A. THE OLIGOCHÆTA OF INDIA, NEPAL, CEYLON, BURMA AND THE ANDAMAN ISLANDS.

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INTRODUCTION.

The present memoir is based mainly on the extensive collection made by the officers and friends of the Indian Museum, Calcutta, and entrusted to me for examination by Dr. N. ANNANDALE, the Superintendent of that institution. I have supplemented the study of this collection by examining smaller ones belonging to the Museum für Naturkunde in Berlin and the Musée d'Histoire Naturelle in Paris. Preliminary descriptions of the new species included in the three collections have been already published in the " Mitteilungen aus dem Naturhistorischen Museum in Hamburg," vol. xxiv, 1907.

Our former knowledge of the oligochæte fauna of India was of a somewhat sporadic character, but the rich materials referred to enable me to give a more complete picture of it. There remain, it is true, rather large districts from which we know nothing or very little about the Oligochæta, especially in the central and western parts of the Indian Empire. Indeed, it does not seem impossible that a further investigation will lead to unexpected results. On the whole, however, we may now be sure as regards the principal characters of this interesting fauna and are justified in drawing conclusions as to its distribution and as to the geological history on which this distribution depends.

I.—GENERAL CONSIDERATIONS.

LIMITS OF THE TERRITORY DISCUSSED.

As regards the limits of the territory dealt with in this memoir; they are determined in the first instance by the *provénance* of the specimens entrusted to me by Dr. ANNANDALE. All these specimens were collected in British India (including Burma and the Andamans), Nepal or Ceylon. The fact that the territory included within these limits does not represent a uniform whole will not interfere with the unity of the treatise, for the Indian fauna is not uniform in itself but is scattered through several faunistic provinces, which are not altogether confined within the political boundaries of the Indian Empire and Ceylon. By including the adjacent islands and countries in my survey I will, however, be better able to describe the Indian provinces and make their relations with the neighbouring faunistic regions more clear.

SYSTEMATIC LIST OF THE OLIGOCHÆTA OF INDIA, NEPAL, CEYLON, BURMA AND THE ANDAMAN ISLANDS.

In the following table I present a complete systematic list of all the species known from India, Nepal, Ceylon, Burma and the Andaman Islands, including those in the recently examined collections. To this list, which forms the first column in the table, I have added four other columns. The second indicates the memoir containing the best description of the species; the third gives the locality of the species within the region discussed; the fourth notes the further distribution of the species and the further endemic occurrence of the genus beyond the limits of the region; while the fifth and last contains notes on the biological characters of the genus and on the general faunistic characters of the species. The endemic localities of the terrestrial, not of the limnic and littoral species, are printed in antique type; this is also the case in the fourth column as regards the endemic localities of the genera that possess endemic terrestrial species in the region:—

Systematic List of the Oligochæta of India, Nepal, Ceylon, Burma and the Andaman Islands.	Literature containing the best description of the species.	Localities of the species in this region.	Further distribution of the genera and of the species.	Biological character of the genera and faunistic character of the species.
FAM. ÆOLOSOMATIDÆ.				
GEN. ÆOLOSOMA	....	....	S. and N. America, N. Africa, Europe.	Limnic.
A. (aff.?) *headleyi*, BEDD.	F. E. BEDDARD, in P.Z.S., 1888, p. 217, t. 12.	Punjab, Lahore	....	Widely distributed.
GEN. PLEUROPHLEPS	....	....	C. America	Limnic.
P. ternaria (SCHMARDA)	L. SCHMARDA, Neue wirbell. Th., i, 2, p. 17, t. 17, f. 153 (*Æolosoma t.*).	Ceylon, Galle	....	? Doubtful species.
FAM. NAIDIDÆ.				
GEN. CHÆTOGASTER	....	....	N. America, Europe, C. Siberia.	Limnic.
Ch. bengalensis, ANNANDALE.	N. ANNANDALE, in J.P. Asiat. S. Bengal, N.S., i, p. 117, f.	Bengal, Calcutta	....	Endemic.
Ch. limnæi, K. BAER	F. VEJDOVSKY, in Syst. Morph. Olig., p. 36, t. 6, f. 16–18.	W. Himalayas, Kumaon distr.	N. America, Illinois; Europe.	Widely distributed.
Ch. pellucidus, STEPHENSON.	J. STEPHENSON, in Rec. Indian Mus., vol. i p. 237.	Punjab, Lahore	....	Endemic.
Ch. punjabensis, STEPHENSON.	J. STEPHENSON, *ibid.*, p. 133, t. 5, f. 1–11.	Punjab, Lahore	....	Endemic.
Ch. spongillæ, ANNANDALE	N. ANNANDALE, J. P. Asiat. S. Bengal, N. S., ii, p. 187.	Bengal, Calcutta	....	Endemic.
Ch., sp.	N. ANNANDALE, *ibid.*, p. 189, f. *B.*	Bengal, Calcutta	....	Endemic.
GEN. BRANCHIODRILUS	....	....	None	Limnic.
B. semperi (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxi, p. 83, t. 12 (*Chætobranchus s.*)	S. India, Madras	....	Endemic.
GEN. NAIS	....	....	N. and S. America, Europe, E. Africa, Kerguelen Isl., Asia.	Limnic.

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N. elinguis, MÜLL., Oerst	É. PIGUET, in R. suisse Zool., xiv, p. 241, t. 10, f. 8; t. 11, f. 8–13; t 12, f. 10.	Bengal, Calcutta; Punjab, Lahore.	N. and S. America, Europe, Kerguelen Isl.	Very widely distributed.
N. obtusa (GERVAIS)	É. PIGUET, *ibid.*, p. 234, t. 10, f. 2–4; t. 11, f. 5; t. 12 f. 8.	Bengal, Calcutta; United Prov., Lucknow.	Europe, C. Siberia	Widely distributed.
N. paraguayensis MICHLSN.	W. MICHAELSEN, in Zoologica, 44, p. 354, f. (see below).	Bengal, Calcutta; Bihar, Mozaffarpur distr.	E. Africa, S. America	Widely distributed.
GEN. AULOPHORUS	....	....	N. and S. America, West Indies, Europe, E. Africa, S. Asia, Sunda Isl.	Limnic.
A. tonkinensis (VEJD.)	W. MICHAELSEN, in Zoologica, 44, p. 353 (*Dero t.*).	W. Himalayas, Kumaon distr.; United Prov., Lucknow; Bengal, Calcutta: (Ceylon, Galle ?)	Tonkin, Java	Somewhat widely distributed.
GEN. RIPISTES	....	....	Europe, C. Asia	Limnic.
R., sp.	N. ANNANDALE, in J. P. Asiat. S. Bengal, N. S. ii, p. 188 (*Pterostylarides sp.*) (see below).	Bengal, Calcutta.	....	....
GEN. SLAVINA	....	....	N. America, Europe	Limnic.
S. appendiculata (UDEK.)	É. PIGUET, in Rev. suisse Zool., xiv, p. 282, t. 12, f. 20.	Bengal, Calcutta	N. America, Illinois; Europe.	Widely distributed.
GEN. PRISTINA	....	....	Cosmopolitan	Limnic.
P. æquiseta, BOURNE, f. *typica*.	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxii, p. 352 (*P. equiseta*).	Bengal, Calcutta	S. America, Europe, E. Africa, Java.	Very widely distributed.
var. *paraguayensis*, MICHLSN.	W. MICHAELSEN, in Zoologica, 44, p. 360 (*P. proboscidæ* var. *p.*) (see below).	Bengal, Calcutta	S. America	Widely distributed.
P. breviseta, BOURNE	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxii, p. 353, t. 27, f. 11–15.	S. India, Madras	....	Endemic.
P. proboscidea, BEDD, f. *typica*.	W. MICHAELSEN, in Zoologica, 44, p. 359.	Bengal, Calcutta	....	Widely distributed.
P. tentaculata (PIGUET)	É. PIGUET, in Rev. suisse Zool., xiv, p. 219.	Bengal, Calcutta	....	Widely distributed.
P. longiseta, Ehrbg., f. *typica*	É. PIGUET, in Rev. suisse Zool., xiv, p. 290, t. 10, f. 22, 23; t. 12, f. 21–25 (see below).	Bengal, Calcutta	Europe, E. Africa	Widely distributed.
FAM. TUBIFICIDÆ.				
GEN. BOTHRIONEURUM	....	....	S. America, Europe	Limnic.
B. iris, BEDD.	F. E. BEDDARD, in P. Z. S., 1901, p. 81 (*Bothrioneuron i.*) (see below).	E. Himalayas, Darjiling distr.	Malay Peninsula, Siamese Malaya.	Somewhat widely distributed.
FAM. ENCHYTRÆIDÆ.				
? GEN. HENLEA	....	....	....	Amphibious.
H. (?) *lefroyi*, BEDD.	F. E. BEDDARD, in P. Z. S., 1905, ii, p. 562.	India	....	Genus uncertain, sp. belonging to *Marionina* or *Lumbricillus* ?

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FAM. MONILIGASTRIDÆ.				
GEN. DESMOGASTER	....	....	Sumatra, Borneo	Terrestrial.
D. doriæ, ROSA.	D. ROSA, in Ann. Mus. Genova, xxix, p. 369, t. 12, f. 2–11.	Burma, Carin Cheba	....	Endemic.
GEN. EUPOLYGASTER	....	....	Sumatra, Borneo	Terrestrial.
E. browni, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 143 (see below).	Burma, S. Ilsweni State.	....	Endemic.
E., sp.	D. ROSA, in Ann. Mus. Genova, xxix, p. 380.	Burma, Pegu	....	?
GEN. DRAWIDA	....	....	None	Terrestrial.
D. barwelli (BEDDARD)	F. E. BEDDARD, in Ann. Mag. Nat. Hist., ser. 5, xvii, p. 94, t. 2, f. 4–6 (*Moniligaster b*).	Burma, Carin Padaung.	Philippines	Peregrine.
D. bournei (MICHLSN.)	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 167 (*Moniligaster b.*)	Ceylon, Kandy, Colombo, Western Prov.	....	Endemic.
D. burchardi, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xix, p. 7 (see below).	S. Andaman Isl.	Sumatra	Somewhat peregrine.
D. chlorina (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 364, t. 23, f. 5 (*Moniligaster ch.*).	S. India, Nilgiri Hills.	....	Endemic.
D. frederici (MICHLSN.)	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 169 (*Moniligaster f.*).	Ceylon, Trincomalee	....	Endemic.
D. grandis (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 307, t. 22, t. 24, t. 25, f. 27 ; t. 26, f. 31–34, 37–41 ; t. 27, t. 28 (*Moniligaster g.*).	S. India, Nilgiri Hills.	....	Endemic.
D. minuta (BOURNE)	A. G. BOURNE, *ibid.*, p. 372, t. 23, f. 13 (*Moniligaster m.*).	S. India, Salem	....	Endemic.
D. naduvatamensis (BOURNE)	A. G. BOURNE, *ibid.*, p. 361 (*Moniligaster n.*).	S. India, Nilgiri Hills.	....	Endemic.
D. nepalensis, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 146 (see below).	C. Himalayas, Nepal Valley (S. India ?).	....	= *D. uniqua* (BOURNE)? Somewhat peregrine or endemic ?
D. nilamburensis (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 362 (*Moniligaster n.*).	S. India, Nilambur	....	Endemic.
D. parva (BOURNE)	A. G. BOURNE, *ibid.*, p. 371, t. 23, f. 11 (*Moniligaster p.*).	S. India, Nilgiri Hills.	....	Endemic.
D. pauli (MICHLSN.)	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 171 (*Moniligaster p.*).	Ceylon, Trincomalee	....	Endemic.
D. pellucida (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 363, t. 23, f. 3 ; t. 25, f. 30 (*Moniligaster p.*).	S. India, Nilgiri Hills.	....	Endemic.
D. ramnadana, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 145 (see below).	S. India, Madura distr.	....	Endemic.
D. robusta (BOURNE) f. *typica*.	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 366, t. 23, f. 7 (*Moniligaster r.*).	S. India, Nilgiri Hills.	....	Endemic.
sub-sp. *indica* (BENHAM)	W. B. BENHAM, *ibid.*, N. S., xxxiv, p. 363, t. 32, t. 33, f. 8–15 (*Moniligaster indicus*).	S. India, Nilgiri Hills.	....	Endemic.
sub-sp. *ophidioides* (BOURNE).	A. G. BOURNE, *ibid* , N. S., xxxvi, p. 365, t. 23, f. 6, t. 25, f. 28, 29 (*Moniligaster o.*)	S. India, Nilgiri Hills.	....	Endemic.
D. sapphirinoides (BOURNE).	A. G. BOURNE, *ibid.*, p. 366, t. 23, f. 8 ; t. 26, f. 35 ; 36 (*Moniligaster s.*).	S. India, Nilgiri Hills.	....	Endemic.
D. sulcata, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 144, f. 1 (see below).	S. India, Nilgiri Hills.	....	Endemic.

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D. uniqua (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 363, t. 23, f. 4 (*Moniligaster u.*).	S. India, Nilgiri Hills (C. Himalayas ?).	....	=*D. nepalensis* MICHLSN. ? Somewhat peregrine or endemic ?
D. willsi, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 145 (see below).	Central Prov., Bilaspur; Deccan, Hyderabad.	....	=*D. japonica* (MICHLSN.) ? Peregrine in a small or in large degree ?
D. sp. *inquirenda*	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 373, t. 23, f. 13 (*Moniligaster rubra*).	S. India, Salem	....	Endemic ?
GEN. MONILIGASTER	....	....	None	Terrestrial.
M. deshayesi, E. PERR.	E. PERRIER, in N. Arch. Mus Paris, viii, p. 130, t. 4, f. 77–84.	Ceylon	....	Endemic.
M. perrieri, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 146 (see below).	S. India, Palni Hills	....	Endemic.
FAM. MEGASCOLECIDÆ.				
SUB-FAM. MEGASCOLECINÆ.				
GEN. PLUTELLUS	....	....	Australia, Western (and Eastern ?), part of N. America.	Terrestrial.
P. halyi (MICHLSN.)	W. MICHAELSEN, in Zool. Jahrb., Syst., xii, p. 142 (*Megascolides h.*).	Ceylon, Colombo	....	Endemic.
P. indicus, MICHLSN., f. *typica*	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 148 (see below).	S. India, Palni Hills	....	Endemic.
var. *silvestris*, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 149 (see below).	S. India, Palni Hills	....	Endemic.
P. palniensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 149, f. 3 (see below).	S. India, Palni Hills	....	Endemic.
P. sikkimensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 147, f. 2 (see below).	E. Himalayas, British Sikkim.	....	Endemic.
P. singhalensis (MICHLSN.)	W. MICHAELSEN, *ibid.*, xiv, p. 174	Ceylon, Nuwara Eliya.	....	Endemic.
GEN. PONTODRILUS	....	....	Circummundane in the tropical and sub-tropical zone.	Littoral (except one limnic species).
P. insularis (ROSA)	D. ROSA, in Ann. Hofmus. Wien, vi, p. 387, t. 14, f. 11 (*Cryptodrilus i.*).	Ceylon, Belligamme	Aru Islands	Rather widely distributed.
GEN. MEGASCOLIDES	....	....	Australia, Auckland, Western part of North America.	Terrestrial.
M. bergtheili, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 150, f. 4 (see below).	E. Himalayas, British Sikkim.	....	Endemic.
GEN. DIPOROCHÆTA	....	....	Australia, New Zealand, Chatham Isl.	Terrestrial.
D. pellucida (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 13, t. 4, f. 17–32; t. 5, f. 42 (*Perichæta p.*).	Doubtless India or Ceylon.	....	Endemic.
GEN. SPENCERIELLA	....	....	Victoria, Little Barrier Isl. (near Auckland).	Terrestrial.
S. duodecimalis, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 152 (see below).	S. India, Palni Hills	....	Endemic.

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GEN. WOODWARDIA	....	....	Australia	Terrestrial.
W. burkilli, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 152, f. 5 (see below).	Burma, Akyab distr.	....	Endemic.
W. uzeli (MICHLSN.)	W. MICHAELSEN, in Sb. böhm. Ges., 1903, p. 4, f. *A—C* (*Plutellus u.*).	Ceylon, Peradeniya	....	Endemic.
GEN. NOTOSCOLEX	....	....	Australia	Terrestrial.
N. ceylanensis (MICHLSN.)	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 183, t. f. 3 (*Cryptodrilus c.*).	Ceylon, Nuwara Eliya.	....	Endemic.
N. crassicystis (MICHLSN.)	W. MICHAELSEN, *ibid.*, p. 194, t.f. 19, 20 (*Cryptodrilus c.*).	Ceylon, Nuwara Eliya.	....	Endemic.
N. dambullaënsis (MICHLSN.)	W. MICHAELSEN, *ibid.*, p. 181, t.f. 6 (*Cryptodrilus d.*).	Ceylon, Northern Region.	....	Endemic.
N. decipiens (MICHLSN.)	W. MICHAELSEN, *ibid.*, p. 197, t.f. 18 (*Cryptodrilus d.*).	Ceylon, Colombo	....	Endemic.
N. jacksoni (BEDD.)	F. E. BEDDARD, in Q. J. Micr. Sci., N. S., xxxi, p. 467, t. 33, f. 12–14; t. 33 *A* f. 15 –19 (*Deodrilus j.*)	Ceylon, Nuwara Eliya, Trincomalee.	....	Endemic.
N. kræpelini (MICHLSN.)	W. MICHAELSEN, in Mt. Mus. Hamburg, xxi, p. 128 (*Trinephrus k.*).	Ceylon, Central Region.	....	Endemic.
N. sarasinorum (MICHLSN.)	W. MICHAELSEN, *ibid.*, xiv, p. 177, t. f. 14, 15 (*Cryptodrilus s.*).	Ceylon.	....	Endemic.
N. scutarius, MICHLSN.	W. MICHAELSEN, *ibid.*, xxiv, p.153, f. 6 (see below).	S. India, Palni Hills	....	Endemic.
N. trincomaliensis (MICHLSN.)	W. MICHAELSEN, *ibid.*, xiv, p. 188 (*Cryptodrilus t.*).	Ceylon, Northern Region.	....	Endemic.
GEN. PERIONYCHELLA	....	....	Australia	Terrestrial.
P. annandalei, MICHLSN.	W. MICHAELSEN, *ibid.*, xxiv, p. 154, f. 7 (see below)	E. Himalayas, Darjiling distr.	....	Endemic.
P. m'intoshi (BEDD.)	F. E. BEDDARD, in P.Z.S., 1892, p. 687 (*Perionyx macintoshii*).	E. Himalayas, Darjiling distr., or Bengal, Sibpur.	....	Endemic.
P. nainiana, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 155 (see below).	W. Himalayas, Kumaon distr.	....	Endemic.
P. sikkimensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 156 (see below).	E. Himalayas, British Sikkim.	....	Endemic.
P. simlaënsis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 157 (see below).	W. Himalayas, Simla distr.	....	Endemic.
P. variegata, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 158 (see below).	E. Himalayas, British Sikkim.	....	Endemic.
GEN. PERIONYX	....	....	None	Terrestrial or amphibious.
P. arboricola, ROSA	D. ROSA, in Ann. Mus. Genova, xxx, p. 119, t. 1, f. 11.	Burma, Monti Carin	....	Endemic.
P. ceylanensis, MICHLSN.	W. MICHAELSEN, in Sb. böhm. Ges., 1903, p. 6, f. *D*.	Ceylon, Peradeniya	....	Endemic.
P. excavatus, E. PERR.	W. MICHAELSEN, in Mt. Mus. Hamburg, viii, p. 33, t. f. 6 (*P. gruenewaldi*) (see below).	W. and E. Himalayas, Bengal, Burma, Andaman Isl.	Philippines, Malay Archipelago, Cochin China, Siam.	Peregrine.
P. himalayanus, MICHLSN.	W. MICHAELSEN, *ibid.*, xxiv, p. 158 (see below).	E. Himalayas, British Sikkim.	....	Endemic.
P. saltans, BOURNE	A. G. BOURNE, in P.Z.S., 1886, p. 669.	S. India, Nilgiri Hills.	....	Endemic.
P. sansibaricus, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, ix, 1, p. 4, t. 1, f. 1 (see below).	S. India, Palni Hills	Zanzibar	Peregrine.
GEN. LAMPITO	....	....	None	Terrestrial.
L. mauritii, KINB.	W. MICHAELSEN, in Arch. Naturg., lvii, 1, p. 227, t. 8, f. 3 (*Perichæta madagascariensis*).	Punjab, Bengal, C. and S. India.	China, Sunda Isl., Singapore, Minikoy, Seychelle Isl., Mauritius, Madagascar, Zanzibar.	Peregrine.

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L. sylvicola, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 161, f. 9 (see below).	S. India, Palni Hills	....	Endemic.
L. vilpattiensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 160, f. 8 (see below).	S. India, Palni Hills	....	Endemic.
GEN. MEGASCOLEX	....	....	Australia, Norfolk Isl.	Terrestrial.
M. acanthodriloides, MICHLSN.	W. MICHAELSEN, *ibid.*, xiv, p. 235, t. f. 9, 10.	Ceylon, Peradeniya	....	Endemic.
M. brachycyclus (SCHMARDA.)	W. MICHAELSEN, *ibid.*, xiv, p. 239, t. f. 28, 29.	Ceylon, Ratnapura	....	Endemic.
M. cæruleus, TEMPLET.	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxii, p. 49, t. 6–9 (*M. cæruleus*).	Ceylon, Kandy, Peradeniya, Nuwara Eliya.	....	Endemic.
M. ceylonicus (BEDD.)	F. E. BEDDARD, in Ann. Mag. N. Hist., ser. 5, xvii, p. 89, t. 2, f. 1–3 (*Perichæta ceylonica*).	Ceylon	....	Endemic.
M. cingulatus (SCHMARDA)	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 229, t. f. 7, 8.	Ceylon, near Badulla	....	Endemic.
M. fanis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 210, t. f. 1, 2 (see below).	Ceylon	....	Endemic.
M. hendersoni, MICHLSN.	W. MICHAELSEN, *ibid.*, xxiv, p. 162, f. 10 (see below).	S. India, Palni Hills.	....	Endemic.
M. imperatrix (BOURNE)	A. G. BOURNE, in Q. J. Micr. Sci., N. S., xxxvi, p. 12, f. 2, t. 4, f. 33, t. 5, f. 34–41 (*Mahbenus i.*).	Probably India or Ceylon.	....	Endemic, locality questionable.
M. konkanensis, FEDARB	S. FEDARB, in J. Bombay S., xi, p. 434, t. 2, f. 1, 6–8, 10.	S. India, Travancore; S.-W. India, Konkan.	....	A little peregrine.
M. leucocyclus (SCHMARDA).	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 215, t. f. 4.	Ceylon, Kandy, Nuwara Eliya.	....	Endemic.
M. longiseta, MICHLSN.	W. MICHAELSEN, *ibid.*, xxiv, p. 163 (see below).	Ceylon, Nuwara Eliya	....	Endemic.
M. lorenzi, ROSA	D. ROSA, in Att. Acc. Torino, xxix, p. 5, t. f. 4.	Ceylon, Kandy	....	Endemic.
M. multispinus, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 221, t. f. 17.	Ceylon	....	Endemic.
M. nureliyensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 232, t. f. 12, 13.	Ceylon, Nuwara Eliya.	....	Endemic.
M. pharetratus, ROSA	D. ROSA, in Atti. Acc. Torino, xxix, p. 3, t. f. 1–3.	Ceylon, Kandy	....	Endemic.
M. sarasinorum, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 224, t. f. 5.	Ceylon, Northern Region.	....	Endemic.
M. schmardæ, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 208, t. f. 30, 31.	Ceylon, Ratnapura	....	Endemic.
M. singhalensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 227, t. f. 16, 17.	Ceylon, Nuwara Eliya.	....	Endemic.
M. templetonianus, ROSA	D. ROSA, in Boll. Mus. Torino, vii, nr. 131, p. 1.	Ceylon, Colombo	....	Endemic.
M. varians, MICHLSN. f. *typica*.	W. MICHAELSEN, in Mt. Mus. Hamburg, xiv, p. 201, t. f. 24, 25.	Ceylon, Nuwara Eliya.	....	Endemic.
var. *simplex*, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 207, t. f. 23.	Ceylon, Nuwara Eliya.	....	Endemic.
M. zygochætus, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 199, t. f. 21, 22.	Ceylon, Ratnapura	....	Endemic.
GEN. PHERETIMA	....	....	Malay Archipelago as far as Solomon Isl. (or New Hebrides, or Samoa or Tahiti ?), Philippines, Japan, S.-E China, Siam, Malay Peninsula (Queensland ?) , (Comoren Isl. ?) [See *Ph. heterochæta* (MICHLSN.)]	Terrestrial (except one limnic species).
Ph. alexandri (BEDD.)	F. E. BEDDARD, in P. Z. S., 1900, p. 998, f. 1, 2*b*, 3*b* (*Amyntas A.*).	Bengal, Calcutta		= *Ph. heterochæta* (MICHLSN.) ? Endemic or largely peregrine ?

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Ph. andersoni, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 166, f. 13 (see below).	Burma, Amherst	....	Endemic.
Ph. anomala, MICHLSN.	W. MICHAELSEN, *ibid.*, xxiv, p. 167, f. 14 (see below).	Bengal, Calcutta	....	Endemic ? out of Botanical Garden.
Ph. andamanensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 164 (see below).	S. Andaman Isl., North Cinque Isl.,	....	Endemic.
Ph. birmanica (ROSA)	D. ROSA, in Ann. Mus. Genova, xxvi, p. 164, t. 3, f. 7–9 (*Perichæta b.*).	Burma, Bhamo	....	Endemic.
Ph. biserialis (E. PERR.)	W. MICHAELSEN, in Abh. Semkenb. Ges., xxi, p. 226 (*Perichæta b.*).	Sind, Deccan, Ceylon.	Philippines, Sumatra, Madagascar, Surinam, West Indies.	Peregrine.
Ph. bournei (ROSA)	D. ROSA, in Ann. Mus. Genova, xxx, p. 110, t. 1, f. 3–5 (*Perichæta b.*).	Burma, Monti Carin	....	Endemic.
Ph. burliarensis (BOURNE)	A. G. BOURNE, in P. Z. S., 1886, p. 667 (*Perichæta b.*).	S. India, Nilgiri Hills.	[See *Ph. rodericensis* (GRUBE)].	= *Ph. rodericensis* (GRUBE)?, endemic or peregrine ?
Ph. carinensis (ROSA)	D. ROSA, in Ann. Mus. Genova, xxx, p. 107, t. 1, f. 1, 2 (*Perichæta c*).	Burma, Monti Carin	....	Endemic.
Ph. feæ (ROSA)	D. ROSA, *ibid.*, xxvi, p. 161, t. 3, f. 1–6 (*Perichæta f.*).	Tenasserim, Kokareet.	....	Endemic.
Ph. hawayana (ROSA), f. *typica*.	D. ROSA, in Ann. Hofmus. Wien, vi, p. 396, t. 14, f. 7, 9 (*Perichæta h.*) (see below).	E. Himalayas, Darjiling distr.	Hawayi Isl., China, S. America, Bermuda Isl.	Peregrine.
sub.-sp. *barbadensis* (BEDD.).	W. MICHAELSEN, in Arch. Naturg. lviii 1, p. 227 (*Perichæta pallida*) (see below).	Punjab, Lahore; E. Himalayas, Dehra Dun.	West Indies, S. America, Tenerife	Peregrine.
Ph. heterochæta (MICHLSN.)	W. MICHAELSEN, in Abh. Ver. Hamburg, xi, 2, p. 6 (*Perichæta h.*).	W., C. and E. Himalayas, S. India, Ceylon.	Hawayi Isl., Japan, Sunda Isl., New Caledonia, Madagascar, Europe, Azore Isl., N. America, Columbia.	Peregrine.
Ph. houlleti (E. PERR.).	E. PERRIER, in N. Arch. Mus. Paris, viii, p 99, t. 2, f. 31–44, t. 3 (*Perichæta h.*).	W. Himalayas, Bengal, Ceylon, Burma.	Philippines, Cochin China, Sunda Isl., Madagascar.	Peregrine.
Ph. peguana (ROSA)	D. ROSA, in Ann. Mus. Genova, xxx, p. 113, t. 1, f. 6–8 (*Perichæta p.*).	Burma, Rangoon	Penang, Siam	Somewhat peregrine.
Ph. osmastoni, MICHLSN.	M. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 163, f 11 (see below).	S. Andaman Island	....	Endemic.
Ph. posthuma (L. VAILLANT)	E. PERRIER, in N. Arch. Mus. Paris, vii, p. 106, t. 4, f. 66 (*Perichæta affinis*).	Bihar, Pusa; Bengal Rajmahal, Rajshahi, Calcutta, Sibpur, Saraghat, Comillah, etc.	Malay Archipelago and Peninsula, Cochin China, Philippines, Bahama Island.	Peregrine.
Ph. quadragenaria (E. PERR.)	E. PERRIER, *ibid.*, viii, p. 122, t. 4, f. 69 (*Perichæta qu.*).	India	....	Endemic ? species questionable.
Ph. suctoria, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 165, p. 12 (see below).	Andaman Island	....	Endemic.
Ph. taprobanæ (BEDD.)	W. MICHAELSEN, *ibid.*, xiv, p. 243, t. f. 26 (*Perichæta pauli*).	Ceylon, Peradeniya	Madagascar	Peregrine.
Ph. travancorensis (FEDARB)	S. FEDARB, in J. Bombay S., xi, p. 435, t. 2, f. 2, 5 (*Perichæta t.*) and in P.Z.S. 1898, p. 447, f. 2 (*Perichæta crescentica*).	W. Himalayas, Dehra Dun, S. India, Travancore.	[*Ph. dubia* (Horst), Sumatra.]	= *Ph. dubia* (Horst)?, peregrine, at least in a small, perhaps in a larger degree.
Ph. violacea (BEDD.)	F. E. BEDDARD, in Monogr. Oligoch., p. 207 (*Perichæta v.*) (see below).	Deccan, Hyderabad	Penang, West Indies	Peregrine.

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SUB-FAM. OCTOCHÆTINÆ.				
GEN. OCTOCHÆTUS	....	....	New Zealand	Terrestrial.
O. aitkeni (FEDARB)	S. FEDARB, in J. Bombay S., xi, p. 432, t. 1, f. 1–5, 7 (*Benhamia a.*).	S. India, Travancore	....	Endemic.
O. beatrix, BEDDARD	F. E. BEDDARD, in Ann. Mag. N. Hist., ser. 7, ix, p. 456.	Bengal, Calcutta	....	Endemic.
O. fermori, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 171 (see below)	Bengal, Burdwan distr.	....	Endemic.
O. hodgarti, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 172 (see below).	C. Himalayas, Nepal Valley.	....	Endemic.
O. maindroni, MICHLSN., f. *typica*.	W. MICHAELSEN, *ibid.*, p. 168, f. 15 (see below).	S. India, Gingi	....	Endemic.
var. *chaperi*, MICHLSN	W. MICHAELSEN, *ibid.*, p. 169 (see below).	S. India, Karur	....	Endemic.
O. pattoni, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 170, f. 16 (see below).	S. India, Madras	....	Endemic.
O. phillotti, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 169 (see below).	Deccan, Hyderabad	....	Endemic.
O. thurstoni, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 173, f. 17 (see below).	S. India, Madras	....	Endemic.
GEN. HOPLOCHÆTELLA	....	....	New Zealand	Terrestrial.
H. stuarti (BOURNE)	A. G. BOURNE, in P. Z. S., 1886, p. 667 (*Perichæta s.*).	S. India, Shevaroi Hills.	....	Endemic.
GEN. EUTYPHOEUS	....	....	None	Terrestrial.
E. andersoni, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 185, f. 28 (see below).	Bengal, Rajshahi	....	Endemic.
E. annandalei, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 174, f. 18 (see below).	W. Himalayas, Kumaon distr.	....	Endemic.
E. bastianus, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 183, f. 27 (see below).	United Prov., Basti distr.; Bihar, Sirsiah.	....	Endemic.
E. bengalensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 183 (see below).	Bengal, Saraghat	....	Endemic.
E. chittagongianus, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 181, f. 25 (see below).	Bengal, Chittagong distr.	....	Endemic.
E. comillahnus, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 187, f. 30 (see below).	Bengal, Chittagong distr.	....	Endemic.
E. foveatus (ROSA)	D. ROSA, in Ann. Mus. Genova, xxix, p. 389 (*Typhæus f.*).	Burma, Rangoon	....	Endemic.
E. gammiei (BEDD.)	F. E. BEDDARD, in Q. J. Micr. Sci., N. S., xxix, p. 111, t. 12, f. 1–9; t. 13, f. 1 (*Typhoeus gammii*).	E. Himalayas, Darjiling distr.	....	Endemic.
E. incommodus (BEDD.)	F. E. BEDDARD, in P. Z. S., 1901, i, p. 200, f. 56, 57 (*Typhoeus i.*) (see below).	Bengal, Calcutta	....	Endemic.
E. khani, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 182, f. 26 (see below).	United Prov., Basti distr.	....	Endemic.
E. lævis (ROSA)	D. ROSA, in Ann. Mus. Genova, xxix, p. 388 (*Typhæus levis*).	Burma, Carin Cheba; Ceylon.	....	Somewhat peregrine.
E. masoni (BOURNE)	A. G. BOURNE, in J. Asiat. S. Bengal, lviii, p. 112, t. 3, f. 1–3 (*Typhæus m.*)	W. Himalayas, Dehra Dun.	....	Endemic.
E. nainianus, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 177, f. 21 (see below).	W. Himalayas, Kumaon distr.	....	Endemic.
E. nepalensis, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 176, f. 20 (see below).	E. Himalayas, Little Nepal Valley.	....	Endemic.
E. nicholsoni (BEDD.)	F. E. BEDDARD, in P. Z. S., 1901, i, p. 195, f. 54, 55 (*Typhoeus n.*).	Bengal, Calcutta	....	Endemic.
E. orientalis (BEDD.)	F. E. BEDDARD, in Ann. Mag. N. Hist., ser. 5, xii, p. 219, t. 8, f. 1, 2, 4, 9–12 (*Typhæus o.*).	Bengal, Calcutta; W. Himalayas, Dehra Dun.	....	Somewhat peregrine.
E. quadripapillatus, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 175, f. 19 (see below).	Bengal, Saraghat: Bihar, Mozaffarpur distr.	....	Endemic.

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E. paivai, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 178, f. 23 (see below).	Bihar, Darbhanga distr.	....	Endemic.
E. pharpingianus, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 177, f. 22 (see below).	E. Himalayas, Nepal valley.	....	Endemic.
E. scutarius, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 186, f. 29 (see below).	Bengal, Chittagong distr.	....	Endemic.
E. waltoni, MICHLSN.	W. MICHAELSEN, *ibid.*, p. 179, f. 24 (see below).	Bihar, Darbhanga distr.; United Prov., Fyzabad, Mainpuri.	....	Somewhat peregrine.
SUB-FAM. TRIGASTRINÆ.				
GEN. EUDICHOGASTER	....	....	None	Terrestrial.
E. ashworthi, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xix, p. 14.	C. India, Nagpur distr.	....	Endemic.
E. indica (BEDD.)	F. E. BEDDARD, in P. Z. S., 1896, p. 209, f. 3 (*Benhamia i.*).	W. India, Thana near Bombay.	....	Endemic.
E. parva (FEDARB)	S. FEDARB, *ibid.*, 1898, p. 449 (*Dichogaster parvus*).	W. Himalayas, Dehra Dun.	....	Endemic.
E. poonensis (FEDARB)	S. FEDARB, in J. Bombay S., xi, p. 434, t. 1, f. 10, t. 2, f. 3, 49 (*Benhamia p.*).	W. India, Poona	....	Endemic.
GEN. DICHOGASTER	....	....	C. America, West Indies, Tropical Africa (Celebes ?, Samoa ?).	Terrestrial
D. affinis (MICHLSN.)	W. MICHAELSEN, in Mt. Mus. Hamburg, vii, p. 9, t. 4, f. 20 (*Benhamia a.*).	Ceylon, Peradeniya	Colombia, West Indies, Tropical Africa.	Peregrine.
D. bolaui (MICHLSN.)	W. MICHAELSEN, *ibid.*, viii, p. 9, t. f. 1, 2 (*Benhamia bolavi*).	Ceylon, Peradeniya; Bengal, Sibpur.	S. America, West Indies [Europe], Tropical Africa, Madagascar.	Peregrine.
D parva (MICHLSN.)	W. MICHAELSEN, in D.-O.- Africa, iv, Regenwürmer, p. 31, t. 1, f. 9–11 (*Benhamia p.*).	Ceylon, Peradeniya	Tropical E. Africa	Peregrine.
D. saliens (BEDD.)	W. MICHAELSEN, in Sb. böhm. Ges., 1903, p. 13, f. *F.*	Ceylon, Peradeniya	Penang, Singapore, Java.	Peregrine.
D. travancorensis (FEDARB)	S. FEDARB, in J. Bombay S., xi, p. 433, t. 1, f. 6, 8, 9, 11, 12 (*Benhamia t.*)	S. India, Travancore	....	Endemic (really ?).
SUB-FAM. OCNERODRILINÆ.				
GEN. NEMATOGENIA	....	....	Tropical W. Africa	Terrestrial.
N. panamaënsis (EISEN)	G. EISEN, in P. Calif. Ac., ser. 3, ii, p. 127, t. 9, f. 55–65, 67 (*Ocnerodrilus* (*N.*) *laccuum* (BEDD.), var. *p.*).	Ceylon, Peradeniya	C. America, Tropical W. Africa.	Peregrine.
SUB-FAM. EUDRILINÆ.				
GEN. EUDRILUS	....	....	Tropical Africa	Terrestrial.
E. eugeniæ (KINB.)	F. E. BEDDARD, in P. Z. S., 1887, p. 372, t. 33, f. 1 in the text (*E. sylvicola*).	W. India; Ceylon, Peradeniya, Kandy.	Circummundane in the tropical zone.	Peregrine.
FAM. GLOSSOSCOLECIDÆ.				
SUB-FAM. GLOSSOSCOLECINÆ.				
GEN. PONTOSCOLEX	....	....	West Indies, C. America.	Terrestrial and littoral.
P. corethrurus (Fr. MÜLL.)	E. PERRIER, in Arch. Zool. exper., iii, p. 379, t. 12–17 (*Urochæta corethrura*).	Deccan, S. India; Ceylon.	Nearly circummundane in the tropical zone (Africa excepted).	Peregrine.

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SUB-FAM. MICROCHÆTINÆ.				
GEN. GLYPHIDRILUS	....	....	Tropical E. Africa, Malay Peninsula, Sunda Isl.	Limnic.
G. papillatus (ROSA)	D. ROSA, in Ann. Mus. Genova, xxix, p. 386, t. 12, f. 1 (*Bilimba papillata*).	Burma, Carin Cheba	....	Endemic.
G. (?) sp.	(See below.)	W. Himalayas, Kumaon distr.	....	Endemic ? perhaps a *Callidrilus* ?
FAM. LUMBRICIDÆ.				
GEN. EISENIA	....	....	Eastern N. America, S. Europe, Turkistan.	Terrestrial.
E. fœtida (SAV.)	D. ROSA, in Mem. Acc. Torino, ser. 2, xliii, p. 424 (*Allolobophora [Notogama] f.*)	W. Himalayas, Simla distr.; S. India, Nilgiri and Palni Hills.	Nearly cosmopolitan	Peregrine.
E. rosea (SAV.)	D. ROSA, *ibid.*, p. 424 (*Allolobophora [Notogama] r.*).	Kashmir, Gurez.	Nearly cosmopolitan	Peregrine.
GEN. HELODRILUS	....	....	Eastern N. America, S. Europe, W. Asia, Persia, Turkistan, Japan.	Terrestrial.
H. (Allolobophora) caliginosus (SAV.), f. *typica.*	W. MICHAELSEN, Oligochæta, in Tierreich, Lief. 10, p. 483.	W. Himalayas, Simla distr.	Nearly cosmopolitan	Peregrine.
var. *trapezoides* (A. DUG.)	W. MICHAELSEN, *ibid.*, p. 483	Kashmir; W. Himalayas, Simla distr.; S. India, Nilgiri Hills.	Nearly cosmopolitan	Peregrine.
H. (Bimastus) constrictus (ROSA).	D. ROSA, in Lumbric. Piemonte, p. 38 (*Allolobophora constricta*).	W. Himalayas, Simla distr; S. India, Nilgiri Hills.	Nearly cosmopolitan	Peregrine.
H. (Bimastus) eiseni (LEVINS.).	D. ROSA, in Mem. Acc. Torino, ser. 2, xliii, p. 462 (*Allolobophora e.*).	W. Himalayas, Kumaon distr.	Azores, Madeira, Canary Isl., Europe.	Peregrine.
H. (Bimastus) indicus, MICHLSN.	W. MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 188 (see below).	Bengal, Calcutta	....	Endemic? (really ?).
H. (Bimastus) parvus, EISEN var. ?	G. EISEN, in Öf. Ak. Förh, xxxi, Nr. 2, p. 46, t. 2, f. 9, 10 (*Allolobophora parva*) (see below).	Kashmir, Gorai.	Nearly cosmopolitan	Peregrine.
H. (Dendrobæna) rubidus (SAV.), f. *typica.*	W. MICHAELSEN, Oligochæta, in Tierreich, Lief. 10, p. 490.	W. Himalayas, Kumaon distr.	Nearly cosmopolitan	Peregrine.
f. subrubicunda (EISEN)	D. ROSA, in Lumbric. Piemonte, p. 36, t. f. 1 (*Allolobophora s.*).	W. Himalayas, Simla distr.; E. Himalayas, British Sikkim.	Nearly cosmopolitan	Peregrine.
GEN. OCTOLASINUM	....	....	S. Europe	Terrestrial.
O. lacteum, OERLEY	D. ROSA, *ibid.*, p. 47, t. f. 9 (*Allolobophora profuga*).	W. Himalayas, Simla distr.	Nearly cosmopolitan	Peregrine.
SPECIES INCERTÆ SEDIS ET SPURIÆ.				
Nais albida, CARTER	CARTER, in Ann. Mag. N. Hist., ser. 3, ii, p. 22, t. 3, f. 47, 48.	W. India, Bombay.	....	....
Nais caudata, SCHMARDA	L. SCHMARDA, in Neue wirbell. Th., i, 2, p. 8.	Ceylon, Kandy.	....	....
Nais fusca, CARTER	CARTER, in Ann. Mag. N. Hist., ser. 3, ii, p. 21, t. 2, f. 1–3.	W. India, Bombay.	....	....

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Perichæta hulikalensis, BOURNE.	A. G. BOURNE, in P. Z. S., 1886, p. 668	S. India, Nilgiri Hills.	....	....
Perichæta lawsoni, BOURNE	A. G. BOURNE, *ibid.*, p. 664	S. India, Nilgiri Hills.	....	....
Perichæta viridis, SCHMARDA	L. SCHMARDA, in Neue wirbell. Th., i, 2, p. 13, f. in the text, t. 18, f. 161.	Ceylon, Belligamme.	....	....
Perichæta (Pleurochæta ?) gracilis, BOURNE	A. G. BOURNE, in P. Z. S., 1886, p. 666.	S. India, Nilgiri Hills.	..	....

DETAILED CONSIDERATION OF THE SPECIES IN VIEW OF THEIR BIOLOGICAL AND FAUNISTIC CHARACTERS.

In order to elucidate the more important faunistic features of the Oligochæta, we must first arrange the whole of the genera and species according to their biological characters. As I have stated in previous memoirs, the migrations of nearly allied genera may proceed in totally different directions and on totally different principles, if their biological environment is different. In consequence of this the geographical distribution of allied forms is not the same, if these forms, although united in a single group by morphological characters, have a different biological habit. For instance, the geographical distribution of the littoral genus *Pontodrilus* is quite different from, and not to be compared with, that of the very nearly allied but terrestrial genus *Plutellus*; while the regions to which limnic Oligochætes are restricted are quite different from those of the most closely allied terrestrial forms; for example, the limits of the limnic *Microchætinæ* (Tropical East Africa, India, Burma, Malay Peninsula, and the Sunda Islands) differ from those of the terrestrial *Microchætinæ* (South Africa and Madagascar). We will not get any clear idea of the features of geographical distribution, if we do not separate the species and genera according to biological habit very sharply. The terrestrial Oligochætes have to undergo a further sifting. Naturally they are found living only in very restricted habitats, but many of them are liable to be exported by man and to settle in localities more or less distant from their original home. These "peregrine forms" and their artificial distribution veil in a high degree the characters of the autochthonic distribution which is generally much more simple. On account of peregrine forms it was once possible to impute a circummundane distribution to the genus *Pheretima*, which is really restricted to the Indo-Malayan region. Only on a basis cleared in this manner can we build with sufficient security further conclusions as to the faunistic relations of the Oligochæta and the geological causes of their present distribution.

LIMNIC OLIGOCHÆTES.

The limnic Oligochætes of our region belong mostly to the most archaic families *Æolosomatidæ* and *Naididæ*. Not only the genera of these but also most of their species have a very wide distribution, some of the latter being cosmopolitan or nearly so, as for instance *Chætogaster limnæi*, *Nais elinguis*, *Pristina longiseta* and *P. æquiseta*. Only a few species seem to be more restricted in their distribution, as for instance *Aulophorus tonkinensis*, or are found only in this region, *viz.*, some *Chætogaster* species, *Branchiodrilus semperi* and *Pristina breviseta*. (The genus *Pleurophleps* and its species are far too doubtful to be included in any geographical discussion.) Moreover, as the region in question and the adjacent regions are not yet well studied in respect to limnic forms, we dare not regard these species as endemic. Nor can we characterize any regions by these as a rule widely distributed, nearly cosmopolitan genera.

No better results are given by the study of the Tubificids, which seem to be very scarce in all regions south of the northern temperate zone. They are represented by a species of *Bothrioneurum*, belonging to a genus which has otherwise been found in Europe and South America. The scarcity of Tubificids corresponds with the apparent absence of *Lumbriculidæ*, a family found only in the northern temperate and cold zones and particularly prevalent in Lake Baikal, and with the apparent scarcity of Enchytræids, also prevalent in the more northern zones. If the *species spuria Nais albida*, CARTER, be not an Enchytræid, we know only one Indian species of this family, namely, *Henlea lefroyi*, BEDD. Further, I do not believe that this species really belongs to the genus *Henlea*, but rather believe it to be a *Marionina* or *Lumbricillus*. It is quite uncertain, moreover, whether it should be regarded as endemic or as an imported peregrine species.

The higher families of Oligochætes are represented only by one species in the limnic fauna of our region, probably a species of *Glyphidrilus*, with less probability a *Callidrilus*, certainly a species of *Microchætinæ*. If belonging to *Glyphidrilus*, this species would be a connecting link between the Burmo-Malayan group of this genus and the somewhat isolated species of tropical East Africa. If belonging to *Callidrilus*, it would represent nearer relations only to tropical East Africa.

LITTORAL OLIGOCHÆTES.

We know only one Littoral Oligochæte from our region, *viz.*, *Pontodrilus insularis* (ROSA) from Ceylon. As the genus *Pontodrilus* is circummundane in the warmer zones, its occurrence does not enable us to characterize any special region.

TERRESTRIAL OLIGOCHÆTES.

The terrestrial species represent the bulk of the Oligochætes, and only they provide us with interesting geographical results. But to get at these results we first

have to clear the whole mass, to sift it and separate the peregrine forms from the endemic ones.

The **peregrine forms** are indicated in the above list by their localities being printed in ordinary (roman) type in the second column, as well as the doubtful forms from which they may be distinguished by the statement of their further distribution in the third column, or by the note " peregrine " in the fourth column. As is natural, the tropical genera prevail among the peregrine forms, especially the easily spread species of the phyletically youngest and most energetic genera *Pheretima* and *Dichogaster*. Besides these, we find widely spread in the tropical zone the circummundane species *Nematogenia panamaënsis* (EISEN), *Eudrilus eugeniæ* (KINB.) and *Pontoscolex corethrurus* (Fr. MÜLL.), as well as some less widely distributed wanderers characteristic of the Indian and Oriental region, *viz.*, *Lampito mauritii* (KINB.) and *Perionyx excavatus* (E. PERR.). Other species are peregrine in a less degree, in part not yet denying their original *patria* and being spread only within our region (for instance *Drawida willsi*, MICHLSN., and *Eutyphoeus orientalis* (Bedd.), in part having intruded into neighbouring regions (for instance *Drawida burchardi*, MICHLSN., and *Perionyx sansibaricus*, MICHLSN.).

A somewhat smaller proportion of the peregrine Oligochætes of our list is of northerly origin, belonging to the family *Lumbricidæ* and being endemic in the moderate zone of the northern hemisphere. It is very characteristic that these forms of northern origin are prevalent in the higher regions of the Himalayas. Only a few species of these are found in South India, and here also in the mountainous higher regions, *viz.*, in the Nilgiri and Palni Hills.

The **endemic forms** of terrestrial genera are distinguished in the above list by the localities in the second column being printed in thicker (antique) type, and the further original distribution of those genera which have endemic species in our region is marked by a thicker type in the third column. A first glance into the second column enables us to sift out the groups of terrestrial Oligochætes which are characteristic of our region. These endemic species form three groups of very different size and corresponding to three different families, namely the *Moniligastridæ*, the *Megascolecidæ* and the *Lumbricidæ*, the last being represented by a single apparently endemic species but the *Megascolecidæ* being in general prevalent.

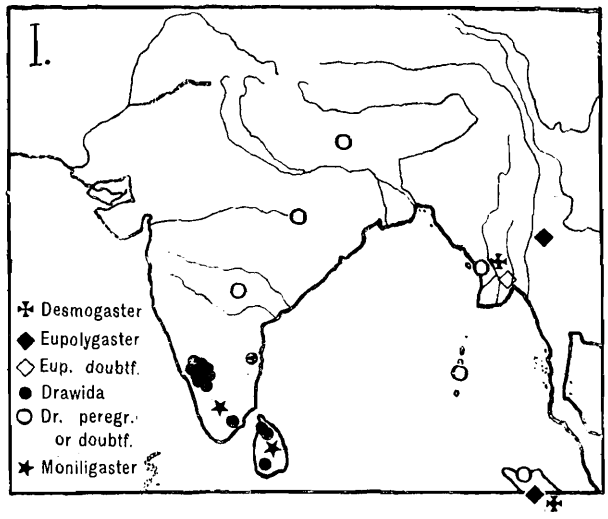
Family *Lumbricidae*.—This family has a great number of endemic species in the southern parts of Europe from Portugal to South Russia and in the adjacent parts of Asia, *viz.*, in Asia Minor, Transcaucasia, Palestine, Syria, Persia (Farsistan and Chusistan at the northern end of the Persian Gulf) and Turkistan. Beside these, there are some outposts endemic in countries apparently rather far distant from this region, *viz.*, some species [*e.g.*, *Eisenia lönbergi* (MICHLSN.)] in the eastern parts of North America (the dominion of the megascolecid sub-family *Diplocardinæ*) and one species [*Helodrilus japonicus* (MICHLSN.)] in Japan belonging to the dominion of the Malayan genus *Pheretima*. The single Indian species, *Helodrilus* (*Bimastus*) *indicus*, MICHLSN., from Calcutta, must be regarded as another outpost. Indeed, the limit of the proper dominion of the *Lumbricidæ*, extending between South Persia

and Eastern Asia towards the locality of *Helodrilus japonicus*, may pass not very far from the locality of *H. indicus*. It would be desirable, however, to ascertain the endemic nature of this species from Bengal, which is not beyond doubt. Indeed, it might as well be a species peregrine in a small degree, imported from the proper dominion of the Lumbricids, which is not far off.

The Indian Lumbricid, even if really endemic in Bengal, in no case influences the faunistic character of this Indian district. It must be regarded as a settler of recent geological date, and of northerly descent.

Family ***Moniligastridae.***—This family is represented by a great number of undoubtedly endemic Indian and Burmese species. The phyletic relations between its four genera have been cleared beyond doubt. The most archaic genus is *Desmogaster*, with a holoandric sexual apparatus. From *Desmogaster* have been derived in two different ways the genera *Eupolygaster* and *Drawida* by a reduction and a dislocation of the sexual apparatus, *Eupolygaster* being protandric and *Drawida* metandric. [The fact of this reduction is confirmed by the study of the new species *Drawida willsi*, MICHLSN., (see below) which still shows rudiments of the last anterior sexual apparatus.] The last genus, *Moniligaster*, is a direct offspring of *Drawida* and nearly allied to it.

The ancestral genus *Desmogaster* is endemic in the eastern part of our region, *viz.*, in Burma, and also in the Great Sunda Islands south of it, in Sumatra and Java. Just the same districts are inhabited by the endemic species of the genus *Eupolygaster*. The other younger phyletic branch of this family, the genera *Drawida* and *Moniligaster*, has a quite different habitat. The bulk of its species, indeed all the undoubtedly en-



demic ones, are found in South India and Ceylon. Only a few species of these generally occur outside of this district; but there is hardly any doubt that these outsiders are wanderers. This is certain as regards *Drawida barwelli* (BEDD.) and *D. burchardi*, MICHLSN., and very probably as regards *D. japonica* (MICHLSN.) (= *D. willsi*, MICHLSN.?) and of *D. bahamensis* (BEDD.), the Bahama Islands surely not being the

original home of any Moniligastrid. As is seen in the above list, some species of *Drawida* occur in the more northerly parts of India. But even these species, extending only a moderately long distance from the proper home of *Drawida*, seem to be peregrine. *Drawida willsi* (peregrine in a large degree, if really identical with *D. japonica*) occurs at the same time in the Deccan and in the Central Provinces. *D. nepalensis*, MICHLSN., on the other hand, is probably identical with *D. uniqua* (BOURNE) from South India. South India and Ceylon, then, are the proper home of the endemic species of *Drawida*. Even if *D. nepalensis* should prove to be endemic in the northern part of India, it could only be regarded as an outpost of southern origin and probably of a very recent geological date. Never has a *Drawida* been found in the large district of Bengal, now so well explored. The proper dominion of *Drawida* and *Moniligaster*, then, is widely separated by the broad Bay of Bengal from the dominion of their ancestor *Desmogaster*. It is at least improbable that the genus *Drawida*, while being derived from *Desmogaster* and on the way to occupying its recent dominion, took the way which in recent times is the only passable one, *viz.*, that across the districts around the Bay of Bengal, across Bengal and the north-eastern parts of India. *Drawida*, so well represented in South India, would have left distinct traces of its once having lived in these districts. There appears no reason why it should have been extirpated here, for instance in Bengal, this district not being the dominion of one of those vigorous phyletically younger forms, like *Pheretima* or the *Lumbricidæ*, which are extirpating nearly all feebler forms that occur in their proper dominions. It is probable that there was in former geological periods another way from the dominion of *Desmogaster* (*i.e.*, from Burma, the Malayan Peninsula and Sumatra) to that of *Drawida*, namely *viâ* Ceylon and South India. This way now is covered by the Bay of Bengal or other parts of the northern Indian Ocean. There are other facts, moreover, which favour the hypothesis of a quite different configuration of land and sea in this part of the world in former geological periods.

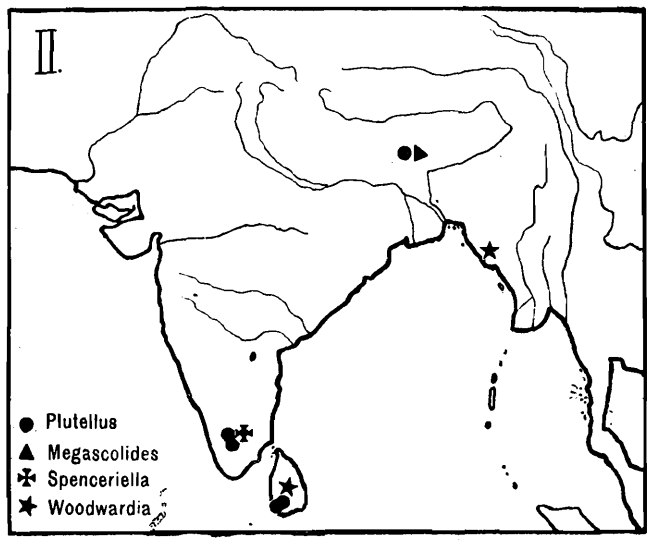
Family *Megascolecidae*.—The pedigree of this large family resembles a much branched tree. Two of the main branches of this tree are represented by endemic species in the region in question. The first of these is identical with the sub-family *Megascolecinæ*, the different parts of the second are placed in two different sub-families, *viz.*, the *Octochætinæ* and *Trigastrinæ*. All these sub-families are derived from the "acanthodriline primordial form" ("*acanthodriline Ur-form*"), which doubtless in its main characters was in accord with the recent genus *Eodrilus* [*Notiodrilus*, *part.*, of former years].

The sub-family *Megascolecinæ* is derived from *Eodrilus* by the intermediate genus *Diplotrema* from Australia, and Australia must be regarded as the headquarters of the phyletically older genera of this sub-family. These older genera spread from the centre (*i.e.*, from Australia) in a centrifugal manner, but to a different extent. Only a few very small side-branches are totally restricted to Australia (*viz.*, the genera *Fletcherodrilus*, *Digaster*, *Perissogaster* and *Didymogaster*, the occurrence of the latter in New Zealand being brought about by a somewhat peregrine species). All the larger

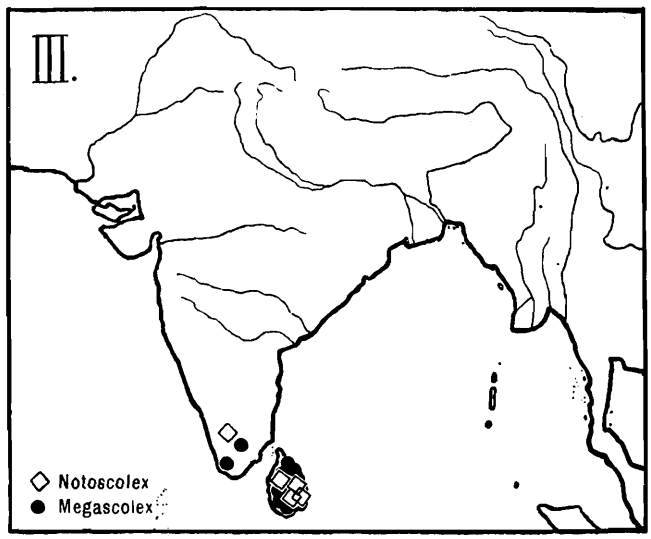
genera of this phyletically older part of the Megascolecine branch have in spreading reached the Indo-Burmese region. The genus *Plutellus* has five species in Ceylon, South India and the Eastern Himalayas ; in another direction it went as far as North America ; it is absent in the direction towards New Zealand. The genus *Megascolides* is represented by a single outpost in the Eastern Himalayas ; in another direction it went as far as North America, while in a third it occupied the North Island of New Zealand. *Diporochæta* is in our region probably represented by one species (*D. pellucida* of BOURNE probably from India) ; in another direction it spread over New Zealand and the Chatham Islands. The genus *Spenceriella* also has only one species in our region, in South India, and is, in the direction of New Zealand, distributed as far as Little Barrier Island near the North Island. *Woodwardia* reaches with two species (one in Ceylon, the other in Burma) into our region, and is for the rest restricted to Australia. The large genus *Notoscolex*, which otherwise, like the foregoing, is restricted to Australia, is represented by a great number of species in our region, by no less than eight in Ceylon and by a ninth in South India. The genus *Megascolex* shows a similar geographical relation and is represented by nineteen species in Ceylon and by two (three ?, the doubtful *M. imperatrix* of BOURNE) in South India. *Megascolex* is on the other hand not totally restricted to Australia, one species being found on Norfolk Island, east of Australia. The nearly allied genera *Perionychella* and *Perionyx* have their headquarters in the Indo-Burmese region, *Perionychella* occurring with five or six species in the Himalayas (one in Bengal ?), *Perionyx* with four endemic species in Burma, the Eastern Himalayas, South India and Ceylon. *Perionyx* is restricted to this region ; the phyletically older *Perionychella* has four species in Australia. The genus *Lampito*, closely allied to *Perionychella*, is restricted, like *Perionyx*, to our region, the only two endemic species occurring in South India. A quite different distribution is shown by the phyletically youngest genus of the *Megascolecinæ*, namely, *Pheretima*, which is derived from *Megascolex*. The headquarters of *Pheretima* is the Malayan Archipelago. It is distributed thence eastwards as far as the Solomon Islands (or as far as the New Hebrides, or Samoa, or Tahiti ?), northwards as far as Japan, East and South China, Siam, Burma and Bengal, eastwards as far as the Andaman Islands and Sumatra (or as far as the Comoro Islands ?), southwards as far as New Guinea (or as far as Queensland ?). As for our region, it is not quite certain how far this genus has invaded it by means of endemic species. *Pheretima* is still prevalent in the Andaman Islands and in Burma. One probably endemic species is found in Bengal (*Ph. anomala*, MICHLSN., from Calcutta). But some other Indian species, for instance *Ph. alexandri* (BEDD.) from Calcutta, are very doubtful. They may be endemic or not : in the former case they are to be regarded only as outposts of a very recent geological date. The proper dominion of *Pheretima* terminates in the northern part of Burma.

The geographical relations of all these genera of *Megascolecinæ* may, without constraint, be arranged in four different categories :—

(1) The phyletically oldest genera *Plutellus*, *Megascolides* (*Diporochæta*), *Spenceriella* and *Woodwardia* (fig. ii in the text), with Australia as their headquarters, are spread, apparently without restriction, over the whole region, without



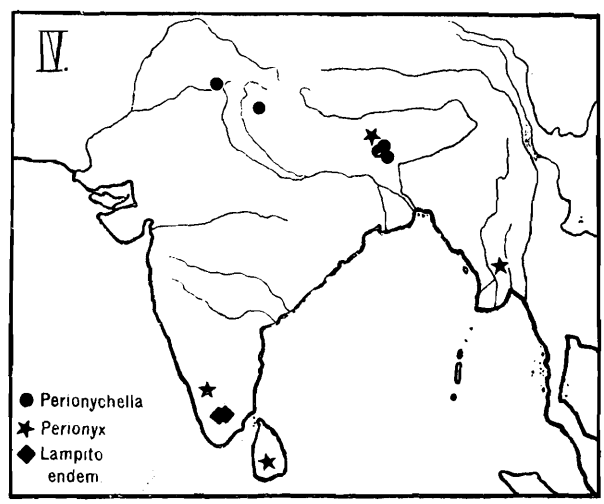
gaining a great importance as to the number of species. At the same time they show a more or less wide distribution in other directions, namely towards North America and New Zealand. But this north-eastward or eastward distribution diminishes in the order of genera from the oldest to the youngest (*Plutellus* and



Megascolides : North America ; *Diporochæta* : Chatham Islands ; *Spenceriella* : Little Barrier Island near the North Island of New Zealand ; *Woodwardia* : Australia).

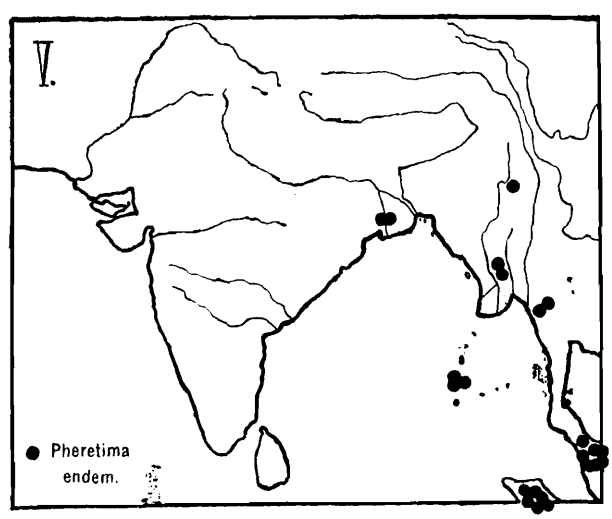
(2) The phyletically intermediate genera *Notoscolex* and *Megascolex* (fig. iii in the text) are, in our region, restricted to Ceylon and South India and on the other hand to Australia.

(3) The side branch consisting of *Perionychella*, *Perionyx* and *Lampito* (fig. iv in the text) shows only in its oldest member relations to Australia, four *Perionychella* species occurring in Victoria and Queensland. On the other hand these genera are restricted to our region, *Perionychella* occupying the Himalayas, *Lampito* South India, and *Perionyx* being spread over the whole region.



Probably this group of genera got its most important development not before having settled in our region, the genera *Perionyx* and *Lampito* having originated within this region from the older *Perionychella*, after its immigration into India.

