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BENGAL :—Bengal Secretariat Book Depôt, Writers' Buildings, Room No. 1, Ground Floor, Calcutta.  
UNITED PROVINCES OF AGRA AND OUDH :—Superintendent of Government Press, United Provinces of Agra and Oudh, Allahabad.  
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CENTRAL PROVINCES AND BERAR :—Superintendent, Government Printing, Central Provinces, Nagpur.  
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Chukervetty, Chatterjee & Co., Ltd., 13, College Square, Calcutta.  
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James Murray & Co., 12, Government Place, Calcutta.  
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Ray Chaudhury & Co., 68-5, Ashutosh Mukherji Road, Calcutta.  
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Chatterjee & Co., 3-1, Bacharam Chatterjee Lane, Calcutta.  
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Kamala Book Depôt, Ltd., 15, College Square, Calcutta.  
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P. C. Sarkar & Co., 2, Shama Charan De Street, Calcutta.  
\* Bengal Flying Club, Dum Dum Cantt.  
Kali Charan & Co., Municipal Market, Calcutta.  
N. M. Roy Chowdhury & Co., 11, College Sqr., Calcutta.  
Granthi Mandir, Cuttack.  
B. C. Basak, Esq., Proprietor, Albert Library, Dacca.  
Higginbothams, Madras.  
Rochouse and Sons, Madras.  
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N. M. Tripathi & Co., Booksellers, Princess Street, Kalbadevi Road, Bombay.  
New and Secondhand Bookshop, Kalbadevi Road, Bombay.  
J. M. Pandia & Co., Bombay.  
A. H. Wheeler & Co., Allahabad, Calcutta and Bombay.  
Bombay Book Depôt, Girgaon, Bombay.  
Bennett, Coleman & Co., Ltd., The Times of India Press, Bombay.  
The Popular Book Depôt, Bombay.  
Lawrence & Mayo, Ltd., Bombay.  
The Manager, Oriental Book Supplying Agency, 15, Shukrawar, Poona City.  
Rama Krishna Bros., Opposite Bishrambag, Poona City.  
S. P. Bookstall, 21, Budhwar, Poona.  
International Book Service, Poona 4.  
Mangaldas & Sons, Booksellers and Publishers, Bhaga Talao, Surat.  
The Standard Book and Stationery Co., 32-33, Arbab Road, Peshawar.  
The Students Own Book Depôt, Dharwar.

Shri Shankar Karnataka Pustaka Bhandara, Malamuddi, Dharwar.  
The English Book Depot, Ferozepore.  
Frontier Book & Stationery Co., Rawalpindi.  
\* Hossenbhoy Karimji and Sons, Karachi.  
The English Bookstall, Karachi.  
Rose & Co., Karachi.  
Keale & Co., Karachi.  
Ram Chandra & Sons, Ambala, Kasauli.  
The Standard Bookstall, Quetta and Lahore.  
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J. Ray & Sons, 43, K. & L., Edwardes Road, Rawalpindi, Murree and Lahore.  
The Standard Book Depôt, Lahore, Nainital, Mussoorie, Dalhousie, Ambala Cantonment and Delhi.  
The North India Christian Tract and Book Society, 18, Clive Road, Allahabad.  
Ram Narain Lal, Katra, Allahabad.  
"The Leader" Allahabad.  
The Indian Army Book Depôt, Dayalbagh, Agra.  
The English Book Depôt, Taj Road, Agra.  
Gaya Prasad & Sons, Agra.  
Narain & Co., Meston Road, Cawnpore.  
The Indian Army Book Depôt, Jullundur City, Daryaganj, Delhi.  
Manager, Newal Kishore Press, Lucknow.  
The Upper India Publishing House, Ltd., Literature Palace, Ammuddaula Park, Lucknow.  
Rai Sahib M. Gulab Singh & Sons, Mufid-i-Am Press, Lahore and Allahabad.  
Rama Krishna & Sons, Booksellers, Anarkali, Lahore.  
Students Popular Depôt, Anarkali, Lahore.  
The Proprietor, Punjab Sanskrit Book Depôt, Saldmitha Street, Lahore.  
The Insurance Publicity Co., Ltd., Lahore.  
The Punjab Religious Book Society, Lahore.  
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The University Book Agency, Kachari Road, Lahore.  
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S. C. Talukdar, Proprietor, Students & Co., Cooch Behar.  
The Manager, The Indian Book Shop, Benares City.  
Nandkishore & Bros., Chowk, Benares City.  
The Srivilliputtur Co-operative Trading Union, Ltd., Srivilliputtur (S. I. R.).  
Raghunath Prasad & Sons, Patna City.  
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S. Krishnaswamy & Co., Teppakulam P. O., Trichinopoly Fort.  
Standard Book and Map Agency, Book Sellers and Publishers, Ballygunge.  
Karnataka Publishing House, Bangalore City.  
Bheema Sons, Fort, Bangalore City.  
Superintendent, Bangalore Press, Lake View, Mysore Road, Bangalore City.

AGENT IN PALESTINE :—Steinmatzky, Jerusalem.

\* Agents for publications on aviation only.

The Report may be bound as Appendix A to Vol. XXXIV  
of the “ *Records of the Indian Museum* ”.

# Report on the Zoological Survey of India for the years 1929-30, 1930-31 & 1931-32.

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## INTRODUCTION.

With the exception of the report for the year 1916-17, which dealt with the work of the newly founded Zoological Survey of India during the previous year, the succeeding reports have all been triennial and have dealt with the work of the Zoological Survey of India during the periods under review. As was pointed out by Lt.-Col. R. B. Seymour Sewell, Director of the Zoological Survey, in his triennial report for the years 1926-29, "the work of the Zoological Survey of India has been steadily progressing and extending" It is, therefore, unfortunate to have to present a report for the period 1929-32 which can hardly be described as an account of the progress of the work of this comparatively young department. During the years 1929-30 and 1930-31 the work of the department was progressing steadily, though not at the rate at which it had been anticipated when the last triennial report was presented, but as a result of the unfortunate financial depression in the country the final year of the period under review has been a particularly critical one in the history of the Zoological Survey of India. In pursuance of the scheme of retrenchment in the Civil expenditure during the year 1931-32 the annual grant of the department was very materially reduced and as a result its activities have had to be considerably curtailed. Indeed, at the present time, its work may be summarised as that of conservation and preservation of the material and information collected since the foundation of the department in 1916 and prior to that by the Natural History Section of the Indian Museum since 1875, rather than of carrying out both extensive and intensive surveys of the fauna of the vast area of India.

2. During the first two years of the period under review the "friendly collaboration either with research institutions or purely educational bodies" referred to in the previous triennial reports steadily increased, and it was generally being recognised more and more by other institutions and Provincial governments that the Zoological Survey can help materially in connexion with any enquiries of a zoological nature that are referred to this department.

3. During the period under review the department has, in addition to numerous minor enquiries, been asked for advice about (1) the shell fisheries in the Andamans and their economic exploitation, (2) the identification of monkeys, rats, Cyclops and other animals for the Cal-

cutta School of Tropical Medicine, together with references to relevant literature in a number of instances in connection with the research work of that institution, (3) supervision in connexion with the excavation and identification of the human and animal remains at Harappa and Mohenjo-daro, and (4) anthropological work connected with the Census operations.

4. It is not necessary to consider in detail the work which this department has had to do in reference to the identification of various kinds of animals for the Calcutta School of Tropical Medicine, the Harcourt Butler Institute of Public Health, Rangoon, the Bombay Natural History Society and other Institutions all over India.

5. The supervision in connexion with the excavation and identification of the human and animal remains at Harappa and Mohenjo-daro has entailed a great deal of work on the Anthropologist and other officers of the department. The amount of work which still remains to be done is fairly large and will take the officers of the department several years before the results can be completed. Details of the Anthropological work in connexion with the Census Operations are given further on and I need only remark here that the work done under the supervision of the Anthropologist of this department will make the forthcoming Census Report much more valuable and complete than the previous Reports.

6. Early in 1930 it was found that fishing for *Trochus* shells had been carried on surreptitiously by Japanese divers coming over to the Andamans in motor boats from Singapore, and at the instance of the then Chief Commissioner, Lt.-Col. M. L. Ferrar, investigations were started by Dr. S. L. Hora and myself for devising means of conserving the fishery and making it into a source of permanent income to the Andaman Administration. After the preliminary investigations referred to above further work was continued by two of the assistants of the department and later by Dr. S. B. Setna, Ph.D., Officiating Assistant Superintendent. Dr. C. Amirthalingam, who was specially appointed as the Research Officer, Andaman Fisheries, started work at Port Blair on the 22nd June 1931. His investigations have mainly been directed to the investigation of the scientific aspects of the various phases in the life-history of the *Trochus*, popularly known as the Top or Pagoda shell. The work which the officer has done has consisted primarily in the charting of the shell-beds in the area, investigations regarding the biology of the mollusc, *Trochus niloticus*, its age of maturity, its breeding season, the season and rate of growth of its shell, and finally, its enemies. A short period of roughly one year is not sufficient for all these problems to be worked out in detail, but Dr. Amirthalingam has achieved certain definite results. In reference to this mollusc he has found that it reaches maturity when about 2 years old; at this stage the shells are approximately 6-7 cm. in diameter. The breeding season of this animal in the Andaman waters appears to extend from April to June, *i.e.*, during the hot months. After careful observation it has been ascertained that it grows during the monsoon and winter months, *i.e.*, from July to February or even March. The rate of growth is 2-3 cm. in height per annum for the first 3-4 years, but later the rate

becomes much slower. Investigations have also been made regarding the biology and the enemies of this gastropod. The economic results of the enquiry are very gratifying. As a result of the modifications in the regulations governing the issue of licenses for the shell-fishing, the royalty for fishing has increased from Rs. 13,114-8-0 in 1929-30 to Rs. 17,920 in 1931-32. Dr. Amirthalingam has also done very useful work in connexion with the drawing up of regulations for fishing (*sensu stricto*) and the sale of fish in the Andaman and Nicobar waters.

7. No greater compliment could have been paid to the biological and the survey work carried on by the staff of the department since its foundation than the fact that for the three important oceanographical and biological expeditions planned or sent out from England during the last decade the leaders of the expeditions should have been selected from the staff of the Zoological Survey of India. The three expeditions are (i) the "Discovery Expedition" to the South Seas for the investigations of the Whale Fisheries, of which Dr. S. W. Kemp, the then Superintendent of the Zoological Survey of India, was selected as leader in 1923, (ii) the "Oxford University Expedition" to the forests of British Guiana in South America of which Major R. W. G. Hingston, who was for a time the Surgeon-Naturalist and an *ex-officio* member of the staff of the Zoological Survey of India, was the leader, and (iii) the "John Murray Oceanographical Expedition" to the Arabian Sea and the Persian Gulf, the leadership of which has been offered to Lt.-Col. R. B. Seymour Sewell. A further recognition of the work of the Zoological Survey is the change initiated in the policy of the work of the Natural History Museum, South Kensington, London. The Trustees on the recommendation of the authorities of the Museum have started sending the workers in the Museum on special expeditions for working in the field and thus gaining a first-hand knowledge of the groups of animals on which they are working. This policy had been adopted by the late Dr. N. Annandale, the first Director and founder of the Zoological Survey of India, in connexion with the work of the Natural History Section of the Indian Museum as early as 1907, and later with the foundation of the Survey in 1916, survey work in the field became an essential part of the duties of the officers of the department.

#### STAFF.

8. The temporary appointment of the Anthropologist referred to in the triennial report for 1926-29 was included in the permanent cadre of the Zoological Survey on 28th June 1929, and Dr. B. S. Guha was confirmed in this post. The post of the Anthropologist is one of the appointments of Assistant Superintendents sanctioned for the department in 1922, some of which for various reasons have not been filled up so far. During the period under review the post of the Surgeon-Naturalist, which hitherto was held by an officer of the Indian Medical Service jointly lent to the Royal Indian Marine and the Zoological Survey of India, was definitely transferred to the cadre of the Zoological Survey, but as a measure of economy the post has not been filled

up. It may here be remarked that there has been no Surgeon-Naturalist or Naturalist as he will be termed hereafter, on board the R. I. M. S. "Investigator" since 1926.

9. At the commencement of the period under review, Lt.-Col. R. B. Seymour Sewell, Director, Zoological Survey of India, was away on combined leave from the 23rd March 1929 to 9th January 1930, during which period I officiated as Director. Part of this leave Col. Sewell spent in study at the British Museum, London, working out the collections of Copepods from the Indian Ocean—a subject on which he had been engaged for several years. Col. Sewell again went on leave on the 21st September 1931 and is not due to return to India till the 21st September 1932. Meanwhile the post of Director has, as a measure of economy, been held in abeyance, and I have been holding charge of the entire department in my capacity as Superintendent.

10. While on leave out of India for 7 months in 1930, I was deputed by the Government of India to the United States of America for a period of 4 months to study museum administration and the Natural History Museums in the United States. I was also placed on deputation from the 1st to the 7th of June 1930 to attend the International Ornithological Congress at Amsterdam.

11. Dr. S. L. Hora officiated as Superintendent, Zoological Survey of India, during the absence of Lt.-Col. R. B. Seymour Sewell, Director, on leave and later when I was away on leave in Europe. He was on combined leave from 7th April 1931 in Europe and during this period worked in various Natural History Museums in Europe studying the types and original specimens of different families of fishes.

12. Dr. B. N. Chopra, Dr. Hem Singh Pruthi and Dr. B. S. Guha were on continuous duty during the period under review and did not take any long leave.

13. Dr. H. S. Rao was away on combined leave in Europe for 15 months from 4th June, 1929. He spent almost the whole of this time working in various Natural History Museums and Marine Biological Stations in Europe. The experience gained by him as a result of this work should prove of great value to the department. Dr. Rao again took leave for one month from 2nd January 1932.

14. Dr. Mohammad Sharif was appointed in the leave vacancy caused by Dr. H. S. Rao's proceeding on leave and continued to act in this vacancy till the 2nd July 1930. He was on leave for two months and one day from the 3rd July 1930 before the termination of his service.

15. Dr. S. B. Setna, Ph.D., was appointed in the chain of my leave vacancy on 28th April 1930 and continued to act in this vacancy till 10th March 1931. During the major part of his tenure he was engaged on useful work connected with the Andaman fisheries.

16. As has been mentioned already, the Government of India in 1930 sanctioned a special Research Officer for the Andaman fisheries, and Dr. C. Amirthalingam, Ph.D., was selected by a specially constituted committee in London. He joined service on 22nd May 1931

and has been working since his appointment in the Andamans. As a measure of economy the post of the Andaman Fishery Research Officer, which was sanctioned in the first instance for 5 years, was brought under reduction from 8th June 1932, and Dr. Amirthalingam in accordance with his contract was served with six months' notice of discharge from 8th December 1931. Later his service was extended for one month and he retired from his present appointment on 8th July 1932.

17. I append below a statement showing the leave taken by various officers during the period under review.

*Leave Statement.*

|                                                     |                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lt.-Col. R. B. Seymour Sewell, I.M.S., Director     | Leave on average pay from 23rd March 1929 to 9th January 1930.<br>Leave on average pay for 8 months and on half average pay for 4 months from the 21st September 1931.                                                                                                   |
| Dr. Baini Prashad, Superintendent                   | Leave on average pay for 7 months from 8th April 1930 with permission to be on deputation in the United States of America for 4 months in interruption of the leave. Also placed on deputation to the International Ornithological Conference from 1st to 7th June 1930. |
| Dr. S. L. Hora, Assistant Superintendent            | Leave on average pay for 6 months combined with study leave for 2 months and 17 days from the 7th April 1931.                                                                                                                                                            |
| Dr. H. Srinivasa Rao, Assistant Superintendent      | Leave on average pay for 8 months combined with study leave for 7 months from 4th June 1929.<br>Leave on average pay for 1 month from 2nd January 1932.                                                                                                                  |
| Dr. M. Sharif, Officiating Assistant Superintendent | Leave on average pay for 22 days from 14th September 1929.<br>Leave on half average pay for 2 months and 1 day from the 3rd July 1930.                                                                                                                                   |

18. Amongst the Superior Non-Gazetted staff I would particularly like to record the very good work done by Babu A. C. Chowdhury and Babu Sib Chandra Mondul, the two senior artists of the department, who have earned an international reputation for the work they have done for the department during the last 35 years. Both of them, though they had reached the maximum age limit were kept on in the department, as both of them, in spite of their age, were still capable of doing work of exceptional merit, and it was found impossible to replace them. I would also like to record here the good work done by Mr. R. A. Hodgart, the Zoological Collector, and Babu J. N. Bagchi, the Head Clerk, both of whom had to retire prematurely in pursuance of the scheme of retrenchment.

## FIELD WORK.

19. In accordance with the general policy of the work of the department every officer, as far as possible, used to spend 2-3 months in the field every year. Special tours were arranged as opportunity offered and so far as funds permitted. The policy of revisiting from time to time areas previously surveyed, to complete the faunistic results or to extend biological information already obtained, has also been followed.

20. Two important tours were undertaken during the year 1929-30, one being to Chitral in connexion with the visit of Dr. George Morgenstierne, who had applied to the Government of India, through the Norwegian Institute for Comparative Research in Human Culture, for permission to proceed to Chitral to carry out a linguistic survey of that area. He was accompanied by a zoologist, Dr. B. N. Chopra, and the Anthropologist, Dr. B. S. Guha, from the Zoological Survey. A very interesting collection, both of the fauna and of the ethnographical objects, was obtained and measurements of a fair number of the inhabitants of the country were taken. The second important tour during the year 1929-30 was a survey of the Eastern Ghats in collaboration with the Bombay Natural History Society. Large collections of the invertebrate and vertebrate fauna of the area were brought back ; parts of these have already been worked out in the laboratories of this department and by specialists abroad, and incorporated in the reserve collections.

21. In 1930-31 the tours were mainly restricted to investigations in connexion with the study of the fauna of the hill-streams under the direction of Dr. S. L. Hora. A party was sent to the Salt Range in the Punjab to study the fauna in the streams that commence as freshwater, but during their flow through salt-bearing regions gradually become strongly saline. Tours in connexion with the investigations regarding the changes that occur in the fauna of streams and rivers as the waters changes from fresh through brackish to salt, were undertaken in various localities along the course of the Hooghly where the admixture of fresh water with the sea water brought in by the tides produces a great deal of change both in the *milieu* and on the biological conditions governing the life of the animals living under such varying conditions.

22. The field investigations of the Survey during the year 1931-32 were very materially restricted as a result of the greatly reduced funds, a great reduction in the staff and the reorganisation of the work of the department on a maintenance basis. During the year under review two of the officers, Lt.-Col. R. B. Seymour Sewell and Dr. H. Srinivasa Rao worked in the Western Ghats in connexion with the problem of the freshwater Medusa, *Limnocyclus*, and a fair amount of valuable information regarding the life-history of this archaic animal was obtained as a result of this investigation. Further investigations on the fauna and biological conditions in the saline waters of the Salt Range were carried out by Dr. Hem Singh Pruthi, and the results of his investigations which have added materially to our knowledge of the biono-

mics of the freshwater animals living under such varying conditions of salinity, are ready for the press. Tours were also undertaken in connexion with further investigations on the changes in the salinity and of the animal life in the waters of the Hooghly referred to in the tours for 1930-31. The work which the Survey has been doing for sometime past on the animal life of the backwaters was further extended under the guidance of Dr. B. N. Chopra to the backwaters to the north of Calicut and Bangalore on the western coast of India.

23. During the period under review several officers of the department worked in the Andamans from time to time in connexion with the investigations of the *Trochus* fishery and the biological conditions governing the life of this mollusc in the Andaman waters. Preliminary investigations were carried out by Dr. S. L. Hora and myself and further work was done by Col. Sewell, Dr. S. B. Setna and the assistants, Babu D. D. Mukerji and Babu K. N. Das. Since the appointment of the special Fishery Research Officer this work has been carried out by Dr. C. Amirthalingam, who made extensive tours in the Archipelago and as far as possible ascertained the extent and nature of the shell-beds in the area.

24. Dr. B. S. Guha's tour to Chitral has been casually mentioned above. During this trip Dr. Guha paid special attention to a study of the anthropology of the very interesting race of Kaffirs of that region. The Kaffirs are being rapidly converted to Islam and all their ancient rites and customs are dying out. Two villages of the Kaffirs were visited by Dr. Guha during his tour and information regarding the various rites and institutions of the Kaffirs was, as far as possible, recorded. Dr. Guha further took anthropometrical measurements of nearly 800 people of almost all the major racial groups represented in the area. It is hoped that the results, when completely worked out, will prove of special importance in reference to the racial constitution of the people of Northwestern India. In connexion with the Census operations the services of Dr. Guha were, with the approval of the Government of India, lent for a time to the Census Department. Dr. Guha on behalf of this department visited Gujrat, Kathiawar, Poona, Orissa, the Indian States of Bhavnagar, Indore, Birwani, Rewa, Hyderabad, Mysore and Cochin, the Portuguese Goa and various parts of the Madras Presidency. During his tours he took anthropometrical measurements and secured photographs of a very large number of inhabitants of the various parts of the country visited by him; the data collected by him are now being worked out in the laboratories of the department.

#### RESEARCH WORK IN THE LABORATORIES.

25. The satisfactory extent of the research work carried out by the officers of the department during the period under review is clearly indicated by the number of papers they have published (*vide* Appendix I). As Col. Sewell noted in his remarks in the report for the years 1926-29, the major part of his time during his tenure as Director had to be devoted to the routine duties connected with the administration of the department and to the editing of the departmental publications.

Since Col. Sewell went on leave the administration of the department has become especially heavy. The reorganisation of the department, as a result of the scheme of retrenchment, has involved much extra work not only in the office but also in connection with the proper upkeep of the various collections and the issue of the publications of the department. In this work I was materially assisted by Dr. B. N. Chopra and Dr. H. S. Rao.

26. During the period under review several papers received from outside sources both in this country and abroad have had to be carefully edited and in several cases almost entirely re-written before they could be published. All this has entailed a great deal of labour, but the time spent on this work has greatly enhanced the value of the contributions for the zoological workers in this country.

27. In 1929 the first part of Col. Sewell's monographic work on the Copepoda of the Indian seas was published as part I of Vol. X of the "Memoirs of the Indian Museum". In this work the author, besides dealing with the species which he had studied himself, has included references to the Indian species and made the memoir as complete as possible. The second part of this monograph is in the press and will be published shortly. In addition to the above, Col. Sewell's Presidential Address to the 18th Session of the Indian Science Congress, entitled "Problems of Evolution", his paper on the *Cercarie Nicobaricae* published in the "Indian Journal of Medical Research", and his contributions on the human and animal remains from Mohenjo-daro and Harappa, in collaboration with Dr. B. S. Guha, published in Sir John Marshall's memorable volumes on Mohenjo-daro, are to be specially noted.

28. During the period under review I was invited by the editor of the "Fauna of British India" to contribute a volume on the Indian Pelecypods to the "Fauna" series. A great deal of work in this connexion has already been done and the work which I had been doing on the Pelecypods of the Dutch East Indies (a volume on the results of this work has been in the hands of printers for over a year, and is expected to be issued during the current year) has greatly advanced the work in connexion with the "Fauna" volume. Reference may also be made to a series of four papers entitled "A Revision of the Asiatic Species of the Genus *Corbicula*" published in Vol. IX of the "Memoirs of the Indian Museum". Other contributions by me on the Indian Fauna were published in the "Records of the Indian Museum", the "Records of the Geological Survey of India", the "Journal of the Bombay Natural History Society", the "Proceedings of the Malacological Society of London" and the "Proceedings of the Royal Society of Edinburgh".

29. The work done by Dr. S. L. Hora on the Ecology, Bionomics and Evolution of the torrential fauna was published during the period under review in the "Transactions of the Royal Society of London". This work, which was presented as a thesis for the D. Sc. Degree of the Edinburgh University, is of very great importance. It is the result of several years' work in the field, in the laboratories of the department

and later in the Zoological Department of the Edinburgh University. In addition to the above Dr. Hora has published several small contributions on fishes from different parts of India. For sometimes past he has been engaged in working out the collections made by the Dutch Karakorum Expedition and the fish collected in Chitral.

30. Dr. B. N. Chopra, the Carcinologist, has been working on the Crustacean collections in the Indian Museum and has published a number of valuable papers on various families of shrimps and crabs in a series entitled "Further Notes on Crustacea Decapoda in the Indian Museum."

31. As has been remarked already, Dr. H. Srinivasa Rao during his combined leave worked in various European Museums studying the collections of Sponges from the Indian Ocean, and a paper by him, in collaboration with Mr. M. Burton of the British Museum, entitled "On a Revision of Indian Sponges" is now in the press. In addition he has published several papers on various groups of invertebrates.

32. The first part of the "Revision of Indian Jassids" by Dr. H. S. Pruthi was published as No. 1 of Vol. XI of the "Memoirs of the Indian Museum" Other parts of the series are in course of preparation. He has also been devoting special attention to Experimental Zoology and has published a paper in the "Indian Journal of Medical Research" on the influence of temperature and hydrogen-ion concentration on mosquito larvae, and another paper on the causes leading to fish mortality in the Museum tank. This latter work, which was published in "*Int. Revue Hydrob. u. Hydrog. Leipzig*", is of special importance in connexion with our knowledge of the several important problems in regard to the biology, distribution and mutual relationships of the various elements of freshwater faunas. It is a well recognised fact that the study of the environments in which various animals live is essential for systematic work, and Dr. Pruthi's investigations of the biological conditions in the Indian Museum tank have greatly advanced our knowledge of the ecology of such areas. The adaptation of marine faunas to freshwater conditions and *vice versa* has a very important bearing on the theory of evolution in reference to the origin of different faunas. We are fairly well-informed about the faunas of the sea coasts and the estuaries, but very few inland streams, the water of which is highly saline, have been investigated from this point of view. Dr. Pruthi's investigations of the highly brackish streams in the Salt Range in the Punjab, the results of which are ready for the press, have materially advanced our knowledge of the conditions which govern the animals living in such areas.

33. Dr. M. Sharif who worked as an Officiating Assistant Superintendent in the department for several years, published a paper on Indian Fleas and this paper together with the one on Indian Ticks published by him previously, served as a thesis for the D.Sc. Examination of the University of the Punjab in 1930.

34. The assistants, Messrs. S. Ribeiro, D. D. Mukerji, J. L. Bhaduri, K. N. Das and M. N. Datta have also published several useful papers either by themselves or in collaboration with the officers under whom they are working.

35. The progress of the research work in the Anthropological Section has been very satisfactory. A number of reports by Col. Sewell and Dr. B. S. Guha on the skulls discovered by Sir Aurel Stein in Mekran and those first found at Mohenjo-daro has already been published and the work on the second find of skeletons from Mohenjo-daro and Harappa is now in progress. In addition, some work has also been done on the skulls discovered by Sir John Marshall at Taxilla and by Mr. Ghose at the Mauryan site at Bulandibag near Patna. At the suggestion of Dr. J. H. Hutton, Census Commissioner for India, Dr. Guha has carried out anthropological investigations on the inhabitants of various parts of India. Several thousand subjects have been measured and a great mass of data collected. These are being biometrically analysed by three statisticians under Dr. Guha's supervision, and it is hoped that the publication of the results, when fully worked out, will supply at least some information regarding the origins and relationships of the inhabitants of different parts of India.

36. In 1931 a new publication sanctioned by the Government of India was started under the title "Anthropological Bulletins from the Zoological Survey of India" The first part of this publication, which was issued in 1931, deals with the human relics recovered by the Naga Hills (Burma) Expedition for the abolition of Human Sacrifice during 1926-27. It is a joint work by Dr. B. S. Guha and Mr. P. C. Basu, a research scholar in Anthropology of the Government of Bengal. Other numbers of this series are being prepared and will be issued when ready.

37. Two distinguished Zoologists, Dr. A. S. Pearse of the Duke University, Durham, North Carolina, and Dr. Percy Moore of the University of Philadelphia, worked in the laboratories of the department for several months on special biological problems.

#### GALLERIES.

38. In the last triennial report Col. Sewell drew attention to the deplorable condition of the zoological (vertebrate) galleries in the Indian Museum. Unfortunately owing to lack of funds very little progress has been made either in the rearrangement of the galleries or the introduction of new exhibits. The old Fish Gallery was entirely dismantled and reconstructed by remodelling the old cases without much additional expenditure. Most of the old exhibits, models, stuffed and spirit specimens have been replaced in the newly arranged gallery by fresh material. Unfortunately owing to the very limited space, this gallery is very congested and consequently a small number of exhibits only can be accommodated in the rearranged gallery. Exhibits illustrating the development and parental care of fishes, fishes of hill-streams and those inhabiting streams of high altitudes, as also peculiar deltaic forms, special types of fishes found in the Burmese and Assamese lakes and useful and poisonous fishes have in addition to the usual systematic exhibits been placed in the new gallery. The rearrangement, however, is a purely make-shift one and will have to be greatly modified when sufficient funds are available. A certain amount of rearrangement and

replacement of the old and deteriorated exhibits in the mammal galleries has also been carried out during the period under review, but with the very greatly reduced staff in the taxidermist department it will not be possible to carry out the scheme of reorganisation which had been prepared for the bird and mammal galleries. Work in these galleries will hereafter, with the small staff available, be confined to maintenance and, as far as possible, to replacement of some of the exhibits from time to time.

39. The rearrangement and cataloguing of the collections in the ethnological gallery referred to in the last triennial report is still going on and unfortunately, owing to lack of storage rooms for the reserve collections, and want of assistants will take several years to complete it. The objects in certain show cases have been rearranged as far as possible with proper descriptive labels and further work in this connexion is being carried on, but it is not possible to bring the gallery to a really first-rate condition till more funds and staff are available. These remarks apply in general to all the galleries under the charge of the Zoological Survey of India, and I am afraid this activity of the department will be further curtailed as a result of the reduction in the staff and the grants of the department under the retrenchment scheme.

40. A detailed list of the specimens added to the exhibits in the public galleries is given in Appendix F.

#### RESERVE COLLECTIONS.

41. The reserve collections of the department have increased tremendously. Large collections of unnamed material have been worked out and incorporated in the reserve collections during the period under review. Amongst the invertebrates mention must be made of the collections of porifera, certain groups of coelenterata, polyzoa, hirudinea, acanthocephala, polychaeta, nematoda and certain groups of echinoderms. The mollusca and crustacea collections are being rearranged and card-catalogues of the various groups are under preparation.

42. In the insect section the spirit collection was taken out of the old show cases and rearranged and put into suitable glass cases. A large amount of material sent out for identification to specialists abroad has been received back and incorporated in the reserve collections.

43. The most important work in connection with the rearrangement of the insect collection was the amalgamation and rearrangement of the Museum and the de Niceville collections of Butterflies which was done by Brigadier W. H. Evans. The de Niceville collection, as is well-known, is one of the finest collections of Oriental Rhopalocera in the world. Brigadier Evans, who is recognised as an authority on these forms, very kindly undertook the work of rearrangement and amalgamation of this collection with the Indian Museum collection, and as a result of uninterrupted work for three months the rearrangement was completed about the end of December 1931. The entire collection is now stored in 30 insect cabinets and is easily available for study. A card-catalogue of the collection is being prepared and the old pins of most of the specimens are being replaced; this work will take several years before it is finally completed.

44. A fair amount of work was done in rearranging the reserve collections of fish and reptiles and a certain amount on the mammal collections. The collection of bones was overhauled and properly labelled.

45. Thanks to the work done by Dr. Satya Churn Law, an enthusiastic ornithologist, the rearrangement of the bird collections of the Survey has been started and a fair amount of work in this connexion has already been done. It will, however, be several years before the entire collection is overhauled and brought up to date, both in reference to the identifications and its arrangement. Dr. Law has, besides devoting a great deal of his time to the bird collection, presented large numbers of skins collected by him in different parts of the country.

46. In Appendices A and B details are given of the collections sent to specialists for study or identification and the collections returned after identification.

#### LIBRARY.

47. Mr. C. O. Bateman, the Librarian, retired on 1st February 1932 after serving in the department for nearly 37 years. Throughout his service he did extremely valuable work, and I should particularly like to place on record here the very good work that he did in connexion with the library and the publications of the department. The excellent condition in which he left the Zoological Survey of India library in spite of the very small staff available is to be attributed to his devotion and energy.

48. In 1931 the already insufficient staff of the library was in consonance with the general scheme of retrenchment in the department still further reduced, and only one assistant, Babu S. C. Ray, who was hitherto known as the Assistant Librarian, has been left in the library.

49. He submits the following report on the library ;—

“ The library is in good order and the books are generally in a good state of preservation. The cataloguing of all additions has been carried out in the manuscript catalogues and the new serials have been entered up in the interleaved copy of the “ Catalogue of Scientific periodicals ”

“ The additions to the library for the years 1929-30, 1930-31 and 1931-32 number 7,921. They are shown in detail in Appendix J. 2,353 books and serials were purchased, 4,764 received in exchange and the remainder presented.

“ During the period under report many valuable and interesting works have been received by gift, exchange and purchase. Dr. Bains Prashad, while on deputation to the United States of America, took the opportunity to secure several rare and valuable books which he has kindly presented to the library. He was also able to obtain from several institutions the missing parts of a number of serial publications which were wanting in our sets.

“ There is a growing demand for the two publications issued by the department, *viz.*, the “ Records ” and the “ Memoirs of the Indian Museum ”, and as a result 10 institutions and societies in Great Britain and in foreign countries have been added to our exchange list during the

last three years. Several other requests for the exchange of publications had to be turned down owing to the limited edition of the "Records" and "Memoirs".

"Storage space in the library is a pressing need with the growth and the development of the library, and although three new cases for the library were added during the last three years still more almirahs will have to be arranged for the library before very long. Unfortunately the library room is already full and there is no space for further almirahs unless a second gallery is arranged above the existing book-cases.

"The practice of lending out books to workers in scientific institutions and colleges throughout India and Burma is a boon that is being greatly appreciated. More than 874 volumes were lent out during the last three years. In most cases the books did not suffer any damage during transit and the scheme has worked satisfactorily. In a few instances, however, owing to faulty packing and bad handling the bindings of the books were received in a damaged condition; these were replaced at the cost of the borrowers.

"Every facility has been given to outside workers to consult the library and during the years under report more than 90 teachers, students and others made use of the library. Among those who consulted the library the following may be specially mentioned:—Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., Rai Bahadur Dr. Gopal Chandra Chatterjee, Medical College, Calcutta, Mr. H. R. Hargreaves, M.A., Director-General of Archæology, Mr. J. N. Basu, M.A., B.L., M.L.C., Calcutta, Dr. J. H. Hutton, D.Sc., I.C.S., C.I.E., Census Commissioner for India, Prof. Hem Chandra Das Gupta, M.A., Presidency College, Calcutta, Prof. Percy Moore, Pennsylvania University, Philadelphia, U. S. A., Dr. S. C. Law, M.A., B.L., Ph.D., Calcutta, Dr. C. Strickland and Dr. P. A. Maplestone, of the Calcutta School of Tropical Medicine, Dr. V. T. Korke, of the Indian Research Fund Association, Mr. J. C. Gardiner, Research Institute, Dehra Dun, Prof. D. R. Bhattacharya, Allahabad University, Prof. A. S. Pearse, Duke University, North Carolina, U. S. A., Dr. Syuti Issiki, School of Agriculture and Forestry, Taihoku Imperial University, Japan, Dr. Ekendra Nath Ghosh, M.D., Calcutta, and the staff of the Zoology Department of the Science College of the Calcutta University.

"The library is one of the largest, if not 'by far the best Zoological library in the whole of Asia', but with the present grant for its maintenance it will hardly be possible to keep up the present condition of the library. Already as a measure of economy several serial publications have been discontinued, and no new works are being purchased".

#### PUBLICATIONS.

50. Fourteen parts of the "Records of the Indian Museum" consisting of two parts and an Appendix to Vol. XXXI and Vol. XXXII complete, have been published during the last three years, as well as five parts of the "Memoirs", and No. I of the "Anthropological Bulletins from the Zoological Survey of India" A complete list of the

papers published in these journals is given in Appendix I (a), while a list of papers by members of the department published in other scientific journals is published in Appendix I (b).

#### CONCLUSION.

51. Before closing this report I should like to record my indebtedness to my colleagues and the staff of the department for the very good work they have done under very difficult conditions. The staff of the department and the grant for its maintenance have been very materially reduced, but the work, except for fresh field investigations, remains the same as ever—in fact in most sections it has very materially increased owing to the smaller number of assistants. It is, however, hoped that with improved conditions it will not be long before the departmental grants are materially increased and the work of the department can be carried on as heretofore.

BAINI PRASHAD,  
*Superintendent,*  
*Zoological Survey of India.*

## APPENDIX A.

### *Specimens sent to specialists for study or identification during the years 1929-1932.*

A collection of sponges (registered and unregistered) were sent (returned) to Dr. H. S. Rao, C/o The Director, British Museum, London.

25 tubes of cestodes to Dr. T. Southwell, School of Tropical Medicine, Liverpool.

3 tubes of cestodes to Dr. T. Southwell, School of Tropical Medicine, Liverpool.

39 tubes of leeches (returned) to Dr. J. Percy Moore, Philadelphia.

1 tube of Polychaetes (returned) to Prof. P. Fauvel, France.

2 tubes of Polychaetes (returned) to Prof. P. Fauvel, France.

1 packet of sponge to Prof. N. Gist Gee, China.

1 tube of worms to Dr. P. A. Maplestone, School of Tropical Medicine, Calcutta.

11 tubes of Earthworms (returned) to Prof. G. E. Gates, Judson College, Rangoon.

A collection of Earthworms (returned) to Prof. G. E. Gates, Judson College, Rangoon.

2 tubes of Trematodes to Mr. S. C. Verma, University of Allahabad.

2 boxes of Hydrozoa (returned) to Dr. E. Leloup, Bruxelles.

Collection of Hydroids (returned) to Dr. E. Leloup, Bruxelles.

1 tube of Polyzoa to Prof. L. F. de Beaufort, Amsterdam Museum, Holland.

7 tubes of Earthworms (returned) to Prof. G. E. Gates, Rangoon.

39 specimens of Hydromedusae to Dr. T. Mortensen, Zoological Museum, Copenhagen.

99 specimens of Echinoids (partly returned) to Dr. Mortensen, Zoological Museum, Copenhagen.

One lot of Temnocephala (returned) to Dr. Jean G. Bear, Geneva.

One tube of Polyzoa to Dr. E. Leloup, Bruxelles.

One tube of Bryozoa to Prof. Ulric Dahlgreen, New Jersey.

3 specimens of Earthworms all types (returned) to Prof. G. E. Gates, Rangoon.

43 packets of Crinoids to Dr. Austin H. Clark, Washington D. C.

9 tubes of leeches (returned) to Prof. J. Percy Moore, Philadelphia.

20 tubes of Earthworms to Prof. G. E. Gates, Rangoon.

19 tubes of Nematodes to Dr. P. A. Maplestone, Calcutta.

1 tube of sponges from type to Prof. N. Gist Gee, China.

Prof. H. Balss, Munich University, Germany. 2 lots of Crabs.

Mr. R. Gurney, Norwich, England. 1 lot of Cyclops.

Dr. von W. Klie, Bremerhaven, Germany. 2 tubes of Crustacea.

Dr. C. Chilton, Christ Church, New Zealand. 1 lot of Amphipod Crustacea.

Dr. A. Schellenberg, Univ. Mus. Berlin. 1 lot of Crustacea.

One type-specimen of Collembola, (returned) to Mr. D. Mukerji, Zoological Laboratory, University of Calcutta, Ballygunge.

One specimen of Gryllid Orthoptera (returned) to Dr. Yin-Ch'i-Hsu, Soochow University, Soochow, China.

Three specimens of Orthoptera including a type to Mr. G. M. Henry, Colombo Museum, Colombo, Ceylon.

A lot of Orthoptera to Dr. R. Hanitsch, Oxford.

A lot of Embioptera including paratypes and four slides of Chironomid Diptera (returned) to Mr. S. Mukerji, Calcutta School of Tropical Medicine.

Three lots of Odonata (returned) to Lt.-Col. F. C. Fraser, I.M.S., Coimbatore.

A lot of Apid Hymenoptera to Mr. T. H. Frison, State Natural History Survey Division, Urbana, U. S. A.

One specimen of Hymenoptera to Mr. C. Dover, Forest Research Institute and College, Dehra Dun.

Two lots of Coprid Coleoptera (partly returned) to Mr. G. J. Arrow, British Museum, London.

One lot each of Cicindelid and Malacodermid Coleoptera (returned) to Dr. W. Horn, German Entomological Institute, Berlin, Germany.

A lot of Carabid Coleoptera to Mr. H. E. Andrewes, London.

Two specimens of Paussid Coleoptera (returned) to Rev. F. P. E. Wasmann, S. J., St. Ignatius College, Valkenburg (L.), Holland.

A lot of Staphylinid Coleoptera to Dr. M. Cameron, London.

Two lots of Hydrophilid (partly returned) and one lot of Dytiscid Coleoptera to Dr. A. D'Orchymont, Royal Museum of Natural History, Brussels, Belgium.

A lot of Elaterid Coleoptera (returned) to Mons. E. Fleutiau, Nogent-sur Marne, France.

A lot of Heterocerid Coleoptera to Dr. R. Mamitza, Vienna, Austria.

Two specimens of Tenebrionid Coleoptera (returned) to Sir G. A. K. Marshall, F. R. S., British Museum, London.

A lot of Ptinid Coleoptera (returned) to Dr. H. Mukherjee, Calcutta.

Two specimens of Chrysomelid Coleoptera (returned) to Prof. S. Maulik, British Museum, London.

A lot of Cerambycid Coleoptera (returned) to Mr. J. C. M. Gardner, Forest Research Institute and College, Dehra Dun.

A lot of miscellaneous Coleoptera (returned) to Dr. H. V. Lengrken, School of Agriculture, Berlin, Germany.

One lot each of Noctuid and Pterophorid Lepidoptera (returned) to Mr. T. B. Fletcher, Imperial Institute of Agricultural Research, Pusa.

One lot of Rhopalocera (returned) to Brig. W. H. Evans, R. E., Quetta.

Seven lots Blepharocerids including types and cotypes (six lots returned) and one lot Psychodid Diptera to Dr. A. L. Tonnoir, Canberra City, Australia.

Three lots of Culicid Diptera (returned) to Capt. P. J. Barraud, Malaria Survey of India, Karnal.

One lot Culicid and two specimens of Chironomid Diptera including a type of the latter (partly returned) to Dr. I. M. Puri, Central Research Institute, Kasauli.

One lot of Muscid Diptera to Miss D. Aubertin, British Museum, London.

One lot of Sarcophagid Diptera (returned) to Mr. R. Senior-White, Calcutta.

Two lots miscellaneous Diptera (returned) to Mr. F. W. Edwards, British Museum, London.

A lot of larval Diptera to Mr. P. V. Isaac, Imperial Institute of Agricultural Research, Pusa.

One lot of slides of ♂ genitalia of the cat-flea *Ctenocephalus felis* to Dr. M. Sharif, Muslim University, Aligarh.

A lot of Aradid Rhynchota to Mr. A. N. Kiritschenko, Zoological Museum, Academy of Science, Leningrad, U. S. S. R.

One lot of Naucorid and two lots of Nipid Rhynchota to Prof. T. Esaki, Keijushu Imperial University, Fukuoka, Japan.

A lot of Pyrrhocorid Rhynchota to Mons. H. Goursat, National Museum of Natural History, Paris, France.

Two lots of Rhynchota to Dr. O. Lundblad, The Swedish Central Agricultural Station, Stockholm, Sweden.

Three lots of Jassid Rhynchota (one lot returned) to Mr. W. E. China, British Museum, London.

A lot of Jassid Rhynchota to Dr. V. Van Straelen, Royal Museum of Natural History, Brussels, Belgium.

A lot of Psyllid Rhynchota to Mr. F. D. Klyver, Stanford University, California, U. S. A.

One lot of Homoptera to Dr. P. Van Duzee, California Academy of Sciences, San Francisco, California, U. S. A.

Four lots of Diplopoda, Isoptera and Thysanura (two lots returned) to Prof. F. Silvestri, Portici, Italy.

Two lots of Myriapoda to Dr. C. Attems, Natural History Museum, Vienna, Austria.

Two lots of Attid Araneae (returned) to Mr. A. P. Mathew, Women's College, Trivandrum, Travancore.

Three lots of Araneae including certain types of Clubionidae to Dr. F. H. Gravely, Government Museum, Madras.

Two lots of Solifugae to Dr. C. F. Roewer, Bremen, Germany.

- One species of fish to Dr. D. Vinciguerra, Genova Museum, Italy.  
Four species of fish to Dr. P. Chabanaud, Paris Museum, France.  
Seven species of fish to Dr. L. F. de Beaufort, Amsterdam Museum, Holland.  
Twelve species of fish to Dr. J. R. Norman, British Museum (Nat. Hist.), London.  
Four species of fish to Dr. G. S. Myers, Stanford University.  
One species of fish to Dr. J. Hewitt, Albany Museum, S. Africa.  
Three species of fish to Dr. B. Sundara Raj, Madras Fisheries.  
One species of fish to Dr. P. E. P. Deraniyagala, Colombo Museum, Ceylon.  
One specimen of *Carpodacus stoliczkae* (returned) to Mr. S. H. Prater, B. N. H. S.  
12 specimens of *Dicrurus M. Macrocerus* to Curator, B. N. H. S.  
One type specimen of *Cryptolopha tephrocephala* (returned) to Mr. N. B. Kinnear, Brit. Mus., London.  
2 Dozens of crows to Mr. H. Whistler, C/o N. B. Kinnear, Esq., Brit. Mus., London.  
One Dozen Birds (returned) to Dr. E. Stresmann, Berlin, Germany.  
4 specimens of *Aegithina tiphia* to Mr. H. Whistler, Caldbec House, Battle, Sussex, England.  
7 specimens of *Leptopoeile stoliczkae* (returned) to Mr. N. B. Kinnear. Brit. Mus., London.  
One specimen of Squirrel (returned) to E. J. N. Mackay, Esq., Archl. Dept., Simla.  
Three lots of Mammals (returned) to M. A. C. Hinton, Esq., British Museum (Nat. Hist.), London.  
Whole collection of Bats to Dr. Glover M. Allen.  
Two lots of Mammals (skin and skulls) (partly returned) to R. I. Pocock, Esq., B. M. (Nat. Hist.), London.  
One lot of Bats (returned) to M. Chasen, Esq., Singapore.  
Several lots of Mammals (Skulls and Skeletons) (returned) to Dr. G. Pilgrim., G. S. I., Calcutta.  
One specimen of Rat to Col. J. Jolly, Rangoon.  
Several lots of Reptiles and Amphibians including (types and cotypes returned) to Dr. Malcolm A. Smith, B. M., London.  
Two lots of Snakes (returned) to Mr. B. C. Mahendra, Agra, India.  
One lot of Frogs (returned) to C. McCann, Esq., B. N. H. S., Bombay.

