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Records of the Zoological Survey of India

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"The sucking lice infesting domesticated and wild mammals"

C. C. ADHIKARY
and
A. K. GHOSH

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INTRODUCTION

The results of the studies on "Systematics and distribution of sucking lice (Insecta : Anoplura) infesting domesticated and wild mammals of India" carried in the Department of Entomology, Zoological Survey of India, Calcutta. A total of 56 species of sucking lice belonging to the 14 genera are recorded from India. Out of these, 45 have been revised or redescribed namely, *Enderleinellus nishimarui* Kaneko, *Phthirunculus sumatranus* Kuhn and Ludwig (Enderleinellidae) ; *Haematopinus channabasavannai* Krishna Rao, Khuddus and Kuppuswamy. *H. oliveri* Mishra and Singh, *H. quadripertusus* Fahrenholz, *H. suis* (Linnaeus), *H. tuberculatus* (Burmeister) (Haematopinidae) ; *Ancistroplax crocidurae* Waterston, *Hoplopleura acanthopus* (Burmeister), *H. alticola* Mishra and Bhat, *H. blanfordi* Mishra and Dhanda, *H. captiosa* Johnson, *H. cutchicus* Mishra and Kaul, *H. erismata* Ferris, *H. himalayana* Mishra, Kulkarni and Bhat, *H. khandala* Mishra, *H. kondana* Mishra, *H. malabarica* Werneck, *H. maniculata* (Neumann), *H. pacifica* Ewing, *H. phaiomydis* Ferris, *H. ramgarh* Mishra, Bhat and Kulkarni, *H. sahyadri* Mishra, *H. sicata* Johnson, *H. silvula* Johnson, *H. sinhgarh* Mishra, Bhat and Kulkarni (Hoplopleuridae) ; *Linognathus africanus* Kellogg and Paine, *L. pithodes* Cummings, *L. setosus* (Von-Olfers), *L. vituli* (Linnaeus) (Linognathidae) ; *Pediculus humanus* Fahrenholz (Pediculidae) ; *Pedicinus longiceps* Piaget, (Pedicinidae) ; *Neohaematopinus echinatus* (Neumann), *N. palearctus* Olsoufiev, *Polyplax asiatica* Ferris, *P. blanfordi* Mishra and Dhanda, *P. cutchicus* Mishra and Kaul, *P. hurrianicus* Mishra, *P. indica* Mishra and Kulkarni, *P. kondana* Mishra, *P. reclinata* (Nitzsch), *P. serrata* (Burmeister), *P. spinulosa* (Burmeister), *P stephensi* (Christophers and Newstead) (Polyplacidae) ; *Pthirus pubis* (Linnaeus) (Pthiridae) and 11 other species, *Haematopinus eurysternus* Denny, *H. longus* Neumann (Haematopinidae) ; *Linognathus ovillus* (Neumann), *L. pedalis* (Osborn), *L. stenopsis* (Burmeister), *Solenopotes capillatus* Enderlein (Linognathidae) ; *Neohaematopinus petauristae* Ferris, *Haemodipsus ventricosus* (Denny), *Docophthirus acinetus* Waterston (Polyplacidae) ; *Pedicinus ancoratus* Ferris, *P. eurygaster* (Burmeister) (Pedicinidae) ; these though recorded from India could not be collected in course of present work and descriptions of such 11 species are mainly based on pnblished literatures. Diagnostic features of all the 14

genera have been reviewed or revised and dichotomous keys for identification of families, subfamilies, genera and species reported here, are provided. Illustrated descriptions of the species provide characteristics covering the most recent usages and terminologies. The occurrence of these ectoparasites on newly recorded mammalian hosts are also listed from different region of the country. The extensive distributional data provided for each species will help to analyse the frequency of distribution in space and time within Indian Union.

The significant part of the present investigation involves the revision of 56 species in 14 genera of 8 families and in many of new hosts and localities in India.

HISTORICAL BACKGROUND

The sucking lice belonging to the order Anoplura are obligatory, permanent ectoparasites adapted to the microenvironment of all the major groups of eutherian mammals except Chiroptera, Edentata, Pholidota, Cetacea, Proboscidea and Sirania (Kim and Ludwig, 1978). They appear to have been associated with mammals ever since their appearence in the evolutionary history. Approximately 65% species of mammals are believed to harbour sucking lice. The morphological adaptation of the lice is much pronounced so as to suit best to the ectoparasitic way of life. These lice have attracted attention due to their suspected involvement in some zoonotic diseases and their association with diverse group of hosts. They have now been proved to the arthropod vector of relapsing fever, epidemic typhus and trench fever. In addition to their role in transmission of diseases, their bites can cause irritation of the skin and interfere with the sleep especially during night ; usually bites are associated with local pigmentation of the skin which was at one time known as vagabond's disease. The adenitis met with in the posterior triangle of the neck in children is generally associated with the presence of lice on the head. Besides, the parasites cause certain viral diseases, such as myxoma of rabbits, lymphocytic choriomeningitis of laboratory animals and tularemia (Horsfall, 1962).

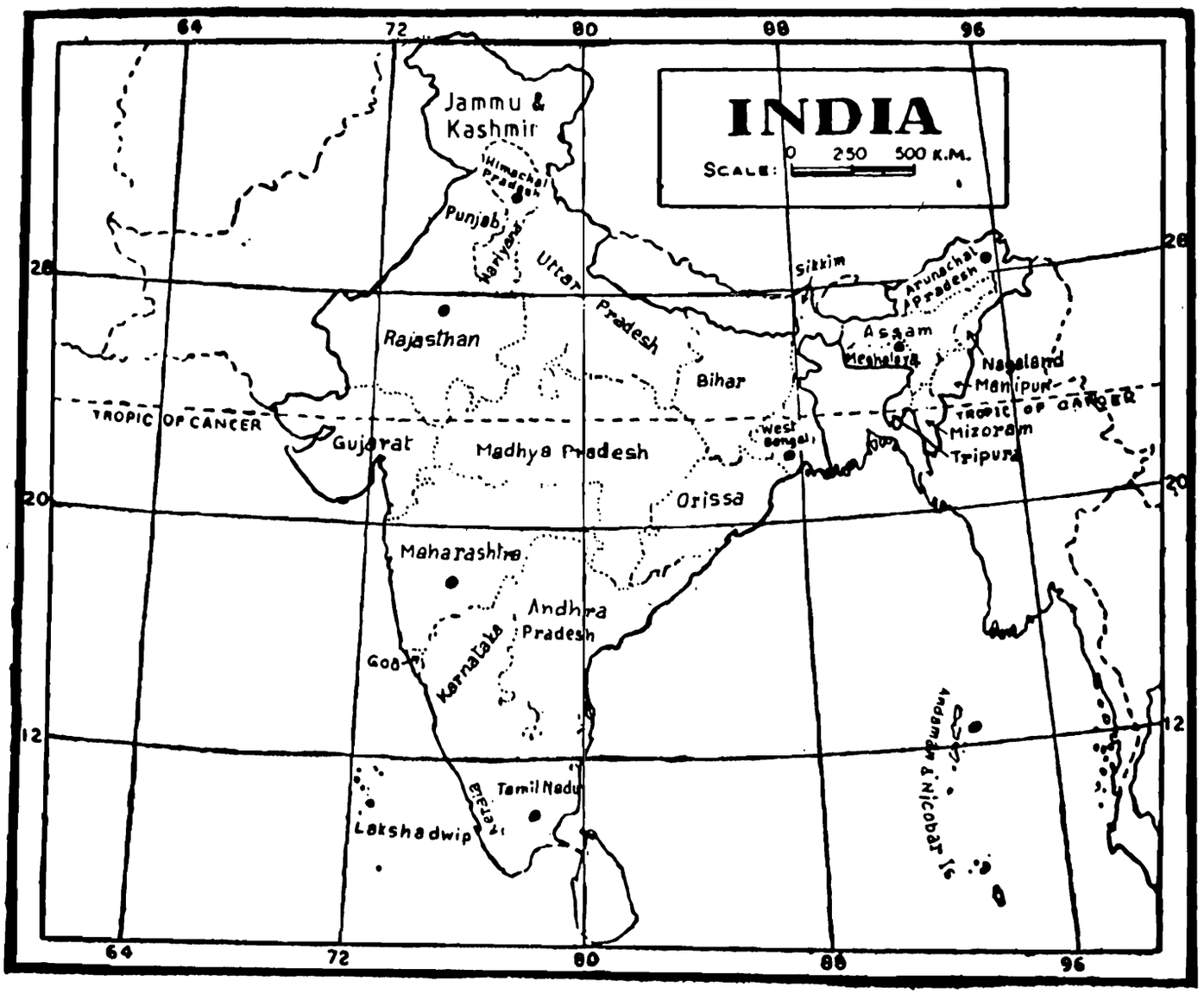
Since the time of Aristotle, the sucking lice have been known to be parasitic upon man and other animals. Prior to Linnaeus's "Systema Naturae (1758)", approximately thirty papers were published dealing mainly with infestation-biology and anatomy of human lice and certain domesticated animal lice. Redi (1688) illustrated many chewing and sucking lice with considerable accuracy.

Anoplura are widely distributed around the world, the fauna being especially rich in Ethiopian region. In recent time, Ferris (1951) recorded 255 species of Anoplura from other region. Ludwig (1968) listed 135 species from Ethiopia, 72 from Palearctic and 52 from the Oriental region. Piotrowski (1973) reported 454 known species from 1356 host species and

sub-species known up to the end of 1971 from the World. Kim and Ludwig (1978) recognised 486 species of sucking lice from about 840 host species belonging to 241 genera of mammals, indicating an increase of 90% of known species during the period of last 25 years. In recent times, 14 more new species have been added to the list of Oriental lice (Mishra 1981). However, the knowledge of lice fauna and their distribution in India subregion remains meagre and scanty. Studies of the Indian fauna of this important group of insects data back to Qadri (1949) who described the anatomy of a buffalo louse, *Haematopinus tuberculatus* (Burmuster). Ansari (1951) may be considered as the first person to study the lice from systematic point of view. After a 'diapause' for a decade, Wattal and Tandon (1965) rejuvenated the study of lice with description of 11 species from small and domesticated mammals of Dehradun Valley of Uttar Pradesh. Immediately after it, Wattal *et al.* (1967) showed the vertical distribution of these ectoparasites in the landscape of Nainital of the same province, while Mitchell *et al.* (1966) reported several parasitic lice on mammals of Madhya Pradesh, indicating their disease-relationship and Srivastava and Wattal (1970) put on record of several haematophagus lice of mammals of Himachal Pradesh. Mishra *et al.* (1974, 77) from survey on the western Himalayas, Sikkim and hill districts of West Bengal discovered/recorded quite a good number of lice from a variety of mammals. Krishna Rao *et al.* (1977) also reported a few species of the genera, *Haematopinus*, *Linognathus* and *Solenopotes* from Karnataka. The works of the earlier authors are based principally around the family Hoplopleuridae in which Mishra and his co-workers Dhanda, Kaul, Bhat and Kulkarni (1972, 73, 74, 80) described more than 39 species in 8 genera, [*Ancistroplax* Waterston—1 species, *Docophthirus* Waterston—1 species, *Enderleinellus* Fahrenholz—2 species, *Haemodipsus* Enderlein-1 species, *Hoplopleura* Enderlein—19 species, *Neohaematopinus* Mjoberg—4 species, *Phthirunculus* Kuhn and Ludwig—1 species and *Polyplax* Enderlein—10 species] belonging to the three sub-families, Enderleinellinae, Hoplopleurinae and Polyplacinae. These insects were recorded as parasites of mammals of the genera under the families Leporidae and Ochotonidae (Lagomorpha), Muridae and Sciuridae (Rodentia), Soricidae (Insectivora) (Mishra and Bhat 1972, Mishra *et al.* 1974, 77 ; Mishra and Dhanda, 1975 and Mishra 1981). In the present investigations, the lice belonging to the following genera *Ancitroplax*, *Docophthirus*, *Enderleinellus*, *Haematopinus*, *Haemodipsus*, *Hoplopleura*, *Linognathus*, *Neohaematopinus*, *Pedicinus*, *Pediculus*, *Pthirus*, *Phthirunculus*, *Polyplax* and *Solenopotes* have been dealt with.

According to Kim and Ludwig (1978), the order Anoplura has been classified into 15 families—Echinophthiriidae, Enderleinellidae, Haematopinidae, Hamophthiriidae, Hoplopleuridae, Hybophthiridae, Linognathidae, Microthoraciidae, Neolinognathidae, Pecaroceidae, Pedicinidae, Pediculidae, Polyplacidae, Pthiridae and Ratemiidae. Subsequently Chin (1980) added two more families viz., Haematopinoididae and Mirophthiridae. Approximately 4060 species of mammals in 1004 genera under 122 families (Anderson and Jones 1967) are known throughout the globe of which nearly 900 species are now known to harbour anopluran parasites. It may be assumed that the members of almost all the families of lice have every

possibility of occurrence on diverse mammalian fauna of India ; so far, mammals belonging mostly to the families—Bovidae (Artiodactyla), Camelidae (Artiodactyla), Caviidae (Rodentia), Canidae (Carnivora), Cervidae (Artiodactyla), Cercopithecidae (Primates), Equidae (Perissodactyla), Giraffidae (Artiodactyla), Hominidae (Primates), Leporidae (Lagomorpha), Mustelidae (Carnivora), Muridae (Rodentia), Ochotonidae (Lagomorpha), Pongidae (Primates), Pinnipedae (Carnivora), Platacanthomyidae (Rodentia), Soricidae (Insectivora), Sciuridae (Rodentia), Simiidae (Primates), Suidae (Artiodactyla), Talpidae (Insectivora) and Tupaiidae (Primates) are known to act as host (Anderson 1981 ; Sclater 1981). They may act as hosts of a large number of lice-parasites showing multiple parasitism.



Map showing collection localities
● Study area

MATERIAL and METHOD

The areas explored during the present study include the localities from the states of Arunachal in the eastern Himalaya to the Andaman and Nicobar islands in the Bay of Bengal. However, most of material was collected in the montane and submontane region of West Bengal, Bihar, Maharastra, Rajasthan, Himachal Pradesh, Orissa, Meghalaya and Tamilnadu. A few specimens were received from Karnataka through exchange. Besides, large collections by National Institute of Virology, Pune and National Zoological Collection at Calcutta, accumulated during the surveys undertaken from different parts of the country, provided the opportunity for intensive study of the group.

The materials of the present study were collected both from domesticated and wild mammals. The specimens from individual host were taken out directly by means of a fine camel hair brush and were put in a vial containing 70% alcohol. To avoid contamination utmost care was taken during the search of ectoparasites. A representative specimen of each species of small mammal from a particular area was preserved for the confirmation of their identity. The large mammals were identified by competent mammalogists.

GENERAL MORPHOLOGY
(Figs., Plates 1 & 2)

General morphology of adult stages of sucking lice has been discussed at length by Ferris (1951). A brief explanation of the terms has been provided by Kim and Ludwig (1978) and Mishra (1981). The important taxonomic characters used in this work are stated below :

The head (Fig. b) is generally conical and may be divided into two parts, fore-head and hind-head, by the presence of a transverse suture (Clypeo-frontal suture). The shape is generally characteristic of each taxon but the head length varies considerably, even within members of a genus. The basic setal arrangement of the head is rather consistent within higher taxa. The chaetotaxy is quite characteristic of the species and genera. The size of dorsal principal head setae and dorsal posterior central head setae (DPoCHS) varies among different taxa. The antennae of the sucking lice are primarily five segmented, with two distinct sensoria, one each on the fourth and the fifth segment. The number of antennal segments varies within a family taxon and is same within a genus-taxon The positions of sensoria in each segment are considered as valid taxonomic characters at the generic level ; the size and shape of the basal segments are often used for determination of species.

The thorax consists largely of pleural and subcoxal structures. The tergum is greatly reduced and often invaginated to form a notal apophysis. The thoracic segments are

PLATE - I

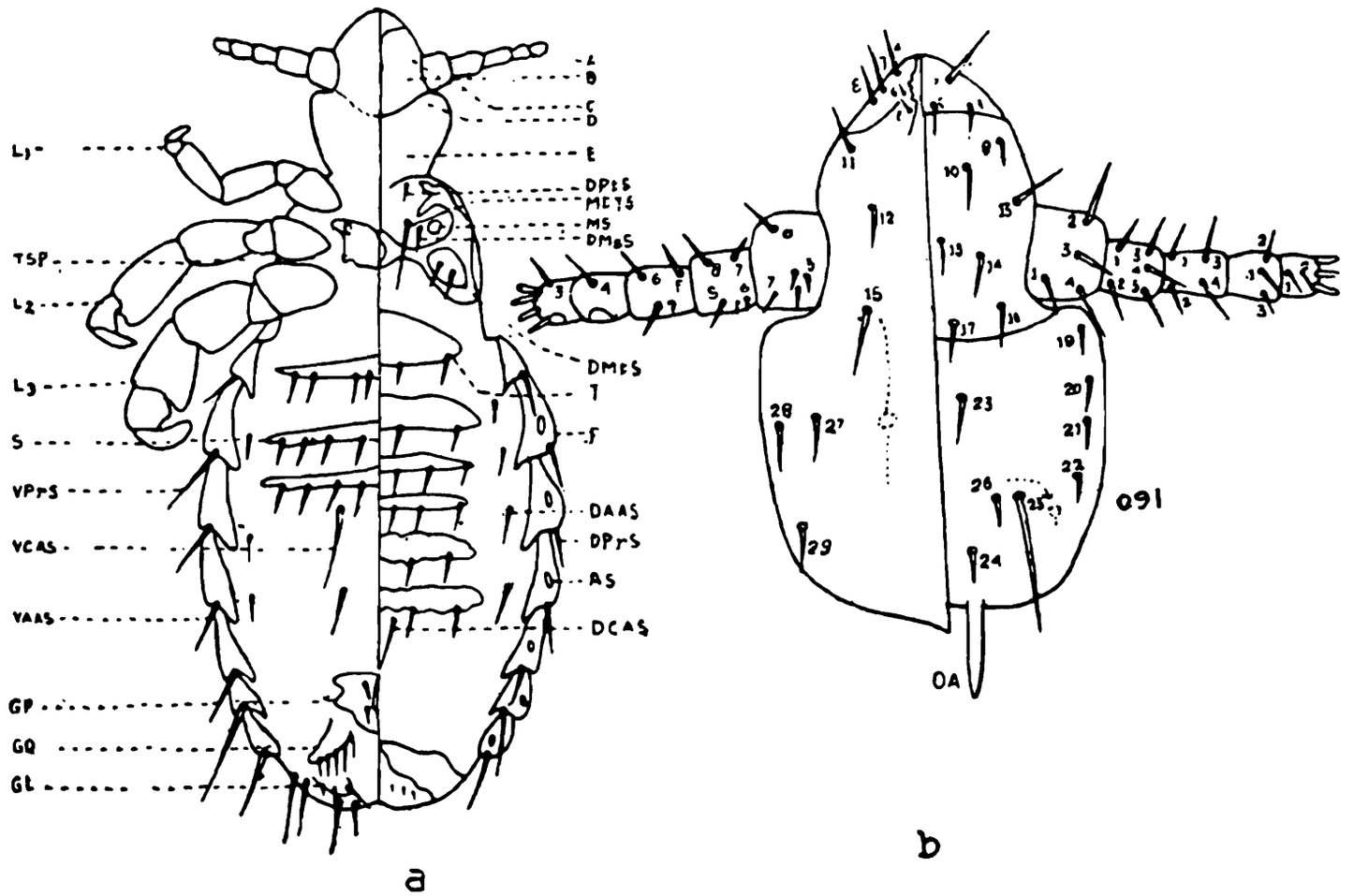


Fig. a : Anatomy and standardised chaetotaxy of typical Anoplura ♀ (generalised). Anatomy : A- Antenna, B- Forehead, C- Clypeus, D- Clypeo-frontal suture, E- Hind head, L_1- Fore leg, L_2- Mid leg, L_3- Hind leg, P- Paratergite, S- Sternite, T- Tergite, AS- Abdominal spiracle, Gl- Genital lobe, Go- Gonopod, Gp- Genital plate, Ms- Mesothoracic spiracle, TPS- Thoracic sternal plate ; Chaetotaxy : DPtS- Dorsal prothoracic setae, DMsS- Dorsal mesothoracic setae, DMtS- Dorsal metathoracic setae, MDTS- Median dorsal thoracic setae, DAAS- Dorsal accessary abdominal setae, DCAS- Dorsal central abdominal setae, DPrS- Dorsal paratergal setae, VAAS- Ventral accessary abdominal setae, VCAS- Ventral central abdominal setae, VPrS- Ventral paratergal setae.

Fig. b : Standardised chaetotaxy of typical Anoplura (generalised)- Head : Left side shows the ventral half and right side is dorsal ; setae on head are continuously numbered and setae on each antennal segment are separately numbered without specific positional designation ; 1, 2 : Dorsal anterior head setae (DAnHS) ; 3, 4 : Apical head setae (ApHS) ; 5, 6 : Oral setae (OS) ; 7, 8 : Anterior marginal head setae (AnMHS) ; 9, 10 : Dorsal preantennal lateral head setae (DPaLHS) ; 11, 12 : Ventral→

dorsally fused. Each segment can be identified by strong pleural apophyses or phragmata and coxal processes. The sternal plate is developed in many taxa and may be variously shaped within a given genus. The sternal plate is an important character at generic and specific level but may be absent in some groups. The thoracic chaetotaxy is rather constant within a family-taxon ; Dorsal prothoracic setae (DPtS), Dorsal mesothoracic setae (DMsS), Dorsal metathoracic setae (DMtS) are usually arranged one on each side ; DMtS are usually missing in most Anoplura.

The abdomen provides the majority of taxonomic characters and shows striking sexual dimorphism within each species, especially in terminalia. The abdomen consists of nine rather distinct segments with the tenth segment and perhaps eleventh segment remaining obscure. The abdomen is primarily membranous and devoid of sclerites in most Anoplura, although tergites and sternites are highly developed in some groups and in these taxa the abdominal sclerites may be divided longitudinally or transversely. The genital plate in both male and female are usually synsternites.

The number, size and shape of the paratergites provide good taxonomic characters at generic and specific levels, when present. Each paratergite usually bears a pair of setae, one on the dorsal side (DPrS) and other on the ventral side (VPrS).

The abdominal spiracles are usually associated with paratergites. The basic number is usually six pairs, one pair each on abdominal segments III-VIII. The spiracle generally consists of a sub globular atrium constricted at its inner end and an oval or circular opening at its outer end.

The male genetalia consists of four primary parts : basal apodeme, a pair of parameres, aedeagus with gonopore and pseudopenis. In addition there are endomeres in some taxa. The basal apodeme is a long, rod like sclerite. The parameres are paired elongate sclerites articulating anteriorly with the basal apodeme. The aedeagus or penis is usually membranous or a weakly sclerotized tube located within the genital sac.

→ preantennal head setae (VPaHS) ; 13 : Dorsal preantennal head setae (DPaHS) ; 14 : Supra antennal head setae (SPAtHS) ; 15 : Supra antennal central head setae (SPAtCHS) ; 16, 17 : Sutural head setae (SHS) ; 18 : Ventral principal head setae (VPHS) ; 19, 20, 21, 22 : Dorsal marginal head setae (DMHS) ; 23 : Dorsal anterior central head setae (DAnCHS) ; 24 : Dorsal posterior central head setae (DPoCHS) ; 25 : Dorsal principal head setae (DPHS) ; 26 : Dorsal accessary head setae (DAcHS) ; 27 : Ventral lateral head setae (VLHS) ; 28 : Ventral anterior marginal head setae (VAnMHS) ; 29 : Ventral posterior marginal head setae (VPoMHS) ; OA : Occipital apophysis.

The pseudopenis is a Y-or V-shaped sclerite between the parameres. The subgenital plate is a synsternite of the abdominal segments VII, VIII and perhaps IX.

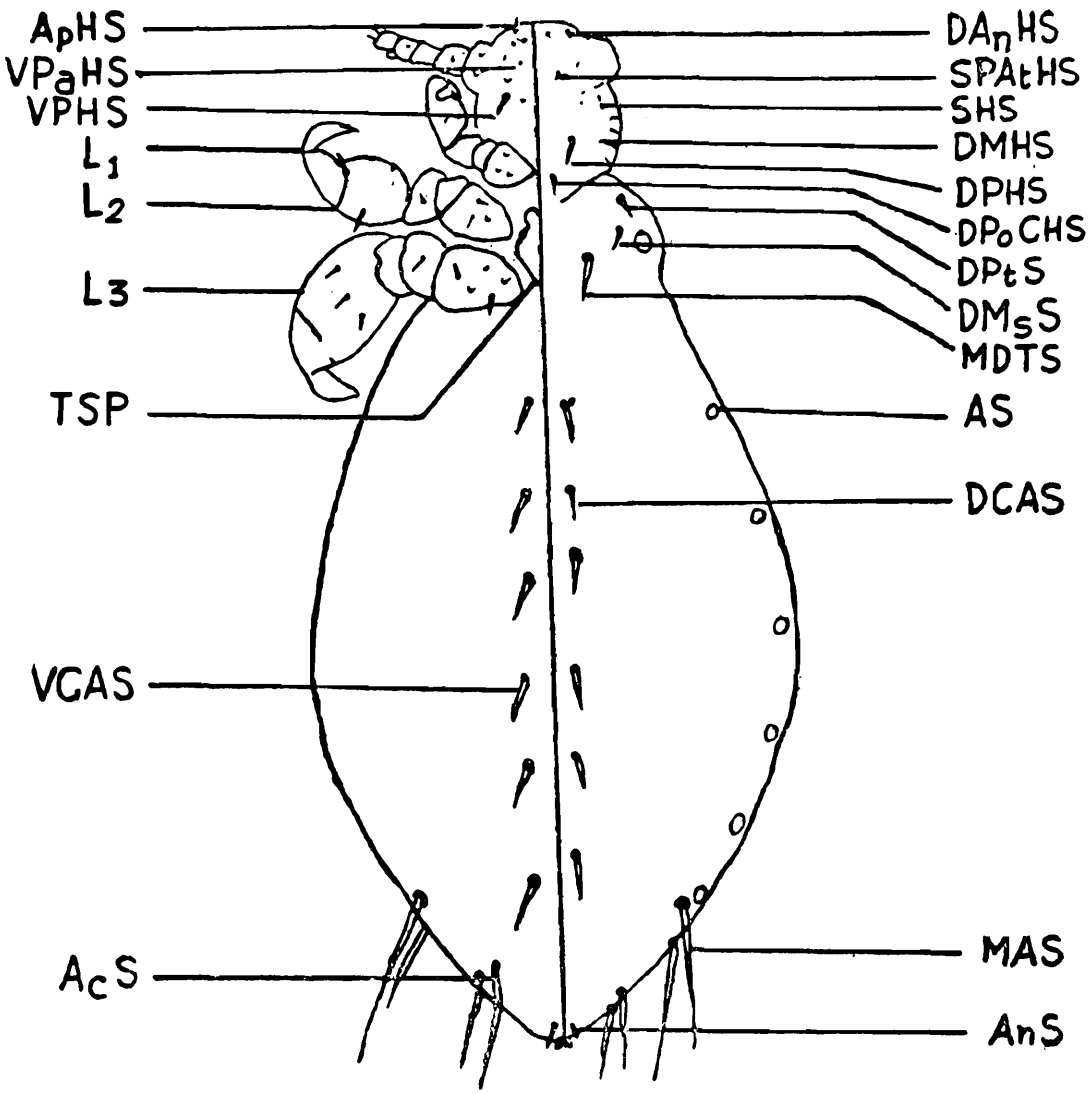
The principal parts of the female genetalia are the subgenital plate, gonopods and spermatheca. The subgenital plate is form of the sternal plate of the abdominal segment VIII and sometimes involves the venter of segment VII. It is variously shaped and usually bears a definite number of setae. The gonopods are paired, sclerotized, flattened lobes or plates on the abdominal segments VII and IX. The gonopods of segment VIII bear a row of marginal setae with typical infra-specific variation. The same on abdominal segment IX have been referred to as genital lobes by several workers ; these are a pair of more or less distinct lobes near the lateral margin of the IXth abdominal segment bearing a tuft or a row of setae. The gonopods of segment IX often bear an enlarged seta which is generally referred to as genital seta (Kim, 1965).

A very delicately sclerotized or inconspicuous spermatheca is present in many genera. An unsclerotized or only partially sclerotized plate (valva) occurs between the gonopods of segment VIII in many cases (Kim 1966 b). The valva is variously shaped ; it may be tapered, serrated, or even blunt at the apex. The spermatheca and valva sometimes are of taxonomic importance at species level.

The principal taxonomic characters used with standard abbreviations are explained below (Fig., Plate 1, a) : Antenna (A) ; Forehead (B) ; Clypeus (C) ; Clypeo-frontal suture (D) ; Hind head (E) ; Foreleg (L_1) ; Midleg (L_2) ; Hind leg (L_3) ; Paratergite (P) ; Sternite (S) ; Tergite (T) ; Abdominal spiracle (AS) ; Genital lobe (GL) ; Gonopod (GO) ; Genital Plate (GP) ; Mesothoracic spiracle (MS) ; Occipital apophysis (OA) ; Thoracic sternal plate (TSP).

Head (Fig., Plate 1, b) : 1, 2 : Dorsal anterior head setae (DAnHS) ; 3, 4 : Apical head setae (ApHS) ; 5, 6 : Oral setae (OS) ; 7, 8 : Anterior marginal head setae (AnMHS) ; 9, 10 : Dorsal preantennal lateral head setae (DPaLHS) ; 11, 12 : Ventral preantennal head setae (VPaHS) ; 13 : Dorsal preantennal head setae (DPaHS) ; 14 : Supraantennal head setae (SpAtHS) ; 15 : Supraantennal central head setae (SpAtCHS) ; 16, 17 : Sutural head setae (SHS) ; 18 : Ventral principal head setae (VPHS) ; 19, 20, 21, 22 : Dorsal marginal head setae (DMHS) ; 23 : Dorsal anterior central head setae (DAnCHS) ; 24 : Dorsal posterior central head setae (DPoCHS) ; 25 : Dorsal principal head setae (DPHS) ; 26 : Dorsal accessary head setae (DAcHS) ; 27 : Ventral lateral head setae (VLHS) ; 28 : Ventral anterior marginal head setae (VAnMHS) ; 29 : Ventral posterior marginal head setae (VPoMHS). Thorax (Fig., Plate 1, a) : Dorsal Prothoracic setae (DPtS) ; Dorsal mesothoracic setae (DMsS) ; Dorsal metathoracic setae (DMtS) ; Median dorsal thoracic setae (MDTS). Abdomen (Fig., Plate 1, a) : Dorsal accessory abdominal setae (DAAS) ;

PLATE - 2



Standardised chaetotaxy of typical Anopluran Nymph : ApHS-Apical head setae, DAnHS-Dorsal anterior head setae, VPaHS- Ventral preantennal head setae, SPAtHS- Supra antennal head setae, VPHS- Ventral principal head setae, SHS- Sutural head setae, DMHS-Dorsal marginal head setae, DPHS- Dorsal principal head setae, DPoCHS- Dorsal posterior central head setae, L_1- Fore leg, L_2- Mid leg, L_3- Hind leg, DPtS- Dorsal prothoracic setae, DMsS- Dorsal mesothoracic setae, MDTS- Median dorsal thoracic setae ; TSP-Thoracic sternal plate, AS- Abdominal spiracle, DCAS- Dorsal central abdominal setae, VCAS- Ventral central abdominal setae, MAS- Major abdominal setae, AcS- Accessary setae, AnS- Anal setae.

Dorsal central abdominal setae (DCAS) ; Dorsal paratergal setae (DPrS) ; Ventral accessary abdominal setae (VAAS) ; Ventral Central abdominal setae (VCAS) ; Ventral paratergal setae (VPrS).

Nymphs (Fig., Plate 2) : The characters and abbreviations used for the head, thorax and abdomen are same as for adults except Major abdominal setae (MAS), Anal setae (AnS) and Accessary setae (AcS).

Mounting of specimens :

During present study permanent slides of lice were prepared in the following manner :

(i) The specimens were transferred from alcohol to water. A small puncture was made with the help of a fine needle in the abdominal region o each specimen, avoiding the setae. The specimens were then soaked in 10% potassiu hydroxide (KOH) solution for about 20-24 hours at room temperature (28°C ± 2).

(ii) Each specimen was then gently pressed with the help of a bent needle to remove the dissolved soft parts. They were then transferred into water and washed for 2 to 3 hours with frequent changes of water.

(iii) The specimens were dehydrated by passing them through the ascending grades of alcohol (30%, 50%, 70%, 90% and 100%). Duration of treatment in each grade varied from 5 to 30 minutes depending upon the type of specimens.

(iv) These were then transferred into clove oil and kept for 20-30 minutes or until they become clear.

(v) The specimens from clove oil were directly mounted in 'Canada Balsam' on clean glass slides.

Unstained specimens were used in most of the cases for study. However, in some cases, where staining were necessary, a few drops of Carbol Fuschin were added to 40% alcohol and the specimens were passed rapidly through the subsequent grades of alcohol to avoid destaining.

Identification :

The preliminary identification of the lice, up to species group were made following Ferris (1951) and confirmed after comparison with the published literature and the types from the National Zoological Collections, Calcutta, National Institute of Virology, Pune. Dr. A. C. Misra of National Institute of Virology also identified several species of Hoplopleurids.

Depositories :

All the material of this study are at present kept in Zoological Survey of India, Calcutta, India, and will be partly deposited to National Institute of Virology, Pune ; British Museum (Natural History), London ; Bishop Museum, Honolulu ; U. S. National Museum, Washington D. C. ; and Zoologische Staatssmulung, Munchen, West Germany in due course.

Key to families recorded in India

1. Head with distinct eyes or prominent occular lobes 2

   Head without distinct eyes 5

2. Head with prominent occular lobes, thoracic sternal plate strongly sclerotized, abdominal paratergites present on segments II or III to VIII which are strongly sclerotized, cap like, their margins not free from body wall ; segmental setae arranged in simple transverse rows ... ... *Haematopinidae.*

   Head with distinct eyes 3

3. Thoracic phragmata well developed 4

   Thoracic phragmata not developed, thorax very wide, fore legs very slender, mid and hind legs very large and stout, each with stout claw ; abdomen membranous, small ; paratergites as sclerotized caps or lobes ... ... *Pthiridae.*

4. Head relatively short, abruptly constricted posteriorly into the neck ; thoracic sternal plate sclerotized or completely lacking ; abdomen long ; paratergites as sclerotized caps or lobes on IV to VIII not free from body wall ; segmental setae arranged in transverse fields ... ... *Pediculidae.*

   Head oval to narrowly oval ; abdominal paratergites triangular, as sclerotized caps or lobes present on IV to VI or V to VI segments, their margins free from body ; segmental setae arranged in single row on each segment ... ... *Pedicinidae.*

5. Fore and midlegs equal in size and shape, with small and slender claw ; ventral side of abdomen usually with a pair of small sclerotized detached plates or if these plates absent then the antennae four-segmented and the terminal segment with two sensoria ... ... *Enderleinellidae.*

   Fore legs smallest ; midlegs little longer, or subequal to hind legs, each with stouter claw ; ventral side of abdomen without detached plates ... 6

6. Abdominal paratergites usually highly developed and its apex free from the body wall ; tergal and sternal plates nsually highly developed on abdomen ... 7

Abdominal paratergites absent or almost represented by small tubercles anterior to each spiracle ; tergal and sternal plate in abdomen entirely absent ... *Linognathidae.*

7. Sternal plate on abdominal segment II extended laterally on each side to articulate with the corresponding paratergal plate ... ... *Hoplopleuridae.*

Sternal plate on abdominal segment II never extended laterally on each side to articulate with the corresponding paratergal plates ... ... *Polyplacidae.*

1. Family : ENDERLEINELLIDAE Ewing

1929. Enderleinellinae Ewing, *Manual of external parasites*, 132.
1951. Enderleinellinae, Ferris, *The sucking lice*, 101-118.
1960. Enderleinellinae, Johnson, U.S.D.A. *Tech. Bull.*, 1211 : 6.
1981. Enderleinellinae, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 11-12.
1963. Enderleinellidae Keler, *Tierwelt Mitteleuropas*, 6.
1978. Enderleinellidae, Kim and Ludwig, *Syst. Ent.*, 3 : 270-271.

Type genus : *Enderleinellus* Fahrenholz, by original designation.

Characters : small sized anoplura. Head : Post antennal angle not developed ; antennae usually 5 segmented. Thorax : Phragmata well developed ; sternal plate usually well developed ; first and second pairs of legs small with slender claw ; third pair stout with larger and flattened claw. Abdomen : Paratergites present on segments II to IV, II to V or II to VI or if absent, the entire abdomen membranous ; tergites and sternites completely absent or usually poorly developed ; spiracles variable in number on segments III to IV, III to V, III to VI or III to VIII.

Remarks : This family is represented by 5 genera throughout the world. Only 2 genera viz. *Enderleinellus* Fahrenholz and *Phthirunculus* Kuhn and Ludwig are recorded from India.

Key to genera of the family *Enderleinellidae* recorded in India

Antennae 4 segmented ; terminal segment compound, abdomen without tergal and sternal plates ... ... *Phthirunculus* Kohn and Ludwig.

Antennae 5 segmented ; abdominal segment II with a pair of detached sclerotized plates ventrally ; abdomen with usually sternal and/or tergal plates ... ... *Enderleinellus* Fahrenholz.

1. Genus : **Enderleinellus** Fahrenholz

1912. *Enderleinellus* Fahrenholz, *Niedersachs. Zool. Ver. Hannover Jahresb. Abhandl.* 2 : 56.

Type species : *Pediculus sphaerocephalus* Nitzsch (Preocc) original designation= ***Enderleinellus nitzschi*** Fahrenholz (nomina nuda).

1929. *Cyclophthirus* Ewing, *Manual of external parasites*, 195.
1929. *Hoplophthirus* Ewing, loc. cit., 194.
1929. *Rhinophthirus* Ewing, loc. cit., 197.
1981. *Enderleinellus*, Mishra *Rec. Zool. Surv. India. Occ. Paper*, 21 : 12-13.

Additional citations of references and synonymies may be found in Ferris (1951), Johnson (1960 b, 1972 b) and Kim (1966 b, 1977).

Characters : Eyes absent ; antennae 5 segmented, which are not sexually dimorphic ; first and second pair of legs small, similar in size ; third pair much larger with a large flattened claw ; abdominal segment II with a pair of chitinized plate ventrally bearing a flattened point, apically free from body.

Host : Sciuridae.

Remarks : Ewing (1929) proposed to include segregates of this genus under 5 genera, namely *Enderleinellus*, *Cyclophthirus*, *Euenderleinellus*, *Hoplophthirus* and *Rhinophthirus*. Subsequently these were discarded by Ewing himself and by Ferris (1951) on the ground that no useful purpose could be served by retaining all of them. Werneck (1947) attempted a grouping based mainly on male genitalia. Although this method appeared to be more natural, it could not satisfactorily classify all the species. This genus is now represented by approximately 43 species. All excepting one, *E. replicatus* Redikorzev, are parasites restricted to the members of subfamily Sciurinae. *E. replicatus* has been in adequately described from *Sciuropterus volans*, a member of Petauristinae.

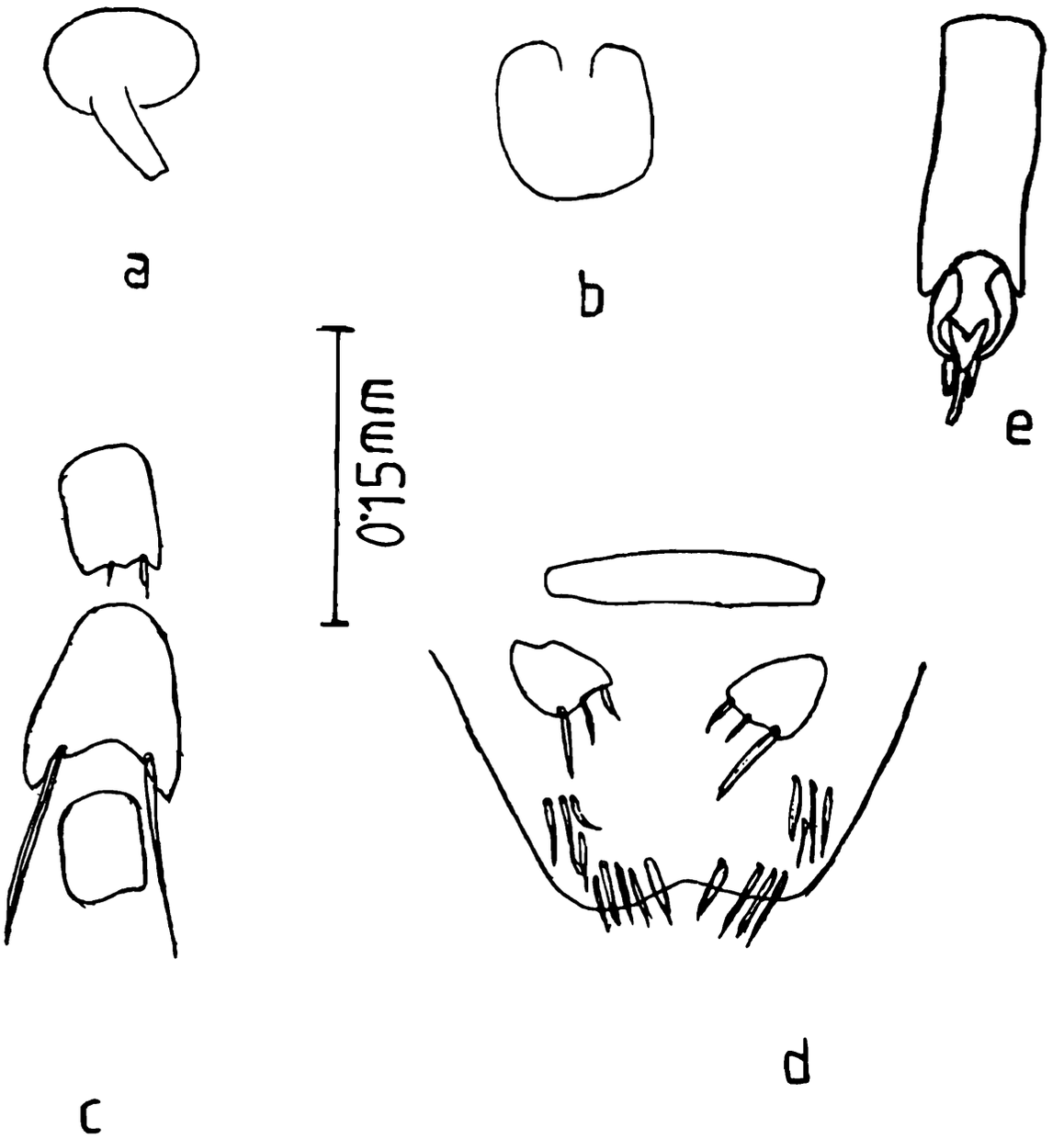
Only one species namely *E. nishimarui* Kaneko, has been recorded from India.

1. **Enderleinellus nishimarui** Kaneko
(Figs., Plate 3)

1962. *Enderleinellus nishimarui* Kaneko, *Bull. Tokyo. Med. Dent. Univ.*, 9 : 129-137.
1981. *Enderleinellus nishimarui*, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 13-15.

Female : Head : Longer than wide ; anterior margin rounded, lateral margins almost parallel ; antennae 5 segmented. Thorax : Sternal plate (Fig. a) with lateral margins

PLATE - 3



Enderleinellsu nishimarui Kaneko

a. Thoracic sternal plate of ♀ ; b. Sclerotized plate on abdominal segment II of ♀ ; c. Paratergites of ♀ ; d. Genitalia of ♀ ; e. Genitalia of ♂.

heavily pigmented and two posteriorly attached kidney shaped piece. Abdomen : Tergites absent except one each on segment II and III, a pair of minute setae medially and an outer pair of slender setae in these tergites on segments II and III ; sternites absent except usual pair of sclerotized plate (Fig. b) on segment II and sclerotization of genital region ; paratergites (Fig. c) present on segment II to IV ; paratergites II and IV each with a pair of small setae ; III with a pair of long setae ; typical abdominal setae elongate and cuneiform. Genitalia (Fig. d) : Genital plate with 2 pairs of small setae ; gonopods paired, each with broad, flattened and two narrow setae ; genital lobe with genital setae thick and flat, 2 thick flattened setae at the outer side and 3 minute setae towards inner side ; a group of 4 long and 2 minute setae posterior to each gonopod.

Male : Head and thorax as in female. Abdomen : Each segment with a single narrow tergite ; sternites absent ; paratergites as in female, Genitalia (Fig. e) : Parameres curved, flattened, having pointed caudal process projecting outside pseudopenis triangular and pointed.

Nymphs : Unknown.

Material examined : 1 ♀, 1 ♂, from type series of Virus Research Center (V.R.C.), Pune.

Host : *Funambulus pennanti.*

Distribution : India (Madhya Pradesh).

Remarks : This species is close to *E. platyspicatus* Ferris but can be identified by presence of tergites in male and of a pair of short setae on paratergites II and IV.

2. Genus : **Phthirunculus** Kuhn and Ludwig

1965. *Phthirunculus* Kuhn and Ludwig, *Senck, Biol.*, 46 : 245-250.
1981. *Phthirunculus*, Mishra, *Rec. Zool. Surv. India. Occ. Paper*, 21 : 15-16.

Characters : Antennae 4 segmented, terminal segment compound ; anterior 2 pair of legs small and slender, with slender claw, claws apically curved, not bifid ; third pair of legs stout with stout claw ; abdominal tergites and sternites absent except terminal segment ; paratergites absent.

Host : Petauristinae.

Remarks : Genus *Phthirunculus* can be separated from the Genus *Enderleinellus* (excepting *E. luxeri*) by the absence of paired sclerotized plates on the venter of the abdomi-

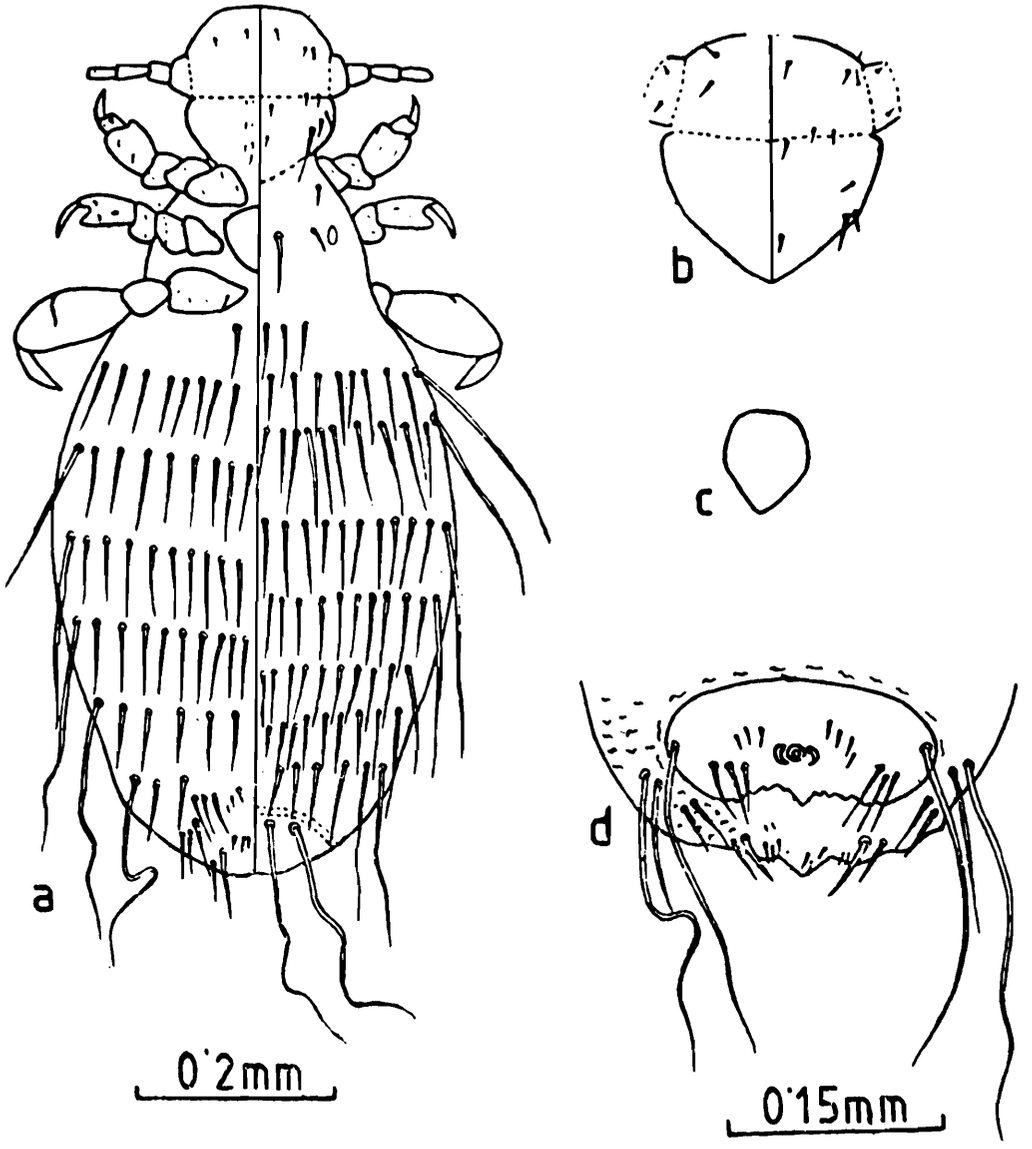
nal segment II. This monotype genus is represented by *Phthirunculus sumatranus* Kuhn and Ludwig.

2. **Phthirunculus sumatranus** Kuhn and Ludwig

(Figs., Plates 4 & 5)

1965. *Phthirunculus sumatranus* Kuhn and Ludwig, *Senck Biol.*, 46 : 245-250.
1981. *Phthirunculus sumatranus*, Mishra, *Rec. Zool Surv. India, Occ. Paper*, 21 : 16-19.

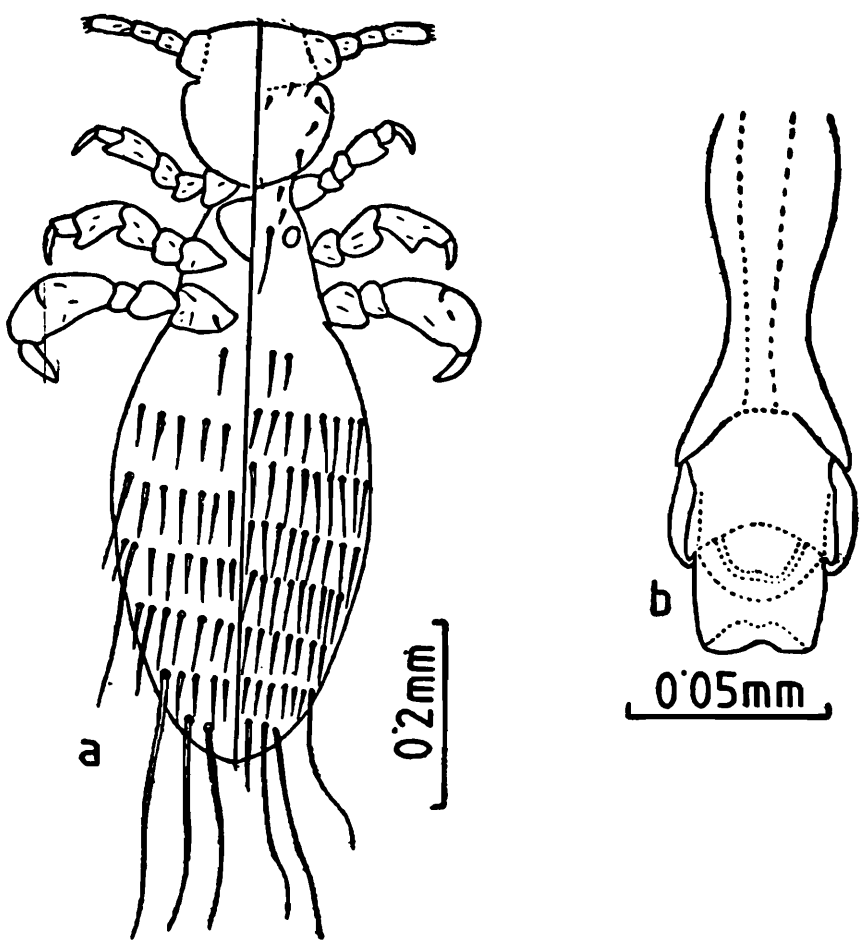
PLATE - 4



Phthirunculus sumatranus Kuhn and Ludwig : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Genitalia.

Female (Figs., Plate 4, a, b, c, d) : Total body length 0·85 mm. Head : (Fig. b) : slightly longer wide ; armature of head broad, antero dorsally convex ; post antennal and occipital angles rounded ; antennae 4 segmented, terminal segment compound with 2 sensoria. Thorax : Sternal plate (Fig. c) 0·05 mm long and 0·03 mm wide ; roughly triangular in shape, rounded anteriorly ; MDTS medium sized, one pair ; DPtS two pairs, small sized ; fore legs and mid legs small and slender, with slender claw ; apically curved ; hind legs stout with stout claw. Abdomen : Dorsal : Tergites absent except on terminal segment ; 9 rows of setae ; first row with 6, second to seventh with 8 to 12, eight with 6 and ninth with 4 setae. · Ventral : Sternites absent except genital region ; 7 rows of setae, first with 2, second to fifth with 8 to 12, sixth with 12 and seventh with 6 setae. Lateral : Paratergites absent ;

PLATE - 5



Phthirunculus sumatranus Kuhn and Ludwig : ♂
a. Whole body (ventral and dorsal views) ; b. Genitalia.

spiracle present on segments III to V. Genitalia (Fig. d) : Genital plate broad with 6 pointed setae, medium sized ; a pair of long and 4 to 5 pair of small thin setae occur laterally ; a group of 4 large setae and 2 or 3 minute setae present posteriorly ; genital setae enlarged.

Male (Fig., Plate 5, a, b) : Total body length 0·76 mm. Head and thorax as in female. Abdomen : Dorsal : Tergites absent except terminal segments ; 8 rows of setae, first with 2 pairs, second to sixth with 8 to 12 pairs, seventh with 8 pairs and last with 3 pairs of setae ; Ventral : Sternites absent except genital region ; 7 rows of setae ; first with single pair, second to fifth with 5 to 10 pairs sixth with 4 pairs and last with 2 pairs of setae. Genetalia (Fig. b) : Parameres small ; pseupopenis thick and blunt.

Nymph 1. Unknown.

Nymph 2. Specimens were not obtained during present study. It has been described by Kim 1971.

Nymph 3. Specimens could not be obtained during present study. Description is based on Mishra (1981). Head : Longer than wide ; post antennal and postero-lateral margins rounded ; antennae 4 segmented, terminal segment with one large and one small sensorium. Thorax : Mesothoracic spiracles distinct, MDTS one pair ; DPtS two pairs ; legs as in adults. Abdomen : Tergites and sternites absent ; spiracles 3 pairs ; dorsal and ventral side each with 8 rows of setae.

Material examined : 1 ♂, 1 ♂, (Regd. Virus Research Center 103216) Sagar Shimoga dist., Coll. A. C. Mishra.

Host : *Petaurista petaurista.*

Distribution : India (Karnataka) ; Indonesia (Sumatra).

Remarks : This species can be separated from all the species of related genera (*Werneckia* Ferris, *Enderleinellus* Fahrenholz, *Microphthirus* Ferris and *Atopophthirus* Kim) by presence of 4 segmented antennae, complete absence of paratergites and in having a large number of characteristic setae.

2. Family : HAEMATOPINIDAE Enderlein

1904. Haematopinidae Enderlein, *Zool. Anz.*, 28 : 136.
1951. Haematopinidae, Ferris, *The sucking lice*, 68.
1978. Haematopinidae, Kim and Ludwig, *Syst. Ent.*, 3 : 271.
1992. Haematopinidae, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : 1-16.
1877. Haematopina Murray (Partim) *Economic Ent.*, 8 : 384.

(restricted to *Hamematopinus*).

Type genus : *Haematopinus* Leach, by original designation.

Characters : Head : without eyes ; occular lobes posterior to antennae ; antennae 5 segmented which are not sexually dimorphic ; occipital apophyses elongated. Thorax : All legs similar in size and form ; tibial lobe bearing few spiniform setae ; tibial thumbs well developed, each with an apical spiniform seta ; sternal plate strongly sclerotized ; notal pit distinct ; mesothoracic phragmata continuous across the entire thoracic dorsum enclosing the notal pit. Abdomen : Paratergites present on II or III-VIII segments, strongly sclerotized, not free from body wall ; abdomen leathery dorsally characteristically more or less sclerotic, setae short arranged in simple transverse rows ; spiracles present on III to VIII segments. Genitalia : Female : Gonopods well developed, each with long strong setae ; valva with a cluster of small setae Male : parameres reduced. their place taken by enlarged pseudopenis ; subgenital plate strongly sclerotized ; aedeagus not symmetrical, pseudopenis 'V' shaped.

Remarks : The family contain only one genus viz. *Haematopinus* Leach, which has been recorded from Indian region.

3. Genus : **Haematopinus** Leach

1915. *Haematopinus* Leach, *Encyclopedia Britannica Supplement* 1.P.24.

Type species : *Pediculus suis* Linnaeus, by original designation.

1929. *Haematopinus* Ewing, *Manual of external parasites*, P. 137.

Characters : Head : Without external eyes ; prominent occular lobes posterior to antennae ; antennae 5 segmented ; a pair of elongated occipital apophyses present. Thorax : With distinct notal pit ; a pair of small sternal apophyseal pit ; thoracic sternal plate strongly sclerotized ; all legs are subequal in size and shape ; tibial thumbs well developed, each with an apical spiniform setae. Abdomen : Strongly sclerotized cap like paratergites on prominent lateral lobes on segment II or III to VIII not free from body wall ; segmental

setae short, arranged in simple transverse rows ; spiracles on segments III to VIII. Genitalia : *Female* : Gonopods well developed on segments VIII and IX ; each with an inner marginal row of long and strong setae ; valva slightly sclerotized. *Male* : Parameres reduced ; subgenital plate strongly sclerotized ; pseudopenis apparently fused to form a large 'V' shaped structure or separated at apex.

Hosts : Suidae, Some Bovidae, Cervidae and Equidae.

Remarks : This genus is represented by 22 species throughout the world (Kim and Ludwig 1978) of which only 7 species are recorded from India.

Key to species of the genus *Haematopinus* recorded in India

1. Abdominal paratergites large and well developed 2

   Abdominal paratergites small, widely separated with conical protuberances ; thoracic sternal plate elongate, not enclosing opening of the ventral apophyses ... *longus*.

2. Fore head long 3

   Fore head short 4

3. Thoracic sternal plate with anterolateral process elongated, median process usually long ; IX abdominal tergite with antero medial process short and blunt ... ... *quadripertusus*.

   Thoracic sternal plate with antero lateral process roughly triangular with a triangular protuberance posterolaterally ; abdominal paratergites quadrate, appearing as a black marginal band, tergites strongly sclerotic, with small, irregular, submarginal plate ... ... *suis*.

4. Abdominal paratergites with a tuft of 5-8 posterior setae ; thoracic sternal plate nearly rectangular with 2 antero lateral process ; head abruptly constricted at the posterior end ... ... *tuberculatus*.

   Abdominal paratergites with not more than 3 posterior setae ... 5

5. Thoracic sternal plate with antero-lateral triangular projection and with a median triangular protuberance laterally ; abdominal paratergites with lateral margin deeply lobed with deepest incision between segments VI to VII and VII to VIII. ... ... *oliveri*.

   Thoracic sternal plate with antero lateral projection not pronounced, rounded 6

6. Abdominal paratergites with 2 or 3 setae along posterior ventral border ; IX abdominal tergite with antero medial processes elongated acute ; female with gonopods short, compact, median subgenital plate subtrapezoid... ... *eurysternus.*

Abdominal paratergites with only one seta along posterior ventral border, closely associated with spiracles ; each abdominal segment with 2 median and one lateral sclerotized plate on each dorsal half ; female with gonopods 'V' shaped, bearing 10-12 setae ... *channabasavannai.*

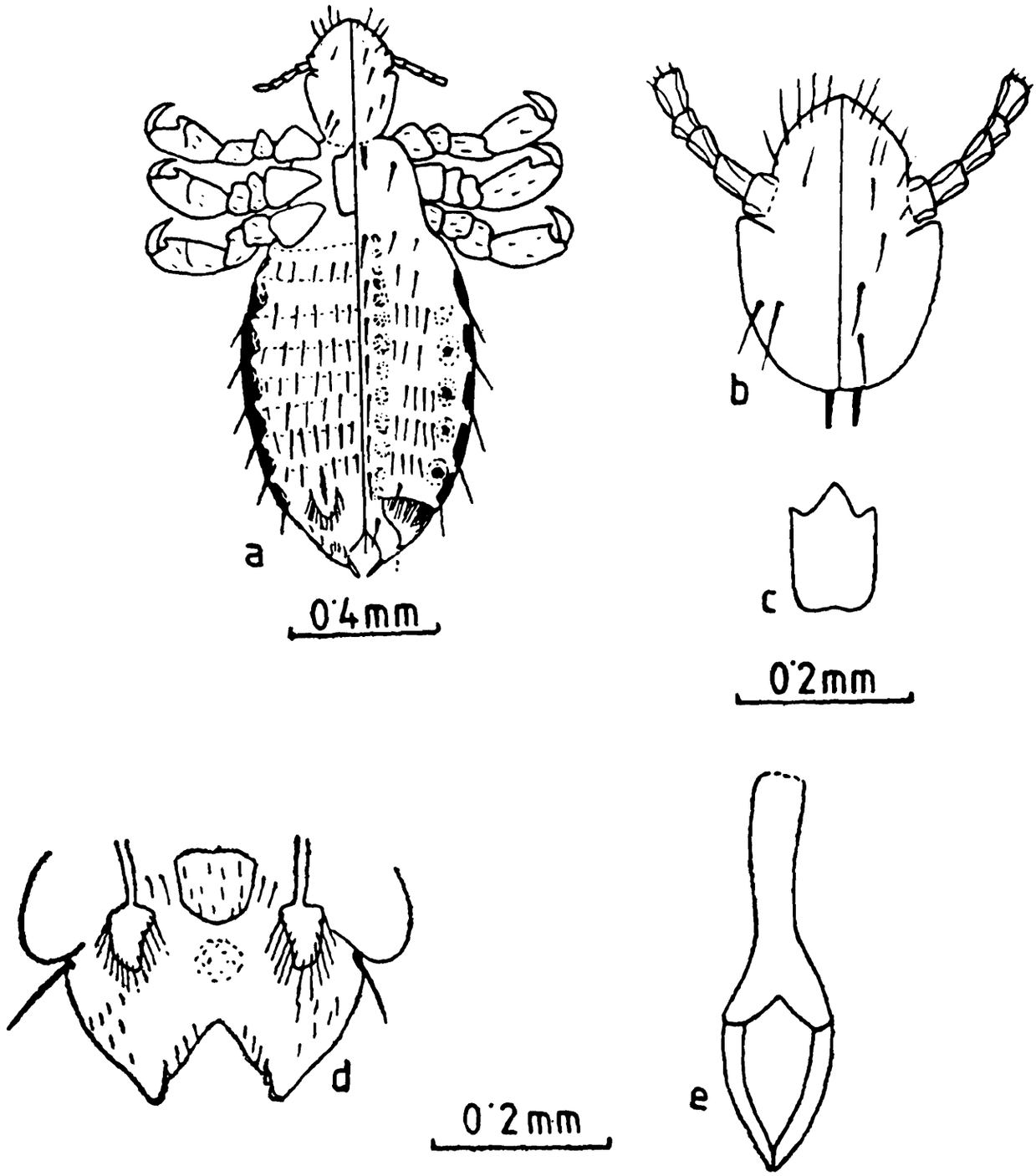
3. **Haematopinus channabasavannai** Krishna Rao, Khuddus and Kuppuswamy (Figs., Plate 6)

1977. *Haematopinus channabasavannai*, Krishna Rao, Khuddus and Kuppuswamy, *Mysore J. agric. Sci.* 11 : 588-595.

Female (Fig. a) : Total body length 1·5 mm ($\bar{X}$, N. 4) ; range 1·1 to 1·7 mm. Head (Fig. b) : Small ; preantennal region approximately one-third of the post antennal region ; occular points well developed ; antennae five-segmented with a sensorium on 4th and 5th segments ; DAnHS 3 pairs ; DAnCHS 2 pairs ; DPaHS and DPoCHS one pair each ; DPaLHS 3 pairs ; DMHS 3 pairs ; VPaHS 2 pairs ; VAnMHS and VPoMHS one pair each. Thorax : Dorsally postero lateral corners of metathorax project back ; notal pit prominent with a conical projection directed to the interior ; prothorax with two pairs of short setae on the anterior border of weakly sclerotized part and one pair in sclerotized part ; mesothorax with a setae anterior and another posterior to spiracles ; metathorax with one pair of setae on either side ; four setae in transverse line on thinly sclerotized posterior part of metathorax. Ventrally with no setae ; sternal plate (Fig. c) well developed, with 0·15 mm long and 0·1 mm wide, antero lateral corners not prolonged and rounded antero medial projection long with a rounded tip in female, longer and broader in male. Abdomen : Segment II to IX clear ; 1 reduced ; X and XI fused with IX ; each segment with 2 median and one lateral sclerotized plate on each dorsal half. Dorsally segment II with 2-3 pairs of setae ; III and IV with 3 to 4 setae each ; V and VI usually 5-8 pairs of setae each ; VII with 2-3 pairs and VIII with 2-4 pairs of setae. VCAS smaller and similar in arrangement to those on dorsal surface ; paratergites on II to VIII segments of which IV to VIII closely associated with spiracles ; each plate with a single seta at its ventro posterior border. Genitalia (Fig. d) : Genital plate variable in shape ; gonopods 'V' shaped, located ventrally on segments VIII and IX with 10-12 setae on its mesal.

Male : Similar to female except thoracic sternal plate and genitalia. Antero medial projection of thoracic sternal plate is much longer and broader than female. Genitalia (Fig. e) : Basal plate articulated with 2 parameres, united together at posterior end ; endomeres scoop like ; preputial sac folded ; genital plate variable in shape.

PLATE - 6



Haematopinus channabasavannai Krishna Rao, Khuddus and Kuppuswamy
a. ♀, Whole body (ventral and dorsal views); b. Head of ♀,
c. Thoracic sternal plate of ♀; d. Genitalia of ♀,
e. Genitalia of ♂.

Nymphs : Unknown.

Material examined : 4 ♀♀, 2 ♂♂, (ZSI Regd. No. 435/H12, 437/H12) Mandya, Karnataka ; 1977 ; Coll. N. S. K. Rao.

Host : *Bos indicus.*

Distribution : India (Karnataka).

Remarks : This species is close to *H. eurysternus* Denny but it can be separated by combinations of following characters : Characteristic shape of the thoracic sternal plate in which the antero-lateral processes are rounded, not prolonged and antero-median process distinctly long ; gonopods 'V' shaped.

4. **Haematopinus eurysternus** Denny

1842. *Haematopinus eurysternus* Denny, *Manographic Anoplurum Britinniae*, London.
1933. *Haematopinus eurysternus*, Ferris, *Cantribution towards a manograph of the Sucking lice*, Pt. VI, P. 448-452.
1974. *Haematopinus eurysternus*, Mishra, Bhat and Kulkarni, *Indian J. Med. Res.*, 62 : 1270,
1974. *Haematopinus eurysternus*, Meleney and Kim, *J. Parasit.*, 60 : 3, 511-513.
1992. *Haematopinus eurysternus*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : 1-16.

Female : Head : Forehead short, strongly pigmented ; length slightly greater than breadth ; post-antennal angles very prominent ; occipital region constricted into a neck ; all typical head setae present. Thorax : Sternal plate somewhat variable in form but in general slightly longer than broad, quadrate and frequently with the anterior angles and the median point of the anterior margin produced ; legs strongly and uniformly pigmented. Abdomen : Elongate, oval, usually rather membranous and pale except for the definitely sclerotic areas ; paratergites for the most part forming conspicuous, conical tubercles, these of the first apparent segment present as minute plates. Tergites with two pairs of small, median plate on each segment and with a single, somewhat irregular submarginal plate. Dorsal setae rather numerous and conspicuous, forming something of a cluster between median and submarginal and just outside of the marginal plates. Setae of the paratergites never with more than two or three setae along their posterior ventral border. Ventral side faintly sclerotic and furrowed. Genetalia : Gonopophyses rather small blunt ; wall of vagina with a median, quadrate, sclerotic area.

Male : In general form and characters closely resembling to female except genitalia. Genitalia : Genital plate very large and conspicuous ; basal plate short and broad ; pseudo-penis 'V' shaped ; preputial sac strongly sclerotic and forming basally a relatively huge hook.

Nymphs : Unknown.

Host : Cattle.

Distribution : India (wide spread) ; Cosmopolitan.

Remarks : This species could not be procured during present study. Description is mainly based on Ferris (1933).

5. **Haematopinus longus** Neumann

1912. *Haematopinus longus* Neumann *Bulletin de la Societe Zoologigue de France* ; 37 : 141.
1916. *Haematopinus longus*, Ferris, Catalogue and Host list of the Anoplura, *Proceeding of the California Academy of Science* (4), 6 : 144.
1935. *Haematopinus longus*, Ferris *Contributions toward a monograph of the Suking lice*, Pt. VI, P. 469-470.

Female : A very slender, pale species. Head rather slender, about twice as long as wide ; the post antennal angles acute and forward pointing the hind head tapering regularity to the occipital margin. Thorax about as long as head and about three times as wide ; quadrate, lobes at the posterior lateral angles usually long ; sternal plate elongate, not enclosing the opening of the ventral apophyses ; legs normal. Abdomen : Elongate and slender with the paratergites forming small widely separated, conical protuberances, those of the second (apparently first) segment lacking ; dorsum membranous, except for the usual areas on the ninth tergite, the derm showing and faintly pigmented and reticulated median longitudinal bands and still fainter submarginal spots ; venter entirely membranous. Genetalia : Gonopophyses elongated, fringed with a single marginal row of setae.

Male ; Same as in female except abdomen which is shorter and relatively wider than female. The genitalia are not described in details.

Nymphs : Unknown.

Host ; *Cervus unicolor.*

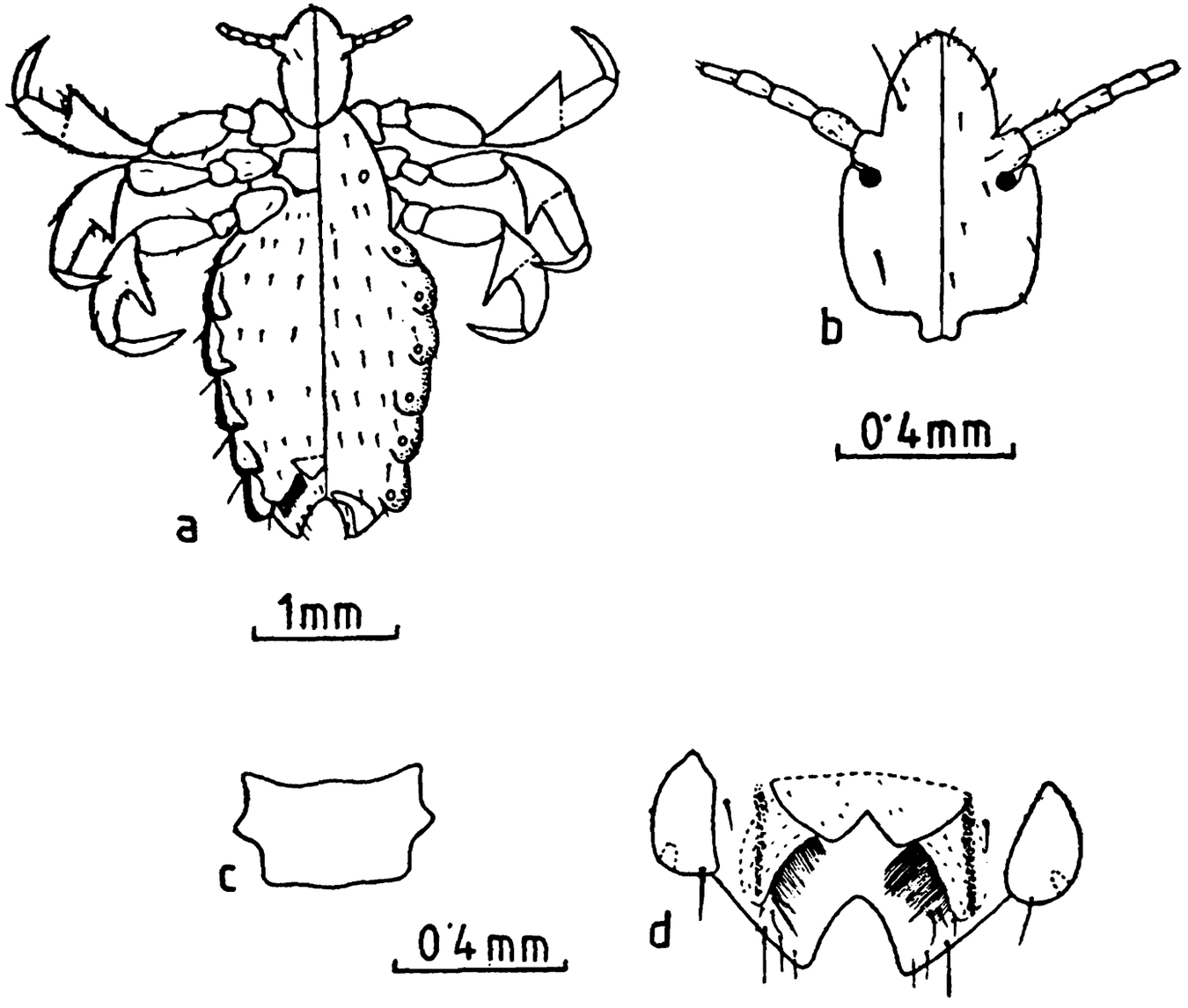
Distribution : India [Rajasthan (Kota)] ; Nepal.

Remarks : This species could not be obtained during present study. The description is based on Ferris (1933).

6. **Haematopinus oliveri** Mishra and Singh
(Figs., Plate 7)

1978. *Haematopinus oliveri*, Mishra and Singh, *Bull. zool. Surv. India*, 1 (2): 167-169.

PLATE - 7



Haematopinus oliveri Mishra and Singh : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Genitalia.

Female (Fig. a) : Total body length 3·4 mm ($\bar{X}$, N=4) ; range 2·7 to 3·9 mm. Head (Fig. b) : Forehead small, with distinct occular points ; arrangement of setae typical haematopinoid type ; clypeus and occipital regions well sclerotized ; antennae 5 segmented, sensoria separate, situated on the distal end of segment IV and V. Thorax : Dorsum with distinct notal pit and one large dorsolateral well chitinized projections of metanotum ; metathoracic pleural phragmata present on each side ; DPtS on each half of the pleural phragmata ; DMsS one pair, next to spiracle ; DMtS to pairs, near to pleural phragmata ; venter with a well developed distinct thoracic sternal plate (Fig. c) with 0·48 mm long and 0·27 mm wide, with anterolateral projections triangular, enclosing the pits of prothoracic pleural apophyses, laterally with a median triangular protuberance ; all legs almost similar in size, tibiotarsi and claws comparatively large. Abdomen : Tergites and sternites absent except some lightly pigmented patches dorsally and clasp-like deeply pigmented tergite of terminal segment, medially connected through weak sclerotized bridge ; paratergites large, well developed, present on segments II to VIII, lateral margins deeply lobed, with the deepest incision between segments VI to VII and VII to VIII ; chaetotaxy as shown in figure. Genetalia (Fig. d) : Gonopod elongated, lobe-like with numerous long setae ; each gonopod with a well developed, strongly chitenized apodeme ; valva possess the paired and serrated median lobes having several minute setae.

Male : Unknown.

Nymph 1-2 Unknown.

Nymph 3 : Similar to female, except for thoracic sternal plate, genital tergite and sternite of terminal segment.

Host : *Sus* (*Porcula*) *salvanius* (Pigmy-hog).

Distribution : India (Assam).

Material examined : Known from type series which consists of paratypes 4 ♀ ♀, (Regd. No. ZSI 378-381-H16).

Remarks : This species appears close to *H. ludwigi* Weisser, *H. latus* Neumann and *H. phacochoeri* Enderlein. It can be separated by combination of following characters ; shape of the thoracic sternal plate, complete absence of paratergite II and semilunar tergites of the abdomen.

7. **Haematopinus quadripertusus** Fahrenholz
(Figs., Plate 8)

1916. *Haematopinus quadripertusus* Fahrenholz, *Arch. F. Naturgesch* (Berlin), 11 : 19-21.
1974. *Haematopinus quadripertusus*, Meleney and Kim, *J. Parasit.*, 60 (3), 507-522.
1977. *Haematopinus quadripertusus*, Krishna Rao, Khuddus and Kuppuswamy, *Mysore J. agric. Sci.*, 11 : 588-589.

Female (Fig. a) : Total body length 1·99 mm ($\bar{X}$, N=5) ; range 1·58 to 2·12 mm. Head (Fig. c) : Forehead long, with distinct occular points ; clypeus distinctly sclerotized ; occiput and occular sinuses strongly sclerotized ; DPHS short ; DMHS 2 pairs ; VPHS one and VPoMHS varies 1-3 ; antennae relatively long, 5 segmented ; segment IV and V each with a dorsal sensorium. Thorax : Heavily pigmented with distinct notal pit ; sternal plate (Fig. d) with 0·1 mm long and 0·051 mm wide with antero lateral processes prolonged and acute ; median process long, sometimes acute ; metanotal projection hardly developed ; DPtS 1 ; DMsS 1, which located anterior to the spiracle ; MDTS short ; DMtS one pair ; no ventral setae ; legs as in other members of *Haematopinus*. Abdomen : Membranous, leathery and wrinkled, with distinct paratergites and spiracles on segments III to VIII ; segment II with a small paratergites and one paratergal seta ; segments III to VIII each paratergite with a pair of paratergal setae ; dorsally with about 17 pairs of small median sclerotic plates and about 6 or 7 lateral sclerotic plates ; 9th tergite not connected medially with antero medial process ; DCAS 9 ; segments IV-VI each with 5 or more intermediate abdominal setae ; segments III and IV each with 3 or 4 dorsal lateral abdominal setae ; ventrally with 7 transverse rows of small abdominal setae ; terminal segment with a pair of apical lobes. Genitalia (Fig. f) : Gonopods long, narrow, with diverging inner margin, long posterior setae on its margin ; median genital plate subtrapezoid or subrectangular, wider than long, with minute setae ; a patch of about 14 long setae present posterior to gonopods on each side.

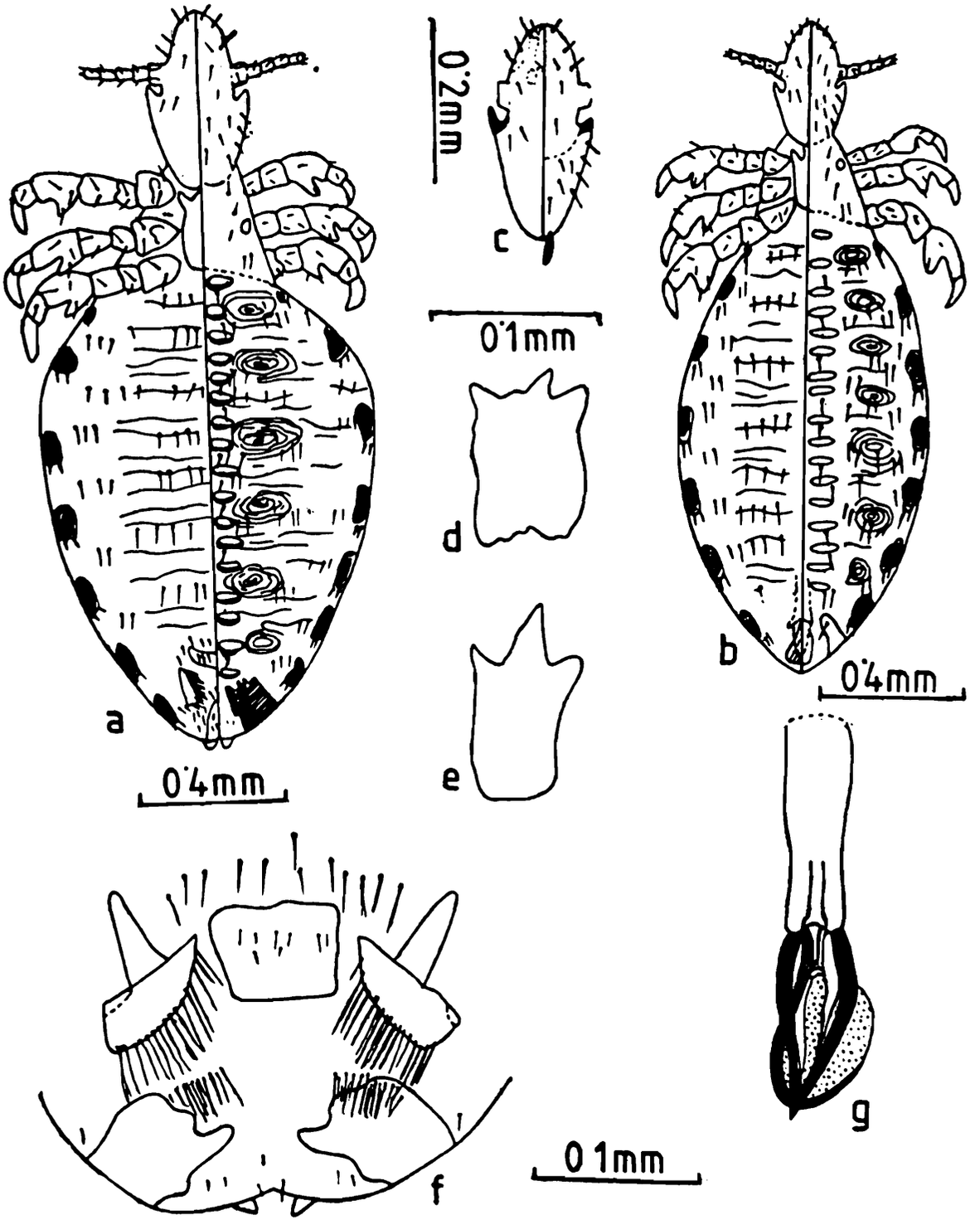
Male (Fig. b) : Total body length 1·75 mm ($\bar{X}$, N=4) ; range 1·5 to 2·13 mm. Head, thorax, legs same as in female. Abdomen : Smaller, with lateral sclerotic plates large and distinct ; venter with slightly sclerotized median plates. Genitalia (Fig. g) : Basal apodeme weakly sclerotized anteriorly ; parameres posteriorly fused into a sharp point surrounding endotheca and aedeogus.