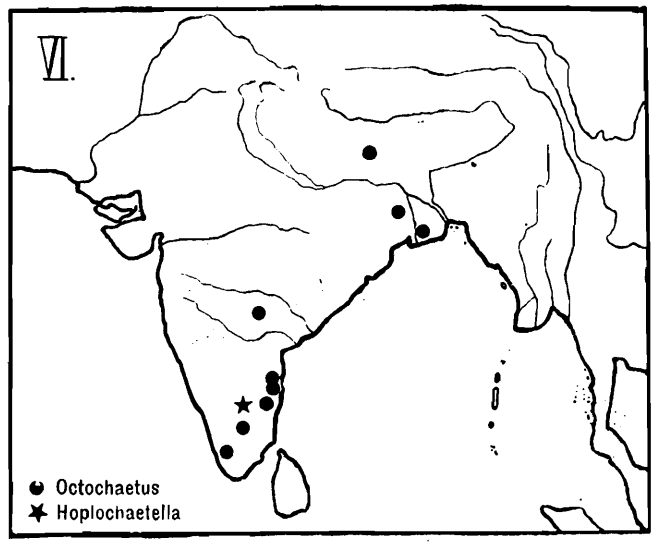
(4) The phyletically youngest genus *Pheretima* (fig. v in the text) enters and occupies Burma and the Andaman Islands, advancing from the centre



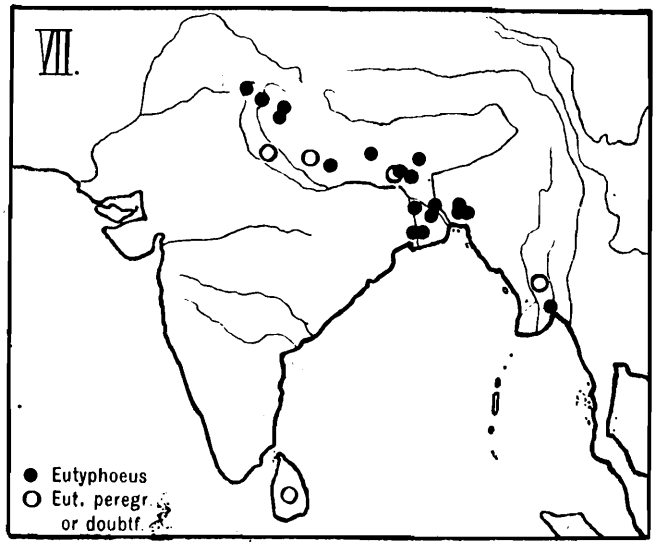
of its Malayan headquarters. Some outposts of this genus have reached Bengal, and perhaps some other localities of the Indian region. On the other hand this genus seems to be restricted to the Malayan archipelago, having a number

of endemic species in New Guinea and the Solomon Islands, but probably not intruding into Australia (*Ph. queenslandica*, FLETCH., from Queensland being somewhat doubtful), certainly not intruding into New Zealand.

The second Megascolecid branch, well represented in our region, is based upon the genus *Octochætus* of the sub-family *Octochætinæ*. A full discussion of the systematic value of the sub-family *Octochætinæ* and of its genera will follow below in the chapter on



"*Octochætinæ*" of the descriptive part. I shall here anticipate the results of that discussion. The phyletically oldest genus of this sub-family, *Octochætus* (fig. vi in the text), is represented by eight endemic species in our region. It occupies a some-



what longitudinal tract which extends from Bengal and the Central Himalayas in a south-western direction to as far as the southern angle of India, leaving free the north-western part of the empire as well as the districts of the Eastern Himalayas and East

Bengal. Outside of this dominion different species of *Octochætus* are found only in New Zealand. Neither Australia nor any other country or island intermediate between these far distant districts presents any *Octochætus*. From *Octochætus* was derived the small genus *Dinodrilus*, found till now only in New Zealand, and from *Dinodrilus* was derived *Hoplochætella*, a small genus found, as well as *Octochætus*, only in New Zealand and India. The single Indian species of this genus lives in the southern part of the *Octochætus* district, namely in the Shevaroi Hills. From *Octochætus* was derived as a second branch the large genus *Eutyphoeus* (fig. vii in the text). This occupies with a great number of species (seventeen or eighteen endemic and some peregrine in a very small degree) the north-eastern part of India, the whole of the Himalayas as far as they have been explored (the extreme eastern part of this chain of mountains is still unexplored) and a small district at its southern base, including almost the whole Province of Bengal. A single isolated, apparently endemic species, probably an outpost of this genus, is found in Burma (Rangoon). Outside of this dominion no *Eutyphoeus* has been found. It therefore appears as if this genus took its full development in this district, having been derived from that part of the genus *Octochætus* which first occupied the Indian dominion, which even now in one part in Bengal is identical with a part of the *Eutyphoeus* district.

We here have then a similar fact as in the distribution of the Megascolecine group *Perionychella*, *Perionyx* and *Lampito*, as the oldest genus shows relations to far distant regions, whilst a younger genus (*Eutyphoeus*) has made its development in the Indian region alone. But the sub-family *Octochætinæ* represents an outward geographical relation quite different from those we observed in other families and sub-families, and in this it differs also from the *Perionychella*-group.

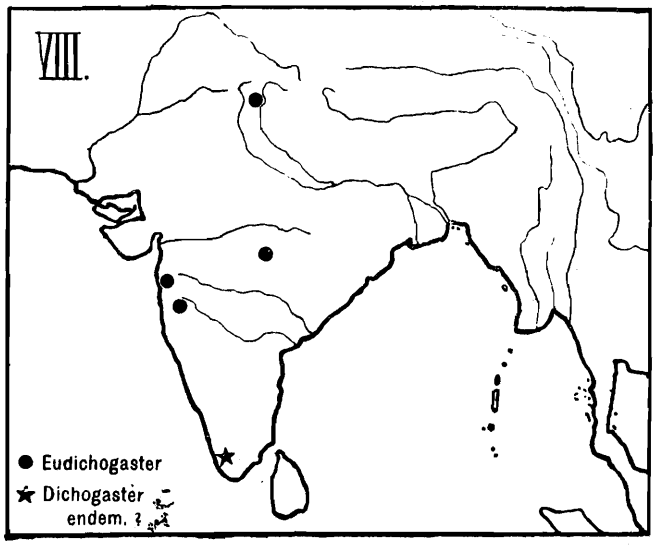
The *Octochætinæ* represent a relation of the Indian region to New Zealand alone, not touching Australia.

I have to mention here another relation of the *Octochætinæ* which, it is true, is a somewhat questionable one. The genus *Howascolex* from Madagascar, somewhat provisionally placed within the sub-family *Acanthodrilinæ*, seems to be allied to the *Octochætinæ*. Perhaps it must even be regarded as the intermediate link between these two sub-families, that is between *Eodrilus* and *Octochætus*. It would be difficult to state whether *Howascolex* represented a geographical relation of Madagascar to New Zealand or to India.

The phyletic relation of the sub-family *Trigastrinæ* (fig. viii in the text) to the sub-family *Octochætinæ* has not been completely cleared.[1] Perhaps *Eudichogaster* is the oldest trigastrine genus and was directly derived from the octochætine genus *Octochætus* by a duplicating of the gizzard. From *Eudichogaster* the large genus *Dichogaster* may be derived by a dislocation of the calciferous glands backwards. *Eudichogaster* is found only in the north-western part of India ; this being just that part of the country which has been left free by the genus *Octochætus*. It almost seems as though the conjectured octochætine ancestor completely changed to *Eudichogaster*

[1] See W. MICHAELSEN, Die geographische Verbreitung der Oligochæten, Berlin, 1903, p. 106.

whilst entering and occupying this north-western district. If *Eudichogaster* really is the ancestor of *Dichogaster*, the north-western district of India on the other hand must be regarded as the focus of distribution of the large genus *Dichogaster*, the headquarters of which is tropical Africa from ocean to ocean, from which region



it finally extends to the West Indies and Central America. Also in India (in Travancore) the genus *Dichogaster* seems to be represented by an endemic species. But as the smaller species of this genus are very apt to be exported by man, we cannot be sure about the endemic nature of this species. An endemic *Dichogaster* in the western part of India indeed would accord very well with the view of an Indian origin of this genus, without being a necessary condition thereof.

The *Trigastrinæ* of India, then, represent probably a relation of the western part of this country to tropical East Africa, India in this case being the older dominion of this phyletic branch and tropical Africa being taken possession of by Indian emigrants.

GEOLOGICAL HISTORY

The endemic terrestrial Oligochætes give us one of the best documents for the geological history of a country. The sea, as well as all deserts, is an insurmountable obstacle to their migration. As these obstacles have changed in different geological periods, the paths of their migration were different in accordance with the periods during which different groups of Oligochætes were in the climax of their migratory capability. Consequently the recent geographical distribution and the relations between the different groups enable us to determine the different paths of the former migrations, and thence the configuration of land and sea in former periods.

It is true that we are not always able to state in what direction a certain migration must have gone. For example *Octochætus* occurs in New Zealand as well as in India, but we cannot say whether it went from New Zealand to India or in the opposite direction, or, indeed, whether it immigrated from a third district, now abandoned, into

both its recent dominions. But we may state that there was once a land bridge between New Zealand and India. In other cases we may even learn from certain facts the direction of a certain migration.

We have to state another premise. If the former track of migration passed through a certain district, we are inclined to look in this district for traces of the migrating genus. The want of traces intermediate between far-separated recent localities does not, however, always permit us to draw the conclusion that the land bridge used by the migrating genus has vanished totally by diving into the sea. In certain cases the genus in question, once occupying a district intermediate between those it now occupies, may have been extirpated in the intermediate district by the appearance of a younger and more vigorous tribe. In the regions here in question one such a younger and vigorous genus occurs, *viz. Pheretima*, phyletically the youngest genus of the *Megascolecinæ*. The species of this genus prove to be of such a vigour of distribution that they have suppressed all terrestrial rivals in their proper dominion and totally extirpated most of them. Indeed, only some scarce *Moniligastridæ* and some scarce species of the nearly allied genus *Plionogaster* have survived in their proper dominion. Besides these we find only a single *Woodwardia* and a single *Perionyx* endemic in the marginal part of their dominion, in Burma; not to speak of the Lumbricid of Japan, *Helodrilus japonicus* (MICHLSN.), which itself belongs to such a vigorous family that it is not surprising that it was able to endure the rivalry of *Pheretima*. In the countries and islands around the dominion of *Pheretima*, namely in New Zealand, Australia, Ceylon and India, we find a great number of phyletically old forms. If a certain genus or sub-family is wanting in a larger district of these countries, we may suppose that it never has occurred here, for none of the genera of these countries has been able to get supremacy over other forms. In these countries we find the most different genera and sub-families living peacefully side by side.

If we now look for the tracks along which foreign terrestrial Oligochætes may have immigrated into the Indian region, or along which Indian Oligochætes may have emigrated to other regions, we have, as stated above, to examine the geographical relations. The principal relations point to a south-eastern direction, towards Australia and New Zealand. But these relations are not uniform. Only some of the phyletically oldest *Megascolecinæ* (the genera *Megascolides*, *Diporochæta* and *Spenceriella*) found their way equally to New Zealand (*Megascolides* and *Spenceriella* only to the North Island of New Zealand) and India, emigrating from their oldest dominion, Australia. Other Oligochætes found a path only between New Zealand and India, avoiding Australia (the *Octochætinæ*), or between Australia and India (*Plutellus*, *Woodwardia*, *Perionychella*, *Notoscolex* and *Megascolex*). The path used by the latter group was not uniform throughout its extent, some of these genera invading only the northern parts of India, *e.g.*, Burma (*Woodwardia*, *Perionychella*); others only the southern part including Ceylon (*Notoscolex*, *Megascolex*). We may draw the conclusion from these facts that the track used by these migrants was no uniform broad land bridge extending between India and Australia + New Zealand in full breadth. The connection between these different regions was of a more complicated figure. There must have been smaller

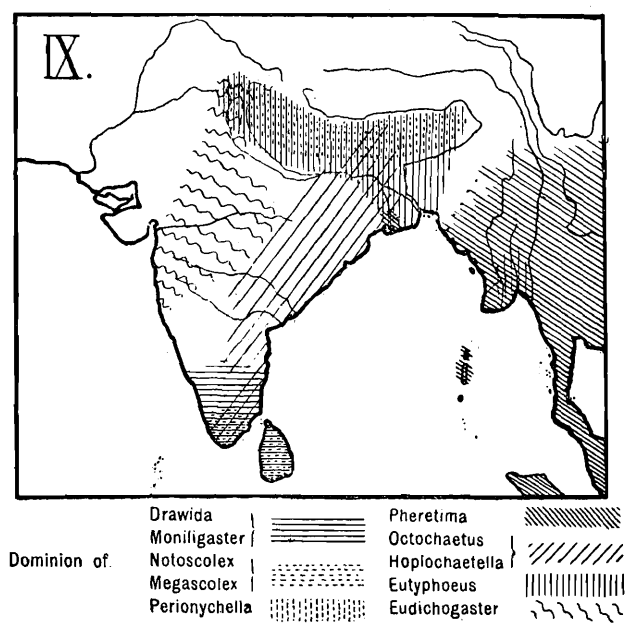
bridges, changing very much in different periods, at one time reaching Australia, at another New Zealand (Australia in the meantime being separated from the land bridge), while the other end once touched North India, at any other period South India without forming in the meantime a connection towards North India. The matter gets even more complex if we now consider also the east-to-west distribution of the Moniligastrids, which suggests a land bridge between the south of India alone and the Malayo-Burmese region, without following the recent track around the northern angle of the Bay of Bengal. There is, in my opinion, only one suitable explanation of this complicated system of different connections—

The different land bridges, interposed between Australia and New Zealand on the one side and India on the other, were formed by an archipelago, resembling the recent Malay Archipelago; the different islands of this old archipelago changing, in the course of geological periods, their outline and their connection with one another, now forming a bridge between two neighbouring islands, now separating the middle part of the former larger island by diving into the sea, the separated parts sometimes again joining with other islands. In their extensive work on the geological history of Celebes, Messrs. SARASIN plead in favour of such changing outline and of a connection between this island and others, constructing different land bridges for the explanation of the complex fauna of these islands.[1] My hypothesis, stated in the above sentence, fully agrees with the results of the SARASINS' study, but demands an amplification thereof. It demands with great stress the supposition that this archipelago once reached very much farther to the west, forming a connection between Australia, New Zealand and India, just as it now is interposed between Australia and South-East Asia. I go further, asserting that—

India itself was divided into a number of islands, once being only the western part of a greater archipelago. The distribution of the endemic terrestrial Oligochætes of India shows clearly that the recent compact mass of land must, in former times, have been divided into isolated provinces; the latter were totally isolated in such a manner that no earthworm was able to cross the intermediate space. This is proved clearly by the sharp separation of the recent provinces of endemic terrestrial Oligochætes, as stated below. (See fig. ix in the text.) We can hardly suppose that these different interspaces between these provinces have been occupied by deserts. Such deserts, indeed, would have been obstacles to the migration of terrestrial Oligochætes. But these interspaces have been too small and somewhat too constant in shorter geological periods to be regarded as deserts. It is much more probable, indeed almost certain, that they have been straits, dividing the land into a number of islands. There must have been a large island in the north—the position of the Himalayas—probably including the whole Province of Bengal. This "North Indian Island" represents the dominion of the genera *Eutyphoeus* and *Perionychella*. Towards the

[1] P. & F. SARASIN, Über die Geologische Geschichte der Insel Celebes auf Grund der Thierverbreitung, Wiesbaden, 1901.

south-east this island was widely separated from the Burmese Province. The immigration of *Pheretima* from Burma into the Himalayan-Bengal Province can be only of very recent date. It has not yet brought about the result of important settlements in Bengal of the genus *Pheretima*, which is so distinctly prevalent in Burma. The scarce occurrences of perhaps endemic *Pheretima* in Bengal (and the Peninsula of India) are not even quite certain. Another great island occupied the southern part of India including Ceylon, the recent dominion of *Drawida*, *Notoscolex*, *Megascolex* and *Lampito*. These genera seem to be restricted totally to the region of this "South Indian Island." Only some feeble outposts, not even certainly endemic, of *Drawida* have been sent northwards. The separation of Ceylon from this South Indian Island must be of a very recent date. We may clearly see even now on the map the former connection between Ceylon and the main part of the formerly greater South



Indian Island. Adam's Bridge is a relic of this former connection. The geographical connection between Ceylon and South India represents in a manner such an occurrence of change in the configuration of land and sea, *viz.*, the dividing of a formerly larger land or island into two parts. There must on the other hand have been a connection between the North Indian Island and the South Indian Island at a far distant period, for the genera *Octochætus* and *Perionyx* occupy both districts and there are other terrestrial Oligochætes which can only have immigrated from the North Island into the South Island, *viz.*, the genus *Lampito*, doubtless derived from *Perionychella*. A third great island may have occupied the western part of India, the dominion of the genus *Eudichogaster*, with questionable connections with tropical Africa. *Eudichogaster* is the only genus that has been found here endemic. But this part of India is not yet explored fully enough. We do better to defer the discussion about this part.

According to these surmises, the Malay Archipelago is only the surviving western part of a formerly greater archipelago, the middle part of which has dived into the sea, whilst the eastern part has consolidated to form the compact Indian land-mass.

The question now is, in what directions the different components of the Indian terrestrial Oligochæte fauna may have used this great archipelago. It is true we have to forego the attempt to delineate these in a precise manner; but we may state some of the more general facts. It is probable that the Moniligastrids have used a path leading directly from the Malay region to the South Indian Island across a bridge now sunk beneath the Bay of Bengal. As stated above, these Oligochætes probably did not use the route through Bengal around the Bay of Bengal. It is probable also that some genera restricted to the South Indian region and showing near relations only to Australia, *viz.*, *Notoscolex* and *Megascolex*, have, at least in part, used a path now sunk beneath the sea. On the other hand, those genera of the North Indian district which show connections with Australia or even with New Zealand alone, have probably used a path across the recent Malayan region. It is true that we have as yet found hardly any relics of these genera, *viz.*, *Perionychella*, *Octochætus* and others, in the Burmo-Malayan region. Perhaps *Woodwardia burkilli*, MICHLSN., from Lower Burma may be regarded as such a relic in the marginal part of this region. Indeed, we can hardly look for more frequent relics in this region, for it is the proper dominion of the vigorous, phyletically youngest Megascolecine genus *Pheretima*, which certainly has extirpated nearly all phyletically older and feebler genera with which it has come in contact. The study of the geographical distribution of earthworms has brought to light cases of such a dispossession or extirpation of older and feebler forms by more vigorous younger ones. The older forms, then, survive only as relics in certain separated localities, mostly islands or districts isolated by deserts, no longer accessible in earlier periods, namely the periods of migration of the more vigorous younger forms.

The northern and western relations of our region now remain to be discussed. The Central Asian region north of India seems to be totally bare of endemic terrestrial Oligochætes. We possess some data as regards Oligochætes from Tibet, and all these refer to peregrine species, doubtless introduced by man. Even in Kashmir, so near to the Western Himalayas, only peregrine Oligochætes seem to occur. Perhaps we have to include also the Punjab in this region devoid of endemic terrestrial Oligochætes. The nearest localities with endemic terrestrial Oligochætes are Persia (Farsistan and Chusistan at the northern angle of the Persian Gulf) and Turkistan. These districts belong to the proper dominion of the family *Lumbricidæ*. It is not quite certain whether the Lumbricid of Bengal, *Helodrilus indicus*, MICHLSN., is really endemic in Calcutta. Perhaps it may prove to be an outpost of the *Lumbricidæ* from the Perso-Turkistan region. In every case this northward connection is a very feeble one. Somewhat more distinct but also not quite certain are the connections of the Western Indian district westwards towards tropical Africa (*Eudichogaster* and a scarce *Dichogaster*, about which we cannot be quite certain, in Western India and the genus *Dichogaster*

prevalent in North-East Africa). But we have no information about the exact path along which these forms may have migrated. The very questionable relation of the Indian region to Madagascar (of *Octochætus* to *Howascolex*) was mentioned above; it would be premature to state any hypothesis as regards it.

RECENT REGIONS AND SUB-REGIONS OF TERRESTRIAL OLIGOCHÆTES.

In my memoir on the geographical distribution of the Oligochætes [1] I defined the different recent regions and sub-regions characterised by certain groups of terrestrial Oligochætes endemic therein. As for the part of the world here in question, I assigned it to three different regions (see the geographical sketch, *l.c.*, p. 154). In this statement Burma and the adjacent parts of East Bengal, as well as the districts north-north-east of it, formed the north-western part of the "*Indo-Malayische Terricolen-Gebiet*," the empire of India with the exception of the said extreme eastern part of Bengal formed the "*Vorderindische Terricolen-Gebiet*," divided into two sub-regions, a broader northern one and a small southern one, and finally Ceylon, the small "*Ceylonische Terricolen-Gebiet.*" The present study of the Indian Oligochæte fauna requires an amendment of these limitations. The error in the latter is principally based on the incompleteness of BOURNE'S faunistic studies. BOURNE described a great number of *Drawida* species from South India, but only very few species of other genera. Just those genera which South India shares with Ceylon were neglected by BOURNE. Consequently the known Oligochæte-fauna of South India assumed quite a distorted appearance. It must be said that this was no fault of BOURNE'S, for he expressly stated that he had studied and published only part of all his material, and that there were many representatives of other genera in his collection. The fault is mine in that I overlooked this remark of BOURNE'S.

The principal amendment then to be stated here is the separation of the South Indian sub-region from the great Indian region, and the joining of the former to the Ceylon region. The terrestrial endemic Oligochætes of South India and Ceylon are nearly identical as regards genera. It is true that South India lodges some endemic species of *Octochætus* and *Lampito*, both these genera being missed in Ceylon. But *Octochætus* occurs also in the north-eastern part of the Indian Peninsula, and forms not merely a feature of the South Indian fauna. *Lampito* also shows near relations to the northern region. The occurrence of these forms may only require a subdivision of the South Indian-Ceylon region into a South Indian and a Ceylon sub-region (*Süd Indische und Ceylonische Subregionen des Süd-Indisch-Ceylonischen Terricolen-Gebiets*). The limit of this southern region may be a west-eastern line somewhat north of the latitude of Madras.

The "*Vorderindische Terricolen-Gebiet*," then, must be restricted to that part of the Indian Empire north of that latitude and its name must be changed into "Northern Indian region" (*Nord-Indisches Terricolen-Gebiet*). The eastern

[1] W. MICHAELSEN, Die geographische Verbreitung der Oligochæten, Berlin, 1903.

frontier of this region must be moved somewhat eastwards. The extreme eastern district of Bengal (the Chittagong district) with its many endemic species of *Eutyphoeus* doubtless belongs to the North Indian region, whilst on the other hand Burma remains a part of the Indo-Malayan region. The Andaman Islands now are to be included in this proper dominion of *Pheretima*.

The middle western part of India, the dominion of *Eudichogaster*, must be separated as a sub-region from the eastern and northern part of the North Indian region, perhaps even as a region. But more detailed explorations are necessary before definitely settling this question.

II.—DESCRIPTIVE PART

FAM. NAIDIDÆ.

GEN. CHÆTOGASTER.

CHÆTOGASTER LIMNÆI, K. BAER.

Hab.—Western Himalayas, Naini Tal in the Kumaon district, 6,400′; Dr. N. ANNANDALE legs., 28-ix—3-x-06.

GEN. NAIS.

NAIS OBTUSA (GERV.).

Hab.—United Provinces, Lucknow; Dr. N. ANNANDALE leg., 21-iv-07.
Bengal, Calcutta, from *Plumatella fruticosa* and *P. emarginata* in a tank at the Zoological Garden; Dr. N. ANNANDALE leg., 5-i-07.

NAIS ELINGUIS, MÜLL., OERST.

Hab.—Punjab, Lahore; Major J STEPHENSON leg.
Bengal, Alipur near Calcutta, edge of a pond, washed from colonies of *Plumatella emarginata*; Dr. N. ANNANDALE leg., 15-iv-06.
Bengal, Calcutta, in *Spongilla carteri*; Dr. N. ANNANDALE leg., 31-viii-06.

NAIS PARAGUAYENSIS, MICHLSN.

Hab.—Bengal, Calcutta, Museum tank; Dr. N. ANNANDALE leg.
Bihar, Sirsiah in the Mozaffarpur district; E. BERGTHEIL leg.

Remarks.—The Indian specimens of this species seem to differ in a slight degree from the type specimens from Paraguay. As only the single specimen from Calcutta is in a good state of preservation, I have regarded only this latter in the following discussion. It is about 10 mm. long, *i.e.*, about twice as long as the largest of the type specimens, and its segments are very much more numerous. I counted about 98 setigerous segments, about the last 34 getting shorter and shorter with the setæ smaller and smaller, finally disappearing at a considerable distance from the hinder end of the body, which shows no more annulation. After segment 63 or 64 the body seems to be a little narrowed and its walls somewhat darker, and just at this place the rapid decreasing of the annulation and of the setæ begins. Perhaps we must regard this narrowed part of the body as a zone of budding. None of the type specimens from Paraguay showed a zone of budding, but this is in correspondence with the shorter stature, the largest of them having only 47 setigerous segments and probably being not yet full grown.

The anus is directed dorsally. The ventral part of the hinder end is somewhat prolonged and turned upwards.

The dorsal setæ always begin at segment 6. The longer prong at the distal end of the bifid setæ sometimes seemed to be bent somewhat towards the shorter prong, but not distinctly so.

GEN. AULOPHORUS.

AULOPHORUS TONKINENSIS (VEJD.).

Dero t., F. VEJDOVSKY, in Mem. Soc. Zool. Fr., vii, p. 244, text f.
Dero t., W. MICHAELSEN, in Zoologica, 44, p. 353.
? *Aulophorus oxycephalus*, SCHMARDA, Neue wirbell. Th., i, 2, p. 9, t. 17, f. 152.

Hab.—Western Himalayas, Bhim Tal in the Kumaon district, 4,500′; Dr. N. ANNANDALE leg., 19—28-ix-06.
United Provinces, Lucknow; Dr. N. ANNANDALE leg., 21-iv-07.
Bengal, Calcutta, in a tank; Dr. N. ANNANDALE leg., 16-vii-07.
? Ceylon, Galle (SCHMARDA).

Remarks.—The frequent occurrence of this species in the Indian region suggests the presumption that the *Aulophorus oxycephalus* of SCHMARDA from Ceylon may be identical with it. It is a fact of no importance that SCHMARDA did not see the gills, for these structures are often contracted so as to be inconspicuous. But in accepting this identity we must regard SCHMARDA's description as very inaccurate. He speaks only about capilliform dorsal setæ, and in his figure these dorsal setæ begin at the second segment. On the other hand I may point out just such an inaccuracy in SCHMARDA's description of *Aulophorus discocephalus* from Jamaica, a species doubtless nearly allied to *A. schmarda*, MICHLSN., from Paraguay and doubtless provided with forked dorsal setæ as well as all other species of this genus. If *A. tonkinensis* should ever be found in Ceylon, the *patria* of *A. oxycephalus*, I should propose to unite the former with it.

About the habits of this worm Dr. N. ANNANDALE gave me the following note: "This worm inhabits a moveable case resembling those of Trichopterous larvæ and formed of minute pieces of vegetable débris, sponge gemmules and the like. It moves along flat horizontal or vertical surfaces in the following manner: It extends the anterior part of its body out of the tube as far as possible along the surface and applies its anterior sucker [doubtless the protrusible pharynx (MICHAELSEN)]. It then contracts its body, still retaining hold by means of the sucker. Its ventral surface, remaining in close contact with the object on which it is moving and aided by the chætæ, retains the animal in position while the sucker is released and the anterior extremity again stretched forward. As this process is repeated continually the worm moves forward with a series of jerks. The case remains free, containing the posterior half of the body, which is not so highly extensive as the anterior part. The processes at the tip of the abdomen [*i.e.*, the palps (MICHAELSEN)] protrude from the posterior extremity of the case throughout each forward movement."

GEN. SLAVINA.

SLAVINA APPENDICULATA (UDEK).

Hab.—Bengal, Alipur, near Calcutta, edge of a pond, washed from colonies of *Plumatella emarginata*; Dr. N. ANNANDALE leg., 15-iv-06.

GEN. PRISTINA.

PRISTINA PROBOSCIDEA, BEDD.

F. TYPICA.

? *P. equiseta*, BOURNE, in Q. J. micr. Sci., N. S., xxxii, p. 352.
P. proboscidea, BEDD., f. *typica*, MICHAELSEN, in Zoologica, 44, p. 359.
P. æquiseta, BOURNE [f. *typica*], MICHAELSEN, in Zeitschr. wiss. Zool., lxxxii, p. 309.

Hab.—Bengal, Calcutta, in *Spongilla crassissima* and *Sp. carteri*; Dr. N. ANNANDALE leg.

Remarks.—In the course of my studies I got more and more convinced that the different *Pristina* specimens without lengthened setæ, *viz.*, *P. proboscidea*, BEDD., and its varieties, should be united to *P. æquiseta*, BOURNE, notwithstanding that their setæ were provided with hair-like appendices, whilst no mention of such a haracter was made as regards *P. æquiseta*. But now I have had occasion to examine the more recent species *Naidium tentaculatum*, PIGUET, which is really a *Pristina*. This species corresponds even more exactly with the description of *P. æquiseta*. I therefore fell back into uncertainty about the synonymy of BOURNE's *P. æquiseta*. I think it now better to leave this question open. The specimens in hand have then to be called *P. proboscidea*, BEDDARD, f. *typica*. I may add some remarks amending and completing the former notes about this species after examining the new and the old material, among the latter the two type specimens of BEDDARD.

The number of setæ in a ventral bundle is in every case larger than that indicated in BEDDARD's figure,[1] even in the type specimen figured by that author. This number may even rise as high as 8. As GARBINI has based his species *P. affinis*[2] principally upon the presumably larger number of setæ in a bundle (5 in *P. affinis*, presumably 3 in *P. proboscidea*), and as this number is variable in a certain degree, there remains no reason for the separation of these two species. In the specimens examined just now, among them the type specimens of BEDDARD, I found in the ventral bundles of the second and third segment 4—6 setæ, while in the bundles of the middle and hinder part of the body the number is mostly 6 or 7, rarely less, sometimes 8. The ventral setæ of the second segment are very much stouter than those of the middle and hinder part of the body from the fourth segment backwards. Whilst a ventral seta of the second segment is about 3 μ thick, a corresponding seta of the fourth segment is hardly $1\frac{1}{2}$ μ thick. In intermediate positions the seta is somewhat longer, but not much. The ventral setæ of the third segment are intermediate between those of the second segment and the very slender setæ of the middle and hinder part of the body. In all the ventral setæ, especially in those of the second segment, the superior tooth of the forked distal end is much longer than the inferior one.

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[1] F. E. BEDDARD, Naiden, Tubificiden und Terricolen; in Erg. Hamburg. Magalh. Sammelreise, 1896, taf., fig. 18.

[2] A. GARBINI, Una nuova specie di Pristina (P. affinis); in Zool. Anzeiger, bd. xxi, 1898, p. 562, fig. 1.

The dorsal bundles contain 1—4 hair-like setæ, mostly 2 or 3, often only 1, very rarely 4. The setæ are somewhat longer than the diameter of the body, slightly curved and provided with a series of very fine hair-like appendices or spinelets. Besides these hair-like setæ there are generally as many needle-like setæ with a fine, simple, hair-like distal end projecting not much above the surface of the body. Generally such a needle-like seta is joined to a hair-like one, but often there is found a hair-like seta without a needle-like one, or *vice versâ*. In one bundle I found only 1 hair-like seta joined to 4 needle-like ones. Formerly I supposed these needle-like setæ to be younger and undeveloped hair-like setæ, but now I accept the view of PIGUET,[1] who regards them as quite a different sort of setæ. I may remark here, that in the var. *paraguayensis*, MICHLSN., of *P. proboscidea* these needle-like setæ are not at all as distinct as in the form *typica*. Only in one bundle of ventral setæ of one of the type-specimens of this variety could I detect such a needle-like seta with fine and simple hair-like distal end. I am even not quite sure whether this was really a true "needle-like" seta. Perhaps we are dealing in this apparently unique case with an undeveloped "hair-like" seta. As the examination of spirit-material is by no means apt to give good results, we had better leave the question open as to the existence of needle-like setæ in *P. proboscidea*, var. *paraguayensis*.

VAR. PARAGUAYENSIS, MICHLSN.

P. proboscidea, BEDD., var. *p.*, MICHAELSEN, in Zoologica, 44, p. 360.
P. æquiseta, BOURNE, var. *p.*, MICHAELSEN, in Zeitschr. wiss. Zool., lxxxii, p. 309.

Hab.—Bengal, Calcutta, washed from colonies of *Plumatella fruticosa* and *P. emarginata*, in a tank of the Zoological Garden; Dr. N. ANNANDALE leg., 5-i-07.

Remarks.—The specimens examined possessed the character of the variety in a rather more distinct manner than those examined by me previously. The hair-like dorsal setæ were partly nearly four times as long as the body was thick and the serration was very distinct.

PRISTINA TENTACULATA (PIGUET).

? *Pristina equiseta*, BOURNE, in Quart. Journ. micr. Sci., N. Ser., vol. xxxii, p. 352.
Naidium tentaculatum, PIGUET, in Rev. suisse Zool., t. xiv, 1906, p. 219; pl. 9, figs. 18—20, 26.

Hab.—Bengal, Calcutta, in *Spongilla carteri*; Dr. N. ANNANDALE leg.

Present one specimen.

Remarks.—I have been able to examine not only this Indian specimen, but also some spirit specimens from the vicinity of Hamburg which undoubtedly belong to this species. I note only the agreement in the shape and relations of the ventral setæ of the fourth segment. I may remark that in one of the North German specimens I found such giant setæ not only on the fourth, but also on the fifth segment, whilst

[1] E. PIGUET, Observations sur les Naididées, etc.; in Rev. suisse Zool., t. xiv, p. 291 (*P. longiseta*, Ehrbg.).

there were no ventral setæ at all on the fourth segment of another specimen. I believe it very probable that BOURNE'S *Pristina equiseta* (corr. *P. æquiseta*) is identical with this species. As BOURNE said that he found giant setæ only in a part of his specimens, I formerly did not lay any stress upon the fact that the specimens now called *P. proboscidea* by me were bare of these setæ, and united them to *P. æquiseta*. I regarded those giant setæ of *P. æquiseta* as sexual setæ, developed during a certain short period. But now my opinion is altered. Perhaps BOURNE had in hand both species, *P. proboscidea* and *P. tentaculata*, which may occur in company, as the Indian material shows. It is in any case of no importance that BOURNE did not see the forked "needle-like" setæ of *P. tentaculata*, for the teeth of the fork are so very fine that they may easily be overlooked and the forked seta be regarded as an undeveloped hair-like seta.

PRISTINA LONGISETA, EHRBG.

F. TYPICA.

P. leidyi, SMITH (part), MICHAELSEN, in Zoologica, 44, p. 357.
P. longiseta, EHRBG. [f. *typica*], MICHAELSEN, in Zeitschr. wiss. Zool., lxxxii, p. 309.

Hab.—Bengal, Calcutta, in *Spongilla crassissima*; Dr. N. ANNANDALE leg.
,, ,, washed from colonies of *Plumatella repens* and *P. emarginata* in a tank of the Zoological Garden; Dr. N. ANNANDALE leg., 5-i-07.

Remarks.—The serration of the dorsal setæ is in the examined specimens very faint, hardly recognisable, even more indistinct than in the specimens from German East Africa. There is, therefore, no doubt about the identity of these Indian specimens with the species of EHRENBERG, who did not see the serration. We now have all grades from the typical form of EHRENBERG, without any serration or without distinct serration, to the var. *leidyi* (SMITH) with roughly serrated dorsal setæ.

FAM. TUBIFICIDÆ.

GEN. BOTHRIONEURUM.

BOTHRIONEURUM IRIS, BEDD.

Bothrioneuron i., BEDDARD, in Proc. Zool. Soc. London, 1901, i, p. 81.

I examined one fully mature complete specimen and some incomplete or young ones.

External Characters.—In the situation of the clitellum and the male pore the mature specimen is in accord with most of the Tubificids (the clitellum occupies the eleventh and twelfth segments, the male pore is found on the eleventh segment), whilst in the type specimens from the Malayan Peninsula all the generative organs are dislocated backwards for one segment. I think this dislocation an abnormity without systematic importance.

Female pores paired, ventrally on the intersegmental furrow between segments 11 and 12.

Internal Anatomy.—Small bodies in segment 9 suspended ventrally at the septum 8-9 like a supernumerary pair of testes, but there are no other supernumerary reproductive organs.

Great sperm-sacs and egg-sacs extend through a great number of segments.

Oviduct short, straight; funnel of oviduct infundibuliform, with thick walls.

The mature specimen at my disposal bore a single spermatophore ventrally at the hinder part of the eleventh segment if not on the intersegmental furrow 11-12. The shape of this spermatophore differed somewhat from BEDDARD's figure of this object (loc. cit., p. 84, text-fig. 10). Its peduncle is much shorter than the main body and is divided into some branches which enter between the cells of the hypoderm. The narrower distal prolongation of the spermatophore is on the contrary somewhat longer than in the specimen of BEDDARD.

In all other respects the specimen from the Himalayas agrees with those from the Malayan Peninsula.

Hab.—Eastern Himalayas, Kurseong in the Darjiling district, 5,000′, in a rotten stick from the bottom of a small artificial pool; Dr. N. ANNANDALE leg.

Remarks.—Dr. N. ANNANDALE writes to me: "The original locality of *Bothrioneuron iris* does not appear to have been given exactly. The type specimens were taken by Dr. R. EVANS and myself in a little pool on the top of the hill Bukit Besar (alt. 3,500 feet), which lies on the border of the states of Jalor (Yäla) and Nawngchik in Siamese Malaya (approximately in lat. 6°48′ N., long. 101°10′ E.).

FAM. MONILIGASTRIDÆ.

Among the rich collections from the Palni Hills made by Dr. J R. HENDERSON there were some well-preserved specimens which belong to a species without doubt very nearly allied to *Moniligaster deshayesi*, PERRIER,[1] the type species not only of the genus *Moniligaster* but also of the whole family *Moniligastridæ*. The examination of the new species, which I dedicate to the author of this interesting genus, throws a fresh light upon some hitherto obscure points in the anatomy of the type species *Moniligaster deshayesi* and therefore upon the genus *Moniligaster* and its relations to the other genera of the *Moniligastridæ*. To be even more sure in my conclusions about the characters of the genus *Moniligaster*, I asked Prof. E. PERRIER and Prof. M. JOUBIN for the type specimen of *M. deshayesi*, which was entrusted to me for re-examination. I use this occasion to express once more my heartiest thanks to these gentlemen. As I supposed, *M. deshayesi* agrees with the new species, *M. perrieri*, in all essential points of generic value as regards anatomy.

Firstly it may be stated that the genus *Moniligaster*, in the arrangement of the

[1] E. PERRIER, Recherches pour servir à l'histoire des Lombriciens terrestres; in Nouv. Arch. Mus. Paris, vol. viii, 1872, p. 130; pl. iv, figs. 77—84.

sexual organs and their pores generally, agrees with the genus *Drawida*, MICHLSN.[1] I committed an error when I wrote "Vielleicht steht sie (*i.e.*, the genus *Moniligaster*) zu *Eupolygaster* in etwas näherer Beziehung."[2] The two genera *Moniligaster* and *Drawida* form a narrow group, which doubtless has a common origin from the most archaic genus of this family, *i.e.*, from the genus *Desmogaster*. Probably *Moniligaster* is a direct descendant of *Drawida*. It might even be justifiable to unite these two genera, to include the genus *Drawida* without restriction in a genus *Moniligaster sensu lato*, or to regard *Moniligaster sensu stricto* and *Drawida* as sub-genera of a genus *Moniligaster sensu lato*. The only essential point of difference between these two genera is based upon the structure of the spermathecæ, *Moniligaster* (*sensu stricto*) possessing at each side a pair of much-branched glandular tubes opening into the muscular atrial cavity of the spermatheca and *Drawida* being destitute of such glands. But these organs are in a manner foreshadowed in some species of *Drawida*. In *D. robusta* (BOURNE) and its sub-species we find a bifurcated muscular atrial cavity at the distal end of the spermatheca, and this atrial cavity seems to correspond exactly with the atrial cavity which bears in *Moniligaster* the branched tubular glands. As we possess a very careful and detailed description and figure of this organ in BENHAM's paper upon *Moniligaster indicus*[3] [=*Drawida robusta* (BOURNE) sub-sp. *indica* (BENHAM)], I am able to make an exact comparison between *Moniligaster* and the adjacent species of *Drawida* in respect to this organ. I may amplify it into a general discussion upon the spermatheca of the *Moniligastridæ* and the morphological and functional significance of its different parts.

In all the *Moniligastridæ* each spermathecal apparatus has a thin-walled pear- or sack-shaped pouch lying in the segment just behind the intersegmental furrow of the spermathecal pore, and opening through a thin, much bent or coiled duct. In all the species of *Desmogaster* and *Eupolygaster* and in one species of *Drawida* this long-stalked pouch, opening directly to the exterior, represents the whole spermathecal apparatus. In some species of *Drawida* the distal end of the duct of this pouch widens and is transformed into a muscular coat. In other species of this genus this widened muscular distal end grows into a real muscular atrial chamber, which further on enlarges at one side to form a separate blind sac, depending into the second segment, or, in the species *D. robusta* and its sub-species, at two sides, forming two outgrowths, one depending into the seventh segment, the other into the eighth segment, the two outgrowths being separated by the septum 7-8, and the duct of the pouch entering the atrial chamber at the angle between these two outgrowths. The structure found in the species of *Moniligaster* may be compared with this structure in *Drawida robusta*. The two outgrowths of the atrial cavity in the latter species are continued in *Moniligaster* each into a large gland, consisting of a large, much-branched tube, the branches and twigs of which are packed together and enveloped in a peritoneal

[1] W. MICHAELSEN, Oligochæta; in Tierreich, Lief. 10, p. 114.

[2] W. MICHAELSEN, Die geographische Verbreitung der Oligochæten, Berlin, 1903, p. 65.

[3] W. B. BENHAM, Description of a New Species of Moniligaster from India; in Quart. Journ. Micr. Sci., N. S., vol. xxxiv, pp. 362—382; pl. xxxii, figs. 1—5, pl. xxxiii, figs. 8—15.

membrane. At first sight these more complicated spermathecæ of the two species of *Moniligaster* and of some species of *Drawida* call to mind the complex spermathecæ of most *Megascolecidæ*, which are composed of a main pouch (ampulla and duct) and one or more diverticula. The question now arises, which part of the *Moniligaster*-spermatheca must be regarded as homologous with the main pouch, and which with the diverticula of those Megascolecid-spermathecæ? In the Megascolecids the diverticula have in general the function of storing the sperm masses received in the copulatory act, whilst the ampulla of the main pouch contains principally granular masses, which are probably secreted by its own walls. In a series of sections through a spermatheca of *Moniligaster perrieri* I studied the corresponding state in this species microscopically. The long-stalked, pear-shaped pouch in the eighth segment was filled with fibrous masses, the fibres of which were in general very fine but partly (probably at one end) thickened, and doubtless represented clusters of sperms, perhaps embedded in protoplasmic substances, which were apparently coagulated by the preserving process. The branched tubes forming the paired appendices of the muscular atrial chamber were in general empty; I could see only a few coarsely granular masses in them, which I think were glandular secretions. The whole structure, which corresponds very well with the figure given by PERRIER (*l.c.*, pl. iv, fig. 80), seems to be glandular. The muscular atrial chamber with its two outgrowths was empty and appeared to be similar to the copulatory pouch figured and described by BENHAM in *Moniligaster indicus* (*Drawida robusta* sub-sp. *indica*). There can be no doubt that the pear-shaped, long-stalked pouch in the seventh segment of *Moniligaster perrieri* as well as of all other *Moniligastridæ* corresponds functionally with the diverticula of the Megascolecid spermatheca, being the magazine of sperm masses received in the copulatory act. The atrial cavity, on the other hand, may act as a copulatory pouch, corresponding functionally with the muscular duct of the main pouch of the Megascolecid spermatheca, whilst in some species of *Drawida*, and more so in the species of *Moniligaster*, a secretory function is added, being confined to special organs—the glandular branched tubes—only in *Moniligaster*. The functional correspondence justifies my former supposition that the pear-shaped, long-stalked pouch did not correspond with the main pouch of the Megascolecid spermathecæ, but with its diverticula, and that the muscular atrial cavity with its eventual appendices represented the main pouch, which, according to this supposition, is often aborted in the *Moniligastridæ*.[1] On the other hand an essential fact is not in agreement with this view. In the Megascolecids the main pouch is the constant part of the spermathecæ, the diverticula often being absent. In the Moniligastrids the pear-shaped, long-stalked pouch is the only constant part of the spermathecæ, in most of the species representing the whole spermatheca, and it is just in the most archaic genus *Desmogaster* that this is the case. We cannot therefore but assume that this pear-shaped, long-stalked pouch is the organ homologous to the simple spermatheca of such more archaic Oligochæta as the *Phreoryctidæ*, as well as the main pouch of the Megascolecids, even if it corresponds

[1] W. MICHAELSEN, Neue Oligochæten und neue Fundorte alt-bekannter; in Mt. Mus. Hamburg, bd. xix, p. 9.

functionally with the diverticula of the spermathecæ of other families. But this assumption need not be urged to the conclusion that the muscular and glandular adjacent organs are homologous with the diverticula of the Megascolecid spermathecæ, which have quite another function. These adjacent organs certainly have been acquired independently in the *Moniligastridæ* and in the *Megascolecidæ* (as well as in other families such as the *Enchytræidæ*). For in the *Moniligastridæ* (as well as in the *Enchytræidæ*) these structures are missing in the more archaic genera, for example in *Desmogaster*, which in the line of descent forms a connecting link between those Moniligastrid and Megascolecid genera with complex spermathecæ. As we can scarcely assume a homology between these organs acquired independently in the two families, and as, furthermore, their function is different, we would do better not to use the same nomenclature for both. I therefore propose to restrict the term "diverticula" to the appendices of the spermathecal main pouch in the *Megascolecidæ* (and the *Enchytræidæ*). I shall use in the *Moniligastridæ* the following terminology: I understand by the term "Main pouch" (=*Hauptt asche*) the simple spermatheca of *Desmogaster* and others, as well as its homologue in *Moniligaster* and *Drawida* (part.), consisting of a thin-walled, more or less regular, pear-shaped "ampulla" (=*Ampulle*) and a long, thin, bent or coiled "duct" (=*Ausführgang*). The muscular widening of the distal end of this duct, as it is found in some species of *Drawida*, namely the muscular pouch into which this duct opens, I call "muscular atrial chamber" (=*muskulöser Atrialraum*) and its sack-like growths the "atrial sacs" (=*atrial Säcke*). The glandular appendices to the atrial sacs in the genus *Moniligaster* may be called "spermathecal glands" (=*samentaschen-Drüsen*)

GEN. EUPOLYGASTER.

EUPOLYGASTER BROWNI, MICHLSN.

E. b., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 143.

Present one specimen.

External Characters.—Dimensions: Length 150 mm., thickness 4—6 mm., number of segments 293.

Colour brownish.

Head prolobous. Prostomium broad. First segment apparently divided into two annuli by a furrow which exactly resembles an intersegmental furrow. As the setæ of the anterior segment are inconspicuous or obliterated, this annulation is only recognised by the situation of the sexual pores, being judged to equal that of other species of *Eupolygaster*. If this apparent annulation should prove to be a true segmentation, all the notes about the number of segments would have to be augmented by one, and then this species would differ from the other species of its genus.

Setæ very small, especially at the anterior part of the body, inconspicuous or missing in the first eight segments, strictly paired, all on the ventral side of the body, the median dorsal distance equalling about $\frac{2}{3}$ of the circumference of the body (*dd* =

ca. $\frac{2}{3}$ *u*). Median ventral distance on the anterior part of the body more than twice as large as the middle lateral distances, at the posterior part only $\frac{3}{2}$ as large (anteriorly $aa = 2\frac{1}{3}\ bc$, posteriorly $aa = 1\frac{1}{2}\ bc$).

Clitellum not yet developed.

Male pores at the intersegmental furrow 11-12 close to and medial from the lines of setæ *c*.

Female pores not seen, probably at the intersegmental furrow 12-13 or at the anterior part of segment 13.

Spermathecal pores at the intersegmental furrow 7-8 in the lines of the male pores, *viz.*, close to and medial from the lines of setæ *c*, which are not distinctly marked here, the lateral setæ of segments 2—9 being obliterated.

Internal Anatomy.—Septa 4-5—8-9 much strengthened, rather thick, the following septa very thin. Septum 9-10 and some following dorsally are somewhat dislocated backwards, the first of them nearly for one segment's length.

Alimentary tract: Œsophagus simple. Six well-developed gizzards, one in each of segments 19—24; a seventh in segment 18. The six gizzards in segments 19—24 are big and distinct. The gizzard in the eighteenth segment is apparently rudimentary, smaller than the posterior gizzards and not distinctly separated from that of the nineteenth segment.

Circulatory system: Dorsal vessel simple. Last hearts in the tenth segment.

Nephridial system meganephric.

Male organs: One pair of rather small testicular vesicles depending from the hinder surface of septum 9-10 into the tenth segment. The testicular vesicles are broadly united to that septum, not stalked. A long, irregularly undulating (but not much bent and not at all coiled) sperm-duct leads from each testicular vesicle downwards at the hinder surface of septum 9-10, and finally opens into the proximal end of the prostate or atrium. The prostate or atrium is tube-like, rather long and thick, externally quite smooth, showing a muscular glittering. It is bent in an U-form, describing a rather long loop, the two branches of which are closely pressed together. The distal end of this organ is a little enlarged, but without distinct copulatory pouch. The proximal end narrows to pass into the thin sperm-duct.

Female organs: A pair of large ovaries in the twelfth segment. A pair of moderately long, somewhat undulating egg-sacs depending backwards from septum 12-13 through some segments.

Spermathecæ entirely in the eighth segment, consisting of an irregularly pear-shaped, somewhat bent or flattened ampulla and a very long duct. The duct is not separated off abruptly from the ampulla. It is pressed throughout its length against the hinder surface of septum 7-8. From the dorsal part of this septum, where the ampulla is situated, it leads downwards, describing irregular windings, which are especially complex in the middle part. The course of the two ampulla-ducts is nearly symmetrical. The proximal parts of these ducts are relatively thick and show a muscular glittering. Distally the ducts are narrowed. The rather narrow distal end opens directly to the exterior. There is no trace of an atrial chamber.

Hab.—Burma, South Hsenwi State, Lashio in the North Shan Hills; J. COGGIN BROWN leg.

Remarks.—There is some doubt about the numbering of the segments in this species. Apparently, if we regard all segment-like annulations as true segments, all the organs are placed one segment further back than in the other species of this genus; but as the setæ of the most anterior segments are inconspicuous or obliterated, we may as well regard the two first annuli as parts of one segment. In this case *E. browni* would exactly agree with the other species of *Eupolygaster* in the arrangement of the different organs; in the other it would differ from them. If we regard all segment-like annulations as true segments, *Eupolygaster browni*, like the other species of *Eupolygaster*, would prove to be proandric in relation to the genus *Desmogaster*, the holoandric primæval genus of the family, but while in the other species of *Eupolygaster* the hearts and sexual organs, with the exception of the spermathecæ, are dislocated forwards for one segment, in *E. browni* these organs would have to be regarded as lying in the original situation (as in *Desmogaster*). But then we would have to regard the one pair of spermathecæ as corresponding to the hinder pair of these organs in *Desmogaster*, whilst in the other species of *Eupolygaster* the hinder pair is obliterated, the remaining pair corresponding to the anterior pair of spermathecæ in *Desmogaster*. This view is not an unjustifiable one, as we know a species of *Desmogaster*, *viz.*, *D. schildi*, ROSA, from Sumatra, in which the anterior pair of spermathecæ is obliterated, whilst only the posterior pair, opening at the intersegmental furrow 8-9, remains. If we regard *Eupolygaster browni* as differing from the other species of *Eupolygaster*, it should at the same time be regarded as a special branch of the *Moniligastridæ*, derived from *Desmogaster* in a special way. Then it would be justifiable to create a separate genus for it. But as this is uncertain, I regard the first two annuli for the present as parts of one segment—the first segment—and the species *browni* as a true *Eupolygaster*.

E. browni seems in many points to resemble *E. modiglianii* (ROSA) from Sumatra. It differs from the latter species in the situation of the gizzards (in *E. modiglianii* seven in segments 26—32, in *E. browni* six in segments 19—24 with an additional rudimentary one in the eighteenth segment), in the situation of the male pores (in *E. modiglianii* between the lines of setæ *b* and *c*, nearer to the former, in *E. browni* close to the lines of setæ *c*), in the number of thickened septa (in *E. modiglianii* the four septa 5-6—8-9, in *E. browni* the five septa 4-5—8-9), and in the shape of the testicular vesicles (stalked and depending from the septum in *E. modiglianii*, unstalked and broadly united to the septum in *E. browni*).

GEN. DRAWIDA.

DRAWIDA SULCATA, MICHLSN.

(Plate xiii, fig. 2.)

D. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 144, f. 1.

Present two mature specimens.

External Characters.—Dimensions: Length 60—70 mm., greatest thickness 3—3⅓ mm., number of segments about 150.

Colour dirty grey (the specimens were not well preserved; softened).

Head?

Setæ very tender, very strictly paired. Ventral median distance only at the anterior part of the body slightly but distinctly larger than the lateral median distances; in general only indistinctly larger ($aa \geq bc$). Dorsal median distance a little larger than half the circumference of the body ($dd > \frac{1}{2}\ u$).

Nephridial pores at least usually in the lines of setæ *cd*.

Clitellum in the hinder part ring-shaped, occupying segments 10—13 (=4).

Male pores (fig. 2) on transversely oval, very prominent papillæ on the intersegmental furrow 10–11 between the lines of setæ *b* and *c*, about equidistant from both of them.

Genital area (fig. 2). The tenth as well as the eleventh segment bear ventrally a very sharp transverse furrow in about the middle zone. Besides these, which represent apparently sharpened ringlet-furrows, there are very characteristic furrows, which run in general longitudinally and correspond with the seminal furrows of other Oligochæta. But these furrows of *D. sulcata* seem not to be connected with the male pores; they may perhaps be connected with the female pores which I could not distinguish with certainty. The two sexual furrows begin at the intersegmental furrow 10-11 just medial from the lines of setæ *a*, *i.e.*, a considerable distance from the male pores. If there is any connection with the latter, it must be mediated by certain parts of the intersegmental furrow 10-11; but I do not believe that this is the case. The sexual furrows first go backwards nearly straight, only converging very little towards the middle line. As they cross the ringlet-furrow ventrally at the eleventh segment the sexual furrows bend somewhat towards the middle line, from this point converging distinctly. They then meet the intersegmental furrow 11-12 rather near the median ventral line. After crossing this intersegmental furrow the sexual furrows diverge in the same manner as they converged before. They finish without sharp points in about the middle zone of the twelfth segment. The sexual furrows are everywhere surrounded by a somewhat darker smooth area, which forms a distinct interruption of the clitellar modification. At the eleventh segment this darker area occupies the whole ventral part of the body-wall between the sexual furrows, at the twelfth segment it shows a sort of V-figure, in correspondence with the here diverging sexual furrows. At the points where these sexual furrows cross the intersegmental furrow 11-12, I believe that I have seen a pair of very small openings; but I am unfortunately not able to state this with certainty. It might be inferred that these were the female pores, which in the genus *Drawida* are constantly found at the intersegmental furrow 11-12. But in general these female pores lie in the lines of setæ *ab*, not medial from these as the questionable and doubtful pores of *D. sulcata*. Furthermore, I do not know any case of the female pores being connected with longitudinal furrows equivalent to the seminal furrows of many Oligochætes. As I could not see the real female pores in the usual position, this point of structure must remain questionable.

Spermathecal pores at the intersegmental furrow 7-8 in the lines of setæ *c*, or rather just ventral from them, touching them with their lateral end.

Internal Anatomy.—Septa 5-6—8-9 very strong, 9-10 very delicate, the following ones delicate.

Alimentary tract: Œsophagus simple. Five rather big, nacreous gizzards in segments 15—19 (?). (This statement may be erroneous for one segment; perhaps the first gizzard must be assigned to the fourteenth segment.) The first two gizzards are gradually somewhat, but not much, smaller than the following, but not at all rudimentary.

Circulatory system: Last hearts in the ninth segment.

Nephridial system meganephric.

Male organs: A pair of large testicular vesicles at septum 9-10, sharply incised by the latter. The anterior parts of the testicular vesicles depending forwards into the ninth segment are as broad as the posterior parts in the tenth segment, but much shorter. The sperm-ducts are very thin, much and irregularly undulated and bent, nearly coiled. Though they are very long, they occupy relatively only a small space. The prostates have a regularly semi-globular glandular part and a moderately thick, very short duct, which is almost totally hidden in the body-wall, the glandular part apparently lying with a flat base on the interior surface of the body-wall. The outer semi-globular surface of the glandular part is delicately mammillated, and white in colour.

Female organs: One pair of rather large ovaries and oviduct funnels in the 11th segment. The 11th segment is in the examined specimen very much inflated and filled with voluminous masses of free eggs. A pair of moderately large egg-sacs depend from septum 11-12 backwards into the 12th and 13th segments. They are very much restricted by septum 12-13, the anterior parts in the 12th segment being nearly globular. The hinder parts in the 13th segment are rather small (united by concrescence ?).

Spermathecæ entirely in the 8th segment, with a pear-shaped ampulla and a very delicate, very long, irregularly coiled duct, which opens through a very small simple atrial chamber. The atrial chamber is nearly hidden in the body-wall. There are no diverticulum-like atrial sacs.

Hab.—South India, Coonoor in the Nilgiri Hills, 2,000 m.; M. MAINDRON leg., x-01 (Mus. Paris).

DRAWIDA WILLSI, MICHLSN.

D. w., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 145.

Present many specimens, some of which are fully mature, provided with a clitellum.

External Characters.—Dimensions of the mature specimens: Length 55 and 60 mm., greatest thickness $2\frac{1}{2}$ mm., number of segments about 155—160.

Colour bluish grey or reddish grey, somewhat variable, even in specimens from the same locality.

Head prolobous; prostomium transversely oval.

Setæ strictly paired, especially the lateral ones. In general middle lateral distances about equal to the ventral median distance, at the anterior part of the body very little larger ($aa \leqq bc$, at the anterior part of the body aa = ca. $1\frac{1}{6}$ bc). The median dorsal distance is somewhat larger than half the circumference of the body (dd = ca. $\frac{5}{9}$ u).

Nephridial pores in the lines of setæ *cd*.

Dorsal pores apparently absent.

Clitellum ring-shaped, occupying segments 10—13 (=4).

Male pores on the top of transversely oval papillæ in the intersegmental furrow 10-11 in the lines of setæ *b*; the male papillæ transgress the lines of setæ *b* laterally somewhat further than the lines of setæ *a* medially.

In a great number of specimens there was an additional pair of rudimentary male pores on the intersegmental furrow 9-10, in the same lines as the true male pores. These rudimentary male pores were always somewhat, very little or distinctly, smaller than the true male pores, and their papillæ were not quite as prominent: they were seen in all the mature specimens from Bilaspur as well as in most of the half mature ones from this locality, but in the latter in a very different degree of distinctness, corresponding to the degree of maturity. In many young specimens from this locality the true male pores were already distinguishable, whilst there was not yet any trace of the additional ones. These, therefore, seem to be developed later than the true male pores. As for the specimens from Hyderabad, I could detect an additional male pore only in one of the three mature ones, and only on one side of the body.

Female pores on the intersegmental furrow 11-12, in about the lines of setæ *ab* (only seen in sections).

Spermathecal pores on the intersegmental furrow 7-8 in the lines of setæ *ab* (inconspicuous).

Internal Anatomy.—Septa 6-7—8-9, very strong, especially the first two; septum 9-10 tender, but apparently a little bit thicker than the very tender following ones. Septa 9-10 and 10-11 are dislocated backwards dorsally, especially the latter, which is dislocated for about half a segment's length.

Alimentary tract: Œsophagus simple. Two rather big muscular gizzards in segments 14 and 15. The œsophagus seems to be somewhat thickened and provided with a stronger muscle layer in the 13th segment, but a distinct gizzard is not developed in this segment. Intestine, at least in the anterior part, without typhlosole.

Nephridial system meganephric.

Male organs: One pair of big seminal vesicles on septum 9-10, restricted by it, depending from it forwards into the 9th segment and backwards into the 10th segment. A big tuft-shaped test enclosed in each seminal vesicle fixed to it ventrally in the restricted zone of septum 9-10. A flat sperm-duct-funnel in each seminal chamber united to its ventral wall behind the test. Sperm-ducts very long, coiled, in segments 9 and 10. I could not detect the mode of entering into the prostates.

Prostates shortly and thickly tubular, somewhat bent or depressed (pressed by the other organs ?), nearly disc-like, with a thick covering of pear-shaped glands. The additional rudimentary male pores lead into an organ formed just like the prostates but somewhat smaller. I could not detect whether these additional rudimentary prostates are connected with an additional sperm-duct. I believe they are not. It is not the first time that such rudimentary prostates have been detected in Oligochætes. I described such organs in certain Lumbriculids, *e.g.*, *Rhynchelmis brachycephala*, MICHLSN.,[1] and called them "Kopulationsdrüsen," just as VEJDOVSKY had done with the corresponding organs of *R. limoscella*, HAFFM., and I showed the identity of the structure of these organs with that of the real prostates and their relation to the rudimentary sperm-ducts.

Female organs: A pair of great ovaries depend from the ventral part of septum 10-11 into the 11th segment. They are apparently enclosed in a special ovarian chamber, separated from the small 11th segment by a fine membrane, which connects septa 10-11 and 11-12. A pair of small straight oviducts with rather small, slipper-shaped funnels at septum 11-12. A pair of big egg-sacs, with wide anterior opening, depend from septum 11-12 backwards through severa (about six) segments. They are restricted by the septa.

Spermathecæ: Main pouch in the 8th segment, with a large egg-shaped ampulla and a long, narrow, somewhat coiled duct, which is abruptly set off from the ampulla. This duct, after piercing septum 7-8, opens from behind into the distal end of a moderately large, simple, egg-shaped, almost unstalked muscular atrial chamber, which depends into the 7th segment.

Hab.—Central Provinces, Bilaspur, 900′; C. U. WILLS leg.
Deccan, Hyderabad; Col. D. C. PHILLOTT leg.
? Western Himalayas, Simla, 7,000′; Dr. N. ANNANDALE leg., 25-iv-07.

Remarks.—The most interesting point in the anatomy of this species is the existence of an additional rudimentary pair of prostates one segment before the true prostates. This structure confirms the statement of ROSA [2] (adopted by myself [3]), that the genus *Drawida* (*Moniligaster* di BOURNE according to ROSA) has arisen from the holoandric genus *Desmogaster* by the loss of the first pair of male organs as well as a dislocation of all the generative organs with the exception of the spermathecæ. This structure in *D. willsi* clearly shows that *Drawida* formerly, as *Desmogaster* still does, possessed two pairs of male organs, the anterior pair of which is reduced and in most species of this genus totally lost, and that the genus *Drawida* is a metandric one.

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[1] W. MICHAELSEN, Oligochæten der zoologischen Museen zu St. Petersburg und Kiew; in Bull. Acad. St. Petersb. (5), xv, p. 180, fig. E (p. 179).

[2] D. ROSA, I Lombrichi raccolti a Sumatra dal Dott. Elia Modigliani; in Ann. Mus. Genova, xxxvi, p. 506—509.

[3] W. MICHAELSEN, Die geographische Verbreitung der Oligochæten, Berlin, 1903, p. 65.

Drawida willsi comes near to the somewhat doubtful species *Moniligaster japonicus* (MICHLSN.),[1] which also possesses only two gizzards. But in the latter species the gizzards occupy the 12th and 13th segments, a point which I may be able to confirm after a renewed examination of a sedes of sections. From the only other species—*Moniligaster minutus*, BOURNE[2]—which possesses two (sometimes three) gizzards, *Drawida willsi* is easily distinguished by the simple pear-shaped atrial chamber of the spermathecæ (divided into two parts in *D. minuta*).

To this species probably, or rather doubtless, belongs a single small, not yet mature specimen from Simla in the Western Himalayas. This specimen possesses two gizzards, like the type specimens of *D. willsi*, but as it is not yet mature, this cannot be determined with certainty. The specimen is remarkable for its brilliant blue colouring; but as the colour in the species of this family, as also in those of other families, is variable, we dare not lay any stress upon it.

DRAWIDA RAMNADANA, MICHLSN.

D. r., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 145.

I examined several weakened sexually mature specimens.

External Characters.—Dimensions of the sexually mature specimens: Length 44—55 mm., greatest thickness $1\frac{3}{4}$—2 mm., number of segments *ca.* 165.

Colour in the fore part dorsally and laterally bluish grey, in the other part yellowish grey.

Head prolobous.

Setæ minute, strictly paired, the median ventral distance somewhat smaller than the lateral distances ($aa < bc$), the median dorsal distance somewhat greater than half the circumference of the body ($dd > \frac{1}{2}u$). Setæ missing only from the first segment, present on the second.

Dorsal pores not seen.

Nephridial pores in the lines of the lateral setæ (in *cd*).

Clitellum developed all round the body, occupying segments 10—13 (=4).

Male pores intersegmentally on the furrow between segments 10 and 11 in the lines of the setæ *b*, on small eye-shaped papillæ.

Female pores on the intersegmental furrow 11-12, if not somewhat behind it, in the lines of the setæ *ab* or near them (seen only in sections).

Spermathecal pores on the boundary line between segments 7 and 8 in line with the setæ *b*.

Internal Anatomy.—Septa 5-6—8-9 thickened, 9-10 and 10-11 laterally and dorsally inserted further behind than ventrally, especially 10-11, which is dorsally inserted in the middle of segment 11.

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[1] W. MICHAELSEN, Terricolen der Berliner zoologischen Sammlung, ii; in Arch. Naturg., lviii, p. 232.

[2] A. G. BOURNE, On Indian Earthworms, Part I. Preliminary notice of Earthworms from the Nilgiris and Shevaroys; in Proc. Zool. Soc. London, 1886, p. 672.

Alimentary tract: Œsophagus simple, without calciferous glands. Three separate gizzards lying in segments 12—14.

Vascular system: Last hearts in the 9th segment.

Nephridial system meganephric.

