

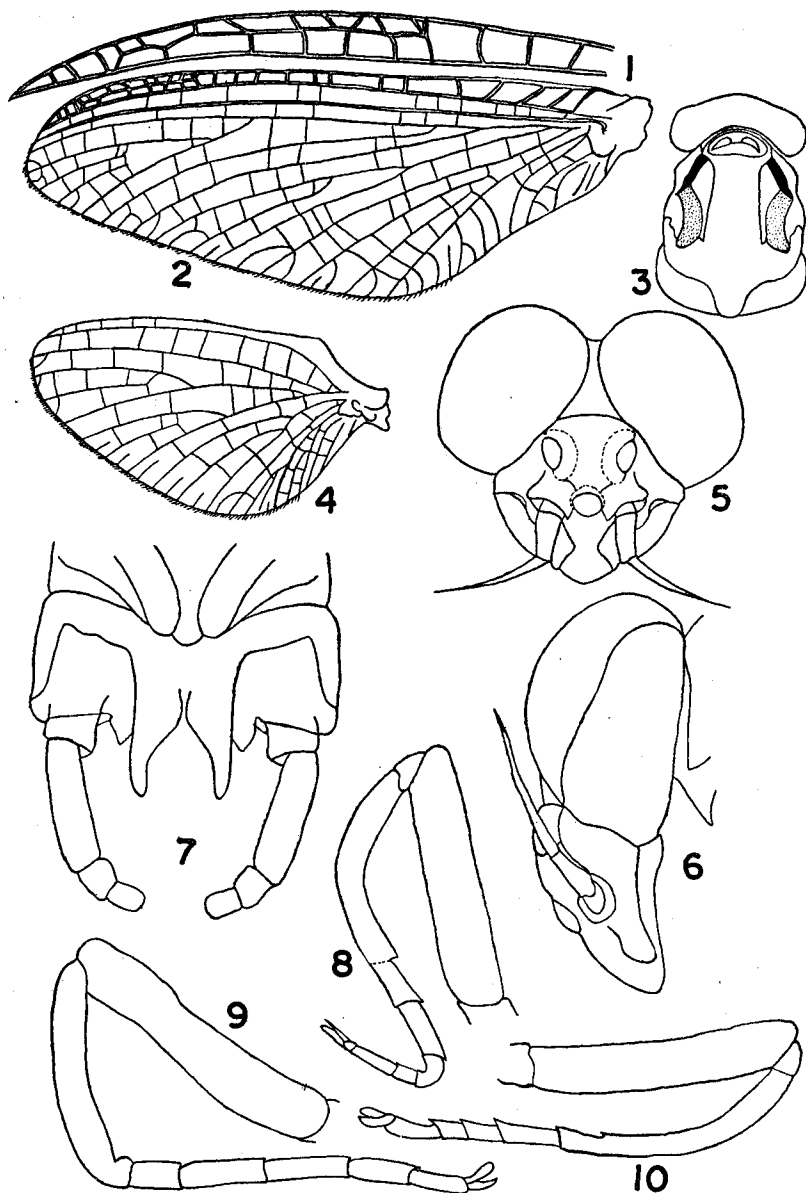
TORRENTICOLE INSECTS OF THE HIMALAYA*VI. DESCRIPTIONS OF NINE NEW SPECIES OF EPHEMERIDA
FROM THE NORTHWEST HIMALAYA****By O. P. Dubey***School of Entomolgy, St. John's College,
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ABSTRACT. This paper contains descriptions of eight new species of Ephemerida, viz., *Ichthybotus dodecus*, *Atalophlebia chialhnia*, *Baetis acuticostalis*, *Baetis solangensis*, *Baetis septemmenes*, *Heptazinia solangensis*, *Afronurus solangensis* and *Afronurus curtus*, collected in the course of the ecological survey of the torrential stream communities in the upper Beas Basin, in the Northwest Himalaya, during 1970-1971. One new species *Ephemerella pramodi* from Nepal is also described. The types of the new forms described here are retained in the School of Entomology, pending deposition in the Zoological Survey of India, Calcutta.

FAMILY EPHEMERIDAE**1. *Ichthybotus dodecus*, sp. nov. (Figs. 1-22)**

Male Imago : Length, excluding cerci and terminal filaments, 13 mm. Head (Fig. 5-6) black, viewed from above transverse, height to width 1 : 1.3, turban eyes yellowish-brown, viewed in front oval, height to width 1 : 0.7 ; viewed from the side ventral eyes black, nearly as large as the dorsal eyes. Ocelli white, arranged in a triangle, slightly elevated, the lateral ocellar space twice the ocellar diameter. Labrum brownish-grey. Antennae basally pale brown, terminal segment dark brown ; length of antennae to head length 3 : 4 ; three-segmented ; the first segment shortest, slightly thicker than long ; second segment cylindrical, wider basally and slightly narrowed apically, nearly 3.75 times the first ; third segment slender, a little less than thrice the second. Thorax (Fig. 3) yellowish-brown, 0.7 times longer than wide, pronotum nearly as wide as long, mesonotum long about one and half times as long as wide, yellowish-brown except for a rectangular transverse brown spot anteriorly and sub-triangular brown spot laterally. Scutellum white, short and broadly rounded. Fore wing (Fig. 2) 9 mm long and 4 mm wide, translucent grey with fringed margin, transversely marked brownish-black along the cross-veins, venation pale brown, costal process subacute, costal and subcostal veins stout, stigmatic area (Fig. 1) with the cross-veins $3+9/7+3$, Cu_1 and A_1 of fore wing diverging very strongly at base as in figure. Hind wing (Fig. 4) 3 mm long and

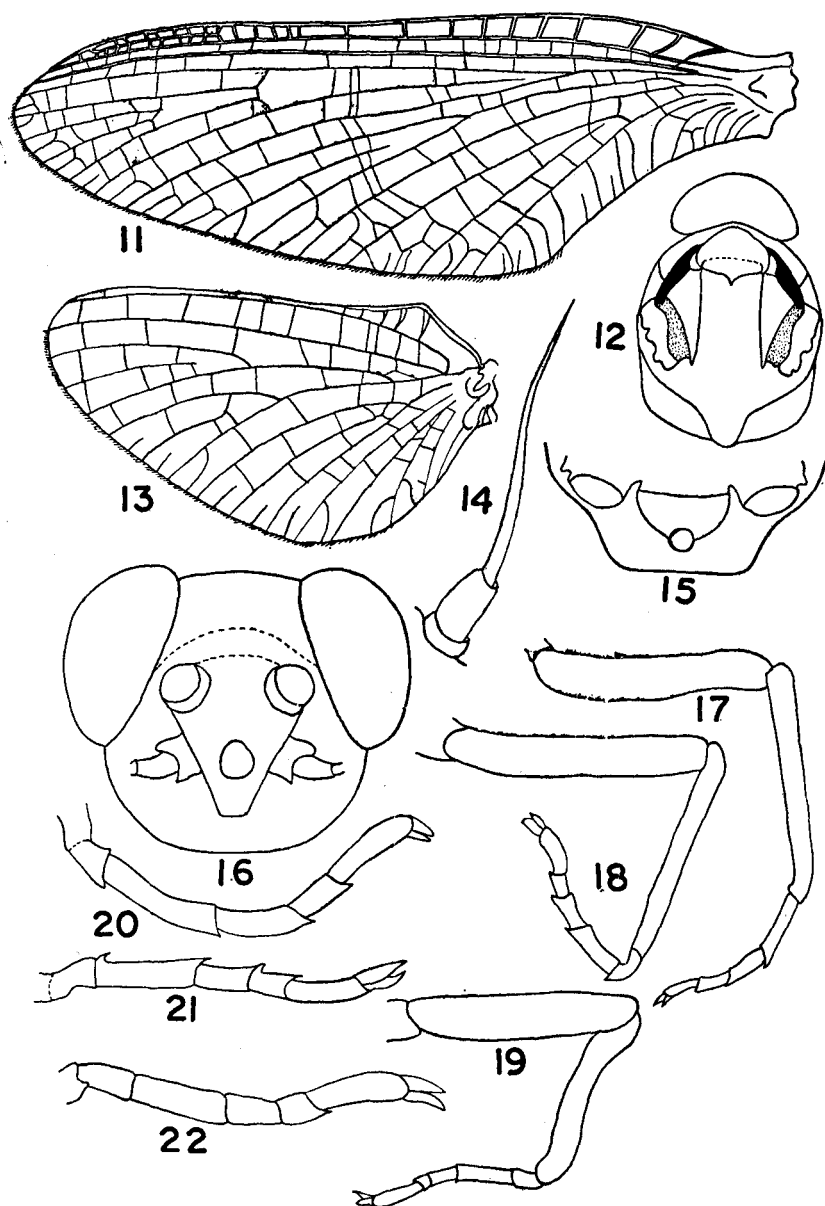
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Figs. 1-10. *Ichthybotus dodecus*, sp. nov., ♂ : 1, stigmatic area ; 2, fore wing ; 3, thorax ; 4, hind wing ; 5, head (front view) ; 6, head (lateral view) ; 7, gonostyle ; 8, middle leg ; 9, fore leg ; 10, hind leg.

2 mm wide, fringed margin translucent with transverse blackish-brown patches along the cross-veins, veins pale brown, no intercalaries in apical region, three free intercalaries in the posterior region. Legs yellowish-brown. Fore leg (Fig. 9) longest, 0.4 times the body ; fore femur moderately stout, tibia slender, 0.8 times the femur, tarsus 1.3 of the tibia, first segment immovably jointed with tibia, 0.6 times the second, the second and third segments subequal, fourth segment 0.7 times the third, fifth segment slightly shorter than the fourth, inner claw hooked and outer claw blunt. Middle femur (Fig. 8) moderately stout, tibia slender, subequal to the femur ; tarsus subequal to the tibia, first segment immovably jointed with tibia, and 0.75 times the second segment ; the second segment 1.6 times the third, fourth segment 0.6 times the third and half the fifth, fifth segment subequal to first ; claw bifid, outer blunt, and inner hooked. Hind femur (Fig. 10) moderately stout, tibia slender, subequal to the femur, tarsus subequal to the tibia, first segment immovably jointed with tibia, and 0.75 times the second segment ; second segment 1.8 times the third ; third segment 1.5 times the fourth ; fourth segment 0.4 times the fifth ; fifth segment slightly longer than the first. Abdomen about 0.8 times the body, uniformly yellowish-brown with irregular coalescent spots laterally, postero-laterally, posteriorly and in the middle of each tergite wholly dark brown ; abdomen as a whole darker apically than basally, terminal filaments two, deep dark brown and 8 mm in length. Gonostyle (Fig. 7) yellowish-white, forceps four-segmented, basal segment shortest, almost twice as thick as long, second segment nearly six times the first, third segment 0.23 times the second and slightly longer than first, terminal segment obtusely rounded and larger than the third segment. Forceps attached to a broad quadrangular plate, which is longer than the basal segment of the forceps ; two sclerotized penes from the antero-dorsal border of the sub-genital plate close to each other, with mesial margin curved and elongated ; titilators two as in figure.