Nymphs : Could not be procured during present study.

Material examined : 5 ♀♀, 4 ♂♂, from *Bos indicus* in Bangalore, Karnataka ; 1977 ; Coll. N. S. K. Rao.

Host : *Bos indicus.*

PLATE - 8



Haematopinus quadripertusus Fahrenholz

a. ♀, Whole body (ventral and dorsal views); b. ♂, Whole body (ventral and dorsal views); c. Head of ♀; d. Thoracic sternal plate of ♀; e. Thoracic sternal plate of ♂; f. Genitalia of ♀; g. Genitalia of ♂.

Distribution : India (Karnataka) ; Cosmopolitan.

Remarks : This species is close to *H. eurysternus* Denny but it can be separated by prolonged and pointed median anterolateral process of thoracic sternal plate, elongated gonopods and blunt anteromedial process of IXth tergite.

8. **Haematopinus suis** (Linnaeus)
(Figs., Plate 9)

1758. *Pediculus suis* Linnaeus *Systema Naturae*, (ed. 10), P. 611.
1810. *Haematopinus suis* Leach, *Encycopaedia Britinnica* Supplement, 1, P. 24.
1933. *Heamatopinus suis*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. VI, 425-431.
1992. *Haematopinus suis*, Adhikary and Ghosh, *State Fauna Series 3*: *Fauna of West Bengal, Pt. 7*: 1-16.

Female (Fig. a) : Total body length 1·92 mm ($\bar{X}$, N = 10) ; range 1·7 to 2·51 mm. Head (Fig. b) : Elongate, two to three times as long as wide ; the forehead slightly longer than hind head. Thorax : Quite strongly trapezoidal in form ; sternal plate (Fig. d) 0·12 mm long, 0·15 mm wide, somewhat variable in form ; the opening of the sternal apophyses included within the limits. Abdomen : Broadly ovate ; usually strongly pigmented ; the more or less quadrate paratergites appearing as a black marginal band, the margins usually quite strongly lobed by inter segmental constrictions ; tergites typically quite strongly sclerotic with small irregular submarginal plates and with three pairs of median plates, separated by a slight median line on the third (first apparent) to fifth segments, there being then a characteristic break, sixth segment having but one plate and seventh and eighth two ; ventral side entirely membraneous. Genitalia (Fig. f) : Gonopophyses elongate ; valva emerginate and simple.

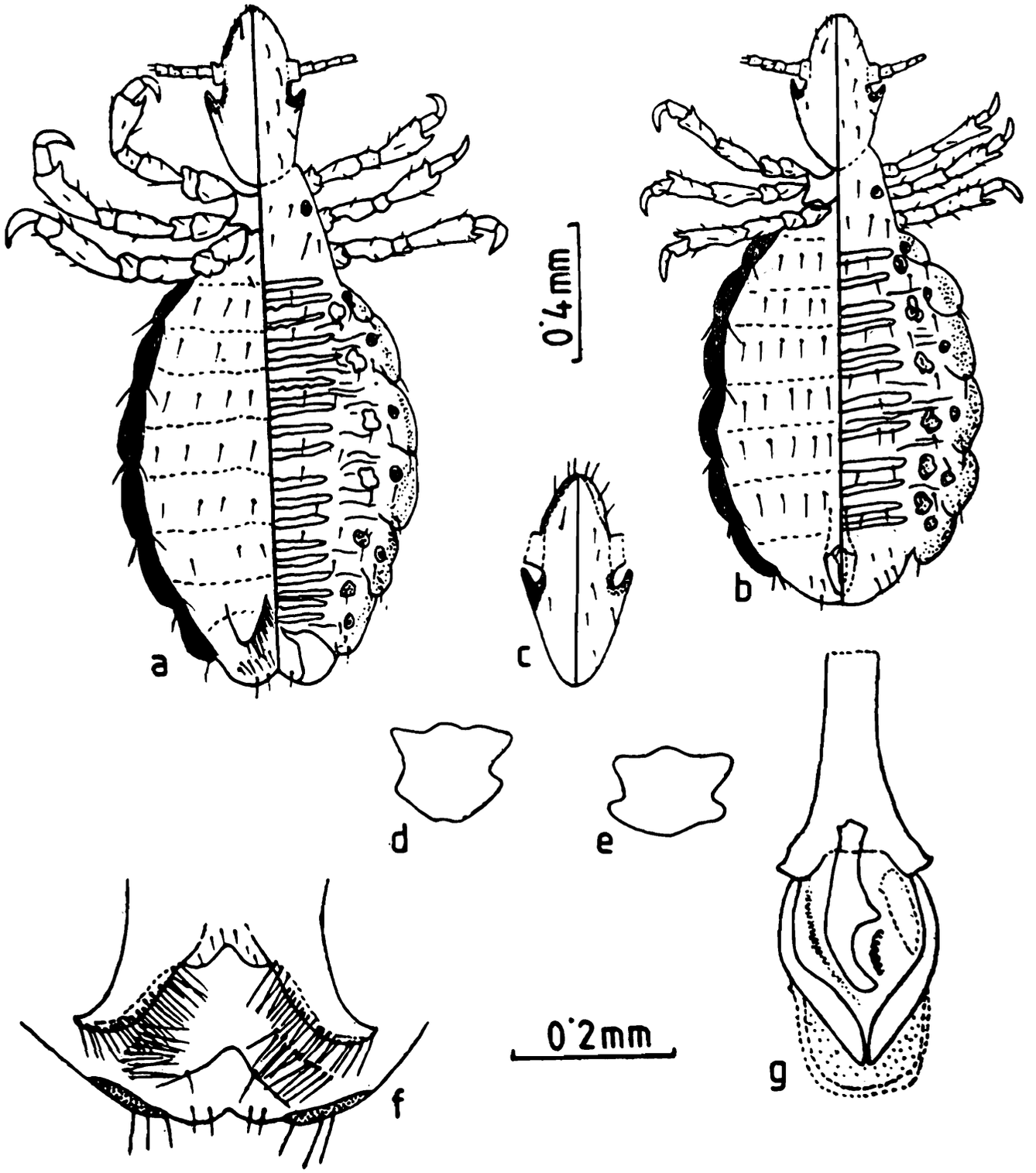
Male (Fig. b) : Total body length 1·69 mm. ($\bar{X}$, N=10), range 1·42 to 2·1 mm. Head and thorax as in female. Abdomen : More rounded, with the margins somewhat less deeply lobed and with but two pairs of median tergal plates on each segment. Genitalia (Fig. g) : Genital plate small but conspicuous ; pseudopenis broad, apically appears as turncate piece which supports the entirely membraneous preputial sac into the folds of which is withdrawn the slender, funnel-shaped penis.

Nymphs : could not be procured during present study.

Material examined : 10 ♀♀, 10 ♂♂, from domestic swine in West Bengal, 10.12.83 ; Coll. C. C. Adhikary.

Host and distribution : It has been recorded from domestic and wild swine all over the world.

PLATE 9



Haematopinus suis (Linnaeus)

a. ♀, Whole body (ventral and dorsal views); b. ♂, Whole body (ventral and dorsal views); c. Head of ♀, d. Thoracic sternal plate of ♀; e. Thoracic sternal plate of ♂; f. Genitalia of ♀; g. Genitalia of ♂

Remarks : This species appears close to *H. aperis* Ferris and it can be separated by combination of following characters : Legs large and strong ; paratergites quadrate, margins usually quite strongly lobed by intersegmental constrictions ; tergites strongly sclerotised.

9. **Haematopinus tuberculatus** (Burmeister)
(Figs., Plate 10)

1839. *Pediculus tuberculatus* Burmeister, *Genera Insecterum, Rhynehota, Species* 20.
1852. *Haematopinus tuberculatus*, Lucas, *Annales de la Societe Entomologigue de France* (2) : **10**: 529-533 ; Pl II, No. 2.
1974. *Haematopinus tuberculatus*, Mishra *et al.*, *Indian J. Med. Res.*, 62 : 1268-1287.
1977. *Haematopinus tuberculatus*, Krishna Rao *et al.*, 1977, *Mysore J. agric. Sci.*, **11** : 588-595.
1992. *Haematopinus tuberculatus*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *1-16.*

Female (Fig. a) : Total body length 3·9 mm ($\bar{X}$, N=20), range 2·7 to 4·7 mm. Head (Fig. b) : Forehead short, strongly pigmented, with conspicuous pustulations about the bases of the dorsal setae ; post-antennal angles very prominent ; occipital region constricted into a neck. Thorax : Dorsum strongly and quite uniformly pigmented ; sternal plate (Fig. c) 0·4 mm long and 0·2 mm wide, with lateral margins emerginate in a characteristic manner, with anterior angles produced laterally. Abdomen : Elongate, oval, usually rather membraneous and pale except for the definitely sclerotic areas ; paratergites for the most part forming conspicuous, conical tubercles, those of the first apparent segment present as minute plates ; tergites with two pairs of small median plates on each segment with a single, somewhat irregular submarginal plate ; number of setae present at the margin of the abdominal segments caudal of the paratergites, there being a series of at least five or six and usually eight or more setae. Genitalia (Fig. b) : Gonopophyses more tapering with their mesal margins sinuate ; a quite conspicuous somewhat variably formed, sclerotic area present between the apices of the gonopophyses.

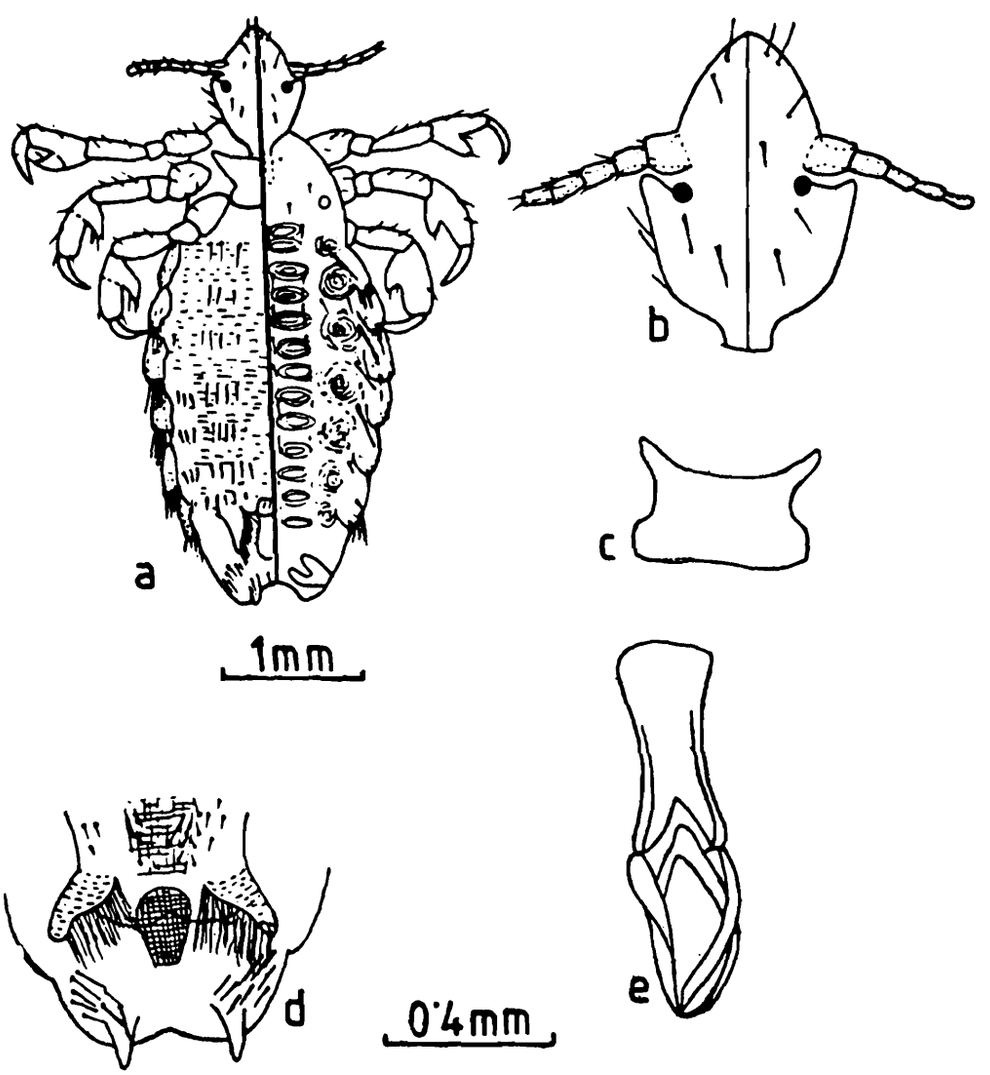
Male : Head, thorax and abdomen same as in female, except genitalia. Genitalia (Fig. e) : Genital plate very large and conspicuous , basal plate short and broad ; the pseudopenis with 'V' shaped ; preputial sac strongly sclerotic and forming basally a relatively huge hook.

Nymphs : Could not be procured during present study.

Materiai examined : 20 ♀ ♀, 15 ♂ ♂, from *Bos bubalis* in West Bengal, 10.10.83, 12.5.85 ; Coll. C. C. Adhikary.

Host : *Bos bubalis* (Water Buffalo) ; Camel ; Cattle.

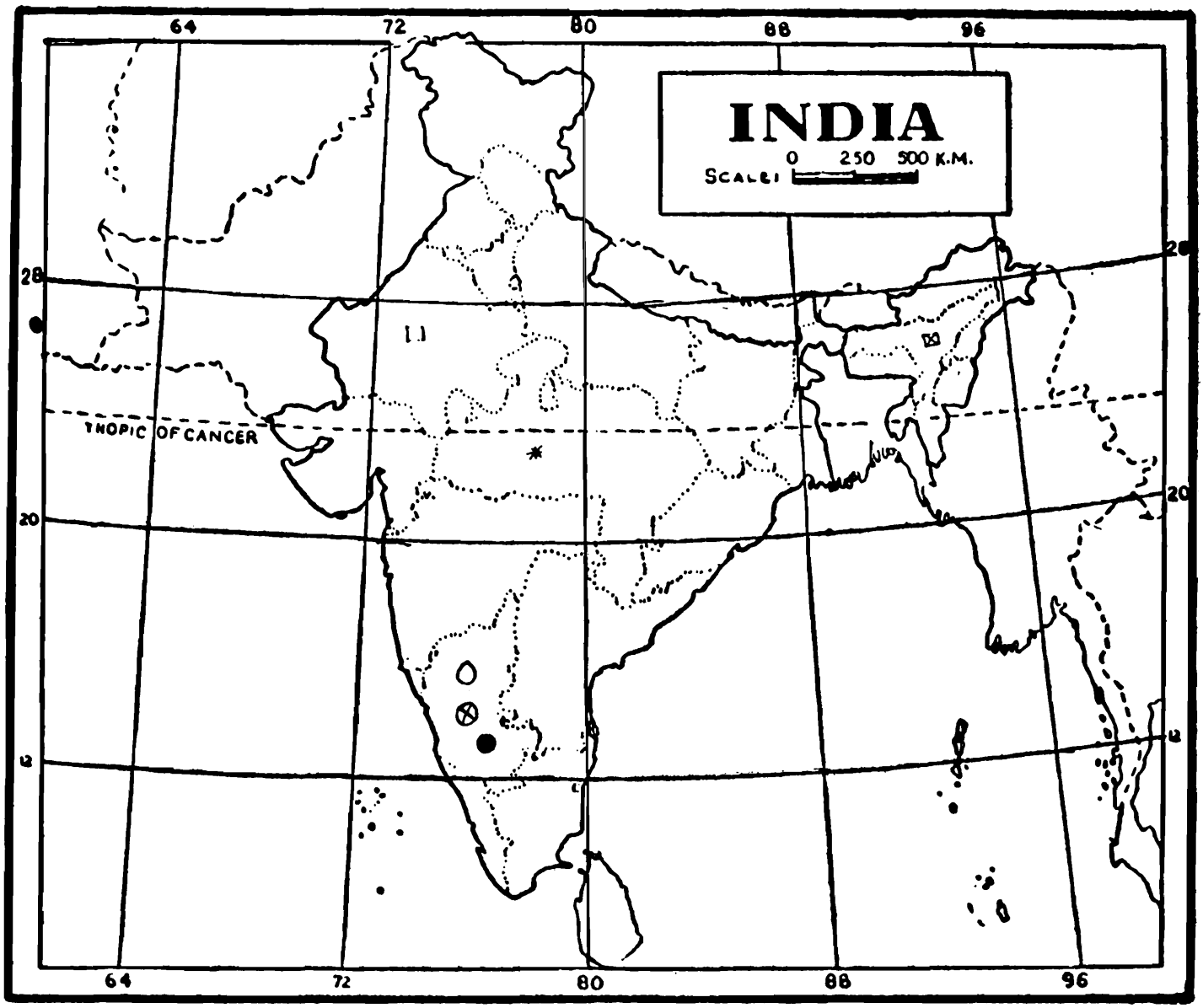
PLATE 10



Haematopinus tuberculatus (Burmeister)

a. ♀, Whole body (ventral and dorsal views); b. Head of ♀, c. Thoracic sternal plate of ♀; d. Genitalia of ♀; e. Genitalia of ♂.

Distribution : India ; China ; Guam ; Philippine Islands ; Europe (Holu.) ; Africa ; Australia.



Map showing distribution of

(*) Enderleinellus nishimarui Kaneko; (O) Phthirunculus sumatranus Kuhn and Ludwig; (⊗) Haematopinus channabasavannai Krishna Rao, Khuddus and Kuppuswamy; (□) H. longus Neumann; (⊠) H. oliveri Mishra and Singh; (●) H. quadripertusus Fahrenholz.

Remarks : This species seems close to *H. eurysternus* Denny ; it can be separated by the number of setae on paratergites which are represented by a series of at least 5 or 6 and usually 8 or more setae.

3. Family : HOPLOPLEURIDAE Ewing

1929. Hoplopleurinae Ewing, *A manual of external Parasites*, 133.
1951. Hoplopleuridae Ferris, *The sucking lice*, 98.
1960. Hoplopleuridae, Johnson, U.S.D.A. *Tech. Bull.*; 1211 : 5.
1964. Hoplopleuridae, Johnson, *Misc, Publ. Ent. Soc. America*, 4 : 68.
1978. Hoplopleuridae, Kim and Ludwig, *Syst. Ent.*, 3 : 272.
1981. Hoplopleuridae, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 9-11.

Type genus : *Hoplopleura* Enderlein by original designation.

Characters : Head : External evidence of eyes absent ; occular lobes prominent ; antennae 5 segmented, at times proximal two or three segments more or less fused together ; strongly sexually dimorphic in some species. Thorax : Phragmata weakly developed ; sternal plate usually present ; ventral prothoracic apophyseal pits lacking ; fore legs always small, with acuminate claw ; middle legs usually larger than fore legs ; hind legs usually largest, each with a stout claw. Abdomen : Paratergites, sternites and tergites usually highly developed except in some species where it is partially or completely lacking ; spiracles present on segments III to VIII. Genitalia : Female : Gonopods usually short, never elongated or leaf like ; subgenital plate large. Male : Basal apodeme large ; paramere well developed.

Remarks : The family contains two subfamilies viz., Hoplopleurinae and Haematopinoidinae (Kim and Ludwig 1978), both of which are available in India.

Key to the subfamilies of family *Hoplopleuridae*

Sternite of the abdominal segment II completely divided into two separate plates longitudinally ... ... *Haematopinoidinae.*

Sternite of the abdominal segment II not divided into separate plates but extended laterally to articulate with the corresponding paratergites ... *Hoplopleurinae.*

1. Sub-family : HAEMATOPINOIDINAE Ewing

1929. Haematopinoidinae *A manual of external parasites*, 140.
1978. Haematopinoidinae, Kim and Ludwig, *Syst. Ent.*, 3 : 273.

Type genus : *Haematopinoides* Osborn.

Characters : Head : Antennae 4 or 5 segmented ; post antennal angles moderately developed. Thorax : First pair of legs small with slender claw ; second pair larger with stouter claw ; third pair still larger generally flattened with very broad claw ; sternal plate well developed, apex free from body wall. Abdomen : Segment II with its sternal plate completely divided and laterally extended to articulate with corresponding paratergites ; sternites and tergites variously developed ; paratergites on segment II to IX.

Remarks : The subfamily contains three genera of which only one genus *Ancistroplax* Waterston is known from Indian region.

4. Genus : **Ancistroplax** Waterston

1929. *Ancistroplax* Waterson, *Parasitology*, 21 : 161.

Type species : *Ancistroplax crocidurae* Waterston.

1951. *Ancistroplax*, Ferris, *The Sucking lace*, P. 119.
1964. *Ancistroplax*, Johnson, *Misc. Publ. Ent. Soc. America*, 4 : 76.
1981. *Ancistroplax*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 20.
1990. *Ancistroplax*, Adhikary and Ghosh, *Rec. Zool. Surv. India*, 86 (3) : 519-524.

Characters : Head : Antennae 4 segmented, terminal segment with a large sensoria. Thorax : First pair of leg small, with a slender claw ; second pair somewhat larger ; third pair largest with flattened claw. Abdomen : Tergites and sternites well developed ; sternite of abdominal segment II divided into 2 parts ; female with 3 tergites and 3 sternites on each of the segments III to VI ; male with one tergite and one sternite on each segment ; tergite of segment VI with postero-lateral angles produced into free process which is bent apically toward midline of the body ; paratergites present on abdominal segment II to VIII in which III to VII gives the appearance of being divided longitudinally into two parts by the median line of weak sclerotization.

Host : Soricidae.

Remarks : This genus is recorded from India for the first time. It contains 2 species viz., *A. crocidurae* Waterston from *Crocidura horsfieldi* and *A. nasuta* Johnson from *Suncus* or *Crocidura* spp., in India only *A. crocidurae* is recorded from *Suncus etruscus* in Arunachal Pradesh.

10. Ancistroplax crocidurae Waterston
(Figs., Plates 11, 12 & 13)

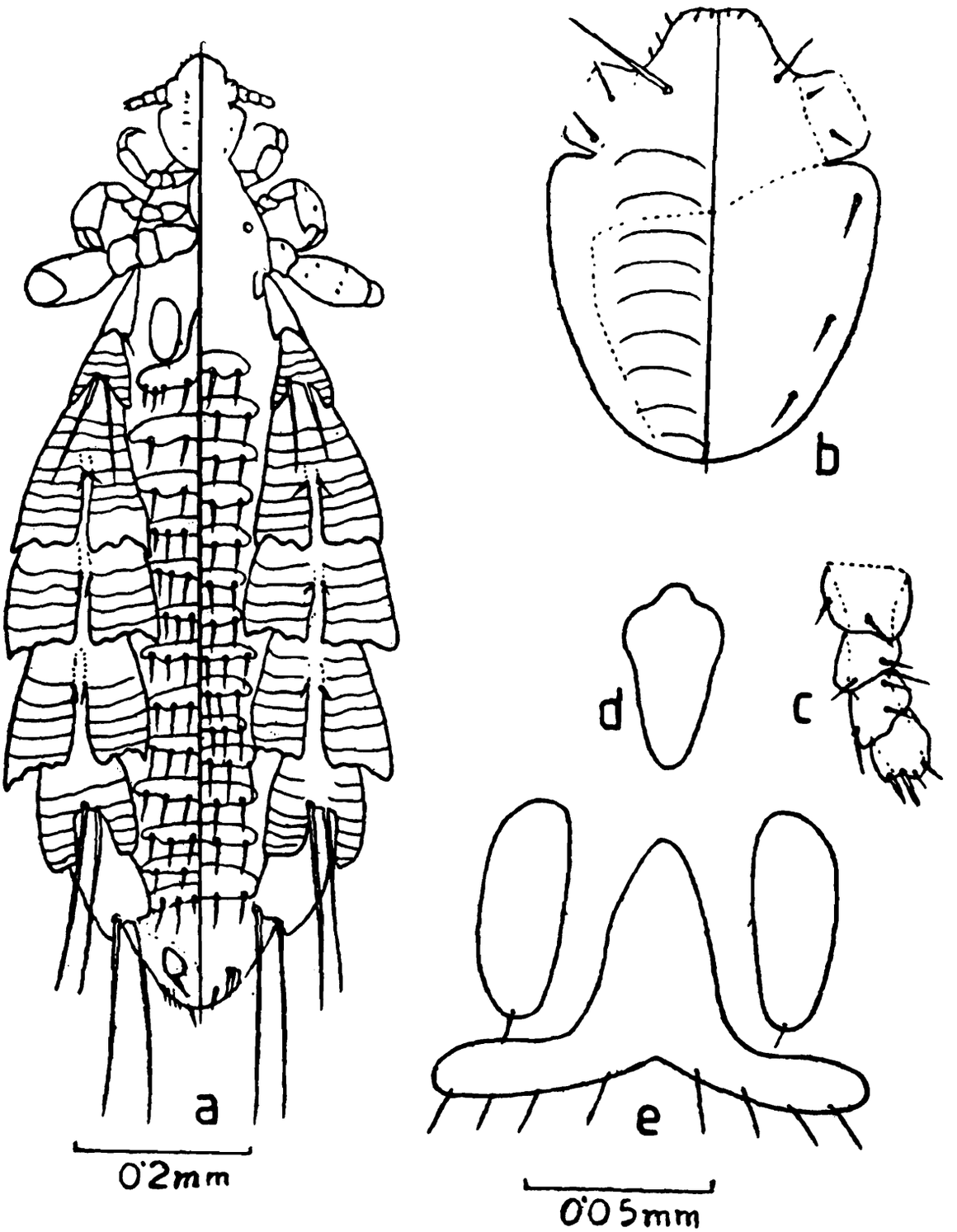
1929. *Ancistroplax crocidurae* Waterston, *Parasitology*, 21 : 161.
1932. *Ancistroplax crocidurae*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. v : 308.
1951. *Ancistroplax crocidurae*, Ferris, *The sucking lice*, P. 120.
1990. *Ancistroplax crocidurae*, Adhikary and Ghosh, *Rec. Zool. Surv. India*, 86 (3) : 519-524.

Female (Fig., Plate 11, a, b, c, d, e ; Plate 12, a, b) : Total body length 1·25 mm ($\bar{X}$, N = 3), range 1·21 to 1·36 mm. Head (Fig., Plate 11, b) : Slightly longer than broad ; weakly pigmented, with distinct sclerotic ventral plate bearing a number of crescentic markings ; post antennal angle present ; occipital angle rounded ; clypeal setae 2-3 pairs, small ; Ventral oral setae 2-4 pairs ; ventral pre-antennal setae long ; oral setae 2-4 pairs ; post antennal setae 2 pairs ; marginal setae 2 pairs ; DPHS absent ; antennae (Fig., Plate 11, c) four segmented, first segment broad, remaining more or less same size, terminal segment bears a large sensorium. Thorax : Sternal plate (Fig., Plate 11, d) wedge-shaped, 0·06 mm long and 0·03 mm wide, with small rounded process anteriorly and long posterior process rounded at the tip ; anterior legs small, weak with slender claw ; middle legs comparatively larger, but of the same type ; posterior legs with all parts enlarged and flattened, whole structure being stout. Abdomen : Elongate and slender. Dorsal : Segment I and II without tergites ; III with single tergite, 2 rows of setae, anterior row with 2 minute, posterior row with 2 pairs of thin elongate setae ; IV to VII, each with 3 tergites, having 4-6 setae each ; segment VIII and terminal segment, each with single tergite, having 4 or 5 setae each. DAAS absent. Ventral : Segment 1 apparently without sternites. Sternites of segment II (Fig., Plate 11, e) divided longitudinally into 2 oval plates which seem to articulate with the corresponding paratergites ; each oval plate with 2 minute setae, one in ventral and other in lateral side of the plates, ventral setae slightly longer than lateral ; segment III with single sternite, cap shaped, prolonged medially between the plates of segment II, with 8 setae ; segments IV to VII, each with 3 sternites having 4-6 setae each ; VAAS absent. Lateral : Paratergites (Fig., Plate 12, a) : II typical, both setae small ; III with dorsal posterior process long and tapering ventral process broad, both processes marked with transverse lines, both setae long ; IV to VII, each with posterior process lobe like, broad and serrated, with posterior outer angles somewhat pointed ; setae small sized except paratergite VII which bear two long setae ; all with marked transverse lines ; paratergite VIII devoid of transverse lines and lobes, both setae long. Genitalia (Fig., Plate 12, b) : Genital plate triangular ; gonopods paired, each with 3 long and 2 small setae ; genital setae enlarged and spiniform.

Male : Could not be obtained during present study.

Nymph 1 : Unknown.

PLATE - II



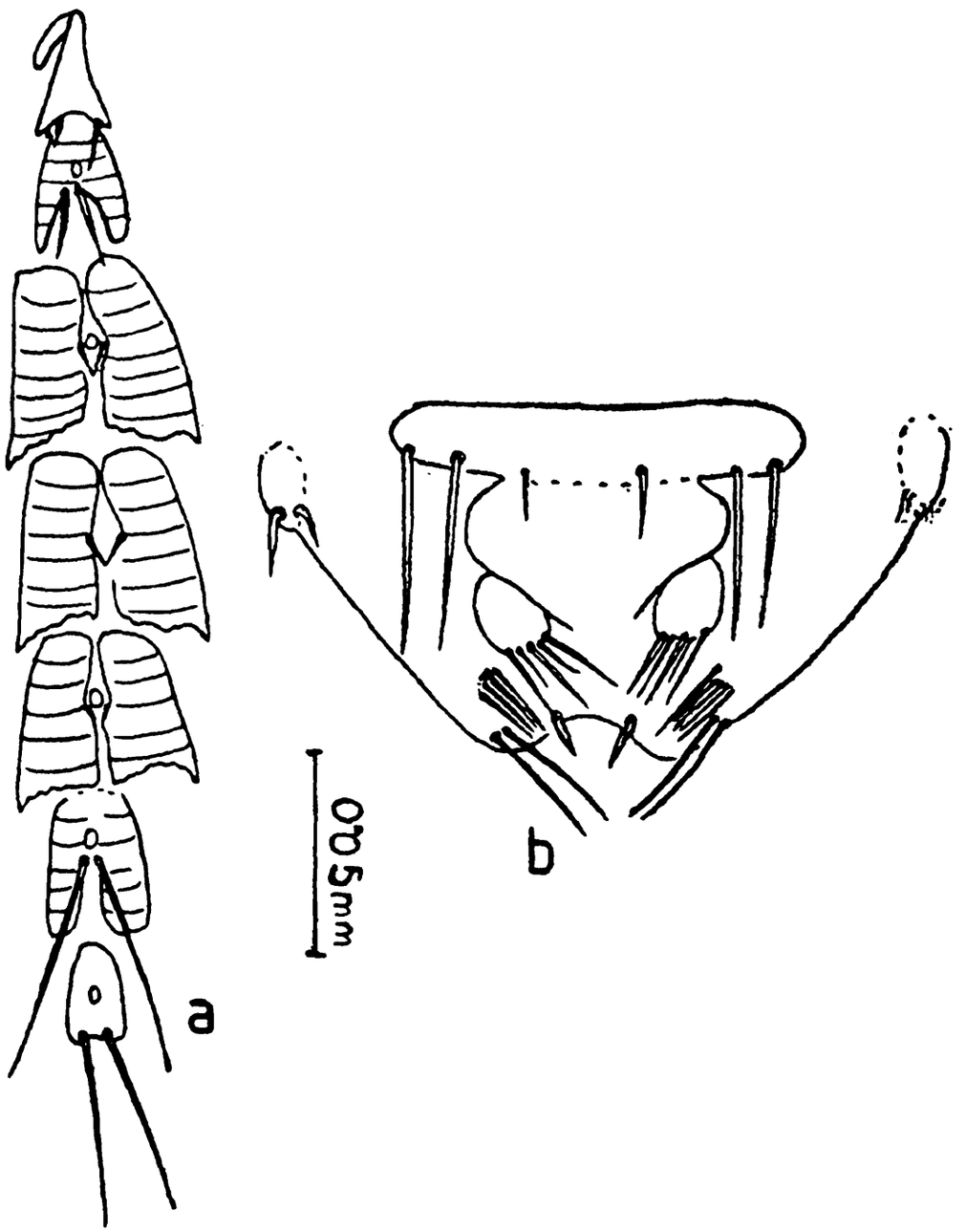
Ancistroplax crocidurae Waterston : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Antenna ; d. Thoracic sternal plate ; e. Sternites of abdominal segment II.

Nymph 2 : Unknown.

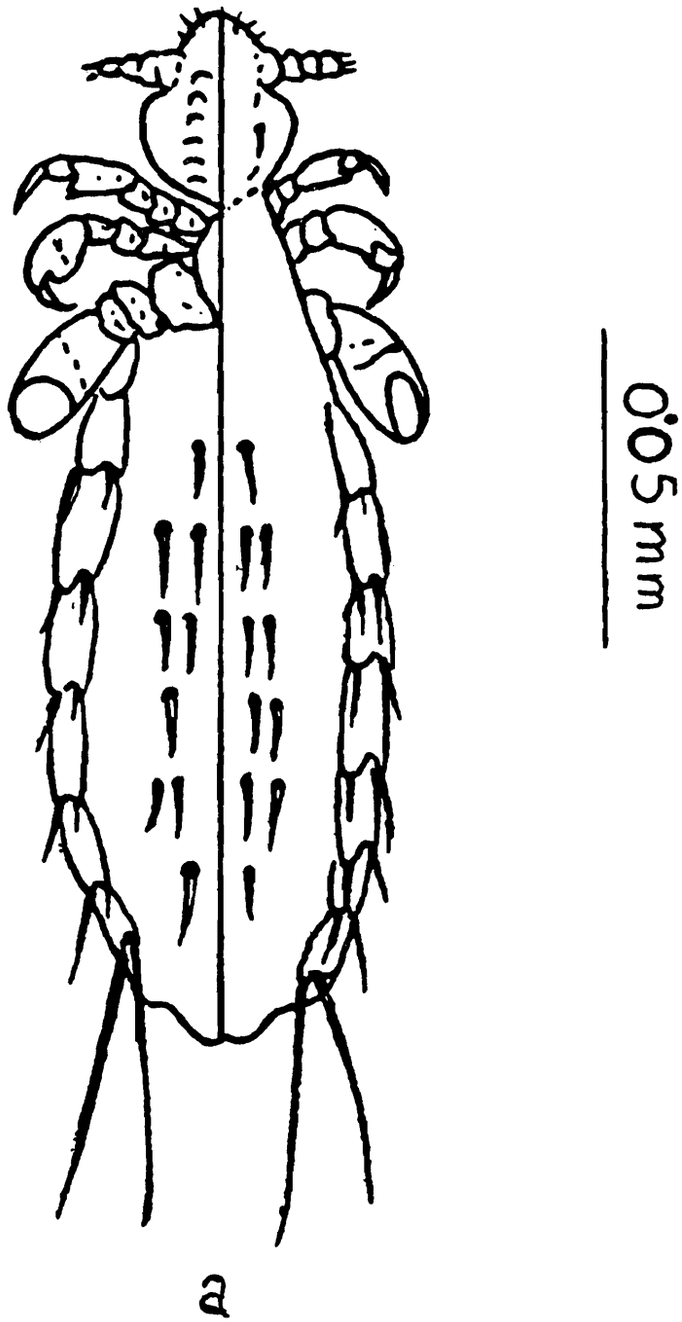
Nymph 3 (Fig., Plate 13) : Head : Slightly longer than broad ; sclerotic ventral plate bearing a number of crescentic margins ; post antennal and occipital angles slightly

PLATE - 12



Ancistroplax crocidurae Waterston : ♀
a. Paratergites ; b. Genitalia.

PLATE - 13



Nymph of *Ancistroplax crocidurae* Waterston
a. Nymph 3.

rounded ; all typical head setae present ; antennae 4 segmented. Thorax : Sternal plate wedge shaped with small rounded process anteriorly ; legs as in adults. Abdomen : Tergites and sternites absent ; only few rows of setae in abdominal regions ; paratergites poorly developed on segments II to VIII ; setae smaller than plates except VIII which has 2 long setae.

Material examined : 3 ♀ ♀, from *Suncus murinus*, from West Kaming dist., Arunachal Pradesh ; 18.10.85, Coll. C. C. Adhikary.

Host : *Suncus etruscus* (New record).

Distribution : India [Arunachal Pradesh (new record)] ; Sri Lanka.

Remarks : This species is recorded from India for the first time. *A. crocidurae* from India corresponds with those described by Waterston (1929) and Ferris (1932) from Sri Lanka but with following differences : VPHS long ; AnMHS 2 pairs ; tergites of segment III having 2 rows of setae ; each oval plate of segment II with 2 minute setae, and dorsal posterior process of paratergite III long and tapering, ventral broad.

2. Sub-family : HOPLOPLEURINAE Ewing

1929. Hoplopleurinae Ewing. *A manual of external parasites*, 133.
1951. Hoplopleurinae, Ferris, *The sucking lice*, 119.
1960. Hoplopleurinae, Johnson, *U.S.D.A. Tech. Bull.*, 1211 : 11.
1978. Hoplopleurinae, Kim and Ludwig, *Syst. Ent.*, 3 : 272.
1981. Hoplopleurinae, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 19-20.

Type genus : *Hoplopleura* Enderlein.

Characters : Head : Post antennal angles developed ; antennae 5 segmented. Thorax : First pair of legs small with slender claw ; second pair larger with stouter claw ; third pair largest, generally flattened, with broad claw ; sternal plate highly developed. Abdomen : Segment II with its sternal plate laterally extended on each side to articulate with the corresponding paratergites ; paratergites highly developed ; tergites and sternites well developed.

Remarks : The subfamily contains two genera of which only one genus viz., *Hoplopleura* Enderlein is known from Indian region.

5. Genus : **Hoplopleura** Enderlein

1904. *Hoplopleura* Enderlein, *Zool. Anz.*, 28 : 221.

Type species : *Pediculus acanthopus* Burmeister by original designation.

1929. *Ferrisella* Ewing *A manual of external parasite*, P. 198.
1929. *Ctenura* Ewing, *Loc. cit.* P. 199.
1929. *Euhoplopleura* Ewing, *Loc. cit.*, P. 199.
1929. *Ctenopleura* Ewing, *Loc. Cit.* P. 200.
1981. *Hoplopleura*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, No. 21 : 21-22.
1992. *Hoplopleura*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7* : 7-8.

Complete citations of references and synonymies may be found in Ferris (1951), Johnson (1960b, 1964 and 1972b).

Characters : *Female* : Head : All typical head setae present. On dorsal side : OS 2 rows ; 2 to 4 pairs each ; DPaHS, ApHS, DAcHS, DPHS, DAnCHS, DPoCHS one pair each ; SHS 2 pairs ; DMHS 3 pairs ; On ventral side : OS 2 rows, 1 or 2 pairs each ; VPAS 1 pair ; antennae 5 segmented, never strongly sexually dimorphic ; sensoria on segments 4 and 5 may be contiguous or well separated. Thorax : MS one pair ; MDTS one pair may be short or long ; DPtS, DMsS and DMtS usually 1-2 pairs each ; small sized ; first pair of leg smallest, with slender and pointed claw : second pair similar to first but larger claw strong and pointed ; third pair much larger and robust, claw broad and flattened. Abdomen : Dorsally segment II with 2 tergites, anterior usually indistinct ; III to VII each with 3 tergites, anterior 2 tergites of segment III normally broad ; VIII and terminal segment each with one broad tergite ; all the tergites with a single row of setae ; ventrally segment II with a single sternite, lateral extensions produced anterolaterally so as to articulate with the corresponding paratergite with 3 or 4 thin setae ; III with 4 sternites, first broad with lateral extension, posterior margin with a group of 2 enlarged setae present laterally on each side and 3-5 thin setae mesially ; IV to VI each with 3 sternites ; VII with two sternites ; all the sternites with a single row of setae ; remaining sternites modified to form genitalia ; VAAS and DAAS none to several pairs. Paratergites : Segment I is probably represented by a small, triangular chitinized plate, lying on dorsal side, partially fused with paratergite of segment II, paratergite II with posterior process, acute, one small seta along its dorsal side and 2 setae of varying length in the cleft on posterior margin ; III to VIII usually well developed and overlapping, provided with 2 setae on posterior margin ; spiracles present on segments III to VIII. Genital plate may be fused anteriorly with posterior sternite of segment VII or well separated ; gonopods lobed and paired, each lobe with 2-4 setae ; genital opening situated numerous filamentous process.

Male : Head and thorax as in female. Abdomen : Dorsally segment II and III with 2 tergites, anterior most targites usually indistinct ; IV to VI each with one or two tergites ; ventrally sternite of segment II and anterior sternite of segment III as in female ; segments IV to VI each with 2 sternites ; VII and VIII each with a single sternite, sometimes fused with one another ; each tergite and sternite provided with a single row of setae ; DAAS and VAAS varies none to several pairs. Genitalia : Parameres paired, usually enclosing part of pseudopenis.

Nymphs : Three nymphal instars present. Morphological characters are discussed with individual species.

Hosts : Rodentia and Lagomorpha.

Remarks : This genus is represented by 117 species throughout the world. Only 18 species have been recorded from India.

Key to the species of the genus *Hoplopleura* recorded in India

1. Paratergite VIII with well developed dorsal and ventral posterior processes ; paratergites III to VI each with lobed and serrated processes ; setae smaller than processes ... ... *sinhgarh.*

   Paratergite VIII devoid of one or both the processes 2

2. Paratergite VIII with dorsal posterior process well developed, ventral posterior process lacking 3

   Paratergite VIII devoid of both the processes 5

3. Setae on paratergite III small, almost half the length of the processes ; MDTS minute ... ... *ramgarh.*

   Setae on paratergite III almost as long as or longer than processes ; MDTS long 4

4. Paratergite VII with dorsal posterior process broad and truncated, ventral posterior process narrow and acute ... ... *sahyadri.*

   Paratergite VII with both processes acute, dorsal longer than ventral ... *captiosa.*

5. Paratergite VII with both dorsal and ventral posterior processes present ... *silvula.*

   Paratergite VII devoid of one or both the processes 6

6. Paratergite VII with dorsal posterior process well developed, ventral posterior process lacking 7

Paratergite VII devoid of both the process 8

7. Paratergite VI with ventral posterior process truncated ... ... *sicata.*

Paratergite VI with ventral posterior process tapering to a blunt tip ... *himalayana.*

8. Paratergite VI with dorsal and ventral posterior processes lacking ... *phalomydis*

Paratergite VI with dorsal and ventral posterior processes present ... 9

9. Anterodorsal and anteroventral angles of paratergites IV and V well developed ... ... *erismata.*

Anterodorsal and anteroventral angles of paratergites IV and V not developed 10

10. Dorsal and ventral setae on paratergite VI, both longer than process ... 11

Dorsal and ventral setae on paratergite VI, both shorter than processes or only ventral seta on paratergite VI longer than process 12

11. Paratergites III to V, each with dorsal and ventral posterior processes small and acute ; thoracic sternal plate devoid of anterior aud posterior process ... *maniculata.*

Paratergites III to V, each with both dorsal and ventral processes well developed and tapering at tip ; thoracic sternal plate with well developed posterior process ... ... *alticola.*

12. Ventral seta on paratergite VI longer than process 13

Ventral and dorsal setae on paratergite VI, both shorter than processes ... 15

13. Paratergites IV to VI, each with dorsal posterior processes notched ; ventral posterior processes small and acute ... ... *malabarica.*

Paratergites III to V, each with dorsal and ventral posterior processes emerginate and serrated 14

14. Paratergites III to V each with dorsal processes comparatively much wider than ventral processes ... ... *khandala.*

Paratergites III to V each with dorsal processes comparatively less wider than ventral processes ... ... *pacifica.*

15. Paratergites III to V, each with dorsal and ventral processes further divided into 2 lobes of almost equal in size ... ... *kondana.*

Paratergites IV to VI, each with dorsal and ventral posterior processes broad and truncated or tapering at tip 16

16. Paratergites IV and V, each with dorsal and ventral posterior processes tapering at tip ; male with prominent tooth like projection laterally at the base of pseudopenis ... ... *acanthopus.*

Paratergites IV and V, each with posterior processes broad and truncated... 17

17. Setae on paratergites IV to VI equal in length ; thoracic sternal plate with anterior margin straight, posterior process narrow ; MDTS minute ... ... *blanfordi.*

Setae on paratergites IV to VI unequal in length, but both smaller than processes ; thoracic sternal plate with posterior process acute at tip ; MDTS medium sized ... ... *cutchicus.*

11. **Hoplopleura acanthopus** (Burmeister)
(Figs., Plates 14, 15 & 16)

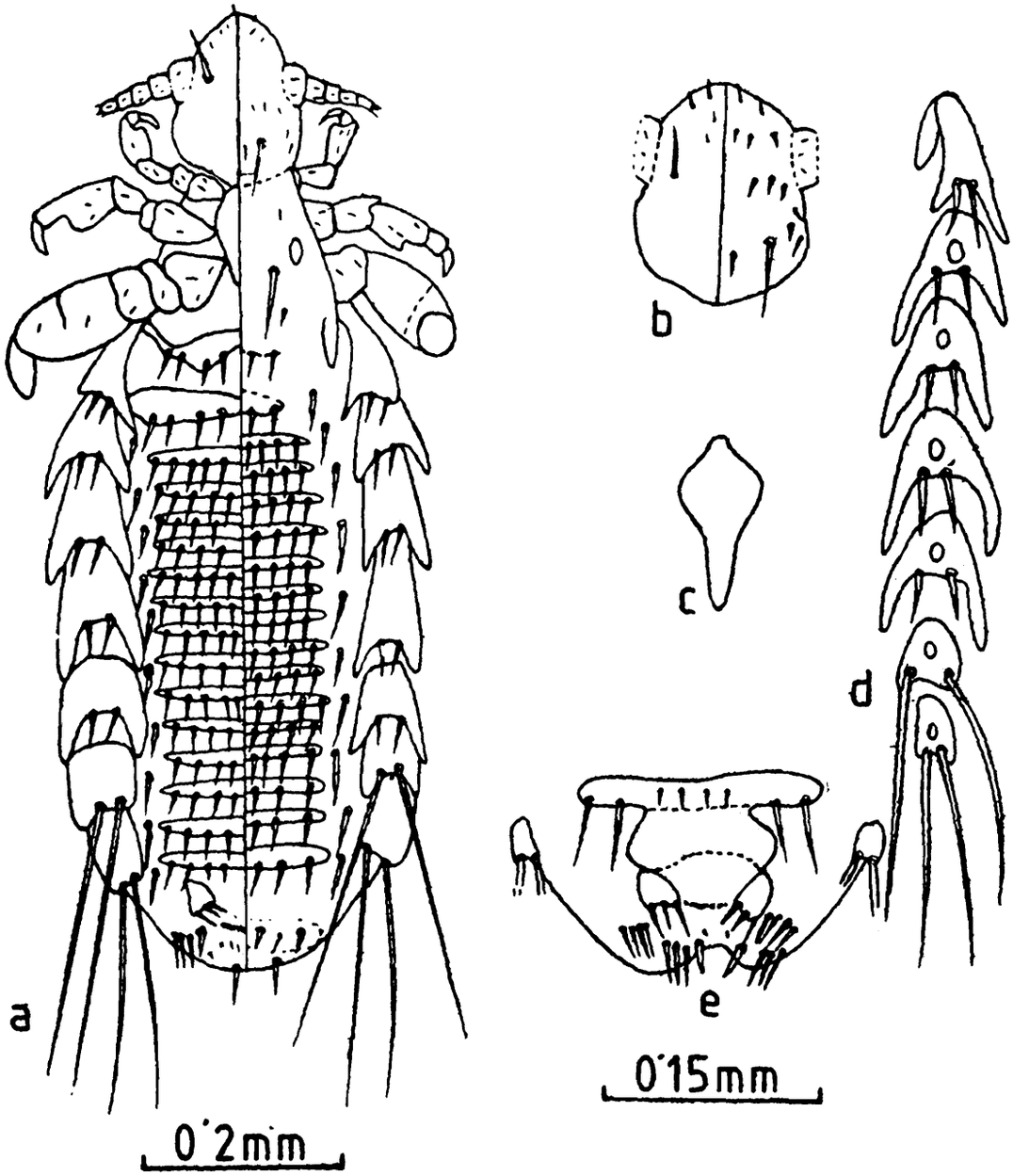
1839. *Pediculus acanthopus* Burmeister, *Genera Quaedam Insectorum*, 1 : 5.
1842. *Haematopinus acanthopus*, Denny, *Monographia Anoplurum Britanniae*, p. 25.
1904. *Polyplax acanthopus*, Enderlein, *Zool. Anz.*, 28 : 142.
1904. *Hoplopleura acanthopus*, Enderlein, *Zool. Anz.*, 28 : 221.
1981. *Hoplopleura acanthopus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 24-27.

Female (Fig., Plate 14, a, b, c, d, e) : Total body length 0·92 mm ($\bar{X}$, N = 2) ; range 0·9 to 0·92 mm. Head (Fig., Plate 14, b) : Longer than wide ; all typical head setae present ; DPHS close to DAcHS. Thorax : Sternal plate (Fig., Plate 14, c) 0·9 mm long and 0·04 mm wide, posterior process rounded at tip ; MDTS long, one pair ; 2 minute setae on each side of mesonotum usually ; legs same as in other member of the genus. Abdomen : Dorsal : Segment II with a single tergite ; 2 rows of setae, anterior row with 2 minute setae posterior row with 2 pairs of thin elongated setae ; segments III to VII each with 3 tergites, having 4 to 7 setae each ; VIII and terminal segment each with a single tergite, having 7 and 6 setae respectively ; DAAS 10 pairs. Ventral : Segment II with a single sternite, 4 pairs of thin setae ; segment III with 4 sternites having 7 to 10 setae each ; segments IV to VI each with 3 sternites having 6-8 setae respectively ; VAAS 10 pairs ; remaining sternites modified to form genitalia. Lateral : paratergites (Fig., Plate 14, d) : II with long posterior processes, both setae medium sized ; III with dorsal posterior process long and tapering, ventral small and serrated, both setae medium sized ; IV to VI each with posterior process well developed and tapering at tip, both setae medium sized, smaller than lobes ; VII and VIII devoid of processes, each with 2 long setae. Genitalia (Fig., Plate 14, e) : Genital setae long and tapering.

Male (Fig., Plate 15, a, b, c, d) : Total body length 0·65 mm ($\bar{X}$, N=2) ; range 0·63 to 0·65 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II as in

female ; III with 2 narrow tergites, anterior with 4, posterior with 8 setae ; IV to VI each with a single tergite having 7-9 setae each ; VII with single broad tergite having 10 setae ; VIII with single tergite, devoid of setae ; DAAS 10 pairs ; terminal segment with several

PLATE - 14

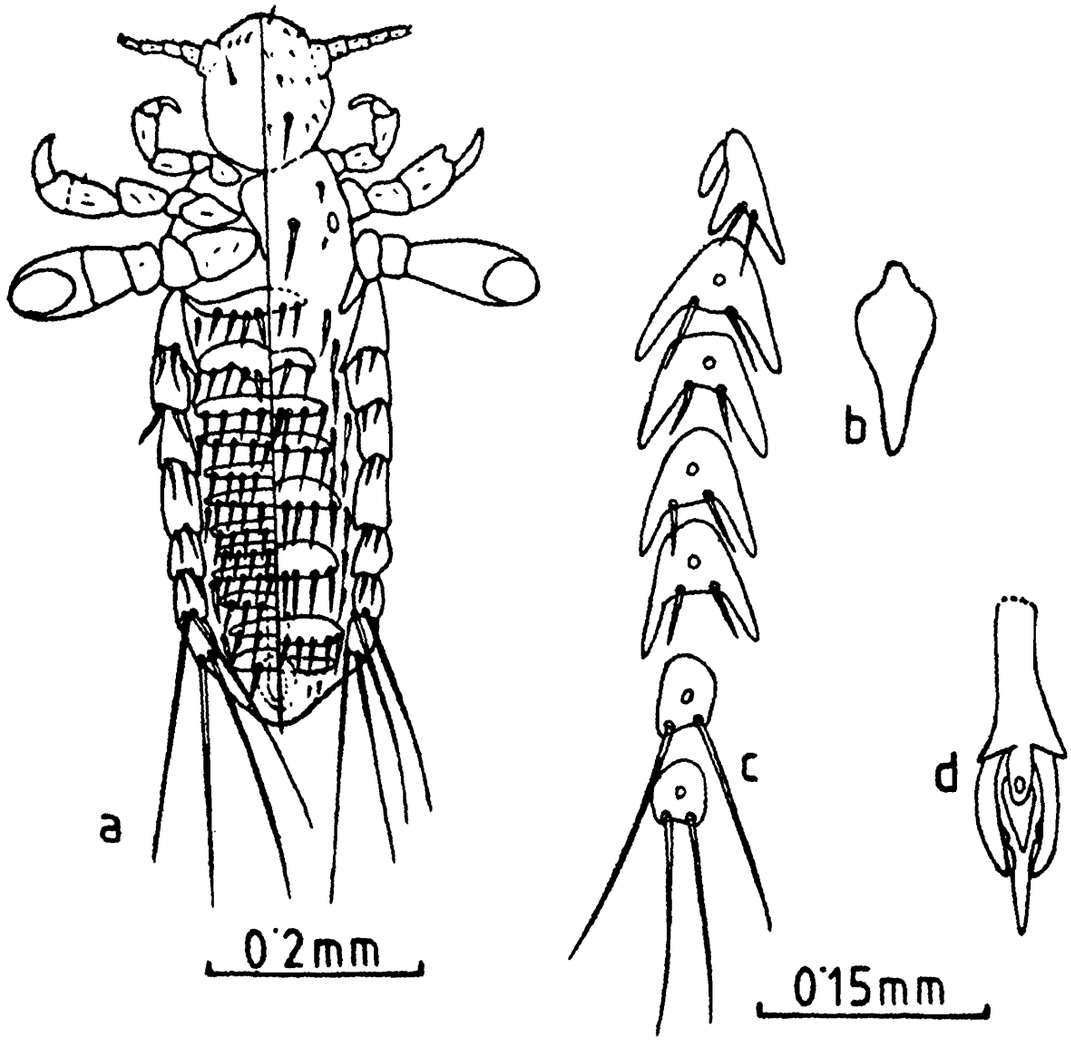


Hoplopleura acanthopus (Burmeister) : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

small setae. Ventral : Segment II as in female ; III with 3 sternites, anterior one as in female, remaining with 7-8 setae each ; IV to VI each with 2 sternites having 4-8 setae each;

VII and VIII each with single sternite having 4 and 2 setae respectively ; terminal segments with several minute setae ; VAAS 6 pairs. Lateral : Paratergites (Fig., Plate 15, c) as in female. Genitalia (Fig., Plate 15, d) : Parameres uniform in thickness ; pseudopenis with prominent basal tooth like projection and serrated sides.

PLATE - 15

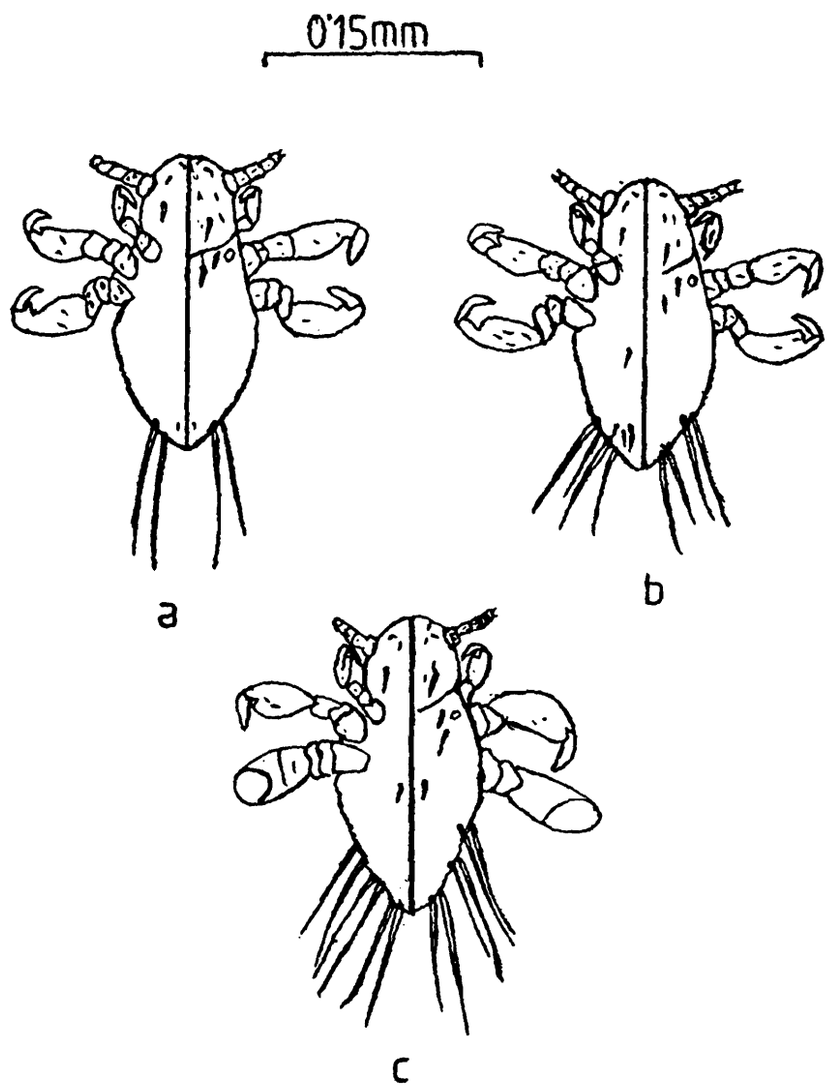


Hoplopleura acanthopus (Burmeister) : ♂

a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

Nymph 1 (Fig., Plate 16, a) : Head : Longer than wide ; all typical head setae present ; antennal sensoria separate ; post-antennal and occipital angles feebly developed. Thorax : Mesothoracic spiracles distinct ; MDTS one pair, medium sized ; sternal plate

PLATE 16



Nymphs of *Hoplopleura acanthopus* (Burmeister)
a. Nymph 1 ; b. Nymph 2 ; c. Nymph 3.

absent ; fore legs smallest with slender claw ; mid and hind legs similar size and shape, with blunt claw. Abdomen : No evidence of segmentation.

Nymph 2 (Fig., Plate 16, b) : Head same as in Nymph 1. Thorax : Hind legs longer

than mid legs : Abdomen : Ventral central abdominal setae one pair ; major abdominal setae 2 pairs and accessory setae 4 pairs.

Nymph 3 (Fig., Plate 16, c) : Same as in Nymph 2 but can be distinguished by major abdominal setae 3 pairs ; central abdominal setae 2 pairs.

Material examined : Paratypes : 2 ♀♀, 2♂♂ (Regd. No. USNM 129396), Athabasco Landing ; Canada, 1921 ; Coll. G. F. Ferris 1921.

Host : Microtine rodent, *Rattus rattus*, *Pitymys sikkimensis*, *Mus* sp.

Distribution : India (Sikkim, Uttar Pradesh) ; Cosmopolitan.

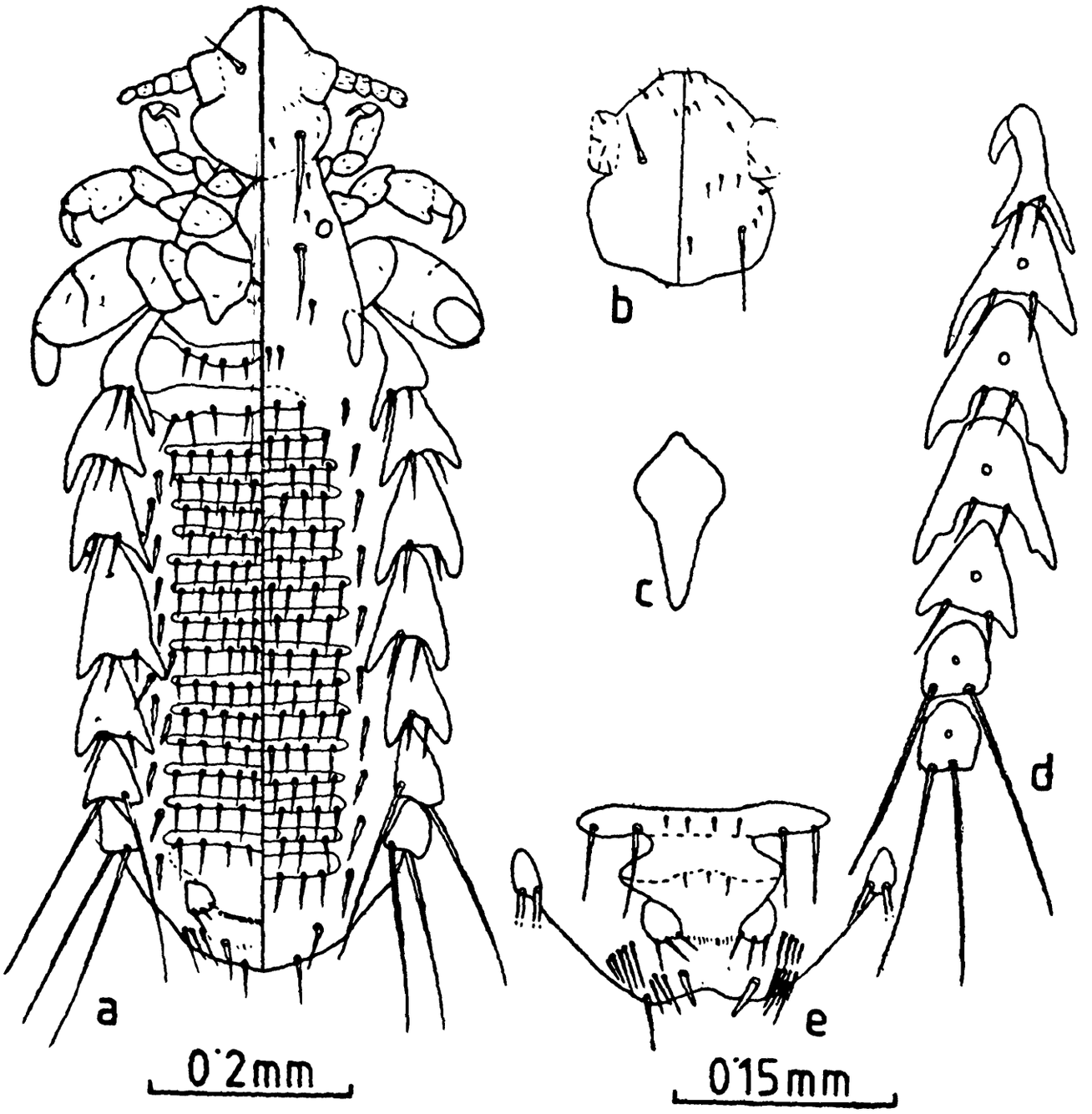
Remarks : This species seems close to *H. alticola* Mishra and Bhat but it can be separated by the shape of the head, setae of the paratergite VI which is shorter than posterior processes of the corresponding paratergites and by the prominent basal tooth-like lateral projection on pseudopenis.

12. **Hoplopleura alticola** Mishra and Bhat
(Figs., Plates 17 & 18)

1972. *Hoplopleura alticola* Mishra and Bhat, *Oriental Ins.*, 6 : 523-530.
1974. *Hoplopleura alticola*, Mishra *et al.*, *Indian J. med. Res.*, 62 : 1271.
1981. *Hoplopleura alticola*, Mishra, *Rec. Zool. Surv. India, Occ. paper*, 21 : 27-28.

Female (Fig., Plate 17, a, b, c, d) : Total body length 0·88 mm ($\bar{X}$, N=2) ; range 0·85 to 0·88 mm. Head (Fig., Plate 17, b) : Longer than wide ; post antennal angles rounded ; all typical head setae present ; pre-antennal region with 7 pairs of setae dorsally, 5 pairs ventrally ; DAcHS close to or almost adjoining DPHS. Thorax : Sternal plate (Fig., Plate 17, c) : 0·085 mm long and 0·032 mm wide, club shaped with posterior process rounded ; one long and two minute setae on each side of the mesonotum. Abdomen : Dorsal : Segment II with a single indistinct tergite having 4 thin elongated setae ; segment III with 3 tergites having 4, 8, and 6 setae each respectively ; segments IV to VII each with 3 tergites having 5 to 10 setae each ; segment VIII with single broad tergite having 7 or 8 setae ; terminal segment with 4 setae near the posterior margin and usually 2 thin setae on each lateral ; DAAS 10 pairs on each sides. Ventral : Segment II with single sternite having 8 setae ; segment III with 4 sternites having 7 to 10 setae each ; segments IV to VI each with 3 sternites having 7 to 10 setae each ; segment VII with 2 sternites having usually 8 setae ; remaining sternites modified to form genitalia ; VAAS 12 pairs. Lateral : Paratergites (Fig., Plate 17, d) : II with longer posterior process, both setae medium sized ; III with dorsal posterior angle long and tapering, ventral posterior angle almost acute and serrate, both setae medium sized ; IV and V bilobed, outer angles well developed

PLATE - 17

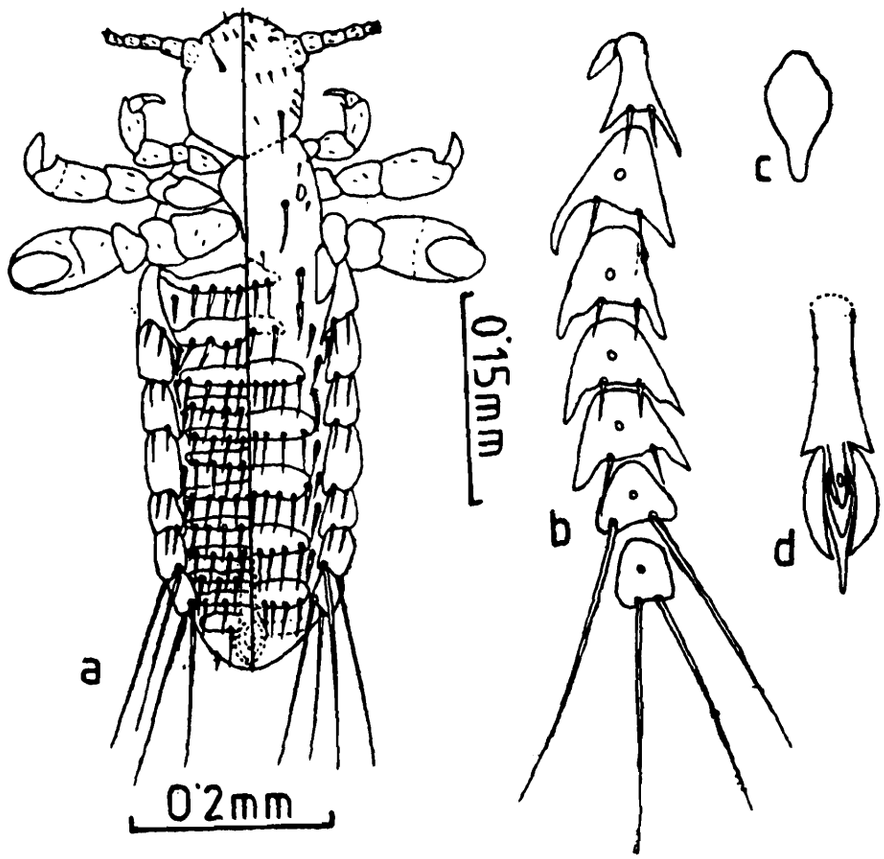


Hoplopleura alticola Misbra and Bhat : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia

and pointed, both setae medium sized, smaller than lobes ; VI with lobes pointed, setae longer than lobes ; VII and VIII devoid of lobes, each with 2 long setae. Genitalia (Fig., Plate 17, e) : Genital plate with 2 pairs of long and 2 pairs of minute setae.

PLATE - 18



Hoplopleura alticola Mishra and Bhat : ♂
a. Whole body (ventral and dorsal views) ; b. Paratergites ;
c. Thoracic sternal plate ; d. Genitalia.

Male (Fig., Plate 18, a,b,c,d) : Total body length 0·65 mm ($\bar{X}$, N=2) ; range 0·63 to 0·65 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II with a single tergite having 4 setae ; segment III with 2 tergites with 4 and 10 setae respectively ;

segments IV to VI each with a single tergite having 8-10 setae each ; VII with broad single tergite having 10 setae ; VIII with indistinct tergite devoid of setae , DAAS 10 pairs. Ventral : Segment II with single sternite having 7 or 8 setae ; segment III with 3 sternites ; anterior one as in female, remaining with 7 and 8 setae respectively ; IV to VI each with two narrow sternites having 7-8 setae each ; VII and VIII each with single sternite having 4 and 2 setae respectively ; VAAS 7 pairs. Lateral : Paratergites (Fig., Plate 18, b) as in female. Genitalia (Fig., Plate 18, d) : Parameres uniform in thickness ; pseudopenis rounded basally with serrated lateral margins.

Nymph : Unknown.

Material examined : Paratypes : 2♀♀, 2♂♂ (VRC Regd. No. A 81243) from *Alticola roylei* ; Martoli, Pithoragarh dist., U.P. ; 19.9.67 ; Coll. H.R. Bhat.

Host : *Alticola roylei*

Distribution : India (Uttar Pradesh, Himachal Pradesh).

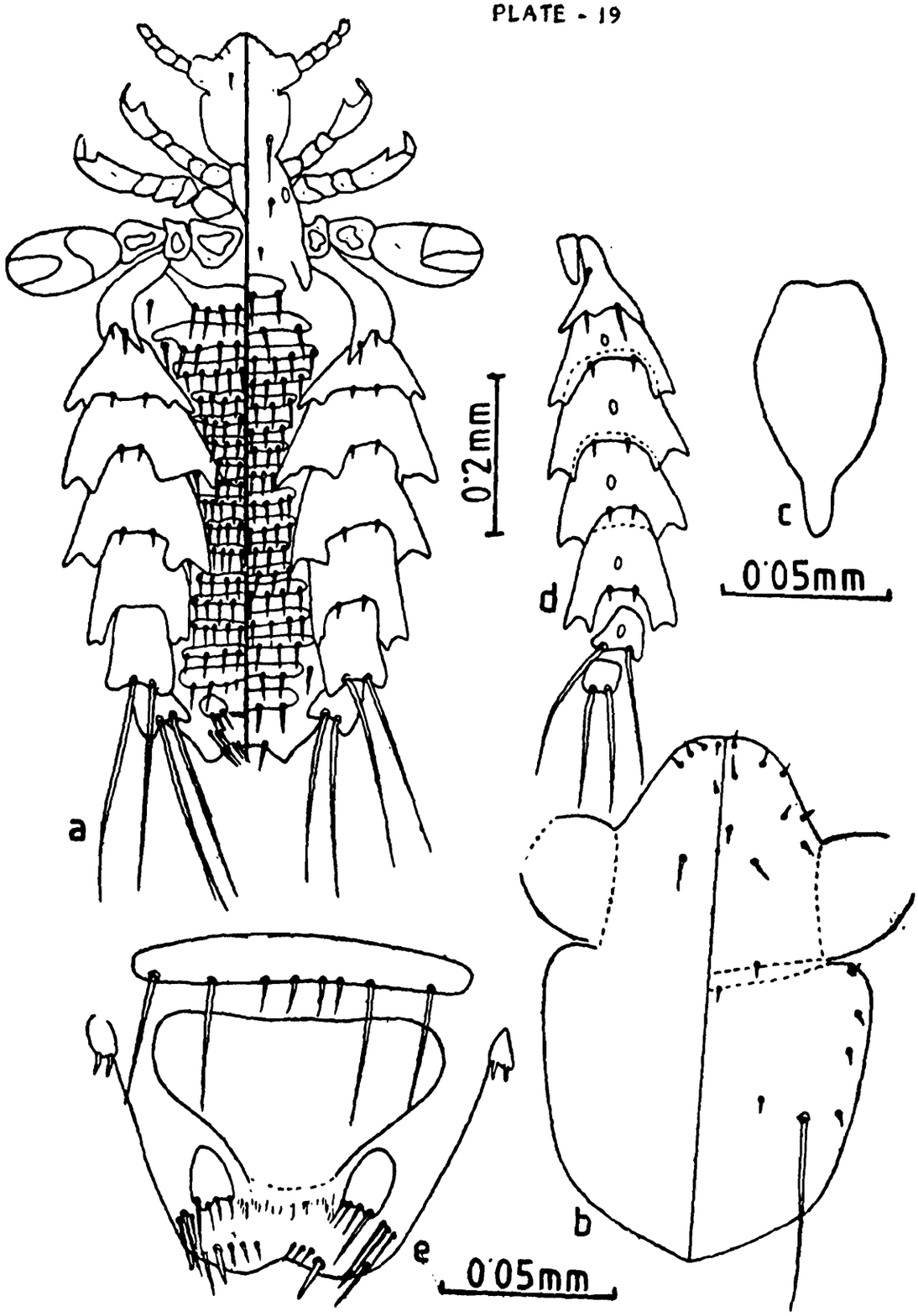
Remarks : This species appears close to *H. acanthopus* (Burmeister) but it can be separated from the former by the setae of paratergite VI which is longer than the posterior processes of the corresponding paratergites.

13. **Hoplopleura blanfordi** Mishra and Dhanda
(Figs. Plates 19,20 & 21)

1972. *Hoplopleura blanfordi* Mishra and Dhanda, *J. Parasit.*, 58 : 393-396.
1981. *Hoplopleura blanfordi*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 28-30.
1992. *Hoplopleura blanfordi*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : 8-9.

Female (Fig., Plate 19, a, b, c, d) : Total body length 0·87 mm ($\bar{X}$, N = 10) ; range 0·85 to 0·91 mm. Head (Fig., Plate 19, b) : Longer than wide ; post antennal angles rounded ; pre-antennal region with 7 pairs of setae dorsally ; antennal region with one pair of setae ; post antennal region with 10 pairs of setae dorsally. Thorax : Sternal plate (Fig., Plate 19, c) : 0·08 long and 0·035 wide ; clavate, anterior margin straight, posterior process narrow ; MDTS one pair, medium sized. Abdomen : Dorsal : Segment II with a single tergite, having 4 setae ; segment III with 3 tergites, each having usually 4-6 setae ; segment IV to VII each with 3 tergites, having 6-10 setae each ; terminal segment with 2 or 3 pairs of setae ; DAAS 1-2 pairs. Ventral : Segment II with a single sternite having 4 pairs of thin setae ; segment III with 4 sternites, first with 7 and remaining with 7-9 setae each ; IV to VI each with 3 sternites having 6-9 setae each ; segment VII with 2 sternites, anterior with 6 and posterior with 8 setae ; remaining sternites modified to form genitalia ; VAAS 4-5 pairs. Lateral : Paratergites (Fig., Plate 19, d) : II typical,

PLATE - 19

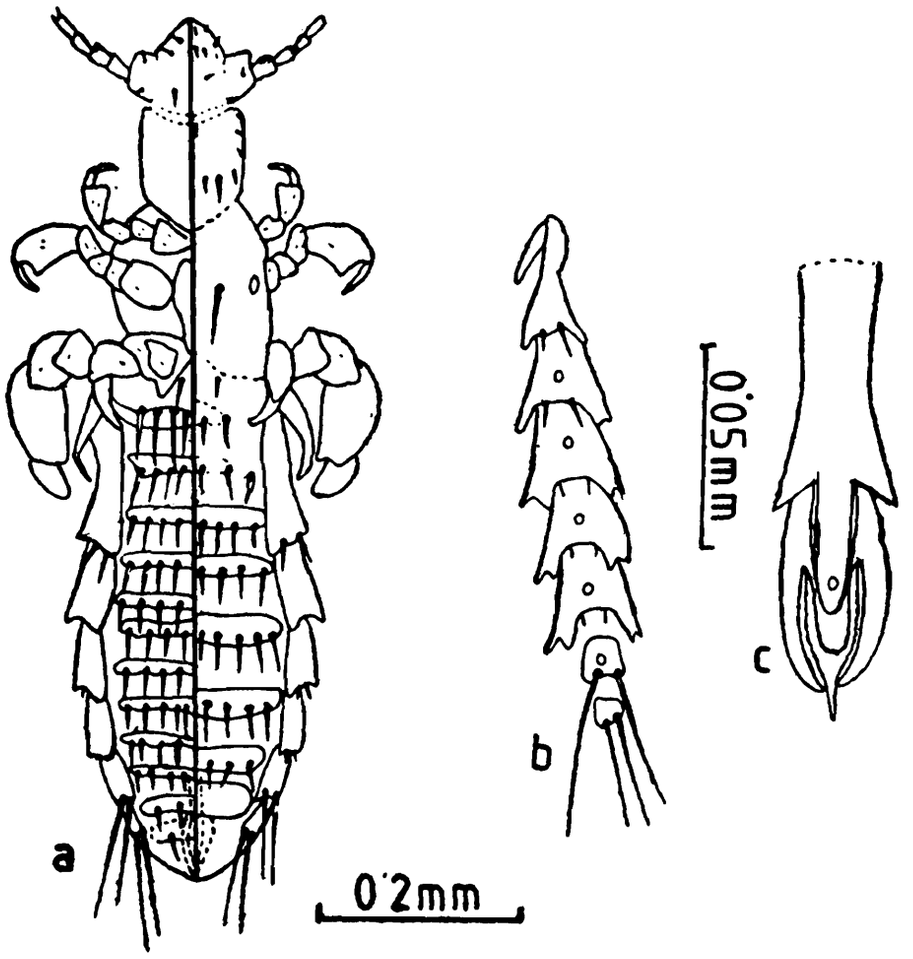


Hoplopleura blanfordi Mishra and Dhanda : ♀

a. Whole body (ventral and dorsal views) b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia

dorsal seta longer than ventral ; III with both processes broad and truncated, both setae medium, IV to VI each with posterior processes broad and truncated, both setae minute ; VII and VIII devoid of processes, both setae long. Genitalia (Fig., Plate 19, e) : Gonopods paired, each with 4 or 5 setae ; each genital lobe with 6-7 small thin setae.

PLATE - 20



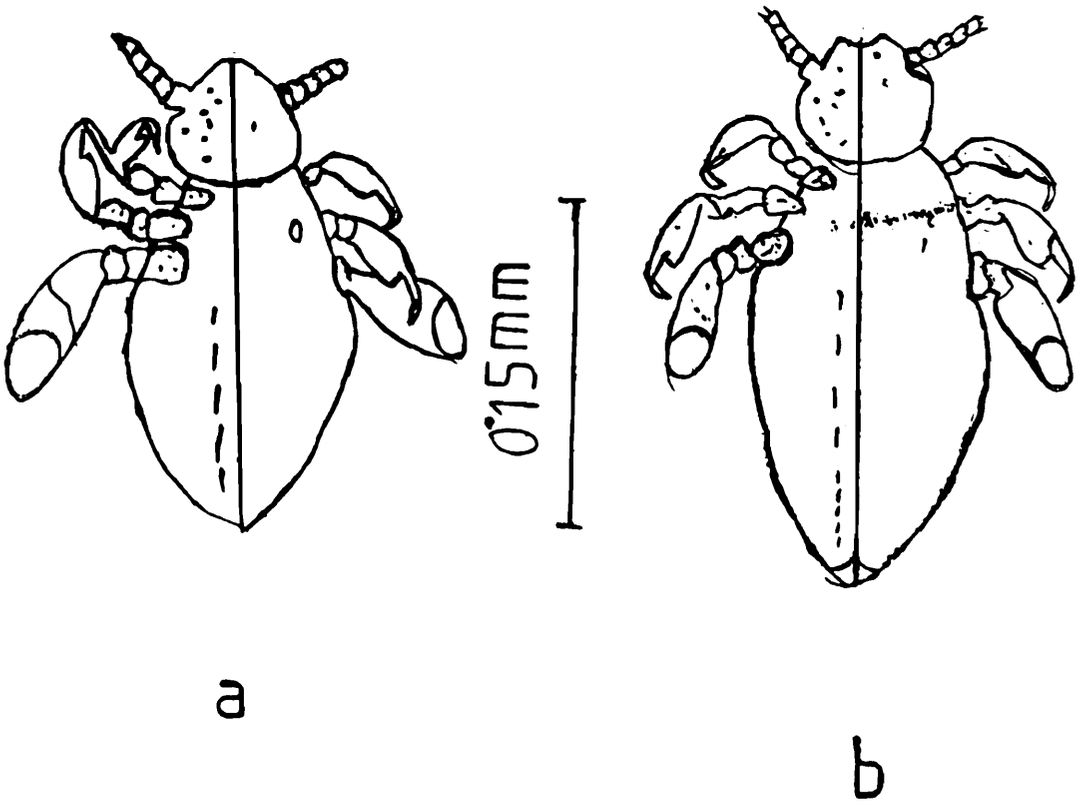
Hoplopleura blanfordi Mishra and Dhanda : ♂
a. Whole body (ventral and dorsal views) ; b. Paratergites ; c. Genitalia.

