Rec. zool. Surv. India, 79 : 1-18, 1981

ON A NEW SPECIES OF THE LAND-LEECH OF THE GENUS *HAEMADIPSA* TENNENT, 1859 FROM THE PENINSULAR INDIA

By

P. J. SANJEEVA RAJ AND M. GLADSTONE,

Department of Zoology, Madras Christian College, Tambaram, Madras

(With 8 Text-figures)

INTRODUCTION

In the course of an extensive survey and study of the haemadipsids of the peninsular India, three stations out of a total of 28 stations, at about c. 4500 to c. 6200 ft. altitude, have a land-leech that seems to have not been described so far and therefore it is described as a new species herein together with anatomical and ecological details concerning the species.

Diagnosis : Monostichodont ; trignathous ; no salivary papillae ; teeth minute, anterior 28 acute but the posterior 40-45 flattened ; annulation of ocular somites, haemadipsoid ; complete annulus 5-annulate ($b_1/b_2/a_2/b_5/b_6$), IX to XXIII, (total 15 complete segments) XXIV, 3-annulate ; sense organs clear, auricles margined by three uniannulate segmental annuli (a_2 of XXIV, XXV and XXVI) ; anus on XXVII ; salivary glands in clusters upto segment VIII ; pharynx moderately muscular, suspended by radial muscles, terminates at b_6 of VIII or b_1 of IX ; Pharynx with a single dorsomedian and paired venterolateral muscular ridges, all the three paired ridges fusing each to enter the jaw ; crop with 11 pairs of simple, blunt and laterally directed caeca except the last forming postcaeca from XIX to XXIV ; lambertian organs present ; intestine without any caeca ; genital pores b_5/b_6 of XI and b_5/b_6 of XII ; reproductive system haemadipsoid ; 10 pairs of testes ; epididymis and sperm duct subparallel in XI and XII at tandem ; small ejaculatory bulbs present ; male median region amyomeric, micromorphic ; ovaries tubular, female, median region myomeric, mesomorphic, glandular oviducal sac truncated and saccular, extending from a_2 of XIII to b_5 of XIV ; size medium, posterior sucker $\frac{1}{3}$ to $\frac{1}{2}$ the width of abdomen ; sucker rays 74-76 ; Terrestrial. Sanguivorous. Peninsular India.

Type species : *Haemadipsa moorei* sp. nov. Holotype specimen deposited in the National Collections of the Zoological survey of India, Calcutta. (An : 191/1.) Collected in November 1968, by *Dr. M. Gladstone*, from Upper Nymakaud, near Munnar in Kerala State, on open grass-lands at an altitude of about *c.* 6500 feet.

Paratypes in the National Collections of the Zoological Survey of India, Calcutta. (3 specimens). An : 192/1.

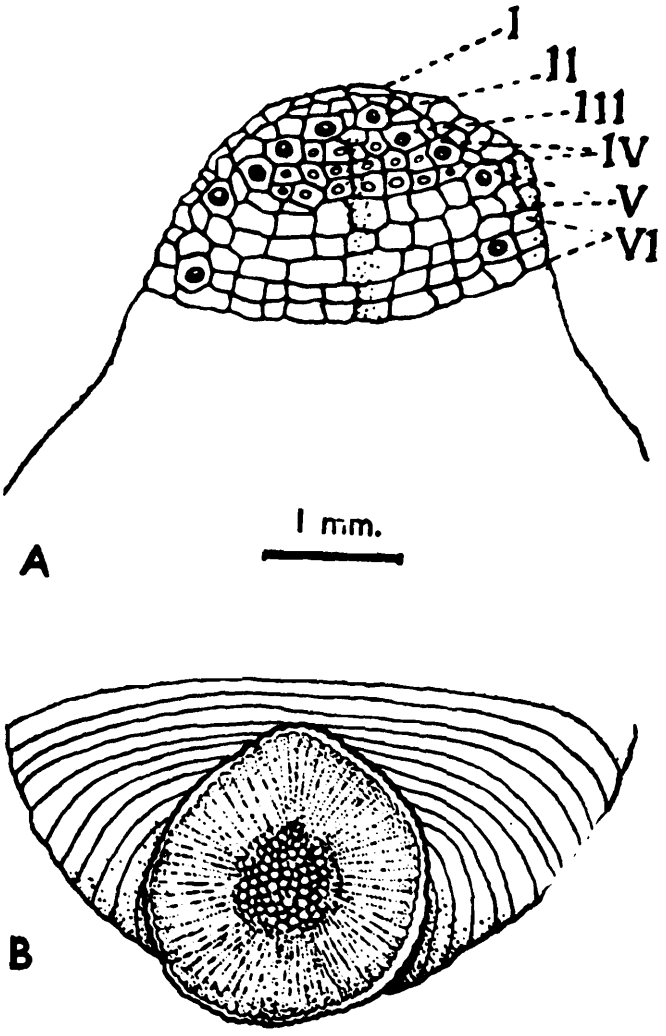
(The specific name *moorei* is in honour of Prof. J. P. Moore)

External morphology : Size smaller than *Haemadipsa zeylanica* and *Haemadipsa montana*. Body width greater than those two species. Sucker relatively very small. Living colours, dark or chocholate brown on venter, and black or dark brown on the dorsum, usually with dark blotches or with black lines in the form of chain stripes, and the markings are variable, Median dorsal black stripe starts from the first median tessellae and reaches up to the anus. Marginal yellow stripes may be observed, continuous with the auricles. Auricle is bordered by a single yellow line. Eyes 3 and 4 not on contiguous annuli but are separated by a complete transverse row of prominent areas representing a_3 of segment IV. Caudal sucker with prehensile papillae well developed. Sucker rays vary from 74 to 76. Centre of the caudal sucker is slightly elevated and not concave as in the case of other species. Bite is very painful and this perhaps is the only peninsular Indian stinging-leech, comparable to *Haemadipsa ornata* of the Himalayas.

Head is triangular and pointed. Margin of the anterior region shows usually 36 serrations. Dorsum of cephalic region strongly areolated with irregular but prominent and deeply furrowed tessellae. Eyes five pairs, small and rounded, similar to those found in *Haemadipsa montana*, but not so prominent as those of *Haemadipsa zeylanica*. Eye-bearing areas are much larger, usually double the size of those not bearing eyes. The first three pairs of eyes on contiguous annuli 2, 3, and 4. Fourth pair of eyes on 6th annulus and separated from the third pair of eyes by a complete row of areas constituting the annulus a_3 of segment IV. The fifth pair of eyes is on annulus 9.

