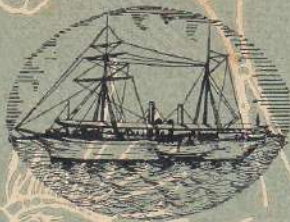


SYMPOSIUM ON CRUSTACEA

PART V

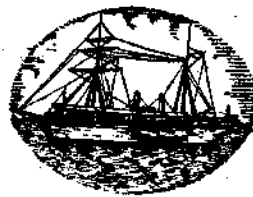


MARINE BIOLOGICAL ASSOCIATION OF INDIA

**MARINE FISHERIES P.O., MANDAPAM CAMP
INDIA**

SYMPOSIUM ON CRUSTACEA

PART V



MARINE BIOLOGICAL ASSOCIATION OF INDIA

**MARINE FISHERIES P.O., MANDAPAM CAMP
INDIA**

PROCEEDINGS
OF THE
SYMPOSIUM ON CRUSTACEA

HELD AT
ERNAKULAM
FROM JANUARY 12 TO 15, 1965

PART V



SYMPOSIUM SERIES 2

MARINE BIOLOGICAL ASSOCIATION OF INDIA
MARINE FISHERIES P.O., MANDAPAM CAMP
INDIA

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AN ANNOTATED BIBLIOGRAPHY OF THE BIOLOGY AND FISHERY COMMERCIALY IMPORTANT PRAWNS OF INDIA*

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ABSTRACT

Prawns and shrimps constitute a very valuable fishery along both the coasts of India and their increased exploitation in recent years necessitates a full knowledge of the biology and bionomics of all the commercially important species. Details of work already done on Indian prawns are scattered throughout a wide range of scientific publications which are not readily available. Hence a compilation of all relevant previous works on the economically important species is attempted in the paper which, it is hoped, may be useful for ready reference on previous works on the subject.

While every attempt has been made to include all relevant and recent literature on the systematics of the species, it was not possible to bring in all such titles that give only passing references or very obsolete systematic notes. Brief annotations on the papers have been included although it is likely that some references that do not give a clear indication of the title or some that do not have a direct bearing on the subject would have been missed in the bibliography.

In the fast developing fishing industry of India, prawn fisheries has gained first place in importance as an exchange earner for the country. Encouraged by the results already achieved and the great scope for further development of this fisheries, well co-ordinated research programmes are formulated and implemented by fisheries research institutions of the country. To help in these research efforts it has been felt that compilation of an annotated bibliography of the published accounts on commercially important prawns could be useful.

The present compilation deals chiefly with references pertaining to prawns and shrimps of the families Penaeidae and Palaemonidae which by and large sustain the prawn fishery of the Indian region. In order to keep the bibliography within a reasonable compass, only those references which cover the Indian region are included. Even though limited in its scope for the above reason, it is hoped that this would be useful for fresh workers entering the field of prawn fisheries research and survey of the prawn resources of this region.

1. AHMAD, NAJIR 1954. Prawn fishery of East Pakistan. *Proc. Indo-Pac. Fish. Council., Fifth Meet., Tech. Pap.* 15. A general account of the prawn fishery of East Pakistan.
2. ——— 1957. Prawn and prawn fishery of East Pakistan. *Govt. of East Pakistan, Directorate of Fisheries*, 31 pp. Systematic account, key to the identification of East Pakistan prawns—*Penaeus canaliculatus*, *P. semisulcatus*, *P. indicus*, *P. indicus* var. *penicillatus*, *Metapenaeus monoceros*, *M. lysianassa*, *M. brevicornis*, *Parapenaeopsis stylifera*, *P. sculptilis*, *P. uncta*, *Solenocera indicus*, *Alpheus euprosyne*, *Leander styliiferus*, *Palaemon mirabilis*, *P. laemereii*, *P. dayanus*, *P. dolichodactylus*, *P. carcinus*, *P. birmanicus birmanicus*, *P. malcolmsonii* and *P. rudis* are given. Production, methods of fishing, price, preservation and curing are also dealt with.
3. AIRAN, J. W. AND ABRAHAM THOMAS 1954. Amino-acids in prawn from Bombay. *J. Univ. Bombay., Sci. Sec.*, 22 B, (5): 48-49.

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4. ALCOCK, A. 1899. A summary of the deep-sea zoological work of the Royal Indian Marine Survey Ship "Investigator" from 1884 to 1897. *Sci. Mem. med. Officers Army, India*, 11: 49 pp.
5. ——— 1901. A descriptive catalogue of the Indian deep-sea Crustacea, Decapoda, Macrura and Anomala in the Indian Museum, being a revised account of the deep-sea species collected by the Royal Marine Survey Ship "Investigator", Calcutta, India, 286 pp.
Decapod Crustacea included in this catalogue number 117 species, belonging to *Penaeidea* (27 species), *Caridea* (58 species), *Stenopidea* (3 species), *Astacidea* (20 species) and *Thalassinidea* (9 species). This classical memoir gives tables, descriptions of species, definitions of the genera, subgenera, families, tribes and suborders under which the species are arranged.
6. ——— 1905. A revision of the "genus" *Peneus* with diagnoses of some new species and varieties. *Ann. Mag. Nat. Hist. Ser.*, 7 (16): 508-532.
Definition of the genus *Peneus*, diagnoses of the constituent genera and tables of the species of several genera, diagnoses of 9 new species described.
7. ——— 1906. Catalogue of the Indian Decapod Crustacea in the collection of the Indian Museum. Part 3. Macrura. Fasc. 1, The prawns of the *Penaeus* group. *Indian Museum, Calcutta*, 55 pp.
Classification, description, synonymy, keys, figures of the prawns of the *penaeus* group; table of the genera and species of the *penaeus* group given.
8. ——— AND A. R. S. ANDERSON 1894. Natural history notes from H.M. Indian Marine Survey Ship "Investigator". Series 11, No. 14. An account of a recent collection of deep-sea Crustacea from the Bay of Bengal and Laccadive Sea. *J. Roy. Asiat. Soc. Bengal*, 63: 141-185.
96 species of crustaceans dredged from Laccadive Sea and Bay of Bengal at a depth from 91 to 1,370 F described.
9. ——— 1899. Natural history notes from H.M. Royal Indian Marine Survey Ship "Investigator". Series 3. No. 2. An account of the deep-sea Crustacea dredged during the surveying season of 1897-1898. *Ann. Mag. Nat. Hist. Ser.*, 7 (3): 278-292.
10. ——— 1899. Illustrations of the zoology of the Royal Indian Marine Surveying Steamer "Investigator" Pt. 7, Crustacea, Calcutta, India.
Parapeneus investigatoris, *Benthescymus investigatoris*, *Haliporus taprobanensis*, *Alpheus shearni*, *Sergestis* sp., *Heterocarpus laevigatus* are figured.
11. ALCOCK, A., N. ANNANDALE AND A. C. MAC GILCHRIST 1907. Illustrations of the zoology of the Royal Indian Marine Survey Ship "Investigator". Part 12. Crustacea (Malacostraca), Calcutta, India.
Benthescymus armatus figured.
12. ——— AND A. F. MACARDLE 1901. Illustrations of the zoology of the Royal Indian Marine Surveying Steamer "Investigator". Part 9. Crustacea, Calcutta, India.
Aristeus spp., *Peneus rectacutus*, *Solenocera* (*Parasolenocera*) *annectens*, *Sergestes bisulcatus*, *Peneus* (*Metapeneus*) *coniger*, *Eryonicus indicus*, *Calocaris alcocki*, *Engystenopus palmipes*, *Heterocarpus tricarlinatus*, *H. wood-masoni*, *Aegeon* sp., *Pandalus* (*Plesionika*) *bifurca*, *P. alcocki*, *Parapasiphaea latirostris*, *Ephyrina hoskynii*, *Psathyrocaris fragilis*, *Phye alcocki*, *Sympasiphaea annectens* are figured.
13. ——— 1905. Illustrations of the zoology of the Royal Indian Marine Surveying Steamer "Investigator". Part 10. Crustacea, Calcutta, India.
Heterocarpus longirostris is figured.
14. ANNANDALE, N., 1923. Advances in our knowledge of the fauna of freshwater and brackish waters of India. *J. Asiat. Soc. Bengal*.
15. ANONYMUS 1951. Agricultural marketing in India. Preliminary guide to Indian fish, fisheries, methods of fishing and curing. *Marketing Ser.*, 66: 1-138.
Commercially important prawns and the fishing methods are given.
16. ——— 1954. Administrative report 1953-54. *Directorate of Marine Products, Govt. of Saurashtra, Rajkot*.
17. ——— 1955. Administrative report, 1954-55. *Ibid.*
18. ——— 1956. Shrimp ground along Indian west coast. *Curr. Sci.*, 25 (6): 207.
Reports vast shrimp ground along the Malabar coast, stretching 140 miles from Beypore to Mangalore.
19. ——— 1960. India—Shrimp industry. *Comm. Fish. Rev.*, 22 (5): 50-51.
Reports fishery, landings, fishing fleets, prices, exports and taxes.
20. ——— 1961. Annual report, 1959-60. *Govt. of Maharashtra, Department of Fisheries, Part 1, Maharashtra Region*.

21. ANONYMOUS 1962. *The Wealth of India. Raw materials*, Vol. IV. *Fish and Fisheries*. Published by the Council of Scientific and Industrial Research, New Delhi: 118-124.
Prawn fisheries, species occurring described.
22. APPANNA AND DEVADATTA 1942. Comparative studies on the nutritive value of fish and prawn muscle. *Curr. Sci.*, 11: 333-35.
The prawns selected for the study are *Metapenaeus*, *Parapenaeus* and *Acetes*. The results show that prawn muscles constitute cheap sources of animal proteins and essential minerals such as phosphorus, calcium and iron. Proteins are found to possess high biological value and digestibility coefficient. In the prawn muscles the digestibility coefficient is as high as 87.09 when the level of intake is 10%, but is lowered to 73.22 when the intake increases to 15%.
23. BALACHANDRAN, K. K. AND A. N., BOSE 1965. Dehydration of prawns in tunnel dryers. *Fishery Technology*, 2 (1): 126-130.
Various aspects of dehydration of prawns in a tunnel dryer described.
24. BANERJI, S. K. 1965. A note on the production trend of marine shrimps in India. *Ibid.*, 2 (1): 43-47.
Reviews the production statistics of marine shrimps in different maritime states of India from 1950 to 1962. Discusses the status of the fishery of *Metapenaeus dobsoni* with reference to the data on catch and effort obtained from trawler operations off cochin.
25. BATE, C. S. 1881. On the Penaeidea. *Ann. Mag. Nat. Hist. Ser.*, 5: 169-196.
Enumeration of the specimens taken during 'Challenger' expedition and description of new species. Generic and species description of many Penaeids are given.
26. ——— 1888. Reports on the Crustacea Macrura. Report on the scientific results of the voyage of H.M.S. 'Challenger' during the years 1873-1876. *Zoology*, 24, i-xc: 942 pp.
Reports on about 2,000 specimens of Macrura collected on the 'Challenger' from various regions.
27. BHATIA, D. R. AND V. NATH 1931. Studies on the origin of yolk. VI. The crustacean oogenesis. *Quart. J. Micr. Sci.*, 74: 669-699.
Palaemon lamarrei and *Paratelson spinigera* are studied. Golgi apparatus, fatty yolk, nucleolus, nucleolar extrusions, mitochondria, albuminous yolk of *P. lamarrei* are studied.
28. BHIMACHAR, B. S., 1962. Informations on prawns from Indian waters—Synopsis of biological data. *Proc. Indo-Pacif. Fish. Council.*, 10th Sess., 124-133.
Gives a brief review of available biological information on the marine, brackish and freshwater prawns and shrimps of India. Estimates of commercial production are given with a brief outline of culture practices. A bibliography of 70 titles from 1906 to 1962 is appended.
29. ——— 1965. Life-history and behaviour of Indian prawns. *Fishery Technology*, 2 (1): 1-11. Reviews the information available on age and growth, embryonic and larval development, food habits, spawning and maturation and certain physiological aspects of commercially important Palaemonids and Penaeids of India.
30. BORRADAILE, L. A., 1910. Penaeidea, Stenopodea and Raptantia from the Western Indian Ocean. *Trans. Linn. Soc. London. 2nd Ser.*, 13 (2), B: 257-264.
31. ——— 1917. On the structure and function of the mouth parts of Palaemonid prawns. *Proc. Zool. Soc. London*.
32. CHACKO, P. I., 1944. Prawn curing in Madras. *Indian Farming*, 5 (6): 259-60.
Fishery seasons for Madras and Colliar lake are given. Various methods of curing in Madras described.
33. ——— 1955. Prawn Fisheries of Madras State, India. *Contribution from the Marine Biological Station, West Hill, Malabar coast*, No. 3, Govt. Press, 14 pp.
The main fishing area; bionomics of the common species that occur in Madras; statistics of prawn fisheries; prawn culture in paddy fields; crafts and gears employed in prawn fisheries; utilization and curing methods and the future of prawn fishing industry are discussed.
34. ——— 1956. Prawn fisheries of Madras State, India. *Madras Govt. Publication, Madras, India*.
35. ——— AND S. V. GANAPATI 1952. Fish culture in Paddy fields. *Ind. Com. J.*, 8: 3 pp.
Refers to raising prawns on a large scale in rice fields along the Malabar coast.

36. CHACKO, P. I., ABRAHAM, J. G. AND R. KUMARI ANDAL 1953. A survey of the flora, fauna and fisheries of the Colliar lake. *Ind-Com. J.*, 8: 274-80.
Prawns represented by *Metapenaeus monoceros*, *Penaeus carinatus*, *Palaemon malcolmsonii*, *P. scabriculus* and *P. carcinus*. Describes the biological condition and the fishery of Colliar lake.
37. — AND R. KUMARI ANDAL 1953. Report on a survey of the flora, fauna and fisheries of the Pulicat lake, Madras State, India, 1951-52. *Contribution from the Freshwater Fisheries Biological Station, Madras*, No. 8: 20 pp.
The results of the survey of the lake and the bionomics of the important species given. Statistics of fish landings, fisherfolk and their conditions are also appended.
38. —, MAHADEVAN, S. AND R., GANESAN 1955. A guide to the field study of the fauna and flora of Krusadi Island, Gulf of Manar. *Contribution from the Marine Biological Station, Krusadi Island, Gulf of Manar*, No. 3: 1-15.
39. CHANDRASEKHAR, B., 1964. Note on the prawn fishing by the Training Centre boats, Mangalore. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin*, 1964, p. 10.
Gives the information regarding the species available, fishing season, fishing grounds and the efficiency of trawl nets.
40. CHARL, S. T., 1948. Nutritive values of some of the West Coast marine food fishes of the Madras Province. *Indian J. Med. Res.*, 36 (3): 253-259.
41. — AND PAI, P. A., 1946. Preservation of prawns and its effects on the nutritive value. *Curr. Sci.*, 15: 342-344.
A method of preservation of prawns (*Penaeus monodon*) by semi-drying method is enunciated. Analyses of prawns—fresh, beach dried and semi-dried are given.
42. CHIDAMBARAM, K. AND R. S. V. RAMAN 1944. Prawn and crab fishery in Madras. *Indian Farming*, 5: 454-455.
Statistics and nutritive values are given.
43. CHOPRA, B. N., 1923. Bopyrid Isopods parasitic on Indian Decapod Macrura. *Rec. Indian Mus.*, 25 (5): 411-550.
A resume of the previous work on the subject; list of Indian species and hosts; geographical distribution; systematic accounts of the parasites with the key for identification are given.
44. — 1930. Pearl-like object found in a prawn. *Nature*, 126 (3179): 502-503.
45. — 1931. The history and progress of the Zoological Survey of India, Crustacea. Section III. *J. Bombay Nat. Hist. Soc.*, 34 (2): 502-506.
Deals with the history and progress of the Crustacea Section of the Zoological Survey of India.
46. — 1936. The cape crawfish Industry of South Africa with some observations on prawn and crab fisheries of India. *Curr. Sci.*, 4 (7): 529-533.
The prawn fisheries of India is reviewed with suggestions for improvement on scientific and commercial lines.
47. — 1937. Notes on Crustacea Decapoda. *Rec. Indian Mus.*, 39.
48. — 1939. Some food prawns and crabs of India and their fisheries. *J. Bombay Nat. Hist. Soc.*, 41 (2): 221-234.
The common food prawns—*Penaeus carinatus*, *P. indicus*, *Metapenaeus brevicornis*, *M. monoceros*, *Palaemon carcinus*, *P. lamarrei*, *P. rudis*, *P. malcolmsonii*, *Caridina gracilirostris*, and the mud shrimps *Macropsis orientalis*, *Potamomysis assimilis* are listed. The salient features of the bionomics and life-history, the prawn resources of Bombay and Malabar coasts, and of Chilka and Colliar lakes; the methods of fishing in different places are discussed. The need for further scientific study of prawn bionomics, fishing grounds, breeding and life-histories, migration, etc., are urged.
49. — 1943. Prawn fisheries in India. *Curr. Sci.*, 12 (2): 71.
A brief account of prawn fishery of India with special reference to *Penaeus carinatus* and *Palaemon carcinus* is given.
50. — 1943. Prawn fisheries of India. *Proc. Indian Sci. Congr.*, 30 (2): 153-173.
Information on the commercially important prawns and shrimps occurring in sea, estuary and backwaters of India are given. The methods employed in curing and preservation are described. Further studies of all the commercial prawns, their bionomics, morphology, food, habits, migration, reproduction, life-history, etc., are suggested.

51. CHOPRA, B. N. 1951. Handbook of Indian Fisheries. Prepared for the 3rd meeting of Indo-Pacific Fisheries Council, Madras, February, 1951.
The article 8 deals with the Crustacean fisheries of India. Important species of prawns and shrimps are given with their distribution and general bionomics.
52. — AND K. K., TIWARI 1947. Decapod Crustacea of the Patna State, Orissa. *Rec. Indian Mus.*, 45: 213-224.
Distribution and taxonomic notes of *Palaemon malcolmsonii*, *P. lamarrei*, *P. dayanus*, *Caridina nilotica* var. *chauhani* and *caridina weberi* prox. var. *sumatrensis* are given.
53. DAS, K. N. 1935. Developmental stages of *Palaemon lamarrei* H. M. Edw. *Proc. Indian Sci. Congr.* 22nd (Abstract).
Descriptions of number of stages within the egg case and the free stages reared in the laboratory are given.
54. DE MAN, J. G. 1908. The fauna of brackish water ponds of Port Canning, lower Bengal. Part X. Decapod Crustacea with an account of small collection from brackish water near Calcutta and in the Dacca District, Eastern Bengal. *Rec. Indian Mus.*, 2: 211-231.
55. DESHPANDE, S. D. AND N. A. GEORGE 1965. On the effect of tickler chain on the catches landed by a 55 ft trawl net. *Fishery Technology*, 2 (1): 82-86.
The results of the operation of trawl net with and without chain discussed. It is concluded that the attachment of tickler chain increases the shrimp catch and is probably due to the disturbance caused by moving chain attached to the foot-rope.
56. DE ZYLVA, E. R. A., 1955. The prawn fisheries of Ceylon. *Proc. Indo-Pacif. Fish. Council.*, 6th Sess.: 324-327.
Discusses the present status of prawn fisheries of Ceylon, important gears employed, off-shore fishing, etc.
57. GANGULY, D. N. 1964. Suggestions for the scientific utilisation of the sources and production of commercially important prawns and shrimps of India. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin, 1964* (Abstract only), p. 7.
Suggestions for studying exploitation and breeding areas, selection of suitable types and size for commercial purposes, artificial culture and storage are given.
58. GEORGE, M. J. 1958. Observations on the plankton of the Cochin backwaters. *Indian J. Fish.*, 5 (2): 375-401.
Records and seasonal variation of post-larvae of *Metapenaeus dobsoni*, *M. monoceros*, *Penaeus indicus*, *P. carinatus* and caridian larvae—*Periclimenes* sp., *Palaemon* sp., and Alpheids are given.
59. — 1959. Notes on the bionomics of the prawn *Metapenaeus monoceros* Fabricius. *Indian J. Fish.*, 6 (2): 268-279.
Various aspects of the bionomics of *M. monoceros* such as growth, age, composition of catches, length-weight relationship, moulting behaviour, breeding and migration and sex ratio are dealt with.
60. — 1961. Studies on the prawn fishery of Cochin and Alleppey coast. *Ibid.*, 8 (1): 75-95.
The prawn fishery at Alleppey, Narakkal and Chellanum is compared with a special emphasis on recruitment. The probable influence of mud banks on the increased prawn landings at Alleppey discussed.
61. — 1962. On the breeding of penaeids and the recruitment of their post larvae into the backwaters of Cochin. *Ibid.*, 9 A (1): 110-116.
A quantitative study of postlarvae of *Metapenaeus dobsoni*, *M. monoceros*, and *Penaeus indicus* in the backwater plankton of Ernakulam for the years 1956 to 1960 is made. The breeding seasons, post-larval recruitment, the size ranges and the relationship of seasonal fluctuations in recruitment of the larvae and salinity of the water discussed.
62. — 1962. Observations on the size groups of *Penaeus indicus* (Milne Edwards) in the commercial catches of different nets from the backwaters of Cochin. *Ibid.*, 9 (2): 468-475.
The backwater catches of *Penaeus indicus* from the Chinese dip net, the stake net and the cast net for the years 1955 through 1958 have been analysed and it is found that the Chinese net catches show the maximum sizes in population mean and modal lengths. The cast net catch sizes come next and stake net catches show minimum sizes. The probable factors influencing the size distribution in the catches of the same species caught in the different nets from the same area of operation are discussed.
63. — 1963. Note on an abnormality in the penaeid prawn, *Metapenaeus monoceros* Fabricius. *J. Mar. biol. Ass. India*, 5 (1): 145-146.
Records a specimen having both male and female characters externally, but only the female gonad with well-developed ovary has been observed internally.

64. GEORGE, M. J. 1964. Post-larval abundance as a possible index of fishing success in the prawn *Metapenaeus dobsoni* (Miers). *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin, 1964.* (Abstract only), pp. 1-2.
For predicting the future commercial prawn fishery of the area, the post-larval abundance is correlated with measures of abundance of juveniles in the backwater fishery and adults in the marine fishery of the coast and is found that the success or failure of the fishery in a year could be foreseen in the magnitude of post-larval recruitment.
65. GEORGE, P. C. AND M. J. GEORGE 1964. On the location of a possible spawning area for the penaeid prawn, *Metapenaeus monoceros* Fabricius off Cochin. *Curr. Sci.*, 33 (8): 251-252.
Reports the breeding area for *Metapenaeus monoceros* off Cochin in the 50-60 metre area; along with the hydrographical conditions.
66. ———, ——— AND P. VEDAVYASA RAO 1963. *Metapenaeus kutchensis* sp. nov., a penaeid prawn from the Gulf of Kutch. *J. Mar. biol. Ass. India*, 5 (2): 285-288.
Describes a new species of prawn from the Gulf of Kutch contributing to the commercial catches.
67. GEORGE, C. J. AND J. C. GEORGE 1944. A note on Crustacean liver oils. *J. Univ. Bombay, n.s.*, 13 B (3): 17.
68. GEORGE, J. C. AND VINOD C. SHAH 1954. A note on the muscle fat of the lobster *Panulirus polyphagus* (Herbst) and the prawn *Palaemon carinus* (Henderson & Mattai). *Jour. Animal morphol. and physiol.*, 1 (1): 61.
69. ——— 1954. A comparative study of the chemical composition of the muscle of the lobster *Panulirus polyphagus* (Herbst) and *Palaemon carinus* (Henderson & Mattai). *Ibid.* 1 (11): 69-70.
70. GIDEON, P. W., P. K. B. MENON, S. R. V. RAO AND K. V. JOSE 1957. On the marine fauna of Gulf of Kutch: A preliminary survey. *J. Bombay Nat. Hist. Soc.*, 54 (3): 690-706.
The area surveyed are Okha, Beyt Dwarka and Pirotan. Refers to the occurrence of *Penaeus*, *Lucifer*, *Hippolytina* and *Alpheus*.
71. GNANAMUTHU, C. P. AND O. RAMACHANDRA REDDY 1960. A potentiometric method for observation of osmotic behaviour of prawns. *Nature*, 188 (4750): 594-595.
The potentiometric method outlined; experiments conducted described.
72. GOPALAKRISHNAN, V. 1951. A note on the chemical composition of the penaeid prawns of Madras. *Curr. Sci.*, 20: 331.
An estimation of the chemical composition of *Penaeus indicus*, *P. carinatus*, *Metapenaeus monoceros* and *M. dobsoni* are made and it is found that the differences due to sex are irregular and not marked.
73. ——— 1952. Food and feeding habits of *Penaeus indicus* M. Edw. *J. Madras Univ.*, 22 B (1): 69-75.
The stomach contents of 380 specimens of *P. indicus* analysed. Although the vegetable matter and crustaceans form the bulk of food items, the presence of other animal matter indicates an omnivorous habit. A few experimental observations on feeding also have been made.
74. ——— 1953. Studies on the biology of Madras Penaeids (Ph.D. Thesis). *University of Madras, Department of Zoology*.
75. ——— 1953. Seasonal fluctuations in the fat content of the prawn *Penaeus indicus* M. Edw. *J. Madras Univ.*, 23: B 193-202.
The seasonal fluctuations in the fat content with reference to the length groups and sexes studied and discussed. The relationship between the fat content and feeding habits surveyed.
76. ——— 1957. Studies on the biology of penaeids. *Madras University Publication*, III, 111 pp.
77. GOPALA IYER, R. 1940. Marine fauna of Madras (Fauna of sandy beach): *Handbook of Indian Sci. Congr.*, 27th Sess., Madras.
78. GOPINATH, K. 1953. Some interesting methods of fishing in the backwaters of Travancore. *J. Bombay Nat. Hist. Soc.*, 51: 466-471.
Description of 'Prawn Junkhar' or 'Pachil' practised in the Kayamkulam and Vembanad lakes is given. Other fishing methods like fishing by listening in, fishing by virali or scare line and lure fishing are described.
79. ——— 1955. Prawn culture in the rice fields of Travancore, Cochin, India. *Proc. Indo-Pacif. Fish. Council*, 6th Sess., 18: 419-425.
Deals with the distribution and disposition of the prawn fields, their ecology, the preparation of the fields, various methods of fishing, species and yield and postcultural treatment of fields.
80. GOVINDAN, T. K. 1962. Some new indices of quality for ice-stored prawns. *Sci. and Cult.*, 28 (1): 36-37.
Discusses the various aspects of the quality of prawn stored in ice and suggests that the results obtained could be used for grading the raw material.

81. GRAVELY, F. H., 1919. A note on the marine invertebrate fauna of Chandipore, Orissa. *Rec. Indian Mus.*, 16: 395-399.
82. HELLER, C., 1865. Reise der österreichischen Fregatte Novara um die Erde in den Jahren 1857-58-59 unter den Befehlen des Commodore B. Von Wüllerstorff-Urbair. *Zool. Theil. Zewiter Band, Crustaceen*, Vienna, 2(3): 121-123.
Refers to 88 species obtained at the Nicobar Islands, 30 from Madras and from other places.
83. HENDERSON, J. R. AND G. MATTHAI 1910. On certain species of *Palaemon* from South India. *Rec. Indian Mus.*, 5: 277-306.
Taxonomic notes and figures of *Palaemon carcinus*, *P. malcolmsonii*, *P. idae*, *P. sulcatus*, *P. rudis*, *P. nobilii*, *P. scabriculus*, *P. dolichodactylus* and *P. dubius* are given.
84. HORA, S. L. 1932. Mud fishing in lower Bengal. *J. Asiat. Soc. Bengal (n.s.)*: 197-205.
85. ——— 1933. Animals in brackishwater at Uttarbhag, Lower Bengal. *Curr. Sci.*, 1(12): 381-386.
Records the occurrence of *Metapenaeus brevicornis* and *Palaemon lamarrei* in the area.
86. ——— AND K. K. NAIR 1944. Suggestions for development of saltwater bheris or Basabadha fisheries in the Sunderbans. *Fishery Dept. Pamphlet No. 1, Depart. of Fisheries, Govt. of Bengal, Calcutta*.
87. HICKLING, C. F., 1963. Expanding tropical prawn fisheries. *Fishing News International*, 2(1): 37-39.
88. IBRAHIM, K. H. 1962. On the early embryonic development of *Macrobrachium malcolmsonii* H.M. Edw. and *Macrobrachium scabriculus* Heller from river Godavari. *Sci. and Cult.*, 28(5): 232-233.
Descriptions of egg cleavages, gastrulation and comparisons with that of *M. scabriculus* given.
89. ——— 1962. Observations on the fishery and biology of the freshwater prawn *Macrobrachium malcolmsonii* Milne Edwards of River Godavari. *Indian J. Fish.*, 9 A (2): 433-467.
Deals with age and growth, length-weight relationship, feeding habits, sex ratio, fecundity and breeding. The effect of parasitisation on sexual development and the record of juveniles over the first anicut of Godavari and the use of this as prawn seed for stocking inland waters discussed.
90. IYENGAR, J. R., VISWESWARIAH, M. N. MOORJANI AND D. S. BHATTIA 1960. Assessment of the progressive spoilage of ice stored shrimp. *J. Fish Res. Bd. Canada*, 17(4): 470-485.
Investigations are made to discuss the findings of the results obtained by employing total bacterial plate-count method, Ph determinations, estimation of trimethylamine and total volatile nitrogen and to describe rapid tests based on use of impregnated papers and reagents as an index for the degree of shrimp spoilage. Experiments were conducted on two species, *Penaeus indicus* and *Metapenaeus monoceros* and the results obtained were discussed.
91. IYER, R. P., 1949. On the embryology of *Palaemon idae* Heller. *Proc. Zool. Soc., Bengal*, 2(2): 101-148.
The embryology of *P. idae* from 4-celled stage to the newly hatched larva has been described in detail.
92. JOB, T. J. 1946. Report on the scheme for manufacture of semi-dried prawns from Colliar and Pulicat lakes for the period of 10 months and 9 days from 23rd May 1945 to 31st March 1946. *Madras Govt. Press*.
93. JOHN, C. C. AND C. V. KURIEN 1959. A preliminary note on the occurrence of deep water prawn and spiny lobster off the Kerala coast. *Bull. Cent. Res. Inst. Trivandrum, Ser. C.*, 7(1): 155-162.
Reports the occurrence of *Penaeopsis philippii* and *Peurulus sewelli* and discusses the distribution and nature of the bottom.
94. JOHN, M. C. 1947. Bionomics and life-history of *Palaemon carcinus*. *Proc. Indian Sci. Congr.*, 34th Sess.: 117 (Abstract).
The ecology, food and feeding habits, methods of offence and defence, the number of eggs produced, the period of hatching, the migration and life-history and the factors influencing it are discussed.
95. ——— 1957. Bionomics and life-history of *Macrobrachium rosenbergii* (deMan). *Bull. Cent. Res. Inst. Univ. Trivandrum, Ser. C*, 5(1): 93-102.
The bionomics, life-history and economics of *M. rosenbergii* are given with a general discussion on the ecology of the prawn fauna of Travancore.
96. ——— 1958. A preliminary survey of the Kayamkulam lake. *Bull. Cent. Res. Inst. Univ. Kerala, Ser. C.*, 6(1): 89-109.
Refers to *Caridina nilotica*, *C. propinqua*, *Macrobrachium idae*, *M. equidens*, *Penaeus indicus*, *P. carinatus*, *P. monodon*, *Penaeopsis affinis*, *P. dobsoni*, *P. monoceros* and *P. brevicornis*.

97. JONES, S. AND K. H. SUJANSINGANI 1954. Fish and fisheries of the Chilka lake with statistics of fish catches for the years 1948-50. *Indian J. Fish.*, 1: 256-344.
Refers to *Penaeus indicus*, *P. carinatus*, *Metapenaeus monoceros*, *M. affinis*, *M. dobsoni*, *Palaemon rudis*, *P. malcolmsonii*. The behaviour of young prawns discussed. Export trends for the years 1948-50 and the important fishing methods are given.
98. KAMASASTRY, P. V. AND P. V. PRABHU 1961, Preparation of chitin and glycosamine from prawn shell waste. *J. Sci. and Ind. Res.*, 20 D (12): 466.
A detailed method for the manufacture of chitin and glucosamine described.
99. KEMP, S. 1910. Notes on Decapoda in the Indian Museum. I. The species of Gennadas. *Rec. Indian Mus.*, 5 (3): 173-181.
Gennadas alcocki, *G. praecox*, *G. sordidus*, *G. scutatus*, *G. bouvier*, *G. carinatus* are described and figured.
100. ——— 1913. Percysladden Trust Expedition to the Indian Ocean. Pelagic Decapoda. *Trans. Linn. Soc. London (zool)*, 16 (2): 53-68.
Refers to *Sergestes challengerii*, *S. gardinarii*, *Lucifer acastra*, *L. reynandii*, *Gennadas scutatus*, *G. alcocki*, *Hoplophorus gracilirostris*, *H. foliaceus*, *Acanthephyra purpurea* and a key for *Notostomus* spp.
101. ——— 1913. Zoological results of the Abhor Expedition. Crustacea Decapoda. *Rec. Indian Mus.*, 8: 289-310.
One species of *Palaemon* and 3 species of *Caridina* are recorded and described.
102. ——— 1914. Notes on the Crustacea Decapoda in the Indian Museum. II. Hippolytidae. *Rec. Indian Mus.*, 10 (2): 80-129.
Species and different genera of the family Hippolytidae are dealt with; a key to the Indo-Pacific genera of Hippolytidae given; a synonymy list of the Indo-Pacific species is appended.
103. ——— 1915. Fauna of Chilka lake. Crustacea Decapoda. *Mem. Indian Mus.*, 5: 199-325.
Taxonomic notes on *Pontophilus hendersoni*, *Palaemon lamarrei*, *P. malcolmsonii*, *P. rudis*, *P. scabriculus*, *Leander styliferus*, *Urocaris indica*, *Periclimenes demani*, *Ogyrides striatocauda*, *Alpheus crassimanus*, *A. malabaricus*, *A. paludicola*, *Caridina nilotica* var. *bengalensis*, *C. propinqua*, *Leptochela aculeocaudata*, *Penaeus carinatus*, *P. indicus*, *Penaeopsis monoceros*, *P. affinis*, *P. dobsoni* and *Lucifer hansenii* are given.
104. ——— 1916. Notes on Crustacea Decapoda in the Indian Museum. *Rec. Indian Mus.*, 12 (8): 355-384.
18 species of *Crangonidae*, ten belonging to the genus *Pontophilus*, 6 to *Aegon* and one each to *Prinocrangon* and *Crangon* are described.
105. ——— 1916. Notes on Crustacea Decapoda in the Indian Museum. VII. Further notes on Hippolytidae. *Ibid.*, 12: 385-405.
Saron marmoratus, *Spirontocaris pandaloides*, *S. rectirostris*, *Thor paschalis*, *T. discosomatis*, *T. maldiveensis*, *Hippolyte ventricosus*, *Phycocaris simulans*, *Latreutes pygmaeus*, *L. planirostris*, *L. mucronatus*, *L. porcinus*, *L. anoplonyx*, *Tozeuma armatus*, *Glestocaris paronae*, *Hyppolysmata ensirostris*, *H. (Lysmatella) prima* are described.
106. ——— 1917. Notes on Crustacea Decapoda in the Indian Museum. IX. *Leander styliferus* Milne Edwards and related forms. *Ibid.*, 13 (1-6): 355-384.
A key for *Leander styliferus* and related species given. *L. tenuipes*, *L. annandeli*, *L. styliferus*, *L. carinatus*, *L. modestus*, *L. fluminicola*, *L. potamiscus*, *Palaemon mirabilis* are described and figured.
107. ——— 1917. Notes on Crustacea Decapoda in the Indian Museum. VIII. Genus *Acetes* M. Edw. *Ibid.*, 2: 43-58.
Acetes indicus, *A. erythraeus*, *A. insularis*, *A. japonicus* are described. A key is provided for their identification.
108. ——— 1917. Notes on the fauna of the Matlah River in the Gangetic Delta. *Ibid.*, 13: 233-244.
Crustacean fauna is represented by the species, *Palaemon mirabilis*, *Leander styliferus*, *L. tenuipes*, *Penaeopsis monoceros*, *P. brevicornis*, *Parapenaeopsis sculptilis*.
109. ——— 1918. Crustacea Decapoda of the Inle lake Basin. *Ibid.*, 14: 81-102.
Refers to *Palaemon naso*, *P. hendersoni*, *Caridina annandelei*, *C. weberi* prox var. *sumatrensis*.
110. ——— 1920. Notes on the Crustacea Decapoda in the Indian Museum. XIV. On the occurrence of Caridean genus *Disclis* in Indian waters. *Ibid.*, 19 (4): 137-143.
Disclis exul Kemp has been described with figures.

111. KEMPS, S. 1924. Crustacea Decapoda of the Siju Cave, Garo Hills, Assam. *Rec. Ind. Mus.*, 24(1): 41-48.
Refers to *Palaemon hendersoni* and describes *P. cavernicola* Kemp., the only cave decapod found in the oriental region.
112. ——— 1925. Notes on the Crustacea Decapoda in the Indian Museum. XVII. On Various Caridea. *Ibid.*, 17(4): 249-344.
Species of the genera *Leptochela* (with key), *Stylodactylus* (with key), *Rhynchocinetes*, *Parapandalus*, *Heterocarpus*, *Chorotocoides*, *Chlorocurtis*, *Thalassocaris*, *Leander* (with key), *Brachycarpus*, *Palaemonetes* (with key), *Periclimenes*, *Harpillus*, *Anchistus*, *Thor*, *Phycocaris*, *Hippolyte*, *Paralatrentes*, *Gelastocaris*, *Mergula*, *Anchistiodes* and *Pontophilus* are described.
113. ——— AND R. B. S. SEWELL 1912. Notes on Decapoda in the Indian Museum. III. The species obtained by R.I.M.S.S. "Investigator" during the survey season 1910-11. *Ibid.*, 7: 15-32.
31 species of Decapoda Crustacea belonging to the families *Penaeidae*, *Sergestidae*, *Pasiphaeidae*, *Hoplophoridae*, *Pandalidae*, *Hippolytidae*, *Crangonidae*, *Eryonidae*, *Galatheididae*, *Uroptychidae*, *Paguridae*, *Homolidae*, *Dorippidae*, *Paninidae*, *Calappidae*, *Leucosiidae*, *Gonoplacidae* and *Majidae* are described.
114. KESTIVEN, G. L. AND T. J. JOB 1957. Shrimp culture in Asia and the Far East. A preliminary review. *Proc. Gulf. Carib. Fish. Inst.*, 10th Ann. Sess., 49-68.
The species of shrimps that are cultivated in Asian countries are given. The habitat and the economics of the important cultivated shrimps are indicated; the extent of areas of shrimp culture in different Asian countries estimated. A description of the various aspects of 'Sugpo' cultivation in Philippines, the paddy field prawn culture of India are given. The economic status of shrimp culture in Asian countries and the problems to be attended are discussed.
115. KUNJU, M. M., 1955. Preliminary studies on the biology of the palaemonid prawn *Leander styliferus* Milne Edwards. *Proc. Indo-Pacif. Fish. Coun.*, 6(3): 404-416.
Distribution and habitat, food and feeding habits, length-weight relationship, egg carriage and ovigerous setae, breeding habits, sex ratio, parasitisation, Length-frequency distribution, fishery and fishing methods of *L. styliferus* described.
116. ——— 1960. On new records of five species of *Penaeidae* (Decapoda Macrura: *Penaeidae*) on the West coast of India. *J. Mar. biol. Ass. India*, 2(1): 82-84.
Records the occurrence of *Parapenaeopsis hardwickii*, *Atypopenaeus compressipes*, *Parapenaeopsis acclivirostris*, *Metapenaeopsis novaeguineae* and *Trachypenaeus curvirostris* from Bombay waters.
117. ——— 1960. Record of male *Parapenaeopsis acclivirostris* Alcock. *Ibid.*, 2(1): 127-129.
Records of 9 males of *P. acclivirostris* and comparison with that of *P. tenellus*.
118. KURIEN, C. V. 1949. On the occurrence of Crangonids (Crustacea Caridea) in the coastal waters of Trivandrum. *Proc. Indian Sci. Congr.*, 35th Sess., 3: 194 (Abstract).
Taxonomic notes on *Pontophilus hendersoni* and *P. parvirostris*.
119. ——— 1952. On the occurrence of Crangonids (Crustacea Caridea) in the coastal waters of Trivandrum. *Curr. Sci.*, 21: 316.
Taxonomic notes on *Pontophilus hendersoni* and *P. parvirostris*.
120. ——— 1953. A preliminary survey of the bottom fauna and bottom deposits of the Travancore coast within the 15 fathom line. *Proc. Nat. Inst. Sci. India*, 19(6): 747-775.
20 species of shrimps belonging to *Hippolytidae*, *Palaemonidae*, *Crangonidae*, *Penaeidae*, and *Sergestidae* are referred. Relation between the bottom animals and texture of the soil, stomach content of bottom living fishes are also studied.
121. ——— 1954. Contribution to the study of Crustacean fauna of Travancore. *Bull. Cent. Res. Inst. Univ. Travancore, Ser. C, Nat. Sci.*, 3(1): 69-91.
Refers to systematics and distribution of shrimps belonging to the family, *Hippolytidae*, *Palaemonidae*, *Penaeidae*, *Crangonidae*, *Sergestidae* and *Mysidae*.
122. ——— 1964. On the occurrence of the deep water prawn *Penaeopsis rectacutus* (Spence Bate) off the Kerala Coast. *Curr. Sci.*, 33(7): 216-217.
Records the occurrence and distribution of *P. rectacutus*.
123. ——— 1965. Deep water prawns and lobsters off the Kerala Coast. *Fishery Technology*, 2(1): 51-53.
Records *Penaeopsis philippi* and *P. rectacutus* from 100-180 fathom area. Discusses their distribution, ecology and possibility of commercial exploitation.

124. KURIAN, G. K. 1951. A note on the eggs and first stage of larva of *Hippolysmata vittata* Stimpson. *J. Bombay Nat. Hist. Soc.*, 50 (2): 416-17.
Number of eggs, different stages of development of eggs and description of the first stage of larva with differences from that of *Hippolysmata* sp. larva given.
125. ——— 1965. Trends in development in the prawn fishing technique in India—A review. *Fishery Technology*, 2 (1): 64-68.
Reviews the development in prawn fishing techniques with reference to indigenous gears, dredges, beam trawls and other trawls.
126. KUMARAN, A. KRISHNA 1954. Ecdysial mechanism in a decapod, *Penaeus indicus*. *Curr. Sci.*, 23 (12): 404-405.
Ecdysial mechanism in *P. indicus* reported and the differences from other crustaceans indicated.
127. ——— 1957. Structure and chemical nature of the cuticle in *Penaeus indicus* M. Edw. (Decapoda Crustacea). *J. zool. Soc. India*, 9 (1): 40-49.
A detailed microscopic structure and chemical nature of the epicuticle and endocuticle of *P. indicus* described.
128. LAKUMB, N. C. 1960. Prawn fishery of Kutch, Gujarat State. The fishing Industry of Gujarat. *Souvenir Published by the Directorate of Fisheries, Gujarat State, on the Occasion of Fishery Festival, October, 1960*, 49-54.
Production, fishery, species composition, processing of prawns, by-products and the socio-economic conditions of fishermen discussed along with suggestions for improvement.
129. LLOYD, R. E. 1907. Contribution to the fauna of the Arabian Sea with the description of new fishes and Crustacea. *Rec. Indian Mus.*, 1: 1-12.
27 species are recorded and described.
130. LARSEN, K. 1964. Fishing off the Westcoast of India. *Fishing News International*, 3 (2): 128-131.
Trawling for shrimp, weather, monsoons, charting of the ground off West coast of India explained.
131. LAKSHMI, A., T. K. GOVINDAN, A. MATHEW AND V. K. PILLAY 1963. Studies on frozen storage of prawns., *Proc. Indo-Pacif. Fish. Coun. Occas., Paper No. 63/2*, 1963.
Studies on the physical, chemical and bacteriological characteristics of the raw material and frozen prawn muscle conducted and the results discussed.
132. MALHOTRA, S. K. 1960. Cytoplasmic inclusions of the neurons of Crustacea. *Quart. J. Micr. Sci.*, 101: 75.
Recognises four kinds of cytoplasmic inclusions and discusses the results obtained by the histochemical studies.
133. MATHAI, T. JOSEPH AND R. SATHIARAJAN 1964. Stake net an indigenous gear for the capture of shrimp in the backwaters of Cochin. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin, 1964* (Abstract only), p. 8.
Deals with the design, construction and method of operation; assesses the efficiency and environmental factors influencing the catch.
134. MATHEN, CYRIAC AND D. R. CHOUDHURY 1965. Factors influencing colour production from the sugar medium used for the rapid approximation of bacterial counts in fishery products. *Fishery Technology*, 2 (1): 144-150.
Results of the studies on the above title reported. The effect of particle size, trace elements, salt soluble protein and non-protein fractions, rate of multiplication of bacteria in the medium, surface bacteria and rate of colour production by individual strains of bacteria were studied. It is observed that best results are obtained when a sea-water homogenate is used.
135. MC GILCHRIST, A. C. 1905. Natural history notes from the R.I.M.S.S. "Investigator" Captain T. H. Heming, R. N. (retired), commanding—Series 3, No. 6. An account of the new and some of the rare Decapod Crustacea obtained during the surveying seasons, 1901-04. *Ann. Mag. Nat. Hist. Ser.*, 7 (15): 233-268.
Prawns described are *Penaeus fissures*, *Benthesicymus armatus*, *Gennadas carinatus*, *Heterocarpus longirostris*, *Glyphocrangon longirostris*, *Calastacus longispinis*, *Iconaxiopsis spinigera*.
136. MENON, M. K. 1933. The life-histories of Decapod Crustacea from Madras. *Bull. Madras Govt. Mus., n.s.*, *Natural History Sec.*, 3 (3): 45 pp.
Refers to the larval forms of *Acetes erythraeus* in addition to other 3 species of decapods.
137. ——— 1937. Decapod larvae from the Madras plankton. *Bull. Madras Govt. Mus., n.s.*, 3 (5): 1-56.
Early larval stages of *Penaeus indicus* described. Also deals with the larval forms of 15 other species of decapods.

138. MENON, M. K. 1938. Early stages of two species of *Palaemon*. *Proc. Indian Acad. Sci.*, 8(4): 288-294.
Descriptions and figures of first two larval stages of *Palaemon rudis* and *P. carcinus*.
139. ——— 1940. Decapod larvae from the Madras plankton—II. *Bull. Madras Govt. Mus., n.s.*, 3 (6): 47 pp.
The different larval stages of *Solenocera crassicornis*, *Lucifer hansenii*, *Lucifer* sp., *Sergestis orientalis*, *Hippolytina* sp., *Lysmata* sp. (A & B), *Alpheus* sp. are described and figured.
140. ——— 1949. The larval stages of *Prilimenes* (*Periclimenes*) *indicus* Kemp. *Proc. Indian Acad. Sci.*, 30 B: 121-133.
Larval and post-larval stages are described and figured. Present knowledge of the larvae of the sub-genus, *Ancyllocaris* discussed.
141. ——— 1951. The life-history and bionomics of an Indian Penaeid prawn *Metapenaeus dobsoni* Miers. *Proc. Indo-Pacif. Fish. Council., 3rd meeting*: 80-93.
Complete development of the species from the egg to the juvenile stage described with figures. Breeding, food of early larvae and post-larvae, growth, maturity, and migration discussed.
142. ——— 1953. Notes on the bionomics and fishery of the prawn *Parapenaeopsis stylifera* (M. Edw.) on the Malabar Coast. *J. zool. Soc. India*, 5(1): 153-162.
Breeding, growth, sex ratio, parasitisation, annual migration and the fishery discussed.
143. ——— 1954. On the paddy field prawn fishery of Travancore-Cochin and an experiment in prawn culture. *Proc. Indo-Pacif. Fish. Council., 5th meet., Sec. 2*: 1-5.
Area of fields under prawn fishing, yield, fishing operations, important shrimps found in the catches, growth of *P. indicus* and *M. dobsoni* are dealt with. Details of experiments in prawn farming for about two months discussed.
144. ——— 1955. Identification of marine and inshore prawns of commercial value in India. *Proc. Indo-Pacif. Fish. Council.*, 6(3): 345-347.
A key for the field identification of the important prawns of India is given.
145. ——— 1955. Notes on the bionomics and fishery of the prawn *Metapenaeus dobsoni* Miers on the South-West-Coast of India. *Indian J. Fish.*, 2(1): 41-56.
The paper deals with growth, sex ratio, migration and fishery of the species.
146. ——— 1957. Contributions to the biology of Penaeid prawns of the South-west Coast of India. I. Sex ratio and movements. *Ibid.*, 4(1): 62-74.
The sex ratio at different periods in the life of 4 species of penaeid prawns, *Metapenaeus dobsoni*, *M. affinis*, *Peneus indicus* and *Parapenaeopsis stylifera*, and their inshore and off-shore movements are discussed. Sexwise and year class wise average percentage contribution to the annual fishery at Narakkal are also determined.
147. ——— 1958. Prawn fisheries. *Fisheries of West Coast of India*. Edited by Dr. S. Jones.
The total estimated landings of prawns and shrimps from India, brief account of the fishing grounds, composition of catches, fishing methods, seasonal variation, processing and marketing, salient features of the biology of the important species and the suggestions for future development of the fishery with mechanised fishing are given.
148. ——— 1965. Life-history of prawns—A review of recent studies with special reference to Indian species. *Fishery Technology*, 2(1): 12-18.
Reviewing the studies made on the life-histories of Indian species of penaeids and palaemonids, the reference is made to the different larval stages and their characteristics. Some aspects of the bionomics especially breeding and migration are also briefly dealt with.
149. ——— AND K. RAMAN 1961. Observations on the prawn fishery of the Cochin backwaters with special reference to the stake net catches. *Indian J. Fish.*, 8(1): 1-23.
Fluctuations in the stake net catches, their correlation with the rainfall, strength of tidal flow and other factors, length frequency distributions of the important species are discussed.
150. MISRA, R. K. 1958. A new approach to the study of growth gradient in the segments of the second pair of chelelped of the Indian freshwater prawn *Palaemon hendersoni* De Man (Crustacea Decapoda, Palaemonidae). *Proc. Nat. Inst. Sci. India*, 24 B: 67-68.
151. MIYAMOTO, H., S. D. DESHPANDE AND N. A. GEORGE 1962. Recent development in trawl fishing for shrimps with trawls from small mechanised boats on the West Coast of Peninsular India. *Proc. Indo-Pacif. Fish. Council., 10th Sess.*, 264-279.
The development of trawling for shrimp on the West Coast of India reviewed. A number of experimental operations with various types of trawls, boats and engines of different h.p. were carried out and the results discussed, particularly the influence of wings and tickler chains on the shrimp catch.

152. MOSES, S. T. 1922. A statistical account of the fish supply of Madras. *Madras Fish. Bull.*, **15**(6): 131-166.
Abundance of prawns and crabs, their seasons, landings are given.
153. NAIDU, M. R. 1939. Report on a survey of Fisheries of Bengal. *Govt. of Bengal, Dept. of Agriculture and Industries, Bengal, India*.
154. ——— 1952. Report on a survey of fisheries of Bengal. *Ibid.*
155. NAIR, S. G. 1947. The newly hatched larva of *Periclimenes (Ancylocaris) brevicarpalis* (Schenkel). *Proc. Indian Acad. Sci.*, **26**: 168-176.
Descriptions of the newly hatched larva given.
156. NAIR, M. R., K. M. IYER, P. N. APPUKUTTAN AND S. JACOB 1962. Storage characteristics of prawns held in crushed ice and chilled sea-water. *Proc. Indo-Pacif. Fish. Council.*, 10th Sess., 295-297.
The effect of holding prawns in crushed ice (ice: Prawn = 3:1) and chilled sea-water (sea-water: prawn = 1:1) on their storage characteristics has been studied and the results discussed.
157. NATARAJ, S. 1942. A note on the prawn fauna of Travancore. *Curr. Sci.*, **11**(12): 468-469.
Penaeus indicus, *P. carinatus*, *P. monodon*, *P. canaliculatus*, *Metapenaeus monoceros*, *M. affinis*, *M. dobsoni*, var. nov., *Metapenaeopsis stridulans*, *M. mogiensis*, *Parapenaeopsis stylifera*, *P. maxillipedo*, *P. uncta*, *Palaemon carcinus*, *P. idae*, *P. dolichodactylus*, *P. sulcatus*, *P. dayanus*, *Palaemonetes hornelli*, *Alpheus malabaricus*, *A. paladiocolax*, *Acetes erythraeus*, *A. sibogae*, *A. dispar*, *A. serrulatus* var. nov. are recorded.
158. ——— 1945. On two new species of *Solenocera* (Crustacea Decapoda Penaeidae) with notes on *Solenocera pectinata* (Spence Bate). *J. Roy. Asiatic Soc. Bengal.*, **11**(1): 91-98.
Solenocera choprai and *S. indicus* described with figures. Distribution and taxonomic notes on *Solenocera pectinata* given.
159. ——— 1947. Preliminary observations on the bionomics, reproduction and embryonic stages of *Palaemonidae* Heller. *Rec. Indian Mus.*, **45**(1): 89-96.
Occurrence, habits, food and feeding habits, colour of the species, fecundity, development of the embryo in the brood, hatching, dispersal and newly hatched larva described.
160. ——— 1947. On some species of *Acetes* (Crustacea Sergestidae) from Travancore. *Ibid.*, **45**: 139-147.
Taxonomic notes on *Acetes erythraeus*, *A. sibogae*, *A. dispar* and *A. serrulatus* var. *johni* are given. Seasons of occurrence, breeding and their presence in the stomach contents of shoal fishes referred.
161. ——— 1948. Prawns of Travancore. *Sept. Rep. Dept. Res. Univ. of Travancore*: 282-285.
162. NANCY SAMUEL 1945. Some aspects of the morphology of the antennary glands of the Decapod Crustaceans. *J. Bombay Univ.*, **14**(3): 124-134.
163. NAGABHUSHANAN, R. AND R. SAROJINI 1963. Effect of low salinity on oxygen consumption in the prawn *Palaemonetes vulgaris*. *Indian J. Exp. Biol.*, **1**(4): 231-232.
164. NATH, V. 1937. Spermatogenesis of the prawn *Palaemon lamarrei*. *J. Morph.*, **61**: 149-157.
165. ——— 1938. The Decapod sperm. *Proc. Indian Sci. Congr.*, 25th Sess.: 172.
Refers to spermatogenesis of *Palaemon lamarrei*.
166. ——— 1941. The Decapod sperm. *Trans. Nat. Inst. Sci. India*, **2**(4): 87-119.
In this paper spermatogenesis of 3 macruran, 4 anomuran and 27 brachyuran species described and a scheme of evolution of the different groups of the order Decapoda attempted.
167. ——— AND D. R. BHATIA 1930. The origin of yolk in the Crustacean egg. *Proc. Indian Sci. Congr.*, 17th Sess., 262.
The oogenesis of the common freshwater prawn of Lahore worked out.
168. PANIKKAR, N. K. 1937. The prawn industry of the Malabar coast. *J. Bombay Nat. Hist. Soc.*, **39**(2): 343-353.
The characteristics of the backwaters of Travancore, the prawns that inhabit backwaters, sea and freshwaters, the fishing operation in the paddy fields, curing and marketing of prawns and suggestion for improvement of prawn industry given.
169. ——— 1940. Influence of temperature on osmotic behaviour of some crustacea and its bearing on problem of animal distribution. *Nature*, **146**: 366.
170. ——— 1940. Osmotic properties of the common prawn, *Ibid.*, **145**: 108.

171. PANIKKAR, N. K. AND R. G. IYER 1937. Brackishwater fauna of Madras. *Proc. Indian Acad. Sci.*, **6B**: 284-337.
92 species of invertebrates and 56 species of vertebrates are recorded. Environmental conditions, vertical and regional distribution, breeding and the general problems on the biology of animal life in the brackishwater discussed.
172. PANIKKAR, N. K., 1941. Osmoregulation in some palaemonid prawns. *J. Mar. Biol. Assn., U.K.*, **25**: 317-379.
173. ——— 1946. Further observations on the osmoregulation of some crustacea. *Proc. Indian Sci. Congr. 33rd Sess.*, **3**: 118.
The paper deals with the results of the experiments conducted on the osmoregulation of palaemonid prawns.
174. ——— 1948. Osmoregulation in Penaeid prawns. *Proc. Indian Acad. Sci. Congr.*, 35th Sess., 192-193.
Osmotic behaviour of *Metapenaeus monoceros*, *Penaeus carinatus* and *P. indicus* studied and the results of cryoscopic data and their significance on the distribution of these species with the general problems of osmoregulation discussed.
175. ——— 1948. Penaeid prawns breeding in freshwater. *Curr. Sci.*, **17**(2): 58.
With reference to Chacko's (1947) paper, the author discusses the breeding of penacids and their tolerance to salinity.
176. ——— 1951. Physiological aspects of the adaptation to estuarine conditions. *Proc. Indo-Pacif. Fish. Coun.*, 2nd meet., Sec. B., 168-175.
Important prawns of the family Penaeidae and Palaemonidae found in the estuarine habitats listed. Gives a brief account of the physical features of estuarine habitat, temperature and salinity, adjustments to low salinities, adaptation without osmoregulation, hyper and hypo osmotic regulation, active regulation of chlorides and transport of ions, adaptation of freshwater invertebrates and vertebrates entering estuaries, temperature and osmotic regulation, osmotic regulation and reproduction, influence of calcium and biochemical adaptations.
177. ——— 1952. Possibilities of further expansion of fish and prawn culture practises in India. *Curr. Sci.*, **21**(2): 29-33.
Refers to the prawn culture practice in the rice fields of Travancore-Cochin.
178. ——— AND IYER, R. G. 1939. Observations on breeding in brackishwater animals of Madras. *Proc. Indian Acad. Sci.*, **25, 9B**(16): 343-364.
Different types of breeding and breeding seasons are described.
179. ——— AND VISWANATHAN, R. 1948. Active regulation of chloride in *Metapenaeus monoceros* Fabricius. *Nature*, **10**(4082): 137-138.
Changes in the chloride content of the blood is studied by employing the micro-modification of the Volhard titration. The results obtained were presented and discussed.
180. ——— AND MENON, M. K. 1955. Prawn fisheries of India. *Proc. Indo-Pacif. Fish. Coun.*, **6**(3): 328-344.
A general review of the prawn fisheries in India—the fishing grounds, the species caught, the fishing methods, seasonal variations, technology and marketing, salient features of the biology of the commercial species, are discussed with suggestions for exploratory fishing up to a depth of 30-40 fathoms and expansion of prawn fishing.
181. PANTULU, V. R. 1965. Inland prawn fisheries resources of India and their development. *Fishery Technology*, **2**(1): 54-58.
The magnitude and disposition of the inland prawn fisheries resources have been described with suggestions for organised survey of resources and researches on culture practices.
182. PATWARDHAN, S. S. 1935. On the structure and mechanism of the gastric mill. The structure of the gastric mill in the Natantous Macrura-Caridea. *Proc. Indian Acad. Sci.*, **11B**.
18 types of caridea are examined. A complete account of the foregut of *Palaemon malcolmsonii* and a comparative account of the same in the remaining types is given. The salient features and the differences found in different species are discussed.
183. ——— 1937. *Palaemon*. *Indian Zool. Mem.*, **6**: 120 pp.
In this monograph a complete account of the anatomy is given. The bionomics, distribution are discussed. Useful directions for practical work are included.
184. PARAMESWARAN, R. 1953. On the female reproductive system of *Palaemon idae*. *J. zool. Soc. India*, **5**: 227-234.
The anatomy and histology of the reproductive system described.
185. PEARSON, J. 1905. Report on the Macrura collected by Professor Herdamm, at Ceylon in 1902. *Report to the Government of Ceylon on the Pearl Oyster Fisheries of Gulf of Mannar*, **4**: 65-92.

186. PER SANDVEN 1959. The Indo-Norwegian Project in Kerala, Norwegian Foundation for assistance to under-developed countries, Oslo.
Gives an account of the organisation; administration and the various activities of the Project in Kerala, especially in relation to exploration of shrimp resources.
187. PILLAI, N. K. 1950. The larval stages of *Periclimenes (Ancyllocaris) grandis* Stimpson. *Bull. Cent. Res. Inst., Univ. of Travancore, Ser. C*, 1: 27-39.
Different larval stages described and figured.
188. ——— 1955. Pelagic Crustacea of Travancore. I. Decapod larvae. *Ibid.*, 4: 47-101.
Various larval stages of the species belonging to *Pasiphaeidae*, *Pandalidae*, *Alphidae*, *Hippolytidae*, *Palaemonidae* and *Processidae* are described.
189. PILLAI, V. K., A. LAKSHMY, T. K. GOVINDAN, CYRIAC MATHEN AND H. KRISHNA IYER, 1965. A survey of the microbiological quality of commercial frozen prawn products. *Fishery Technology*, 2(1): 115-125.
The paper presents the results of a bacteriological survey carried out on large samples over a period of three years and concludes the majority of samples had bacterial load well within the limits prescribed for such products.
190. PILLAY, T. V. R., 1948. Marine Fisheries of Kodinar in Kathiawar. *J. Bombay Nat. Hist. Soc.*, 48(1): 47-61.
A general survey of the fishing industry of Kodinar area given. Fishing crafts, nets, methods of fishing, catch composition, by-products are dealt with.
191. ——— 1954. The ecology of a brackish water *bheri* with special reference to fish cultural practices and biotic interaction. *Proc. nat. Inst. Sci. India*, 20: 399-427.
A detailed description of the topography, salinity, depth, chief micro and macro fauna given. The culture practices of fish and prawns, the ecology of the important fauna, their food relationship are given. Possible means of increasing production are discussed.
192. ——— 1958. Land reclamation and fish culture in the deltaic areas of West Bengal, India. *Prog. Fish. Cult., F. W. S.*, 20(3): 99-103.
193. PILLAI, P. R. P. 1957. Pests of stored fish and prawns. *Bull. Cent. Res. Inst. Kerala, Trivandrum, Ser. C*, 5(3): 1-79.
The pests that attack stored prawns in Kerala given. The nature and extent of the damage, the experiments conducted on pest control and the results obtained are discussed.
194. PRADHAN, M. J. 1965. A preliminary account and review of the simple methods for determining the operational parameters of fishing gear, underwater, with notes on its application. *Fishery Technology*, 2(1): 69-81.
An account and review of the simple methods for determining the operational parameters of fishing gear, underwater, such as tilt of otter boards, vertical height of net, its horizontal spread, angle of divergence at bottom, spread between wing tips, angle of inclination of danleons, butterfly, slope of legs and sweep line has been given.
195. PRASAD, K. N. 1961. Decapoda crustacea from the fuller's earth deposits of Kapurdi, Rajasthan. *Indian Min. (Calcutta)*, 15: 435.
196. QURESHI, M. R. 1949. Prawn fisheries of Sind, West Pakistan. *Sind Observer*.
197. ——— 1955. Shrimp fisheries of Pakistan. *Proc. Indo-Pacif. Fish. Council*, 6th Sess.: 359-362.
A general account of the shrimp fisheries, fishing grounds, fishing gears and boats, catch statistics, seasonal variations, processing and marketing, distribution of shrimps and a list of the species recorded from the commercial catches given.
198. RAI, B. S. 1964. Some aspects of shrimp processing. *Symposium on Prawn Fisheries in India, Society of Fishery Technologists (India), Cochin*, 1964, p. 17.
Experiments carried out on semi-drying of small-sized prawns are presented.
199. RAI, H. S. 1933. Shell fisheries of Bombay Presidency. *J. Bombay Nat. Hist. Soc.*, 36(4): 884-897.
Species of economic value along the Bombay coast, their migration, movement, breeding and food are described. The distribution, value of yields, nets, methods of fishing, processing and suggestions for further development discussed.
200. RAJAGOPAL, M. V. 1965. Effect of different media on the determination of number of micro-organisms in frozen prawns (shrimp). *Fishery Technology*, 2(1): 151-154.
Changes in the medium for total bacterial count have been suggested and the reasons for the same discussed.

201. RAJYALAKSHMI, T. 1943. Report of the fisheries of Madras. *Dept. of Industries and Commerce, Madras.*
202. ——— 1960. Observations on the embryonic and larval development of some estuarine Palaemonid prawns. *Proc. Nat. Inst. Sci. India*, 26 B (6): 395-408.
An account of the embryonic development, hatching and structure of the early larvae of *Palaemon malcolmsonii*, *P. rudis*, *P. scabriculus* and *P. mirabilis* is given. A comparison between different species described, shows certain difference in size, time taken for development and hatching and the time of appearance or functioning of various embryonic structures. Differences in the nature of chromatophores and their arrangement in the first stage larvae of all the species studied have been described and the salient features of variation in morphometric characters that distinguish larvae are described. The second stage larva of *P. mirabilis* is described in detail.
203. ——— 1961. Larval development of *Palaemon lamarrei* H.M. Edw. and *Leander fluminicola* Kemp. *J. zool. Soc. India*, 13 (2): 220-237.
An account of the structure of the 4 stages in the development of *P. lamarrei* and first three stages and 5th stage in that of *L. fluminicola* are given. A comparison with the larvae of similar types of development made.
204. ——— 1961. Studies on maturation and breeding in some estuarine Palaemonid prawns. *Proc. Nat. Inst. Sci. India*, 27 B (4): 179-188.
An account of the studies on ova maturation, fecundity, spawning, breeding period is given.
205. ——— 1962. Key for the identification of some commercially important prawns of India. *Publication of Central Inland Fisheries Research Institute, Barrackpore.*
Key for the important species of *Penaeidae* and *Palaemonidae* given.
206. ——— 1961. Observations on the biology and fishery of *Metapenaeus brevicornis* (M. Edw.) in the Hooghly estuarine system. *Indian J. Fish.*, 8 (2): 383-401.
Deals with the fishery, growth, migrations, spawning, etc.
207. ——— 1964. The prawn fishery of Hooghly estuarine system. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin, 1964*, p. 18.
Trend of distribution of 7 species of prawns in the estuarine system studied. Regulations in mesh sizes of bag nets to improve the fishery suggested.
208. RAO, K. P., 1958. Oxygen consumption as a function of size and salinity in *Metapenaeus monoceros* Fabr' from the marine and brackish water environments. *J. Exp. Biol.*, 35 (2): 307-313.
The oxygen consumption in relation to the salinity medium has been studied in a marine and brackish water population of *M. monoceros*. The results obtained were presented and the reasons for difference discussed.
209. RAO, S. N. AND A. G. VASAN 1961. Some aspects of prawn drying in Kerala. *Proc. Indo-Pacif. Fish. Coun. Occas. Paper* 61.
210. RAO, R. MALLIKARJUNA 1965. Breeding behaviour in *Macrobrachium rosenbergii* (De Man). *Fishery Technology*, 2 (1): 19-25.
Different aspects of the mating behaviour and its pattern discussed.
211. RAO, S. NAGARAJA 1964. A note on the prawn fisheries of Kakinada. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin, 1964*.
Deals with the composition of catches, fishing season, gear employed, and disposal of catches. The results of the exploratory fishing conducted off Kakinada discussed.
212. ROY CHOUDHURY, R. L., 1964. Some considerations in the selection of sizes of shrimp trawlers. *Ibid.*, 1964, p. 5.
Factors affecting the length of voyage are discussed briefly and it is found that the cost of indices are least for vessels between 40 to 45 feet length.
213. RAMAN, K. 1964. On the location of a nursery ground of the giant prawn *Macrobrachium rosenbergii* (de Man). *Curr. Sci.*, 33 (1): 27-28.
Breeding period, occurrence of larvae, nursery ground described.
214. RAMAMURTHY, S. 1963. A note on the prawn fishery of Kutch. *J. Mar. biol. Ass. India*, 5 (1): 146-148.
List of species, composition of catch, fishery of Kutch area, distribution of the species discussed.
215. ——— 1963. A note on the prawn fishery of Adesar Camp. *Ibid.*, 5 (2): 318-320.
Fishing season, estimation of landings, composition of catch, growth, maturity and sex composition are studied.

216. REDDY, A. R. 1935. On the modus operandi of certain ossicles in the gastric armature of Decapod Crustacean. *Curr. Sci.*, 4: 34-37.
217. ——— 1935. A note on the variations in the gastric armature of some South Indian Decapod Crustaceans. *Proc. Indian Sci. Congr.*, 22nd Sess., 313.
The gastric armature of 6 decapods studied. The variation found were correlated with the nature of food. The peculiar nature of the gastric armature of *Penaeus* and the graded series of complexities among the decapods studied are discussed.
218. ——— 1935. On the structure, mechanism and development of the gastric armature in Stomatopoda with a discussion as to its evolution in Decapoda. *Proc. Indian Acad. Sci.*, 1(10): 650-675.
The nature of evolution of gastric armature in decapods in relation to habits and habitats discussed. The trend of evolution in Decapoda traced.
219. SAROJINI, S. 1961. The androgenic organ in some Indian Crustacea. I. *J. zool. Soc., India*, 13 (2): 188-193.
The androgenic gland in 13 species of decapod crustacea belonging to 11 genera has been described with reference to its shape, size, position and morphology.
220. SATYANARAYANA, A. V. V., G. K. KURIAN AND R. S. NAIR, 1962. Commercial prawn trawling gear of Cochin (India). *Proc. Indo. Pacif. Fish. Council.*, 10th Sess., 226-263.
The designs of prawn trawling gears used by the mechanised fishing boats at Cochin are described.
221. SATYANARAYANA, A. V. V., 1965. Note on the size groups of prawns landed by shrimp trawls of four different cod-end-meshes. *Fishery Technology*, 2(1): 87-92.
The results of the investigation on the above subject indicate that small-sized prawns of mean length 77.15 mm. were captured by the net having 23.38 mm. cod-end at 5-6 fathoms depth, medium prawns of mean length 105.22 mm. was caught in 25.21 mm. and 19.88 mm. cod-end at 8 fathoms depth and big-sized prawns of mean length 117.98 mm. were caught in 21.29 mm. cod-end. The relation of length on breadth of prawn is also worked out.
222. SEWELL, R. B. S., 1926. Fauna of Chilka lake, Crustacea, Decapoda. *Mem. Indian Mus.*, 5: 771-852.
223. ——— 1934. A study of the fauna of the salt lakes, Calcutta. *Rec. Indian Mus.*, 36.
224. SHAIKHMAHMUD, F. S. AND N. G. MAGAR 1956. Bacteriological study of Bombay prawns (*Parapenaeopsis stylifera* M. Edw.). *J. Sci. & Indust. Res.*, 15 C (7): 174-176.
Bacterial flora on *Parapenaeopsis stylifera* studied. 40 isolates obtained from the different parts of the body of the prawn are examined for their tolerance to salt and temperature, and for their biochemical characteristics. The proteolytic types of bacteria are responsible for the spoilage of prawns.
225. ——— 1957. Studies on the nutritive value of Bombay prawns. Part I. Chemical composition of prawns. *Ibid.*, A 16 (1): 44-46.
5 species of prawns from the Bombay coast are analysed for their fat, protein, glycogen, lactic acid, mineral and vitamin contents. The results obtained are presented and discussed.
226. ——— 1961. Studies on the nutritive value of Bombay prawns. II. Chemical composition and nutritional constituents of penaeid prawns. *Ibid.*, 20 D (4): 157-158.
The protein, fat, glycogen, mineral and vitamin contents of *Acetes indicus*, *Penaeus carinatus*, *P. indicus*, *Metapenaeus monoceros*, *M. brevicornis*, *Parapenaeopsis sculptilis*, *P. maxillipedo* and *Solenocera indicus* are studied and the variations and differences found are discussed.
227. ——— 1961. Studies of prawn spoilage. II. Handling and storage of prawns. *J. Bombay Univ.*, 29 (3 & 5): 16-21.
The spoilage rates of prawns stored at 0° C. under different conditions, the maximum 'hold life' for these conditions, the effects of different temperatures are studied.
228. ——— 1961. Studies on the prawn spoilage. II. The role of pH in determining the quality of prawns. *Ibid.*, 29 (3 & 5): 22-26.
The spoilage pattern and the seasonal changes in the pH value and the bacterial count studied.
229. ——— 1961. Studies of prawn spoilage. III. Conditions affecting the quality of prawns. *J. Sci. & Indust. Res.*, 29 (3 & 5): 23-30.
Gives a general account of the conditions affecting the quality of prawns and offers some suggestion for improvement.
230. ——— 1961. Studies of prawn spoilage. IV. Study of the spoilage and standard quality of prawns in relation to different species, sizes and sex. *Ibid.*, 29 (3 & 5): 31-38.
Experiments were designed to study the spoilage and standard quality of 5 varieties of prawns. The results obtained are given and discussed.

231. SHAIKHMAHMUD, F. S. 1965. Evaluation of chemical tests for the quality of prawns. *Fishery Technology*, 2(1): 102-108.
The results of the study to determine the value of physical, bacteriological and chemical tests used to find out and compare the indices of quality of prawns stored at 0° C. and 18° C. discussed.
232. ——— 1965. Preservation of prawns with chemicals. *Ibid.*, 2(1): 109-114.
The preservation of prawns with boric acid, dipotassium hydrogen phosphate, sodium bisulphite, ascorbic acid, citric ascorbic acid mixture, acronise pd, ferromycin and penicillin are investigated and the results discussed.
233. ——— AND V. B. TEMBE 1958. Study of Bombay prawns. The reproductive organs of *Parapenaeopsis stylifera* (M. Edw.). *J. Bombay Univ.*, 27(3): 99-110.
The reproductive organs of the prawn studied anatomically and histologically. The important differences found from other Decapods given.
234. ——— 1960. Study of Bombay prawns. The seasonal fluctuation and variation in abundance of the commercially important species of Bombay prawns with a brief note on their size, state of maturity and sex ratio. *Indian J. Fish.*, 7(1): 69-81.
The seasonal fluctuation, abundance, size, maturity, sex ratio of Bombay prawns studied.
235. ——— 1961. A brief account of the changes in the developing ovary of penaeid prawn, *Parapenaeopsis stylifera* (M. Edw.) in relation to maturation and spawning cycle. *J. Bombay Univ.*, 29(3 & 5): 62-77.
The general pattern of ovarian development, macroscopical and microscopical changes in the ovary development, the different maturity stages, the breeding season studied.
236. SHARIFF, A. T. 1959. Shrimp trawling along the Malabar coast during the years 1955 and 1956. *Indian Fish. Bull.*, 6(3): 40-43.
The potential shrimp ground along the inshore belt from Tanur to Mangalore and the increased landings along the whole Malabar coast from January to April mentioned.
237. SIVALINGAM, S. AND J. C. MEDCOF 1955. The study of Wadge Bank trawl fishery. *Fish. Res. Statn., Ceylon, Progress Report I*.
238. SRINIVASAN, R. AND N. SABAPATHY 1964. Prawn processing practices and experiments in Madras State. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin, 1964*.
Experiments conducted on the canning preservation of prawns using brine pack, oil pack and 'masala' pack and the scope for prawn processing industries in Madras discussed.
239. SRIVATSA, K. R. 1953. A survey and comparative analysis of the prawn (shrimp) fishery of the Gulf of Kutch in Saurashtra in Western India. *Govt. of Saurashtra Publication, Saurashtra, India*.
240. SUBRAHMANYAM, C. B. 1963. A note on the annual reproductive cycle of the prawn *Penaeus indicus* (M. Edw.) of Madras coast. *Curr. Sci.*, 32(4): 165-166.
The breeding activities of the species as indicated by the gonad index appears to be pronounced in the month of May, July, August and September and a lesser activity in March.
241. ——— 1965. On the unusual occurrence of penaeid eggs in the inshore waters of Madras. *J. Mar. biol. Ass. India*, 7(1): 83-88.
An unprecedented quantity of penaeid eggs reported and these were referred to *Penaeus indicus*. Eggs and three naupliar stages are described.
242. SUBRAMANYAM, M. 1965. Lunar, diurnal and tidal periodicity in relation to the prawn abundance and migration in the Godavari estuarine systems. *Fishery Technology*, 2(1): 26-33.
The results of the investigations conducted to study the lunar, diurnal and tidal periodicity in abundance and migration of prawns based on the stake net catches presented.
243. TAGORE, PRADIP 1965. Prawn fishing by M.F.V. Jeenga in Bombay waters. *Ibid.*, 2(1): 59-62.
The design and construction of the M.F.V. Jeenga and the gears used are described. The abundance and seasonal catches of prawn in area 18-72 in Bombay region discussed.
244. TEMBE, V. B. AND F. S. SHAIKHMAHMUD 1955. Maturation in *Parapenaeopsis stylifera* (Crustacea). *Proc. Indian Sci. Congr.*, 42nd Sess., 287.
Maturity stages classified; study of intraovarian eggs indicates that the species breeds continuously.

243. TIWARI, K. K. 1947. On a new species of *Palaemon* from Banares with a note on *Palaemon lanchestri* de Man. *Rec. Indian Mus.*, 45 (4): 333-345.
Palaemon choprai described; *P. lanchestri* recorded and taxonomic notes appended.
246. ——— 1947. Preliminary descriptions of two new species of *Palaemon* from Bengal. *Ibid.*, 45 (4): 329-331.
Palaemon villosimanus and *P. kempi* described.
247. ——— 1952. Diagnosis of new species and sub-species of the genus *Palaemon* Fabricius (Crustacea, Decapoda). *Ann. Mag. Nat. Hist. Ser. 12*, 5: 27-32.
Diagnostic characters and distribution of 8 new species and 3 sub-species of *Palaemon* are given.
248. ——— 1955. Distribution of Indo-Burmese freshwater prawns of the genus *Palaemon* Fabricius and its bearing on the Satpura hypothesis. *Bull. Nat. Inst. Sci. India*, 7. *Symposium on Organic Evolution*: 230-239
Distributional record of 30 species of *Palaemon* given. Based on their distribution, origin of the genus, their migration to freshwaters, the distributional anomalies of freshwater prawns and their similarities to that of torrential fishes and other groups of animals discussed. The existing distribution of this group of prawns explained on the basis of Satpura hypothesis.
249. ——— 1955. Trend of evolution in the *Hendersoni* group of species of *Palaemon* Fabricius (Crustacea Decapoda). *Ibid.*, 189-197.
A comparative morphological study of the *Hendersoni* group which contains 9 species and sub-species given and it has been indicated that their ancestry can be traced back to a generalised common form resembling *P. hendersoni*. The main lines along which evolution appears to have taken place in this group discussed.
250. ——— 1958. New species and sub-species of Indian freshwater prawns. *Rec. Indian Mus.*, 53 (1 & 2): 297-300.
Diagnostic characters and distribution of 3 new species of *Palaemon* and 2 sub-species are given.
251. ——— 1961. Occurrence of freshwater prawn *Macrobrachium latimanus* (Von Martens) in India and Ceylon. *Crustaceana*, 3 (2): 98-104.
Taxonomic notes and distribution of *M. latimanus* given.
252. ——— 1963. Lower tertiary penaeid shrimps from Kapurdi (Barmer District, Rajasthan, India), *Ibid.*, 5 (3), 205-212.
Description of 2 new species of *Penaeus* from the fuller's earth quarry at Kapurdi given. This is the first record of fossil penaeids from tertiary beds and a fossil penaeid being recorded from India.
253. ——— 1964. Geographical distribution of the marine and estuarine representatives of the family Palaemonidae (Crustacea Decapoda, Caridea) with special reference to the sub-family Pontoniinae. Paper submitted to the seminar on 'Marine Science' sponsored by the Indian National Committee on Oceanic Research.
254. VELANKAR, N. K. AND T. K. GOVINDAN 1958. A preliminary study of the distribution of non-protein nitrogen in some fishes and marine invertebrates. *Proc. Indian Acad. Sci.*, 47 B (4): 202-209.
The distribution of non-protein nitrogen in some fishes, crustaceans, and molluscs studied. The significance of the results from the comparative aspects and in the processing discussed.
255. ——— 1960. Trimethylamine oxide content of marine prawns occurring in the backwaters and in the sea off Cochin. *Ibid.*, 52 B (4): 111-115.
Trimethylamine oxide content of marine and backwater prawns determined and the results obtained were discussed in relation with the habitat. The use of this test for spoilage suggested.
256. ——— (1959, 1960). Preservation of prawns in ice and assessment of their qualities by objective standards. *Indian J. Fish.* (1959), 6 (2): 306-321.
Observations are made on the trimethylamine, total volatile nitrogen, acid-soluble orthophosphate and free amino-acid nitrogen contents and bacterial counts of some Indian prawns and the results obtained are presented and discussed.
257. ———, ———, P. N. APPUKUTTAN AND K. MAHADEVA IYER, 1961. Spoilage of prawns at 0° C. and its assessment by chemical and bacteriological tests. *Ibid.*, 8 (1): 241-251.
Investigations on the development of spoilage products of prawns held at 0° C. are carried out and the results of these studies reported.
258. ———, ———, K. MAHADEVA IYER AND P. N. APPUKUTTAN 1961. Spoilage of un-iced prawns and its assessment by objective standards. *J. Sci. & Ind. Res.*, 20 D (5): 189-191.
Spoilage of prawns of Cochin is studied by following the changes in TMA, TVN, VAN and bacterial counts. The results of the observation are given.