## APPENDIX B.

*Collections returned during the years 1929-1932 that were sent out in previous years.*

|                                             |                                                                                  |
|---------------------------------------------|----------------------------------------------------------------------------------|
| By Prof. P. Fauvel . . . . .                | One lot of Polychaetes.                                                          |
| „ Mr. B. P. Uvarov . . . . .                | One lot of Acridiid Orthoptera.                                                  |
| „ Dr. S. L. Hora . . . . .                  | One lot of Trichoptera.                                                          |
| „ Prof. W. M. Wheeler . . . . .             | Five boxes of Formicid Hymenoptera.                                              |
| „ Dr. L. Masi . . . . .                     | Remainder of collection of Chalcidid Hymenoptera.                                |
| „ Mr. H. E. Andrewes . . . . .              | One lot of Carabid Coleoptera.                                                   |
| „ Dr. A. D'Orohyont . . . . .               | Two lots of Hydrophilid Coleoptera.                                              |
| „ Mr. G. J. Arrow . . . . .                 | One lot of Coprid Coleoptera of the Ner-budda Survey Collection.                 |
| „ Mr. M. O. T. Iyengar . . . . .            | Remainder of collection of Coprid Coleoptera.                                    |
| „ Dr. G. Ochs . . . . .                     | One lot of Gyrinid Coleoptera.                                                   |
| „ Dr. A. G. Böving . . . . .                | Two lots of Parnid Coleoptera.                                                   |
| „ Dr. C. F. C. Beeson . . . . .             | One lot of Platypodid and Scolytid Coleoptera including one cotype.              |
| „ Dr. M. Regimbart . . . . .                | Two boxes of Aquatic Coleoptera.                                                 |
| „ Major J. A. Sinton, V. C., I.M.S. . . . . | Two lots of Psychodid Diptera including fourteen types and two cotypes.          |
| „ Dr. I. M. Puri . . . . .                  | Larvae and adult types of <i>Anopheles annandalei</i> Prashad.                   |
| „ Mr. F. W. Edwards . . . . .               | ♂ and ♀ cotypes of <i>Phylorus bionis</i> Agkr.                                  |
| „ Dr. A. L. Tonnoir . . . . .               | One lot of Blepharocerid Diptera.                                                |
| „ Mr. R. Senior-White . . . . .             | One lot of Sarcophagid Diptera.                                                  |
| „ Major W. S. Patton, I.M.S. . . . .        | Thirty-two tubes of Muscid and Aestrid Diptera and three tubes of bat parasites. |
| „ Rao Sahib Y. R. R. Rao . . . . .          | Five specimens of Anthomyid Diptera.                                             |
| „ Mr. S. W. Bromley . . . . .               | A lot of Asilid Diptera.                                                         |
| „ Mrs. Q. Cattell Kessel . . . . .          | Eight tubes of Streblid Diptera.                                                 |
| „ Dr. O. Lundblad . . . . .                 | One lot of Corixid Rhynchota.                                                    |
| „ (the late) Mr. C. F. Baker . . . . .      | Three lots of Jassid Rhynchota.                                                  |
| „ Mr. W. E. China . . . . .                 | Two lots of Jassid Rhynchota.                                                    |
| „ Mr. G. Mason . . . . .                    | 2 lots of Mammals.                                                               |

## APPENDIX C.

*Exchanges and presentations for the years 1929-1932.**(a) Specimens received.*

|                                                                                    |                                                                                                  |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| From Dr. K. S. Padambha Aiyer, Maharaja's College of Science, Trivandrum           | 18 new species of Earthworms.                                                                    |
| „ Prof. N. Gist Gee, China.                                                        | 3 cotypes of Freshwater sponges.                                                                 |
| „ Dr. S. N. Bal, Industrial Section, Indian Museum, Calcutta                       | Corals and sponges.                                                                              |
| „ Mr. S. C. Verma, University of Allahabad.                                        | 6 slides of Acanthocephala.                                                                      |
| „ Prof. J. Percy Moore, Philadelphia                                               | A lot of leeches.                                                                                |
| „ Dr. H. A. Baylis, British Museum (Natural Hist.), London                         | 12 tubes and 1 bottle of Trematodes.                                                             |
| „ Prof. N. Gist Gee, China                                                         | 20 packets of sponges.                                                                           |
| „ Dr. P. A. Maplestone, School of Tropical Medicine, Calcutta.                     | 10 tubes of Nematodes Types.                                                                     |
| „ Prof. F. J. Meggit, University College, Rangoon                                  | 6 tubes of worms.                                                                                |
| „ „ P. Fauvel, France                                                              | 27 tubes of Polychaetes.                                                                         |
| „ The British Museum (Natural History), London                                     | 35 species of Porifera (Dendy's duplicates).                                                     |
| „ Dr. H. L. Clark, Museum of Comp. Zoology, Cambridge                              | 20 boxes of Echinoids.                                                                           |
| „ Direcção do Instituto Bacteriológico de Nova Goa                                 | 34 slides of Protozoa.                                                                           |
| „ Dr. P. A. Maplestone, School of Tropical Medicine, Calcutta                      | 40 tubes of named Nematodes (Types).                                                             |
| „ Dr. F. H. Gravely, Madras                                                        | 2 tubes of <i>Indiapyz gravelyi</i> (Type and <i>Lepidocampa gravelyi</i> (paratype).            |
| „ Prof. N. Gist Gee, China                                                         | One packet of sponges (Type and cotype).                                                         |
| „ Col. F. de Mello, Nova Goa                                                       | 3 slides of Protozoa.                                                                            |
| „ Prof. A. S. Pearse, Duke University, Durham, N. C., U. S. A.                     | 5 slides of Protozoa, 7 tubes of parasites.                                                      |
| „ Smithsonian Institute, Washington, U.S.A.                                        | 1 lot of Crustacea.                                                                              |
| „ Rev. E. Blatter, Bombay                                                          | 2 lots of Crustacea.                                                                             |
| „ P. V. Lady Fraser, Esq.                                                          | 2 lots of Crustacea.                                                                             |
| „ Mr. K. P. Biswas, Royal Botanical Garden, Sibpur, Calcutta                       | 1 lot of Crustacea.                                                                              |
| „ Dr. F. H. Gravely, Government Museum, Madras                                     | 1 Crustacea.                                                                                     |
| „ Dr. S. B. Setna, Royal Institute of Science, Bombay                              | 1 tube of Prawns.                                                                                |
| „ Government Museum, Madras                                                        | 12 type and paratype specimens of 2 species of Thysanura; 1 type-specimen of Carabid Coleoptera. |
| „ Prof. G. Okajima, Imperial College of Agriculture and Forestry, Kagoshima, Japan | 3 tubes of 1 species of Embioptera.                                                              |
| „ the Agricultural Research Institute, Pusa                                        | 7 specimens of Embioptera.                                                                       |
| „ Dr. T. V. R. Ayyar, Agricultural Research Institute, Coimbatore                  | 6 slides of Chalcid Hymenoptera including 8 type and cotype-specimens.                           |

|                                                                                                        |                                                                                               |
|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| From Mr. M. O. T. Iyengar, Bengal Malaria Research Laboratory, Calcutta . . . . .                      | A lot of Coprid Coleoptera.                                                                   |
| „ Dr. O. Krampe, Darmstadt, Germany . . . . .                                                          | 13 specimens of Carabid Coleoptera.                                                           |
| „ Mr. C. A. Thomas, Pennsylvania State College, Lohester County, Rv., U. S. A. . . . .                 | 87 specimens of Coleoptera.                                                                   |
| „ Prof. A. Alfaro, San José, Costa Rica, Central America . . . . .                                     | A lot of Insecta chiefly Coleoptera.                                                          |
| „ Brigadier W. H. Evans, R. E., Quetta . . . . .                                                       | Four boxes of Rhopalocera.                                                                    |
| „ Mr. N. D. Riley, British Museum, London . . . . .                                                    | 22 specimens of Tibetan and Western Chinese Papilios (Rhopalocera).                           |
| „ Major J. A. Sinton, V. C., I.M.S., Malaria Survey of India, Kasauli . . . . .                        | 20 slides comprising 10 species of <i>Phlebotomus</i> (Diptera).                              |
| „ Dr. I. M. Puri, Central Research Institute, Kasauli . . . . .                                        | A lot of Anopheline Diptera including 4 syntype-specimens; two specimens of Bibionid Diptera. |
| „ Prof. K. Brodsky, U. S. S. R. State University, Tashkent, Russia . . . . .                           | 5 larvae and 2 pupae of Deuterophlebid Diptera.                                               |
| „ Dr. A. L. Tonnoir, Camberra City, F. C. T., Australia . . . . .                                      | 7 tubes larvae and pupae of Blepharocerid and Deuterophlebid Diptera.                         |
| „ Rao Sahib Y. R. R. Rao, Agricultural Research Institute, Coimbatore . . . . .                        | 35 specimens of Anthomyid Diptera.                                                            |
| „ Dr. D. Roy, School of Tropical Medicine and Hygiene, Calcutta . . . . .                              | 1 specimen of Pentatomid Rhynchota.                                                           |
| „ Prof. T. Esaki, Keijushu Imperial University, Fukuoka, Japan . . . . .                               | A lot of Jassid Rhynchota.                                                                    |
| „ Dr. W. Horn, German Entomological Institute, Berlin, Germany . . . . .                               | 28 specimens of Jassid Rhynchota.                                                             |
| „ Mr. A. N. Kiritschenko, Zoological Museum, Academy of Science, Leningrad, U. S. S. R. . . . .        | 70 specimens of Jassid Rhynchota.                                                             |
| „ „ P. B. Lawson, University of Kansas, Lawrence, U. S. A. . . . .                                     | 89 specimens of Jassid Rhynchota.                                                             |
| „ „ E. R. Leach, Piedmont, California, U. S. A. . . . .                                                | A lot of Jassid Rhynchota.                                                                    |
| „ the Smithsonian Institution, Washington, D. C., U. S. A. . . . .                                     | 38 specimens of Jassid Rhynchota.                                                             |
| „ Mr. O. H. Swezey, Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu . . . . . | 6 specimens of 1 species of Jassid Rhynchota.                                                 |
| „ the Forest Research Institute and College, Dehra Dun . . . . .                                       | 79 specimens of Jassid Rhynchota from sandal wood; 2 specimens of a species of Ephemeroptera. |
| „ Mr. Kan-fan Chen, Entomological Society of China, Nanking, China . . . . .                           | A lot of Cicadid and Fulgorid Rhynchota.                                                      |
| „ K. Singh, College of Science, Nagpur . . . . .                                                       | 11 slides of Aleyrodid Rhynchota including 10 type specimens.                                 |

|                                                                  |                                                                        |
|------------------------------------------------------------------|------------------------------------------------------------------------|
| From Mr. A. Giordani Soika, Venice, Italy                        | 2 lots of Insecta.                                                     |
| „ „ J. Karlovich, Zeigler, Illinois,<br>U. S. A.                 | 3 lots of Insecta.                                                     |
| „ Dr. F. H. Gravely, Government<br>Museum, Madras                | 5 tubes of Clubionid Araneae.                                          |
| „ Mr. B. C. Mahendra, St. John's<br>College, Agra                | 8 specimens of Scorpions.                                              |
| „ „ E. G. Bacon                                                  | 1 lot of Molluscs.                                                     |
| „ Dr. S. N. Bal, Indian Museum,<br>Calcutta                      | 1 lot of Molluscs.                                                     |
| „ Mr. H. E. J. Biggs, Persia                                     | 8 species of Molluscs.                                                 |
| „ the British Museum of Natural<br>History, London               | 195 species of Molluscs.                                               |
| „ Dr. Ph. Dautzenberg, Paris                                     | 153 species of Molluscs.                                               |
| „ „ F. H. Gravely, Government<br>Museum, Madras                  | 2 new species of Molluscs.                                             |
| „ Mrs. M. Hopley, Calcutta                                       | 2 cabinets of shells (donation in memory of<br>Late Mr. G. H. Booley). |
| „ Miss N. E. Northup, Rangoon.                                   | 1 lot of Mollusc.                                                      |
| „ Mr. A. Sen, Dehra Dun                                          | 8 tubes of shells.                                                     |
| „ „ R. V. Seshaiya, Tirupati, Madras                             | 2 species of Molluscs.                                                 |
| „ „ G. Stephens, Grand Hotel, Cal-<br>cutta                      | 4 shells.                                                              |
| „ „ J. R. le B. Tomlin, Hastings,<br>England                     | 96 species of Molluscs.                                                |
| „ U. S. National Museum, Smithsonian<br>Institute                | 3 species of Molluscs.                                                 |
| „ Prof. Max Weber, Amsterdam, from<br>"Siboga Collection"        | 174 species of Molluscs.                                               |
| „ Mr. R. Winckworth, London                                      | 2 species of Molluscs.                                                 |
| „ the Zoological Museum, Java                                    | 17 species of Molluscs.                                                |
| „ Prof. P. R. Awati, Bombay                                      | 1 lot of Molluscs.                                                     |
| „ Dr. D. Vinciguerra, Genova Museum,<br>Italy                    | 27 species of fishes.                                                  |
| „ „ F. P. Koumans, Rijks Museum,<br>Leiden                       | 2 species of fishes.                                                   |
| „ „ J. T. Nichols, American Museum<br>of Natural History         | 4 species of fishes.                                                   |
| „ Prof. L. F. de Beaufort, Amsterdam<br>Museum, Holland          | 1 species of fishes.                                                   |
| „ „ L. Gianferrari, Milano, Italy                                | 2 species of fishes.                                                   |
| „ „ L. S. Berg, Leningrad, U. S. S.<br>R.                        | 5 species of fishes.                                                   |
| „ Dr. H. W. Fowler, Academy of<br>Nat. Sci., Philadelphia        | 82 species of fishes.                                                  |
| „ „ P. W. Fang, Metropolitan Mu-<br>seum, Nanking, China         | 2 species of fishes.                                                   |
| „ Prof. L. Roule, Natural History<br>Museum, Paris               | 2 species of fishes.                                                   |
| „ the British Museum (Natural<br>History)                        | 4 species fishes.                                                      |
| „ Anti-Malaria officer, Peshawar                                 | 1 species of fish.                                                     |
| „ Assistant Director of Fisheries (In-<br>land), Chepauk, Madras | 48 species of fishes.                                                  |
| „ Director, Colombo Museum, Ceylon                               | 2 species of fishes.                                                   |
| „ the Bombay Natural History Society                             | Several lots of fish.                                                  |
| „ Mr. M. K. Bose, Burdwan                                        | 1 species of fish.                                                     |
| „ Dr. P. E. P. Deraniyagala, Fisheries<br>office, Colombo Museum | 2 species of fishes.                                                   |
| „ „ B. Sundara Raj, Director of<br>Fisheries, Madras             | 5 lots of fish.                                                        |

|                                                             |                                  |
|-------------------------------------------------------------|----------------------------------|
| From Dr. H. M. Smith, Adviser in Fisheries, Bangkok, Siam   | 5 species of fishes.             |
| „ Rev. E. Blatter, Bombay                                   | 1 lot of fish.                   |
| „ Prof. P. R. Awati, Royal Institute, Bombay                | 1 lot of fish.                   |
| „ Mr. Ch. McCann, Bombay                                    | 2 lots of fish.                  |
| „ „ G. E. Shaw, Mungpoo, Siliguri                           | Several lots of fish.            |
| „ Locust Research office, Quetta                            | 1 lot of fish.                   |
| „ P. V. "Lady Fraser"                                       | 2 lots of fish.                  |
| „ Lt.-col. R. W. Miller, District Laboratory, Colaba        | 1 species of fish.               |
| „ District Health officer, Chitaldrug, Mysore               | 1 species of fish.               |
| „ Dr. G. S. Freegrade, Malariologist, Moulmein              | 1 species of fish.               |
| „ The Warden of Fisheries, Dharamsala, Punjab               | 2 lots of fish.                  |
| „ Mr. K. P. Biswas, Royal Botanical Gardens, Bengal         | 2 lots of fish.                  |
| „ Dr. S. C. Law, Calcutta                                   | *210 Birds.                      |
| „ Miss M. L. Cleghorn, Tollygunge, Calcutta                 | 1 Duck.                          |
| „ „ E. Rivett, U. M. Girls School, Calcutta                 | Feather of Bird of Paradise.     |
| „ Mr. M. N. Datta, Calcutta                                 | 15 Birds.                        |
| „ „ S. C. Ray, Bonhughly, Calcutta                          | 1 Owl.                           |
| „ „ H. A. Fooks, Calcutta                                   | 2 Hawks.                         |
| „ Director, Cuba Museum                                     | 1 Bird.                          |
| „ Zoological Gardens, Calcutta                              | 17 Birds.                        |
| „ Mr. A. Rahim                                              | 33 Birds.                        |
| „ „ R. Bagchi                                               | 1 Bird.                          |
| „ Thompson Bequest                                          | One lot of snakes.               |
| „ Col. H. W. Acton, School of Tropical Medicine, Calcutta   | 15 snakes.                       |
| „ Mr. A. Dutt, Calcutta                                     | One snake.                       |
| „ „ F. C. Algers                                            | One snake.                       |
| „ Mrs. S. L. Hora                                           | One snake.                       |
| „ Mr. R. S. Huestis                                         | One snake.                       |
| „ Dist. Lab., Maymyo                                        | One lot of snakes.               |
| „ Mr. K. P. Biswas, Sibpur                                  | Frogs nest and one Bear's Skull. |
| „ Col. F. de Melo, Nova Goa                                 | One lot of Frogs.                |
| „ Lt.-Col. H. E. Shortt.                                    | One Lizard.                      |
| „ Mr. S. C. Ray, Bonhughly, Calcutta                        | One Civet Cat.                   |
| „ Mrs. J. V. Ellis                                          | One lot of Mammal Skulls:        |
| „ the British Museum (N. H.) (through Dr. Malcolm A. Smith) | One lot of Dracos.               |
| „ Mr. M. N. Datta, Calcutta                                 | One snake.                       |

## (b) Specimens sent out.

|                                                                             |                                                           |
|-----------------------------------------------------------------------------|-----------------------------------------------------------|
| To Prof. J. H. Ashworth, Edinburgh University                               | Specimens of named worms.                                 |
| „ Dr. G. A. Abrikossoff, University of Moscow                               | Polyzoa.                                                  |
| „ „ van Oort, Director S' Rijk's Museum of Natural History, Lieden, Holland | 35 specimens of Echinoids, Holothurians and Aloyonarians. |

\* A collection of birds from Darjiling, Ranchi, Nilgiris and South India.

|                                                                                             |                                                         |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------|
| To Dr. H. L. Clark, Museum of Comparative Zool., Harvard College, Cambridge, U. S. A.       | 38 packets of Echinoids.                                |
| „ Prof. N. Gist Gee, China                                                                  | 1 tube containing a piece of type-specimen of Porifera. |
| „ Smithsonian Institution, Washington                                                       | 1 lot of Crustacea.                                     |
| „ Mr. E. W. Benett, Dept. of Biology, Australia                                             | 1 lot of Crabs.                                         |
| „ „ Maurice Burton, British Museum (Natural History), London                                | 1 lot of Crustacea.                                     |
| „ Dr. Sunder Rao, School of Tropical Medicine, Calcutta                                     | 1 lot of Crustacea.                                     |
| „ Mr. S. H. Prater, Curator, Bombay Natural History Society                                 | 1 lot of Crustacea.                                     |
| „ Dr. K. W. Dammerman, Director, Zool. Mus., Java                                           | 1 lot of Crustacea.                                     |
| „ Mr. C. Dover, The Forest Research Institute and College, Dehra Dun                        | 1 lot of Crustacea.                                     |
| „ Dr. S. B. Setna, Royal Institute of Science, Bombay                                       | 2 lots of Acridiid and Gryllid Orthoptera.              |
| „ Prof. A. S. Pearse, Duke University, Durham, N. Carolina, U. S. A.                        | 6 specimens of Orthoptera.                              |
| „ „ G. Okajima, Imperial College of Agriculture and Forestry, Kagoshima, Japan              | 2 specimens of Embioptera.                              |
| „ „ K. Brodsky, U. S. S. R. State University, Tashkent, Russia                              | 2 lots of Ephemeroptera.                                |
| „ Mr. G. A. Mavromoustakis, Limassol, Cyprus                                                | 6 specimens of Apid Hymenoptera.                        |
| „ „ A. Giordani Soika, Venice, Italy                                                        | 3 lots of Hymenoptera.                                  |
| „ „ E. R. Leach, Piedmont, California, U. S. A.                                             | 2 lots of Lucanid Coleoptera.                           |
| „ Dr. G. Ochs, Frankfurt a Maine, Germany                                                   | A lot of Gyrinid Coleoptera.                            |
| „ „ A. D'Orchymont, Royal Museum of Natural History, Brussels, Belgium                      | 2 lots of Hydrophilid Coleoptera.                       |
| „ „ O. Krampe, Darmstadt, Germany                                                           | 12 specimens of Coleoptera.                             |
| „ Mr. C. A. Thomas, Pennsylvania State College, Chester County, Pa., U. S. A.               | 41 specimens of Coleoptera.                             |
| „ „ J. Karlovich, Zeigler, Illinois, U. S. A.                                               | 3 specimens of Coleoptera ; 4 specimens of Lepidoptera. |
| „ Dr. A. L. Tonnoir, Canberra City, F. C. T., Australia                                     | A pupa of Deuterophlebid Diptera.                       |
| „ Prof. T. Esaki, Kyushu Imperial University, Fukuoka, Japan                                | 48 specimens of Aquatic Rhynchota.                      |
| „ Mr. A. N. Kiritschenko, Zoological Museum, Academy of Sciences, Leningrad, U. S. S. R.    | 72 specimens of Heteroptera (Rhynchota).                |
| „ „ O. H. Swezey, Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu. | 10 specimens of 2 species of Fulgorid Rhynchota.        |
| „ the Government Museum, Madras                                                             | 10 specimens of Jassid Rhynchota.                       |
| „ Dr. W. Horn, German Entomological Institute, Berlin, Germany.                             | 28 specimens of Jassid Rhynchota.                       |

|                                                                                 |                                       |
|---------------------------------------------------------------------------------|---------------------------------------|
| To Mr. P. B. Lawson, University of Kansas, Lawrence, U. S. A.                   | 28 specimens of Jassid Rhynchota.     |
| „ „ T. J. Nande, Department of Agriculture, Pretoria, Union of S. Africa        | 46 specimens of Jassid Rhynchota.     |
| „ the Smithsonian Institution, Washington, D. C., U. S. A.                      | 38 specimens of Jassid Rhynchota.     |
| „ Mr. A. Walcsuch, Zoological Institute and Museum, Breslau, Germany            | 4 specimens of Coccid Rhynchota.      |
| „ Prof. Dr. V. Franz, Jena, Germany                                             | 4 specimens of Snails.                |
| „ „ R. Gestro, Genova, Italy                                                    | 1 lot of Molluscs.                    |
| „ Col. R. Coldstream, Nabha                                                     | 2 specimens of <i>Cypraea</i> .       |
| „ „ A. J. Peile, London                                                         | 1 lot of Molluscs.                    |
| „ Mr. J. R. le B. Tomlin, Hastings, England                                     | 1 lot of Molluscs.                    |
| „ Dr. J. Sinermass, Valencia, Espangne                                          | 5 tubes of Molluscs.                  |
| „ Prof. E. Rafaele, University of Rome, Italy                                   | 4 species of Fishes.                  |
| „ „ E. Zavattari, Institute of Anatomy and Comparative Physiology, Pavia, Italy | 12 species of Fishes.                 |
| „ Dr. D. Vinciguerra, Genova Museum, Italy                                      | 10 species of Fishes.                 |
| „ „ J. T. Nichols, American Museum of Natural History, New York                 | 11 species of Fishes.                 |
| „ „ F. P. Koumans, Rijks Museum, Lieden                                         | 3 species of Fishes.                  |
| „ „ E. Ahl, Zoological Museum, Berlin                                           | 5 species of Fishes.                  |
| „ „ L. F. de Beaufort, Amsterdam Museum, Holland                                | 7 species of Fishes.                  |
| „ „ E. J. Cole, University of Reading, Reading                                  | 2 species of Fishes.                  |
| „ „ P. Chabanaud, Paris Museum                                                  | 5 species of Fishes.                  |
| „ Prof. L. Gianferrari, Melano, Italy                                           | 4 species of Fishes.                  |
| „ Dr. L. S. Berg, Leningrad, U. S. S. R.                                        | 5 species of Fishes.                  |
| „ Prof. Max Weber, Holland                                                      | 3 species of Fishes.                  |
| „ Dr. T. Barbour, Harvard College, Cambridge                                    | 2 species of Fishes.                  |
| „ Prof. L. Roule, Paris Museum                                                  | 3 species of Fishes.                  |
| „ Dr. J. R. Norman, British Museum (Natural History)                            | 10 species of Fishes.                 |
| „ „ P. W. Fang, Metropolitan Museum, Nankin, China                              | 2 species of Fishes.                  |
| „ the Department of Zoology, University of Calcutta                             | 3 species of Fishes.                  |
| „ Dr. G. S. Myers, Stanford University                                          | 1 species of Fishes.                  |
| „ Col. H. W. Acton                                                              | One lot Snakes.                       |
| „ Dr. R. de la Torre                                                            | Two Mammal Skulls & 3 Reptiles.       |
| „ „ H. K. Mukerji, Calcutta                                                     | One lot Lizards and eggs of Reptiles. |
| „ „ W. Meise                                                                    | One lot Snakes.                       |
| „ Prof. G. Sondhi, Agra                                                         | One lot Snakes.                       |
| „ the British Museum (Through Dr. Malcolm A. Smith)                             | Several lots of Reptiles.             |
| „ Dr. G. Schonwelter                                                            | One lot of Frogs.                     |

## APPENDIX D.

*List of types and cotypes of new genera, species, sub-species and varieties added to the collections during the years 1929-1932.*

## PORIFERA.

*Tubella vesparium*, *Ephydatia fluviatilis* var. *chui*, *Ecrateriformis* var. *cantonensis*, *spongilla linei*, *Trochospongilla lotonchiana* var. *pasigensis*, *spongilla luzonensis*, Gee.

*Spongilla* (*Eunapius*), *S. microscierifera*, *S. nana*, Annandale.

*Corvosquilla victoriae* Annandale.

*Corvospongilla bohmi* Hilg.

*Pheronema raphanus* Schulze.

*Myxilla barenfsi*, *Clathria elegans*, *Demacidon elastica*, *Phakellia arctica*, *Gellius infundibuliformis*, *Artemisina suberitoides*, *Anletta elegans*, *Phakellia bowerbanki*, *Poly-mastia capitata*, *Acanthella multiformis*, Vosmaer.

*Pachastrella compressa* (Bowerbank) Lindenfeld. *Poecillastra cuma*, sp. nov.

*Phakellia incisa*, *P. plicata* O. Schmidt.

*Pachychalina rugosa* (D. & M.) var. *rubens*, *Ceraochalina vanderhorsti* Arndt.

*Pericharax heterorhaphis* Polejaeff.

*Petrosia mammiformis* Dendy.

*Lissomyxilla hanitschi* Kirkpatrick.

## CESTODA.

*Proteocephalus woodlandi* Moghe.

## NEMATODA.

*Cruzia oreintalis*, *Gnathostoma doloresi*, *Oesophagostomum suis*, *O. conicum*, *Acuaria anthuris* (Rudolphi 1819), *A. lata*, *A. conica*, *A. scutata*, *A. (Synhimantus) invaginata* (V. Lenistow, 1901), *A. (Sybhimantha) nana*, *Echinuria spinosa*, *Rasguniella brevis*, *Microtetrameres spiralis* (Seurat 1915), *Paraprocta brevicauda* (Chandler 1924), *Setaria cervi*, *Papillosetaria veversi*, *Hastospiculum macrophallos* (Parona 1889), *Diplotrienia graculi*, *D. dubia*, *D. urocissae*, *Kalicephalus elongatus*, *K. brachycephalus*, *K. naiae*, *K. longior*, *K. gongilophis*, *K. willeyi* (Linstow 1904), *K. fimbriatus* (Ortlepp, 1923), *Heterakis longespiculum*, *H. parva*, *H. variabilis* (Chandler 1926), *Allodapo multipapillata* (Chandler 1926), *Syphaciella indica*, *Subulura turnicis*, *Africana varari*, *Probstmayria simiae*, *Oesophagostomum indicum*, *O. curvatum*, *O. radiatum* (Rud. 1803), *O. aphistomum* (Willach 1891), *O. blanchard* (Railliet and Henry, 1912), *Bunostomum bovis*, *B. cobi*, *Uncinaria longespiculum*, *Typlophoros lamellaris*, *Polycocum gangeticum*, *Goezia gavialidis*, *Amidostomum fuliginea*, *Epomidiostomum uncinatum*, *Pseudamidostomum boulengeri*, *Habronema euplocami*, *H. indica*, *H. imbricata* P. A. Maplestone, *Rhabd-coma uca* Pearse.

## ACANTHOCEPHALA.

*Centrorhynchus maryasis*, *Echinorhynchus robustus* Datta.

*Acanthosentis antapinus* Verma & Datta.

## ANNULATA.

*Thalassema bombayensis* Prasad & Awati.

## CRUSTACEA.

## Types.

*Limnetis denticularis* Gurney, *Pinnotheres deccanensis* Chopra, *P. setnai* Chopra, *Lissocarcinus ornata* Chopra, *Rhynchoplax kempi* Chopra & Das, *R. tuberculata* Chopra & Das, *R. tuberculata* var. *attennipes* Chopra & Das, *Bopyrina Sewelli* Chopra, *Bopyrella nierstraszi* Chopra, *Diplophryxus richardsoni* Chopra, *D. kemni* Chopra, *Paracalanus denudatus* Sewell, *P. nudus* Sewell, *Clausecalanus farrani* Sewell, *Euchirella orientalis* Sewell, *Chirundina indica* Sewell, *Valdiviella ignota* Sewell, *Paraeuchzeta investigatoris* Sewell, *P. malayensis* Sewell, *Cornucalanus indicus* Sewell, *Scottocalanus investi-*

*gatoris* Sewell, *S. daughishi* Sewell, *Macandrewella scotti* Sewell, *Scolecithrix nicobarica* Sewell, *Amallothrix indica* Sewell, *Pseudione indica* Chopra, *Canthocampatus zschoklei*, subsp. *orientalis* Chappuis, *C. zschoklei* subsp. *himalayensis* Chappuis, *C. sewelli*, subsp. *indicus* Chappuis, *C. sewelli*, subsp. *eremita* Chappuis, *Maraebiotus insignipes*, subsp. *indicus* Chappuis, *M. brucei* subsp. *himalayensis* Chappuis, *Pycnogonum indica* Sundara Raj, *Hemiaegina quadripunctata* Sundara Raj, *Pseudocaprellina pambanensis* Sundara Raj.

## PARATYPES.

*Synsynella deformanus* Hay.

## ARACHNIDA.

## Opiliones.

*Eupygoplus gracilis* Roewer.

## ACARINA.

*Ornithodoros piriformis* Warburton.

## MYRIAPODA.

## Diplopoda.

*Mesocanthus perporosus*, *Zephronia brevilamina*, *Z. tigrinoides* Silvestri.

## INSECTA.

## Odonata.

*Perrisogomphus stevensi* Laidlaw.

## Hymenoptera.

*Euchalcidia crassicornis*, *Hockeria atra*, *Sphaerakis maculata* Masi.

*Tetracnemus indicus* Ramakrishna Ayyar.

*Scolia carmichaelis*, *S. elizabethae* subsp. *maculicollis*, *S. kumaonensis*, *S. kumaonensis* subsp. *calcultensis*, *S. rubrobrunnea*, *S. rubrosinuata*, *S. suratensis*, *S. trivandrumensis*, *S. vollenhveni* subsp. *rufohirta* Betrem.

## Coleoptera.

*Dyschirius seistanus*, *Gnaphon castutus* Andrewes.

*Dineutus spinosus* subsp. *nepalensis*, *Orectochilus similis*, *O. volubilis* Ochs.

*Anthicus aquatilis*, *A. scrotinus*, *Formicomus braminus badius*, *F. cinchonae*, *F. nigrivestis*, *F. psilopterus*, *Inamblyderus scabridus*, *Pseudoleptalens apicans*, *P. carmichaeli*, *P. fumatus* v. Krekich.

## Thysanoptera.

*Arrhenothrips dhumra-paksha*, *Thilakothrips babuli*, *Veerabahuthrips bambusa* Ramakrishna Ayyar.

## Diptera.

*Euliponeura assamensis*, *E. horai*, *Horaia montana* Tonnoir.

*Andrenosoma choprai*, *Apoclea indica*, *Asilus ricardoi*, *Astochia canis*, *Cyrtopogon khasiensis*, *C. laxenecera*, *Damalis claripennis*, *Machimus hirsutus*, *M. infrafemoralis*, *M. inutilis*, *M. subgenitalis*, *M. (Tolmerus) incisularis*, *M. (T.) punjabensis*, *Maira longirostra*, *Neotamess khasiensis*, *Neolophonotus indicus*, *Ommatius ater*, *O. carmichaeli*, *O. nigrifemorata*, *O. subgracilis*, *Philodicus pruthii*, *Promachus ghumtiensis*, *Stenopogon subtus* Bromley.

## Siphonaptera.

*Xenopsylla hussaini*, *X. sewelli* Sharif.

## Rhynchota.

*Aconura dindorensis*, *A. tolla*, *Agallia robustus*, *Arya rotundus*, *Baileyus brunneus*, *Balcluthissa viridis*, *Bella apicalis*, *Bumizana ruberosa*, *Chiasmus alata*, *C. (Kartua) mustelina*, *Cicadula bipunctatus*, *C. fletcheri*, *C. indica*, *C. indrina*, *C. maculata*, *C. (Deltocephalus) montanus* var. *macropterus*, *Drabescus kempi*, *Durgades indiocerus*, *D. mirabilis*, *Eugnathodus indica*, *E. micropterus*, *E. ocellatus*, *Gurawa minorcephala*, *Idicerus nagpurensis*, *Leofa parwala*, *Magentius clavatus*, *Orosius maculatus*, *Parabolocratus mandlensis*, *Paternus vertica*, *P. viridula*, *Platymetopius rakmani*, *Rhombopsis viridis*, *selenocephalus brunneus*, *symphygya maculatus*, *Thamnotettix bicolor*, *T. chhota*, *T. prabha*, *T. veinatus*, *Trocnadella punctatus*, *T. shillongensis*, *T. viridis*, *Ulopa brunneus* Pruthi.

*Aleurotrachelus multipapillus*, *Dialeurodes cephalidistinctus*, *D. cuningum*, *D. dorsi-demarcata*, *D. hexpuncta*, *D. nitidus*, *D. oweni*, *D. papeulae*, *D. rangooni*, *Trialeurodes megapapillae* K. Singh.

## MOLLUSCA.

## Types.

*Parreyssia choprae* Prashad; *P. olivacea* Prashad; *P. burmanus* var. *myitkyinae* Prashad; *Lamellidens indawgyiensis* Prashad.

*Viviparus indawgyiensis* Rao; *Macrochlamys strophoides* Stol.

*Petalifera krusadaiiae* O'Donoghue; *Notarchus gravelyi* O'Donoghue.

## Cotypes.

*Abra weberi* Prashad; *A. sibogai* Prashad; *Calopodium* (*Kennerlia*) *carinatum* Prashad; *Cardium* (*Trachycardium*) *beauforti* Prashad; *C. (Ctenocardia) translutum* Prashad; *Cuspidaria tomlini* Prashad; *C. mitis* Prashad; *C. solidula* Prashad; *C. (Cardiomya) persculpta* Prashad; *C. (Rhinoclama) dubai* Prashad; *Dentilucina* (*Bellucina*) *hedleyi* Prashad; *D. (Bellucina) hedleyi*, var. *quadrata* Prashad; *D. (Bellucina) macassari* Prashad; *D. inanis* Prashad; *Gari* (*Gari*) *sibogai* Prashad; *Hysteroconcha* (*Lamelli-concha*) *dautzenbergi* Prashad; *Malletia humilior* Prashad; *Neilonella schexmani* Prashad; *Nucula diaphana* Prashad; *Nuculana* (*Nuculana*) *approximans* Prashad; *N. (Nuculana) robsoni* Prashad; *N. (Nuculana) sibogai* Prashad; *N. (Ledella) discrepans* Prashad; *N. (Thestylida) elaborata* Prashad; *Tellina* (*Peronidia*) *macassariensis* Prashad; *Amussium albugo* Watson; *Xylophaga praetorosa* Smith; *Nodularia persculpta* Haas.

*Chiton iatricus* Winckworth; *Patella* (*Cellana*) *karrachiensis* Winckworth; *Rissoa crispa* Watson; *R. euschilia* Watson; *R. moniziana* Watson; *R. macandrewi* var. *spreti* Watson; *R. spadix* Watson; *R. leacocki* Watson; *R. tirata* Watson; *R. similis* var. *levis* Watson; *R. ourantiaca* Watson.

## PISCES.

## Types.

*Olyra horae* Prashad and Mukerji, *Akysis variegatus* Subsp. *variegatus* Prashad and Mukerji, *Glyptothorax tuberculatus* Prashad and Mukerji, *Glyptothorax burmanicus* Prashad and Mukerji, *Chopraia rupicola* Prashad and Mukerji, *Bairus seuelli* Prashad and Mukerji, *Barbus myitkyinae* Prashad and Mukerji, *Parasphaerichthys ocellatus* Prashad and Mukerji, *Indostomus paradoxus* Prashad and Mukerji, *Doryichthys dunckeri* Prashad and Mukerji.

*Nemachilus peguensis* Hora, *Nemachilus shanensis* Hora, *Nemachilus rivulicola* Hora, *Nemachilus acuticephalus* Hora, *Nemachilus paucifasciatus* Hora, *Nemachilus raoe* Hora.

## Cotypes.

*Laubuca caeruleostigma* Smith, *Labeo hensawi* Fowler, *Garra persica* Berg, *Ehiraya fluviatilis* Deraniyagala, *Puntius titiya* Deraniyagala, *Homaloptera amphisquamata* Weber and Beaufort, *Homaloptera heterolepis* Weber and Beaufort, *Lissochilus sumatranus* Weber and Beaufort.

## APPENDIX E.

*List of Donors for the years 1929-1932.*

- |                                                               |                                                      |
|---------------------------------------------------------------|------------------------------------------------------|
| Academy of Natural Sciences, Philadelphia.                    | District Laboratory, Maymyo.                         |
| Agricultural Research Institute, Pusa.                        | Dormieux, E. C.                                      |
| Aiyer, Dr. K. S. Padmanava.                                   | Dormieux, Miss J.                                    |
| Algers, F. C.                                                 | Dutt, A.                                             |
| Anthropological Society of Bombay.                            | Economic Botanist, Poona.                            |
| Anti-Malaria Officer, Peshawar.                               | Ellis, Mrs. J. V.                                    |
| Assistant Director of Fisheries (Inland),<br>Chepauk, Madras. | Evans, Brig. W. H.                                   |
| Awati, Prof. P. R.                                            | Fang, Dr. P. W.                                      |
| Ayer, R. G.                                                   | Feegrade, Dr. G. S.                                  |
| Ayyar, Dr. T. V. R.                                           | Ferrar, Lt.-Col. M. L.                               |
| Bacon, Commander E. G. (P. V. "Lady<br>Fraser").              | Firpo, A., Ltd.                                      |
| Bagchi, R.                                                    | Fooks, H. A.                                         |
| Bal, Dr. S. N.                                                | Forest Research Institute and College,<br>Dehra Dun. |
| Ballygunge Dairy Farm.                                        | Fowler, Dr. F. H.                                    |
| Banerji, R. G.                                                | Fujita, Dr. S.                                       |
| Beaufort, Prof. L. F. de                                      | Gee, Prof. N. Gist                                   |
| Berg, Prof. L. S.                                             | Genova Museum.                                       |
| Berlin Museum.                                                | Ghosh, C. C.                                         |
| Bhaduri, J. L.                                                | Gianferrari, Prof. L.                                |
| Biggs, H. E. J.                                               | Government Museum, Madras.                           |
| Biswas, K. P.                                                 | Gravelly, Dr. F. H.                                  |
| Blatter, Rev. E.                                              | Guha, Dr. B. S.                                      |
| Bombay Natural History Society.                               | Hill, H. B. C.                                       |
| Bose, M. K.                                                   | Hodgart, R.                                          |
| Böving, Dr. A. G.                                             | Hooper, Miss E. F.                                   |
| Brahmachari, Dr. U. N.                                        | Hopely, Mrs. N.                                      |
| Bretton, H. M. de                                             | Hora, Dr. S. L.                                      |
| British Museum (Natural History).                             | Hora, Mrs. S. L.                                     |
| Brodsky, Dr. K.                                               | Huestes, R. S.                                       |
| Campbell Brown, J. A.                                         | Hummetinck, P.                                       |
| Chakravarti, P. K.                                            | Hutton, Dr. J. H.                                    |
| Chatterji, A.                                                 | Iyengar, M. O. T.                                    |
| Chen, Kan-fan.                                                | Kawamura, Dr. T.                                     |
| Chopra, Dr. B. N.                                             | Kemp, Dr. S. W.                                      |
| Clark, Dr. H. L.                                              | Keventer, E. Ltd.                                    |
| Cleghorn, Miss M. L.                                          | Koumans, Dr. F. P.                                   |
| Colthrust, Mrs. J.                                            | Law, Dr. S. C.                                       |
| Colombo Museum.                                               | Locust Research Officer, Quetta.                     |
| Courtois, Rev. Fr.                                            | Lyon, (Jr.), M. W.                                   |
| Das, Prof. B. K.                                              | Mackie, Lt.-Col. F.                                  |
| Das, K. N.                                                    | Mahendra, B. C.                                      |
| Datta, M. N.                                                  | Maplestone, Dr. P. A.                                |
| Dautzenberg, Dr. Ph.                                          | Mathew, A. P.                                        |
| Department of Zoology, University of<br>Pennsylvania.         | McCann, C.                                           |
| Deraniyagala, Dr. P. E. P.                                    | McIntosh, W. C.                                      |
| Director, Cuba Museum.                                        | Melo, Col. F. de                                     |
| District Health Officer, Chitaldrug, Mysore.                  | Moghe, Prof. M. A.                                   |
|                                                               | Mondul, S. C.                                        |
|                                                               | Mukerji, D. D.                                       |
|                                                               | Mukerji, Miss Jutheca.                               |

- Munro, A. E. M.  
Nath, S. B.  
Natural History Museum, Hamburg.  
Nayar, Prof. K. K.  
Nichols, Dr. J. T.  
Northup, Miss N. E.  
Paterson Filter Company.  
Pearse, Prof. A. S.  
Pillay, R. S. N.  
Prasad, Rai Bahadur Dr. H.  
Prashad, Dr. B.  
Pruthi, Dr. H. S.  
Puri, Dr. I. M.  
Queens University, Belfast.  
Rahim, A.  
Rahman, Khan A.  
Raj, Dr. B. Sundara.  
Rao, Dr. H. S.  
Rao, Rao Sahib, Y. R. R.  
Ray, S. C.  
Ribeiro, S.  
Rijks Museum, Leiden.  
Rivett, Miss E.  
Rodrigues, H.  
Roule, Prof. L.  
Roy, B. K.  
Roy, Dr. D.  
Sen, A.  
Senior-White, R.  
Seshiya, R. V.  
Setna, Dr. S. B.  
Sewell, Lt.-Col. R. B. S.  
Sharif, Dr. M.  
Shaw, J. E.  
Shore, Rev. T. E. T.  
Shortt, Lt.-Col. H. E.  
Silner, Capt. G. I.  
Silvestri, F.  
Singh, K.  
Singh, L. Y.  
Sinha, P. C.  
Sinton, Lt.-Col. J. A.  
Smith, G. A.  
Smith, Dr. H. M.  
Smithsonian Institute, Washington.  
Snaith, J. F.  
Stephens, G.  
Thacker Spink & Co.  
Thetis Expedition.  
Thompson, Mrs. A. J.  
Tomlin, J. R. le B.  
Tonnoir, Dr. A. L.  
United States National Museum.  
Verma, S. C.  
Verugis, G.  
Vinciguerra, Dr. D.  
Walton, Col. H. J.  
Warden of Fisheries ; Dharamsala, Punjab.  
Weber, Prof. Max.  
Winckworth, R.  
Zoological Gardens, Calcutta.  
Zoological Institute, University of Berlin.  
Zoological Museum, Amsterdam.  
Zorab, L. K.

## APPENDIX F.

## List of Specimens added to the Exhibits in the Public galleries during the years 1929-1932.

## (a) Zoological Specimens.

## Insecta.

A model of *Anopheles funestus* var. *listoni* Liston, a malaria transmitting mosquito in Bengal.

## Pisces.

*Chaudhuria caudata* Annandale.  
*Microrasbora rubescens* Annandale.  
*Sawbwa resplendens* Annandale.  
*Ctenogobius alcocki* Annandale.  
*Danio* (*Brachydanio*) *shanensis* Hora.  
*Danio* (*Brachydanio*) *choprae* Hora.  
*Esomus ahli* Hora and Mukerji.  
*Esomus danricus* (Ham. Buch.).  
*Indostomus paradoxus* Prashad and Mukerji.  
*Haplochilus melanostigma* (McClelland).  
*Tetraodon reticulatus* Bloch.  
*Balistes undulatus* (Bl. and Schn.).  
*PlatyGLOSSUS hortulanus* (Lacépède).  
*Synanceia verrucosa* (Bl. and Schn.).  
*Aoria gulio* (Ham. Buch.).  
*Polynemus paradiseus* Linn.  
*Kurtus indicus* Bloch.  
*Harpodon nehereus* (Ham. Buch.).  
*Pseudechenies sulcatus* (McClelland).  
*Balitora brucei*. Gray.  
*Nemachilus multifasciatus* Day.  
*Garra lamta* (Ham. Buch.).  
*Glyptothorax striatus* (McClelland).  
*Apogon bifasciatus* (Rüppel).  
*Chilodipterous lineatus* (Forsk.).  
*Apogon taeniatus* (Cuv. and Val.).  
*Tetradacnum aruanum* (Linn.).  
*Heniochus macrolepidotus* (Linn.).  
*Glyphisodon sexatilis* (Linn.).  
*Rita rita* (Ham. Buch.).  
*Rohitee alfrediana* (Cuv. and Val.).  
*Rasbora daniconius* (Ham. Buch.).  
*Barbus sarana caudimarginatus* Blyth.  
*Osteochilus hasselti*, (Cuv. and Val.).  
*Oreinus sinuatus* (Heckel).  
*Schizopygopsis stoliczkae* Steindachner.  
*Schizothorax esocinus* Heckel.  
*Psilorhynchus balitora* (Ham. Buch.).  
*Diptychus maculatus* Steindachner.  
*Ptychobarbus conirostris* Steindachner.  
*Glyptosternon reticulatus* McClelland.

*Catlocarpio siamensis* Boulenger.

*Acanthopthalmus pangia* (Ham. Buch.).

*Ophicephalus striatus* Bloch } Showing  
*Clarias batrachus* (Linn.) } accessory  
*Saccobranthus fossilis* } respiratory  
 (Bloch). } organs.  
*Anabas testudineus* (Bloch.) }

Egg case of *Scyllium catulus* (Edward).

Embryo of *Stegostoma tigrinum* (Gem.).

Developing eggs removed from the Mouth of *Osteogobius militaris* (Linn.).

A group of Indian fishes of proved utility as Mosquito destroyers.

