.

From the "Thor" area we have altogether 11 (10) known species, all of which were also taken by the "Thor" with the exception of the three mentioned below.

Willemoësia leptodactyla Will.-Suhm (BATE 1888, p. 163, Pl. 18—20) is said to have been taken (1 spec.) off the west coast of Sicily (GIGLIOLI in "Nature" vol. 24, 1881, p. 358; Ann. Sic. Nat., ser. 6, vol. 13, p. 5); possibly this record is based on error, since DE MAN l. c. gives its distribution as N. and S. Atlantic 1900 fms.

and West coast of South America 1375—2275 fms., without mentioning any finding of the species in the Mediterranean.

Eryoneicus Puritani Lo Bianco (1903, p. 187—88, Pl. 9, fig. 24; Bouvier 1905 [3], p. 6) has been taken at the following localities: Capri 500 and 1200 m.w., and closing net with 1000 and 1900 m.w., total 5 spec. 5—10 mm., all taken in the middle of the day; 10 am. to 3^{30} pm. (Lo Bianco 1903); Azores surface 1 spec. and Bay of Biscay 1500 m.w. depth to bottom 4780 m. 1 spec. (Bouvier l. c.).

? *Stereomastis nanus* Smith was perhaps taken in the area; but this cannot be stated with certainty, as it was formerly lumped together with *S. Grimaldii* (see Selbie 1914, p. 21—23).

Just outside the limits of the area, another species has been taken, *Eryoneicus Scharffii* (Selbie 1914, p. 35, Pl. 5, figs. 9—12; S.W. Ireland); also *E. Alberti* (Bouvier 1905 [2], p. 645; Bouvier 1905 [4], p. 4; Bouvier, Bull. Inst. Océanogr. Monaco, No. 93, 1907, fig. 36, p. 46; 35°04′ N, 32°11′ W, 0—2000 m., 1 spec.).

Fam. Eryonidæ Dana.

Eryonidæ Stebbing 1910, p. 377 (lit.).
— Selbie 1914, p. 8.
— de Man 1916, p. 1 (with list of all genera and species).
— Pesta 1918, p. 161.
— Bouvier 1917, p. 26.

Genus Eryoneicus Sp. Bate.

Eryonicus Selbie 1914, p. 26 (lit and key to the species).
— Sund, Eryonicus-Polycheles; "Nature", June 3, 1915.
Eryoneicus Bouvier, Observations nouvelles sur le genre Eryoneicus; Bull. Inst. Océanogr. Monaco, No. 309, 1915.
— de Man 1916, p. 6 (list of species, distrib., vertical occurence).
— Bouvier 1917, p. 54 (key to species).

Selbie (l. c.) has given a key to the species known; some alterations, however, must be made in consequence of information since published.

E. hibernicus Selbie is synonymous with *E. spinoculatus* Bouv. (Bouvier 1915, p. 2). Two species have been added since Selbie's list appeared; viz. *E. atlanticus* (Lenz & Strunck 1914, p. 292, Pl. 13, 14) and *E. Richardii* (Bouvier 1915, pp. 6—8).

1. ERYONEICUS SPINOCULATUS Bouvier.

Eryoneicus spinoculatus Bouvier 1905 (3), p. 7 (no fig.).
Eryonicus hibernicus Selbie 1914, p. 29, 33, Pl. 5, figs. 1—2 (*teste* Bouvier 1915, p. 2).
Eryoneicus spinoculatus Bouvier 1917, p. 74, Pl. 3, figs. 5—8 (col. figs.), Pl. 4, figs. 1—12.

St. 75. 4000 m. 45°57′ N, 7°53′ W. 9-3-1909. 4500 m.w., 1^{45} pm., 120 min. 1 spec. 34 mm.

This specimen, though rather soft, is yet considerably firmer-skinned than any of the other species here concerned. Dorsal spines on the abdomen are: 1, (1 +) 1, 2, 2, 2 (+ 1), 1, (2 +) 1 (the figures in brackets denoting very small spines).

Disregarding the peculiarity in the matter of spines on the dorsal side of abdomen, the spec. agrees very well with Bouvier's and Selbie's descriptions.

Distribution. S.W. Ireland, 0—1150 fms., 1 spec., 34 mm. (Selbie). — Terceira (Azores), 2870 m., 1 ♂ 35 mm. (Bouvier).

2. ERYONEICUS RICHARDI Bouvier.

Eryoneicus Richardi Bouvier 1915, p. 6 (no fig.).
— — — 1917, p. 68, Pl. 6, figs. 3—10, Pl. 7, figs. 1—4.

St. 64. 2140 m. 49°17′ N, 14°03′ W. 5-6-1906. 300 m.w., 120 min., 10^{35} pm. 1 spec. abt. 45 mm.

At this station, the "Thor" took a specimen which must be referred to this species, though in certain respects I have been unable to make it agree with Bouvier's description. The specimen is very soft and very hirsute, and was further entirely enveloped in remains of medusæ which clung to the hairs, making it very difficult to clean it even approximately without damage.

Ant. 1 and 2 are not short, as stated by Bouvier, but as long as in the other species. The formula for teeth on the dorsal carina of the carapace agrees; for the reasons stated above, however, I was unable to determine how far this also applies to the other carinæ. P. 3—5 are cheliform, not sub-cheliform; this, however, is possibly only due to difference in size of the specimens. Spines on dorsal side of tail: 1, 3, 3, 3, 3, 2, 1.

Thus, in spite of the fact that various details could not be determined with certainty (especially spines on the carinæ of the carapace, save for the dorsal) I have nevertheless no hesitation in referring the present specimen to this species, especial from the entire agreement with regard to teeth on the dorsal carina of the carapace and lack of teeth on outer margin of 1. joint in the peduncle of ant. 1. All existing species with the exception of *E. Richardi* have 1 or 2 teeth here, possibly, however, with exception of *E. Alberti*, *E. Puritani* and *E. spinulosus*, for which species nothing is stated as to this character; these last three species, however, are out of the question here, from the mere fact of their having an entirely different formula for teeth on the dorsal carina of the carapace.

Distribution. Cap Finisterre in Spain (Monaco St. 3312), 0—3500 m., 1 spec., carapace 15 mm. (Bouvier l. c.).

3. ERYONEICUS FAXONI Bouvier.

Eryoneicus Faxoni Bouvier 1905 (1), p. 482.
— — — 1905 (3), p. 5.
Eryonicus — Selbie 1914, p. 29, Pl. 4, figs. 1—5.
Eryoneicus — Bouvier 1917, p. 78, Pl. 4, figs. 14—15 (col. fig.), Pl. 5, figs. 13—16.

Mediterranean.

St. 129. 3420 m. 40°05′ N, 11°31′ E. 12-7-1910. 3500 m.w., 3^{05} pm., 120 min. 1 spec. 13 mm.

Atlantic.

St. 178. 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w., 120 min., 1 spec. 22 mm.

The arrangement of the median abdominal spines in both specimens is as in the specimen from Ireland, SR 806 (Selbie, p. 32).

Distribution. 1. Mediterranean. SW of the Baleares, 0—2375 m., 1 spec., size? (Bouvier 1905 [2]).

2. Atlantic. SW Ireland, 0—893 fms., 5 spec., 13.5—35 mm. (Selbie). — Off Cap Cantin (West coast of Morocco), 2200 m., 1 spec., 30 mm. (Bouvier 1905 [1, 3]).

4. ERYONEICUS KEMPI Selbie.

Eryonicus Kempi Selbie 1914, p. 37, Pl. 5, figs. 3—8.

Mediterranean.

St. 15. 1000 m. 40°14′ N, 19°06′ E. 22-12-1908. 1400 m.w., 5^{20} am., 60 min. 1 spec. 17 mm. — **St. 115.** 2800 m. 38°17′ N, 4°11′ E. 29-6-1910. 2000 m.w., 0^{30} am., 60 min. 2 spec. 18 mm.

The spines of the median carina of the carapace are arranged as in Selbie's specimens.

The median spines of the abdominal segments are arranged thus: (stat. 15) 1, 2, 2, 2, 2, 1, 1; (stat. 115) 1, 2, (1 +) 2, 3, (1 +) 2, (2 +), 1, (1 +) 1, and 1, 2, (1+) 2, 2, 3, 2, (1 +) 1, 1. (The figures in ( ) indicate very small spines).

Distribution. 1. The species is new to the Mediterranean.

2. Atlantic. SW Ireland, 523—735 fms., 2 spec., 22—25 mm. (Selbie).

Genus Stereomastis Sp. Bate.

Stereomastis de Man 1916, p. 4 (list of species), p. 7 (lit.).
Polycheles (partim) Bouvier 1917, p. 35 (key to Atlantic species).

1. STEREOMASTIS SCULPTA S. I. Smith.

Polycheles sculptus Senna 1903, p. 338 (lit. and syn.).
— — H. J. Hansen 1908, p. 41.
— — Selbie 1914, p. 11, 18, Pl. 2, figs. 1—9.
Stereomastis sculpta de Man 1916, p. 8 (lit. and syn.).
Polycheles sculptus Bouvier 1917, p. 51 (lit. and syn.), Pl. 3, fig. 1 (col. fig.).

Atlantic.

St. 93. 1275—1180 m. 49°25′ N, 12°20′ W. 25-6-1905. 2 spec. 67—70 mm. — **St. 74.** 1220 m. 49°23′ N, 12°13′ W. 9-6-1906. Eel drift-seine, 2500 m.w. 1 spec. 44 mm. — **St. 178.** 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w. 2 spec. 46—55 mm.

The three smallest specimens from the "Thor" are soft, the two largest are hard. All specimens have the formula noted by Selbie for teeth on the median carina of the carapace.

Distribution. 1. Mediterranean. 3 localities SW of Corsica, 2145—2835 m. (Senna 1903).

2. Atlantic. N. Atlantic 62°—abt. 45° N (see H. J. Hansen 1908 and Selbie 1914). — On the "Thor" see above. — S of Madeira 32°32½′ N, 17°02′ W, 1968 m. (Bouvier 1905 [4], p. 4). — See also Bouvier 1917, p. 51.

3. Indian Ocean. See Selbie 1914, p. 20. — 7°28.2′ S, 115°24.6′ E, 1018 m., 1 ♂ 5°40.7′ S, 120°45,5′ E, 1158 m., 1 ♂ (de Man 1916).

2. STEREOMASTIS GRIMALDII Bouvier.

Polycheles Grimaldii Bouvier 1905 (3), p. 4 (no fig.).
— *nanus* var. *Grimaldii* Selbie 1914, p. 21, Pl. 1, figs. 14—15.
Stereomastis Grimaldii de Man 1916, p. 4.
Polycheles — Bouvier 1917, p. 52, Pl. 3, figs. 2—4 (col. fig.).

Atlantic.

St. 78. 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w. 3 spec.: 44, 53, 63 mm.; the largest spec. is a ♀ with ova.

The smallest spec. has 2 spines at the inner angle of the orbital sinus; on the left, the one is shifted markedly over towards the rostrum. A female with ova in our museum ("Ingolf" st. 40, 74 mm.) has 2 spines on the left, only one on the right.

The largest specimen has the following formula for teeth down the back of the carapace: 2, 1, 1, 1, 1, 2, 1; 2, 2, 2. The other specimens have the usual formula (see Selbie). H. J. Hansen 1908 mentions spec. with 3, 4 and 5 unpaired spines just behind the rostrum (N. B., all the specimens of "*Polycheles nanus*" mentioned by H. J. Hansen 1908 from the "Ingolf" really belong to the species *S. Grimaldii*). Females with ova are: 56—74 mm. ("Thor" st. 78; "Ingolf" st. 10, 18, 40, 41, 67, 68, 83).

Distribution. Davis Straits, W, SW and S of Iceland, 695—1435 fms., (all the specimens from the "Ingolf"-Exp., *P. nanus* H. J. Hansen 1908). — SW Ireland, 982 fms. (Selbie). — Numerous localities see Bouvier 1917, p. 52.

The distribution is possibly far wider that this, but the point cannot be decided from extant literature, as the species was formerly lumped together with *S. nana*. For the distribution of *S. nana* (+ *S. Grimaldii*) see Selbie, p. 23; de Man, on the other hand (1916) has altogether overlooked H. J. Hansen's work 1908 on the "Ingolf"-Exped.

Genus Polycheles Heller.

Polycheles (partim) Selbie 1914, p. 9 (lit.).
— de Man 1916, p. 5 (list of species), p. 21 (lit.).
— (partim) Bouvier 1917, p. 34 (key to Atlantic species).

1. POLYCHELES TYPHLOPS Heller.

Polycheles typhlops Selbie 1914, p. 12 (lit. and syn.), Pl. 1, figs. 1—13.
Polycheles typhlops de Man 1916, p. 24 (lit. and syn).
— — Pesta 1918, p. 162 (lit. and syn.), textfig.
— — Bouvier 1917, p. 36 (lit. and syn.), Pl. 2, figs. 1—6 (col. fig.).

Atlantic.

St. 80. 960 m. 51°34′ N, 11°50′ W. 16-6-1906. Eel driftseine, 1900 m.w. 1 spec. 70 mm.

Distribution. 1. Mediterranean. Adria (see Pesta l. c.). — From Sardinia to south coast of Asia Minor (Lo Bianco 1903, p. 250; Selbie, p. 16). — See also Bouvier 1917, p. 37.

2. Atlantic. It was not taken by the "Ingolf" and thus does not appears to go very far north. The outer limits for distribution are $59^1/_2$° N (see below), West Indies (see Selbie) and Cape Verde Islands (Bouvier 1917). Bouvier 1917, pp. 37 and 43 gives numerous localities. — 59°37′ N, 8°49′ W, 1326 m. (*P. intermedius*, Balss, Zool. Anzeiger, vol. 44, 1914, p. 599, teste de Man 1916).