Male organs: A pair of great testicular vesicles suspended at and somewhat restricted by septum 9-10 in segments 9 and 10, the greater part in the latter. A pair of testes and sperm-duct-funnels in these testicular vesicles, inserted in their interior walls in the dissepimental zone. Sperm-ducts long, coiled, in segments 9 and 10, distally entering the basal front of the prostate in the thickness of the body-wall. The prostates are short tubes with a thick and dense covering of pear-shaped glands; in consequence of this thick covering the prostates have the appearance of clumsy stumps. The copulatory pouch seems to be missing. The small papilla on the top of which the prostate opens has not the appearance of being an everted copulatory pouch.

Female organs: A pair of ovaries in segment 11. A pair of great egg-sacs extending from septum 11-12 backwards through several segments, restricted by the septa. Oviducts short, straight; funnel of the oviducts rather large, obliquely infundibuliform.

Spermathecæ: Main pouch in the 8th segment, with large pear-shaped ampulla and very long, thin, coiled duct. This duct opens from behind into the basal part of the hinder wall of the atrial chamber. The latter is widened to form a small, simple, thickly pear-shaped or stump-shaped atrial sack depending into the 7th segment.

Hab.—South India, Ramnad in the Madura district, sandy coastal plains; Dr. N. ANNANDALE leg.

Remarks.—*Drawida ramnadana* seems to be nearly allied to *D. bahamensis* (BEDD.) of unknown *provénance* (certainly imported by man to the Bahamas, if this indeed was the locality from which the "Kew Garden specimens" were derived). It differs from the latter chiefly in the situation of the male pores and of the spermathecal pores, by the absence of distinct copulatory pouches and by the presence of setæ on the second segment. Perhaps there is also a difference in the situation of the gizzards.

DRAWIDA NEPALENSIS, MICHLSN.

(Plate xiii, fig. 1.)

? *Moniligaster uniquus* + *M. papillatus*, BOURNE, in Proc. Zool. Soc., 1887, pp. 671, 672.
? *Moniligaster uniqua*, BOURNE, in Q. Journ. micr. Sci., N. S., xxxvi, p. 363, t. 23, f. 4.
Drawida nepalensis, n. sp. (?), MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 146.

Present some partly mature specimens of a species which may perhaps prove to be identical with *D. uniqua* (BOURNE).

External Characters.—Dimensions: Length 50—60 mm. (*D. uniqua*: living animals (?), 220 mm.), thickness $3\frac{1}{3}$ mm. (*D. uniqua*: nearly 5 mm.), number of segments 160—175 (*D. uniqua*: 316).

Colour yellowish grey; apparently without pigmentation.

Head prolobous.

Setæ strictly paired. Median ventral distance a little smaller than the middle lateral ones (*aa* = ca. $\frac{4}{5}$ *bc*). Median dorsal distance a little larger than half the circumference (*dd* = ca. $\frac{5}{9}$ *u*).

Nephridial pores in the lines of setæ *d*.

Dorsal pores apparently absent.

Clitellum ring-shaped, occupying segments 10—13 (=4).

Male pores on prominent transversely oval papillæ on the intersegmental furrow 10-11, about midway between the lines of setæ *b* and *c*.

Female pores in the intersegmental furrow 11-12 in the lines of setæ *b*.

Spermathecal pores in the intersegmental furrow 7-8 just ventral from the lines of setæ *c*, touching these lines with the superior end of the slit-like external opening (*D. uniqua* : between the lines of setæ *c* and *d*).

Copulatory organs: Some of the mature specimens (four out of eight) are provided with two broad, transversely oval glandular cushions, median, ventral, on segments 7 and 8.

Internal Anatomy.—Septa 5-6—8-9 very strong, especially the two anterior ones. Septa 9-10 and 10-11 dorsally dislocated backward for about half a segment's length.

Alimentary tract with four big gizzards behind the genital region.

Nephridial system meganephric.

Male organs: One pair of oblong seminal vesicles on septum 9-10, depending from it, forwards and backwards, into the 9th and 10th segments. In each seminal vesicle is a great tuft-shaped test, fixed by a narrow, short stalk to the wall of the seminal vesicle in the ventral part of the zone, marked by septum 9-10. Behind the point of attachment of this test a flat sperm-duct-funnel interiorly tapestries the ventral wall of the seminal vesicle. The sperm-ducts are very long, coiled, in segment 11. The prostates are rather long, tube-like, bent forward to form an U-shaped loop. The sperm-duct enters the proximal end of the prostate.

Female organs: Ovaries and oviduct-funnels apparently enclosed in an ovarian chamber, formed by septa 10-11 and 11-12 and a connective membrane (?). Irregular egg-sacs depending backwards from septum 11-12 through some segments.

Spermathecæ (fig. 1) : Main pouch in the 8th segment, consisting of a somewhat irregular pear-shaped ampulla and a long, narrow, irregularly bent, nearly coiled duct. This duct, piercing septum 7-8, enters from behind the distal end of the atrial chamber. The atrial chamber, narrow at the distal end, is continued proximally into a large, flattened, proximally broadened atrial sac, which extends into the 7th segment. The narrow distal part, which describes some narrow and short undulations, is not set off abruptly from the broader sac. The whole atrial chamber as well as the atrial sac shows a rather regular annulation, externally marked by fine, but distinct, transverse furrows, internally marked by densely crowded foldings of the epithelium, the folds depending broadly into the lumen of the sac. (*D. uniqua* : atrial sac [copulatory pouch of BOURNE] simple.)

Hab.—Nepal, Gowchar in the Nepal Valley, near Katmandu; R. A. HODGART leg.

Remarks.—This species comes near to *D. uniqua* (BOURNE), if it is not identical with it. BOURNE does not make any remarks about a peculiar structure of the atrial sac of the spermathecæ (BOURNE's "copulatory pouch"). He only describes this organ as simple, *i.e.*, not divided into two diverging parts as in other species of this genus. I do not believe that BOURNE could have overlooked the above-described very characteristic structure or that he would have abstained from mentioning it had it been present in his species.

DRAWIDA BURCHARDI, MICHLSN.

D. b., MICHAELSEN, in Mt. Mus. Hamburg, xix, p. 7.

Present some specimens, three of which are mature, but without clitellum.

Hab.—South Andaman Isl., Mount Harriet, 800′ in dense forest, a few inches below surface of soil; B. B. OSMASTON leg., 2-xii-06.

Remarks.—I identify these specimens with *Drawida burchardi*, MICHLSN., notwithstanding some small differences. The prostates are thickly tubular, but externally smooth. There are no glands projecting above the surface of the atrium. In the type specimen the prostates are "ziemlich klein, etwa ½ mm. lang und im Maximum ¼ mm. dick, zipfelförmig nach hinten ausgezogen, mit Drüsenbesatz." The greater length of the prostates in the present specimens may correspond with a more completely mature state, and the absence of pear-shaped glands projecting above the surface of the atrium may also depend on another state of sexuality. Very characteristic of this species are the long, slender pear-shaped atrial sacs of the spermathecæ in the seventh segment and the long sperm-sac depending backwards from septum 9-10.

There is a pair of long irregularly bent egg-sacs in the examined specimen.

D. burchardi is a somewhat peregrine species, having been found also in Sumatra.

GEN. MONILIGASTER.

By the courtesy of Prof. M. JOUBIN of the "Museé d'Histoire Naturelle de Paris" I was enabled to re-examine the type specimen of *Moniligaster deshayesi*, E. PERR., the type species of the genus *Moniligaster*. A ter this re-examination some points of doubt in the organisation of this species and in the character of this genus may be settled now. Firstly, the female pores may with certainty be assigned to the intersegmental furrow 11-12. I saw them clearly in *M. deshayesi* as well as in *M. perrieri*; in both species they lie in the lines of setæ *ab*. I could not fix the position of the last pair of hearts in *M. deshayesi*, as I dared not tear the organs of the type specimen more than necessary. There is hardly any doubt that this species is similar to *M. perrieri* in this point of structure. We may take it for granted that in all the species of *Moniligaster* the last hearts are to be found in the 9th segment, the same as in *Drawida*. If there still remained any doubt about the spermathecal apparatus of *Moniligaster*

deshayesi, we now know with certainty that it is nothing but the "paire antérieure d'organes males." Finally we have to settle the question about the "petit gésier musculaire qui occupe le sixième anneau" in *M. deshayesi* after PERRIER (*l.c.*, p. 131). In the nearly allied *M. perrieri* I could detect no trace of such an anterior gizzard. The œsophagus was equally narrow throughout, and in a series of longitudinal sections it everywhere showed a uniformly tender muscular layer,—nowhere a thickened portion which might be regarded as a rudimentary gizzard. I was eager after this statement to re-examine the œsophagus of *M. deshayesi*, and it was principally on this account that I asked the author of this species and the officer in charge of the collection which contained the type specimen, for permission to re-examine the latter. I can state now that *M. deshayesi* agrees in this point throughout with *M. perrieri* and all the other *Moniligastridæ*. There is no gizzard in the 6th segment. PERRIER mistook a casual swelling of the œsophagus in the 6th segment for a gizzard. Without intending to open the organ for a more exact examination, I could see its structure by a small accidental rent. The wall of this apparently different part of the œsophagus was very delicate and thin, not at all muscular, and doubtless in consequence of the extension whilst swelling, even more tender than the neighbouring parts of the œsophagus. This delicacy of the wall may have misled PERRIER, for in consequence of it the wall of this inflated part is more transparent, and appears darker by the dark contents which even now fill it. As PERRIER abstained from opening the œsophagus of the unique specimen, it is no wonder that he took this apparently thicker and darker part of the œsophagus for a gizzard.

After this we may diagnose the genus *Moniligaster* as follows :—

One pair of male pores at 10-11, one pair of female pores at 11-12, one pair of spermathecal pores at 7-8. Four to five gizzards at the anterior end of the intestine, behind the sexual region. Last pair of hearts in the 9th segment. One pair of testicular vesicles at septum 9-10. Prostates with distinct glandular part and duct. Ovaries in the 11th segment. Egg-sacs at septum 11-12. Spermathecæ with a two-fold muscular atrial chamber, each sac of which bears a gland consisting of branched tubes.

MONILIGASTER PERRIERI, MICHLSN.

M. p., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 146.

Present five specimens, four quite mature with developed clitellum, and one half mature one.

External Characters.—Dimensions of the only complete quite mature specimen (all the other mature specimens proved to be regenerated at the hinder end): Length 210 mm., greatest thickness 5 mm., number of segments about 175. Other mature specimens seemed to be somewhat smaller.

Colour more or less intensely bluish grey, dorsally darker than ventrally.

Head prolobous or indistinctly zygolobous. Prostomium often retracted into the buccal cavity.

Setæ very small, very strictly paired. Median ventral distance about as large as the middle lateral distances, median dorsal distance about as large as half the circumference of the body (*aa* = ca. *bc*, *dd* = ca. $\frac{1}{2}$ *u*).

Nephridial pores in the lines of setæ *cd*

Dorsal pores apparently absent.

Clitellum ring-shaped, occupying the segments $\frac{1}{3}$ 9—14 (=$5\frac{1}{3}$), at the $\frac{1}{3}$ of 9th and at the 14th segment distinct, but somewhat less marked.

Male pores on the intersegmental furrow 10-11, a little lateral from the lines of setæ *b*, in the centre of hexagonal, apparently not glandular, depressions, the medial edges of which touch the imaginary lines of setæ *b*.

Female pores small, but distinct, on the intersegmental furrow 11-12 in the lines of setæ *ab*.

Spermathecal pores one pair, on the intersegmental furrow 7-8 in the lines of setæ *cd*.

Internal Anatomy.—Septa 6-7—8-9 thickened, moderately strong, 8-9 very tender, pushed backwards very far, the following tender.

Alimentary tract: Œsophagus simple, without any trace of a gizzard in the anteclitellar region. Even in sections no thickening of the muscular layer can be seen in any part of the œsophagus. Thus we cannot speak even of a rudimentary gizzard in the anterior part of the œsophagus. Five strongly muscular gizzards in segments 17—21. The size of the gizzards is very different, the fourth is the largest, the third slightly smaller, the second and first gradually distinctly smaller, the fifth the smallest of all, nearly rudimentary. In two opened specimens from different localities, this arrangement was likewise found, but in that from Kodaikanal the smallest (fifth) gizzard was even more minute than in the examined specimen from Tiger Shola.

Circulatory system: Dorsal vessel simple. Last hearts in the 9th segment.

Nephridial system meganephric.

Male organs: A pair of large egg-shaped testicular vesicles depend backwards from the pushed back septum 9-10, thus *in situ* lying further back than what seems to be the real position, the hinder parts of these organs being pressed against the anterior ends of the egg-sacs. These testicular vesicles enclose the sperm-duct-funnels, which may be seen shining through the thin walls of the vesicles as PERRIER saw them in *M. deshayesi*, and doubtless also the testes, as in all other exactly studied species of *Moniligastridæ*. From the anterior poles of the testicular vesicles arise the tube-like, enormously long sperm-ducts. The greater middle parts of the sperm-ducts form a great number of long narrow loops, the branches of which are closely united and which have the appearance of densely crowded villi, depending forwards from septum 9-10 into the 9th segment, only the somewhat narrower proximal ends and the distal ends of the sperm-ducts are free, not forming narrow loops, but irregular windings. Doubtless the "feuillets d'apparence glandulaire," which are "formés par un ou plusieurs tubes entortillés" of *M. deshayesi*, PERRIER (*l. c.*, pl. iv, fig. 81 n et fig. 83), are nothing but such loops of the sperm-duct, somewhat more complicated than in the

present species, *M. perrieri*. The distal ends of the sperm-ducts enter the proximal poles of a pair of prostates. These prostates are not elongated as in *M deshayesi*, in which species they reach backwards through a number of segments as far as into the 17th segment. In *M. perrieri* these organs are restricted to the 11th segment. They consist of a glandular part and a distinct duct. The white glandular part is about twice as long as thick, formed like a very thick, somewhat bent sausage, the surface of which is not smooth, but mammillated. The proximal pole into which enters the sperm-duct, is directed forwards. The concavity is directed towards the body-wall. Out of the convex under side, behind the middle of it, and somewhat before the posterior pole of the glandular part arises the muscular duct, which is only a little thinner than the glandular part and about as long as thick, and of a nacreous appearance.

Female organs: The ovaries and oviduct-funnels occupy the 11th segment. A pair of very large, rather thick egg-sacs depend from septum 11-12 backwards through a rather great number of segments, in one case, for example, as far as into the 20th segment.

Spermathecæ: Main pouch with pear-shaped ampulla and a very long, thin, coiled duct. The whole main pouch lies in the 7th segment. The duct distally enters a short, broad muscular atrial chamber which opens to the exterior by a short muscular duct tapering distally. The muscular atrium has two rather short sacs not differing in structure, one at the anterior and one at the posterior side, both separated by septum 7-8, the thin duct of the main pouch entering the atrial chamber between these two sacs. Each of these sacs is continued into a much-branched glandular tube. The branching of these tubes seems to be principally dichotomous. The final twigs are rather short, only sometimes as long as thick. These tubes with their many branches and twigs are packed together to form a rather compact, shortly ovoid, distally broader mass, enveloped by a fine peritoneous membrane. Seen *in toto* the surface appears densely mammillated, being composed of all the proximal blind ends of the final twigs covered by the peritoneum. The anterior gland lies in the 7th segment, the posterior in the 8th segment. This spermatheca resembles in all principal points the spermatheca of *M. deshayesi* with the single exception, that the muscular atrial chamber and its sacs are shorter and thicker than, and not as distinctly tubular as, in PERRIER's species.

Hab.—South India, Kodaikanal in the Palni Hills, 7,000′; Dr. J R. HENDERSON leg., vi-07.

,, ,, Tiger Shola (near Kodaikanal) in the Palni Hills, virgin forest, 5,500′; Dr. J R. HENDERSON leg., vi-07.

Remarks.—*Moniligaster perrieri* is closely allied to the type species of its genus,—*M. deshayesi*, PERRIER. It differs from the latter in the position of the sexual pores, in the number of gizzards, in the shape of the prostates, in the length of the atrial chamber of the spermatheca and in the length of its atrial sacs.

FAM. MEGASCOLECIDÆ.

Sub-fam. Megascolecinæ.

In the definition of the genera of this great sub-family I maintain in general the views I published lately in connection with my descriptions of the Oligochætes from South-Western Australia.[1] The following pages contain only one change or rather elaboration of the system. I separate from the large genus *Megascolex* with a micronephric condition of the excretory system, those species in which there is found a pair of meganephridia besides the micronephridia in the segments of the middle and posterior parts of the body. We formerly knew only one species with such a nephridial system, *i.e.*, *Lampito mauritii*, KINB. (=*Perichæta armata*, BEDD.), and in my former systematic discussions I did not lay any stress upon the deviation of this species. As I now have had occasion to study two more species of the kind, I think it necessary to separate this group from *Megascolex*. This separation does not alter the verbal definition of the genus *Megascolex*; but, owing to the use of the term "micronephric," we must bear in mind that this definition no longer includes a reference to the condition characteristic of *Lampito mauritii*. The new group separated from *Megascolex* must be called genus *Lampito*, KINB. (see below).

GEN. PLUTELLUS.

PLUTELLUS INDICUS, MICHLSN.

(Plate xiii, fig. 9.)

P. i., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 148.

Present four half mature specimens, one of which represents a variety.

External Characters.—Dimensions: Length 60—110 mm., greatest thickness $2\frac{1}{2}$—3 mm., number of segments *ca.* 160.

Colour uniformly grey or brownish grey.

Head indistinctly epilobous, if not tanylobous.

Setæ widely paired till nearly separated. At the anterior part of the body the pairs equal about a half (the variety) or a third part (typical form) of the median ventral distance and about $\frac{2}{3}$ of the middle lateral distances (anteriorly $aa = 2$—$3ab$, $ab = 1\frac{1}{2}$, $bc = cd$ or $aa : ab : bc : cd = 4$—$6 : 2 : 3 : 2$). Just behind the clitellar region the pairs get distinctly narrower (postclitellar $aa = 3$—$4ab$, $ab = 2bc = cd$ or $aa : ab : bc : cd = 3$—$4 : 1 : 2 : 1$). Towards the posterior end the pairs grow wider, finally almost equalling the middle lateral distances and in the variety getting near the median ventral distance (at the hinder end $aa = \frac{3}{4}$—$2ab$, ab, bc and cd differing only a little, $ab < bc > cd$). The median dorsal distance is in general smaller than half the circumference of the body, at the anterior part of the body only a little, at the hinder part very much ($dd < \frac{1}{2}\ u$); at the hinder end it is only $3\frac{1}{2}$ times (typical form) or even not

[1] W. MICHAELSEN, Oligochæta, in Die Fauna Südwest-Australians, etc., Hamburg, 1907, i, p. 149, ff.

more than twice as wide (the variety) as the width of the pairs (at the posterior end $dd = 2—3\frac{1}{2}\ cd$).

First dorsal pore on the intersegmental furrow 12-13, if not more anteriorly.

Clitellum not developed in any of the present specimens.

Male pores on large transversely oval papillæ on the middle zone of the 18th segment, opposite the setæ *a* and *b*, surpassing the lines of the latter distinctly, of the former hardly. The male papillæ are connected with one another by a narrow, median, transverse, apparently somewhat glandular, but not prominent bridge, and (only in the typical form ?) surrounded by a common dumb-bell-shaped wall.

Female pores before the setæ *a* of the 14th segment, but a little further medial.

Spermathecal pores two pairs, those of each side approximated to one another more or less (in the variety nearly uniting), between the lines of setæ *a* and *b* or in the lines of setæ *a*, the hind pair in the intersegmental furrow 8-9, the fore pair on segment 8, in the zone of setæ (typical form) or close to the intersegmental furrow 8-9 (the variety).

Copulatory organs not present.

Internal Anatomy (principally examined in the specimen of the variety): The septa of the anterior sexual region, from about 6-7—12-13, somewhat thickened, especially the middle ones.

Alimentary tract: A big gizzard in the 6th (5th ?) segment. There are no calciferous glands set off from the œsophagus, but in the six segments 12—17 the œsophagus is swollen segmentally, narrowed intersegmentally, moniliform, with rich blood-supply and internally with a longitudinal lamellar structure. Intestine without typhlosole.

Nephridial system meganephric. The meganephridia are relatively small.

Anterior male organs: Two pairs of sperm-duct-funnels free in the 10th and 11th segments; two pairs of sperm-sacs, depending from septum 9-10 into the 9th segment and from septum 11-12 into the 12th segment. The latter (posterior sacs) are the larger, and consist of a number of globular or oval and pear-shaped parts of various sizes. Those of the anterior pair are smaller and their partitions less numerous.

The prostates are tubular. The glandular part is long and rather thick, coiled; the duct is rather short and narrow, nearly straight. There are no penial setæ, but a moderately strong transverse muscle-band, converging towards the male pores.

Spermathecæ (fig. 9): Main pouch with an oval or thickly tubular ampulla, and a duct about as long as the ampulla, but only half as thick, and not very abruptly set off from the ampulla. Distally this duct narrows rapidly. Somewhat beneath its middle opens a simple, shortly tubular, straight or bent diverticulum which is about as long as the duct or even somewhat longer; this diverticulum contains a simple seminal chamber, which occupies nearly all its length.

Two different forms of this species may be distinguished:—

F. TYPICA.

Setæ: Median ventral and dorsal distances larger than in the variety; anteriorly $aa = 3ab$, at the hinder end $aa = 2ab$ and $dd = 3\frac{1}{2}\ cd$.

Spermathecal pores of first pair on the 8th segment in the zone of setæ.

Hab.—South India, Kodaikanal in the Palni Hills, 7,000′; Dr. J. R. HENDERSON leg.

VAR. SILVESTRIS, MICHLSN.

Setæ: Median ventral and dorsal distances smaller than in the typical form; anteriorly $aa = 2ab$, at the hinder end $aa = \frac{4}{5}\, bc$ and $dd = 2cd$.

Spermathecal pores of the first pair on the 8th segment, but close to the intersegmental furrow 8-9, nearly united to those of the posterior pair.

Hab.—South India, Tiger Shola (near Kodaikanal) in the Palni Hills, 5,500′, virgin forest; Dr. J. R. HENDERSON leg.

PLUTELLUS SIKKIMENSIS, MICHLSN.

(Plate xiii, fig. 8.)

P. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 147, f. 2.

Present fourteen partly half mature, partly immature specimens.

External Characters.—Dimensions of the largest half mature specimen: Length 42 mm., thickness $\frac{3}{4}$—$1\frac{1}{2}$ mm., number of segments 90.

Colour white; without pigmentation.

Head epilobous (about $\frac{3}{5}$). Dorsal appendix of prostomium with parallel lateral borders, open behind, divided by a median longitudinal furrow.

Setæ rather stout, paired, but not strictly, nearly separated, especially the dorsal ones, the ventral ones only in the anteclitellar region. In general the median ventral distance is twice as large as the width of the ventral pairs, somewhat larger than the middle lateral distances, and the latter a little larger than the width of the dorsal pairs ($aa = 2ab$, $ab = \frac{2}{3}bc$, $bc = \frac{6}{5}cd$, or $aa : ab : bc : cd = 8 : 4 : 6 : 5$). At the anterior part of the body the width of the ventral pairs enlarges so as to be as large as the width of the dorsal pairs, which also enlarges, but less (anteclitellar $aa : ab : bc : cd = 6 : 5 : 6 : 5$). The median dorsal distance is about four times as large as the width of the dorsal pairs, about equal to the third part of the whole circumference ($dd = 4cd = \frac{1}{3}u$).

First dorsal pore at the intersegmental furrow 6-7.

Clitellum not yet developed.

Male pores on minute papillæ on the eighteenth segment in the lines of setæ *b*.

Male area: A nearly circular, not sharply bordered median ventral area of darker colour (glandular ?) extends from segment 18, a little upon the 17th and 19th segments and laterally about as far as the lines of setæ *b*.

Female pores before the setæ *a* of segment 14.

Spermathecal pores not seen distinctly, probably five pairs at the intersegmental furrows 4-5—8-9 just medial from the lines of setæ *b*.

Copulatory organs: A pair of transversely oval glandular areas at the intersegmental furrow 12-13 and divided by it, in the lines of the ventral pairs of setæ, sometimes connected by a glandular median area.

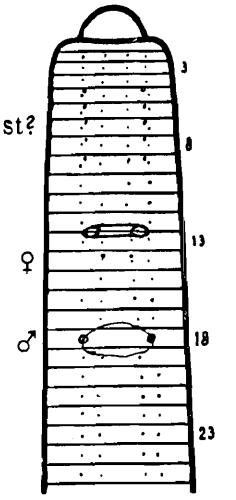

FIG. 10. *Plutellus sikkimensis.*

Internal Anatomy.—Septa 4-5 and 5-6 tender, 6-7—12-13 thickened, especially 9-10 and 10-11, which are very strong, the others becoming gradually less strong.

Alimentary tract: A small but distinct gizzard in the 5th segment, distinctly thicker than the neighbouring parts of the œsophagus and with thick muscular wall. Œsophagus behind the gizzard moniliform, with folded but not exactly calciferous gland-like walls. There are no calciferous glands. Intestine begins in segment 14.

Circulatory system: Last hearts in segment 12.

Nephridial system meganephric.

Anterior male organs: Two pairs of large tuft-like testes and two pairs of sperm-duct-funnels free in segments 10 and 11. There seem to be sperm-sacs in the 9th, 11th, and 12th segments, but I am not able to state this with certainty; perhaps I mistook compact masses of sperms for sperm-sacs.

Prostates tubular. Glandular part moderately long, with delicate axial tube, formed by a low epithelium and a thick glandular coat of large, roughly granular cells. The glandular part is narrowly and rather broadly undulated, and the undulations are closely pressed together. Examined *in toto* the glandular part appears nearly tongue-shaped. Only in sections is its tubular nature seen distinctly. Duct thin, about half as long as the entire glandular part (indeed, it is really much shorter than the glandular part when stretched out).

Penial setæ about $\frac{1}{3}$ mm. long and in the middle 9μ thick, curved at the proximal end, the distal end being bent at an obtuse angle. The distal end tapers somewhat and ends in a sharply pointed, slender tip, which is recurved in a very small, scarcely perceptible degree. With the exception of the naked tip the distal end is ornamented by about nine oblique annulets of more or less slender, relatively very large teeth which number about four or five in the half of an annulet as seen in examining the penial seta from the side. The teeth which stand at the concave curvature of the distal end seem to be larger than the others.

Female organs in normal position. Ovaries large. Oviduct funnels slipper-shaped. Oviduct moderately long, straight.

Spermathecæ: At first I could find no spermathecæ. In a series of sections, however, I found small outgrowths of the body-wall, projecting very little into the cœlom. Though these outgrowths had not a distinct lumen, I believe they were spermathecæ in a very early state of development. There were five pairs of such organs close behind the septa 4-5—8-9, just medial from the lines of setæ *b*. As the other sexual organs, for example the prostates and the penial setæ, seem to be fully developed, the stunted condition of the spermathecæ is remarkable. Perhaps these

organs remain in a rudimentary state throughout, but it is difficult to state this with certainty with only half-mature specimens to judge by.

Hab.—Eastern Himalayas, Sandakphu in the Darjiling district (British Sikkim); C. J. BERGTHEIL and I. H. BURKILL leg.

PLUTELLUS PALNIENSIS, MICHLSN.

(Plate xiii, fig. 7.)

P. p., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, 149, f. 3.

Present four mature specimens.

External Characters.—Dimensions of complete specimens: Length 170—225 mm., thickness in shorter, contracted specimens 3—4 mm., in longer, extended specimens 2—4 mm., number of segments 240—260.

Colour yellowish white or light grey; apparently without any pigmentation.

Body in general very slender.

Head epilobous (about $\frac{2}{5}$); prostomium small, short and broad, its hinder appendix nearly triangular, tapering backwards. Segments of the anterior part of the body, with exception of the first two, divided into 2—5 secondary annulets.

Setæ rather small, paired, but not very strictly; in general the lateral pairs nearly twice as wide as the ventral ones, only for one-third of the middle lateral distances narrower than the latter; middle lateral distances only a little smaller than the median ventral (in general $cd = 2ab = \frac{2}{3}bc = \frac{3}{5}aa$, or $aa : ab : bc : cd = 10 : 3 : 9 : 6$). At the anterior part of the body (anteclitellar) the ventral pairs get wider, principally at the cost of the middle lateral distances, getting nearly as wide as the lateral pairs, whilst the middle lateral distances get almost as narrow as the latter; the median ventral distance is on and just in front of the clitellum only a little larger than the width of the ventral pairs (anteclitellar, $ab = \frac{7}{8}cd = \frac{7}{9}bc = \frac{5}{6}—\frac{1}{2}aa$ or $aa : ab : bc : cd = 8—14 : 7 : 9 : 8$). The medial dorsal distance nearly equals half the circumference of the body (dd=ca. $\frac{1}{2}$ u). At the hinder end the dorsalmost setæ, those of the lines d, stand somewhat irregular.

Dorsal pores seen only behind the clitellum.

Clitellum indistinctly saddle-shaped, the ventral part less prominent and differing in appearance from the very prominent lateral and dorsal parts, constantly occupying segments 12—19 (=8).

Male pore unpaired, a minute median ventral longitudinal slit at the middle zone of segment 18 on a small papilla, which is surrounded or bordered behind and before by a rather thick wall.

Female pores in the place of the missing setæ a of segment 14, on a common median ventral transversely oval cushion.

Spermathecal pores two, unpaired, situated medially and ventrally on the intersegmental furrows 7-8 and 8-9.

Copulatory organs: Unpaired, indistinctly bordered cushions just behind the spermathecal pores on the anterior part of segments 8 and 9. Sometimes a similar, but smaller and rather more indistinct cushion behind the male pore at the anterior part of segment 19.

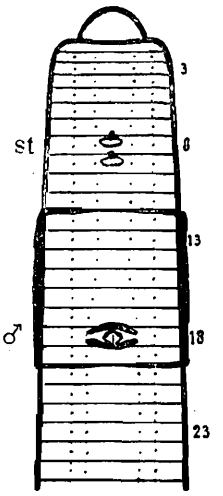

FIG. 11.
Plutellus palniensis.

Internal Anatomy.—Septa 6-7—12-13 thickened, septa 8-9—11-12 especially strong.

Alimentary tract: A rather big cylindrical gizzard in segment 6 (or in segment 5 ?). Two pairs of lateral sacculations with the longitudinal lamellar structure of calciferous glands in segments 14 and 15. These calciferous gland-like structures are very distinct but not separated from the main œsophagus, and their lumen is not separated from the general lumen of the œsophagus. Intestine without typhlosole.

Circulatory system: Dorsal vessel simple. Last hearts in segment 13.

Nephridial system meganephric.

Anterior male organs: One pair of testes and of sperm-duct-funnels free in segment 11. One pair of grape-like sperm-sacs depending from septum 11-12 into segment 12.

Prostates paired, tubular. Glandular part moderately thick and long, coiled. Duct short and narrow, nearly straight.

Penial setæ seem to be missing. The ducts of the two prostates enter the body-wall in about the lines of the setæ *a* and join in the interior of the latter to open through the common male pore.

A pair of tuft-like ovaries and of relatively large, folded oviduct-funnels in the 13th segment.

Spermathecæ (fig. 7) unpaired, a single one corresponding to each of the two intersegmental furrows 7-8 and 8-9; in the examined specimen the anterior one extending forwards into segment 7, the posterior one backwards into segment 9, and both arising from beneath the median ventral nerve chord, to the left side of the cœlomic cavity. Main pouch consisting of a sack-shaped ampulla which is somewhat broader distally than at the rounded proximal end, and an abruptly separated duct about a third as long and as broad as the ampulla. Into the distal end of this duct open, not far from one another, two small diverticula of different appearance. One of them, the smaller one, is nearly globular, and contains a single simple cavity (seminal chamber ?); the other is about as long as the former, but much broader, its lumen being divided into two or three incompletely separated seminal chambers. Externally the separation of these chambers is only indistinctly marked by slight furrows. Both diverticula open through a very short but narrow stalk, that of the simple diverticulum being not quite as distinct as that of the other, while its main cavity is only a little thicker than the stalk. The length of the diverticula about equals the thickness of the duct of the main pouch. Both spermathecæ of the dissected specimen were constructed quite similarly.

Hab.—South India, Tiger Shola (near Kodaikanal) in the Palni Hills, 5,500′; Dr. J. R. HENDERSON leg., vi-07.

GEN. MEGASCOLIDES.

MEGASCOLIDES BERGTHEILI, MICHLSN.

(Plate xiii, fig. 3.)

M. b., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 150, f. 4.

Present five mature specimens, of which two are incomplete.

External Characters.—Dimensions: Length 100—120 mm., greatest thickness $4\frac{1}{2}$—5 mm., number of segments 146—175.

Colour light grey; without pigmentation.

Head tanylobous. Prostomium small, its dorsal hinder appendix only a little narrower than the prostomium itself, with parallel lateral borders, often divided by a transverse furrow.

Segments 1—3 are simple, segments 4—6 are divided into two ringlets, 7 into four, 8 and 9 into five, 10—12 into three, as well as also the postclitellar segments, the latter somewhat less distinctly.

Setæ rather small, the ventral paired, the lateral remote from one another; the distance between those of the ventral pair only about a fifth part of the median ventral distance ($aa = 5ab$), the latter a little larger than the median lateral distances ($bc = \frac{4}{5}\ aa$) and these a little smaller than the distance between the lateral setæ ($bc = \frac{8}{9}cd$) ($aa : ab : bc : cd = 10 : 2 : 8 : 9$). The median dorsal distance is somewhat less than half the circumference ($dd =$ ca. $\frac{8}{17}u$).

Dorsal pores distinctly visible on the clitellum and behind it, the first in the intersegmental furrow 12-13.

Clitellum ring-shaped, occupying segments 13—17 (=5), but on the 13th segment somewhat lower than on the others.

Male pores on segment 18 in about the lines of the setæ *b* if not between *a* and *b*, each on a penis-like short tip which rises out of a transversely oval, nearly circular opening just in the centre of a big, knob-like papilla. These papillæ are transversely oval and occupy the whole length of segment 18; they nearly meet in the ventral median line, where they are connected with each other by a transverse lower and narrower bridge.

Female pores transverse slits in the 14th segment, anterior to and medial from the setæ *a*, on a more or less distinct transverse furrow.

Spermathecal pores one pair on the intersegmental furrow 7-8, between the lines of setæ *a* and *b*, each on a small, but mostly distinct, transversely oval, eye-shaped papilla, which extends between the lines of setæ *a* and *b*.

Copulatory organs very distinct and prominent and apparently constant on segments 12, 13 and 20, in one specimen an additional organ on segment 21, in two other specimens an additional one on segment 11. The copulatory

organs are ventral median biscuit-shaped areas, occupying the whole length of their segment and even widening the borders of it, and extending laterally over the lines of setæ *b*. They are surrounded by a big prominent wall. The depressed inner area of the copulatory organs is occupied by two transversely oval papillæ, the centres of which lie in abou the lines of setæ *a*, and which are connected with each other by a lower and narrower transverse bridge.

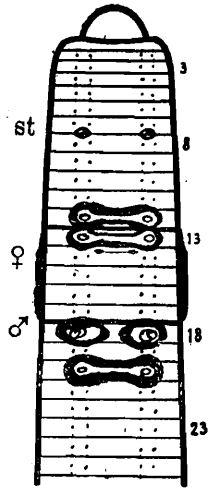

FIG. 12. *Megascolides bergtheili.*

The additional copulatory organs on segments 11 and 21 are smaller than the constant ones and are present, in two of the three cases, only on one side.

Internal Anatomy.—Septum 6-7 (5-6?) very strong, (6-7 and?) 7-8 missing, 8-9 and 9-10 very strong, 10-11 moderately strong, 11-12 only a little thickened, the following tender.

Alimentary tract: A big oblique gizzard between the two strengthened septa 6-7 (5-6 ?) and 8-9. Œsophagus in segment 11 swollen, with calciferous gland-like structure but no particular calciferous glands, separated from the œsophagus. Intestine beginning in segment 12, sacculated laterally in the anterior part, with a pair of lateral cæca in segment 20 (?) and a very small typhlosole in the middle part. The cæca are broad and short and restricted to their segment of origin.

Nephridial system micronephric. The micronephridia are scattered over the lateral parts of the body-wall between the lines of setæ *b* and *c*, but there is also at each side a somewhat irregular additional row dorsal to the lines of setæ *d*. In the anteclitellar segments the lateral micronephridia are crowded to form a rosette-like bunch, which almost looks like a meganephridium. In the segments of the extreme hinder part of the body a part of the micronephridia seems to be replaced by a greater nephridium, apparently a meganephridium (?).

Anterior male organs: Two pairs of testes and great sperm-duct-funnels in segments 10 and 11, at least those of the anterior pair free, those of the posterior pair perhaps enclosed in seminal vesicles. The sperm-duct-funnels of the anterior pair in segment 10 are close together and near the median ventral line, whilst those of the posterior pair in segment 11 are placed more laterally. A pair of big, grape-like, but rather compact sperm-sacs depend from septum 11-12 into segment 12, a pair of smaller rosette-like sperm-sacs from septum 9-10 into segment 9.

Prostates tubular. Glandular part rather thick, densely coiled, occupying about three segments. Duct much shorter and thinner, somewhat increasing in thickness towards the distal end, irregularly bent or coiled. The two sperm-ducts of one side are separated all along their course from their anterior end to segment 18. Here, leaving the body-wall, they ascend beside the duct of the prostate, unite to form a single duct and then enter the proximal part of the duct just beneath (distal to) the point where it changes into the glandular part of the prostate. In the interior of the prostate, piercing longitudinally the wall of the muscular duct of the prostate, the now single sperm-duct descends distally, that is towards the male pore. Before reaching

the latter, at about the end of the distal fourth of the duct of the prostate, the sperm-duct enters the lumen of the latter.

There are no penial setæ.

Spermathecæ (fig. 3): Main pouch with a big sack-like ampulla, the wall of which is transversely striated or rather folded at one side, and a very short duct about half as thick as the ampulla. Into the main pouch at about the border line between ampulla and duct enter two opposite groups of diverticula. Each group consists of about three short, globe-like diverticula about a third as long as the ampulla. The diverticula of one group are more or less grown together, rarely separated as far as the common short and broad stalk, mostly only representing separate swellings of a united diverticulum. Each swelling or each separate part of a diverticulum represents a simple seminal chamber.

Hab.—Eastern Himalayas, Sandakphu in the Darjiling district (British Sikkim), 11,900′; C. J. BERGTHEIL and I. H. BURKILL leg.

GEN. SPENCERIELLA.

SPENCERIELLA DUODECIMALIS, MICHLSN.

Sp. d., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 152.

Present two mature specimens, but only one with developed clitellum.

External Characters.—Dimensions: Length 32—40 mm., greatest thickness 2—2½ mm., number of segments 94—109.

Colour anteriorly reddish grey, at the middle and hinder parts of the body yellowish or brownish, partly greenish grey.

Head epilobous (½). Hinder appendix of prostomium open behind.

Setæ rather large at the ends of the body, moderately large in the middle part. They are quite regularly arranged at the anterior part of the body as far as the middle or nearly as far. Here we find twelve setæ on each segment, which are placed in regular longitudinal lines. At the anteclitellar part of the body the twelve setæ are arranged in wide but distinct pairs, the distance between the two setæ of a pair being a little smaller than the intermediate distances, which nearly equal the median dorsal and ventral distances (anteclitellar, $ab = cd = ef < bc = de < aa = ff$). At the postclitellar part the pairs get wider until they equal the intermediate distances (postclitellar, $ab = bc = cd$—$de = ef = \frac{3}{4}aa = \frac{2}{3}ff$). From about the 45th or 50th segment the arrangement of the setæ gets irregular whilst the number of them increases to 16 or 17. The lines of setæ *a* and *b* are regular throughout and nearly so the lines of setæ *z* (resp. *f*).

First dorsal pore at the intersegmental furrow 5-6 ?

Clitellum ring-shaped, occupying the segments $\frac{2}{3}$ 13—$\frac{2}{7}$ 17 ($= 4\frac{1}{3}$).

Male pores on moderately large circular papillæ on the 18th segment just medial from the lines of setæ *b*. The male papillæ are somewhat inclined medially.

Spermathecal pores one pair at the intersegmental furrow 7-8 just lateral to the lines of setæ *b*.

There are no distinct copulatory organs.

Internal Anatomy.—Septa 7-8—12-13 somewhat thickened, but not much, septa 8-9—11-12 the most distinctly.

Alimentary tract: A large gizzard in the 7th segment, if not further anteriorly. Œsophagus up to the 12th segment simple, only a little swollen segmentally. In each of the two segments 13 and 14 is a pair of large, kidney-shaped lateral swellings with the characteristic structure of calciferous glands. But these swellings are not set off from the general wall of the œsophagus (not stalked), and their lumen is not separated from the general lumen. Œsophagus narrow in the 15th segment. The intestine, which begins suddenly in the 16th segment, is not provided with a typhlosole.

Circulatory system: Dorsal vessel simple. Last hearts in the 12th segment.

Nephridial system micronephric. In the posterior part of the body some (four in one segment?) seem to be somewhat larger than the others, nearly equalling small meganephridia.

Anterior male organs: Two pairs of sperm-duct-funnels free in the 10th and 11th segments. Two pairs of broad grape-like sperm-sacs depend from septa 10-11 and 11-12 into the 11th and 12th segments.

Prostates tubular. The glandular part is rather thick and very long, describing in each segment some irregular windings, closely pressed together; it extends through about twelve segments, from the 23rd to about the 34th. The duct arises abruptly from the glandular part. It is relatively long, describing some irregular, but not very broad windings, especially in its proximal part. It extends from the 23rd segment to the point of its opening in the 18th segment. The proximal third part of the duct is very narrow; the distal part is rather thick and muscular. There are no penial setæ.

Spermathecæ: Main pouch with a large sack-like ampulla, which opens through a very short and narrow, indistinct duct. Into this latter opens a thin tube-like diverticulum, about half as long as the main pouch and somewhat bent, and containing in its proximal half a simple seminal chamber. This seminal chamber is formed only by a widening of the lumen consequent on a thinning of the walls of the diverticulum. The diverticulum is not at all broader in the region of this seminal chamber; on the contrary it is somewhat narrower.

Hab.—South India, Kodaikanal in the Palni Hills, 7,000′; Dr. J R. HENDERSON leg., vi-07.

GEN. WOODWARDIA.

WOODWARDIA BURKILLII, MICHLSN.

(Plate xiii, fig. 6.)

W. b., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 152, f. 5.

Examined three specimens of which only one is complete.

External Characters.—Dimensions: Length 50 mm., thickness $\frac{9}{10}$—$\frac{11}{10}$ mm., number of segments 125.

Colour white; without pigmentation. Colour of living animals "roseus."

Head prolobous.

Setæ moderately large, paired, but not very strictly. Distance between the setæ of a pair about half as large as the ventral median distance. Lateral median distances somewhat smaller than the ventral median distance ($aa = 2ab = \frac{6}{7}bc = 2cd$). Median dorsal distance about as large as half the circumference ($dd = \frac{1}{2}u$).

Clitellum ring-shaped, occupying segments 14—17 (=4).

Male pores (fig. 6) at the 18th segment just medial from the lines of setæ *b*, between the lines of setæ *b* and *a*, on distinct papillæ having a distinct curved border anteriorly which becomes gradually indistinct posteriorly. At each side a distinct but narrow furrow proceeds from the male pore to the intersegmental furrow 18-19 and a little across it on to the 19th segment. These furrows converge somewhat towards the median ventral line and are somewhat deepened at the point of crossing the intersegmental furrow 18-19. At first sight I thought these stitch-like depressions were the male pores, and the openings on the papillæ of the 18th segment only the openings of the prostates, the furrows being seminal furrows. A more exact study of two series of transverse and longitudinal sections showed me that this species is a true *Woodwardia*, the sperm-ducts not opening separately, but entering the duct of the prostates near its origin from the glandular part of the prostates. The furrows proceeding from the pores on the papillæ are no true seminal furrows and contain no separate male pores.

Female pores at the anterior ventral part of the 14th segment medial from the lines of setæ *a* and before the zone of setæ, on a common ventral-median almost linear transverse area, which surpasses on each side the lines of the setæ *a*.

Spermathecal pores two pairs on the intersegmental furrows 7-8 and 8-9, a little lateral from the lines of setæ *a*, nearer to these than to the lines of setæ *b*.

Copulatory organs not present, but the ventral setæ of segments 8 and 9 seem to be obliterated (or changed into copulatory setæ and fallen out during the act of copulation?).

Internal Anatomy.—Septa 7-8—15-16 somewhat thickened, especially the middle ones, 10-11 and 11-12.

Alimentary tract: A rather big gizzard before the first thickened septum (in the 7th segment?). Œsophagus widened in segments 9, 10, 11 and 12, its walls showing quite the densely lamellated structure of calciferous glands; but there are no separated calciferous glands set off from the œsophagus. Intestine with a simple, moderately thick typhlosole.

Nephridial system meganephric. Meganephridia rather small.

Anterior male organs: Two pairs of testes and sperm-duct-funnels free in segments 10 and 11. One pair of small sperm-sacs depending from septum 11-12 into the 12th segment.

Prostates with an oblong, densely grape-like glandular part, extending through the 5th or 6th segment (*Pheretima*-prostates). A moderately long somewhat coiled duct leaves the anterior end of the prostates. The sperm-ducts enter near the proximal end of the duct of the prostates.

Penial setæ are missing.

Spermathecæ: The main pouch consists of a big irregularly pear-shaped ampulla, narrowed distally, and a very short and very narrow muscular duct, almost completely hidden in the body-wall. Into the narrowed distal end of the ampulla opens a relatively large club-shaped diverticulum, which is somewhat shorter than the ampulla, the greater proximal part of which represents a large, simple seminal chamber.

Hab.—Lower Burma, Buthidaung, in Western Akyab district, in damp soil of thick forest; I. H. BURKILL leg., 17-i-07.

GEN. NOTOSCOLEX.

NOTOSCOLEX SCUTARIUS, MICHLSN.

(Plate xiii, figs. 4, 5.)

N. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 153, f. 6.

Present three mature specimens.

External Characters.—Dimensions: Length 68—90 mm., greatest thickness $1\frac{1}{3}$—2 mm., middle and hinder part of the body thinner, hardly 1 mm. thick; number of segments 120—140.

Colour yellowish grey; apparently without pigmentation.

Head pro-epilobous.

Setæ rather tender, widely paired. At the anterior part of the body: the lateral pairs only a little narrower, the ventral pairs distinctly narrower than the middle lateral distances; median ventral distance about $\frac{3}{2}$ as large as the distance between the setæ of the ventral pairs; median dorsal distance equalling about $\frac{1}{3}$ of the circumference (at the anterior end $aa = \frac{5}{2}ab$, $ab = \frac{4}{5}bc$, $bc = \frac{9}{8}cd$, $dd = \frac{1}{3}u$, or $aa : ab : bc : cd : dd = 12 : 8 : 10 : 9 : 33$). Towards the posterior end the ventral pairs widen somewhat, getting nearly if not quite as wide as the lateral pairs. The median dorsal distance, on the other hand, diminishes (at the posterior end $aa = 1\frac{2}{3}\ ab$, $ab = \frac{3}{4}$, $bc = cd$, $dd = \frac{1}{5}\ u$, or $aa : ab : bc : cd : dd = 5 : 3 : 4 : 3 : 6$).

First dorsal pore at the intersegmental furrow 13-14, if not somewhat more forward.

Clitellum ring-shaped, distinctly only on the three segments 14—16, more or less indistinctly on the hinder part of segment 13 (or on the whole of the 13th segment and on the anterior part of segment 17 ?).

Male pores (fig. 4) in the lines of setæ *b* on the 18th segment, on a common median ventral area. The male area has the figure of a trapezium rounded at the angles and somewhat broader at the anterior part than behind. It occupies the whole length of the 18th segment and surpasses laterally the lines of setæ *b*. The longitudinal borders are somewhat convex laterally, the transverse borders are more or less concave. The whole organ has the appearance of a shield, having somewhat prominent sharply marked borders and a flat or even a slightly depressed interior

plane, which bears the male pores on its lateral parts. The male pores are at the tip of very small papillæ, which are connected with the lateral borders of the male area.

Female pores on a median ventral, transversely elongated dark (glandular?) area, which is stretched out between the setæ *a* of the 14th segment.

Spermathecal pores two pairs, on the intersegmental furrows 7-8 and 8-9 in the lines of setæ *b*.

There are no distinctly circumscribed copulatory organs, but in one specimen the whole ventral part of the body-wall at segments 7—9 is swollen, glandular. In the other specimens this modification of the body-wall is indistinct.

Internal Anatomy.—Septa 6-7—12-13 thickened, but not much so, in general only moderately, 12-13 very little. Septum 5-6 very tender.

Alimentary tract: A relatively big cylindrical gizzard in the 5th segment. Œsophagus simple, without set-off calciferous glands or distinct glandular swellings. Intestine, at least in the anterior part, without typhlosole.

Circulatory system: Dorsal vessel simple. Last hearts in the 13th segment.

Nephridial system micronephric. The micronephridia are not scattered over the whole body-wall nor even over the greater part of it, but occupy in general in each segment only an area at the anterior half of the lateral body-wall, where they form a rather densely crowded, villose turf. In the segments of the clitellar region these turfs are more expanded, occupying nearly the whole ventral and lateral parts of the body-wall. I could detect no meganephridia in the hinder end of the body. At least in the tenth segment from behind micronephridia were still found.

Anterior male organs: One pair of large testes and sperm-duct-funnels free in the 11th segment. One pair of broad grape-like sperm-sacs depending from septum 11-12 into the 12th segment.

Prostates: Glandular part much and rather loosely lobed, forming in general a flat, moderately broad, very long ribbon, which, pressed against the dorsal part of the body-wall, stretches through about six segments backwards. Duct relatively long, about half as long as the glandular part, rather thin, only a little thicker in the proximal half or two-thirds, describing one large loop and one or two smaller ones. There are no penial setæ.

Female ogans: One pair of tuft-like ovaries and of somewhat folded oviduct-funnels in the 13th segment.

Spermathecæ (fig. 5): Main pouch with a pear-shaped ampulla, which distally passes without any break into a thin, rather long duct, which is only a little shorter than the ampulla and a little thickened at the distal end. Into this distal end opens a single slender, club-shaped diverticulum about as long as the main pouch, but much thinner, somewhat swollen at the proximal half, containing a single simple seminal chamber.

Hab.—South India, Vilpatti in the Palni Hills; Dr. J R. HENDERSON leg., vi-07.

GEN. PERIONYCHELLA.

PERIONYCHELLA ANNANDALEI, MICHLSN.

P. a., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 154, f. 7.

I had one sexually mature specimen, broken into several pieces, but apparently complete.

External Characters.—Dimensions: Length *ca.* 280 mm. if not more, thickness 6—10 mm., number of segments 215 if not more.

Colour: dorsally dark violet-blue, ventrally lighter, reddish grey.

Head pro-epilobous, if not shortly epilobous.

Setæ of the anterior part of the body very minute, of the posterior part larger; dorsally further apart one from another than ventrally. Circles of setæ in general complete, only dorsally sometimes shortly interrupted, the two median setæ standing further apart than other neighbouring setæ ($zz \gtrless yz$). Number of setæ *ca.* 80-iv (or more?), 85-x, 70-xix.

First dorsal pore on the intersegmental furrow between segments 21 and 22 or more in front ?).

Clitellum distinguished only by its darker colour, occupying segments 12—24 (=13), developed all round the body, but at the most anterior and the most posterior part ventrally less distinct if not interrupted; anterior and posterior border of clitellum not sharp.

On the 18th segment a circular male area somewhat deepened, especially at the periphery, occupies the whole length of the segment in the ventral median line. The surface of this area is wrinkled, and, in the zone of the setæ, elevated to a small rampart. The pale colour of this area extends somewhat over the surrounding surface. A pair of inconspicuous male pores is situated on the lateral parts of this male area in the zone of setæ. Some setæ are to be found between the male pores on the rampart-like zone of the area.

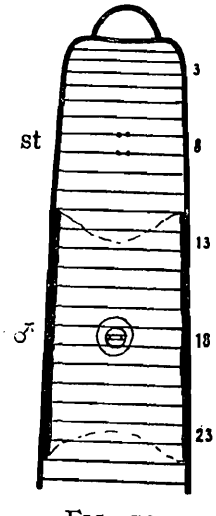

FIG. 13. *Perionychella annandalei.*

Spermathecal pores inconspicuous, two pairs in the intersegmental furrows 7-8 and 8-9 very near the ventral median line.

Internal Anatomy.—Septa in the region of the sperm-sacs thickened.

Alimentary tract: A moderately great gizzard in the 6th (?) segment. Œsophagus simple, without calciferous glands. Intestine without typhlosole and cæca.

Nephridial system meganephric.

Anterior male organs: Two pairs of great sperm-duct-funnels in the 10th and 11th segments, apparently free, not enclosed in sperm-reservoirs, which seem to be missing. Paired grape-like sperm-sacs in segments 11, 12 and 13, suspended at the septa in front. The sperm-sacs of the 13th segment are smaller than the foregoing and seem to be continuous with those of the 12th segment.

Prostates: *Pheretima*-prostates. Glandular part occupying segments 18 and 19, thick, compact, with rough and fissured surface, cleft by the septum 18-19. Duct short, thick.

There are no penial setæ.

Spermathecæ: Ampulla sack-like, duct half as long and as thick, somewhat projecting into the ampulla. A few (always two?) seminal chambers are enclosed in the wall of the spermathecal duct, projecting externally as small, flat papillary knobs which are remarkable for their metallic lustre. There are no free diverticula.

Hab.—Eastern Himalayas, Kurseong in the Darjiling district, 5,000′; Dr. N. ANNANDALE leg., 21—29-v-06.

Remarks.—This unique specimen lay broken on the footpath. The collector supposes that the animal in creeping about was mistaken for a snake, and therefore broken to pieces.

PERIONYCHELLA VARIEGATA, MICHLSN.

(Plate xiii, fig. 11.)

P. v., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 158.

Examined ten specimens, among which were some mature ones.

External Characters.—The shape of the body is very peculiar, and, together with the colouring, gives this worm nearly the appearance of a terricole planarian or a leech. The body is very short and depressed, much broader than high, narrowing towards both ends, towards the hinder end somewhat more slender than towards the fore end.

Dimensions of the mature specimens: Length 21—24 mm., greatest breadth 2—2⅔ mm., number of segments relatively small, *i.e.*, 49—63.

Colour: Prime colour yellowish grey. At the dorsal side speckled with irregular dark violet-grey spots, large enough to be distinctly seen with the naked eye. A dark longitudinal stripe, sometimes interrupted intersegmentally in the dorsal median line. The darker colour of these spots is caused by a black pigment placed in the layer of the transverse muscles of the body-wall, whilst the black pigment of the median dorsal longitudinal stripe lies in the layer of the longitudinal muscles of the body-wall.

Head epilobous (⅔); hinder appendix of prostomium open behind, divided by a median longitudinal furrow, which is continued backwards as far as the intersegmental furrow 1-2.

Setæ moderately large. Circles of setæ only slightly interrupted dorsally by a relatively short median distance, being about 1½ times as large as the neighbouring distances, ventrally indistinctly interrupted. Distances dorsally in general somewhat larger than ventrally. Number of setæ about 45—60 in the middle part of the body.

First dorsal pore at the intersegmental furrow 5-6.

Clitellum at segments 13—17 (=5), only distinguishable in some specimens by the smothered pigmentation of the dorsal side.

Male pores at the 18th segment in the lines of about the five setæ from the ventral median line (setæ *e*), in the centre of large, but not very prominent, nearly circular papillæ which occupy nearly the whole length of the 18th segment. The interspace between these two papillæ is somewhat smaller than their diameter. The distance between the male pores amounts to about $\frac{1}{7}$ of the whole circumference of the body. There are about eight or nine setæ between the male pores, some of them standing on the papillæ.

Female pore unpaired, in the median ventral line at the anterior part of the 14th segment.

Spermathecal pores three pairs at the intersegmental furrows 6-7, 7-8 and 8-9, about in the lines of the eight setæ from the ventral median line, those of one pair further distant from each other than the male pores.

Copulatory organs not present.

Internal Anatomy.—The septa throughout the body are relatively strong, being much thicker than is usual in earthworms. Especially thickened septa, about twice as thick as the septa in the middle parts of the body, are the septa 7-8 and 8-9, in a lesser degree also 6-7 and 9-10, whilst 12-13 seems to be even thinner than the normal septa, perhaps because it is stretched out in a high degree by the great sperm-sacs of segment 12. Septum 5-6 is normally thick, 4-5 is very much thinner.

Alimentary tract: A very small gizzard in segment 5. It is only a very little thicker than the other parts of the œsophagus, but provided with a thick layer of transverse muscles, the lumen of this part of the œsophagus being very much reduced. It is a matter of opinion whether this gizzard should be called rudimentary or well developed. Œsophagus simple, with folded walls, but without calciferous glands. Intestine begins in the 14th segment, somewhat dilated segmentally, without typhlosole.

Circulatory system: Dorsal vessel simple. Last hearts in the 12th segment.

Nephridial system meganephric. Nephridia with a long and moderately thick terminal vesicle.

Anterior male organs: Two pairs of sperm-duct-funnels free in the 10th and 11th segments. Three pairs of large sperm-sacs in the 10th, 11th and 12th segments, the two latter depending from septa 10-11 and 11-12 backwards into the 11th and 12th segments.

Prostates in structure intermediate between those of *Plutellus* and *Pheretima*. Muscular duct moderately long, slightly bent, proximally changing into a glandular much-branched tube. The branches of the latter are compressed by a thin enveloping membrane to a rather compact kidney-shaped "glandular part." The duct enters this glandular part at the deep ventral incision of the "kidney." The lumen of the glandular tubes is tapestried by an epithelium of rather short cylindrical cells, whilst the glandular cells form an outer layer to each tube. The sperm-ducts enter the glandular part of the prostates from behind.

Penial setæ are not present.

Female organs: A pair of relatively large, folded oviducal funnels in the 13th segment.

Spermathecæ (fig. 11): Ampulla globular, hardly as long as broad, opening by means of a duct, which is as long as the ampulla and hardly thinner. The lumen of the duct is somewhat widened and distinctly set off from that of the ampulla. There are no diverticula.

Hab.—Eastern Himalayas, Phallut in the Darjiling district (British Sikkim), 11,800–12,000′; C. J BERGTHEIL and I. H. BURKILL leg.

PERIONYCHELLA NAINIANA, MICHLSN.

P. n., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 155.

Present four more or less mature specimens and some young ones.

External Characters.—Dimensions of a fully mature specimen: Length 85 mm., thickness $2\frac{1}{2}$—$3\frac{1}{3}$ mm., number of segments *ca.* 105.

Colour dorsally dark bluish violet, with greenish iridescence, ventrally in general grey, at the anterior part of the body the pigmentation, becoming violet-grey, passes all round the body.

Head epilobous (about $\frac{1}{2}$). Hinder appendix of prostomium nearly square, open behind.

Setæ moderately and equally large everywhere, nearly equidistant from one another. Circles of setæ complete. Numbers of setæ differing very little relatively on different segments, about fifty on the segments close behind the male pores.

Dorsal pores distinct from the intersegmental furrow 3-4. There appears to be a narrower or perhaps rudimentary dorsal pore already at the intersegmental furrow 2-3.

Clitellum, in external appearance only differing by its colour, occupying segments 13—18 (=6).

Male pores at the 18th segment a very short distance behind the circle of setæ, which is interrupted before them; they are small transverse slits, distant one from the other about $\frac{1}{5}$ of the circumference of the body. The circle of setæ of the 18th segment is broadly interrupted in the median part. There remain only five or six setæ in this circle medial from the lines of the male pores, and these medial setæ, without being pushed out of the regular row, are modified (see below).

Spermathecal pores two pairs at the intersegmental furrows 7-8 and 8-9, those of each pair distant one from the other about $\frac{1}{4}$ of the circumference of the body.

There are no distinct copulatory organs, but the whole ventral surface of the 18th segment appears glandular and whitish in colour.

Internal Anatomy.—The septa of the anterior male region are a little thickened, but not much. The thickening of the septa gradually decreases; the septa 5-6 and 14-15 are tender.

Alimentary tract: A very small, but not exactly rudimentary, gizzard in the 5th segment. This gizzard is only a little thicker than the neighbouring parts of the œsophagus, but its muscle-layer is relatively thick, being about eight times as thick as the inner epithelium or the muscle-layer of the neighbouring parts of the œsophagus.

There are no distinct calciferous glands, but in the 13th and 14th segments the œsophagus is somewhat swollen and the inner surface of its wall is irregularly lamellated and papillated.

Circulatory system: Last hearts in the 12th segment.

Nephridial system meganephric. Meganephridia of neighbouring segments quite equal.

Anterior male organs: Two pairs of tuft-like testes and of much folded sperm-duct-funnels free in the 10th and 11th segments. Two pairs of rather compact, at the surface roughly mammillated, sperm-sacs depending from septa 10-11 and 11-12 into the 11th and 12th segments.

Prostates quite restricted to the 18th segment. Glandular part relatively small, lobate, deeply incised at the medial side, duct about as long as the glandular part, straight, rather thin, especially at its distal end, which opens directly to the exterior.

Copulatory setæ: The setæ of the 18th segment medial from the lines of the male pores are modified. They are more than twice as long as the setæ just lateral from those lines. Whilst the latter ordinary setæ are about 0·3 mm. long and 13 μ thick, these modified setæ are about 0·7 mm. long and 17 μ thick. They are nearly straight, being only very slightly bent at the distal end, which has a simple tip. I could not detect a distinct ornamentation. Only at high microscopical powers I saw what seemed to be some very fine hair-like structures near the distal tip, closely appressed to the surface of the seta. These copulatory setæ represent the first step of modification towards the development of penial setæ from ordinary setæ. They still remain in the original situation, being not yet strictly united to the opening of the prostates, and, further, show only a slight difference from the shape of the ordinary setæ.

Female organs: A pair of great tuft-like ovaries in the 13th segment.

Spermathecæ very simple, consisting only of a small, nearly globular ampulla, which opens to the exterior by means of a short thin duct. There are no diverticula. I am not quite sure whether these spermathecæ have already attained their full growth and their final structure, but it is probable, as the examined specimen appeared fully mature in all other respects.

Hab.—Western Himalayas, Naini Tal in the Kumaon district, 6,400′; Dr. N. ANNANDALE leg., 28-ix—3-x-06.

Perionychella sikkimensis, Michlsn.

(Plate xiii, figs. 12, 13.)

P. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 156.

Present one mature specimen and five immature ones, some of which are somewhat doubtful.

External Characters.— Dimensions of the mature specimen, which, perhaps, is not quite complete: Length 120 mm., thickness 4—5 mm., number of segments 109 (hinder end regenerated).

Colour: Dorsally violet-grey, somewhat more intensive at the anterior part of the body; ventrally grey.

Head epilobous (*ca.* ½): first segment divided by a median longitudinal furrow.

Setæ rather small. Circles of setæ nearly complete, only very slightly and irregularly interrupted dorsally; ventrally, somewhat denser than dorsally (*zz* = 1–1½ *yz*). Number of setæ: 60-vii, 64-x, 78-xiii, 72-xxv.

First dorsal pore at the intersegmental furrow 7-8, if not 6-7.

Clitellum in the middle part ring-shaped, but ventrally somewhat less distinct, at the anterior and posterior part ventrally rather broadly interrupted; dorsally occupying segments 13—17 (= 5).

Male pores on small papillæ on the 18th segment, distant one from the other about ⅛ of the circumference of the body. The narrow median ventral part between the papillæ of the male pores is somewhat depressed.

Female pores unpaired (?), on a circular whitish area which lies medial-ventrally at the anterior part of segment 14.

Spermathecal pores two pairs, on the intersegmental furrows 6-7 and 7-8, those of one segment distant one from the other about ⅐ of the circumference of the body. They are inconspicuous, being seen only from the interior side of the body-wall by pursuing the duct of the spermathecæ.

Copulatory organs not developed.

Internal Anatomy.—Septa 6-7—16-17 thickened, the extreme ones only a little, the middle ones gradually more intensive.

Alimentary tract: A small cylindrical gizzard in the 6th (?) segment. This gizzard is hardly thicker than the neighbouring parts of the œsophagus, but not exactly rudimentary; it has a rather big muscular wall, and appears in longitudinal section rather sharply set off from the unmodified œsophagus. There are no calciferous glands, but in the 14th and 15th segments, somewhat less in the 13th segment, the œsophagus is somewhat enlarged. The intestine begins in the 17th segment. It is broadly sacculated in the anterior part. As far as the 30th segment I could detect no typhlosole.

Circulatory system: Dorsal vessel simple. Last hearts in the 12th (?) segment.

Nephridial system meganephric.

Anterior male organs: Two pairs of testes and sperm-duct-funnels free in the 10th and 11th segments. Two pairs of great sperm-sacs depending from the ventral parts of septa 10-11 and 11-12 into the 11th and 12th segments; they embrace together the œsophagus in these segments, those of each pair meeting dorsally from the latter.

Prostates with a rather small, nearly compact, irregularly-shaped glandular part and a moderately thick nearly straight duct, which is about as long as the glandular part. The duct leaves the glandular part at the angle of a medial incision of the latter.

Penial setæ (fig. 12) apparently one in a bundle, about 0·9 mm. long and 28 μ thick, narrowing only a little distally, nearly straight, only very slightly bent at

the distal end which has a moderately sharp, simple tip. The distal part of the seta is ornamented with irregular, sometimes oblique, transverse rows of, small triangular teeth.

