Rec. zool. Surv. India, **80** : 127-155, 1982

EARTHWORM FAUNA OF THE ANDAMAN AND NICOBAR ISLANDS, INDIA

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INTRODUCTION

The first records of earthworms from the Andaman and Nicobar Islands were provided by Rosa (1891). He reported two species, *viz.*, *Lumbricus rubellus* Hoffmeister and *Eisenia foetida* (Savigny) from the Nicobars. Both the species are now believed to have been transported to the Nicobars from Europe by man alongwith the soil around the roots of the introduced plants. Michaelsen (1907) discovered the first endemic earthworms, *viz.*, *Metaphire* (*Pheretima* s. l.) *andamanensis*, *Amynthas* (*Pheretima* s. l.) *osmastoni* and *Amynthas* (*Pheretima* s. l.) *suctorius* from the Andamans. Subsequently, more endemics belonging to *Metaphire* and *Amynthas* were discovered by Stephenson (1925) and Gates (1932, 1936). The other reports on the earthworms of the Andaman and Nicobar Islands are limited to incidental records in the literature (Michaelsen, 1909 ; Stephenson, 1916 ; Gates, 1933, 1954, 1958, 1960, 1962a ; Julka & Halder, 1975). Recently, Soota & Julka (1970) recorded fourteen species from these islands, all of which probably have been introduced there.

This article deals with a comprehensive account of twenty seven megadrile species so far reported from the Andaman and Nicobar Islands. For a detailed account on the world distribution and synonomies of the species Gates (1972) may be consulted. The classification followed is that proposed by Gates (1959). For explanation of latest technical terms and conventions necessary for earthworm description, the articles by Ljungström (1970), Gates (1972) and Reynolds (1977) may be referred.

ZOOGEOGRAPHY

Of the twenty seven species (Table I) known from the Andaman and Nicobar Islands, twenty are exotic and are best excluded from zoogeographical discussions. The endemics belong to the former genus *Pheretima* s. l. (Michaelsen, 1900) and now transferred to *Amynthas* and *Metaphire* by Sims and Easton (1972). Relationships of the endemics

are to be found with presently unknown Sumatran species (Gates, 1972). Geologically also, the Andaman and Nicobar Islands are believed to have once formed the part of the land mass of South East Asia. There was a continuous mountain range along the whole length of these islands connected to the Arakans of Burma at one end and to Sumatra at the other end. About 150 million years ago, due to geological activity, the land near about these islands was submerged and the summits of the mountain range standing out of the sea became the present day islands. According to Gates (1972), the separation of the islands from Burma must have been prior to that from Sumatra and before *Eutyphoeus* (endemic in Burma) could have reached so far south.

Among the twenty exotic species, 2 are of European, 7 of South or South East Asian, 2 of South American, 1 of Central American, 3 of African and 5 of Indian origin. All the exotics are suspected to have been introduced alongwith the soil around the roots of the plants brought by man to the islands. It is of course not definite that they have been introduced from their original homes directly to the Andaman and Nicobar group of islands but might have arrived via other continent. Gates (1976) records instances of interceptions of peregrine earthworms (transported by man) in soil around roots of ornamental plants arriving in U. S. A. by ships or aeroplanes. The European species, viz., *Eisenia foetida* and *Lumbricus rubellus* were not found in recent collections from the Andaman and Nicobar Islands (Gates, 1972). Possibly they have failed to establish themselves on these islands because of climatic reasons.

Systematic Account

KEY TO FAMILIES

1.	Testes and male funnels intraseptal.	...	Moniligastridae
	Testes and male funnels not intraseptal.	...	... 2
2.	Prostates with muscular ducts present.	...	... 3
	Prostates generally absent.	...	... 6
3.	Last pair of hearts in XI.	...	Ocnerodrilidae
	Last pair of hearts behind XI.	...	... 4
4.	Prostates racemose.	...	Megascolecidae
	Prostates tubular.	...	... 5
5.	Nephridia holoic.	...	Acanthodrilidae
	Nephridia meroic	...	Octochaetidae
6.	Dorsal pores present.	...	Lumbricidae
	Dorsal pores absent.	...	Glossoscolecidae

TABLE—I. *List of earthworms known from the Andaman & Nicobar Islands.*

	Species	Introduced/endemic	Original Home
Fam.	ACANTHODRILIDAE		
	Pontodrilus bermudensis	Introduced	? S. Asia
Fam.	GLOSSOSCOLECIDAE		
	Pontoscolex corethrurus	Introduced	S. America
Fam.	LUMBRICIDAE		
	Eisenia foetida	Introduced	Europe
	Lumbricus rubellus	Introduced	Europe
Fam.	MEGASCOLECIDAE		
	Amynthas aculeatus	Endemic	
	Amynthas alexandri	Introduced	S. E. Asia
	Amynthas facetus	Endemic	
	Amynthas malacus	? Introduced	? S. E. Asia
	Amynthas osmastoni	Endemic	
	Amynthas suctorius	Endemic	
	Lampito mauritii	Introduced	Peninsular India
	Metapheretima elongata	Introduced	Region incl. Indonesia & Philippines
	Metaphire andamanensis	Endemic	
	Metaphire harrietensis	Endemic	
	Metaphire houlleti	Introduced	S. E. Asia
	Metaphire planata	? Introduced	? S. E. Asia
	Metaphire posthuma	Introduced	S. E. Asia
	Metaphire scitula	Endemic	
	Perionyx excavatus	Introduced	Himalayas, India
Fam.	MONILIGASTRIDAE		
	Drawida nepalensis	Introduced	Himalayas, India
Fam.	OCNERODRILIDAE		
	Eukerria kukenthali	Introduced	S. America
	Gordiodrilus elegans morph *paski*	Introduced	Tropical Africa
	Ocnerodrilus occidentalis	Introduced	Central America
	Thatonia gracilis	Introduced	? India
Fam.	OCTOCHAETIDAE		
	Dichogaster bolaui	Introduced	W. Africa
	Dichogaster modiglianii	Introduced	? W. Africa
	Ramiella bishambari	Introduced	Sub-Himalayan India

Family ACANTHODRILIDAE

Genus **Pontodrilus** Perrier, 1874

Pontodrilus bermudensis Beddard

1891. *Pontodrilus bermudensis* Beddard, *Ann. Mag. nat. Hist., Ser.* 6, **7** : 96. (Type loc.—Bermuda ; Type in Musée Royal de l 'Afrique Centrale, Bruxelles).

1970. *Pontodrilus bermudensis*, Soota & Julka, *Proc. zool. Soc., Calcutta*, **23** : 202.

1972. *Pontodrilus bermudensis*, Gates, *Trans. Am. phil. Soc.*, **62** : 47.

Diagnosis.—Length 32-120 mm ; diameter 2-4 mm. Segments 78-125. Prostomium epilobic, tongue open. Dorsal pores absent. Setae lumbricin, ornamented ectally, *a*, *b* of XVIII lacking, $AB<CD$, AA *ca.*$=CD$, $DD<\frac{1}{2}C$. Clitellum saddle-shaped, XIII—XVII, XVIII. Nephropores minute, in $\frac{1}{2}BC$. Spermathecal pores 2 pairs, at 7/8—8/9, in line with or just lateral to *B*. Male pores minute on XVIII, at *B* ; each pore surrounded by a small porophore on lateral wall of a longitudinal depression. Genital markings unpaired, median, transversely oval, in *AA*, across 19/20 but sometimes on 12/13, 13/14.

Unpigmented. Septa 5/6—12/13 muscular. Gizzard absent ; gut somewhat thickened in V but apparently not muscular ; intestinal origin may be in the region of XIV—XVII ; calciferous glands lacking. Last pair of hearts in XIII. Nephridia holoic ; ducts slightly thickened before entering parietes ; nephridia lacking on preclitellar segments. Testes holandric, free in X, XI ; seminal vesicles small, racemose, in XI and XII. Prostates tubular. Spermathecae diverticulate ; duct shorter than ampulla ; diverticulum digitiform to club-shaped, arising from ectal end of duct. Genital marking glands lacking.

Distribution.—Andaman & Nicobar Islands : Port Blair ? (Gates, 1936) ; Car Nicobar (Soota & Julka, 1970).

Range.—Mainland India, Laccadive and Maldive Islands, Sri Lanka, Vietnam, Indonesia, Australia, some islands in the middle of Pacific Ocean, U. S. A., West Indies, South America, Africa, Madagascar.

Family GLOSSOSCOLECIDAE

Genus **Pontoscolex** Schmarda, 1861

Pontoscolex corethrurus (Müller)

1856. *Lumbricus corethrurus* Müller, *Abhandl. Naturgesch. Ges. Halle*, **4** : 26. (Type loc.—Itajahy, Brazil ; typus amissus)

1972. *Pontoscolex corethrurus*, Gates, *Trans. Am. phil. Soc.*, **67** : 54.

