Pictorial Handbook on
Indian Thysanura

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ZOOLOGICAL SURVEY OF INDIA

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FOREWORD

The order Thysanura comprises of popularly known insects of 'Silverfish' and 'bristle tail' Thysanurans are small, soft bodied, fishlike, scaled, and wingless insects. They are considerably larger insects than the other members belonging to subclass Apterygota. They are easily distinguished by very long many segmented antennae and 2 anal cerci and single median telson projecting posterior from the terminal part of abdomen. They are blind as well as eyed and most species are heavily clothed with scales which give these insects a mottled black, brown, silvery or golden appearance. The free living forms are found in the forest floor, under bark of trees, under rocks, in the nests of ants and termites.

I am sure that the present handbook will help the student, researchers, agricultural and soil scientist in the country, as no such publication so far available for the beginners to identify this little studied insect order.

Dr. RAMAKRISHNA
Director-in-Charge
Zoological Survey of India

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Dedicated in memory

of

Late Mihir Biswas

a budding Thysanuran Taxonomist

who has prematurely left us in the year 2000

INTRODUCTION

The order Thysanura (Greek, *thysanos* = fringe) comprises of popularly known insects of 'Silverfish' and firebrats. Silverfish are primitive, wingless insects covered with silvery scales that rub from the insect's body very easily. Silverfish are nocturnal insects *i.e.* they feed and are active at night.

The scales are the reason for the common name "silverfish" Silverfish are small and flattened. Compound eyes are either reduced or absent. If eyes are present they are formed of single elements. One, two or three simple eyes (ocelli) may be present. Mandibles are present but may be covered by a 'beard' of hairs. Three abdominal filaments are present. Two, equal length appendages (cerci) arise from the sides of the second last abdominal segment. A third (median caudal appendage) arises from the middle of the last abdominal segment.

Thysanurans are small, soft bodied, fishlike, scaled, and wingless insects. They are considerably larger insects than the other members belonging to subclass Apterygota, they are easily distinguished by very long many segmented antennae and 2 anal cerci and single median telson projecting posterior from the terminal part of abdomen. They are blind as well as eyed and most species are heavily clothed with scales which give these insects a mottled black, brown, silvery or golden appearance. The free living forms are found in the forest floor, under bark of trees, under rocks, in the nests of ants and termites.

Silverfish may live for up to four years. Various species of silverfish are adapted to human dwellings, but others use caves or live under bark. Several species are commensals in ant or termite colonies. Firebrats are a group which have adapted to the high temperatures around ovens and fireplaces.

There is no metamorphic life cycle: egg-larva-pupa-adult. The juvenile (nymph) emerges from the egg as a replica of the adult and develops through moults. Eventually a final moult leaves it sexually mature.

Bush land species, feed on lichens and fungi. In commensal situations, silverfish have been observed to "steal" nectar droplets from ants that are transferring regurgitated nectar from one to the other. Firebrats appear to feed on flour and similar materials. Household silverfish have been noted as attacking almost anything

that contains food value: paper surfaces, starchy foodstuffs, silk, their own cast skins, other dead insects, cellulose materials (cotton, plant debris), etc.

Thysanuran order comprises of many segmented antennae, cerci and median tail. They are very widespread in their occurrence but owing to their concealed habits are comparatively obscure. They frequently inhibit rotting timber, leaf debris, the nests of ants and termites, and the cervices of rocks along sea costs, while some kinds are to be found in houses, libraries and food industries where they feed upon organic matters. Some species like *Lepisma sp* and *Ctenolepisma longicaudata* are often the cause of much damage to books and building.

Blind as well as eyed forms occur and most species are heavily clothed with scales which give the insects a mottled black or brown, silvery or golden appearance. Their motion is that of a quick short run, but in Machilidae jumping is possible, apparently by means of the apical ventral stylets.

The members of the family Machilidae occur mostly in the decomposing litter of the forest floor, and are capable of jumping by means of the apical ventral stylets. A few species, such as, *Lepisma saccharina* and *Ctenolepisma longicaudata* cause damage to books, photographs, bakery and other household articles.

Silverfish do not appear to have any importance in either agriculture or horticulture. Their significance seems to be limited to the nuisance effects or damage done to household or paper materials stored undisturbed for extended periods of time (*e.g.* archival books in libraries and museums). In bush land, silverfish undoubtedly play a role in litter recycling and food chains.

Thysanuran are primitive but well-adapted to survive in domestic environments such as basements and attics. They are nocturnal scavengers or browsers, hiding under rocks or leaves during the day. They survive on a wide range of food, but prefer algae, lichens, or starchy vegetable matter.

There are around 370 species from five different families in the order Thysanura from World wide and in India 32 species from five families were recorded. Their distribution is worldwide.

REVIEW OF LITERATURE

A fairly large work has been done from the various parts of the world on Thysanura *viz.*, Annandale, (1906), Bitsch (1968), Dufour (1931), Escherich (1905,06), Folsom (1923), Grassi (1887), Janetschek (1957 & 1964), Lucas (1846),

Mendes (1977,1980), Oudemans (1890), Paclt (1961, 1967, 1969, 1972), Slabaugh (1940), Silvestri (1908, 1911a, 1913, 1936, 1938, 1948), Swan (1961), Womersley (1937) and Wygodzinsky (1941, 1944, 1952).

Thereafter, Bach De Roca (1981), Lefroy (1990), Mendes (1977, 1980), Wygodzinsky (1963, 1972, 1974) contributed to our knowledge of Thysanura from world but in comparison to the world fauna a very little is known on these insects in India.

The history of Taxonomic studies on Indian Thysanura dates back to 1903 when Escherich first recorded Thysanura from India describing the species as *Lepisma indica*. In a short duration he came out with a monograph "Das system der *Lepismatiden*" in 1905.

A year later, Dr. Annandale (1906), founder director of Zoological Survey of India collected *Lepisma* (*Acrotelsa*) *collaris* Fabricius as a fish insect of Calcutta and mentioned this as the only record from Indian subcontinent. Escherich in 1906 again described three more new species from Indian limits in which he never mentioned the collection locality.

Silvestri (1911, 1913, 1936 and 1938) described new genus of Machilidae and ten new species from the family Machilidae, Nicolitidae and Lepismatidae and explored several new records from Indian region.

Dover, 1922 contributed to the family Lepismatidae and Machilidae with a description of 3 species from houses and dried water weeds on the shore of Barkuda Island and Chilka in Orrisa (India).

Wygodzinsky (1944, 1952, 1954, 1957, 1962 and 1974) contributed a new genus of Machilidae and described 5 new species including two new species and one new genus from N.W. Himalayas, of the family Machilidae and recorded 2 species of *Lepisma* from Sikkim and Manipur. Joseph and Mathew (1963) described termitophilous Thysanura, a new genus of Ateluridae from India.

After that Hazra (1980, 1993) described some Indian Thysanura from West Bengal and Mendes (1990) published on Zoogeographic affinities of Indian Thysanura.

Mendes (1990) have been noticed 28 species of Thysanura by eleven species of Microcoryphia and seventeen species of Zygentoma.

Hazra (1980, 1993, and 1996) contributed significantly on the family Lepismatidae with a new species to science from West Bengal. His contribution

explored several new records throughout India which include from West Bengal and Delhi.

Hazra and Biswas (1999 & 2001), Hazra and Mandal (2004, 06 and 2007) have further made note worthy records of the family Lepismatidae, Machilidae, Ateluridae and Nicoletiidae from India which includes Tripura, Sikkim, Manipur, Orissa, West Bengal, Andhra Pradesh and Andaman and Nicober Islands.

GENERAL MORPHOLOGY OF THYSANURA
(Fig. 1a & b)

Body form

- Body relatively flat, tapered and often covered with scales
- Compound eyes small or absent
- Antennae long, thread-like, and multi segmented
- Abdomen with ten complete segments
- Eleventh abdominal segment elongated to form a median caudal filament
- Cerci present, nearly as long as median caudal filament
- Styli form appendages located on abdominal segments 7-9

Thysanurans are more or less elongated and flattened in form of bilaterally symmetrical; that the right and the left sides of the body. The body is segmented and grouped into three distinct regions; the head, thorax and abdomen. The head bears the eyes, antennae and the mouth parts; the thorax bears the legs and the vestigial wing structures. The abdomen bears the abdominal sterites, styli, ovipositor and median caudal filament etc.

The body wall

The body wall of an insect is composed of three principal layers: an outer cuticle that contains a characteristic chemical compound called chitin, made up proteins, and often pigments; a cellular layer, the epidermis that lies beneath and secretes the cuticle; and a thin noncellular layer beneath the epidermis, called the basement membrane. The body wall completely covers the insect and bends inward at various points to form supporting ridges and braces. The tracheae (breathing tubes) and the anterior and posterior ends of the digestive tract are invaginations of the body wall and are lined with cuticle.

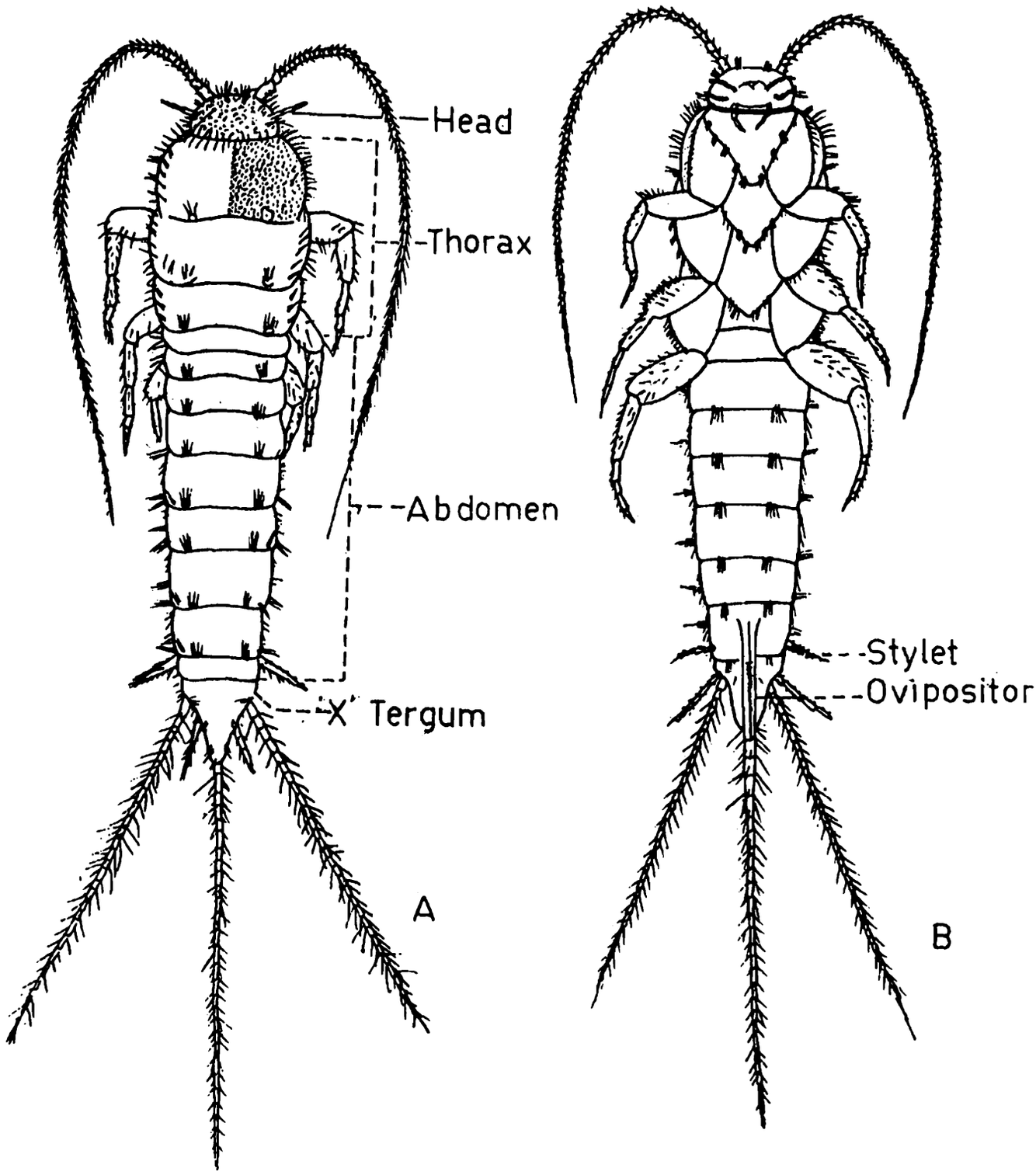

Fig. 1a. Showing external morphology of a typical Thysanura, A. Dorsal view; B. Ventral view.

