IV. NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

V.—HIPPOLYTIDAE.

By STANLEY KEMP, *B.A., Assistant Superintendent, Indian Museum.*

(Plates I-VII.)

With the exception of a few more or less isolated records little has hitherto been written on the Hippolytidae occurring in Indian waters. The family is well represented in the Indian Museum, but there can be no doubt that many new and unrecorded forms remain to be discovered.

On a recent visit to the coasts of S. India in the vicinity of Rameswaram Island, made in company with Dr. J. R. Henderson of the Madras Museum, several species hitherto unknown from Indian coasts were obtained and there is little doubt that collections from other localities would prove equally interesting. Hippolytidae seem, for the most part, to prefer shallow water and a weedy bottom; it was at any rate in such situations that all the species found in S. India were obtained. Our collection was made in February and at this season the majority of the females were found bearing eggs.

The family Hippolytidae is one of somewhat unusual interest on account of the great diversity of form found in the different genera and of the different modes in which the secondary sexual characters may find expression.

Several genera such as *Leontocaris, Cryptocheles, Tozeuma* and *Gelastocaris* exhibit structural modifications of the most bizarre character; this specialization is presumably correlated with some unusual form of livelihood, but the reasons for the peculiar adaptations have not as yet been definitely ascertained.

In many of the genera no conspicuous secondary sexual characters are developed, but in others they form a most noticeable feature. In some, such as *Latreutes* and to a less marked extent in *Saron*, the sexes may be distinguished by the development of the upper antennular flagellum, that of the male being longer and stouter than that of the female. Young males of *Saron* in other respects bear a close resemblance to females, but in large individuals of the former sex the third maxillipedes and first peraeopods may attain a monstrous development, being often proportionately twice as long as those of the female. This condition, which is also found in the genus *Alope*, has been discussed at length by Coutière ; he considers it to be a case of ' dimorphism ', but his application of the term to the phenomena found in these genera is open to question.

In *Thor*, on the other hand, it is the third peraeopods which are affected. In males of this genus the third leg is proportionately much longer than in the female and bears a different type of spinulation.

If my results be accepted, the sexual modifications in one species of *Latreutes* (*L. mucronatus*) are of a very far-reaching nature, the whole form of the animal being different, while distinctions of the most striking character are found in the form of the rostrum.

The normal variation found in the species of certain genera is astonishingly great, especially as regards the form and armature of the rostrum, and it is unfortunate that almost implicit reliance was placed on this character by many of the older authors. As a consequence, a very large number of species stand in need of redefinition and considerable difficulties have been met with in identification, more particularly in the genera *Latreutes* and *Hippolysmata*.

In examining the Indian forms I have described three new species and one variety, while two fresh genera are proposed, both based on forms already described. Out of a total of twenty-two genera, the number now known from the Indo-pacific region[1] is fifteen, of which twelve have been found on the coasts of British India.

A sound basis for the classification of the genera was outlined by Calman in 1906[2] on characters derived from the branchial formula and the development of the mandible. The Indo-pacific genera may be distinguished by the use of the following key, which is adapted and expanded from that given by Calman. The genera *Ogyris*, Stimpson, and *Pterocaris*, Heller, are regarded as members of the Alpheidae and are not included therein. I have not seen examples of the genera *Nauticaris*, *Ligur* and *Mimocaris*.

KEY TO THE INDO-PACIFIC GENERA OF HIPPOLYTIDAE.

A. Arthrobranchiae present at base of first four pairs of peraeopods [mandible with three-segmented palp ; many segments in carpus of second peraeopods].

I A movable tooth at base of uropods.
A. Mandible with incisor-process ... ... *Saron*.
B. Mandible without incisor-process ... ... *Nauticaris*.

II. No movable tooth at base of uropods.
A. Mandible with incisor-process ; last three peraeopods not abnormally slender ... ... *Merhippolyte*.

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1 Under this term I include the area extending from the Red Sea and Delagoa Bay to New Zealand, Oceania, the Hawaiian Is. and Japan.

2 Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 29.

B. Mandible without incisor-process; last three peraeopods abnormally slender ... ... *Ligur* (= *Parhippolyte*).

B. No arthrobranchiae at base of peraeopods.

I. Mandible with palp [carpus of second peraeopods composed of six to eight segments].

A. Mandibular palp three-segmented; supra-orbital spines of carapace very large [incisor-process of mandible present or absent] ... ... *Alope.*

B. Mandibular palp two-segmented; supra-orbital spines of carapace, if present, not very large [mandible with incisor-process] ... ... *Spirontocaris.*

II. Mandible without palp.

A. Mandible with incisor-process.

I. Carpus of second peraeopods composed of six or seven segments; ultimate segment of antennular peduncle with movable distal plate ... ... *Thor.*

II. Carpus of second peraeopods composed of only three segments; ultimate segment of antennular peduncle without movable plate (normal) ... *Hippolyte.*

B. Mandible without incisor-process.

I. Carpus of second peraeopods composed of three segments.

a. No post-ocular spine on carapace; carpus and chela of first peraeopods short and stout, dactyli of last three pairs normal.

1. Form of body stout; lateral process of basal antennular segment anteriorly rounded; third maxillipede with exopod; epipods at base of first three or four peraeopods ... *Latreutes.*

2. Form of body very slender; lateral process of basal antennular segment anteriorly pointed; third maxillipede without exopod; no epipods at base of peraeopods ... ... *Tozeuma.*

b. A post-ocular spine on carapace: carpus and chela of first peraeopods slender; dactylus of last three pairs composed of a short basal portion bearing a cluster of large teeth [third maxillipede without exopod; epipods at base of first four peraeopods] ... ... *Gelastocaris.*

II. Carpus of second peraeopods composed of many segments.

a. Abdomen bearing argespines dorsally and ventrally; carapace with longitudinal lateral carinae [exopod of third maxillipede present ?] ... *Mimocaris.*

b. Abdomen without large spines; carapace without lateral carinae.

1. Third maxillipede with exopod; epipods at base of first four peraeopods, ultimate segment of antennal peduncle not abnormal in size.

α. Upper antennular flagellum unequally biramous ... ... *Lysmata.*

β. Upper antennular flagellum uniramous ... *Hippolysmata.*

2. Third maxillipede without exopod; no epipods at base of first four peraeopods, ultimate segment of antennal peduncle abnormal in size ... ... *Merguia.*

As the literature dealing with the family is much scattered, I have given, at the end of this paper, a list of the Indo-pacific species with references.

Genus **Saron**, Thallwitz.

Saron marmoratus (Olivier).

1869. *Hippolyte kraussi*, Bianconi, Spec. Zool. Mossambic., XVII, in Mem. Acad. Sci. Bologna (2), IX, p. 209, pl. i, fig. 2*a*.
1878. *Hippolyte kraussi*, Hilgendorf, Monatsb. Akad. Wiss. Berlin, p. 836.
1898. *Saron marmoratus*, Borradaile, Proc. Zool. Soc. London, p. 1009.
1902. *Saron marmoratus*, Borradaile, in Willey's Zool. Results, p. 413.
1903. *Saron gibberosus*, de Man, Abhandl. Senck. nat. Ges., XXV, p. 852, pl. xxvi, fig. 57.
1905. *Nauticaris grandirostris*, Pearson, Ceylon Pearl Oyster Rep., IV, p. 79, pl. i, fig. 6.
1906. *Spirontocaris marmorata*, Rathbun, Bull. U.S. Fish. Comm. for 1903, p. 913.
1906. *Saron gibberosus*, Nobili, Ann. Sci. nat. Zool. (9), IV, p. 40.
1906. *Saron gibberosus*, Nobili, Bull. sci. France et Belg., XL, p. 35.
1910. *Saron gibberosus*, Coutière, Bull. Soc. philomath. Paris (10), II, p. 71, text-figs.

Most of the earlier synonymy of this species is given in full by Borradaile (*loc. cit.*, 1898). It should however be noticed that de Man (*loc. cit.*, 1902) has referred Ortmann's Japanese specimens [1] and some of those recorded by himself both in 1888 [2] and 1897 [3] to a new and very closely allied species, *Saron neglectus*, which is recorded in the present paper from the Andaman Is.

Among the male specimens of *S. marmoratus* preserved in the Indian Museum the variation in the proportional lengths of the third maxillipedes and first pair of peraeopods is enormous; in twenty individuals of this sex from a single locality the third maxillipedes vary from 35 to 77% and the first peraeopods from 30 to 88% of the total length. It is this great variation that has led to the confusion that exists in the taxonomy and has induced earlier authors to describe the species under two separate names, *marmoratus* and *gibberosus*. Thanks to the work of Borradaile and de Man this confusion no longer exists, but there is still, I believe, a certain amount of misconception regarding the occurrence of dimorphism in the genus.

Borradaile, while including *gibberosus* as a synonym of *marmoratus*, notes that in his specimens "the males can be sharply divided into two groups having the *marmoratus* and *gibberosus*-characteristics respectively" and suggests the possibility that the males of the species are dimorphic. This view is upheld by Coutière in a most interesting paper entitled "Les crevettes à mâles dimorphes du genre *Saron*" (*loc. cit.*, 1910); but an examination of the material at my disposal leads me to believe that this supposed dimorphism has no foundation in fact.

The variation shown in the relative lengths of the third maxillipedes and first peraeopods is, as shown in the table on page 85, of enormous extent. In some males these two appendages

[1] Zool. Jahrb., Syst., V, p. 497 (1890).
[2] Arch. f. Naturgesch., p. 533.
[3] Zool. Jahrb., Syst., IX, p. 761.

attain a monstrous size, while in others they are small and approximate more or less closely to those of the female. But this alone is, in my opinion, insufficient to prove the existence of dimorphism: it is essential that the specimens should fall into two well-defined groups and that their measurements, when plotted, should yield a bimodal curve. Measurements of our specimens show no indication of this. The greatest proportional size of the limbs is found in large specimens, but the figures, when plotted, give little other information of interest; there is no trace of a bimodal curve and even on casual examination of the specimens, it is evident that for all practical purposes the series is a graded one.

MEASUREMENTS OF MALE *Saron marmoratus.*

Locality.	Total length.	Length of		Percentage of total length.	
		3rd mxpde.	1st prpd.	3rd mxpde.	1st prpd.
	mm.	mm.	mm.		
Karachi	42	16·5	14	39·3	33·3
	43·5	19·5	17·5	44·8	40·2
	44	19	17	43·2	38·6
	44	19	16·4	43·2	37·3
	46	22·5	21·5	48·9	46·7
	48	25	25	52·1	52·1
	49·5	23·5	22·3	47·5	45
	49·5	23·5	22·5	47·5	45·4
	51	24·2	22	47·4	43·1
	53	25·5	24	48·1	45·3
	53	28	26·7	52·3	50·4
	53	29	30·5	54·7	57·5
	53·5	26·5	26·5	49·5	49·5
	55	30	29	54·5	52·7
	56	32	—	57·1	—
	58	33	34·5	55·2	59·5
	58	44·5	51	76·7	87·9
	61	37	42	60·6	68·8
	61·5	—	45·5	—	72·3
Andamans	33	11·7	10	35·4	30·3
	43	10	15·2	44·2	35·3
Port Canning ...	41	15	12·8	36·6	31·2
	43·5	16	14	36·8	32·2
	46	19	16·5	41·3	35·9
	49	21	16·7	42·8	34·1
	52	—	21·7	—	41·7
	61·5	27·7	25·5	45	41·5

In the measurements taken my specimens seem to agree with those examined by Coutière who has nowhere stated that they can be sharply divided into two groups. They are, however, directly at variance with the results obtained by Borradaile and for this I am unable to offer any adequate explanation.

Judging from the Indian examples the variation in the males of *Saron marmoratus* is closely similar to that found in certain freshwater prawns of the family Palaemonidae. In a number of species of this family the second peraeopods of some males are found to have attained a huge size, while in other individuals of the same sex and species they resemble those of the female: if sufficiently large numbers are examined it is found that the specimens fall into a more or less well-graded series and that it is impossible to separate them into two or more groups. Coutière considers that dimorphism also occurs in the Palaemonidae; but his detailed study of its occurrence in *Palaemon* (*Eupalaemon*) *lar*,[1] although of great interest, does not convince me that this is the case.[2]

Smith defines high and low dimorphism in the following terms[3]:—" It consists essentially in the existence among the males of any species of a graduated series, as regards size and the development of the secondary sexual characters, such that the smaller males have relatively poorly developed secondary sexual characters while the larger males attain to a much greater relative development of those characters. The smaller males are then termed 'low,' and the larger males "high": when there is a more or less abrupt transition in point of numbers from high to low males we may most properly speak of a high and low dimorphism existing in the males of that species, but we also apply the term more loosely to those cases in which no such abrupt transition is proved to occur."

If the last sentence in this paragraph be accepted, the phenomena found in these Caridea may correctly be described as dimorphism, but to do so would, in my opinion, only tend to obscure the real nature of the case. In *Saron*, *Palaemon*, and certain other genera it appears that the male may become sexually mature at a period when, in its secondary sexual characters, it shows but little external difference from the female; but that it gradually assumes the more striking features of its sex in the course of subsequent moults, just as the male parr in which the milt may be ripe gradually assumes the appearance of the adult milt salmon. In Caridea, therefore, the case is one of gradual transition rather than of true dimorphism, by which is implied either a

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1 Coutière, Ann. Sci. nat. Zool. (8), XII, p. 292 (1901).

2 Henderson and Matthai in their account of the freshwater Palaemonidae of Southern India (Rec. Ind. Mus., V, 1910, p. 280) have advanced certain facts which seem to indicate that *Palaemon scabriculus*, *P. dolichodactylus* and *P. dubius*, belong in reality to a single species. This suggestion is a most interesting one and, if it be proved, trimorphism in the males of Palaemonidae will be established. The case, however, is on an entirely different footing from that cited above, for the three forms, all founded on males of large size, differ from one another in well-marked characters drawn from the proportional lengths of the individual segments of the second peraeopods.