3. Indian Ocean. From the Arabian Sea to the Malabar coast, several loc. 7°15′ S, 115°15.6′ E, 289 m., 1 ♀; 7°35.4′ S, 117°28.6′ E, 521 m., 1 spec. (de Man 1916).

2. POLYCHELES GRANULATUS Faxon.

Polycheles granulatus Selbie 1914, p. 23, Pl. 3 (lit. and syn.).
— — de Man 1916, p. 5.
— — Bouvier 1917, p. 45 (lit. and syn.), Pl. 2, figs. 7—14 (col. fig.).
non Polycheles Beaumontii (?) Stebbing 1908, p. 25, = *P. Beaumontii* (?) Stebbing 1910, p. 377, = *P. Demani* n. sp. Stebbing 1918, p. 28, Pl. 92.

Atlantic.

St. 74. 1220 m. 49°23′ N, 12°13′ W. 9-6-1906. Eel driftseine, 2500 m.w. 1 spec. 44 mm.

P. dubius Bouv. and *P. eryoniformis* Bouv., which were taken together at a st. S. of Madeira, 1968 m., are noted by Selbie and Bouvier 1917 as synonymous with *P. granulatus*, but established by de Man 1916, p. 5, as independent species.

Total length of the spec. from the "Thor" is 44 mm.; carapace is 16 mm. broad, 20 mm. long.

The specimen agrees excellently with Selbie's description but some observations must be made. On the margin of the carapace we find on the right side the following no. of teeth: 8 (incl. the foremost large tooth) 3, 15; on the left side, 7, 3, 15. On the outer margin of the orbital sinus (apart from the large corner tooth), right, 2 teeth, left only 1. Median carina on back of carapace has, from the rostrum, first 5 single teeth, then some granulations; behind the cervical groove there are in the middle 2, 1,2, 2,1 teeth, while in front and behind there are only some granulations.

Distribution (Atlantic, Indian Ocean, Pacific) see SELBIE, p. 25—26, and BOUVIER 1917, pp. 46—47 and 50.

Scyllaridea Stebbing. (Fam. Scyllaridæ + Palinuridæ).

Scyllaridea Pesta 1918, p. 164 (lit. and syn.).
Loricata Bouvier 1917, p. 81.

In addition to the three species which are distributed throughout the whole of the "Thor" area, (*Scyllarus arctus*, *Scyllarides latus*, *Palinurus vulgaris*) 4 others are also stated as found within the limits of that area, viz. *Palinurus Thomsoni* Selbie (1914, p. 43, Pl. 6, figs. 1—2; SW Ireland 212—229 fms.). *Palinurus vulgaris* Latr. var. *mauritanica* Gruvel 1911 (DE MAN 1916, p. 32: Coast of Mauritania from Cape Barbas to a little N of St. Louis, Senegambia), *Panulirus regius* de Brito Capello 1864 (DE MAN 1916, p. 34: West Africa from Cape Barbas to the South of Angola; observed in 1907 off Marseille by DARBOUX and STEPHAN), and *Thenus orientalis* (T.-Lund) Fabr. (see below p. 76). —

In the material, only one species, *Scyllarus arctus*, is represented by adult specimens. We have, however, the Phyllosomæ of 4 species, of which two can be determined with certainty, viz. *Scyllarus arctus* and *Palinurus vulgaris*. The entire developmental series of *Palinurus vulgaris* was previously known; in the case of the commonest Mediterranean form, however, *Scyllarus arctus*, only the first Phyllosoma stages and the natant stage were known. The "Thor" has found all the intermediate stages, so that this species also is now known throughout its entire development from the egg to the adult.

The two other larvæ taken by the "Thor" are referred to *Scyllarides latus* and *Thenus orientalis*; in the remaining species, nothing is known as to development beyond a mention by BOUVIER of the natant stage of *Panulirus regius*, (BOUVIER: Le stade Natant ou "Puérulus" des Palinuridés; Transact. Second Entomol. Congress 1912, pp. 85—87).

Fam. Scyllaridæ Gray.

Scyllaridæ de Man 1916, p. 64 (list of all genera and species).
— Pesta 1918, p. 168 (lit. and syn.).
— Bouvier 1917, p. 98.

Genus Scyllarus Fabr.

Scyllarus de Man 1916, p. 64 (list of all species).
— Pesta 1918, p. 172 (lit.).
— Bouvier 1917, p. 105.

1. SCYLLARUS ARCTUS L.
(= **ARCTUS URSUS** Hbst.). (Chart 7, figs. 21—24).

A. **Full grown stage.**

Scyllarus arctus Pesta 1918, p. 172 (lit. and syn.), text-fig. 56.
— — A. Milne-Edwards, in Cuvier, Règne Animal, Crust., p. 119, Pl. 45, fig. 1.
— — Bouvier 1917, p. 106.

Mediterranean.

St. 149. 75—80 m. 30°30′ N, 19°02′ E. 26-7-1910. Dredge. 1 spec. 32 mm.

B. **Development** (*Phyllosoma* and *Natant-stage*).

Chrysoma mediterraneum Risso, Hist. Nat. mérid. de l'Europe[1], tome 5, p. 88, Pl. 3, fig. 9 (*teste* GUÉRIN 1833).
Phyllosoma mediterranea Guérin 1833, No. 11, Pl. 13, fig. 2.
— — Claus 1863, p. 425, Pl. 25, figs. 2—4 (stage I).
— — Claus 1863, p. 431, Pl. 27, figs. 11—12 (st. VIII).
Scyllarus arctus Dohrn 1870, p. 251—60, Pl. 16, figs. 8—10.
Phyllosoma mediterranea Richters 1873, p. 638 (separate p. 16), Pl. 33, fig. 1.
? — *Raynaudii* Richters 1873, p. 638 (separate p. 16), Pl. 32, fig. 2.
? — *Duperreyi* Richters 1873, ibid., Pl. 33, fig. 3.
(non — — Guérin 1833, No. 9, Pl. 12.
non — *Raynaudii* Guérin 1833, No. 10, Pl. 13, fig. 1).
Scyllarus arctus Hornell, J.: The Phyllosoma a Glass-Crab larva of Scyllarus; Journ. Marine Zool., vol. 1, No. 3, 1894, p. 69—74.[1]
— — Williamson 1915, p. 436, fig. 195.

[1] I have not had access to this paper.

Nisto lævis + *N. asper* Sarato, Etudes sur les Crustacés de Nice, genre Arctus, Dana, sousgenre Nisto Nob.; Le Moniteur des étrangers de Nice, 1er mars 1885[1] (*teste* Bouvier l. c. 1913).

— — — Bouvier 1913, p. 1644, 1647—48.

— — — Bouvier 1917, p. 108, Pl. 10, figs. 1—2, Pl. 11, figs. 1—2.

B. 1: *Phyllosoma.*

Mediterranean.

St. 10. > 2100 m. 37°21′ N, 16°45′ E. 15-12-1908. 65 m.w. 6^{10} am., 15 min. Stage VII, 15 mm. — **St. 10.** ibid. 300 m.w., 8^{00} am., 30 min. Stage VI, 8 mm. — **St. 11.** 3750 m. 36°50′ N, 18°16′ E. 16-12-1908. 25 m.w., 4^{00} am., 60 min. Stage VI, 12 mm.; st. VII, 19 mm. — **St. 11.** ibid. 65 m.w., 5^{25} am., 60 min. St. VII, 19 mm. — **St. 13.** > 1200 m. 39°43′ N, 17°30′ E. 19-12-1908. 15 m.w., 10^{15} pm., 60 min. St. VI, 8 mm.; st. VII, 16 mm.; st. VIII (2 spec.), 23 mm. — **St. 13.** ibid. 300 m.w., 5^{35} pm., 60 min. St. VI, 8 mm.; st. VII, 16 mm. — **St. 14.** 1125 m. 41°24′ N, 17°45′ E. 19-12-1908. 65 m.w., 5^{00} am., 60 min. Stage VII, 15 mm. — **St. 21.** > 500 m. 37°51′ N, 15°21′ E. 5-1-1909. 10 m.w., 11^{50} pm., 30 min. St. VI, 13 mm. — **St. 22.** > 750 m. 38°57′ N, 15°18′ E. 7-1-1909. 25 m.w., 30 min., 8^{00} pm. St. VII, 17 mm. — **St. 26.** 560 m. 40°40′ N, 13°59′ E. 19-1-1909. 65 m.w., 0^{45} am., 60 min. St. VI, 11 mm. — **St. 26.** ibid. 300 m.w., 6^{40} am., 180 min. St. VI, 12 mm.; st. VIII, 21 mm. — **St. 28.** 600 m. 43°53′ N, 13°43′ E. 19-1-1909. 25 m.w., 7^{30} pm., 60 min. St. VII, 18 mm. — **St. 28.** ibid. 400 m.w., 6^{40} pm., 30 min. St. VIII, 23 mm. — **St. 30.** > 1800 m. 41°15′ N, 11°55′ E. 21-1-1909. 65 m.w., 5^{30} pm., 60 min. St. VI, 12 mm.; st. VII, 20 mm. — **St. 31.** 1420 m. 41°44′ N, 10°52′ E. 22-1-1909. 65 m.w., 4^{30} am., 30 min. St. VI, 15 mm. — **St. 33.** 150 m. 43°04′ N, 9°35′ E. 22-1-1909. 65 m.w., 6^{30} pm., 30 min. St. VI, 15 mm. — **St. 38.** > 75 m. 40°45′ N, 9°50′ E. 31-1-1909. 25 m.w., 7^{10} pm., 30 min. St. V, 8 mm. — **St. 39.** 1750 m. 39°41′ N, 10°02′ E. 1-2-1909. 25 m.w., 5^{00} am., 60 min. St. VI (2 spec.), 9-10 mm.; st. VII, 19 mm. — **St. 39.** ibid. 65 m.w., 6^{10} am., 60 min. St. VI, 11 mm. — **St. 58.** 85 m. 36°36′ N 04°24′ W. 20-2-1909. 100 m.w., 2^{00} pm., 30 min. St. VIII, 22 mm. — **St. 59.** 1250 m. 36°02′ N, 4°24′ W. 21-2-1909. 100 m.w., 1^{00} am., 30 min. St. VIII, 22 mm.; st. VII, 15 mm. — **St. 115.** 2800 m. 38°17′ N, 4°11′ E. 29-6-1909. 25 m.w., 1^{40} am., 15 min. St. V (4 spec.), 4.5—5 mm.; st. VI (3 spec.), 7—8 mm.; st. VII, 9 mm.; st. VIII, 19 mm. — **St. 115.** ibid. 65 m.w., 1^{20} am., 15 min. St. V, 6 mm.; st. VIII, 21 mm. — **St. 115.** ibid. 2000 m.w., 0^{30} am., 60 min. St. IV, 4 mm.; st. V (3 spec.), 5—6 mm. — **St. 116.** 2860 m. 39°27′ N, 5°26′ E. 30-6-1910. 25 m.w., 3^{00} am., 15 min. St. V, 5 mm.; st. VI, 11 mm. — **St. 116.** ibid. 300 m.w., 1^{40} am., 30 min. St. VI, 8 mm. — **St. 118.** > 2700 m. 41°00′ N, 6°43′ E. 1-7-1910. 25 m.w., 0^{20} am., 15 min. St. VII (2 spec.), 13 mm. — **St. 118.** ibid. 65 m.w., 11^{35} pm., 30 min. St. VI, 8 mm. — **St. 123.** > 600 m. 44°14′ N, 8°55′ E. 3-7-1910. 10 m.w., 2^{30} am., 15 min. St. V, 6 mm.; St. III, 3 mm. — **St. 123.** ibid. 25 m.w., 1^{50} am., 15 min. St. IV (2 spec.), 3—4 mm.; st. V (2 spec.), 5—6 mm. — **St. 125.** 1082 m. 43°54′ N, 9°13′ E. 9-7-1910. 25 m.w., 10^{30} pm., 30 min. St. III, 2.5 mm.; st. VI (2 spec.), 9—10 mm. — **St. 125.** ibid. 300 m.w., 9^{45} pm., 30 min. St. VI, 9 mm. — **St. 126.** 588 m. 42°43′ N, 9°50′ E. 10-7-1910. 25 m.w., 30 min., 10^{10} pm. St. III, 3 mm.; st. V, 6 mm. — **St. 129.** 3420 m. 40°05′ N, 11°31′ E. 12-7-1910. 300 m.w., 3^{40} am. 30 min. St. IV, 4.5 mm. — **St. 130.** > 3000 m. 39°35′ N, 11°20′ E. 13-7-1910. 25 m.w., 0^{50} am., 30 min. St. VII, 12 mm. — **St. 132.** 1227 m. 38°57′ N, 9°47′ E. 14-7-1910. 25 m.w., 3^{05} am., 30 min. St. V, 8 mm.; st. VI (2 spec.), 10 mm.; st. VII, 12 mm. — **St. 133.** 602 m. 38°18′ N, 9°59′ E. 14-7-1910. 25 m.w., 11^{00} pm., 30 min. St. V (3 spec.), 5 mm.; st. VI, 9 mm.; st. VII (3 spec.), 10—11 mm. — **St. 134.** 350 m. 37°37′ N, 10°17′ E. 15-7-1910. 25 m.w., 4^{50} am., 30 min. St. IV, 3.5 mm. — **St. 134.** ibid. 300 m.w., 5^{40} am., 30 min. St. II, 1.5 mm. — **St. 136.** 80 m. 37°01′ N, 10°31′ E. 19-7-1910. 25 m.w., 3^{10} am., 30 min. St. IV, 4 mm. — **St. 137.** 175—195 m. 37°17′ N, 10°56′ E. 19-7-1910. 25 m.w., 8^{15} am., 30 min. St. IV, 3 mm. — **St. 138.** 788 m. 37°37′ N, 11°25′ E. 19-7-1910. 25 m.w., 9^{50} pm., 30 min. St. III, 2.5 mm.; st. IV (2 spec.), 3—4 mm. — **St. 139.** 580 m. 37°57′ N, 11°54′ E. 20-7-1910. 800 m.w., 3^{40} am., 60 min. St. III, 3 mm. — **St. 141.** 530 m. 36°42′ N, 13°34′ E. 20-7-1910. 25 m.w., 10^{35} pm., 15 min. St. IV, 4 mm.; st. VI, 9 mm. — **St. 142.** 98 m. 35°44′ N, 15°07′ E. 22-7-1910. 150 m.w., 3^{40} am., 30 min. St. IV, 4 mm. — **St. 143.** 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 25 m.w., 1^{20} am., 30 min. St. V (2 spec.), 5—6 mm.; st. VII, 18 mm. — **St. 144.** 3340 m. 34°31′ N, 18°40′ E. 24-7-1910. 25 m.w., 2^{00} am., 30 min. St. V (3 spec.), 5—7 mm.; st. VI (2 spec.), 10—12 mm.; st. VII (2 spec.) 16—18 mm.; st. VIII (2 spec.), 21 mm. — **St. 144.** ibid. 2000 m.w., 3^{45} am., 60 min. St. VI, 9 mm. — **St. 145.** 1925 m. 32°38′ N, 19°02′ E. 25-7-1910. 25 m.w., 3^{30} am., 30 min. St. III, 3 mm.; st. VI (2 spec.), 10—11 mm.; st. VII (3 spec.), 13—18 mm. — **St. 152.** > 2200 m. 33°11′ N, 21°44′ E. 27-7-1910. 25 m.w., 10^{50} pm., 15 min. St. VII, 18 mm. — **St. 154.** 365 m. 32°10′ N, 24°46′ E. 29-7-1910. 300 m.w., 4^{30} am., 30 min. St. VI, 9 mm. — **St. 156.** > 3000 m. 32°24′ N, 26°51′ E. 30-7-1910. 25 m.w., 2^{15} am., 30 min. St. IV, 3 mm.; st. V (5 spec.), 5—9 mm.; st. VI (2 spec.) 10 mm.; st. VII (2 spec.) 14—16 mm. — **St. 156.** ibid. 300 m.w., 3^{50} am., 30 min. St. VI, 9 mm. — **St. 156.** ibid. 600 m.w., 3^{00} am., 30 min. St. VIII, 21 mm. — **St. 158.** 2800 m. 34°23′ N, 27°57′ E. 31-7-1910. 300 m.w., 7^{30} am., 30 min. St. VII (2 spec.), 17—18 mm.; st. VIII, 22 mm. — **St. 160.** > 1000 m. 35°59′ N, 28°14′ E. 1-8-1910. 25 m.w., 2^{00} am., 30 min. St. IV (2 spec.), 3 mm.; st. V (3 spec.), 4—6 mm.; st. VI, 13 mm. — **St. 161.** > 1000 m. 36°12′ N, 27°16′ E. 2-8-1910. 25 m.w., 3^{00} am., 30 min. St. V, (5 spec.), 4—7 mm.; st. VI (3 spec.), 16—17 mm.; st. VII, 19 mm. — **St. 163.** 1180 m. 37°52′ N, 26°22′ E. 3-8-1910. 25 m.w., 1^{35} am., 15 min. St. IV, 3 mm. — **St. 174.** 120 m. 40°54′ N, 28°53′ E. 11-8-1910. 65 m.w., 11^{50} am., 30 min. St. III—V (9 spec.), 3—5 mm. — **St. 175.** 1103 m. 40°48′ N, 27°59′ E. 11-8-1910. 100 m.w., 10^{45} pm., 15 min. St. IV, 4 mm.; st. V, 6 mm.; st. VII (2 spec.), 12—14 mm.; st. VIII (2 spec.), 18—20 mm. — **St. 175.** ibid. 1200 m.w., 0^{25} am., 30 min. St. IV, 4 mm. — **St. 175.** ibid. 400 m.w., 10^{20} pm., 30 min. St. IV, 4 mm.; st. VI, 8 mm. — **St. 176.** > 500 m. 40°45′ N, 27°43′ E. 12-8-1910. 65 m.w., 4^{00} am., 30 min. St. II, 2 mm.; st. III (6 spec.), 3 mm.;

