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XL.—The British Species of the Genus *Ecdyonurus* (*Ephemeroptera*). By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).

THE genus *Ecdyonurus* was proposed by Eaton in 1868 (Trans. Ent. Soc. p. 142, footnote), with genotype *Ephemerella venosa* Fabricius, 1775, but in the same year (Ent. Mon. Mag. v. p. 90) he suppressed it as a synonym of *Heptagenia* Walsh, at the same time pointing out that the name *Ecdyonurus* was a mis-spelling of *Ecdyurus*. The International Rules (Art. 19), however, state that the original orthography of a name is to be preserved unless an error of transcription, a *lapsus calami*, or a typographical error is evident, and continental and American workers have mostly adopted the original orthography.

In 1881 (Ent. Mon. Mag. xviii. p. 25) Eaton reinstated

the genus, under the name *Ecdyurus*, but gave no specific names other than that of the genotype, although the proportions of the male fore tarsal segments given suggest that at least three species of this genus were known to the author. In 1885-7, in his Revisional Monograph of the Ephemeridæ, pp. 276-295, seventeen species are listed under the genus *Ecdyurus*, of which four (*E. venosus* F., *E. insignis* Etn., *E. volitans* Etn., and *E. lateralis* Curt.) are recorded as British.

In 1930 (Ent. Mon. Mag. lxvi. p. 56) Blair extracted *Ecdyonurus longicauda* Etn. (*nec* Steph.) as a valid species from the synonymy of *Ecdyonurus venosus*. At the same time he pointed out that there appeared to be at least two other species involved in the *venosus* complex in Britain, but that sufficient material was not then to hand to warrant definite separation.

Schoenemund (1930, Zool. Anz. xc. pp. 45-8, and Tierwelt Deutschl. xix. pp. 21-29) restricted the genus *Ecdyonurus*, transferring two of our species to the genus *Heptagenia* (*H. fuscogrisea* Retz. = *volitans* Etn., and *H. lateralis* Curt.), thus leaving three British species in the genus *Ecdyonurus* (*venosus*, *longicauda* and *insignis*). In 1935, Hincks and Dibb (J. Soc. Brit. Ent. i. pp. 75-76) published a note recording the probable addition of *E. forcipula* (Pict.) to the British list, based on the discovery of nymphal material answering to the description given by Schoenemund (1930).

Miss R. Rawlinson (1939, Proc. Zool. Soc. Lond. (B) cix. pp. 377-450) in her excellent paper on the life-history and breeding of *Ecdyonurus venosus* reviews the various specific characters which have been used and suggests that either (1) *venosus*, *longicauda* and *forcipula* are local varieties, races or seasonal forms which will be found to grade into one another, or (2) that the *Ecdyonurus* population of the stream upon which she was working is incompletely separated into the species described from elsewhere as distinct.

In considering the synonymy of the various species of *Ecdyonurus* on the British list, Dr. K. G. Blair drew my attention some time ago to a detail which has apparently been overlooked by most workers since Eaton, namely, that Curtis had described from the neighbourhood of Ambleside a *Baëtis dispar*, which species Eaton had

placed in the synonymy of *E. venosus*. Dr. Blair was collecting in the Lake District in June 1929, and on the shores of Windermere he took some examples of *Ecdyonurus* which were not *venosus*, and which he suspected might be *dispar* of Curtis. Curtis's types are in the National Museum, Melbourne, and a male specimen from the series taken by Dr. Blair was sent there for comparison. Mr. Clark replied that it was identical with the type. Recently I have had opportunities of collecting further material of this species from Windermere, and having examined males, females and subimagines, I believe it to be identical with *longicauda* Etn., 1871, the August or Autumn Dun. (As has recently been pointed out, *longicauda* Stephens, 1836, is a *Heptagenia*, and not identical with *E. longicauda* Etn., 1871, Blair, 1930, etc.) *Dispar* of Curtis is an earlier name than *longicauda* of Etn., and thus takes precedence.

Apart from the question of *E. dispar*, I have been studying the available material of the *venosus* complex in Britain, and here I must express my thanks to Dr. T. T. Macan, of the Freshwater Biological Association, who generously made available to me for study the material of this group which he had been accumulating for about two years. This material, much of it accompanied by nymphal exuviae, has been very helpful, as the habitat data are more detailed than one usually finds in museum collections. As a result of these investigations it seems that the *venosus* complex in Britain can be conveniently resolved into two species. Two of the specific characters used were not discussed by Miss Rawlinson in her paper: The proportions of the male front tibia to front tarsus were found to be reasonably constant, and in the seventy-odd specimens measured there was no overlap. In most cases the difference could be appreciated by eye, without the aid of measurements, as the increased proportion of the tarsus made the front leg look noticeably longer. The pattern of the subimaginal wing is rather less constant; *dispar* is easily separable, but the other two tend to grade into one another to some extent, and I have seen examples whose identity is somewhat doubtful.