Diagnosis.—Length 48-120 mm ; diameter 2-6 mm. Segments 60-232. Prostomium lacking. Dorsal pores lacking. Clitellum saddle-shaped,

XV, XVI—XXI, XXII or XXIII ; tubercula pubertatis narrow, slightly elevated, longitudinal bands, between *BC* on XVIII, XIX—XX, XXI, XXII. Setae lumbricin, on I—II very closely paired, from III widely paired, at hinder end of body usually arranged in "quincunx" ; setae on posterior segments enlarged and ornamented. Nephropores obvious, at *C* on anterior segments and about at mL on postclitellar segments. Spermathecal pores 3 pairs, minute (often unrecognizable), at *C*, on 6/7—8/9. Male pores minute (often unrecognizable), probably at 20/21. Female pore minute, on left side, at *AB*, slightly in front of 14/15. Genital tumescences around *a*, *b*, or *a* or *b* of XIX—XXI, sometimes of XIV, XVI, XVIII, XXII.

Unpigmented. Septa 5/6 thin, 6/7—13/14 funnel-shaped, 6/7—9/10 thickly muscular and displaced posteriorly. Gizzard in VI ; calciferous glands in VII, VIII and IX ; intestinal origin probably in XIV or XVI. Last pair of hearts in XI. Nephridia vesiculate ; bladders ocarina-shaped. Testes probably metandric ; seminal vesicles present or absent, if present, only one pair in XII, rudimentary or small or large, extending back through 8-10 segments. Spermathecae adiverticulate, somewhat club-shaped. Tubercula pubertatis glands tripartite, in XVIII bigger in size, then diminishing posteriorly.

Distribution.—Andaman & Nicobar Islands : Ross Island (Stephenson, 1916) ; Aberdeen (Stephenson, 1925) ; Port Blair, Mount Harriet (Gates, 1933, 1954) ; Minnie Bay (Gates, 1933) ; Wrightmyo (Soota & Julka, 1970).

Range.—Indian sub-continent, S. E. Asia, Hong Kong, Malay Peninsula, Indonesia, Philippines, Australia with adjacent islands, some islands in Pacific Ocean, West Indies, U. S.A., Mexico, South America, Africa, Madagascar with adjacent islands, Iran.

Family LUMBRICIDAE

KEY TO GENERA

1. Spermathecal pores near mid-dorsal line ; prostomium epilobic. ... **Eisenia**

   Spermathecal pores in *CD* ; prostomium tanylobic. ... **Lumbricus**

Genus **Eisenia** Malm, 1877

Eisenia foetida (Savigny)

1826. *Enterion fetidum* (corr. *foetidum*) Savigny, *Mém. Acad. Sci. Inst. Fr.*, **5** : 182. (Type loc. —Paris ; types in Museum National d'Histoire Naturelle, paris).

1972. *Eisenia foetida*, Gates, *Trans. Am. phil. Soc.*, **62** : 97.

Diagnosis.—Length 27-130 mm ; diameter 3-5 mm. Segments 80-131. Colour purple or red or brown, usually in transverse mid-segmental bands dorsally. Prostomium epilobic, tongue open. First dorsal pore at 4/5 or 5/6. Clitellum saddle-shaped ; XXVI—XXXII, sometimes extending to XXIV and XXXIV ; tubercula pubertatis on XXVIII—XXX, sometimes extending to XXVII and XXXII. Setae lumbricin, closely paired, present on clitellar segments, $AB=CD$, $BC<AA$, anteriorly $DD=\frac{1}{2}$ C but posteriorly $DD<\frac{1}{2}$ C. Spermathecal pores 2 pairs, near mid-dorsal line, in 9/10, 10/11. Male pores with large glandular papillae on XV, in *BC*. Female pores paired, just lateral to *B*, at eq/XIV. Genital tumescences around any of the setae on VIII-XII, usually around setae *a* and *b* of XXIV—XXXIII.

Pigmented, pigment red. Gizzard mainly in XVII ; intestinal origin in XV ; calciferous sacs absent. Extra-oesophageals passing to dorsal trunk along 9/10 ; last pair of hearts in XI. Nephridia vesiculate ; bladders transversely placed and sausage-shaped. Testes holandric ; in X, XI ; seminal vesicles in IX—XII. Spermathecae adiverticulate ; ducts short.

Distribution.—Andaman & Nicobar Islands : Nicobar Island (Rosa, 1891).

Range.—Mainland India, Australia, New Zealand, North America, South America, West Indies, Europe, some of the islands in Atlantic Ocean, U. S. S. R., Korea, Japan, Afghanistan, Turkey, Lebanon.

Genus **Lumbricus** Linnaeus, 1758

Lumbricus rubellus Hoffmeister

1843. *Lumbricus rubellus* Hoffmeister, *Arch. Naturgesch.*, **9** : 187. (Type Loc.— unknown ; types in Museum National d'Histoire Naturelle, Paris).

1972. *Lumbricus rubellus* Gates, *Trans. Am. phil. Soc.*, **67** : 115.

1978. *Lumbricus rubellus* Gates, *Megadrilogica*, **3** (6) : 100.

Diagnosis.—Length 41-150 mm ; diameter 3-6 mm. Segments 70-126. Prostomium tanylobic. Colour ruddy brown or red-violet dorsally. First dorsal pore in region of 5/6-8/9. Clitellum saddle-shaped, XXVII—XXXII, rarely extending to XXVI or XXXIII ; tubercula

pubertatis on XXVIII-XXXI. Setae lumbricin, closely paired, present on clitellar segments, $AA > BC$, $AB > CD$, $DD = \text{or} < \frac{1}{2}C$. Spermathecal pores 2 pairs, at *CD*, in 9/10, 10/11. Male pores inconspicuous, without glandular tumescences on XV, in median half of *BC*. Female pores paired, above *B*, on XIV. Genital tumescences in VIII—XII (less frequently on X), XX—XXIII, XXVI—XXXVI.

Pigmented, pigment red. Gizzard mainly in XVII ; intestinal origin in XV ; calciferous sacs digitiform, opening into gut posteriorly and ventrally near 10/11. Extra-oesophageals joining dorsal trunk along 9/10 ; last pair of hearts in XI. Nephridia vesiculate ; bladders J-shaped. Testes holandric, contained in unpaired sacs, in X, XI : seminal vesicles in IX, XI, XII. Spermathecae adiverticulate ; ducts short.

Distribution.—Andaman & Nicobar Islands : Nicobar Island (Rosa, 1891).

Range.—New Zealand, North America, Mexico, Europe, Iceland, some of the islands in Atlantic Ocean, South Africa, Turkey, Iran, Afghanistan, U.S.S. R., Far East.

Family MEGASCOLECIDAE

Nomenclature and taxonomy of the pheretimoid earthworms is that of Sims and Easton (1972). All the endemics so far known from the Andaman and Nicobar Islands belong to this family.

KEY TO GENERA

1.	Nephridia stomate, and with preseptal funnels.	...	**Perionyx**
	Nephridia astomate, at least in some part of body.	... ...	2
2.	Gizzard in front of 7/8.	...	**Lampito**
	Gizzard behind 7/8.	... ...	3
3.	Intestinal caeca absent.	...	**Metapheretima**
	Intestinal caeca present.	... ...	4
4.	Copulatory pouches absent.	...	**Amynthas**
	Copulatory pouches present.	...	**Metaphire**

Genus **Amynthas** Kinberg, 1867

KEY TO SPECIES OF GENUS AMYNTHAS

1.	Spermathecal pores intrasegmental.	...	*A. facetus*
	Spermathecal pores intersegmental.	... ...	2

2.	First spermathecal pores at 5/6 ; pores 4 pairs.	...	3
	First spermathecal pores behind 5/6 ; pores less than 4 pairs. ...	...	5
3.	Genital markings lacking. ...		*A. alexandri*
	Genital markings present. ...	...	4
4.	Genital marking glands sessile. ...		*A. suctorius*
	Genital marking glands stalked. ...		*A. aculeatus*
5.	Spermathecal pores one pair, at 6/7. ...		*A. malacus*
	Spermathecal pores three pairs, at 6/7-8/9. ...		*A. osmastoni*

Amynthas aculeatus (Gates)

1936. *Pheretima aculeata* Gates, *Rec. Indian Mus.*, **38** : 390. (Type loc.—Port Blair ; types in Zoological Survey of India, Calcutta).

1972. *Pheretima aculeata*, Gates, *Trans. Am. phil. Soc.*, **62** : 154.

1972. *Amynthas aculeatus*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 234.

