

Report of the Biological Survey of Mutsu Bay.

20. Echiuroidea.¹⁾

By

HAYAO SATÔ.

Biological Institute, Tôhoku Imperial University, Sendai, Japan.

(With 4 text-figures.)

(Received March 2, 1931.)

The Echiuroidea collected by the Biological Survey of Mutsu Bay is represented by only two species belonging to different genera. They are *Urechis unicinctus* (VON DRASCHE) (Text-figs. 1-3) and *Ikeda taenioides* (IKEDA) (Text-fig. 4).

Of these two species the former is rather common, being found at several localities in Mutsu Bay, while the latter is imperfectly known, only the proboscis of the animal being obtained.

I wish to express my sincere thanks to Professor S. HÔZAWA for his kind advices given during the course of the present investigation.

DESCRIPTION OF THE SPECIES.

Genus URECHIS SEITZ.

Prae-oral proboscis short, scoop-shaped. Two genital hooks exist close to and behind the mouth, and a circle of anal hooks surrounds the anus. Two or three pairs of segmental organs, each provided with two long spiral extentions of the lips of the coelomic aperture. Alimentary canal long, convoluted. A spacious rectum which serves as a respiratory organ, is led to a muscular cloaca. Two anal vesicles are attached to the cloaca at its ventro-lateral surface. No definite blood-system is present.

1. *Urechis unicinctus* (VON DRASCHE).

(Text-fig. 1-3)

Ein Echiuroid, WILLEMOES-SUHM, 1876, p. 102.

Echiurus unicinctus, VON DRASCHE, 1881, pp. 3-5, Pl. XX, Fig. 1; E. SELENKA,

¹⁾ Contributions from the Marine Biological Station, Asamushi, Aomori-Ken. No. 63.

1885, pp. 6-7, Pls. I, III; W. FISCHER, 1895, p. 21; A. SHIPLEY, 1899 (2), p. 344; A. L. EMBLETON, 1900, pp. 77-97, Pls. VII-X, Text-fig. 1; I. IKEDA, 1904, pp. 59-60; 1924, p. 38; A. OSTROUMOV, 1909, p. 319; J. W. SPENGLER, 1921 (1), p. 356.

Urechis unicinctus, PH. SEITZ, 1907, p. 30; J. W. SPENGLER, 1912 (2), pp. 173-212; W. FISCHER, 1914 (2), pp. 1-28; 1921, p. 423.

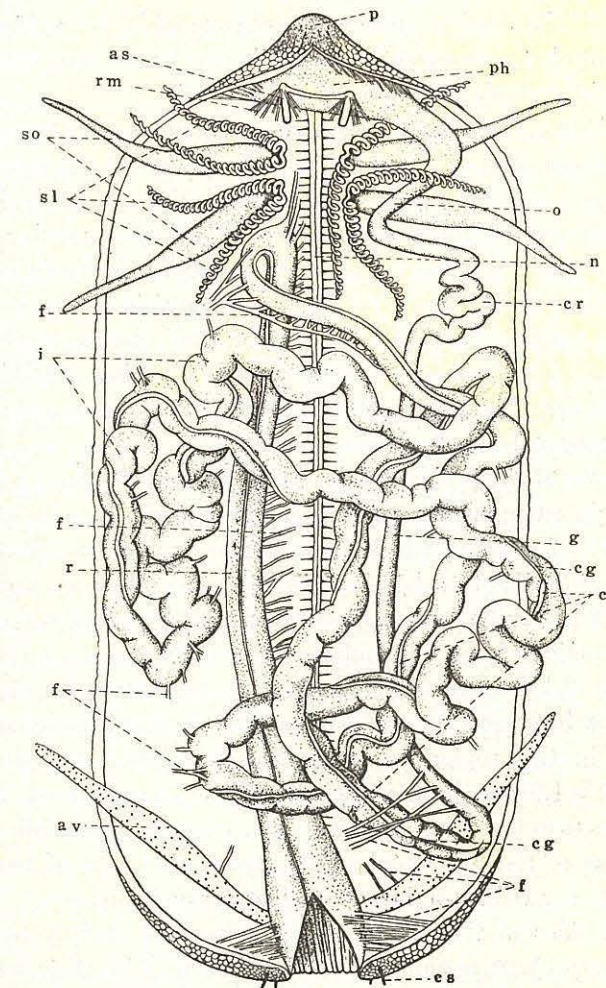
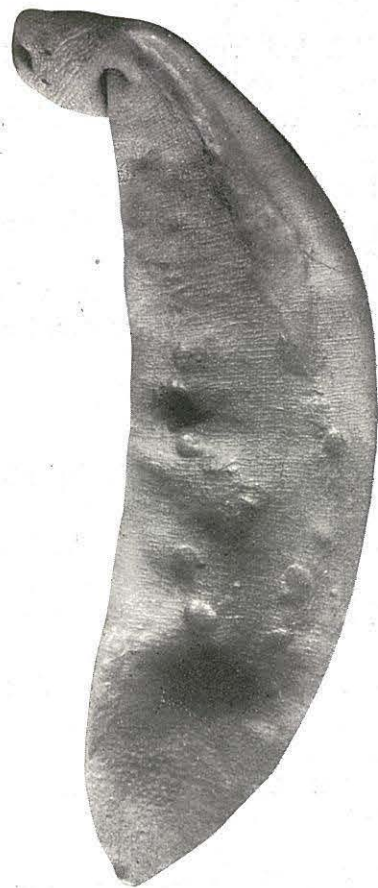
Spiroctetor unicinctus, A. S. SKORIKOV, 1909, pp. 77-102.