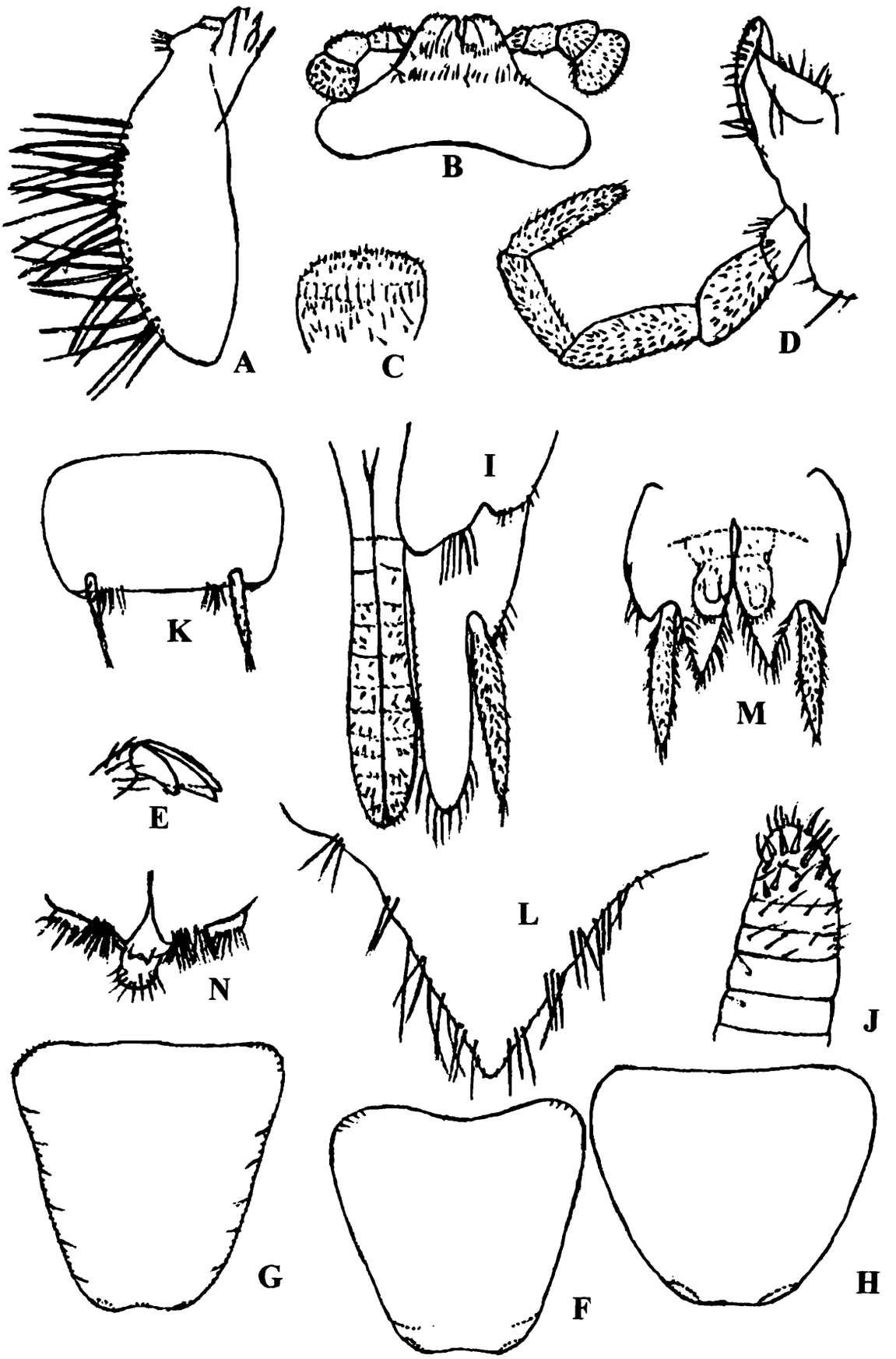

Fig. 1b. Different body parts of Thysanura used in studying their taxonomy. A. Mandible; B. Labium and Labial palp; C. Tip of labial palp; D. Maxillary palp; E. Claws; F. Prosternum; G. Mesosternum; H. Metasternum; I. Female ovipositor and right half of sternum VIII & IX; J. Tip of female gonapophysis; K. Sternum VIII; L. Tergum X; M. Male genitalia; N. Anal plates.

The cuticle is made up of two principal parts, the epicuticle and the procuticle; the outer half or third of the procuticle is often darker and harder than the rest, and is called exocuticle; the unchanged inner part is called the three body wall layers. Some external processes, such as setae, are outgrowths of individual epidermal cells; others are of multicellular origin. The internal processes of the body wall may be ridge like or spinelike; these infoldings strengthen the body wall and serve as the place of attachment of muscles.

Body segmentation

The body segmentation of an insect is most evident in the abdomen, where the segments have their simplest structure. Each abdominal segment typically consists of two sclerites, a dorsal tergum and a ventral sternum; these are connected laterally by a membranous area, the pleural membrane, and successive terga and sterna are connected by an inter segmental membrane. These membranous areas make movement possible. At the anterior end of each tergum and sternum is an infolding of the body wall, forming a ridge internally and a suture externally; the internal ridge is called the ante costa, and the external suture the antecostal suture. The narrow anterior flange of the tergum, in front of the antecostal suture, is called the acrotergite, and the corresponding anterior piece of the sternum is called the acrosternite. The antecosta provide places for muscle attachments. There are sometimes small sclerites in the pleural membrane; these usually represent detached portions of the terga or sterna, and are called laterotergites or laterosternites.

The segmentation of the thorax is some-what modified as compared to that of the abdomen, and these modifications are associated with the presence on the thorax of the locomotor organs (legs and wings). Each thoracic segment, in addition to the main dorsal and ventral sclerites, has pleural sclerites, and the dorsal and ventral sclerites are generally more complex than those of the abdomen. The pleural sclerites develop from the subcoxal region of the legs, and in pterygote insects each pleuron bears a suture (the pleural suture) extending upward from the base of the leg; this suture marks an infolding of the pleural wall, which forms a ridge (the pleural ridge) internally. The main dorsal sclerite of each thoracic segment is usually called the notum (rather than tergum). Additional infoldings usually occur on the nota and sterna, and the external sutures thus formed set off subdivisions (tergites and sternites) of these areas. In winged insects the antecostae of the first abdominal segment and the last two thoracic segments are enlarged, forming what are called phragmata (singular, phragma), and the acrotergites of the metathorax and first abdominal segment enlarge to form the postnota of the segment just anterior to them.

The head

The head is the anterior capsule like body region that bears the eyes, antennae, and mouth parts. The shape of the head varies considerably At the lower end of the frontal sutures is a trans-verse suture, which extends across the face just above the base of the mouth parts; the medial or anterior part of this suture is called the epistomal suture, and the lateral portions, above the mandibles and maxillae, the subgenal sutures. The anterior sclerite of the head, between the frontal and epistomal sutures and including the median ocellus, is the frons. The area on each side of the head, lateral of the frontal sutures and between the compound eye and the subgenal suture, is the gena. Below the epistomal suture is a flap like structure composed of two sclerites; the upper sclerite is the clypeus, and the lower one is the labrum, or upper lip. Behind the labrum are the mandibles, a pair of heavily sclerotized jaws; behind the mandibles are the maxillae, segmented mouthpart structures that bear feeler like palps and behind the maxillae is the lower lip, or labium, which also bears palps. These mouthpart structures will be discussed in more detail later. Typically, the vertex and genae is limited posterior by the occipital suture; behind the occipital suture dorsally is the occiput, and behind it on the sides of the head are the postgenae. The occipital and postgenae are limited posterior by the post occipital suture, behind which is a narrow ring like sclerite, the post-occipital, which forms the posterior rim of the head and surrounds the foramen magnum or occipital foramen

There is considerable variation in the development of the head sutures and the shape of the head sclerites. The frontal sutures are often short or poorly developed, and there may be sutures extending ventrally from the compound eyes or the antennae. There are usually sutures closely paralleling the compound eyes and surrounding the bases of the antennae. The head sclerites posterior to the occipital suture are often on the posterior sur-face of the head.

The antennae

The antennae of insects vary greatly in size and form and are much used in classification. They are sensory in function and act as tactile organs, organs of smell, and in some cases as organs of hearing. They are usually located between or below the compound eyes. The first segment is called the scape; the second segment, the pedicel; and the remaining segments, the flagellum.

Mouth parts

Thysanuran mouth parts are mandibulate (chewing) types. In mandibulate mouth parts the mandibles move sideways, and the insect is usually able to bite off and

chew its food. Mandibulate mouth parts are subject to considerable variation and are primitive type and occur in adult Thysanura.

The thorax

The thorax is the middle region of the body and bears the legs (thysanurans are wingless, and in many immature and a few adults there are no legs). The thorax is composed of three segments: the pro-thorax, mesothorax, and metathorax. Each thoracic segment typically bears a pair of legs, are borne by the mesothorax and the metathorax. There are usually one or two small sclerites on each side of the neck, which link the head with the episterna of the prothorax.

The legs

The legs of thysanurans typically consist of the following segments : the coxa (*ex*), the basal segment; the trochanter (*tr*), a small segment (rarely two segments) following the coxa; the femur (*fm*), the first long segment of the leg; the tibia *(tb),* the second long segment of the leg; the tarsus (*ts*), a series of small segments beyond the tibia; and the pretarsus (*ptar*), consisting of the tarsal claws and other structures at the end of the tarsus. A true leg segment is a subdivision with its own musculature; the subdivisions of the tarsus, though commonly referred to as "segments," do not have their own musculature and hence are not true leg segments. The number of tarsal segments varies from one to another. The legs may be variously modified in different thysanurans, and the characters of the legs are made considerable use of in identification. The different segments of the leg may vary in size, shape, or spination, and the number of tarsal segments varies in different species.

SYSTEMATIC LIST

Order THYSANURA

Suborder MICROCORYPHIA

Family MACHILIDAE

1. *Machilanus insensilis*
2. *Machilanus lapidicola*
3. *Machilanus schmidi*
4. *Machilanus hutchinsoni*

5. *Graphitarsus surindicus*

6. *Haslundichilis qadrii*

7. *Himalayachilis murreensis*

Family MEINERTELLIDAE

8. *Machilontus lawrencei*

Suborder ZYGENTOMA

Family LEPISMATIDAE

9. *Acrotelsa collaris*

10. *Afrolepisma nigrina*

11. *Ctenolepisma longicaudata*

12. *Ctenolepisma nigra*

13. *Ctenolepisma ciliata*

14. *Ctenolepisma targionii*

15. *Ctenolepisma tripurensis*

16. *Ctenolepisma dubitalis*

17. *Lepisma saccharina*

18. *Tricholepisma gravelyi*

19. *Xenolepisma subnigrina*

20. *Lepisma indica*

21. *Stylifera wygodzinski*

22. *Silvestrilla termitophila*

Family NICOLETIDAE

23. *Lepidospora ceylonica*

24. *Lepidospora notabilis*

Family ATELURIDAE

25. *Atelura typhloponis*

26. *Thermobia domestica*

SYSTEMATIC ACCOUNT

Suborder MICROCORYPHIA

Family MACHILIDAE

Compound eyes large, ocelli present. Abdominal segments usually with one or two exsertile vesicles. Thoracic coxal stylets present. Body always scaled.

Bristletails of the suborder Microcoryphia are among the few insects that have successfully colonized very high altitudes in various parts of the world. Swan (1961) gave a short report on the ecology of a species *Machilanus* Silvestri found by him between 17,500 and 19,000 feet in the Nepal-Himalayas. Mani (1968) mentioned Swan's finding but misspelled the insect's name as *Machilinus,* which happens to be the name of a genus of the Microcoryphian family Meinertellidae. The genus *Machilinus* Silvestri has not been reported from the Himalayas but Wygodzinsky (1967) reported a species occurring in the Pre-cordillera of western Argentina above 14,700 feet.

Body length from 7.5 to 15 mm. Body and appendages with varied amounts of hypodermal pigment. Frons only slightly convex not was protruding. Eyes sub circular, slightly shorter than wide, line of can tact in all cases much shorter than length. Ocelli oval, not more than twice as wide as long, situated sub laterally to eyes. Antennae stouter in male that in female, not distinctly longer than body, in some cases shorter; scapus, pedicellus, and flagellum with scales. Mandibles normal, with four teeth. Maxillary palps of male in most cases with long, slender hairs and setulae on under surface of some segments. Terminal segment of labial palp widened to varied degree; terminal and subterminal segments in males with long slender setae and, in most cases, setulae. Legs with stylet on second and third pairs. Tarsi three-segmented; pretarsus without scopula; spinelike setae on various leg segments. Femur and tibiae of foreleg of males thickened; femur with a more or less conspicuous postero-ventral bulge beset with conspicuous group of stout setae that may extend to rest of under surface of femur. Disc of fore femur in most species with field of ramose sensillae.

Sternites II–VII well developed, from right to obtuse angled. Coxites I, VI, and VII with 1 + 1, II–V with either also 1 + 1 or with 2 + 2 eversible vesicles. Disc of sternites and coxites with a varied number of setae, in some cases quite numerous; poster-lateral lobes of coxites with strong and in many cases spinelike setae.

Ovipositor of primary or secondary type, in latter case with strongly sclerotized fossorial spines. Parameres present only on ninth abdominal segment, with very

long basal and very long apical article; intermediate articles sub-equal, shorter than wide, each with field of short hairs in addition to ordinary setae and marginal comb--like row of spine like setae. Parameres about as long as penis. Penis with apical portion as long as, or slightly longer than, basal portion. Penis opening sub apical, sub circular or narrowly elongate, surrounded by field of short specialized setae. Cerci with single apical spur.

1. *Machilanus insensilis* Wygodzinsky, 1974
(Fig. 2)

Diagnosis : Color : Intense hypodermal pigment on first segment of maxillary palp. Pattern formed by scales unknown. Eyes and ocelli ratio L/l = 1.0, c/l = 0.3. Ocelli two and one-half times as wide as long, their distance slightly longer than their width. Maximum observed length of antennae 9 mm, shorter than body; antennae of male slightly thicker than those of female. Scapus of male not quite twice as long as wide. Flagellum brown color. Sub-articles of middle of antennae in both sexes with setae arranged in one or two transversal rows. Apical preserved portion of antennae with articles divided into 9-12 sub articles. Apical segment of maxillary palp of male sub-cylindrical, not swollen, narrowly rounded apically. Long hairs of undersurface of segments of maxillary palp absent, but segment V–VII with minute spine like setulae. Sensory spines of maxillary palp of male hyaline elongate except on apical portion of segment VII. Apical segment of labial palp of male with setulae similar to those of maxillary palp.

Field of ramose sensillae not developed. Fore tibia of male short, with only a few long spinelike setae. Femora of all legs of female, and of legs II and III of male without spine like setae. Number of spine like setae on tibiae; tibia I, 0; tibia II, male, 3-5, female, 7 or 8; tibia III, male, 6-8, female, 10-12; spine like setae on tibia III arranged in three irregular series.

Abdominal segments I, II, and III with 1 + 1, II-V with 2 + 2 eversible vesicles. Posterior angle of sternite V approximately 105 degrees. Shape of sternum VIII of male as shown in figure 1P. Apices of lobes of coxites VII of female forming a short projection with almost straight posterior border. Coxites with a few spinelike setae on posterolateral lobes. Ratio of stylus and coxite, on segments II–VII, 0.5; segment VIII, male, female, 0.73; segment IX, male, 0.75, female, 0.62. Setae on apical half of styli slightly darker than on basal half. Styli IX of male without conspicuous ciliate setae.