[1] I have not had access to this paper.

st. IV (5 spec.), 4—4.5 mm.; st. V (2 spec.), 6 mm.; st. VI, 7 mm.; st. VII (3 spec.), 12—14 mm.; st. VIII, 18 mm. — **St. 178.** 68 m. 40°16′ N, 26°32′ E. 12-8-1910. 65 m.w., 0^{20} pm., 15 min. St. I, 1.5 mm. — **St. 179.** 85 m. 40°02′ N, 25°55′ E. 13-8-1910. 65 m.w., 2^{15} am., 30 min. St. II, III, IV (18 spec.), 2—4 mm. — **St. 181.** 255 m. 38°49′ N, 25°09′ E. 13-8-1910. 65 m.w., 2^{55} pm., 15 min. St. III, 3 mm.; st. IV, 4 mm.; st. V (2 spec.), 5—6 mm.; st. VI, 6 mm. — **St. 182.** 480 m. 38°13′ N, 24°48′ E. 13-8-1910. 10 m.w., 11^{00} pm., 15 min. St. VI (2 spec.), 8—9 mm.; st. VII, 12 mm.; st. VIII, 20 mm. — **St. 182.** ibid. 65 m.w., 10^{30} am., 15 min. St. V, 5 mm.; st. VI, 9 mm. — **St. 182.** ibid. 600 m.w., 11^{40} pm., 30 min. St. IV, 4 mm.; st. V, 5 mm.; st. VI (4 spec.), 8—10 mm. — **St. 183.** 233 m. 37°52′ N, 23°09′ E. 16-8-1910. 65 m.w., 5^{10}pm., 15 min. St. IV, 4 mm.; st. V, 5 mm.; st. VI, 7 mm.; st. VII, 12 mm. — **St. 183.** ibid .300 m.w., 4^{45} pm., 15 min. St. VIII (4 spec.), 20—21 mm. — **St. 186.** > 3000 m. 37°57′ N, 19°51′ E. 17-8-1910. 65 m.w., 12^{00} pm., 15 min. St. VII (2 spec.), 11—15 mm. — **St. 192.** 652 m. 38°07′ N, 15°35′ E. 20-8-1910. 25 m.w., 8^{40} pm., 15 min. St. V, 5 mm. — **St. 193.** > 100 m. 38°15′ N, 15°39′ E. 21-8-1910. 10 m.w., 0^{50} am., 30 min. St. VIII, 20 mm. — **St. 194.** 1140 m. 38°33′ N, 15°29′ E. 21-8-1910. 25 m.w., 5^{00} am., 15 min. St. VII (2 spec.), 12—17 mm. — **St. 195.** 3160 m. 39°02′ N, 14°55′ E. 21-8-1910. 65 m.w., 6^{50} pm., 15 min. St. V, 5 mm. — **St. 197.** > 1000 m. 40°34′ N, 13°36′ E. 24-8-1910. 25 m.w., 7^{45} pm., 15 min. St. III, 2 mm.; st. V (2 spec.), 5—6 mm.; st. VII (2 spec.), 11—14 mm. — **St. 199.** 2700 m. 39°32′ N, 10°49′ E. 25-8-1910. 1000 m.w., 10^{10} pm., 30 min. St. V, 4 mm. — **St. 202.** 760 m. 38°59′ N, 9°25′ E. 26-8-1910. 300 m.w., 5^{05} pm., 15 min. St. VIII, 19 mm. — **St. 204.** > 1000 m. 38°52′ N, 7°43′ E. 27-8-1910. 25 m.w., 4^{00} am., 15 min. St. VI (2 spec.), 6—8 mm. — **St. 204.** ibid. 65 m.w., 4^{30} am., 15 min. St. IV, 4 mm.; st. V (2 spec.), 5—6 mm. — **St. 204.** ibid. 300 m.w., 5^{00} am., 30 min. St. IV, 4 mm. — **St. 204.** ibid. 1000 m.w., 5^{55} am., 30 min. St. VI, 7 mm. — **St. 205.** 2860 m. 39°16′ N, 5°52′ E. 27-8-1910. 25 m.w., 7^{35} pm., 30 min. St. VI (3 spec.), 7—10 mm.; st. VII (6 spec.), 13—18 mm. — **St. 206.** 2782 m. 39°32′ N, 5°15′ E. 28-8-1910. 25 m.w., 0^{30} am., 15 min. St. V (3 spec.), 5—8 mm.; st. VI (2 spec.), 9—11 mm.; st. VII, 12 mm. — **St. 206.** ibid. 300 m.w., 1^{05} am., 15 min. St. V, 6 mm. — **St. 206.** ibid. 1000 m.w., 1^{40} am., 45 min. St. V, 7 mm.; st. VI (3 spec.), 8—12 mm. — **St. 207.** 64 m. 39°58′ N, 3°41′ E. 28-8-1910. 25 m.w., 8^{40} pm., 15 min. St. I, 1.5 mm.; st. IV, 2.5 mm. — **St. 207.** ibid. 65 m.w., 9^{20} pm., 15 min. St. IV, 3 mm. — **St. 208.** > 1600 m. 40°13′ N, 3°20′ E. 29-8-1910. 25 m.w., 1^{40} am., 15 min. St. V, 6 mm.; st. VI (4 spec.), 9 mm.; st. VII, 15 mm. — **St. 209.** > 2000 m. 40°34′ N, 3°03′ E. 29-8-1910. 25 m.w., 4^{55} am., 15 min. St. V (3 spec.), 6—7 mm.; st. VI, 9 mm. — **St. 209.** ibid. Vertical haul, 75—35 m., 4^{10} pm. St. VI, 8 mm. — **St. 209.** ibid. 100 m.w., 3^{45} pm., 20 min. St. V (2 spec.), 5—6 mm.; st. VI (5 spec.), 7—12 mm. — **St. 209.** ibid. 150 m.w., 4^{25} pm., 20 min. St. V, 5 mm.; st. VI (3 spec.), 8—9 mm.; st. VII (3 spec.), 10 mm. — **St. 209.** ibid. 2000 m.w., 7^{25} am., 45 min. St. VI (4 spec.), 8—10 mm. — **St. 210.** 775 m. 41°10′ N, 2°23′ E. 30-8-1910. 25 m.w., 2^{45} am., 30 min. St. IV—V (40 spec.), 4—7 mm.; st. VI—VII (abt. 60 spec.), 8—13 mm.; st. VIII, 23 mm. — **St. 210.** ibid. 600 m.w., 3^{35} am., 30 min. St. VI (2 spec.), 9—10 mm. — **St. 220.** 375 m. 36°23′ N, 0°43′ E. 4-9-1910. 25 m.w., 2^{15} am., 30 min. St. VIII, 26 mm. — **St. 223.** > 2000 m. 36°13′ N, 1°28′ W. 5-9-1910. 25 m.w., 4^{35} am., 15 min. St. VI, 10 mm.; st. VII, 13 mm. — **St. 223.** ibid. 300 m.w., 4^{55} am., 30 min. St. V, 5 mm.; st. VII (2 spec.), 15—17 mm. — **St. 276** ("Pangan"). > 3000 m. 36°30′ N, 19°20′ E. 4-4-1911. 132 m.w., 11^{55} pm., 35 min. St. IV (3 spec.), 3.5—4 mm.; st. V (5 spec.), 5—7 mm.; st. VI—VII (4 spec.), 11—16 mm. — **St. 277** ("Pangan"). > 3000 m. 33°20′ N, 27°30′ E. 6-4-1911. 11^{35} pm., 35 min., 132 m.w. St. VI, 9 mm.; st. VII (3 spec.), 13—14 mm. — **St. 296** ("Pangan"). > 2000 m. 32°10′ N, 29°50′ E. 25-6-1911. 28 m.w. 2^{30} am., 30 min. St. III, 3 mm.; st. VIII, 19 mm. — **St. 297** ("Pangan"). > 2000 m. 33°10′ N, 25°35′ E. 25-6-1911. 28 m.w. 12^{00} pm., 30 min. St. V—VII (21 spec.), 5—14 mm.; st. VIII, 23 mm. — **St. 298** ("Pangan"). > 2000 m. 34°20′ N, 21°10′ E. 26-6-1911. 38 m.w., 12^{00} pm., 30 min. St. V, 8 mm.; st. VI, 10 mm. — **St. 339** ("Pangan"). > 2000 m. 40°30′ N, 3°10′ E. 20-8-1911. 28 m.w., 3^{00} am., 30 min. St. V, 5 mm.; st. VI, 10 mm. — **St. 340** ("Pangan"). > 2000 m. 35°50′ N, 21°30′ E. 26-8-1911. 28 m.w., 9^{00} pm. St. V—VII (24 spec.), 6—15 mm.; st. VIII (6 spec.), 19—24 mm. — **St. 341** ("Pangan). > 2000 m. 34°0′ N, 26°20′ E. 27-8-1911. 28 m.w., 11^{30} pm., 30 min. St. VI, 12 mm.; st. VIII (2 spec.), 22—24 mm. — **St. 729** ("Nordboen"). 200 m. 41°00′ N, 17°44′ E. 14-4-1913. St. VI, 12 mm.