Spermathecæ (fig. 13) with an oblong, nearly cylindrical ampulla and a somewhat shorter and thinner, but externally not abruptly set off duct, without any trace of diverticula, not even hidden in the interior of the wall. The ampulla is smooth externally, but with irregular folds on the interior surface of its wall.

Hab.—Eastern Himalayas, Sandakphu in the Darjiling district (British Sikkim), 11,900′; C. J BERGTHEIL and I. H. BURKILL leg.

? ,, ,, Subarkum in the Darjiling district (British Sikkim), 11,600′; C. J BERGTHEIL and I. H. BURKILL leg.

? ,, ,, Kurseong in the Darjiling district; Dr. N. ANNANDALE leg., 21—29-v-06.

Remarks.—*Perionychella sikkimensis* comes near to the genus *Perionyx*, not only in the external appearance, but also in more important features, *viz.*, in the smallness of the gizzard and in the approximation of the male pores and the spermathecal pores towards the median ventral line. In certain points it resembles *Perionychella m'intoshi* (BEDD.) (=*Perionyx m'intoshi*, BEDD.). It is distinguished from the latter by its smaller size, by the lesser extension of its clitellum and by the position of its spermathecal pores.

PERIONYCHELLA SIMLAËNSIS, MICHLSN.

(Plate xiii, figs. 14, 15.)

P. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 157.

Present six mature specimens and some young ones.

External Characters.—Dimensions of the mature specimens: Length 85—100 mm., greatest thickness 4—5 mm., number of segments about 128, all nearly alike.

Colour violet-red dorsally, at the anterior part of the body darker,—nearly dark blue-violet; ventrally grey with exception of some of the most anterior segments, at which the violet pigmentation surrounds the whole body but is rather lighter ventrally.

Head epilobous ($\frac{2}{5}$). Hinder appendix of prostomium open behind.

Setæ moderately small. Circles of setæ complete ventrally, nearly complete dorsally, here at least not distinctly interrupted, ventrally much denser than dorsally. Number of setæ 45-v, 46-viii, 52-xii, 45-xix, 45-xxvi.

First dorsal pore in the intersegmental furrow 4-5.

Clitellum occupying the segments 13—17 (=5), ring-shaped, interrupted only ventrally at the 13th segment by a trapezoidal median interspace, which is narrower behind and here joins the circular non-glandular area of the female pore. Setæ and intersegmental furrows quite distinct in the whole clitellar region.

Male area (fig. 15) occupying the whole length of the 18th segment, quadrangular with rounded angles, somewhat broader than long, deeply depressed especially in the median part, at the sides bordered by glandular elevations which occupy the remainder of the ventral surface of segment 18. The depressed male area bears on the lateral parts, inclined towards the median ventral line, a pair of nearly circular wrinkled cushions. The hinder part of these cushions bears a penis, directed obliquely and medially backwards, and formed like a cone rounded at the top and with a deep longitudinal furrow at the anterior side; the tips of the penial protuberances nearly meet above the median ventral line. The furrows at the anterior side of the penial protuberances may be called seminal furrows; they are continued forward as far as the centre of the glandular cushions, ending here in the male pores.

Female pore single, at the median ventral line on the anterior part of the 14th segment, surrounded by a circular area dark in the middle and white at the borders.

Spermathecal pores two pairs on the intersegmental furrows 7-8 and 8-9, those of one pair distant one from the other about $\frac{1}{10}$ of the circumference of the body.

Internal Anatomy.—Septa all tender, those of the testicular region and some adjacent ones only very little thicker than the others, but not at all strong.

Alimentary tract: A very small gizzard in the 5th segment. The gizzard hardly thicker than the adjacent parts of the œsophagus, but not exactly rudimentary. It has moderately thick muscular walls, the muscle-layer being about three times as thick as the interior epithelium. The œsophagus is simple, without calciferous glands or walls of a calciferous gland-like structure.

Circulatory system: Last hearts in the 13th segment.

Nephridial system meganephric. There is no perceptible difference between the nephridia of different segments.

Anterior male organs: Two pairs of tuft-like testes and two pairs of much folded sperm-duct-funnels free in the 10th and 11th segments. Four pairs of great, much incised sperm-sacs depending forward from septa 9-10 and 10-11 and backward from septa 10-11 and 11-12 into segments 9, 10, 11 and 12—14 respectively, the hindermost being very great, extending through three segments.

Prostates with a compact, thickly disc-shaped, much incised glandular part and a rather thick, irregularly bent muscular duct, which is about as long as the glandular part. There are no penial setæ. The circle of setæ of the 18th segment is broadly interrupted ventrally; the most medial setæ stand on the lateral part of the thick glandular protuberances laterally from the male area. There may occasionally be found a seta even more medial, but this does not project; it is entirely embedded in the thick glandular masses, as if overgrown by them. It may, seen in sections, be taken for a penial seta, which it is by no means; it has quite the normal shape and structure. There are no setæ between the male pores.

Spermathecæ (fig. 14): Main pouch with a big sac-shaped ampulla. The external appearance of the ampulla is very peculiar; the outer surface is areolated,

being densely crowded with moderately large bladder-like outgrowths, some of which partly overhang. In section it may be seen that these outgrowths are really hollow inflations of the wall. The duct of the main pouch is very much shorter and thinner than the ampulla, and is almost totally surrounded and covered by a diverticulum. This diverticulum forms three-fourths of a ring wall, very thick in the middle and tapering towards the ends, which embraces the duct of the main pouch. The surface of the diverticulum is roughened by the projecting seminal chambers; the whole diverticulum is like a conglomeration of numerous small, globular seminal chambers. The sperm-masses in these seminal chambers give the whole organ a glittering, metallic appearance. The diverticulum does not open into the duct of the main pouch, but into the distal part of the ampulla. Occasionally one of these seminal chambers may project somewhat more, being nearly free from the general conglomeration.

Hab.—Western Himalayas, Dharmpur in the Simla district, *ca.* 5,000′; Dr. N. ANNANDALE leg., 6—8-v-07.

Remarks.—Like *P. sikkimensis* and others this species comes near the genus *Perionyx*. It may perhaps seem justifiable to transfer it to the latter genus.

GEN. PERIONYX.

PERIONYX SANSIBARICUS, MICHLSN.

P. s., MICHAELSEN, in Mt. Mus. Hamburg, ix 1, p. 4, t. 1, f. 1.
P. s., MICHAELSEN, in Sb. böhm. Ges. Prag., 1903, xl, p. 8, text-f. *E*.

Hab.—South India, Kodaikanal in the Palni Hills, 7,000′; Dr. J. R. HENDERSON leg.

Remarks.—When I first saw a species of *Perionyx* with alternately placed nephridial pores in the collection from the Palni Hills, I did not doubt that it was a specimen of BOURNE's *P. saltans* formerly found in the vicinity of the Nilgiri Hills. A closer examination, however, proved that the specimen before me belonged to my own species *P. sansibaricus*, first described from a unique specimen from Zanzibar. The greater extension of the clitellum at segments 13—17 (=5), and the spermathecæ being throughout provided with a single knob- or stump-like diverticulum, were characters in which the specimens differed from *P. saltans* and agreed with *P. sansibaricus*. This species, therefore, must be regarded as a peregrine one, an opinion that I published formerly, putting in question the identity of this species with *P. saltans*.[1] Zanzibar, then, does not belong to the original region of the genus *Perionyx*.

As to the organisation of *P. sansibaricus* I may add the following remarks:—

External Characters.—Dimensions: The present three specimens are 32—45 mm. long (type specimen 63 mm. long) and about 3½ mm. thick. Number of segments 84—94 (type specimen 108).

[1] W. MICHAELSEN, Die geographische Verbreitung der Oligochæten, Berlin, 1903, p. 89.

Colour violet-grey dorsally with lighter, yellowish grey intersegmental bands growing broader ventrally.

Head epilobous ($\frac{1}{2}$). First segment dorsally with a sharp median longitudinal furrow.

First dorsal pore in the intersegmental furrow 4-5.

Internal Anatomy.—Two pairs of grape-like sperm-sacs depending from septa 10-11 and 11-12 into segments 11 and 12.

Alimentary tract: A rudimentary gizzard, not thicker than the other parts of the œsophagus, in the 5th segment. Calciferous gland-like swelling in the 13th segment indistinct.

Prostates with a thin and rather short, quite straight duct. I could not detect penial setæ. The setæ in the vicinity of the male pores all proved to be ordinary setæ of the usual $\int$-shape. I take it for granted that I was mistaken when I believed certain pores in the male area to be the hollows left by penial setæ which had fallen out (*l.c.*, 1903, p. 9).

PERIONYX EXCAVATUS, E. PERR.

P. e., E. PERR., plus *P. intermedius*, n. sp., BEDDARD, Proc. Zool. Soc. London, 1892, p. 689.

Hab.—Western Himalayas, Dharmpur in the Simla distr., *ca.* 5,000′; Dr. N. ANNANDALE leg., 6—8-v-07.

" " Matiana in the Simla district, 8,000′; Dr. N. ANNANDALE leg., 30-vi-07.

" " Simla; A. PARSONS leg., 23-xi-06.

Eastern Himalayas, Phallut in the Darjiling district (British Sikkim), 11,800—12,000′; C. J. BERGTHEIL and I. H. BURKILL leg.

" " Kurseong in the Darjiling district, 5,000′; Dr. N. ANNANDALE leg., 21—29-vi-06.

Bengal, Rajshahi; Major A. R. S. ANDERSON leg.

" Calcutta; Dr. N. ANNANDALE leg.

" Sibpur near Calcutta, Royal Botanical Garden; Dr. KING leg., ix-1893 (Mus. Berlin).

Ceylon, Kandy; Col. D. C. PHILLOTT leg.

Little Andaman Isl.; F. FINN leg.

? Western Himalayas, Bhim Tal in the Kumaon district, 4,500′; Dr. N. ANNANDALE leg., 19—28-ix-06.

This widely-distributed peregrine species is rather variable in certain points of organisation. Firstly the size is very different in different quite mature specimens. Often all the specimens of a certain locality are nearly equal in size, all very large and robust or all very small; often the specimens of one locality show a great variety of sizes, from a very small to a rather large one. Another difference is seen in the shape

of the spermathecæ. As I have stated before,[1] the appearance of the diverticulum is very different in different states of the spermathecæ. If the ampulla of the latter is filled with secretory masses, the diverticulum appears to be reduced to one or more wart-like protuberances; if the ampulla is empty or partly filled, the diverticulum projects more distinctly as a separated hump. There may be, however, in the shape of the diverticulum some real variation besides.

All these different specimens agree in the very characteristic shape of the penial setæ, and as the principal differences are connected by intermediate conditions, we may unite all these forms in the one somewhat variable species *P. excavatus*.

In this species I also include the *P. intermedius*, BEDD., from Sibpur near Calcutta. I can see no important difference between this species and *P. excavatus*. Unfortunately the penial setæ were broken off in BEDDARD's type specimen (*l.c.*, p. 688). We therefore may presume that BEDDARD's statement: "there are no specially modified setæ in the neighbourhood of the male pores" (*l.c.*, p. 688, some lines further down) is a mistake. BEDDARD found only one seta at each side in the male area. But this may be declared as of minor importance, the number of penial setæ being variable in *P. excavatus*. Furthermore, we are not sure whether there was really only one at each side; other penial setæ may have fallen out or been retracted in the copulatory act. I may add that I myself was enabled to examine some specimens collected in the same locality (Royal Botanical Garden at Sibpur) by the same collector (Dr. KING) which were in all probability topotypes of *P. intermedius*. These specimens, which partly agreed with BEDDARD's specimens in the stouter build, were true *P. excavatus*, with the characteristic penial setæ.

A great collection of worms from Bhim Tal in Kumaon contains only immature specimens of a *Perionyx* with nephridial pores in one line at each side of the body. Probably they belong to *P. excavatus*. Dr. ANNANDALE makes the following remarks about the mode of living of these worms: "This worm lives chiefly in accumulations of dead leaves and rain water formed in the hollows of trees. Enormous numbers of individuals are often present in one such hollow. They remain with the anterior part of the body out of the water and pressed against the side of the hollow or some object on the surface and with the remainder of the body in the water, into which they sink entirely when alarmed. At night and in wet weather they make their way from tree to tree."

PERIONYX HIMALAYANUS, MICHLSN.

(Plate xiii, figs. 16, 17.)

P. h., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 158.

Present two mature specimens.

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[1] W. MICHAELSEN, Oligochæten von Madagaskar, den Comoren und anderen Inseln des westlichen Indischen Ozans; in VOELTZKOW, Reise in Ostafrika in den Jahren 1903—1905, Stuttgart, 1907, bd. ii, p. 43.

External Characters.—Dimensions: Length 50 and 62 mm., greatest thickness $2\frac{2}{3}$ and 3 mm., number of segments 86 and 95.

Colour in general grey, at the anterior part of the body with a slight reddish tint, especially on the dorsal surface. The very slightness of pigmentation, which distinguishes this species from other *Perionyx* species, seems to be a real character and not merely caused by bad preservation. The specimens were prepared and kept together with specimens of another species, which had entirely preserved their brilliant colouring.

Head epilobous (about $\frac{2}{5}$). Hinder appendix of prostomium moderately broad, open behind.

Setæ moderately large. Circles of setæ nearly complete, only indistinctly interrupted in the dorsal median line ($zz = 1\text{–}1\frac{1}{2}yz$). Number of setæ: 40-viii, 42-xxi.

First dorsal pore in the intersegmental furrow 8-9, if not 7-8 or 6-7.

Clitellum occupying segments 13—17 (=5), ring-shaped on segments 14—17, interrupted ventrally on the 13th segment.

Male pores (fig. 16) on the 18th segment somewhat behind the zone of setæ, distant one from the other about $\frac{1}{5}$ of the circumference of the body, on small, transversely oval papillæ, which are somewhat inclined backwards. These papillæ are situated in the central depression of great, nearly circular, glandular protuberances, which are bordered distinctly at the posterior edge, indistinctly at the anterior edge.

Female pore in the median ventral line before the zone of setæ of the 14th segment, surrounded by an oval, nearly circular area, the longitudinal diameter of which is a little longer than the transverse one.

Spermathecal pores two pairs, in the intersegmental furrows 6-7 and 7-8, those of one pair distant one from the other about $\frac{1}{8}$ of the circumference of the body.

Internal Anatomy.—Septa of the testicular region and some adjacent ones a little thickened.

Alimentary tract: A rudimentary gizzard, hardly broader than the adjacent parts of the œsophagus and with hardly thicker walls in the 6th (?) segment. There are no calciferous glands.

Nephridial system meganephric. There seems to be no difference between the nephridia of different segments (no alternation of length of the terminal duct as in *P. sansibaricus*, MICHLSN.).

Anterior male organs: Two pairs of sperm-duct-funnels ventrally in the 10th and 11th segments. These are apparently enclosed in unpaired testicular vesicles which laterally are continued into great sperm-sac-like sacs. Three (?) pairs of sperm-sacs (the foremost being a sperm-sac-like protuberance of a testicular vesicle ?) in the 10th, 11th and 12th segments.

Prostates with a small, rather compact, irregularly shaped glandular part on a moderately thick, irregularly bent or coiled duct, which is about as long as the glandular part. There are no penial setæ.

Spermathecæ (fig. 17): Main pouch with a big egg-shaped ampulla, which is placed obliquely in regard to the axis of the duct. The duct of the main pouch is rather

abruptly set off from the ampulla, about half as long as the latter and about half as thick as long. It is nearly cylindrical, only narrowed at the distal end, and bears at the proximal end, nearly opposite to one another, two very small, knob-like, unstalked diverticula. The diverticula are simple, containing a single simple seminal chamber, not yet filled in the examined specimen. In all the examined spermathecæ (three) one of the two diverticula was distinctly flatter than the other.

Hab.—Eastern Himalayas, Sandakphu in the Darjiling district (British Sikkim), 11,900′; C. J BERGTHEIL and I. H. BURKILL leg.

GEN. LAMPITO, KINB., EMEND.

Emended Definition.—Besides the general characters of the sub-family *Megascolecinæ*: At least at the middle part of the body many (more than 8) setæ on each segment. Spermathecal pores two or five pairs, the hindermost at the intersegmental furrow 8-9. One well-developed gizzard in the 5th (or 6th?) segment. In the segments from about the 19th, one pair of meganephridia besides a number of micronephridia. Holoandric or metandric; testes and sperm-duct-funnels free. Prostates with branched ducts in the more or less broad glandular part (of the *Pheretima* type).

Type species: *Lampito mauritii*, KINB. (=*Perichæta armata*, BEDD.).

In the present collection I found two new species which resemble *Lampito mauritii*, KINB. (*Perichæta armata*, BEDD.), in various points of importance, especially in the peculiar formation of the nephridial system, having in each segment behind that of the male pores one pair of typical meganephridia besides a number of micronephridia. I therefore considered it justifiable to unite these three species in a separate genus, the type of which must be the oldest of them, *viz.*, *Lampito mauritii*, KINB., from which, in consequence, the genus should be called *Lampito*, as this name has not been used for any other species. Of course in using this old name I have greatly to alter the definition of KINBERG.

The genus *Lampito*, as defined by me, is in certain respects intermediate between the clearly meganephric genus *Perionychella* and the micronephric genus *Megascolex*. It is not certain whether *Lampito* is really the connecting link between *Perionychella* and *Megascolex*. Indeed we do not know even whether the latter is really derived from *Perionychella*. It might be derived from the genus *Notoscolex* as well, *Perionychella* —*Perionyx* being a side-branch. Nor is it necessary, even if we assume the first view (*Megascolex* being derived from *Perionychella*), to consider *Lampito* as the real connecting link between the two. The passage from the meganephric to the micronephric condition may have taken another course in this case than that shown by the nephridial arrangement in *Lampito*. The latter genus may be a side-branch. In any case *Lampito* must be regarded as nearly allied to *Perionychella*.

All the three species, though differing considerably in specific characters, agree in the main character of the spermathecæ. In all of them the spermathecæ are provided with two club-shaped or tubular diverticula placed opposite each other beneath the middle of the duct of the main pouch. As an eventual deviation from this condition could hardly be assigned more than specific value, I do not put this common character of the three known species into the definition of the genus *Lampito*.

The original home of the widespread type species *L. mauritii* is unknown. As the two other species of this genus are endemic in the southern part of India, and as *L. mauritii* has been found there as well, we may assume that S. India is the original home of the latter also.

LAMPITO MAURITII, KINB.

Megascolex mauritii, MICHAELSEN, Oligochæta, in Tierreich, Lief. 10, p. 227.
For synonymy and literature see "Megascolecinæ," p. 153.

Hab.—South India, Ramnad in the Madura distr., sandy coastal plains; Dr. N. ANNANDALE leg.
,, ,, Pondicherry in the South Arcot district, M. MAINDRON leg. (Mus. Paris).
,, ,, Madras (Numgumbaukum, Kilpauk, Peoples' Park, Pursevaukann, Museum Grounds, Egmore, Spur Tank and Red Hills); E. THURSTON leg.
,, ,, Madras (Egmore, Mylapore, Kooum, Choolaie, Royapurum and Mackay's Gardens; Capt. W. S. PATTON leg.
Deccan, Hyderabad; Col. D. C. PHILLOTT leg.
Bombay Presidency, Gujerat, Godhra; W. S. MILLARD leg.
Punjab, Lahore; Major J. STEPHENSON leg.
Bengal, Ranigunj in the Burdwan district; L. L. FERMOR leg.
,, Calcutta; Dr. N. ANNANDALE leg., 29—30-v-06.
,, Bhogaon, Purneah; C. A. PAIVA leg.
,, Rajshahi; Major A. R. S. ANDERSON leg.
,, Saraghat; Dr. N. ANNANDALE leg., 29—30-vi-06 and 3-xii-03.
,, Betracona in the Mymensing district; H. E. STAPLETON leg.

LAMPITO VILPATTIENSIS, MICHLSN.

(Plate xiii, fig. 18.)

L. v., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 160, f. 8.

Present a great number of specimens.

External Characters.—Dimensions of mature specimens: Length 70—90 mm., greatest thickness 2—2½ mm., number of segments 154—178.

Colour uniformly light grey; without pigmentation.

Head indistinctly epilobous (*ca.* ⅗); hinder appendix of prostomium small, often equalling the walls between the longitudinal furrows, which occupy the anterior part of the 1st segment.

Setæ at the ends of the body distinctly enlarged, ventrally more than dorsally. Circles of setæ regularly interrupted at the ventral and dorsal median lines

($aa = 1\frac{1}{2}$—$2ab$, $zz = 2$—$3yz$), dorsally in general more narrowly than ventrally. The setæ *a* and *b* regularly situated throughout, mostly somewhat closer together than the setæ *b* and *c* (*a* and *b* paired, $ab = \frac{1}{2}$—$1bc$). On the first two or three setigerous segments the setæ are placed in four pairs (always ?), the ventral ones closer together than the lateral ones (*ab* > *cd*). Numbers of setæ : 8-ii—iii, 8 or 9-iv, 9—10-v, 9—11-ix, *ca.* 11-xiii, *ca.* 21-xix, *ca.* 24-xxvi, *ca.* 26 on the segments of the hinder end.

First dorsal pore in the intersegmental furrow 10-11.

Clitellum ring-shaped, occupying segments 13—18 (=6), sometimes less distinct at the anterior part of the 13th segment.

Male pores at the 18th segment in or very little behind the zone of setæ, between the lines of setæ *a* and *b*, distant one from the other about $\frac{1}{10}$ of the circumference of the body (♂ ♂ = *ca.* $\frac{1}{10}$ *u*), on the tip of very small conical papillæ, which are bent forward, their anterior basal margin lying in about the zone of setæ.

Female pores paired, before the setæ *a* of the 14th segment, closer together than the setæ.

Spermathecal pores two pairs, in the intersegmental furrows 7-8 and 8-9, in the lines of setæ *a*, those of one pair distant one from the other about $\frac{1}{8}$ of the circumference of the body (♀ ♀ = *ca.* $\frac{1}{8}$ *u*).

Copulatory organs apparently constant throughout, equally formed in all the mature and half mature specimens present, the number of which is about 36 : these organs are prominent glandular cushions just behind the male pores, at the intersegmental furrow 17-18, extending nearly as far as the zones of setæ of the 17th and 18th segment and transversely about between the lines of setæ *a* and *c*, even somewhat surpassing the former towards the ventral median line. They are shortly oval or egg-shaped in outline and placed obliquely, the longer diameters converging backwards.

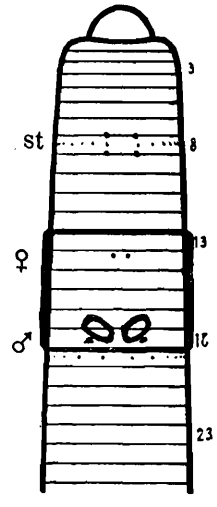

FIG. 14.
Lampito vilpattiensis.

Internal Anatomy.—Septum 5-6 tender, but quite complete and distinct. Septa 6-7—12-13 thickened, 8-9 and 9-10 especially strong, the others gradually less so.

Alimentary tract: A big cylindrical gizzard in the 5th segment. Œsophagus simple, without set-off calciferous glands, hardly swollen in some of the segments of the anterior male organs.

Circulatory system: Dorsal vessel simple ; last hearts in the 13th segment.

Nephridial system: Each segment contains at least a pair of meganephridia in the postclitellar region besides a number of micronephridia.

Anterior male organs: One pair of sperm-duct-funnels free in the 11th segment. One pair of broad, grape-like sperm-sacs depending from septum 11-12 into the 12th segment.

Prostates: Glandular part flat, broad, nearly ribbon-like, with some deep incisions and lobes and many tender furrows. Muscular duct suddenly arising from

the median edge of the glandular part, very long, irregularly coiled, in general thin, somewhat increasing in thickness towards the distal end (typical *Pheretima*-prostates). There are no penial setæ.

Female organs: One pair of tuft-like ovaries and one pair of platter-shaped oviduct-funnels in the 13th segment.

Spermathecæ (fig. 18): Main pouch with an oval ampulla and a moderately abruptly set-off duct, which is about twice as long and in general about half as thick as the ampulla, and at the distal end a little thickened. Into this distal end open two opposed, nearly straight, sausage-shaped diverticula about half as long or nearly as long and half as thick as the duct of the main pouch. These diverticula contain a simple seminal chamber, which occupies almost their entire length.

Hab.—South India, Vilpatti in the Palni Hills; Dr. J. R. HENDERSON leg., vi-07.

LAMPITO SYLVICOLA, MICHLSN.

(Plate xiii, fig. 19.)

L. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 161, f. 9.

Present a single half mature specimen.

External Characters.—Dimensions: Length 185 mm., thickness $2\frac{1}{2}$—$3\frac{1}{2}$ mm., number of segments *ca.* 200.

Colour uniformly light grey (any pigmentation lost during preservation).

Head epilobous (*ca.* $\frac{1}{2}$). Dorsal appendix of prostomium narrow.

Setæ in general small, a little enlarged at the anterior half of the anteclitellar region. Circles of setæ regularly interrupted ventrally (*aa* = ca. 2*ab*), irregularly but broadly interrupted dorsally especially at the anterior part of the body; setæ *a* and *b* regularly placed throughout the length of the body. Numbers of setæ: 10-iii, 12-iv, 11-v, 15-xiii, 21-xvii, 27-xxiv, *ca.* 30 on the segments of the hinder end.

First distinct dorsal pore in the intersegmental furrow 9-10.

Clitellum not yet developed.

Male pores at the 18th segment between the lines of setæ *a* and *b*, on minute papillæ, which are surrounded by a common whitish wall with the outline of a transverse dumb-bell.

Spermathecal pores two pairs at the intersegmental furrows 7-8 and 8-9 in the lines of setæ *a*.

Copulatory organs: A single great, rounded, rectangular cushion, broader in the transverse than in the longitudinal direction, and surrounded by a whitish margin median-ventrally on the anterior part of the 19th segment and pushing backwards the middle zone of this segment, the setæ being found on the whitish posterior margin of the cushion. Laterally it extends about as far as the lines of setæ *d*, *i.e.*, distinctly further than the dumb-bell-shaped wall of the male pores.

Internal Anatomy.—Septa 6-7—13-14 thickened, the septa 7-8—9-10 especially strong, the others gradually less strong.

Alimentary tract: A big gizzard in the 6th (5th ?) segment. Œsophagus simple, without set-off calciferous glands, a little swollen in the 13th segment (and in some neighbouring ones ?). Intestine with a small, indistinct typhlosole,—apparently formed only by the immersion of the dorsal vessel.

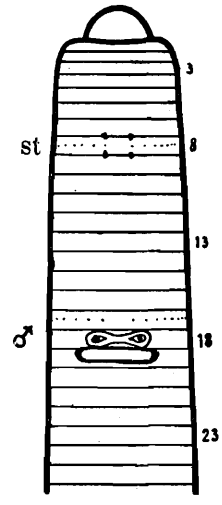

FIG. 15.
Lampito sylvicola.

Circulatory system: Dorsal vessel simple ; last hearts in the 13th segment.

Nephridial system: In each segment behind the clitellar region is found a pair of meganephridia besides a number of micronephridia. In the more anterior segments only micronephridia were seen.

Anterior male organs: One pair of sperm-duct-funnels free in the 11th segment. One pair of grape-like sperm-sacs depending from septum 11-12 into the 12th segment.

Prostates: Glandular portion consisting of two irregular disc-shaped broadly united parts, each of which has some more or less deep incisions. Duct arising from the medial incision between these two parts of the glandular portion, rather thin and long, irregularly undulating. There are no penial setæ.

Spermathecæ (fig. 19) : Main pouch with a pear-shaped ampulla, which distally passes without distinct break into a slender duct, about twice as long and proximally about half as thick as the ampulla, tapering at the distal end. Beneath the proximal part of this duct two club-shaped or nearly tubular diverticula, which are about half as long and thick as the duct of the main pouch, open opposite to each other. The greatest proximal part of the diverticula is occupied by a simple seminal chamber. (The spermathecæ of this species are nearly equal to those of *H. vilpattiensis*.)

Hab.—South India, Tiger Shola (near Kodaikanal) in the Palni Hills, virgin forest, 5,500′ ; Dr. J R. HENDERSON leg., vi-1907.

GEN. MEGASCOLEX.

MEGASCOLEX LONGISETA, MICHLSN.

(Plate xiii, figs. 20, 21.)

M. l., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 163.

Present one much softened specimen.

External Characters.—Dimensions : Length 180 mm., thickness about 5—6 mm., number of segments about 240 (in large parts of the body only roughly counted) ; hinder end regenerated, with very short segments.

Colour yellowish and partly brownish grey.

Setæ at the anteclitellar part of the body somewhat enlarged ventrally (especially the median ones), and more distant from one another. Anteclitellar circles

with a rather large and regular median ventral gap and with a rather larger, but apparently irregular dorsal median gap. Number of setæ on the anteclitellar segments about 16 up to segment 26, after which point they are much more numerous (about 40 or even more ?).

First dorsal pore at the intersegmental furrow 7-8.

Clitellum not yet developed.

Male pores at the 18th segment, placed ventral-laterally about $\frac{2}{7}$ of the circumference of the body apart.

Spermathecal pores two pairs, at the intersegmental furrows 7-8 and 8-9, those of one pair about $\frac{1}{4}$ of the circumference of the body distant from one another.

Copulatory organs not (yet ?) developed.

Internal Anatomy.—Septum 5-6 very thin, 6-7—12-13 rather strong, 13-14 hardly thickened, the succeeding ones very tender.

Alimentary tract: A big gizzard in the 5th segment. Œsophagus without calciferous glands.

Anterior male organs: Two pairs of sperm-duct-funnels ventrally in the 10th and 11th segments. Two pairs of rather small, grape-like sperm-sacs depending from septa 10-11 and 11-12 into the 11th and 12th segments.

Prostates with a rather small, rather loose grape-like glandular part and a moderately thick duct, about as long as the glandular part, somewhat bent irregularly, somewhat narrowed at the distal end.

Penial setæ (fig. 21) very slender, about 7 mm. long, proximally about 25 μ thick, distally about 8 μ thick, nearly filiform, strongly and irregularly bent. They are ornamented by small triangular teeth, irregularly scattered over the surface and closely pressed against it. Perhaps this ornamentation may change its character somewhat toward the distal end of the seta, but I was not able to free this end from the soft cap enveloping it. The distal tip of the seta is quite plain and rather blunt.

Spermathecæ (fig. 20) with a long, club-shaped main pouch, the ampulla of which is about three times as long as thick, whilst the duct is about half as thick and long as the ampulla. The duct is not abruptly set off from the ampulla. Into the distal part of the duct, a short distance from the end, opens a single diverticulum which is club shaped, and about as long and half as thick as the main pouch. Its distal half is somewhat broadened and contains about four tube-like, narrowly undulating seminal chambers. Some of these seminal chambers extend into the proximal end of the diverticulum and some end before reaching it. They are somewhat visible externally by causing distinct longitudinal protuberances on the surface of the diverticulum. They are partly filled with sperm masses which do not always occupy the proximal end of the seminal chambers. Distally the seminal chambers join in a dichotomous manner. The distal half of the diverticulum is first somewhat narrowed and then broadens before opening into the duct of the main pouch. The lumen of the duct of the diverticulum is simple but apparently narrowed by irregular foldings of the wall.

Hab.—Ceylon, Nuwara Eliya; Col. D. C. PHILLOTT leg.

MEGASCOLEX HENDERSONI, MICHLSN.

(Plate xiii, figs. 22, 23.)

M. h., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, 162, f. 10.

Present four mature specimens.

External Characters.—The dimensions of the specimens differ somewhat. The smallest is 140 mm. long, and 5—6 mm. thick, and is composed of 110 segments. The largest is 230 mm. long, 7—8 mm. thick and composed of 152 segments.

Colour dorsally, at the anterior part of the body with the exception of the first segment, bluish grey, sometimes distinctly iridescent, passing into a brownish or reddish grey backwards; yellowish grey ventrally.

Head tanylobous, the sharply marked lateral borders of the rather broad hinder appendix of the prostomium converging somewhat backwards. The intersegmental furrow 1-2 is distinct only dorsally, ventrally it is nearly extinct. Each segment of the anterior part of the body, with the exception of the first, is distinctly annulated by two ringlet-furrows. The middle ringlet, which bears the setæ, is very prominent, like a rounded wall.

The setæ, indistinct (missing ?) on the 2nd segment, are in general moderately large, somewhat larger on the anterior part of the body than elsewhere. They are of the usual S-shape, but highly ornamented and provided with irregular toothed transverse ridges; the distal end has an obliquely twice-ridged tip. The circles of setæ are regularly but not broadly interrupted ventrally ($aa = 1\frac{1}{2}$—$2ab$), irregularly and not broadly interrupted dorsally ($zz = 1$—$2yz$). There is no marked difference between the density of the circles ventrally and dorsally, but dorsally they are somewhat irregular. Numbers of setæ : 28-v, 33-viii, 38-xii, 36-xx, 40-xxvi.

First dorsal pore at the intersegmental furrow 5-6.

Clitellum saddle-shaped, leaving free the ventral side, occupying segments 13—19 (=7), but at the 13th and 19th segments not quite as distinctly marked as at the intermediate segments. The clitellum is not prominent and is distinguished only by its darker colour and by the absence of a middle wall-shaped annulet, bearing the setæ,—the segments being divided by only a single ringlet-furrow into two annulets, the hinder one bearing the setæ.

Male pores (fig. 22) at the 18th segment in the lines of setæ *b* somewhat behind the zone of setæ, each on a small, nearly circular papilla. The male pores are distant one from the other about one-tenth of the circumference of the body ($♂\,♂ = ca.\ \frac{1}{10}\ u$).

Female pores indistinct (on the 14th segment in front of the setæ *a* ?).

Spermathecal pores one pair in the intersegmental furrow 8-9, opposite the interspace between the setæ *b* and *c*, distant one from the other about one-eighth of the circumference of the body ($♀\,♀ = ca.\ \frac{1}{8}u$).

Copulatory organs (fig. 22), in an apparently constant arrangement: three pairs of rather small transversely oval papillæ at the hinder border of seg-

ments 17, 18 and 19, that is to say, at the intersegmental furrows 17-18, 18-19 and 19-20, about opposite the interspace between the setæ *b* and *c*. The papillæ of the first pair at the intersegmental furrow 17-18, in each of the four present specimens, are longitudinally, but not laterally, narrower than the others. The papillæ of the second pair in the intersegmental furrow 18-19 are united at their medial-anterior border to the papillæ of the male pores. The ventral part of segments 17 and 20 is swollen, glandular, and somewhat overhanging the space between them, *i.e.*, the anterior part of segment 18 and the posterior part of segment 19. The lateral ends of these thickenings lean against the copulatory papillæ of the first and third pair, and are connected by a pair of more or less distinct longitudinal walls, which run outside the copulatory papillæ, crossing the 18th segment. The ridges of these lateral thickenings together with the longitudinal walls, marked by the copulatory papillæ, define a male area, which is mostly somewhat but not much depressed.

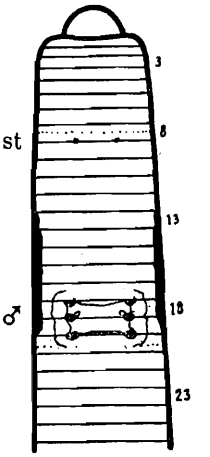

FIG. 16. *Megascolex hendersoni.*

Internal Anatomy.—Septum 6-7 is very tender, septa 7-8—13-14 (or 14-15?) are thickened, especially septa 10-11 and 11-12, which are very strong, the others gradually less so.

Alimentary tract: A very large gizzard, in one of the larger specimens measuring 8 mm. in length and 5 mm. in thickness, lies before the tender septum 6-7. The œsophagus is plain in segments 7—11 and segmentally swollen, nearly globular, in segments 12 and 13. In the 14th segment there are rather thicker swellings, which are, however, confined to the lateral parts of the œsophagus; these appear almost like a pair of thick, bean-shaped calciferous glands, but they are not strictly set off from the œsophagus, being merely lateral sacculations of the latter, their lumina not being separated from the general lumen of the œsophagus. The walls of these lateral diverticulum-like organs of the 14th segment as well as those of the swellings in the 12th and 13th segments have the lamellated structure of real calciferous glands. In the 15th segment the œsophagus is narrow. The wide (in the anterior part laterally sacculated) intestine suddenly begins in the 16th segment. There is no distinct typhlosole.

Circulatory system: Dorsal vessel simple. Last hearts in the 13th segment.

Nephridial system micronephric, consisting of very small scattered nephridial villi.

Anterior male organs: Two pairs of moderately large (apparently free?) sperm-duct-funnels in the 10th and 11th segments attached to septa 10-11 and 11-12. Two pairs of loose racemose sperm-sacs depending from septa 9-10 and 11-12 into the 9th and 12th segments. The sperm-sacs of the 12th segment are distinctly larger than those of the anterior pair in the 9th segment. There seem to be no testicular vesicles, but I saw what seemed to be special strings and cœlomic membranes expanding between septa 9-10—10-11 and 10-11—11-12. I did not see the testes.

The prostates are confined to the 18th segment, the septa of which seem to be somewhat widened out by them. The glandular part is irregularly disc-shaped or

broadly tongue-shaped, not compact, but much, and in parts rather deeply, incised at the margin and furrowed at the surface. The duct is rather thick and short, hardly as long as the glandular part, quite straight, muscular.

There are no penial setæ.

Female organs: A pair of tuft-like ovaries depend from septum 12-13 into the 13th segment. A pair of organs of similar appearance (egg-sacs ?) are found in a corresponding position in the 14th segment.

Spermathecæ (fig. 23): The main pouch consists of an oblong, somewhat flattened, sac-shaped ampulla and an abruptly set-off muscular duct about a third as long and thick as the ampulla. Into the proximal end of this duct opens an oblong diverticulum hanging downwards and pressed against the duct of the main pouch. The diverticulum is about half as long as the duct of the main pouch and much thinner. It is indistinctly stalked and contains in the distal two-thirds some (3—5) partly oval, partly more globular seminal chambers which cause by their flatulence,—being filled with sperm masses,—rounded swellings projecting above the general surface of the diverticulum.

Hab.—South India, Tiger Shola (near Kodaikanal) in the Palni Hills, 5,500′; Dr. J R. HENDERSON leg., vi-07.

MEGASCOLEX FUNIS, MICHLSN.

(Plate xiii, fig. 24.)

M. f., MICHAELSEN, in Mt. Mus. Hamburg. xiv, p. 210, t. f, f. 2.

Present a single specimen without hinder end.

Hab.—Ceylon, Kandy, Col. D. C. PHILLOTT leg.

Remarks.—The present specimen resembles in nearly all respects the type specimens of this species. Only in the shape of the spermathecæ there seemed at first to be an important difference. A re-examination of the type specimens, however, showed that this apparent difference was not very great. The type specimens are doubtless somewhat less mature than the new one collected by Col. PHILLOTT. In the latter the diverticula of the spermathecæ (fig. 24) are relatively very much larger than in the type specimens, being about three-quarters as long and as thick as the main pouch. After preparing it in acetic acid, it proved to be not a simple tube or sack, as may have been expected from my original description. The proximal part for about $\frac{2}{5}$ of the entire length is somewhat enlarged, and its lumen is not simple. The lumen consists of a great number of somewhat pear-shaped or globular seminal chambers, partly united at the base in twos, threes or fours, all of them opening into a central channel, which leads down through the distal part of the diverticulum and finally opens into the distal end of the main pouch. A re-examination of the spermathecæ of the type-specimens convinced me that their diverticulum possesses the same complex structure, though not perhaps quite as complex as that of the new specimen, the number of seminal chambers being a little smaller;

but then these type specimens are not quite as mature as the new specimen. Figure 24 of plate xiii may illustrate the structure of the spermathecal diverticulum of the Kandy specimen.

The habitat of the type specimens was not quite certain,—"probably Peredeniya." The new-found specimen makes it probable that the type specimens also came from Kandy, for the Messrs. SARASIN, who collected them, collected at Kandy as well as at Peredeniya.

GEN. PHERETIMA.

PHERETIMA BISERIALIS (E. PERRIER).

Hab.—Deccan, Hyderabad; Col. D. C. PHILLOTT leg.
Ceylon, Kandy; Col. D. C. PHILLOTT leg.
Sind, Kurrachee; M. MAINDRON leg., 1896.

PHERETIMA HOULLETI (E. PERRIER).

Hab.—Western Himalayas, Bhim Tal in the Kumaon distr., 4,500′; Dr. N. ANNANDALE leg., 19—28-ix-06.
Bengal, Raniganj in the Burdwan district; L. L. FERMOR leg.

PHERETIMA HAWAYANA (ROSA), F. TYPICA.

Perichæta h., MICHAELSEN, Oligochæta, in Tierreich, Lief. 10, p. 271.
Amyntas hawayanus (part.), BEDDARD, in Proc. Zool. Soc. London, 1900, p. 645.

Hab.—Eastern Himalayas, Kurseong in the Darjiling district, 5,000′; C. J BERGTHEIL leg.

Remarks.—Each of the two specimens possesses two papillæ somewhat medial and behind each male pore. The two papillæ of each group lie close together in a common depression, instead of being elevated as I have seen them in most other specimens which I have been able to examine. This apparent difference may be caused by a different method of preservation.

For the systematic relations of this form, see the following discussion under the sub-sp. *barbadensis* (BEDD.).

PHERETIMA HAWAYANA (ROSA), SUB-SP. BARBADENSIS (BEDD.).

Ph. barbadensis, MICHAELSEN, Oligochæta, in Tierreich, Lief. 10, p. 254.
Amyntas hawayanus (part.), BEDDARD, in Proc. Zool. Soc. London, 1900, p. 645.

Hab.—Punjab, Lahore, Major J STEPHENSON leg.

Remarks.—BEDDARD, in his valuable paper "A Revision of the Earthworms of the genus Amyntas (Perichæta)," in the Proc. Zool. Soc. London, 1900, pp. 609–652, has united this form with *Pheretima hawayana* (ROSA) (*Amyntas hawayanus* in BEDDARD'S paper *loc. cit.*). I am not yet quite convinced that this view is correct. Till now I have not seen a specimen—and I have examined many—which aroused any doubt

as to whether it should be placed in the typical form or in the sub-sp. *barbadensis* (=*Perichæta barbadensis*, BEDD., =*P. pallida*, MICHLSN., =*P. amazonica*, ROSA, =*P. sancti-jacobi*, BEDD.). In the generally more robust typical form with stronger setæ in the anterior part of the body the papillæ near the male pores are always united at each side, occupying an oblong oval area medial from the male pores and mostly somewhat oblique. In the sub-sp. *barbadensis* the papillæ near the male pores are scattered, partly very near the male pores, partly near the median ventral line. I therefore think it is best to separate the two forms at least as varieties of a very variable species. A more careful study of these forms later may settle this question definitely.

In the present specimens from Lahore, which doubtless all belong to the sub-sp. *barbadensis*, the papillæ near the male pores are very variable, in some specimens in great numbers, partly in pairs near the ventral median line at the anterior part of segment 18; often pairs of papillæ are seen at the hinder part of segment 17, and the anterior part of segment 19 in the lines of the male pores. These papillæ are completely separated from those in the immediate vicinity of the male pores. In most specimens papillæ are also seen in the region of the spermathecal pores, two pairs on the anterior part of segments 6 and 7 somewhat medial from the lines of the spermathecal pores. In all the specimens examined I found only two pairs of spermathecæ at the intersegmental furrows 5-6 and 6-7.

PHERETIMA VIOLACEA (BEDDARD).

Examined fourteen specimens of this interesting little *Pheretima*, which enables me to complete the description given by BEDDARD.

External Characters.—Dimensions: Most of my specimens are larger than BEDDARD's type specimen. Their length varies from 50 to 80 mm.

The head shows constantly a singular shape. It is tanylobous, the prostomium being continued backwards as far as the furrow between segments 1 and 2. The hinder part of the prostomium is not sharply set off, and its lateral borders converge backwards, almost meeting at the hinder end. The 1st segment or buccal ring has a deep ventral median incision almost completely dividing the ring.

The clitellum extends from the intersegmental furrow 13-14 to about as far as the zone of setæ of the 16th segment, leaving the hinder part of this segment free.

The pair of papillæ in the intersegmental furrow 18-19 is not always very distinct, but seems to be present in all the specimens, being marked internally by glandular cushions even if not distinctly visible externally. A deep ventral median depression extends over about segments 16 to 20. In all save two of my specimens a pair of very small, slightly glandular depressions is present in the intersegmental furrow 9-10, ventro-lateral in position and somewhat resembling a needle puncture. I could not find any special organs or free glands connected with these depressions.

Internal Anatomy.—The intestine is provided in the 26th (?) segment with a pair of broad and very short lateral cæca which seem to be rudimentary. They are

directed forward but hardly reach as far as the middle of the preceding segment, being much broader than long.

The swollen seminal chamber of the diverticulum of the spermathecæ is simple and nearly as long as the stalk of the diverticulum.

In other respects my specimens agree with the description given by BEDDARD, for instance in the characteristic shape of the prostates.

Hab.—Deccan, Hyderabad; Col. D. C. PHILLOTT leg.

PHERETIMA HETEROCHÆTA (MICHLSN.).

Hab.—Western Himalayas, Simla, 6,750′; A. PARSONS leg.
,, ,, Naini Tal in the Kumaon district, 6,400′; Dr. N. ANNANDALE leg.
Eastern Himalayas, Kurseong in the Darjiling district; Dr. N. ANNANDALE leg., 21—29-v-06.
South India, Kodaikanal, 7,000′; and Tiger Shola (near Kodaikanal) in the Palni Hills, virgin forest; Dr. J R. HENDERSON leg., vi-07.
,, ,, Coonoor in the Nilgiri Hills; M. MAINDRON leg., x-01.
Burma, Manchio in the North Shan Hills; J COGGIN BROWN leg., 28-iv-07.

PHERETIMA POSTHUMA (L. VAILL.).

Hab.—Bengal, Pusa; C. A. PAIVA leg.
,, Bhogaon, Bhagalpur, Purneah; C. A. PAIVA leg.
,, Calcutta; Dr. N. ANNANDALE leg., 30-vii-06 and 4-viii-06.
,, Sibpur near Calcutta; Dr. KING leg., ix-93 (Mus. Berlin).
,, Dhalla; H. E. STAPLETON leg.
,, Betracona in the Mymensing district; H. E. STAPLETON leg.
,, Raniganj in the Burdwan district; L. L. FERMOR leg.
,, Rajshahi; Major A. R. S. ANDERSON leg.
,, Saraghat; Dr. N. ANNANDALE leg., 29—30-vi-06.
,, Comillah in the Chittagong district; Major A. R. S. ANDERSON leg.

PHERETIMA ANOMALA, MICHLSN.

Ph. a., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 167, f. 14.

Present eight mature specimens of this curious species.

External Characters.—Dimensions: Length 80—90 mm., thickness 3—5 mm. to $3\frac{1}{2}$—$5\frac{1}{2}$ mm., number of segments about 130.

Natural colour not known, the specimens having been preserved in corrosive sublimate.

Head epilobous (about $\frac{1}{2}$).

Setæ very small. Circles of setæ equally close, unbroken; number of setæ: 70-v, 84-x, 74-xxv.

Clitellum ring-shaped, occupying segments 14—16 (=3). Circles of setæ present and regular on the ventral part of the 16th segment, on the 14th and 15th segments totally absent or only represented by a few scattered setæ.

Male pores at the 20th (!) segment, on the top of large, conical papillæ, distant one from the other about $\frac{1}{6}$ of the circumference of the body. There are about sixteen setæ between the papillæ of the male pores, which lie in about the tenth line of setæ reckoned from the median ventral line (in the line of setæ *k*). This remarkable and anomalous situation of the male pores, which are as a rule in this genus as well as in the whole sub-family *Megascolecinæ* situated in the 18th segment, and here seem to be pushed backwards for two segments, is found in all the eight specimens present. In order to make certain of the connection of these papillæ with the prostates, I opened some of the specimens. This was the more necessary as there are copulatory organs in the vicinity of these male papillæ, and even in the usual position of the male pores at the 18th segment, which closely resemble the male papillæ. This examination of the internal anatomy assured me that I had not mistaken a pair of copulatory papillæ for the male pores.

Copulatory organs: These are paired, moderately large, conical papillæ, very much resembling the male papillæ but somewhat smaller, on some segments behind the clitellum in the circles of setæ, those of each pair being a very little further apart than the male papillæ. There are about twenty setæ between the papillæ of one pair. As a rule there are four pairs of such copulatory papillæ on the 18th, 19th, 21st and 22nd segments, *i.e.*, two before and two behind the male papillæ. Only three specimens showed this presumably normal arrangement; in four other specimens it was found only on one side of the body, on the other side the papilla of the 22nd segment being absent. In the eighth specimen there was a supernumerary pair of papillæ on the 17th segment and a single unpaired supernumerary papilla on one side of the 23rd segment.

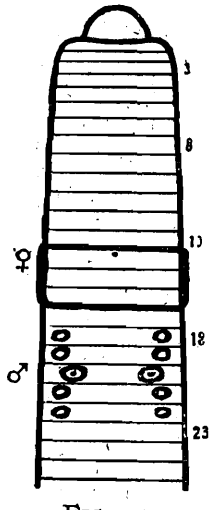

FIG. 17. *Pheretima anomala.*

On opening the worm large semi-globular cushions may be seen depending from the body-wall into the cœlom and corresponding to these copulatory papillæ.

Female pore unpaired, at the anterior part of the 14th segment in the median ventral line.

Spermathecal pores missing.

Internal Anatomy.—Septa 4-5—8-9 moderately thick, 9-10 tender, 10-11—13-14 very little strengthened, none missing.

Alimentary tract: A very large gizzard in the 8th segment. Œsophagus simple, without calciferous glands. Intestine with a pair of large, simple, slender, conical cæca, extending forward from the point of origin.

Circulatory system: Last heart in the 13th segment.

Nephridial system micronephric.

Anterior male organs very peculiarly developed. There are seven pairs of testes, attached to the posterior surface of septa 4-5—10-11, *i.e.*, in segments 5—11, somewhat above the ventral margin of the septa. Corresponding with these there are seven pairs of rather large, much folded and lobed sperm-duct-funnels in the same segments, but attached to the anterior surface of septa 5-6—11-12, the latter being pierced by the relatively thick sperm-ducts. The special sperm-ducts of two consecutive funnels join directly behind the septum of the hinder one, but the lumina of these special ducts remain separate for a while, uniting only just before the approach of the second special sperm-duct. The five anterior pairs of testes and sperm-duct-funnels lie free in their segments; the two posterior pairs in the 10th and 11th segments, the homologue of the normal male organs of this genus, are enclosed in small testicular chambers. I could not detect sperm-sacs. This strikingly peculiar organisation,—which may perhaps be in correspondence with the unusual position of the prostates and their papillæ,—was found in three specimens, two of which I opened and dissected, whilst I made a series of sections through the third one. I must therefore regard this arrangement, *i.e.*, the presence of supernumerary testes and sperm-duct-funnels, as characteristic of this species.

Prostates: Glandular part large, occupying several segments, much incised and lobed, moderately loose, nearly grape-like. Duct moderately long, describing a broad loop, almost in the form of an S; the duct is somewhat thickened, distally nacreous. It opens directly to the exterior; there is no copulatory pouch.

Penial setæ missing.

I could detect no trace of spermathecæ, neither in the worms opened and dissected nor in sections.

Hab.—Bengal, Sibpur near Calcutta, Botanical Gardens; Dr. KING leg. (Mus. Berlin).

PHERETIMA OSMASTONI, MICHLSN.

(Plate xiii, fig. 26.)

Ph. o., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p 163, f. 11.

Present eight mature specimens.

External Characters.—Dimensions: Length 250—320 mm., maximum thickness 10—11 mm., number of segments 126—148.

Colour: Dorsally violet-grey, darker and with bluish or greenish tints at the ends, iridescent. Ventrally yellowish grey.

Head epilobous (about $\frac{1}{2}$). Dorsal hinder appendix of prostomium nearly as broad as the prostomium, open behind.

Setæ somewhat enlarged in the anteclitellar part and at the hinder half of the body, especially in the dorsal parts of the circles. In general the dorsal setæ are somewhat larger and further apart than the ventral setæ of the same segment. Circles of setæ complete or irregularly interrupted in the median ventral line, regularly

interrupted in the dorsal median line (*zz* about equal to $\frac{5}{3}$ or $\frac{3}{2}yz$). Number of setæ: 28-v, 50-ix, 58-xiii, 72-xix, 70-xxvi.

Dorsal pores inconspicuous, distinct only in the clitellar region. First dorsal pore in the intersegmental furrow 12-13 (?).

Clitellum ring-shaped, occupying segments 14—16 (=3).

Male pores about one quarter of the circumference of the body apart, on the 18th segment in the zone of setæ, on moderately large transversely oval papillæ, the tops of which form special small papillæ with the pores. There are about eighteen setæ between the male pores.

Female pores apparently at the lateral ends of a small median ventral transverse furrow on the 14th segment just before (nearly in) the zone of setæ, apparently paired, but very near each other.

Spermathecal pores three pairs in the intersegmental furrows 6-7—8-9, ventro-lateral, those of one pair about $\frac{2}{7}$ of the circumference of the body distant one from the other.

Copulatory organs: Broad transversely oval or rounded-rectangular median ventral cushions, occupying the hinder two-thirds or three-quarters of their respective segments, which are ventrally widened out somewhat by these cushions. The cushions are about twice as broad as long, extending laterally nearly as far as the lines of the spermathecal pores and occupying about one quarter of the circumference of the body. The surface of these copulatory cushions bears a great number (more than 200) of densely crowded very fine circular depressions or stigmata—the pores of small glands, as may be seen on dissection. The number and position of these cushions is somewhat variable. In six specimens there is only one cushion, situated on the 8th (one specimen) or 10th segment (five specimens). In three specimens there are two cushions, situated on the 12th and 13th segments. In one of these latter specimens the hinder cushion of the 13th segment is distinctly smaller than the anterior cushion of the 12th segment.

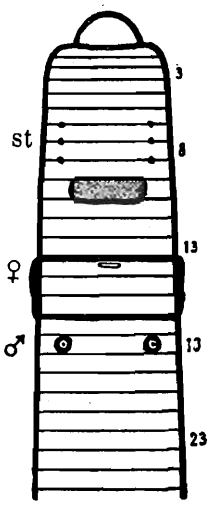

Fig. 18. *Pheretima osmastoni.*

Internal Anatomy.—Septa 6-7 moderately strong, 7-8 very strong, 8-9 and 9-10 missing, 10-11—12-13 very strong, 13-14 rather strong, the following ones delicate.

Alimentary tract: A big, thickly pear-shaped anteriorly thickened gizzard between the thickened septa 7-8 and 10-11. Intestine in the 26th (?) segment with a pair of moderately large, plain and slender cone-shaped cæca, which do not stretch forward as is the rule with *Pheretima*, but upward. Behind the zone of the cæca the intestine bears internally a simple, membranous typhlosole, externally a pair of much lobed blood-glands in each segment.

Circulatory system: Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: Two pairs of nearly globular seminal vesicles in segments 10 and 11. The two seminal vesicles of one segment are united in the median line, but there is no communication between the two seminal vesicles of

one side. The anterior pair of male organs is completely separated from the posterior pair. Each seminal vesicle communicates with a sperm-sac. There are two pairs of large, somewhat incised granular sperm-sacs depending from septa 10-11 and 11-12 into segments 11 and 12.

Prostates: The glandular part is rather large, occupying about segments 18—22. It is much lobed, the lobes being relatively long and irregular and only very loosely united. The duct is long and describes a rather long and somewhat irregular loop, the distal branch of which is thick and muscular, whilst the proximal part is much thinner. There is no copulatory pouch, the duct opening directly into the male pore, which is situated on the top of the male papilla. Connected with each prostate is a pair of accessory glands, one before and one behind each prostate and pressed against the glandular part of it. These accessory glands have *in situ* the appearance of being part of the prostate-gland, but on a more careful examination they will be found to possess an entirely different structure. They are long, irregularly bent, pressed together, and grape-like, consisting of a great number of small, rounded, pear-shaped or somewhat lobed glandular divisions, each of which is provided with a rather long and narrow tube-like duct. These small glandular masses are about ½ mm. thick. They consist of rather large, more or less regular, pear-shaped cells, and resemble in a certain degree the septal glands of Enchytræids. The long and thin hair-like ducts of these cells form compact bundles, which occupy the interior of the tube-like ducts of the gland. The outer sheath of these gland-ducts, which are about ·15 mm. thick, is provided with a circular muscle-layer about 20 μ in thickness. The ducts of the glandular bulbs are more or less free in the proximal part. Their distal parts, however, are closely packed together, forming a nearly compact mass in the interior of the whole organ. In the middle of this conglomerate mass of narrow ducts is found a thicker main duct forming the axis of the organ. This main duct, into which open all the narrow ducts of the small glands, is about ½ mm. thick and is provided with a sheath of circular muscles which are about 40 μ thick. The main ducts of the two grape-like glands go backwards and forwards respectively and join in the 18th segment close to the middle line of the duct of the prostate to form a common duct. The latter goes downwards to open to the exterior just medial from the prostate-duct. It might be justifiable to regard these two grape-like glands as one gland, consisting of two parts with a proximally bifurcated, distally simple, main duct. Between the opening of the prostate and that of the gland, on the male papilla near the top of it, stands a seta apparently somewhat larger than the ordinary setæ of the circle, from which it is distinctly separated. It must be regarded as a penial seta, a very extraordinary occurrence in *Pheretima*, in which genus penial setæ have, I believe, never before been found. Unfortunately in all specimens before me the distal end of the penial seta has been broken off and lost, so that I am not able to say whether this seta was modified in shape.

Spermathecæ (fig. 26): Main pouch irregularly pear-shaped, the ampulla not being set off abruptly from the narrower, shorter duct. Into the distal end of the duct opens a narrow tubular diverticulum, somewhat swollen at the proximal end to form here a small pear-shaped seminal chamber. The diverticulum stretched out is more

than twice as long as the main pouch, and is coiled in a different manner in the different spermathecæ of the specimen examined.

Hab.—South Andaman, Wimberleyganj, Port Blair, in dense forest 20′ to 60′ above sea-level; B. B. OSMASTON leg., 10-xii-06.

Remarks.—*Pheretima osmastoni* seems to be allied to *Ph. burchardi*, MICHLSN., from Sumatra. It differs from the latter in the situation of the copulatory cushion, which is postclitellar in *Ph. burchardi*, and in different points of the internal anatomy, for instance in the thickness of certain septa, the shape of the seminal vesicles and spermathecæ, and in the existence of accessory glands in the vicinity of the prostates. A re-examination of the type specimen of *Ph. burchardi* convinced me that there are no real grape-like accessory glands in this species. There are near the prostates, more exactly between them, only those small, shortly-stalked glands that correspond with the external copulatory pouch situated on the 18th segment in this species. These small copulatory glands form a median ventral circular group, the outline of which coincides with the outline of the external copulatory pouch. These glands are homologous with the copulatory glands found in the anteclitellar region of *Ph. osmastoni* in the segments which bear externally the copulatory pouches.

Another form closely allied to these two is *Ph. andamanensis*, MICHLSN., described below. It is distinguished from both by its smaller size, by the absence of copulatory cushions, and by the structure of the spermathecæ. *Ph. andamanensis* is provided with only one pair of accessory glands, which lie just before the prostates and differ widely in structure from those of *Ph. osmastoni*. These glands have in *Ph. andamanensis* rather more the appearance of prostates in their internal structure.

PHERETIMA ANDAMANENSIS, MICHLSN.

(Plate xiii, fig. 25.)

Ph. a, MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 164.

Present three specimens.

External Characters—Dimensions of two mature specimens: Length 108 and 120 mm., greatest thickness 6 and 6½ mm., number of segments *ca.* 110.

Colour: Dorsally dark brownish to violet-grey, ventrally yellowish grey.

Head epilobous (about ⅔). Prostomium small, hinder appendix of prostomium nearly as broad as the prostomium, with parallel borders, open behind.

Setæ a little enlarged in the anteclitellar region. Circles of setæ nearly continuous, only the median dorsal distance somewhat larger than the neighbouring distances. Setæ placed somewhat closer together ventrally than dorsally. Number of setæ: 32-v, 45-x, 52-xii, 58-xix, 54-xxvi.

Dorsal pores distinct only behind the clitellum (first in the intersegmental furrow 12-13 ?).

Clitellum ring-shaped, occupying segments 14—16 (=3), with setæ on all the three segments.

Male pores on nearly circular, smooth papillæ, which are placed on a great transversely oval, nearly circular, rough protuberance. The latter occupies the whole length of the 18th segment. The male pores are distant one from the other about a quarter of the circumference of the body. There are about fifteen setæ between the male pores.

Female pore (or pores) on a small oval median ventral area in the zone of setæ of the 14th segment.

Spermathecal pores two pairs ventro-lateral in the intersegmental furrows 7-8 and 8-9, those of each pair distant one from the other about $\frac{2}{7}$ of the circumference of the body.

Copulatory organs are missing.

Internal Anatomy.—Septa 7-8 moderately strong, 8-9 and 9-10 missing, 10-11 and 11-12 moderately strong, 12-13 and 13-14 somewhat stronger, but not very strong.

Alimentary tract: A big gizzard between septa 7-8 and 10-11. Intestine with a pair of long, simple lateral cæca stretching forward for about four segments and tapering towards the blind end. Behind the point of origin of the cæca begins a simple crest-shaped typhlosole.

Circulatory organs: Dorsal vessel simple; last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: Two unpaired, semi-circular, anteriorly convex seminal vesicles in the 10th and 11th segments in the median ventral line beneath the œsophagus, completely separated one from the other, each unpaired seminal vesicle representing a pair, united completely in the median line. Two pairs of somewhat granular sperm-sacs depend from septa 10-11 and 11-12 into the 11th and 12th segments and communicate with the seminal vesicle of the preceding segment. Each sperm-sac bears at the top a rather large, shortly-stalked appendix of somewhat different appearance (of lighter colour).

Prostates: The glandular part, which is loose and tuft-like, occupies segments 19—23. Each branch of the tuft is long and rather narrow, irregularly restricted and partly lobed, granular. The duct is thickened and muscular in the distal two-thirds of its length, thinner in the proximal third. It forms an S-shaped double loop. There are no distinct copulatory pouches. Before each prostate is situated an accessory gland which resembles in appearance and in structure rather a *Pheretima*-prostate than the real prostate of this species. Its glandular part, which occupies segments 16—18, is more compact than that of the real prostate, irregular, moderately thick and disc-shaped, much incised and granular. It differs from the accessory glands of *Ph. osmastoni* (see above), the small divisions of the gland having no distinct ducts. Its duct, which is proximally rather thin, distally somewhat inflated, opens to the exterior before and more ventrally than the prostate.

Spermathecæ (fig. 25): Main pouch with a sac-shaped ampulla and a duct which is moderately sharply set off from the ampulla. The duct is somewhat shorter than the ampulla, about half as thick in the proximal part and much thickened and inflated in the distal part. This distal part of the duct bears a number of irregular,

sac-shaped, sessile accessory pouches, in appearance nearly resembling the ampulla. Besides these the main pouch bears a long, tubular, thread-like diverticulum, swollen at the proximal end to form a pear-shaped simple seminal chamber nearly three times as thick as the thread-like stalk of the diverticulum. The diverticulum is irregularly coiled. Extended it would surpass the main pouch in length, being nearly twice as long as the latter. It opens into the distal part of the duct of the main pouch.

Hab.—South Andaman Isl., N. Cinque Island, 100′, in dense forest about 3″ below surface of ground; B. B. OSMASTON leg., 23-xii-06.

Remarks.—This species is allied to *Ph. burchardi* (MICHLSN.) and *Ph. osmatoni*, MICHLSN. (*Vide* " Remarks" below the description of the latter species, *supra*.)

PHERETIMA SUCTORIA, MICHLSN.

(Plate xiii, fig. 28.)

Ph. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 165, f. 12.

I examined several partly mature specimens.

External Characters.—Dimensions of the mature specimens very different: Length 75—135 mm., greatest thickness 4½—7 mm., number of segments 103—123.

Colour: At the anterior segments dorsally chestnut-coloured, in other parts of the body lighter, yellowish brown.

Head epilobous (about ⅕). The dorsal hinder appendix of the prostomium is very short and broad, close behind.

Setæ all nearly of equal size. Circles of setæ continuous, in general of equal density, only on the anteclitellar segments dorsally somewhat further apart than ventrally. Numbers of setæ on the anterior segments vary greatly: 25—38-v, 35—58-x, 60—70-xiii, 75-xix, 80-xxvi.

First dorsal pore on the intersegmental furrow 12-13.

Clitellum developed all round the body, occupying segments 14—16 (=3), without setæ.

Male pores on small papillæ in the zone of the setæ of the 18th segment, about one-third of the circumference of the body distant one from the other.

Female pores very near the ventral median line, if not in juxtaposition, on a minute, transversely oval area or a short transverse furrow.

Spermathecal pores four pairs on the intersegmental furrows 5-6—8-9, ventro-lateral, about one-fourth of the circumference of the body distant from one another.