Genital appendages of male reaching level of apex of coxites IX, parameres attaining level of apex of penis. Genital opening narrow, elongate, surrounded by

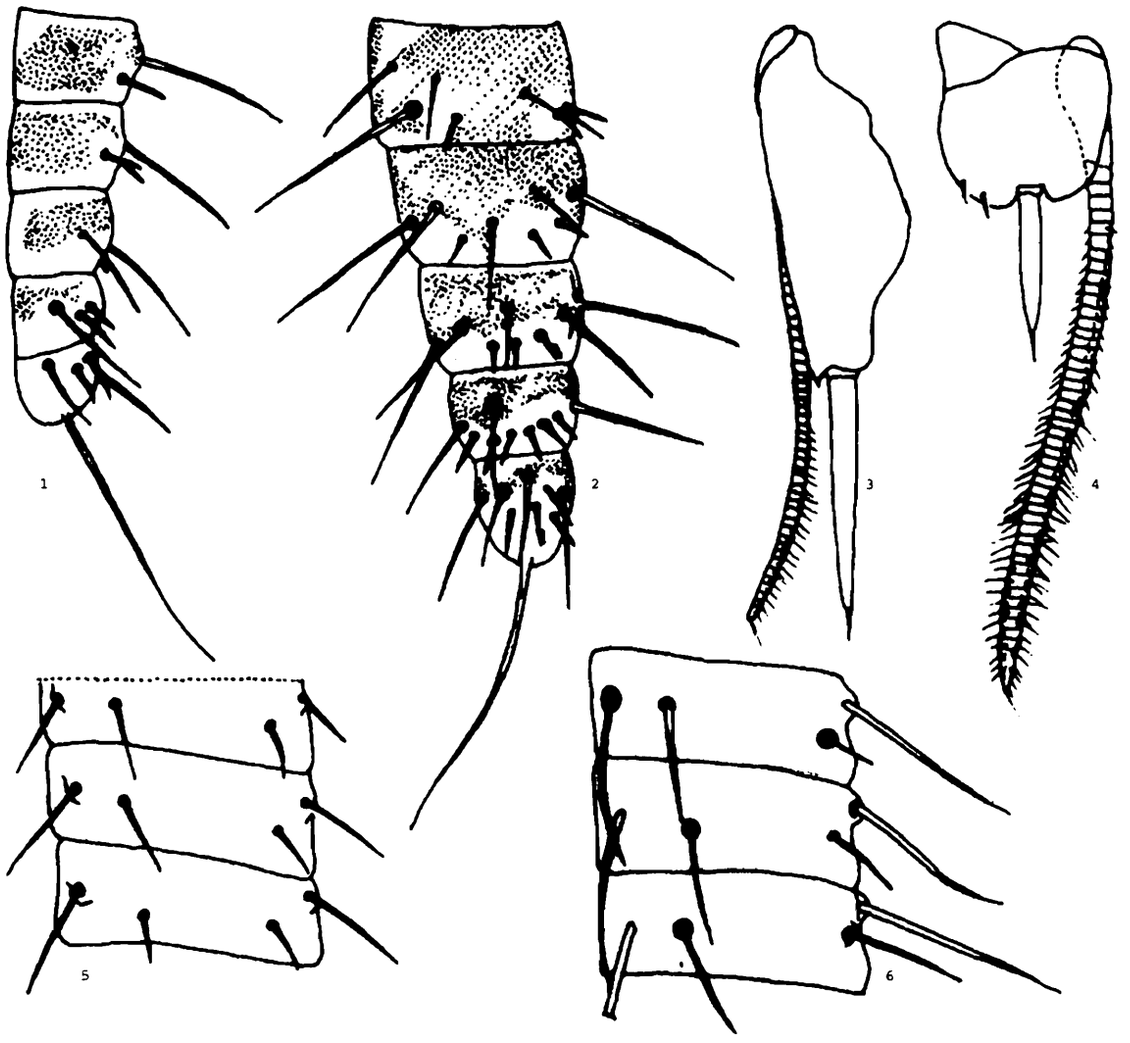

Fig. 2. *Machilanus insensilis* female. 1. Apical portion of posterior gonaphophysis; 2.Idem, anterior gonaphophysis; 3. coxite IX with posterior gonaphosis; 4. coxite VIII, with anterior gonaphophysis; 5.tenth to twelfth articles of anterior gonaphophysis; 6.twent fifth to twenty seventh articles of anterior gonaphosis.

field of short hairs. Parameres with 1 + 4 or 1 + 5 articles, the apical about as long as the basal one. Ovipositor of primary type slender, elongate, attaining level of apex of terminal spine of stylus IX. Anterior gonapophyses with 50 or 51 articles, their chaetotaxy has basal five segments bare. Basal portion of gonapophyses lightly, apical half more heavily pigmented, distal articles with irregular unpigmented areas. Terminal spine about as long as the three apical articles combined. Posterior gonapophyses with approximately 55 articles, the basal is bare, the remaining with similar but fewer setae than anterior gonapophyses.

Distribution : India : Uttarakhand (Kumaon Hills, Pauri Gharwal, Dharasu), Andaman & Nicober Islands

Remarks : Wygodzinsky (1974) described this species from Kumaon Hills, Uttarakhand, India at an altitude of 5000-6000 ft.

2. *Machilanus lapidicola* Wygodzinsky, 1974

(Fig. 3)

Diagnosis : Maximum body length of male 12 mm and female 14 mm. General body color whitish. Hypodermal pigment on body and appendages, in some places very intense on head. Pattern formed by scales unknown. Eyes and ocelli ratio L/l = 1.0, c/L = 0.31. Ocelli about twice as wide as long, their distance equal to, or

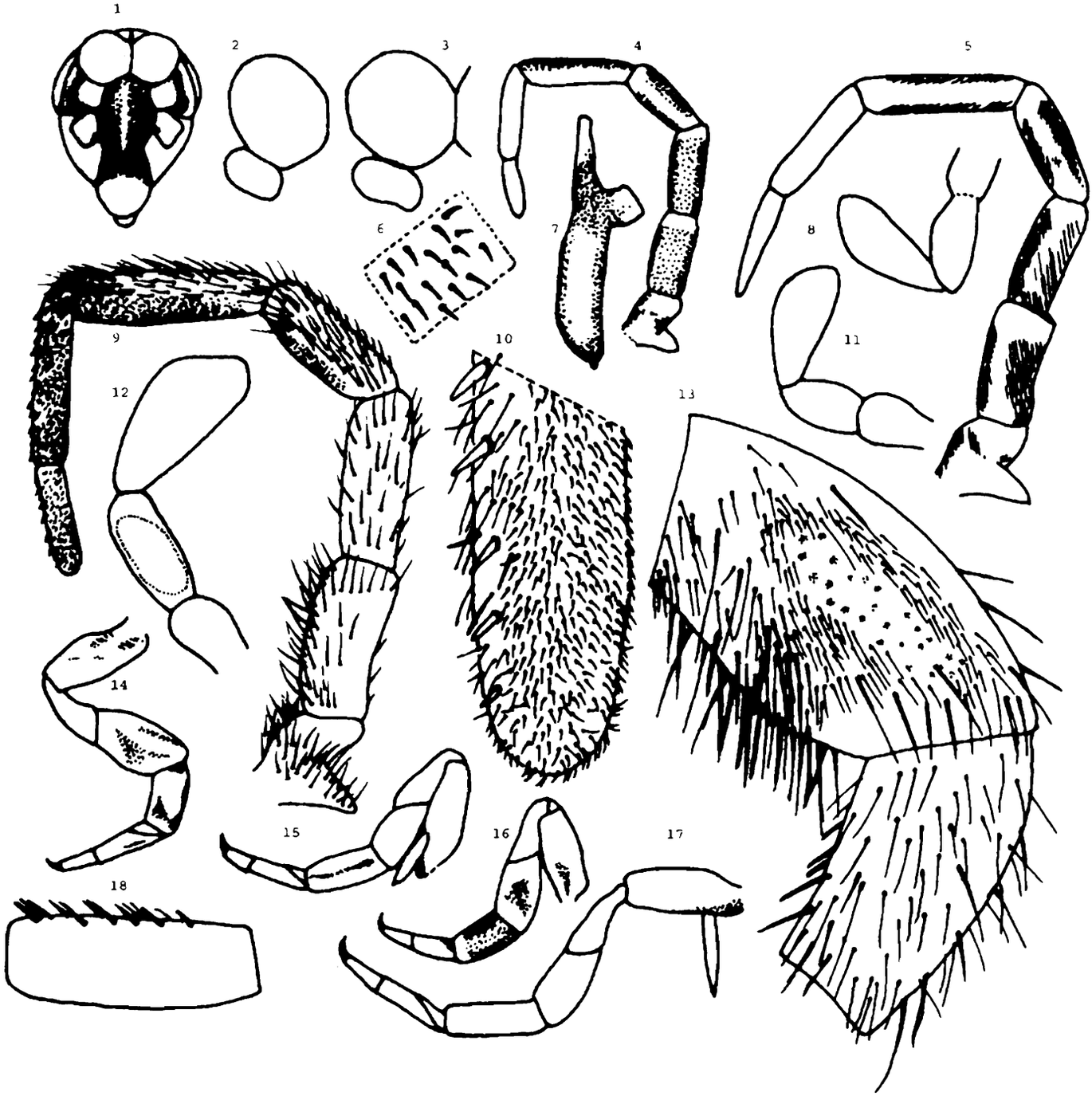

Fig. 3. ***Machilanus lapidicola*** 1. Head, front view. 2. Eye & ocellus front view. 3. Eye & ocellus lateral view. 4. Maxillary palp male.5. Maxillary palp female. 6. Setulae of maxillary palp of male.7. Mandible. 8. Labial palp of female. 9. Maxillary palp male (high magnification).10. Apical segment of maxillary palp.11 & 12. Labial palp of male.13. femur and tibia of foreleg of male.14. foreleg of male.15. Hind-leg of female.16. foreleg of female.17. hindleg of male. 18. Hind tibia of male.

slightly longer than, their width. Maximum observed length of antennae 11 mm; antennae of male thicker than those of female. Scapus of male not quite twice as long as wide. Scapus and pedicellus with heavy hypodermal pigment. Flagellum brown, with distal chains alternately slightly darker and slightly lighter. Articles of middle of antennae of male and female with setae arranged in one or two transversal rows. Apical preserved articles divided into up to 12 sub-articles; last segment more than half as long as penultimate, in both sexes. Apical segment of maxillary palp of male sub-cylindrical, not swollen, broadly rounded distally. Undersurface of segments I and II with long hairs; segments II–VII with abundant setulae. Sensory spines of maxillary palp of male hyaline, becoming very short toward apex of seventh segment. Apical segment of labial palp only moderately widened in both sexes. Second and third segment of labial palp of male with setulae similar to those of maxillary palp, occupying almost entire disc of segments.

Pigmentation of legs more extensive in male than in female. Fore femur of male widened; strong setae forming compact group of projecting portion of undersurface. Ramose sensilla forming a field one-half as long and about one-fourth as wide as femur. Fore tibiae of male stout, somewhat curved, with a few spine like setae. Femora of all pairs of legs of female and of pairs II and III of male without distinct spine like setae. Number of spinelike setae on tibiae: tibia I, male, 1 or 2, female, 1 or 2; tibia II, male, 3-5, female, 2 or 3; tibia III, male, 10-12, female, 8-10; spinelike setae of hind tibia arranged in two or three irregular series.

Abdominal sterna I, VI and VII with 1 + 1, II–V with 2 + 2 eversible vesicles. Posterior angle of sternite V approximately 120 degrees. Apices of lobes of coxites VII of female forming a projection with a conspicuous apical incision 3 disc of sternites and coxites with numerous long setae. Ratio stylus/coxite, on segments II–VII, 0.50-0.54; segment VIII, male. 0.76, female, 0.70-0.80; segment IX, male, 0.91, female, 0.62.0.70. Setae of apical portion of styli darker than those of basal portion. Styli IX of male without conspicuous ciliate setae.

Genital appendages of male attaining level of apex of coxites IX, parameres attaining level of apex of penis. Genital opening elongate oval, surrounded by field of fine hairs. Parameres with 1 + 5 articles, apical one slightly longer than the four preceding combined. Ovipositor of secondary type, stout, only attains level of middle of styli IX. Anterior gonapophyses with 26-31 articles; terminal articles each with two or three closely grouped fossorial spines, the distal most articles with small groups of sensory rods. Posterior gonapophyses with about 30 articles.

Distribution : India : Jammu & Kashmir, Andhra Pradesh, Sikkim (Ravangla).

Elsewhere : Pakistan.

Remarks : Wygodzinsky (1974) described this species from Chittakatha Sar, Jammu & Kashmir at an altitude of 15,000 ft.