## Aves.

*Phoeniconais minor* (Geoffr.).  
*Phalacrocorax niger* (Vieill.) ♂, ♀  
*Butorides striatus javanicus* (Horsf.).  
*Graculus macei nipalensis* (Hodgs.).  
*Rollulus roulroul* (Scop.).  
*Baza leuphotes leuphotes* (Dumont).  
*Lamprocorax panayensis tytleri* (Hume) ♂, ♀.  
*Graculus dobsoni* Ball.  
*Demigretta s. sacra* (Gmel.).  
*Numenius a. arquata* (Linn.).  
*Oriolus chinensis andamanensis* (Tytler) ♂, ♀.  
*Eurystomus orientalis gigas* Stressmann.  
*Xantholaema haemacephala lutea* (Lesson) ♂, ♀.  
*Merops o. orientalis* (Lath) ♂, ♀.  
*Pterocles orientalis* (Linn.), ♂, ♀.  
*Antigone a. antigone* Linn. ♂, ♀.  
*Falco c. chiquera* Dauden. ♂, ♀.  
*Picus canus barbatus* (Hardwieke).  
*Caloenas n. nicobarica* (Linn.).  
*Glareola m. maldivarum* Forster. ♂, ♀.  
*Lophophorus impejanus* (Lath).  
 Group display of Birds of the Darjeeling District in one case :—  
*Dicrurus macrocercus albinctus* (Hodgs.).  
*Alcurus striatus* (Blyth). ♂, ♀.  
*Leioptila c. capistrata* (Vigors.).  
*Niltava g. grandis* (Blyth). ♂, ♀.  
*Notodela leucura* (Hodgs.) ♂, ♀.  
*Niltava s. sundara* (Hodgs.) ♂, ♀.  
*Pteruthius erythropterus* (Vigors.) ♂, ♀.  
*Pericrocotus b. brevirostris* (Vigors.) ♂, ♀.

**Reptilia & Mammalia.**

*Giraffa camelopardalis* (Linn.).  
*Ovis nahura* (Hodgson).  
*Ateleus ater* Cuvier.  
*Ateleus hybridus*. Geoff.  
*Hylobates hoolock*. (Harlan).  
*Hylobates lar* (Linn.).  
*Macacus silenus* (Schreb.).  
*Midas rosalia* (Linn.).  
*Felis pardus* Linn.  
*Felis tigris* Linn.  
*Paradoxurus hermaphoditus* (Pallas).  
*Canis aureus* Linn.  
*Semur varius* Geoff.  
*Lemur catta* Linn.  
*Lutra lutra nair* (Linn.).  
*Nasua nasua* (Linn.).  
*Eoglaucmys fimbriatus* (Gray.).  
*Sciurus indicus* (Erxleben).  
*Manis pentadactyla* Linn.

*Antelope cervicapra* (Linn.).  
*Stenopus frontatus* (Shaw).  
*Loris lydekkerianus* Cabrera.  
*Melursus ursinus* (Shaw.).  
*Hapale jacchus* (Linn.).  
*Galago senegalensis* Geoff.  
*Capra falconeri megaceros* (Adams).  
*Cemas goral* (Hardwicke).  
*Cervis porcinus* Zimm.  
*Bos frontalis* Lambert.  
*Semnopithecus entellus* (Hodgson).  
*Sus andamanensis* Blyth ♂.  
*Sus andamanensis* Blyth ♀.  
*Sus andamanensis* Blyth (Young).  
*Halicore dugong* (Erxleben).  
*Chelone mydas* (Linn.).  
*Gavialis gangeticus* (Gmel.).  
*Crocodylus porosus*, Schneid.  
*Zaocys mucosus* (Linn.).  
*Python molurus* (Linn.).

**(b) Anthropological Specimens.**

A collection of Naga specimens. 21 specimens.  
A collection of fishing instruments from Burma. 11 specimens.  
A collection of Bhil specimens from Panchmahal, Bombay Presidency. 32 specimens.  
A collection of Chitral specimens of Red Kaffirs and Khakashes. 72 specimens.  
Wooden figure of a god of the South Sea Islanders. 1 specimen.  
A Collection of Kadirs and Malayans specimens from Cochin State. 27 specimens.

A wooden life like figure of a Palaung woman with remarkable collars and other heavy brass ornaments.  
One Sora Plough complete with Yoke and Goad.  
A pair of Lama boots.  
Tibetan tea cups with Stand and Cover. 2 specimens.  
Japanese diving goggles. 1 specimen.  
Conical basket. 1 specimen.  
Fishing net. 1 specimen.  
Miscellaneous collections.

## APPENDIX G.

*Specimens received for identification during the years 1929-1932.***Vermes.**

|                                                                          |                                         |
|--------------------------------------------------------------------------|-----------------------------------------|
| From Health Officer, Calcutta Corporation.                               | One flatworm.                           |
| „ Dr. C. J. van der Horst, Zool. Dept., Univ. of Johannesburg, S. Africa | Corals 45 packets.                      |
| „ Anant Narayan Rao, C. O. D.                                            | One slide of cercaria.                  |
| „ Daya Ram Sahni, Esq., Dy. Director General, Archæology for Exploration | One Coral.                              |
| „ K. S. Padmanabha Aiyer, Maharaja's Coll. of Science, Trivandrum.       | One worm.                               |
| „ Dr. P. A. Maplestone, School of Tropical Medicine, Calcutta.           | 3 lots of Acanthocephala.               |
| „ Mr. S. K. Ghose, Calcutta Corporation                                  | One worm.                               |
| „ Secretary, Agri-Horticultural Gardens, Alipore, Calcutta               | Earthworm.                              |
| „ Col. F. de Mello, Nova Goa                                             | 1 Roundworm.                            |
| „ Govt. Entomologist, Agric. College, Coimbatore                         | 4 leeches.                              |
| „ Dr. Sixten Bock, Naturhistoriska Museum, Stockholm                     | One lot of Sponges (dry and in spirit). |
| „ Dr. Fater, Bombay                                                      | One Earthworm.                          |

**Crustacea.**

|                                                        |                                        |
|--------------------------------------------------------|----------------------------------------|
| From Dr. F. H. Gravely, Govt. Mus., Madras.            | 4 lots of Crustacea.                   |
| „ Prof. D. R. Bhattacharya, Univ. of Allahabad         | 1 lot of Crustacea.                    |
| „ Rev. E. Blatter, Bombay                              | 2 lots of Crustacea, 1 tube of Prawns. |
| „ Dr. Viswa Nath, Govt. College, Lahore                | 1 tube of Crustacea.                   |
| „ Mr. K. P. Biswas, Royal Botanical Gardens, Sibpur    | 1 lot of Crustacea.                    |
| „ Dr. Ekendra Nath Ghose, Medical College, Calcutta    | „ „ „                                  |
| „ Mr. S. H. Prater, Bomb. Nat. Hist. Soc.              | 2 lots „                               |
| „ Prof. C. John, St. Berchman College, S. India        | 1 lot „ „                              |
| „ Prof. C. R. Narayan Rao, Central College, Bangalore. | „ „ „                                  |
| „ Prof. G. E. Gates, Judson College, Rangoon           | „ „ „                                  |
| „ Mr. C. Dover                                         | 1 Crustacea.                           |
| „ Dr. S. B. Setua, Royal Inst. of Science, Bombay      | 1 tube of Prawns.                      |

**Insecta, etc.**

|                                                              |                                 |
|--------------------------------------------------------------|---------------------------------|
| From the Harcourt Butler Institute of Public Health, Rangoon | One lot of Orthoptera.          |
| „ Dr. D. R. Bhattacharya, University of Allahabad            | „ „ „ Orthoptera and Rhynchota. |
| „ Col. F. de Mello, Nova Goa                                 | Two lots of Isoptera.           |
| „ Mr. R. A. Senior White, Malariologist, B. N. Ry., Calcutta | A specimen of Hymenoptera.      |
| „ Mr. B. K. Roy, Calcutta                                    | One lot of Coleoptera.          |

|                                                                |                                         |
|----------------------------------------------------------------|-----------------------------------------|
| From Mr. H. B. C. Hill, Chabua, Upper Assam                    | Two specimens of Coleoptera.            |
| „ Miss E. F. Hooper, Calcutta                                  | A cocoon of Lepidoptera.                |
| „ Mr. J. F. Snaith, Calcutta                                   | A chrysalis of Lepidoptera.             |
| „ Lt.-Col. F. Mackie, I. M. S., Pasteur Institute, Shillong    | Two specimens of Lepidoptera.           |
| „ Prof. K. K. Nayar, Maharaja's College, Ernakulam             | One tube of Diptera Pupipara.           |
| „ the Government Museum, Madras                                | A specimen of Siphonaptera.             |
| „ the King Institute, Guindy, Madras                           | Two tubes of Siphonaptera.              |
| „ Dr. D. Roy, School of Tropical Medicine & Hygiene, Calcutta  | A specimen of Rhynchota.                |
| „ the Rev. T. E. T. Shore, Calcutta                            | „ „ „                                   |
| „ Kan-fan Chen, Entomological Society of China, Nankin         | One lot of Rhynchota.                   |
| „ Mrs. I. Colthurst, Kurseong                                  | Two lots of Rhynchota.                  |
| „ the Colombo Museum, Colombo                                  | One lot of Jassid Rhynchota.            |
| „ the Entomologist to the Government of Burma, Mandalay        | Two lots of Jassid Rhynchota.           |
| „ the Forest Research Institute and College, Dehra Dun         | Four lots of Jassid Rhynchota.          |
| „ the German Entomological Institute, Berlin                   | Two lots of Jassid Rhynchota.           |
| „ Mr. J. A. Campbell Brown, Calcutta                           | One lot of Insecta.                     |
| „ „ A. P. Mathew, Women's College, Trivandrum.                 | Two lots of Insecta.                    |
| „ Messrs. Thacker Spink & Co., Calcutta                        | Two specimens of Insecta.               |
| „ the Officer-in-charge, District Laboratory, Maymyo           | Three lots of Insecta.                  |
| „ Mr. V. H. James, Calcutta                                    | One lot of Insecta.                     |
| „ „ K. P. Biswas, Royal Botanical Gardens, Sibpur              | One lot of Insecta and Arachnida.       |
| „ the Bombay Natural History Society, Bombay                   | Three lots Insecta and one lot Acarina. |
| „ the Malaria Survey of India, Kasauli                         | One lot of Insecta and Acarina.         |
| „ Mr. P. C. Sinha, Calcutta                                    | One tube of Acarina.                    |
| „ Rai Bahadur Dr. H. Prasad, Civil Surgeon, Jaunpur, U. P.     | A specimen of Araneae.                  |
| „ Messrs. Edw. Keventer, Ltd., Ballygunge                      | One lot of Insecta and Myriapoda.       |
| „ Dr. K. N. Bahl, Zoology Dept., University of Lucknow         | Four tubes of Myriapoda.                |
| „ Prof. C. John, St. Berchman's College, Changanacherry, S. I. | One lot of Myriapoda and Arachnida.     |
| „ Mr. B. C. Mahendra, St. John's College, Agra                 | Two lots of Arachnida.                  |
| „ Prof. A. Das Gupta, Calcutta                                 | Two lots of Insecta and Crustacea.      |

#### Mollusca.

|                                                                             |                                 |
|-----------------------------------------------------------------------------|---------------------------------|
| From Dr. R. Sparek, Copenhagen, Denmark                                     | 2 boxes of Molluscs.            |
| „ „ Ph. Dautzenberg, Paris, France                                          | 1 lot of Corbicula.             |
| „ „ L. Germain, Paris, France                                               | 3 boxes of Molluscs.            |
| „ Prof. Dr. F. Haas, Senckenberg Museum                                     | 1 lot of Corbiculas.            |
| „ Mr. G. C. Robson, British Museum, London                                  | 2 lots of Corbicula.            |
| „ Dr. Paul Bartsh, U. S. National Museum, Smithsonian Inst., U. S. A. . . . | 1 lot of Molluscs (Pelecypods). |

|                                                                |                              |
|----------------------------------------------------------------|------------------------------|
| From Dr. D. R. Bhattacharya, University of Allahabad . . .     | 2 lots of Molluscs.          |
| „ Rev. E. Blatter, Bombay . . .                                | 1 lot of Molluscs.           |
| „ Mr. Carmelo Bonacurso, Spain . . .                           | 2 shells.                    |
| „ C. F. C. Beeson, Dehra Dun Institute . . .                   | 1 lot of Molluscs.           |
| „ G. D. Bhalero, Mukteswar . . .                               | 1 lot of Molluscs.           |
| „ Prof. L. F. de Beaufort, Amsterdam . . .                     | Prof. Max Weber's collection |
| „ Mr. H. E. J. Biggs, Persia . . .                             | 1 lot of Molluscs.           |
| „ K. P. Biswas, Royal Botanic Gardens, Sibpore, Calcutta . . . | 2 shells.                    |
| „ Mrs. Ida Colhurst, Kurseong . . .                            | 1 lot of Molluscs.           |
| „ Curator, B. N. H. S., Bombay . . .                           | 6 lots of Molluscs.          |
| „ Mr. C. Dover, Dehra Dun Institute . . .                      | 7 tubes of Molluscs.         |
| „ T. B. Fletcher, Esq., Imperial Institute, Pusa . . .         | 1 slug.                      |
| „ Director, Harcourt Butler Institute, Rangoon . . .           | 1 lot of Molluscs.           |
| „ Director, Colombo Museum, Ceylon . . .                       | 1 small coll. of shells.     |
| „ Dr. F. H. Gravely, Government Mus., Madras . . .             | 4 lots of Molluscs.          |
| „ G. E. Gates, Judson College, Rangoon . . .                   | 1 lot of Molluscs.           |
| „ J. C. M. Gardner, Esq., F. I., Dehra Dun . . .               | 8 tubes of Molluscs.         |
| „ Government Fisheries, Ennur, Madras . . .                    | 3 slugs.                     |
| „ Yin Chi Hsu, Department of Biology, Soochow, China . . .     | 1 lot of Molluscs.           |
| „ Mr. G. Hobson, G. S. I., Calcutta . . .                      | 91 shells.                   |
| „ E. Hillel, Calcutta . . .                                    | 1 shell.                     |
| „ Prof. C. John, S. India . . .                                | 1 lot of Molluscs.           |
| „ Mr. C. McCann, B. N. H. S., Bombay . . .                     | 1 lot of shells.             |
| „ Dr. H. R. Mehra, University of Allahabad . . .               | 1 lot of shells.             |
| „ F. J. Meggitt, University of Rangoon . . .                   | 5 lots of Molluscs.          |
| „ Mr. E. J. Mackay, Mahenjo-daro, Sind . . .                   | 2 lots of shells.            |
| „ Dr. E. Mjöberg, Sarawak Museum, Borneo . . .                 | 1 lot of Molluscs.           |
| „ Miss N. Northup, Judson College, Rangoon . . .               | 1 lot of Molluscs.           |
| „ Rao Sahib Y. R. C. Rao, Govt. Entomologist, Coimbatore . . . | 3 lots of Molluscs.          |
| „ Dr. S. G. M. Ramanujam, Presidency College, Madras . . .     | 4 lots of shells.            |
| „ J. Pearson, Colombo Museum, Ceylon . . .                     | 1 small coll. of shells.     |
| „ Mr. P. C. Singha, Puri . . .                                 | 1 boring Mollusc.            |
| „ Special Officer for Exploration, Mahenjo-daro, Sind . . .    | 2 lots of shells.            |
| „ Mr. R. V. Seshaiya, Tirputi, S. India . . .                  | 4 lots of Molluscs.          |
| „ Dr. R. A. Senior White, Malariologist, B. N. Ry. . . .       | 2 lots of shells.            |
| „ Mr. Nazir Ahmed, Lahore, Punjab . . .                        | 1 lot of Molluscs.           |
| „ R. Winckworth, Royal Soc., London . . .                      | 2 packets, of Molluscs.      |
| „ Prof. C. P. Gnanamutha, Madras . . .                         | 1 lot of Molluscs.           |

*Specimens received for study or identification during the years 1929-1932.*

**Fishes.**

*(a) Specimens received for Study.*

|                                                        |            |
|--------------------------------------------------------|------------|
| From Dr. D. Vinciguerra, Genova Museum                 | 1 species. |
| „ „ J. R. Norman, British Museum<br>Nat. Hist., London | 2 species. |
| „ „ P. W. Fang, Metropolitan<br>Museum, Nankin, China  | 3 species. |
| „ „ F. P. Koumans, Leiden Museum                       | 1 species. |

*(b) Specimens received for identification.*

|                                                                |                            |
|----------------------------------------------------------------|----------------------------|
| From Anti-Malaria Officer, Peshawar                            | 1 lot of fish.             |
| „ Bombay Natural History Society                               | 14 lots of fish.           |
| „ Netherland Karakorum Expedition                              | Entire collection of Fish. |
| „ Director, Colombo Museum                                     | 2 lots of Fish.            |
| „ Dr. H. R. Mehra, University of Alla-<br>habad                | 1 lot of Fish.             |
| „ „ S. B. Setna, Imperial Inst. of<br>Sci., Bombay             | 1 lot of Fish.             |
| „ Rev. E. Blatter, Bombay                                      | 1 lot of Fish.             |
| „ Director, Harcourt Butler Inst. of<br>Public Health, Rangoon | Several lots of Fish.      |
| „ Prof. P. R. Awati, Bombay                                    | 1 lot of Fish.             |
| „ Mr. C. McCann, Bombay                                        | 2 lots of Fish.            |
| „ Asst. Prof. of Zoology, Mysore                               | 1 lot of Fish.             |
| „ Dr. F. H. Gravely, Govt. Museum,<br>Madras                   | 1 lot of Fish.             |
| „ Mr. A. Das Gupta, Calcutta                                   | 1 lot of Fish.             |
| „ „ G. E. Shaw, Siliguri.                                      | Several lots of Fish.      |
| „ Prof. Gordon Gates, Rangoon                                  | 1 lot of Fish.             |
| „ Locust Research Officer, Quetta                              | 1 lot of Fish.             |
| „ Lt.-Col. R. W. H. Miller, Colaba,<br>Bombay                  | 1 lot of Fish.             |
| „ Dr. H. M. Smith, Bangkok, Siam                               | Several lots of Fish.      |
| „ „ G. E. Feegrade, Moulmein                                   | 1 lot of Fish.             |
| „ Malariologist, Moulmein Municipality                         | 1 lot of Fish.             |
| „ Malariologist, E. B. Railway                                 | 1 lot of Fish.             |
| „ Curator, Natural History Museum,<br>Darjiling                | Several lots of Fish.      |

**Miscellaneous.**

|                                                                                 |                        |
|---------------------------------------------------------------------------------|------------------------|
| „ Imperial Inst. of Vet. Res., Muk-<br>teswar                                   | 1 skin of Parroquet.   |
| „ Mr. R. Bagchi, Calcutta                                                       | 1 skin of Bird.        |
| „ Sheikh Nasir Ahamed, Hon. Secy.,<br>Shikar Club, Mukteswar, U. P.             | 1 skin of Kestrel.     |
| „ Mr. E. J. H. Mackay, Spécial Officer<br>for exploration Mohenjo-daro,<br>Sind | 2 clay models of Birds |
| „ Superintendent, Calcutta Zoo.                                                 | 3 live Birds.          |
| „ Mr. K. P. Biswas                                                              | 3 lots of Snakes.      |
| „ Prof. J. J. Asana, Gujrat College,<br>Ahmedabad                               | 1 lot of Lizards.      |
| „ Mr. F. C. Algers, Dooars                                                      | 1 specimen of Snake.   |
| „ „ L. K. Lorab, Calcutta                                                       | 1 specimen of Snake.   |
| „ „ G. Makrell, Calcutta                                                        | 1 specimen of Snake.   |
| „ Dr. V. V. Sohoni, Calcutta                                                    | 1 specimen of Snake.   |

|                                                                                                          |                                          |
|----------------------------------------------------------------------------------------------------------|------------------------------------------|
| From C. S. Fox., Esq., Calcutta . . .                                                                    | 1 specimen of Snake.                     |
| „ Lt. W. E. Harvey, Punjab                                                                               | 1 specimen of Snake.                     |
| „ Officer-in-Charge, District Lab.,<br>Maymyo                                                            | 1 specimen of Snake.                     |
| „ Prof. A. S. Khan, Med. College, Patna                                                                  | 1 specimen of Snake.                     |
| „ Ballygunge Dairy Farm, Calcutta                                                                        | Several lots of Snake.                   |
| „ Col. F. de Melo, Nova Goa                                                                              | Several lots of Reptiles and Amphibians. |
| „ School of Tropical Medicine, Calcutta<br>(through, Col. Acton, Dr.<br>Strickland and Dr. Das<br>Gupta) | Several lots of Mammals.                 |
| „ Prof. L. P. Mathur, St. Johns<br>College, Agra .                                                       | 1 lot of Lizards.                        |
| „ the Chemical Examiner, U. P. and<br>C. P. Governments, Agra                                            | One lot of Lizards.                      |
| „ Prof. G. D. Bhalerao                                                                                   | One lot of Lizards.                      |
| „ Harcourt Butler Institute, Rangoon                                                                     | One lot of Mammals.                      |
| „ Dr. F. H. Gravely                                                                                      | One Frog.                                |
| „ Mr. R. A. Senior White, B. N. R.                                                                       | One lot of Frogs.                        |
| „ „ H. A. Fookes, Calcutta                                                                               | Leopard Skin.                            |
| „ „ I. A. Isaacs                                                                                         | Python Skin.                             |
| „ Lt.-Col. A. E. Shortt .                                                                                | One Lizard.                              |
| „ Rev. E. Blatter                                                                                        | One small Mammal.                        |
| „ Rev. E. Blatter                                                                                        | One lot of Reptiles.                     |
| „ Mr. W. Perno, Shillong                                                                                 | One lot of Amphibian Eggs.               |
| „ Imperial Entomologist, Pusa                                                                            | One Frog.                                |
| „ Lt.-Col. F. P. Mackie, Shillong .                                                                      | One lot of Snakes.                       |
| „ Prof. C. John                                                                                          | One lot of Snakes.                       |
| „ Mr. S. S. Choudhury, Prince of Wales<br>Med. College, Patna                                            | One lot of Snakes.                       |

## APPENDIX H.

*A list of Zoologists and Anthropologists who have made use of the library and laboratories during the years 1929-1932.*

| Name.                                            | Institution.                                                        |
|--------------------------------------------------|---------------------------------------------------------------------|
| Dr. Syuti Issiki                                 | School of Agriculture and Forestry,<br>Taihoku Imperial University. |
| Dr. S. B. Setna, Ph.D.                           | Bombay.                                                             |
| Prof. M. A. Moghe, M.Sc.                         | College of Science, Nagpur.                                         |
| Mr. G. Sondhi                                    | Agra College.                                                       |
| Dr. S. R. Bose, D.Sc.                            | Belgachia Medical College, Calcutta.                                |
| Dr. H. K. Mookerji, D.Sc.                        | Science College, Calcutta.                                          |
| Mr. G. D. Bhalerao, M.Sc.                        | College of Science, Nagpur.                                         |
| Mr. B. S. Bhimachar, M.Sc.                       | Science College, Calcutta.                                          |
| Prof. C. R. Narayan Rao.                         | Central College, Bangalore.                                         |
| Mr. Gopi Mohan Das., M.Sc.                       | Calcutta University.                                                |
| Mr. G. N. Roy, M.Sc.                             | Allahabad University.                                               |
| Mr. Makunda Behari Lal, M.Sc.                    | Lucknow University.                                                 |
| Dr. S. Sunder Rao                                | School of Tropical Medicine, Calcutta.                              |
| Mr. Sukh Dyal, M.Sc.                             | Government College, Lahore.                                         |
| Prof. A. S. Pearse                               | Duke University, U. S. A.                                           |
| Dr. P. A. Maplestone                             | School of Tropical Medicine, Calcutta.                              |
| Mr. Harish Chandra Roy, M.Sc.                    | Calcutta University.                                                |
| Mr. K. S. Lamba, M.Sc.                           | Science College, Calcutta.                                          |
| Prof. D. R. Bhattacharya, Ph.D.                  | Allahabad University.                                               |
| Prof. P. Mitra, Ph.D.                            | Calcutta University.                                                |
| Mr. A. Aiyappam, M.A.                            | Madrâs Museum.                                                      |
| Mr. Bijoy Kumar Chatterjee, M.Sc.                | Science College, Calcutta.                                          |
| Mr. A. C. Sen, M.Sc.                             | . Locust Research Office, Quetta.                                   |
| Mr. Santosh Kumar Bose, M.Sc.                    | . Calcutta University.                                              |
| Mr. Balbir Singh, M.Sc.                          | . Govt. College, Lahore.                                            |
| Mr. Debi Prashad Roy Chowdhury, M.Sc.            | Calcutta University.                                                |
| Mr. Najm-ud-Din Aziz, M.Sc.                      |                                                                     |
| Mr. S. Mukerji, M.Sc.                            | School of Tropical Medicine, Calcutta.                              |
| Dr. Provash Chandra Basu, M.Sc., M.B.,<br>P.R.S. | Bose Institute, Calcutta.                                           |
| Mr. J. L. Bhaduri, M.Sc.                         | Calcutta University.                                                |
| Dr. Ekendranath Ghosh, M.Sc., M.D.               | Medical College, Calcutta.                                          |
| Mr. Durgadas Mukerji, M.Sc.                      | Science College, Calcutta.                                          |
| Dr. B. K. Das, D. Sc.                            | Science College, Calcutta.                                          |
| Mr. R. C. Chatterjee, M.Sc.                      | Rangoon University.                                                 |
| Dr. Kribbs                                       | Christian College, Allahabad.                                       |
| Prof. H. R. Mehra.                               | Allahabad University.                                               |
| Mr. Khagendra Nath Das, M.Sc.                    | Science College, Calcutta.                                          |
| Mr. & Mrs. C. Dover                              | Calcutta.                                                           |
| Dr. C. Strickland                                | School of Tropical Medicine, Calcutta.                              |
| Dr. S. C. Law, M.A., B.L., Ph.D.                 | Calcutta.                                                           |
| Mr. A. C. Dunsdon                                | Calcutta.                                                           |
| Mr. J. N. Bose                                   | Calcutta.                                                           |
| Mr. J. C. M. Gardner                             | Forest Research Institute and College<br>Dehra Dun.                 |
| Dr. V. T. Korke                                  | Central Research Institute, Kasauli.                                |

| Name.                                        | Institution.                                           |
|----------------------------------------------|--------------------------------------------------------|
| Miss B. Ray . . . . .                        | Bethune College, Calcutta.                             |
| Prof. J. Percy Moore . . . . .               | Pennsylvania University, Philadelphia,<br>U. S. A.     |
| Dr. H. N. Roy, Ph.D.                         | Science College, Calcutta.                             |
| Dr. P. Sen, Ph.D.                            | Calcutta.                                              |
| Mr. G. R. Kshirsagar                         | Baroda College.                                        |
| Prof. Hem Chandra Das Gupta                  | Presidency College, Calcutta.                          |
| Dr. C. Amirthalingam, Ph.D. . . . .          | Calcutta.                                              |
| Mrs. C. Amirthalingam . . . . .              | Calcutta.                                              |
| Mr. S. K. Datta, M.Sc. . . . .               | Allahabad University.                                  |
| Mr. D. S. Sarbahi . . . . .                  | Lucknow University.                                    |
| Dr. N. Chakrabartty                          | Medical College, Calcutta.                             |
| Mr. A. W. Chater . . . . .                   | Messrs. Angus & Co. Calcutta.                          |
| Mr. J. B. Goodyear . . . . .                 | Calcutta.                                              |
| Prof. B. L. Bhatia                           | Intermediate College, Hoshiarpur.                      |
| Mr. M. N. Acharjie, M.Sc.                    | Calcutta.                                              |
| Rai Bahadur Dr. G. C. Chatterjee             | Medical College.                                       |
| Brigadier W. H. Evans, C.S.I., C.I.E. D.S.O. | Quetta.                                                |
| Mr. R. C. Chatterjee, M.Sc.                  | Calcutta University.                                   |
| Dr. Xollecley                                | Vienna.                                                |
| Mr. K. L. Harshey . . . . .                  | Allahabad.                                             |
| Dr. Mrs. C. L. E. Colthurst                  | Kurseong.                                              |
| Mr. S. C. Verma . . . . .                    | Allahabad University.                                  |
| Mr. Nazeer Ahmed Janjua, M.Sc.               | Government College, Lahore.                            |
| Mr. Bajro Kumar Chatterjee, M.Sc.            | Calcutta.                                              |
| Mr. Rajani Kanto Paul, M.Sc.                 | Dacca.                                                 |
| Dr. S. C. Kukherji . . . . .                 | Bengal Veterinary College, Calcutta.                   |
| Mr. Himansu Kumar Bose, M.Sc.                | Calcutta.                                              |
| Mr. A. Mitra . . . . .                       | Calcutta.                                              |
| Dr. C. Handy, Ph.D. . . . .                  | Bishop's Museum, Honolulu.                             |
| Mrs. C. Handy, Ph.D.                         | Bishop's Museum, Honolulu.                             |
| Dr. Girindra Sekhar Bose, D.Sc. . . . .      | Calcutta University.                                   |
| Mr. H. R. Hargreaves, M.A.                   | Director General of Archæology.                        |
| Mr. Mohammad Sahaulah, M.A.                  | Archæological Chemist to the Govern-<br>ment of India. |
| Mr. J. N. Basu, M.A.B.L., M.L.C.             | Calcutta.                                              |
| Mr. Sasanka Sekhar Sarkar, M.Sc. . . . .     | Calcutta.                                              |
| Mr. M. A. Rahim, M.A.                        | Calcutta.                                              |
| Mr. J. N. Sen Dupta, B.Sc.                   | Calcutta.                                              |
| Miss Malvina Hoffman                         | Field Museum, Chicago.                                 |
| Miss G. Green                                | Field Museum, Chicago.                                 |
| Mr. S. N. Goswami, M.Sc.                     | Nadia.                                                 |
| Dr. J. H. Hutton, D.Sc., I.C.S., C.I.E.      | Census Commissioner for India.                         |
| Mr. L. A. K. Aiyar, B.A.                     | Calcutta University.                                   |
| Mr. Tarak Nath Das, M.A.                     | Calcutta University.                                   |
| Mr. Tarak Chandra Roy Choudhuri, M.A.        | Calcutta University.                                   |
| Major P. J. Barrand                          | Malaria Survey of India, Kasauli.                      |
| Dr. C. F. C. Beeson                          | Forest Research Institute and College,<br>Dehra Dun.   |
| Mr. Buta Mal Bhatia, B.Sc.                   | Forest Research Institute and College,<br>Dehra Dun.   |
| Lt.-Col. M. L. Ferrar, C.I.E.,               | Chief Commissioner, Andaman and Nicobar<br>Islands.    |
| Mr. J. D. Roy                                | National Quarantine Service, Republic of<br>China.     |

| Name.                             | Institution.                                       |
|-----------------------------------|----------------------------------------------------|
| Dr. R. A. O. Smith . .            | Calcutta School of Tropical Medicine.              |
| Mr. G. E. Shaw . .                | Siliguri.                                          |
| Mr. O. E. Shebbeare . .           | Forest Office, Darjeeling.                         |
| Dr. H. M. Smith .                 | Department of Fisheries, Bangkok, Siam.            |
| Dr. Krishna Rao, F.R.C.S. (Edin.) | Prof. of Anatomy, Medical College,<br>Vizagapatam. |
| Dr. R. Naidu . . .                | Port Blair.                                        |

## APPENDIX I.

*Publications for the years 1929-30, 1930-31 and 1931-32.**(a) Official—Issued by the Survey.*

| Name of Journal.                                   | List of Papers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Records of the Indian Museum, Vol. XXXI, Pt. 2.    | <p>On the Sexual Organs of the Tubifoid worm <i>Aulodrilus remex</i> Steph. K. S. Padmanabha Aiyer.</p> <p>Two new species of Nematodes from Indian Hosts. P. A. Maplestone.</p> <p>Thysanoptera from India. Dudley Moulton.</p> <p>The Style-sac of some Freshwater Gastropods. R. V. Seshaiya.</p> <p>On a collection of Indian Palpatores (Phalangiidae) with a revision of the Continental genera and species of the Sub-family Gagrellinae Thorell. C. Fr. Roewer.</p>                                                                                                                                                                                   |
| Records of the Indian Museum, Vol. XXXI, Pt. 3.    | <p>The Fish of the Indawgyi Lake and the streams of the Myitkyina District (Upper Burma). B. Prashad and D. D. Mukerji.</p> <p>The Oligochaeta of the Indawgyi Lake (Upper Burma). J. Stephenson.</p> <p>On the Gyrinidae of the Nerbudda River. G. Ochs.</p> <p>Descriptions of two new Gyrinidae from Assam. G. Ochs.</p> <p>On the immature stages of an Indian species of <i>Helichus</i> (Dryopidae: Coleoptera). H. S. Pruthi.</p>                                                                                                                                                                                                                      |
| Records of the Indian Museum, Vol. XXXI, Pt. 4.    | <p>On a new species of the genus <i>Thalassema</i> from Bombay. B. Prashad and P. R. Awati.</p> <p>Description of a new genus and species of Geophilida (Myriapoda, Chilopoda) from Madras (India). F. Silvestri.</p> <p>Sponges and Polyzoa of the Indawgyi Lake, Burma. H. S. Rao.</p> <p>The Freshwater and Amphibious Gastropod Molluscs of the Indawgyi Lake and of the connected freshwater areas in the Myitkyina District, Burma. H. S. Rao.</p> <p>Corals of the genus <i>Flabellus</i> from the Indian Ocean. J. S. Gardiner.</p> <p>Notes on Fishes in the Indian Museum. XVII. Loaches of the genus <i>Nemachilus</i> from Burma. S. L. Hora.</p> |
| Records of the Indian Museum, Vol. XXXI, Appendix. | <p>List of Literature referring to Indian Zoology (excluding Insecta) received in Calcutta during the year 1929.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Records of the Indian Museum, Vol. XXXII, Pt. 1.   | <p>Anatomy of <i>Mysorella costigera</i> Küster. R. V. Seshaiya.</p> <p>A Revision of the Indian Siphonaptera. Pt. I. Family Pulicidae. M. Sharif.</p> <p>A new species of Brachiopod from Southern India. R. Gurney.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Name of Journal.                                    | List of Papers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Records of the Indian Museum, Vol. XXXII, Pt. 2.    | <p>Distributional Records of Indian Muscoids, with descriptions of two new species. <i>R. A. Senior White.</i></p> <p>Nematode Parasites of Pigs in Bengal. <i>H. P. A. Mapleston.</i></p> <p>A Note on Monstrosities observed in Ixodid Ticks. <i>M. Sharif.</i></p> <p>Further Notes on Bopyrid Isopods parasitic on Indian Decapoda Macrura. <i>B. Chopra.</i></p> <p>The mechanism of the throat-fan in a ground lizard, <i>Sitana ponticeriana</i> Günth. <i>C. P. Gnanamuthu.</i></p> <p>Notes on Indian Blepharocerid Larvae and Pupae with remarks on the Morphology of Blepharocerid Larvae and Pupae in general. <i>A. L. Tonnoir.</i></p>                                                                                                                                                 |
| Records of the Indian Museum, Vol. XXXII, Pt. 3.    | <p>The Siluroid Fish <i>Pseudecheneis</i> and an Allied New Genus. <i>Sunder Lal Hora and Paul Chabanaud.</i></p> <p>Notes on Some Indian Paussidae with the description of a New Species. <i>S. Ribeiro.</i></p> <p>Pelecypoda of the Indawgyi Lake and of its connected freshwater areas in the Myitkyina District, Upper Burma. <i>B. Prashad.</i></p> <p>The Earthworms of Burma. I. <i>G. E. Gates.</i></p>                                                                                                                                                                                                                                                                                                                                                                                     |
| Records of the Indian Museum, Vol. XXXII, Pt. 4.    | <p>The Evolution of the Excretory System in certain groups of the Furcocercous Cercariae. <i>R. B. Seymour Sewell.</i></p> <p>Parasitic Nematodes obtained from animals dying in the Calcutta Zoological Gardens. Parts 1-3. <i>P. A. Mapleston.</i></p> <p>Further Notes on Crustacea Decapoda in the Indian Museum. I. <i>B. Chopra and K. N. Das.</i></p> <p>Notes on the Ophiuroid genus <i>Trichaster</i> with a description of <i>T. acanthifer</i> Doderlein. <i>S. B. Setna.</i></p> <p>Ein neuer <i>Heterocerus</i> (Coleoptera) aus Calcutta. <i>R. Mamitza.</i></p> <p>Contributions to a knowledge of the Indo-Malayan Japygidae (Thysanura). <i>F. Silvestri.</i></p> <p>Notes on the Fresh-water Sponge <i>Trochospongilla phillottiana</i> and its varieties. <i>N. Gist Gee.</i></p> |
| Records of the Indian Museum, Vol. XXXII, Appendix. | <p>List of Literature referring to Indian Zoology (excluding Insecta) received in Calcutta during the year 1930.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Records of the Indian Museum, Vol. XXXIII, Pt. 1.   | <p>Notes on Fishes in the Indian Museum. XVIII. On two small collections of Fishes from Burma. <i>S. L. Hora.</i></p> <p>Some Solitary Corals from the Indian Ocean. <i>C. J. van der Horst.</i></p> <p><i>Neoniphargus indicus</i> (Chilton), an Indian Fresh-water Amphipod. <i>K. Stephensen.</i></p> <p>Notes on some hitherto unknown Indian Hymenoptera. <i>A. C. Sen.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                 |

| Name of Journal.                                                | List of Papers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Records of the Indian Museum, Vol. XXXIII, Pt. 1— <i>contd.</i> | Notes on Scyphomedusae in the Indian Museum. <i>H. S. Rao.</i><br>The Generic Position of the Nepalese Fish <i>Diptychus annandalei</i> Regan. <i>D. D. Mukerji.</i><br>Classification of the Homalopterid Fishes. <i>S. L. Hora.</i>                                                                                                                                                                                                                                                                                                                                                                     |
| Records of the Indian Museum, Vol. XXXIII, Pt. 2.               | Parasitic Nematodes obtained from animals dying in the Calcutta Zoological Gardens. Parts 4-8. <i>P. A. Maplestone.</i><br>Descriptions of Indian Oligochaeta. II. <i>J. Stephenson.</i><br>On three new Gregarines, <i>Bhatiella morphysae</i> , n. g., n. sp., <i>Ferraria cornucephali</i> , n. g., n. sp. and <i>Extremocystic dendrostomi</i> , n. g., n. sp. from Indian Polychaetes. <i>S. B. Setna.</i>                                                                                                                                                                                           |
| Records of the Indian Museum, Vol. XXXIII, Pt. 3.               | Some Indian Spiders of the Families Ctenidae, Sparassidae, Selenopidae and Clubionidae. <i>F. H. Gravely.</i><br>Notes on some types of Indian Blepharoceridae. <i>A. L. Tonnoir.</i><br>On the Internal Anatomy of the Families of Opisthomi. <i>B. K. Mitra and E. Ghosh.</i><br><i>Angulyagra oxytropis</i> (Benson) nom. nov.—A correction. <i>H. S. Rao.</i><br>Further Notes on Crustacea Decapoda in the Indian Museum. II. On some Decapod Crustacea found in the cloaca of Holothurians. <i>B. Chopra.</i><br><i>Extremocystic dendrostomi</i> , n. g., n. sp. A correction. <i>S. B. Setna.</i> |
| Records of the Indian Museum, Vol. XXXIII, Pt. 4.               | The Earthworms of Burma. II. <i>G. E. Gates.</i><br>Additions to the Survey of the Odonate (Dragonfly) Fauna of Western India, with descriptions of nine new species. <i>F. C. Fraser.</i><br>Trematode Parasites of Pigs in Bengal. <i>G. D. Bhalerao.</i><br>On <i>Virgularia gracillima</i> (Kolliker) from the Chilka Lake. <i>Abdul Hamid.</i><br>A Preliminary Account of the Madras Plankton. <i>K. Sankara Menon.</i>                                                                                                                                                                             |
| Records of the Indian Museum, Vol. XXXIV, Pt. 1.                | Land Leeches in the "Fauna of British India,"—Some Corrections. <i>J. P. Moore.</i><br>A Revision of the genus <i>Coelliccia</i> (Order Odonata). <i>F. F. Laidlaw.</i><br>On a new genus and species of Strepsiptera. <i>T. V. Subramaniam.</i><br>Description of a new species of Collembola and its Anatomy. <i>Durgadas Mukerji.</i>                                                                                                                                                                                                                                                                  |
| Memoirs of the Indian Museum, Vol. IX, No. 3.                   | A Revision of the Fissilabioidae (Cordulegasteridae, Petaliidae and Petaluridae) (Order Odonata). Part I.—Cordulegasteridae. <i>F. C. Fraser.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Memoirs of the Indian Museum, Vol. IX, No. 4.                   | An Aid to the Study of Hamilton Buchanan's "Gangetic Fishes." <i>S. L. Hora.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| Name of Journal.                              | List of Papers.                                                                                                                                                                       |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Memoirs of the Indian Museum, Vol. IX, No. 5. | Revision of the Asiatic Species of the genus <i>Corbicula</i> . IV. The species of the genus <i>Corbicula</i> from the Sunda Islands, the Celebes and New Guinea. <i>B. Prashad</i> . |
| Memoirs of the Indian Museum, Vol. X.         | The Copepoda of Indian Seas. Calanoida. <i>R. B. Seymour Sewell</i> .                                                                                                                 |
| Memoirs of the Indian Museum, Vol. XI, No. 1. | Studies on Indian Jassidae (Homoptera). Part I.—Introductory and Description of some new genera and species. <i>Hem Singh Pruthi</i> .                                                |

*New publication from 1931.*

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| Anthropological Bulletins from the Zoological Survey of India. Bulletin No. 1. | A Report on the Human Relics recovered by the Naga Hills (Burma) Expedition for the abolition of Human Sacrifice during 1926-27. <i>B. S. Guha and P. C. Basu</i> . |
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*(b) Unofficial—Published in India or abroad by officers of the Department.*

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| Journ. Bombay Nat. Hist. Soc. XXXIII, pp. 922, 926 (1929).                                                    | The History and Progress of the Zoological Survey of India. Introduction. <i>R. B. S. Sewell</i> .                                           |
| The Indus Valley Civilization and Mohenjo-daro, II, Chap. XXX and XXXI (1931).                                | Report on the Human Remains and Zoological Remains excavated at Mohenjo-daro. <i>R. B. S. Sewell</i> (In collaboration with Dr. B. S. Guha). |
| Journ. Med. Res. XVIII, pp. 785-806 (1931)                                                                    | Cercariae nicobaricae. <i>R. B. S. Sewell</i> .                                                                                              |
| Journ. Bombay Nat. Hist. Soc. XXXIV, pp. 347-358 (1931), also in the XVIII Report of Indian Science Congress. | The Problems of Evolution, Pt. II. <i>R. B. S. Sewell</i> .                                                                                  |
| Journ. Bombay Nat. Hist. Soc. XXXIV, pp. 164-169 (1930).                                                      | On the Fishes of the manchar Lake, Sind. <i>B. Prashad &amp; D. D. Mukerji</i> .                                                             |
| Rec. Geol. Surv. Ind. LXIII, pp. 428-433 (1930).                                                              | On some undescribed Freshwater Molluscs from various parts of India and Burma. <i>B. Prashad</i> .                                           |
| Journ. Proc. Asiat. Soc. Bengal (N. S.) XXVI, pp. 291-300 (1930).                                             | Some Reflections on Zoological Research in India. <i>B. Prashad</i> .                                                                        |
| Journ. Bombay Nat. Hist. Soc. XXXIII, pp. 926-930 (1930).                                                     | The History and Progress of the Zoological Survey of India. The Public Galleries and Library. <i>B. Prashad</i> .                            |
| Nat. Hist. Mag. London, III, No. 18 (1931)                                                                    | The Indian Museum, Calcutta. <i>B. Prashad</i> .                                                                                             |
| Proc. Malac. Soc. London, XIX, pp. 167-170 (1931).                                                            | Further Notes on Indian Ampullaridae (Pilidae). <i>B. Prashad</i> .                                                                          |
| Proc. Roy. Soc. Edinburgh, LI, pp. 42-53 (1931).                                                              | Some Noteworthy Examples of Parallel Evolution in the Molluscan Faunas of S. E. Asia and S. America. <i>B. Prashad</i> .                     |
| Indian Zoological Memoirs, No. IV (1932)                                                                      | <i>Pila</i> . <i>B. Prashad</i> .                                                                                                            |
| Journ. Asiat. Soc. Bengal (n. s.) XXIV, pp. 481-484 (1929).                                                   | The habitat and systematic position of two imperfectly known loaches from Afghanistan. <i>S. L. Hora</i> .                                   |
| Phil. Trans. Roy. Soc. London, (B) CCXVIII, pp. 171-282 (1930).                                               | Ecology, Bionomics and Evolution of the Torrential Fauna, with special reference to the organs of attachment. <i>S. L. Hora</i> .            |
| Nature, CXXVI, pp. 435-436 (1930).                                                                            | Animal plasticity and Environment. <i>S. L. Hora</i> .                                                                                       |

| Name of Journal.                                            | List of Papers.                                                                                                                                                                                                                                      |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Journ. Dept. Sci. Calcutta Univ. X, pp. 1-10 (1929).        | Abnormal Anterior Abdominal Vein in an Indian Frog <i>Rana tigrina</i> Daud., and in an Indian Toad <i>Bufo melanostictus</i> Schneid., together with a review of the recorded cases of Abnormalities of the Anterior Abdominal Vein. J. L. Bhaduri. |
| Journ. Asiat. Soc. Bengal (n. s.) XXVI, pp. 301-315 (1930). | Notes on the Arterial System of the common Indian Toad <i>Bufo melanostictus</i> Schneid. J. L. Bhaduri.                                                                                                                                             |
| Proc. of the Indian Science Congress, 1931 (1932).          | A new species of <i>Centrorhynchus</i> , <i>Centrorhynchus maryasisa</i> sp. from <i>Urocissa melanocephalus occipitalis</i> (Blyth). M. N. Datta.                                                                                                   |

| Name of Journal.                                                               | List of Papers.                                                                                                                                                                                        |
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| Ann. Mag. Nat. Hist. (10) VI, pp. 582-586 (1930).                              | On a new Homalopterid fish from Annam. <i>S. L. Hora</i>                                                                                                                                               |
| Proc. Zool. Soc. London., Pt. 1, pp. 205-207 (1932).                           | Biological Notes on a Fish from Brazil in the Society's Aquarium. <i>S. L. Hora</i> .                                                                                                                  |
| Journ. Asiat. Soc. Bengal (n. s.) XXV, pp. 311-313 (1929).                     | On a "Drop-Door" Fishing Trap used in the Myitkyina District, Upper Burma. <i>B. Chopra</i> .                                                                                                          |
| Journ. Bombay Nat. Hist. Soc., XXXIV, pp. 502-506 (1930).                      | The History and Progress of the Zoological Survey of India (Crustacea section). <i>B. Chopra</i> .                                                                                                     |
| Nature, CXXVI, pp. 502-503 (1930)                                              | Pearl like object found in a Prawn. <i>B. Chopra</i> .                                                                                                                                                 |
| Journ. Bombay Nat. Hist. Soc. XXXIV pp. 205-212 (1930).                        | The History and progress of the Zoological Survey of India, Part II. (Invertebrate section). <i>H. S. Rao</i> .                                                                                        |
| Entom. Monthly Magazine, London 1929).                                         | Homologies of the Genitalia of Insects. <i>H. S. Pruthi</i> .                                                                                                                                          |
| Ind. Journ. Med. Res., XIX, p. 131 (1931).                                     | Preliminary observations on the Influence of Different Concentrations of Hydrogen ions and temperature of water on Mosquito Larvae. <i>H. S. Pruthi</i> .                                              |
| Nature, CXXVIII, pp. 869-870 (1931)                                            | Effects of inadequate feeding on Insect Metamorphosis. <i>H. S. Pruthi</i> .                                                                                                                           |
| Int. Rev. Hydrobiol. u. Hydrograph. XXVI, pp. 242-257 (1932).                  | Investigations regarding a recent Epidemic of Fish mortality in the Tank in the Indian Museum compound with Remarks on the causation of such Epidemics in general. <i>H. S. Pruthi</i> .               |
| Mem. Archaeol. Survey No. 35, (1929)                                           | Report on the bones excavated at Nal. By Mr. H. Hargreaves. <i>B. S. Guha</i> .                                                                                                                        |
| Nature, CXXIII, pp. 942-943 (1929)                                             | Negrito Racial strain in India. <i>B. S. Guha</i> .                                                                                                                                                    |
| Mem. Archaeol. Survey No. 43 (1931).                                           | Report on a collection of bones made by Sir Aurel Stein. <i>B. S. Guha</i> .                                                                                                                           |
| The Indus Valley Civilisation and Mohenjo-daro, II, Chapter, XXX, XXXI (1931). | Report on the Human Remains and Zoological Remains excavated at Mohenjo-daro. <i>B. S. Guha</i> . (In collaboration with Lt.-Col. R. B. Sewell, I.M.S.).                                               |
| The Modern Review, Calcutta March (1932)                                       | Among the Red Indians of U. S. A. <i>B. S. Guha</i> .                                                                                                                                                  |
| Journ. Bombay Nat. Hist. Soc. XXXIV, pp. 164-169 (1930).                       | On the Fishes of the Manchar Lake. (Sind). <i>D. D. Mukerji</i> . (In collaboration with B. Prashad.).                                                                                                 |
| Journ. Bombay Nat. Hist. Soc. XXXV, pp. 164-171 (1931).                        | On a small collection of Fish from the Bhavani River (S. India). <i>D. D. Mukerji</i> .                                                                                                                |
| Journ. Bombay Nat. Hist. Soc. XXXV, pp. 359-361 (1931).                        | On a small collection of Fish from the streams in the Billigirirangan Hills (S. India). <i>D. D. Mukerji</i> .                                                                                         |
| Journ. Asiat. Soc. Bengal (n. s.) XXIII, pp. 449-452 (1929).                   | A note on Double Chick Embryo. <i>J. L. Bhaduri</i> .                                                                                                                                                  |
| Journ. Asiat. Soc. Bengal (n. s.) XXIV, pp. 485-499 (1929).                    | A case of Hermaphroditism in a common Indian Frog <i>Rana tigrina</i> Daud., with a note on the classification of Hermaphroditic cases. <i>J. L. Bhaduri</i> .                                         |
| Proc. Zool. Soc. London, pp. 177-180 (1929)                                    | The Persistence of Left Posterior Cardinal vein and the Presence of an Abnormal vein opening into the Isthmus of the Liver of an Indian Toad <i>Bufo melanostictus</i> Schneid. <i>J. L. Bhaduri</i> . |

## APPENDIX J.

*Additions to the Library for the years 1929-30, 1930-31 and 1931-32.**Books purchased.*

- Adolph, E., The Regulation of Size as Illustrated in Unicellular Organisms.  
 Alexander, W. B., Birds of the Ocean.  
 Antonius, O., Stammesgeschichte der Haustiere.  
 Arldt, T., Die Entwicklung der Kontinente.  
 Barlow's Table.  
 Barrell, J., The Evolution of the Earth.  
 Bang-Haas, Novitates Macrolepidopterologicae. Katalog, Vol. IV.  
 Baylis, H. A., Manual of Helminthology.  
 Bijdragen tot de Dierkunde, Afd. 26.  
 Bijlmer, Outline of the Anthropology of Timor-Archipelago.  
 Bloch, D., Allgemeine Naturgeschichte der Fische Nos. 1-12.  
 Bronn, H. G., Klassen und Ordnungen des Tier-Reichs, Vol. III, 1, Vol. III, 1, 2.  
 Vol. III, 3, 1-3. Vol. IV, 1C. 178. Vol. IV, 2. Vol. IV, 2, 2, 1. Vol. V, 2. II. Vol.  
 V, 4, III. Vol. V, 2. II, 9-10. Vol. VI, 1, II. 2.  
 Brooks, W. K., The Foundation of Zoology.  
 British Hydrocarina, Ray Society.  
 Bryn, H., Der Nordische Mensch.  
 Catalogue of Scientific Papers of the Royal Society of London, Vols. I-VIII.  
 Catalogues Coleopterorum, Pts. 102-118.  
 Catalogues Lepidopterorum, Pts. 34-40.  
 Carpenter, K. E., Life in Inland Waters.  
 Castle, F., Five Figures Logarithmic and other Tables.  
 Chapman, A., Retrospect, 1851-1928.  
 Congres Internationale de Zoologie, Compte Rendu des Sciences, Vol. X.  
 Conklin, E. G., Heredity and Environment.  
 Davis, J. B., Thesaurus Craniorum, etc.  
 Davis, W. M., The Coral Reef Problem.  
 Doflein, F. und Reichenow, E., Lehrbuch der Protozoenkunde, Vol. II, 2.  
 Ellenberger, M., Handbook of Anatomy of Animals.  
 Eltringham, H., Histological and Illustrative Method for Entomology.  
 Fauna de France, Nos. 20-22.  
 Faust, E. C., Human Helminthology.  
 Faust, C. M., Index-Tabellen.  
 Further Corresp. of John Ray, Ray Society.  
 Gazetteers—Burma District Gazetteer—Maubin District, Vol. A. ; Thanton District  
 Vol. A. ; Shwebo District Vol. A. Punjab District Gazetteer—Mazaffargarh District.  
 Goodrich, E. S., Studies on the Structure and Development of Vertebrates.  
 Gruenbery, B. C., The Story of Evolution.  
 Guide to Current Official Statistics of the United Kingdom, No. IX.  
 Günther, A., Catalogue of Fishes, British Museum, Vols. VII-VIII.  
 Guyer, M. F., Animal Micrology.  
 Hall and Woothey, Ur Excavations at Ubaid, Vol. I.  
 Handbuch der biologischen Arbeitsmethoden, Lief. 294-371.  
 Handbuch der Entomologie, Lief. 41.  
 Handbuch der Vergleichenden Anatomie Wirbeltiere, Vol. I.  
 Handbuch der Vergleichenden Physiologie, Vols. I-III.  
 Hartlaub, G., Die Vogel Madagascars.  
 Hegner, R., Problems and Methods of Research in Protozoology.  
 Heilmann, G., The Origin of Birds.