Copulatory organs, apparently always constant, and similar in all mature specimens examined by me; a pair of great, circular or transversely oval areas on the 18th segment in the zone of setæ, placed medially between the male pores. The papillæ of the male pores project a little over the lateral borders of these areas, and the rim-like zone of the setæ over the medial borders. The diameter of the

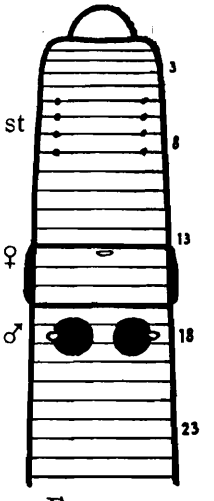

FIG. 19. *Pheretima suctoria.*

areas is somewhat larger than the distance between them, which bears 4 to 8 setæ. The border of each of these areas is sharply marked. The surface is smooth and somewhat depressed or elevated, and shows a dark ground colour with numerous lighter spots which are situated so densely that the ground colour is reduced to a reticulation.

Internal Anatomy.—Septa 4-5—7-8 and 10-11 a little thickened, 11-12—13-14 rather more thickened, 8-9 and 9-10 missing.

Alimentary tract: A great gizzard between septa 7-8 and 10-11. Œsophagus simple, without calciferous glands. Intestine without typhlosole, with a pair of cæca. The cæca are simple and slender; they are suspended by a broad base from the intestine in the 26th segment and extend forward into the 22nd segment.

Circulatory system: Dorsal vessel simple, provided in the region of the intestine with disc-like, shortly-stalked blood-glands,—a pair to a segment. Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: Two pairs of nearly globular seminal vesicles of equal size in segments 10 and 11 each containing a great sperm-duct-funnel. The seminal vesicles of each side as well as those of each pair are connected by a very short and very thick intermediary process, the whole having the appearance of a thick tubular ring with four regularly arranged globular swellings. Each sperm-reservoir communicates with a great, compact sperm-sac in the following segment (the 11th and 12th segments). The sperm-sacs show some slight fissures.

Prostates: Glandular part occupying segments 17—19, having many fissures and divided by deep incisions into some only loosely connected parts. Duct moderately long and uniformly thick, bent strongly but not always regularly. The ducts of the prostates open directly, without copulatory pouches, laterally from a pair of glandular cushions which correspond with the circular male areas mentioned among the external characters. The sperm-ducts enter the proximal end of the duct of the prostates.

Female organs: A pair of ovaries and oviduct-funnels free in the 13th segment. A pair of egg-sacs in the 14th segment suspended at septum 13-14.

Spermathecæ (fig. 28): Ampulla of main pouch bulb-shaped, proximally narrowed. Duct of main pouch abruptly set off from the ampulla, half as long and proximally one-third as thick as the ampulla, distally narrowed. At the distal part of this duct enters a very long and very thin tube-like diverticulum, the proximal end of which is slightly swollen. The diverticulum is irregularly bent and curved, nearly coiled. *In situ* it does not reach the tip of the main pouch, but if extended it would be two or three times as long as the main pouch.

Hab.—Andaman Islands.

Remarks.—The anterior male organs of *Pheretima suctoria* agree with none of UDE's schemes,[1] as the seminal vesicles not only of each side but also of each segment are connected.

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[1] H. UDE, Terricole Oligochäten von den Inseln der Südsee und von verschiedenen anderen Gebieten der Erde; in Zeitschr. wiss. Zool., lxxxiii, p. 403, ff.

PHERETIMA ANDERSONI, MICHLSN.

(Plate xiii, fig. 27.)

Ph. a., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 166, f. 13.

I examined two mature specimens which were rather weakened and stretched.

External Characters.—Dimensions: Length *ca.* 250 mm., greatest thickness 6 mm., number of segments *ca.* 120.

Colour: On the anterior segments dorsally chestnut-coloured, on the other parts of the body yellowish brown.

Head epilobous (*ca.* $\frac{1}{3}$). Dorsal hinder appendix of the prostomium rather broad, not closed behind.

Setæ everywhere very minute. Circles of setæ equally dense, continuous ventrally and dorsally. Numbers of setæ very great, according to a rough calculation about 100 on the 10th segment.

Dorsal pores seen only behind the clitellar region.

Clitellum developed all round the body, occupying segments 14—16 (=3), apparently without setæ.

Male pores in the zone of setæ of the 18th segment about one-third of the circumference of the body distant one from the other, on broad, only slightly prominent papillæ. The top of each papilla represents a broad, longitudinally oval area, bordered by a delicate but well-marked furrow. The male pore lies in the centre of this area. In one specimen the area shows before and behind the male pore a transverse depression, in the other specimen the whole middle part of the area is somewhat depressed. I counted twenty-six setæ between the male pores.

Female pores very near each other, if not united in the ventral median line, in a ventral median depression of the 14th segment.

Spermathecal pores four pairs in the intersegmental furrows 5-6—8-9, ventro-lateral, distant one from another about two-fifths of the circumference of the body, distinct, on small papillæ, surrounded by curved transverse rims.

Copulatory organs in both specimens equally arranged and formed: six great, very prominent, regularly transversely-oval glandular cushions in the intersegmental furrows 19-20—24-25 in the ventral median line. The distance between two neighbouring cushions is very small, being restricted to the zone of setæ of the intermediate segment. The copulatory organs resemble a row of great buttons.

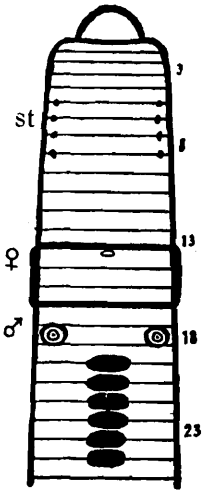

FIG. 20. *Pheretima andersoni.*

Internal Anatomy.—Septum 4-5 tender, 5-6 hardly thickened, 6-7 and 7-8 strong, 8-9 and 9-10 totally missing, 10-11 and 11-12 very strong, the following septa tender.

Alimentary tract: A big gizzard between septa 7-8 and 10-11. Œsophagus simple, without calciferous glands. Intestine with a pair of great, simple, slender, apparently quite smooth cæca which arise from the intestine in the 26th (?) segment.

Circulatory system: Dorsal vessel simple. Last hearts in the 12th segment. Nephridial system micronephric.

Anterior male organs: Two pairs of seminal vesicles united in their entire length and placed ventral-medially in the 10th and 11th segments, those of the fore pair smaller than those of the hind pair. Each seminal vesicle contains a sperm-duct-funnel and communicates with a sperm-sac in the following segment. Sperm-sacs sack-like, laterally fissured and incised, those in the 12th segment bigger than those in the 11th segment. The seminal vesicles of the fore pair in segment 10 apparently communicating also with a pair of sperm-sacs in the 10th segment. These latter sperm-sacs are flat, deeply incised and hand-shaped.

Prostates: Glandular part big, occupying several segments, flat, heart-shaped, with notched border and densely fissured surface. Duct rather long, muscular, narrowed at both ends, forming a great loop extending backwards. Duct opening directly, without the intermediacy of a copulatory pouch.

Spermathecæ (fig. 27): Main pouch with big sac-like ampulla and very short, rather thick, but in relation to the ampulla thin duct. A diverticulum opens into the distal end of this duct. The diverticulum is a slender tube, swollen at the free end to form a simple pear-shaped seminal chamber. The diverticulum forms some wide loops. Extended it would surpass by far the tip of the main pouch.

Hab.—Lower Burma, Amherst; Major A. R. S. ANDERSON leg.

Sub-fam. Octochætinæ.

The validity of this sub-family has lately been doubted by BENHAM,[1] but I cannot at all acknowledge the correctness of his arguments. He says, *l.c.*, p. 230, in reference to the genera *Octochætus* and *Dinodrilus*: "It seems to me that MICHAELSEN is in error in separating these two genera from other acanthodriline forms and associating them in a separate sub-family, the Octochætinæ, with *Eutyphoeus* and *Hoplochætella*; for, apart from the micronephric condition there is really little to distinguish *Octochætus* from *Notiodrilus*; moreover their presence in New Zealand indicates their close association therewith." The geographical part of this argument may provisionally be laid aside to be discussed later. As for the near affinity between *Octochætus* and *Notiodrilus* (or *Eodrilus*, as it is to be called now after a convenient restriction. All these discussions deal with the recent representatives of what I called "Acanthodriline Urform," the primordial acanthodriline form), I never denied it. But it might as well be pointed out that *Notiodrilus* (*Eodrilus*) is closely related to *Maoridrilus*, which only differs from it by the arrangement of the nephridial pores, or to *Chilota*, which only differs by the loss of the hinder pair of testes and sperm-ducts, or to *Diplocardia*, which only differs by the possession of two gizzards instead of one, or to other acanthodriline genera only differing from *Notiodrilus* (*Eodrilus*) in one particular. It means quite to misunderstand the particular systematic (*i.e.*, phyletic) position of the acanthodriline primordial form, represented by the recent genus

[1] W. B. BENHAM, On some Edible and other New Species of Earthworms from the North Island of New Zealand; in *Proc. Zool. Soc. London*, 1904, vol. ii, p. 220.

Notiodrilus (*Eodrilus*), to argue as BENHAM does. I think it best to recapitulate the considerations and arguments which led me to constructing the systematic scheme of the family *Megascolecidæ*. As I have pointed out, and as all my colleagues in this special study, among them BENHAM, have acknowledged, the family *Megascolecidæ* is a much-branched tree, which took its origin from the acanthodriline primordial form, that is to say, from *Notiodrilus* (*Eodrilus*). The greater branches of this tree, the different sub-families, are well defined in their distal parts. There is, for instance, no doubt about *Polytoreutus* belonging to a special sub-family *Eudrilinæ*, or *Pheretima* and *Megascolex* belonging to a sub-family *Megascolecinæ*, etc. The difficulty lies in defining the proximal parts of these branches or sub-families. To construct a systematic scheme I am obliged to cut off these branches from the main stem. In any case I am bound to separate two nearly allied forms, for the tree *Megascolecidæ* represents an almost completely continuous structure. There may be a dispute at what points to make these separations. I resolved to make them as near as possible to the main stem *Notiodrilus* (*Eodrilus*). The proximal ends of these cut-off branches must necessarily be very nearly allied to the main stem-genus; *e.g.*, *Octochætus*, the proximal end of the generally well-defined sub-family *Octochætinæ*, is very nearly allied to *Notiodrilus* (*Eodrilus*), and so also are *Kerria*, *Chilota* and *Diplocardia*, these genera being the proximal ends of other sub-families or groups. But I cannot see any reason in this near affinity for not making the separation at this point, for an intersection at any other point would separate affinities just as close. *Eutyphoeus* and *Dinodrilus* are allied to *Octochætus* [1] quite as closely as the latter is to *Notiodrilus* (*Eodrilus*), and *Hoplochætella* is as near to *Dinodrilus* as the latter is to *Octochætus*. I may as well separate *Notiodrilus* (*Eodrilus*) and *Octochætus* as any two others of these genera, which represent a continuous row of closely allied forms. Furthermore, the difference between *Notiodrilus* (*Eodrilus*) and *Octochætus*, the first being meganephric, and the latter, like all the other *Octochætinæ* micronephric, seems to be of sufficient importance for choosing this point as the limit between the *Octochætinæ* and the *Acanthodrilinæ* (*Eodrilus*). As little as I could formerly follow BENHAM when he made the condition of the nephridia the chief distinguishing character between the greatest groups of earthworms, can I follow him now when he, falling into the opposite extreme, denies these characters of the nephridial system any systematic importance. It may be granted that there are often difficulties in determining the character of the nephridial system. As the micronephric condition is derived from the meganephric condition, perhaps in various ways, there are certain intermediate and doubtful states not easy to be ranged under these two main groups of mega- and micronephric condition (for instance the genus *Lampito*). Furthermore, the micronephric condition may secondarily produce a state that may easily be mistaken for a meganephric condition (if the originally scattered micronephric villi approximate to one another and unite at each side of one segment to form

[1] The very near affinity between *Eutyphoeus* and *Octochætus* is still more confirmed by the recent studies of BEDDARD and of myself. See the discussions about the genera *Octochætus* and *Eutyphoeus* below.

a tuft-like bunch). But these technical difficulties should not cause us to undervalue the systematic importance of the nephridial characters.

The underestimation of these nephridial characters has misguided BENHAM in other ways. Firstly, he places near the micronephric Octochætine genus *Dinodrilus*, the meganephric genus *Dinodriloides*.[1] As I have pointed out on another occasion,[2] *Dinodriloides* is not at all allied to *Dinodrilus*. It is a genus of the sub-family *Acanthodrilinæ*, nearly allied to *Rhododrilus* as lately defined by me (*l.c.*, p. 142). It resembles *Dinodrilus* and differs from *Rhododrilus* only in the increased number of setæ in one segment, and this increase is an occurrence of only secondary systematic importance, noted in different sub-families of the *Megascolecidæ* and even in other families of earthworms (genus *Periscolex* of fam. *Glossoscolecidæ*). Still more confusion has been caused by BENHAM in the well-defined sub-families *Octochætinæ* and *Acanthodrilinæ*, when he put some Octochætine species into the acanthodriline genus *Plagiochæta*.[3] The type species of *Plagiochæta*, *P. sylvestris* (HUTTON) (=*P. punctata*, BENHAM), belongs to the sub-fam. *Acanthodrilinæ*, to a group of nearly allied genera characterised by the position of the nephridial pores alternating in two different lines at each side of the body (genera *Maoridrilus*, *Neodrilus* and *Plagiochæta*). This character may *a priori* seem to be of little systematic importance. But the geographical restriction of the group in which it is found is remarkable. It is a character that occurs only in a small group of holoandric[4] *Acanthodrilinæ* with free testes and sperm-duct-funnels, which is divided into three genera only by the ordinary principles of the microscolecine decrease (*Neodrilus* from the acanthodriline genus *Maoridrilus*) and the perichætine increase of setæ (*Plagiochæta* from the lumbricine genus *Maoridrilus*). All the species which bear this character—the number of them is rather great—are endemic in the New Zealand region. This character is found in none of the many extra-New-Zealand *Acanthodrilinæ*. We may therefore conclude, as regards

[1] W. B. BENHAM, On some Edible, etc., *l.c.*, p. 226.

[2] W. MICHAELSEN, Oligochæta; in Die Fauna Südwest-Australiens, etc., bd. i, p. 140.

[3] W. B. BENHAM, On the Old and some New Species of Earthworms belonging to the Genus Plagiochæta; in Trans. New Zealand Inst., vol. xxxv, art. 31.

[4] BENHAM says about *Neodrilus*, which belongs to this group, but in *Neodrilus*, which MICHAELSEN has termed a "microscolecine form," the number of testes has also been reduced' (On some Edible, etc., *l.c.* p. 229). Is this not a mistake? Unfortunately I have not at hand BEDDARD's original description of *N. monocystis*, but I believe that my note, '2 *Paar freie Hoden und Samentrichter*' (Oligochaeta; in Tierreich, Lief. 10, p. 125), according to which *Neodrilus* would be holoandric, is taken from the original description. Furthermore BENHAM's note, according to which *Neodrilus* would be meroandric, does not conform with his earlier notes. In "Notes on two Acanthodriloid Earthworms from New Zealand" (in Quart. Journ. Micr. Sci., N.S., vol. xxxiii, p. 292, he says, 'The testes and ovaries have the usual position'—that is, for the definition of an "Acanthodriloid earthworm" of that day, a holoandric arrangement. The holoandric nature of *N. monocystis* may also doubtless be derived from BENHAM's delineation (*l.c.*, pl. xv, fig. 8). Here he figures in a diagrammatic longitudinal section through the body-wall 'two' sperm-ducts, spoken of in the explanation of plates (*l.c.*, p. 310) as 'sperm-ducts,' *i.e.*, in the plural. *N. monocystis* having, then, two sperm-ducts at each side, must have as well two sperm-duct-funnels at each side and must be regarded as "holoandric" in conformity with these earlier notes of BENHAM.

this geographical restriction, that it is the sign of consanguinity, that the *Maoridrilus* group is a natural one, and that the genera which bear the said character are not to be confounded with any species that is devoid of this character. Now, there is firstly BENHAM's *Plagiochæta rossii* (On the Old *Plagiochæta*, *l.c.*, p. 284), a species with micronephridial condition (whilst the *Maoridrilus* group including *Plagiochæta* is typically meganephridial), resembling *Plagiochæta* only in the possession of a great number of setæ on each segment, these setæ not even being arranged in pairs as in the typical *Plagiochæta*. It is obvious that *P. rossii* has nothing to do with the genus *Plagiochæta*; it is a typical Octochætine, an Octochætine with acanthodriline genital apparatus and perichætine increase of setæ, *viz.*, a *Hoplochætella*. The genus *Hoplochætella* was formerly known only from India, but just this apparent incoherence in geographical distribution confirms my view, for all the *Octochætinæ* are found in New Zealand, on the one hand, and on the other in India and adjacent districts. *Hoplochætella* is not the first Octochætine genus living equally in both these far separated territories. The genus *Octochætus* is also found both in New Zealand and India. I have to discuss these particular geographical points further on. To this genus *Hoplochætella* probably belong also the species *Plagiochæta ricardi*, BENHAM (*l.c.*, p. 286), and *P. montana*, BENHAM (*l.c.*, p. 288). The nephridial system of these species is called micronephric in the first description, whilst BENHAM later, in a footnote in "On some Edible, etc.," p. 229, declares it to be meganephric. If I understand aright the later note of BENHAM, we here have before us a case of that secondary, only apparently meganephric condition I spoke of above, with micronephridia united at each side of the body to form tufts. If this view should prove to be correct, these two species must be regarded as *Hoplochætellæ*, as well as *P. rossii* (BENHAM).

Most difficult is a judgment about a fourth *Plagiochæta* species of BENHAM, *viz.*, *P. lateralis* (*l.c.*, p. 282). This species seems really to be meganephric. Though BENHAM did not see the nephridial pores externally he saw them in sections. If this species really be typically meganephric, it should be placed in the sub-family *Acanthodrilinæ*, but not in the *Maoridrilus* group of this sub-family (*e.g.*, *Plagiochæta*), for the nephridial pores are not alternating, but "in the lateral gap." This species, then, should be the type of a new Acanthodriline genus and be placed at the side of *Dinodriloides*. Here I put it in my table of the genera of the sub-fam. *Acanthodrilinæ*[1] as "Gen. ? (Typus *Plagiochæta lateralis*, BENHAM)." In the same questionable genus must be placed *P. ricardi* and *P. montana*, BENHAM, if they should prove to be meganephric, which I do not believe to be the case. But I am far from being convinced of the necessity to form such a genus. I cannot yet give up the idea that even in *P. lateralis* we have only a modified micronephric condition before us. There is another peculiarity in this species as well as in *P. ricardi* and *P. montana* which makes me believe them to belong to the sub-family *Octochætinæ*, *viz.*, the characteristic apparatus of strong transverse muscles in the vicinity of the prostates and male pores. This is a character very often found in the *Octochætinæ*,—in the genus *Octochætus* as well

[1] W. Michaelsen, Oligochaeta; in Die Fauna Südwest-Australiens, bd. i, p. 140.

as in *Eutyphoeus*,—while it is not present in the typical species of *Plagiochæta*. I hope the further examination of the nephridial system of the species, as promised to us by BENHAM, will settle these questions. I, in the meanwhile, must be contented with the result, that *P. rossii* surely, and *P. ricardi* and *P. montana* probably, belong to the genus *Hoplochætella*, while the systematic position of *Plagiochæta lateralis*, which is certainly no *Plagiochæta*, remains an open question.

As for the geographical aspect of BENHAM's arguments regarding the near affinity between *Octochætus*, *Dinodrilus* and *Notiodrilus* (*Eodrilus*), I cannot understand the meaning of it. BENHAM says: " moreover their presence (that of *Octochætus* and *Dinodrilus*) in New Zealand indicates their close association therewith (with *Notiodrilus*)." Now on the one hand *Notiodrilus* (*Eodrilus*) is a genus with a world-wide distribution, occurring not only in New Zealand, but also in New Caledonia, Australia, Madagascar, South Africa, Tropical Western Africa, South Patagonia, Chile, Central America and Mexico, and this distribution, with the exception perhaps of the Tropical West African locality, was known when BENHAM wrote that sentence, published in April, 1905. On the other hand *Octochætus*, as has been known since the year 1899, is endemic in India as well as in New Zealand. Its distribution, then, is quite different from that of *Notiodrilus* (*Eodrilus*), and there is nothing in the distribution of these genera, that could favour the idea of a special relationship between them. This distribution just confirms my view of the systematic substantialness of the sub-family *Octochætinæ*, for all its genera are endemic in these districts, either in one of them or at the same time in both of them. The genus *Octochætus* is endemic in New Zealand and India, *Dinodrilus* in New Zealand, *Hoplochætella* in New Zealand and India, and finally *Eutyphoeus* in India and the adjacent districts of Burma (and Ceylon ?). There could hardly be a distribution more characteristic than this. I need not explain to any zoo-geographer that the discontinuation of these two regions of distribution in the *Octochætinæ* is quite a common matter in geographical distribution, the two regions, New Zealand and India, perhaps together with a third region, Madagascar, the home of *Howascolex*,[1] representing the peripheral parts of a circular distribution, the internal parts of which have been obliterated by the mighty development of younger and stronger forms, in this case of the vigorous genus *Pheretima*, which, from Burma to New Hebrides in one direction and Japan in another, has suppressed and partly exterminated all other genera of earthworms, those of its own phylum or sub-family as well as those of other tribes.

GEN. OCTOCHÆTUS.

This genus is represented by six species in the examined collections. I shall discuss the relation of this genus to *Eutyphoeus* further on in connection with the special discussion on the latter.

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[1] The genus *Howascolex*, MICHLSN., from Madagascar, till now regarded as belonging to the sub-family *Acanthodrilinæ*, seems to represent a link between this sub-family and the *Octochætinæ*. It might be justifiable to place it among the *Octochætinæ* at the side of *Octochætus*.

Synopsis of the principal characters and localities of the species of Octochætus *from the East Indies.*

Species.	Testes and sperm-duct-funnels.	Penial setæ.	Diverticula of Spermathecæ.	Prostate pores.	Spermathecal pores.	Copulatory papillæ or areas.	Locality.
O. aitkeni (FEDARB.) ..	2 pairs	Distal end simple. Ornamentation: missing.	1, simple, tubular, about half as long as the ampulla.	Near the ventral median line ? (in *a* ?)	Near the ventral median line ? (line *a* ?).	Missing..	Travancore.
O. phillotti, MICHLSN. ..	2 pairs	Distal end spoon-like, not broadened, straight. Ornamentation: irregular annulets of moderately strong teeth. Copulatory setæ near the spermathecæ.	1, short, broad, divided by deep incisions into lobes.	In *a*	In *a*	On segment 18 (20), unpaired, occupying all the ventral part of the segments.	Deccan, Hyderabad.
O. maindroni, MICHLSN. ..	2 pairs	Distal end flattened, but not broadened, with two edges and simple tip. Ornamentation: very irregular, partly oblique transverse rows of rather slender, large teeth.	1, broad, very short, nearly encircling the duct, with a small number (f. *typ.*) or large number (var. *chaperi*) of seminal chambers.	In *b*	Between *a* and *b*.	Unpaired, one on $\frac{2}{3}$ 13—$\frac{1}{3}$ 14 (f *t pica*), or two on 13 and 18 (var. *chaperi*).	South India, Gingi, Karur.
O. pattoni, MICHLSN. ..	2 pairs	Distal end with two lateral wings with serrulate distal margin. Ornamentation: regular annulets of fine teeth, with greater lateral teeth. Copulatory setæ near the spermathecæ.	1, nearly as large as the ampulla, externally simple, with many not sharply separated seminal chambers.	In *b*	In *a* or just medial from *a*.	On parts of 11-12, 14-15, 21-22 or 22-23, paired, sometimes united at the median line.	South India, Madras.
O. fermori, MICHLSN. ..	2 pairs	Distal end simple. Ornamentation: some scattered, moderately strong triangular teeth.	1, half as long as the ampulla, pear-shaped, externally simple, with many not sharply separated seminal chambers.	Medial from *a*	Quite near the ventral median line.	Missing..	Bengal, Raniganj.
O. hodgarti, MICHLSN. ..	2 pairs	Missing	1, half as long as the ampulla, externally simple, with many not sharply separated seminal chambers.	Medial from *a*	Somewhat medial from *a*.	Missing..	Nepal, Gowchar.
O. beatrix, BEDD.	?	Missing	Missing	Medial from *a*	?	Missing..	Bengal, Calcutta.
O. thurstoni, MICHLSN. ..	2 pairs	Missing	1, quarter as long as the ampulla, with many separated seminal chambers, somewhat projecting externally.	Between *a* and *b*.	Between *a* and *b*.	On (21) (22) 23, 24, unpaired, transversely elongated.	South India, Madras.

OCTOCHÆTUS PHILLOTTI, MICHLSN.

(Plate xiv, figs. 65—67.)

O. ph., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 169.

Examined about a dozen mature specimens and some younger ones.

External Characters.—Dimensions of the mature specimens: Length 35—55 mm., greatest thickness 2—2½ mm., number of segments *ca.* 125.

Colour greyish.

Head epilobous (about $\frac{3}{5}$). Prostomium small. Hinder dorsal appendix of prostomium moderately broad, open behind.

Setæ rather small, paired, but in general not very strictly, the ventral somewhat more strictly than the lateral, especially at the clitellum and at a number of preceding and succeeding segments ($ab < cd$). The median lateral distances about 1½ times the width of the dorsal pairs and about $\frac{3}{5}$ as large as the median ventral distance ($bc = \frac{3}{5}\ cd = \frac{3}{5}\ aa$). Median dorsal distance somewhat larger than half the circumference of the body ($dd = \frac{3}{5}\ u$).

First dorsal pore on the intersegmental furrow 11-12.

Clitellum ring-shaped, extending over segments 13—17 (=5).

Prostate pores on the 17th and 19th segments in the lines of setæ *a*.

Seminal furrows nearly straight, curving only very slightly towards the median ventral line.

Male area much depressed, bordered at the side by broad, almost wall-like protuberances which often somewhat overhang at the 18th segment, giving the depressed male area a biscuit-like form.

Female pores at the 14th segment before the zone of setæ somewhat medially in the lines of setæ *a*, on a common biscuit-shaped glandular area.

Spermathecal pores on the 8th and 9th segments just before the setæ *a*.

Copulatory organs: The ventral part of segment 18 and sometimes 20 may be somewhat glandular. Also the ventral part of the 8th and 9th segments is often glandular. Sometimes the spermathecal pores of one segment are connected with each other by a backward-curved transverse furrow. Sometimes the hinder border of this furrow appears wall-like.

Internal Anatomy.—Septum 4-5 is very strong; septa 5-6 and 6-7 are very tender, apparently rudimentary (not reaching the gizzard?); septa 7-8—14-15 are strengthened, especially 10-11, 11-12 and 12-13, the others gradually somewhat less; septum 15-16 is tender, but somewhat thicker than the following ones which are very tender.

Alimentary tract: A big somewhat oblique gizzard between the thickened septa 4-5 and 7-8. Œsophagus narrow, with folded walls. A pair of big calciferous glands in the 15th segment surrounding the œsophagus dorsally and laterally. These calciferous glands are divided by a great number of longitudinal septa and are each connected with the œsophagus by a very short and narrow stalk. Intestine beginning

in the 15th segment, with a big typhlosole which consists of two longitudinal lamellæ rising from a common base.

Circulatory system: Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: Two pairs of sperm-duct-funnels and testes in the 10th and 11th segments, embedded in free sperm-masses which are not enclosed in seminal vesicles. Two pairs of sperm-sacs depending from septum 11-12 into the 12th segment and from septum 9 10 into the 9th segment. The latter are simple and very much smaller than those in the 12th segment which are incised and consist of some rather big divisions.

Prostates of moderate size, hardly exceeding the segment of their opening, tube-like. Glandular part moderately thick and rather long, convoluted in a plane. Duct much shorter and thinner than the glandular part, abruptly set off from the latter, describing one or two short, broad loops.

Penial setæ (fig. 65) about 0·9 mm. long and 17 μ thick, rather straight, only bent a little at the distal end, especially at the tip, which narrows rather rapidly and is excavated like a spoon at the concave side of its curve. Beneath this spoon-like outer end the penial seta bears some more or less regular, some very irregular, oblique or broken circles or rows of delicate triangular teeth.

Spermathecæ (fig. 66): Main pouch with a long oval or sac-like ampulla and a much shorter and thinner duct which is set off more or less abruptly from the ampulla. Into this duct opens an indistinctly stalked diverticulum which is generally divided by one or two more or less deep incisions into two or three irregular lobes; it is rarely simple. Sometimes the incisions or one of them even splits the diverticulum almost to its base. The diverticulum is about a fourth as long as the ampulla and generally broader than long.

Copulatory setæ (fig. 67): The ventral setæ of the 8th and 9th segments are changed to copulatory setæ. They are about 0·6 mm. long and 17 μ thick, and somewhat bent. The distal end is almost bill-shaped, a little depressed at the sides and showing at each side a longitudinal, not very prominent ridge which disappears further down the seta. The distal half of the seta, with the exception of the bill-shaped end, is ornamented with a great number of rather densely placed circles of small triangular teeth. These circles are sometimes a little irregular.

Hab.—Deccan, Hyderabad; Col. D. C. PHILLOTT leg.

OCTOCHÆTUS MAINDRONI, MICHLSN.

F. TYPICA.

(Plate xiv, fig. 29.)

O. m., typ., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 168, f. 15.

Present one mature specimen.

External Characters.—Dimensions: Length 180 mm., thickness 4½—5 mm., number of segments 198.

Colour uniformly grey.

Head epilobous (about $\frac{1}{2}$). Some of the segments of the anterior part of the body divided into two (segments 2—4) and some (segments 5 *et seq.*) into three ringlets by one or two ringlet-furrows.

Setæ very delicate, in general paired, but not very strictly, the lateral ones less so than the ventral ones, which are distant one from the other for about $\frac{2}{5}$ of the middle lateral or the median ventral distances ($aa = bc$, $cd = \frac{3}{5}bc$, $ab = \frac{2}{5}bc$). Median dorsal distance larger than half the circumference of the body ($dd > \frac{1}{2}\ u$). Setæ of the first segments more separated (here $cd = bc$ or even a little larger, $ab = \frac{2}{3}bc$).

First dorsal pore in the intersegmental furrow 12-13.

Clitellum not yet quite distinct (occupying the segments 13—17 (=5) as in var. *chaperi* ?).

Prostate pores on the 17th and 19th segments in the lines of setæ *b*, on very small circular papillæ; the male papillæ of each side are connected by a sharply marked seminal furrow. The seminal furrows curve towards the median ventral line. The whole male area, limited by the male papillæ and the seminal furrows, is somewhat, but not much depressed. The body-wall in the neighbourhood of the male area is somewhat thickened. Male pores apparently in the seminal furrows on the middle zone of the 18th segment.

Female pores not seen.

Spermathecal pores rather inconspicuous, two pairs, at the anterior part of the 8th and 9th segments on the anterior ringlet-furrow between the lines of setæ *a* and *b*, somewhat nearer to the former.

Copulatory organs: A single median ventral very prominent cushion on the intersegmental furrow 13-14, occupying the last two ringlets of the 13th segment and the first ringlet of the 14th segment; copulatory cushion broader than long, laterally reaching nearly as far as the lines of setæ *d*, with convex anterior margin and concave posterior margin.

Internal Anatomy.—Septa 7-8—13-14 thickened, 9-10—11-12 very strong, the others gradually less strong.

Alimentary tract: A very large gizzard before septum 7-8, in the 7th, 6th or 5th segment. Œsophagus with one pair of very large calciferous glands, which open into the œsophagus in the 15th segment, but reach from here into the 16th segment. The calciferous glands are of rather complex shape, consisting of a number of parts, which are separated from one another by deep incisions and constrictions.

Circulatory system: Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: Two pairs of sperm duct-funnels free in the 10th and 11th segments. Two pairs of sperm-sacs depending from septa 10-11 and 11-12 into the 11th and 12th segments. Those of the posterior pair are larger, much divided, grape-like, those of the anterior pair are smaller, simple sack-shaped.

Prostates tubular, restricted to the 17th and 19th segments. Glandular part moderately thick, much bent, nearly coiled; duct shorter, but relatively long, thin, irregularly bent.

Penial setæ like that of var. *chaperi* (see fig. 31), very tender, about 1·2 mm. long and 10 μ thick, somewhat bent only at the distal end. Distal end somewhat flattened, but not broadened, with two rather sharp side-edges, ending in a simple tip. Below the flattened portion the seta is ornamented with very irregular, partly oblique, transverse rows of large, rather slender teeth.

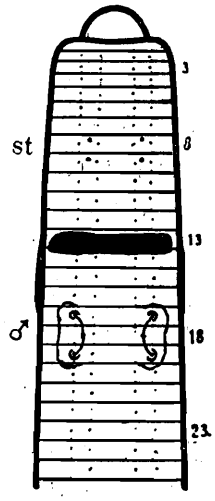

FIG. 21. *Octochætus maindroni*, f. *typica*.

Spermathecæ (fig. 29): Main pouch with an elongated sack-shaped ampulla and a thinner, short duct. Into the distal end of this duct opens a broad and very short diverticulum which nearly encircles the duct. The diverticulum contains a number (about 7 ?) of small seminal chambers, which externally are separated by very slight to somewhat deep furrows or incisions. As the distal end of the duct gets narrower in the region of the diverticulum, the latter hardly projects above the general surface of the duct. The diverticulum of the anterior spermathecæ seems to be even more inconspicuous than that of the posterior pair. Perhaps these spermathecæ are not yet quite mature. It is possible that at a more advanced stage they may resemble more those of var. *chaperi*.

I could not detect copulatory setæ in the vicinity of the spermathecæ, but I dare not say that there are none.

Hab.—South India, Gingi in South Arcot; M. MAINDRON leg. (Mus. Paris).

VAR. CHAPERI, MICHLSN.

(Plate xiv, figs. 30, 31.)

O. m., ch., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 169.

A single unfortunately very badly-preserved specimen of an *Octochætus* species I regard as a variety of *O. maindroni*.

External Characters.—Dimensions: Length 50 mm., thickness $2\frac{1}{2}$—3 mm., number of segments *ca.* 130.

Clitellum ring-shaped, occupying segments 13—17 (=5).

Female pores at the anterior part of the 14th segment, somewhat closer together than the lines of setæ *a*.

Copulatory organs: A large unpaired, median ventral, transversely oval papilla on the 18th segment between the seminal furrows, a still broader unpaired, median ventral cushion on the 13th segment. The latter laterally transgresses the lines of setæ *b*.

Spermathecæ: Main pouch with elongated sack-shaped ampulla which opens through a short narrow duct not sharply set off from the ampulla. Into the duct opens a single large, nearly semi-globular, very short and narrow stalked diverticulum nearly as thick as the ampulla. The diverticulum contains a great number of seminal chambers which project a little above the surface, making the latter appear mammillated.

Hab.—South India, Weyra Karur in the Madras Presidency; CHAPER leg., 1883.

Remarks.—This variety is distinguished from the typical form of this species principally by the smaller size and by the arrangement of the copulatory organs, of which it possesses two, one on the 13th and one on the 18th segment, whilst in the typical form there is only one on the 13th segment, backwards transgressing somewhat the intersegmental furrow 13-14. There is probably also an important difference in the shape of the spermathecæ, but it is not quite certain whether that described in the typical form should be regarded as completely developed.

OCTOCHÆTUS PATTONI, MICHLSN.

(Plate xiv, figs. 33—35.)

O. p., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 170, f. 16.

Examined many partly mature specimens.

External Characters.—Dimensions of mature specimens only slightly differing. Length about 90 mm., thickness in the middle about 3 mm., number of segments about 180.

Colour in general greyish, at the anterior segments dorsally brown.

Head tanylobous (not always quite distinct, as the lateral furrow sometimes gets indistinct behind). Prostomium small, hardly broader than the hinder dorsal appendix.

Setæ moderately large, all at the ventral side of the body, the dorsal distance being somewhat larger than half the circumference of the body ($dd = \frac{7}{12} u$). Setæ paired, but not very strictly, the distance between the two setæ of each pair measuring about two-thirds of the median ventral and the median lateral distances ($ab = cd = \frac{2}{3} aa = \frac{2}{3} bc$).

Clitellum mostly marked by a dark brown colour, ring-shaped or sometimes interrupted ventrally in the median line, but without sharp borders along the interruption; occupying segments 13 or $\frac{1}{2}$ of 13 to 16 (= 4 or $3\frac{1}{2}$).

Prostate pores two pairs on the 17th and 19th segments in the lines of the setæ *ab*.

Seminal furrows between the prostate pores of each side curving slightly towards the median ventral line.

Male pores in the seminal furrows on the 18th segment in the zone of setæ (not quite distinctly seen).

The male area, bordered by the seminal furrows, very much deepened and surrounded by thick swellings forming a biscuit-shaped wall which extends from the 16th segment to the middle of the 20th segment.

Female pores on the 14th segment closer together than the lines of setæ *a* and a little before the zone of setæ, surrounded by a common, transverse, white biscuit-shaped area.

Spermathecal pores two pairs in the intersegmental furrows 7-8 and 8-9, all of them in the lines of setæ *a*, or those of the hinder pair very little nearer together.

Copulatory organs: Large transversely oval glandular cushions with a depression in the middle, and a more or less distinct papilla on its centre, intersegmental,

mostly paired, on each side between the lines of setæ *a* and *c*, sometimes somewhat nearer together or even united in the ventral median line (but without getting unpaired), in variable number and situation. The most constant, in thirteen out of twenty-three mature specimens, on the intersegmental furrow 11-12, in eight of the twenty-three specimens a pair on the intersegmental furrow 14-15, in nine specimens a pair on the intersegmental furrow 21-22 or 22-23. Only in two specimens all of them were present, in three mature specimens only they were totally absent. In four specimens more or less distinct glandular cushions of a somewhat varying appearance were found on segments 7 and 8 or 8 and 9. These cushions were unpaired, transversely-median, or, if paired, connected in the middle line.

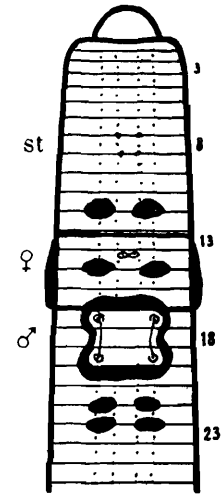

FIG. 22.
Octochætus pattoni.

Internal Anatomy.—Septum 5-6 strong, 6-7—8-9 very thin, apparently partly rudimentary, 9-10 thin, dorsally dislocated backwards, not reaching the body-wall, united with the strong septum 10-11, forming a rather small ventral chamber with the latter. Septum 11-12 strong, dorsally dislocated forward and united with the preceding septum 10-11 forming with it a small ventral chamber. Septum 12-13 and 13-14 strong, 14-15 somewhat strengthened, about half as thick as the preceding ones; those that follow are thin.

Alimentary tract: A big somewhat oblique gizzard between the two first strong septa 5-6 and 10-11, apparently enclosed by the thin septum 6-7 (in segment 6?). Œsophagus thin, with much folded walls. A pair of very large, densely striated calciferous glands opening by short and thin stalks into the œsophagus near each other and near the dorsal median line, at about the border-line between segments 15 and 16 (just behind this line in the 16th segment?). The calciferous glands are not arranged symmetrically, the one extending into the 15th segment, the other into the 16th. Intestine beginning in the 19th segment, with a big typhlosole, consisting of two longitudinal edges with a common basal part.

Nephridial system micronephric.

Anterior male organs: Two pairs of testes and two pairs of sperm-duct-funnels, imbedded in developing sperm-masses, lie in the two rather small ventral chambers which represent the reduced segments 10 and 11. Two pairs of grape-like sperm-sacs depend forward and backward from the dorsally united septa 9-10—11-12. These sperm-sacs,—one pair evidently depending from the front of septum 9-10, the other pair evidently depending from the back of septum 11-12,—therefore lie in segments 9 and 12, the more archaic arrangement often seen in the sub-family *Octochætinæ*. This curious arrangement shows the sperm-ducts, which are very long and form in segments 11, 12 and 13 big, nearly compact convolutions, lying free in the cœlomic cavity. The convolutions of the 13th segment are not quite as big as those of the preceding segment and pass backwards without a sudden break over into the dense undulations of the hinder part of the sperm-ducts. The two sperm-ducts of one side do not unite until they pierce through the body-wall just before opening by the male pores.

The prostates are very long convoluted tubes. The glandular part is thicker and much longer than the abruptly set-off muscular duct, but the latter is relatively (in regard to other species) very long and describes some wide convolutions.

The penial setæ (fig. 33) are about 1·7—2 mm. long and in nearly the whole length 17 μ thick. They are regularly, but not very strongly bent. For the distal fourth the seta seems to be bordered at the sides, but only at the most distal end are the two edges more flattened, so as to form, together with the thicker axial part, a sort of shovel which is somewhat bent down. The axial part forms a tip, projecting from the distal end of this shovel. The distal ends of the edges at each side of the projecting tip are serrated, forming a row of regular small teeth. Below the commencement of the two projecting sides the seta is ornamented by eight or nine circles of slender teeth directed forwards, and not diverging much from the axial part of the seta. Besides these circles the seta bears on each side eight or nine larger more diverging teeth which are generally placed in the circles of smaller teeth, but not always exactly; some of them stand somewhat before the circle of smaller teeth. This ornamented part of the seta is very slightly broadened on account of the projecting edges.

Spermathecæ (fig. 35): The main pouch is pear-shaped, consisting of a thick ampulla and a cone-shaped duct, not set off strictly from the ampulla. Into the distal end of the duct opens a thick diverticulum, about $\frac{2}{3}$ as long and as thick as the main pouch and with the proximal end bent against the side of the latter. The walls of the proximal part of the diverticulum are irregularly folded, the folds depending into the interior of the diverticulum. The spaces between these folds form indistinctly separated seminal chambers, being filled with clumps of sperms.

Copulatory apparatus with setæ (fig. 34): The ventral setæ of the 8th and 9th segments are changed to copulatory setæ, about 0·8—1·0 mm. long and in general about 20 μ thick, only a little thicker at the proximal end, and tapering somewhat only a little before the distal end which is a little depressed at the sides and bluntly pointed. The extreme distal end shows a very fine annulation, caused by the internal structure. Below this part the seta bears a number of smooth, transverse ridges. The ridges are curved in a bow, concave towards the distal end of the seta. There appear to be three or four longitudinal rows of such ridges, each row consisting of about eleven ridges. The corresponding ridges of two longitudinal rows meet to form together a long, slender tooth which diverges somewhat from the axial part of the seta. The opposite end of each ridge forms a smaller tooth. Each bundle of copulatory setæ is combined with a glandular tube which opens together with the sac of setæ. This glandular tube is irregularly coiled. It is hidden in the thick body-wall, not extending into the cœlomic cavity. It causes by its thickness the cushion-like thickenings of segments 7 and 8 or 8 and 9, mentioned above.

Hab.—South India, Madras (Egmore, Spur Tank, Red Hills, Museum Grounds, Peoples' Park, Kilpauk and Pursevaukann); E. THURSTON leg.
" " " (Mackay's Garden); Capt. W. S. PATTON leg.

OCTOCHÆTUS FERMORI, MICHLSN.

(Plate xiv, figs. 42, 43.)

O. f., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 171.

Examined a dozen mature specimens.

External Characters.—Dimensions: Length 60—100 mm., greatest thickness about $2\frac{1}{2}$—3 mm., number of segments 150—190.

Colour light grey, somewhat yellowish.

Head epilobous ($\frac{1}{2}$—$\frac{2}{3}$); dorsal appendix of prostomium varying, nearly linear.

Setæ rather small, all at the ventral side of the body, the dorsal median distance being as large as about $\frac{2}{3}$ of the whole circumference (dd = ca. $\frac{2}{3}$ u). Setæ paired, but not strictly, the lateral pairs being only a little nearer together than those bordering the median lateral distance (cd = ca. $\frac{4}{5}$ bc). The ventral pairs are at the anterior and middle parts of the body distinctly closer together than the lateral pairs (at the anterior segments $ab = \frac{1}{2}$ cd), at the posterior segments they are less so (at the posterior segments $ab = \frac{3}{4}$—$\frac{4}{5}$ cd). The ventral median distance is distinctly larger than the lateral median ones (aa = ca. $\frac{4}{3}$ bc).

Dorsal pores indistinct, if not missing.

Clitellum ring-shaped, from the 13th to the 17th segment (=5).

Prostate pores two pairs on the 17th and 19th segments medial from the lines of setæ *a*.

Seminal furrows curve towards the median ventral line.

Male pores apparently in the seminal furrows in the zone of setæ of the 18th segment (not distinctly seen).

Male area only slightly or not at all depressed.

Female pores on the 14th segment somewhat medial from the lines of setæ *a*, just before the zone of setæ, with a common transversely oval glandular area.

Spermathecal pores on the 8th and 9th segments in the zones of setæ, very close to the ventral median line, sometimes on small papillæ which touch each other in the middle line.

None of the twelve mature specimens showed any copulatory cushions or grooves.

Internal Anatomy.—The first distinct septum, 4-5, very stout, the following very tender, apparently rudimentary, or quite absent, septum 8-9 about half as strong as 4-5, 9-10—11-12 as strong as 4-5, 11-12 half as strong, the following tender.

Alimentary tract: A big, somewhat oblique gizzard between septa 4-5 and 8-9, but not occupying the whole space between them. A pair of very great calciferous glands in the 15th segment, pushing septum 14-15 far forward and septum 15-16 far backward. The calciferous glands are of irregular shape, short and narrow stalked, divided by slight constrictions into some parts. They are not arranged symmetrically, that from one side of the œsophagus crossing its middle line dorsally and extending into the other side of the body behind the calciferous gland of that side. Their internal structure depends on a great number of transverse lamellæ.

Intestine commencing in the 18th segment, with a big typhlosole consisting of two longitudinal lamellæ depending from a common base and pressed against each other.

Circulatory system: Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: One pair of testes and large spermiducal funnels in the 11th segment enclosed in a pair of relatively small seminal vesicles. A second pair of smaller sperm-duct-funnels in the 10th segment, free, not enclosed in seminal vesicles, apparently rudimentary, in correspondence with the absence of testes in this segment. A pair of large, incised sperm-sacs depending from septum 11-12 into the 12th segment.

Prostates small, extending sideways from the point of their opening, tube-shaped, describing some irregular undulations or windings. Glandular part rather thick; duct much thinner and shorter.

Penial setæ (fig. 42) about $\frac{2}{3}$ mm. long and 15 μ thick, nearly straight, only the distal end somewhat bent in the form of an S, but very little. Distal end simply pointed like a slender lead pencil. Below the upper end the distal part of the seta bears some irregularly placed, short and rather small teeth, standing on the proximal ridge of small scars, which are partly covered by these teeth.

Ovaries in the 13th segment.

Spermathecæ (fig. 43): Main pouch pear-shaped, with a short muscular duct which is not set off abruptly from the ampulla. Into the duct opens a pear-shaped diverticulum hardly half as long and as thick as the main pouch. The diverticulum contains some partially separated seminal chambers filled with clusters of convoluted sperm.

Hab.—Bengal, Raniganj in the Burdwan district; L. L. FERMOR leg.

Remarks.—This interesting little species seems to represent an intermediate condition between holoandric and metandric species, the anterior pairs of male organs having disappeared with the exception of the sperm-duct-funnels, which, however, are much smaller than the functional sperm-duct-funnels of the 11th segment.

OCTOCHÆTUS HODGARTI, MICHLSN.

(Plate xiv, fig. 30.)

O. h., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 172.

Examined two mature specimens, one of which is incomplete, and two doubtful young ones.

External Characters.—Dimensions of the complete mature specimen: Length 40 mm., greatest thickness $2\frac{1}{2}$ mm., number of segments 138.

Colour greyish.

Head epilobous ($\frac{3}{4}$). Prostomium small; dorsal appendix of prostomium diverging somewhat backwards.

Setæ all on the ventral side, the median dorsal distance being greater than half the circumference ($dd = \frac{2}{3}u$), the ventral setæ strictly paired, the lateral setæ less strictly, especially at the anterior and middle parts of the body ($cd = 1\frac{1}{2}$—$2ab$). Ventral median distance a little larger than the median lateral distances ($aa = 1\frac{1}{4}bc$).

Dorsal pores present.

Clitellum ring-shaped, extending over segments 13—18 (=6).

Prostate pores on the 17th and 19th segments somewhat medial from the lines of setæ *a*.

Seminal-furrows a little curved towards the ventral middle line.

Male area a little depressed, but not much, nearly circular.

Male pores not seen (on the 18th segment in the seminal-furrows ?).

Female pores on the anterior part of the 14th segment medial from the lines of setæ *a*.

Spermathecal pores two pairs on the 8th and 9th segments in the zones of setæ somewhat medial from setæ *a*.

External copulatory organs are missing.

Internal Anatomy.—Septum 5-6 strong, 6-7 apparently missing, 8-9—13-14 strong, especially 9-10—11-12.

Alimentary tract: A big gizzard behind septum 5-6. A pair of thick, strongly bent calciferous glands in the 15th segment. The calciferous glands show a number of transverse restricting furrows, which give them almost the shape of moniliform wreaths. Intestine with a big typhlosole, consisting of two longitudinal bladders depending from a common base.

Circulatory system: Last hearts in the 13th segment. Dorsal vessel simple.

Nephridial system micronephric.

Anterior male organs: Two pairs of testes and sperm-duct-funnels free in the 10th and 11th segments. Sperm-duct-funnels of the first pair smaller than those of the second pair and not glittering so intensely. One pair of sperm-sacs depending from septum 11-12 into the 12th segment. I have not seen further sperm-sacs but it seems to me possible that I overlooked such organs.

Prostates small, tubular, stretching to the side and describing some irregular undulations. Muscular duct small and tender.

I could not detect any penial setæ.

Spermathecæ (fig. 32) with short sac-like ampulla which narrows distally to go over into a cone-shaped muscular duct. This duct is about as long as the ampulla, not abruptly set off from the latter, distally narrowing. Into the proximal part of this duct, if not into the distal part of the ampulla, opens a small, clumsy diverticulum about half as thick as long, and about half as long as the main pouch, bent against the side of the ampulla. The diverticulum contains in its proximal lumen some small clusters of sperm, but I could not make out whether these were lying free in a general simple lumen or whether they were separated into different small seminal chambers.

Hab.—Central Himalayas, Gowchar in the Nepal Valley near Katmandu; R. A. HODGART leg.

OCTOCHÆTUS THURSTONI, MICHLSN.

(Plate xiv, fig. 36.)

O. th., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 173, f. 17.

Examined three mature specimens.

External Characters.—Dimensions: Length 130—160 mm., maximum thickness 5½—6 mm., number of segments 198 to about 204.

Colour greyish.

Head tanylobous (?); lateral borders of the hinder appendix diverging backwards. Prostomium small.

Setæ moderately large, all at the ventral part of the body, the dorsal distance being somewhat larger than half the circumference of the body (*dd* = ca. $\frac{4}{7}u$). Setæ paired, but not strictly, those of the lateral pairs almost as distant one from the other as the median lateral distance (*cd* = ca. $\frac{4}{5}$ *bc*), those of the ventral pairs a little closer together (*ab* = ca. $\frac{2}{3}bc$). The median ventral distance is somewhat larger than the median lateral (*aa* = ca. $1\frac{1}{2}bc$).

Dorsal pores present, but distinct only from the intersegmental furrow 18-19 (missing anterior to it ?).

Clitellum complete, but ventrally depressed from segment 13—17 (=5).

Prostate pores on the 17th and 19th segments between the lines of setæ *a* and *b*.

Seminal furrows nearly straight.

Male area a little depressed in all, but with a broad cushion-like elevation between the seminal furrows.

Female pores probably in the anterior median ventral part of the 14th segment, where a white glandular area is to be seen.

Spermathecal pores two pairs on segments 8 and 9 between the lines of setæ *a* and *b*, just before and not far from the ventral pairs of setæ of these segments.

Copulatory organs: Two, three or four big and broad transverse glandular cushions median ventral on some of the segments behind the clitellum, the last at the 24th segment, beginning at the 21st, 22nd or 23rd segment. The cushions reach as far as the lines of setæ *b* on either side, or not quite so far.

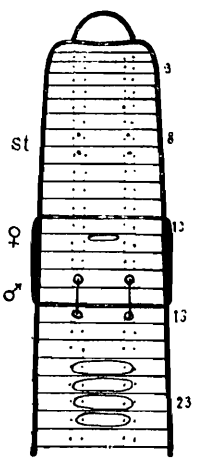

FIG. 23. *Octochætus thurstoni.*

Internal Anatomy.—Septum 5-6 rather strong, the following, 6-7 and 7-8 (and 8-9?) missing, those of the anterior male organs, 8-9 (?)—12-13, very strong.

Alimentary tract: A big gizzard behind septum 5-6. A pair of great calciferous glands opening into the œsophagus in the 15th (?) segment, but occupying a space of more than one segment (pushing back the septa ?). They are very thick, tightly rolled up to an irregularly spiral form and are closely pressed against the œsophagus and dorsal-medially against each other. Externally they show deep furrows and incisions surrounding big cushion-like protuberances. The intestine contains a typhlosole,

consisting of two folds projecting from a common base into the interior of the intestine.

The nephridial system seems to be micronephric, as large nephridia could not be seen.

Anterior male organs: Two pairs of sperm-sacs, each composed of a few separated sacs, depend from septa 10-11 and 11-12 into segments 11 and 12. Sperm-duct-funnels large, apparently free.

The prostates are very long, much coiled tubes. The glandular part is somewhat thicker than the relatively short muscular duct, which describes a broad loop.

There seem to be no penial setæ, but there are strong transverse muscles combined with the distal part of the male apparatus.

Spermathecæ (fig. 36) : Main pouch with a long cucumber-like ampulla which narrows distally to go over into a short cone-shaped duct. Into about the middle of this duct opens a single diverticulum of somewhat irregular shape, thickly and clumsily pear-shaped, narrowed or restricted distally, but without distinct stalk. The diverticulum is about as broad as the ampulla and contains a great number of very small seminal chambers. These seminal chambers project a little outwards, giving a somewhat uneven appearance to the outer wall of the diverticulum.

Hab.—South India, Madras (Numgumbaukunn and Pursevaukann); E. THURSTON leg.

,, ,, ,, (Mackay's Garden); Capt. W. S. PATTON leg.

GEN. EUTYPHOEUS.

This genus is represented by a great number of species in the present collections, and is one of the genera prevalent in India.

The most interesting point in the study of these species is the discovery of some holoandric species (with two pairs of testes and sperm-duct-funnels in the 10th and 11th segments). One of the earlier known of BEDDARD's species—*E. incommodus*—really belongs to these, as I am able to confirm by the study of one specimen (see below). The existence of holoandric species of *Eutyphoeus* bridges a gap which formerly separated the sub-family *Octochætinæ*, the known species of the more archaic genus *Octochætus* being all holoandric. But even in this holoandric genus *Octochætus* we may find a step towards the metandric condition shown by the greater part of the species of *Eutyphoeus*, *e.g.*, in *Octochætus fermori* the testes of the anterior pair in the 10th segment are obliterated and the sperm-duct-funnels rudimentary: *O. hodgarti* also shows some traces of a vanishing of the first pair of male organs). There is after this no other general difference between *Octochætus* and *Eutyphoeus* than the "acanthodriline" and the "microscolecine" state of the sexual organs. There are other characters which unite these two genera besides those adopted in the diagnosis of the sub-family *Octochætinæ*, for instance the absence of some septa in the region of the gizzard; some species of both genera are provided with very characteristic transverse muscles near the prostates.

There remains no doubt that these genera are closely allied, and that they must be united in one sub-family which I have called "*Octochætinæ*." BENHAM's[1] attempt to dissolve this sub-family, must at any rate be refused. Now, having had occasion to study many species of this sub-family, I am throughout confirmed of the justness of my former theoretical statement about this part of my classification.

EUTYPHOEUS ANNANDALEI, MICHLSN.

(Plate xiv, fig. 44.)

E. a., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 174, f. 18.

Present a single complete mature specimen and a shred of the anterior body of another. Unfortunately all the penial setæ (which are of such great importance in diagnosis) were broken, having lost their distal extremities, and I would, therefore, have renounced all wish to describe this species, had not certain points of the internal anatomy—the species belonging to those rarer holoandric forms with two pairs of testes, etc.—been of such great interest as to induce me to discuss them. The remaining characters will, I hope, be sufficient to identify the species.

External Characters.—Dimensions: Length 65 mm., thickness $1\frac{2}{3}$—$2\frac{1}{3}$ mm., number of segments 91. In spite of the relatively small number of segments the specimen has the appearance of being quite complete.

Colour in general grey; clitellum dark brown.

Head indistinctly tanylobous.

Setæ paired, in general not strictly, in the postclitellar region somewhat strictly, especially the ventral ones. Behind the clitellum closely (aa: ab : bc : cd = 8 : 4 : 10 : 5). Just before the clitellum the distance ab is somewhat larger, being nearly equal to cd, the setæ a and b themselves being here somewhat stouter. Median dorsal distance larger than half the circumference ($dd > \frac{1}{2}u$).

Dorsal pores present, but distinct only at the middle and posterior part of the body.

Clitellum ring-shaped, occupying segments 13—17 (=5), but missing at the ventral part of the 17th segment.

Male pores on the 17th segment, consisting of transverse slits on the top of big, transversely oval, nearly circular papillæ, the centres of which lie in the lines of setæ b, if not a little lateral from them, whilst the circumferences extend medially as far as the lines of setæ a.

Female pores before, and somewhat closer together than, the setæ a of the 14th segment.

Spermathecal pores one pair in the intersegmental furrow 7-8, being eye-shaped transversely oval slits between the lines of setæ b and c, reaching the latter with their lateral end.

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[1] W. B. BENHAM, "On some edible and other species of Earthworms from the North Island of New Zealand"; in *Proc. Zool. Soc. London*, 1904, ii, p. 230.

Synopsis of the principal characters and localities of the species of Eutyphoeus.

Species.	Testes and sperm-duct-funnels.	Penial setæ.	Diverticula of Spermathecæ.	Male pores.	Spermathecal pores.	Copulatory papillæ or areas.	Locality.
E. annandalei, MICHLSN.	2 pairs	Present	2, partly simple, partly twins, united at the base.	In *a*, if not a little lateral from *a*.	Just medial from *c*.	On 13-14, 14-15, paired	Kumaon distr., Bhim Tal.
E. quadripapillatus, MICHLSN.	2 pairs	Missing	Many, short, stump-like, forming a circle, sometimes shortly interrupted at two points.	Just medial from *b*.	Somewhat medial from *b*.	On 13-14, 14-15, paired	Bengal, Saraghat and Bihar, Mozaffarpur.
E. incommodus (BEDD.) ..	2 pairs	Distal end simple. Ornamentation: a few serrulate transverse ridges.	Many, short, simple, forming a complete circle round the duct of the main pouch.	In *b*	Between *b* and *c*.	On 13-14—16-17, paired	Bengal, Calcutta.
E. nepalensis, MICHLSN. ..	1 pair	Missing	Many, short, crowded in two groups. In each group a larger one, nearly resembling an additional ampulla.	A little lateral from *b*.	In *c*	On (14-15), 15-16, (18-19—21-22), paired.	Nepal, Chitlong.
E. nainianus, MICHLSN. ..	1 pair	Missing	Many, short, mostly simple, partly twins, united at the base, forming a circle, broadly interrupted at two points.	In *b* or just lateral from *b*.	In *c*, if not somewhat medial from *c*.	On 16-17, transversely oval, unpaired, but divided by a median furrow.	Kumaon distr., Naini Tal.
E. pharpingianus, MICHLSN.	1 pair	Distal end simple. Ornamentation: scattered, fine teeth or transverse groups of teeth.	Many, short, simple or united, forming a circle interrupted at different (4) points.	In *b*	In *b*	On 13-14—16-17, paired	Nepal, Pharping.
E. paivai, MICHLSN. ..	1 pair	Distal end flattened, not broadened, curved. Ornamentation: irregular transverse rows and annulets of fine teeth.	3, simple, oblong, near one another.	In *b*	Between *b* and *c*.	On 15-16, 16-17, 18-19—22-23, paired.	United Prov., Pusa.
E. waltoni, MICHLSN. ..	1 pair	Distal end spoon-like, hardly broadened, nearly straight. Ornamentation: scattered, fine hair-like teeth.	2, abreast of one another and united at the base, broad, short, with lobed margin.	In *b*, if not lateral from *b*.	In *c*	On (9-10), 14-15, 15-16, 18-19, (19-20), paired.	United Prov., Mainpuri, Fyzabad, Pusa.
E. chittagongianus, MICHLSN.	1 pair	(Distal end hook-like ?) Ornamentation: crowded convex transverse rows of small teeth.	1, fan-shaped, lobed at the margin.	In *b*	In *b*	On (13-14), (19-20), 20-21, (21-22), unpaired, transversely oval.	Bengal, Comillah.
E. nicholsoni (BEDD.) ..	1 pair	Distal end curved, (simple ?). Ornamentation: scattered fine pits.	1, fan-shaped, lobed at the margin.	In *ab*.. ..	In *ab*.. ..	On 15-16, a pair of circular areas surrounded by a common furrow.	[Bengal, Calcutta.]

E. provincialis, MICHLSN. ..	1 pair	Distal end simple. Ornamentation: scattered fine triangular teeth.	2, not opposite, broad, short, knob-like, with many protuberances, formed by seminal chambers.	Just medial from *a*.	In *a*	On 15-16, paired, large circular areas, meeting medially.	United Prov., Kalwari Bazar.
E. bengalensis, MICHLSN. ..	1 pair	Distal end spoon-like, hardly broadened, strongly curved. Ornamentation: missing.	2, opposite, short, broad, externally simple, internally 5- or 6-chambered.	In *b*, on a common handle-shaped cushion.	Between *b* and *c* (?).	Missing	Bengal, Saraghat.
E. bastianus, MICHLSN. ..	1 pair	Distal end spoon-like, not broadened, nearly straight. Ornamentation: densely crowded short convex transverse rows of very fine teeth.	2, opposite, three-lobed	In *ab*, surrounded by walls, forming $\frac{3}{4}$ of a circle, united medially.	Between *b* and *c*.	On 15-16, 18-19, (19-20, 20-21), paired.	United Prov., Kalwari Bazar.
E. andersoni, MICHLSN. ..	1 pair	Distal end flattened, with rounded tongue-shaped tip. Ornamentation: densely crowded convex transverse rows of fine teeth, more distally stout hooked blisters.	2, opposite, much lobed, grape-like.	In *b*	Between *b* and *c*.	On (9-10), 18-19, 19-20, (20-21), paired.	Bengal, Rajshahi.
E. masoni (BOURNE) ..	1 pair	Two kinds, distal end simple. Ornamentation: (1) missing; (2) with internal fibrous structure.	2, opposite, two or three-lobed.	Just lateral from *b*.	Just lateral from *b*.	On 15-16, 16-17, 18-19, 19-20, paired.	Central Himalayas, Dehra-Dun.
E. gammiei (BEDD.) ..	1 pair	Distal end simple? Ornamentation: transverse rows (or annulets ?) of moderately stout teeth.	2, opposite, lobed ..	In *ab*, on a common handle-like cushion.	In *ab* ..	On 19-20, 20-21, unpaired, transversely elongated.	Eastern Himalayas, Darjeeling.
E orientalis (BEDD.) ..	1 pair	Distal end simple. Ornamentation: missing, internal structure convergingly fibrous.	2, opposite, three-lobed	In *b*	In *b* or lateral from *b* (?).	On (13-14), 14-15—16-17, 18-19, 19-20, paired.	Bengal, Calcutta.
E. scutarius, MICHLSN. ..	1 pair	Distal end simple. Ornamentation: transverse rows and annulets of very fine teeth.	2, opposite, partly simple, partly twins more or less widely united at the base.	Just lateral from *b* in a common hexagonal area.	Between *b* and *c*.	On 15-16, unpaired, a median hexagonal shield-like cushion.	Bengal, Comillah.
E. foveatus (ROSA)	1 pair	Distal end simple? Ornamentation: small scattered points.	2, simple, short	In *b*	In *b*	Missing	Lower Burma, Rangoon.
E. comillahnus, MICHLSN.	1 pair	Distal end hollow at the convex side of the curvature with narrow lateral expansions. Ornamentation: irregular transverse rows or annulets of moderately stout teeth.	2, simple, oblong; near one another.	In *a* or medial from *a*, near one another.	Just lateral from *a*, near one another.	On 12-13, 13-14, unpaired, but laterally somewhat enlarged.	Bengal, Comillah.
[*E. lævis* (ROSA)]	?	?	?	In *ab* ..	In *c*	Missing	Burma, district Cheba (Ceylon ?).

The body-wall round the spermathecal pores is glandular and thickened.

Copulatory organs: Paired, intersegmental, transversely oval areas at the intersegmental furrows 13-14 and 14-15 in the lines of the ventral pairs of setæ.

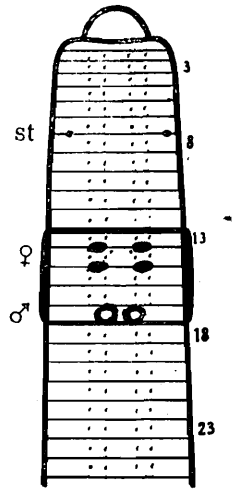

Fig. 24.
Eutyphoeus annandalei.

Internal Anatomy.—Septum 4-5 strong, 5-6 very strong, 6-7 and 7-8 missing, 8-9 a little thickened, 9-10 and 10-11 moderately strong, equalling one another, 11-12 and succeeding septa very tender.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus swollen in the 12th segment, containing a pair of big lamellated calciferous glands lying laterally; the lumen of the calciferous glands opens dorsally into the lumen of the œsophagus.