3. *Machilanus schmidi* Wygodzinsky, 1974
(Fig. 4)

Diagnosis : Maximum body length of male 13 mm, of female 14.5 mm. General body color yellowish. Hypodermal pigment faint, only perceptible on head. Pattern formed by scales unknown. Eyes and ocelli ratio L/l = 1.2, c/l = 0.32. Ocelli approximately twice as wide as long, their distance equal to twice their width. Setae of frons of male and female as illustrated. Maximum preserved portion of antennae 14 mm long. Flagellum uniformly light brown. Sub-articles of middle of antennae with setae arranged in from two to four transversal rows. Apical pre-served articles

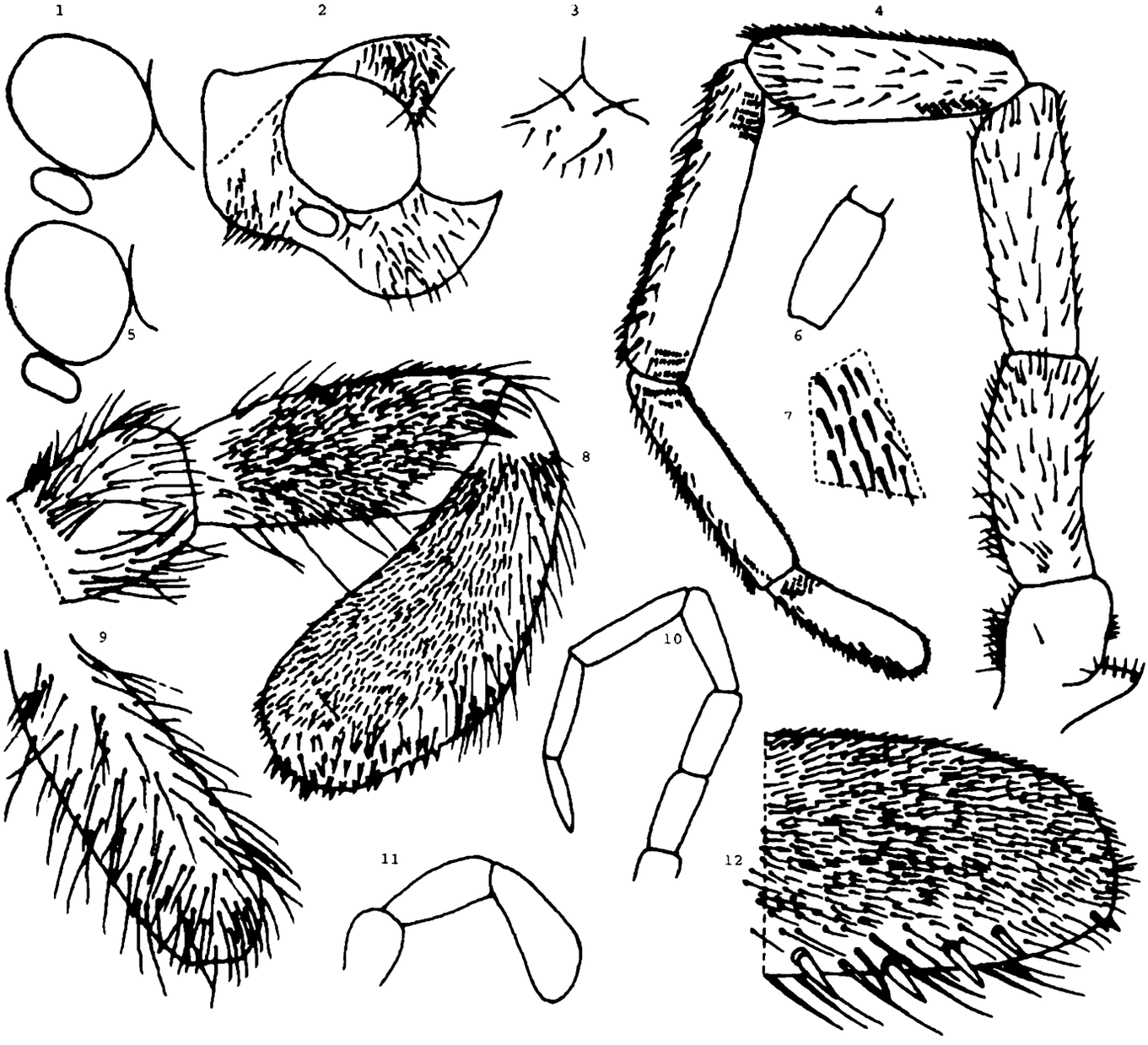

Fig. 4. *Machilanus schmidi* 1. Eye & ocellus (lateral). 2. portion of head. 3. Setae on frons of female. 4. Maxillary palp of female. 5. Eye & ocellus (frontal). 6. scapus of male. 7. setulae of maxillary palp. 8. Labial palp of male. 9. labial palp of male (anterior surface). 10. Maxillary palp female (outline). 11. Labial palp of female. 12. Apical segment of maxillary palp of male.

divided into up to 16 sub-articles. Scapus of male distinctly more than twice as long as wide. Shape of maxillary palp of male, and female as illustrated. Last segment of palp more than one-half as long as penultimate, in both sexes. Apical segment of maxillary palp of male sub cylindrical, very slightly thicker on apical than on basal half, its apex broadly rounded. Undersurface of segments III–VII with setulae, becoming gradually more numerous toward distal portion of palp. Sensory spines of maxillary palp hyaline, becoming very short on distal end of segment VII. Apical segment of labial palp more strongly widened in male than in female Second and third segments of labial palp of male with setulae similar to those of maxillary palp.

Outline of legs as shown in figure. Fore femur of male widened, subapically below with pigmented strong setae aggregated in brush like group. Ramose sensillae forming field about half as long and one third as wide as femur. Fore tibia of male not as much shortened as in other species of genus; its spinelike setae short. Femora of all legs of female and legs of pairs II and III of male without spine like setae. Number of spine like setae of tibiae: tibia I, male, 10, female, 2; tibia II, male, 18, female, 6-8; tibia III, male, 17-19, female.

Abdominal sterna I, VI, and VII with 1 + 1, II–V with 2+2 eversible vesicles. Posterior angle of sternite V approximately 100 degrees. Shape of sternum VIII of male as shown in figure 88. Apices of lobes of coxites VII of female forming projection with distinct apical incision. Sternites glabrous, posterolateral portions of posterior coxites with a few scattered spinelike setae. Ratio stylus/coxite, on segments II & VII, male, 0.73, female, 0.63; VIII, male, 0.81, female, 0.82; IX, male, 1.26, female, 0.86. Setae on basal half of styli weakly pigmented, becoming darker on apical portion of stylus. Styli IX of male without conspicuous ciliate setae.

Genital appendages of male reaching level of apex of coxites IX; parameres surpassing apex of penis. Genital opening narrow, elongate, surrounded by field of short hairs Parameres with 1 + 5 articles, the apical one as long as the four preceding combined. Ovipositor of primary type, slender, elongate, falling slightly short of apex of styli IX Anterior gonapophyses with 58-60 articles, their chaetotaxy as illustrated (basal three or four articles glabrous. Pigmentation of gonapophyses uniformly light brown except light colored areas on distal articles. Terminal spine about as long as three apical articles combined. Posterior gonapophyses with 58-60 articles, the basal 8-10 articles bare, the remaining with similar but fewer setae than on anterior gonapophyses.

Distribution : India : Jammu & Kashmir, Uttarakhand (Kumaon Hills, Pauri Gharwal).

Remarks : Wygodzinsky (1974) described this species from Kumaon Hills, Pauri Gharwal, Jagrao, Uttarakhand, India at an altitude of 17,500 ft.

4. *Machilanus hutchinsoni* Silvestri, 1936

(Fig. 5)

Diagnosis : Abdominal sterna with 1 + 1 eversible vesicles; apical spine of distal article of gonapophyses bristle-like, not heavily sclerotized; hypodermal pigment absent; line of contact of eyes distinctly longer than one-third of length of eyes. Ovipositor distinctly surpassing apex of coxites IX, thus apical portion of ovipositor free; posterior sub median lobes of coxites VII not conspicuously projecting, much shorter than wide at base. Distal articles of gonapophyses each with more than three fossorial spines; sternites II–VI right-angled posteriorly.

Distribution : India : Ladak, Jammu & Kashmir.

Elsewhere : SOUTH AFRICA.

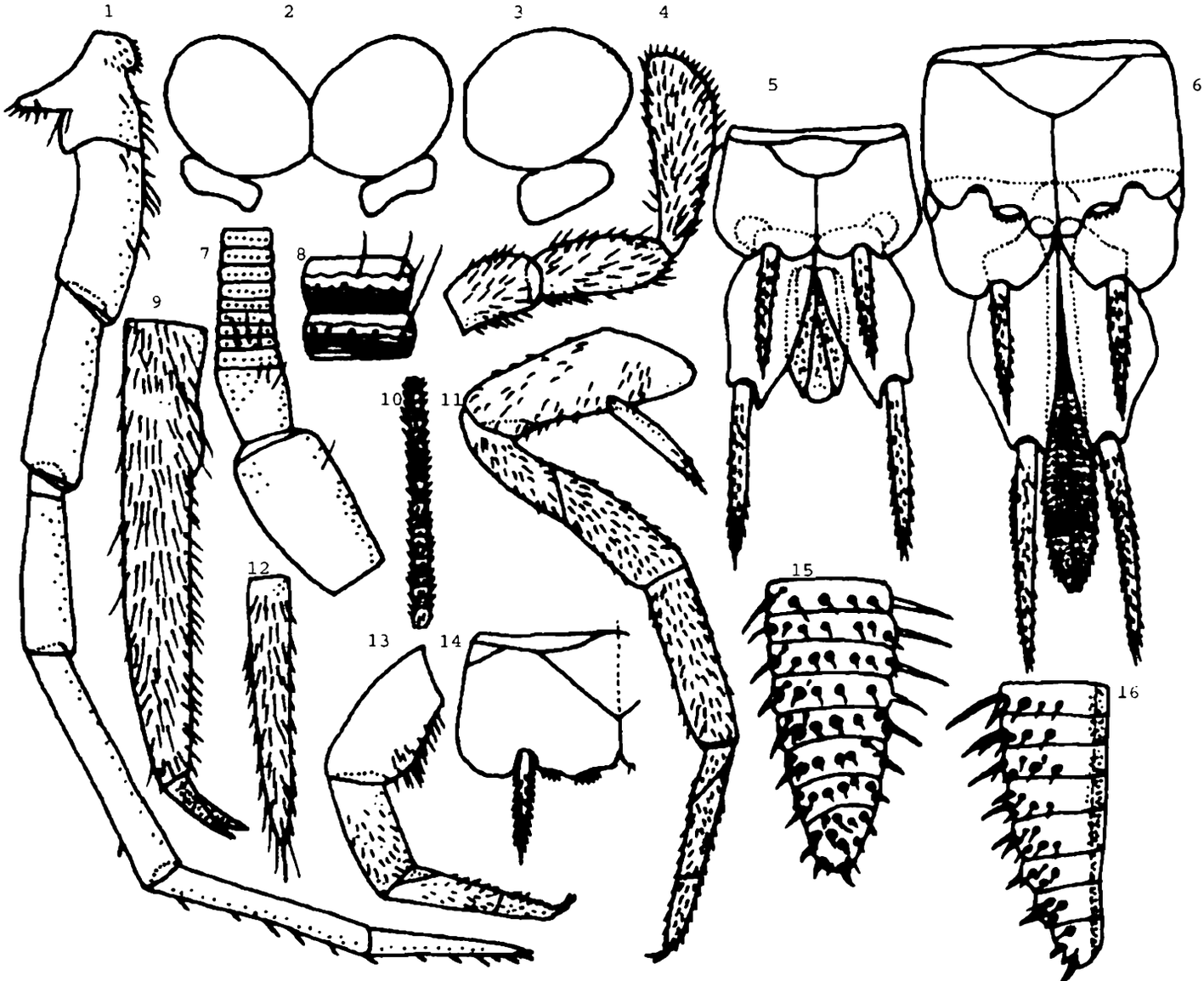

Fig. 5. ***Machilanus hutchinsoni*** 1. Maxillary palp female. 2. Eye & ocellus (lateral). 3. Eye & ocellus (frontal). 4. Labial palp of female. 5. Urosternum & parameres. 6. female urosternum. 7. & 10. Antennae. 8, 9 & 12. ejusdem. 11. Female primi paris. 13. Femur of male.14. Urosternum male. 15. ovipositor (anterior).16. Ovipositor (posterior).

5. *Graphitarsus surindicus* Carmen Bach de Roca, 1981
(Fig. 6)

Diagnosis : Body length : Male 10 mm and Female 9.5-10 mm. Design of scales unknown. Hypodermic pigment present. Cephalic pigmentation with a very smooth elongated spot on the frons, the latter being slightly convex. Ocular ratios : Lc / 1 = 0.4; L/a = 0.8. Dark brown ocelli, transversely elongated in front of the eyes and extraordinarily narrow towards the middle. The pedicel has a strong hypodermic pigment. The labial palp shows a very wide third article in the male; in the female, the form is normal. Legs with no special setae. Coxal styli on the second and third pair of legs; a pair of scopule on the third tarsus. Urosternites II–VII with two pairs of coxal vesicles, the remainder with a single pair. The terminal spine of the styli is

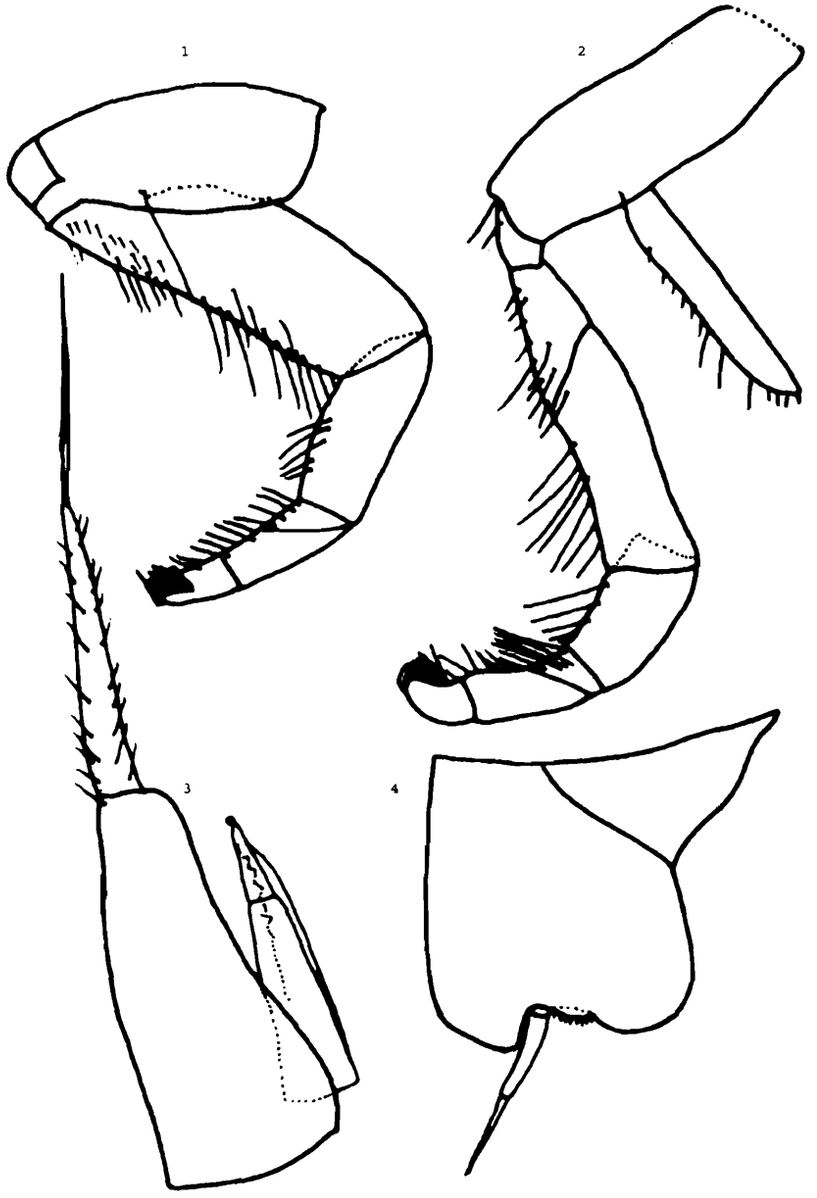

Fig. 6. *Graphitarsus surindicus* 1. Foreleg. 2. Second leg. 3. Portion of genital region. 4. Sternum VI.

longer than the midway point of the same. Ratio styles/coxite V = 0.33. Ratio styles/coxite IX = 0.78. Parameres IX with 1 + 7 articles. Penis projecting from the parameres and showing a slight apical projection. Basal part penis/terminal part = 0.92.