Anterior sucker rays and papilla are prominent. Clitellum not prominent as in the case of *Haemadipsa montana*. Gonopores separated by five annuli. The male at b_5/b_6 of segment XI and the female at b_5/b_6 of segment XII, strictly in the furrows and not on any tessellae. They are small prominent and round orifices. Auricles conspicuous, trilobate, and smaller than in the other two species, *Haemadipsa zeylanica* and *Haemadipsa montana*, supported on the dorsal margins of

a_8 of segment XXIV, XXV and XXVI. The auricles are flat and project outwards while the leech is at rest, but when in locomotion, they fit closely to the sucker border, leaving two small openings. Anus is a small round opening in segment XXVII on a tessella and not in the furrow as is the case in *Haemadipsa zeylanica*. Caudal sucker is



Text-fig. 1.—A—*Haemadipsa moorei* sp. nov., Dorsal tessellae of the head, B—Ventral view of the posterior sucker showing sucker rays.

smaller and is usually ventrally placed (Text-fig. 1B) and not exposed behind the body. It is round with a prominent prehensile papilla ventrally. Venter with radiating rays of prehensile papillae, but not uniformly spaced. Central region is areolated and the rest occupied by rays. The areolated region is elevated as a small protrubance in the centre.

Annulation : Annulation is general resembles that of *Haemadipsa montana annulata* subsp. nov. The furrows deep and the rings prominent, the areas being marked longitudinally by prominent furrows. Head tessellae prominent and irregular. (Text-fig. 1A) The areas are marked very clearly. On the middle complete segments, there are about fifty four of these areas on the entire surface of each annulus and each bears a white simple annular receptors. The tessellae are more

prominent dorsally than on the ventral side. On sensory annuli, the metameric sensillae stand out conspicuously mainly due to their larger size and paler colour. They are of the same number and arrangement as are found in *Haemadipsa montana annulata* subsp. nov., *Haemadipsa montana montana* subsp. nov., *Haemadipsa zeylanica zeylanica* and *Haemadipsa zeylanica cochiniana.*

Segment I, consist of a preocular row of six small areas and is the apical portion of the body just above the cephalic sucker. The anterior margin of the cephalic sucker which is ventrally attached fits in this area (Segment I).

Segment II, consists chiefly of five or six tessellae. Two outer marginal tessellae, two occular tessellae and one or two tessellae in between the occulars. The two eyes are bourne on the two larger occular tessellae.

Segment III, has a pair of still larger occuliferous tessellae corresponding to the larger size of the eyes. Two or more lateral tessellae just like those of II and interocular complete areas of four tessellae, bearing prominent sensory papillae in all the four and forming a regular transverse row.

Segment IV, consists of a pair of occuliferous areas about the same size as that of III and bearing the third pair of eyes. In between the two occulars there are seven tessellae, one close to the eyes and much smaller than the other five tessellae. Segmental papillae are present on two tessellae only, lateral to the median dorsal tessellae. In few specimens, five tessellae only are present. This segment is biannulate. There is a complete row of areas next to the third pair of eyes bearing annulus a_2 of IV and is considered as a_3 of IV. This annulus gradually narrows towards the ventral median line and forms the lateral and posterior rim of pre-oral region.

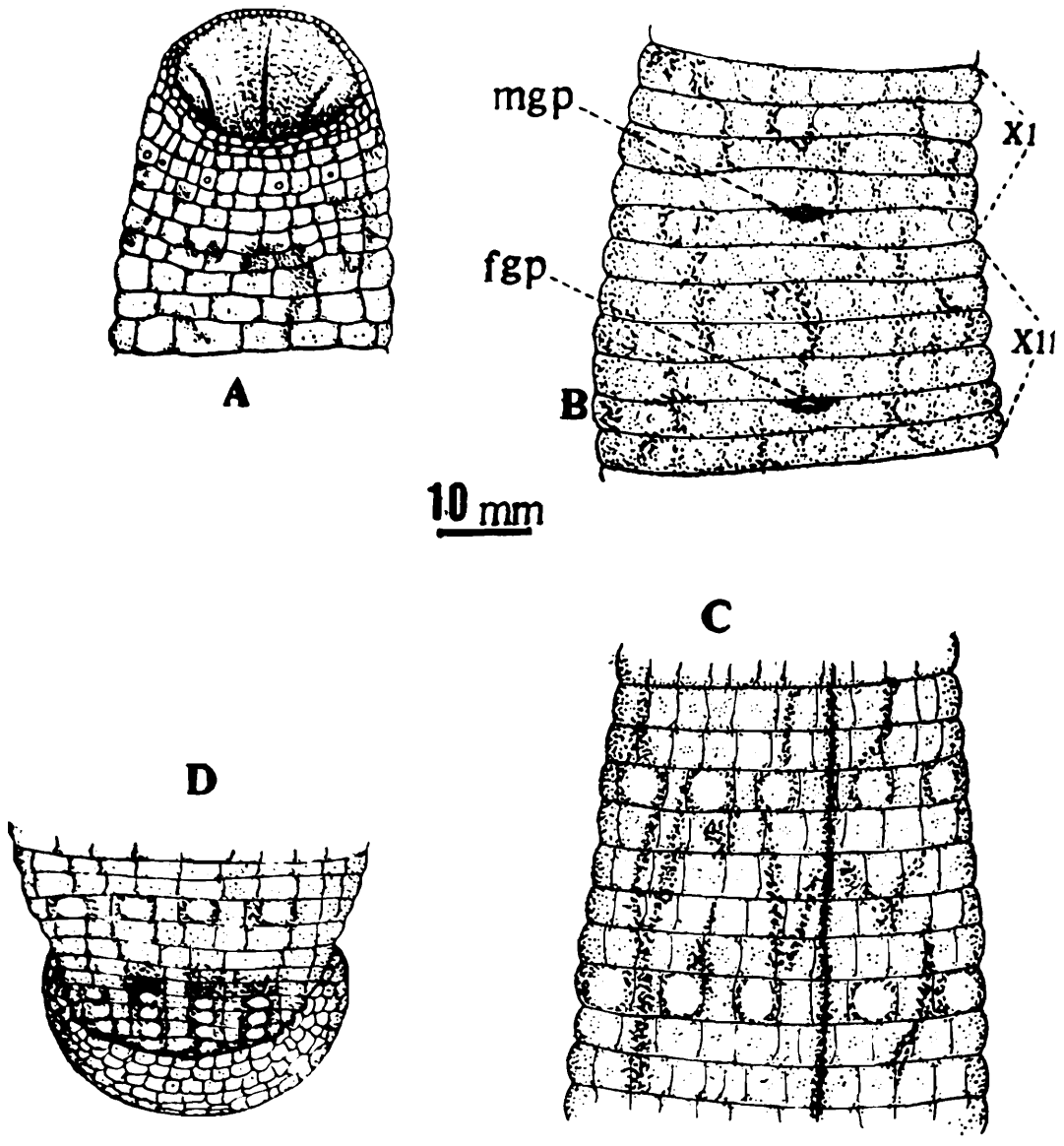
Segment V, is clearly biannulate and forms the posterior rim of the buccal ring ventrally, a_3 of V is the definite ventral annulus, and the furrow which separates it from a_2 continues throughout the ventral area. The tessellae in this somite are very regular and more convex than those of the preceeding annuli and each bearing a small white sensory papilla. The first annulus a_2 of V is continuous dorsally and consists of ten or more tessellae. The second annulus a_3 on the lateral sides bears the two oculars in a line with 3rd pair of eyes. In between these are six or eight tessellae.