3 Smith, Mitth. zool. Stat. Neapel, XVII, p. 312 (1906).

discontinuity in the development of the individual or a marked dichotomy of evolution within the limits of a species.

Coutière at the close of his paper on the males of the genus *Saron* gives an account of certain investigations which he has made on the condition of the testes in *S. marmoratus* and *neglectus*. In those specimens in which the third maxillipedes and first peraeopods were very large he found that the testes were reduced. The suggestion that he makes to account for the condition of the individuals that he examined is a most interesting one, namely that the production of very large limbs is the result of senility. This suggestion should form the basis of further investigation, but the fact that Coutière does not state whether all or any of his specimens, which came from widely separated localities, were killed during the breeding season, makes it impossible to accept his views without further evidence and this, unfortunately, my own material does not provide.

The specimens of *Saron marmoratus* in the Indian Museum were obtained at the following localities:—

8103/9	Queensland, Australia.	Queensland Museum.	One, 44 mm.
248/7, 2455/10, 6403/10	Andaman Is.	A. R. Anderson, J. Wood-Mason.	Six, 33–44 mm.
6400/10	Port Canning, Ganges delta.	J. Wood-Mason.	Six, 41–61·5 mm.
8456/10	Kilakarai, Ramnad Dist., S. India. From coral reef.	S. Kemp.	One, 44 mm.
8454-5/10	Pamban, Ramnad Dist., S. India. From coral reef.	S. Kemp.	Twenty-four, 10–43 mm.
1637, 3186/5, 3169-77/7	Karachi, M. of R. Indus.	Karachi Museum.	Forty-eight, 36–65 mm.
6401/10	Kubbar I. reef, Persian Gulf.	'Investigator.'	Two, 34 and 59 mm.
1460/7	Mauritius.	(Purchased.)	One, 50 mm.

The Pamban specimens were collected in February, 1913. All the larger individuals are ovigerous females and many of them bear coarse tufts of hairs on the rostrum, carapace and abdomen much as in *Hippolyte varians* form *fascigera*.

Saron marmoratus has been recorded from Australia (Milne-Edwards) from the Hawaiian Is. (Randall), and from many localities in Oceania and in the Malay Archipelago (Dana, Heller, de Man, Borradaile etc.). It is also known from Ceylon (Pearson), Mozambique (Bianconi, Hilgendorf), Zanzibar (Ortmann), the Arabian coast (Nobili), and from the Red Sea (Heller, Nobili).

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1903. *Alope palpalis*, Thomson, Trans. Linn. Soc., Zool. (2), VIII, p. 440, pl. xxviii, figs. 3-12.
1903. *Merhippolyte spinifrons*, Thomson, *ibid.*, p. 444.
1909. *Alope palpalis*, McCulloch, Rec. Australian Mus., VII, p. 313, text-figs. 2, 3.
1906. *Merhippolyte spinifrons* = ? *Alope palpalis*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 32.

Dr. Calman has suggested that *Hippolyte spinifrons*, Milne-Edwards, is probably a species of *Alope* and with this view I am in entire agreement. It seems likely that the phrase "les épines suborbitaires" in Milne-Edwards' description is a clerical error for "les épines supra-orbitaires"; this hypothesis explains the italicization of the whole passage and appears to me more probable than the view advanced by Bate [1] that the words refer to the lateral process of the antennular peduncle. In other respects the description agrees well enough with *Alope palpalis*; but until the matter has been placed beyond all doubt it is, in my opinion, not advisable to change the name of this well-known form.

Several subsequent authors have recorded both *Alope palpalis* and *Hippolyte spinifrons* from the New Zealand coast; but it does not appear that any of them, with the possible exception of Filhol, examined both forms. Filhol's *Hippolyte spinifrons*, as is shown by the figure, is undoubtedly synonymous with White's *Alope palpalis*; he refers to the supra-orbital spines as "épines sus-orbitaires" following Milne-Edwards' mistake in terminology. He gives no description of his *Alope palpalis* and it is possible that he has supplied records of its occurrence without examining specimens; his work, as a whole, is not such as to inspire confidence.

Thomson, under the name *Merhippolyte spinifrons*, merely quotes Filhol's account, and the examples subsequently recorded by Chilton [2] under this name from the Kermadec Is. are, as I have been able to determine by examination of specimens kindly sent me by the author, to be referred to the genus *Lysmata* (see p. 110). It is, I believe, most improbable that Milne-Edwards' description was based on this species.

Alope palpalis is represented in the Indian Museum by a single ovigerous female which differs rather markedly from Thomson's description and figures (*loc. cit.*). In the second pair of peraeopods the ischium and merus on the right side are composed of two segments and the carpus of seven (fig. 2). On the left side the ischium is two–, the merus three– and the carpus eight–segmented (fig. 1). The processes on the thoracic sternum bear little resemblance to Thomson's figure and are closely similar in form to those of the allied species, *A. australis* (see pl. I, fig. 5).

Thomson does not refer in any definite way to the great development of the third maxillipedes and first peraeopods in

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[1] Bate, Rep. 'Challenger' Macrura, pp. 621, 622 (1888).
[2] Chilton, Trans. N. Zealand Inst., XLIII, p. 547 (1911).

large males of this species, but from Mier's figure (1874, *loc. cit.*) it is evident that this is sometimes a conspicuous feature.

$\frac{8457}{10}$	New Zealand.	Canterbury Mus. exch.	One, 39 mm.

Alope palpalis appears to be restricted to the coasts of New Zealand and the neighbouring islands, the records of its occurrence in Australian waters refer to the following species.

Alope australis, Baker.

(Plate I, figs. 3-5.)

1882. *Alope palpalis*, Haswell, Cat. Australian Crust., p. 193.
1898. *Alope palpalis*, Stead, Zoologist (4), II, p. 211.
1904. *Alope australis*, Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 154, pl. xxx, figs. 1-7.
1909. *Alope australis*, McCulloch, Rec. Australian Mus., VII, p. 313, text-fig. 1.

The chief distinctions between this species and *A. palpalis*, White, are as follows :—

A. australis.	*A. palpalis.*
Rostrum not reaching as far forwards as basal segment of antennular peduncle.	Rostrum reaching as far forwards as basal segment of antennular peduncle.
Supra-orbital spines scarcely reaching beyond base of eye-stalks.	Supra-orbital spines reaching to tips of eyes.
Lateral process of basal segment of antennular peduncle extending little, if at all, beyond end of segment.	Lateral process of basal segment of antennular peduncle extending far in advance of basal segment.
Mandible without incisor-process.	Mandible with incisor-process.

The five Burmese specimens examined differ from Baker's description and figures in a few particulars. The antennular peduncle reaches beyond the middle of the antennal scale, the second segment is longer than the third and is longer than broad ; the lateral process of the basal segment extends at most to the distal end of the segment, usually falling far short of it (fig. 3).

Baker states that *A. australis* differs from *A. palpalis* " in the less divided state of the second pereiopods—except the carpus " and in his figure the merus and ischium of this limb are not segmented. In four of the Indian examples the ischium and merus of this pair are each divided into two segments, while the carpus is composed of seven. In the fifth specimen, a large male, the left leg is similarly segmented, but the right, which is abnormally short, shows traces of subdivision into two and three segments in the ischium and merus and the carpus consists of ten segments, two of these, however, being only feebly indicated (fig. 4).

Three of the specimens examined possess five dorsal teeth on the rostrum; in the other two there are only four.

The mandible agrees closely with Baker's figures; but the second segment of the palp is as broad as long. A small ridge at the base of the palp is all that remains of the incisor-process.

The processes on the thoracic sternum of the large male (fig. 5) consist of (i) a sharp upstanding keel between the third and fourth pairs of peraeopods, (ii) a pair of acute backwardly directed teeth between the fourth and fifth pairs, and (iii) a conspicuous plate, very deeply bifurcated anteriorly, behind the base of the last pair. In small males and in an ovigerous female the processes are similar, but the anterior bifurcation in the plate behind the fifth peraeopods is much less pronounced.

The endopod of the first pair of peraeopods is, in the male, unequally bifid at the apex; in the female it is simple and ends acutely.

In the large male example the third maxillipedes are as long as the entire length of the animal (measured from the tip of the rostrum to the apex of the telson), though in other males and in the female they are less than half the same proportional length. The five specimens yield the following measurements:—

Sex.	Total length.	Length of 3rd mxpde.	Ratio of 3rd mxpde. to total length.
	mm.	mm.	
♂	22	8·5	·39
♂	25	11	·44
♂	30	14	·47
♂	44	44	100
♀	30	12·3	·41

The phenomenon is doubtless precisely similar in nature to that already discussed in the case of *Saron marmoratus*. It is to be noted, however, that in males of *Saron* and also, according to Mier's figure, in those of *A. palpalis*, the first peraeopods grow *pari passu* with the outer maxillipedes, whereas in *A. australis* the latter alone appear to affect an extreme development. The point is one of some interest, but it cannot be decided until large collections of both species have been examined.

The specimens of *Alope australis* in the Indian Museum were all found at one locality.

$\frac{6398}{10}$ Arrakan coast, Lower Burma. W. Theobald. Five, 22-44 mm.

The species has hitherto been recorded only from the Australian Coast, from Port Jackson (Stead), Kangaroo I., Smith's Bay (Baker) and Sydney (McCulloch).

Genus Spirontocaris, Bate.

1860. *Hippolyte*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, pp. 33-35.
1906. *Spirontocaris*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 32 (*ubi cet. syn.*)

Spirontocaris pandaloides (Stimpson).

1860. *Hippolyte pandaloides*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.
1902. *Hippolyte pandaloides*, Doflein, Abhandl. bayerisch. Akad. Wiss., XXI, p. 637.
1907. *Spirontocaris pandaloides*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 418, pl. xxxii, figs. 47, 48.

The Indian specimens differ from the long description given by de Man only in respect of the length of the sixth abdominal somite which, in all the larger examples, is little, if at all, more than two-thirds the length of the preceding somite.

On comparison with examples collected at Yokohama by Dr. Haberer and received in exchange from the Munich Museum the only difference that I can find is that in the Japanese specimens the distal end of the third abdominal somite is rather more strongly produced: in the proportions of the last two abdominal somites there is close agreement.

The rostrum in the Indian specimens bears 8 to 12 (usually 9) teeth on the upper margin and 8 to 12 on the lower. The two posterior teeth of the dorsal series are always situated on the carapace behind the orbit.

$\frac{6399}{10}$	Karachi, mouth of R. Indus.	Karachi Museum.	Nine, 33-53 mm.
$\frac{7731}{10}$	Yokohama, Japan.	Munich Mus. exch.	Three, *ca.* 42-50 mm.

Spirontocaris pandaloides has hitherto been recorded only from Japan; from Hakodadi (Stimpson), Yokohama (Doflein) and the Inland Sea (de Man).

Genus Thor, Kingsley.

1878. *Thor*, Kingsley, Proc. Acad. Sci. Philadelphia, XXX, pp. 6, 94.
1899. *Thor*, Kingsley, American Naturalist, XXXI, pp. 714, 718.
1901. *Thor*, Rathbun, Bull. U. S. Fish Comm. for 1900, II, p. 116.
1905. *Paschocaris*, Nobili, Bull. Mus. d'Hist. nat., Paris, p. 394.
1906. *Paschocaris*, Nobili, Ann. Sci. nat. Zool., Paris (9), IV, p. 37.

The genus *Thor* is very closely related to *Hippolyte*, but differs from *H. varians*, the type species of the latter genus, in the greater number of segments in the carpus of the second peraeopods and in the absence of supra-orbital and pterygostomian spines from the carapace. It is also distinguished by the presence of a curious movable triangular plate situated dorsally at the end of the ultimate segment of the antennular peduncle.

Thor paschalis (Heller).

Plate I, figs. 6-10.

1861. *Hippolyte paschalis*, Heller. Sitz-ber. Akad. Wiss. Wien, XLIV, p. 276, pl. iii, fig. 24.
1878. *Thor floridanus*, Kingsley, Bull. Essex Inst., X, p. 64.
1878. *Thor floridanus*, Kingsley, Proc. Acad. Sci. Philadelph., pp. 7, 95.
1879. *Thor floridanus*, Kingsley, *ibid.*, p. 421, pl. xiv, fig. 6.
1887. *Hippolyte paschalis*, de Man, Arch. f. Naturgesch., LIII, i, p. 534.
1887. *Hippolyte amboinensis*, de Man, *ibid.*, p. 535.
1901. *Thor floridanus*, Rathbun, Bull. U. S. Fish Comm. for 1900, II, p. 116.
1901-3. *Thor floridanus*, Verrill, Trans. Conn. Acad., XI, p. 19.
1905. *Hippolyte paschalis*, Lenz, Abh. Senck. naturf. Ges. Frankfurt, XXVII, p. 382.
1905. *Paschocaris paschalis*, Nobili, Bull. Mus. d'Hist. nat., Paris, p. 394.
1906. *Paschocaris paschalis*, Nobili, Ann. Sci. nat. Zool., Paris (9), IV, p. 38, pl. iii, fig. 1.

The synonymy shown above is given with confidence. Not only is it at once evident from comparison between Nobili's description of *Paschocaris* (1906) and that of *Thor*, as given by Miss Rathbun, that the two genera are identical, but I have been able to compare American examples, received under the name of *Thor floridanus* from the United States National Museum, with specimens from S. India which unquestionably belong to the form described by Nobili as *Paschocaris paschalis*.

The identity of the two forms is complete, unless it be that any importance can be attributed to the slightly stouter and more gibbous form of the S. Indian specimens: microscopic examination of the appendages fails to yield evidence for the recognition even of a subspecies in the case of the American form. The fact is one of considerable interest, for, among littoral Decapoda, it is most unusual to find a species inhabiting both the Atlantic and the Pacific without exhibiting any distinct structural differences.[1]

It is scarcely necessary to describe the species in detail for good accounts have already been given by Heller, de Man, Rathbun and Nobili.