Male : (Fig., Plate 20, a, b, c) : Total body length 0·85 mm ($\bar{X}$, N=10) ; range 0·78 to 0·93 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II with a single tergite having 4 setae ; III with 2 tergites, each with 4-6 setae ; segment IV to VI

each with a single tergite, having 7-9 setae each ; segment VIII with a single tergite devoid of setae ; DAAS 1-2 pairs. Ventral : Segment II with single sternite having 8 setae ; III with 3 sternites, anterior with 7 and remaining with 6-8 setae each ; segment IV to VI each with 2 sternites having 6-8 setae each ; segment VII and VIII each with single sternite, anterior with 5-6 and posterior with 2 setae ; terminal segment with several minute setae. Lateral : Paratergites (Fig., Plate 20, b) as in female. Genitalia (Fig., Plate 20, c) : Parameres thickened near the base ; pseudopenis pointed towards tip.

Nymph 1 (Fig., Plate 21, a) : Head : Longer than wide ; post-antennal angles rounded ; dorsal head setae indistinct ; ventral surface with well developed tubercles.

PLATE - 21



Nymphs of *Hoplopleura blanfordi* Mishra and Dhanda
a. Nymph 1 ; b. Nymph 2.

Thorax : Mesothoracic spiracle distinct ; sternal plate absent. Abdomen : Spiracles absent ; ventral central abdominal setae 5 pairs.

Nymph : 2 (Fig., Plate 21, b) : Head : Longer than wide, anterolateral angles with strong hook like protuberance ; dorsal head setae minute ; antennae well developed. Thorax : Mesothoracic spiracle distinct, setae minute ; legs as in adults. Abdomen : Spiracles absent ; ventral central abdominal setae 7 pairs ; dorsal central abdominal setae, major abdominal setae, anal setae and accessary setae indistinct, terminal segment bifurcated.

Nymph 3 : Similar to Nymph 2.

Material examined : 10 ♀ ♀, 10 ♂ ♂, from *Rattus blanfordi* ; Ajadhya hill, W. Bengal ; 12.1.1985 ; Coll. C. C. Adhikary.

Host : *Rattus blanfordi.*

Distribution : India [West Bengal (New record), Orissa, Maharastra, Karnataka].

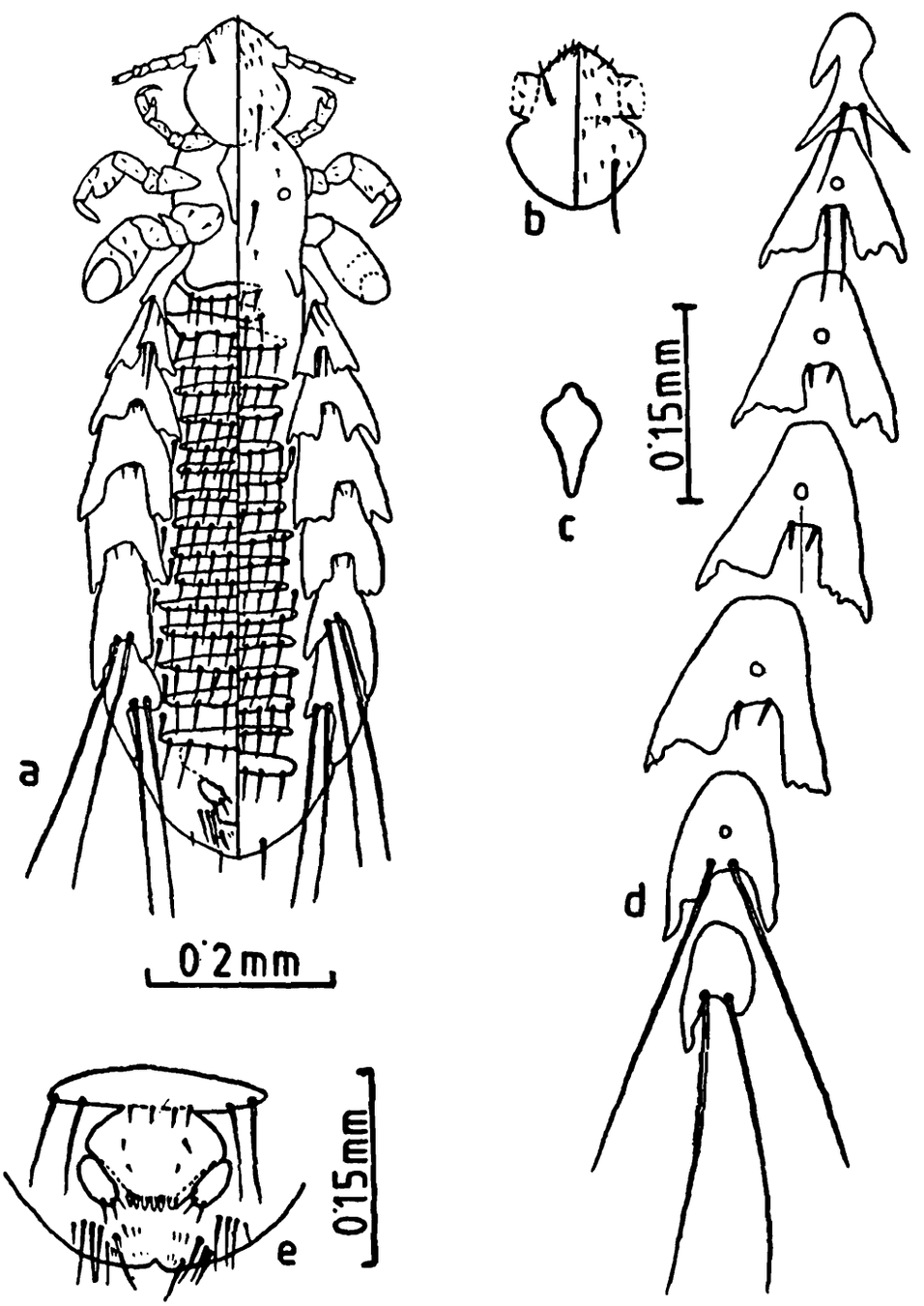
Remarks : This species seems close to *H. patersoni* Johnson, *H. kondana* Mishra, *H. cutchicus* Mishra and Dhanda and *H. pacifica* Ewing. However, it can be separated from *H. patersoni* by truncated ventral process of paratergite VI ; from *H. kondana* by dorsal seta of paratergite III ; no division of dorsal and ventral processes of paratergites III to VI ; from *H. cutchicus* by dorsal and ventral setae of paratergite IV to VI which are thin and minute and from *H. pacifica* by broad and serrated dorsal and ventral processes of paratergite VI. *H. blanfordi* is recorded for the first time from West Bengal.

14. Hoplopleura captiosa Johnson
(Figs., Plates 22 & 23)

1960. *Hoplopleura captiosa* Johnson, U. S. D. A. *Tech. Bull.*, 1211 : 23-28.
1961. *Hoplopleura musculi* Wegner, *Bull. Inst. Mar. Med. Gdans.*, 12 : 155-164.
1981. *Hoplopleura captiosa*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 30-32.
1992. *Hoplopleura captiosa*, Adhikary and Ghosh, *State Fauna Series* 3 : *Fauna of West Bengal, Pt.* 7 : 9

Female (Fig., Plate 22, a, b, c, d, e) : Total body length 0·9 mm ($\bar{X}$, N = 3) ; range 0·88 to 0·9 mm. Head (Fig., Plate 22, b) : Longer than wide ; all typical head setae present ; marginal head setae not in a straight line ; post antennal angles broad ; antennal sensoria large and contiguous. Thorax : Sternal plate (Fig., Plate 22, c) 0·08 mm long and 0·03 mm wide, with a long posterior process, rounded at tip ; MDTS long. Abdomen : Dorsal : Segment II with a single tergite, 2 rows of setae, anterior with 2 and posterior with 4 setae ; III with 3 tergites each having 5-7 setae ; IV to VII each with 3 tergites, with 7-10 setae each ; terminal segment with 4 or 6 setae ; DAAS 2 pairs. Ventral : Segment II with a single sternite with 8 setae ; III with 4 sternites, first with 7 and remaining with 7-10 setae each ; IV to VI each with 3 sternites, having 6-9 setae each ; segment VII

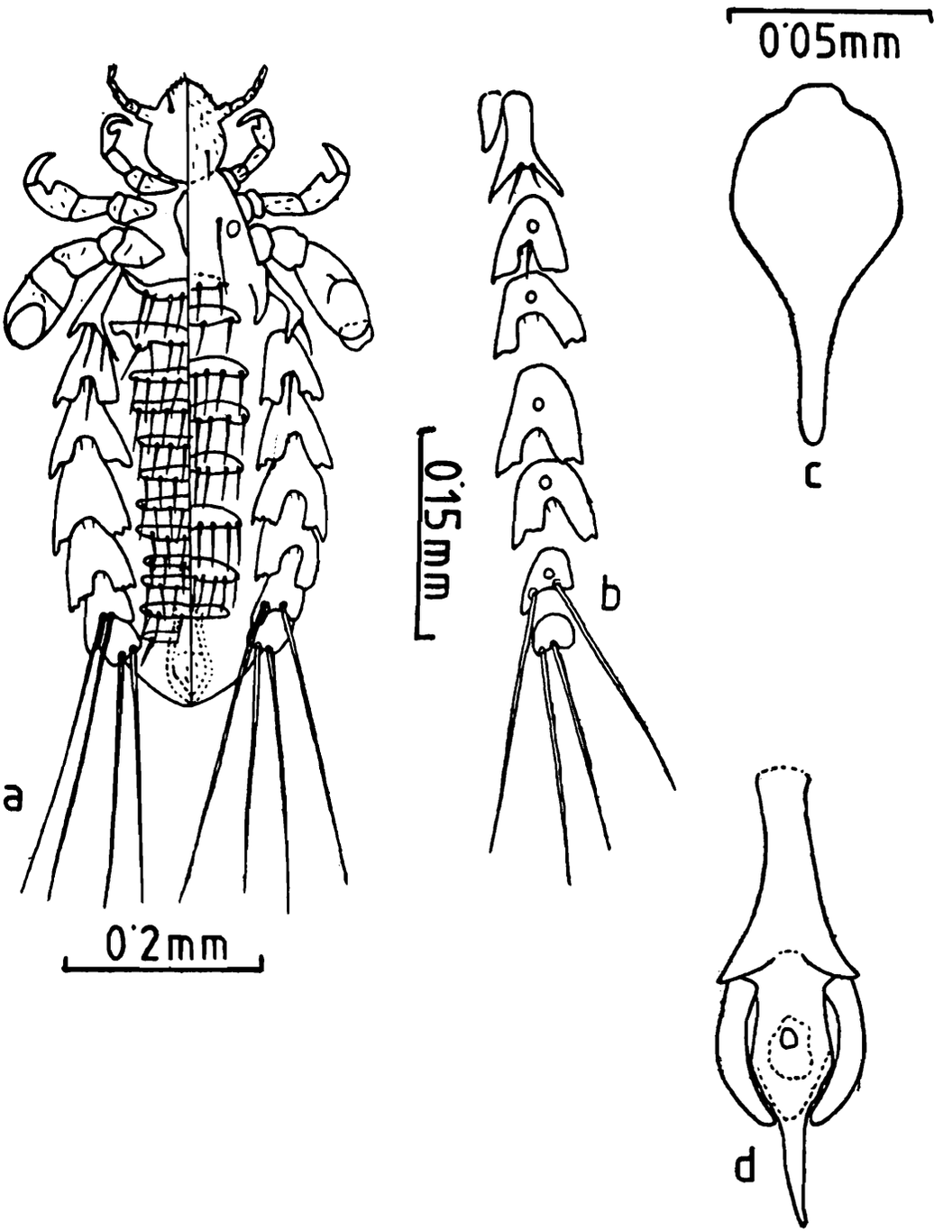
PLATE - 22



Hoplopleura captiosa Johnson : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia

PLATE - 23



Hoplopleura captiosa Johnson : ♂

a. Whole body (ventral and dorsal views) ; b. Paratergites ; c. Thoracic sternal plate ; d. Genitalia.

with 2 sternites, former with 6 and latter with 8 setae ; VAAS 7 pairs. Lateral : Paratergites (Fig., Plate 22, d) : II with ventral seta shorter than processes and dorsal seta long : III to VI, each with posterior processes lobed, both setae short except on paratergite III which extends beyond the apices of lobes ; VII with both processes acute, dorsal longer than ventral ; both setae long ; VIII with dorsal lobe long and acute, ventral lobe absent, both setae long. Genitalia (Fig., Plate 22, e) : Genital lobe with 3 thin setae each ; genital setae long and tapering.

Male (Fig., Plate 23, a, b, c, d) : Total body length 0·64 mm ($\bar{X}$, N = 2) ; range 0·63 to 0·64 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II with a single tergite having 4 setae ; III with 2 tergites, with 4 setae anteriorly and 8 setae posteriorly ; segment IV to VII each with single tergite, having 7-9 setae each ; segment VIII with single tergite, devoid of setae ; DAAS absent. Ventral : Segment II with single sternite, having 8 setae ; III with 3 sternites, anterior with 7 and remaining with 5-8 setae each ; IV to VI each with 2 sternites, having 6-9 setae each ; VII and VIII each with single sternite, anterior with 6 and posterior with 2 setae ; VAAS absent ; terminal segment with several minute setae. Lateral : Paratergites (Fig., Plate 23, b) as in the female except III with dorsal seta minute, VII with dorsal process small and acute, ventral process absent ; VIII devoid of process. Genitalia (Fig., Plate 23, d) : Parameres almost uniform in thickness ; pseudopenis narrow and margin serrated.

Nymphs : Could not be procured during present study ; descriptions of nymphs is mainly based on Mishra (1981).

Nymph 1 : Head : Longer than wide ; post antennal angle rounded : typical head setae present. Thorax : MDTS medium sized ; one pair ; sternal plate absent. Abdomen : Paratergite absent ; spiracles indistinct ; ventral central abdominal setae 1 pair ; anal setae 2 pairs.

Nymph 2 : Head : Longer than wide ; antennal sensoria large and contiguous ; typical head setae present. Thorax : MDTS one pair, medium sized ; DPtS 2 pairs ; legs as in adults. Abdomen : Paratergites with spiracles 6 pairs ; ventral central abdominal setae 2 pairs ; major abdominal setae one pair ; anal setae 3 pairs.

Nymph 3 : Same as in Nymph 2.

Material examined : Paratype ; 1 ♀, 1 ♂, (V.R.C. Regd. No. 81327) from *Mus booduga* ; Kargil, Ladakh ; 31.8.67 ; Coll. A. C. Mishra ; 2 ♀♀, 1 ♂, from *Mus booduga* ; Midnapore, West Bengal ; 16.9.85 ; Coll. C. C. Adhikary.

Host : *Mus booduga*, *Mus musculus* and *Mus* spp.

Distribution: India [West Bengal (New Record), Madhya Pradesh, Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir) ; Oriental and Palearctic regions.

Remarks: This species seems close to *H. johnsonae* Kim, *H. hesperomydis* (Osborn), *H. intermedia* Kellogg and Ferris, *H. inexpectans* Johnson and *H. sahyadri* Mishra. However, it can be separated from *hesperomydis* by DPHS, posterior process of thoracic sternal plate blunt ; from *intermedia* and *inexpectans* by having both paratergal setae on abdominal segment III which are much longer than the depth of median emergination in female, two long paratergal setae on abdominal segment VII in male ; from *sahyadri* by narrow and acute posterior process of paratergite VII. *H. johnsonae* is best recognised in nympal stage (Kim, 1966). *H. captiosa* is recorded for the first time from West Bengal.

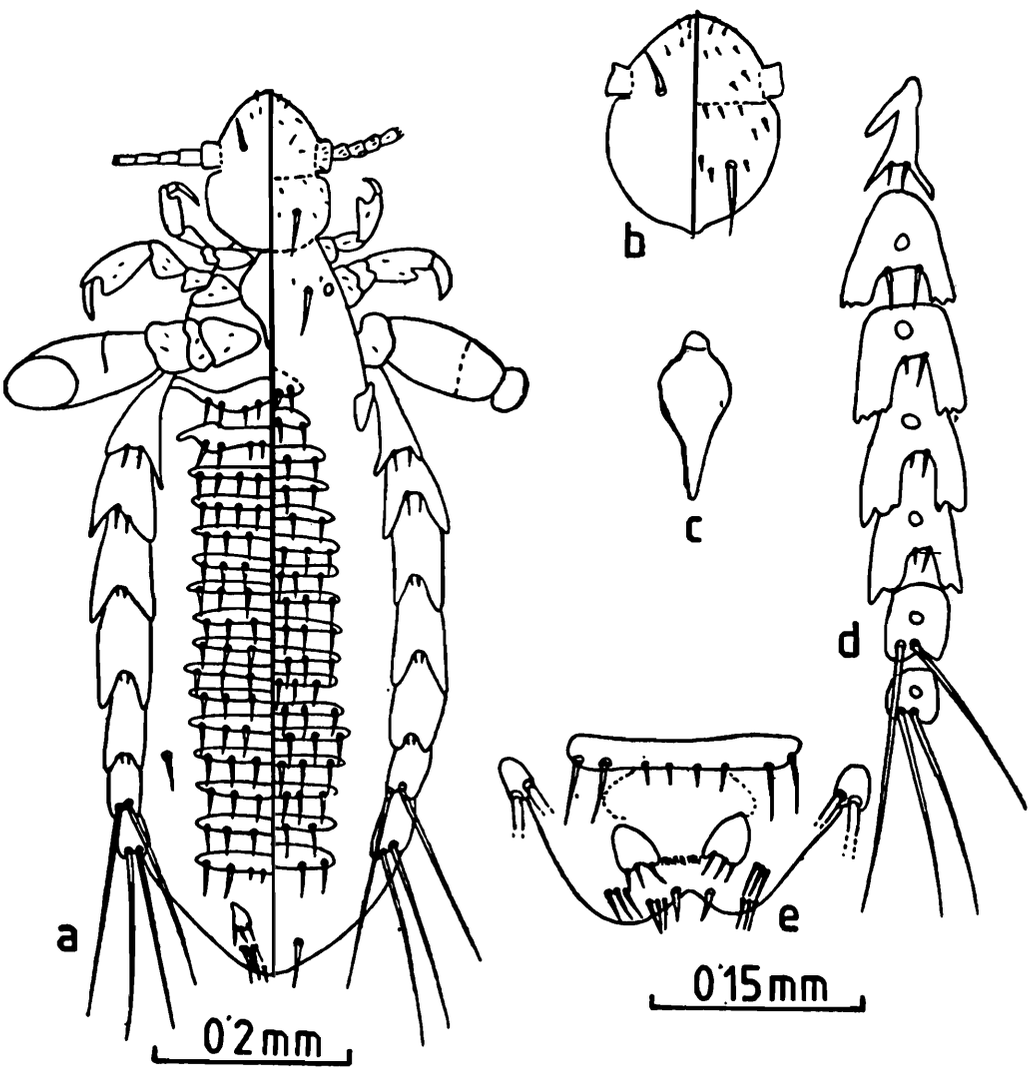
15. **Hoplopleura cutchicus** Mishra and Kaul
(Figs., Plates 24 & 25)

1973. *Hoplopleura cutchicus* Mishra and Kaul, *J. Med. Ent.*, 10 : 43-44, figs. 1-9.
1981. *Haplopleura cutchicus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 33-34.

Female (Fig., Plate 24, a, b, c, d, e): Total body length 0·9 mm ($\bar{X}$, N=5) ; range 0·87 to 0·92 mm. Head (Fig., Plate 24, b): Slightly longer than wide ; dorsal pre-antennal region with 7 pairs of setae, antennal region with one pair and post-antennal region with 10 pairs of setae ; ventrally antennal region only with one pair of setae. Thorax: Sternal plate (Fig., Plate 24, c) 0·09 mm long and 0·04 mm wide ; with small rounded process anteriorly and long tapering posterior process ; MDTS one pair, medium sized. Abdomen: Dorsal: Segment II with a single tergite with 4 setae ; III with 3 tergites having 4 or 5 setae each ; IV to VII each with 3 tergites having 4-6 sword shaped setae each ; VIII with single tergite with 4 setae ; terminal segment with 2 or 3 pairs thin small setae ; DAAS absent. Ventral: Segment II with single sternite with 4 pairs of thin setae ; segment III with 4 sternites, first with 7 and remaining with 6 or 7 setae each ; segment IV to VI, each with 3 sternites having 5-7 setae each ; segment VII with 2 sternites having 6 and 8 setae respectively ; remaining sternites modified to form genitalia ; VAAS 1 pair. Lateral: Paratergites (Fig., Plate 24, d): II typical, setae as long as lobes ; III with posterior process truncated and serrated, both setae extending beyond the lobes ; IV and V each with posterior process broad and truncated, dorsal setae thin and minute, ventral stout but smaller than lobes ; VI bilobed, lobes are narrow, dorsal seta minute, ventral stout and smaller than lobes ; VII and VIII devoid of lobes, both setae long. Genitalia (Fig., Plate 24, e): Genital

plate almost rectangular; gonopods paired, each bilobed, with 4 or 5 thin setae; genital setae slightly enlarged and modified.

PLATE - 24

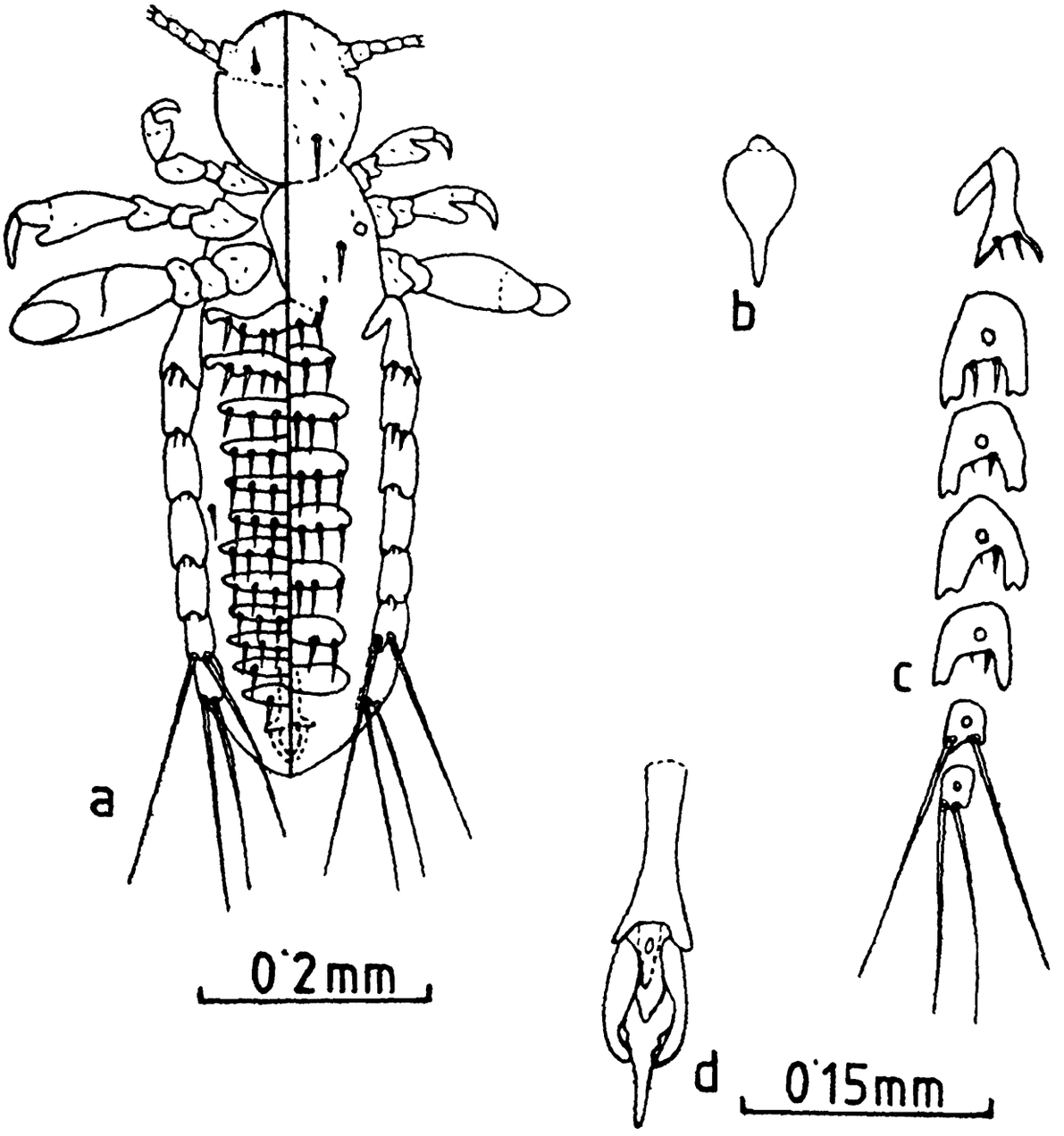


Hoplopleura cutchicus Mishra and Kaul : ♀
a. Whole body (ventral and dorsal views); b. Head; c. Thoracic sternal plate; d. Paratergites; e. Genitalia.

Male: (Fig., Plate 25, a, b, c, d): Total body length 0·65 mm ($\bar{X}$, N=4); range 0·62 mm to 0·68 mm. Head and thorax as in female. Abdomen: Dorsal: Segment II with 2 tergites with 2 and 4 setae respectively; segment III with 2 tergites having 4 setae anteriorly and 6 setae posteriorly; segment IV to VII each with a single tergite having 5-7 setae each; segment VIII with single tergite without

setae ; DAAS absent. Ventral : Segment II with a single sternite having 8 setae ; segment III with 3 sternites, first with 7 and remaining with 6 to 7 setae each ; segment IV to VI each with 2 sternites, having 6 or 7 setae each ; VII and VIII each

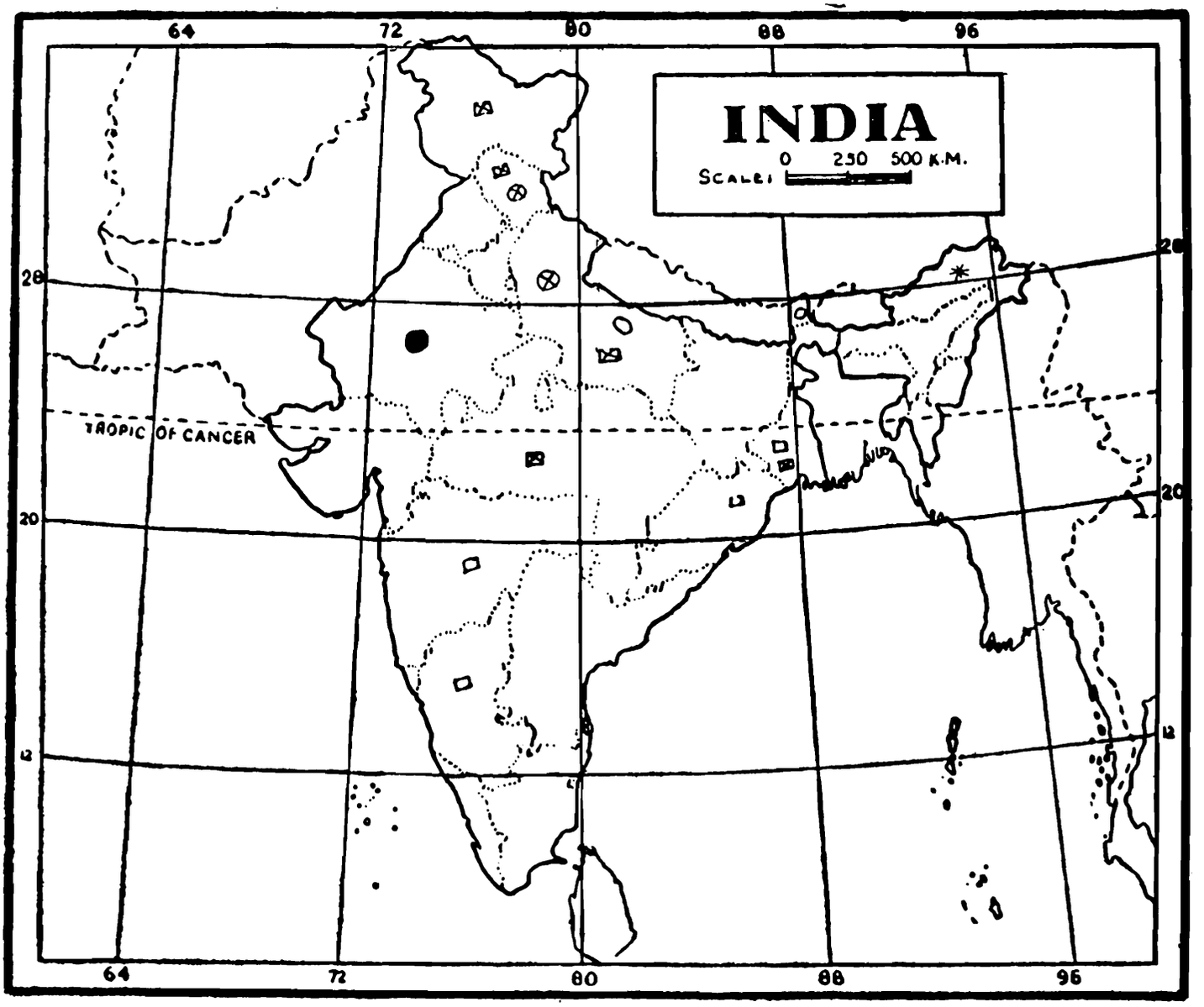
PLATE - 25



Hoplopleura cutchicus Misra and Kaul : ♂

a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

with a single sternite, anterior with 4 and posterior with 2 setae; VAAS one pair. Lateral: Paratergites (Fig., Plate 25, c) as a female. Genitalia (Fig., Plate 25 d): Parameres thickened near the base; pseudopenis curved dorsally and pointed towards tip.



Map showing distribution of
(*) Ancistroplax crocidurae Waterston; (○) Hoplopleura acanthopus (Burmeister); (⊗) H. alticola Mishra land Bhat; (▭) H. blanfordi Mishra and Dhanda; (⊠) H. captiosa Johnson; (●) H. cutchicus Mishra and Kaul.

Nymph : Could not be obtained during present study.

Material examined: 5 ♀♀, 4 ♂♂, from *Rattus cutchicus*; Jodhpur, Rajastan; 17.3.86; Coll. C. C. Adhikary.

Host : *Rattus cutchicus.*

Distribution : India : Rajasthan.

Remarks : This species appears close to *H. blanfordi* Mishra and Dhanda and *H. pacifica* Ewing, but it can be separated by combination of following characters : Posterior process of thoracic sternal plate acute at the tip ; MDTS medium sized ; paratergites IV to VI each with dorsal setae thin and minute, ventral stout and smaller than lobes.

16. **Hoplopleura erismata** Ferris
(Figs., Plates 26 & 27)

1921. *Hoplopleura erismata* Ferris *Contributions toward a monograph of the sucking lice*, Pt. II, 113-115.

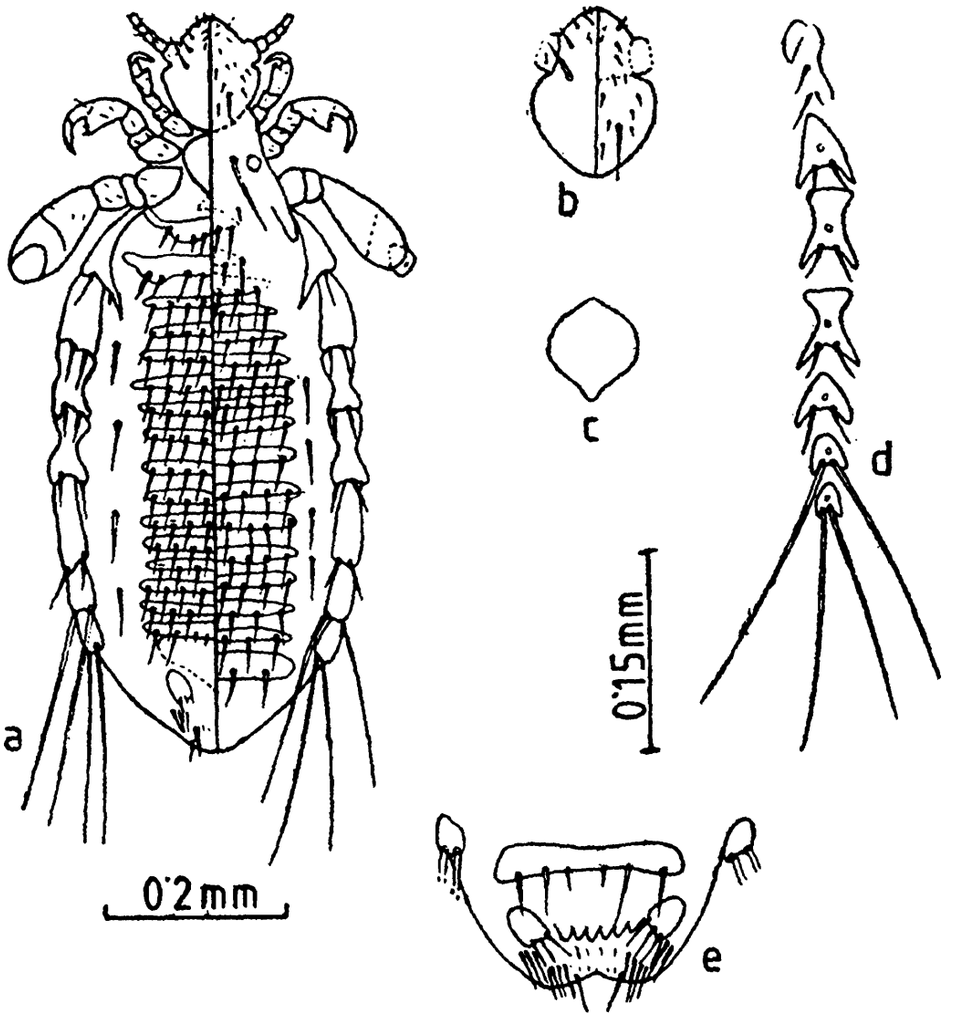
1981. *Hoplopleura erismata*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 34-35.

Female (Fig., Plate 26, a, b, c, d, e) : Total body length 0·76 mm ($\bar{X}$, N=1) ; Head (Fig., Plate 26, b) : Longer than wide ; post antennal angles rounded ; all typical head setae present ; antennal sensoria small and widely separated. Thorax : Sternal plate (Fig., Plate 26, c) 0·07 mm long and 0·03 mm wide ; almost rectangular in shape ; MDTS long. Abdomen : Dorsal : Segment II with a single tergite with 4 setae ; III with 3 tergites each having 6-8 setae ; IV to VII each with 3 tergites, having 7-10 setae each ; terminal segment with 4 setae ; DAAS 4 pairs. Ventral : Segment II with single sternite with 8 setae ; III with 4 sternites, first with 7 and remaining with 7-10 setae each ; IV to VI each with 3 sternites having 6-10 setae each ; VII with 2 sternites, having 6 and 8 setae respectively ; remaining sternites modified to form genitalia : VAAS 4 pairs. Lateral : Paratergites (Fig., Plate 26, d) : II typical, dorsal seta medium sized, ventral minute ; III with small acute posterior processes, setae longer than posterior processes ; IV and V with anterior angles strongly produced towards middle of the body, both setae extends far beyond the processes ; VI with small acute posterior processes, both setae extends beyond the processes ; VII and VIII devoid of processes and both setae long. Genitalia (Fig., Plate 26, e) : Gonopod paired, bilobed ; genital setae enlarged and modified.

Male (Fig., Plate 27, a, b, c, d) : Total body length 0·67 ($\bar{X}$, N=1). Head and thorax as in female. Abdomen : Dorsal : Segment II with a single tergite having 4 setae ; III with 2 tergites having 4 and 7 setae respectively ; IV to VII each with single tergite, having 7-9 setae each ; VIII with single tergite devoid of setae ; DAAS absent. Ventral : Segment II with single sternite having 8 setae ;

III with 3 sternites, anterior with 7 and remaining with 5-8 setae each ; IV to VI each with 2 sternites, having 6-9 setae each ; VII and VIII each with single sternite, former with 4 and latter with 2 setae ; terminal segment with several

PLATE 26



Hoplopleura erismata Ferris : ♀

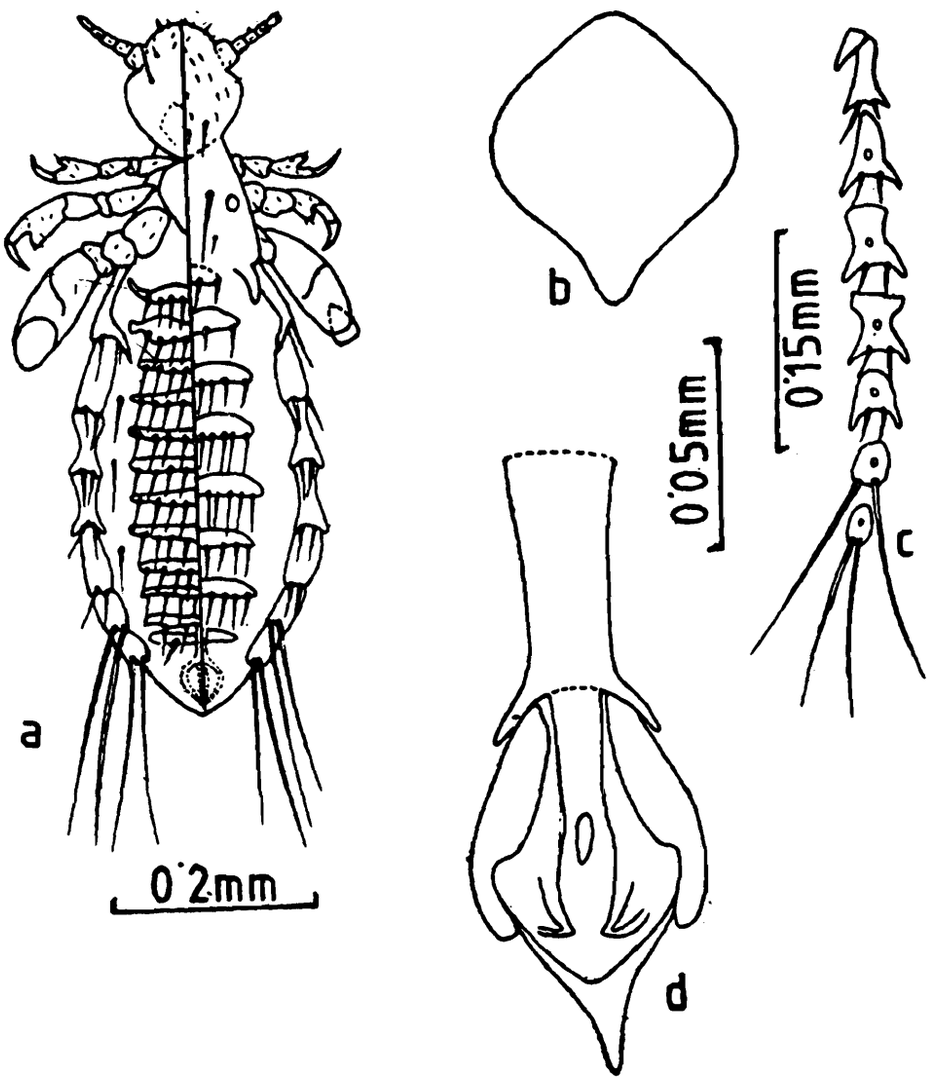
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

minute setae. VAAS 3 pairs. Lateral : Paratergites (Fig., Plate 27, c) as in female. Genitalia (Fig., Plate 27, d) : Parameres almost uniform in thickness with a definite notch at the tip ; pseudopenis narrow.

Nymphs : Unknown.

Material examined : Paratypes. 1 ♀, 1 ♂, (Regd. No. USNM 201408) from *Callosciurus ferrugineus* ; South East Thailand ; 1921 ; Coll. C. F. Ferris.

PLATE - 27



Hoplopleura erismata Ferris : ♂

a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

Host : *Callosciurus ferrugineus*, *C. finlaysoni ferrugineus*, *C. caniceps*, *C. f. tacherdi*, *C. nigrovittatus*, *C. erythraceus*, *C. pygerythrus*, *C. macclellandi* and *Funambulus palmarum*.

Distribution : India (Punjab) ; Burma ; Thailand ; China ; Vietnam and Malayasia.

Remarks : This species seems close to *H. thurmanae* Johnson, *H. maniculata* (Neumann) and *H. distorta* Ferris. It can, however, be separated from *H. thurmanae* by the setae of the paratergites IV to VI which extend much beyond the produced angle of the plates ; from *maniculata* by well developed antero dorsal and antero ventral angles of paratergites IV and V and from *distorta* by broader thoracic sternal plate and outer setae on first sternite of abdominal segment III which are similar to corresponding sternal setae.

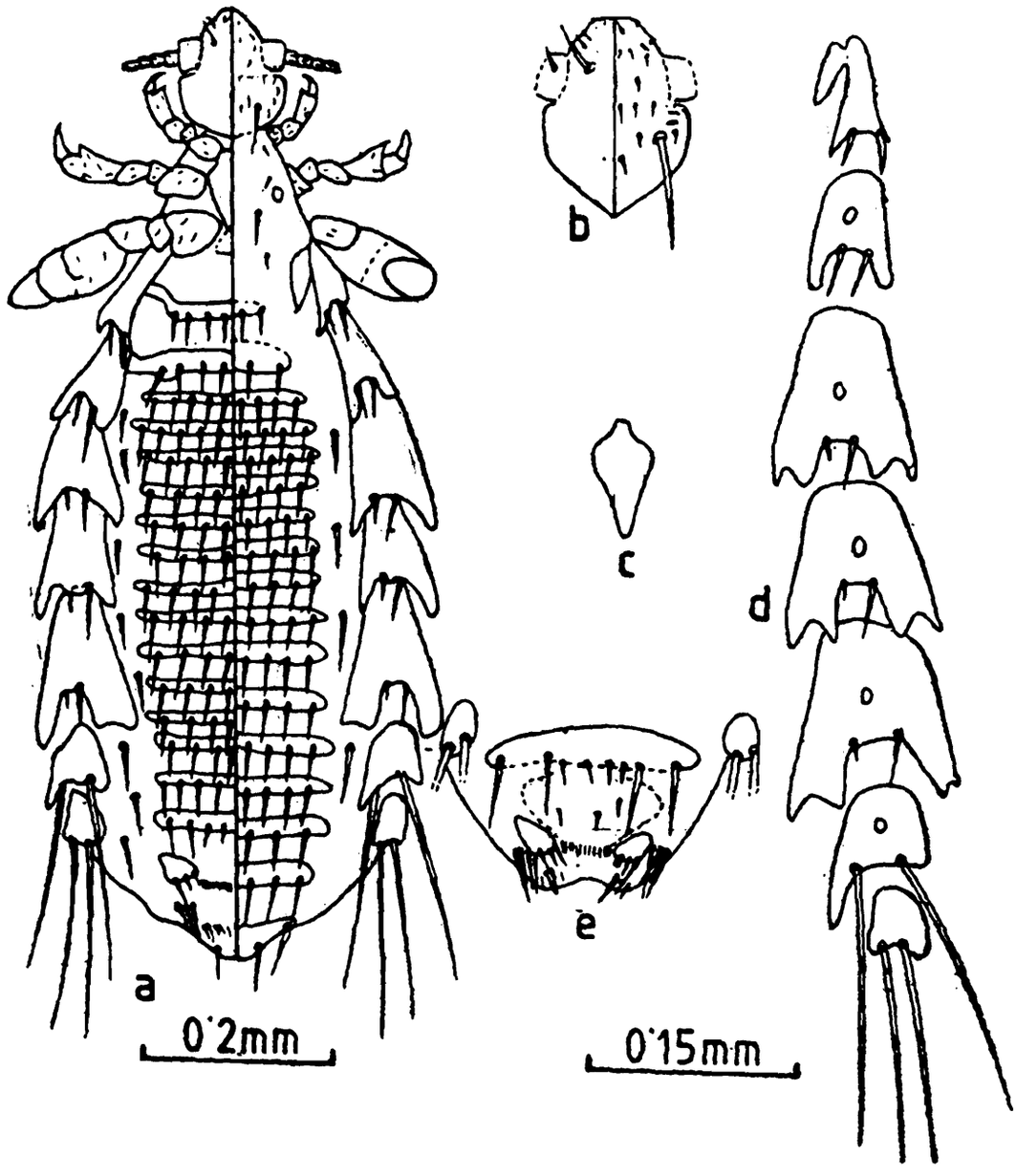
17. **Hoplopleura himalayana** Mishra, Kulkarni and Bhat (Figs., Plates 28 & 29)

1973. *Hoplopleura himalayana* Mishra, Kulkarni and Bhat ; *Oriental Ins.*, 7 : 501-506.
1974. *Hoplopleura himalayana*, Mishra et al., *Indian J. med. Res.*, 62 : 1272.
1981. *Hoplopleura himalayana*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 34-38, figs. 57-64.

Female : (Fig., Plate 28, a, b, c, d, e) : Total body length 0·97 mm (X, N=1) ; Head (Fig., Plate 28, b) : Longer than wide, all typical head setae present ; antennal sensoria contiguous. Thorax : Sternal plate (Fig., Plate 28, c) 0·05 mm long and 0·025 mm wide, with a small anterior process and long posterior process, rounded at tip ; MDTS medium sized. Abdomen : Dorsal : Segment II with a single tergite, having 4 setae ; III with 3 tergites, each having 6-8 setae ; IV to VII each with 3 tergites having 7-10 setae each ; terminal segment with 4 setae ; DAAS 4 pairs. Ventral : Segment II with single sternite with 4 pairs of setae ; III with 4 sternites, first with 7 and remaining with 7-10 setae each ; IV to VI each with 3 sternites having 6-10 setae each ; VII with 2 sternites having 7 and 8 setae respectively ; VAAS 8 pairs. Lateral : Paratergites (Fig., Plate 28, d) : II typical, dorsal seta is similar to corresponding process and ventral seta is shorter than corresponding process ; III with both processes broad and truncated, setae extends beyond the lobes ; IV to VI, each with both lobes truncated and slightly emerginate, with pointed outer angles posteriorly, dorsal seta minute, ventral as long as process ; VII with dorsal process narrow, ventral lobe absent, both setae long. VIII devoid of processes, both setae long. Genitalia (Fig., Plate 28, e) : Gonopods paired ; genital seta enlarged and modified.

Male (Fig., Plate 29, a, b, c, d) : Total body length 0·68 mm ($\bar{X}$, N=1) ; Head and thorax as in female. Abdomen : Dorsal : Segment II with a single tergite, having 4

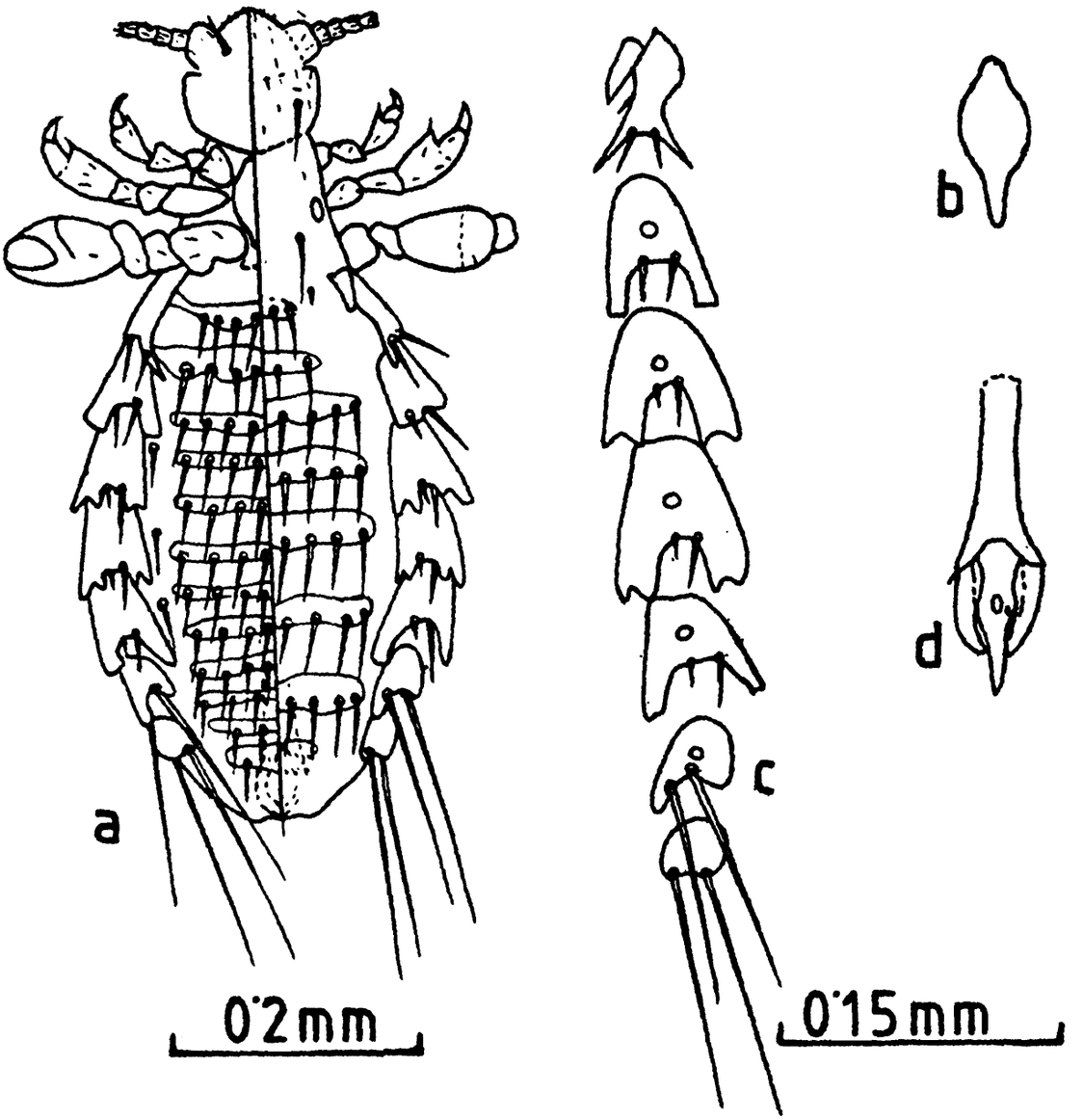
PLATE - 28



Hoplopleura himalayana Mishra, Kulkarni and Bhat : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

setae ; III with 2 tergites, having 4 and 8 setae respectively ; IV to VII each with single tergite, having 7-10 setae each ; VIII devoid of tergites without setae ;

PLATE - 29



Hoplopleura himalayana Mishra, Kulkarni and Bhat : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ;
c. Paratergites ; d. Genitalia.

DAAS absent. Ventral : Segment II with single sternite, having 8 setae ; III with 3 sternites, anterior with 7 and remaining with 5-9 setae each ; IV to VI, each with 2 sternites, having 6-9 setae each ; VII and VIII with single sternite, with 4 and 2 setae respectively ; terminal segment with several minute setae ; VAAS 3 pairs. Lateral : Paratergites (Fig., Plate 29, c) as in female. Genitalia (Fig., Plate 29, d) : Parameres thickened near the base ; pseudopenis pointed towards tip.

Nymphs : Were not obtained during present study. Descriptions is based on Mishra, 1981.

Nymph 1 : Head : Longer than wide ; anterior margin straight ; post-antennal and posterolateral angles not prominent ; central setae, oral setae, ventral principal head setae and antennal setae distinct ; DPHS one pair, medium sized ; ventral surface of head and antennae with sparsely scattered tubercles. Thorax : Mesothoracic spiracle distinct ; sternal plate absent ; MDTS one pair. Abdomen : Dorsal side with indistinct segmentation ; dorsal and ventral abdominal setae absent ; major abdominal setae one pair on each side ; accessory and anal setae indistinct.

Nymph 2 : Similar to nymph 1 except thorax with 2 pairs of accessory dorsal thoracic setae ; third pair of legs larger than second pair ; abdomen devoid of distinct segmentation ; 2 or 3 small leathery patches present dorsally at lateral extremities ; anal setae 2 pairs.

Nymph 3 : Same as in nymph 2 except that abdomen with 7 pairs of distinct leathery patches laterally.

Material examined : Paratype : 1 ♀, 1 ♂ (Regd. No. V.R.C. A 82028) from *Apodemus flavicollis* ; Kothi Kulu, Himachal Pradesh ; 2.10.67 ; Coll. S.M. Kulkarni.

Host : *Apodemus flavicollis*.

Distribution : India (Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir).

Remarks : This species appears close to *H. akanezumi* Sesa, *H. hmianezumi* Kaneko and *H. cutchicus* Mishra and Kaul. But, it can be separated from *H. akanezumi* by minute MDTS ; from *H. hmianezumi* by broad dorsal lobe of paratergite III and shape of the thoracic sternal plate and from *H. cutchicus* by narrow dorsal lobe of parategite VII.

18. **Hoplopleura khandala** Mishra
(Figs., Plate 30 & 31)

1981. *Hoplopleura khandala* Mishra, *Rec. Zool. Surv. India, Occ. Paper.* 21 : 38-42.

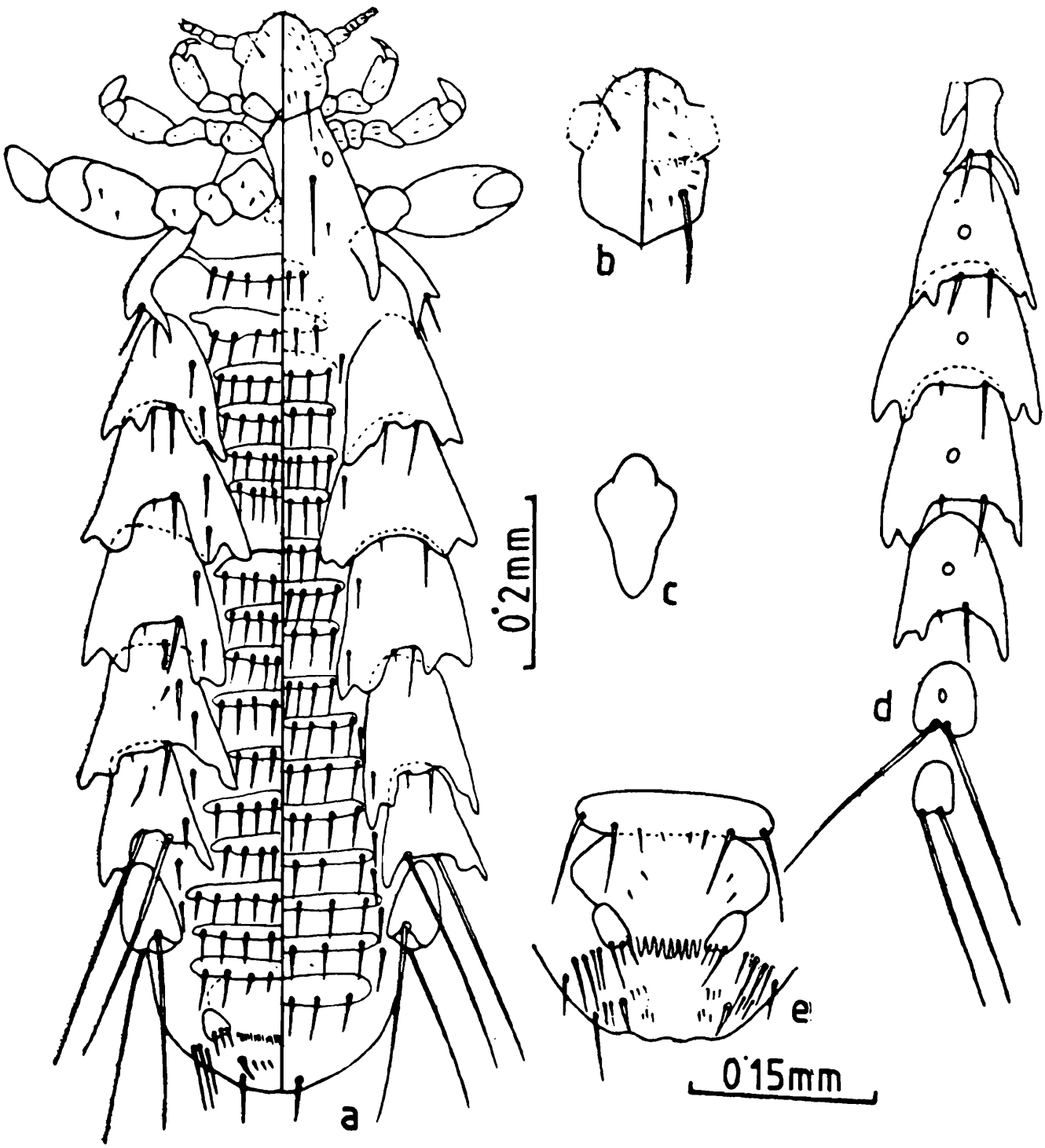
Female (Fig., Plate 30, a, b, c, d, e) : Total body length 1·25 mm ($\bar{X}$, N=1); Head (Fig., Plate 30, b) : Longer than wide ; all typical head setae present, DPaHS not in straight line, antennal sensoria contiguous. Thorax : Sternal plate (Fig., Plate 30, c) 0·087 mm long and 0·052 mm wide ; pear shaped, posterior process rounded at tip. MDTS long, one pair. Abdomen : Dorsal : Segment II with single tergite having 4 setae ; segment III to VII each with 3 tergites having 5-10 setae each, except first tergite of segment III which bear only 4 setae ; VIII and terminal segment with a single tergite each, having 5 and 2 setae respectively ; DAAS 10 pairs. Ventral : Segment II with a single sternite having 8 setae ; III with 4 sternites, first with 7 and remaining with 7-9 setae each ; IV to VI each with 3 sternites, having 6 to 8 setae each ; VII with 2 sternites having 9 and 8 setae respectively ; remaining sternites modified to form genitalia ; VAAS 12 pairs. Lateral : Paratergites (Fig., Plate 30, d) : II typical, with 2 setae, dorsal smaller, and ventral longer than lobes ; III to V, each bilobed, lobes emerginate and serrated ; III with both setae extends beyond the processes ; IV and V each dorsal seta minute, ventral longer than processes. VI with dorsal lobe broad and emerginate, ventral lobe almost acute, dorsal seta minute, ventral longer than lobes ; VII and VIII devoid of lobes, with 2 long setae each. Genitalia (Fig., Plate 30, e) : Genital plate wide anteriorly and narrow posteriorly with 4 setae ; gonopods paired, 3 setae on each ; genital setae enlarged and tapering.

Male (Fig., Plate 31, a, b, c, d) : Total body length 0·85 mm ($\bar{X}$, N=1); Head and thorax as in female. Abdomen : Dorsal : Segment II as in female ; III with 2 tergites, anterior with 4, posterior with 8 setae ; IV to VII, each with a single tergite, having 7-9 setae each ; VIII with a single tergite, devoid of setae ; DAAS 5 pairs. Ventral : Segment II as in female ; III with 3 sternites, first one as in female, remaining with 8 setae each ; IV to VI each with 2 sternites, 5-7 setae each ; VII and VIII, each with a single sternite with 4 and 2 setae respectively ; terminal segment with several minute setae ; VAAS 4 pairs. Lateral : Paratergites (Fig., Plate 31, c) as in female. Genitalia (Fig., Plate 31, d) : Parameres thickened near the base ; pseudopenis with serrated sides and pointed.

Nymphs could not be obtained during present study. Description is based on Mishra (1981).

Nymph 1 : Head : Approximately as long as wide ; post-antennal and occipital angles rounded ; all typical head setae present except DPoCHS and DAcHS,

PLATE 30

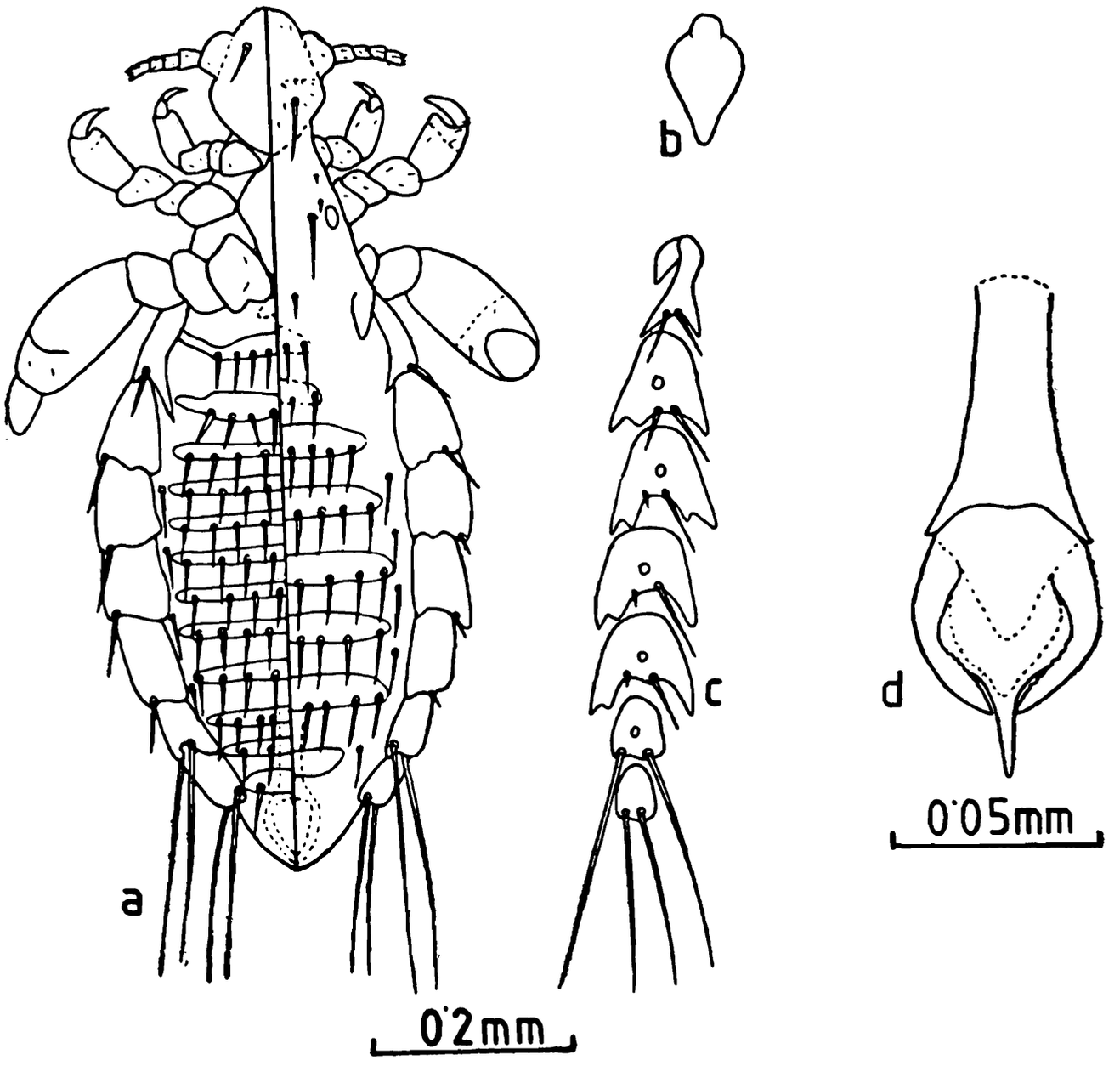


Hoplopleura khandala Mishra : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

indistinct; ventral side of head and antennae with sparsely scattered tubercles; DMHS 2 pairs. Thorax: Sternal plate absent; MDTS one pair; first pair of leg

PLATE - 31



Hoplopleura khandala Mishra : ♂

a. Whole body (ventral and dorsal views); b. Thoracic sternal plate; c. Paratergites; d. Genitalia.

smallest ; second and third pair of legs larger but similar size. Abdomen : Dorsally with 8 distinct segments ; ventrally unsegmented, scaly with small trachae ; dorsal central abdominal setae absent ; ventral central abdominal setae 7 pairs ; a single long major abdominal seta and anal setae one pair.

Nymph 2 : Similar to nymph 1 except head with DMHS 3 pairs ; thorax with third pair of legs larger than second pair ; abdomen devoid of segmentation ; accessary abdominal setae 3 pairs ; dorsal, ventral and central abdominal setae absent.

Nymph 3 : Similar to nymph 2 except abdomen with 8 transverse rows of long setae, arranged in 3 groups.

Material examined : Paratypes 1 ♀, 1 ♂, (Regd.. No. V.R.C. AA 3197) from *Golunda ellioti* ; Khandala, Pune, Maharastra ; 26.11.75 ; Coll. A.C. Mishra.

Host : *Golunda ellioti.*

Distribution : India (Maharastra).

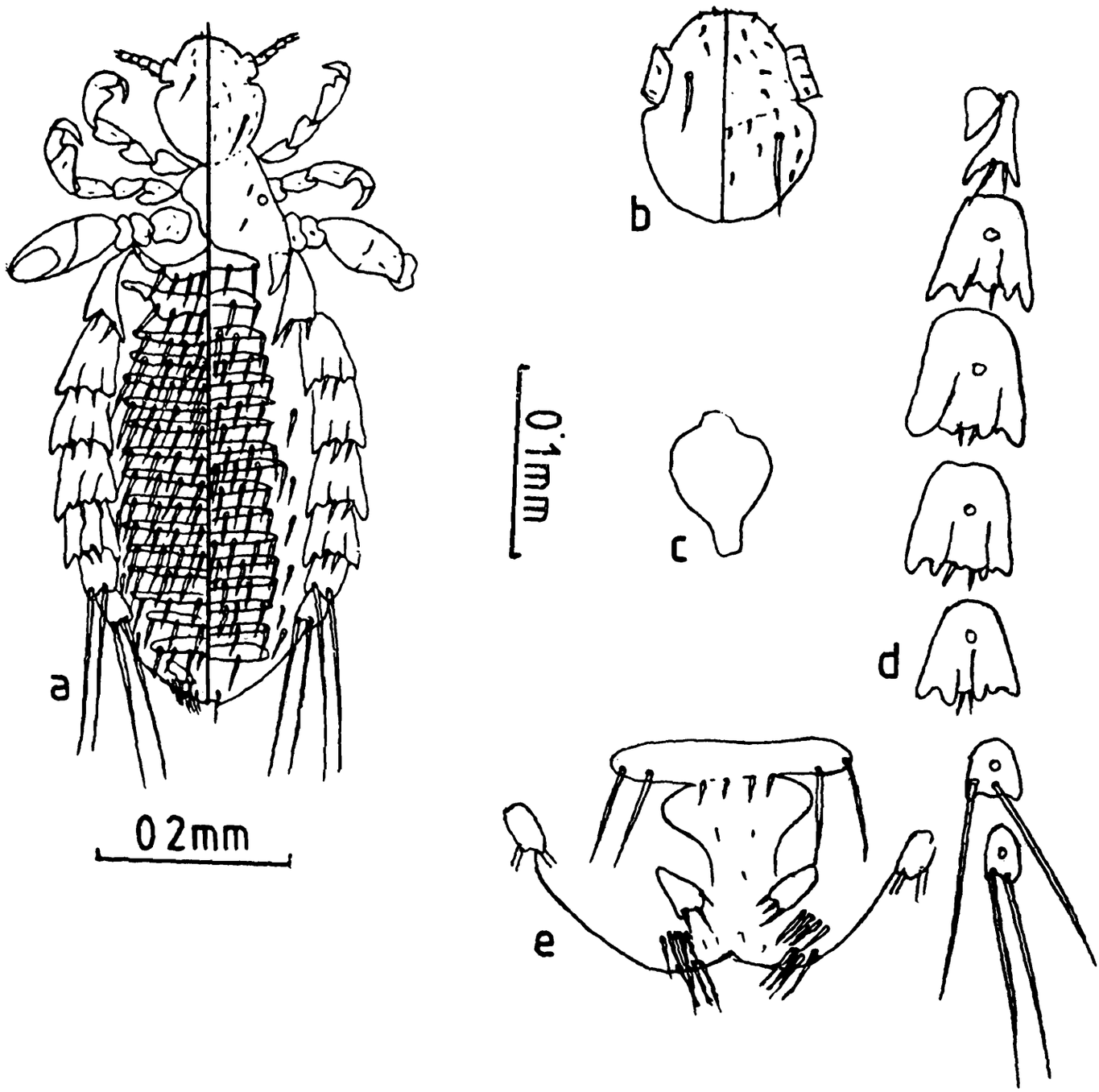
Remarks : This species appears close to *H. pacifica* Ewing and *H. silvula* Johnson. It can be separated from *H. pacifica* by broader dorsal processes than ventral ones on paratergites III to V and from *H. silvula* by dorsal and ventral processes of paratergite VII.

19. **Hoplopleura kondana** Mishra
(Figs., Plates 32, 33 & 34)

1981. *Hoplopleura kondana* **Mishra**, *Rec. Zool. Surv. India. Occ. Paper*, 21 : 42-46.

Female (Fig., Plate 32, a, b, c, d, e) : Total body length 0·69 mm ($\bar{X}$, N=10) ; range 0·59 to 0·75 mm. Head (Fig., Plate 32, b) : Longer than wide ; post-antennal angles rounded ; all typical head setae present ; antennal sensoria contiguous. Thorax : Sternal plate (Fig., Plate 32, c) 0·073 mm long and 0·05 mm wide ; pear shaped with anterior process small and rounded, posterior process long ; MDTS one pair, medium sized. Abdomen : Dorsal : Segment II with a single tergite having 2 rows of setae, with 2 and 4 setae respectively ; III to VII each with 3 tergites, each having 5-10 setae except first tergite of III which bear 4 thin setae ; VIII and terminal segment each with single tergite, having 2 setae each ; DAAS 3-6 pairs. Ventral : Segment II with single tergite having 8 setae ; III with 4 sternites, first with 7 and remaining with 6-7

PLATE - 32

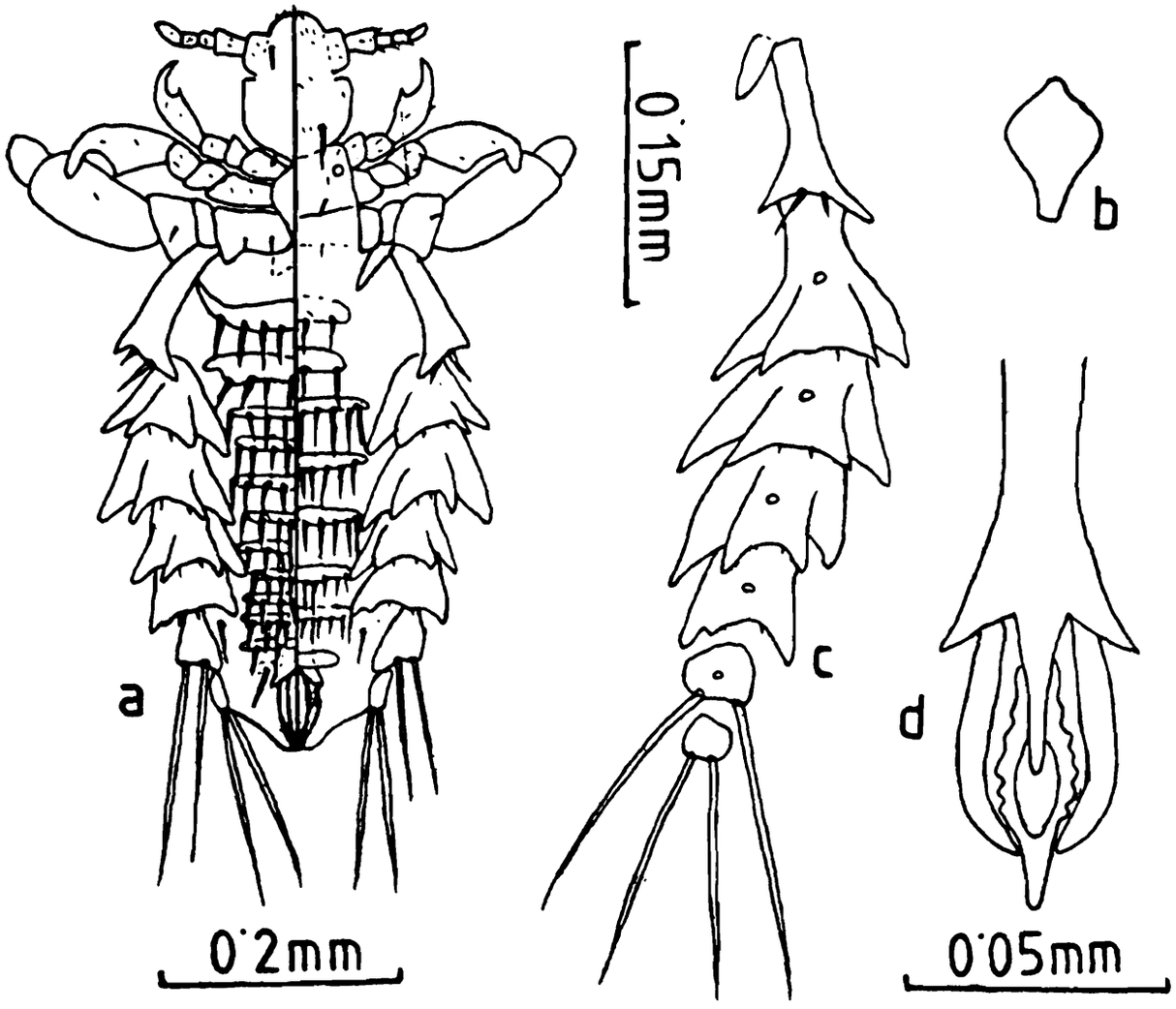


Hoplopleura kondana Mishra : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

setae each ; IV to VI, each with 3 sternites having 5-9 setae each ; VII with 2 sternites having 5 to 7 setae anteriorly and 8 setae posteriorly ; VAAS 1-3 pairs. **Lateral :** Paratergites (Fig., Plate 32, d) : II typical, dorsal seta longer than ventral ; III to VI, both lobes further divided into 2 lobes of almost equal size with somewhat rounded apices, median emergination with 2 small setae each except III which has only ventral seta ; VII and VIII devoid of lobes, both setae long.

PLATE - 33

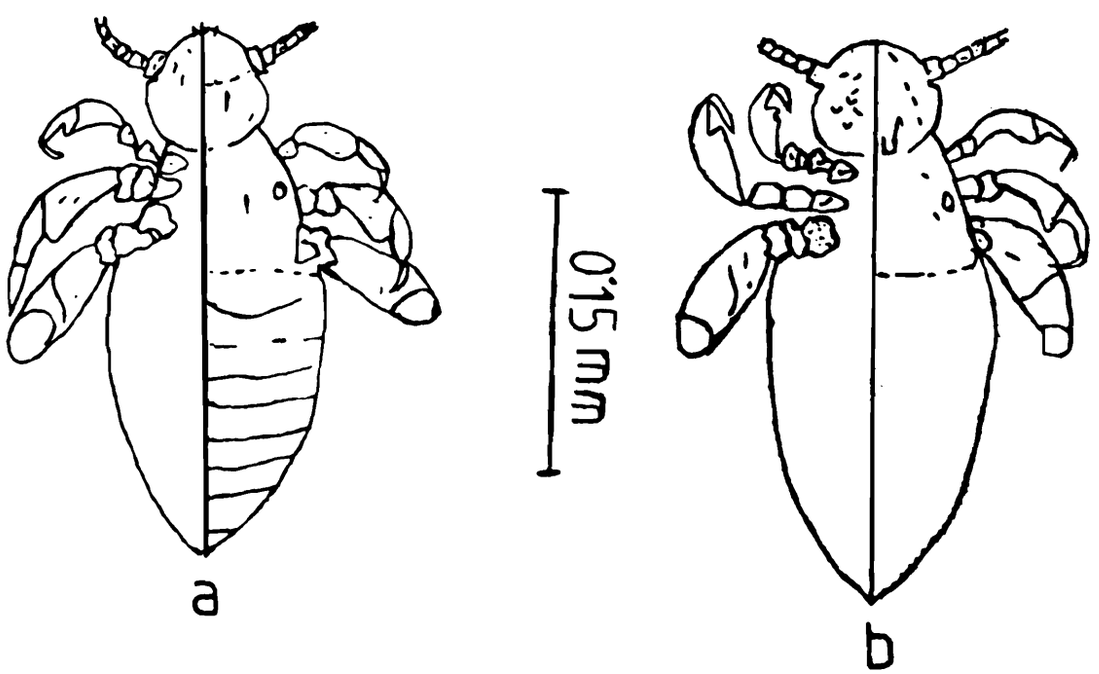


Hoplopleura kondana Mishra : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

Genitalia (Fig., Plate 32, e) : Gonopods with 3 or 4 setae each ; each genital lobe with 7-9 setae.

Male (Fig., Plate 33, a, b, c, d) : Total body length 0·62 mm ($\bar{X}$, N=10) ; range 0·58 to 0·65 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II as in female ; III with 2 tergites, anterior with 4, posterior with 8-10 setae ; IV to VII, each with a single tergite, 7-10 setae each ; VII with a single tergite without setae ; DAAS 1-2 pairs. Ventral : Segment II as in female ; III with 3 sternites, first as in female, remaining 2 with 7-8 setae each ; IV to VI, each with two sternites, having 7-9 setae each ; VII and VIII, each with single sternite having 4 and 2 setae respectively ; VAAS 1-2 pairs. Lateral : Paratergites (Fig., Plate 33, c) as in female except ventral lobe of paratergite VI which is not

PLATE - 34



Nymphs of *Hoplopleura kondana* Mishra
a. Nymph 1 ; b. Nymph 2.

subdivided. Genitalia (Fig., Plate 33, d) : Parameres thickened near the base ; pseudopenis serrated and pointed towards tip.

Nymph 1 (Fig., Plate 34, a) : Head : Almost as long as wide, post-antennal and posterolateral angles not developed ; all typical head setae present except DPoCHS which is indistinct. Thorax : Sternal plate absent ; MDTS minute, one pair ; first pair of legs smallest with slender claw ; second and third pair larger, equal in size with strong claw. Abdomen : 8 distinct segments dorsally ; ventrally unsegmented with small numerous trachae ; dorsal and ventral central abdominal setae absent ; accessary and anal setae indistinct.

Nymph 2 (Fig., Plate 34, b) : Same as in nymph 1 except head with DPoCHS distinct. Thorax with 2 pairs of accessary dorsal thoracic setae ; third pair of leg larger than second pair. Abdomen : Devoid of segmentation ; ventral side scaly with numerous small trachae ; ventral setae 5 pairs.

Nymph 3 : Similar to nymph 2.

Material examined : 10 ♀ ♀, 10 ♂ ♂, from *Millardia kondana* ; Singharh, Pune, Maharastra ; 11.7.84 ; Coll. C. C. Adhikary and A. C. Mishra.

Host : *Millardia kondana, M. meltada.*

Distribution : India (Maharastra, Rajasthan, Jammu & Kashmir).

Remarks : This species seems close to *H. mylomydis* Ferris, *H. enormis* Kellogg and Ferris, *H. pelomydis* Ferris and *H. spiculifer* (Gervain). It can be separated from all these species except *mylomydis* by the absence of lobes on paratergites VII and VIII and by absence of ventral seta on paratergite III ; from *mylomydis*, it can be separated by postero-dorsal process on paratergites III to VI which are almost equal to corresponding lobes.