259. VELANKAR, N.K. AND K. MAHADEVA IYER 1961. On the qualitative distribution of amino-acids in different species of prawns. *Ibid.*, 20 C (2): 64-65.
The free amino-acids of prawns, lobsters and crabs are examined and the results presented.
260. VELANKAR, N. K. 1965. Biochemical aspects of the spoilage of prawns. *Fishery Technology*, 2 (1): 98-101.
Certain biochemical aspects of prawn spoilage discussed.
261. VENKATARAMAN, R., A. SRINIVASAN AND A. G. VASAN 1953. Preservation of semi-dried prawns. *J. Sci. & Ind. Res.*, 12 A (10): 473-474.
The results of the experiments conducted on processed prawn discussed.
262. ——— AND ——— 1954. Manufacture and preservation of semi-dried prawns. *Indian Farming*, N.S., 10 (3): 22-23.
Importance of prawns, methods of preservation, 4 types of manufacture of dried prawns, storage, nutritive value, direction for use and by-products are discussed.
263. ——— AND A. G. VASAVAN 1953. Semi-drying. A novel method of preserving and packing prawns. *J. Indian Com.*, 8 (3): 284-286.
264. ———, S. T. CHARI AND A. SRINIVASAN 1955. Some aspects of preservation of prawns in Madras. *Proc. Indo-Pacif. Fish. Council.*, 6 (3): 434-438.
Various methods of curing and preservation described. The nutritive value of different prawns and the methods of capture and transportation are given.
265. ——— AND S. A. BEATTY 1961. The role of technological laboratory in the rapid development of fish processing industry in India. *Ibid.*, 9 (3), 89-94.
The problems connected with the process of prawns and their distribution discussed.
266. ———, P. S. SAMBANDA MURTHY AND S. MAHADEVAN 1958. Some preliminary observations on the prawn catches off Finakayal near Tuticorin. *Proc. Indian Sci. Congr.*, 45th Sess., 3 : 374.
Prawn fishery, sex composition, biometrical values, hydrography of the ground described.
267. VELU, M. 1964. Design aspects of mechanical gear handling accessories for prawn fishery. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin, 1964.*
Six types of designs of trawl winches are described.
268. WOOD-MASON, J., 1892. Illustrations of the Zoology of H.M. Indian Marine Surveying Steamer "Investigator" Part I. Crustacea, Calcutta, India.
Acanthephyra spp., *Pasiphae* spp., *Aristaeopsis* spp., *Aristaeomorpha* spp., and *Aristaeus* sp. are figured.
269. ——— AND A. ALCOCK 1891. Natural history notes from H. M. Indian Marine Surveying Steamer "Investigator" Commander R. F. Hoskyn, R. N. Commanding, No. 21. Notes on the results of the last seasons deep sea dredging. *Ann. Mag. Nat. Hist.*, Ser. 6 (7): 186-202.
270. ——— 1891. Natural history notes from H.M. Indian Marine Surveying Steamer "Investigator" Commander R. F. Hoskyn, R. N. Commanding, Ser. 2, No. 1. On the results of the deep sea dredging during the season 1890-91. *Ibid.*, Ser. 6 (8): 268-286.
271. ——— 1894. Illustrations of the Zoology of H.M. Indian Marine Surveying Steamer "Investigator" under the command of A. Carpenter, R. N. and of Commander R. F. Hoskyn, R. N., Crustacea 2, VI-VIII.
Glyphocrangon spp., *Pentacheles* spp. are figured.
272. ——— 1895. Illustrations of the Zoology of H.M. Indian Marine Surveying Steamer "Investigator" under the command of A. Carpenter, R. N. and of Commander R. F. Hoskeyn, R. N., Crustacea, IX-XV.
Crangon spp., *Sergestes hamifer*, *Prinocrangon onmatosteres*, *Alpheus* sp., *Glyphocrangon* sp., *Pentacheles* sp. and *Psathyrocaris* sp. are figured.
273. WILKES, S. N., 1956. The Indian shrimp industry. *Fish. Bull. (F.A.O. Publ.)*.

SUPPLEMENT

274. ANONYMOUS 1965. Prawn fishery of Gujarat. Location of new prawn grounds off Veraval. *Fishery Technology*, 2 (1): 48-49.
Potential prawn fishing ground off veraval reported. Suitability of gear and composition of catch given. Possibility of better prawn grounds in deeper areas indicated.

275. BALACHANDRAN, K. K. AND A. N. BOSE 1964. Dehydration of prawns by rotary dryers. *Proc. Indo-Pacif. Fish. Council., 11th Sess., Sec. II*: 272-277.
The use of rotary drum dryer for drying, deshelliling and deveining of prawns discussed.
276. BANERJI, S. K. AND M. J. GEORGE 1967. Size distribution and growth of *Metapenaeus dobsoni* Miers and their effect on the trawler catches off Kerala. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part II: 634-648.
The paper discusses the role played by the size distribution in influencing the catch and abundance. The instantaneous mortality rate was also found out from the approximate formulae of Holt-Beverton.
277. BENSAM, P. AND K. N. RASACHANDRA KARTHA 1967. Notes on the eggs and early larval stages of *Hippolyssmata ensirostris* Kemp. *Ibid.*, 1965, Part II: 736-743.
Gives an account of three different stages of the eggs and three early larval stages.
278. CHAUDHURI, D. R. AND K. K. BALACHANDRAN 1965. Preliminary studies on blanching of prawn. *Fishery Technology*, 2(1): 139-143.
The paper represents results on the studies undertaken to find out the causes of irregular drained weight conditions in commercial canned prawn samples.
279. DESHPANDE, S. D., V. C. GEORGE AND T. M. SIVAN 1964. Experiments and fishing with shrimp trawls. On the effectiveness of Beam trawl net. *Proc. Indo-Pacif. Fish. Council., 11th Sess., Sec. II*: 191-193.
Particulars of the design, construction of each net and method of assembly of 3.04 m. and 1.52 m. beam trawls operated simultaneously from a single wrap are given. The results obtained were discussed.
280. GEORGE, M. J. 1964. On the occurrence of *Metapenaeus burkenroadi* Kubo (Family: Penaeidae, Crustacea Decapoda) in Indian waters. *J. Mar. biol. Ass. India*, 6(2): 313-314.
Reports the occurrence of *M. burkenroadi* from Cochin.
281. GEORGE, M. J., K. RAMAN AND P. KARUNAKARAN NAIR 1963. Observations on the off-shore prawn fishery of Cochin. *Indian J. Fish.*, 10 A (2).
Species composition, seasons of abundance, size distribution, age and growth, maturity, sex ratio, and the general fishery discussed.
282. GEORGE, M. J. 1963. Post-larval abundance as a possible index of fishing success in the prawn *Metapenaeus dobsoni* (Miers). *Ibid.*, 10 A (1), 135-39.
The abundance of postlarvae in the backwater is correlated with the measures of abundance in the backwater and inshore fishery and shown that success or failure of the fishery in a year could be foreseen in the magnitude of the recruitment of post-larvae.
283. ——— 1966. On a collection of penaeid prawns from the off-shore waters off the South-west Coast of India. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part I: 337-346.
13 species of penaeid prawns are reported.
284. ——— 1967. Mark recovery experiments in Crustaceans. *Ibid.*, 1965, Part IV: 1284-95.
The various methods used in marking studies of prawns, lobsters and crabs are described and the typical movements elucidated so far are described.
285. ——— AND P. VEDAVYASA RAO 1966. On some decapod crustaceans from the South-west Coast of India. *Ibid.*, 1965, Part I: 327-336.
8 caridean and 3 penaeid prawns are reported.
286. ——— 1967. Distribution of sex ratios of penaeid prawns in the trawl fishery of Cochin. *Ibid.*, 1965, Part II: 698-700.
Sex ratio data of four penaeid prawns are studied and their movements discussed.
287. GEORGE, M. J. AND K. C. GEORGE 1964. On the occurrence of the caridean prawn *Thalassocaris lucida* (Dana) in the stomach of *Neothunnus macropterus* (Temminck and Schlegel) from the Arabian sea. *J. Mar. biol. Ass. India*, 6(1): 171-172.
Records the occurrence of *T. lucida* off Quilon, in the Arabian sea.
288. ——— AND K. H. MOHAMED 1966. An assessment of marine prawn fishery resources of Kanyakumari District, South-west Coast of India. *Proc. Indo-Pacif. Fish. Council., 12th Sess.*
The prawn fishery of Kanyakumari District which accounts for about 500 tonnes of prawns a year is exclusively constituted by large-sized first and second year classes of a single species of penaeid prawn—*Penaeus indicus*. Fishing season, growth rates and recruitment to the fishery are discussed.

289. GOVINDAN, T. K. 1962. Studies on Ice-stored prawns. *Indian J. Fish.*, 9 B(1): 7-15.
The results of the quantitative study made on major changes taking place in prawns stored in ice discussed.
290. GOPALAKRISHNAN, T. S. AND D. R. CHAUDHURI 1965. Investigation on sanitational aspects (microbiological) of prawn processing factories. *Fishery Technology*, 2(1): 131-138.
Methods for cleaning the utensils and equipments in prawn processing factories and peeling centres suggested.
291. GNANAMUTHU, C. P. 1965. Changes in volume of a prawn moulting in hypotonic sea-water. *Curr. Sci.*, 34(2): 53-54.
292. ——— 1965. Hydrostatic pressure of body fluids in relation to osmoregulation in brackishwater prawn. *Indian J. Exp. Biol.*, 4: 271-272.
293. ——— 1966. Changes in volume of a brackish water prawn in different media. *Proc. Indian Acad. Sci.* 64 B(2): 96-109.
The changes in volume in *Metapenaeus monoceros* in different media and the part played by the gut discussed.
294. GNANADOSS, D. A. S. 1965. Standardisation and mass production of shrimp trawlers and other fishing boats in India. *Fishery Technology*, 2(1): 93-95.
The paper deals with the existing fishing crafts, new vessel types, boat building programmes, their standardisation and mass production in India.
295. JONES, S. 1967. The Crustacean fishery resources of India. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part IV: 1328-40.
The present status of crustacean fisheries in India discussed.
296. KAGWADE, P. V. 1967. Prawn catches by mechanised vessels in the trawling grounds of Bombay and Saurashtra. *Ibid.*, 1965, Part IV: 1348-81.
The relative abundance in the regional, seasonal and depth-wise distribution of prawns in Bombay and Saurashtra waters discussed.
297. KUNJU, M. M. 1967. Observation on the prawn fishery of the Maharashtra coast. *Ibid.*, 1965, Part IV.
The magnitude of fishery, species and size composition, relative abundance of various species of the Maharashtra coast are given.
298. KAMASTRY, P. V. AND B. VIJAY 1964. Chemical and bacteriological quality of prawns transported from Ratnagiri to Bombay. *Symposium on Prawn Fisheries in India, Society of Fisheries Technologists (India), Cochin*, 1964, p. 17.
Results of the study on organoleptic, chemical and bacteriological quality of the prawns transported from Ratnagiri to Bombay discussed.
299. LEKSHMY, A. (MISS), T. K. GOVINDAN AND V. K. PILLAI 1962. Studies on the quality of dry prawn. *Indian J. Fish.*, Sec 9 B(1): 1-6.
The effect of moisture variation on the quality and shelf life of the products during storage are studied.
300. ——— 1962. Storage characteristics of frozen prawns in relation to quality assessment. *Ibid.*, 9 B(1): 58-70.
Freezing trials were carried out with the fresh prawns (*P. indicus*) stored for different periods in ice. The changes in chemical and bacteriological characteristics of the frozen products during storage have also been followed. It is observed that these characteristics are subjected to wide fluctuations as a result of the initial storage in ice. The implication of these changes in quality assessment of the products discussed.
301. MOHAMED, K. H. 1961. Penaeid prawns in the commercial shrimp fisheries of Bombay with notes on species and size fluctuations. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part IV: 1408-18.
Species composition, size frequencies, recruitment and spawning season of important prawns of Bombay area studied.
302. PANIKKAR, N. K. 1966. Fishery resources of the Indian ocean. *Curr. Sci.*, 35(18): 451-455.
Refers to the prawn fisheries of India and the potential prawn grounds in the Indian ocean.
303. QURESHI, S. AND T. A. HASHMI, 1965.* Shrimp fisheries of West Pakistan. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India (Abstract of Papers), p. 73.
The paper deals with the taxonomy of the marine shrimps; length-weight relationship, growth rate, breeding season, sex ratio of *Panaeus merguensis*; fishing crafts, fishing grounds and exports and foreign markets.

* The paper was subsequently withdrawn.

304. RADHAKRISHNAN, N. 1967. On the prawn resources of Karwar region. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part IV: 1421-23.
Species composition and detailed area and depth-wise analysis of prawn catches in trawling operations off Karwar studied.
305. RAMAMURTHY, S. 1967. On the prawn fishery of Gulf of Kutch. *Ibid.*, 1965, Part IV: 1424-36.
Fishery, growth, sex ratio, breeding, migration and survival rates discussed.
306. RAMAN, K. 1967. Observations on the fishery and biology of the giant freshwater prawn *Macrobrachium rosenbergii* de Man. *Ibid.*, 1965, Part II: 649-669.
Methods of fishing, annual trends in production, effort and catch rate, monthly fluctuations in the fishery, age and growth, maturity, breeding, fecundity and seasonal migrations are dealt with. The possibility of over-fishing problems are posed and certain conservation methods suggested.
307. RANADE, M. R. AND S. M. WAKNIS 1965. Prawn resources of Southern Maharashtra (Ratnagiri)—an outlook for a new industry. *Curr. Aff. Bull.*, 43: 6-10.
A brief review of the origin and growth of prawn fishery of Southern Maharashtra is given together with some observations on the catches of prawns, as a result of the exploratory survey, indicating their potentiality as a fishery.
308. RAJYALAKSHMI, T. 1964. On the age and growth of some estuarine prawns. *Proc. Indo-Pacif. Fish. Council*, 11th Sess., Sec. II: 52-83.
Age and growth of some commercially important prawns from the Hooghly Estuary have been estimated by length-frequency method. It has been observed that in the majority of the cases each age group is bimodally distributed. Normally, females are observed to have a faster rate of growth, though the reverse situation was also observed in a few cases. Usually prawns with identical maximum sizes had identical rate of growth.
309. SEBASTIAN, A. V., A. V. V. SATYANARAYANA AND R. S. NAIR 1964. On the prawn trawling experiments conducted off Kakinada (Andhra Pradesh). *Ibid.*, 198-201.
Presents the results of trial fishing for prawns with beam and otter trawls and results encourage large-scale exploratory fishing for prawns in the Bay of Bengal.
310. SUBRAHMANYAM, M., 1964. Fluctuations in prawn landings in the Godavari estuarine system. *Ibid.*, 44-48.
Studies on the fluctuations in the fishery of two species of prawns in the Gautami estuary in relation to the monthly river discharges are made and the results discussed.
311. SUSAMMA JACOB, K. MAHADEVA IYER, M. RAJENDRANATHAN AND V. K. PILLAI 1962. Quality studies on round, headless and peeled and deveined prawns held in ice storage. *Indian J. Fish.*, 9 B (2): 97-107.
Presents the results of the investigations carried out on the chemical and bacteriological changes in prawns during storage in ice when held in three forms of 'round', 'headless' or 'peeled and deveined' under chemical handling conditions.
312. ANONYMOUS 1966. Notes on the development of a practical mass culturing technique of the giant prawn *Macrobrachium rosenbergii*. IPFC/C66/W.
313. GANAPATHY, P. N. AND M. SUBRAHMANYAM 1966. The prawn fishery in Godavari estuary. *J. Zool. Soc. India*, 16 (1 & 2): 11-20.
The systematics and seasonal distribution of the prawns of the Gautami-Godavari estuary have been described. Some aspects of the biology and fishery of important estuarine prawns, craft and gear, curing methods have been dealt with.
314. GEORGE, M. J. 1967. A synopsis of biological data on penaeid prawn *Metapenaeus dobsoni* (Miers) 1878. F.A.O. World Scientific Conference on the Biology and Culture of Shrimps and Prawns, Mexico, 12-24 June, 1967.
Information on the biology and fishery of the penaeid prawn *Metapenaeus dobsoni* is given briefly.
315. ——— 1967. A synopsis of biological data on penaeid prawn *Metapenaeus monoceros* (Fabricius, 1798). *Ibid.*
Information on the biology and fishery of the penaeid prawn *Metapenaeus monoceros* is given briefly.
316. ——— 1967. A synopsis of biological data on penaeid prawn *Metapenaeus brevicornis* (H. Milne-Edwards, 1837). *Ibid.*
Information on the biology and fishery of the penaeid prawn *Metapenaeus brevicornis* is given briefly.
317. ——— 1967. A synopsis of biological data on penaeid prawn *Metapenaeus affinis* (H. Milne-Edwards, 1837). *Ibid.*
Information on the biology and fishery of penaeid prawn *Metapenaeus affinis* is given briefly.

318. GEORGE M.J., S. K. BANERJI AND K. H. MOHAMED 1967. Size distribution and movement of the commercial prawns of the South-west Coast of India. *Ibid.*
A detailed study of the distribution pattern of size and abundance of the commercial penaeid prawns of the south-west coast of India, *Metapenaeus dobsoni*, *M. affinis*, *M. monoceros*, *Penaeus indicus* and *Parapenaeopsis stylifera* has been carried out. The movement of these prawns in different depth zones of the fishing grounds as seen from the analysis of data are size-oriented. With the exception of *M. dobsoni*, all the species were seen to enter the fishing grounds from deeper zones at the beginning of the season by September. They begin to move out of the fishing grounds into deeper zones from February-March onwards. *M. dobsoni* exhibits this movement in the opposite direction. The role of monsoon and upwelling in bringing about these movements is discussed.
319. —, K. H. MOHAMED AND N. NEELAKANTA PILLAI 1967. Observations on the paddy-field prawn filtration of Kerala, India. *Ibid.*
The results of the experiments conducted to determine whether culture methods could be advantageously introduced into the existing prawn filtration practices in the paddy fields are presented. Culturing of juvenile prawns for about a month resulted in relatively better catches of large-sized prawns than could be obtained by cultivation for longer periods. The yield of prawns appeared to be better during the spring tide period associated with full-moon than that associated with the new-moon. Species composition, recruitment to the fishery, size composition and movement of juvenile prawn are discussed.
320. — AND P. VEDAVYASA RAO 1966. A new species of *Metapenaeus* (Decapoda, Penaeidae). *J. Mar. biol. Ass. India*, 8 (1): (in Press).
Metapenaeus alcocki, collected from the Gulf of Kutch, is described as a new species. The diagnostic features along with comparisons with those of allied species are given.
321. — 1967. Observations on the development of the external genitalia in some Indian penaeid prawns. *Australian/New Zealand Meeting on Decapod Crustacea, Sydney, 24-28 October, 1967.*
The development of petasma and thelycum of *Penaeus indicus*, *Metapenaeus monoceros*, *M. affinis*, *M. dobsoni* and *Parapenaeopsis stylifera* is described. The size at which fifty per cent of the males had petasmat endopodites fused was determined. A comparison of the developmental features of the different species is made and their phyletic position discussed.
322. JONES, S. 1967. The prawn fishery resources of India. *F.A.O. World Scientific Conference on the Biology and Culture of Shrimps and Prawns, Mexico, 12-24 June, 1967.*
The growth of prawn fishing industry in India in recent years is reviewed. Prawn exports, commercially important species, the geographical areas of their fishery, maximum size attained by each species the depth in which they are fished and the nets and boats used are given. More extensive culturing of prawns is recommended.
323. JOSEPH, K. M. 1967. Exploratory trawling off the south-west coast of Mysore by M. F. V. Tarpon, November 1960—May 1965. *International Indian Ocean Expedition, News letter*, 4 (4): 14 (Abstract only).
The results of the exploratory trawling in the off-shore waters between latitudes of 12° N and 14° N. and the longitudes of 74° E and 75° E are presented. Species-wise composition of catch with special reference to prawns has been discussed. A comparative study of the productivity of different fishing centres in the area of survey and between other areas along the west and east coasts has been made. The commercial possibilities of trawl fishing in the area have been discussed.
324. KRISHNASWAMY, S. 1967. Reproductive and nutritional cycles in a few invertebrates from the east coast of India. *Ibid.*, 4 (4): 18.
Study of the gonad and hepatic index of a few invertebrates including *Penaeus indicus* has been made. *P. indicus* belongs to the group of continuous breeders. Various environmental factors influencing these are discussed.
325. KUNJU, M. M. 1967. A synopsis of biological data on the penaeid prawn *Solenocera indica* Nataraj 1945. *F.A.O. World Scientific Conference on the Biology and Culture of Shrimps and Prawns, Mexico, 12-24 June, 1967.*
Information on the biology and fishery of *Solenocera indica* is briefly given.
326. — 1967. On some aspects of the biology of *Solenocera indica* Nataraj (Penaeidae, Sub-Fam. Solenocerinae). *Ibid.*
Distribution, feeding, breeding behaviour, spawning period, migration, growth rates, life span and sex ratio are given.
327. MHALATHKAR, H. N. AND H. KRISHNA IYER 1966. Belly depth studies for shrimp trawls. *IPFC/C66/TECH.*

328. MENON, M. DEVIDAS 1967. "Carpe Diem". *Seafood Trade Journal* 2 (1): 99-106.
The problem of natural environments and conditions that facilitate the growth of shrimps and other crustaceans, the difficulties these organisms face in their natural habitats by the many and varied changes and developments that take place in estuaries and backwaters by reclamations are discussed. Production, biological data of important prawns, breeding ground of prawns are also given.
329. MENON, M. KRISHNA 1967. Prawns, Shrimps and Lobsters. *Ibid.*, 151-157.
Commercial species, life-history, growth and length of life, movements, catches and their composition are given briefly.
330. MOHAMED, K. H. 1967. A synopsis of biological data on Indian prawn *Penaeus indicus* H. Milne-Edwards 1837. *F.A.O. World Scientific Conference on the Biology and Culture of Shrimps and Prawns, Mexico, 12-24 June, 1967.*
Information on the biology and fishery of *Penaeus indicus* is given briefly.
331. ——— 1967. A synopsis of biological data on jumbo tiger prawn *Penaeus monodon* Fabricius 1798. *Ibid.*
Information on the biology and fishery of *Penaeus monodon* is given briefly.
332. ———, P. VEDAVYASA RAO AND M. J. GEORGE 1967. Postlarvae of penaeid prawns of south-west coast of India with a key to their identification. *Ibid.*
The first postlarval stage of *Penaeus indicus*, *Metapenaeus monoceros*, *M. affinis*, *M. dobsoni*, and *Parapenaeopsis stylifera* is described. A comparison of their diagnostic features and a key for their identification together with a few remarks on distribution and swimming behaviour are included.
333. MOHAMED, K. H. 1967. Prawn fisheries. *Souvenir, 20th Anniversary of Central Marine Fisheries Research Institute (Government of India)*, pp. 75-81.
Production, catch composition, fishing season processing and export biology of prawns given. Suggestions for future work are given.
334. MUTHU, M. S. 1965. On the occurrence of *Metapenaeus ensis* (De Haan) in the Bay of Bengal. *J. Mar. biol. Ass. India*, 7 (2): 465-468.
Reports the occurrence of *M. ensis* in the Bay of Bengal and its distribution. Three additional characters that distinguish *M. ensis* from *M. monoceros* are pointed out.
335. NARAYANAN KUTTY, M. 1967. Oxygen consumption of the prawns *Penaeus indicus* Milne-Edwards and *Penaeus semisulcatus* de Haan. *F.A.O. World Scientific Conference on the Biology and Culture of Shrimps and Prawns, Mexico, 12-24 June, 1967.*
The results of the experiments showed that oxygen consumption of *P. indicus* and *P. semisulcatus* declined sharply by about the second day of starvation. Changes in the metabolic rates due to starvation in these species are discussed.
336. PANIKKAR, N. K. 1967. Osmotic behaviour of shrimps and prawns in relation to their biology and culture. *Ibid.*
The paper discusses the distribution of prawns and shrimps of the decapod families Penaeidae and Palaemonidae, their value in culture, existing knowledge of their osmotic properties, influence of salinity and temperature on their physiology and related problems.
337. RAO, R. MALLIKARJUNA 1967. Studies on the biology of *Macrobrachium rosenbergii* (de Man) on the Hooghly estuary with notes on its fishery. *Proc. nat. Inst. Sci. India*, 33 B.
Age and growth, length-weight relationship and fluctuations in relative condition with size and seasons of the year, sex-ratio, breeding, food habits, identification of young and their distribution in the Hooghly estuary are given.
338. RAO, P. VEDAVYASA 1967. A synopsis of biological data on penaeid prawn *Parapenaeopsis stylifera* (H. Milne-Edwards), 1837. *F.A.O. World Scientific Conference on the Biology and Culture of Shrimps and Prawns, Mexico, 12-24 June, 1967.*
Information on the biology and fishery of *Parapenaeopsis stylifera* is given briefly.
339. ——— 1967. Maturation and spawning of the penaeid prawns of the south-west coast of India. *Ibid.*
Maturity stages, maturation process, minimum size at first maturity, breeding season, spawning frequencies, fecundity, salinity, temperature and spawning are given.
340. RAMAN, K. AND M. K. MENON 1963. A preliminary note on an experiment in paddy field prawn fishing. *Indian J. Fish.* 10 A (1): 33-39.
The results of the experiments to find out the effect of variation in size and number of sluice gates, area of the field, etc., on the catch are given.

341. RAMACHANDRAN NAIR, P. V., G. LUTHER AND CLEMENT ADLOPH 1965. An ecological study of some pools near Mandapam (South India) formed as a result of the cyclone and tidal wave of 1964. *J. Mar. biol. Ass. India*, 7(2): 420-439.
Refers to *Penaeus indicus*, *P. merguensis*, *P. semisulcatus*, *P. monodon*, *Metapenaeus affinis*, *M. dobsoni*, *M. burkenroadi*, *M. lysianassa*, *P. canaliculatus* and *Acetes* sp. The total number, size range, dominant size and total weight, salinity tolerance of the species are given. The hydrological and phytoplanktonological characteristics of the pools discussed.
342. SUBRAHMANYAM, C. B. 1965. On the reproductive cycle of *Penaeus indicus* (M. Edw.). *J. Mar. biol. Ass. India*, 7(2): 284-290.
The external and internal structure of testes and ovary at different stages of maturity, the length at which the sexual maturity is attained, breeding season, and stages of maturity are given.
343. ——— 1963. Notes on the bionomics of the penaeid prawn *Metapenaeus affinis* (Milne-Edwards) of the Malabar coast. *Indian J. Fish.*, 10 A (1): 11-22.
Fishing seasons, age and growth, stomach contents, sexual maturity and breeding seasons and migration of the species discussed.
344. SUBRAHMANYAM, M. 1966. Fluctuations in the prawn landings in Chilka lake. *Proc. Indo-Pac. Fish. Coun.*, 12th Sess. IPFC/C66/TECH.
345. VENUGOPALA PILLAI, S. 1966. Some observations on the early larval stages of *Hippolyssmata vittata* (Stimpson). *J. Mar. biol. Ass. India*, 8(1) (in Press).
Deals with the eggs and three larval stages of the species.
346. ——— 1966 b. Early development at larval stages of *Palaeomon tenuipes* (Henderson). *Ibid.*, 8(2), (in press).
Descriptions of eggs and three larval stages of *P. tenuipes* are given. Differences noticed from the allied species from Indian waters are also noted.

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AN ANNOTATED BIBLIOGRAPHY OF THE BIOLOGY AND FISHERY OF THE EDIBLE CRABS OF INDIA*

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ABSTRACT

All available information on the edible crabs of India are brought under this bibliography. The number of species that come under this group is limited. The term "edible" crab includes only those species that are accepted as common food crabs and such that support a fishery of some magnitude at least in some areas of the country. Since great importance is attached at present to the increased exploitation of the Indian crustacean fisheries, a compilation that would give a complete and connected account of the relevant sources of information is considered quite desirable, although the accounts relating to the biology and bionomics are scattered and diffused.

The species dealt with are *Portunus pelagicus* (Linnaeus), *P. sanguinolentus* (Herbst), *Scylla serrata* (Forsk.) and the different species of the genera *Charybdis* and *Paratelphusa*.

The edible crab resources of the Indian region, exploited at present to a limited extent, give scope for further development. Of late, attempt has been made to study the biology and fishery of some of the important species. With the increased research activities envisaged in the overall development of the crustacean fishery of the country, crab fisheries would naturally receive great attention. It is hoped that the compilation of a bibliography mainly on the fishery and biology of the edible crabs of India would be of practical use to workers in this field.

Only those species that support a fishery of some magnitude and are accepted as common food crabs are dealt with in this bibliography. The main species that come under this group are *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis* spp., *Scylla serrata* and *Paratelphusa* spp.

1. ALCOCK, A., 1896-1901. Materials for a carcinological fauna of India. (Nos. 1-6. The Brachyura, Oxyrhyncha, Oxystoma, Cyclometopa, Primigenia or Dromiacea and Catometopa or Grapsoidea). *J. Asiat. Soc. Bengal*, 64: 157-291; 65: 134-296; 67: 67-233; 68: 1-104; 123-169; 69: 279-486.
Detailed description and notes on distribution of crabs given along with exhaustive keys to Indian genera and species.
2. ALI, J. A. 1955. Hunting the land crab *Paratelphusa guerini* (M. Edw.). *J. Bombay Nat. Hist. Soc.*, 52: 941-945.
Discusses the harm done to the cultivator and control of the crab.
3. ANONYMOUS 1951. Agricultural marketing in India. Preliminary guide to Indian Fish, Fisheries, methods of fishing and curing. *Marketing Series* No. 66: 1-138.
Scylla serrata, *Neptunus pelagicus* and *Paratelphusa spinigera* are described. Special notes on fishing methods for crustaceans given.
4. ——— 1950. *The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products*. Vol. 2. Council of Scientific and Industrial Research, Delhi.
5. ——— 1962. *Ibid.*, Vol. 4. *Fish and Fisheries*. Council of Scientific and Industrial Research, Delhi.
Important species listed; seasons of fishing in Bombay, Madras, West Bengal and South-west coast of India given.

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6. ANNANDALE, N. 1907. The fauna of brackish ponds at Port Canning, lower Bengal. Part I. Introductions and preliminary account of the fauna. *Rec. Indian Mus.*, 1: 35-43.
Varuna is recorded in the neighbourhood of the estuary.
7. BALSS, H. 1935. On three South Indian crabs (Decapoda Brachyura) of the Madras Museum. *Ibid.*, 37: 45-48.
8. BHATIA, D. R. AND V. NATH 1931. Studies on the origin of yolk. VI. The crustacean oogenesis. *Quart. J. Micr. Sci.*, 74: 669-699.
 The behaviour of golgi elements studied in *Paratelphusa spinigera* and *Palaeomon lamarrei* and the results obtained compared.
9. BHATTACHARYA, D. R. 1931. On cytoplasmic inclusions in the oogenesis of *Scylla serrata*. *All. Univ. Studies*, 8 (2): 63-103.
 Detailed account of the structure and function of the various cytoplasmic inclusions given and their relation in regard to vitellogenesis discussed.
10. BORRADAILE, L. A. 1902. The fauna and geography of the Maldiv and Laccadive Archipelagoes, being the account of the work carried on and of the collections made by an expedition during the years 1899 and 1900 by J. Stanley Gardiner. Marine Crustaceans I. On varieties II. *Portunidae*, Part I, ii: 191-208.
 Systematic list of the species of Portunidae, nature of varieties, the relation between varieties and species given.
11. CHACKO, P. I. AND S. THYAGARAJAN 1952. On the development and parental care in the potaminid crab, *Paratelphusa (Barytelphusa) jacquemontii* (Rathbun). *J. Bombay Nat. Hist. Soc.*, 51 (1): 289-291.
 Breeding season, fecundity, structure of the egg, early development and parental care described.
12. ——— AND E. PALANI 1955. An unusual crab fishery in the sea off Ennur, near Madras. *Ibid.*, 52 (4): 946-947.
 Unusual crab fishery during August 1954 and the gear employed described.
13. CHHAPGAR, B. F., 1957. On the marine crabs (Decapoda Brachyura) of Bombay State. I-II. *Ibid.*, 54: 399-439; 503-549.
 78 species of crabs from the Bombay coast described. A key for their identification provided. Geographical distribution, ecological adaptation and the importance of crabs in the nature's economy discussed.
14. CHIDAMBARAM, K. AND R. S. V. RAMAN 1944. Prawn and crab fishery in Madras. *Indian Farming*, 5: 454-455.
 Statistics and nutritive values are given.
15. CHOPRA, B. N. 1931. The history and progress of the Zoological Survey of India. Crustacea Section III. *J. Bombay Nat. Hist. Soc.*, 34 (2): 502-506.
 History and progress of the crustacea section of the Zoological Survey of India given.
16. CHOPRA, B. N., 1935. Further notes on Decapoda Crustacea in the Indian Museum. On the Decapoda Crustacea collected by the Bengal Pilot Service off the mouth of the river Hooghly. Brachygnatha (Oxyrhyncha and Brachyrhyncha). *Rec. Indian Mus.*, 37: 463-514.
17. ——— 1936. The cape crawfish industry of South Africa with some observations on the prawn and crab fisheries of India. *Curr. Sci.*, 4 (7): 529-533.
 Cape crawfish industry reviewed. A short account of fisheries in different parts of India given. A few suggestions for further development offered.
18. ——— 1939. Some food prawns and crabs of India and their fisheries. *J. Bombay Nat. Hist. Soc.*, 41 (2): 221-234.
 Important food crabs listed; brief information on bionomics, food habits, life-history, fishing methods, medicinal values given; suggestions for future development offered.
19. ——— AND K. N. DAS 1937. Further notes on Crustacea Decapoda in the Indian Museum. On three collections of crabs from Tavoy and Mergui Archipelago. *Rec. Indian Mus.*, 39: 377-434.
 Records 57 species with taxonomic notes.
20. ——— AND K. K. TIWARI 1947. Decapoda Crustacea of Patna State, Orissa. *Ibid.*, 45: 213-224.
Paratelphusa (Barytelphusa) jacquemontii and *P. (Oziotelphusa) hydrodromus* recorded.
21. DAS GUPTA HEM CH. 1924. On the occurrence of *Scylla serrata* Forskal in the upper Tertiary bed of Hathab Bhavanagar (Kathiawar). *J. Asiat. Soc. Bengal, n.s.*, 10: 239-241.
 Fossil remains of *Scylla serrata* and *Neptunus* sp. described.

22. DE MAN, J. G., 1887. Report on the Podophthalmus Crustacea of Mergui Archipelago collected for the Trustees of the Indian Museum, Calcutta, by Dr. John Anderson, F.R.S., Superintendent of the Museum. *J. Linn. Soc. London (Zool)*, 22 (1-5): 1-212.
Descriptions and figures of many old and new species of Brachyura and a list of Podophthalmus species.
23. ——— 1908-1909. The fauna of brackish ponds at Port Canning, Lower Bengal. Part X. Decapoda Crustacea with an account of small collection from brackish water near Calcutta and in the Dacca District, Eastern Bengal. *Rec. Indian Mus.*, 11: 211-231.
Taxonomic notes of the crabs collected, and a list of species given.
24. DESHMUKH REKHA AND P. V. RANGNEKAR 1965. Some observations on the neurosecretory system of the marine crab, *Scylla serrata* (Forsk.). *J. Biol. Sci.*, 8 (1).
25. GEORGE, M. J. 1949. Early stages in the development of *Sacculina* sp., parasitic on *Neptunus sanguinolentus* from Madras. *Proc. Indian Acad. Sci.*, 30 B: 207-214.
Nauplius and cypris larva of the parasite described.
26. ——— 1958. Observations on the plankton of Cochin backwaters. *Indian J. Fish.*, 5 (2): 375-401.
Occurrence of zoea larvae of Brachyura and seasons of occurrence.
27. ——— 1961. On the internal skeleton and musculature of the crab *Neptunus sanguinolentus* (Herbst). *J. Madras Univ.*, 31 B (3): 217-240.
The endophragmal skeletal system and musculature of the crab described; comparison is made with that of *Cancer pagurus*.
28. ——— 1961. The anatomy of the crab *Neptunus sanguinolentus* (Herbst). Part II. Nervous system and sense organs. *Ibid.*, 31 B (3): 241-256.
The nervous system and sense organs described.
29. ——— 1961. The anatomy of the crab *Neptunus sanguinolentus* (Herbst). Part III. Respiratory, Excretory and blood vascular system. *Ibid.*, 31 B (3): 257-273.
Respiratory, excretory and blood vascular system described in detail; comparison made with that of *Cancer pagurus*.
30. GEORGE, P. C. AND K. RAMESH NAYAK 1961. Observations on the crab fishery of Mangalore coast. *Indian J. Fish.*, 8 (1): 44-53.
Important crabs of the region, crab resources, fishery season, fishing methods, breeding, maturity, feeding habits, size composition, fluctuations of crab zoea described.
31. GEORGE, A. I., 1943. Preliminary observation of the occurrence of a new species of rhizocephalan on *Neptunus pelagicus* from Madras coast. *Proc. Indian Sci. Congr.*, 30th Sess., 58.
32. ——— 1959. *Heterosaccus rugosus* (Boschma) a rhizocephalan parasite on the crab *Neptunus sanguinolentus* (Herbst). *J. zool. Soc. India*, 11 (2): 171-204.
Life-history of the parasite and the effect of the parasite on the host discussed.
33. GIDEON, P. W., P. K. B. MENON, S. R. V. RAO AND K. V. JOSE 1957. On the marine fauna of Gulf of Kutch: A preliminary Survey. *J. Bombay Nat. Hist. Soc.*, 54 (3): 690-706.
Crabs collected in the surveyed area listed.
41. KEMP, S. 1924. Crustacea Decapoda of the Siju Cave, Garo Hills, Assam. *Rec. Indian Mus.*, 24 (1): 41-48.
Paratelphusa (*Barytelphusa*) *falcidigitis* recorded.
42. LAURIE R. DOUGLAS 1906. Report on the pearl oyster fisheries of the Gulf of Mannar. Part V. Report on the Brachyura collected by Prof. Herdman at Ceylon in 1902, 349-432 pp.
43. MECANN, C. 1937. Notes on the common land crab *Paratelphusa* (*Barytelphusa*) *guerinii* of Salsette Island. *J. Bombay Nat. Hist. Soc.*, 39: 531.
Describes the life-history and habits of the crab.
44. MENON, M. K. 1952. A note on the bionomics and fishery of the swimming crab, *Neptunus sanguinolentus* (Herbst) on the Malabar coast. *J. Zool. Soc. India*, 4 (2): 177-184.
Fishery season, breeding season, rearing experiments, growth, food are described.
45. MIERS, E. J. 1884. Report of the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert", 1881-82. *Crustacea (Brachyura)*: 178-232.
121 species of Brachyura are enumerated and discussed.

46. MIERS, E. J. 1888. The Brachyura collected by H.M.S. 'Challenger'. *Challenger Rep. Zool.*, 17: 412 pp.
Systematics, distribution, list of species given.
47. MOSES, S. T. 1924. Crab folklore. *Man in India* (3 & 4): 165-173.
Common beliefs about the crab in Indian region described.
48. MUTHUSWAMY IYER, M. S. 1933. The spermatogenesis of *Paratelphusa hydrodromus* with a note on oogenesis. *J. Mysore Univ.*, 7: 43-50.
49. NANCY SAMUEL 1945. Some aspects of the morphology of the antennary glands of three decapod crustaceans. *J. Bombay Univ.*, 14 (3): 124-134.
50. NATH, V., 1932. Spermatid and sperm in *Paratelphusa spinigera*. *Quart. J. Micr. Sci.*, 75: 543-556.
An account of the spermatogenesis with reference to the transformation of spermatid into sperm given.
51. ——— 1938. The decapod sperm. *Proc. Indian Sci. Congr.*, 25th Sess., 3: 72.
Spermatogenesis of *Paratelphusa* studied.
52. ——— 1941. The decapod sperm. *Trans. Nat. Inst. Sci. India*, 2(4): 87-119.
Spermatogenesis of 27 Brachyuran species worked out; evolution of the different groups attempted.
53. NIRMAL, H. B. 1964. Neurosecretory cells in the freshwater crab, *Paratelphusa jacquemontii* Rathbun. *J. Biol. Sci.*, 7: 15-21.
54. PANIKKA N. K., 1937. Brackishwater fauna of Madras. *Proc. Indian Acad. Sci.*, 6B: 284.
The fauna of brackishwater of Madras studied; habitat, distribution, breeding, general biology of animal life described.
55. ——— 1951. Physiological aspects of adaptation to estuarine conditions. *Proc. Indo-Pacif. Fish. Council*, 3: 168-175.
Crabs of the family Portunidae referred. Brief account of the adaptations of the animals to various ecological factors of the habitat discussed.
56. ——— AND R. G. IYER 1939. Observations on breeding in brackishwater animals of Madras. *Proc. Indian Acad. Sci.*, B 9 (6): 343-364.
Breeding habits of the brackishwater animals and the different types of breeding discussed.
57. PADMANABHA NAIDU, B. AND R. RAMAMURTHY 1961. The influence of sex and size on the osmotic pressure, the chloride and the free aminoacids of the blood of the freshwater crab, *Paratelphusa* sp. and the freshwater mussel *Lamellidens marginalis*. *J. Exp. Biol.*, 38 (1): 35-41.
The influence of sex, body size on the osmotic pressure, chloride and free aminoacids in the blood of the species were investigated and the results obtained were discussed.
58. PARAMESHWARAN, R. 1955. Neurosecretory cells in *Paratelphusa hydrodromus* (Herbst). *Curr. Sci.*, 24: 23.
Neurosecretory cells of the thoracic ganglion and the brain, their nature and disposition described.
59. ——— 1956. Neurosecretory cells of the central nervous system of the crab *Paratelphusa hydrodromus*. *Quart. J. Micr. Sci.*, 97: 75-81.
60. PATWARDHAN, S. S., 1934. On the structure and mechanism of the gastric mill in Decapoda. I. The structure of the gastric mill in *Paratelphusa guerini* (M. Edw.). *Proc. Indian Acad. Sci.*, 1B: 183-196.
The gastric mill of the crab, anatomy of the foregut, and *modus operandi* of the gastric mill described.
61. ——— 1934. A comparative account of the gastric mill in Brachyura. *Ibid.*, 1 (7): 359-375.
12 types of decapods belonging to 11 families are studied and the structure of the gastric mill compared.
62. PATIL, A. M. 1951. Study of the marine fauna of the Karwar coast and neighbouring Islands. *J. Bombay Nat. Hist. Soc.*, 50 (1): 128-139.
63. PILLAI, N. K. 1945. The crabs of Travancore with special reference to edible varieties. *Proc. Indian Sci. Congr. Sec. 10*: 99.
Bionomics and distribution of edible crabs and methods for developing crab fisheries described.
64. ——— 1951. Decapoda (Brachyura) from Travancore. *Bull. Cent. Res. Inst. Univ. of Travancore. Trivandrum, Ser. C*, 2 (1): 1-46.
59 species belonging to the families Maitidae, Calappidae, Leucosidae, Dorrippidae, Xanthidae, Potamonidae, Portunidae, Dromiidae, Pinnotheridae, Ocypodidae, Hymenosomatidae and Crapsidae are described.

65. PRASAD, R. R. 1954. Observations on the distribution and fluctuation of planktonic larvae off Mandapam. *Proc. Indo-Pacif. Fish. Council.*, 21-34.
Refers to crab larvae and distribution in the Gulf of Mannar and Palk Bay.
66. — AND P. R. S. TAMPI 1952. An account of the fishery and fishing methods for *Neptunus pelagicus* (Linnaeus) near Mandapam. *J. zool. Soc. India*, 3 (2): 335-339.
The gear used, description of the gear, mode of operation described.
67. — 1953. A contribution to the biology of the blue swimming crab, *Neptunus pelagicus* (Linnaeus) with a note on the zoea of *Thalamita crenata* Latreille. *J. Bombay Nat. Hist. Soc.*, 51: 674-689.
The habits and habitat; segregation according to sex and size; breeding season; early larval stages described. A description of the zoea of *T. crenata* is given.
68. — 1954. Some aspects of relative growth in the blue swimming crab, *Neptunus pelagicus* (Linnaeus). *Proc. Nat. Inst. Sci., India*, 20 B (2): 218-234.
The paper deals with the relative growth in relation to different parts of the body. The data obtained reported and discussed.
69. RAJA BAI NAIDU, K. G. 1955. The early development of *Scylla serrata* (Forsk.) and *Neptunus sanguinolentus* (Herbst.). *Indian J. fish.*, 2: 67-76.
The early first zoea and the late zoea of the two species described.
70. RAI, H. S. 1933. The shell fisheries of Bombay Presidency. Part II. *J. Bombay Nat. Hist. Soc.*, 36 (4): 884-897.
Important crabs of Bombay coast, breeding season, fishery season, gears employed and value of yield given.
71. RAMAKRISHNA, G. 1950. Notes on some Indian Potaminid crab (Crustacea Decapoda). *Rec. Indian Mus.*, 48 (2): 89-92.
4 potaminid crabs described.
72. RANGNEKAR, P. V. 1954. A comparative study of the blood volume in the crustaceans *Scylla serrata*, *Panulirus polyphagus* and *Paratelphusa guentheri*. *J. Animal Morphol. & Physiol.*, 1 (1): 62-64.
73. —, P. B. SABNIS AND H. B. NIRMAL 1961. The occurrence of hypoglycemic factor in the eyestalks of freshwater crab, *Paratelphusa jacquemontii* (Rathbun). *J. Animal Morphol. & Physiol.*, 8 (2): 137-144.
The presence of hypoglycemic factor in the eyestalks is experimentally demonstrated. It is suggested that this factor is concerned with maintaining a constant level of blood sugar. Its action is compared with that of insulin on blood sugar concentration in higher vertebrates.
74. RAO, K. P., 1959. Some contributions towards an understanding of metabolism of freshwater poikilotherms. *Bull. zool. Soc. India*, 3: 6-8.
75. — 1963. Metabolism of tropical poikilotherms with special reference to temperature acclimatisation. Recent advances in Zoology in India. *Proc. of the first Summer School of Zoology (Simla, 1961) of Govt. of India*, 311-317.
The results of the study of some poikilotherms to understand the temperature acclimation in tropical poikilotherm given and discussed.
76. — AND R. RAMACHANDRA 1961. Effects of acclimatisation to high temperature on the blood chloride, free aminoacids and osmotic pressure in the freshwater field crab *Paratelphusa* sp. and the freshwater mussel *Lamellidens marginalis*. *J. Exp. Biol. Cambridge*, 38: 29-34.
Experiments conducted on acclimatisation of the freshwater crab and mussel to high temperature reported and the results discussed.
77. — AND V. VENKATA REDDY 1961. Compensation to high temperature in the loss and active absorption of chloride in the freshwater field crab *Paratelphusa* sp. *Comp. Biochem. Physiol.*
78. — AND G. MADANAMOHAN RAO 1963. Chloride regulation and its relation to oxygen consumption in the brackishwater crab *Sesarma plicatum* (Latreille). *Crustaceana*, 5 (3): 188-192.
Reports the changes in oxygen consumption to chloride gradient from blood to medium and the results discussed.
79. REDDY, A. R., 1935. On the *modus operandi* of certain ossicles in the gastric armature of Decapod crustacean. *Curr. Sci.*, 4: 34-37.
80. — 1934. The gastric armature of some South Indian Decapod Crustacea. *J. Annam. Univ.*, 4 (1).

81. REDDY, A.R., 1935. On the structure and mechanism and development of the gastric armature in Stomatopoda with a discussion as to its evolution in Decapoda. *Proc. Indian Sci. Congr.*, 1 (10): 650.
The structure of gastric armature in *Squilla nepa* given and the trend of evolution of gastric armature in decapods traced.
82. ——— 1937. The physiology of digestion and absorption in the crab *Paratelphusa (Oziotelphusa) hydrodromus* (Herbst). *Proc. Indian Acad. Sci.*, 6: B 170-192.
General description and histology of alimentary canal, structure of gastric armature, the *modus operandus* of gastric armature, the passage of food through the digestive tract, specificity of digestive enzymes, nature of absorption and food reserves are described.
83. SANKARANKUTTY, C. 1961. On Decapoda Brachyura from Andaman and Nicobar Islands. I. Families *Portunidae*, *Ocypodidae*, *Grapsidae* and *Micrhyidae*. *J. Mar. biol. Ass., India*, 3: 101-119.
30 species belonging to *Portunidae*, *Ocypodidae*, *Grapsidae* and *Micrhyidae* are described.
84. ——— 1961. On some crabs (Decapoda Brachyura) from the Laccadive Archipelago. *J. Mar. biol. Ass. India*, 3: 120-136.
36 species belonging to *Portunidae*, *Grapsidae*, *Ocypodidae*, *Xanthidae*, *Maitidae*, *Parthenopidae* and *Calappidae* are described.
85. SAROJINI, S. 1961. The androgenic organ in some Indian Crustacea. I. *J. zool. Soc. India*, 13 (2): 188-193.
The androgenic organ of 8 crabs described in relation to its shape, size and position. The gland differs in its morphology in different species.
86. VASUDEO, R. B. AND H. G. KEWALRAMANI 1960. Transport of common crab (*Scylla serrata*) in living condition. *Indian J. Fish.*, 7 (1): 169-173.
Experiments done for packing live crabs explained; the results and the observations are reported; commercial possibility recommended.
87. VELANKAR, N. K. AND K. MAHADEVA IYER 1961. On the qualitative description of aminoacids in different species of prawns. *J. Sci. & Indust. Res. India*, 20 C (2): 64-65.
The free aminoacids present in the muscle of *Neptunus pelagicus* studied and the results reported.
88. WOOD-MASON, J. 1871. Contribution to the Indian Carcinology. Part I. On Indian and Malayan *Telphusidae*. *J. Asiat. Soc. Bengal*, 11 (2): 189-207; 449-454.
Indian *Telphusidae* reviewed; describes 2 species of *Paratelphusa* and 7 *Telphusa*.

SUPPLEMENT

89. AGRAWAL, V. P. AND A. P. TYAGI 1967. Respiratory behaviour of *Paratelphusa masoniana*, under different conditions. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part III.
The respiratory behaviour of the crab in relation to variations in temperature, light intensity and size of the animal studied.
90. ——— AND S. K. SHARMA 1967. Physiology of digestion of *Potamon martensi* Wood Mason. *Ibid.*, 1965, Part III.
The food and the physiological studies on the determination of pH and the qualitative estimation of enzymes in different parts of the gut of the crab described.
91. ——— AND K. A. GOEL 1967. Pharmacology of the heart of the freshwater crab *Potamon martensi* Wood Mason. *Ibid.*, 1965, Part III.
The effect of a few sedative medicines on the heart of the crab studied.
92. ALCOCK, A. AND A. R. S. ANDERSON 1894. Natural history notes from H.M. Indian Marine Survey Ship "Investigator". Ser. II, No. 17. List of shore and shallow water Brachyura collected during the season 1893-1894. *J. Asiat. Soc. Bengal*, 63 (5): 197-209.
93. GEORGE, M. J., 1963. The anatomy of the crab *Neptunus sanguinolentus* Herbst. Part IV. Reproductive system and embryological studies. *J. Madras Univ.*, 33 B (3): 289-304.
The male and female reproductive organs of the crab and the embryonic development during the three days before hatching described.
94. ——— (in Press). The anatomy of the crab *Portunus sanguinolentus* (Herbst). Part V. Digestive system. *J. Madras Univ.*

95. GEORGE, M. J. (in Press). The effect of salinity changes on weight and respiratory rate of the crab *Portunus sanguinolentus* (Herbst). *Crustaceana*.
Experiments conducted have shown that an increase of weight and oxygen consumption of the animal after it is transferred to dilute medium and the maximum is reached by the end of first hour, and then declines to almost to initial weight and respiratory movements, within 4 to 6 hours. The initial increase in weight is due to the influx of water from the hypotonic medium. In the hypertonic medium the respiratory movements are irregular and intermittent.
96. ——— 1967. Mark recovery experiments in Crustaceans. *Proceedings of Symposium on Crustacea*, Marine Biological Association of India, 1965, Part IV: 1284-95.
The various methods used in marking studies, and the movements elucidated so far described.
97. HASHMI, S. S. 1965. Crabs of West Pakistan. *Symposium on Crustacea. Mar. biol. Ass. India*, p. 67.
The present status of the crab fisheries in West Pakistan described. Edible crabs—*Neptunus pelagicus*, *N. sanguinolentus*, *Scylla serrata* and *Charybdis cruciata* listed.
98. KRISHNAMURTHY, K., T. N. C. RAMAPRASAD AND T. VENKATESWARLU 1967. Free aminoacids in the blood of *Ocypoda paltys* and *Scylla serrata*. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part III.
The distribution of free aminoacid in the blood of the two crabs studied, and the differences noted.
99. NOBLE, A. 1964. Abnormality in the portunid crab, *Neptunus* (*Neptunus*) *sanguinolentus* Herbst. *J. Mar. biol. Ass., India*, 6(2): 312-313.
An abnormality in the left chela in having two additional thumbs reported.
100. SANKARANKUTTY, C. 1966. On Decapoda Brachyura from the Gulf of Mannar and Palk Bay. *Proceedings of the Symposium on Crustacea*, Marine Biological Association of India, 1965, Part I: 347-362.
86 species collected from the Gulf of Mannar and Palk Bay described with a brief outline on the species of Brachyura associated with the various habitats of the area.
101. KRISHNASWAMY, S. 1967. Reproductive and nutritional cycles in a few invertebrates from the east coast of India. *International India Ocean Expedition, Newsletter*, 4(4): 18.
Based on the systematic study of the gonad and hepatic index, it has been shown that on the basis of their breeding behaviour *Portunus pelagicus* are continuous breeders.
102. PATEL, B. S., Y. M. BHATT, T. M. KRISHNAMOORTHY, G. R. DOSHI, P. M. A. BHATTATHIRI, C. K. UNNI AND R. VISWANATHAN 1966. Uptake of radionuclides by some marine shellfish of commercial importance. *Ibid.*, 4(2), 20-21.
Experiments were conducted on the uptake, accumulation and loss of radionuclides by two species of bivalves, and a crab *Scylla serrata* (Forsk.). The concentration factor for cesium-137 in this crab was sex-dependant, the female crab concentrating the maximum amount. The hepatopancreas showed the maximum concentration of cesium-137. Equilibrium was reached in about 9-10 days of exposure.
103. RAJABAI, K. G., 1961. Studies on the oxygen consumption in tropical poikilotherms. VI. Effect of starvation on the oxygen consumption of the freshwater field crab, *Paratelpusa* sp. *Proc. Ind. Acad. Sci.*, 54 B(6): 276-280.
The effect of starvation on the oxygen consumption at the habitat temperature has been described in detail.
104. ——— 1963. Studies on the oxygen consumption in tropical poikilotherms. VII. Effect of starvation on the temperature response of metabolism in the freshwater crab, *Paratelpusa* sp. *Ibid.*, 58(4): 207-214.
Starvation stress is reflected in changes in thermal response but differences in oxygen consumption are not pronounced. On the first day of the experiment the Q_{10} values decrease with increasing weight but increase with increasing temperature at all temperatures studied. On the 14th and 21st day of starvation Q_{10} values increase with increasing body weight between 25 and 30°C. but between 30 and 35°C. decrease with size. The b values on the 14th day of starvation are intermediate between surface area dependence and weight dependence at all temperatures and surface area dependent on the 21st day at all temperatures.

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COPEPODS PARASITIC ON INDIAN MARINE FISHES—A REVIEW

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ABSTRACT

The main purpose of this study is to bring together in one publication all the scattered references on the copepods parasitising the marine fishes inhabiting the waters around the Indian mainland. The area selected for the present study comprises the Arabian Sea, Bay of Bengal and the Indian Ocean, north of the equator. In all, nearly two hundred species are included. A short diagnosis emphasising the more important characters, one or two selected references and a simple illustration of the female are included under each species. To avoid repetition of characters, as far as possible full generic and family characters are given. Since this is not intended as a critical resume, opinions regarding the validity of the various species are avoided. For the help of new entrants into this field of study, comments on the methods of collection, preservation and examination of the parasites are given. To facilitate ready reference an alphabetical list of the hosts with the names of their parasites is included as appendix.

INTRODUCTION

THE first important study on the piscicolous copepods of the waters around the Indian peninsula was those of Bassett-Smith (1898 a, 1898 b, 1898 c). He described about 30 species collected at Bombay, Ceylon and the Persian Gulf. After a lapse of nearly fifty years Kirtisinghe (1932-1964) studied the copepods of the Ceylon waters. More recently Gnanamuthu (1947-1960) studied the copepods of the East coast of India and Rangnekar (1948-1965) studied those of the west coast. There are also a few publications by Kurian, Tripathi, Rao, Redkar, Murti, Sebastian and Bennet, to which reference will be made in appropriate places. Descriptions of Indian forms also occur in the works of C. B. Wilson (1906), Heegaard (1943) and Shiino (1958).

Recently I made a routine search of the common food fishes for parasites and this resulted in a very rich collection of copepods. These were described in a series of papers (Pillai, 1961-1967). My study has shown that the two hundred and odd species so far described from the present locality form only a small part of what awaits discovery. I, therefore, present this review with the hope that it may stimulate further work on this extremely common and highly interesting group of animals.

MATERIAL AND METHOD

The distribution of piscicolous copepods is more or less dependant on the distribution of the host fishes and hence the limits of the "Indian waters" can be fixed only arbitrarily. For the sake of the present work the Arabian Sea, the Bay of Bengal and the Indian Ocean north of the equator alone are considered.

In the taxonomic part of this review, each species is briefly described emphasising the most salient features, and as far as possible, a figure of the female is given. In the synonymy only important references are mentioned. As specific identification of copepod parasites is based almost entirely on the characters of the female, the characters of the male are omitted from the present study. As far as possible the illustrations were based on material in the author's collection, but in those cases where specimens were not available the figures were taken from the original

paper or from a subsequent publication. Brief notes on classification, terminology of the appendages, methods of collecting, preserving and studying copepod parasites are also included for the sake of those not well versed with this group.

CLASSIFICATION

Till recently the accepted classification was that proposed by C. B. Wilson (1932) which divided Order Copepoda into eight suborders, Arguloida, Calanoida, Harpacticoida, Cyclopoida, Noto-delphoida, Monstrilloida, Caligoida and Lernaeopodoida. The main virtue of this classification was its simplicity. But subsequent work showed that the Chondracanthidae treated under Lernaeopodoida are more closely related to Cyclopoida. This view was generally accepted.

Recently Yamaguti (1963) suggested a new classification. The main change he effected was to raise the status of Order Copepoda to that of a Class and upgrade Wilson's suborders to Orders. Thus under Subclass Copepoda he recognised six Orders, Cyclopidea, Caligidea, Philichthyidea, Andreinidea, Lernaeopodidea and Sarcotacidea; Argulidea was placed under Subclass Branchiura. Below orders he effected regroupings at the familial and subfamilial levels. The published comments on this new classification show that it has failed to receive unqualified acceptance. More over, Yamaguti's work contains some unfortunate contradictions and errors that it needs immediate revision. For the present review, therefore, the old classification is followed. The chondracanthids will, however, be dealt with under Cyclopoida.

TERMINOLOGY

The terminology of the cephalothoracic appendages of parasitic copepods is still a controversial subject. Hence a few words on the terminology adopted in the present review are necessary. The first cephalothoracic appendage is the first antenna and the next is the second antenna. In caligids the second antenna is described as two- or three-segmented. In a typical genus like *Caligus* the first segment is fused with the carapace and hence the appendage would appear to be only two-segmented. But the boundary of the fused segment is clearly visible and has often a spine-like process which has some specific value. Hence I am describing the second antenna as three-segmented. In *Hatschekia* and *Lernanthropus* the two members are fused together, but the appendages show indications of three segments.

Following the second antennae there are five appendages about which there is wide difference of opinion. The third appendage is the mandible. According to one school the mandible is followed by two pairs of maxillae and two pairs of maxillipeds respectively. This is the terminology adopted by Shiino, Heegaard and Yamaguti. But nearly 25 years back, Lang (1946) showed that copepods possess only one pair of maxillipeds. Until agreement is reached I prefer to use the more popular method of recognising two pairs of maxillipeds.

Behind and slightly lateral to the base of the second antenna in *Caligus* is a chitinous process carrying on its base two bunches of fine hairs. This is the first maxilla. Lateral to the buccal tube is another conical process associated with a projection usually carrying three setae. This is the second maxilla. Then the two appendages just behind the buccal tube become the first and second maxillipeds respectively. Lewis (1964) designated the two pairs of maxillae as the post-antennal and post-oral process respectively and the two pairs of maxillipeds as the maxillae and maxillipeds. According to him the cuticular processes termed maxillae do not show segmentation and hence cannot be considered as true appendages. Without taking sides I propose to name the cephalothoracic appendages as two pairs of antennae, one pair of mandibles, two pairs of maxillae and two pairs of maxillipeds. In those cases where only one pair of maxillae is evident, they will be simply called maxillae as in *Lernanthropus*.

COLLECTION, PRESERVATION AND EXAMINATION OF COPEPODS

Copepod parasites are very common on both elasmobranchs and teleosts. Those inhabiting the buccal cavity or the branchial chamber usually remain where they are, even after the death of the host. But those inhabiting the surface of the body fall off on death or may get rubbed off while the fishes are handled. Hence it would be worthwhile to examine fishes as soon as they are caught.

Comparatively large copepods like the caligids can be easily located and picked up, but there are others which require careful search. Gill parasites like the chondracanthids, dichelesthiids, eudactylinids and anthosomatids are often indistinguishable among the gill filaments. The best method to collect them is to cut out the gills and tease the filaments carefully with a needle in a petri dish. The residue in the petri dish, if examined under a binocular will yield a number of small forms. Lernaeopodids always remain fused to the body of the host with the help of what is called the bulla. Unless care is taken while separating the parasite from the host the bulla will be lost. The shape of the bulla has some taxonomic value. Lernaeids remain deeply buried in the body of the host. Hence the body of the host should be cut open and the course of the parasite followed up to its head. The structure of the head is most important in their identification. Cyclopoid parasites, especially the males, are often invisible among the mucus that is invariably present on the gills and the opercle of dead fishes. Flushing the branchial chamber with a dropper and examining the residue in a petri dish will often yield a large number of them. I have found this method very rewarding in collecting the males.

Copepod parasites are invariably covered with mucus secreted by the host. If the parasites are directly transferred to the preservative the mucus will harden and stick on to the body and the appendages. This would make detailed study difficult. The mucus can be easily removed if the parasites are immersed for 10 to 15 minutes in a dilute solution of Sodium bicarbonate and then rinsed with a dropper.

Though alcohol has certain advantages over formalin as a preservative, the latter is adequate for preserving parasitic copepods. It is less volatile and easy to carry. While storing or transporting collections care should be taken to prevent the cork from contacting the preservative. Otherwise the specimens may be blackened. This can be avoided by covering the cork with tissue paper. The best method is to plug the tubes with cotton and keep them in a large bottle filled with the preservative.

In the preservative most of the copepods become opaque and clearing is necessary before examination. Various kinds of clearing fluids are in use, but for routine study ordinary lactic acid is quite sufficient. This fluid quickly penetrates the tissues and if the specimen is kept in one or two drops of the acid on a cavity slide for about five minutes it will get sufficiently cleared. As lactic acid is not volatile, temporary mounts can be left over for subsequent examination. It readily mixes with water, alcohol or formalin and hence the material can be transferred from one to the other. Lactic acid treatment makes the specimens relax and regain their true shape. The only defect is that it destroys the soft tissues and renders the specimens unsuitable for histological work.

It is the practice with some workers to stain and prepare permanent mounts of copepods for taxonomic study. This is unnecessary and even undesirable. A temporary mount in lactic acid is in every way superior to permanent mounts,

TAXONOMIC SURVEY OF COPEPODS

Suborder CYCLOPOIDA

Family TAENIACANTHIDAE

Genus *Taeniacanthus* Sumpf

Wilson, 1911, p. 387; Yamaguti, 1963, p. 20.

Head fused with first thoracic segment, the resulting cephalothorax cup-like, forming an efficient sucking disc. Thoracic segments 2 to 5 free, narrowing backwards, genital segment slightly enlarged, abdomen tapering, 3 or 4-segmented, anal laminae longer than broad, Antenna 1 cylindrical, basal segments not flattened. Antenna 2 prehensile. Mandible 3-segmented, third segment with 2 blades. Maxilla 1 composed of 2 widely separated parts, a chitinised maxillary hook placed near the base of the first antennae and a flat lobe carrying 3 to 4 long setae placed just behind the mandibles, paragnath present. Maxilla 2 with 2 blades. Maxilliped variously shaped, placed behind the other mouth parts. First pair of legs flattened, rami indistinctly 3-segmented, legs 2 to 4 biramous, with 3-segmented rami, leg 5 uniramous, 2-segmented, leg 6 represented by a bunch of setae near the insertion of the egg sacs.

Taeniacanthus indicus Pillai

(Fig. 1)

Pillai, 1963 *d*, p. 112, fig. 1.

Carapace roughly semicircular, first 3 trunk segments rectangular, abdomen 4-segmented, anal laminae shorter than the last abdominal segment. Endopod of leg 1 broad and 2-segmented, legs 2 to 4 with 3-segmented rami, exopod of leg 2 with blunt, jointed spines, that of second with stout sickle-shaped flanged claws, that of third with apically forked spines carrying a spinule. Second segment of leg 5 rounded. Maxilliped 1-segmented, with 2 setae on the hind border. Length 2.4 mm.

Host: *Chiloscyllium indicum* (Gmelin).

Location: Surface of body.

Distribution: Kerala.

This species closely resembles *T. albidus* Wilson (1911) and *T. flagellans* Wilson (1913) but differs in the armature of the legs.

Taeniacanthus narcini Pillai

(Fig. 2)

Pillai, 1963 *d*, p. 114, fig. 2.

Carapace roughly triangular, with a transverse posterior line probably indicating the line of fusion with the first trunk segment, second trunk segment short. Abdomen 4-segmented, anal laminae less than half the length of the last abdominal segment. First segment of maxilliped with 1 seta, second fused with the first segment and carrying 2 setae. Rami of first leg 2-segmented, those of legs 2 to 4 armed with barbed spines carrying an apical trigger-like spinule. Length 2.4 mm.

Host: *Narcine timlei* (Bloch and Schneider).

Location: Gills.

Distribution: Kerala.

Taeniacanthus longicaudus Pillai

(Fig. 3)

Pillai, 1963 *d*, p. 116, fig. 3.

Carapace with prominent rostral projection, postero-laterally angular, with indistinct transverse line. Thoracic segments 2 to 4 subequal in length. Abdomen 4-segmented, anal laminae nearly as long as the last abdominal segment, with a very long apical seta. Second segment of maxilliped partially fused with the first, carrying 2 setae. Exopod of leg 2 with blunt jointed spines, that of leg 3 with sickle-shaped claws and that of leg 4 with cylindrical, flanged spines carrying an apical spinule. Length 3.2 mm.

Host: *Saurida tumbil* (Bloch).

Location: Branchial cavity.

Distribution: Kerala.

Taeniacanthus dentatus Sebastian

(Fig. 4)

Sebastian, 1964, p. 94, figs. 1-10.

Carapace nearly circular, with very small rostral projection, trunk segments 2 to 5 subequal in length, genital segment not broader than trunk segment 5, abdomen long, 4-segmented, anal laminae long and slender. Maxilla 1 with three setae, one seta with swollen base. Distal segment of maxilliped with 5 large rounded protuberances. Exopod segments of legs 2 to 4 armed with setiform spines, endopod segment 3 armed with stout blunt spines. Second segment of leg 5 slender and long. Length 2.5 mm.

Host: *Bembrops caudimaculata* Steendachner.

Location: Buccal cavity.

Distribution: (Pamban) Gulf of Mannar.

Genus *Parataeniacanthus* Yamaguti

Yamaguti, 1939, p. 409; 1963, p. 23.

Closely resembling *Taeniacanthus* but differing in the incomplete fusion of the first trunk segment with the cephalon and of the fifth trunk segment with the genital segment, abdomen 4-segmented and comparatively very long.

Parataeniacanthus miles Pillai

(Fig. 5)

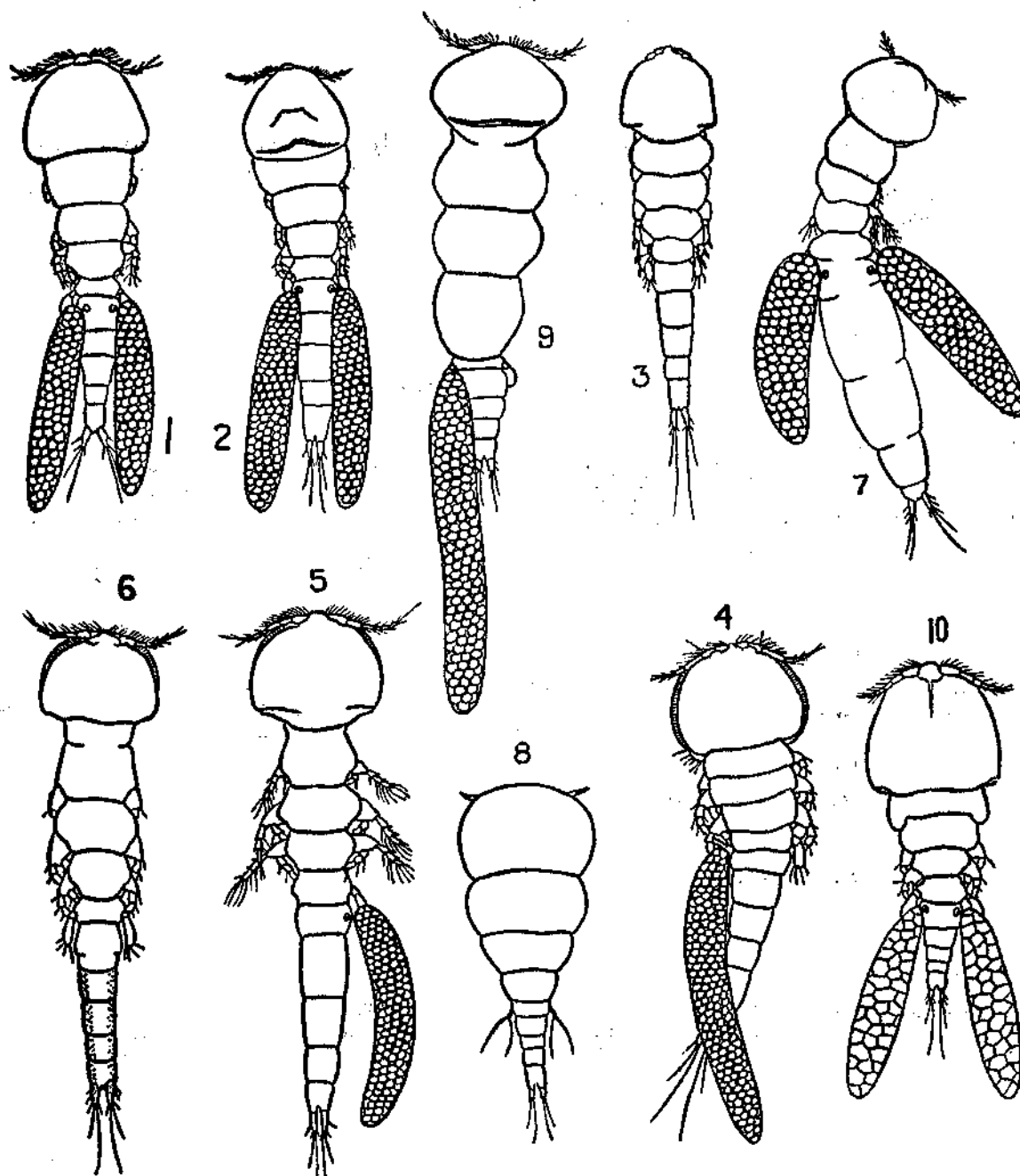
Pillai, 1963 *d*, p. 118, fig. 4.

Carapace nearly circular, first thoracic segment demarcated from the cephalon by a transverse groove. Trunk segments 2-5 laterally angular, abdomen 4-segmented, segment 1 longest, anal laminae as long as abdominal segment 4. Second segment of maxilliped curved inwards with the hind border spiny. Exopod of legs 2 to 4 armed with setiform spines, third endopod segment with blunt flanged spines. Length 1.1 mm.

Host: *Pterois russellii* Bennett.

Location: Branchial chamber.

Distribution: Kerala.



FIGS. 1-10. (1) *Taeniacanthus indicus*; (2) *Taeniacanthus narctici*; (3) *Taeniacanthus longicaudus*; (4) *Taeniacanthus dentatus* (Sebatian, 1964)*; (5) *Parataeniacanthus miles*; (6) *Parataeniacanthus longicervis*; (7) *Metataeniacanthus synodi*; (8) *Irodes tetradontis* (Bassett-Smith, 1898); (9) *Irodes lagocephali*; (10) *Anchistrostos sauridi*.

* The sources of the figures are indicated by giving the appropriate reference in brackets. Where there is no such indication it is to be understood that the illustrations are from the author's publications.

Parataeniacanthus longicervis Pillai

(Fig. 6)

Pillai, 1963 *d*, p. 120, fig. 5.

Carapace semicircular, with prominent rostral process, first trunk segment almost free, segments 2 to 5 laterally angular. Abdomen 4-jointed, dorsally spiny, anal lamirae as long as last abdominal segment. Distal segment of maxilliped with a row of strong teeth. Exopod segments of legs armed with setiform spines, exopod segments of leg 3 modified, endopod segment 3 with stout apical spine. Length 2.9 mm.

Host: *Saurida tumbil* (Bloch).

Location: Branchial cavity.

Distribution: Kerala.

Genus *Metataeniacanthus* PillaiPillai, 1963 *d*, p. 122.

Carapace globular, fused with first thoracic segment, thoracic segments 2 to 4 narrower than carapace, successively decreasing in size, fifth segment broad, as broad as genital segment. Abdomen 4-segmented, highly swollen and as long as rest of body. Other characters as in *Taeniacanthus*.

Metataeniacanthus synodi Pillai

(Fig. 7)

Pillai, 1963 *d*, p. 122, fig. 6.

With the characters of the genus. Maxilliped composed of a single unsegmented plate carrying 3 setae, legs 1 to 4 with 3-segmented rami, exopod of legs 2 to 4 armed with slender pectinate spines, third segment of endopods with short flanged spines, leg 5 with second segment rather broad. Length 2.0 mm.

Host: *Synodus indicus* (Day).

Location: Gills.

Distribution: Kerala.

Genus *Irodes* Wilson

Wilson, 1911, p. 390; Yamaguti, 1963, p. 23.

Cephalothorax not much longer than the free trunk segments, latter becoming successively smaller backwards, genital segment not enlarged, abdomen cylindrical and very short, 4-segmented, less than a third of the total length of the body, anal laminae small. Appendages generally as in *Taeniacanthus*.

Irodes tetradontis (Bassett-Smith)

(Fig. 8)

Bassett-Smith, 1898, p. 3, pl. 1, fig. 2 (*Bomolochus*).

Carapace broader than long, anterior border deflexed downwards and perfectly rounded in dorsal view, thoracic segments 2 to 5 regularly narrowing backwards. Genital segment short, broader than the previous segment. Anal laminae 3 times as long as broad. Length not given.

Host: *Torquigener oblongus* (Bloch).

Location: Branchial cavity.

Distribution: Bombay.

As the original description is meagre, sufficient details about this species are not available. Yamaguti (1963) transferred this species to *Taeniacanthus*. Because of the uncertainty about the identity of this species I have cited only the original description.

***Irodes lagocephali* (Pearse)**

(Fig. 9)

Pearse, 1952, p. 8, figs. 1-4 (*Taeniacanthus*); Pillai, 1963 *d*, p. 124, fig. 7.

Carapace transversely ovate, with posterior transverse rib, free trunk segments swollen and subequal to the carapace in size, fifth and genital segments narrower than the fourth segment. Abdomen very short, 3-segmented, nearly a quarter of the length of the rest of the body. Egg tubes as long as body. Proximal part of distal segment of maxilliped produced. Exopods of legs 2 to 4 armed with setiform spines, segment 3 of endopod with large flanged claws. Length 2.8 mm.

Host: *Gastrophysus lunaris* (Bloch), *Lagocephalus inermis* (Schlegel).

Location: Buccal cavity.

Distribution: Texas, Kerala.

This species was originally placed in *Taeniacanthus*. It closely resembles *I. tetradontis* Bassett-Smith.

Genus *Anchistrotos* Brian

Wilson, 1911, p. 391; Yamaguti, 1963, p. 22.

Cephalothorax large, much broader than any of the trunk segments, trunk segments 2 to 4 short, decreasing in length and width backwards, genital segment not widened, as broad as fifth segment, abdomen half the length of rest of body, narrowing backwards, anal laminae small. Egg tubes stout, elongate oblong, with large eggs. Appendages generally as in *Taeniacanthus*.

***Anchistrotos sauridi* Pillai**

(Fig. 10)

Pillai, 1963 *d*, p. 126, fig. 8.