Circulatory system: Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: Two pairs of testes and sperm-duct-funnels in the 10th and 11th segments, embedded in free sperm masses. The testes and sperm-duct-funnels of the anterior pair in the 10th segment are somewhat smaller, being about half as large as those of the posterior pair. Two pairs of sperm-sacs depend from septum 9-10 forwards and from septum 11-12 backwards. They are much incised and lobed. Those of the anterior pair are relatively small, being confined to the 9th segment. Those of the posterior pair are very large, extending through a great number of segments as far as into the 18th segment.

Prostates tubular; glandular part very long, much bent or coiled, but not forming a compact mass; the coils are loose and the organ extends backwards for a rather great number of segments, about as far as into the 23rd segment. Muscular duct thin, very much shorter, but relatively rather long, describing some large loops.

Penial setæ unfortunately all broken, without distal end, apparently not much bent, at least in the proximal half, stout, about 20 μ thick.

Sperm-ducts very thick throughout their length, with a still thicker, spindle-shaped muscular coat at the distal end; distal end of sperm-ducts passing the distal end of prostates laterally and opening from behind through the common male pore.

Spermathecæ (fig. 44): Main pouch with a nearly globular ampulla, the walls of which show transverse folds, and a somewhat thinner and shorter duct, into which open two opposite, moderately large diverticula. The diverticula are longer than broad, distally narrowed, having a kind of short stalk, proximally with one or two globular seminal chambers, which, if two, are more or less separated from each other. The diverticula are about as long as half the thickness of the ampulla, and are not hidden beneath it as in other species.

Hab.—Western Himalayas, Bhim Tal in the Kumaon district, 4,500′; Dr. N. ANNANDALE leg., 19—28-ix-06.

EUTYPHOEUS QUADRIPAPILLATUS, MICHLSN.

E. g., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 175, f. 19.

Examined many specimens.

External Characters.—Dimensions: Length 60—70 mm., greatest thickness $3\frac{3}{4}$ mm., number of segments 120—155.

Colour in general yellowish green at the anteclitellar region, with a very light rose tint.

Setæ all at the ventral side of the body, the median dorsal distance being larger than half the circumference (*dd* = ca. $\frac{3}{5}u$). Setæ paired but not very strictly, in general, in the middle of the body, *aa* : *ab* : *bc* : *cd* = 4 : 2 : 4 : 3. At the hinder end of the body *ab* and *cd* nearly as large as *bc*.

First dorsal pore on the intersegmental furrow 11-12.

Clitellum indistinctly saddle-shaped, at least in the hinder parts. In the fore part of the clitellar region the ventral side is sometimes also somewhat glandular, but less so than the clitellum proper; clitellum occupying segments 13 or $\frac{2}{3}$ of 13—17 (=5 or $4\frac{2}{3}$).

Male pores on the 17th segment on sharply bordered transversely oval, prominent papillæ which extend between the lines of setæ *a* and *b*, transgressing the latter, their summits lying only a little medial from the lines of setæ *b*.

Female pores just before the setæ *a* of the 14th segment.

Spermathecal pores one pair on the intersegmental furrow 7-8 on small transversely oval papillæ between the lines of setæ *a* and *b*, somewhat nearer to the latter.

Copulatory organs: Apparently constantly two pairs of transversely oval papillæ or glandular areas on the intersegmental furrows 13-14 and 14-15 in about the lines of setæ *b*, only in one of the sixteen mature specimens the second pair of copulatory organs was represented only on one side, the glandular area of the other side being absent.

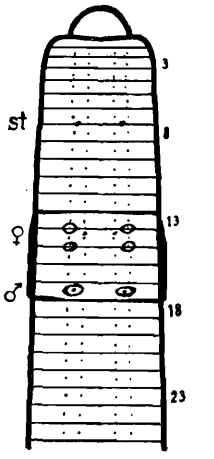

FIG. 25. *Eutyphoeus quadripapillatus.*

Internal Anatomy.—Septum 4-5 strong, 5-6 very strong, 6-7 and 7-8 missing, 8-9 hardly strengthened, 9-10 moderately strong, less than 4-5, 10-11 very little strengthened, rather tender, 11-12 tender, hardly thicker than the following very tender ones. Septa 9-10 and 10-11 approach one another in the middle, but are not united.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus swollen in the 12th segment, containing a pair of big lamellated calciferous glands depending from the wall into the lumen. Intestine beginning in the 15th segment, sacculated laterally in the anterior part, with a small simple typhlosole beginning further back.

Circulatory system: Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: Two pairs of tuft-shaped testes and two pairs of much folded sperm-duct-funnels in segments 10 and 11, apparently embedded in free sperm masses. The testes and sperm-duct-funnels of the anterior pair in the 10th segment are very much smaller than those of the posterior pair in the 11th segment, but are by no means rudimentary. The sperm-ducts are relatively very thick; those of one side seem to unite not before having reached the 17th segment. Two pairs of sperm-sacs depend from septum 9-10 forwards, from septum 11-12 backwards. They are broad and much incised, those of the anterior pair short, confined to the 9th segment, those of the posterior pair longer, extending through several segments as far as into the 30th segment.

Prostates tubular; glandular part long, coiled, and pressed together to form a rather compact mass, occupying about three segments; muscular duct thin, very much shorter, somewhat bent.

Penial setæ missing, but some stout transverse muscles present.

The distal end of the sperm-ducts, which are relatively very thick throughout their length, is provided with a pear-shaped muscular coat, which is about twice as thick in the thickest portion as the other parts of the sperm-ducts. The two sperm-ducts of one side unite just before going over into this muscular coat; then they pass the distal end of the prostates laterally and, turning round it, open from behind into the same pore with them. The lumina of the sperm-ducts and of the prostates unite in the thickness of the body-wall just before reaching its outer surface.

Spermathecæ: Main pouch consisting of a nearly circular, sometimes somewhat depressed and shortened ampulla, which opens through a short, conical duct; into this duct open a great number (about 10) of stump-like diverticula of different sizes, generally somewhat longer than thick and distally hardly, if at all, narrowed. Sometimes two of these diverticula are united at the base. They contain a single sperm chamber, which, however, is not quite simple, the walls of the diverticula being partly thickened to form transverse ridges depending into the lumen and narrowing it. The diverticula surround the duct of the main pouch in a rosette-like manner, forming sometimes a nearly complete circle round it. In other specimens the circle of diverticula is more or less shortly interrupted at two points, these interruptions dividing the whole number of diverticula into two groups. The diverticula are *in situ* nearly hidden beneath the ampulla, only the proximal ends of some larger ones projecting over the edge of the ampulla.

Hab.—Bihar: Sirsiah in the Mozaffarpur district; Mrs. C. J BERGTHEIL leg. Bengal, Saraghat on the Ganges; R. HODGART.

EUTYPHOEUS INCOMMODUS (BEDD.).

Typhoeus i., BEDDARD, in Proc. Zool. Soc. London, 1901, i, p. 20, f. 56, 57.

I examined one mature specimen somewhat larger than the largest specimen examined by BEDDARD. My specimen showed the following features:—

Dimensions: Length 112 mm., number of segments 151. In all other external and in most of the internal characters my specimen agrees with the description given by BEDDARD. The following remarks may be made regarding this species.

Internal Anatomy.—Septa 6-7 and 7-8 are missing, 4-5, 5-6, 9-10 and 10-11 very strong, 8-9 moderately strong.

Alimentary tract: A large gizzard between septa 5-6 and 8-9. The calciferous glands seem to occupy not only the 12th but also the 11th segment. The glands are externally not set off from the œsophagus, but internally their lumen is somewhat separated from the main lumen of the œsophagus.

Male organs: I can confirm the existence of two pairs of sperm-sacs in the 9th and 12th segments, the former smaller, depending from septum 9-10. BEDDARD's type specimens showed a curious disharmony, being holoandric in relation to the sperm-sac (and, as may be inferred from these, in relation to the testes), metandric in relation to the sperm-duct-funnels, which are seen in the 11th segment. My specimen, on the contrary, seemed to be formed more normally, being apparently holoandric throughout. There are surely sperm-duct-funnels in the 10th segment as well as in the 11th, but I am not able to affirm that they are separated from one another. There might be a single sperm-duct-funnel at each side, divided by septum 10-11, the divisions depending into both segments. That would be, however, a very curious arrangement. I believe the view that *E. incommodus* is normally a holoandric species, as are some other species of this genus, a justifiable one.

Hab.—Bengal, Calcutta; Dr. N. ANNANDALE leg.

EUTYPHOEUS NEPALENSIS, MICHLSN.

(Plate xiv, fig. 37.)

E. n., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 176, f. 20.

Examined seven mature specimens.

External Characters.—Dimensions: Length 110—140 mm., thickness about 3½ mm. at the hinder end, to 6 mm. at the clitellar region; number of segments 150—180.

Colour greyish.

Head more or less distinctly tanylobous. Prostomium small, more or less retracted; dorsal hinder appendix at the anterior end very small, increasing backwards; lateral borders of it not always distinctly different from the densely crowded longitudinal furrows of the 1st segment.

Segments 4 and 5 divided by one transverse furrow, 6—8 by two, 9 by four, 10 by two.

Setæ moderately large, especially the ventral ones of the anteclitellar region, widely paired or separated, all at the ventral part of the body, the median dorsal distance being distinctly larger than half the circumference of the body ($dd = \frac{3}{5}-\frac{2}{3}u$). Median ventral distance a little greater than the median laterals, these subequal to the

distance between the setæ of the lateral pairs, a little larger than that between the setæ of the ventral pairs ($aa > bc \lessgtr cd > ab$; aa = ca. $1\frac{1}{2} ab$).

First dorsal pore in the intersegmental furrow 10-11.

Clitellum more or less distinctly ring-shaped, ventrally less prominent or in parts apparently not particularly glandular, occupying segments 13—17 (=5).

Male pores on the 17th segment, on thick, transversely oval, prominent papillæ, the centres of which are situated a little lateral from the lines of setæ *b*, much nearer to these than to the lines of setæ *c*.

Female pores on the 14th segment just before the setæ *a*, surrounded by a not sharply bordered whitish area, nearly confluent in the ventral median line.

Spermathecal pores one pair, distinct, eye-shaped, on the intersegmental furrow 7-8, their centres in the lines of setæ *c*.

Copulatory organs apparently always present, only slightly variable in number and position. They are paired, transversely oval intersegmental cushions, which transgress the lines of setæ *a* ventral-medially and those of setæ *b* more or less laterally. The most constant is a pair of such organs at the intersegmental furrow 15-16 (all seven specimens) ; in two specimens there is on one side an unpaired additional one at 14-15. In five specimens there are postclitellar cushions at 19-20 and 20-21, in one of these specimens an additional unpaired one on one side at 21-22. In one specimen the latter are dislocated for the length of one segment, being situated on the intersegmental furrows 18-19 and 19-20. The last specimen possessed only one pair of postclitellar cushions on 18-19.

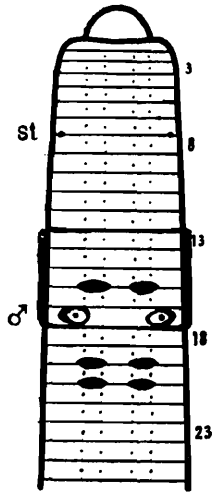

FIG. 26. *Eutyphoeus nepalensis.*

Internal Anatomy.—Septa 5-6 and 8-9 very thick, the intermediate ones being apparently missing, or else very tender or rudimentary, 9-10 and 10-11 somewhat thickened, the following tender.

Alimentary tract: A big, oblique gizzard between the two strengthened septa 5-6 and 8-9. In the 12th segment the œsophagus is thickened, globular, and contains a pair of big calciferous glands of the shape of a pair of coffee-berries which are not, however, visible externally. Intestine with a big typhlosole which is triangular in a transverse section and has a broad base and a moderately sharp edge.

Nephridial system micronephric.

Anterior male organs: One pair of large sperm-duct-funnels in the 11th segment, enclosed in a common seminal vesicle which seems to embrace the œsophagus in a ring-like manner. One pair of large, lobed sperm-sacs depending from septum 11-12 into the 12th segment.

Prostates very long, tube-like ; glandular part convoluted, occupying about six segments (about 17—22). Muscular duct abruptly set off from the glandular part, describing some large irregular loops, much thinner and very much shorter than the glandular part, but nevertheless having a length of about 20 mm.

There are no penial setæ, but some strong transverse muscles in the vicinity of the distal part of the prostates.

Spermathecæ (fig. 37) very large. Main pouch with a big irregular sac-like ampulla and a somewhat shorter, conical duct which is proximally about half as thick as the ampulla, and tapers toward the distal end. Into the distal part of the duct open two groups of thickly pear-shaped or globular and shortly stalked diverticula, about five or six in each group; most of these diverticula are simple, but some are partly divided by a more or less deep oblique or longitudinal furrow or constriction, containing two more or less imperfectly separated seminal chambers. At each side of these true diverticula, which are relatively small and very much shorter than the duct of the main pouch, opens into this duct a very much greater diverticulum, consisting of an irregular sac-like, sometimes much lobed, sac and a broad, short stalk. These two greater diverticula generally stand near the ampulla, opening into the proximal part of the duct of the main pouch, but sometimes one of them is dislocated towards the distal end of the duct, standing near or amidst the true diverticula. These two greater diverticula are often nearly half as long and thick as the main pouch, and are in appearance more similar to this than to the true diverticula; these seem to have assumed the function of auxiliary ampullæ.

Hab.—Central Himalayas, Chitlong in the Little Nepal Valley; R. HODGART leg.

EUTYPHOEUS NAINIANUS, MICHLSN.

(Plate xiv, fig. 64.)

E. n., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 177, f. 21.

Examined one mature specimen.

External Characters.—Dimensions: Length 60 mm., thickness 3—4½ mm., number of segments 138.

Colour grey.

Head tanylobous; hinder dorsal appendix of prostomium slender, triangular, at the anterior end very narrow, increasing backwards.

Setæ moderately large, in general paired, but not strictly, at the hinder end separated. In the postclitellar region $aa : ab : bc : cd = 7 : 4 : 6 : 5$; at the hinder end $aa : ab : bc : cd = 7 : 4 : 6 : 6\frac{1}{3}$. Median dorsal distance hardly larger than half the circumference (dd = ca. $\frac{5}{9}$ u).

Dorsal pores for the most part inconspicuous, only seen in the postclitellar region.

Clitellum ring-shaped, occupying segments 13—17 (= 5).

Male pores on the 17th segment on very prominent, transversely oval, nearly circular papillæ, the centres of which are situated in the lines of setæ *b* or very little lateral from them.

Female pores just before the setæ *a* of the 14th segment.

Spermathecal pores one pair on the intersegmental furrow 7-8 in, if not somewhat median from, the lines of setæ *c*.

Copulatory organs: One transversely oval area, ventral median in the intersegmental furrow 16-17, laterally hardly surpassing the lines of setæ *a* ; the area is surrounded by a whitish wall and is divided into two symmetrical parts by a similar longitudinal wall in the ventral median line.

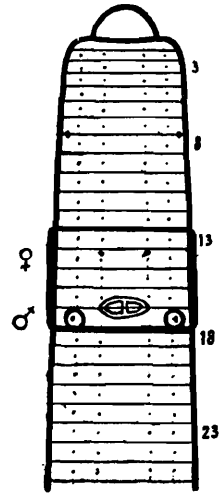

FIG. 27.
Eutyphoeus nainianus.

Internal Anatomy.—Septa 4-5, 5-6, and 8-9—10-11 very thick, 6-7 and 7-8 missing.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus in the 12th segment swollen, containing a pair of thick lateral calciferous glands depending from the wall into the interior of the œsophagus. Intestine beginning in the 14th (15th ?) segment, laterally sacculated in the anterior part, with a small and simple typhlosole beginning rather far behind (not before the 30th segment).

Nephridial system micronephric.

Anterior male organs: A pair of very large sperm-duct-funnels ventrally in the 11th segment, enclosed in a common seminal vesicle. The lateral parts of the seminal vesicle, quite filled with the sperm-duct-funnels, stretch far upwards at the side of the œsophagus. A pair of large sperm-sacs depend from the hinder surface of septum 11-12 ; they are flattened and broad in the anterior part, tapering backwards and, restricted by the septa, extend through a great number of segments, in the examined specimen as far as the 20th segment. The broader anterior part of the sperm-sacs communicates with the lower part of the seminal vesicle (on one side of the specimen) or with the whole length of the lateral appendix of the seminal vesicle (on the other side). A part of the large sperm-duct-funnel enters the proximal part of the sperm-sacs.

Prostates tubular. Glandular part large, coiled, occupying about four segments. Muscular duct narrower, relatively long, describing a large loop extending laterally.

There are neither penial setæ nor strongly developed transverse muscles in the vicinity of the prostates.

Spermathecæ (fig. 64) : Main pouch with a nearly globular ampulla with a very short duct about half as broad as the ampulla. Into this duct open two groups of short, simple and nearly globular or compound diverticula, the compound ones consisting of two or more united simple ones. The diverticula of the two groups form an incomplete rosette interrupted at two points by interspaces of different width. *In situ* the diverticula are nearly hidden beneath the broad ampulla.

Hab.—Western Himalayas, Naini Tal in the Kumaon district; Dr. N. ANNANDALE leg., 28-ix—3-x-06.

EUTYPHOEUS PHARPINGIANUS, MICHLSN.

(Plate xiv, figs. 56, 57.)

E. ph., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 177, f. 22

Examined one mature specimen.

External Characters.—Dimensions: Length 130 mm., thickness 4—4½ mm., number of segments 118.

Colour grey.

Head indistinctly tanylobous; prostomium small, in the examined specimen completely retracted into the buccal cavity.

Setæ moderately large, the ventral ones paired, but not strictly, the lateral ones separated, $cd = bc = 1\frac{1}{2}ab = \frac{4}{5}$—$\frac{3}{4}aa$. Median dorsal distance hardly larger than half the circumference (dd = ca. $\frac{5}{9}$ u).

First dorsal pore on the intersegmental furrow 11-12.

Clitellum nearly regularly ring-shaped, only on the median ventral part between the lines of setæ *a* somewhat less distinct, occupying the segments 13—17 (=5).

Male pores on the 17th segment, on nearly circular papillæ the centres of which are situated in about the lines of setæ *b*.

Female pores before the setæ *a* of the 14th segment.

Spermathecal pores one pair in the intersegmental furrow 7-8 in the lines of setæ *b*.

Copulatory organs: Four pairs of transverse slits or narrow transverse areas behind the ventral setæ of segments 13—16, if not in the intersegmental furrows 13-14—16-17, apparently a little before these intersegmental furrows.

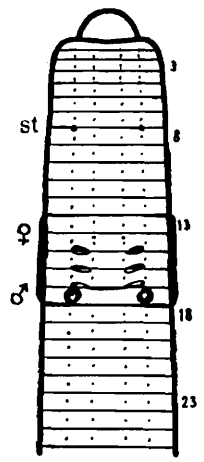

FIG. 28. *Eutyphoeus pharpingianus.*

Internal Anatomy.—Septa 4-5, 5-6 and 8-9—10-11 thickened, 6-7 and 7-8 missing.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus in the 12th segment swollen, doubtless containing a pair of calciferous glands.

Nephridial system micronephric.

Anterior male organs: One pair of sperm-duct-funnels in the 11th segment (enclosed in a common seminal vesicle ?). A pair of sperm-sacs depending backwards from septum 11-12, extending through a great number of segments, in the examined specimen as far as into the 33rd segment, broader and lobed in the anterior part, restricted by the septa.

Prostates tube-like, glandular part very long, convoluted, occupying about four segments, muscular duct thinner and very much shorter, but nevertheless relatively long, describing two loops.

Penial setæ (fig. 57) about 1⅔ mm. long and 26 μ thick, bent only at the distal part, hardly tapering towards the distal end which has a simple, blunt tip. Beneath the extreme distal end, which is quite smooth, the seta is ornamented by sparse, scattered, small, irregularly-toothed transverse ridges, or rows of short teeth.

Spermathecæ (fig. 56): Main pouch with a nearly globular ampulla which opens by an indistinct, very short duct, about half as broad as the ampulla. Into this duct open three or four groups of diverticula. The diverticula are unstalked, simple and globular, or formed by a more or less complete union of two, three or four such ones. They form an interrupted rosette round the duct, *in situ* hidden by the ampulla.

Hab.—Central Himalayas, Pharping in the Nepal Valley near Katmandu; R. HODGART leg.

EUTYPHOEUS PAIVAI, MICHLSN.

(Plate xiv, figs. 38, 39.)

E. p., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 178, f. 23.

Present one specimen.

External Characters.—Dimensions: Length 195 mm., thickness $3\frac{1}{2}$—5 mm., number of segments *ca.* 220.

Colour violet-brown dorsally with a darker median dorsal stripe, greyish laterally and ventrally.

Head tanylobous; borders of the dorsal hinder appendix of prostomium parallel to each other.

Setæ all at the ventral side of the body, the medial dorsal distance being larger than half the circumference ($dd > \frac{1}{2}u$). Setæ paired, but not strictly, in general *aa*: *ab* : *bc* : *cd* = 3 : 2 : 3 : 2—$2\frac{1}{4}$; the setæ of the lateral pairs are only at the posterior end of the body further remote one from the other than those of the ventral pairs.

Dorsal pores present, but inconspicuous, seen only in the middle parts of the body.

Clitellum occupying the segments $\frac{1}{3}$ of 13—17 ($= 4\frac{1}{3}$), ring-shaped, but ventrally less developed, totally missing ventrally at the 17th segment.

Male pores in deep hollows on the 17th segment in about the lines of setæ *b*, surrounded by tumid parts of the body-wall.

Spermathecal pores one pair on the intersegmental furrow 7-8, distinct transverse slits between the lines of setæ *b* and *c*, nearly reaching the lines of setæ *b*, accompanied by tumid patches before and behind them.

Copulatory organs paired transversely oval areas in the lines of the ventral pairs of setæ, somewhat transgressing them in both directions, seven pairs, on the intersegmental furrows 15-16, 16-17 and 18-19—22-23.

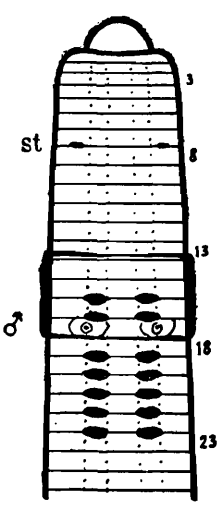

FIG. 29.
Eutyphoeus paivai.

Internal Anatomy.—Septa 4-5, 5-6 and 8-9—10-11 very strong, 6-7 and 7-8 missing.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus swollen in the 12th segment, showing externally many densely crowded lateral transverse stripes indicating the lamellar structure of the calciferous glands in the interior of the œsophagus. Intestine beginning in the 15th segment, laterally sacculated in the anterior part, with a typhlosole further back. Typhlosole in transverse section triangular, with a broad base and a sharp edge; the margins of the base are incised laterally, the incisions of both sides alternating and thereby giving to the base the form of a zigzag line pressed together longitudinally.

Circulatory system: Dorsal vessel simple, last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: One pair of large sperm-duct-funnels ventrally in the 11th segment, enclosed in a common seminal vesicle. A pair of large, tongue-shaped, at the margins much incised and lobate sperm-sacs communicating with the seminal vesicle and extending backwards from it through some segments, as far as into the 16th segment.

Prostates tubular; glandular part very long, much coiled, occupying segments 17—21; muscular duct thin, relatively long, describing some large loops.

Distal ends of sperm-duct with a thick muscular spindle-shaped coat, passing the distal end of the prostates laterally and opening from behind into the same pore with them.

Penial setæ (fig. 39) about 4 mm. long and 32 μ thick, slightly or hardly bent, hardly tapering towards the distal end. Extreme distal end generally bent somewhat more strongly, flattened vertically to the plane of the curve, but not at all broadened, with a simple tongue-shaped tip. Distal third of the penial seta, with the exception of the tip, ornamented by densely crowded irregular transverse rows of fine teeth. In the beginning, near the distal end of the seta, the rows, which have a tendency to be curved, converge towards the distal end, are rather long, nearly embracing the seta; further proximally they get shorter, being finally reduced to single teeth.

Spermathecæ (fig. 38): Main pouch with an irregular sac-shaped ampulla, which is constricted (constantly ?) before the middle, the hinder part being thicker; a broad short duct arises from the under side of the ampulla. Into this duct open three or four irregularly sausage-shaped or stump-like diverticula near each other, not distinctly divided into different groups, apparently forming a single group. They are about as long as the width of the duct of the main pouch, and about half as thick as long.

Hab.—Bihar, Pusa in the Darbhanga district; C. A. PAIVA leg.

EUTYPHOEUS WALTONI, MICHLSN.

(Plate xiv, figs. 45, 46.)

E. w., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 179, f. 4.

Present many specimens.

Internal Characters.—Dimensions of mature specimens differing greatly. Length 90—230 mm., greatest thickness about $4\frac{1}{2}$—$6\frac{1}{2}$ mm., number of segments *ca.* 190—210.

Colour dorsally brownish to violet-grey, with a darker violet-grey median dorsal longitudinal line at the postclitellar region, laterally and ventrally yellowish grey.

Head tanylobous; borders of the hinder dorsal appendix of prostomium parallel to each other.

Setæ rather small, in general paired, but not strictly, the lateral ones somewhat further remote one from the other than the ventral ones. In the postclitellar region

$ab = \frac{2}{5}\ aa = \frac{1}{2}bc = \frac{3}{4}cd$. In the anteclitellar region and at the hinder end of the body the setæ are nearly separated : ab = ca. $\frac{5}{6}\ cd = \frac{4}{5}\ bc = \frac{2}{3}\ aa$. Setæ all at the ventral part of the body, the median dorsal distance being somewhat larger than half the circumference (dd = ca. $\frac{3}{5}u$).

First dorsal pore at the intersegmental furrow 12-13.

Clitellum ring-shaped, but ventrally depressed and thinner, less glandular, occupying the segments $\frac{1}{2}$ of 13—17 ($=4\frac{1}{2}$).

Male pores in the 17th segment lateral of, if not in, the lines of setæ *b* (here at least the penial setæ are arising), in the lateral part of deep transverse slits or grooves which surpass a little the lines of setæ *a* as well as those of setæ *b*. The body-wall lateral of and behind the grooves of the male pores is somewhat elevated, the body-wall before them somewhat depressed.

Female pores at the 14th segment anterior to the zone of setæ, a little lateral from the lines of setæ *a*, nearly touching these lines.

Spermathecal pores one pair at the intersegmental furrow 7-8 in the lines of setæ *c*, in the centre of transverse eye-shaped areas.

Copulatory organs intersegmental transversely oval areas or glandular slits in the lines of the ventral pairs of setæ, somewhat transgressing these lines. Nearly constant on the intersegmental furrows 14-15, 15-16 and 18-19, those of 14-15 as well as those on 18-19 being absent only in two of the twenty-four specimens ; rarely (twice) an additional pair on 19-20, often similar areas on 16-17, just before, and with the hinder part drawn back into the slits of, the male pores. In one of the ten specimens from Mainpuri, and in all the specimens (fourteen) from Pusa, there was a pair of somewhat different copulatory organs,—a kind of eye-shaped papillæ in the intersegmental furrow 9-10 in the lines of the ventral pair of setæ.

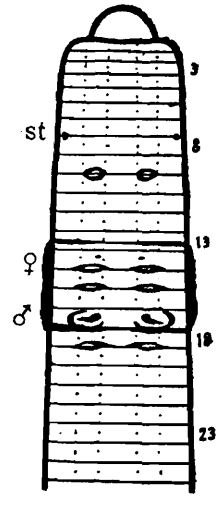

FIG. 30.
Eutyphoeus waltoni.

Internal Anatomy. Septa 6-7 and 8-9—10-11 very thick, 7-8 missing.

Alimentary tract: A big gizzard between septa 6-7 and 8-9. Œsophagus in the 12th segment swollen, globular, containing a pair of thick lateral calciferous glands which have the shape of hemispheres. Intestine from the 14th (15th ?) segment, with a big simple typhlosole, beginning not before the 22nd (?) segment.

Circulatory system: Dorsal vessel simple, last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: A pair of large sperm-duct-funnels ventrally in the 11th segment, touching in the middle and enclosed in a common seminal vesicle. One pair of large, much lobed sperm-sacs depending from septum 11-12 into the 12th segment.

Prostates tube-like, very long, occupying about three segments. Glandular part convoluted ; muscular duct thinner and very much shorter than the glandular part, nevertheless about 6 mm. long.

Penial setæ (fig. 46) about $3\frac{1}{2}$ mm. long, curved to form about a quarter of a circle, very thin, proximally about 16 μ thick, distally tapering only very little, before the distal end still 15 μ thick. Distal end curved somewhat more strongly, broadened a little and hollowed at the concave side, having a spoon-like shape, tip of the distal end simple, forming a blunt hook. The surface of the convex side of the distal end bears very many irregular but rather densely distributed, very fine and slender, hair-like spines, closely pressed against the surface and directed towards the distal tip of the penial seta.

Spermathecæ (fig. 45): Main pouch with a thick, sack-like ampulla and a thin duct about half as long as the ampulla. Into the proximal half of the duct open two diverticula, each consisting of about four nearly globular seminal chambers which externally are separated only by shallow depressions. The seminal chambers are arranged in nearly a fan-like manner; the under side of the diverticulum is pressed against and attached to the duct of the main pouch; the whole diverticulum resembles an irregular scale of the duct, proximally leaning against the distal part of the ampulla. The two diverticula are not situated opposite each other, but abreast of each other, sometimes looking almost like one diverticulum somewhat depressed in the middle.

Hab.—Central India, Mainpuri in the United Provinces; Captain H. J WALTON leg.

,, ,, Fyzabad in the United Provinces; Major F. WALL leg.

Bihar, Pusa in the Darbhanga district; C. A. PAIVA leg.

Remarks.—In most of the specimens from Fyzabad examined I could detect no perfectly formed penial setæ, but only imperfect ones, the tips of which appeared as though corroded and embedded in weak sheaths. Besides such setæ I found in at least one of these specimens a penial seta just like those described above, projecting out of the groove of the male pore. In all the other specimens from Fyzabad the perfect penial setæ must have been lost, probably during the copulatory act. I suppose that in some cases such imperfect penial setæ may have been described as the characteristic forms of penial setæ.

EUTYPHOEUS CHITTAGONGIANUS, MICHLSN.

(Plate xiv, fig. 54.)

E. ch., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 181, f. 25.

Present two very much softened mature specimens.

External Characters.—Dimensions: Length about 250 mm., greatest thickness about 7 mm., number of segments about 250.

Colour in general grey, at the anterior end dorsally light brownish, laterally and ventrally yellowish.

Setæ small, paired, but not strictly, behind the clitellum $aa : ab : bc : cd = 12 : 4 : 8 : 5$. Before the clitellum more separated, $aa : ab : bc : cd = 6 : 4 : 6 : 5$. Median dorsal distance somewhat larger than half the circumference (dd = ca. $\frac{3}{5}u$).

First dorsal pore at the intersegmental furrow 11-12.

Clitellum ring-shaped, occupying segments ½ of 13—17 (=4½).

Male pores on the 17th segment in deep transverse grooves, the centres of which lie in the lines of setæ *b*. The ventral surface of the body round the male pores is in the regions of segments 16—18 somewhat swollen. This swollen area is nearly circular.

Female pores on transversely oval small glandular areas before the zone of the setæ of the 14th segment. The two areas nearly meet each other in the median ventral line and reach laterally as far as the lines of setæ *b*.

Spermathecal pores one pair on the intersegmental furrow 7-8, small slits, the centres of which lie in the lines of setæ *b*.

Copulatory organs: Unpaired, ventral-median, transversely oval intersegmental areas, reaching laterally as far as the lines of setæ *b* or, the hinder ones, not so far, the last one even not so far as the lines of setæ *a*. The number of copulatory organs is different in the two specimens. In one I found four on the intersegmental furrows 13-14, 19-20, 20-21 and 21-22. In the other specimen I could detect only one on the intersegmental furrow 20-21.

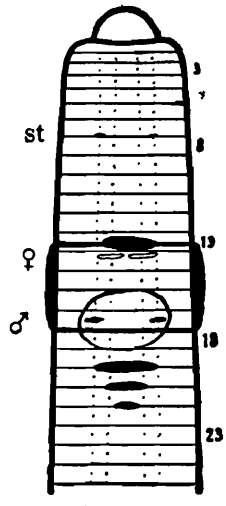

Fig. 31. *Eutyphoeus chittagongianus.*

Internal Anatomy.—Septa 4-5, 5-6 and 8-9—10-11 thickened, 5-6 especially very strong; 6-7 and 7-8 apparently missing.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus swollen in the 12th segment, here containing a pair of large calciferous glands with transverse lamellæ, depending from the walls into the lumen of the œsophagus.

Circulatory system: Last hearts in the 13th segment; dorsal vessel simple.

Nephridial system inconspicuous, doubtless micronephric.

Anterior male organs: One pair of large sperm-duct-funnels ventrally in the 11th segment apparently enclosed in a common seminal vesicle. One pair of very large sperm-sacs depending from septum 11-12 backwards as far as into the 16th segment. The sperm-sacs are broadly tongue-shaped, much incised and lobate at the margin.

Prostates tubular; glandular part very long, much bent, but not specially coiled, reaching backwards as far as into the 20th segment. Muscular duct thinner, especially at the distal end, relatively long, describing a long, somewhat irregular loop, the knee of which is directed forwards.

The distal ends of the sperm-ducts pass the distal ends of the prostates laterally and open from behind into the common male pores. The distal ends of the sperm-ducts are provided with a thick muscular coat, having the shape of a thick bent spindle, turning round the distal end of the prostate.

Penial setæ about 3 mm. long and 26 μ thick, somewhat, but not much, tapering towards the distal end, a little, but not much bent, especially at the distal ends. The examined penial setæ, even the largest one of the bundles, were apparently not

completely developed, the developed setæ being probably lost during the copulatory act. The distal end was not yet hardened, but formed a long soft cap bent in the shape of a hook at the distal tip. The distal portion of the hardened part of the seta was ornamented by rather densely crowded transverse rows of small teeth; the rows are mostly somewhat curved outwards.

Spermathecæ (fig. 54): Main pouch irregularly sac-like, with a very short and narrow duct. Into the duct opens a single broad, fan-shaped diverticulum, the free edge of which shows a number of notches, the intermediate protuberances being formed by the projecting gobular seminal chambers, *ca.* 7—9 in number.

Hab.—Bengal, Comilla in the Chittagong district; Major A. R. S. ANDERSON leg.

EUTYPHOEUS KHANI, MICHLSN.

(Plate xiv, figs. 62, 63.)

E. k., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 182, f. 26.

Examined two specimens, one of which was rather smaller, apparently only half mature.

External Characters.—Dimensions of the larger specimen: Length 185 mm., thickness 4—5½ mm., number of segments about 225.

Colour dorsally brownish to violet-grey, ventrally yellowish grey.

Head epilobous?

Setæ moderately large, all at the ventral side of the body, the median dorsal distance being larger than half the circumference (dd = ca. $\frac{3}{5}u$). Setæ paired but not strictly, the distance between the setæ of the ventral pair somewhat smaller than that between the lateral, and this somewhat smaller than the median lateral distances; difference in the postclitellar region the greatest, at the hinder end of the body the smallest ($ab < cd < bc$, ab: bc: cd = 3 : 5 : 4 and 4 : 5 : 4½ respectively). Median ventral distance at the anteclitellar region smaller than the middle lateral distances, in the postclitellar region larger ($aa = \frac{4}{5}$—$\frac{6}{5}bc$).

Dorsal pores present but inconspicuous.

Clitellum ring-shaped, occupying the segments ⅓ of 13—17 (=4⅓).

Male pores on the 17th segment in the lines of setæ *a* or a little closer together. They are represented by small grooves at the lateral borders of a somewhat depressed arc; this male area is surrounded laterally and behind by a semicircular, broad swelling of the body-wall.

Female pores just in front of the setæ *a* of the 14th segment.

Spermathecal pores one pair in the intersegmental furrow 7-8 in the lines of setæ *a*, if not closer together. The median ventral part of segments 7 and 8 is swollen as far as the lines of setæ *b*, to form two broad, not distinctly bordered walls which comprehend the inconspicuous spermathecal pores.

Copulatory organs: Ventrally on the intersegmental furrow 15-16 there is a pair of great, broadly oval, nearly circular areas surrounded by a well-marked, narrow

but very prominent wall. The two walls meet at the median ventral line, surpassing at the other side the lines of setæ *b*. The area is somewhat prominent round the centre, depressed at the periphery.

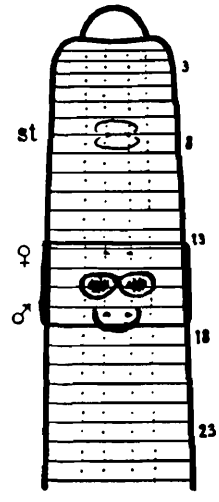

FIG. 32. *Eutyphoeus khani.*

Internal Anatomy.—Septa 4-5 and 8-9—10-11 very strong, 5-6—7-8 missing, 11-12 and the following tender.

Alimentary tract: A big gizzard between septa 4-5 and 8-9. Œsophagus with globular swelling in the 12th segment (containing probably a pair of calciferous glands[1]). Intestine beginning in the 15th segment, laterally sacculated in the anterior part, with a big simple typhlosole, triangular in transverse section, with a broad base, beginning about the 26th (?) segment.

Circulatory system: Dorsal vessel simple; last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: One pair of great sperm-duct-funnels ventrally in the 11th segment, enclosed in a common seminal vesicle which communicates with a pair of large, much lobed sperm-sacs, depending from septum 11-12 into segments 12—14.

Prostates tubular, with a very long, coiled glandular part which occupies about three segments, and a thinner, but still moderately thick, very much shorter, but relatively long, muscular duct which describes an S-like curve with a longer proximal end.

Penial setæ (fig. 63) about 4 mm. long and 20 μ thick, nearly straight. Distal end not at all broadened and only very little, if at all flattened, ending in a rather blunt tip. The ornamentation is restricted to some rather indistinct triangular teeth sparsely distributed over the part of the seta below the extreme distal end. I could not detect these teeth on all penial setæ I examined more carefully.

Spermathecæ (fig. 62): Main pouch with a broad and very short ampulla which is divided by some more or less distinct longitudinal incisions into some broad protuberances; the latter are not simple, but bear a great number of small nearly circular protuberances. The duct of the main pouch is about half as thick as the ampulla and nearly three times as long as the width of the proximal part, not tapering before the end of the distal third part. The main pouch has in all the form of a mushroom. Into the proximal part of the duct of the main pouch open two diverticula which are situated neither opposite nor just abreast of each other. The diverticula are broad, short, unstalked, irregular knobs containing from three to five globular, glittering seminal chambers which cause slight protuberances on the surface of the diverticula.

Hab.—Central India, United Provinces, Kalwari Bazar in the Basti district; DHARM KHAN leg.

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[1] As I did not wish to damage the single mature specimen more than was absolutely necessary, I did not open the œsophagus to confirm this point.

EUTYPHOEUS BENGALENSIS, MICHLSN.

(Plate xiv, figs. 47, 48.)

E. b., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 183.

Examined a single mature specimen.

External Characters.—Dimensions: Length 12 mm., thickness $2\frac{1}{2}$—$3\frac{1}{2}$ mm., number of segments *ca.* 185.

Colour at the anterior segments dorsally rather dark smoke-brown, at the other parts of the body yellowish brown.

Head prolobous. Prostomium transversely oval, nearly circular, calotte-shaped.

Setæ minute, rather widely paired. Median ventral distance nearly equal to the middle lateral distance and twice as wide as the distance between the setæ of a pair ($aa = 2ab = bc = 2cd$). Median dorsal distance equal to about three-fifths of the circumference of the body.

Dorsal pores present.

Male pores in the 17th segment, in deep, broad transverse clefts, the centres of which coincide with the lines of setæ *b*. These clefts are bordered above and below by thick lips which somewhat transgress the limits of the 17th segment and which are connected by low, narrow, transverse bridges, the two clefts of the male pores being connected by a transverse furrow.

Spermathecal pores in the intersegmental furrow 7-8 (between the lines of setæ *b* and *c* ?).

External copulatory organs are not present.

Internal Anatomy.—Septa 4-5 and 5-6 strengthened, especially 5-6; septa 6-7 and 7-8 missing, 8-9—10-11 rather strong, especially the latter two.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus with broad lateral calciferous glands in segment 12. The calciferous glands are not set off from the œsophagus, but are lateral swellings of it, their lumina being hardly separated from the main lumen of the œsophagus. Intestine with broad lateral sacculations, without typhlosole in the anterior part (examined only as far as segment 26).

Circulatory system: Dorsal vessel simple. Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: One pair of testes and sperm-duct-funnels free (?) in the 11th segment. One pair of large, lobed and incised sperm-sacs depending from septum 11-12 backwards through several segments.

Prostates long slender tubes; glandular part longer and coiled; duct somewhat thinner and much shorter, forming two wide loops.

Penial setæ (fig. 48) *ca.* 3 mm. long, proximally 20 μ thick, distally hardly thinner, just before the distal end still 17 μ thick. The penial setæ are strongly but simply bent, forming nearly a semicircle. The distal extremity bent somewhat more strongly in the same direction, ending in a strong, simple prong. Below this prong the seta is enlarged and excavated in the concave side like a spoon. There is no

external ornamentation to be seen, but in the distal quarter is an internal structure consisting of oblique fibres.

Female organs in normal situation. Ovaries tuft-like.

Spermathecæ (fig. 47). Main pouch with nearly globular ampulla and a duct about as long and one third as thick as the ampulla from which it is abruptly set off. From the proximal part of this duct depend two thick, unstalked, kidney-shaped diverticula. These diverticula are nearly smooth externally and show neither distinct incisions nor dilations. After being made semi-transparent by acetic acid they show a rather regular internal division. Both the diverticula of the examined spermatheca contained five seminal chambers regularly arranged in the same plane around the centre of the diverticulum. The seminal chambers opened into the distal end of a common canal which, going somewhat obliquely upwards, entered the proximal part of the duct of the main pouch. The seminal chambers were empty and somewhat collapsed. I think it probable that after being filled with sperm masses they may cause dilations on the external surface of the diverticulum.

Hab.—Bengal, Saraghat on the Ganges; R. HODGART leg., 29—30-vi-06.

Remarks.—*Eutyphoeus bengalensis* seems to be nearly allied to *E. gammiei* (BEDD.) from Darjiling, but it is a much more slender form. It differs from *E. gammiei* principally in the shape of the penial setæ.

EUTYPHOEUS BASTIANUS, MICHLSN.

(Plate xiv, figs. 58–61.)

E. b., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 183, f. 27.

Examined seven specimens.

External Characters.—Dimensions of mature specimens: Length 150—190 mm., thickness of smallest specimen 3—4½ mm., of largest specimen 3—5½ mm., number of segments *ca.* 215 (in the smallest as well as in the largest specimen).

Colour dorsally dark violet grey, ventrally dark grey (much changed in preservation ?).

Head tanylobous. Segment 3 divided into two ringlets, the succeeding segments divided into a greater number of ringlets, those just before the clitellum into as many as seven.

Setæ rather small, all at the ventral side of the body, the median dorsal distance being somewhat larger than half the circumference (dd = ca. $\frac{3}{5}$ u). Setæ paired but not very strictly, especially at the ends of the body where they are almost separated. In the postclitellar region aa = ca. $2\frac{1}{2}ab$, bc = ca. $1\frac{1}{2}ab$, $cd = ab$ or very little larger. At the ends of the body ab is hardly smaller than bc, and bc nearly equals cd, aa being distinctly larger than the other distances except the median dorsal (aa = ca. $1\frac{1}{2}$ ab).

Dorsal pores present but not visible at the anteclitellar region of the body.

Clitellum ring-shaped, ventrally somewhat depressed and lower, occupying the segments $\frac{1}{3}$ of 13—17 ($=4\frac{1}{3}$).

Male pores on the 17th segment about in the lines of the ventral pair of setæ, in deep grooves, each of which is surrounded by a broad wall forming three quarters of a circle. The medial ends of these walls converge and unite forward and the enclosed space opens forward. Two deep furrows issue from the grooves of the male pores and, converging somewhat in going forward, lead to a pair of somewhat depressed, transversely oval, nearly circular glandular areas which lie in the intersegmental furrow 16-17 in the lines of setæ *a*, but which slightly surpass these lines towards the ventral median line, while in the other direction they extend nearly as far as the lines of setæ *b*.

Female pores before setæ *a* on the 14th segment.

Spermathecal pores one pair in the intersegmental furrow 7-8 between the lines of setæ *b* and *c* between two broad, but not sharply bordered, somewhat prominent, transverse walls.

Copulatory organs: Besides the constantly present glandular areas on the intersegmental furrow 16-17 mentioned above, there is, almost constantly, a pair of narrower, nearly slit-like depressed areas before the male pores in the intersegmental furrow 15-16. In one specimen these are represented only by a single unpaired area, but at the same time there is an additional unpaired one on the same side in furrow 14-15; in another specimen there is an unpaired one in 14-15 besides the complete pair in 15-16. Similar transverse glandular areas with an eye-shaped periphery are constantly lying behind the male pores, somewhat variable in number, the first pair always on the intersegmental furrow 18-19. In two specimens there are two pairs on 18-19 and 19-20, in two specimens three pairs on 18-19, 19-20 and 20-21, in the two remaining specimens the pair of 20-21 or those of 19-20 and 20-21 are represented only on one side, in the last there was only an unpaired one on 19-20 besides the complete pair on 18-19.

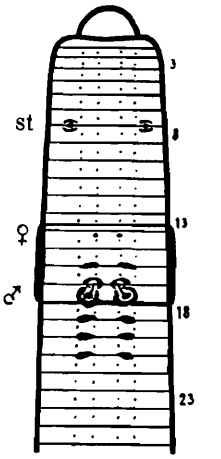

FIG. 33. *Eutyphoeus bastianus.*

Internal Anatomy.—Septa 4-5, 5-6 and 8-9—10-11 very much thickened, 6-7 and 7-8 rudimentary if not missing.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus in the 12th segment swollen, globular, containing a pair of big, bean-shaped calciferous glands depending from the wall into the lumen of the œsophagus. Intestine in the fore part sacculated laterally, further back with a big, simple typhlosole, triangular in a transverse section, with a broad base.

Circulatory system: Dorsal vessel simple, last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: A pair of great sperm-duct-funnels in the 11th segment enclosed in a common ventral seminal vesicle, which at each side extends forward as far as septum 10-11 to enclose the testes also. The seminal vesicles communicate with a pair of very large and very much lobed sperm-sacs depending from septum 11-12 into the 12th segment and some of the following ones.

Prostates long, tubular; glandular part much coiled, occupying some segments, duct thinner and very much shorter, nevertheless still 6 mm. long, winding irregularly.

Penial setæ (figs. 58, 59, 61) about $3\frac{1}{2}$ mm. long and 36 μ thick, only very slightly bent, distal end flattened without being broadened, somewhat hollowed at one side, but not enough to be described as spoon-like, flattened distal end tapering triangularly to end in a simple tip. The distal third part of the seta, with the exception of about the distal third part of the flattened end, is ornamented in a very characteristic manner. It bears a great number of transverse serrulate rows which curve outward. On the flattened part of the seta these rows of teeth are very densely and rather regularly arranged, giving the surface of the seta almost the appearance of a fish-skin covered with serrulate scales. Towards the distal end of the seta this ornamentation ceases rather suddenly, leaving the distal third part of the flattened end of the seta quite smooth; towards the proximal part of the seta the ornamentation alters its character slowly, becoming less dense, the rows at first getting somewhat broader and less curved, then becoming shorter and changing into small groups of somewhat larger teeth, and finally disappearing altogether.

Spermathecæ (fig. 60): Main pouch with an irregular ampulla with broad short lobes and protuberances and a thick and very short duct. Into the duct open two opposite diverticula which, *in situ*, are generally hidden beneath the overlapping ampulla. The diverticula consist of a few (about three) rounded seminal chambers which are united to form a single irregular, shortly stalked diverticulum, or are more or less separated, to form two simple or somewhat compound diverticula united by a common short stalk.

Hab.—Central India, United Provinces, Kalwari Bazar in the Basti district; DHARM KHAN leg.
Bihar: Sirsiah, Mozaffarpur district; Mrs. E. BERGTHEIL leg.

EUTYPHOEUS ANDERSONI, MICHLSN.

(Plate xiv, figs. 40, 41.)

E. a., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 185, f. 28.

Examined three mature specimens, all of which were mutilated, two at the anterior part of the body.

External Characters.—Dimensions: Length 200—220 mm., thickness about $2\frac{1}{2}$—4 mm. at the hinder end, about $6\frac{1}{2}$ mm. at the anterior part of the body, number of segments about 200—220.

Colour dorsally violet-grey with a darker median line; ventrally grey.

Head indistinctly tanylobous (?).

Setæ rather small, all at the ventral side of the body, the median dorsal distance being larger than half the circumference of the body (dd = ca. $\frac{5}{9}u$); setæ paired, in general the ventral ones rather strictly, the lateral ones not so, $aa : ab : bc : cd = 6 : 3 : 6 : 5$; in the anteclitellar region ab nearly equal to aa, bc and cd.

Dorsal pores present on the clitellum and the following part of the body; not seen in the anteclitellar region.

Clitellum ring-shaped, occupying the segments $\frac{1}{3}$ of 13—17 ($=4\frac{1}{3}$).

Male pores: On the 17th segment there is a pair of deep grooves of somewhat irregular shape, surrounded by more or less broad swellings which meet in the ventral median line and are slightly interrupted before these grooves. Each of these grooves is somewhat narrowed by a papilla which is situated at its anterior margin about in the lines of setæ *b*, and which I suppose to bear the male pore.

Female pores before setæ *a* of the 14th segment.

Spermathecal pores one pair at the intersegmental furrow 7-8 between the lines of setæ *b* and *c*.

Copulatory organs: Transversely oval areas or slits, intersegmental, paired, about in the lines of the ventral pairs of setæ, laterally somewhat transgressing the lines of setæ *b*, somewhat variable in number and arrangement: postclitellar on the intersegmental furrows 18-19 and 19-20 (one specimen), or 18-19, 19-20, 20-21 (two specimens, in one specimen on the two hinder furrows only at one side), intraclitellar on 15-16 and 16-17 (in one specimen indistinct), and anteclitellar in one specimen, a pair of smaller ones in the intersegmental furrow 9-10.

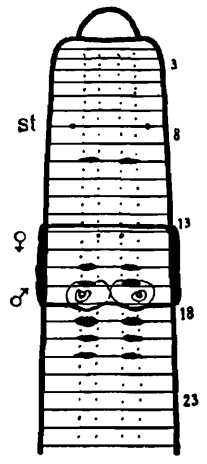

FIG. 34. *Eutyphoeus andersoni.*

Internal Anatomy.—Septa 4-5, 5-6 and 8-9—10-11 very thick, 6-7 and 7-8 missing.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus in the 12th segment swollen, containing a pair of thick lateral calciferous glands, depending from the wall into the lumen. Intestine beginning in the 15th segment, in the anterior part sacculated laterally, with a small simple typhlosole not beginning before the 26th segment (in this segment ?).

Circulatory system: Dorsal vessel simple, last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: A pair of great sperm-duct-funnels ventrally in the 11th segment meeting above the median ventral line, enclosed in separate (?) seminal vesicles which communicate with a pair of very great, broad, much lobed sperm-sacs; the sperm-sacs occupy segments 12—16.

Prostates tubular; glandular part very long, much coiled, occupying about four segments; muscular duct thin, very much shorter, but relatively long, describing two long loops. Sperm-ducts relatively thick and distinct, but not with a thickened muscular distal end, opening from behind and laterally into the same pores as the prostates.

Penial setæ (fig. 40) robust, about 5 mm. long and in the middle 50 μ thick, slightly but not much tapering towards the distal end, nearly straight, somewhat bent only in the distal half. Distal end somewhat flattened, but not broadened, bent off in a wide angle. The distal half of this bent flattened part of the distal end is smooth and abruptly set off from the following part; it appears as if the latter were

covered with a thin ornamented bark which had fallen off from the extreme distal end. The ornamentation of this bark-like covering on the concave under side of the distal part of the seta consists of many crowded, relatively large, oval, blister-like protuberances which partly end in a fine, curved thorn or hook, bent against the surface of the seta. I suppose that all these blister-like protuberances normally end in such a hook, but that in most of them this hook is inconspicuous (being pressed against the surface of the seta) or worn off. In most of the penial setæ the distal end has the appearance of being much worn off or mutilated; and in these the characteristic shape and ornamentation is not easy, if at all, to be detected. Beneath the flattened distal end the seta bears all round another ornamentation which consists of densely crowded serrulate bent transverse ridges curving outward. This ornamentation gives to the surface of the seta the appearance of a scaled fish-skin. Towards the proximal part of the seta the ornamentation gets sparser and is reduced to irregularly distributed small groups of teeth.

Spermathecæ (fig. 41): Main pouch with an irregular, oblique sac-like ampulla and a thick short duct which does not arise from the narrow end of the ampulla, but from the under side of the ampulla somewhat behind the narrow end which surpasses the intersegmental furrow 7-8 towards the anterior end of the worm. At each side of the duct of the main pouch opens a diverticulum which consists of a rather great number of nearly globular seminal chambers. The seminal chambers are united and form more or less prominent protuberances on the outer surface of the diverticulum which is sometimes divided by deep incisions into two parts with a common short and narrow stalk.

Hab.—Bengal, Rajshahi (Rampur Bhoolia); Major A. R. S. ANDERSON leg.

EUTYPHOEUS SCUTARIUS, MICHLSN.

(Plate xiv, figs. 51—53.)

E. s., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 186, f. 29.

Present three mature specimens.

External Characters.—Dimensions: Length 140—180 mm., thickness from 3—4 mm. at the posterior end, to 5 mm. at the anterior part of the body, number of segments *ca.* 290.

Colour greyish with violet tints at the anterior part of the body.

Head indistinctly epilobous (?).

Setæ all on the ventral side of the body, the median dorsal distance being larger than half the circumference ($dd > \frac{1}{2}\ u$). Setæ paired, but not strictly: at the anterior part of the body closely: $aa : ab : bc : cd = 3 : 2 : 3 : 2$; behind the clitellum the distance *ab* becomes smaller: $aa : ab : bc : cd = 3 : 1 : 3 : 2$; at the posterior end *cd* grows nearly as large as *bc*: $aa : ab : bc : cd = 2\frac{1}{2} : 1 : 2 : 1\frac{3}{4}$; but at the posterior end the arrangement of the setæ seems to be somewhat irregular.

First dorsal pore in the intersegmental furrow 11-12.

Clitellum ring-shaped, occupying the segments $\frac{1}{2}$ of 13—17 ($= 4\frac{1}{2}$).

Male pores on the 17th segment a little lateral from the lines of setæ *b*, small openings each surrounded by a small ring-shaped wall.

A median ventral male area of hexagonal form present, extending longitudinally as far as the middle zones of segments 16 and 18, and laterally nearly as far as the lines of setæ *c*, the anterior and lateral borders often marked by a wall, the posterior limit sometimes not so well marked, in which case the hexagonal form is not complete. The ring-shaped walls of the male pores lie within the lateral angles of the male area and are connected by a transverse wall. The space between this transverse wall and the anterior wall of the male area is often depressed, and sometimes also the room behind this transverse wall.

Copulatory organs: A single great median ventral cushion or area resembling the male area in outline and lying just before it on the intersegmental furrow 15-16. It is a little smaller than the male area, but corresponds closely with the space within the bordering wall of that area. It is of transversely oval or hexagonal shape, and extends longitudinally between the zones of setæ of the 15th and 16th segments and laterally to midway between the lines of setæ *b* and *c*. It is bordered by a small wall or by a furrow, depressed or somewhat prominent, according to the state of puberty.

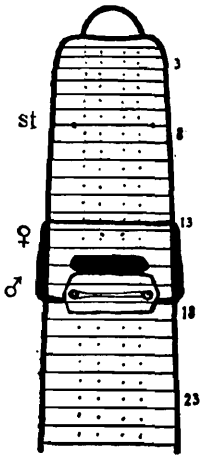

FIG. 35. *Eutyphœus scutarius.*

Female pores varying somewhat in position, just before, or before and closer together than, the setæ *a* of the 14th segment, on a common transverse median area.

Spermathecal pores one pair on the intersegmental furrow 7-8 between the lines of setæ *b* and *c*.

Internal Anatomy.—Septa 4-5 and 5-6 very strong, especially 5-6 which is nearly as thick as the body-wall. Septa 6-7 and 7-8 missing, 8-9—10-11 somewhat thickened but far less so than 4-5.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus swollen in the 12th segment, with a pair of thick calciferous glands which occupy the whole of the lateral part of the œsophagus but are not set off from it. The calciferous glands are separated from one another by a median longitudinal furrow, but they meet ventrally. Intestine begins in the 15th segment, laterally sacculated in the anterior part.

Circulatory system: Dorsal vessel simple; last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: One pair of great sperm-duct-funnels ventrally in the 11th segment, enclosed in a common seminal vesicle. One pair of great, broad sperm-sacs, much incised and lobed at the margins, communicate with the seminal vesicle and depend backwards as far as into the 15th segment.

Prostates tubular; glandular part very long, very much coiled, but not forming a compact mass, reaching backwards as far as into the 24th segment; duct thinner, relatively long, describing one or two large loops.

Distal ends of sperm-ducts with a big muscular coat, embracing the distal ends of the prostates laterally and opening from behind into the same pores with the latter.

There are strong transverse muscles in the vicinity of the male pores.

Penial setæ (figs. 52, 53) robust, about 2 mm. long, proximally about 95 μ thick, tapering very little towards the distal end, being still 80 μ thick at the end of the distal fourth, slightly bent in the proximal half, more strongly bent distally. The distal end is simple, often irregular, apparently corrugated, fibrous. The distal half of the seta shows a characteristic ornamentation, consisting of very densely crowded, irregular, transverse rows of fine teeth, the rows probably embracing the whole seta. This superficial ornamentation is not easy to be detected on account of the rough internal structure of the seta, consisting of a combination of annulose and fibrous structure; these fibres diverge from the axis of the seta obliquely towards the periphery and the distal end. By this rough structure the appearance of the seta varies very much if the focus and the direction of the light be changed during the microscopical examination. I suppose that the penial setæ of *E. orientalis* (BEDD.)[1] may have a similar structure (and ornamentation, which was probably overlooked ?).

Spermathecæ (fig. 51): Main pouch with an irregular sac-like ampulla and a rather short and narrow muscular duct which arises in about the middle of the long side of the ampulla. Into the duct open from opposite sides two diverticula which may be either simple or compound. In the latter case they consist of two more or less widely separated seminal chambers which are sometimes united only at their bases. The diverticula are somewhat longer than thick, relatively small, and *in situ* totally hidden beneath the ampulla.

Hab.—Bengal, Comillah in the Chittagong district; Major A. R. S. ANDERSON leg.

EUTYPHOEUS COMILLAHNUS, MICHLSN.

(Plate xiv, figs. 49, 50.)

E. c., MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 187, f. 30.

Present one mature specimen, somewhat mutilated behind the clitellum, and some immature or half-mature ones. Owing to their immaturity it is somewhat uncertain whether the latter belong to this species.

External Characters.—Dimensions of the mature specimen: Length 90 mm., thickness 3—4 mm., number of segments *ca.* 240.

Colour in general yellowish grey, at the anterior parts of the body with violet-grey tints.

Head tanylobous, first segment very long.

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[1] *Typhœus orientalis*, BEDDARD, Note on some Earthworms from India; in Ann. Mag. N. Hist. (5), xii, t. 8, f. 11 *a*, *b*.

Setæ all on the ventral side of the body, the median dorsal distance being distinctly greater than half the circumference ($dd > \frac{1}{2}u$). Setæ paired, the ventral ones more strictly than the lateral ones, especially in the vicinity of the male pores. At the 18th segment *aa* : *ab* : *bc* : *cd* = 3 : 1 : 4 : 3. Towards the head the setæ of the ventral pairs become somewhat separated, the distance *ab* growing nearly as large as *aa*; at the 8th segment *aa* : *ab* : *bc* : *cd* = 3 : 2 : 5 : 4. Towards the hinder end of the body the median ventral distance, relatively very small at the anterior part of the body, enlarges, becoming larger than the middle lateral distances; here *aa* : *ab* : *bc* : *cd* = 6 : 3 : 5 : 4.

First dorsal pores in the intersegmental furrow 11-12.

Clitellum ring-shaped, occupying segments 14—17 (= 4).

Male pores on the 17th segment in about the lines of setæ *a*, which are relatively very near each other in the anterior part of the body.

A common male area surrounds the male pores. The male area is hardly deepened in the middle parts and not sharply bordered, somewhat glandular, transversely oval.

Female pores doubtless on a ventral median transverse glandular area just before the zone of setæ of the 14th segment.

Spermathecal pores in the intersegmental furrow 7-8, just outside the lines of setæ *a*, which are very close together in this part of the body.

Copulatory organs: A transverse glandular cushion on each of the intersegmental furrows 12-13 and 13-14. The cushions are somewhat wide, being apparently formed by the union of pairs of cushions. The cushion on furrow 13-14 is much narrower than that on 12-13.

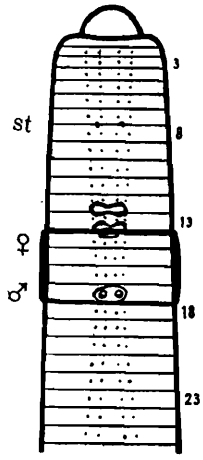

FIG. 36. *Eutyphoeus comillahnus.*

Internal Anatomy.—Septum 4-5 strong, 5-6 very strong, 6-7 and 7-8 missing, 8-9—10-11 somewhat thickened, especially 9-10, which is, however, not as thick as 4-5.

Alimentary tract: A big gizzard between septa 5-6 and 8-9. Œsophagus swollen in the 12th segment, containing a pair of thick lateral calciferous glands with transversely lamellar structure. Intestine beginning in the 15th (?) segment, laterally sacculated in the anterior part (with a typhlosole further back ?).

Circulatory system: Last hearts in the 13th segment.

Nephridial system micronephric.

Anterior male organs: One pair of great sperm-duct-funnels ventrally in the 11th segment, enclosed in a pair of nearly globular seminal vesicles, which are united in the middle, and communicate each with a broad sperm-sac much incised and lobed at the margins. This pair of sperm-sacs depends backwards as far as into the 14th segment.

Prostates tubular; glandular part moderately long, coiled, occupying about three segments; muscular duct relatively short, hardly 2 mm. long, nearly straight or a little undulated. The prostates (the whole organ as well as its various parts) are very much smaller than in other species of this genus.

Sperm-ducts relatively very thick, passing the distal end of the prostates to a considerable distance laterally, then turning towards the ventral median line; at the same time they become very thick, and are provided with a muscular coat at the distal end. Finally they open, narrowing again, from behind into the same pores as the prostates.

Penial setæ (fig. 50) about 2 mm. long and in the middle about 40 μ thick, at the proximal parts nearly straight, somewhat bent only in the distal fourth part. The distal end has a simple rather blunt tip and is somewhat broadened just below the latter; on the convex side in relation to the curvature of the seta this broadened part is somewhat hollowed. With the exception of the differentiated distal extremity the distal fourth part of the seta is ornamented by irregular transverse rows of moderately great triangular teeth. These transverse rows sometimes combine to form an irregular annulation.

Spermathecæ (fig. 49): Main pouch with an irregular sac- or pear-shaped ampulla, which is nearly as long as thick, and a short narrow duct. Into the latter open, abreast of each other or somewhat above one another, two oblong simple diverticula, the one half as thick as the other and more than half as thick as long; the longer one nearly as long as the ampulla. The diverticula, which are hardly narrowed at the base, are occupied in almost their entire length by a simple seminal chamber.

Hab.—Bengal: Comillah in the Chittagong district; Major A. R. S. ANDERSON leg.

FAM. GLOSSOSCOLECIDÆ.

Sub-fam. Glossoscolecinæ.

GEN. PONTOSCOLEX.

PONTOSCOLEX CORETHRURUS (FR. MÜLL.).

Hab.—Deccan, Hyderabad; Col. D. C. PHILLOTT leg.
South India, Coonoor in the Nilgiri Hills, 2,000 m.; M. MAINDRON leg., x-01 (Mus. Paris).
Ceylon, Kandy; Col. D. C. PHILLOTT leg.

Sub-fam. Microchætinæ.

GEN. GLYPHIDRILUS ?

GLYPHIDRILUS, SP.

Hab.—Base of Western Himalayas, Kichha near Naini Tal in the Kumaon district; R. HODGART leg., 22—29-iii-07.

Remarks.—The present collection contains two specimens of a Glossoscolecid which unfortunately cannot be determined as the specimens are quite immature. This is the first time that an apparently endemic Glossoscolecid has been noticed from India

—of course the largely peregrine, nearly circummundane *Pontoscolex corethrurus* (FR. MÜLL.) occurs also in this country. There are only two genera to which the Himalayan species—which possesses a well-developed gizzard—might belong, *viz.*, the genera *Glyphidrilus* and *Callidrilus*. As the genus *Callidrilus* occurs, as far as we know, only in tropical East Africa, it is not probable that this Himalayan species belongs to that genus. On the other hand, the new locality is easily joined to the other localities in which *Glyphidrilus*-species are found, *viz.*, Borneo, Celebes, Java, the Malay Peninsula, Burma and (a somewhat isolated species) tropical East Africa. The new locality would in an important degree reduce the great gap between the East African and the Indo-Malayan localities. From a geographical point of view, therefore, I think it probable that the Himalayan species belongs to the genus *Glyphidrilus*.