This species is very common and is obtainable abundantly everywhere along the coast of Japan. The fishermen use this animal as bait. In Mutsu Bay it is found in great abundance, too. This animal was reported for the first time by WILLEMOES-SUHM (1876, p. 102), who says, "Ein Echiurid der den Fischern als Köder dient und wohl in Schlamm dicht am Ufer vorkommt. Der 3-4 Zoll lange Wurm stimmt ganz mit den Merkmalen der Gattung *Echiurus* überein, hat aber hinter nicht zwei Hakenkränze, sondern nur einen." But it was not named specifically at that time. In 1881, RICHARD VON DRASCHE described this animal as a new species under the name of *Echiurus unicinctus*, using the specimens collected by A. VON RORETZ from South Japan.

I have collected a great number of specimens of this species at Moura, Nonai, and Asamushi near the Marine Biological Station.

The animal (Text-fig. 1) lives in a U-shaped tube made in the muddy sand of the sea-bottom. The inner surface of the tube is smooth being plastered with the mud mixed with mucous secretion of the worm. The tube has two apertures, one

Text-fig. 1. *Urechis unicinctus* (VON DRASCHE). Natural size.



Text-fig. 2. *Urechis unicinctus* (VON DRASCHE). Specimen dissected. as, muscle sheath of anterior ventral setae; av, anal vesicle; cg, ciliated groove; ci, collateral intestine; cr, crop; cs, caudal seta; f, fixing-muscles; g, gizzard; i, intestine; n, ventral nerve-cord; o, oesophagus; p, proboscis; ph, pharynx; r, rectum; rm, radiating-muscles; sl, spiral lips; so, segmental organs. (Natural size).

at each end. Both ends of the tube are slightly elevated above the level of the sand in the manner of short chimneys.

The said specimens measure 13-250 mm. in length and 9-30 mm.

in thickness. The smaller specimens are covered by very thin, colourless and somewhat translucent skin, while the larger ones are covered by thick, light reddish and entirely opaque skin.

The proboscis (Text-fig. 2, p) is represented merely by a bluntly-pointed prae-oral lobe of conical shape, about 5 mm. long, not showing any constriction which distinguishes the proboscis from the body proper as in the cases of *Echiurus pallasii* and of all the members of the genus *Thalassema*. In these forms, the proboscis is easily cut off at the point of the constriction, but in *Urechis unicinctus* it is not the case for the reason above mentioned. Of the present species, VON DRASCHE denied the existence of the proboscis saying, "Beide Exemplaren fehlte der Kopflappen (Rüssel)." This misunderstanding is also said to be caused from the same reason.

At the base of the proboscis-lobe exists the mouth, facing ventrally.

The whole outer surface of the body is densely covered with a large number of papillae which do not show any definite arrangement, save that they are apt to be arranged in transverse rows surrounding the body. The papillae are extremely variable both in form and size: they are sometimes roundish and sometimes elliptical in surface view, and measure 0.1-0.6 mm. in diameter at the base. In the middle region of the body proper, the papillae are comparatively small and flat; while in the regions near both extremities, they are larger measuring 0.5-1.0 mm. both in height and in diameter at the base. The papillae found on the proboscis are exceedingly small and flat. In the region of the segmental organs there exists a broad band which is beset with a number of large papillae arranged in rows.