Atlantic.

St. 190. > 4000 m. 46°30′ N, 7°00′ W. 11-9-1906. 65 m.w., 0^{45} am., 120 min. St. VIII (2 spec.), 19—21 mm. — **St. 8.** > 600 m. 36°33′ N, 7°36′ W. 4-12-1908. 65 m.w., 8^{20} pm., 30 min. St. V, 7 mm.; st. VI (2 spec.), 9—11 mm. — **St. 63.** 490 m. 35°50′ N, 6°03′ W. 22-2-1909. 600 m.w., 1^{15} am., 60 min. St. VII, 13 mm. — **St. 65.** > 1300 m. 35°53′ N, 7°26′ W. 24-2-1909. 25 m.w., 5^{50} am., 30 min. St. VI, 11 mm.; st. IX, 26 mm. — **St. 65.** ibid. 65 m.w., 6^{30} am., 60 min. St. VII—VIII (4 spec.), 16—18 mm.; st. IX (3 spec.), 17—27 mm. — **St. 65.** ibid. 300 m.w., 7^{45} am., 120 min. St. VI (2 spec.), 16—17 mm.; st. VIII, 22 mm. — **St. 65.** ibid. 600 m.w., 10^{00} am., 120 min. St. IX, 20 mm. — **St. 66.** > 735 m. 36°16′ N, 6°52′ W. 25-2-1909. 25 m.w., 0^{05} am., 30 min. St. VII, 18 mm. — **St. 66.** ibid. 65 m.w., 1^{45} am., 60 min. St. VII, 16 mm. — **St. 68.** 550 m. 36°39′ N, 7°21′ W. 27-2-1909. 65 m.w., 7^{00} pm., 30 min. St. VI (2 spec.), 10—11 mm. — **St. 68.** ibid. 800 m.w., 5^{55} pm., 45 min. St. IX, 21 mm. — **St. 69.** > 3500 m. 36°13′ N, 9°48′ W. 1-3-1909. 25 m.w., 0^{30} am., 30 min. St. IX, 22 mm. — **St. 69.** ibid. 65 m.w., 10^{45} pm., 30 min. St. IX, 22 mm. — **St. 69.** ibid. 300 m.w., 3^{05} pm., 30 min. St. VII, 11 mm. — **St. 69.** ibid. 300 m.w., 11^{40} pm., 30 min. St. VIII—IX (3 spec.), 21—28 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 5-3-1909. 25 m.w., 0^{05} am., 30 min. St. IX, 20 mm. — **St. 74.** 2000 m. 44°21′ N, 7°55′ W. 8-3-1909. 300 m.w., 10^{50} pm., 60 min. St. IX, 21 mm. — **St. 89.** 1310 m. 36°28′ N, 8°22′ W. 18-6-1910. 65 m.w., 3^{00}am., 15 min. St. VI (2 spec.), 7 mm. — **St. 89.** ibid. 1000 m.w., 4^{10} am., 30 min. St. V, 5 mm. — **St. 91.** 1225 m. 35°53′ N, 7°26′ W. 18-6-1910. 1600 m.w., 5^{25} pm., 60 min. St. VII, 11 mm. — **St. 95.** 275 m. 35°57′ N, 6°00′ W. 23-6-1910. 65 m.w., 5^{50} am., 30 min. St. IX? (VIII?), 15 mm. — **St. 232.** 3760 m. 36°28′ N, 9°26′ W. 9-9-1910. 25 m.w., 8^{50} pm., 30 min. St. V, 6 mm.; st. VII (2 spec.), 10—11 mm. — **St. 232.** ibid. 300 m.w., 10^{35} pm., 30 min. St. VI, 7 mm. — **St. 234.** 920 m. 38°10′ N, 9°20′ W. 10-9-1910. 25 m.w., 9^{45} pm., 30 min. St. VIII, 19 mm. — **St. 242.** 4941 m. 46°19′ N, 6°48′ W. 16-9-1910. 65 m.w., 10^{55} pm., 30 min. St. V, 5 mm.; st. VII (2 spec.), 14-16 mm.; st. VIII, 21 mm. — **St. 242.** ibid. 4350 m.w., 7^{00} pm., 60 min. St. VII, 15 mm. — **St. 264** ("Ingolf"). > 3200 m. 38°14′ N, 24°35′ W. 19-3-1911. 25 m.w., 7^{30} pm., 30 min. St. VI, 7 mm.; st. VII, 11 mm. — **St. 266** ("Ingolf"). > 4300 m. 40°47′ N, 21°10′ W. 20-3-1911. 47 m.w., 7^{30} pm., 30 min. St. IX, 23 mm. — **St. 375** ("Florida"). > 3500 m. 40°11′ N, 12°11′ W. 21-7-1911. Surf., 4^{15} am., 30 min. St. VI—VII (20 spec.), 8—15 mm. — **St. 375.** ibid. 30 m.w., 4^{10} am., 30 min. St. V, 7 mm.; st. VI, 11 mm.; st. VII (2 spec.), 15 mm. — **St. 386** ("Pangan"). 1000 m. 36°30′ N, 7°30′ W. 15-11-1911. 122 m.w., 5^{30} am., 30 min. St. III, 2.5 mm.

B. 2: *The Natant-stage.*

Mediterranean.

St. 11. > 3700 m. 36°57′ N, 18°16′ E. 16-12-1908. 300 m.w. 9^{30} am. 1 spec. 21 mm.

Atlantic.

St. 190. > 4000 m. 46°30′ N, 7°00′ W. 11-9-1906, 65 m.w., 0^{45} am., 120 min. 1 spec. 16 mm. — **St. 71.** 1150 m. 39°35′ N, 9°45′ W. 4-3-1909. 300 m.w., 8^{40} pm., 120 min. 1 spec. 20 mm. — **St. 234.** 920 m. 38°10′ N, 9°20′ W. 10-9-1910. 25 m.w., 9^{45} pm., 30 min. 1 spec. 14 mm.

The material comprises only 1 adult specimen, but 553 Phyllosomæ and 4 spec. in the natant stage. Nearly all were taken in the Mediterranean.

In the following, I take first the morphological characters in the different Phyllosoma stages (and the natant), then passing to the biology. The larval development was previously in part unknown, only the youngest Phyllosoma and natant stages being known; the "Thor", however, has joined up these two extremes by a regular sequence of intermediate stages.

Literature and determination of the larvæ.

Williamson (1915) gives a survey of what is known as to the development; several of the writers he mentions, however, do not really refer the larvæ they investigated to a definite species, but only to the genus *Scyllarus*.

All that the writers themselves have referred with certainty to the present species is that Dohrn (1870) hatched out a larva from the egg and showed that this larva was undoubtedly identical with that shown by Claus (1863, fig. 2—4).

According to Williamson's account 1915 from Hornell 1893 (Hornell's work I have not been able to consult) it would seem that H. also hatched out the young larva he describes, but he does not appear to have seen more that the first stage of it. The natant stage, however, is described by Sarato (whose work I have not seen) under the name of *Nisto lævis* + *N. asper*, shown by Bouvier 1913; Sarato's and Bouvier's works, however, were unknown to Williamson at the time.

As far as I can see, no other larvæ or developmental stages have been referred by the writers in question to this species. That a number of the larvæ described and figured in the literature can with considerable degree of probability be referred to this species is another matter; for these, see under the separate stages.

The "Thor" material.

The "Thor" has collected all the larval stages, right from the newly hatched Phyllosoma to the natant stage. The correctness of the determination is apparent partly from the fact that the first stage agrees exactly with the larvæ hatched out and described by Claus 1863 and Hornell 1894, and partly from the fact that one can, in some few specimens of the oldest Phyllosoma, clearly discern through the skin the antennal plate with 5 large teeth of similar shape to the largest ones in the natant stage.

There are 9 Phyllosoma stages in all; in some of them, however, the difference between the previous and succeeding ones is only slight. The stage of development of p. 4—5 and the abdomen, with corresponding pleopoda and urop. seems to give the best means of distinguishing the stages, and I have therefore used these characters, and describe them first accordingly, afterwards going through the development of eyes, antennæ and oral parts, these, however, do not seem to afford quite such good age characters, as they do not altogether keep pace in point of development with the pereiopoda and the abdomen; the antennæ, for instance, may often be alike in two specimens which must, from the abdominal development, be classed as different stages.

Phyllosoma stages (figs. 21—23).

A. Pereiopoda and abdomen (fig. 21).

1. stage. 1.5 mm. Newly hatched larva (Claus 1863, p. 425, Pl. 25, figs. 2—4; Hornell 1894 in Williamson 1915, p. 437, fig. 195). The identity of the larva shown by Claus was pointed out by Dohrn (1870, p. 256). — I have not been able to consult Hornell l. c. and only know his work from the brief report of it given in Williamson l. c. with a rather poor copy of Hornell's figure. There can be no doubt that the larva here in question is identical with that described and figured by Hornell, which was hatched out in England; unfortunately, W.'s copy of Hornell's figure does not reproduce the tip of the tail, and this is particularly

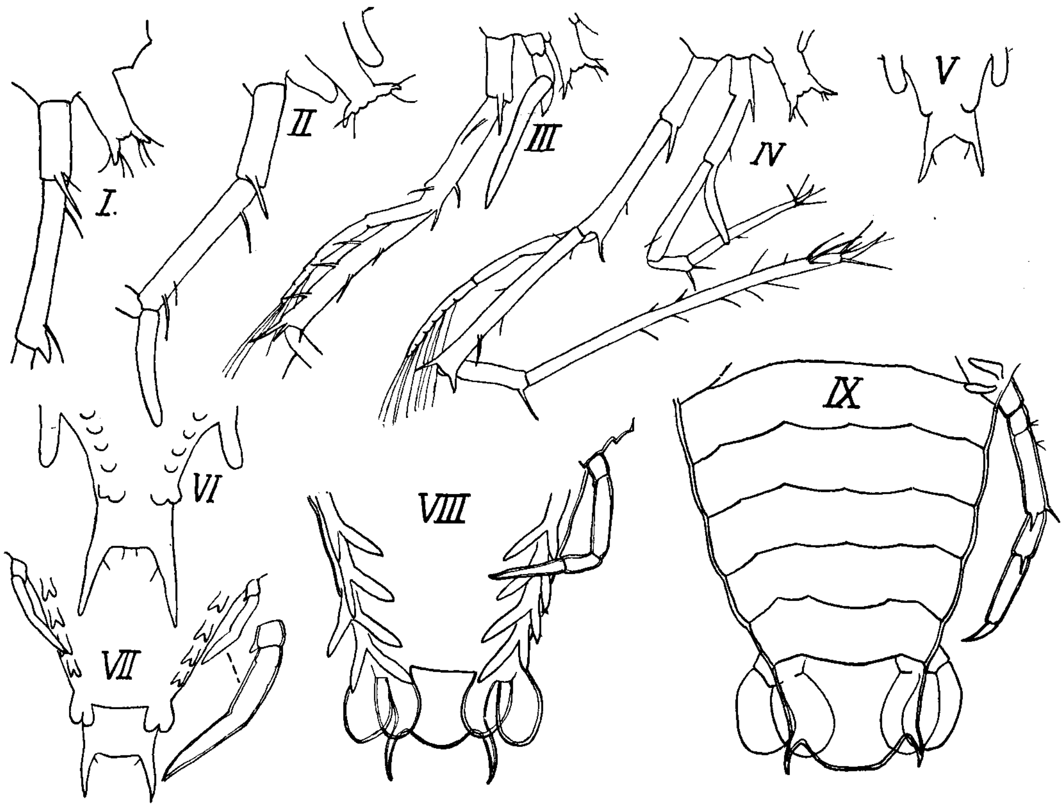

Fig. 21. Scyllarus arctus. Abdomen etc. of the Phyllosoma-stages. I—IX = 1. to 9th stage.

characteristic (see my fig.) being drawn out into a not very long point on either side, armed with three bristles. For the rest, this stage is characterised by lacking exopodite on p. 3, the second joint of which is furnished at its distal end with a short, rather thick process.

2. stage. 1.5—2 mm. The process at distal end of 2. joint in p. 3 now nearly as long as the joint and is now articulated, showing clearly that it is really the exopodite. P. 4 indicated, but much shorter than abdomen.

3. stage. 2.5—3 mm. The exopodite in p. 3 is now fully developed and has natatory setæ. P. 4 abt. 3—4 times as long as the abdomen, with a slight exopodite. P. 5 indicated as a small process.

4. Stage. 3—5 mm. P. 4 has grown considerably, as also its exopodite. P. 5 grown somewhat, but not much.

5. stage. 4—9 mm. (*Phyllosoma mediterranea*, Richters 1873, p. 638 (separately p. 16), Pl. 33, fig. 1; loc.: Sicily). P. 4 fully developed. P. 5 half the length of abdomen minus the large terminal spines. Urop. distinctly indicated as a pair of warty protuberances (in a few cases they could be already distinguished faintly in the foregoing stage).

6. stage. 7—15 (17) mm. P. 5 grown somewhat longer. Plp. 2—5 indicated as small protuberances. Urop. bifid at the point.

7. stage. (9) 12—20 mm. P. 5 has not increased appreciably in length, but is thinner and divided into two joints, the proximal very short, terminating in a small spine, the apical very long, with an indication of articulation at the middle; further articulation discernible through the skin. Plp. 2—5 increased in length and bifid. Urop. somewhat longer than in previous stage. The telson now separated off by a sinus from the remaining part of the abdomen, which is not otherwise articulated; posterior margin between the spines slightly convex.