FAM. LUMBRICIDÆ.

GEN. EISENIA.

EISENIA ROSEA (SAV.).

Hab.—Kashmir, Gurez, Kishanganga River, 6,000–7,000′; H. HAYDEN and Captain R. McCARRISON leg.

EISENIA FŒTIDA (SAV.).

Hab.—Western Himalayas, Simla, 7,500′; Mrs. H. D. HENRY and A. PARSONS leg.

South India, Shembaganur (near Kodaikanal) in the Palni Hills; Dr. J R. HENDERSON leg., vi-07.

,, ,, Kodaikanal in the Palni Hills, 7,000′; Dr. J R. HENDERSON leg., vi-07.

,, ,, Coonoor in the Nilgiri Hills, 2,000 m.; M. MAINDRON leg., x-01 (Mus. Paris).

GEN. HELODRILUS.

HELODRILUS (ALLOLOBOPHORA) CALIGINOSUS (SAV.).

F. TYPICA.

Hab.—Western Himalayas, Simla, 7,500′; Mrs. H. D. HENRY and A. PARSONS leg.

F. TRAPEZOIDES (ANT. DUG.).

Hab.—Kashmir, Gilgit, *ca.* 4,000′, Gilgit Road, 8,100′; Col. A. W. ALCOCK leg. Gurez, Kishanganga River, 6,000—7,000′; H. HAYDEN and Captain R. McCARRISON leg.

South India, Ootacamund in the Nilgiri Hills; Col. D. C. PHILLOTT leg.

Remarks.—This is not the first time that Lumbricids of the common European species (which have become nearly cosmopolitan, being widely spread by man) have been found in Kashmir. In the Report of the Pamir Boundary Commission we may read as follows:—

" Three species of earthworms were obtained, one in the Kishenganga Valley at 8,100 feet, one in the Gilgit River Valley at over 7,000 feet, and one in the Yasni Valley at 8,000 feet. Specimens of all of these were sent to Mr. F. E. BEDDARD, F.R.S., who writes as follows concerning them:—

' They are entirely European, *i.e.*, Palæarctic species: they belong, in fact, to the usual British forms. This is of interest, as being an approximation to discovering the limits of the Oriental region for worms.' " [1]

I do not agree with BEDDARD in his interpretation of this occurrence. I am of the opinion that the use of these nearly cosmopolitan European species, which are certainly imported by man into all extra-European localities, for the determination of the geographical distribution of the genera of earthworms cannot on any account be allowed. I do not mean to say by this that Kashmir may not belong to the region of the endemic *Lumbricidæ*. We know endemic species of this family from the south of Persia (Chusistan and Farsistan at the northern angle of the Persian Gulf) as well as from Turkistan. On the other hand we do not know how far the region of the Indian Terricolæ extends to the north. Further, the two regions meeting here may overlap one another. This view seems to be confirmed by the occurrence of a Lumbricid apparently endemic in Calcutta (*Helodrilus indicus*—see below).

HELODRILUS (BIMASTUS) EISENI (LEVINS.).

Hab.—Western Himalayas, Naini Tal in the Kumaon district, 6,400′; Dr. N. ANNANDALE leg., 28-ix—3-x-06.

HELODRILUS (BIMASTUS) CONSTRICTUS (ROSA).

Hab.—Western Himalayas, Matiana in the Simla Hills, 8,000′, in a cultivated field; Dr. N. ANNANDALE leg., 30-iv-05.

South India, Ootacamund in the Nilgiri Hills; Col. D. C. PHILLOTT leg.

HELODRILUS (BIMASTUS) INDICUS, MICHLSN.

H. (*B.*) *i.*, MICHAELSEN, in Mt. Mus. Hamburg, xxiv, p. 188.

Examined three mature and two young specimens, all very much weakened.

External Characters.—Dimensions of the mature specimens: Length (42 ?) 58—75 mm., greatest thickness *ca.* 6 mm., number of segments (87 ?—) 107. (One

[1] Report on the Natural History Results of the Pamir Boundary Commission, by A. W. ALCOCK, M.B., Surgeon Naturalist to the Commission, Calcutta, 1898.

very short specimen is probably an individual which has been injured and has recovered with a regenerated hinder extremity.)

Colour grey; without pigmentation.

Head epilobous (⅔). Lateral borders of dorsal hinder appendix of the prostomium convergent backwards. Hinder appendix not closed behind.

Setæ strictly paired. Ventral median distance nearly equal to the median lateral and smaller than the median dorsal distance ($aa = bc = \frac{3}{5}dd$; $ab = cd =$ ca. $\frac{1}{2}aa$). I looked in vain for sexual setæ with ornamentation consisting of longitudinal furrows as are so often met with in the Lumbricids; but I am not yet sure that they are missing.

First dorsal pore on the intersegmental furrow 5-6.

Clitellum saddle-shaped, occupying segments 25—32 (=8), at the 32nd segment less distinct and only developed dorsally.

Copulatory organs: Glandular cushions beneath the ventral-lateral borders of the clitellum on segments 26—30, in general transgressing the lines of setæ *a* a little, the lines of setæ *b* rather far; on the 26th segment they are smaller, not reaching as far as setæ *a*.

Male pores deep transverse clefts in the 15th segment between the lines of setæ *b* and *c*, nearer to the first, on broad longitudinal glandular cushions with gradual medial and steep lateral declivity, extending over segments 14—16.

One individual bore on each side a spermatophore just lateral of or above the cushions of the male pore. This spermatophore had the shape of an irregular disc somewhat longer than broad, and was furnished with two oval sperm-masses in the interior of an irregular protuberance in its centre. When the spermatophores fell off they left sharply bordered flat depressions on the surface of the body.

Internal Anatomy.—Alimentary tract: Gizzard occupying segments 17 and 18. Calciferous glands apparently not distinctly set off from the œsophagus (reduced to lateral dilations of the œsophagus ?).

Male organs: Two pairs of big lobed sperm-sacs depending from septa 10-11 and 11-12 into segments 11 and 12.

Spermathecæ missing.

Hab.—Bengal, Calcutta; Dr. N. ANNANDALE leg.

Remarks.—*Helodrilus* (*Bimastus*) *indicus* does not at all show the general appearance of the sub-genus *Bimastus*. It rather resembles an *Eophila* in its somewhat large size and in its pale, pigmentless colour. The resemblance in appearance corresponds with a real inclination towards this sub-genus which is allied to *Bimastus*. *H.* (*Bimastus*) *indicus* seems to be closely allied to *H.* (*B.*) *syriacus* (ROSA), the species differing from one another principally in the arrangement of the setæ.

It is a surprising fact to meet with an apparently endemic Lumbricid in Bengal, a territory which is rather far from the proper dominion of the fam. *Lumbricidæ* (see the remarks under *Helodrilus* (*Allolobophora*) *caliginosus* (SAV.) *supra*). If *H. indicus* really should prove to be endemic in Calcutta, it must be regarded as an outpost of the *Lumbricidæ*, whose proper dominion is South Europe and South-Eastern Asia as far as

South Persia and Turkistan. It must be borne in mind that there are similar outposts of this family in other regions outside the proper dominion of the *Lumbricidæ*, *e.g.*, some species of *Eisenia* and *Helodrilus* in the eastern territories of North America, the dominion of the *Diplocardinæ*, and on the other hand *Helodrilus* (*Allolobophora*) *japonicus* (MICHLSN.) in Japan, the dominion of the Indo-Malayan genus *Pheretima*.

HELODRILUS (BIMASTUS) PARVUS (EISEN).

VAR. ?

Hab.—Kashmir, Gorai (about 14 miles N. of Kashmir Valley), *ca.* 9,000′; H. HAYDEN, and Captain R. MCCARRISON leg.

The specimen examined differs somewhat from typical specimens. It is 62 mm. long. The clitellum extends only over the six segments 25—30, and the tubercula pubertatis over the four segments 26—29. The ventral body-wall of segments 14—16 is greatly thickened and glandular. The male pores on the 15th segment are broad, transverse slits surrounded by a white, slightly elevated area, which extends from the 15th segment to some extent on to the 14th and 16th segments but is not very conspicuous on account of the glandular nature of the whole ventral part of these segments.

HELODRILUS (DENDROBÆNA) RUBIDUS (SAV.).

F. TYPICA.

Hab.—Western Himalayas, Naini Tal in the Kumaon district, 6,400′; Dr. N. ANNANDALE leg., 28-ix—3-x-06.

F. SUBRUBICUNDA (EISEN).

Hab.—Western Himalayas, Simla, 7,500′; Mrs. H. D. HENRY leg. Eastern Himalayas, Sandakphu and Phallut in the Darjiling district (British Sikkim); C. J BERGTHEIL and I. H. BURKILL leg.

GEN. OCTOLASIUM.

OCTOLASIUM LACTEUM, OERLEY.

Hab.—Western Himalayas, Simla, 7,500′; Mrs. H. D. HENRY and Dr. N. ANNANDALE leg.

In concluding this work I must express my heartiest thanks to Dr. N. ANNANDALE, Superintendent of the Indian Museum, who not only gave me the opportunity of studying the Oligochæte fauna of the Indian Empire, which has proved most interesting, but also burdened himself with the troublesome task of amending the by no means faultless English of my manuscript, and of correcting the proofs.

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EXPLANATION OF PLATE XIII.

FIG. 1.—*Drawida nepalensis*, MICHLSN. Spermatheca ; × 12.
,, 2.—*Drawida sulcata*, MICHLSN. Sexual region of the body from the ventral side ; × 8.
,, 3.—*Megascolides bergtheili*, MICHLSN. Spermatheca ; × 8.
,, 4.—*Notoscolex scutarius*, MICHLSN. Hinder sexual region of the body from the ventral side; × 5.
,, 5.— ,, ,, ,, Spermatheca made transparent by acetic acid ; × 15.
,, 6.—*Woodwardia burkilli*, MICHLSN. Sexual region from the ventral side; × 8.
,, 7.—*Plutellus palniensis*, MICHLSN. Spermatheca made transparent by acetic acid ; × 10.
,, 8.—*Plutellus sikkimensis*, MICHLSN. Distal end of a penial seta; × 450.
,, 9.—*Plutellus indicus* var. *silvestris*, MICHLSN. Spermatheca made transparent by acetic acid ; × 26.
,, 10.—*Spenceriella duodecimalis*, MICHLSN. Spermatheca made transparent by acetic acid ; × 20.
,, 11.—*Perionychella variegata*, MICHLSN. Spermatheca made transparent by acetic acid; × 25.
,, 12.—*Perionychella sikkimensis*, MICHLSN. Distal end of a penial seta ; × 440.
,, 13.— ,, ,, ,, Spermatheca made transparent by acetic acid ; × 20.
,, 14.—*Perionychella simlaënsis*, MICHLSN. Spermatheca ; × 20.
,, 15.— ,, ,, ,, Hinder sexual region of the body from the ventral side ; × 7.
,, 16.—*Perionyx himalayanus*, MICHLSN. Hinder sexual region of the body from the ventral side ; × 14.
,, 17.— ,, ,, ,, Spermatheca made transparent by acetic acid ; × 20.
,, 18.—*Lampito vilpattiensis*, MICHLSN. Spermatheca made transparent by acetic acid ; × 18.
,, 19.—*Lampito sylvicola*, MICHLSN. Spermatheca made transparent by acetic acid ; × 15.
,, 20.—*Megascolex longiseta*, MICHLSN. Spermatheca made transparent by acetic acid ; × 12. (The ampulla is somewhat pressed and flattened in the figured preparation.)
,, 21.— ,, ,, ,, Penial seta: *a* the whole seta, × 10; *b* a part of the same, × 250.
,, 22.—*Megascolex hendersoni*, MICHLSN. Hinder sexual region of the body from the ventral side ; × 5.
,, 23.— ,, ,, ,, Spermatheca made transparent by acetic acid ; × 8.
,, 24.—*Megascolex funis*, MICHLSN. Diverticulum of a spermatheca made transparent by acetic acid ; × 45.
,, 25.—*Pheretima andamanensis*, MICHLSN. Spermatheca ; × 5.
,, 26.—*Pheretima osmastoni*, MICHLSN. Spermatheca ; × 4.
,, 27.—*Pheretima andersoni*, MICHLSN. Spermatheca ; × 5.
,, 28.—*Pheretima suctoria*, MICHLSN. Spermatheca ; × 8.


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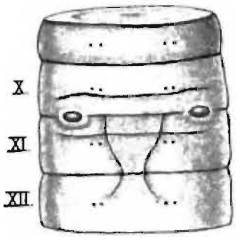

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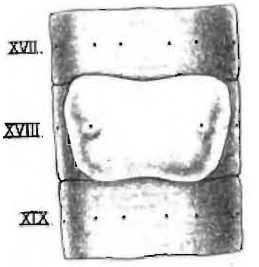

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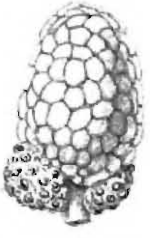
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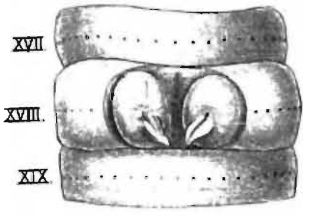

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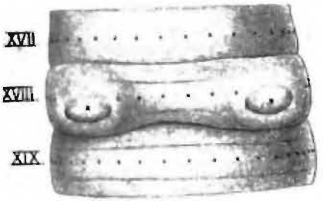

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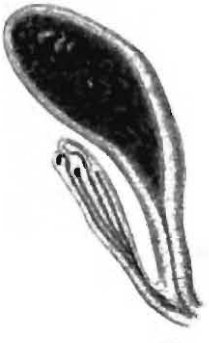
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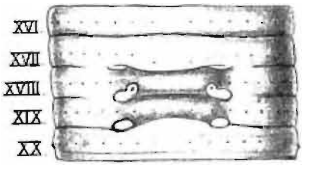

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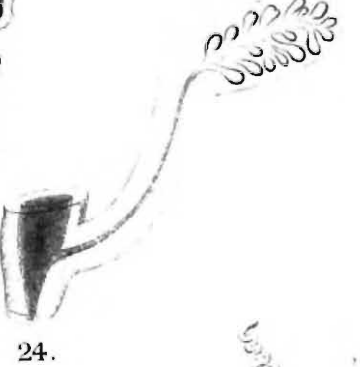
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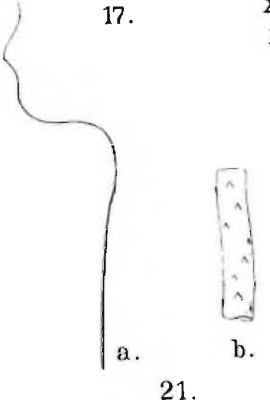

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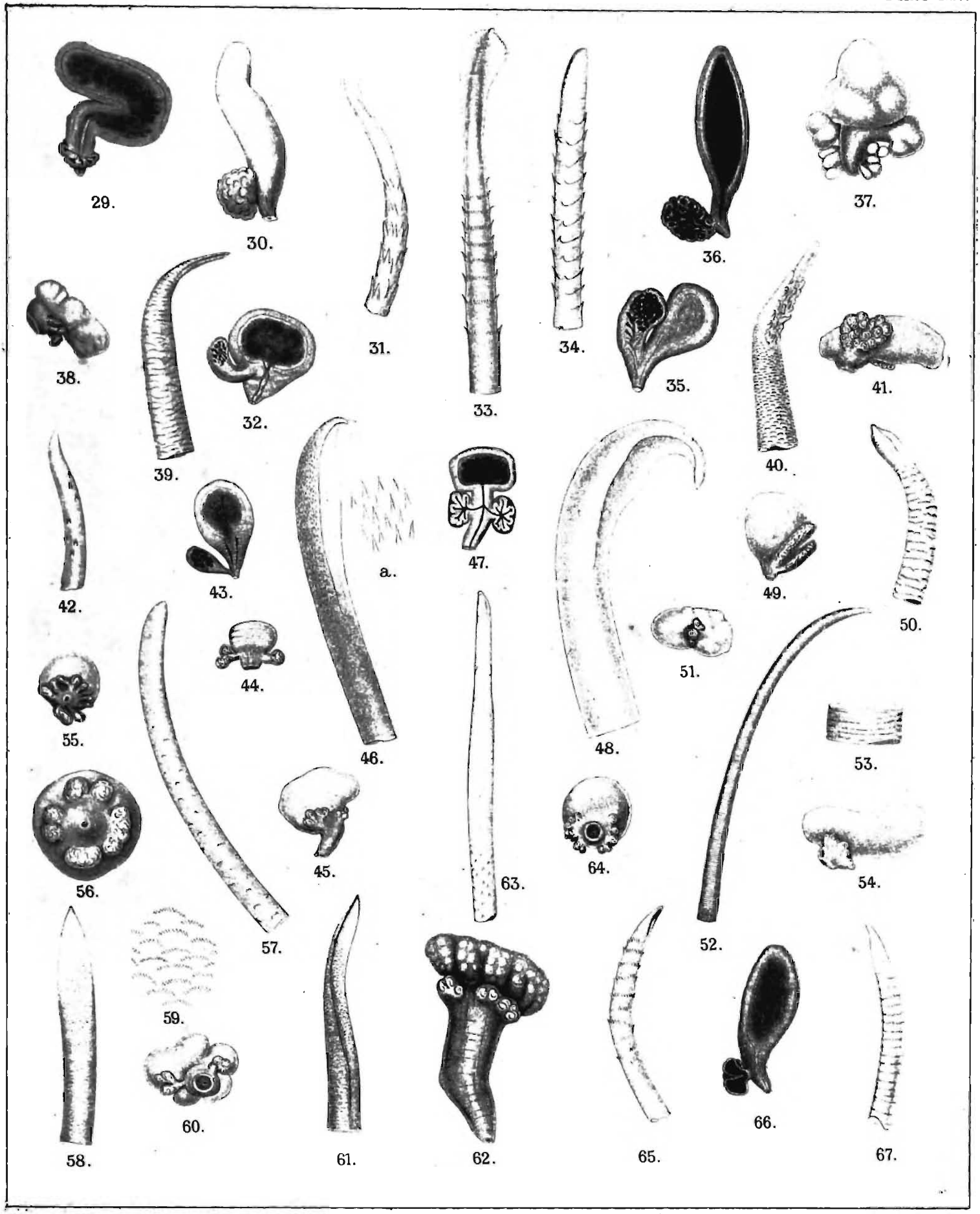
EXPLANATION OF PLATE XIV.

FIG. 29.—*Octochætus maindroni*, MICHLSN., f. *typica*. Spermatheca made transparent by acetic acid ; × 25.
,, 30.— ,, ,, ,, var. *chaperi*, MICHLSN. Spermatheca ; × 45.
,, 31.— ,, ,, ,, ,, ,, Distal end of penial seta ; × 500.
,, 32.—*Octochætus hodgarti*, MICHLSN. Spermatheca made transparent by acetic acid ; × 30.
,, 33.—*Octochætus pattoni*, MICHLSN. Distal end of a penial seta ; × 325.
,, 34.— ,, ,, ,, Distal end of a copulatory seta ; × 240.
,, 35.— ,, ,, ,, Spermatheca made transparent by acetic acid ; × 20.
,, 36.—*Octochætus thurstoni*, MICHLSN. Spermatheca made transparent by acetic acid ; × 12.
,, 37.—*Eutyphoeus nepalensis*, MICHLSN. Spermatheca ; × 5.
,, 38.—*Eutyphoeus paivai*, MICHLSN. Spermatheca ; × 5.
,, 39.— ,, ,, ,, Distal end of a penial seta ; × 250.
,, 40.—*Eutyphoeus andersoni*, MICHLSN. Distal end of a penial seta ; × 200.
,, 41.— ,, ,, ,, Spermatheca ; × 5.
,, 42.—*Octochætus fermori*, MICHLSN. Distal end of a penial seta ; × 400.
,, 43.— ,, ,, ,, Spermatheca made transparent by acetic acid ; × 35.
,, 44.—*Eutyphoeus annandalei*, MICHLSN. Spermatheca ; × 8.
,, 45.—*Eutyphoeus waltoni*, MICHLSN. Spermatheca ; × 5.
,, 46.— ,, ,, ,, Distal end of a penial seta ; × 400 ; *a*, ornamentation of the same, × 3,000.
,, 47.—*Eutyphoeus bengalensis*, MICHLSN. Spermatheca made transparent by acetic acid ; × 16.
,, 48.— ,, ,, ,, Distal end of a penial seta ; × 700.
,, 49.—*Eutyphoeus comillahnus*, MICHLSN. Spermatheca ; × 12.
,, 50.— ,, ,, ,, Distal end of a penial seta ; × 200.
,, 51.—*Eutyphoeus scutarius*, MICHLSN. Spermatheca ; × 4.
,, 52.— ,, ,, ,, Penial seta ; × 45.
,, 53.— ,, ,, ,, Part of a penial seta ; × 190.
,, 54.—*Eutyphoeus chittagongianus*, MICHLSN. Spermatheca ; × 6.
,, 55.—*Eutyphoeus quadripapillatus*, MICHLSN. Spermatheca ; × 8.
,, 56.—*Eutyphoeus pharpingianus*, MICHLSN. Spermatheca ; × 15.
,, 57.— ,, ,, ,, Distal end of a penial seta ; × 225.
,, 58.—*Eutyphoeus bastianus*, MICHLSN. Distal end of a penial seta, flat side ; × 200.
,, 59.— ,, ,, ,, Ornamentation of a penial seta ; *ca.* × 3000.
,, 60.— ,, ,, ,, Spermatheca ; × 8.
,, 61.— ,, ,, ,, Distal end of a penial seta, edge ; × 200.
,, 62.—*Eutyphoeus khani*, MICHLSN. Spermatheca ; × 10.
,, 63.— ,, ,, ,, Distal end of a penial seta ; × 225.
,, 64.—*Eutyphoeus nainianus*, MICHLSN. Spermatheca ; × 10.
,, 65.—*Octochætus phillotti*, MICHLSN. Distal end of a penial seta ; × 300.
,, 66. ,, ,, ,, Spermatheca made transparent by acetic acid ; × 20.
,, 67.— ,, ,, ,, Distal end of a copulatory seta ; × 300.



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Lith. Anst. v. K. Wesser, Jena.

W. Michaelsen, The Oligochaeta of Jndia etc.

B. THE ANATOMY OF SOME AQUATIC OLIGOCHÆTA FROM THE PUNJAB.

By J STEPHENSON, *Major, I.M.S.*

CONTENTS.

B. THE ANATOMY OF SOME AQUATIC OLIGOCHÆTA FROM THE PUNJAB.

By J STEPHENSON, *Major, I.M.S.*

NAIDIDÆ.

Nais variabilis, Piguet, var. *punjabensis*, var. nov. (Pl. xv, fig. 1.)

The form here described was found first in the tank at Shalimar near Lahore, and afterwards in other places.

Externa' characters.—The animals are of an indefinite light grey colour, and are fairly transparent under the microscope. The average *length* of a single individual is about 5-6 mm.; they may be only 2-3 mm., or on the other hand a fully extended specimen about to divide may reach 12-14 mm. They live for the most part crawling freely in the mud or on aquatic vegetation; but in the month of May, a considerable number were found concealed, probably temporarily, in the tubes of insect larvæ. I could not differentiate these tube-inhabiting forms by any certain means from others previously observed. Backward progression is quite easy to these animals, and is not uncommon, at least while under examination.

The *prostomium* is short, slightly extensible, rounded, and bears sensory hairs; the surface epithelium is thicker at its tip than elsewhere in the body. The *mouth* is transverse, reaching from side to side. The *eyes* are placed laterally exactly at the level of the mouth; they are ovoid or somewhat irregular masses of black pigment, with, in addition, a violet tinge; additional smaller eyes ("Nebenaugen") may be present near the two principal ones (fig. 3). In several cases (in the posterior half of an animal which was about to divide) the eyes were being formed by the deposition of a brown pigment; in one case the pigment appeared to have a violet tinge from the beginning. The body-wall is pigmented irregularly over the few most anterior segments, in one case as far back as the ninth; the pigment is of a light brown colour, and is contained in the deepest portion of the body-wall, probably in the epithelium lining the body-cavity. Behind the head the general shape of the body is uniformly cylindrical. The *anus* is posterior and very slightly dorsal.

The *number of segments* is frequently about 26; but it may apparently vary between 18 and 32, as computed from the number of ventral setal bundles; these, however, diminish gradually in size at the hinder end of the animal, and cease altogether some little distance in front of the anus (*v.* fig. 4).

Asexual multiplication.—There is never more than one constriction present; that is to say, the chains of three, four or five incomplete individuals formed by *Æolosoma* or *Chætogaster* are not found. Figure 5 shows the site of an approaching division;

the budding of new segments has taken place behind the sixteenth segment of the original single animal, the first five segments of the posterior animal also have been newly formed, so that the seventeenth segment of the original animal would in this way become the sixth, or first with dorsal setæ of the second. It may be mentioned that I found [8 and 9] in *Chætogaster* also that the first five segments are intercalated at the head end of the second animal; in *Pristina*, however (*v. infra*), seven are so added; and with these facts may be mentioned two others, that in *Chætogaster* and *Nais* the nephridia begin in the seventh, in *Pristina* in the ninth segment; and that in *Pristina* the position of the reproductive organs also is two segments further back than in the others. Figure 6 shows the hind end of an animal which had apparently recently divided; here the budding of new segments took place behind the fourteenth original segment; the site of the zone of budding would seem, therefore, not to be a fixed one.

The *ventral setæ* (text-fig. 1) occur in all segments from the second onwards; but those of the second, third, fourth and fifth segments differ slightly from the rest. All agree in being curved so as to resemble an elongated $\int$, in being forked distally, the proximal prong being shorter and thicker than the distal, in possessing a nodulus, and in projecting but slightly from the body-wall; their total length is at most about half the diameter of the extended body.

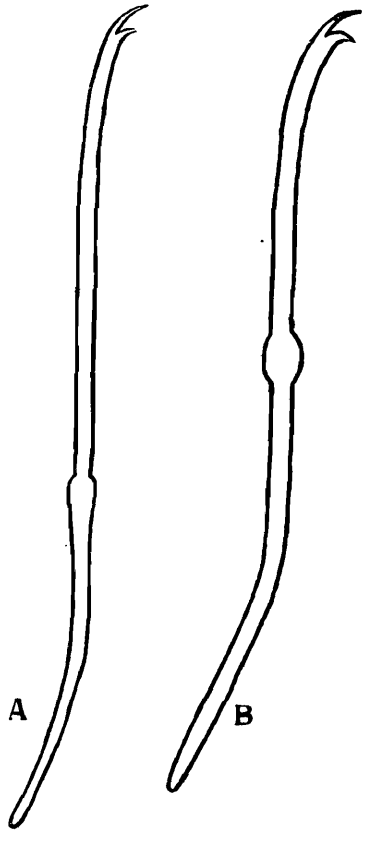

FIG. 1.—Ventral setæ of *Nais variabilis*, var. *punjabensis*—
A, of ii, iii, iv, v segments;
B, of the remaining segments.

From the sixth segment onwards, they measure ·075—·08 mm. in length, are moderately stout, and have the distal prong of the fork 1½ times as long as the proximal, though only ⅔ as thick at the base. The nodulus is distal to the middle, the proportions being—

proximal to nodulus : distal to nodulus : : 4 : 3.

A variation in the relative form of the two prongs of the fork was occasionally met with, where both were of the same length, but the proximal prong was twice as thick at its base as the distal.

The ventral setæ of the second to the fifth segments are slightly longer, *e.g.*, ·09—·095 mm. in a case where the more posteriorly placed setæ were ·08 mm. They are also considerably thinner; the distal prong of the fork is twice as long as the proximal, and is of the same thickness at the base. The nodulus is proximal to the middle of the length of the seta, the proportions previously given being about reversed, *i.e.*—

proximal to nodulus : distal to nodulus : : 3 : 4.

The usual number of ventral setæ in a bundle is 3 to 5; numbers from 2 to 7 are also met with.

The *dorsal setæ* (text-fig. 2) begin in the sixth segment; in one specimen the seventh was the first to bear them, though there seemed to be a small lobulated setal sac in the sixth; like the ventral setæ, they diminish in size towards the posterior end, and usually cease altogether a few segments in front of the ending of the ventral setæ. They may be divided into long and short, or hair-setæ and needle setæ.

FIG. 2.—Dorsal needle-seta of *Nais variabilis*, var. *punjabensis*.

The length of the hair-setæ varies; they may be equal or nearly equal to the diameter of the body, or may be only a half or two-thirds of the diameter; in some cases they have obviously been broken off short; in others they have either fallen out altogether or have not been developed. They are frequently smooth; but frequently also they may have few (fig. 8) or many extremely fine thorn-like projections, which may even be branched; to these "thorns" minute foreign particles frequently adhere; an extreme example of this condition is shown in plate xvi, fig. 9. The thorn-like processes are, when present, not arranged in definite lines or at regular distances. They seem to be due to the fraying out from the side of the seta of some of its component fibrils and to the forcible breaking back, without actual detachment, of the frayed ends. Their presence would thus be an indication of age or hard wear; and as a matter of fact they appear to be most numerous in those cases where age or hard wear are also evidenced by the irregular lengths of the setæ, by their broken condition, or even their entire absence from certain segments. It has seemed to me that the earlier specimens of a batch of material examined soon after being taken from their natural surroundings, do not show these thorn-like processes so often nor to so extreme a degree as those examined subsequently, after having been kept, perhaps, a month in the laboratory. Here, again, we have perhaps an indication that the processes are due to disintegration brought about by relatively unfavourable conditions.

In the first draft of this paper, I described the needle-setæ of the dorsal bundles as having usually a single point, and only very occasionally being bifid at the free end. During the last month or two, however, I have examined a considerable number of specimens from a different source (the river Ravi), and in these I have usually found some, at least, of the needle-setæ to be bifid; indeed I have thought it possible that all are bifid, and that the failure actually to see this depends on the fact that in many cases the prongs of the forked end are so placed under the microscope as to overlie one another and hence are not seen separately. It is possible that my earlier failure to note the bifid ends of these setæ may have been due to a lack of sufficiently close observation; on the other hand, both doubly- and singly-pointed needle-setæ may perhaps occur, as is stated to be the case in an allied form (*N. variabilis*, var *simplex*, Piguet [7]).

Describing, however, the bifid form as the typical one, these needle-setæ of the dorsal bundles are about ·06 (·058—·07) mm. long, slightly sickle-shaped, with an

indefinite nodulus about one-third of the length from the free end. The forking is always very fine, and is practically never visible without the employment of an immersion lens (*cf.* text-fig. 2 : plate xvi, figs. 10 and 11, represent my earlier views as to these setæ, the one (fig. 10) representing the usual and the other (fig. 11) what I at first considered the " abnormal," *i.e.*, bifid, variety).

What is perhaps the most typical constitution of a dorsal bundle is the presence of one long and one short seta. But the bundle may be constituted by two hair- with one needle-seta, or one hair- with two needle-setæ, or two of each, or one needle-seta alone. It occasionally happens that no dorsal setæ of any kind are visible on a segment which ought normally to bear them. When it is remembered that the hair-setæ themselves may or may not have the thorn-like processes described above, may be of various lengths, and may or may not be broken short, it will be seen that the dorsal setal bundles may vary in different cases very widely indeed; in one and the same animal almost every bundle may present differences as compared with every other.

Two varieties of *setal sacs* are shown in figs. 12 and 13; it will be seen that one is lobulated and massive, the other attenuated. The lobulated form is apparently the rarer.

The *body-cavity* contains many *lymph-corpuscles*; these are of two kinds, white and brown. The white (fig. 12) contain a large number of bright refractile spherical granules, usually indeed appearing to be made up of them. The brown ones contain a number of minute particles which appear to be droplets of a brown oily substance; they resemble those described later for *Pristina*. An animal may have only white corpuscles, or may have both white and brown; never, so far as I have seen, brown only. I did not observe any brown corpuscles till May; it is possible that their presence is seasonal, and perhaps determined by the more plentiful food-supply at the beginning of the hot weather; the brown particles appear to be of the same nature as those in the wall of the alimentary canal. I could not correlate the presence of the brown corpuscles with any other structural peculiarity.

The *septa* are well-marked; there are also strands connecting alimentary canal and body-wall.

Alimentary tract.—The *buccal cavity* occupies the second segment. The *pharynx* occupies the third, fourth and fifth (*v.* plate xv, figs. 1 and 2); it is mobile, but not protrusible. Surrounding the pharynx on all sides are a number of ovoid or pear-shaped hyaline nucleated cells, the masses of which give to the pharynx a somewhat nodular appearance. Occasionally a portion of this cellular mass is somewhat detached from the pharyngeal tube; in plate xvi, fig. 14, is shown such a mass, partially detached from the dorsal wall of the pharynx, the alimentary tube itself being ventrally situated, and possessing apparently no specially thickened muscular walls (*cf.* the description of the pharynx and septal glands of *Pristina*, *post.*). The *œsophagus* occupies the sixth and part of the seventh segments; it contains in its wall numbers of minute brownish particles looking like oil droplets. A dilatation, more or less defined, in the seventh and eighth segments, may be called the *stomach*; this portion of the tract

is, however, variable. Usually the stomach is fairly sharply delimited anteriorly (fig. 1), the œsophagus in some cases being invaginated backwards into it after the manner of an intussusception; the stomach is less sharply delimited posteriorly, where it is continued into the intestine; it may appear as merely a gentle fusiform dilatation on the alimentary tube; or in some cases may not be distinguishable at all. In the latter case, there is then no differentiation of the alimentary canal behind the pharynx. The *intestine* is ciliated, the cilia being obvious, and working in a postero-anterior direction; peristaltic movements throughout its extent occur constantly and with a fairly regular rhythm; these movements, like the ciliary action, proceed from behind forwards, and, borrowing a term from mammalian physiology, may for convenience be described as "antiperistaltic." It would seem, therefore, that the intestine performs a respiratory function.

Circulatory system.—The blood is yellowish red, and contains no corpuscles. The dorsal vessel is contractile, the contractions progressing in a postero-anterior direction; it is incorporated in the wall of the alimentary canal as far forwards as the œsophagus; the brown globules present in the wall of the intestine may be seen superficial to the vessel. The ventral vessel is non-contractile and is not incorporated in the intestinal wall; it divides about the level of the setal bundle of the third segment, and the branches join in the prostomium to form the dorsal vessel; for the relations of the blood vessels to the nerve ganglion *vide* fig. 15. There are not fewer than four, perhaps five, transverse commissures joining dorsal and ventral vessels in the pharyngeal region; they occur in the third, fourth and fifth segments, but apparently there may be more than one in a segment.

Nephridia.—The first nephridium is in the seventh segment. The beginning of the tube can be seen as a ciliated open mouth, or small ciliated funnel, in the preceding segment; the tube at once pierces the septum, and is then somewhat dilated for a short distance, after which it appears to maintain a uniform diameter throughout its numerous windings till it opens into a terminal ciliated dilatation which discharges to the exterior on a level a little in front of the insertion of the ventral setæ. The walls are composed of a granular protoplasm in which nuclei and cell outlines are not to be distinguished in the living animal.

Nervous system.—The cerebral ganglion is deeply indented behind, less deeply in front (fig. 15). The commissures join its anterior part (figs 2 and 15); the first ganglion of the ventral chain is immediately behind the mouth; the ganglia in general can be seen in a side view as swellings, situated each at the level of the ventral setæ; seen from the ventral surface the cord has an irregular lobulated outline, and the ganglionic swellings are not distinguishable from this aspect.

Genital organs.—The genital organs were observed in various stages of development in the months of March and April. The appearances were as follow: as to the interpretation of the appearances I am not in all cases quite clear. Both sexual and asexual reproduction may go on together; an individual that was about to divide asexually was not uncommonly found to have sexual organs in a moderately advanced stage of development.

The first sign of sexual organs is the appearance of an apparently homogeneous hyaline mass, presumably the testis, in the fifth segment, close to septum 4/5. Next (fig. 16) there is seen at the sides of the hinder end of the pharynx a sac containing mulberry-shaped masses of sperm-mother-cells, dull and hyaline in appearance; among the morulæ are large numbers of round cells, with many bright granules in their interior, similar to the lymph-corpuscles of the body-cavity. In the specimen shown in the figure (16), there is a similar sac (or probably an extension of the former one) on the right side of the sixth segment.

In a subsequent stage (fig. 17) the spermathecæ form as sausage-shaped structures, hollow, with cellular walls and with external openings at the anterior part of the fifth segment. The vesicula seminalis in the same segment contains developing spermatozoa, as does that in the sixth; another seminal vesicle has developed, perhaps as an outgrowth of that in the sixth segment, and this extends back through the seventh, eighth and ninth segments, containing developing spermatozoa. At the hinder end of the ninth segment was seen a mass of ova; the ovaries must therefore have developed.

In fig. 18 the seminal vesicles are smaller; but the ova are more numerous, and a large mass in the sixth segment probably represents the ovary; the eggs seem to develop in the body-cavity; thus there are masses of them in the fifth segment, and again a small mass in the ninth, at the hinder end of the seminal vesicle; it is quite possible, however, that the masses in the fifth segment are sperm-morulæ. In the seventh segment is seen the earliest stage of what later becomes a very prominent structure; there are seen three small masses, opaque, and composed of a number of small glancing or refractile particles aggregated together. At or about this stage the seminal vesicles may attain an enormous dilatation, as shown in plate xvii, fig. 19, for the posterior vesicle; the anterior, however, was not obvious. Genital products (either egg masses or sperm-morulæ) are sometimes visible free in the body-cavity as far forward as the third segment, or even occasionally in the second (*v.* fig. 20); and slight and unintentional violence may cause spermatozoa to burst through the body-wall and be discharged from the tip of the prostomium.

The clitellum forms as a wrinkling and thickening of the epidermis at the region of septum 6-7 (fig. 20). Later it extends over both fifth and sixth segments; the skin is finely tuberculated throughout this region ,which is sharply defined both in front and behind. The thickening and tuberculation are accompanied by considerable opacity, so that it is impossible to make out the internal anatomy of this part after the establishment of the clitellum.

The opaque granular mass or masses referred to above increase in size; if multiple at first, they appear to unite into a single mass. This mass has apparently no definitely fixed position; though it was first seen forming in the seventh segment, in another case it was found, while still of small size, to be present in the ninth. Later, however (fig. 21), it grows to such an extent as to occupy the seventh, eighth and ninth segments. It can then be easily seen with the naked eye in a living free-moving worm as a bright white particle, the size of a small pin's head. On slight

pressure it may be extruded whole from the body of the worm. When teased, it is found to consist entirely of oval particles, each homogeneous and non-nucleated, bright and highly refractile, in diameter a third or a quarter the size of a lymph-corpuscle of the animal's body-cavity. Singly these particles are transparent; in the aggregate, in the body of the animal, they are opaque, and the mass which they compose is under the microscope by transmitted light quite dark. The similarity of the particles to those included in the corpuscles of the body-cavity has been mentioned; it may be added that appearances would seem to suggest that certain of the body-cavity corpuscles are mere aggregates of such particles.

It may be conjectured that the great swelling of the body in segments v and vi of the specimen represented in fig. 21 is due mainly to the growth of the opaque body, and the consequent pushing forwards of the dilated seminal vesicles, which formerly stretched backwards as far as the hinder end of the ninth segment.

The *genital setæ* (text-fig. 3) are the modified ventral setæ of the sixth segment, and replace the setæ of ordinary type in animals with sexual organs in an advanced state of development. They are ·09 mm. or less in length, stout in build, curved

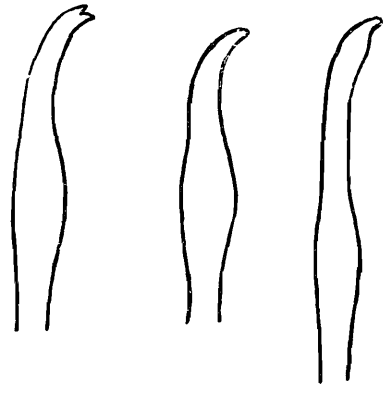

FIG. 3.—Genital setæ of *Nais variabilis*, var. *punjabensis*.

and somewhat swollen near the free end, which may or may not be bifid. If bifid, the prongs of the fork are short, blunt, and approximately equal in length; if not, the extremity is blunt and rounded. There may be two setæ in each bundle, or sometimes three, one at least in either case being bifid, the other frequently with a single point.

I cannot find any reference to a white mass of similar constitution to the one described above. Michaelsen [4] figures and describes only ova in the ovisac of *N. elinguis*; Piguet [7] figures something similar for *Pristina longiseta*, and describes the ovisac of *N. communis*, but again speaks only of ovarian cells and ova. The ordinary works of reference do not contain any allusion to a white mass of the nature of the above. It is always stated that "albumen" is found within the cocoons of Oligochæta, but its source is not mentioned; it seems possible that we have here an indication of its origin. (*Cf.* also *Pristina*, *post.*)

NOTE.—Since writing the above account I have been able to obtain a fair number of sexual individuals, with the organs in various stages of development. Unfortunately I am unable to work through this material at present, but hope to have an opportunity of returning to this subject.

Parasite.—In almost all cases there are a number of protozoan ectoparasites attached to the head, and in smaller numbers to other parts of the body, of these worms. Strictly speaking they are commensals rather than parasites, since occasionally they are found attached to the setæ, and hence cannot then draw any nutriment from the body of the worm. I have not identified the form, though it appears to be related to *Spirochona*. It is of a vase shape, with stiff processes projecting from the rounded angles of its free extremity; these are actively motile, performing sharp sudden movements inwards at irregular intervals; there is also a spirally coiled ciliated oral process. The animal is attached by a "foot"; the nucleus, as brought out by acetic acid, is moniliform, with a narrower central portion, or may appear as divided into two separate halves (plate xx, fig. 49 *a-e*).

The species described above has a certain similarity to *N. elinguis*, O. F. M., and agrees in most particulars with the diagnosis given by Michaelsen [3] in 1900; and I was at first inclined to consider this form as, at most, a variety of *N. elinguis*.

Through the kindness of Dr. Piguet, I have recently received a copy of his dissertation [7] on the Naididæ of Switzerland. He remarks as follows: "La systématique des *Nais* était très incomplète, les diagnoses souvent insuffisantes. La description sommaire de *N. elinguis* s'applique à au moins 3 *Nais* différentes, et le désaccord entre les zoologistes au sujet des espèces de ce genre s'explique très facilement. Une détermination exacte basée sur une description rapide des soies est impossible, et permettrait de confondre *N. communis*, *N. variabilis* et *N. elinguis*, qui ont toutes trois des aiguilles bidentées et des soies capillaires dans les faisceaux dorsaux; et cependant ces trois espèces sont parfaitement distinctes."

Of the species and varieties into which the old *N. elinguis* has thus been broken up, the one which most closely resembles the present form is *N. variabilis*. From *N. elinguis* as now defined the present form is distinguished by the constitution of the dorsal bundles, which in *N. elinguis* have a larger number of component setæ; and by having shorter terminal prongs to the dorsal needle-setæ; the distinction between the ventral setæ of segments ii-v, and those which follow them is also wanting in *N. elinguis*. From *N. communis*, Piguet, also it is distinguished by the colour, the less marked bifurcation and less obvious nodulus of the dorsal needles, the frequent bifid termination of the genital setæ, and apparently by the very definite difference in the thickness of the ventral setæ in segments ii-v and of those posterior to this.

In considering *N. variabilis*, Piguet, we have to take into account the type form, the variety of the large lakes of Switzerland, the variety with very long hair-setæ, *N. variabilis*, var. *simplex*, and a form called by Piguet "seconde forme annexe." I have gone carefully through these forms, which differ among themselves in details of colour and relative size and visibility of the prongs of the dorsal needle-setæ,

as well as in a few other details; and I cannot find in any one of them the exact counterpart of the form I have here described. Indeed it is perhaps hardly to be expected that such a highly variable species should present exactly the same aspect in such a distant region and different climate.

There is, moreover, one peculiarity of the Indian form which distinguishes it absolutely, so far as I have seen, from all forms of *Nais* hitherto described; that is, the frequent thorn-like processes on the dorsal hair-setæ. Since these are by no means always present, it would probably be better (accepting the explanation of the phenomena previously suggested) to describe this as a general tendency or predisposition to disintegration of these particular setæ.

That this characteristic has any greater value than that belonging to a geographical variety I do not for an instant suppose; it occurs also in *Pristina longiseta* and *Slavina punjabensis* (*v. post.*), and hence is in all probability connected with local or climatic peculiarities. I would therefore suggest that the present form be considered as a variety of *N. variabilis*, Piguet, to be denoted as var. *punjabensis*.

Nais paraguayensis, Mchlsn. (Pl. xvii, fig. 22.)

This form was first found on April 27th in water from a pond in the Zoological Gardens, Lahore. It is somewhat larger than the preceding, being from 8 to as much as 20 mm. in length. It is of a light orange colour. It may progress at the bottom of the vessel by active wriggling movements, or sometimes by undulations freely through the water. There are no eyes.

The *prostomium* is rounded, and not elongated. The anterior part of the body, as far as the sixth segment, may be much thinner than the portion that succeeds (fig. 22). There may be an immense number of *segments*; on examining fig. 22, it will be seen that the larger number, however, have probably been recently formed; rapid budding seems to have taken place after the twenty-first original segment, twenty or more new segments being indicated by the presence of small dorsal setæ, and still more by annulations and rudimentary septa, while at the extreme posterior end segments are still altogether undifferentiated. In another case this budding took place after the thirtieth segment; rudimentary septa, but as yet no setæ, were present in the newly formed portion.

The *ventral setæ* are of the previous type; the prongs of the fork are of about equal length, the proximal one being slightly stouter; the nodulus is slightly more prominent on one side than on the other (fig. 23). They are usually six in number in each bundle.

The *dorsal setæ* consist of both hair- and hook-setæ. The hair-setæ are equal in length to the diameter of the animal, or sometimes somewhat shorter than this; they are smooth, and usually one, sometimes two, per bundle; in the latter case the second hair-seta may be considerably shorter than the first. The hook-setæ (fig. 24) are slightly curved distally in a sickle-shaped manner, and are very unequally forked, the smaller prong of the fork being on the convex side of the "sickle" and much shorter and finer than the larger, which continues the axis of the curve; these

"hook-setæ" are one or two in number in each bundle. The bundles of the dorsal setæ begin in the sixth segment, and are perhaps most commonly composed merely of one hair- and one hook-seta.

Septa are well marked; the corpuscles of the body-cavity resemble the white corpuscles of *Nais variabilis*; brown corpuscles were not seen.

The remaining systems require only brief mention. The *pharynx* was seen to be ciliated; there was no differentiation of a stomach, the whole of the alimentary canal behind the pharynx having the same character throughout; its walls contained brown oil-like globules, as in the previous form. The usual "antiperistaltic" movements were observed. The *œsophageal* or *pharyngeal commissures* were plexiform and irregular. The first *nephridium* was in the seventh segment. In other points this form appeared to correspond entirely with the *Nais* previously described. The points of distinction consist in the absence of eyes, the forked sickle-shaped dorsal setæ, and the pharyngeal plexus. The sickle-shaped setæ appear to be identical in form with those of *N. heterochæta*, Benham, which species, however, possesses eyes. But the form which comes closest to the present one is *N. paraguayensis*, Mchlsn. (Michaelsen [4]), recently described from Paraguay; there appears to be a slight difference in the hooked dorsal setæ, no sickle-shaped curve being figured or described by Michaelsen for his form; the forking, however, is of the same nature, and there would hardly seem to be sufficient reason for separating the two, though my specimens appear to be considerably larger than those from Paraguay.

Pristina longiseta, Ehrbg. (Pl. xvii, fig. 25.)

External characters.—Specimens have an average length of 3—4 mm. The animal is whitish in colour, and fairly transparent. The prostomium is prolonged into a proboscis-like projection, which, during the forward progression of the animal, is frequently bent backwards, at least when examined in the usual way under a cover-slip; it is in length about equal to the diameter of the body (*v.* plates xvii, xviii, figs. 25, 29). The number of segments in the single animal appears to vary between about 20 and 30 (see also below, *Asexual reproduction*). Backward progression is as free and almost as often resorted to as forward progression, and indeed some specimens have appeared to move backwards for choice; in this connection it may be noted that the posterior end of the body is specially well furnished with large sensory "hairs."

Asexual reproduction.—The greater number of specimens examined exhibited some phase of the process of fission. In one case, after the twelfth segment intercalation of new segments had taken place, evidenced by small newly-developed setal bundles; of these there were ten pairs, four belonging to the anterior and six to the posterior animal. In a second case, intercalation had again taken place behind the twelfth segment, and five newly-formed setal bundles belonged to the anterior animal, six, as before, to the posterior; 15 segments had thus been established in the anterior animal, and others were probably in process of formation at the posterior end; while in the posterior animal 21 were established, and others were apparently being produced posteriorly. In a third case the setæ were apparently well grown as

far as the seventeenth segment, behind which three smaller bundles were visible; as before, the first six setal bundles of the posterior animal were new formations; the number of definable segments was thus 20 in the anterior animal, while in the posterior there were 21 In an animal which divided under observation there were in the anterior portion 22 segments *plus* several newly forming at its hinder end, and in the posterior portion 24 *plus* similarly several newly forming posteriorly.

The zone of budding may therefore form as far forward as the twelfth segment; and in the posterior animal it appears to be the rule that the first seven (prostomium, peristomium, and six seta-bearing segments) are new formations.

Chains of three animals are occasionally met with.

Setæ.—The ventral setæ (fig. 27) are of an elongated shape, straight for the greater part of their length, with curved ends; they are unequally forked at their free extremity, and possess a slight nodulus; their length is from a half to two-thirds the diameter of the body; they do not project far outside the body-wall; they occur in bundles of 3 to 9, 5 being the commonest number.

The dorsal setæ begin like the ventral setæ on the second segment, and are capilliform. Those of the second segment are as a rule somewhat shorter than those of other segments. Those of the *third* segment, two or occasionally three on each side, are much longer, about three times the diameter of the body; frequently where there are two in the bundle, however, while one is of the full length just stated, the other is only about two-thirds as long, that is, about equal to twice the diameter of the animal's body. When turned forwards the long setæ reach about as far as the tip of the prostomium. These long setæ, however, appear to be liable to damage on account of their length; they may be found on one side only; or on the posterior of two not yet separated animals only, or even only on one side of this. They may break off while under examination; or a specimen which had them when first examined may, on re-examination after an interval, be found to have lost them. The distinction between this species and the next is thus sometimes rendered difficult. On *the remaining segments* the dorsal setæ attain a length equal to or somewhat greater than the diameter of the body; in the posterior part of the body, where the diameter is somewhat less, they may be nearly twice as long as the diameter of the body.

The dorsal setæ of this species were formerly supposed to be smooth; of late years, however, it has been recognised that they present on one side a fine notching, or series of saw-teeth (Michaelsen [5], [6]; Piguet [7]). These saw-teeth vary in size and visibility in specimens from different localities, and are absent from the specially elongated setæ of the third segment.

I have detected this notching in all specimens where I have specially looked for it; it is visible, though it cannot be called obvious, with a $\frac{1}{12}$ inch oil-immersion lens; it is absent towards the base of the setæ, and does not occur on the setæ of the third segment; the setæ themselves are slightly bowed, and the notching is present on the convex side only; the teeth are set apart at a distance of about 3 μ from each other.

Besides this notching, the dorsal setæ may show also a fine fraying out of the sides, such as has been already described for the *Nais variabilis* of this country. This is often absent, sometimes hardly visible, sometimes obvious; in one case in the dorsal setæ of segments ii and iii, it far surpassed that figured (for *Nais variabilis*) in plate xvi, fig. 9, and the setæ resembled nothing so much as minute feathers with close-set though unconnected barbs.

The explanation of this phenomenon I take to be the same as in the *Nais* previously described.

In number the dorsal setæ are 2, 3, 4 or 5 per bundle; but they are not all of equal length; they may be roughly classified into long, intermediate, and short; the long may be said to be those which are of the full length described above; the intermediate are a half to two-thirds the length of the long; while the short may hardly project beyond the surface of the body.

The *setal sacs* are large, conspicuous, and of bulbous shape (fig. 25). Those of the specially elongated setæ of the third segment were very frequently noticed to be quivering, or oscillating slightly and rapidly in an antero-posterior direction; this occurred when the animal was quite at rest, and when all the other setal sacs (and setæ) were motionless; on seeing it in an animal whose long setæ had been damaged, I thought it might be due to irritation, but I soon found that it occurred also in animals whose long setæ were quite intact. It appears probable, therefore, that the elongated setæ of the third segment have a special sensory function; and that this, and not any advantage in locomotion, is the purpose subserved by their lengthening; the slight vibration of the setæ brought about by the continual small contractions of the muscles attached to the setal sacs would be of use in exploring the surface at the extremities of the setæ.

The *septa* are well-developed. The body-cavity contains *corpuscles*, which contain a varying number of spherical brown bodies resembling minute drops of oil (*v.* fig. 28); in each corpuscle there may be only a few—three or four—such bodies, which are then of relatively large size; or the corpuscles may appear to be made up of a large number of very small brown particles. As a rule these particles are larger than those of similar colour in the walls of the intestine; they may also sometimes be found free in the body-cavity. White refractile particles like those in the corpuscles of *Nais variabilis* may co-exist with the above-described brown droplets.

Alimentary canal.—The *mouth* is transversely placed; the *buccal cavity* occupies the first segment. The *pharynx* is protrusible; cilia may be seen working in its interior, sometimes particularly in an oval patch in its centre (*v.* fig. 25); its apparent extent varies slightly; it may be limited to the second segment, or may extend partly or wholly through the third (*v. inf.*, *septal glands*); it may have a distinctly nodular appearance (figs. 25, 29). The *œsophagus* reaches to the end of the seventh segment; it is of uniform calibre, and has the septal glands attached to it. The *septal glands* (figs. 25, 29, 30, 38) are small masses of somewhat irregular shape, situated at the sides of the œsophagus; they usually appear to rest against the septum posterior to them, but sometimes no definite relation to the septa is to be

made out. They vary in number from two to four on each side; one specimen, however, appeared to have one only on one side; the two sides have not always the same number; there may be four on one side and two on the other. They are attached to the œsophagus by strands of tissue which are probably ducts, often also to the body-wall and to each other. They are present in the fourth and fifth segments, sometimes also in the third, or sixth, or in both third and sixth. The duct of the gland in the sixth segment usually runs transversely to the œsophagus, while the ducts of the glands of the fourth and fifth segments take a more forward course; that of the gland of the fourth segment may reach the hinder end of the pharynx, or may enter the œsophagus in the third segment; when glands are present in the third segment, their ducts enter the hinder end of the pharynx (figs. 25, 29).

In general, the glands are somewhat lobed, of hyaline appearance, and may have some resemblance to an ovary. Their size, like their distribution, is variable.

Beddard [1] describes the septal glands as masses of pear-shaped cells, each cell being prolonged to form its own duct, and the ducts appearing to enter the pharynx. He thinks they are simply epidermic glands which have been invaginated along with the stomodæum.

I have not been able to see the actual prolongation of each cell into a separate duct; and the ducts seem in the majority of cases to enter the œsophagus and not the pharynx. Instead of saying that they are epidermic glands which have become invaginated, I should prefer to describe them as pharyngeal digestive cells which have lost their direct connection with the alimentary canal. My meaning will be clear on comparing the diagrams of the pharynx of *Nais variabilis*, plates xv, xvi, figs. 2, 14, with figs. 29 and 38, plate xviii. The pharynx of *Nais* occupies the third, fourth and fifth segments, and has a nodular appearance due to its being surrounded by a number of ovoid or pear-shaped hyaline cells; it will be at once apparent that the pharynx of *Nais* is the equivalent of the pharynx *plus* most of the œsophagus of *Pristina*; that this part of the œsophagus of *Pristina* is simply the pharynx of *Nais* stripped of its cells, which are here aggregated to form septal glands; and that the variable length of the pharynx of *Pristina* (*v. sup.*) simply depends on the amount of this "stripping" that has taken place. The variations in size, distribution and ducts of the septal glands are thus easier to account for; and it would seem that the "pharynx" of these animals is not so much a muscular organ as a glandular one.

The *stomach* (glandular ventricle of Beddard) is a small globular saccule in the eighth segment (fig. 25). The glandular appearance of its walls is due to large ovoid or tailed nucleated cells, and the longitudinal markings which may be faintly seen are the intervals between these cells. The walls of the stomach contain also a number of brown particles resembling minute droplets of oil. The *intestine* also contains in its wall these coloured particles, which may, however, be absent from the posterior fourth of the body; an "antiperistaltic" action is usually to be observed, as in *Nais*; and the large cilia of this part of the tract work, as also in *Nais*, in a direction from behind forwards.

Circulatory system.—The general relations of the blood-vessels are the same as in *Nais*. The ventral vessel appears to fork at a more posterior level, at about septum 6-7; and the transverse commissures in the œsophageal region are more numerous. These occur regularly in all segments from the second to the seventh inclusive; those in the second segment are non-pulsatile, and are situated in the anterior part of the segment, in front of the level of the setæ of the segment; in all the remaining segments the commissures are pulsatile, and are placed posteriorly, lying on the septum; they increase somewhat in calibre as one passes backwards; and the largest and most obviously contractile are thus those of the seventh segment, which lie against septum 7-8, just in front of the stomach. My description, therefore, does not quite agree with that of Beddard [1, p. 291], who states that there are four vascular arches, in segments v-viii; in another place [*ib.*, p. 290] he admits five. Michaelsen [3] also, in defining the species, places the vascular arches, six in number, in segments iii-viii. As to the position of the most anterior commissure in the second segment in the Lahore specimens there can be no doubt; nor, I think, as to the remainder being on the anterior, not the posterior, face of their respective septa.

The *nephridia* commence regularly in the ninth segment, two segments behind the corresponding position in *Nais*; which may be correlated with the fact that the genital organs in this genus also occur two segments further back than is usual in the Naididæ. Beddard [1] places the first nephridium in the tenth segment. They possess a ciliated funnel, which projects through the septum into the next anterior segment.

The *nervous system* has the usual relations. The cerebral ganglion is deeply indented in front and behind (plate xviii, fig. 31). It reaches behind to the level of the dorsal setæ of segment ii, in front to a level somewhat anterior to that of the mouth. On one occasion when a specimen was viewed from the ventral surface (fig. 32) the ventral nerve cord was seen to present a series of small "button-holes," somewhat similar to those seen in *Chætogaster*, in its anterior portion as far back as the fifth segment.

Sensory organs are apparently represented only by small hair-like projections on the proboscis, and especially also at the hinder end of the body (*cf. ant., External characters*).

The *reproductive organs* will be described afterwards for the two species of the genus. The same ectoparasite so often seen on *Nais variabilis* was also found here on several occasions.

P. longiseta appears to be a somewhat variable species, and Piguet [7] remarks on the differences between his specimens, obtained in Switzerland, and those previously studied by Vejdovsky in Bohemia. The forms observed by me agree with those of Vejdovsky in the gradual passage of the tentacle-like "proboscis" into the pre-oral lobe at its base, whereas in Piguet's specimens the "proboscis" is sharply marked off at its base; and also in the comparatively moderate length of the dorsal setæ of the third segment. They agree, however, with Piguet's rather than with Vejdovsky's in the smaller number of dorsal setæ per bundle, in the facts that the

nephridia begin in the ninth segment and not the tenth, and that there are six pairs of œsophageal commissures, not five, the last being in the seventh segment, not the eighth.

Pristina æquiseta, Bourne.

This worm is also common in certain situations in or near Lahore; a large number were obtainable at one time from a small tank surrounding an artificial fountain in the Municipal Gardens. In general it closely resembles the former species, and the description may therefore be considerably abbreviated.

It is smaller than *P. longiseta*, averaging about 2 mm. in length; it resembles the former species in the elongated prostomium, and frequent backward progression.

The *ventral setæ* are usually three in number in each bundle; in their characters they correspond to those of *P. longiseta*. The *dorsal setæ* of the third segment are not elongated. There are throughout the extent of the animal almost always two in each bundle, of which one is capilliform, and in length equal to the diameter of the body; the other a short "needle" hardly projecting at all from the surface of the body, straight and without nodulus; this second, short seta does not appear to be an immature hair-seta, since its length does not vary, and in all the bundles it is found, as said, just protruding from the surface. I have no record of a "toothed" condition of these setæ similar to that of *P. longiseta*, but quite possibly I have overlooked it.

The *alimentary canal* may be described in the same words as that of *P. longiseta*. Septal glands were seen in segments iv, v, and vi.

The *circulatory system* is also on the same lines, and the œsophageal commissures occur in exactly the same positions; only those in segments vi and vii were, however, seen to be contractile. The *corpuscles* of the body-cavity are of the type described for the former species; and the nephridia begin, similarly, in the ninth segment.

Asexual reproduction was observed, and the number of segments appears to be about 20.

I have no record of *genital organs* in an undoubted specimen of this species; the appearances noted in an animal which most probably belongs to it are recorded below.

This species is distinguished from the last by the absence of the greatly elongated setæ of the third segment; but it is evident that where the long setæ have been damaged, or broken off, or have fallen out altogether, the distinction will be difficult. I have, I believe, been careful to take only specimens where these setæ were quite sound and uninjured for the purpose of the above description; and I believe, further, that the distinction between the two forms can be made by the usually smaller size of this second form, as well as by the peculiarities noted as common to all the bundles of its dorsal setæ, the general occurrence, that is, of only one long capilliform seta with one short needle-shaped seta in each bundle; my specimens of *P. longiseta* have possessed varying numbers of setæ of varying lengths in each bundle, and all capilliform.

I hesitate, however, to describe this second form confidently as *P. æquiseta*, for the following reasons: This species is described, as indeed is the whole genus (Michaelsen [3]), as possessing only capilliform setæ in the dorsal bundles; there is stated to be only one pair of transverse commissural vessels (Michælsen [3]; and Beddard [1]); and the length of the animal is given (Michælsen [3]) as 7—8 mm. In a later publication [5], however, the latter author brings down the length to 2—4 mm.; which does not seriously conflict with the description I have given.

As regards the dorsal setæ it is possible, I think, to suppose that the "needles" described above are in reality hair-setæ arrested at an early stage in their growth; which, so long as their companions are entire, remain in their immature stage, and only receive an impulse to further growth when the accompanying hair-setæ fall out. Seeing that, as stated above, I purposely chose only specimens with perfect setæ, at least on the third segment, for purposes of description, it would follow on the above hypothesis that I should, as happened, find the second or short setæ of each bundle arrested at the stage in which I have described them.

I cannot, however, reconcile the two descriptions of the commissural blood-vessels.

Reproductive Organs of Pristina.

I have grouped together my observations on the genital system of both species of *Pristina*, because they are few in number, and because probably the anatomy of both is the same; moreover, I am not quite confident of the species of one or two of my specimens.

The earliest condition met with is shown in fig. 38. Here there was no clitellum; the seminal vesicles occupy the seventh and eighth segments, and, though apparently consisting of four separate masses, may be all portions of the same sac. These organs had a hyaline or finely granular appearance, and no distinct cells could be made out. Anteriorly in the sixth segment were a few aggregations of small round cells, possibly developing sperm-morulæ.

In fig. 39 the clitellum has developed over the eighth and ninth segments; when this has happened, it is impossible by ordinary examination to make out with exactitude the internal anatomy in that region; the seminal vesicles, however, occupy a large part of those two segments. In segments ix and x is seen an oval mass, pure white in colour to the naked eye, dull and opaque under the microscope by transmitted light, and evidently similar to the mass described (*v. ant.*) in *Nais variabilis*.

In fig. 40, plate xix, the clitellum reaches forwards half way over the seventh segment; a small nodular mass just behind septum 6-7 perhaps represents the testis; the vesiculæ seminales extend backwards to the posterior boundary of the ninth segment, and now contain filiform spermatozoa; a number of sperm masses appeared to be free in the body-cavity in the seventh segment, and at the hinder border of the ninth segment also were two masses of cells which might, from their appearance, have been either young ova or sperm-morulæ. The large opaque body occupied segment x,

This "opaque body" may be extruded uninjured from animals which are beginning to break up under examination in consequence of the drying up of the water or pressure of the cover-glass; it may also be extracted from the animal by manipulation with needles. Its substance consists, as in the case of *Nais variabilis*, of oval or slightly irregular highly refractile structureless particles.

In two specimens modified *genital setæ* were seen. In one case they were on the sixth segment, two in number on each side, and of the shape shown in fig. 33. In the other, the setæ of the sixth segment were not modified, but those of the fourth, though of the usual type, were extraordinarily massive, being slightly longer and twice as thick as the normal form; the forking of the distal end was much more unequal, and the curve sharper, than usual (fig. 34): it is, however, possibly incorrect to call these genital setæ. Both specimens were well advanced as regards the development of the genital organs, and resembled the stage shown in fig. 39.

Variations met with in the genus Pristina.

I wish here to describe two specimens, one of *P. longiseta* and one of *P. æquiseta* which differ from the normal individuals in the greater or less length of the prostomium.