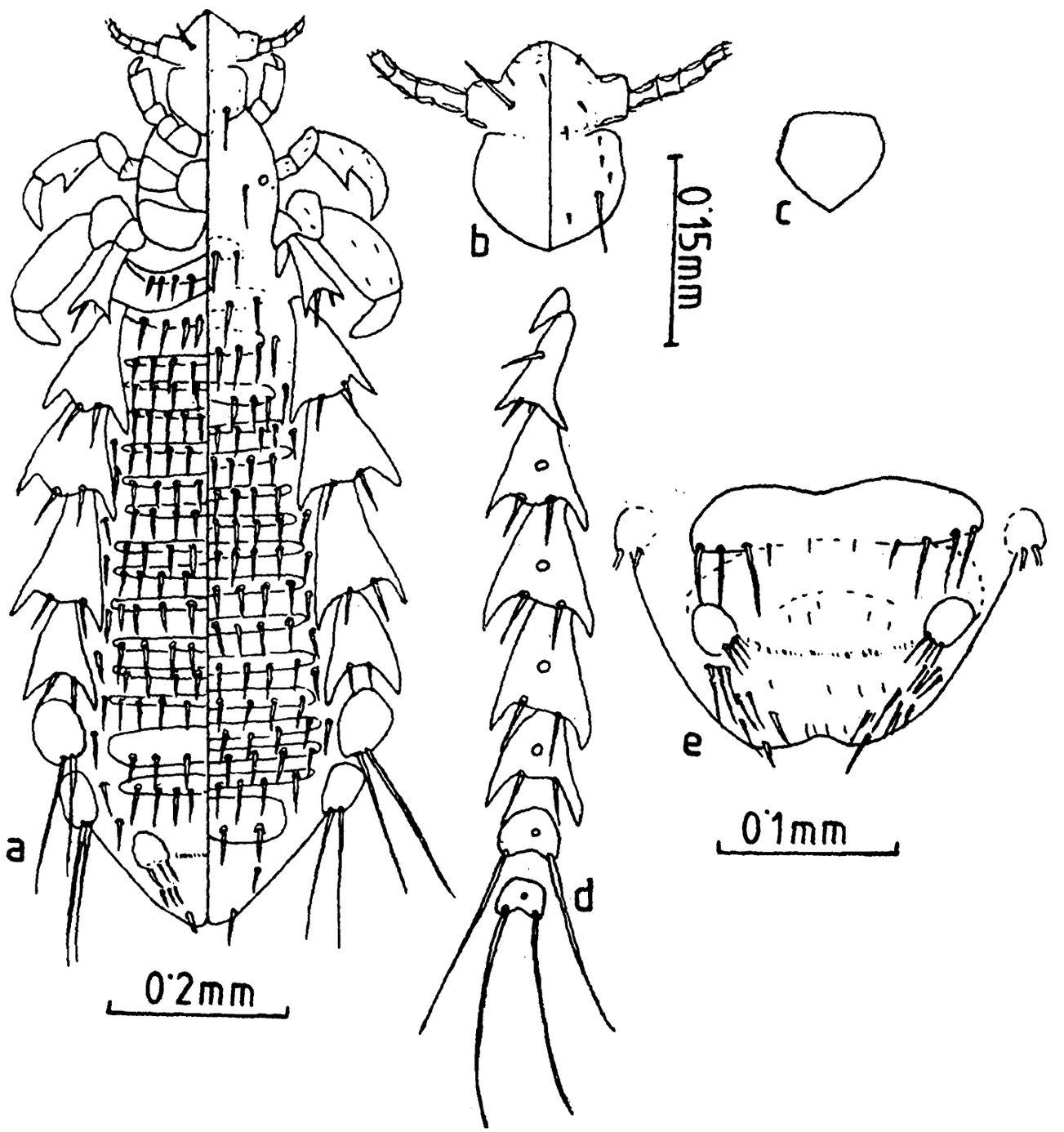
20. **Hoplopleura maniculata** (Neumann)
(Figs., Plates 35, 36 & 37)

1909. *Haematopinus* (*Polyplax*) *maniculatus* Neumann, *Arch. Parasit.* ; 13 : 521-23.
1921. *Hoplopleura maniculata*, Ferris, *Contributions towards a monograph of the sucking lice*, pt II : 112-13.
1962. *Hoplopleura mitsuii* Kaneko, *Bull. Tokyo Med. Dent. Univ.*, 9 : 129-132.
1981. *Hoplopleura maniculata*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 48-51.
1992. *Hoplopleura maniculata*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : 9.

Female (Fig., Plate 35, a, b, c, d, e) : Total body length 1 mm ($\bar{X}$, N = 15) ; range 0·88 mm to 1·52 mm. Head (Fig., Plate 35, b) : Longer than wide ; all typical

head setae present, post-antennal angles rounded ; antennal sensoria separate. Thorax : Sternal plate (Fig., Plate 35, c) 0·07 mm long and 0·06 mm wide with anterior and

PLATE - 35

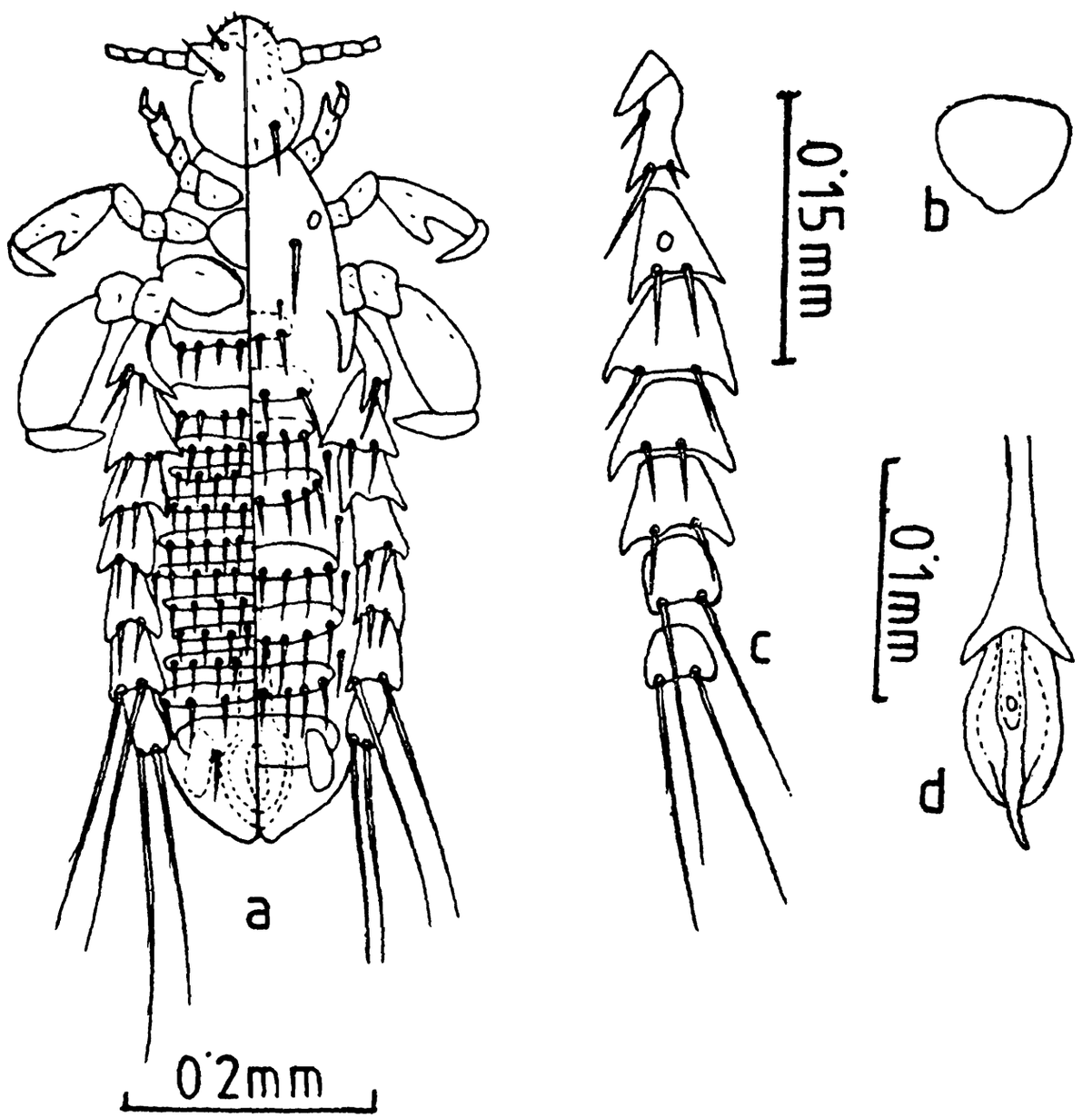


Hoplopleura maniculata (Neumann) : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sernal plate ; d. Paratergites ; e. Genitalia.

posterior processes absent. MDTS long sized. Abdomen : Dorsal : Segment II with single tergite having 2 rows of setae, anterior with 2 and posterior with 4 setae ; III

PLATE - 36

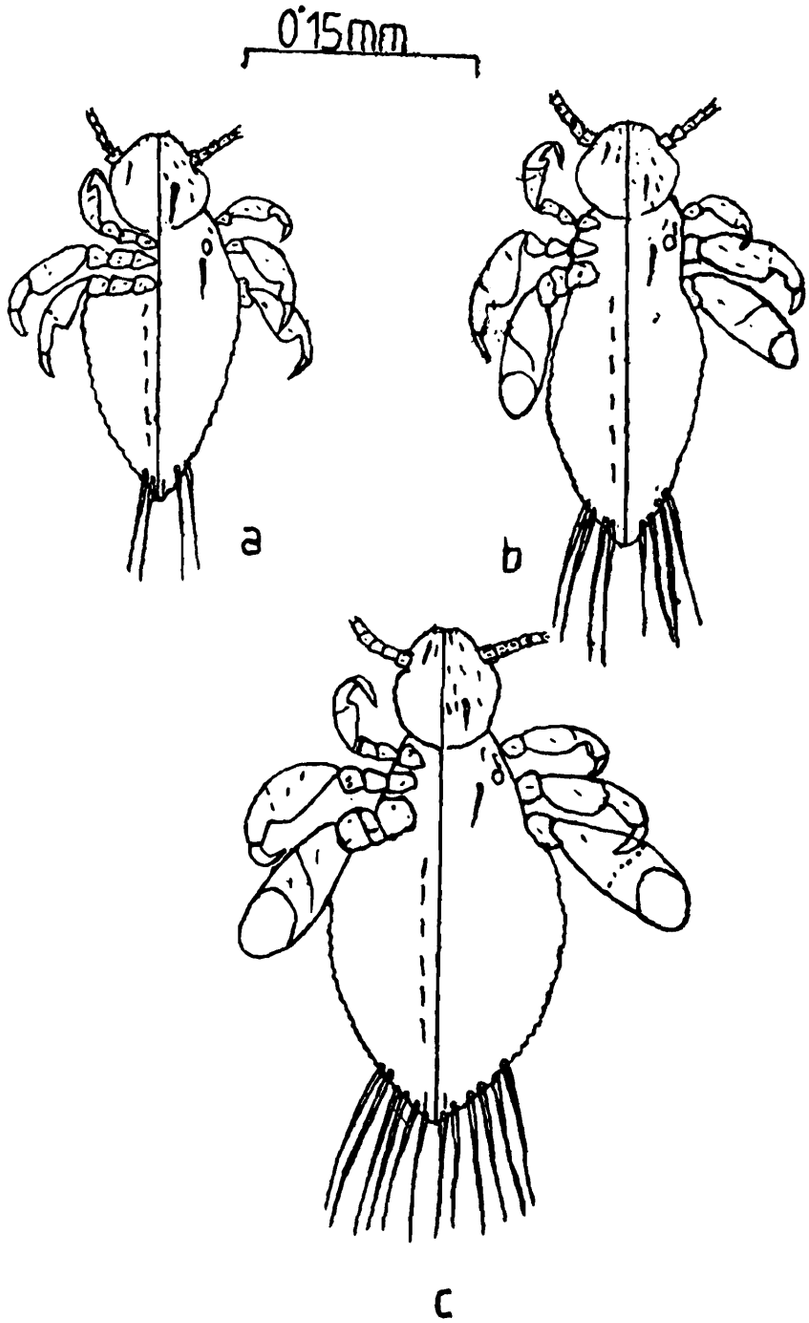


Hoplopleura maniculata (Neumann) : ♂

a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

to VII, each with 3 tergites, each having 6-10 setae except first tergite of III segment which bear 4 thin setae ; VIII and terminal segment, each with single tergite having 4 and 2 setae respectively ; DAAS 10-12 pairs. Ventral : Segment II with single tergite having 8 setae,

PLATE - 37



Nymphs of *Hoplopleura maniculata* (Neumann)
a. Nymph 1 ; b. Nymph 2 ; c. Nymph 3.

III with 4 sternites, first with 7 and remaining with 6-8 setae each ; IV to VI each with 3 sternites having 6-9 setae each ; VII with 2 sternites having 6-8 setae anteriorly and 8 setae .posteriorly ; VAAS 9-11 pairs. Lateral : Paratergites (Fig., Plate 35, d) : II typical, dorsal seta medium sized, ventral minute ; III to VI, each with small acute posterior processes, both setae longer than posterior processes ; VII and VIII devoid of processes, both setae long. Genitalia (Fig., Plate 35, e) : Gonopods paired ; genital seta enlarged and modified.

Male (Fig., Plate 36, a, b, c, d) : Total body length 0·66 mm ($\bar{X}$, N=10) ; range 0·57 to 0·72 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II as in female ; III with 2 tergites, anterior with 4, posterior with 8-10 setae ; IV to VII each with single tergite, 7-10 setae each ; VIII with single tergite without setae ; DAAS 1-4 pairs. Ventral : Segment II as in female ; III with 3 sternites, first as in female, remaining with 7-9 setae each ; IV to VI each with 2 sternites, with 7-9 setae each ; VII and VIII each with single sternite having 4 and 2 setae respectively. VAAS 3-4 pairs ; ventral terminal segment is provided with a pronounced lobe like extension on each side. Lateral : Paratergites (Fig., Plate 36, c) as in female. Genitalia (Fig., Plate 36, d) : Parameres with a definite notch at the tip ; pseudopenis slightly pointed towards tip.

Nymph 1 (Fig., Plate 37, a) : Head as long as wide ; all typical head setae well developed and distinct ; antennal sensoria small and separate. Thorax : Sternal plate absent ; MDTS one pair, small ; first pair of legs small with slender claw ; second and third pair considerably larger and equal in size. Abdomen : Devoid of segmentation ; major abdominal setae one pair on each side ; ventral central abdominal setae 6 pairs, anal setae 2 pairs.

Nymph 2 (Fig., Plate 37, b) : Same as in nymph 1 except anterior dorsal thoracic setae 2 pairs ; third pair of legs larger than second ; major abdominal setae 2 pairs on each side.

Nymph 3 (Fig., Plate 37, c) : Same as in nymph 2 except 3 pairs of marginal setae on abdomen on each side.

Material examined : 15 ♀♀, 10 ♂♂, from *Funambulus palmarum*, *F. pennanti* ; Purulia, Bankura, West Bengal ; 15.9.85, 18.1.85 ; Coll. C. C. Adhikary.

Hosts : *Funambulus palmarum*, *F. pennanti* and *F. tristriatus*.

Distribution : India [West Bengal (New record) ; Maharastra, Gujarat, Madhya Pradesh, Uttar Pradesh, Himachal Pradesh, Tamil Nadu (New record)] ; Sri Lanka.

Remarks : This species seems close to *H. erratica* (Osborn), *H. arboricola* Kellogg and Ferris and *H. erismata* Ferris. However, it can be separated from *erratica* by well developed tergites and sternites ; from *arboricola* by a short seta on either end of the median sternites on abdominal segments V and VI and from *erimata* by the absence of lateral angles on paratergite V and VI.

21. Hoplopleura malabarica Werneck
(Figs., Plates 38, 39 & 40)

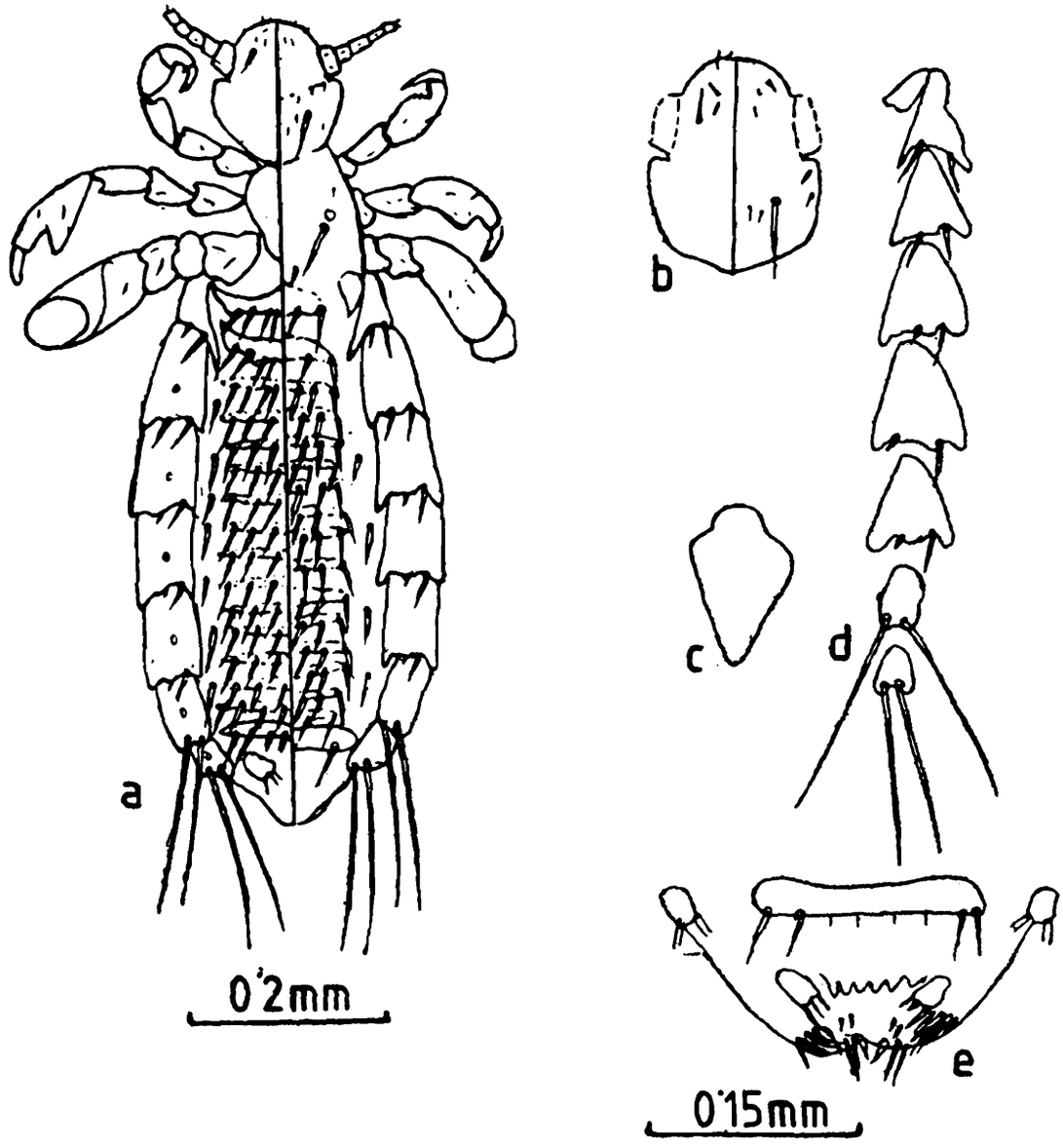
1954. *Hoplopleura malabarica* Werneck, *Rev. Brazil. Biol.*, 14 : 113-116.
1959. *Hoplopleura malabarica*, Johnson, *Proc. U.S. Nat. Mus.*, 110 : 575.
1966. *Hoplopleura malabarica*, Kim, *Parasitology*, 56 : 611.
1981. *Hoplopleura malabarica*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 46-47.
1987. *Hoplopleura malabarica*, Adhikary, *Bull. Zool. Surv. India*, 8 (1-3), 127-130.
1992. *Hoplopleura malabarica*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : 9.

Female (Fig., Plate 28, a, b, c, d, e) : Total body length 0·8 mm ($\bar{X}$, N = 10) ; range 0·72 to 0·91 mm. Head (Fig., Plate 38, b) : Slightly longer than wide ; post-antennal angles rounded ; all typical head setae present ; antennal sensoria contiguous. Thorax : Sternal plate (Fig., Plate 38, c) 0·085 mm long 0·061 mm wide ; pear shaped with anterior process small, posterior process rounded at apex ; MDTS long. Abdomen : Dorsal : Segment II with a single tergite, 2 rows of setae, anterior with 2 minute and posterior with 4 elongated setae ; III with 3 tergites, first distinct, others being narrow and indistinct, having 4-6 setae each ; IV to VII, each with 3 indistinct very narrow tergites, having 6-10 sword shaped setae each ; VIII and terminal segment, each with single tergite, having 4 and 2 setae respectively ; DAAS 4-6 pairs. Ventral : Segment II with a single sternite, having 8 setae ; III with 4 sternites, first distinct, having 7 setae, remaining very narrow, indistinct, having 7-8 setae each ; IV to VI, each with very narrow 3 indistinct sternites, having 6-9 setae each ; VII with 2 narrow sternites with 8 setae each ; remaining sternites modified to form genitalia ; VAAS 7-9 pairs. Lateral : Paratergites (Fig., Plate 38, d) : II typical, dorsal seta much longer than ventral ; III with dorsal and ventral posterior angle long and acute, both setae long ; IV to VI, each with dorsal posterior lobes notched, ventral posterior outer angle well developed and pointed, ventral seta long and dorsal seta minute ; VII and VIII devoid of lobes, with 2 long setae each. Genitalia (Fig., Plate 38, e) : Gonopods paired with 3-4 setae each ; genital seta slightly enlarged.

Male (Fig., Plate 39, a, b, c, d) : Total body length 0·66 mm ($\bar{X}$, N = 10) ; range 0·58 to 0·71 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II as in female ; III with 2 tergites, anterior distinct, with 4 setae, posterior narrow, indistinct, having 8 setae ; IV to VI, each with single narrow indistinct tergite having 8-10 setae each ;

VII with a single narrow tergite, having 10 setae ; VIII with single tergite without setae. DAAS 4-5 pairs. Ventral : Segment II as in female. Segment III with 3 sternites, first as in female, remaining with indistinct and narrow sternites, having 7 or 8 setae each ; IV to VI, each with 2 very narrow sternites, having 6-9 setae each ; VII and VIII, each with a single sternite having 4 and 2 setae respectively.

PLATE - 38

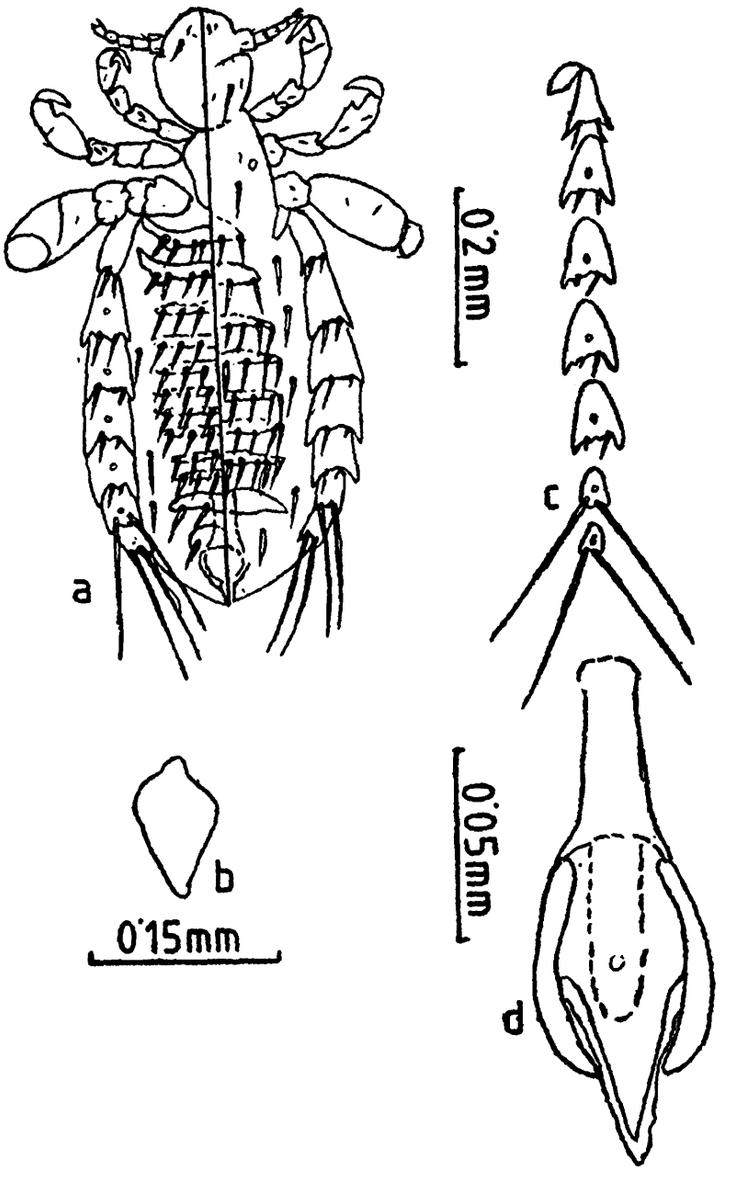


Hoplopleura malabarica Werneck : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Nymph 1 (Fig., Plate 40, a) : Approximately as long as wide ; post antennal angles not developed ; antennal sensoria small and separate ; all typical head setae well developed and distinct ; ventral side of head with numerous scattered tubercles. Thorax : MDTS

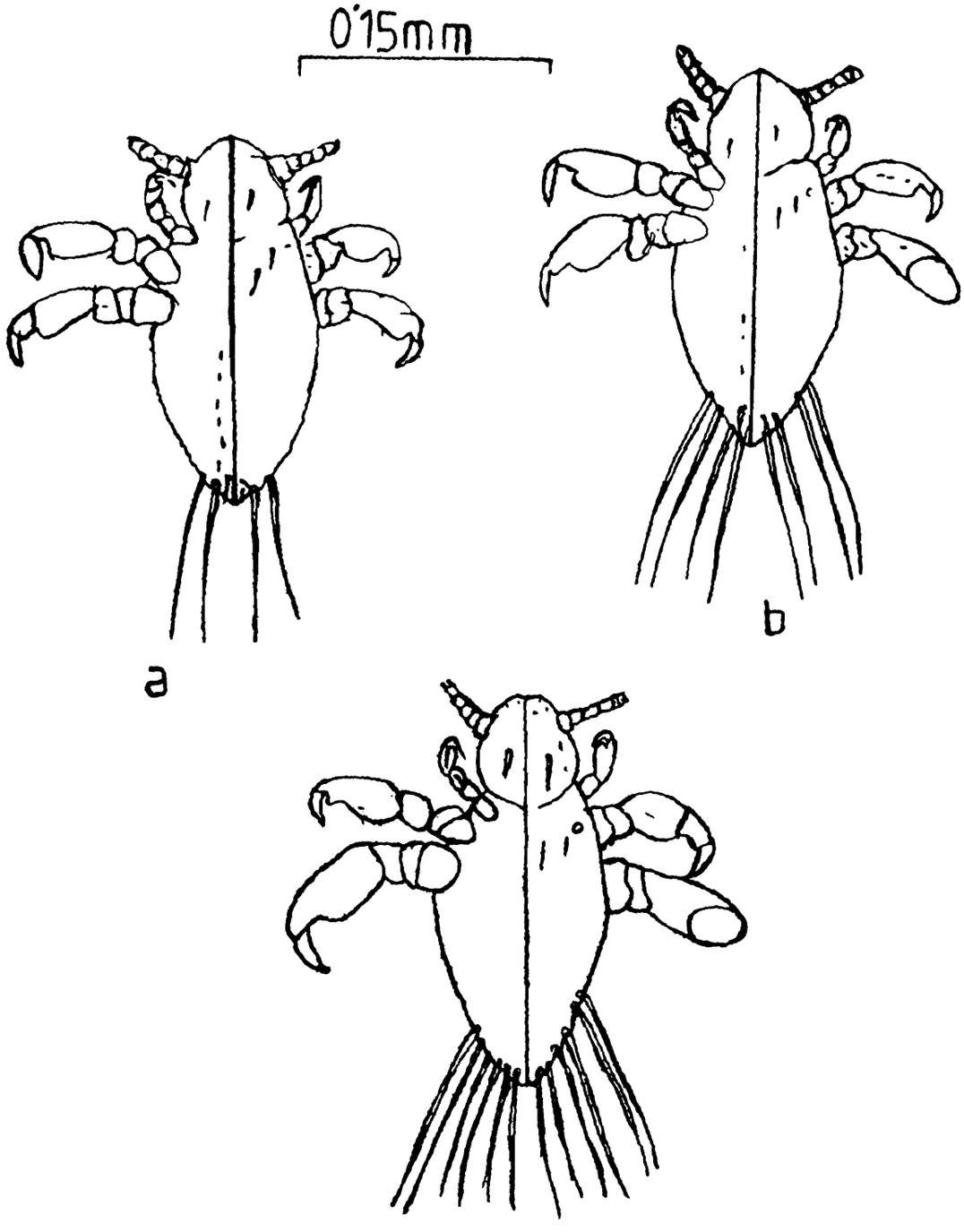
PLATE 39



Hoplopleura malabarica Werneck : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ;
c. Paratergites ; d. Genitalia.

one pair, small sized ; first pair of leg small with slender claw ; second and third pair considerably larger with blunt claw, both legs are similar sized. Abdomen : Devoid of

PLATE - 40



Nymphs of *Hoplopleura malabarica* Werneck
a. Nymph 1 ; b. Nymph 2 ; c. Nymph 3.

segmentation, ventral central setae 6 pairs ; major abdominal setae one pair, dorsal central setae absent ; accessary setae 1 pair and anal setae 2 pairs.

Nymph 2 (Fig., Plate 40, b) : Same as in nymph 1 except third pair of leg larger than second ; abdomen with 2 pairs of major abdominal setae.

Nymph 3 (Fig., Plate 40, c) : Same as in nymph 2 except major abdominal setae 3 pairs on each side.

Material examined : 10 ♀♀, 10 ♂♂, from *Bandicota bengalensis* ; Midnapur, West Bengal ; 10.9.1984 ; Coll. C. C. Adhikary.

Host : *Bandicota bengalensis*.

Distribution : India [West Bengal (New record from India)] ; Sri Lanka and Thailand.

Remarks : This species appears close to *H. hirsuta* Ferris, *H. ochotonae* Ferris and *H. angulata* Ferris. It can be separated from *hirsuta* by presence of narrow, indistinct tergites and sternites on segments III to VI ; from *ochotonae* by long ventral setae on paratergites III to VI ; from *angulata* by dorsal posterior notched lobes on paratergites IV to VI.

H. malabarica from India correspond with those described by Johnson (1959) and Kim (1966) from Sri Lanka and Thailand but for following differences ; DPHS long ; tergites and sternites of anterior and posterior segments on both males and females distinct, other being indistinct ; paratergites IV to VI with dorsal posterior lobes notched ; DAAS and VAAS present in both sexes.

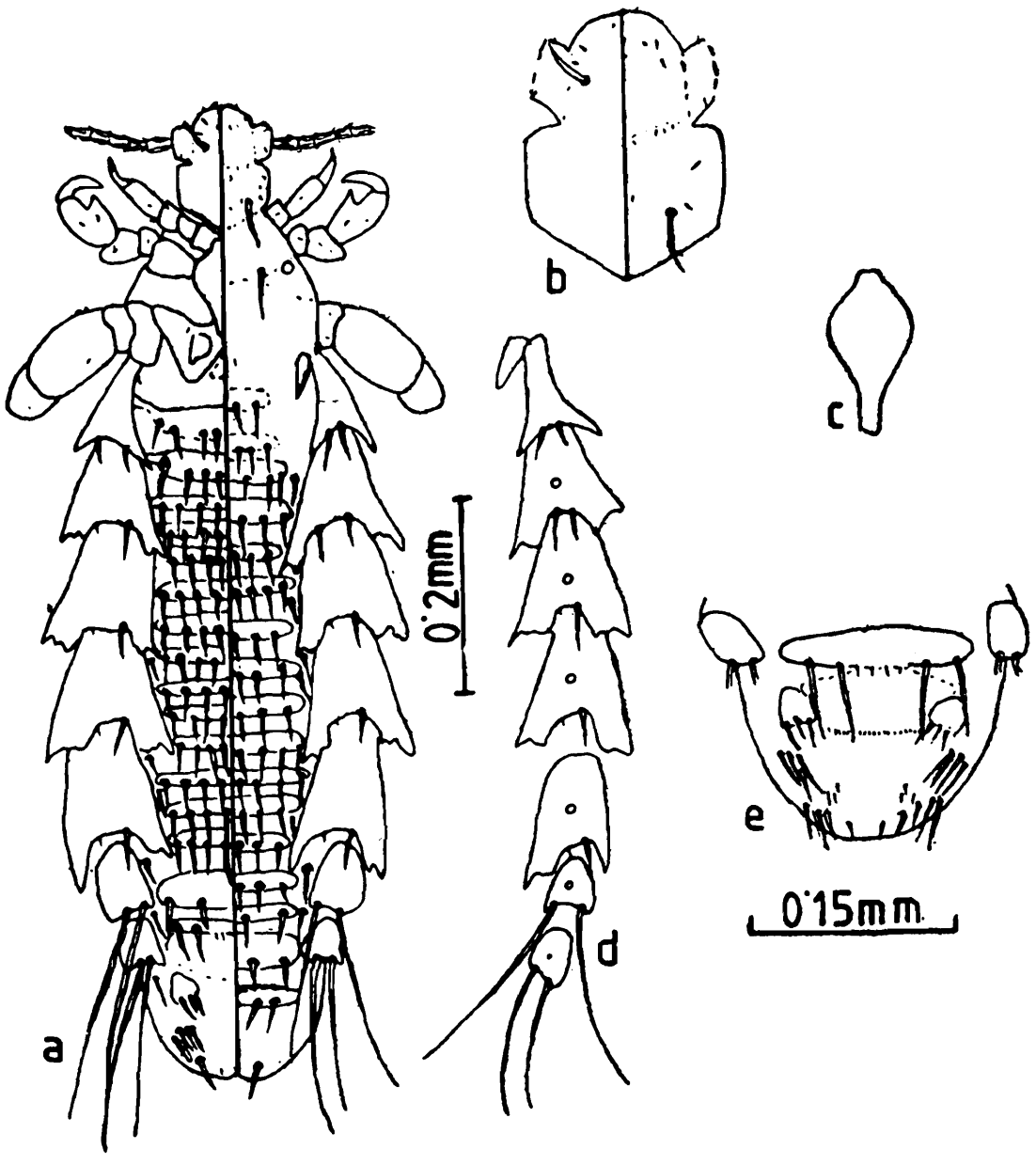
22. **Hoplopleura pacifica** Ewing
(Figs., Plates 41, 42 & 43)

1924. *Hoplopleura pacifica* Ewing, *Bull. Bishop Mus. Honolulu*, 14 : 9.
1972. *Hoplopleura pacifica*, Johnson, *J. Med. Ent.*, 9 : 220-221.
1981. *Hoplopleura pacifica*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 52-54.
1992. *Hoplopleura pacifica*, Adhikary and Ghosh, *State Fauna Series* 3 : *Fauna of West Bengal, Pt. 7* : 9-10.

Female (Fig., Plate 41, a, b, c, d, e) : Total body length 1 mm ($\bar{X}$, N = 18) ; range 0·9 mm to 1·3 mm. Head (Fig., Plate 41, b) : Longer than wide, all typical head setae present ; post antennal and postero lateral angles rounded. Thorax : Sternal plate (Fig., Plate 41, c) 0·07 mm long, 0·037 mm wide, posterior process rounded at tip ; MDTS one pair, long. Abdomen : Dorsal : Segment II with single tergite, having 2 rows of setae, anterior with 2 and posterior with 4 setae ; III to VII, each with 3

tergites, having 6-10 setae each except first tergite of III which bear 4 thin setae ; VIII and terminal segment, each with single tergite ; having 4 and 2 setae respectively ; DAAS 5-7 pairs. Ventral : Segment II with single sternite, having 8 setae ; III with 4 stermites ; first with 7 and remaining with 6-9 setae each ; IV to VI, each with 3 sternites having 6-10

PLATE 41

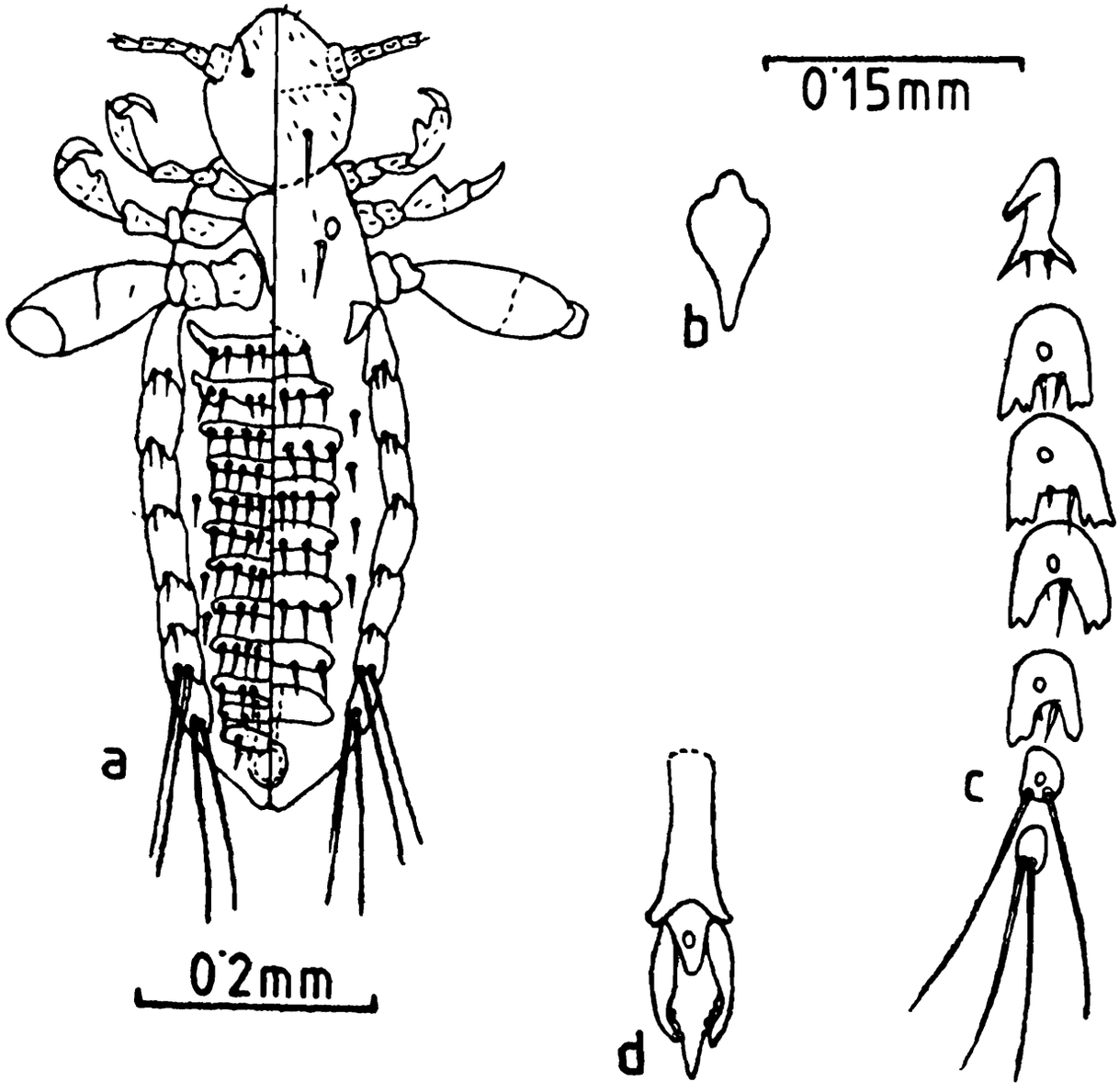


Hoplopleura pacifica Ewing : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

setae each ; VII with 2 sternites having 7-8 setae anteriorly and 8 setae posteriorly ; VAAS 8-9 pairs. Lateral : Paratergites (Fig., Plate 41, d) : II typical, dorsal seta longer than

ventral ; III to V, each with posterior processes truncated and emerginate, each with dorsal seta minute, ventral equal to processes except III which has both setae long ; VI with dorsal process emerginate and truncated, ventral process acute, dorsal seta minute,

PLATE - 42

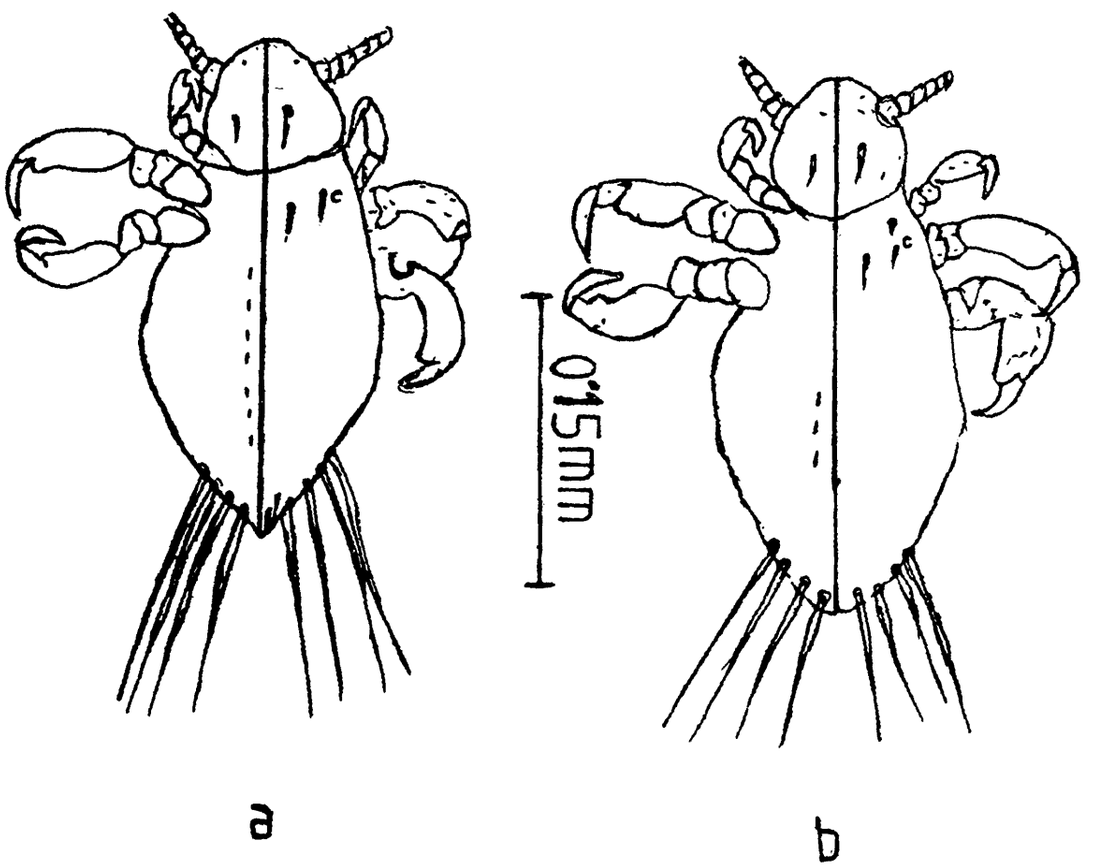


Hoplopleura pacifica Ewing : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ;
c. Paratergites ; d. Genitalia.

ventral longer than process ; VII and VIII devoid of processes, both setae long. Genitalia (Fig. Plate 41, e) : Gonopods paired ; each genital lobe with 3 setae ; genital setae short and slightly enlarged.

Male (Fig., Plate 42, a, b, c, d) : Total body length 0·67 mm ($\bar{X}$, N=13) ; range 0·58 to 0·72 mm. Head and thorax as in female ; Abdomen : Dorsal : Segment

PLATE - 43



Nymphs of *Hoplopleura pacifica* Ewing
a. Nymph 1 ; b. Nymph 2.

II as in female ; III with 2 tergites ; anterior with 4 and posterior with 8-10 setae ; IV to VII, each with single tergite, 8-10 setae each ; VIII with single tergite without setae ;

DAAS 1-2 pairs. Ventral: Segment II as in female; III with 3 sternites, first as in female, remaining with 7-9 setae each; IV to VI, each with 2 sternites, with 7-9 setae each; VII and VIII, each with single sternite having 4 and 2 setae respectively; VAAS 3-4 pairs. Lateral: Paratergites (Fig., Plate 42, c) as in female. Genitalia: Parameres uniform in thickness; pseudopenis serrated.

Nymph 1 (Fig., Plate 43, a): Head: Slightly longer than wide; post antennal angle rounded; antennal sensoria contiguous. Thorax: Sternal plate absent; MDTS one pair; first pair of legs small with slender claw; second and third pair legs equal in size, both are larger, with stout claw. Abdomen: Devoid of segmentation; major abdominal setae 2 pairs; ventral central setae 7 pairs and anal setae 2 pairs.

Nymph 2 (Fig., Plate 43, b): Same as in nymph 2 except head and antennae with sparsely scattered tubercles; thorax with anterior dorsal thoracic setae 2 pairs; third pair of legs larger thsn second. Abdomen with dorsal surface leathery; ventral scaly, with numerous trachae; ventral central setae 5 pairs; dorsal marginal setae and anal setae indistinct.

Nymph 3: Same as in nymph 2.

Material examined: 5 ♀ ♀, 3 ♂ ♂, from *Rattus rattus*; Shillong, Meghalaya; 4.7.85; Coll. C. C. Adhikary; 2 ♀ ♀, 2 ♂ ♂, from *R. nitidus*; Kaming dist., Arunachal Pradesh; 14.12.85; Coll. C. C. Adhikary; 3 ♀ ♀, 2 ♂ ♂, from *R. r. andamanensis*; Andaman Island; 30.9.86; Coll. C. C. Adhikary; 5 ♀ ♀, 3 ♂ ♂, from *R. r. rufescens*; Jodpur, Rajasthan; 21.3.86; Coll. C. C. Adhikary; 3 ♀ ♀, 3 ♂ ♂, from *R. r. arboreus*; West Bengal; 18.9.87; Coll. C. C. Adhikary.

Host: *Rattus rattus*, *R. r. rufescens* (New record), *R. r. andamanensis* (New record), *R. nitidus*, *R. rattoides*, *R. narbadae*, *R. r. brunneusculus*, *R. r. satarae*, *R. r. arboreus*, *R norvagicus*, *R. exulens*, *R. r. gangutrianus*.

Distribution: India [Arunachal Pradesh, Meghalaya (New record), West Bengal (New record), Orissa, Maharastra, Rajasthan (New record), Madhya Pradesh, Himachal Pradesh, Andaman Island (New record)]; Oriental and Australian regions.

Remarks: This species seems close to *H. khandala* Mishra and *H. oenomydis* Ferris. It can be separated from *khandala* by dorsal and ventral processes on paratergites III to V, which are more or less equal in size and DAAS being less than 10 pairs; from *H. oenomydis*, it differs by two setae on abdominal tergite I which are always shorter than posterior setae on abdominal tergite II.

23. **Hoplopleura phaiomydis** Ferris
(Figs., Plates 44 & 45)

1921. *Hoplopleura phaiomydis* Ferris, *Contributions towards a monograph of the sucking lice*, pt.II : 120.
1949. *Hoplopleura phaiomydis*, Hopkins, *Proc. Zool. Soc. Lond.*, 119 : 476.
1951. *Hoplopleura phaiomydis*, Ferris, *The sucking lice*, p. 142.
1981. *Hoplopleura phaiomydis*, Mishra, *Rec. Zool. Surv. India. Occ. Paper*, 21 : 54-55.

Female (Fig., Plate 44, a, b, c, d, e) : Total body length 0·75 mm long ($\bar{X}$, N=1). Head (Fig., Plate 44, b) : Longer than wide ; all typical head setae present ; antennal sensoria contiguous. Thorax : Sternal plate (Fig., Plate 44, c) 0·08 mm long and 0·042 mm in wide ; with sharp lateral angles, posterior process long, rounded at tip. Abdomen : Dorsal : Tergites are narrow ; segment II with single tergite, with 2 rows of setae, having 2 minute and 4 long setae respectively ; III to VII, each with 3 tergites, having 5-10 setae each, except first tergite of segment III which bear only 4 setae ; VIII and terminal segment with a single tergite each, having 5 and 2 setae respectively. Ventral : Sternites are narrow ; segment II with a single sternite having 8 setae ; III with 4 sternites, first with 7 and remaining with 7-9 setae each ; IV to VI, each with 3 sternites having 6-8 setae each ; VII with 2 sternites having 9 and 8 setae respectively ; remaining sternites modified to form genitalia. Lateral : Paratergites (Fig.. Plate 44, d) : II with dorsal process short and acute, ventral long and tapering ; III to V, with both posterior processes long and tapering ; both dorsal and ventral setae on paratergites II to V small ; VI to VIII devoid of processes ; VI with dorsal and ventral setae small ; VII and VIII both setae long. Genitalia (Fig., Plate 44, e) : Gonopods paired ; each genital lobe with 6-8 setae.

Male (Fig., Plate 45, a, b, c, d) : Total body length 0·064 mm ($\bar{X}$, N=1). Head and thorax as in female. Abdomen : Dorsal : Tergites are narrow ; segment II with single tergite having 4 setae ; III with 2 tergites with 4 and 10 setae respectively ; IV to VI, each with 2 tergites, having 7-10 setae each ; VII with a single tergite having 10 setae ; VIII with also single tergite devoid of setae. Ventral : Segment II with single sternite having 8 setae ; III with 3 sternites ; anterior one as in female, remaining with 7 and 8 setae respectively ; IV to VI, each with 2 sternites having 7-8 setae each ; VII and VIII, each with single sterrnite having 4 and 2 setae respectively ; all sternites are narrow. Lateral : Paratergites (Fig., Plate 45, c) : As in female. Genitalia (Fig., Plate 45, d) : Parameres uniform in thickness ; pseudopenis slightly large, arms short and slender, shaft long and stout with its margins toothed.

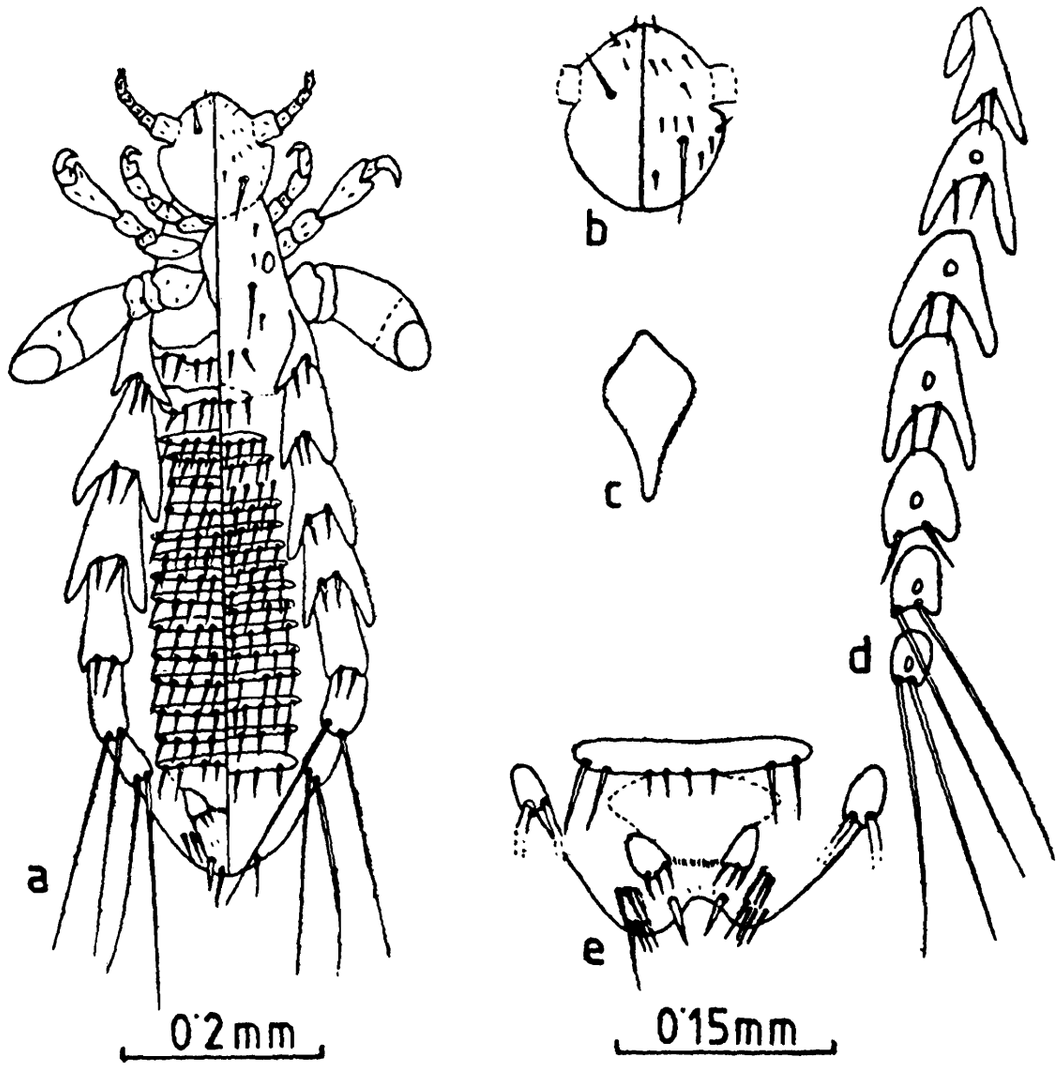
Nymphs : Unknown.

Material examined : Paratypes : 1 ♀, 1 ♂ (Regd. No. USNM 198570) from *Phaiomys* sp., East Ladakh, Kashmir ; 1921 ; Coll. G. F. Ferris.

Host : *Microtus* (*Phaiomys*) sp.

Distribution : India (Jammu and Kashmir).

PLATE - 44

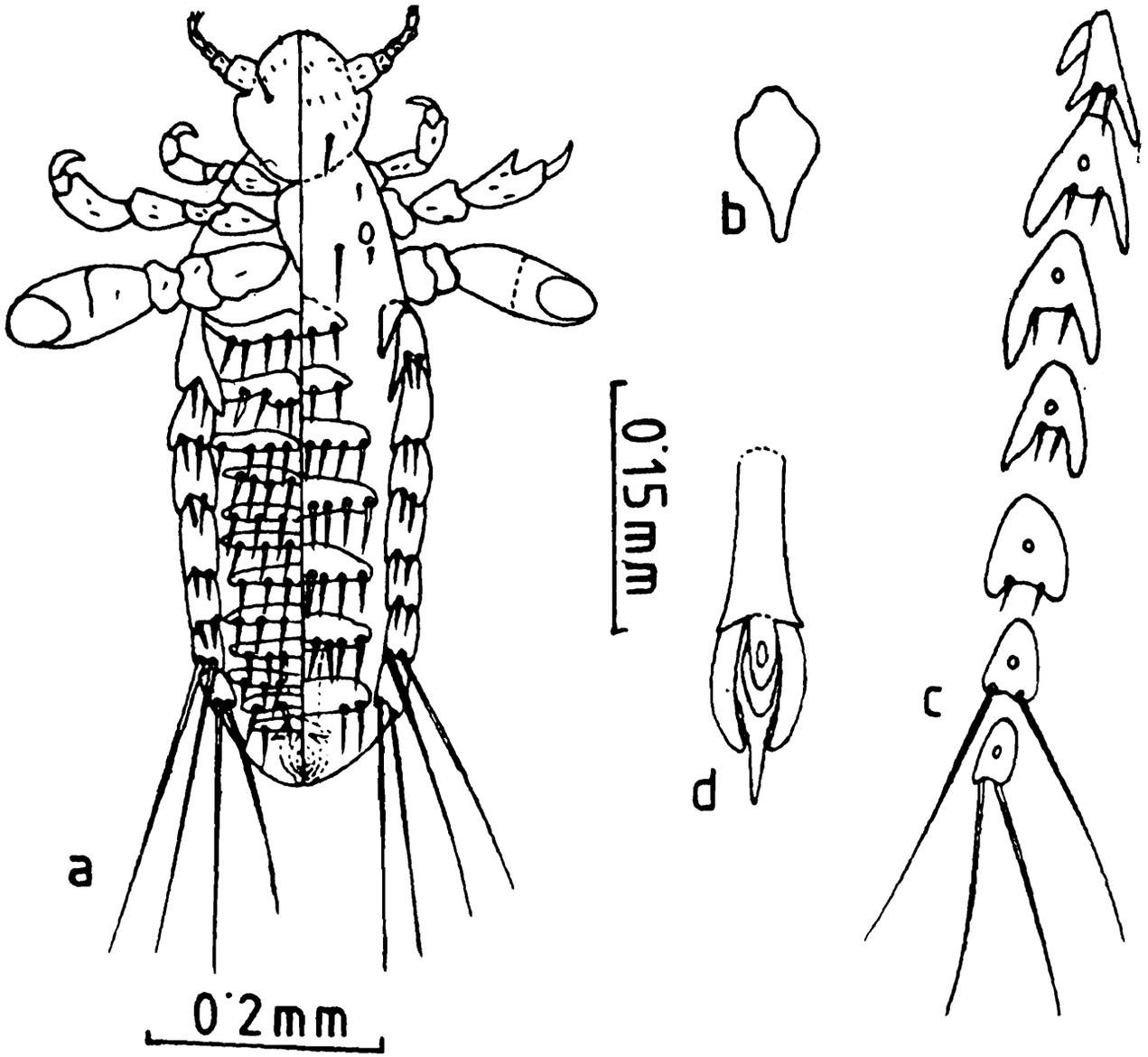


Hoplopleura phaiomydis Ferris : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Remarks : This species appears close to *H. acanthopus* (Burmeister), *H. alticola* Mishra and Bhat, *H. erratica* (Osborn). It can be separated from *acanthopus* by absence

PLATE - 45



Hoplopleura phaiomydis Ferris : ♂

a. Whole body (Ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

of both processes on paratergite VI in both sexes and basal prominent tooth-like lateral projection on pseudopenis in male ; from *alticola* by the shape of thoracic sternal plate and absence of processes on paratergite VI and from *erratica* by well developed tergites and sternites in both sexes.

24. **Hoplopleura ramgarh** Mishra, Bhat and Kulkarni
(Figs., Plates 46, 47 & 48)

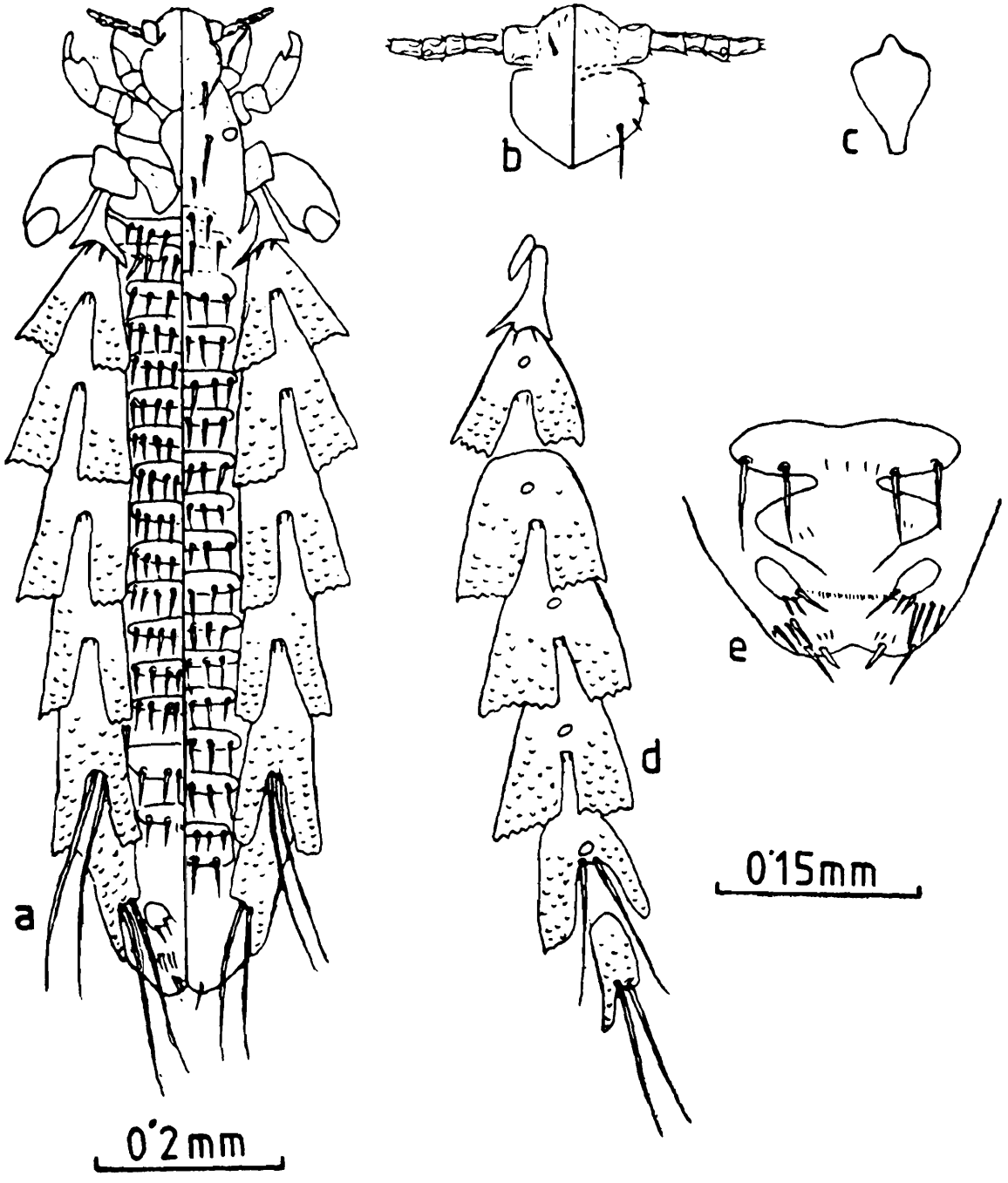
1972. *Hoplopleura ramgarh* Mishra et al., *Parasitolagy*, 65 : 11-21.
1974. *Hoplopleura ramgarh*, Mishra et al., *Indian J. Med. Res.*, 62 : 1275.
1981. *Hoplopleura ramgarh*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 55-57.
1992. *Hoplopleura ramgarh*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 10.*

Female (Fig., Plate 46, a, b, c, d, e) : Total body length 1·05 mm ($\bar{X}$, N=20) ; range 0·88 to 1·12 mm. Head (Fig., Plate 46, b) : Longer than wide ; all typical head setae present ; post antennal angle rounded ; antennal sensoria large and contiguous. Thorax : Sternal plate (Fig., Plate 46, c) with 0·07 mm long and 0·03 mm wide ; posterior process long, rounded at tip ; MDTS medium sized. Abdomen : Dorsal : Segment II with single tergite, having 2 rows of setae, anterior with 2 and posterior with 2 pairs of setae ; III to VII, each with 3 tergites, each having 7-10 setae except first tergite of segment III which has 4 thin elongated setae ; VIII and terminal segment, each with single tergite having 4 and 2 setae respectively ; DAAS absent. Ventral : Segment II with single sternite having 8 setae ; III with 4 sternites, first with 7 and remaining with 6-9 setae each ; IV to VI, each with 3 sternites, having 6-9 setae each ; VII with 2 sternites having 6-8 setae anteriorly and 8 setae posteriorly ; VAAS 1-2 pairs. Lateral : Paratergites (Fig., Plate 46, d) : All paratergites are scaly. II typical, both setae smaller than processes ; III to VI, each with both processes lobed with serrated margins, posterior outer angles usually produced into points, both setae small, situated laterally in cleft ; VII with dorsal process wide ; Ventral narrow, both setae long ; VIII with well developed dorsal process, ventral process lacking, both setae long. Genitalia (Fig., Plate 46, e) : Gonopods paired ; genital setae flattened and spiniform.

Male : (Fig., Plate 47, a, b, c, d) : Total by length 0·66 mm ($\bar{X}$, N=20) ; range 0·55 mm to 0·73 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II with single tergite having 4 setae ; III with 2 tergites with 4 and 10 setae respectively ; IV to VI, each with a single tergite having 8-10 setae each ; VII with broad single tergite having 8-9 setae ; VIII with also single tergite without setae ; DAAS absent. Ventral : Segment II with single sternite having 7 or 8 setae ; segment III with 3 sternites ; anterior one as in female, remaining with 7 and 8

setae respectively ; IV to VI each with 2 sternites having 7-8 setae each ; VII and VIII each with single sternite having 4 and 2 setae respectively ; VAAS 1-2

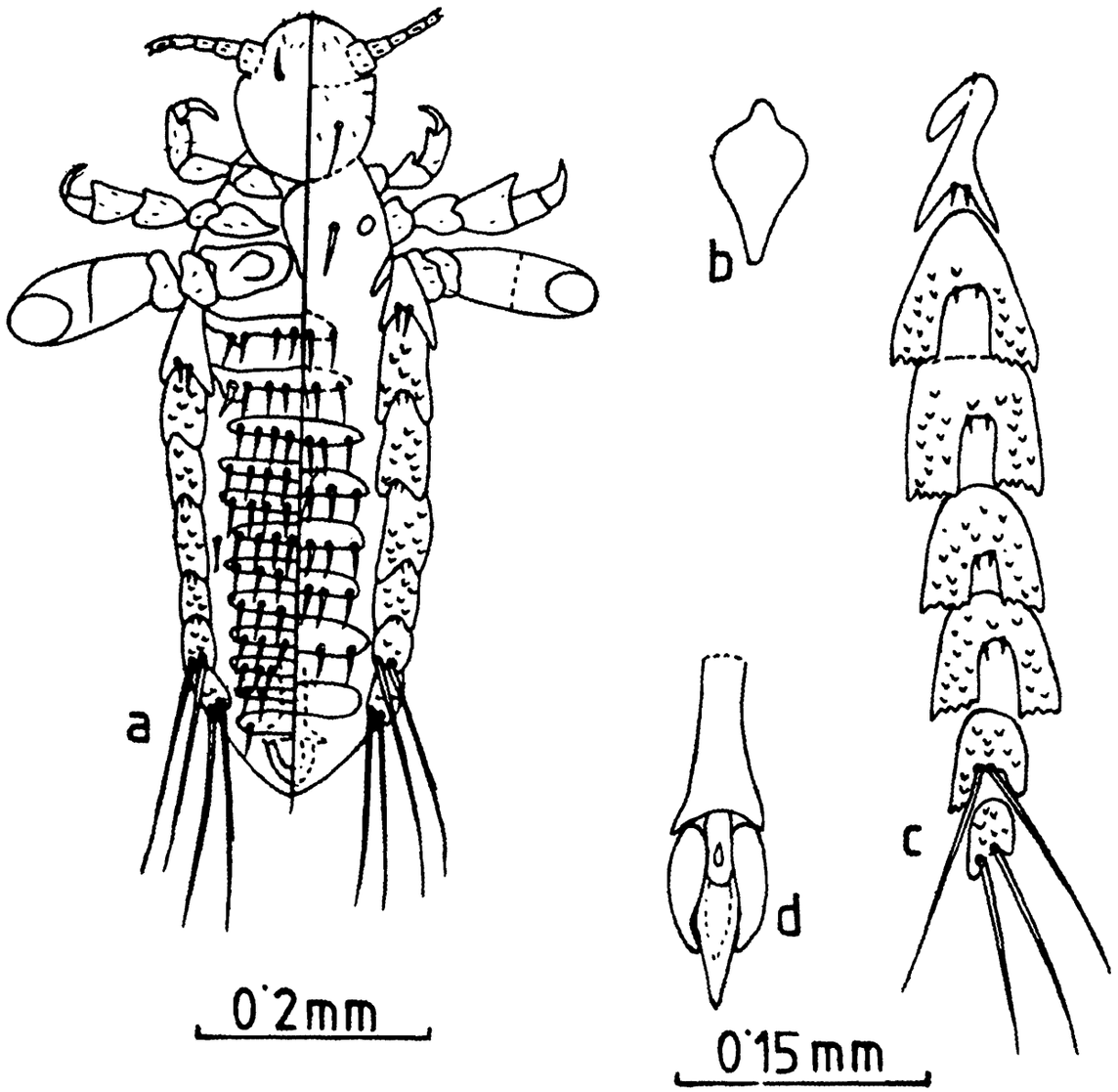
PLATE 46



Hoplopleura ramgarh Mishra, Bhat and Kulkarni : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; C. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

pairs. Lateral : Paratergites (Fig., Plate 47, c) : As in female. Genitalia (Fig., 47, d) : Parameres thickened near the base ; pseudopenis pointed at tip.

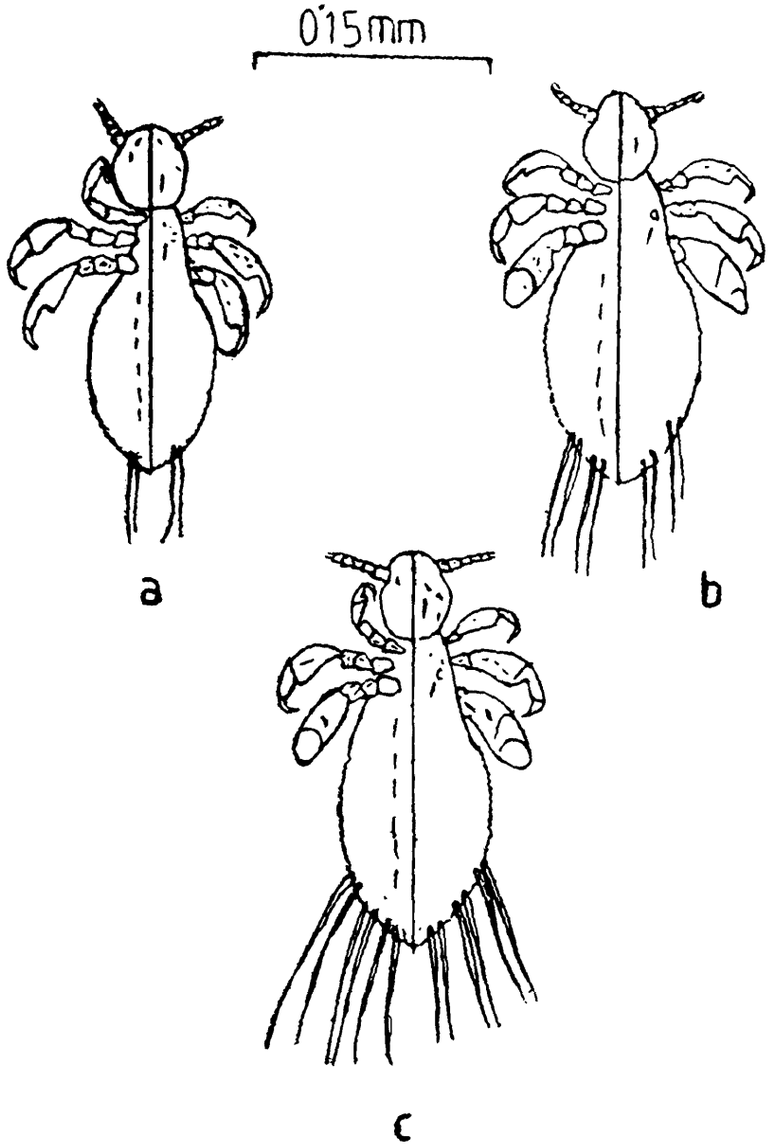
PLATE - 47



Hoplopleura ramgarh Mishra, Bhat and Kulkarni : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ;
c. Paratergites d. Genitalia

Nymph 1 (Fig., Plate 48, a) : Head as long as wide ; antennal sensoria small and separate. Thorax : Sternal plate absent ; MDTS one pair, small ; first pair of legs small with slender claw, second and third pair equal in size and shape both are larger with stout claw. Abdomen : Devoid of segmentation ; major abdominal setae one pair, on each side ; ventral central setae 6 pairs ; anal setae 2 pairs.

PLATE 48



Nymphs of *Hoplopleura ramgarh* Mishra, Bhat and Kulkarni
a. Nymph 1 ; b. Nymph 2 ; c. Nymph 3.

Nymph 2 (Fig., Plate 48, b): Same as in nymph 1 except anterior thoracic setae 2 pairs; third pair of legs larger than second; major abdominal setae 2 pairs on each side.

Nymph 3 (Fig., Plate 48, c): Same as in nymph 2 except major abdominal setae 2 pairs on each side.

Material examined: 5♀♀, 5♂♂, *Mus saxicola* in Maharastra; 11.7.84; Coll. C. C. Adhikary and A. C. Mishra; 10♀♀, 10♂♂, from *Mus saxicola*, in Purulia, West Bengal; 18.1.85; Coll. C. C. Adhikary; 5♀♀, 5♂♂, from *Mus saxicola* in Ajadhya Hill, Purulia, West Bengal; 23.1.85; Coll. C. C. Adhikary.

Host: *Mus saxicola.*

Distribution: India [West Bengal (New record), Orissa and Maharastra].

Remarks: This species seems close to *H. inexpectans* Johnson, *H. zelotomydis* Johnson, *H. intermedia* Kellogg and Ferris and *H. ismailiae* Johnson. It can be separated from all these species in having MDTS medium sized; setae on paratergite III about half the length of processes; VAAS 1-2 pairs; setae on paratergite VII long. Mishra (1977) described this species (from Maharastra) as devoid of scales on paratergites. The author collected the material from West Bengal and observed scaly paratergites.

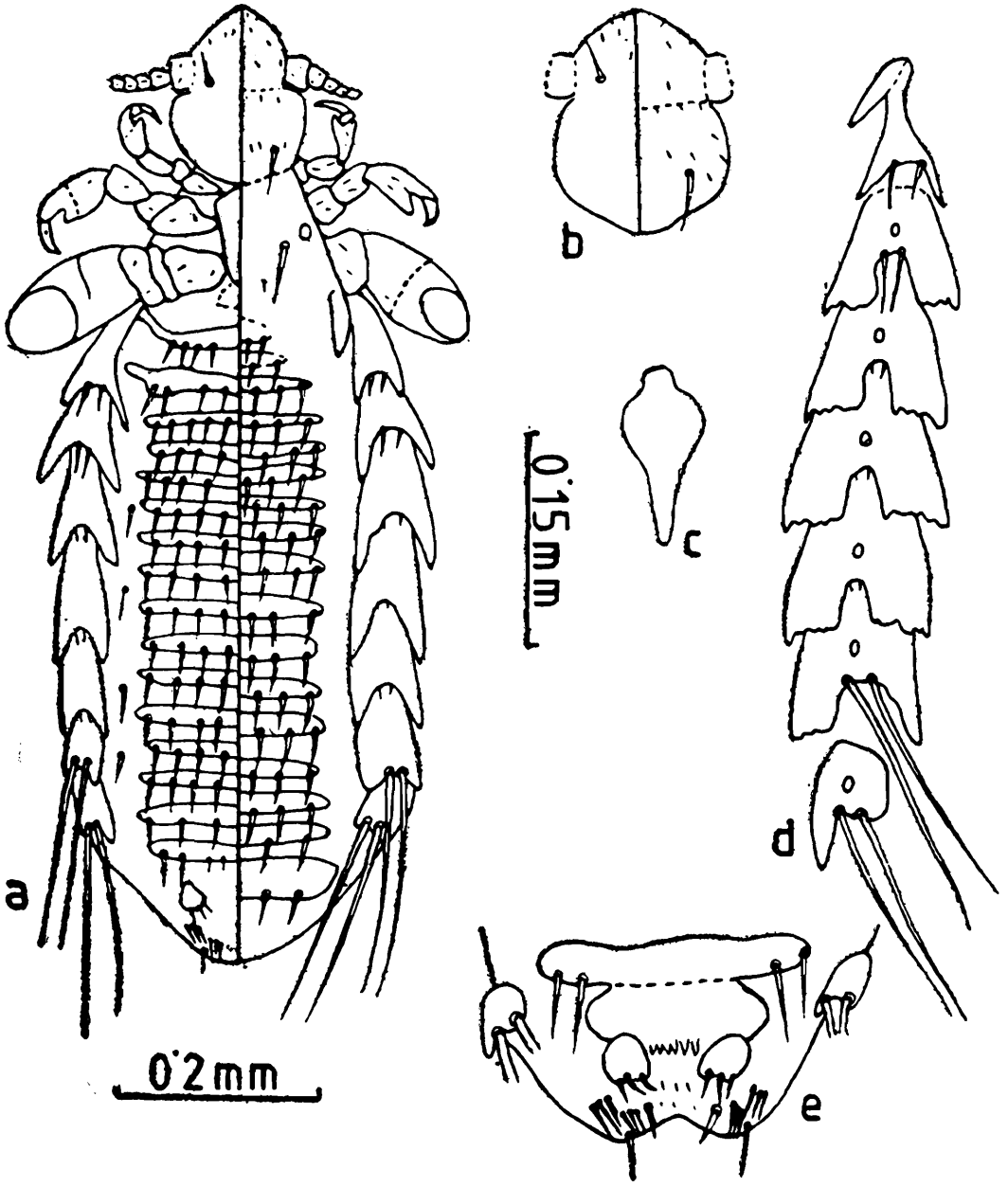
25. **Hoplopleura sahyadri** Mishra
(Figs., Plates 49 & 50)

1981. *Hoplopleura sahyadri* **Mishra**, *Rec. Zool. Surv. India, Occ. Paper*, 21: 57-59; figs. 116-124.

Female (Fig., Plate 49, a, b, c, d, e): Total body length 0·95 mm ($\bar{X}$, N=2). Head (Fig., Plate 49, b): Slightly longer than wide; post antennal angles rounded with lateral margins slightly convex; all typical head setae present; antennal sensoria contiguous. Thorax: Sternal plate (Fig., plate 49, c) 0·08 mm long and 0·03 mm wide; with posterior process pointed at apex. Abdomen: Dorsal: Segment II with single tergite, with 2 rows of setae, having 2 and 4 setae respectively; III to VII, each with 3 tergites having 3-6 setae each; VIII and terminal segment, each with a single tergite having 5 setae; DAAS absent. Ventral: Segment II with single sternite having 8 setae; III with 4 sternites, first with 7 and remaining with 6-8 setae each; IV to VI each with 3 narrow sternites having 5-8 setae each; VII with 2 sternites having 6 and 8 setae respectively; remaining

sternites modified to form genitalia ; VAAS 4 pairs. Lateral : Paratergites (Fig., Plate 49, d) : II typical, dorsal seta longer than ventral, almost equal to processes of its side ; III to VI, each with posterior processes lobe like, lobes broad and serrated ; both setae small sized except paratergite III in which both setae extend

PLATE 49

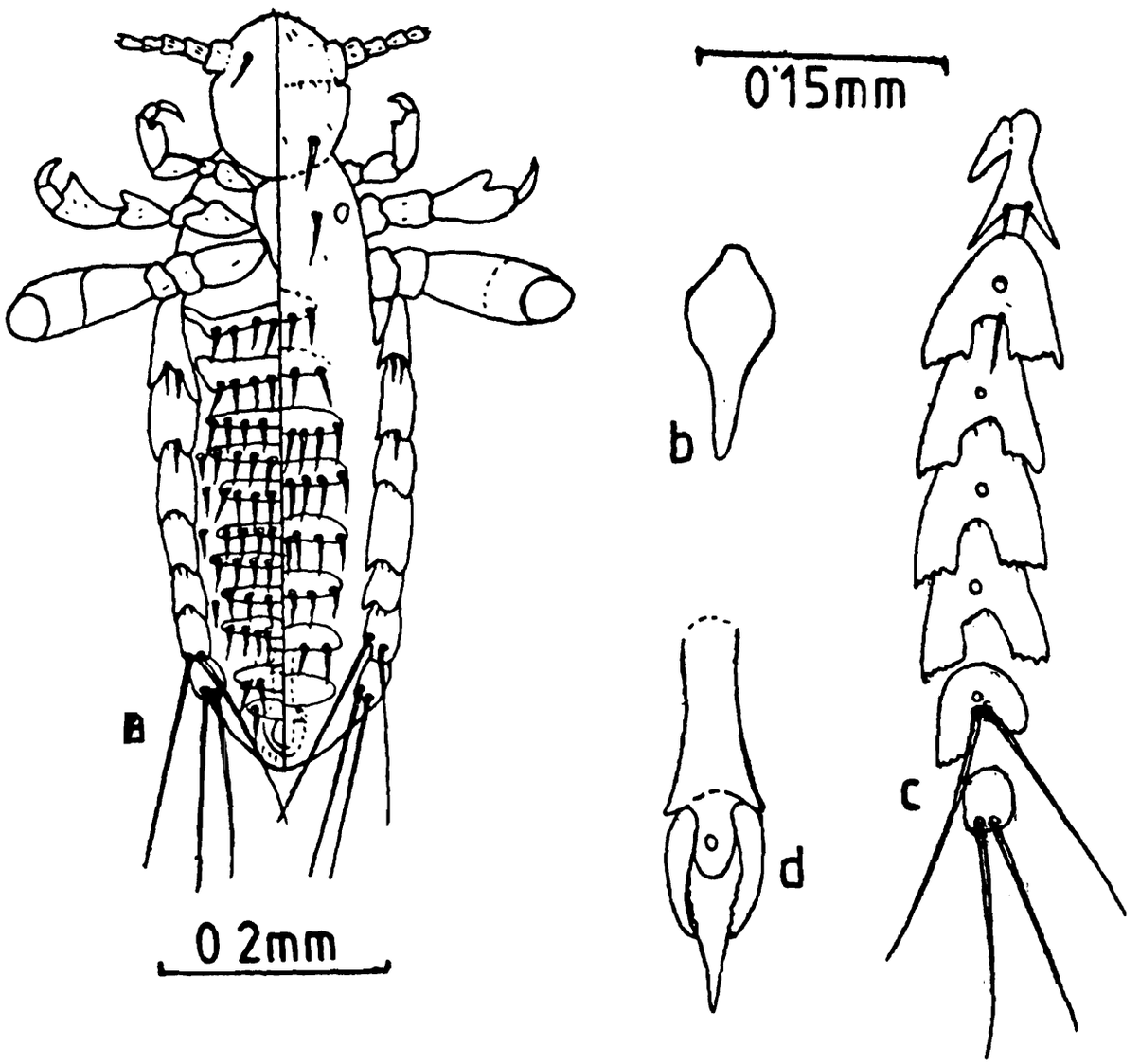


Hoplopleura sahyadri Mishra : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

beyond the processes ; VII with dorsal process broad and almost truncated ; ventral narrow and pointed, both setae long ; VIII with dorsal process narrow and pointed, ventral process absent, both setae long. Genitalia (Fig., Plate 49, e) : Gonopods lobed, paired ; genital setae slightly enlarged and pointed.