Diagnosis.—Length 128 mm ; diameter 4 mm. Segments (?). Prostomium epilobic (?). First dorsal pore at 12/13 (?). Clitellum annular, XIV—XVI. Setae perichaetin, present ventrally on clitellar segments, 36 on VIII, 61 on XX, 9-13 between spermathecal pores, 3-4 between male pores. Spermathecal pores 4 pairs, superficial, on tiny circular discs, in 5/6-8/9. Male pores in XVIII, minute, superficial, each at the centre of a small circular disc. Female pore single, mid-ventral, on XIV. Genital markings small, paired, on XVIII, slightly medially to male porophores.

Pigmented, pigment red. Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV ; intestinal caeca simple, paired, origin in XXVII, extending forward to (?). Last pair of hearts in XIII. Testes holandric, contained in unpaired and ventral testis sacs, in X, XI. Prostates racemose, large, extending from XVII to XX ; ducts spindle-shaped. Penial setae 0.58-0.6 mm long, 85 μ thick entally, straight ; ornamentation of short, transverse rows of fine spines ectally, tip slightly concave on one side. Spermathecae unidiverticulate ; duct bulbous, shorter than ampulla ; diverticulum may be longer than combined lengths of duct and ampulla, stalked, with a looped middle portion and an ovoidal to ellipsoidal seminal chamber at ectal end, arises from ectal end of duct. Genital marking glands stalked.

Distribution.—Andaman & Nicobar Islands : Port Blair (Gates, 1936).

Amynthas alexandri Beddard

1900. *Amyntas alexandri* Beddard, *Proc. zool. Soc. Lond.*, **1900** ; 988. (Type loc.—supposedly Calcutta ; type in Brit. Mus. (Nat. Hist.), London).

1972. *Pheretima alexandri*, Gates, *Trans. Am. phil. Soc.*, **62** : 155.

1972. *Amynthas alexandri alexandri, a. gracilor*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 234.

Diagnosis.—Length 105-290 mm ; diameter 4-9 mm. Segments 90-141. Prostomium rudimentary. First dorsal pore at 12/13. Clitellum annular, XIV—XVI, occasionally reaching to XVII. Setae perichaetin, apparently lacking on clitellar segments, 44 (?) on IX, 58-76 on XX, 9-22 between spermathecal pores, 9-28 between male pores. Spermathecal pores 4 pairs, minute, in 5/6-8/9, about 0.33 circumference apart. Male pores in XVIII, minute, each in a rather circular disc. Female pore single, mid-ventral, on XIV. Genital markings absent.

Pigmented, pigment reddish brown. Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV or sometimes in XVI (?) ; intestinal caeca paired, simple, origin in XXVII, extending forward to XX. Last pair of hearts in XIII. Testes holandric, contained in paired and vertical or unpaired and horseshoe-shaped testis sacs, in X, XI, hearts and seminal vesicles of XI included ; seminal vesicles in XI, XII. Prostates racemose, extending from XVI to XXII ; duct variously looped. Spermathecae unidiverticulate ; duct markedly narrowed in parietes ; diverticulum longer than combined lengths of duct and ampulla, arises from median face and ectal end of duct, with a slender stalk and a variously looped wider portion (seminal chamber) entally.

Distribution.—Andaman & Nicobar Islands : Wimberleygunj (Stephenson, 1925) ; Minnie Bay, Mount Harriet (Gates, 1932).

Range.—Indian mainland, Burma, Thailand.

Amynthas facetus (Gates)

1932. *Pheretima faceta* Gates, *Rec. Indian Mus.*, **34** : 422. (Type loc.—John Lawrence Island ; types in Zoological Survey of India, Calcutta).

1972. *Pheretima faceta*, Gates, *Trans. Am. phil. Soc.*, **62** : 185.

1972. *Amynthas facetus*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 235.

Diagnosis.—Length 75-113 mm ; diameter 4 mm. Segments 93-114. Prostomium epilobic, tongue open. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin, apparently lacking on clitellar segments, 48 on XII, 52-56 on XX, 16-22 between spermathecal pores,

10-15 between male pores. Spermathecal pores 2 pairs, minute, segmental, on anterior portions of VIII, IX. Male pores in XVIII, minute, each at centre of a small, transversely elliptical disc. Female pores closely paired (?), on XIV. Genital markings absent.

Pigmented, pigment red. Septum 8/9 absent. Gizzard between septa 7/8 and 9/10 ; intestinal origin in XV ; intestinal caeca paired, simple, originating in XXVII, extending forward to XXIII. Last pair of hearts in XIII. Testes holandric, contained in unpaired and ventral testis sacs, in X, XI ; seminal vesicles in XI, XII. Prostates racemose, extending from XVII to XIX ; ducts nearly straight. Spermathecae unidiverticulate ; duct shorter than ampulla ; diverticulum longer than combined lengths of duct and ampulla, with a sinuous or zigzag-looped stalk and a slightly thicker seminal chamber, arises from anterior face and ectal end of duct.

Distribution.—Andaman & Nicobar Islands : John Lawrence Island (Gates, 1932) ; vicinity of Port Bonington, N. Andaman Island (Gates, 1960).

Amynthas malacus (Gates)

1933. *Pheretima maculosa* (non *P. "maculosus"* Hatai 1930) Gates, *Rec. Indian Mus.*, **35** : 534. (Type loc.—Between Kyaukmedaung and Kameik ; types in Zoological Survey of India, Calcutta)

1936. *Pheretima malaca*, Gates. *Rec. Indian Mus.*, **38** : 429. (Nom. nov. pro *maculosa* Gates, 1933).

1972. *Pheretima malaca*, Gates, *Trans. Am. phil. Soc.*, **62** : 199.

1972. *Amynthas malacus*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 237.

1975. *Pheretima malaca*, Julka & Halder, *Newsl. zool. Surv. India*, **1** (4) : 65.

Diagnosis.—Length 46-82 mm ; diameter 2-4 mm. Segments 109-119. Prostomium epilobic. First dorsal pore in region of 10/11-12/13. Clitellum annnular, XIV—XVI. Setae perichaetin, ventrally present on clitellar segments, 77 on VIII, 55-77 on XX, 26-31 between spermathecal pores, 4-10 between male pores. Spermathecal pores one pair, minute, in 6/7. Male pores in XVIII, minute, each on a circular disc. Female pore single, mid-ventral, on XIV. Genital markings small and circular discs, in transverse rows on or near 17/18, 18/19 ; paired and presetal, median to spermathecal pore lines on VII or VIII or XV or XVI : unpaired, median and postsetal on some of IX—XVI ; paired on anterior faces of male porophores.

Pigmented, pigment red. Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV ; intestinal caeca paired, simple, origin in XXVII, extending forward to XXII. Hearts of X, XI

lacking, last pair of hearts in XIII. Testes holandric, contained in paired and vertical or unpaired and U-shaped or annular testis sacs, in X, XI ; seminal vesicles in XI, XII, of XI included in testis sac. Prostates racemose, small, confined to XVIII ; duct straight or in a hairpin loop. Spermathecae unidiverticulate ; duct shorter than ampulla ; diverticulum shorter than combined lengths of duct and ampulla, middle portion looped, with an ovoidal seminal chamber at ental end, arises from anterior face and ectal end of duct.

Distribution.—Andaman & Nicobar Islands : Bara Balu village, nr. Cheria Tapu, S. Andaman (Julka & Halder, 1975).

Range.—Burma.

Amynthas osmastoni (Michaelsen)

1907. *Pheretima osmastoni* Michaelsen, *Jb. hamb. wiss. Anst.*, **24** : 163. (Type loc.—Port Blair ; types in Zoologisches Institut und Zoologisches Museum Universität, Hamburg, Zoological Survey of India, Calcutta and Museum für Naturkunde der Humboldt Universität, Berlin).

1972. *Pheretima osmastoni*, Gates, *Trans. Am. phil. Soc.*, **62** : 204.

1972. *Amynthas osmastoni*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 237.

Diagnosis.—Length 185-320 mm ; diameter 8-11 mm. Segments 126-153. Prostomium epilobic, tongue open. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin ; 50 on IX, 65-84 on XX, 8-17 between spermathecal pores, 10-20 between male pores. Spermathecal pores 3 pairs, minute, at centres of small porophores, in 6/7-8/9, *ca.* 0.28 circumference apart. Male pores in XVIII, minute, each towards the lateral margin of a transversely elliptical disc. Female pores closely paired (?), on XIV. Genital markings small, circular, postsetal, closely crowded in a median or paired patches, on VIII, X, XII, occasionally on XIII.