In the examples from S. India the rostrum is bifid at the apex (in one specimen trifid) and bears three or four (very rarely two) teeth on its dorsal margin; one of the dorsal teeth is usually situated on the carapace behind the orbital notch. In the American examples the apex is bifid in four specimens, trifid in a fifth, and there are four dorsal teeth.

[1] Faxon (Mem. Mus. Comp. Zool. Harvard, 1895, XVII, p. 235, footnote) gives a list of Decapoda which have been recorded both from the Gulf of Panama and from the West Indian side of America: the identity of the species of *Alpheus* mentioned in this list is, as he remarks, doubtful. Excluding free-swimming forms such as *Pasiphaë sivado* and those having a circumpolar distribution, the only littoral Decapoda Natantia that I can call to mind which inhabit both the Atlantic and the Indo-pacific are *Peneus caramote, Stenopus hispidus, Processa canaliculata* and *Athanas nitescens*, and some of these cases require further investigation.

The carpus of the second peraeopod is composed of six, less commonly of seven, segments. It is described by Miss Rathbun as " five annulate ", and six segments are distinct in the American examples which I have examined. The two proximal articulations are much less clearly marked than the remaining three, and the fact that in one specimen (fig. 9) there is a further subdivision, making three short proximal segments, indicates that the character is subject to some variation. In the normal 6-segmented carpus the proportional lengths of the segments differ somewhat from Miss Rathbun's description, but agree closely with the account given by Nobili. Comparison of fig. 7, which represents the carpus and chela of a specimen from Florida, with fig. 8, in which the same segments of a S. Indian individual are shown, will indicate the almost exact similarity in segmentation.

A feature of the species which seems to have escaped notice hitherto is the great development of the third peraeopod in the male. In the female (fig. 6) this limb is closely similar to those of the two succeeding pairs, but in males, both from Florida and from S. India, it is very much longer (fig. 10), reaching beyond the apex of the antennal scale by the dactylus and about one-half of the propodus. The propodus, moreover, is broadened towards its ultimate end and the inferior margin is, for rather more than its distal third, thickly beset with slender spines. The dactylar spines of the limb are also far more numerous.

As regards the spinulation of the merus in the last three pairs of legs there is considerable variation. In one example (from America) it bears five spines, in others two, three, or none at all. The telson bears three pairs of dorsal spinules : in some specimens four on one side and three on the other. The spinulation of the apex of the telson agrees with Nobili's description.

The following specimens have been examined :—

$\frac{8462\text{-}3}{10}$	Kilakarai, Ramnad Dist., S. India.	S. Kemp.	Seventeen, 7-12 mm.
$\frac{8464}{10}$	Pamban, Ramnad Dist., S. India.	S. Kemp.	One, 12 mm.
$\frac{7977}{10}$	Punta Rassa, Florida.	Smiths. Inst.	Five, 10-14 mm.

The specimens from Kilakarai and Pamban were found among weeds in water only a few feet deep. They were caught in February, 1913, and all, with the exception of two, are ovigerous females.

Thor paschalis has been recorded from Amboina (de Man), the Red Sea (Heller, Nobili) and from Zanzibar (Lenz). In the Atlantic it is known from the West Indies, the Bermudas, Florida, Yucatan and neighbouring localities (Kingsley, Rathbun, Verrill).

Genus **Hippolyte**, Leach.

1860. *Virbius*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 35.

Hippolyte ventricosus, H. Milne-Edwards.

Plate II, figs. 1-3.

1837. *Hippolyte ventricosus*, H. Milne-Edwards, Hist. nat. Crust., II, p. 371.
1878. *Virbius mossambicus*, Hilgendorf, Monatsb. Akad. Wiss. Berlin, p. 836, pl. iv, fig. 1.

This species is very closely related to *Hippolyte varians*, Leach, and should perhaps be regarded merely as a subspecies. The two forms may be distinguished by the following characters :—

H. ventricosus.	*H. varians.*
Rostrum rather more slender; armed with one or two dorsal teeth in its proximal third; apex acuminate (fig. 1).	Rostrum less slender, armed (usually) with only a single dorsal tooth in its basal third; a small dorsal tooth nearly always present close to apex, giving it a bidentate appearance.
Antennal scale not more than three times as long as broad (fig. 2).	Antennal scale three and a quarter to three and a half times as long as broad (fig. 4).
Thoracic appendages proportionately stouter; middle carpal segment of second peraeopods as broad as long (fig. 3).	Thoracic appendages proportionately more slender; middle carpal segment of second peraeopods nearly twice longer than broad (fig. 5).
Sixth abdominal somite about one and a half times as deep as long.	Sixth abdominal somite twice as deep as long.
Size smaller, ovigerous females not exceeding 20 mm. in length.	Size larger, ovigerous females sometimes 31 mm. in length.

Apart from the characters afforded by the rostrum, which, owing to the enormous range of variation that exists in both species, must necessarily be somewhat inconclusive, the principal difference between the two forms rests in the stouter build of that found in the Indo-pacific region. Structural distinctions of this nature are found in almost every part of the body, but in most cases they are so slight that it is scarcely possible to demonstrate them mathematically. They are, however, clearly shown in the proportions of the last abdominal somite and carpal segments of the second peraeopods and find less well-marked expression in the form of the antennal scale. The three segments composing the carpus of the second peraeopods have the same longitudinal proportions as in *H. varians*. The mouth parts of the two species are in closest agreement (the mandibles are nearly identical in structure) and no noteworthy differences are to be found in the arrangement of the gills and epipods or in the spinulation of the telson-tip and of the dactyli of the last three pairs of peraeopods.

Milne-Edwards' description of *Hippolyte ventricosus* is extremely brief and runs as follows:—

"Espèce extrêmement voisine de l'H. variable, mais dont le rostre ne porte en dessus qu'une seule dent située près de sa base, et dont les prolongemens latéraux des trois premiers anneaux de l'abdomen présentent des dimensions très-considerables. Longuer environ 4 lignes."

"Trouvée par M. Dussumier dans les mers d'Asie. (C. M.)"

The species does not seem to have been recorded—as *H. ventricosus*—since Milne-Edwards' time; but I believe that *Virbius mossambicus*, a name given by Hilgendorf in 1879 to a species found off the mouth of the Zambesi, is synonymous.

Milne-Edwards' reference to the abdominal segments is perplexing, for no definite differences are to be found in this respect between the Indian specimens and English examples of *Hippolyte varians*. The description of the rostrum seems, however, to leave little doubt of the identity of the species, more especially as, with the exception of *V. mossambicus*, no form closely resembling *H. varians* has yet been found in Asiatic waters.

The species appears to be very nearly related to *H. orientalis*, Heller[1], and it is possible that this name must be included in the synonymy of *H. ventricosus*. South Indian specimens agree well with Heller's description except that it is extremely rare to find among them an example with four teeth on the inferior margin of the rostrum.

Nobili[2] considers Paulson's *H. proteus*[3] a synonym of Heller's *H. orientalis*; but according to Czerniavsky[4] Paulson has confounded under the former name several known species, viz. *H. brullei*, Guérin, (=*H. prideauxiana*, Bell), *H. gracilis*, Heller, and *H. leptocerus*, Heller. Czerniavsky may be right, in part; but on general grounds it appears to me very unlikely that *H. prideauxiana* and *H. gracilis* occur in the Red Sea. It is probable that *H. ventricosus* does so, but it is impossible to speak with any certainty until further information is available. Indian specimens of *H. ventricosus* differ from *H. proteus*, as figured by Paulson, in the shorter antennular peduncle and in the carpal segmentation of the second peraeopods.

The specimens of *H. ventricosus* in the Indian Museum are registered thus:—

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[1] Heller, Sitzber. math.-naturw. Klasse d. Kais. Acad. Wiss. Wien, XLIII, p. 277 (1861).

[2] Nobili, Ann. Sci. nat. Zool. (9), IV, p. 33 (1906).

[3] Paulson, Red Sea Crustacea, Kiew, p. 109, pl. xvi, figs. 2-5; pl. xviii, fig. 1 (1875).

[4] Czerniavsky, Crustacea Decapoda Pontica Littoralia, p. 13 (1884).

$\frac{8458-60}{10}$	Kilakarai and Apa I., Ramnad Dist., S. India, 0-2 fms.	S. Kemp.	Many, 7-20 mm.
$\frac{8461}{10}$	Pamban, Ramnad Dist., S. India, 0-2 fms.		

The species was found in abundance at both the above localities, living among Zostera and other weeds inside the coral reef at depths ranging from low water to two fathoms. The specimens were obtained in an environment closely similar to that in which *H. varians* abounds on the English and Irish coasts and, at the time of capture, it was thought they must certainly belong to that species.

In colour the majority were of a brilliant green; but very many other types, each having its counterpart in home waters, were observed. The collection, which was made in February, 1913, contains a high proportion of ovigerous females.

Hippolyte australiensis (Stimpson).

Plate II, fig. 6.

1860. *Virbius australiensis* Stimpson, Proc. Acad. Sci. Philadelphia, p. 35.
1882. *Virbius australiensis*, Haswell, Cat. Australian Crust., p. 186.

Specimens of this species received in exchange from the Australian Museum differ from those of the preceding form in possessing no teeth on the dorsal margin of the rostrum and in having from four to six teeth (rarely three) ventrally. The ultimate segments of the antennular peduncle are shorter and broader, the second being broader than long, the antennal scale (in an ovigerous female) is three and a third times as long as broad and the last segment of the third maxillipede is scarcely twice the length of the penultimate. The proportions of the segments in the carpus of the second peraeopods are also different (fig. 6). The middle segment, as in *H. varians* and *H. ventricosus*, is much the shortest, but the third is decidedly longer than the first. The last three pairs of legs are stout. In an ovigerous female the propodus of the fifth pair is only five and a half times as long as broad and is little more than twice the length of the dactylus (spines included).

$\frac{7634-9}{10}$	New South Wales Coast.	Australian Mus. exch.	Twelve, 13-22 mm.

Hippolyte australiensis is known only from the Australian coast.

Genus **Latreutes**, Stimpson.

1906. *Latreutes*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 33 (*ubi syn.*)

Carapace without supra-orbital, but with antennal spine; a series of small spines on antero-lateral margin. Basal process of antennular peduncle anteriorly rounded; upper antennular flagellum uniramous. Mandible without incisor-process or palp.

Third maxillipede with exopod. No arthrobranchs at base of peraeopods; epipods present on at least first three pairs. Carpus of second peraeopods composed of three segments.

Nearly all the species of this genus stand in need of re-definition. They are for the most part based on the character of the rostrum which, in this genus, is subject to even greater variation than in *Spirontocaris* or *Hippolyte.*

The three species known from the Indian coasts may be separated thus:—

I. Dactyli of last three pairs of peraeopods with conspicuous spines on margin.
 A. Form very slender, basal segment of antennular peduncle three times as long as wide, antennal scale more than six times as long as wide; legs short, second pair not reaching to end of eyes ... ... *L. pygmaeus.*
 B. Form stouter, basal segment of antennular peduncle twice as long as wide, antennal scale not more than four and a half times as long as wide (less in adults); legs longer, second pair reaching beyond end of antennular peduncle ... ... *L. mucronatus.*
II. Dactyli of last three pairs of peraeopods simple claws, without spines on margin ... ... *L. anoplonyx.*

I have seen no specimens of the very curious *Latreutes ceylonensis* described by Pearson from the Ceylon pearl banks.[1] The species differs from all other members of the genus with which I am acquainted in the peculiar spinulation of the carapace and antennal scale and in the armature of the dactyli of the last three peraeopods. In many respects it appears to be allied to Nobili's *Latreutes paronae* which is here regarded as the type of a new genus, *Gelastocaris.*

Latreutes pygmaeus, Nobili.

Plate II, figs. 7, 8; Plate III, figs. 1-7.

1904. *Latreutes pygmaeus,* Nobili, Bull. Mus. d'hist. Nat., Paris, p. 230.
1906. *Latreutes pygmaeus,* Nobili, Bull. sci. France Belg., XL, p. 37, pl. iii, figs, 4, a-h.
1906. *Latreutes pygmaeus,* Nobili, Ann. Sci. nat. Zool. (9), IV, p. 41.

Large series of specimens obtained at Kilakarai and Pamban in S. India may undoubtedly be referred to this species, which is a very close ally of the Atlantic *L. ensifer.*

Nobili's account may be supplemented as follows:—

The small dorsal spine on the carapace behind the orbit is movable, as in *L. ensifer,* and not fixed as in certain other species of the genus. The rostrum is sometimes wholly unarmed, but more usually bears from 1 to 3 dorsal teeth and 1 to 3 ventral teeth, all situated in the distal third. The apex may be acute or bluntly rounded (pl. II, figs. 7, 8; pl. III, figs. 1-3).

Close to the cornea on the inner and superior aspect of the stalk the eye bears a small conical process similar to that described by Nobili in allied species.

[1] Ceylon Pearl Oyster Rep., IV, p. 81, pl. ii, figs. 7, 7 *a—e.*

The antennular peduncle reaches to less than half the length of the antennal scale. Its basal segment is elongate (pl. III, fig. 4), about three times as long as broad, and its lateral process is anteriorly rounded and feebly bilobed. The second segment is, in the female, longer than broad. The antennal scale (pl. III, fig. 5) is very sharply pointed anteriorly and is more than six times as long as broad.

The third maxillipedes reach to the base of the antennal scale, the peraeopods of the second pair to the middle of the eye, those of the fifth pair extending scarcely further forwards. Of the three segments composing the carpus of the second peraeopods the middle one is the longest and the third the shortest. The middle segment is about one and a half times the length of the first and the first is one and a third, or rather more than one and a third times the length of the third : there is a little variation in the precise measurement of these segments. The dactyli of the last three peraeopods terminate in sharp curved spines : there are a few other spines on the posterior margin, the ultimate being large and placed close to the terminal spine, giving the apex a biunguiculate appearance (pl. III, fig. 6). Epipods are present at the base of the first four pairs of legs.