Segment VI, is triannulate (a_1, a_2 and a_3), the furrows of a_1 and a_2 continuing on to the ventral side and are very conspicuous unlike those of *Haemadipsa montana.* Fifth pair of eyes and dorsal and ventral sensillae are present on a_2.

Segment VII, is also triannulate. The furrows and tessellae are very prominent.

Segment VIII, is quadrannulate (a_1, a_2, b_5 and b_6). The number of areolae being 24 to 30. Segmental papillae are very prominent on the annulus a_2.

Segment IX to XXIII are quinquannulate (b_1, b_2, a_2, b_5, b_6). They are the complete segments of *Haemadipsa*. The segmental papillae are all very clear and paler in colour. (Text-fig. 2C).



Text-fig. 2.—*Haemadipsa moorei*, A—Ventral view of the anterior region, B—Region of gonopores, C—Dorsal view of two complete segments, D—Dorsal view of the posterior end.

mgp—male gonopore, fgp—female gonopore, XI—segment XI, XII—segment XII.

Segment XXIV, is triannulate (b_1, b_2 and a_2), with no traces of a_3 which is entirely absent. The sensillae are very clear and prominent on a_2 as in the case of the preceeding segments. Lateral ends of a_2 bear the first lobe of the auricle.

Segment XXV, XXVI and XXVII are all uniannulate, all bearing sensillae. (Text-fig. 2D) The first two annuli (segments XXV and XXVI) bear the second and third lobes of the auricle, on their lateral edges respectively. The auricle arises from the marginal sensiliferous papillae. Anus is on the mid-dorsal tessellae of segment XXVII, just anterior to the sucker and not in the furrow.

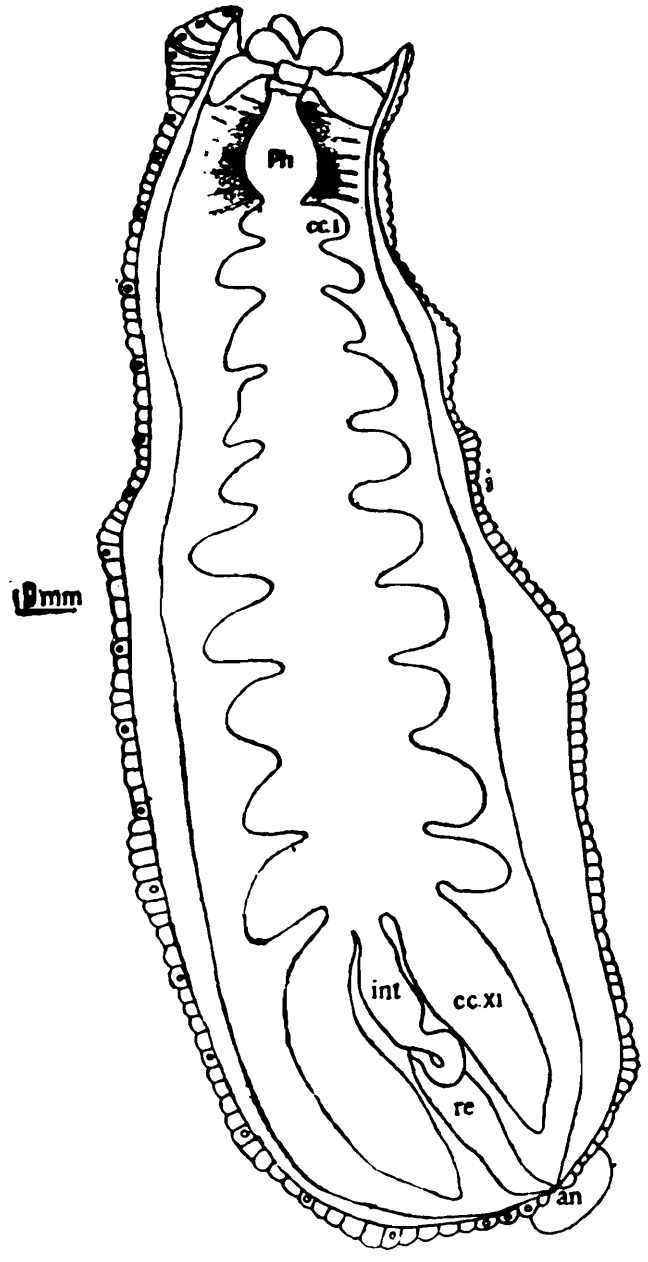
Nervous system : The nervous system is on the usual annelidan plan, but there is a fusion of ganglia at the anterior and posterior extremities. The descriptive pattern given by Lambert (1897 and 1898) for nervous system is followed here. In the cephalic region, there is a (paired) supra-pharyngeal ganglia or brain lying dorsal to the pharynx in a_2 of segment VI, Subpharyngeal ganglia are more or less triangular with the broader end directed forwards and occupy the whole of a_3 of segment VI and a_1 of segment VII. Brain is connected to the sub-pharyngeal ganglia by peri-pharyngeal connectives. (Text-fig. 6A & B) From the sub-pharyngeal ganglia 5 pairs of nerves are given off to the five eyes.

TABLE 1. Ventral Ganglia in Relation to Segments and Annuli.

Brain	in a_3 of segment VI	(9th annulus)
sub-pharyngeal ganglion	in a_3 of segment VI and a_1 of segment VII	(10th and 11th annulus)
1st ganglion	in a_3 of segment VII	(12th annulus)
2nd ganglion	in a_2 of segment VIII	(15th annulus)
3rd ganglion	in a_1 of segment IX	(20th annulus)
4th ganglion	in a_2 of segment X	(25th annulus)
5th ganglion	in a_3 of segment XI	(30th annulus)
6th ganglion	in a_2 of segment XII	(35th annulus)
7th ganglion	in a_3 of segment XIII	(40th annulus)
8th ganglion	in a_2 of segment XIV	(45th annulus)
9th ganglion	in a_2 of segment XV	(50th annulus)
10th ganglion	in a_2 of segment XVI	(55th annulus)
11th ganglion	in a_3 of segment XVII	(60th annulus)
12th ganglion	in a_2 of segment XVIII	(65th annulus)
13th ganglion	in a_3 of segment XIX	(70th annulus)
14th ganglion	in a_2 of segment XX	(75th annulus)
15th ganglion	in a_3 of segment XXI	(80th annulus)
16th ganglion	in a_2 of segment XXII	(85th annulus)
17th ganglion	in a_3 of segment XXIII	(90th annulus)
18th ganglion	in a_2 of segment XXIV	(95th annulus)
19th ganglion	in a_2 of segment XXV	(96th annulus)
20th ganglion	in a_2 of segment XXVI	(97th annulus)
21st ganglion	in a_1 of segment XXVII	(98th annulus)

