and partly on metabolism of non-feeding pupal and adult stages.

The feeding life stages of these 2 species have so far been considered as a single unit. Hence it is not clearly known whether the higher feeding rate and efficiencies of assimilation and conversion observed in *B. mori* are features limited to one or more life stages and if so, to what extent the rates are altered during the different instars. With a view to compare the quantitative data on food consumed, assimilated, and converted as a function of life stages, the basic data were calculated on the basis of dry substance/g live weight of the animal/day and the values obtained are plotted in Fig. 1. The feeding rate decreases from about 100 mg dry substance/g live weight/day during the early stage of *O. velox* to about 70 mg/g live weight/day during the adult stage. In *B. mori* feeding rate decreases from 180 mg/g live weight/day during the first instar to 134 mg/g live weight/day during the fourth instar. A regression calculated for feeding rate-body weight relationship suggests that mean feeding rate is 7 mg food/g animal/day for the 5th instar individuals, but actually they consume 226 mg food/g animal/day. Thus the feeding rate of *B. mori* is 2 times greater during the first 4 instars and 3 times greater during fifth instar in comparison to the corresponding first few and the seventh or eighth instars of *O. velox*. The levels of the trends obtained for the rates of assimilation and conversion-life stage relations of *B. mori* are also correspondingly higher than those of *O. velox*.

While an Orthopteran like *O. velox* feeds throughout the life, a lepidopteran like *B. mori* accumulates sufficient food energy during larval period to tide over the subsequent non-feeding pupal and adult stage. Available information indicates higher feeding rate and assimilation and conversion efficiencies for lepidopterans[4] than for herbivorous orthopterans like *Poecilocerus pictus*[2,5]. Consequently the food intake and utilizations in these two insect groups show considerable adaptive differences.

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RECORD OF *HYDROPHITREMA GIGANTICA* SANDARS, 1960 (TREMATODA : HEMIURIDAE) FROM SEA SNAKES OF WALTAIR COAST BAY OF BENGAL

Hydrophitrema gigantica Sandars, 1960 is one of the two hemiurid trematodes reported from the lungs of sea snakes. It has been reported previously from the lungs of *Hydrophis elegans* (Gray, 1842) and *Aepysurus laevis* at Australia, *Kolpophis annandalei* (Laidlow, 1901) from Indochina and *Hydrophis cyanocinctus* Daudin, 1803 from Malaya and Formosa[1-3]. There appear to be no other reports although the sea snakes are widely distributed in Indopacific regions.

In the course of studies on parasites of sea snakes from Waltair Coast, Bay of Bengal, six mature *H. gigantica* were obtained from lungs of *Enhydrina valakadyen* Gray and one juvenile fluke from lungs of *Microcephalophis gracilis* Shaw. The three whole mounts of mature flukes measured 15·6 to 16·0 mm in length and 2·5 to 3·5 mm in width, possessed a short but distinct ecsoma (Fig. 1) and agreed closely with the description of Sandars[1]. A comparison of the descriptions of the species from different localities, however, revealed that those described from Malaya differ from both the type and present specimens in respect of the size of seminal vesicle. The Malayan specimens possess a considerably longer seminal vesicle with two or more coils situated posterior to acetabulum and the seminal vesicle body length ratio is 1 : 1·7. In the type and present specimens the seminal vesicle is smaller with only one coil situated posterior to acetabulum (Fig. 2) and seminal vesicle body length ratio is 1 : 4·1 to 4·3. The length of seminal vesicle does not appear to vary independently of the body length since the juvenile fluke measuring 4·32 mm from the lungs of *Microcephalophis gracilis* had a correspondingly smaller seminal vesicle with the ratio approaching 1 : 4·0. Vercammen-Grandjean and Heyneman[2] also noted the difference in the size of seminal vesicle and stated that their specimens have a consistently longer seminal vesicle than the type specimens but did not consider this difference specific. The Malayan specimens also possess a characteristic

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cuticular fold surrounding oral and ventral suckers. Such a fold occurs in the present specimens also but has not been indicated in the type material.