8. stage. (?15) 18—23 mm. (Claus 1863, p. 431, Pl. 27, figs. 11—12; *Ph. mediterranea* Guérin 1833. No. 11, Pl. 13, fig. 2; ?*Ph. Reynaudii* Richters 1873, p. 638 [separately, p. 16], Pl. 33, fig. 2 [loc.: Sicily], but this can despite its great resemblance, hardly be identical with *Ph. Reynaudii* (Guérin 1833, No. 10, Pl. 13, fig. 1) which is from a region [Rangoon and Pondicherry] where *Scyllarus arctus* has never been found). — P. 5 has grown a little in length and now consists of 4 joints (in some specimens, however, there are 5, the dactyl forming a joint by itself). Plp. much longer and deeply cleft; the same applies to the urop. but the rami not yet articulated to peduncle. Posterior margin of telson highly convex. Apart from the telson, there is no articulation between the different segments of the abdomen; in some places, however, a trace of articulation can be discerned through the skin, especially distinct midway down the back (but not out to the sides).

9. stage. (17) 20—28 mm. (? *Ph. Duperreyi*, Richters 1873, p. 638 [separately, p. 16], Pl. 33, fig. 3 [loc. ?], but cannot be identical with *Ph. Duperreyi* Guérin 1833, No. 9, pl. 12, for this is from Port Jackson, and the telson is different). — Articulation of the tail now visible through the skin at all segments, but the telson is the only one really free. The two spines on the telson

have become somewhat smaller than in the previous stage. Dactyl in p. 5 now a distinct joint. On the plp. the appendix interna of the inner ramus is distinctly visible through the skin: the next stage is the natant stage.

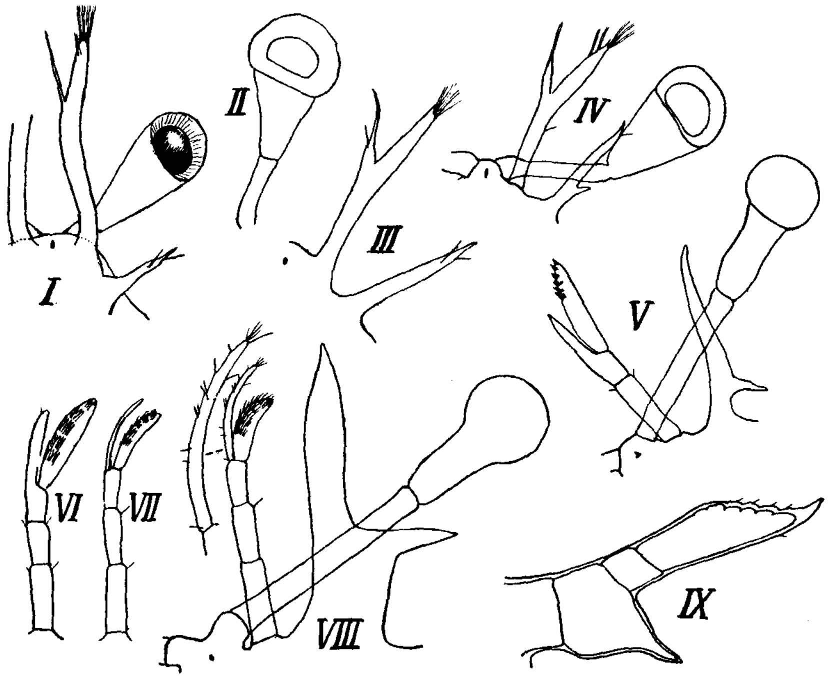

Fig. 22. Scyllarus arctus. Antennæ and eye of the Phyllosoma-stages. I—IX = 1. to 9th stage.

B. Eyes and Antennæ (Fig. 22).

1. stage. The eyes thick-stalked and apparently immobile. Ant. 1 longer than the eyes, and hardly articulated to the carapace; at commencement of the extreme third of its length there is a long thin process, and abt. 4 bristles (broken in all spec.) at the tip. Ant. 2 only abt. $^1/_3$ the length of ant. 1, not articulated.

2. stage. The eye-stalk consists of a proximal cylindrical part connected by articulation with the distal, conical part.

3. stage. In Ant. 1, the long bristle has become greatly thickened at its base, and it is clearly seen to be inarticulate. Besides the setæ at the point of the ant. 1 there is a small tooth. Ant. 2 somewhat longer being now $^2/_3$ the length of ant. 1.

4. stage. The eye a good deal longer, and the stalk clearly articulated to the carapace. Articulation between carapace and Ant. 1. Ant. 2 has developed a process on the outer side of the end of the proximal third.

5. stage. Eye still longer, the cornea itself of much greater diameter than the stalk. Ant. 1, now consists distinctly of 3 joints, and has developed many more sensory setæ. Ant. 2 further prolonged.

6. stage. Peduncle in ant. 1 now divided into 3 joints, (5 stage has 2) occasionally, ant. 1 has at this stage same shape as st. 7.

7. stage. The process at point of 3 joint in peduncle (i. e. inner flagellum) now distinctly articulated at its base, and as long as the joint which becomes the outer flagellum. Also, both the eyes and the two pairs of ant. are further prolonged.

8. stage. Ant. 1, has now the inner flagellum still more prolonged, and armed with bristles. Ant. 2 very large and heavy, but not yet articulated.

9. stage. One can now see through the skin that ant. 2 is divided into 3 joints, the distal one has on the median side 5 teeth as in the natant stage.

C. Oral Parts (Fig. 23).

1. stage. Upper lip convex, the lower cleft. Md. very much the same shape as described and figured by RICHTERS (1873, p. 631 [separately p. 9], Pl. 32, fig. 1) in *Phyllosoma longicorne*, and the same applies to mx. 1 (RICHTERS l.c., Pl. 32, fig. 2). Mx. 2 and mxp. 2—3 (mxp. 1 not yet indicated) can be seen in CLAUS 1863, Pl. 25, fig. 2—3, but mx. 2 consists in reality of 2 joints, there being a very small apical joint (see my fig. 23).

6. stage. Even here the oral parts are essentially the same, save that mx. 2 has lost its apical joint, and mxp. 1 is now in formation as a small protuberance between mx. 2 and mxp. 2. In some cases, mxp. 1 can be seen in formation already at the 5. stage (RICHTERS 1873, Pl. 33, fig. 1).

7. stage. Mx. 2 now very broad; mxp. 1 a cylindrical process, as long as mx. 2.

8. stage. (RICHTERS 1873, Pl. 22, fig. 2′). Mx. 2 beginning to assume same shape as in the adult, with indication of a large exopodite. The same can, in some specimens, also be found in mxp. 1 being then approximately as shown in RICHTERS 1873, Pl. 22, fig. 3′. Mxp. 2 has exop. in formation.

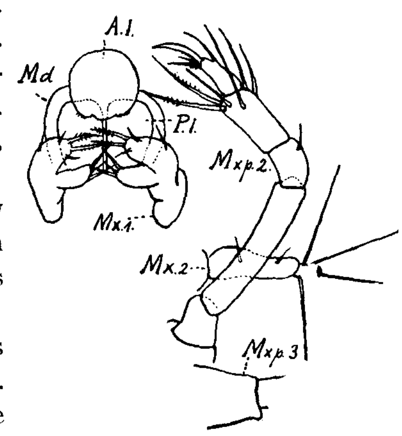

Fig. 23. Scyllarus arctus. Oral parts of a Phyllosoma, 1. stage.

9. stage differs nowise from the more developed spec. of 8. stage as regards the oral parts.

The Natant stage. (10. stage). (Fig. 24).

(*Nisto lævis* + *N. asper* SARATO l.c., *teste* BOUVIER l.c. 1913)[1].

BOUVIER l.c. 1913 gives a characterisation of this stage (but without fig.) showing that it has already long since been described by SARATO, who did not, however, realise its true nature, but regarded *Nisto* as a sub-genus of *Scyllarus*. SARATO's work has also been apparently ignored by all writers, being published in a little-known journal which is not even of zoological character.

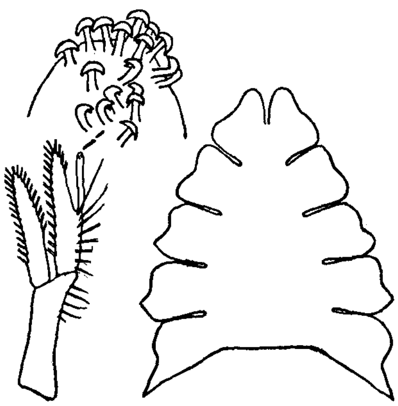

Fig. 24. Scyllarus arctus, Natant stage. Plp. 5 and sternum.

I have here shown two of the characters where by this stage is most readily distinguished from the adult, viz. the sternum with the long points at the base of p. 5 and a pleopod (Fig. of these parts in the adult see MILNE-EDWARDS l.c. whose fig. of plp. 3 [Pl. 45, fig. 1 C] however, only applies to the male; in the female, the inner ramus of the three hindmost pairs of plp. is as long as the outer ramus [though quite thin] to serve as a holder for the ova).

The two largest specimens from the "Thor" (20—21 mm.) are hard-shelled like the adults; the two smallest (14—16 mm.) still soft. The smallest specimen then, is not more than half the size of the largest 9. Phyllosoma stage (28 mm.).

The natant stage attains the same size as the young, fully developed *Scyllarus*, 18—22 mm., (SARATO, teste BOUVIER). The fishermen of Nice are said to know them so well that they even have a special name for them: "machottes blanches". This, however, must doubtless be taken with some reserve, as we can hardly suppose the fishermen would be able to distinguish them from the adults, which they so greatly resemble. It is more remarkable that SARATO (teste BOUVIER) has seen or taken "plus de 150 échantillons" for other writers do not know this stage, and not even BOUVIER (1913), who goes through SARATO's work, seems to have seen a single specimen himself. They are said to be taken at night with a dredge at 30—40 fms. depth.

All the 4 spec. from the "Thor" were taken pelagically at 920—over 4000 m. depth, by day with 300 m.w., at night with 25, 65 and 300 m.w.

[1] BOUVIER's paper 1917 with elaborate descriptions (pp. 108 seq.) and several figures (Pl. 10, figs. 1-2; Pl. 11, figs. 1-2) I have not seen till the present paper was ready to the press; see the note p. 3.

A. Mediterranean. (Phyllosoma).

From here we have 479 Phyllosomæ, of which the "Thor" has taken 403, and 1 natant stage.

"Thor" 1908—10	No. of stations	Hauls	Specimens
Dec. 1908	4	7	12
Jan. 1909	8	10	12
Feb. —	3	4	7
June 1910	2	5	18
July —	22	29	75
Aug. —	26	42	273
Sept. —	2	3	6
total...	67	100	403

Depth of the sea and occurrence (Chart 7).

The depth to bottom for the Phyllosoma is 64— > 3000 m. and over; experiments with a view to ascertaining whether the species prefers any particular depth within these limits gave no definite result.

Depths in m.	No. of stations
0— 250 m ..	12
> 250— 500 - ..	5
> 500—1000 - ..	14
> 1000—2000 - ..	18
> 2000—3000 - ..	11
> 3000 - ..	7
total...	67

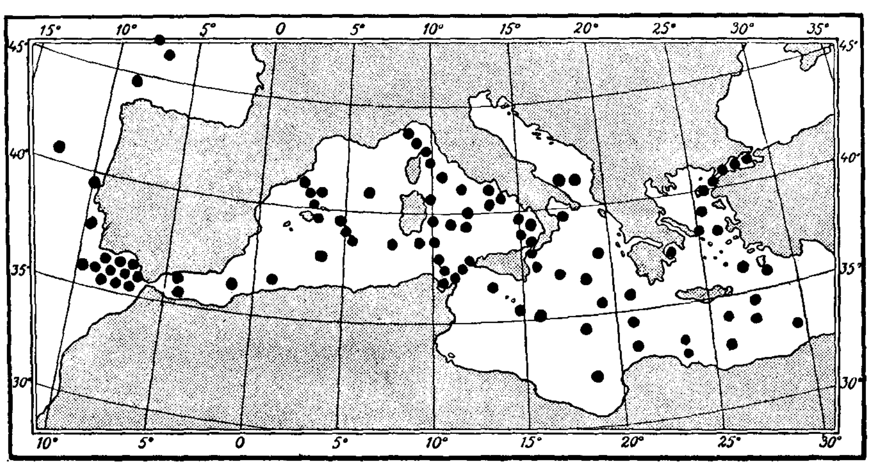

Chart 7. Scyllarus arctus, Phyllosoma-stages. Some stations lie outside the Chart to S.W.

It is found throughout the whole of the Mediterranean (as is the adult) from Gibraltar to Constantinople, and seems to be evenly distributed in both basins.

Season. The no. of spec. is not evenly distributed in regard to season. The winter hauls (Dec.—Febr.) only yielded 1.3—2.3 spec. per hour, the summer hauls on the other hand 4.8—17.9, with a marked maximum from 7—8 in June—July to 17.9 in August, falling again to 4.8 in Sept.

"Thor" 1908—10	Specimens	Duration of hauls in hours	Average no. of spec. pr. hour
Dec.	12	5.75	2.1
Jan.	12	9	1.3
Feb.	7	3	2.3
June	18	2.25	8
July	75	10.75	7
Aug.	273	15.25	17.9
Sept.	6	1.25	4.8

Dividing the various stages according to months, we find that in winter, only the older stages (5) 6—8 stage, were taken, whereas in summer, also the youngest were taken, the result in September, however, being already as in winter.