Caudal ganglionic mass in the caudal sucker

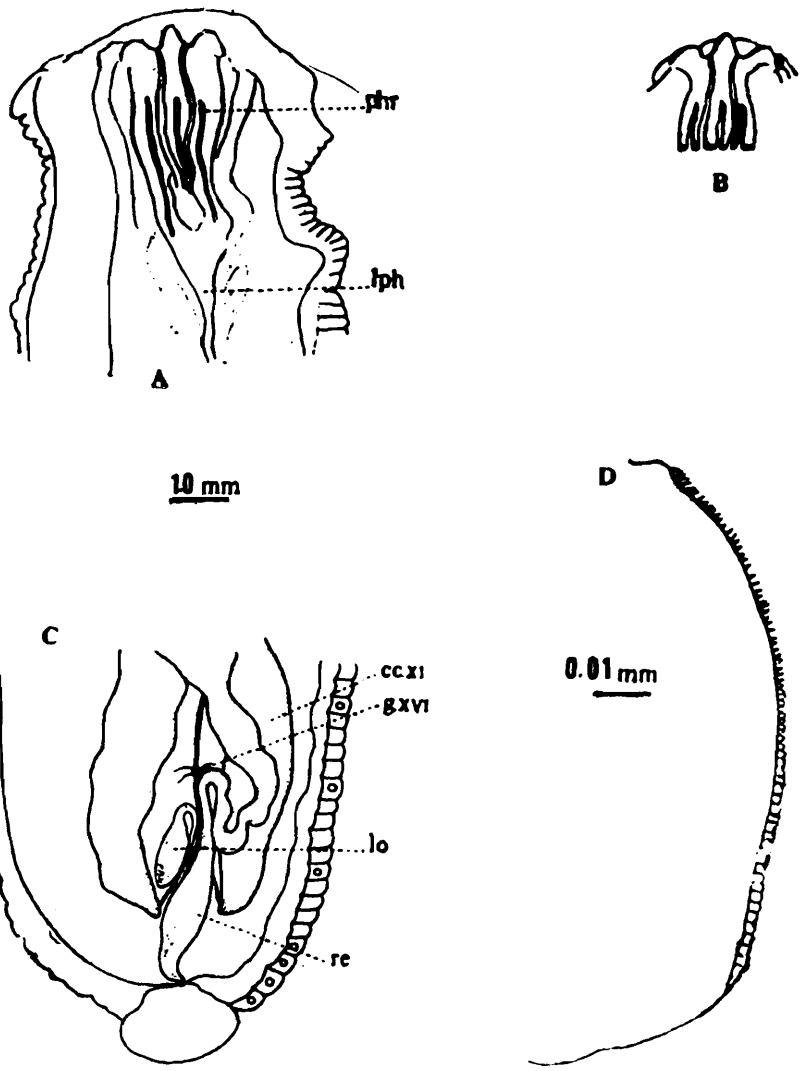
The ventral nerve cord runs along the mid-ventral line from the sub-pharyngeal ganglionic mass to the terminal ganglionic mass lying in the caudal sucker. Although the ventral nerve cord appears single, it is really double and consists of two longitudinal chains closely approximated to each other in the ventral sinus. There are 21 ventral ganglia (Text-fig. 5) in a_2 of each segment from segments VII to XXVII, inclusive of both. (Table 1). The last four ganglia of segments XXIV,



Text-fig. 3.—Alimentary tract of *Haemadipsa moorei*,
an—anus, cc.i—crop caeca I, cc. xi—crop caeca XI,
int—Intestine, ph—Pharynx, re—rectum.

XXV, XXVI and XXVII are in close contact with each other (Text-fig. 6 C) showing no ventral nerve cord inbetween. From each free ganglion of the ventral nerve cord a pair of nerves are given off to either sides. Terminally, there is the large ganglionic mass formed by the fusion of all the nervous elements of the caudal segments. From this trilobed caudal ganglionic mass nerves are given off to the caudal sucker,

Segmental papillae : These are present on a_2 of each segment. They are more prominent and elevated on the dorsal side than on the venter. They are not so clear in the first six segments but they are more prominent in the rest of the segments. On the sensory a_2 of a typical 5-annulate segment, there are three pairs of papillae on the dorsal side, whereas only two pairs on the venter. Laterally on either side of the marginal yellow stripe, a pair of such papillae are seen, so that there is a total 12 papillae around each sensory annulus. On the ocular



Text-fig. 4.—*Haemadipsa moorei* ; A—Pharyngeal ridges and lumen, lph—lumen of pharynx, phr—pharyngeal ridges ;

B -Pharyngeal ridges ; C—Posterior region of the alimentary tract, cc. xi —crop caeca XI, g. xvi—16th ganglion, 10—lambertian organ, re—rectum ; D—Jaw.

annuli or segments, the place of the segmental papillae is occupied by the eyes, whereas in the caudal region on a_2 of segments XXIV and on segments XXV and XXVI the place of the marginal segmental papillae is occupied by the auricular lobes.

Auricles : The auricles (Text-fig. 6 D) are three-lobed and are situated close to the posterior sucker. They are bourne on the lateral

margins of a_2 of segment XXIV and on segments XXV and XXVI. If the auricular lobes are raised there are two openings at their base intersegmentally, between segments XXIV/XXV and XXV/XXVI. The anterior and posterior lobes are semicircular or convex and measure about 0.48 mm and 0.40 mm along the anterio-posterior axis respectively. The middle lobe is triangular or pointed and measures about 0·24 mm at the base. The auricular lobes occupy about 1·12 mm in total length, anterio-posteriorly.

Alimentary tract : The ventral surface of the oral (Text-fig. 2 A) sucker has well developed radial rays of fine granules, comparable to the radial rays of the posterior sucker, perhaps to aid in a good grip while feeding.

