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**TAXONOMIC STUDIES ON THE EARTHWORMS
COLLECTED DURING THE SUBANSIRI
EXPEDITION IN ARUNACHAL
PRADESH, INDIA**

by

J. M. JULKA

Issued by the Director
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सत्यमेव जयते

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TAXONOMIC STUDIES ON THE EARTHWORMS COLLECTED DURING THE SUBANSIRI EXPEDITION IN ARUNACHAL PRADESH, INDIA

By

J. M. JULKA

High Altitude Zoology Field Station

Zoological Survey of India, Solan

INTRODUCTION

The Subansiri Scientific Expedition was organised by the Geological Survey of India in November 1974-February 1975 to survey the unexplored areas in the Subansiri district of Arunachal Pradesh. The route of the expedition was along the Subansiri river to its upper reaches from Taliha to Taksing, along Tsari Chu river from Galensinaik to Maja, from Lemeking through Kechi Pass to Huri and from Huri to Tamin along Kamala river. The present studies are based on a number of earthworms collected by the author as a member of the expedition party. The specimens are deposited in the collections of High Altitude Zoology Field Station, Zoological Survey of India, Solan. Duplicates of all species will be deposited in due course of time in the collections of Zoological Survey of India (Headquarters), Calcutta and Eastern Regional Station, Zoological Survey of India, Shillong. A set of figures united with dashes, e.g., 2-0-9 before locality in the material means that 2 juvenile, 0 acitellate and 9 clitellate specimens were collected.

The earthworm fauna of Arunachal Pradesh is known only from the contributions of Stephenson (1914), Julka and Halder (1975) and Julka (1976), although the earthworms of neighbouring areas of Burma have been studied extensively by Gates (1972) and of Assam, Nepal, Tibet and West China to certain extent by Stephenson (1924, 1925 a, 1925 b), Michaelsen (1909), Sims (1963), Cernosvitov (1941) and Chen (1931, 1936, 1946). The present article records twenty seven species, of which eleven species are new to science. Of the eleven species described by Stephenson (1914) from the Abor country (Arunachal Pradesh), *Drawida kempi*, *Perionyx depressus*, *Perionyx kempi* and *Tonoscolex striatus* are recorded.

GENERAL TOPOGRAPHY OF THE AREA

The area is mountainous and drained by the Subansiri river and its tributaries which flow through narrow precipitous gorges. Three high mountain ridges, the Takpa Shiri, the Keru and Mela-yebba stand out prominently on the left bank of the Subansiri river and on the right bank there is a chain of snow covered high ranges forming the watershed between the Subansiri and Kamala rivers. The climate ranges from tropical heat in the low lying areas to extreme cold in the upper regions. The main rainy season is from April to October, but frequent light showers even in December to March are not uncommon. The average annual rainfall ranges from 1000 mm. (at higher elevations in the north) to 3000 mm. (at lower elevations in the south).

The vegetation varies at different altitudes. Broadly, the following main vegetational zones can be recognized.

1. *Tropical evergreen forests* (upto 900 m.).—The top canopy in these forests is represented by tall trees, viz., *Altingia excelsa*, *Artocarpus* sp. (Jack tree), *Bombax ceiba* (Sembal), *Dillenia indica*, *Dipterocarpus gracilis* (Wood-oil tree), *Magnolia campbellii*, *Quercus glauca* (Oak), *Shorea assamica* (Sal) and *Terminalia* sp. (Harai). The next canopy is represented by small trees and shrubs like *Ardisia humilis*, *Bauhinia* sp. (Kachnar), *Ficus hispida*, etc. The canes (*Calamus* spp.) occur in swampy places and form impenetrable thickets. The wild banana, *Musa balbisiana*, is quite abundant in these forests.

2. *Sub-Tropical forests* (900–1800 m.).—These forests are dominated by tall trees like *Alnus nepalensis* (Alder), *Bauhenia* sp. (Kachnar), *Bombax ceiba*, *Callicarpa* sp., *Kydia calycina*, *Quercus glauca* and *Saurauja* spp. Apart from these, some species of bamboos, such as, *Cephalostachyum latifolium*, *Chimonobambusa callosa* and *Phyllostachyus bambusoides* are also found in this zone. Among the small trees the common ones are *Capparis multiflora* and *Photinia* sp.

3. *Temperate forests* (1800–3300 m.).—These are not so dense as the tropical evergreen and sub-tropical forests. The common trees found are *Castanopsis indica*, *Acer hookeri* (Maple), *Quercus lamellosa* (Oak), *Magnolia* sp., *Rhododendron* spp., *Cupressus torulosa* (Himalayan Cypress) and *Tsuga dumosa* (He. nlock Spruce of Nepal). The pine trees (*Pinus wallichiana*) are also found in this zone.

4. *Sub-alpine forests* (3300–4000 m.).—The vegetation in these forests mainly consists of coniferous trees, viz., *Pinus wallichiana* (Pine), *Abies spectabilis* (Fir) and *Juniperus recurva* (Cedar). A few species of *Rhododendron* are also commonly found in these forests.

LIST OF LOCALITIES

Format.—Name of locality; altitude; soil; main vegetation (common name if known given the first time species is encountered).

1. Ayumuring; 450 m; silt loam; *Altingia excelsa*, *Dipterocarpus gracilis* (Wood-oil), *Shorea assamica* (Sal), *Quercus glauca* (Oak).

2. Damin; 1100 m; loam; *Callicarpa* sp., *Quercus glauca*.

3. Doginalo; 800 m; clay loam; *Bombax ceiba* (Sembal), *Quercus glauca*.

4. Doju Bung; 1670 m; clay loam rich in organic matter; *Castanopsis indica*, *Cephalostachyum latifolium* (Bamboo).

5. Galensinaik; 1300 m; sandy loam; *Bauhenia* sp. (Kachnar), *Phyllostachyus bambusoides* (Bamboo), *Quercus glauca*.

6. Gelemo; 1550 m; loam; *Alnus nepalensis* (Alder), *Cephalostachyum latifolium*, *Quercus glauca*.

7. Gimba; 700 m; loam; *Callicarpa* sp., *Musa balbisiana* (Wild banana).
8. Holin; 700 m; sandy loam; *Callicarpa* sp., *Musa balbisiana*, *Quercus glauca*.
9. Huri; 1150 m; loam; *Callicarpa* sp., *Kydia calycina*, *Quercus glauca*.
10. Kabak; 1100 m; sandy loam; *Cephalostachyum latifolium*, *Musa balbisiana*.
11. Nr. Kau Pass; 1350 m; clay; *Castanopsis indica*, *Chimonobambusa callosa* (Bamboo), *Quercus glauca*.
12. Kolang; 1200 m; sandy loam; *Cephalostachyum latifolium*, *Quercus glauca*.
13. Kotar Nala; 2300 m; silt loam; *Castanopsis indica*, *Quercus lamellosa* (Oak).
14. Lemeking; 1400 m; loam; *Chimonobambusa callosa*, *Phyllostachyus bambusoides*, *Quercus glauca*.
15. Lingpo; 1250 m; sandy loam; *Cephalostachyum latifolium*, *Quercus glauca*.
16. Maja; 2300 m; sandy loam; *Acer hookeri* (Maple), *Castanopsis indica*, *Magnolia* sp., *Quercus lamellosa*.
17. Orak; 1150 m; sandy loam; *Bombax ceiba*, *Phyllostachyus* sp.
18. Pabin; 650 m; loam; *Bombax ceiba*, *Musa balbisiana*, *Quercus glauca*.
19. Parsipala; 600 m; sandy loam; *Dipterocarpus gracilis*, *Shorea assamica*.
20. Richik; 450 m; silt loam; *Dillenia indica*, *Shorea assamica*, *Quercus glauca*.
21. About 3 km. E. of Richik; 1300 m; clay loam; *Chimonobambusa callosa*.
22. Riding Camp; 1900 m; loam; *Acer hookeri*, *Castanopsis indica*, *Quercus lamellosa*.
23. Rui; 750 m; loam; *Altingia excelsa*, *Artocarpus* sp. (Jack), *Shorea assamica*.
24. Seiom; 500 m; loam; *Altingia excelsa*, *Terminalia* sp. (Harar), *Quercus glauca*.
25. Siki; 550 m; silt loam; *Shorea assamica*, *Quercus glauca*.
26. Surila Top; 3200m; sandy loam; *Cupressus torulosa* (Himalayan Cypress), *Rhododendron campanulatum*, *Pinus wallichiana* (Pine), *Tsuga dumosa* (Hemlock Spruce of Nepal).

27. Taksing; 2500 m; sandy loam; *Acer hookeri*, *Castanopsis indica*, *Quercus lamellosa*.
28. Tali; 800 m; loam; *Cephalostachyum latifolium*, *Quercus glauca*.
29. About 4 km. N.W of Tali; 1000 m; loam; *Chimonobambusa callosa*, *Shorea assamica*.
30. Taliha; 800-900 m; clay loam rich in organic matter; *Bombax ceiba*, *Shorea assamica*, *Quercus glauca*, *Musa balbisiana*.
31. Tongba; 2100 m; clay; *Acer hookeri*, *Castanopsis indica*, *Magnolia* sp.
32. Tumbia; 600 m; sandy loam; *Dipterocarpus gracilis*, *Magnolia* sp., *Musa balbisiana*.
33. Vidak; 600 m; silt loam; *Dipterocarpus gracilis*, *Shorea assamica*.
34. Yame; 1200 m; clay; *Callicarpa* sp., *Quercus glauca*.

SYSTEMATIC ACCOUNT

Family MONILIGASTRIDAE

Drawida aruna sp. nov.

(Text Fig. 1A, B, C)

Material.—Holotype : 0-0-1; Seiom; 25.xi.74; An 122. Paratypes : 0-2-0; Taliha; 19.xi.74; An 123. 2-2-0; Siki; 24.xi.74; An 124. 0-19-2; Seiom; 25.xi.74; An 125. 0-3-0; Ayumuring; 26.xi.74; An 126. 0-5-0; Orak; 5.xii.74; An 127. 0-4-0; Doginalo; 29.xi.74; An 128.

External characteristics.—Length 36-82 mm. Diameter 2.5-4 mm. Segments 108-142. Unpigmented. Prostomium prolobous. Setae begin on II; $AA=8AB=BC=8CD=0.33DD$. Nephropores recognizable from III, at or close to *D* lines, on VIII midway between *D* and *mD*. Clitellum X-XIII, indicated by epidermal tumescence; intersegmental furrows and setae present.

Spermathecal pores (secondary) large, transverse slits at $7/8$ in *CD* with fissured tumescent borders. Primary spermathecal pores minute on conical thickenings on posterior walls of deep invaginations. Male pores transverse slits at tips of tubular penes eversible from parietal invaginations near middle of *BC* at $10/11$. Female pores minute, at $11/12$, close to *B* lines. Genital tumescences semi-circular whitened areas of epidermal thickening, one in front of and one behind each male porophore in *BC*, between $10/11$ and equators of X-XI.

Internal anatomy.—Septa 5/6-8/9 thickly muscular, 9/10 thin and slightly displaced posteriorly. Gizzards 4-6, in XII-XVII (1), XIV-XVIII (2), XIV-XIX (1), XV-XVIII (7), XV-XIX (4). Intestinal origin in XXIII (2), XXIV (8), XXV (5).

Dorsal blood vessel traceable anteriorly upto III. Connectives between extra-oesophageals and dorsal blood vessel on posterior faces of 8/9 and 9/10.

Excretory system holoic; nephridia vesiculate, bladders sausage-shaped.

Testis sacs either entirely in X or equally in IX and X. Vas deferens about 105 mm. long, coiled in a mass of long loose loops in IX and X, the mass itself slightly less than or of same size as testis sac. Prostates sessile, ovoidal or dome-shaped, firmly attached to parietes, glandular; capsule ovoidal and sessile; lumen of capsule elliptical in cross section and ridged. Vas enters the prostate on its inner face.

Spermathecae adiverticulate; ducts short, about 8 mm. long, loosely coiled, opening at the ental end of an elongated pear-shaped or barrel-shaped atrial widening in VIII which is five to six times as wide as duct; lumen of atrial widening elliptical in cross section and ridged, duct opens into the lumen of the atrial widening on a small conical thickening.

No glands on the inner faces of genital tumescences.

Habitat.—Clayey soil along hill slopes in forests of *Shorea assamica* and *Quercus glauca*; altitudinal range 450-1100 m.

Relationship.—*Drawida aruna* sp. nov. is closely related to *Drawida nemora* Kobayashi (from Korea) and *Drawida tihunensis* Julka (from Arunachal Pradesh, India) which are characterized by adiverticulate spermathecae, male pores on penes in parietal invaginations and prostates glandular, sessile and ovoidal. From *D. nemora*, this new species is clearly distinguished by the shape of the penes (tubular versus conical), presence of atrial widening of the spermathecal duct and absence of genital marking glands. From *D. tihunensis*, *D. aruna* is distinguished by differences in size of the atrial widening of the spermathecal duct (5-6 times versus slight) and by the absence of genital marking glands.

***Drawida beddardi* (Rosa)**

1890. *Moniligaster beddardi* Rosa, *Ann. Mus. Civ. Sto. nat. Genova*, 29: 379.

1972. *Drawida beddardi*, Gates, *Trans. Am. phil. Soc.*, 62: 246.

Material.—6-3-0; Seiom; 25.xi.74. 15-8-1; Ayumuring; 25.xi.74. 2-4-0; Yame; 15-i-75. 4-6-0; Huri; 20-i-75. 1-12-0; Damin; 22.i.75. 4-12-0; Pabin; 24.i.75. 0-0-1; Tumbia; 26.i.75. 1-1-0; about 3 km. E. of Richik; 29.i.75. 0-1-0; Kabak; 6.ii.75.

External characteristics.—Length 62-95 mm. Diameter 2-3.5 mm. Segments 117-153. Unpigmented. Prostomium prolobous. Setae begin on II; $AA=7AB=0.74-0.82BC=7CD=0.17-0.2DD$. Nephropores recognizable from III, slightly dorsal to *D* lines on III-VIII, at *D* on IX and posterior segments (including of X). Clitellum IX-XIV, reddish in colour, intersegmental furrows distinct, setae present.

Spermathecal pores (secondary) large, transverse slits at 7/8 in

CD. Male pores minute on tips of short tubular penes eversible from parietal invaginations in *BC* at 10/11. Female pores minute, at 11/12, close to *B* lines. Genital tumescences whitened areas of epidermal thickening, just in front of and behind male pores.

Internal anatomy.—Septa 5/6-8/9 muscular, 9/10 membranous and slightly displaced posteriorly. Gizzards 4-6, in XIII-XVII (1), XIV-XVII (3), XIV-XVIII (5), XIV-XIX (1), XV-XVIII (5), XV-XIX (8), XV-XX (1). Intestinal origin in XXIII (4), XXIV (8), XXV (8).

Dorsal blood vessel traceable anteriorly upto III. Connectives from extra-oesophageals on anterior face of 8/9 ventrally, but opening into dorsal blood vessel through septum 8/9 (15) or on posterior face of 8/9 (4). Subneural adherent to parietes, untraceable in front of X.

Excretory system holoic; nephridia present in X (in both the acitellate and clitellate specimens), vesiculate, bladders elongately sausage-shaped.

Testis sacs equally in IX and X. Vas deferens short, about 17mm. long, slightly coiled, passing directly into a little below ental end of prostate. Prostates 2-3.5 mm. long (15), digitiform, erect or bent, glandular investment lacking towards ectal end; capsule digitiform.

Spermathecae adiverticulate; duct 5-6 mm. long (15), loosely coiled, ectal end slightly thickened, conical in shape and mostly confined to parietes. Ovarian chamber closed off from parietes. No glands on the inner faces of genital tumescences.

Habitat.—Clayey soil along hill slopes in open grassland and forests of *Chimonobambusa callosa*, *Callicarpa* sp. and *Shorea assamica*; under stones in the vicinity of streams; altitudinal range 450-1300 m.

Remarks.—It is the first record of *Drawida beddardi* (Rosa) from India. In Burma, Gates (1972) recorded this species at altitudes of 3000-4000 ft. (900-1200 m.). The present record of this species at an altitude of 450 m. extends its range to lower elevations.

Distribution.—INDIA : Arunachal Pradesh-Seiom, Ayumuring, Yame, Huri, Damin, Pabin, Richik, Tumbia and Kabak (all present record).

Outside India : BURMA, THAILAND (?).

Drawida constricta Gates

1929. *Drawida constricta* Gates, *Proc. U.S. natl. Mus.*, 75 : 10.

1972. *Drawida constricta*, Gates, *Trans. Am. phil. Soc.*, 62 : 248.

Material.—0-3-0; Taliha; 18.xi.74.

Habitat.—Black clayey soil in a cultivated field; altitude 900 m.

Remarks.—*Drawida constricta* Gates is recorded for the first time from India. Gates (1972) mentions that details of nephridia of X and intestinal origin of this species are unknown. The studies on the pre-

sent material reveal: nephridia are present in X but their ducts are not traceable to the parietes, and intestinal origin is in XXIV (2), XXV (1). Further, the specimens from Arunachal Pradesh slightly differ from those found in Burma regarding the length (107-110 mm. versus 73-95 mm.), number of segments (191-196 versus 148) and number of gizzards (3-4 in XIII-XVI versus 2-3 in XIV-XVIII).