PLATE - 50



Hoplopleura sahyadri Mishra : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

Male (Fig., Plate 50, a, b, c, d) : Total body length 0·65 mm ($\bar{X}$, N=1). Head and thorax as in female. Abdomen : Dorsal : Segment II as in female ; III with 2 tergites having 4 and 8 setae respectively ; IV to VII, each with a single tergite, having 4-9 setae each ; VIII with a single tergite devoid of setae ; DAAS absent. Ventral : Segment II as in female ; III with 3 sternites, anterior one as in female, remaining with 8 setae each ; IV to VI, each with 2 sternites having 4-8 setae each ; VII and VIII fused with each other with a single row of 2 setae ; terminal segment with several minute setae ; VAAS 4 pairs. Lateral : Paratergites (Fig., Plate 50, c) as in female except III which has only long ventral seta ; VII with ventral process absent and VIII devoid of both processes. Genitalia (Fig., Plate 50, d) : Parameres thickened near the base, pointed towards tip ; pseudopenis long with serrated sides.

Nymphs : Unknown.

Material examined : Paratypes : 2♀ ♀, 1♂, from *Mus dunni* in Sinhgarh, Pune, Maharashtra ; 9.9.1971 ; Coll. A. C. Mishra.

Host : *Mus dunni.*

Distribution : India (Maharastra).

Remarks : This species seems close to *Hoplopleura captiosa* Johnson and H. *johnsonae* Kim ; it can be separated from both these species by combination of following characters : Posterior process of thoracic sternal plate pointed at apex ; dorsal lobe of paratergite VII broad and almost truncated at the tip, never tapering, ventral lobe narrow and rounded at apex ; VAAS 4 pairs.

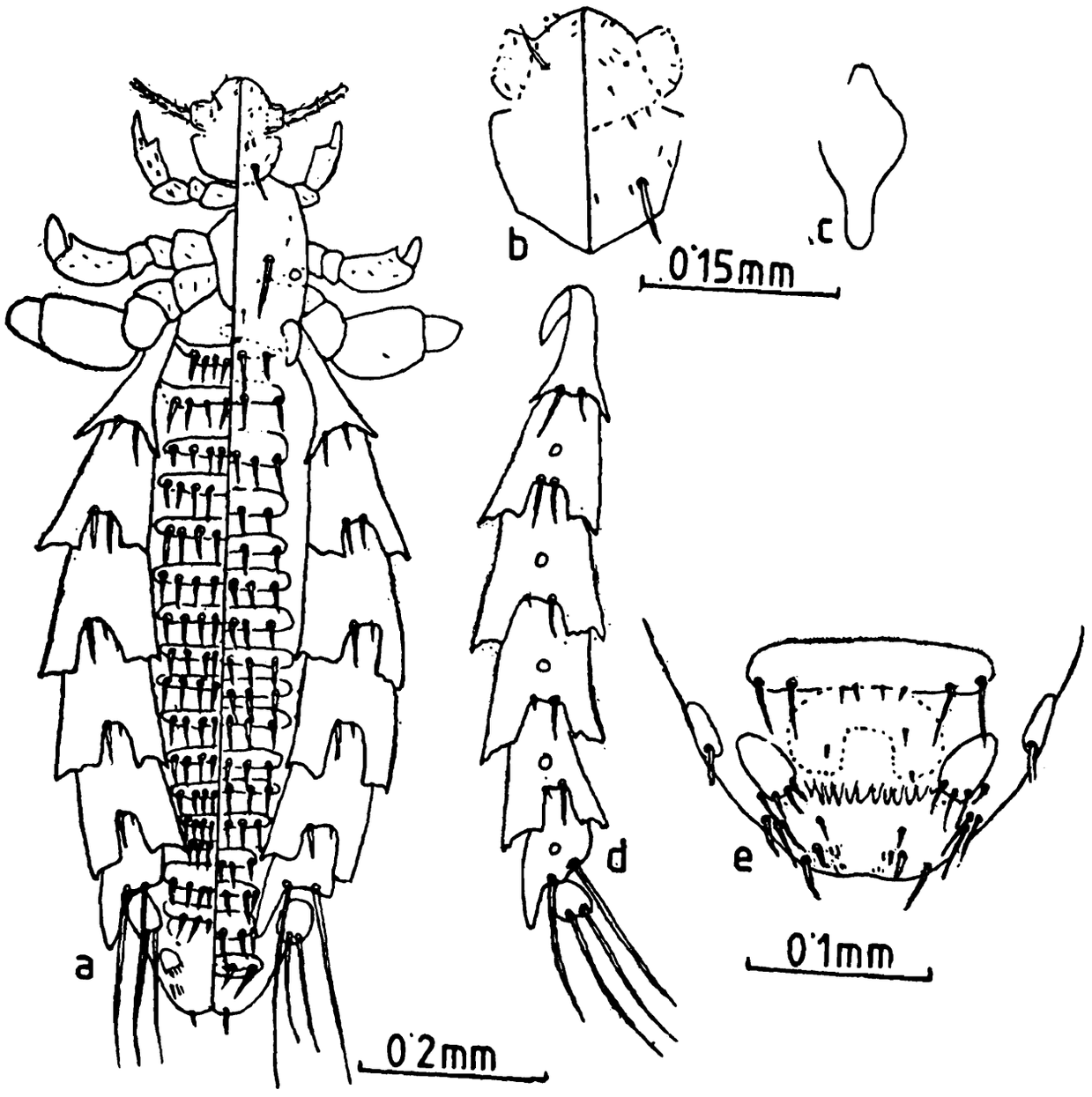
26. **Hoplopleura sicata** Johnson
(Figs., Plates 51 & 52)

1964. *Hoplopleura sicata* Johnson, *Misc. Publs. Ent. Soc. Am.*, 4 : 73.
1972. *Hoplopleura sicata*, Johnson, *J. Med. Ent.*, 9 : 221.
1974. *Hoplopleura sicata*, Mishra et al., *Indian J. Med. Res.*, 62 : 1275.
1981. *Hoplopleura sicata*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 59-61.
1992. *Hoplopleura sicata*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 10.*

Female (Fig., Plate 51, a, b, c, d, e) : Total body length 1 mm ($\bar{X}$, N=12) ; range 0·88 mm to 1·51 mm. Head (Fig., Plate 51, b) : Longer than wide ; all typical head setae present ; antennal sensoria large and contiguous ; marginal head setae not in a straight line. Thorax : Sternal plate (Fig., Plate 51, c) 0·09 mm long and 0·04 mm wide ; with posterior process long, rounded at tip ; MDTS medium sized. Abdomen : Setae sword shaped. Dorsal : Segment II with single

tergite, having 2 rows of setae, with 2 and 4 setae respectively; III to VII, each with 3 tergites having 7-10 setae each except first tergite of III which bear 4 thin setae; VIII and terminal segment each with single tergite having 4 setae each, Ventral: Segment II with single sternite with 4 pairs of setae; III with 4 sternites,

PLATE - 51



Hoplopleura sicata Johnson : ♀

a. Whole body (ventral and dorsal views); b. Head; c. Thoracic sternal plate; d. Paratergites; e. Genitalia.

first with 7 and remaining with 6 or 7 setae each ; IV to VI each with 3 sternites having 5-8 setae each ; VII with 2 sternites having usually 6 or 7 setae each ; remaining sternites modified to form genitalia. Lateral : Paratergites (Fig., Plate 51, d) : II typical, dorsal seta longer, ventral equal to or shorter than processes of their sides ; III to VI, each with posterior processes truncated and emerginate, each with dorsal seta minute, ventral medium sized but shorter than process of their sides, except III which has dorsal seta longer, ventral equal to or shorter than processes of their sides ; VII with dorsal process narrow, ventral process lacking ; both seate long ; VIII devoid of processes with usual 2 long setae. Genitalia (Fig., Plate 51, e) : Gonopods paired ; genital setae short and thick.

Male (Fig., Plate 52, a, b, c, d) : Total body length 0·65 mm ($\bar{X}$, N=10) ; range 0·61 mm to 0·72 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II with a single tergite, with 4 setae ; segment III with 2 tergites having 4 setae anteriorly and 6 setae posteriorly ; IV to VII each with single tergite having 5-8 setae each, segment VIII without setae. Ventral : Segment II with a single sternite having 8 setae ; III with 3 sternites, first with 7 and remaining with 6-7 setae each ; IV to VI, each with 2 sternites, having 6-8 setae each ; VII and VIII, each with a single sternite with 4 and 2 setae respectively. Lateral : Paratergites (Fig., Plate 52, c) : As in female. Genitalia (Fig., Plate 52, d) : Parameres thickened near the base ; pseudopenis curved dorsally and pointed towards tip.

Nymphs : Could not be obtained during present study. Description is based on Mishra (1981).

Nymph 1 : Head slightly longer than wide, post antennal angles narrowly rounded, all typical head setae present, antennal sensoria contiguous. Thorax : Sternal plate absent ; MDTS one pair, first pair of leg small, with slender claw, second and third pairs, both are equal in size and shape with stout claw. Abdomen : Devoid of segmentation ; dorsal and ventral abdominal setae absent, accessary and anal setae indistinct.

Nymph 2 : Same as in nymph 1 except thorax with third pair of legs larger than second, accessary dorsal thoracic setae 2 pairs ; abdomen with ventral central setae 5 pairs and anal setae 2 pairs.

Nymph 3 : Similar to nymph 2.

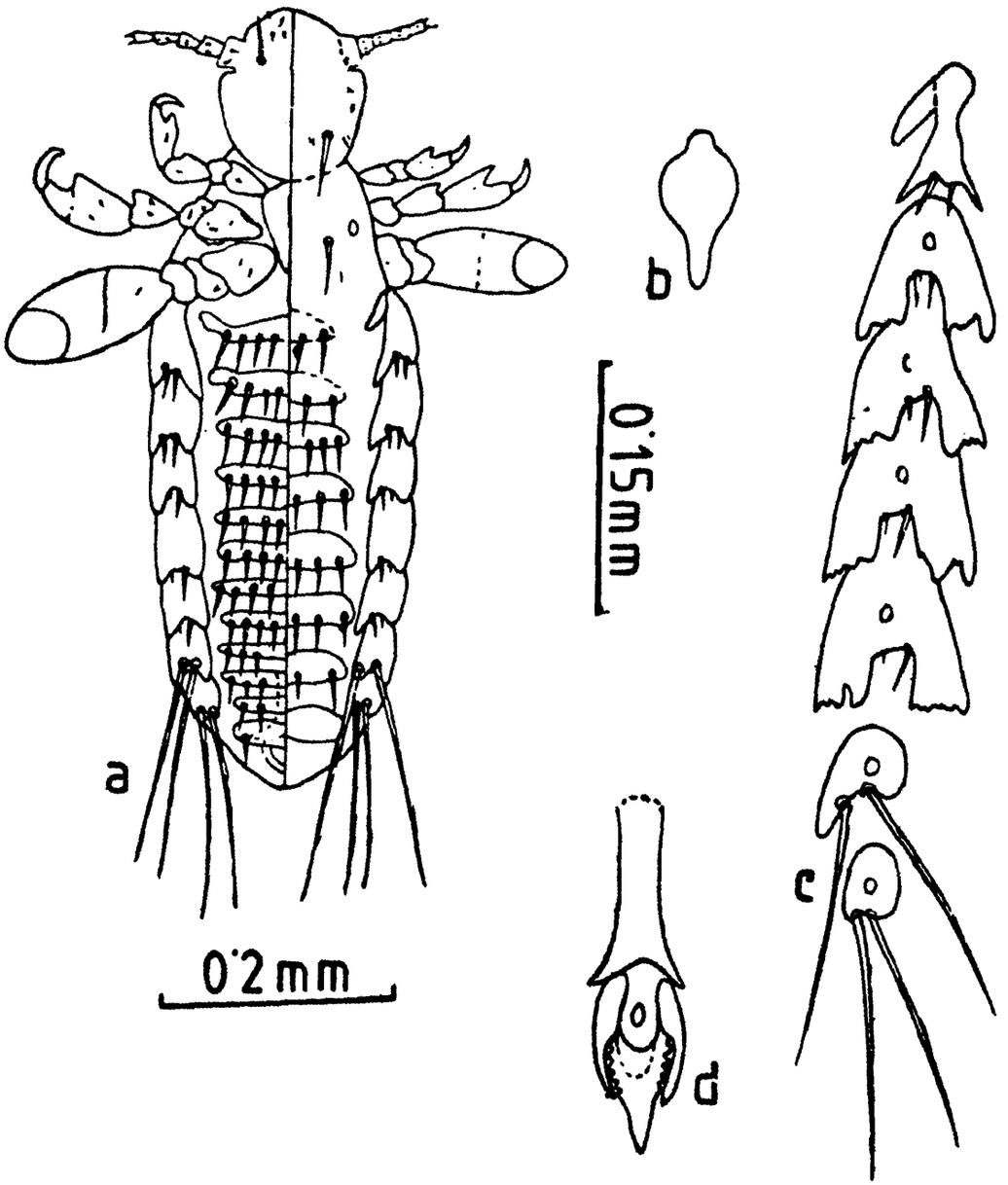
Material examined : 12 ♀ ♀, 10 ♂ ♂, from *Rattus niviventer* in Shillong, Meghalaya ; 4.7.85 ; Coll. C. C. Adhihary.

Host : *Rattus niviventer*, *R. cremoriventer*, *R. fulvescens*, *R. arjentiventer*, *R. exiguus*, *R. eha* and *R. rattoides*.

Distribution: India [Meghalaya (New record), West Bengal, Sikkim, Jammu & Kashmir]; Laos; Indonesia.

Remarks: This species appears close to *H. pacifica* Ewing, *H. dissicula* Johnson, *H. himalayana* Mishra, Kaul and Bhat, *H. oenomydis* Ferris. However, it can be

PLATE - 52



Hoplopleura sicata Johnson: ♂

a. Whole body (ventral and dorsal views); b. Thoracic sternal plate; c. Paratergites; d. Genitalia.

separated from *pacifica* by well developed dorsal process on paratergite VII ; from *dissicula* by sword-shaped abdominal setae and less projected post antennal angles ; from *himalayana* by ventral setae on paratergite III which are equal to or shorter than process of their sides, MDTS medium sized ; rounded tip of the dorsal posterior process on paratergite VII ; from *oenomydis* by rounded tip on posterior proeess of thoracic sternal plate and well developed dorsal posterior process on paratergite VII.

27. **Hoplopleura silvula** Johnson
(Figs., Plates 53 & 54)

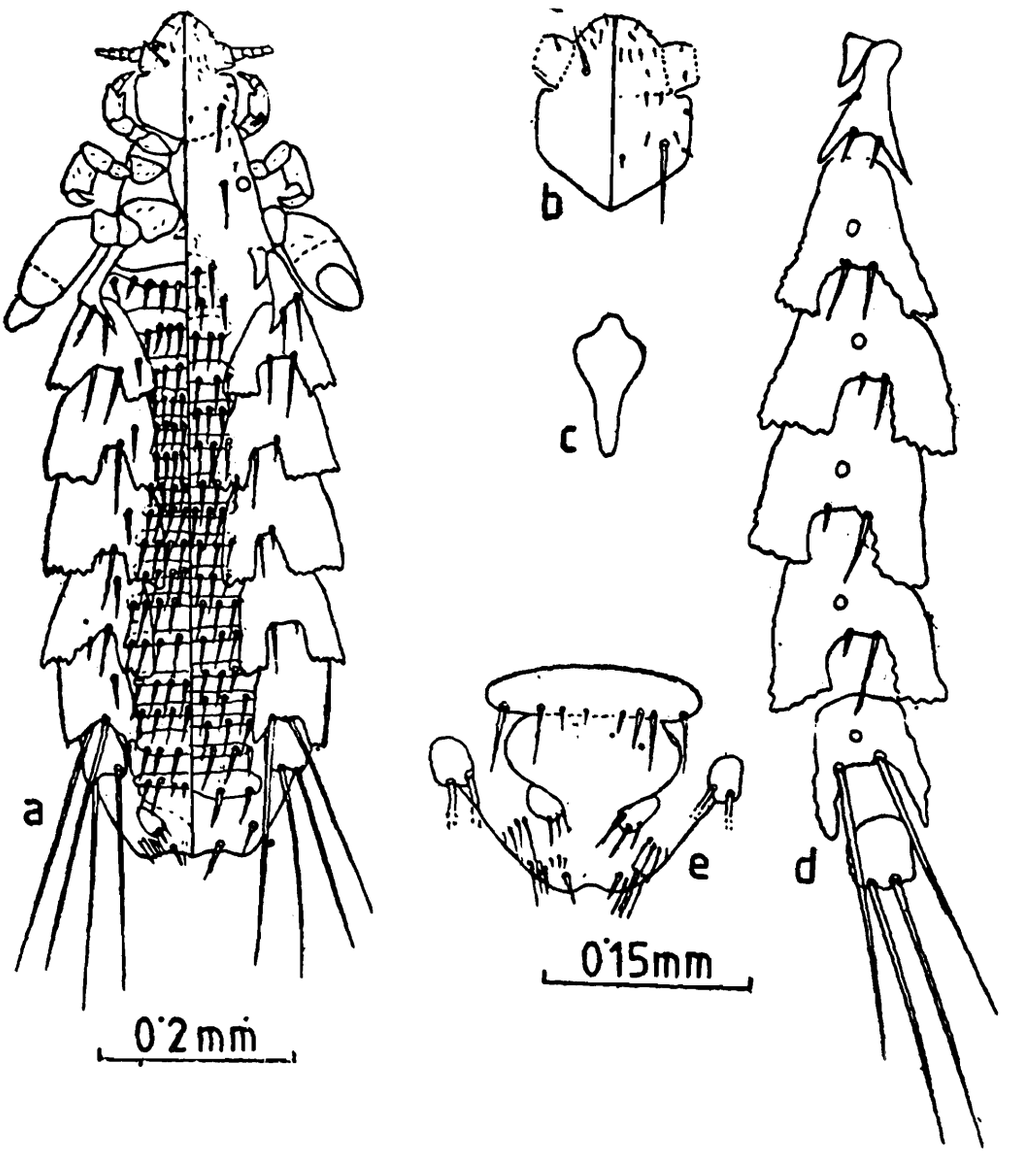
1972. *Hoplopleura silvula* Johnson, *Pacific Ins.*, 14 : 607-611.
1972. *Hoplopleura vandeleuria* Mishra and Bhat, *Oriental Ins.*, 6 : 521-530.
1974. *Hoplopleura vandeleuria*, Mishra et. al., *Indian J. med. Res.*, 62 : 1276.
1981. *Hoplopleura silvula*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 61-66.
1992. *Hoplopleura silvula*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7* : 10.

Female (Fig., Plate 53, a, b, c, d, e) : Total body length 0·86 mm ($\bar{X}$, N=2) ; range 0·86 to 0·87 mm. Head (Fig., Plate 53, b) : Longer than wide ; post antennal angles rounded ; preantennal region with 7 pairs of setae dorsally, 5 pairs ventrally ; antennal region 1 pair minute setae dorsally ; 1 pair ventrally, medium sized ; post antennal region 9 pairs of dorsal setae. Thorax : Sternal plate (Fig., Plate 53, c) 0·89 mm long and 0·04 mm wide, with small rounded process anteriorly and long process posteriorly ; MDTS long. Abdomen : Dorsal : Segment II with a single tergite, having 4 thin setae ; III to VII, each with 3 tergites having 5-7 setae each except first tergite of III segment which bear 4 thin setae ; VIII with single tergite having 4 setae ; DAAS absent. Ventral : Segments II with single sternite having 8 setae ; III with 4 sternites having 7-8 setae each ; IV to VI, each with 3 sternites having 6-9 setae each ; VII with 2 sternites having 6 and 7 setae respectively ; remaining sternites modified to form genitalia ; VAAS 7 pairs. Lateral : Paratergites (Fig., Plate 53, d) : II typical, with dorsal seta long, ventral shorter than process ; III with processes lobed, lobes are serrated and emerginated, both setae extending beyond the lobes ; IV and V with both processes lobed, serrated and emerginated posterior processes, dorsal seta minute, ventral as long as processes ; VI with dorsal process serrated and emerginated, ventral narrow ; dorsal seta minute, ventral as long as process ; VII with both processes well developed and acute but ventral narrower than dorsal, dorsal and ventral setae long ; VIII devoid of processes ; both setae long. Genitalia (Fig., Plate 53, e) : Gonopods paired, lobed ; genital setae enlarged and flattened.

Male (Fig., Plate 54, a, b, c, d) : Total body length 0·67 mm ($\bar{X}$, N=2) ; range 0·71 mm to 0·72 mm. Head and thorax as in female. Abdomen : Dorsal :

Segment II with a single tergite having 4 setae ; III with 2 tergites, anterior with 4 and posterior with 8 setae ; IV to VI, each with single tergite having 7-8 setae each ; VII with also single tergite having 5 setae ; VIII with single tergite without setae ; DAAS absent. Ventral : Segment II with a single sternite having 8 setae ; III with 3 sternites, first with 7 and remaining with 6-7 setae each ; IV to VI, each with 2 sternites, having 6-8 setae each ; VII and VIII with single sternite each,

PLATE 53

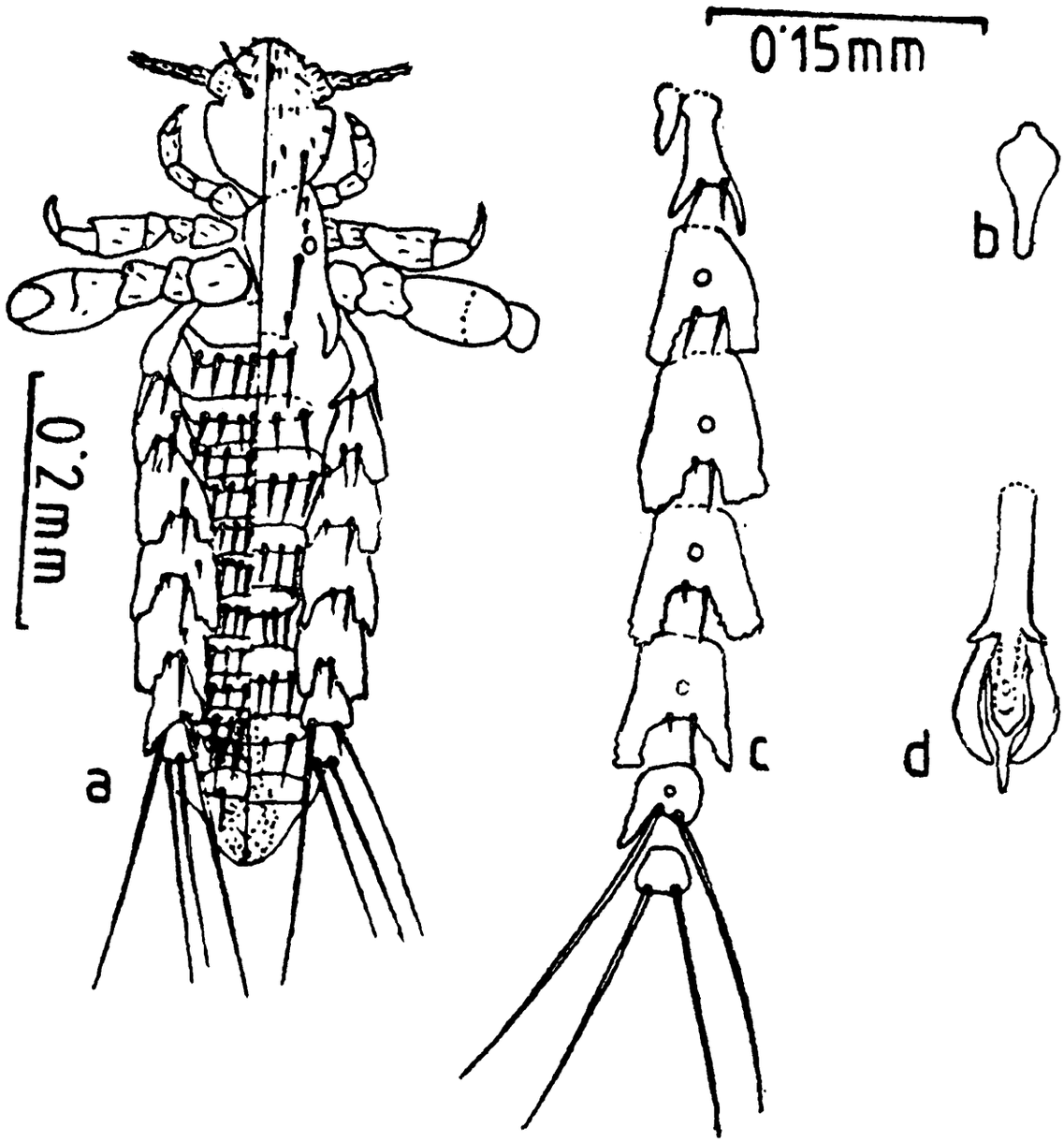


Hoplopleura silvula Johnson : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

having 4 and 2 setae respectively ; VAAS 4 pairs. Lateral : Paratergites (Fig., Plate 54, c) as the female, except VII which has only well developed dorsal process. Genitalia (Fig., Plate 54, d) : Parameres thickened near the base ; pseudopenis pointed towards tip, curved dorsally.

PLATE - 54



Hoplopleura silvula Johnson : ♂

a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

Nymph 1 : Unknown.

Nymph 2 : Head : Longer than wide, anterior margin straight with pointed angles ; postantennal and post erolateral angles rounded ; typical head setae present except DPoCHS which is indistinct. Thorax : Mesothoracic spiracle distinct ; sternal plate absent ; MDTS one pair, small ; legs as in adult. Abdomen : Devoid of segmentation ; dorsal central setae absent ; ventral central setae 5 pairs ; major setae 2 pairs and anal setae one pair.

Nymph 3 : Similar to nymph 2.

Material examined : Paratypes : 1 ♀, 1 ♂, (Regd. No. V.R.C. A 27516). from *Vandeleuria oleracea* in Kaisodi, Shimoga, Karnataka ; 15.8.71 ; Coll. H. R. Bhat ; 1 ♀, 1 ♂, from *V oleracea* in Purulia, West Bengal ; 19.1.1985 ; Coll. C. C. Adhikary.

Host : *Vandeleuria oleracea.*

Distribution : India [West Bengal (New record), Maharastra, Karnataka, Himachal Pradesh] ; Laos.

Remarks : *Hoplopleura silvula* is a member of *H. hesperomydis* group (Kim 1965) and *H. pacifica* group (Johnson 1972) and seems close to *H. difficilis* Kim, *H. reithrodontomydis* Ferris, *H. onychomydis* Cook and Beer, *H. pacifica* Ewing, *H. captiosa* Johnson and *H. johnsonae* Kim. It can be separated from *H. difficilis*, *H. reithrodontomydis* and *H. onychomydis* by a combination of following characters : Posterior process of thoracic sternal plate truncated at tip. Paratergites II and III with both setae well developed ; paratergites IV to VI, each with dorsal setae minute, ventral setae well developed ; VAAS more than 6 pairs in female. It can be separated from *H. pacifica* group by combination of following characters : Female with dorsal and ventral lobes on paratergites VII and male with only dorsal lobe on paratergite VII. It can further be separated from *H. captiosa* and *H. johnsonae* by the absence of lobes on paratergites VIII and well developed ventral setae on paratergites IV to VI in female.

Johnson (1972) described this species on the basis of female holotype, male allotype, and 2 males and 6 females paratypes from *Vandeleuria oleracea* from Laos. Mishra and Bhat (1972) described *H. vandeleuria* from the same host-species from India. After careful comparison, it was later found that the latter is a synonym of *silvula.*

28. **Hoplopleura sinhgarh** Mishra, Bhat and Kulkarni (Figs., Plates 55, 56 & 57)

1972. *Hoplopleura sinhgarh* Mishra et al. *Parasitology*, 65 : 11-21.
1981. *Hoplopleura sinhgarh*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 66-69.

Female (Fig., Plate 55, a, b, c, d, e) : Total body length 1·75 mm ($\bar{X}$, N = 15) ; range 0·92 to 2·1 mm. Head (Fig., Plate 55, b) : Longer than wide ; post antennal angles pointed, antennal sensoria contiguous, all typical head setae present. Thorax : Sternal plate (Fig., Plate 55, c) 0·17 mm long and 0·05 mm wide ; with rounded anteriorly and tapering posteriorly with rounded apex ; MDTS small sized. Abdomen : Dorsal : Segment II with a single tergite having 4 setae ; III with 3 tergites, each having 6-8 setae ; IV to VI, each with 3 tergites having 7-10 setae each. DAAS absent. Ventral : Segment II with single sternite with 8 setae ; III with 4 sternites, first with 7, remaining with 7-10 setae each ; IV to VI, each with 3 sternites having 6-10 setae each ; VII with 2 sternites having 6 and 8 setae respectively ; VAAS absent. Lateral : Paratergites (Fig., Plate 55, d) : II typical dorsal seta longer than process, ventral smaller than process ; III to VI, each with both processes lobed and serrated, both setae small ; VII same in shape as VI, both setae long ; VIII with also both processes well developed, both setae long. Genitalia (Fig., Plate 55, e) : Gonopods paired ; genital setae short and spiniform.

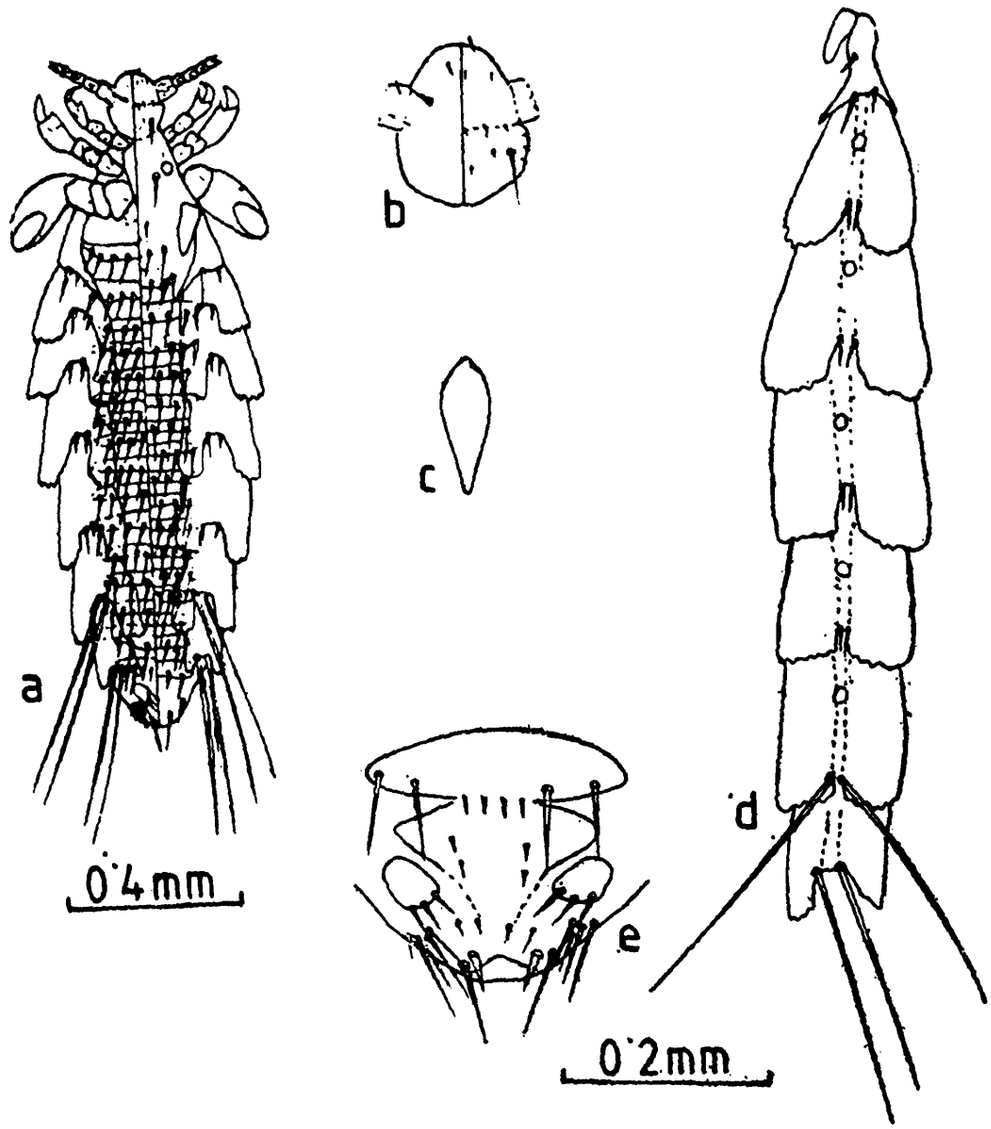
Male : (Fig., 56, a, b, c, d) : Total body length 0·85 mm ($\bar{X}$, N=12) ; range 0·78 to 0·98 mm. Head and thorax as in female. Abdomen : Dorsal : Segment II with a single tergite, having 4 setae ; III with 2 tergites having 4 and 8 setae respectively ; IV to VII, each with single tergite, having 7-9 setae each ; VIII with a single tergite, devoid of setae. Ventral : Segment II as in female ; III with 3 sternites, first one as in female, remaining with 8 setae each ; IV to VI, each with 2 sternites, 5-8 setae each ; VII and VIII, each with a single sternite with 4 and 2 setae respectively. Lateral : Paratergites (Fig., Plate 56, c) as in female. Genitalia (Fig., Plate 56, d) : Parameres thickened near the base, gradually tapering towards tip ; pseudopenis pointed at apex.

Nymph 1 (Fig., Plate 57, a) : Head : Slightly longer than wide ; post antennal angles rounded ; typical head setae present except posterior central head setae which is indistinct ; antennal sensoria large and contiguous ; ventral side of the head and antennae with sparsely scattered tubercles. Thorax : Mesothoracic spiracles distinct ; sternal plate absent ; MDTS one pair, small ; first pair of leg small with slender claw ; second and third pairs larger, both equal in size with blunt claw. Abdomen : Dorsally VIII segmented ; ventrally devoid of segmentation

except on lateral sides ; dorsal and ventral central setae absent ; major abdominal setae and anal setae one pair each.

Nymph 2 (Fig., Plate 57, d) : Similar as a nymph 1 except as follows : Thorax with third pair of leg larger than second. Abdomen : Devoid of segmentation ; several tergal plates of irregular outlines dorsally ; major abdominal setae absent.

PLATE - 55

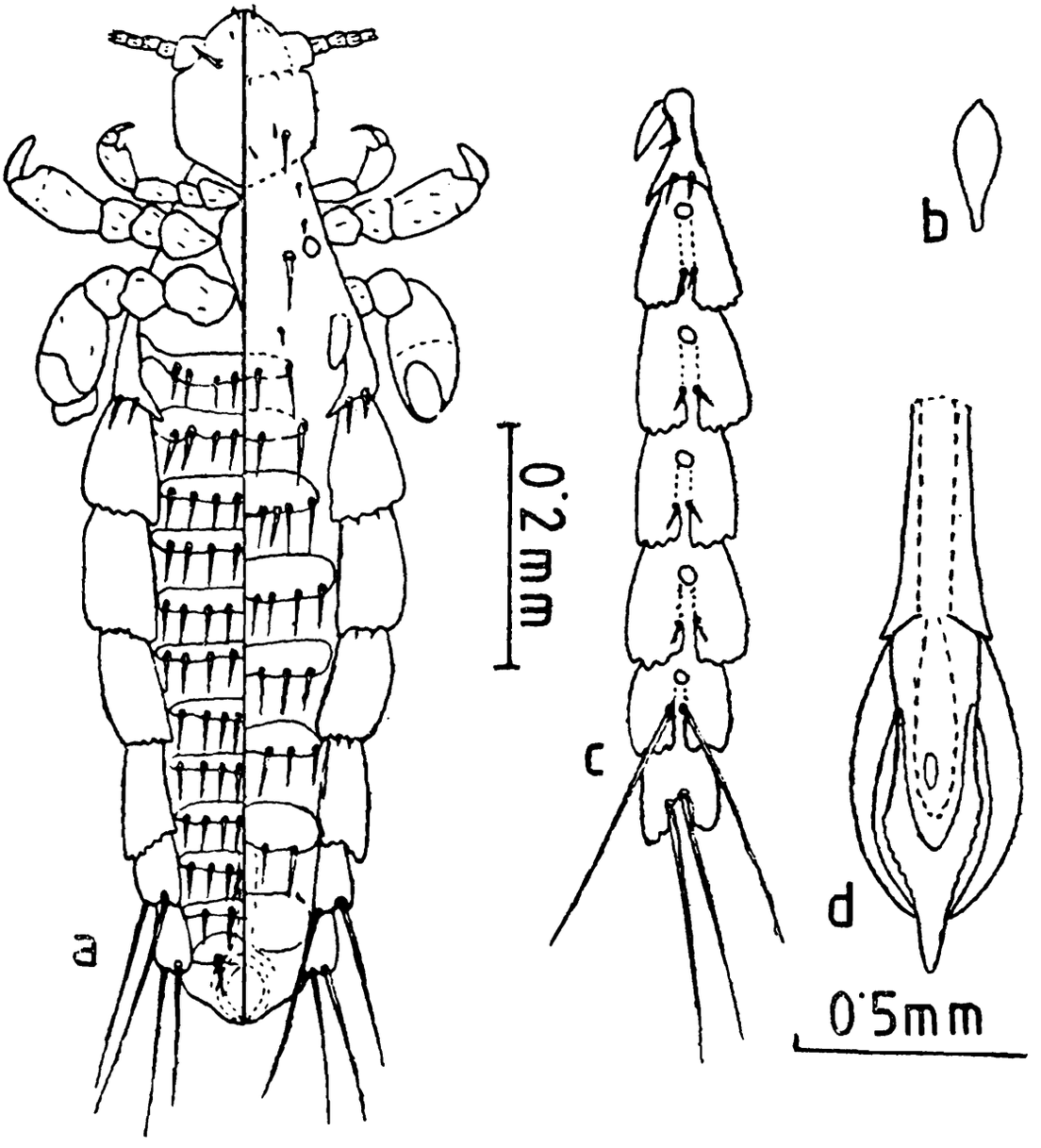


Hoplopleura sinhgarh. Mishra, Bhat and Kulkarni : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Nymph 3 (Fig., Plate 57, c) : Similar as in nymph 2 except thorax with a small sternal plate.

Material examined : Paratypes : 1 ♀, (Regd. No. V.R.C. 96846), 1 ♂ (Regd. No. V.R.C. A 95351) from *Mus platythrix*, in Sinhgarh, Pune, Maharastra ; 16.10.70 ; Coll. A. C. Mishra ; 1 ♂ (Regd. No. V.R.C. A 95351) from *M. platythrix* ; in

PLATE - 56



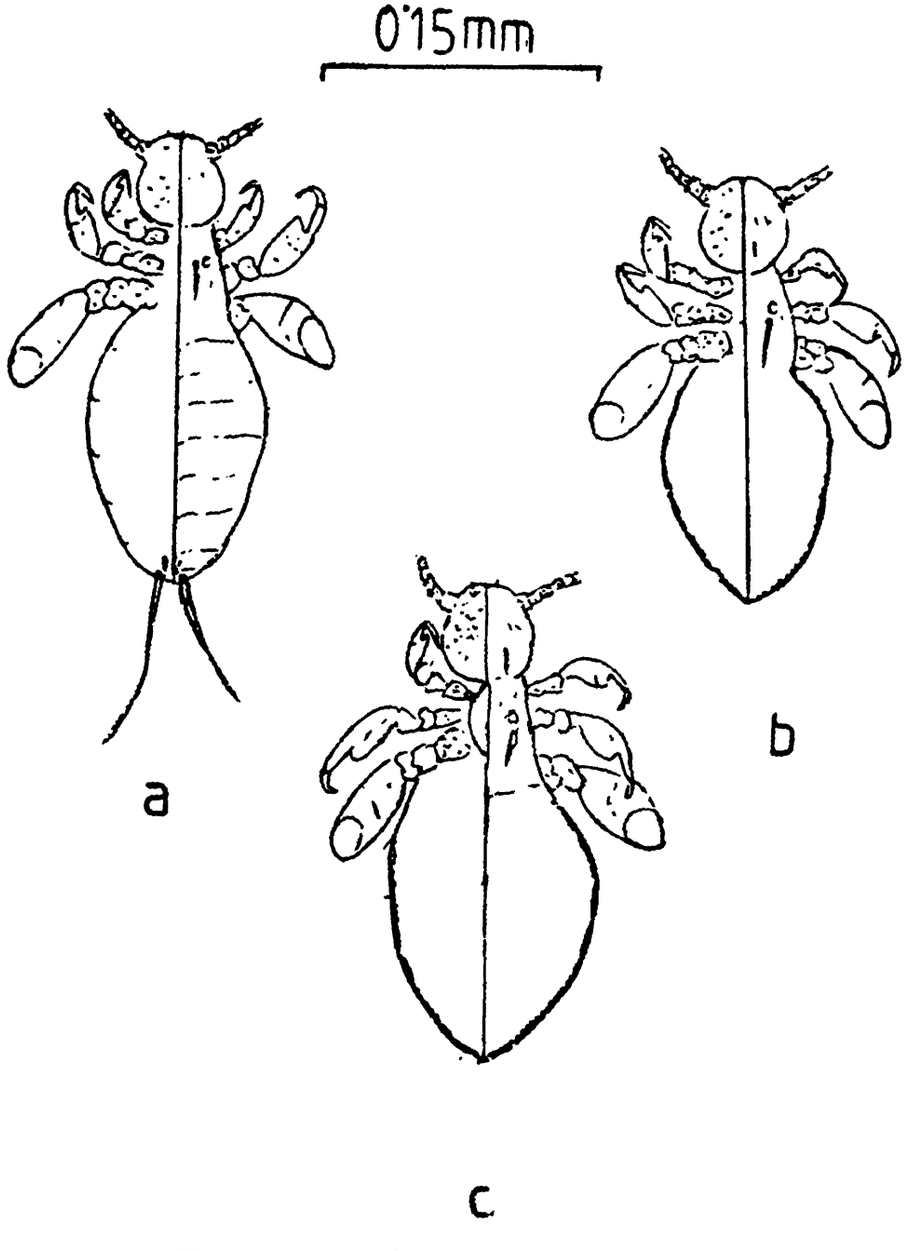
Hoplopleura sinhgarh Mishra, Bhat and Kulkarni : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

Atkarweali, Pune, Maharastra ; 20.1.71 ; Coll. A. C. Mishra ; 14 ♀ ♀, 10 ♂ ♂, from *M. platythrix*, Sinhgarh, Pune, Maharastra, 11.7.84 ; Coll. C.C. Adhikary and A.C. Mishra.

Host : *Mus platythrix.*

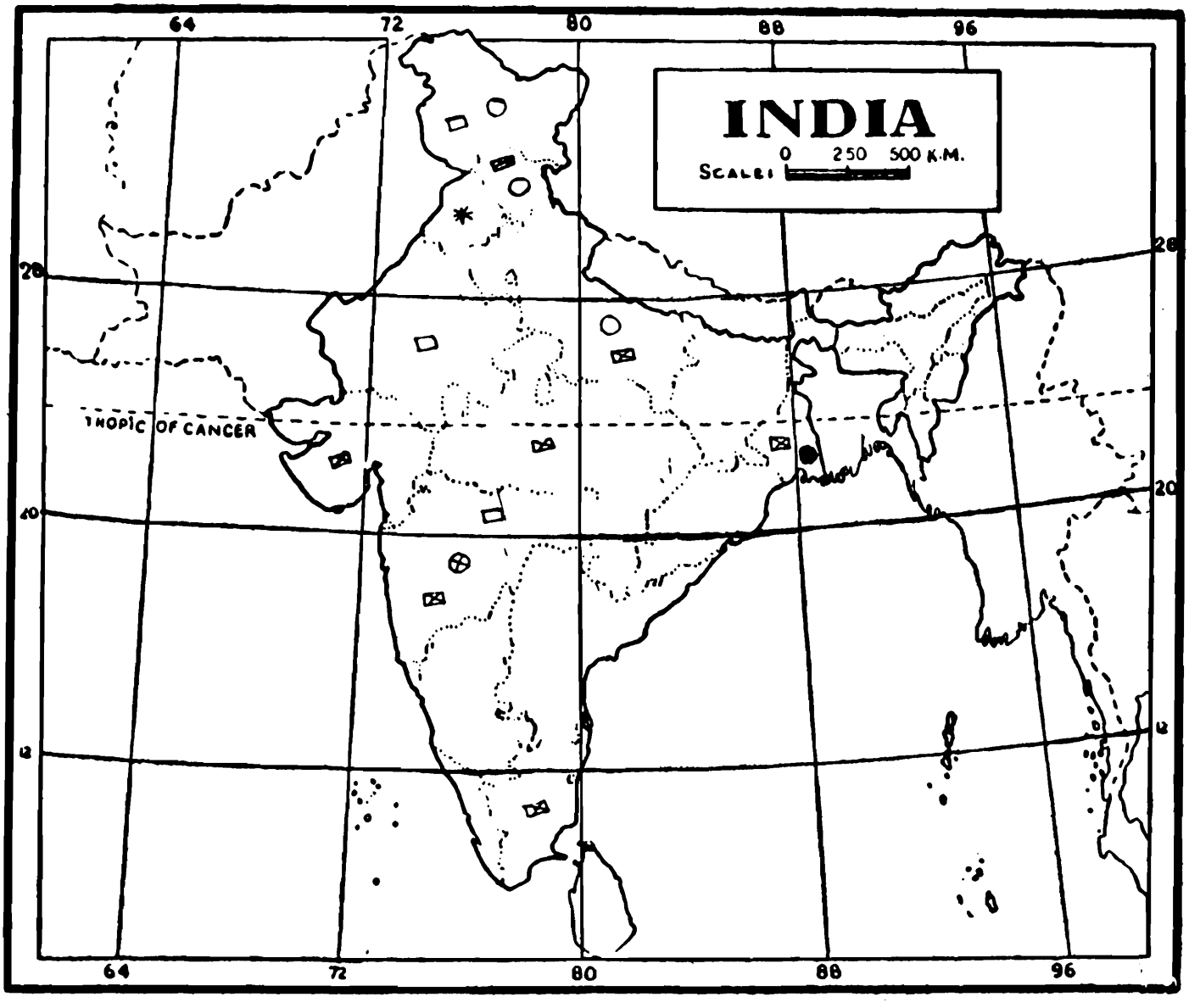
Distribution : India (Maharastra).

PLATE - 57



Nymphs of *Hoplopleura sinhgarh* Mishra, Bhat and Kulkarni
a. Nymph 1 ; b. Nymph 2 ; c. Nymph 3.

Remarks : This species seems close to *H. pectinata* (Cummings) and *H. brasiliensis* (Werneck). It can be separated from *pectinata* by the absence of finger shaped prolongations on the tergite of terminal segment and from *brasiliensis* by the shape of thoracic sternal plate, less serrated margin on paratergites and by modified genital setae.



Map showing distribution of
(*) Hoplopleura erismata Ferris; (○) H. himalayana Mishra, Kulkarni and Bhat; (⊗) H. khandala Mishra; (▭) H. kondana Mishra; (▭) H. maniculata (Neumann); (●) H. malabarica Werneck.

4. Family LINOGNATHIDAE Enderlein

1904. Trichaulinae Enderlein, *Zool. Anz.*; 28 : 138.
1906. Linognathinae Enderlein, *Zool. Anz.*, 28 : 194.
1946. Linognathidae Webb, *Proceedings of the Zoological Society*, 116 : 107.
1978. Linognathidae, Kim and Ludwig, *Syst. Ent.*, 3 : 273-274.

Type genus : *Linognathus* Enderlein.

Characters : Head : Without eyes, post antennal angles variously developed; antennae usually 5 segmented which are not sexually dimorphic. Thorax : Meso and metathoracic phragmata well developed; sternal plate absent, narrow pigmented longitudinal band occupy in this area, or if present, its apex not free from the body; fore legs small with slender claw, middle and posterior legs subequal in size, but larger than fore legs with broad and heavy claw; tibial thumb with a single spiniform seta. Abdomen : Membranous; sternites and tergites absent except genitalia and terminal segments; paratergites entirely lacking; spircales on III to VIII segments, more or less globular and not borne within sclerotic tubercles; more than four longitudinal rows of long setae both dorsally and ventrally and usually not more than two transverse rows of setae in each segment. Genitalia : Female : Median genital plate various shaped if present or sometime lacking; gonopod well developed; spermatheca present; genital lobes prolonged posteriorly. Male : Basal apodeme slender; parameres well developed; free at apex; endomere with distinct aedeagus; pseudopenis elongate.

Remarks : This family contains three genera of which only 2 viz., *Linognathus* Enderlein and *Solenopotes* Enderlein are known from Indian region.

Key to generaof the family *Linognathidae* recorded in India

Thoracic sternal plate large and wide, occupying most of the sternal area enclosed by the coxae; abdominal spiracles borne in a slightly sclerotized tubercles projected at leasl slightly from the body ... ... *Solenopotes* Enderlein.

Thoracic sternal plate absent, narrow longitudinal median pigmented strips present in this region; abdomen with two transverse rows of setae dorsally; spiracles large ... ... *Linognathus* Enderlein.

6. Genus : **Linognathus** Enderlein

1905. *Linognathus* Enderlein, *Zool. Anz.*, 29 : 194.
1932. *Linognathus*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. v, P. 66-67.
1992. *Linognathus*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 10-11.*

Type species : *Pediculus setosus* Von-Olfers by original designation.

Characters : Head : With no external evidence of eyes ; post antennal angles variously developed ; occipital apophyses not developed ; antennae 5 segmented. Thorax : Meso and meta thoracic phragmata well developed ; notal pit obscure ; sternal plate absent, almost narrow longitudinal median pigmented stripes, or if present its apex not free from the body ; fore legs small and slender, with accuminate claw ; mid legs and hind legs subequal but larger than fore legs, each with stout claw, tibial thumb developed, with a single spiniform seta. Abdomen : Membranous, with no trace of tergites and sternites except for those associated with genitalia and terminal segments ; dorsally with two transverse rows of setae on each segment, anterior row may be reduced to a few microsetae ; ventrally with more than four longitudinal rows of long setae, each segment usually with not more than two transverse rows of setae ; spiracles present on 3-8 segments. Genitalia : Female : Genital plate variously shaped ; gonopods well developed ; genital lobes well developed and prolonged posteriorly ; spermatheca not strongly sclerotized. Male : Basal apodeme slender ; pseudopenis elongate ; parameres well developed, never fused apically and enclosing the aedeagus.

Nymphs : Three nymphal instars present.

Hosts : Bovidae, Giraffidae and Canidae.

Remarks : This genus is represented 51 species throughout the world (Kim and Ludwig 1978) ; out of 51 only 7 species are recorded from India.

Key to the species of the genus *Linognathus* recorded in India

1. Female with no trace of a sclerotized, median, genital plate ... *2*
   Female with prominent a small or large median genital plate present ... *4*

2. Abdomen with short, shout, more or less fusiform setae ; gonopods of the female broad, leaf like, set close together and with a tuft of long setae at the apex ... ... *pithodes.*
   Abdomen without such type of fusiform setae *3*

3. Head elongate and slender ; gonopods of the female with a slight tooth, close to the posterior border near the mesal angle ... ... *stenopsis*

   Head small and short ; gonopods of the female broadly truncate, with the apex more or less serrate, bearing a few small setae ... ... *pedalis.*

4. Gonopods of the female with a sclerotized hook at inner angle of emarginate posterior margin ... ... *vituli.*

   Gonopods of female not bearing such type of sclerotic hook ... 5

5. Genital plate of the female large and elongate ; gonopods slender, convergent, narrowly rounded at the extreme apex ... ... *africanus.*

   Genital plate of the female relatively small 6

6. Head large and broad ; parameres of the male genitalia strongly curved and acute at apex ... ... *ovillus.*

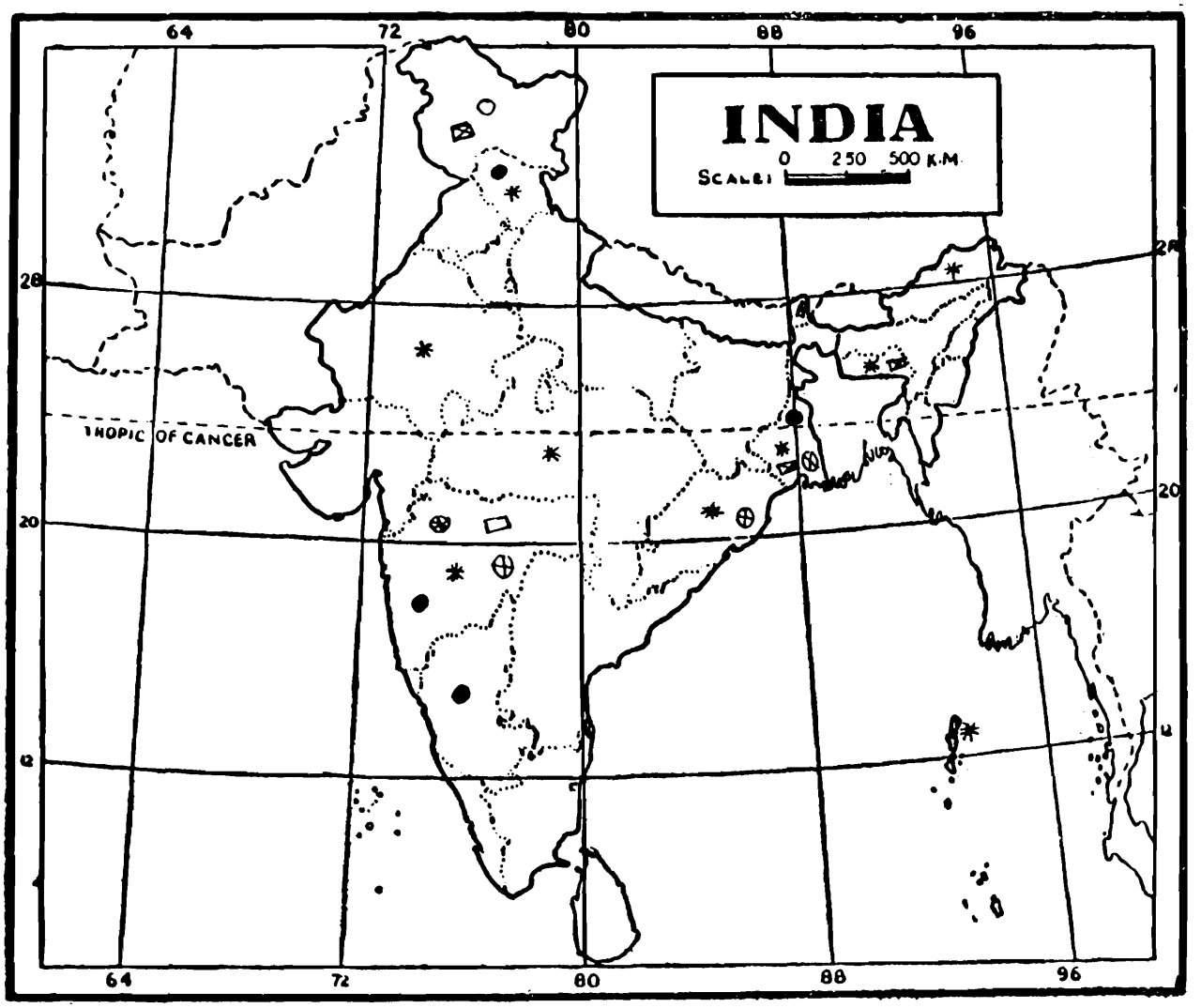
   Head small, slightly longer than wide ; parameres of the male genitalia pointed at the tip ... ... *setosus.*

29. **Linognathus africanus** Kellogg and Paine
(Fig., Plate 58)

1911. *Linognathus africanus* Kellogg and Paine, *Bull. Ent. Res.*, 2 : 146.
1932. *Linognathus, africanus,* Ferris, *Contributions towards a monograph of the sucking lice,* Pt V ; P. 353-355.
1951. *Linognathus africanus,* Ansari, *Indian J. Ento.*, 13 : 117-159.
1974. *Linognathus africanus,* Mishra et al., *Indian J. Med. Res.*, 62 : 1280.
1977. *Linognathus africanus,* Krishna Rao *et al. Mysore J. agric. Sci,,* 11 : 589.
1992. *Linognathus africanus,* Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7* : 11.

Female (Fig. a) : Total body length 1 mm ($\bar{X}$, N = 50) ; range 0·7 mm to 2·1 mm. Head (Fig. b) : Elongate and slender ; forehead sharply parabolic ; the antennae set quite well forward ; lateral margins of the hind head strongly and angularly convex ; dorsal setae in no case very long and slender ; pharynx with brushes ; mouth parts only slightly exceeding the posterior margin of the head. Thorax : About as long as the head, quite narrow and parallel-sided ; meso thoracic phragmata well developed. Abdomen : Relatively large, elongate, oval, moderately hairy, the setae very slender, stouter and arranged in the normal pattern ; spiracles normal, globular form, not strikingly large. Genitalia (Fig. c) : Gonopophyses slender, convergent, narrowly rounded at the apex, which bears a cluster of slender setae ; median genital plate present, large and elongate ; apical lobes usually shorter.

Male : In general very similar to female but slightly less hairy than female. **Genitalia** (Fig. d) : Parameres without a mesal expansion and is having the endomeral piece in the form of a very narrow, almost tube like structure enclosed between the apical half of the parameres.



Map showing distribution of

(✱) Hoplopleura pacifica Ewing; (○) H. phaiomydis Ferris; (⊗) H. ramgarh Mishra, Bhat and Kulkarni; (□), H. sahyadri Mishra; (▭) H. sicata Johnson; (●) H. silvula Johnson; (✱) H. sinhgarh Mishra, Bhat and Kulkarni.

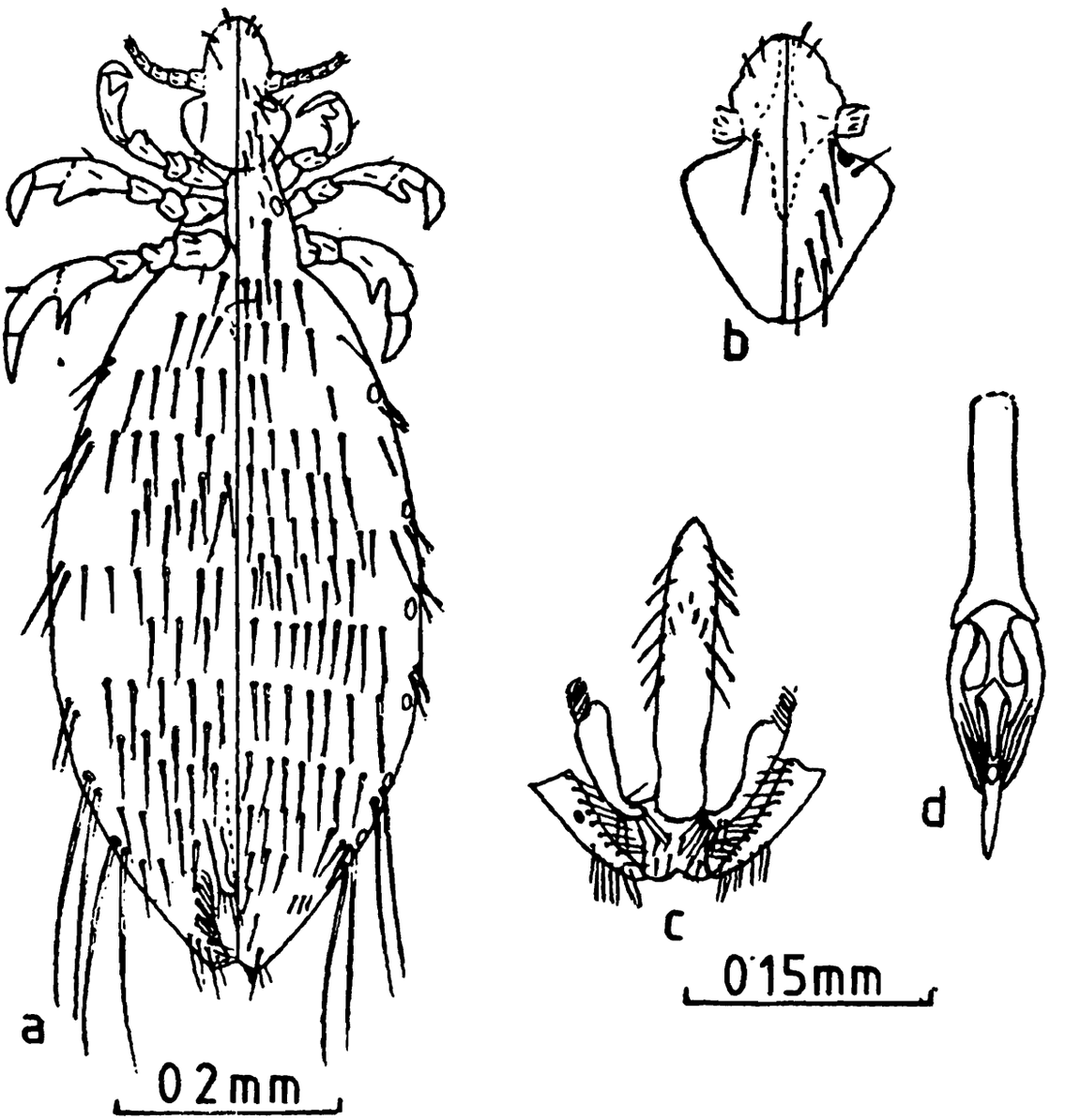
Nymph : Could not be obtained during present study.

Material examined : 10 ♀ ♀, 8 ♂ ♂ from Goat in Sagar Island, West Bengal; 12.12.83 ; Coll. C. C. Adhikary ; 15 ♀ ♀, 10 ♂ ♂ from Goat in Shillong, Meghalaya ;

4.7.85 ; Coll. C. C. Adhikary ; 20 ♀ ♀, 15 ♂♂ from Goat in Itanagar, Arunachal Pradesh ; 8.12.85 ; Coll. C. C. Adhikary ; 5 ♀ ♀, 3 ♂♂ from Goat in Port Blair, Andaman Island ; 30.9.86 ; Coll. C. C. Adhikary.

Host : Sheep and Goat (domesticated).

PLATE 58



Linognathus africanus Kellogg and Paine

a. ♀, Whole body (ventral and dorsal views) ; b. Head of ♀, c. Genitalia of ♀ ; d. Genitalia of ♂.

Distribution : India : (Arunachal Pradesh, Meghalaya, West Bengal, Karnataka, Punjab, Andaman Island) and various localities throughout the world.

Remarks : This species seems close to *L. stenopsis* (Burmeister), but it can be separated from the former by the characters of gonopophyses which are slender, convergent, narrowly rounded at the apex and bear a cluster of slender setae ; median genital plate present, large and elongate ; parameres without a mesal expansion ; endomeral piece in the form of narrow and tube like structure.

30. **Linognathus ovillus** (Neumann)

1907. *Haematopinus ovillus* Neumann, *Revue veterinaire*, 32 : 520.
1913. *Linognathus ovillus* (Neumann), Evans, *Proceedings of the Royal Physical Society of Edinburgh*, 19 : 94.
1932. *Linognathus ovillus*, Ferris, *Contributions toward a monograph of the Sucking lice*, pt. V. P. 346-349.
1974. *Linognathus ovillus*, Mishra *et al. Indian J. Med. Res.*, 62 : 1281.

Female : Head : Relatively large, broad ; the forehead quite sharply parabolic ; antennae set well forward ; hind head with sides nearly parallel, but slightly convex ; fore head with a transverse band on the ventral side ; the hind head with rather weak lateral sclerotic areas ; pharynx with distinct brushes. Thorax : About as long as the head, relatively narrow, the sides nearly parallel ; sternal plate very small and slender or lacking ; dorsum but slightly sclerotic. Abdomen : Very hairy, the hairs in two fairly well defined rows on the dorsum, with a longitudinal bare area on each side and clusters of setae near the margins which bear also one or more very long setae on each segment ; venter with two longitudinal bare strips on each side, thus leaving a cluster of setae between the marginal and median groups ; spiracles noticeably large and conspicuous. Genitalia : Gonopophyses rather small, broadly rounded at the apex and bearing a number of moderately large hairs ; genital plate very small, not reaching the valva ; apical lobes small, bearing three or four long and several small setae and with a very small, stout seta at the apex.

Male : In general similar to female, but slightly less hairy. Genitalia : Parameres strongly curved and acute at the apex and with the endomeral piece forming an elongate ring ; apex of the abdomen forming a slight point.

Nymphs : Unknown.

Host : Sheep and Goat (Domesticated).

Distribution : India (Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir) ; New Zealand ; Scotland.

Remarks : During present study the specimen could not be procured. Description of the species is mainly based on Ferris (1932).

31. **Linognathus pedalis** (Osborn)

1896. *Haematopinus pedalis* Osborn, *United States Dept. of Agric. Div. Ent. Bull.*, (New Series) 5 : 170.

1905. *Linognathus pedalis*, Enderlein, *Zool. Anz.*, 29 : 194.

1932. *Linognathus pedalis*, Ferris, *Contributions toward a monograph of the Sucking lice*, Pt. V.P. 344-346.

1974. *Linognathus pedalis*, Kim and Weisser, *Parasitology*, 69 : 109.

1977. *Linognathus pedalis*, Krishna Rao et. al, *Mysore J. Agric. Sci.*, 11 : 589.

Female : Head : Very small and short, with the antennae placed close to the broadly conical anterior margin ; fore head dorsally with a narrow transverse sclerotic band which is continuous with a narrow longitudinal ventral band, connects with the sclerotic marginal band of the hind head ; pharynx apparently without brushes ; mouth parts scarcely exceeding the posterior margin of the head. Thorax : Relatively very small ; the transverse bands strongly sclerotic, the remainder membranous ; sternal plate lacking ; posterior lateral angles with a free lobe. Abdomen : Elongate, oval, very thicky beset dorsally with quite long, slender setae, the arrangement of rows being obscured ; ventral side with the setae fewer and arranged in longitudinal bands ; spiracles relatively small. Genitalia : Gonopophyses broadly truncate, with the apex more or less serrate and bearing but a few small setae ; median genital plate lacking ; cluster of moderately long setae in the space between the gonopods and the short, inconspicuous apical lobes which terminate in a blunt point.

Male : Very similar to the females but somewhat less hairy abdomen. Genitalia : Parameres blunt at the tip, the endomeral piece forming a distinct ring ; genital plate of distinctive form, being composed of two arms which are connected only at the apex of the body.

Nymphs : Unknown.

Host : Sheep (domesticated).

Distribution : India (Karnataka, Punjab) ; United States ; S. America ; S. Africa ; Australia ; New Zealand.

Remarks : This species could not be procured during present study. Description of the species is mainly based on Ferris (1951).

32. **Linognathus pithodes** Cummings
(Fig., Plate 59)

1916. *Linognathus pithodes Cummings, Proceeding of the Zoological Society London,* P. 260.
1932. *Linognathus pithodes,* Ferris, *Contributions toward a monograph of the sucking lice,* Pt. V. P. 385-386.

Female (Fig. a) : Total body length 0·8 mm. Head (Fig. c) : Short and broad, longer than wide, sclerotic and exceptionally sclerotic band encircling the oral region ; antennae set well forward and with the forehead almost truncate, the whole head quite sclerotic and with an exceptionally sclerotic band encircling the oral region ; buccal funnel and pharynx short and broad, the latter without brushes ; mouth parts scarely exceeding the posterior margin of the head. Thorax : Slightly longer than head and relatively very broad ; the coxae widely separated ; sternal plate lacking ; posterior lateral angles with a broad free lobe ; legs very large and stout. Abdomen : Broadly oval ; setae arranged in the normal pattern but distinguished by their lanceolate form ; margins of the abdomen with a single long seta on segments III and IV and two long setae on segment V to VIII ; spiracles small, globular, with coarse reticulations. Genitalia (Fig. d) : Gonopophyses distinctive form, broad, leaf like, set close together and with a tuft of long setae at the apex ; median genital plate lacking except for a very small area at the tip of valva ; apical lobes short, with a fringe of short setae on the ventral side.

Male (Fig. b) : Total body length 0·6 mm. Head and thorax same as in female. Abdomen : Distinct tergal plates on III to VII segments, these occupying about the median third of the abdomen ; apex of the abdomen strongly trilobed ; setae of the abdomen fewer than in female, those along the tergal plates spike-like in form. Genitalia (Fig. e) : Parameres slender not directly comparable with those of related species ; pseudopenis short and wedge-shaped ; endomeral piece delicate and forming an oval ring.

Nymphs : Unknown.

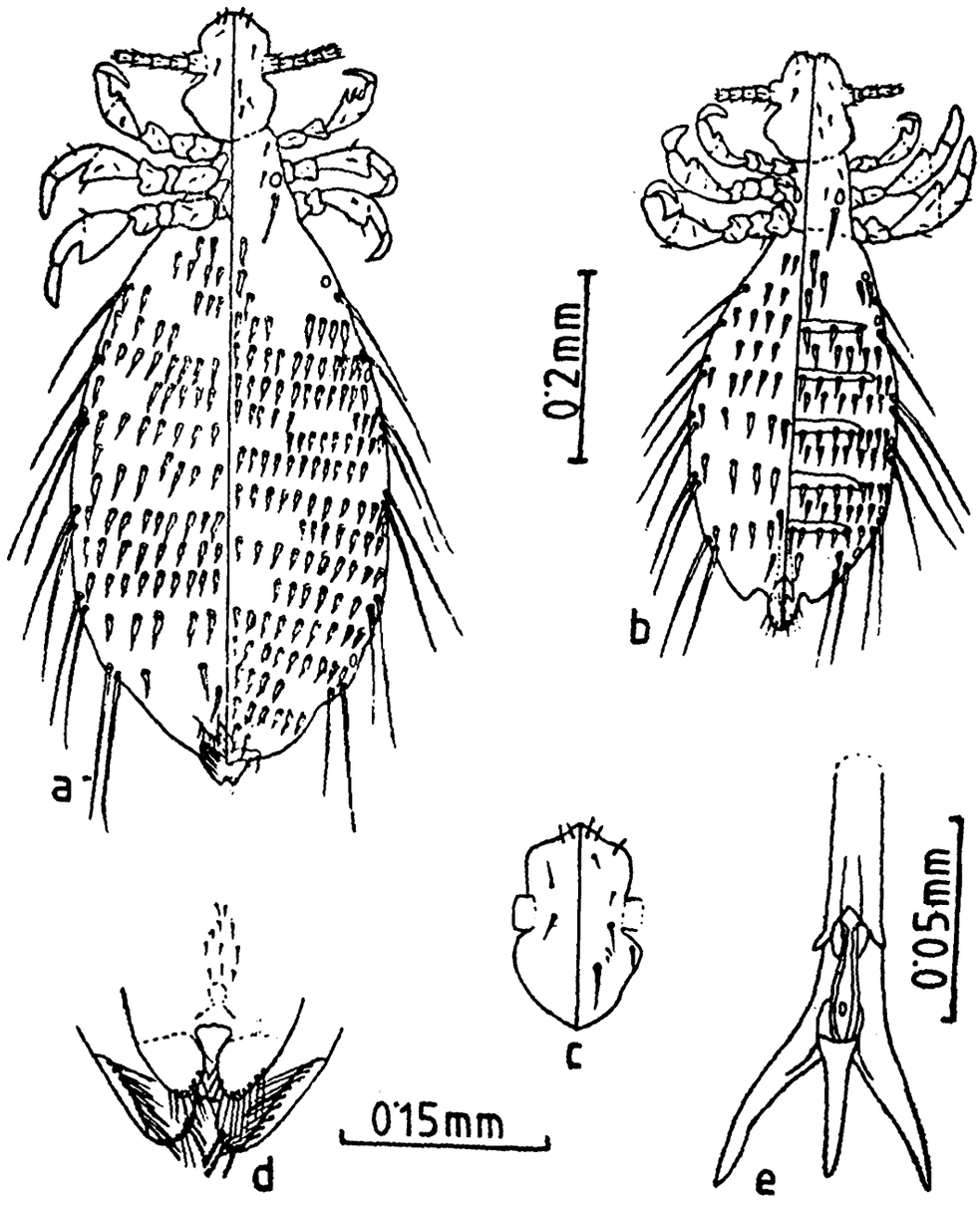
Material examined : 1 ♀, 1 ♂ from *Antelope cervicapra* in Lucknow Zoo Garden, Uttar Pradesh., 10.12.84 ; Coll. C. C. Adhikary.

Host : *Antelope cervicapra.*

Distribution : India [Uttar Pradesh (Lucknow) (New record)] ; United Kingdom.

Remarks : This species seems close to *Linognathus bedfordi* Ferris but it can be separated by the combination of following characters : Abdomen more hairy ;

PLATE 59



Linognathus pithodes Cummings

a. ♀, Whole body (ventral and dorsal views) ; b. ♂, Whole body (ventral and dorsal views) ; c. Head of ♀ ; d. Genitalia of ♀ ; e. Genitalia of ♂.

gonopophyses more slender and more widely separated ; genitalia of male differently formed. This species is recorded for the first time from India.

33. **Linognathus setosus** (Von Olfers)
(Fig., Plate 60)

1816. *Pediculus setosus* Von Olfers, *De vegetativis el animatis corporibus in corporibus animatis reperiundis commentarius*, Page 80.

1932. *Linognathus setosus* Ferris, *Contributions toward a monograph of the sucking lice*, Pt. V.P. 340-344.

1974. *Linognathus setosus*, Mishra et. al, *Indian J. Med. Res.*, 62 : 1281.

1992. *Linognathus setosus*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *11.*

Female (Fig. a) : Total body length 0·83 mm ($\bar{X}$, N=4) ; range 0·72 to 0·89 mm. Head (Fig. b) : Short and broad, the fore head rather trapezoidal., the antennae arising from about the middle of the head ; fore head with a strong, heavily pigmented with transverse band both dorsally and ventrally ; antennae quite short and stout ; mouth parts barely exceeding the posterior border of the head., pharynx without brushes. Thorax : Not sclerotic except for the transverse bands, with a slight tendency toward the development of a free lobe in the posterior lateral angles ; sternal plate lacking ; spiracles unusually large. Abdomen : Broadly oval, thickly beset with slender setae in rows, the arrangement of rows being obscure by the numbers on the dorsal sides, the ventral side somewhat less hairy and with a bare longitudinal area on each side ; margins with long setae on VII and VIII segments and sometimes on other segments as well ; spiracles strikingly large. Genitalia (Fig. c) : Gonopophyses short and broad, the posterior margin broadly rounded and beset with a row of moderately large setae ; slightly or not at all sclerotic except for a narrow longitudinal area ; median genital plate relatively small ; a tuft of small setae between each gonopod and the corresponding apical lobe, the latter small and inconspicuous and terminating in a sclerotic spine.

Male : Head and thorax as in female. Abdomen : Smaller, more pointed but less hairy than in female, dorsal side almost without setae posteriorly of the segment VI. Genitalia (Fig. d) : Genital plate strongly developed, somewhat shield shaped ; parameres pointed at the tips ; endomeral piece constitutes a flattened elongate plate.

Nymphs : Unknown.

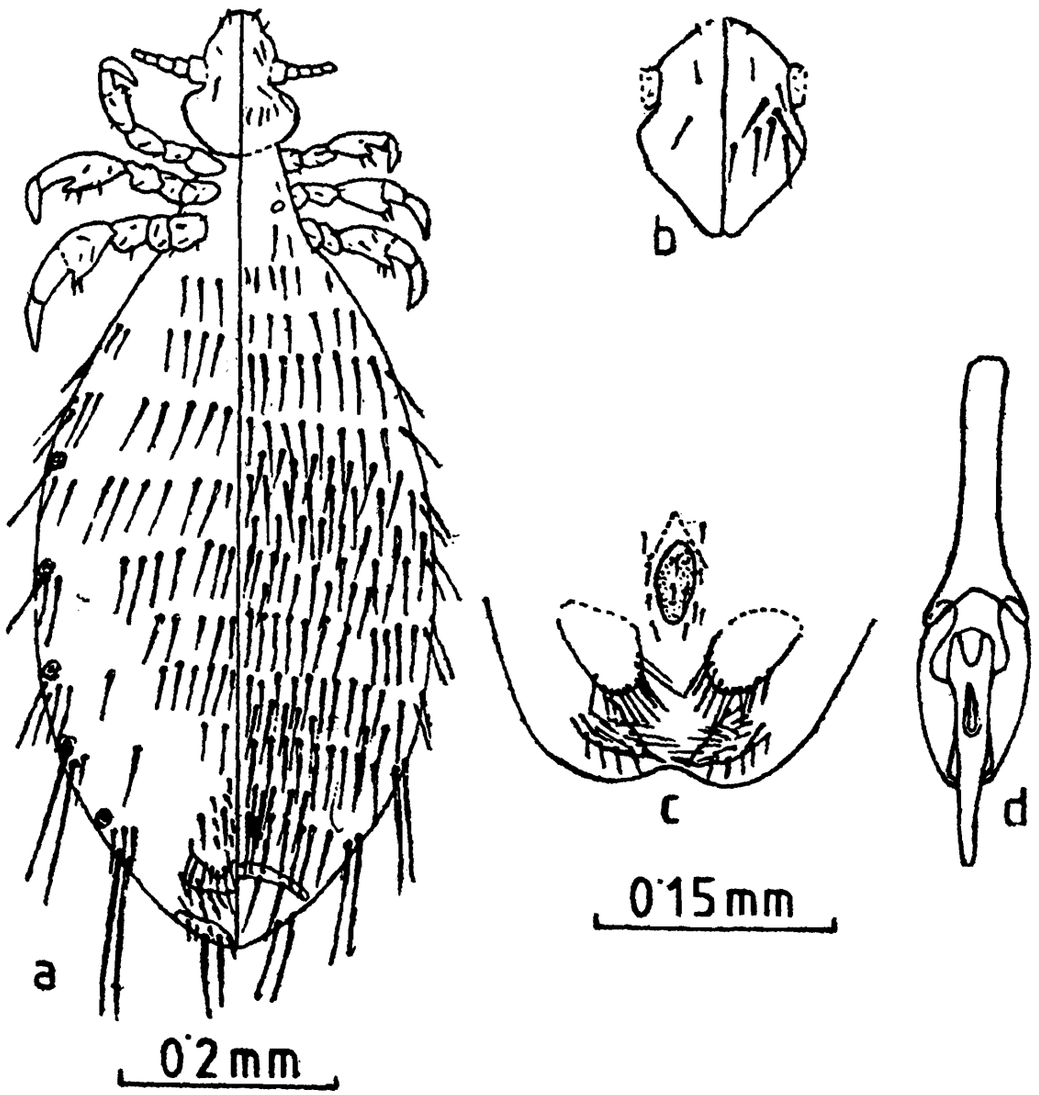
Material examined : 4♀♀, 5♂♂, from domesticated Dog, in Uttar Pradesh ; 9.10.86 ; Coll. C. C. Adhikary.

Host : Dog (domesticated), Fox, Rabbit and Ferret.

Distribution : India (West Bengal, Uttar Pradesh, Himachal Pradesh, Jammu and Kashmir) and various localities throughout the world.

Remarks : This species seems close to *L. pedalis* (Osborn) but it can be separated by the combination of following characters : Antennae arising from about

PLATE - 60



Linognathus setosus (Olfers)

a. ♀, Whole body (ventral and dorsal views) ; b. Head of ♀ ;
c. Genitalia of ♀ ; d. Genitalia of ♂.

middle of the head ; spiracles strikingly large ; endomeral piece of male genitalia consists of a flattened, elongate plate.

34. **Linognathus stenopsis** (Burmeister)

1838. *Pediculus stenopsis* Burmeister, *Genera insectorum Rhynchota*, species 3.
1905. *Linognathus stenopsis*, (Burmeister), Enderlein, *Zool. Anz.*, 29 : 194.
1932. *Linognathus stenopsis*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. V.P. 349-353.
1974. *Linoghathus stenopsis*, Mishra et. al, *Indian J. Med. Res.*, 62 : 1281-1282.

