Rec. zool. Surv. India, 88 (1) : 49-61, 1991

ON AN ACCOUNT OF INDIAN LEPTOPHLEBIIDAE (EPHEMEROPTERA) WITH KEY TO THEIR IDENTIFICATION

V. D. SRIVASTAVA
Zoological Survey of India, New Alipore, Calcutta- 700 053.

INTRODUCTION

Mayflies are amphibiotic insect and represent order Ephemeroptera which inhabit both lotic and lentic ecosystem of our waters. Leptophlebiidae is one of the family of these insects which in our country are represented by 10 species under 9 genera. It represents 1/9 of our mayfly species as there are another 80 mayflies recorded under 24 genera and 11 families (Table-I, Page 61). This family has maximum number of genera, though species wise Baetidae with 35 species occupies first position among our mayfly faunal component. All Indian Leptophlebiids are endemic to our limits except one which is endemic to Hong Kong. These represents 1/10 of our high altitude mayflies. A detailed taxonomic position, salient characteristics of family and genera with reference to Indian forms has been provided. A key has been formulated to distinguish Indian Leptophlebiids alongwith verification table providing parallel taxonomic characters at a glance.

SYSTEMATICS

Leptophlebiidae is one of the most distinctive family of mayflies represented almost all over the world by 377 species under 62 genera. In contrast to it our own Leptophlebiid mayflies are represented by 10 species under 9 genera (Table-II, Page 61). It thus represents only a very small fraction of world's fauna of this group and obviously indicates strong possibility of more representation, as is also true for the whole order, on further detailed investigation of our lotic and lentic ecosystem both at high altitude and plains.

Our knowledge of Indian Leptophlebiids is due to Gillies (1951), Demoulin (1955), Peters and Edmunds (1970), Dubey (1971), Peters (1975). Srivastava (1979, 1982) has discussed our high altitude mayflies representation and our endemic component. In the Indian subregion (India, Sri Lanka, Pakistan, Nepal, Sikkim, Bhutan, Bangladesh, Burma) Leptophlebiids are represented by 20 species under 12 genera (Hubbard and Peters, 1978). Among these a few genera like *Hagenulus* Eaton, *Kimminsula* Peters and Edmunds, *Megalena* Peters and Edmunds are not represented in India while genera like *Gilliesia* Peters and Edmunds, *Indialis* Peters and Edmunds, *Nathanella* Demoulin, *Notophlebia* Peters and Edmunds, *Thraulodes* Ulmer and *Thraulus* Eaton have no representatives in neighbouring countries. Peters and Edmunds (1970) have considered overall oriental Leptohlebiidae alongwith Ethiopian and Palearctic region in study of this group from Eastern Hemisphere.

Salient features of Leptophlebiidae :

Eaton 1884 (1883-84) first fecognized this family as "section 5 of Leptophebio", though Banks (1900) established the family name as Leptophlebini. Initially Jacobson and Bianchi (1905) gave it status of subfamily Leptophlebiinae and (Traver *et al.* 1935) placed it under Baetidae alongwith Caeninae, Baetinae, Ephemerellinae etc. most of which were assigned family status subsequently. Demoulin (1958) placed this family under Superfamily Heptagenioda alongwith two other families Ametropodidae and Heptageniidae.

Member of this family are distinguished by following salient point, specially considering our own Leptophlebiid representatives.

These are small to medium sized mayfly. Smallest is *Choroterpes (Euthraulus) parvula* with body 4 mm. and largest is *Atalophlebia chialhnia.* Eyes of male divisible into upper larger and lower smaller part mounted on long or short stalk. Both eyes may be closely placed but not meeting on dorsum as in *Choroterpes (Euthraulus) parvuls, Indialis rossi, Isca (Isca) purpurea, Nathanella indica, Thraulus semicastaneous* or they meet on dorsum as in *Gilliesia hindustanica, Indialis badia, Notophlobia hyalina.* Eyes in female not divided, remain well seperated in all members by distinct gap.

Both fore and hind wing may be present as in *Indialis, Thraulus, Choroterpes, Gilliesa, Atalophlebia, Thraulodes* or hind wing absent as in *Isca, Nathanella* and *Notophlebia.* Fore wing almost of same size as body, may be hyaline or translucent. Its vein MA_1 and MA_2 attached at base and 1 inter calary in between them at wing margin. MP_1 and MP_2 independent as in *Gilliesia* or attached at wing base and 1 intercalary between them. Attachment may be by a cross vein as in *Nathanella, Notophlebia* or directly to form a fork as in *Isca (Isca) purpurea.* No intercalary between MP_2 and CuA but there are 2-8 between CuA and CuP. Anal veins 2-3 strongly arched. Cross veins are many or few, in former they may be well spread as in *Atalophlebia, Gilliesia, Thraulodies* but in latter restricted to apical half as in *Nathanella indica* or absent from tip and periphery as in *Isca (Isca) purpurea* cross vein surrounded by yellowish brown pigments. Rs and M_p forked at varying distance from base to margin. It may be at 1/4-1/7 in case of Rs and normally 1/2 in case of Mp. Fork may be symmetrical or asymmetrical.