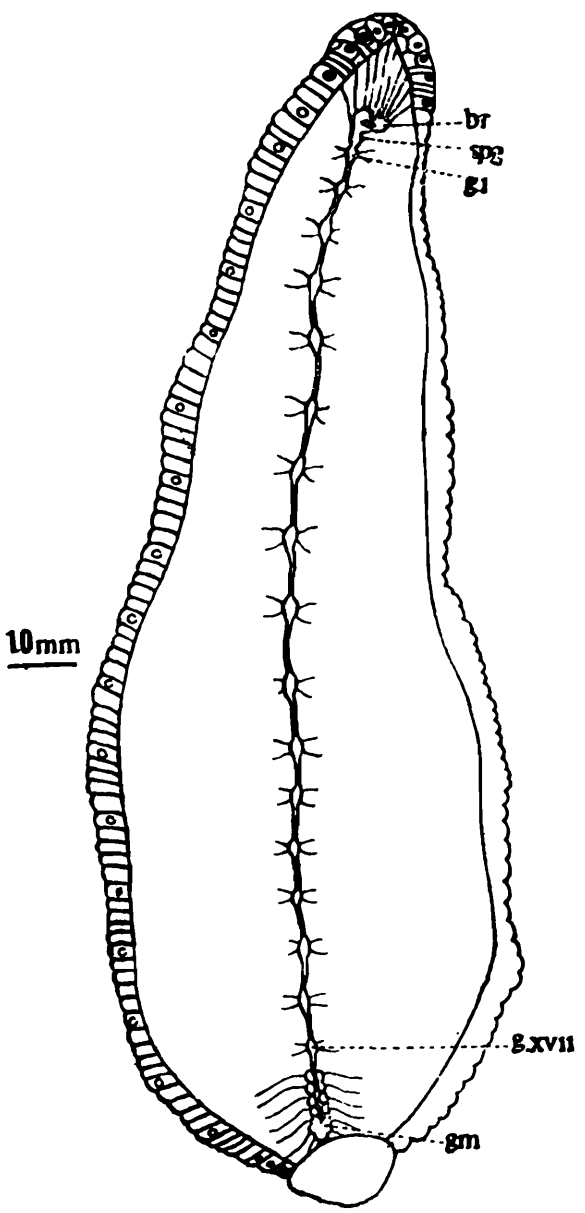
The pharynx conforms to the hirudoid form described by Richardson (1969 *a*) for hirudinid leeches, particularly for *Hirudo medicinalis*. It is bulbous, muscular, attached by obvious radial muscle strands extending up to b_6 of segment VIII or b_1 of IX and clearly remote from the body wall musculature. Pharynx terminates in b_5/b_6 of segment VIII. Internal muscular ridges are six, a pair of dorsomedian and two pairs of ventrolateral, each pair fusing to form single ridges and entering the bases of the jaws. No ridges ending independently on margin of the entrance to pharynx. Lumen of pharynx restricted, tapering posteriorly (Text-fig. 4A&B). Jaws (Text-fig. 4D) are moderately compressed with no salivary papillae visible, retractile into pockets. Dental edge strongly convex, with a single row (monostichodont) of closely approximated, minute and sharp teeth, varying from 68 to 73 in number. The first or the anterior 28 teeth are slender, curved and acutely conical, while the following broaden out gradually. They measure 0.0266 to 0.020 mm in length or height and 0·0063 to 0.0163 mm in width at the base. Salivary glands extend the whole length of the pharynx upto segment VIII and are packed in irregular clusters.

Crop (Text-fig. 3) unlike most of the hirudinoid and even the haemadipsoid leeches does not show clearly defined compartments although the eleven pairs of caeca from segments IX to XIX are clearly indicative of this compartmentalisation. The caeca gradually increase in size towards the posterior end, but all the caeca except the postcaeca are directed straight laterally and not posteriorly. They are obtusely blunt and wide pouch-like caeca and not fingerlike. The postcaeca extend from segment XIX to XXIV without any lateral lobes and taper gently towards the posterior end.

The lambertian organs extend from b_6 of segment XXII to b_1 of segment XXIV, of which the right one is slightly anterior to the left

one. The saccular part measures about 0.18 mm long and about 0.06 mm in average width in an adult specimen and the size varies with the age obviously ; The duct arises from the anterior end of the saccular part and turns round sharply towards the dorsolateral end and runs posteriorly, dorsal to the saccular part to join the postcaecum at b_1 or b_2 of segment XXIV.

The intestine (Text-fig. 4C) commences from XIX/XX and in segments XXII and XXIII, it is thrown into a single 'S' loop before joining the short rectum. The 'S' loop of the intestine occupies from a_2 of segment XXII to a_2 of segment XXIII. There are no intestinal



Text-fig. 5.—Nervous system,
br—brain. g. i—1st ganglion, g. xvii—17th ganglion,
gm—ganglionic mass, spg—subpharyngeal ganglion.

caeca. The rectum opens by the anus situated dorsally on the caudal margin of the middle tessellae of the uniannulate segment XXVII but not in any furrow.

Excretory system : There are seventeen pairs of nephridia placed intersegmentally from segments VIII to XXIV. The nephridiopores (Text-fig. 6E) are marginal openings on the caudal border of b_2 of segments IX to XXIII and not on the furrows, except the first and the last pair. The first pair opens on the sides of the buccal margin, whereas the last pair opens at the base of the anteriormost lobe of the auricle. Nephridiopores are not visible to the naked eye but under the binocular microscope they can be seen by the small spot of dark brown pigment, around each pore. A little stain or ink on the venter will also show them up very well.

The first six pairs and the last pair of nephridia are not associated with the testes, but the rest are connected to the testis sac by the testis lobe. They are all placed in a ventro-lateral position between the adjacent caeca of the crop.

Typical nephridium (Text-fig. 6F) has a testicular lobe which lies ventero-laterally near the outer margin of the testis. The testicular lobe is continuous with the main lobe or central portion which forms the loop. From the inner side of the loop, a duct is given off which before opening out, enters into a thin-walled vesicle. The vesicle opens out on the caudal border of b_2 of each nephridial segment.

Reproductive system : The regional morphology of the reproductive system in 3-jawed, 4 and 5-annulate and 2-jawed, 4, 5 and 6 annulate haemadipsoids, based both on fresh dissections as well as on the literature available, has been reviewed by Richardson (1969*b*) showing the complete contrast between the system in the aquatic arhynchobdellids and the land-leeches and more particularly pointing out that the elaboration of organs at the anterior end of the paired male ducts within the median longitudinal chamber, the absence of vagina and the presence of an oviducal glandular sac, are all decidedly the typical or distinctive haemadipsoid features with no parallel in the hirudinoids. He (Richardson, 1969*b*) further mentions that whereas in the hirudinoids he (Richardson, 1969*a*) has shown five distinctive patterns of reproductive systems, there is only one pattern in the haemadipsoids perhaps with the exception of the genus *Nesophilaemon*.