Female Imago : Length, excluding cerci and terminal filament, 15 mm ; Head (Fig. 16) pale grey, viewed in front broadly oval, height to width 1 : 1.2, eyes black, oval ; ocelli white, slightly elevated, the lateral ocellar space twice the ocellar diameter. Labrum brownish-grey. Antennae (Fig. 14) basally brown, terminal segment dark brown ; length of antennae to head length 0.7 : 1 ; three-segmented, the first segment shortest, nearly three times thicker than long, second segment cylindrical, wider basally and slightly narrowed apically, nearly five times the first, third segment slender, 4.25 times the second. Thorax (Fig. 12) yellowish-brown, slightly longer than wide, mesonotum yellowish-brown except for a rectangular tranverse brown spot anteriorly, subtriangular dark brown spot laterally, scutellum white, short and broadly rounded. Metanotum greyish-brown. Fore wing (Fig. 11) 12 mm long and 4 mm wide, costal and subcostal veins slightly stout, stigmatic area with the cross-veins $5+9/10+1$, Cu_1 and A_1 of fore wing diverging very strongly at base as in figure. Hind wing (Fig. 13) 5 mm long and 3 mm wide, margin



Figs. 11-22. *Ichthybotus dodecus*, sp. nov., ♀ : 11, fore wing ; 12, thorax ; 13, hind wing ; 14, antenna ; 15, ovipositor ; 16, head ; 17, fore leg ; 18, middle leg ; 19, hind leg ; 20, fore tarsus ; 21, middle tarsus ; 22, hind tarsus.

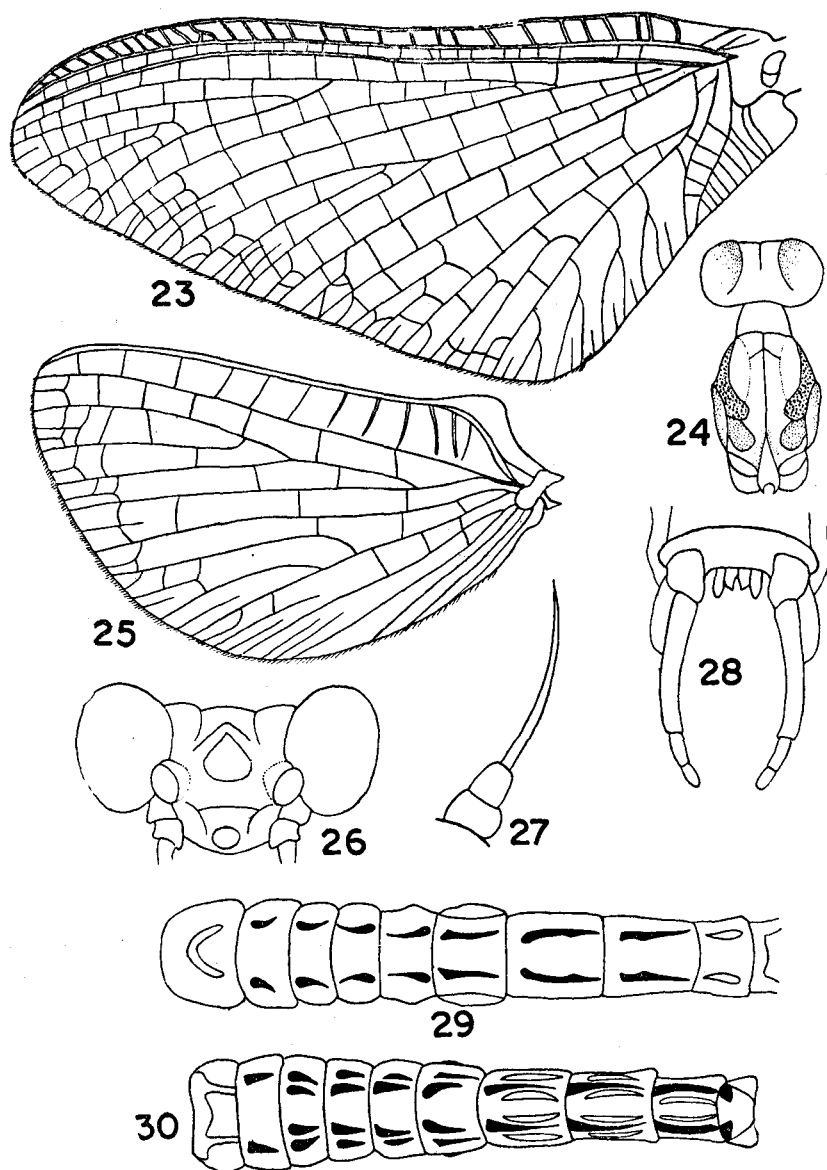
fringed, short blackish-brown patches along the cross-veins, veins pale brown; five free intercalaries present in the posterior region, otherwise as in male. Legs in general brownish-yellow, fore leg (Fig. 17) 0.4 times the body, fore femur moderately stout, tibia slender, subequal to the femur; tarsus (Fig. 20) 0.9 times the tibia, the first 0.3 times the second, the second 3.6 times the first, the third 0.6 times the second, the fourth segment 0.6 times the third, the fifth segment a little less than twice the fourth and 2.7 times the first. Middle femur (Fig. 18) moderately stout, tibia 0.8 times the femur, tarsus (Fig. 21) 0.8 times the tibia, the first segment 0.6 times the second segment, third segment 0.7 times the second, fourth segment 0.7 times the third, fifth segment twice the fourth and a little shorter than the second. Hind femur (Fig. 19) stout, tibia slender, subequal to the femur, tarsus (Fig. 22) 0.8 times the tibia, the first segment about 0.6 times the second, second segment twice the third, the third segment twice the fourth segment, fourth segment about 0.3 times the fifth, and subequal to the second. Abdomen 0.6 times the body, uniformly yellowish-brown with irregular coalescent dark brownish markings laterally and posteriorly, tergites as a whole darker apically than basally; terminal filaments two, deep dark brown, incomplete in the specimen. Ovipositor (Fig. 15) pale yellow, two segmented, the first segment wider basally than apically, nearly thrice as long as wide, second segment rounded, 0.5 times the first segment.

Holotype 1 ♂ in spirit, *allotype* 1 ♀ in spirit, *paratypes* 2 ♂♂ in spirit and on slide, Northwest Himalaya: St. 12, Right bank Manalsu Nullah, southern slope of the Pir Panjal Range, 1900 m above mean sea level, Coll. O. P. Dubey, 5.vi.70.

This is the first record of the genus *Ichthybotus* Etn. from India.

2. *Ephemera pramodi*, sp. nov. (Figs. 23-44)

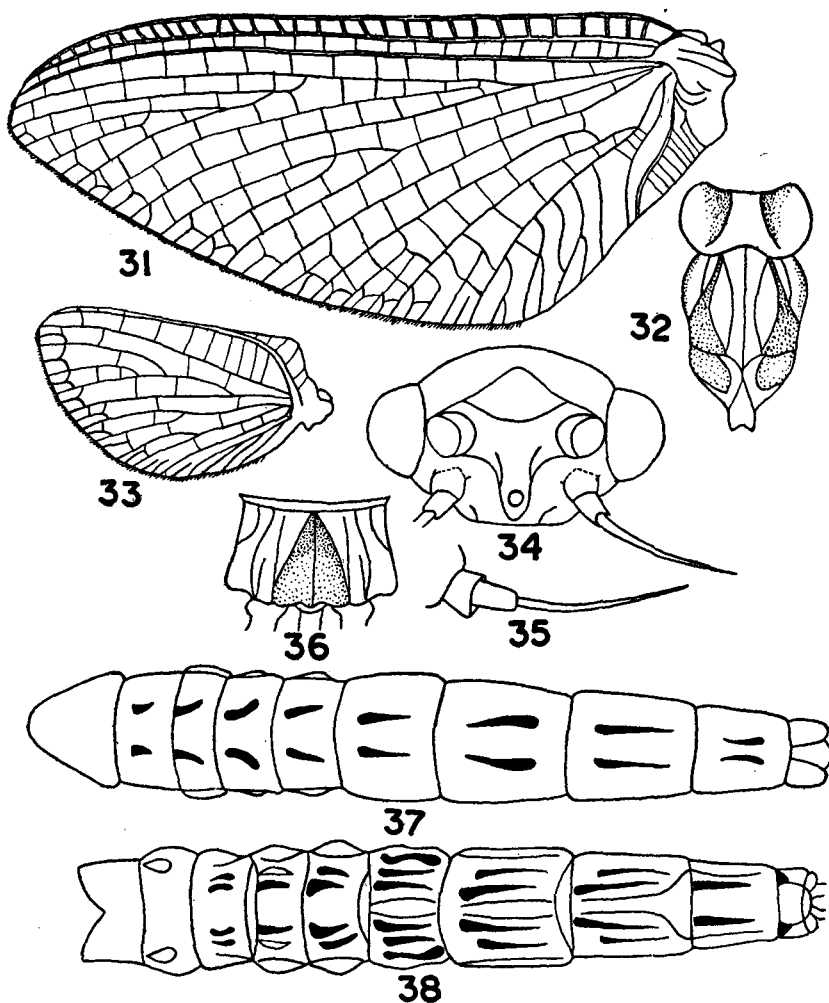
Male Imago: Excluding cerci and terminal filament, 14 mm; general colour pale yellowish-brown. Head (Fig. 26) pale yellowish-brown, when viewed in front transversely rectangular, height to width in the ratio of 1:2, turban eyes absent, dorsal eyes pale yellow, one-third the ventral eyes, the latter greyish-black, thrice the dorsal eyes when viewed dorsally; ocelli white with black base, lateral interocellar space nearly 3.6 times the ocellar diameter. Antennae (Fig. 27) three segmented, the first segment stout, about 1.6 times as thick as long, pale brown; second segment stout, a little longer than thick and more slender than the first, pale brown, and a little longer than the first; the third segment slender, a little less than five times the second, brown. Thorax (Fig. 24) yellowish-brown, except for two dark brown lateral longitudinally moderately wide stripes; pronotum twice as wide as long, mesonotum two and half times as long as pronotum; scutellum truncated apically, pale white, rest as in figure. Fore wing (Fig. 23) 10 mm long and 5 mm wide, brown,



Figs. 23-30. *Ephemera pramodi*, sp. nov., ♂ : 23, fore wing ; 24, thorax ; 25, hind wing ; 26, head ; 27, antenna ; 28, gonostyle ; 29, abdomen (dorsal view) ; 30, abdomen (ventral view).