- Hesse, u. Dofflein, Tierbau u. Tierleben, Vols. I-II.  
Hogben, L. T., Principles of Animal Biology.  
Holmes, S. J., The Evolution of Animal Intelligence.  
Holmes, S. J., Life and Evolution.  
Imms, A. D., General Text Book of Entomology.  
India House, London.  
Ivens, W. G., Melanesians of the South East Solomon Islands.  
Keith, A., New Discoveries relating to the Antiquity of Man.  
Kleinschmidt, O., The Formenkreis Theory.  
Kohler, W., The Mentality of Apes.  
Kramer, A., Atlas d. Volkerkunde, West Indonesien.  
Kükenthal, W., Handbuch der Zoologie, Vol. II, Nos. 4-14 ; Vol. III, Nos. 2. I, 2, II Vol. IV, Nos. 6-8, Vol. VI, Nos. 1, I, 2, I, 2, II, Vol. VII, Nos. 1, II, 2, V, 2, VI.  
Landtman, G., The Karvai Papuans of British New Guinea.  
La Touche, J. D. D., Handbook of the Birds of Eastern China, Pt. V.  
Lebour, M. V., The Planktonic Diatoms of Northern Seas.  
Lindner, E., Die Fliegen der Palaearktischen Region, Lief. 33-61.  
List of Entomologists Employed in the British Empire.  
List of Scientific Periodicals in Bombay Presidency.  
Loomis, F. B., The Evolution of the Horse.  
Lubbert, H and Ehrenbaum, E., Handbuch d. Seefischerei Nordeuropas, Vol. I, No. 4, Vol. III, No. 2, Vol. V, No. 3, Vol. VI, Nos. 1-4, Vol. VII, No. 4, Vol. VIII, Nos. 2, 7, Vol. IX, No. 3a.  
Marine Regulations in India, Pt. I.  
Martini and Chemnitz, Die Gathungen Tridacna und Hippopus von Küster, Vol. VIII, No. 4.  
Martini and Chemnitz, Familia Limidae von Dr. Joh. Thiele VII, No. 2.  
Mason, F., Creation by Evolution.  
Mason, F., Burma : its People, Notes, etc.  
Mathews, M., Systema Avium Australasianarum, Vols. I-II.  
Mead, M., Coming of Age in Samoa.  
Mell, R., Grundzüge einer Ökologie der Chinesischen Reptilien.  
Metcalf, Z. P., A Text Book of Economic Zoology.  
Michaelis, L., Oxidation Reduction Potentials.  
Molesworth, G., Decimal Tables.  
Mortensen, Th., Monograph of the Echinoidea.  
Neave, S. A., Summary of Data Relating to Economy and Entomology of British Empire.  
Needham, J. G., Leaf-Mining Insects.  
Newman, H. H., Evolution Genetics and Eugenics.  
Newman, H. H., The Gist of Evolution.  
Nomenclator Animalium generum et subgenerum, Lief. 10-15.  
Nordenskiöld, E., The History of Biology.  
Nordisches Plankton, Lief. 21.  
Norman, A., History of Fishes.  
Notes and Queries on Anthropology.  
Osborn, H. F., The Origin and Evolution of Life.  
Patton, W. S. and Evans, A. M., Insects, Ticks, Mites and Venomous Animals, Pt. I. Medical, Pt. II. Public Health.  
Perty, M., Coleoptera Indiae Orientalis.  
Pierce, F. N. and Metcalfe, J. W., The Genitalia of the Group Tortricidae.  
Radl, E., The History of Biological Theories.  
Recueil Zoologique Suisse, Vols. I-IV.  
Rensch, B., Das Prinzip Geograph. Rassen u. des Problem der Artbildung.  
Report of Indian Statutory Commission, Vols. I and II.  
Report of the Princeton University Expeditions to Patagonia, Vol. VI, Nos. 4-5.  
Report, 3rd. Imperial Entomological Conference.

- Ruska, J., *Turba Philosophorum*, Vols. I and II.  
 Saunders, J. T. and Manton, S. M., *A Manual of Practical Vertebrate Morphology*.  
 Schebest, P., *Bei den Urwoldzwerger von Malaya*.  
 Slater, W. L., *Systema Avium Ethiopicarum*, Vols. I and II.  
 Scott, W. B., *The Theory of Evolution*.  
 Seitz, A., *The Macrolepidoptera of the World*, Pts. 463-524 and Supplements Pts. 1-29.  
 Stephenson, J., *The Oligochaeta*.  
 Swann, H. K., *A Monograph of the Birds of Prey*, Pts. VIII-X.  
 Theobald, F. V., *Monograph Culicidae*, Vol. III.  
 Thomson, J. A., *New Natural History*, Vols. I and III.  
 Uvarov, B. P., *Locusts and Grasshoppers*.  
 "Valdivia" *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition*, Vol. XVIII, No. 2, Vol. XXI, No. I, Vol. XXII, Nos. 5, 6, 6a<sup>2</sup> 112, 113.  
*Verhandlungen International Ornithologische Kongress VI*. Copenhagen.  
 Watson, E. Y., *Hesperiidae Indicae*.  
 Willey, A., *Lectures on Darwinism*.  
 Williston, S. W., *The Osteology of the Reptiles*.  
 Wytsman, P., *Genera Insectorum*, Pts. 190-193.

*Serials purchased.*

- Allahabad*.—*Indian Forester*, Vol. LV, No. 4 to Vol. LVII, No. 12.  
*Baltimore*.—*Journal of Experimental Zoology*, Vol. LII, No. 3 to Vol. LXI, No. 2.  
*Berlin*.—*Arbeitsphysiologie*, Vol. I, Nos. 5-7; Vol. II, Nos. 1-8; Vol. III, Nos. 1-7; Vol. IV, Nos. 1-7; Vol. V, No. 1.  
*Berlin*.—*Archives für Naturgeschichte*, 1917, Nos. 5-12.  
*Berlin*.—*Archives für Protistenkunde*, Vols. LXV, No. 3 to Vol. LXXVI, No. 1.  
*Berlin*.—*Das Tierreich*, Lief. 52-56.  
*Berlin*.—*Deutsch. Entomologisch Zeitschrift*, 1929-1931, No. 3.  
*Berlin*.—*Sitzungsberichte der. nat. Freunde zu Berlin*, 1928, No. 4 to 1930.  
*Berlin*.—*Zeitschrift für Anatomie und Entwicklungs*, Vol. LXXVIII, No. 4 to Vol. XCVI, No. 1.  
*Berlin*.—*Zeitschrift für Zellforschung und Mikros. Anatomie*. Vol. VIII, No. 4 to Vol. XV, No. 1.  
*Bonn*.—*Archives für die ges. Physiologie*, Vol. CCXXI, No. 5 to Vol. CCXXIX, No. 3.  
*Bonn*.—*Archives für Entwicklungs. der Organ.*, Vol. CXV-CXXV, No. 3.  
*Boston*.—*American Naturalist*, March 1929 to December 1931.  
*Boston*.—*Journal of Morphology*, Vol. XLVI to Vol. LII, No. 1.  
*Boston*.—*The Nautilus*, Vol. XLII, No. 4 to Vol. XLV, No. 2.  
*Brussels*.—*Annales de Biologie Lacustre*, Vol. VII, Nos. 2-4, Vol. VIII to Vol. XI; Vol. XIII to Vol. XV continuation *Recueil de l'Inst. Zool. Torley Rousseau*, Vol. 1 to Vol. III, No. 2.  
*Brussels*.—*Revue Zoologique Africaine*, Vol. XVI, No. 4 to Vol. XXI, No. 2.  
*Calcutta*.—*Indian Medical Gazette*, April 1929 to February 1932.  
*Calcutta*.—*Department of Agriculture in India; Memoirs (Entomological Series)*, Vol. XI, Vol. XII, Nos. 1-2, *Bulletin Agricultural Research Institute*, Nos. 187, 188, 205, 207. *Agricultural Journal of India*, Vol. XXIV, No. 2 to Vol. XXV, No. 1. *Review of Agricultural Operation in India*, 1928-1929. *Scientific Reports*, 1929-1931.  
*Cambridge*.—*Annals of Applied Biology*, Vol. XVI, No. 2 to Vol. XIX, No. 1.  
*Cambridge*.—*Biometrika*, Vol. XX, No. 3 to Vol. XXIII, No. 4.  
*Cambridge*.—*Journal of Anatomy*, Vol. LXIII, No. 3 to Vol. LXVI, No. 1.  
*Cambridge*.—*Journal of Genetics*, Vol. XXI to Vol. XXV, No. 2.  
*Cambridge*.—*Parasitology*, Vol. XXI to Vol. XXIII.  
*Cambridge (U. S. A.)*.—*Psyche*, Vol. XXXVI to Vol. XXXVIII.  
*Cassel*.—*Journal für Ornithologie*, Vol. LXXVII, No. 2 to Vol. LXXX, No. 1.  
*Columbus*.—*Annals of the Entomological Society of America*, Vol. XXII to Vol. XXIV.

- Erlangen*.—Biologisches Zentralblatt, Vol. XLIX, No. 2 to Vol. LII, No. 2.
- Florence*.—Bolletino della Societa Entomologica Italiana, Vol. LXI to Vol. LXIII, No. 9. Memoirs, Vol. VI, No. 2 to Vol. IX, No. 1.
- Frankfurt a-M.*—Archiv für Molluskenkunde, Vol. LXI, No. 3 to Vol. LXIV, No. 2.
- Ghent*.—Archives de Biologie, Vol. XXXIX, No. 2 to Vol. XLIII, No. 1.
- Hague*.—Capita Zoologica, Vol. II, Nos. 7-8.
- Hague*.—Resumptio Genetica, Vol. III, No. 4 to Vol. VI, No. 5.
- Jena*.—Anatomischer Anzeiger, Vol. LXVI, No. 23 to Vol. LXXIII, No. 16.
- Jena*.—Ergebnisse und Fortschritte der Zoologie, Vol. VII, No. 4.
- Jena*.—Jenaische Zeitschrift für Naturwissenschaften, Vol. LXIV to Vol. LXV, No. 3.
- Jena*.—Zoologisches Jahrbucher, Anat. Abt., Vol. L, No. 4 to Vol. LV, No. 2; Syst. Abt., Vol. LVII to Vol. LXII, No. 4; Zool. Abt., Vol. XLVI, No. 2 to Vol. L, No. 3.
- Leipzig*.—Bibliographia Zoologica, Vol. XXXIX to Vol. XLI.
- Leipzig*.—Internationale Revue ges. Hydrobiol. und Hydrographie, Vol. XXI, No. 5 to Vol. XXVI, No. 4.
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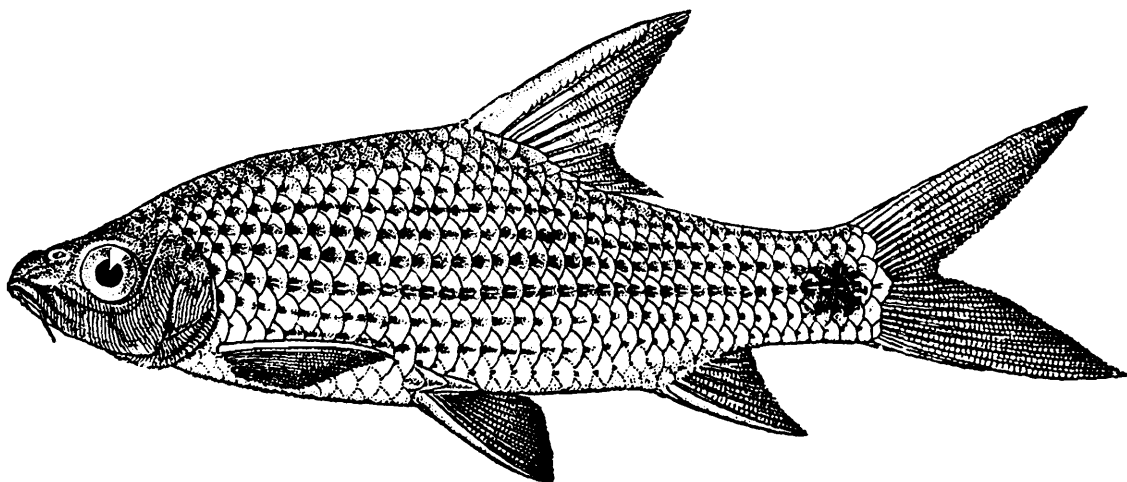
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## NOTES ON FISHES IN THE INDIAN MUSEUM.

### XVIII. ON TWO SMALL COLLECTIONS OF FISHES FROM BURMA.

By SUNDER LAL HORA, D.Sc. (*Punjab et Edin.*), F.R.S.E., F.L.S., F.Z.S., F.A.S.B., Zoological Survey of India, Calcutta.

In May last Mr. K. Biswas presented to the Zoological Survey of India a small collection of fish made by him in the Kyenchong River in the Cinchona Reserve 10 miles off La-poke-chong, Mergui District, Lower Burma. The collection contains representatives of six species, viz., *Aoria armatus* (Day), *Danio aequipinnatus* (McClelland), *Barbus sarana caudimarginatus* (Blyth), *Cyclocheilichthys repasson* (Bleeker), *Xenentodon cancila* (Ham. Buch.) and *Ambassis nama* (Ham. Buch.). Of these species *C. repasson* is new to the fauna of British India. It has hitherto been found in Sumatra, Java, Borneo and Siam and is recorded here from Burma for the first time. The single specimen of the species obtained by Mr. Biswas was sent to Dr. L. F. de Beaufort for comparison with the specimens of *C. repasson* from the Indo-Australian Archipelago. Dr. de Beaufort has favoured me with the following remarks: "I agree with you that it is *C. repasson*, although the barbels are generally smaller. I cannot count more than 18 scales round the caudal peduncle, but I find the same number in a specimen in our collection" Generally there are 20 scales round the caudal peduncle in this species.

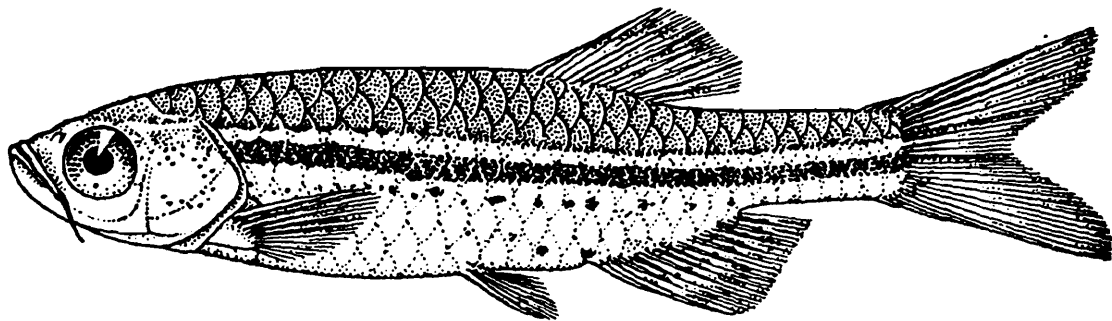


TEXT-FIG. 1.—Lateral view of *Cyclocheilichthys repasson* (Bleeker).  $\times \frac{1}{2}$ .

Besides the two features to which Dr. de Beaufort refers in his note, the Burmese example differs in its bodily proportions, etc., from the typical form. The head is contained 4 times in the total length without the caudal, whereas in the typical form it is contained 3.5 times in the same dimension. The height of the body is contained 3 times in the total length without the caudal, whereas in the typical form it is contained 2.6 times only. The diameter of the eye is contained 3.9 times in the length of the head, whereas in the typical form it is contained 3 to 3.5 times. In the Burmese example the fourth osseous and strongly denticulated ray

of the dorsal fin together with its flexible portion is considerably longer than the head, whereas in the typical form it is equal to the length of the head. The differences noted above are sufficiently important to warrant the erection of a subspecies but I hesitate to do so as I have examined only a single specimen from Burma. In order to facilitate reference in future I give here a figure of the Burmese example.

The Director of the Harcourt Butler Institute of Public Health, Burma, sent to the Zoological Survey of India a small collection of fish made by Dr. Feegrade, the Malariologist of the Institute, for identification. The fish were collected from a tidal drain at Rangoon. There are eight species represented in this collection, namely, *Ophiocephalus gachua* Ham. Buch., *O. striatus* Bloch, *O. marulius* Ham. Buch., *Anabas testudineus* (Bloch), *Lepidocephalichthys berdmorei* (Blyth), *Esomus* ~~affi~~ Hora and Mukerji, *Danio* (*Brachydanio*) *albolineatus* (Blyth) and *D.* (*Brachydanio*) *nigrofasciatus* (Day). The last two species are of special interest as very few specimens of these are to be found in the Museum collections. *D. albolineatus* was originally described by Blyth<sup>1</sup> from Tenasserim but subsequently Day<sup>2</sup> found it to be quite common in tanks and streams at Moulmein. In the collection of the Zoological Survey of India there are several old and fresh specimens from Moulmein and a few fresh examples from Tenasserim (base of Dawna Hills)<sup>3</sup>. So far as I am aware this species has not been recorded from Rangoon.



TEXT-FIG. 2.—Lateral view of *Danio* (*Brachydanio*) *nigrofasciatus* (Day).  $\times 3$ .

*Danio nigrofasciatus* is a small species, which has so far been known from a type-series of twenty specimens none exceeding  $\frac{7}{10}$  of an inch in length collected by Day<sup>4</sup> at Pegu and Moulmein. I received six specimens of this species all exceeding an inch in length from Rangoon. Of these five are now in the collection of the Zoological Survey of India. To facilitate reference in future I give here a figure of the species and a table of measurements. No figure of this interesting species has so far been published.

*Measurements in millimetres.*

|                                  |    |      |      |      |
|----------------------------------|----|------|------|------|
| Total length including caudal .. | .. | 33.3 | 31.1 | 26.9 |
| Length of caudal ..              | .. | 7.0  | 5.8  | 5.1  |
| Length of head ..                | .. | 6.8  | 6.2  | 5.4  |
| Depth of body ..                 | .. | 6.2  | 6.3  | 5.5  |
| Diameter of eye ..               | .. | 2.6  | 2.1  | 2.2  |
| Length of snout ..               | .. | 1.5  | 1.2  | 1.1  |

<sup>1</sup> Blyth, *Journ. As. Soc. Bengal*, XIX, p. 163 (1860).

<sup>2</sup> Day, *Proc. Zool. Soc. London*, p. 621 (1869).

<sup>3</sup> Chaudhuri, *Rec. Ind. Mus.*, II, p. 126 (1908).

<sup>4</sup> Day, *ibid.*, p. 620 (1869).

## SOME SOLITARY CORALS FROM THE INDIAN OCEAN.

By C. J. VAN DER HORST, *University of the Witwatersrand, Johannesburg.*

(Plates I, II.)

The following is a report on a small collection of solitary corals, the majority of which belong to the Indian Museum at Calcutta and form part of the "Investigator" collections. Others were collected by Professor Stanley Gardiner in the western part of the Indian Ocean ("Sealark" Expedition) and, as they are few in number, it is considered advisable that they should be included in the same report as the "Investigator" corals. With regard to the literature, only those references are cited that give the most important details.

### ***Caryophyllia clavus* Scacchi.**

*Caryophyllia clavus*, Marenzeller, 1904; Döderlein, 1913.

*Caryophyllia ambrosia*, Alcock, 1898.

13° 17' N., 93° 7' E., Andaman Sea, 90 fms., "Investigator", 1 specimen.

7° 11' N., 76° 35' 30" E., Laccadive Sea, 1006 fms., "Investigator", 2 specimens.

9° 20' N., 75° 24' E., Laccadive Sea, 930 fms., "Investigator" 1 specimen.

8° 43' 30" N., 76° E., off Travancore Coast, 400 fms., "Investigator", 1 specimen.

Cargados, 30 fms., "Sealark", 1 specimen.

Mauritius, over 80 fms., "Sealark", 1 specimen.

In view of the adequateness of the description of this species, given by Marenzeller and Döderlein, it need only be stated here that *C. ambrosia* Alcock, the description of which entirely agrees with one of my specimens, is undoubtedly synonymous with *C. clavus*.

### ***Caryophyllia arcuata* M.-Edw. et H.**

*Caryophyllia arcuata*, Marenzeller, 1904; Döderlein, 1913.

*Caryophyllia ephyala* Alcock, 1898.

Providence, 70 fms., "Sealark", 2 specimens.

Seychelles, 44 fms., "Sealark", 1 specimen.

Saya de Malha, 300-500 fms., "Sealark", 1 specimen.

The two specimens from Providence are in good condition and agree in every respect with Marenzeller's description. In the specimens from the Indian Ocean studied by Marenzeller, as well as in those among my material, the calicle is deeper than it is in specimens from the Mediterranean, described by Lacaze-Duthiers.

*Caryophyllia ephyala* Alcock is undoubtedly synonymous with *C. arcuata*; Marenzeller is also of this opinion.

***Caryophyllia cincticulatus* (Alcock).**

? *Thecocyathus cincticulatus*, Alcock, 1898.

13° 17' N., 93° 7' E., Andaman Sea, 90 fms., "Investigator"  
1 specimen.

Saya de Malha, 150 fms., "Sealark", 1 specimen.

Providence, 70 fms., "Sealark", 1 specimen.

Alcock in describing this species put a query in front of the name and it therefore seems that he was rather doubtful as to its generic name. The genus *Thecocyathus* was established by Milne-Edwards and Haime and is, according to them, a.o. characterised by the presence of "plusieurs couronnes de palis." In Pourtalès' figure of *Thecocyathus cylindraceus* two rings of pali are clearly visible, but in Alcock's figure of *Th. cincticulatus* only a single ring of pali is evident. Alcock writes: "In addition to the true pali there is an outer crown of almost paliform thickenings of the edges of the 9 or 10 principal septa," but these thickenings are not present at all. The inner edges of the septa are markedly wavy, as is quite evident from Alcock's figure as well as from my specimens. Seen from above this inner edge seems to be thickened, but in reality it is sharp and does not in the least resemble a palus. The single row of pali, arising only in front of the septa of higher order, immediately removes this species from *Thecocyathus* and places it in the genus *Caryophyllia*.

Gardiner described *Trochocyathus cincticulatus* from South Africa (*Thecocyathus* is often regarded as merely a subgenus of *Trochocyathus*). This seems to be a different species than Alcock's as it has pali in front of the primary septa.

*Caryophyllia cincticulatus* is closely allied to *C. cyathus* from the Mediterranean, which is also recorded by Marenzeller from South Africa. The principal difference seems to be that in *C. cyathus* the pali are much thickened in older specimens, whereas in *C. cincticulatus* they have the form of thin wavy ribbons. Moreover the fine undulating lines on the epitheca distinguish the present species from *C. cyathus*.

***Caryophyllia gigas*, n. sp.**

(Plate II, figs. 1, 4.)

Mauritius, 100-200 fms., "Sealark", 1 specimen.

This single specimen is gigantic in size for a *Caryophyllia*. It is broken off from its base and if the break has taken place near the base, which seems probable, its height is slightly over 10 cm. The diameter near the base is about 8 mm., but owing to some irregularities this could not be measured with absolute certainty. Although somewhat irregularly curved, the corallum widens gradually and regularly towards the calicular margin, becoming at the same time more and more elliptical in cross-section. At the margin it has a diameter of 40 × 32 mm. There are 12 principal septa of similar size and form; these are therefore the sepra

of the first and second orders. They are exsert for about 3 mm. above the margin. Their margins are entire, showing no waves; the septa are thin and are no thicker near the periphery than at their inner margin; their sides are covered with blunt granules, which are arranged more or less in rows perpendicular to the septal edge. These principal septa reach nearly as far inwards as the inner side of the pali and are at this point very close to the columella. The septa of the third order only differ from the principal septa in being somewhat narrower and less exsert. The septa of the fourth order are smaller than, but do not differ in form from the tertiaries except by the pali being in front of the quaternaries. These pali are separated from the septa by a well marked, though not very deep, incision. The septa of the fifth order are narrower than the quaternaries. They are all present, so that, there being no septa of the sixth order, the total number of septa is 96. Those septa of the fifth order adjoining the principal septa are broader and more exsert than those adjoining the tertiaries and they are more exsert than the quaternaries. All these septa of higher order are, like the principal septa, covered with granules. The pali, of which there should be 24 in all, are broad, thin plates, the edges of which are straight and the sides of which are covered with granules. The columella is formed by a dozen irregularly curved ribbons. The pali may extend between the lobes of the columella, so that there is no sharp demarcation between pali and columella, as is found, for example, in *Caryophyllia clavus*. The surface of the columella is about 5 mm. below the upper edge of the pali. The depth of the calicle is about 16 mm.

Ribs are faintly visible as mere striae over the whole of the outer surface, except in places covered by other animals. It is only in the upper part, down to about 15 mm. from the calicular margin, that the ribs are well developed. They have a rather sharp crest in the middle, without any denticulations. The ribs corresponding to the principal septa project rather more than the others; those corresponding to the septa of the fifth order are usually only indicated by slightly projecting crests, so that an alternation in size of the ribs is plainly visible.

Pourtales in describing the genus *Thecocyathus* mentions hollow roots, starting from the interseptal chambers, not visible externally, and forming a concentric circle round the original base of attachment. As the coral grows, new roots are formed and a new circle, concentric with the preceding, arises. He gives some excellent figures of these peculiar structures (*Ill. Cat. Mus. Comp. Zool.* IV, 1871, pl. v, figs. 3 and 4). In *Caryophyllia* (*Thecocyathus*) *cincticulatus* Alcock also found a series of diverticula from the interseptal spaces. Similar structures are present in *Caryophyllia gigas*; they are clearly visible where the coral is broken off from its base, although they are not so regularly arranged as in Pourtales' figures. The regularity in their formation is also disturbed by two young corals attached to the base of the specimen. These young corals are to some extent overgrown by the subsequently formed roots and in consequence look like buds. I do not, however, think that they are buds, because these never occur in *Caryophyllia* and, moreover, some more young corals have attached themselves higher up on the wall of the specimen.

**Acanthocyathus grayi** M.-Edw. et H.

*Acanthocyathus grayi*, Alcock, 1893 and 1898.

15° 25' N., 93° 45' E., off C. Negrais, Burma, 40-49 fms., "Investigator", 9 specimens.

Andamans, 53 fms., "Investigator", 1 specimen.

8 miles W of Interview Island, Andamans, 45-270 fms. "Investigator", 1 specimen.

Off Port Blair, Andamans, 100 fms., "Investigator", 1 specimen.

The locality of the type-specimens of Milne-Edwards and Haime is unknown. Alcock reported the species from the Andamans and it is also found in the East Indies. The full-grown specimens are entirely free, but younger ones are attached by a narrow base that seems to break off later on. Of two small specimens in the present collection the one is attached to a piece of shell, the other to a Serpulid.

**Deltocyathus andamanicus** Alcock.

*Deltocyathus andamanicus*, Alcock, 1898; Vaughan, 1907.

Off Andamans, 185 fms., "Investigator", 1 specimen.

This specimen agrees in every respect with Alcock's specimen from the same locality.

**Deltocyathus rotulus** (Alcock).

*Trochocyathus rotulus*, Alcock, 1898.

8° 53' 15" N., 81° 20' 30" E., East of Ceylon, 1,086 fms., "Investigator", 1 specimen.

This species is best included in the genus *Deltocyathus*. It closely resembles *D. magnificus* Moseley, but can immediately be distinguished from the latter by its margin which is scalloped by the exsert septa and costae, whereas in *D. magnificus* the septa are not exsert and the margin is simple. According to Alcock "this singularly beautiful species has no close resemblance, except in general shape, to *Deltocyathus*". It can indeed be easily distinguished from *D. andamanicus*, but it is nevertheless a species of *Deltocyathus*. Milne-Edwards and Haime who established the genus *Deltocyathus* write: "Sous les autres rapports, le Deltocyathe paraît se rapprocher des Trochocyathes; mais la base pédicellée de ceux-ci et leur fossette calicinale toujours bien marquée les en distinguent tout de suite." It is somewhat doubtful whether the pedicellated base is really a distinguishing character. Moseley mentions one out of a great number of specimens of *D. magnificus* "with a most distinct pedicle and scar of attachment that evidently remained fixed up to a period of full maturity." On the other hand Lindström and Pourtalès do not mention any attached specimen. Alcock, however, reports in *D. andamanicus* a small central scar, a feature also found by Vaughan and which is also present in my specimen. Although traces of a former attachment may be left in some specimens and occasionally a full grown attached specimen may be found, the characters distinguishing *Deltocyathus* from *Trochocyathus*, as pointed out by Milne-Edwards and Haime, are valid and are even clearer in *D. rotulus* than in *D. andamanicus*.

**Paracyathus.**

Pourtalès writes: "Like *Caryophyllia*, this genus presents so many points of variation that it is very difficult to define a species." Quite a number of species of *Paracyathus* have been described and I feel very doubtful as to their validity. Owing to the amount of variation it is extremely difficult to recognize a species merely from a description. Duncan's descriptions are particularly inadequate. He describes any aberrant specimen as a new species. His numerous species from the Mediterranean seem to be all based on young and imperfect specimens. Like Lacaze-Duthiers and Döderlein I am greatly in doubt as to their validity.

I have before me quite a number of different forms, most of which can be identified as known species, but a few are doubtful.

**Paracyathus pulchellus** Philippi.

(Plate I, fig. 7 ; Plate II, fig. 2.)

*Paracyathus pulchellus*, Döderlein, 1913 ; Gravier, 1920.

Mauritius, over 80 fms., "Sealark", 1 specimen.

This is a fine specimen undoubtedly belonging to the above-named species, which was previously known only from the Mediterranean, Atlantic and West Indies.

**Paracyathus stokesi** M.-Edw. et H.

(Plate I, figs. 1—6 ; Plate II, fig. 3.)

*Paracyathus stokesi*, Milne-Edwards et Haime, 1848.

8° 51' 30" N., 81° 11' 52" E., off Ceylon, 28 fms., "Investigator", 2 specimens.

Puri Beach, "Investigator", 1 specimen.

W of Mangalore, 26-31 fms., "Investigator", 12 specimens.

Off Akyab, Arracan Coast, 17 fms., "Investigator", 7 specimens.

Entrance to Palk Strait, 3 miles N. N. W of St. Pedro, 6-8 fms., "Investigator", 1 specimen.

6° 1' N., 81° 16' E., S. of Ceylon, 34 fms., "Investigator", 2 specimens.

Mergui, 3 specimens.

The type-specimen of Milne-Edwards and Haime was from an unknown locality. Typical specimens in the present collection conform entirely to the original description and figure, leaving no doubt regarding the identity and, therefore, the locality of the species. This species has had no further mention by later authors. Perhaps some species, described later, e.g., *P. caeruleus* Duncan, are synonymous with *Paracyathus stokesi*. This is undoubtedly the case in *P. rotundatus* Semper.

A typical specimen is attached by a rather broad, expanded base, above which it is narrowed into a pedicle. It then spreads out regularly towards the calicular margin. Ribs are faintly visible externally over the whole surface. They are broad, round, scarcely projecting, separated by very narrow grooves and covered with blunt granules. All the ribs are equal in size. Towards the base of the coral they become less and

less visible, until on the base they are hardly visible or may be recognized only by the rows of granules. Near the calicular margin the principal ribs, corresponding to the septa of the first, second, third and fourth order, project more than the intervening ones; there is thus a very apparent alternation. Near the margin the ribs have a sharp edge, while lower down they are rounded.

Although the pedicle is cylindrical, the calicle is oval. The relation between the short and the long axis is as 7 : 10. The margin of the calicle may even be somewhat inwardly curved along the longer side of the oval. The longer axis is on a lower level than the shorter.

The fifth order of septa is nearly always complete. The principal septa, *i.e.*, those of the first and second order, are exserted above the calicular margin for 2 mm. at the most and may be scarcely exsert at all. The exsertion of the other septa diminishes according to their order, but even those of the fifth order may be exsert for 1 mm. The septal edge is entire, sharp and often somewhat undulating, with very small waves, so that striae perpendicular to the edge may be distinguished on the faces of the septa. The septa are, in addition, densely covered with blunt granules. In places, where septa have been broken, they appear to be thickest near the wall and that from there they gradually become thinner towards their inner edge. The principal septa, although thicker than the adjoining interseptal space, are rather thin. Without taking the granules into consideration, the septa of the third order are at the most as thick as the adjoining space. The septa are broadest at the level or slightly below the level of the calicular margin. The septa of higher order are similar to the principal septa in form and shape, but differ from them in being smaller in every way.

The pali in front of the principal septa have on the whole the form of flat lamellae, somewhat pointed at their upper ends, whence they are directed almost perpendicularly or more gradually into the interior of the calicle. The incision between these pali and the septa is not deep. The principal pali are often divided by incisions into two or three lappets. The part of the principal septa projecting above the upper end of the palus is about twice as long as the palus. The pali corresponding to the tertiaries are more divided into lappets than are the principal pali; otherwise they are similar to the latter. They reach to a higher level, so that the part of the septum above them is almost equal in height to the palus. The pali of the quaternaries again are about twice as high as the upper end of the septum; these pali are divided into about 5 or 6 lobes, the upper lobes being broader and the lower lobes either narrow or merely in the form of small columns. Further at the lower end of the pali of the third order, one or two of these small columns is present and there may also be one at the lower end of each of the principal pali. The quaternaries fuse with the tertiaries; in the majority below the point of fusion there are two more small columns. The septa of the fifth order are short and soon fuse with the quaternaries. Their edges are usually entire, but there may be one or two palus-like protrusions immediately in front of the place of fusion. When the septa of the fifth order are absent and those of the fourth are short, the latter are of a form resembling that which is otherwise characteristic of the fifth order.

The columella is oval, concave, and is formed by a number of small columns that are placed more or less closely together. These columns of the columella are exactly like the inferior pali and there is no limit between the columella and the crown of pali, so that the columella seems to be continuous with the septa of the third order.

The largest specimen of the collection is 26 mm. high ; the diameter of its pedicle is 7 mm.; the longer axis of the calicle is 19 and the shorter 13 mm.; the bottom of the calicle is 8 mm. below the upper edge of the septa in the shorter axis.

The general shape of the coral is extremely variable. Some specimens are rather slender with a long narrow pedicle, while others are almost cylindrical. The ribs, except near the calicular margin, may be hardly or not at all distinguishable. In other specimens the ribs extend as highly projecting ridges over the greater part of the outer surface and in these instances the alternation is very marked. The two axes of the calicle may be almost on the same level and the calicle may be almost round instead of oval. The septa are more or less exsert. The interior of the calicle shows a greater constancy.

### ***Paracyathus pruinus* Alcock.**

(Plate I, figs. 9, 11 ; Plate II, fig. 6.)

*Paracyathus pruinus*, Alcock, 1902.

Saya de Malha, 150 fms., "Sealark", 13 specimens.

Although differing somewhat in general form from Alcock's figure, I have no doubt that the specimens before me belong to this species. Alcock's specimens seem to be attached to a rather narrow base, from which they spread out gradually towards the calicular margin. I have only one specimen exhibiting a somewhat similar shape. The remainder expand from a stout pedicle which is attached by a broad, encrusting base ; the longer axis of their oval calicle is on a considerably lower plane than the shorter. Otherwise the specimens agree entirely with Alcock's description.

It is possible that *Paracyathus pruinus* is synonymous with *P. porphyreus* Alcock (1893) ; further, Folkeson's description and figure of *P. porphyreus* are almost applicable to my specimens, but as I am not fully convinced, I prefer to identify the present specimens as *P. pruinus*. It is possible that *P. lifuensis* Gardiner is a young specimen of *P. pruinus*.

### ***Paracyathus indicus* Duncan.**

(Plate I, fig. 8 ; Plate II, fig. 5.)

*Paracyathus indicus*, Duncan, 1886 ; Alcock, 1893.

17° 27' N., 71° 41' E., Arabian Sea, 56-58 fms., "Investigator",  
2 specimens.

Andamans, 53 fms., "Investigator", 1 specimen.

With some hesitation I identify three specimens as belonging to this species. It is evident that my specimens are only young ones. Septa

of the fifth order are found only in one system of the largest specimen. In one specimen the costae are, as indicated in Duncan's description, small, nearly equal, rounded, barely projecting, and sparsely and minutely granular. In this specimen the costae extend over the whole outer surface of the corallum. In the second specimen the costae are visible as minute striae in the basal part. Nearer the calicle they project more, the alternation is distinct, and there are no granules. In the third specimen neither costae nor granules are visible in the lower part of the corallum, while near the calicle the costae project, alternate distinctly, and are sparsely covered with granules.

Over their whole extent the septa are thin, much thinner than the interseptal spaces adjoining them; they are covered with pointed granules. According to Duncan the pali in front of the primaries and secondaries are small and one-lobed and those in front of the tertiaries resemble the outer papillae of the columella. In my specimens the single lobe in front of the principal septa also resembles a papilla of the columella, a fact which may be ascribed to the youth of my specimens.

### ***Bathyactis symmetrica* Moseley.**

*Bathyactis symmetrica*, Moseley, 1881.

11° 16' 30" N., 92° 58' E., Andaman Sea, 669 fms., "Investigator", 1 specimen.

18° 18' N., 93° 25' E., Bay of Bengal, 843 fms., "Investigator", 4 specimens.

### ***Balanophyllia imperialis* Kent.**

*Balanophyllia imperialis*, Saville Kent, 1871; van der Horst, 1922.

6° 1' N., 81° 16' E., S. of Ceylon, 34 fms., "Investigator", 15 specimens.

### ***Balanophyllia affinis* (Semper).**

*Balanophyllia affinis*, van der Horst, 1926.

6° 1' N., 81° 16' E., S. of Ceylon, 34 fms., "Investigator", 4 specimens.

15° 25' N., 93° 45' E., off C. Negrais, Burma, 40-49 fms., "Investigator", 1 specimen.

Entrance to Palk Strait, 3 miles N. N. W of St. Pedro, 6-8 fms., "Investigator", 1 specimen.

### ***Balanophyllia bairdiana* M.-Edw. et H.**

(Plate I, fig. 10.)

*Balanophyllia bairdiana*, Moseley, 1881.

Puri Beach, "Investigator", 7 specimens.

These 7 specimens are attached to a Gorgonid. Though their bases touch each other, they have not fused. They lack the fine teeth on the ribs, characteristic of typical *B. bairdiana*.

**Balanophyllia parallela** (Semper).

*Balanophyllia parallela*, van der Horst, 1922.

26° 22' N., 56° 10' E., Persian Gulf, 48-49 fms., "Investigator", 2 specimens.

Palk Strait, "Investigator", 1 specimen.

15° 25' N., 93° 45' E., off C. Negrais, Burma, 40-49 fms., "Investigator", 2 specimens.

**Balanophyllia cornu** Moseley.

*Balanophyllia cornu*, Moseley, 1881.

Off Akyab, Arakan Coast, 17 fms., "Investigator", 2 specimens.

26° 22' N., 56° 10' E., Persian Gulf, 48-49 fms., "Investigator", 1 specimen.

**Endopachys grayi** M.-Edw. et H.

*Endopachys grayi*, Milne-Edwards et Haime, 1848; Semper 1872.

26° 22' N., 56° 10' E., Persian Gulf, 48-49 fms., "Investigator", 10 specimens.

**Stephanophyllia complicata** Moseley.

*Stephanophyllia complicata*, Moseley, 1881.

Saya de Malha, 125 fms., "Sealark", 2 specimens.