"Thor" 1908—10	No. of specimens, 1.—8. stage								
	1. st.	2. st.	3. st.	4. st.	5. st.	6. st.	7. st.	8. st.	total
Dec.	..	..	..	..	..	4	6	2	12
Jan.	..	..	..	..	1	6	3	2	12
Feb.	..	..	..	..	—	3	2	2	7
June	..	..	..	1	9	5	1	2	18
July	—	1	6	11	18	17	18	4	75
Aug.	2	7	17	47	58	76	55	11	273
Sept.	..	..	..	..	1	1	3	1	6

This seems to suggest that even though the species may propagate in winter, the summer is its chief spawning season, and that the metamorphoses must take place comparatively quickly, probably in the course of very few months.

This agrees very well with what we find in the literature as to females with ova. Pesta 1918 gives the spawning season as July, but Dohrn (l.c. 1870) who made his incubating experiments at Messina in winter, (1868—69) states that the fishermen brought him daily large quantities of specimens, "unter denen fast immer eiertragenden Weibchen sich fanden". Our Zool. Museum has a female with ova from Syracuse, taken May or June 1893.

No. of ova is stated as "sehr verschieden, erreicht aber niemals die grosse Masse der Palinuruseier". (Dohrn 1870 p. 251). The eggs are a golden yellow, 0,4 mm. diam. (Dohrn 1870, p. 251, Pl. 16, fig. 1—col. fig.).

Vertical occurence.

"Thor" 1908—10	No. of hauls			
	Night		Day	
	Winter	Summer	Winter	Summer
10—25 m.w.	7	35	—	2
65—100 —	6	9	4	6
150 —	—	1	—	1
300—400 —	1	10	3	4
> 400 —	—	10	—	1
total....	14	65	7	14

At night, it was taken in winter evenly distributed from surface to a depth answering to 100 m.w., in summer chiefly with 10—25 m.w. (35 out of a total 65 hauls). The few day hauls (21 in all) seem to show that it is taken both winter and summer chiefly with 65 m.w., i. e. not much deeper than at night.

B. Atlantic.

In the Atlantic, 74 spec. of the Phyllosoma stages were taken in all. The stations are distributed from the Bay of Biscay to near the Azores, most, however, in the Bay of Cadiz. In the Atlantic it seems to occur more or less as in the Mediterranean.

Summary.

The adult form, which is edible, lives more especially at 4—20 m. depth, being evidently rare deeper down, and seems to prefer a muddy bottom. Though females with ova may be met with all the year round, the summer is evidently their chief spawning season. From the egg there emerges a Phyllosoma, which in the course of probably only a few months passes through 9 stages; these stages live at the surface, or not far below (answering to 10—65 [100] m.w.) The Phyllosoma passes into the natant stage, which doubtless lives for a very short time pelagically, then turning hard-shelled, and sinking to the bottom, when it enters on the adult stage.

Distribution. (See Pesta 1918, p. 175).

1. Probably the whole of the Mediterranean, incl. Adriatic.
2. Atlantic from the Channel to the Azores and Canaries; southern N. America, Rio de Janeiro.
3. Pacific. Mazatlan in Mexico.

Genus Scyllarides Gill.

Scyllarides de Man 1916, p. 65 (list of all species).
— Pesta 1918, p. 169 (lit. and syn.).
— Bouvier 1917, p. 104.

? 1. SCYLLARIDES LATUS Latr. (Fig. 25).

A. *The adult stage.*

Scyllarides latus de Man 1916, p. 65.
— — Pesta 1918, p. 169, textfig. 55 (lit. and syn.).
— — Bouvier 1917, p. 104 (lit. and syn.).

B. *Development* (Natant stage; Phyllosoma see below).

Pseudibacus Veranyi Guérin-Méneville, Notice sur un nouveau genre de Crustacés de la tribu des Scyllariens, découvert par M. Verany, aux environs de Nice; Revue et Mag. de Zool., ser. 2, vol. 7, 1855, p. 137—41, Pl. 5.
— — Heller 1863, p. 198.
— — Bouvier 1913, p. 1644—46.

Mediterranean.

St. 145. 1925 m. 32°38′ N, 19°02′ E. 25-7-1910. 300 m.w., 4^{10} am., 30 min. 1 spec. 4 mm. — **St. 297** ("Pangan"). > 2000 m. 33°10′ N, 25°35′ E. 25-6-1910. 28 m.w., 12^{00} pm., 30 min. 2 spec. 4—5 mm.

At the above-mentioned stations were taken 3 specimens in all of an unknown Scyllarid-Phyllosoma, at a stage of development roughly corresponding to stage 4 of *Scyllarus arctus*, which it altogether resembles greatly, save for the fact that the apical spines of the tail are so long as to render the tail itself bifid for half its length (see fig. 25); also, ant. 2 is nearly as long as ant. 1, and p. 4 is at the same stage of development as p. 3 but a little shorter.

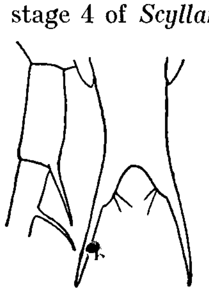

Fig. 25. Phyllosoma of ?Scyllarides latus (St. 145, 1900, 300 m.w.). Abdomen etc.

Owing to the very long apical spines on the tail, this larva can hardly be identical with that of *Scyllarus arctus*, but since it is at any rate closely allied to this, and as no other species of the group of *Phyllosomæ laticaudatæ* but *Scyllarus arctus* and *Scyllarides latus* have ever been found in the Mediterranean, it must belong to the latter species.

Bouvier, l. c. has shown that *Pseudibacus Veranyi* is not an independent species, but only the natant stage of *Scyllarides latus*. *Pseudibacus* is only known from Sainte-Hospice, near Nice, in deep water (Guérin-Méneville), and from $39°49^{2}/_{3}'$ N, 9°49′ E, 60 m. (Senna 1903, p. 341).

Distribution. 1. Mediterranean. This species, the "grosse Bärenkrebs" of the Mediterranean, is probably distributed throughout the whole of the Mediterranean (Carus) in shallow water (4—10 m.) among rocks, where it buries itself in the bottom, but is not nearly so numerous as the small *Scyllarus arctus*. In the Adriatic, it has only been found at a few localities (Pesta), but I have myself seen it in several fish-markets in Dalmatia.

2. Atlantic. Portugal; coasts and islands of West Africa, Azores, Cuba (Pesta).

3. Red Sea.

Genus Thenus Leach.

Thenus Bate 1888, p. 65 (lit.).
— de Man 1916, p. 66.

? 1. THENUS ORIENTALIS (Tønder-Lund) Fabr. (Fig. 26).

Thenus orientalis Milne-Edwards, Règne Animal Pl. 45, fig. 2.
— — Bate 1888, p. 66 (lit.).
— — Babic, Thenus orientalis (Fabr.) in der Adria; Zool. Anzeiger, vol. 41, 1912—13, p. 273—74 (lit.).
— — Pesta 1918, p. 168, 458.

? **St. 209.** > 2000 m. 40°34′ N, 3°03′ E. 29-8-1910. 200 m.w., 7^{25} am. 1 larva, 7 mm.

At this station, the "Thor" took a single specimen of a Phyllosoma which must be referred to the group of *Phyllosomæ brevicaudes*, as defined by Richters (Richters 1873, p. 640 [separately, p. 8]) and must therefore be ascribed to the fam. *Scyllaridæ*. It cannot belong to the genus *Scyllarus* (+ *Scyllarides*) itself, as the larvæ of the two Mediterranean species belonging here are known (supra); consequently, it must belong to the *Ibacus-Thenus* group.

Of this group, only a single species has ever been found in the Mediterranean, viz. *Thenus orientalis*, which is said to have been taken (1 spec.) in the Adriatic at Fiume (Babic l. c.). Pesta, however, is disposed to regard this as due to error, e. g. in the locality marked on the label, as it has never yet been found in the Mediterranean area, but only farther east (Red Sea, Indo-Pacific).

The carapace of the head is pear-shaped, somewhat longer than it is broad. The thorax nearly as long as broad, with a notch in the posterior margin, in which the quite short abdomen is set. Eye-stalks long, thin,

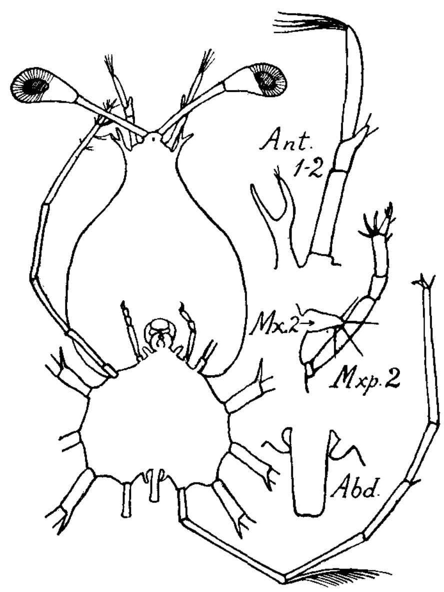

Fig. 26. Phyllosoma of ? Thenus orientalis.

articulated to the carapace. Ant. 1 as long as the eye-stalks, consisting of 3 joints, of which the distal is about as long as the two others together. Inner flagellum indicated but not articulated. Ant. 2 is formed by a small short fork, as long as 1. joint in ant. 1; the two rami are not articulated. Oral parts: nothing to remark save that they are as in *Scyllarus arctus* at the same stage; for the rest, see my detail figures of mx. 2 and mxp. 2. P. 1—4 completely developed and with natatory rami; dactyl rather short. P. 5 only abt. $^1/_3$ as long as the very short abdomen. The abdomen itself has neither pleopoda nor caudal fan; indications of plp., however, are discernible through the skin.

Fam. Palinuridæ Stebb.

Palinuridæ Gruvel, Ann. Inst. Océanogr. 3, 1911, p. 5.
— de Man 1916, p. 31 (list of all genera and species).
— Pesta 1918, p. 165 (lit. and syn.).
— Bouvier 1917, p. 83.

On the species from the "Thor" area see above p. 68 (under Scyllaridea).

Genus Palinurus Fabr.

Palinurus Gruvel 1911, p. 16.
— Selbie 1914, p. 42.
— de Man 1916, p. 32 (list of all species).
— Pesta 1918, p. 165.
— Bouvier 1917, p. 87 (key to species).

1. PALINURUS VULGARIS Latr. (= P. ADRIATICUS Costa).

A. *Full grown stage.*

Palinurus vulgaris Gruvel 1911, p. 20.
— — Selbie 1914, p. 42.
— — Pesta 1918, p. 166, textfig. (lit. and syn.).
— — Bouvier 1917, p. 89 (lit. and syn.).

B. *Development (Phyllosoma* and *Puerulus).*

Palinurus vulgaris Cunningham, On the Development of *Palinurus vulgaris*, the Rock Lobster or Sea Crayfish; Journ. Marine Biol. Assoc., vol. 2 (new ser.), 1891, p. 141—50, Pl. 8—9.
— — Bouvier, Recherches sur le Développement postembryonaire de la Langouste commune (*Palinurus vulgaris*); ibid., vol. 10, 1914, p. 179—93, 6 textfigs.
— — Williamson 1915, p. 435—36, 2 textfigs.

Mediterranean.

St. 31. 1420 m. 41°44′ N, 10°52′ E. 22-1-1909. 65 m.w., 4^{30} am., 30 min. St. II. — **St. 39.** 1750 m. 39°41′ N, 10°02′ E. 1-2-1909. 65 m.w., 6^{10} am., 60 min. St. I, II. — **St. 58.** 85 m. 36°36′ N, 4°24′ W. 20-2-1909. 100 m.w., 2^{00} pm., 30 min. St. II. — **St. 59.** 1280 m. 36°02′ N, 4°24′ W. 21-2-1909. 100 m.w., 1^{40} am., 30 min. St. III. — **St. 282.** 200 m. 38°12′ N, 15°37′ E. 8-3-1911. 40 m.w., 8^{45} pm., 90 min. St. II. — **St. 282.** ibid. 9-3-1911. 40 m.w., 3^{30} am., 90 min. St. II. — **St. 283.** ibid. 12-3-1911. 40 m.w., 9^{30} pm., 180 min. St. II, III. — **St. 283.** ibid. 13-3-1911. 40 m.w., 0^{45} am., 180 min. St. V.

Atlantic.

St. 288. 105 m. 59°34′ N, 5°41′ W. 4-9-1904. 120 m.w. St. IX. — **St. 167.** Depth? 57°46′ N, 9°55′ W. 31-8-1905. 100 m.w. St. IX, 3 spec. — **St. 40.** 110 m. 43°23′ N, 2°02′ W. 11-5-1906. 100 m.w., 1^{15} pm., 30 min. St. I, 2 spec. — **St. 41.** 102 m. 43°23′ N, 2°01′ W. 14-5-1906. 15 m.w., 11^{00} pm., 120 min. St. I, III, V (2 spec.). — **St. 42.** 348 m. 43°31′ N, 2°13′ W. 15-5-1906. 15 m.w., 11^{35} am., 60 min. St. II, III (2 spec.), IV. — **St. 44.** 40 m. 43°58′ N, 1°27′ W. 16-5-1906. 50 m.w., 4^{00} pm., 30 min. St. VII. — **St. 190.** > 4000 m. 46°30′ N, 7°00′ W. 11-9-1906. 300 m.w., 3^{00} am., 120 min. St. IX. —

St. 70. 94 m. 39°06′ N, 9°47′ W. 4-3-1909. 65 m.w., 9^{00} am., 60 min. St. I (2 spec.), III. — **St. 73.** 180 m. 43°46′ N, 8°11′ W. 8-3-1909. 65 m.w., 3^{00} am., 30 min. St. I (4 spec.), II. — **St. 74.** 2000 m. 44°21′ N, 7°55′ W. 8-3-1909. 300 m.w., 10^{50} pm., 60 min. St. II. — **St. 75.** 4000 m. 45°37′ N, 7°03′ W. 9-3-1909. 300 m.w., 7^{45} pm., 60 min. St. I. — **St. 79.** $>$ 150 m. 47°30′ N, 6°43′ W. 13-6-1910. 65 m.w., 8^{40} am., 15 min. St. II, V—VII (8 spec.) — **St. 80.** $>$ 4000 m. 46°17′ N, 7°31′ W. 13-6-1910. 65 m.w., 10^{00} pm., 30 min. St. VII. — **St. 85.** $>$ 700 m. 38°22′ N, 9°28′ W. 17-6-1910. 65 m.w., 2^{00} am., 15 min. St. VI.