subhyaline, venation dark brown, stigmatic area with sixteen cross-veins, an obscure dark brown minute spot at the fork of M_1-M_2 ; A_3 not forked, but united with margin of the wing by about ten cross-veins, no free intercalaries in the apical region of the wing but in the anal area six free intercalaries present. Hind wing (Fig. 25) 4 mm long and 2.5 mm wide, somewhat paler than fore wing, subhyaline, with costal process obtuse, veins brown, the inner sectoral fork ($R_2 + R_4$) 1.8 times its stem. Fore legs (Fig. 42) longest, dark brown, 0.4 times the body, femur moderately stout, tibia slightly more slender, nearly 1.6 times the femur, tarsus about 0.6 times the tibia, the tip conspicuously constricted indicating the immovable true first tarsal segment; the first tarsal segment 1.2 times the second, the second segment nearly 1.3 the times the third, third and fourth segments subequal, fourth segment 0.6 times the first, claw one blunt and other acute. Middle leg (Fig. 43) shortest, femur moderately stout, tibia distinctly more slender, 1.5 times the femur; tarsus nearly 0.4 times the tibia, first and second tarsal segments subequal, third segment half the second, fourth segment about half the length of the tarsus and six times the third and 2.4 times the first, claw blunt. Hind leg (Fig. 44) longer, femur slightly stouter than the middle femur, tibia slender, 1.25 times the femur, tarsus about 0.3 times the tibia, first, second and third tarsal segments subequal, short, fourth segment subequal to the three preceding segments combined, claw blunt. Abdomen a little more than 0.6 times the body, yellowish-brown, with paired longitudinal stripes on either side on tergites third, fourth, fifth and sixth as in Fig. 29; the first tergite marked as in figure; second tergite with only single stripe on either side; seventh and eighth tergite with three stripes on either side of which the middle one is longer; ninth tergite with one outer longer and one inner slightly shorter stripe on either side, ventrally first segment with a crescentic marking, the remaining segment with one marking on either side as in Fig. 30. Caudal filaments three, as long as body, pale brown. Gonostyles (Fig. 28) pale brown, basal segment 1.2 times as long as thick, second segment almost thrice the basal segment, but more slender, third segment 0.25 times the second, fourth segment shortest nearly 0.7 times the third and half the basal segment. Penes rod-like, separated near base, almost parallel with a long stout process on inner margin of each penis.

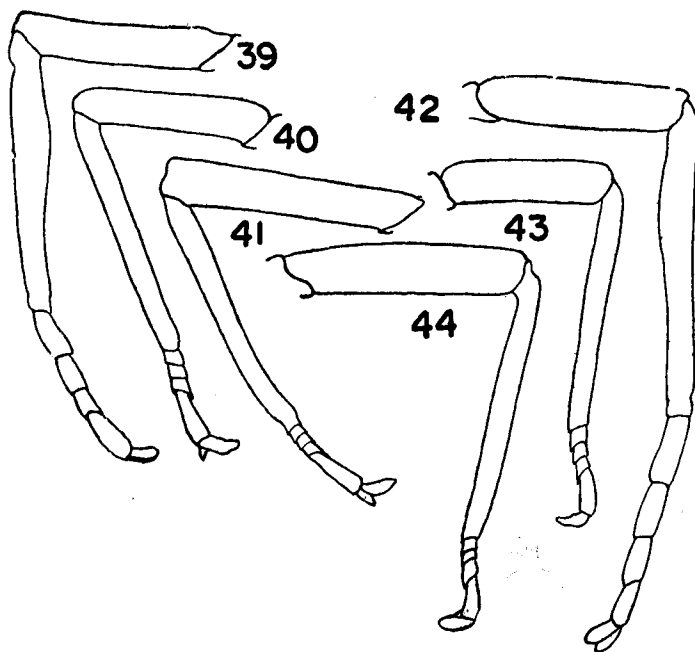
Female Imago : Length, excluding caudal filament, 15 mm; general colour of the body yellowish-brown. Head (Fig. 34) viewed in front broadly oval, width to height in the ratio of 5 : 3, eyes greyish-black, oval; ocelli white, elevated, lateral interocellar space a little more than three times the ocellar diameter. Colour of antennae (Fig. 35) as in male, antennal length to head length subequal, three segmented, the first segment stout, a little less than twice as long as thick, with a narrow longitudinal dark brown stripe ventrally, second segment cylindrical, a little less than twice the first and about twice as long as thick, third segment about 3.6 times the second. Thorax (Fig. 32) as in male. Fore wing (Fig. 31) 13 mm long and 5.5 mm wide, colour and



Figs. 31-38. *Ephemera pramodi*, sp. nov., ♀ : 31, fore wing; 32, thorax; 33, hind wing; 34, head; 35, antenna; 36, ovipositor; 37, abdomen (dorsal view); 38, abdomen (ventral view).

venation as in male. Hind wing (Fig. 33) 4 mm long and 2 mm wide, the inner sectoral fork ($R_2 + R_4$) 2.75 times its stem. Fore legs (Fig. 39) longest, dark brown, nearly 0.3 times the body, femur moderately stout, tibia slender, about 1.3 times the femur; tarsus 0.6 times the tibia, the first segment 1.3 times the second, the second segment 1.4 times the third, the fourth segment a little longer than twice the third and also a little longer than the first, claws blunt. Middle legs (Fig. 40) shortest, pale brown,

femur moderately stout; tibia slender, about 1.3 times the femur; tarsus about 0.4 times the tibia, the first, the second and the third segments subequal as in male. Hind leg (Fig. 41) shortest, femur moderately stout, tibia slender, about 1.1 times the femur; tarsus 0.3 times the tibia; the first, second and third segments subequal, fourth segment five times the third. Abdomen (Figs. 37-38) 0.7 times the body, yellowish-brown, markings as in male. Caudal filaments three, subequal to the body, pale brown. Ovipositor (Fig. 36) with a median V-shaped cleft on apical margin of subanal plate.

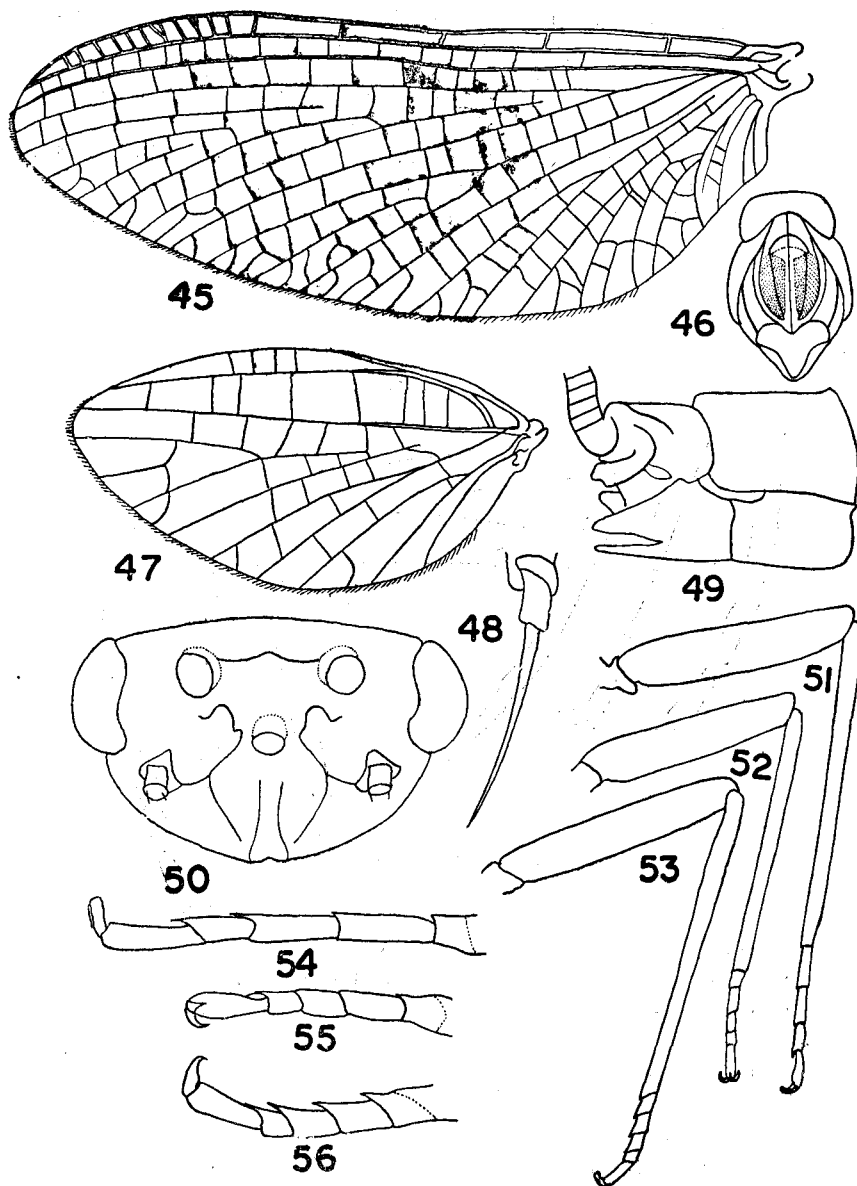


Figs. 39-44. *Ephemer a pramodi*, sp. nov.: 39, ♀ fore leg; 40, ♀ middle leg; 41, ♀ hind leg; 42, ♂ fore leg; 43, ♂ middle leg; 44, ♂ hind leg.

Holotype 1 ♂ in spirit, *allotype* 1 ♀ in spirit, *paratypes* ♂ ♀, in spirit and mounted on slides, NEPAL : Pokhra, 1200 m above mean sea level, Coll. Pramod K. Garg, 22.vi.1970.

This species superficially resembles *Ephemer a annandalei* Chopra*, from which it is readily distinguished by the presence of dark brown colour on the mesonotum and different markings. The markings on the tergites and sternites are very conspicuous and yellowish-brown in colour. The wings

*Hafiz, H.A., 1938, The Indian Ephemeroptera (Mayflies) of the suborder Ephemeroidea. *Rec. Indian Mus.*, 39 : 360-363.



Figs. 45-56. *Atalophlebia chialhnia*, sp. nov., ♀ : 45, fore wing; 46, thorax; 47, hind wing; 48, antenna; 49, ovipositor; 50, head; 51, fore leg; 52, middle leg; 53, hind leg; 54, fore tarsus; 55, middle tarsus; 56, hind tarsus.

subhyaline and dark brown cross-veins, with fewer cross-veins in the stigmatic area of the fore wing. The gonostyle is shorter and proportions of the segments are different. The penes rod-like and pointed towards apex. The legs colour and proportions are altogether different.