Text-fig. 4 shows the specimen of *P. longiseta*. The *Stylaria*-like elongation

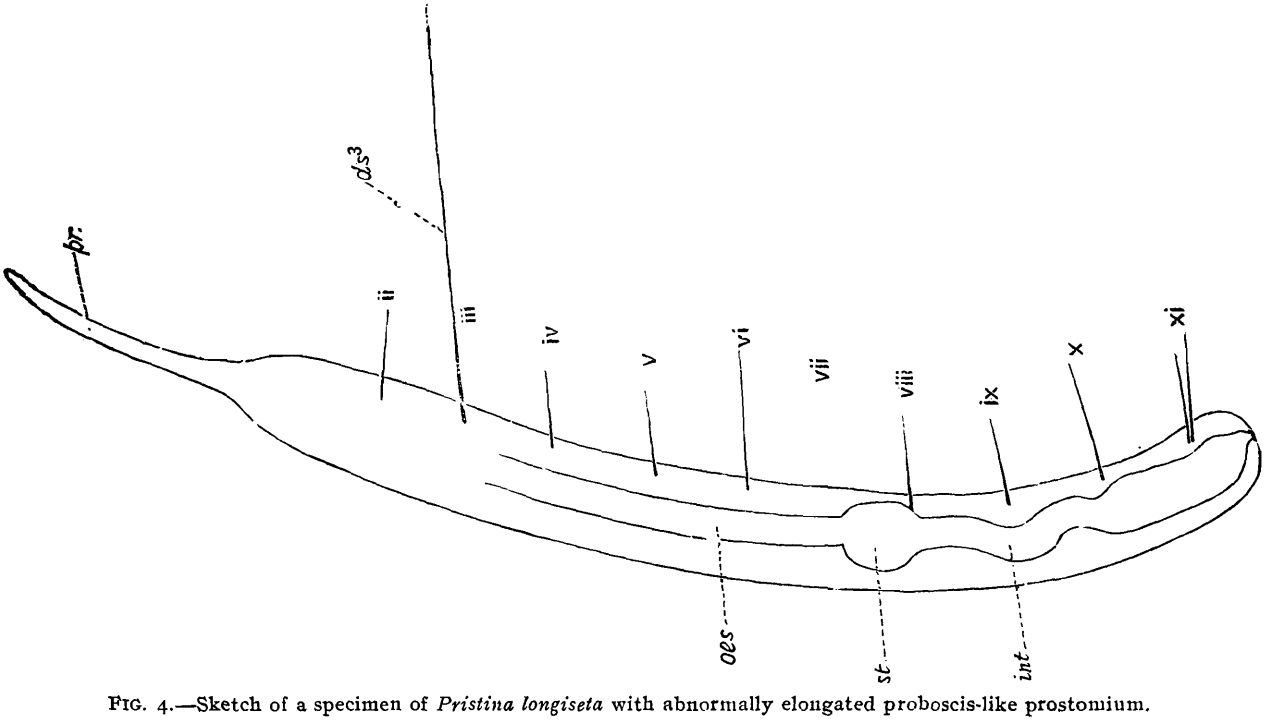

FIG. 4.—Sketch of a specimen of *Pristina longiseta* with abnormally elongated proboscis-like prostomium.

of the prostomium is obvious; but the species of the specimen can hardly be doubtful, in view of the presence of dorsal hair-setæ on all segments behind the first (they have, however, fallen out in the seventh), the great elongation of those of

the third segment, the œsophagus occupying segments iv-viii, and the globular stomach in segment viii. The animal has been mutilated at its posterior end.

Text-fig. 5 shows what is, I think, a specimen of *P. æquiseta*, the prostomium

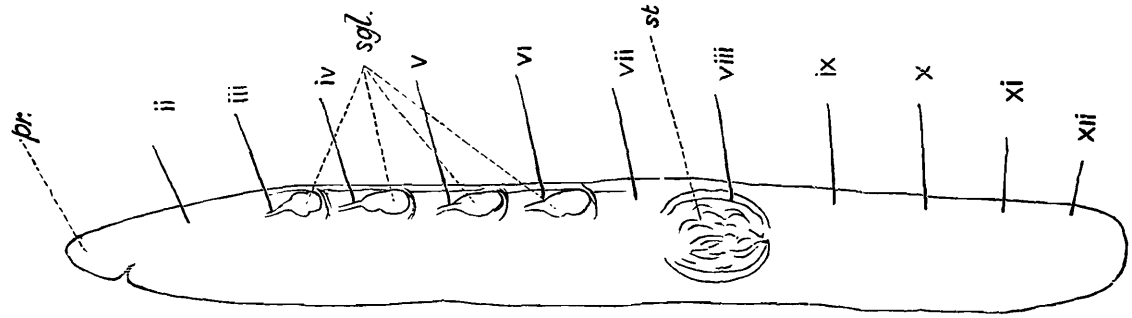

FIG. 5.—Sketch of a specimen of *Pristina æquiseta* with abnormally short prostomium.

exhibiting no elongation at all. It will be seen that the dorsal setæ begin in the second segment and are of equal length in all segments; septal glands are present in segments iii-vi, and a globular stomach in segment viii; and to my original sketch notes are appended to the effect that the dorsal bundles contained constantly one long and one short seta, that the ventral bundles contained three setæ, and that the first nephridium occurred in the ninth segment. In all these points, the specimen agrees with the form just described as *P. æquiseta*. It is curious that this animal, like the last, should also have been mutilated at its posterior end. A second specimen of *P. æquiseta* was also met with, showing a prostomium but little larger than that of text-fig. 5, and much shorter than that of the normal animal.

These variations are interesting as bearing on the morphological value of the length of the prostomium. Beddard [2] is of opinion that it is slight, and would group together under one name genera which differ in little else than the length of the prostomium. It would, in fact, appear from the above specimens that an amount of variation supposed to characterize different genera may occur within the limits of a single species.

Slavina punjabensis, sp. nov. (Pl. xix, fig. 41.)

This worm was found in considerable numbers in two ponds in the Lawrence Gardens, Lahore, during the months of April and May, 1907; and again in April, 1908. In length it varies considerably; the average length appears to be about 6 mm., but specimens up to 12 or 15 mm. have been met with. Like the species of *Pristina* previously described, it moves backwards apparently with as great freedom as forwards.

As seen with the naked eye, its colour is whitish and somewhat opaque; under the microscope, the animal is seen to be covered with foreign particles, diatoms and grains of inorganic matter, which may be so thickly spread as to obscure almost completely the internal anatomy; these foreign particles may be more thinly distributed posteriorly, where the animal is then consequently more transparent. In such cases (fig. 42), there may be seen a homogeneous colourless or slightly yellow

coating on the surface of the body, in which the foreign particles are entangled; this is presumably a mucoid secretion produced by the epidermal cells.

The *prostomium* is rounded, and not at all pointed or conical; in some animals, perhaps recently separated, it is even flattened in front; it is provided with *sensory hairs*. There is a pair of *eyes*, at the level of the mouth, laterally situated, the black pigment of which they are composed having, as in *Nais variabilis*, a violet tinge. One eye may be smaller than the other; there are sometimes numerous "Nebenaugen" in the vicinity (plate xviii, fig. 35). The skin of the general surface very often contains numerous small masses of *pigment*, of a more or less circular, or it may be quite irregular form; their relative size may be seen in plate xx, fig. 50, and will be observed to vary from mere points upwards. In animals which possess this pigmentation the pigment is of a brown colour, and is almost absent from the first five segments; it is absent again from several segments at the posterior end of the animal, and, as seen in the figure, from the newly-formed segments at the zone of budding. The extreme posterior end of the animal, immediately around the anus, is ciliated, the cilia being an extension of those which here, as elsewhere, line the intestine.

The skin bears a number of small sensory papillæ; these are projections of the shape of a truncated cone, or are sometimes cylindrical; they bear a number of minute stiff hairs on their summit; they are clear, colourless, and not covered by foreign particles.

Their distribution is somewhat variable; they may, for example, be arranged fairly regularly in rows across the dorsal surface of the animal, one row in each segment from the anterior to the posterior end; or they may be absent from the posterior end of the body; or they may be segmentally arranged as far back as the sixth segment, and be less numerous and less regular behind this; or the converse may be the case, *i.e.*, the segmental arrangement may be better marked behind the sixth segment than in front. The prostomium may or may not bear them; the ventral surface appears to be altogether without them; and they frequently seem to be especially well-developed in two lines along the lateral surfaces of the body.

The level of the transverse rows of papillæ is that of the insertion of the dorsal setæ in each segment. The papillæ are not themselves retractile, but the papilla as a whole may be (probably temporarily) depressed into a slight pit on the external surface of the body, from the bottom of which it then appears to arise.

The number of *segments* varies considerably. The smallest number counted was 23; several animals were noted as having over 40, in one case 46. There is a small region of the body posteriorly where definite segments are unrecognizable, not as yet having been differentiated The first five segments may be very short.

A number of specimens were seen which I was at first inclined to regard as pathological. They possessed no distinctly differentiated head (plate xx, fig. 51), no eyes, and no recognizable pharynx. That the portion of the animal shown in the figure is the anterior end is evidenced by the long setæ; and what has presumably happened

is that this specimen has been separated by fission before the complete development of the structures at the head end; thus there are only three pairs of ventral seta; bundles in front of the beginning of the dorsal setæ and these contain only one seta each. Figure 52 shows an animal with eyes as yet on one side only. It seems possible that this early separation may be the rule in the species; but my observations do not allow of a definite statement.

The *ventral setæ* are present in all segments from the second onwards. They resemble those of the foregoing genera in type, being curved like an elongated ∫ the length varies from about ·14 mm. (anteriorly) to ·12 or ·10 mm. (posteriorly); they are forked distally, with the prongs of equal length, and the proximally situated prong of the fork much stouter than the other. The nodulus is situated slightly proximally to the middle of the length of the seta, and is a little more prominent on one side than the other (fig. 36). There are usually three in a bundle, sometimes two or four.

The *dorsal setæ* begin in the sixth segment. They are long and short, the long being typical hair-setæ, and the short probably having the same relation to these as that surmised to exist between the long and short setæ of *Pristina* (*v. antea*); that is to say, they may be looked on as immature hair-setæ, destined to take on further growth when the long setæ of the bundle drop out. In the sixth segment the long setæ may be as much as three times the body-diameter in length, about ·8 mm.; shorter lengths, for example one of two diameters, may be met with; these specially elongated setæ may be broken, or may exist only on one side. In the remaining segments their ordinary length is about the diameter of the body, or somewhat less than this (max. 4 mm.; more usually ·3—·25 mm.); they diminish somewhat in size towards the hinder end of the body.

These setæ are frequently smooth; but not uncommonly they present, like the corresponding setæ of *Nais* and *Pristina* (*v. antea*), many fine thorn-like projections (plate xviii, fig. 37), to which foreign particles may adhere. The explanation of these "thorns" I take to be the one I have given for *Nais variabilis*; and this is to some extent supported by the fact that the setæ in the anterior part of the body may be found to possess these "thorns," that is, to have become frayed out, while the younger setæ, at the hinder end of the body, remain quite smooth.

The short setæ are needle-like, ·07 mm. in length, have no curve, end in a single point, and may scarcely project at all from the surface of the body; in any case they are very short. Intermediate sizes between the long and short setæ are not found, or found only rarely.

The general rule as to the composition of the dorsal setal bundles is that one long and one short seta exist together in each. Two long setæ are sometimes seen, two short setæ with one long one also occur; rarely a bundle occurs where no short seta is visible at all. All setæ may be absent from a bundle, perhaps in consequence of injury.

The body-cavity contains a large number of *corpuscles*. These are unlike those of the previous genera; they are very large, and the bulk of the substance of which

they are composed is perfectly clear, like clear glass; but the majority contain also a quantity of granular matter, opaque, and of a dark brown colour, which may be aggregated within the corpuscle into all kinds of irregular shapes (fig. 43). Some corpuscles contain no granular matter and are quite clear.

Alimentary tract.—The *pharynx* occupies the second, third, fourth and fifth segments; it is lobulated in appearance (fig. 41), this being due to the large cells with which it is surrounded. The *œsophagus*, in the sixth and seventh segments, has in its walls a number of minute brownish globules, similar to those described in the alimentary tract of the previous genera; these globules are present throughout the subsequent length of the tract. The *stomach* is shown in fig. 41 as a globular dilatation in the eighth segment; it varies, however, in distinctness, it may be but a slight dilatation, or there may be no recognizable stomach at all. Since the actual character of the walls of the tract is the same from the œsophagus onwards, it follows that in the last case no differentiation of separate parts of the canal exists behind the pharynx.

The *intestine* presents the same phenomena of a reversed ciliary action and antiperistalsis as have been noted for *Nais* and *Pristina*.

It will not be necessary to describe the remaining systems in detail. The *pharyngeal commissures* of the vascular system form a plexus, not a series of simple arches. The first *nephridium* is in the seventh segment; on one occasion it was seen in the sixth, and fig. 52 shows a specimen where it is drawn in what appears to be the fifth segment. In the case where it was seen in the sixth, the dorsal setæ were observed to begin in the fifth segment; and the figure just referred to is (*v. antea*) that of an animal whose anterior end is not fully developed. It would seem, therefore, that one, or in the second case two, segments are still to be added before these particular animals are fully formed; and we may here compare what was said previously as to the possibility of early separation of the posterior animal, before the full number of anterior segments has been produced, being the rule in *Slavina*. The two halves of which the *cerebral ganglion* of the Naididæ is always more or less obviously composed, are much more distinct in this species than is usual. Figures 44 and 45 show it to consist of two oval or somewhat triangular masses, distinct from each other, but closely apposed in the middle line. *Reproductive organs* were not observed.

Only two species of *Slavina* are described by Michaelsen [3], and of these only *S. appendiculata*, Udek., possesses cutaneous papillæ. This species has, besides small papillæ, regular circular rows of larger sensory projections, which correspond, I think, to the papillæ I have described for the present form. There can be little doubt as to the close connection of this form with *S. appendiculata*, from which latter, however, it differs in possessing only one row of the large papillæ per segment, in having pseudexiform instead of simple commissural vascular arches, as well as, perhaps, a smaller number of setæ in the sixth dorsal bundle. I propose for it the name *Slavina punjabensis*.

Stylaria lacustris, L. (Pl. xix, fig. 46.)

A single specimen of *Stylaria* was observed, of which the following is a short description:—

The worm was very active, resembling certain insect larvæ in its quick wriggling movements. Under the microscope, it was transparent The long proboscis-like *prostomium* is shown in the figure (fig. 46); *eyes* were present; the posterior end of the body was provided with *sensory "hairs."* The specimen was preparing to divide asexually, the anterior half having 21, the posterior 22, segments; the region around the site of division was darker and less transparent, and the skin was thicker here.

The dorsal setæ began in the sixth segment, were capilliform, smooth, in length equal to the diameter of the body, or somewhat shorter than this; they were two, or sometimes three, per bundle, but of these only one in each bundle was of the full length given above. The *ventral setæ* occurred in all segments from the second onwards; while more or less of the usual type, the proximal prong of the fork was very small, and the nodulus distinctly one-sided (*v.* fig. 47); there were five or six in each bundle.

A few brown *corpuscles* were present in the body-cavity. The *pharynx* occupied the region from the second to the fifth segment inclusive; the *stomach* was a slight dilatation in the eighth; the *intestine* showed the usual antiperistalsis, and ciliary motion in its posterior portion. The *blood* was colourless; there were no blood-corpuscles. The first nephridium occurred in the ninth segment (as in *Pristina*, not as in *Nais* and *Slavina*). The posterior horns of the *cerebral ganglion* were much elongated, and the anterior portion of the mass was of a more granular appearance than the rest (fig. 48).

Though no reproductive organs were seen, the above description, so far as it goes, corresponds to that of *S. lacustris*, L., and is perhaps of interest as being probably the first record of the genus from the Punjab. Up till 1900, at least, it had been recorded only from Europe and North America.

General Remarks on the foregoing species.

Though most of the species described above are already known, I have given somewhat detailed accounts of them, because it may be of interest to compare descriptions even of the same species from widely distant countries; and because in some respects, *e.g.*, the reproductive organs, our knowledge of the anatomy of the Naididæ is still defective.

Besides referring to the interest of the fact of the occurrence of the forms in the Punjab, I may be allowed here to mention the following points, brought out in the above descriptions, which, though not in all cases new, seem to me to merit notice:—

(1) The very variable and irregular thorn-like projections on the dorsal setæ of several forms, and their probable cause.

(2) The suggested sensory function of the dorsal setæ of the third segment of *Pristina longiseta*.

(3) The variations of the length of the prostomium in the genus *Pristina*, and the morphological value of this structure.

(4) The comparison of the pharynx of *Pristina* with that of *Nais*, and the conception of the morphology of the septal glands of the former.

(5) The "antiperistaltic" action and the reversed ciliary current in the intestine of all these forms, and the probable respiratory significance of these. Though the phenomenon of intestinal respiration is well known in the Polychæta, I have not, even in the larger works of reference, found mention of a similar occurrence among the Oligochæta. (*Cf.*, also, its occurrence in a species of *Æolosoma* described by me [9].)

(6) The concomitance of sexual and asexual reproduction in *Nais variabilis*; it was formerly stated that these two processes alternate and are mutually exclusive in the Naididæ; I have, however, also observed their co-existence in a species of *Chætogaster* [9]. Michaelsen [4] has done so in *Nais elinguis*, and Piguet [7] has observed the same in several forms.

(7) The ectoparasite of *Nais variabilis*.

ÆOLOSOMATIDÆ.

Æolosoma hemprichi, Ehrbg. (Pl. xx, figs. 53—55.)

The following record of the occurrence of this form, not hitherto, apparently, described from anywhere in Asia, may be of interest. The description which follows is fairly full, in order to facilitate more accurate comparisons with the accounts of the species as it occurs in Europe and America.

The worm is fairly common in stagnant waters in and near Lahore. It will live and multiply under somewhat unfavourable artificial conditions; thus it was found in numbers in a glass vessel in the laboratory verandah after the summer vacation, and I found it again in the same vessel a few days ago (January); the vessel has remained in the same place for six months, the water being occasionally replenished from the tap. *Chætogaster punjabensis* was similarly found on both occasions and seems to be equally hardy, and resistant to both heat and cold. *A. hemprichi* will live a whole morning under microscopic examination, though the water around it may, through inadvertence or otherwise, be suffered repeatedly to evaporate almost completely.

Its length is on the average about 1 mm. (·85—1·35 mm. extended, as little as ·45 mm. contracted). Its diameter varies greatly, according to the degree of contraction or extension, and is usually about ·06 mm. Owing to its transparency, it is scarcely discoverable by the naked eye in its usual surroundings, and has to be searched for with a lens. Progression in an anterior direction is a smoothly-gliding

movement, as in other species of the genus; backward progression is effected by a series of jerks, as in the Naididæ.

The *prostomium* is large, rounded, flattened, broader than the body, very mobile, and continually altering its shape; its ventral surface is ciliated; no special ciliated pits were observed. The œsophageal region, which succeeds the buccal funnel, is followed by the region of the stomach, where the diameter of the body is greater than at other parts; the region of the stomach may be said roughly to comprise the middle third of the animal; behind it, the diameter gradually diminishes to the posterior end.

The *oil-drops*, which occur in the integument over the whole body, are of a bright brownish-red or very deep orange colour. They vary in size, and there is always a special aggregation of very large droplets at the extreme posterior end of the animal; the single drops may here reach ·01 mm. in diameter, or about one-fifth of the width of the animal at this part (figs. 53—55). Over the remainder of the body they vary from ·006 mm. downwards. They are absent from the under surface of the prostomium. They lose their colour soon after the death of the animal.

The number of *segments* of the single animal varies from eight to eleven. Specimens preparing to divide asexually contained seven or eight segments in the anterior, six or seven in the posterior half. Elongated chains of three, four, or more animals have not, so far, been met with.

The *setæ* are arranged in four bundles per segment, two dorsal and two ventral, beginning just behind the posterior end of the buccal funnel. They are almost straight, sometimes very slightly bowed or ∫-shaped. They are all capilliform, and vary in length, being usually about equal to the diameter of the body. The number in each bundle varies from two to five.

There are no definite septa, but strands stretch across the body-cavity from body-wall to alimentary tube; these are more numerous at the site of an approaching division. Some large body-cavity *corpuscles* were seen on one occasion, possibly broken off from the sides of the alimentary canal (*cf.* the large cells, *c.*, in fig. 55).

The *buccal funnel* has a thick, prominent rim, the lateral limbs of which bend outwards at their dorsal and anterior ends (fig. 53, *r.*). Ciliary motion is markedly visible in the interior of the funnel. The *œsophagus* occupies the second and third segments, the *stomach* the fourth, fifth and sixth. The *stomach* has thicker and more granular walls than the rest of the tract, and its calibre is greater; its walls are ciliated; the cilia move in an antero-posterior direction sometimes, sometimes in the posterior half in the reverse direction, and sometimes the motion is not definitely in either direction.

The case is different in the *intestine*, where the ciliary action is always postero-anterior; it may be very violent and distinct, so as to be visible with the low power of the microscope. The intestine also exhibits the same "antiperistaltic" movements that are such a marked feature in the Naididæ; these may extend as far forwards as the anterior end of the stomach; or may, for a time, be confined to the stomach; or, as in one case observed, there may be an antero-posterior peristaltic movement

in the anterior third of the stomach, and an "antiperistaltic" (postero-anterior) movement through the whole of the alimentary tract behind this, which, meeting the direct (antero-posterior) movement in the stomach-walls, overcomes the latter and then continues forward.

The *ventral blood-vessel* is intimately connected with the alimentary canal for the greater part of its extent; it is a wide tube, nearly as wide as the lumen of the alimentary tract itself (*cf.* fig. 55), non-contractile, bifurcating posteriorly to the buccal funnel, and thence continued forwards as two commissural vessels in the funnel-wall, meeting dorsally at the base of the cerebral ganglion. There is in the intestinal region no separate *dorsal vessel*, but a system of lacunæ or *sinuses* in the intestinal wall; this system does not seem usually to be independently contractile, apart from the "antiperistaltic" contractions of the intestinal wall; but on one occasion, in a very sluggish, somewhat contracted animal, where the "antiperistaltic" contractions were entirely in abeyance for some time, the sinuses in the intestinal wall kept up a rhythmical postero-anterior contraction of their own. The system of sinuses extends through the stomach also; but here a distinct though small dorsal vessel makes its appearance as an interrupted cavity much smaller in its vertical calibre, as seen from the side, than the well-marked ventral vessel. In the œsophageal region there is, dorsally situated, a series of large, vacuole-like chambers, or a single chamber traversed by strands or septa, which extends forwards to just behind the first setal bundles; this, probably formed posteriorly by the union of the dorsal vessel and sinus system of the stomach, is continued forwards as a definite blood-vessel as far as the base of the cerebral ganglion; it is contractile as far as this latter point, usually in a postero-anterior direction, the contractions at times appearing to be a continuation forwards of the "antiperistalsis" of the alimentary tube, while at other times they are quite unconnected with the rhythm of the latter. On two occasions the contractions of this part of the vascular system were certainly not definitely postero-anterior, and appeared to be rather in the reverse (antero-posterior) direction.

The *blood* is colourless, and contains no corpuscles.

The *nephridia* usually begin in the space between the first and second setal bundles; on one occasion one only could be defined in this place, and on two occasions they were absent here on both sides, beginning between the second and third setal bundles. They are always present here and in the succeeding space, but posteriorly there are slight variations in their distribution, the fourth, or fifth, or sixth setal interspace being sometimes destitute of nephridia. The hindmost segments seem never to have nephridia; I have not noted their occurrence behind the seventh setal bundles. They open anteriorly by a large ciliated funnel; and appear to have an attachment to the wall of the alimentary canal.

The *cerebral ganglion* is rounded in front, markedly indented behind. As is the rule in the genus, it is closely connected to the surface epithelium, appearing in a lateral view (fig. 54, *c.g.*) merely as a local thickening of the latter. No nerve cords or commissures were discoverable.

Genital organs were not seen in any of the specimens examined.

This form thus resembles closely *A. hemprichi*, according to the diagnosis of the latter as given in Michaelsen's Oligochæta [3]. The specimens hitherto observed elsewhere would appear, however, to have been considerably larger (2—5 mm.), and to have varied more widely (4—13) in the number of their segments.

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EXPLANATION OF REFERENCE LETTERS USED IN THE PLATES.

The small Roman numerals (i, ii, iii, etc.) indicate the numbers of the segments.

An., anus; *b.c.*, buccal cavity; *b.f.*, buccal funnel; *c.*, large cells adhering to cœlomic surface of intestinal wall; *c.g.*, cerebral ganglion; *cil.*, cilia; *cl.*, clitellum; *con.*, constriction where fission is about to take place; *conn.*, connecting strands between intestine and body-wall; *corp.*, corpuscles of the body-cavity; *d.*, duct of

septal gland; *d.b.v.*, dorsal blood-vessel; *d.s.*, dorsal setæ; *d.s*^{1}., first dorsal setal bundle; *d.s*^{2}., *d.s*^{6}., etc., the dorsal setæ of the second, the sixth segment, etc.; *e.*, eye; *f.b.*, foreign bodies; *gg.*, the ganglia of the ventral chain; *int.*, intestine; *int. cil.*, ciliated wall of intestine; *m.*, mouth; *mor.*, sperm-morulæ; *m.s.*, muscle of the setal sac; *muc.*, mucoid coating; *n*^{1}.—*n*^{4}., the four pairs of nephridia; *nau.*, "Nebenaugen"; *n.c.*, nerve-commissure; *o.*, oil-drops; *o.b.*, "opaque body"; *oes.*, œsophagus; *ov.*, ova; *par.*, parasite; *pg.*, pigment-bodies; *ph.*, pharynx; *ph.cil.*, the specially ciliated region of the pharynx; *pr.*, prostomium; *pr*^{2}., prostomium of second animal; *r.*, rim of buccal funnel; *r. sem.*, receptaculum seminis; *s.*, spaces of peri-intestinal sinuses; *s.gl.*, septal glands; *s.h.*, sensory hairs; *sp.*, septum; *sp.g.*, subpharyngeal ganglion; *s.s.*, setal sac; *st.*, stomach; *sz.*, spermatozoa; *tes.*, testis; *v.n.c.*, ventral nerve cord; *v.s.*, ventral setæ; *v.s*^{1}., first ventral setal bundle; *v.s*^{2}., *v.s*^{3}., etc., the ventral setæ of the second, third segments, etc.; *v.sem.*, vesicula seminalis; *v.v.*, ventral blood-vessel.

EXPLANATION OF PLATE XVI.

FIG. 9. An extreme example of the thorn-like processes on the dorsal setæ of *Nais variabilis*, var. *punjabensis*.

,, 10. Needle-seta of a dorsal bundle of *Nais variabilis*, var. *punjabensis*.

,, 11. Abnormal seta from a dorsal bundle of *Nais variabilis*, var. *punjabensis*.

,, 12, 13. Two forms of setal sac of *Nais variabilis*, var. *punjabensis*.

,, 14. Anterior end of a specimen of *Nais variabilis*, var. *punjabensis*, to show partial detachment of pharyngeal glandular cells from alimentary tube.

,, 15. Anterior portion of *Nais variabilis*, var. *punjabensis*, to show relations of cerebral ganglion and commissures.

,, 16—18, and Plate XVII, figs. 19—21. Various stages in the development of genital organs of *Nais variabilis*, var. *punjabensis*.

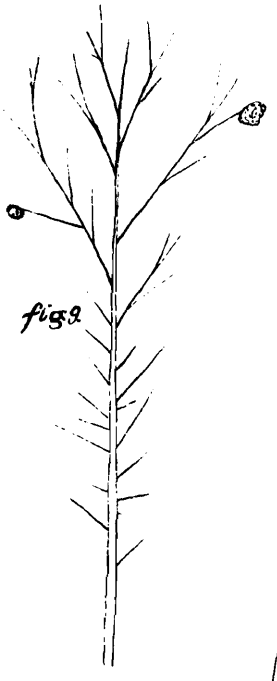

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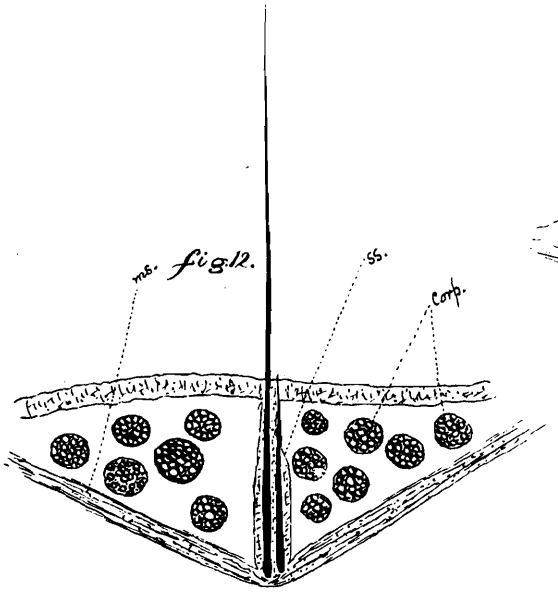
fig. 10.



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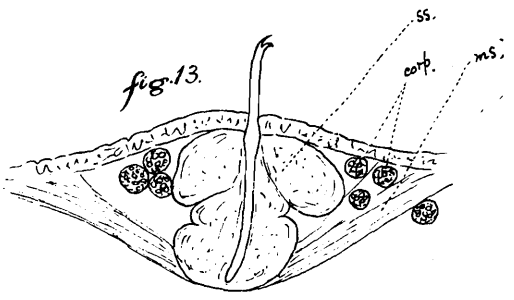

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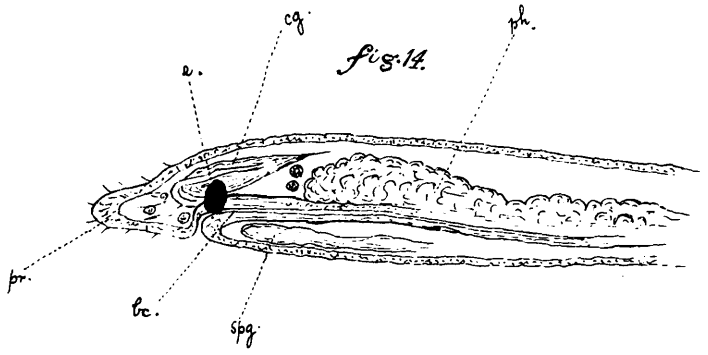

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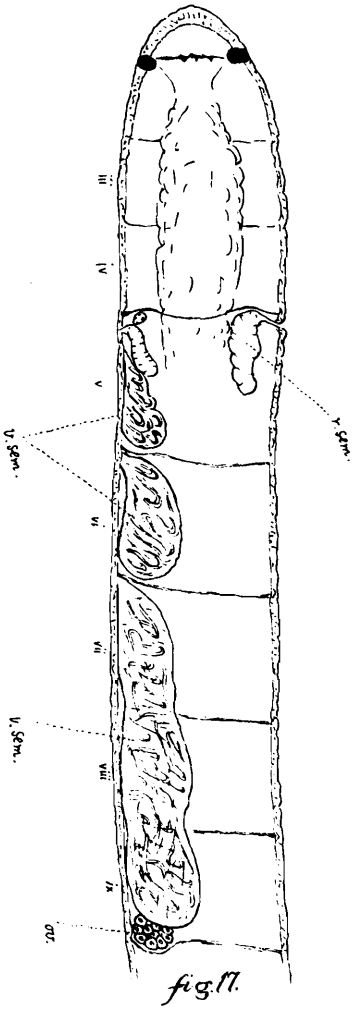

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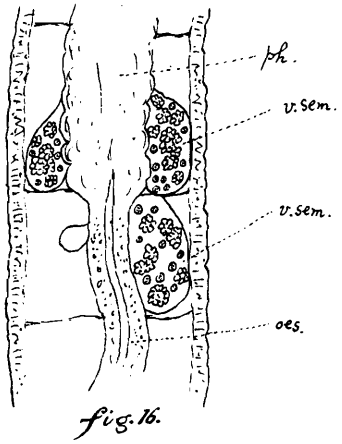

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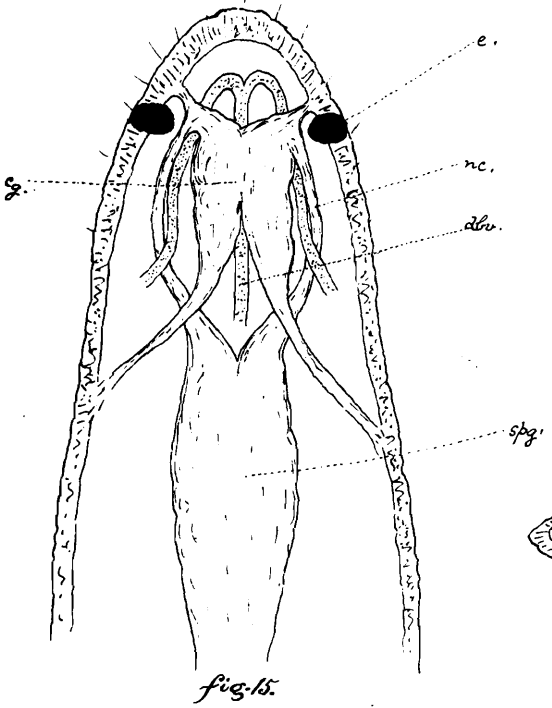

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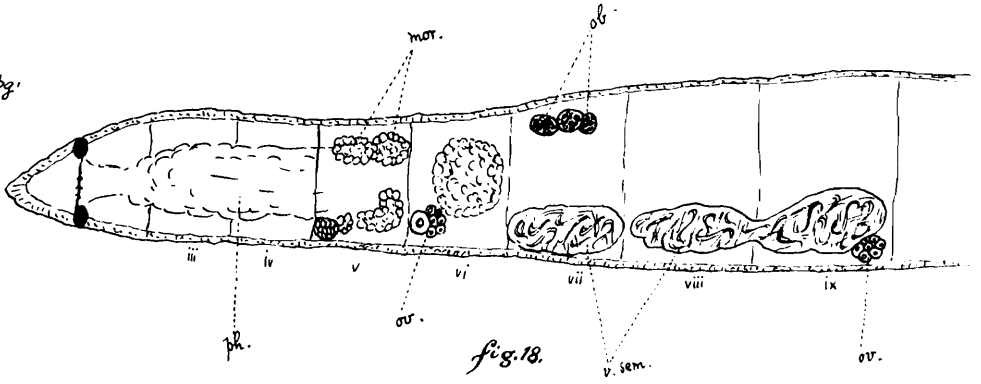


fig. 18.

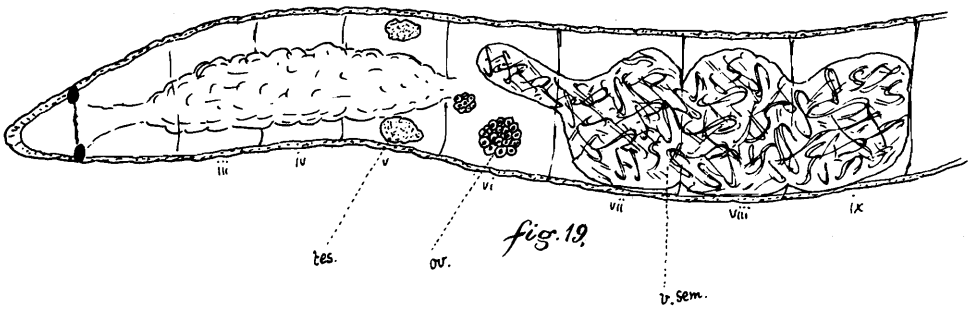
EXPLANATION OF PLATE XVII.

FIG. 22. General outline of a specimen of *Nais paraguayensis*, with active budding at the posterior end.

,, 23. Ventral seta of *Nais paraguayensis*.

,, 24. Shorter seta of the dorsal bundles of *Nais paraguayensis*.

,, 25. General view of *Pristina longiseta*; the species is determined by the elongated dorsal seta of the third segment of the posterior animal, the corresponding setæ of the anterior animal having probably been damaged.



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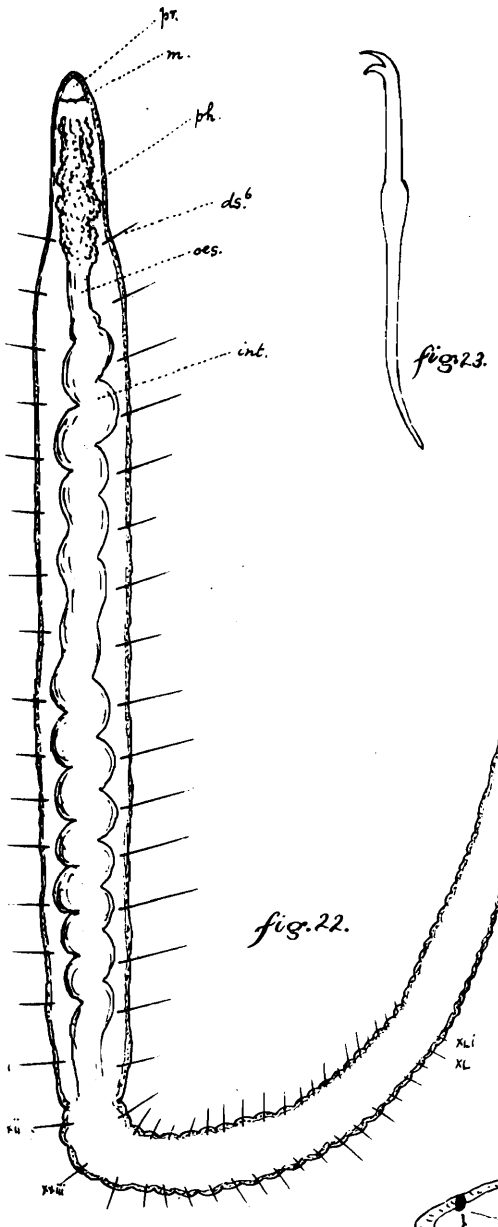

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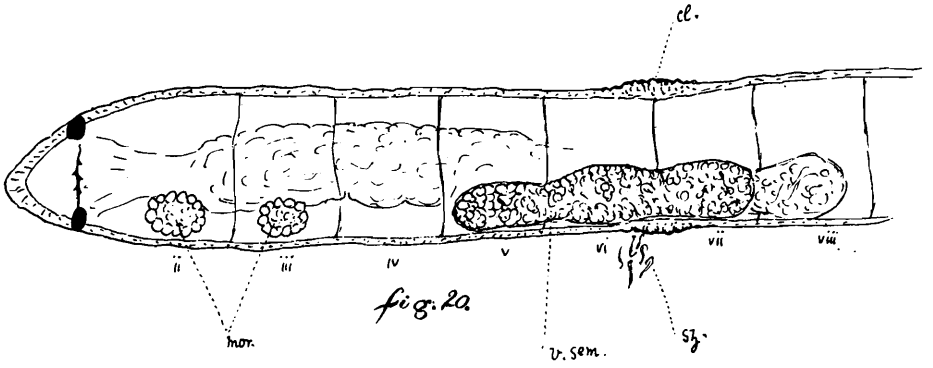
fig. 22.



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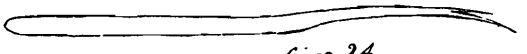

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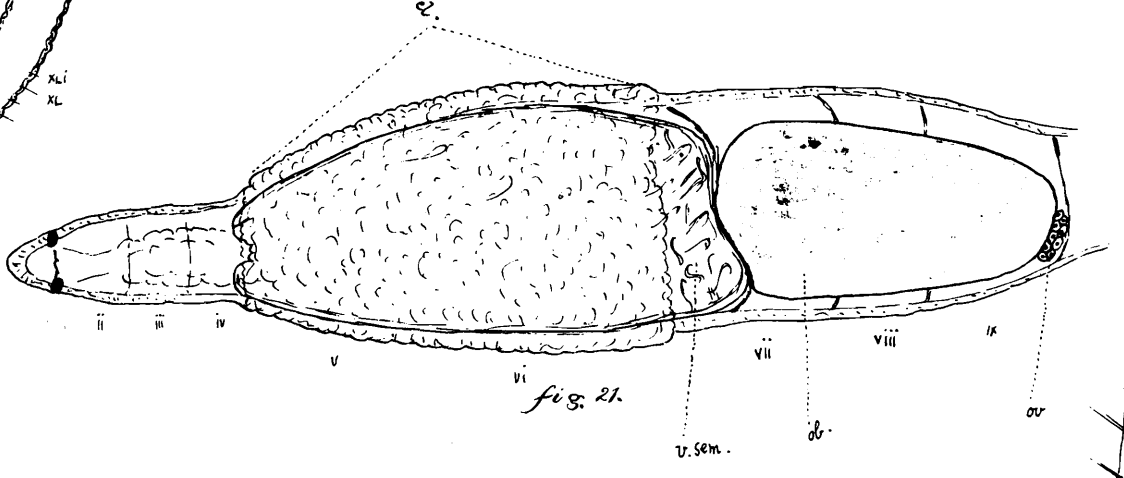

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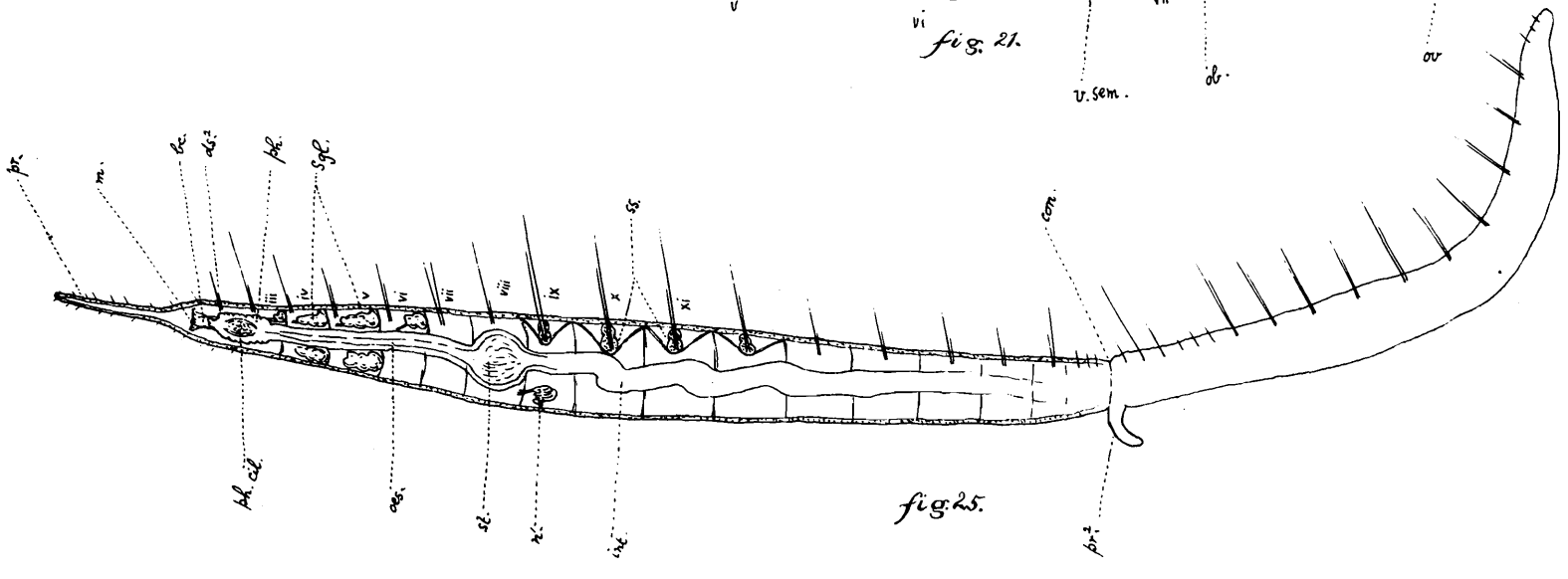


fig. 25.

EXPLANATION OF PLATE XVIII.

FIG. 26. Ventral seta of *Pristina longiseta*.

,, 27. Dorsal seta of *Pristina longiseta*, showing thorn-like projections.

,, 28. Corpuscles of the body-cavity of *Pristina longiseta*.

,, 29. Anterior part of a specimen of *Pristina longiseta*, showing an arrangement of the septal glands, with the ducts of those of the third segment.

,, 30. A septal gland of the sixth segment of a specimen of *Pristina longiseta*, showing attachments to œsophagus and body-wall.

,, 31. Anterior part of *Pristina longiseta*, to show shape and relation of cerebral ganglion.

,, 32. Anterior part of ventral nerve cord of *Pristina longiseta* to show "button-holing."

,, 33. Genital setæ from the sixth segment of *Pristina longiseta*; the distal end is upwards.

,, 34. Modified ventral seta from the fourth segment of a reproductive individual of the species *Pristina longiseta*.

,, 35. Eyes and "Nebenaugen" of *Slavina punjabensis*.

,, 36. Ventral seta of *Slavina punjabensis*. (The ventral prong of the fork is shown slightly too short.)

,, 37. Dorsal seta of *Slavina punjabensis* with small thorn-like projections.

,, 38, 39, and Plate XIX, fig. 40, stages in the development of the reproductive organs of *Pristina*. Figure 38 is a specimen of *P. longiseta*, and shows also the septal glands with their ducts; fig. 39 is probably *P. æquiseta*, and fig. 40, Plate XIX, is also *P. æquiseta*.

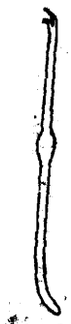


fig. 26.

fig. 27.

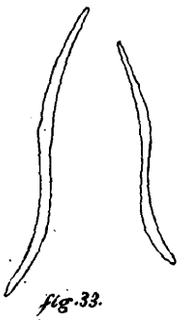


fig. 33.

fig. 28.

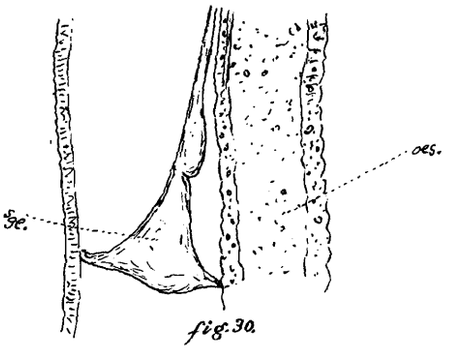
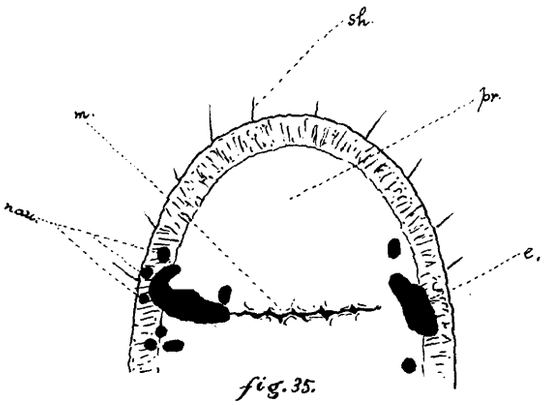


fig. 30.

fig. 37.

fig. 34.



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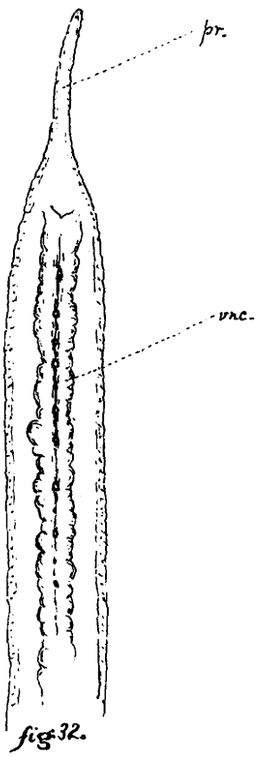

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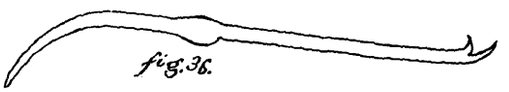

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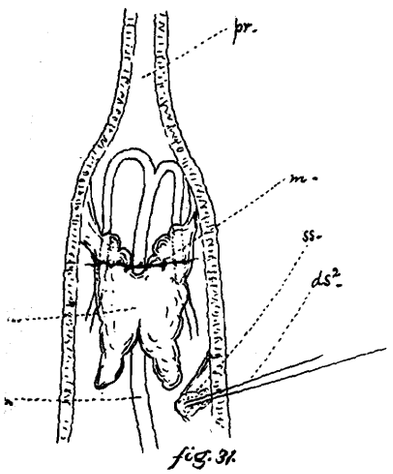

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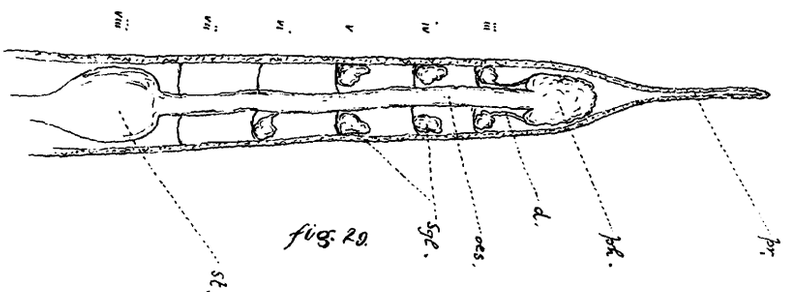

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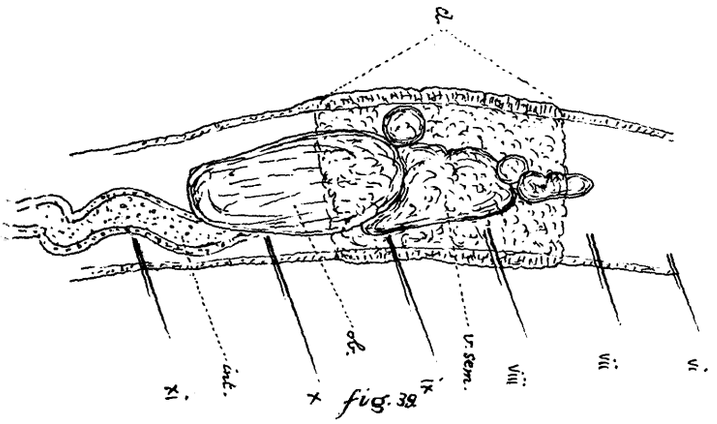

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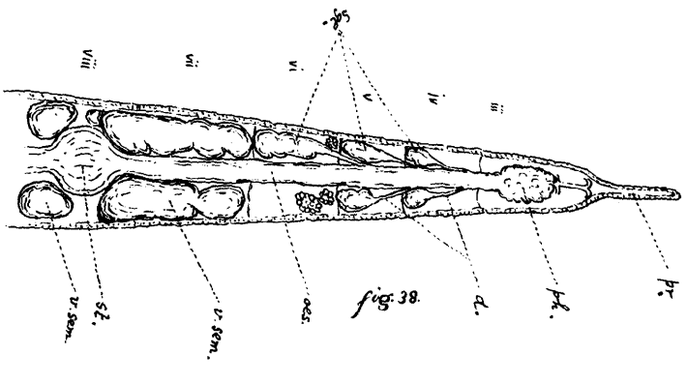

fig. 38.

EXPLANATION OF PLATE XIX.

FIG. 41. General view of *Slavina punjabensis*.

,, 42. Hinder end of *Slavina punjabensis*, to show the posterior cilia, the secretion covering the body, and the entangled foreign particles.

,, 43. Corpuscles of the body-cavity of *Slavina punjabensis*.

,, 44. Relations of the cerebral ganglion of *Slavina punjabensis*.

,, 45. Cerebral ganglion of *Slavina punjabensis*, the two halves being of a triangular shape.

,, 46. General view of the anterior part of *Stylaria lacustris*.

,, 47. Ventral seta of *Stylaria lacustris*.

,, 48. Cerebral ganglion of *Stylaria lacustris*.

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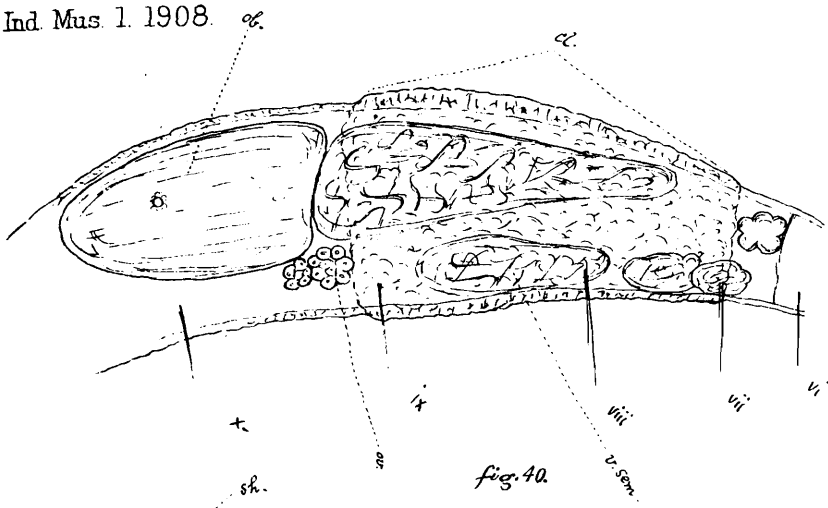

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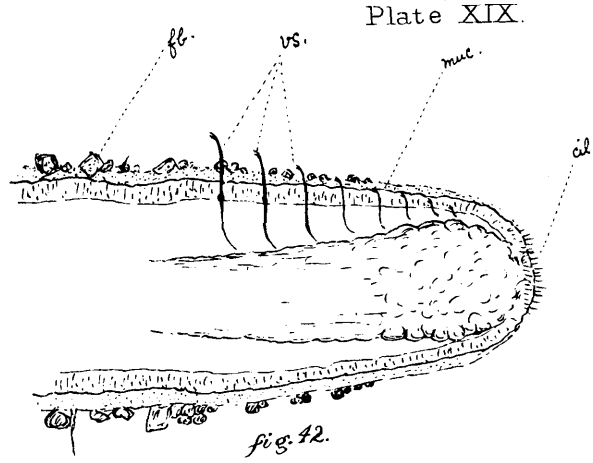

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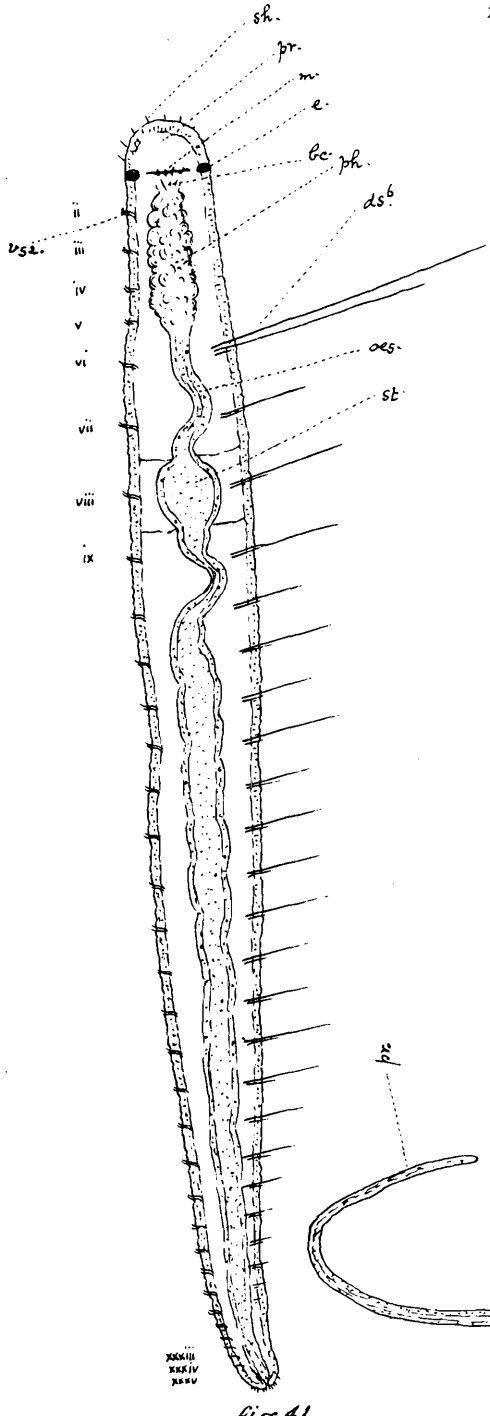
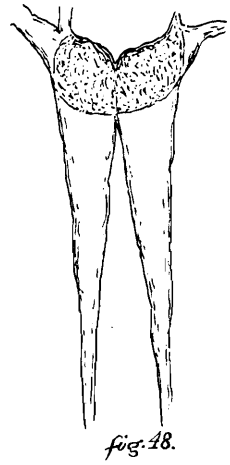


fig. 41.

fig. 47.



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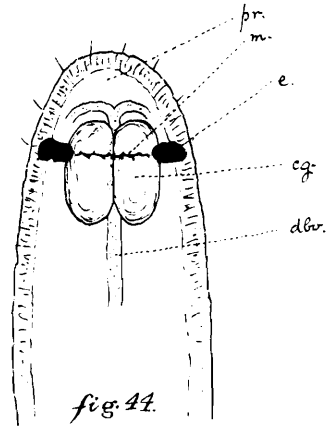


fig. 44.

fig. 45.

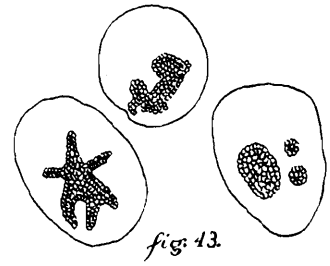


fig. 43.

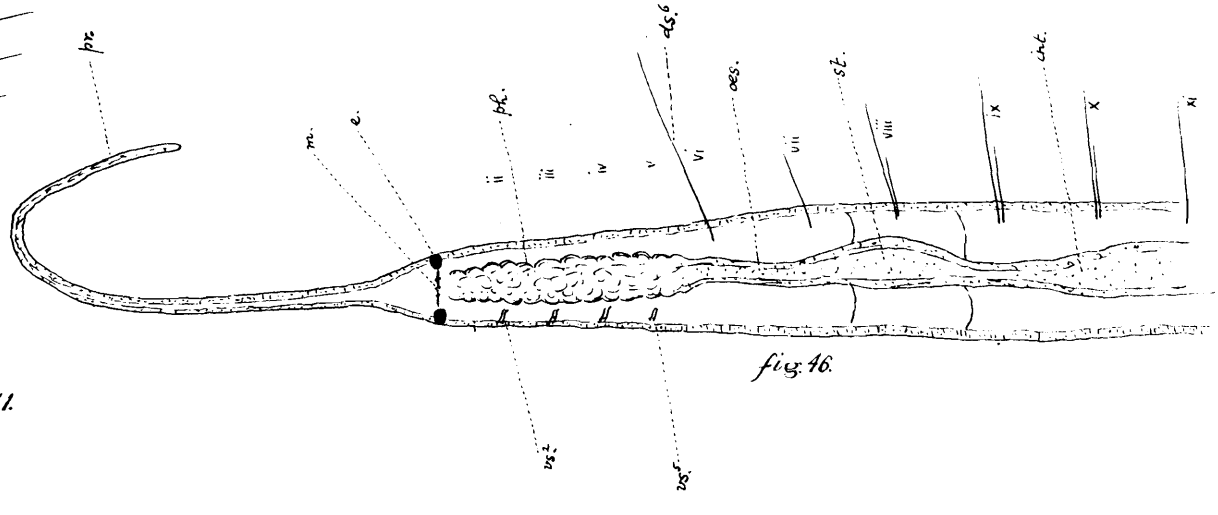


fig. 46.

EXPLANATION OF PLATE XX.

FIG. 49 *a-e*. The ectoparasite of *Nais variabilis*, var. *punjabensis*.

,, 50. Site of approaching fission in *Slavina punjabensis*, to show distribution of pigment.

,, 51, 52. Two individuals of *Slavina punjabensis* which have probably recently separated and the anterior ends of which have not yet developed completely. The first nephridium in fig. 52 is in the fifth segment.

,, 53. *Æolosoma hemprichi*, seen by transparency. Only one set of setæ is shown, and the oil-drops in the superficial epithelium are indicated only in the prostomium and at the posterior end. The nephridia are absent from the first and fifth setal interspaces.

,, 54. Head of the same, seen from the side.

,, 55. Hinder end of the same, showing peri-intestinal sinuses. A few oil-drops are shown near the anus.

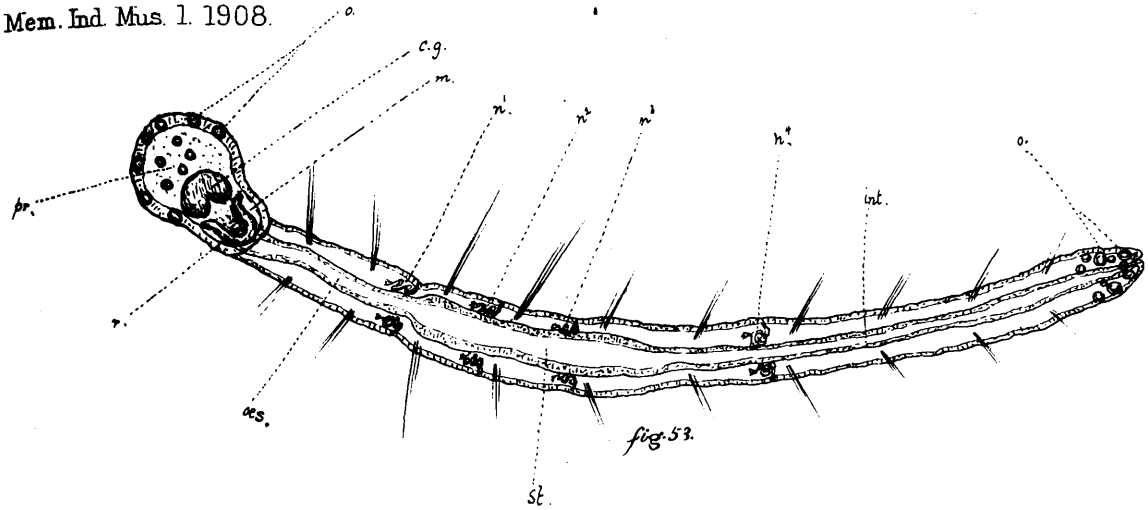


fig. 53.

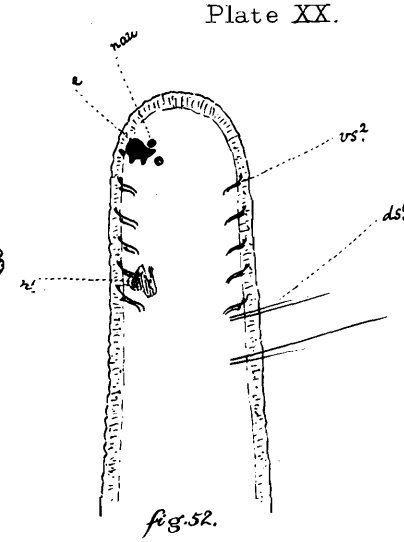


fig. 52.

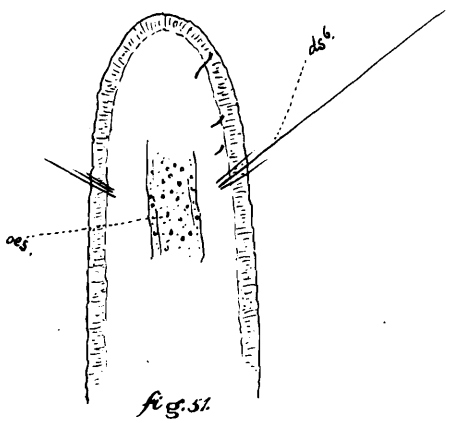
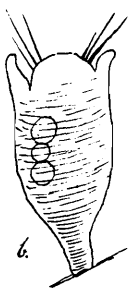


fig. 51.



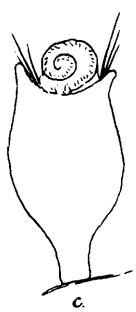


fig. 49.

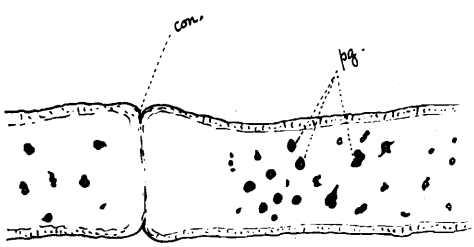


fig. 50.

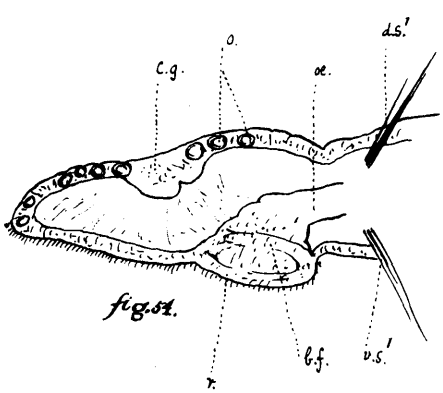


fig. 54.

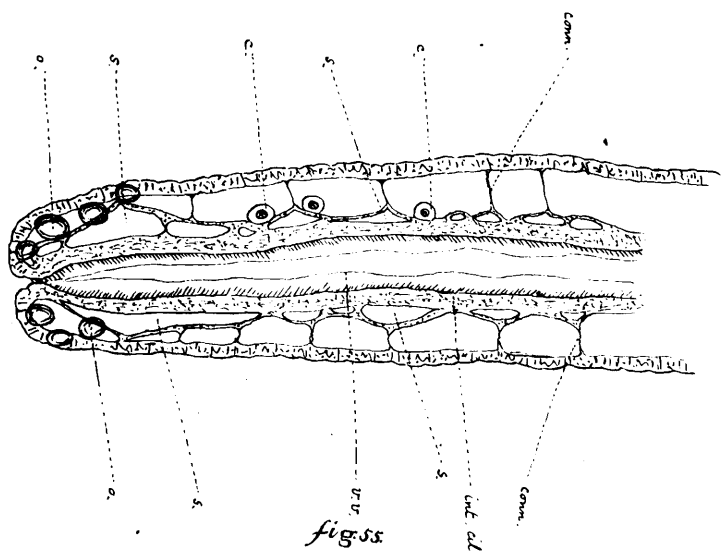


fig. 55.