Distribution.—INDIA : Arunachal Pradesh-Taliha (present record).

Outside India.—BURMA.

Drawida duttai sp. nov.

(Text Fig. 2A, B; 3C, D, E)

Material.—Holotype : 0-0-1; Yame; 15.i.75; An 119. Paratypes : 1-1-0; Lingpo; 10.i.75; An 120. 0-1-0; about 4 km. N.W of Tali; 30.i.75; An 121.

External characteristics.—Length 105-110 mm. Diameter 4.5-6mm. Segments 109-137 Unpigmented. Prostomium prolobous. Setae begin on II; $AA=6.5-7.5$ $AB=0.6-0.82$ $BC=6.5-7.5$ $CD=0.33$ DD . Nephropores recognizable from III, on III-IX slightly dorsal to D lines, on X and posterior segments at or close to D lines. Clitellum X-XIII, indicated by epidermal tumescence, intersegmental furrows and setae present.

Spermathecal pores (secondary) large, transverse slits at $7/8$ in CD with fissured tumescent lips; primary spermathecal pores minute, each on a circular area in a deep parietal invagination. Male pores (secondary) invaginate, transverse slits at $10/11$ in BC , nearer to B than C ; primary male pores minute, each pore at the tip of an antero-posteriorly compressed eversible tubular pene. Female pores minute, at $11/12$, close to B lines.

Genital tumescences thickened areas of epidermis, in front of and behind the male pores on X and XI in BC .

Internal anatomy.—Septa $5/6-8/9$ thickly muscular, $9/10$ thin and displaced posteriorly. Gizzards 4-6, in XIV-XVIII (1), XV-XVIII (1), XV-XX (1). Intestinal origin in XXV (± 1).

Dorsal blood vessel continued anteriorly to the region of pharyngeal bulb. Connectives between extra-oesophageals and dorsal blood vessel on anterior faces of or within septum $8/9$ and posterior faces of $9/10$. Subneural adherent to parietes, becoming very thin upto X but again increases in size after receiving a vessel from extra-oesophageal in IX and is continued anteriorly to the region of brain.

Excretory system holoic; nephridia present in X; vesiculate, bladders elongately sausage-shaped.

Testis sacs equally in X and XI. Vas deferens about 190 mm. long, coiled into a mass of long loops, the mass slightly less than testis sac in size; vas rises up from parietes and coils around the prostate to open at the ental end of the latter. Prostates 9-10 mm. long, 1.5-2 mm. thick, tubular, bent backwards to extend upto XIV-XV, XVIII, glan-

dular investment sparse, slightly bulbous before entering parietes; capsule tubular, thickly muscular, walls of its lumen spirally ridged and lumen is circular in cross section. Ovarian chamber closed off from parietes, sacs extending back to XIV-XV.

Spermathecae adiverticulate; duct about 11 mm. long, muscular, loosely coiled, opening at the ental end of an elongated pear-shaped or ellipsoidal to tubular atrial widening which is 2.5-4 mm. long and 1-1.5 mm. thick at ental end and slightly narrowed towards the ectal end; atrial widening with four longitudinal ridges and X-shaped in cross section.

No glands on the inner faces of genital tumescences.

Habitat.—Clayey, sandy loam soil near streams in a forest of bamboo, *Cephalostachyum latifolium*; altitudinal range 1000-1250 m.

Relationship.—*Drawida duttai* sp. nov. is closely related to *Drawida spissata* Gates, *Drawida gisti* Michaelsen, *Drawida sinica* Chen and *Drawida linhaiensis* Chen in having unusually long prostates. From *D. spissata*, this new species is clearly distinguished by the location of male pores on tubular penes eversible from parietal invaginations (which in *D. spissata* are on conical epidermal protuberances) and by the shorter length of the spermathecal duct (11 mm. versus 45-70 mm.). *D. gisti*, *D. sinica* and *D. linhaiensis*, *D. duttai* is distinguishable by the tubular shape of the penes (which are conical in *D. gisti*, and *D. sinica* and ovoidal in *D. linhaiensis*). Further, it can be distinguished from both *D. gisti* and *D. sinica* by the absence of genital marking glands and from *D. sinica* by the shape of the prostatic capsules (which in *D. duttai* are slightly bent and in *D. sinica* are deeply looped and the two limbs of the loop closely twisted C).

Remarks.—The species is named after Mr. A. Dutta, Geologist, Leader of the Expedition.

Drawida kemp Stephenson

1914. *Drawida kemp* Stephenson, *Rec. Indian Mus.*, 8 : 376.

1972. *Drawida kemp*, Gates, *Trans. Am. phil. Soc.*, 62 : 250.

1976. *Drawida kemp*, Julka, *Rec. zool. Surv. India*, 69 : 229.

Material.—0-2-0; Taliha; 19.xi.74. 0-0-1; Yame; 15.i.75. 0-1-0; Damin; 22.i.75. 1-5-0; Pabin; 24.i.75. 0-4-0; Parsipala; 25.i.75. 0-3-3; Richik; 28.i.75. 0-2-0; about 3km. E. of Richik; 29.i.75. 1-16-0; Vidak; 8.ii.75.

External characteristics.—Length 52-95 mm. Diameter 3 mm. Segments 104-172. Unpigmented. Prostomium prolobous. Setae begin on II, A and B of IX (5), X (6), XI (23) lacking; $AA=5AB=BC=5CD=0.2DD$. Nephropores recognizable from III, at or close to D lines (including of X), more dorsal in VIII and occasionally also in IX. Clitellum reddish, in IX-XIII; intersegmental furrows and setae present.

Spermathecal pores minute at C. Male pores minute at BC, each on a transversely elliptical porophore. Genital tumescences whitened areas of epidermal thickening, paired in X and XI, one in front of and one behind each male pore; of X semicircular in shape extending from B to C, of XI diagonally placed from A to C.

Internal anatomy.—Septa 5/6-8/9 thickly muscular, 9/10 thin and slightly displaced posteriorly. Gizzards 4-6, in XIII-XVI (1), XIII-XVIII (1), XIV-XVIII (3), XIV-XIX (2), XV-XVIII (2), XV-XIX (7). Intestinal origin in XXIII (5), XXIV (8), XXV (3).

Dorsal blood vessel traceable anteriorly upto III. Connectives between extra-oesophageals and dorsal blood vessel on anterior face of 8/9 and posterior face of 9/10. Subneural thin, adherent to parietes, traceable anteriorly upto XI.

Excretory system holoic; nephridia of X present, but their ducts not traceable to the parietes; vesiculate, bladders sausage-shaped.

Testis sacs equally in IX and X, occasionally either of left or right side displaced posteriorly. Vas deferens 7-8 mm. long, loosely coiled, muscular, opening directly at the median face of spheroidal glandular prostate; prostatic capsule spheroidal, ventral face embedded in the parietes. Spermathecae adiverticulate; ducts short, about 5 mm. long, muscular, looped entally, slightly widened before entering the parietes. Ovarian chamber closed off from parietes. No genital marking glands.

Habitat.—Clayey soil along hill slopes in a forest of *Quercus glauca* and soil near the roots of wild bushes; altitudinal range 450-1300 m.

Distribution.—INDIA : Arunachal Pradesh—Egar stream between Rotung and Renging (Stephenson, 1914); Chowkham, Wakro and Tihun (Julka, 1976); Taliha, Yame, Damin, Pabin, Parsipala, Richik, Vidak (present record).

***Drawida nepalensis* Michaelsen**

1907. *Drawida nepalensis* Michaelsen, *Mitt. naturh. Mus. Hamb.*, 24:146.

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

1976. *Drawida nepalensis*, Julka, *Rec. zool. Surv. India*, 69:230

Material.—6-6-5; Taliha; 18.xi.74.

Habitat.—Under stones near a torrential stream; altitude 900 m.

Remarks.—Gates (1972) notes that this species occurs between sea level and 1200 m., but the author only found it at 900 m. during the Subansiri Expedition.

Distribution.—INDIA : Arunachal Pradesh—Chowkham, Wakro (Julka, 1976); Taliha (present record). Andaman Islands—Mount Harriet, Port Blair. Meghalaya—Siju cave (Garo Hills). Assam—Katlichera,

Amingaon, Balipara Frontier Tract. West Bengal-Kalimpong, Sukiapokri, Teesta Bridge, Jalpaiguri. Bihar-Kierpur (Purneah Dist.). Himachal Pradesh-Nagrota (Kulu Dist.). Uttar Pradesh-Dehra Dun.

Outside India : JAVA, BURMA, BANGLA DESH, NEPAL, PAKISTAN.

Family ACANTHODRILIDAE

Genus *Plutellus* Perrier¹

The genus *Plutellus* has been recently restricted by Jamieson and Nash (1976) to include only Australian species. The restriction of the genus by Jamieson and Nash is not acceptable since they do not assign the excluded species to any genera.

Plutellus bahli sp. nov.

(Text Fig. 4C, D, E, F, G)

Material.—Holotype : 0-0-1; Tumbia; 26.i.75; An 88. Paratypes: 1-1-2; Pabin; 24.i.75; An 89. 0-2-2; Parsipala; 25.i.75 ; An 90.

External characteristics.—Length 31-47 mm. Diameter 1-1.25 mm. Segments 67-89. Unpigmented. Prostomium epilobous, tongue open. Setae begin on II ; on XII, $AA=1.65-1.85$ $AB=0.77-0.92$ $BC=1.08-1.20$ $CD=0.25-0.30$ DD . First dorsal pore at 5/6. Clitellum saddles-haped, $\frac{1}{2}$ XIII-XVII, $\frac{1}{2}$ XVIII, intersegmental furrows lacking, dorsal pores occluded, setae present.

Octothecal; pores at 5/6-8/9, minute, in line with C. Male pores minute, in line with B, each pore at the centre of a low whitish porophore on XVIII, each male porophore extends from middle of AB to a little lateral to B. Female pores minute, paired, on XIV, in front of and slightly mesial to A setae.

Genital markings transversely elliptical, each with a circular whitish central portion. They are paired and located in AB on 15/16 (3), 16/17 (5), 19/20 (5), and in line with B on 17/18 (1).

Internal anatomy.—Septa 5/6-6/7 membranous, 7/8-9/10 slightly muscular. Gizzard vestigial in V. Oesophagus vascular in X-XII with closely crowded longitudinal ridges on the inner wall. Intestinal origin in XIV No typhlosole.

Dorsal blood vessel single, continued anteriorly to the region of cerebral ganglion. Supra-oesophageal present in IX-XII, anteriorly disappearing into dorsal face of gut just behind 8/9 and posteriorly with the hearts of XII. Latero-parietals, extra-oesophageals and sub-neural not recognizable. Commissures of V-IX lateral loops, of X-XII latero-oesophageal hearts. Last hearts in XII.

1. This manuscript was written in 1976. Recently, all Oriental species of *Plutellus* have been transferred to *Diporochoeta* by Jamieson (1977; *Bull. Mus. natn. Hist. nat., Paris*. ser. 3, no. 450, Zool. 313: 477-502).

Excretory system holoic; nephridia in postclitellar segments flattened against body wall, extending from *B* lines to middle of *CD*; nephridial ducts entering the parietes in front of follicles of *C* setae.

Holandric; male funnels iridescent; seminal vesicles in IX and XII. Prostates tubular, loosely looped in XVIII-XX, XXII; duct thin, long, with one or two loops at its ental end, slightly muscular and widened before entering the parietes; a delicate filament (presumably the *vas*) meets the prostatic duct at its ectal end just above the parietes. Penial setae 0.696-0.759 mm. long and 4-6 μ thick; shaft undulating; tip truncate; no ornamentation.

Spermathecae medium; ampulla spheroidal; duct shorter than ampulla, gradually narrows towards parietes; diverticulum shortly stalked, with an ellipsoidal iridescent seminal chamber at tip, opening on the medial face and ental end of duct.

Metagynous; ovaries fan-shaped with several egg strings.

Habitat.—Soil sandy loam, near streams in forests of *Bombax ceiba* and *Musa balbisiana*; altitudinal range 600-650 m.

Relationship.—*Plutellus bahli* sp. nov. belongs to a group of Oriental species of the genus in which seminal vesicles are present in IX and within that group it is closely related to *P. macer* Gates, *P. montanus* Gates, *P. rudis* Gates, *P. sikkimensis* Michaelsen and *P. subtilis* Gates which have intestinal origin in front of XV. From all these species, it is distinguishable by the location of spermathecal pores in 5/6-8/9, which are at 7/8-8/9 in *P. montanus*, *P. rudis* and *P. subtilis*, at VII-VIII in *P. macer* and at 4/5-8/9 in *P. sikkimensis*.

Remarks.—The species is named after Dr. K.N. Bahl, whose work on excretory system of annelids is well-known.

Plutellus daminensis sp. nov.

(Text Fig. 3A, B)

Material.—Holotype : 0-0-1 ; Damin; 20.i.75; An 91.

External characteristics.—Length 13 mm. Diameter 0.7 mm. Segments 67 Unpigmented. Prostomium epilobous, tongue open. Setae begin on II; on XII $AA=2AB=1.14BC=1.6CD=0.33DD$. Dorsal pores recognizable only on postclitellar segments. Clitellum XIII-XVII, saddle-shaped, setae present, intersegmental furrows distinct.

Bithecal; pores at 8/9, minute, in line with *C*. Male pores minute, on XVIII, in line with *B*; each pore at the centre of a whitish and slightly raised porophore. Female pores minute, paired, on XIV, in front of and mesial to *A* setae.

No genital markings.

Internal anatomy.—Septa 5/6-9/10 delicate and membranous. Gizzard vestigial in V Oesophagus moniliform in IX-XIII, with

longitudinal ridges on its inner wall. Intestinal origin in XIV. No typhlosole.

Dorsal blood vessel single, continued anteriorly onto the pharyngeal bulb. Supra-oesophageal present in IX–XII. Extra-oesophageals and latero-parietals unrecognizable. Commissures of V–IX lateral loops, of X–XII latero-oesophageal hearts. Last hearts in XII.

Excretory system holoic; nephridia behind clitellum flattened against parietes, between *B* and mid *CD*; nephridial ducts entering parietes just in front of setae *C*.

Metandric; testes and male funnels iridescent, in XI; seminal vesicles in XII. Prostates tubular in XVIII–XIX; duct slightly muscular with an U-shaped loop at ental end. Penial setae present but broken, only their basal parts could be traced in the penisetal follicles; at base they are $9\ \mu$ thick.

Spermathecae small; ampulla irregularly elongated; duct about half as long as ampulla, narrowed towards ectal end; bidiverticulate, diverticula tubular, opening on the medial and lateral sides of duct near its ental end.

Habitat.—Loamy soil in a forest of *Callicarpa* sp.; altitude 1100m.

Relationship.—*Plutellus daminensis* sp. nov. belongs to a group of oriental species of *Plutellus* which lack seminal vesicles in IX and within that group it is closely related to metandric species viz., *P. macrochaetus* Stephenson and *P. palniensis* Michaelsen. From both these species, it is distinguishable by the location of spermathecal pores at 8/9 which in *P. macrochaetus* and *P. palniensis* are at 7/8–8/9. Further, it can be distinguished from *macrochaetus* by the location of last hearts in XII (in XIII in *P. macrochaetus*) and bidiverticulate condition of spermathecae. From *palniensis*, it can also be differentiated by the paired spermathecal and male pores (unpaired and median in *P. palniensis*).

Plutellus richikensis sp. nov.

(Text Fig. 4A, B)

Material.—Holotype: 0–0–1; Richik; 28.i.75; An 92. Paratypes: 0–2–3; Kolang; 11.i.75; An 93. 0–2–0; Lingpo; 10.i.75; An 94. 1–1–0; Huri; 20.i.75; An 96. 0–2–0; Richik; 14.i.75; An 95. 3–8–0; Damín; 22.i.75; An 97. 2–10–4; Richik; 28.i.75; An 98.

External characteristics.—Length 31–53 mm. Diameter 1 mm. Segments 70–91 Unpigmented. Prostomium epilobous, tongue open. Setae begin on II; on XII $AA=2AB=1.08BC=1.4CD=0.33DD$. First dorsal pore at 4/5 (18), 5/6 (2). Clitellum saddle-shaped, XIII–XVIII, intersegmental furrows distinct, setae present, dorsal pores occluded.

Sexthecal; pores minute, at 6/7–8/9, in line with *C*. Male pores minute, on XVIII, in line with *B*, each pore at the centre of a slightly

raised circular porophore. Female pores minute, paired, on XIV, in front of and just mesial to *A* setae.

Genital markings transversely elliptical, each with a circular whitish central area. They are paired and located as follows: in *AB*, on 16/17 (5), 19/20 (24); in *BC* but nearer to *B* than *C*, on 17/18 (4), 18/19 (1). One of the paired genital markings either of left side or right side may be missing on left side of 16/17 (1), on right side of 16/17 (1), on left side of 17/18 (3) and on right side of 17/18 (1).