Hind wing when present are minute about 1/4 to 1/5 of fore wing, elongated, oval or spherical. *Choroterpes (Euthraulus) parvula, Gilliesia hindustanica, Thraulodes marhieus* have void or spherical hind wing but *Indialis badia I. rossi* have elongated oval hind wing. Hind wing may have costal projection which may be well developed and acute as in *Gilliesia hindustanica, Indialis badia, Thraulus semicastaueous* or well developed but obtusely rounded as in *Indialis rossi.* In *Thraulodes marhieus* costal projection though present but not well developed, only slightly bulging outwards. In *Atalophebia chialhnia* costal projection is absent but costa is outwardly arched. Longitudinal vein are costa, Subcosta, Radial sector which may be branched once or twice. Anal veins are present but not well developed; There may be free inter calary between the fork of Rs in *I. rossi, Gillesia hindustanica Thraulus semicastaneus, Choroterpes (Euthraulus) parvula. Atalophlebia chialhnia* has also one intercalary but is not free as in previous cases. *Indialis badia* has two free intercalary. Cross veins are only a few 3-4 as in *Thraulus semicastaneous, Indialis rossi, Choroterpes (Euthraulus) parvula. Indialis badia* and *Gilliesia hindustanica* has

10-11 cross vein, while *Atalophlebia chialhina* has 25-30 cross veins well spread throughout wing expanse between all longitudinal veins.

Fore leg longest, in some cases it may be even longer than body as in *Isca (Isca) purpurea, Nathanella indica.* Tarsus of fore leg of male 5 segmented, the basal one is very short, middle and hind tarsus of fore leg and tarsus of all the three legs in female four segmented. Claws may be similar in shape in all the three legs as in *Atalophlebia, Nathanella,* or may be disimilar fore claw apicaly hooked and other 2 obtuse pad like as in *Choroterpes, Gilliesia, Indialis, Isca, Notophlebia, Thraulodes.*

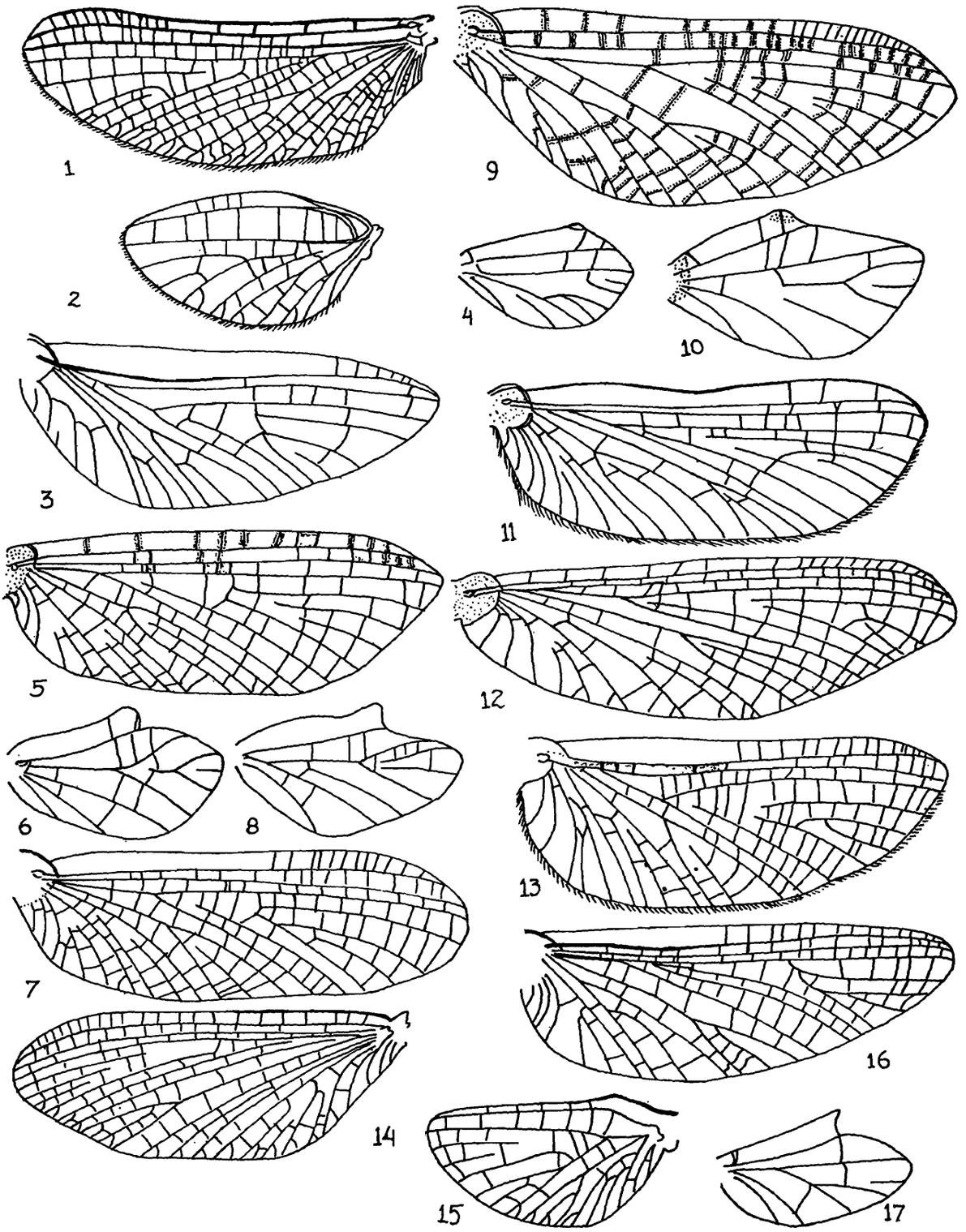
Genital forcep of male 2-3 segmented in the family but all our Leptoplebiids have 3 segmented forcep except *Choroterpes (Euthraulus) parvula* which has been reported to be 4 segmented but so called 3 and 4 are not completely separated segmented but are faint constriction. Penes lobes simple tubular, may be seperate all along their length as in *Notophlebia , Isca, Indialis badia, Gilliesia* or may be closely apposed all along their length as in *Indialis rossi, Choroterpes.* Penes is generally straight, may be slightly incurved or curved outwards almost at right angles as in *Gillisia.* Top of penes may have 5-6 denticles as in *Isca (Isca) purpurea,* apex pointed and finely serrated as in *Notophlebia hyalina* or beset with minute apical hook as in *Thraulus semicastaneus.* In female ovipositor are not well developed, simple, minute, two segmented. 7 sternite is slightly extended, not enough to cover oviduct's opening in two of our forms *Choroterpes (Euthraulus) parvula* and *Gillea hindustanica.* Ninth sternum may be shallowly cleft as in former, deeply cleft as in latter or may be even entire as in others. Caudal filament well developed ususlly 3, one median which may be sometimes reduced and two lateral cerci which are almost always relatively longer.