Female : Head : Elongate, slender sharply parabolic, the antennae set quite well forward, the hind head with the lateral margins smoothly and but slightly convex ; fore head with a transverse band on the ventral side extending partially to the dorsal side ; hind head with lateral markings ; dorsal setae unusually long and slender ; the posterior lateral setae being nearly as long as head ; pharynx with brushes ; mouth parts only exceeding the posterior margin of the head. Thorax : About as long as head, quite narrow and parallel sided ; sternal plate very small and narrow. Abdomen : Relatively very large, elongate, oval, moderately hairy ; setae very slender and arranged in normal patterns ; spiracles normal globular form. Genitalia : Gonopophyses of a distinctive type, broadly truncate, with setae only along the apical margin which bears a distinct tooth ; median genital plate lacking ; apical lobe prominent, fringed with long setae.

Male : In general very similar to the female except genitalia. Genitalia : Parameres large and stout, expanded mesally about their middle, rather indistinct, but ring-shaped ; endomeral piece lying caudad of this expansion ; apex of the abdomen ending in a simple, blunt point.

Nymphs : Unknown.

Hosts : Goat and Sheep (Domesticated).

Distribution : India (Jammu & Kashmir, Ladakh, Punjab) and also recorded from almost all over the world.

Remarks : This species could not be procured during present study and the description of the species is mainly based on Ferris (1932).

35. Linognathus vituli (Linnaeus)
(Fig., Plate 61)

1758. *Pediculus vituli* Linnaeus, *Systema naturae*, Edition X, Page 611.
1904. *Linognathus vituli*, Enderlein, *Zool. Anz.*, 29 : 194.
1932. *Linognathus vituli*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. V.P. 356-360.
1974. *Linognathus vituli*, Mishra *et. al*, *Indian J. Med. Res.*, 62 : 1282-1283.
1977. *Linognathus vituli*, Krishna Rao *et. al*, *Mysore J. Agric. Sci.*, 11 : 589.
1992. *Linognathus vituli*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 11.*

Female (Fig. a) : Total body length 1·9 mm ($\bar{X}$, N=20) ; range 1·4 to 2·7 mm. Head (Fig. b) : Without eyes, elongate ; the fore head acutely conical, slightly shorter than hind head ; entire head strongly sclerotic ; all typical head setae present ; ventral pre antennal setae long ; sutural setae 2 pairs ; DPHS long ; DMHS 2-3 pairs ; antennae 5 segmented. Thorax : Meso and meta thoracic phragmata well developed ; fore legs small and slender with acuminate claws ; mid and hind legs subequal and larger than fore legs, each with stout claw ; tibial thumbs highly developed, each with a spiniform seta ; MDTS medium sized, one pair. Abdomen : Membranous, with no sternal and tergal plates except genital and terminal segments ; paratergites absent ; central abdominal setae in 2 rows both dorsal and ventral side ; in dorsal anterior row having 3-5 setae ; terminal row with 2 setae ; remaining with 7-9 setae each ; in ventral, anterior having 2-4 setae and remaining with 9-11 setae each ; 6 pairs of spiracles with distinct internal ledges on III to VIII segments. Genitalia (Fig. c) : Gonopods very distinctive form set close together, broad, with posterior margin emerginate and bearing a sclerotic hook at its inner angle.

Male : In general very similar to female except genitalia. Genitalia (Fig. d) : Parameres long and acutely tapering, elongate ; ring like endomeral piece ; basal apodeme longer than terminal complex ; pseudopenis small with slender arms.

Nymphs : Could not be obtained during present study.

Material examined : 20 ♀♀, 15 ♂♂, from domesticated Cattle in Burdwan, West Bengal ; 10.12.84 ; Coll. C. C. Adhikary.

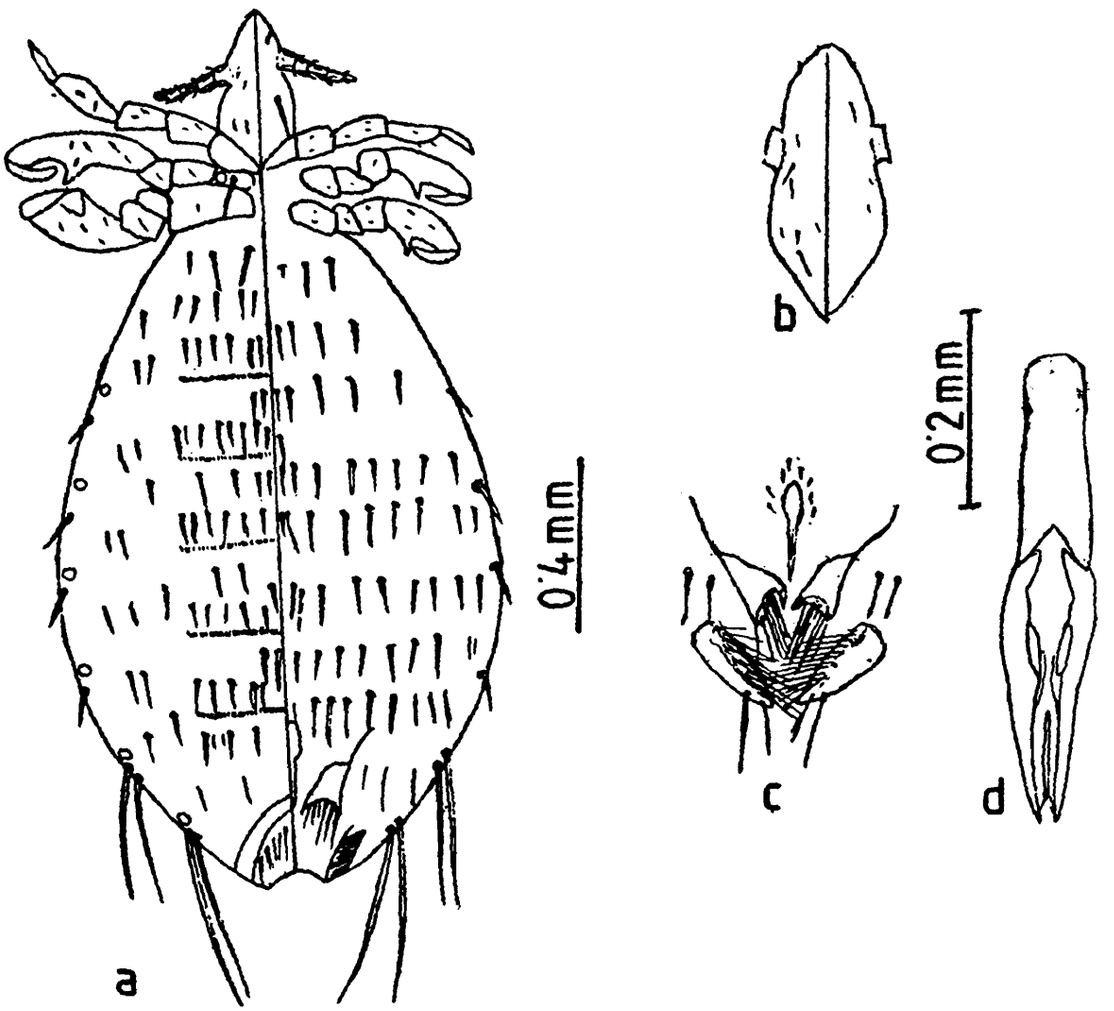
Hosts : Cattle (domesticated), Boar (Wild) and Dog.

Distribution : India and various localities throughout the world.

Remarks : The present specimens correspond with those described by Ferris

(1932, 51) but with following differences. Head with DPHS long ; DMHS 2-3 pairs ; thorax with MDTS one pair, medium sized ; abdomen with central setae in 2 rows, both dorsal and ventral.

PLATE - 61



Linognathus vituli (Linnaeus)
a. ♀, whole body (ventral and dorsal views) ; b. Head of ♀ ;
c. Genitalia of ♀; d. Genitalia of ♂.

7. Genus : **Solenopotes** Enderlein

1904. *Solenopotes* Enderlein, *Zool. Anz.*, 28 : 143.
1951. *Solenopotes*, Ansari, *Indian J. Ent.*, 13.
1974. *Solenopotes*, Kim and Weisser, *Parasitology*, 69 : 110.

Type species : *Solenopotes capillatus* Enderlien.

Characters : Head : Without eyes and ocular points ; antennae 5 segmented. Thorax : Broad and short ; sternal plate large and wide, occupying most of the sternal area enclosed by the coxae but not apically free from the body ; mesothoracic phragmata medio-laterally fused with metathoracic phragmeta ; notal pit distinct ; fore legs smallest having thin acuminate claw ; middle legs larger and hind legs subequal to or slightly larger than middle legs ; middle legs and hind legs similar in shape, with thicker claws. Abdomen : Membranous throughout without any indication of tergites or sternites except the usual genital sclerotization ; paratergites absent but occasionally spiracles on dorso laterally protruding tubercles ; each segment dorsally and ventrally with a single transverse row of setae of varying size. Genitalia : Female with prominent gonopods and genital lobes but usually without median genital plate ; male with subgenital plate reduced, lyriform and with parameres well developed, elongate and enclosing aedeagus and pseudopenis ; pseudopenis sometimes indistinct.

Hosts : Cervidae and Bovidae.

Remarks : This genus represented by 10 species throughout the world. Only one species viz., *S. capillatus* has been recorded from India.

36. **Solenopotes capillatus** Enderlein

1904. *Solenopotes capillatus* Enderlein, *Zool, Anz.*, 28 : 144.
1932. *Solenopotes capillatus*, Ferris, *Contributions towards a monograph of the sucking lice*, Pt.V, 397-401.
1951. *Solenopotes capillatus*, Ansari, *Indian J. Ent.*, 13 : 129.
1974. *Solenopotes capillatus*, Kim and Weisser, *Parasitology*, 69 : 118-120.
1977. *Solenopotes capillatus*, Krishna Rao et al. *Mysore J. Agric. Sci.*, 11 : 589.

Female : Head : Comparatively short and broad, with its lateral margins nearly straight ; antennal segments IV and V, each with a distinct sensorium. Thorax : Sternal plate sub rectangular, almost as wide as long, with its anterior margin concave and posterior margin rounded. Abdomen : With numerous setae ; segments III to V, each with one dorsal lateral abdominal setae ; 2 or 3 dorsal median abdominal setae on each side and 4 dorsal central abdominal setae ; segments III to VIII, each with spiracle on clearly pronounced sclerotized tubercles which are protruding dorsolaterally. Genitalia : Gonopods small and rounded apically.

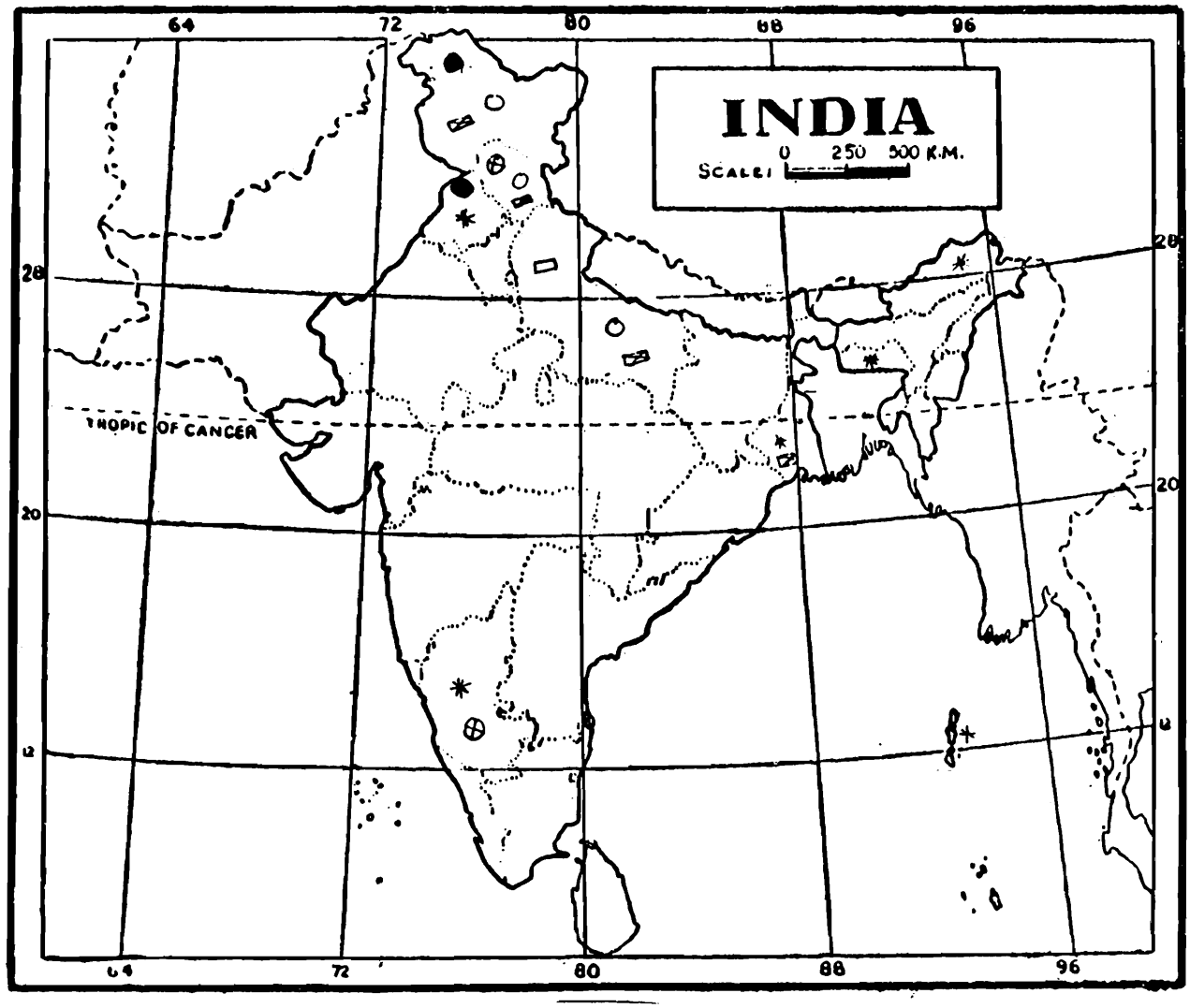
Male : Same as in female except genitalia. Genitalia : Parameres appearing as if broken by a thin, weak portion and pseudopenis large and 'V' shaped.

Nymphs : Unknown.

Host : Cattle (Domesticated).

Distribution : India (Karnataka) ; United States ; England ; Germany ; Canada ; Quebec and Wyoming.

Remarks : No specimen was available for study. Description is mainly based on Kim and Weisser (1974).



Map showing distribution of
(✱) Linognathus afrricanus Kellogg and Paine; (○) L. ovillus (Neumann); (⊗) L. pedalis (Osborn); (▭) L. pithodes Cummings; (▭) L. setosus (Von Olfers); (●) L. stenopsis (Burmeister).

5. Family : PEDICINIDAE Enderlein

1904. Pedicininae *Enderlein, Zool. Anz.*, 28 : 136.
1951. Pedicininae, Ferris, *The sucking lice*, 69.
1967. Pedicininae, Kuhn and Ludwig, *Zeits chrift fur zoologische systematia und Evolutionsforschung*, 5 : 270.
1963. Pedicinidae, Keler, *Tierwelt Mitteleuropas*, 4.
1978. Pedicinidae, Kim and Ludwig, *Syst. Ent.*, 3 : 275-276.

Type genus : *Pedicinus* Gervais.

Characters : Head : Oval to narrowly oval ; distinct eyes with lens and pigments ; antennae 5 segmented, with last three segments more or less fused, causing a three-segmented appearance ; sexually dimorphic, male with a short, stout seta on each of the last three segments dorsally. Thorax : Phragmata well developed ; median longitudinal ridge articulating with occipital sclerotization of the head ; sternal plate and sternal apophyses absent ; legs variable in form ; fore legs slender with slender claw ; middle and hind legs large and stout, each with stout claw or all legs sub equal in size and shape, slender, each with occuminate claw ; tibial thumbs well developed, each with a single spiniform apical seta. Abdomen : Membranous, except for the usual sclerotization of the IX tergite and genital region. Tergites and sternites entirely lacking ; segments IV or V to VI, each with a pair of triangular paratergites, their margin free from body wall ; setae small, arranged in a single definite transverse row on each segment both dorsally and ventrally ; spiracles present on III to VIII segments. Genitalia : Female : Genital plate small ; gonopods weakly developed. Male : Genital apodeme deeply emerginate at apex ; parameres well developed ; pseudopenis weakly sclerotized ; aedeagus and endomere sclerotized.

Remarks : This family contains a single genus viz. *Pedicinus* which is also known from Indian region.

8. Genus : **Pedicinus** Gervais

1844. *Pedicinus* Gervais, in Walckenaer's *Histoire naturelle des insects apteres*, 3 : 301.
1934. *Pedicinus*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. VII, P. 502-503.
1967. *Pedicinus*, Kuhn and Ludwig, Sonderdruck aus : *Zeitschrift Zool. Syst. Evolutionsforschung*, 5, 3, S. 257-297.
1967. *Pedicinus*, Kuhn and Ludwig, *Zeitschrift Zool. Syst. Evolutionsforschung*, 5, 2, S. 152-166.

Type species : *Pedicinus eurygaster* Burmeister by original designation.

Characters : Female : Head : With eyes ; antennae five segmented, frequently last three segments more or less fused, causing a three segmented appearance. Thorax : Dorsum with pleural ridges uniting the meson into a sclerotic area which incloses a slit-like median fold or pit which probably represents the vestiges of the true notum ; sternal plate lacking ; anterior legs always slender with slender claw ; middle and posterior legs ranging from but little stouter than the first to much stouter and with heavy claws. Abdomen : Membranous except for the usual sclerotization of the IX tergite and genital area ; free paratergal plates present on the IV to VI or V and VI segments ; abdominal setae very small, arranged in a single definite transverse row on each segment both dorsally and ventrally. Genitalia : Gonopophyses vestigial, their position indicated chiefly by a row of small setae.

Male : Head and thorax as in female except a short, stout seta on the dorsal side of each of the last three antennal segments. Abdomen : Same as in female except genitalia. Genitalia : Parameres present and well developed, inclosing the pseudopenis between their apices ; the penis borne at the apex of a sclerotic tube of varying form, the preputial sac not evident.

Host : Cercopithecidae.

Remarks : This genus is represented by 16 species ; out of 16 only 3 species are recorded from India.

Key to the species of the genus *Pedicinus* recorded in India

1. Thorax with coxal condyles united by a longitudinal bar ; paratergites present on IV to VI segments, only sclerotic except for a small median seta ... *longiceps.*

   Thorax with cosal condyles not united by a longitudinal bar ... 2

2. Paratergites present on V and VI segments, their outer angle projecting from abdomen ... ... *eurygaster.*

   Paratergites present on IV to VI segments, their posterior half strongly sclerotic ... ... *ancoratus.*

37. Pedicinus ancoratus Ferris

1934. *Pedicinus ancoratus* Ferris, *Contributions toward a monograph of the sucking lice,* Pt. VII, P. 516-518.

1967. *Pedicinus (Neopedicinus) ancoratus,* Kuhn and Ludwig, *Zeitschrift Zool. Syst. Evolutionsforschung,* 5. 2, S. 182-186.

Female : Head : Relatively slender, with the antennae set at about the anterior third ; the anterior margin of the head smoothly rounded, the occiput constricted into a short neck, the markings of the usual type ; antennae with the last three segments quite closely fused. Thorax : Coxal condyles not connected by the longitudinal bar ; anterior legs with the tibio-tarsus moderately slender and with slender claw ; middle and posterior legs with tibio-tarsus stout and flattened, with stout claw and with a heavily sclerotic area on the inner face of the tarsus, this opposing a similar area on the claw. Abdomen : Setae rather sparse and without marginal clusters ; paratergites present on segments IV to VI, their posterior half strongly sclerotic. Genitalia : Genital plate of a distinctive form.

Male : In general closely resembling the female, but with the head shorter and broader ; third and fourth antennal segment quite closely fused. Genitalia : Penis strongly produced anteriorly between the arms of the basal plate, with its posterior prolongation short, strongly sclerotic and with distinct lateral points, the form of the suggesting the specific name ; parameres with their apices truncate and inclosing the broad pseudopenis ; genital plate relatively large.

Nymphs : Unknown.

Hosts : *Presbytis pullata*, *Presbytis cristata*, *Presbytis germaini mandibularis*, *Presbytis schistacea*, *Presbytis rubicunda rubida*, *Pygathrix priamus*.

Distribution : India (Kashmir) ; Sri Lanka ; Malaya ; East Sumatra ; Thailand ; West Borneo and Banka.

Remarks : This species could not be procured during present study. Description of the species is mainly based on Ferris (1934) and Kuhn and Ludwig (1967).

38. **Pedicinus eurygaster** (Burmeister)

1838. *Pediculus eurygaster* **Burmeister**, *Genera Insectorum Rhynchota*, *Species* 21.
1874. *Pedicinus eurygaster* (**Burmeister**), **Giebel**, *Insecta Epizoa*, 23.
1934. *Pedicinus eurygaster*, **Ferris**, *Contributions toward a monograph of the Sucking lice*, **Pt. VII**, P. 521-526.
1967. *Pedicinus* (*Pedicinus*) *eurygaster*, **Kuhn and Ludwig**, *Zeitschrift Zool. Syst. Evolutionsforschung*, 5, 2, S. 172-175.

Female : Head : Relatively small, fore head short and rounded, markings much reduced except for the dorsal band of the fore head ; antennae with the last three segments fused. Thorax : Without a lateral band uniting the condyles ; anterior legs with the claw slender and the tibio-tarsus relatively so ; middle and posterior

legs with tibio-tarsus stout and flattened, the claw stout, the tarsus with three distinct, sclerotic ridges on its inner face. Abdomen : Setae very small, paratergites present on only V and VI segments, small their outer angle projecting from the abdomen ; VII and VIII segments with from two to four slender marginal setae. Genitalia : A small median plate present.

Male : Head : Somewhat shorter and broader than in the female ; antennae with last three segments distinctly separate and each bearing dorsally a short, stout seta. Abdomen : As in female but blunter at the apex. Genitalia : Apices of the parameres widely separated by the broadly divergent arms of the pseudopenis, the penis in the form of an elongate, conical tube which is produced as a narrow ; a flat plate between the arms of the basal plate.

Nymphs : Unknown.

Host : *Inuus sinicus*, *Macacus cynomolgus*, *Macacus rhesus*, *Pithecus rhesus*, *Cynomolgus cynomolgus*, *Macaca mulatta*, *Pithecus* spp. *Rhinopithecus concolor*, *Semnopithecus entellus*.

Distribution : India (Bihar, Kashmir) ; recorded from various parts of the world.

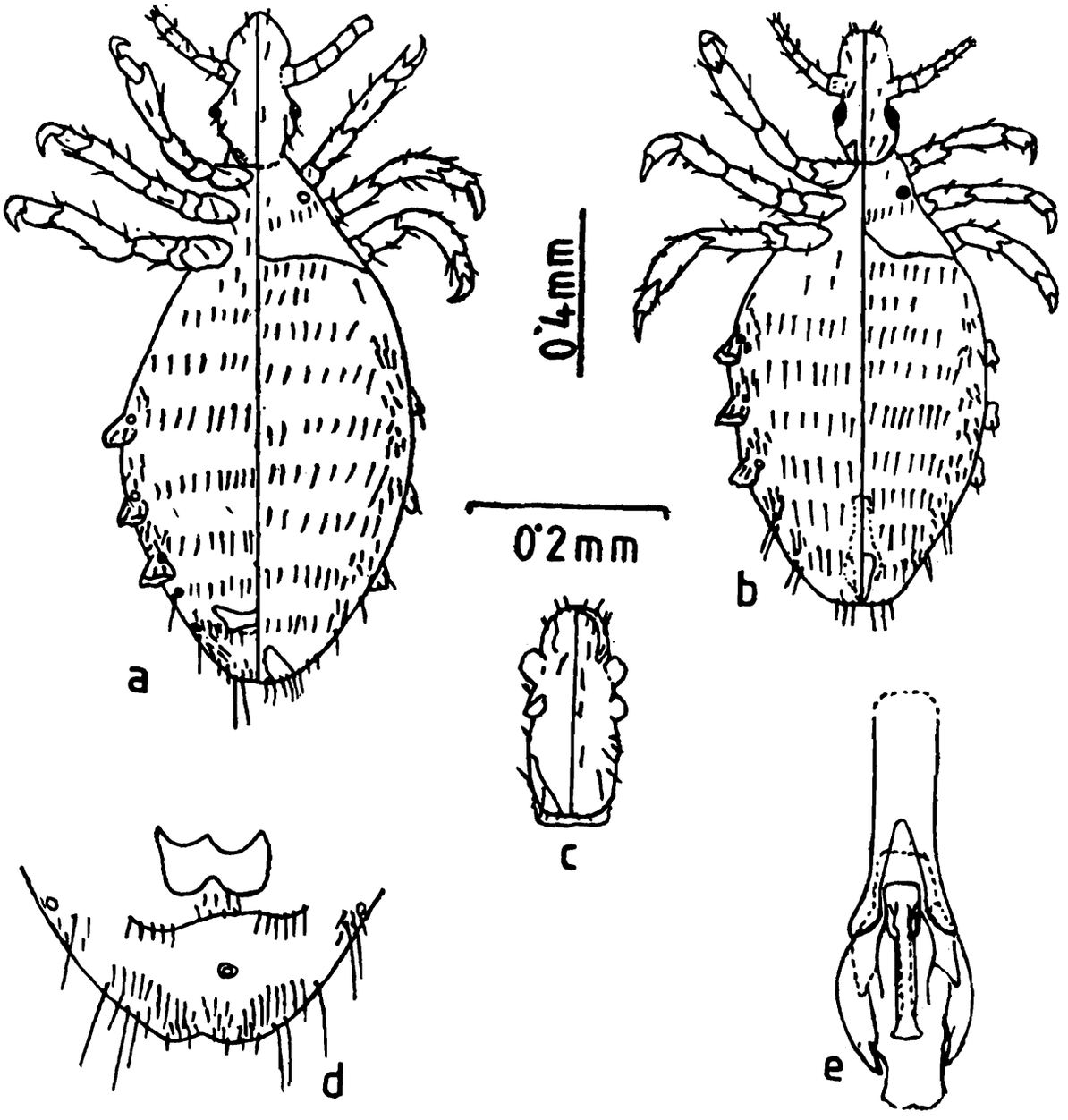
Remarks : This specimen could not be procured during present study. Description of the species is mainly based on Ferris (1934) and Kuhn and Ludwig (1967).

39. **Pedicinus longiceps** Piaget
(Figs., Plate 62)

1880. *Pedicinus longiceps* Piaget, *Les pediculines* PP. 630-632 ; Pl. 51.
1934. *Pedicinus longiceps*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. VII. 505-511.
1967. *Pedicinus (Parapedicinus) obtusus longiceps*, *Zeitschrift Zool. Syst. Evolutionsforschung*, 5, 2, S. 240-242.

Female : (Fig. a) : Total body length 1·5 mm ($\bar{X}$, N=3) ; range 1·5 to 1·7 mm. Head (Fig. c) : Elongate and slender ; fore head sharply rounded, the sclerotic areas forming a curved band across the dorsum of the forehead and longitudinal lateral areas on the hind head ; eyes distinct ; antennae with last three segments fused partially. Thorax : Pro and mesothoracic coxal condyles united by a longitudinal bar ; all legs with slender claws, the tibio-tarsus of the fore legs longer and relatively more slender than that of middle and posterior legs. Abdomen : Numerous setae

PLATE - 62



Pedicinus longiceps Piaget

a. ♀, Whole body (ventral and dorsal views); b. ♂, Whole body (ventral and dorsal views); c. Head of ♀; d. Genitalia of ♀; e. Genitalia of ♂.

arranged in transverse rows and lateral margins both dorsally and ventrally with scattered setae. Paratergites present on IV to VI segments, only slightly sclerotic except for a small median area. Genitalia (Fig. d) : Genital plate very small.

Male : (Fig. b) : Total body length 1·2 mm ($\bar{X}$, N=3) ; range 1·1 to 1·3 mm. Head and thorax as in female except antennae clearly 5 segmented. Abdomen as in female except genitalia. Genitalia (Fig. e) : Basal apodeme about as long as parameres ; the parameres acutely pointed and inclosing the rather narrow pseudopenis ; penis in the form of an elongated tube ; genital plate quite small.

Nymphs : Could not be procured during present study.

Material examined : 3♀♀, 3♂♂, from Rhesus monkey in Nidadavole, Andhra Pradesh ; 1975 ; Coll. P V. R. Rao.

Hosts : *Semnopithecus pruinosus*, *Cercopithecus pruinosus*, *Macacus cynomolgus*, and other species of *Pithecus*, *Macacus* and *Cynocephalus*.

Distribution : India ; Cosmopolitan.

Remarks : This species seems close to *P. hamadryas* Mjoberg and it can be separated by combination of following characters : Tibio-tarsus of the fore legs longer and relatively more slender than that of middle and posterior legs ; rows of setae on abdomen more than in *hamadryas* ; parameres acutely pointed ; penis slightly expanded at apex and forming a flat, truncate anterior process between the arms of basal plate.

6. Family : PEDICULIDAE Leach

1817. Pediculidae Leach, *The Zoological Miscellany*, 3 : 64.
1978. Pediculidae, Kim and Ludwig, *Syst. Ent.*, 3 : 276.
1992. Pediculidae, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 12.*

Type genus : *Pediculus* Linnaeus.

Characters : Head : Short, constricted posteriorly into a short neck, eyes with distinct lenses and pigmentation on lateral lobes ; antennae 5 segmented which are not sexually dimorphic. Thorax : Phragmata well developed ; notal pit reduced ; sternal plate weakly sclerotized, not free from margins or entirely lacking ; all legs subequal in size and form, each with a long accuminate claw ; tibial thumbs well developed, each with a spiniform seta. Abdomen : Usually membranous

except genital and terminal segments ; small variable tergal sclerotization in male. Paratergites present on III to IX segments, forming a cap over the apices of the laterally lobed segment, their margins not free ; spiracles present on III to VIII segments ; segmental setae arranged in transverse field. Genitalia : Female : Sub genital plate distinct and large ; gonopods strongly developed ; spermatheca weakly developed. Male : Basal apodeme large ; parameres reduced apparently and fused with the base of the pseudopenis ; statum penis forming a sclerotic tube ; toothed preputial sac.

Remarks : This family contain single genus viz. *Pediculus* Linnaeus, and also known from Indian region.

9. Genus : **Pediculus** Linnaeus

1758. *Pediculus* Linnaeus, *Systema Naturae*, Edition X, P. 610.
1905. *Pediculus*, Enderlein, *Zool. Anz.*, 28 : 138.
1935. *Pediculus*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. VIII, P. 534-535.
1992. *Pediculus*, Adhikary and Ghosh, *State Fauna Series, 3 : Fauna of West Bengal, Pt. 7 : 12.*

Type species : *Pediculus humanus* Linnaeus.

Characters : Female : Head : Eyes present ; 5 segmented antennae which are not sexually dimorphic. Thorax : All legs bearing same character, claws slender ; thoracic notum reduced to a median line and a median pit ; sternal plate sclerotized but without free margins ; Abdomen : Membranous except paratergites and genitalia ; paratergites present on segments III to IX forming a cap over the apices of the laterally lobed segments, their margin not free ; abdominal setae tending to be in the part more or less spike-like, their arrangement variable ; spiracles present on III to VIII segments, the first two pairs not displaced toward the meson. Genitalia : Sub genital plate large ; gonopophyses well developed.

Male : Head and thorax same as in female except tibio-tarsus of fore legs is stouter than the others and anterior claw slightly toothed. Abdomen : Same as in female except genitalia. Genitalia : Parameres apparently greatly reduced and fused with the base of pseudopenis ; penis forming a sclerotic tube arising from the conspicuous and much-toothed preputial sac.

Hosts : Cebidae, Pongidae and Hominidae.

Remarks : This is represented by two species throughout the world, only one viz., *Pediculus humanus* is recorded from India.

40. **Pediculus humanus** Linnaeus
(Figs., Plate 63)

1758. *Pediculus humanus* Linnaeus, *Systema Naturae*, Edition ×, P, 610.
1935. *Pediculus humanus*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. VIII, P. 543-602.
1974. *Pediculus humanus*, Mishra et al., *Indian J. Med. Res.*, 62 : 1283.
1992. *Pediculus humanus*, Adhikary & Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 12.*

Female (Fig. a) : Total body length 1·7 mm ($\bar{X}$, N=10) ; range 1·4 to 2·3 mm. A very variable species from very pale to very dark in colour, from short and compact to elongate and swollen in shape. Head (Fig. c) with antennae shorter than head or equal to head ; thorax with sternal plate (Fig. d) 0·16 mm long and 0·12 mm wide. Abdomen with setae varying from sparse and more or less arranged in rows to numerous and without definite arrangement. Paratergites varying to some extent, but never with dorsal and ventral lobes. Genitalia (Fig. e) with gonopophyses varying from short and blunt to almost sickel shaped ; genital plate variable in form.

Male (Fig. b) : Total body length 1·4 mm ($\bar{X}$, N=10) ; range 1·1 to 2·2 mm. Head and thorax as in female except fore leg with tibio-tarsus stouter than in the female. Abdomen with tergal plates of variable pigmentation and extent normally present on the III to VIII segments ; 2 plates on III to VI segments each ; VII and VIII segments, each with a single tergite, but occasionally with a plate developed on second segment ; an additional plate on eighth and sometimes with the plates more or less fused. Genitalia (Fig. f) presenting no specific pecularities ; the genital plate always present, small and variable in form ; parameres apparently reduced and fused with the base of the pseudopenis ; preputial sac toothed.

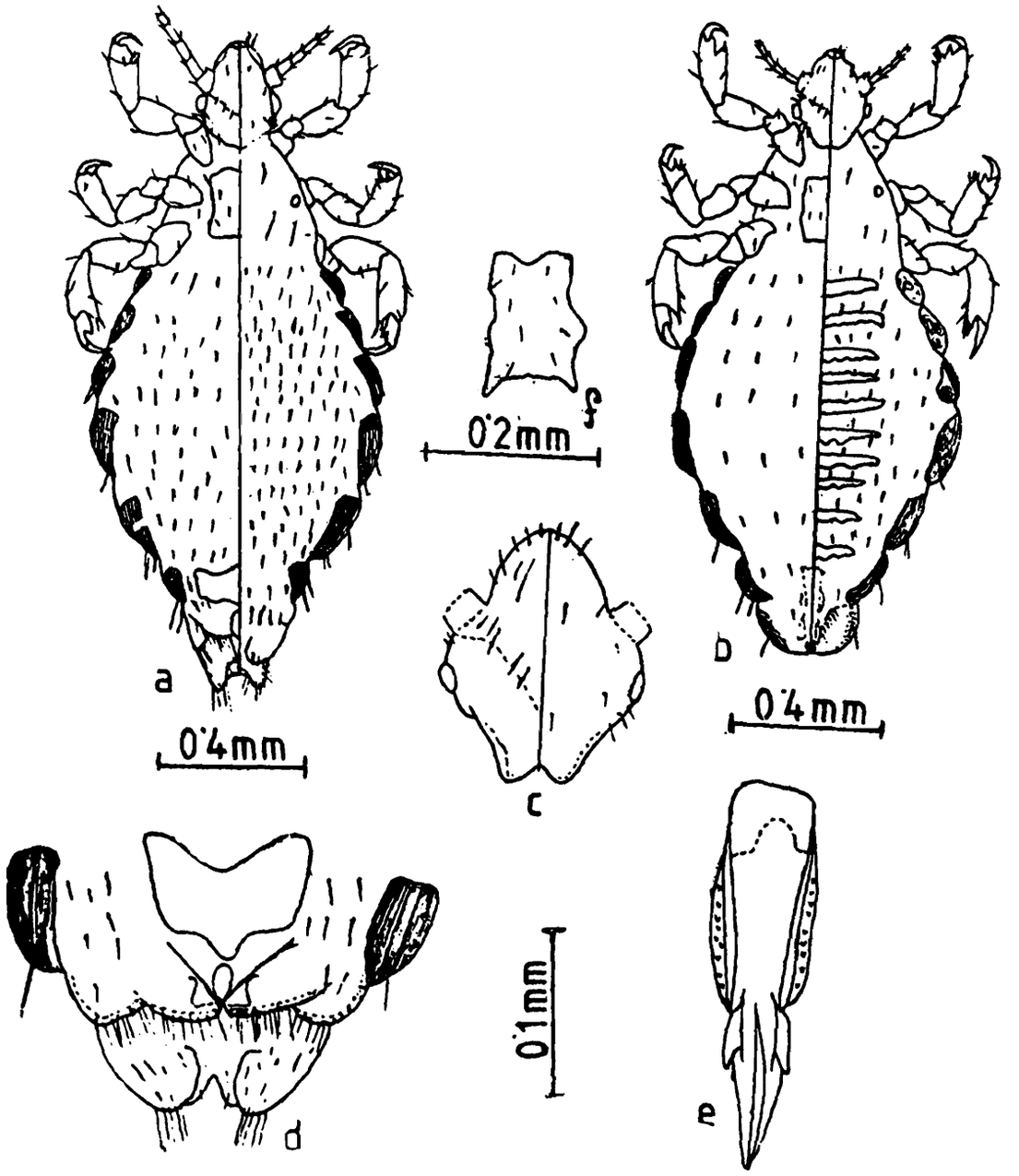
Nymphs : Could not be obtained during present study.

Material examined : 13 ♀ ♀, 10 ♂ ♂, from Human head in Calcutta, West Bengal ; 10.9.83 ; Coll. C.C. Adhikary.

Host : Common lice on Human head but occasionally found other primates.

Distribution : India ; cosmopolitan.

PLATE - 63



Pediculus humanus Linnaeus

a. ♀, Whole body (ventral and dorsal views); b. ♂, Whole body (ventral and dorsal views); c. Head of ♀; d. Genitalia of ♀; e. Genitalia of ♂; f. Thoracic sternal plate of ♀.

7. Family : POLYPLACIDAE Fahrenholz

1912. Polyplacinae Fahrenholz, *Jahresbericht des Niedersachsinchen Zoologischen vereins*, 58.
1951. Polyplacinae, Ferris, *The Sucking lice*, P. 101.
1963. Polyplacidae Keler, *Tierwelt Mitteleuropas, Peipzig, Insekten*, 1 : 6.
1978. Polyplacidae, Kim and Ludwig, *Syst. Ent.*, 3 : 276-277.
1992. Polyplacidae, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal*, Pt. *7 : 12.*

Type genus : *Polyplax* Enderlein by original designation.

Characters : Head : Antennae 5 segmented, usually sexual dimorphism, male with apical preaxial angle of antennal segment III prolonged. Thorax : Fore legs small with slender claw ; middle legs larger with stout claw ; hind legs largest with stouter claw ; mesothoracic phragmata usually well developed., sternal plate usually well sclerotized. Abdomen : Paratergites usually present ; tergites and sternites usually highly developed ; sternites of segment II never extended laterally articulate with corresponding paratergites. Genitalia : Female with well developed gonopods and sub genital plate ; spermatheca usually poorly developed. Male with different shaped basal apodeme, parameres and pseudopenis ; basal apodeme well sclerotized.

Remarks : This family contains 14 genera of which only 4 viz. *Docophthirus* Waterston, *Haemodipsus* Enderlein. *Neohaematopinus* Mjoberg and *Polyplax* Enderlein are known from Indian region.

Key to genera of the family *Polyplacidae* recorded in India

1. First antennal segment enlarged and with both basal and distal anterior angles prolonged into a hook ... ... *Docophthirus* Waterston.
   First antennal segment without such hook 2

2. Abdominal paratergites very small, consisting of a slight, sclerotized point projected from the body wall and is supported by a slight, expanded sclerotization at the base ... ... *Haemodipsus* Enderlein.
   Abdominal paratergites well developed 3

3. Paratergite of abdominal segment II divided into two plates bearing one seta on each plate ... ... *Polyplax* Enderlein.
   Paratergite of abdominal segment II not divided into two plates ... ... *Neohaematopinus* Mjoberg.

10. Genus : **Docophthirus** Waterston

1923. *Docophthirus* Waterston, *Bull. Ent. Res.*, **14** : 101.
1932. *Docophthirus*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. V : 303.
1951. *Docophthirus*, Ferris, *The sucking lice*, 164-65.
1981. *Docophthirus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 70.

Type species : *Docophthirus acinetus* Waterston by monotype.

Characters : Head : Anoplura without eyes ; with five segmented antennae which are not sexually dimorphic, with the first segment having the anterior margin produced basally and ventrally into sclerotized hooks. Thorax : Sternal plate not developed ; fore leg small and weak ; middle and hind legs both enlarged and practically equal in size. Abdomen : Paratergal plates of the abdomen present on atleast segments II-VI, those of segment III not longitudinally divided, those of all the segments with each posterior angle produced into a distinct point. Abdomen of the female with two rows of tergal setae on segments III-VII and one row on segment I and VIII, with a small tergal plate present in connection with the anterior most row of setae on segments II-VII ; with two rows of setae on the sternites of segments II-VII ; but with a distinct plate present only on segment II. Male with a single row of tergal setae on all tergites except segment II, which has two rows, with one row and one plate on segments I and IV-VII and two plates on segment II ; ventrally with but one plate and one row of setae on segment II and with but one row of setae on any other segment and no plates except on segment VII and VIII ; spiracles present on segments II-VIII.

Host : Tupaiidae,

Remarks : This genus is represented by a single species *Docophthirus acinetus* Waterston. No specimen could be obtained during present study. Description of the genus is based on Ferris 1951.

41. **Docophthirus acinetus** Waterston

1923. *Docophthirus acinetus* Waterston, *Bull. Ent. Res.*, **14** : 101.
1932. *Docophthirus acinetus*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. V : 304.
1951. *Docophthirus acinetus*, Ferris, *The sucking lice*, P. 168.
1981. *Docophthirus acinetus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 70.

Female : Head : Short and broad ; the antennae continuous with the flat anterior margin, the post antennal angles moderately prominent ; the occipital angles barely indicated ; ventral side with a series of stout, strongly sclerotic hooks ; antennae normal form, except the first segment much enlarged and with both basal and distal anterior angles prolonged into hooks and with a third hook on the ventral side along the anterior margin. Thorax : Trapezoidal form, the lateral margins straight ; the lateral band connecting the condyles is broad and heavy ; the prothoracic pleural apophysis and pleural ridge are lacking ; the spiracle is very small and set far behind the middle coxal condyle ; the mesothoracic pleural ridge is faint and continued across the meson ; sternal plate apparently lacking ; legs presenting no unusual features. Abdomen : Long and slender, the setae rather stout, the anterior row of each tergite associated with a well defined plate ; paratergal plates small but distinct, the posterior angle both dorsally and ventrally prolonged into a slight point and each plate, as well as the VIII segment, bearing a pair of long slender setae. Genitalia : Not described in details.

Male : Closely resembling the female in general features except for the presence of but a single row of setae dorsally and ventrally on each abdominal segment other than the second tergite. Tergal plates larger than in female. Genitalia : Basal plate long and slender, expanded at the apex ; the parameres long and broad and almost parallel ; pseudopenis long, rod like and somewhat irregular piece that extends from beyond the apex of the parameres almost to their bases.

Nymphs : Unknown.

Host : Recorded from *Anathana ellioti*, the tree shrew.

Distribution : India (Tamilnadu).

Remarks : During the present study no specimen could be obtained. The description is based on Ferris (1951).

11. Genus : **Haemodipsus** Enderlein

1904. *Haemodipsus* Enderlein, *Zool. Anz.*, 28 : 139, 143.
1909. *Haematopinus* (*Polyplax*) Neumann, *Arch. Parasitol.*, 14 : 536.
1981. *Haemodipsus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 71.

Type species : *Pediculus lyriocephalus* Burmeister.

Characters : Head : Antennae five segmented not sexually dimorphic. Thorax : First pair of legs small and with slender claw ; Second and third pair of legs moderately stout

and with stout claw, about equal to eaeh other ; sternal plate present. **Abdomen :** Membranous throughout except for the usual areas on the ninth tergite and the genital region ; paratergal plates entirely lacking in the type species, present as minute vestiges on the III to VI segments in others ; spiracles present on III to VIII segments ; each abdominal segment in both sexes with a single transverse row of setae both dorsally and ventrally ; Genitalia : Gonopophyses greatly reduced, being but mere vestiges marked by the presence of setae.

Hosts : Members of the rodent family Leporidae (rabbits and hares).

Remarks : This genus is represented by 7 species from different parts of the world (Ferris, 1951, Blagoveshtchensky 1965, 66). Out of 7 only single species viz *H. ventricosus* (Denny) has been recorded from India. No specimens could be obtained during present study. Description of the genus is based on Ferris (1951).

42. **Haemodipsus ventricosus** (Denny)

1842. *Haematopinus ventricosus* Denny, *Monographia Anoplurorum Britanniae*, P. 30, pl. 25.
1909. *Haematopinus* (*Polyplax*) *ventricosus* Denny, Neumann, *Arch. Parasitol* ; 13 : 527, fig. 27.
1913. *Polyplax ventricosus* (Denny) Evans, *Proc. R. Phys. Soc. Edin.*, 19 : 94.
1904. *Haemodipsus ventricosus* (Denny) Enderlein, *Zool. Anz.*, 28 : 143.
1981. *Haemodipsus ventricosus* (Denny), Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 71-72.

Female : Head : Very distinctive form, relatively small and somewhat deflexed ; the fore head rounded ; the lateral margins of the hind head strongly swollen, each forming almost a sector of a circle ; the occipital region forming a neck ; lateral margins of the head without a sclerotic area. Thorax : Shorter than the head and scarcely one and a half times as wide, the lateral margins revolute toward the ventral side, the condyles of the coxae thus being concealed ; sclerotic transverse bands of the pleurites not uniting across the dorsum ; sternal plate somewhat irregular and variable but typically narrow and transverse, its margins not free ; legs of the form typical for the genus. Abdomen : Pyriform configuration ; setae slender, arranged both dorsally and ventrally into median and marginal groups ; paratergites present on the third to sixth segments, exceedingly minute, forming merely a slight tooth which bears a long seta at its base ; spiracles small. Genitalia : Narrow and transverse genital plate ; gonopophyses slightly more strongly developed ; apical angles of the IX segment, each with a long, stout seta.

Male : Head, thorax and abdomen like female except genitalia. Genitalia : Basal plate broad, its apex articulating with the stout, curved parameres, which inclose

between their apices the very small, wedge-shaped pseudopenis and between their bases the quite large penis.

Nymphs : Unknown.

Hosts : *Oryctolagus cuniculus* and domestic and wild rabbit.

Distribution : India ; United Kingdom ; Cosmopolitan.

Remarks ; No specimen could be procured during the present study. Description of the species is based on Ferris (1951).

12. Genus : **Neohaematopinus** Mjoberg

1910. *Neohaematopinus* Mjoberg, *Arch. Zool.* (Stockholm), 6 : 160.
1910. *Acanthopinus* Mjoberg, *Loc. Cit.*, 6 : 13.
1914. *Linognathoides* Cummings, *Bull. Ent. Res.*, 5 : 159.
1916. *Lutegus* Fahrenholz, *Arch.* f. *Naturgesch.* (Berlin), 31.
1929. *Ahaematopinus* Ewing, *Manual of external parasites*, p. 197.
1949. *Petauristophthirus* Eichler, *Soc. Ent. Ital. Biol.*, 79 : 12.
1981. *Neohaematopinus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 72.
1992. *Neohaematopinus*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *14.*

Type species : *Haematopinus sciuropteri* Osborn, by original designation.

Characters : Anoplura without eyes. Head : As long as wide or slightly longer, with post antennal angles convex ; 5 segmented antennae, basal segment with or without posteroapical angle usually bearing a stout seta ; male with 3rd segment usually somewhat produced anteroapically and always bearing 2 strong spines or spiniform setae at apex ; female with 3rd segment not bearing a strong spine or seta. Thorax : Usually with sternal plate posteriorly emerginate or truncate and having distinct posterior angles produced ; fore legs small and weak with an acuminate claw ; mid hind legs larger and usually sub equal or with hind leg slightly longer, each with a strong claw. Abdomen : Paratergal plates well developed on the II to VIII segments ; plates III to VI usually subquadrangular or triangular ; plates VII and VIII usually ellipsoid with slender setae ; tergites and sternites well developed ; dorsally and ventrally covered with rows of setae ; II plate of the 2nd tergite usually emerginate posteriorly with a group of setae on each lateral knob.

Nymphs : Three nymphal instars present. Morphological characters are discussed with individual species.

Hosts : Sciuridae, other Rodentia and Insectivora.

Remarks : This genus is represented by 41 species, out of which only 3 species have been recorded from India.

Key to species of the genus *Neohaematopinus* recorded in India

1. Thoracic sternal plate hepatogonal ; paratergites IV to VI, each with both dorsal and ventral posterior lateral angles small and acute, having 2 setae each ... ... *Petauristae.*

   Thoracic sternal plate not hepatogonal 2

2. Tergites and sternites absent except tergites on segment II and terminal segment in female and some narrow tergites in male ... ... *palearctus.*

   Tergites and sternites well developed, paratergites IV to VI, each with setae arranged in 2 groups, dorsal group with 3 and ventral group with 4 setae ... ... *echinatus.*

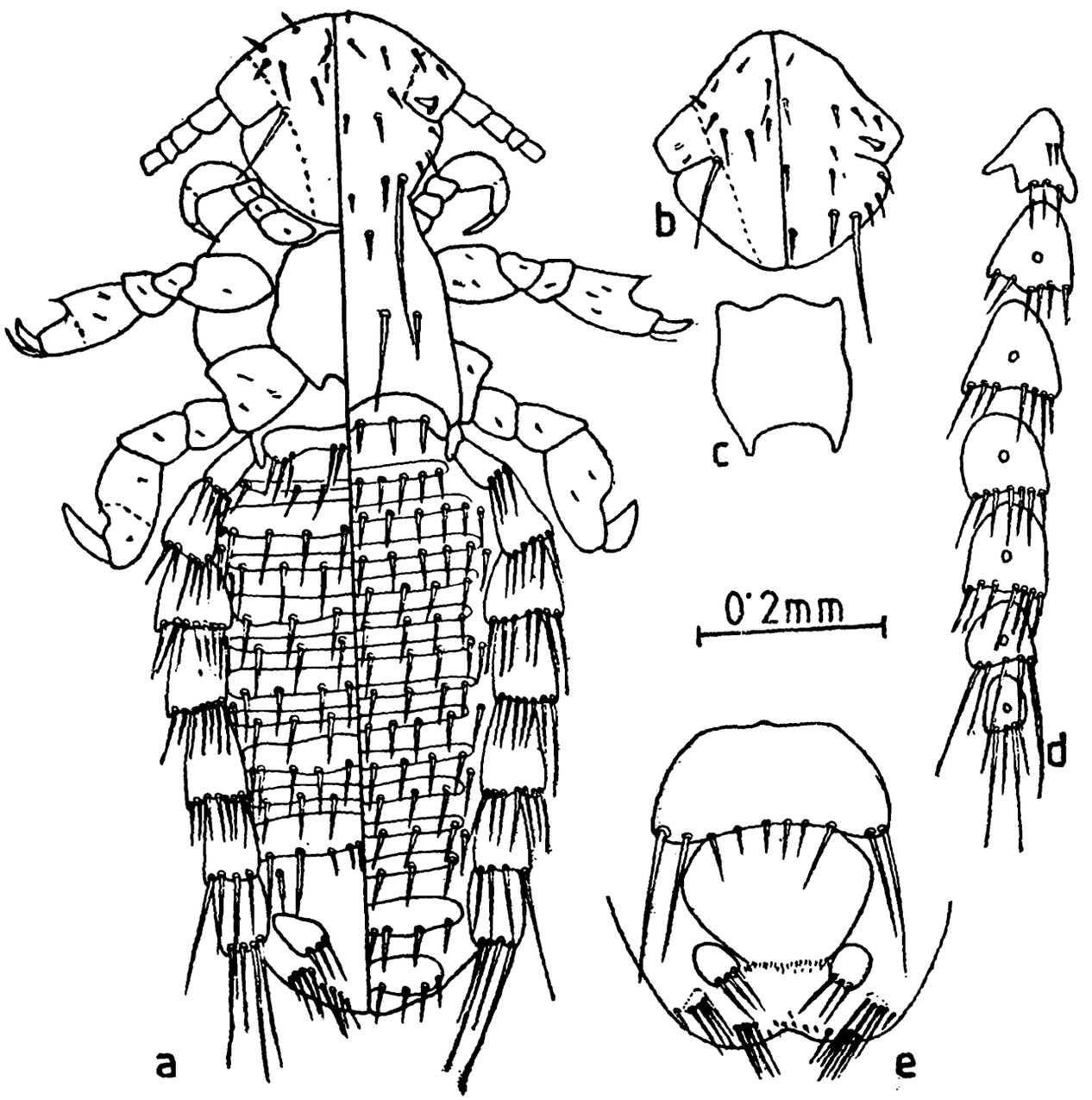
43. **Neohaematopinus echinatus** (Neumann)
(Figs., Plates 64, 65 & 66)

1909. *Haematopinus (Polyplax) echinatus* Neumann, *Arch. parasit.*, 13 : 517.
1912. *Neohaematopinus echinatus* (Neumann), Cummings, *Bull. Ent. Res.*, 3 : 393.
1951. *Neohaematopinus echinatus*, Ferris, *The Sucking lice*, P. 191.
1962. *Neohaematopinus echinatus*, Kaneko, *Bull. Tokyo Med. Dent. Univ.*, 9 : 136.
1974. *Neohaematopinus echinatus*, Mishra *et al.*, *Ind. J. med. Res.*, 62 : 1276.
1981. *Neohaematopinus echinatus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 73-77.
1992. *Neohaematopinus echinatus*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *14.*

Female (Fig., Plate 64, a, b, c, d, e) : Total body length 1·1 mm, ($\bar{X}$, N=15) ; range 0·95 mm to 1·98 mm. Head (Fig., Plate 64, b) : Longer than wide ; post antennal angles prominent ; occipital angles weakly developed. All typical head setae present ; first antennal segment enlarged, bearing a stout, short thorn like seta on dorsal side ; sensoria on segments IV and V well separated. Thorax : Sternal plate (Fig., Plate 64, c) 0·17 mm long and 0·13 mm wide, with convex anterior and lateral margins, posterior margin straight ; MDTS one pair, long. Abdomen : Dorsal : Segment I with a single tergite, concave posteriorly, having 5 or 6 setae, outer setae stout and thorn like ; II to VII, each with 2 tergites, having 7-12 setae each ; VIII and terminal

segment, each with a single broad tergite having 8 setae each; DAAS 6-8 pairs. Ventral : Segment II with 2 sternites; anterior broad having 4 stout setae on each side on the lateral convexity and 2 or 3 setae medially; posterior sternite

PLATE - 64

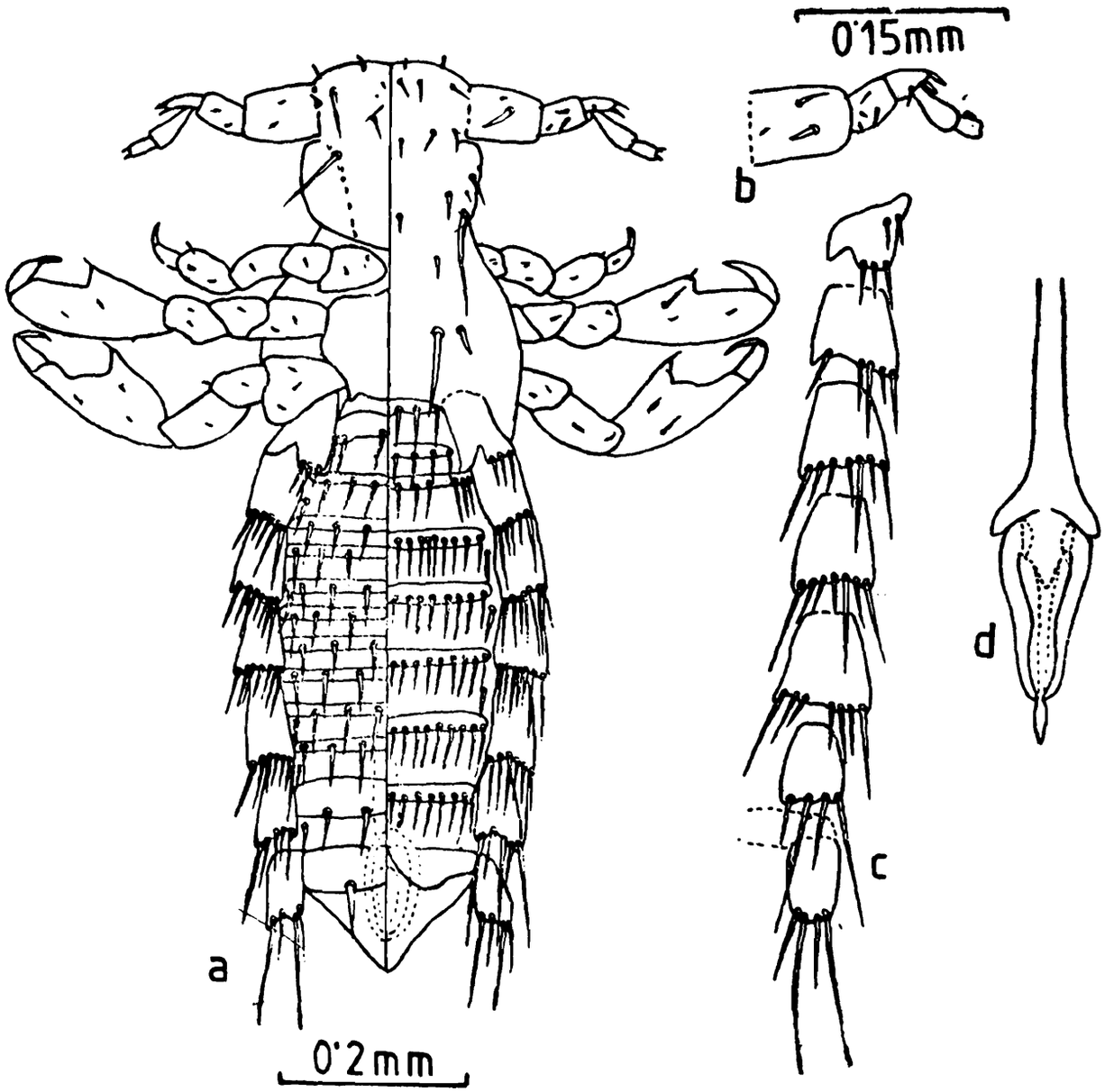


Neohaematopinus echinatus (Neumann) : ♀

a. Whole body (ventral and dorsal views); b. Head; c. Thoracic sternal plate; d. Paratergites; e. Genitalia.

narrow having 6 setae ; segments III to VI each with 2 sternites having 6-9 setae each ; VII with a single broad sternite with 10 setae ; remaining sternites modified to form genitalia ; VAAS 9-11 pairs. Lateral : Paratergites (Fig., Plate 64, d) : I small, partially fused with II having 2 setae ; II with a board ventral process and narrow dorsal process

PLATE - 65

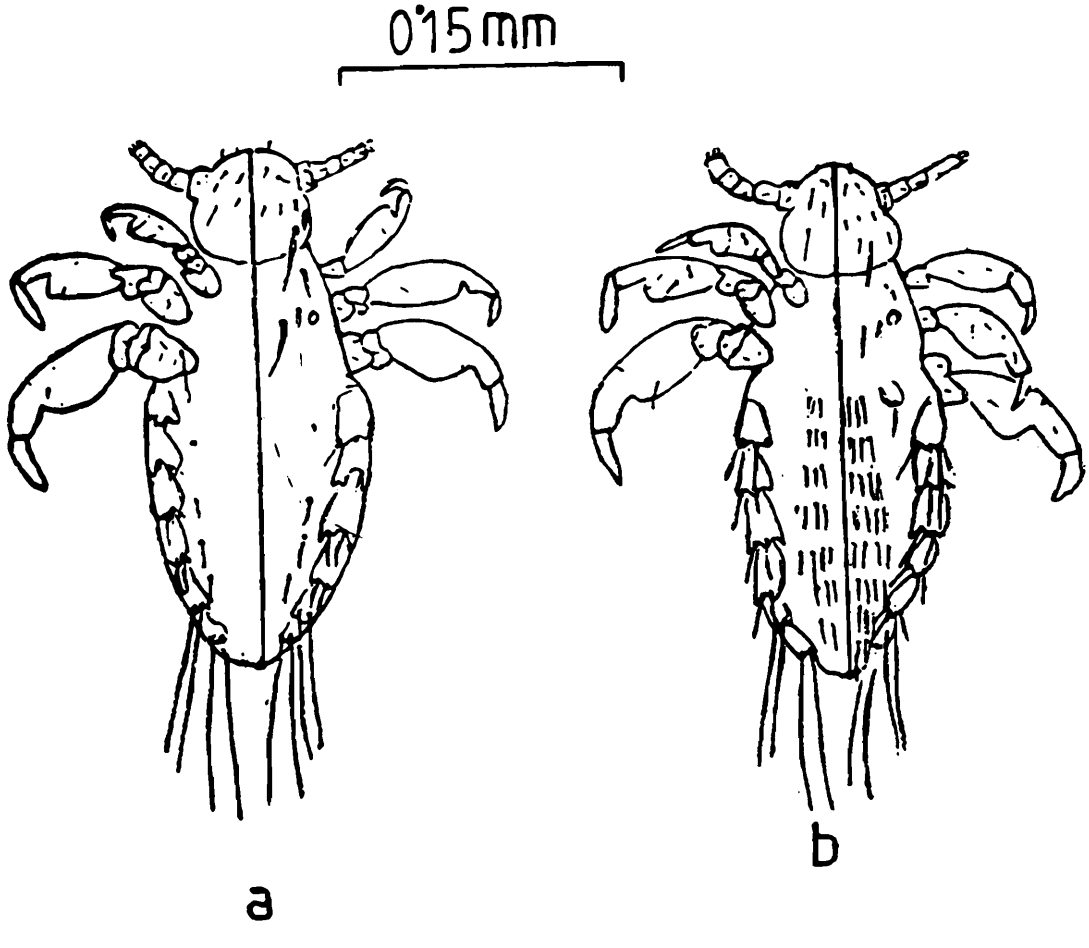


Neohaematopinus echinatus (Neumann) : ♂
a. Whole body (ventral and dorsal views) ; b. Antenna ; c. Paratergites ; d. Genitalia.

having 3 setae on ventral process, dorsal process devoid of setae ; III to VI, each with postero-lateral angles acute, posteroventral margins with 4 setae, postero dorsal margin with 3 setae except III which bear only 2 setae on posterodorsal margin ; VII and VIII with rounded posterolateral angles ; VII with 3 long and 2 short setae and VIII with 2 long and 2 short setae. Genitalia (Fig., Plate 64, e) : Genital plate broad anteriorly and narrow posteriorly ; gonopods paired, 3 setae on each ; genital setae stout and tapering at tip.

Male (Fig., Plate 65, a, b, c, d) : Total body length 0·92 mm ($\bar{X}$, N=15) ; range 0·68 to 1·23 mm. Head and thorax as in female except antennal segment III (Fig., Plate 65, b) which is apicodorsally prolonged into a hook like process, bearing

PLATE - 66



Nymphs of *Neohaematopinus echinatus* (Neumann)
a. Nymph 1 ; b. Nymph 2.

two short and stout setae. Abdomen: Dorsal: Segment I with a single tergite, having 6 setae; II with 2 tergites, with 8 setae anteriorly and with a group of 5 lateral setae and 5 or 6 mesial setae posteriorly; III to VII, each with a single tergite having 16-20 setae each; VIII with a pair of triangular tergite, devoid of setae; DAAS 4-5 pairs. Ventral: Segment II to VI, each with 2 sternites, anterior most as in female, remaining with 5-8 setae each; VII and VIII, each with a single broad sternite having 4 and 2 setae respectively; VAAS 5-6 pairs. Lateral: Paratergites (Fig., Plate 65, c) as in female except III with single seta on posterodorsal margin; segment VIII fused with triangular abdominal tergites. Genitalia (Fig., Plate 65, d): Parameres uniform in thickness, apically curved and pointed; pseudopenis long, smooth, extending beyond the apices of parameres.

Nymph 1 (Fig. 66, a): Head: As long as wide, all typical head setae present; antennae 5 segmented. Thorax: Sternal plate absent; legs as in adult. Abdomen: Tergites and sternites absent. Paratergites III to V with posterior angles acute, posterodorsal and posteroventral margins with 2 setae each; paratergites VII and VIII small, with 2 setae each.

Nymph 2 (Fig. 66, b): Similar to nymph 1 except as follows: Antennae as in female; abdomen with 9 rows setae dorsally and 7 rows of setae ventrally. Paratergites I small with a single seta; II large, 3 setae on posterodorsal margin and one seta on posteroventral margin. Major abdominal setae one pair and anal setae indistinct.

Nymph 3: Similar to nymph 2.

Material examined: 5 ♀♀, 5 ♂♂, from *Funambulus palmarum* in Purulia, West Bengal; 19.1.85; Coll. C. C. Adhikary; 5 ♀♀, 5 ♂♂, from *F. pennanti* in Port Blair, Andaman Islands; 30.9.86; Coll. C. C. Adhikary; 5♀♀, 5 ♂♂, from *F. pennanti* in Madras, Tamil Nadu; 21.3.87; Coll. C. C. Adhikary.

Hosts: ***Funambulus pennanti***, ***F. palmarum*** and ***F. tristriatus***.

Distribution: India [West Bengal (New record), Maharastra, Madhya Pradesh, Gujrat, Himachal Pradesh, Uttar Pradesh, Tamil Nadu (New record), Karnataka and Andaman Islands (New record)].

Remarks: This species seems close to *N. sciuropteri* (Osborn) and *N. ceylonicus* Ferris. It can be separated from the former by the shape of anterior sternite on segment II and from the latter by the number of setae on posteroventral margin of paratergites IV to VI (3 setae in each).

44. **Neohaematopinus palearctus** Olsoufiev
(Figs., Plate 67)

1938. *Neohaematopinus palearctus Olsoufiev*, V.I E.M. *Ot. Med. Trudy Moscow*, 3 : 210-212.
1974. *Neohaematopinus palearctus*, Mishra *et al.*, *Indian J. med. Res.*; 62 : 1276.
1981. *Neohaematopinus palearctus*, Mishra, *Rec. Zool. Surv, India, Occ. Paper*, 21 : 77-80.

Female (Fig. a) : Total body length 1 mm ($\bar{X}$, N=1). Head : Longer than wide ; preantennal and postantennal regions with strong chitinous armature ; all typical head setae present, comparatively long and slender ; antennal sensoria on segment IV and V well separated. Thorax : Sternal plate (Fig. c) 0·07 mm long and 0·06 mm wide, roughly oblong in shape ; MDTS one pair. Abdomen : Dorsal : Tergites and sternites absent except narrow tergites on II and terminal segments and usual sclerotization of genital region. Dorsal side with 15 rows of setae ; first 14 rows with groups of 4-8 setae on each side laterally and 9-18 setae mesially ; last row with 2 setae. Ventral side with 12 rows of setae, first two rows with 6-8 setae medially ; remaining rows with groups of 2-4 setae laterally on each side and 7-16 setae mesially. Lateral : Paratergites : I unchitinized with one small and one long setae ; II to VI chitinized ; II with one small and one long setae ; III to VI, each with 3 setae of varying in length ; VII and VIII also unchitinized with 2 long setae each. Genitalia (Fig. d) : Genital plate roughly pentagonal in shape ; gonopods paired, each with one long and two small setae ; genital setae enlarged and stout.

Male (Fig. b) : Total body length 0·75 mm. Head and thorax as in female. Abdomen : Dorsal : Tergites are narrow and small, with 8 rows of 6-16 long, slender setae in middle and 7 rows of 2-5 setae (in groups) on lateral side ; terminal segment with several small setae. Ventral : Sternites absent except genitalia, with 11 rows of 2-12 long thin setae medially, 5-6 rows of 2-4 setae in lateral groups ; terminal segment with several minute setae. Lateral : Paratergites as in female. Genitalia (Fig. f) : Parameres almost uniform in thickness with pointed and slightly curved apices ; pseudopenis with distinct serration on sides.

Nymphs : Unknown.

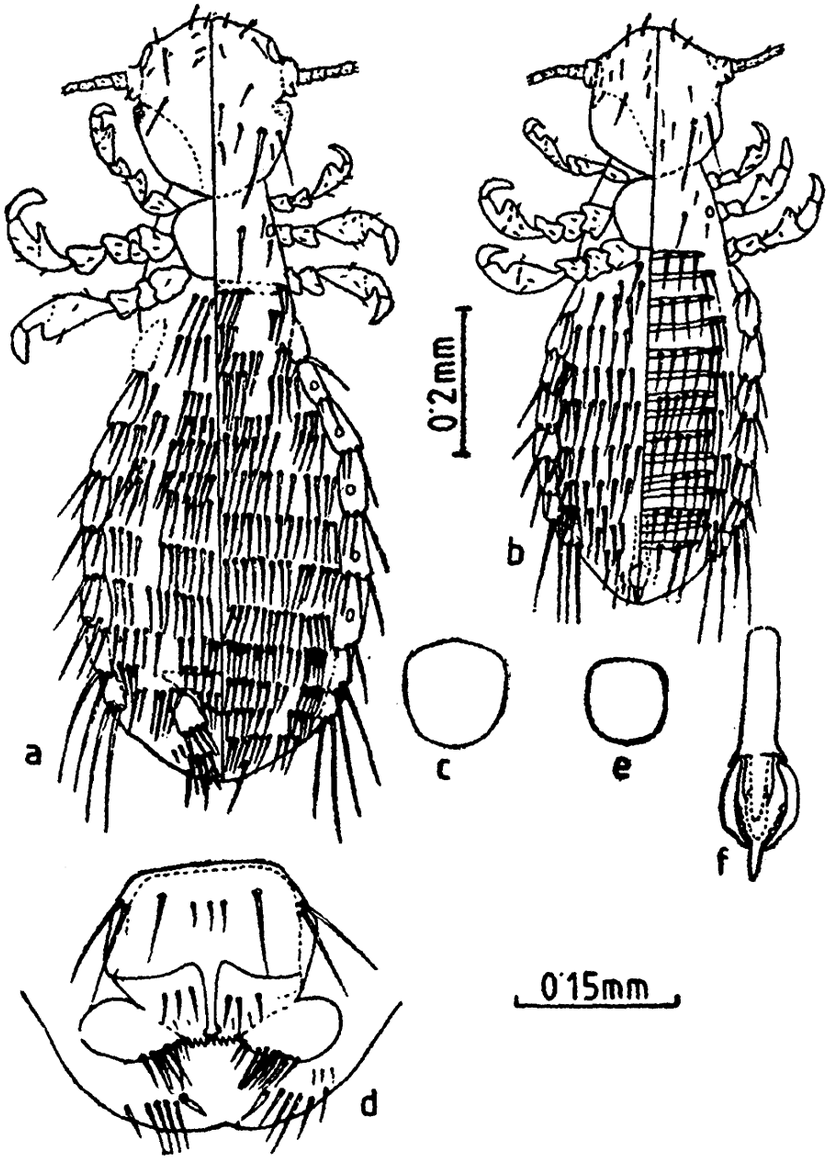
Material examined : Paratypes 1 ♀, 1 ♂ (Regd. No. VRC A63993) from *Marmota caudata* in Mine Marg, Ladakh ; 30.7.67 ; Coll. A.C. Mishra.

Host : *Marmota caudata.*

Distribution : India (Jammu and Kashmir) ; U.S S.R.

Remarks: This species seems close to *Neohaematopinus marmotae* Ferris and *N laeviusculus* (Grube) but it can be separated by combination of following characters: Head comparatively large; thoracic sternal plate roughly oblonged; mesothoracic spiracle large; shape of the male genitalia different.

PLATE - 67



Neohaematopinus palearctus Olsoufiev

a. ♀, Whole body (ventral and dorsal views); b. ♂, Whole body (ventral and dorsal views); c. Thoracic sternal plate of ♀; d. Genitalia of ♀; e. Thoracic sternal plate of ♂; f. Genitalia of ♂.

45. **Neohaematopinus petauristae** Ferris

1923. *Neohaematopinus petauristae* Ferris, *Contributions towards a monograph of the sucking lice.* Part IV : 258.
1951. *Neohaematopinus petauristae*, Ferris, *The sucking lice*, P. 195.
1964. *Neohaematopinus petauristae*, Johnson, *Misc. Publs. Ent. Soc. Am*, 4 : 80, 81.
1949. *Petauristophthirus petauristae* (Ferris) Eichler, *Soc. Entomol. Ital. Biol.*, 79 : 12.
1981. *Neohaematopinus petauristae*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 80-81.

Female : Head : Somewhat longer than broad, acutely rounded in front with the antennae set somewhat back from the apex ; post antennal angles practically obsolate, with a distinctly constricted occipital region and with the lateral margins of the head nearly straight and parallel ; antennae with a quite long, slender seta at the distal post axial angle of the first segment. Thorax : Considerably shorter than the head ; sternal plate irregularly seven sided. Abdomen : Tergites and sternites narrow, usually with 7 to 10 slender setae ; each segment except the ventral side of the first with 1 to 3 setae near the margin opposite the end of each row of setae. Paratergites : 1 obsolete, having 3 slender setae ; II with a small and acute dorsal postero-lateral angle ; having 2 long setae. III to VI, each with both dorsal and ventral postero lateral angles small and acute, having 2 setae, setae longer than plates ; VII and VIII devoid of acute angles, having 2 long and slender setae. Genitalia : Gonopod paired, each with one long and two small setae ; genital setae enlarged and stout.

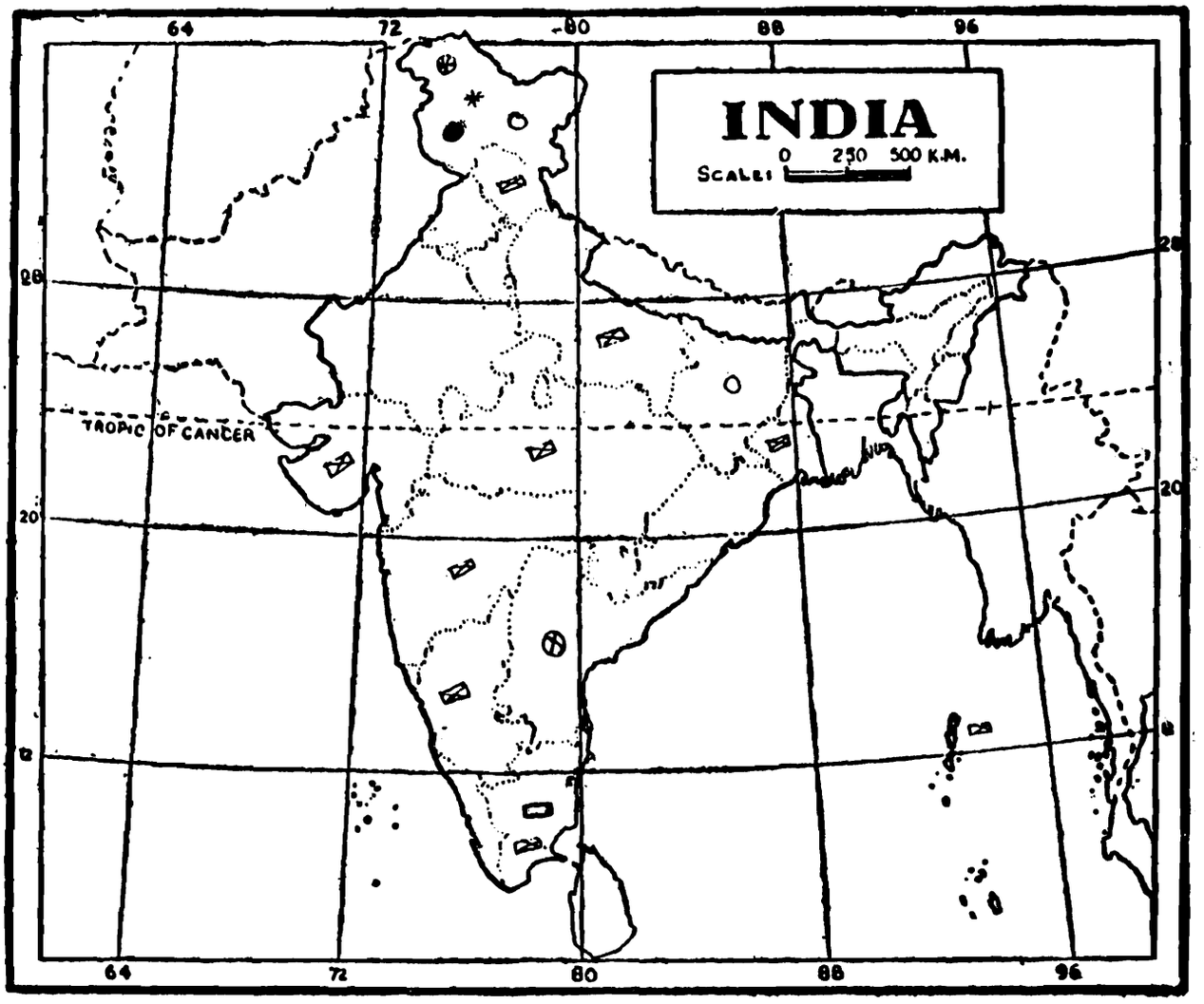
Male : Head and thorax as in female, except third antennal segment which is modified and bear a pair of stout, recurved setae. Abdomen : Segment III to VI, each with 2 tergites. Paratergites as in female. Genitalia : Basal plate moderately broad ; parameres more than half as long as basal plate, stout, somewhat curved but nearly parallel, enclosing part of pseudopenis ; pseudopenis long and serrated.

Nymphs : Unknown.

Host : *Petaurista petaurista albiventer.*

Distribution : India (Kashmir).

Remarks : During the present study the specimen could not be procured. Description of the species is mainly based on Mishra (1981).



Map showing distribution of
(✱) Pedicinus ancoratus Ferris; (○). P. eurygaster (Burmeister); (⊗) Pedicinus longiceps Piaget; (▭) Docophthirus acinatus Waterston; (▭) Neohaematopinus echinatus (Neumann); (●) N. palearctus Olsoufiev; (●). N. petauristae Ferris

13. Genus : **Polyplax** Enderlein

1904. *Polyplax* Enderlein, *Zool. Anz. Leipzig*, Vol., 28 : P. 142, 223.
1909. *Haematopinus* (*Polyplax*) Neumann, *Arch. Parasit* ; 13 : 529.
1923. *Polyplax*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. IV, P. 183.
1938. *Polyplax*, Fahrenholz, *Ztschr parasitenk*, vol., 10, P. 239.
1951. *Polyplax*, Ferris, *The sucking lice*, P. 199.
1960. *Polyplax*, Johnson, U.S.D.A. *Tech. Bull.*, 1211, P. 48.
1981. *Polyplax*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 81-83.
1992. *Polyplax*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *12.*

Type species : *Pediculus spinulosus* Burmeister by original designation.

Characters : *Female* : Head : Antennae 5 segmented, sensoria on segments 4 and 5 may be contiguous or well separated ; typical head setae on dorsal side ; OS 3 to 5 pairs ; SHS 2 pairs ; DMHS 3 pairs ; DPaHS, DPHS, DAcHS, DAnCHS, DPoCHS one pair each ; and on ventral side ; ApHS 3 or 4 pairs ; OS 3 or 4 pairs and VPHS one pair. Thorax : Sternal plate well developed ; MDTS one pair, usually long ; DPtS and DMsS one to several pairs ; first pair of leg small and weak, with a slender claw ; second pair large with stout claw ; third pair largest with stouter claw, but not flattened or expanded. Abdomen : Segments I and II fused with each other and are considered as segment II only ; segments II to VII, each usually with 2 tergites and sternites ; VIII and terminal segment each with a single tergite dorsally and with usual genital sclerotization ventrally. Tergites and sternites may be well developed, narrow or sometime absent, each with a row of setae. DAAS and VAAS none to several pairs ; paratergite II characteristic in shape, having appearance of being divided into 2 plates, with a membraneous area in between ; several small setae on the membranous area, and a single seta on each plate. Genitalia : Consist of genital plate, beset with several small setae ; genital lobe paired, each with 2 or 3 setae ; a group of several small to long setae posterolateral to gonopods and a group of setae on each genital lobe, genital setae may be normal or slightly enlarged.

Male : Head and thorax as in female ; antennae sometimes with preaxial angle of segment 3 prolonged and terminating in a sclerotized point or with some modified setae, exhibiting sexual dimorphism. Abdominal segments II and III usually 2 tergites and 2 sternites ; IV to VIII and terminal segment, each with a single tergite and sternite. Tergites and sternites may be well developed, narrow, or absent, each with a row of setae. Paratergites as in female. Genitalia consist of a basal apodeme ; a pair of parameres and pseudopenis.

Nymphs : Three nymphal instars present. Morphological characters are discussed with individual species.

Remarks : This genus is represented by 76 species throughout the world (Kim and Ludwig 1978). Only 10 species have been recorded in India.