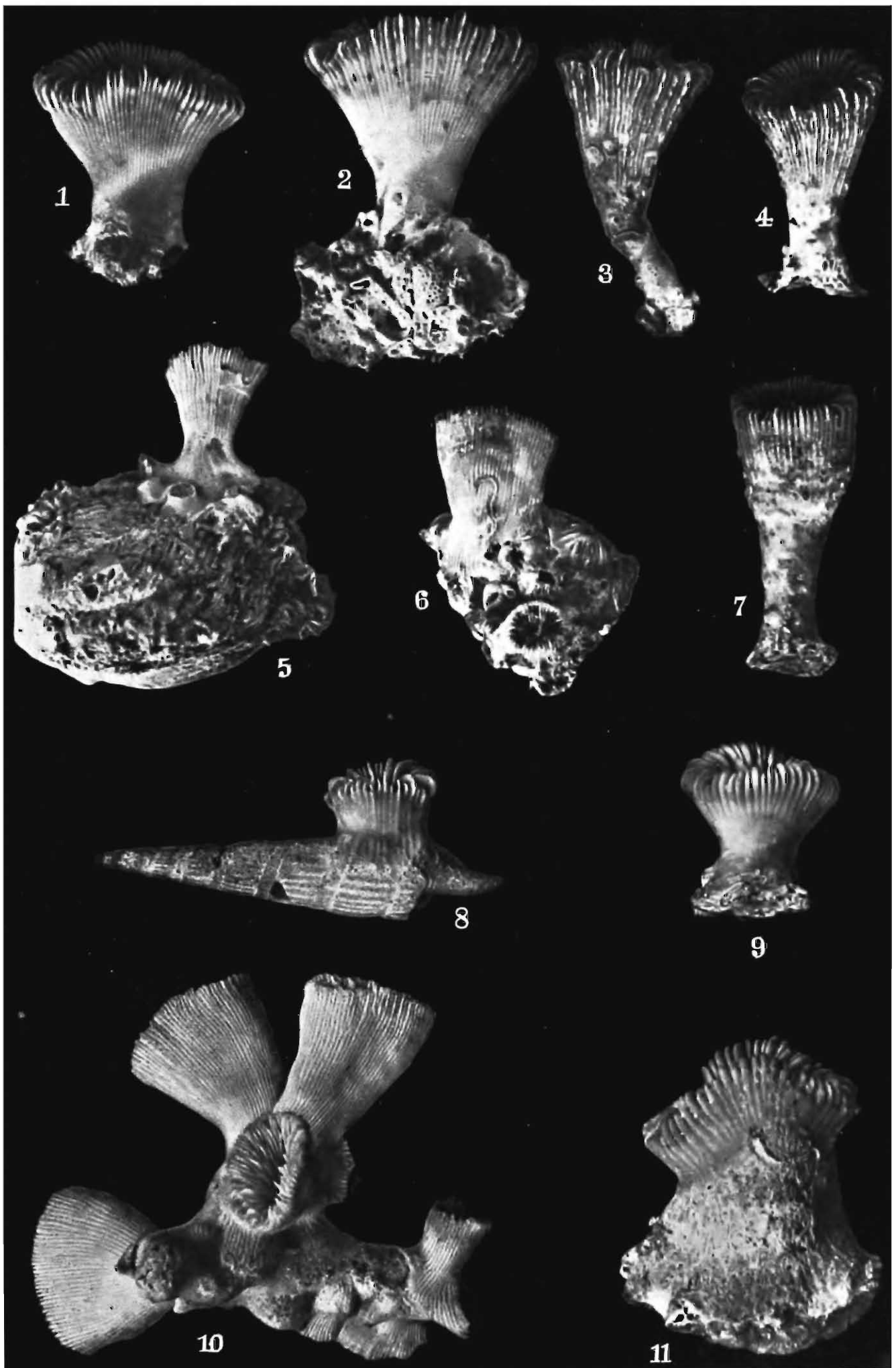
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## EXPLANATION OF PLATE I.

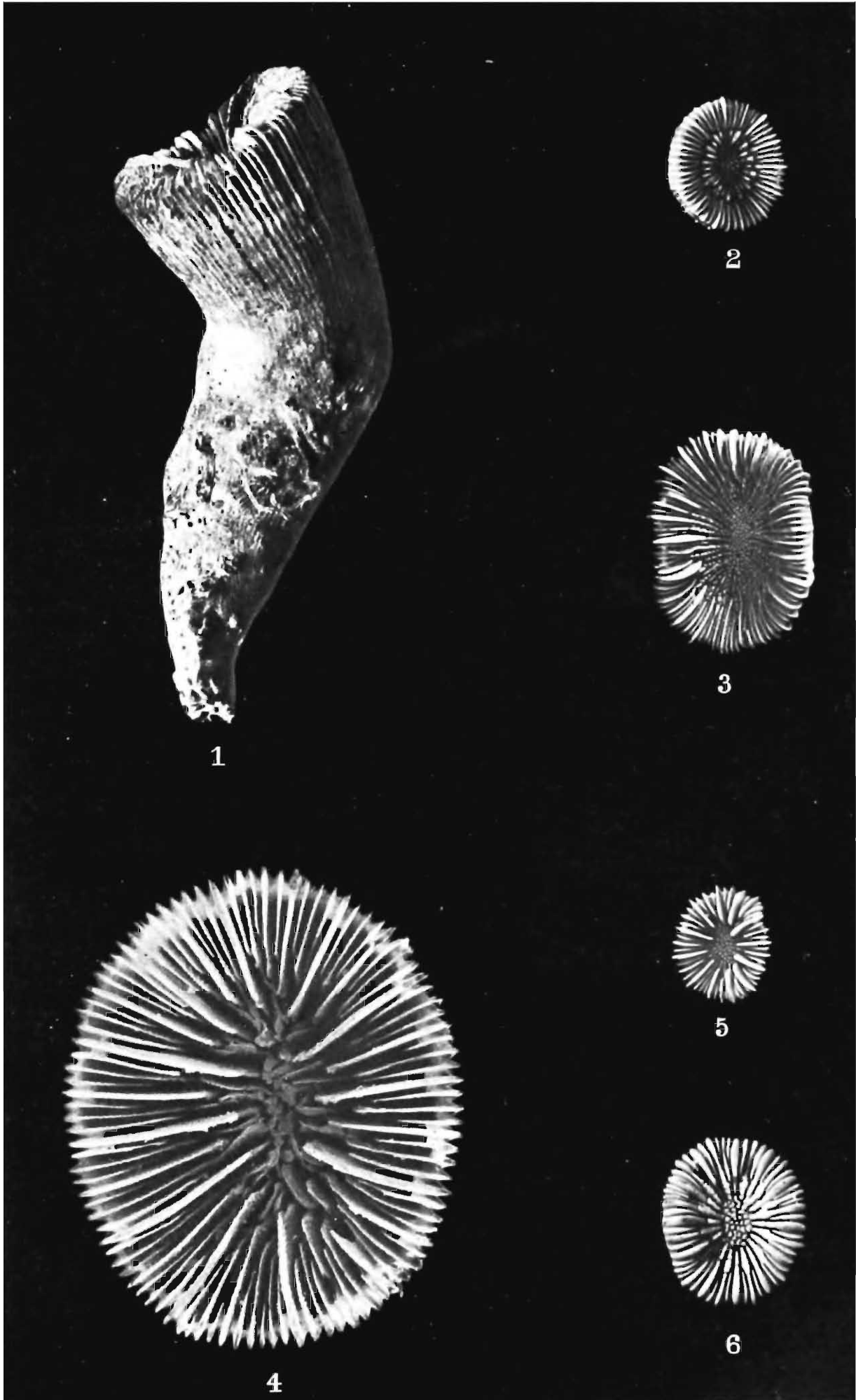
- FIGS. 1-6.—*Paracyathus stokesi* M.-Edw. et H.  
FIG. 7.—*Paracyathus pulchellus* Philippi.  
FIG. 8.—*Paracyathus indicus* Duncan.  
FIG. 9.—*Paracyathus pruinus* Alcock.  
FIG. 10.—*Balanophyllia bairdiana* M.-Edw. et H.  
FIG. 11.—*Paracyathus pruinus* Alcock.



CORALS FROM THE INDIAN OCEAN.

## EXPLANATION OF PLATE II.

- FIG. 1.—*Caryophyllia gigas*, n. sp.  
FIG. 2.—*Paracyathus pulchellus* Philippi.  
FIG. 3.—*Paracyathus stokesi* M.-Edw. et H.  
FIG. 4.—*Caryophyllia gigas*, n. sp.  
FIG. 5.—*Paracyathus indicus* Duncan.  
FIG. 6.—*Paracyathus pruinosis* Alcock.



CORALS FROM THE INDIAN OCEAN.

# NEONIPHARGUS INDICUS (CHILTON), AN INDIAN FRESH-WATER AMPHIPOD.

By K. STEPHENSEN (Zoological Museum, Copenhagen, Denmark).

Some time ago Mrs. E. W. Sexton of the Marine Laboratory, Plymouth, sent me some Indian fresh-water Amphipods, collected by Mr. R. Senior White, F.R.S.E., Malariologist to the Bengal Nagpur Railway, India, and begged me to examine them.

They turned out to belong to the genus *Neoniphargus*. The species is, however, not new to science, as it has been described by Chilton under the name of *Niphargus indicus* (see below). Nevertheless the find is very interesting, as the present specimens were found in a seepage spring skeletonizing leaf debris, whilst the type-specimens were secured in a coal mine. Probably all the other *Neoniphargus* species live in surface-waters, not (—like most of the *Niphargus* species—), in subterranean waters.

## Genus *Neoniphargus* Stebbing.

- Neoniphargus*, Stebbing, *Trans. Linn. Soc. London*, (2) VII, p. 424 (1899).  
*Niphargus*, G. M. Thomson, *Proc. Royal Soc. Tasmania*, 1892 (1893), p. 67.  
*Unamelita*, Sayce, *Proc. Royal Soc. Victoria*, XIII, p. 238 (1901).  
*Neoniphargus*, Stebbing, *Gammaridea*; *Das Tierreich*, 1906, p. 404.  
*Neoniphargus*, Geoff. Smith, *Trans. Linn. Soc. London*, (2) XI, p. 73 (1909).

The genus *Neoniphargus* was established by Stebbing (*l. c.* 1899) in order to accommodate *Niphargus montanus* Thomson (*l. c.* 1892, p. 70, pl. vi, figs. 1-13)<sup>1</sup>, as the only species.

*Type-species*.—*N. thomsoni* Stebbing 1906, p. 404 (= *Niphargus montanus* Thomson, *l. c.* 1892). “Agrees very closely with *N. yuli*” (Smith, *l. c.* 1909, p. 76). Found in Tasmania, swampy ground near top of Mount Wellington, about 1,200 m. (Thomson, 1892; Smith 1909, p. 76).

Later on the following additional species were established. *Neoniphargus (Unamelita) spenceri* (Sayce); Sayce (*l. c.* 1901, p. 238, figs.). “Agrees most closely with *N. tasmanicus*” (Smith, 1909, p. 76). Found amongst spongy moss at the source of a spring running into Wallaby Creek, Plenty Ranges, Victoria, about 600 m., and Lake Petrarch, Tasmania, about 900 m., (Sayce, *l. c.*)—Lake Petrarch, Tasmania (Smith, 1909, p. 76).

*N. fultoni* Sayce, *Proc. Royal Soc. Victoria*, Vol. 14, 1902, p. 57, figs. Found in a spring at Collin's Coach stage, near to Wood's Point, Victoria, about 930 m.

*N. yuli* Smith (*l. c.* 1909, p. 73, figs.). Yule's Lake on the top of Ben Lomond, Tasmania, about 1,200 m.

*N. exiguus* Smith (*l. c.* 1909, p. 74, figs.). In weed and mud in small stream near Huntingfield, Tasmania.

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<sup>1</sup> I have not had access to Thomson, *l. c.*, and know it only from the review in Stebbing, *l. c.*, 1906, p. 404.

*N. tasmanicus* Smith (*l.c.* 1909, p. 74, figs.). In the littoral zone of the Great Lake, Tasmania.

*N. wellingtoni* Smith (*l.c.* 1909, p. 75, figs.). Under stones and in small streams on the eastern face of Mount Wellington, Tasmania, about 900 m.

*N. alpinus* Smith (*l.c.* 1909, p. 75, figs.). In mountain tarns on the West Coast (Mt. Read), Tasmania, about 900 m.

*N. niger* Smith (*l.c.* 1909, p. 76, figs.). Under stones in Lake Perry, Harz Mountains, Tasmania.

*N. ripensis* (n. sp. ?) Smith, *Naturalist in Tasmania*,<sup>1</sup> 1909, p. 82, fig. 20.

*N. indicus* (Chilton), see below.

*N. branchialis* Nicholls, *Journ. Royal Soc. W. Austral.*,<sup>1</sup> Vol. 10, 1924, pp. 105-111, figs. (W. Australia).

*N. westralis* Chilton, *ibid.* Vol. 11, 1925, pp. 81-84, figs. (Darlington, W. Australia).

*N. obrieni* Nicholls, *ibid.*<sup>2</sup> Vol. 12, 1926, p. 79 seq., figs. (W. Australia).

Thus the genus comprises 13 (14 ?) species, all except one (*N. indicus*, from India) found in fresh-water in Australia or Tasmania.

The best description of the genus is no doubt that given by Smith (1909, p. 73).

*Neoniphargus* is very closely allied to *Niphargus* (for *Niphargus* see Stebbing, *l.c.* 1906, p. 405, or Chevreux and Fage, *Amphipodes (Faune de France*, No. 9, 1925, p. 208); the most important differences are the following :—

|                                             | <i>Neoniphargus</i> .                | <i>Niphargus</i> (according to Chevreux and Fage, 1925, p. 208). |
|---------------------------------------------|--------------------------------------|------------------------------------------------------------------|
| Lower lip, inner lobes                      | Not distinct.                        | Distinct.                                                        |
| Mandibles, 3rd joint of palp                | Shorter than 2nd joint.              | Longer than 2nd joint.                                           |
| Maxilla 1, the right and the left palp.     | Different.                           | Alike.                                                           |
| Maxillipedes, inner margin of outer plates. | Not spiny.                           | .. Spiny.                                                        |
| Pereiopods 1-2, 6th joint                   | Not broader than 5th joint.          | Broader than 5th joint. <sup>2</sup>                             |
| Uropod 3, 2nd joint of outer ramus.         | Minute or quite missing, never long. | Long (♂) or short (♀), always present.                           |

Pereiopods 1-2 have the dactylus unguiculate in both genera.

<sup>1</sup> I have not had access to these papers.

<sup>2</sup> The 5th and 6th joints are equally broad (at all events in pereiopod 1) in some species.

*N. philippensis* Chilton, *Philippine Journ. Sci.*, Vol. XVII, 1920, p. 515-521, figs. (Philippine Islands).

*N. chilensis* Chilton, *Mem. Ind. Mus.*, Vol. V, 1921, pp. 531-535, figs. (Chilka Lake, India; "one of the commonest species.")

*N. australiensis* Chilton, *Rec. Austral. Mus., Sydney*, Vol. XIV, 1923, pp. 79-81, figs. (New South Wales).

The morphological differences are frequently accompanied by a difference in habitat ; the species of *Neoniphargus* live nearly always in surface waters (lakes, streams, tarns), the *Niphargus* species in subterranean waters or in springs.

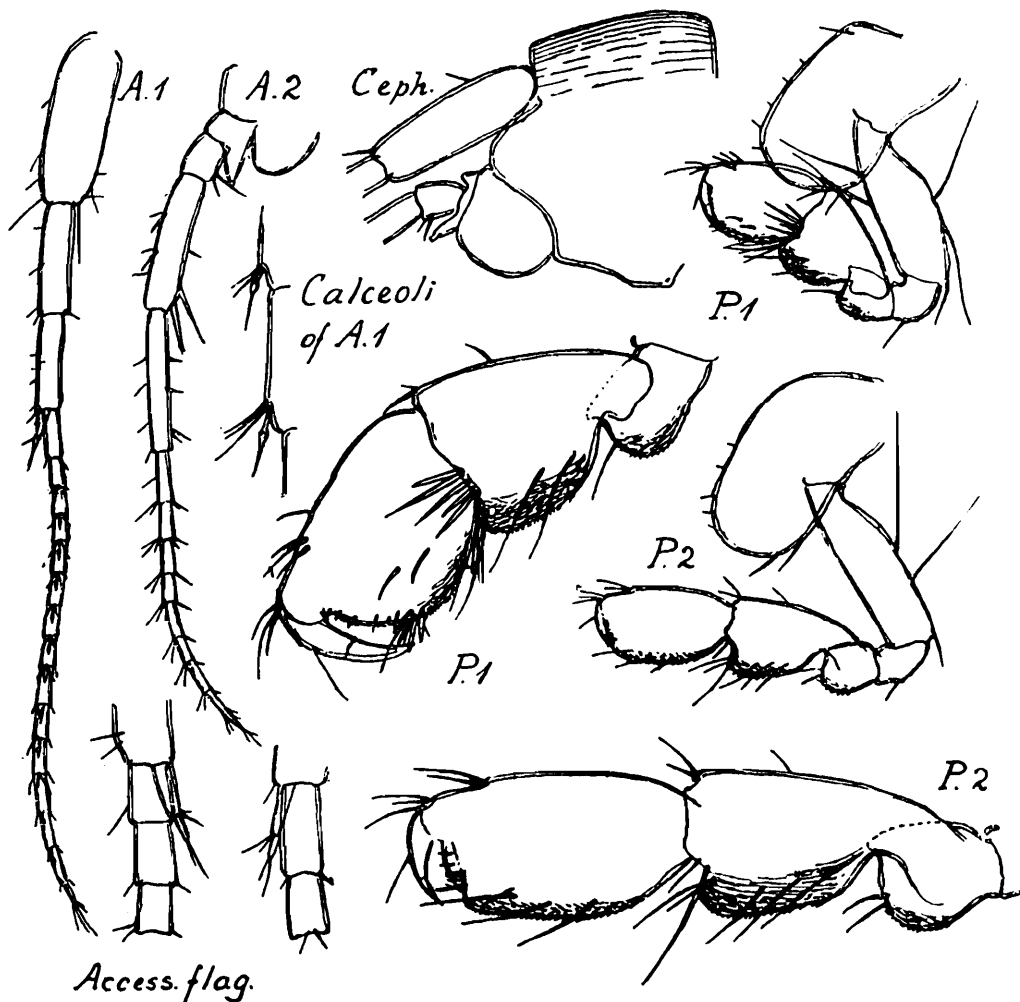
The present species differs in several details from the diagnosis of the genus, but these differences are probably partly due to the fact that the characters in question are only with difficulty ascertained, and no doubt minor details have been overlooked.

### ***Neoniphargus indicus* (Chilton).**

*Niphargus indicus*, Chilton, *Rec. Ind. Mus.*, XXV, pp. 195-96, 3 figs. (1923).

*Description of ♂(?)*, about 5 mm.

The sex of the specimens could not be ascertained with certainty ; there are no ♀ with marsupium in the material. Head (fig. 1, *Ceph.*) longer than segment 1, ocular lobe rounded. Eyes could not be traced. Back evenly vaulted, with a few setae, especially near hind margin of the segments ; on the urosome segments there are both spines and setae (fig. 4, *Uros.*)

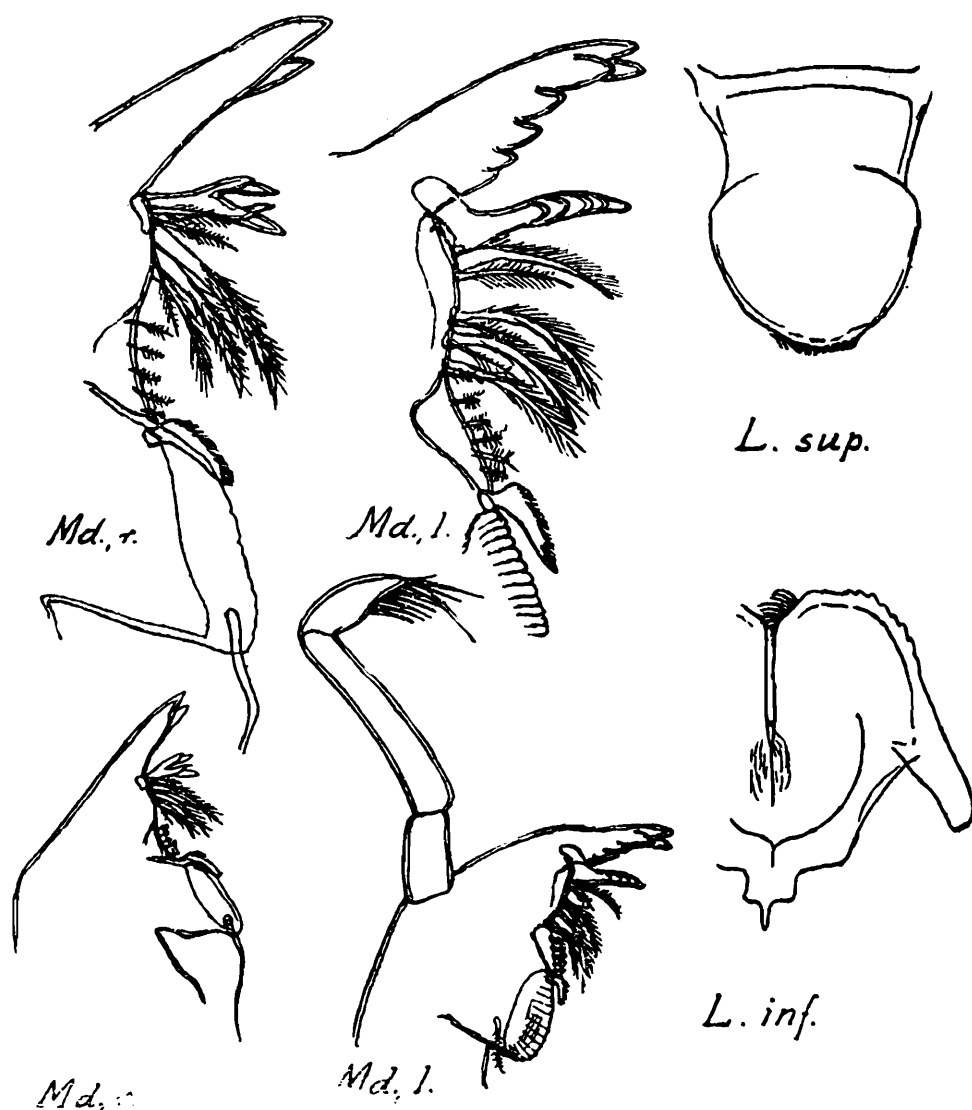


TEXT-FIG. 1.—*Neoniphargus indicus*. Head (*Ceph.*). Antenna 1-2 (*A. 1-2*) and pereipods 1-2 (*P. 1-2*). *Access. flag.* = Accessory flagellum of antenna 1.

Antenna (fig. 1, *A. 1*) about half as long as mesosome, not very setose ; 1st joint of peduncle heavier and not much shorter than the two next

joints combined. Accessory flagellum short, 2-articulate, 1st joint about twice as long as 2nd joint. Flagellum about  $1\frac{1}{2}$  time as long as peduncle, 15-20-articulate. In a few cases 1st and 2nd joints of flagellum are not separated from one another, and then these 1st and 2nd joints combined are twice as long as the next joint. The joints of flagellum have sensory organs (calceoli?), each ending in a long narrow apex.

Antenna 2 (fig. 1, A. 2) somewhat shorter than antenna 1. 1st joint of peduncle very large, globular; 2nd joint has a rather long projection, containing the opening of the antennal gland; 3rd joint short; 4th and 5th joints rather long, subequal. Flagellum a little shorter than peduncle, has about 9 joints.



TEXT-FIG. 2.—*Neoniphargus indicus*. Mandibles (*Md.*, *r*=right mandible, *Md. l.*=left mandible, upper lip (*L. sup.*) and lower lip (*L. inf.*).

Upper lip (fig. 2, *L. sup.*) large, apically rounded. Posterior lip (fig. 2, *L. inf.*) with the two halves very little gaping, apically rounded, with spines on median margin and with about 8 minute protuberances on lateral margin. No distinct inner lobes.

Mandibles (fig. 2, *Md.*) very heavy and strong. The left mandible (fig. 2, *Md. l.*) has, the cutting edge divided into 6-7 strong teeth; lacinia mobilis long, with 5 teeth. Spine row consists of 4 pairs of strong dentate spines (each pair consisting of 1 larger and 1 smaller spine), and about 5 small plumose hairs. Molar process heavy, at upper distal corner has

a strong, curved, pectinate spine, and at lower distal corner a plumose seta. The right mandible (fig. 2, *Md. r.*) has the cutting edge cleft into two strong teeth; lacinia mobilis has apically 4 teeth. Spine row consists of 3 small and 3 longer pectinate spines, 2 of them very strong. The rest of the mandible not different from left mandible. Palp long, 1st joint short, 2nd joint three times as long as 1st. 3rd joint much shorter than 2nd joint, apically narrower.

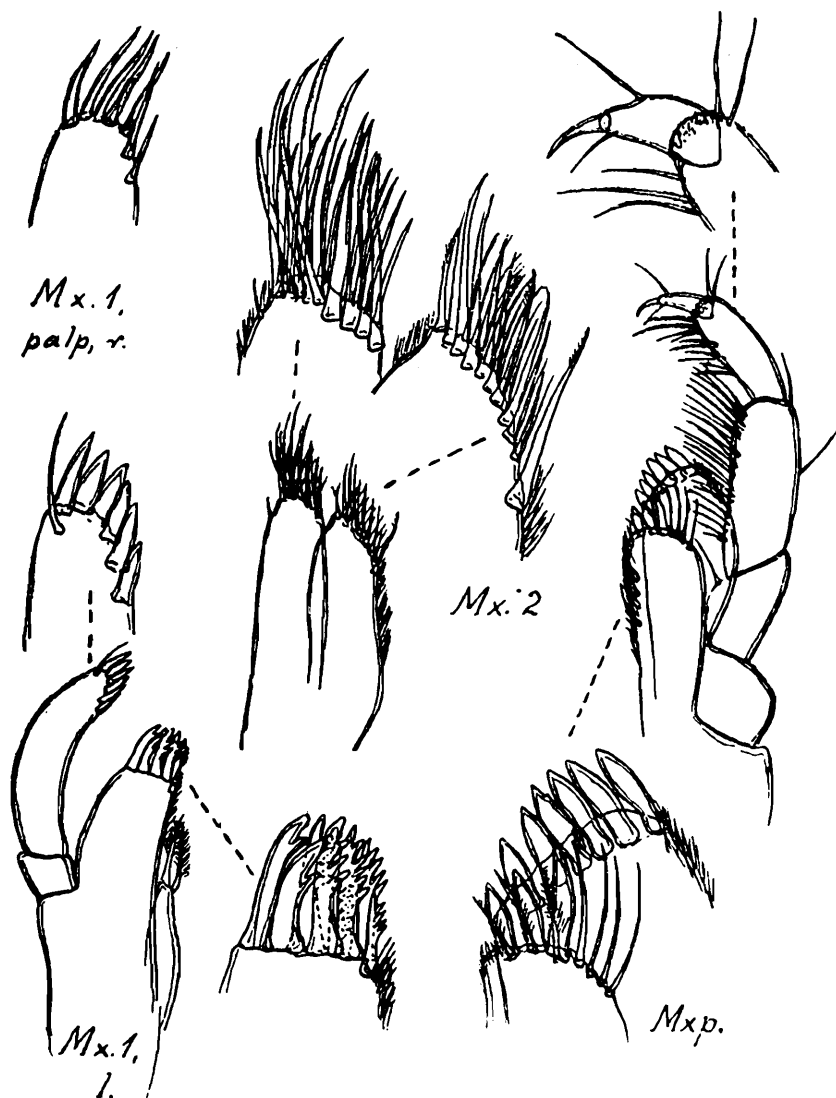


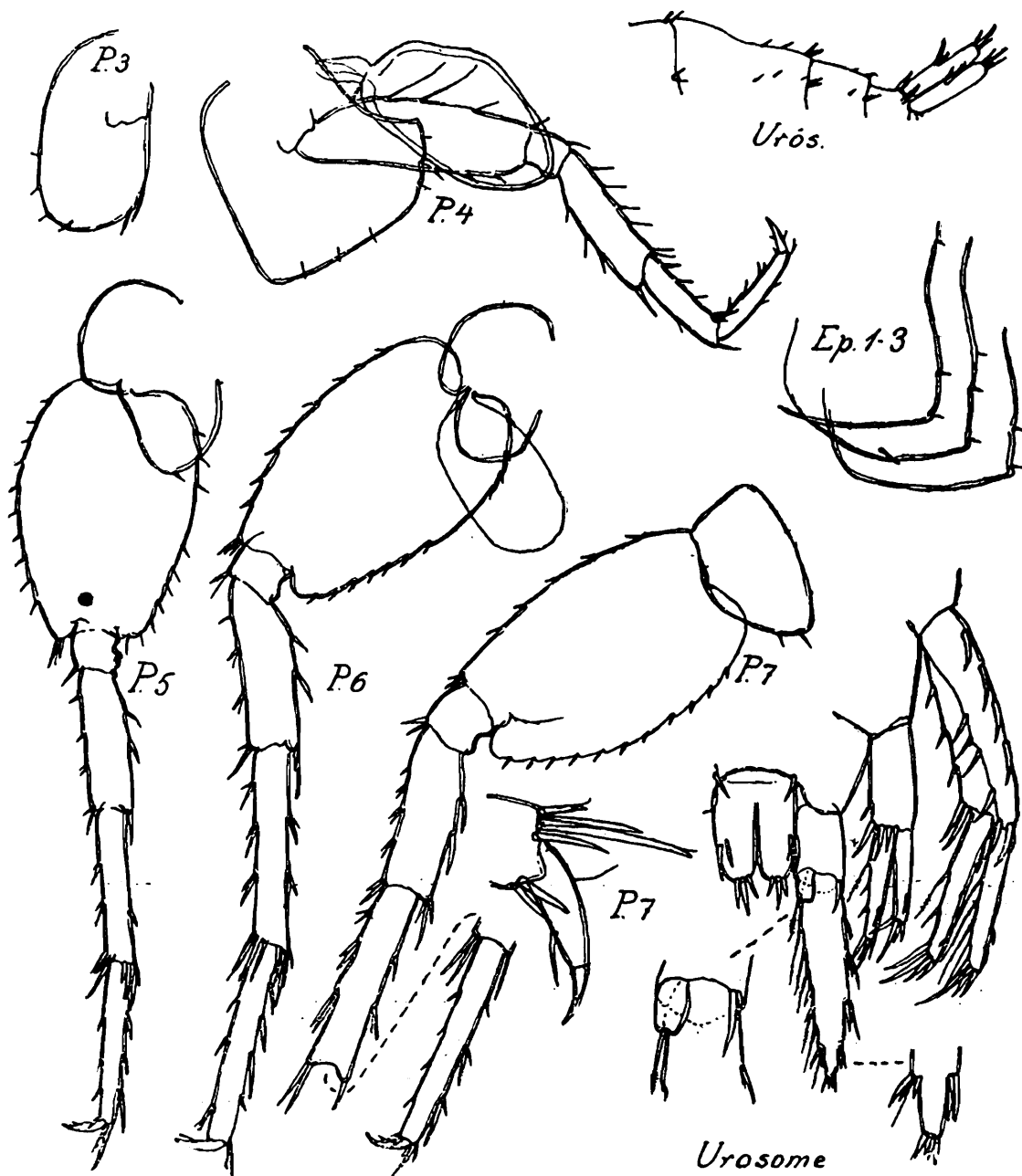
FIG. 3.—*Neoniphargus indicus*. Maxilla 1 (*Mx. 1*); the left Maxilla (*Mx. 1, l.*) and the apex of the palp of the right maxilla (*Mx. l., palp, r.*), Maxilla 2 (*Mx. 2*) and Maxillipeds (*Mxp.*).

Maxilla 1 (fig. 3, *Mx. 1*). Inner lobe short, narrow, apically with two plumose setae. Outer lobe much broader, apically with 8 spines, viz., 2 strong bifid spines, 4 long and 2 shorter pectinate spines. Palp 2-articulate, 1st joint being very short; apically (left mandible, fig. 3, *Mx. 1, l.*) 1 rather fine spine and 6 spine-teeth, or (right mandible, fig. 3, *Mx. 1, r.*) 6 simple spines.

Maxilla 2 (fig. 3, *Mx. 2*). The lobes are of equal breadth. Inner lobe has about 10 strong and a similar number of finer spines; the proximal strong spine is longer and heavier than the others. Outer lobe has a similar armature, but all the spines are longer than the corresponding ones of inner lobe, and the proximal strong spine is not different from the others.

Maxillipeds (fig. 3, *Mxp.*). Inner plate about as broad as outer plate, reaches a little beyond 1st joint of palp, apically rounded truncate, with 3 spine-teeth and 7 spines at apex, and hairs and 4 spines on median margin. Outer plate reaches to middle of 2nd joint of palp; apically there are 6 spine-teeth, but probably no other armature. Palp has 2 first joints rather broad, 2nd joint about twice as long 1st joint; 1st joint has only one, 2nd joint numerous setae on median margin, 3rd joint about  $\frac{2}{3}$  as long as 2nd joint and somewhat narrower; apically there is a blunt, rounded, finely-haired process or, rather, plate, much shorter than that of *N. (Unamelita) spenceri* Sayce (l. c. 1900, p. 241, pl. 40); a similar process has not been recorded in any of the other species. 4th joint curved, strong.

Branchiae are simple sacs.



TEXT-FIG. 4.—*Neoniphargus indicus*. Pereiopods 3-7 (*P. 3*=side-plate of pereopod 3), epimeral parts of the metasome segments (*Ep. 1-3*), urosome in dorsal view with the uropods and telson (*Urosome*) and in lateral view (*Uros.*).

Pereiopod 1 (fig. 1, *P. 1*) has side-plate rounded rectangular, like those of pereiopods 2-3. 4th joint has inferior corner produced into a rounded lobe provided with fine setae. 5th joint rounded triangular, rather

broad, with hind margin produced into a hairy lobe like that of 4th joint. 6th joint rounded quadrangular, subchelate, with palm somewhat oblique and not defined from the curved hind margin, except that 4 strong spines are placed opposite the apex of dactylus. Dactylus strong, feebly curved.

Not only in pereiopod 1 but also in pereiopod 2 the hinder surface of 3rd or 4th to 6th joints is densely beset with fine hairs.

Pereiopod 2 (fig. 1, *P.* 2) not very different from pereiopod 1, but more elongate, especially in 5th and 6th joints and palm more transverse and distinctly marked off from the rounded lobe at the end of dactylus.

Pereiopods 3-4 alike (fig. 4, *P.* 3-4), longer than pereiopod 2. Side-plate of pereiopod 4 as broad as deep, with a moderately deep excavation in hind-margin; inferior fore-corner rectangular, inferior hind-corner rounded, inferior angle of the excavation rectangular. Dactylus moderately strong, with one spine on hind-margin.

Pereiopods 5-7 (fig. 4, *P.* 5-7) slightly increase in length from pereiopod 5 to pereiopod 7; pereiopod 5 longer than pereiopod 3-4. Side-plate of pereiopod 5-6 slightly bilobate. 2nd joint in all 3 pairs oval; 4th to 6th joints subequal in length.

Inferior hind-corners of metasome segments 1-3 (fig. 4, *Ep.* 1-3) rectangular.

Uropod 1 (fig. 4, *urosome*) has rami subequal in length, a trifle shorter than peduncle. Uropod 2 much shorter than uropod 1, with inner ramus a little longer than outer ramus, which is as long as peduncle. Both these two pairs of uropods strongly spinose. Uropod 3 (fig. 4, *uros.*) about as long as uropod; outer ramus more than twice as long as peduncle, with spines on outer margin and spines and plumose setae on inner margin. There is no apical joint; the single joint of outer ramus terminates in 4 spines. Inner ramus very short, suboval, apically with 1 or 2 spines.

Telson (fig. 4, *urosome*) has the sides almost parallel, deeply cleft; each of the two lobes has 2 dorsal spines and 3 apical spines.

*Occurrence.*—The specimens described above were secured at Badampahar, Morbhang State, Orissa (India), in a seepage spring at *ca.* 400 m. The finder, Mr. R. Senior White writes, that “they were skeletonizing leaf debris—mainly *Shorea robusta*. I have examined hundreds of similar springs in various parts of India without noticing Amphipods before.”

The type-specimens of Chilton were found in a pit (depth about 100 m.) in the Januria Colliery in the Thana of Januria in the Asansol Sub-Division (Bengal).



# NOTES ON SOME HITHERTO UNKNOWN INDIAN HYMENOPTERA.

By ATUL CHANDRA SEN, *M.Sc.*

(*From the Entomological Laboratory, Zoological Survey of India, Calcutta.*)

When I was working in the Entomological Section of the Zoological Survey of India, Mr. S. Ribeiro, the Entomological Assistant, drew my attention to the fact that certain Hymenopterous insects have been recorded from one sex only by Bingham in the *Fauna of British India*, Hymenoptera, Volume I (1887). Since the publication of this work examples of the unknown sex have been obtained in India and are now in the collections of the Indian Museum. I record below the occurrence of the unknown sex of such insects, adding short notes on their structure.

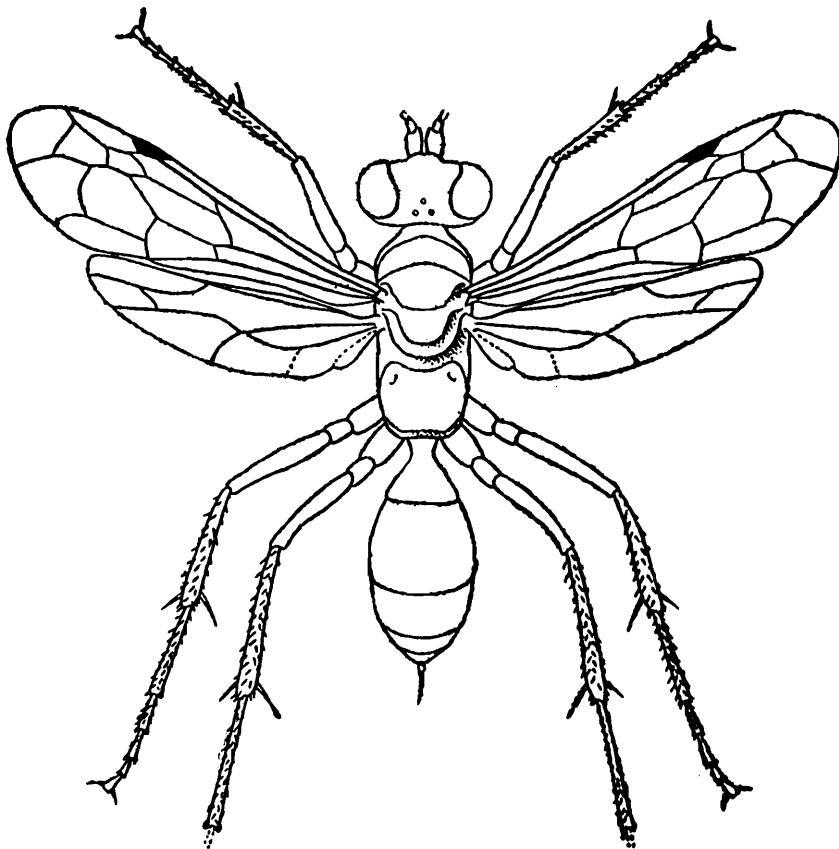
## Family POMPILIDAE.

Genus **Pseudagenia** Kohl.

**Pseudagenia bipennis** Sauss.

1887. *Pseudagenia bipennis*, Bingham, *Fauna of British India*, Hymenoptera, p. 116; the male only.

♀. The female is stouter and larger than the male. The second abdominal segment is twice as long as the third, while in the male the



TEXT-FIG. 1.—*Pseudagenia bipennis*, ♀ × 5.

second abdominal segment is only slightly longer than the third. The clypeus and the sides of the face in front (the genae) are white; the wings, as in the male, are hyaline. The ovipositor is visible externally and is about 2 mm. in length; it is thicker at the base and tapers in the distal region.

Length 12 mm. Collected by Bingham in August, 1898 in Tenasserim, Lower Burma. There is only one specimen in the collection of the Indian Museum.

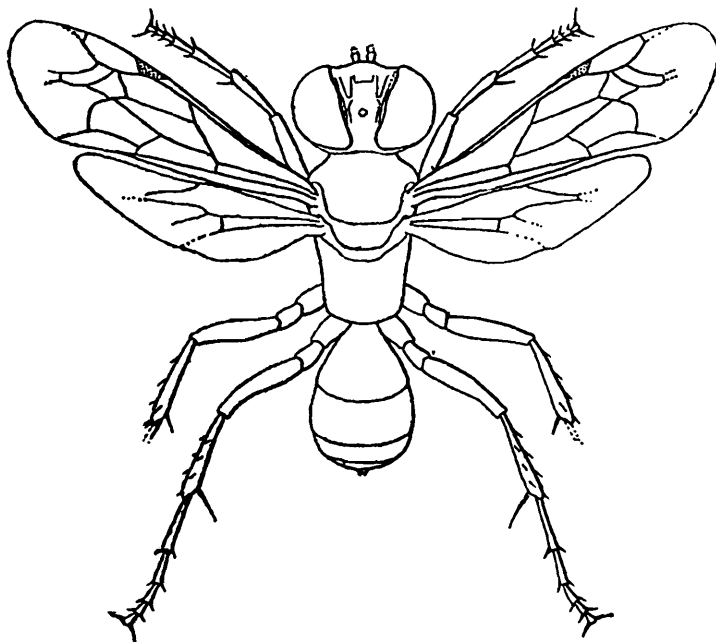
### Family SPHEGIDAE.

#### Genus *Larra* Latr.

#### *Larra tisiphone* Smith.

1887. *Larra tisiphone*, Bingham, *Fauna of British India*, Hymenoptera, p. 198; the female only.

♂. There is very little difference between the two sexes. In the male the abdomen is narrow and shorter than the head and thorax together.



TEXT-FIG. 2.—*Larra tisiphone*, ♂ × 5.

Length 9 mm. Collected by Bingham in December, 1897 in Tenasserim, Lower Burma. One specimen in the collection of the Indian Museum.

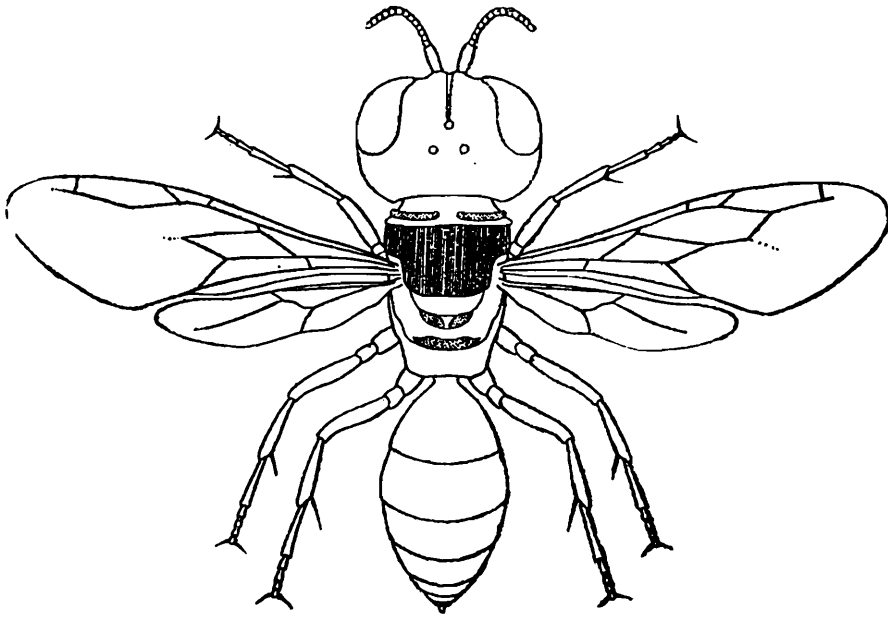
#### Genus *Crabro* Fabr.

#### *Crabro palitans* Bingham.

1887. *Crabro palitans*, Bingham, *Fauna of British India*, Hymenoptera, p. 329; the female only.

♂. The male is much smaller than the female. The abdomen is much smaller than the head and thorax together, whereas in the female the abdomen is as long as the head and thorax. Another striking difference between the two sexes is that in the male there are no lateral spots on any of the abdominal segments.

Length 7 mm. Collected by Bingham in October, 1898 at Moulmein in Burma. Two specimens in the collection of the Indian Museum.



TEXT-FIG. 3.—*Crabro palitans*, ♂ × 5.

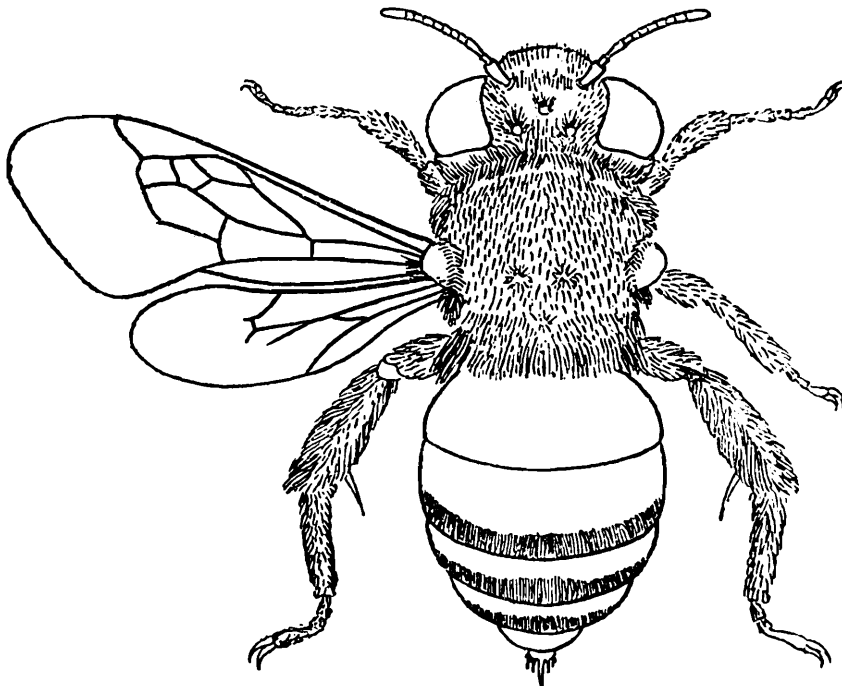
Family APIDAE.

Genus *Anthophora* Latr.

*Anthophora crocea* Bingham.

1887. *Anthophora crocea*, Bingham, *Fauna of British India*, Hymenoptera, p. 526; the male only.

♀. In the male the head and thorax are covered above with dense griseous pubescence but in the female the pubescence is of a rather blacker



TEXT-FIG. 4.—*Anthophora crocea*, ♀ × 5.

tint. The two black patches, below the antennae, present in both the sexes, are much larger in the female. The bands in the abdominal

region in the female are of a deep red colour, whereas in the male these are yellow. The dorsal surface of the abdominal segments (the tergites) in the male are convex but in the female they are more or less flattened.

Length about 13 mm. Collected by Bingham in June, 1898 at Taungoo in Tenasserim. One specimen in the collection of the Indian Museum.

I must express my sincere thanks to Mr. S. Ribeiro, who drew my attention to the above named Hymenoptera. My best thanks are also due to Lt.-Col. R. B. Seymour Sewell, I.M.S., Director, Zoological Survey of India, for allowing me to work in his laboratories, and to Dr. H. S. Pruthi, Officer-in-Charge of the Entomological Section for his constant guidance and advice in my research work.

## NOTES ON SCYPHOMEDUSAE IN THE INDIAN MUSEUM.

By H. SRINIVASA RAO, *M.A., D.Sc., Assistant Superintendent, Zoological Survey of India.*

(Plates III, IV.)

The material on which these notes are based consists of occasional catches of medusae obtained from various sources since the year 1885. A great proportion has, however, been collected in recent years by the R. I. M. S. "Investigator" in the course of its cruises in the Bay of Bengal and the Arabian Sea. A few were obtained on the coasts of India by the members of the Zoological Survey and others.

At the suggestion of Col. Sewell I commenced the study of the Indian Museum Scyphomedusae in April 1926, but owing to frequent unavoidable interruptions the completion of the work has been considerably delayed.