Internal anatomy.—Septa 5/6–6/7 thin and delicate, 7/8–9/10 slightly muscular. Gizzard vestigial, in V Oesophagus highly vascular in IX–XII, moniliform in X–XII with longitudinal ridges on its inner wall, the mid-ventral longitudinal ridge on the floor of gut quite prominent. Intestinal origin in XIV No typhlosole.

Dorsal blood vessel single, continued anteriorly to the region of brain. Supra-oesophageal present in IX–XII. Extra-oesophageals pass into ventral face of gut in IX and disappear in the gut wall in XII. Latero-parietals recognizable from XIX forwards, in *CD*, turning mesially in XIII to join the extra-oesophageals in XII. Commissures of V–IX lateral loops, of X–XII latero-oesophageal hearts. Last hearts in XII.

Excretory system holoic; nephridia in postclitellar segments flattened against parietes from *B* to just lateral to *C* lines; ducts entering parietes in front of *C* setal follicles.

Holandric; seminal vesicles in IX and XII. Prostates tubular in XVIII–XXI, XXII; duct with a muscular sheen, looped at ental end or undulating, slightly widened before entering parietes; a delicate filament with slight iridescence (presumably vas deferens) rises from parietes in XVIII and enters the ectal end of prostatic duct. Penial setae 0.519–0.655 mm. long and 4–7 μ thick; shaft slightly bent on one side, tip truncate and expanded; no ornamentation.

Spermathecae large; ampulla spheroidal; duct slightly longer than ampulla and narrows before entering parietes; diverticulum club-shaped on the medial face and ental end of duct, bent upwards.

Metagynous; ovaries fan-shaped with several egg strings.

Habitat.—Soil silt loam along hill slopes and streams in forests of *Dillenia indica*, *Quercus glauca* and *Cephalostachyum latifolium*; altitudinal range 450–1250 m.

Relationship.—*Plutellus richikensis* sp. nov. belongs to a group of Oriental species of *Plutellus* which have seminal vesicles in IX and within that group it is closely related to *P. macer* Gates, *P. montanus* Gates, *P. rudis* Gates, *P. sikkimensis* Michaelsen and *P. subtilis* Gates, in which intestinal origin is in front of XV. From all these species, it is distinguished by the location of spermathecal pores in 6/7–8/9, which are at 7/8–8/9 in *P. rudis*, *P. montanus* and *P. subtilis*, at VII–VIII in *P. macer* and at 4/5–8/9 in *P. sikkimensis*. It is also closely related to *P. bahli* Julka (previously described in this paper) in having seminal

vesicles in IX and intestinal origin in XIV, but it can be distinguished by the three pairs of spermathecae at 6/7-8/9 which in *P. bahli* are four pairs with pores at 5/6-8/9.

***Plutellus taksingensis* sp. nov.**

(Text Fig. 5A, B, C, D)

Material.—Holotype : 0-0-1; Taksing; 22.xii.74; An 99. Paratypes: 3-0-22; Orak; 5.xii.74; An 100. 2-3-14; Riding camp; 10.xii.74; An 101. 1-0-22; Gelemo; 13.xii.74; An 102. 0-0-1; Doju Bung; 15.xii.74; An 103. 0-1-12; Taksing; 22.xii.74; An 104. 0-1-1; Kotar Nala; 6.i.75; An 105. 0-1-0; Lingpo; 10.i.75; An 106. 0-1-0; Huri; 20.i.75; An 107. 2-0-2; Pabin; 24.i.75; An 108. 0-1-0; Parsipala; 25.i.75; An 109.

External characteristics.—Length 36-68 mm. Diameter 1.5-2.5 mm. Segments 66-109. Unpigmented. Prostomium epilobous, tongue open. Setae begin on II; on XII $AA=2.45AB=1.12BC=1.6CD=0.33DD$. Dorsal pores unrecognizable. Clitellum saddle-shaped, XIII-XVII or $\frac{1}{2}$ XVIII, dorsal pores and intersegmental furrows lacking, setae present.

Quadrithecal; pores at 7/8-8/9, minute, located at the centre of elliptical to spheroidal epidermal thickening, in line with *B*. Male pores minute, on XVIII, each pore at the centre of a slightly raised circular to broadly elliptical male porophore in *AB*, the two porophores connected with each other by a slightly raised transverse ridge of epidermal thickening. Female pores minute, paired, on XIV, just in front of *A* setae.

Genital markings transversely elliptical tubercles, each with an opaque whitish rim indistinctly delimited peripherally and a greyish translucent central portion, paired or unpaired, segmental or intersegmental. They are located as follows:—

Median and unpaired: presetal on VII (3), VIII (3), IX (3); postsetal on VII (10), VIII (10), IX (9); intersegmental on 6/7 (1), 7/8 (1), 8/9 (1), 9/10 (1).

Paired: in *AB* near spermathecal pores on VII (37), VIII (52), IX (12); presetal in line with *A* on VIII (9), IX (11); postsetal in *AA* on VII (22), VIII (24), IX (18); presetal in *AA* on XX (2); intersegmental in *AA* on 6/7 (1), 7/8 (1), 9/10 (19), 8/9 (1), 15/16 (23), 16/17 (68), 17/18 (1), 19/20 (63), 20/21 (8); just behind the male porophores in *AB* on XVIII (1). One of the paired genital markings, either of left or right side, may be missing in some specimens. The markings of the right side located at 16/17 and 18/19 are double in one specimen.

Internal anatomy.—Septa 5/6-6/7 thin and membranous, 7/8-9/10 muscular. Gizzard small in V. Oesophagus vascular from IX-XIII, with closely crowded, irregular, longitudinal ridges on its inner wall, the ridges being straight and more spaced in XIV-XV. Intestinal origin in XVI. No typhlosole.

Dorsal blood vessel single, continued anteriorly onto the pharyngeal bulb. Supra-oesophageal present in IX–XIII, anteriorly it disappears into the dorsal face of gut just behind 8/9, posteriorly it bifurcates to enter the hearts of XIII. Extra-oesophageals pass into ventral face of gut in IX and disappear into the gut wall in XII. Lateroparietals recognizable from XVIII forwards, in *CD*, turning mesially in XIII to join the extra-oesophageals in XII. Commissures of V–IX lateral loops, of X–XIII latero-oesophageal hearts. Last pair of hearts in XIII.

Excretory system holoic; nephridia in XIII and posterior segments flattened against body wall, extending from *B* to slightly lateral to *D* lines; nephridial ducts entering the parietes in front of follicles of *C* setae.

Holandric; male funnels iridescent; seminal vesicles in IX and XII. Prostates tubular, loosely looped in XIX–XXII; duct slightly muscular, bent into a J-shaped loop, the short ental limb posteriorly; a delicate filament with slight iridescence (presumably the vas) rises from the parietes in XVIII and forming a loop passes to the middle or a little below towards ectal end of prostatic duct. Penial setae 0.719–0.937 mm. long, 8–9 μ thick; shaft pointed with a slight bend ectally and slightly widened just below the tip; ornamentation of small, sharp, scattered spines towards the ectal end.

Spermathecae large; duct shorter than ellipsoidal ampulla, widened in the middle; diverticulum shortly stalked with an ellipsoidal iridescent seminal chamber, bent downwards, opening at right angles on the inner face in the middle portion of duct.

Metagynous; ovaries fan-shaped with several egg strings.

Habitat.—Under mosses on rocks and logs, under stones near a stream, under decaying leaves in a forest of *Acer hookeri*; altitudinal range 600–2500 m.

Relationship.—*Plutellus taksingensis* sp. nov. belongs to a group of Oriental species of *Plutellus* in which seminal vesicles are present in IX and within that group it is closely related to *P. campsiaulus* Stephenson and *P. singhalensis* (Michaelsen) which have intestinal origin behind XIV and spermathecal pores at 7/8–8/9. It is distinguished from both the species in the location of last hearts in XIII, which are in XI in *P. singhalensis* and in XII in *P. campsiaulus*. The intestinal origin in *P. taksingensis* is in XVI as compared to XVII in *P. campsiaulus* and XVIII or XIX in *P. singhalensis*.

Abnormality.—In one specimen from Orak, spermathecal pores, female pores and male pores are one segment forward than their usual location. In another specimen from Riding Camp, spermathecal, female and male pores are two segments forward than their usual location.

Distribution.—INDIA: Arunachal Pradesh—Abor Hills (Stephenson, 1914); Chowkham, Alubari, Chakama village, Wakro, Chamba, Hawaii, Kharang, Hayuliang and Tezu (Julka, 1976); Taliha, Siki, Seiom, Lemeking, Orak, Galensinaik, Doju Bung, Yame, Holin, Huri, Damin, Richik, Tali, Rui and Gimba (present record). Several localities in hilly areas of Manipur, Assam, Meghalaya, W Bengal, Sikkim, Karnataka, Tamil Nadu, Himachal Pradesh and Uttar Pradesh.

Outside India : BURMA, BANGLA DESH, SRI LANKA, PAKISTAN, AUSTRALIA, NEW ZEALAND, INDONESIA, PHILIPPINES, PACIFIC ISLANDS, North, Central and South AMERICA, WEST INDIES, JAPAN, CHINA, KOREA, HONGKONG, HAWAIIAN ISLANDS, EGYPT, RHODESIA, SOUTH AFRICA, and several countries in Europe.

Perionyx depressus Stephenson

1914. *Perionyx depressus* Stephenson, *Rec. Indian Mus.*, 8: 394.

1914. *Perionyx aborensis* Stephenson, *Rec. Indian Mus.*, 8: 392.

1923. *Perionyx depressus*, Stephenson, *Fauna Brit. India*, Oligochaeta: 328.

Material.—1-0-1; Galensinaik; 8.xii.74. 2-3-1; near Kau Pass; 27.i.75. 0-0-1; about 4 km. N. W of Tali; 30.i.75.

External characteristics.—Length 76-97 mm. Diameter 2.5-3.5 mm. Segments 95-127. Colour dark blue dorsally, lighter ventrally. Prostomium epilobous, tongue open with a mid-dorsal longitudinal groove extending upto 1/2 (faintly marked on II and III). First dorsal pore at 4/5. Setae present from II, closely spaced ventrally than dorsally. Setal formula: 46-48/II, 47-49/III, 65-73/VIII, 62-64/XII, 57-63/XX; VIII/26-30, XVII/18, XVIII/0, XIX/16-18. Clitellum XIII-XVIII, annular, intersegmental furrows and setae present, dorsal pores occluded.

Quadrithecal; pores on 6/7-7/8, transverse slits with tumescent lips, in JO, 0.21-0.25 body circumference apart. Male field depressed in MM; male pores large in line with I, 0.14-0.16 circumference apart, lateral to a bunch of 6-8 penial setae, on an eye-like epidermal thickening, bounded anteriorly and posteriorly by grooves. Female pore, unpaired, median, presetal, on XIV, at the centre of a circular whitish area.

Internal anatomy.—Pigmentation red, restricted to circular musculature, lacking just below intersegmental furrows. Special dorsal muscular band densely pigmented. Septa 5/6-7/8 thin, 8/9 and posterior ones slightly muscular. Gizzard slightly muscular, small, in V. Oesophagus highly vascular in IX-XIII with interrupted longitudinal ridges on its inner wall, moniliform in XIII, longitudinal whitish ridges on inner wall in XIV-XV. Intestinal origin in XVI.

Dorsal blood vessel single, continued anteriorly to the region of brain. Supra-oesophageal VIII-XIII, giving off two pairs of branches in each segment from X-XII, one pair to the hearts of respective segment and the other pair to the lateral walls of oesophagus.

Subneural adherent to parietes, turns laterally in XIII and piercing through 12/13 passes onto gut in XII to join an extra-oesophageal (a narrow, thin subneural continues forward for some distance). Extra-oesophageals recognizable anteriorly upto III. Hearts of X–XII latero-oesophageal. Last hearts in XII.

Excretory system holoic; nephridia vesiculate, bladders sausage-shaped entering the parietes in an irregular longitudinal rank on each side.

Holandric; male funnels and testes free, iridescent; seminal vesicles in XI–XII, united above the gut. Prostates racemose, lobed, in XVIII–XIX; duct slightly muscular, looped, widened towards its ectal end. Penial setae 1.26–1.78 mm. long, 15–18 μ thick in the middle, 11 μ thick near the tip; shaft pointed with 14–16 rings of small spines towards the tip. Spermathecae reaching the dorsal face of gut; ampulla ovoid; duct bulbous before entering the parietes, about half as long as ampulla; adiverticulate. Ovaries fan-shaped with several egg strings.

Habitat.—Black clayey soil along hill slopes and under decaying leaves in forests of *Chimonobambusa callosa* and *Quercus glauca*; altitudinal range 1000–1350 m.

Distribution.—INDIA: Arunachal Pradesh—Abor Hills (Stephenson, 1914); Galensinaik, near Kau Pass, about 4 km. N. W of Tali (present record).

***Perionyx daflaensis* sp. nov.**

(Text Fig. 6B; 7D)

Material.—Holotype: 0–0–1; Kolang; 11.i.75; An 129. Paratypes: 0–0–3; near Kau Pass; 27.i.75; An 130. 0–0–20; 3 km. E. of Richik; 29.i.75; An 131. 0–0–3; Rui; 3.ii.75; An 132.

External characteristics.—Length 36–58 mm. Diameter 1.5–3 mm. Segments 53–71. Colour dark blue, restricted to dorsum. Prostomium epilobous, tongue open, a mid-dorsal groove present on the prostomium extending posteriorly to 1/2. First dorsal pore at 2/3 (13). Setae present from II, closely spaced ventrally than on the dorsum, circles with a dorsal gap $ZZ=1\frac{1}{2}YZ$. Setal formula: 14g, 27–34/II, 21g, 28–34/III, 26g, 40–48/VIII, 40–49/XII, 37–48/XX; VIII/10–12, XVII/6–8, XVIII/0–2, XIX/6–8. Clitellum XIII–XVI, annular, reddish, furrows faintly marked, setae present, dorsal pores occluded.

Quadrithecal; pores on 7/8–8/9, each pore a transverse slit in line with *E* or *F*, 0.14–0.16 circumference apart. Male field transversely depressed on XVIII in *EE* or *FF* slightly dislocating 17/18 anteriorly and 18/19 posteriorly, occupied by a pair of somewhat ovoid epidermal thickenings with narrow ends directed posteriorly. At the centre of each ovoidal thickenings, there is a presetal tag-like whitish swelling of circular or somewhat squarish shape, distinctly demarcated by a fine groove from the surrounding area, and the swelling itself is transversely divided by a short deep groove. Male pores 0.08–0.09 circumference apart; each pore a minute transverse slit,

located in the groove just behind the posterior margin of the tag-like swelling. A short groove parallel to the mid-ventral line runs posteriorly for some distance from the male pore. Female pore median, unpaired, minute, presetal, at the centre of a circular whitish area on XIV

Internal anatomy.—Pigment red, associated with circular musculature, lacking below intersegmental furrows. Special longitudinal muscle band at mD densely pigmented. Septa 3/4-5/6 membranous, 6/7 and posterior ones slightly muscular. Gizzard muscular in V Oesophagus widened in XII-XIII, with irregular longitudinal interrupted white ridges on its inner wall in VIII-XIII. Intestinal origin in XIV No typhlosole.

Dorsal blood vessel single, continued anteriorly to the region of brain, where it bifurcates, the two branches reuniting above subpharyngeal ganglion to form the ventral blood vessel. Supra-oesophageal VIII-XII, bifurcating posteriorly twice, one branch to the hearts of XII and the other to the lateral face of gut in XII. Subneural trunk adherent to parietes, turns laterally in XIII and piercing through 12/13 passes onto gut in XII to join an extra-oesophageal (a narrow, thin subneural is traceable anteriorly upto X). Extra-oesophageals recognizable anteriorly upto V. Hearts of X-XII latero-oesophageal. Last hearts in XII.

Excretory system holoic ; nephridia avesculate, ducts long and slender entering the parietes in an irregular longitudinal rank on each side.

Holandric ; male funnels and testes free, iridescent ; seminal vesicles in XI-XII, united dorsally above the gut. Prostates racemose, lobed, in XVIII-XIX ; duct slightly muscular, with one or two loops and widend before entering the parietes. No penial setae. Spermathecae large, reaching above the gut; ampulla pear-shaped ; duct slightly shorter than ampulla narrowing towards the ectal end ; diverticula represented by 3-4 iridescent sessile seminal chambers on the antero-mesial face at the ental end of duct. Ovaries fan-shaped with several egg strings.

Habitat.—Sandy loam soil in cultivated fields, in rotten plantain stem, under decaying leaves in a forest of *Quercus glauca*; altitudinal range 750-1350 m.

Relationship.—*Perionyx daflaensis* sp. nov. belongs to a group of quadrithecal and holandric species with spermathecal pores at 7/8-8/9 and within that group it is closely related to *P. minimus* Stephenson, *P. pullus* Stephenson and *P. pulvinatus* Stephenson in the absence of penial setae and the location of last pair of hearts in XII. From all these, it is distinguished by the location of first dorsal pore at 2/3 (at 4/5 in *P. minimus*, 1/2 in *P. pullus* and 5/6 in *P. pulvinatus*), intestinal origin in XIV (in XIX in *P. minimus*, XVII in *P. pullus* and XV in *P. pulvinatus*) and shape of the male genital shield. Further, it can be distinguished from both *P. pullus* and *P. pulvinatus* by the clitellum restricted to XIII-XVI (XI-XX in *P. pullus* and XIII-½XIX in *P. pulvinatus*), from *P. pullus* by the wider location

of spermathecal pores and *P. pulvinatus* by the presence of spermathecal seminal chambers. This species is also closely related to *P. daminensis* Julka (described as a new species elsewhere in this paper), but can be distinguished by the location of spermathecal pores (7/8-8/9 versus VII-VIII), clitellum XIII-XVI (XIII-XVII in *P. daminensis* and shape of the male genital shield.