FAMILY LEPTOPHLEBIIDAE

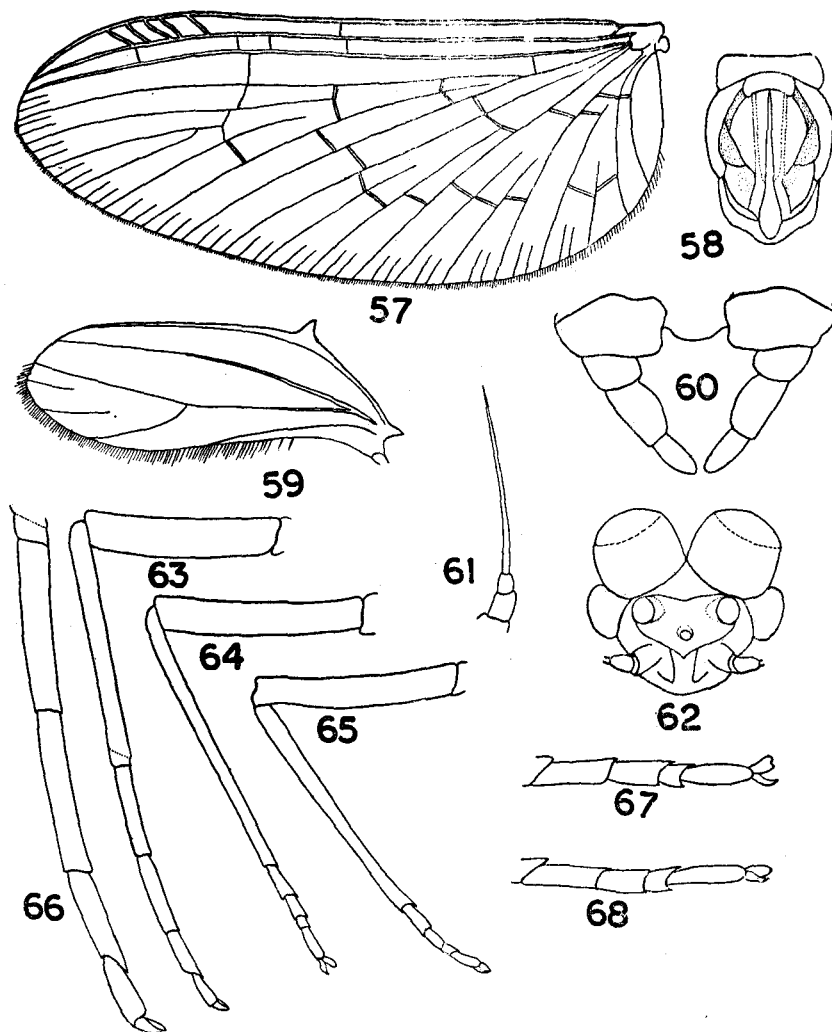
3. *Atalophlebia chialhnia*, sp. nov. (Figs. 45-56)

Female Subimago : Length, excluding caudal cerci and caudal filament, 10 mm. Head (Fig. 50) brown, when viewed in front broadly oval, height to width 1 : 1.3; eyes black, inner orbital border slightly sinuate below, ocelli white, slightly elevated, the lateral interocellar space nearly thrice the ocellar diameter, labrum pale brown. Antennae (Fig. 48) brown, length of antennae to head 3:4, three segmented; the first segment shortest about twice as thick as long, second segment cylindrical, a little longer than the first, and about 0.6 times as long as thick; third segment slender, 4.25 times the second. Thorax (Fig. 46) blackish-brown, slightly less than twice as long as wide, pronotum blackish-brown, twice as wide as long, mesothorax somewhat oval, with one narrow median longitudinal furrow, except for an obscure anterior pale and a postero-lateral apical area largely blackish-brown, scutellum pale brown apically but darker on disc, 0.6 times as wide as long, 0.4 times the mesothorax. Fore wing (Fig. 45) 9 mm in length and 3.5 mm in width, translucent brown, venation pale white; A_1 separated from A_2 at base, A_2 close to A_3 , no free intercalaries between $Cu_2 + A_1$, A_2 is forked. Hind wing (Fig. 47) 2 mm long and 1.25 mm wide, translucent pale brown, more or less broadly oval, the anterior margin convex, without prominent process. Sc long, costal area long and narrow, the subcostal area wider than costal area. The tip of Sc about 0.9 of wing length, marginal fringe conspicuous. Rest as in figure. Fore legs (Fig. 51) brown, mid (Fig. 52) and hind legs (Fig. 53) pale. Fore leg longest and about half the body. All legs with four free movable tarsal segment and the basal tarsal segment immovably jointed with tibia, claws similar, slender and hooked. Fore femora moderately stout, tibia slender, nearly 1.4 times the femur, tarsus (Fig. 54) 0.4 times the tibia, the first and the second tarsal segment subequal, third segment 0.6 times the second, fourth segment subequal to the second. Middle femur moderately stout, tibia slender about 1.4 times the femur, tarsus (Fig. 55) 0.3 times the tibia, the first and second tarsal segments subequal, third segment nearly 0.7 times the second, the fourth segment nearly twice the third. Hind femur moderately stout, subequal to fore femur, tibia slender, about 1.4 times the femur, tarsus (Fig. 56) about 0.2 times the tibia, the first and second tarsal segments subequal, the third segment 0.6 times the second, the fourth a little shorter than thrice the third, and 1.6 times

the first. Abdomen dark brown, about 0.7 times the body, tip as shown in Fig. 49.

Holotype 1 ♀ in spirit, Northwest Himalaya : St. 4, north-south sector of the R. Alhni about 500 m stretch from the confluence with the Jobri Nullah upstream, 3200 m above mean sea level, Coll. O.P. Dubey, 25.v.1970.

This is the first record of the genus *Atalophlebia* Etn. from India.

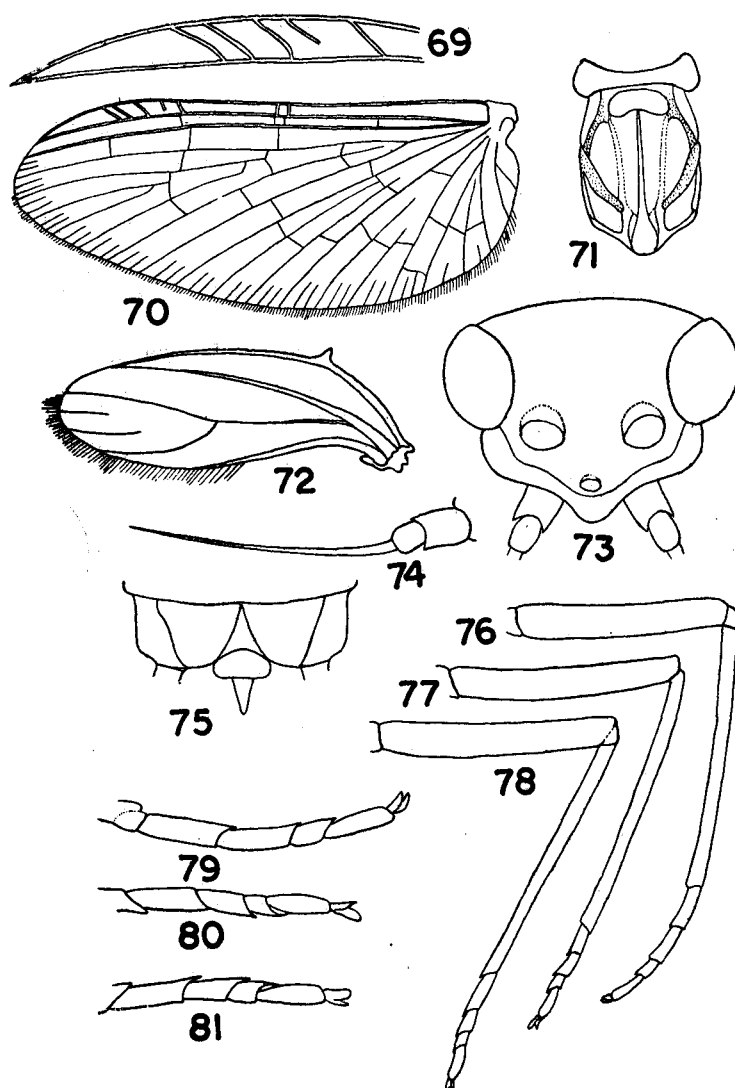


Figs. 57-68. *Baetis acuticostalis*, sp. nov., ♂ : 57, fore wing; 58, thorax; 59, hind wing; 60, gonostyle; 61, antenna; 62, head; 63, fore leg; 64, middle leg; 65, hind leg; 66, fore tarsus; 67, middle tarsus; 68, hind tarsus.

4. *Baetis acuticostalis*, sp. nov. (Figs. 57-81)

Male Imago : Length, excluding cerci and terminal filament, 7 mm. General colour of body brown, head and thorax dark brown. Head (Fig. 62) viewed in front broadly rectangular, height to width in the ratio of 2 : 3, turban eyes deep yellowish-brown, subquadrate in frontal view, ventral eyes black, about 0.6 times the length of the dorsal eyes. Ocelli white, except the elevated black base; lateral interocellar space nearly thrice the ocellar diameter. Antennae (Fig. 61) brown, nearly twice the head, three segmented, the first segment a little longer than thick; segment cylindrical about 0.7 times the first and more slender, the third segment ten times the second segment. Thorax (Fig. 58) dark brown, pronotum six times as long as wide, mesonotum seven times the length of pronotum, with two longitudinal dark brown stripes on either side of faint median line, scutellum yellowish-brown. Fore wing (Fig. 57) 6 mm long and 2.5 mm wide, hyaline greyish, venation pale brown, marginal fringe conspicuous; stigmatic area with 5 complete cross-veins, intercalary veins paired. Hind wing (Fig. 59) 0.9 mm long and 0.3 mm wide, hyaline, with the costal process acute, venation pale brown, the first and second longitudinal veins parallel, the second vein forked, two intercalaries in between the fork of the second longitudinal vein, the third vein reaching the wing margin almost in the middle of the wing, without cross-veins, margin with fine fringe. Legs pale brown, outer claw blunt, inner hooked, fore legs (Fig. 63) longest, about 0.6 times the body, fore femur moderately stout, tibia slender, nearly 1.3 times the femur; tarsus (Fig. 66) as long as the tibia, the first and second segments subequal, the third 0.6 times the second, the fourth segment nearly 0.7 times the third. Middle femur (Fig. 64) moderately stout, tibia slender, nearly 1.4 times the femur, tarsus (Fig. 67) about 0.4 times the tibia, the first segment 1.5 times the second, the second twice the third, the fourth about thrice the third and subequal to the first. Hind femur (Fig. 65) a little shorter than the middle femur, moderately stout, tibia slender nearly 1.2 times the femur, tarsus (Fig. 68) about 0.4 times the tibia, the first tarsal segment 1.5 times the second segment; the second segment twice the third, the fourth segment a little less than thrice the third. Abdomen about 0.7 times the body, brown, terminal filament pale brown, about 1.4 times the body. Gonostyle (Fig. 60) pale yellowish-brown, four segmented, basal segment a little less than half its width, slightly wider basally than apically, the second segment 0.7 times the first segment and very much narrowed a little over half as basal; the third segment subequal to the first segment and nearly 1.5 times the second segment; the fourth segment shortly cylindrical, moderately stout, nearly 0.8 times the third segment.