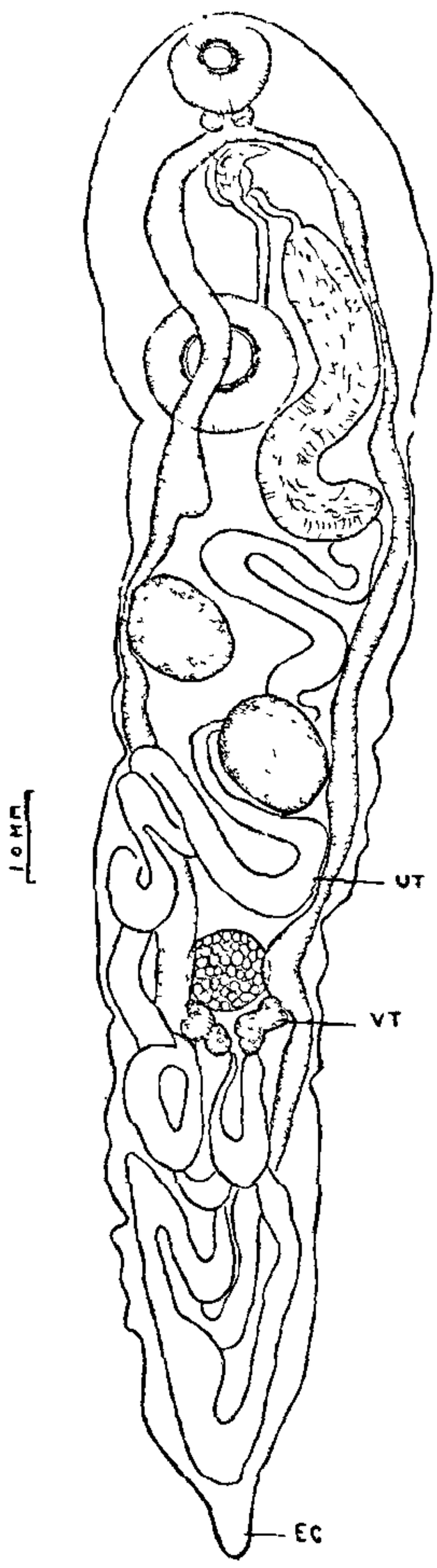

FIG. 1. *Hydrophitrema gigantica* entire, dorsal view.
(EC, Ecsoma ; UT, Uterus ; VT Vitellaria.)

Sandars[4] erected the subfamily Pulmovermiinae (spelling emended from Pulmoverminae Sandars) to include *Pulmovermis* Coil and Kuntz, 1960 and *Hydrophitrema* Sandars, 1960 and compared it with the subfamilies of Hemiuridae proposed by Yamaguti. However, the categorisation of subfamilies given by Yamaguti[5] appears arbitrary. The scheme proposed by Manter[6] in which the hemiurid trematodes are grouped into six subfamilies is the most satisfactory scheme. The subfamily Pulmo-