Key to species of the genus *Polyplax* recorded in India

1. Thoracic sternal plate with distinct, well sclerotized, handle-like prolongation, about one fourth length of plate, extending anteriorly between the coxae of first pair of legs ... ... *stephensi.*

   Thoracic sternal plate devoid of such prolongation 2

2. Setae of paratergite VI longer than plate, spiracles unusually large ... *reclinata.*
   Setae of paratergite VI never longer than plate 3

3. Dorsal and ventral setae of paratergite IV shorter than corresponding plate 5
   Only dorsal seta of paratergite IV shorter than corresponding plate ... 4

4. Ventral seta of paratergite VII about 2 x of dorsal seta ; thoracic sternal plate with anterior margin concave medially ... ... *blanfordi.*
   Ventral and dorsal setae of paratergite VII, both long, equal in size ; thoracic sternal plate with anterior margin with a small convexity in middle ... *serrata.*

5. Dorsal and ventral setae of paratergite VII smaller than plate ... *cutchicus*
   Dorsal and ventral setae of paratergite VII longer than plate ... 6

6. Dorsal seta of paratergite II and III much longer than corresponding plates 7
   Dorsal seta of paratergite II and III shorter than corresponding plates ... 9

7. Female with tergites and sternites absent except for a few small tergites on anterior part of the abdomen and sternites associated with genital region. Male with tergites and sternites narrow and reduced ... ... *asiatica.*
   Tergites and sternites well chitinized 8

8. Paratergites III to VI, each with posteroventral angles prolonged into a rounded lobe ... ... *hurrianicus.*
   Paratergites III to VI, each with postero-ventral angles prolonged into a pointed lobe ... ... *indica.*

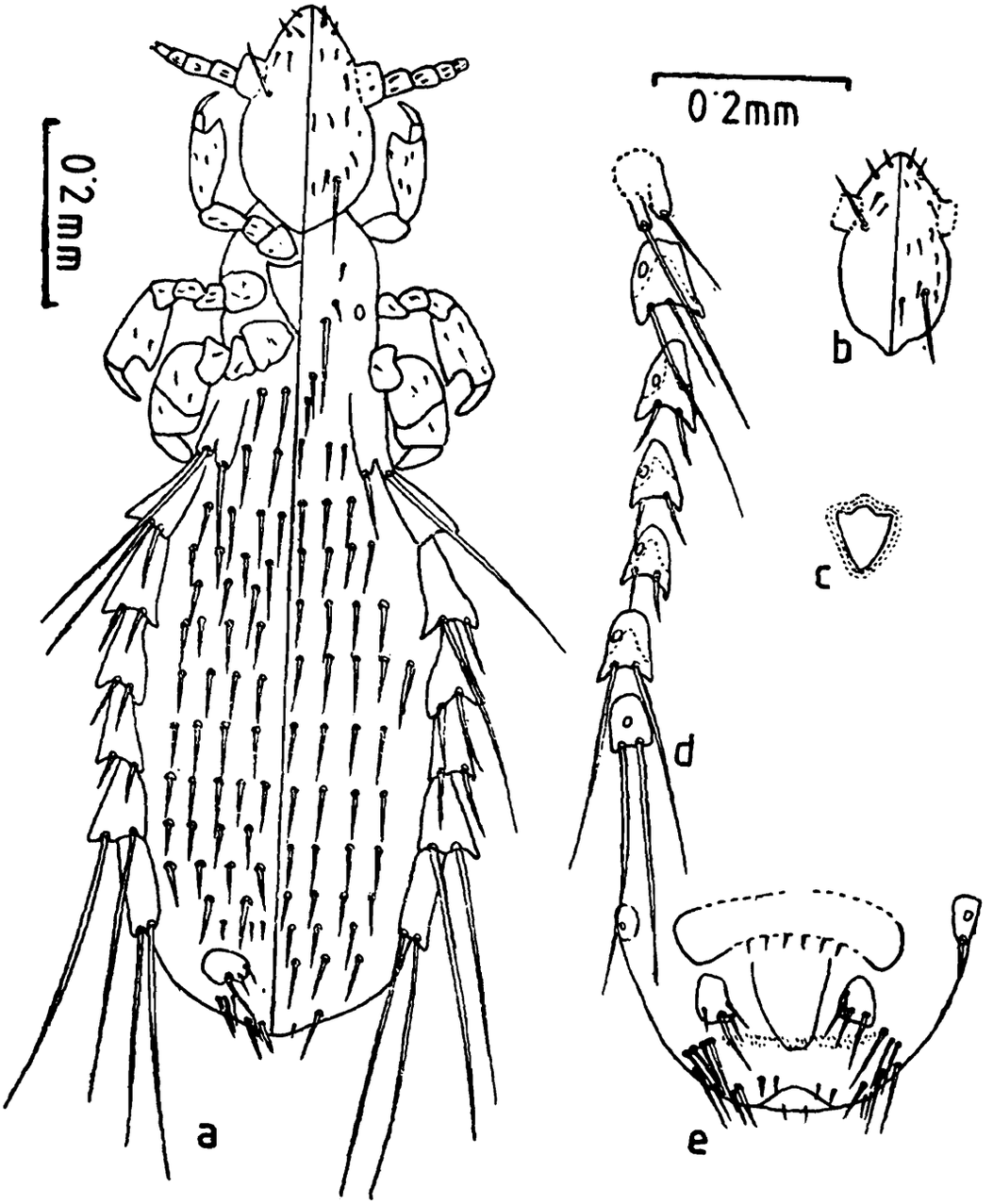
9. Setae on paratergite VII long but about half length of setae on VIII ... *kondana.*
   Setae on paratergites VII and VIII long but equal in length ... *spinulosa.*

46. **Polyplax asiatica** Ferris
(Figs., Plate 68 & 69)

1923. *Polyplax asiatica* Ferris, *Contributions toward a monograph of the sucking lice*, Pt. IV : 233.
1950. *Polyplax turkestanica turkestanica* Blagoveshtchensky, *Parazital. Sbron. Zool. Inst. Acad. Nauk.* S.S.S.R. 12 : 81.
1950. *Polyplax turkestanica major* Blagoveshtchensky, *Loc. Cit.*, 12 : 85.
1981. *Polyplax asiatica*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 81-87.
1992. *Polyplax asiatica*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 13.*

Female (Fig., Plate 68, a, b, c, d, e) : Total body length 1·15 mm ($\bar{X}$, N=3) ; range 0·98 to 1·19 mm. Head (Fig. Plate 68, b) : Longer than wide ; gular area not raised ; all typical head setae present ; post antennal angles not developed ; DPaHS close to DMHS ; antennal sensoria large and contiguous. Thorax : Sternal

PLATE 68

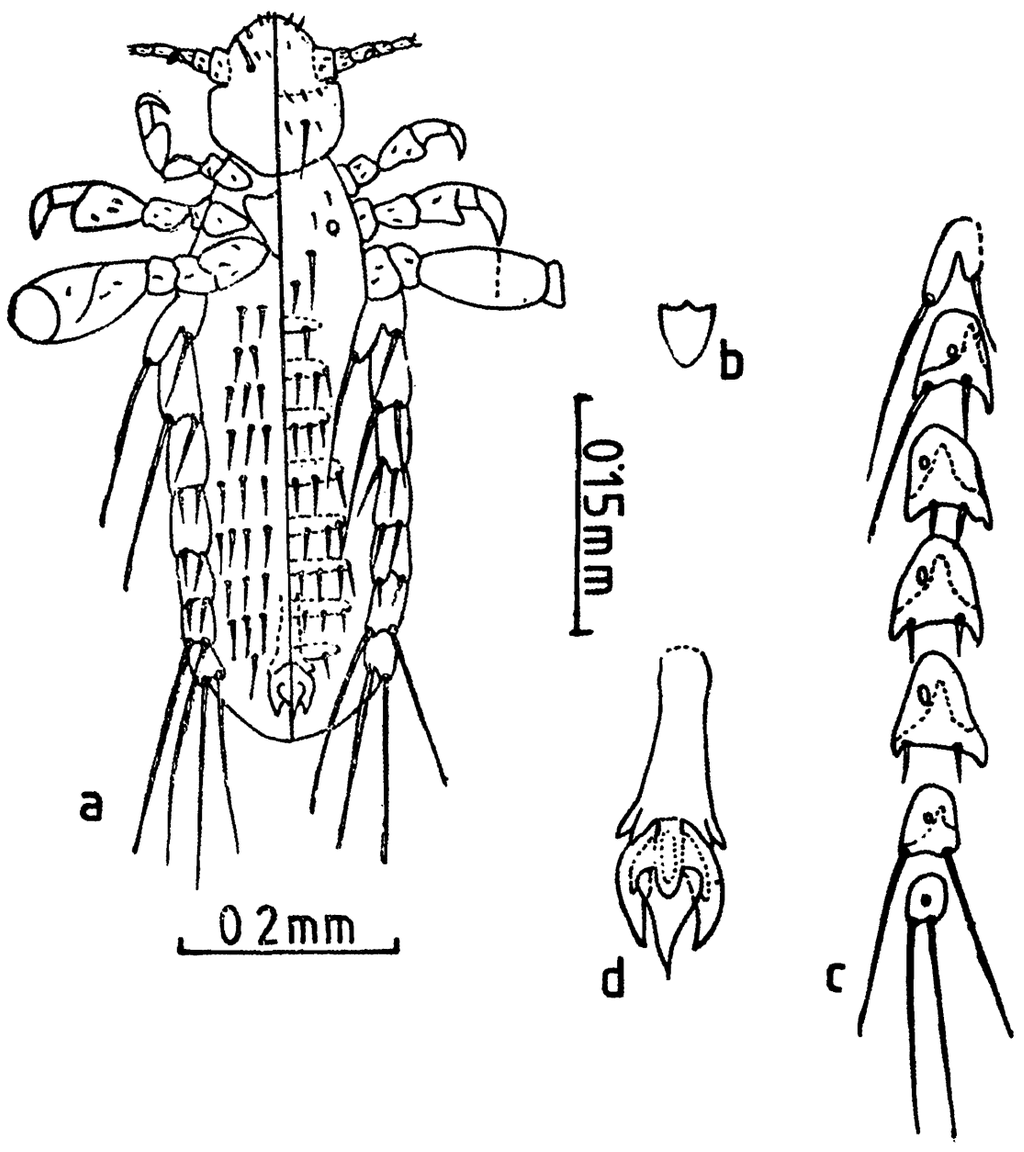


Polyplax asiatica Ferris ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

plate (Fig., Plate 68, c) 0·04 mm long and 0·03 mm wide, roughly triangular, enclosed in a semi-membranous rim; MDTS one pair, long. Abdomen: Tergites and sternites absent except few small tergites on anterior segments. Paratergites (Fig., Plate 68, d): II typical, dorsal seta long, ventral small; III to VI, each irregularly

PLATE - 69



Polyplax asiatica Ferris : ♂

a. Whole body (ventral and dorsal views); b. Thoracic sternal plate; c. Paratergites; d. Genitalia.

pigmented with postero dorsal angle small and acute, both setae smaller than plates except III, which bear long dorsal seta, ventral seta small ; VII with a small, acute postero-dorsal angle, both setae long ; VIII devoid of acute angles, both setae long. Genitalia (Fig., Plate 68, e) : Genital plate wide anteriorly, narrow posteriorly ; gonopods lobed, each situated postero-lateral to genital plate, usually having 3 setae each ; each genital lobe with 7-8 setae.

Male (Fig. Plate 69, a, b, c, d) : Total body length 0·67 mm ($\bar{X}$, N=2) ; range 0·66 to 0·67 mm. Head and thorax as in female. Abdomen : Tergites present, although much reduced ; sternites absent ; paratergites (Fig. Plate 69, c) as in female. Genitalia (Fig., Plate 69, d) : Pseudopenis narrow and pointed, enclosed by recurved parameres.

Nymphs : Could not be obtained during present study. Description is based on Mishra (1981).

Nymph 1 : Head : Longer than wide, typical head setae present. Post antennal and occipital angles not developed. Thorax : Sternal plate absent ; MDTS long, one pair. Legs as in adults. Dorsal central setae 9 pairs ; ventral central setae 7 pairs ; anal setae minute, one pair.

Nymph 2 : Similar to nymph 1 except abdomen shows some development of paratergites and major abdominal setae one pair on each side.

Nymph 3 : Similar to nymph 2 except abdominal paratergites comparatively more chitinized.

Material examined : Paratypes 1 ♀, 1 ♂, (Regd. No. VRC 82204) from *Nesokia indica* in Mahasu, Himachal Pradesh ; 24.10.67 ; Coll. A. C. Mishra ; 2 ♀ ♀, 1 ♂, from *Bandicota bengalensis* in Midnapur, West Bengal ; 15.9.84 ; Coll. C. C. Adhikary.

Hosts : *Crocidura caerulea*, *Nesokia indica*, *Bandicota bengalensis*, *B. malabarica* and other species of *Bandicota* and *Nesokia*.

Dtstribution : India [West Bengal (New record), Maharastra, Uttar Pradesh, Punjab, Himachal Pradesh] ; Burma ; Asia and Africa.

Remarks : This species seems close to *P. insulsa* Ferris and *P indica* Mishra and Kulkarni. It can be separated from *insulsa* by the absence of sternites and by well developed postero-ventral process on paratergites III to VI ; from *indica* by the presence of tergites in male ; ventral posterior angles on paratergites III to VI well developed and postero dorsal angles small and acute.

47. **Polyplax blanfordi** Mishra and Dhanda
(Figs., Plates 70, 71 & 72)

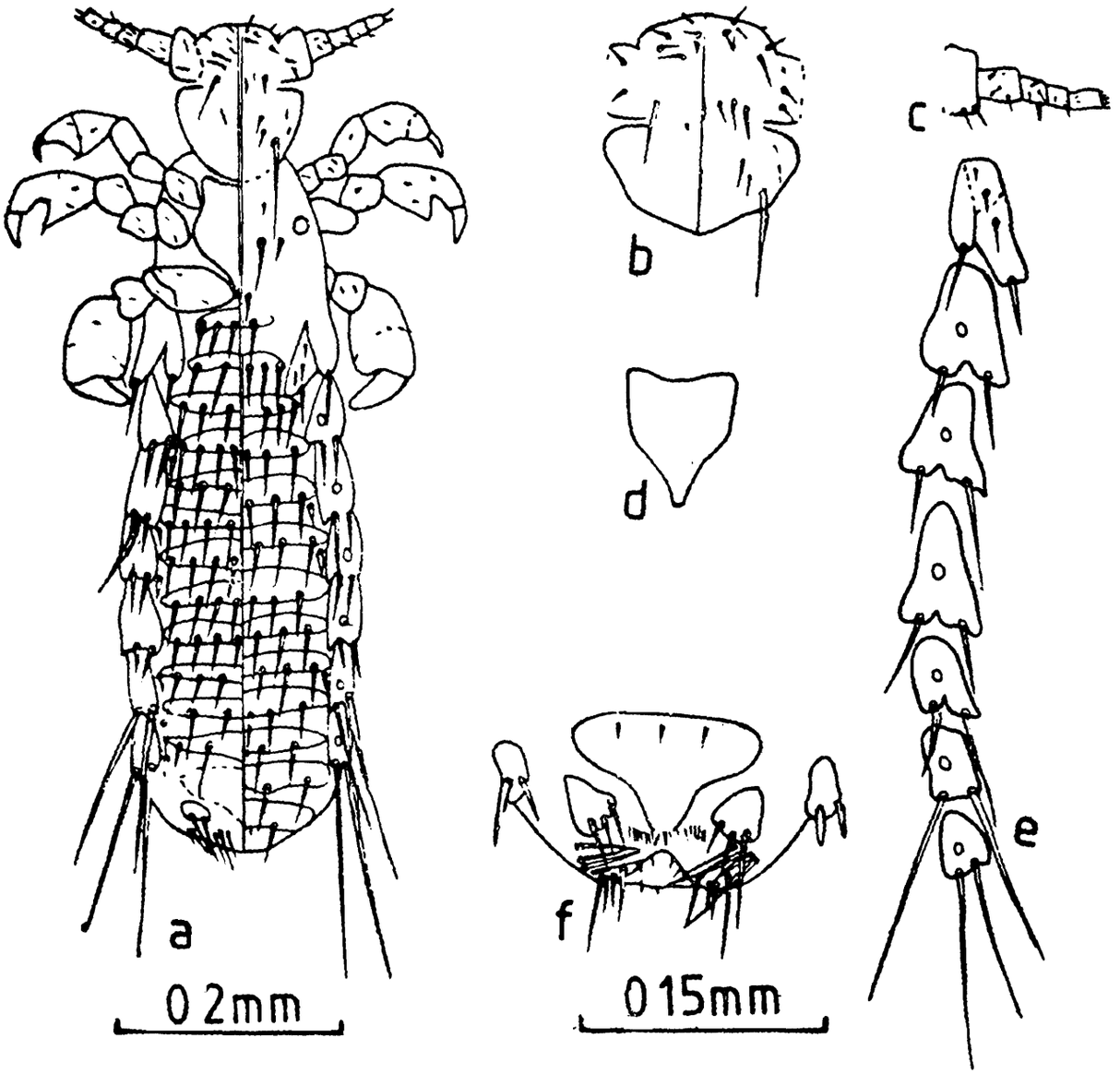
1972. *Polyplax blanfordi* Mishra and Dhanda, *J. Parasit*; 58 : 393-399.
1981. *Polyplax blanfordi*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 87-89.
1992. *Polyplax blanfordi*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *13*.

Female (Fig., Plate 70, a, b, c, d, e, f) : Total body length 0·73 mm ($\bar{X}$, N = 5) ; range 0·68 to 0·78 mm. Head (Fig. Plate 70, b) : Slightly longer than wide ; antennal sensoria (Fig., Plate 70, c) well separated ; preantennal region with 4 pairs of setae dorsally, 6 pairs ventrally ; antennal region with 1 pair small setae dorsally ; 1 pair long setae ventrally ; post antennal region 2 pairs of setae dorsally. Thorax : Sternal plate (Fig., Plate 70, d) 0·05 mm long and 0·03 mm wide, with anterior margin concave medially, posterior process rounded at tip ; MDTS one pair, long. Abdomen : Dorsal : Segment II with 2 tergites, anterior indistinct, posterior distinct, 2 setae on each ; III to VII, each with 2 tergites, having 4-8 setae each ; VIII and terminal segment, each with single tergite having 4 setae each ; DAAS 3-4 pairs. Ventral : Segment II to VII, each with 2 sternites having 4-7 setae each ; remaining sternites modified to form genitalia ; VAAS 5-6 pairs. Lateral : Paratergites : (Fig., Plate 70, e) II typical, setae smaller than plates ; III to VI, each subtriangular with dorsal posterior angles produced into small tooth like process, ventral posterior angles rounded ; both setae smaller than plates except ventral seta of paratergites IV, which is much longer ; VII devoid of process, dorsal seta about half of the ventral seta, both setae long ; VIII devoid of processes, both setae long. Genitalia (Fig., Plate 70, f) : Gonopods lobed ; genital seta stout and modified.

Male : (Fig., Plate 71, a, b, c, d, e) : Total body length 0·58 mm ($\bar{X}$, N = 5) ; range 0·48 to 0·62 mm. Head and thorax as in female except antennal segment III (Fig., Plate 71, b) apicodorsally prolonged with a stout seta. Abdomen : Dorsal : Segment II with indistinct tergites, 2 rows of 2 setae each ; segment III with 2 distinct tergites, each having 8 setae ; IV to VII, each with a single tergite having 7-10 setae each ; segment VIII with single tergite having 4 setae ; DAAS absent. Ventral : Segment II and III, each with 2 sternites having 4-6 setae each ; IV to VII, each with single sternite, having 4-7 setae each ; VIII with single sternite having 2 setae ; VAAS absent. Lateral : Paratergites as in female. Genitalia (Fig., Plate 71, e) : Parameres short ; pseudopenis well developed ; gradually tapering distally, articulating with apices of parameres.

Nymph 1 (Fig. Plate 72, a) : Head : Longer than wide ; typical head setae present ; postantennal and occipital angles not developed ; marginal head setae 2

PLATE - 70

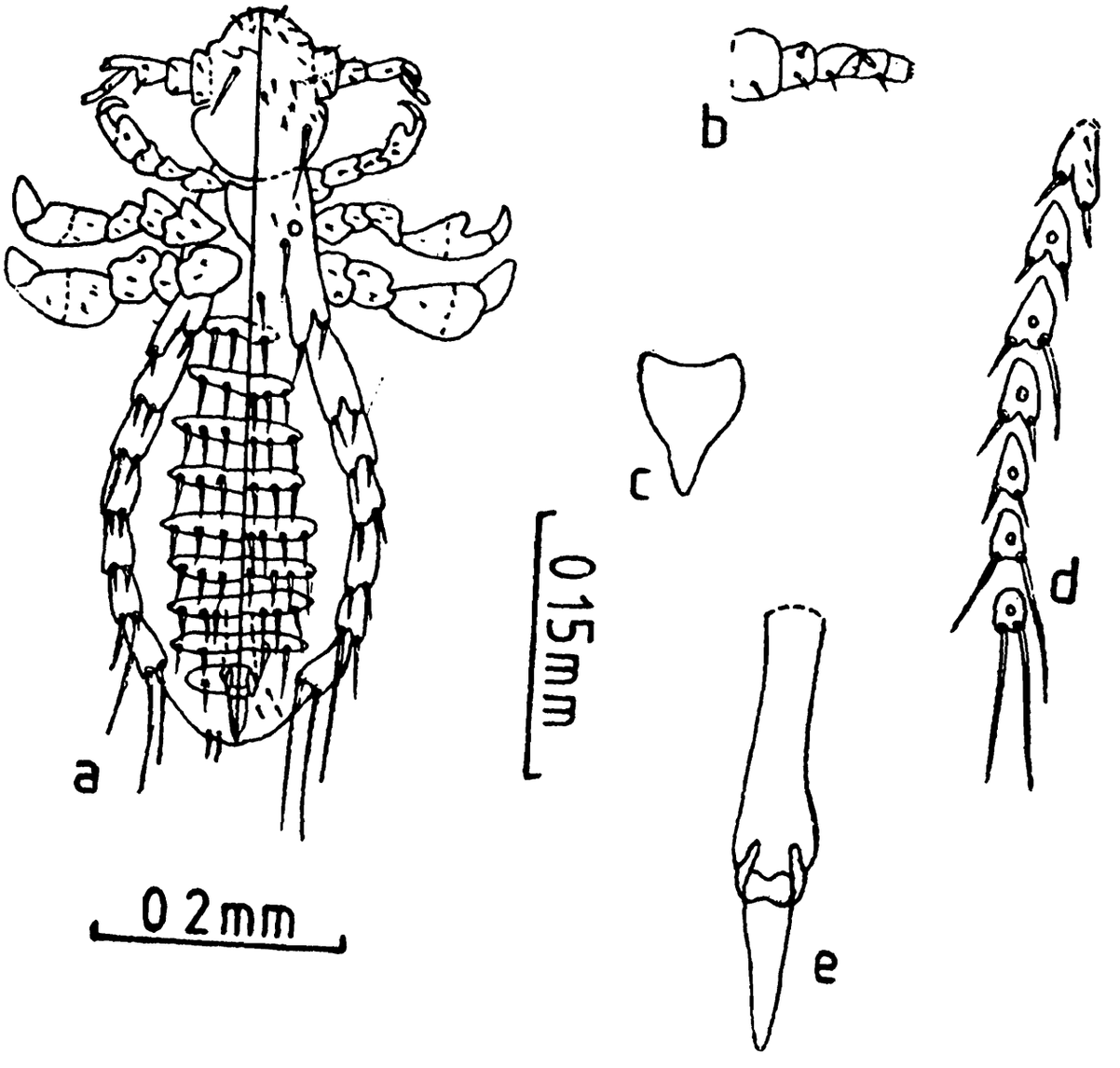


Polyplax blanfordi Mishra and Dhanda : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Antenna ; d. Thoracic sternal plate ; e. Paratergites ; f. Genitalia.

pairs. Thorax : Sternal plate absent ; MDTS 1 pair, long ; legs as in adults. Abdomen : Few indication of segmentation laterally ; dorsal and ventral central setae 9 and 7 pairs ; anal setae one pair ; accessory setae indistinct.

PLATE - 71



Polyplax blanfordi Mishra and Dhanda : ♂

a. Whole body (ventral and dorsal views) ; b. Antenna ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Nymph 2 (Fig., Plate 72, b) : Similar to nymph 1 except thorax with 2 pairs of accessory dorsal thoracic setae. Abdomen with some development of paratergites ; major abdominal setae one pair on each side.

Nymph 3 : Similar to nymph 2 except paratergites are more chitinized.

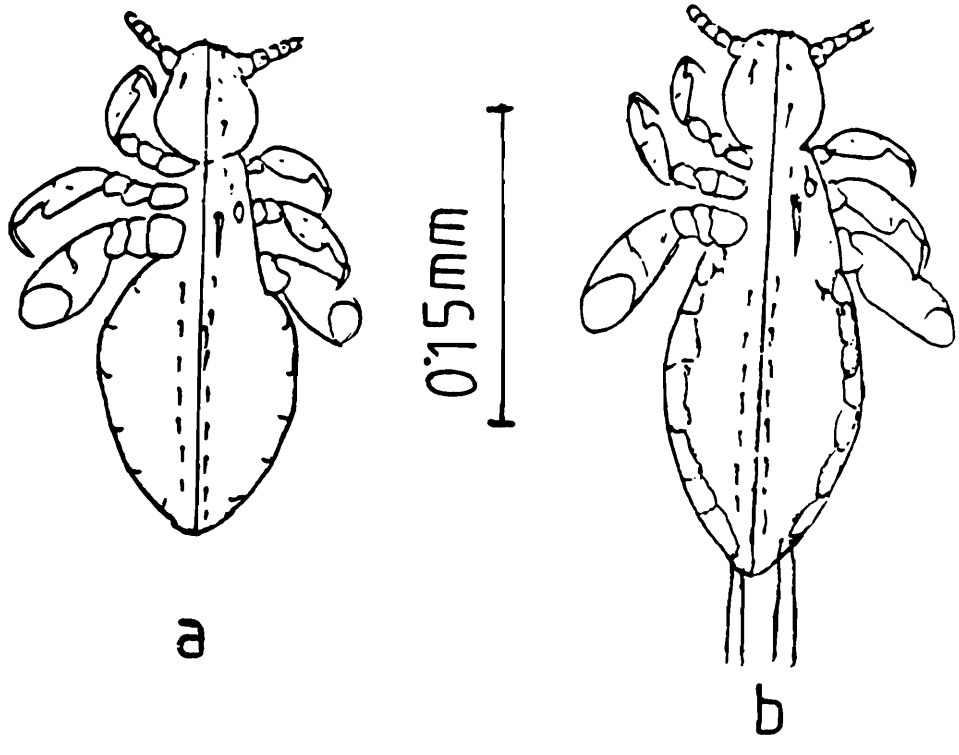
Material examined : 2♀♀, 2♂♂, from *Rattus blanfordi* in Sinhgarh, Pune, Maharastra ; 11.7.84 ; Coll. A. C. Mishra and C. C. Adhikary ; 3♀♀, 3♂♂, from *R. blanfordi* in Purulia, West Bengal ; 21.1.85 ; Coll. C. C. Adhikary.

Host : *Rattus blanfordi.*

Distribution : India [West Bengal (New record), Maharastra, Karnataka].

Remarks : This species seems close to *P. spinulosa* (Burmeister), *P. serrata* Burmeister, and *P cutchicus* Mishra and Kaul. However, it can be separated from *spinulosa* by the shape of thoracic sternal plate in which anterior margin concave medially ; ventral seta on paratergite IV which is much longer than the one on

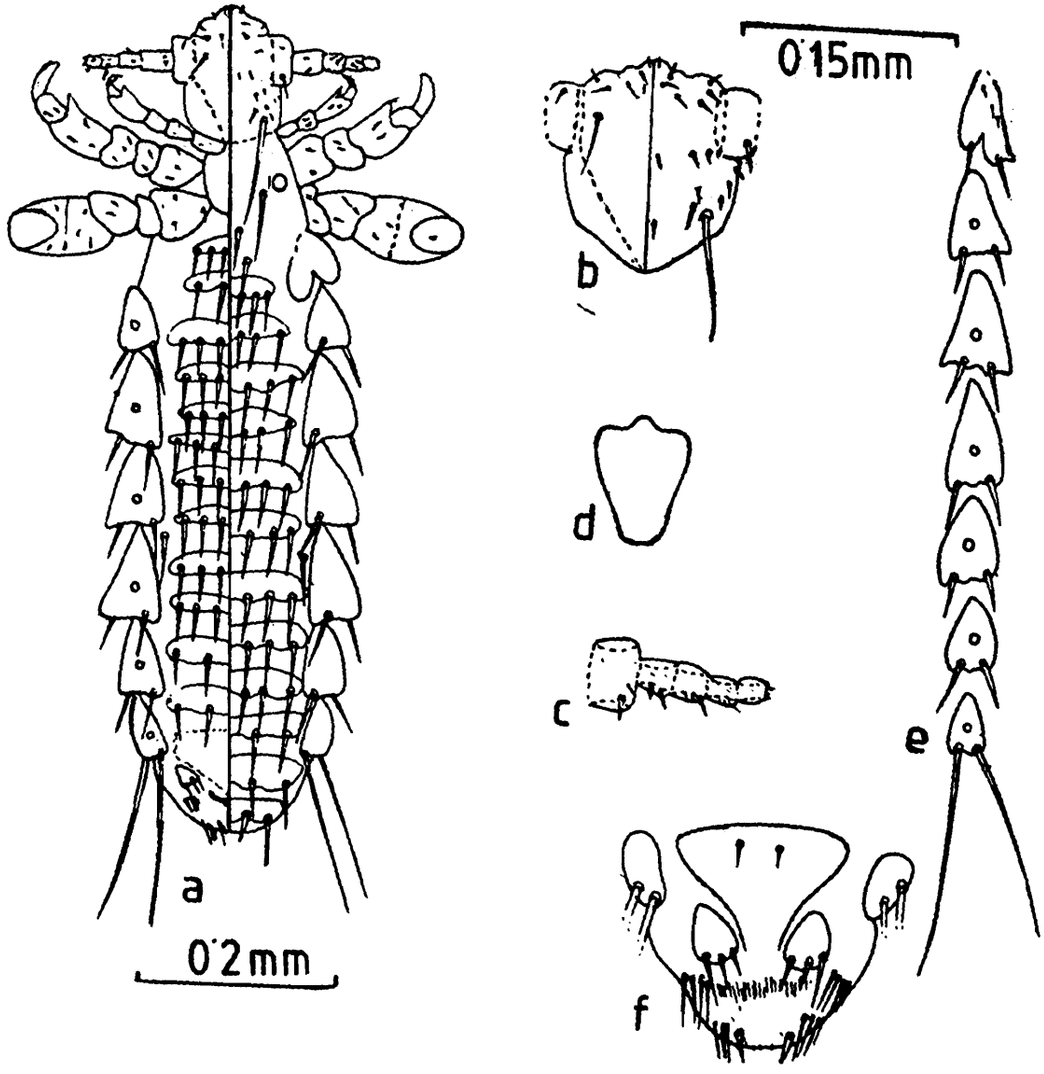
PLATE - 72



Nymphs of *Polyplax blanfordi* Mishra and Dhanda
a. Nymph 1 ; b. Nymph 2.

corresponding paratergites; from *serrata* by rounded postero ventral angles on paratergites III to VI and the ventral seta on paratergite VII, being double in length than dorsal seta; from *cutchicus* by lateral margins almost parallel of thoracic sternal plate and long ventral seta on paratergite IV and VII.

PLATE - 73



Polyplax cutchicus Mishra and Kaul : ♀

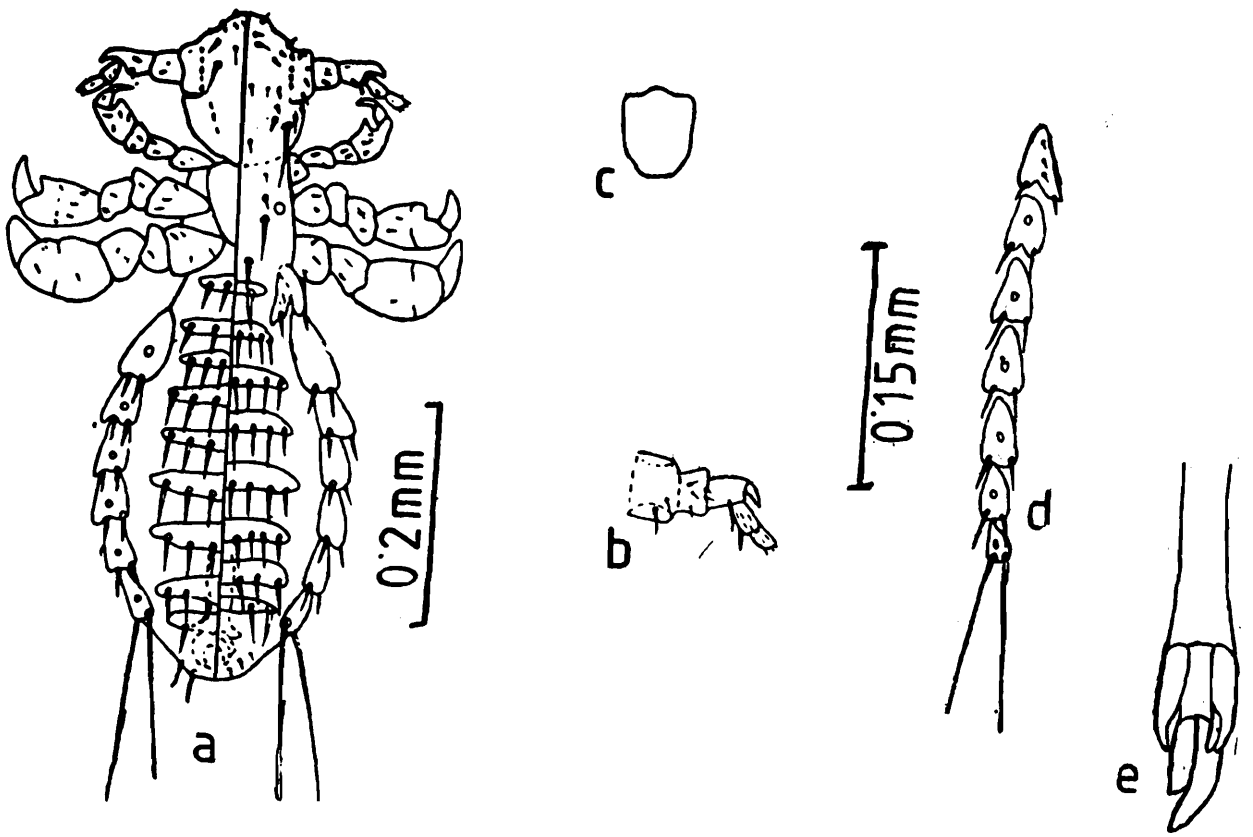
a. Whole body (ventral and dorsal views); b. Head; c. Antenna; d. Thoracic sternal plate; e. Paratergites; f. Genitalia.

48. **Polyplax cutchicus** Mishra and Kaul
(Figs., Plates 73 & 74)

1973. *Polyplax cutchicus* Mishra and Kaul, *J. med. Ent.*, 10 : 43-46.
1981. *Polyplax cutchicus*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 89-91.

Female (Fig., Plate 73, a, b, c, d, e, f): Total body length 0·83 mm ($\bar{X}$, N=2) ; range 0·82 to 0·83 mm. Head (Fig., Plate 73, b) : Slightly longer than wide ; post antennal and occipital angles well developed ; gular area raised ; gular folds present ; pre antennal regions 4 pairs of setae dorsally ; 6 pairs ventrally ; antennal region 1 pair small setae dorsally and 1 pair long setae ventrally ; post antennal region with 10 pairs of setae dorsally. Antennal sensoria (Fig., Plate 73, c) on segment IV and V well separated. Thorax : Sternal plate (Fig., Plate 73, d) 0·08

PLATE - 74



Polyplax cutchicus Mishra and Kaul : ♂
a. Whole body (ventral and dorsal views) ; b. Antenna ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

mm long and 0·08 mm wide; with anterior margin with a slight convexity medially; lateral margins concave. Abdomen: Dorsal: Segment II with 2 tergites, anterior indistinct, posterior small, but distinct; 2 setae on each; segments III to VII, each with 2 tergites having 4-8 setae each; VIII and terminal segment, each with single tergite having 4 setae each; DAAS one pair. Ventral: Segment II to VII, each with 2 sternites having 4-7 setae each; remaining sternites modified to form genitalia; VAAS 1 pair. Lateral: Paratergites (Fig., Plate 73, e): II typical, both setae short; III to VII, each subtriangular, dorsal and ventral posterior angles with minute serrations, both setae smaller than plates; VIII without such serrations, with 2 long setae. Genitalia (Fig., Plate 73, f): Gonopods lobed, having 3 setae each; each genital lobe with 7 or 8 setae.

Male (Fig., Plate 74, a, b, c, d, e): Total body length 0·57 mm ($\bar{X}$, N=1). Head and thorax as in female except antennal segment III, (Fig., Plate 74, b) which is apicodorsally prolonged bearing a small hook like seta. Abdomen: Dorsal: Segment II with indistinct tergites having 2 rows of 2 setae each; segment III with 2 distinct tergites, each having 8 setae; IV to VII, each with a single tergite having 7-11 setae each; VIII with a single tergite having 4 setae. DAAS absent. Ventral: Segments II and III, each with 2 distinct sternites, 4-6 setae each; IV to VI, each with single sternite having 6 setae each; VII and VIII, each with single sternite having 4 and 2 setae respectively. VAAS absent. Lateral: Paratergites (Fig., Plate 74, d) as in female. Genitalia (Fig., Plate 74, e): Parameres short; pseudopenis well developed, articulating apices of parameres.

Nymphs: Unknown.

Material examined: Paratypes: 2♀♀, 1♂, (Regd. No. VRC 102102) from *Rattus cutchicus* in Baneshwar, Sirchi, Rajasthan; 16.11.1971; Coll. A. C. Mishra.

Host: *Rattus cutchicus*.

Distribution: India (Rajasthan).

Remarks: This species seems close to *P. blanfordi* Mishra and Dhanda and *P. spinulosa* (Burmeister); it can be separated from both of these species by the combination of following characters: Thoracic sternal plate well developed with a slight convexity medianly, lateral margins concave; Paratergites III to VII, each with both setae smaller than plates; VAAS 1 pair in female.

49. **Polyplax hurrianicus** Mishra
(Figs., Plates 75 & 76)

1981. *Polyplax hurrianicus* Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 91-94.

Female (Fig., Plate 75, a, b, c, d, e) : Total body lengh 0·84 mm ($\bar{X}$, N = 10) ; range 0·74 to 1·02 mm. Head (Fig., Plate 75, b) : Longer than wide ; post antennal and occipital angles not marked ; gular area not raised ; all typical head setae present ; antennal sensoria small and well separated. Thorax : Sternal plate (Fig., Plate 75, c) 0·05 mm long and 0·03 mm wide, with anterior margins with a convexity in middle, posterior tip almost acute, shield shaped ; MDTS one pair, long. Abdomen : Dorsal : Segment II devoid of tergites having 2 rows of 2 setae each ; III to VII, each with 2 tergites having 5-12 setae each ; VIII and terminal segment, each with a single tergite with 2 and 4 setae respectively ; DAAS absent. Ventral : Segment II with 2 sternites, anterior with 4 and posterior with 3 setae ; III to VII, each with 2 sternites having 4-8 setae each ; remaining sternites modified to form genitalia ; VAAS 1-2 pairs. Lateral : Paratergites (Fig., Plate 75, d) : II typical, dorsal seta much longer than ventral ; III to VI, each with postero ventral angle prolonged into a somewhat rounded lobe ; setae always smaller than plates except dorsal seta of III which is much longer ; VII and VIII devoid of prolonged angles, both setae long. Genitalia (Fig., Plate 75, e) : Genital plate wide anteriorly and narrow posteriorly ; genital setae enlarged and spiniform.

Male (Fig., Plate 76, a, b, c, d) : Total body lengh 0·65 mm ($\bar{X}$, N=10) ; range 0·53 to 0·72 mm. Head and thorax as in female except antennal segments III and IV, each with one small stout seta. Abdomen : Dorsal : Segment II as in female ; III with 2 tergites, 8 setae on each ; IV to VII, each with a single tergite having 8-10 setae each ; VIII with indistinct tergite having 4 setae ; DAAS absent. Ventral : Segment II and III, each with 2 sternites having 3-4 setae each ; IV to VII, each with a single sternite having 5-8 setae each ; VIII with a single sternite having 2 setae ; VAAS 1-2 pairs. Lateral : Paratergites (Fig., Plate 76, c) : As in female except III to VI, each with ventral apical angles not much prolonged, seta medium sized except usual long dorsal seta of III. Genitalia (Fig., Plate 76, d) : Parameres slender, apically acute ; pseudopenis narrow and apically pointed.

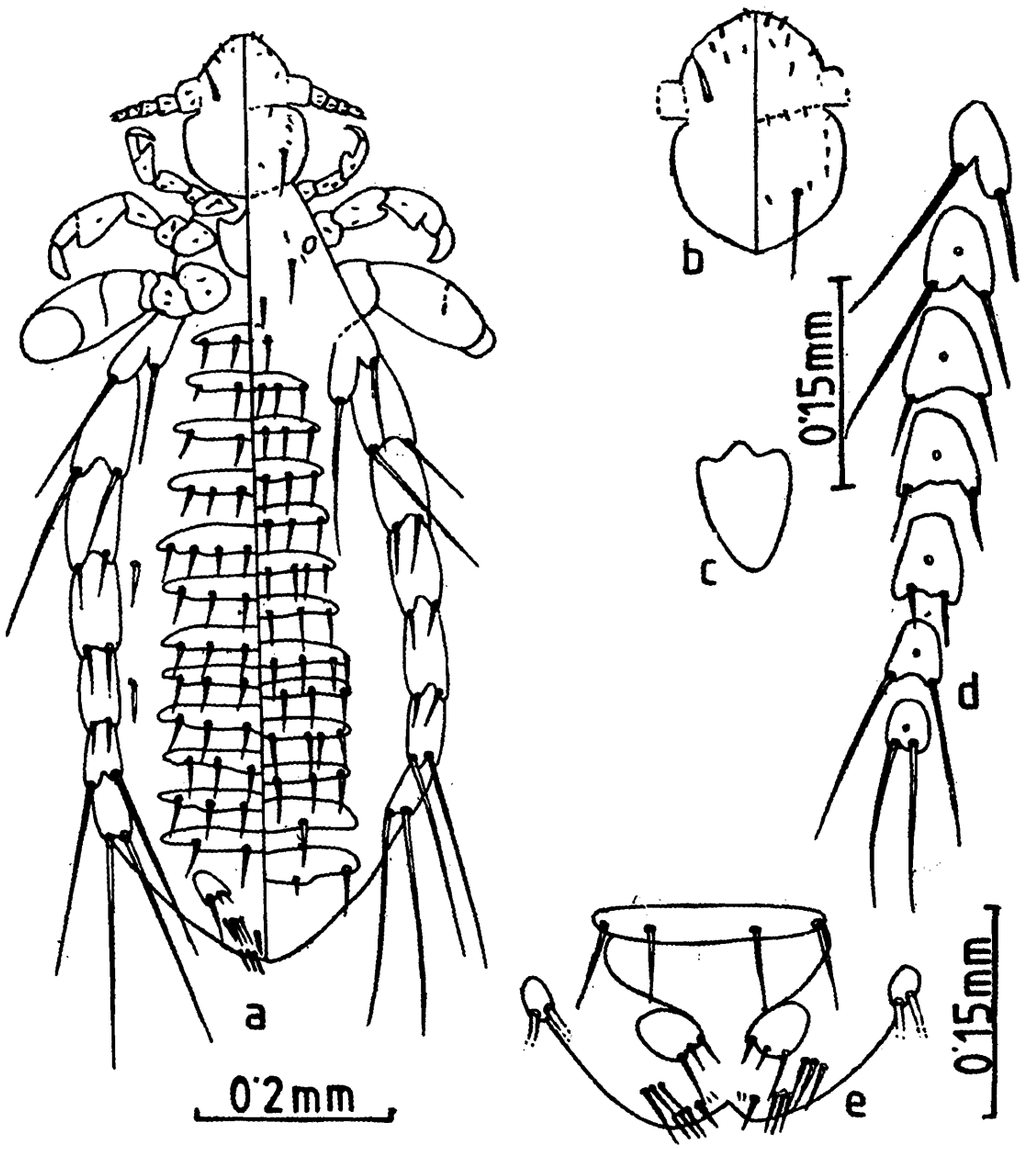
Nymphs : Could not be obtained during present study. Description is based on Mishra (1981).

Nymph 1 : Head : Longer than wide ; typical head setae present ; postantennal

angles not developed. Thorax : Sternal plate absent. MDTS long, one pair ; legs as in adult. Abdomen : Few indication of segmentation laterally ; dorsal and ventral central setae 8 and 7 pairs respectively ; anal setae one pair.

Nymph 2 : Similar to nymph 1 except abdomen with some development of paratergites ; major abdominal setae one pair on each side.

PLATE - 75



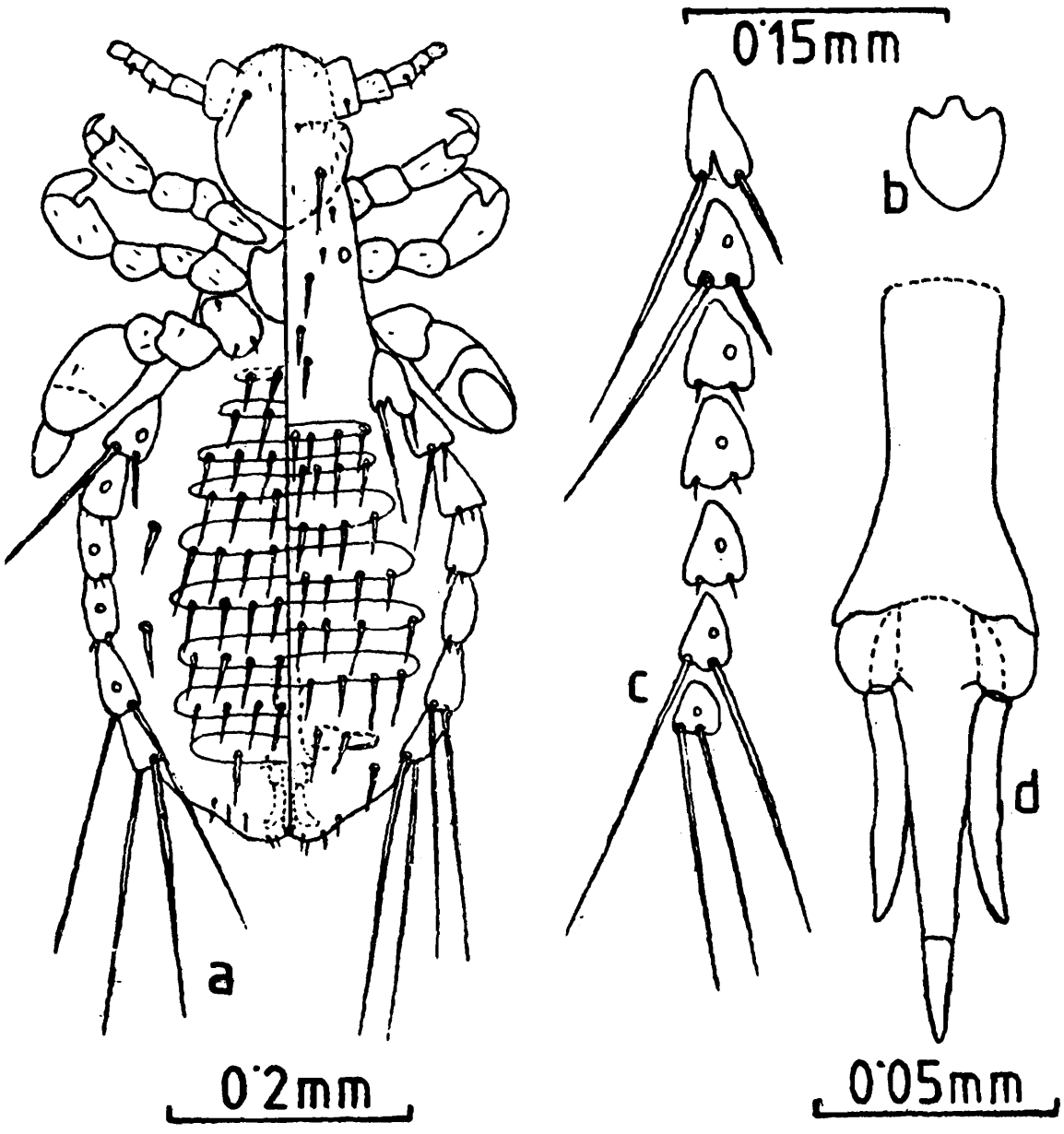
Polyplax hurrianicus Mishra : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Nymph 3 : Similar to nymph 2 except paratergites are more chitinized.

Material examined: Paratypes 1 ♀, 1 ♂, (Regd. No. VRC 33975) from *Meiones hurrianae*, in Banni Kutch, Gujrat ; 21.3.1960 ; Coll. H. Trapido ; 9 ♀ ♀, 9 ♂ ♂, from *M. hurrianae* in Jodhpur, Rajasthan ; 16.3.86 ; Coll. C. C. Adhikary.

PLATE - 76



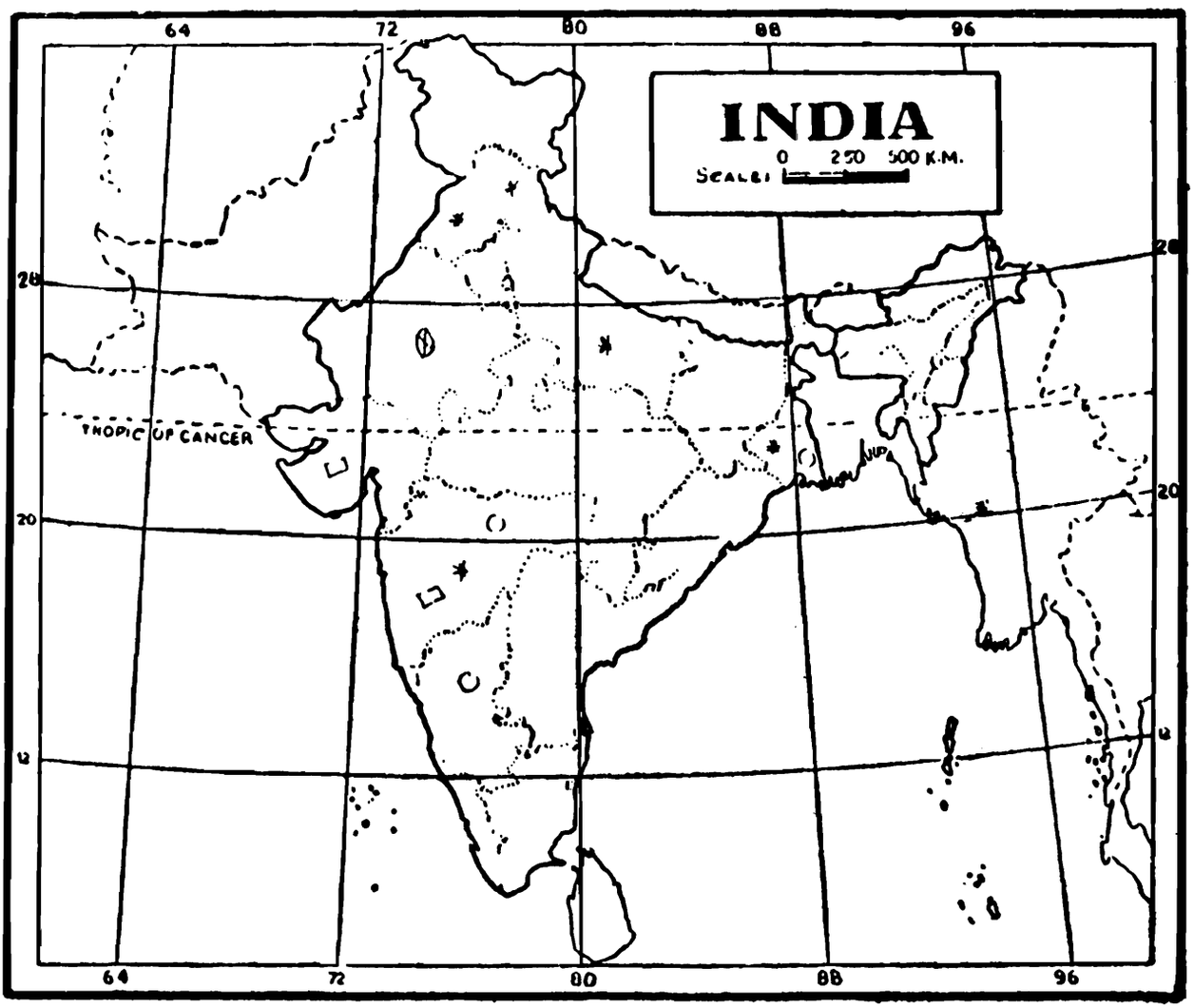
Polyplax hurrianicus Mishra : ♂

a, Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

Host : ***Meriones hurrianae.***

Distribution : India [Rajasthan (New record), Gujrat].

Remarks : This species seems close to *P. paradoxa* Johnson, *P insulsa* Ferris, *P. indica* Mishra and Kulkarni and *P. asiatica* Ferris. It can be separated from all the former species by the combination of following characters : Thoracic sternal plate shield shaped, with a convexity in middle ; tergites and sternites not highly chitinized ; DAAS absent ; VAAS 1-2 pairs.



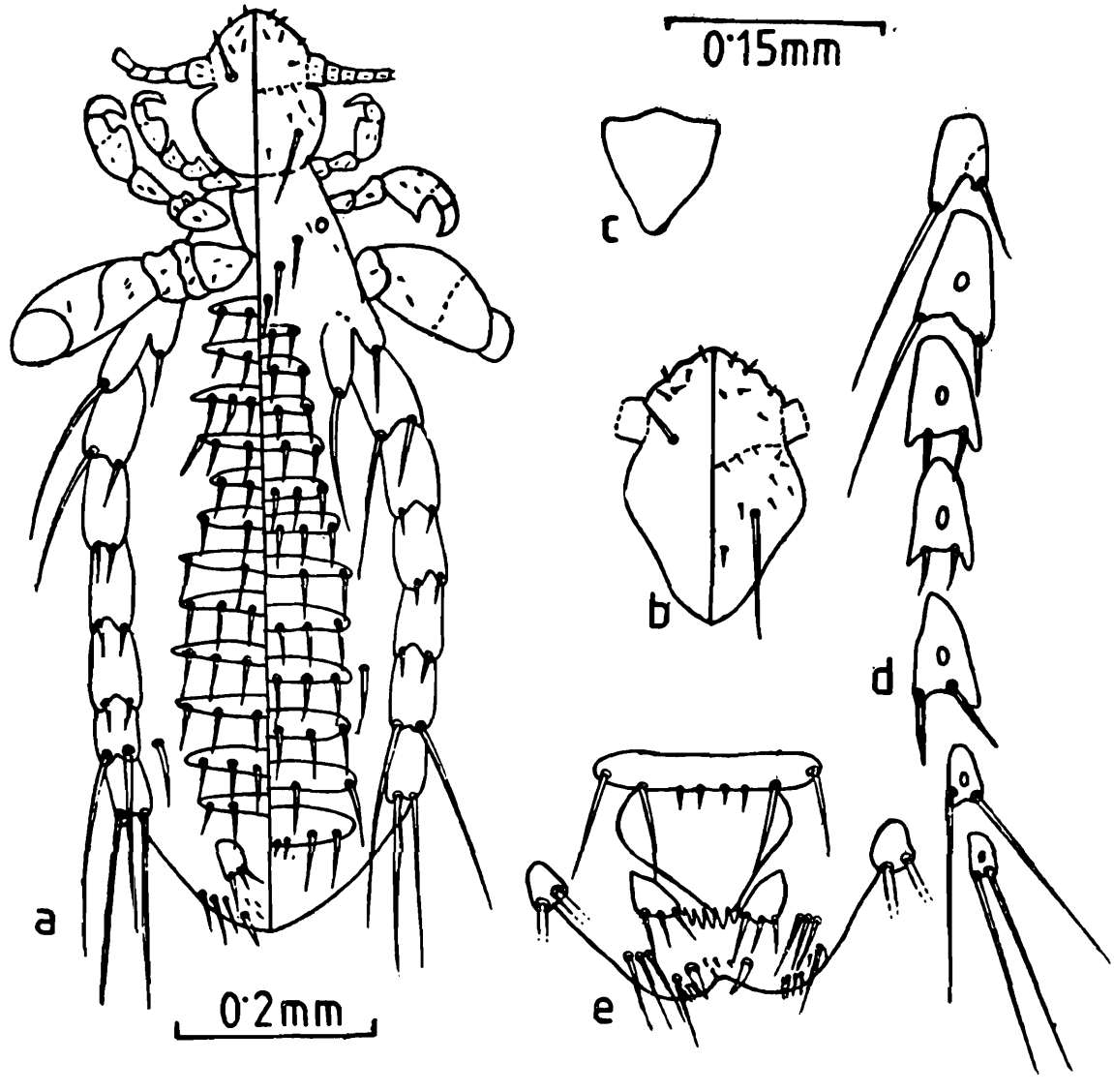
Map showing distribution of
(*) Polyplax asiatica Ferris; (O) P. blanfordi Mishra and Dhanda; (⊗) P. cutchicus Mishra and Kaul; (□) P. hurrianicus Mishra.

50. **Polyplax indica** Mishra and Kulkarni
(Figs., Plates 77 & 78)

1974. *Polyplax indica* Mishra and Kulkarni, *Oriental Ins.*, 8 : 89-94.
1974. *Polyplax indica*, Mishra et al. *Indian J. Med. Res.*, 62 : 1278.
1981. *Polyplax indica*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 94-96.

Female (Fig., Plate 77, a, b, c, d, e) : Total body length 0·91 mm ($\bar{X}$, N=1). Head (Fig., Plate 77, b) : Longer than wide ; post antennal and occipital angles

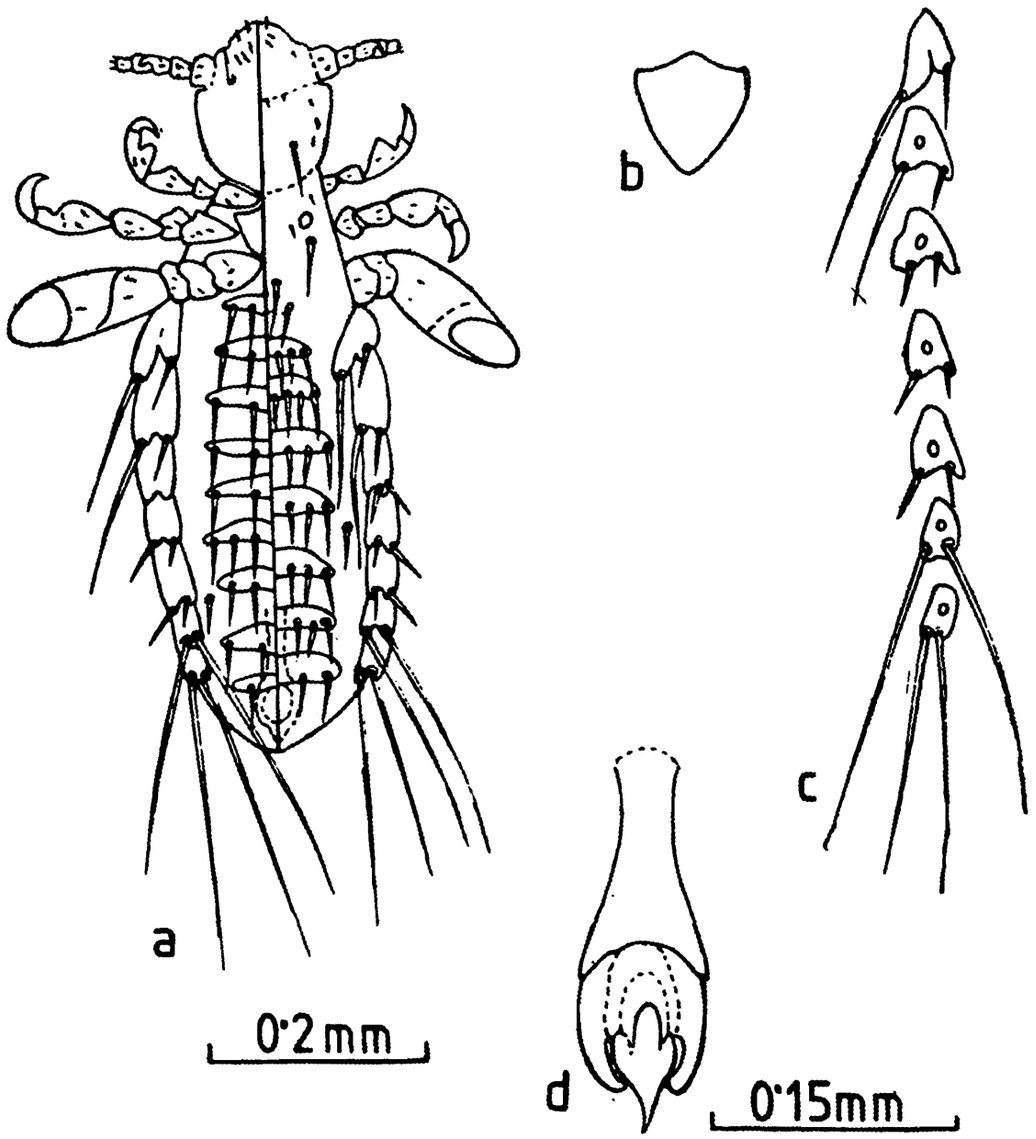
PLATE - 77



Polyplax indica Mishra and Kulkarni : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia

not marked ; gular area not raised ; antennal sensoria contiguous. Thorax : Sternal plate (Fig., Plate 77, c) 0·05 mm long and 0·04 mm wide ; with a median convexity of anterior margins, lateral margins subparallel anteriorly, posterior

PLATE - 78



Polyplax indica Mishra and Kulkarni : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ;
c. Paratergites ; d. Genitalia.

process rounded at tip. MDTS one pair, long. Abdomen : Dorsal : Segment II devoid of tergites with 2 rows of 2 setae each ; III to VII, each with 2 tergites having 4-6 setae each ; VIII and terminal segment, each with a single tergite having 4 and 8 setae respectively ; DAAS one pair. Ventral : Segment II to VII, each with 2 sternites having 3-6 setae each ; remaining sternites modified to form genitalia ; VAAS one pair. Lateral : Paratergites (Fig., Plate 77, d) : II typical, both setae long, dorsal much longer than ventral ; III to VI, each with ventral posterior angles prolonged into bluntly pointed lobe, all setae shorter than plates except dorsal seta of III which is much longer ; VII and VIII without prolonged angles, both setae long. Genitalia (Fig., Plate 77, e) : Gonopods paired ; each genital lobe with 8 setae.

Male (Fig., Plate 78, a, b, c, d) : Total body length 0·65 mm ($\bar{X}$, N = 1). Head and thorax as in female. Abdomen : Segment II as in female ; III with 2 tergites, having 8 setae on each ; IV to VII, each with a single tergite, having 6-8 setae each ; VIII with a single tergite, having 4 setae ; DAAS 1 pair. Ventral : Segments II and III, each with 2 sternites, having 3 to 4 setae each ; IV to VI, each with single sternite ; having 3 to 4 setae each ; VII with a single sternite having 4 setae ; VIII with a single sternite having 2 setae ; VAAS one pair. Lateral : Paratergites (Fig., Plate 78, c) : Same as in female except ventral apical angles on paratergites V and VI not much prolonged. Genitalia (Fig., Plate 78, d) : Parameres incurved apically, shorter than pseudopenis ; pseudopenis narrow and pointed apically.

Nymphs : Unknown.

Material examined : 1 ♀, 1 ♂, from *Golunda ellioti* in Jammu and Kashmir ; 30.ii.60 ; Coll. H. R. Bhat.

Host : *Golunda ellioti.*

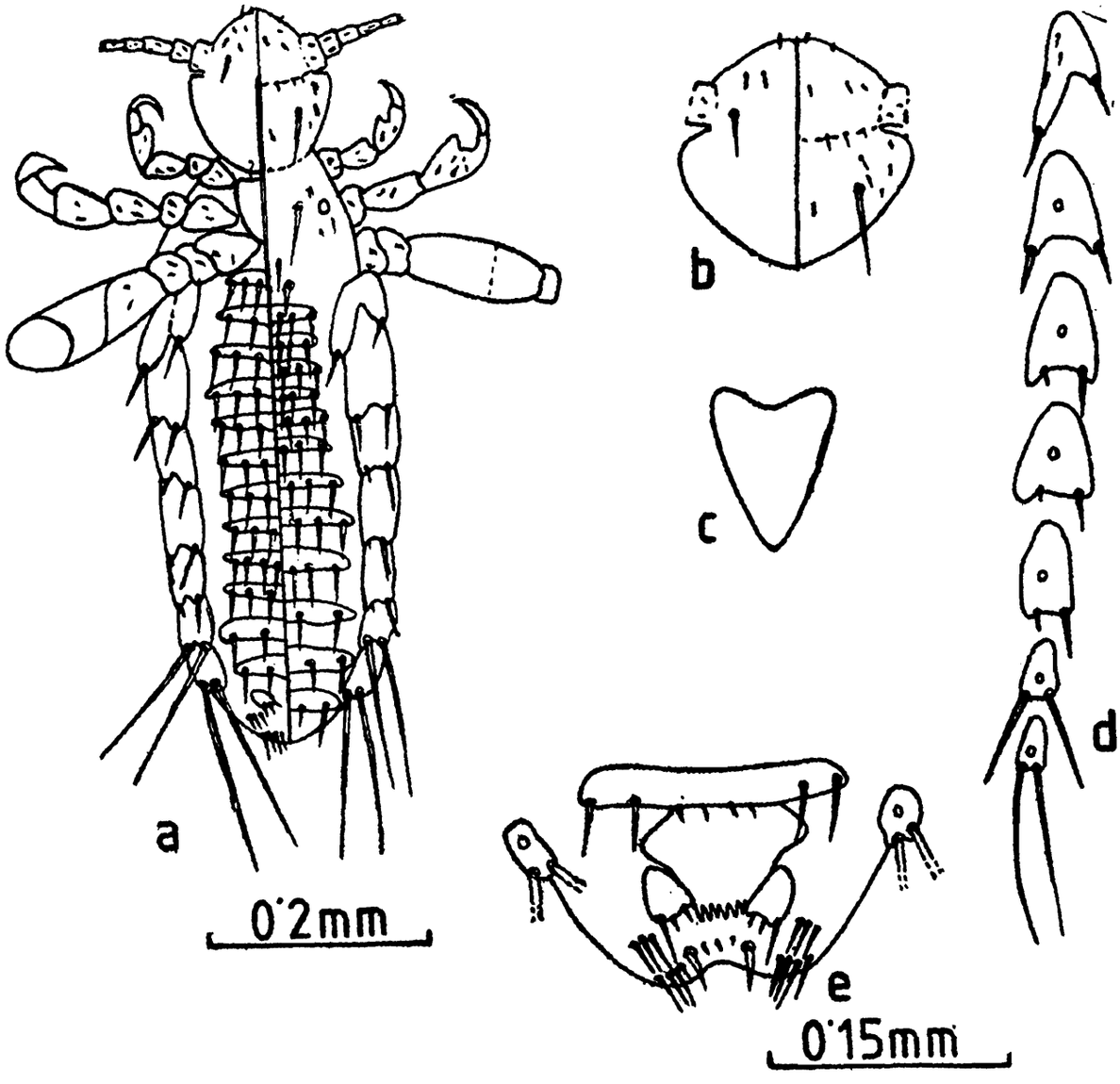
Distribution : India (Maharastra, Jammu and Kashmir).

Remarks : This species appears close to *P. asiatica* Ferris, *P. insulsa* Ferris and *P. hurrianicus* Mishra. It can be separated from *asiatica* by the well developed sternites and tergites in both sexes ; from *insulsa* by the blunt posteroventral angles on paratergites III to VI and from *hurrianicus* by the convexity of anterior margins of thoracic sternal plate ; DAAS and VAAS one pair each.

51. **Polyplax kondana** Mishra
(Figs., Plates 79 & 80)

1981. *Polyplax kondana* **Mishra**, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 96-98.

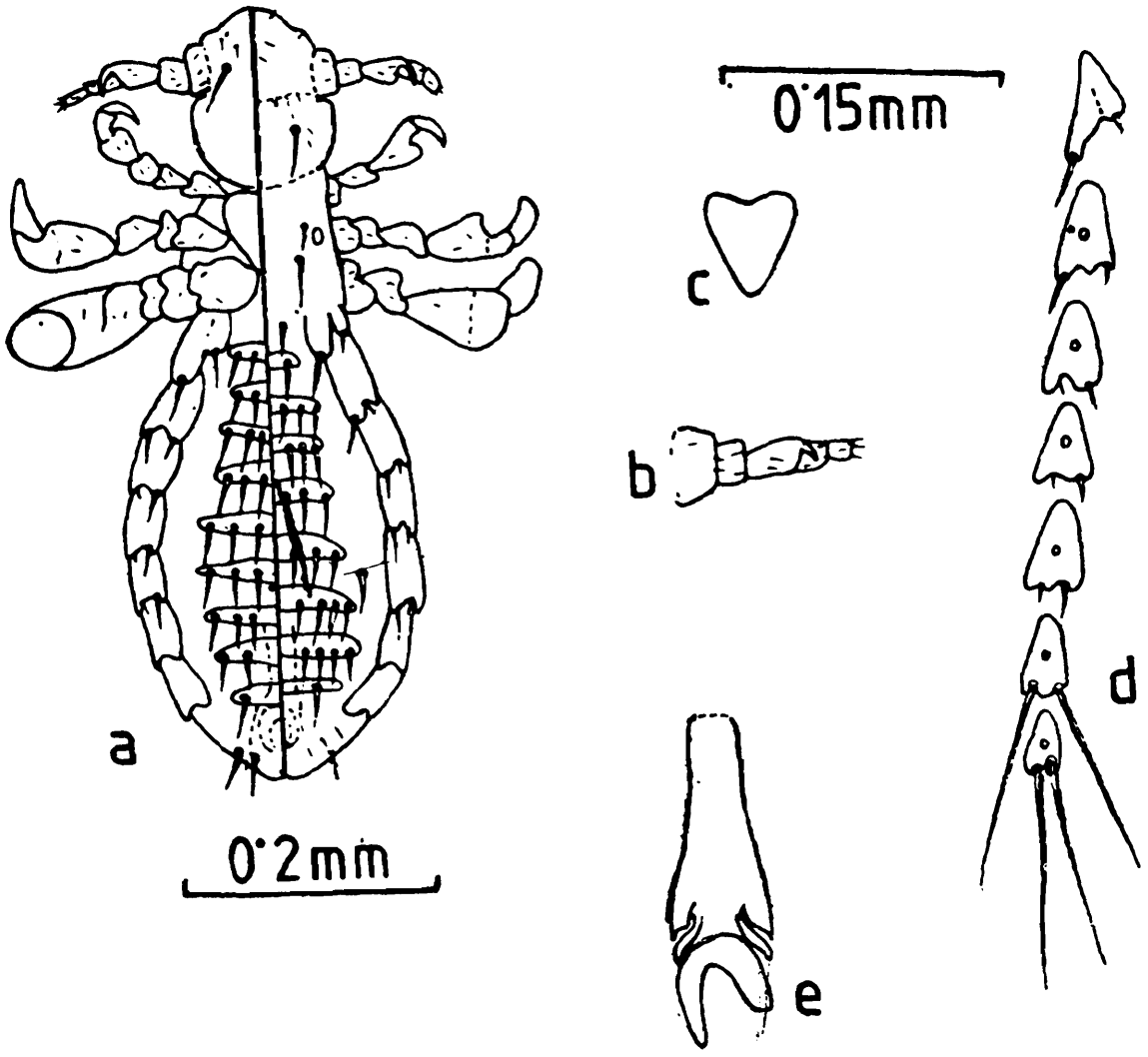
PLATE - 79



Polyplax kondana Mishra : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Female (Fig., Plate 79, a, b, c, d, e) : Total body length 0·67 mm ($\bar{X}$, N=5) ; range 0·61 to 0·71 mm. Head (Fig., Plate 79, b) : Slightly longer than wide ; gular area raised ; all typical head setae present ; antennal sensoria well separated. Thorax : Sternal plate (Fig., Plate 79, c) 0·082 mm long and 0·57 mm wide ; roughly triangular with concavity on anterior margin ; MDTS one pair, long.

PLATE - 80



Polyplax kondana Mishra : ♂

a. Whole body (ventral and dorsal views) ; b. Antenna ; c. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Abdomen : Dorsal : Segment II without tergites, but with 2 rows of 2 setae each ; III to VII, each with 2 tergites having 4-6 setae each ; VIII and terminal segment, each with single tergite having 4 setae each ; DAAS absent. Ventral : Segment II to VII, each with 2 sternites, 4-8 setae each ; remaining sternites modified to form genitalia ; VAAS absent. Lateral : Paratergites (Fig., Plate 79, d) : II typical, both setae small ; III with ventral posterior angles not prolonged, both setae equal in length, but smaller than plates ; IV to VI, each with ventral seta long, dorsal small, but both smaller than plates ; VII with both setae long and about half of the length of setae on VIII ; VIII with 2 long setae. Genitalia (Fig., Plate 79, e) : Genital plate triangular ; gonopods paired, each with 2 small and a long setae ; genital seta slightly enlarged and spiniform.

Male (Fig., Plate 80, a, b, c, d, e) : Total body length 0·57 mm ($\bar{X}$, N=5) ; range 0·52 to 0·61 mm. Head and thorax as in female except antennal segment III (Fig., Plate 80, b) which bear one short stout seta. Abdomen : Dorsal : Segment II with a single tergite with 2 rows of 2 setae each ; III with 2 tergites 6 setae on each ; IV to VII, each with single tergite having 6-10 setae each ; VIII with single tergite having 2 setae ; DAAS absent. Ventral : Segments II and III, each with 2 sternites, 4-6 setae each ; IV to VII, each with a single sternite having 4-7 setae each ; VIII with also a single sternite having 2 setae ; terminal segment with several minute setae ; VAAS absent. Lateral : Paratergites (Fig., Plate 80, d) : As in female. Genitalia (Fig., Plate 80, e) : Parameres short ; pseudopenis well developed articulating with apices of parameres.

Nymphs : Unknown.

Material examined : 5 ♀ ♀, 5 ♂ ♂, from *Millardia kondana* in Sinhgarh, Pune, Maharastra ; 11.7.84 ; Coll. C. C. Adhikary and A. C. Mishra.

Host : *Millardia kondana.*

Distribution : India (Maharastra).

Remarks : This species appears close *P. spinulosa* (Burmeister), *P. blanfordi* Mishra and Dhanda, *P. cutchicus* Mishra and Kaul and *P. serrata* Burmeister. It can be separated from *spinulosa* by the concavity on anterior margin of thoracic sternal plate and comparatively short setae on paratergite VII ; from *blanfordi* by short dorsal seta on paratergite IV and absence of DAAS and VAAS ; from *cutchicus* and *serrata* by the short dorsal seta on paratergites IV to VI and absence of DAAS and VAAS.

52. Polyplax reclinata (Nitzsch)
(Figs., Plates 81, 82 & 83)

1864. *Pediculus reclinatus* Nitzsch, *Gesam. Naturw.*, 23 : 23.
1874. *Haematopinus reclinatus* Giebel, *Insecta Epizoa*, P. 37.
1904. *Polyplax reclinata* (Nitzsch) Enderlein, *Zool. Anz.*, 28 : 142.
1909. *Haematopinus (Polyplax) reclinatus* Neumann, *Arch.* Parasitol., 13 : 524.
1932. *Polyplax reclinata leucodontis* Jancke, *Z. Parasitenk.*, 4 : 525.
1938. *Polyplax reclinata reclinata* Fahrenholz, *loc. cit.*, 10 : 257.
1957. *Polyplax shimizui* Kaneko, *Tokyo Med. Dent. Univ. Bull.*, 4 : 271.
1981. *Polyplax reclinata*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 98-101.
1992. *Polyplax reclinata*, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 13.*

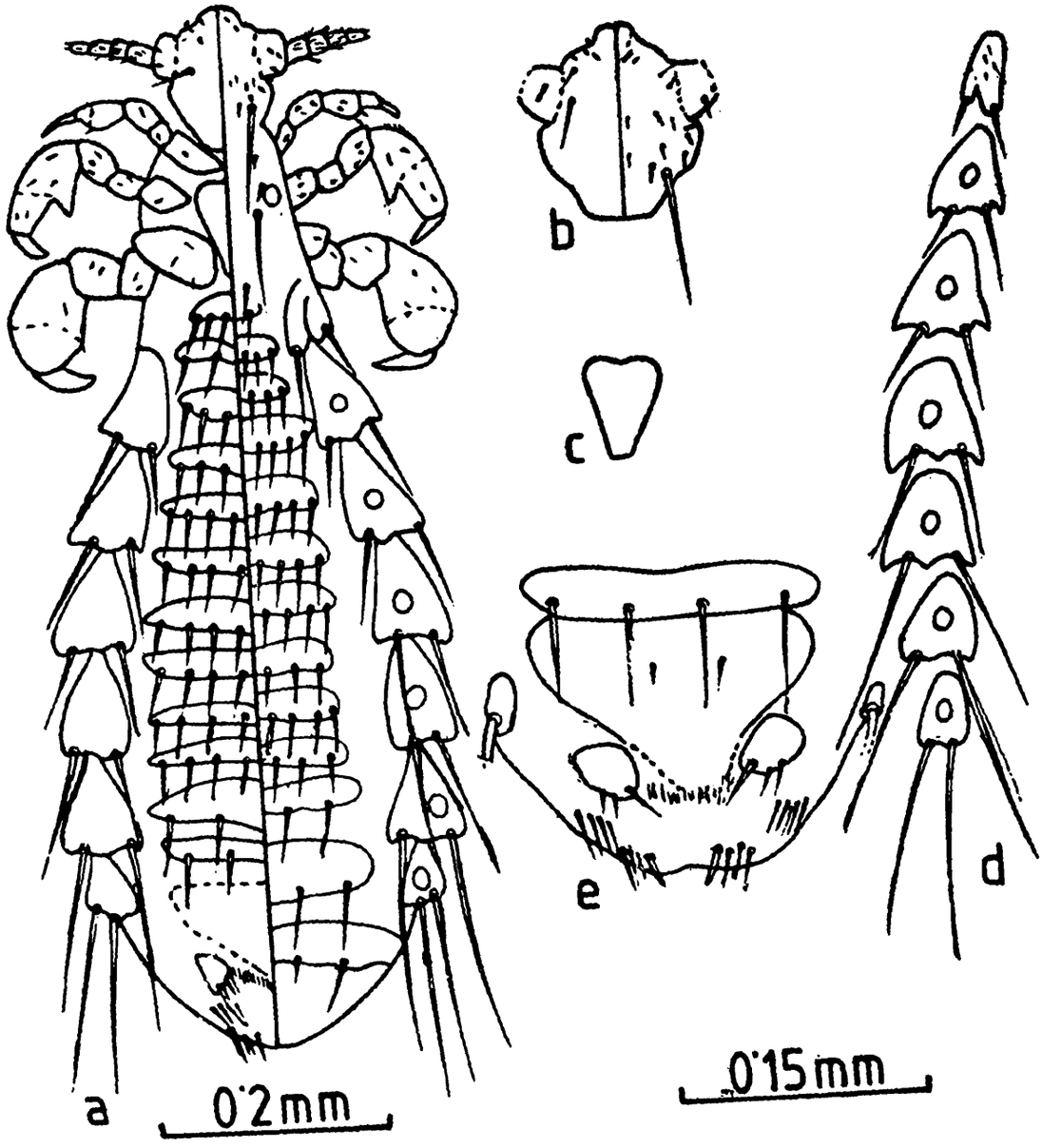
Female (Fig., Plate 81, a, b, c, d, e) : Total body length 0·9 mm ($\bar{X}$, N=15) ; range 0·78 to 1·51 mm. Head (Fig., Plate 81, b) : Longer than wide ; post antennal and occipital angles weakly developed ; gular fold present ; all typical head setae present ; DPHS long. Thorax : Sternal plate (Fig., Plate 81, c) 0·053 mm long and 0·042 mm wide ; roughly triangular, anterior margin straight, posterior process rounded at tip ; MDTS one pair, long. Abdomen : Dorsal : Segment II with 2 rows of 2 setae each, with indistinct tergites ; III to VII, each with 2 tergites having 5-7 setae each ; VIII and terminal segment with a single tergite each, having 4 setae each ; DAAS absent. Ventral : Segments II to VII, each with 2 sternites, 4-8 setae each ; remaining sternites modified to form genitalia ; VAAS absent. Lateral : Paratergites (Fig., Plate 81, d) : II typical, setae usually shorter than plates ; III to VIII, each roughly triangular, posterior angles usually rounded ; both setae on paratergites III to V variable in length ; VI to VIII, always with both setae long. Spiracles unusually large. Genitalia (Fig., Plate 81, e) : Genital plate roughly triangular ; gonopods paired ; genital setae short and spiniform.