Salient taxonomic points of Indian Leptophlebiids :

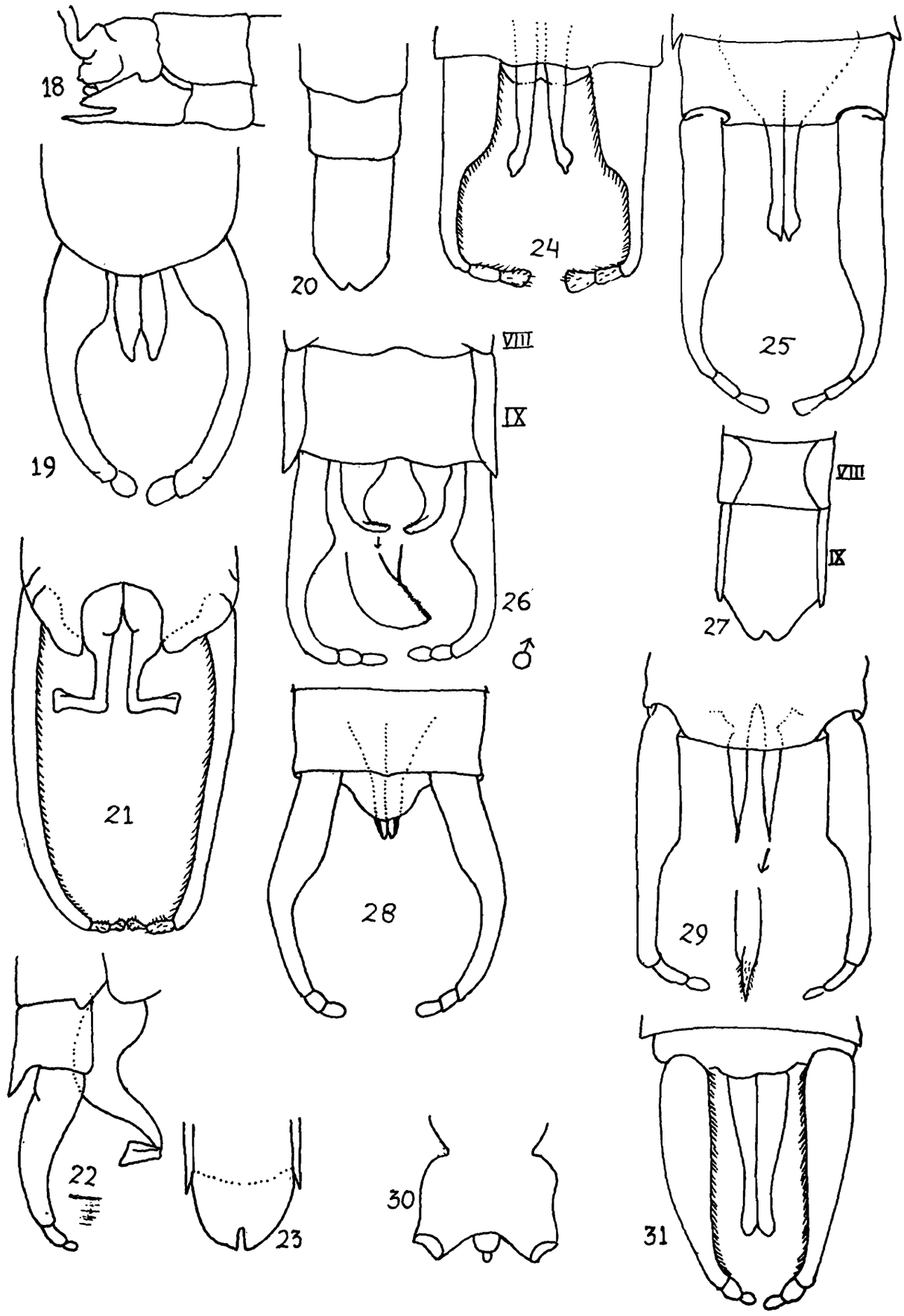
Genus *Atalophlebia* Eaton (1881) has been established with *Ephemera australis* Walker and within our limits it is represented by *A. chialhnia* Dubey (1971) from riverine ecosystem (alhni) in Himachal Pradesh at an altitude of 3200 Meters. Within Indian subregion it is represented by one more species is *A. femoralis* (Hagen 1858) from Sri Lanka.