Distribution : India : Kerala (Tenmalai, Travancore).

Remarks : This genus and species first described by Carmen Bach de Roca, 1981 from India.

6. *Haslundichilis qadrii* Wygodzinsky, 1952
(Fig. 7)

Diagnosis : Male : Length of body 9.5 mm. Hypodermal pigment absent, with exception of a few small spots near insertion of antennae and on basal half of mandibles. Ocelli sub-elliptical, relatively large. Antennae apparently not longer

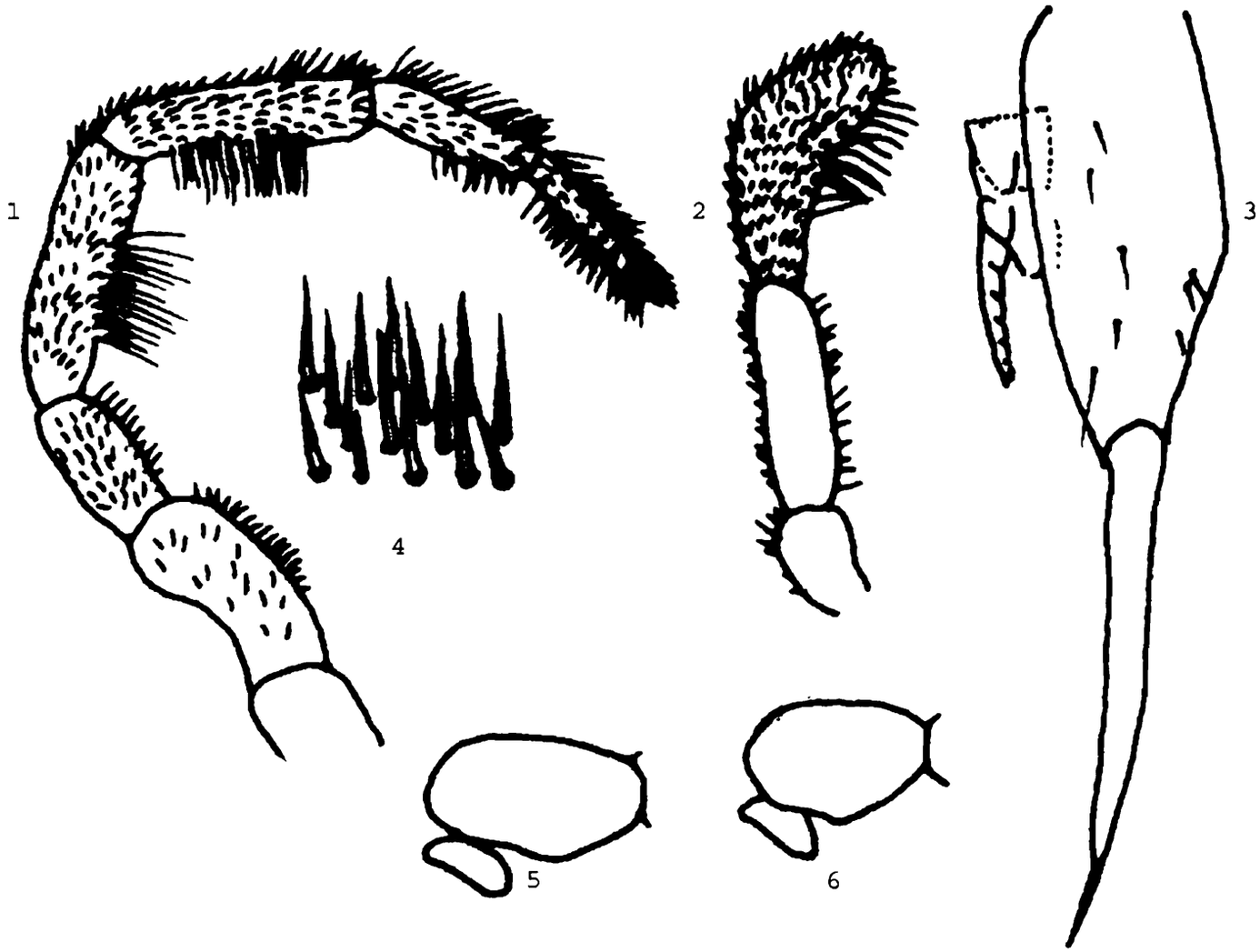

Fig. 7. ***Haslundichilis qadrii*** 1. Maxillary palp. 2. Labial palp. 3. Urosternite.4.spiniform bristles. 5. Eye and ocellus lateral view.6. Eye and ocellus frontal view.

than body, delicate, uniformly light brownish. Joints of normal shape; each sub joint with one wreath of scales and one of simple bristles. Joints III–VII ventrally with slightly pigmented spiniform bristles, those on V and VI very long and conspicuous, accompanying the ventral fields of spiniform bristles. Hairs of labial palp short, with exception of numerous long ciliae on inner surface of apical joint. Fore legs of male simple, rather slender, without sensory field and without ventral spinelike bristles. Legs of second and third pair simple, tarsus ventrally with a few slightly pigmented and rather short spinelike bristles, one or two of which may be present also on the tibia. Sternites of fore and median segments acute-angled. Terminal spine of stylets very short, hyaline; distal half of stylets with spine- like bristles, basal half of the hairs only. Relation of length stylet: coxite on segments: II–VII = 0.45; VIII = 0.7; IX = 0.75. Basal segment of penis as long as apical, the latter with a few delicate bristles, its opening triangular, apically and ventrally situated.

Distribution : India : Jammu and Kashmir, North West Himalayas (Muree Hills).

Remarks : The species named after M.A.H. Qadri of Commonwealth Institute of Entomology who collected this specimen from North West Himalayas, Murree Hills, on 06.xii.1950.

7 *Himalayachilis murreensis* Wygodzinsky, 1952
(Fig. 8)

Diagnosis : Length of male 9.5, of female 11.5 mm. Pattern unknown. Hypodermal pigment absent, with exception of base of mandibles and maxillae. Ocelli reddish, narrowly bordered with white, transversely elongate, their extension almost two thirds of width of eye. Antennae apparently not longer than body, rather delicate, uniformly brownish. Joints of normal type, distal joints composed of about 10 sub-joints, these wider than long, with scales, irregularly arranged bristles and tiny sensory pits. Last joint of maxillary palp in male slightly longer than penultimate, only very slightly narrowed towards apex, its distal spines extremely short. Joints III–VIII on whole ventral surface with very numerous tiny bristles and a few short ciliae, which are longest on joints III–V Legs of both sexes without special characters, those of male not swollen. Spiniform bristles ventrally on apex of all tibiae and on tarsus, in both sexes, rather slender, hyaline, slightly pigmented at their apex. Sternites of median segments right angled. Terminal spine of stylets much shorter than half the length of stylets, hyaline, slightly enfuscated apically. Distal portion of stylets ventrally with a few spinelike bristles, the rest with fine hairs only. Relation of length stylet: coxite on segments of male: II–VII=0.5, VIII = 0.7, IX = 0.9; of female : II–VII = 0.6, VIII = 0.654, IX = 0.8. Anterior parameres with 1+2 or 1+3 joints, posterior parameres with 1+18 joints, extending beyond apex of penis. Apical portion of penis about as long as basal one. Ovipositor of female

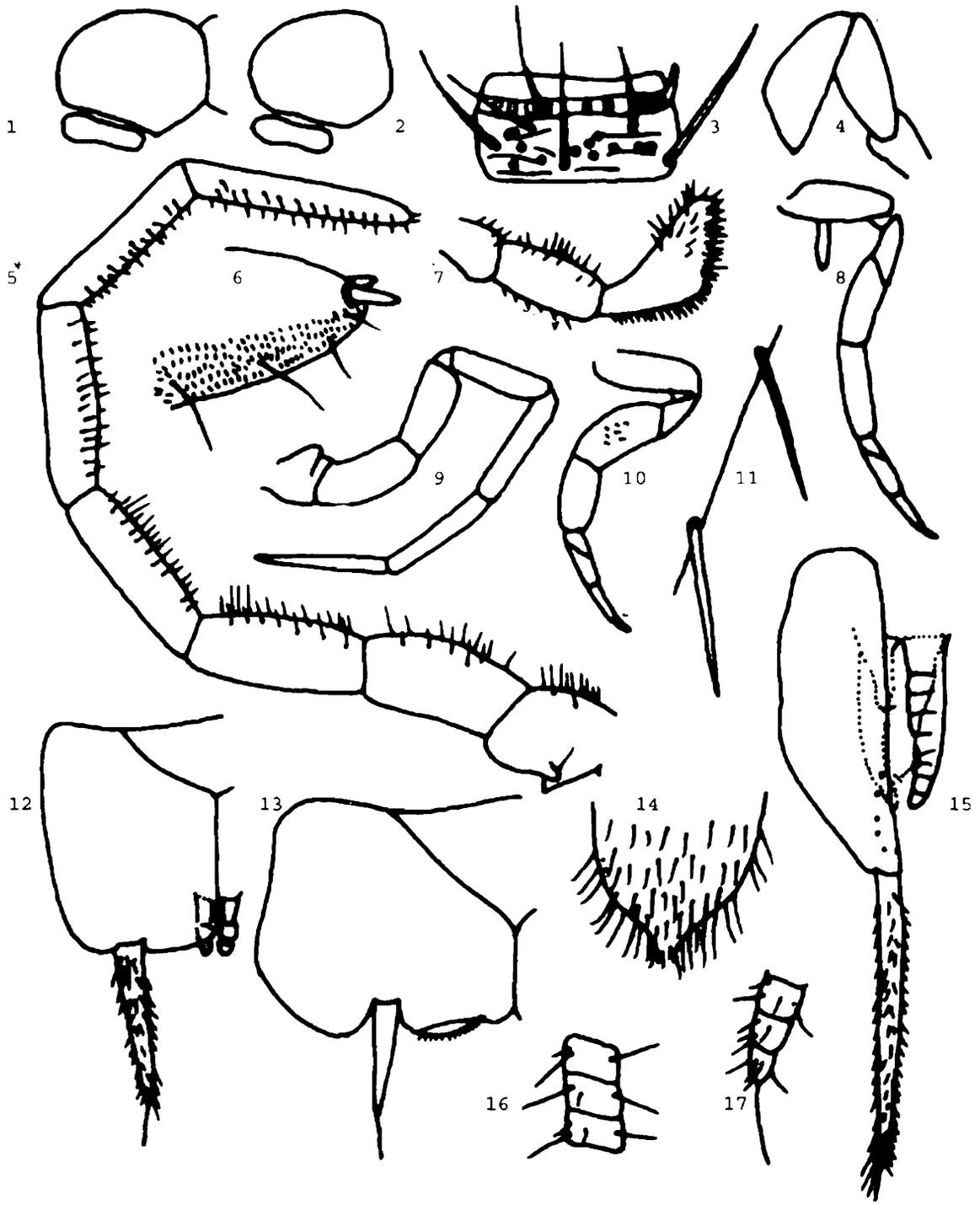

Fig. 8. ***Himalayachilis murreensis*** 1. & 2. Eye and ocellus. 3. Subjoint of distal article of antennae. 4. labial palp of female. 5. Maxillary palp, male. 6. Apex of Maxillary palp, male.7.labial palp of male. 8. hind leg of male. 9. Maxillary palp, female.10. Foreleg of male.11.spiniform bristles of tibia. 12. Urosternite VIII of male with parameres.13. urosternite V of male. 14. Apex of penis. 15. Urosternite IX of male.16. Anterior gonaphophysis of female. 17. Idem, terminal joints.

attaining tip of apical spine of posterior stylets. Anterior gonapophyses with 53-60 joints, the basal 26-28 joints batre, the remainder with two elongate and a few short bristles.

Distribution : India : Uttar Pradesh, Uttarakhand and North West Himalayas (Murree Hills).

Family MEINERTELLIDAE

Abdominal segments all with the median sternal sclerites almost, if not quite, invisible. At most, each sternite with only one pair of exsertile vesicles.

8. *Machilontus lawrencei* Carmen Bach de Roca, 1981

(Fig. 9)

Diagnosis : Length of body of male 11 mm, of female 20 mm. General body colour whitish; hypodermal pigment present on head and appendages. Head with two triangular spots of pigment between the ocelli. Ocelli strongly constricted at the middle, their width equal to 5/6 of that of eye. Antennae longer than body; delicate. Scapus and pedicellus whitish, flagellum light brown. Scapus of male on inner surface with several rather long, strongly pigmented spinelike setae. Labium and palps without pigment. Legs of median size, coxa completely without pigment; short and strongly pigmented spinelike setae on ventral surface of tibiae and first and second tarsal segments, not accompanied by conspicuous hairs. Clypeus without hypodermal pigment; segment III of maxillary palp almost twice as long as wide, distinctly longer than IV, its apex dorsally without specialized structures; legs with hypodermal pigment. Urosternites I–VII with a single pair of coxal vesicles. Urosternite IX with a hyaline terminal spine. Ratios stylus/ coxae = 1.14–1.15.

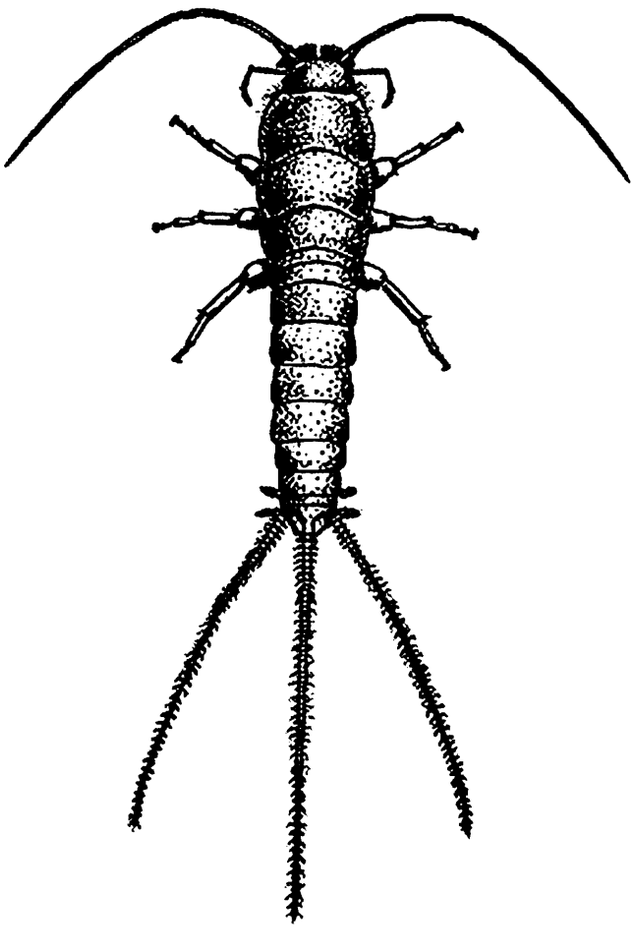

Fig. 9. *Machilontus lawrencei*

Distribution : India : Meghalaya (Khasi Hills).