The present collection, though not large, includes representatives of all the orders of the Scyphomedusae except the Stauromedusae which are not known to occur in tropical seas. With the exception of a few medusae which have been preserved with care the collection consists of specimens which are incomplete or are very badly contracted. Consequently the identification of specimens presented no small difficulties. Many of the examples are preserved in alcohol which renders the tissues of jelly-fish extremely brittle. Formalin (about 5-10 per cent.) is a very good preservative for medusae, and should be employed instead of alcohol. A very useful note on the collecting and preserving of medusae published by Mr. E. T. Browne may be consulted with advantage.<sup>1</sup>

Although there have been several records of Scyphomedusae from the region of the Philippines and the Malay Archipelago, very few are known from the coasts of India and Burma. Our knowledge of medusae from the Indian region proper is due to Browne who has reported on the collections from the Laccadives and Maldives, the Ceylon Pearl Oyster Banks, the Okhamandal Coast of Kathiawar, and the Indian Ocean ("Sealark").<sup>2</sup> A short paper on the Scyphomedusae of Madras by Mahadeva Aiyar was published in 1911 with for the most part only generic identifications<sup>3</sup>. This has recently been supplemented by Mr. M. G. K. Menon in a more or less complete account of the species of jelly-fishes occurring on the Madras coast.<sup>4</sup>

Judging from the collection in the Indian Museum, which consists of 26 species belonging to 18 genera, it seems that the shallow waters along the coasts of India and Burma are rich in Scyphomedusae, and it is surprising that this group of animals has attracted so little attention

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<sup>1</sup> Browne, *Trans. Linn. Soc. London*, X, pp. 166-170 (1906).

<sup>2</sup> Browne, *ibid*, XVII, p. 208 (1916).

<sup>3</sup> Mahadeva Aiyar, T. R.—*Some notes on the Scyphomedusae of Madras*.—Guardian Press, Madras (1911).

<sup>4</sup> Menon, M. G. K.—*Bull. Govt. Museum, Madras* (N. S.), III, 26 pp. 3 pls. (1930)

hitherto. It is also evident that some species are casual visitors or semi-permanent inhabitants of the estuaries, the deltaic areas, and lakes and backwaters on the coasts of India. A systematic survey of the coastal waters is certain to increase the number of species known from the Indian seas.

In the preparation of these notes I have found the works of Mayer and Stiasny indispensable, and no student of this group can afford to miss them.

In respect of the Rhizostomae I have followed the classification of Stiasny as emended by Uchida.<sup>1</sup>

My best thanks are due to Dr. Gustav Stiasny of Leiden for going through my manuscript and suggesting various improvements, and to the skilful artists of the Zoological Survey of India for the drawings and photographs illustrating this paper.

#### LIST OF SPECIES IN THE COLLECTION OF THE INDIAN MUSEUM.

- |                                                            |                                                                |
|------------------------------------------------------------|----------------------------------------------------------------|
| 1. <i>Periphylla hyacinthina</i> Steenstrup.               | 13. <i>Cassiopea andromeda</i> var. <i>maldivensis</i> Browne. |
| 2. <i>Atolla wyvillei</i> Haeckel.                         | 14. <i>Netrostoma typhlodendrium</i> Schultze.                 |
| 3. <i>Tamoya alata</i> Reynaud.                            | 15. <i>Mastigias ocellata</i> (Modeer).                        |
| 4. <i>Tamoya</i> sp.                                       | 16. <i>Mastigias albipunctata</i> Stiasny.                     |
| 5. <i>Chiropsalmus quadrumanus</i> L. Agassiz.             | 17. <i>Mastigias</i> sp.                                       |
| 6. <i>Pelagia noctiluca</i> (Forskål).                     | 18. <i>Mastigias papua</i> var. <i>sibogae</i> Maas.           |
| 7. <i>Chrysaora helvola</i> Brandt.                        | 19. <i>Versura anadyomene</i> (Maas).                          |
| 8. <i>Chrysaora melanaster</i> Brandt.                     | 20. <i>Thysanostoma thysanura</i> Haeckel.                     |
| 9. <i>Cyanea capillata</i> var. <i>nozakii</i> Kishinouye. | 21. <i>Acromitus flagellatus</i> (Haeckel).                    |
| 10. <i>Aurelia aurita</i> Lamarck.                         | 22. <i>Acromitus rabanchaçu</i> Annandale.                     |
| 11. <i>Aurelia solida</i> Browne.                          | 23. <i>Crambionella annandalei</i> , sp. nov.                  |
| 12. <i>Cassiopea</i> (?) <i>frondosa</i> (Pallas) Lamarck. | 24. <i>Lobonema smithii</i> Mayer.                             |
|                                                            | 25. <i>Lobonemoides sewelli</i> , sp. nov.                     |
|                                                            | 26. <i>Rhopilema hispidum</i> (Vanhöffen) Maas.                |

#### Order CORONATAE.

#### Family PERIPHYLLIDAE.

#### Genus **Periphylla** Steenstrup.

1910. *Periphylla*, Mayer, *Medusae of the World*, III, p. 543.

#### **Periphylla hyacinthina** Steenstrup.

1913. *Periphylla hyacinthina*, Kramp, *Vidensk. Med. fra Dansk Naturh. Foren.* LXV, p. 277.

1928. *Periphylla hyacinthina*, Bigelow, *Zoologica N. Y. Zool. Soc.*, VIII, p. 496.

This species is represented by four much contracted specimens of which only one is more or less entire. The diameter of the bell is 70 mm. There are twelve tentacles, and the rhopalia are mostly damaged.

Marine Survey Station 120 (Bay of Bengal—15° 56' 50" N., 81° 30' 30" E., 24-xii-1890); 240 fathoms—1 specimen.

<sup>1</sup> Uchida, *Journ. Fac. Sci. Imp. Univ. Tokyo*, I, pp. 85-90 (1926).

Marine Survey Station 386 (Laccadive Sea—11° 55' N., 74° 22' E., 13-x-1909) ; 360 fathoms—3 specimens.

Family ATOLLIDAE.

Genus **Atolla** Haeckel.

1910. *Atolla*, Mayer, *op. cit.*, p. 561.

1928. *Atolla*, Bigelow, *op. cit.*, p. 505.

**Atolla wyvillei** Haeckel.

1916. *Atolla wyvillei*, Browne, *Trans. Linn. Soc. London*, VI, p. 203.

1928. *Atolla wyvillei*, Bigelow, *op. cit.*, p. 508.

There are several specimens of this species in the collection. Some are greatly contracted and crumpled, while others in a better state of preservation are evidently immature forms. The diameter of the bell varies from 25-55 mm. in the young medusae to 80-100 mm. in the older forms. The central lens varies from 20-70 mm. in diameter. The tentacles are 20-29 in number and alternate with as many rhopalar pedalia, which are rather minute. The margin of the central lens is more or less entire, and the marginal lappets are very much contracted, and have dropped off altogether in some individuals.

Marine Survey Station 134 (off Kistna delta, Bay of Bengal ; 13-iv-1892) ; 753 fathoms—one specimen.

Marine Survey Station 260 (Laccadive Sea, 18-i-1900) ; 487 fathoms—one specimen.

Marine Survey Station 322 (Andaman Sea, 20-xi-1903), 378 fathoms—3 specimens. Off the Gangetic delta in the swatch of no ground, 285-409 fathoms—10 small specimens.

Marine Survey Station 682 (Laccadive Sea, 10° 26' N., 74° 82' 30" B., 28-iv-1925) from midwater—one well-preserved specimen.

Four badly preserved specimens bearing the Register Nos. 4907-4910/7 and without a locality label. Presumably they are from the Indian seas.

Order CUBOMEDUSAE.

Family CHARYBDEIDAE.

Genus **Tamoya** Müller.

1859. *Tamoya*, F. Müller, *Abhandl. Naturf. Ges. Halle*, V, p. i, pl. i-ii.

**Tamoya alata** Reynaud.

1929. *Tamoya alata*, Uchida, *Japanese Journ. Zool.*, II, p. 172.

The species is represented in the collection by a fairly large series of specimens from the Bay of Bengal.

Ennur, near Madras—one specimen : The bell is 75 mm. high and 50 mm. in diameter, and the tentacles are 230-250 mm. long. The pedalia have a sharp outer and inner edge, and are 25-30 mm. long, 10-12 mm. broad. There are 8 much branched canals in the velarium of each quadrant.

Puri, Orissa Coast (Dr. S. W. Kemp, 24-29-iii-1916), 4-4½ fathoms : One specimen 50 mm. high, 50 mm. broad with tentacles 28-40 mm. long ; (P. C. Singh, June 1909) one specimen 75 mm. high, 70 mm. broad, tentacles 10-25 mm. long, much contracted. The pedalia are 30 mm. long, 15 mm. broad, pyramidal at the base and flattened near the apex, and have sharp outer and inner edges. The sense clubs have large median eyes with conspicuous lens, but no trace of the lateral eyes was found. The velarium has ten canals in a quadrant, each of them branched near its origin.

Marine Survey Station 565 (11° 57' 30" N., 98° 19' 00" E., 13-xi-1913) ; 7 fathoms—one immature specimen.

Marine Survey Station 569 (11° 52' 10" N., 98° 18' 40" E., December 1913), 4 specimens obtained near the surface of the sea. Bell 45-80 mm. high, 30-60 mm. broad ; tentacles 50-65 mm. long, 6-8 complexly branched velarial canals in each quadrant. Small spindle-shaped fish (*Clupeidae* ?), crustacean larvae (of *Squilla*, etc.), a few prawns and Isopods were found in the stomach of these medusae.

Marine Survey Station 580 (Celerity Passage, 1914)—one specimen 40 mm. high, 25 mm. broad.

Bay of Bengal, between Pilot Ridge Light Vessel and Eastern Channel (Pilot Vessel "Lady Fraser", February and March 1928)—one large specimen 150 mm. high, 70 mm. broad, which is greatly contracted. The tentacles are missing, but the pedalia (35 mm. high and 20 mm. broad) and the velarium (10-15 mm. broad) are present. The velarial canals end in trident-like distal branches.

### **Tamoya** sp.

One specimen which is obviously very young was obtained near the surface at the Marine Survey Station 524 (Mergui Archipelago, 13-iii-1913). I am unable to refer this to any well-known species. The bell is 12 mm. high, 8 mm. broad, somewhat pyramidal, and tapering towards the apex. Several prominent warts are present on the exumbrella. The tentacles have several ring-like ridges consisting of nematocysts. There are four main velarial canals in each quadrant of which the central or perradial is simple and unbranched. The lateral canals are, however, branched, each resembling a trident. Some of them show traces of further branching. The sense organs are placed in deep niches, and the rhopalium hangs by a slender basal stalk from the roof. There are two median eyes with lens, but the lateral eyes seem to be absent. The colour of the medusa is orange.

### Family CHIROPIDAE.

#### Genus **Chiropsalmus** L. Agassiz.

1862. *Chiropsalmus*, L. Agassiz, *Contr. Nat. Hist. U. S.*, IV, p. 174.

#### **Chiropsalmus quadrumanus** L. Agassiz.

1910. *Chiropsalmus quadrumanus*, Mayer, *op. cit.*, p. 515.

There are four medusae belonging to this species in the collection. Only one is well-preserved, the remaining three being considerably damaged

The sac-like subumbrellar processes of the perradial pouches are, however, intact, and my identification is based on an examination of these structures.

Ennur, near Madras (1925)—one well-preserved specimen 75 mm. high and 60 mm. broad. The pedalia are hand-shaped with 5-8 finger-like branches of which the longest is near the exumbrellar side of the bell. The subumbrellar processes of the perradial pouches do not extend much beyond the manubrium.

Puri, Orissa Coast (Mr. P. C. Singh, June 1909)—one much damaged specimen. The processes of the perradial pouches are rudimentary.

Marine Survey Station 509 (Elphinstone Island, Mergui Archipelago, 1912-13).—Two specimens were obtained off shore with a seine net. They are crumpled and brittle. The colour is orange brown.

As far as I am aware this species has never been recorded from the Indian Ocean. It is "found in the warmer waters along the Atlantic Coasts of North and South America, south of Cape Hatteras" according to Mayer. Taking into consideration the fact that certain species of Scyphomedusae have a wide range in distribution in both tropical and temperate seas the present record of *C. quadrumanus* in tropical waters should cause no surprise. It is, however, curious that *C. quadrigatus* Haeckel and *C. buitendijki* Horst previously recorded from the Indo-Pacific area were not found during the cruises of the Marine Survey steamer "Investigator".<sup>1</sup>

## Order SEMAEOSTOMAE.

### Family PELAGIDAE.

#### Genus *Pelagia* Peron and Lesueur.

1928. *Pelagia*, Bigelow, *op. cit.*, p. 517.

In the work cited above Bigelow has summarised conclusive evidence of the futility of recognising more than one species of *Pelagia* on the characters hitherto believed to be of systematic importance.

#### *Pelagia noctiluca* (Forskål).

1910. *Pelagia noctiluca*, Mayer, *op. cit.*, p. 572.

There are two specimens in the collection which agree with the description of *P. noctiluca*. One is from the Bay of Naples, and the other is from an unknown locality in the Indian seas. They are of the same size. The colour of the Indian example has been lost in preservation while the specimen from Naples is purple.

In the specimen from Naples the nettle-warts are elliptical and somewhat depressed and transversely furrowed. They are so transparent when immersed in spirit that they appear to be elliptical spots on the exumbrella. In the Indian specimen the warts are elongate and ridge-like and more evenly distributed, those on the marginal lappets being more numerous and smaller in size. On their outer surface the marginal

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<sup>1</sup> Menon (*loc. cit.*), however, records *C. buitendijki* Horst from the Madras Coast.

lappets have an elongate conical thickening in which a prolongation of the gastric cavity is present. The rhopalium is conical and spear-shaped and is lodged in a deep niche roofed over by a membranous flap of the umbrella at the base of the rhopalar lappets. The tentacles are transversely wrinkled and thus have a segmented appearance. They arise from the membranous part of the umbrella between the velar lappets.

*Measurements in millimeters of the Indian specimen.*

|                     |       |                                |       |
|---------------------|-------|--------------------------------|-------|
| Diameter of bell    | 90    | Length of tentacles            | 90    |
| Height of bell      | 55    | Breadth of marginal lappets at |       |
| Length of manubrium | 25-30 | base                           | 18-20 |
| Length of mouth-arm | 80    | Length of marginal lappets     | 12    |

Genus **Chrysaora** Peron and Lesueur.

1809. *Chrysaora*, Peron and Lesueur, *Ann. Mus. Hist. Nat. Paris*, XIV, p. 364.

1862. *Chrysaora*, *Melanaster*, L. Agassiz, *Contr. Nat. Hist. U. S.*, IV, pp. 124-127.

1910. *Chrysaora*, Mayer, *op. cit.*, p. 577.

From what has been written hitherto on the affinities of this genus to the very closely allied genera *Dactylometra* and *Kuragea* it does not seem to be at all easy to distinguish these by any set of characters. It has been pointed out by Mayer that some of the so-called species of *Chrysaora* are only stages in the developmental history of *Dactylometra*, while some species of *Dactylometra* become sexually mature in the *Chrysaora* stage. Assuming for the moment that *Dactylometra* is a good genus, it would seem, therefore, to be an extremely difficult task to say whether a *Chrysaora* represents the developmental stage of *Dactylometra*, or the sexually precocious *Dactylometra*, or the adult phase of any one of the numerous species of *Chrysaora* itself. Mayer seemed to be almost in despair when he said "that the conditions characteristic of the genera *Chrysaora*, *Dactylometra* and *Kuragea* may therefore be transitional stages in the growth of one and the same medusa"; but if so, which amongst the numerous described species of the three genera that medusa is no one seems to have yet been able to discover.

In the following notes I have referred the specimens in the collection to well-known tropical species of *Chrysaora* giving short descriptions of individual specimens.

**Chrysaora helvola** Brandt.

1906. *Chrysaora helvola*, Vanhöffen, *Nordisches Plankton*, V, p. 48.

1910. *Chrysaora* sp., Kishinouye, *Journ. Coll. Sci. Tokyo*, XXVII, Art. 9, p. 13.

1910. *Chrysaora helvola* var. *chinensis*, var. *calliparea*, Mayer, *op. cit.*, pp. 581-582.

A large number of individuals of this species preserved in the collection comes from the Bay of Bengal. They are mostly preserved in alcohol and the colour has consequently been lost. In a small medusa preserved in Formol the colour is a bright orange. The exumbrellar surface is generally covered with numerous small warts variously developed in different individuals. The rhopalia are more or less vertical

in position and depend from the conical inner end of the exumbrellar sense-pit. There are, as a rule, only 3 tentacles to each octant. The marginal lappets vary both in size and in shape. The tentacles are flattened, and nearly all of them are incomplete. The gastric pouches are narrow at their origin from the central gastric cavity and gradually widen out towards the margin where the rhopalar and tentacular pouches are not of the same width. The rhopalar pouches are widest a little below the rhopalium and the tentacular at the extreme margin. The sides of the pouches are minutely sinuous. In specimens measuring 100 mm. or more across the bell the gonads are well developed, and often protrude outside through the subgenital ostia.

12 medusae from the Puri Coast, Orissa, were collected in the months of February and March between the years 1908 and 1912. The diameter of the bell varies from 60-140 mm., and the length of the mouth-arms from 50-370 mm. In some the mouth-arms are incomplete. The marginal lappets are crumpled in many, but they seem to be roughly triangular in shape. There are usually three tentacles in each octant.

7 small medusae with the bell not exceeding 70 mm. in diameter and with incomplete mouth-arms are from the Marine Survey Stations 524, 579, 582 in the Mergui Archipelago, at depths varying between 7-12 fathoms.

The geographical range of this species with its numerous forms and varieties seems to be very wide, extending from the coastal waters of E. Africa, India, China and Japan to the Pacific Coasts of N. America.

*Dactylometra quinquecirrha* ("Chrysaora stage") recorded by Light from the Philippine seas is probably a form of *Chrysaora helvola*.<sup>1</sup>

### ***Chrysaora melanaster* Brandt.**

1899. *Chrysaora gilberti*, Kishinouye, *Zool. Anz.*, XXII, p. 44.

1906. *Chrysaora melanaster*, Vanhöffen, *Nordisches Plankton*, V, p. 49.

1915. *Chrysaora melanaster*, Mayer, *Publ. Carnegie Instit. Washington*, No 212, p. 179.

There are 3 specimens of this species in the collection, all from the Bay of Bengal. They differ from the hitherto recorded medusae in the great length of the mouth-arms which are nearly 8 times as long as the diameter of the bell, and in several minor features, but in view of the great variability of the structures it would be useless to give these medusae even a new varietal name.

The bell is dome-shaped, and has well-defined marginal lappets and long mouth-arms. The tentacles are either much contracted or incomplete. There are 48 marginal lappets, 32 of which are large, broadly rounded and overlapping the adjacent ones, and the remaining are comparatively small. The tentacular and the rhopalar pouches are nearly of the same width except near the margin of the umbrella where the rhopalar are only half as broad as the tentacular. The mouth-arms have long folded curtain-like lips nearly as broad as the radius of

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<sup>1</sup> Light, *Philip. Journ. Sci.*, IX, p. 198 (1914).

the bell, which narrow down gradually to the extremity of the arm. The subgenital ostia lie at right angles to the radius of the umbrella, and are roughly oval in shape. The centrifugal side of the ostia is, however, flattened. The exumbrellar surface is covered with closely packed, raised, rounded or triangular lobed warts of unequal size, but on the margin they are fewer and of an elongate shape. The exumbrellar sense-pit is minutely furrowed, and the rhopalium short and spindle-shaped.

There are a few small rounded white or greyish spots on the subumbrellar surface near the base of the manubrium. The gonads and mouth-arms are pink in colour.

The diameter of the bell varies from 100-125 mm., and the length of the mouth-arms from 150-940 mm.

|                                                     |               |
|-----------------------------------------------------|---------------|
| Mar. Surv. Sta. 590 (Whale Bay, E. of Kisserian I.) | One specimen. |
| Madras Sta. 14                                      | " "           |
| Madras Sta. 1                                       | " "           |

One of the three medusae is abnormal in having only 21 tentacles and 7 rhopalia—4 tentacles in each of two radii, 3 in each of four radii, and only one in the remaining radius. There are only 14 radial pouches. The marginal lappets have undergone corresponding changes. In one of the radii with 4 tentacles there are 4 velar lappets, the outer ones small, and the inner resembling the rhopalar lappets in having a cleft which is shallow, and in lodging a small sac-like structure which presumably represents the rhopalium of that radius. The tentacle belonging to this radius is, however, found a little below the cleft.

### Family CYANEIDAE.

#### Genus *Cyanea* Peron and Lesueur.

- 1809. *Cyanea*, Peron and Lesueur, *Ann. Mus. Hist. Nat. Paris*, XIV, p. 363.
- 1862. *Cyanea*, Agassiz, L., *Contr. Nat. Hist. U. S.*, IV, p. 115.
- 1910. *Cyanea*, Mayer, *op. cit.*, p. 595.
- 1913. *Cyanea*, Bigelow, *Proc. U. S. Nat. Mus.*, XLIV, p. 92.
- 1921. *Cyanea*, Stiasny, *Kunzl. Svens. Vetensk. Akad. Handl.*, LXII, p. 7.
- 1930. *Cyanea*, Menon, *Bull. Govt. Mus. Madras*, (N. S.), III, p. 8.

The genus is known to be well-represented in the Arctic and the Antarctic regions along the coasts of N. America and N. Europe. A few species are also recorded from the coasts of Japan, Australia, and the Malay Archipelago.

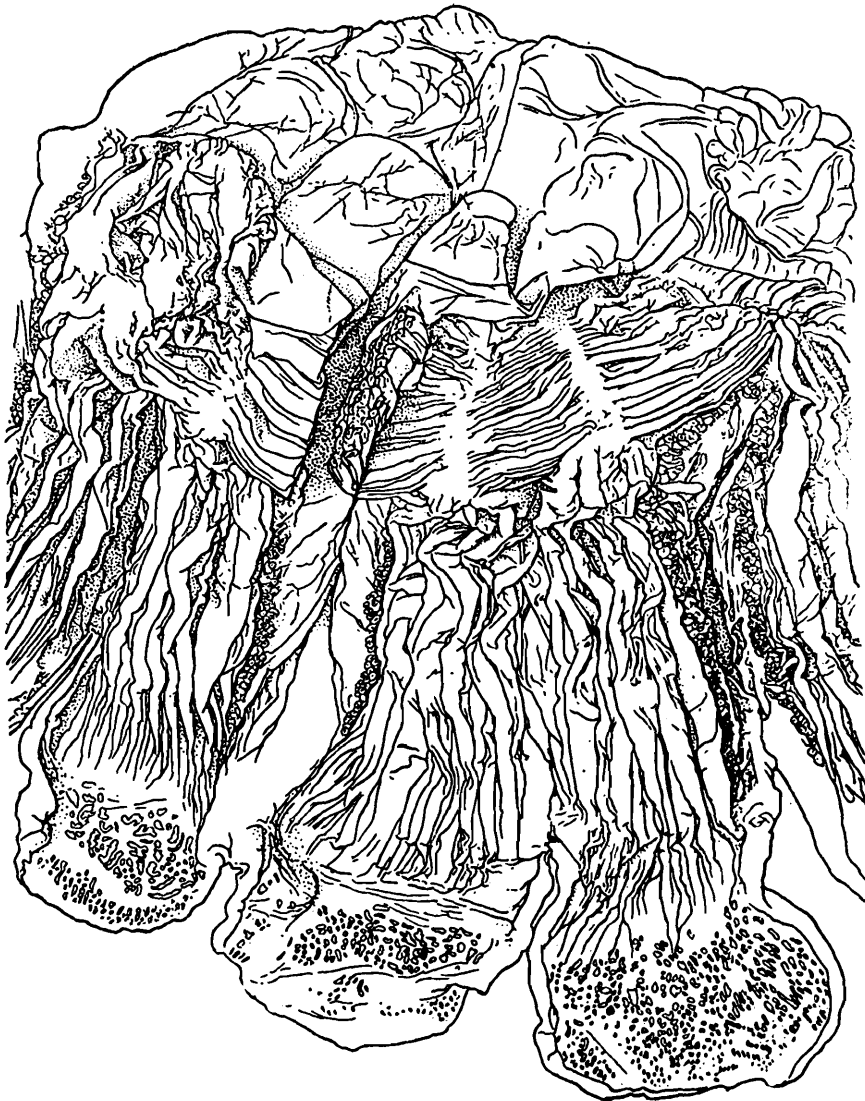
Menon refers the specimen from the Madras coast doubtfully to *Cyanea purpurea* Kishinouye.

#### *Cyanea capillata* var. *nozakii* Kishinouye.

- 1913. *Cyanea capillata* var. *nozakii*, Bigelow, *op. cit.*, p. 93, pl. iv, figs. 5-7.

I refer to this variety, with some hesitation, a fragment of a large medusa obtained by the R. I. M. S. "Investigator" in November 1913

in the Mergui Archipelago (Mar. Surv. Sta. 565— $11^{\circ} 57' 30''$  N.,  $98^{\circ} 19' 00''$  E.). It is less than a half of the entire medusa and is greatly contracted, but the marginal lappets, the sense organs, the radial and circular muscles, the stomach and the mouth-arms are preserved in part and makes a fairly accurate determination possible.

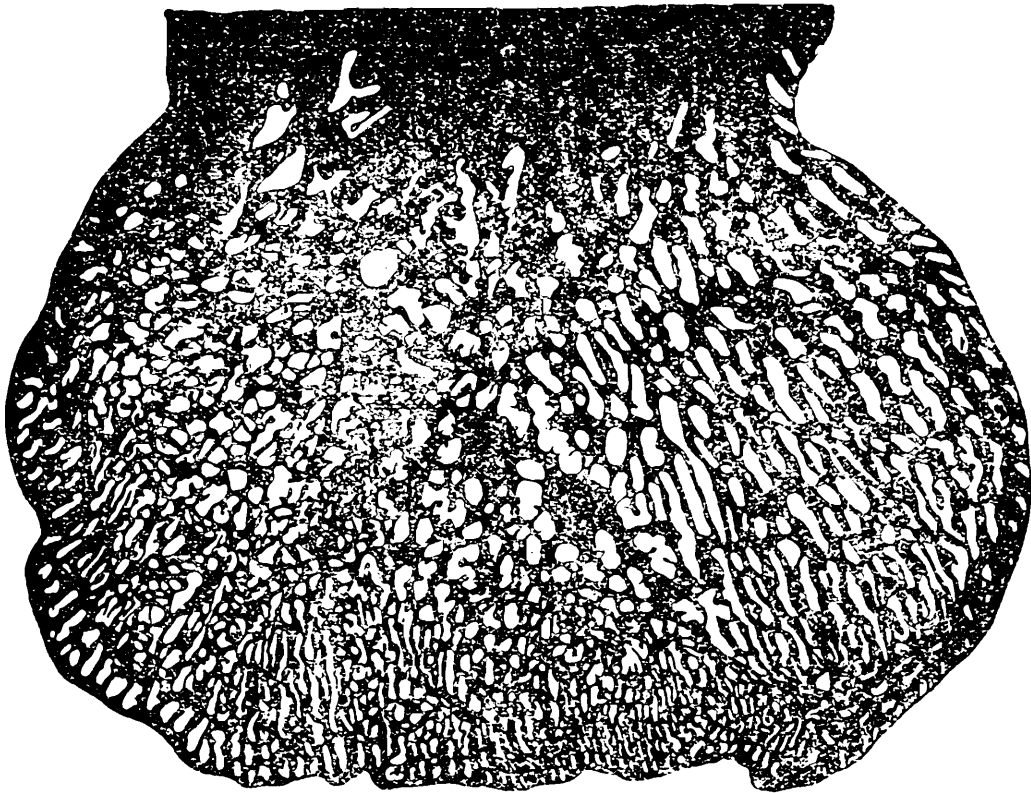


TEXT-FIG. 1.—*Cyanea capillata* var. *nozakii*. Subumbrellar view of a portion of the specimen from the Bay of Bengal showing the circular and radial muscles and the tentacles. The circular muscles of one radius are cut in the middle.  $\times \frac{1}{2}$ .

The centre of the umbrella up to the base of the marginal lappets is very coarsely granular, and is divided into large diamond-shaped areas by oblique parallel grooves which cross one another at a distance of 15 mm. The roof of the central stomach is also divided by deep furrows into a number of large fleshy polygonal cushions. The approximate radius of the bell from the centre of the stomach to the tip of the marginal lappets is 125 mm., and the bell is 25 mm. thick at the centre. The marginal lappets are large, slightly narrower at the base than at the free margin, broader than high in the widest part (40-45 mm. broad, 25 mm. high). They are not entire, and have presumably a rounded even margin. The rhopalar cleft is deeper than the cleft between the marginal lappets. A shallow niche facing the axis of the umbrella lies concealed at the bottom of the rhopalar cleft, along both sides of which the

margin of the velar lappets forms a vertical fold. In this niche lies the minute rod-like rhopalium with its free end directed towards the margin of the umbrella.

The radial canals and their extensions could not be made out satisfactorily except in the marginal lappets. Fig. 2 represents a lappet incomplete near the margin showing the distribution of the distal branches of the radial canals. The tentacles are arranged in 2-3 rows. The radial muscles occupy an area 70 mm. long, 20 mm. broad at the narrower end,



TEXT-FIG. 2.—*Cyanea capillata* var. *nozakii*. One of the velar lappets showing the branched and anastomosed canals. The extreme margin of the lappet is damaged and the canals are very indistinct in that region.  $\times 2\frac{1}{4}$ .

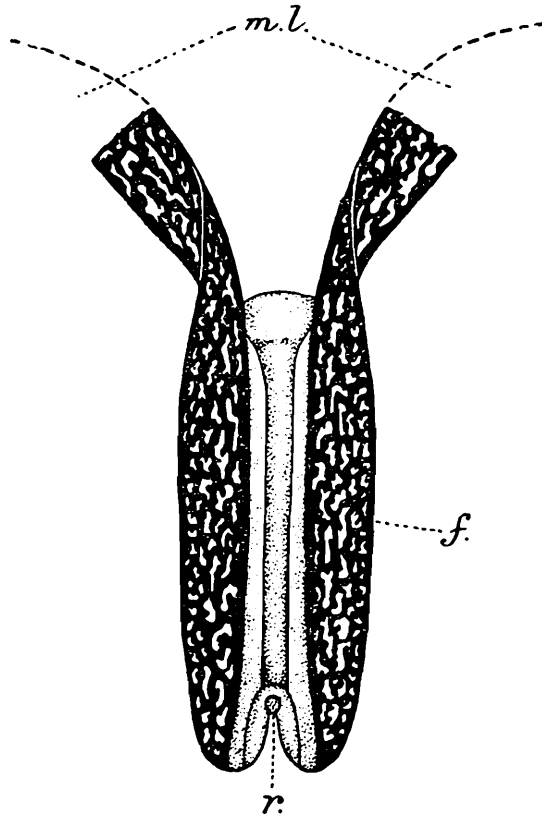
and consist of 7-8 strands, 5 mm. high intercalated by a few relatively narrow ones 2-3 mm. high. The circular muscles consist of 8-10 strands which are interrupted by muscle-less ridges along a line which, continued to the marginal lappets, divides each of them into two equal halves.

In the form of the rhopalia, in the nature of the radial canals and the circular muscles, and in the absence of rhopalar lappets the present specimen agrees very closely with the description of the var. *nozakii*, but differs in having a complete system of anastomosing canals in the marginal lappets. It is quite possible, however, that stages intermediate between the *capillata* condition of the radial canals and that of the present specimen may be found if a sufficiently large series be examined from one or more localities.<sup>1</sup>

*C. capillata* var. *mjobergi* Stiasny appears to have a partial anastomosis of the canals in the basal part of the marginal lappets, the distal

<sup>1</sup> Cf. Kishinouye's *C. purpurea*, *Journ. Sci. Coll. Tokyo*, XXVII, p. 18, pl. iv, fig. 18 (1910).

branches being free.<sup>1</sup> Uchida has suggested that the var. *nozakii* may be separated specifically from *C. capillata* on the characters of the radial canals, of the muscle system, and the colour of the medusa.<sup>2</sup> Until



TEXT-FIG. 3.—*Cyanea capillata* var. *nozakii*. Rhopalar cleft viewed from the subumbrellar side. *m. l.* marginal lappets; *f.* fold of the marginal lappet along the rhopalar cleft; *r.* rhopalium.  $\times 3$ .

sufficient evidence is gathered to show that the characters mentioned are constant, on an examination of a large series of medusae, it would be best to leave *nozakii* as a variety of *C. capillata*.

### Family ULMARIDAE.

#### Genus *Aurelia* Peron and Lesueur.

1910. *Aurelia*, Mayer, *op. cit.*, p. 619.

1913. *Aurelia*, Bigelow, *op. cit.*, p. 98.

1922. *Aurelia*, Stiasny, *Vidensk. fra Dansk Naturh. Foren.* LXXIII, p. 522.

Several species of this genus have been described (many of them based on very variable features) from various parts of the world. The species have been considerably reduced in number in recent years. Mayer recognised *aurita*, *labiata*, *solida* and *maldivensis*. He merged *A. limbata* in *A. labiata* with, I believe, some justification, though it is held that *A. limbata* can be separated from all other species by the anastomosis of

<sup>1</sup> Stiasny, *Kungl. Svens. Vetensk. Akad. Handl.*, LXII, p. 5 (fig.) (1921).

<sup>2</sup> Uchida, *Sci. Rep. Tohoku Imp. Univ. Sendai*, II, p. 232 (1927).

the radial canals and by the marginal pigmentation of the umbrella.<sup>1</sup> Anastomosis of the radial canals occurs to some extent in the peripheral part of the umbrella in many examples of *A. aurita*; and the condition observed in individuals of *A. limbata* may represent one extreme in the scale of variation. It is also a matter of common experience that pigmentation by itself cannot be a safe guide in differentiating species.<sup>2</sup>

Bigelow has shown that *A. labiata* cannot be distinguished from *A. aurita*. Stiasny, on the other hand, has suggested that *A. maldivensis* may represent the developmental stage of a *Cyanea*, and that *A. solida* cannot be distinguished by the characters of the subgenital ostia and by the solid appearance of the jelly.

I have examined examples of all the species except *A. maldivensis* and *A. limbata*. A number of specimens of *A. aurita* which I was at first prepared to separate into *A. labiata* proved on closer examination to consist of intermediate stages between the condition of the umbrellar margin in *A. aurita* and that of the so-called *A. labiata*. The specimens in the collection therefore support Bigelow's observations.

With regard to *A. solida*, of which I have examined three well preserved examples, there seems to be good evidence of its being a distinct species. In my notes under that species I have enumerated the characters by which the species can be distinguished from *A. aurita*.

### ***Aurelia aurita* Lamarck.**

1910. *Aurellia aurita*, *Aurellia labiata*, Mayer, *op. cit.*, pp. 623-627, 628.

The collection contains several specimens in a fairly good state of preservation, which vary in size and thickness of the bell, in the length of the mouth-arms, in the number and size of the velar lappets, in the number of rhopalia and in the branching of the radial canals. The accompanying table of measurements, etc., shows at a glance the extent of variability.

Several contributions have been made on the subject of variation in *Aurelia aurita* chief among which may be mentioned the works of Mayer,<sup>3</sup> Browne,<sup>4</sup> Hargitt,<sup>5</sup> and M'Intosh.<sup>6</sup>

All but one of the medusae in the collection were obtained off Ross Island, Port Blair Harbour, Andamans (April 16, 1925). Col. Sewell has recorded the following observations on them in the "Investigator" station book: "About noon, the harbour-waters of Port Blair were swarming with large numbers of a species of *Aurelia*. The colour of the gonads was a light reddish-purple, almost mauve, and the jelly of the umbrella was tinged with the same colour." The precise locality from which the remaining medusa was obtained is not known, though a label indicates its provenance to be Indian seas.

<sup>1</sup> Vanhöffen, *Nordisches Plankton*, No. 11, p. 61, fig. 32 (1906).

<sup>2</sup> Kramp, *Vidensk. Med. fra Dansk. Naturh. Foren.*, LXV, p. 285 (1913).

<sup>3</sup> Mayer, *Bull. Mus. Brooklyn Inst. Arts and Sciences*, I, pp. 1-27, pls. i-ii (1901).

<sup>4</sup> Browne, *Biometrika*, I, pp. 90-108 (190).

<sup>5</sup> Hargitt, *Journ. Exp. Zool.*, II, pp. 547-582, pl. i (1905).

<sup>6</sup> M'Intosh, *Proc. Roy. Phys. Soc. Edinburgh*, XVIII, pp. 125-143 (1909-1912).

*Measurements in millimeters.*

| Diameter of Bell. | Thick-ness of Bell. | No. of velar lobes and condition of margin.      | No. of rhopalia. | Length of mouth-arms. | No. of adradial canals. |
|-------------------|---------------------|--------------------------------------------------|------------------|-----------------------|-------------------------|
| 95                | 8                   | 8 unequal—not notched                            | 8                | 30-35                 | 5-7                     |
| 90                | 9                   | 7     „     „                                    | 7                | 40                    | 3-4                     |
| 78                | 11                  | 7     „     „                                    | 7                | 48                    | 5-7                     |
| 110               | 12                  | 13 notched in some places, 8 deep and 5 shallow. | 8                | 40                    | 5-7                     |
| 90                | 10                  | 8 unequal—deeply notched                         | 8                | 30                    | 5                       |
| 98                | 7                   | 16—shallow notches                               | 8                | 45                    | 5-7                     |
| 115               | 20                  | 16 equal—shallow notches                         | 8                | 50-55                 | 5                       |
| 105               | 18                  | 16 unequal— „     „                              | 8                | 50                    | 5                       |
| 122               | 10                  | 16     „     „     „                             | 8                | 40-45                 | 5-7                     |
| 115               | 18                  | 13     „     8 deep and 5 shallow notches.       | 8                | 40-45                 | 5-7                     |
| 105               | 12                  | 8 unequal—8 deep notches                         | 8                | 40                    | 5                       |
| 95                | 12                  | 12     „     8 deep and 4 shallow notches.       | 8                | 40-42                 | 5-8                     |
| 105               | 12                  | Ditto                                            | 7                | 40-45                 | 2-5                     |
| 75                | 7                   | 16 equal, 8 deep and 8 shallow notches.          | 8                | 40                    | 4-5                     |
| 100               | 11                  | Undefined and unequal—margin irregular.          | 8                | 40                    | 5-6                     |

Amongst the individuals having only 7 rhopalia, one of the perradial rhopalia is missing in one specimen while the corresponding radial canal is present, one of the interradial canals and the corresponding rhopalium are missing in a second specimen. One of these individuals from the Andamans has 3 gonads, and an extra perradial rhopalium. There is a distinct fold in one of the gonads which appears to indicate that the missing fourth gonad is fused with it abnormally.

The number of rhopalia in this lot of medusae is, as a rule, eight. The velar lappets are not of the same size, and this is presumably due to the unequal spacing of the rhopalia on the margin of the umbrella, and to the variation in the number of adradial canals which often spread out or anastomose with adjacent radial canals.

Amongst the medusae with 8 rhopalia there are two in which the gonads are unequally developed. In one of these, two of the gonads are normal and the other two are undeveloped ; while in the other there are only three gonads with one of the subgenital sacs incomplete at the centrifugal end. The gonad corresponding to this incomplete subgenital

sac is also incomplete, but here again there is an infolding which seems to indicate the abnormal fusion of the gonads belonging to two adjacent quadrants.

***Aurelia solida* Browne.**

1906. *Aurelia solida*, Browne, *Fauna and Geogr. Maldives and Laccadive Archipelagoes*, II, pp. 960-962, pl. xciv.  
1910. *Aurelia solida*, Mayer, *op. cit.*, pp. 627-628.

There are three well-preserved individuals in the collection. One of them is as large as the type-specimen from the Maldives, and another larger than the type. The margin of the bell is slightly injured in places. The bell is a solid dome-like mass of firm jelly, 20-25 mm. thick in the stoutest part of the medusa. The diameter of the bell is 80-105 mm. Numerous small oval or rounded warts are present on the exumbrellar surface, somewhat more closely packed on the margin than in the centre. There are 16 equal velar lappets and 8 rhopalia. The rhopalar clefts are deep and regularly spaced on the margin. Numerous tentacles alternate with the marginal lappets which form regular compartments between them for lodging the tentacles. The rhopalia lie at the head of the cleft below the exumbrellar sensory pit, and are not hidden from view owing to the ledge of the pit being small. The exumbrellar sensory pit is relatively shallow, and is with or without branched radiating folds. The direction of the sense-rod is somewhat variable. It may be tilted outwards and upwards in the manner described by Browne for his Maldives specimen, or directed towards the margin of the umbrella more or less horizontally. Having examined all the rhopalia of a single medusa, and several others of the remaining medusae in the collection I am convinced that there is considerable variation with regard to the direction of the sense-rod.

The mouth-arms constitute a compact pillar-like structure at the centre of the subumbrella, resembling the manubrium of some of the Hydromedusae. The four arms are, however, distinct at their origin and separated from one another by vertical slits down their sides and centre. The height of the raised mouth-arm pillar is 25 mm. The distal part of each mouth-arm is spread out at right angles to the central pillar, and is somewhat thick and folded. The length of the mouth-arm from the centre of the subumbrella to the tip of the arm is 40-45 mm. The radial canals are long, and anastomose with adjacent branches at some points near the margin of the umbrella. The adradials vary from 5-7 in number. The subgenital sacs are not conspicuous, being hidden away from view under the folds of the mouth-arms. They are not raised much above the subumbrellar surface. In this respect the Indian Museum medusae differ from the type-specimen from the Maldives and agree with the North Atlantic specimen described by Browne.<sup>1</sup> The subgenital ostia are very small and are directed obliquely towards the margin of the umbrella.

*A. solida* is undoubtedly closely allied to *A. aurita*, but it seems to differ from the latter in the distinctly deeper position of the rhopalia

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<sup>1</sup> Browne, *Trans. Roy. Soc. Edinburgh*, XLVI, p. 249 (1908).

on the margin of the umbrella, in the rhopalia being more or less exposed on the exumbrellar side as a result of the ledge of the sensory pit being very small, in the structure of the mouth-arm pillar, and in the great thickness of the jelly. The specific name, in fact, aptly describes this species, and it is the solidity of the bell more than any other character which serves to distinguish it at sight from *A. aurita*.

The more or less vertical position which the sense-rods assume frequently in *A. solida*, and rarely in *A. aurita*, seems to be correlated with the consistency of the jelly. With an increase in the solidity of the tissues there appears to be a tendency towards tension in all parts of the medusa, which influences in turn the disposition of the mouth-arms, of the subgenital sacs and ostia, and of the rhopalia in relation to the margin of the umbrella. One or other of these structures, or all, may be affected by this consistency factor of the jelly to the same or varying degree. A comparison of the Maldives, the North Atlantic, and the Bay of Bengal forms shows that the species may be distinguished from *A. aurita* chiefly by the consistency of the jelly, the deeper position of the rhopalia, and by the inconspicuous size of the ledge of the sensory pit.

Further examination of a large series from one or more localities may reveal, however, that some of these characters are unreliable for diagnostic purposes.

The specimens in the collection were found stranded by Col. Sewell in a rock pool close to a reef on the north side of Fuladu Island, Goifurfehendu atoll, Maldives (December 10, 1923).<sup>1</sup>

The distribution of the species seems to be fairly wide over the Indian and Atlantic Oceans.

## Order RHIZOSTOMAE.

### Family CASSIOPEIDAE.

#### Genus **Cassiopea** Peron and Lesueur.

1809. *Cassiopea*, Peron and Lesueur, *op. cit.*, p. 356.

1903. *Cassiopeja*, Maas, *Die Scyphomedusen der Siboga Expedition*, p. 38.

1910. *Cassiopea*, Mayer, *op. cit.*, p. 636.

1921. *Cassiopeia*, Stiasny, *Capita Zoologica*, I, p. 61.

Numerous species and varieties not readily distinguishable from one another have hitherto been described. To those who have the misfortune of studying medusae in the preserved condition, characters based on colour and on proportions of structures which are liable to contraction in preservatives are of doubtful diagnostic value. Descriptions or diagnoses of species from preserved material are equally difficult to interpret in fresh living material.

As far as I can make out there are only 2 species in the present collection, but of the identity of one I have considerable doubt on account of its rarity in the Indo-Pacific seas.

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<sup>1</sup> In 1926 while surveying the backwater in Vizagapatam I found a small medusa of this species in a small muddy tidal pool separated from the main backwater by a stretch of bog. As the specimen was partially decomposed it was not taken.

**Cassiopea (?) frondosa** (Pallas) Lamarck.

1910. *Cassiopea frondosa*, Mayer, *op. cit.*, p. 647, pls. 69, figs. 1-3, and 72.

The species has hitherto been recorded from the West Indies and Florida, while the present specimen, a small one undoubtedly young, is from Maskat at the head of the Arabian Sea. My identification is, however, based on the excellent figures given by Mayer and on his description. The bell is 12-16.5 in diameter, and the mouth-arms do not extend much beyond the umbrellar margin. The markings on the exumbrella are similar to those of the medusae figured by Mayer. The appendages on the mouth-arms are minute and opaque. On an olive-gray background, which is the colour of the specimen in alcohol, the markings on the exumbrella and on the appendages of the mouth-arms stand out as opaque white spots. The under-surface of the mouth-arms and the capitate ends of the mouth-frills are also opaque white. There are granular whitish speckles scattered all over the medusa in addition to the markings on the umbrella.

The specimen was dredged at a depth of 6 fathoms off Maskat on the coast of Arabia bordering the Gulf of Oman (H. J. Walton).

Individuals of this species grow to a large size, the bell often exceeding 100 mm. in diameter. The distribution of the species is probably restricted to the Atlantic Ocean, but if my identification of the present specimen is correct the range of the species must be much wider.

**Cassiopea andromeda** var. **maldivensis** Browne.

1905. *Cassiopea andromeda* var. *maldivensis* Browne, *op. cit.*, p. 962.

There are seven medusae in the collection from 'Indian seas'. The precise provenance of 5 out of the 7 medusae is not known.<sup>1</sup> They are presumably from seas along the Indian Coast. The remaining two are from Krusadai Island and Rameswaram on the Gulf of Manaar.

The range of variation in this small collection is striking. The Krusadai specimen (Dr. Hora, 1925) agrees with the original description of the variety. It has a well-defined circular band on the exumbrella, and a slightly raised dome in the centre with a slight depression. The breadth of the band is 10 mm. Except for the minute indentation opposite each of the rhopalia, the margin of the umbrella is entire, but it has a wavy outline, the crest of the wave corresponding to a lappet. The mouth-arms are long, and extend beyond the margin of the umbrella. They are somewhat laterally compressed, narrow at either end and broader in the middle. Curiously the arms are both dichotomously and pinnately branched, the dichotomous arm alternating with the pinnate one. This is not apparent at first, but a closer examination reveals the nature of branching. At the base of each principal and secondary branch of the arm there is an elongate flattened, leaf-shaped appendage. Usually ten appendages are clearly visible, but

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<sup>1</sup> On p. 346 of his Notes on the Biological work of the R. I. M. S. "Investigator" (*Journ. As. Soc. Bengal* (N. S.), IX, 1913) Col. Sewell refers to a few examples of *Cassiopea* sp. having been obtained in Fisher Bay, Tavoy I., Burma. Presumably these five specimens are from the Tavoy Coast.

many are, however, concealed from view amongst the branches of the arm.