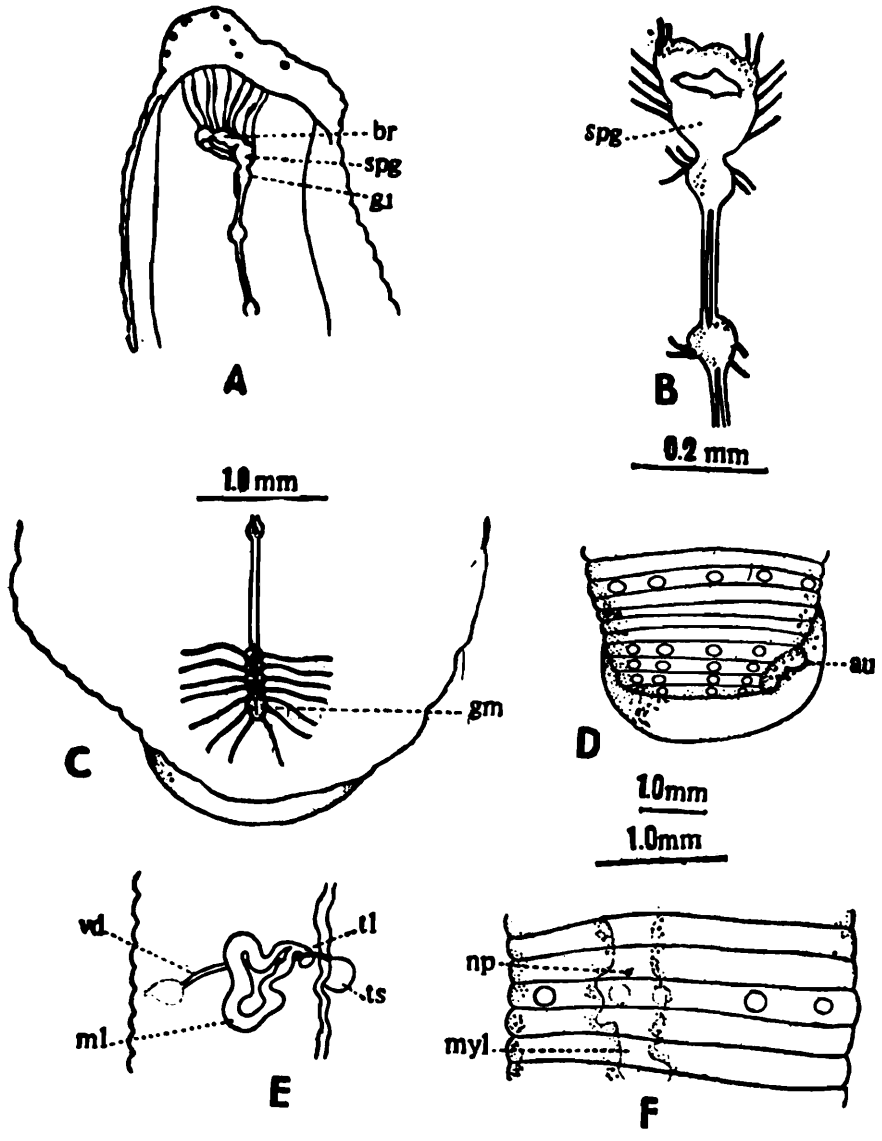
Perhaps the best accounts of the regional morphology of the reproductive systems of the genus *Haemadipsa* so far, may be of Whitman (1886) for the Japanese haemadipsids and those of Moore (1927) for *Haemadipsa zeylanica*, *Haemadipsa montana* and *Haemadipsa sylvestris*.

The male reproductive system(Text-fig. 8C) may conform to the amyomeric and micromorphic type described by Richardson (1969 *a* and 1969 *b*) for the hirudinoids and for the haemadipsoids respectively.

There are ten pairs of simple sac-like testes in segments XIII/XIV to XXII/XXIII, each about 0.263 to 0.413 mm in diameter. Towards the vasa efferentia, each testis is deep brown externally but the inner end is colourless. All the vasa efferentia and the lateral vas deferens from the hindermost end upto about segment XII are enveloped in a thick white tissue, giving a prominently white and tubular wavy appearance for them. Otherwise, the ducts by themselves are fine and transluscent white in colour. In b_2 of segment XII the right and left vasa deferentia emerge out of this envelope and in b_6 of segment XI they converge towards the median line and turn round laterally and run backwards as the recurrent limb including the thin vasa deferentia upto a_2 of segment XI, and begin to enlarge as the epididymis, convoluted and accommodated in segments XI and XII. The procurrent limb forms the other limb of the typical U shaped anterior end of the paired male ducts so characteristic of the haemadipsoids. This procurrent sperm duct also is equally thick and convoluted as the recurrent limb, but is located anterior in segments XI and XII to the recurrent limb, and this tandem arrangement is explained (Richardson, 1969*b*) to be of functional adaptative significance for land-leeches. The sperm ducts of either side run medially once again in segment XII, before they open into the atrium in a_2 of segment XI. Prior to that, the sperm ducts narrow down and enlarge into small fusiform, perhaps muscular (as is seen by their lustrous appearance) ejaculatory bulbs located in a_2 of segment XI, and narrow down again as they open into the atrium. The atrium is a small pear shaped structure about 0.525 mm in diameter and is located ventral to the nerve cord, with its apical end alone sometimes above the level of the nerve cord. No atrial cornua are seen but the atrium continues as a short and thin tubular prolongation, before it opens out to the exterior at b_5/b_6 of segment XI. (Text-fig. 2B) The apical or free end of the atrium bears a sparse covering of unicellular glands each about 0.015 mm in size, the prostate glands. There is no sign of albumen glands.

The female reproductive system may conform to the myomeric and mesomorphic condition as per Richardson (1969*b*). The single pair of ovaries (Text-fig. 8C) located in segment XI/XII appear to be tubular, folded to form a compact mass of about 0.462 mm. The tubes when elongated may extend to about 1.04 mm. The oviducts are thin and almost straight without any convolutions and are about 9.59 mm in length and either the left or the right one passes underneath the nerve cord and they unite with each other in a_2 of segment XII to form the common oviduct or the recurrent limb. The common oviduct is sligtly longer than the paired oviducts and is about 0.66 mm

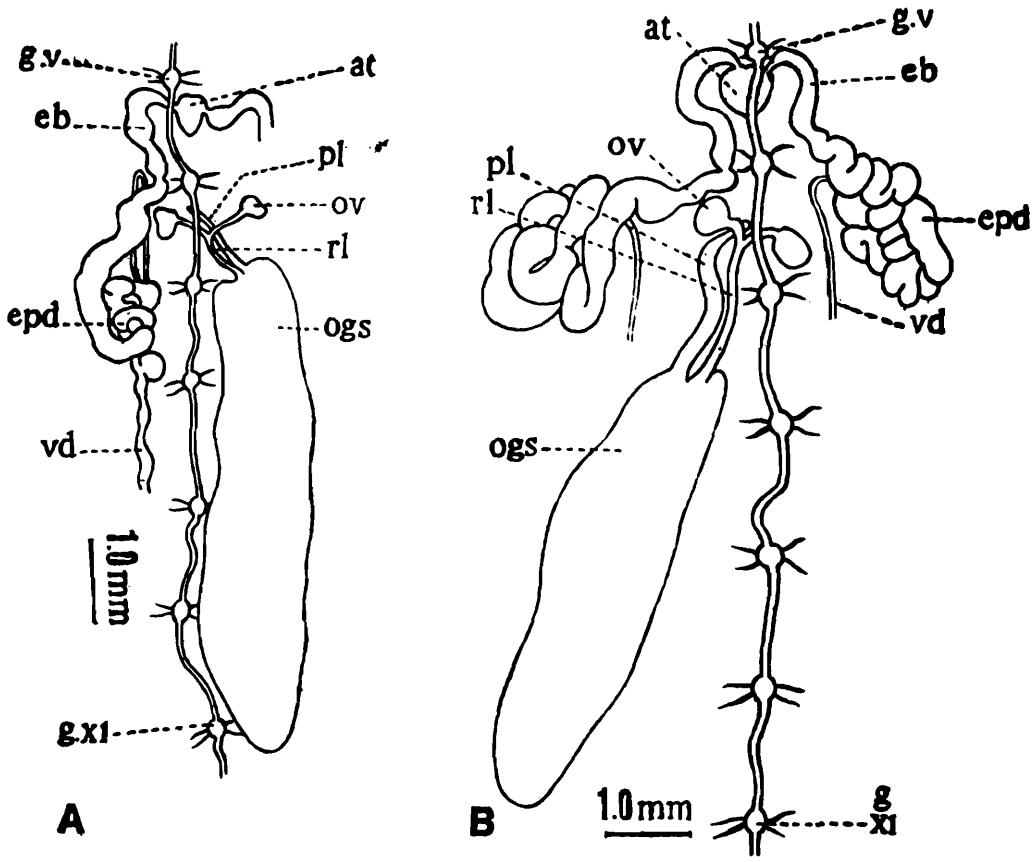
long, and about the same thickness as the paired oviducts. The common oviduct opens into the oviducal glandular sac in a_2 of segment XIII. The oviducal sac is truncated and saccular and extend from a_2 of segment XIII to b_5 of segment XIV, but never posterior to a_2 of segment XV. It may be about 2.046 mm long and 1.32 mm at its broadest point. The procurrent limb comparable to the vagina or the vaginal duct of the hirudinoids (Richardson 1969 *b*), arises just poste-