Elsewhere : SOUTH AFRICA.

Remarks : This species first described by Carmen Bach de Roca, 1981 from Meghalaya, India.

Suborder ZYGENTOMA

Family LEPISMATIDAE

Body flattened, clothed in scales; mouth parts exserted. Compound eyes small or wanting. Ocelli absent. Abdomen usually with stylets and exsertile vesicles on some sternites. Thoracic coxal stylets absent. Abdominal styli on sternites 7-9 or 8-9; tarsi three or four semented. Body much flattened and fishlike, or elongate and parallel-sided. Scales present or absent.

9. *Acrotelsa collaris* (Fabricius, 1793)

(Fig. 10)

Diagnosis : Eyes present; body elongate and robust, whitish in colour, often with violaceous hypodermal pigment; scales generally dark. The macrochaete in submedian field of the head capsule are arranged in a narrow elongated strip, which do not touch the anterior border of the head capsule. The prosternum is covered by the fore coxae from underside. A bunch of solitary macrochaete is present in the middle of the prosternum. Last tergite sharply pointed apically, with more than 1 + 1 bristle combs. Median portion of the thoracic sterna covered by coxae, prosternum with tuft of large setae centrally on disc; male with parameres. The species can also be recognized by the arrangement of macrochaetae on legs and cerci which are in distinct whirls, this type of arrangement of setae on these appendages are not found in other Lepismatids. Tergum X is triangular and sharply pointed with at least 5 pairs of bristle tails.

Fig. 10. ***Acrotelsa collaris***

Distribution : India : West Bengal, Orissa, Bihar.

Elsewhere : USA, Caribbean Islands.

Remarks : This is common silverfish insects of houses.

10. *Afrolepisma nigrina* (Silvestri, 1913)

(Fig. 11)

Diagnosis : Hypodermal pigment absent. Antennae segmented. Body ordinarily ciliated. Apical part of mandible sclerotized. Terminal part numerously dented. Terminal part of maxilla with 3 sclerotized dentes. Maxilla robust with 5 sensory papilla. Pronotum with numerous lateral hairs and setae.

Fig. 11. *Afrolepisma nigrina*

Distribution : India : West Bengal, Orissa (Puri).

Elsewhere : SOUTH AFRICA

Remarks : Silvestri (1913) described this species from coast of Puri collected by S.W Kemp. It is the first time recorded the species from West Bengal.

11. *Ctenolepisma longicaudata* Escherich, 1905

(Fig. 12)

Diagnosis : A large white species without marked silvery sheen. Body long. Thorax is very little broader than the abdomen which is gradually tapering with relatively short segments. Length ranges from 13 mm to 15 mm, whitish brown in color without marked silvery shun. Antennae, cerci and median tail appendages are distinctly longer than the body length. Abdominal terga II–VI with 3+3 bristle combs, tergum 'X' twice as long as tergite IX and wide at base. Posteriorly last abdomen tergum distinctly truncates. Long styles are present on sternum VIII–IX. Ovipositor long and slender.

Distribution : India : West Bengal, Uttar Pradesh, Sikkim, Bihar, Tripura, Manipur Andhra Pradesh and Uttarakhand.

Elsewhere : USA, South Africa, Australia.

Remarks : The tropicopolitan species is very common in houses and libraries everywhere and is frequently a very serious pest.

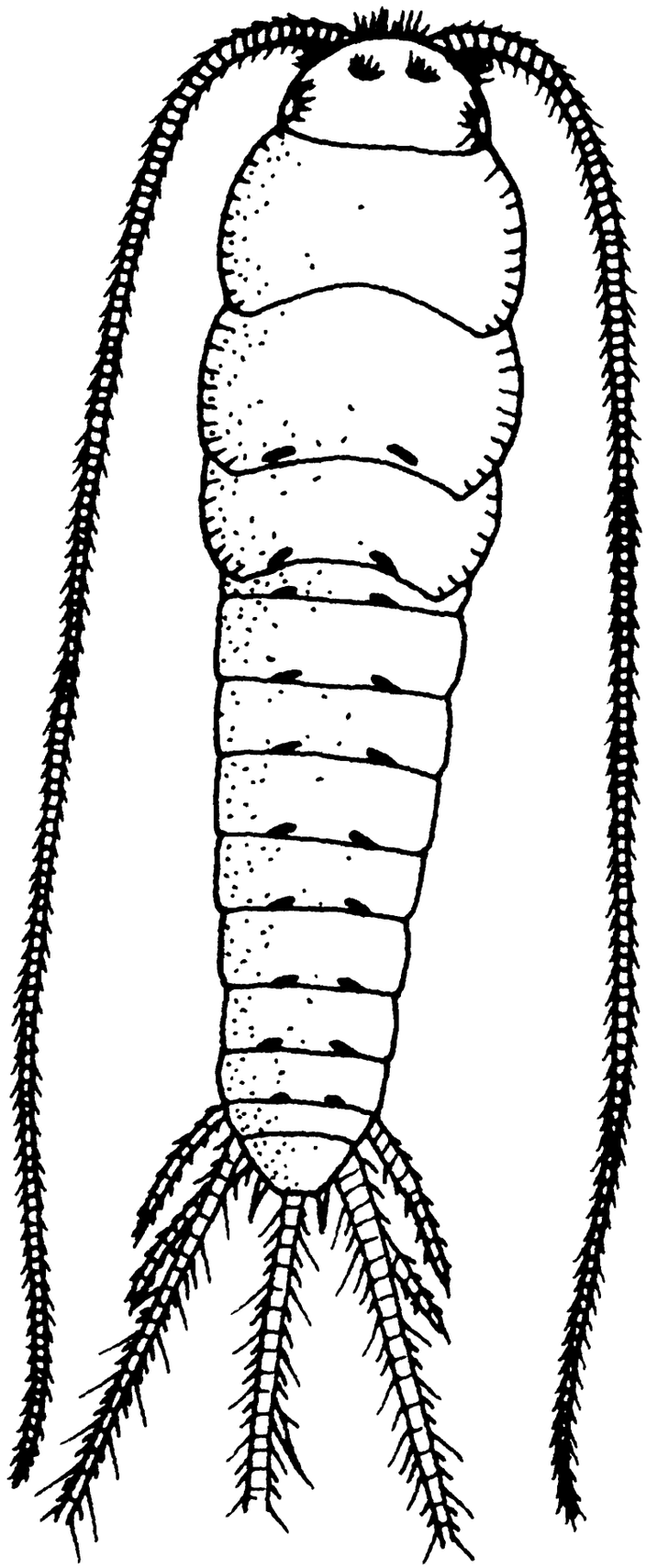

Fig. 12. *Ctenolepisma longicaudata*

12. *Ctenolepisma nigra* (Oudemans, 1890)

(Fig. 13)

Diagnosis : Body covered with dorsal scales, base of the legs, antennae and cerci are pale yellow in color. Antennae and caudal appendages are shorter than the body length. Thorax is not wider than the abdomen more or less equal in width. Posterior margin of each thoracic segment with few short and long simple setae. The middle portion of the metasternum is slightly narrower and posterior is rounded. Posterior part of abdomen is very little narrower than the anterior abdomen part. First tergum with 2+2 bristle comb tergite II–V with 3+3 bristle comb and tergite VI–VIII with 2+2 bristle combs. Sternite 3-8 with 2-3 sub-lateral bristle comb. Internal part of sub-coxae IX long, triangular, narrow and pointed at the tip. Tergite X short, sub-trapezoidal, angular portion rounded, posterior margin truncate. Ovipositor long, slender, body length: 6 mm.

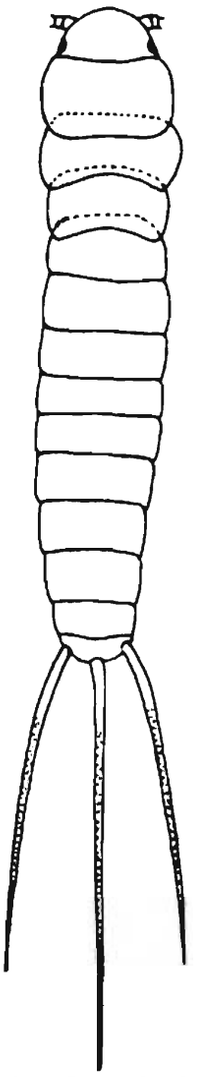

Fig. 13. *Ctenolepisma nigra*

Distribution : India : West Bengal, Orissa.

Elsewhere : SRILANKA, JAVA, SOUTH AFRICA.

Remarks : This species is recorded from seacoast of Puri, Orissa, India.

13. *Ctenolepisma ciliata* (Dufour, 1831)

(Fig. 14)

Diagnosis : Body elongated, head broad, eyes clearly projecting. Thorax broader than the abdomen. Tergite IX small, half the length of tergite VIII. Tergite X is as long as those of IX and VIII together, trapezoidal shape. Hypodermal pigment on head, body and appendages.

Fig. 14. *Ctenolepisma ciliata*

Antennae and cerci shorter than body. Abdominal terga II–VI with 3 + 3 bristle combs. Stylets 2 pairs on VIII and IX. Ovipositor long and slender. Body length : 10 mm.

Distribution : India : West Bengal, Delhi, Bihar, Sikkim Manipur.

Elsewhere : USA, MEXICO, AFRICA, JAPAN.

Remarks : This species is the first record from the state of Sikkim, Bihar and Manipur. It is widely distributed in Mediteranean.

14. *Ctenolepisma targionii* (Grassi and Rovelli), 1889

(Fig. 15)

Distribution : Eyes present; body elongate, whitish in colour, often with violaceous hypodermal pigment; scales generally dark. Tergite X not sharply pointed apically, with only 1 + 1 bristle combs. Large setae feathered or barbed; last tergite sub trapezoidal or broadly rounded apically. Last tergite of different shape; distribution of brisle combs on abdominal tergites different; 3 pairs of stylets in both sexes.

Distribution : India : West Bengal, Orissa.

Elsewhere : USA, AFRICA.

Fig. 15. ***Ctenolepisma targionii***

15. *Ctenolepisma tripurensis* Hazra, 2000

(Fig. 16)

Diagnosis : Male and Female: Maximum length : 8 mm (M) and 7 mm (F); colour (in spirit) dorsally pale yellow with a dense covering of reddish brown scales, ventrally yellowish white; shape of the body elongate, more or less parallel sided, dorsoventrally compressed anteriorly. Eyes relatively small, located well behind from the origin of the antennae; antennae shorter than the body length.

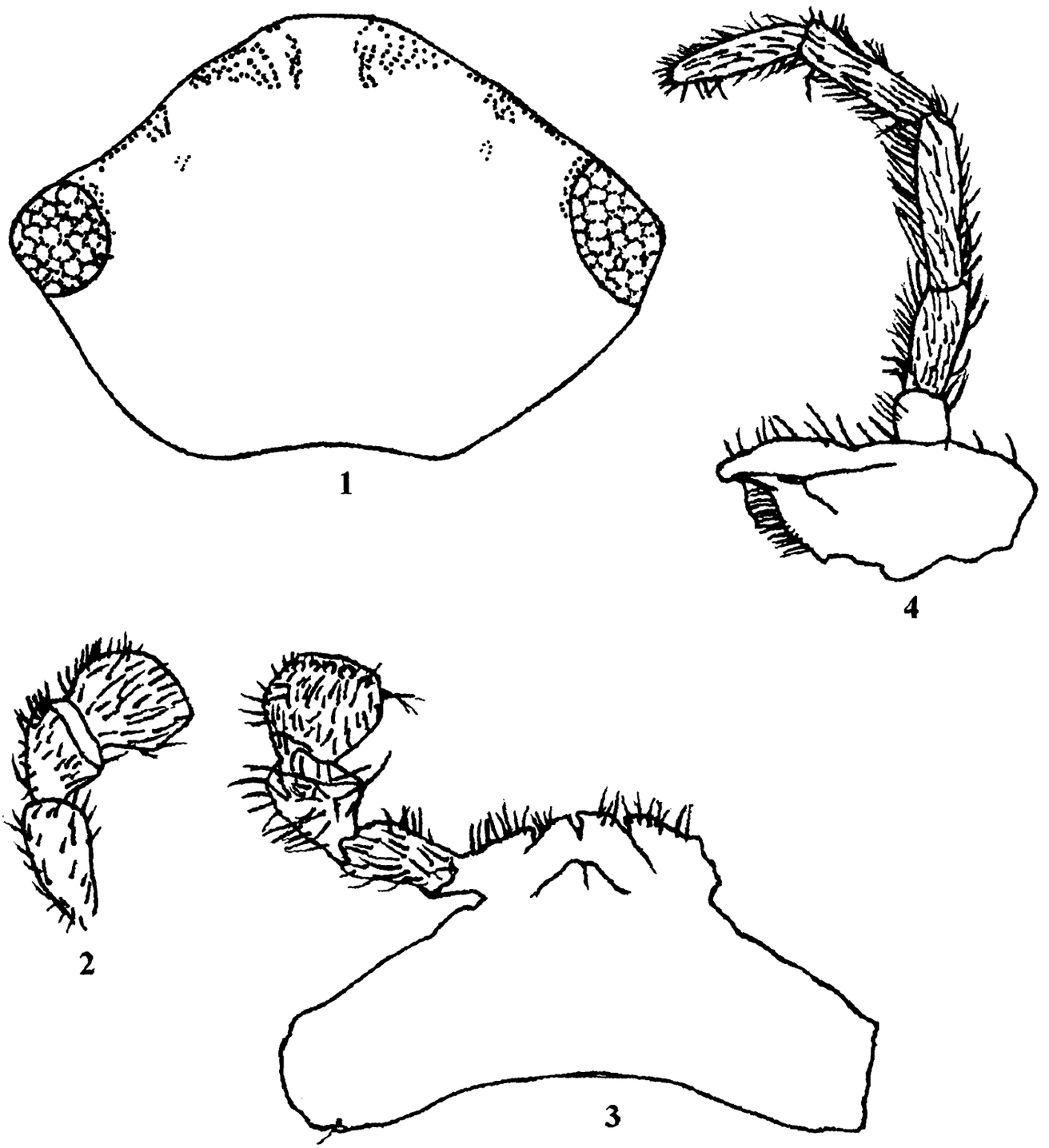

Fig. 16. ***Ctenolepisma tripurensis*** showing head and mouth parts, 1. Dorsal view of head capsule with fields of macrochaetae. 2. Dorsal view of labial palp. 3. ventral view of labial palp showing the arrangement of sensory papillae. 4. Dorsal view of maxillary palp.