On both sides of the ventral median line and slightly behind the mouth, there projects a pair of hooks (or setae) with their free extremities markedly recurved. They are called genital hooks (or setae) or anterior ventral hooks (or setae). Of each of the hooks two parts may be distinguished: the straight basal portion and the curved apical portion. The basal portion of the hook lies always in the body cavity enclosed in a muscular sheath supported by numerous strong radiating-muscles. (Text-fig. 2, rm). The apical portion of the hook which occupies about one-fourth of the whole length of the hook is laterally compressed and is sometimes exposed outside of the body surface but also is able to be withdrawn into the body-wall by means of the

radiating-muscles above alluded to.

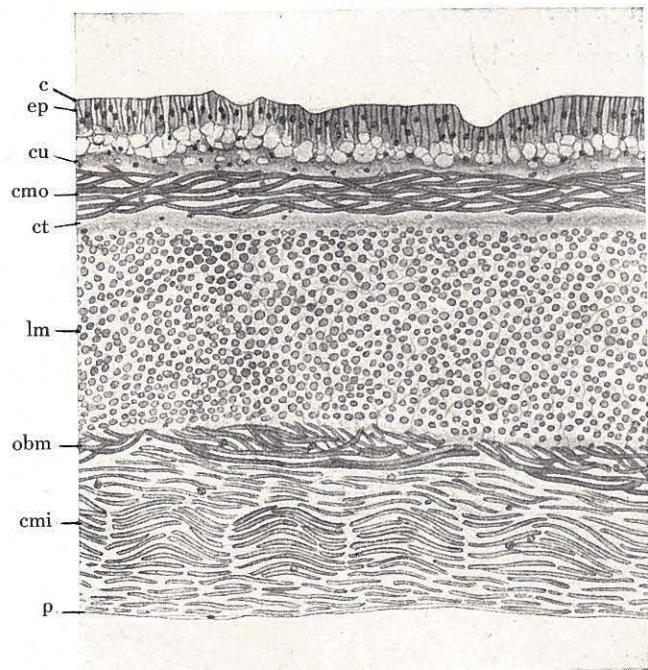
At the posterior end of the body, surrounding the anus, there is a single circlet of hooks (or setae) called caudal hooks (or setae) or peri-anal hooks (or setae) (Text-fig. 2, cs). The circlet consists of 10-13 setae which are smaller and thinner than the anterior ventral setae, measuring 4-8 mm. in length. Each of the setae is nearly straight and is sharply pointed at its free extremity, while the basal three-fourths of its length are enclosed in a muscular sheath and protrude into the body-cavity. Two of these hooks placed on each side of the mid-ventral line are rather widely separated from each other; while the others are arranged almost at equidistance.

Just behind the genital hooks, on the ventral side, two pairs of minute pores are found; these are the external apertures of the segmental organs (or nephridia) (Text-fig. 2, so).

The body-wall (Text-fig. 3) is covered externally by a thin cuticle (Text-fig. 3, c). Beneath this comes the epidermal layer (Text-fig. 3, ep) which is comparatively thick and appears to be composed of cells of glandular nature. Beneath the epidermal layer there occurs the cutis (Text-fig. 3, cu), namely, a connective tissue layer. The muscle layers come next: the outermost, first layer is made up of circularly arranged fibres (Text-fig. 3, cmo); the second is of longitudinal fibres (Text-fig. 3, lm). There exists a well-developed connective tissue layer (Text-fig. 3, ct) between these two muscle layers. The third is oblique (Text-fig. 3, obm). The fourth is again circular (Text-fig. 3, cmi). The innermost layer of the body-wall is formed by the peritoneum (Text-fig. 3, p) which is made up of a single cell-layer, and lines the body cavity.

The alimentary canal is represented by a long coiled tube fastened to the body-wall by means of numerous stout fixing-muscles (Text-fig. 2, f). The mode of convolution of the alimentary canal seems to be generally constant. Of the alimentary canal, there may be distinguished the following eight parts:—

- 1) Mouth.
- 2) Pharynx (Text-fig. 2, ph), the first portion led from the mouth, is a large muscular sac about 15 mm. long and is attached to the body-wall by the fixing-muscles.
- 3) Oesophagus (Text-fig. 2, o), thick-walled muscular tube, measur-



Text-fig. 3. *Urechis uncinatus* (VON DRASCHE). Transverse section through the body-wall in the middle of the worm. c, cuticle; cmi, inner circular muscle layer; cmo, outer circular muscle layer; ct, connective tissue layer; cu, cutis; ep, epidermal layer; lm, longitudinal muscle layer; obm, oblique muscle layers; p, peritoneum. ($\times 44$).

ing about 30 mm. in length.