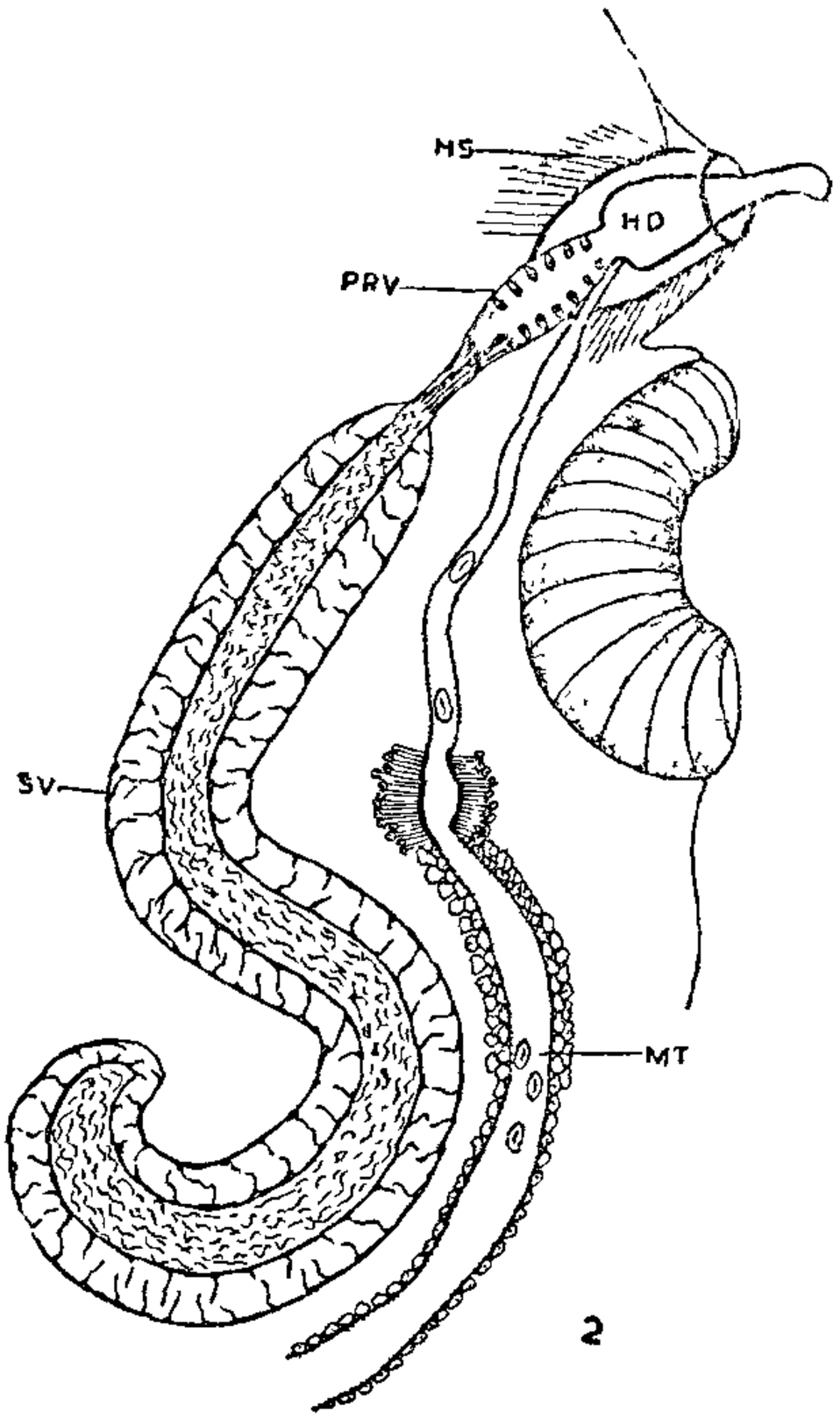

FIG. 2. Terminal genitalia of *H. gigantica*, free hand diagram.
(HD, Hermaphroditic duct ; HS, Hermaphroditic sac ; MT, Metraterm ; PRV, Prostatic vesicle ; SV, Seminal vesicle.

vermiinae comes close to Lecithochiriinae as defined by Manter. The genus *Musculovesicula* Yamaguti, 1940 of Lecithochiriinae has a highly muscular but smaller seminal vesicle and terminal genitalia identical to the condition in *H. gigantica*. *Hydrophitrema* may be considered as nearest to *Musculovesicula*. However, Pulmovermiinae stands distinct in its short ecsoma and extremely long seminal vesicle and occurrence of its members in lungs of sea snakes.

It now becomes evident that the genus *Hydrophitrema* is reported in Autralia, Malaya, Indochina, Formosa and Bay of Bengal in the lungs of 5 genera of hydrophiid snakes.

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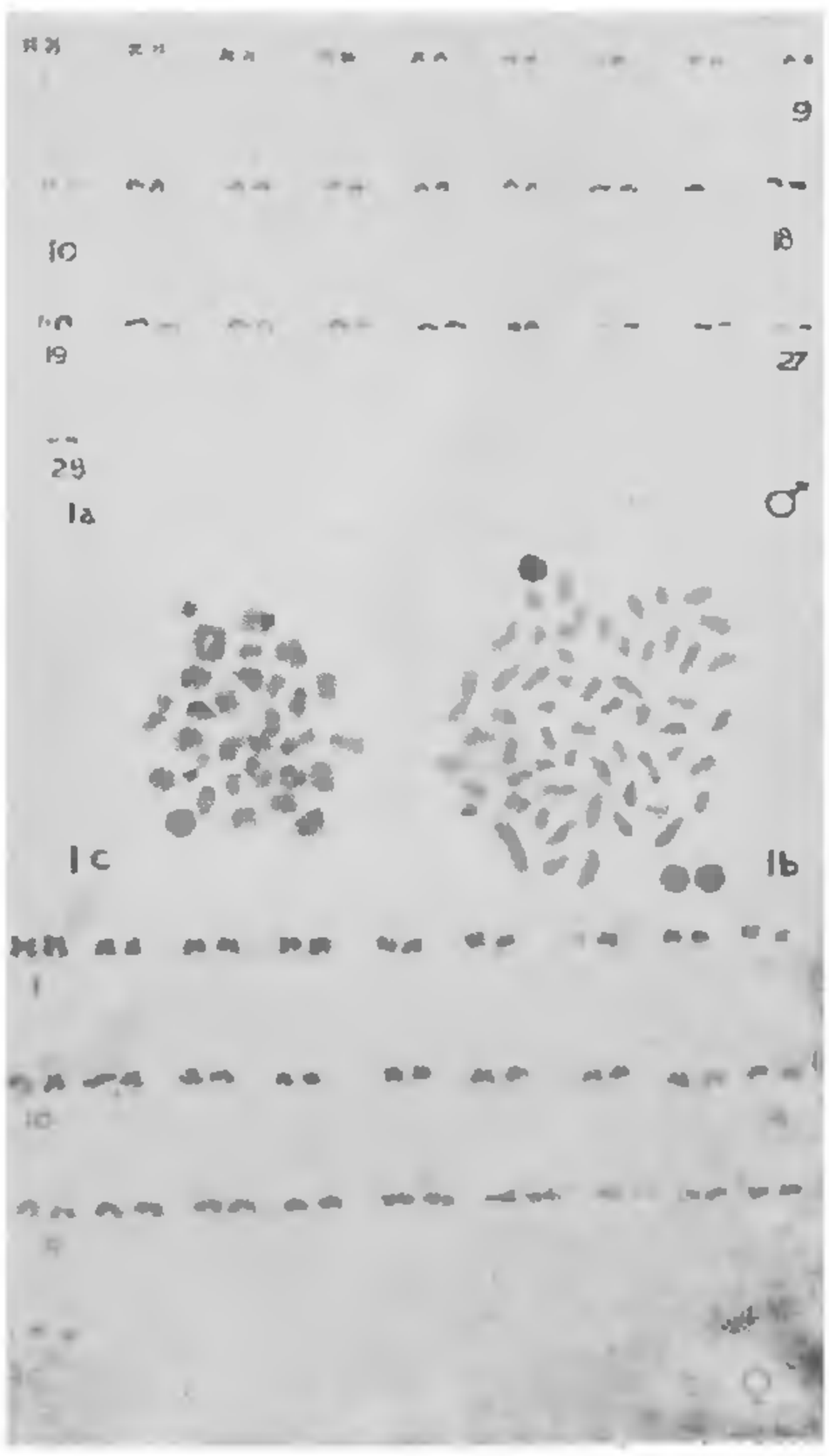
SOMATIC AND MEIOTIC CHROMOSOMES OF *HETEROPNEUSTES FOSSILIS* (BLOCH)