Indian representative of the genus is known only by female imago and is characterized with following main points : Body length 10 mm., brown to blackish brown. Forewing are 9 mm., translucent brown, venation pale, 10-12 ; cross vein in stigmatic area, cross veins many well spread. A_1 seprated from A_2 at base, A_2 forked close A_3. Hindwing is 2 mm. ; 1/5 of former, oval, costal side outwardly arched but with out costal process, 20-30 cross veins well spread. Fore leg longest, twice that of body, tarsus 4 segmented. All claws similar, slender, apically hooked. Abdomen dark brown ovipositor simple not well developed.

Choroterpes Eaton (1881) is also represented within our limits by single species under subgenus *Eutharulus* Barnard (1932) namely *C. (E.) parvula* Gillies(1951). It has been recorded inhabiting riverine ecosystem at Sonar near Saugor (Madhya Pradesh). This species is known by male and female imago. Salient features : Body 4-4.5 mm, blackish brown. Eyes of male divided on a short stalk, slightly separated on dorsum. Forewing



1-17 wing : 1,2 Fore wing (F.W.) and Hind Wing (H.W.) of *Atalophlebia chialhnia* ; 3,4 F.W. and H.W. of *Choroterpes (Euthraulus) parvula* ; and H.W 5,6 F.W. and H.W. of *Gilliesia hindustanica* ; 2,8 F.W. and H.W. of *Indialis badia* ; 9,10 F,W, of *I. rossi* ; 11 F.W. *Isca (Isca) purpurea* ; 12 F.W. *Nathanella indica* ; 13 F.W. *Notophlebia hyalina* ; 14,15 F.W. and H.W. of *Thraulodes marhieus* ; 16,17 F.W. and H.W. of *Thraulus semicastaneous.*



18-31 Genitalia: 18 Male *Atalophlebia chialhnia*; 19,20 Male/Female *Choroterpes* (*Euthraulus*) ***parvula***; 21,22,23, (M), dorsal, lateral, (F) *Gilliesia hindustanica* ; 24 (M) *Indialis badia* ; 25 (M) ***Indialis rossi*** ; 26, 27 (M),(F) *Isca* (*Isca*) *purpurea* ; 28(M) *Nathanella indica* ; 29 (M) *Notophlebia hyalina* ; 30(M) *Thraulodes marhieus* ; 31(M) *Thraulus semicastaneous*

colourless hayline, except brown at extreme base. RS and MP are forked at 1/4 from base to margin, MA forked at half. All forks symmetrical. Cross veins very few mostly in costo-apical portion. Hindwing about 1/4 of former, spherical, costal projection well developed, rounded, cross vein 4, 2 each in costal and subcostal space. Fore femora dark brown but mid and hind femora has dark spot at middle third and apex. Tarsus 5 jointed. Fore claws apically hooked, others obtuse pad like. Genital forcep 4 segmented penes simple, tubular, contiguous basaly, separated apically and tapered. Female's stermum shallowly cleft apically, stermite 7 not extended to cover the oviduct opening.