Perionyx daminensis sp. nov.

(Text Fig. 6A; 7C)

Material.—Holotype: 0-0-1; Damin; 22.1.75; An 133.

External characteristics.—Length 34 mm. Diameter 2 mm. Segments 56. Colour red, restricted to dorsum. Prostomium tanylobous, with a mid-dorsal groove extending to 1/2. First dorsal pore at 2/3. Setae present from II, closely spaced ventrally than on the dorsum, with dorsal gap $ZZ=1\frac{1}{2}-2YZ$. Setal formula: 27/II, 33/III, 49/VIII, 47/XII, 37/XX; VIII/6, XVII/6, XVIII/0, XIX/6. Clitellum XIII-XVII, annular, reddish, setae present, intersegmental furrows indistinct, dorsal pores occluded.

Quadrithecal; pores on VII and VIII just in front of 7/8 and 8/9, minute, transverse slits, in line with C, 0.06 circumference apart. Male field an epidermal thickening dislocating 17/18 and 18/19 posteriorly, reaching, laterally to F; seminal grooves slightly converging before meeting a somewhat bow-shaped transverse groove anteriorly. Male pores minute, located at the posterior ends of seminal grooves, 0.05 circumference apart. Female pore minute, unpaired, median, presetal, surrounded by a whitish circular area on XIV.

Internal anatomy.—Pigmentation red, associated with circular muscle layer, lacking just beneath the intersegmental furrows. Gizzard in V Special longitudinal muscle band at mD densely pigmented. Septa thin and delicate. Oesophagus vascular in XII-XIII, swollen and bead-shaped in XIII, with longitudinal ridges on its inner wall in IX-XIII. Intestinal origin in $\frac{1}{2}$ XIV

Dorsal blood vessel single, continued anteriorly to the region of brain, where it bifurcates, the two branches meeting each other above the subpharyngeal ganglion to form the ventral blood vessel. Supra-oesophageal recognizable from IX-XIII, posteriorly it bifurcates twice, one branch to the hearts of XII and the other passing through 12/13 disappears on the dorsal surface of the gut in XIII. Subneural adherent to parietes, turns laterally in XIII to pass into an extra-oesophageal. Extra-oesophageals recognizable anteriorly upto VIII. Hearts of X-XII latero-oesophageal; last hearts in XII.

Excretory system holoic; nephridia avesculate, ducts slender, entering the parietes in an irregular longitudinal rank on each side.

Holandric; male funnels and testes free, iridescent. Seminal vesicles in XI and XII, of XI meeting each other above the gut, of XII

pushing 12/13 back into contact with 13/14, Coelomic cavity of X filled with a whitish coagulum. Prostates racemose, squarish, in XVII-XIX; duct slightly muscular, forming a loop at its ental end and narrowed before entering the parietes in the posterior half of XVIII. No penial setae. Spermathecae reaching a little below the dorsal surface of gut; ampulla spherical; duct a little shorter than ampulla; diverticulum represented by a ridge of 3-4 iridescent seminal chambers, located on the anterior face and ental end of duct. Ovaries fan-shaped with egg strings.

Habitat.—Loamy soil along hill slopes in a forest of *Callicarpa* sp.; altitude 1100 m.

Relationship.—*Perionyx daminensis* sp. nov. belongs to quadrithecal group of holandric species having spermathecal pores at 7/8-8/9 and within that group it is closely related to *P. minimus* Stephenson, *P. pullus* Stephenson and *P. pulvinatus* Stephenson in the absence of penial setae and presence of last pair of hearts in XII. It is distinguishable from all these species by the segmental location of spermathecal pores just in front of intersegmental furrows 7/8 and 8/9, shape of the male genital field, location of first dorsal pore at 2/3 (at 4/5 in *minimus*, at 1/2 in *pullus* and at 5/6 in *pulvinatus*) and intestinal origin in XIV (in XIX in *minimus*, XVII in *pullus* and XV in *pulvinatus*). It is also closely related to *P. daflaensis* Julka (previously described in this paper), but can be distinguished by the clitellum at XIII-XVII (at XIII-XVI in *daflaensis*), segmental location of spermathecal pores and shape of the male genital field.

Perionyx excavatus Perrier

1872. *Perionyx excavatus* Perrier, *Nouv. Archs Mus. nat. Paris*, 8 : 126.
 1914. *Perionyx excavatus*, Stephenson, *Rec. Indian Mus.*, 8 : 386.
 1972. *Perionyx excavatus*, Gates, *Trans. Am. phil. Soc.*, 62 : 141.
 1976. *Perionyx excavatus*, Julka, *Rec. zool. Surv. India*, 69 : 235.

Material.—3-7-11; Talhia; 18. xi. 74. 9-1-0; Ayumuring; 26. xi. 74. 1-2-1; Richik; 14. i. 75. 0-1-0; Huri; 20. i. 75. 0-1-2; Pabin; 24. i. 75. 0-0-1; Parsipala; 25. i. 75. 0-1-4; Tumbia; 26. i. 75. 0-1-4; near Kau Pass; 27. i. 75. 1-3-2; 3 km. E. of Richik; 29. i. 75. 0-0-7; Kabak; 6. ii. 75. 1-0-17; Vidak; 8. ii. 75.

Habitat.—Debris in axils of leaves and roots of wild banana (*Musa balbisiana*), under stones near streams, decaying leaves, sandy soil on the banks of a river; altitudinal range 450-1350 m.

Abnormality.—In two specimens from Taliha, the spermathecal pores are on 7/8, 8/9, 9/10, female pore at XV, male pores at XIX, last hearts in XIII, ovaries in XIV. In one specimen from Ayumuring, there is an additional pair of spermathecal pores on 6/7. In one specimen from 3 km. E. of Richik, spermathecal pores, female pore and male pores are on one segment forward than their normal location at 7/8-8/9, XIV and XVIII respectively. On one specimen from Kabak, spermathecal pores, female pore and male pores are on one segment behind than their normal location. These abnormalities may have

developed during the regeneration of lost parts. The occurrence of such abnormalities is greater in *Perionyx*, all species of which have a high regenerative capacity (Gates, 1960; Julka, 1975).

Distribution.—INDIA: Arunachal Pradesh—Abor Hills (Stephenson, 1914) ; Chowkham (Julka, 1976) ; Taliha, Ayumuring, Richik, Huri, Pabin, Parsipala, Tumbia, Kau Pass, Kabak and Vidak (present record). Assam—Dibrugarh, Katlicherra, Sadiya. W.Bengal—Darjeeling district, Calcutta, Sibpur. Uttar Pradesh—Dehra Dun, Almora, Pilibhit Dist. Himachal Pradesh—Simla Hills. Maharashtra—Talewadi. Tamil Nadu—Kodaikanal. Andaman & Nicobar Islands—Parnashala, little Andaman.

Outside India : Widely transported, successful colonization restricted to tropical lowlands from MADAGASCAR east to the HAWAIIAN ISLANDS.

Perionyx gravelyi Stephenson

1917. *Perionyx gravelyi* Stephenson, *Rec. Indian Mus.*, 13 : 378.

1923. *Perionyx gravelyi*, Stephenson, *Fauna Brit. India*, Oligochaeta : 334.

Material.—6-7-0; Ayumuring; 26. xi. 74. 2-3-2; Lingpo; 10.i.75. 0-1-1; Kolang; 11. i. 75. 0-1-1; Parsipala; 25. i 75. 0-1-1; Rui; 3.ii.75. 0-1-0; Vidak; 8. ii. 75.

External characteristics.—Length 38–68 mm. Diameter 1–2 mm. Segments 77–115. Colour light purple dorsally, pale ventrally. Prostomium epilobous, tongue open. First dorsal pore at 4/5 (11), 5/6 (5). Setae present from II, closely spaced ventrally than dorsally, ZZ = 2YZ; setal formula : 23–25/II, 26–29/III, 30–33/VIII, 30–39/XII, 28–32/XX; VIII/5-8, XVII/4, XVIII/0, XIX/4. Clitellum annular, XIII–XVII (3), intersegmental furrows and setae present, dorsal pores occluded. Nephropores inconspicuous, in one irregular rank on each side of the body and near mL.

Quadrithecal; pores on 6/7–7/8, small transverse slits, in line with B or C or D, 0.09–0.13 circumference apart. Male pores small, transverse slits, slightly postsetal in AB, 0.06–0.07 circumference apart; 2–3 penial setae protrude from male pores; the pores and setae are on small papillae which meet in the middle line, the conjoined papillae are bounded in front and behind by shallow depressions. Female pore, unpaired, median, presetal, on XIV, at the centre of a circular whitish area.

Internal anatomy.—Pigmentation red, restricted to circular musculature, lacking just below intersegmental furrows. Special dorsal longitudinal muscle band densely pigmented. Septa 5/6–7/8 thin, 8/9 and posterior ones slightly muscular. Gizzard slightly muscular, small, in V Oesophagus highly vascular in X–XIV with interrupted longitudinal ridges on its inner wall, slightly moniliform in XIII and XIV, longitudinal whitish ridges on inner wall in XV–XVI. Intestinal origin in XVI (1), XVII (5).

Dorsal blood vessel single, continued anteriorly to the region of brain. Supra-oesophageal recognizable in IX–XII, giving off branches in each segment from X–XII, one pair to the lateral walls of oesophagus and the other pair to the hearts of the respective segment. Subneural adherent to parietes, turns laterally in XIII and piercing through 12/13 passes onto gut in XII to join an extra-oesophageal. Hearts of X–XII latero-oesophageal. Last hearts in XII (6).

Excretory system holoic; nephridia aversiculate; ducts entering the parietes in an irregular longitudinal rank on each side.

Holandric; male funnels and testes free, iridescent; seminal vesicles in XI, XII, touching each other above the gut. Prostates racemose, squarish, in XVIII; duct slightly muscular, straight, narrows before entering parietes. Penial setae 0.437–0.515 mm. long, 9–11 μ thick just below the tip; reserve penial setae 0.25–0.28 mm. long, 9 μ thick; shaft pointed, slightly bowed towards one side near the tip; ornamentation 8–10 rows of fine pointed spines near the tip. Spermathecal ampulla spherical; duct narrows towards parietes and about twice as long as ampulla; diverticulum represented by a transverse ridge around the ental end of duct, consisting of small iridescent seminal chambers. Ovaries fan-shaped with several egg strings.

Habitat.—Clayey and sandy loam soil in forests of *Quercus glauca*, *Cephalostachyum latifolium* and *Altingia excelsa*; altitudinal range 450–1250 m.

Remarks.—This is the first record of *P. gravelyi* since its original description from Pashok (Darjeeling Dist., W. Bengal).

Distribution.—INDIA: Arunachal Pradesh—Ayumuring, Lingpo, Kolang, Parsipala, Rui, Vidak (present record). W. Bengal—Pashok (Darjeeling District).

*Perionyx kemp*i Stephenson

1914. *Perionyx kemp*i Stephenson, *Rec. Indian Mus.*, 8 : 389.

1923. *Perionyx kemp*i, Stephenson, *Fauna Brit. India*, Oligochaeta : 338.

Material.—0–0–1; Doju Bung; 15. xii. 74.

External characteristics.—Length 57 mm. Diameter 3 mm. Segments 108. Colour dark blue, restricted to dorsum. Prostomium epilobous, tongue closed; a mid-dorsal longitudinal groove present, reaching posteriorly upto 2/3. First dorsal pore at 5/6. Setae begin on II; much more closely spaced on ventrum than on dorsum. Setal formula : 58/II, 59/III, 74/VIII, 73/XII, 72/XX; VIII/24, XVII/20, XVIII/13, XIX/22. Clitellum annular, XII–XVIII; setae present, dorsal pores occluded, intersegmental furrows faintly demarcated.

Quadrithecal; pores transverse slits, at 6/7–7/8, in line with LM, 0.15 circumference apart. Male pores transverse slits in a somewhat rectangular depression on XVIII, in line with K, 0.12 circumference apart. Female pore median, minute, presetal, on XIV, surrounded by a whitish circular area.

Internal anatomy.—Pigment red, associated with circular muscle layer, lacking beneath intersegmental furrows. Special longitudinal muscle band at mD densely pigmented. Septa 5/6–6/7 thin, 7/8–10/11 slightly muscular. Gizzard vestigial, in V Oesophagus with longitudinal white ridges on its inner wall from IX–XVII, ridges interrupted in IX–XIV Intestinal origin in XVIII.

Dorsal blood vessel single, continuous anteriorly to the region of brain. Supra-oesophageal recognizable in IX–XIII; in XIII it bifurcates twice, one branch to the hearts of XIII and the other to the lateral wall of gut. Subneural and extra-oesophageals unrecognizable. Commissures of X–XIII latero-oesophageal. Last hearts in XIII.

Excretory system holoic; nephridia avesculate, ducts slender, entering parietes on either side in an irregular longitudinal rank.

Holandric; testes and male funnels free, iridescent. Seminal vesicles in XI–XII. Prostates racemose, squarish, in XVIII; duct short, with muscular sheen, slightly looped, widens before entering the parietes. No penial setae. Spermathecae small; ampulla cap-shaped, duct about one and a half times as long as ampulla, slightly narrowed before entering parietes; diverticula represented by 6–7 sessile and iridescent seminal chambers on the anterior face of duct near its junction with ampulla.

Habitat.—Loam soil under decaying leaves in a forest of *Castanopsis indica*; altitude 1670 m.

Distribution.—INDIA: Arunachal Pradesh—Kobo, Abor Hills (Stephenson, 1914); Doju Bung (Present record).

Remarks.—This is the second record of the species since its discovery from Kobo by Stephenson (1914).

Perionyx macintoshi Beddard

1883. *Perionyx* "*m'intoshii*" Beddard, *Ann. & Mag. nat. Hist. Soc. Ser.* 5, 12: 217.
 1972. *Perionyx macintoshi*, Gates, *Trans. Am. phil. Soc.*, 62: 144.
 1975. *Perionyx macintoshi*, Julka & Halder, *Proc. zool. Soc., Calcutta*, 28: 15.

Material.—1–0–0; Yame; 15. i. 75. 1–1–1; Pabin; 17, 24. i. 75. 3–0–0; Damin; 20, 22. i. 75. 0–2–0; Vidak; 8. ii. 75.

External characteristics.—Length 150–320 mm. Diameter 5–7 mm. Segments 176–197. Colour apparently light blue dorsally, reddish ventrally. Prostomium epilobous, tongue open. First dorsal pore at 5/6 (6), 6/7 (1). Setae begin on II, closely spaced ventrally than dorsally; setal formula: 46–52/II, 53(gaps)–77/III, 79–109/VIII, 65–102/XII, 65–85/XX; VIII/8–10, XVII/7–8, XVIII/4–8, XIX/4–8. Clitellum not fully developed, being indicated only by a slight whitening of the epidermis between 12/13 to 20/21 (1 specimen). Nephropores

minute. 4 pores (2 dorsal and 2 ventral) on preclitellar segments and 8 pores (2 dorsal, 2 on either side and 2 ventral) on postclitellar segments.

Quadrithecal ; pores transverse slits, on 7/8–8/9 in line with *F*, 0.10–0.11 circumference apart. Male pores, minute, located in deepened lateral portions of a postsetal transverse groove, in line with *D*, 0.06–0.08 circumference apart.

Internal anatomy.—Pigment red, associated with circular musculature. Special longitudinal muscle band at mD deeply pigmented. Septa 6/7–19/20 thickly muscular. Gizzard large, in VI, pushing septa 6/7, 7/8, 8/9 posteriorly into funnel-shape. Oesophagus slender in VII–X, widened, moniliform and highly vascular in XI–XVI, slender and sigmoid in XVII–XVIII ; inner wall with low, thick and regular longitudinal ridges in VII–X, high, irregular, more or less lamelliform calciferous ridges in XI–XVII. Intestinal origin in XIX.

Dorsal blood vessel single throughout. Supra-oesophageal recognizable in VIII–XIII, in X–XIII a pair of branches from supra-oesophageal pass on to the hearts of respective segments. Subneural adherent to parietes, turns laterally in XIV and passes on to extra-oesophageal along 13/14. Last hearts in XIII.

Nephridia meromeganephric, with 4–5 preseptal nephridial funnels, avesculate ; in each of postclitellar segments four nephridial ducts have been traced to enter the parietes on either side.

Holandric ; seminal vesicles in XI–XII, united dorsally above the gut, small discrete vesicles also present in XIII. Prostates in XVIII ; ducts slender, slightly looped, with muscular sheen, slightly widened before entering parietes. Penial setae absent. Spermathecal ampulla antero-posteriorly compressed ; duct narrow, slightly longer than ampulla. Ovaries fan-shaped with several egg strings.