The development of this species has recently been elucidated by Bouvier (l.c. 1914) with the aid of specimens from the Eddystone lighthouse; his work is unknown to Williamson (l. c.) who otherwise gives a survey of what was hitherto known. Cunningham had only the two first stages.

There are 10 Phyllosoma stages of from 3—21 mm.; the natant stage is 21 mm. All the spec. from the Eddystone were taken (by Cunningham and Bouvier) from latter half of June to abt. 1 Sept. the development seems to progress rather rapidly.

Depth to bottom for the larvæ within very wide limits, 40—over 4000 m. The adults, on the other hand, live largely at 60—70 m., in winter somewhat deeper (Pesta).

All the "Thor" spec. were taken near the surface, as a rule 15—100 m.w. and there is no essential difference between depths for day and night. Most of the Phyllosoma stages are represented in the "Thor" material, but not the Natant, which is extremely difficult to procure, as it doubtless hides among the stones on the bottom (Bouvier l.c., p. 191; Bouvier's specimen is indeed the only one known).

In the Atlantic (The Channel) Phyllosoma is found from latter half of June to abt. 1 Sept.; (Cunningham and Bouvier); the last stages are common, about end July and in August (Bouvier, p. 191). This agrees well with the "Thor" results, save for the fact that the first stages are taken as early as March; all the "Thor" spec. were taken between $38^1/_2°$ and $47^1/_2°$ N, except 4 taken $57^3/_4$—$59^1/_2°$ N, i. e. north of the true area of the species. In the winter months proper the larva was not taken.

Atlantic. "Thor"	No. of larvæ (I—X = stages I—X)									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Mar.	7	2	1	—	—	—	—	—	..	—
May	3	1	2	1	2	—	1	—	—	—
June	—	1	—	—	2	4	4	—	—	—
Aug.	..	—	..	..	—	—	—	—	3	—
Sept. (4.-11.)	..	..	..	..	..	..	..	—	2	—

In the Mediterranean, on the other hand, we find a different state of things. All (there are, however, but few) were here taken in winter, from 22 Jan. to 13 March; in summer, or indeed outside the mentioned months, it was not found at all. Pesta (l.c.) gives the spawning time as spring, on towards May, and also August; as, however, he does not state the locality to which these seasons apply, the former should probably be taken valid for the Mediterranean, and the other for the Atlantic. Dohrn (1870) hatched it out at Messina in winter without further details given.

Distribution. 1. Mediterranean, very common. 2. E. Atlantic, from British waters to Cape Bojador. See also Selbie, l.c. and Pesta, l.c.

Astacura Borradaile.

Astacura Borradaile, Ann. Mag. Nat. Hist., ser. 7, vol. 19, 1907 p. 475.
Homaridea Bouvier 1917, p. 9.

Nephropsidea Ortmann.

Nephropsidea Pesta 1918, p. 175 (lit. and syn.).

Fam. Nephropsidæ Stebb.

Nephropsidæ Stebbing, Hist. of Crustacea 1893, p. 201.
— de Man 1916, p. 95 (with list of all genera and species).
— Pesta 1918, p. 175 (lit.).
Homaridæ Bouvier 1917, p. 12 (key to the genera).

Of this family, only the three species taken by the "Thor" are known from the area here concerned.

One, *Nephropsis atlantica*, is a deep sea form, living at a depth of over 1000 m., and with colourless eyes; nothing is known as to its development.

The other two, however, belong almost exclusively to the littoral zone, and as they occur in great numbers are thus of economical importance, their life history is more or less well known. *Homarus vulgaris* is even supposed to be, with its near relative, *H. americanus*, the best investigated of all Evertebrata (Herrick 1909 [1911]).

Genus Nephropsis Wood-Mason.

Nephropsis Selbie 1914, p. 48 (lit.).
— de Man 1916, p. 97 (list of all species), p. 110.
— Bouvier 1917, p. 19 (key to the species).

1. NEPHROPSIS ATLANTICA Norman.

Nephropsis atlantica Selbie 1914, p. 48, Pl. 7 (lit.).
— — Bouvier 1917, p. 22, Pl. 1, fig. 1 (col. fig.), figs. 2—5.

St. 93. 1275—1180 m. 49°25′ N, 12°20′ W. 25-6-1905. 13 spec. 73—100 mm. — **St. 74.** 1200 m. 40°23′ N, 13°23′ W. 9-6-1906. 4 spec. 78—88 mm. (incl. 1 ♀ with ova 79 mm.).

This red species with colourless eyes lives at great depths especially 1200—1400 m.

Nothing is known as to its development. The ova from the ♀ taken by the "Thor" are 2.25 mm. diam. This spec. was taken in June; Selbie mentions (p. 4) females with ova as taken in Feb. and August; size of females with ova is 79—97 mm. (Selbie and "Thor").

It is evidently very common off S.W. Ireland; for the distribution (Atlantic, Indian Ocean) see H. J. Hansen 1908, p. 43, Selbie 1914, p. 52—53, and Bouvier 1917, p. 23.

Genus Nephrops Leach.

Nephrops de Man 1916, p. 96 (list of all species), 97.
— Pesta 1918, p. 182.
— Bouvier 1917, p. 17.

NEPHROPS NORVEGICUS L.

The adult stage.

Nephrops norvegicus Selbie 1914, p. 47 (lit.).
— — Pesta 1918, p. 183 (lit. and syn.), fig. 58.
— — Bouvier 1917, p. 18.

Development.

Nephrops norvegicus G. O. Sars, Bidrag til Kundskaben om Decapodernes Forvandlinger I; Archiv f. Math. og Naturvid., Christiania, 1884, p. 159, Pl. 1.
— — G. O. Sars, Bidrag ... II; ibid. 1889, p. 191, Pl. 7, fig. 27.
Astacus — Williamson 1915, p. 442, figs. 206—07.

Larvæ.

Mediterranean.

St. 35. 2000 m. 43°36′ N, 7°36′ E. 29-1-1909. 200 m.w., 6^{40} pm., 1 spec., stage III. — **St. 38.** 75 m. 40°45′ N, 9°50′ E. 31-1-1909. 25 m.w., 7^{10} pm., 30 min. 2 spec., st. I. — **St. 40.** 235 m. 39°10′ N, 9°40′ E. 1-2-1909. 65 m.w., 9^{30} pm., 30 min. 1 spec., st. I. — **St. 55.** 75 m. 36°46′ N, 2°18′ W. 19-2-1909. 25 m.w., 7^{40} am., 60 min. 3 spec., st. I—II. — **St. 58.** 85 m. 36°36′ N, 4°24′ W. 20-2-1909. 100 m.w., 2^{00} pm., 30 min. 5 spec., st. I—III.

Atlantic.

St. 62. 58 m. 35°45′ N, 5°59′ W. 21-2-1909. 100 m.w., 8^{30} pm., 30 min. 1 spec., stage III. — **St. 63.** 490 m. 35°50′ N, 6°03′ W. 22-2-1909. 600 m.w., 1^{45} am., 60 min. 1 spec., st. II. — **St. 40.** 110 m. 43°23′ N, 2°02′ W. 11-5-1906. 100 m.w., 1^{15} pm., 30 min. 1 spec., st. I. — **St. 68.** 550 m. 36°39′ N, 7°21′ W. 27-2-1909. 800 m.w., 5^{55} pm., 45 min. 1 spec., st. I. — **St. 73.** 180 m. 43°46′ N, 8°11′ W. 8-3-1909. 65 m.w., 3^{30} pm., 30 min. 5 spec., st. I—III.

The finding of the larvæ of this well-known species is of no interest save in as much as it shows that the larva is in the Mediterranean evidently only found in winter; none have ever been met with in summer. In the southern area of the Atlantic (Bay of Cadiz) the same would seems to apply, but in more northerly waters (abt. $43^1/_2$° N) a single larva has also been taken in May off S.W. Ireland. Females with ova are found nearly all the year round (Selbie 1914, p. 4).

For the distribution (Atlantic from Iceland to Morocco, Mediterranean, Adriatic) see H. J. Hansen, 1908, p. 43, Selbie l. c., Bouvier 1917, p. 19, and Pesta l. c.

Genus Homarus H. M.-Edw.

Homarus H. Milne-Edwards 1837, p. 333.
Astacus Pesta 1918, p. 176 (lit. and syn.).

1. HOMARUS VULGARIS M.-Edw.

Homarus vulgaris Appellöf, Untersuchungen über den Hummer, mit besonderer Berücksichtigung seines Auftretens an den norwegischen Küsten. — Bergens Museums Skrifter, Ny Række, Bd. 1, Nr. 1, 1909 (with a long list of lit.).
Homarus gammarus, in Fr. H. Herrick, Natural History of the American Lobster; Bull. Bureau of Fisheries, Washington, vol. 29, 1909 (1911), Document No. 747 (bibliography on Homarus, p. 384—408).
Homarus vulgaris Selbie 1914, p. 53 (lit., distrib.).
Astacus gammarus Pesta 1918, p. 177 (lit. and syn.), fig. 57.

Development.

Homarus vulgaris G. O. Sars, Om Hummerens postembryonale Udvikling; Christiania Vid.-Selsk. Forhandlinger 1874, p. 1—26, Pl. 1—2.

Astacus gammarus Williamson 1915, p. 439, figs. 200—205.

Larvæ.

Atlantic.

St. 95. 74 m. 49°56′ N, 5°00′ W. 27-6-1906. 25 m.w. 2 spec., stage I. — **St. 43.** 1081—1650 m. 43°37′ N, 2°08′ W. 16-5-1906. 250 m.w. 1 spec., st. III. — **St. 195.** 170 m. 48°28′ N, 5°12′ W. 13-9-1906. 65 m.w. 1 spec., st. I.

III. APPENDIX.

I have here noted in a brief appendix a few species which are it is true outside the plan of the work, but on the other hand ought not to be omitted, since they present certain features of interest.

?GLYPHOCRANGON NOBILIS M.-Edw.

Glyphocrangon nobile A. Milne-Edwards 1881 (2), p. 5.
— — — 1883, fig.
— *nobilis* (?) Faxon 1895, p. 142.

St. 178. 4000 m. 48°04′ N, 12°40′ W. 2-9-1906. 1800 m.w. 8 spec.: 2 ♀ with ova 90—96 mm., 6 spec. 57—73 mm.

The genus *Glyphocrangon* (*Rhachocharis*) comprises a number of species; see Milne-Edwards l. c., Smith 1882, p. 41, Bate 1888, p. 503, Faxon l.c., p. 137. For the literature see Stebbing 1910, p. 387.

The determination of the present specimens is not certain, as Milne-Edward's description is quite short, and I have not been able to compare with his figures l.c. 1883. I refer the specimens in question to this species partly (though in lesser degree) on account of their agreement with Faxon's description of a no. of specimens, though these again were not determined with certainty; partly, and more particularly, from some observations by Faxon, which would seem to show that *G. nobilis* differs chiefly from *G. longirostris* Smith (Smith 1882, p. 51, Pl. 5, fig. 1, Pl. 6, fig. 1) in the fact that the rostrum is no broader towards the point, and that *G. acuminata* Bate (Bate 1888, p. 522, Pl. 94, fig. 2—3) is possibly only a smooth form of *G. nobilis*; for both the two latter characters apply in a high degree to the present specimens. The largest specimen has, (in spirits) brownish eyes; in the others the eyes are colourless. All the specimens are now altogether colourless; but it is plainly evident that the oral parts and the tips of many of the spines were originally red. —

The genus *Glyphocrangon* is not new to the "Thor" area; Kemp 1910, p. 170, mentions a specimen of *G. longirostris* from S.W. Ireland, 900 fms. and Coutière, (1911, p. 156) a *G.* sp. taken at 36°—45° N, 11° W, but without further details.

Distribution (of *G. nobilis*): Dominica, West-Indies, 1 spec., 1131 fms. (Milne-Edwards l.c.). — Pacific Ocean: ??Gulf of Panama, 1270 fms.; Cocos Islands, 770—1067 fms.; from here to Malpelo Isl., 1132—1201 fms.; between Galera Point and Galapagos Isl., 1322 fms.; Galapagos Isl., 1189 fms., and from here to Acapulco, 1360 fms.; Acapulco 772 fms.; Gulf of California, 24° N, 995 fms. (totally 25 spec. from 11 stations; *G. nobilis*?, Faxon 1895).

PANDALUS (STYLOPANDALUS) RICHARDI Coutière.

Pandalus (*Stylopandalus*) *Richardi* Coutière 1905, p. 18, fig. 6.

Parapandalus Richardi de Man 1920, p. 108, 138, 140.

Atlantic.