In the medusa from the Rameswaram Coast (March, 1925) the exumbrella is without a circular band, the mouth-arms do not extend much beyond the bell-margin, and the mouth-arm appendages are inconspicuous. The appendage at the centre of the oral disc is well developed.

In the following table are given the measurements, etc. (in millimeters), of the various individuals :—

| —                                         | Krusa-dai. | Rames-waram.    | Unknown locality, Indian seas. |       |       |       |       |
|-------------------------------------------|------------|-----------------|--------------------------------|-------|-------|-------|-------|
|                                           |            |                 |                                |       |       |       |       |
| Diameter of bell                          | 145        | 110             | 65                             | 105   | 105   | 120   | 105   |
| Diameter of central depressed area.       | 110        | 70              | 50                             | 82    | 85    | 90    | 82    |
| Length of mouth-arm.                      | 90-100     | 45              | 25-40                          | 60-70 | 45    | 65    | 55-60 |
| Diameter of mouth-arm disc.               | 60         | 45-50           | 20                             | 50    | 47    | 47    | 45    |
| Number of rhopalia                        | 16         | 25              | 16                             | 16    | 14    | 15    | 16    |
| Number of velar lappets between rhopalia. | 3-4        | 1-4             | 4-5                            | 2-5   | 4-5   | 3-4   | 3-4   |
| Length of mouth-arm appendage.            | 20         | 30<br>(central) | 5                              | 30-35 | 15-24 | 20-25 | 25-35 |
| Breadth at base of mouth-arm appendage.   | 5          | 7               | 2                              | 8     | 4     | 5     | 7     |

Family CEPHEIDAE.

Genus **Netrostoma** Schultze.

1898. *Netrostoma*, Schultze, *Denkschr. Med. Naturwiss. Gessel. Jena*, VIII, p. 457, pl. 34, figs. 10-12a.

**Netrostoma typhlodendrium** Schultze.

1910. *Cephea typhlodendrium*, Mayer, *op. cit.*, p. 658.

Several specimens of this species are preserved in the collection. Some of them are undoubtedly young. The chief interest of the collection lies in the fact that a large number of our specimens was taken in estuaries of deltaic Bengal which are subject to constant tidal influences.

There are 4 small medusae from the Matlah estuary near Canning Town, Lower Bengal. The diameter of the bell is 50-70 mm., and the length of the mouth-arm 25-40 mm. The exumbrellar central dome seems to vary in size, and in the form and number of warts on it. There are a few warts not exceeding 20 in number. In one specimen they are scattered on a very much flattened dome. The rhopalar lappets are usually conical and pointed in shape, but narrower than the velar. There are 7 velar and 2 rhopalar lappets in each octant. The interrhopalar

radial canals are relatively short and do not exceed three in number. The distal ends of these canals are frequently branched and anastomosed so that a net-work is formed between two rhopalar canals. Short blind canals project into the squares and rectangles of this anastomosing net work. Though there is no ring canal the rhopalar and interrhopalar canals are connected centrifugally by the extension of anastomosis.

A fairly well-preserved individual and the largest in the collection is from the Gangetic delta in Lower Bengal. The diameter of the bell is 90 mm. and the length of the mouth-arm 60 mm. The velar lappets are 3 mm. long and 6 mm. broad, and have a somewhat crenulated margin. The rhopalar lappets are narrower than the velar, and spread outwards instead of being pendulous. The rhopalia are rather small and are placed in a deep niche. The sense-rod is flame-shaped and more or less pendulous.

There are also 2 specimens from the Mergui Archipelago (Mar. Surv. Sta. 569— $98^{\circ} 18' 40''$  E.,  $11^{\circ} 52' 10''$  N.). The diameter of the bell is 70 mm., and the length of the mouth-arms 40 mm. The central dome of the umbrella has ten large warts 5-10 mm. long and several smaller ones surrounding them. The marginal lappets are well-defined. There are 8 rhopalar and 24 interrhopalar canals. The exumbrellar surface round the central dome is furrowed, and reticulate in appearance. A few minute warts are also present on this part of the exumbrella. On the subumbrellar surface there is a furrow outside the mouth-arm disc along which the thinner outer portion of the umbrella is folded. The formation of the furrow has apparently no morphological significance as the flexure of a thin outer part of the umbrella against the thicker central dome is purely a mechanical process in the preserved specimen. There are no appendages on the mouth-arms, but the arm-disc bears several small elongate club-shaped appendages carrying a number of warts full of nematocysts. The gonads are mature, and protrude through the small rounded ostia.

These two medusae were taken on a muddy bottom at a depth of 5 fathoms in the month of December 1913. They were of a blue colour, and had white spots in the living condition.

The geographical range of the species seems to extend from the Malay Archipelago to the head of the Bay of Bengal. The species has presumably a preference for protected arms of the sea amongst Archipelagoes rather than for the open sea.

#### Family MASTIGIADIDAE.

#### Genus **Mastigias** L. Agassiz.

1910. *Mastigias*, Mayer, *op. cit.*, p. 677.

1921. *Mastigias*, Stiasny, *op. cit.*, p. 87.

Stiasny divides the known species of this genus into two groups, *e.g.*, (1) the *papua* group including those with less than ten interrhopalar anastomosing canals, and (2) the *ocellata* group including species with more than ten interrhopalar anastomosing canals. If the character on which this division is based is proved to be constant in a large number of individuals of the species known, it will then be convenient to erect

a new genus to receive the species belonging to the second group, as has been done in separating *Netrostoma* from *Cephea*.

***Mastigias ocellata* (Modeer).**

1791. *Medusa ocellata*, Modeer, *Nova Acta Phys. Med. Nat. Curio.*, App. VIII, p. 27.

1918. *Mastigias ocellata*, Mayer, *Bull. U. S. Nat. Mus.*, I, p. 220.

Four well-preserved medusae of this species are in the collection. Three of them are very young and do not exceed 15 mm. in diameter. They are rusty brown in colour, but the velar portion of the exumbrella is a deeper shade of brown. There are elongate, elliptical or circular elevated warts scattered on the exumbrella, the more prominent ones occupying the central region of the umbrella. In addition to the spots there are fine but distinct granules on the whole of the exumbrella. The eye-spots, which give the species its name, are indistinct on the exumbrella. The subumbrella and the arms are minutely spotted. Thin rod-like filaments with minute warts at their free end are present on the central part of the mouth-arm disc, one at the base of each mouth-arm where the mouth-frills commence. From the centre of the subumbrella hangs a pointed or knob-like filament. These filaments are about half as long as the mouth-arm. Similar but shorter filaments are found scattered amongst the frills of the arms close to the mouth-openings. They gradually diminish in size towards the distal end of each arm until they are reduced to short-stalked, knob-like processes. The terminal mouth-arm process is a relatively large, fig-shaped knob with a short stalk, and a number of scattered, large, dark-brown warts. There are 8 radial canals reaching the rhopalia. Each perradial canal is short and stout, and without branches on either side of it centripetal to the ring canal. There are, however, a few minute projections in the course of the canal which seem to represent incipient branches. The interrarial rhopalar canals are longer, and are connected with the ring-canal centrifugally and on its sides with short canals, usually 14-17 in number, arising direct from the stomach. Each rhopalar canal corresponds to the rhopalium of that radius, and divides into three branches at the base of the rhopalar lappets, the median branch, short, and extending to the base of the sense-club, and the lateral branches ending blindly into the rhopalar lappets. The rhopalium is protected above by a pale membranous hood between the rhopalar lappets. There are 8 velar lappets in each octant. The circular muscles are interrupted only along the perradial canals inside the ring canal. The subgenital ostia are roughly dumb-bell shaped in outline, and are a little less than twice as broad as the interostial pillars at their base.

*Measurements in millimeters of the largest specimen.*

|                               |       |                                 |     |
|-------------------------------|-------|---------------------------------|-----|
| Diameter of bell              | 45    | Diameter of mouth-arm disc in   |     |
| Length of mouth-arm           | 20    | the widest part                 | 26  |
| Length of winged portion of   |       | Height of velar lappets         | 3.4 |
| mouth-arm                     | 15-17 | Breadth of velar lappets        | 2   |
| Breadth of wing of mouth-arm  | 5     | Length of terminal appendage on |     |
| Breadth of ostium             | 13    | mouth-arm                       | 3   |
| Breadth of interostial pillar | 6.8   |                                 |     |

Locality : North of Maingy I. (Mar. Surv. Sta. 521—98° 16' E., 12° 35' 15" N.), Mergui Archipelago. The individuals were collected with the help of a small hand-net from the gangway of the R. I. M. S. " Investigator " (10th March, 1913). A note in the Mar. Surv. Station Book refers to certain fish having accompanied them. The fish are unfortunately not preserved with the medusae. In the same station another species of medusa was also taken, and it is not certain which of the two species of medusae was accompanied by the fish referred to.

Two much contracted young medusae without terminal clubs on the arms from Mergui Archipelago (Mar. Surv. Sta. 579—11° 53' 04" N., 98° 18' 17" E.), and 3 small examples from Celerity Passage (Mar. Surv. Sta. 580) probably belong to this species.

### **Mastigias albipunctata** Stiasny.

1921. *Mastigias albipunctata*, Stiasny, *op. cit.*, p. 93, pl. i, fig. 5; pl. iii, figs. 24, 25 a, b, 26; pl. v, fig. 46.

Seven well-preserved examples from Mergui Archipelago (Mar. Surv. Sta. 521) agree closely with the description of this species. All but one are young. The general colour of the medusae is brown, but there is a shade of orange on the marginal part of the umbrella, on the mouth-arm disc and on the arms. There are 17-20 interrhopalar canals arising from the stomach and anastomosing with one another. The interrarial canals are connected with this anastomosis by short branches. The perrarial canals are, however, without these connections inside the ring-canal.

In the young medusae the circular muscles are not interrupted, but in the adult they are interrupted along the radial canals between the point of their origin from the stomach up to a little distance below or above their junction with the ring-canal. The interrupted area at this junction is usually broad and diamond-shaped. The muscles on either side of the ring-canal tend to form an elliptical figure between two rhopalar canals.

A short cylindrical filament or a long one with a terminal club-shaped or rounded thickening is present at the outer end of each arm. The filament and the terminal portion are covered with numerous warts consisting of nematocysts. A long filament covered with warts is present at the centre of the mouth-arm disc which bears no other filaments or clubs. The extremity of the mouth-arm has a long three-winged filament with a club-shaped knob which carries a few stalked or ridge-like warts along its edges. There is a continuation of the radial canal into the filament where it divides into branches which anastomose. Amongst the mouth-frills on the arms there are small clubs with a short stalk and a conical terminal knob. The extremity of each knob is thin and filamentous and often devoid of warts, while the knob itself is closely studded with warts containing nematocysts.

The largest example in the collection has the following measurements in millimeters :—

|                                                          |      |
|----------------------------------------------------------|------|
| Diameter of the bell                                     | 75   |
| Length of the mouth-arm                                  | 30   |
| Length of distal winged part of the mouth-arm            | 25   |
| Breadth of the mouth-arm wing                            | 15   |
| Length of the terminal filament of mouth-arm             | 80   |
| Breadth of ostium at the widest point                    | 20   |
| Breadth at narrow part of the base of interostial pillar | 8-10 |
| Diameter of mouth-arm disc                               | 35   |
| Height of velar lappets (8 in each octant)               | 6-7  |
| Breadth of velar lappets at the base                     | 4    |

The diameter of the bell of younger medusae ranges from 10-25 mm.

### **Mastigias** sp.

A badly preserved example from Mergui Archipelago (Mar. Surv. Sta. 590—11° 31' 45" N., 98° 34' 30" E.) is probably closely related to *M. albipunctata*. As all the characters of the species could not be made out in the specimen it is impossible to be certain regarding its identity. The bell is 60 mm. in diameter, and the mouth-arm 50 mm. long. The terminal appendages of the mouth-arm are filamentous, and have anastomosing branches of the radial canal. They are, however, mostly damaged.

### **Mastigias papua** var. **sibogae** Maas.

1903. *Mastigias papua* var. *sibogae*, Maas, *Scyphomedusen der Siboga Exped.*, Monogr. 11, p. 66, pl. vi, figs. 54-57; pl. vii, figs. 58, 59, 61, 64; pl. viii, figs. 75-77; pl. ix, figs. 84-85; pl. xii, fig. 110.

A small medusa from the Celerity Passage (Mar. Surv. Sta. 580) belongs to the *papua* group. The interrhopal canal does not exceed ten in number in an octant. There are 9 velar lappets between each pair of rhopalia. The terminal appendage of the mouth-arm is very small, but its resemblance in form to Maas' figure of this appendage is very close. There are no markings on the exumbrella.

### Genus **Versura** Haeckel.

1921. *Versura*, Stiasny, *op. cit.*, p. 102.

Although I have in the main adopted in these notes Stiasny's scheme of classification for the Rhizostomes, I am not fully convinced that the necessity has yet arisen for erecting a separate family to receive this genus, and would therefore retain *Versura* in the Mastigiadidae.<sup>1</sup>

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<sup>1</sup> Uchida (*Journ. Fac. Sci. Imp. Univ. Tokyo*, I, p. 89 (1926)) has suggested the division of Mastigiadidae into three subfamilies, one of which includes the genus *Versura*. There is much to be said in favour of this view.

Stiasny has ably discussed the synonymy of the genus, and has designated *Versura anadyomene* (Maas) as the genotype, being the first fully described species. There is, I believe, sufficient justification for adopting this course, as *V. palmata* Haeckel which Mayer accepted as the genotype is imperfectly known with regard to the gastrovascular system, which is now generally accepted to be of great importance in generic differentiation.

***Versura anadyomene* (Maas).**

1903. *Crossostoma anadyomene*, Maas, *op. cit.*, p. 56, pl. vii, figs. 65-68.

1921. *Versura anadyomene*, Stiasny, *op. cit.*, p. 106.

Several individuals collected from various parts of the Bay of Bengal are present in the collection. Owing to preservation in alcohol many of them are stiff and brittle. The collection includes several immature examples also. There is a wide range in size of the bell, the largest being 225 mm. and the smallest 30 mm. in diameter across the bell. In the table below the various measurements of the medusae are given.

The umbrella is more or less flat, but somewhat arched near the central part giving it a resemblance to a watch-glass. The surface of the exumbrella is irregularly furrowed, and has little or no trace of granulation in the larger individuals. There are usually 8 velar lappets between two rhopalia, but small prominences on the margin between the lappets give the impression that the lappets are more numerous. The rhopalar lappets are elongately conical, but shorter and narrower than the velar. Both the velar and the rhopalar lappets bear a prolongation of the anastomosing net-work of canals outside the ring-canal.

The circular muscles are strongly developed and are more or less uninterrupted along the radial canals. They form elliptical areas between two radial canals with the ring-canal as their axis. In the inter-rhopalar area the circular muscles are arched with their convex side turned centrifugally.

There is a wide lacuna at the junction of the radial and ring-canals and its walls are so delicate that the lacuna is often in a collapsed condition. This junction of the radial and ring-canals is nearly always obscured by the circular muscles overlying it.

The subgenital ostia are wide, reniform, and about  $1\frac{1}{2}$  times as broad as the interostial pillars which form the support of the mouth-arms. The mouth-arms extend slightly beyond the margin of the umbrella, the maximum breadth of the wings of the mouth-arm is nearly half the length of the mouth-arm excluding the wingless basal part. There are a few short club-like appendages 3-5 mm. long close to the frilled mouths. Numerous long filaments with a knob-like extremity are present on the mouth-arm disc and on the base of the mouth-arms. If not damaged in preservation they give a distinctive appearance to the full-grown individual.

*Measurements in millimeters.*

| Locality.                                                                    | Diameter of umbrella. | Maximum diameter of mouth-arm disc. | Length of winged part of mouth-arm. | Maximum breadth of wing of mouth arm. |
|------------------------------------------------------------------------------|-----------------------|-------------------------------------|-------------------------------------|---------------------------------------|
| Off Sandheads, mouth of the Ganges (Capt. J. H. Row), Feb., 1892 (damaged).  | 110                   | ..                                  | 75                                  | ..                                    |
| Mar. Surv. Sta. 569 (11° 52' 10" N., 98° 18' 40" E., Dec., 1913).            | 160                   | 90                                  | 50                                  | 20-25                                 |
| Mar. Surv. Sta. 580—Various places in Celerity Passage (Jan., 1914).         | 185                   | 90                                  | 100-130                             | 45-65                                 |
| Ditto ditto                                                                  | 145                   | 90                                  | 55-65                               | 25-30                                 |
| Ditto ditto                                                                  | 220                   | 110                                 | 65-85                               | 50                                    |
| Ditto ditto                                                                  | 225                   | 120                                 | 75-90                               | 40-45                                 |
| Mar. Surv. Sta. 565 (11° 57' 30" N., 98° 19' 00" E., Nov., 1913).            | 100                   | 42                                  | 42-50                               |                                       |
| Mar. Surv. Sta. 579 (11° 53' 04" N., 98° 18' 17" E., Jan., 1914) (Juvenile). | 30-70                 | ..                                  |                                     |                                       |

In one of the individuals from Sta. 580 young stomatopods were found firmly sticking to the frilled mouths. In another specimen from Sta. 569 a small cuttle-fish, probably a *Loligo*, was found amongst the mouth-arms.

All but one of the medusae in the collection are from the Mergui Archipelago. In the Bay of Bengal its distribution is probably restricted to coastal waters.

Genus **Thysanostoma** L. Agassiz.

1910. *Thysanostoma*, Mayer, *op. cit.*, p. 691.

1921. *Thysanostoma*, Stiasny, *op. cit.*, p. 111.

**Thysanostoma thysanura** Haeckel.

1918. *Thysanostoma thysanura*, Mayer, *Bull. U. S. Nat. Mus.*, I (Bulletin 100), p. 227.

A mutilated example of this species is in the collection. The mouth-arms are the only structures which are in a fairly good condition. A portion of the margin of the umbrella with two rhopalia, and the circular muscles are more or less intact. The approximate diameter of the umbrella is 70 mm., and the average length of the mouth-arms 35 mm. The exumbrellar surface is granular, and in some parts of the exumbrella the granules are enlarged into short, low ridges. Clusters of short, thin filaments carrying nematocysts are present on the mouth-arm disc. A few of them near the base of the mouth-arms carry terminal knobs.

*Locality*.—Puri, Orissa coast.

FAMILY LYCHNORHIZIDAE.<sup>1</sup>Genus **Acromitus** Light.

1914. *Acromitus*, Light, *Philip. Journ. Sci.*, IX, p. 210.

**Acromitus flagellatus** (Haeckel).

1921. *Acromitus flagellatus*, Stiasny, *op. cit.*, p. 131, pl. ii, fig. 10 ; pl. iv, fig. 30 ; pl. v, fig. 40.

1930. *Acromitus flagellatus*, Menon., *op. cit.*, p. 19, pl. ii, figs. 9a-c.

This species appears to be one of the commonest along the coasts of India and Burma ; and our collection contains several specimens some of which are, however, badly preserved.

Doarakar, Sunderban, L. Bengal (Dr. B. Prashad, March, 1918)—3 large and 5 small specimens, the bell-diameter ranging from 110-140 mm. in the larger ones. The exumbrella in one of them has peculiar, polygonal, cushion-shaped swellings, which are large in the centre and small in the marginal region. In one specimen the terminal mouth-arm filaments are absent except on one arm where they are quite rudimentary. The filaments on the rest of the mouth-arm are not conspicuous. A few, however, can be detected on the upper part of the mouth-arm with the help of a magnifying glass. The mouth-arms are unequal, relatively stout and longer than the radius of the umbrella. The subgenital papillae are very well developed. There are small circular or oblong yellowish brown spots on the exumbrella, somewhat more numerous in the central part than on the marginal, and minute granules on the exumbrella external to the ring-canal. The spots are generally depressed in the centre and pit-like. This specimen is presumably abnormal.

Backwaters of Cochin State, S. India (Dr. H. S. Rao, December, 1927)—8 specimens. The species was found everywhere in the backwater up to 5 miles south of British Cochin, and ten miles north of Ernakulam. In using our bottom nets for collecting various other organisms it was found extremely difficult to avoid filling them with scores of these medusae while hauling up the nets. They were particularly abundant in the northern part of the backwater, at or near the surface of the water in the early part of the day, *i.e.*, not later than 9 o'clock. In the southern part of the backwater on the borders of Travancore State the medusae are comparatively rare. This is presumably due to the fact that in this part of the backwater the influence of the tides from the Arabian Sea is much less, and to the fact that the salinity is considerably lower as a result of the flow of several freshwater streams into the backwater.

In creeks and channels connected directly with the backwater young medusae were occasionally found. In two individuals obtained in January 1928 the granulation on the exumbrella is quite marked. There are three branches on each side of the rhopalar canal arising from the centripetal side of the ring-canal. The ostia are broad and open, but the subgenital papillae are absent. The rhopalar and velar lappets are well developed. The mouth-arms are pyramidal, and there are

<sup>1</sup> This family name is used in the sense of Uchida (*loc. cit.*, p. 90) who merges Catostylidae and Lobonemidae in it giving them the rank of subfamilies.

only a few filaments on them. The terminal filament on the mouth-arm is well developed and longer than the mouth-arm.

Matlah River, Canning Town, L. Bengal (Dr. Southwell, Dec., 1918)—2 examples.

Fisher Bay, Port Owen, Tavoy I., Burma (Mar. Surv. Sta. 414, 1911)—2 examples.

Puri, Orissa Coast (1912)—one specimen. A few Clupeid fish are found entangled amongst the mouth-arms.

Tuticorin, S. India (Dr. H. S. Rao, Feb., 1926)—one individual, rather damaged.

An example from Celerity Passage (Mar. Surv. Sta. 580, 1914) is very much contracted and broken, and it is impossible to be certain of its specific identity. It probably belongs to this species.

*Measurements in millimeters.*

| —                                    | Diameter of bell. | Length of mouth-arm. | Diameter of mouth-arm disc. |
|--------------------------------------|-------------------|----------------------|-----------------------------|
| Cochin Backwater (abnormal specimen) | 135               | 55-95                | 73                          |
| Cochin Backwater, normal examples    | 140-145           | 110-110              | 75                          |
| Fisher Bay, Tavoy I.                 | 90                | 50-60                | 52                          |
| Puri                                 | 75                | 40-45                | 40                          |

***Acromitus rabanchatu* Annandale.**

1915. *Acromitus rabanchatu*, Annandale, *Mem. Ind. Mus.*, V, p. 96, pl. vi, figs. 4-6, pl. viii.

Our collection contains a large series which Annandale reported on in his account of the coelenterates of the Chilka Lake. From his description of the species it appears that it is much more closely allied to *A. flagellatus* than to *A. maculosus* from the Philippine Seas. *A. rabanchatu* differs from *A. flagellatus* chiefly in the size and form of the rhopalia, and of the marginal lappets. It is probable that this species is only a form of *A. flagellatus*.

The distribution of the species is probably restricted to the Chilka Lake and the shallow coasts along Ganjam and Orissa. The records from the coast of Tenasserim and the Ennur backwater pertain to *A. flagellatus* rather than to the present species.

**Genus *Crambionella* Stiasny.**

1921. *Crambionella*, Stiasny, *op. cit.*, p. 129.

This genus was erected by Stiasny to include two previously described species, *e.g.*, *Crambessa stuhlmanni* Chun<sup>1</sup> from the mouth of the Quilimane river in East Africa, and *Mastigias orsini* Vanhöffen<sup>2</sup> from Assab

<sup>1</sup> *Mitteil. Naturhist. Mus. Hamburg*, XIII, p. 10, pl. i and fig. 1 (1896).

<sup>2</sup> *Bibliotheca Zool.*, I, p. 34, pl. iv, figs. 2-4 (1888).

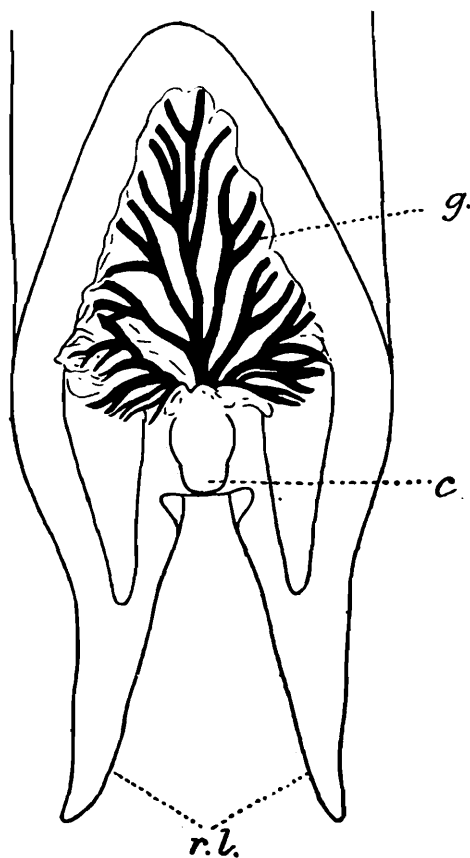
on the Red Sea Coast. One of the chief characteristics of this genus is the pyramidal, three-winged mouth-arm with a terminal appendage, which is the naked continuation of the mouth-arm into which an extension of the stomach forms a small network of anastomosing canals. The other important but negative character is the absence of whip-like filaments on the mouth-arm. In the new species described below, which undoubtedly belongs to this genus, the mouth-arm has a long tapering terminal appendage instead of a short rounded one, and a number of small foliaceous appendages amongst the frilled mouths. Stiasny's definition of the genus in the work cited is more or less complete, but with the inclusion of this species in it slight modifications are necessary. The following may be added to the diagnosis of the genus given by Stiasny :

Rhizostomae with three-winged stout, pyramidal mouth-arms terminating in a long or short appendage, which is the naked continuation of the mouth-arm, usually with button-shaped or foliaceous appendages among the frilled mouths and without whip-like filaments.

***Crambionella annandalei*<sup>1</sup> sp. nov.**

1930. ?*Crambionella stuhlmanni*, Menon., *Bull. Govt. Mus. Madras* (N. S.), III, p. 18, pl. iii, figs. 14 a, c, e.

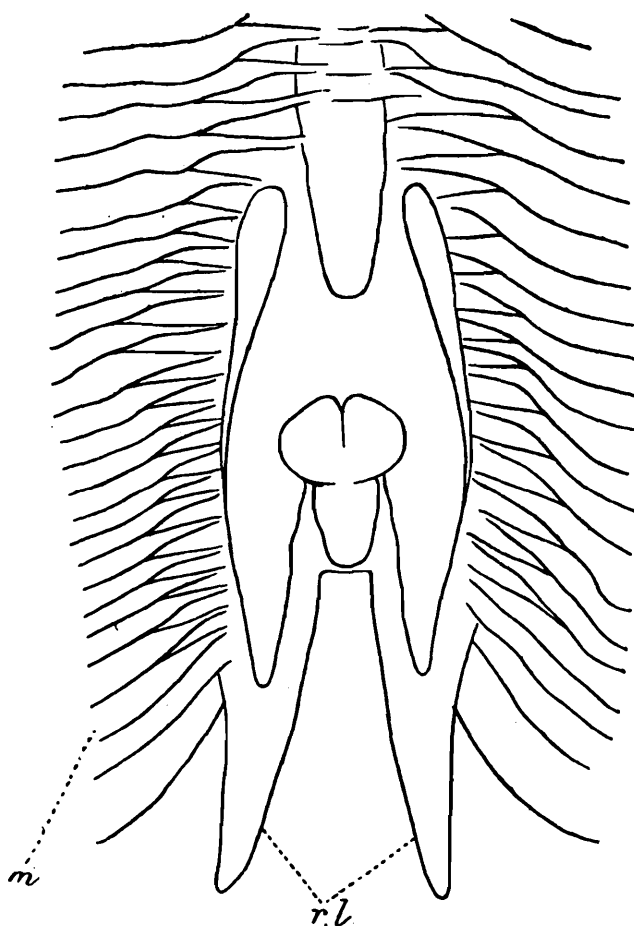
The bell is hemispherical or dome-shaped, with a diameter of 100-160 mm. Its margin is more or less incurved. The surface of the exumbrella is finely granular, and has minute short furrows and ridges arranged



TEXT-FIG. 4.—*Crambionella annandalei*. Exumbrellar view of rhopalium. c. Sense-club ; g. radiating grooves of the rhopalium ; r.l. rhopalar lappets.  $\times 16$ .

<sup>1</sup> A small collection of individuals of this species from Puri which the late Dr. Annandale studied some years ago had been labelled by him as an undescribed species of *Pseudorhiza*, but no description was published. I have great pleasure in associating his name with this species.

radially. The general appearance of the exumbrellar surface is comparable to a distant surface view of a meandrine coral. The granules are somewhat unevenly distributed, more being found near the margin. The marginal part of the umbrella is comparatively thin and forms a distinct region with its numerous short longitudinal or radially directed triangular ridges on the entire circumference of the umbrella. The ridges usually correspond in number with the velar lappets. Each ridge carries at its apex a row of small but prominent, mound-like or pointed conical tubercles, the largest of them being in the middle of the ridge and the smaller ones at the ends. The tubercles vary in number, there being usually 14-16 of them on each ridge. The rhopalar ridges, *i.e.*, those lying next to the rhopalium generally converge above it, and sometimes unite. Abnormally, any two or more ridges besides the rhopalar may converge and unite. There are usually no tubercles above the exumbrellar sense-pit, but rarely there are three or four of them in a row. There are 8 rhopalia on the margin of the umbrella in moderately deep notches. Each rhopalium has a short stout stalk with a spherical mass at its free end enclosed in a membrane, and containing a number of elliptical or lens-shaped refringent concretions. The rhopalar lappets are elongate and narrow and diverge near their distal ends. They do

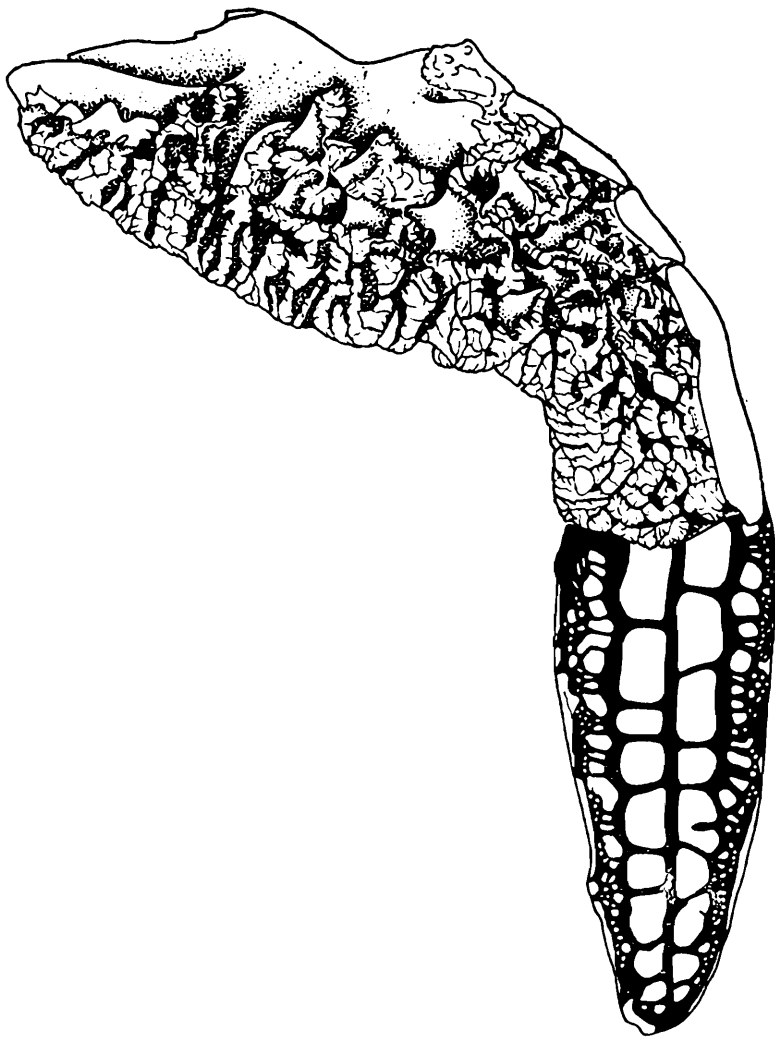


TEXT-FIG. 5.—*Crambionella annandalei*. Subumbrellar view of rhopalium. *m.* muscle strands of the subumbrella; *r.l.* rhopalar lappets.  $\times 16$ .

not extend beyond the velar lappets. There are, as a rule, 14 velar lappets in each octant, relatively broad and triangular. The exumbrellar sense-pit is elongate, triangular, and radially furrowed. The distal ends

of the furrows are branched. The area immediately around the sense-pit is flattened, and there is a smooth ridge on the sides and on the inner margin of the pit.

The mouth-arms are well developed, stout and long, and arise in pairs from the arm disc on the subumbrella. Each mouth-arm may be divided into three parts, *e.g.*, (1) the very short basal shaft which is more or less cylindrical, (2) the trifoliate winged middle part bearing the mouth-frills which are arranged in transverse pleats on its three sides, and the foliaceous appendages, and (3) the long stout, tapering pyramidal naked terminal club. The last is simply a continuation of the mouth-arm without mouth-frills or appendages. In a cross-section of the terminal club which will be triangular the outer or centrifugal side forms the base

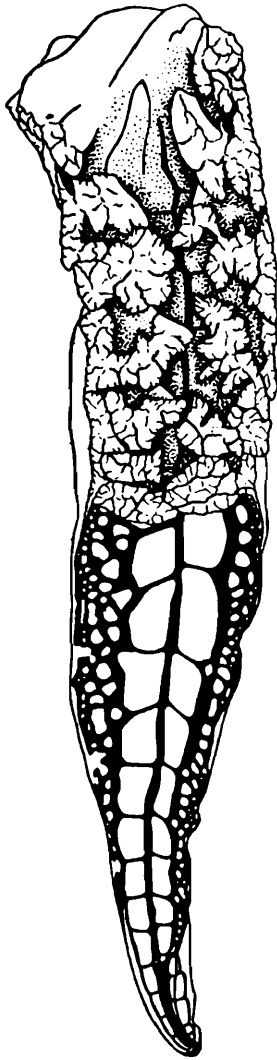


TEXT-FIG. 6.—*Crambionella annandalei*. Distal part of mouth-arm of a full-grown specimen (Holotype) showing the distribution of the canals in the terminal appendage.  $\times \frac{5}{6}$ .

of the triangle, and the inner or the axial the apex. The terminal club is about half as long as the entire mouth-arm, but its length on the centrifugal side is greater than on its centripetal. This feature is clearly seen in the figure at the top on pl. III.

The middle part of the mouth-arm is a little shorter than the terminal appendage. The mouth-frills are found in regular rows, though in the fully adult medusa they are somewhat complicatedly arranged, presumably as a result of the displacement of the rows of mouth-frills due to growth. By careful manipulation, however, the disposition of the struc-

tures on the mouth-arm can be made out. The mouth-frills bear at their free edge a number of minute filaments with club-shaped extremities which carry small rounded nematocysts. Scattered amongst the frills and near the small mouths are a few flattened, usually orbicular, appendages. They are conspicuous in mature examples on all sides of the middle part of the mouth-arm, but are generally more numerous on the centripetal side. In some individuals, slightly smaller in size, they are minute and escape notice unless the mouth-frills are carefully



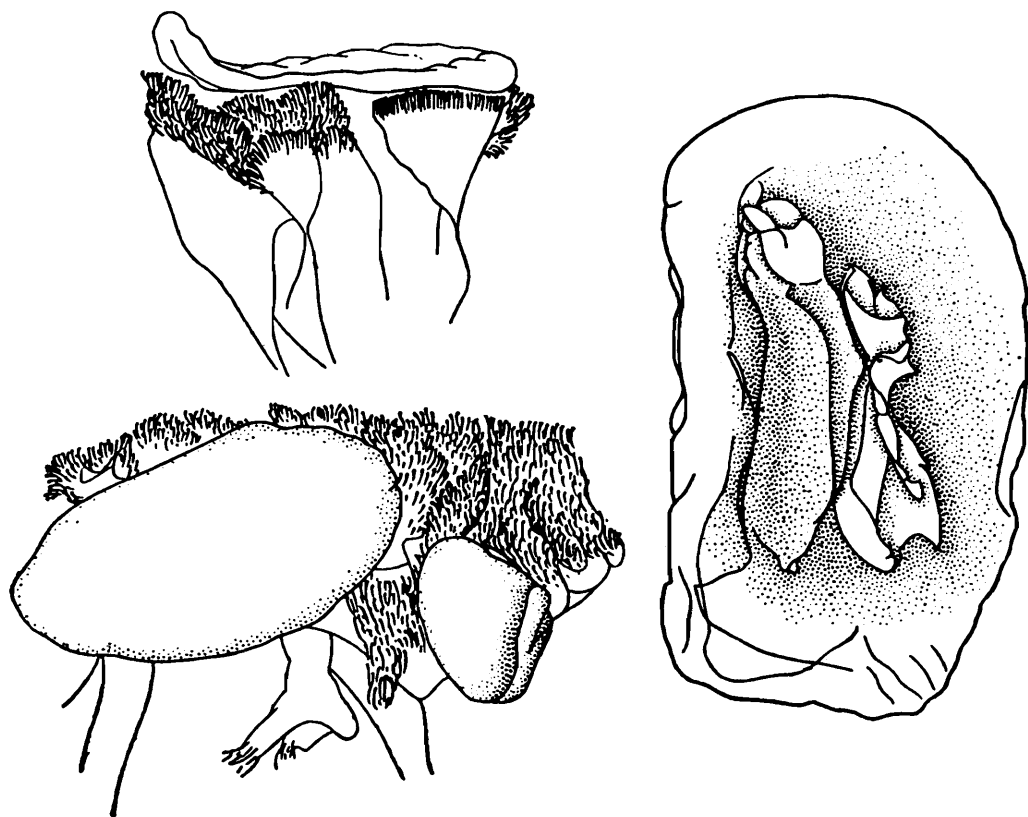
TEXT-FIG. 7.—*Crambionella annandalei*. Distal part of mouth-arm of a young medusa from the Bay of Bengal showing the distribution of the canals in the terminal appendage.  $\times 1\frac{1}{2}$ .

dissected out. They are usually semi-circular or orbicular in outline, but a few are elongate and leaf-like. They are full of small rounded or oval nematocysts, fringed along their margin by a row of elongate, relatively large spindle-shaped nematocysts which stand at right angles to the outline of the appendage.

The mouth-arm disc is roughly octagonal, each side being sinuous. Its diameter is about half of that of the bell. There are four crescent-shaped genital ostia the edge of which is somewhat thick and fleshy. When the ostium is contracted the hemispherical ridge-like inner or centripetal side fits exactly like a plug into the opening of the ostium. The interostial pillars are much broader than the genital ostia. On the centrifugal face of each pillar there is a triangular depressed area

nearly as large as or slightly larger than the ostium. The subgenital cavity is deep and dome-shaped. The centre of the mouth-arm disc is cross-shaped.

The muscular system is well developed. The ring-muscle area on the subumbrella is extensive, and divisible into two distinct regions, an outer and an inner clearly indicated by a groove along the ring-canal. The outer is wide and has well-defined curtain-like muscles, each consisting of a fold of muscle doubled on itself. The inner is narrow and its muscles are comparatively less conspicuous. The muscles are interrupted slightly along the rhopalar canals, and in the larger individuals along part of the length of the interrhopalar canals also.



TEXT-FIG. 8.—*Crambionella annandalei*. Foliaceous appendages from three different points on the mouth-arm of the Holotype viewed from the sides in the top left figure, from above in the figure below, and from below in the figure on the right. The frilled appendages surrounding the foliaceous ones have been removed in the figure on the right, and only partly in the figures on the left.  $\times 10$ .

There are 16 radial canals, 8 rhopalar extending to the margin of the umbrella, 8 interrhopalar ending in the ring-canal. Internal to the ring-canal and arising from it there is a network of anastomosing canals extending over less than half the area between two radial canals. The narrow-meshed network of anastomosing canals outside the ring-canal consists of a number of narrow radial canals arising from the ring-canal with still narrower transverse connections between them. It extends up to the base of the velar lappets. The rhopalar lappets have a pair of short blindly ending extensions of the rhopalar canal. Eight canals branch off from the central gastric cavity, each extending down the middle of the mouth-arms. In the terminal naked club the axial canal gives off a number of narrow transverse canals, usually 8 or 9, rarely 10-16. Their peripheral ends near each corner of the club are joined together by a sinuous longitudinal canal extending to the extremity

of the club. External to the longitudinal canal there is a network of canals formed by the short branches from the longitudinal. The terminal club is so transparent that the disposition of the canals and the network in it can be easily studied. The photographs of the holotype (pl. III) show these features well.

The colour of the medusa in the living state is not recorded ; in the preserved condition it is a pale pink or cream.

*Holotype*.—P.  $\frac{492}{1}$  Zool. Surv. Ind. (*Ind. Mus.*).

The holotype was collected in December, 1923 (Drs. Annandale and Prashad) in the Andaman Sea near Port Blair. It is the largest of the individuals of the species in the collection. Several medusae from various parts of the Bay of Bengal not far from the coasts of India and Burma are present in the collection.

*Measurements in millimeters.*

| Locality.                                                            | Diameter of bell. | Length of m. arm from its base to tip of terminal club. | Length of terminal club on its longest side. | Length of basal shaft of m. arm. | Breadth of umbrellar margin bearing tubercles. | Number of medusae and remarks.                      |
|----------------------------------------------------------------------|-------------------|---------------------------------------------------------|----------------------------------------------|----------------------------------|------------------------------------------------|-----------------------------------------------------|
| Andaman I. (Drs. Annandale and Prashad). December, 1923. Holotype.   | 170               | 140                                                     | 83                                           | 20                               | 35                                             | One.                                                |
| Akyab Harbour (Major R. W. G. Hingston), October, 1925.              | 160               | 100—125                                                 | 45—78                                        | 20—25                            | 30                                             | Do.                                                 |
| Off Hamji Basin (Hinzé)                                              | 43                | 26                                                      | 15                                           | ..                               | ..                                             | Do.                                                 |
| Puri, Orissa Coast (Dr. Annandale and Captain Lloyd), January, 1908. | 45                | 30                                                      | 10                                           | ..                               | ..                                             | One small and 3 large—not in good condition.        |
| Puri, February-March, 1908.                                          | 85—120            | 70—145                                                  | ..                                           | ..                               | ..                                             | Two. 14-18 velar lappets. Rhopalia not equidistant. |
| Puri Beach, February, 1909.                                          | 60—80             | ..                                                      | ..                                           | ..                               | ..                                             | Four.                                               |
| Vizagapatam Backwater (Dr. S. W. Kemp), April, 1910.                 | 65                | 50—72                                                   | 50                                           | ..                               | ..                                             | One.                                                |
| Madras (Prof. J. J. Asana), April, 1925.                             | 55                | 52                                                      | 24                                           | ..                               | ..                                             | Six—immature.                                       |

This species is closely allied to the other two species included in the genus, but its relationship to *Crambionella stuhlmanni* (Chun) is much closer in several features, particularly in the form of the umbrella, in the occurrence of pyramidal ridges and of tubercles on the marginal part of the umbrella, and in the position of the rhopalia. It, however, differs from that species in the great length of the terminal club and in its tapering form, and in having small foliaceous appendages amongst the mouth-arm frills. The “ungestielte Gallertknöpfe” of *C. orsini* (Vanhöffen) probably correspond to the appendages described in the present species, but unfortunately they are not figured by Vanhöffen.

Genus **Lobonema** Mayer.1910. *Lobonema*, Mayer, *op. cit.*, p. 688.1914. *Lobonema*, Light, *op. cit.*, p. 216.

Although Light described a new species from Palawan, Philippines, differing in certain respects from Mayer's genotype, *L. smithii* from Manila Bay, Philippines, he seems to be now more or less convinced that the two species are identical.<sup>1</sup>

**Lobonema smithii** Mayer.1910. *Lobonema smithii*, Mayer, *op. cit.*, p. 689.1914. *Lobonema mayeri*, Light, *op. cit.*, p. 217.1921. *Lobonema mayeri*, *Lobonema smithii*, Light, *Philip. Journ. Sci.*, XVIII, pp. 43-44.

A more or less well preserved individual from Celerity Passage (Mar. Surv. Sta. 580, 1914) belongs to this species. The diameter of the bell excluding the marginal lappets is 145 mm., and that of the mouth-arm disc from one interostial pillar to the one opposite at 180° is 95 mm. The mouth-arm is 85 mm. long, and bears a number of thin whip-like filaments. The velar lappets are about 25 mm. long. The subgenital ostia are only two-thirds as broad as the base of the interostial pillar. There are 14 rhopalia on the margin of the bell. Light described in the Philippine medusae a slit-like false ostium on the interostial pillar, and in one individual a large cone-shaped papilla on the upper margin of the false ostium. Both are absent in the present specimen. The interostial pillar on the other hand is supported by firm tissue at the sides of its base, and the enclosed area between the bands of tissue is membranous and transparent. The ring muscles are well developed on the subumbrella and are not completely interrupted along the rhopalar canals.

This specimen agrees in essentials with the original description of the Palawan specimens given by Light, but differs in that the circular muscles are not completely interrupted along the rhopalar radii, and in lacking the false ostia. These differences are presumably due to variability which is a common feature in most species of Scyphomedusae.

Mayer's description was based on three imperfect specimens, probably abnormal.<sup>2</sup> The fact that Light examined several specimens from Manila Bay, the type-locality, and found not one of them agreeing with Mayer's description of the species lends support to this view.

Genus **Lobonemoides** Light.1914. *Lobonemoides*, Light, *op. cit.*, p. 222.

In erecting this genus Light remarked that the medusae representing his genotype were very puzzling to place systematically. In the present collection there is a single medusa from the Bay of Bengal which I am

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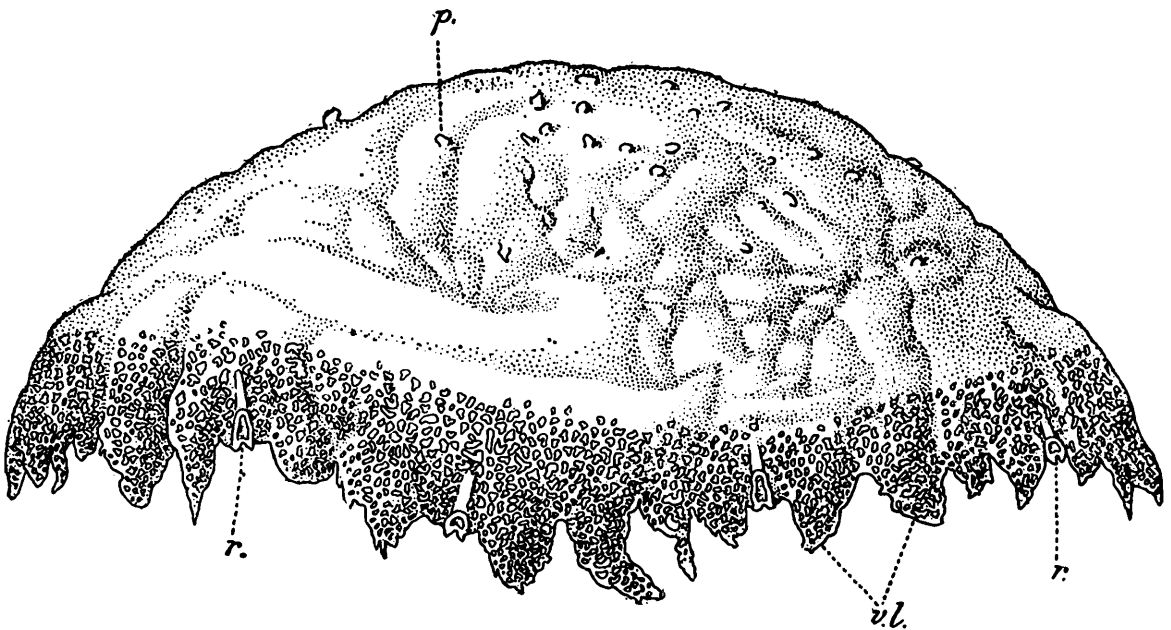
<sup>1</sup> Light, *Philip. Journ. Sci.*, XVIII, p. 44 (1921).