Pigmented, pigment red (?). Septum 8/9 absent. Gizzard between septa 7/8 and 9/10 ; intestinal origin in XV ; intestinal caeca paired, simple, origin in XXVII, extending forward to XXIV. Last pair of hearts in XIII. Testes holandric, contained in unpaired and ventral testis sacs, in X, XI ; seminal vesicles in XI, XII ; pseudovesicles in XIII, XIV. Prostates racemose, large, extending from XVII to XXII ; ducts looped. Penial setae 1.13-1.25 mm long and 0.20-0.28 mm thick ; ornamentation, circles of fine teeth towards ectal end. Spermathecae unidiverticulate ; duct shorter than ampulla ; diverticulum longer than combined lengths of duct and ampulla, stalked, seminal chamber short and small, arises from anterior face and ectal end of duct. Gland to

male porophore in XV—XXV, bilobed, composed of numerous stalked glands, each passing to a common T-shaped duct with thick and straight horizontal limbs and a slender, vertical leg especially narrowed in parietes. Genital marking glands stalked.

Distribution.—Andaman & Nicobar Islands : Wimberleyganj—Port Blair (Michaelsen, 1907, 1909 ; Stephenson, 1925) ; Mount Harriet (Stephenson, 1925 ; Gates, 1932) ; Minnie Bay (Gates, 1932) ; Port Bonington, N. Andaman Island (Gates, 1960).

Amynthas suctorius (Michaelsen)

1907. *Pheretima suctoria* Michaelsen, *Jb. hamb. wiss. Anst.*, **24** : 165. (Type loc.—Andaman Islands ; types in Zoological Survey of India, Calcutta and Zoologisches Institut und Zoologisches Museum Universität Hamburg.)

1972. *Pheretima suctoria*, Gates, *Trans. Am. phil. Soc.*, **62** : 220.

1972. *Amynthas suctorius*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 235.

Diagnosis.—Length 70-140 mm ; diameter 4-7 mm. Segments 103-123. Prostomium epilobic, tongue closed. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin, apparently lacking on clitellar segments, 35-38 on X, 66 on XX, 10-16 between spermathecal pores, 4-8 between male pores. Spermathecal pores 4 pairs, minute, superficial, in 5/6-8/9, *ca.* 0.25 circumference apart. Male pores in XVIII, minute, each on the central portion of a small disc. Female pores closely paired, on XIV. Genital markings paired, just median to male porophores, in XVIII.

Pigmented, pigment red (?). Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV (?) ; intestinal caeca paired, simple, origin in XXVII, extending forward to XXII. Last pair of hearts in XIII. Testes holandric, contained in unpaired and ventral testis sacs ; seminal vesicles in XI, XII. Prostates racemose, in XVII—XIX ; ducts straight or looped. Spermathecae unidiverticulate ; duct shorter than ampulla ; diverticulum longer than combined lengths of duct and ampulla, with a short stalk and a more or less regularly zigzagged seminal chamber, arises from anterior face and ectal end of duct. Genital marking glands sessile.

Distribution.—Andaman & Nicobar Islands : Andaman Islands : (Michaelsen, 1907, 1909) ; Camorta (Gates, 1936).

Genus **Lampito** Kinberg, 1866

Lampito mauritii Kinberg

1866. *Lampito mauritii* Kinberg, *Ofvers. K. Vetens. Akad. Förhandl. Stockholm*, **23** : 103. (Type loc.—Mauritius ; types in Naturhistoriska Riksmuseet, Stockholm).

1972. *Lampito mauritii*, Gates. *Trans. Am. phil. Soc.*, **62** : 133.

Diagnosis.—Length 95-155 mm ; diameter 3-6 mm. Segments 157-201. Prostomium apparently prolobic, often retracted into buccal cavity. First dorsal pore in region of 10/11-12/13. Clitellum annular, XIV—17/18. Setae perichaetin, present on clitellar segments, circles interrupted mid-ventrally, 40-51 on VIII, 30-43 on XX, 11-16 between spermathecal pores, none between male pores. Spermathecal pores 3 pairs, large, in *EG*, at 6/7, 7/8, 8/9. Male pores on XVIII, at or lateral to *B*, in paired, circular, slightly raised porophores that extend from *A* into *CE*. Genital markings absent.

Pigmented, pigment brown. Septa all present from 4/5. Gizzard in V ; oesophagus on its inner wall with longitudinal calciferous lamellae in X—XIII ; intestinal origin in XV. Last pair of hearts in XIII. Prostates racemose ; ducts straight. Testes holandric, free, in X, XI ; seminal vesicles in IX and XII. Penial setae with horseshoe-shaped or scoop-shaped tips, ornamentation of closely set circles of triangular teeth. Spermathecae bidiverticulate ; ducts barrel-shaped ; diverticula digitiform, from lateral and median faces of duct.

Distribution.—Andaman & Nicobar Islands : Ross Island (Stephenson, 1916) ; Middle Point, Mount Harriet, Jinghighat (Gates, 1932) ; Haddo, Pahargaon, Aberdeen (Gates, 1960) ; Port Blair (Gates, 1960 ; Soota & Julka, 1970) ; Rajatgarh, Maya Bundar (Soota & Julka 1970).

Range.—Mainland India, Sri Lanka, Maldive & Laccadive Islands, Minicoy, Burma, Thailand, Malay Peninsula, Indonesia, Philippines, Hong Kong, China, New Caledonia, Mauritius, Seychelles, Comoro Island, Madagascar, Zanzibar.

Genus **Metapheretima** Michaelsen, 1928

Metapheretima elongata (Perrier)

1872. *Perichaeta elongata* Perrier, *Nouv. Archs Mus. Hist. nat. Paris*, **8** : 121. (Type loc.—Peru ; types in Museum National d'Histoire Naturelle, Paris).

1972. *Pheretima elongata*, Gates, *Trans. Am. phil. Soc.*, **62** : 182.

1972. *Metapheretima elongata*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 233.

1976. *Metapheretima elongata*, Easton, *Bull. Br. Mus. nat. Hist.* (*Zool.*), **30** (20) : 40.

Diagnosis.—Length 75-300 mm ; diameter 3-6 mm. Segments 136-297.

Prostomium rudimentary or lacking. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin, may be present on clitellar segments, 67-140 on VIII, 55-75 on XX, 13-17 between spermathecal pores, 7-15 between male pores. Spermathecal pores lacking or numerous, minute, in paired groups of 2-5, in 5/6-6/7 or 5/6 or 6/7 only. Male pores in XVIII, minute, each in a small disc on median wall entally of a deep copulatory pouch. Female pore single, mid-ventral, on XIV. Genital markings transversely elliptical, presetal, on XIX and successive segments in line with or slightly ventral to male pores.

Unpigmented (?). Septum 9/10 absent. Gizzard between septa 7/8 and 8/9 ; intestinal origin in XV ; intestinal caeca lacking. Last pair of hearts in XIII. Testes holandric, contained in unaired and annular testis sacs, in X, XI ; seminal vesicles in XI, XII, of XI alongwith hearts of X and XI included in testis sacs ; pseudovesicles well-developed in XIII, rudimentary or lacking in XIV. Prostates racemose, extending from XVI to XXI ; ducts looped. Spermathecae unidiverticulate, in paired batteries of 2-5 ; duct shorter than ampulla ; diverticulum arises from ectal end of duct, with a long stalk and an ovoidal seminal chamber. Genital marking glands sessile.

Distribution.—Andaman & Nicobar Islands : Mount Harriet (Gates, 1932) ; Minnie Bay (Gates, 1932, 1933) ; Wrightmyo, Rajatgarh (Soota & Julka 1970).

Range.—Mainland India, Pakistan, Burma, Sri Lanka, Thailand, Malay Peninsula, Indonesia, Formosa, Philippines, some Islands in Pacific Ocean, South America, Egypt, Madagascar, Comores.

Genus **Metaphire** Sims & Easton, 1972

KEY TO SPECIES OF **METAPHIRE**

1.	First spermathecal pores at 5/6 ; pores 4 pairs. ...	*M. posthuma*	
	First spermathecal pores behind 5/6 ; pores less than 4 pairs. ...	...	2
2.	First spermathecal pores at 6/7 ; pores 3 pairs. ...	...	3
	First spermathecal pores behind 6/7 ; pores 2 pairs. ...	...	5
3.	Genital markings lacking. ...	*M. scitula*	
	Genital markings present. ...	...	4

4.	Genital markings in two median patches of *ca.* 9 irregular transverse rows each, on XVIII. ...	*M. harrietensis*
	Genital markings. when present, in the vicinity of spermathecal•pores. ...	*M. houlleti*
5.	Spermathecal pores intrasegmental, on VII, VIII. ...	*M. planata*
	Spermathecal pores intersegmental, on 7/8, 8/9. ...	*M. andamanensis*

Metaphire andamanensis (Michaelsen)

1907. *Pheretima andamanensis* Michaelsen, *Jb. hamb. wiss. Anst.*, **24** : 164. (Type loc.—N. Cinque Island ; types in Zoologisches Institut und Zoologisches Museum Universität Hamburg and Zoological Survey of India, Calcutta.)