The sixth abdominal somite is fully one and three quarters the length of the fifth. The telson in S. Indian specimens bears only two pairs of dorso-lateral spinules in addition to those at the apex, not three as Nobili has stated.

The male is very different in appearance to the female. It is much more slender in build and the rostrum seldom bears more than one tooth on either margin near the apex. The antennular peduncle is shorter than in the other sex, but the upper flagellum is stouter and very much longer. In the female the flagellum does not nearly reach the apex of the antennal scale, whereas in the male it extends beyond that point by almost half its length.

The colour of living specimens is very variable. As a rule they are of a uniform dull green, but olive, brown and brownish red specimens are frequent.

Latreutes pygmaeus has exceedingly close affinities with *L. ensifer*, Milne Edwards, the type species of the genus. I have compared South Indian specimens of the former species with examples of the latter obtained in the Sargasso Sea. The Atlantic form is slightly more robust in build, the rostrum is more strongly concave above and the teeth are more closely restricted to the apex. The legs are a little longer, the second pair reaching the ends of the eyes, the antennal scale is proportionately a trifle broader and the sixth abdominal somite is shorter and a little less slender. The second segment of the antennular peduncle is about as broad as long in the female Probably the best distinction between the two forms rests in the number of epipods at the base of the legs; in *L. pygmaeus* they are found on the first four pairs, while in *L. ensifer* they occur only on the first three.

$\frac{8474-6}{10}$	Kilakarai, Ramnad Dist., S. India.	S. Kemp.	Many, 9-20 mm.
$\frac{8477-8}{10}$	Pamban, Ramnad Dist., S. India.		

Latreutes pygmaeus was common at both of the above localities living among weeds in a few feet of water; in life the species bore a close general resemblance to the British *Hippolyte prideauxiana*. The collection, made in the month of February, includes a large proportion of ovigerous females.

The species has been recorded by Nobili from the S. E. coast of Arabia and the Red Sea.

Latreutes mucronatus (Stimpson).

Plate III, figs. 8-15; plate IV, figs 1, 2.

1860. *Rhynchocyclus mucronatus*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 28.
1902. *Latreutes mucronatus*, Doflein, Abhandl. bayerisch. Akad. Wiss., XXI, p. 638, pl. v, fig. 6.
1904. *Latreutes gravieri*, Nobili, Bull. Mus. Hist. nat., p. 231.
1906. *Latreutes gravieri*, Nobili, Bull. sci. France et Belg., XL, p. 39, pl. iii, figs. 4-44.
1906. *Latreutes gravieri*, Nobili, Ann. Sci. nat. Zool. (9), IV, p. 41.
1906. *Latreutes mucronatus* var. *multidens*, Nobili, *ibid.* p. 41, pl. ii, fig. 3.

Examination of a series of specimens from S. India suggests that *L. gravieri* must be regarded as a synonym of *L. mucronatus* and that there is no foundation for the retention of the varietal name *multidens*.

The series comprises twenty-nine examples, and of these eighteen were immediately separated from the rest on account of their stout and gibbous form and more or less circular rostrum (pl. III, figs. 8, 9; pl. IV, fig. 1). They were at once referred to *L. mucronatus* and examination of their rostral formulae indicated that the type specimen of *L. mucronatus* with a formula of $\frac{6}{6}$ and those referred by Nobili to his var. *multidens*, with formulae ranging from $\frac{2-1\,5\;1}{8-2\;1}$, are only terms in a series exhibiting continuous variation. The formulae which the S. Indian specimens yield are as follows[1] :—

$$\frac{1)15}{15}\quad\frac{1)13}{13}\quad\frac{1)12}{13}\quad\frac{1)11}{12}\quad\frac{1)10}{11}\quad\frac{1)11}{9}\quad\frac{1)9}{8}\quad\frac{1)7}{8}\quad\frac{1)12}{7}\quad\frac{1)9}{7}$$

$$\frac{1)8}{7}\quad\frac{1)8}{7}\quad\frac{1)8}{7}\quad\frac{1)7}{7}\quad\frac{3)10}{6}\quad\frac{3)9}{6}\quad\frac{1)8}{6}\quad\frac{4)13}{4}$$

The remaining specimens characterized by their more slender form and narrower rostrum (pl. III, figs. 10, 11; pl. IV, fig. 2) afforded a more difficult problem. Not only did the rostrum exhibit a most remarkable diversity of form, but the proportions

[1] The figure on the left, separated by a bracket, represents the number of teeth on the carapace in the median line.

of the antennal scale and the spinulation of the antero-lateral margin of the carapace also showed extensive variation. A single specimen, however, the only one which possessed two teeth on the carapace (pl. III, fig. 11) was referred without difficulty to to *L. gravieri*, and by an attentive study of the remainder the conclusion that they also must belong to that species was reached.

It was only when these preliminary results were obtained that it was noticed that all the examples referred to *L. mucronatus* were female, while all referred to *L. gravieri* were male. The fact that both forms were found together at each of the two localities where specimens were obtained, suggested that the conclusions derived from the form of the animal and the characters of the rostrum were fallacious and a renewed study of the proportional measurements of the appendages and comparison with the sexual distinctions found in *L. pygmaeus* led to the conclusions outlined in the above synonymy.

In the female specimens (pl. IV, fig. 1) the rostrum reaches almost to or a little beyond the end of the antennal scale. At its base it is inferiorly excavate for the accommodation of the eye and in lateral view the length from the back of the orbit to the apex is less than twice, often not more than one and a half times the greatest height. Anteriorly the rostrum is sometimes almost circular in outline, but more often it is distinctly pointed. The dorsal and ventral teeth are borne only in its distal half.

The carapace is strongly arched dorsally. It is not carinate in the median line but bears, as a rule, a single stout fixed tooth behind the base of the rostrum: in rare instances three or four teeth (pl. III, fig. 8) are found in this position. There is a sharp antennal tooth and a series of small spines, usually 11—14, on the antero-lateral margin.

The eyestalk is a trifle wider than the cornea and bears a conspicuous pointed process on its inner distal aspect. The antennular peduncle reaches a little beyond the middle of the antennal scale and has the proportions shown in pl. III, fig. 12. The antennal scale (pl. III, fig. 13) is about three times as long as wide.

The outer maxillipede reaches a little beyond the antennal peduncle.

The second peraeopods reach about to the apex of the rostrum. The carpus is divided into three segments, of which the first and third are approximately equal, each being about half the length of the middle segment. The palm is a little longer than the last carpal segment and is decidedly longer than the dactylus.

The dactylus of the last three pairs of peraeopods, as in *L. pygmaeus*, terminates in two stout claws and bears three or four small spines on the posterior margin. In the fifth pair the carpus is a little more than two-thirds the length of the propodus. The dactylus is rather more than one-third the length of the propodus.

The last abdominal somite is about twice the length of the fifth. The telson bears two pairs of dorsal spinules and terminates in a narrow pointed process flanked by a pair of spines on either side. The innermost of these is more than twice the length of the outer and is often nearly twice as long as the median process. The outer uropod is shorter than the inner and is about three and a half times as long as broad.

In the male the whole form of the animal is far more slender, as will be seen on comparing figs. 1 and 2, plate IV. The rostrum is longer and much narrower in lateral view; it extends well beyond the apex of the antennal scale and exhibits the following spine formulae —

$$\frac{1)7}{9} \quad \frac{1)7}{9} \quad \frac{1)7}{7} \quad \frac{1)8}{6} \quad \frac{1)5}{6} \quad \frac{1)5}{6}$$

$$\frac{1)4}{6} \quad \frac{1)4}{6} \quad \frac{1)5}{4} \quad \frac{1)6}{1} \quad \frac{2)5}{0}$$

It seems that, as in *L. pygmaeus*, the teeth are on the whole less well-developed in males than in females; some of the males, however, are of very small size and may not have developed the full complement. Seen laterally the greatest length of the rostrum from the back of the orbit to the apex varies from two and a half to four times its greatest height: proportions strikingly variable and different from those found in the female (*cf.* pl. III, figs. 10, 11, pl. IV, fig. 2, and pl III, figs. 8, 9, pl. IV, fig. 1).

The carapace is not arched in lateral view. It bears a single dorsal fixed spine in ten of the specimens examined, while in the eleventh, which in this respect resembles the type of *L. gravieri*, there are two. It will be noticed that one, three, or four spines have been found in this situation in females.

The differences in other respects between the two sexes are less striking. There may be only six or seven spines on the antero-lateral margin of the carapace. The upper antennular ramus is stouter and very considerably longer than in the female; this feature affording the readiest distinction between the two sexes. The antennal scale may be four and a half times as long as broad in young males (pl. III, fig. 14); in older specimens the length is usually about three and a half times the breadth. In one individual the outer margin is very definitely concave (pl. III, fig. 15).

The third maxillipede scarcely reaches beyond the antennular peduncle. The second peraeopods in large specimens reach beyond the middle of the antennal scale, but are shorter in small examples. They agree precisely with those of the female in the proportional length of the segments.

The dactylus of the last three pairs agrees with that of the female and is a little more than one third the length of the propodus. The propodus of the fifth leg is usually shorter than in the female and is not quite so long as the merus.

According to Miss Rathbun[1] Stimpson's *Rhynchocyclus mucronatus* is synonymous with *Latreutes planirostris* (De Haan); but no reasons are advanced for this view and Stimpson appears to have had both species before him when writing in 1860. The Indian specimens differ widely from *L. planirostris* as figured and described by De Haan.[2]

$\frac{8472}{10}$	Kilakarai, Ramnad Dist., S. India.	S. Kemp.	Twenty nine, 9-13·5 mm.
$\frac{8473}{10}$	Pamban, Ramnad Dist., S. India.		

The specimens were obtained in February, 1913, among weeds in water only a few feet deep; the females are ovigerous.

Latreutes mucronatus has been recorded from Sagami Bay, Japan (Doflein), Hongkong (Stimpson), Java (Nobili, *sub* var. *multidens*), the S. E. coast of Arabia and the Red Sea (Nobili, *sub* var. *multidens* and *L. gravieri*).

Latreutes anoplonyx, sp. nov.

Plate IV, figs. 3—5.

This species, founded on a single adult female, is readily distinguished from the two preceding by the simple claw-like dactyli of the last three peraeopods.

The specimen is robust in build. The carapace is not carinate mid-dorsally, but bears a single prominent fixed tooth in the middle of its anterior third. The antennal spine is strong and there is a series of eleven small spines on either antero-lateral angle (fig. 3).

The rostrum is triangular in shape; it reaches beyond the apex of the antennal scale and is rather more than three-quarters the length of the carapace; its greatest height in lateral view is rather more than one-third its extreme length from the back of the orbit. The dorsal margin is concave (the apex being directed obliquely upwards) and bears thirteen teeth in the distal two-thirds of its length; the inferior margin is evenly curved and is furnished with nine teeth in its distal half. The extreme apex is broken off and on it one or two additional teeth may have been situated.

On the eyestalk there is a lobe similar to that found in the preceding species, but much less conspicuous.

The antennular peduncle is very short, reaching to little more than one-third the length of the antennal scale. The lateral process is rounded and the second segment is broader than long. The stout upper antennular ramus reaches (in the female) almost to the end of the scale. The antennal scale (fig. 4) is pointed anteriorly and is about four times as long as wide.

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[1] Proc. U.S. Nat. Mus., XXVI, p. 46 (1902).

[2] In Siebold's Fauna Japonica, Crust., p. 175, and atlas, pl. xlv, fig. 7 (1843-9).

The oral appendages do not differ noticeably from those of the two preceding species. The third maxillipedes reach beyond the end of the antennular peduncle; the ultimate segment is less than twice the length of the antepenultimate.

In the chela of the first peraeopods the finger is about as long as the palm. The second peraeopod reaches to the middle of the rostrum. Of the three segments composing the carpus, the first is scarcely half the length of the second and is a little longer than the third; the chela is as long as the middle segment and the dactylus is shorter than the palm.

The third peraeopods reach forward a little beyond the end of the second and the fifth extend to the end of the eyes. The dactylus in each of the last three legs consists of a strong curved claw about one third the length of the propodus; it may bear a few microscopic spinules, but is otherwise wholly unarmed.

Large epipods are present at the base of the first four pairs of peraeopods.

The sixth abdominal somite is more than one and a half times the length of the fifth. The outer uropod is two and two-thirds times as long as broad. The telson bears two pairs of dorsal spinules and terminates in a narrow apex composed of a short median process with two spines on either side; the inner spine is longer than the median process and nearly twice the length of the outer (fig. 5).

In the absence, in the majority of cases, of any information regarding the spinulation of the dactyli of the last three legs, it is difficult to make suggestions regarding the affinities of the species described above. It appears to be most nearly related to Ortmann's *L. laminirostris*, but differs from that, and apparently from all other known species of the genus, in the form of the rostrum.

Bombay.	Bombay Nat. Hist. Soc.	One, ovigerous female, 39 mm. TYPE.

For the opportunity of examining the single known example of this species I am indebted to the Secretary of the Bombay Natural History Society.

Genus **Tozeuma**[1], Stimpson.

1860. *Tozeuma*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 26.
1863. *Angasia*, Bate, Proc. Zool. Soc. London, p. 498.

Form extremely slender. Carapace without supra-orbital, but with antennal spine; a single spine at antero-lateral (pterygostomian) angle. Lateral process of antennular peduncle sharply pointed anteriorly. Upper antennular flagellum uniramous. Mandible without incisor-process or palp. Third maxillipede without exopod.

[1] Stimpson informs us that this name is derived from the Greek Τόξευμα, but, if the spelling is emended, the name is preoccupied by Walker for a genus of Hymenoptera.