Carapace large, as long as broad, rostrum prominent and projecting, trunk segments 2 to 4 narrow, only half the width of carapace. Abdomen 4-segmented and narrowing backwards. Maxilliped a simple plate with 2 setae. Exopods of legs 2 to 4 with simple spines, segment 2 of leg 5 flattened and pear-shaped. Length 1.6 mm.

Host: *Upeneus vittatus* (Forsk.) *Saurida tumbil* (Bloch).

Location: Branchial cavity.

Distribution: Kerala.

Family BOMOLOCHIDAE

This family was recently revised by Vervoort (1962). He recognised two subfamilies Bomolochinae and Tuccinae; the latter is not represented in the present locality.

Subfamily BOMOLOCHINAE

Genus *Bomolochus* Nordmann

Vervoort, 1962, p. 9.

Head fused with first thoracic segment forming a large cephalothorax, thoracic segments 2 to 5 regularly narrowing backwards and usually slightly overlapping, rostral plate distinct. Genital segment slightly swollen, abdomen 3 to 4-segmented. Basal segments of antenna 1 flattened and armed with 14 to 15 strong densely plumose sensory setae. Antenna 2 prehensile, armed with spines and strong claws. Mandible with 2 cutting blades. Maxilla 1 with 3 to 4 long setae, paragnath present. Maxilla 2 with 2 barbed blades. Maxilliped 3-segmented, segment 3 claw-like. Leg 1 with highly flattened indistinctly segmented rami, legs 2 to 4 with 3-segmented rami, leg 5 uniramous and 2-segmented. Leg 6 formed of a bunch of 3 to 4 setae.

Bomolochus acutus Gnanamuthu

(Fig. 11)

Gnanamuthu, 1948, p. 18, figs. 1-3; Vervoort, 1962, p. 20.

Cephalothorax semicircular, together with the second trunk segment forming a perfect circle, rest of body considerably narrow and as long as the part in front, frontal sinus very deep. Antenna 1 without chitinised processes. Terminal claw of maxilliped with 2 accessory processes. Leg 1 with moderately flattened rami, rami of leg 2 subsimilar, spines on exopod barbed only on the outer side. Fifth leg 3-segmented? Length 2.7 mm.

Host: *Dussumieria acuta* Val.

Location: Gills.

Distribution: Madras.

The presence of two accessory processes on the terminal claw of the maxilliped and of a 3-segmented fifth leg, if true, will be unique. The only available description of this species is far from satisfactory.

Genus *Parabomolochus* Vervoort

Vervoort, 1962, p. 31.

Differs from *Bomolochus* as follows: Antenna 1 with 3-jointed peduncle carrying 15 setae, ventral side with chitinised plates fusing with the third to the thirteenth setae, fourth seta modified into a strong curved hook.

Parabomolochus unicirrus (Brian)

(Fig. 6)

Vervoort, 1962, p. 41; Kirtisinghe, 1964, p. 46, fig. 4 (*Bomolochus*).

Cephalothorax anteriorly flat, with wide rostral base, thoracic somites 2 to 4 gradually narrowing, thorax imperceptibly merging into the abdomen, sides of genital segment rounded. Spines on the outer border of exopod of legs 2 to 4 with 3 to 6 strong spines along their outer edge, inner edge smooth. Length 2.5 mm.

Host: *Lichia glauca* Risso, *Centriscus scutatus* Linn., *Lichia amia* Cuvier, *Sphyræna vulgaris* C. & V., *Lichia vadigo* Risso and *Tylosurus lejurus* (Bleeker).

Location: Branchial cavity,

Distribution: Italy, Ceylon, West Africa.

The above description is from Vervoort (1962). This species was recorded by Thompson and Scott (1903) and Kirtisinghe (1964) from Ceylon.

***Parabomolochus megaceros* (Heller)**

(Fig. 13)

Heller, 1865, p. 153, pl. 13, fig. 2 (*Bomolochus*); Bassett-Smith, 1898 *b*, p. 358, pl. 10, fig. 1, (*Bomolochus*); Pillai, 1965, p. 43, fig. 17 (*Bomolochus*); Vervoort, 1962, p. 43.

Carapace nearly twice as broad as long, frontal sinus shallow, second thoracic segment only slightly narrower than carapace, fourth segment transversely ovate, genital segment slightly swollen, abdomen short but stout, 3-segmented. Basal part of antenna 1 with the fourth seta modified into a long, apically curved hook, there are two simple setae, one of them very long. Claw of maxilliped strongly curved with prominent accessory process. Endopod of leg 2 more than twice as broad as exopod, latter armed with spines barbed on both sides. Length 2.9 mm.

Host: *Parastromateus niger* (Bloch.)

Location: Branchial cavity.

Distribution: Indian ocean, Bombay, Ceylon, Aden, Madras and Kerala.

According to Vervoort *B. decapteri* Shen (1957) is a synonym of this species.

***Parabomolochus selaroides* (Pillai)**

(Fig. 14)

Pillai, 1965, p. 47, fig. 19 (*Bomolochus*).

Carapace with deep frontal sinus and projecting rostral plate, genital segment not enlarged, abdomen short and 3-segmented. Basal part of antenna 1 with the fourth seta modified into a strong hook, claw of maxilliped with prominent accessory process. Endopod of leg 2 highly flattened, more than twice as broad as the exopod, latter with spiny surface, spines on exopod barbed only on the outer border, lower border pectinate, spines on legs 3 to 4 only barbed. Length 2.1 mm.

Host: *Selaroides leptolepis* (Cuvier).

Location: Branchial cavity.

Distribution: Kerala.

***Parabomolochus hemirhamphi* (Pillai)**

(Fig. 15)

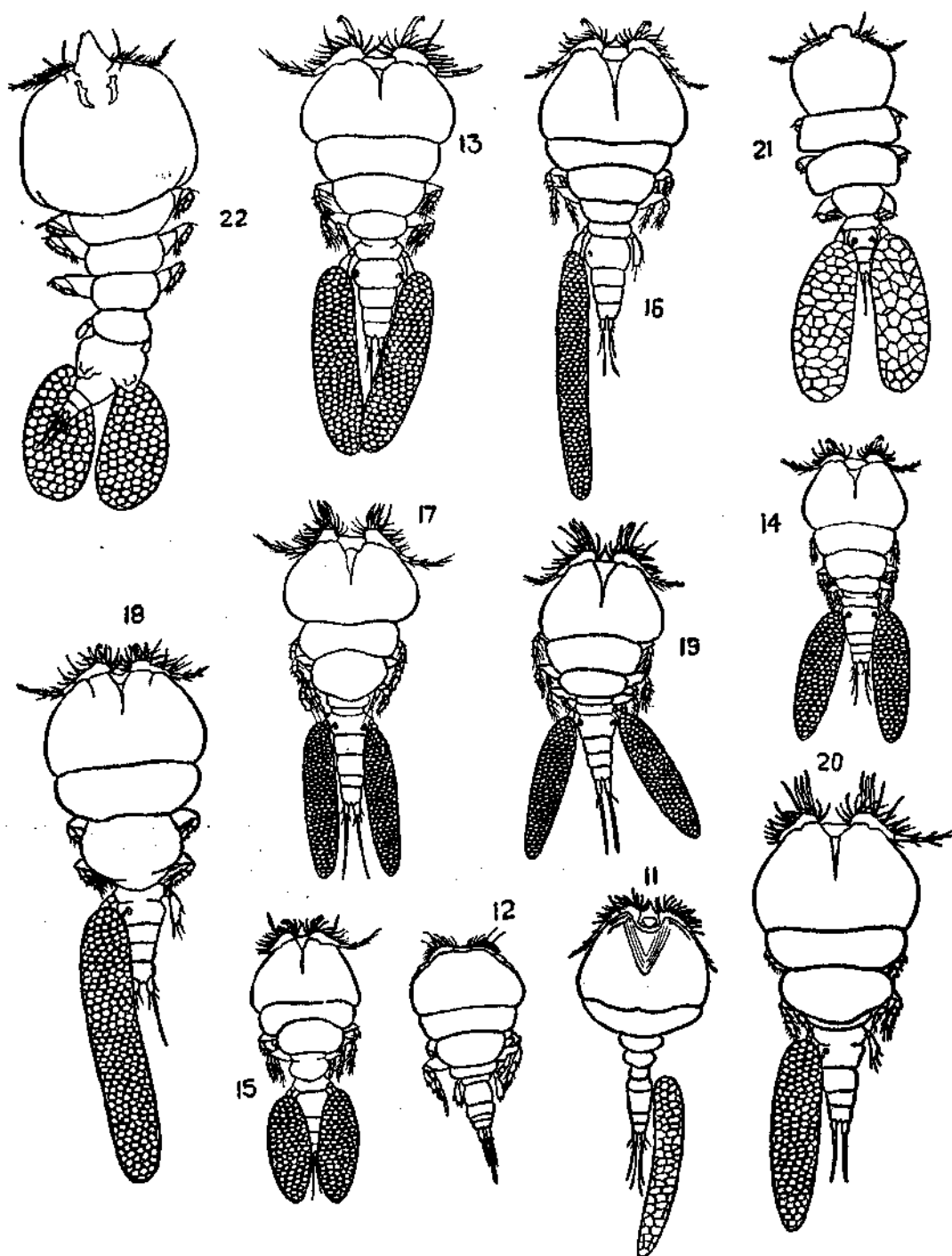
Pillai, 1965, p. 49, fig. 20 (*Bomolochus*).

Carapace hemispherical, second trunk segment slightly immersed in the carapace, third segment much narrower than the second, genital segment as broad as fifth segment. Egg sacs oblong. Basal part of antenna 1 with comparatively short hook, accessory process of claw of maxilliped strongly curved. Endopod of leg 2 twice as broad as exopod, latter armed with spines pectinate on the outer side. Length 1.8 mm.

Host: *Hemirhamphus marginatus* (Forsk.)

Location: Branchial cavity.

Distribution: Kerala.



FIGS. 11-22. (11) *Bomolochus acutus* (Gnanamuthu, 1948); (12) *Parabomolochus unicirrus* (Kirtisinghe, 1964); (13) *Parabomolochus megaceros*; (14) *Parabomolochus selaroides*; (15) *Parabomolochus hemirhamphi*; (16) *Parabomolochus monoceros*; (17) *Nothobomolochus tricerus*; (18) *Nothobomolochus denticulatus*; (19) *Nothobomolochus multispinosus*; (20) *Nothobomolochus kanagurta*; (21) *Orbitacolax aculeatus*; (22) *Pumilioopsis sardimellae*.

Parabomolochus monoceros (Pillai)

(Fig. 16)

Pillai, 1965, p. 53, fig. 22 (*Bomolochus*).

Carapace with deep frontal sinus and projecting rostral plate, trunk somites regularly narrowing to the fifth, genital segment broader than the adjacent segments. Egg sacs slender and very long. Hook on basal part of antenna 1 intermediate in length between that of *P. hemirhamphi* and *P. megaceros*. Accessory process of maxilliped strong and slightly curved. Endopod of leg 2 twice as broad as exopod, spines arming the exopod barbed on both edges, spines on the third exopod barbed only on the outer side. Distal segment of leg 5 long and strongly spiny. Length 1.9 mm.

Host: *Carangoides malabaricus* (Bloch).*Location*: Buccal cavity.*Distribution*: Kerala.Genus *Nothobomolochus* Vervoort

Vervoort, 1962, p. 58.

Differs from *Bomolochus* as follows: Third thoracic somite often produced backwards and overlapping the fourth. Basal part of antenna 1 with a chitinated plate, finger-shaped processes of which fuse with the third to the fifth setae converting them into spines and altering the shape of the appendage. Claw of maxilliped without accessory process, a knob may be present.

Nothobomolochus tricerus (Bassett-Smith)

(Fig. 17)

Bassett-Smith, 1898, p. 2, pl. 1, fig. 1 (*Bomolochus*); Vervoort, 1962, p. 64; Pillai, 1965, p. 39, fig. 15 (*Bomolochus*).

Carapace broader than long, frontal sinus deep, third trunk segment produced and covering the fourth, genital segment not broader than fifth segment, abdomen long and 4-jointed. Basal part of antenna 1 with 3 subequal processes, median process apically blunt and strongly chitinated, others apically pointed and transversely wrinkled. Claw of maxilliped very long, without accessory process. Endopod of leg 2 only slightly broader than exopod, spines on exopod barbed on both sides, with long stiff apical spinule. Distal segment of leg 5 well armed. Length 2.2 mm.

Host: *Pampus argenteus* (Euphrasen).*Location*: Branchial cavity.*Distribution*: Bombay and Kerala.*Nothobomolochus denticulatus* (Bassett-Smith)

(Fig. 18)

Bassett-Smith, 1898 a, p. 77, pl. 3, fig. 1 (*Bomolochus*); Vervoort, 1962, p. 65; Pillai, 1965, p. 41, fig. 16 (*Bomolochus*).

Carapace nearly semicircular, with comparatively shallow frontal sinus. Second trunk somite only slightly narrower than carapace, third somite triangular, completely overlapping fourth segment, fifth segment much broader than long. Abdomen short, 3-segmented. Basal part of antenna 1

with a projecting plate carrying 3 comparatively short processes, median process longest, chitinised, apically blunt and curved, lateral processes apically pointed and transversely wrinkled. Claw of maxilliped without accessory process. Endopod of leg 1 slightly less than twice the width of exopod, spines on exopod armed with a few barbs on the outer side. Length 2.6 mm.

Host: *Sphyræna jello* Cuvier.

Location: Branchial cavity.

Distribution: Bombay and Kerala.

Nothobomolochus multispinosus (Gnanamuthu)

(Fig. 19)

Gnanamuthu, 1947, p. 309, figs. 1-5 (*Bomolochus*); Vervoort, 1962, p. 68; Pillai, 1965, p. 45, fig. 18 (*Bomolochus*).

Carapace nearly one and a half times as broad as long, frontal sinus deep, second trunk somite transversely rectangular, third partially overlapping fourth, fourth and fifth very short. Abdomen 3-segmented, anal laminae 3 times as long as broad. Basal part of antenna 1 with 3 long chitinised processes, median process longer and stouter than the others. Claw of maxilliped without accessory process. Endopod of leg 2 only slightly broader than exopod, spines on exopod naked, with an apical fork lodging a flexible seta. Length 2.3 mm.

Host: *Dussumieria acuta* Val., *D. hasseltii* Bleeker.

Location: Branchial cavity.

Distribution: Madras, Kerala.

Nothobomolochus scomberesocis (Kroyer)

Thompson and Scott, 1903, p. 259 (*Bomolochus*); Vervoort, 1962, p. 61; Kirtisinghe, 1964, p. 47, fig. 5 (*Bomolochus*).

Carapace twice as broad as long, second trunk somite much narrower, third produced backwards and covering fourth, abdomen short. Base of antenna 1 with a tripartite dorsal plate, the spines widely diverging and finger-shaped, the median process longer than the lateral ones. Claw of maxilliped without accessory process. Length 2.0 mm.

Host: *Scomberesox* sp., *S. saurus* Walbaum, *Selaroides leptolepis* Cuvier.

Location: Branchial cavity.

Distribution: Atlantic ocean, N.E. Spain and Ceylon.

According to Vervoort (1962) the record of this species from Ceylon is questionable. Kirtisinghe considered *B. denticulatus* Bassett-Smith as a synonym of this species. I have no specimens and the above characters were taken from Vervoort (1962).

Nothobomolochus kanagurta (Pillai)

(Fig. 20)

Pillai, 1965, p. 51, fig. 21 (*Bomolochus*).

Body tumid, carapace broader than long, with nearly straight hind border; second trunk segment only slightly narrower than carapace, its hind border concave, third somite produced backwards and overlapping the fourth and part of the fifth, abdomen 3-segmented. Basal part of antenna 1

with a projecting plate carrying 3 spines, middle spine chitinated and shorter than the others, claw of maxilliped short, with an accessory knob. Endopod of leg 2 less than twice as broad as exopod, spines arming latter barbed on the outer side, endopod of leg 3 broader than exopod. Maxillae 1 and 2 very characteristic. Length 2.5 mm.

Host: *Rastrelliger kanagurta* (Cuvier).

Location: Branchial cavity.

Distribution: Kerala.

Genus *Orbitacolax* Shen

Shen, 1957, p. 316; Vervoort, 1962, p. 79.

Cephalothorax not much broader than the trunk somites, variously shaped, rostrum prominent and projecting. Trunk somites 2 to 4 broad, fifth abruptly narrowed, genital somite swollen, abdomen short. Base of antenna 1 with none of the setae modified. Cephalic appendages as in *Bomolochus*. Endopod of leg 1 highly flattened, legs 2 to 4 projecting, with expanded basipod, rami 3-segmented, with much reduced armature, spines setiform, setae pectinate, not plumose.

Orbitacolax aculeatus (Pillai)

(Fig. 21)

Pillai, 1962, p. 610, fig. 1 (*Bomolochus*).

Carapace with a short projecting rostral plate, broader than long. Trunk somites 2 to 3 as broad as carapace, fourth abruptly narrowed, fifth somite small, genital segment swollen, abdomen 3-segmented and spiny. Distal segment of maxilla 2 proximally produced. Claw of maxilliped comparatively short, curved like an S, with very small accessory process. Distal segment of maxilla 2 produced proximally backwards. Legs with prominently spiny surface, third endopod segment of leg 4 small, with a very long apical seta. Length 1.3 mm.

Host: *Rastrelliger kanagurta* (Cuvier).

Location: Branchial cavity.

Distribution: India.

This species was originally described under *Bomolochus*, but in the light of the recent revision of the family it has to come under *Orbitacolax* Shen.

Genus *Pumiliopsis* Pillai

Pillai, 1967, p. 249, figs. 1-29.

Cephalothorax swollen, rostrum triangular, longer than broad. Trunk somites 2 to 5 much narrower than carapace, genital segment swollen, abdomen short, 3-segmented. Egg sacs oblong, eggs large. Antenna 1 without modified setae. Leg 1 highly flattened, endopod 2-jointed. Rami of legs 2 to 4 2-jointed and spiny, with reduced armature, apical claw of exopod strong and barbed, endopod of leg 4 3-segmented, leg 5 2-segmented.

Pumiliopsis sardinellae (Bennet)

(Fig. 22)

Bennet, 1964, p. 84, figs. 1-2 (*Bomolochus*); Pillai, 1967, p. 250, figs. 1-29.

Cephalothorax comparatively very large, with conical rostrum, latter longer than broad, rest of body narrow. Second trunk somite much narrower than carapace, genital segment enlarged.

Abdomen short and 3-segmented. Antenna 1 7-segmented, basal part with 15 normal setae. Maxilla 1 with 3 setae, middle seta very long. Second segment of maxilliped very long, claw only very slightly curved, without accessory process. Endopod of leg 1 2-segmented, flattened and sparsely setose. Basipod of legs 2 to 4 large, rami, except the endopod of leg 4, 2-jointed and spiny. Length 2.1 mm.

Host: *Sardinella albella* (Val.).

Location: On eye ball.

Distribution: Gulf of Mannar.

This species originally described under *Bomolochus* certainly belongs to a new genus.

Family CHONDRACANTHIDAE

Genus *Chondracanthus* De La Roche

Wilson, 1932 p. 497; Barnard, 1955, p. 285; Yamaguti, 1963, p. 272.

Head separated from thorax by a more or less constricted neck, with barb-like processes at each hind corner. First 2 thoracic segments more or less free, other segments fused with genital segment, with paired processes. Abdomen very small, with small caudal rami. Antenna 2 prehensile. 2 pairs of fleshy biramous legs. Ovisacs multiseriate.

Chondracanthus alatus Heller

(Fig. 23)

Heller, 1865, p. 175; Bassett-Smith, 1898, p. 13; Kirtisinghe, 1950, p. 85, figs. 44-51 (*Protochondracanthus psettodes*); 1956, p. 20; 1964, p. 48, figs. 7-9; Pillai, 1964, p. 76, figs. 109-120.

Body long and depressed, remotely fusiform. Head asymmetrical, postero-laterally produced, into triangular processes, dorsal side with 3 subparallel grooves. Trunk segments completely fused with a prominent neck constriction but no septum. Anterior part of trunk with a pair of long slender processes carrying 3 small apical teeth, postero-lateral parts produced into blunt lobes. Abdomen 2-segmented. Egg tubes slender and longer than body. Legs 1 and 2 with unsegmented rami, rami with spines. Anal laminae as long as distal segment of abdomen, apically drawn out. Length 5.2 mm.

Host: *Psettodes erumei* (Bloch).

Location: Gills.

Distribution: Singapore, Bombay, Ceylon and Kerala.

Chondracanthus trilobatus Pillai

(Fig. 24)

Pillai, 1964, p. 78, figs. 121-132.

Body elongate, cylindrical, narrowing backwards, always twisted to one side. Head large, broader than long, anterior border prominently trilobed. Anterior part of trunk with a pair of long slender lateral processes. Trunk nearly 5 times as long as head, postero-laterally produced into blunt lobes. Abdomen 1-segmented, as long as broad. Anal laminae long. Egg sacs shorter than trunk. Length 2.9 mm.

Host: Psettodes erumei (Bloch).

Location: Gills.

Distribution: Kerala.

***Chondracanthus elongatus* Bassett-Smith**

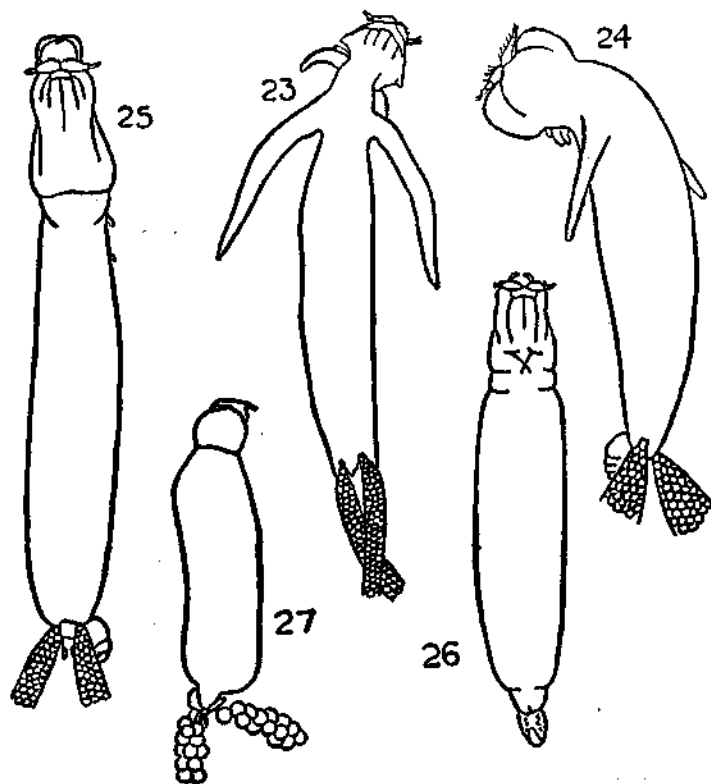
Bassett-Smith, 1898, p. 13, figs. 4–6.

Head oblong, with greatly indented sides and well-marked medio-dorsal groove, one-seventh the total length. Trunk with 2 pairs of slender processes, bifurcate at tip. Genital segment long and cylindrical, posteriorly produced into long processes about a third of the length of the trunk. Abdomen short, anal laminae long. Length 6.0 mm.

Host: Solea sp.

Location: Gills.

Distribution: Bombay.



FIGS. 23–27. (23) *Chondracanthus alatus*; (24) *Chondracanthus trilobatus*; (25) *Pseudochondracanthus longitruncus*; (26) *Pseudochondracanthus* sp.; (27) *Heterochondria longa* (Tripathi, 1960).

Genus *Pseudochondracanthus* Wilson

Wilson, 1932, p. 495; Yamaguti, 1963, p. 294.

Head distinctly separated from first trunk segment, with a small dorsal carapace, first segment free, others including the genital segment, fused into an elongate body without any trace of segmentation. Abdomen small, 2-segmented, anal laminae present.

Pseudochondracanthus longitruncus Yamaguti

(Fig. 25)

Yamaguti, 1939 *b*, p. 541, pl. 40, figs. 62-65, pl. 41, figs. 66-71; Pillai, 1964, p. 79, figs. 133-148.

Body long and cylindrical, demarcated into head and trunk. Anterior border of head trilobed, lateral borders constricted at the anterior one-third, dorsal side with 5 longitudinal ridges. First trunk segment faintly indicated, others fused into a long trunk, 3 times the length of head. Abdomen short, 2-segmented, anal laminae slightly longer than distal abdominal segment. Legs 2 pairs, first bilobed, second uniramous. Length 3.6 mm.

Host: *Pseudorhombus arsius* (Ham. Buch.).

Location: Gills.

Distribution: Japan, Kerala.

Pseudochondracanthus sp.

(Fig. 26)

Pillai, 1964, p. 81, figs. 149-150.

Differing from *P. longitruncus* as follows: Cephalon and trunk shorter and more plump. Abdomen 1-segmented. First trunk segment distinct. Both legs bilobed. Length 2.3 mm.

Host: *Plagusia* sp.

Location: Buccal cavity.

Distribution: Kerala.

Genus *Heterochondria* Yu

Yamaguti, 1963, p. 286.

Body elongate, head projecting laterally at the region of the second antenna, trunk elongate-ovate to subcylindrical, without segmentation, lobes or processes. Abdomen small, 2-segmented, anal laminae present. Antenna 1 cylindrical, usually 1-segmented, antenna 2 with strong prehensile claw. Mandible toothed on both sides. Maxilla blade-like, spiny along convex margin, apically bifid. Maxilliped with distal segment smaller than basal. Legs 1 or 2 pairs, bilobed or not.

Heterochondria longa Tripathi

(Fig. 27)

Tripathi, 1960, p. 51, figs. 1-10.

Cephalon roughly circular, fused with first trunk segment, trunk long and cylindrical. Genital segment slightly longer than broad. Abdominal segments subequal in length, anal laminae as long as abdomen. Antenna 1 biramous, antenna 2 2-jointed. Leg 1 biramous, with 2-jointed rami, leg 2 uniramous and 1-jointed. Length 1.9 mm.

Host: *Pseudorhombus arsius* (Ham. Buch.), *P. triocellatus* (Bloch).

Location : Not given.

Distribution : Orissa, Madras.

Genus *Acanthochondria* Oakley

Yamaguti, 1963, p. 275.

Head distinct from trunk, first 2 trunk segments free, others fused into a trunk produced postero-laterally, no other trunk processes. Abdomen small, 2-segmented, anal laminae small, present or not. Legs 2 pairs, varying in shape.

Acanthochondria cornuta (Muller)

Thompson and Scott, 1903, p. 294; Scott and Scott, 1913, p. 168, pl. 47, figs. 1-2, pl. 52, fig. 5, pl. 53, figs. 1-9 (*Chondracanthus*); Kirtisinghe, 1964, p. 50.

Head ovate, somewhat longer than broad, thorax narrow. Genital segment wider than head, moderately elongated and usually with a constriction dividing it into subequal portions; postero-lateral corners of the genital segment produced backwards into narrow processes. Abdomen very small, 2-segmented and rather shorter than the lateral processes of the genital segment. Length 6.0 mm.

Host : *Cynoglossus macrolepidotus* (Bleeker).

Location : Gills.

Distribution : North Sea, English Channel, North America, Ceylon.

Description from Kirtisinghe (1964).

Acanthochondria cynoglottidis (Thompson and Scott)

Thompson and Scott, 1903, p. 294, fig. 1 (*Chondracanthus*); Oakley, 1930, p. 186; Kirtisinghe, 1954, p. 49.

Head rounded, as wide as the widest part of the body. Latter narrow for about a third of its length from the front end when it expands at the genital segment. Abdomen small, 1-segmented, caudal rami small and tapering. Length 4.65 mm.

Host : *Cynoglossus puncticeps* (Richardson), *C. brachycephalus* Bleeker.

Location : Nasal caecum.

Distribution : Ceylon.

Description from Kirtisinghe (1964).

Suborder CALIGOIDA

Family CALIGIDAE

Genus *Caligus* Muller

Yamaguti, 1963, p. 47.

Head fused with first 3 thoracic segments forming a cephalothorax, fourth thoracic segment free, segments 5 and 6 fused and enlarged forming the genital segment. Abdomen slender, generally 2-segmented. Antenna 1, 2-segmented, basal joint partially fused with the carapace and

associated with an attachment organ called lunule. Antenna 2 prehensile, 3-segmented, first segment fused with carapace. Maxilla 1 a simple chitinated process. Maxilla 2 a triangular process with a palp composed of a small process generally carrying 3 setae. Maxilliped 1 2-segmented, distal segment with an outer thin lobe and 2 distal claws. Maxilliped 2 2 or 3-segmented, falcate. Sternal fork generally present. Legs 1 and 4 uniramous, 2 and 3 biramous, basipods of leg 3 fused and forming a broad apron. Legs 5 and 6 vestigial.

Caligus coryphaenae Stp. & Lutk.

(Fig. 28)

Shiino, 1959 *b*, p. 2, figs. 1-2; Pillai, 1963 *b*, p. 514, fig. 1; Kirtisinghe, 1964, p. 50, figs. 10-21 (in part).

Carapace distinctly longer than broad, with the postero-median lobe nearly 3 times as broad as lateral lobes. Fourth thoracic segment much broader than long. Genital segment swollen, antero-laterally shoulder-like and postero-laterally produced into rounded lobes. Abdomen indistinctly 4 to 6-segmented. Anal laminae squarish, sunk into the abdomen. Antenna 1 with long setae. Maxilla 1 absent. Sternal fork with pointed diverging limbs. Second and third claws of distal segment of leg 1 with broad serrate dorsal crest and accessory claw. Basal claw of leg 3 winged and slightly curved outwards. Leg 4 4-jointed, last claw one and a half times the length of the penultimate. Length 7.0 mm.

Host: Various fishes mainly scomberoid, *Euthynnus affinis* (Cantor).

Location: Surface of body.

Distribution: Circumtropical.

Caligus euthynnus Kurian

(Fig. 29)

Kurian, 1961, p. 63, figs. 1-15; Heegaard, 1962, p. 156, figs. 37-44 (*alveolaris*); Pillai, 1963 *a*, p. 520, fig. 4; Kirtisinghe, 1964, p. 50, figs. 10-21 (*coryphaenae* in part).

Differing from *C. coryphaenae* as follows: Fourth thoracic segment longer. Postero-lateral lobes of genital segment rounded and overlapping abdomen, abdomen 2-segmented, first segment slightly swollen. Anal laminae with a strong outer spine. Sternal fork with apically blunt parallel limbs. Basal claw of exopod of leg 3 curved inwards. Last claw of leg 4 only slightly longer than the penultimate. Length 4.4 mm.

Host: *Euthynnus affinis* (Cantor).

Location: Surface of body.

Distribution: Kerala and Ceylon.

Caligus asymmetricus (Pillai) Kabata

(Fig. 30)

Pillai, 1963 *a*, p. 89, fig. 14 (*thynni*); Kabata, 1965 *a*, p. 110, figs. 1 B, D, E.

Carapace remotely triangular, with projecting frontal plates, lunules as deep as frontal plates. Postero-median lobe about 4 times as broad as lateral lobes and projecting far beyond them. Posterior sinuses fully open. Genital segment swollen, longer than broad, broader behind, its hind border nearly transverse. Abdomen nearly squarish, with the anal laminae sunk into it. Sternal fork asymmetrical. Distal segment of exopod of leg 1 very characteristically armed, first

claw stout and directed outwards, second and third with large accessory claw and directed backwards. Basal segment of endopod of leg 2 with 4 teeth and second segment with a row of strong teeth, leg 4 3-segmented, last claw about two-and-a-half times as long as the previous. Length 3.5 mm.

Host: *Euthynnus affinis* (Cantor), *E. alliteratus* (Rafinesque).

Location: Gill arch.

Distribution: Kerala and Queensland.

Caligus arii Bassett-Smith

(Fig. 31)

Bassett-Smith, 1898 *a*, p. 82, pl. 4, fig. 1; Pillai, 1963 *a*, p. 71, fig. 3; nec Barnard, 1955, p. 248, fig. 10 *a-b*.

Genital segment longer than abdomen, distally subtruncate. Abdomen long and slender, 2-segmented, second segment very small, anal laminae minute. Maxilla 1 absent. Maxilla 2 very weak and slender. Sternal fork with spatulate limbs. Endopod of leg 1 stout and spiny, claws on distal segment winged and bifid. Claws on exopod of leg 2 small. Apron of leg 3 reduced in size, rami broad. Leg 4 4-segmented. Length 6.0 mm.

Host: *Pseudarius jatus* (H.B.).

Location: Buccal cavity.

Distribution: Bombay and Kerala.

Caligus hamruri Pillai

(Fig. 32)

Pillai, 1964, p. 61, figs. 1-13.

Carapace nearly circular, frontal plates with deep circular lunules. Antero-lateral borders of carapace with small incision, postero-median lobe twice as broad as lateral lobes and projecting far beyond the latter. Genital segment swollen, with rounded postero-lateral parts. Abdomen short, 2-segmented. Basal segment of maxilliped 2 with a stout hollowed projection. The claws arming the distal segment of leg 1 apically subtruncate. Length 3.0 mm.

Host: *Priacanthus hamrur* (Forsk.).

Location: Buccal cavity.

Distribution: Kerala.

Caligus priacanthi Pillai

(Fig. 33)

Pillai, 1961, p. 104, fig. 11.

Carapace large, postero-median lobe slightly more than twice as broad as lateral lobes, with rounded corners. Abdomen short and 1-segmented. Distal claw of maxilliped 1 with 2 rows of strong teeth. Basal segment of leg 1 with 1 short and 3 long claws, first 2 claws of exopod of leg 2 with an outer row of strong teeth. Length 2.9 mm.

Host: *Priacanthus hamrur* (Forsk.),

Location: Branchial cavity.

Distribution: Kerala.

Caligus lagocephali Pillai

(Fig. 34)

Pillai, 1961, p. 107, fig. 12.

Lateral parts of carapace folded ventralwards making it appear longer than broad, postero-medial lobe about 5 times as broad as lateral lobes and projecting. Genital segment longer than broad. Abdomen 2-segmented, segment 1 twice as long as segment 2. Segment 1 of antenna 2 with an unusually large process. Basal segment of maxilliped 2 with a large conical process. Distal segment of leg 1 without ventral setae. Second segment of endopod of leg 2 with 4 rows of teeth. Length 2.8 mm.

Host: *Lagocephalus inermis* (Schlegel).

Location: Buccal cavity.

Distribution: Kerala.

Caligus clavatus Kirtisinghe

(Fig. 35)

Pillai, 1963 a, p. 90, fig. 15 (*sphyraeni*); Kirtisinghe, 1964, p. 63, figs. 51-56.

Carapace as long as broad, with projecting frontal plates. Posteromedian lobe slightly broader than lateral lobes and projecting slightly beyond them. Genital segment very large, longer than broad and only slightly narrower than carapace, resembling a short-necked round-bottomed flask, abdomen long, 1-segmented and swollen, slightly shorter than genital segment. Distal exopod segment of leg 1 with 3 very small ventral setae. Basal segment of endopod of leg 2 with a crest of spines, spines on exopod with broad serrate wings. Leg 4 4-segmented, with subequal claws. Length 3.4 mm.

Host: *Sphyræna jello* Cuvier, *S. obtusata* Cuvier.

Location: Branchial cavity.

Distribution: Kerala and Ceylon.

Caligus quadratus Shiino

(Fig. 36)

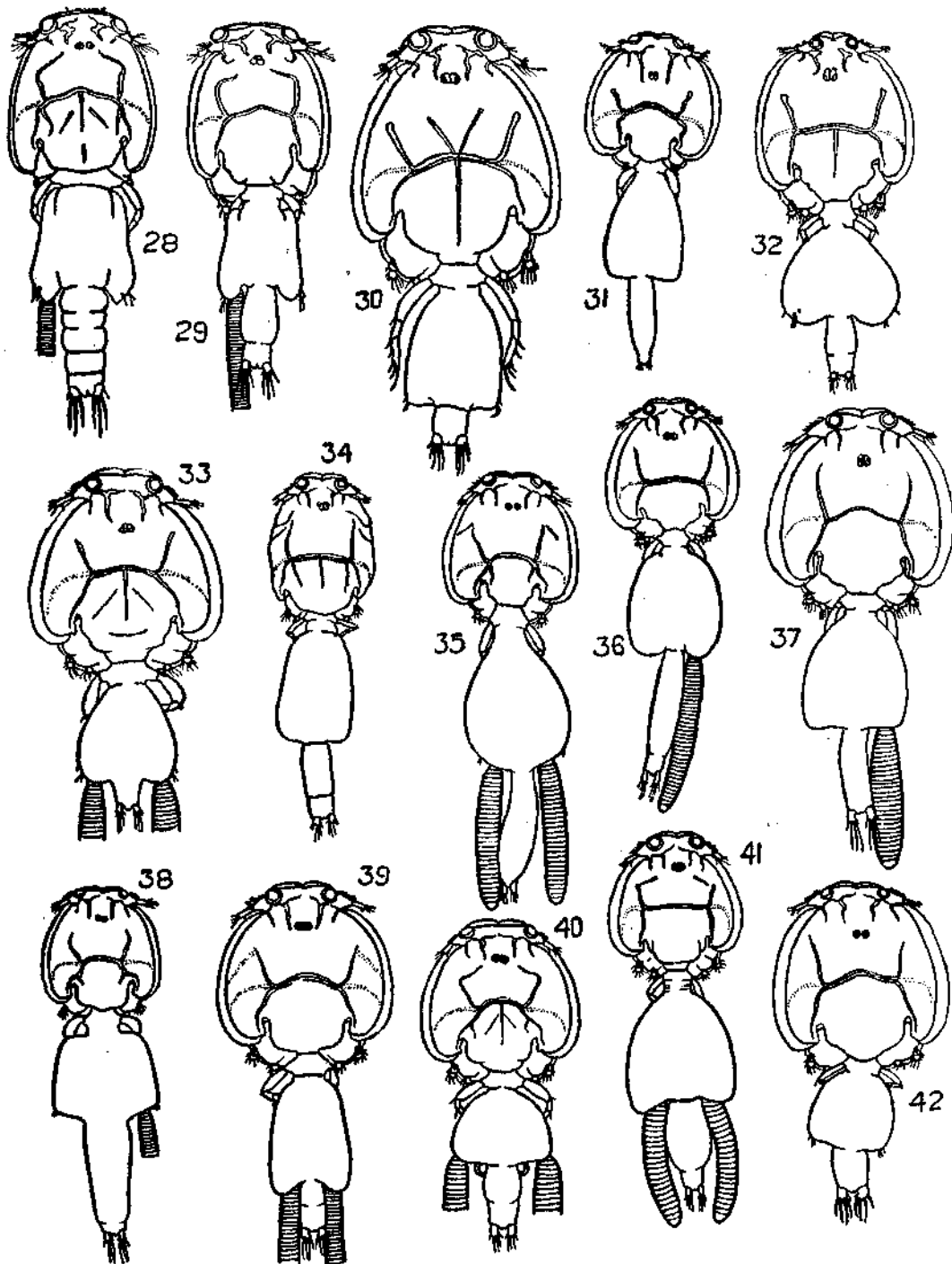
Shiino, 1954, p. 26, figs; 1959 b, p. 8, figs. 3-5; Pillai, 1964, p. 61.

Carapace almost circular, postero-medial lobe twice as broad as lateral lobes. Genital segment swollen, longer than broad, with short anterior neck-like part. Abdomen elongated and 2-segmented, as long as genital segment. Sternal fork with straight diverging limbs. First two segments of endopod of leg 2 with closely packed spines, leg 4 3-segmented. Length 6.0 mm.

Host: *Coryphaena hippurus* Linn.

Location: Branchial cavity.

Distribution: Pacific, Atlantic and Indian oceans,



FIGS. 28-42. (28) *Caligus coryphaenae*; (29) *Caligus euthynus*; (30) *Caligus asymmetricus*; (31) *Caligus arii*; (32) *Caligus hamruri*; (33) *Caligus priacanthi*; (34) *Caligus lagocephali*; (35) *Caligus clavatus*; (36) *Caligus quadatus*; (37) *Caligus auxisi*; (38) *Caligus cybil*; (39) *Caligus indicus*; (40) *Caligus laticaudus*; (41) *Caligus malabaricus*; (42) *Caligus russellii*.

To some extent this species resembles *C. longicaudatus* Bassett-Smith but can be distinguished by the nearly circular carapace and the longer abdomen.

***Caligus auxisi* Pillai**

(Fig. 37)

Pillai, 1963 *a*, p. 85, fig. 12.

Carapace nearly equal in length and width, postero-median lobe projecting well beyond lateral lobes. Genital segment swollen, inverted U-shaped, with transverse hind border. Abdomen long and slender, 1-segmented. Sternal fork with narrow base and long subparallel limbs, with broad wings. Distal exopod segment of leg 1 with 3 very short lower setae. First and second segments of endopod of leg 2 with strong teeth, setae on third segment with basal spines and distal hairs. Leg 4 3-segmented, basal segment longer than rest of the limb, inner border of first and second segments spiny. Length 3.8 mm.

Host: *Auxis thazard* (Lacepede).

Location: Branchial cavity.

Distribution: Kerala.

This species closely resembles *C. kuroshio* Shiino and *C. indicus* Pillai but differs in the shape of the abdomen and the sternal fork.

***Caligus cybii* Bassett-Smith**

(Fig. 38)

Bassett-Smith, 1898, p. 6, pl. 2, fig. 3; Pillai, 1961, p. 87, fig. 1 (*brevisoris*); Kirtisinghe, 1964, p. 58, figs. 33-34.

Abdomen longer than genital segment, 2-segmented, distal segment very short. Distal segment of antenna 1 with long setae. Distal exopod segment of leg 1 with 4 long claws successively increasing in length. Leg 4 4-segmented, with long spiny lobes at the base of the claws. Length 6.0 mm.

Host: *Indocybium guttatum* (Bloch & Schn.), *I. lineolatum* (Cuvier), *Cybium commersoni* (Lacepede).

Location: Branchial cavity.

Distribution: Bombay, Kerala and Ceylon.

Kirtisinghe's opinion that *C. brevisoris* Pillai (1961) is *C. cybii* Bassett-Smith seems correct. However, the original description of this species by Bassett-Smith is very inadequate.

***Caligus indicus* Pillai**

(Fig. 39)

Pillai, 1961, p. 102, fig. 9.

Carapace circular, with broad projecting postero-median lobe. Genital segment broader behind, longer than broad. Abdomen short 2-segmented. Spine at lower distal angle of distal segment of leg 1 very long, leg 4 3-segmented, apical claw about 3 times the length of the penultimate claw. Length 6.3 mm.

Host: *Trachinotus blochi* (Lacepede).

Location: Branchial cavity.

Distribution: Kerala.

***Caligus laticaudus* Shiino**

(Fig. 40)

Shiino, 1960 *a*, p. 482, figs. 5-6; Pillai, 1961, p. 91, fig. 3.

Genital segment hemispherical, abdomen as long as genital segment, 2-segmented, first segment swollen. Basal segment of maxilliped 2 with a spooned process. Leg 4 4-segmented, with 5 long winged claws. Length 2.6 mm.

Host: *Polynemus heptadactylus* Cuvier, *Rhabdosargus sarba* (Forsk.) *Pagrosomus major* (Basilewsky).

Location: Branchial cavity.

Distribution: Japan and Kerala.

***Caligus malabaricus* Pillai**

(Fig. 41)

Pillai, 1961, p. 109, fig. 13.

Carapace narrower in front, with large frontal plates and lunules, postero-median lobe projecting far beyond lateral lobes. Genital segment large, roughly semicircular, as broad as carapace. Abdomen 2-segmented, first segment large, swollen and elliptic, second segment short and squarish. Distal inferior claw of leg 1 long and plumose, basal part of ventral setae spiny. Second endopod segment of leg 2 with overlapping rows of strong teeth. Leg 4 3-segmented. Length 4.4 mm.

Host: *Tylosurus crocodilus* (Le Sueur).

Location: Buccal cavity.

Distribution: Kerala.

***Caligus russellii* Kurian**

(Fig. 42)

Kurian, 1950, p. 2, figs. 2-15; Pillai, 1963 *a*, p. 79, fig. 8.

Carapace roughly equal in length and width, postero-median lobe very broad and produced beyond lateral lobes. Genital segment roughly equal in length and width, abdomen short and 1-segmented. Sternal fork with wide massive base and widely separate winged rami. Fourth claw of leg 1 very long. Third claw of exopod of leg 2 minute. Leg 4 3-segmented, apical claw very long. Length 5.8 mm.

Host: *Pterois russellii* Bennett, *P. miles* (Bennett).

Location: Surface of body.

Distribution: Kerala.

Caligus amblygenitalis Pillai

(Fig. 43)

Pillai, 1961, p. 98, fig. 7.

Carapace longer than broad, with large projecting postero-median lobe nearly 4 times as broad as lateral lobes. Genital segment very large, as long as carapace, with rounded posterior lobes. Abdomen 1-segmented. Second claw of exopod of leg 2 with a row of teeth. Leg 4 3-segmented, with 4 claws. Length 3.2 mm.

Host: *Euthymus affinis* (Cantor).

Location: Surface of body.

Distribution: Kerala.

Caligus confusus Pillai

(Fig. 44)

Kirtisinghe, 1937 *a*, p. 435, figs. 1-14 (*alalongae*); Wilson, 1937, p. 25, pl. 3, figs. 3 *a-i* (*constrictus*); Yamaguti, 1964, p. 379, pl. 2, fig. 19, pl. 3, fig. 21 (*alalongae*); Shiino, 1959, p. 285, figs. 9-10 (*constrictus*); Pillai, 1961, p. 104, fig. 10; Kirtisinghe, 1964, p. 68, figs. 70-71.

Carapace large and perfectly circular, postero-median lobe only slightly broader than lateral lobes and meeting the incurved lateral lobes, posterior sinuses closed. Genital segment broadening backwards. Abdomen apparently 2-segmented, very short and nearly rounded. Maxilla 1 with 1 and maxilla 2 with 2 accessory processes. Sternal fork with parallel apically acute and externally winged rami. Length 2.9 mm.

Host: *Caranx sanson* (Forsk.) *Coryphaena hippurus* Linn.

Location: Buccal and branchial cavities.

Distribution: Ceylon, Panama, Galapagos, Celebes, Japan and Kerala.

Caligus kuroshio Shiino

(Fig. 45)

Shiino, 1959 *a*, p. 51, figs. 1-2; Pillai, 1963 *a*, p. 80, fig. 9; Kabata, 1965 *a*, p. 120, fig. 2 D, E.

Carapace slightly broader than long, frontal plates projecting with deep circular lunules, postero-median lobe of carapace projecting well beyond lateral lobes. Genital segment enlarged and broadening backwards. Abdomen slender, as long as genital segment, indistinctly 2-segmented, first segment nearly 4 times as long as second. Maxilla 1 long, slender and curved. Sternal fork with slender bracket-shaped rami. Leg 1 with prominently spiny basipod. Basal segment of endopod of leg 2 with 3 large spines and second segment with 2 rows of strong teeth. Leg 4 3-segmented, basal segment longer than rest of the limb. Length 4.2 mm.

Host: *Euthymus affinis* (Cantor).

Location: Gill arches.

Distribution: Japan, India and Queensland.

This species closely resembles *C. bonito* Wilson.

Caligus kanagurta Pillai

(Fig. 46)

Pillai, 1961, p. 100, fig. 8.

Genital segment reniform, broader than carapace. Abdomen 2-segmented, longer than carapace, first segment long and swollen, second segment short. Second segment of antenna 1 with long inferior distal setae. Leg 4 4-segmented, with 5 claws crowded and strongly feathery, each with a long process at its base. Length 4.2 mm.

Host: *Rastrelliger kanagurta* (Cuvier).

Location: Branchial cavity.

Distribution: Kerala.

Caligus annularis Yamaguti

(Fig. 47)

Yamaguti, 1954, p. 385, figs. 33-34; Pillai (in press, *f*).

Carapace nearly circular, with projecting frontal plates, lunules large and circular, postero-median lobe projecting well beyond lateral lobes. Genital segment roughly triangular with rounded corners. Abdomen 1-segmented. Antenna 2 with large basal process. Maxilla 1 strong and falcate. Sternal fork with bracket-shaped limbs. Distal segment of leg 1 without ventral setae. Second segment of endopod of leg 2 with rows of teeth. Leg 4 3-segmented. Length 2.3 mm.

Host: *Otolithus maculatus* (Cuvier), *Otolithus* sp., *Caranx* sp.

Location: Gills.

Distribution: Celebes, Japan and Kerala.

Caligus platurus Kirtisinghe

(Fig. 48)

Kirtisinghe, 1964, p. 61, figs. 38-48; Pillai (in press, *f*).

Carapace proportionately wide, narrowing forwards, frontal plates narrow, with projecting lunules. Postero-lateral lobes curving inwards and closing the posterior sinuses. Fourth segment small, genital segment enlarged, with rounded postero-lateral lobes, abdomen 1-segmented, semi-circular, anal laminae minute. Maxilla 2 with an accessory process. Sternal fork with stout base and short parallel rami. Outer claw of exopod of leg 3 strongly curved. Leg 4 stout and 4-segmented. Length 4.0 mm.

Host: *Caranx melanampygus* Cuvier, *Caranx* sp.

Location: Branchial cavity.

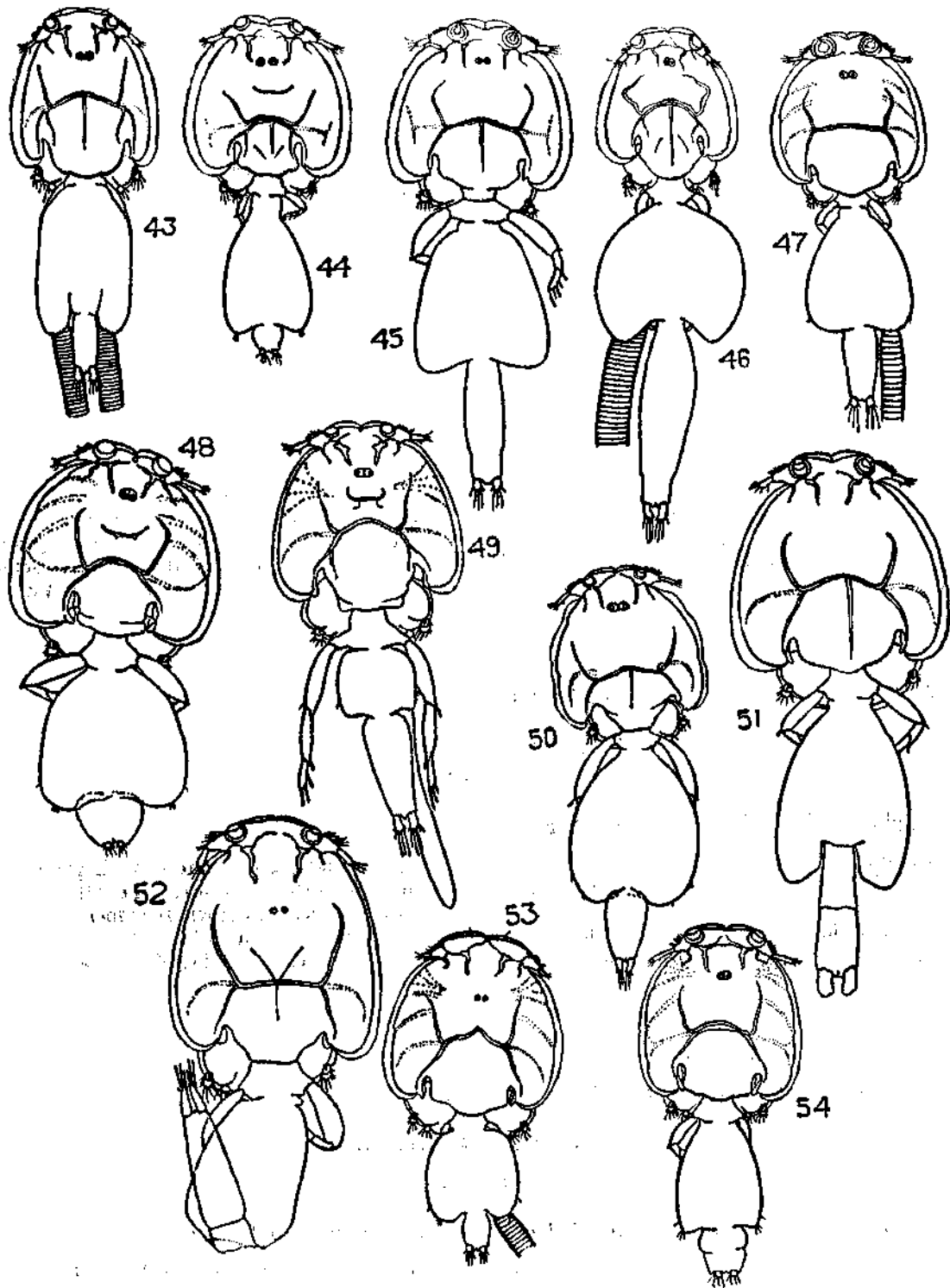
Distribution: Ceylon and Kerala.

Caligus dasyaticus Rangnekar

(Fig. 49)

Rangnekar, 1957, p. 16, figs.; Shiino, 1950 *a*, p. 473, fig. 2; Pillai (in press, *e*).

Carapace proportionately large, nearly rounded, median lobe strongly narrowing backwards and projecting far beyond lateral lobes, posterior sinuses deep and wide open. Fourth thoracic



FIGS. 43-54. (43) *Caligus amblygenitalis*; (44) *Caligus confusus*; (45) *Caligus kuroshio*; (46) *Caligus kanagurta*; (47) *Caligus annularis*; (48) *Caligus platurus*; (49) *Caligus dasyoticus*; (50) *Caligus longicervicis*; (51) *Caligus productus*; (52) *Caligus hilsae*; (53) *Caligus lepeophtheropsis*; (54) *Caligus cornutus*.

segment large, nearly equal in length and width. Genital segment semioblong, slightly produced postero-laterally. Abdomen 2-segmented, first segment short. Distal segment of antenna 2, maxilla 1 and 2 and the limbs of the sternal fork long and spine-like. Length 6.0 mm.

Host: *Dasyatis akajeti* (Muller and Henle), *Pristis* sp.

Location: Surface of body and buccal cavity.

Distribution: Bombay, Kerala and Japan.

A few specimens recently collected from Kerala have highly swollen genital segment with parallel sides, swollen and progressively narrowing 1-segmented abdomen which is much longer than the genital segment and comparatively very long and slightly twisted fourth legs. This species is thus somewhat variable.

***Caligus longicervicis* Gnanamuthu**

(Fig. 50)

Gnanamuthu, 1950, p. 115, figs. 31-46; Pillai, 1963 a, p. 77, fig. 7 (*cunicephalus*); Kirtisinghe, 1964, p. 65, fig. 57; Pillai (in press, f').

Carapace narrowing forwards, frontal plates projecting, with small lunules, posterior sinuses wide open. Genital segment swollen, as long as carapace and slightly narrower, abdomen short, 1-segmented, anal laminae much longer than broad. Maxilla 1 very minute. Sternal fork absent. Distal segment of leg 1 with 3 strongly serrate claws, first claw longest, ventral setae small. First claw of exopod of leg 2 large, second and third very small. Leg 4 3-segmented and comparatively long, first segment longer than rest of the limb. Length 3.3 mm.

Host: *Trichiurus haumela* (Forsk.), *T. savala* Cuvier.

Location: Buccal cavity.

Distribution: Madras, Kerala and Ceylon.

Gnanamuthu has described 4 species of *Caligus*, *C. savala*, *S. scabiei*, *C. cunicephalus* and *C. longicervicis* from *Trichiurus*. With the available information on these species a firm opinion whether all are valid cannot be expressed. A detailed study of the four species is desirable.

***Caligus productus* Dana**

(Fig. 51)

Shiino, 1959 b, p. 14, figs. 6-8; Kirtisinghe, 1964, p. 53, figs. 25-26.

Carapace nearly circular, with projecting frontal plates, posteromedian lobe twice as broad as lateral lobes and not much projecting. Fourth segment short, genital segment swollen, with large rounded postero-lateral lobes almost reaching the distal border of the first abdominal segment. Second abdominal segment longer than first. Basal segment of maxilliped 1 with a small process. Sternal fork with diverging limbs. Distal segment of leg 1 without ventral setae. Second segment of endopod of leg 2 with rows of teeth. Leg 4 3-segmented. Length 5.0 mm.

Host: *Coryphaena hippurus* Linn., *Katsuwonus pelamis* (Linn.), *Euthynnus affinis* (Cantor) and several other scomberoid fishes.

Location: Branchial cavity.

Distribution: Widely distributed in the Pacific, Atlantic, Mediterranean and Indian oceans.

Caligus hilsae Shen

(Fig. 52)

Shen, 1957 *a*, p. 372, pl. 7; Pillai and Lal Mohan, 1967, p. 45, figs. 1-19.

Carapace longer than broad, frontal plates low, with comparatively low lunules, median lobe twice as broad as lateral lobes and slightly projecting, genital segment swollen, longer than broad, abdomen longer than genital segment, 2-segmented, anal laminae long, with stout setae armed with stiff hairs. Maxilla 1 reduced. Distal segment of leg 1 with 3 claws armed ventrally like a saw, the seta at the lower distal corner very stout. Leg 4 3-segmented, last claw very long. Length 9.6 mm.

Host: *Hilsa toli* (Day), *H. reevesii* Richardson.

Location: Buccal and branchial cavities.

Distribution: China and Kutch (Arabian sea).

The description of the abdomen as 4-segmented by Shen is obviously an error, if otherwise the present specimens will form a new species.

Caligus lepeophtheropsis Pillai

(Fig. 53)

Pillai (in press *e*).

Carapace nearly circular, with the postero-median lobe projecting slightly beyond the lateral lobes, frontal plates prominent, lunules very small and rather indistinct. Genital segment swollen, as long as broad, with rounded corners. Abdomen 1-segmented, slightly longer than broad. Antenna 2 with stout basal process. Maxilla 1 stout. Sternal fork with apically blunt, short, parallel limbs. Maxilliped 2 slender. Distal segment of leg 1 with the seta at the lower distal angle very small. Leg 4 3-segmented, last claw very long. Length 5.3 mm.

Host: *Pristis* sp.

Location: Gills.

Distribution: Kerala.

Caligus cornutus Heegaard

(Fig. 54)

Heegaard, 1962, p. 164, figs. 92-98; Pillai, 1963 *a*, p. 76, fig. 6 (*spinosus*).

Carapace slightly longer than broad, frontal plates very deep, postero-median lobe trilobed, touching the lateral lobes and closing the posterior sinuses, fourth segment large, genital segment enlarged, widening backwards, abdomen 2-segmented and enlarged, anal laminae small and sunk into the abdomen. Appendages very much like those of *Midias lobodes*. Maxilla 2 with a small accessory process. Length 5.1 mm.

Host: *Sphyræna jello* Cuvier, *S. obtusata* Cuvier.

Location: Buccal cavity.

Distribution: Queensland and Kerala.

This species closely resembles *M. lobodes* Wilson and poses the question whether *Midias* is a valid genus (see under *Midias*).

Caligus tylosuri (Rangnekar)

(Fig. 55)

Rangnekar, 1956, p. 52, figs. (*Tuxophorus*); Pillai, 1961, p. 96, fig. 6; Pillai (in press, f).

Genital segment swollen, broader than long, abdomen very short and 1-segmented. Leg 4 3-segmented, with 4 claws, second claw very short, fourth very long. Leg 5 formed of a process carrying a spine and a seta, leg 6 formed of a large process with 4 peculiarly shaped spines and 3 plumose setae. Length 4.4 mm.

Host: *Tylosurus crocodilus* (Le Sueur), *Chorinemus lysan* (Forsk.).

Location: Surface of body.

Distribution: Bombay and Kerala.

Caligus djedabae Rangnekar

(Fig. 56)

Rangnekar, 1956, p. 42, figs.; Pillai, 1961, p. 96, fig. 5.

Genital segment transversely rectangular or squarish, as broad as or even slightly broader than carapace. Abdomen short and 1-segmented. Distal segment of leg 1 with 2 very short inferior setae. Length 1.9 mm.

Host: *Selar kalla* (Cuvier).

Location: Branchial cavity.

Distribution: Bombay and Kerala.

Caligus multispinosus Shen

(Fig. 57)

Shen, 1957 a, p. 370, pl. 3; Pillai, 1961, p. 89, fig. 2.

Genital segment postero-laterally angular, abdomen as long as genital segment, 2-segmented, distal segment short. Leg 4 4-segmented, first 4 claws hirsute all over, fifth simple, each claw with a long patch of spinules near its base. Length 4.1 mm.

Host: *Pampus argenteus* (Euphrasen).

Location: Branchial cavity.

Distribution: China and Kerala.

Kirtisinghe (1964) made *C. multispinosus* Pillai (1961) a synonym of *C. diaphanus* Nordmann. But I still believe that my original identification is correct. The doubt arose from an error in the caption for Pl. III of Shen's paper. It should be *C. multispinosus* instead of *C. eleutheronemi*, the numbering of the plates in the text is correct.

Caligus constrictus Heller

(Fig. 58)

Heller, 1865, p. 175, pl. 15, fig. 5; Kirtisinghe, 1956, p. 14, figs. 3-4; Rangnekar, 1956, p. 49, figs. (*Midias carangis*); neck Wilson, 1937, p. 25, pl. 3, figs. 3 a-i; Shiino, 1959, p. 285, figs. 9-10.

SM-V-5

Genital segment swollen, inverted U-shaped and longer than broad. First segment of abdomen very much swollen, second segment small. Maxilla 1 with small accessory process. Leg 4 5-segmented. Length 4.7 mm.

Host: *Carangoides malabaricus* (Bloch), *Alectis indica* (Ruppell).

Location: Buccal cavity.

Distribution: Indian Ocean, Ceylon, Kerala and Bombay.

***Caligus infestans* Heller**

(Fig. 59)

Heller, 1865, p. 167, pl. 14, figs. 3-4; Kirtisinghe, 1964, p. 52, figs. 22-24.

Cephalothorax slightly more or less than half the entire length; lunules moderate, median lobe more than half the width of the cephalothorax, extending beyond the posterior level of the lateral lobes. Genital segment flask-shaped, with well-developed postero-lateral lobes in the adults. Abdomen 2-segmented, proximal segment slightly the longer. Total length 6.5 mm.

Host: *Cybium commersoni* (Lacepede), *Sphyaena picuda* Bloch.

Location: Gills.

Distribution: Indian ocean, Madagascar, Queensland and Ceylon.

The above description is from Kirtisinghe (1964). According to him *C. sphyaenae* Nunes-Ruivo and Fourmanoir (1956) and *C. maculatus* Heegaard (1962) are synonymous with *C. infestans*.

***Caligus diaphanus* Nordmann**

(Fig. 60)

Kirtisinghe, 1964, p. 56, fig. 31.

Cephalothorax as long as broad, less than half the entire length, lunules hemispherical, median lobe about half the width of cephalothorax, projecting a little beyond the posterior level of the lateral lobes. Free thoracic segment narrow. Genital segment sac-shaped. Abdomen about as long as genital segment, 2-segmented, proximal segment longer than the distal. Length 3.4 mm.

Host: *Trigla* sp., *Autistes puta* (Cuvier), *Lates calcarifer* (Bloch).

Location: Buccal cavity.

Distribution: North Sea, British Isles, Mauritania and Ceylon.

This species is included here on the authority of Kirtisinghe and the description is from his work.

***Caligus dakari* Van Beneden**

(Fig. 61)

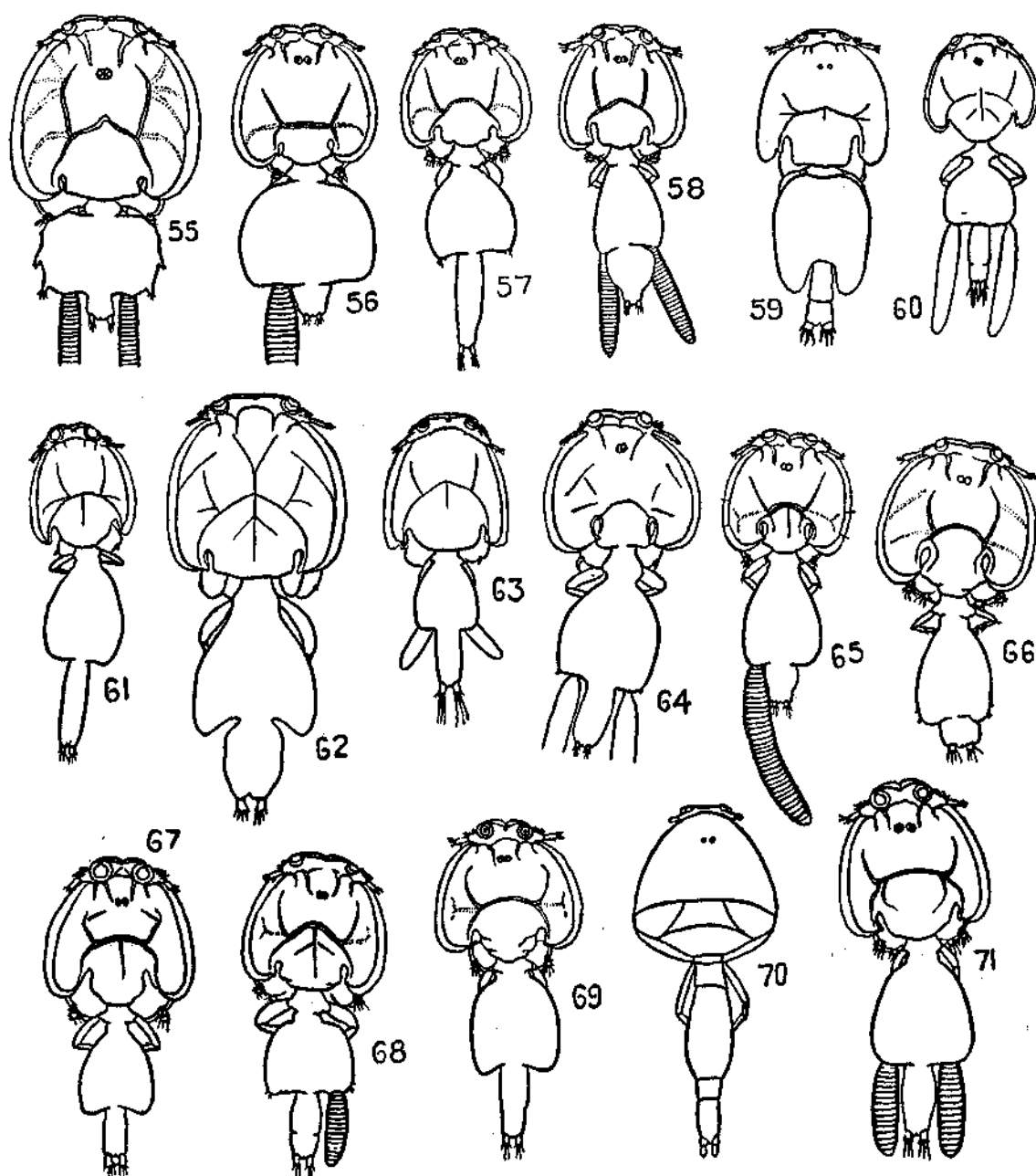
Barnard, 1955, p. 248, figs. 10 a-b (*arii*); Kirtisinghe, 1964, p. 60, figs. 36-37.

Differing from *C. arii* Bassett-Smith in the 1-segmented abdomen, larger anal laminae, 3-segmented fourth leg and the differently shaped sternal fork. Length 4.6 mm.

Host: *Arius dussumieri*, *Arius* sp.

Location: Branchial cavity.

Distribution: South Africa and Ceylon.



FIGS. 55-71. (55) *Caligus tylosuri*; (56) *Caligus djedabae*; (57) *Caligus multispinosus*; (58) *Caligus constrictus*; (59) *Caligus infestans* (Kirtisinghe, 1964); (60) *Caligus diaphanus* (Kirtisinghe, 1964); (61) *Caligus dakari* (Kirtisinghe, 1964); (62) *Caligus curtus* (Kirtisinghe, 1964); (63) *Caligus acutus* (Kirtisinghe, 1964); (64) *Caligus tenax* (Kirtisinghe, 1964); (65) *Caligus cordyla*; (66) *Caligus brevicaudus*; (67) *Caligus phipsoni*; (68) *Caligus robustus*; (69) *Caligus epinepheli*; (70) *Caligus sciaenae* (Gnanamuthu, 1947 a); (71) *Caligus chiloscyllii*.

Caligus curtus Muller

(Fig. 62)

Kirtisinghe, 1964, p. 62, figs. 49-50.

Cephalothorax semielliptical, longer than wide, a little less than half the entire length, lunules moderate, median lobe about half the width of the cephalothorax, projecting but little beyond the posterior level of the lateral lobes. Genital segment sac-shaped, with postero-lateral lobes. Abdomen short, 1-segmented, with convex lateral margins. Length 5.5 mm.

Host: *Pristipomoides typus* Bleeker and other gadoid fishes.

Location: Branchial cavity.

Distribution: North Atlantic, British Isles, North America and Ceylon.

Caligus acutus (Kurian) Kirtisinghe

(Fig. 63)

Kurian, 1961, p. 71, figs. 37-45 (*affinis*); Kirtisinghe, 1964, p. 66, figs. 58-67.

Carapace nearly half the total length, postero-median lobe more than twice as broad as lateral lobes and projecting beyond the latter. Genital segment enlarged, slightly longer than broad, with parallel sides. Abdomen subcylindrical, 1-segmented. Egg tubes short. Sternal fork with long pointed limbs. Leg 4 3-segmented, segment 3 with 4 claws. Length 4.1 mm.

Host: *Euthymus affinis* (Cantor), *Gasterin lineatus* (Linn.).

Location: Surface of body.

Distribution: Kerala and Ceylon.

As the original name *affinis* was preoccupied Kirtisinghe (1964) suggested the new name *acutus*.

Caligus tenax Heller

(Fig. 64)

Heller, 1865, p. 172, pl. 15, fig. 3; Bassett-Smith, 1898 *b*, p. 363, pl. 2, fig. 3; Wilson, 1913, p. 208, pl. 26, pl. 29, figs. 99-101; Kirtisinghe, 1937 *a*, p. 437, figs. 15-29; 1964, p. 67, figs. 68-69.

Body rather stout, carapace ovate, lateral lobes of carapace wide, curved inwards, posterior sinuses closed behind. Genital segment acorn-shaped, more than half the width of carapace, with bluntly rounded posterior angles. Abdomen 1-segmented, more than half the length of genital segment. Second segment of antenna 1 long and slender. Maxilla 2 with accessory claw, distal claws of leg 1 decreasing in length from first to third. Leg 4 4-segmented. Length 2.3 mm.

Host: *Caranx hippos* (Linn.), *C. crysos*.

Location: Gills.

Distribution: Brazil, West Indies and Ceylon.

Caligus cordyla Pillai

(Fig. 65)

Pillai, 1963 *a*, p. 82, fig. 10.

Carapace elegantly rounded, nearly equal in length and width, postero-median lobe hardly projecting beyond the lateral lobes which curve inwards to close the posterior sinuses. Genital

segment enlarged and pyriform, regularly broadening backwards. Abdomen short, 2-segmented, first segment swollen and broader than long. Maxillae 1 and 2 with large accessory process. Sternal fork with stout base, rami straight and diverging. Distal segment of exopod of leg 1 with 3 small ventral setae. First segment of endopod of leg 2 with a spiny crest. Leg 4 4-segmented. Length 3.0 mm.

Host: *Megalaspis cordyla* (Linn.).

Location: Branchial cavity.

Distribution: Kerala.

This species closely resembles *C. brevicaudus* Pillai but differs in the shape of the abdomen.

***Caligus brevicaudus* Pillai**

(Fig. 66)

Pillai, 1963 *a*, p. 83, fig. 11.

Carapace nearly equal in length and width, postero-median lobe projecting well beyond lateral lobes, latter curved inwards and slightly overlapping median lobe, posterior sinuses closed. Genital segment longer than broad, widening backwards. Abdomen short, 1-segmented and broader than long. Distal segment of antenna 1 long. Maxillae 1 and 2 with an accessory process. Sternal fork with short slightly diverging limbs. Basal segment of endopod of leg 2 with a row of spines successively increasing in length. Leg 4 4-segmented. Length 4.3 mm.

Host: *Caranx* sp.

Location: Branchial cavity.

Distribution: Kerala.

***Caligus phipsoni* Bassett-Smith**

(Fig. 67)

Bassett-Smith, 1898 *a*, p. 6, pl. 3, figs. 3-4; Pillai, 1963 *a*, p. 68, fig. 1.

Postero-median lobe of carapace only slightly broader than lateral lobes, lunules deep and circular. Genital segment with short anterior neck. Abdomen 1-segmented, base constricted. Vestigial endopod of leg 1 with 2 spines, claws 2 and 3 of distal segment of exopod with accessory spine, fourth claw stout and feathery. Second endopod segment of leg 2 with 3 to 4 rows of teeth. Leg 4 3-segmented. Length 3.9 mm.

Host: *Polynemus plebeius* (Broussonet).

Location: Branchial cavity.

Distribution: Bombay and Kerala.

***Caligus robustus* Bassett-Smith**

(Fig. 68)

Bassett-Smith, 1898 *b*, p. 361, pl. 2, figs. 1-2; Pillai, 1963 *a*, p. 73, fig. 4; Kirtisinghe, 1964, p. 55, figs. 29-30.

Genital segment hemispherical, abdomen 2-segmented, subequal in length to the genital segment. Maxilla 2 with a false partition at the distal part. First claw on distal segment of leg 1

very small, second longest. Endopod of leg 2 strongly spiny. Leg 4 robust, 4-segmented. Length 5.4 mm.

Host: *Caranx sansun* (Forsk.) *C. melanampygus* Cuvier.

Location: Branchial cavity.

Distribution: West Indies, Bombay, Kerala and Ceylon.

Caligus epinepheli Yamaguti

(Fig. 69)

Yamaguti, 1936, p. 4, pl. 3, figs. 27-39; Shiino, 1952, p. 80, figs. 1-2; Rangnekar and Murti, 1959, p. 78, figs. (*cossacki*); Pillai, 1963 a, p. 75, fig. 5; Kirtisinghe, 1964, p. 57, fig. 32.

Genital segment roughly squarish, with the antero-lateral parts rounded and the postero-lateral slightly angular and produced. Abdomen 2-segmented, second segment half the length of first. Antenna 2 with a prominent prolongation on its basal segment. Maxilla 1 strongly falcate. Sternal fork with slender bracket-shaped limbs. Distal exopod segment of leg 1 without spines or setae on the ventral border. Second segment of endopod of leg 2 with closely packed long spines. Leg 4 3-segmented. Length 4.5 mm.

Host: *Chorinemus tala* Cuvier, *Drepane punctata*, *Epinepheles septemfasciatus*, *E. akara*.

Location: Branchial and buccal cavities.

Distribution: Japan, Bombay, Kerala and Ceylon.

Caligus sciaenae Gnanamuthu

(Fig. 70)

Gnanamuthu, 1947 a, p. 43, figs. 1-2.

Carapace nearly circular, postero-median lobe completely overlapping the fourth segment. Genital segment nearly twice as broad as the succeeding segment and nearly 4 times as long, the succeeding segment (first abdominal segment) broader than long. Leg 3 biramous, natatory, with 3-segmented rami. Leg 4 3-segmented. Leg 5 long and 4-segmented. Length 1.7 mm.

Host: *Sciaena glaucus* Day.

Location: Gill filaments.

Distribution: Madras.

The description of this species is very unsatisfactory and its identity is far from clear. If the third and fifth legs are as described they would indeed be unique.

Caligus chiloscyllii (Pillai)

(Fig. 71)

Pillai, 1963 a, p. 87, fig. 13 (*minutus*).

Carapace slightly longer than broad, with deep projecting lunules, postero-median lobe comparatively very broad and projecting, genital segment swollen, longer than broad, abdomen 1-segmented, two-and-a-half times as long as broad. Sternal fork inverted U-shaped, with stout limbs. Distal exopod segment of leg 1 twice as long as broad, without lower setae. Second segment of endopod of leg 2 with 4 longitudinal rows of sharp spines. Leg 4 3-segmented. Length 2.4 mm.

Host: *Chiloscyllium indicum* (Gmelin).

Location: Surface of body.

Distribution: Kerala.

The specific name *chiloscyllii* is proposed for the preoccupied name *minutus*.

***Caligus longicaudus* Bassett-Smith**

(Fig. 72)

Bassett-Smith, 1898, p. 7, pl. 4, figs. 1-3; Pillai, 1963 *a*, p. 70, fig. 2; Kirtisinghe, 1964, p. 59 fig. 35.

Genital segment semicircular, with well-rounded corners, abdomen long, 2-segmented, second segment very short. Distal segment of leg 1 with 4 claws, first claw very small, third longest. Endopod of leg 2 spiny, third spine of exopod small. Leg 4 4-segmented and robust, with 5 prominently winged claws. Length 5.0 mm.

Host: *Chirocentrus dorab* (Forsk.).

Location: Branchial and buccal cavities.

Distribution: Bombay, Kerala and Ceylon.

***Caligus cunicephalus* Gnanamuthu**

(Fig. 73)

Gnanamuthu, 1950, p. 113, pl. 1; nec Pillai, 1963 *a*, p. 77, fig. 7.

Carapace triangular, narrowing forwards, postero-median lobe strongly projecting, posterior sinuses wide open. Genital segment swollen, widening backwards. Abdomen oblong, 1-segmented. Maxilla 1 slender and long, maxilla 2 with an adhesion pad. Basal segment of maxilliped 2 with a pair of high bosses. Sternal fork with flat apically rounded limbs. Leg 4 3-segmented. Length 4.1 mm.

Host: *Trichiurus haumela* Forskal.

Location: Buccal cavity.

Distribution: Madras.

***Caligus polycanthi* Gnanamuthu**

(Fig. 74)

Gnanamuthu, 1950 *a*, p. 159, figs. 1-5; Shiino, 1959 *c*, p. 338, figs. 2-3.

Carapace distinctly longer than broad, postero-median lobe hardly projecting beyond the lateral lobes. Fourth thoracic segment broader than long. Genital segment slightly broader than long, postero-laterally produced into large rounded lobes. Abdomen short, 1-segmented. Maxilla 1 long and falcate. Basal segment of maxilliped 2 with a small bilobed elevation. Sternal fork with diverging rami. Distal claws of exopod of leg 1 regularly increasing in size from the first to the fourth. Leg 4 3-segmented. Length 4.0 mm.

Host: *Balistes maculatus* (Bloch).

Location: Surface of body.

Distribution: Madras and Japan.

Caligus savaia Gnanamuthu

(Fig. 75)

Gnanamuthu, 1948 *a*, p. 591, figs. 1-8.

Carapace nearly half the total length, narrowing forwards; membranous flange broad. Median lobe of carapace twice as broad as lateral lobes and projecting far beyond them. Fourth thoracic segment very short. Genital segment half the size of the carapace and as long as broad with truncate hind border. Abdomen 1-segmented, as long as genital segment. Sternal fork with long diverging limbs curved inwards at tip. Leg 4 3-segmented. Length 3.6 mm.

Host: *Trichiurus savaia* Cuvier.

Location: Surface of body.

Distribution: Madras.

Caligus rotundigenitalis Yu

(Fig. 76)

Yu, 1933, p. 117; Rangnekar, 1959 *a*, p. 43, fig. 1.