Female Imago : Length, excluding cerci and caudal filament, 7 mm. General colour of body brown, head and thorax darker brown. Head (Fig. 73)



Figs. 69-81. *Baetis acuticostalis*, sp. nov., ♀ : 69, stigmatic area; 70, fore wing; 71, thorax; 72, hind wing; 73, head; 74, antenna; 75, ovipositor; 76, fore leg; 77, middle leg; 78, hind leg; 79, fore tarsus; 80, middle tarsus; 81, hind tarsus.

viewed in front rectangular, height to width in the ratio of 3 : 4; eyes black, oval, interorbital space of about twice the eye diameter. Ocelli white except elevated black base, lateral interocellar space nearly twice the ocellar diameter. Antennae (Fig. 74) dark brown, length of antennae to head length 7 : 4, three segmented, the first segment 1.3 times as long as thick, second segment cylindrical about 0.8 times the first and slightly more slender, the third segment eight times the second segment. Labrum pale brown. Thorax (Fig. 71) as in male. Fore wing (Fig. 70) 8 mm long and 3 mm wide, stigmatic area (Fig. 69) with four complete and one incomplete cross-veins, rest as in male. Hind wing (Fig. 72) 1 mm long and 0.5 mm wide, rest as in male. Legs pale brown, outer claw blunt, inner claw hooked, fore legs (Fig. 76) longest, about 0.4 times the body; fore and mid legs (Fig. 77) with the femora moderately stout, tibiae slender, slightly longer than the femur, tarsi (Figs. 79, 80) about half the tibia, the first and second tarsal segments subequal, the third a little more than half the second, the fourth segment twice the third. Hind femur (Fig. 78) moderately stout; tibia slender, slightly longer than femur; first tarsal segment (Fig. 81) about 1.4 times the second segment, the second segment a little more than twice the third, the second and third segments combined nearly equal to first segment, the fourth segment thrice the third. Abdomen about 0.7 times the body, brown, terminal filament incomplete. Ovipositor (Fig. 75) pale brown, two segmented, the first segment twice as wide as long, the second segment pointed nearly 1.25 times the first segment.

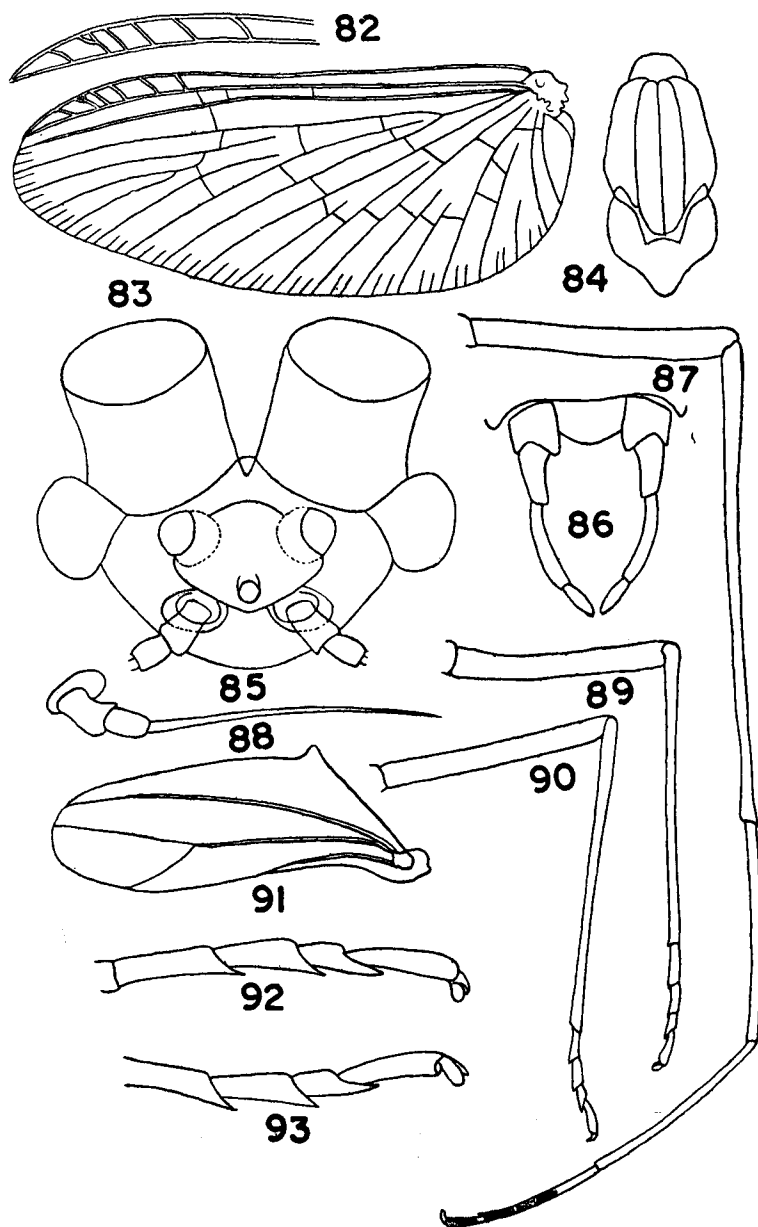
Holotype 1 ♂ in spirit, *allotype* 1 ♀ in spirit, and *paratypes* ♂ ♀ in spirit, Northwest Himalaya : St. 15, Right bank of the R. Solang, southern slopes of the Pir Panjal Range, 2800 m above mean sea level, Coll. O. P. Dubey, 6.x.1970.

This species has a superficial resemblance to *Baetis himalayana* Kapur and Kripalani*, from which it is readily distinguished by the presence of two intercalaries in between the forks of the second longitudinal vein and acute costa in the hind wing, different arrangement of the cross-veins in the stigmatic area of the fore wing, different mesonotal markings and the greatly elongated terminal segment of the gonostyles of the male.

5. *Baetis solangensis*, sp. nov. (Figs. 82-93)

Male Imago : Length, excluding cerci and terminal filament, 7 mm, head and thorax very dark brown. Head (Fig. 85) viewed in front subtrapezoid, height to width in the ratio of 2:3; turban eyes yellowish-brown, conspicuous, about 0.8 times the head, viewed from above peg-shaped, length to width in the ratio of 20:19. Ventral eyes greyish-black, 0.7 times the dorsal eyes. Ocelli white, elevated, with black base, the lateral interocellar space about three

*Kapur, A.P. and M.B. Kripalani, 1963, *Rec. Indian Mus.*, 59 : 194,



Figs. 82-93. *Baetis solangensis*, sp. nov., ♂ : 82, stigmatic area; 83, fore wing; 84, thorax; 85, head; 86, gonostyle; 87, fore leg; 88, antenna; 89, middle leg; 90, hind leg; 91, hind wing; 92, middle tarsus; 93, hind tarsus,

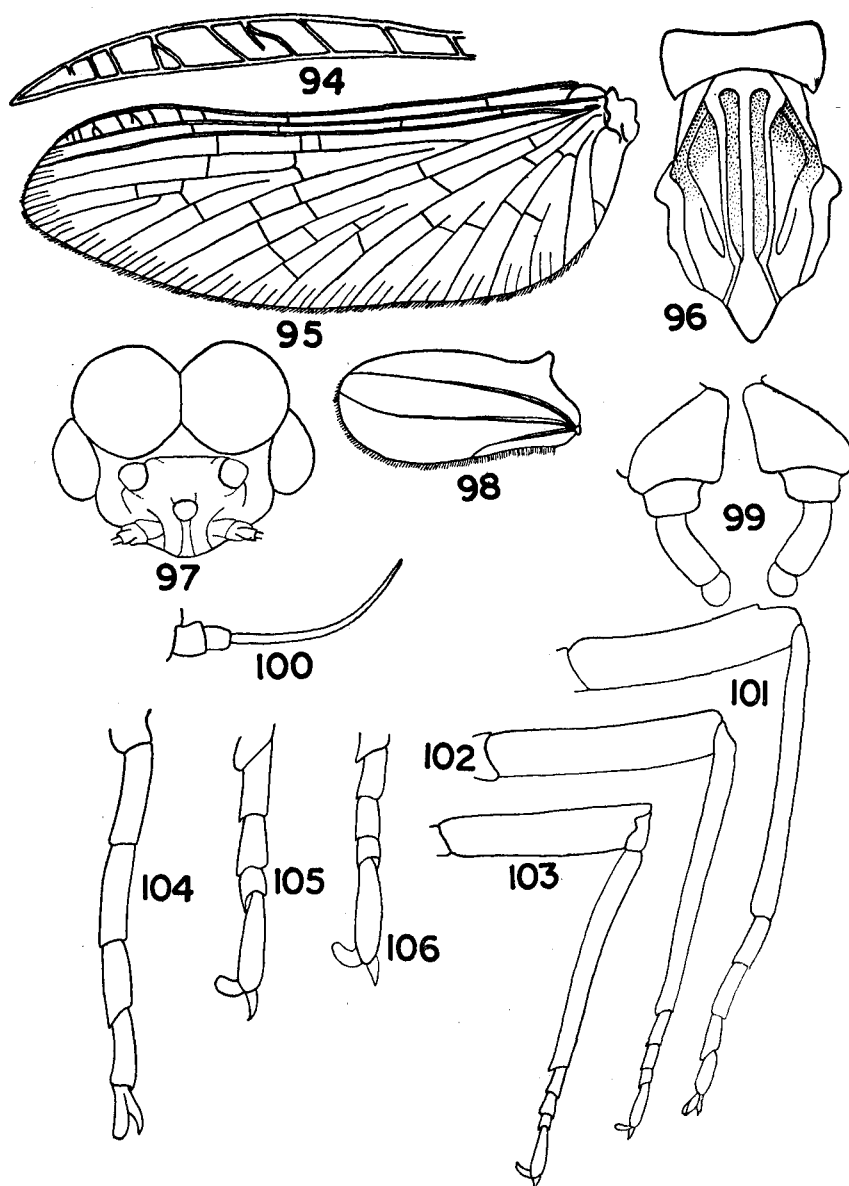
times the ocellar diameter. Antennae (Fig. 88) brown basally, terminal segment pale white, length of antenna to head length 2:1; three-segmented, the first segment stout, about 1.5 times as thick as long; second segment stout, a little less than twice its thickness, and slightly more slender than the first, third segment slender, nearly 7.2 times the preceding. Thorax (Fig. 84) very dark brown; prothorax twice as wide as long, mesothorax six times as long as prothorax, with two lateral longitudinal streaks on either side of the submedian groove. Scutellum dark brown. Fore wing (Fig. 83) 6.1 mm long and 2.5 mm wide; hyaline with venation pale brown; stigmatic area (Fig. 82) with 6 complete cross-veins; intercalary veins paired. Hind wing (Fig. 91) 1 mm long and 0.3 mm wide, hyaline with costal process acute, veins pale yellow, three longitudinal veins, the first and second parallel, second vein forked, third vein shortest and running nearly parallel to the hind margin and meeting at basal 0.3 of the wing length. Fore legs (Fig. 87) pale yellow, subequal to the body, tibia a little less than twice the femur, tarsi four segmented, about 1.2 times the tibia, the first and the second segment subequal, the third segment 0.6 times the second, the fourth segment 0.3 times the third. Middle (Fig. 89) and hind legs pale brown; middle femur moderately stout, tibia slender, (Fig. 90), about 1.4 times the femur, tarsus (Fig. 92) about 0.4 times the tibia; the first tarsal segment 1.25 times the second, the second twice the third, third segment half the second, fourth segment 2.25 times the third; hind femur distinctly slightly longer than the middle femur, tibia 1.3 times the femur, tarsus (Fig. 93) 0.3 times the tibia, the first and second tarsal segments subequal, the third segment 0.7 times the second, fourth segment 1.8 times the third. Claws in all legs similar, one blunt and other subacute, transparent white. Abdomen about 0.7 times the body, pale except last four segments, which are dark brown; terminal filament white, 13 mm in length, nearly twice as long as body. Gonostyle (Fig. 86) four segmented, basal two segments dark brown, basal segment with length 0.8 times the thickness, second segment more slender and reduced apically; thickness at apex about 0.3 that of the basal segment, 1.6 times the first; third segment nearly 1.4 times the second segment and somewhat more slender; fourth segment subequal to the first, and thickness about one-fourth that of the basal segment.