Text-fig. 6.—*Haemadipsa moorei* A—Lateral view of the brain ; B—Dorsal view of the brain, C—Posterior region showing ganglionic mass, gm—ganglionic mass ; D—Posterior region of *Haemadipsa moorei* showing the auricle, au—auricle ; (E—F) Excretory system, E—Typical nephridium, ml—main lobe, tl—testicular lobe, ts—testicular sac, vd—vesicular duct ; F—A single segment showing the position of the nephridiophore, myl—marginal yellow line, np—nephridiopore.

rior to the base of the opening of the recurrent into the oviducal sac and runs parallel but ventral to the recurrent limb and is one and a half times longer, though of the same thickness but more muscular (myomeric), and it opens to the exterior at b_5/b_6 of segment XII (Text-fig. 2B).

The glandular sac of the haemadipsoids has received considerable attention at the hands of Richardson (1969 *b*) and to quote him, "The glandular sac of the haemadipsoid can in no way be assessed as morphologically an equivalent of the vagina or the vaginal caecum in the hirudinoids. To apply to it such terms as "vagina", "vaginal sac" and to refer to a "vaginal duct" is misleading, confusing and obscures the distinctive nature of the organization in this region of the reproductive system of haemadipsoids." However, he has dealt with the regional morphology of the oviducal sac in various genera and species under investigation but a detailed morphogenesis of the oviducal sac may throw more light on its exact homologies and analogies with hirudinoid equivalents.



Text-fig. 7.—A—*Haemadipsa zeylanica zeylanica*, B—*Haemadipsa zeylanica cochiniana* at—atrium, eb—ejaculatory bulb, epd—epididymis, g. v—5th ganglion, g. xi—11th ganglion, ogs—oviducal glandular sac, ov—ovary, pl—procurrent limb, rl—recurrent limb, vd—vas deferens.

Comparison of the female reproductive system : There are no significant differences between the anterior ends of the paired male ducts in the various species of the genus *Haemadipsa* of the peninsular India but the oviducal glandular sac in the female reproductive system in various species of *Haemadipsa* shows very specific differences of taxonomic value. The shape of the oviducal sac and its posterior extension or the total length matters most. In *Haemadipsa moorei*, the oviducal sac (Text-fig. 8C) extends up to a_2 of segment XIV or up to the 9th

ganglion, thus occupying about 7 to 12 annuli only. The oviducal sac is ovoid and sometimes its width may be more than its length. In *Haemadipsa montana* inclusive of both the subspecies *Haemadipsa montana montana* and *Haemadipsa montana annulata*, the oviducal sac (Text-fig. 8 A & B) extends upto b_6 or segment XVI or sometimes upto a_2° of segment XVII or upto 10th ganglion, occupying 15 to 17 annuli. It is linear in shape and has a clear cylinderical appearance. In *Haemadipsa zeylanica* inclusive of the two subspecies, *Haemadipsa zeylanica zeylanica* and *Haemadipsa zeylanica cochiniana*, the oviducal sac (Text-fig 7A & B) extends upto a_2 of segment XVII or b_1 of segment XVIII or upto the 11th ganglion, thus occupying 20 to 23 annuli. It is decidedly linear or cylindrical and longest among these species. The functional or adaptive significance in relation to the length of the oviducal sac is worth looking into.

Distribution : During the present survey of the Western Ghats, this species has been encountered in the Nymakaud and Rajamalai stations of the Munnar area and in Seelaliparai station of the Anaimalais. At the Seelaliparai station, they are encountered in the high altitudes (*c.* 5000 ft. to 6200 ft) and mostly in the grass-lands. They are totally absent in the rest of the Western Ghats. Special efforts to locate them in the other regions have been in vain.

Season of occurrence : Immediately after the south-west monsoon they come out of their summer haunts and usually in the begining of June, and are seen up to November and are rarely seen after November. Compared to the other species they are far fewer in number.