4) Crop (Text-fig. 2, cr), the short coiled portion.

5) Gizzard (Text-fig. 2, g), a narrow straight canal running down to the posterior end of the body-cavity. It is about 60 mm. in length.

6) Intestine (Text-fig. 2, i). It is represented by a long coiled tube, attached to the body-wall at several places, by means of fixing-muscles. The intestine is accompanied by a narrow canal called the collateral intestine (Text-fig. 2, ci) running along nearly its whole length. The collateral intestine is otherwise called "siphon", "accessory intestine" and "Nebendarm" by various authors. GREEFF thought that it was a blood vessel and said that it was to be called "Darm-vene". In regard to this organ, Selenka was of the same opinion as GREEFF and thus he also used the term "blood vessel" in his

report on *Gephyrea* of the Challenger Expedition. The collateral intestine, at both its extremities, is transferred into the ciliated groove (Text-fig. 2, cg) which also runs along the intestine.

7) Rectum (Text-fig. 2, r), a broad and greatly extensible tube about 90 mm. long. It runs down straightly along the left side of the ventral nerve-cord (Text-fig. 2, n), and terminates in the anus at the posterior extremity of the body. A number of fixing-muscles arranged in a row fasten the rectum to the inner surface of the body-wall at the left side.

8) Anus, which is terminal in position.

There exist no blood vessels in the body proper, but an irregular sinus system is met with in the proboscis. The sinuses are narrow at first but gradually become broader and form at last very spacious cavities which directly communicate with the body cavity.

There is a single ventral nerve-cord (Text-fig. 2, n), extending from mouth to anus; it sends off many side branches on both sides which penetrate into the body-wall and thus the cord is at the same time fixed to the inner surface of the body-wall. No ganglia are seen in the ventral nerve-cord.

Situated at the posterior end of the body-cavity is a pair of anal vesicles (Text-fig. 2, av), which are often called "posterior nephridia". Each vesicle arises from the posterior region of the rectum at the ventro-lateral side. The basal one-fourth of its length is fastened to the body-wall by means of several fine fixing-muscles; while the remaining three-fourths are set free in the body-cavity. A large number of ciliated funnels are distributed on the outer wall of the anal vesicle. The function of these organs, according to EMBLETON (1900, p. 89), is excretory.

Behind the two anterior ventral hooks, there exist two pairs of segmental organs (Text-fig. 2, so), each consisting of a tube provided with two orifices at the inner end. By means of one of these orifices it communicates with the body-cavity and it also opens to the exterior by the other. Two lips (Text-fig. 2, sl) which surround the inner orifice of the segmental organ are greatly prolonged and, moreover, are spirally twisted forming 12-20 coils. They are broad at the base but taper towards the extremity and contain no lumen inside. A ciliated groove runs spirally along its whole length. The segmental organs serve as the gonoducts and the eggs and the sperms are carried to

the exterior from the body-cavity by these organs.

Localities. — This species has been reported by many authors from various localities in Japan such as: Inland Sea (WILLEMOS-SUHM, 1876, SELENKA, 1885); East coast of South Japan (DRASCHE, 1881); Tôkyô (EMBLETON, 1900); Shikoku (FISCHER, 1914); Along the Pacific coast of Japan (IKEDA, 1904); Hokkaidô (IKEDA, 1924); North Japan (OSTROUMOV, 1909).

Excluding Japan it was reported from Russia by SKORIKOV (1909) and from Amurland and De Castries Bay by FISCHER (1895).

In Mutsu Bay the species was obtained at Moura, Nonai, and Asamushi near the Marine Biological Station.

Remarks. — EMBLETON (1900, p. 80) says, showing the figure of the transverse section of the body-wall, that: — "The muscle-sheath comes next, the outermost layer is made up of circularly arranged fibres; below this is a band of longitudinal muscles, followed on the inner side by another layer of circular muscles, showing, however, a slight obliquity as compared with the outer circular layer." The specimens from Mutsu Bay show some differences in the arrangement of the muscle layers of the body-wall compared with those reported by EMBLETON: namely, in the specimens from Mutsu Bay there are found two muscular layers beneath the longitudinal muscle layer, while in those reported by EMBLETON there exists only one. I have also examined a great number of specimens collected from the following localities in Japan: — Tateyama Bay, Osaka Bay, Onomichi Bay, Hiroshima Bay and Ariake Bay. But I could not find any specimen which bears the muscular arrangement identical with that reported by EMBLETON. All the specimens from various localities in Japan above mentioned have shown the same features in the muscular arrangement as the specimens from Mutsu Bay.