No arthrobranchs or epipods at base of peraeopods. Carpus of second peraeopods composed of three segments.

Tozeuma armatum, Paulson.

1875. *Tozeuma armatum*, Paulson, Red Sea Crustacea, Kiew, p. 99, pl. xv, figs. 2, *a-o*.
1893. *Angasia stimpsoni*, Henderson, Trans. Linn. Soc., Zool., V, p. 437, pl. xl, figs. 18-20.
1906. *Angasia armata*, Nobili, Ann. Sci. nat. Zool., Paris (9), IV, p. 42.

The specimens agree well with the published descriptions and figures. In two perfect individuals there are respectively twenty and twenty-four teeth on the inferior margin of the rostrum. Of the segments composing the carpus of the second peraeopods the first is the longest and the second the shortest, the third being only a little longer than the second. The dactyli of the last three pairs of legs bear several spines much as in Paulson's figure, but in an ovigerous female only two are found in this position.

All the examples bear a sharp inferior spine on either side of the sixth abdominal somite near its distal end. The lateral spine on the posterior edge of the fifth somite is present in all the specimens and in one individual there is a second large spine on this margin placed lower down: the difference is not correlated with sex.

The only male individual is badly damaged, but in the proportions of the upper antennular flagellum does not differ from the female.

$\frac{8599}{6}$	Off Cinque I., Andamans, 36 fms.	'Investigator.'	One, imperfect.
$\frac{8479}{10}$	S. E. of Ceylon; 6° 2′ 30″ N., 81° 29′ E., 52-68 fms.	'Investigator.'	Three, the largest an ovigerous female, 77 mm.

Tozeuma armatum has been recorded from the Gulf of Martaban, Burma (Henderson) and from the Red Sea (Paulson and Nobili).

Genus **Gelastocaris**, nov.

Carapace without supra-orbital spine and without spine or spinules on antero-lateral margin. Post-orbital and antennal spines present, the latter strong and flanked by a well-marked carina. Rostrum triangular in dorsal view, forming eaves which conceal the eyestalks. Basal segment of antennule terminating in an upstanding process which protects the eyes anteriorly; its lateral process large and subquadrate. Upper antennular flagellum uniramous. Outer margin of antennal scale furnished with spinules. Mandible without incisor-process or palp. Third maxillipede without exopod. Carpus and chela of first peraeopods elongate; chela smaller than that of second peraeopods and furnished with peculiar interlocking spines at apex. Carpus of second peraeopods composed of three segments. Dactylus of last three pairs consisting of a very short basal portion bearing four large spines two of which are lateral in position. No arthrobranchs at base of peraeopods, epipods present on first four pairs.

This genus is instituted to receive the very peculiar species described by Nobili under the name of *Latreutes paronae*. In the absence of the exopod on the third maxillipede and in the presence of epipods at the base of the peraeopods the genus is intermediate in position between *Latreutes* and *Tozeuma*, but differs from both in the extraordinary structure of the first peraeopods and in several other characters mentioned in the above diagnosis ; it is most improbable that it has any close genetic relationship with either of these genera. The structure of the second maxillipede is peculiar ; the ultimate segment of the exopod articulates terminally with the penultimate, resembling that found in the primitive families of Caridea.

Gelastocaris, like several other genera of Hippolytidae, shows an extraordinary degree of specialization and, except for the fact that it belongs to the Latreutid section of the family, its affinities are obscure. Judging from its peculiar structure it seems probable that the genus is specially adapted to some unusual mode of life ; but inasmuch as only three specimens are known, regarding none of which are any biological data available, this must remain a matter of conjecture.

Gelastocaris paronae (Nobili).

Plate V, figs. 1—11.

1905. *Latreutes paronae*, Nobili, Boll. Mus. Torino, XX, No. 506, p. 2, text-fig.

The species is of a very robust build; the carapace, rostrum and abdomen are beset with minute papillae, while on many of the appendages there are delicate feathery setae.

The carapace (fig. 1) is not definitely carinate above, but there is a rounded mid-dorsal prominence a little behind the middle and anteriorly, a huge blunt ridge which is highest above the orbital notch and thence rapidly declines to the smooth non-carinate surface of the rostrum. There is no supra-orbital spine, but the anterior margin is produced to a sharp point defining the lower limit of the orbit and immediately below this point, above the insertion of the antennae, is a sharp outstanding post-orbital spine. The antennal spine is very strong and is flanked by a sharp carina which extends backwards to the middle of the carapace. The antero-lateral portion beneath this carina is flexed inwards on either side, enclosing the first two pairs of maxillipedes. The antero-lateral angle is obtusely rounded ; it is not provided with a spine, or, as in *Latreutes*, with a series of spinules. In lateral view the inferior margin of the carapace is seen to be excavate posteriorly, leaving the apices of the last four pleurobranchs exposed.

The rostrum is triangular in dorsal view and its breadth at the base is fully two-thirds its length. In transverse section it would be T-shaped as in *Tozeuma*, for the inferior part of the blade is well developed, the dorsal part is flat or only a trifle convex, and there is a sharp ridge on either side running to the back of the orbit. This lateral ridge is produced in the vicinity of the eye and forms an eave which conceals the greater part of the eyestalk. In lateral view the dorsal line of the rostrum is straight and greatly depressed, forming an angle of nearly 45° with the mid-dorsal line of the carapace. The total length of the rostrum is about half that of the carapace; it extends a little beyond the apex of the antennal scale and terminates in a sharp upwardly directed point. On the dorsal surface, close behind the apex, there is a conspicuous movable spine. The greatest depth of the inferior blade is nearly one-half the total length It is strongly curved in lateral view, excavated at the base for the accommodation of the eyes, and is devoid of spines.

The corneal part of the eyes is well pigmented and is a little narrower than the stalk.

The antennular peduncle is peculiar. The basal segment appears as if moulded round the eye; in lateral view it is almost semicircular in shape and distally it projects upwards in front of the cornea in the form of a thin lamella. The lateral process is large, parallel-sided and apically truncate; it projects outwards at right angles from the segment and its distal portion, which is somewhat reflected upwards, is pressed closely against the eyes. The second and third segments are extremely short. The upper ramus is thickened and (in the female) reaches a little beyond the apex of the rostrum; the lower ramus is more slender and a trifle longer.

The antennal scale (fig. 2) is about twice as long as broad and is very strongly narrowed apically. It terminates in a stout spine and on its outer margin there is a series of small movable spinules, twenty to twenty-two in number Its dorsal surface is covered with small papillae similar to those found on the carapace; the ventral surface is beset with very long finely plumose setae (fig. 3), a few occurring on the upper surface also.

The mandible is furnished neither with incisor-process nor palp. The second maxillipedes (fig. 4) are peculiar in that the ultimate segment of the endopod is not applied as a strip along the whole length of the penultimate, as in the more typical Caridea, but is terminal in position resembling that found in the more primitive families, the Pasiphaeidae and Bresiliidae. The epipod is entire and not partially divided into branchial plumes as in many Hippolytidae.

The third maxillipedes reach a little beyond the rostrum and possess an epipod but no exopod. The basal segments are very broad and the ultimate, which is about twice the length of the penultimate, bears a series of eight spines on its margins (fig. 5).

The first peraeopods (fig. 6) differ from those found in most Hippolytidae in being slender; they reach a little beyond the eyes. The ischium is short and the merus, which is rather strongly curved, is one and a half times the length of the carpus. The carpus is four times, and the chela, which is a little longer, is four and a half times as long as broad. The length of the dactylus, excluding its spines, is contained nearly two and a half times in that of the palm. The armature of the chela is, I believe, unique. The fingers (fig. 7) bear no teeth on their inner margins, but the apex of each is truncate. At the end of the fixed finger there are three large blunt spines, curved near the tip, arranged side by side in a transverse row; the dactylus is similarly armed, but bears only two spines which, when the claw is closed, fit into the interstices between those of the opposing segment. All the spines are movable. At their base, on either side both of the dactylus and of the fixed finger, there is a tuft of long setae which are shortly plumose; two of these setae, situated alongside the dactylar spines but on a slightly lower level, are stouter than the rest and probably assist in grasping.

The second peraeopods (fig. 8) are more normal in structure. They reach to the apex of the rostrum and are stouter than those of the first pair. The merus, the middle of the three segments composing the carpus, and the chela are approximately equal in length. The first carpal segment is equal to the third and the two combined are a little longer than the median segment. The dactylus is about two-thirds the length of the palm. There are no teeth on the inner edges of the claw, but the fixed finger has an angulate prominence a little behind its middle point. The limb bears scattered plumose setae.

The last three pairs of legs are similar; the third reaches to the end of the antennal scale and the fifth to the anterior third of the carapace; all are densely beset with long plumose setae. In the third pair (fig. 9) the merus is about four times as long as wide; it bears a stout spine at the distal end of its inferior margin and movable spinules on its upper edge. The carpus is massive and the protuberance at the distal end, overhanging the articulation with the propodus (found in most Hippolytidae), is very strongly developed; the total length of the carpus is nearly three-quarters that of the propodus. In the fifth leg the merus is much broader, about twice as long as wide, but the proportions of the other segments are much the same. The dactylus is very peculiar. In the third and fourth pairs it consists of a very short basal portion to which four large teeth are attached. Two of these lie in the same plane (the normal plane of the dactylus), while the others, which are a little smaller, are attached one on each side. In the fifth pair the arrangement is similar, but the lateral teeth are, in one specimen, reduced to small conical processes.

The abdominal somites are obscurely furrowed transversely and their inferior margins bear short spines. These are most strongly developed on the fourth and fifth somites, where there are in one specimen five and seven respectively. The sixth somite is only a very little longer than the fifth.

The telson (fig. 10) is broad at the base and narrows rapidly towards the apex ; it bears two pairs of dorsal spinules. The apex (fig. 11) consists of a slender median tooth with a pair of spines on either side, the inner nearly twice the length of the outer. The outer uropod is less than twice as long as broad.

The specimens examined are ovigerous females ; the eggs measure from ·55 to ·65 and from ·45 to ·55 mm. in longer and shorter diameter.

The specimens described above agree well with Nobili's brief account. In the type, however, the carina from the antennal spine extends backwards nearly to the posterior end of the carapace and the ultimate carpal segment of the second peraeopods is said to bear a spine at its distal end.

There are two examples in the Indian Museum—

$\frac{8485}{10}$	3 miles N.N.W. of Pt. Pedro, Ceylon.	'Investigator'.	One, 15 mm.
$\frac{8496}{10}$	Ceylon Pearl banks.	T. Southwell.	One, 14 mm.

The type was found in shallow water at Zanzibar.

Genus **Lysmata**, Risso.

Carapace without supra-orbital, but with antennal spine; pterygostomian spine present or absent. Lateral process of antennular peduncle anteriorly pointed. Upper antennular flagellum biramous, the two rami fused at base. Third maxillipede with exopod. Epipods but no arthrobanchs at base of first four peraeopods. Carpus of second peraeopods composed of many segments.

Lysmata chiltoni, sp. nov.

Plate VI, fig. 1-4.

1911. *Merhippolyte spinifrons*, Chilton, Trans. N. Zealand Inst., XLIII, p. 549.

Owing to the doubt that exists regarding the identity of Milne-Edwards' *Hippolyte spinifrons*, a species referred to the genus *Merhippolyte* by subsequent authors, I asked Dr. Chilton if he would permit me to examine the specimens which he recorded under this name in 1911 from the Kermadec Is. He very kindly sent me two examples, which most unfortunately dried up in transit, and subsequently forwarded two others, all the material that remained at his disposal.

The question of the identity of Milne-Edwards' *H. spinifrons* is discussed above and the conclusion I have reached is the same as that advanced by Calman, namely that the species is in all probability synonymous with *Alope palpalis*. Dr. Chilton's examples do not agree at all closely with Milne-Edwards' description.

Examination shows that the mandible lacks both incisor-process and palp, that there are no arthrobranchs at the base of the peraeopods and that the inner antennular flagellum is conspicuously biramous. The species therefore belongs to the genus *Lysmata* and I believe has not hitherto been described.

The rostrum (fig. 1) commences as a median dorsal crest a little in front of the middle of the carapace ; it is straight and extends only a trifle beyond the eyes. On its upper margin it bears five teeth, two of which are situated on the carapace behind the orbital notch, while the third is placed almost immediately above that point ; the distance between the two posterior teeth is slightly greater than that between those placed further forwards. Inferiorly the rostrum bears two or three teeth very much smaller than those on the upper edge and placed close to the apex in advance of the anterior dorsal tooth.

The only spine on the carapace is the antennal, the pterygostomian angle is obtuse but not spinous.

The lateral process on the basal segment of the antennular peduncle (fig. 2) is sharply pointed anteriorly and reaches to the end of the segment ; the second segment is about as broad as long. The inner antennular flagellum is biramous ; but the two branches are fused basally for a distance equal to half the length of the shorter ramus. The fused portion is composed of from nine to twelve segments.

The antennal scale is a little less than three and a half times as long as wide and is not much narrowed distally. The outer margin is concave and terminates in a spine which scarcely extends beyond the lamellar portion.

The third maxillipedes reach beyond the antennal scale by one-half the length of the ultimate segment. The exopod is conspicuous.

The first peraeopods just fail to reach the apex of the scale. The carpus is a trifle shorter than the chela and the finger is about half the length of the palm. The second peraeopods, in the single perfect specimen examined, are a little unequal, the longer one extending beyond the antennal scale by the whole length of the carpus and chela. Both ischium and merus are annulate and there are 25 or 26 segments in the carpus. The last carpal segment is about as long as the palm, and the dactylus, which is decidedly longer than the fixed finger and bears two small teeth at its apex, is almost as long as the palm (fig. 4).

The third peraeopods reach beyond the antennal scale by the dactylus and three-quarters the length of the propodus ; the fifth scarcely reach the apex of the scale. There are no spines on the ischium and merus, but there are four large teeth, increasing in size distally, on the dactylus.