Readily distinguished from the other species of *Ctenolepisma* by the presence of more truncated tenth tergite with 1 + 1 distinct bristle combs, composed of 3-4 macrochaetae and also in the shape of labial palp and arrangement of the sensory papillae.

The legs stout, femur short, one stout setae each on its outer and inner margins distally near the junction with tibia, tibia and tarsus moderately elongate, tarsus with slightly curved claws.

Abdomen parallel sided, slightly tapering from the VIII segment to X; scales more abundant on abdominal segments than thorax. Tergum I with 1 + 1 bristle comb, II–V each with 3 + 3 bristle combs; ovipositor elongate and longer than the extended process of the coxite IX , both dorsal and ventral valves carry fine bristle only; apex of anterior gonapophyses with 3 such setae and numerous short spinelike setae, ovipositor without any trace of fossorial spines.

Distribution : India : Tripura

Remarks : Hazra (2000) described this new species of the genus *Ctenolepisma* from the state of Tripura.

16. *Ctenolepisma dubitalis* Wygodzinsky, 1959

(Fig. 17)

Diagnosis : Body length 9 mm; body yellowish-white; antennae faintly and caudal appendages distinctly violaceous; thorax almost as long as abdomen, slightly wider than abdomen; antennae longer than the body. Maxillary palp slender; labial palp with apical segment slightly wider than long, bearing 5 sensory papillae. Abdominal tergite II–VII with 3 + 3 bristle combs, tergite X shorter than wide, broadly truncate with 1 + 1 bristle comb. Two pair of stylets present on VIII and IX segments; ovipositor of the female short and stout with fossorial spine.

Distribution : India : Manipur.

Elsewhere : AUSTRALIA, USA.

Remarks : Wygodzinsky (1959) described this species for the first time from India as well as from the state of Manipur.

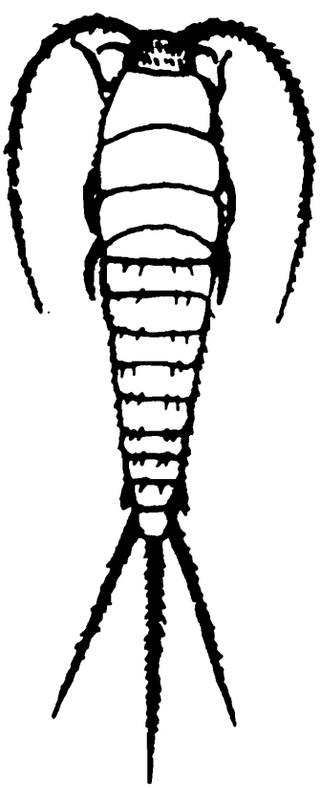

Fig. 17. *Ctenolepisma dubitalis*

17 *Lepisma saccharina* Linnaeus, 1758
(Fig. 18)

Diagnosis : This is a small silvery species of about ½ inch in length. Body elongate, whitish in colour, often with violaceous hypodermal pigment; scales generally dark. Tergite X not sharply pointed apically, with only 1 + 1 bristle combs. Large setae bare, often bifid or trifid apically. Abdominal sternites with median bristle-combs in addition to sub-lateral ones; abdominal tergites with only 1 + 1 bristle combs in addition to isolated macrochaete; ovipositor of female hardly extends beyond apex of inner process of coxites IX ; two pairs of stylets; tergites X rather elongate, distinctly longer than wide.

Fig. 18. *Lepisma saccharina*

Distribution : India : Sikkim.

Elsewhere : USA, AUSTRALIA, EUROPE.

Remarks : The species is normally free living, domestic and widely distributed.

18. *Tricholepisma gravelyi* (Silvestri, 1913)
(Fig. 19)

Diagnosis : Body limuloid, thorax not much shorter than abdomen and clearly wider than it. Scales present, macrochaetae bifid. Antennae medium size. Head small, free, eyes well developed and highly pigmented. Maxillary palp 5 segmented, labial palp 4 segmented. Trichobothrial area on all the nota is open type. Last segment of labial palp with 5 sensory papillae in two rows. Terga II–VIII with 12 macrochaetae in hind border. The length of X tergum is more or less equal to the

width of the base of the same. Its distal margin only a little concave with several thin setae along the lateral margins with 1 + 1 posterolateral macrochaetae with an inner of lesser setae. Urosternum 1 glabrous, the 2nd with a median comb with 5 setae. Urosterna 3-7 with a median comb with 7-9 setae and 1 + 1 lateral combs, each one with 1-3 setae. Abdominal stylets are two pairs in coxites VIII and IX. Ovipositor strong, surpassing clearly the apex of the IX stylets.

Distribution : India : West Bengal (Kolkata).

Remarks : Silvestri (1913) was first described this species from Indian Museum campus, Kolkata.

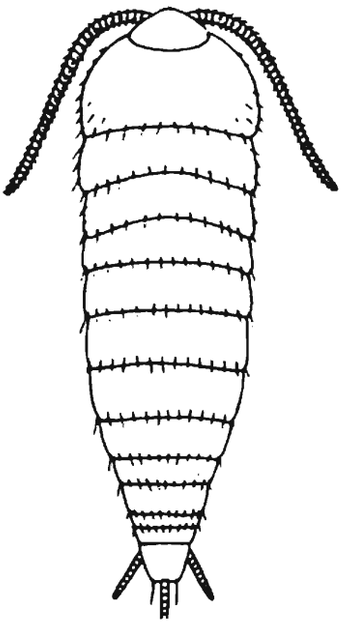

Fig. 19. *Tricholepisma gravelyi*

19. *Xenolepisma subnigrina* (Silvestri, 1938)

(Fig. 20)

Diagnosis : Body dorsally flattened sides parallel and not, or only slightly, converging posteriorly. Head broad; thorax not much broader than the abdomen, the single tergites being approximately rectangular; prothorax anteriorly scarcely narrower. Abdomen not distinctly demarcated from thorax; tergite X very short and broad, mostly half as long as wide at base, trapezoidal or half-rounded. The longer bristles of the dorsum are arranged in weak combs consisting of a few long ones and some shorter setae; on the head the bristles are in somewhat stronger brushes, while ventrally on abdomen II–VIII there may be a strong bristles or a comb of four or five bristles.

Fig. 20. *Xenolepisma subnigrina*

Distribution : India : Tamil Nadu (Coimbatore).

20. *Lepisma indica* sp inq. Escherich, 1903
(Fig. 21)

Diagnosis : Body more or less elongate, broader anteriorly than posteriorly. Head narrower than thorax without distinct neck; eyes present but not outstanding. Thorax mostly broader than abdomen, prothorax the longest. Abdomen laterally mostly distinctly separated tergites I–IX. Comparatively equally long, 'X' lengthened, mostly longer than broad at base, the apex truncate or incised.

Distribution : India : Maharashtra

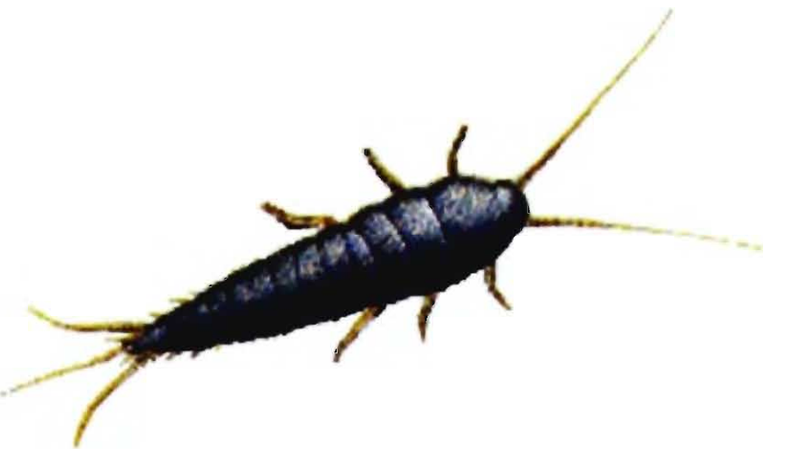

Fig. 21. *Lepisma indica* sp inq.

21. *Stylifera wygodzinskyi* Hazra, 1980
(Fig. 22)

Diagnosis : Male and Female : Maximum length of the body 12 mm. Shape of the body more or less parallel-sided, thorax very slightly wider than abdomen. Dorsally scales are darker, ventrally light yellowish, hypodermal pigments distinct on the antennae, on the labial palp, apex of tibia, tarsus also on the caudal appendages and on the tip of the trochanter.

Chaetotaxy of head mandibles normal, palp as usual, apical segment distinctly broader and bears 10 normal sized sensory papillae arranged in a single row. Antennae more or less as long as body. Lateral borders of the nota with 8-9 bristle combs each composed of 1-2 macrochaete, hind border of the nota with 1 + 1 bristle combs, each composed of 5-7 setae.

Prosternum triangular posteriorly. Dot narrow lateral borders with 3 + 3 bristle combs each composed of setae; mesosternum somewhat more wider than prosternum lateral border with 2 + 2 bristle combs each comb consisting of 4-5 setae; wider and apically rounded with 1 + 1 bristle combs each comb consisting of 7-9 setae. Ovipositor is as long as the inner process of coxite IX and covered by it. Anterior gonapophyses with 6-7 pointed fossorial spines.

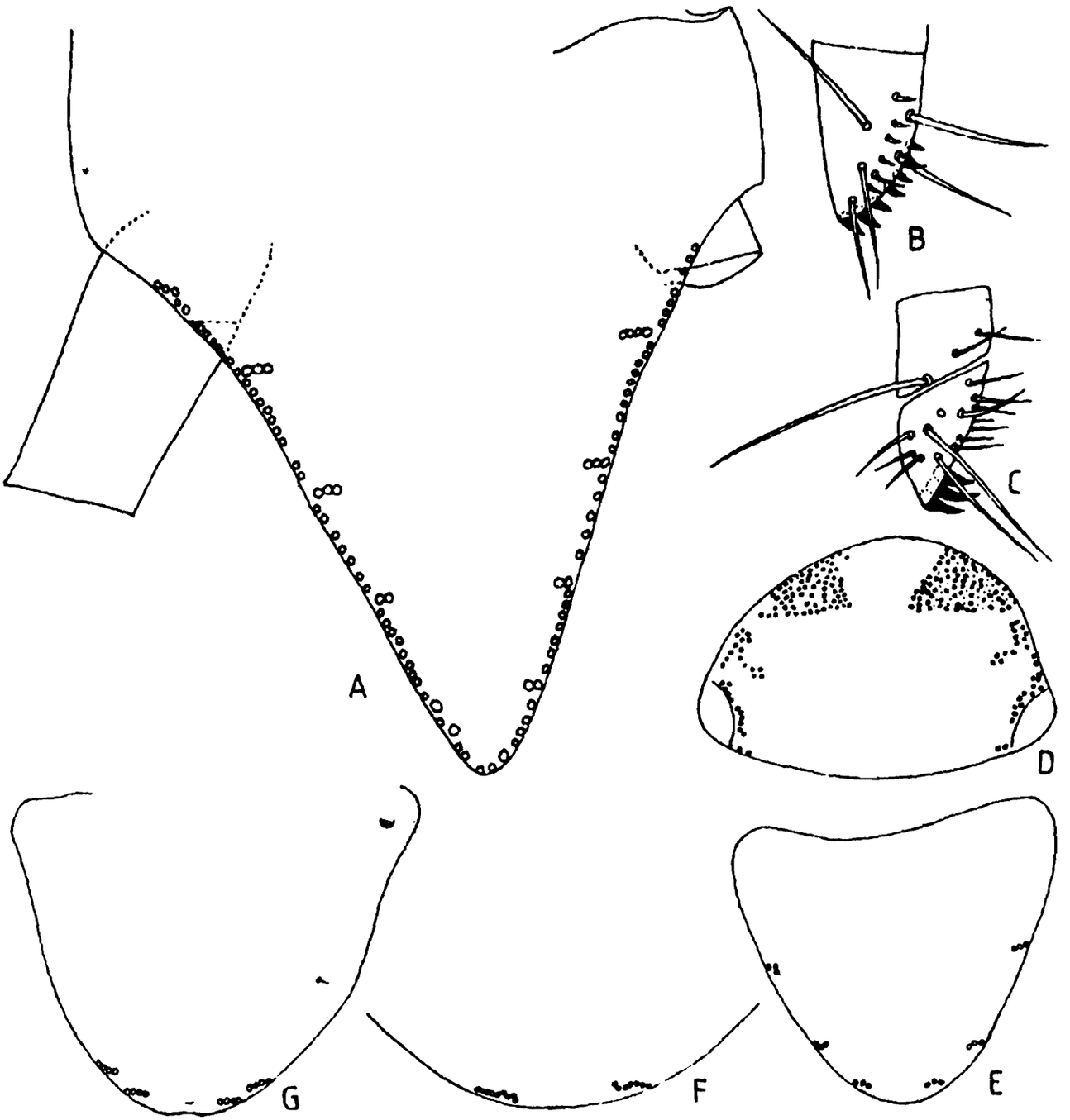

Fig. 22. ***Stylifera wygodzinskyi*** A. Tergum X of male. B. apex of the anterior gonaphophysis. C. Apex of the posterior gonaphophysis. D. head capsule with fields of macrochaetae.E. Prosternum. F. Mesosternum. G. Metasternum.