1972. *Pheretima andamanensis*, Gates, *Trans. Am. phil. Soc.*, **62** : 157.

1972. *Metaphire andamanensis*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (6) : 237.

Diagnosis.—Length 108-120 mm ; diameter 6-6.5 mm. Segments 110. Prostomium epilobic, tongue open. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin, present on clitellar segments ventrally at least, 52 on XII, 54 on XXVI, 11-12 between spermathecal pores, 10-15 between male pores. Spermathecal pores 2 pairs, small, in 7/8, 8/9, *ca.* 0.28 circumference apart. Male pores in XVIII, minute, on lateral walls of copulatory pouches, *ca.* 0.25 circumference apart. Female pores closely paired (?). Genital markings paired, on XVIII, median to copulatory pouches.

Pigmented, pigment red. Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV (?) ; intestinal caeca paired, simple, origin in XXVII, extending forward to XXIII. Last pair of hearts in XIII. Testes holandric, contained in unpaired and ventral testis sacs, in X, XI ; seminal vesicles in XI, XII. Prostates racemose, extending from XIX to XXIII ; ducts S-shaped. Spermathecae unidiverticulate ; duct shorter than ampulla ; diverticulum longer than combined lengths of duct and ampulla, arises from median face and ectal end of duct, with a thread-like stalk and ovoidal seminal chamber ; a lobed annular gland on parietes around base of each spermatheca. Genital marking glands stalked.

Distribution.—Andaman & Nicobar Islands : North Cinque Islan (Michaelsen, 1907, 1909).

Metaphire harrietensis (Stephenson)

1925. *Pheretima harrietensis* Stephenson, *Rec. Indian Mus.*, **27** : 59. (Type loc.—Mount Harriet ; types in Zoological Survey of India, Calcutta).

1972. *Pheretima harrietensis*, Gates, *Trans. Am. phil. Soc.*, **62** : 188.

1972. *Metaphire harrietensis*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (6) : 238.

Diagnosis.—Length 200 mm ; diameter 11.5 mm. Segments 123. Prostomium epilobic, tongue open. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin, present ventrally on clitellar segments, 75 on IX, 91 on XIX, 24-25 between spermathecal pores, 30 between male pores. Spermathecal pores 3 pairs, transverse slits, in 6/7-8/9, *ca.* 0.33 circumference apart. Male pores in XVIII ; each pore minute, at the tip of a conical papilla protrusible from a copulatory pouch. Female pore median (?), on XIV. Genital markings small circular discs, in two median patches of *ca.* 9 irregular transverse rows each, presetal and postsetal in XVIII.

Pigmented ; pigment red (?). Septa 8/9 and 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV ; intestinal caeca single, origin in XXVII, extending forward to (?). Last pair of hearts in XIII. Testes holandric, contained in unpaired and ventral (?) testis sacs, in X, XI ; seminal vesicles in XI, XII ; pseudovesicles well-developed, in XIV. Prostates racemose, extending from XVII to XXI ; ducts short and curved. Penial setae *ca.* 1 mm long, ornamented ectally with transverse rows of five spines. Spermathecae unidiverticulate ; duct shorter than ampulla ; diverticulum much longer than combined lengths of duct and ampulla, arises from anterior face and ectal end of duct, slightly dilated entally. Genital marking glands stalked.

Distribution.—Andaman & Nicobar Islands : Mount Harriet (Stephenson, 1925).

Metaphire houlleti (Perrier)

1872. *Perichaeta houlleti* Perrier, *Nouv. Archs. Mus. Hist. nat. Paris*, **8** : 99. (Type loc.—Calcutta ; types in Museum National d'Histoire Naturelle, Paris).

1972. *Pheretima houlleti*, Gates, *Trans. Am. phil. Soc.*, **62** : 190.

1972. *Metaphire houlleti, h. rugosa, h. tortuosa ; campanulata campanulata, c. meridiana, c. penetralis ; wimberlayana*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 238.

Diagnosis.—Length 40-200 mm ; diameter 3-8 mm. Segments 90-140. Prostomium epilobic, tongue open. First dorsal pore in the region of 7/8-11/12. Clitellum annular, XIV—XVI. Setae perichaetin, often

present on clitellar segments, 30-55 on VIII, 48-62 on XX, 11-26 between spermathecal pores, 4-16 between male pores. Spermathecal pores 3 pairs, minute, within parietal invaginations, in 6/7-8/9, *ca.* 0.5 circumference apart. Male pores in XVIII, minute, each pore on a penial body within a copulatory pouch. Female pore single, mid-ventral, on XIV. Genital markings either present or lacking externally.

Pigmented, pigment reddish brown. Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV ; intestinal caeca paired, simple, origin in XXVII, extending forward to XXII. Last pair of hearts in XIII. Testes holandric contained in unpaired and ventral testis sacs, in X, XI ; seminal vesicles in XI, XII ; pseudovesicles rudimentary, in XIII, XIV. Prostates racemose. Spermathecae unidiverticulate ; diverticulum arises from ectal end of duct, with a short stalk and an elongate, variously looped seminal chamber. Genital marking glands when present stalked.

Remarks.—Gates (1972) recognizes seven morphs within the *houlleti*-complex. The specimens of *houlleti* hitherto recorded from the Andaman & Nicobar Islands belong to H morph and smaller Hp morph.

(i) **Metaphire houlleti** H morph (Gates)

1970. *Pheretima houlleti*, Soota & Julka, *Proc. zool. Soc., Calcutta*, **23** : 204.

1972. *Pheretima houlleti* H morph, Gates, *Trans. Am. phil. Soc.*, **62** : 191.

Diagnosis.—Genital markings, when present externally, in the vicinity of spermathecal pores and near 6/7-8/9. Prostates extending from XVI to XXI. Seminal vesicles well-developed. Penial body columnar with trilobed tip, male pore on middle lobe. Penial setae present, 1-3 in copulatory pouches, 0.47-0.9 mm long, tip bifid, sparsely ornamented ectally with small teeth. Internal genital markings, one on each of two lateral lobes at tip of penial body, others at or near base of penial body or elsewhere on wall of copulatory pouch, one on anterior and one on posterior wall of each spermathecal invagination.

Distribution.—Andaman & Nicobar Islands : Wimberleyganj (Stephenson, 1925) ; Minnie Bay (Gates, 1932, 1933) ; Mount Harriet (Gates, 1933) ; Viper Island (Gates, 1936) ; Port Blair (Gates, 1936 ; Soota & Julka, 1970).

Range.—Mainland India, Burma, Indonesia.

(ii) **Metaphire houlleti** smaller Hp morph (Gates)

1972. *Pheretima houlleti* smaller Hp morph, Gates, *Trans. Am. phil. Soc.*, **62** : 194.

Diagnosis.—Genital markings none externally. Prostates extending from XVI to XXIII. Seminal vesicles juvenile. Penial body slenderly

conical with a male pore at distal end. Penial setae lacking. Internal genital markings, one on median wall of each copulatory pouch, 1-3 on or near base of penial body, one on anterior wall of each spermathecal invagination.

Distribution.—Andaman & Nicobar Islands : Minnie Bay (Gates, 1932) ; Mount Harriet (Gates, 1932, 1933) ; Andaman Islands (Gates, 1960).

Range.—Mainland India, Burma, Thailand, Malay Peninsula, Java, Philippines, Fiji Island, South America, U. S. A.

Metaphire planata (Gates)

1926. *Pheretima planata* Gates, *Ann. Mag. nat. Hist.* (*ser. 9*), **17** ; 411. (Type loc.—Rangoon ; types in U. S. National Museum, Washington ; Brit. Mus. (Nat. Hist.), London ; Zoological Survey of India, Calcutta).

1972. *Pheretima planata,* Gates, *Trans. Am. phil. Soc.*, **62** : 211.

1972. *Metaphire planata,* Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 239.

Diagnosis.—Length 64-176 mm ; diameter 4-7 mm. Segments 115-142. Prostomium lacking or rudimentary (?). First dorsal pore at 10/11 or 11/12. Clitellum annular, XIV—XVI. Setae perichaetin, present on clitellar segments, 75-87 on VIII, 56-65 on XX, 35-42 between spermathecal pores, 8-14 between male pores. Spermathecal pores 2 pairs, minute, segmental, on anterior margins of VII, VIII. Male pores in XVIII, minute, each in a circular area on roof of a copulatory pouch. Female pore single, mid-ventral, on XIV. Genital markings small, circular, 1-4 slightly median to each spermathecal pore, 8-13 on roof and walls of each copulatory pouch.