The fifth abdominal somite, measured dorsally, is three quarters the length of the sixth and is about half as long as the telson. The telson is shorter than both inner and outer uropods. It bears two pairs of dorsal spinules and its convex lateral margins meet in a comparatively narrow setose apex, minutely pointed in the middle and with two pairs of spines on either side, the innermost much the longest.

Lysmata chiltoni [1] differs in many respects from the well-known *L. seticaudata*, Risso, the chief points being the length and dentition of the rostrum, the form of the pterygostomian angle and antennal scale, the length of the fused portion of the rami of the upper antennular flagellum and the number of segments in the carpus of the second peraeopods. *Lysmata intermedia* (Kingsley) may be distinguished by the much greater length of the fused portion of the antennule and by the comparatively short dactylus of the first peraeopods.

It is in Heller's *Lysmata pusilla* from the Red Sea that *L. chiltoni* seems to find its nearest ally; but in that species the thicker ramus of the upper antennular flagellum is fused proximally with its fellow for only one-third its length, there are only four dorsal teeth on the rostrum and the two situated on the ventral margin are more widely spaced. In the antennal scale, moreover, the distal spine projects beyond the apex of the lamella.

Four specimens were obtained at Meyer I. in the Kermadec group. The type specimen is 27 mm. in length and is preserved in the Canterbury Museum, New Zealand.

Genus **Hippolysmata**, Stimpson.

Carapace without supra-orbital, but with antennal spine; antero-lateral (pterygostomian) spine present, reduced, or absent. Lateral process of antennular peduncle anteriorly pointed. Upper antennular flagellum uniramous. Mandible without incisor-process or palp. Third maxillipede with exopod. Epipods (sometimes rudimentary), but no arthrobranchs at base of first four peraeopods. Carpus of second peraeopods composed of many (more than 10) segments.

The only difference between this genus and Risso's *Lysmata* is that in the latter the outer antennular flagellum is split and is composed of two unequal rami which are fused basally. In *Hippolysmata* the flagellum is simple. The character does not seem a very important one, but in my experience is reliable [2]; it is, however, not improbable that further investigation will reveal such a degree of gradation that two distinct genera can no longer be recognized, and in this case all the species must take rank under *Lysmata*.

In two West Indian species, *Hippolysmata moorei*, Rathbun [3] and *H. intermedia*, [3] Kingsley, the additional ramus is well developed and they must in consequence be transferred to Risso's genus.

Two new species are here described from material in the

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[1] I have compared specimens with both *L. seticaudata* and *L. intermedia*.

[2] In addition to the species mentioned in this paper I have examined *Lysmata seticaudata*, Risso, *Lysmata intermedia* (Kingsley), *Hippolysmata californica*, Stimpson, and *Hippolysmata wurdemanni* (Gibbes).

[3] See Rathbun, Bull. U. S. Fish Comm. for 1900, XX, ii, pp. 115, 116 (1902).

Indian Museum. One of these, *H. ensirostris*, a peculiar form which shows but little affinity with any species hitherto known, is remarkable for its wide range of variation. It seems, indeed, that extensive variation exists throughout the genus in regard to the rostral armature, the proportional length of the legs and the number of segments in the carpus of the second pair; in consequence it is not advisable to found species on these characters alone. In the case of the Indian species the armature of the dactylus of the last three peraeopods, the development of the epipods and of the antero-lateral spine of the carapace and the form of the telson have proved of considerable value in systematic work. The colouration of at least some of the species is very striking and it is probable that they could be more easily recognized in the field than from preserved material.

The Indian species of *Hippolysmata* may be determined by the following characters :—

I. Rostrum shorter than carapace, without elevated basal crest; pterygostomian spine, if present, smaller than antennal: lateral margins of telson convex, apex blunt with a pair of spines.
  A. Rostrum not reaching beyond second segment of antennular peduncle, inferior margin with 2-4 teeth; dactylus of last three peraeopods terminating in two large claw-like spines.
    1. A minute spine at antero-lateral angle of carapace; fingers of first peraeopods, when closed, meeting only at tips.
      a. Second peraeopods symmetrical, carpus composed of 15-24 segments ... ... *H. vittata.*
      b. Second peraeopods asymmetrical, carpus composed of 28-32 segments. ... . *H. vittata*, var.
    2. No spine at antero-lateral angle of carapace; fingers of first peraeopod, when closed, meeting throughout their length. .. .. *H. kükenthali.*
  B. Rostrum reaching beyond antennular peduncle, inferior margin armed with 6-7 spines; dactylus of last three peraeopods simple. ... . *H. dentata.*

II. Rostrum longer, usually very much longer than carapace, with an elevated dentate basal crest; pterygostomian spine as large as antennal; lateral margins of telson concave, apex acute and unarmed.
  A. Carapace smooth or sparsely punctate laterally, depression between branchial and cardiac regions usually obscure; basal crest of rostrum with 7-12 teeth; fifth peraeopods not extending beyond antennal scale. ... *H. ensirostris.*
  B. Carapace coarsely and closely punctate laterally, depression between branchial and cardiac regions distinct; basal crest of rostrum with 4-8 teeth; fifth peraeopods extending beyond antennal scale by at least length of dactylus. ... ... do. var. *punctata.*

Hippolysmata vittata, Stimpson.

Plate VI, figs. 6—10.

1901. *Hippolysmata vittata*, Lanchester, Proc. Zool. Soc., London, p. 563.
1906. *Hippolysmata vittata*, Nobili, Ann. Sci. nat. Zool. (9), IV, p. 46.
1907. *Hippolysmata vittata*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 423, pl. xxxiii, figs. 49, 50.

Under the last reference de Man quotes the earlier synonymy of this abundant species. To his detailed description I have little to add. I would, however, remark on the presence of a small (pterygostomian) spinule at the antero-lateral angles of the carapace (fig. 6) and to the gape at the base of the fingers of the chela of the first peraeopods when the claw is closed (fig. 7); it is only by attention to these seemingly trivial details that spirit specimens of *Hippolysmata vittata* can be distinguished from the allied *H. kükenthali.*

The rostrum in Indian examples of *H. vittata* bears six to nine dorsal teeth; the hindmost is situated just in front of the middle of the carapace and is always separated by a considerable interval from the next of the series. On the inferior margin there are from two to four very small teeth

The antennal scale, in adults, is a little less than three times as long as broad.

The second peraeopods are symmetrical and the distal end of the merus, which may be annulated, reaches to about one-third the length of the antennal scale. The carpus is composed of 15—19 segments. Stimpson in his original description gives 20, and subsequent authors 17—24. In the proportions of the last segment and of the chela the specimens agree closely with de Man's account. On the last three legs there are five or six dactylar spines which increase in size as they approach the apex (fig. 8)

The telson (fig. 9) has convex margins and a comparatively broad apex which is furnished with the two pairs of spines found in most members of the family.

The colour of living specimens is very striking The whole animal is practically transparent with narrow longitudinal stripes and streaks on the carapace and abdomen. At the anterior end of the first abdominal somite there is a complete transverse band and another is distinct at the anterior end of the fourth somite. The latter stops half way down on either side where it meets the uppermost of the three complete longitudinal stripes of the abdomen. There are other short longitudinal streaks on the carapace and abdomen, those on the anterior portion of the former being oblique. There is a median red stripe on the telson and on each inner uropod. The thoracic appendages are clear red and the eggs light green.

The following specimens are preserved in the Indian Museum :—

$\frac{6677}{10}$	Madras.	J. R. Henderson.	One, 31 mm.
$\frac{8451-3}{10}$	Kilakarai Ramnad Dist., S. India, 0—2 fms.	S. W. Kemp.	Many, 14—27 mm.
$\frac{8450}{10}$	N. Cheval Paar, Ceylon.	T. Southwell.	One, 21 mm.
$\frac{3187}{5}$, $\frac{3045-60}{7}$, $\frac{3193}{7}$	Karachi.	Karachi Museum.	Forty, 18—30 mm.
$\frac{6682}{10}$	Persian Gulf, 28° 59′ N., 50° 3′ E., 25 fms.	'Investigator.'	Three, 24—34 mm.

The examples from Kilakarai were found among weeds in only a few feet of water; many of them are ovigerous females.

The Persian Gulf specimens differ from others in the collection in having the teeth on the inferior margin of the rostrum (4 or 5 in number) larger, though still smaller than those on the upper edge. The rostrum also is longer, reaching to the middle of the ultimate segment of the antennular peduncle (fig. 10). The form perhaps deserves nomenclatorial recognition.

Hippolysmata vittata has been recorded from the Inland Sea of Japan (de Man), Hongkong (Stimpson), Cebu (Thallwitz), Penang (Lanchester) and the Red Sea (Nobili).

H. vittata var.?

Two specimens in the collection differ from typical *H. vittata* in the development of the second pair of peraeopods.

In the larger example the left merus of this pair of limbs reaches beyond the apex of the antennal scale by one-fifth of its length and the carpus, which is composed of 31 segments, is as long as the rostrum and carapace combined. In this specimen the right leg of the second pair is unfortunately missing.

In the smaller example the right merus reaches to three-quarters the length of the antennal scale and the carpus, which is composed of 28 segments, is almost three-quarters the length of the carapace and rostrum. On the left side the ischium, merus and carpus are each almost exactly two-thirds the length of the same segments on the right; the carpus, however, is composed of the same number of segments.

The rostrum in each case bears seven teeth above and two below.

The form is, in all probability, merely a variety of *H. vittata* in which the second peraeopods are unequal and with a greater number of segments in the carpus. In all other respects there appears to be the closest resemblance between the specimens and typical examples.

The variation is similar to, though not as extensive as that found in *Processa canaliculata* on the Irish coast.[1]

The two specimens were found at the Andamans, in which locality typical *H. vittata* have not yet been found.

$\frac{6396}{10}$ East I., Andamans. A. R. Anderson. Two, 14 and 23 mm.

Hippolysmata kükenthali (de Man).

Plate VI, fig. 11.

1892. *Merhippolyte orientalis*, de Man (*nec* Bate), in Weber's Zool. Ergebn. Reise in Niederland. Ost-Ind., II, p. 407.

1902. *Merhippolyte orientalis* Bate?, de Man, Abhandl. Senck. naturf. Ges. Frankfurt, XXV, p. 849, pl. xxvi, fig. 56.

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[1] Kemp, Fisheries Ireland, Sci. Invest. for 1908, p. 124 (1910).

1902. *Hippolyte kükenthali*, de Man, *ibid.*, p. 850.
1905. *Nauticaris unirecedens*, Pearson (*nec* Bate), Ceylon Pearl Oyster Rep., IV, p. 81.
1907. *Hippolysmata kükenthali*, de Man, Trans. Linn. Soc. Zool. (2), IX, p. 426.

Along with an example of the preceding species obtained by Mr. T. Southwell on the Ceylon pearl banks and forwarded to the Indian Museum preserved in formalin are specimens of a very closely allied form which appears to be the same as that originally described by de Man under the name of *Merhippolyte orientalis*, Bate When received, the two forms were distinguished at once by their colouration, for the specimen of *H. vittata* was streaked longitudinally with narrow red stripes, as already described, while those of *H. kükenthali* were broadly banded transversely, the colour of the bands being bright red in the preserved material.

The species is so closely allied to *H. vittata* that had it not been for the colour distinction it is possible that the distinctions would have escaped detection; the only important structural differences that I have been able to find are the following:—

H. vittata.	*H. kükenthali.*
A minute spine at antero-lateral angles of carapace (fig. [illegible]).	No spine at antero-lateral angles of carapace
Fingers of first peraeopods, when closed, meeting only at the tips (fig. 7).	Fingers of first peraeopods, when closed, meeting throughout their length (fig 11)

These two characters seem to prevail with absolute constancy.

The rostrum in *H. kükenthali* is a trifle more bent downwards and is provided on an average with fewer teeth. On the dorsal margin there are from four to seven, usually five or six; the two hindmost, as in *H vittata*, are situated on the carapace and are separated by a considerable interval from the next of the series. On the inferior margin there are one or two, rarely three, small teeth.

The lateral process of the antennular peduncle is a trifle longer than in the allied form and often reaches the distal end of the proximal segment.

In the antennal scale, oral appendages, maxillipedes and peraeopods there appears to be the closest resemblance between the two forms, the only difference being that noticed above in the shape of the chelae of the first peraeopods, a feature not mentioned by de Man. The carpus of the second peraeopod is divided into 19-21 segments, the proportions of the proximal segment and of the chela being as in *H. vittata*; the spinulation of the dactyli of the last three pairs is the same as in that species.

The epipod at the base of the fourth leg appears to be more deeply bifid apically than in *H. vittata*, otherwise the branchial formulae of the two forms are in agreement. No differences could be found in the structure of the male pleopods, in the proportions of the abdominal somites, or in the characters of the telson and uropods.

I believe I am correct in referring these specimens to *H. kükenthali* (de Man); at any rate I am unable to point to any features in which they differ noticeably from his lengthy descriptions. The examples recorded by Pearson in 1905 from the Ceylon pearl banks under the name of *Nauticaris unirecedens*, Bate, almost certainly belong to the same species. *N. unirecedens*, Bate, as de Man has pointed out, is a synonym of *H. vittata*; but Pearson notes that in his specimens the rostral teeth are less numerous than in those described in the 'Challenger' Report.

The specimens in the Indian Museum were caught during the months of January and February and many of the females bear eggs.

$\frac{8445-9}{10}$	N. Cheval Paar, Ceylon, 6 fathoms.	T. Southwell.	Many, 20-32 mm.

The species is recorded by de Man from Ternate and Flores.

Hippolysmata dentata, sp. nov.

Plate VI, fig. 5.