Habitat.—Soil loam and clay along hill slopes in open grassland and forests of *Callicarpa* sp., *Quercus glauca* and *Shorea assamica*; altitudinal range 600–1200 m.

Remarks.—Gates (1952) distinguishes the Nepalese form from the Burmese and Meghalayan form by the nephropores more than two per segment, large number of setae and possible postsetal location of male pores. The worms from Arunachal Pradesh belong to the Nepalese form.

Distribution.—INDIA: Arunachal Pradesh—Mursing village (Julka & Halder, 1975) : Yame, Pabin, Damin, Vidak (present record). Meghalaya—Khasi Hills. W Bengal—Sibpur (?).

Outside India : BURMA, NEPAL, E. BHUTAN (Naningphu).

Perionyx modestus Stephenson

1922. *Perionyx modestus* Stephenson, *Rec. Indian Mus.*, 24 : 455.

1972. *Perionyx modestus*, Gates, *Trans. Am. phil. Soc.*, 62 : 145.

1976. *Perionyx modestus*, Julka, *Rec. zool. Surv. India*, 69 : 235.

Material.—2-7-3 ; Lingpo ; 10. i. 75. 0-2-0 ; Yame ; 15. i. 75. 1-0-0 ; Parsipala ; 25. i. 75. 5-1-3 ; Richik ; 28. i. 75. 0-2-0 ; 3 km. E. of Richik ; 29. i. 75. 0-10-7 ; about 4 km. N. W of Tali ; 30. i. 75. 1-3-4 ; Rui ; 3. ii. 75.

External characteristics.—Length 80-135 mm. Diameter 2-3.5 mm. Segments 118-160. Colour reddish to dark blue dorsally, faint on the ventrum. Prostomium epilobous, tongue open. First dorsal pore at 3/4 (1), 4/5 (19), 5/6 (8). Setae present from II, closely spaced ventrally than on the dorsum ; setal formula : 18 (gaps), 20-27/II, 32-39/III, 47-58/VIII, 44 (gaps), 46-62/XII, 46-55/XX ; VIII/4-6, XVII/9-13, XVIII/0, XIX/11-14. Clitellum annular, indicated by epidermal thickening at XIII-XVI (1), XIII-XVII (15); intersegmental furrows distinct, setae present, dorsal pores occluded. Nephropores minute, in an irregular longitudinal rank just above ventral limit of pigmentation on each side.

Quadrithecal ; pores on 7/8-8/9, transverse slits, at BC, 0.03-0.05 circumference apart. Male pores, 0.08-0.11 circumference apart, on flattened ends of shortly tubular penes retracted into prostatic ducts which open laterally in an equatorial groove on XVIII within a swollen male field that reaches GH and dislocates 17/18 and 18/19. Female pore single, median, presetal, on XIV, at the centre of a circular whitish area.

Internal anatomy.—Pigmentation red, restricted to circular muscle layer. Special mid-dorsal muscle band densely pigmented. Septa 4/5-5/6 thin and membranous, 6/7-13/14 muscular. Gizzard small, slightly muscular, in V Oesophagus tubular in VIII-XII with low, interrupted, longitudinal whitish ridges on its inner wall; highly vascular and moniliform in XIII-XV with high lamelliform and interrupted ridges on its inner wall; tubular in XVI-XVIII with low, whitish, uninterrupted longitudinal ridges on the inner wall. Intestinal origin in $\frac{1}{2}$ XIX (1), XIX (11).

Dorsal blood vessel single, continued anteriorly to the region of brain. Supra-oesophageal recognizable in IX-XIII ; in XIII it bifurcates to enter the hearts of XIII. Subneural adherent to parietes, turns laterally in XIV and upwards along the anterior face of 13/14 to join an extra-oesophageal. Extra-oesophageals recognizable anteriorly upto VII. Hearts of X-XIII latero-oesophageal ; last hearts in XIII (12).

Excretory system holoic ; nephridia vesiculate, bladders sausage-shaped entering the parietes in an irregular longitudinal rank on each side.

Holandric ; male funnels and testes free, iridescent ; seminal vesicles in XI, XII, reaching above the gut to meet each other, of XII push back 12/13 into contact with 13/14. Prostates racemose, in XVIII; duct 4–5 mm. long, with one or two twists, narrowed at ental end but thickly muscular and widened before entering the parietes. Spermathecae large ; duct slightly shorter than ampulla and narrows towards parietes ; diverticulum sessile on the lateral face of duct, near the junction of duct and ampulla, consisting of 6–10 iridescent seminal chambers aggregated into a cluster. Ovaries fan-shaped with several egg strings.

Habitat.—Sandy loam soil under stones, decaying leaves and logs near streams ; altitudinal range 450–1300 m.

Abnormality.—Some abnormalities are observed in a few specimens regarding the location of spermathecal pores, female pore, male pore and clitellum which are normally located at 7/8–8/9, XIV, XVIII and XIII–XVI, XVII respectively. They are recorded as follows : Spermathecal pores at 8/9–9/10 (7 specimens), at 8/9–10/11 (2 specimens), at 7/8–9/10 (2 specimens) ; female pore at XV (4 specimens), at XVI (6 specimens) ; male pores at XIX (4 specimens), at XX (4 specimens), at XXI (1 specimen), at XXII (4 specimens) ; clitellum XV–XIX (1 specimen). The abnormalities are known to occur in most of the species of *Perionyx* which have a high rate of regenerative capacity.

Distribution.—INDIA : Arunachal Pradesh—Chowkham (Julka, 1976) ; Lingpo, Yame, Parsipala, Richik, Tali and Rui (present record). Meghalaya—Cherrapunji to Dumpep, Khasi Hills.

***Perionyx vidakensis* sp. nov.**

(Text Fig. 6C; 7A)

Material.—Holotype : 0–0–1 ; Vidak ; 8. ii. 75 ; An 134. Paratypes : 4–3–0 ; Rui ; 3.ii.75 ; An 135. 0–3–5 ; Kabak, 6.ii.75 ; An 136. 2–4–5 ; Vidak ; 8. ii. 75 ; An 137.

External characteristics.—Length 115–163 mm. Diameter 3–5 mm. Segments 120–181. Colour dark blue, restricted to dorsum except on first few segments where it reaches to ventrum also. Prostomium epilobous, tongue open. First dorsal pore at 4/5 (12), but a pore-like present at 3/4 (5). Setae present from II, closely spaced ventrally, circles with a dorsal gap $ZZ=1\frac{1}{2}-2YZ$. Setal formula : 19(gaps), 26–32/II, 27(gaps), 34–40/III, 44(gaps), 47–62/VIII, 49–63/XII, 44–58/XX ; VIII/20–26, XVII/14–18, XVIII/6–12, XIX/13–16. Clitellum XIII–XVII, annular, faintly demarcated and tumescent, furrows distinct, setae present, dorsal pores occluded.

Quadrithecal ; pores widely separated on 7/8–8/9 ; each pore minute, located at the centre of a tiny elliptical thickening, in line with *J* or *K* or *L* or *M*, 0.21–0.25 circumference apart. Male field dumb-bell shaped, transversely placed epidermal thickening, marked

with short longitudinal fissures, in *KK* or *LL* on XVIII. Male pores minute on setal arcs; each pore located at the centre of a somewhat broadly circular porophore, in line with *G* or *H* or *I*, 0.17–0.21 circumference apart. A short groove runs mesially from each male pore. Female pore median, single, minute, presetal, surrounded by a whitish circular area on XIV.

Internal anatomy.—Pigment red, associated with circular muscle layer, lacking just beneath intersegmental furrows. Special longitudinal muscle band at mD densely pigmented. Septa 1/2–5/6 delicate, membranous; the rest of the posterior ones slightly muscular. Gizzard small in V. Oesophagus highly vascular in X–XIII, bead-shaped in XIV–XVI, with irregular ridges on its inner wall in X–XVIII. Intestinal origin in XIX or ½XVIII. No typhlosole.

Dorsal blood vessel, single, continuous anteriorly to the region of brain, where it bifurcates, the two branches reuniting above the subpharyngeal ganglion to form the ventral blood vessel. Supra-oesophageal recognizable in VIII–XIII, bifurcating posteriorly twice, one branch passing to the hearts of XIII and the other disappears in the lateral face of gut in XIII. Subneural adherent to parietes, turns laterally in XIII and passes onto gut in XIII to join an extra-oesophageal (a narrow, thin, subneural continues forward upto X). Extra-oesophageals recognizable anteriorly upto III. Hearts of X–XIII latero-oesophageal; last hearts in XIII.

Excretory system holoic; nephridia vesiculate, ducts long and slender, entering the parietes in a slightly irregular longitudinal rank on each side.

Holandric; male funnels and testes free and iridescent; seminal vesicles in XI, XII, united dorsally above the gut, those of XII push 12/13 back into contact with 13/14. Coelomic cavity of X filled with coagulum. Prostates racemose, in XVIII, dislocating 17/18 and 18/19 anteriorly and posteriorly respectively; duct slender, muscular, straight but with a twist at ental end. No penial setae. Spermathecae reaching the dorsal face of gut; ampulla of irregular shape; duct almost half as long as ampulla; diverticula a ridge or 1–3 wart-like structures, a little below the junction of ampulla and duct, composed of 3–10 iridescent seminal chambers. Ovaries fan-shaped, each with many egg strings.

Habitat.—Mixed black clayey and sandy soil near streams in forests of *Dipterocarpus gracilis* and *Musa balbisiana*; altitudinal range 600–1100 m.

Relationship.—*Perionyx vidakensis* sp. nov. belongs to a quadrithecal group of species having spermathecal pores on 7/8–8/9 and within that group of species, it is closely related to *P. festivus* Gates, *P. horai* Stephenson, *P. macintoshi* Beddard, *P. modestus* Stephenson and *P. simlaensis* (Michaelsen) in the absence of penial setae and presence of last pair of hearts in XIII. It is distinguished from *P. festivus* and *P. macintoshi* by wider location of spermathecal pores and shape of the male genital shield. From *P. horai*, *P. modestus* and *P. simlaensis*, it is distinguished by the absence of penes.

Abnormality.—In one specimen from Vidak, the anterior spermathecae at 7/8 are missing and in another specimen from Vidak there is an additional pair of spermathecae at 6/7. In a specimen from Kabak, the female pore and male pores are located one segment forward than their normal location.

***Tonoscolex indicus* sp. nov.**

(Text Fig. 7E ; 8A)

Material.—Holotype : 0-0-1 ; Siki; 24.xi.74; An 110. Paratypes: 0-0-1 ; Taliha ; 19. xi.74 ; An 111. 4-4-0 ; Siki ; 24. xi. 74 ; An 112. 2-3-1 ; Seiom ; 25.xi.74 ; An 113. 2-0-1 ; Ayumuring ; 26.xi.74 ; An 114. 0-0-1 ; Doginalo ; 29.xi.74 ; An 115. 1-0-0; Lemeking ; 3.xii.74; An 116.

External characteristics .—Length 162-207 mm. Diameter 4-5 mm. Segments 176-383. Unpigmented. Prostomium prolobous or combined pro- and epilobous. First segment with short longitudinal furrows on its anterior half ; IV-V with postsetal secondary furrows ; VI and the posterior ones in addition with presetal secondary furrows ; VII with postsetal, VIII-IX with presetal faintly marked tertiary furrows restricted to dorsum. First dorsal pore at 10/11 (11), 11/12 (2). Setae lumbricin, $AA=1.43-1.83$ $AB=0.75-0.92$ $BC=1.10-1.12$ $CD=0.11-0.15$ DD (on preclitellar segments) and $AA=2.25-2.60$ $AB=1.13-1.62$ $BC=1.50-1.86$ $CD=0.12-0.15$ DD (on postclitellar segments). Clitellum annular, XIII-XV, setae present, intersegmental furrows lacking, dorsal pores occluded.

Quadrithecal ; pores minute, in line with *A*, at 6/7-7/8. Male genital shield extends across just behind setal arcs of XVI, XVII and in front of setal arcs of XVIII (in one specimen upto 19/20). Male pores large, in mid *AB* or in line with *B*, on XVII, in seminal grooves, connected with each other by a deep transverse depression. Seminal grooves straight with both ends bent inwards or one of the ends may be bent outwards or grooves may be somewhat E-shaped, bounded by tumescent borders, extending from just behind setal arcs of XVI or 16/17 to setal arcs of XVIII (in one specimen they extended upto 19/12); both the anterior and posterior ends of seminal grooves located in U-shaped tumescences ; copulatory organs two pairs, transversely ovoidal, near mV, mesial to seminal grooves at 16/17 and 17/18 retractile into deep and diagonally placed slit-like invaginations ; areas in front of and behind the copulatory organs depressed. Female pores paired, minute, presetal, just mesial to *A*, on XIII.

Internal anatomy .—Septa 6/7-10/11 thickly muscular. Gizzard large in VI. Calciferous glands three pairs in X-XII, with short stalks, passing to lateral faces of oesophagus, just in front of the septa. Oesophagus with longitudinal white ridges on its inner wall in VIII-XII. Intestinal origin in XIV. Typhlosole lamelliform, beginning in XIV and ending anterior to 95-100 segments from posterior end.

Dorsal blood vessel single, extending anteriorly to the region of brain. Supra-oesophageal recognizable in IX-XII, in X-XII it gives off branches to calciferous glands. Latero-parietals recognizable from

XVI, in XIII they turn up along 12/13 to open into calciferous glands of XII. Extra-oesophageals arise from calciferous glands of XII and after giving off branches to calciferous glands of XI and X, they are unrecognizable beyond 9/10. No subneural. Hearts of IX–XII latero-oesophageal; last hearts in XII.

Excretory system merocytic; clustered, astomate, micronephridia around gut associated with 5/6; V-shaped, parietal, exonephric, micronephridia from IV posteriorly; V-shaped, enteronephric, meganephridia in posterior segments only.

Holandric; testes and male funnels in IX–X, iridescent; seminal vesicles in VIII, IX and XII. Prostates strap-shaped, in XVI–XX; duct small, with muscular sheen, bent near its ental end and narrows towards the ectal end. Spermathecal ampulla spherical or sausage-shaped; duct about half as long as ampulla, stout, narrows before entering parietes; diverticulum a little shorter than or as long as combined length of ampulla and duct, club-shaped, on anterior face and ental end of duct.

Habitat.—Loamy soil along hill slopes and cultivated fields, black soil in forests of *Phyllostachyus bambusoides*, *Quercus glauca*, *Shorea assamica* and *Terminalia* sp.; altitudinal range 450–1400 m.

Relationship.—*Tonoscolex indicus* sp. nov. belongs to a group of species with lumbricin arrangement of setae, and within that group it is distinguished from all the known species of the genus by the location of seminal vesicles in VIII, IX and XII (as against X and XI). Except *T striatus* (Stephenson), this species is also distinguishable from all the other species with lumbricin setae by the presence of two pairs of copulatory organs ("tags"). It can be distinguished from *T striatus* by the location of seminal vesicles and location of copulatory organs mesial to seminal grooves near mV, which in *T striatus* are lateral to seminal grooves.

***Tonoscolex kabakensis* sp. nov.**

(Text Fig. 7B; 8B)

Material.—Holotype: 0-0-1; Kabak; 6. ii. 75; An 117 Paratypes: 3-2-0; Kabak; 6. ii. 75; An 118.

External characteristics.—Length 175–210 mm. Diameter 4–5 mm. Segments 304–419. Unpigmented. Prostomium proepilobous. First segment in anterior half with irregular short longitudinal furrows; fifth and sixth with postsetal secondary furrows; seventh and the posterior ones in addition with presetal secondary furrows. First dorsal pore at 9/10 (3). Setae perichaetin, present from II; on VIII $ZZ=7.86AA$, on XXIV $ZZ=2.5AA$, on posterior segments $ZZ=1.33-1.50AA$. Setal formula: 5-10/II, 4-11/III, 15-21/VIII, 19-30/XII, 34-39/XX, 36-40/posterior segments. Clitellum annular, XIII–XVI, dorsal pores occluded, intersegmental furrows faintly marked, setae present.

Quadrithecal; pores minute, at 6/7–7/8, in line with A, 0.05 circumference apart. Genital shield across XVII and anterior portion

of XVIII, slightly narrower anteriorly than posteriorly, a little depressed along the mid-ventral line but with a lateral pair of protuberant areas with glossy surfaces, on which are located doubly curved seminal grooves. Each seminal groove begins from middle of anterior annulus of XVII in line with *B* and curves inwards at presetal secondary furrow ; it forms an outward curve in equatorial annulus and an inward curve at postsetal secondary furrow, from where it again curves outwards in posterior annulus to end at 17/18 in line with *C*. Male pores minute, equatorial, in the anterior outward curve of seminal grooves, 0.09 circumference apart. Female pores paired, minute, each pore just anterior and mesial to *A* setae.

Internal anatomy.—Septa 6/7–10/11 thickly muscular. Gizzard large in VI. Calciferous glands five pairs in VIII–XII, with short stalks passing to lateral walls of oesophagus just in front of the septa. Oesophagus highly vascular in VIII–XII with longitudinal white ridges on its inner wall. Intestinal origin in XIV Typhlosole lamelliform, beginning in XIV and ending in front of 90–95 segments from the posterior end.