Carapace as broad as long, broader behind, median lobe projecting far beyond lateral lobes, posterior sinuses wide open. Genital segment enlarged and perfectly rounded, as broad as carapace minus the flange. Abdomen 2-segmented, segment 1 slightly swollen. Sternal fork with flat foliaceous limbs. Leg 4 4-segmented, with 5 claws, first 4 claws highly plumose, fifth not plumose. Length 2.9 mm.

Host: *Lutjanus malabaricus* (Schn.), *Caranx speciosus* (Forsk.)

Location: Gill filaments.

Distribution: China and Bombay.

In the structure of the sternal fork and leg 4 this species resembles *C. platytarsis*.

Caligus furcisetifer Redkar, Rangnekar and Murti

(Fig. 77)

Redkar *et. al.*, 1949, p. 40, figs. 12-24.

Carapace roughly equal in length and breadth, median lobe projecting beyond lateral lobes. Genital segment as long as broad, narrowing backwards, antero-lateral parts shoulder-like and postero-lateral slightly angular, abdomen 1-segmented. Sternal fork with stout subparallel rami. Distal claws of exopod of leg 1 short but stout, second and third with accessory claws, fourth very small. Leg 4 3-segmented, first 3 claws short, fourth very long. Length 6.5 mm.

Host: *Sphyrna blochii* (Cuvier).

Location: Surface of body.

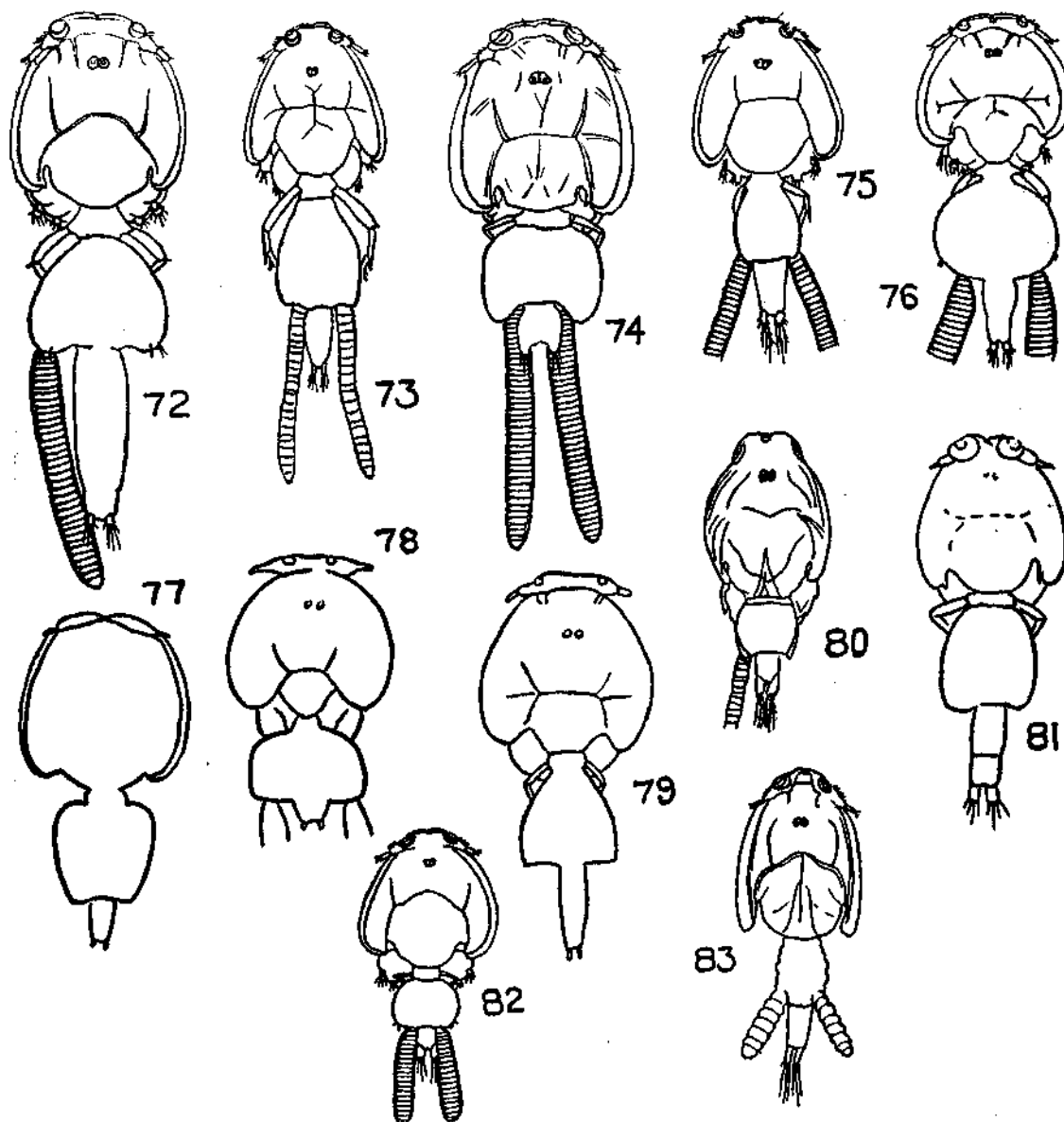
Distribution: Bombay.

Caligus parvus Bassett-Smith

(Fig. 78)

Bassett-Smith, 1898, p. 4, pl. 2, figs. 1-2.

Carapace nearly circular, slightly broader than long, as long as rest of body. Genital segment squarish, angles rounded. Abdomen very short. Maxilliped 2 very stout, with long stout claw closing against a large process on the basal segment. Distal segment of leg 1 with 3 short bristles and 4 long plumose setae (?), the one at the angle being the longest. Length 3.4 mm.



FIGS. 72-83. (72) *Caligus longicaudus*; (73) *Caligus cunicephalus* (Gnanamuthu, 1950); (74) *Caligus polycanthi* (Shilno, 1950 a); (75) *Caligus savala* (Gnanamuthu, 1948 a); (76) *Caligus rotundigenitalis* (Rangnekar, 1959 a); (77) *Caligus fureisetifer* (Redkar et al., 1949); (78) *Caligus parvus* (Bassett-Smith, 1898); (79) *Caligus platystalis* (Rangnekar, 1955); (80) *Caligus scabiei* (Gnanamuthu, 1950); (81) *Caligus cossacki* (Barnard, 1955); (82) *Caligus pelagicus* (Kurian, 1961); (83) *Caligus undulatus* (Yamaguti, 1963).

Host: Tetradon oblongus Bloch.

Location: Branchial cavity.

Distribution: Bombay.

***Caligus platytarsis* Bassett-Smith**

(Fig. 79)

Bassett-Smith, 1898 *a*, p. 82, pl. 4, fig. 2; Rangnekar, 1955 *b*, p. 55, figs. (*bombayensis*).

Carapace rounded, as broad as long, with very shallow lunules, postero-median lobe not much broader than lateral lobes and only slightly projecting beyond them. Genital segment triangular, with truncate hind border and angular posterior corners. Abdomen 1-segmented, longer than genital segment. Sternal fork with flattened rounded limbs. Leg 4 4-segmented, with 5 claws, first 4 claws flat and modified, fifth normal. Length 6.0 mm.

Host: Mugil sp., Mugil cephalus Linn.

Location: Branchial cavity.

Distribution: Bombay.

Rangnekar was aware of the close resemblance between *platytarsis* and *bombayensis*. Nevertheless she created the new species on certain differences which are nothing but minor omissions in the description of *platytarsis*. One should take into account the fact that Bassett-Smith's illustrations are generally inadequate.

***Caligus scabiei* Gnanamuthu**

(Fig. 80)

Gnanamuthu, 1950, p. 114, figs. 17-30.

Carapace nearly two-thirds of total length, broadly elliptical, frontal plates and lunules conspicuous and projecting. Median lobe of carapace very broad and projecting far beyond the narrow lateral lobes, posterior sinuses deep. Fourth segment 4 times as broad as long. Genital segment quadrangular, its ventral side folded into an apron-like plate. Abdomen 1-segmented, as long as broad. Sternal fork with narrow base, rami broad and foliaceous. Leg 4 3-segmented, first segment very long. Length 4.1 mm.

Host: Trichiurus haumela (Forsk.).

Location: Surface of body.

Distribution: Madras.

The description of this species was obviously based on a badly preserved specimen and the illustrations are therefore unsatisfactory. The presence of an apron-like plate on the ventral side of the genital segment is peculiar, so also is the presence of 6 distal spines in addition to 3 setae on the distal segment of leg 1.

***Caligus cossackii* Bassett-Smith**

(Fig. 81)

Bassett-Smith, 1898 *a*, p. 85, pl. 4, fig. 3; Heegaard, 1943, p. 5, fig. 12; Barnard, 1955, p. 248, fig. 8 *e*; Kirtisinghe, 1964, p. 57,

Cephalothorax about as long as wide, less than half the entire length; lunules spherical, median lobe about half the width of the cephalothorax, scarcely projecting beyond the posterior level of the lateral lobes. Free thoracic segment short. Genital segment flask-shaped, with short postero-lateral lobes, only a little shorter than the cephalothorax. Abdomen 2-segmented, segments nearly of equal lengths. Length 6.0 mm.

Host: *Rhabdosargus sarba* (Forsk.), *Acanthopagurus berda* (Forsk.).

Location: Branchial cavity.

Distribution: Persian Gulf, Madagascar and Ceylon.

The above description is from Kirtisinghe (1964).

Caligus pelagicus Kurian

(Fig. 82)

Kurian, 1961, p. 103, fig. 1.

Cephalothorax large and roughly triangular, with large projecting frontal plates, postero-median lobe about 3 times the width of the lateral lobes and projecting far beyond the latter, posterior sinuses open. Fourth thoracic segment short, genital segment swollen, broader than long, abdomen short, 1-segmented. Maxilla 1 long and claw-like. Sternal fork with broad base, limbs short and spatulate. Length 3.1 mm.

Host: Unknown.

Location: Planktonic.

Distribution: Kerala.

Caligus undulatus Shen and Li

(Fig. 83)

Shen and Li, 1959, p. 15; Pillai (in press, f).

Carapace much longer than broad and prominently narrowing forwards, lunules semicircular, lateral lobes comparatively very narrow and median lobe very broad. Genital segment small, with irregular borders (?). Abdomen short, 1-segmented, anal laminae cylindrical, with long setae. Antenna 1 with long setae on basal segment. Sternal fork with slightly diverging rami. The seta on the inferior distal angle of distal segment of leg 1 very long, lower setae stout, leg 4 3-segmented. Length 4.2 mm.

Host and location: Planktonic.

Distribution: China and India.

Genus *Pseudocaligus* A. Scott

Yamaguti, 1963, p. 65.

Characters same as those of *Caligus* but the fourth leg reduced to a 1 or 2-segmented stump.

Pseudocaligus fistulariae Pillai

(Fig. 84)

Pillai, 1961, p. 112, fig. 14; Shiino, 1964, p. 249, figs. 3-4 (*tenuicauda*).

Carapace longer than broad, slightly narrowing forwards, frontal plates and lunules rather deep, genital segment enlarged, subequal to the carapace in size, abdomen as long as genital segment, 2-segmented. Distal segment of leg 1 without lower setae. Leg 4 2-segmented, segment 1 with a plumose seta and segment 2 with 2 spines. Length 5.65 mm.

Host: *Fistularia villosa* Kluzinger.

Location: Buccal cavity and inside proboscis.

Distribution: Kerala and Japan.

***Pseudocaligus laminatus* Rangnekar**

(Fig. 85)

Rangnekar, 1955 a, p. 44, figs. 1-15.

Carapace roughly triangular and narrowing forwards, postero-median lobe as broad as lateral lobes, truncate and not projecting beyond the lateral lobes. Fourth thoracic segment very small, genital segment very large, rectangular, with rounded corners and with median constriction, abdomen very short, 1-segmented. Maxilliped 2 with unusually large accessory claw. Leg 4 reduced to a small lobe carrying 3 long spines. Length 3.6 mm.

Host: *Gastrophysus lunaris* (Bloch).

Location: Pectoral fin.

Distribution: Bombay.

Genus *Parapetalus* Steenstrup and Lutken

Pillai, 1962 b, p. 287; Yamaguti, 1963, p. 64.

Carapace similar to that of *Caligus*, genital segment enlarged and laterally produced into wing-like lobes, horizontal or curved ventralwards, abdomen long, expanded into wings, extending backwards, horizontal or curved ventralwards. Appendages as in *Caligus*.

***Parapetalus orientalis* Stp. & Lutk.**

(Fig. 86)

Stp. & Lutk., 1861, p. 365, fig. 10; Pillai, 1962 b, p. 290, fig. 2.

Wings on genital segment horizontal, abdominal wings narrow and overlapping genital wings and reaching far beyond the tip of the abdomen, distal half of abdomen not taking part in the formation of the wings. Length 2.7 mm.

Host: *Mene maculata*, *Alectis indica* (Ruppell).

Location: Gills.

Distribution: East Indies, Indian ocean and Kerala.

***Parapetalus hirsutus* (Bassett-Smith)**

(Fig. 87)

Bassett-Smith, 1898, p. 5, pl. 3, figs. 1-2 (*Caligus*); Kirtisinghe, 1950, p. 77, figs. 1-4; Shen, 1957 a, p. 373, pl. 8 (*Caligus*); Pillai, 1962 b, p. 288, fig. 1.

Genital segment and abdomen subequal in size, wings narrow and horizontal. Leg 4 with 4 bunches of fine hairs, claws shovel-like. Length 7.9 mm.

Host: *Eleutheronema tetradactylum*, *Polynemus plebeius* (Broussonet).

Location: Branchial cavity.

Distribution: Batavia, Ceylon, China, Bombay and Kerala.

***Parapetalus longipennatus* Rangnekar**

(Fig. 88)

Rangnekar, 1956, p. 46, figs.

Thoracic segment 4 comparatively long, genital segment roughly squarish, postero-laterally conical, abdomen with deep posterior sinus. Length 3.9 mm.

Host: *Caranx nigrescens* Day.

Location: Not given.

Distribution: Bombay.

***Parapetalus occidentalis* Wilson**

(Fig. 89)

Wilson, 1908, p. 606, pl. 53; Pillai, 1962 *b*, p. 293, fig. 3; Pearse, 1952, p. 24, figs. 87-93 (*gunteri*).

Wings of genital segment and abdomen very large and folded downwards, antero-lateral parts of carapace with or without a pair of marginal indentations. Length 7.3 mm.

Host: *Johnius* sp., *Rachycentron canadus* (Linn.).

Location: Branchial cavity.

Distribution: North America and Kerala.

Genus *Pseudopetalus* Pillai

Pillai, 1962 *b*, p. 290.

Differs from *Parapetalus* as follows: Carapace comparatively very small, genital segment and abdomen subequal in length, latter broader, both somewhat flattened but not winged.

***Pseudopetalus formicoides* (Redkar, Rangnekar and Murti)**

(Fig. 90)

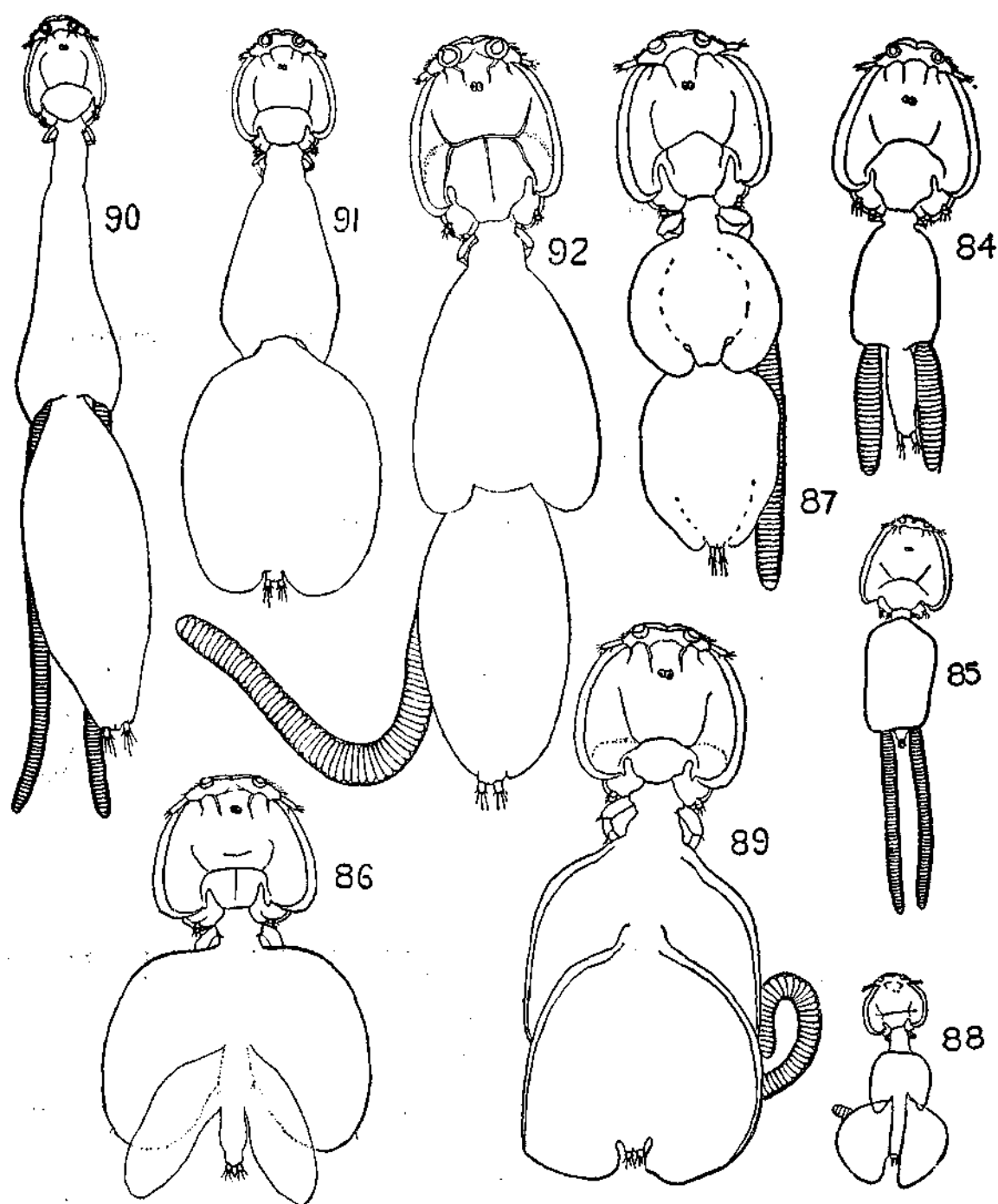
Redkar *et al.*, 1949, p. 36, figs. (*Caligus*); Rangnekar and Murti, 1950, p. 44, figs. (*Parapetalus*); Pillai, 1962 *b*, p. 297, fig. 5.

Abdomen elliptical, without posteromedian sinus. Length 10.2 mm.

Host: *Sardinella fimbriata* (Val.).

Location: Buccal cavity.

Distribution: Bombay and Kerala.



FIGS. 84-92. (84) *Pseudocaligus fistulariae*; (85) *Pseudocaligus laminatus* (Rangnekar, 1955 a); (86) *Parapetalus orientalis*; (87) *Parapetalus hirsutus*; (88) *Parapetalus longipennatus* (Rangnekar, 1956); (89) *Parapetalus occidentalis*; (90) *Pseudopetalus formicoides*; (91) *Pseudopetalus caudatus*; (92) *Pseudopetalus dussumieri*.

A variety of this species, *denticulatus* (Shen, 1957) is recognised. It is characterised by the presence of 3 plumose setae instead of spines on the lower border of the distal segment of leg 1, the abdomen is oblong and not elliptic.

Pseudopetalus caudatus (Gnanamuthu)

(Fig. 91)

Gnanamuthu, 1950 *b*, p. 125, figs. 1-5 (*Parapetalus*); Pillai, 1962 *b*, p. 299, fig. 6.

Abdomen oblong, only slightly longer than broad, with prominent postero-median sinus. Length 8.5 mm.

Host: *Dussumieria hasseltii* Bleeker.

Location: Buccal cavity.

Distribution: Madras and Kerala.

A variety, *rotundus* Pillai (1962) is parasitic in the buccal cavity of *Ablennes hians* (Val.) It is characterised by the perfectly circular abdomen and the presence of 3 plumose setae instead of spines on the lower border of the distal segment of leg 1.

Pseudopetalus dussumieri (Rangnekar)

(Fig. 92)

Rangnekar, 1957, p. 18, fig. 2 (*Caligus*); Pillai (in press, *e*).

Carapace longer than broad, frontal plates prominent, with large circular lunules, genital segment as long as abdomen but broader, broadest behind. Leg 1 rather stout, distal segment with 3 stout lower setae, plumose on the inner and spiny on the outer side. First claw of exopod of leg 2 very long and apically flattened and enlarged, second segment of endopod with prominent teeth. Leg 4 3-segmented. Length 5.2 mm.

Host: *Dussumieria acuta* Day, *D. hasseltii* Bleeker.

Location: Branchial cavity.

Distribution: Bombay and Kerala.

The description is based on specimens collected from Kerala which are slightly different from those described by Rangnekar, but the identity is clear.

Genus *Sciaenophilus* Van Beneden

Yamaguti, 1963, p. 66.

Carapace comparatively very small, like that of *Caligus*, genital segment elongated, broader than carapace, abdomen longer than rest of body, subcylindrical, sternal fork absent.

Sciaenophilus tenuis Van Beneden

(Fig. 93)

Van Beneden, 1852, p. 464; Scott, T. & A, 1913, p. 63, pl. 40, figs. 1-6; Pillai, 1961, p. 115, fig. 16.

Genital segment elongate triangular, about two-and-a-half times as long as carapace, abdomen very long and slender, subcylindrical, twice as long as genital segment. Length 16.6 mm.

Host: *Johnius* sp.

Location: Buccal and branchial cavities.

Distribution: France, England and Kerala.

Sciaenophilus pharaonis (Nordmann)

(Fig. 94)

Humes, 1957, p. 201 (*inopinus*); Rangnekar, 1959 a, p. 46, fig. 2 (*inopinus*); Humes, 1965, p. 1009.

Carapace broader than long, genital segment reniform, broader than carapace and nearly twice as broad as long, abdomen as long as rest of body, apparently 2-segmented. Fourth leg 3-segmented, claws flattened, with crenate border, exactly like those of *Lepeophtheirus longipalpus* Bassett-Smith. Length 3.8 mm.

Host: *Lates niloticus*, *Labeo forskalii*, *Sciaena semiluctosa* Day, *Chrysophrys bifasciatus*.

Location: Gills.

Distribution: Red Sea, Egypt and Bombay.

Sciaenophilus benedeni (Bassett-Smith)

(Fig. 95)

Bassett-Smith, 1898, p. 8, pl. 4, fig. 3 (*Caligus*); Kirtisinghe, 1964, p. 64 (*Caligus*).

Genital segment nearly twice as long as carapace, longer than broad, inverted U-shaped, abdomen stout, narrow in front, about one-and-a-half times as long as rest of body. Length 6.0 mm.

Host: *Sciaena diacanthus* (Lacepede); *Larimus fasciatus*, *Johnius hololepidotus* and *J. angolensis*.

Location: Branchial cavity.

Distribution: Bombay, Ceylon, Mexico and West Africa.

Genus *Caligodes* Heller

Yamaguti, 1963, p. 63.

Carapace small, like that of *Caligus*, genital segment long, steadily widening backwards and posteriorly produced into two foliaceous processes reaching beyond the abdomen or slightly shorter, abdomen cylindrical, shorter than genital segment. Maxilla 1 absent. Leg 4 degenerated.

Caligodes laciniatus (Kroyer)

(Fig. 96)

Kirtisinghe, 1937 a, p. 439, figs. 30-40; Rangnekar, 1959 a, p. 49, fig. 3; Pillai, 1961, p. 114, fig. 15.

Posterior processes of genital segment longer than the segment itself, clearly overreaching the abdomen, distal segment of leg 1 with 1 stout and 2 small claws and 3 setae, leg 4 2-segmented, with a long apical claw. Length 4.5 mm.

Host: *Tylosurus crocodilus* (Le Sueur), *T. strongylurus* (van Hass), *T. leiurus* (Bleeker) and *Ablennes hians* (Val.).

Location: Buccal cavity.

Distribution: Indian Ocean, West Africa, Italy, Bombay, Ceylon, Kerala.

Genus *Parechetus* Pillai

Pillai, 1962 *b*, p. 287.

Carapace small, like that of *Caligus*, genital segment elongated, like that of *Echetus*, posteriorly swollen and produced into 2 wing-like lobes remaining ventral to the abdomen, abdomen flattened, forming 2 large horizontal wings reaching far beyond the anal laminae.

Parechetus carangis (Bassett-Smith)

(Fig. 97)

Bassett-Smith, 1898 *b*, p. 361, pl. 11, fig. 4 (*Caligodes*); Pillai, 1961, p. 118, fig. 18.

Carapace nearly equal in length and width, genital segment long and cylindrical at the anterior two-thirds, enlarged at the posterior one-third and produced backwards into 2 large lobes situated ventro-lateral to the abdomen, abdomen nearly half the length of the genital segment, highly flattened and produced into 2 lobes reaching beyond the prolongations of the genital segment. Maxilla 1 with stout basal process. Maxilliped 2 with a pair of claws on basal segment. Basal segment of leg 1 with stout processes or teeth, distal segment without ventral setae. Length 8.1 mm.

Host: *Caranx* sp., *C. ferdan*.

Location: Throat.

Distribution: Aden and Kerala.

Parechetus constrictus Kirtisinghe

(Fig. 98)

Kirtisinghe, 1964, p. 74, figs. 81–86.

Differing from *P. carangis* as follows: Median lobe of carapace produced far beyond lateral lobes, fourth thoracic segment very long, separated from genital segment by a distinct constriction or septum. Length 5.8 mm.

Host: *Caranx melanampygus* Cuvier.

Location: Throat.

Distribution: Ceylon.

From the figure it appears that Kirtisinghe illustrated the body in front of the constriction in the dorsal view and the part behind in the ventral view.

Genus *Synestius* Stp. & Lutk.

Yamaguti, 1963, p. 67.

Carapace like that of *Caligus*, genital segment swollen, subequal to the carapace in length and breadth, posteriorly produced into two pairs of subcylindrical processes, dorsal pair longer than ventral, abdomen longer than genital processes.

SM-V-6

Synestius caliginus Stp. & Lutk.

(Fig. 99)

Gnanamuthu, 1950 *d*, p. 253, figs. 1-3; Shen, 1957 *a*, p. 376, pl. 11; Pillai, 1961, p. 117, fig. 17; Kirtisinghe, 1964, p. 75, fig. 87.

With the characters of the genus. Length 4.6 mm.

Host: *Parastromateus niger* (Bloch).

Location: Buccal cavity.

Distribution: East Indies, China, Madras and Kerala.

Genus *Midias* Wilson

Wilson, 1911, p. 625; Yamaguti, 1963, p. 106; Pillai (in press, *f*).

General form intermediate between that of *Caligus* and *Euryphorus*, carapace exactly like that of *Caligus*, fourth thoracic segment with a pair of very rudimentary dorsal plates (?), abdomen long, 2-segmented, basal segment with large lateral lobes, distal segment postero-laterally produced.

The type species, *M. lobodes*, the only species so far described does not possess dorsal plates (Shiino, 1958) and in fact does not show any valid difference from *Caligus*. The validity of *Midias* is, therefore, very doubtful.

Midias lobodes Wilson

(Fig. 100)

Wilson, 1911, p. 626, pl. 65; Shiino, 1958, p. 98, figs. 1-3; Kirtisinghe, 1964, p. 71, fig. 76.

Carapace orbicular, with rounded sides, median posterior lobe almost truncate, not reaching beyond lateral lobes, latter curved inwards closing the posterior sinuses. Fourth thoracic segment produced over the base of the legs. Genital segment swollen, as long as broad and broader behind. Abdomen 2-segmented, segment 1 with crescentic lateral lobes making it as broad as genital segment, second segment roughly squarish, with its hind corners produced into prominent spiny lobes reaching beyond the anal laminae. Length 10.0 mm.

Host: *Sphyraena barracuda*, *Sphyraena* sp.

Location: Surface of body.

Distribution: Dry Tortugas, Florida, Jamaica, Texas, Indian ocean and Ceylon.

Genus *Abasia* Wilson

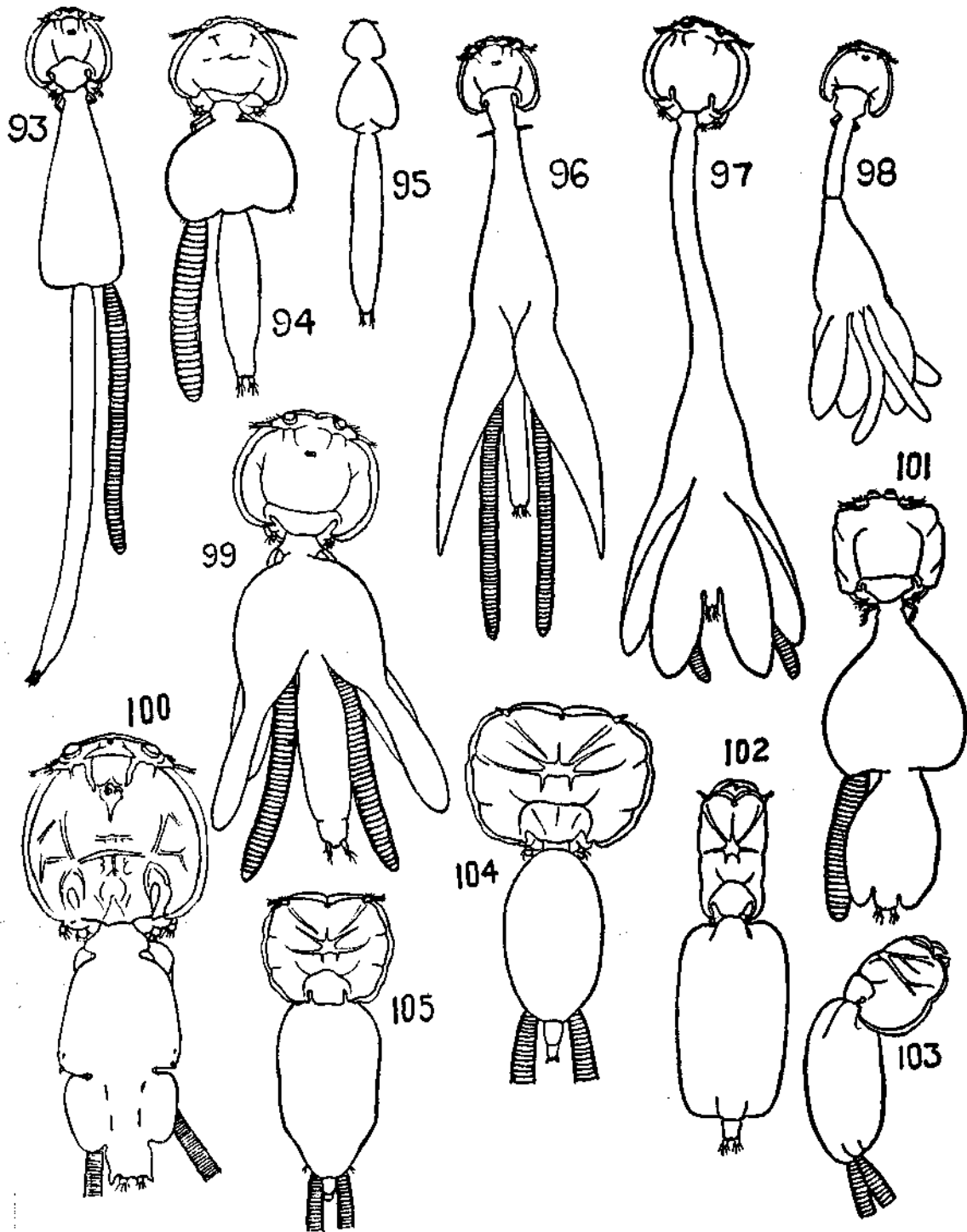
Wilson, 1908, p. 612; Pillai, 1963 *c*, p. 1; Yamaguti, 1963, p. 78.

Carapace, genital segment and abdomen large and subequal in size, frontal plates and lunules indistinct but present, borne on a distinct rostral process, lateral parts of carapace folded downwards. Maxilla 1 and sternal fork absent. Other characters as in *Caligus*.

Abasia platyrostris Pillai

(Fig. 101)

Pillai, 1963 *c*, p. 5, figs. 2-3.



FIGS. 93-105. (93) *Sciaenophilus tenuis*; (94) *Sciaenophilus pharaonis* (Rangnekar, 1959); (95) *Sciaenophilus benedini* (Bassett-Smith, 1898); (96) *Caligodes laciniatus*; (97) *Parechetus carangis*; (98) *Parechetus constrictus* (Kirtisinghe, 1964); (99) *Synestius caliginus*; (100) *Midas lobodes* (Shiino, 1958); (101) *Abasia platyrostris*; (102-103) *Hermillus pyriiventris*; (104) *Hermillus longicornis*; (105) *Hermillus helleri*.

Rostrum apically subtruncate, lunules indistinct, first segment of abdomen comparatively broad and winged. Length 3.8 mm.

Host: *Synodus indicus* (Day), *Saurida tumbil* (Bloch).

Location: Buccal cavity.

Distribution: Kerala.

The only other known species, *A. pseudorostris* Wilson, can be easily distinguished by the apically triangular rostrum and the more degenerated frontal plates and lunules.

Genus *Hermilius* Heller

Heller, 1865, p. 186; Pillai, 1962 c, p. 179; Yamaguti, 1963, p. 82; Kabata, 1964 b, p. 617.

Carapace folded lengthwise like the shell of a bivalved mollusc, lunules absent, frontal plates indistinct. Genital segment enlarged, longer than carapace. Abdomen very short, indistinctly 2-segmented. Antenna 2 long and sickle-shaped, with stout accessory claw. Maxilliped 2 long and slender. Legs 3 and 4 reduced in size.

Hermilius pyriventris Heller

(Figs. 102-103)

Heller, 1865, p. 187, pl. 18, fig. 1; Barnard, 1955, p. 100; Pillai, 1962 c, p. 181, figs. 1 A-P.

Genital segment pyriform, narrowing towards both ends, antenna 2 with a distinct septum beyond the origin of the accessory claw, claw at the base of the exopod of leg 3 straight. Length 3.5 mm.

Host: *Arius acutus*, *A. hendeloti*, *Pseudarius platystomus* (Day), *Galeichthys feliceps*.

Location: Gill filaments.

Distribution: Indian Ocean, Kerala, Java, Mauritania and South Africa.

Hermilius longicornis Bassett-Smith

(Fig. 104)

Bassett-Smith, 1898 a, p. 79, pl. 3, fig. 2; Pillai, 1962 c, p. 182, fig. 2; Rangnekar, 1963, p. 80, figs. a-k; Kirtisinghe, 1964, p. 76, fig. 88.

Genital segment oblong or rectangular, antero-lateral parts shoulder-like, antenna 2 without septum beyond the base of the accessory claw, claw at the base of the exopod of leg 3 curved inwards. Length 5.1 mm.

Host: *Arius acutirostris*, *A. dussumieri* (Val.).

Location: Gills.

Distribution: Ceylon, Kerala and Bombay.

Hermilius helleri Pillai

(Fig. 105)

Pillai, 1962 c, p. 185, fig. 3.

Distinguished from *H. pyriventris* by the genital segment which is abruptly constricted at the posterior one-third. Length 4.0 mm.

Host: *Pseudarius jatus* (Ham. Buch.).

Location: Gills.

Distribution: Kerala.

Genus *Lepeophtheirus* Nordmann

Wilson, 1905, p. 615; 1932, p. 409; Barnard, 1955, p. 250; Yamaguti, 1963, p. 71.

Carapace comparatively large, broadly oval or suborbicular; abdomen usually small, 1 or 2-segmented, rarely 3-segmented. No lunules. Maxilla 2 small, bifurcate. Sternal fork present, Leg 4 4-segmented, rarely 3-segmented. Vestigial fifth and sixth legs usually present. Closely resembling *Caligus* but distinguished by the absence of lunules.

Lepeophtheirus longipalpus Bassett-Smith

(Fig. 106)

Bassett-Smith, 1898 *a*, p. 86, pl. 5, fig. 2; Pillai, 1961, p. 127, fig. 22 (*Indocaligus echinus*); 1963 *a*, p. 92.

Carapace almost equal in length and width, postero-median lobe projecting well beyond lateral lobes. Fourth thoracic segment large, genital segment roughly triangular, longer than broad, abdomen 2-segmented and rather long. Maxilla 1 absent, sternal fork with long blunt limbs. Endopod of leg 1 large and spiny, claws on distal segment winged, setae spiny. Leg 4 indistinctly 4-segmented, claws flattened with crenate wings. Length 5.6 mm.

Host: *Ariodes dussumieri* (Val.), *Pseudarius jatus* (Ham. Buch.) *Arius acutirostris* Day.

Location: Branchial cavity.

Distribution: Ceylon, Kerala.

Lepeophtheirus spinifer Kirtisinghe

(Fig. 107)

Kirtisinghe, 1937 *a*, p. 441, figs. 41–58; Rangnekar, 1959 *a*, p. 51, fig. 4; Pillai, 1961, p. 128, fig. 23; Pillai (in press, *f*).

Carapace slightly longer than broad and visibly narrowing forwards, postero-median lobe projecting beyond lateral lobes and slightly overlapping fourth thoracic segment, latter broader than long. Genital segment roughly equal in length and width, with prominent rounded postero-lateral lobes. Abdomen short, 1-segmented, with slightly swollen base. Leg 5 a long strongly chitinated process reaching far beyond the anal laminae. Length 6.0 mm.

Host: *Rachycentron canadus* (Linn.), *Chorinemus tala* Cuvier.

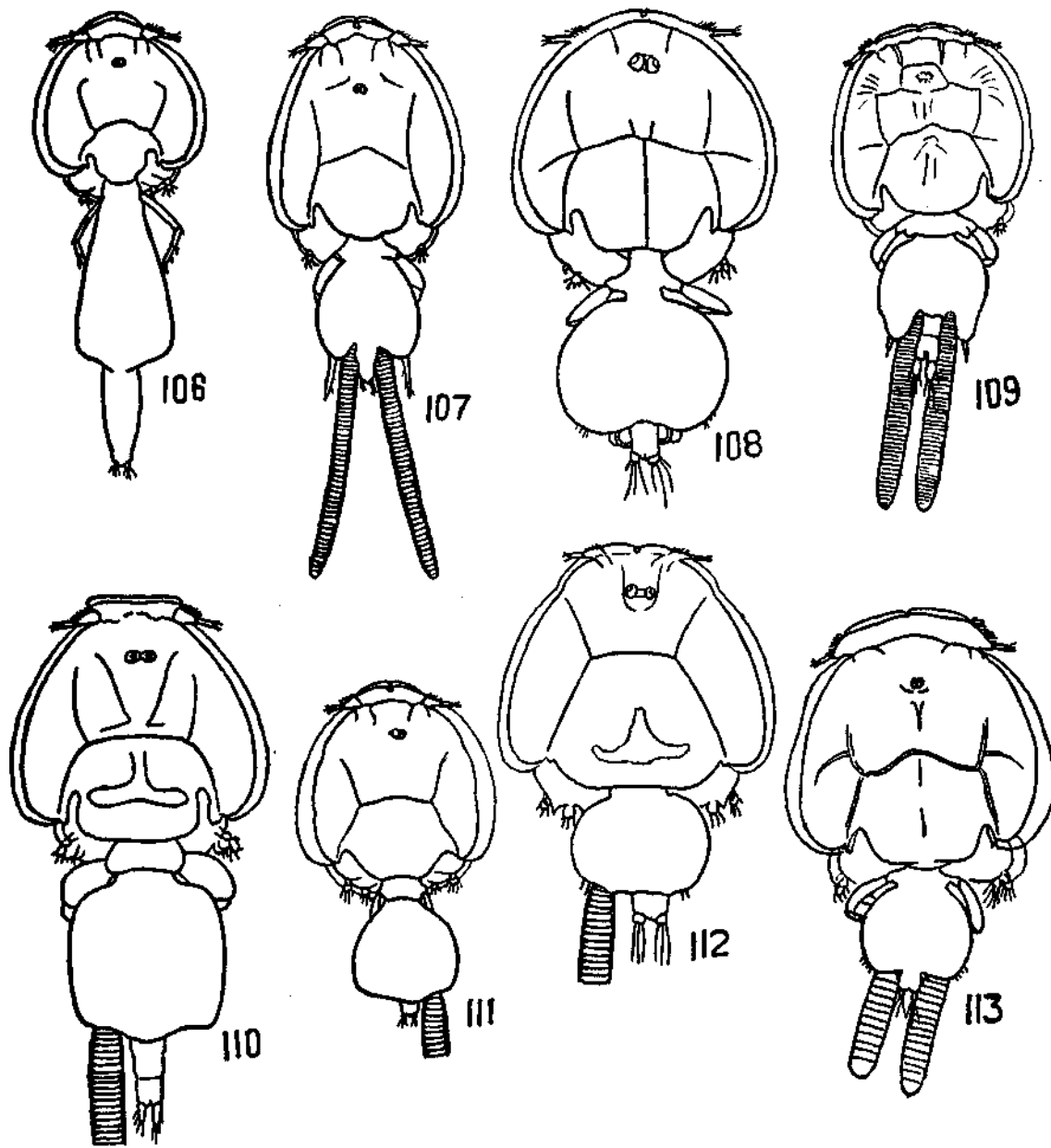
Location: Branchial cavity.

Distribution: Ceylon, Kerala and Bombay.

The extreme development of the fifth leg is an important character of *Dentigryps* Wilson and hence Lewis (1964 *a*) suggested the transfer of this species to *Dentigryps*. I have shown elsewhere that it would be more natural to sink *Dentigryps* in the synonymy of *Lepeophtheirus*.

Lepeophtheirus rotundiventris Bassett-Smith

(Fig. 108)

Bassett-Smith, 1898 *a*, p. 85, pl. 5, fig. 1; Kirtisinghe, 1964, p. 80, fig. 93.

FIGS. 106-113. (106) *Lepeophtheirus longipalpus*; (107) *Lepeophtheirus spinifer*; (108) *Lepeophtheirus rotundiventris* (Kirtisinghe, 1964); (109) *Lepeophtheirus crassus* (Shiino, 1960); (110) *Lepeophtheirus aesopus* (Kirtisinghe, 1964); (111) *Lepeophtheirus lagocephali*; (112) *Lepeophtheirus brachyurus* (Wilson, 1906); (113) *Lepeophtheirus gonistli* (Shiino, 1959).

Cephalothorax about as long as wide, half the entire length of body, median lobe a little less than half the width of the cephalothorax, projecting a little beyond the posterior level of the lateral lobes. Free thoracic segment narrow. Genital segment transversely oval. Abdomen 1-segmented. Anal laminae very small. Length 3.9 mm.

Host: *Serranus* sp., *Lutianus* sp.

Location: Branchial cavity.

Distribution: Persian Gulf and Ceylon.

***Lepeophtheirus crassus* (Bere)**

(Fig. 109)

Bere, 1936, p. 590, pl. 5, figs. 104–111, pl. 6, figs. 125–155 (*Glutopotes*); Shiino, 1960, p. 546, figs. 3–4.

Carapace orbicular, as wide as long, frontal plates small, membranous flange narrow. Postero-median lobe more than twice as broad as lateral lobes and not projecting beyond them. Fourth thoracic segment transversely linear, with poorly developed dorsal plates or lobes (?). Genital segment three-fifths as wide as carapace, with gracefully curved shoulders and posteriorly produced into oval lobes. Abdomen 2-segmented, segments subequal in length. Maxilla 1 simple, maxilla 2 bifid. Sternal fork with pointed limbs. Leg 4 with last claw very long. Leg 5 a stout process. Length 6.0 mm.

Host: *Echeneis albescens* T. & S.

Location: Surface of body.

Distribution: Gulf of Mexico and Bay of Bengal.

***Lepeophtheirus aesus* Wilson**

(Fig. 110)

Wilson, 1906, p. 192, pl. 1, figs. 11–19; Kirtisinghe, 1964, p. 78.

Carapace ovate, narrowing forwards. Thoracic area exceptionally small, about three-fifths the total width, lateral lobes of carapace broad, posterior sinuses wide open. Fourth thoracic segment transversely elliptical. Genital segment quadrate, two-thirds the size of the carapace, with rounded corners. Abdomen narrow, 3-jointed, anal laminae long. Sternal fork absent. Leg 4 4-jointed, with swollen basal segment, distal segments small, with 5 subsimilar claws. Length 5.75 mm.

Host: Unknown.

Distribution: Ceylon.

***Lepeophtheirus lagocephali* Pillai**

(Fig. 111)

Pillai, 1963 a, p. 93, fig. 16.

Carapace nearly circular, comparatively very broad, narrower in front, postero-median lobe 3 times as broad as lateral lobes, posterior sinuses fully open. Membranous flange of carapace broad. Genital segment as broad as long, roughly semicircular in outline. Abdomen short, indistinctly 2-segmented. Maxilla 2 simple, maxilla 1 bifid. Leg 4 4-segmented, last claw very long, more than 3 times the length of the just previous. Length 4.4 mm.

Host: Lagocephalus inermis (Schlegel).

Location: Surface of body.

Distribution: Kerala.

***Lepeophtheirus brachyurus* Heller**

(Fig. 112),

Wilson, 1906, p. 190, pl. 1, figs. 1-10; Barnard, 1955, p. 253, figs. 12 C-D; Kirtisinghe, 1964, p. 79, fig. 92.

Carapace ovate, twice as long as the rest of the body, median lobe of carapace very broad, three-fourths the total width, with concave hind border. Fourth thoracic segment concealed in dorsal view. Genital segment transversely elliptical, nearly half the width of carapace. Abdomen short and 1-segmented. Maxillae bifid. Basal segment of maxilliped 2 with a stout hollowed process. Leg 4 small, 2-jointed, segment 2 with 2 subsimilar terminal claws. Length 4.5 mm.

Host: Tetodon stellatus Bloch & Schneider, *Arothron reticulatus* (Bloch),

Location: Branchial cavity and surface of body.

Distribution: Java, Ceylon and South Africa.

The figure of this species given by Barnard is different from that given by Heller in the shape of the post-cephalothoracic part of the body. The 2-jointed leg 4 distinguishes this species.

***Lepeophtheirus gonistii* Yamaguti**

(Fig. 113)

Yamaguti, 1936, p. 10, pl. 9, figs. 132-133; Shiino, 1959, p. 343, fig. 5; Kirtisinghe, 1964, p. 78, fig. 91.

Carapace orbicular, frontal plates large, postero-median lobe half as wide as carapace and projecting slightly beyond lateral lobes. Fourth thoracic segment short, projecting outwards. Genital segment rounded. Abdomen 1-segmented, short. Basal claw of exopod of leg 3 bifid, the lower prong a large apically rounded lobe. Leg 5 a stout conical process. Length 5.4 mm.

Host: Gonistius zonatus (C. & V.), *G. quadricornis* (Günther), *Promicrops lanceolatus* (Bloch).

Location: Branchial cavity and surface of body.

Distribution: Japan and Ceylon.

Genus *Pupulina* Van Beneden

C. B. Wilson, 1935, p. 593; M. S. Wilson, 1952, p. 246; Yamaguti, 1963, p. 84; Pillai and Padmanabhan, 1963, p. 91.

Carapace like that of *Caligus*, without lunules. Genital segment postero-laterally produced into small conical processes or long laminae over-reaching the abdomen. Abdomen long and 2-segmented, anal laminae long and rod like. Surface of body denticulate. Appendages like those of *Caligus*. Sternal fork absent. Legs 1 to 3 biramous, leg 4 uniramous. First 2 endopod segments of leg 2 and endopod segment 2 of leg 3 winged, apron of leg 3 produced into a large flat lamina overlapping the ramii,

Pupulina brevicanda M.S. Wilson

(Fig. 114)

M. S. Wilson, 1952, p. 258, pl. 14, figs. 1-7, pl. 5; Pillai and Padmanabhan, 1963, p. 94, figs. 1-3.

Genital segment postero-laterally produced into long dorso-ventrally flattened laminae considerably overreaching the anal laminae. Abdomen comparatively long, anal laminae flat, elongate-oblong. Basal part of maxilla 1 prominently produced forwards. Length 14.4 mm.

Host: *Mobula diabolus* (Shaw), *M. lucasana* Beebe & Teevan.

Location: Surface of body.

Distribution: California and Kerala.

Pupulina minor M. S. Wilson

(Fig. 115)

M. S. Wilson, 1952, p. 254, pl. 13; Pillai, 1964 c, p. 238, figs. 1-19.

Genital segment slightly broader than long, postero-laterally produced into short conical processes. Abdomen short, slightly shorter than genital segment, anal laminae rod-shaped, basal part of maxilla 1 only moderately produced. Length 6.8 mm.

Host: *Mobula diabolus* (Shaw), *M. lucasana* Beebe & Teevan.

Location: Surface of body.

Distribution: California and India.

Genus *Anuretes* Heller

Yamaguti, 1963, p. 67.

Carapace large and orbicular, lunules absent. Fourth thoracic segment small, without dorsal plates, often hidden in dorsal view. Genital segment rounded, postero-laterally produced or not. Abdomen reduced and fused with genital segment, furca present or absent. Closely resembles *Lepeophtheirus* but distinguished by the near absence of abdomen.

Anuretes anomalus Pillai

(Fig. 116)

Pillai (in press, c).

Carapace comparatively large, postero-median lobe twice as broad as lateral lobes and not projecting beyond the latter, considerably overlapping the fourth segment, genital segment transversely rectangular, with rounded corners, abdomen indicated by a small bifid lobe. Antenna 2 with large basal process. Maxilla 1 stout, maxilla 2 with palp placed a little apart from the claw, sternal fork with apically rounded diverging limbs. Leg 4 3-segmented, with long claws. Length 2.0 mm.

Host: *Platax teira* (Forsk.).

Location: Gills.

Distribution: Kerala.

This species so closely resembles *Heniochophilus branchiatus* (Rangnekar) that one may reasonably suspect whether *Heniochophilus* is a valid genus (see below).

Anuretes perplexus Bassett-Smith

(Fig. 117)

Bassett-Smith, 1898 a, p. 88, pl. 5, fig. 3; Kirtisinghe, 1964, p. 78.

Carapace broader than long, postero-median lobe projecting beyond lateral lobes. Genital segment two-thirds the length of the cephalothorax, nearly circular. Abdomen reduced and fused to the ventral side of the genital segment, anal laminae present. Maxilliped 2 forming a very powerful holding organ, with a strong triangular process on the basal segment, second segment long and claw-like. Sternal fork very small. Leg 4 3-segmented. Length 3.0 mm.

Host: *Lutianus* sp.

Location: Not given.

Distribution: Ceylon.

Genus *Pseudanuretes* Yamaguti

Yamaguti, 1936, p. 17; 1963, p. 68; Kabata, 1965, p. 29.

Kabata defined the genus thus: Carapace oval, postero-median lobe overlapping genital segment. Fourth segment free. Lunules absent. Maxilla 1 and 2 absent, palp of maxilla 2 present. Prominent seta (maxillary whip) present near base of maxilliped 1. Sternal fork absent. Fourth leg either normally developed or reduced. Parasitic on marine teleosts.

Pseudanuretes schmitti Rangnekar

(Fig. 118)

Rangnekar, 1957 a, p. 10, fig. 2.

Carapace elliptical, longer than broad, median posterior lobe more than 4 times as broad as lateral lobes and projecting far beyond the latter and covering the fourth segment and part of the genital segment. Posterior sinuses absent. Genital segment acorn-shaped. Abdomen rudimentary, fused to the genital segment. Maxilla 1 present. Leg 4 reduced. Length 1.7 mm.

Host: *Platax teira* (Forsk.).

Location: Gills.

Distribution: Bombay.

According to Kabata (1965) this species should be removed from the genus *Pseudanuretes*. But before this question is decided the status of the genus itself needs reevaluation (see below).

Genus *Heniochophilus* Yamaguti and Yamasu

Yamaguti and Yamasu, 1959, p. 124; Yamaguti, 1963, p. 81; Kabata, 1965, p. 29; Pillai (in press, c).

Carapace comparatively very large, posterior sinuses reduced to mere slits, postero-median lobe large, produced backwards covering fourth segment and part of genital segment, genital segment swollen, abdomen reduced to a small bifid lobe. Maxilla 1 absent.

Heniochophilus branchialis (Rangnekar)

(Fig. 119)

Rangnekar, 1953, p. 239, figs. (*Anuretes*); Yamaguti and Yamasu, 1959, p. 121, pl. 10, figs. 198-204 (*japonicus*); Kabata, 1965, p. 22, figs. 2 A-K, 3 A-J; Pillai and Lal Mohan, 1965, p. 270, figs. 1-14.

Carapace longer than broad, postero-median sinuses not visible, median lobe slightly overlapping lateral lobes and produced backwards, reaching the anterior quarter of the genital segment, genital segment rounded, slightly broader than long (shape slightly variable), abdomen indistinguishable. Maxilla 1 very small, but present. Maxilla 2 small, palp separated by a small distance. Leg 4 indistinctly 3-segmented, with 4 long claws. Length 2.48 mm.

Host: *Katsuwonus pelamis* (Linn.), *Platax teira* (Forsk.), *Heniochus acuminatus* (Linn.).

Location: Gills.

Distribution: Japan, Brisbane, Bombay and Kerala.

Genus *Mappates* Rangnekar

Rangnekar, 1955, p. 303; Yamaguti, 1963, p. 86; Kabata, 1964 c, p. 648.

Carapace longer than broad, together with the postero-median lobe nine-tenths the total length. Postero-median lobe transversely oblong, with circular hind border and separated from the carapace proper by a prominent transverse rib and produced backwards. Fourth segment hidden both dorsally and ventrally. Genital segment produced below the abdomen and overlapped by the median lobe of carapace. Abdomen 1-segmented, fused to the dorsal side of the genital segment. Lunules, maxilla 1 and sternal fork absent. Leg 4 2-segmented, with 5 long claws.

Mappates plataxus Rangnekar

(Fig. 120)

Rangnekar, 1955, p. 304, figs. 1-2; Kirtisinghe, 1964, p. 77, figs. 89-90 (*Eirgos*).

Cephalothorax oval, longer than wide, more than half the entire length, median lobe about half the width of the cephalothorax, produced over the third thoracic segment into a semilunar dorsal plate extending over the fourth thoracic segment and over the anterior half of the genital segment. Latter wider than long, bearing the reduced fifth and sixth legs at its postero-lateral borders. Abdomen reduced to a short lobe bearing the anal laminae. Length 3.0 mm.

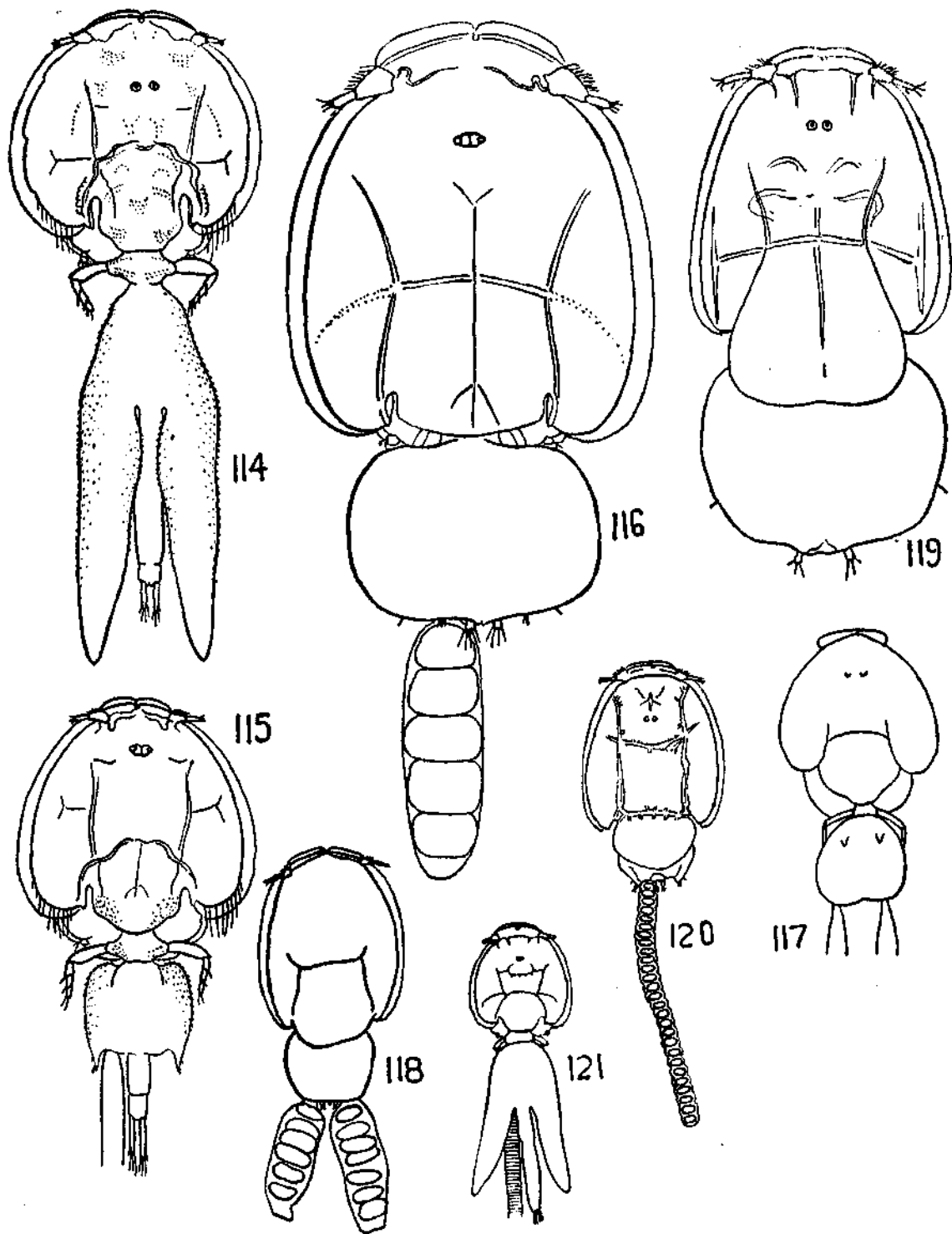
Host: *Platax teira* (Forsk.).

Location: Gills.

Distribution: Bombay and Ceylon.

Contrary to Kabata's opinion I am inclined to agree with Kirtisinghe that *Mappates* is not different from *Eirgos* Bere.

The four species described above, namely, *Anuretes anomalus*, *Pseudanuretes schmitti*, *Heniochophilus branchialis* and *Mappates plataxus* are parasites of *Platax teira* and these four genera show difference only in the presence or absence of maxilla 1, maxilla 2 and sternal fork. Kabata recently expressed the view that some of these characters are of doubtful generic value. As such a comparative study of these genera alone will show whether they are all valid.



FIGS. 114-121. (114) *Pupulina brevicauda*; (115) *Pupulina minor*; (116) *Anuretes anomalus*; (117) *Anuretes perplexus* (Bassett-Smith, 1898 a); (118) *Pseudanuretes schmitti* (Rangnekar, 1957 a); (119) *Hentiochophilus branchialis*; (120) *Mappates plataxus* (Kirtisinghe, 1964); (121) *Paralebion altuncus* (Rangnekar, 1955 a).

Genus *Paralebion* Wilson

Wilson, 1911, p. 628; Yamaguti, 1963, p. 104.

Carapace similar to that of *Alebion*, frontal plates small and ill-defined, without lunules. Fourth thoracic segment narrow and elongated, genital segment postero-laterally produced into long conical processes or short rounded lobes. Abdomen long or short.

Like *Midias*, *Paralebion* does not show any definite euryphorid character. It is therefore transferred to Caligidae.

Paralebion aliuncus (Rangnekar)

(Fig. 121)

Rangnekar, 1955 a, p. 48, figs. 18–28 (*Diphylllogaster*).

Carapace longer than broad, with low frontal plates, postero-median lobe truncate and very slightly projecting beyond lateral lobes, fourth trunk segment small, genital segment produced into large distally narrowed lobes stopping short of the tip of the abdomen, abdomen apparently 3-segmented, second segment longest, third very small. Length 6.7 mm.

Host: *Pampus argenteus* (Euphrasen).

Location: Surface of body.

Distribution: Bombay.

Closely resembles *P. elongatus* Wilson but differs in the shape of the sternal fork, the claw of the exopod of the third leg and the shape of the fourth leg.

Family EURYPHORIDAE

First three thoracic segments fused with head, frontal plates with or without lunules. Fourth thoracic segment small, with a pair of large dorsal plates, genital segment large, generally with postero-lateral lobes, abdomen 1 or 2-segmented, winged or not. All 4 pairs of legs biramous or the first and fourth uniramous.

The one character which distinguishes euryphorids from caligids is the presence of dorsal plates on the fourth thoracic segment. But hitherto a few genera like *Midias* and *Paralebion* have been placed under Euryphoridae. I have removed them from this family.

Genus *Tuxophorus* Wilson

Wilson, 1908, p. 617; Yamaguti, 1963, p. 105.

Carapace very much like that of *Caligus*, with lunules. Fourth thoracic segment with a pair of dorsal plates overlapping the genital segment. Sternal fork dichotomously branched except in *T. cybii*.

Tuxophorus caligodes Wilson

(Fig. 122)

Wilson, 1908, p. 617, pls. 55–56; Heegaard, 1946, p. 45, fig. 8; Rangnekar, 1959, p. 20, figs. 1–2; Pillai, 1961, p. 120, fig. 19.

Abdomen 2-segmented. Leg 5 formed of a tubercle carrying 2 setae. Sternal fork branched. Length 6.1 mm.

Host: *Rachycentron canadus* (Linn.).

Location: Surface of body.

Distribution: North America, East Africa, Bombay and Kerala.

***Tuxophorus wilsoni* Kirtisinghe**

(Fig. 123)

Kirtisinghe, 1937 *a*, p. 443, figs. 59–73; Pillai, 1961, p. 122, fig. 20.

Differs from *T. caligodes* by the following characters: Abdomen 1-segmented, leg 5 composed of a long chitinous process carrying spines and setae. Length 4.3 mm.

Host: *Chorinemus lysan* (Forsk.).

Location: Surface of body.

Distribution: Ceylon and Kerala.

***Tuxophorus cybii* Nunes-Ruivo and Fourmanoir**

(Fig. 124)

Nunes-Ruivo and Fourmanoir, 1956, p. 76, fig. 7; Kurian, 1961, p. 72, figs. 25–36 (*solandri*).

Easily distinguishable by the following characters: Anal laminae long and rod-like, sternal fork not branched, leg 5 formed of a conical process. Length 9.0 mm.

Host: *Cybbium commersoni* (Lacepede), *Acanthocybbium solandri* (Cuvier).

Location: Branchial cavity.

Distribution: Madagascar and Kerala.

T. cervicornis Heegaard (1962) closely resembles *T. cybii* but differs in the branched fifth legs.

Genus *Gloiopotes* Stp. & Lutk.

Wilson, 1932, p. 415; Yamaguti, 1963, p. 103; Hewitt, 1964, p. 85.

Carapace large, ovate, with antero-lateral rows of hairs and scattered spines all over, fourth thoracic segment with a pair of dorsal plates, genital segment large, produced into two fleshy lobes carrying a styliform process postero-laterally, abdomen slender and 2-segmented, anal laminae rod-like. Antenna 1 with a false partition on segment 2. Maxilla 2 bifid, sternal fork dichotomously branched. Distal claws on leg 1 bifurcated, with a third spine in the fork.

***Gloiopotes longicaudatus* Marukawa**

(Fig. 125)

Kirtisinghe, 1934, p. 167, figs. 1–17 (*watsoni*); Rao, 1951, p. 248, figs. 1–15 (*zeugopteri*); Shiino, 1954 *a*, p. 274, figs. 1–2; 1959, p. 348; Pillai, 1964, p. 63, figs. 14–15 (*watsoni*).

Carapace ovate, postero-median lobe truncate, with antero-lateral and postero-lateral rows of hairs. Dorsal plates of fourth segment posteriorly produced and triangular, considerably overlapping genital segment. Posterior lobes of genital segment apically rounded and curved inwards,

the chitinised process reaching tip of abdomen. First segment of abdomen broader but shorter than second. Length 10.5 mm.

Host: *Makaira indica* (Cuv.), *Tetrapturus brevirostris* (Playfair).

Location: Surface of body.

Distribution: Japan, Ceylon and India.

Hewitt (1964) expressed the opinion that *G. longicaudatus* is a synonym of *G. huttoni* (Thomson). This view might be correct since most of the known species of *Gloiopotes* show very little specific difference.

Genus *Euryphorus* Milne-Edwards

Yamaguti, 1963, p. 98.

Carapace orbicular, with small lateral notches, prominently pigmented. Lunules absent. Fourth thoracic segment with a pair of dorsal plates. Genital segment large, with a pair of posterior lobes above the insertion of the egg sacs. Abdomen 2 or 3-segmented, basal segment with large lamelliform expansion. Anal laminae ovoid. Legs 1 to 4 biramous, rami of first and endopod of fourth 2-segmented.

Euryphorus nympa Stp. & Lutk.

(Fig. 126)

Shiino, 1954 a, p. 284, figs. 5-6; Kirtisinghe, 1937 a, p. 445, figs. 74-87 (*nordmanni*); Pillai, 1964, p. 64, fig. 16; Kirtisinghe, 1964, p. 88, fig. 104; Kabata and Gusev, 1966, p. 164, figs. 16-24, 27, 28.

Carapace somewhat squarish, as long as broad, lateral borders nearly straight, with 2 pairs of median notches, posterior sinuses shallow and wide open, postero-median lobe extending slightly beyond lateral lobes. Fourth thoracic segment with a pair of rectangular dorsal plates, longer than broad, slightly overlapping genital segment. Genital segment very large, transversely ovate and slightly broader than carapace, its hind border with a pair of distally rounded lobes, longer than broad. Abdomen apparently 3-segmented, first segment twice as long as the rest of the abdomen, produced into a pair of large flattened lobes, apically narrowed and extending well beyond the anal laminae, third segment short. Length 11.3 mm.

Host: *Coryphaena hippurus* Linn.

Location: Branchial cavity.

Distribution: Kerala and Ceylon; cosmopolitan.

Genus *Elytrophora* Gerstaecker

Wilson, 1932, p. 416; Yamaguti, 1963, p. 102.

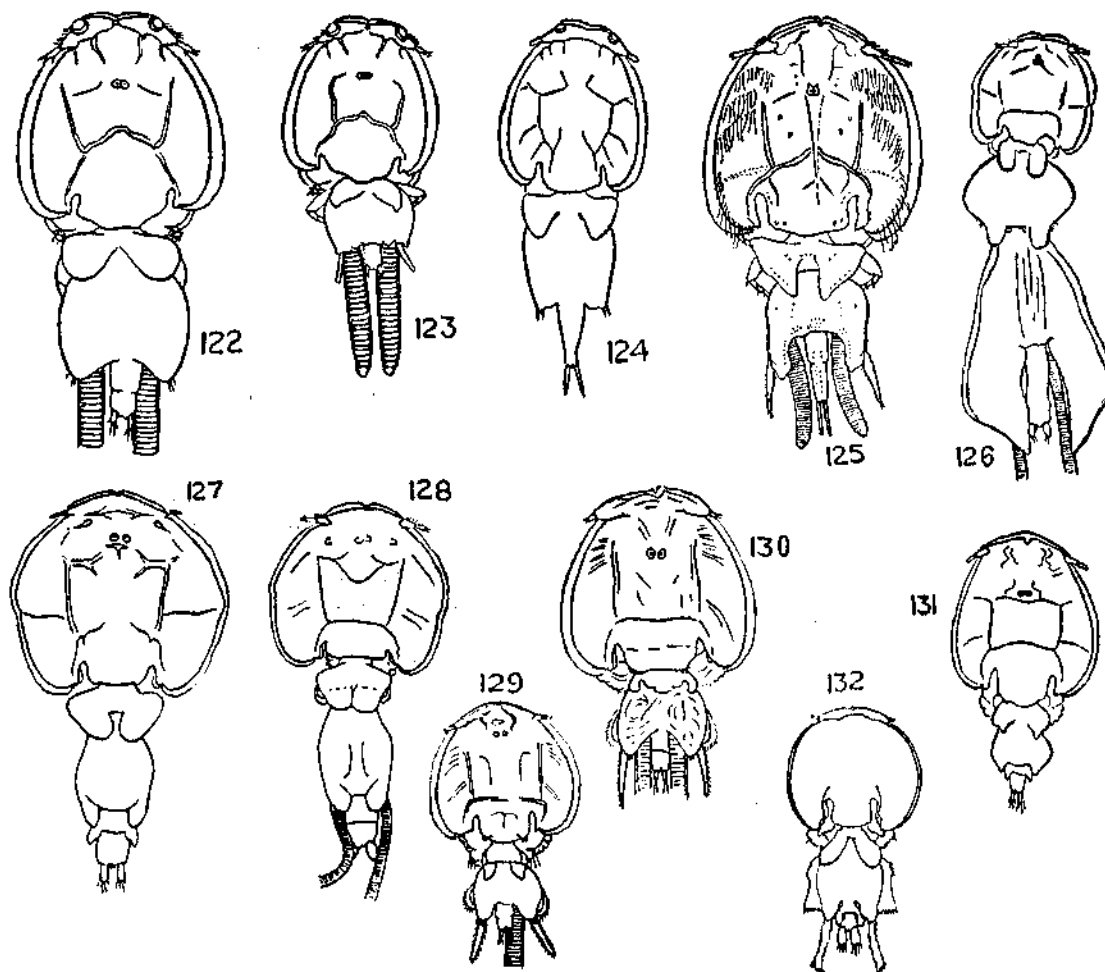
Carapace as wide as long, nearly circular, with short and broadly rounded posterior lobes. Fourth segment with a pair of small dorsal plates slightly overlapping the genital segment, fused at their base. Genital segment of medium size, longer than wide, with broad lobes at the posterior corners. Abdomen 2-segmented, caudal rami laminate, setose. Legs 1 to 4 biramous, rami of first 2-segmented, of second and third pairs 3-segmented, exopod of fourth pair 3-segmented, endopod 2-segmented. Maxilla absent.

Elytrophora hemiptera Wilson

(Fig. 127)

Wilson, 1921, p. 4, pl. 2, figs. 13-19; Shiino, 1954 a, p. 279, figs. 3-4 (*brachyptera*); 1958, p. 105.

Carapace orbicular, wider than long, lateral lobes broad, only slightly narrower than the median lobe. Fourth thoracic segment with a short neck, dorsal plates fused into a trapezoid lobe, overlapping in the middle. Genital segment three-fourths the length of carapace, longer than broad, barrel-shaped, hind margin produced into an obovate lobe overlapping abdomen. Abdomen short, first segment with angular posterior corners. Length 8.3 mm.



FIGS. 122-132. (122) *Tuxophorus caligodes*; (123) *Tuxophorus wilsoni*; (124) *Tuxophorus cybii* (Nunes-Ruivo and Fourmanoir, 1956); (125) *Gloiopotes longicaudatus*; (126) *Euryphorus numpha*; (127) *Elytrophora hemiptera* (Shiino, 1954 a); (128) *Elytrophora indica* (Shiino, 1958); (129) *Alebion spinosus* (Rangnekar, 1959 a); (130) *Alebion alatus* (Gnanamuthu, 1951); (131) *Alebion megacephalus* (Kirtisinghe, 1964); (132) *Alebion echinatus* (Yamaguti, 1963).

Host: *Thynnus orientalis*, *Neothynnus albacora* (Lowe).

Location: Gills.

Distribution: Cosmopolitan. Indian ocean and Ceylon.

Elytrophora indica Shiino

(Fig. 128)

Shiino, 1958, p. 107, figs. 4-6.

Carapace half the total length, circular and very slightly wider than long. Postero-median lobe small, one-fourth the width of carapace, with truncate hind border, lateral lobes overreaching median lobe. Fourth thoracic segment half the width of carapace, dorsal plates oblong ovate, meeting but not overlapping. Genital segment half as long as carapace, parallel sided, with a pair of posterior lobes extending nearly straight backwards. First abdominal segment with prominent postero-lateral lobes extending oblique backwards. Length 8.4 mm.

Host: *Parathynnus obesus* (Lowe).

Location: Gills.

Distribution: South of Ceylon.

Genus *Alebion* Kroyer

Barnard, 1955, p. 254; Yamaguti, 1963, p. 99.

Carapace shield-like, fourth segment free, with a pair of dorsal plates. Genital segment with hind corners usually produced. Abdomen 2-segmented, hind corners of basal segment produced, caudal rami lamelliform. First 3 pairs of legs biramous, outer ramus with horny claws, rami of first leg 2-jointed, of second and third 3-jointed, fourth leg rudimentary. Lunules and sternal fork absent.

Alebion spinosus Rangnekar

(Fig. 129)

Rangnekar, 1959 a, p. 53, figs. 5-6.

Carapace orbicular, postero-median lobe slightly broader than lateral lobes, posterior sinuses deep. Dorsal plates of fourth thoracic segment cordiform, narrow and curved outwards at the tip. Genital segment produced into rounded postero-lateral lobes with a few apical spines and carrying a pair of long processes with spiny border reaching far beyond the anal laminae, a pair of lateral processes also present. Abdomen 2-segmented, first segment without postero-lateral lobes. Length 5.8 mm.

Host: Unidentified shark.

Location: Surface of body.

Distribution: Bombay.

Though Rangnekar has clearly stated that this species is different from *A. alatus*, there is a possibility that they may prove to be the same.

SM-V-7

Alebion alatus Gnanamuthu

(Fig. 130)

Gnanamuthu, 1951, p. 1237, figs. 1-22.

Carapace orbicular, postero-median lobe extending beyond lateral lobes, the hind border of both median and lateral lobes spiny. Fourth segment half as broad as median lobe of carapace, dorsal plates extending over the genital segment. Genital segment large, 3 times as broad as fourth segment, with a wing-like lobe on either side, bearing 2 rows of short spines along the outer margin, each lobe continued as a long process reaching beyond the anal laminae, postero-lateral lobes of genital segment conical. Abdomen slender and 2-jointed, first segment without posterior lobes. Length 5.08 mm.

Host: Carcharinid shark.

Location: Surface of body.

Distribution: Gulf of Mannar.

Alebion megacephalus Kirtisinghe

(Fig. 131)

Kirtisinghe, 1956, p. 15, figs. 5-8; 1964, p. 82, fig. 96.

Carapace elliptical, longer than wide and more than half the length, postero-median lobe much wider than lateral lobes and projecting far beyond the latter. Dorsal plates of fourth segment projecting sideways, with small posterior lobe overlapping genital segment, genital segment with posterior processes embracing abdomen and armed with a row of inner spines. Abdomen 2-segmented, first segment short, its posterior lobes reaching middle of second segment. Length 5.0 mm.

Host: Carcharinid shark.

Location: Surface of body.

Distribution: Ceylon.

Alebion echinatus Capart

(Fig. 132)

Rao, 1950, p. 302, figs. 1-9 (*Platyporinus alatus*); Capart, 1953, p. 655, fig. 4; Shiino, 1955a, p. 177, figs. 1-3; Vaissiere, 1959, p. 544, fig. 5; Lewis, 1966, p. 130, figs. 33-35.

Carapace perfectly circular, frontal plates very low, postero-median lobe as broad as lateral lobes, latter curved inwards and overreaching median lobe, posterior sinuses closed. Dorsal plates of fourth trunk segment overlapping genital segment and widening distalwards, genital segment with a pair of wing-like lobes projecting laterally and produced into long posterior processes with spiny border, postero-lateral corners produced and spiny. Abdomen 2-segmented, lobes of segment 1 reaching tip of segment 2. Length including egg sacs 13.0 mm.

Host: *Sphyrna diplana*, *Sphyrna* sp.

Location: Surface of body.

Distribution: Senegal, Japan, India, Hawaii.

Family DISSONIDAE

Genus *Dissonus* Wilson

Wilson, 1906, p. 198; Kirtisinghe, 1950, p. 83; 1964, p. 85; Kabata, 1966, p. 225.

First thoracic segment fused with head, second, third and fourth free, second provided with lateral plates. Ventral surface of genital segment with or without backwardly directed spines. Antennae and mouthparts as in Caligidae. Maxilla 1 absent, sternal fork present or absent. Legs 1 to 4 biramous, rami of first 2-jointed, of others 3-jointed. Abdomen 1-segmented, except in one species.

Dissonus spinifer Wilson

(Fig. 133)

Wilson, 1906, p. 198, pl. 3, figs. 34–47; Kirtisinghe, 1964, p. 85; Kabata, 1965 *b*, p. 8.

Carapace transversely semilunar, twice as wide as long. Thoracic segments 2 to 4 diminishing regularly in size, second as broad as carapace with the lateral lobes as wide as the postero-lateral lobes of the carapace. Genital segment quadrangular, wider than long and narrower than fourth segment, its entire ventral surface covered with spines. Abdomen three-eighths the length of the genital segment, 1-jointed. Maxilla 2 with accessory process. Maxilliped 2 stout, basal segment with raised corrugated pad. Length 3.0 mm.

Host: Unknown.

Distribution: Ceylon.

Dissonus furcatus Kirtisinghe

(Fig. 134)

Kirtisinghe, 1950, p. 77, figs. 5–12; 1964, p. 86, figs. 100–101; Kabata, 1965 *b*, p. 8.

Cephalothorax broader than long, thoracic segments 2 and 3 as broad as cephalothorax, lateral plates of second segment not as wide as the lateral lobes of cephalothorax, fourth thoracic segment narrower but longer than the two previous ones. Genital segment longitudinally ovate with an arc of bifid spines at the anterior third of the ventral side. Abdomen 1-segmented, two-thirds as long as genital segment, longer than broad, anal laminae oval. Length 5.5 mm.

Host: Orectolobid shark.

Location: Gills.

Distribution: Ceylon.

Family TREBIDAE

Genus *Trebius* Kroyer

Wilson, 1932, p. 413; Yamaguti, 1963, p. 130.

First and second thoracic segments fused with head, third and fourth segments free, without dorsal plates. Lunules absent. Genital segment swollen. Abdomen long, 1 to 3-segmented. Cephalothoracic appendages as in *Caligus*. Legs 1 to 4 biramous, rami of first pair 2-segmented, those of others 3-segmented (rarely 2-segmented) fourth endopod occasionally reduced.

Trebius exilis Wilson

(Fig. 135)

Wilson, 1906, p. 194, pl. 2, figs. 20-33; Kirtisinghe, 1964, p. 77.

Carapace ovate, narrowing forwards. Third thoracic segment slightly wider than fourth, laterally projecting beyond the lateral lobes of carapace. Fourth segment longer than third, widened at the base of the legs producing a spindle shape. Genital segment perfectly elliptical, with a short anterior neck, without spines or postero-lateral processes. Abdomen nearly half the length of genital segment, 1-segmented, anal laminae long. Sternal fork small, 4 times as long as broad, with very short diverging branches. Endopod of leg 4 much smaller than exopod, 2-segmented. Length 5.75 mm.