Gillisia Peters and Edmunds (1970) is a monotypic genus to accommodate the only Indian representative for *G. hindustanica* (Gillies) (=*Thraulus hindustanicus* Gillies). It was initially described from Mirik (Darjeeling, West Bengal) and subsequently recorded from Assam, Arunachal Pradesh ranging at an altitude of 210-1800 meters. Salient features : Body in male 6 mm., white marked with brown and buff but in female it is 6-7 mm ; chocolate brown. Eyes in male divisible into upper blackish grey and lower darker, meet on dorsum. Forewing 7 mm., translucent, speckled, faintly milky in outer fifth of costal and subcostal area. Cross veins are numerous, well spread. MP_2 is independent of MP_1 at base in which this genus differs from other Leptophlebiids as they have either cross vein connecting them or they directly meet to form fork. Hindwing minute ovoid, translucent, without pigmentation, costal projection well developed acute. Radial branch well developed, outerfork absent, cross vein few. Tarsus 5 jointed, fore claw apically hooked, others obtuse pad like. Genital forcep 3 segmented, 9 sternum of female deeply cleft. 7 stermite only slightly elongated to cover oviduct opening.

Indialis Peters and Edmunds (1970) is endemic to India with two species *I. badia* Peters and Edmunds and *I. rossi* Peters of which former genotype. This genus is distinguishable from allied genus *Thraulus* in veins Rs and MP of forewing being forked about equidistant from base to margin in contrast to Rs forked at 1/4 and MP at 1/2. Fork of MP are symmetrical rather asymmetrical. In larval stage two are distinguished by Gills 1-7 alike, slender, branched tracheae in contrast to gill 1 with dorsal lanceolate and ventral ovate with fringed margin and 2-7 with both parts ovate with fringed margin. Posterolateral spines are present on 5-9 in contrast to 7-9.

Two Indian representative of the genus are distinguished by following contrasting characters. *I. badia* is known only by its imago which is 4.5 mm. long, brown while that of *I. rossi* has longer body 7.1 mm, with different shade of brown. Eyes in male are divisible in both but in former two eyes meet on dorsum but in latter species separated by a gap equivalent to diameter of one eye. Fore wing in former is 5.8 mm., hayline except brown at base, venation light brown, cubito - anal area normal, cross vein few with extra pigmentation. Latter species in contrast has fore wing 6.5 mm. ; hayline except yellowish brown at base, apically 1/4 cells at costa and subcosta are translucent, cubitoanal area relatively broad, cross veins many, well spread with additional zone of yellowish brown pigmentation. Hind wing in both are small, oval but costal projection in former is well developed-acute, 2 intercalary between fork of Rs while in latter species costal projection is well developed-rounded, 1 intercalary between fork of Rs. Genital forcep in both are three segmented but in former penes lobes are seprate all along with slightly expanded apical lobe while in latter penes lobes closely apposed all along with apical expansion.

Larva of only *I. badia* is known. It has following main features : Small sized, broad bodied, dorsoventrally flattened body-specially in the region of head and thorax, brown but *sutures* and stermites paler. Head is prognathus slightly broader than long. Labrum with dorsal hair and 5 denticles on anteriormedian border. Mandible with 5-6 digital process at its molar surface. Maxillae triangular, 3 segmented and large, tooth like projection on inner margin. Eyes large, rounded, seperated by half diameter of one eye. Antennae twice longer than head. Apex of claw hooked apically and denticles on inner side. Progressively larger postero-lateral spines on 5-9. Seven pairs of gills on 1-7, tracheation black, branched.

Isca Gillies (1951) is represented in our country by a single species under subgenus *Isca* Gillies, namely *I. (I) purpurea* Gillies. It has been described from two mountaneous stream at an altitude of Ca. 1350 meters from HongKong. Within our limits, it has also been recorded from a mountain stream at Mirik (West Bengal) at 2200 meters. This species is characterized by following features Body 4.5 - 5 mm. long dark brown. Eyes divisible into upper orange brown, lower dark purple, on a longer stalk, facets very large, dorsaly eyes closely placed. Only one pair of wing present, translucent, pinikish-brown, darker pigmentation in costa 1 and subcostal areas. Cross veins few, fine or absent. MA forked symmetrically at half distance from base to margin. Cubitoanal area poorly developed. Hind margin with fringe of fine hairs. Fore leg longest, 1.25 times longer than body, tarsus 5 segmented, fore claws apically hooked others obtuse pad-like. Genital forcep 3 segmented, penes basaly contiguous but not fused, then diverging and incurving at apex, 5-6 divides on inner apical end of penes lobes. In female 9 tergite deeply cleft forming bilobed sub-anal plate.

Its larva is prognathus, antennae 2.5 times longer than head. Claws of leg similar, apically hooked, row of denticles on inner side, apical most longest. Seven pairs of gills ventrally on 2-8, 1-6 divided into two slender lamellae with simply unbranched tracheae, 7 unbranched. Abdominal tergites expanded and curved ventraly covering part of sternites. Progressively longer posteriolateral spines on 7-9

In absence of hindwing this genus agrees with other two Leptophbiids from South India namely *Notophlebia* Peters and Edmunds and *Nathanella* Demoulin. From former it is differentiated by the absence of enlargment of fore wing posteriorly in the anal area and shape of penes with apical denticles instead of straight pointed penes without apical denticle but finely serreated on either sides. From latter it differs in tubular penes closely placed at basal half and separated at apex without denticles and spines. *Isca* is also relatively smaller in body length as well, ranging between 2.2-5 mm. whereas both *Nathanella* and *Notophlebia* range around 7.5 mm.