This species differs from *H. vittata* in the following particulars:—

The rostrum, which is only slightly shorter than the carapace, extends beyond the apex of the antennular peduncle (fig 5). Dorsally it is provided with seven or eight teeth, the hindmost of which, as in *vittata*, is situated just in front of the middle of the carapace and is separated by a considerable interval from the next of the series. On its inferior margin it is furnished with six or seven teeth which are as large as those above. The pterygostomian spine on the antero-lateral angle of the carapace is much more prominent than in *H. vittata*, but is not nearly as large as the antennal.

The eyes are short and reach only to half the length of the basal segment of the antennular peduncle; the cornea is a little wider than the stalk. The antennular peduncle reaches almost or quite to the apex of the antennal scale and its lateral process scarcely extends as far as the eyes[1].

The form of the antennal scale is similar to that of *H. vittata* but in the larger (type) specimen the apical spine reaches well beyond the lamellar part.

The oral appendages, maxillipedes and first peraeopods resemble those of *H. vittata*; in the chelae of the first pair the fingers meet only at the tips when the claw is closed. In the second peraeopods the carpus is composed of from 20 to 22

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[1] In the smaller of the two examples this process is considerably shorter than the eyes, which themselves reach well beyond the middle of the basal peduncular segment.

segments; the merus in the larger example is divided into eight segments and there are traces of sub-division in the ischium. The last carpal segment, the palm and the dactylus are almost equal in length.

The last three peraeopods are longer than in *H. vittata* or *H. kükenthali.* Those of the third pair reach beyond the antennal scale by the whole length of the carpus, propodus and dactylus; the fourth reach beyond the same point by the length of the last two segments and the fifth by the dactylus and one-half of the propodus. The usual spines are found on the ischium and merus; in the third peraeopod there are two or three on the former and four on the latter. The dactylus in all three pairs is slender and curved and nearly one-third the length of the propodus. It bears a few very slender spines close to the base, but otherwise is wholly unarmed, offering a striking contrast to the same appendage in *H. vittata* (cf. figs. 5 and 8).

In the proportions of the abdominal somites and in the characters of the telson and uropods *H. dentata* does not present any noticeable difference from its allies.

Two specimens are preserved in the Indian Museum:—

$\frac{1630}{7}$	Off M. of Irrawaddy R., 15°20′ N., 94°55′ E., 20 fms.	'Investigator.' One, 33 mm. TYPE.
$\frac{2945}{7}$	False Point Harbour, Orissa, Bay of Bengal.	'Investigator.' One, 18 mm.

The colour of the species in life, according to a note found in the bottle containing the smaller specimen, is as follows:—"Carapace and abdomen striped pink. Antennae and antennules pink. Thoracic appendages light pink."

Hippolysmata ensirostris, sp. nov.

Plate VII, figs. 1—4.

The carapace, measured dorsally from the back of the orbit to the posterior margin, is a little less than half the length of the abdomen, excluding the telson. The branchiostegal walls are smooth in some specimens, in others punctate, sometimes rather closely so. The pterygostomian spine is prominent and is as large as the antennal (fig. 1).

The rostrum (figs. 1, 2) is always longer than the carapace and in some specimens (presumably those in which it has escaped fracture throughout the animal's existence) is fully twice the length. Dorsally it bears from 11 to 16 teeth, of which the posterior 7 to 12 form an elevated basal crest, extending on to the carapace. The teeth on this crest diminish in size from before backwards. In front of the crest there are scarcely ever more than five widely separated teeth on the upper edge of the blade. The inferior margin is armed with 7 to 16 stout teeth which are close-set proximally. The rostrum is a little depressed basally; but, after passing the second segment of the antennular peduncle, is slightly ascendant and thence to the apex is quite straight or (rarely) a trifle upturned.

The carapace is bluntly carinate mid-dorsally in its anterior half and bears one, less commonly two, minute spinules behind the basal crest of the rostrum.

The corneal portion of the eyes is, in dorsal view, only very little wider than the stalk and is smaller than in the preceding species. The antennular peduncle hardly reaches to two-thirds the length of the antennal scale; the second segment is longer than the third and the lateral process, though it extends beyond the eyes, fails to reach the distal end of the segment. The antennal scale is unusually variable in form and ranges from three to rather more than three and a half times as long as wide. The distal end of the lamella always extends well beyond the spine which terminates the straight or slightly concave outer margin, and the flagellum is nearly twice the entire length of the animal measured from the tip of the rostrum to the apex of the telson.

The mandibular palp bears neither incisor-process nor palp and the oral appendages are closely similar to those of *H. vittata.* The third maxillipede falls short of the apex of the antennal scale, the exopods reaching to rather more than half the length of the antepenultimate segment.

The carpus of the first peraeopods is a little shorter than the chela, the dactylus is scarcely two-thirds the length of the palm and the fingers, when the claw is closed, are in contact throughout their length. In the second peraeopods the merus is indistinctly divided into from 7 to 11 segments, while the carpus is composed of from 12 to 17. The palm of the chela is shorter than the last carpal segment and is a little longer than the fingers.

The last three pairs of peraeopods are provided with a variable number of spines on the ventral aspect of the merus. Those of the fifth pair extend to two-thirds or three-quarters the length of the antennal scale. The dactylus varies considerably in length; it is usually one-quarter or one fifth the length of the propodus; but occasionally in smaller examples is longer (two-sevenths the length of the propodus). The dactylus (fig. 4) is furnished with a few small spinules posteriorly; in several ovigerous females a small spine is also found near the apex; but this is never sufficiently large to give it the characteristic appearance seen in *H. vittata* and *H. kükenthali.*

The epipods at the base of the first four pairs of peraeopods are strikingly different from those found in the preceding species. They are short and rudimentary and entirely concealed from view by the downward growth of the pleurobranchs.

The sixth abdominal somite is one-quarter longer than the fifth. The telson (fig. 3) is about twice the length of the sixth somite and bears two pairs of dorsal spinules. Its lateral margins are concave, setose towards the apex, and terminate in a very narrow and acute point which reaches almost to, or considerably beyond, the distal end of the uropods. It differs widely in shape from that found in the preceding species and there is no trace of the usual terminal spines.

This very variable and, as it appears, abundant species of *Hippolysmata* seems to be rather an outstanding form, differing markedly from any species of the genus with which I am acquainted in the peculiar characters of the rostrum and telson and in the rudimentary condition of the epipods.

The following specimens are in the Indian Museum :—

$\frac{680-1}{7}$	Madras.	...	Two, 51 and 54 mm.
$\frac{6676}{10}$	Pondicherry.	J. Wood-Mason.	One, 64 mm.
$\frac{6395}{10}$	Colombo.	J. Anderson.	Six, 50-79 mm. TYPES.
$\frac{6397}{10}$	Akyab, Lower Burma.	F. Stoliczka.	Four, 52-60 mm.
$\frac{6402}{10}$	Bombay.	H. P. Mesurier.	Two, 35 and 63 mm.

var. **punctata**, nov.

Plate VII, figs. 5—7.

The rostrum in this form is nearly always more upturned distally than in typical *ensirostris* (figs. 5, 6). It bears from 8 to 13 dorsal teeth of which the posterior 4 to 8 form a basal crest. On the carapace a groove above the oral region, barely distinguishable in the typical form, is comparatively well-marked and a depression between the branchial and cardiac regions is always definite (fig. 5). The cardiac regions are somewhat swollen on each side of the middle line, so that the posterior third of the carapace is nearly flat dorsally. The branchiostegal walls are covered with a rather coarse pitting, the pits being very close and often confluent (fig. 7).

The antennal scale is hardly ever more than three times as long as wide. The third maxillipedes reach as far as, or a little beyond, the apex of the antennal scale. The carpus of the second pair of peraeopods is composed of 15 to 22 segments and the fifth pair reaches beyond the antennal scale by at least the whole of the propodus and sometimes by as much as one-half of the propodus as well. The dactylus of this pair is longer than in most typical examples of the species, the propodus being only three and a half times its length.

After careful examination I have come to the conclusion that this form is nothing more than a variety of *H. ensirostris*, for the points of difference are entirely matters of degree. The variety *punctata* appears to be an extreme form of *ensirostris* in which the areolation and pitting of the carapace is more definite, the legs longer and more slender and the basal crest of the rostrum composed of a smaller number of teeth.

$\frac{3434-5}{10}$	Green I., Amherst, Tenasserim,	'Investigator.'	Fifty-two, 35-60 mm.
$\frac{8471}{10}$	Thongwa, Burma.	I. H. Burkill.	Three, 51-63 mm.
$\frac{3137-47}{7}$	Sandheads, Ganges delta.	A. J. Milner.	Twenty-four, 37-60 mm.

Genus **Merguia**, nov.

Carapace without supra-orbital or antero-lateral (pterygostomian) spines ; antennal spine present. Upper antennular flagellum uniramous. Mandible without incisor-process or palp. Third maxillipede without exopod. Neither epipods nor arthrobranchs at base of first four peraeopods. Carpus of second peraeopods composed of many (24 or 25) segments.

This genus is founded to receive de Man's *Hippolyte oligodon*, of which species the type and only known example is preserved in the Indian Museum.

Examination of the mandible shows that both incisor-process and palp are absent (pl. VII, fig. 8) and that in the number of segments in the carpus of the second peraeopods and in the suppression of the arthrobranchs at the base of the first four thoracic limbs it approaches the genera *Lysmata* and *Hippolysmata*. From both these it is easily distinguished by the absence of the exopod on the third maxillipede and of the epipods at the base of the peraeopods.

In addition the species differs from other Hippolytidae in two very peculiar features. The first of these is the enormous development of the second segment of the antennal peduncle, which reaches beyond the apex of the antennal scale : this feature is well shown in de Man's figure The second is the undivided condition of the distal endite of the second maxilla (pl. VII, fig. 9). Except in the Pasiphaeidae in which both endites are suppressed, the distal endite is, in the Caridea, always divided.

Merguia oligodon (de Man).

Plate VII, figs. 8, 9.

1888. *Hippolyte oligodon*, de Man, Journ. Linn. Soc., XXII, p. 27, pl. xviii, figs. 1-6.

To de Man's detailed description there is little to add except as regards the characters of the oral appendages, noted above, the absence of the exopod on the third maxillipede and the suppression of the epipods at the base of the peraeopods.

The specimen, as de Man noted, is not in perfect condition ; the antennules are broken off shortly above the base of the peduncle, but enough remains to render it almost certain that no additional ramus is present on the upper flagellum The flagellum is, indeed, very different in appearance to that found in *Hippolysmata*, for it is round in section and without setae, whereas in the preceding genus it is more or less oval at the base, apparently formed by the fusion of two rami, and bears numerous setae, probably olfactory in function, on its inferior aspect.

$\frac{8239}{6}$ Elphinstone I., Mergui Archipelago. J. Anderson. One, 28 mm. TYPE.

SYNONYMIC LIST OF THE INDO-PACIFIC SPECIES OF HIPPOLYTIDAE.

Genus **Saron**, Thallwitz.

Saron marmoratus (Olivier).

See p. 84.

Saron neglectus, de Man.

See p. 87.

Genus **Nauticaris**, Bate.

Nauticaris marionis, Bate.

1888. *Nauticaris marionis*, Bate, Rep. 'Challenger' Macrura, p. 603, pl. cviii.
1902. *Merhippolyte australis*, Hodgson, Rep. 'Southern Cross' Crust., p. 233, pl. xxix.
1902. *Nauticaris marionis*, Lenz, Zool. Jahrb. Syst., suppl. Bd. V, p. 735.
1906. *Nauticaris marionis*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 31.

Prince Edward I., Falkland Is., Auckland I., Cavancha.

Nauticaris stewarti (Thomson).

1888. *Hippolyte stewarti*, Thomson, Trans. N. Z. Inst., XXI, p. 259, pl. xiii, fig. 1.
1903. *Nauticaris stewarti*, Thomson, Trans. Linn. Soc. (2), VIII, p. 445, pl. xxix, fig. 1.

New Zealand.

Genus **Merhippolyte**, Bate.

Merhippolyte calmani, Kemp and Sewell.

See p. 88.

Merhippolyte kauaiensis (Rathbun) (see pp. 88, 89).

1906. *Spirontocaris kauaiensis*, Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 913, pl. xxiv, fig. 5.

Hawaiian Is.

Merhippolyte orientalis, Bate.

1888. *Merhippolyte orientalis*, Bate, Rep. Challenger Macrura, p. 621.
1907. *Merhippolyte orientalis*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 426.

Off New Guinea.

The original description is almost valueless and the type specimen (*fide* Calman, see de Man, *loc. cit.*) is in hopelessly bad condition.

Genus **Ligur**, Sarato.

1885. *Ligur*, Sarato, Moniteur des Etrangers, IX, année, n. 222, p. 2, (Nice)[1].
1902. *Parhippolyte*, Borradaile, in Willey's Zool. Results, p. 414.
1903. *Ligur*, Senna, Bull. Soc. entom. Ital., ann. XXXIV, p. 319.

[1] I have not been able to consult this publication.

Ligur uveae (Borradaile).

1902. *Parhippolyte uveae,* Borradaile, in Willey's Zool. Results, p. 414, pl. figs. 11, *a-g.*

Loyalty Is.

Genus **Alope,** White.

Alope palpalis, White.

See p. 89.

Alope australis, Baker.

See p. 91.

Genus **Spirontocaris,** Bate.

Spirontocaris alcimede, de Man.

1906. *Spirontocaris alcimede,* de Man, Ann. Mag. Nat. Hist. (7), XVII, p. 404.
1907. *Spirontocaris propugnatrix,* de Man, Trans. Linn. Soc., Zool. (2), IX, p. 416, pl. xxxii, figs. 42-46.

Japan.

Spirontocaris geniculata (Stimpson).

1860. *Hippolyte geniculata,* Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 34.
1890. *Hippolyte geniculata,* Ortmann, Zool. Jahrb., Syst., V, p. 503, pl. xxxvii, figs. 3, 3*d-i.*
1902. *Hippolyte geniculata,* Doflein, Abh. Akad. Wiss. München, XXI, iii, p. 636.
1902. *Spirontocaris geniculata,* Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 45, fig. 19.