Pigmented ; pigment brownish red. Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XV ; intestinal caeca paired, simple, origin in XXVII, extending forward to XX. Last pair of hearts in XIII. Testes holandric, contained in paired testis sacs, of X ventral, of XI vertical and including seminal vesicles of XI ; seminal vesicles in XI, XII. Prostates racemose, in XVI—XXI ; duct U-shaped. Spermathecae unidiverticulate ; duct elongate ; diverticulum longer than combined lengths of duct and ampulla, with a short stalk and an elongately ellipsoidal seminal chamber. Genital marking glands stalked.

Distribution.—Andaman & Nicobar Islands : Garai-Berana, Corbyn's Cove, Navy Bay (Gates, 1933) ; Port Blair (Soota & Julka, 1970).

Range.—Mainland India, Burma, Bangla Desh, Thailand, Malay Peninsula.

Metaphire posthuma (Vaillant)

1868. *Perichaeta posthuma* Vaillant, *Annls Sci. nat.* (*ser.* 5), **10** : 228. (Type loc.—Java ; types in Museum National d'Histoire Naturelle, Paris).

1972. *Pheretima posthuma*, Gates, *Trans. Am. phil. Soc.*, **62** : 212.

1972. *Metaphire posthuma*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 239.

Diagnosis.—Length 60-140 mm ; diameter 3-8 mm. Segments 91-124. Prostomium epilobic, tongue usually open. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin, present on clitellar segments ventrally, 106-129 on VIII, 60-95 on XX, 36-44 between spermathecal pores, 16-22 between male pores. Spermathecal pores 4 pairs, minute, in 5/6-8-9, *ca.* 0.33 circumference apart. Male pores in XVIII, minute, each in a small disc on median wall near roof of a copulatory pouch. Female pore single, mid-ventral, on XIV. Genital markings paired, equatorial, slightly median to male pore line, on XIV—XXX, but usually on XVII and XIX.

Pigmented ; pigment brown. Septum 8/9 present, 9/10 absent. Gizzard between septa 7/8 and 8/9 ; intestinal origin in XV ; intestinal caeca simple, origin in XXVII, extending forward to XXIV. Last pair of hearts in XIII. Testes holandric, contained in unpaired testis sacs, of X ventral, of XI vertically U-shaped and including seminal vesicles of that segment ; seminal vesicles in XI, XII ; pseudovesicles small, in XIII. Prostates racemose, in XV—XXI ; ducts U-shaped. Spermathecae unidiverticulate ; duct shorter than ampulla, diverticulum of variable length, with a short stalk and an ellipsoidal seminal chamber, arises from median face and near ental end of duct. Genital marking glands sessile.

Distribution.—Andaman & Nicobar Islands : Jinghighat (Gates, 1932) ; Minnie Bay (Gates, 1933) ; Ross Island (Soota & Julka, 1970).

Range.—Mainland India, Bangla Desh, Burma, Malay Peninsula, South East Asia, Formosa, Indonesia, Philippines, U. S. A.

Metaphire scitula (Gates)

1936. *Pheretima scitula* Gates, *Rec. Indian Mus.*, **38** : 457. (Type loc.—Port Blair ; types in Zoological Survey of India, Calcutta).

1972. *Pheretima scitula*, Gates, *Trans. Am. phil. Soc.*, **62** : 219.

1972. *Metaphire scitula*, Sims & Easton, *Biol. J. Linn. Soc.*, **4** (3) : 238.

Diagnosis.—Length 100-200 mm ; diameter 5 mm. Segments (?). Prostomium epilobic, tongue open. First dorsal pore at 12/13. Clitellum annular, XIV—XVI. Setae perichaetin, apparently absent on clitellar

segments, 37-44 on VIII, 44-46 on XX, 12-25 between spermathecal pores, 12-14 between male pores. Spermathecal pores 3 pairs, minute, each at centre of a small circular porophore, in 6/7, 7/8, 8/9, *ca.* 0.5 circumference apart. Male pores in XVIII, minute, each on a thick circular disc on roof of a deep copulatory pouch. Female pore single, mid-ventral, on XIV. Genital markings absent.

Pigmented ; pigment red. Septa 8/9, 9/10 absent. Gizzard between septa 7/8 and 10/11 ; intestinal origin in XVI ; intestinal caeca paired, simple, origin in XXVII, extending forward to (?). Last pair of hearts in XIII. Testes holandric, contained in unpaired and ventral testis sacs, in X, XI ; seminal vesicles in XI, XII. Prostates racemose, in XVII—XIX ; duct A-, U- or C-shaped. Spermathecae unidiverticulate ; duct almost confined to parietes ; diverticulum much longer than combined lengths of duct and ampulla, arises from anterior face of duct in parietes, with stalk partly looped in a zigzag manner and a short spheroidal to ellipsoidal seminal chamber.

Distribution.—Andaman & Nicobar Islands : Port Blair (Gates, 1936).

Genus **Perionyx** Perrier, 1872

Perionyx excavatus Perrier

1872. *Perionyx excavatus* Perrier, *Nouv. Arch. Mus. Hist. Nat. Paris*, **8** : 126. (Type loc.—Saigon ; types in Museum National d'Histoire Naturelle, Paris).

1972. *Perionyx excavatus*, Gates, *Trans. Am. phil. Soc.*, **62** : 142.

Diagnosis.—Length 30-180 mm ; diameter 3-7 mm. Segments 123-178. Prostomium epilobic, tongue open. First dorsal pore in region of 2/3-5/6. Clitellum annular, XIII-XVII. Setae perichaetin, present on clitellar segments, 56 on IX, 46-52 on XX, 4-6 between spermathecal pores. Nephropores inconspicuous, in one rather irregular longitudinal rank on each side near mL. Spermathecal pores 2 pairs, near mid-ventral line, in 7/8, 8/9. Male pores in small transverse protuberances within a single male field, each protuberance with a slightly irregular transverse groove containing apertures of 4-9 penisetal follicles. Female pore, single, mid-ventral, on XIV.

Pigmented ; pigment red. Septa all present from 4/5. Gizzard absent or rudimentary in V ; oesophagus widened and moniliform in XIII, with longitudinal calciferous ridges on its inner wall in IX—XIV ; intestinal origin in XV or XVI. Last pair of hearts in XIII. Testes holandric, free, in X, XI ; seminal vesicles in XI, XII. Prostates racemose, in XVIII ; ducts straight. Penial setae 0.60-0.69 mm long, 15-25 μ thick, ornamentation of 6-16 circles of triangular spines ectally, tip

bluntly rounded or finely pointed or flattened and truncate. Spermathecae large, duct short and stout, often with intramural seminal chambers located near ental end of duct.

Distribution.—Andaman & Nicobar Islands : Little Andaman (Michaelsen, 1909) ; John Lawrence Island (?) (Gates, 1933) ; Parnashala (Soota & Julka, 1970).

Range.—Mainland India, Burma, Sri Lanka, South East Asia, Indonesia, Philippines, Formosa, Hawaii, West Indies, Madagascar and adjacent islands.

Family MONILIGASTRIDAE

Genus **Drawida** Michaelsen, 1900

Drawida nepalensis Michaelsen

1907. *Drawida nepalensis* Michaelsen, *Jb. hamb. wiss. Anst.*, **24** : 146. (Type loc.— Gowchar, Nepal ; types in Zoologisches Institut und Zoologisches Museum, Hamburg aud Zoological Survey of India, Calcutta).

1972. *Drawida nepalensis*, Gates, *Trans. Am. phil. Soc.*, **62** : 256.

Diagnosis.—Length 78-130 mm ; diameter 4-5 mm. Segments 129-180. Clitellum IX/n-XIV/n. Setae lumbricin, present on clitellar segments, AA=or slightlyor> <BC, DD *ca.*=or slightly>$\frac{1}{2}$C. Nephropores at D, somewhat more dorsal in VIII or VII—VIII, lacking in X (and XII ?) of adults. Spermathecal pores one pair, transverse slits, just median to C, in 7/8. Male pores at or median to m BC, in 10/11 each usually on or near end of a protuberant ventrally directed porophore, apparently independent of both X and XI. Female pores paired, at 11/12. Genital markings, one small, circular translucent area on lateral or anterior face of each male porophore, a similar area in VII just anterior to each spermathecal pore.