Nathanella Demoulin (1955) was errected to accommodate single species from Palney and Annamali Hills, Tamilnadu at an altitude of Ca. 1200-2200 meters inhabiting mountaneous stream . This monotypic genus is endemic to India and is known by its male imago, female is yet to be discovered. Its larva was subsequently described by Peters and Edmunds (1970) by association of developing wing pad and nymphal genitalia. It is characterized by following points : Body 7.5-8 mm. brown. Eyes blackish brown, large occupying 3/5 of head, divisible, closely approximated dorsally. Fore leg longest, equal to body. Only forewing is present in which it agrees with two other Leptophebiid genera *Notophlebia* and

Isca. It also shares former in having few but evenly distributed cross veins. It is distinguishable from these genera in points discussed in previous genus. Forewing 8 mm., hayline, clourless, venation brown, pterostigma dark, cross veins few in apical area, 5 before bulla and 11 beyond, the MP_2 and MP_1 connected by a cross vein Rs forked at 1/4 and distance from base to margin forks symmetrical. Genitalia brown, gonobase trapezeform, 3 segmented genital forcep, penes tubular, closely approximated at basal half, separated and diverging at apex.

Its larva has prognathus head, antennae twice the maximum length of head. Thorax beset with long hairs. Claws all similar, narrow, hook shaped, one enlarged apical denticles with row of smaller denticles. Abdomen beset with long hairs. Posterio-lateral spines are on 7-9, last longest. Gills 1-6, plate like, each with equal sized, shaped lamellae, tracheation branched. Its larva has similarity with that of *Choroterpids* but are distinguishable by the shape of outer margin, presence of hairs on mandibles and prominently large apical denticle to the claws.

Notophlebia Peters and Edmunds (1970) was errected to accommodate single species from Kunjan Khuzi (Tamil Nadu) at an lower altitude of Ca 120 meters. This monotypic genus is also endemic to India and is known only by its male imago. Peters and Edmunds had put it alongwith Nath*anella* and *Isca* in one evolutionary line. All these are restricted to oriental region. Besides disposition of cross veins, the enlargement of fore wing posteriorly and straight tubular, apically pointed penes distinguishes it from other two genera of the evolutionary complex. Other salient points are as follows : Body 7.5 mm., chestnut brown. Eye divisible in upper chestnut brown, lower 3/4 smaller, black, on a short stalk, meets dorsaly. Thorax chestnut brown. Fore claws apically hooked, other obtuse, pad like. Only fore wing present, 8 mm., hayline, colourless except brown basal half of Sc. Membrane of anal area enlarged posteriorly. Cross veins few evenly spaced. Rs forked at 1/6 and MA at 1/2 from base, fork symmetrical MP_2 and MP_1 attached by a cross vein at 1/4 from base to margin. Genital forcep pale, 3 segmented. Penes brown, separated all along, apex sharply pointed, finely serrated.

Thraulodes Ulmer (1920) is yet another genus represented in our country by a single species, namely *T marhieus* Dubey (1970) It has been recorded from a high altitude Ca 3880 m. in lotic ecosystem at Marhi, Pir Panjal range, Himachal Pradesh. It is known only by female imago and is not only sole representative of the genus in India but also neighbouring countries in the subcontinent. It is distinguishable from its counter parts occurring in Palearctic zone in antennae and head are lengthwise related as 40: 5, hind wing being 3/4 as long as wide and tarsus and tibia of fore leg are length wise related as 3 : 4.

The other salient points of it are as follows : body 9.5 mm.,head, thorax dark brown, abdomen yellowish brown. Eyes simple separated dorsaly by gap equivalent to three times diameter of an eye. Fore leg longest, tarsus 5 segmented, claws disimilar. Forewing 12 mm., hayline, veins dark brown, 10 cross veins in stigmatic area, other cross veins many, well spread. A_1 and A_2 separated at base, no free intercalary between Cu_2 and A_1 and between long intercalary and Cu_2 Hindwing 4 mm. hayline, almost globular, M forked, costal process obtuse i11 developed, cross veins well spread. Ovipositor 2 segmented, simple minute yellowish.

Thraulus Eaton (1881) is also represented within our limits by only *T. semicastaneus* (Gillies, 1951). This is known to inhabit riverine ecosystem (Mutha) at relatively low altitude at Poona (Maharashtra). The genus was established for European species *T. Bellus* Eaton. Its nearest genus is *Simothraulus* Ulmer, which has no representative in India and is restricted to Borneo, from which it is differentiated in more acute well developed costal spur of hindwing and unserrated penes.