The question next arises, To which of these two species (if either) should the name *venosus* Fabricius be applied? The species as interpreted by Eaton in his

Monograph was, we know, a composite one. Blair (1930), when reinstating *E. longicauda*, restricted *venosus* Fabr. to a form in which the cross-veins of the subimago were bordered with black. Mosely (1932), when dealing with the identity of the March Brown (*Rhithrogena haarupi* Esb.-P.), figured and described *E. venosus* Fabr., the False March Brown, as having the cross-veins of the subimago bordered with blackish but the coloration not forming definite bands arranged transversely across the wing, and the forceps-base of the male simple, not toothed. I have examined the continental material of *Ecdyonurus* in the British Museum and found there examples from several localities of one of the two British species in question, *E. venosus* of Blair and Mosely, but failed to find any of the other species. This latter species is very closely allied to *E. forcipula* (Pict.), but distinguishable from it by certain small characters in the male genitalia, and the nymph lacks the very definite white markings of the *forcipula* nymph figured by Schoenemund. It seems desirable, therefore, to accept as the true *venosus* Fabr. the species with simple forceps-base, proportions of the male front tibia to tarsus I : 1.5, subimaginal wings with the cross-veins bordered with blackish, giving a mottled, not banded, appearance. This restriction is in conformity with the definitions of Blair and Mosely, and works out to the name *venosus* in Schoenemund's key. As the other species does not appear to occur outside the British Isles, one may discount such synonyms of *venosus* as *Baëtis purpurascens* Pict. and *E. quæstor* Etn., and I am describing it as a new species.

I had expected to find Eaton's series of *E. quæstor* in the McLachlan collection, where much of Eaton's material is preserved, but all I could discover was a large male *dispar* from the Pyrénées Orientales over a label; in Eaton's handwriting, "*Ecdyurus longicauda* v. *quæstor*." Apart from the fact that the specimen is not one of the type series, the pattern does not agree with the description, the lateral stripes being very weak and obscure. The only Apennine specimens of *Ecdyonurus* in the McLachlan collection at the time of its purchase by the British Museum were over the label "*forcipula* Pict." and were a mixture of that species and *E. helveticus* Etn.

Ecdyonurus venosus (Fabricius, 1775).

(Figs. 1, 2 V, 3 V, 4.)

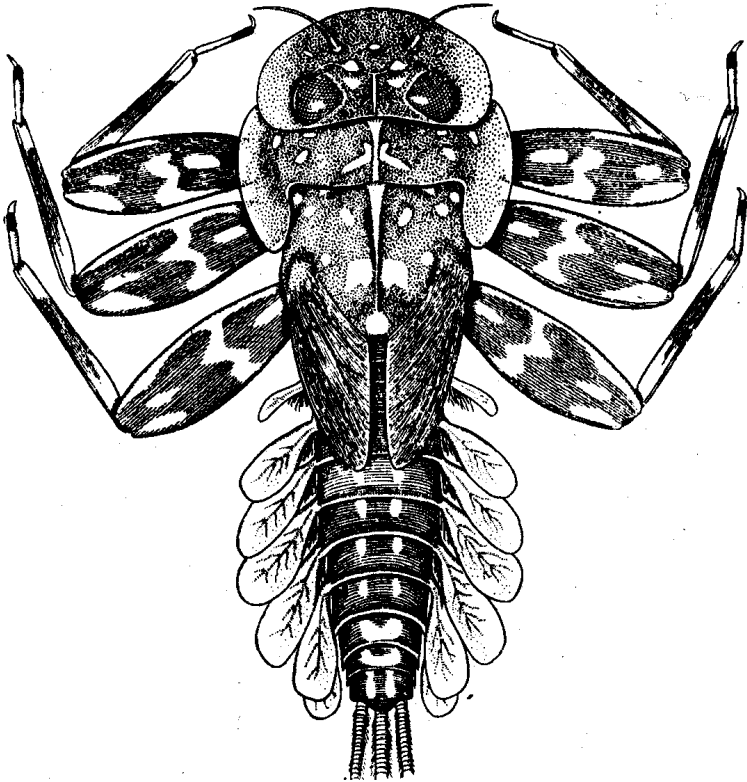
1775. *Ephemera venosa* Fabricius, Syst. Ent. p. 304.
 1789. *Ephemera nervosa* Villers, C. Linn. Ent. iii. p. 22.
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 1844. *Baëtis purpurascens* Pictet, *op. cit.* p. 174, pl. 20, fig. 4.
 1863. *Baëtis montana* Hagen, Ent. Ann. p. 26 (partim).
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 pl. 6, fig. 24.
 1881. *Ecdyurus venosus* Eaton, Ent. Mon. Mag. xviii. p. 25.
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 pl. 24, fig. 46 b.
 1887. *Ecdyurus venosus* Eaton, *op. cit.* p. 283 (partim).
 1887. *Ecdyurus venosus* var. *quæstor*, Eaton, *op. cit.* p. 286.
 1909. ? *Ecdyurus venosus* Klapálek, Süßwasserf. Deutschl. viii. p. 29.
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 p. 24, figs. 29-30.
 1932. *Ecdyurus venosus* Mosely, Ann. & Mag. Nat. Hist. (10) ix.
 pp. 91-96.