Host: *Rhinoptera javanica* Mull. & Henle.

Distribution: Ceylon.

The 1-segmented abdomen, unbranched maxilla 2 and the rudimentary endopod of leg 4 distinguish this species.

Family PANDARIDAE

Genus *Pandarus* Leach

Wilson, 1932, p. 432; Barnard, 1955, p. 256; Yamaguti, 1963, p. 110.

Head fused with first trunk segment. Carapace smooth, without grooves, postero-lateral lobes moderate in size, hind margin excavate and dentate. Free segments 3, each with a pair of plates, those of second dorso-lateral, others dorsal. Genital segment large, with lobately prolonged posterior corners. Sixth segment represented by a median lobe hiding the abdomen. Abdomen short, 2-segmented, anal laminae lateral, flattened, subtriangular or conical and acicular.

Pandarus cranchii Leach

(Fig. 136)

Wilson, 1907, p. 403, pl. 28; Heegaard, 1943 a, p. 27, figs. 76-78; Lewis, 1966, p. 81, figs. 10-13.

Body ovate, carapace wedge-shaped, frontal plates wide and prominent. Eyes far in front. Hind border of carapace armed with 7 to 10 large teeth, postero-lateral lobes short and wide, reaching beyond the first pair of dorsal plates. Dorsal plates of second trunk segment very large, reaching beyond the centre of those of the fourth segment, roughly oblong in shape. Third pair of plates fused, with deep median sinus, as long as the exposed part of the succeeding plate. Genital segment produced into a pair of long triangular processes. Length 9.6 mm.

Host: Unidentified shark.

Distribution: Cosmopolitan, Bay of Bengal.

Pandarus niger Kirtisinghe

(Fig. 137)

Kirtisinghe, 1950, p. 83, figs. 13-28; 1964, p. 83, figs. 97-98.

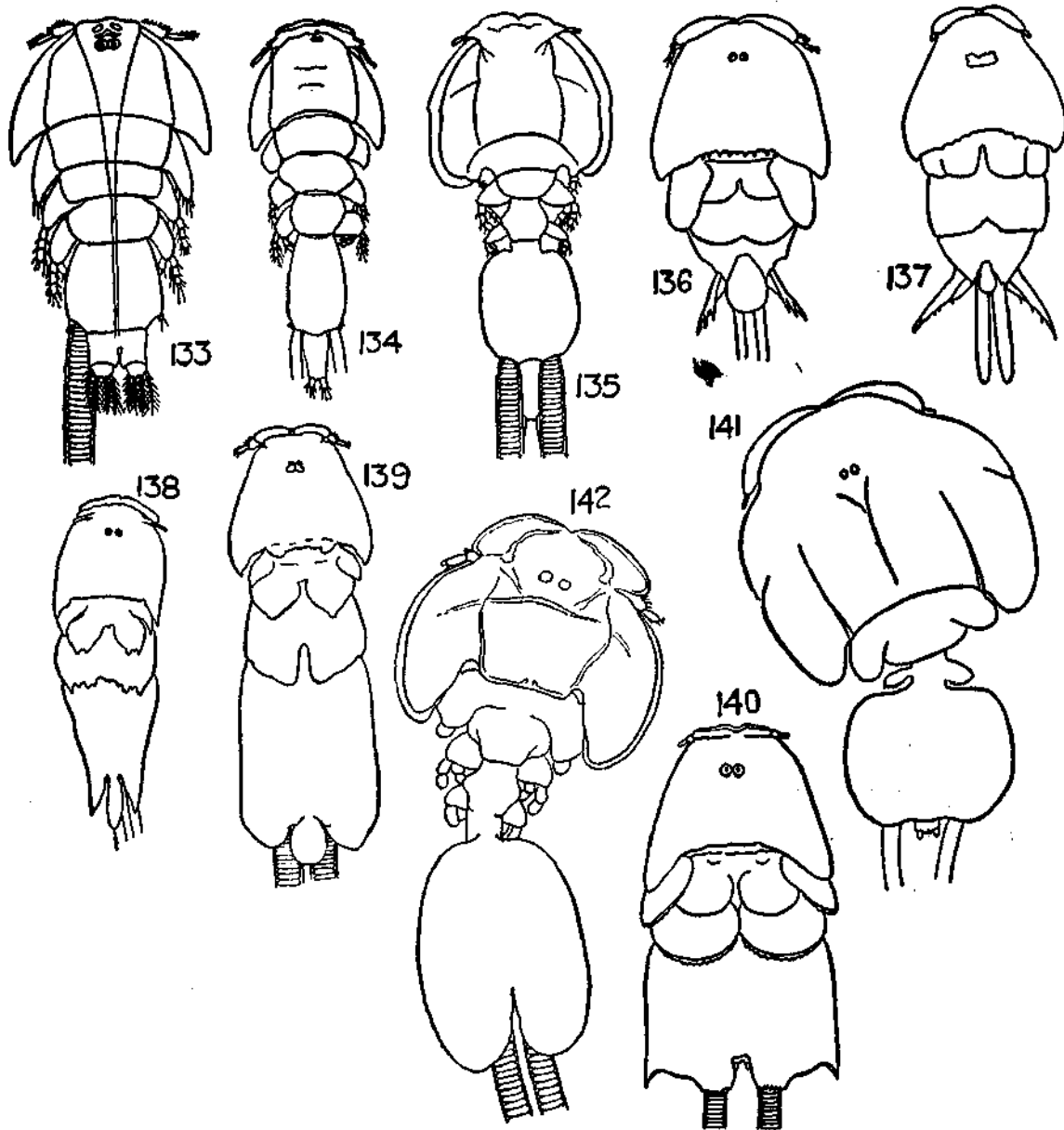
Cephalothorax triangular, hind border twice the frontal width and toothed, frontal plates wide. Dorsal plates of segments 2 and 3 extending backwards to the same level, latter wider and separated by a median incision, dorsal plates of segment 4 fused into a rectangular plate overlying more

than half the genital segment, that of genital segment produced backwards into bifid lobes on either side of the abdominal plate. Anal laminae large, pointed. Length 6.5 mm.

Host: Carcharinid shark.

Location: Surface of body.

Distribution: Ceylon.



FIGS. 133-142. (133) *Dissonus spinifer* (Wilson, 1906); (134) *Dissonus furcatus* (Kirtisinghe, 1950); (135) *Trebius exilis* (Wilson, 1906); (136) *Pandarus cranchii* (Wilson, 1907); (137) *Pandarus niger* (Kirtisinghe, 1950); (138) *Pseudopandarus gracilis* (Kirtisinghe, 1950); (139) *Pseudopandarus longus*; (140) *Perissopus manuolensis*; (141) *Echthyrogadus pectinatus* (Kirtisinghe, 1964); (142) *Nesippus vespa*.

Genus *Pseudopandarus* Kirtisinghe

Kirtisinghe, 1950, p. 84; Yamaguti, 1963, p. 128.

Differing from *Pandarus* as follows: Dorsal plates of genital segment produced backwards into three lobes, median lobe extending over and fully hiding the abdomen. Anal laminae broad, flattened and setose.

Pseudopandarus gracilis Kirtisinghe

(Fig. 138)

Kirtisinghe, 1950, p. 84, figs. 29-35; 1964, p. 84, fig. 99.

Body 3 times as long as broad, cephalothorax semielliptical, less than one-third the total length, lateral lobes triangular. Dorsal plates of second thoracic segment triangular, of third broad, covering about half of those of the fourth, latter about half as broad as cephalothorax and with lobed hind border. Dorsal plates of genital segment narrowing backwards, posteriorly trilobed, lateral lobes triangular, median lobe long and linguiform. Abdomen 1-segmented, anal laminae broad, with 6 spine setae. Length 4.0 mm.

Host: Dog fish.

Location: Surface of body.

Distribution: Ceylon.

Pseudopandarus longus (Gnanamuthu)

(Fig. 139)

Gnanamuthu, 1951, p. 1245, figs. 23-44 (*Pandarus*); Kurian, 1955, p. 114, fig. 38 (*Pandarus*); Pillai, 1964, p. 65, figs. 17-19.

Carapace roughly semicircular, hind margin lobed, postero-lateral lobes narrow. Dorsal plates of second thoracic segment roughly elliptic and obliquely placed, slightly overlapping the plates of the third segment, latter fused into a semicircular plate with narrow and deep postero-medial incision. Dorsal plates of fourth segment fused, with shallow but broad posterior incision. Genital segment as long as rest of body. Abdomen 2-segmented. Length 4.9 mm.

Host: *Scoliodon sorrakowah* (Cuvier).

Location: Surface of body.

Distribution: Madras and Kerala.

Genus *Perissopus* Stp. & Lutk.

Wilson, 1932, p. 424; Barnard, 1955, p. 260; Yamaguti, 1963, p. 125.

Body ovate, posteriorly squarish. Carapace smooth, without grooves. Free thoracic segments 3, each with a pair of plates, those of the second segment dorso-lateral, those of third and fourth dorsal and meeting but not fused medially. Genital segment large, postero-lateral corners quadrate, hind margin with small incision exposing the abdomen. Abdomen 1-segmented,

Perissopus manuelensis Gnanamuthu

(Fig. 140)

Gnanamuthu, 1951 e, p. 9, figs. 1-5; Kurian, 1955, p. 108, figs. 19-37 (*travancoriensis*); Pillai, 1964, p. 67, figs. 40-59.

Carapace roughly triangular, postero-lateral lobes blunt, posterior border trilobed. Dorsal plates of second trunk segment oblong, obliquely placed, with thin flange on distal inner border, dorsal plates of third segment not overlapping in the middle, those of fourth segment semicircular, overlapping in the middle, with thin flange on hind border. Genital segment posteriorly produced into 2 pairs of lobes, inner lobe apically dentate, outer pointed. Length 4.4 mm.

Host: *Scoliodon sorrakowah* (Cuvier).

Location: Surface of body.

Distribution: Ceylon and Kerala.

Capart (1953) observed that the genus *Perissopus* contains only one species, *dentatus* Stp. & Lutk, and that all the others recorded under various names are its synonyms. Though this view appears to be correct, for the present it is not followed here.

Genus *Echthrogaleus* Stp. & Lutk.

Wilson, 1932, p. 426; Barnard, 1955, p. 263; Yamaguti, 1963, p. 118.

Carapace with grooves, dorsal plates of fourth segment large and covering more than half of the genital segment, genital segment large, often larger than carapace, with deep posterior sinus. Abdomen small, concealed, caudal rami large, with non-plumose setae. Rami of leg 1 2-jointed, exopod of legs 2 and 3 3-segmented, rami of leg 4 indistinctly jointed.

Echthrogaleus pectinatus Kirtisinghe

(Fig. 141)

Kirtisinghe, 1964, p. 89, figs. 105-114.

Cephalothorax about as long as wide, more than half the entire length, second and third thoracic segments of equal length, partially fused, lateral lobes of the second reaching distal margin of third, fourth segment narrow, with a pair of small plates bearing teeth and projecting sideways, genital segment much smaller than carapace, with a pair of postero-lateral spines, posterior incision absent. Length 6.4 mm.

Host: *Rhincodon typus* Smith.

Location: Gills and buccal cavity.

Distribution: Ceylon.

This species is quite unlike all the other species and appears to necessitate slight modification of the existing definition of the genus.

Genus *Nesippus* Heller

Wilson, 1932, p. 438; Barnard, 1955, p. 264; Yamaguti, 1963, p. 122.

Carapace smooth, without grooves, second and third segments fused, with lateral plates, fourth segment free, with a pair of fused dorsal plates. Genital segment large, without posterior

processes or rudiments of legs. Abdomen small, concealed, caudal rami large, more or less concealed. Rami of legs 1 to 3 2-jointed, of fourth 1-jointed.

Nesippus vespa Kirtisinghe

(Fig. 142).

Kirtisinghe, 1964, p. 91, figs. 115-122; Pillai (in press, e).

Carapace slightly broader than long, with prominent frontal plates and postero-lateral lobes, second segment with large lateral plates, third segment distally narrowed, fourth segment narrow, together with the narrow neck of the genital segment forming a prominent waist, genital segment as long as broad or longer than broad, with deep postero-median incision. Length 3.3 mm.

Host: *Rhynchobatus* sp.

Location: Surface of body and gills.

Distribution: Ceylon and Kerala.

Family ANTHOSOMATIDAE

Genus *Lernanthropus* Blainville

Yamaguti, 1963, p. 146.

Body clearly demarcated into a carapace and trunk, latter divided into anterior and posterior divisions, the anterior division formed by the fusion of segments 2 and 3 and the posterior by the incomplete fusion of segments 4 and 5, genital segment and abdomen, the posterior division is generally overlapped by the dorsal plate which is a backward extension of the third trunk segment. Lateral parts of carapace expanded into large flaps folded downwards. Antenna 1 6 to 7-segmented, borne on an antennal lobe. Antenna 2 uncinat. Legs 1 and 2 small, biramous, rami unsegmented. Leg 3 biramous, rami large and foliaceous, generally remaining at right angles to the trunk. Leg 4 biramous, rami long and flattened. Leg 5 uniramous, often reduced or absent. Anal laminae generally with small spines or setules.

Lernanthropus koenigii Stp. & Lutk.

(Fig. 143)

Gnanamuthu, 1950 e, p. 277, figs. 19-33.

Carapace nearly equal in length and width, antero-lateral parts produced into prominent forwardly projecting lobes. Anterior division of trunk much broader than long, postero-laterally produced into triangular lobes. Dorsal plate pyriform, longer than broad and narrowing backwards, hind border with shallow concavity. Fourth and fifth legs projecting beyond the dorsal plate. Length 5.0 mm.

Host: *Parastromateus niger* (Bloch).

Location: Gills.

Distribution: Madras.

Lernanthropus decapteri Pillai

(Fig. 144)

Pillai, 1964 b, p. 57, fig. 14,

Carapace with prominent antero-lateral lobes, anterior division of trunk short but broad, dorsal plate cleft right up to its base. Maxilliped 2 massive. Leg 3 uniramous, the two members fused into a conical lobe, leg 4 short, endopod shorter than exopod, leg 5 rudimentary. Length 3.4 mm.

Host: *Decapterus russellii* (Ruppell).

Location: Gills.

Distribution: Kerala.

Lernanthropus alatus Pillai

(Fig. 145)

Pillai, 1964 b, p. 46, fig. 8.

Carapace oblong, longer than broad, anterior division of trunk swollen at the posterior two-thirds and ending in blunt postero-lateral corners, dorsal plate narrower behind, with a postero-median concavity. Basal segment of antenna 1 enlarged and placed at right angles to the rest of the appendage. Maxilliped 1 with 2 subsidiary claws, leg 3 biramous, leg 4 with subequal rami, narrowing towards the tip, leg 5 rudimentary. Anal laminae longer than abdomen. Length 3.9 mm.

Host: *Selaroides leptolepis* (Cuvier).

Location: Gills.

Distribution: Kerala.

Lernanthropus opisthopteri Pillai

(Fig. 146)

Pillai, 1964 b, p. 54, fig. 12.

Carapace with large lateral flaps forming two rounded antero-lateral lobes, posterior part narrower. Anterior division of trunk not clearly demarcated from dorsal plate, the two forming a pyriform structure. Rami of leg 3 fused, leg 4 very long, rami drawn out into slender filaments as long as the trunk, leg 5 absent. Egg tubes very long. Length 2.1 mm.

Host: *Opisthopterus tardoer* (Cuvier).

Location: Gills.

Distribution: Trivandrum.

Lernanthropus gibbosus Pillai

(Fig. 147)

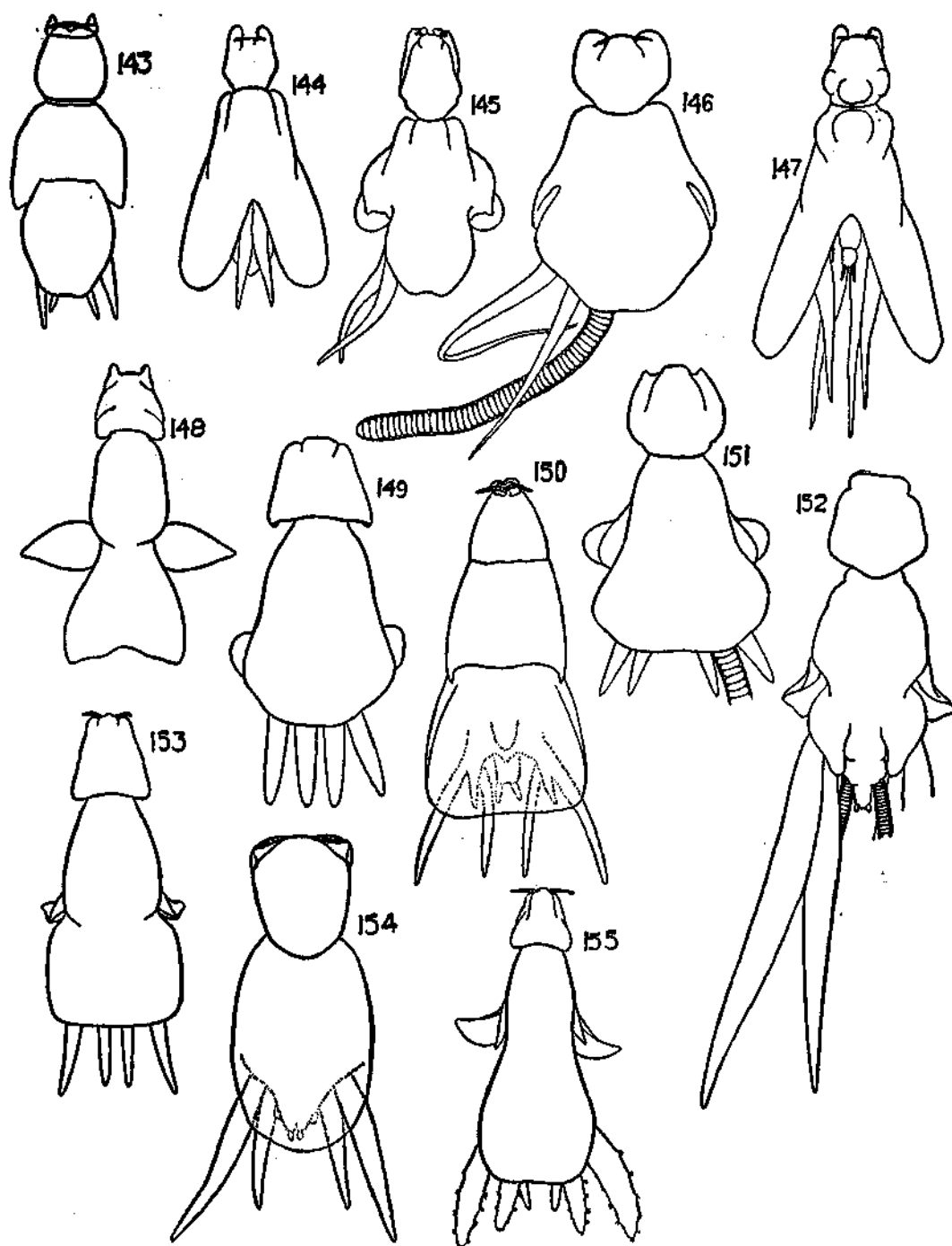
Pillai, 1964 b, p. 56, fig. 13.

Carapace with very large antero-lateral lobes, a pair of lateral bosses and a postero-median boss. Anterior division of trunk with antero-lateral and dorso-median bosses. Dorsal plate deeply cleft. Leg 3 uniramous and narrow, leg 4 long and slender, endopod only slightly shorter than exopod, leg 5 very short. Anal laminae as long as abdomen. Length 6.1 mm.

Host: *Saurida tumbil* (Bloch).

Location: Gills.

Distribution: Kerala.



FIGS. 143-155. (143) *Lernanthropus koenigii* (Gnanamuthu, 1950 e); (144) *Lernanthropus decapteri*; (145) *Lernanthropus alatus*; (146) *Lernanthropus opisthopteri*; (147) *Lernanthropus gibbosus*; (148) *Lernanthropus robustus*; (149) *Lernanthropus pristipomoides* (Kirtisinghe, 1937 a); (150) *Lernanthropus sclaeae* (Gnanamuthu, 1947 b); (151) *Lernanthropus sillaginii*; (152) *Lernanthropus shishidoi*; (153) *Lernanthropus triangularis*; (154) *Lernanthropus dussumieri* (Gnanamuthu, 1949); (155) *Lernanthropus lappaceus*.

Lernanthropus robustus Pillai

(Fig. 148)

Pillai, 1964 *b*, p. 50, fig. 10.

Carapace triangular, with prominent blunt antero-lateral processes, anterior division of trunk oblong, dorsal plate triangular, with deeply concave hind border. Abdomen longer than broad, anal laminae as long as abdomen. Maxilliped 1 with 2 accessory claws. Exopod of leg 2 with 2 spines, leg 3 uniramous and cut into 4 lobes, leg 4 with short subsimilar distally narrowed rami, leg 5 fusiform. Length 8.7 mm.

Host: *Caranx* sp.*Location*: Gills.*Distribution*: Kerala.*Lernanthropus pristipomoides* Kirtisinghe

(Fig. 149)

Kirtisinghe, 1937 *a*, p. 450, figs. 99–107; 1964, p. 97, figs. 130–131.

Antennal lobe of carapace prominent and projecting beyond the antero-lateral lobes, carapace roughly triangular. Anterior division of trunk longer than dorsal plate, not clearly demarcated from the latter, dorsal plate transversely oblong, with evenly rounded hind border. Basal segment of antenna 1 enlarged and remaining at right angles to the rest of the limb like that of *L. alatus* Pillai (1964). Length 4.0 mm.

Host: *Pristipomoides typus* Bleeker.*Location*: Gills.*Distribution*: Ceylon.*Lernanthropus sciaenae* Gnanamuthu

(Fig. 150)

Gnanamuthu, 1947 *b*, p. 291, figs. 1–3.

Carapace subtriangular, with antero-median acuminate projection. Anterior division of trunk gradually broadening backwards, roughly equal in length and width, its postero-lateral corners produced into triangular processes overlapping the dorsal plate. Dorsal plate similar to the anterior division of trunk but broader, hind border concave. Leg 4 triramous, leg 5 vestigial. Anal laminae longer than abdomen. Length 3.2 mm.

Host: *Sciaena glauca* Day.*Location*: Gills.*Distribution*: Madras.

The alleged third ramus of the fourth leg might be the fifth leg.

Lernanthropus sillaginis Pillai

(Fig. 151)

Pillai, 1963, p. 666, fig. 6; Kirtisinghe, 1964, p. 96, figs. 128–129 (*villiersi*).

Carapace with comparatively very large lateral lobes, dorsal plate transversely oblong. Leg 3 biramous, rami subequal in size, leg 4 with subsimilar rami, leg 5 absent. Length 2.5 mm.

Host: *Sillago sihama* (Forsk.)

Location: Gills.

Distribution: Kerala.

In *L. villiersi* Delamare-Duboutteville and Nunes-Ruivo (1954) the dorsal plate has a postero median sinus which is absent in Kirtisinghe's specimens.

***Lernanthropus shishidoi* Shiino**

(Fig. 152)

Shiino, 1955, p. 64, figs. 6-7; Pillai, 1964, p. 69, figs. 60-62; Kirtisinghe, 1964, p. 93, figs. 124.

Carapace large, equal in length and width, antennal lobe large and transversely oblong, anterior part of trunk nearly circular, subequal to posterior part. Dorsal plate absent, posterior division of trunk postero-laterally produced into two apically rounded processes, fifth and genital segments subequal, abdomen as long as broad, anal laminae small. Leg 3 small and uniramous, leg 4 very long, inner ramus only slightly shorter than outer, leg 5 absent. Length 10.3 mm.

Host: *Mugil cephalus* Linn.

Location: Gills.

Distribution: Japan and Kerala.

***Lernanthropus triangularis* Pillai**

(Fig. 153)

Pillai, 1963, p. 668, fig. 7.

Carapace triangular, postero-laterally produced, anterior division of trunk as long as dorsal plate, latter squarish, broader than anterior division of trunk. Maxillipeds 1 and 2 with accessory claws. Leg 3 small, biramous, leg 4 biramous, with subequal rami, leg 5 absent. Length 2.4 mm.

Host: *Pertica filamentosa* (Cuv.).

Location: Gills.

Distribution: Kerala.

***Lernanthropus dussumieria* Gnanamuthu**

(Fig. 154)

Gnanamuthu, 1949, p. 209.

Carapace slightly longer than broad, with large lateral lobes projecting antero-laterally. Dorsal plate not demarcated from anterior part of trunk, the whole forming an oblong part. Leg 3 biramous, leg 4 projecting beyond dorsal plate. Length 2.6 mm.

Host: *Dussumieria acuta* Val.

Location: Gills.

Distribution: Madras,

Lernanthropus lappaceus Wilson

(Fig. 155)

Pillai, 1963, p. 655, fig. 1 Q (*trifolatus* in part); Pillai (in press, f).

Carapace roughly triangular, with rounded projecting postero-lateral corners. Anterior part of trunk longer than broad, demarcated from dorsal plate by a distinct constriction. Dorsal plate longer than broad, with rounded hind border. Leg 4 biramous, outer ramus much longer than inner, with bunches of spinules as in *L. trifolatus*, leg 5 uniramous, projecting beyond the dorsal plate. Length 4.8 mm.

Host: *Polynemus plebeius* (Broussonet).

Location: Gills.

Distribution: Batavia and Kerala.

Lernanthropus priacanthi Kirtisinghe

(Fig. 156)

Kirtisinghe, 1956, p. 17, figs. 9–10; 1964, p. 95, figs. 126–127.

Carapace trapezoidal, with the antero-lateral lobes prominent and projecting, anterior division of trunk short, laterally produced into prominent wing-like expansions, dorsal plate pyriform, narrowing backwards, its hind border medially concave. Length 3.7 mm.

Host: *Priacanthus hamrur* (Forsk.)

Location: Gills.

Distribution: Ceylon.

Lernanthropus corniger Yamaguti

(Fig. 157)

Yamaguti, 1954, p. 387, figs. 35–41; Pillai, 1963, p. 660, fig. 3.

Carapace with 2 large apically acute antero-lateral horns projecting forwards, anterior division of trunk subequal to the dorsal plate in size, both roughly circular. Leg 3 biramous, the 2 endopods fused together. Leg 4 with long slender rami. Distal segment of antenna 2 produced below the prominent unguis into a flat lobe with irregular border. Length 3.1 mm.

Host: *Megalaspis cordyla* (Linn.).

Location: Gills.

Distribution: Celebes, Borneo and Kerala.

Lernanthropus forficatus Redkar, Rangnekar and Murti

(Fig. 158)

Redkar *et. al.*, 1949, p. 43, figs. 25–35.

Carapace with prominent antero-lateral lobes projecting far beyond the head, dorsal plate deeply cleft. Length 6.1 mm.

Host: *Trichiurus savala* Cuv.

Location: Gills.

Distribution: Bombay.

The description of this species contains many mistakes and its identity is far from clear. As diagnostic characters the authors mention the splitting of the carapace into two halves, the absence in the female of the maxillary hook and the furca. But the dorsal plate and not the carapace is split and I do not understand what they designate as maxillary hook and furca. This species appears to be somewhat related to *L. decapteri* Pillai (1964).

***Lernanthropus indicus* (Pillai)**

(Fig. 159)

Pillai, 1964 *b*, p. 48, fig. 9, (*carangis*).

Very closely resembling *L. alatus* Pillai but the antero-lateral horns of the carapace larger and the postero-lateral corners of the anterior division of the trunk rounded. Dorsal plate as in *L. alatus*. Leg 3 biramous, with simple long leaf-like rami, leg 4 with short subsimilar rami, narrowing towards the apex, leg 5 short, uniramous. Anal laminae as long as abdomen. Length 3.6 mm.

Host: *Caranx sanson* (Forsk.)

Location: Gills.

Distribution: Kerala.

The name *indicus* is substituted for *carangis* which is preoccupied.

***Lernanthropus cornutus* Kirtisinghe**

(Fig. 160)

Kirtisinghe, 1937 *a*, p. 448, figs. 88-96; Pillai, 1963, p. 658, fig. 2; Shiino, 1965 *c*, p. 375, figs. 1-2.

Carapace with a pair of large antero-lateral lobes projecting forwards and a pair of large postero-lateral lobes obliquely directed backwards, dorsal plate roughly triangular, with a high dorso-median longitudinal carina progressively narrowing backwards. Leg 3 uniramous, leg 4 biramous, rami subequal, leg 5 absent. Length 4.2 mm.

Host: *Tylosurus crocodilus* (Le Sueur), *Ablennes hlans* (C. & V.).

Location: Gills.

Distribution: Ceylon, Senegal, Gilbert Island, Japan and Kerala.

***Lernanthropus rubiginosus* Redkar, Rangnekar and Murti**

(Fig. 161)

Redkar *et. al.*, 1949, p. 46, figs. 36-44.

Carapace hexagonal, antero-median part slightly projecting, anterior and posterior divisions of trunk completely fused, oblong in shape, its antero-lateral parts angularly produced, more or less embracing the carapace. Fourth leg biramous, exopod much longer than endopod. Length 1.98 mm.

Host: *Nematalosa nasus* (Bloch).

Location: Gills.

Distribution: Bombay.

The description of this species is somewhat unsatisfactory.

***Lernanthropus secutoris* Pillai**

(Fig. 162)

Pillai, 1963, p. 662, fig. 4.

Carapace triangular, narrower behind, anterior division of trunk as broad as dorsal plate. Distal segment of antenna 2 with an apically flared stout accessory process, leg 3 cup-shaped, rami of leg 4 dissimilar, leg 5 absent. Length 1.3 mm.

Host: *Secutor insidiator* (Bloch).

Location: Gills.

Distribution: Kerala.

***Lernanthropus oblongus* Pillai**

(Fig. 163)

Pillai, 1964 b, p. 52, fig. 11.

Carapace comparatively very small, anterior border triangular, anterior division of trunk fused with dorsal plate forming an oblong lobe, with small antero-lateral projections. Leg 3 large and biramous, leg 4 with exopod twice the length of endopod, leg 5 absent. Length 2.3 mm.

Host: *Sardinella fimbriata* (Val.).

Location: Gills.

Distribution: Kerala.

***Lernanthropus giganteus* Kroyer**

(Fig. 164)

Wilson, 1913, p. 227, pl. 33; Pillai, 1963, p. 655; Kirtisinghe, 1964, p. 98, figs. 132-137.

Carapace with fairly prominent antero-lateral lobes, anterior division of trunk with a pair of long postero-lateral processes narrowing towards the apex. Dorsal plate roughly circular, with distal border truncate or slightly emarginate. Genital segment large, abdomen small, anal laminae longer than abdomen. Leg 4 with subsimilar rami, leg 5 uniramous. Length 7.1 mm.

Host: *Caranx* sp.

Location: Gills.

Distribution: East Indies, Ceylon and Kerala.

***Lernanthropus otolithi* Pillai**

(Fig. 165)

Pillai, 1963, p. 664, fig. 5.

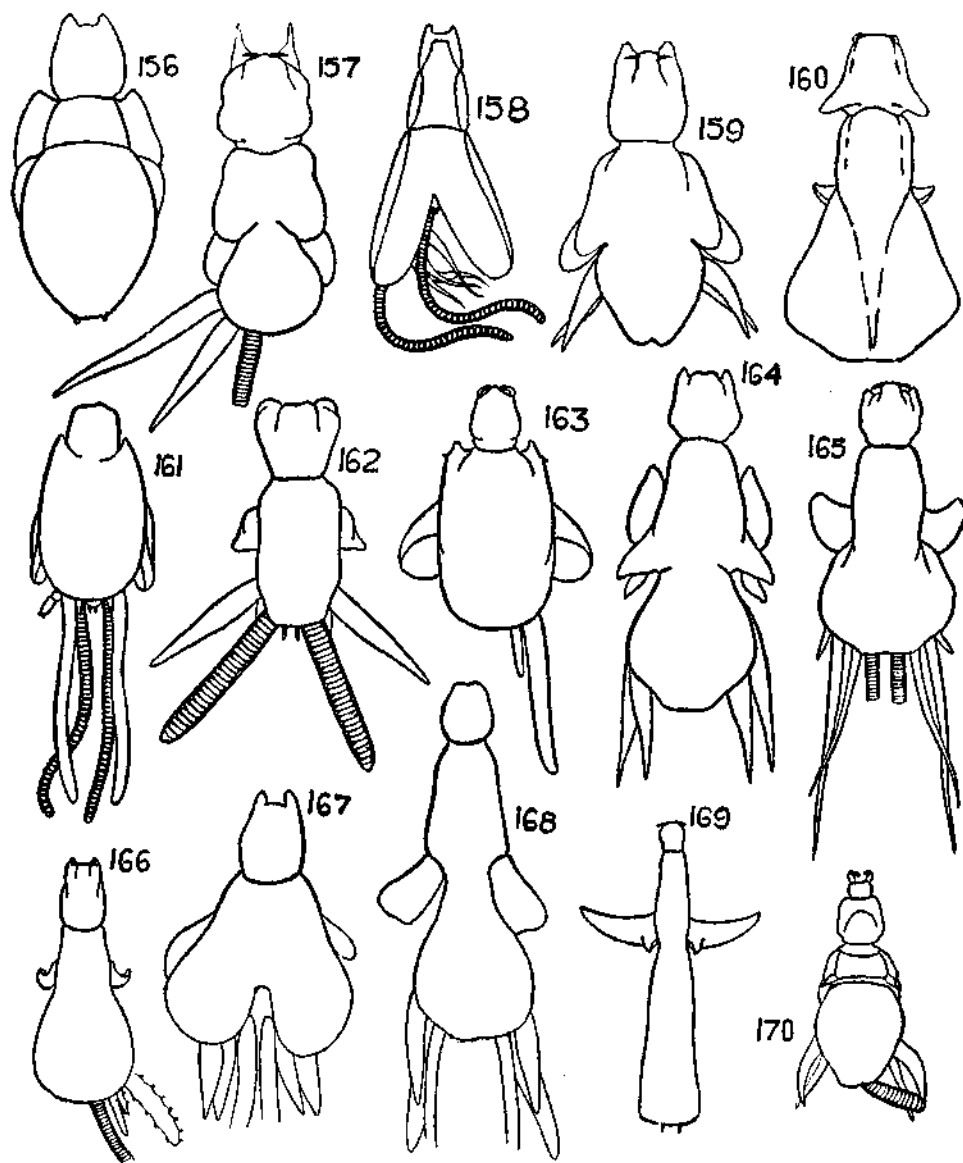
Carapace nearly circular, anterior division of trunk longer than broad, with parallel sides, dorsal plate large and circular; leg 3 uniramous, leg 4 with long slender dissimilar rami, leg 5 short and slender. Anal laminae slender and long. Length 3.0 mm.

Host: *Otolithus argenteus* Cuvier.

Location: Gills.

Distribution: Kerala.

Closely resembles *L. gisteri* van Beneden.



FIGS. 156-170. (156) *Lernanthropus priacanthi* (Kirtisinghe, 1956); (157) *Lernanthropus corniger*; (158) *Lernanthropus forficatus* (Redkar et al., 1949); (159) *Lernanthropus indicus*; (160) *Lernanthropus cornutus*; (161) *Lernanthropus rubiginosus* (Redkar et al., 1949); (162) *Lernanthropus secutoris*; (163) *Lernanthropus oblongus*; (164) *Lernanthropus giganteus*; (165) *Lernanthropus otolithi*; (166) *Lernanthropus trifolatus*; (167) *Lernanthropus sphyraenae* (Kirtisinghe, 1964); (168) *Lernanthropus latis* (Kirtisinghe, 1964); (169) *Lernanthropus cruciatus*; (170) *Lernanthropus brevicephalus* (Rangnekar, 1957 a).

Lernanthropus trifoliatus Bassett-Smith

(Fig. 166)

Bassett-Smith, 1898, p. 11, pl. 7, fig. 3; Pillai, 1963, p. 655, fig. 1; nec Kirtisinghe, 1956, p. 18, fig. 11.

Carapace longer than broad, dorsal plate nearly circular. Leg 3 uniramous, leg 4 biramous, exopod much longer than endopod, with bunches of marginal spinules making the border uneven, leg 5 uniramous and slender. Length 3.4 mm.

Host: *Polynemus heptadactylus* Cuvier, *P. sextarius* Bloch and *Eleutheronema tetradactylum* (Shaw).

Location: Gills.

Distribution: Bombay and Kerala.

Lernanthropus sphyraenae Yamaguti and Yamasu

(Fig. 167)

Yamaguti and Yamasu, 1959, p. 126, pl. 11, figs. 221–230; Kirtisinghe, 1964, p. 95.

Carapace anteriorly truncate, with projecting antero-lateral parts, postero-median part with dorsal hump. Anterior part of trunk merging into the dorsal plate, latter with deep posterior incision demarcating it into 2 lateral rounded lobes. Endopods of leg 3 fused, leg 4 biramous, rami projecting beyond dorsal plate, leg 5 very small. Length 3.9 mm.

Host: *Sphyraena pinguis* Gunther, *S. obtusata* Cuvier.

Location: Gills.

Distribution: Japan and Ceylon.

Lernanthropus latis Yamaguti

(Fig. 168)

Yamaguti, 1954, p. 389, pl. 5, figs. 42–48; Kirtisinghe, 1964, p. 100, fig. 140.

Carapace nearly ovate, anterior part of trunk oblong, dorsal plate very broad, oval, separated from anterior part of trunk by a neck-like part. Basal joint of antenna 2 with stout process on inner side. Leg 3 uniramous, leg 4 biramous, with subsimilar fairly broad rami, exopod much shorter than endopod, leg 5 rudimentary. Length 6.5 mm.

Host: *Lates calcarifer* (Bloch).

Location: Gills.

Distribution: Celebes and Ceylon.

Lernanthropus cruciatus Pillai

(Fig. 169)

Pillai, 1962 a, p. 613, fig. 1.

Body much elongated, dorsal plate forming an incomplete tube open ventro-medially and covering the posterior division of the body and the appendages. Leg 3 biramous, exopod large and folded, endopod represented by a vestigial lobe. Leg 4 just visible beyond the dorsal plate. Length 10.3 mm.

SM-V-8

Host: Sciaenid fish.

Location: Gills.

Distribution: Kerala.

***Lernanthropus brevicephalus* Rangnekar**

(Fig. 170)

Rangnekar, 1957 *a*, p. 12, fig. 3.

Carapace longer than broad, broadening backwards, anterior one-third of the carapace demarcated by prominent constrictions into an antennal lobe. Anterior division of trunk with prominent postero-lateral processes. Dorsal plate pyriform, narrowing backwards, hind border with shallow median concavity. Length 3.9 mm.

Host: *Lutianus* sp.

Location: Gills.

Distribution: Bombay.

The above diagnosis is based on Rangnekar's description. The author speaks of a subdivision of the posterior division of the trunk, of a pair of lateral lobes carrying a seta, of a pair of ventral muscular discs and doubtfully of 2-jointed rami for the second pair of legs. These do not appear correct. This species shows some resemblance to *L. eddiwarneri* Delamare-Duboutteville and Nunes-Ruivo (1954).

Both are nearly of the same size and are parasites of the same host.

***Lernanthropus cadenati* Delamare-Duboutteville and Nunes-Ruivo**

(Fig. 171)

Delamare-Duboutteville and Nunes-Ruivo, 1954, p. 145, figs. 2-3; Pillai (in press, *f*).

Carapace oblong, longer than broad, with antero-lateral lobes, anterior part of trunk nearly circular, dorsal plate narrower than anterior division of trunk, roughly squarish, distal border irregularly truncate. Distal segment of maxilliped 1 with a bifid process, maxilliped 2 with a small process at the base of the unguis. Leg 4 biramous, rami slender, as long as body. Leg 5 very small. Length 4.3 mm.

Host: *Megalops cyprinoides*, *Elops senegalensis* Regan.

Location: Gills.

Distribution: Senegal and Kerala.

Genus *Lernanthropodes* Bere

Bere, 1936, p. 602; Yamaguti, 1963, p. 145.

Carapace similar to that of *Lernanthropus*, trunk cylindrical and comparatively long. Third pair of legs ventrally fused and tube-like, enclosing the posterior division of trunk. Leg 4 biramous, leg 5 absent. Appendages as in *Lernanthropus*.

***Lernanthropodes trachinoti* Pillai**

(Fig. 172)

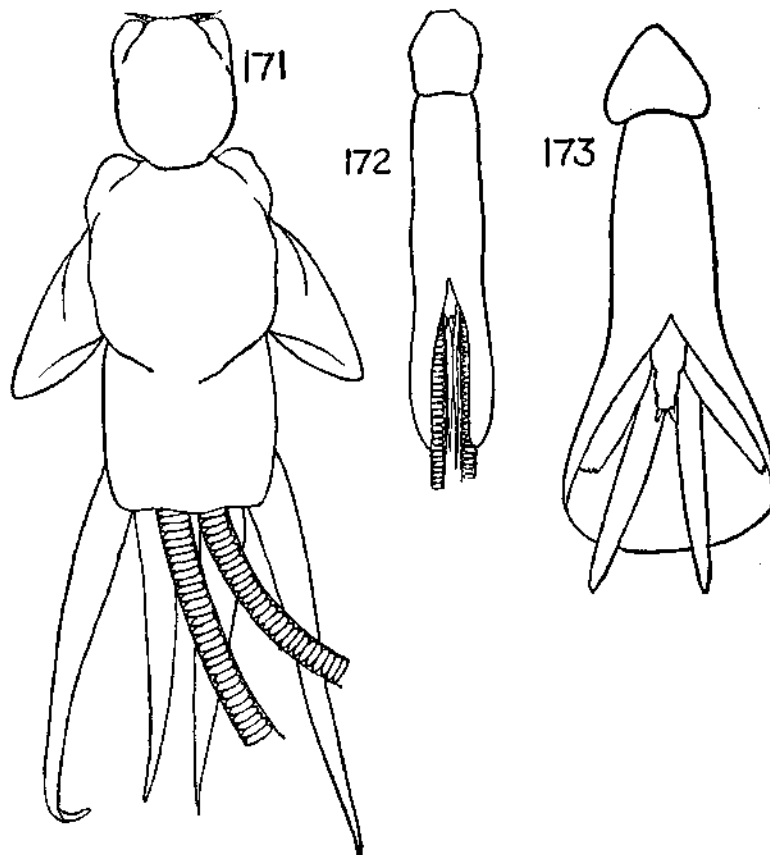
Pillai, 1962 *a*, p. 614, fig. 2.

Carapace somewhat squarish, with antennal lobe projecting in front. Anterior division of trunk twice as long as carapace. Third pair of legs as long as anterior division of trunk, apically 4-lobed. Leg 4 long, with subsimilar rami projecting beyond leg 3. Length 9.4 mm.

Host: *Trachinotus blochi* (Lacepede).

Location: Gills.

Distribtuion: Kerala.



FIGS. 171-173. (171). *Lernanthropus cadenati*; (172) *Lernanthropodes trachinoti*; (173) *Lernanthropodes chorinemi*.

***Lernanthropodes chorinemi* Pillai**

(Fig. 173)

Pillai, 1962 *a*, p. 617, fig. 3.

Carapace perfectly triangular in dorsal view. Anterior division of trunk stout, about 3 times as long as carapace. Third pair of legs as long as anterior division of trunk, its distal border entire. Leg 4 with subsimilar rami reaching well beyond leg 3. Length 8.2 mm.

Host: *Chorinemus lysan* (Forsk.)

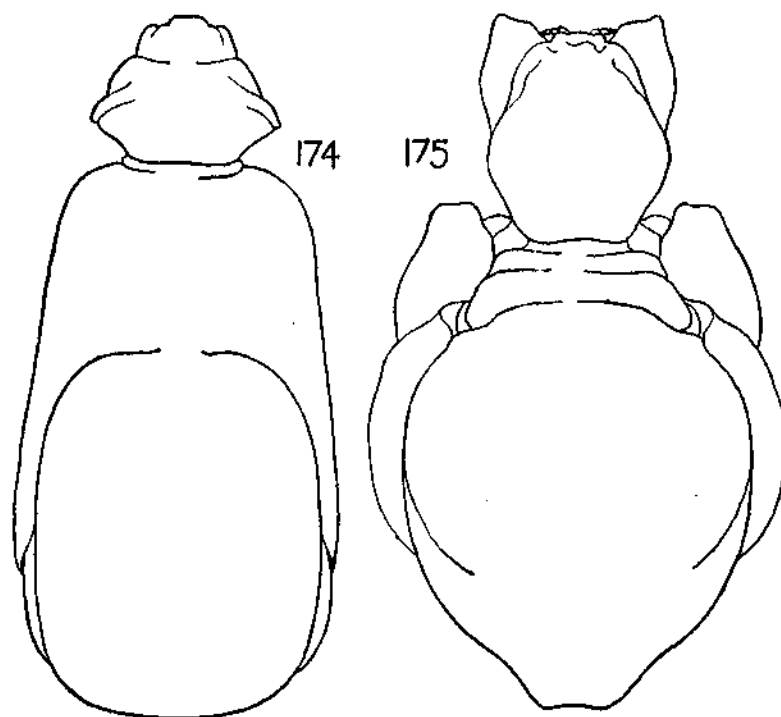
Location: Gills.

Distribution: Kerala.

Genus *Sagum* Wilson

Wilson, 1913, p. 235; Yamaguti and Yamasu, 1960, p. 146 (*Pseudolernanthropus*); Yamaguti, 1963, p. 154.

Differs from *Lernanthropus* as follows: Body shorter and stouter, cephalothorax laterally produced, postero-lateral parts of anterior division of trunk fused with the exopod of the third legs to form 2 large elytra-like plates completely hiding the hind part of the body, dorsal plate large. Leg 4 biramous, rami demarcated into broad proximal part and slender distal part. Egg tubes long and considerably coiled.



FIGS. 174-175. (174) *Sagum epinepheli*; (175) *Norton gibbosus*.

Sagum epinepheli (Yamaguti and Yamasu)

(Fig. 174)

Yamaguti and Yamasu, 1960, p. 145, pl. 11, figs. 17-28 (*Pseudolernanthropus*); Yamaguti, 1963, p. 153, pl. 168, fig. 3 (*Pseudolernanthropus*); Pillai and Sebastian (in press).

Carapace hexagonal, laterally produced, antennal lobe small but distinct, anterior part of trunk short, antero-lateral parts shoulder-like, dorsal plate large, distal border perfectly rounded. Third legs biramous, rami subequal in length, almost reaching the hind border of the dorsal plate, exopod fused with the postero-lateral lobes of the anterior division of trunk forming two large plates. Anal laminae large, twisted and armed with spines and setae. Length 4.0-6.0 mm.

Host: *Epinepheles akaara* (Temm. & Schlegel), *Epinepheles* sp.

Location: Gills.

Distribution: Japan and Kerala.

The presence of a notch followed by a seta on the outer border of the exopod of the third leg is the main character which distinguishes *Pseudolernanthropus* from *Sagum*. But this alone does not constitute a valid generic character. This character is also variable as shown elsewhere (Pillai and Sebastian, in press).

Genus *Norion* Nordmann

Lewis, 1964, p. 225; Pillai (in press, d).

Differing from *Lernanthropus* as follows: Body swollen or dorso-ventrally flattened, trunk segments 2 and 3 dorsally distinct, dorsal plate very large. Antero-lateral parts of trunk with a pair of plates projecting forwards. Leg 2 absent, leg 3 uniramous, leg 4 like that of *Sagum*, leg 5 short. Egg tubes as in *Sagum*.

Norion gibbosus Pillai

(Fig. 175)

Pillai (in press, d).

Carapace roughly triangular, with antero-lateral lobes overreaching frontal margin, antero-lateral lobes of trunk stopping short of the middle of the carapace, dorsal plate pyriform, narrowing backwards, hind border short and concave. Leg 3 biramous, leg 4 with the narrow part of rami short, leg 5 fairly well developed. Abdomen broader than long, anal laminae twisted, as long as abdomen. Length 4.1 mm.

Host: *Lutianus waigiensis* (Q. & G.).

Location: Gills.

Distribution: Kerala.

Family EUDACTYLINIDAE

Genus *Eudactylina* Van Beneden

Wilson, 1932, p. 466; Yamaguti, 1963, p. 157.

Head fused with first trunk segment to form a cephalothorax with a large dorsal carapace; thoracic segments 2 to 4 with dorsal plates, often spiny, genital segment small, abdomen short, 2-segmented. Caudal rami laminate. Antenna 1 stout, terminal part at right angles to the basal, with setae and strong claws. Antenna 2 4-segmented, segment 4 claw-like. Maxilliped 1 3-segmented, third segment claw-like. Maxilliped 2 3-segmented, third segment finger-shaped and

forming a chela with the process of the second segment. Legs 1 to 4 biramous, rami of leg 1 2-segmented, of 2 to 4 2 or 3-segmented. Exopod of leg 2 often modified. Leg 5 uniramous, 1-segmented.

***Eudactylina lancifera* Pillai**

(Fig. 176)

Pillai (in press, e).

Carapace oblong, with an antero-median point, dorsal plates of segments 2 and 3 broader than long and those of 4 and 5 as long as broad, abdomen 2-segmented. Segment 3 of maxilliped 2 apically flattened. Intercoxal plate of leg 2 forming a very long dagger-shaped process, exopod of leg 2 with 3 flat spines and 2 blunt spines. Length 1.6 mm.

Host: *Pristis* sp.

Location: Gills.

Distribution: Kerala.

***Eudactylina alata* Pillai**

(Fig. 177)

Pillai (in press, e).

Carapace triangular, with apically pointed backwardly directed antero-lateral lobes, dorsal plate of trunk segment 2 laterally expanded and postero-laterally produced backwards, segment 3 much narrower than segment 2, segment 5 rather long. Segment 3 of maxilliped 2 apically bifid. Intercoxal plate of leg 2 forming a short apically flattened and spatulate process, exopod with 3 flat spines and 1 blunt spine. Length 1.0 mm.

Host: *Rhynchobatus* sp.

Location: Gills.

Distribution: Kerala.

Genus *Eudactylinopsis* Pillai

Pillai (in press, e).

Body long and vermiform, with poorly developed dorsal plates. Antenna 1 straight and armed with setae only, antenna 2 stout, without accessory claws. Maxilliped 2 with the prolongation of segment 2 conical. Rami of legs 1 to 4 3-segmented, exopod of leg 2 not modified.

***Eudactylinopsis curvatus* Pillai**

(Fig. 178)

Pillai (in press, e).

Body long and cylindrical, carapace longer than broad, trunk segment 2 short, broader than long, segment 3 circular, segment 4 very large, segment 5 as long as fourth, abdomen very short, 2-segmented. Antenna 1 8-segmented, without spines. Antenna 2 with very short second segment. Maxilliped 1 with very stout basal segment. Segment 3 of maxilliped 2 bifid. Legs 1 to 4 subsimilar in size and shape. Leg 5 indistinct. Length 3.3 mm.

Host: *Pristis* sp.

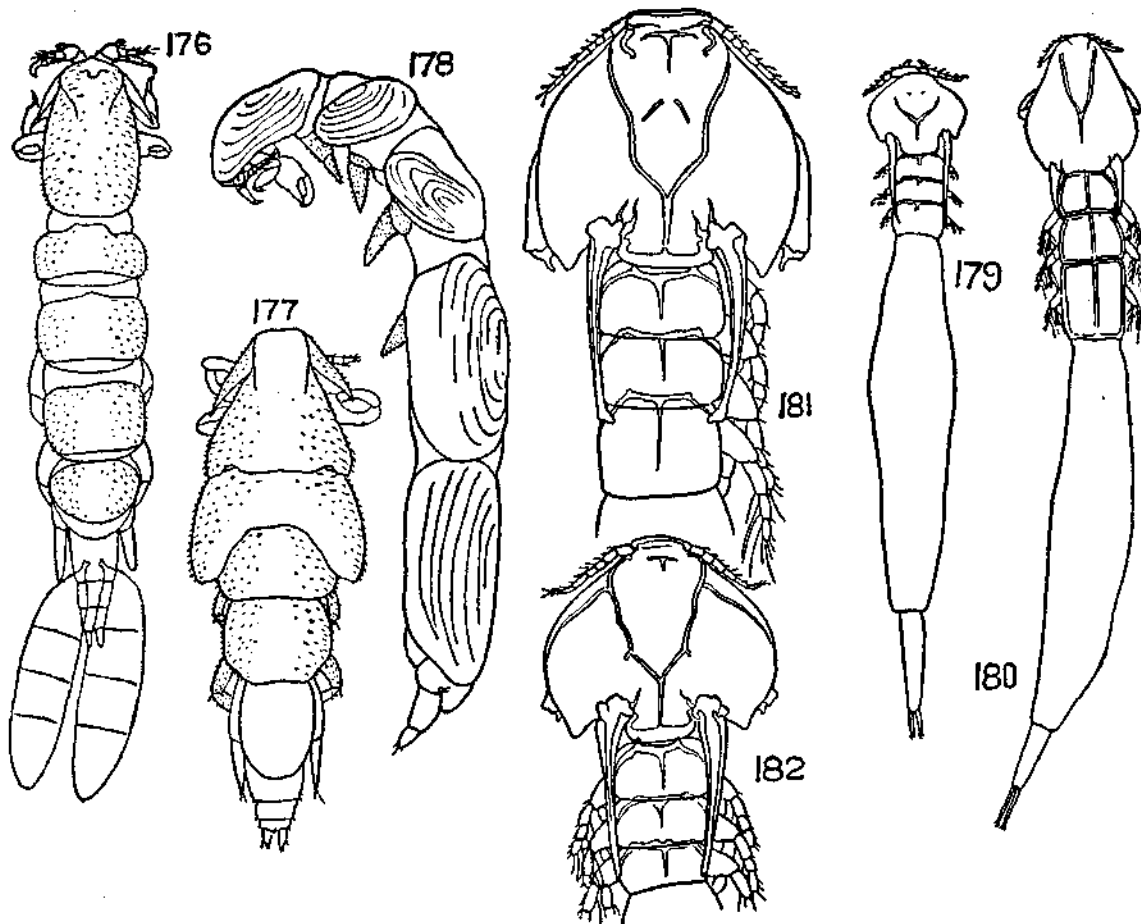
Location: Gills.

Distribution: Kerala.

Genus *Kroyeria* Van Beneden

Wilson, 1932, p. 452; Yamaguti, 1963, p. 161; Kabata and Gusev, 1966, p. 172.

Head fused with first trunk segment to form a cephalothorax, with a pair of postero-lateral sinuses lodging a long styliform process. Trunk segments 2 to 4 free, fifth and genital segments completely fused and subcylindrical, often longer than rest of body. Abdomen short, 1 to 3-segmented, caudal rami long and narrow. Antenna 1 slender, antenna 2 stout and chelate. Maxilliped 1 small, 4-segmented, maxilliped 2 massive, distal segment strongly falcate and closing against the proximal. Legs 1 to 4 biramous, rami 3-segmented, with long plumose setae and short strong teeth.



FIGS. 176-182. (176) *Eudactylina lancifera*; (177) *Eudactylina alata*; (178) *Eudactylinopsis curvatus*; (179) *Kroyeria sphyrynae* (Rangnekar, 1957); (180) *Kroyeria echinata* (Rangnekar, 1956); (181) *Kroyeria elongata*; (182) *Kroyeria minuta*.

Kroyeria sphyrnae Rangnekar

(Fig. 179)

Rangnekar, 1957, p. 14, fig. 4; Pillai (in press, a).

Carapace nearly semicircular, cephalic processes very long, slender and flexible and overreaching the fourth trunk segment. Trunk segment 4 nearly one-and-a-half times as long as third. Genital segment 8 times the combined length of the free thoracic segments. Abdomen long-elliptic, apparently 3-segmented. Intercostal processes of legs 2 to 4 nearly of the same size. Maxilliped 2 comparatively stout. Length 4.7 mm.

Host: *Sphyrna* sp., *Sphyrna zygaena* (Linn.).

Location: Gills.

Distribution: Bombay and Kerala.

Kroyeria echinata Rangnekar

(Fig. 180)

Rangnekar, 1956, p. 57, figs. a-k.

Carapace triangular and broader than the rest of body. Cephalic processes short but stout, scarcely overreaching second trunk segment, trunk segments 2 to 4 successively increasing in length. Genital segment fusiform, twice as long as the part of body in front, abdomen 1-segmented. Length 3.15 mm.

Host: *Sphyrna zygaena* (Linn.).

Location: Gills.

Distribution: Bombay.

Kroyeria elongata Pillai

(Fig. 181)

Pillai (in press, a).

Carapace roughly triangular, as long as broad, cephalic processes comparatively short, just overreaching the third trunk segment, apically truncate and slightly produced inwards. Trunk segment 4 longest, genital segment 3 times as long as the part in front. Abdomen short, 3-segmented. Both fingers of the chela of antenna 2 apically flattened. The intercostal processes of legs 2 to 4 unequal in length. Length 3.8 mm.

Host: *Scoliodon sorrakowah* (Cuvier).

Location: Gills.

Distribution: Kerala.

Kroyeria minuta Pillai

(Fig. 182)

Pillai (in press, e).

Carapace roughly triangular, slightly broader than long, cephalic processes long, stopping slightly short of the anterior border of the genital segment, its apex bifid, trunk segments 2 to 4

successively decreasing in length, genital segment 3 times the length of the part in front, abdomen 1-segmented. Intercostal processes of legs 2 to 4 dissimilar in length. Length 3.0 mm.

Host: *Scoliodon sorrakowah* (Cuvier).

Location: Gills.

Distribution: Kerala.

Family DICHELESTHIIDAE

Genus *Hatschekia* Poche

Wilson, 1932, p. 476; Yamaguti, 1963, p. 135.

Head free from first trunk segment, first two trunk segments more or less distinct, but often fused together, the rest of the thorax fused with the genital segment into an elongated trunk. Abdomen short, 1-segmented or lacking, caudal rami minute. Antenna 1 filiform, 3 to 6-segmented, antenna 2 with stout apical claw. Maxillipeds slender and uncinata. 2 pairs of biramous legs, rudiments of legs 3 and 4 sometimes present, leg 5 absent.

Hatschekia pholas (Wilson)

(Fig. 183)

Wilson, 1906, p. 203, pl. 4, figs. 48–57 (*Caetrodes*); Pillai (in press, b).

Head covered with obovate carapace much wider in front, the rounded posterior part overlapping a large part of the trunk, frontal margin curved ventralwards. Trunk long ovate, narrowing backwards, postero-laterally produced into 2 rounded spiny lobes reaching the tip of the abdomen. Abdomen small, hemispherical, egg sacs stout, longer than body. Anal laminae with a stout distal seta. Length 1.4 mm.

Host: *Arothron stellatus* (Bloch).

Location: Gills.

Distribution: Ceylon and Kerala.

Wilson placed this species under the new genus *Caetrodes*, mainly relying on the unusually large carapace, the shape of the fifth trunk segment, the armature of the anal laminae and the structure of maxilla 2 and maxilliped 1. A recent study by me has shown that Wilson's original description is inaccurate and that *Caetrodes* is the same as *Hatschekia*.

Hatschekia elliptica Pillai

(Fig. 184)

Pillai (in press, b).

Cephalon transversely elliptic, anteriorly trilobed and posteriorly overlapping trunk, trunk elliptic, segments 1 and 2 distinct, postero-lateral parts produced into rounded lobes on either side of abdomen, abdomen small, anal laminae present. Third segment of antenna 2 with a distinct unguis carrying a small tooth at its base. Each of the segments of the exopod of leg 2 with a stout spine seta. Length 0.7 mm.

Host: *Diodon hystrix* Linn.

Location: Gills.

Distribution: Kerala.

Hatschekia sphyraeni Pillai

(Fig. 185)

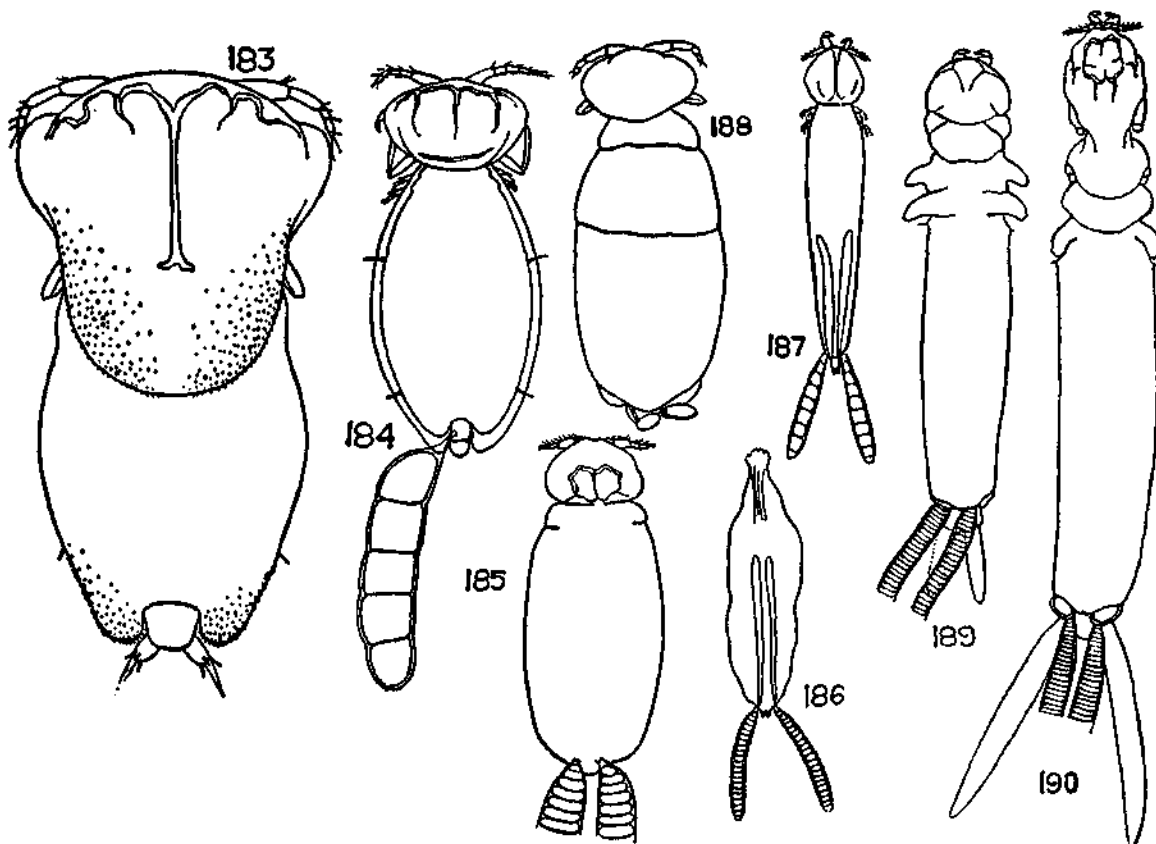
Pillai, 1964, p. 72, figs. 74-82.

Cephalon transversely oblong, with small antero-median concavity. Dorsal side with 2 longitudinally rectangular areas bounded by prominent ribs. Cephalon fused with trunk, but demarcated by deep lateral constrictions, trunk oblong, twice as long as broad, thoracic segment 1 indicated by a small constriction. Abdomen and anal laminae present. Antenna 1 with indistinct segmentation. Length 1.2 mm.

Host: *Sphyraena acutipinnis* Day.

Location: Gills.

Distribution: Kerala.



FIGS. 183-190. (183) *Hatschekia pholas*; (184) *Hatschekia elliptica*; (185) *Hatschekia sphyraeni*; (186) *Hatschekia foliata*; (187) *Hatschekia elongata* (Redkar *et. al.*, 1950); (188) *Hatschekia* sp. (Wilson, 1906); (189) *Pseudocycnus armatus*; (190) *Pseudocycnus appendiculatus*.

Hatschekia foliata Redkar, Rangnekar and Murti

(Fig. 186)

Redkar *et. al.*, 1950, p. 39, figs. 8-14; Pillai, 1964, p. 69, figs. 63-73.

Head transversely oblong, anteriorly bilobed, dorsal side with prominent ribs demarcating 6 areas, trunk segments 1 and 2 indistinct, rest of body forming a flat thin laminate elliptical trunk. Abdomen short, anal laminae present. Antenna 1 3-segmented. Length 2.8 mm.

Host: *Nemipterus japonicus* (Bloch).

Location: Gills.

Distribution: Bombay and Kerala.

***Hatschekia elongata* Redkar, Rangnekar and Murti**

(Fig. 187)

Redkar *et. al.*, 1950, p. 35, figs. 1-7.

Cephalothorax roughly circular, with longitudinal dorso-median rib. Trunk elongate oblong, slightly narrowing backwards, segmentation not visible. Abdomen short but distinct. Antenna 1 indistinctly 4-segmented. Anal laminae tipped with spine-setae. Length 1.8 mm.

Host: *Lutianus johni* (Bloch).

Location: Gills.

Distribution: Bombay.

***Hatschekia* sp.**

(Fig. 188)

Wilson, 1906, p. 205, pl. 5, figs. 58-60.

Cephalon transversely elliptic, one-and-a-half times as long as broad. Trunk formed of 2 free segments and the genital segment, segment 1 slightly narrower than head, segment 2 and genital segment much wider. Genital segment with 2 blunt posterior processes, as long as abdomen. Abdomen very small, with a pair of minute anal papillae carrying 3 setae. Length 1.07 mm.

Host: Unknown.

Distribution: Ceylon.

Family PSEUDOCYCNIIDAE

Genus *Pseudocycnus* Heller

Kirtisinghe, 1937, p. 455; Yamaguti, 1963, p. 169.

Head fused with first thoracic segment, thoracic segments 2 and 3 free, 4 and 5 fused with genital segment to form a cylindrical body several times longer than wide and of uniform diameter. Abdomen 1-segmented, narrower than genital segment, anal laminae large.

***Pseudocycnus armatus* (Bassett-Smith)**

(Fig. 189)

Bassett-Smith, 1898, p. 9, pl. 5, figs. 1-2 (*Helleria*); Kirtisinghe, 1935, p. 339; 1937, p. 453, figs. 1-11; Gnanamuthu, 1950 *e*, p. 276, figs. 1-18; Kurian, 1961, p. 75, figs. 46-48; Pillai, 1964, p. 75, figs. 95-108; Kirtisinghe, 1964, p. 104, figs. 144-145.

Body short but stout, carapace semicircular, completely fused with first trunk segment and postero-laterally produced into conical lobes. Trunk segment 2 large, third and fourth very indistinct, succeeding segments fused to form a large trunk. Segments 3 and 4 with large blunt lateral processes. Abdomen distinct but fused with the trunk. Anal laminae short and stout. Antenna 1 7-segmented, segment 2 with a large curved process. Legs 2 and 3 associated with a circular pad just external to the basipod. Length 5.7 mm.

Host: *Indocybium guttatum* (Bloch & Schn.).

Location: Gills.

Distribution: Bombay, Madras, Kerala and Ceylon.

***Pseudocycnus appendiculatus* Heller**

(Fig. 190)

Heller, 1865, p. 218, pl. 22, fig. 7; Bassett-Smith, 1898, p. 368; Kirtisinghe, 1935, p. 339, figs. 10-28; Shiino, 1959, p. 325, figs. 24-25; Pillai, 1964, p. 73, figs. 83-94.

Body slender and subcylindrical. Carapace longitudinally oblong, with prominent dorsal ribs demarcating 4 squarish areas. Trunk segment 1 completely fused with head, 2 and 3 large and distinct, fourth fused with the rest of body but forming 2 antero-lateral lobes. Abdomen indistinct, anal laminae long, half the length of the trunk. Antenna 1 3 to 4-segmented, without spine. Length 12.3 mm.

Host: *Euthynnus affinis* (Cantor), *Neothunnus macropterus* (Schlegel).

Location: Gills.

Distribution: Atlantic, Mediterranean and Indian oceans and both coasts of America.

Family LERNAEIDAE

Genus *Lernaeenicus* Le Sueur

Wilson, 1932, p. 480; Yamaguti, 1963, p. 185.

Head fused with the thorax and furnished with 2-10 slender cylindrical horns, simple or branched. Thorax just behind head enlarged and with 4 pairs of legs placed close together, behind the legs body filiform and chitinous, twisted and usually flexed for half the body length or more, further on enlarging into a straight cylindrical trunk and finally narrowing into an abdomen, caudal rami minute or absent. Egg strings filiform and very long. 2 pairs of antennae, second chelate. Legs 1 and 2 biramous, 3 and 4 uniramous, fifth absent.

***Lernaeenicus polynemi* (Bassett-Smith)**

(Figs. 191-192)

Bassett-Smith, 1898, p. 12, pl. 7, fig. 1 (*Lernaeonema*).

Head triangular, with blunt ends, posteriorly with 3 short horns, all sharply pointed, lateral horns slightly divergent. Neck very long, expanding into the genital part of trunk, latter long and flask-shaped. Abdomen tapering. Length 70.0 mm.

Host: *Polynemus heptadactylus* Cuvier.

Location: Surface of body.

Distribution: Bombay.

Lernaeenicus hemirhamphi Kirtisinghe

(Figs. 193–194)

Kirtisinghe, 1933, p. 550, figs. 4–7; Gnanamuthu, 1953, p. 1, figs. 1–8; Shiino, 1965 *b*, p. 435, figs. 1–2.

Head roughly as long as broad, rounded in front, dorso-ventrally flattened, with a longitudinal depression lodging the mouth, posterior part produced into 3 stiff chitinous horns, median horn longer and in a line with the long axis of the head, lateral ones nearly at right angles to the median. Neck at right angles to the head, trunk 3 times as wide as neck. Abdomen half the width of trunk, anal laminae present. Length 42.0 mm.

Host: *Hemirhamphus xanthopterus* (Val.), *H. far* Forskal.

Location: Surface of body.

Distribution: Ceylon, Madras, Kerala and Hawaii.

Lernaeenicus ramosus Kirtisinghe

(Figs. 195–196)

Kirtisinghe, 1956, p. 20, figs. 12–14; Shiino, 1958 *a*, p. 84, figs. 5–7; Rangnekar, 1961, p. 196, fig. 2; Kirtisinghe, 1964, p. 109, fig. 151.

Head in line with the body and roughly hemispherical, with flat ventral surface and paired groups of attachment pads, one group on either side of the mouth and a pair further back. Horns in 2 sets, one set of 3 pairs of branched ones arising anteriorly, antero-laterally and postero-ventrally, the other set of a pair of much branched horns arising from the thorax dorso-laterally. Main horns constant in number, branches not definite in number and not radiating. Length 18.0 mm.

Host: *Epinephelus morrhua* (Val.), *Nemipterus japonicus* (Bloch).

Location: Surface of body.

Distribution: Ceylon, Japan and Bombay.

Lernaeenicus sayori Yamaguti

(Fig. 197)

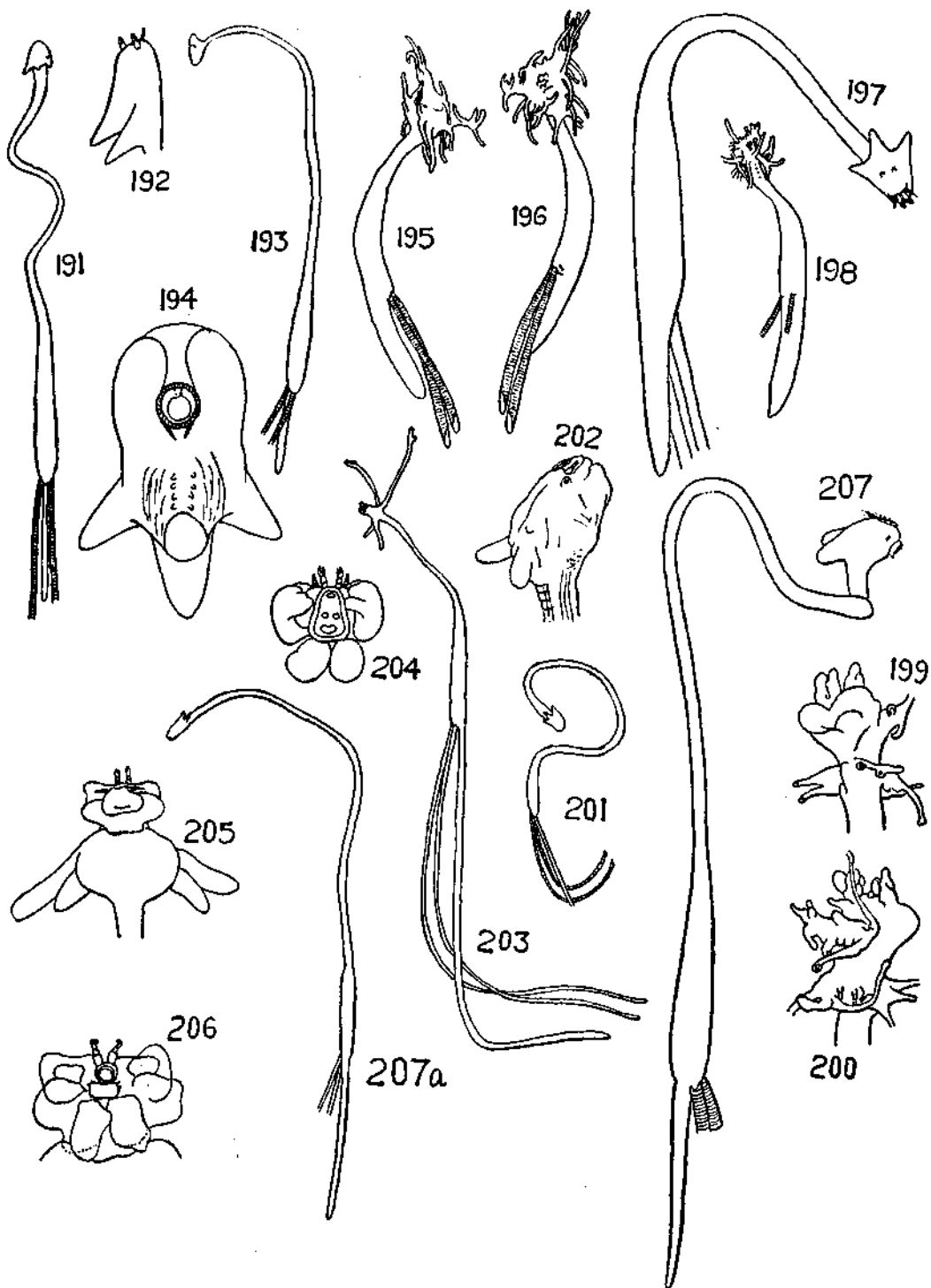
Yamaguti, 1939 *a*, p. 479, pl. 31, figs. 174–175, pl. 32, figs. 176–182; Rangnekar, 1961, p. 193, fig. 1.

Head rounded in front, dorsally with a pair of small conical processes and posteriorly with a median and 2 lateral horns, a number of irregular transverse folds on either side of the median line behind the mouth. Thorax slender, genital part long and only slightly widening backwards. Abdomen tapering, anal laminae absent. Length 16–17 mm.

Host: *Hemirhamphus sayori* T. & S., *Rastrelliger kanagurta* (Cuvier).

Location: Below the eye, beneath the pectoral fin.

Distribution: Japan and Bombay.



FIGS. 191-207 a. (191-192) *Lernaeniscus polynemi* (Bassett-Smith, 1898); (193-194) *Lernaeniscus hemirhamphi* (Kirtisinghe, 1933); (195-196) *Lernaeniscus ramosus* (Shiino, 1958 a); (197) *Lernaeniscus sayori* (Yamaguti, 1939 a); (198-200) *Lernaeniscus nemipteri* (Gnanamuthu, 1953); (201-202) *Lernaeniscus stromatei* (Gnanamuthu, 1953); (203-204) *Lernaeniscus seeri* (Kirtisinghe, 1934); (205-206) *Lernaeniscus alatus* (Rangnekar, 1961); (207) *Lernaeniscus anchoviellae* (Sebastian and George, 1965); (207 a) *Lernaeniscus longiventris* (Kirtisinghe, 1964).

Lernaeenicus nemipteri Gnanamuthu

(Figs. 198–200)

Gnanamuthu, 1953, p. 2, figs. 9–16.

Head club-shaped, tapering backwards, with 2 whorls of branched horns, one behind the mouth and maxillipeds and the other in front of the free thoracic segment, the body constricted between the 2 whorls. Horns simple or branched. Anterior whorl incomplete, the gap filled by 2 pairs of large swellings, frontal margin with a pair of short stout forked processes. Neck short, genital part swollen, 5 times the length of the neck. Abdomen longer than genital part, anal laminae absent. Length 19.6 mm.

Host: *Nemipterus marginatus* C. & V.*Location*: Lateral sides of body.*Distribution*: Madras.*Lernaeenicus stromatei* Gnanamuthu

(Figs. 201–202)

Gnanamuthu, 1953, p. 3, figs. 17–22.

Head stout, anteriorly blunt, slightly flattened dorso-ventrally and with 3 identical posterior horns. Antennae and eye displaced to the right side and the legs to the left side. Neck at right angles to the head, limb-bearing segments indicated dorsally. Genital part of trunk 4 times the width of neck, with mid-ventral groove. Abdomen narrow and tapering, anal laminae present. Length 63.0 mm.

Host: *Parastromateus niger* (Bloch).*Location*: Surface of body.*Distribution*: Madras.*Lernaeenicus seeri* Kirtisinghe

(Figs. 203–204)

Kirtisinghe, 1934, p. 173, figs. 1–5; 1964, p. 109, fig. 152.

Head slightly longer than broad and in a line with the trunk, its anterior border slightly emarginate, with the antennae projecting. In addition to the usual horns a pair of long dissimilar apically bifid processes present. Neck slightly longer than trunk or genital part. Abdomen slender, very long, one-and-three-fourths times the length of the rest of the body. Length 99.0 mm.

Host: *Cybium* sp.*Location*: Surface of body.*Distribution*: Ceylon.*Lernaeenicus alatus* Rangnekar

(Figs. 205–206)

Rangnekar, 1961, p. 198, fig. 3.

Head demarcated from trunk by a groove, with 2 pairs of flattened lateral wing-like expansions. On either side of the oral disc an anterior pair of lobes and a larger pair postero-medially. Anterior part of trunk swollen, with 2 pairs of digitiform processes directed obliquely backwards, ventral ones nearly twice as long as dorsal. Abdomen one-and-three-fourths times the length of trunk, anal laminae absent. Length 54.9 mm.

Host: *Cybium commersoni* (Lacepede).

Location: Not given.

Distribution: Bombay.

Lernaeenicus anchoviellae Sebastian and George

(Fig. 207)

Sebastian and George, 1965, p. 235, figs. 1-11.

Head at right angles to neck, with 2 short but thick posterior horns. Leg bearing segments indicated by incipient septa. Neck very long, two-and-a-half to three times the length of the genital part, narrowing backwards. Abdomen tapering, as long as genital part. Length 2.0 mm.

Host: *Anchoviella bataviensis* (Hardenberg).

Location: Preanal region.

Distribution: Gulf of Mannar.

Lernaeenicus longiventris Wilson

(Fig. 207 a)

Wilson, 1917, p. 66, pl. 7; Kirtisinghe, 1964, p. 108, fig. 149.

Head produced into 3 knobs, one posterior and the others postero-lateral. Neck slender and very long. Trunk only about a fourth of the length of the neck, 4 times as long as wide. Abdomen half as long as the neck and narrower. Length 40.0 mm.