In regard to the size of the body, the specimens from Mutsu Bay show exceedingly greater dimension than those reported by other authors.

Only three species are hitherto known of the genus *Urechis*: they are *U. uncinatus* (VON DRASCHE), *U. chilensis* (M. MÜLLER) and *U. caupo* FISCHER. *U. uncinatus* may be easily distinguished from the other two species by the number of the segmental organs. It bears only two pairs of these organs, while the others carry three pairs.

Genus IKEDA WHARTON.

Nephridia, provided with terminal funnels, are variable in number, and are not arranged in pairs; longitudinal muscle layer of the body-wall always lying outside of both the circular and oblique muscle layers.

2. *Ikeda taenioides* (IKEDA)

(Text-fig. 4)

Thalassema taenioides, IKEDA, 1904, pp. 63-64; 1907, pp. 16-47, Pl. I, Fig. 3, Pl. II, Figs. 18-22, Pl. III, Figs. 23-36, Pl. IV, Figs. 37-47.

Ikeda taenioides, WHARTON, 1913, pp. 243-270.

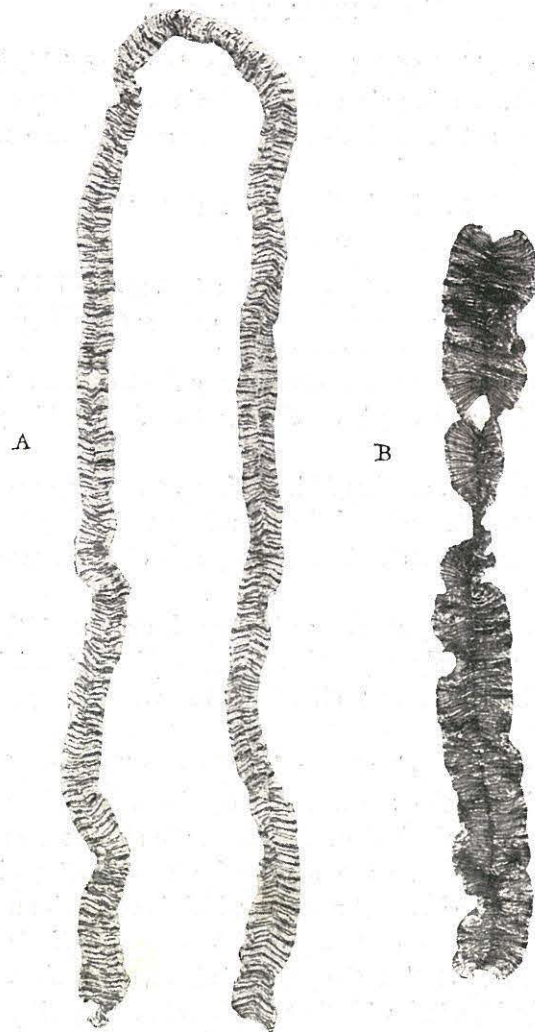
Several pieces of the proboscis were collected from the muddy-bottom of 3-6 fathoms depth off the coast of Asamushi by means of a dredge.

They are long, flat, and band-like in form, measuring up to 600 mm. long and 5-7 mm. wide when fully extended; while they become much shorter when they contract. The photograph of these two specimens is shown in Text-fig. 4.

In both external appearance and internal structure, the proboscis from Mutsu Bay closely resembles that of *Ikeda taenioides*, which was fully described by IKEDA (1907) dealing with the specimens from Sagami Bay.

The most important characters for the classification of the group of these animals are the arrangement of the nephridia and that of the muscle layers of the body-wall. From the above reason, of course, it is a hard task to define the species by means of proboscis only. But judging from the fact that no form which bears such an enormously long proboscis has been ever reported except for *Ikeda taenioides*, and also from the fact that the proboscis in question shows structural features entirely identical with that of the said species, it seems highly reasonable to assume that the proboscis is of *Ikeda taenioides*.

Localities. — Sagami Bay, Tsushima, Amakusa, Tomo, Inland Sea, Tateyama, Haneda, Japan (IKEDA, 1904); Off Asamushi (3-6 fathoms) in Mutsu Bay.