Indian species was originally placed under *Habrophlebiodes* as *H. semicastanea* Gillies. Peters, Gillies and Edmunds (1964) put it under *Masharikella* was synonomised to *Thraulus*. Our species is known only by male imago which is characterised by following salient features : Body 5-6 mm., chestnut brown-darkened at head, thorax. Eyes divisible into upper buff, broad, flat part and lower small, black part. Tarsus 5 jointed. Forewing 5.5 mm., translucent colourless, main veins amber. Stigmatic area with 9-11 simple sinuous veinlets, other veins numerous, very fine, quite well spread except cubito-anal area. Rs forked at 1/4, MA at 1/2, fork symmetrical, MP forked at 1/3-1/4 assymetrical branch. 2 intercalary in cubital area. Hindwing 1/4-1/5 of forewing in length. Costal projection well developed, located at 3/4 distane from base to apex, subcosta upturned, 2 intercalary in cubital area. Cross weins 3- one in middle and two at the level of costal projection. Genital forcep 3-segmented basal longest with inner bend and fringe of hairs. Penes lobes closely placed all along, apex slightly thickened with minute terminal hook.

ENDEMISM AND HIGH ALTITUDE REPRESENTATION

In our faunal component of mayflies, it is evident from above, that all genera and species of Indian Leptophlebiids except *Isca* Gillies are endemic. Last named genus has one Indian representative under subgenus *Isca* Gillies namely *Isca* (*Isca*) *purpurea* Gillies which was originaly described occurring in Hong Kong with extended distribution in West Bengal, within our limits. There is only one other species of *Isca* occurring in Sri Lanka, among the adjacent countries in Indian subcontinent. This species is under subgenus *Tanycola* Peters and Edmunds (1970) namely *Isca* (*Tanycola*) *serendiba* Peters and Edmunds. Thus within family endemism is 90% (9 : 1). This endemism in our mayflies as whole is 5 : 1, 75 species out of total 90 species while in other of major families like *Baetidae* this proportion is 29 species out of 35, *Heptgeniidae* 12 out of 13, *Ephemeridae* 10 out of 14. *Ephemerellidae* has all 3 endemic, while *Palingeniidae* and *Polymitareyidae* each has one out of 3 endemic. *Euthyplocidae*, *Potamanthidae*, *Prosopistomatidae*, *Siphlonuridae* each are represented by lobe species endemic to our limits. 1/5 or 18 species of our mayflies are known to leave extended distribution in orient, while one among these *viz.*, *Cloeon inscriptum* Bengtsson (Baetidae) has extended distribution even beyond orient into Europe.

High altitude representation of Indian *Leptophebiids* is by 2 species beyond 3000 meterm another 3 species occurring in range of 1200-2200 meters. Thus 50% are high altitude inhabitants and all of these occupy different niches in lotic ecosystem of river, streams etc. Srivastava (1979) has indicated that 1/3 or 31 : 90 of Indian mayflies are high altitude inhabitants mostly occurring between 3000-4000meters, though a few occur in transitory altitude of 2000-3000 meters inhabiting torrential streams of Himalayan mountain range. Highest altitudinal record, however, within our mayflies is that of *Ororotsia*

hutchinsoni Traver 1939 (Heptageniidae) recorded occurring at 5927 meters.

Key to Indian species of LEPTOPHLEBIIDAE

1. Hind wing present 2
- Hind wing absent..... 11

2. Costal process to hind wing absent..... 3
- Costal process to hind wing present..... 4

3. 10-12 cross veins to stigmatic area, many cross veins, well spread in fore wing, costal side of hindwing outwardly arched..... *Atalophlebia* (*A.. chialhnia*)

4. Costal projection of hind well developed, either acute of rounded..... 5

- Costal projection in hindwing present but not well developed, only slightly bulging outwards..... 10

5. Costal process to hindwing acute..... 6
- Costal process to hind obtusly rounded..... 9

6. Eyes in male divisible, both eyes meeting on dorsum..... 7
- Eyes in male divisible but both eyes are not meeting on dorsum. Body 5-6 mm, Forewing 5.5 mm, translucent, stigmatic are with 9-11 sinuous crossveins, 2 intercalary in cubital area. Penes lobes closely placed all along its length, apex slightly thickened with minute terminal hook..... *Thraulus* (*T. semicastaneous*)

7. Penes lobes well separated all along its length, not recurved but slightly expanded at apex, body 4.5 mm brown. Fore wing 5.8 mm., hayline except brown at base, veins light brown, cross veins few, RS forked with two intercalary ..... *Indialis* (*I. badia*)
- Penes lobes contiguous at base but seprated at apical part 8

8. Penes lobes recurved at apical half to form acute lateral angle, body 6 mm., white. Forewing 7 mm., translucent, venation amber, cross veins numerous well spread, 3 costal vein before bulla..... *Gilliesia* (*G. hindustanica*)