Holotype 1 ♂ in spirit and *paratypes* ♂ ♂ in spirit, Northwest Himalaya : St. 15, Right bank of the R. Solang, southern slopes of the Pir Panjal Range, 2800 m above mean sea level, Coll. O. P. Dubey, 2.x.1970.

This species differs from *Baetis acuticostalis* Dubey in having more elongated dorsal eyes, no intercalaries in between the forks of the second longitudinal vein in the hind wing, different proportions of the gonostyle, very long fore legs and different mesonotal markings on the thorax.

6. *Baetis septemmenes*, sp. nov. (Figs. 94-106)

Male Imago : Length excluding cerci and terminal filament 6 mm. General colour of the body yellowish-brown; head and thorax brown. Head (Fig. 97)



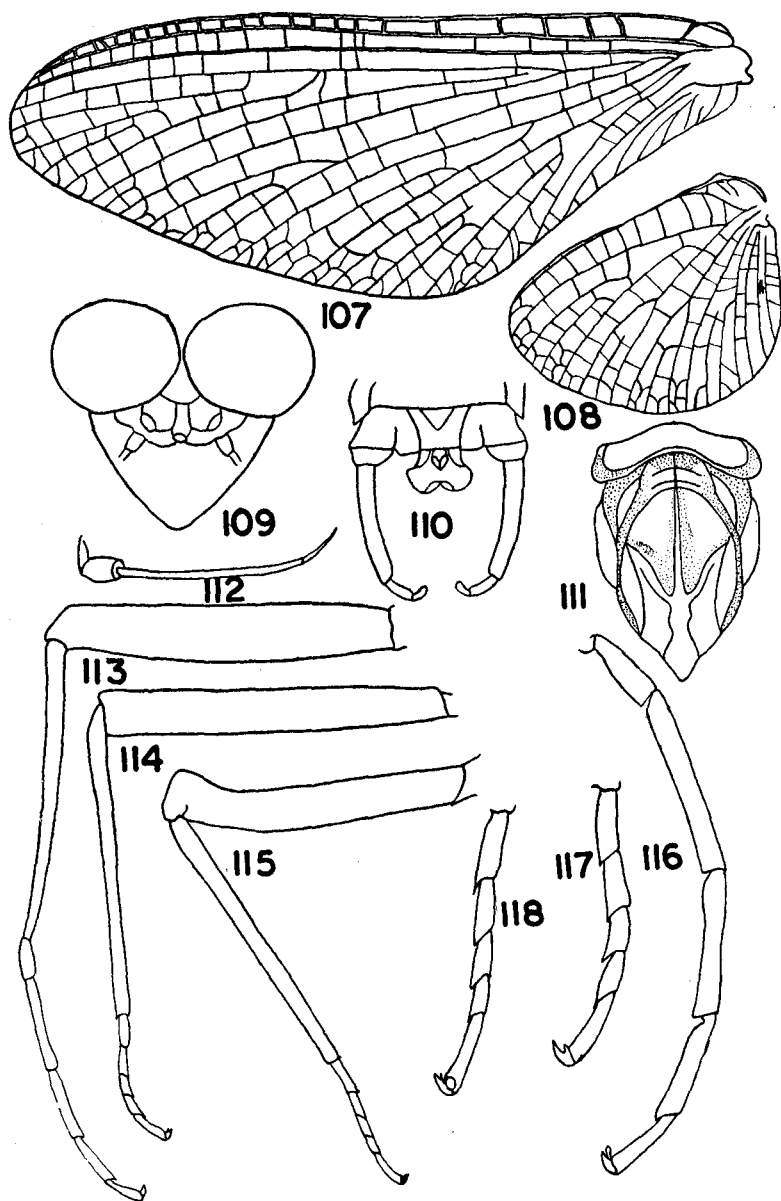
Figs. 94-106. *Baetis septemmenes*, sp. nov., ♂ : 94, stigmatic area; 95, fore wing; 96, thorax; 97, head; 98, hind wing; 99, gonostyle; 100, antenna; 101, fore leg; 102, middle leg; 103, hind leg; 104, fore tarsus; 105, middle tarsus; 106, hind tarsus.

viewed in front broadly rectangular, height to width in the ratio of 7:10; turban eyes deep yellowish-brown; oval. Ventral eyes greyish-black, about 0.7 times the length of the dorsal eyes. Ocelli white with black base; interocellar space nearly 2.5 times the ocellar diameter. Antennae (Fig. 100) brown, except for the yellowish-brown base, about 1.3 times longer than the head, three segmented, first segment as long as thick; second segment cylindrical, about 0.8 times the first and more slender, third segment nine times the second. Thorax (Fig. 96) brown, pronotum five times as long as wide, mesonotum five times the pronotum with two longitudinally dark brown stripes on either side of mesial faint line. Scutellum yellowish-brown. Fore wing (Fig. 95) 8 mm long and 2.6 mm wide, hyaline, venation pale brown, marginal fringe conspicuous, stigmatic area (Fig. 94) with 8 complete cross-veins and one cross-vein incomplete apically, intercalary veins paired. Hind wing (Fig. 98) 1 mm long and 0.5 mm wide, hyaline, with the costal process obtuse; venation pale brown, three longitudinal veins, the first and the second longitudinal veins parallel, third vein reaching margin almost in the middle of wing, without cross-veins; margin with fine fringe. Legs pale brown, outer claw blunt, inner hooked; fore legs (Fig. 101) longest, about 0.7 times the body. Fore femur moderately stout, tibia slender nearly 1.25 times the femur, tarsus (Fig. 104) 0.6 times the tibia, the first and second segments subequal, third and fourth subequal, each about 0.6 times the second. Middle femur (Fig. 102) moderately stout, equal to fore femur, tibia slender about 1.3 times the femur, tarsus (Fig. 105), 0.4 times the tibia, the first segment 1.5 times the second, the second segment 1.5 times the third, the third segment nearly 0.3 times the fourth, fourth segment 1.3 times the first. Hind femur (Fig. 103) a little shorter than the middle femur, moderately stout, tibia slender nearly 1.3 times the femur, tarsus (Fig. 106) about 0.4 times the tibia, first tarsal segment 1.3 times the second segment, the second twice the third, the fourth segment a little less than five times the third. Abdomen about 0.7 times the body, brown, terminal filament pale brown, a little shorter than body. Gonostyle (Fig. 99) pale yellowish-white, four segmented, basal segment as long as thick wider apically, than, basally second segment 0.6 times as thick as long about 0.4 times the basal segment, third segment moderately slender, a little more than twice the second, and 0.8 times the basal segment, fourth segment globose, nearly 0.3 times the third segment.

Holotype 1 ♂ in spirit and *paratypes* ♂♂ in spirit, Northwest Himalaya : Sta. 14, Right bank of the R. Solang, southern slopes of the Pir Panjal Range, 2800 m above mean sea level, Coll. O. P. Dubey, 28.ix.1970.

This species has a superficial resemblance to *Baetis lahaulensis* Kaul & Dubey* from which it is readily distinguished by the presence of 8 complete cross-veins and one cross-vein incomplete in the stigmatic area of fore wing,

*Kaul, B. K. & O. P. Dubey, 1970, *Oriental Ins.*, 4 (1) : 147.



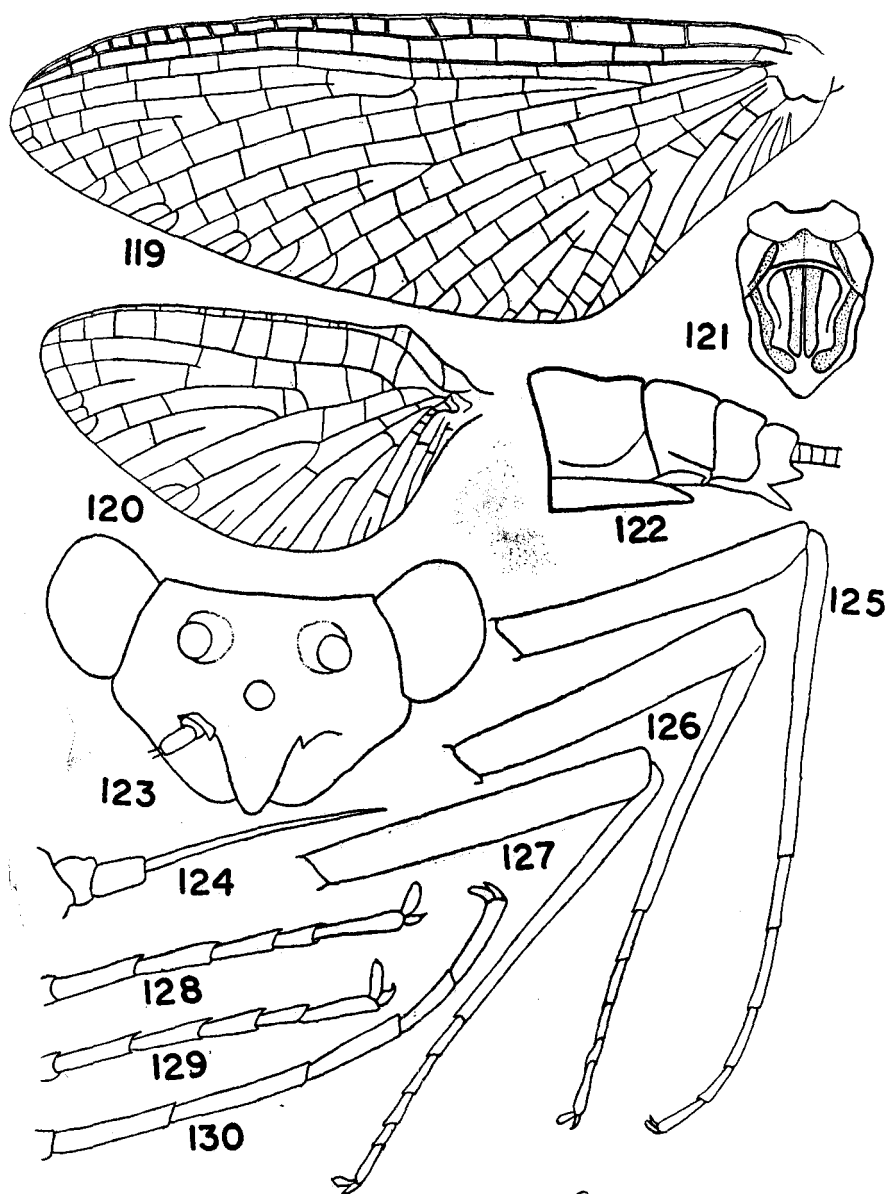
Figs. 107-118. *Heptagenia solangensis*, sp. nov., ♂ : 107, fore wing; 108, hind wing; 109, head; 110, gonostyle; 111, thorax; 112, antenna; 113, fore leg; 114, middle leg; 115, hind leg; 116, fore tarsus; 117, middle leg; 118, hind tarsus.

obtuse costal process, in the hind wing, different mesonotal markings and different proportions of body, wing and gonostyles.