Host: *Caranx ignobilis* (Forsk.)*, Gnathanodon speciosus* (Forsk.)*, Coryphaena hippurus* Linn.

Location: Surface of body.

Distribution: Atlantic coast of United States, Ceylon.

Genus *Peroderma* Heller

Yamaguti, 1963, p. 216.

Cephalothorax short, placed at right angles to the trunk, latter inserted slightly behind the anterior end. Head covered with irregularly placed lobes and a bunch of long branched processes. Trunk elongate-cylindrical, abdomen and anal laminae absent. Cephalic appendages reduced, antennae, mandibles and maxillipeds present. Legs 4 pairs, 1 and 4 rudimentary and 2-segmented, 2 and 3 well developed.

Peroderma cylindricum Heller

Heller, 1865, p. 250, pl. 25, fig. 6 (*cylindrica*); Bassett-Smith, 1898, p. 13, pl. 7, fig. 2 (*branchiata*)
Bennet, 1963, p. 70, figs. 1-2.

Body cylindrical, anterior part in front of neck rounded, one-fourth the total length. Neck narrow, longer than broad, placed at right angles to the body. Head irregularly lobed and furnished with a large number of branched processes, the terminal branches showing a regular manner of division, each branch with a bifid end and a third long side branch. Length 9.0 mm.

Host: *Coilia dussumieri* Day, *Sardinella albella* (Val.).

Location: Above the pectoral fin.

Distribution: Bombay and Mandapam.

Genus *Cardiodectes* Wilson

Yamaguti, 1963, p. 188.

Cephalothorax ellipsoidal, anterior part covered with branched processes usually radiating from 2 horns, neck narrow, generally a third of the diameter of the trunk and usually bent, trunk straight and cylindrical, abdomen hemispherical and dorsal, with minute caudal rami. Antenna 2 chelate. Legs 1 and 2 placed close together, biramous, third uniramous, fourth without rami.

Cardiodectes anchorellae Brian and Gray

(Figs. 208–209)

Kirtisinghe, 1950, p. 84, figs. 36–39 (*medusaeus*); Gnanamuthu, 1951 a, p. 240, figs. 1–2; Kirtisinghe, 1964, p. 105, fig. 146.

Cephalothorax demarcated into an anterior semicircular region and a posterior suborbicular region, the former extended laterally into 2 short arms branched to form a bunch of rounded lobes grouped into 3 masses, central, anterior and dorsal, on either side. Posterior region of cephalothorax with lateral wings varying in number and shape. Neck short and curved, trunk two-thirds the total length and swollen, abdomen short, with bilobed tip. Length 6.0 mm.

Host: *Anchoviella hamiltoni* (Gray).

Location: Base of caudal fin.

Distribution: Madras and Ceylon.

Genus *Peniculus* Nordmann

Wilson, 1932, p. 479; Yamaguti, 1963, p. 201.

Head fused with the first trunk segment, often having lateral lobes, without horns or processes trunk segments 2 and 3 narrow, dorso-ventrally flattened and chitinised, forming a short neck, segment 4 wide and swollen, fifth and genital segments and abdomen fused into a cylindrical trunk, caudal rami minute, laminate and setose. Antenna 1 filiform, with few segments, antenna 2 strongly chelate, proboscis long and retractile, mandibles, maxillae and maxillipeds present. Legs 1 to 4 usually represented by their basal plates, leg 5 absent.

Peniculus scombri Gnanamuthu

(Figs. 210–211)

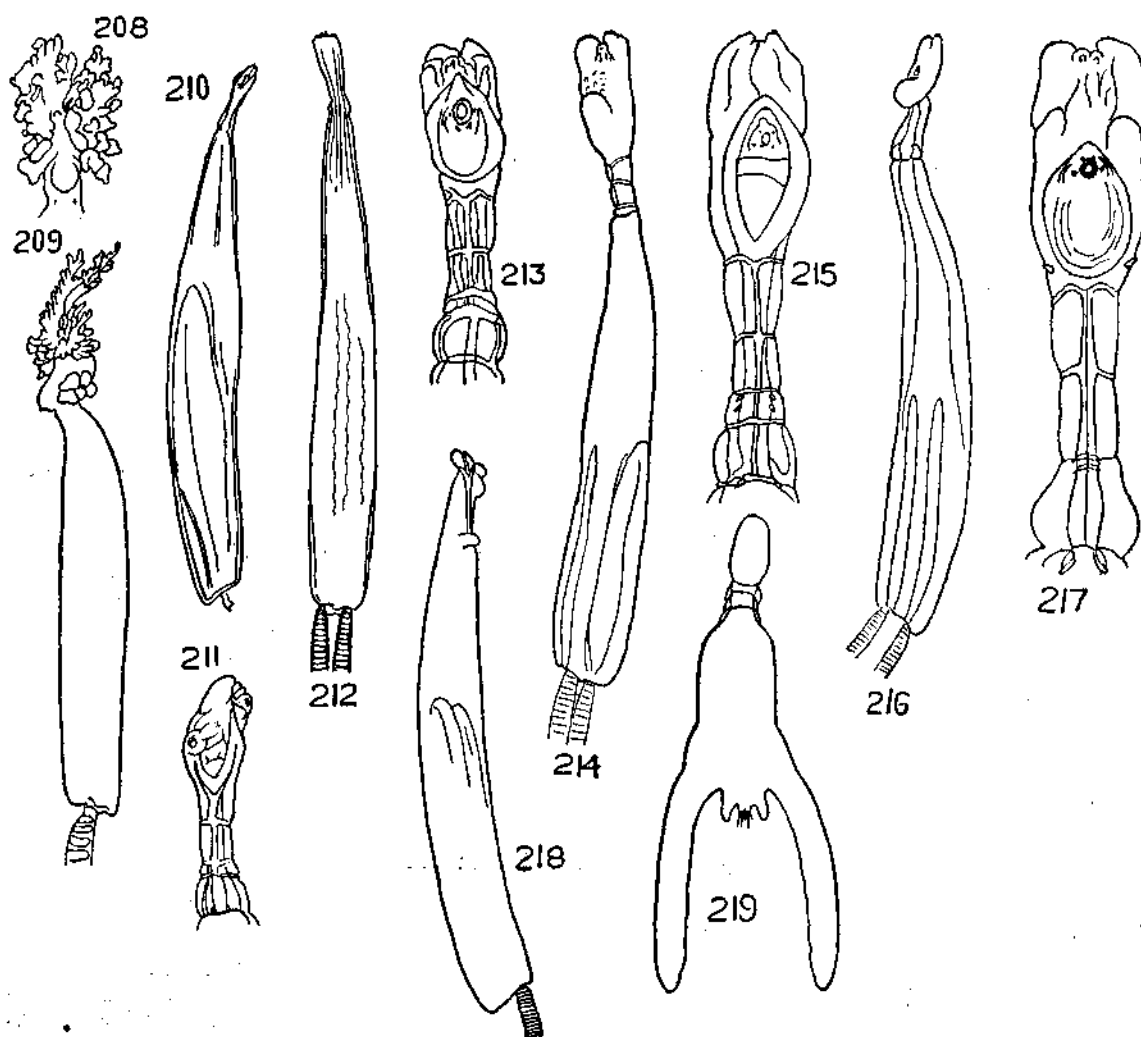
Gnanamuthu, 1951 c, p. 224, fig. 2; Kirtisinghe, 1964, p. 106, fig. 147.

Gnanamuthu characterised this species thus: The trunk is six-and-a-half times longer than head. It is five times broader than the fourth segment, the cephalothorax is uniformly swollen behind, slightly twisted and asymmetrical. The proboscis is conspicuous. Length 11.0 mm.

Host: *Rastrelliger kanagurta* (Cuvier).

Location: Median fin.

Distribution: Madras.



FIGS. 208-219. (208-209) *Cardiodectes anchorellae* (Kirtisinghe, 1950); (210-211) *Peniculus scombri* (Gnanamuthu, 1951 c); (212-213) *Peniculus stromatei* (Gnanamuthu, 1951 c); (214-215) *Peniculus therapomi* (Gnanamuthu, 1951 b); (216-217) *Peniculus trichiuri* (Gnanamuthu, 1951 b); (218) *Peniculus sciaenae* (Gnanamuthu, 1951 b); (219) *Peniculisa furcata* (Wilson, 1906).

***Peniculus stromatei* Gnanamuthu**

(Figs. 212-213)

Gnanamuthu, 1951 c, p. 221, fig. 1.

Gnanamuthu defined it thus: Trunk 8 times longer than wide, fourth thoracic segment one-third as wide as trunk, proboscis inconspicuous, cephalothorax marked by prominent postero-ventral swelling, head and neck one-sixth the length of trunk and head three-fourths the length of the neck. Abdomen a short stout swelling and the egg strings are thin. Length 9.32 mm.

Host: *Parastromateus niger* (Bloch).

Location: Dorsal and caudal fins.

Distribution: Madras.

Peniculus theraponi Gnanamuthu

(Figs. 214–215)

Gnanamuthu, 1951 *b*, p. 80, figs. 12–23.

Cephalothorax cylindrical, with a cushion-like swelling in the middle of the ventral side making the proboscis conspicuous. Neck narrow and comparatively long. Trunk broad, about one-eighth of its length and five-and-a-half times as long as the part in front. Legs 1 and 4 uniramous, others biramous, rami 2-segmented. Anal laminae with 4 spines. Length 10.4 mm.

Host: *Therapon jarbua* (Forsk.)

Location: Dorsal and pectoral fins.

Distribution: Madras.

Peniculus trichiuri Gnanamuthu

(Figs. 216–217)

Gnanamuthu, 1951 *b*, p. 77, figs. 1–11.

Cephalothorax quadrangular, with pointed antero-median process, lateral parts folded downwards and stiffened by chitinous bars, ventral side with a large post-oral swelling. Trunk segment 1 short, second long, forming a narrow neck, third segment short, fourth widening to form the trunk. Trunk uniformly swollen, flattened from side to side, six-sevenths of the total length. Abdomen short and semicircular, anal laminae rounded, with 5 spines. Leg 1 uniramous, others biramous, with 2-segmented rami. Length 11.8 mm.

Host: *Trichiurus haumela* (Forsk.), *T. savala* Cuvier.

Location: Tail fin.

Distribution: Madras.

Peniculus sciaenae Gnanamuthu

(Fig. 218)

Gnanamuthu, 1951 *b*, p. 82, figs. 24–29.

Cephalothorax cylindrical, with large mouth cone, as long as the cushion-like swelling behind. Trunk 7 times as long as rest of the body and 4 times as stout as the fourth trunk segment. Length 11.7 mm.

Host: *Sciaena albida* Day.

Location: Pectoral fin.

Distribution: Madras.

Genus *Peniculisa* Wilson

Yamaguti, 1963, p. 203.

Head elliptical, first trunk segment distinctly separated from head, second and third forming a sort of neck, fourth, fifth and genital segments fused into a trunk produced postero-laterally into a pair of wide flattened processes. Abdomen small, 1-segmented, with the postero-lateral corners produced. Caudal rami reduced.

Peniculisa furcata (Kroyer)

(Fig. 219)

Wilson, 1906, p. 206, pl. 5, figs. 61-66 (*Peniculus*); Kirtisinghe, 1964, p. 106.

Head elliptical, narrow in front. Thoracic segments 1 to 3 distinct, forming a pronounced narrow neck, segments 4 and 5 and genital segment forming a dorso-ventrally flattened trunk, its postero-lateral processes nearly as long as the body proper. Postero-lateral corners of abdomen produced into blunt lobes. Caudal rami small, each with 3 setae. Length 2.35 mm.

Host: *Tetrodon* sp.

Location: Not given.

Distribution: Ceylon.

Family PENNELLIDAE

Genus *Pennella* Oken

Wilson, 1917, p. 105; 1932, p. 489; Barnard, 1955, p. 280; Yamaguti, 1963, p. 206.

Head more or less globular, truncated, with 2 or 3 horns, usually chitinous and unbranched. Neck long, cylindrical, passing insensibly into the trunk, latter wider, straight and transversely rugulose. Abdomen shorter than trunk, with a row of plumose appendages along each side, and a pair of minute caudal rami with long setae. Antennae dorsal, antenna 1 with few joints, antenna 2 chelate. Mouth-parts obsolete. Legs 1 and 2 biramous, close together, 3 and 4 uniramous, rami 2-jointed and setose.

Pennella instructa Wilson

(Fig. 220)

Wilson, 1917, p. 122, pl. 18; 1932, p. 491, fig. 285 c; Kirtisinghe, 1932, p. 137, figs. 1-5 (*zeylanica*); 1964, p. 110, fig. 153.

Head almost spherical, its anterior end slightly concave, a little inclined downwards. 2 sets of pads, inner set surrounding the mouth enclosed within the larger outer set. A pair of gradually tapering horns. Neck long, of uniform diameter, passing insensibly into the trunk. Trunk much shorter than the neck. Abdomen narrower and shorter than the trunk. Abdominal processes much branched. Length 137.0 mm.

Host: *Histiophorus gladius* (Brossonet), *Xiphias gladius*, *Isticompax australis*.

Location: Surface of body.

Distribution: Ceylon, East coast of America, Japan and N. S. Wales.

Pennella biloba Kirtisinghe

(Figs. 222–223)

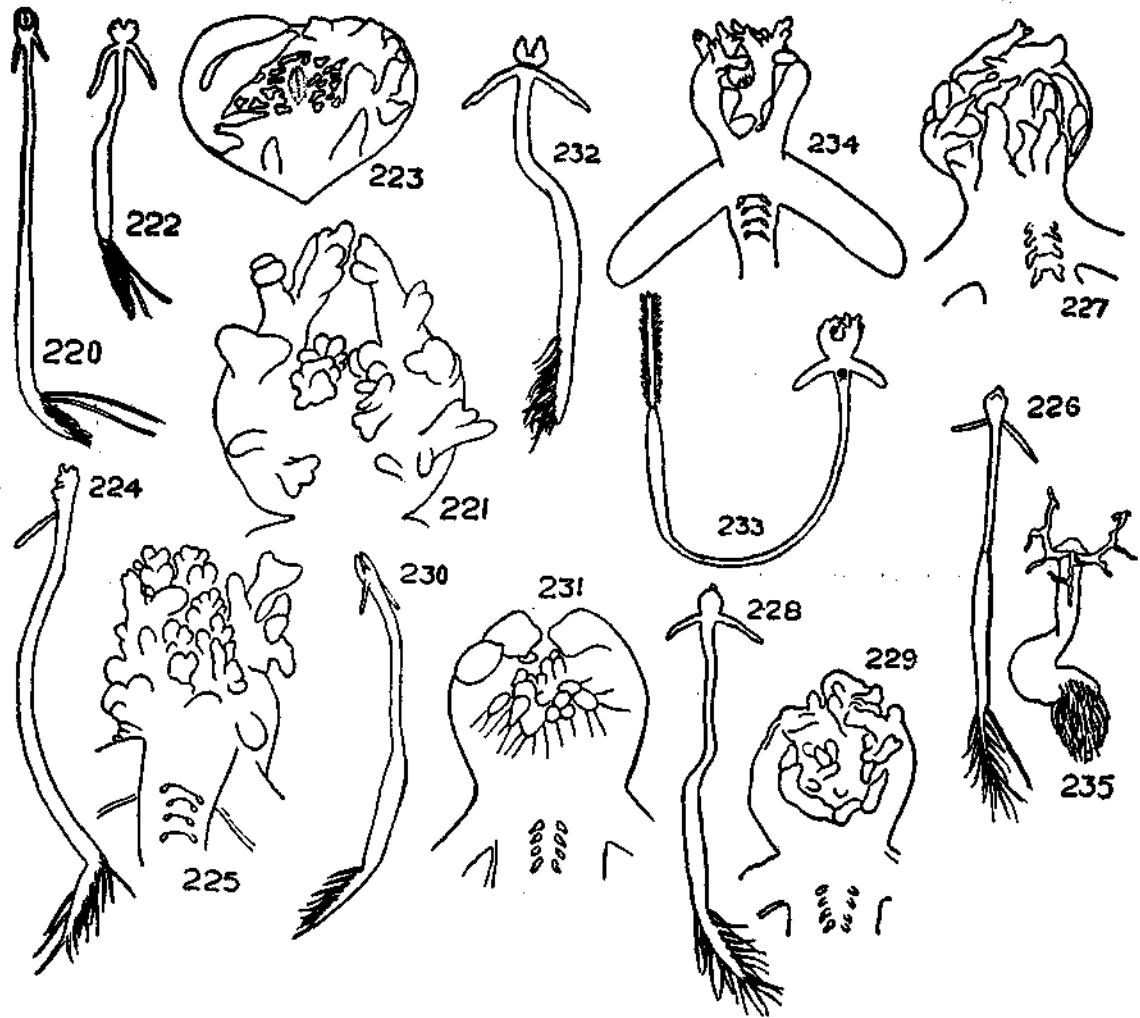
Kirtisinghe, 1933, p. 548, figs. 1–3.

Head twice as broad as long, with 2 grooves demarcating it into 3 lobes, wedge-shaped in lateral view. Arising from the borders are large irregularly arranged papillae and much smaller papillae around the mouth. Horns of head of uniform diameter, apex rounded. Neck as long as trunk, latter gently narrowing backwards. Abdominal appendages unbranched. Length 32.0 mm.

Host: *Histiophorus brevirostris* Playfair (= *Tetrapturus brevirostris*).

Location: Near pelvic fin.

Distribution: Ceylon.



FIGS. 220–235. (220) *Pennella instructa* (Kirtisinghe, 1934); (221) *Pennella diodontis* (Hoegaard, 1943); (222–223) *Pennella biloba* (Kirtisinghe, 1933); (224–225) *Pennella robusta* (Gnanamuthu, 1957); (226–227) *Pennella longicauda* (Gnanamuthu, 1957); (228–229) *Pennella elegans* (Gnanamuthu, 1957); (230–231) *Pennella platycephalus* (Gnanamuthu, 1957); (232) *Pennella diodontis* (Kirtisinghe, 1964); (233–234) *Pennella selaris* (Kirtisinghe, 1964); (235) *Lernaeolophus sultanus* (Kirtisinghe, 1964).

Pennella robusta Gnanamuthu

(Figs. 224-225)

Gnanamuthu, 1957, p. 119, figs. 1-6.

Head nearly rectangular due to the presence of anterior and lateral papillae, irregularly arranged and more numerous anteriorly, small ones in a semicircle behind the mouth. Head with a pair of posterior horns. Neck longer than genital region, abdomen nearly half the length of the genital region, with 17 pairs of unbranched or bifid appendages. Anal laminae present. Length 55.0 mm.

Host: *Parexocoetus brachypterus* Richardson.

Location: In front of ventral fin.

Distribution: Madras.

Pennella longicauda Gnanamuthu

(Figs. 226-227)

Gnanamuthu, 1957, p. 124, figs. 20-26.

Head circular and flattened, horns projecting obliquely backwards, ventral surface fully covered with irregularly overlapping papillae, dorsal side demarcated into a raised median and low lateral areas. Neck as long as genital part, abdomen relatively long, with 22 pairs of appendages, mostly forked. Each anal lamina with a spine. Length 35.0 mm.

Host: *Cypsilurus bahiensis* [= *Cypsilurus comatus* (Mitchell)].

Location: In front of the ventral fin.

Distribution: Madras.

Pennella elegans Gnanamuthu

(Figs. 228-229)

Gnanamuthu, 1957, p. 122, figs. 7-13.

Head comparatively small, horns long. Anterior half of head with an antero-median cleft and covered with papillae. Neck longer than genital part. Abdomen nearly half the length of the genital part, with 18 pairs of processes, the first 17 pairs bifurcate. Length 35.0 mm.

Host: *Cypsilurus* sp.

Location: Not given.

Distribution: Not given.

Pennella platycephalus Gnanamuthu

(Figs. 230-231)

Gnanamuthu, 1957, p. 121, figs. 7-13.

Head nearly circular, medially cleft and dorso-ventrally flattened. Papillae in the form of a dense oral cluster in the middle and large ones extending from the front part forwards and curving inwards. Lateral horns extending outwards and backwards. Neck longer than genital part. Abdomen three-fourths the length of the genital part, with 16 pairs of appendages, each, except the first 2 pairs, with 3 to 4 branches. Length 37.0 mm.

Host: *Cypselurus spilopterus*.

Location: Not given.

Distribution: Madras.

***Pennella diodontis* Oken**

(Figs. 221, 232)

Kirtisinghe, 1935, p. 332, figs. 1-6; Heegaard, 1943 a, p. 28, figs. 79-81 (*cervicornis*); Kirtisinghe, 1964, p. 112, fig. 155.

Head with deep anterior concavity lodging the antennae, ventral side with branched papillae, small ones around the mouth and large ones marginally, the anteriormost pair projecting forwards, more prominently in subadults. A pair of unbranched obliquely directed pointed horns behind the head. The neck imperceptibly merges with the genital part of trunk, the latter as long as the former but thicker, abdomen short, with 2 rows of slender, unbranched processes. Length 14.0 mm.

Host: *Diodon maculifer* Kaup.

Location: Surface of body.

Distribution: Ceylon, Bay of Bengal and Antarctic.

According to Kirtisinghe *cervicornis* Heegaard is the same as *diodontis* Oken.

***Pennella selaris* Kirtisinghe**

(Figs. 233-234)

Kirtisinghe, 1964, p. 112, figs. 156-158.

Anterior margin of head concave, with the second antennae projecting inside the concavity, a pair of apically rounded horns projecting outwards and backwards from the sides of the head, branched papillae projecting forwards from the ventral side of the head. Neck tubular, about half the total length, trunk less than half the length of neck but wider, abdomen as thick as the neck, with about 20 pairs of processes, tip of abdomen indented, with a pair of setae. Length 26.4 mm.

Host: *Selar malam* Bleeker.

Location: In the middle of the left side.

Distribution: Ceylon.

Genus *Lernaeolophus* Heller

Yamaguti, 1963, p. 209.

Head fused with first trunk segment, inclined at right angles to the neck, armed with 3 horns, one dorsal and 2 lateral. Neck stout and cylindrical, twisted. Trunk curved, with chitinated wall. Abdomen with a double row of simple or dichotomously branched processes on either side, caudal rami rudimentary. Egg strings coiled. Antenna 1 rod-shaped or nodular, 1-segmented. Antenna 2 2-segmented, chelate or rudimentary. 4 pairs of legs close together at anterior end of neck, each a 1-segmented lamina.

Lernaeolophus sultanus (Nordmann)

(Fig. 235)

Wilson, 1917, p. 91, pl. 13; 1932, p. 487, fig. 293; Kirtisinghe, 1935, p. 334, fig. 9; Heegaard, 1962, p. 185, fig. 209; Kirtisinghe, 1964, p. 113, fig. 159.

Head hemispherical, flattened on its anterior surface. Cephalothorax with three branched horns, one dorsal and two lateral. Neck cylindrical. Trunk twice as wide as neck. Abdomen with dichotomously branched lateral processes. Length 15.0 mm.

Host: *Histiophorus gladius* (Broussonet), *Rastrelliger kanagurta* (Cuvier).

Location: Surface of body.

Distribution: Atlantic Ocean, Mediterranean, N.S. Wales and Ceylon.

Suborder LERNAEOPODOIDA

Family LERNAEOPODIDAE

Genus *Lernaeopoda* Blainville

Wilson, 1915, p. 631; 1932, pp. 617, 619; Barnard, 1955, p. 290; Yamaguti, 1963, p. 223.

Cephalothorax more or less inclined to the axis of trunk, with dorsal carapace. Trunk ovoid, with a cylindrical or foliaceous process on either side of the minute genital process, ventral to the ovisacs; no anal laminae. Antenna 1 2-jointed. Maxilliped 2 inside maxilliped 1, both close to the mouth, maxilliped 1 long, separate.

Lernaeopoda stromatei Gnanamuthu

(Fig. 236)

Gnanamuthu, 1950 c, p. 175, figs. 1-15.

Cephalothorax circular, dorso-ventrally flattened and inclined downwards, carapace present. Trunk oval, with short spherical genital process and a pair of elongate-conical postero-dorsal trunk processes. Maxilliped 1 longer than cephalothorax, free, bulla button-shaped. Length 2.62 mm.

Host: *Parastromateus niger* (Bloch).

Location: Gill arch.

Distribution: Madras.

Lernaeopoda upenei Pillai

(Fig. 237)

Pillai, 1962 d, p. 58, fig. 1.

Body rather stout, cephalothorax short, about a third of the length of maxilliped 1 and inclined downwards, carapace present. Genital processes apically acuminate. Maxilliped 1 long and slender, free, bulla vine glass-shaped. Length 3.3 mm.

Host: Upeneus vittatus (Forsk.).

Location: Branchial cavity.

Distribution: Kerala.

Lernaeopoda scoliodontis Kirtisinghe

(Fig. 238)

Kirtisinghe, 1964, p. 117, fig. 169.

Cephalothorax at right angles to trunk, neck short, half the length of cephalothorax. Trunk club-shaped, broader behind, posterior processes cylindrical. Maxilliped 1 long and slender, fully free. Length 8.0 mm.

Host: Scoliodon walbeehmi (Bleeker).

Location: Cloaca.

Distribution: Ceylon.

Genus *Thysanote* Kroyer

Wilson, 1915, p. 650; 1932, p. 509; Yamaguti, 1963, p. 262.

Cephalothorax short, depressed and usually in line with the trunk. Trunk depressed and enlarged posteriorly, with 2 bundles of long finger-shaped processes at each posterior corner and a pair of ventro-median processes. A small genital process but no abdomen. Maxilliped 1 short or long, free except at tip, with branched processes on it or very near the place where it meets the trunk, bulla mushroom-shaped.

Thysanote longimanus Wilson

(Fig. 239)

Wilson, 1913, p. 257; Pillai, 1962 *d*, p. 61, fig. 3.

Body regularly broadening backwards, with a small swelling at the region of maxilliped 1. Postero-lateral parts of trunk with 2 pairs of dichotomously branched processes, postero-median part produced into a large bilobed genital process, with a pair of ventro-median processes below. Maxilliped 1 as long as trunk, each carrying a bifid process at its base and a dichotomously branched process in the middle. Length 4.7 mm.

Host: Carangoides malabaricus (Bloch).

Location: Branchial cavity.

Distribution: West Indies and Kerala.

Thysanote appendiculata (Stp. & Lutk.)

(Fig. 240)

Wilson, 1915, p. 650; Kirtisinghe, 1935, p. 343; Gnanamuthu, 1950 *f*, p. 259, figs. 1-3; Pillai, 1962 *d*, p. 60, fig. 2; Kirtisinghe, 1964, p. 114, figs. 160-161.

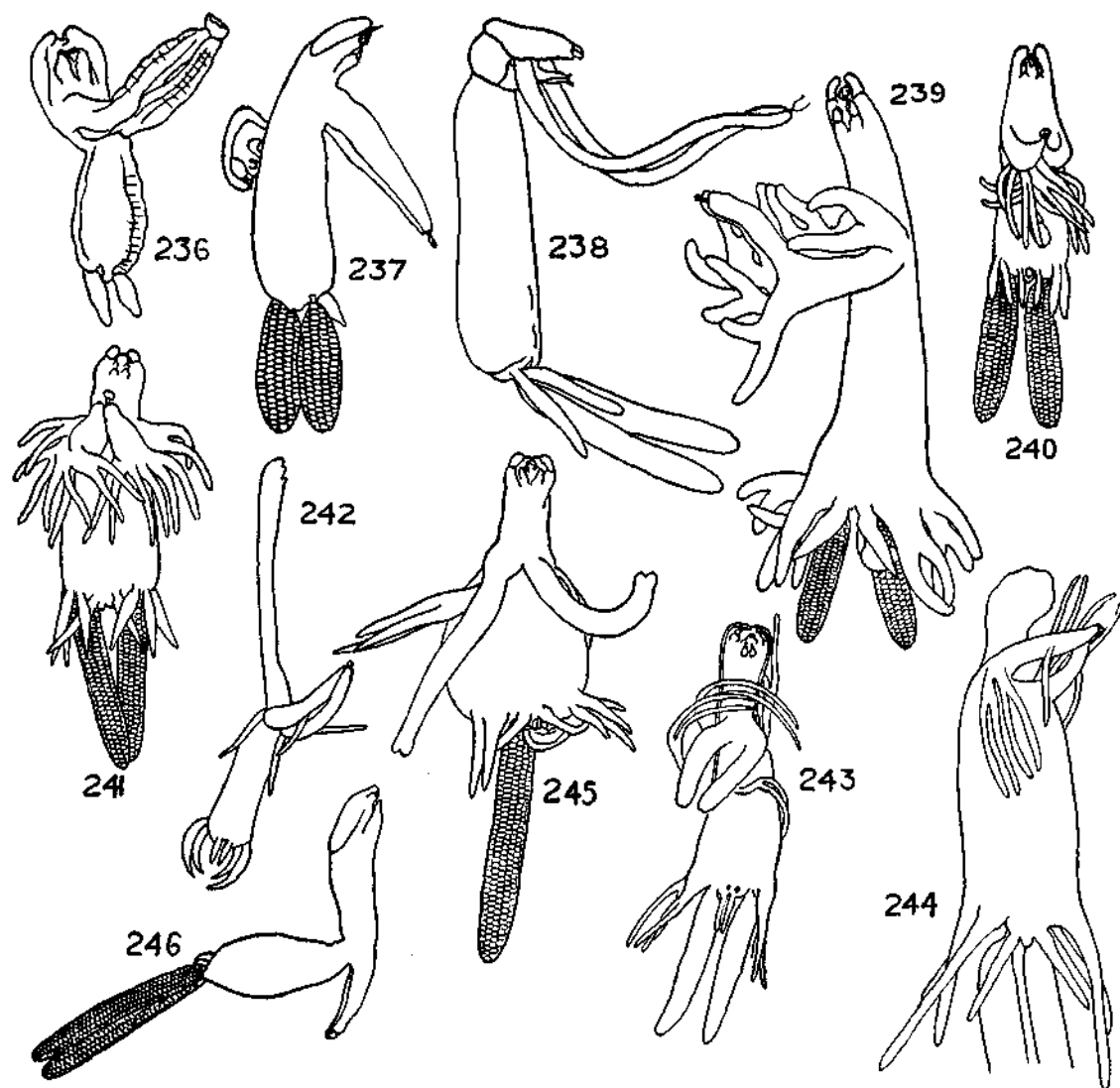
Cephalothorax indistinctly demarcated from trunk and slightly inclined ventralwards. Trunk widening backwards, with a pronounced bulge at the base of the first maxillipeds, posterior border

with a very short genital process. Maxilliped 1 short, bulla mushroom-shaped and flanked by wing-like thickenings, each maxilliped with 2 pairs of digitiform processes, originating from the middle of its ventral side. Postero-lateral parts of trunk with 2 pairs of processes, ventro-median part with a pair of processes. Length 5.2 mm.

Host: *Parastromateus niger* (Bloch).

Location: Gill arch.

Distribution: Bombay, Ceylon, Madras and Kerala.



FIGS. 236-246. (236) *Lernaeopoda stromatei* (Gnanamuthu, 1950 c); (237) *Lernaeopoda upenei*; (238) *Lernaeopoda scoliodontis* (Kirtisinghe, 1964); (239) *Thysanote longimanus*; (240) *Thysanote appendiculata*; (241) *Thysanote eleutheronema*; (242) *Thysanote rastrelligeri* (Rangnekar, 1961); (243) *Thysanote furcata* (Kirtisinghe, 1964); (244) *Thysanote heterodactyla* (Kirtisinghe, 1964); (245) *Thysanote* sp.; (246) *Pseudocharopinus dasyticus*.

Thysanote eleutheroneuma Rangnekar

(Fig. 241)

Rangnekar, 1961, p. 202, fig. 5; Pillai, 1962 *d*, p. 63, fig. 4 (*decemfimbriata*).

Body very clearly demarcated into a narrow cephalothorax and broad, dorso-ventrally flattened trunk, latter much broader than the former, with small genital process. Fimbriate processes attached to the base of the maxillipeds, 5 pairs, biramous and thickly massed around the ventral and lateral parts of the trunk. Posterior trunk processes 4 pairs, uniramous and apically pointed. Ventro-median processes like the lateral trunk processes. Length 5.0 mm.

Host: *Polynemus plebeius* (Broussonet).*Location*: Branchial cavity.*Distribution*: Bombay and Kerala.*Thysanote rastrelligeri* Rangnekar

(Fig. 242)

Rangnekar, 1961, p. 200, fig. 4.

Cephalothorax long and slender, nearly twice the length of trunk, trunk only slightly wider than cephalothorax, with convex hind border, trunk processes 2 pairs, one dorso-lateral and the other ventro-lateral. Maxilliped 1 long and slender, as long as trunk, each with 2 processes, one originating at its base and the other from the middle. Length 8.8 mm.

Host: *Rastrelliger kanagurta* (Cuvier).*Location*: Gill filaments.*Distribution*: Bombay.*Thysanote furcata* Kirtisinghe

(Fig. 243)

Kirtisinghe, 1964, p. 115, figs. 162–165.

Cephalothorax short, trunk about twice the length of cephalothorax, widening backwards. Maxilliped 1 as long as cephalothorax, each with a pair of bifid processes arising from its ventral side. Posterior part of trunk with a pair of median processes and 3 pairs of lateral processes, of the latter, the inner dorsal unbranched, others bifid. Length 5.8 mm.

Host: Carangid.*Location*: Branchial cavity.*Distribution*: Ceylon.*Thysanote heterodactyla* Kirtisinghe

(Fig. 244)

Kirtisinghe, 1964, p. 116, figs. 166–168.

Cephalothorax short, swollen in front and bent downwards, trunk with subparallel sides. Maxilliped 1 as long as cephalothorax, each with a basal process dichotomously branched and an

unbranched median process. Hind end of trunk with a pair of ventro-median processes and 3 pairs of unbranched processes. Length 6.6 mm.

Host: *Carangoides armatus* (Forsk.)

Location: Dorsal fin.

Distribution: Ceylon.

Thysanote sp.

(Fig. 245)

Pillai, 1962 d, p. 65, fig. 5.

Cephalothorax continued imperceptibly into the pear-shaped trunk, latter with a conical genital process. Maxilliped 1 as long as trunk. Anterior processes 4 pairs, biramous, originating from the trunk below the insertion of maxilliped 1, posterior processes 4 pairs, uniramous. Length 4.5 mm.

Host: *Chorinemus tala* Cuvier.

Location: Peduncle of pectoral fin.

Distribution: Kerala.

Genus *Pseudocharopinus* Kabata

Kabata, 1964 a, p. 92.

Cephalothorax elongate, cylindrical, about two-thirds as long as trunk. Head distinctly delimited from the rest of the cephalothorax, definite and well developed dorsal carapace present. The first maxillipeds longer or slightly shorter than the cephalothorax, united at their tips to form a bulla of the usual lernaeopodid type. The second maxillipeds well developed and close to the mouth cone, on the ventral aspect of the cephalothorax. Trunk somewhat flattened dorso-ventrally, longer than or as long as broad, its anterior part distinctly narrower and forming a "neck" region. Posterior processes two in number, in some species vestigial, dorsal to the egg strings (Definition from Kabata).

Pseudocharopinus dasyaticus (Pillai)

(Fig. 246)

Pillai, 1962 d, p. 66, fig. 6 (*Charopinus*).

Cephalothorax rather short, longer than the first maxillipeds or the trunk, head swollen and covered with a carapace. Trunk elongate pear-shaped, with a small apically bilobed genital process and a pair of apically acuminate posterior processes. First maxillipeds comparatively short, free except at the tip, each enlarged into a semicircular cup-shaped structure flanked by two wings, bulla button-like and dark. Length 6.1 mm.

Host: *Dasyatis imbricatus* (Bloch & Schn.).

Location: Margin of body.

Distribution: Kerala.

Kirtisinghe made this species a synonym of *P. markewitschi* (Gusev). The present species certainly shows close resemblance to *P. pastinacae* and *P. markewitschi*, but whether all are the same has to be decided.

Pseudocharopinus narcinae (Pillai)

(Fig. 247)

Pillai, 1962 *d*, p. 68, fig. 7 (*Charopinus*).

Cephalothorax comparatively short, shorter than trunk, with a swollen head. Postero-medial part of trunk produced into a bilobed process and with 2 large laminate processes. First maxillipeds long and slender, longer than cephalothorax and as long as trunk, free except at the tip, bulla boat-shaped. Length 10.7 mm.

Host: *Narcine timlei* (Bloch & Schn.).

Location: Gill arches.

Distribution: Kerala.

This species is a true *Pseudocharopinus*, but the bulla is boat-shaped as in *Charopinus* as defined by Kabata.

Genus *Charopinopsis* YamagutiYamaguti, 1963, p. 250; Kabata, 1964 *a*, p. 104.

Cephalothorax of medium length, cylindrical, head not clearly delimited. It is either in line with or slightly dorsally inclined to the longitudinal axis of the trunk. Trunk elongate, posterior processes four and ventral to the egg strings. The first maxillipeds are fused at the tips and form a small bulla (Definition from Kabata).

Charopinopsis quaternia (Wilson)

(Fig. 256)

Pearse, 1952, p. 35, figs. 129–135 (*Brachiella*); Pillai, 1962 *d*, p. 85, fig. 18 (*Brachiella*); Kabata, 1964 *a*, p. 104, pl. 12, figs. 91–100.

Body bottle-shaped and smooth. Cephalothorax as long as first maxillipeds, dorso-ventrally flattened, with carapace. Trunk anteriorly narrow but suddenly widening and further on nearly parallel-sided, dorso-ventrally flattened. Genital process short, bilobed. Trunk processes 2 pairs, ventral pair close together and nearly 4 times as long as lateral, latter wide apart. First maxillipeds short and stout, free, apically expanding into a circular disc. Length 5.4 mm.

Host: *Coryphaena hippurus* Linn.

Location: Gill filaments.

Distribution: Caribbean and India (Kerala).

Genus *Clavella* Oken

Barnard, 1955, p. 291; Yamaguti, 1963, p. 241.

Cephalothorax long, bent backwards at an angle with axis of trunk, with or without dorsal carapace. Trunk ovoid, without posterior processes, abdomen, or anal lamellae; an unpaired genital process often present. Antenna 1 3-jointed. Antenna 2 uniramous, 3-jointed. Maxilla 1 bipartite. No anal lamellae (After Barnard).

Clavella uncinata (Muller)

Wilson, 1915, p. 680, pls. 27, 28 and 49; Shiino, 1956, p. 287, figs. 10-11; Kirtisinghe, 1964, p. 120.

Cephalothorax slightly longer than the trunk, cylindrical, straight or only a little curved, bent back over the trunk but in line with the first maxillipeds. Head squarely truncated anteriorly carapace indistinct. Trunk depressed, somewhat quadrilateral with rounded corners and a re-entrant posterior margin. Genital processes on a level with the ventral surface. First maxillipeds completely fused and reduced so much as often to appear vestigial. Length 10-13 mm.

Host: *Gazza minuta* (Bloch).

Location: On the operculum.

Distribution: Atlantic, Mediterranean and Pacific oceans and Ceylon.

From *Gazza minuta* I collected a few specimens which superficially resemble *C. uncinata*. Kabata who examined my material in detail expressed the opinion that they might belong to a new genus. The material is under further study.

Genus *Clavellopsis* Wilson

Wilson, 1915, p. 686; Barnard, 1955, p. 293; Yamaguti, 1963, p. 255.

Cephalothorax usually shorter and thicker than in *Clavella*. Trunk squat, often wider than long, sometimes with posterior processes, but no abdomen or anal lamellae. An unpaired genital process present. Antenna 1 4-jointed. Antenna 2 biramous, endopod 1-segmented, exopod 2-segmented. First maxillipeds short, broad, fused, with folds of skin or swellings, with apical bulla.

Clavellopsis appendiculata Kirtisinghe

(Fig. 253)

Kirtisinghe, 1950, p. 84, figs. 40-43; Pillai, 1962 d, p. 70, figs. 8-9; Yamaguti, 1963, p. 260 (*Isobranchia ceylonensis*).

Cephalothorax stout, cylindrical and bent backwards over the trunk, head covered by a quadrangular carapace. Trunk pear-shaped, as broad as long, hind border bilobed, with a short genital process and 2 pairs of long cylindrical processes, ventral processes nearer each other than the dorsal. First maxillipeds short but stout, completely fused. Length 4.0 mm.

Host: *Chirocentrus dorab* (Forsk.).

Location: Gills arches.

Distribution: Ceylon and Kerala.

Isobranchia appendiculata Heegaard is most probably the same as *Clavellopsis appendiculata* Kirtisinghe and *Isobranchia* does not appear to be a valid genus.

Clavellopsis bilobata Pillai

(Fig. 254)

Pillai, 1962 d, p. 72, fig. 10.

Body short and plump. Cephalothorax cylindrical, about 3 times as long as broad and remaining more or less on a line with the first maxillipeds. Basal part of cephalothorax housing the glands prominently bulged. Trunk short, much broader than long, demarcated into 2 nearly

rounded lobes separated by a deep median groove, postero-median part produced into a prominent genital process. First maxillipeds short and completely fused, bulla flanked by 2 semicircular swellings. Length 2.2 mm.

Host: *Nemipterus japonicus* (Bloch).

Location: Gill arch.

Distribution: Kerala.

This species closely resembles *C. branchiostegi* Yamaguti (1939).

Genus *Clavellisa* Wilson

Wilson, 1915, p. 693; Yamaguti, 1963, p. 253; Kabata, 1964, p. 7.

Cephalothorax much longer than trunk, often wrinkled and attached to the centre of the dorsal side of the latter, head covered by a carapace. Trunk wider than long, depressed, no genital or posterior processes, abdomen or caudal rami. First antenna stout and heavily armed, second antenna biramous. Maxilla bi- or tri-partite, with a palp. First maxillipeds flat and laminate, fused or separate and apparently attached to the anterior end of the trunk, some distance in front of the base of the neck. Posterior part of trunk with vestigial structures of uncertain homology.

Clavellisa emerginata (Kroyer)

(Fig. 248)

Wilson, 1915, p. 694; Pillai, 1962 *d*, p. 74, fig. 11; Kabata, 1964, p. 1, figs. 1-3.

Cephalothorax long and slender, more than twice as long as trunk, bent at right angles to the latter. Carapace bulging on the dorsal side of head. Trunk nearly chordate, posteriorly emarginate, with prominent longitudinal dorso-median groove. First maxillipeds shifted towards the ventral side, completely fused, bulla vine-glass-shaped. Length 3.6 mm.

Host: *Thrissocles malabarica* (Bloch).

Location: Gills rakers.

Distribution: Kerala.

Clavellisa dussumieriae Gnanamuthu

(Fig. 250)

Gnanamuthu, 1947 *c*, p. 748, figs. 1-7; Pillai, 1962 *d*, p. 76, fig. 12.

Cephalothorax very long and slender, about 4 times as long as trunk. Trunk transversely oblong, about twice as broad as long. First maxillipeds short, completely fused, bulla vine glass-shaped. Egg sacs large, nearly globular, with large eggs. Length 2.9 mm.

Host: *Dussumieria hasselti* Bleeker.

Location: Gill arches and gill rakers.

Distribution: Madras and Kerala.

Clavellisa chordata Wilson

(Fig. 249)

Wilson, 1915, p. 697; Pillai, 1962 *d*, p. 78, fig. 13.

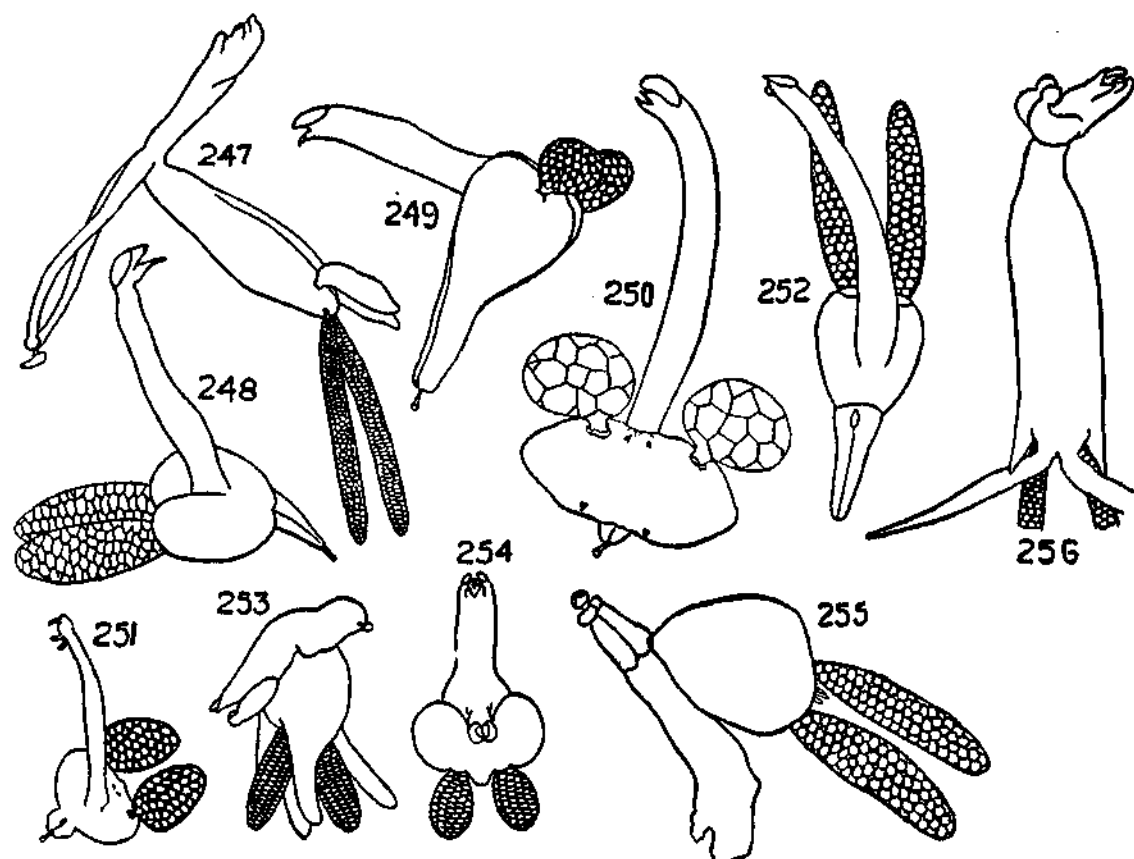
Cephalothorax one-and-a-half times as long as trunk, comparatively stout, trunk roughly triangular, equal in length and breadth, hind border nearly straight. Egg-sacs small, ovate. First maxillipeds rather long, about three-fourths the length of cephalothorax. Length 3.1 mm.

Host: *Pellona indica* Jerdon.

Location: Gill rakers.

Distribution: North America and India (Kerala).

The specimens collected at Trivandrum differ from Wilson's specimens in some characters and may probably belong to a new species.



FIGS. 247-256. (247) *Pseudocharopinus nariniae*; (248) *Clavellisa emarginata*; (249) *Clavellisa chordata*; (250) *Clavellisa dussumieriae*; (251) *Clavellisa ilishae*; (252) *Clavellisa obchordata* (Rangnekar, 1957 a); (253) *Clavellopsis appendiculata*; (254) *Clavellopsis bilobata*; (255) *Clavellopsis dasyaticus* (Rangnekar, 1957 a); (256) *Charopinus quaternia*.

Clavellisa ilishae Pillai

(Fig. 251)

Pillai, 1962 d, p. 79, fig. 14.

Cephalothorax slender, nearly 3 times as long as trunk, trunk transversely oblong, about one-and-a-half times as broad as long. Egg-sacs large, pyriform, roughly equal to the trunk in size. First maxillipeds short but broad, completely fused. Length 2.5 mm.

Host: *Ilisha filigera* (Val.), *Euplatygaster indica* (Swainson).

Location: Gill rakers.

Distribution: Kerala.

Clavellisa obchordata Rangnekar

(Fig. 252)

Rangnekar, 1957 a, p. 17, fig. 6.

Cephalothorax nearly 3 times as long as trunk. Trunk pyriform, longer than broad, with a pair of posterior lobes and a genital lobe. Egg-sacs cylindrical. First maxillipeds long, completely fused, nearly as long as trunk, bulla lacking? Length 6.3 mm.

Host: *Nematalosa nasus* (Bloch).

Location: Branchial filaments.

Distribution: Bombay.

This species shows obvious likeness to *C. chordata* but has a differently shaped egg-sac and there is difference in the comparative lengths of the cephalothorax and first maxillipeds. What Rangnekar has described as the posterior processes might be the vestigial structures characteristic of this genus. Obviously the bulla was lost while removing the specimen from the host.

Genus *Brachiella* Cuvier

Wilson, 1915, p. 698; 1932, pp. 520, 618 and 619; Barnard, 1955, p. 296; Yamaguti, 1963, p. 246.

Cephalothorax elongate, more or less flexed backwards, head with dorsal carapace. Trunk swollen, flattened dorso-ventrally, with rows of pits, grooves, or knobs on dorsal and ventral surfaces in some species, 2 or 4 posterior processes and an unpaired genital process, no abdomen or anal lamellae. Ovisacs long, slender. Antenna 1 2 to 4-segmented (usually 3-segmented). Antenna 2 biramous, first maxillipeds long, separate and united at tips by a bulla, but sometimes fused.

Brachiella thynni Cuvier

(Fig. 259)

Shiino, 1956, p. 283, figs. 8-9; Pillai, 1962 d, p. 81, figs. 15-16.

Cephalothorax nearly cylindrical, as long as trunk and in a line with it. Trunk slightly flattened dorso-ventrally and 3-segmented, genital process bilobed. Posterior trunk processes cylindrical, dorsal pair short, ventral long, more than twice as long as the dorsal, with curved swollen base. First maxillipeds completely free. Length 8.7 mm.

Host: *Indocybium lineolatum* (Cuv.).

Location: Base of pectoral fin.

Distribution: Japan, Ceylon and Kerala.

SM-V-10

***Brachiella trichiuri* Gnanamuthu**

(Fig. 257)

Gnanamuthu, 1951 *d*, p. 13, fig. 1; Pillai, 1962 *d*, p. 83, fig. 17.

Cephalothorax about 3 times as long as first maxilliped, bent backwards, often describing a semicircle. Trunk pear-shaped and inflated, with slight dorso-ventral flattening. Genital process large and indistinctly bilobed. Trunk processes 2 pairs, long and cylindrical, ventral slightly shorter than dorsal. First maxillipeds short, free except at tip, bulla vine glass-shaped and flanked by wing-like thickenings. Length 4.1 mm.

Host: *Trichiurus savala* Cuvier.

Location: Buccal cavity.

Distribution: Madras and Kerala.

***Brachiella merlucii* Bassett-Smith**

Kirtisinghe, 1964, p. 120.

Cephalothorax not clearly marked off from the trunk and curving around and forwards at nearly a right angle to the rest of the body. Genital segment swollen and furnished with two pairs of processes, one pair moderately long arising from the postero-lateral corners of the segment, the other pair longer and springing from the ventral surface in front of the egg-sacs. First maxillipeds very short and enclosed together by a covering but not fused except at the apex. Length 8 mm.

Host: *Johnius diacanthus* (Lacepede).

Location: Gills.

Distribution: Atlantic and Mediterranean seas and Ceylon.

***Brachiella albida* (Rangnekar)**

(Fig. 260)

Rangnekar, 1956, p. 62, figs. (*Charopinus*); Pillai, 1962 *d*, p. 86, fig. 19; Kabata, 1964 *a*, p. 106 (*Charopinopsis*).

Cephalothorax roughly as long as first maxillipeds, stout and subcylindrical, bent dorsalwards at right angles to the trunk and remaining in a line with the first maxillipeds. Trunk elongate pear-shaped, slightly flattened dorso-ventrally. Trunk processes 2 pairs, dorsal ones wide apart, 3 times as long as ventral, latter apically pointed. Genital process small, bilobed. First maxillipeds free, connected to a rod-shaped bulla. Length 3.0 mm.

Host: *Otolithus ruber* (Schn.), *O. argenteus* Cuvier.

Location: Gill filaments.

Distribution: Bombay and Kerala.

Kabata placed this species under *Charopinopsis* Yamaguti alleging that it has 2 pairs of posterior trunk processes ventral to the egg-sacs. I have a large number of specimens including a single male. In the female the longer processes are dorsal and the shorter ventral to the egg-sacs. More over the male is exactly like the male of *Brachiella*. I therefore, retain it in *Brachiella*.

Brachiella otolithi Pillai

(Fig. 258)

Pillai, 1962 *d*, p. 88, fig. 20.

Cephalothorax long and slender, about one-and-a-half times as long as trunk, flexed backwards and arched forwards. Trunk pear-shaped, slightly longer than broad. Genital process long, cylindrical and apically bilobed. Trunk processes 2 pairs, subsimilar, ventral pair placed close together. First maxillipeds short, completely fused, bulla mushroom-shaped and flanked by wing-like thickenings. Length 2.6 mm.

Host: *Otolithus argenteus* Cuvier.*Location*: Gill arch.*Distribution*: Kerala.

Family NAOBRANCHIDAE

Genus *Naobranchia* Hesse

Yamaguti, 1963, p. 303.

Cephalothorax long and narrow, with small but distinct carapace. Trunk broad, elliptical, posteriorly emarginate, with a pair of posterior ventral processes. Abdomen distinct, with long caudal rami enclosed in a membranous sac formed by extension of integument of trunk. First maxillipeds in the form of bands, containing longitudinal muscles, bulla absent.

Naobranchia variabilis Brian

(Fig. 263)

Brian, 1924, p. 57, figs. 60–65; Bere, 1936, p. 610, pl. 12, figs. 304–313; Pillai, 1962 *d*, p. 90, fig. 21.

Cephalothorax shorter than trunk, nearly cylindrical and gradually narrowing forwards, head demarcated by a transverse septum, 2 arcuate thickenings on the dorsal side of the base of the cephalothorax. Trunk roughly circular and encircled by the egg sacs, eggs small, arranged into 8 groups. Length 5.8 mm.

Host: *Lagocephalus inermis* (Schlegel).*Location*: Gills.*Distribution*: Morocco, Monaco and Kerala.*Naobranchia vermiformis* Rangnekar

(Fig. 261)

Rangnekar, 1956, p. 60, figs.

Cephalothorax cylindrical, narrowing forwards and nearly one-and-a-half times as long as trunk. Head without a distinct carapace, but with a pair of lateral swellings. Trunk dorso-ventrally flattened, with a bulging dorsal hump. Egg-sacs lateral, projecting behind the trunk. Length 6.4 mm.

Host: *Nematalosa nasus* (Bloch).

Location: Gills.

Distribution: Bombay.

Naobranchia lizae (Kroyer)

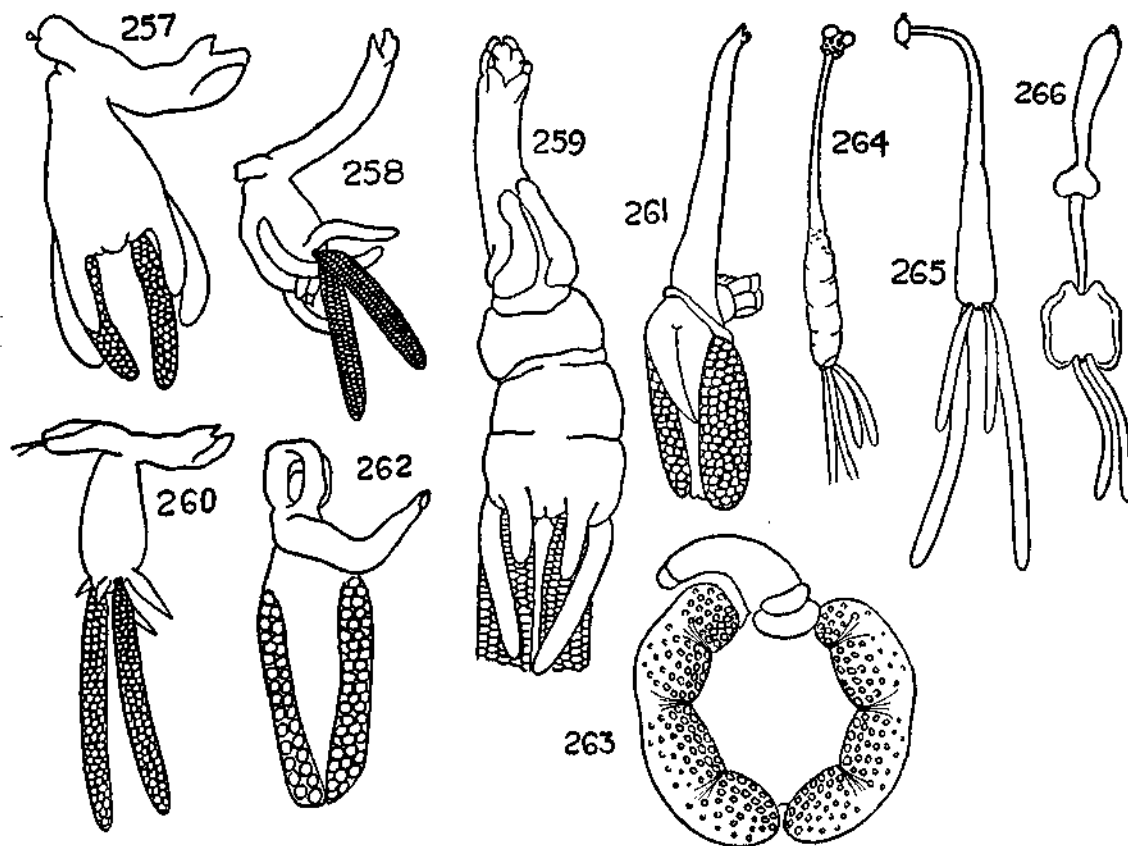
Kirtisinghe, 1964, p. 122.

Length not given.

Host: *Pellona ditchela* Val.

Location: Gill filaments.

Distribution: North America, Mexico and Ceylon.



FIGS. 257-266. (257) *Brachiella trichiuri*; (258) *Brachiella otolithi*; (259) *Brachiella thynni*; (260) *Brachiella albida*; (261) *Naobranchia vermiformis* (Rangnckar, 1956); (262) *Naobranchia* sp.; (263) *Naobranchia variabilis*; (264) *Paeon lobatus* (Kirtisinghe, 1964); (265) *Trypaphylus hemigalei* (Kirtisinghe, 1964); (266) *Medesicaste penetrans* (Barnard, 1955).

Naobranchia sp.

(Fig. 262)

Pillai, 1962 d, p. 91, fig. 22.

Cephalothorax slightly shorter than trunk, cylindrical and narrowing very gradually forwards. Carapace very indistinct, postero-dorsal side with 2 transverse thickenings. Trunk roughly oblong,

narrowing backwards, egg-sacs long, extending the entire length of the trunk, eggs fairly large. Length 3.7 mm.

Host: *Chorinemus tala* Cuvier.

Location: Gill filaments.

Distribution: Kerala.

Family SPHYRIIDAE

Genus *Paeon* Wilson

Yamaguti, 1963, p. 310.

Body demarcated into head, neck and trunk, head enlarged and with globular paired processes, neck slender and straight, trunk swollen, with a pair of posterior processes dorsal to egg-sacs. Abdomen minute, with small globular caudal rami. Egg strings multiseriate. Antenna 1 absent, antenna 2 rod-like, apically bifid. Maxilla 2 chelate, maxilliped uncinat.

Paeon lobatus Kirtisinghe

(Fig. 264)

Kirtisinghe, 1964, p. 123, figs. 180–183.

Head broader than long, with the anterior corners forming a pair of spherical lobes and the posterior a smaller pair of oval lobes. On the ventral side anteriorly a pair of triangular lobes surround the mouth and posteriorly there is a median swelling flanked by 3 swellings on each side. Neck smooth, imperceptibly merging into the club-shaped trunk, latter indistinctly 3-segmented, distally the trunk has a pair of lateral genital lobes and a pair of posterior processes. Abdomen short, bilobed. Length 29.3 mm.

Host: *Hemipristis elongatus* (Kluzinger).

Location: Branchial cavity.

Distribution: Ceylon.

Genus *Trypaphylum* Richardi

Yamaguti, 1963, p. 312 (*Trypaphylus*).

Body elongated, slender and smooth, head rounded, with stiff horns. Neck slender, trunk enlarged posteriorly and with 2 long slender posterior processes ventral to egg strings.

Trypaphylus hemigalei Kirtisinghe

(Fig. 265)

Kirtisinghe, 1964, p. 124, figs. 184–191.

Head transversely elliptical, with a pair of lateral horns directed obliquely backwards, anterior border demarcated into a median and 2 lateral lobes. Neck very slender, but gradually increasing in diameter and continued as the trunk, the junction between the two marked by a constriction.

Trunk as long as neck, divided into 2 equal halves by a constriction, a small median posterior lobe with bilobed distal border, posterior trunk processes nearly as long as trunk. Length 14.3 mm.

Host: *Hemigaleus balfouri* Day.

Location: Gill arch.

Distribution: Ceylon.

Incertae sedis

Genus *Medescaste* Kroyer

Barnard, 1955, p. 300.

Head and neck cruciform, bulla on anterior part of head. Neck long and thin, enlarged at base. Body-dorso-ventrally flattened, longer than broad, marked with faint transverse and longitudinal grooves. Thoracic appendages absent. Posterior processes convergent, enclosing a small 1-segmented abdomen. Ovisacs cylindrical (After Barnard, 1955).

Medescaste penetrans Heller

(Fig. 266)

Barnard, 1955 p. 301, fig. 31, Pillai; 1964, p. 82, figs. 151-152.

Head transversely ovate, separated by a constriction from the elongate cylindrical thorax which is bilobately expanded posteriorly; followed by a more slender elongate neck. Genital segment quadrangular, bilobed anteriorly and posteriorly; abdomen small (After Barnard, 1955).

Length 28.0 mm.

Host: *Trigla* sp.

Location: Buccal cavity.

Distribution: South Africa and Kerala.

Yamaguti (1963) placed *Medescaste* in subfamily Lernentominae under family Chondracanthidae. As the latter family is now placed in Cyclopoidea the position of *Medescaste* become uncertain. I, therefore, follow Barnard (1955).

LIST OF HOSTS AND THEIR PARASITES

(Names of hosts in italics)

<i>Ablennes hians</i>	<i>Anchoviella bataviensis</i>
Caligodes laciniatus	Lernaeenicus anchoviellae
Pseudopetalus caudatus	<i>Anchoviella hamiltoni</i>
Lernanthropus cornutus	Cordiodes anchorellae
<i>Acanthocybium solandri</i>	<i>Arius acutirostris</i>
Tuxophorus cybii	Lepeophtheirus longipalpus
<i>Acanthopagurus berda</i>	Hermilius longicornis
Caligus cossackii	<i>Ariodes dussumieri</i>
<i>Alectis indica</i>	Caligus dakari
Caligus constrictus	Lepeophtheirus longipalpus
Parapetalus orientalis	Hermilius longicornis

- Arothron stellatus*
Lepeophtheirus brachyurus
Hatschekia pholas
Autisthes puta
Caligus diaphanus
Auxis thazard
Caligus auxis

Belone sp.
Lernanthropus cornutus
Bembrops caudimaculatus
Taeniacanthus dentatus

Canthidermis maculatus
Caligus polycanthi
Carangoides armatus
Thysanote heterodactyla
Carangoides chrysophrys
Parapetalus longipennatus
Carangoides malabaricus
Parabomolochus monoceros
Caligus constrictus
Thysanote longimanus
Caranx sp.
Caligus tenax
Caligus brevicaudus
Parechetus carangis
Lernanthropus robustus
Lernanthropus giganteus
Caranx hippos
Caligus tenax
Caranx melanampygus
Caligus robustus
Caligus platurus
Parechetus constrictus
Caranx nigrescens
Parapetalus longipennatus
Caranx sansun
Caligus confusus
Caligus robustus
Lernanthropus indicus
Caranx sexfasciatus
Caligus tenax
Caranx speciosus
Caligus rotundigenitalis
Centriscus scutatus
Parabomolochus unicirrus
Chiloscyllium indicum
Taeniacanthus indicus
Caligus chiloscyllii
Chirocentrus dorab
Caligus longicaudus
Clavelloopsis appendiculata
Chorinemus lysan
Caligus tylosuri

Tuxophorus wilsoni
Lepeophtheirus spinifer
Lernanthropodes chorinemi
Chorinemus tala
Caligus epinepheli
Lepeophtheirus spinifer
Thysanote sp.
Naobranchia sp.
Coilia dussumieri
Peroderma cylindricum
Coryphaena hippurus
Caligus confusus
Caligus productus
Caligus quadratus
Euryphorus nympha
Lernaeenicus longiventris
Charopinopsis quaternia
Cybium sp.
Lernaeenicus seeri
Cybium commersonii
Caligus cybii
Caligus infestans
Tuxophorus cybii
Lernaeenicus alatus
Cynoglossus brachycephalus
Acanthochondria cynoglottides
Cynoglossus macrolepidotus
Acanthochondria cornuta
Cynoglossus puncticeps
Acanthochondria cynoglottidis
Cypselurus sp.
Pennella elegans
Cypselurus comatus
Pennella longicauda
Cypselurus spilopterus
Pennella platycephalus
Dasyatis akajei
Caligus dasyaticus
Dasyatis imbricatus
Pseudocharopinus dasyaticus
Decapterus russellii
Lernanthropus decapteri
Diodon hystrix
Hatschekia elliptica
Diodon maculifer
Pennella diodontis
Dussumieria acuta
Nothobomolochus multispinosus
Bomolochus acuta
Pseudopetalus dussumieri
Lernanthropus dussumieria
Dussumieria hasseltii
Nothobomolochus multispinosus
Pseudopetalus caudatus
Clavellisa dussumieriae

- Echeneis albescens*
Lepeophtheirus crassus
Eleutheronema tetradactylum
Parapetalus hirsutus
Lernanthropus trifolius
Epinepheles sp.
Sagum epinepheli
Epinepheles morrhua
Lernaeenicus ramosus
Euplatygaster indica
Clavellisa ilishae
Euthynnus affinis
Caligus productus
Caligus amblygenitalis
Caligus kuroshio
Caligus coryphaenae
Caligus asymmetricus
Caligus euthynnus
Caligus acutus
Pseudocycnus appendiculatus
- Fistularia villosa*
Pseudocaligus fistulariae
- Gastrophysus lunaris*
Pseudocaligus laminatus
Irodes lagocephali
Gasterin lineatus
Caligus acutus
Gazza minuta
Clavella uncinata
Germo albacora
Elytrophora hemiptera
Gnathanodon speciosus
Caligus rotundigenitalis
Lernaeenicus longiventris
- Hemigaleus balfouri*
Trypaphylum hemigalei
Hemipristis elongatus
Paeon lobatus
Hemirhamphus far
Lernaeenicus hemirhamphi
Hemirhamphus marginatus
Parabomolochus hemirhamphi
Hilsa toli
Caligus hilsae
Histiophorus gladius
Pennella instructa
Lernaeolophus sultanus
Hyporhamphus xanthopterus
Lernaeenicus hemirhamphi
- Ilsha filigera*
Clavellisa ilishae
- Indocybium guttatum*
Caligus cybii
Pseudocycnus armatus
Indocybium lineolatum
Caligus cybii
Brachiella thynni
- Johnius* sp.
Sciaenophilus tenuis
Johnius coibor
Peniculus sciaenae
Johnius diacanthus
Brachiella merlucii
Johnius dussumieri
Caligus sciaenae
Lernanthropus sciaenae
- Katsuwonus pelamis*
Caligus productus
Heniochophilus branchiatus
- Lagocephalus inermis*
Irodes lagocephali
Caligus lagocephali
Lepeophtheirus lagocephali
Naobranchia variabilis
Lates calcarifer
Caligus diaphanus
Lernanthropus lates
Lutianus sp.
Anuretes perplexus
Lepeophtheirus rotundiventris
Lepeophtheirus brachycephalus
Lernanthropus brevicephalus
Lutianus johni
Hatschekia elongata
Lutianus malabaricus
Caligus rotundigenitalis
Lutianus walgiensis
Norion gibbosus
- Makaira indica*
Gloiopotes longicaudatus
Megalaspis cordyla
Caligus cordyla
Lernanthropus corniger
Megalops cyprinoides
Lernanthropus cadenati
Mene maculata
Parapetalus orientalis
Mobula diabolus
Pupulina brevicauda
Pupulina minor
Mugil sp.
Caligus platytarsis

Mugil cephalus
 Caligus platytarsis
 Lernanthropus shishidoi

Narcine timlei
 Taeniacanthus narcini
 Pseudocharopinus narcini
Nematalosa nasus
 Lernanthropus rubiginosus
 Clavellisa obchordata
 Naobranchia vermiformis
Nemipterus japonicus
 Hatschekia foliata
 Lernaeenicus ramosus
 Clavellopsis bilobata
Nemipterus marginatus
 Lernaeenicus nemipteri
Neothunnus macropterus
 Pseudocycnus appendiculatus

Opisthopterus tardoore
 Lernanthropus opisthopteri
Otolithus argenteus
 Lernanthropus otolithi
 Brachiella albida
 Brachiella otolithi
Otolithus maculatus
 Caligus annularis
Otolithus ruber
 Brachiella albida

Pagrosomus major
 Caligus laticaudus
Pampus argenteus
 Nothobomolochus tricerus
 Caligus multispinosus
 Paralebion aliuncus
Parastromateus niger
 Parabomolochus megaceros
 Synestius caliginus
 Lernanthropus koenigii
 Lernaeenicus stromatei
 Peniculus stromatei
 Thysanote appendiculata
 Lernaeopoda stromatei
Parathynnus obesus
 Elytrophora indica
Parexocoetus brachypterus
 Pennella robusta
Pellona ditschela
 Naobranchia lizae
Pellona indica
 Clavellisa chordata
Pertica filamentosa
 Lernanthropus triangularis

Plagusia sp.
 Pseudochondracanthus sp.
Platax teira
 Anuretes anomalus
 Pseudanuretes schmitti
 Mappates plataxus
 Heniochophilus branchiatus
Polynemus heptadactylus
 Caligus laticaudus
 Lernanthropus trifolius
 Lernaeenicus polynemi
Polynemus plebeius
 Caligus phipsoni
 Parapetalus hirsutus
 Lernanthropus lappaceus
 Thysanote eleutheronemi
Polynemus sextarius
 Lernanthropus trifolius
Priacanthus hamrur
 Caligus priacanthi
 Caligus hamruri
 Lernanthropus priacanthi
Pristis sp.
 Caligus dasyaticus
 Caligus lepeophtheropsis
 Eudactylina lancifera
 Eudactylinopsis curvata
Pristipomoides typus
 Caligus curtus
 Lernanthropus pristipomoides
Promicrops lanceolatus
 Lepeophtheirus gonistii
Psettodes erumei
 Chondracanthus alatus
 Chondracanthus trilobatus
Pseudarius jattus
 Caligus arii
 Hermilius helleri
 Lepeophtheirus longipalpus
Pseudarius platystomus
 Hermilius pyriiventris
Pseudorhombus arsius
 Pseudochondracanthus longitruncus
 Heterochondria longa
Pseudorhombus triocellatus
 Heterochondria longa
Pterois miles
 Parataeniacanthus miles
 Caligus russellii
Pterois russellii
 Parataeniacanthus miles
 Caligus russellii
Rachycentron canadus
 Parapetalus occidentalis

- Tuxophorus caligodes*
Lepeophtheirus spinifer
Rastrelliger kanagurta
Orbitacolax aculeatus
Nothobomolochus kanagurta
Caligus kanagurta
Lernaeenicus sayori
Lernaeolophus sultanus
Peniculus scombri
Thysanote rastrelligeri
Remora albescens
Lepeophtheirus crassus
Rhabdosargus sarba
Caligus laticaudus
Caligus cossackii
Rhincodon typus
Echthrogaleus pectinatus
Rhinoptera javanica
Trebis exilis
Rhynchobatus sp.
Nesippus vespa
Eudactylina alata

Sardinella albella
Pumiliopsis sardinellae
Peroderma cylindricum
Sardinella fimbriata
Pseudopetalus formicoides
Lernanthropus oblongus
Saurida tumbil
Taeniakanthus longicaudus
Parataeniakanthus longicervis
Anchistrotos sauridi
Abasia platyrostris
Lernanthropus gibbosus
Sciaena albida
Peniculus sciaenae
Sciaena diacanthus
Sciaenophilus benedeni
Sciaena glaucus
Caligus sciaenae
Lernanthropus sciaenae
Sciaena semiluctosa
Sciaenophilus pharaonis
Scoliodon sorrakowah
Pseudopandarus longus
Perissopus manuelensis
Kroyeria elongata
Kroyeria minuta
Scoliodon walbeehmi
Lernaeopoda scoliodontis
Secutor insidiator
Lernanthropus secutoris
Selar kalla
Caligus djedabae

Selar malam
Pennella selaris
Selaroides leptolepis
Parabomolochus selaroides
Nothobomolochus scomberesocis
Lernanthropus alatus
Serranus sp.
Lepeophtheirus rotundiventris
Sillago sihama
Lernanthropus sillaginis
Solea sp.
Chondracanthus elongatus
Sphyræna sp.
Midias lobodes
Sphyræna acutipinnis
Hatschekia sphyræni
Sphyræna barracuda
Midias lobodes
Sphyræna jello
Nothobomolochus denticulatus
Caligus clavatus
Caligus cornutus
Sphyræna obtusata
Caligus cornutus
Caligus clavatus
Lernanthropus sphyrænae
Sphyræna plicuda
Caligus infestans
Sphyræna pinguis
Lernanthropus sphyrænae
Sphyrna sp.
Alebion echinatus
Kroyeria sphyrænae
Sphyrna blochii
Caligus furcisetifer
Sphyrna diplana
Alebion echinatus
Sphyrna zygaena
Kroyeria echinatus
Kroyeria sphyrænae
Synodus indicus
Metataeniakanthus synodi
Abasia platyrostris

Tetrapturus brevirostris
Gloiopotes longicaudatus
Pennella biloba
Tetrodon stellatus
Lepeophtheirus brachyurus
Tetrodon oblongus
Caligus parvus
Tetrodon sp.
Peniculisa furcata
Therapon jarbua
Peniculus theraponi

<i>Thrissocles hamiltoni</i>	<i>Caligus savala</i>
<i>Cardiodectes anchorellae</i>	<i>Peniculus trichiuri</i>
<i>Thrissocles malabarica</i>	<i>Lernanthropus forficatus</i>
<i>Clavellisa emarginata</i>	<i>Brachiella trichiuri</i>
<i>Thynnus orientalis</i>	<i>Trigla</i> sp.
<i>Elytrophora hemiptera</i>	<i>Medesicaste penetrans</i>
<i>Torquigener oblongus</i>	<i>Tylosurus crocodilus</i>
<i>Irodes tetradontis</i>	<i>Caligus tylosuri</i>
<i>Caligus parvus</i>	<i>Caligus malabaricus</i>
<i>Trachinotus blochi</i>	<i>Caligodes laciniatus</i>
<i>Caligus indicus</i>	<i>Lernanthropus cornutus</i>
<i>Lernanthropodes trachinoti</i>	<i>Tylosurus leiurus</i>
<i>Trichiurus haumela</i>	<i>Parabomolochus unicirrus</i>
<i>Caligus scabiei</i>	<i>Caligodes laciniatus</i>
<i>Caligus cunicephalus</i>	
<i>Peniculus trichiuri</i>	<i>Upeneus vittatus</i>
<i>Trichiurus savala</i>	<i>Anchistrotos sauridi</i>
<i>Caligus longicervicis</i>	<i>Lernaeopoda upenei</i>
<i>Caligus cunicephalus</i>	

REFERENCES

- BARNARD, K. H. 1955. South African parasitic copepods. *Ann. S. Afric. Mus.*, 41: 223-312.
- BASSETT-SMITH, P. W. 1898. Some new parasitic copepods found on fishes at Bombay. *Ann. Mag. nat. Hist.*, 1 (7): 1-17.
- 1898 a. Further new parasitic copepods found on fish in the Indo-tropical region. *Ibid.*, 2 (7): 77-98.
- 1898 b. Some new or rare parasitic copepods found on fish in the Indo-tropical region. *Ibid.*, 2 (7): 357-372.
- BENNET, P. S. 1963. *Peroderma cylindricum* Heller, a copepod parasite of *Sardinella albella*. *J. Mar. biol. Ass. India*, 3: 70-74.
- 1964. On *Bomolochus sardinellae* sp. nov. (Copepoda, Cyclopoida) parasitic on *Sardinella albella*. *Ibid.*, 6: 84-88.
- BENEDEN, P. J. VAN 1852. Note sur un nouveau genre de Crustace parasite de la famille des Peltocéphales. *Bull. Acad. Roy. Belg.*, 19: 462-467.
- 1892. Quelques nouveaux Caligides de la cote d'Afrique et de l'archipel des Açores. *Ibid.*, 24: 241-262.
- BERG, R. 1936. Parasitic copepods from Gulf of Mexico fish. *Amer. Midl. Nat.*, 17: 577-625.
- BRIAN, A. 1924. Parasitologia mauritanica. Part 1. Copepoda. *Bull. Com. d'Etud. Hist. Scient. Afric. Occid. Franc.*, 66 pp.
- CAPART, A. 1953. Copepodes parasites de poissons marine de la region de Dakar. *Bull. de l'I.F.A.N.*, 15: 647-670.
- DELAMARE-DEBOUTTEVILLE, CL. AND L. P. NUNES-RUIVO 1954. Parasites de poissons de mer Ouest-africains recoltés par M. J. Cadenat. II. Copepodes genre *Lernanthropus*. *Ibid.*, 16: 139-166.
- GNANAMUTHU, C. P. 1947. *Bomolochus multispinosus* sp. nov. an ergasilid copepod observed in copulation. *Rec. Ind. Mus.*, 45: 309-319.
- 1947 a. *Caligus sciaenae* n. sp. parasitic on *Sciaena glauca* from Madras. *Proc. Ind. Acad. Sci.*, 25: 43-49.
- 1947 b. *Lernanthropus sciaenae* sp. nov. a copepod parasitic on the gills of the fish *Sciaena glauca* from Madras. *Rec. Ind. Mus.*, 45: 291-298.
- 1947 c. A new copepod parasite *Clavellisa dussumieriae* belonging to the subfamily Clavellinae from the gills of a Madras fish. *Proc. zool. Soc. London*, 117: 748-755.
- 1948. *Bomolochus acuta* n. sp. a copepod parasitic on the gills of *Dussumieria acuta*. *Proc. Ind. Acad. Sci.*, 27: 18-25.