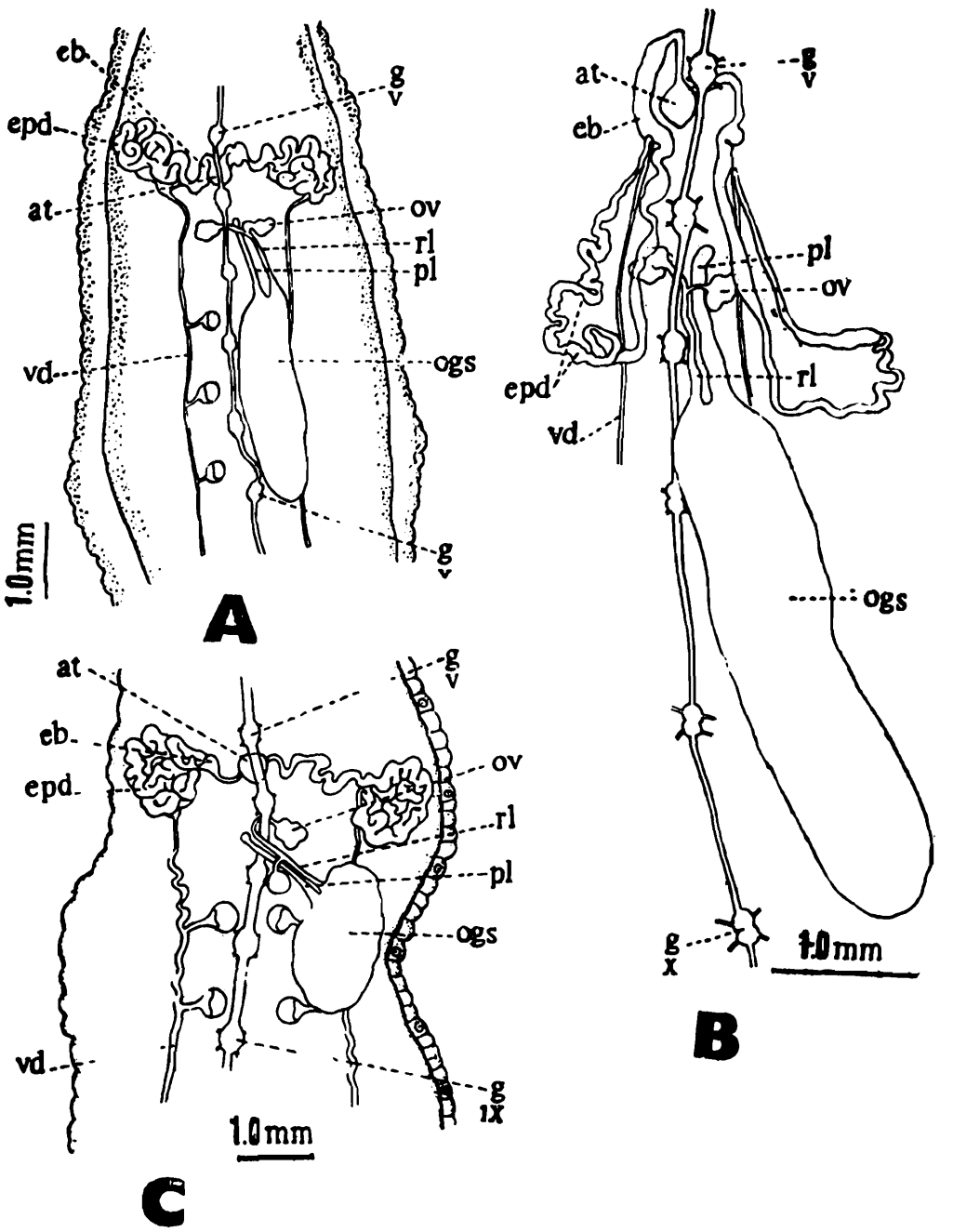
Habitat : They are mostly found in the grass-lands often under the grass stems, at the higher altitudes. They attack the cattle and human beings, sometimes entering even into the nasal cavities of the cattle. The bite of this species is said to be very painful.

Elevation : They occur from an elevation of *c.* 5000 ft. at Nymakaud to about *c.* 6200 ft. in the Rajamalai of the Munnar region. They are present above *c.* 5000 ft. in the Seelaliparai of the Anaimalai Hills. They are not found in the lower elevations at all, thereby showing definite preference to high altitude.

Vegetation : Even in the forest areas they are found on the grasses and not among bushes. Among the plantations too, they seem to prefer the undergrowth of grass.

Species or subspecies co-existing : *Haemadipsa moorei* co-exists with *Haemadipsa montana montana* subsp. nov. They are not found associated with any other subspecies or species of the land-leeches known.

Population : In the heavily infested areas, they figured about 1 to 4 from an area of about 4 feet by 4 feet. They are fewer in number when they are usually found along with *Haemadipsa montana* and the latter species usually dominates in such areas.



Text-fig. 8.—A—*Haemadipsa montana montana* ; B—*Haemadipsa montana annulata* ; C—*Haemadipsa moorei* ;

at—atrium, eb—ejaculatory bulb, epd—epididymis, g.v—5th ganglion, g. ix—9th ganglion, g.x—10th ganglion, ogs—oviducal glandular sac, ov—ovary, pl—procurrent limb, rl—recurrent limb, vd—vas deferens.

Size and Colour ranges : Dark brown or black on the dorsal surface with black blotches or chain-striped. Venter usually mottled. Marginal yellow stripes very clear, sometimes a pair of such lines present. This line if continuous with the nephridial auricles. Mid-dorsal dark line is very prominent extending up to segment XXVI. In some cases, it ends at segment XXIV,

Comparison of Haemadipsa moorei sp. nov. with related species :

The new species *Haemadipsa moorei* resembles the other species of ***Haemadipsa*** from the peninsular India, in all general appearance but the form of the body which is conspicuously narrower at the front end and broader at the hinder end is more obvious in this species and also there is the difference in colour pattern. More than anything else, the posterior sucker in relation to the maximum width of the body is much smaller in this leech compared to the other species from the peninsular India. It is only one third to half of the maximum width of the body in this species whereas in *Haemadipsa zeylanica* the sucker is three fourth to equal to the width of the body and in ***Haemadipsa montana***, the sucker is also three fourth to equal the body width.

Internally, the oviducal sac shows remarkable differences being the shortest (7-12 annuli) in *Haemadipsa moorei*, longest (20-23 annuli) in *Haemadipsa zeylanica* and medium (15-17 annuli) in *Haemadipsa* ***montana***, as detailed under the female reproductive system.

Haemadipsa moorei seems to be ecologically isolated also, being confined to higher altitudes and this is a rather sluggish leech compared to the other land-leeches of India and also, this seems to be the only land-leech in the peninsular India whose bite is rather painful.

ACKNOWLEDGEMENTS

We are grateful to the Council of Scientific and Industrial Research for the award of a Research Scheme to the senior author as the Investigator-in-charge, where the junior author worked as a junior Research Fellow from August 1967 to August 1969. We thank the authorities of the Madras Christian College for facilities given for work. To several friends and workers in the inaccessible and inhospitable high altitudes of the Western Ghats, we are most obliged for hospitality, protection and kindness to the junior author, during his field work. To Dr. S. Jeyadev Babu, for help with the diagrams, we are grateful.

SUMMARY

A new species of land-leech *Haemadipsa moorei* is described in detail from the Western Ghats of the peninsular India. It is compared with the earlier known species.

References

LAMBERT, A. M. 1897. The structure of an Australian land-leech. *Proc. Roy. Soc. Victoria*, **10** : 211-235.

LAMBERT, A. M. 1898. Description of two new species of Australian Land-leeches, with notes on their anatomy. *Ibid.*, **11** : 156-163.

MOORE, J. P. 1927. *The Fauna of British India including Ceylon and Burma. Hirudinea* : 244-290. (Taylor and Francis, Red Lion Court, Fleet St.) London.

RICHARDSON, L. R. 1969*a*. A contribution to the systematics of the hirudinid leeches, with description of new families, genera and species. *Acta. zool. Hung.*, **15** : 97-149.

RICHARDSON, L. R. 1969*b*. On a distinctive new subequational Australian quadrannulate land-leech and related matters. *Aus. zoologist*, **15** (2) : 201-213.

WHITMAN, C. O. 1886. The leeches of Japan, *Quart. J. microsc. Sci.*, **26** : 317-416.