Unpigmented. Gizzards 2-4, in XII-XX (XXIII ?) ; intestinal origin in XXVII ($\pm$1). Connectives from extra-oesophageals on anterior face of 8/9. Nephridia of X lacking in adults. Sperm duct in a cluster of loops that may be larger than testis sac, passing into ental end of prostate directly. Prostates glandular ; prostatic capsule, 2-4 mm long, club-shaped. Spermathecae diverticulate ; diverticulum saccular, 3-5 mm long, in VII. Genital marking glands solid, spheroidal.

Distribution.—Andaman & Nicobar Islands : Mount Harriet (Michaelsen, 1909 ; Stephenson, 1925 ; Gates, 1933) ; Port Blair (Gates, 1962 a, Soota & Julka, 1970).

Range.—Mainland India, Pakistan, Bangla Desh, Burma, Indonesia.

Family Ocnerodrilidae

KEY TO GENERA

1.	Extramural calciferous glands lacking.	...	**Thatonia**
	Extramural calciferous glands present.	...	... **2**
2.	Calciferous glands unpaired and ventral.	...	**Gordiodrilus**
	Calciferous glands paired and lateral.	...	... **3**
3.	Gizzard lacking.	...	**Ocnerodrilus**
	Gizzard present, in VII.	...	**Eukerria**

Genus **Eukerria** Michaelsen, 1935

Eukerria kukenthali (Michaelsen)

1908. *Kerria kukenthali* Michaelsen, *Zool. Jb.* (*Supp.*), **11** : 24. (Type loc.—St. Thomas Island, West Indies ; types in Museum für Naturkunde der Humboldt Universität, Berlin and Zoologisches Institut und Zoologisches Museum Universität Hamburg).

1970. *Eukerria peguana* Soota & Julka, *Proc. zool. Soc., Calcutta*, **23** : 204.

1970. *Eukerria kukenthali* Jamieson, *Bull. Br. Mus. nat. Hist.* (*Zool.*), **20** : 144.

1972. *Eukerria kukenthali* Gates, *Trans. Am. phil. Soc.*, **62** : 269.

Diagnosis.—Length 20-70 mm ; diameter 0.75-1.0 mm. Segments 105-142. Prostomium prolobic. Dorsal pores lacking. Clitellum annular, XIII-XIX, XX. Setae lumbricin ; $AB=CD$, $AA=BC$, $DD=\frac{1}{2}$C. Spermathecal pores 2 pairs, at AB, in 7/8-8/9. Prostatic pores 2 pairs, at AB, minute, on roofs of transversely slit-like parietal invaginations with transversely placed apertures, on protuberant anterior and posterior ends of paired, longitudinal, dumbbell-shaped porophores, in XVII and XIX ; a solid 'clear gland' with a short stalk protrusible from each prostatic pore invagination. Male pores one pair, minute, at equator of XVIII, slightly lateral to B. Female pores paired, on XIV. Genital marking, a transversely placed area of epidermal thickening in XXI, with a pair of minute pores, each pore just lateral to B.

Unpigmented. Septa all present from 4/5. Gizzard in VII ; calciferous glands paired, in IX ; intestinal origin in XII. Last pair of hearts in XI. Testes proandric, free, in X ; seminal vesicles in IX, XI. Prostates tubular, long. Spermathecae adiverticulate ; duct about as long as ampulla, moniliform and bound to parietes. Genital marking glands tubular, stalked, prostate-like.

Distribution.—Andaman & Nicobar Islands : Maya Bundar, Port Blair, Car Nicobar (Soota & Julka, 1970).

Range.—Burma, Malay Peninsula, Indonesia, South America.

Genus **Gordiodrilus** Beddard, 1892

Gordiodrilus elegans morph **paski** Stephenson

1928. *Gordiodrilus paski* Stephenson, *Ann. Mag. nat. Hist.* (*ser. 10*), **1** : 1. (Type loc.—Kigoma Harbour, Lake Tanganyika ; types in Brit. Mus. (Nat. Hist.). London).

1963. *Gordiodrilus paski*, Jamieson, *Bull. Br. Mus. nat. Hist. Zool.*, 9 : 312.

1970. *Gordiodrilus paski*, Soota & Julka, *Proc. zool. Soc., Calcutta*, **23** : 205.

1972. *Gordiodrilus elegans* (?), Gates, *Trans. Am. phil. Soc.*, **62** : 271.

Diagnosis.—Length 35-47 mm ; diameter 1-1.5 mm. Segments (?). Prostomium epilobic. Clitellum annular, XIII-XIX, XX. Setae lumbricin ; $AB=CD$, $AA<BC$, $DD=\frac{1}{2}C$; *a*, *b*, of XVII and XVIII absent or some of them present. Spermathecal pores 2 pairs, in or near *B*, on 7/8, 8/9. Prostatic pores 2 pairs, on setal arcs of XVII and XVIII, in *AB*, at anterior and posterior ends of straight or slightly outwardly curved seminal grooves ; male pores one pair, apparently at 17/18 in seminal grooves. Male shield a squarish or dumbbell-shaped area. Female pores paired, just lateral to *B*, on XIV.

Unpigmented. Septa all present from 4/5. Gizzard absent ; intestinal origin in XII. Calciferous glands unpaired and ventral in IX. Last pair of hearts in XI. Testes holandric, probably contained in testis sacs, in X, XI ; seminal vesicles in XII, sometimes in XI also. Spermathecae adiverticulate ; duct slightly spindle-shaped, longer than ampulla, the walls of the swollen region possess 2-8 small chambers.

Distribution.—Andaman & Nicobar Islands : Maya Bundar (Soota & Julka, 1970).

Range.—Mainland India, Burma, South America, Africa.

Remarks.—Jamieson (1963) included *G. paski* alongwith another 15 species in the *elegans* group. Further, he considers possibly that *G. niloticus*, *G. bonacanus*, *G. travancorensis*, *G. worthingtoni*, *G. madagascariensis* and *G. paski* (including *G. unicus* and *G. peguanus*) as all synonyms of *G. dominicensis*. However, Gates (1962 b) lists *G. dominicensis*, *G. ditheca*, *G. zanzibaricus*, *G. travancorensis*, *G. habessinus*, *G. paski*, *G. unicus*, *G. wemanus*, *G. bonacanus* and *G. peguanus* as synonyms of *G. elegans*. The synonymy proposed by Gates is due to the frequent reduction of certain genital organs in parthenogenetic morphs of a Burmese species and the presumption that most of the other 'species' in the *elegans* group are also parthenogenetic morphs derived from a sexprostatic H morph.

Genus **Ocnerodrilus** Eisen, 1878

Ocnerodrilus occidentalis Eisen

1878. *Ocnerodrilus occidentalis* Eisen, *Nova Acta R. Soc. Sci. upsaliensis (ser. 3)*, **10** (4) : 10 (Type loc.—Fresno, California ; types in Brit. Mus. (Nat. Hist.), London).

1972. *Ocnerodrilus occidentalis*, Gates, *Trans. Am. phil. Soc.*; **62** : 273.

1973. *Ocnerodrilus occidentalis*, Gates, *Bull. Tall Timbers Res. Stn.*, no. 14 : 14.

Diagnosis.—Length 12-46 mm ; diameter 1-2 mm. Segments 70-84. Prostomium epilobic, tongue open. Dorsal pores absent. Clitellum annular, XIV—XIX, sometimes covering XIII and XX. Setae lumbricin ; $AA=BC$, $DD=\frac{1}{2}C$. Spermathecal pores absent. Male pores at centres of whitish, low, porophores ; each porophore lateral to *B*, in XVII, Female pores paired, on XIV, at or slightly lateral to *B*. Genital markings lacking.

Unpigmented. Septa all present from 4/5. Gizzard lacking ; calciferous glands paired, in IX ; intestinal origin in XII. Last pair of hearts in XI. Testes holandric, in X, XI ; seminal vesicles lacking. Prostates tubular, of variable length, either confined to XVII or passing back into region of XVIII—XXX.

Distribution.—Andaman & Nicobar Islands : Ross Island (Stephenson, 1916) : Car Nicobar, Maya Bundar, Port Blair (Soota & Julka, 1970).

Range.—Mainland India, Burma, Pakistan, Sri Lanka, Singapore, China, Japan, Philippines, some islands in Pacific Ocean, U. S. A., Mexico, St. Thomas, Europe, Africa, Cape Verde Islands, Great Comoro, Israel, Lebanon, Central Asia Basin (SSSR).

Genus **Thatonia** Gates, 1942

Thatonia gracilis Gates

1942. *Thatonia gracilis* Gates, *Bull. Mus. comp. Zool. Harv.*, **89** : 101. (Type loc.—Thongwa, Burma ; typus amissus).

1972. *Thatonia gracilis*, Gates, *Trans. Am. phil. Soc.*, **62** : 266.