FAMILY HEPTAGENIIDAE

7. *Heptagenia solangensis*, sp. nov. (Figs. 107-130)

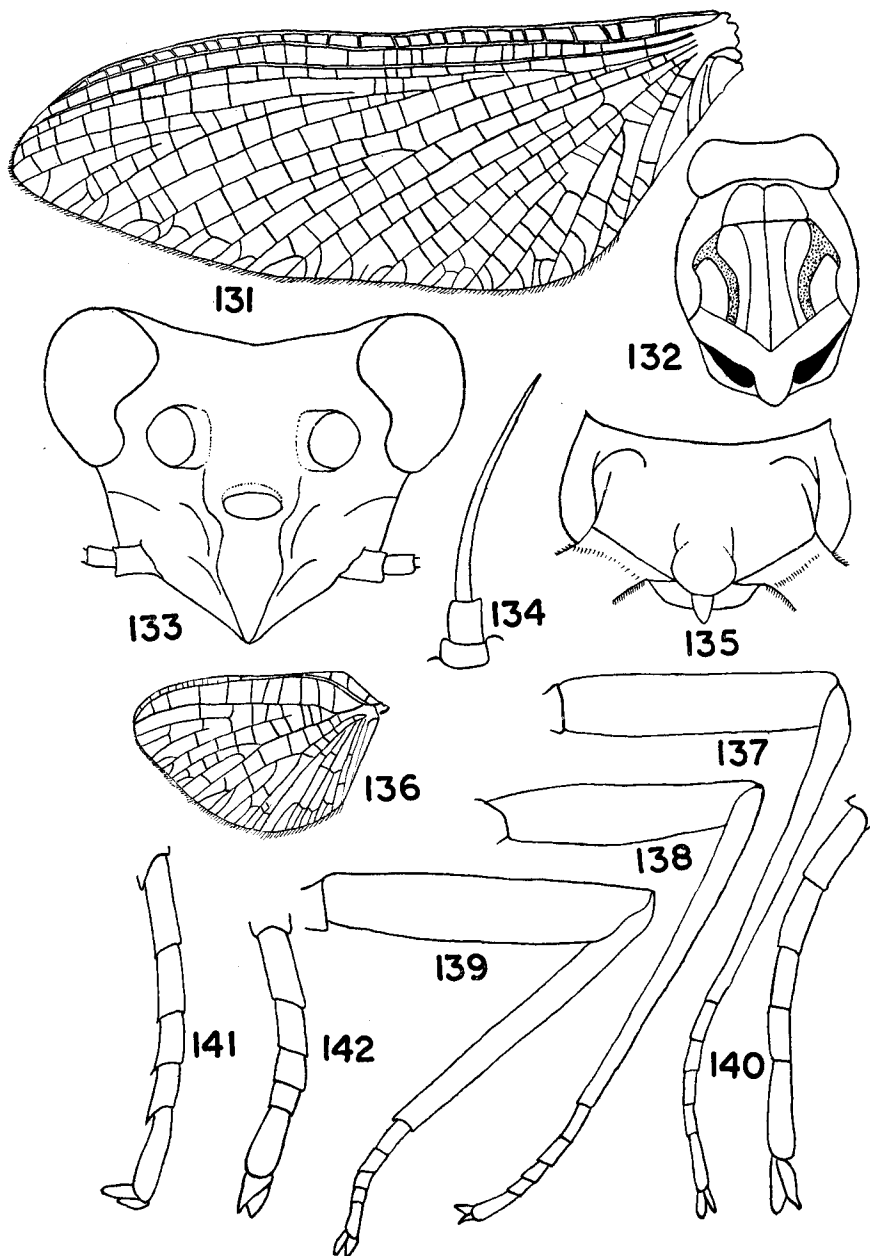
Male Imago : Length, excluding cerci and terminal filaments, 11 mm; caudal cerci 22 mm. Head and thorax brownish-black. Head (Fig. 109) viewed in front transverse, height to width 1:2, turban-eyes deep yellowish-brown, viewed in front oval, length to height in the ratio of 9:7; viewed from the side ventral eyes dark brown, one-third the dorsal eyes. Ocelli whitish, arranged in a triangle, elevated strongly, the lateral ocellar space twice the ocellar diameter. Labrum black. Antennae (Fig. 112) basally dark brown, terminal segments yellowish-brown; length of antennae to head length 10:11; three segmented; the first segment stout, about 1.3 times as long as thick, the second segment cylindrical of uniform thickness nearly six times the first segment, the third segment slender nearly 0.3 times the second segment. Thorax (Fig. 111) black, a little less than twice as long as wide. Pronotum deeply transversely excavated in front of the posterior margin, distinctly wider, width nearly double the length, mesonotum long about 1.5 times as long as wide with one narrow median longitudinal furrow in the middle with a large lateral stripe as in figure. Scutellum black, more or less rectangular with front margin concave, more than twice as long as wide, length one-seventh the mesonotum. Fore wing (Fig. 107) 11 mm long and 4 mm wide, hyaline, with brownish-black veins; costal and subcostal cross-veins thick, stigmatic area with 19 complete cross-veins without indication of anastomosis, two parallel pairs of cubital intercalaries, the posterior pair 1.5 times longer than the anterior pair. Hind wing (Fig. 108) 4 mm long and 3.5 mm wide, hyaline, veins brownish-black, outer fork of *Rs* present, for the rest as in figure. Legs long, slender, with claws dissimilar, one acute and curved and the other stout straight and blunt. Fore legs (Fig. 113) blackish-brown, mid and hind legs yellowish-brown, fore leg is longest, 0.75 times the body; fore femur moderately stout, tibia slender, a little longer than femur, tarsus (Fig. 116) a little shorter than tibia, first segment shortest two-fifths the second, second segment one-fourth the third, fourth segment 0.75 times the third; the fifth slightly longer than first, about 0.75 the fourth. Middle femur (Fig. 114) slender; tibia slender, slightly shorter than femur, tarsus (Fig. 117) half the tibia, first segment slightly longer than the second, second segment slightly longer than the third, third segment slightly longer than fourth, fourth segment shortest, nearly half the fifth. Hind femur (Fig. 115) subequal the tibia, tarsus (Fig. 118) 0.45 times the tibia; first segment about one-fourth the tarsus, second segment about three-fourths the first, third segment nearly 0.65 times the first and subequal to the second, fourth segment shortest, nearly half the first and terminal segment slightly more than two and half of the fourth segment. Abdomen about 0.64



Figs. 119-130. *Heptagenia solangensis*, sp. nov., ♂: 119, fore wing; 120, hind wing; 121, thorax; 122, ovipositor; 123, head; 124, antenna; 125, fore leg; 126, middle leg; 127, hind leg; 128, middle leg; 129, hind leg; 130, fore leg.

times the length of the body, dark brown, at base and apices of the abdominal tergites obscurely darkened, terminal filament dark brown. Gonostyles (Fig. 110) brown, forceps four-segmented, basal segment shortest, twice wider than long, second segment eight times the first, third segment one-fourth the second and twice the first, fourth segment slightly longer than first, about 0.6 the third; mesial margin distinctly convex and the two together are about 0.4 of the second; two sclerotized penes from the antero-dorsal border of the subgenital plate very close to each other, with one stout short spine basally, the titillator from the middle of the inner margin of each.

Female Imago : Length, excluding terminal filament and cerci 10 mm. Head (Fig. 123) blackish-brown; viewed in front transverse, height to width 1 : 2, eyes black, broadly oval, separated by a distance 2.6 times their diameter. Ocelli white, slightly elevated, the lateral ocelli separated from each other by nearly thrice their diameter, Labrum blackish-brown. Antennae (Fig. 124) dark brown, length of antennae to head length 9 : 10; three segmented, the first segment stout, about one and half times as thick as long; second segment cylindrical of uniform thickness, nearly one and half the first, third segment slender, slightly less than five times the second. Thorax (Fig. 121) in general brown, pronotum distinctly wider than long, deeply transversely excavated just in front of the posterior margin, mesonotum with moderately wide complete dark brown stripe on either side of the groove extending the whole groove of the mesonotum, scutellum dark brown, obtusely rounded at the tip. Metathorax dark brown. Fore wing (Fig. 119) 12 mm long and 5 mm wide, hyaline, faintly brownish infumated in the stigmatic area, veins brownish-black, costal and subcostal cross-veins thick, stigmatic area with 13 complete cross-veins without indication of anastomosis, two parallel pairs of cubital intercalaries present, the posterior pair 1.2 times longer than the anterior. Hind wing (Fig. 120) 4 mm long and 2.5 mm wide, hyaline, costal process subacute, veins brown, outer fork of *Rs* present, rest as in figure. Fore legs (Fig. 125) brown, mid and hind legs paler brown. Fore leg the longest, about 0.7 times the body, fore femur moderately stout, tibia cylindrical, subequal to femur, tarsus (Fig. 130) nearly equal to tibia, first segment 0.9 times the second segment, second segment 1.4 times the third segment, third segment 1.5 times the fourth, fourth segment 0.8 times the fifth, fifth 0.7 times the first. Middle femur (Fig. 126) moderately stout, tibia slender about 0.9 times the femur, tarsus (Fig. 128) nearly 0.7 times the tibia, first segment 1.2 times the second segment, second segment 1.2 times the third, third segment 1.7 times the fourth, fourth segment 0.4 times the fifth, fifth segment distinctly longer than the first. Hind femur (Fig. 127) slightly longer than the tibia, tarsus (Fig. 129) 0.6 times the tibia, first and second segments equal, third segment 0.8 times the second, fourth segment 0.8 times the third, fifth segment 1.7 times the fourth and subequal to the first. Oviduct lies well on the ventral side of abdomen and opens



Figs. 131-142. *Afronurus solangensts*, sp. nov., ♀: 131, fore wing; 132, thorax; 133, head; 134, antenna; 135, ovipositor; 136, hind wing; 137, fore leg; 138, middle leg; 139, hind leg; 140, fore tarsus; 141, middle tarsus; 142, hind tarsus.