Japan.

Spirontocaris gracilirostris (Stimpson).

1860. *Hippolyte gracilirostris,* Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.

Japan.

Spirontocaris grebnitskii, Rathbun.

1902. *Spirontocaris grebnitzkii,* Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 44, fig. 18.

Japan.

Spirontocaris jordani, Rathbun.

1902. *Spirontocaris jordani,* Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 44, fig. 17.

Japan.

Spirontocaris leptognatha (Stimpson).

1860. *Hippolyte leptognatha,* Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.
1879. *Hippolyte leptognatha,* var., Miers, Proc. Zool. Soc., pp. 22, 56.

Japan.

Spirontocaris mororani, Rathbun.

1902. *Spirontocaris mororani*, Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 43, fig. 16.

Japan.

Spirontocaris ochotensis (Brandt).

1851. *Hippolyte ochotensis*, Brandt, in Middendorff's Reise Sibiriens, II, Zool., i, p. 120, pl. v, fig. 17.
1860. *Hippolyte ochotensis*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.
1910. *Spirontocaris ochotensis*, Rathbun, Harriman Alaska Exped., X, Crust., p. 71, text-fig. 26.

Bering Sea to Sitka, Kamchatka, Okhotsk Sea, Japan.

Spirontocaris orientalis (de Man).

1890. *Hetairocaris orientalis*, de Man, Notes Leyden Mus., XII, p. 122, pl. vi, fig. 6.
1890. *Hippolyte ponapensis*, Ortmann, Zool. Jahrb., Syst., V, p. 502, pl. xxxvi, figs. 20, 20d.
1892. *Hippolyte ponapensis*, de Man, Notes Leyden Mus., XIV, p. 263.

Caroline Is.

Spirontocaris pandaloides (Stimpson).

See p. 93

Spirontocaris pectinifera (Stimpson).

1860. *Hippolyte pectinifera*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 35.

Japan.

Spirontocaris profunda, Rathbun.

1906. *Spirontocaris profunda*, Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 914, pl. xxiv, fig. 10.

Hawaiian Is.

Spirontocaris propugnatrix, de Man.

1906. *Spirontocaris propugnatrix*, de Man, Ann. Mag. Nat. Hist. (7), XVII, p. 404.
1907. *Spirontocaris propugnatrix*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 414, pl. xxxii, figs. 35-41.

Japan.

Spirontocaris rectirostris (Stimpson).

1860. *Hippolyte rectirostris*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 33.
1902. *Hippolyte rectirostris*, Doflein, Abh. Akad. Wiss. München, XXI, iii, p. 637, pl. iii, fig. 7.
1906. *Spirontocaris rectirostris*, de Man, Ann. Mag. Nat. Hist. (7), XVII, p. 403.
1907. *Spirontocaris rectirostris*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 411, pl. xxxii, figs. 31-34.

Japan.

Genus **Thor**, Kingsley.

Thor paschalis (Heller).

See p. 94.

Genus **Hippolyte**, Leach.

Hippolyte acuta (Stimpson).

1860. *Virbius acutus*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 35.
1906. *Hippolyte acuta*, Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 912, pl. xxiv, fig. 3.

Liu Chiu Is.; Hawaiian Is.

Hippolyte australiensis (Stimpson).

See p. 98.

Hippolyte bifidirostris, Miers.

1876. *Virbius bifidirostris*, Miers, Ann. Mag. Nat. Hist. (4), XVII, p. 224.
1876. *Virbius bifidirostris*, Miers, Cat. N. Z. Crust., p. 81, pl. xi, fig. 1.
1903. *Hippolyte bifidirostris*, Thomson, Trans. Linn. Soc., Zool. (2), VIII, p. 443, pl. xxviii, figs. 13-16.

New Zealand.

Hippolyte orientalis, Heller.

See p. 97.

1861. *Hippolyte orientalis*, Heller, Sitz-ber. Akad. Wiss. Wien, XLIV, p. 277.
? 1875. *Virbius proteus*, Paulson, Rech. Crust. Mer Rouge, p. 109, pl. xviii, fig. 1, pl. x, figs. 2-5.
1906. *Virbius orientalis*, Nobili, Ann. Sci. nat., Zool. (9), IV, p. 33.

Red Sea.

Hippolyte ventricosus, H. Milne-Edwards.

See p. 96.

Genus **Latreutes**, Stimpson.

Latreutes acicularis, Ortmann.

1890. *Latreutes acicularis*, Ortmann, Zool. Jahrb., Syst., V, p. 506, pl. xxvii, figs. 6, 6 d-k, 6 n.
1902. *Latreutes acicularis*, Doflein, Abh. Akad. Wiss. München, XXI, p. 638.
1907. *Latreutes acicularis*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 421.

Japan.

Latreutes anoplonyx, Kemp.

See p. 104.

Latreutes (?) ceylonensis, Pearson (see p. 99).

1905. *Latreutes ceylonensis*, Pearson, Ceylon Pearl Oyster Rep., IV, p. 81, pl. ii, fig. 7.

Ceylon.

Latreutes compressus (Stimpson).

1860. *Rhynchocyclus compressus*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 28.

Port Jackson, Australia.

Latreutes dorsalis, Stimpson.

1860. *Latreutes dorsalis*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 27.

Hakodadi, Japan.

Latreutes laminirostris, Ortmann.

1890. *Latreutes laminirostris*, Ortmann, Zool. Jahrb., Syst. V, p. 506.
1907. *Latreutes laminirostris*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 422.

Japan.

Latreutes mucronatus (Stimpson).

See p. 101.

Latreutes phycologus, Nobili.

1905. *Latreutes phycologus*, Nobili, Bull. Mus. Hist. nat., p. 159.
1906. *Latreutes phycologus*, Nobili, Bull. sci. France. Belg., XL, p. 41, pl. ii, figs. 6, 6 d.

Persian Gulf.

Latreutes planirostris (De Haan).

1849. *Cyclorhynchus planirostris*, De Haan, Fauna Japonica, Crust., p. 175, pl. xlv, fig. 7.
1860. *Rhynchocyclus planirostris*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 27.
1879. *Rhynchocyclus planirostris*, Miers, Proc. Zool. Soc., p. 55.
1890. *Latreutes planirostris*, Ortmann, Zool. Jahrb., Syst., V, p. 505, pl. xxxvii, figs. 4d-l, 4 n.
1902. *Platybema planirostre*, Rathbun, Proc. U. S. Nat. Mus,, XXVI, p. 46.
1907. *Latreutes planirostris*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 421.

Japan.

Latreutes pristis (Nobili).

1899. *Platybema pristis*, Nobili, Ann. Mus. civ. Genova (2), XX, p. 233 (p. 4 of reprint).

Beagle Bay, New Guinea.

Latreutes pygmaeus, Nobili.

See p. 99.

Genus **Tozeuma**, Stimpson.

Tozeuma armatum, Paulson.

See p. 106.

Tozeuma elongatum (Baker).

1904. *Angasia elongata*, Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 147, pl. xxvii, figs. 1-4.

Port Victor, S. Australia ; 15 fms.

Tozeuma erythraeum, Nobili.

1904. *Tozeuma erythraeum*, Nobili, Bull. Mus. Hist. nat. Paris, p. 231.
1906. *Angasia erythraea*, Nobili, Ann. Sci. nat., Zool. (9), IV, p. 44.

Red Sea.

Tozeuma kimberi (Baker).

1904. *Angasia kimberi*, Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 149, pl. xxvii, fig. 5.

Port Willunga, S. Australia ; 4 fms.

Tozeuma lanceolatum, Stimpson.

1860. *Tozeuma lanceolatum*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 27.
1879. *Tozeuma lanceolatum*, Kingsley, Proc. Acad. Nat. Sci. Philadelphia, p. 413.

Hongkong.

Tozeuma pavoninum (Bate).

1863. *Angasia pavonina*, Bate, Proc. Zool. Soc., p. 498, pl. xl, fig. 1.

St. Vincent's Gulf, Australia ; 4½ fms.

Tozeuma robustum (Baker).

1904. *Angasia robusta*, Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 150, pl. xxviii, figs. 1-8.

St. Vincent Gulf, S. Australia, 10-12 fms.

Tozeuma tomentosum (Baker).

1904. *Angasia tomentosa*, Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 152, pl. xxix, figs. 1-4.

S. Australia ; 20 fms.

Genus **Gelastocaris,** Kemp.

Gelastocaris paronae (Nobili).

See p. 107.

Genus **Mimocaris,** Nobili.

Mimocaris heterocarpoides, Nobili.

1903. *Mimocaris heterocarpoides*, Nobili, Boll. Mus. Torino., XVIII, no. 447, p. 6, fig. 2.

Borneo.

Genus **Lysmata,** Risso.

Lysmata seticaudata (Risso).

1816. *Melicerta seticaudata*, Risso, Hist. nat. Crust. Nice, p. 110, pl. ii, fig. 1.
1825. *Lysmata seticauda*, Guerin, Encycl. méthod., X, p. 328.
1826. *Lysmata seticaudata*, Risso, Hist. Nat. de l'Europe Mérid., V, p. 62.
1863. *Lysmata seticauda*, Heller, Crust. südlich. Europa., p. 234, pl. viii, fig. 1.
1902. *Lysmata seticaudata*, Senna, Bull. Soc. entom. Ital., xxxiv, p. 326.

Mediterranean ; Atlantic Coast of France and Spain ; Channel Is.

var. **ternatensis,** de Man.

? 1849. *Lysmata seticaudata,* De Haan, Fauna Japonica, Crust., p. 176, pl. xlv, fig. 13. (*P. dentatus* on plate).
1888. *Lysmata seticaudata,* de Man, Arch. f. Naturgesch., LIII, i, p. 492.
? 1890. *Lysmata seticaudata,* Ortmann, Zool. Jahrb. Syst., V, p. 507 *(partim).*
1902. *Lysmata seticaudata,* de Man, Abhandl. Senck. naturf. Ges. Frankfurt, XXV, p. 846.

Ternate; Amboina. Japan?

Lysmata trisetacea (Heller).

1861. *Hippolyte trisetacea,* Heller, Verhandl. zool-bot. Ges. Wien, XI, p. 29.
1861. *Lysmata pusilla,* Heller, Sitz-ber. Akad. Wiss. Wien, XLIV, p. 287, pl. iii, fig. 26.
1888. *Lysmata pusilla,* de Man, Arch. f. Naturgesch., LIII, i, p. 493.

Red Sea.

Lysmata chiltoni, Kemp.

See p. 110.

Genus **Hippolysmata,** Stimpson.

Hippolysmata amboinensis, de Man.

1881. *Hippolysmata vittata* var. *amboinensis,* de Man, Arch. f. Naturgesch., LIII, i, p. 494.
1907. *Hippolysmata amboinensis,* de Man, Trans. Linn. Soc., Zool. (2), IX, p. 426.

Amboina.

Hippolysmata acicula, Rathbun.

1906. *Hippolysmata acicula,* Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 912, pl. xxiv, fig. 6.

Hawaiian Is.

Hippolysmata dentata, Kemp.

See p. 117.

Hippolysmata ensirostris, Kemp.

See p. 118.

var. **punctata,** Kemp.

See p. 120.

Hippolysmata kükenthali, de Man.

See p. 115.

Hippolysmata multiscissa, Nobili.

1906. *Hippolysmata multiscissa,* Nobili. Ann. Sci. nat. Zool., Paris (9), IV, p. 47, pl. ii, fig. 5.

Red Sea.

Hippolysmata paucidens, Rathbun.

1906. *Hippolysmata paucidens,* Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 913, pl. xxiv, fig. 4.

Hawaiian Is.

Hippolysmata vittata, Stimpson.

See p. 113.

Genus **Merguia**, Kemp.

Merguia oligodon (de Man).

See p. 121.

INCERTAE SEDIS.

1888. *Nauticaris futilirostris*, Bate, Rep. Challenger Macrura, p. 606, pl. cix, fig. 1.
1905. *Nauticaris futilirostris*, Pearson, Ceylon Pearl Oyster Rep., IV, p. 81, pl. ii, fig 8.

Japan, Ceylon.

1839. *Hippolyte gracilipes*, Randall, Journ. Acad. Nat. Sci. Philadelphia (1), VIII, p. 142.

Hawaiian Is.

1871. *Hippolyte grayi*, Cunningham, Trans. Linn. Soc., XXVII, p. 496, pl. lix, fig. 8.

Port Otway.

1858. *Hippolyte ignobilis*, Kinahan, Journ. Roy. Dublin Soc., I, p. 131.

Port Philip, Victoria.

1830. *Hippolyte leachii*, Guérin, Voy. de 'La Coquille', II, pt. 2, p. 37.

Caroline group.

1904. *Virbius* (?) *jactans*, Nobili, Bull. Mus. d'Hist. nat., Paris, p. 239.
1906. *Virbius* (?) *jactans*, Nobili, Ann. Sci. nat., Zool., Paris (9), IV, p. 37, pl. ii, fig. 2.

Red Sea.

1888. *Latreutes planus*, Bate, Rep. Challenger Macrura, p. 584, pl. lxxix, fig. 5.

Philippine Is.

1837. *Hippolyte quoyanus*, H. Milne-Edwards, Hist. nat. Crust., II, p. 375.

New Guinea.

1837. *Hippolyte serratus*, H. Milne-Edwards, Hist. Nat. Crust., II, p. 377.

"Baie de Jarvis."

1837. *Hippolyte spinicaudus*, H. Milne-Edwards, Hist. nat. Crust., II, p. 378.
1882. *Hippolyte spinicaudus*, Haswell, Cat. Australian. Crust., p. 184.

New Holland.

1888. *Latreutes unidentatus*, Bate, Rep. Challenger Macrura, p. 586, pl. lxxix, fig. 6.

Philippine Is.