- Penes not recurved at apical half but straight, body 4-4.5 mm., brown. Forewing 4.5 mm., colourless hayline, cross veins few mostly in costo-apical portion of wing. No costal vein before bulla ..... Choroterpes*(Choroterpes (C) parvula)*

9. Body 7.1 mm.brown, Forewing 7 mm., veins yellowish cross veins sorrounded by yellowish brown pigments, cubito-anal area relatively broad, penes lobes closely apposed all along, apical lobes slightly expanded, Rs forked with only one intercalary ..... *Indialis (crossi)*

10. Body 9.5 mm., yellowish-dark brown. Forewing 12 mm., hayline, veins dark brown 10 cross veins in stigmatic area, cross veins many, well spread. No free intercalary between Cu2-A1 and between long intercalary and Cu2. Hindwing 4 mm., almost globular, M forked, cross veins well spread..... *Thraulodes* (*T marhieus*)

11. Vein MP2 attached to MP1 by a cross vein .....12.
- Vein MP2 attached to MP1 directly to form a fork, hairs present on the posterior margin of forewing, abdominal terga extended around venter of abdomen, prominently so on segment 7.....*Isca purpurea*

12. Claws of pair alike-each apically hooked with an aposing subapical hook, penelobes closely apposed at basal half, diverging at apex not specially pointed or serrated.....*Nathanella indica*
- Claws of pair disimilar-one apically hooked other obtuse pad like. Penes lobes well separated , apex pointed and finely serrated.....*Notophlebia hyalina*

SUMMARY

A detailed taxonomic status and salient features of Leptophlebiidae with special reference to the Indian forms comprising of 10 species under 9 genera has been presented. A key to species has also been provided. Endemic component has been shown to be 9 : 1 within family which is 5 : 1 in all our mayflies. Half of the Indian Leptophlebiid are high altitude dweller, 2 species beyond 3000 m. and another 3 species in the range of 1200-2200 meters.

ACKNOWLEDGEMENTS

Author is highly thankful to the Director, Zoological Survey of India, Calcutta for constant encouragement and facilities to bring out this work.

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For sake of brevity only relevant references are indicated, hereunder and all references mentioned can be found in Hubbard and Peter's catalogue of the Ephemeroptera of Indian subregion (1978, *Oriental Insects*, supplement, No. 9 pp. 43).

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Table I. Qualitative composition of Indian Ephemeroptera.

Families	India		World		High Altitude			Distribution	
	G	S	G	S	G	S	ES	O	EO
Ametropodidae			1	4					
Baetidae	6	35	17	519	3	15	29	5	1
Baetiscidae			1	12					
Behningiidae			3	5					
Caenidae	1	5	6	81	1	1	4	1	
Ephemerellidae	2	3	7	120	1	2	3		
Ephemeridae	2	14	8	99	1	4	9	5	
Euthyplociidae	1	1	7	12			1		
Heptageniidae	7	13	28	378	6	8	12	1	
Leptophlebiidae	9	10	62	377	2	2	9	1	
Metrotropidae			2	7					
Neoephemeridae			2	8					
Oligoneurillidae			9	49					
Palingeniidae	1	3	6	31			1	2	
Polymitarcyidae	2	3	6	70			1	2	
Potamanthidae	1	1	7	27			1		
Prosopistomatidae	1	1	1	11			1		
Siphlanigmatidae			1	1					
Siphlonuridae	1	1	26	163	1	1	1		
Tricorythidae			13	122					
Total	34	90	213	2146	15	33	72	17	1

EO = Extra Oriental, ES=Endemic Species, G=Genera, O=Oriental S=Species

Table II. FAUNAL COMPONENT OF INDIAN LEPTOPHLEBIIDAE

GENERA	SPECIES	M	F	L	DISTRIBUTION ENDEMIC(E) ORIENTAL(O)	REMARKS
Atalophlebia	chialhnia Dubey	-	+		H. P. (R. Alhni) (E)	3200M
Choroterpes	(euthraulus) harva (Gillies)	+	+	-	M. P. (R. Sonar Br.) (E)	
Gilliesia	Hindustanica(Gillies)	+	+	-	W. B. (Mirik) Assam (E)	210-1800M
Indialis	badia P. & E.	+	-	+	Kerala(Erumels Korattye.) Andhra P. (Kabkam Thannur Pandal r.) (E)	
	Rosi Peters	+			Kerala(Kittikanam) (E)	
Isca	isca Purpurea Gillies	+	+	-	W. B. (Mirik) ; Hongkong (O)	1350M
Nathanella	indica Demolin	+	-	-	Tamil Nadu (Kodai Kanal	1200M
					Palney Hills) (E)	2200M
Notophlebia	hylina P. & E.	+		-	Tamil Nadu(Khujankhuzi) (E)	120M
Thraulodes	marhiens Dubey		+		H. P.(Near Marhi) (E)	3880M
Thraulus	semicastaneous(Gillies)	+			Maharastra(R. Mutha, Poona) (E)	

M= Male; F= Female; L= Larva.