Text-fig. 4. *Ikeda taenioides* (IKEDA). Two pieces of the proboscides. a, Extended specimen; b, Contracted specimen. (Natural size).

LIST OF REFERENCES.

- AUGENER, H. 1903. Beiträge zur Kenntnis der Gephyreen nach Untersuchung der im Göttinger zoologischen Museum befindlichen Sipunculiden und Echiuriden. Arch. Naturg. Jahrg. 69, Bd. 1, pp. 297-371, Pls. I-V.
- BAIRD, W. 1868. Monograph of the Species of Worms belonging to the Subclass Gephyrea. Proc. Zool. Soc. London, 1868, pp. 76-114, Pls. IX-XI.
- BALTZER, F. 1917. Echiuriden. Fauna und Flora des golfes v. Neapel, 34^e monographie, pp. 1-234, Pls. I-XII.
- COLLIN, A. 1891. Über *Echiurus chilensis* MAX MÜLLER. Zool. Anz. Bd. 14, No. 380, p. 463.
- CUÉNOT, L. 1922. Sipunculien, Echiuriens, Priapuriens. Fauna de France, pp. 1-25, Text-figs. 1-14.
- . 1927. Contributions a la faune du bassin d'Arcachon IX. — Revue général de la faune et bibliographie. Bull. de la Stat. Biol. d'Arcachon, Tome XXIV, p. 248.
- DRASCHE, R. VON. 1881. Über eine neue *Echiurus* Art aus Japan nebst Bemerkungen über *Thalassema erythrogrammon* S. LEUCKART von der Insel Bourbon. Verhand. d. K. K. zoologisch-botanischen Gesellsch. in Wien, Jahrg. 1880, pp. 3-5, Pl. XX, Fig. 1.
- EMBLETON, A. 1900. On the Structures and Affinities of *Echiurus uncinatus*. Trans. Linn. Soc. London, (2) Vol. 8, pp. 77-98, Pls. VII-X.
- FISCHER, W. 1892. Übersicht der von Herrn Dr. Fr. STUHLMANN auf Sansibar und an der gegenüberliegenden Festlandküste gesammelten Gephyreen. Jahrb. d. Hamb. Wissensch. Anstalt. Bd. 9, Nr. 2, pp. 80-89, Pl. I.
- . 1895. Die Gephyreen des Naturhistorischen Museums zu Hamburg. Abhandl. a. d. Gebiete d. Naturwiss., Bd. 13, pp. 1-24, Pl. I.
- . 1896. Gephyreen. Hamburger Magalhaensische Sammelreise, pp. 1-7.
- . 1914 (1). Gephyrea. Beiträge zur Kenntnis der Meeresfauna Westafrikas, pp. 59-84, Pl. II.
- . 1914 (2). Weitere Mitteilungen über die Gephyreen des Naturhistorischen (Zoologischen) Museums zu Hamburg. Mitt. Nat. Mus. Hamburg, Jahrg. 31, Beih. 2, pp. 1-28, Pl. I.
- . 1917. Die Gephyreen ausbeute der Deutschen Tiefsee-Expedition (1898-1899). Zool. Anz., Bd. 48, pp. 14-20.
- . 1921. Gephyreen der Antarktischen und Subantarktischen Meere. Deutsche Südpolar-Expedition XVI, Zoologie VIII, pp. 407-430.
- . 1922. Gephyreen des Arktischen Meere. Wiss. Meeresuntersuch. Abt. Helgoland N. F., Bd. 13, pp. 229-246.
- . 1926. Sipunculiden und Echiuriden der Hamburger Südsee-Expedition, 1908-1909. Mitteil. aus dem Zool. Stat. u. Zool. Museum in Hamburg, Bd. 42, pp. 104-117, Pl. III.
- . 1928 (1). Die Sipunculiden, Priapuliden und Echiuriden der Arktis. Fauna arctica, Bd. 5, Lief. 2, pp. 451-490, Pl. VI, Text-figs. 1-3.
- . 1928 (2). A New Echiuroid Worm from California. Ann. Mag. Nat. Hist. (Zool.), Ser. 10, Vol. 1, No. 2, pp. 199-204, Pl. IX.