- GNANAMUTHU, C. P. 1948 a. Notes on the anatomy and physiology of *Caligus savala* n. sp. a parasitic copepod from Madras plankton. *Proc. zool. Soc. London*, 118: 591-606.
- 1948 b. A new copepod parasite *Lernanthropus dussumieria* n. sp. from the gills of a marine fish. *Parasitology*, 39: 209-213.
- 1950. Three new copepod parasites of the ribbon fish from South India. *J. Parasitology*, 36: 113-116.
- 1950 a. Sex difference in the Chalimus and adult form of *Caligus polycanthi* sp. nov. (Crustacea, Copepoda) parasitic on *Ballistes maculatus* from Madras. *Rec. Ind. Mus.*, 47: 159-170.
- 1950 b. *Parapetalus caudatus* n. sp. a copepod parasitic on *Dussumieria acuta* from Madras. *Proc. Ind. Acad. Sci.*, 31: 125-133.
- 1950 c. *Lernaeopoda stromatei* n. sp., a copepod parasite of the grey pomfret. *Ibid.*, 31: 175-180.
- 1950 d. *Synestius caliginus* Stp. & Lutk. a copepod parasite of the grey pomfret. *Rec. Ind. Mus.*, 47: 253-258.
- 1960 e. Two dichelethiid copepods from Madras fish. *Parasitology*, 40: 276-282.
- 1950 f. *Thysanote appendiculata* (Stp. & Lutk.) a lernaeopodid parasitic on the gills of the grey pomfret. *Rec. Ind. Mus.*, 47: 259-264.
- 1951. New copepod parasites of sharks. *Ann. Mag. nat. Hist.*, 4(12): 1236-1256.
- 1951 a. Studies on the lernaeid copepod *Cardiodectes anchorellae* Brian and Gray. *Proc. zool. Soc. London*, 121: 237-252.
- 1951 b. Three new lernaeid copepods parasitic on South Indian fishes. *Ann. Mag. nat. Hist.*, 4(12): 77-96.
- 1951 c. Two new species of copepods of the genus *Peniculus* parasitic on Madras fishes. *Rec. Ind. Mus.*, 49: 221-226.
- 1951 d. *Brachiella trichiuri* n. sp. a copepod parasitic in the mouth cavity of the ribbon fish. *Spol. Zeylan.*, 26: 13-15.
- 1951 e. *Perissopus manuelensis* n. sp. a pandarine copepod parasitic on *Mustelus monazo* Bleeker. *Ibid.*, 26: 9-12.
- 1953. Three lernaeid copepods parasitic on South Indian fishes. *J. Parasitology*, 39: 1-6.
- 1957. Lernaeid copepods parasitic on flying fish. *Parasitology*, 47: 119-125.
- HEEGAARD, P. E. 1943. Some new caligids from the Gilbert Islands. *Ark. for Zool.*, 34 A(16): 1-12.
- 1943 a. Parasitic copepods mainly from tropical and Antarctic seas. *Ibid.*, 34 A, No. 18: 1-37.
- 1946. Parasitic copepods from tropical East Africa. *Atlantide Rep.*, 3: 41-56.
- 1947. Contribution to the phylogeny of the Arthropods. *Spolia Zool. Mus. Haunensis*, 8: 1-227.
- 1962. Parasitic copepods from Australian waters. *Rec. Austr. Mus.*, 25: 149-234.
- HELLER, C. 1865. Crustaceen: *Reise der Osterreichischen Fregatte 'Novara' um die Erde in den Jahren 1857-59*. Zool. Teil, 2: 1-280.
- HEWITT, G. C. 1964. A redescription of *Glotopotes huttoni* (Thomson, 1889) with a key to the species of the genus. *Trans. Roy. Soc. N. Zealand*, 5: 85-96.
- HUMES, A. G. 1957. Two new caligoid copepods from Egyptian fishes. *J. Parasitology*, 43: 201-203.
- 1965. *Sciaenophilus inopinus* Humes, 1957, a synonym of *Sciaenophilus pharaonis* (Nordmann, 1832) comb. n. (Copepoda, Caligidae). *Ibid.*, 51: 1009-1010.
- KABATA, Z. 1964. *Clellisa emarginata* (Kroyer, 1873): morphological study of a parasitic copepod. *Crustaceana*, 7: 1-10.
- 1964 a. Revision of the genus *Charopinus* Kroyer, 1863 (Copepoda, Lernaeopodida). *Vidensk. Medd. fra Dansk. naturh. Foren.*, 127: 82-112.
- 1964 b. Copepoda parasitic on Australian fishes. I. *Hermilius youngi* sp. nov. (Caligidae). *Ann. Mag. nat. Hist.*, 7(13): 609-618.
- 1964 c. Copepoda parasitic on Australian fishes. II. *Mappates alter* sp. nov. (Caligidae). *Ibid.*, 7(13): 641-649.

- KABATA, Z. 1965. Copepoda parasitic on Australian fishes. III. Genera *Dentigryps*, *Hentiochophilus* and *Pseudanuretes* (Caligidae). *Ibid.*, 8 (13): 19-31.
- 1965 a. Copepoda parasitic on Australian fishes. IV. Genus *Caligus* (Caligidae). *Ibid.*, 8 (13): 109-126.
- 1965 b. Parasitic copepoda of fishes. *B.A.N.Z.A.R. Expedition, 1929-1931*, 8 (6): 1-16.
- 1966. Copepoda parasitic on Australian fishes. V. Genus *Dissonus* (Dissonidae). *Ann. Mag. nat. Hist.*, 9 (13): 211-226.
- AND A. V. GUSEV. 1966. Parasitic copepoda of fishes from the collection of the zoological institute in Leningrad. *J. Linn. Soc. (Zool.)*, 46: 155-207.
- KIRTISINGHE, P. 1932. *Pennella zeylanica* n. sp. a parasitic copepod of *Histiophorus gladius* Day. *Parasitology*, 24: 137-139.
- 1933. Two new parasitic copepods from Ceylon. *Ibid.*, 24: 548-551.
- 1934. *Glotopotes watsoni* n. sp. and *Lernaeenicus sceri* n. sp. parasitic copepods of fish from Ceylon. *Ibid.*, 26: 167-175.
- 1935. Parasitic copepods of fish from Ceylon. *Ibid.*, 27: 332-344.
- 1937. On the genus *Cybicola* Bassett-Smith. *Ibid.*, 29: 453-456.
- 1937 a. Parasitic copepods of fish from Ceylon. *Ibid.*, 29: 435-452.
- 1950. Parasitic copepods of fish from Ceylon. *Ibid.*, 40: 77-86.
- 1956. Parasitic copepods of fish from Ceylon. *Ibid.*, 46: 14-21.
- 1964. A review of the parasitic copepods of fish recorded from Ceylon with descriptions of additional forms. *Bull. Fish. Res. Station Ceylon*, 17: 45-132.
- KURIAN, C. V. 1950. Bionomics, structure and development of *Caligus russellii* sp. nov. parasitic copepod on the scorpion fish *Pterois russellii* (van Hass). *Bull. Res. Inst. Univ. Travancore*, 1: 1-21.
- 1955. Parasitic copepods of Travancore-Cochin. *Ibid.*, 4: 103-116.
- 1961. Parasitic copepods of fishes from Kerala. *Bull. Res. Inst. Univ. Kerala*, 8: 63-77.
- LEWIS, A. G. 1964. Caligoid copepods (Crustacea) of the Hawaiian islands. Parasitic on fishes of the family Acanthuridae. *Proc. U.S. nat. Mus.*, 115: 137-244.
- 1964 a. The caligid copepod genus *Dentigryps* (Crustacea, Caligoida). *Ibid.*, 115: 347-380.
- 1966. Copepod crustaceans parasitic on elasmobranch fishes of the Hawaiian islands. *Ibid.*, 118: 57-154.
- NUNES-RUIVO, L. P. AND P. FOURMANOIR. 1956. Copepodes parasites de poissons de Madagascar. *Mem. Inst. Sci. Madagascar*, 10: 69-80.
- OAKLEY, C. L. 1930. The Chondracanthidae (Crustacea, Copepoda): with a description of five new genera and one new species. *Parasitology*, 22: 182-201.
- PEARSE, A. S. 1952. Parasitic crustacea from the Texas coast. *Publ. Inst. Mar. Sci. Univ. Texas*, 2: 6-42.
- PILLAI, N. K. 1961. Copepods parasitic on South Indian fishes. 1. Caligidae. *Bull. Res. Inst. Univ. Kerala*, 8: 87-130.
- 1962. On a new species of *Bomolochus* (Copepoda) with remarks on *Orbitacolax* Shen. *J. Parasitology*, 48: 610-612.
- 1962 a. Three new species of anthosomid copepods parasitic on South Indian fishes. *Ibid.*, 48: 613-617.
- 1962 b. A revision of the genera *Parapetalus* Stp. & Lutk., and *Pseudopetalus* nov. *Crustaceana*, 3: 285-303.
- 1962 c. A revision of the genus *Hermillus*. *J. zool. Soc. India*, 14: 179-187.
- 1962 d. Copepods parasitic on South Indian fishes. Families Lernaeopodidae and Naobranchidae. *J. Mar. biol. Ass. India*, 4: 58-94.
- 1963. Copepods parasitic on South Indian fishes. Family Anthosomidae. 1. *J. Bombay nat. Hist. Soc.*, 60: 655-670.
- 1963 a. Copepods parasitic on South Indian fishes. Family Caligidae. *J. Mar. biol. Ass. India*, 5: 68-90.

- PILLAI, N. K. 1963 *b*. Observations on the synonymy of *Caligus coryphaenae* Stp. & Lutk. *Ann. Mag. nat. Hist.*, 5 (13): 513-522.
- 1963 *c*. Observations on the genus *Abasia* (Copepoda) with the description of a new species. *Crustaceana*, 5: 1-9.
- 1963 *d*. Copepods of the family Tactiacthidae parasitic on South Indian fishes. *Ibid.*, 6: 110-128.
- 1964. A miscellaneous collection of copepods parasitic on South Indian fishes. *J. Mar. biol. Ass. India*, 6: 61-83.
- 1964 *a*. Copepods parasitic on South Indian fishes. Family Anthosomidae 2. *J. Bombay nat. Hist. Soc.*, 61: 46-59.
- 1964 *b*. A redescription of the copepod *Pupulina minor* M.S. Wilson. *Zool. Anz.*, 173: 237-242.
- 1965. Copepods parasitic on South Indian fishes. Family Bomolochidae. *J. Bombay nat. Hist. Soc.*, 62: 38-55.
- In press (*a*). Three species of dichelesthid copepods parasitic on South Indian sharks. *Zool. Anz.*
- In press (*b*). Redescription of *Caetrodes pholas* C. B. Wilson and its transfer to *Hatschekia* Poche and the description of *Hatschekia elliptica* n. sp. *Crustaceana*.
- In press (*c*). Description of a new species of *Anuretes* (Copepoda, Caligidae) and comments on the validity of a few caligid genera. *Zool. Anz.*
- In press (*d*). Description of a new species of *Norion* (Copepoda, Anthosomatidae) and a redescription of the type species, *N. expansus* Nordmann. *Crustaceana*.
- In press (*e*). Additions to the copepod parasites of South Indian fishes. *Parasitology*.
- In press (*f*). Notes on copepods parasitic on South Indian marine fishes. *J. Mar. biol. Ass. India*.
- In press (*g*). Description of *Brachiella trichiuri* Gnanamuthu, *B. indica* n. sp. and *Clavellopsis appendiculata* Kirtisinghe, together with comments on *Isobranchia* Heegaard. *Crustaceana*.
- 1967. Redescription of *Bomolochus sardinellae* Bennet and its transfer to *Pumiliopsis* nov. *Crustaceana*, 12: 249-56.
- AND K. G. PADMANABHAN 1963. A redescription of *Pupulina brevicauda* M. S. Wilson (Copepoda, Caligoida) with observations on the genus *Diphylogaster* Brian. *J. Univ. Bombay*, 31: 91-99.
- AND M. J. SEBASTIAN. 1967. Redescription of *Sagum epinepheli* (Copepoda, Anthosomatidae) with comments on the validity of *Pseudolernanthropus*. *Crustaceana*, 13: 73-80.
- AND R. S. LALMOHAN. 1967. Description of the male of *Caligus hilsae* Shen. *Crustaceana*, 13: 45-50.
- 1965. Observations on the genus *Heniochophilus* (Copepoda) with a redescription of the type species. *J. Mar. biol. Ass. India*, 7 (2): 270-76.
- RANGNEKAR, M. P. 1953. *Anuretes branchialis* sp. nov. a copepod parasitic on the fish *Thynnus pelamys*. *J. Zool. Soc. India*, 5: 239-242.
- 1955. *Mappates plataxus* gen. et. sp. nov. a copepod parasitic on the fish *Platax teira* (Forsk.). *Rec. Ind. Mus.*, 53: 303-308.
- 1955 *a*. *Pseudocaligus laminatus* sp. nov. and *Diphylogaster aliuncus* sp. nov. (Copepoda) parasitic on Bombay fishes. *J. Univ. Bombay*, 23: 44-52.
- 1955 *b*. *Caligus bombayensis* sp. nov. a copepod parasitic on *Mugil cephalus* L. *Ibid.*, 24: 55-59.
- 1956. Parasitic copepods from the marine fishes of Bombay. *Ibid.*, 24: 42-65.
- 1957. *Caligus dasyaticus* sp. nov. and *Caligus dussumieri* sp. nov. (Copepoda) parasitic on Bombay fishes. *Ibid.*, 25: 16-22.
- 1957 *a*. Copepod parasites of the families Argulidae, Caligidae, Dichelesthidae and Lernaeopodidae. *Ibid.*, 26: 8-20.
- 1959. *Tuxophorus caligodes* Wilson, a copepod parasitic on a local fish. *J. biol. Sci.*, 3: 20-25.
- 1959 *a*. Parasitic copepods from fishes of the Western coast of India with descriptions of one new and redescription of four known species. *J. Univ. Bombay*, 28: 43-58.
- 1961. Copepods parasitic on fishes of Bombay. 1. Lernaeopodoida. *Ibid.*, 29: 193-205.

- RANGNEKAR, M. P. 1963. Redescription of *Hermilius longicornis* Bassett-Smith, a copepod parasitic on a fish of Bombay coast. *Ibid.*, 31: 80-83.
- , P. G. RANGNEKAR AND N. N. MURTI 1953. A new species of *Caligus* (Copepoda) from the fish *Arius nenga* Ham. Buch. *Ibid.*, 22: 47-52.
- RANGNEKAR, P. G. AND N. N. MURTI. 1950. A new caligid copepod parasitic on the fish *Clupea toli*. *Ibid.*, 18: 21-28.
- 1950 a. A note on the transfer of *Caligus formicoides* to the genus *Parapetalus*. *Ibid.*, 19: 43-53.
- 1959. *Caligus cossackii* Bassett-Smith, a copepod parasitic on a marine fish at Bombay. *Ibid.*, 28: 78-81.
- RAO, T. S. S. 1950. On a new caligid parasite from the Indian hammerhead shark. *Proc. Indian Acad. Sci.*, 31: 302-307.
- 1951. On a new caligid parasite *Gloiopotes zeugopteri* sp. nov. from *Xiphias zeugopteri*, Laccadive Bay, Waltair. *Ibid.*, 34: 249-255.
- REDKAR, M. V., P. G. RANGNEKAR AND N. N. MURTI 1949. Four new species of parasitic copepods from the marine fishes of Bombay. *J. Univ. Bombay*, 18: 36-50.
- 1950. Two new species of *Hatschekia* parasitic on Bombay fishes. *Ibid.*, 19: 35-42.
- SEBASTIAN, M. J. 1964. *Taeniocanthus dentatus* n. sp. a copepod parasite of the fish *Bembrops caudimaculata* Steindachner. *J. Mar. biol. Ass. India*, 6: 94-97.
- AND K. C. GEORGE 1965. *Lernaenicus anchoviellae* n. sp. (Copepoda, Lernaecidae) parasitic on *Anchoviella bataviensis* (Hardenberg) with descriptions of its three post-larval stages. *Ibid.*, 6: 235-240.
- SHEN, C. J. 1957. Parasitic copepods from fishes of China. I. Cyclopoida 1. *Acta Zool. Sinica*, 9: 314-327.
- 1957 a. Parasitic copepods from fishes of China. II. Caligoida, Caligidae (1). *Ibid.*, 9: 369-377.
- AND H. L. LI 1959. Parasitic copepods from fishes of China. IV. Caligoida, Caligidae (3). *Ibid.*, 11: 12-23.
- SHIINO, S. M. 1952. Copepods parasitic on Japanese fishes. 1. On the species of *Caligus* and *Lepeophtheirus*. *Rep. Fac. Fish. Pref. Univ. Mie*, 1: 79-113.
- 1954. Note on *Caligus quadratus* n. sp. a copepod parasitic on the fish *Neothunnus macropterus* (T & S). *Bull. Jap. Soc. Sci. Fish.*, 20: 26-29.
- 1954 a. Copepods parasitic on Japanese fishes. 4. The family Euryphoridae. *Rep. Fac. Fish. Pref. Univ. Mie*, 1: 271-290.
- 1955. Copepods parasitic on Japanese fishes. 8. The Anthosomidae. *Ibid.*, 2: 50-69.
- 1955 a. *Alembion echinatus* Capart from Japanese waters with observations on the newly found male form. *Pacific Sci.*, 9: 177-182.
- 1956. Copepods parasitic on Japanese fishes. 12. Family Lernaecopodidae. *Rep. Fac. Fish. Pref. Univ. Mie*, 2: 269-311.
- 1958. Parasitic copepods from fishes collected in the Indian ocean. *Annual Rep. Fac. Fish. Pref. Univ. Mie*, 2: 98-113.
- 1958 a. Copepods parasitic on Japanese fishes. 17. Lernaecidae. *Rep. Fac. Fish. Pref. Univ. Mie*, 3: 75-100.
- 1959. Ostpazifische Parasitierende Copepoden. *Ibid.*, 3: 267-333.
- 1959 a. Neuer Artname für Japanische Exemplare von *Caligus bonito*. *Bull. Biogeog. Soc. Japan*, 20: 51-57.
- 1959 b. Revision der auf Goldmakrele *Coryphaena hippurus* L. Schmarotzenden Caligidarten. *Annual Rep. Pref. Univ. Mie*, 3: 1-34.
- 1959 c. Sammlung der Parasitischen copepoden in der Prefekturuniversität von Mie. *Rep. Fac. Fish. Pref. Univ. Mie*, 3: 334-374.
- 1960. Copepods parasitic on remoras from Bay of Bengal. *Ibid.*, 3: 542-552.
- 1960 a. Copepods parasitic on fishes collected on the coast of Province Shima, Japan. *Ibid.*, 3: 471-500.
- 1964. Results of the Anami Expedition. 6. Parasitic copepoda. *Ibid.*, 5: 243-255.

- SHIINO, S. M. 1965. On *Lernanthropus cornutus* Kirtisinghe found in Japanese waters. *Ibid.*, 5: 375-380.
- 1965 a. Parasitic copepods of the Eastern Pacific fishes. 5. *Caligus*. *Ibid.*, 5: 391-420.
- 1965 b. Parasitic copepods of the Eastern Pacific fishes. 6. Euryphoridae. *Ibid.*, 5: 421-433.
- 1965 c. Parasitic copepods of the Eastern Pacific fishes. 7. *Lernaeenicus hemirhamphi* Gnanamuthu. *Ibid.*, 5: 435-440.
- STEENSTRUP, J. J. S. AND C. F. LUTKEN 1861. Bidrag til kundskab om det aabne Havs Snyltekrebs og Lernaer.... *K. Dansk. Vidensk. Selsk. 5 R. Naturh. og. Math.*, 5: 343-432.
- THOMPSON, I. C. AND A. SCOTT 1903. Report on the copepoda. *Ceylon Pearl Oyst. Fish. Rep.*, 1: 227-307.
- TRIPATHI, Y. R. 1960. Parasitic copepods from Indian fishes. 1. Family Chondracanthidae. *J. zool. Soc. India*, 12: 51-59.
- VAISSIERE, R. 1959. Parasites de poissons de mer ouest-africaines recoltés par J. Cadenat. 2. Le Euryphorinae. *Bull. I.F.A.N.*, 25 A: 534-553.
- VERVOORT, W. 1962. A review of the genera and species of the Bomolochidae (Crustacea, Copepoda) including the description of some old and new species. *Zool. Verhand.*, No. 56: 1-111.
- WILSON, C. B. 1905. North American parasitic copepods belonging to the family Caligidae. *Proc. U.S. Nat. Mus.*, 28: 479-672.
- 1906. Report on some parasitic copepods collected by Prof. Herdmann at Ceylon in 1902. *Ceylon Pearl Oyst. Fish. Rep.*, 5: 189-210.
- 1907. North American parasitic copepods belonging to the family Caligidae. Parts 3 and 4. A revision of the Pandarinae and Cecropinae. *Proc. U.S. nat. Mus.*, 33: 323-430.
- 1908. North American parasitic copepods, new genera and species of Caliginae. *Ibid.*, 33: 593-627.
- 1911. North American parasitic copepods belonging to the family Ergasilidae. *Ibid.*, 39: 263-400.
- 1913. Crustacean parasites of West Indian fishes and land crabs with descriptions of new genera and species. *Ibid.*, 44: 189-277.
- 1915. North American parasitic copepods belong to the family Lernaeopodidae, with a revision of the entire family. *Ibid.*, 47: 565-729.
- 1917. North American parasitic copepods belonging to the family Lernaeidae with a revision of the entire family. *Ibid.*, 53: 1-150.
- 1921. New species and new genus of parasitic copepods. *Ibid.*, 59: 1-7.
- 1932. The copepods of the Woods Hole region, Massachusetts. *Bull. U.S. nat. Mus.*, No. 158: 1-635.
- 1935. A parasitic copepod *Pupulina flores*, redescribed after fifty years. *Parasitology*, 27: 593-597.
- 1937. Parasitic copepods taken during the third Hancock Expedition to the Galapagos. *Rep. Allan Hancock Pac. Exped.*, 2: 23-30.
- WILSON, M. S. 1952. An emended diagnosis of the copepod genus *Pupulina* (Caligidae) with descriptions of new species and redescription of the genotype. *Proc. U.S. nat. Mus.*, 102: 245-263.
- YAMAGUTI, S. 1936. Parasitic copepods from fishes of Japan. Part 2. Caligoida 1. Private publication. 18 pp.
- 1939. Parasitic copepods from fishes of Japan. Part 4. Cycloppida 2. *Vol. Jubil. Prof. Yoshida.*, 2: 391-415.
- 1939 a. Parasitic copepods from fishes of Japan. Part 5. Caligoida 2. *Ibid.*, 2: 445-483.
- 1939 b. Parasitic copepods from fishes of Japan. Part 6. Lernaeopodoida. 1. *Ibid.*, 2: 531-572.
- 1954. Parasitic copepods from fishes of Celebes and Borneo. *Publ. Seto. Mar. biol. Lab.*, 3: 375-398.
- 1963. *Parasitic Copepoda and Branchiura of Fishes*. Interscience Publishers, New York, 390 pp., 333 pls.
- AND T. YAMASU 1959. Parasitic copepods from fishes of Japan with descriptions of 26 new species and remarks on two known species. *Biol. J. Okayama Univ.*, 5: 89-165.
- 1960. New parasitic copepods from Japanese fishes. *Publ. Seto. Mar. biol. Lab.*, 8: 141-152.
- YU, S. C. 1933. Chinese parasitic copepods collected by H. W. Wu with descriptions of new genera and species. *Bull. Fan. Mem. Inst. Biol.*, 4: 117-138.

A REVIEW OF THE WORK ON THE SHALLOW WATER MYSIDACEA OF THE INDIAN WATERS

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ABSTRACT

The total number of mysids recorded from the waters around the Indian mainland is about seventy-five. Since W. M. Tattersall briefly reviewed the earlier literature on the subject, a number of species have been added. The present paper, therefore, is an attempt to bring together in a single publication, all the information on the species recorded up-to-date. Each species is described briefly, synonymy is restricted to those which are of special value in the understanding of the species, and the telson, which in a vast majority of cases, provides very useful diagnostic characters, is illustrated. A full bibliography is also included to help future workers. As indicated in the title, the suborder Lophogastrida, which comprises exclusively of deep water forms, is left out of the present study.

INTRODUCTION

WOOD-MASON and Alcock (1891, 1891 a), Alcock and Anderson (1894, 1899) and Anderson (1897) were the first to record mysids from the present region. Their works dealt exclusively with the lophogastrids dredged by the "*Investigator*" from deep waters in the Bay of Bengal and the Arabian Sea. In a series of papers W. M. Tattersall (1906, 1908, 1914, 1915, 1922) described the shallow water and brackish water mysids collected by the Indian Museum. W. M. Tattersall (1939) also described the Mysidacea of the John Murray Expedition to the Arabian Sea. More recently Pillai (1957, 1961, 1964, 1964 a, 1964 b, 1964 c) studied the littoral mysids of the Kerala coast and the planktonic mysids in the collections of the Central Marine Fisheries Research Institute. In addition to these a few species were described by Hansen (1910), Zimmer (1915), Colosi (1920) and Nouvel (1954). In the context of the present study the work of Li (1964) is specially important. His work contains detailed descriptions of several genera and species included in the present work. He has fully illustrated several species and these illustrations are particularly useful.

Only very few lophogastrids have been recorded from Indian waters and almost all of them are well-known species having a very wide distribution. These have been excluded from the present review and I refer the readers to the list published by W. M. Tattersall (1922, p. 445). Shallow water mysids of the Indian region are rich and varied and can be easily collected provided suitable methods are employed. As remarked by W. M. Tattersall (1922, p. 447) "extended knowledge of the distribution of the shallow water forms is desirable, and when it is remembered that the majority of the species reported here (W. M. Tattersall, 1922) were collected during two short expeditions only, the results, if continuous observation and collection were possible, are distinctly promising." It is hoped that this review will help those who take up this suggestion.

In the systematic part of this study a short enumeration of the salient characters of each species is given. As the telson in a vast majority of the species provides very useful characters for specific identification, this is illustrated. The illustrations are taken from well-known works or from the author's publications. As far as possible the generic definitions have been adopted from the excellent monograph by Tattersall and Tattersall (1951) on the British Mysidacea.

LIST OF SPECIES

Order MYSIDACEA

Suborder MYSIDA

Family PETALOPHTHALMIDAE

Petalophthalmus armiger W. Suhm
P. oculatus Illig.

Family LEPIDOMYSIDAE

Spelaeomysis longipes (Pillai and Mariamma)

Family MYSIDAE

Subfamily BOREOMYSINAE

Boreomysis sp.
B. tattersalli O.S. Tattersall (= *B. microps* W. M. Tattersall, 1939)
B. sibogae Hansen (= *B. spinifera* Coifmann)
B. verrucosa W. M. Tattersall

Subfamily SIRIELLINAE

Siriella paulsoni Kossmann?
S. gracilis Dana
S. aequiremis Hansen
S. brevicauda Paulson
S. quadrispinosa Hansen
S. vulgaris Hansen
S. affinis Hansen
S. dubia Hansen
S. hansen W. M. Tattersall
S. thompsoni (H. M. Edwards)
S. quilonensis Pillai
S. robusta Pillai
S. jonesi Pillai
Hemisiriella parva Hansen

Subfamily RHOPALOPHTHALMINAE

Rhopalophthalmus chilkensis O. S. Tattersall
R. kemp O. S. Tattersall
R. indicus Pillai
R. tattersallae Pillai
R. macropsis Pillai

Subfamily GASTROSACCINAE

Gastrosaccus muticus W. M. Tattersall
G. simulans W. M. Tattersall
G. bengalensis Hansen
G. dunckeri Zimmer

G. pacificus Hansen
G. kemp W. M. Tattersall
Anchialina typica (Kroyer)
A. grossa Hansen (= *A. frontalis* Zimmer)
A. penicillata Zimmer
A. dentata Pillai
Pseudanchialina pusilla (G. O. Sars)
P. inermis (Illig)

Subfamily MYSINAE

Tribe *Erythropini*

Erythrop sp.
E. minuta Hansen
E. nana W. M. Tattersall
Echinomysis chuni Illig
Hypererythrop spinifera (Hansen)
Meterythrop indica Hansen
Dactylamblyops murrayi W. M. Tattersall
Synerythrop intermedia Hansen
Pseuderythrop gracilis Coifmann
Gibberythrop acanthura (Illig)
G. brevisquamosa (Illig)
Euchaetomera typica G. O. Sars
E. tenuis G. O. Sars
E. oculata Hansen
E. glyphidophthalmica Illig
Echinomysis chuni Illig

Tribe *Leptomysini*

Leptomysis xenops W. M. Tattersall (= *L. apiops* Zimmer)
Dioptrmysis perspicillata Zimmer
Promysis orientalis Dana (= *Uromysis armata* Hansen)
Mysidopsis indica W. M. Tattersall
M. kemp W. M. Tattersall
Afromysis macropsis W. M. Tattersall
A. dentisinus Pillai
Prionomysis stenolepis W. M. Tattersall
Doxomysis littoralis W. M. Tattersall
D. anomala W. M. Tattersall
D. longiura Pillai
D. quadrispinosa Illig (= *D. zimmeri* Colosi)
Bathymysis varunae Pillai
Thalassomysis sewelli W. M. Tattersall

Tribe *Mysini*

Potamomysis assimilis W. M. Tattersall
Indomysis annandalei W. M. Tattersall
Mesopodopsis orientalis (W. M. Tattersall)
M. zeylanica Nouvel
Acanthomysis indica (W. M. Tattersall)
A. hodgarti (W. M. Tattersall)

A. pelagica (Pillai)
A. anomala Pillai
Idiomysis inermis W. M. Tattersall
Lycomysis spinicauda Hansen (= *L. pusilla* Zimmer)
L. platycauda Pillai

Tribe *Heteromysini*

Heteromysis proxima W. M. Tattersall
H. zeylanica W. M. Tattersall
H. gymnura W. M. Tattersall
H. macropsis Pillai

DESCRIPTION OF SPECIES

Order MYSIDACEA

Suborder MYSIDA

Family PETALOPHTHALMIDAE

Genus *Petalophthalmus* W. Suhm

Tattersall and Tattersall, 1951, p. 120.

Carapace short, leaving the last two thoracic somites exposed. Rostrum short and acute. Antennal scale narrowly lanceolate, setose all around. Mandibular palp enormous, long and prehensile. First thoracic limb robust, without exopod, second without exopod. Pleopods of female uniramous, of male biramous and natatory. Telson large, quadrangular, apex truncate, lateral margins spiny, apex with large barbed spines.

1. Eyes without visual elements, apex of telson without plumose setae.....*armiger*
 Eyes with functional visual elements, apex of telson with plumose setae.....*oculatus*

Petalophthalmus armiger W. Suhm

(Fig. 1)

Tattersall, W. M., 1939, p. 229; 1951, p. 35, figs. 3-4; Tattersall and Tattersall, 1951, p. 120, figs. 17-18.

Eyes flattened and leaf-like, without visual elements. Telson quadrangular, apex emarginate, with rounded angles, armed with a short median spine and five pairs of long barbed spines, lateral borders armed throughout with 40-50 small spines.

Length: Up to 50 mm.

Distribution: Widely distributed in the deep waters of the Atlantic, Pacific and Indian oceans.

Petalophthalmus oculatus Illig

(Fig. 2)

Illig, 1930, p. 411; Tattersall, W. M., 1939, p. 229, fig. 3; 1951, p. 40, fig. 5; Tattersall, O. S., 1955, p. 65, fig. 10.

Eyes with functional visual elements. Telson with slightly emarginate apex, apex armed with five pairs of spines and a short but strong median spine and two pairs of long plumose setae on either

side of the median spine, lateral borders armed throughout with 17 pairs of spines, armature of the telson varies depending on maturity of the individual.

Length: Upto 10 mm.

Distribution: Indian ocean and the Carribean Sea.

Family LEPIDOMYSIDAE

Genus *Spelaeomysis* Caroli

Pillai and Mariamma, 1964, p. 123.

Body depressed. Penultimate segment of thorax with a forwardly directed scale. Sixth abdominal segment longer than fifth. Telson triangular or linguiform, with partly or fully spiny border, distal border with or without a pair of setae. Antennular flagella longer or shorter than body. Maxillule with a two-segmented palp. Eyes reduced to a single or a pair of plates. First thoracic limb with exopod reduced to a small scale. Pleopods almost similar in both sexes. Sternal side of pleon segments with single or paired chitinous lamellae. Protopod of uropod produced backwards, exopod two-segmented, statocyst absent.

Spelaeomysis longipes (Pillai and Mariamma)

(Fig. 3)

Pillai and Mariamma, 1964, p. 113, figs. 1-34.

Anterior border of carapace convex. Eyes reduced to a rectangular plate without visual elements. Abdominal segments with a pair of chitinous lamellae on the sternal side. Telson short and linguiform, lateral borders armed throughout with thirteen spines, apex with a long spine flanked by a pair of setae. Exopod of first thoracic limb oblong, broader than long. Eighth thoracic endopod much longer than seventh. Exopod of uropod with partition, outer border of basal segment with ten spines. Thoracic endopods three to five of male with pectinate setae on segments three to five.

Length: 5.6 mm.

Distribution: Kerala (in freshwater wells).

Family MYSIDAE

This family includes five subfamilies which can be distinguished by the following key:

1. Seven pairs of brood lamellae in the female..... *Boreomysinae*
Two to three pairs of brood lamellae in the female..... 2
2. Exopod of uropod with a well marked distal suture..... 3
Exopod of uropod undivided..... 4
3. Proximal segment of exopod of uropod armed with spines but no setae, endopod of uropod undivided..... *Siriellinae*
Proximal segment of exopod of uropod with setae but no spines, endopod of uropod with a distal segment..... *Rhopalophthalminae*

4. Exopod of uropod with outer margin armed with one, two or many spines, without setae in between, telson cleft.....*Gastrosaccinae*
 Exopod of uropod without spines on outer margin, with normal setae along its entire length.....*Mysinae*.

Subfamily BOREOMYSINAE

Genus *Boreomysis* G. O. Sars

Tattersall and Tattersall, 1951, p. 127; O. S. Tattersall, 1955, p. 66; Li, 1964, p. 16.

Antennal scale with the outer margin entire, terminating in a strong spine, apex truncate, distal suture present. Labrum without frontal process. Endopods of thoracic limbs three to eight with the carpus distinct, propodus usually divided into two to three subsegments. Pleopods of male well developed, biramous, exopod of second and third pairs elongated, one or both with exopod distally modified. Exopod of uropod with proximal outer border naked, ending in one or two spines, a transverse indistinct articulation present. Telson distally cleft, cleft armed with teeth.

1. Proximal part of cleft of telson with a distinct dilatation.....2
 Proximal part of cleft of telson without a dilatation.....3
2. Surface of body verrucose, carpopropodus of second thoracic limb not excavated...*verrucosa*.
 Surface of body smooth, carpopropodus of second thoracic limb excavated.....*tattersall*.
3. Antennal scale without apical lobe, outer spine overreaching apex, apices of telson without long spine.....*sibogae*
 Antennal scale with apical lobe, outer spine not overreaching apex, apices of telson with a long spine.....*Boreomysis* sp.

Boreomysis tattersalli O. S. Tattersall

(Fig. 4)

Tattersall, W. M., 1939, p. 231, fig. 4 (*microps*); Tattersall, O. S., 1955, p. 77, fig. 12 A-G.

Rostral part of carapace acute, reaching the tip of the eyes. Last abdominal segment very long, equal to the combined lengths of the three previous segments. Eyes large, eye-stalk with a small dorsal papilla, cornea slightly wider than stalk and terminal. Inner distal part of carpopropodus of second thoracic endopod excavate, but not armed with spine. Telson longer than last abdominal segment, lateral margins nearly straight and armed along the distal three-fourths with spines arranged in very definite series, cleft of telson with a marked proximal dilatation. Unarmed border of exopod of uropod short, one-tenth the total length, terminating in a single spine, endopod with one spine.

Length: 17 mm.

Distribution: Middle Arabian Sea.

The long sixth abdominal segment, the terminal cornea and the absence of a spine on the carpopropodus distinguish this species from *B. microps* G. O. Sars.

Boreomysis verrucosa W. M. Tattersall

(Fig. 5)

W. M. Tattersall, 1939, p. 232, figs. 5-8,

Surface of thorax and abdomen covered with small tubercles. Frontal plate considerably produced, reaching the level of the eyes, apex acuminate. Eyes small, ocular papilla prominent, major portion of cornea facing downwards. Antennal scale extending beyond antennular peduncle by a quarter of its length, broadest in the middle, outer margin slightly concave, terminal lobe small, outer spine extending beyond apex of scale. Exopod of uropod with unarmed part very short, one-tenth of total length, with two spines, endopod without spine. Telson three and one-fourth times as long as broad, considerably narrowed at the distal half, terminal cleft one-sixth the total length, with distinct proximal dilatation, lateral margins armed at the distal two-thirds with serially arranged spines, about ten long spines alternating with groups of three to seven small spines.

Length: 20 mm.

Distribution: Arabian Sea.

Boreomysis sibogae Hansen

(Fig. 6)

Hansen, 1910, p. 25, pl. 2, figs. 3 a-c; Coifmann, 1936, p. 83 (*spinifera*); Tattersall, W. M., 1939, p. 232 (*spinifera*); O. S. Tattersall, 1955, p. 74; Li, 1964, p. 49.

Frontal plate moderately produced, with an acuminate rostral prolongation. Eyes much broader than deep, eye-stalk short, with indistinct dorsal tubercle, cornea broader than stalk. Antennal scale less than four times as long as broad, broadest before the middle, terminal lobe wanting, outer spine reaching beyond apex of scale. Exopod of uropod with two spines, naked part one-fourth the total length of outer border. Telson comparatively broad, cleft one-fourth the total length, lateral borders with very numerous equally spaced spines, serially arranged except near the ends, spines near the ends nearly uniform.

Length: 21 mm.

Distribution: East Indies, Indian Ocean and Arabian Sea.

Boreomysis sp.

(Fig. 7)

Pillai, 1964c, p. 41, fig. 1.

Antero-lateral parts of carapace forming prominent spines, frontal lobe broadly rounded, with small triangular rostral process. Sixth abdominal segment more than twice as long as fifth. Eyes small, cornea narrower than peduncle, peduncle with dorsal prolongation. Basal segment of antennular peduncle as long as the rest of the peduncle. Antennal scale with prominent outer spine, more than four times as long as broad, reaching beyond outer spine. The non-setose basal part of outer border of exopod of uropod long, ending in two unequal spines, endopod with two spines. Telson about three-and-a-half times as long as broad, narrowing at the proximal one-third, distal two-thirds of border armed with about nine long spines alternating with groups of one to four small spines. Apex of telsonic lobes with three spines, outer longest. Cleft without proximal dilatation.

Length: 14 mm.

Distribution: Arabian Sea.

Subfamily SIRIELLINAE

Genus *Siriella* Dana

Tattersall and Tattersall, 1951, p. 141; Li, 1964, p. 57,

Antennal scale with obliquely truncate distally rounded apex, extending well beyond the outer distal spine, outer margin naked. Labrum anteriorly produced into a large spine. Endopods of thoracic limbs with carpus distinct, propodus sometimes with a faint division, dactylus together with the unguis forming a large claw encircled by a circlet of stiff setae. Pleopods of male biramous, with curved or coiled biramous pseudobranchial lobes. Exopod of uropod two-segmented, proximal segment externally spiny. Telson entire.

1. Apex of telson with three small spines and one pair of more lateral long spines.....2
 Apex of telson with three small spines and two pairs of more lateral long spines.....*quadrispinata*
 Apex of telson with three small spines and three pairs of more lateral long spines.....8
2. Telson short, less than twice as long as broad, rostral process virtually absent... *harseni*
 Telson long, more than twice as long as broad, rostral process present.....3
3. Endopod of uropod overreaching exopod.....4
 Endopod of uropod not overreaching exopod.....5
4. Eyes large, antennal scale about five times as long as broad..... *thompsoni*
 Eyes small, antennal scale about three times as long as broad..... *gracilis*
5. Spines on lateral borders of telson not arranged in series..... *vulgaris*
 Spines on lateral borders of telson arranged in definite series.....6
6. Carpopropodus of second thoracic limb distally excavated..... *robusta*
 Carpopropodus of second thoracic limb distally not excavated.....7
7. Base of telson with three pairs of spines and a pronounced waist just beyond, pseudobranchiae of male not spirally twisted..... *aequirenis*
 Base of telson with two pairs of spines, waist absent, pseudobranchiae of male spirally twisted..... *affinis*
8. Outer border of exopod of uropod setose..... *dubia*
 Outer border of exopod of uropod not setose.....9
9. Third thoracic endopod considerably longer than the adjacent ones..... *jonesi*
 Third thoracic endopod not much longer than the adjacent ones.....10
10. Telson less than twice as long as broad, apex truncate, spines on apex dissimilar... *brevicauda*
 Telson more than twice as long as broad, apex rounded, spines subsimilar..... *quilonensis*

Note: *S. paulsoni* as described by W. M. Tattersall (1906) is different from *S. paulsoni* Kossman (see Nouvel, 1959, p. 202) and hence is omitted from the above key.

Siriella dubia Hansen

(Fig. 8)

Hansen, 1910, p. 44, pl. 5, fig. 4; W. M. Tattersall, 1922, p. 455, fig. 5; Li, 1964, p. 131, fig. 35; Pillai, 1964 c, p. 7, fig. 2.

Eyes rather short, cornea narrower than peduncle. Labrum produced into a very long spine. Cutting edge of mandibles modified, like that of *Hemisiriella*. Pseudobranchial lobes of pleopods two to five spirally coiled. Outer border of the basal segment of the exopod of uropod setose and

armed with four equidistant spines. Telson with broadly rounded apex armed with three pairs of long spines, three small spines and two long feathered setae.

Length: 7.8 mm.

Distribution: East Indies, Andaman Islands, Great Barrier Reef, Philippines and Arabian Sea.

This species is unique in the presence of setae on the outer border of the basal segment of the exopod of the uropod.

***Siriella robusta* Pillai**

(Fig. 9)

Pillai, 1964 c, p. 8, figs. 3-4.

Body rather stout. Eyes very large and globular. Antennal scale reaching the tip of antennular peduncle in male, shorter in female. Second thoracic endopod robust, carpopropodus distally excavated. Pseudobranchial lobes of pleopods two to five simple and bilobed, third and fourth pleopods not modified. Exopod of uropod very slightly overreaching endopod, more than half of outer border of basal segment armed with nine long spines. Telson four times as long as broad, steadily narrowing to the apex, lateral borders throughout spiny, first three spines large, others in series of two to four, apex with a pair of large spines, three small spines and a pair of setae.

Length: 9.6 mm.

Distribution: Arabian Sea.

***Siriella jonesi* Pillai**

(Fig. 10)

Pillai, 1964 c, p. 11, figs. 5-6.

Body rather stout, abdomen steadily narrowing backwards, giving the animal the appearance of *Gastrosaccus*. Sixth abdominal segment twice as long as fifth. Eyes small, cornea narrower than peduncle. Thoracic endopods stout and armed with strong spines, fifth endopod very long and stout, reaching beyond the antennular peduncle when bent forwards. Pleopods not modified, pseudobranchial lobes small and bilobed. Telson with two pairs of spines at the base, distal half of the border fully spiny, the spines arranged in series, apex of telson with a pair of stout spines and three small spines.

Length: 5.6 mm.

Distribution: Arabian Sea.

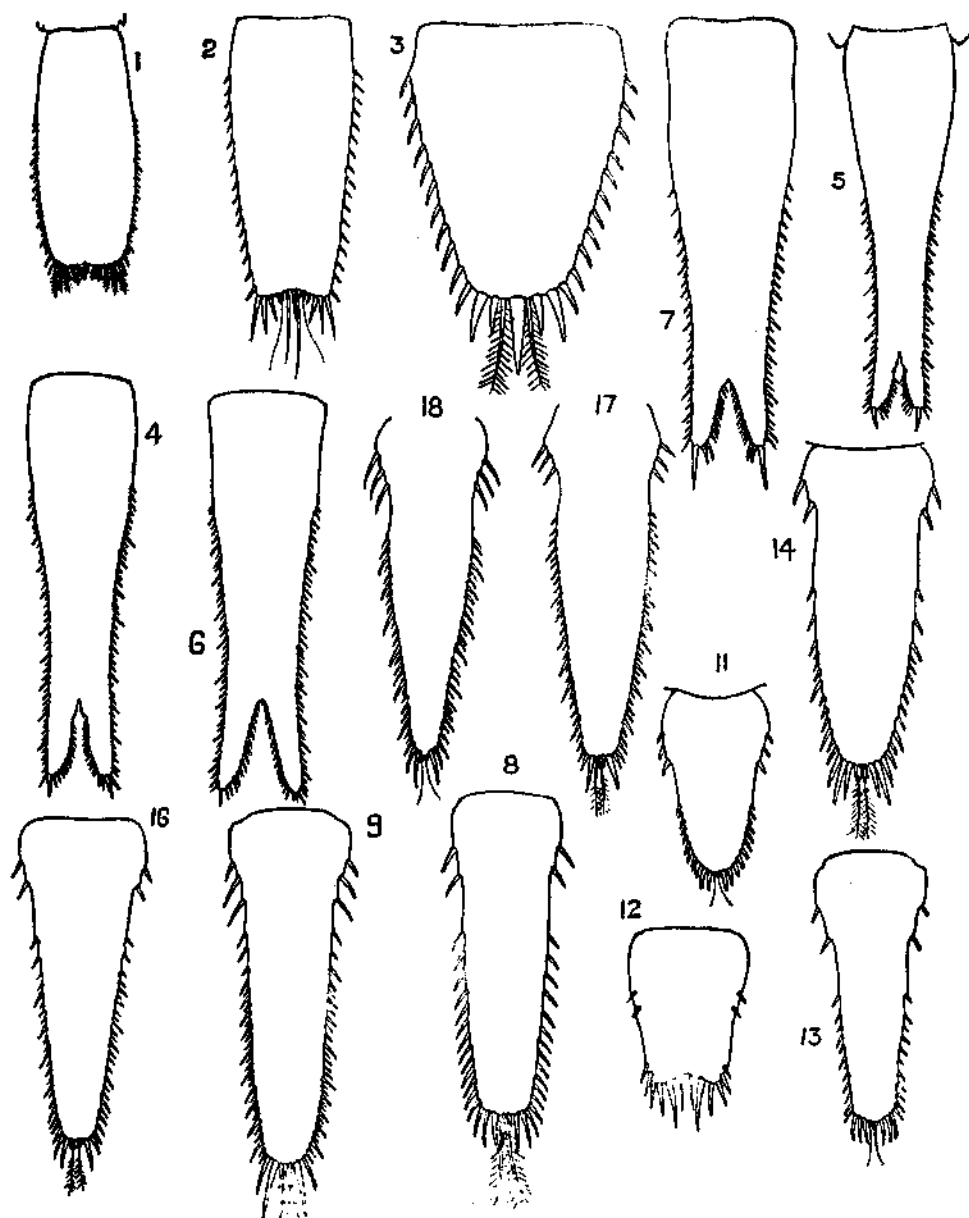
This species can be easily distinguished by the shape of the body and the stout fifth thoracic endopod. It is closest to *S. nodosa* Hansen (1910).

***Siriella hansenii* W. M. Tattersall**

(Fig. 11)

W. M. Tattersall, 1922, p. 448, figs. 1-2.

Antennal scale reaching the tip of the antennular peduncle in female, slightly shorter in male. Pseudobranchial lobes of pleopods two to four spirally twisted, fourth not modified. Exopod of uropod longer than endopod, basal segment with three spines, endopod with about ten widely spaced spines. Telson short, one-and-a-half times as long as broad, apex broadly rounded and armed with three small spines, distal half of lateral border with twelve spines regularly increasing in length, proximal part with three spines.



FIGS. 1-9, 11-14 AND 16-18. (1) *Petalophthalmus armiger* W. Suhm (after Tattersall, W.M. & O.S., 1951); (2) *Petalophthalmus oculus* Illig (after Illig, 1930); (3) *Spelaemysis longipes* (Pillai and Mariamma) (after Pillai and Mariamma, 1964); (4) *Boreomysis tattersalli* O. S. Tattersall (after O. S. Tattersall, 1955); (5) *Boreomysis verrucosa* W. M. Tattersall (after W. M. Tattersall, 1939); (6) *Boreomysis sibogae* Hansen (after Hansen, 1910); (7) *Boreomysis* sp. (after Pillai, 1964 c); (8) *Sirtiella dubia* Hansen (after Pillai, 1964 c); (9) *Sirtiella robusta* Pillai (after Pillai, 1964 c); (11) *Sirtiella hanseni* W. M. Tattersall (after W. M. Tattersall, 1922); (12) *Sirtiella brevicauda* Paulson (after W. M. Tattersall, 1922); (13) *Sirtiella quilonensis* Pillai (after Pillai, 1961); (14) *Sirtiella quadrispinosa* Hansen (after Hansen, 1910); (16) *Sirtiella affinis* Hansen (after Hansen, 1910); (17) *Sirtiella aequitremis* Hansen (after Hansen, 1910); (18) *Sirtiella paulsoni* Kossmann (after W. M. Tattersall, 1906).

Length: 7.0 mm.

Distribution: Gulf of Mannar.

The shape and armature of the telson and the uropods easily distinguish this species.

Siriella brevicauda Paulson

(Fig. 12)

W. M. Tattersall, 1922, p. 450, fig. 3.

Rostral process short and broadly rounded. Eyes fairly large. Antennal scale reaching tip of antennular peduncle in female, slightly shorter in male. Thoracic endopods one to two stout, with stout curved dactylus. Uropods about twice as long as telson, endopod slightly shorter than exopod, with ten to twelve spines gradually increasing in length, proximal segment of exopod with five small spines in a group. Pseudobranchial lobes of pleopods two to five spirally twisted, pleopods not modified. Telson very short, one-and-a-half times as long as broad, proximal part of lateral border with two to three spines, apex broadly truncated or slightly emarginate, with five to six pairs of spines, increasing in length rather suddenly inwards.

Length: 6.0 mm.

Distribution: Red Sea and Gulf of Mannar.

The shape of the telson and the exopod of the uropod are very characteristic.

Siriella quilonensis Pillai

(Fig. 13)

Pillai, 1961, p. 16, pl. 1, figs. A-G.

Rostral process triangular, longer in the female. Antennal scale broader in the female, not quite reaching the distal border of the antennular peduncle. Thoracic endopods comparatively stout. Pseudobranchial lobes of pleopods two to five not spirally twisted, outer ramus with an apical seta. Pleopods not modified. Exopod of uropod slightly overreaching endopod, basal segment with four spines in male and three in female, endopod with about ten long spines alternating with groups of one to four small spines. Telson two-and-a-half times as long as broad, with a distinct constriction beyond its base, apex broadly rounded, with three pairs of long subequal spines and three small median ones, lateral borders with fourteen spines, the two proximal spines separated from the third by a longer interval, distal spines falling into indistinct series.

Length: 10.0 mm.

Distribution: Arabian Sea.

The characters of this species are intermediate to those of *S. vulgaris* and *S. affinis*.

Siriella quadrispinosa Hansen

(Fig. 14)

Hansen, 1910, p. 32, pl. 2, fig. 5; Li, 1964, p. 91, fig. 22.

Body moderately slender. Frontal plate in both sexes considerably produced. Pseudobranchial lobes spirally coiled, pleopods not modified. Exopod of uropod clearly overreaching endopod proximal segment with six to nine spines spread over less than half the border. Telson reaching

articulation of exopod, basal part wide, with two pairs of strong spines, apex rounded, with three small spines and two pairs of long spines, outer pair longer than inner, lateral borders with the spines on the distal one-third increasing in length and arranged in irregular indistinct series.

Length: 7.0 mm.

Distribution: East Indies, Gulf of Mannar.

***Siriella vulgaris* Hansen**

(Fig. 15)

Hansen, 1910, p. 34, pl. 3, fig. 2; Ii, 1964, p. 94, 577.

Rostrum narrowly triangular and apically acute. Antennal scale narrower in male than in female, distal lobe unusually long. Pseudobranchial lobes spirally twisted, pleopods not modified. Exopod of uropod as long as or slightly longer than endopod with three to nine spines occupying less than one-third the margin, endopod, with serially arranged spines. Telson reaching beyond the articulation of the exopod, its base with two pairs of spines, more than half of the lateral border with small spines gradually increasing in length, apex, with a pair of long spines.

Length: 7.7 mm.

Distribution: East Indies, Andamans.

***Siriella affinis* Hansen**

(Fig. 16)

Hansen, 1910, p. 35, pl. 3, fig. 3; Ii, 1964, p. 89.

Rostrum as in *S. vulgaris* but less produced, in female much more produced than in male. Eyes large, subglobular. Exopod of uropod slightly longer than endopod, with three to five or rarely six to seven spines, spines on endopod proximally in series, distally not in series. Telson reaching far beyond the articulation of exopod, armature similar to that of *S. vulgaris*, but the lateral spines regularly distributed and increasing in length at the distal one-fourth, with a distinct arrangement into series.

Length: 7.5 mm.

Distribution: East Indies, Gulf of Mannar.

This species closely resembles *S. vulgaris* but differs in the strong sexual dimorphism in the rostrum and in the shorter terminal lobe of the antennal scale.

***Siriella aequiremis* Hansen**

(Fig. 17)

Hansen, 1910, p. 40, pl. 3, fig. 4, pl. 4, fig. 1; Ii, 1964, p. 135, figs. 36-37.

Body rather robust, frontal plate low and triangular. Terminal lobe of antennal scale broader than long. Pseudobranchial lobes nearly straight. Rami of pleopods two to three not modified, fourth pair with endopod armed with long spines. Uropods slender, rami subequal in length, exopod with nine to ten spines occupying more than half the border. Telson three times as long as broad, distal half of lateral border straight, with close set spines arranged in distinct series, apex with a pair of long spines.

Length: 11.2 mm.

Distribution: Bay of Bengal.

Siriella paulsoni Kossmann?

(Fig. 18)

W. M. Tattersall, 1906, p. 163, pl. 1, figs. 3-7; 1922, p. 456.

Body robust. Carapace produced into a short acute rostrum. Eyes large and globose. Antennal scale almost reaching the distal end of the antennular peduncle, about three times as long as broad. Thoracic endopods three to eight with the tarsus as long as the merus and with a partition. Telson nearly one-and-a-half times the length of the sixth pleon segment, narrowly linguiform and strongly tapering and with a pronounced waist at the proximal one-third, apex armed with a pair of long spines, three short spines and a pair of setae; lateral borders with serially arranged spines and the basal part with three pairs of spines. Uropods clearly overreaching telson, exopod overreaching endopod, with fifteen spines distributed along the distal two-thirds of the border of the basal segment, spines on endopod serially arranged.

Length: 12 mm.

Distribution: Ceylon, Gulf of Mannar.

W. M. Tattersall (1922) himself suspected the identity of the specimens collected from Ceylon. Nouvel (1959) proved that Tattersall's specimen does not belong to *S. paulsoni* Kossmann. Without seeing the specimens I do not want to make a guess on the true identity of this species.

Siriella thompsoni (Milne-Edwards)

(Fig. 19)

G. O. Sars, 1885, p. 205, pl. 36, figs. 1-24; Hansen, 1910, p. 31; O. S. Tattersall, 1955, p. 84; 1962, p. 233; Li, 1964, p. 62, figs. 14-15.

Body rather slender. Rostrum acute. Eyes very large, with expanded cornea. Antennal scale narrow, apex obliquely truncate and not reaching tip of antennular peduncle. Propodus of thoracic endopods undivided. Telson very narrow, apex truncate, with three small teeth between the innermost pair of apical spines, lateral borders with the spines regularly increasing in length. Exopod of uropod much shorter than endopod, with six spines on proximal segment.

Length: 10 mm.

Distribution: Widely distributed in the tropical Atlantic, Pacific and Indian oceans.

The characters of this species show very wide variation but the endopod of the uropod is characteristic in far overreaching the exopod.

Siriella gracilis Dana

(Fig. 20)

G. O. Sars, 1885, p. 209, pl. 36, figs. 25-28; Hansen, 1910, p. 31; O. S. Tattersall, 1955, p. 86; Li, 1964, p. 72, fig. 16; Pillai, 1964 c, p. 6.

Body very slender. Frontal plate triangular. Sixth abdominal segment as long as the two preceding segments combined. Eyes small, cornea not wider than the stalk. Antennal scale scarcely three times as long as broad, with very obliquely truncate apex. Propodus of thoracic limbs with distinct partition, claw very long. Telson linguiform, apex rounded, with a small tridentate plate and a pair of long spines, lateral border with the spines regularly increasing in length. Endopod of uropod overreaching exopod.

Length: 6 mm.

Distribution: An oceanic surface species widely distributed in the tropical and subtropical parts of the Pacific and Indian oceans, not recorded from the Atlantic.

Genus *Hemisiriella* Hansen

Hansen, 1910, p. 45; Li, 1964, p. 149.

Differs from *Siriella* as follows: Carapace shorter. Third segment of antennular peduncle in female twice as long as broad, as long as first segment. Antennal scale small, shorter than the antennal peduncle. Cutting edge of mandible reduced. Third thoracic endopod extremely elongated, twice the length of fourth, claw rudimentary.

Hemisiriella parva Hansen

(Fig. 21)

Hansen, 1910, p. 47, pl. 6, fig. 2; W. M. Tattersall, 1922, p. 456; Li, 1964, p. 161, figs. 42-43; Pillai, 1964 c, p. 13, fig. 7.

Body slender. Frontal plate small, with rounded tip. Cornea much narrower than eye-stalk. Uropods narrow, similar in both sexes, exopod shorter than endopod, with three to six marginal spines. Telson reaching articulation of exopod, two-and-a-half times as long as broad, tapering gradually, apex broad, with three small spines and three pairs of long ones, second pair longer than the others, lateral border of telson with two to three small proximal spines and six to eight irregularly distributed distal ones.

Length: 6.5 mm.

Distribution: East Indies, Bay of Bengal, Java and Arabian Sea.

Subfamily RHOPALOPHTHALMINAE

Genus *Rhopalophthalmus* Illig

O. S. Tattersall, 1957, p. 84; Li, 1964, p. 166.

Carapace short, with a pair of post-orbital spines continued backwards as dorsal keels. Pleura of first abdominal segment in male produced into a pair of lobes. Antennal scale with strong outer distal spine, sympod armed with two or more spines. Thoracic endopods three to seven with varying number of carpopropodal segments, eighth endopod reduced in size and showing pronounced sexual dimorphism. Endopod of second pleopod of male long and multisegmented. Rami of uropods two-segmented, endopod with a spine below statocyst. Telson linguiform, with a pronounced waist beyond the base and in front of the spine row, distal half of lateral border armed with strong spines regularly increasing in length, distal border armed with two pairs of long barbed spines.

1. Carapace without dorso-median tubercles, antennal sympod with three subsimilar spines *chilensis*

Carapace with dorso-median tubercles, antennal sympod with four or more dissimilar spines 2

2. Cheeks of carapace evenly concave, thoracic endopods with four carpopropodal segments, endopod of eighth limb longer than basal segment of exopod *kempi*

Cheeks of carapace sinuous, thoracic endopods three to seven with four to seven carpopropodal segments, endopod of eighth thoracic limb not longer than basal segment of exopod 3

3. Antennal sympod armed with five spines arranged in the form of a cone.....*Indicus*
Antennal sympod with spines regularly increasing in length.....4
4. Antennal sympod with four spines, third spine barbed, inner pair of apical spines of telson longer than outer.....*tattersallae*
Antennal sympod with five spines, third spine not barbed, inner pair of apical spines of telson shorter than outer.....*macropsis*

Rhopalophthalmus chilensis O. S. Tattersall

(Fig. 22)

W. M. Tattersall, 1927, p. 151 (*egregius*); O. S. Tattersall, 1957, p. 90, fig. 1B-J.

Rostral prolongation absent, cheeks of carapace evenly concave, carapace without dorso-median tubercles. Inner distal angle of antennal sympod with three very long subsimilar spines. Thoracic endopods slender, third with three subsegments, fourth to sixth with four and seventh with five subsegments. Endopod of eighth thoracic limb three-segmented in male, third segment bent at right angles to the second, latter with a group of five to six long setae, the whole limb when straightened overreaching the basal segment of the exopod, endopod in the female slender and shorter than the basal segment of exopod, with an indistinct articulation and a seta in the middle. Lateral borders of telson with fifteen to sixteen spines, apical spines very long, inner pair longer than outer.

Length: 11.4 mm.*Distribution*: Chilka lake (brackish water).*Rhopalophthalmus kempfi* O. S. Tattersall

(Fig. 23)

W. M. Tattersall, 1922, p. 457 (*egregius*); O. S. Tattersall, 1957, p. 97, figs. 4 A-K.

Rostrum short, triangular and obtusely rounded, cheeks evenly concave, dorso-median nodules present. Antennular peduncle in male twice as robust as that of female. Antennal sympod armed with two long equal spines and one or two very small spines, antennal peduncle very short. Propodus of posterior thoracic endopods divided into two subsegments. Endopod of eighth thoracic limb long and unsegmented, overreaching the basal segment of exopod, cylindrical and straight in male, with one proximal plumose seta, longer and more slender in female, with a small apical tooth. Telson with fourteen spines on lateral borders, inner pair of distal spines slightly longer than outer.

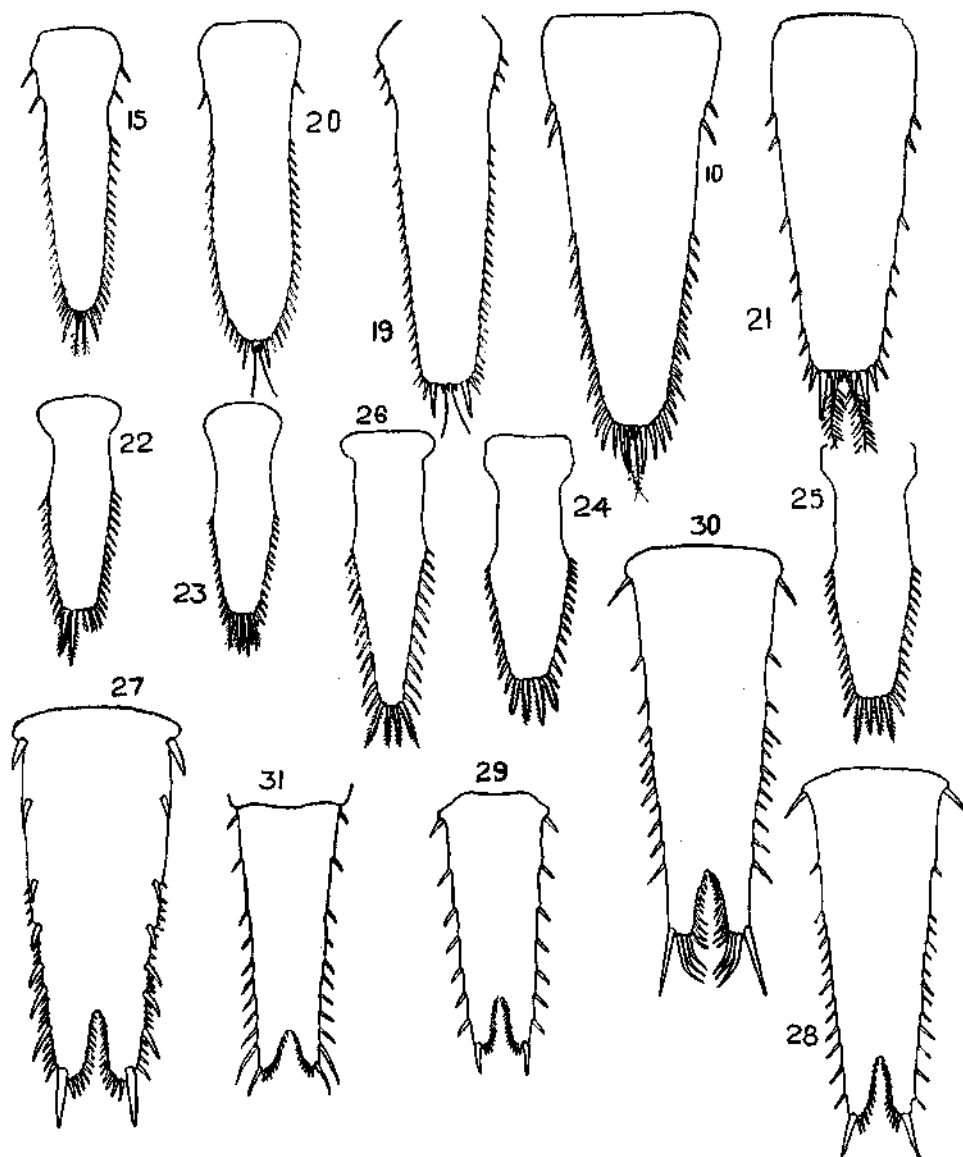
Length: 10.2 mm.*Distribution*: Mormogoa Bay and Andaman Islands.*Rhopalophthalmus tattersallae* Pillai

(Fig. 24)

Pillai, 1957, p. 2, fig. 1 (*egregius*); 1961, p. 18, pl. 1, figs. H-R, pl. 2, figs. A-B.

Rostrum prominent, triangular and apically rounded, cheeks sinuous, dorso-median tubercles present. Antennal sympod with four strong spines, first two short and subequal, third long and barbed, fourth slightly shorter than third. Propodus of thoracic endopods three to seven divided into three subsegments. Eighth thoracic endopod small, two-segmented in male, first segment with four long setae, second segment with two apical and one subapical seta, in the female slender and two-segmented, basal segment with one seta, distal segment with an apical cusp or spinule. Lateral

Order of telson with thirteen spines rapidly increasing in length, distal border with the inner pair of spines longer than outer, all the four spines armed with broad obliquely truncated teeth.



FIGS. 10, 15 AND 19-31. (10) *Siriella jonesi* Pillai (after Pillai, 1964 c); (15) *Siriella vulgaris* Hansen (after Hansen, 1910); (19) *Siriella thompsoni* (M. Edwards) (after G. O. Sars, 1885); (20) *Siriella gracilis* Dana (after G. O. Sars, 1885); (21) *Hemisiriella parva* Hansen (after Pillai, 1964 c); (22) *Rhopalophthalmus chilensis* O. S. Tattersall (after O. S. Tattersall, 1957); (23) *Rhopalophthalmus kempfi* O. S. Tattersall (after O. S. Tattersall, 1957); (24) *Rhopalophthalmus tattersallae* Pillai (after Pillai, 1961); (25) *Rhopalophthalmus indicus* Pillai (after Pillai, 1961); (26) *Rhopalophthalmus macropsis* Pillai (after Pillai, 1964 c); (27) *Gastrosaccus kempfi* W. M. Tattersall (after W. M. Tattersall, 1922); (28) *Gastrosaccus muticus* W. M. Tattersall (after Pillai, 1961); (29) *Gastrosaccus simulans* W. M. Tattersall (after Pillai, 1957); (30) *Gastrosaccus dunckeri* Zimmer (after Pillai, 1957); (31) *Gastrosaccus pacificus* Hansen (after Hansen, 1912).

Length: 13.3 mm.

Distribution: Arabian Sea (Kerala coast).

Rhopalophthalmus indicus Pillai

(Fig. 25)

Pillai, 1961, p. 20, pl. 2, figs. C-L.

Carapace with dorso-median nodules, rostrum wide and obtuse, cheeks evenly concave. Antennal sympod armed with five short spines arranged in the form of a cone. Endopod of thoracic limbs three to seven with the propodus divided into five to six subsegments. Endopod of eighth limb in male stout, as long as basal segment of exopod, two-segmented, basal segment armed with seven long setae, in the female two-segmented and straight, basal segment with one seta. Lateral borders of telson with fourteen slender spines, outer pair of distal spines longer than inner.

Length: 15-17 mm.

Distribution: Kerala (brackish water).

Rhopalophthalmus macropsis Pillai

(Fig. 26)

Pillai, 1964 c, p. 15, fig. 8.

Rostral process broadly arched, cheeks of carapace sinuous, dorso-median nodules present. Eyes large. Antennal sympod armed with four spines, first and second short, third longest, fourth slightly shorter than third. Propodus of thoracic endopods three to seven divided into three subsegments. Exopod of second male pleopod thirteen-to-fourteen-segmented, each of the last three segments with a long spine. Endopod of eighth limb of male three-segmented and overreaching the basal segment of the exopod, second segment short, with four long setae, third segment very long. Telson comparatively narrow, lateral border with twelve fairly long spines, outer pair of distal spines longer than inner, armed with blunt barbs.

Length: 7.8 mm.

Distribution: Arabian Sea.

Subfamily GASTROSACCINAE

Genus *Gastrosaccus* Norman

Tattersall and Tattersall, 1951, p. 160; Li, 1964, p. 233.

Carapace forming a small triangular rostrum, hind border deeply emarginate, with filaments or reflected lappets or entire. Eyes small. Antennal scale short, outer margin terminating in a spine. Labrum anteriorly produced into a spine. Thoracic endopods three to eight with several carpopropodal segments. First abdominal segment of female with expanded pleural plates. Pleopod one in female biramous, others simple unsegmented plates. Pleopods one and two in male biramous, exopod of third very long, pleopods four and five biramous. Telson long, with armed apical cleft, lateral border throughout armed. Exopod of uropod externally armed with spines, inner border of endopod with sharp spines.

1. Lateral border of telson with groups of small spines alternating with long ones *kempi*
Lateral border of telson with the spines uniform or nearly so 2

SM-V-12

2. Posterior border of carapace with filaments.....3
Posterior border of carapace without filaments.4
3. Apex of antennal scale below level of outer spine, telson with fourteen to fifteen spines (some of the spines small).....*muticus*
Apex of antennal scale above level of outer spine, telson with eight to ten lateral spines *simulans*
4. Posterior border of carapace with two large reflexed lappets, endopod of uropod with fourteen to fifteen spines, spines in the telsonic sinus bent inwards.....*dunckeri*
Posterior border of carapace without lappets, spines in the telsonic sinus straight.....5
5. Telson with twelve lateral spines, penultimate spine much longer than ultimate....*pacificus*
Telson with thirteen spines, last two spines subequal in size, much longer than the antepenultimate..... *bengalensis*

Gastrosaccus kempi W. M. Tattersall

(Fig. 27)

W. M. Tattersall, 1922, p. 460, fig. 7; Pillai, 1961, p. 22, pl. 2, figs. M-R, pl. 3, figs. A-B.

Hind border of carapace deeply emarginate, with a pair of small triangular lobes directed inwards and backwards, margin of carapace behind the lobes with a deep notch. Endopod of third pleopod of male seven-segmented, exopod eight-segmented, last segment with two stout barbed spines, the distal spine two and-a-half times as long as the other. Endopod of uropod with twelve spines. Lateral border of telson with eight long spines, distal ones alternating with groups of small spines.

Length: 8.1 mm.*Distribution*: Coast of Orissa and Kerala.

The only other species which shows the same type of armature for the telson is *G. gordonae* O. S. Tattersall (1952). This species appears to be the same as *G. kempi* W. M. Tattersall (see Pillai, 1961, p. 23).

Gastrosaccus muticus W. M. Tattersall

(Fig. 28)

W. M. Tattersall, 1915, p. 152, fig. 1; Pillai, 1961, p. 24, pl. 3, figs. C-H.

Hind border of carapace with a row of nine filaments and beyond this a pair of notches. Endopod of third pleopod of male seven-segmented and exopod seven-segmented, distal exopod segment with two spines and a grooved process arising from the middle of the outer border and two barbed spines from the distal, one of the distal spines very short. Endopod of uropod with four equidistant spines. Lateral border of telson with fifteen pairs of spines, the first and the last longer than the others.

Length: 13 mm.*Distribution*: Orissa, Gangetic Delta and Kerala coast.

***Gastrosaccus simulans* W. M. Tattersall**

(Fig. 29)

W. M. Tattersall, 1915, p. 155, fig. 1 C; Pillai, 1961, p. 24, pl. 3, figs. I-J.

Hind border of carapace with six filaments and a pair of notches, a similar notch on the outer border opposite the inner notch. Endopod of third pleopod of male eight-segmented, exopod eight-segmented, last segment with three distal barbed spines and a grooved median process and two small spines. Endopod of uropod with four spines. Lateral border of telson with eight spines, first large, others slightly increasing in length from the second to the eighth.

Length : 12 mm.

Distribution : Orissa coast, Goa and Kerala coast.

***Gastrosaccus dunckeri* Zimmer**

(Fig. 30)

Zimmer, 1915, p. 165, figs. 13-18; Pillai, 1961, p. 25, pl. 3, figs. K-N; Li, 1964, pp. 235, 580, fig. 59.

Posterior border of carapace with a pair of large forwardly directed lobes larger than those of any other species. Endopod of third pleopod of male eight-segmented, exopod four-segmented, fourth segment with two subequal spines, the longer with a few strong barbs. Endopod of uropod with eighteen spines. Telson with fifteen lateral spines, some of them at intervals smaller than the adjacent ones, there are two spineless areas between the first two and the last two lateral spines. In the specimens collected in the inshore waters of Kerala coast the spines arming the telsonic sinus are bent towards each other, but nearly straight in off-shore material.

Length : 12 mm.

Distribution : Ceylon, Orissa and Kerala coast.

***Gastrosaccus bengalensis* Hansen**

Hansen, 1910, p. 58; Zimmer, 1915, p. 164; W. M. Tattersall, 1922, p. 462; Li, 1964, p. 256, figs. 67-68.

Eye-stalks broader than cornea. Third pleopod of male with rudimentary endopod, a small oblong segment marked off from the peduncle, exopod four-segmented, reaching beyond the middle of the telson, proximal part with two to three small spines and terminating in a claw-like process, penultimate segment widened and produced into a plate, terminal segment ending in a minute claw. Telson with twelve to thirteen spines along the lateral border, last two pairs very long and subequal, twice as long as the antepenultimate.

Length : 6 mm.

Distribution : India, Formosa.

***Gastrosaccus pacificus* Hansen**

(Fig. 31)

Hansen, 1912, p. 198, pl. 2, fig. 3; W. M. Tattersall, 1922, p. 461, fig. 8; Li, 1964, p. 255.

Third pleopod of male with endopod reduced to a mere lobe or a triangular process, exopod composed of three segments, third segment terminating in two straight spines, one longer than the

other and barbed, there is also a long seta curved like an 'S' the terminal segment abruptly narrowed distally. Endopod of uropod with four spines. Telson with twelve lateral spines, first three wide apart, four to ten close together, eleventh spine very long, nearly twice as long as the tenth, twelfth spine smaller than eleventh. Apical cleft rather shallow and wide.

Length not given.

Distribution: Gilbert Islands and India.

Genus *Anchialina* Norman and Scott

Tattersall and Tattersall, 1951, p. 179.

Body robust. Hind border of carapace transverse and nearly straight. Eyes large. Base of outer flagellum of antennule in male swollen. Antennal scale short, outer margin terminating in a small spine. Second thoracic endopod in female simple, fifth segment in male internally expanded. Basal segment of endopods three to eight large, propodus with a few partitions. First abdominal segment of female with a pair of lateral plates. Pleopods in female rudimentary, in male well developed, pseudobranchial lobes large and lamellar, exopod of third pleopod modified. Exopod of uropod smaller than endopod, outer margin armed with small spines, endopod with long and short spines. Telson large, apical cleft small, margin armed with spines.

1. Third pleopod of male with the exopod highly modified.....2
Third pleopod of male with the exopod only slightly modified.....3
2. Carpus of third thoracic endopod short, uropods reaching or slightly overreaching apex of telson, antennular peduncle smooth.....*grossa*
Carpus of third thoracic endopod long, uropods not reaching apex of telson, antennular peduncle hairy (male only).....*penicillata*
3. Rostrum truncate, exopod of third male pleopod with distal segments produced, inner expansion of fifth segment of third male thoracic endopod simple.....*typica*.
Rostrum not truncate, exopod of third male pleopod with distal segments not produced, inner expansion of fifth segment of third male thoracic endopod dentate.....*dentata*

Anchialina typica Kroyer

(Figs. 32-34)

Hansen, 1910, p. 52, pl. 7, fig. 2; W. M. Tattersall, 1922, p. 457; Li, 1964, p. 188, 579, figs. 48-49; Pillai, 1964 c, p. 18, fig. 10.

Anterior margin of frontal plate truncated and emarginate. Second thoracic endopod in male with large second segment, fifth segment expanded and ending in a sharp process, border beyond this concave; third thoracic endopod with sixth segment wide and undivided, distal border obliquely truncate, with six long modified setae, seventh segment small. Exopod of third pleopod not twice as long as endopod, the two distal segments small, the previous six segments characteristically produced. Endopod of uropod reaching tip of telson, exopod shorter. Lateral border of telson armed at the distal two-thirds.

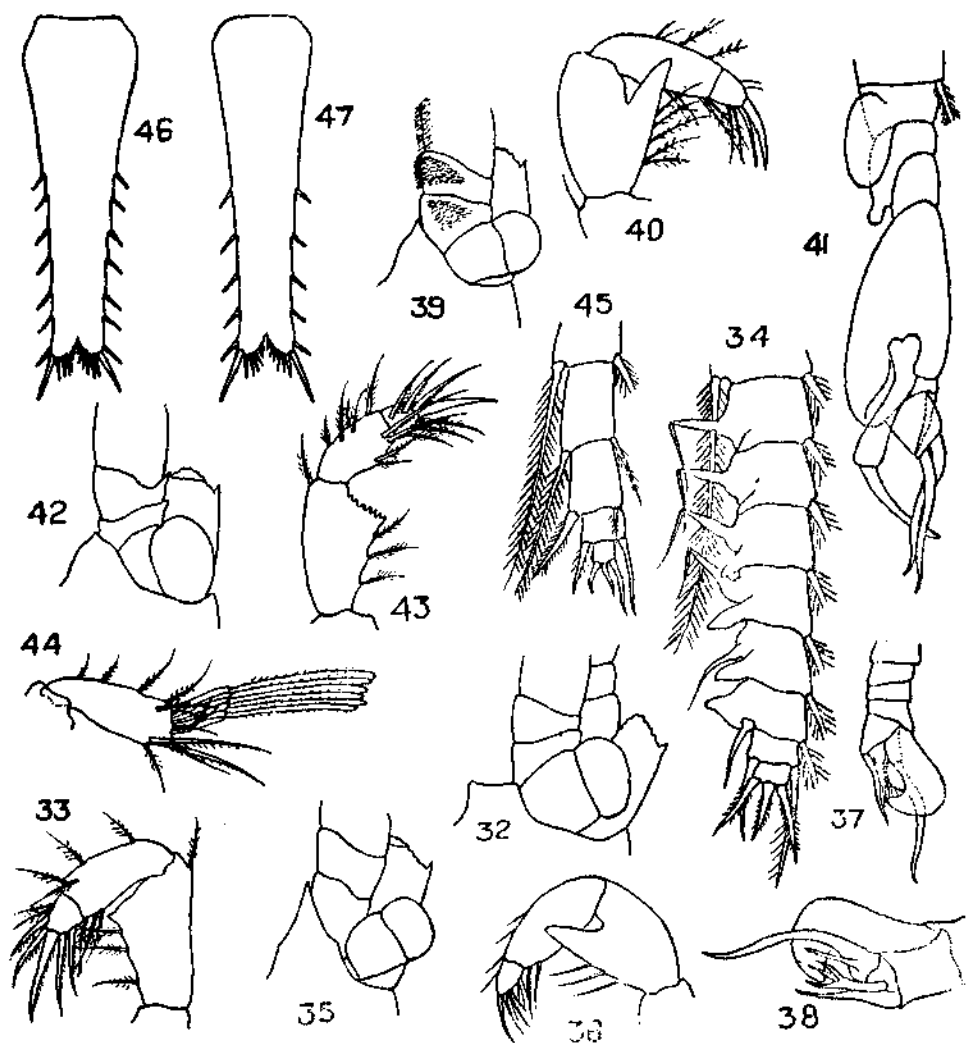
Length: 6 mm.

Distribution: Tropical Atlantic, West Indies, Gulf of Siam, East Indies, Hawaiian Islands, Andaman Islands and Arabian Sea.