<sup>2</sup> The description of the species is admitted by Mayer to be partial, being based on a 'perfect specimen' with 'a quadrant of its disk and all of its mouth-arms' preserved, and on 'two other imperfect specimens'. The exact significance of these terms 'perfect and imperfect' is not quite clear.

unable to refer to any known species in the sub-family Loboneminae. It is in some respects intermediate between *Lobonema* and *Lobonemoides*, and may prove to be the type of a new genus, but in view of the fact that the specimen is unique, and slightly damaged in places I refrain from erecting a new genus, but describe it as a new species of *Lobonemoides* with the genotype of which it seems to have certain affinities.

***Lobonemoides sewelli*,<sup>1</sup> sp. nov.**

In outline the bell of the medusa is less than a hemisphere, but is not very flat. Its diameter is about 260 mm., and its consistency somewhat firm except in the marginal region which is limp from the ring-canal outwards. The central part of the umbrella overlying the mouth-arm disc is 10 mm. thick, and the marginal region immediately inside the ring canal 12 mm. thick. The marginal region, outside the ring-canal, is thin, about 35 mm. wide and 3 mm. thick. On the central part of the exumbrellar surface there are a few scattered papillae, 5 mm. long and 2 mm. broad at their base. There are fleshy tongue-shaped thickenings of the exumbrella at the base of the velar lappets.



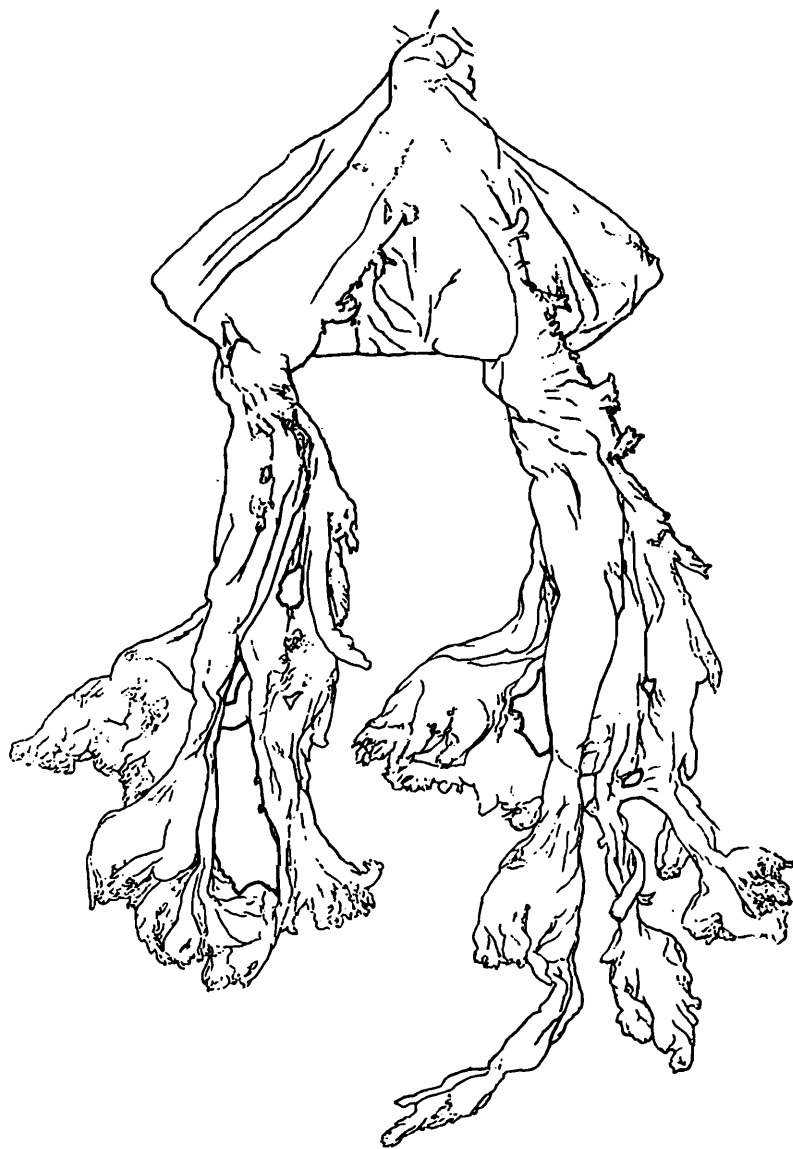
TEXT-FIG. 9.—*Lobonemoides sewelli*. Side-view of exumbrella. *p.* exumbrellar processes; *r.* rhopalia; *v.l.* velar lappets.  $\times \frac{2}{3}$ .

There are 16 rhopalia, 3 in each quadrant and opposite the interostial pillar, and one opposite each of the subgenital ostia, lodged in the membrane stretching between two adjacent velar lappets. Each rhopalium has a short minute club-shaped sense-rod lying in a sinus covered over by a thin membrane extending between two rhopalar lappets. The exumbrellar sense-pit is broad and radially grooved, the distal end of the grooves being usually forked. The rhopalar lappets are small, beak-shaped structures directed outwards, not exceeding 2 mm. in length. The number of velar lappets between a pair of rhopalia is not constant, and varies between 2 and 6. There are 52 velar lappets in the holotype,

<sup>1</sup> Named after my chief, Col. Sewell, to whose energy as Surgeon Naturalist on the "Investigator" the Indian Museum owes its large collection of Scyphomedusae.

but as part of the margin of the bell is incomplete the number is presumably larger. They are elongately triangular, 10-15 mm. long and slightly longer than broad at base. Some of them show slight fission at their tapering end, and have small accessory triangular projections on their sides near the base, or minute crenulations.

There are twice as many radial canals as there are rhopalia, the rhopalar canals being prominent, and reaching the margin of the umbrella,

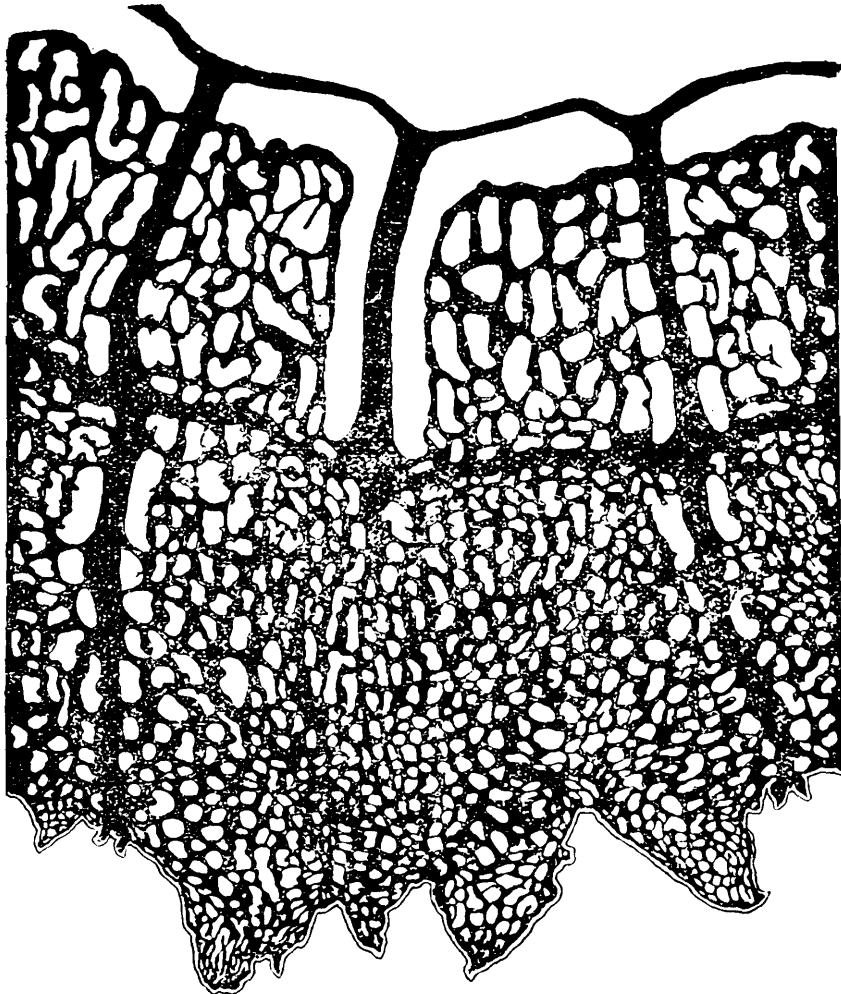


TEXT-FIG. 10.—*Lobonemoides sewelli*. Subumbrellar view of a part of the mouth-arm disc with two arms. The spaces enclosed by thick black lines represent the small windows of the proximal part. In this radius the distal connection between the wings of the mouth-arm is broken.  $\times \frac{3}{4}$ .

and the interrhopalar extending usually a little beyond the ring-canal. The radial canals form a large sinus at their junction with the ring-canal. The ring-canal is very narrow and inconspicuous in places, losing its individuality as a distinct canal in the interradiar network of anastomosis. The interrhopalar centrifugal network of canals is narrow-meshed and is connected to the rhopalar canal on its sides by several narrow transverse canals. The network of canals centripetal to the ring-canal is large-meshed, and connected with the rhopalar canal by a few short transverse canals, usually four or five in number. It is not directly connected with the central stomach at any point. The rhopalar canal on reaching the margin of the umbrella near the base of the rhopalar lappets enters

the floor of the rhopalium where it divides into two diverging blindly ending-canals in the rhopalar lappets. A branch from each of the per-radial canals is given off to the mouth-arm at the base of which it divides into three distinct branches, one for each wing of the trifoliate arm. Smaller canals branch off from the main canal and enter the fleshy thickenings of the periphery of the wing and the appendages at the base of the frilled mouths.

The whole of the subumbrella outside the arm-disc up to the base of the marginal lappets constitutes the region of the ring-muscles. The part which lies inside the ring-canal is raised, convex and fleshy, and the muscles are much more prominent than on the part outside the ring-

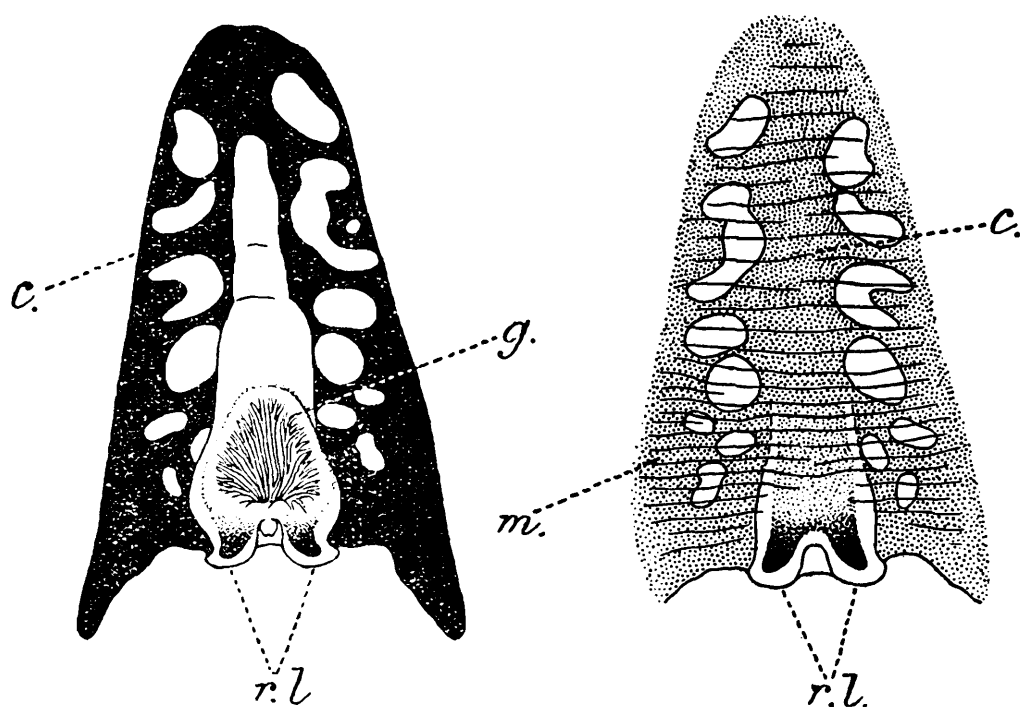


TEXT-FIG. 11.—*Lobonemoides sewelli*. Canal system of two adjacent rhopalar radii of the umbrella.  $\times 1\frac{1}{2}$ .

canal. Each strand of muscle is a vertical fold of the subumbrellar tissue. The muscles are only interrupted part of the way along the radial canals, usually up to the point of their junction with the ring-canal.

The mouth-arm disc is octagonal in shape, firm, and divided into four sectors by broad radial grooves. Measured diagonally from an interostial pillar to the one opposite, its diameter is 95 mm., and its thickness 10 mm. Each mouth-arm pillar arises from the peripheral region of its sector, and carries at the base of its centrifugal side a broad lunate depression. It is narrow above, broad and sloping below. Its breadth varies from 20-50 mm. The subgenital ostia are large, more or

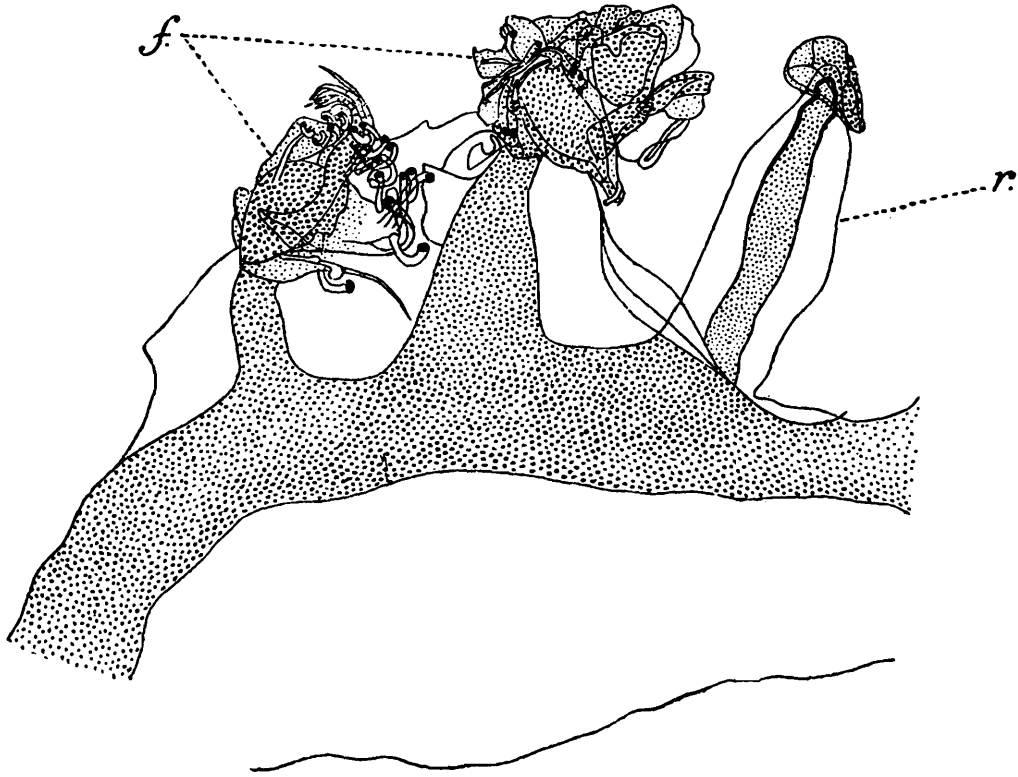
less circular openings about 30-40 mm. broad and 30 mm. high. The floor of each ostium is elevated at the entrance into a broad lunate fleshy prominence which is nearly as wide as the ostium. On its convex side it bears a number of flattened gonadial filaments joined together in a series and lying in the unitary subgenital cavity. The mouth-arms arise in pairs from each sector of the mouth-arm disc, and extend considerably beyond the margin of the umbrella. Excluding the interostial pillars the length of the mouth-arm ranges from 90 to 155 mm. The mouth-arm may be divided into two regions, *e.g.*, the basal shaft, and the distal winged part. The former is 45 mm. long; and in the longest arm it is roughly a third of its entire length. It is slightly flattened from side to side, and triangular in cross-section, the apex of the triangle being directed inwards. The winged part of the mouth-arm is also



TEXT-FIG. 12.—*Lobonemoides sewelli*. Exumbrellar and subumbrellar views of the rhopalium and its adjacent region. *c.* anastomosing canals of the margin of the umbrella; *g.* radiating grooves above the rhopalium; *m.* circular muscles of the subumbrella; *r.l.* rhopalar lappets.  $\times 4\frac{1}{5}$ .

flattened, and bears on the periphery of each wing a series of stout bead-like swellings of varying size joined together by a strip of membrane which is usually perforated. There is one large window-like opening in each wing of the mouth-arm instead of three or four small ones as in *Lobonema smithii* Mayer. There is, however, no evidence to indicate that this large window has been formed by the tearing of the wing-membrane with several smaller windows. A number of frilled mouths with short club-shaped filaments is present on the distal end of the bead-shaped structures. These structures may be compared in general appearance to the ovaries and stigma of certain flowers belonging to the natural order Euphorbiaceae. Instead of long whip-like filaments as in *Lobonemoides gracilis* there are short, stiff, rod-like appendages scattered amongst the frilled mouths with a prolongation of the mouth-arm canal. Their free ends are usually knob-like with minute frills or folds of tissue on them. Minute rounded and elongate nematocysts are

found scattered on these appendages. On the axial or centripetal wing of the mouth-arm the bead-shaped structures undergo gradual reduction



TEXT-FIG. 13.—*Lobonemoides sewelli*. Mouth-arm appendages. *f.* frilled appendages; *r.* rod-like appendages. The canal system sends branches into both these forms of appendages.  $\times 28$ .

in size and complexity towards the margin of the mouth-arm disc, until on the latter the mouth-frills and appendages are so much reduced that they appear to be mere Y-shaped ridges, the tail ends of which meet at the centre of the mouth-arm disc.

The colour in spirit is pale pink or cream. No markings or pigment spots are present. The specimen is greatly contracted and somewhat brittle owing to preservation in alcohol.

Certain worms, probably immature Distomes, are present on the exumbrella and on the mouth-frills and the appendages. They are reddish brown in colour, and have several refringent oval or elliptical bodies in them.

*Holotype*.—P  $\frac{493}{1}$  Zool. Surv. Ind. (*Ind. Mus.*).

*Locality*.—Vicinity of Mergui Archipelago (Mar. Surv. Sta. 565—11° 57' 30" N., 98° 19' E.). The medusa was taken by Col. Sewell (13th November, 1913) with the help of a large surface tow-net.

This species, while agreeing with *Lobonemoides gracilis* in having pointed marginal lappets and in the general arrangement of the radial and anastomosing canals, differs from it in having window-like openings on the mouth-arm membrane, in lacking filamentous appendages on the mouth-arms and in details of the canal system.<sup>1</sup> The most characteristic features are, however, in the mouth-arms and their curious bead-shaped

<sup>1</sup> Stiasny (1921, p. 156) is of the opinion that *Lobonemoides gracilis* is the young of his *Lobonemoides robustus* from Java,

swellings with their short, stiff appendages, and in the one large window-like opening occupying the entire area of the mouth-arm membrane with several small ones at the periphery of the wing.

The arrangement of the canals appears to be subject to slight variations. The interradi al canals may or may not reach the margin of the umbrella. Judging from the figures of the canal system given by Mayer for *Lobonema smithii* and by Light for *Lobonemoides gracilis* it seems that the interrhopalar canals are not at all well-defined outside the ring-canal, although the authors say that they extend up to the margin of the umbrella. In the present species they break up into an anastomosing network between the rhopalar canals a little beyond the point of emergence from the ring-canal. The ring-canal itself is reduced in size and often inconspicuous at some points.

It is probable that a closer study of a large number of specimens of these so-called species will show that they are no more than varieties of a single species with a wide distribution in the Indo-Pacific seas.

#### Family R<sub>P</sub>IZOSTOMIDAE.

#### Genus **Rhopilema** Haeckel.

1921. *Rhopilema*, Stiasny, *op. cit.*, p. 161.

#### **Rhopilema hispidum** (Vanhöffen) Maas.

1903. *Rhopilema hispidum*, Maas, *Scyphomedusen der Siboga Exped.*, Monogr. 11, p. 73, pl. ix, figs. 78-81.

1910. *Rhopilema hispidum*, Mayer, *op. cit.*, p. 706.

1921. *Rhopilema hispidum*, Stiasny, *op. cit.*, p. 163, pl. ii, fig. 15; pl. iv, figs. 34 a, b, 35, 36; pl. v, fig. 48.

Two specimens in a somewhat damaged condition are preserved in the collection. One is from Puri, Orissa Coast (Dr. Annandale and Capt. R. E. Lloyd, Jan., 1908). The diameter of the bell is 80 mm., and the length of the mouth-arm 75 mm. There are numerous conical and spiniform projections on the exumbrella. The scapulets are 25 mm. long. There are no wart-like papillae at the sides of the subgenital ostia.

The other example bears the register number  $\frac{6756}{4}$  only, and the locality is not given. Presumably it is from some part of the Bay of Bengal. The diameter of the bell is 80 mm., and the length of the mouth-arm to the tip of its terminal appendage is 55 mm. The scapulets are 15 mm. long. There are a few conical projections on the exumbrellar surface. The terminal club on the mouth-arm is compressed, elongate and more or less three-cornered. The subgenital cavities are distinct and separated from one another by a thin membranous partition, and the ostia are as wide as the interostial mouth-arm pillars. An elongate somewhat pear-shaped papilla with very few warts is present a little in front of the entrance of the subgenital ostia.

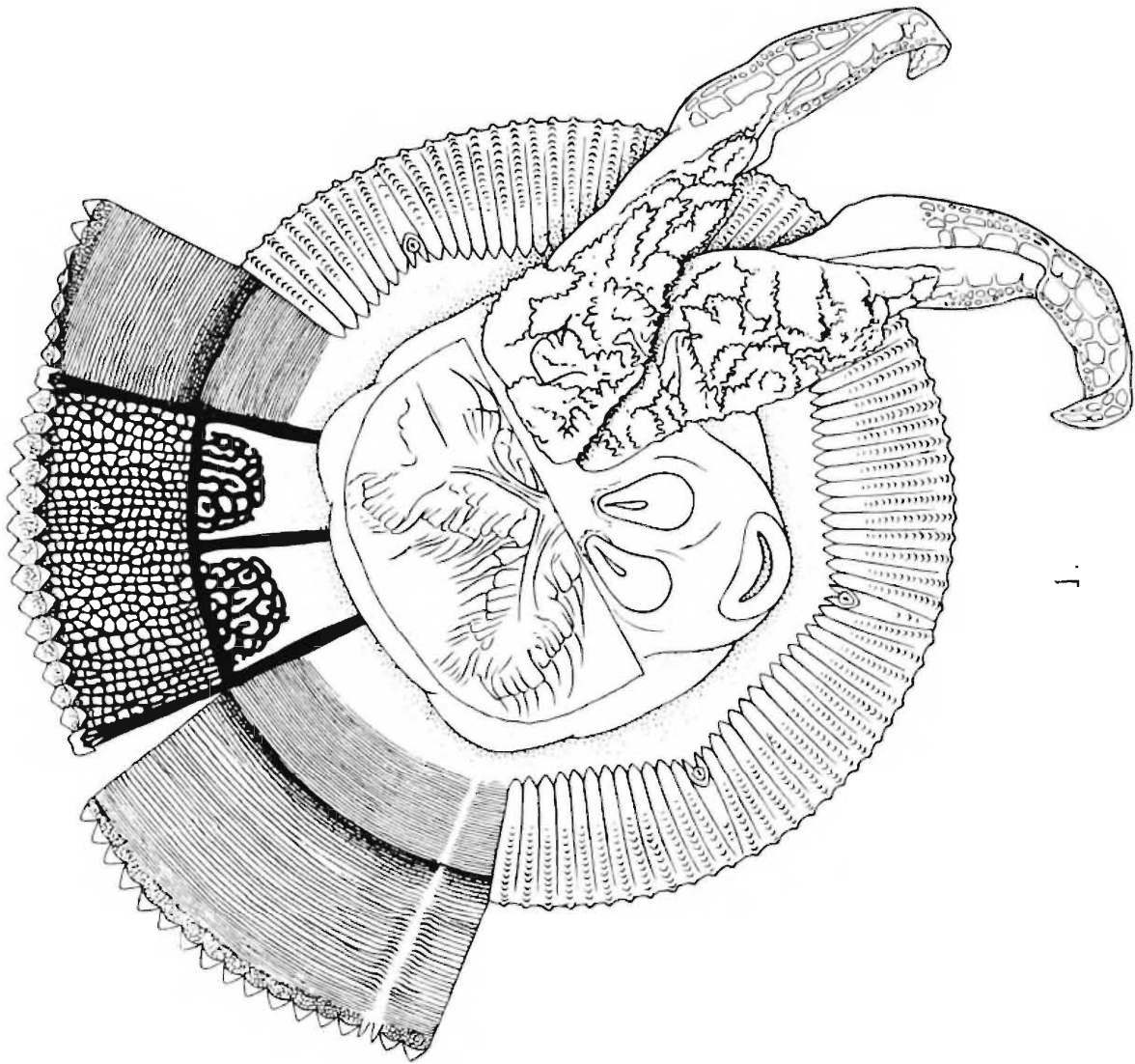
### EXPLANATION OF PLATE III.

*Crambionella annandalei*.—Two views of the Holotype. The outlines of the foliaceous appendages are clearly seen on the abaxial side of the mouth-arms. ( $\times \frac{2}{3}$ ).



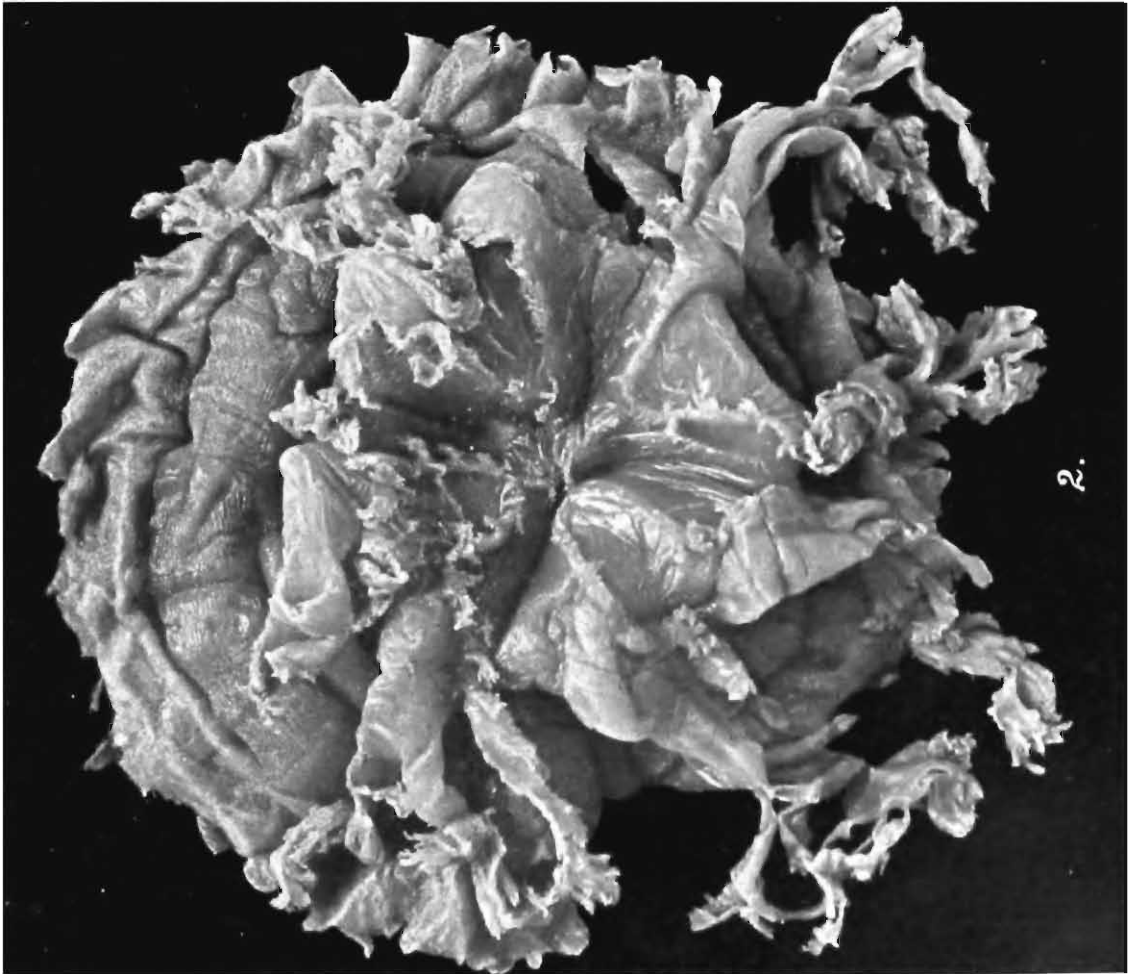
#### EXPLANATION OF PLATE IV.

- FIG. 1.—*Crambionella annandalei*. Subumbrellar view of a young injected specimen partially dissected out to show the distribution of the canals in the peripheral region. (Semi-diagrammatic).
- „ 2.—*Lobonemoides sewelli*. Subumbrellar view of the Holotype. The large windows in the wing-membranes of the mouth-arm are noticeable. ( $\times \frac{4}{7}$ ).



1. *CRAMBIONELLA ANNANDALEI* n. sp.

2. *LORONEMOIDES SEWELLI* n. sp.

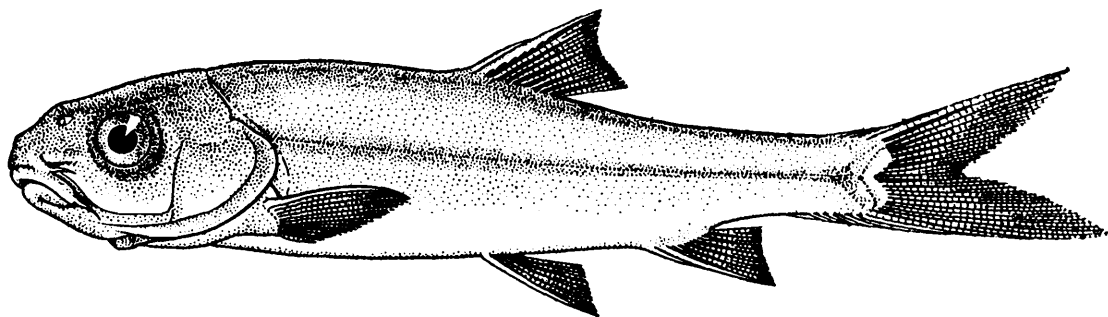


S. C. Mendenhall del. & photo.

# THE GENERIC POSITION OF THE NEPALESE FISH *DIPTYCHUS ANNANDALEI* REGAN.

By D. D. MUKERJI, M.Sc., Zoological Survey of India, Calcutta.

In 1907 Regan<sup>1</sup> described a new species of the genus *Diptychus*, *D. annandalei*, from Pharping and Katmandu in Nepal. His description was based on three<sup>2</sup> young specimens, the largest being 70 mm. in total length. Recently I had occasion to examine these examples and I find that, besides possessing two pairs of short barbels to which Regan had already referred, they are provided with a well-marked, osseous and denticulate dorsal spine. A combination of these two characters clearly shows that the fish cannot be retained in the genus *Diptychus* which is characterised<sup>3</sup> by the presence of a single pair of barbels at the angles of the mouth and a smooth dorsal spine.



TEXT-FIG. 1.—Lateral view of *Diptychus annandalei* Regan,  $\times 3$ .

Another feature of importance noted by Regan in “*D. annandalei*” is that the body is “nearly entirely naked.” This character and the presence of four barbels led Vinciguerra<sup>4</sup> to suggest tentatively that the species is referable to a distinct genus rather than to *Diptychus*. It was also indicated by him that the absence of scales on the body shows that the species is closely allied to the members of the genus *Gymnodiptychus*.<sup>5</sup>

I have examined the pharyngeal bone and teeth of a specimen of “*D. annandalei*” (fig. 3) and find that the pharyngeal teeth are, like those in *Schizothorax*, more or less hooked at the tip and arranged in

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<sup>1</sup> Regan, C. Tate—*Rec. Ind. Mus.*, I, p. 158 (1907).

<sup>2</sup> There are, however, four specimens in the collection of the Zoological Survey of India labelled as *Diptychus annandalei* Regan (Reg. Nos. F  $\frac{1551}{1}$  & F  $\frac{1552}{1}$ ).

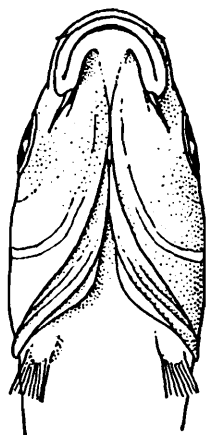
<sup>3</sup> Steindachner, F.—*Verh. Zoo.-bot. Ges. Wien*, XVI, p. 787 (1866).

<sup>4</sup> Vinciguerra, D.—*Ann. Mus. Civ. Stor. Nat. Genova*, (3) VII (XLVII), p. 146 (1916).

<sup>5</sup> Herzenstien, S., ‘Ichthyologische Bemerkungen aus dem zoologischen Museum der Kaiserlichen Akademie der Wissenschaften.’—*Mélanges Biol. Bull. Acad. Sc. St. Petersb.*, XIII, p. 225 (1892).

three rows,—the arrangement being 4.3.2-2.3.4.<sup>1</sup> Both in *Diptychus* (fig. 4) and *Gymnodiptychus*, on the other hand, there are only two rows of teeth—the formula being 4.3-3.4.

The nearest allies of the form “*D. annandalei*” are *Schizopygopsis*<sup>2</sup> and *Schizocypris*.<sup>3</sup> But it differs from *Schizopygopsis* chiefly in having (i) four barbels (*versus* none) and (ii) three rows of pharyngeal teeth (*versus* two rows), while from *Schizocypris* it differs among other features in the possession of (i) a more or less narrow and horse-shoe shaped mouth (*versus* broad and transverse), (ii) four barbels (*versus* none or a minute posterior pair) and (iii) hooked pharyngeal teeth (*versus* flat teeth with grinding surfaces).



TEXT-FIG. 2.—Ventral view of *Diptychus annandalei* Regan, showing the characters of the mouth and the lips,  $\times 4$ .

Judged from the characters present in “*D. annandalei*” referred to above, *viz.* (i) three rows of hooked pharyngeal teeth, (ii) a denticulate dorsal spine and (iii) four barbels, as well as from the general build (fig. 1) and the shape of the mouth and the lips (fig. 2) the fish appears to correspond more closely, if not entirely, to the genus *Schizothorax* than to *Diptychus*, *Gymnodiptychus*<sup>4</sup> or any other allied genus, and should, therefore, be placed in *Schizothorax*. In regard to its specific identity it is difficult to be certain, from the fact that all the specimens are immature and seem roughly to agree with any of the species of the genus *Schizothorax* found in the mountain streams and rivers of the Himalayan region. I am, therefore, inclined to think that “*D. annandalei*” should, for the present, stand as *Schizothorax* sp.

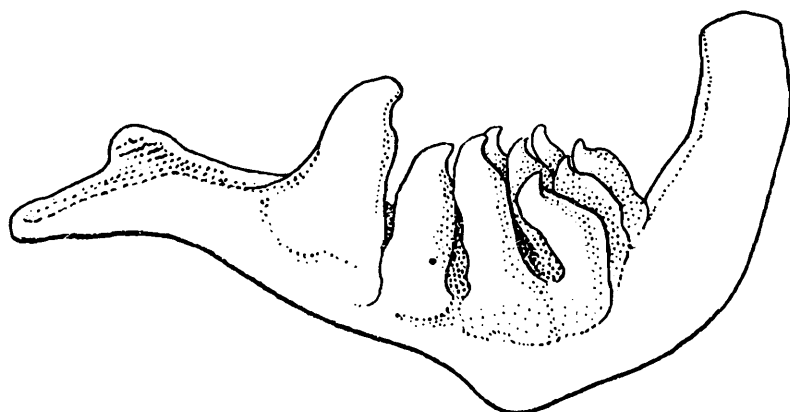
<sup>1</sup> Ordinarily there are ten pharyngeal teeth on each side in *Schizothorax*, 5.3.2-2.3.5. But it has been remarked by Heckel (*Fische Kaschmir's* in Hugel's *Kaschmir und Das Reich Der Seik*, p. 355, footnote, 1848) that the total number of pharyngeal teeth on each side may vary from nine to ten. Of the species of *Schizothorax* that I have examined in this connection *S. nasus* has nine pharyngeal teeth—the formula being 4.3.2-2.3.4.

<sup>2</sup> Steindachner, F.—*Verh. Zoo.-bot. Ges. Wien*, XVI, p. 785 (1866).

<sup>3</sup> Regan, C. Tate—*Ann. Mag. Nat. Hist.* (8) XIII, p. 262 (1914).

<sup>4</sup> At my request Dr. S. L. Hora very kindly wrote to the authorities of the British Museum (Natural History) for a specimen of *Gymnodiptychus dybowskii*, and recently a fine specimen has been presented by the British Museum (Nat. Hist.) to the Zoological Survey of India. My sincere thanks are due to Dr. Hora and the authorities of the British Museum (Nat. Hist.) for their acts of courtesy that afforded me an opportunity of studying the fish. Dr. L. S. Berg (*Faune de la Russie, Poissons*, III, p. 675, 1914) considers the form *Gymnodiptychus dybowskii* congeneric with *Diptychus* Steind. I have very carefully examined the specimen of *G. dybowskii* and do not also find sufficient justification for its generic separation from *Diptychus*.

Having assigned the form "*D. annandalei*" to the genus *Schizothorax* it remains for me to explain the absence of scales in the speci-



TEXT-FIG. 3.—Pharyngeal bone and teeth of *Diptychus annandalei* Regan,  $\times 16$ .

mens. This is essential, for the fish could not be a *Schizothorax*, if normally its body were "nearly entirely naked." The absence of scales in the specimens under report, however, does not appear to me to be characteristic inasmuch as scales in *Schizothorax* are generally small and in many species they are poorly developed. In immature stages, again, scales are either not developed or extremely minute and liable to drop off owing to improper preservation. As a matter of fact in badly preserved specimens it is often found that the lepidosis is partly or completely lost. In the collection of the Zoological Survey of India there are large series of young specimens of *Schizothorax* from the hill-streams of Chitral in the N. W. F. Province and elsewhere. I have examined these specimens and find that scales are not developed in many, have partly dropped off in some and are entirely lost in others.



TEXT-FIG. 4.—Pharyngeal bone and teeth of *Diptychus maculatus* Steind.,  $\times 8$ .

It appears to me that scales are not developed in the specimens under report. If, however, the absence of scales on the body of "*D. annandalei*" be proved by later researches to be a constant feature of the species, then "*D. annandalei*" merits a claim to a distinct genus which will be intermediate between *Schizothorax* on one hand and *Diptychus* on the other. But the question cannot be settled until adult specimens of the fish have been obtained and studied,



## CLASSIFICATION OF THE HOMALOPTERID FISHES.

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The taxonomy of the Homalopterid fishes has been involved in a great confusion and this fact has greatly impeded the progress of my work on the bionomics and evolution of the Homalopteridae. During my visit to Europe in 1927-29 I availed myself of the opportunity of examining the collections of these fishes in the British Museum, as well as in the zoological museums at Paris, Leiden, Amsterdam, Berlin and Genova. With the knowledge thus gained I am preparing an account of the generic classification, bionomics and evolution of the Homalopterid fishes, but as this work is likely to take some time yet and as the study is fairly advanced I have thought it advisable to give in this short note my views on the classification of the family.<sup>1</sup>

The Homalopterid fishes constitute a remarkable family of torrent-inhabiting loaches which are characterised by a subterminal and inferior mouth, a flattish lower surface and horizontal paired fins with the anterior rays "simple" As I have indicated elsewhere,<sup>2</sup> the so-called simple rays are of two kinds. In *Balitora*, for example, the simple rays are apparently produced by the coalescence of the branches of an ordinary ray, whereas in *Gastromyzon* there is only one true simple ray, the neighbouring rays, although appearing simple superficially, being in reality forked. In this last case the primary branching is retained and each of these branches is then modified into a simple ray. On the morphological structure of the "simple" rays the members of the family Homalopteridae can be grouped into two subfamilies—Homalopterinae and Gastromyzoninae.<sup>3</sup> The former is characterised by the presence of *two or more* undivided rays in the paired fins, whereas the latter possesses only *one* undivided ray in the paired fins. The genera *Homaloptera*, *Balitora*, *Hemimyzon*, *Sinogastromyzon*, *Sinohomaloptera*, *Chopraia* and *Lepturichthys* are thus referable to the Homalopterinae and the genera *Parhomaloptera*, *Pseudogastromyzon*, *Gastromyzon*, *Crossostoma* and *Formosania* to the Gastromyzoninae. The remaining genera such as *Glanioptis*, *Homalosoma* and *Octonema* are more closely related to the Cobitidae than to the Homalopteridae.

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<sup>1</sup> After this article had gone to press I received a copy of Mr. P. W. Fang's very interesting paper entitled "New and Inadequately Known Homalopterin Loaches of China" (*Contributions Biol. Lab. Sci. Soc. China, Zool. Ser. VI*, No. 4, pp. 25-43, 1930), in which he gives a rearrangement and revision of the generic characters of *Gastromyzon*, *Sinogastromyzon* and their related genera. It is not possible to discuss his system of classification in this note, but I hope to do so in the near future when publishing a detailed account of the classification, bionomics and evolution of the Homalopterid fishes.

<sup>2</sup> Hora, *Phil. Trans. Roy. Soc. London (B)* CCXVIII, p. 267 (1930).

<sup>3</sup> I am retaining the subfamily designations proposed by Fowler (*Proc. Acad. Nat. Sci. Philad.* (2) LVII, pp. 475, 477; 1905), though my characterisation of the two subfamilies is entirely different from that given by Fowler.

Among the Homalopterinae, *Homaloptera*, *Balitora*, *Hemimyzon* and *Sinogastromyzon* form a regular graded series, while the 8-barbelled *Sinohomaloptera*, the many-barbelled *Lepturichthys* and the large-eyed *Chopraia* represent side branches of the main stem of evolution. Similarly among the Gastromyzoninae, *Parhomaloptera*, *Pseudogastromyzon* and *Gastromyzon* constitute a regular series, whereas the many-barbelled *Crossostoma* and *Formosania* seem to have diverged from the main line. A close study of the two subfamilies shows that evolution has proceeded among them along parallel lines and the most specialized forms of the two subfamilies show remarkable convergence of characters. It is interesting to note that both in *Sinogastromyzon* and in *Gastromyzon* the ventral fins are united posteriorly to form a disc for the purposes of adhesion.

For convenience of reference I give below a list of the genera of the Homalopteridae with references to their original descriptions and the names of the type-species with such other information as I consider it is desirable to publish at this stage of my work.

#### Subfamily **Homalopterinae.**

1. *Homaloptera* van Hasselt, *Algem. Konst-en Letterbode* II, p. 130 (1823).  
*Type-species* :—*Homaloptera wassinki* Bleeker (= *H. fasciata* van Hasselt).  
*Synonyms* :—*Helgia* Vinciguerra, *Homalopteroides* Fowler and *Bhavana* Hora.
2. *Balitora* Gray, *Illustr. Ind. Zoology* I, pl. lxxxviii, fig. 1 (1832).  
*Type-species* :—*Balitora brucei* Gray.
3. *Hemimyzon* Regan, *Ann. Mag. Nat. Hist.* (8) VIII, p. 32 (1911).  
*Type-species* :—*Hemimyzon formosanum* (Boulenger).  
*Homaloptera abbreviata* Günther (Pratt's *Snows of Tibet*, p. 248, pl. iii, fig. B, 1892) and *Psilorhynchus sinenses* Sauvage et Dabry (*Ann. Sci. Nat. Paris* (6) I, art. 5, p. 14, 1874) belong to the genus *Hemimyzon*.
4. *Sinogastromyzon* Fang, *Sinensia* I, p. 35 (1930).  
*Type-species* :—*Sinogastromyzon wui* Fang.
5. *Sinohomaloptera* Fang, *Sinensia* I, p. 26 (1930).  
*Type-species* :—*Sinohomaloptera kwangsiensis* Fang.
6. *Chopraia* Prashad & Mukerji, *Rec. Ind. Mus.* XXXI, p. 188 (1929).  
*Type-species* :—*Chopraia rupicola* Prashad & Mukerji.
7. *Lepturichthys* Regan, *Ann. Mag. Nat. Hist.* (8) VIII, p. 31 (1911).  
*Type-species* :—*Lepturichthys fimbriata* (Günther).

#### Subfamily **Gastromyzoninae.**

8. *Parhomaloptera* Vaillant, *Notes Leyden Mus.* XXIV, p. 129 (1902).  
*Type-species* :—*Parhomaloptera microstoma* (Boulenger).
9. *Pseudogastromyzon* Nichols, *Amer. Mus. Novitates*, No. 167, p. 1 (1925).

*Type-species* :—*Pseudogastromyzon fasciatus* Sauvage <sup>1</sup> (= *P. zebroidus* Nichols).

10. *Gastromyzon* Günther, *Ann. Mag. Nat. Hist.* (4) XIV, p. 454 (1874).

*Type-species* :—*Gastromyzon borneensis* Günther.

*Synonyms* :—*Lepidoglanis* Vaillant and *Neogastromyzon* Popta.

11. *Crossostoma* Sauvage, *Bull. Soc. Philom. Paris* (7) II, p. 88 (1878).

*Type-species* :—*Crossostoma davidi* Sauvage.

12. *Formosania* Oshima, *Ann. Carnegie Mus.* XII, p. 194 (1919).

*Type-species* :—*Formosania formosanum* (Steindachner) <sup>2</sup> (= *F. gilberti* Oshima).

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<sup>1</sup> Sauvage, *Bull. Soc. Philom. Paris* (7) II, p. 88 (1878).

<sup>2</sup> Steindachner, *Ann. Akad. Wiss. Wien* XLV, p. 82 (1908).