Dorsal blood vessel single, continuous anteriorly to the region of brain. Supra-oesophageal in VIII–XII, gives off branches to calciferous glands of these segments. Latero-parietals recognizable from XVIII, turn mesially in XII on anterior face of 12/13 to open into the calciferous glands of XII, in XI and X they give off branches to calciferous glands of these segments but are not recognizable anteriorly. No subneural. Hearts of IX–XII latero-oesophageal ; last hearts in XII.

Excretory system merocic ; clustered, astomate, micronephridia around gut near 5/6 ; V-shaped, parietal, exonephric, micronephridia from IV posteriorly ; V-shaped, enteronephric, meganephridia in posterior segments only.

Holandric ; testes and male funnels in IX and X ; seminal vesicles in X and XI. Prostates strap-shaped, in XVII–XVIII ; duct muscular with a little sheen, bent at its ental end and slightly thickened before entering the parietes. Spermathecal ampulla round and flattened ; duct about half as long as ampulla, stout, straight and narrows towards the ectal end ; diverticulum short, stalked, broadly club-shaped on the anterior face and ental end of duct.

Habitat.—Sandy loam soil in a forest of bamboo (*Cephalostachyum latifolium*) ; altitude 1100 m.

Relationship.—*Tonoscolex kabakensis* sp. nov. is closely related to *T. horai* (Stephenson) and *T. ferinus* Gates in the perichaetin arrangement of setae. It is distinguished from these both by the shape of seminal grooves and presence of five pairs of calciferous glands in VIII–XII, which in *T. horai* are three pairs from X–XII and in *T. ferinus* four pairs from IX–XII. Further, it differs from *horai* by the location of seminal vesicles in X and XI which in the latter are in VIII and XI.

Tonoscolex striatus (Stephenson)

1914. *Notoscolex striatus* Stephenson, *Rec. Indian Mus.*, 8 : 380.
 1914. *Notoscolex stewarti* Stephenson, *Rec. Indian Mus.*, 8 : 382.
 1934. *Tonoscolex striatus*, Gates, *Rec. Indian Mus.*, 36 : 255.
 1972. *Tonoscolex striatus*, Gates, *Trans. Am. phil. Soc.*, 62 : 232.

Material .— 0-0-1 ; Taliha ; 19.xi.74. 0-0-2 ; Ayumuring ; 26.xi.74. 0-0-2 ; Yame ; 15.i.75. 0-0-4 ; Damin ; 20, 22.i.75. 0-0-1 ; Huri ; 20.i.75. 0-0-1 ; Pabin ; 24.i.75. 0-0-16 ; Parsipala ; 25.i.75. 0-0-1 ; Tumbia ; 26.i.75. 0-0-2 ; near Kau Pass ; 27.i.75. 1-2-4 ; Richik ; 28.i.75. 1-0-3 ; 3 km. E. of Richik ; 29.i.75. 0-1-14 ; Tali ; 2.ii.75. 0-0-3 ; Rui ; 3.ii.75. 0-0-3 ; Gimba ; 4-ii.75. 0-1-4 ; Kabak ; 6.ii.75.

External characteristics .—Length 82-226 mm. (18). Diameter 3-5 mm. (18). Segments 103-275 (18). Unpigmented. Prostomium prolobous, tongue open. First segment with short longitudinal furrows on its anterior half. First dorsal pore at 9/10 (30). Setae lumbricin, on XI, $AA=1.8-2.6$ $AB=1.14-1$ $33BC=1.12-1.44$ $CD=0.11-0.15$ DD ; setae AB of XVI (23), AB of XVIII (8), A of XVI (2), B of XVI (1), B of XVIII (2), AB of right side of XVIII (1), AB of left side of XVIII (2) lacking, but setae A & B of XVI present in 31 specimens and of XVIII in 45 specimens. Clitellum annular, XIII-XV, setae present, intersegmental furrows lacking, dorsal pores occluded.

Quadrithecal ; pores small, in line with A , at 6/7-7/8. Male genital shield thickened, marked by short transverse furrows, and by a pair of longitudinal seminal grooves, bent laterally at levels of 16/17 and 17/18, extending from posterior part of XVI to anterior part of XVIII, with small tag-like copulatory organs in the bends. Male pores large, in seminal grooves, on XVII, at A . (In some specimens, the seminal grooves are straight or bent mesially at tips and they may extend from setal arcs of XVI to setal arcs of XVIII, 15/16-18/19, 15/16-17/18, 16/17-setal arcs of XVIII). Female pores minute, paired, just in front of and internal to setae A of XIII.

Internal anatomy .—Septa 6/7-8/9 thickly muscular, 9/10-11/12 slightly muscular. Gizzard large, in VI. Calciferous glands three pairs in X-XII (30), with short stalks, passing to lateral faces of oesophagus. Oesophagus vascular in IX-XII, with whitish longitudinal ridges on its inner wall. Intestinal origin in XIV. Typhlosole lamelliform, from XIV to 90-95 segments in front of the posterior end.

Dorsal blood vessel single, extending anteriorly to the region of brain. Supra-oesophageal recognizable in IX-XII, giving off branches to the calciferous glands in X-XII. Latero-parietals turn up along 12/13 to open into calciferous glands of XII. Extra-oesophageals arise from calciferous glands of XII, and after giving off branches to calciferous glands of XI and X they are not recognizable beyond 9/10. No subneural. Hearts of IX-XII latero-oesophageal; last hearts in XII.

Excretory system merocic ; clustered, astomate micronephridia around gut attached with 5/6 ; V-shaped, parietal, exonephric micronephridia from IV posteriorly ; V-shaped, enteronephric, meganephridia found in posterior segments only.

Holandric; testes and male funnels in IX-X, iridescent; seminal vesicles in X and XI. Prostates strap-shaped, in XVII-XIX, ducts short and U-shaped. Spermathecal ampulla pear-shaped ; duct short, almost confined to parietes ; diverticulum club-shaped, about as long as combined lengths of duct and ampulla, at ectal end of duct.

Habitat.—Black sandy loam soil in a forest of *Shorea assamica*; decaying leaves and soil deposited on a fallen log, under stones in a forest of *Callicarpa* sp. ; altitudinal range 450–1350 m.

Remarks.—Gates (1934) synonymized *T. stewarti* with *T. striatus* and characterized *T. striatus* in having four pairs of calciferous glands IX–XII (the absence of these glands in IX in a type of *T. stewarti* was regarded as an abnormality by that author). After dissecting thirty specimens from the material at hand, it is found that calciferous glands are three pairs in X–XII. In view of similarity of the present material in all other diagnostic characters of *T. striatus* as given by Gates (1934, 1972), the absence or presence of calciferous glands in IX is considered to be an intra-specific variation. An emended diagnosis of *T. striatus* based on the present material and that of Gates is given below.

Diagnosis.—Length 82–226 mm. Diameter 3–6 mm. Segments 103–297. Prostomium prolobous, tongue open. First dorsal pore at 9/10, 10/11. Setae lumbricin, both *A* and *B* or one of these on XVI and XVIII may be lacking, on XI $AA=1.8-2.6$ $AB=1.14-1.33$ $BC=1.12-1.44$ $CD=0.11-0.15$ DD . Clitellum XIII–XV, XVI. Quadrithecal ; pores at or median to *A*, at 6/7–7/8. Male pores in seminal grooves at *A* ; seminal grooves bent laterally at levels of 16/17 and 17/18 ; copulatory organs tag-like, two pairs, in the angles of seminal grooves.

Gizzard large, in VI. Calciferous glands three pairs in X–XII or four pairs in IX–XII. Intestinal origin in XIV. Typhlosole lamelliform, beginning in XIV, ending 90–95 segments from posterior end. Last hearts in XII. Holandric ; seminal vesicles in X, XI. Prostates in XVII–XIX, duct short and U-shaped. Spermathecal duct short and almost confined to parietes ; diverticulum club-shaped, shorter than or as long as combined lengths of duct and ampulla, at ectal end of duct.

Distribution.—INDIA : Arunachal Pradesh—Rotung and Renging in Abor Hills (Stephenson, 1914); Taliha, Ayumuring, Yame, Damin, Huri, Pabin, Parsipala, Tumbia, Kau Pass, Richik, Tali, Rui, Gimba and Kabak (present record).

Family OCTOCHAETIDAE

Dichogaster affinis (Michaelsen)

1890. *Benhamia affinis* Michaelsen, *Mitt. naturh. Mus. Hamb.*, 7: 9.

1972. *Dichogaster affinis*, Gates, *Trans. Am. phil. Soc.*, 62: 278.

Material.—0-7-8; Taliha ; 18.xi.74.

Habitat.—Rotten wood in a forest of *Shorea assamica*; altitude 900 m.

Abnormality.—In one specimen, the spermathecal pores are at 6/7-7/8, prostatic pores at XVI and XVIII, female pore at XIII and male pores at XVII, which are located one segment forward than their normal location.

Remarks.—Genital markings median, unpaired, at 7/8 (7), 8/9 (7), 9/10 (9). No genital markings are found in one specimen.

Distribution.—INDIA : Arunachal Pradesh—Taliha (present record). Madhya Pradesh—Jubbulpore. Uttar Pradesh—Gangetic plain. Maharashtra—Bombay. Gujarat—Baroda. Kerala—Shasthancottah, Trivandrum.

Outside India: BURMA, SRI LANKA, THAILAND, NEW CALEDONIA, MEXICO, EL SALVADOR, COLOMBIA, FRENCH GUIANA, BRAZIL, HAITI, ST. THOMAS, CAPE VERDE ISLANDS, SOUTHWEST AFRICA, MADAGASCAR, ZANZIBAR, COMORO ISLANDS.

Dichogaster bolau (Michaelsen)

1891. *Benhamia bolavi* Michaelsen, *Mitt. naturh. Mus. Hamb.*, 8: 307.

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

1976. *Dichogaster bolau*, Julka, *Rec. zool. Surv. India*, 69: 237.

Material.—0-2-2; Taliha; 18.xi.74. 0-0-1; Ayumuring; 26.xi.74.

Habitat.—Soil along hill slopes in a forest of *Bombax ceiba*; altitudinal range 450-900 m.

Distribution.—INDIA : Arunachal Pradesh—Wakro (Julka, 1976); Taliha, Ayumuring (present record). Meghalaya—Siju Cave. West Bengal—Sibpore, Calcutta. Uttar Pradesh—Gangetic Plain. Madhya Pradesh—Rewa, Nowgong, Jubbulpore. Rajasthan—Bayana. Gujarat—Junagarh, Baroda. Maharashtra—Bombay, Bassein Road. Goa—Yelle village. Karnataka—Bangalore. Tamil Nadu—Courtallam. Kerala—Ernakulum, Trivandrum. Nicobar Islands—Car Nicobar.

Outside India: Widely distributed including SRI LANKA, BURMA, BANGLA DESH, PAKISTAN, tropical AFRICA, North, Central and South AMERICA, the WEST INDIES, MALAY PENINSULA, INDONESIA, AUSTRALIA, PACIFIC ISLANDS, GERMANY.

Dichogaster saliens (Beddard)

1893. *Microdrilus saliens* Beddard, *Proc. zool. Soc. Lond.*, 1892: 683.

1972. *Dichogaster saliens*, Gates, *Trans. Am. phil. Soc.*, 62: 281.

1976. *Dichogaster saliens*, Julka, *Rec. zool. Surv. India*, 69: 238.

Material.— 0-6-2 ; Taliha ; 18.xi.74.

Habitat.—Clay loam soil around roots of wild bushes along a hill slope ; altitude 900 m.

Distribution.—INDIA : Arunachal Pradesh—Chowkham, Wakro (Julka, 1976) ; Taliha (present record). West Bengal—Darjiling.

Outside India: BURMA, SRI LANKA, MALAY PENINSULA, INDONESIA, CHRISTMAS ISLAND, AUSTRALIA, U. S. A., EL SALVADOR, PANAMA, CONGO, UGANDA, SOUTH AFRICA.

Family LUMBRICIDAE

Dendrobaena rubida (Savigny)

1826. *Enterion rubidum* Savigny, *Mem. Acad. Sci. Inst. France*, 5: 182.

1972. *Dendrobaena rubida*, Gates, *Trans. Am. phil. Soc.*, 62: 92.

Material.—0-0-9 ; Galensinaik ; 8, 9. xii. 74. 1-1-7 ; Gelemo ; 9. xii. 74. 4-3-20 ; Riding Camp ; 10. xii. 74. 1-5-95 ; Maja : 11. xii. 74. 0-0-6 ; Gelemo : 13. xii. 74. 0-0-1 ; Doju Bung ; 15. xii. 74. 0-0-2 ; Tongba ; 18. xii. 74. 1-1-38 ; Taksing ; 20, 26. xii. 74. 0-1-9 ; Taksing ; 22. xii. 74. 1-3-2 ; Surila Top ; 22. xii. 74.

Habitat.—Under stones and black soil near torrential streams in forests of *Quercus lamellosa*, *Castanopsis indica* and *Acer hookeri*, under bark of a fallen log, mosses on a rock, snow, cow dung ; altitudinal range 1300–3200 m.

Distribution.—INDIA: Arunachal Pradesh—Galensinaik, Gelemo, Doju Bung, Maja, Tongba, Taksing, Riding Camp, Surila Top (present record). Himachal Pradesh—Simla, Matiana, Mashobra. Uttar Pradesh—Naini Tal, Almora. West Bengal—Sandakphu, Phallut, Darjiling, Sukiapokri. Sikkim. Tamil Nadu—Fern Hill, Ootacamund, Kodaikanal, Nilgiri and Palni Hills.

Outside India.—Widely distributed including PAKISTAN, AUSTRALIA, NEW ZEALAND, HAWAII, North, Central and South AMERICA, S. AFRICA, S.W. AFRICA, MADAGASCAR, JAPAN, KOREA, TURKEY, U.S.S.R.

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SUMMARY

The present article deals with the taxonomic studies on the earth-

worms collected during the Subansiri Expedition in Arunachal Pradesh. As a result, twenty seven species are reported, of which eleven species, *Drawida aruna*, *Drawida durtai*, *Plutellus bahli*, *Plutellus daminensis*, *Plutellus richikensis*, *Plutellus taksingensis*, *Perionyx daflaensis*, *Perionyx daminensis*, *Perionyx vidakensis*, *Tonoscolex indicus* and *Tonoscolex kabakensis* are new to science. *Drawida beddardi* (Rosa), *Drawida kempi* Stephenson, *Perionyx depressus* Stephenson, *Perionyx gravelyi* Stephenson, *Perionyx macintoshi* Beddard, *Perionyx modestus* Stephenson and *Tonoscolex striatus* (Stephenson) have been redescribed.