Anchialina grossa Hansen

(Figs. 35-38)

Hansen, 1910, p. 54, pl. 7, fig. 3, pl. 8, fig. 1; W. M. Tattersall, 1922, p. 458, fig. 6; Li, 1964, pp. 202, 579.



FIGS. 32-47. (32-34) *Anchialina typica* (Kroyer): (32) Anterior part of head (after Pillai, 1964 c); (33) First thoracic endopod of male (after Pillai, 1964 c); (34) Third pleopod of male (after Pillai, 1964 c); (35-38) *Anchialina grossa* Hansen: (35) Anterior part of head (after Hansen, 1910); (36) First thoracic endopod of male (after Hansen, 1910); (37) Third pleopod of male (after Hansen, 1910); (38) Same, enlarged (after Hansen, 1910); (39-41) *Anchialina paniculata* Zimmer: (39) Anterior part of head (after Zimmer, 1915); (40) First thoracic endopod of male (after Zimmer, 1915); (41) Third pleopod of male (after Zimmer, 1915). (42-45) *Anchialina dentata* Pillai: (42) Anterior part of head (after Pillai, 1964 c); (43) First thoracic endopod of male (after Pillai, 1964 c); (44) Second thoracic endopod of male (after Pillai, 1964 c); (45) Third pleopod of male (after Pillai, 1964 c); (46) *Pseudanchialina pusilla* (G. O. Sars) (after Pillai, 1964 c); (47) *Pseudanchialina inermis* (Illig) (after Hansen, 1910).

Body clumsy, with large carapace, hind border feebly emarginate, rostrum large, triangular and acuminate. Second thoracic endopod with long second segment, fifth segment internally produced into a long, oblong apically rounded process, sixth segment broad. Sixth segment of third endopod four-segmented. Pseudobranchial lamellae of male pleopods bilobed, outer lobe very large. Exopod of third pleopod one-and-a-half times as long as endopod, its terminal segments modified, varying in shape depending on maturity. Endopod of uropod overreaching telson, longer than exopod.

Length: 9.2 mm.

Distribution: East Indies, Bay of Bengal, Gulf of Siam, Gilbert Islands and Arabian Sea.

Anchialina penicillata Zimmer

(Figs. 39-41)

Zimmer, 1915, p. 161, figs. 7-12; W.M. Tattersall, 1951, p. 103; Li, 1964, p. 201, 579.

Carapace produced into an apically rounded rostrum, with an anteromedian point. Eyes large, cornea wider than stalk. Dorsal surface of the basal segment and inner surface of the second and third segments of the antennular peduncle with dense matting of hairs. Antennal scale slightly more than twice as long as broad. Inner distal part of fifth segment of second endopod produced into a blunt process. Carpus of third thoracic endopod very long, twice as long as the combined length of the propodal segments. Exopod of third pleopod of male elaborately modified. Telson with short sparse spinulation, uropods not reaching apex of telson.

Distribution: Ceylon, New South Wales, Marshall Islands, Philippines.

Anchialina dentata Pillai*

(Figs. 42-45)

Pillai, 1964 c, p. 19, fig. 11.

Differing from *A. typica* as follows: Rostrum produced, with small antero-median point. Apical sinus of telson less deep and wider, lateral border with lesser number of spines, distal spines barbed. Antennal scale broader. Second thoracic endopod with the distal border of the inner expansion of fifth segment cut into about seven sharp teeth. Exopod of third pleopod of male ten-segmented, distal segments not produced, the last three segments armed with strong spines.

Length: 4.3 mm.

Distribution: Arabian Sea.

Genus *Pseudanchialina* Hansen

Hansen, 1910, p. 59; Li, 1964, p. 215.

Carapace covering the whole of the thorax, frontal plate large, hind border feebly concave. Eyes well developed. Antennular peduncle of male thicker than in female. Antennal scale small, rapidly broadening distalwards, outer distal spine long, terminal suture present, setae very long. Labrum anteriorly produced into a spine. Endopods of thoracic limbs slender, sixth segment divided into a few subsegments. First abdominal segment in female with lateral wings, sixth segment longer than the combined length of the two previous segments. Pleopods in female simple, third pair in male as in *Gastrosaccus*, with long peduncle. Uropods slender, with long setae, exopod not longer

*This species is very much similar to *A. parva* Li (1964) if not synonymous.

than endopod, its outer margin naked, with a subapical spine. Telson as long as or longer than uropod, with a few evenly spaced lateral spines, apex incised, with two rows of spines, extreme lateral spines very long.

Pseudanchialina pusilla (G. O. Sars)

(Fig. 46)

Hansen, 1910, p. 60, pl. 8, fig. 4, pl. 9, fig. 1; Li, 1964, p. 217, 580; Pillai, 1964 c, p. 21, fig. 12.

Frontal plate in female very large, distally broadly rounded, in the male narrower in the middle. Eyes of moderate size. Antennal scale less than three times as long as broad, rapidly increasing in width. Second pair of pleopods in male with very short endopod, exopod two-segmented, terminating in two long setae. Exopod of third pleopod long, two-segmented, reaching beyond the middle of the sixth abdominal segment, with three very long apical setae. Telson less than three times as long as broad, each half of the terminal lobe with five to six spines, lateral border with seven spines.

Length: 3.2 mm.

Distribution: Celebes Sea, Bay of Bengal and Arabian Sea.

Pseudanchialina inermis (Illig)

(Fig. 47)

Hansen, 1910, p. 61, pl. 9, fig. 2; Illig, 1930, p. 422, fig. 40.

Differing from *P. pusilla* as follows: Frontal plate considerably narrower. Eyes larger, the stalk increasing in width distalwards and broader than long. Endopod of pleopods two and three shorter and smaller. Telson more than three times as long as broad, median part half as broad as the base, lateral border with five spines, distal border with seven pairs of spines.

Length: 3.2 mm.

Distribution: Bay of Bengal and off Ceylon.

Subfamily MYSINAE

This subfamily is divided into four tribes, all of which are well represented in Indian waters.

1. Third thoracic endopod normally developed, propodus or carpopropodus subdivided...2
Third thoracic endopod stouter than the rest, carpus and propodus undivided, armed with spines.....*Heteromysini*
2. Endopod of thoracic limbs three to eight with carpus undivided and marked off from propodus by oblique articulation.....*Erythropini*
Endopod of thoracic limbs three to eight with carpus and propodus fused, subdivided, no oblique articulation.....3
3. Antennal scale setose all around, without terminal outer tooth, pleopods two to five of male usually well developed, biramous, with exopod elongated and armed with modified setae.....*Leptomysini*
Antennal scale variable, pleopod two of male rudimentary as in female, exopod of fourth pleopod long and modified.....*Mysini*

Tribe *Erythropini*Genus *Erythrops* G. O. Sars

Tattersall and Tattersall, 1951, p. 187; Li, 1964, p. 351.

Body slender and delicate. Antennule robust in male, outer distal corner of basal segment of peduncle forming a hirsute lobe. Antennal scale with outer margin entire or serrate, terminating in a strong spine. Eyes short, flattened, cornea reniform. Thoracic endopods three to eight long and slender, carpus separated from propodus by oblique partition, propodus two-segmented. Pleopods two to five of male biramous, endopod of first one-segmented. Inner margin of endopod of uropod smooth or spiny. Telson very short, trapeziform, lateral margins naked or finely serrate, apex truncated, armed with two pairs of stout spines and a pair of plumose setae.

1. Outer border of antennal scale without teeth, distal border of telson with three pairs of spines, lateral border of telson not serrulate.....*nana*
Outer border of antennal scale with teeth, lateral border of telson serrulate.....2
2. Outer border of antennal scale with four teeth including the apical, latter overreaching apex of scale.....*minuta*
Outer border of antennal scale with three teeth including the apical, latter just reaching apex of scale.....sp.

Erythrops nana W. M. Tattersall

(Fig. 48)

W. M. Tattersall, 1922, p. 463, fig. 10.

Frontal plate short and acute. Eyes small, cornea as broad as stalk. Antennal scale shorter than antennular peduncle, four times as long as broad, outer border without teeth, terminal spine long, terminal lobe of scale overreaching spine, terminal partition present. Telson broader than long, hind border half the total width, with three pairs of spines and a pair of plumose setae, inner pair of spines long, outer very small, lateral margin of telson unarmed. Rami of uropods of the same length, endopod without marginal spines or teeth.

Length: 3 mm.

Distribution: Andaman Islands.

Tattersall and Tattersall (1951, p. 187) have stated that in *Erythrops* the antennal scale has no distal partition. In *E. nana* W. M. Tattersall (1922, p. 463, fig. 10 c) has illustrated and described a partition. Similarly in the definition of the genus, the distal border of the telson is described as having two pairs of spines. In *E. nana* there are three pairs.

Erythrops minuta Hansen

(Fig. 49)

Hansen, 1910, p. 63; W. M. Tattersall, 1922, p. 463, fig. 9; Li, 1964, pp. 352, 582, fig. 89.

Eyes small, cornea only slightly wider than the stalk. Antennal scale about four times as long as broad, terminal lobe obsolete, outer distal spine long, overreaching apex of scale, outer border of scale with three teeth besides the apical. Telson broader than long, distal border more than one-third the total width, with two pairs of spines and a pair of plumose setae, in female the inner pair of spines longer than outer, distal two-thirds of lateral border of telson serrulate.

Length : 2.9 mm.

Distribution : Gulf of Mannar, Gulf of Siam.

Erythropops sp.

(Fig. 50)

Pillai, 1964 c, p. 22, fig. 13.

Carapace large, deeply emarginate behind, rostrum short, conical. Eyes large, dorso-ventrally flattened, cornea narrow and crescentic, slightly broader than the stalk. Antennal scale reaching tip of antennular peduncle, nearly of uniform width, outer border with three teeth including the apical, latter just reaching apex of scale. Endopod of uropod without spines or serrulations. Telson triangular, equal in length and width, apex truncated, one-third the total width, apical spines broken, a pair of long setae present. Lateral border of telson, except very near the base, armed with eight very small spines.

Length : 3.5 mm.

Distribution : Arabian Sea.

Genus *Hypererythropops* Holt and Tattersall

Tattersall and Tattersall, 1951, p. 217; Li, 1964, p. 326.

Body slender. Rostrum slightly produced and apically rounded. Basal segment of antennular peduncle produced at the outer distal part. Antennal scale longer than antennular peduncle, outer border terminating in a strong spine not reaching apex of scale, distal suture present. Eyes large, cornea wider than peduncle, latter with a small papilla. Pleopods of male with broad branchial plate, pleopods two to five biramous, endopod of first an unsegmented plate, pleopods of female simple unsegmented plates. Telson longer than broad, lateral margin armed with spines, apex truncate, armed with three pairs of spines and a pair of setae. Uropods usually unarmed, endopod rarely with one to two spines. Posterior thoracic segments in male with ventro-medial processes.

Hypererythropops spinifera (Hansen)

(Fig. 51)

Hansen, 1910, p. 62, pl. 9, fig. 3 (*Erythropops*); W. M. Tattersall, 1922, p. 464, fig. 11; Li, 1964, p. 328, fig. 85; Pillai, 1964 c, p. 24, fig. 14.

Rostrum small, triangular and acute. Eyes large, depressed and reddish-brown. Antennal scale five times as long as broad, outer border not serrated, terminal lobe reaching beyond outer spine. Uropods with slender rami. Telson half as long as endopod of uropod, lateral margin concave, with ten to thirteen spines, terminal spine much longer than others, apex nearly transverse, with three pairs of spines, inner pair very small, middle pair slightly longer than outer.

Length : 6.5 mm.

Distribution : East Indies, Andaman Islands and Arabian Sea.

As in Hansen's specimens the present specimens do not have setae on the apex of the telson. W. M. Tattersall has shown a pair of setae. The spinulation of the lateral borders of the telson is as shown by Hansen.

Genus *Meterythrops* S. I. Smith

Tattersall and Tattersall, 1951, p. 209; Li, 1964, p. 312.

Antennular peduncle thick and strong, basal segment without outer prolongation, distal segment longest. Antennal scale with outer margin entire or serrated, terminating in a strong spine, not reaching apex of scale. Eyes large, globular, not compressed. Thoracic endopods rather strong with strong claw. Pleopods of female biramous, natatory, endopod of first single-segmented. Telson a long narrow triangle, lateral borders unarmed, hind border with two pairs of spines and a pair of setae. Uropods with or without spines on inner margin of endopod.

Meterythrops indica Hansen

(Fig. 52)

Hansen, 1910, p. 63, pl. 9, fig. 4; W. M. Tattersall, 1939, p. 235.

Body robust. Carapace deeply emarginate behind, rostrum broadly triangular, with rounded apex. Eyes large, very broad, stalk short. Antennular peduncle in male thick, male lobe large and protruding. Antennal scale nearly four times as long as broad, with one denticle besides the terminal, latter fairly long, terminal lobe much broader than long, overreaching terminal outer tooth. Uropods slender, exopod seven to eight times as long as broad, much longer than endopod. Telson less than one-and-a-half times as long as broad, lateral margins concave, apex truncate and very short.

Length: 9.7 mm.

Distribution: East Indies, Arabian Sea.

Genus *Dactylamblyops* Holt and Tattersall

Tattersall and Tattersall, 1951, p. 260; Li, 1964, p. 279.

Carapace posteriorly emarginate, anterior margin rounded, with or without rostral projection. Antennular peduncle generally more robust in male than in female. Antennal peduncle short, third segment may overlap the second, outer border of scale naked, usually terminating in a long spine. Eyes set close together but separate, visual elements imperfect, a long or short papilla may be present on the dorsal side. Thoracic endopods similar to those of *Amblyops*. Pleopods as in *Amblyops*. Endopod of uropod with one to four spines near the statocyst. Telson linguiform, entire, tapering to a narrowly rounded apex, distal two-thirds of border armed with evenly graduated close set spines, distal border with one or two small median spines. Two pairs of brood lamellae.

Dactylamblyops murrayi W. M. Tattersall

(Fig. 53)

W. M. Tattersall, 1939, p. 235, figs. 9-10; Li, 1964, p. 289, figs. 74-75.

Body slender. Frontal plate conically produced, apically blunt and reaching beyond the eyes. Eyes small, with long ocular process projecting well beyond the cornea. Antennal scale long and narrow, extending beyond the antennular peduncle by a third of its length, outer margin terminating in a spine reaching the apex of the scale. Exopod of uropod twice as long as telson, endopod with a spine near the statocyst. Telson elongate-triangular, twice as long as broad, distal half armed with about twenty-eight rather closely set spines increasing in size to the apex, apex without setae.

Length: 12 mm.

Distribution: Arabian Sea.

Genus *Synerythrope* Hansen

Hansen, 1910, p. 64; Li, 1964, p. 341.

Eyes of moderate size, not depressed, with a small papilla. Antennular peduncle in female robust. Antennal scale of the usual type. Posterior thoracic endopods with two propodal segments. Pleopod one of male with small unsegmented endopod, pseudobranchial lobe as long as endopod, two to five biramous, with small pseudobranchial lobe. Telson longer than broad, triangular, apical part of border with five pairs of spines rapidly increasing in length, setae as long as the last pair of spines.

Synerythrope intermedia Hansen

(Fig. 54)

Hansen, 1910, p. 64, pl. 9, fig. 5, pl. 10, fig. 1; W. M. Tattersall, 1936, p. 150, fig. 3; 1939, p. 237, figs. 11-13; Li, 1964, p. 342.

Frontal plate broad and triangular, apex rounded. Eyes of moderate size, subglobose, stalk very much broader than long. Antennal scale overreaching antennular peduncle, less than four times as long as broad, outer margin slightly concave, terminal lobe much broader than long, overreaching outer spine. Exopod of uropod less than seven times as long as broad. Telson longer than broad, subtriangular, apex transverse, with a pair of long spines and a pair of setae, distal part of lateral margin with four pairs of spines increasing in length. Pseudobranchial lobe of first pleopod of male as long as endopod. Eyes with small papilla. Inner uropod with two spines on inner margin.

Length: 13 mm.

Distribution: East Indies, Great Barrier Reef and Arabian Sea.

Genus *Pseuderythrope* Coifmann

Coifmann, 1936, p. 83; 1937, p. 35; Nouvel, 1959, p. 233.

Carapace without frontal plate, with deep lateral indentations. Eyes large and globular, with short conical stalk devoid of papilla. Antennular peduncle slender and long. Antennal scale curved, outer border terminating in a triangular tooth not reaching apex of scale. Mandibular palp with a characteristic inward curve. Endopod of uropod with very large statocyst. Telson entire, triangular, distal half of lateral border spiny. First pleopod of male with well-developed exopod. Brood lamellae three pairs, anterior pair rudimentary.

Pseuderythrope gracilis Coifmann

(Fig. 55)

Nouvel, 1959, p. 234, figs. 119-137; Pillai, 1964 c, p. 25, fig. 15.

Body slender. Carapace with a prominent lateral indentation at the anterior third, frontal plate hardly evident exposing the base of the eyes, antennules and antennae. Antennal scale overreaching antennular peduncle by the length of its distal segment, outer border naked, gracefully curved and ending in a large conical tooth. Second segment of palp of mandible curved inwards. Exopod of uropod twice as long as telson, overreaching endopod by one-fourth of its total length, endopod with a large basal bulge enclosing the statocyst. Telson elongate-triangular, distal half of lateral border with about fifteen spines slowly increasing in length, apex with a pair of long spines, no setae.

Length: 8.4 mm.

Distribution: Red Sea, Arabian Sea.

Genus *Gibberythrops* Illig

Illig, 1930, p. 431; Li, 1964, p. 333.

Closely resembling *Hypererythrops* Holt and Tattersall and *Holmesiella* Ortmann. Eyes well developed with swollen eye-stalk. Cephalothorax, particularly in front of the cervical sulcus, highly swollen, not covering the whole of the trunk. Telson distinctly longer than broad, elongate-triangular, with a broadly truncated apex, apex armed with two to three pairs of dissimilar spines, a pair of setae present or absent, lateral border of telson distally armed with four to five pairs of short spines.

Gibberythrops brevisquamosa (Illig)

(Fig. 57)

Illig, 1930, p. 429, figs. 47-50 (*Hypererythrops*); W. M. Tattersall, 1939, p. 245; Li, 1964, p. 336, fig. 87.

Carapace produced into a perfectly semicircular rostral lobe just reaching the base of the eyes. Eyes with thick short stalks. Antennal scale about two-and-a-half times as long as broad, outer distal spine small, apex of scale produced far beyond outer spine, not reaching apex of antennular peduncle. Telson nearly twice as long as broad, narrowing towards the rounded apex, apex more than half the basal width, with three pairs of spines, inner pair very small, distal third of lateral borders armed with five pairs of spines. Endopod of uropod only slightly shorter than exopod, with two spines below the statocyst, statocyst moderately large.

Length: 5.5 mm.

Distribution: Gulf of Aden, Arabian Sea.

Gibberythrops acanthura (Illig)

(Fig. 56)

Illig, 1906, p. 197 (*Parerythrops*); 1930, p. 431, figs. 51-54; W. M. Tattersall, 1939, p. 244; O. S. Tattersall, 1955, p. 115; Li, 1964, p. 335.

Rostral lobe similar to that of *G. brevisquamosa* but not quite reaching the base of the eyes. Eye-stalks swollen, broader than cornea, cornea with a papilla in the middle of the dorsal side. Antennal scale narrower than in *G. brevisquamosa* with the distal lobe comparatively longer but not reaching tip of antennular peduncle. Telson one and a half times as long as broad and rapidly narrowing towards the apex, apex truncate, about a fourth of the basal width, with two pairs of spines and a pair of long setae, lateral borders armed along the distal half with four pairs of spines. Endopod of uropod much shorter than exopod, with one or two spines below the statocyst, statocyst large.

Length: 7.6 mm.

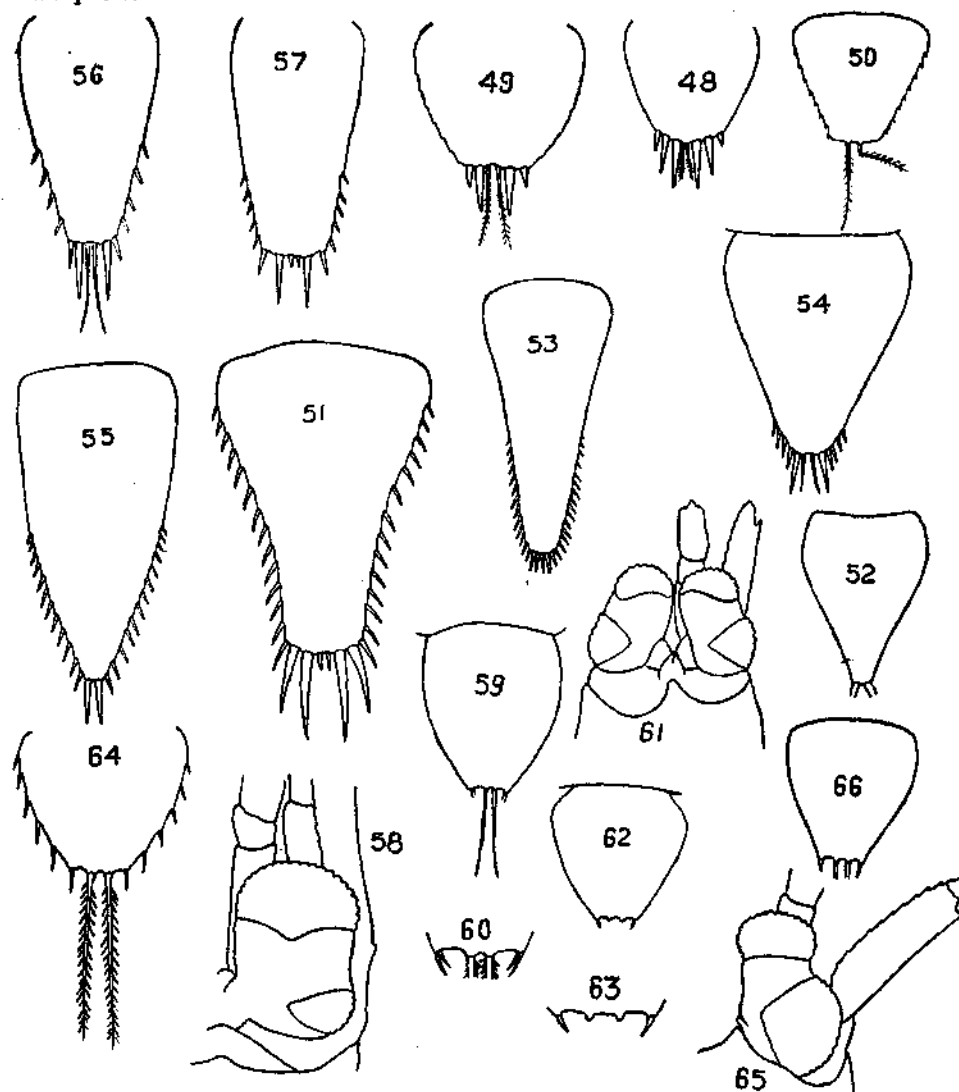
Distribution: Off Ceylon, Red Sea, Gulf of Aden and Philippines.

Genus *Euchaetomera* G. O. Sars

Tattersall and Tattersall, 1951, p. 273; Li, 1964, p. 360.

Carapace rather short, rostrum may or may not be prominent. Abdomen long, sixth segment equal to the combined length of segments four and five. Antennal scale slender, outer margin terminating in a prominent spine, apex of scale one-third to one-sixth the total length of scale. Eyes

large, with two functional groups of ocelli, peduncle with an inner flexible process, long in male. Uropods long and slender, with prominent statocyst. Telson short, lateral margins convex, apex straight, armed with one to two pairs of small spines and a pair of long plumose setae. Brecc lamellae two pairs.



FIGS. 48-66. (48) *Erythrops nana* W. M. Tattersall (after W. M. Tattersall, 1922); (49) *Erythrops minuta* Hansen (after W. M. Tattersall, 1922); (50) *Erythrops* sp. (after Pillai, 1964 c); (51) *Hypererythrops spinifera* (Hansen) (after Pillai, 1964 c); (52) *Meterythrops indica* Hansen (after Hansen, 1910); (53) *Dactylamblyops murrayi* W. M. Tattersall (after W. M. Tattersall, 1939); (54) *Synerythrops intermedia* Hansen (after Hansen, 1910); (55) *Pseuderythrops gracilis* Coifmann (after Pillai, 1964 c); (56) *Gibberythrops acanthura* (Illig) (after Illig, 1930); (57) *Gibberythrops brevisquamosa* (Illig) (after Illig, 1930); (58-60): *Euchaetomera tenuis* G. O. Sars; (58) Anterior part of head (after Illig, 1930); (59) Telson (after W. M. and O. S. Tattersall, 1951); (60) Same, tip enlarged (after W. M. and O. S. Tattersall, 1951). (61-63) *Euchaetomera oculata* Hansen: (61) Anterior part of head (after Hansen, 1910); (62) Telson (after Hansen, 1910); (63) Same, tip enlarged (after Hansen, 1910); (64) *Euchaetomera typica* G. O. Sars (after Illig, 1930). (65-66) *Euchaetomera glyphidophthalmica* Illig; (65) Anterior part of head (after Pillai, 1964 c); (66) Telson (after Pillai, 1964 c).

1. Lateral borders of telson with spines *typica*
Lateral borders of telson without spines 2
2. Rostral process acute, lateral area of ocelli of eye larger than apical *glyphidophthalmica*
Rostral process blunt, lateral area of ocelli of eye not larger than apical 3
3. Lateral area of ocelli of eye as large as apical, apex of telson with a single pair of spines *oculata*
Lateral area of ocelli of eye much smaller than apical, apex of telson with two pairs of spines *tenuis*

***Euchaetomera tenuis* G. O. Sars**

(Figs. 58-60)

Tattersall and Tattersall, 1951, p. 275, fig. 66; Ii, 1964, p. 366, figs. 94-95.

Anterior border of carapace nearly transverse, with slight median projection, antero-lateral angles on a level with the median projection. Antennal scale long and slender, five times as long as broad and reaching beyond antennular peduncle by one-seventh of its length, apical spine long, distal segment very small. Eyes roughly cylindrical, anterior group of ocelli confined to the anterior one-fourth, posterior group triangular, the two separated by a long interval, inner ocular process projecting beyond the eye. Telson extending slightly beyond the middle of the statocyst, longer than broad, lateral margins unarmed, hind border very short and armed with two pairs of close set lateral spines curved inwards and a pair of long setae situated slightly apart.

Length: 11 mm.

Distribution: South Pacific, Tropical and North Atlantic, Mediterranean, Indian Ocean and Arabian Sea.

***Euchaetomera oculata* Hansen**

(Figs. 61-63)

Hansen, 1910, p. 66, pl. 10, fig. 4.

This species closely resembles *E. tenuis* but is more clumsy. Rostrum protruding and triangular, eyes thicker, the posterior group of ocelli much larger, thus reducing the length of the interval between the two groups. Antennal scale shorter, three-and-a-half times as long as broad. Telson as long as broad, distal border very short, one-fifth the total width, with a single pair of very oblique slender spines placed at the lateral angles and a pair of small protuberances.

Length: 5.8 mm.

Distribution: Indian and Pacific oceans.

***Euchaetomera typica* G. O. Sars**

(Fig. 64)

G. O. Sars, 1885, p. 211, pl. 37, figs. 1-20; Illig, 1930, p. 434; W. M. Tattersall, 1939, p. 243; Ii, 1964, p. 361, figs. 92-93.

Body rather stout. Carapace broadly emarginate posteriorly exposing the last two trunk segments, frontal projection acute. Last abdominal segment comparatively short. Eyes of mode-

rate size, separated proximally by a distinct interval. Antennal scale oblong, curved, four times as long as broad, with remarkably strong outer distal spine. Telson equal in length and breadth, with five to six strong lateral spines and two distal median long setae.

Length: 14 mm.

Distribution: Tropical and subtropical parts of the world.

Euchaetomera glyphidophthalmica Illig

(Figs. 65-66)

Illig, 1930, p. 445, figs. 84-87; W. M. Tattersall, 1939, p. 243; O. S. Tattersall, 1955, p. 131; Pillai, 1964 c, p. 27, fig. 16.

Rostral process small and acute. Antennal scale with curved outer distal spine overreaching antennular peduncle. Eyes with the lateral area of ocelli much larger than the terminal and separated from the latter by a very short colourless area. Telson without lateral spines, apex with a pair of lateral spines and a pair of median setae.

Length: 8 mm.

Distribution: Atlantic and Indian oceans.

Genus *Echinomysis* Illig

Echinomysis chuni Illig

(Figs. 67-68)

Illig, 1930, p. 453, figs. 104-126; W. M. Tattersall, 1939, p. 244; O. S. Tattersall, 1955, p. 125.

Body armed with long spines. Carapace anteriorly produced into a trifid rostral process, each limb of the fork ending in long slender spines, median limb just reaching the base of the eye-stalks, hind border of carapace deeply emarginate exposing the last three trunk segments. Eye, with long slender stalk carrying a process at the inner distal part, cornea divided into a small ventro-lateral part and a large apical part. Antennal scale short, not reaching tip of antennular peduncles, apically rounded and without outer distal spine or apical partition, distal half of the border of the scale setose. Telson ovate, with six pairs of lateral spines and two apical setae. Endopod of uropod much shorter than exopod, with a spine below the statocyst.

Length: 11 mm.

Distribution: Gulf of Guinea, Sumatra, Ceylon, Gulf of Aden and Arabian Sea.

Tribe Leptomysini

Genus *Leptomysis* G. O. Sars

Tattersall and Tattersall, 1951, p. 287.

Rostrum acute and triangular. Antennal scale two-segmented, long and setose all round. Thoracic endopods three to eight with the carpopropodus divided into four subsegments, dactylus very small. Pleopods of female rudimentary unjointed plates, of male biramous, exopod of fourth pleopod with each of the three distal segments carrying long modified setae. Uropods long and slender, inner border of endopod armed with a close row of spines. Telson entire, linguiform,

lateral margins armed with several spines, series of small spines alternating with long ones. Three pairs of brood lamellae.

***Leptomysis xenops* W. M. Tattersall**

(Fig. 69)

W. M. Tattersall, 1922, p. 470, fig. 14.

First segment of antennular peduncle longest. Antennal scale narrow-lanceolate. Fourth pleopod of male with exopod longer than endopod. Telson linguiform, with more or less truncated apex, base drawn out and armed with a pair of long spines, lateral border with fourteen to seventeen pairs of spines successively increasing in length, distal border with three pairs of spines, inner small, middle very stout, outer smaller than the latter. Endopod of uropod with eleven spines successively increasing in length.

Length not given.

Distribution: Andaman Islands.

According to W. M. Tattersall *L. apiops* Zimmer (1915) is the same as *L. xenops*.

Genus *Dioptrromysis* Zimmer

Zimmer, 1915, p. 168.

Closely allied to *Leptomysis*. Antennal scale lanceolate, setose all around. Carpopropodus three-segmented. Telson wedge-shaped and apically cleft, lateral border fully armed, apex with a stout spine, cleft widening, with a pair of spines and a pair of long setae.

***Dioptrromysis perspicillata* Zimmer**

(Fig. 70)

Zimmer, 1915, p. 168, figs. 20-22; W. M. Tattersall, 1922, p. 477; Pillai, 1963, p. 9, figs. 1-20.

Body rather strongly built. Eyes large, cornea broader than peduncle, with a large lens on the distal lower part. Antennal scale setose all round, overreaching antennular peduncle. Thoracic endopods three to eight with three carpopropodal segments. Exopod of fourth pleopod seven-segmented, seventh segment with a long barbed spine and a short seta. Endopod of uropod armed with a row of seventeen sharp spines. Telson more than twice as long as wide, narrowing to a third of the total length and further on parallel sided, apical cleft deep, one-fourth the total length, lateral borders armed with eleven to thirteen sharp teeth, more or less regularly distributed, last spine large, slit armed with a single pair of spines and a pair of long setae.

Length: 4.3 mm.

Distribution: Ceylon and Arabian Sea.

Genus *Promysis* Dana

Dana, 1850, p. 130; Hansen, 1910, p. 71 (*Uromysis*); Li, 1964, p. 291.

Frontal plate moderate in size. Eyes very large, stalks moderately long. First segment of antennular peduncle longer than the rest of the peduncle, male lobe as long as the third segment. Antennal scale lanceolate, with distal suture, setose all around. Thoracic endopods slender, sixth segment divided into three subsegments, claw very long. Exopod of fourth pleopod in male longer

than endopod, with a strong spine and a thick seta. Uropods slender, exopod longer than endopod, latter spiny, spines irregularly long and short. Telson much shorter than endopod of uropod, cleft deep with a pair of setae, lateral border of telson spiny.

Promysis orientalis Dana

(Fig. 71)

Hansen, 1910, p. 72, pl. 11, fig. 2 (*U. armata*); Zimmer, 1915, p. 170 (*U. armata*); W. M. Tattersall, 1936, p. 154, fig. 5; 1951, p. 151; Li, 1964, p. 392, 582, fig. 99.

Body slender. Frontal plate triangular, apex subtruncate. Eyes large. Antennal scale reaching far beyond the antennular peduncle, seven times as long as broad, distal segment nearly twice as long as broad. The armature of the endopod of the uropod showing sexual dimorphism, distal half of the inner border with four very long curved processes. Telson more than half as long as uropods, tapering, cleft one-fourth the total length and with a pair of setae, lobes of the cleft narrow and terminating in a large spine, lateral border of telson with eight to eleven spines.

Length: 4 mm.

Distribution: East Indies, Eastern Pacific, Queensland, Philippines and Ceylon.

W. M. Tattersall (1936) supplemented Hansen's description and made *U. armata* a synonym. The telson and the endopod of the uropod show variation in armature.

Genus *Mysidopsis* G. O. Sars

Tattersall and Tattersall, 1951: p. 315; Li, 1964, p. 397.

Rostrum pointed. Antennal scale lanceolate, setose all round; distal segment small. Eyes large, usually with a dorsal papilla. Endopod of first thoracic limb with segments three and four fused, endopod of limbs three to eight short, with three carpopropodal segments. Pleopods of female rather broad, of male biramous, exopod of fourth pair longer than endopod, ending in a long barbed spine. Exopod of uropod much broader and longer than the endopod, spines on latter confined to the region near the statocyst or extending the whole border. Lateral margin of telson with a varying number of spines, apex entire or with a small median unarmed notch.

The six-segmented endopod of the first thoracic limb is very characteristic of this genus.

1. Carapace with dorso-median nodules, telson with only two pairs of lateral spines confined to the base, endopod of uropod with a single inner spine..... *indica*

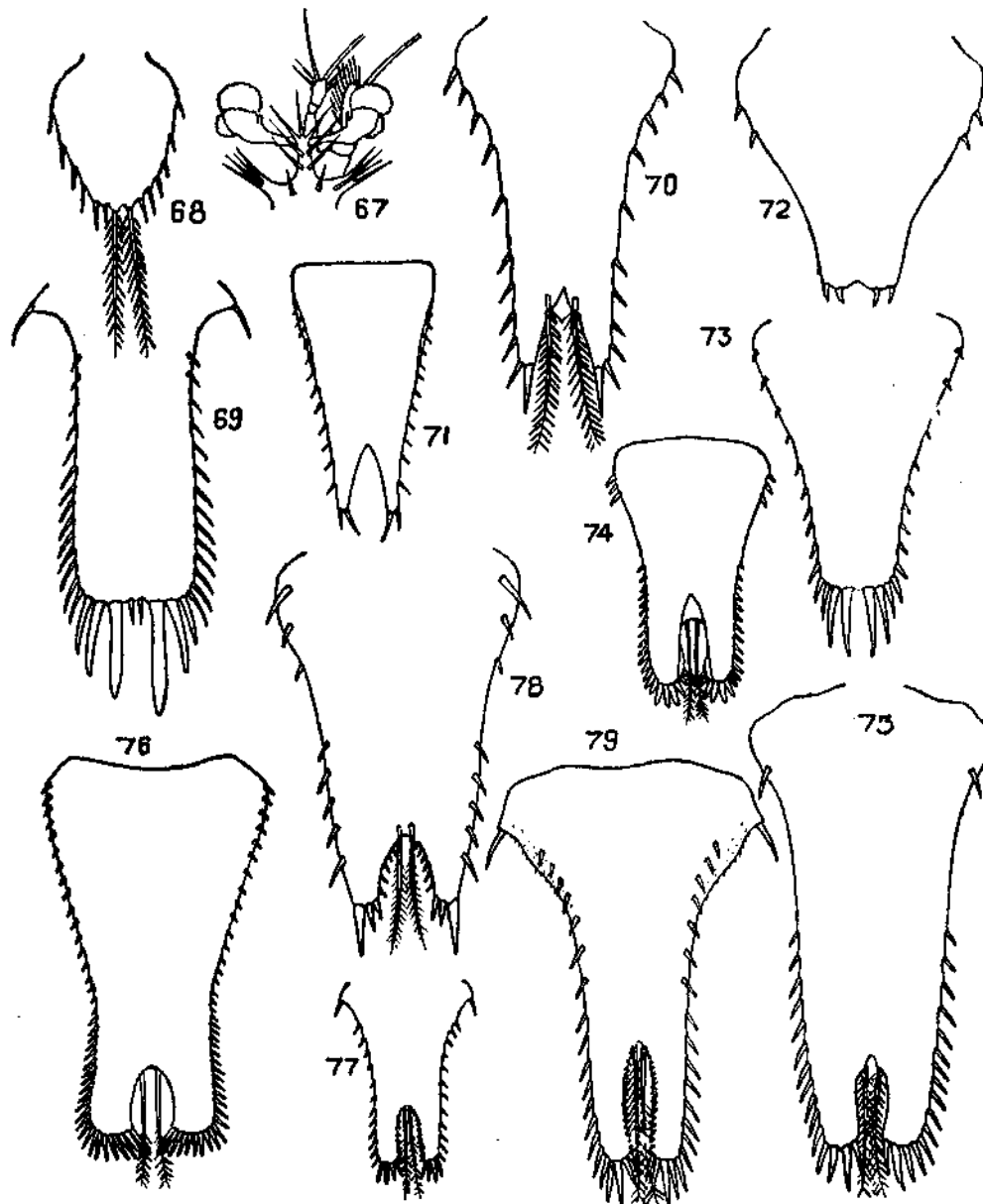
Carapace without dorso-median nodules, telson with ten pairs of lateral spines spread along the entire border, endopod of uropod with ten spines... .. *kempi*

Mysidopsis indica W. M. Tattersall

(Fig. 72)

W. M. Tattersall, 1922, p. 466, fig. 12; Li, 1964, p. 398, fig. 100.

Median dorsal part of carapace with three nodules, slightly less prominent in male. Frontal plate broadly triangular, completely covering the basal segments of the eye-stalks. Antennal scale two-and-a-half times as long as broad, overreaching the antennular peduncle. Telson slightly longer than half the length of the uropods, roughly equal in length and width, distal part suddenly narrowed, apex with a shallow notch, distal border with two pairs of spines, lateral borders with two spines near the base. Endopod of uropod with a single spine near the statocyst. Pleopods two to five of male with a lamella-like expansion near the base of the endopod.



FIGS. 67-79. (67) *Echinomysis chuni* Illig, anterior part of head (after Illig, 1930); (68) Same, telson (after Illig, 1930); (69) *Leptomysis xenops* W. M. Tattersall (after W. M. Tattersall, 1922); (70) *Diopromysis perspicillata* Zimmer (after Pillai, 1964); (71) *Promysis orientalis* Dana (after Hansen, 1910); (72) *Mysidopsis indica* W. M. Tattersall (after W. M. Tattersall, 1922); (73) *Mysidopsis kempi* W. M. Tattersall (after W. M. Tattersall, 1922); (74) *Afromysis macropsis* W. M. Tattersall (after W. M. Tattersall, 1922); (75) *Afromysis dentisinus* Pillai (after Pillai, 1964 c); (76) *Prionomysis stenolepis* W. M. Tattersall (after W. M. Tattersall, 1922); (77) *Doxomysis littoralis* W. M. Tattersall (after W. M. Tattersall, 1922); (78) *Doxomysis anomala* W. M. Tattersall (after W. M. Tattersall, 1922); (79) *Doxomysis longlura* Pillai (after Pillai, 1964).

Length: 4 mm.

Distribution: Andaman Islands.

Mysidopsis kemp W. M. Tattersall

(Fig. 73)

W. M. Tattersall, 1922, p. 468, fig. 13; Li, 1964, p. 402, fig. 101.

Carapace without nodules. Eyes large. Antennal scale elongate-ovate, four times as long as broad, setose all round, terminal segment extending beyond antennular peduncle by one-third of its length. Telson as long as last abdominal segment, apex quadrate, with four pairs of long stout spines, inner pair nearly one-third the length of telson, lateral margin armed with about ten spines distributed along the whole border, distally more crowded. Endopod of uropod with a comb of ten spines in the region of the statocyst.

Length: 6 mm.

Distribution: Gulf of Mannar.

The shape and armature of the telson is very characteristic.

Genus *Afromysis* Zimmer

Zimmer, 1916, p. 62.

Frontal plate conical and apically blunt. Antennal scale lanceolate, with a distal suture. Second segment of palp of second maxilla considerably produced, its inner border armed with a closely packed row of long and short spines. Thoracic endopods with only two propodal segments. Exopod of fourth pleopod of male longer than endopod, armed with two to three spiny setae. Inner border of endopod of uropod throughout armed with spines grouped into irregular series. Lateral border of telson generally with two groups of spines separated by a gap, cleft deep, armed or not, a pair of setae present.

1. Telsonic cleft unarmed, a fair proportion of the spines arming the telson and the endopod of the uropod blunt..... *macropsis*
- Telsonic cleft armed with one to three pairs of sharp teeth, spines arming the telson and the endopod of the uropod sharp..... *dentisinus*

Afromysis macropsis W. M. Tattersall

(Fig. 74)

W. M. Tattersall, 1922, p. 472, fig. 15; Pillai, 1957, p. 10, fig. 5.

Eyes rather elongated, cornea wider than the stalk. Antennal scale shorter than antennular peduncle. Thoracic endopods with two propodal segments. Telson one-and-a-half times as long as broad, cleft a third of the length and unarmed, except for the customary setae, lateral border with three proximal teeth and about twenty distal teeth, the most distal ones blunt. Endopod of uropod armed with a dense row of about forty spines varying in length, majority of them blunt. Exopod of fourth pleopod of male longer than endopod, each of the last three segments with a strongly barbed seta.

Length: 11 mm.

Distribution: India.

Afromysis dentisinus Pillai

(Fig. 75)

Pillai, 1957, p. 11, fig. 6; 1964 c, p. 28, fig. 17.

Closely resembling *A. macropsis* in general shape of body, but smaller and more slender. Eyes more slender and longer. Telson wedge-shaped, lateral borders with one proximal and twelve distal spines, cleft armed with one to three pairs of spines. Endopod of uropod with a dense row of sharp spines. Exopod of fourth pleopod of male with a single barbed seta.

Length: 6.7 mm.

Distribution: Arabian sea.

Genus *Prionomysis* W. M. Tattersall

W. M. Tattersall, 1922, p. 474.

Antennal scale long and narrow, setose all round, terminal partition present. Thoracic endopods three to eight with three tarsal segments. Telson linguiform and cleft, cleft furnished with a pair of setae, no spines, lateral margin armed throughout with spines successively increasing in length, on the lobes of the telson arranged saw-like. Endopod of uropod with a dense row of spines. Pleopods in the male as in *Leptomysis*. Three pairs of brood lamellae.

Differs from *Leptomysis*, which it closely resembles, in the shape of the telson.

Prionomysis stenolepis W. M. Tattersall

(Fig. 76)

W. M. Tattersall, 1922, p. 475, fig. 16.

Rostral process triangular. Eyes large, cornea wider than peduncle. Antennal scale very long and narrow, thirteen times as long as broad, setose all round. First thoracic endopod with a robust nail, thoracic endopods three to eight with three tarsal segments terminating in a long stout nail. Exopod of fourth pleopod of male longer than endopod, each of the last three segments with a stout plumose spine. Telson gradually narrowing for three-fourths of its length, then widening and terminating in two broad lobes, cleft ovate, with two setae, margin of cleft unarmed, lateral margin of telson armed throughout, spines becoming shorter to the narrowest part of the telson and then becoming longer. Endopod of uropod with a prominent spine on the dorsal surface of the statocyst, inner margin armed with a dense row of spines grouped in series.

Length: 8-9 mm.

Distribution: Andaman Islands.

Genus *Doxomysis* Hansen

Hansen, 1912, p. 205; Li, 1964, p. 380.

Frontal plate short and triangular. Eyes large, with short stalks. Antennal scale setose all round, apex rounded. Labrum without anterior process. Terminal segment of palp of second maxilla expanded, with stout spines, broader than long. Carpopropodus of thoracic endopods three-segmented. Endopod of uropod with several spines. Telson with deep apical cleft armed with small teeth, lateral border of telson partly or fully armed.

Distal segment of the palp of the second maxilla is characteristic, intermediate in shape between those of *Afromysis* and *Bathymysis*.

1. Lateral border of telson fully spiny.....2
Only the distal half of the lateral border of telson spiny.....*quadrispinosa*
2. Spines on lateral border of telson grouped into a proximal and a distal group.....*anomala*
Spines on lateral border of telson forming a single series.....3
3. Apical spines of telson blunt, endopod of uropod one and a quarter times the length of telson, antennal scale overreaching antennular peduncle.....*littoralis*
Apical spines of telson pointed, endopod of uropod twice the length of telson, antennal scale not reaching tip of antennular peduncle.....*longiura*

Doxomysis littoralis W. M. Tattersall

(Fig. 77)

W. M. Tattersall, 1922, p. 478, fig. 17; Li, 1964, p. 381, fig. 97.

Body smooth. Rostrum short. Eyes of moderate size. Antennal scale overreaching antennular peduncle. Thoracic endopods three to eight with three carpopropodal segments, first segment less than twice as long as second. Telson one-and-a-half times as long as broad, cleft one-third the total length, apical lobes of telson rounded, cleft parallel-sided, with fifteen pairs of spines and a pair of setae, apical lobes with four large spines, lateral borders with thirteen spines extending the whole length. Endopod of uropod one and a quarter times the length of telson, armed with about thirty-two closely packed blunt teeth alternately long and short.

Length: 5 mm.*Distribution*: Andaman Islands.*Doxomysis longiura* Pillai

(Fig. 79)

Pillai, 1964 *b*, p. 258, figs. 1-19; 1964 *c*, p. 30, fig. 18.

Body spiny. Rostrum moderately produced. Eyes stout. Antennal scale lanceolate, setose all round, not reaching tip of antennular peduncle. Thoracic endopods three to eight with three carpopropodal segments, first segment nearly twice as long as second. Fourth pleopod of male with seven-segmented exopod, fifth segment with a long barbed seta, sixth with a short seta. Endopod of uropod twice as long as telson, with swollen base, inner border closely spiny, proximal spines blunt, the spines arranged in series of two or three beginning with the seventh spine. Telson abruptly narrowed slightly behind the base and further on parallel-sided, apical cleft deep and parallel-sided, apical lobes rounded, cleft armed with a pair of setae and about twenty pairs of sharp closely packed spines, the entire lateral border armed with about twenty spines, of which the last two are blunt.

Length: 6.4 mm.*Distribution*: Arabian Sea, Bay of Bengal and Barrier Reef.

This species closely resembles *D. littoralis* but can be distinguished by the spiny body, longer antennal scale which overreaches the antennular peduncle and the endopod of the uropod which is nearly twice as long as the telson.

Doxomysis anomala W. M. Tattersall

(Fig. 78)

W. M. Tattersall, 1922, p. 480, fig. 19.

Bodysmooth. Rostrum obtuse. Cornea of eye wider than stalk. Antennal scale overreaching antennular peduncle by one-third of its length. Endopod of posterior thoracic limbs slender, with three carpopropodal segments, segments subequal, with oblique partition. Telson one-and-a-half times as long as broad, cleft one-fourth the total length and armed with six pairs of spines and a pair of long setae, lobes of cleft apically truncate and armed with three spines, lateral margins with seven to eight spines, in two groups of three and five. Endopod of uropod with twenty to twenty-five closely set short spines. Fourth pleopod of male with exopod longer than endopod, last segment with a simple seta and each of the two previous segments with a long stout seta.

Length : 5.5 mm.

Distribution : Andaman Islands.

Doxomysis quadrispinosa Illig

(Fig. 80)

Hansen, 1912, p. 205, pl. 3, fig. 3 (*pelagica*); Colosi, 1920, p. 247, pl. 19, fig. 7 (*zimmeri*); Illig, 1930, p. 480, figs. 163-166; W. M. Tattersall, 1951, p. 152; Li, 1964, p. 385.

Frontal plate acute. Eyes large. Antennal scale tapering, overreaching antennular peduncle, distal segment longer than broad. Telson more than half the length of exopod of uropod, almost twice as long as broad, apical cleft deep and wide with a pair of setae and thirteen to fourteen pairs of spines, distal half of lateral border of telson with eight pairs of spines, apices of the telson with four spines. Endopod of uropod with nine spines increasing in length.

Length : 5 mm.

Distribution : Widely distributed in the tropical Indian and Pacific oceans.

Genus *Bathymysis* W. M. Tattersall

Pillai, 1964 a, p. 263.

Body smooth or spiny. Rostral process apically rounded or acute. Antennal scale lanceolate and setose all round, apical segment present. Eyes with or without functional ocelli. Carpopropodus of thoracic endopods three to eight divided into three subsegments. Pleopods in female unsegmented plates, in male biramous, exopod of fourth long, with three spine setae. Uropods long and slender, endopod with a row of spines along the inner border. Telson deeply cleft, cleft narrow or diverging, lateral border fully spiny or the proximal part without spines.

The distal segment of the endopod of the maxilla is very characteristic, broader than long, with a row of strong spines, its distal border is convex whereas in *Doxomysis* and *Afromysis* it is concave.

Bathymysis varunae Pillai

(Fig. 81)

Pillai, 1964 a, p. 264, figs. 1-20; 1964 c, p. 31, fig. 18 A.

Carapace produced into a broadly triangular rostrum. Body spiny. Eyes with well-developed ocelli. Antennal scale reaching clearly beyond antennular peduncle, distal segment longer than broad. Thoracic endopods three to eight with the first tarsal segment subequal to third in length. Each of the last three segments of the exopod of fourth pleopod of male with a spine seta, third seta without barbs. Endopod of uropod with a row of about fifteen spines steadily increasing in length. Telson wedge-shaped, with deep broad apical cleft armed with nine pairs of teeth, distal

half of lateral border with eight subsimilar spines, apex of the lobes of telson with three large spines, outer spine longest.

Length: 3.9 mm.

Distribution: Arabian Sea.

Genus *Thalassomysis* W. M. Tattersall

W. M. Tattersall, 1939, p. 238.

Carapace without rostral plate, frontal margin evenly arcuate. Antennal scale with setose subparallel sides, apex rounded, without terminal lobe. First thoracic limb with both exopodite and epipodite. Telson very long and narrowly pointed, longer than endopod of uropod, apex entire, without terminal incision, lateral margin armed with numerous spines on distal part.

The antennal scale and the telson are very characteristic of this genus.

Thalassomysis sewelli W. M. Tattersall

(Fig. 82)

W. M. Tattersall, 1939, p. 239, figs. 14-21.

Carapace covering the whole of the thorax, its anterior border semicircular, hardly forming a rostrum and fully exposing the eyes and the base of the antennae. Eyes small, flattened, cornea almost ventral, dorsal inner part of stalk with a papilla. Second segment of the antennular peduncle very short. Antennal scale overreaching antennular peduncle by a quarter of its length, about six times as long as broad, slightly narrowed in the middle, with long slender setae all around, apex broadly rounded. Third segment of antennal peduncle with a backward extension. Endopods of thoracic limbs long and slender, sixth segment divided into three subsegments, first much longer than the other two combined. Telson six times as long as broad, narrowly triangular and very long, longer than the endopod of uropod, distal two-thirds of its lateral border armed with about thirty long spines, apex narrowly truncate, with a pair of spines.

Length: 12 mm.

Distribution: Arabian sea.

Tribe Mysini

Genus *Potamomysis* Czerniavsky

W. M. Tattersall, 1908, p. 234.

Antennal scale narrow, long and two-segmented, setose all around. Thoracic endopods with three to four tarsal segments. Telson short, apex truncated and armed with several spines, lateral margins with short spines throughout. Pleopods one to four of male rudimentary as in female, fourth with the exopod very long and slender, three-jointed, terminal segment with two long ciliated filaments and a third smooth filament.

This genus closely resembles *Neomysis* and *Diamysis* but differs in the shape of the telson.

Potamomysis assimilis W. M. Tattersall

(Fig. 83)

W. M. Tattersall, 1908, p. 234, pl. 21, figs. 1-8; 1922, p. 487, fig. 22.

Carapace large, covering all but the last thoracic segment, anteromedian part forming a small projection. Antennal scale narrow, lanceolate, reaching far beyond the antennular peduncle. Thoracic endopods three to seven with three tarsal segments, eighth with four segments. Telson longer than broad, apex truncated and armed with about nineteen subsimilar spines, the extreme lateral pair longer than the others, lateral margins armed with about ten short spines. Fourth pleopod of male with short unsegmented endopod, exopod three-segmented, third segment longest, with two hirsute setae and a longer simple seta.

Length: 5 mm.

Distribution: Bengal (Brackish water).

Genus *Indomysis* W. M. Tattersall

W. M. Tattersall, 1914, p. 77.

Body rather slender. Eyes well developed. Rostral plate absent, antero-lateral parts of carapace acute. Antennular peduncle in the male without the hirsute lobe. Antennal scale long ovate in shape, setose all round, apical partition absent. Telson short, quadrangular, lateral margins armed with a few short spines, apex truncate, armed with a row of small teeth, lateral corners with a pair of long spines. Pleopods one to three in male as in female, fourth biramous, inner ramus very long, reaching beyond the sixth pleon segment and composed of a single segment carrying a long barbed seta.

This genus closely resembles *Potamomysis* Czerniavsky but can be easily distinguished by the unjointed antennal scale and the different form of the pleopods.

Indomysis annandalei W. M. Tattersall

(Fig. 97)

W. M. Tattersall, 1914, p. 78, pl. 12, figs. 1-15, pl. 13, figs. 6-13.

With the characters of the genus.

Length: 7 mm.

Distribution: Bombay (brackish water).

Genus *Mesopodopsis* Czerniavsky

Tattersall and Tattersall, 1951, p. 391.

Body long and slender. Carapace in front of cervical sulcus very narrow. Abdomen stout, sixth segment nearly twice as long as fifth. Frontal plate broad and semicircular, hind border of carapace slightly emarginate, antero-lateral angles produced into strong spines. Antennal peduncle slender and long, that of male with a very large hirsute lobe and an extra flagellum. Antennal scale setose all around. Eyes with long slender stalks. Exopod of thoracic limbs without distinct nail, pleopods one, two and five in male rudimentary, third small and biramous, fourth with small endopod, exopod very long and three-segmented, the small third segment with two spine setae. Telson short, lateral margins ending in a pair of strong spines and the region beyond these spines abruptly constricted and armed with a comb of spines.

1. Frontal plate semicircular, first segment of exopod of fourth pleopod of male shorter than endopod *orientalis*
- Rostrum angular, first segment of exopod of fourth pleopod of male longer than endopod *zeylanica*

Mesopodopsis orientalis (W. M. Tattersall)

(Fig. 84)

W. M. Tattersall, 1908, p. 236, pl. 22 (*Macropsis*).

Rostrum very short, perfectly semicircular. Thoracic limbs three to eight with five to nine carpopropodal segments. Fourth pleopod of male with the endopod nearly twice as long as the first segment of the exopod, the spines on the third exopod segment not spirally twisted. Telson with four lateral spines, narrow distal part more than one-third the total length.

Length: 7 mm.*Distribution*: India.*Mesopodopsis zeylanica* Nouvel

(Fig. 85)

Nouvel, 1954, p. 33, figs. 1-17; Pillai, 1961, p. 28, pl. 5, figs. A-M.

Frontal plate angular at the antero-median part, antero-lateral angles produced into curved spines. Thoracic limbs three to eight with six carpopropodal segments. Fourth pleopod of male very long, reaching far beyond the tip of telson, endopod very small, only half as long as the first segment of exopod, third segment of exopod with two long spines, the shorter of the two barbed and the longer spirally twisted. Telson with four lateral spines, narrowed part of telson one-third the total length, armed with fifty to fifty-five teeth. Endopod of uropod without spine below statocyst.

Length: 5.6 mm.*Distribution*: Ceylon and India.Genus *Acanthomysis* Czerniavsky

Ii, 1936, p. 588; Tattersall and Tattersall, 1951, p. 409; Ii, 1964, p. 464.

Antennal scale setose all around, long and narrow, with rounded apex. Carpopropodus of thoracic endopods three to eight three-segmented. Pleopods in female rudimentary unsegmented plates, in the male pleopods one to three and five as in female, fourth with unsegmented endopod, exopod long, two to three-segmented, terminating in two long barbed setae. Telson subtriangular, elongate, apex entire, lateral margins with a small number of proximal spines and a large number of distal ones, arranged in distinct series, apex of telson with one to two pairs of long spines.

This genus differs from *Neomysis* Czerniavsky in the apically rounded antennal scale. According to Tattersall and Tattersall (1951, p. 409) the absence of sternal processes in *Acanthomysis* may also be a generic difference.

1. Lateral border of telson with groups of small spines alternating with long ones....*indica*
Lateral border of telson with nearly uniform spines..... 2
2. Distal two-thirds of lateral border of telson spiny, apical spines similar and much longer than the last lateral spine.....*hodgarti*
Distal half of lateral border of telson spiny, apical spines dissimilar, only moderately longer than the last lateral spine..... 3
3. Second segment of exopod of fourth pleopod of male about one-fourth length of first segment, basal part of telson with a single pair of spines.....*anomala*

Second segment of fourth pleopod of male one-eighth length of first segment, basal part of telson with four pairs of spines.....*pelagica*

Acanthomysis indica (W. M. Tattersall)

(Fig. 86)

W. M. Tattersall, 1922, p. 483, fig. 20 (*Neomysis*); Pillai, 1957, p. 14, fig. 7 (*Neomysis*).

Telson slightly more than twice as long as broad, with a proximal group of three spines successively increasing in length and a distal group of about thirty spines showing a serial arrangement into groups of short spines alternating with long ones. Apex of telson with two to three pairs of long subequal spines, some of the spines near the apex may be blunt. Endopod of uropod with four to five spines below the statocyst.

Length: 7-8 mm.

Distribution: Andaman Islands, Gulf of Mannar, Mormugoa Bay and Arabian Sea.

Acanthomysis hodgarti (W. M. Tattersall)

(Fig. 87)

W. M. Tattersall, 1922, p. 486, fig. 31 (*Neomysis*).

Telson narrowly linguiform, lateral borders with up to twenty-eight comparatively small spines distributed at the distal two-thirds and slowly increasing in length, distal border rounded or subtruncate, with four comparatively very long spines nearly subequal in size. Exopod of fourth pleopod of male terminating in a single long seta. Endopod of uropod with a single spine below the statocyst.

Length: 7 mm.

Distribution: This species was collected from Borneo and hence is not an Indian species.

Acanthomysis pelagica (Pillai)

(Fig. 88)

Pillai, 1957, p. 15, fig. 8 (*Neomysis*).

Telson elongate-triangular, lateral borders armed with two sets of spines, a proximal set of four subsimilar spines and a distal set of about twenty spines regularly increasing in length, apex with two pairs of spines, outer of the two twice as long as the inner. Endopod of uropod with four spines just below the statocyst.

Length: 7 mm.

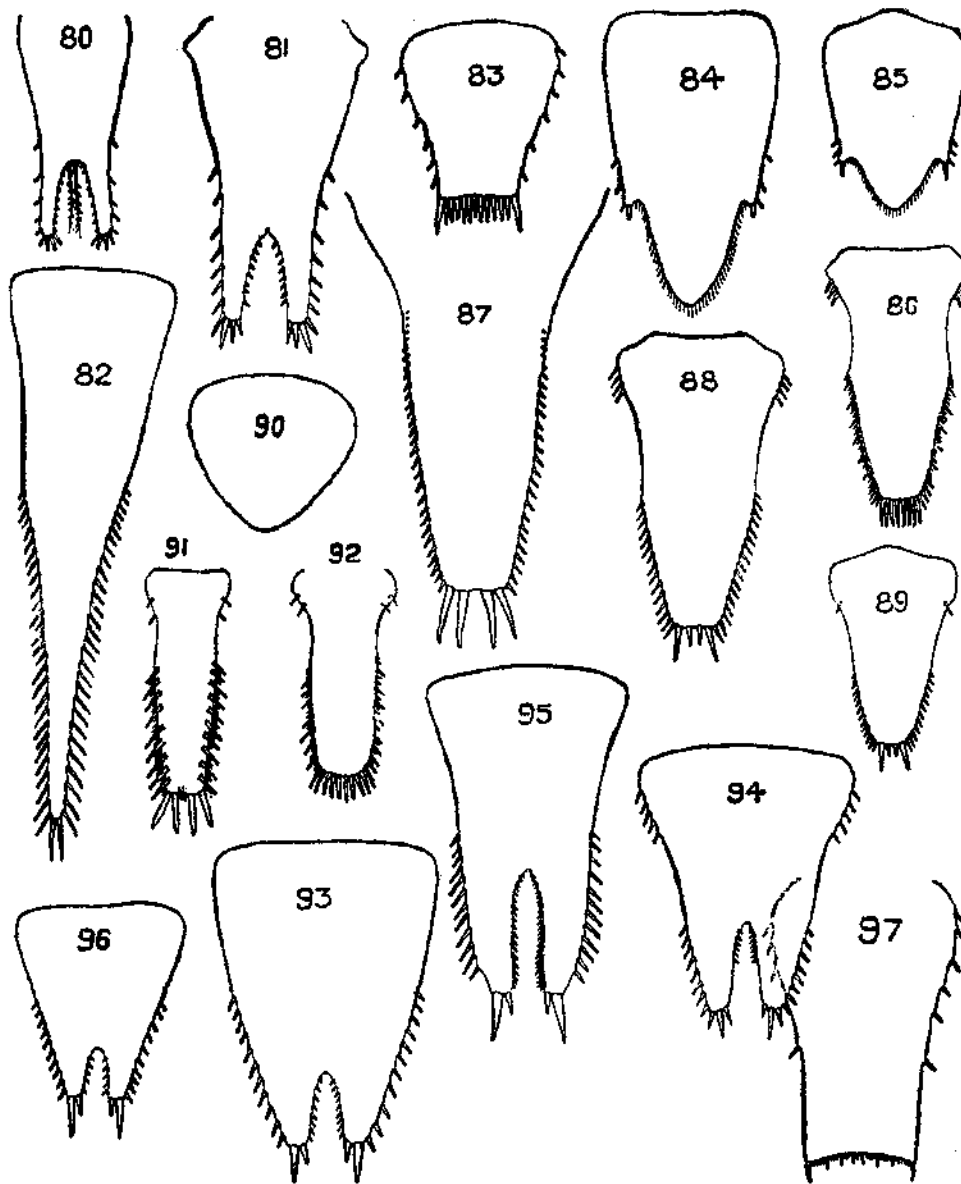
Distribution: Arabian Sea (Kerala coast).

Acanthomysis anomala Pillai

(Fig. 89)

Pillai, 1961, p. 26, pl. 4 A-L.

Carapace produced into a short apically rounded rostrum. Thoracic endopods three to eight short but strong, with three tarsal segments. Fourth pleopod of male barely reaching base of telson. Telson elongate-triangular, less than twice as long as broad, proximal part of lateral border with



FIGS. 80-97. (80) *Doxomysis quadrispinosa* (Illig) (after Hansen, 1912); (81) *Bathymysis varunae* Pillai (after Pillai, 1964); (82) *Thalassomysis sewelli* W. M. Tattersall (after W. M. Tattersall, 1939); (83) *Potamomysis assimilis* W. M. Tattersall (after W. M. Tattersall, 1908); (84) *Mesopodopsis orientalis* (W. M. Tattersall) (after W. M. Tattersall, 1908); (85) *Mesopodopsis zeylanica* Nouvel (after Pillai, 1961); (86) *Acanthomysis indica* (W. M. Tattersall) (after Pillai, 1957); (87) *Acanthomysis hodgarii* (W. M. Tattersall) (after W. M. Tattersall, 1922); (88) *Acanthomysis pelagica* (Pillai) (after Pillai, 1957); (89) *Acanthomysis anomala* Pillai (after Pillai, 1961); (90) *Idiomysis inermis* W. M. Tattersall (after W. M. Tattersall, 1922); (91) *Lycomysis spinicauda* Hansen (after Hansen, 1910); (92) *Lycomysis platycauda* Pillai (after Pillai, 1961); (93) *Heteromysis proxima* W. M. Tattersall (after W. M. Tattersall, 1922); (94) *Heteromysis zeylanica* W. M. Tattersall (after W. M. Tattersall, 1922); (95) *Heteromysis gymmura* W. M. Tattersall (after W. M. Tattersall, 1922); (96) *Heteromysis macropsis* Pillai (after Pillai, 1961); (97) *Indomysis annandalei* W. M. Tattersall (after W. M. Tattersall, 1914).

one to two pairs of spines, distal part with fifteen spines increasing in length distalwards, but some of the spines at irregular intervals short. Distal border of telson with two pairs of spines, outer pair very stout, more than twice as long as inner. Endopod of uropod with two to three spines below the statocyst.

Length: 6.0 mm.

Distribution: Arabian sea (Kerala coast).

Closely resembles *A. pelagica* but differs in the shape of the telson and the exopod of the fourth pleopod of the male.

Genus *Idiomysis* W. M. Tattersall

W. M. Tattersall, 1922, p. 488.

Body robust, characteristically flexed. Frontal plate large, broadly rounded. Eyes very large with short stalk. Male lobe on antennular peduncle well developed and densely hairy. Antennal scale very short and broad, without distal partition, greater part of outer border smooth, without apical spine. Exopod of second maxilla reduced in size. Tarsus of thoracic endopods three, four, six, seven and eight undivided, endopod of fifth limb longer than all the others, with two-jointed tarsus and prominent nail. Eighth endopod much reduced, shorter than exopod. Telson very short, a broad triangular unarmed plate. Uropods short and robust, subequal, without spines, statocyst large. Pleopods one to three and five of male small unjointed plates, fourth with a basal joint carrying a one-jointed endopod and large exopod terminating in a very long seta, annulose at the tip.

Idiomysis inermis W. M. Tattersall

(Fig. 90)

W. M. Tattersall, 1922, p. 489, figs. 23-24.

With the characters of the genus.

Length: 4 mm.

Distribution: Gulf of Mannar.

Genus *Lycomysis* Hansen

Hansen, 1910, p. 75; Li, 1964, p. 543.

Frontal plate short. Eyes very large. Antennal scale lanceolate, setose all around, with distal partition. Labrum anteriorly produced. Second segment of first thoracic endopod very long. Propodus of thoracic endopods three to eight divided into three subsegments, claw setiform. Pleopods one to three and five of male simple unjointed plates with prominent side lobe, fourth with exopod three-jointed and terminating in a very long seta. Endopod of uropod with a few spines in the region of the statocyst. Telson with two rows of spines, a dorsal marginal row of long spines and a ventral row of small spines.

Of the three species recorded within this genus *L. pusilla* Zimmer is the same as *L. spinicauda* Hansen.

1. Apex of telson subtruncate, with two pairs of long spines and a pair of very short spines
.....*spinicauda*
Apex of telson rounded, with five pairs of long spines, no median small spines....*platycauda*

Lycomysis spinicauda Hansen

(Fig. 91)

Hansen, 1910, p. 77, pl. 11, fig. 3; pl. 12, fig. 2; W. M. Tattersall, 1922, p. 492, fig. 25.

Antennal scale more than five times as long as broad, reaching the end of the antennular peduncle, terminal segment longer than broad. Endopod of uropod without spines. Telson two-and-a-half times as long as broad, dorsal row of lateral spines eleven to twelve, rapidly increasing in length, ventral row of spines small, apex with two pairs of long rather blunt spines and a median pair of small spines. Second segment of palp of mandible serrated.

Length: 4.2 mm.

Distribution: East Indies, China sea, Ceylon and Andaman Islands.

Lycomysis platycuada Pillai

(Fig. 92)

Pillai, 1961, p. 30, pl. 5, figs. N-R, pl. 6, figs. A-J;

Frontal plate broadly triangular. Eyes thick, as long as broad, stalk spiny. Antennal scale overreaching antennular peduncle, distal segment longer than broad. Endopod of uropod with four spines below the statocyst. Telson with basal part bulged and armed with two pairs of spines, lateral border of distal half with seven long dorsal spines and about fifteen small ventral spines, apex rounded, with five pairs of large subequal blunt spines.

Length: 6.6 mm.

Distribution: Arabian sea.

Tribe Heteromysini

Genus *Heteromysis* S. I. Smith

Tattersall and Tattersall, 1951, p. 414; O. S. Tattersall, 1962, p. 235; Ii, 1964, p. 568.

Antennal scale short, ovate, setose all around. Endopod of third thoracic limb massive and prehensile, carpopropodus stout and undivided, armed with strong spines, dactylus with stout long claw. Carpopropodus of thoracic endopods four to eight slender, subdivided. Pleopods of male rudimentary, as in female, simple unjointed plates. Telson triangular, apically cleft.

1. Peduncle of the eye with a process, proximal part of telson spiny *zeylanica*
Peduncle of the eye without a process, proximal part of telson not spiny 2
2. Cleft of telson a quarter of the total length of telson, with up to ten pairs of spines, antennal, scale as long as antennular peduncle 3
Cleft of telson one-third the total length of telson, with up to twenty-five pairs of spines, antennal scale longer than antennular peduncle *gymnura*
3. Cleft of telson with ten pairs of spines, endopod of uropod with one spine, cornea not narrower than peduncle *proxima*
Cleft of telson with five pairs of spines, endopod of uropod with eight spines, cornea narrower than peduncle *maropsis*

Heteromysis zeylanica W. M. Tattersall

(Fig. 94)

W. M. Tattersall, 1922, p. 499, fig. 27; O. S. Tattersall, 1962, pp. 236, 246.

Rostral plate triangular and apically rounded. Eyes short, peduncle with a prominent process, cornea narrower than peduncle. Antennal scale slightly shorter than peduncle. Carpopropodus of third thoracic endopod twice as long as broad, inner margin with four to five spines, penultimate segment small. Endopods four to eight four-segmented, nail setiform and curved. Telson one and one-fourth times as long as broad, cleft more than one-fourth the total length, proximal part of cleft with seven pairs of teeth, apex of each lobe with two spines, proximal part of lateral margin of telson with five spines, distal part with eight to nine spines. Inner margin of endopod of uropod with eleven stout spines. Third thoracic endopod in female less robust than in male.

Length: 4-6 mm.

Distribution: Gulf of Mannar, South Africa.

***Heteromysis gymnura* W. M. Tattersall**

(Fig. 95)

W. M. Tattersall, 1922, p. 500, fig. 28; O. S. Tattersall, 1962, p. 243, figs. 25-28.

Eyes large, cornea wider than stalk. Antennal scale longer than peduncle. Third thoracic endopod only moderately stout, carpus shorter than merus, with three distal inferior spines. Endopods of thoracic limbs four to eight with three tarsal segments. Telson one and three-fourth times as long as broad, cleft more than one-third the total length, with twenty-five pairs of closely packed teeth, distal part of lateral border of telson with twelve to fifteen pairs of spines. Endopod of uropod without spines.

Length: 4-6 mm.

Distribution: Gulf of Mannar and South Africa.

***Heteromysis proxima* W. M. Tattersall**

(Fig. 93)

W. M. Tattersall, 1922, p. 496, fig. 26; O. S. Tattersall, 1962, p. 236.

Eyes small, cornea narrower than peduncle. Antennal scale as long as peduncle. Third thoracic endopod massive, carpopropodus stout, longer than merus, its inner margin armed with three types of spines, stout apically truncate ones, slender spine-setae and simple spines, penultimate segment with an acute process, nail long and curved. Endopods four to eight with five-segmented tarsus. Telson less than one-and-a-half times as long as broad, cleft one-fourth the total length, armed with ten pairs of spines, lateral margin with ten to twelve spines at the distal half. Endopod of uropod with a single spine at the region of the statocyst.

Length: 6-7 mm.

Distribution: Gulf of Mannar.

***Heteromysis macropsis* Pillai**

(Fig. 96)

Pillai, 1961, p. 32, pl. 6, figs. K-S.

Carapace produced into a broadly triangular rostrum. Eyes large, with the cornea small and shifted to the antero-lateral part of the peduncle. Endopod of third thoracic limb massive, ischium and merus with a row of small setae on the inferior border, dactylus short, claw long and falcate. Endopods four to eight with five tarsal segments. Telson triangular, slightly longer than broad, distal half of lateral border with ten pairs of spines, lobes of telson with two pairs of spines, outer

pair much longer than inner, cleft one-fifth the length of telson, with five pairs of spines. Endopod of uropod with eight spines.

Length: 4-5 mm.

Distribution: Arabian Sea (Kerala coast).

REFERENCES

- ALCOCK, A. AND A. R. S. ANDERSON 1894. An account of a recent collection of deep sea Crustacea from the Bay of Bengal and Laccadive Sea. *J. Asiat. Soc. Bengal*, 63: 141-185.
- 1899. An account of the deep sea Crustacea dredged during the surveying season of 1897-98. *Ann. Mag. Nat. Hist.*, 3 (7): 1-27.
- ANDERSON, A. R. S. 1897. An account of the deep sea Crustacea collected during the season 1894-95. *J. Asiat. Soc. Bengal*, 65: 88-106.
- COIFMANN, L. 1936. Alcuni Misidacei nuovi raccolti dal Prof. L. Sanzo nella crociera della R. N. Ammiraglio Mag-naghi al Mar Rosso. *Bollett. Zool. Torino*, 6: 83-88.
- 1937. I Misidacei del mar Rosso. *R. Com. Talassogr. Ital. Mem.*, No. 233: 1-52.
- COLDI, G. 1920. Misidacei Raccolti Planctonischefatte Nave Liguria. 2: 229-260, 3 pls.
- DANA, J. 1850. Synopsis genus crustaceorum ordinis Schizopoda etc. *Amer. J., Sci.*, 9 (2): 129-133.
- HANSEN, H. J. 1910. The Schizopoda of the Siboga Expedition. *Siboga Exped. Monogr.*, 37: 1-123, 12 pls.
- 1912. The Schizopoda. Reports.....Albatross. *Mem. Mus. Comp. Zool. Harvard*, 35: 175-296, 16 pls.
- II, N. 1936. Studies on Japanese Mysidacea-I. *Jap. J. Zool. Tokyo*, 6: 577-619.
- 1964. *Fauna Japonica Mysidae*. 1-610, 154 figs.
- ILLIG, G. 1906. Bericht über die neuen Schizopodengattungen und arten der Deutschen Tiefsee Expedition. *Zool. Anz.*, 30: 194-211.
- 1930. *Die Schizopoden der Deutsche Tiefsee Expedition Valdivia*, 22: 399-625.
- NOUVEL, H. 1954. Description d'un mysidace nouveaux de Ceylon, *Mesopodopsis zeylanica* n. sp. *Zool. Meded.*, 33: 33-39.
- 1959. Mission Robert Ph. Dollfus en Egypte. 29. Mysidacea. *Scient. Res.*, 195-240.
- PILLAI, N. K. 1957. Pelagic Crustacea of Travancore. 1. Schizopoda. *Bull. Res. Inst. Univ. Travancore*, 5: 1-28.
- 1961. Additions to the Mysidacea of Kerala. *Ibid.*, 8: 15-35, 6 pls.
- 1963. A redescription of *Diopromysis perspicillata* Zimmer. *Ibid.*, 1: 9-14.
- 1964 a. Description of a new species of *Bathymysis* with a revised definition of the genus. *J. Mar. biol. Ass. India*, 5: 263-268.
- 1964 b. On a new mysid from the inshore waters of the Kerala coast. *Ibid.*, 5: 258-262.
- 1964 c. Report on the Mysidacea in the collections of the Central Marine Fisheries Research Institute, Mandapam Camp, South India. Part 1. *Ibid.*, 6: 1-41.
- AND T. MARIAMMA 1964. On a new lepidomysid from South India. *Crustaceana*, 7: 113-124.
- SARS, G. O. 1885. Report on the Schizopoda collected by H.M.S. Challenger during the years 1873-1876. *Sci. Rep. Voyage of H.M.S. Challenger, Zool.*, 13: 1-228, 1-38 pls.
- TATTERSALL, O. S. 1952. Report on a small collection of Mysidacea from estuarine waters of South Africa. *Trans. Roy. Soc. S. Africa*, 33: 153-187.
- 1955. Mysidacea. *Discovery Reports*, 28: 1-190.

- TATTERSALL, O. S. 1957. Report on a small collection of Mysidacea from the Sierra Leone estuary together with a survey of the genus *Rhopalophthalmus* Illig and a description of a new species of *Tenagomysis* from Lagos Nigeria. *Proc. Zool. Soc. London*, 129: 81-128.
- 1962. Report on a small collection of Mysidacea from South African off-shore and coastal waters (1957-59) and from Zanzibar (1961). *Ibid.*, 139: 221-247.
- TATTERSALL, W. M. 1906. Report on the Leptostraca, Schizopoda and Stomatopoda collected by Prof. Herdman at Ceylon in 1902. *Rep. Ceylon Pearl Oyster Fish. Rep. London*, Pt. 5: 157-188, 3 pls.
- 1908. The fauna of the brackish water ponds at Port Canning, lower Bengal. Pt. 11. Two new Mysidae from brackish water in the Ganges delta. *Rec. Ind. Mus.*, 2: 233-239, 2 pls.
- 1914. Further records of Indian brackish water Mysidae with descriptions of a new genus and species. *Ibid.*, 10: 75-80, 2 pls.
- 1915. Fauna of the Chilka lake. The Mysidacea of the lake with the description of a new species from the coast of Orissa. *Mem. Ind. Mus.*, 5: 149-161.
- 1922. Indian Mysidacea. *Rec. Ind. Mus.*, 24: 445-546.
- 1936. Mysidacea and Euphausiacea. *Gt. Barrier Reef. Exped., Sci. Rep.*, 5: 143-176.
- 1939. *The Euphausiacea and Mysidacea of the John Murray Expedition to the Indian Ocean*, 5: 203-246.
- 1951. A review of the Mysidacea of the United States National Museum. *Bull. U.S. Nat. Mus.*, No. 201, 1-292.
- AND O. S. TATTERSALL 1951. *The British Mysidacea*, Ray Society, London, No. 136, 1-460.
- WOOD-MASON, J. AND A. ALCOCK 1891. Note on the results of the last season deep sea dredging. *Ann. Mag. Nat. Hist.*, 7 (6): 186-202.
- 1891 a. On the results of deep sea dredging during the season 1890-91. *Ibid.*, 8 (6): 268-286.
- ZIMMER, C. 1915. Schizopoden des Hamburger Naturhistorischen (Zoologischen) Museums. *Mitth. Nat. Mus. Hamburg*, 32: 159-182.
- 1916. Beiträge zur Kenntnis der Meeresfauna Westafrikas. Crustacea 4. Cumacea und Schizopoda. Hamburg, 55-66.