Distribution : India : West Bengal (Bankura, Purulia, East Medinipur West Medinipur, Murshidabad), Orissa.

Remarks : The species occurs in the forest of southern part of West Bengal. It is likely that this species will also occur from other districts of West Bengal and also in the other state of India where "Saal" trees prevailed.

22. *Silvestrella termitophila* Escherich, 1905
(Fig. 23)

Diagnosis : Maximum length of male 5.2, of female 6.2 mm. General body colour whitish, nacreous when covered by scales. Hypodermal pigment absent. Setae golden yellow and simple. Head subglobose, convex, not hidden by pronotum, covered with scales. Antennae delicate, slightly shorter than body. Macrochaetae of basal portion of flagellum very delicately feathered. Thorax longer than abdomen, and distinctly wider than the latter at base. Pro, meso and metanotum along lateral borders with numerous single short macrochaetae and simple hairs. Legs relatively short, the hind pair more slender. Tarsi three segmented, the second joint very short. Three simple claws, the median very small. Abdominal tergites I–VIII with 1 + 1 sub median, I and VIII with 1 + 1, II–VII with 1-2 + 1-2 sub lateral macrochaetae. Cerci about half as long as abdomen.

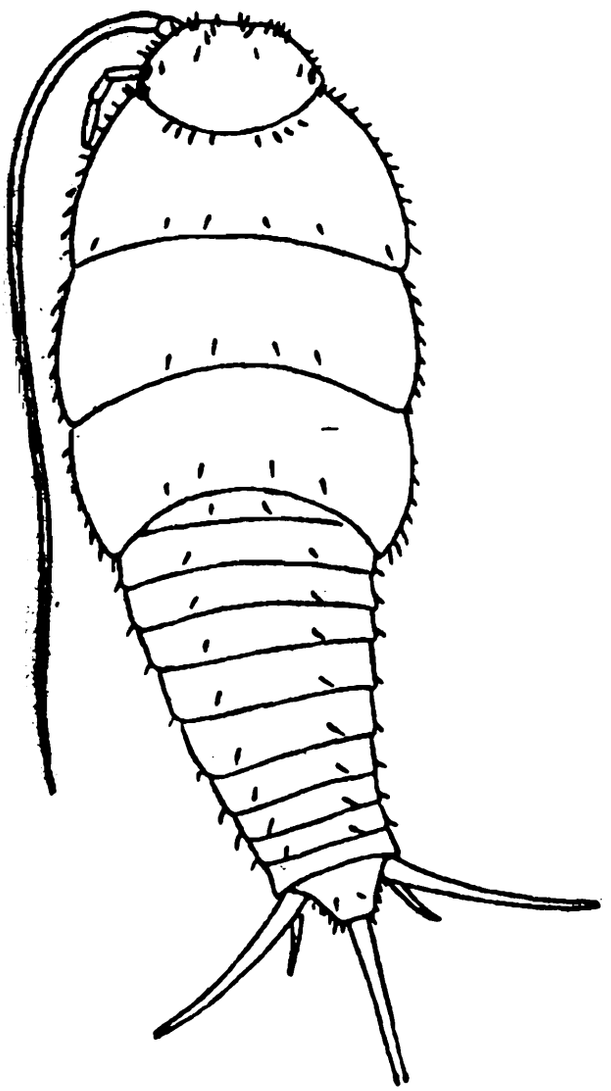

Fig. 23. ***Silvestrella termitophila***

Distribution : India : West Bengal, Orissa and Andhra Pradesh.

Elsewhere : SOUTH AFRICA.

Remarks : This genus and species originally described from South Africa (Escherich, 1905) being recorded for the first time from India. This species is generally found in the Termite mound and Ant nests.

Family NICOLETIIDAE

The Nicoletiinae are blind, not or only weakly pigmented, elongate sub-cylindrical or slightly flattened Thysanura. Head never longer than prothorax. Inner edge of lacinia of maxillary palp with teeth and bristles. Sub-coxae of genital segments narrow, not covering bases of gonapophyses. Last segment of maxillary palp with conspicuous sensory papillae. Eyes absent. Body with or without scales.

23. *Lepidospora ceylonica* Silvestri, 1911 (Fig. 24)

Diagnosis : These specimens are small and white. Head with scales. Urosternites entire; coxites IX of male not fused. Stylets present on Urosternites II–IX; Scales present; body shape flattened, *Lepisma*-like; thorax distinctly wider than abdomen, the former not conspicuously constricted at level of limits between nota. A female is 5 mm long, and fusiform, segmented ovipositor approaches the level of the apex of stylets IX.

Distribution : India : Nilgiri Hills (Ootacamund), Uttar Pradesh, Uttarakhand.

Elsewhere : SRI LANKA.

Remarks : This species is very small, white and without eyes found in ant and termite nests.

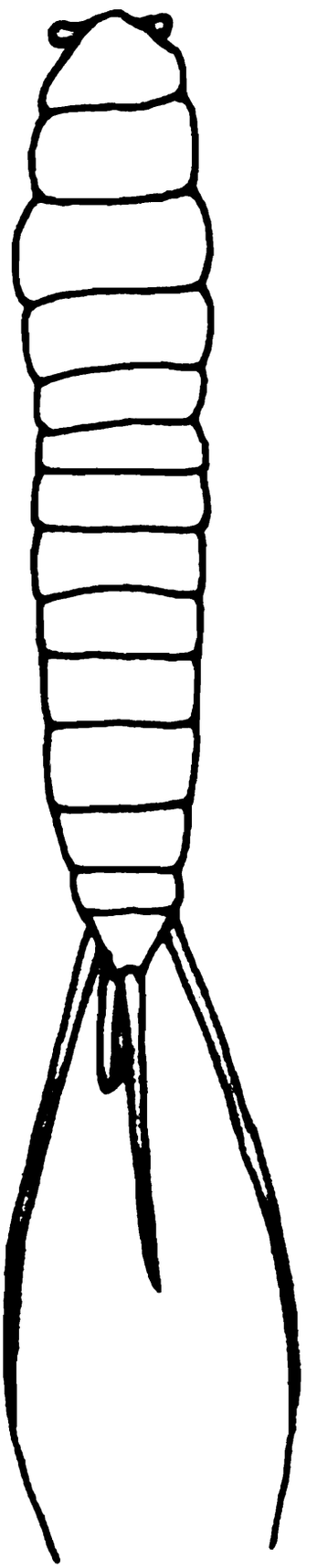

Fig. 24. *Lepidospora ceylonica*

24. *Lepidospora notabilis* Silvestri, 1911
(Fig. 25)

Diagnosis : Maximum body length 6 mm. Antennae and caudal appendages approximately half as long as body. Head with numerous strong setae on frons. Thoracic notas usual; anterolateral and posterolateral angles each with one long macrochaetae; smaller macrochaetae along lateral borders and hind margin of nota. Urostergites I–VIII with 2 + 2 closely spaced large posterolateral macrochaetae. Urostergites X of female conspicuously emarginated. Caudal appendages of female and cerci of male simple.

Distribution : India : Uttar Pradesh, Uttarakhand.

Elsewhere : PAKISTAN

Remarks : This species is very small, white and without eyes.

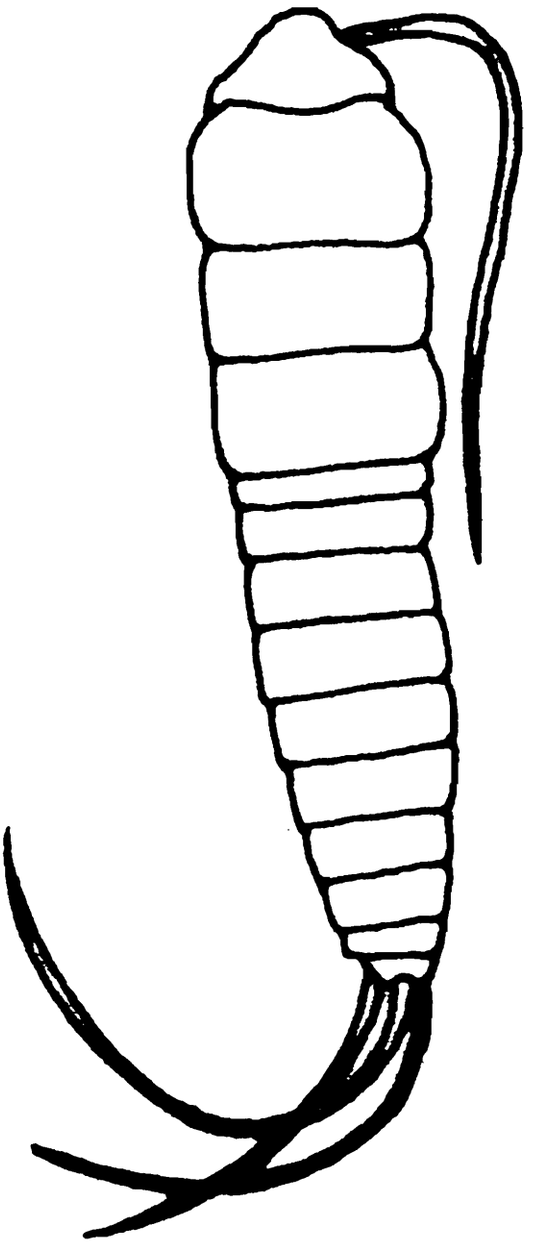

Fig. 25. *Lepidospora notabilis*

Family ATELURIDAE

Subcoxae of genital segments broad and flat, covering bases of gonapophyses. Last segment of maxillary palp without sensory papillae. Eyes present. Body always scaled.

25. *Atelura typhloponis* Silvestri, 1913

(Fig. 26)

Diagnosis : Body color whitish yellow, covered with scales. Head dorsally with scales, anterior and lateral margins with isolated setae, four larger and isolated, with apex bifid. Antennae shorter than body. Thorax not much more widened than the anterior part of abdomen and about 1/3 shorter than abdomen, the hind margin of terga without any setae, the lateral margin with two short setae. Abdomen gradually narrower posterior, the hind margin of the terga with only one robust bifid seta, the other shorter. Tergum 'X' is 1/3 wider at the base than long and hind margin gradually thinner, and the margin is deeply sinuate, the posterior angles acute with a long and strong apical seta. Sternum II with a pair of median vesicles, the sterna III–VII with a pair of sub median setae. Sterna V–IX with sty lets and the VIIth with pseudo vesicle stylus elongated in the IX, where they are clearly stronger and more than twice longer than in the VIII.

Ovipositor robust attains more or less the half of the length of IX stylets, not conspicuously annulated and with short setae. Body length : 3 mm.

Distribution : India : West Bengal, Sikkim and Andhra Pradesh.

Remarks : This species are to be found living as commensals in the nests of ant and termites. They are extraordinarily quick runners and great dexterity is required in capturing them.

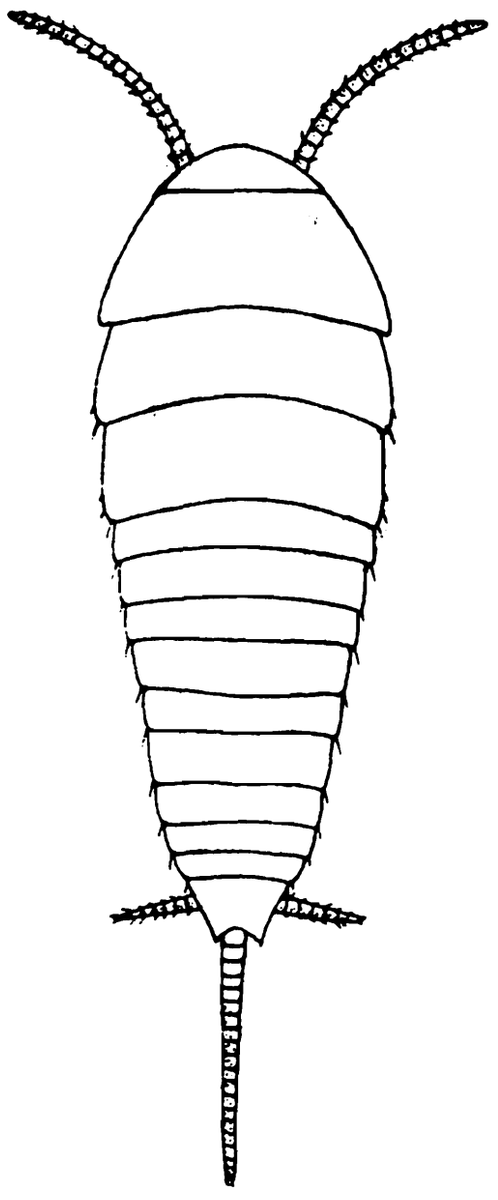

Fig. 26. *Atelura typhloponis*

26. *Thermobia domestica* (Packard) 1873
(Fig. 27)

Diagnosis : Body form rather flat and broad, posteriorly tapering. Head broad, anteriorly rounded, behind the eyes rather concave. Thorax as long as abdomen. Abdominal tergites II–VIII with only two brushes. Abdomen basally as broad as thorax; segments short and broad; tergite X short and bluntly triangular. Antennae

Fig. 27. *Thermobia domestica*

very long, almost twice as long as body. Maxillary palpi very long, 5 or 6 segmented. Labial palpi 4 segmented, apical segment swollen and somewhat oval. Legs long and slender with the usual two large claws and one small median claw or pseudonychium. Cerci and median tail appendage longer than body. Stylets in two or three pairs according to the sex. Ovipositor long and slender. The larger dorsal setae are serrated and arranged in the usual combs but on abdomen II–VIII and X there is only a single dorsal pair; ventrally there is a pair of very broad lateral combs on sternites II–VIII and also a median comb on II–VI.

Distribution : India : West Bengal (Kolkata); Tamil Nadu.

Elsewhere : USA, EUROPE, NEW ZEALAND, ASIA.

Remarks : This large brown species is the common "fire-brat" of Europe, America, New Zealand and Asia and elsewhere. It generally appears at night and inhabits warm corners in bake-houses and factories, hence its popular name.

SUMMARY

The present book contains diagnostic character, geographical distribution of twenty six species of Indian Thysanura. These 26 species belonging to 19 genera under 5 families of two suborder MICROCORYPHIA and ZYGENTOMA. This book is the first of its kind on Indian Thysanura, earlier there was no consolidated report on this order of Insect. It contains some coloured photographs either taken from nature or in laboratory and some black and white diagrams keeping in mind the condition of the specimens.

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