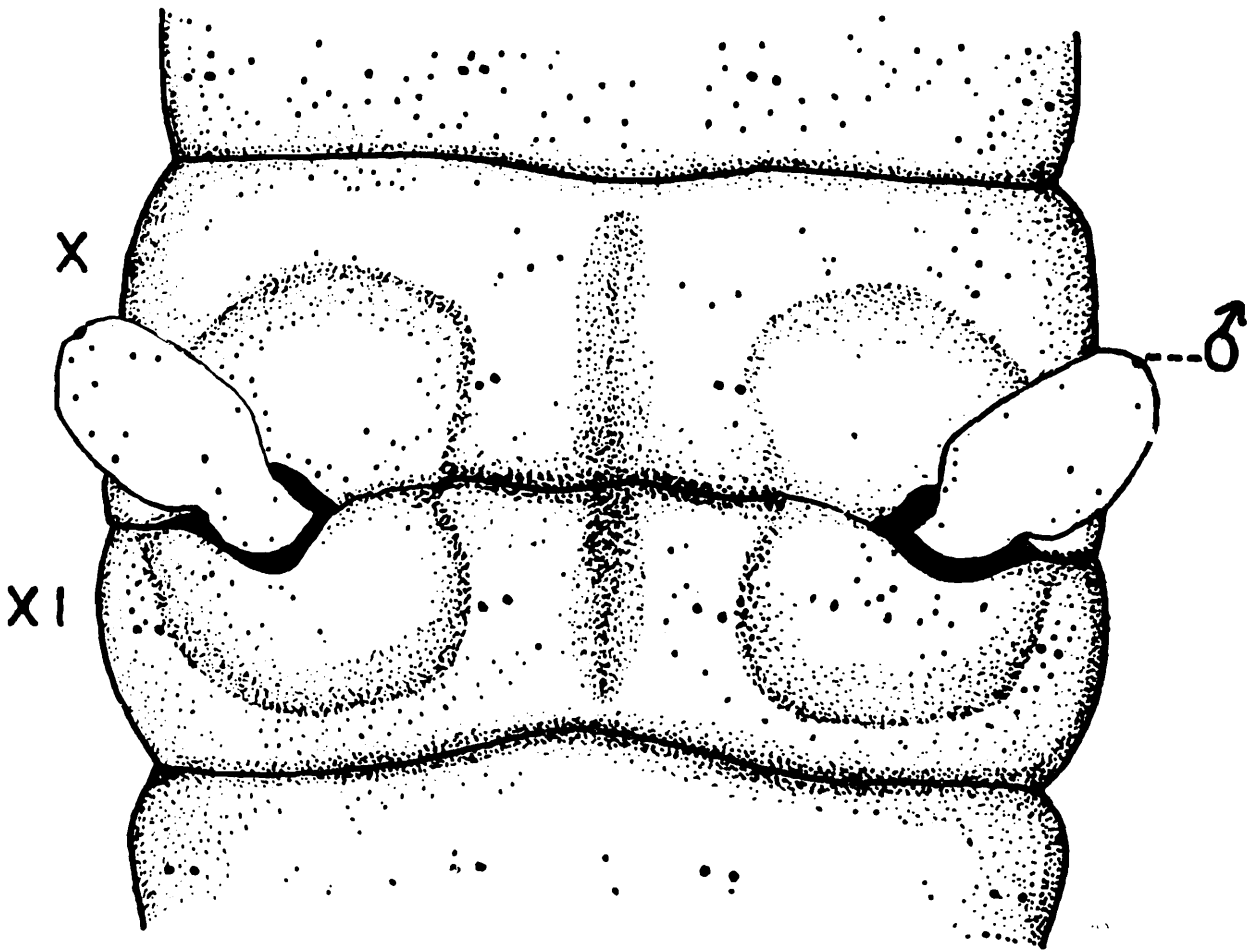
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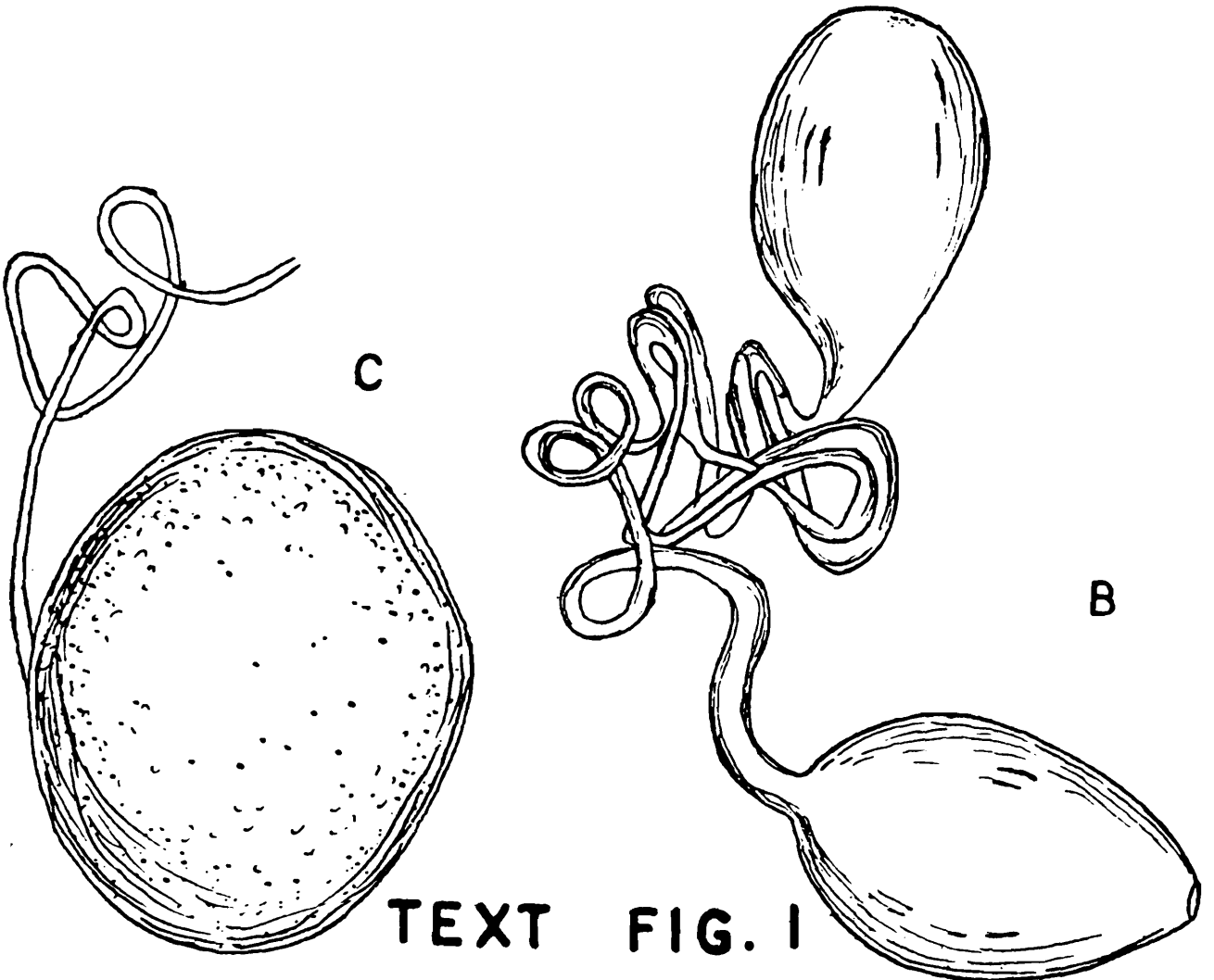
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Explanation to Text Fig. 1

- A. *Drawida aruna* sp. nov., male genital area; ×16.
- B. *Drawida aruna* sp. nov., spermatheca ;×25.
- C. *Drawida aruna* sp. nov., prostate; ×25.



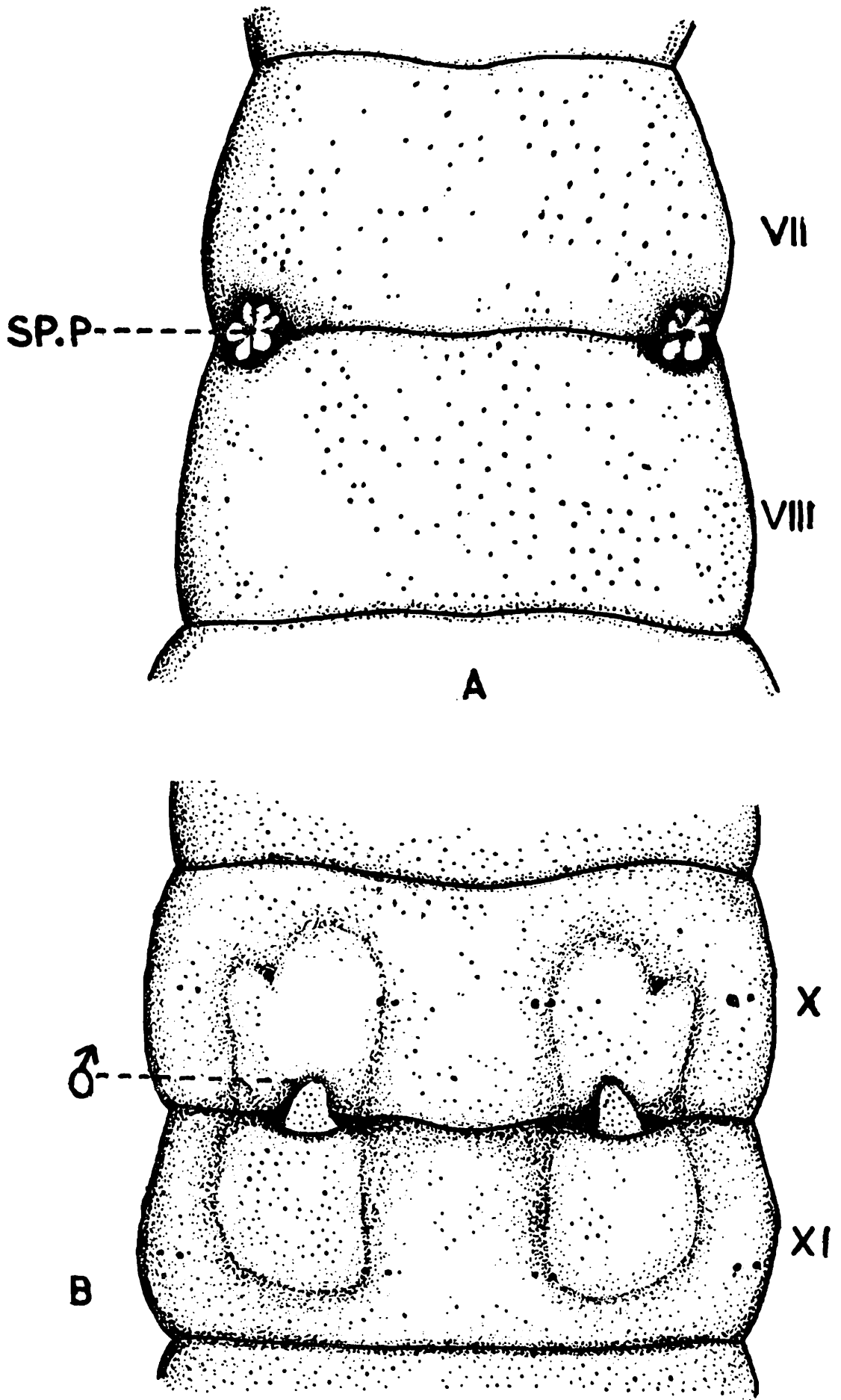
A



TEXT FIG. I

Explanation to Text Fig. 2

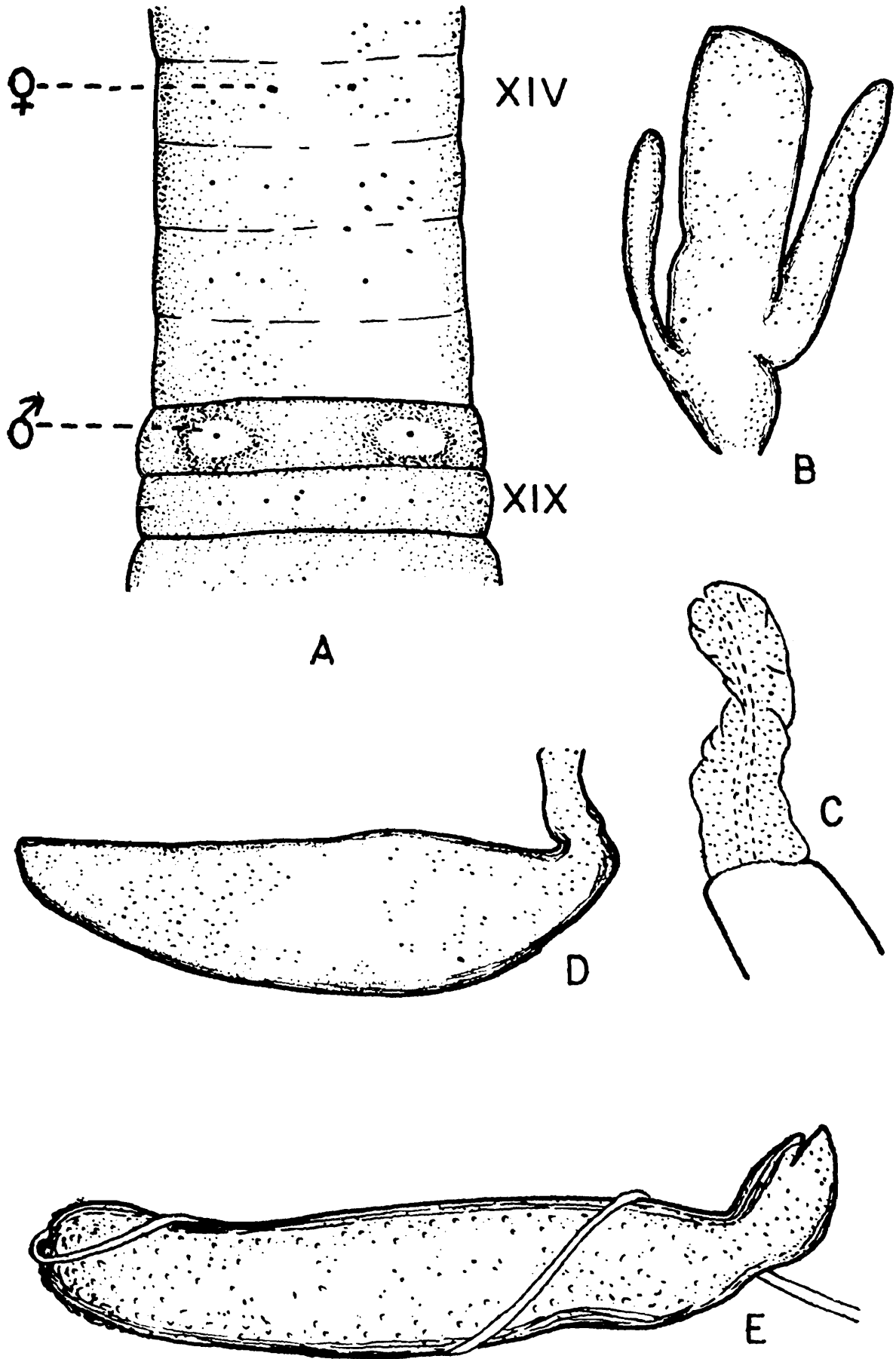
- A. *Drawida duttai* sp. nov., spermathecal pore (SP. P) area; $\times 10$.
- B. *Drawida duttai* sp. nov., male genital area; $\times 10$.



TEXT FIG. 2

Explanation to Text Fig. 3

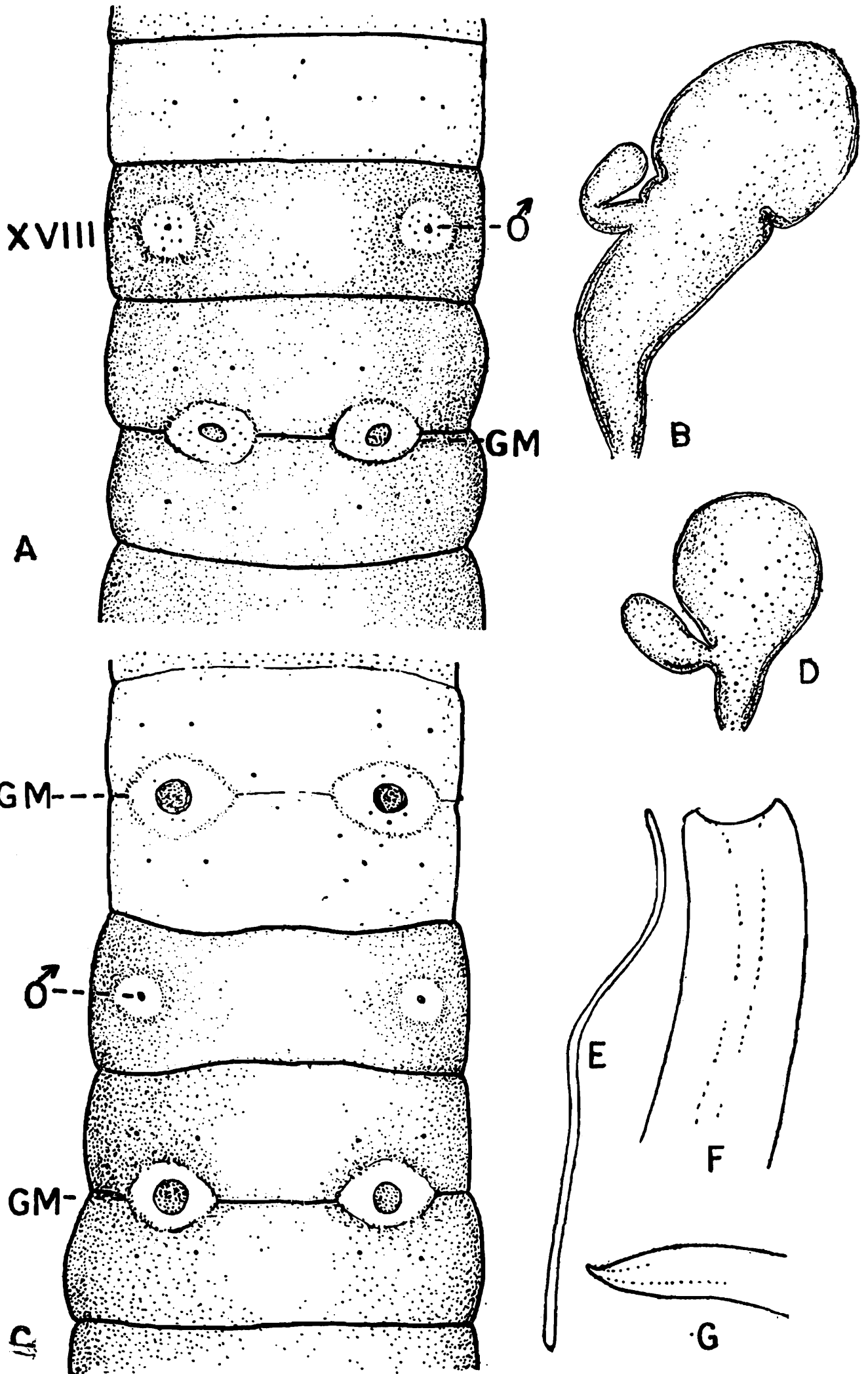
- A. *Plutellus daminensis* sp. nov., male genital area; $\times 25$.
- B. *Plutellus daminensis* sp. nov., spermatheca; $\times 150$.
- C. *Drawida duttai* sp. nov., tip of pene; $\times 30$.
- D. *Drawida duttai* sp. nov., artial widening of spermathecal duct; $\times 18$.
- E. *Drawida duttai* sp. nov., prostate; $\times 6.3$.