AMONG vertebrates, karyological studies of fishes are comparatively less documented and this is more so for the fishes of the Indian sub-continent[5,6]. Recently, various techniques have been reported for preparing fish chromosomes[4,6,7]. We report here the somatic and meiotic chromosomes of the Indian cat fish, *Heteropneustes fossilis* (Bloch) by a simple technique for obtaining chromosomes from kidney, spleen, and testis. *Heteropneustes fossilis* (Bloch) shows a clear external sexual dimorphism, and it would be, therefore, of interest to study whether any chromosomal differences exist.

Male and female (ten each) fishes were injected with 0·5 ml colchicine (0·2%) intra-muscularly and six hours later sacrificed. Kidney and spleen were removed to a clean petridish containing 10 ml saline and cut into small pieces which were later made into a cell suspension. The latter was centrifuged for five minutes at 600 rpm and the cell pellet was suspended in 5 ml KCl (0·56%) at 26° C for 25 minutes. The suspension was again spun down at 600 rpm for five minutes and fixed in acetic-alcohol for 30 minutes. After two changes in fixative, slides were prepared for chromosomes by air dry method.

For meiotic chromosomes testes were freed from the surrounding material in saline before they were cut into small pieces. They were transferred to a small petridish containing 5 ml glass distilled water (hypotonic treatment). The hypotonic treatment was carried at room temperature for 8 to 10 minutes and thereafter fixed in 10 ml acetic-alcohol. After 30 minutes the fixative was removed and a few drops of 45% acetic acid was added to make a homogeneous cell suspension and centrifuged at 600 rpm. for five minutes. Freshly prepared fixative (acetic-alcohol) was slowly added to the cell pellet and agitated vigorously. After two changes in fixative, slides were prepared by air dry method.

The diploid number of *Heteropneustes fossilis* (Bloch) was found to be 56 in both sexes (Figs. 1 *a*, 2). Chromosome number scored from testicular preparations confirms the diploid number of 56 (Fig. 1 *b*). The karyotypes of both male and female show 9 pairs of metacentric, 9 pairs of submetacentric and 10 pairs of acrocentric, chromosomes. No heteromorphic pair that could be described as sex-chromosomes were found. In leptotene, a typical "bouquet" arrangement was not observed ; so also the sex-vesicle at zygotene. Metaphase I showed 28 (Fig. 1 *c*) ring bivalents. None of the pairs showed an end-to-end association characteristic of the sex-chromosomes. All the chromosomes segregate in the first division.



FIGS.1–2. Fig. 1 *a*, Karyotype of male *Heteropneustes fossilis* from spleen showing nine pairs of metacentries, 9 pairs of submetacentries and 10 pairs of acrocentrics. Note the absence of any heteromorphic pair ; Fig. 1 *b*, Spermatogonial metaphase showing 56 chromosomes ; Fig. 1 *c*, Metaphase I from the testis, showing 28 bivalents. Fig. 2. Karyotype of female *Heteropneustes fossilis*, from spleen, showing 9 pairs of metacentries, 9 pairs of submetacentries and 10 pairs of acrocentrics. Note absence of a heteromorphic pair.