Diagnosis.—Length 63-87 mm ; diameter 1 mm. Segments (?). Prostomium epilobic. Dorsal pores absent. Clitellum saddle-shaped, XIII—XXII, XXIII. Setae lumbricin ; $AB=CD$, $AA>BC$, DD *ca.* $=\frac{1}{2}C$; setae *a*, *b* of II—XV or XVI enlarged. Spermathecal pores 2 pairs, at *B*, in 7/8, 8/9. Prostatic pores 2 pairs, on setal arcs of XVII and XIX, at anterior and posterior ends of seminal grooves ; male pores one pair, in XVIII, a little in front of setae *a* ; seminal grooves H-shaped. Female pores paired, at *B*, on XIV. Genital markings lacking.

Unpigmented. Septa all present from 4/5. Gizzard in VII ; calciferous glands lacking ; intestinal origin in XII. Last pair of hearts in XI. Testes holandric, free, in X, XI ; seminal vesicles in XI, XII. Prostates tubular. Spermathecae adiverticulate ; ampulla tubular, coiled ; duct short.

Distribution.—Andaman & Nicobar Islands : Port Blair (Soota & Julka, 1970).

Range.—Mainland India, Burma.

Family OCTOCHAETIDAE

KEY TO GENERA

1.	Gizzard single ; discrete calciferous glands absent. ...	**Ramiella**
	Gizzard doubled ; one pair of trilobed discrete calciferous glands present, in XV-XVII. ...	**Dichogaster**

Genus **Dichogaster** Beddard, 1888

KEY TO SPECIES OF DICHOGASTER

1.	Female pore single, at mid-ventral. ...	**D. bolaui**
	Female pores paired ; ...	**D. modiglianii**

Dichogaster bolaui (Michaelsen)

1891. *Benhamia bolavi* Michaelsen, *Jb. hamb. wiss. Anst.*, **8** (2) : 9. (Type loc.—Bergedorf, Hamburg ; types in Zoologisches Institut und Zoologisches Museum Universität, Hamburg).

1972. *Dichogaster bolaui*, Gates, *Trans. Am. phil. Soc.*, **62** : 279.

Diagnosis.—Length 20-40 mm ; diameter 1-3 mm. Segments 70-98. Prostomium epilobic, tongue narrowing posteriorly ; intersegmental furrow 1/2 often lacking or indistinct. First dorsal pore in 5/6 or 6/7. Clitellum annular, XIV-XVIII, sometimes extending to XIII, XIX, XX, XXI. Setae lumbricin, present on clitellar segments, $AA=BC$, $DD>\frac{1}{2}C$. Spermathecal pores 2 pairs, at *A*, in 7/8, 8/9. Prostatic pores 2 pairs, at *A*, on XVII and XIX, at anterior and posterior ends of seminal grooves ; male pores one pair, in seminal grooves, on XVIII. Female pore single, mid-ventral, on XIV.

Unpigmented (?). Septa all present from 7/8. Gizzards in VI and VII ; one pair of trilobed calciferous glands in XV-XVII ; intestinal origin in XIX. Last pair of hearts in XII. Testes holandric, contained in testis sacs (?), in X, XI ; seminal vesicles in XI, XII. Prostates tubular,

confined to XVII and XIX ; ducts straight. Spermathecae unidiverticulate ; duct barrel-shaped, as long as ampulla ; diverticulum digitiform, arises from ental end of duct. Penial setae 0.27-0.4 mm long, 3.5-7.5 μ thick at midshaft ; tip hooked or widened and then scalpel—, spatula—, oar—, spoon-shaped ; ornamentation of several triangular teeth.

Distribution.—Andaman & Nicobar Islands : Car Nicobar (Soota & Julka, 1970).

Range.—Indian subcontinent, Malay Peninsula, Indonesia, Philippines, some islands in Pacific Ocean, Australia, Hawaii, U. S. A., Mexico, South America, West Indies, Africa, Madagascar and adjacent islands.

Dichogaster modiglianii (Rosa)

1896. *Benhamia modiglianii* Rosa, *Ann. Mus. Sto. Nat. Genova*, **36** : 510. (Type loc.—Padang, Sumatra ; types in Museo Civico di Storia Naturale, Genova).

1972. *Dichogaster modiglianii*, Gates, *Trans. Am. phil. Soc.*, **62** : 280.

Diagnosis.—Length 22-60 mm ; diameter 1-2 mm. Segments 76-120. Prostomium epilobic, tongue narrowed posteriorly and reaching 1/2. First dorsal pore in 4/5 or 5/6. Clitellum annular, XIII-XX. Setae lumbricin, present on clitellar segments, $AA=BC$, $DD>\frac{1}{2}C$. Spermathecal pores 2 pairs, in 7/8, 8/9, at or close to *A*. Prostatic pores 2 pairs, at anterior and posterior ends of seminal grooves, at *A*, on XVII and XIX ; male pores one pair, in seminal grooves, on XVIII. Female pores paired, on XIV, just median or posteromedian to *A* setae.

Unpigmented (?). Septa 7/8 as well as 5/6 and 6/7 lacking (?). Gizzards in VII, VIII (?) ; calciferous glands one pair, trilobed, in XV-XVII ; intestinal origin in XIX. Last pair of hearts in XII. Testes holandric, contained in unpaired testis sacs, in X, XI ; seminal vesicles lacking or vestigeal in XII. Prostates tubular, confined to XVII and XIX ; ducts straight. Spermathecae unidiverticulate ; duct bulbous and longer than ampulla ; diverticulum stalked with a small spheroidal to ellipsoidal seminal chamber, arises from middle region of duct ; Penial setae 0.31-0.42 mm long, 5-9 μ thick entally, straight or slightly bowed ; tip slightly thickened or recurved ; ornamentation of scale-like markings.

Distribution.—Andaman & Nicobar Islands : Port Blair, Haddo, Pahargaon (Gates, 1958).

Range.—Mainland India, Burma, Pakistan, Malay Peninsula, Indonesia, Philippines, some of the islands in Pacific Ocean, South America,

Genus **Ramiella** Stephenson, 1921

Ramiella bishambari (Stephenson)

1914. *Octochaetus bishambari* Stephenson, *Rec. Indian Mus.*,, **10** : 347. (Type loc.— Saharanpur ; types in Brit. Mus. (Nat. Hist.), London).

1972. *Ramiella bishambari*, Gates, *Trans. Am. phil. Soc.*, **62** : 312.

Diagnosis.—Length 20-35 mm ; diameter 1-1.2 mm. Segments 82-87. Prostomium epilobic, tongue open. First dorsal pore in region of 6/7-10/11. Clitellum annular, XIII-XVII. Setae lumbricin, present on clitellar segments, $AB=CD$, $AA=BC$. Spermathecal pores 2 pairs, at B, just behind intersegmental furrows 7/8, 8/9. Prostatic pores 2 pairs, in AB, at anterior and posterior ends of seminal grooves, on XVII and XIX ; male pores one pair, in seminal grooves, on XVIII. Female pores paired ; anteromedian to A, on XIV. Genital markings small, circular to shortly elliptical, paired, in or near AB, presetal on VII, VIII, IX, XVII and XX, postsetal on VII, VIII, X, XI ; unpaired and median, postsetal in XIX or at 19/20.

Unpigmented. Septa all present from 4/5. Gizzard in VI ; intestinal origin in XIV. Nephridia in postclitellate segments arranged in 2 or 3 longitudinal ranks on each side. Last pair of hearts in XII. Testes holandric, free, in X, XI ; seminal vesicles in (XI), XII. Prostates tubular ; ducts S-shaped. Penial setae ribbon-like, rolled so as to appear solid, 0.50-0.95 mm long ; 0.020-0.036 mm thick, tip narrowed and hooked ; ornamentation of 7-15 transverse rows of triangular teeth. Spermathecae diverticulate ; duct slender, longer than ampulla ; diverticulum single, spheroidal to ellipsoidal, sessile, arises from ental end of duct. Genital marking glands (?).

Distribution.—Andaman & Nicobar Islands : Aberdeen, Port Blair (Gates, 1958).

Range.—Mainland India, Burma, Indonesia, Philippines.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, Calcutta for the facilities extended for the completion of the paper. Thanks are due to Dr. H. Khajuria, Deputy Director, High Altitude Zoology Field Station, Zoological Survey of India, Solan for his guidance and encouragement.

SUMMARY

This paper presents a comprehensive account of twenty seven earthworm species so far reported from the Andaman and Nicobar

Islands. For each of these is presented a synonymy, diagnosis, distribution in Andaman and Nicobar Islands and range of distribution in the world. Of the 27 species, 20 are exotic and probably have been transported to these islands by man alongwith the soil around the roots of plants. The zoogeographical relations of the earthworm fauna of these islands have also been discussed.

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