TEXT FIG. 3

Explanation to Text Fig. 4

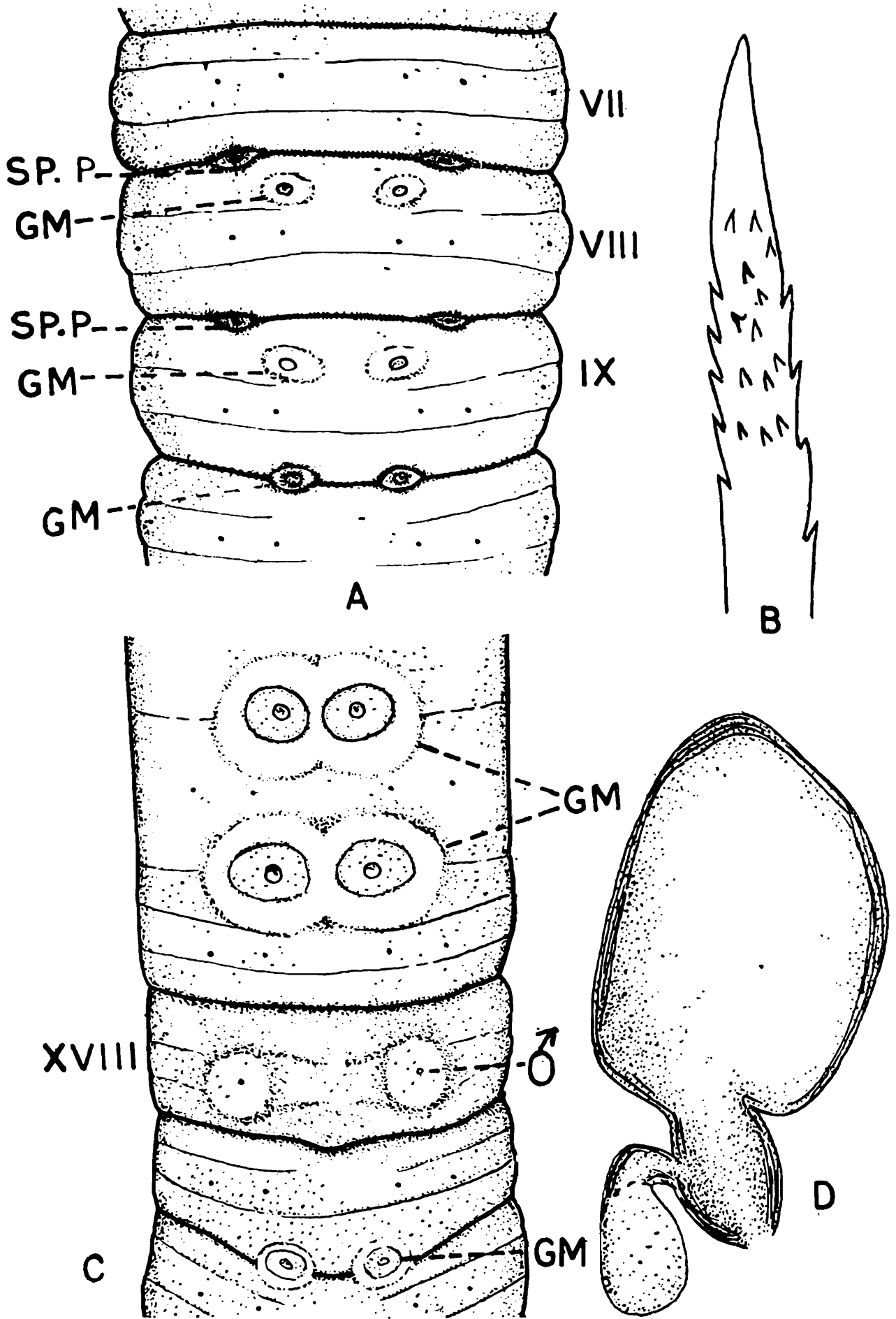
- A. *Plutellus richikensis* sp. nov., male genital area (GM-genital marking);
×25.
- B. *Plutellus richikensis* sp. nov., spermatheca; ×100.
- C. *Plutellus bahli* sp. nov., male genital area (GM-genital marking); ×25.
- D. *Plutellus bahli* sp. nov., spermatheca; ×100.
- E. *Plutellus bahli* sp. nov., penial seta; ×100.
- F. *Plutellus bahli* sp. nov., dorsal view of tip of penial seta; ×1000.
- G. *Plutellus bahli* sp. nov., lateral view of tip of penial seta; ×1000.



TEXT FIG. 4

Explanation to Text Fig. 5

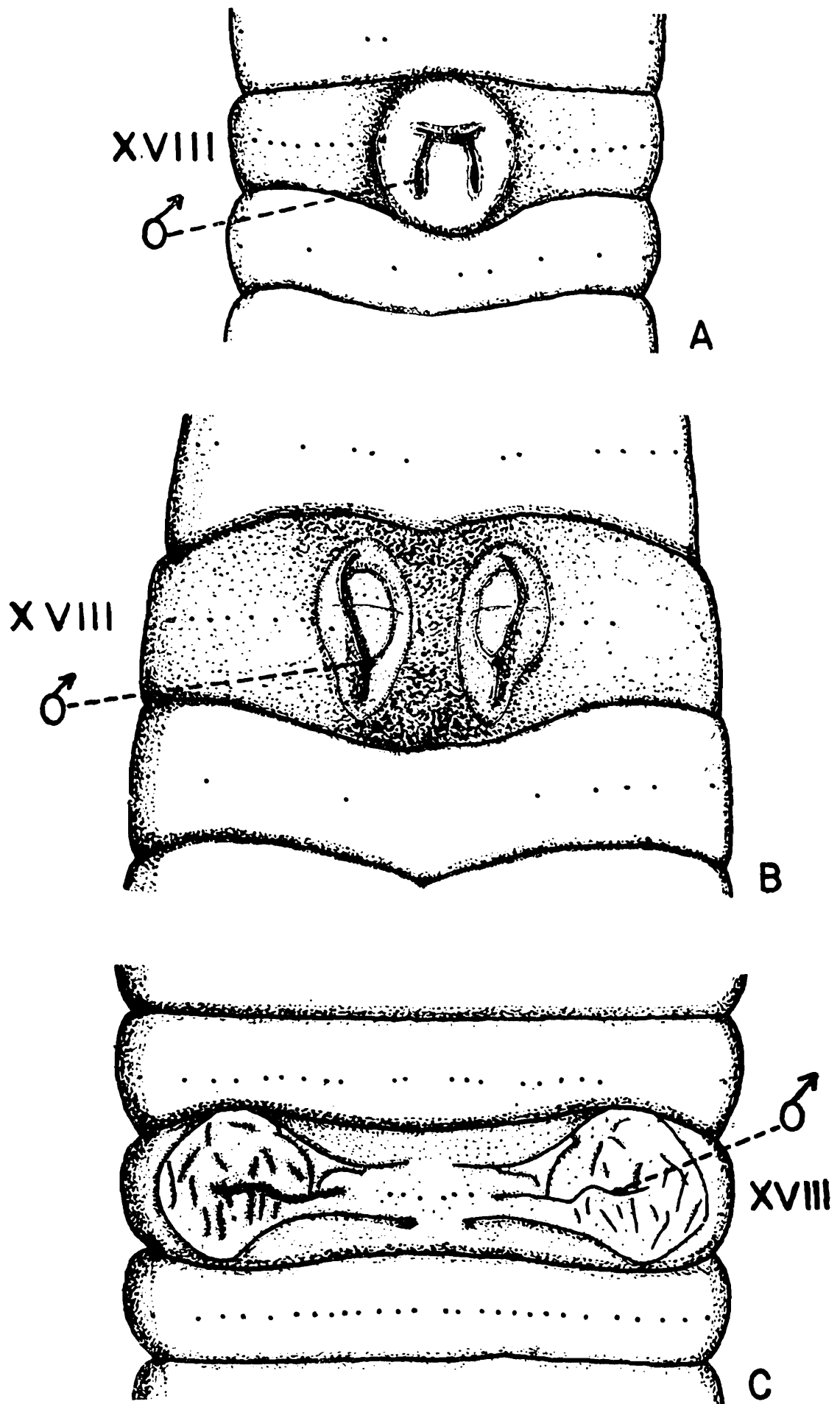
- A. *Plutellus taksingensis* sp. nov., spermathecal pore area (GM-genital marking, SP. P-spermathecal pore); $\times 16$.
- B. *Plutellus taksingensis* sp. nov., penial seta; $\times 1000$.
- C. *Plutellus taksingensis* sp. nov., male genital area (GM-genital marking); $\times 16$.
- D. *Plutellus taksingensis* sp. nov., spermatheca; $\times 25$.



TEXT FIG. 5

Explanation to Text Fig. 6

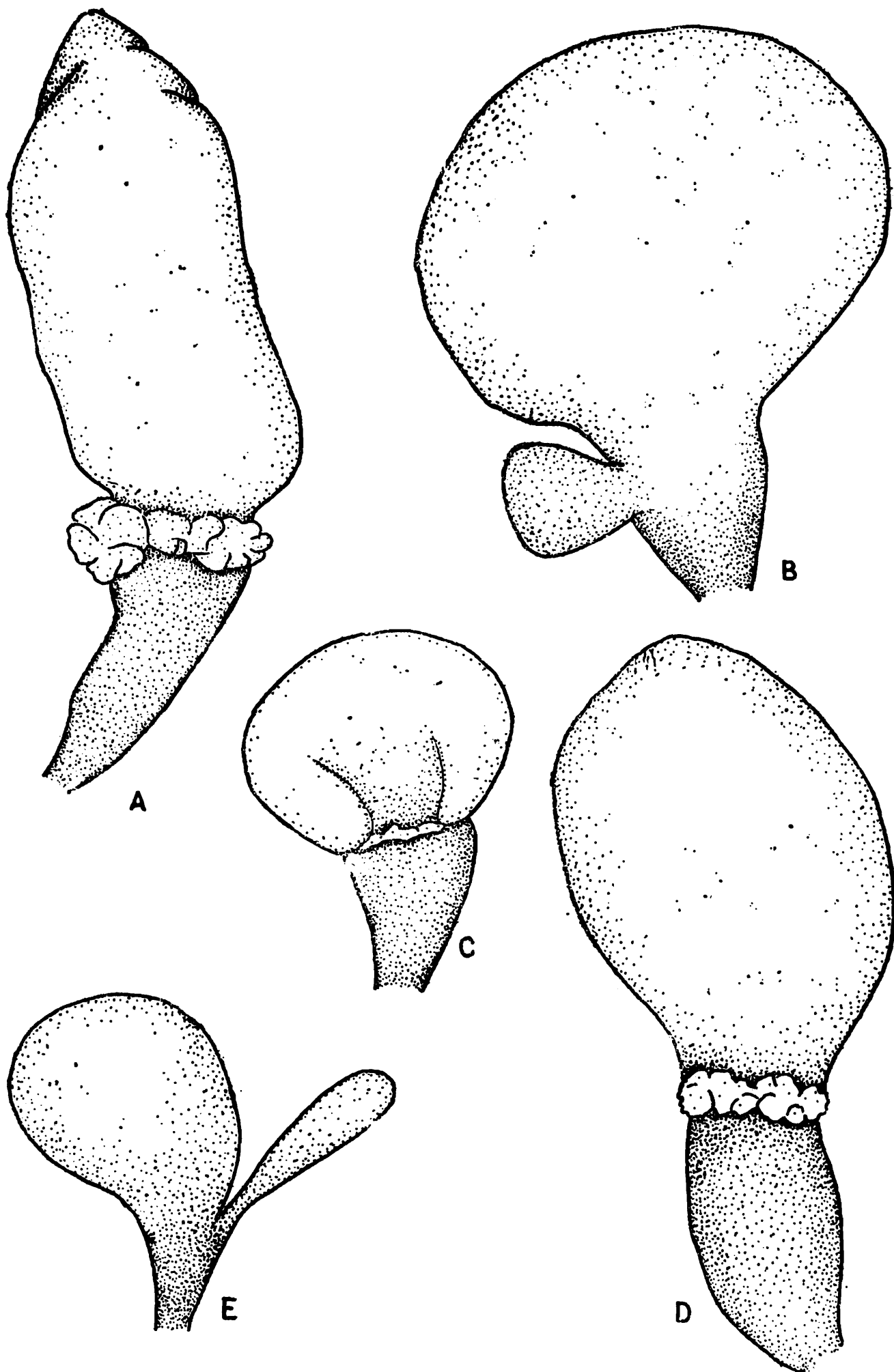
- A. *Perionyx daminensis* sp. nov., male genital area; ×18.
- B. *Perionyx daflaensis* sp. nov., male genital area; ×18.
- C. *Perionyx vidakensis* sp. nov., male genital area; ×12.



TEXT FIG. 6

Explanation to Text Fig. 7

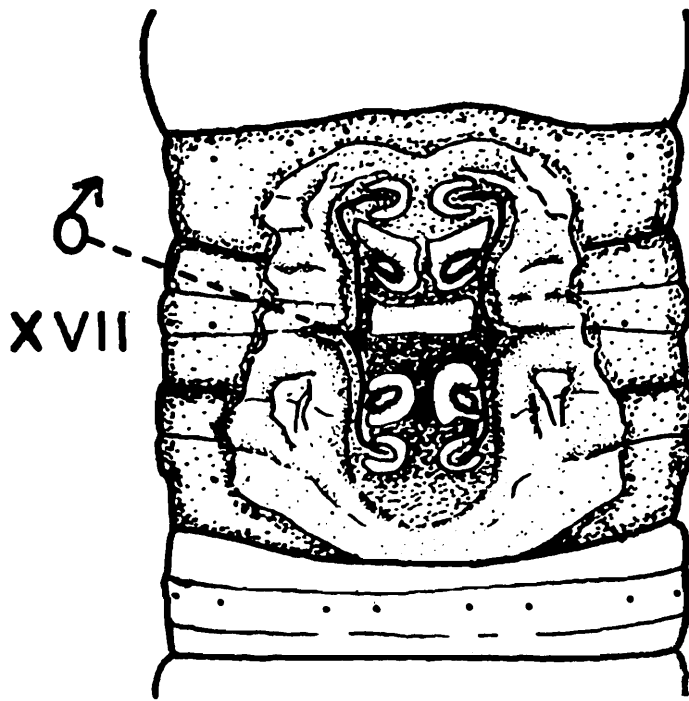
- A. *Perionyx vidakensis* sp. nov., spermatheca; ×33.3.
- B. *Tonoscolex kabakensis* sp. nov., spermatheca; ×26.6.
- C. *Perionyx daminensis* sp. nov., spermatheca; ×26.6.
- D. *Perionyx daflaensis* sp. nov., spermatheca; × 26.6.
- E. *Tonoscolex indicus* sp. nov., spermatheca; ×33.3.



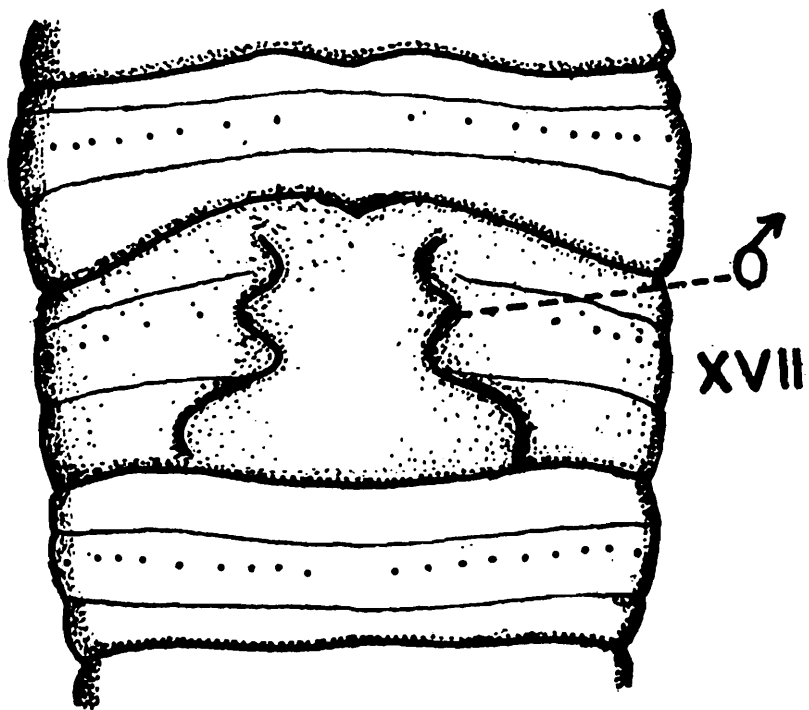
TEXT FIG. 7

Explanation to Text Fig. 8

- A. *Tonoscolex indicus* sp. nov., male genital area; ×12.
- B. *Tonoscolex kabakensis* sp. nov., male genital area; ×12.



A



B

TEXT FIG. 8