St. 63. 490 m. 35°50′ N, 6°03′ W. 22-2-1909. 25 m.w., 0^{05} am., 30 min. 1 spec. abt. 28 mm. — **St. 65.** 1300 m. 35°53′ N, 7°26′ W. 24-2-1909. 1600 m.w., 0^{30} pm., 120 min. 3 spec.: 2 spec. abt 60 mm. (rostrum broken), 1 ♀ with ova 70 mm. — **St. 66.** 735 m. 36°16′ N, 6°52′ W. 25-2-1909. 65 m.w., 1^{45} am., 60 min. 1 spec. abt 40 mm. — **St. 66.** ibid. 300 m.w., 2^{55} am., 120 min. 2 spec. abt 33 mm. — **St. 66.** ibid. 1200 m.w., 8^{30} pm., 120 min. 1 spec. abt 40 mm. — **St. 69.** > 3500 m. 36°13′ N, 9°48′ W. 28-2-1909. 300 m.w., 11^{40} pm., 4 spec. 25—abt. 55 mm. — **St. 91.** 1225 m. 35°53′ N, 7°26′ W. 18-6-1910. 1600 m.w., 5^{25} pm., 60 min. 8 spec. 55—60 mm.

We have in the "Thor" material 20 specimens of this species, which has hitherto only been mentioned by Coutière (l.c.). Depth to bottom is 490—over 3500 m.; it was taken at night with 25, 65 and 300 m.w., by day with 1200 and 1600 m.w. All the stations are situate in the Bay of Cadiz, which brings the distribution right over to the coast of Europe; formerly, it was only known at some distance from Europe: 32°18′ N, 23°58′ W, 1000 and 2000 m.w.; 31°46′ N, 25°00′ W, 3000 m.w., and 27°43′ N, 18°28′ W, 3000 m.w. (Coutière l.c.).

ALPHEUS RUBER H. M.-Edw. (Fig. 27, Chart 8).

Adult stage.

Alpheus ruber Kemp, Ireland 1910, p. 120, Pl. 19, figs. 1—2.
— — Pesta 1918, p. 91 (lit.), fig. 30.

Larval development.

Diaphoropus sp. Lo Bianco 1904, p. 32, Pl. 11, fig. 41 (col. fig.)
Alpheus ruber Coutière 1907, p. 51, fig. 14 R, 18.
— Williamson 1915, p. 388, fig. 107.

Adult stage.

Mediterranean.

St. 18. 220 m. 37°51′ N, 23°14′ E. 30-12-1908. 1 spec. — **St. 27.** 90 m. 40°58′ N, 13°49′ E. 19-1-1910. 3 spec. — **St. 137.** 195 m. 37°17′ N, 10°56′ E. 19-7-1910. 3 spec. — **St. 140.** 112 m. 37°29′ N, 12°34′ E. 20-7-1910. 7 spec. — **St. 213.** 75 m. 40°14′ N, 0°54′ E. 31-8-1910. Abt. 35 spec.

Larvæ.

Mediterranean.

? **St. 20.** > 1300 m. 37°48′ N, 15°49′ E. 5-1-1909. 25 m.w. 1 spec. (defective). — **St. 21.** > 500 m. 37°51′ N, 15°21′ E. 5-1-1909. 10 m.w., 11^{50} pm. 1 spec. — **St. 118.** > 2700 m. 41°00′ N, 6°43′ E. 30-6-1910. 65 m.w., 11^{35} pm., 30 min. 1 spec. — **St. 123.** > 600 m. 44°14′ N, 8°55′ E. 3-7-1910. 10 m.w., 2^{30} am., 15 min. 13 spec. — **St. 123.** ibid., 25 m.w., 1^{50} am., 15 min. Abt. 25 spec., stage V—VII. — **St. 124.** 86 m. 44°20′ N, 9°05′ E. 3-7-1910. 65 m.w., 3^{30} am., 90 min. Abt. 50 spec. — **St. 126.** 600—620 m. 42°43′ N, 9°50′ E. 10-7-1910. 25 m.w., 10^{10} pm., 30 min. 10 spec. — **St. 126.** ibid. 300 m.w., 9^{30} pm., 30 min. 1 spec. — **St. 134.** 350 m. 37°37′ N, 10°17′ E. 15-7-1910. 25 m.w., 4^{50} am., 30 min. 7 spec. — **St. 139.** 600 m. 37°57′ N, 11°54′ E. 20-7-1910. 25 m.w., 1^{40} am., 30 min. 2 spec. — **St. 142.** 98 m. 35°44′ N, 15°07′ E. 22-7-1910. 25 m.w., 2^{50} am., 25 min. 4 spec. — **St. 142.** ibid. 150 m.w., 3^{40} am., 150 min. 4 spec. — **St. 143.** 1842 m. 35°18′ N, 16°25′ E. 23-7-1910. 25 m.w., 1^{20} am., 30 min. 3 spec. — **St. 171.** 50 m. 41°07′ N, 29°05′ E. 10-8-1910. 50 m.w., 3^{30} pm., 15 min. 1 spec. — **St. 174.** 120 m. 40°54′ N, 28°53′ E. 11-8-1910. 65 m.w., 11^{50} am., 30 min. 1 spec. — **St. 176.** 560 m. 40°45′ N, 27°43′ E. 12-8-1910. 65 m.w., 4^{00} am., 30 min. 2 spec. — **St. 179.** 85 m. 40°02′ N, 25°55′ E. 13-8-1910. 65 m.w., 2^{15} am., 30 min. 2 spec. — **St. 181.** 225 m. 38°49′ N, 25°09′ E. 13-8-1910. 65 m.w., 2^{55} pm., 15 min. 1 spec., st. I. — **St. 183.** 223 m. 37°52′ N, 23°09′ E. 16-8-1910. 65 m.w., 5^{10} pm., 15 min. 2 spec. — **St. 183.** ibid. 300 m.w., 4^{45} pm., 15 min. 1 spec. — **St. 190.** 360 m. 37°51′ N, 15°19′ E. 19-10-1910. 25 m.w., 8^{15} pm., 10 min. 12 spec. — **St. 192.** 650 m. 38°07′ N, 15°35′ E. 20-10-1910. 600 m.w., 10^{50} pm., 30 min. 10 spec. — **St. 194.** 1140 m. 38°33′ N, 15°29′ E. 21-8-1910. 1200 m.w., 6^{00} am., 30 min. 1 spec. — **St. 200.** 940 m. 39°18′ N, 10°11′ E. 26-8-1910. 25 m.w., 3^{45} am., 30 min. 3 spec. — **St. 206.** 2782 m. 39°32′ N, 5°15′ E. 28-8-1910. 1000 m.w., 1^{40} am., 45 min. 1 spec. — **St. 208.** 1600 m. 40°18′ N, 3°20′ E. 29-8-1910. 25 m.w., 1^{40} am., 15 min. 3 spec. — **St. 209.** > 2000 m. 40°34′ N, 3°03′ E. 28-8-1910. 150 m.w., 4^{25} am., 20 min. 3 spec. — **St. 210.** 775 m. 41°10′ N, 2°23′ E. 30-8-1910. 600 m.w., 3^{35} am., 30 min. 1 spec. — **St. 215.** 1050 m. 39°14′ N, 0°52′ E. 31-8-1910. 25 m.w., 9^{20} pm., 30 min. 1 spec. — **St. 276** ("Pangan"). > 3000 m. 36°30′ N, 19°20′ E. 4-4-1911. 132 m.w., 11^{55} pm., 35 min. 1 spec. — **St. 277** ("Pangan"). > 3000 m. 33°20′ N, 27°30′ E. 6-4-1911. 132 m.w., 11^{35} pm., 35 min. 3 spec. — **St. 340** ("Pangan"). > 2000 m. 35°50′ N, 21°30′ E. 26-8-1911. 28 m.w., 9^{00} pm. 1 spec. — **St. 340.** ibid. 108 m.w., 9^{00} pm., 30 min. 1 spec. — **St. 385** ("Pangan"). > 3000 m. 35°10′ N, 18°10′ E. 9-11-1910. 122 m.w., 9^{00} pm., 30 min. 1 spec. — **St. 410** ("Pangan"). > 1000 m. 37°12′ N, 1°18′ W. 29-12-1911. 112 m.w., 7^{00} pm., 30 min. 1 spec. — **St. 730** ("Nordboen"). > 1000 m. 38°36′ N, 13°37′ E. 16-4-1913. 2^{00} pm. 1 spec.

Atlantic.

St. 65. 1300 m. 35°53′ N, 7°26′ W. 24-2-1909. 600 m.w., 10^{00} am., 120 min. 2 spec. — **St. 376** ("Florida"). 34°41′ N, 16°14′ W. 22-7-1911. 15 m.w., 8^{45} pm., 30 min. 2 spec.

All that we know of the development of this species, of which Williamson 1915 has given a survey, is, that Lo Bianco (1904) found some larvæ which he hatched out to the adult species, but he gives no description, — and that Coutière (1907) has briefly described the larval stages he borrowed from Lo Bianco (but not the transition stages to the adult).

The larvæ in the "Thor" material agree very well with Coutière's description, and belong almost exclusively to the oldest stages (4.—6. stages); it is not altogether impossible, however, that they may belong to another species, for C.s description is very brief, and there are in the Mediterranean at least 4 other species of *Alpheidæ*, viz.: in addition to *Athanas nitescens* (whose larva is described in detail by G. O. Sars in Archiv f. Math. og Naturvid., Bd. 27, No. 10, Christiania 1906) also *Synalpheus lævimanus*, *Alpheus dentipes* and *A. megacheles* and the larvæ of these last three species are not yet known.

Coutière describes 6 stages of which even the youngest has free uropoda and articulation between telson and 6. caudal segment. The "Thor" (st. 225, 1910, 65 m.w.) has, however, taken a single specimen of a still younger stage, somewhat over 3 mm. long (fig. 27) (COUTIÈRE's "St. I" is 4 mm.). The telson is not separated as a distinct segment, and the uropoda can be seen through the skin lying in the very broad, triangular telson, which has on its posterior margin (incl. corners) the same 8 pairs of spines as in COUTIÈRE's stage 1; the only discrepancy in regard to these spines is that in COUTIÈRE's stage 1, spine No. 4 (from the middle) is considerably shorter than nos. 3 and 5—6, whereas in the "Thor" spec. all the spines 3—6 are about the same length.

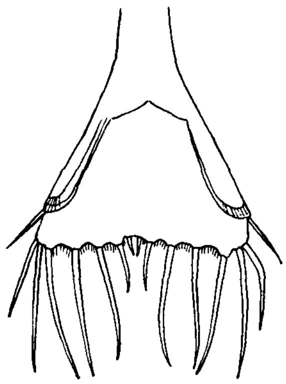

Fig. 27. Alpheus ruber. Telson of the youngest known larval stage. (St. 225. 1910, 65 m.w.).

As to the pereiopoda, nothing can be stated, as they are partly or entirely lacking in the specimen here considered.

The habitus-figure given by COUTIÈRE is better than LO BIANCO's fig.; p. 5 in particular is drawn too short by Lo B. The stage shown must, from the development of the pleopoda, answer to stage 4 or 5. The largest larvæ from the "Thor" are abt. 9 mm., they have a small appendix interna on the inner ramus of the plp. and the telson is as in COUTIÈRE's 6. stage.

We have adult specimens from 5 st. in the Mediterranean; from the Balearic Isles to the Bay of Ægina.

The larva was taken at a no. of stations, evenly distributed from the coast of Spain to the Marmora. True, a great number of the specimens were taken over great depths to bottom, (up to over 3000 m.) but it will be seen from the chart that most of the stations are comparatively close in to land, and it is not remarkable that a pelagic organism should be found above relatively great depths to bottom, even though it may originate from places where the soundings are not very great (the adult appears to live especially at 50 80 m., rarely as deep as 200 m. or more).

Depths in m.	No. of stations
0— 500	9
> 500—1000	8
> 1000	14

About half the night hauls were made just at the surface, with 10—25 m. w., it is thus a surface form, as the colour (transparent with orange spots; see LO BIANCO's coloured fig.) also suggests; it was taken somewhat deeper in the daytime, only with 65 m.w., in the Mediterranean.

Nearly all the larvæ were found in the summer half year, June—Aug. only very few specimens were found outside this season; (Nov.—Jan., April). This agrees with PESTA's record (l.c.) of ♀ with ova (from the Adriatic) found in May and Sept.

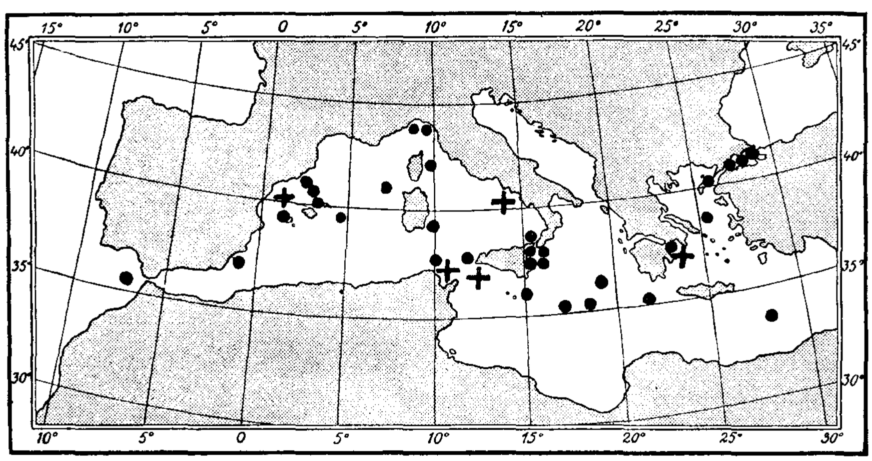

Chart 8. Alpheus ruber. + adult, • larvæ.

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