- GREEFF, R. 1879. Die Echiuren. Nova Acta der Kaiserlichen Leopoldinisch-Carolinischen Deutschen Academie der Naturforscher, Bd. 41, Pars. 2, Nr. 1, pp. 1-172, Pl. XVI-XXIV.
- HERDMAN, W. 1897. Note on a New British Echiuroid Gephyrean, with Remark on the Genera *Thalassema* and *Hamingia*. Quart. Jour. Micr. Sci., Vol. 40, p. 367.
- HÉRUBEL, M. A. 1924. Quelques Echiurides et Sipunculides des côtes du Maroc et de Mauritanie. Bull. Soc. Sc. Nat. Maroc, T. 4, pp. 108-112, Text-figs. 1-5.
- . 1925. Quelques Echiurides et Sipunculides des côtes du Maroc. Bull. Soc. Sc. Nat. Maroc. T. 5, pp. 260-263.
- IKEDA, I. 1904. The Gephyrea of Japan. Jour. Coll. Sc. Imp. Univ. Tokyo, Japan. Vol. 20, Art. 4, pp. 1-87, Pl. I-IV.
- . 1905. Gephyreans collected by Prof. DEAN at Manjiodi Southern Negroes (Philippine Island). Annot. Zool. Jap., Vol. 5, pp. 169-174, Pl. VIII.
- . 1907. On three new and remarkable species of Echiuroids. Jour. Coll. Sc. Imp. Univ. Tokyo, Japan. Vol. 21, Art. 8, pp. 1-64, Pl. I-IV.
- . 1924. Further Notes on the Gephyrea of Japan, with Descriptions of Some New Species from the Marshall Caroline and Palau Islands. Jap. Jour. Zool. Vol. 1, No. 2, pp. 23-44, Pl. I.
- JAMESOM, L. 1899 (1). *Thalassema papillosum* (DELLE CHIAJE), a forgotten Echiuroid Gephyrean. Mitt. Zool. Stat. Neapel, Bd. 13, Heft 4, pp. 433-439.
- . 1899 (2). Contributions to the Anatomy and Histology of *Thalassema neptuni* GAERTNER. Zool. Jahrb. Abt. Anat. Bd. 12, Heft 4, pp. 535-566.
- LAMPERT, K. 1883. Über einige neue Thalassemen. Zeit. Wiss. Zool., Bd. 39, pp. 334-342.
- LANCHESTER, W. F. 1905 (1). The Marine Fauna of Zanzibar and British East Africa, from Collections made by CYRIL CROSSLAND in the Years 1901-1902, Gephyrea. Proc. Zool. Soc. London, 1905, Vol. 1, pp. 28-35, Pl. I.
- . 1905 (2). On the Sipunculids and Echiurids collected during the "Skeat" Expedition to the Malay Peninsula. Proc. Zool. Soc. London, 1905, Vol. 1, pp. 35-41, Pl. II.
- LANKESTER, R. 1881. On *Thalassema neptuni* G. Zool. Anz., Jahrg. 4, p. 350.
- LEIGH-SHARPE. 1928. *Thalassema neptuni* GAERTNER — a British Echiuroid. Ann. Mag. Nat. Hist., Ser. 10, Vol. 2, No. 11, p. 499.
- OSTROUMOV, A. A. 1909. Sur les géphyriens du nord de la mer du Japon. Ann. Mus. Zool. Acad. Sc. St-Petersbourg, T. 14, pp. 319-324.
- PRASHAD, B. 1919. Zoological Results of a Tour in the Far East. Echiuroids from Brackish water, with the description of New species from the Andamans. Mem. Asiat. Soc. Bengal, Vol. 6, pp. 321-338, Pl. XI.
- . 1920. On a New species of *Thalassema* from the Gulf of Manaar with notes on THURSTON's species, *Th. formulosum*. Records of the Indian Museum, Vol. 19, Part 11, No. 8.
- RIETSCH, M. 1886. Étude sur les Géphyriens armés ou Échiuriens. Thèses présentées à la Faculté des Sciences de Paris, Sérir A, No. 81, pp. 1-203, Pls. XVII-XXII.
- SEITZ, PH. 1907. Der Bau von *Echiurus chilensis* (Urechis, n. g.). Zool. Jahrb. Abt.