Male (Fig., Plate 82, a, b, c, d) : Total body length 0·67 mm ($\bar{X}$, N=15) ; range 0·58 to 0·77 mm. Head and thorax usually as in female. Abdomen : Dorsal : Segment II with single indistinct tergite with 2 rows of 2 setae each ; III with 2 tergites usually 8 setae on each ; IV to VII, each with single tergite having 6-9 setae each ; VIII with single tergite having 2 setae ; DAAS absent. Ventral : Segment II and III, each with 2 sternites, 4-6 setae each ; IV to VII, each with a single sternite, having 4-8 setae each ; VIII with also single sternite having 2 setae ; VAAS absent. Lateral : Paratergites (Fig., Plate 82, c) and spiracles as in female. Genitalia (Fig., Plate 82, d) : Pseudopenis long and tapering, articulating at the apices of parameres.

Nymph 1 (Fig., Plate 83, a) : Head : As long as wide ; post antennal and occipital

angles slightly developed ; antennal sensoria large and contiguous. Thorax : MDTS long ; sternal plate absent. Abdomen : Dorsal and ventral central setae 9 and 2 pairs respectively ; accessary and major abdominal setae one pair each.

PLATE - 81

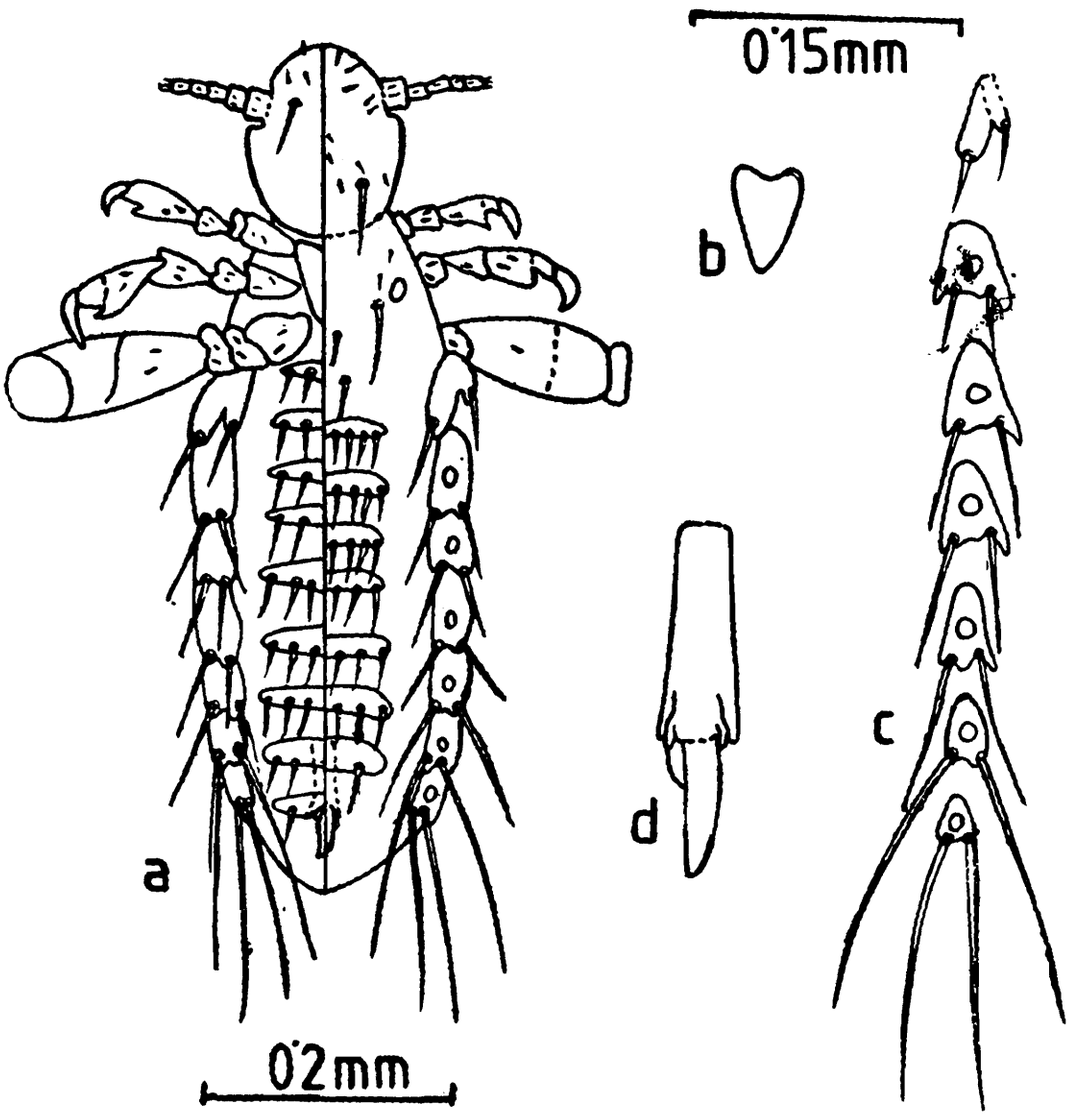


Polyplax reclinata (Nitzsch) : ♀

a. Whole body (ventral and dorsal views) ; b. Head ; c. Thoracic sternal ; plate ; d. Paratergites ; e. Genitalia.

Nymph 2 (Fig., Plate 83, b) : Similar to nymph 1 except thorax with small sternal plate ; accessary dorsal thoracic setae 2 pairs ; abdomen with dorsal major setae 2 pairs, dorsal and ventral central abdominal setae 9 and 7 pairs

PLATE - 82

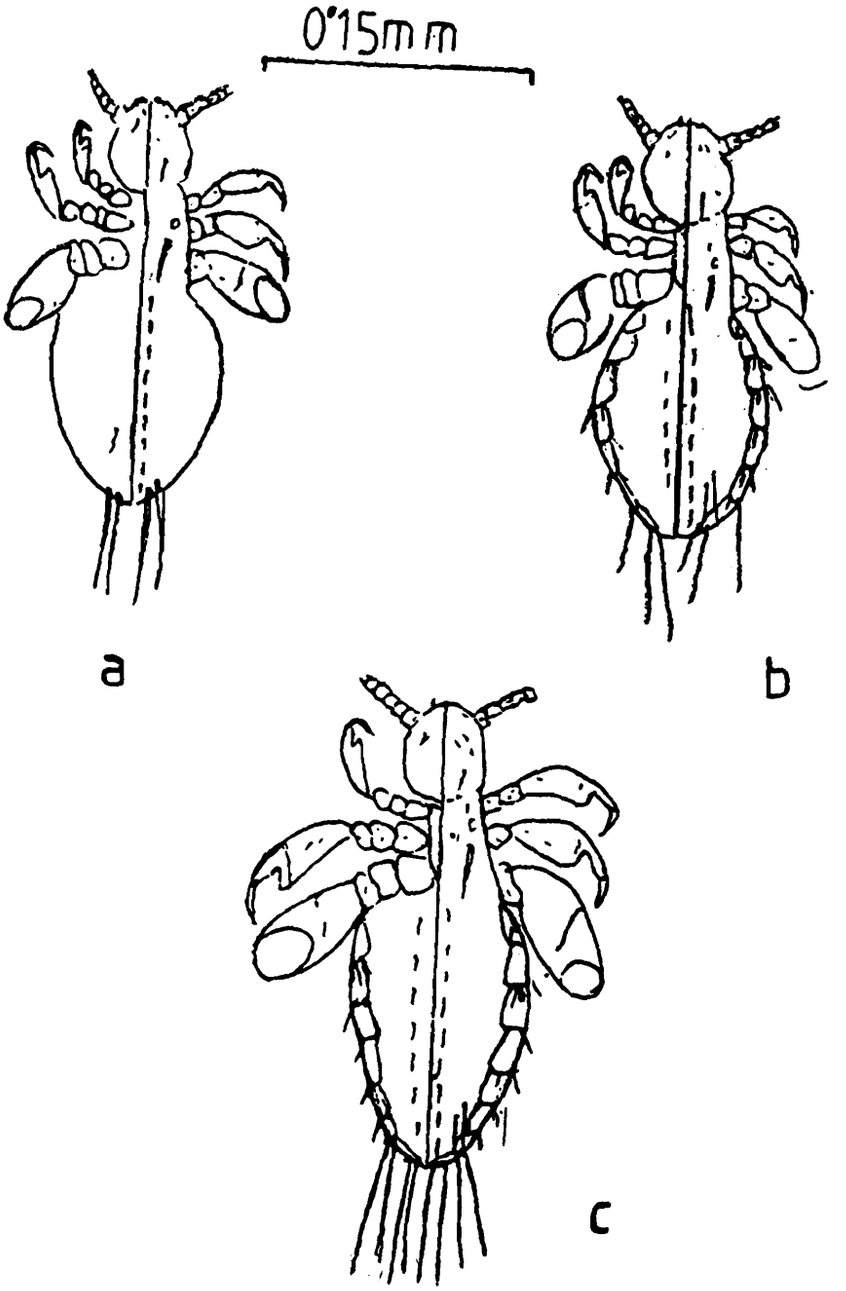


Polyplax reclinata (Nitzsch) : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ;
c. Paratergites ; d. Genitalia.

respectively ; 7 pairs of developing paratergites present ; paratergites II to VI, each with a pair of small setae ; VII with a long and other small setae ; VIII with 2 long setae.

Nymph 3 (Fig., Plate 83, c) : Similar to nymph 2 except thorax with sternal plate elongated ; abdomen with paratergites well developed and sclerotized, paratergites II to VI, each with both small setae, remaining paratergites with 2 long setae each.

PLATE - 83



Nymphs of *Polyplax reclinata* (Nitzsch)
a. Nymph 1 ; b. Nymph 2 ; c. Nymph 3.

Material examined : 5♀♀, 5♂♂, from *Suncus murinus* in Midnapore, West Bengal ; 20.9.84 ; Coll. C. C. Adhikary ; 5♀♀, 5♂♂, from *Suncus murinus* in Itanagar, Arunachal Pradesh ; 12 12.86 ; Coll. C. C. Adhikary ; 2♀♀, 2♂♂, from *S. murinus* in Shillong, Meghalaya ; 30.6.85 ; Coll. C. C. Adhikary ; 3♀♀, 3♂♂, from *S. murinus* in Solan, Himachal Pradesh ; 10.10.87 ; Coll. C. C. Adhikary.

Hosts : *Suncus murinus*, *Suncus* spp., *Sores* spp., *Crocidura* spp.

Distribution : India [Arunachal Pradesh (New record), Meghalaya (New record) West Bengal (New record), Orissa, Maharastra, Rajasthan, Uttar Pradesh, Himachal Pradesh, Jammu and Kashmir] ; Sri Lanka ; Cosmopolitan.

Remarks : *P. reclinata* is an isolated species and .seems to have no close relatives ; it can be separated from distantly related species *P. serrata* (Burmeister) by long dorsal and ventral setae on paratergite VI and *P. stenphensi* (Christophers and Newstead) by straight anterior margin of thoracic sternal plate and large spiracles on abdominal segments II to VIII.

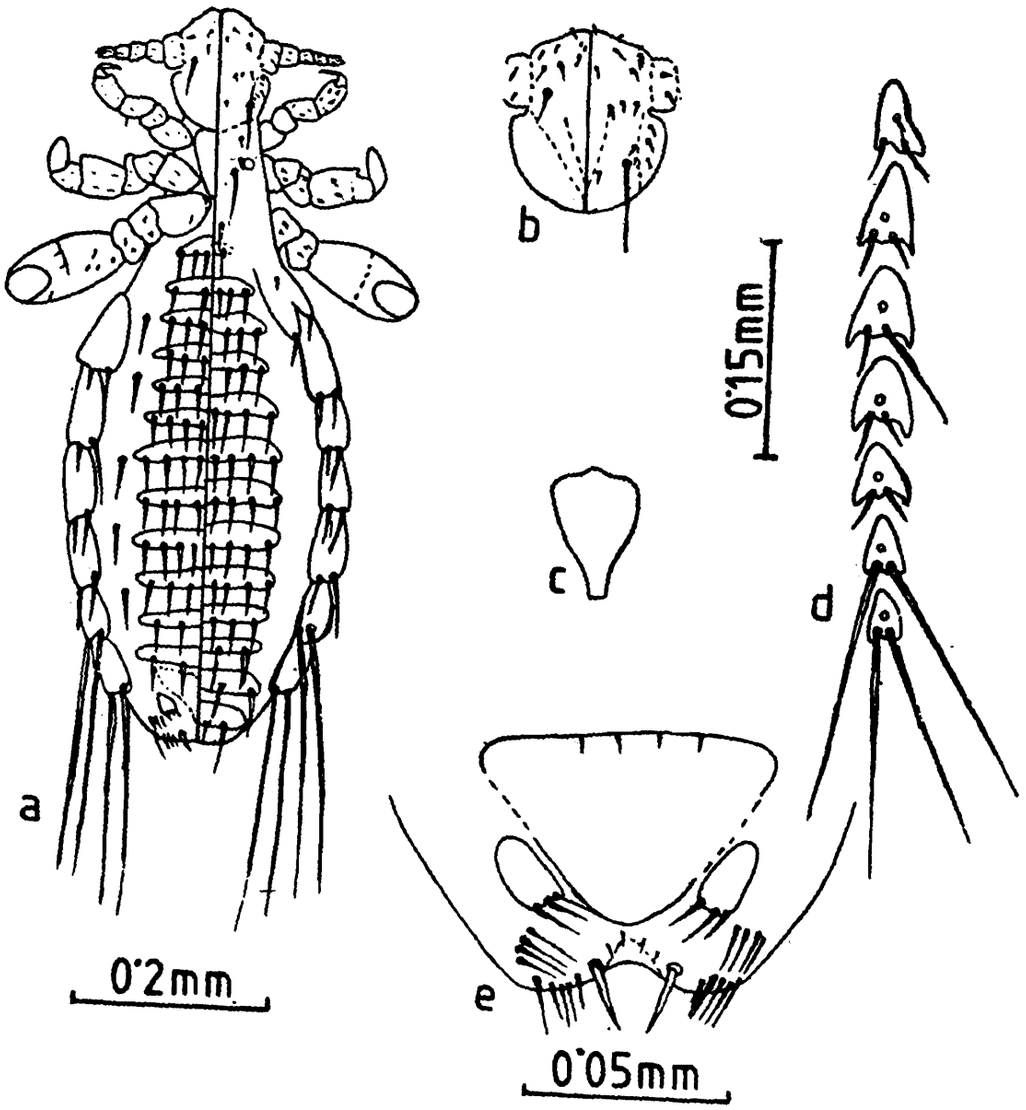
53. **Polyplax serrata** (Burmeister)
(Figs., Plate 84 & 85)

1838. *Pediculus serratus* Burmeister, *Genera Insectorum, Rhynchota*, No. 6.
1904. *Polyplax serrata*, Enderlein, *Zool. Anz.*, 28 : 142.
1842. *Haematopinus serratus*, Denny, *Monographia Anoplurorum Britanniae*, P. 36.
1912. *Polyplax affinis*, Fahrenholz, *Abhandl. Niedersachs. Zool. Ver. Hannover. Jahresb.*, 2-4 : 39-42.
1938. *Polypax serrata affinis* Fahrenholz, *Zs. Parasitenk*, 10 : 261.
1952. *Polyplax serrata paxi* Eichler, *Behandlungstechnik parasitarer insecten* (Leipzig). P. 206.
1981. *Polyplax serrata*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 101-103.

Female (Fig., Plate 84, a, b, c, d, e) : Total body length 0·74 mm ($\bar{X}$, N=1). Head (Fig., Plate 84, b) : Slightly longer than wide ; post antennal and occipital angles well marked and rounded ; gular folds present ; gular area raised ; all typical head setae present. Thorax : Sternal plate (Fig., Plate 84, c) 0·06 mm long and 0·04 mm wide ; roughly triangular, anterior margin with small convexity in middle, posterior process rounded at tip ; MDTS one pair, long. Abdomen : Dorsal : Segment II with 2 tergites with 2 rows of 2 setae each, first tergite indistinct, second distinct ; III to VII, each with 2 tergites having 4-8 setae each ; VIII and terminal segments, each with a single tergite having 4 setae each ; DAAS absent. Ventral : Segments II to VII, each with 2 sternites, 4-8 setae each ; remaining sternites modified to form genitalia ; VAAS 5 pairs. Lateral : Paratergites (Fig., Plate 84,

d): II typical, both setae small; III to VI, each triangular with both posterior angles acute, both setae shorter than plates except ventral seta of IV which is much longer than others; VII and VIII devoid of acute angles, both setae long. Genitalia (Fig., Plate 84, e): Gonopods paired; genital setae short and stout.

PLATE - 84

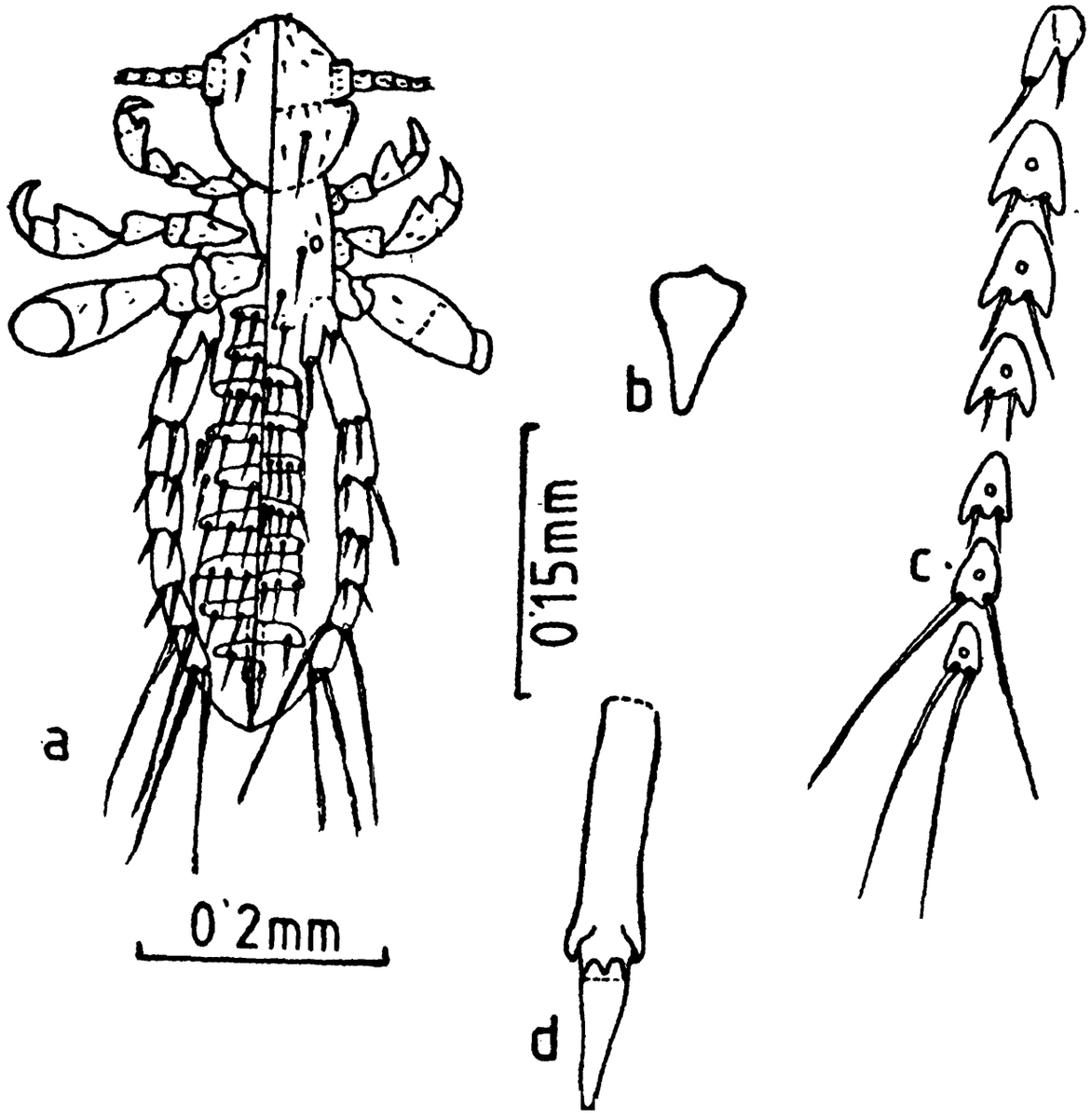


Polyplax serrata (Burmeister): ♀

a. Whole body (ventral and dorsal views); b. Head; c. Thoracic sternal plate; d. Paratergites; e. Genitalia.

Male (Fig., Plate 85, a, b, c, d) : Total body length 0·57 mm ($\bar{X}$, N = 1). Head and thorax as in female. Abdomen : Dorsal : Segment II with single indistinct tergite with 2 rows of 2 setae each ; III with 2 tergites, each with 6 setae ; IV to VII, each with single tergite having 6-10 setae each ; VIII with single tergite

PLATE - 85



Polyplax serrata (Burmeister) : ♂
a. Whole body (ventral and dorsal views) ; b. Thoracic sternal plate ; c. Paratergites ; d. Genitalia.

having 2 setae. DAAS absent. Ventral : Segment II and III, each with 2 sternites, 4-6 setae on each ; IV to VII, each with single sternite having 4-8 setae each ; VIII with also single sternite having 2 setae. VAAS 4 pairs. Lateral : Paratergites (Fig., Plate 85, c) : As in female. Genitalia (Fig., Plate 85, d) : Parameres short ; pseudopenis long, tapering and articulates at tips of parameres.

Nymphs : Could not be obtained during present study. Description of all nymphs are based on Mishra 1981.

Nymph 1 : Head as long as wide ; post antennal and occipital angles not pronounced ; all typical head setae present. Thorax : Mesothoracic spiracle distinct ; sternal plate absent ; MDTS long, one pair ; legs as in adult. Abdomen : Spiracles 6 pairs ; dorsal central abdominal setae 9 pairs ; ventral central abdominal setae and major abdominal setae one pair each ; accessary and anal setae indistinct.

Nymph 2 : Similar to nymph 1 except as follows : Thorax with accessary dorsal setae 2 pairs. Abdomen : Paratergites weakly developed, paratergites II to VI, each with a pair of small setae except ventral seta of paratergite IV which is much longer ; VII with a pair of medium sized setae ; VIII with a pair of long setae. Major abdominal setae one pair on each side.

Nymph 3 : Similar to nymph 2.

Material examined : 1 ♀, 1 ♂, from *Mus musculus* in Kargil, Ladakh ; 15.8.67 ; Coll. A. C. Mishra.

Hosts : *Mus musculus*, *Apodemus* spp.

Distribution : India (Ladakh) ; wide spread.

Remarks : This species seems close to *P. spinulosa* (Burmeister), *P. blanfordi* Mishra and Dhanda and *P. cutchicus* Mishra and Kaul. It can be separated from *spinulosa* by the shape of thoracic sternal plate and long ventral seta on paratergite IV ; from *blanfordi* by long ventral setae on paratergite VII and acute posteroventral angles of paratergites III to VI ; from *cutchicus* by long ventral seta on paratergite IV and long dorsal and ventral setae on paratergite VII.

54. Polyplax spinulosa (Burmeister)
(Figs., Plates 86 & 87)

1839. *Pediculosus spinulosus* Burmeister, *Genera Insectorum, Rhynchota* No. 8.
1904, *Polyplax spinulosa* Enderlein, *Zool. Anz.*, 28 : 142.
1842. *Haematopinus spinulosus* Denny, *Monographia anoplurum Britanniae*, P. 26, Pl. 24.
1864. *Pediculus donticulatus* Nitzsch, *Zs. Gesam. Naturw.*, 23 : 24.
1981. *Polyplax spinulosa*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 103-105.

Female (Fig., Plate 86, a, b, c, d, e) : Total body length 0·85 mm ($\bar{X}$, N=3) ; range 0·84 to 0·87 mm. Head (Fig., Plate 86, b) : Slightly longer than wide ; post antennal and occipital angles well developed ; gular area raised ; all typical head setae present ; antennal sensoria separate. Thorax : Sternal plate (Fig., Plate 86, c) 0·072 mm long and 0·058 mm wide, with lateral margins almost parallel, posteriorly produced into a blunt point ; MDTS one pair, long. Abdomen : Dorsal : Segment II with single tergite, with 2 rows of setae, 2 setae on each row ; III to VII, each with 2 tergites having 4-9 setae each ; VIII and terminal segment, each with a single tergite having 4 setae each ; DAAS 3-4 pairs. Ventral : Segments II to VII, each with 2 sternites, 4-9 setae each ; remaining sternites modified to form genitalia. VAAS 3-4 pairs. Lateral : Paratergites (Fig., Plate 86, d) : II typical, both setae short, III to VI, each with triangular acute posterodorsal and rounded posteroventral angles, with 2 setae on each, both setae shorter than plates ; VII and VIII devoid of acute angles, both setae long. Genitalia (Fig., Plate 86, e) : Gonopods paired ; genital setae small and enlarged.

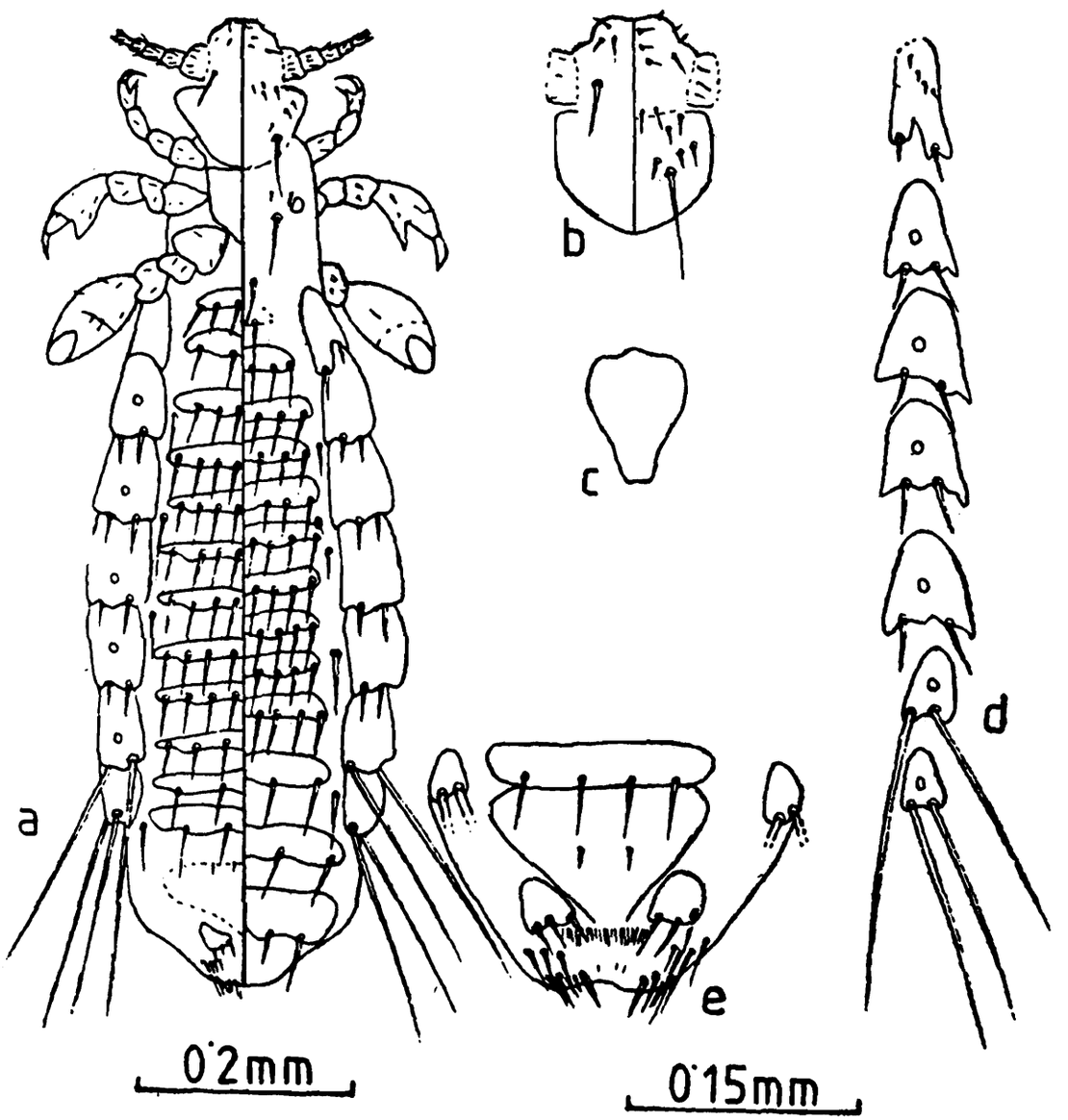
Male (Fig., Plate 87, a, b, c) : Total body length 0·52 mm ($\bar{X}$, N=2) ; range 0·52 to 0·53 mm. Head and thorax as in female except antennal segment III apicodorsally prolonged and bear a short stout seta. Abdomen : Dorsal : Segment II with single tergite with 2 rows of 2 setae each ; III with 2 tergites usually 6 setae each ; IV to VII, each with single tergite having 6-10 setae each ; VIII with single tergite with 2 setae ; DAAS 2-3 pairs. Ventral : Segment II and III, each with 2 sternites having 4-6 setae each ; IV to VIII, each with single sternite, 5-9 setae each ; VIII with also single sternite having 2 setae ; VAAS 2-3 pairs. Lateral : Paratergites (Fig., Plate 87, b) as in female. Genitalia (Fig., Plate 87, c) : Parameres short and convex ; pseudopenis almost equal to parameres in length, articulating at their tip.

Nymphs : Could not be obtained during present study. Description of all nymphs are based on Mishra 1981.

Nymph 1 : Head : As long as wide ; postantennal and occipital angles not

pronounced; all typical head setae present; antennal sensoria separate. Thorax: Mesothoracic spiracle distinct; sternal plate absent; MDTS long, one pair; legs as in adults. Abdomen: Spiracles 6 pairs; dorsal central setae 9 pairs; ventral central setae one pair; major abdominal setae single pair; anal setae indistinct.

PLATE - 86



Polyplax spinulosa (Burmeister) : ♀

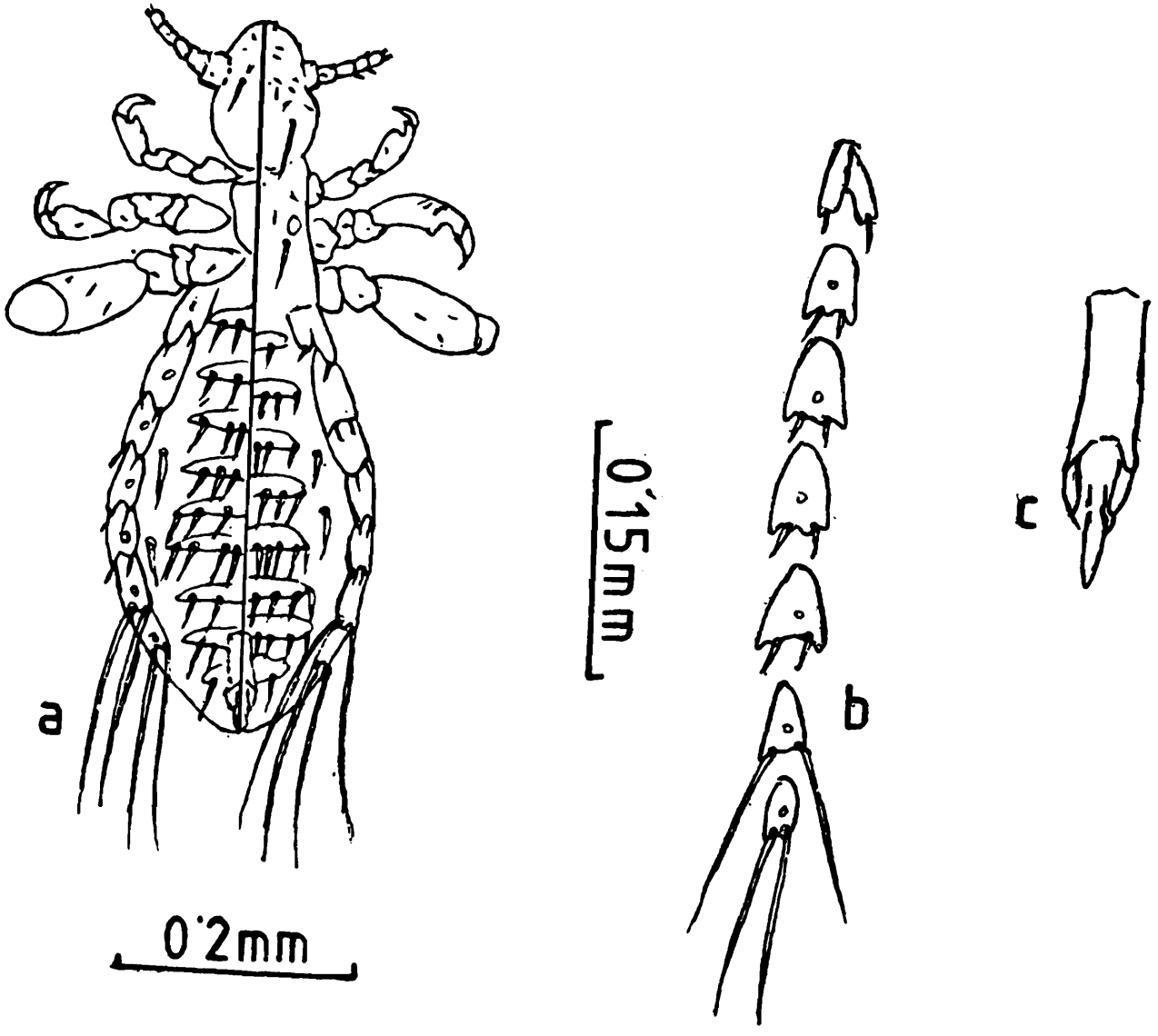
a. Whole body (ventral and dorsal views); b. Head; c. Thoracic sternal plate; d. Paratergites; e. Genitalia.

Nymph 2 : Similar to nymph 1 except thorax with accessary dorsal setae 2 pairs ; abdomen with paratergites weakly developed ; paratergites II to VII, each with a single pair of small setae ; VIII with a pair of long setae ; major abdominal setae one pair on each side.

Nymph 3 : Similar to nymph 2.

Material examined : 3 ♀ ♀, 2 ♂ ♂, from *Rattus norvagicus* in Kariavattom, Kerala ; 1976 ; Coll. R. S. Prosad.

PLATE - 87



Polyplax spinulosa (Burmeister) : ♂

a. Whole body (ventral and dorsal views) ; b. Paratergites ; c. Genitalia.

Hosts : *Rattus norvagicus* (New record), *R. r. gangutrianus*, *R. r. satarae*, *R. r. rufescens*, *R. rattoides R. niviventer*, *R. r. arboreus* and other species of Rattus.

Distribution : India (All parts) ; wide spread.

Remarks : This species appears close to *P. serrata* (Burmeister), *P. cutchicus* Mishra and Kaul and *P. kondana* Mishra. It can be separated from *serrata* by the parallel lateral margins of thoracic sternal plate, short ventral seta on paratergite IV ; from *cutchicus* and *kondana* by the combination of following characters : paratergites IV to VI, each with both setae small and almost equal in length ; paratergite VII with both setae long and almost equal to the setae of paratergite VIII.

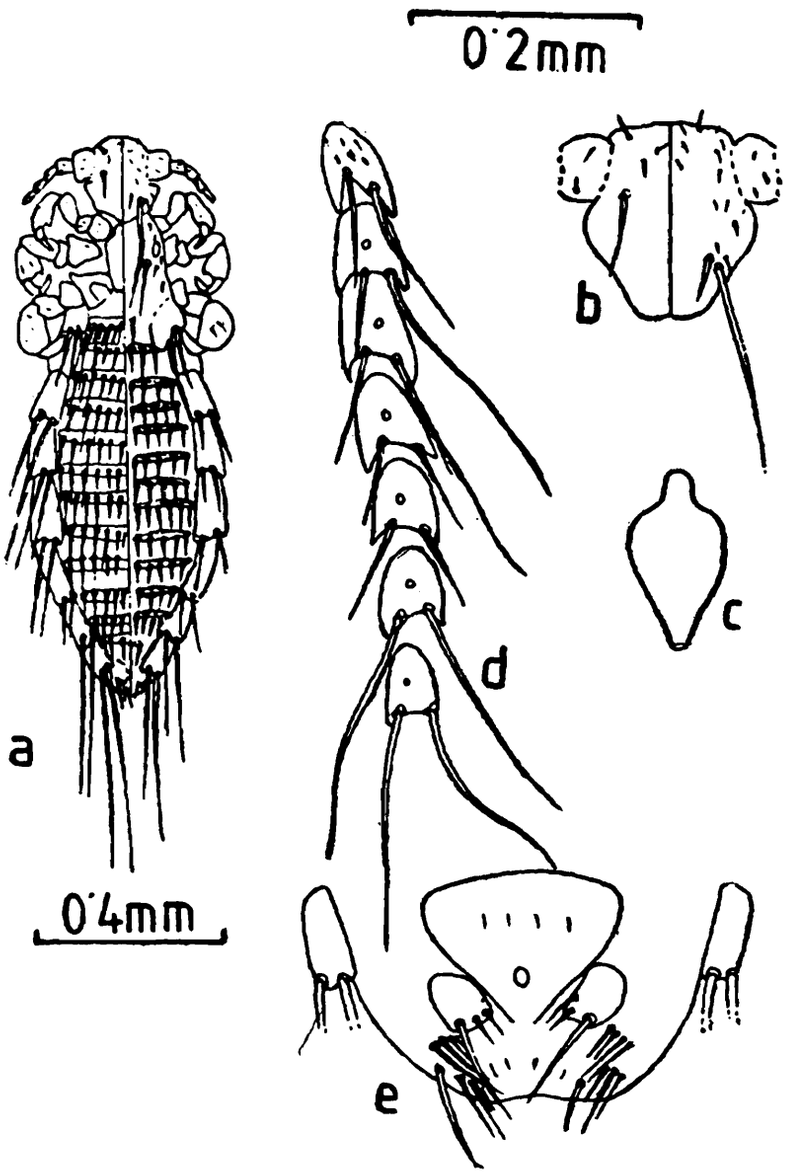
55. **Polyplax stephensi** (Christophers and Newstead) (Figs., Plates 88, 89 & 90)

1906. *Haematopinus stephensi* Christophers and Newstead, *Thomp. Yates Lab. Rept.* (n. s.), 7 : 3.
1923. *Polyplax stephensi*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. IV : 206.
1951. *Polyplax stephensi*, Ansari, *Indian J. Ent.*, 13 : 127.
1971. *Polyplax stephensi*, Kim and Emerson, *J. Med. Ent.*, 8 : 13.
1974. *Polyplax stephensi*, Mishra *et al.*, *Indian. J. med. Res.*, 62 : 1279.
1981. *Polyplax stephensi*, Mishra, *Rec. Zool. Surv. India, Occ. Paper*, 21 : 105-108.
1992. *Polyplax stephensi*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *13-14.*

Female (Fig., Plate 88, a, b, c, d, e) : Total body length 1·1 mm ($\bar{X}$, N = 20) ; range 0·92 to 1·51 mm. Head (Fig., Plate 88, b) : Slightly longer than wide ; post antennal and occipital angles well developed and rounded ; gular area raised ; gular folds present ; all typical head setae present ; DPHS very long ; antennal sensoria separate. Thorax : Sternal plate (Fig., Plate 88, c) 0·16 mm long and 0·057 mm wide, with anterior margin narrow and handle-like prolongation extending forward between the coxae, MDTS long, one pair ; accessary dorsal thoracic setae 6 pairs. Abdomen : Dorsal : Tergites are narrow ; segment II with 2 rows of setae ; first with 2 and second with 6-8 setae, with a single distinct tergite ; III to VII, each with 2 tergites having numerous setae each ; VIII with also single tergite having 2 setae, terminal segment with several minute setae. Ventral : Sternites are narrow. Segments II to VI, each with 2 sternites, having 11 to 18 setae each except first sternite of segment II, which has 13-16 setae ; segment VII with 2 sternites, first with 18 setae and second with 8 setae ; second sternite of segment VII devoid of small setae. Remaining sternites modified to form genitalia. Paratergites (Fig., Plate 88, d) : II typical, both setae long, III to VI, each with posterior angles acute, both setae long, slightly longer than plates except ventral seta of III and IV which are very

long ; VII and VIII devoid of acute angles, both setae long.. Genitalia (Fig., Plate 88, e) : Genital plate roughly triangular, with a distinct spermathecal opening, usually 4 setae ; gonopods paired, each with 2 small and one long seta ; genital seta enlarged and tapering.

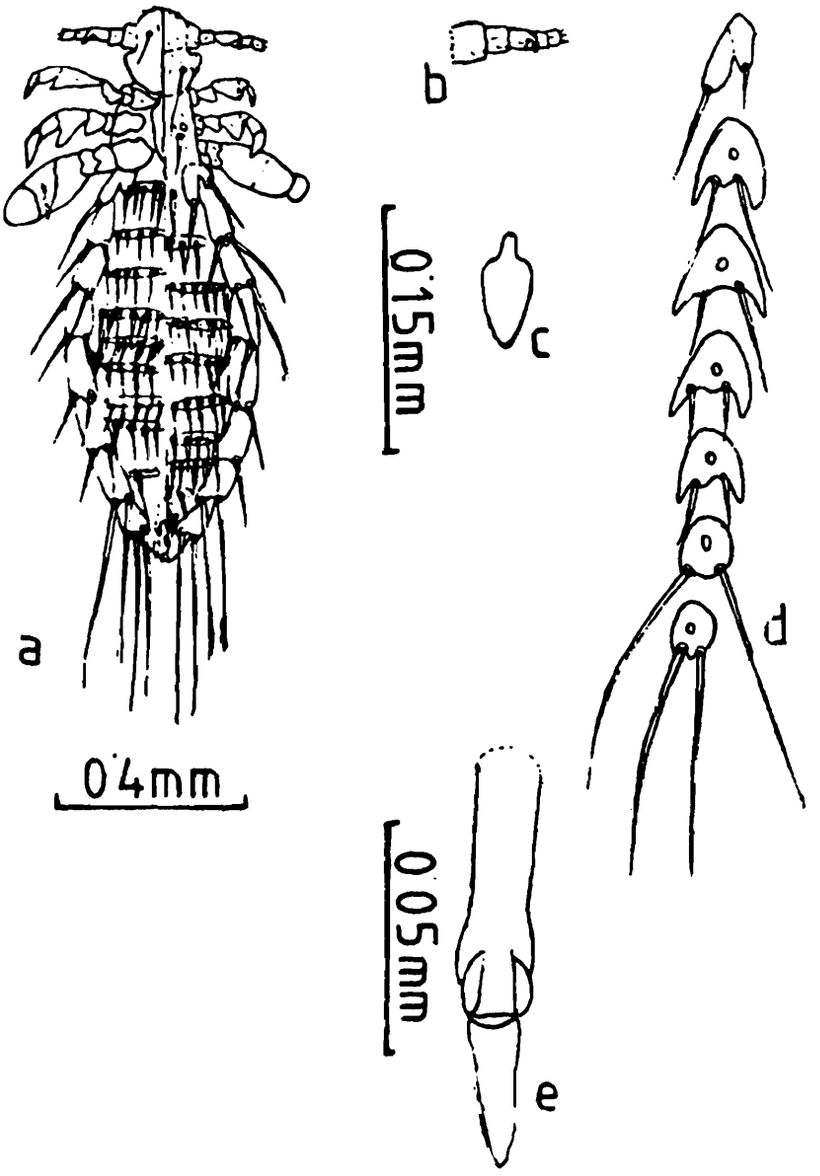
PLATE - 88



Polyplax stephensi (Christophers and Newstead) : ♀
a. Whole body (ventral and dorsal views) ; b. Head ; C. Thoracic sternal plate ; d. Paratergites ; e. Genitalia.

Male (Fig., Plate 89, a, b, c, d, e): Total body length 1·16 mm ($\bar{X}$, N=20); range 0·85 mm. to 1·3 mm. Head and thorax as in female except antennal segment III (Fig., Plate 89, b) which is apicodorsally prolonged into a small extension and bear a

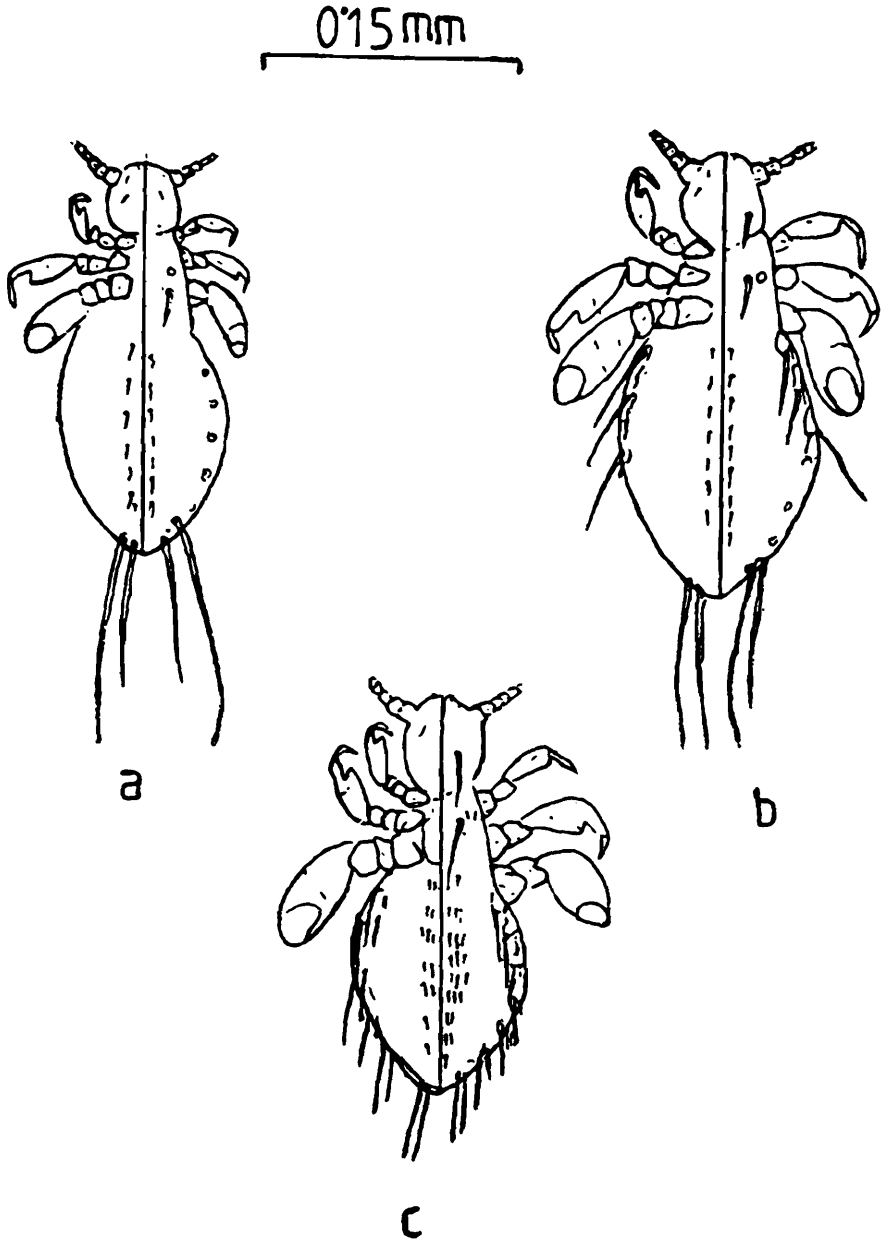
PLATE 89



Palyplax stephensi (Christophers and Newstead): ♂
a. Whole body (ventral and dorsal views); b. Antenna; c. Thoracic sternal plate; d. Paratergites; e. Genitalia.

small thick seta. Abdomen : Dorsal : Tergites are narrow. Segment II with single tergite having 2 rows of setae, first row with 2, second with 6-8 setae ; III with 2 tergites with numerous setae on each tergite, IV to VII, each with single tergite, having large number of setae each, particularly in laterally ; VIII with also single tergite having 2 setae. Ventral : Sternites are narrow. Segment II and III, each with 2 sternites, with numerous

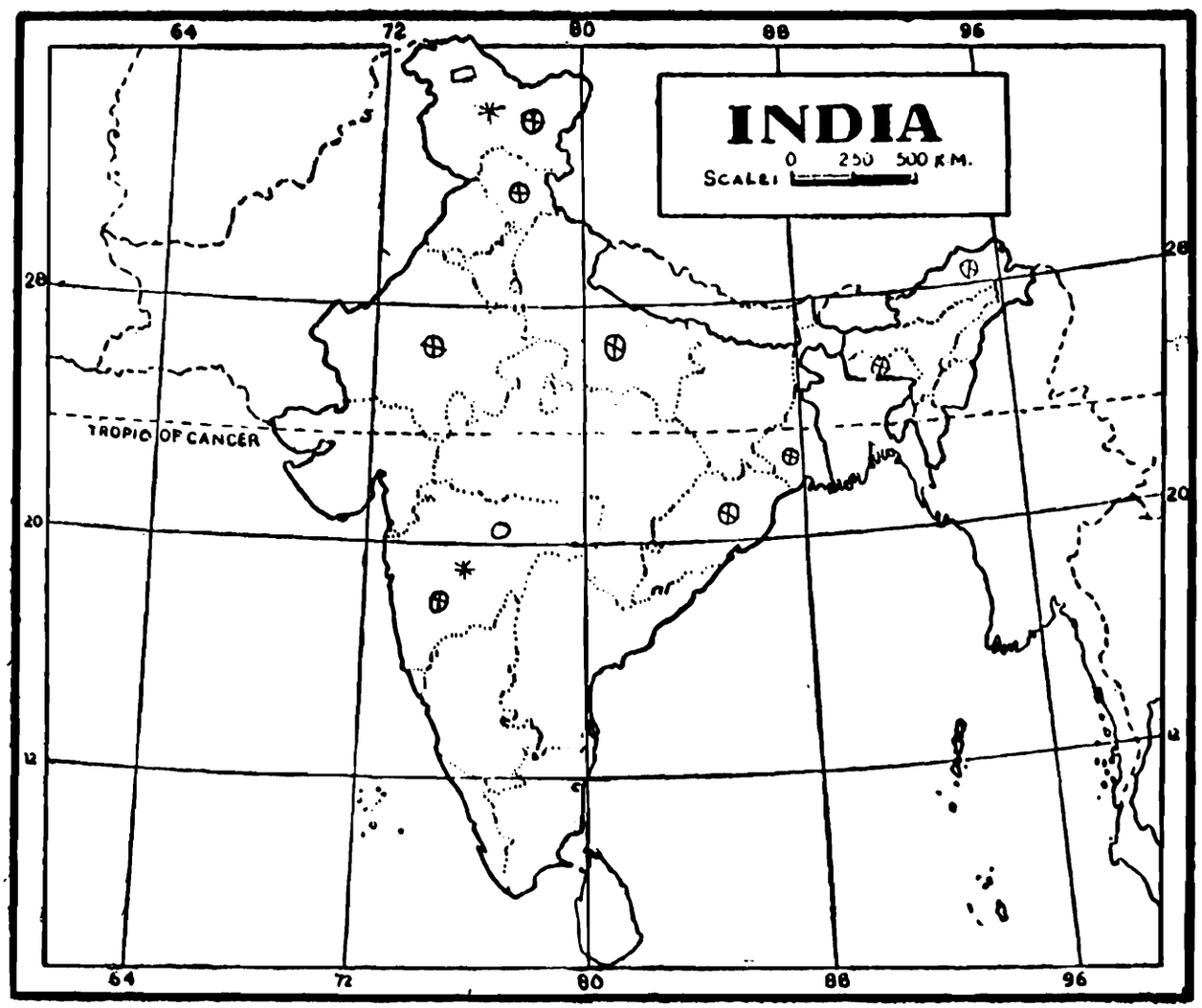
PLATE 90



Nymphs of *Polyplax stephensi* (Christophers and Newstead)
a. Nymph 1 ; b. Nymph 2, c. Nymph 3.

setae on each ; IV to VII, each with a single sternite, having numerous setae each ; VIII with also a single sternite having 2 setae ; terminal segment triangular, with many small setae. Lateral : Paratergites (Fig., Plate 89, d) : As in female. Genitalia (Fig., Plate 89, e) : Parameres small ; pseudopenis long, stout and articulates at the tip of parameres.

Nymph 1 (Fig., Plate 90, a) : Head : Slightly longer than wide, post antennal and occipital angles weakly developed ; all typical head setae present ; DPHS minute ; antennal sensoria separate. Thorax : Sternal plate absent ; MDTS long. Abdomen : Spiracles 6 pairs ; dorsal and ventral central setae 8 and 7 pairs respectively ; major abdominal setae one pair on each side ; accessary and anal setae indistinct.



Map showing distribution of

(✳) Polyplax indica Mishra and Kulkarni; (○) P. kondana Mishra; (⊗) P. reclinata (Nitzsch); ▭ P. serrata (Burmeister).

Nymph 2 (Fig , Plate 90, b) : Similar to nymph 1 except as follows : Head : DPHS long. Thorax : Accessary dorsal setae 2 pairs. Abdomen : Paratergites weakly developed ; II to IV, each with one long and one small setae ; V to VII not developed and devoid of setae ; VIII with a pair of long setae ; anal setae 2 pairs ; dorsal central abdominal setae and ventral central abdominal setae 9 and 7 pairs respectively.

Nymph 3 (Fig., Plate 90, c) : Similar to nymph 2 except thorax with accessary dorsal thoracic setae 3 pairs ; sternal plate distinct, shape as in adult. Abdomen : Dorsal central abdominal setae in 9 rows, each row with 4-6 setae except first and terminal, which has 2 setae each ; ventral central abdominal setae in 7 rows, first 5 rows with 4-6 setae each and remaining with 2 setae each ; paratergites V to VI, each with a pair of small setae ; VII with a single long seta.

Material examined : Paratypes 2♀♀, 1♂, (Rcgd. No. VRC A 81734) from *Tatera indica* in Ramnagar, Nainital, Uttar Pradesh ; 18.11.67 ; Coll. A. C. Mishra ; 5♀♀, 5♂♂, from *Tatera indida* in Midnapore, West Bengal ; 18.9.84 ; Coll. C. C. Adhikary ; 5♀♀, 5♂♂ from *T. indica* in Madurai, Tamil Nadu ; 1986 ; Coll. S. Saha ; 8♀♀, 9♂♂, from *T. indica* in Purulia, West Bengal ; 15.1.85 ; Coll. C. C. Adhikary.

Host : *Tatera indica.*

Distribution : India (wide spread) ; Iran.

Remarks : This species seems close to *P. taterae* Ferris and *P. biseriata* Ferris. It can, however, be separated from *taterae* by long ventral seta on paratergite III and IV ; from *biseriata* by the absence of stout and large seta on antennal segment I and by comparatively large setae on paratergites II, V and VI.

8. Family : PTHIRIDAE Ewing

1929. Phthiridae Ewing, *A manual of external parasites*, 132.
1976. Pthiridae, Kim and Ludwing, *Syst. Ent.*, 3 : 277-278.
1992. Pthiridae, Adhikary and Ghosh, *State Fauna Series 3 : Fauna of West Bengal, Pt. 7 : 2.*

Type genus : *Phthirus* = *Pthirus* Leach, by monotype.

Characters : Head : Short, narrow, eyes present externally with distinct lenses ; antennae 5 segmented which are not sexually dimorphic ; occipital apophyses lacking. Thorax : Fore legs slender with slender claw ; mid and hind legs largest and stout, with stout claw ; tibial thumbs well developed with a spiniform apical seta ; sternal

plate absent but sternal apophyses present ; no distinct notal pit. Abdomen : Small, membranous except for genital segments and lateral lobes ; 6 pairs of spiracles ; segmental setae arranged in transverse rows. Genitalia : Female with large spermatheca ; gonopods well developed ; sub genital plate wide. Male with parameres pointed, a pair of pointed sclerotized structure ; endomere and aedeagus well sclerotized.

Remarks : This family is represented by a single genus viz.. *Pthirus* Leach which is also recorded from India.

14. Genus : **Pthirus** Leach

1815. *Pthirus* Leach, *Edinburgh Encyclopaedia*, 9 : 77.
1904. *Pthirus*, Enderlein, *Zool. Anz.*, 28 : 138.
1935. *Pthirus*, Ferris, *Contributions toward a monograph of the sucking lice*, Pt. VIII, P. 602-603,
1992. *Pthirus*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : 2.

Type species : *Pediculus humanus* Linnaeus by original designation.

Characters : *Female* : Head : Eyes present ; five segmented antennae which are not sexually dimorphic. Thorax : Short and very wide, without notal pit and prothoracic pleural apophyses ; sternal plate lacking ; fore legs slender, with slender and slightly toothed claw ; middle and posterior legs very large and stout with heavy claw. Abdomen : Weakly sclerotic, without sclerotic plates, setae stout, spike like, arranged in a single transverse row on each segment dorsally ; paratergites absent but V to VIII segments produced laterally into prominent, nipple like, sclerotized protuberances ; spiracles very large and conspicuous, present on III to VIII segments, those of the III to V segments close together with the first two displaced towards the meson. Genitalia : Gonopophyses well developed.

Male : Same as in female except genitalia. Genitalia : Parameres not fused with the pseudopenis which is divided into two pieces the preputial sac small and without teeth.

Remarks : This genus is represented by 2 species throughout the globe, only the *Pthirus pubis* (Linnaeus) is recorded from India.

56. **Pthirus pubis** (Linnaeus)
(Fig., Plate 91)

1758. *Pediculus pubis* Linnaeus, *Systema Naturae*, P, 611.
1904. *Phthirus pubis*, Enderlein, *Zool. Anz.*, 28 : 136.
1908. *Phthirus pubis*, Dalla Torre, 1908, "Anoplura" in *Wytsman's Genera Insectorum*, P. 9 ; fig. 2.
1935. *Phthirus pubis*, Ferris, *Contributions toward a monograph of the sucking lice*. Pt. VIII, P. 603-608. fig. 335-337.
1936. *Phthirus pubis*, Bedford, G.A.H. *Onderstepont, J. Vet. Sci. and Animal Industry* ; 7 : 69.
1972. *Phthirus pubis*, Alwar and Ebenezer, *Cheiron* ; 1, 111-113.
1992. *Pthirus pubis*, Adhikary and Ghosh, *State Fauna Series 3* : *Fauna of West Bengal, Pt. 7* : *14*.

Female (Fig., Plate 91, a, c, d) : Total body length 3·6 mm ($\bar{X}$, N = 10) ; range 2·8 to 4·6 mm. A strikingly short and broad species, with sprawling legs. Antennae relatively very large and slender ; five segmented, apical segments apparently without sensoria. The extraordinary breadth of the thorax has resulted in separating the pleural areas very widely, at least a third of the dorsal aspect of the thorax. Anterior leg slender but distinctly toothed. The tibia and tursus of the middle and posterior legs are completely fused and bear on the inner face a series of strongly sclerotic tubercles. The coxae of all legs bear a small, flattened lobe. Abdomen much reduced, partly through a reduction in length of all segments, but more through the fusion of the first five segments and is membranous throughout except for the usual plates of the ninth tergum, the genital plate and the sclerotic lateral tubercles. The first three pairs of spiracles are close together, the first two displaced toward the meson, and they are all very large and conspicuous and of a peculiar mushroom-like form. The gonopophyses (Fig., Plate 91, d) are strongly developed and only slightly sclerotic.

Male (Fig., Plate 91, b, e) : Total body length 3·4 mm ($\bar{X}$, N=10) ; range 2·5 to 4·1 mm. Head and throax closely resembling the female except that the thorax is not so wide. Abdomen much smaller than in the female, tending to be somewhat sclerotic ; other structures usually as in female except genitalia. Genitalia (Fig., Plate 91, e) : Quite small, with a long and broad basal plate to the apex of which articulate the short, acutely pointed parameres ; articulating near the apices of the parameres are two short, acute pieces which seem to be homologous with the central V-shaped piece that has herein been called the pseudopenis ; filling the central area is a small, wrinkled preputial sac, which bears the long statumen penis and the penis.

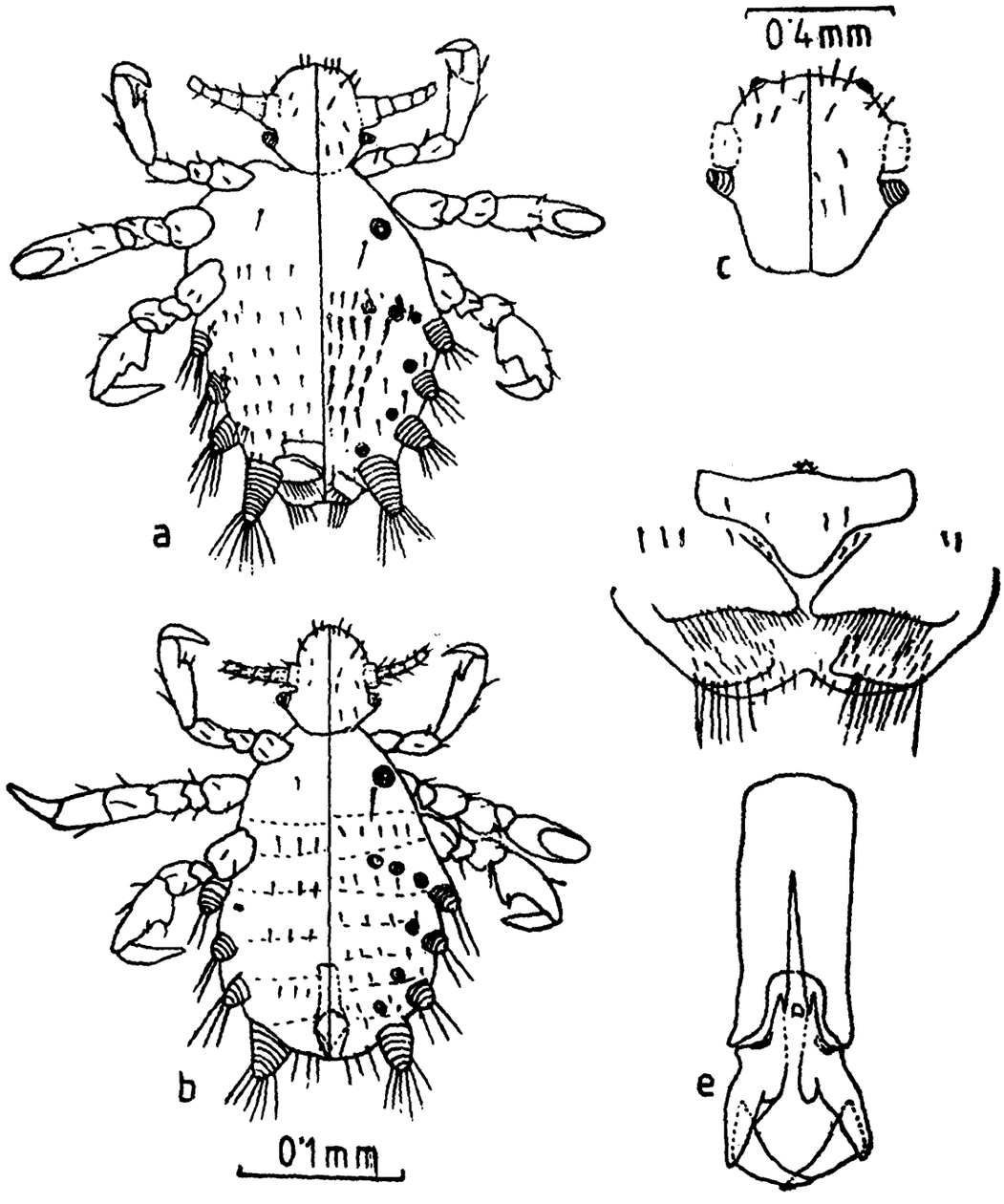
Nymphs : Could not be obtained during present study.

Material examined : 10♀ ♀, 10♂ ♂, from Human, Calcutta, West Bengal : 10.3.85 ; Coll. C. C. Adhikary.

Host : Common lice of human pubic region.

Distribution : India ; Cosmopolitan.

PLATE 91



Pthirus pubis (Linnaeus)

a. ♀, Whole body (ventral and dorsal views) ; b. ♂, Whole body (ventral and dorsal views) ; c. Head of ♀ ; d. Genitalia of ♀ ; e. Genitalia of ♂.

HOST-PARASITE LIST

[To avoid ambiguity, records which are considered dubious are not included in the list.]

Host		Parasite
	Order INSECTIVORA	
	Family SORCIDAE	
Anathana ellioti	:	*Docophthirus acinetus*
Suncus etruscus	:	*Ancistroplax crocidurae*
Suncus murinus	:	*Polyplax reclinata*
	Order LAGOMORPHA	
	Family LEPORIDAE	
Oryctolagus cuniculus	:	*Haemodipsus ventricosus*
	Order RODENTIA	
	Family SCIURIDAE	
Callosciurus finlaysoni ferrugineus	:	*Hoplopleura erismata*
C. macclellandi	:	*Hoplopleura erismata*
Funambulus palmarum	:	*Hoplopleura maniculata* *Neohaematopinus echinatus*
F. pennanti	:	*Hoplopleura maniculata* *Neohaematopinus echinatus* *Enderleinellus nishimarui*
F. tristriatus	:	*Hoplopleura maniculata* *Neohaematopinus echinatus*
Marmota caudata	:	*Neohaematopinus palearctus*
Petaurista petaurista albiventer	:	*Neohaematopinus petauristae*
P. p. philippinensis	:	*Phthirunculus sumatranus*

Host		Parasite
	Family MURIDAE	
Alticola roylei	:	*Hoplopleura alticola*
Apodemus flavicollis	:	*Hoplopleura himalayana* *Polyplax serrata*
Banicota bengalensis	:	*Hoplopleura malabarica* *Polyplax asiatica*
B. malabarica	:	*Polyplax asiatica*
Golunda ellioti	:	*Hoplopleura khandala* *Polyplax indica*
Meriones hurrianae	:	*Polyplax hurrianicus*
Millardia meltada	:	*Hoplopleura kondana*
Millardia kondana	:	*Hoplopleura kondana*
Mus. booduga	:	*Hoplopleura captiosa*
M. dunni	:	*Hoplopleura sahyadri*
M. musculus	:	*Hoplopleura captiosa* *Polyplax serrata*
M. platythrix	:	*Hoplopleura sinhgarh*
M. saxicola	:	*Hoplopleura ramgarh*
Nesokia indica	:	*Polyplax asiatica*
Phaiomys sp.	:	*Hoplopleura phaiomydis*
Pitymys sikkimensis	:	*Hoplopleura acanthopus*
Rattus rattus andamanensis	:	*Hoplopleura pacifica*
Rattus rattus arboreus	:	*Hoplopleura pacifica* *Polyplax spinulosa*
Rattus blanfordi	:	*Hoplopleura blanfordi* *Polyplax blanfordi*
R. r. brunneusculus	:	*Hoplopleura pacifica*
R. cremoriventer	:	*Hoplopleura sicata*
R. cutchicus	:	*Hoplopleura cutchicus* *Polyplax cutchicus*
R. eha	:	*Hoplopleura sicata*
R. exulens	:	*Hoplopleura pacifica*

Host		Parasite
R. fulvescens	:	*Hoplopleura sicata*
R. r. gangutrianus	:	*Hoplopleura pacifica* *Polyplax spinulosa*
R. r. narbadae	:	*Hoplopleura pacifica*
R. niviventer	:	*Hoplopleura sicata* *Polyplax spinulosa*
R. nitidus	:	*Hoplopleura pacifica*
R. norvegicus	:	*Hoplopleura pacifica* *Polyplax spinulosa*
R. r. rattoides	:	*Hoplopleura pacifica* *Hoplopleura sicata* *Polyplax spinulosa*
R. r. rufescens	:	*Hoplopleura pacifica* *Polyplax spinulosa*
R. r. satarae	:	*Hoplopleura pacifica* *Polyplax spinulosa*
Vandeleuria oleracea	:	*Hoplopleura silvula*
Tatera indica	:	*Polyplax stephensi*
	Order PRIMATES	
	Family HOMINIDAE	
Homo sapiens	:	*Pediculus humanus* *Pthirus pubis*
	Family CERCOPITHECIDAE	
Macacus sp.	:	*Pedicinus eurygaster* *Pedicinus longiceps*
Presbytis sp.	:	*Pedicinus ancoratus*
	Order CARNIVORA	
	Family CANIDAE	
Canis sp.	:	*Linognathus setosus*

Host		Parasite
	Order ARTIODACTYLA	
	Family BOVIDAE	
Antilope cervicapra	:	*Linognathus pithodes*
Bos bubalis	:	*Haematopinus tuberculatus*
Bos taurus domesticus	:	*Haematopinus eurysternus* *Linognathus vituli*
Bos indicus	:	*Haematopinus channabasavannai* *Haematopinus quadripertusus*
Bos sp.	:	*Solenopotes capillatus*
Capra sp.	:	*Linognathus ovillus* *Linognathus africanus* *Linognathus stenopsis*
Ovis sp.	:	*Linognathus ovillus* *Linognathus stenopsis* *Linognathus pedalis*
	Family CERVIDAE	
Cervus unicolor	:	*Haematopinus longus*
	Family SUIDAE	
Sus salvanius	:	*Haematopinus oliveri*
Sus sp.	:	*Haematopinus suis*

DISCUSSION

1. *Host parasites association* :

All the stages of Anoplura are obligatory external parasites of mammals. Mammals provide the only acceptable ecological setting for the survival and unique specific niches and microenvironments for the sucking lice. The host association is therefore of great significance in understanding classification and phylogeny. The host associations have been used to infer phylogeny of the sucking lice and then the inter-relationships of lice have been employed to make quasi-phylogenetic inferences about mammalian evolution (Ferris 1951). The present diversity and distribution of Anoplura is believed to be the result of long co-evolutionary processes and host information as such forms an integral part of biological data on species of sucking lice. The primary infestation is defined by Hopkins (1949) as the presence of a parasite taxon dating back at least to the time when its host group diverged from the ancestral stock. The secondary infestations comprise those infestations which originate after divergence of a host group from its parental stack. The type of infestation is usually determined by the studying the distribution of the sucking lice on the host groups. An attempt has been made here to discuss the relationship between hosts and parasites found in Indian region.

2. *Interrelationship between hosts and parasites and their phylogeny* :

The family Enderleinellidae is represented by 2 genera, namely *Enderleinellus* Fahrenholz and *Phthirunculus* Kuhn and Ludwig. *Enderleinellus* is represented by a single species, *E. nishimarui* Kaneko, parasitising squirrels of the genus *Funambulus*. *Phthirunculus* is a monotypic genus, represented by *P sumatranus*, parasitising member of the genus *Petaurista* in this region.

Family Haematopinidae is represented by a single genus *Haematopinus* Leach, parasitising members of Ungulata, Artiodactyla and Perissodactyla. In this region, *Haematopinus* is represented by seven species ; these species exhibit generalized or primitive character in paratergites, thoracic apophyses, thoracic sternal plate, notal pit, legs and genitalia. Perhaps, this suggests that *Haematopinus* diverged from main Phylogenetic line much earlier.

Of the seven species *Haematopinus channabasavannai*, *H. eurysternus* and *H. quadripertusus* parasites of cattle, while *H. eurysternus* closely resemble *H. channabasavannai* in body, size and shape of the head, *H. quadripertusus* and *H. eurysternus* possess

some common characters viz., Head long ; paratergites rounded or compact, with only 2 p sterior setae ; thoracic sternal plate longer than wide ; gonopods not tapering posteriorly. Thus, it can be surmised that present kinship observed amongst *H. eurysternus*, *H. quadripertusus* and *H. channabasavannai* is due to the divergence from a common ancestral stock. *H. tuberculatus* is principally a parasite of the water Buffalo but apparently it has been fully established on Cattle in Australia (Roberts, 1938, 1950, 1953). Of the remaining species, *H. suis* parasite of domestic and wild swine, *H. oliveri* parasitise *Sus salvanius* and *H. longus* act as a parasite of *Cervus unicolor* ; morphologically these species do not show close resemble amongst each other and this may reflect phylogenetic isolation of their hosts.

Family Hoplopleuridae is the largest family of Anoplura and is divided into two subfamilies viz., Haematopinoidinae and Hoplopleurinae. Haematopinoidinae is represented by 3 genera ; only *Ancistroplax* Waterston and a single species *Ancistroplax crocidurae* parasitising member of the genus *Suncus* (of the family Soricidae) is recorded in this region ; this is recognizable by the presence of distinctly divided sternal plates of the abdominal segment II, laterally extended to articulate with corresponding paratergites.

Hoplopleurinae is known by 2 genera ; in this region, only one genus, *Hoplopleura* Enderlein with 18 species, parasitising members of Sciuridae and Muridae are known. Of these 18 species, *H. pacifica*, *H. blanfordi*, *H. cutchicus*, *H. sicata*, *H. kondana* are known parasitise members of the genus *Rattus* and the related genus *Millardia*, and show some common characters viz., Paratergites well developed. III to VI, each with posterior process broad and lobed, VII and VIII devoid of posterior process (except *H. sicata* in which paratergite VII is provided by a dorsal posterior process) and this kinship may be due to the divergence of their hosts from a common ancestral stock. It may be noted that Ellerman (1941) considered *Millardia* as an independent genus ; Missione (1969) also recognized it as an independant genus on the basis of dental characters. However, nymphal study of the lice parasitising these hosts also suggest kinship with one another and show great morphological similarity.

Of the remaining species *Hoplopleura*, *H. captiosa*, *H. sahyadri*, *H. ramgarh*, *H. sinhgarh* parasitise members of the genus *Mus* and possess the following common characters : Abdominal tergites and sternites well developed ; paratergites well developed and overlapping, VII and VIII with well developed posterior processes. It is presumed that *H. sinhgarh* is a morphologically aberant species and not very close to *H. ramgarh* but their hosts i.e., *Mus platythrix* and *M. saxicola* are known to be closely related species (Mishra, 1981). Ellerman (1961) regarded *M. saxicola* as a synonym of *M. platythrix* but the study by Mishra, Bhat and Kulkarni (1972) indicate that they are two distinct species having distinctly different louse fauna of hosts.

Three species, viz., *Hoplopleura acanthopus*, *H. alticola*, *H. phaiomydis* are known to be the parasites of the members of the subfamily Microtinae (rodent) and possesses the following common characters : Tergites and sternites narrow, having large number of setae ; paratergites III to VI, each with posterior process long and tapering, VII and VIII devoid of posterior processes. This kinship of three species of lice may be due to the common and recent ancestry of their hosts. Similarly, *H. maniculata* and *H. erismata* parasitising rodent family Sciuridae, possess some common characters, viz., Antennal sensoria on segment III and IV well separated ; thoracic sternal plate devoid of long process ; paratergites III to V, each with posterior lobes small and acute etc., which may be attributed to the common ancestry of the hosts.

Hoplopleura himalayana, *H. khandala* parasitise *Apodemus* and *Golunda* spp., but possess some common characters, such as paratergites III to V, each with broad posterior processes and lobed and VI with dorsal posterior process broad, which again may be due to close affinity of their hosts from common ancestral stock.

H. silvula parasitising *Vandeleuria* sp. resembles other *Hoplopleura* spp. found in *Mus* spp. and this resemblance may be due to some phylogenetic relationship within host groups. *H. malabarica* is not related to any other species in this region.

The family Linognathidae is represented by 2 genera viz., *Linognathus* Enderlein and *Solenopotes* Enderlein in this region. *Linognathus* is represented by 7 species and *Solenopotes* is represented by a single species. Of the seven species of *Linognathus*, *Linognathus africanus*, *L. ovillus* and *L. stenopsis* parasitising hosts like Sheep and Goat, reflect a kinship which may be due to divergence of their lice pests from common ancesral stock. On the other hand, two species *L. pithodes* and *L. pedalis* possesses some common characters, such as absence of thoracic sternal plate, absence of median genital plate in female, small abdominal spiracles etc. although hosts are different, while *L. pithodes* parasitise *Antilope cervicapra*, *L. pedalis* parasitise sheep. This relationship may also be attributed to some phylogenetic connection. It is interesting to note that while *L. vituli* parasitise Cattle, Boar and Dog and *L. setosus* parasitise on Dog, Fox, Rabbit and Ferrit, nevertheless they possess some common characters, such as absence of thoracic sternal plate, presence of median genital plate and broad gonopophyses in female etc. This relationship may again be due to convergence of parasites from common ancestral stock. *S. capillatus* parasitises only domestic cattle.

The family Polyplacidae is represented by 4 genera viz., *Docophthirus* Waterston, *Haemodipsus* Enderlein, *Neohaematopinus* Mjoberg and *Polyplax* Enderlein. The genus *Docophthirus* is a monotypic genus, represented by *D. acinetus* parasitising

Anathana ellioti. The genus *Haemodipsus* is represented by a single species, *H. ventricosus* a parasite of the family Leporidae in this region. The genus *Neohaematopinus* represent specific parasites of Sciuromorpha except few species. In this region only 3 species viz., *N. echinatus* parasitising *Funambulus* spp., *N. palearctus* parasitising *Marmota caudata* and *N. petauristae* parasitising *Petaurista inormata* are recorded ; of these, *N. echinatus* closely resembles *N. ceylonicus* from Sri Lanka, both being specific parasites on *Funambulus* spp., suggesting a close relationship of their hosts ; other 2 species are isolated in this region and do not show any relationship between their respective hosts. The genus *Polyplax* is represented by 10 species parasitising Rodentia and Insectivora in this region ; of these *Polyplax spinulosa*, *P blanfordi*, *P. cutchicus*, *P. kondana* are recorded as parasites of the members of the genus *Rattus* and related genus *Millardia* and possesses following common characters. Paratergites II and III devoid of long setae, parameres short, pseudopenis articulates at the tip of parameres. These kinship may be due to divergence of their hosts from common ancestral stock as has been earlier noted for Hoplopleuran parasites and hosts of the genera *Rattus* and *Millardia* ; *Polyplax serrata* parasitising *Mus* and *Apodemus* spp., resembles other *Polyplax* spp., found in *Rattus* spp., and this resemblance may be some phylogenetic relationship.

Of the other *Polyplax* species, *P. asiatica* parasitise *Bandicota* and *Nesokia* spp, *P. hurrianicus* parasitise *Meriones hurrianae* and *P. indica* parasitise *Gulunda ellioti*. These species share some common features, such as paratergites II and III, each with a very long seta ; male genitalia with long parameres ; pseudopenis long and pointed and showing some relationship of their hosts ; this again can be attributed to divergence of their hosts from common ancestral stock.

On the other hand, *P. stephensi* parasitising *Tatera indica* and *P. reclinata* parasitising *Suncus* spp. (of the family Soricidae) do not show any resemblance to other *Polyplax* spp. recorded in India. So it may be due to an isolation from main stock.

The members of the genus *Pediculus* Linnaeus and the genus *Pthirus* Leach are found on anthropoid primates ; *Pediculus* is found on Hominidae, Pongidae and Cabidae whereas *Pthirus* on Hominidae and Pongidae. *Pediculus* and *Pthirus* have some Plesiomorphic characters, such as a pair of distinctive lens and 5 segmented antennae. Morphological details distinguishing these 2 genera include the structure of the head, thorax, legs, paratergites and genitalia. On the basis of morphological evidence, these two genera are considered to represent two well separated lineages, although their mammalian hosts are closely linked or even common. It is suggested that *Pthirus* diverged early from the major phylogenetic line and coevolved with their hosts for long time (Kim & Ludwig, 1978). In India, only one species of *Pediculus*,

Pediculus humanus has been recorded on hair of Man and a species of *Pthirus*, ***Pthirus pubis*** has been recorded only in the pubic region of Man.

The family Pedicinidae is represented by a single genus *Pedicinus* Gervais, parasitising Cercopithecidae or old world monkeys. In this region, *Pedicinus* is represented by 3 species ; viz., *P. longiceps*, *P eurygaster* and *P. ancoratus*. *Pedicinus* is morphologically distinct from *Pediculus* and *Pthirus*, but in some respects appear similar to the forms of *Hoplopleura*. Considering all morphological characters of adult and nymphs, it may be considered to represent two well separated lineages.

Host specificity differs at varying levels in different groups. In some instances, several species of the same genus of host harbour the same species of Anoplura while individual host species of a genus may harbour different species of Anoplura.

Endemism of the sucking lice on a particular mammalian species is considered important in discussing Anopluran phylogeny and accurate data on the host distribution of the sucking lice provide invaluable correlates of mammalian evolution (Hopkins, 1957 ; Patterson, 1957 ; Kim *et al.*, 1975).

SUMMARY

The taxonomic study of Anoplura of India carried out at Zoological Survey of India, Calcutta has resulted in the revision or redescription of 56 species and new dichtomous keys for identification of the family, subfamily, genera and species. The present communication presents comprehensive data on Anoplura collected from the states of Arunachal in the eastern Himalaya to Andaman and Nicobar Islands in the Bay of Bengal. However, most of the material was collected in the montane and submontane region of West Bengal, Bihar, Orissa, Meghalaya, Maharastra, Rajasthan, Uttar Pradesh, Himachal Pradesh and Tamil Nadu. A few specimens were also received from Karnataka through exchange. Besides, large collections of National Institute of Virology, Pune and National Zoological Collection at Calcutta provided the opportunity for intensive study of the group. A total of 56 species representing 14 genera under 8 families are listed. This includes 4 new records and existence of new hosts from this region. This account has been supplemented by 9 maps and 91 plates.

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