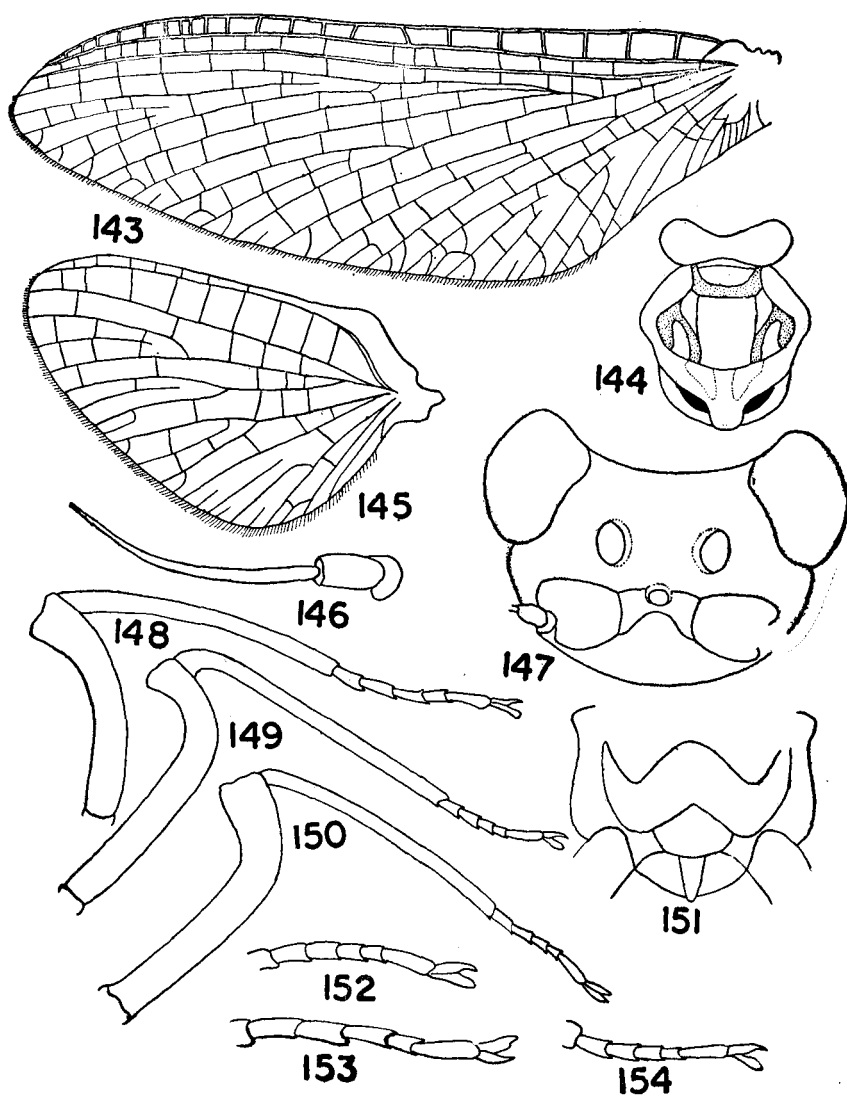
between the seventh and eighth sternites, each opening is perfectly distinct, the seventh sternite elongate and projecting posteriorly beneath the eighth sternite to its middle, the under surface of the egg valve is armed with heavily sclerotized, compound mating spines as in figure 122.

Holotype ♂ in spirit, *allotype* ♀ in spirit and paratypes 1 ♂ in spirit and 1 ♂ on slide, Northwest Himalaya : Station 15, Right bank of R. Solang, southern slopes of the Pir Panjal Range, 2800 m above mean sea level, Coll. O. P. Dubey, 5.x.1970.

This is the first record of the genus *Heptagenia* Walsh from India. It differs from its nearest species *Heptagenia maculipennis* Walsh in length of the body, fore wing and hind wing, dark brown colour of the body, mesonotal markings on the thorax, fore legs stout and longest, and difference in the proportions of gonostyles.

8. *Afronurus solangensis*, sp. nov. (Figs. 131-142)

Female Imago : Length excluding terminal filament and caudal cerci 18 mm. Head (Fig. 133) pale yellowish-brown, viewed in front subtriangular, height to width 1 : 1.5; eyes black, viewed in front inner orbital border conspicuously sinuate, separated by a space twice their maximum diameter. Ocelli white, slightly elevated, interocellar space 2.3 times the ocellar diameter. Labrum pale yellow. Antennae (Fig. 134) brown, length of antennae to head length 3 : 4, three segmented, the first segment stout, nearly twice as thick as long; second segment cylindrical of uniform thickness, slightly less than twice the first; third segment a little less than six times the second. Thorax (Fig. 132) in general pale yellow, pronotum three times as wide as long, mesonotum broadly oval, pale yellow, with one narrow median longitudinal groove; the whole length with dirty brown, curved lateral stripe as in figure; scutellum white, with the apex obtusely rounded, about 0.3 times the length of the mesonotum. Metathorax dark brown laterally. Fore wing (Fig. 131) 16 mm long and 6 mm wide, translucent pale brown, with brownish-black narrow transverse bands on cross-veins, venation brown, costa and subcosta thick, stigmatic area with 16 complete cross-veins without indication of anastomosis, first anal area narrow only at base, distinctly widening towards apex, A_2 much shorter and more strongly curved than A_1 , only A_2 and A_3 parallel to each other, first anal area with two pairs of long intercalaries, the longer pair always lying to A_2 . Hind wing (Fig. 136) 5 mm in length and 3 mm in width, translucent pale brown, broadly and obliquely oval, banded transversely like fore wing, veins brown. Legs pale brown, fore legs (Fig. 137) somewhat darker, knee dark brown, one obscure dark brown spot in middle of the femora, all tarsi with five freely movable segments, claws on legs dissimilar, one claw acute and curved, the other blunt and straight. Fore femur moderately stout, tibia slender about 1.2 times the femur, tarsus (Fig. 140)



Figs. 143-154. *Afronurus curtus*, sp. nov., ♀: 143, fore wing; 144, thorax; 145, hind wing; 146, antenna; 147, head; 148, fore leg; 149, middle leg; 150, hind leg; 151, ovipositor; 152, hind tarsus; 153, fore tarsus; 154, middle tarsus.

nearly 0.6 times the tibia, the first segment 1.25 times the second segment, the second segment slightly shorter than the third, the third segment slightly longer than the fourth, the fourth segment subequal to the second and nearly half the fifth, the fifth segment 1.5 times the first segment. Middle femur (Fig. 138) moderately stout, tibia slender, nearly 1.3 times the femur, tarsus (Fig. 141) about 0.4 times the tibia, first tarsal segment 1.4 times the second, the second segment slightly longer than the third, the third and fourth segment subequal, the fifth segment twice the fourth and nearly 1.2 times the first. Hind femur (Fig. 139) moderately stout, tibia slender, about 1.1 times the femur, tarsus (Fig. 142) 0.4 times the tibia, the first tarsal segment 1.4 times the second segment, second segment 1.4 times the third, the third and fourth segment subequal, the fourth segment 0.4 times the fifth, the fifth segment subequal to the first segment. Abdomen about 0.7 times the body, the anterior and posterior margins of the tergites obscurely darkened, terminal filament dark brown about 1.3 times the body. Ovipositor (Fig. 135) dark brown, one segmented, wider basally than apically slightly exerted and a little longer than wide.

Holotype ♀ in spirit, Northwest Himalaya : St. 15, Right bank of the R. Solang, southern slopes of the Pir Panjal Range, 2800 m above mean sea level, Coll. O. P. Dubey, 8.x.1970.

This is the first record of the genus *Afronurus* Lest. from India. It resembles *Afronurus curtus*, sp. nov. described hereafter in having similar colour markings on the abdomen. It is however, distinguished from the latter by the different head proportions, shape of the thorax and different mesonotal markings, different body and wing length.

9. *Afronurus curtus*, sp. nov. (Fig. 143-154)

Female Imago : Length excluding terminal filament and caudal cerci 10 mm. Head (Fig. 147) pale yellowish-brown, viewed in front quadrangular, height to width 11 : 19; eyes black, when viewed in front inner orbital border sinuate, separated by a space a little less than twice their maximum diameter. Ocelli white with black base, lateral interocellar space 2.5 times the ocellar diameter. Labrum pale yellow. Antennae (Fig. 146) pale yellow at base, apically dark brown, length of antennae to head length 4 : 5, three segmented, the first segment globular, nearly twice as thick as long, second segment subcylindrical, slightly thicker in the middle than at the ends, four times the first, third segment 4.4 times the second segment. Thorax (Fig. 144) in general pale yellow, pronotum well developed, six times as wide as long, mesonotum oval, with one narrow median longitudinal groove, with a dark brown lateral stripe as in figure; scutellum white, with the apex obtusely rounded, half the mesonotum, two laterally pale yellow patches. Metathorax dark brown. Fore wing (Fig. 143) 12 mm long and 4 mm wide, translucent pale brown,

with brownish-black narrow transverse bands on cross-veins, venation pale brown except costa and subcostal region, which are thick and dark brown, stigmatic area with 13 complete cross-veins without indications of anastomosis, the first anal area narrow: only at base, distinctly widening towards apex, A_2 much shorter and more strongly curved than A_1 , only A_2 and A_3 parallel to each other, first anal area with two pairs of long intercalaries, the longer pair lying to A_2 , many S-shaped cross-veins present in this area. Hind wing (Fig. 145) 4 mm in length and 2 mm in width, translucent pale yellow, broadly oval, banded transversely as in fore wing, veins light brown. Legs brown, fore legs dark brown, knee dark brown, all femora distally curved, all tarsi with five freely movable segments, claws on all legs dissimilar with one claw acute and curved and the other blunt and straight. Fore femora (Fig. 148) moderately stout, tibia slender nearly 1.25 times the femur, tarsus (Fig. 153) nearly 0.6 times the tibia, the first segment 0.8 times the second, the second and third subequal, the fourth segment 0.6 times the third, the fifth segment 1.4 times the fourth and 1.7 times the first. Mid femora (Fig. 149) moderately stout, tibia slender a little longer than femur, tarsus (Fig. 154) about 0.4 times the tibia, the first and second segment subequal, the third segment a little less than the second, the fourth segment 0.6 times the second, the fifth segment a little more than thrice the fourth and twice the first. Hind femora (Fig. 150) moderately stout, tibia slender 0.9 times the femur, tarsus (Fig. 152) 0.4 times the tibia, the first and second tarsal segments subequal, the third segment a little less than the second, the fourth segment half the second, the fifth segment a little more than thrice the fourth and about 1.7 times the first. Abdomen pale brown, except the anterior and posterior margins of the tergites dark brown, mid dorsally at the apical end of the tergites an obscure brownish patch. Terminal filament dark brown about 1.3 times the body. Ovipositor (Fig. 151) pale yellow, two segmented.

Holotype ♀ in spirit, Northwest Himalaya : St. 16, Right bank of the R. Solang, southern slopes of the Pir Panjal Range, 2900 m above mean sea level, Coll. O.P. Dubey, 3.x.1970.

This is the second record of the genus *Afronurus* Lest. from India. It differs from its nearest species *Afronurus solangensis* Dubey, described earlier in having curved femora and two segmented ovipositor.