- Anat., Bd. 24, pp. 323-356.
- SELENKA, E. 1885. Report on the Gephyrea. Challenger Report, Zool., Vol. 13, pp. 1-25, Pls. I-IV.
- SHIPLEY, A. 1898. Report on the Gephyrean Worms, collected by Mr. STANLEY GARDINER at Rotuma and Funafuti. Proc. Zool. Soc. London, Part 3, p. 468.
- . 1899 (1). Notes on a collection of Gephyrean Worms found at Christmas Island by Mr. C. W. ANDREWS. Proc. Zool. Soc. London, Part 1, pp. 54-57.
- . 1899 (2). On a collection of Echiuroids from the Loyalty Island. WILLEY's Zool. Results, Part III, pp. 335-356, Pl. XXXIII.
- . 1902. Echiuroidea. Fauna and Geogr. Maldive Laccadive Archip., Vol. 1, pp. 127-130, Pl. VI.
- SKORIKOV, A. 1905. Eine neue *Echiurus*-Species aus dem Mittelmeer. Zool. Anz., Bd. 29, pp. 217-221.
- . 1909. Subfam. Echiurini, nov. (*Spiroctetor* n. g. pro *Echiurus uncinatus*). Ann. Mus. Zool. Acad. Sc. St-Petersbourg, T. 14, pp. 77-102, Pl. I.
- SLUITER, C. 1883. Beiträge zu der Kenntniss der Gephyreen aus dem Malayischen Archipel. Naturkundig Tijdschrift voor Nederlandsch Indie, Bd. 43, pp. 1-65, Pl. I-III.
- . 1888. Über zwei merkwürdige Gephyreen aus der Bai von Batavia. Naturkundig Tijdschrift voor Nederlandsch Indie, Bd. 48, pp. 233-248, Pls. I-III.
- . 1898. Gephyreen von Süd-Africa, nebst Bemerkungen über *Sipunculus indicus* PETERS. Zool. Jahrb., Abt. Syst., Bd. 11, pp. 442-450.
- . 1900. Gephyriens provenant des campagnes de l'Hirondelle et du la Princesse-ALICE (1886-1897). Résult. des Campag. Sc. d. Pr. de Monaco, Fasc. 15, p. 18.
- . 1902. Die Sipunculiden und Echiuriden. Siboga Expedition, Bd. 25, pp. 46-49, Pl. IV.
- . 1912. Gephyriens provenant des Campagnes de la Princesse-ALICE (1898-1910). Résult. des Campag. Sc. d. Pr. de Monaco, Fasc. 36, pp. 23-25, Pl. I.
- SOUTHERN, R. 1913. Gephyrea of the Coasts of Ireland. Fisheries Ireland Sci. Invest. 1912. No. 3, pp. 1-46, Pls. I-IV.
- SPENGLER, J. W. 1879. Über die Organisation des *Echiurus pallasii*. Zool. Anz. Bd. 2, p. 542.
- . 1880. Beiträge zur Kenntniss der Gephyreen. II. (Die Organisation des *Echiurus pallasii*.) Zeit. Wiss. Zool., Bd. 34, p. 460.
- . 1912 (1). Beiträge zur Kenntnis der Gephyreen. III. (Zum Bau des Kopflappens der armaten Gephyreen.) Zeit. Wiss. Zool., Bd. 101, pp. 342-385.
- . 1912 (2). Beiträge zur Kenntniss der Gephyreen. IV. (Revision der Gattung *Echiurus*.) Zool. Jahrb. Abt. Syst., Bd. 33, pp. 173-212.
- . 1912 (3). Über den Hautmuskelschlauch gewisser *Thalassema*-Arten und seine Bedeutung für die Systematik dieser Tiere. Verh. Deutsch. Zool. Ges. Vers. 22, pp. 309-317.
- TEN BROEKE, A. 1925. Bijdragen tot de Kenntnis der Fauna van Curacao. Resultaten einer Reis van Dr. C. J. VAN DER HORST in 1920. Westindische Sipunculiden und Echiuriden. Bijdrag. Dierkd. Afl. 24, pp. 81-96, Text-figs. 1-25.

- THÉEL, H. 1906. Northern and Arctic Invertebrates in the Collection of the Swedish State Museum. II. Priapulids, Echiurids etc. Kungl. Svensk. Vet-Akad. Handl., Bd. 40, No. 4, pp. 1-26, Pls. I-II.
- WHARTON, L. D. 1913. A Description of some Philippine Thalamemae with a Revision of the Genus. Phil. Jour. Sc., Vol. 8, pp. 243-270, Pls. I-II, Text-figs. 1-8.
- WILLEMOES-SUHM, R. VON. 1876. Briefe an C. TH. SIEDOLD von R. VON. WILLEMOES-SUHM vii. Zeit. Wiss. Zool. Bd. 27, p. 102.
- WILSON, C. B. 1900. Our north-american Echiuroids. Biol. Bull., Vol. 1, No. 4, pp. 163-178, Pl. I.