♂ (dried).—Notum of thorax reddish-piceous. Dorsum of abdomen reddish-brown, apical margins of segments rather darker. Segments 2-8 marked at the sides with obscure reddish-purple triangles, a yellowish-brown area at the base of each segment above the spiracle. Pleuræ and sternites dull yellowish-brown. Forceps dark brown or piceous, forceps-base paler, its apical margin convex and usually without teeth. Lobes of the penis outspread, boot-shaped, rather slender. The outer sclerite truncate at its apex, which projects beyond the basal sclerite in the form of a small beak. Inner apical sclerites usually armed with two or three stout teeth, the sclerite projecting tailward and forming the heel of the boot. The out-turned portion of the basal sclerite slender, acute at its apex, the margin thickened to form a rim and set with a number of setæ. Caudal setæ fuscous, becoming apically and somewhat indistinctly annulate with fuscous. Fore leg dark reddish-fuscous, tarsus rather short (only 1.5 times as long as tibia), basal segment about half as long as second, but appearing shorter. Middle and hind legs yellowish-brown, tarsi pale fuscous. Wings vitreous, almost colourless, costal and subcostal areas often suffused with pale yellowish-green, especially near the base; pterostigma dark fuscous. Venation piceous, cross-veins in costal and subcostal area not weaker or paler than

elsewhere. Thickened area at base of anal veins in fore wing pale yellowish.

♀ (dried).—Notum of thorax reddish- or yellowish-brown. Abdomen reddish-brown, lateral stripes or triangles rather obscure. Subanal plate somewhat variable in outline, angularly produced at its centre, lateral margins also

Fig. 1.



Ecdyonurus venosus. Female nymph, mature.

obtusely angled. Setæ smoky brown at base, becoming paler apically, with indistinct annulations. Fore legs light reddish-brown, middle and hind legs yellowish-brown, tarsi sometimes fuscous. Wings vitreous, costal and subcostal areas paler than in male, pterostigma less marked.

Subimago (dried).—Membrane of wings colourless or pale yellowish-grey, venation reddish-brown or piceous,

cross-veins bordered with blackish-brown, the pigment not extending far on to the membrane, so that the general effect is one of mottling rather than the formation of transverse bands. The lateral abdominal stripes usually rather indistinct, as in the imago.

Nymph.—Sprawling, flattened dorso-ventrally, especially the head, the side margins of which in the mature nymph are usually rounded; eyes dorsal. Hind angles of pronotum strongly produced backwards. Seven pairs of lateral abdominal lamellæ, the first six pairs covering tufts of branchiæ. Three caudal setæ, pale yellowish-brown. General colour of nymph brownish or greenish-brown, with pale yellowish markings. Tarsi usually darker at apex, tarsal claw generally with two small teeth ventrally before the apex.

Length of anterior wing: ♂ 11–13, ♀ 12–16 mm.

Length of seta: ♂ 30–32, ♀ 22 mm.

Distribution.—DEVON: R. Bray, vi. 1932; R. Bovey, v.–3. vi. 1931; R. Teign, Newton Abbott, 26. v. 1931; East Lyn R., viii. 1899; Lustleigh, 28. iv. 1922; Dartmoor, Two Bridges, 10, 27. v. 1932. BRECON: Talybont-on-Usk, 16. v.–4. x. 1931; Brecknock Beacons, 900–1400 ft., 12. x. 1931. CARDIGAN: Tregarron, 13. vi. 1930. CAERNARVON: R. Llugwy, Capel Curig, vi. 1919. DERBY: R. Dove, iv. 1914. YORKS.: R. Wharfe, Bolton Abbey, 11–19. v. 1922. WESTMORLAND & N. LANCS.: Rydal Beck, 1. vi. 1941; Troutbeck, vi. 1940, 21. ix. 1941; R. Rothay, vi. 1940, 31. v. 1941; Black Beck, Hawkshead, vi. 1940. PERTH: St. Fillans, 6–18. vi. 1935. KINCARDINE: Auchenblae, viii.–ix. 1928. ARRAN: Slidery, viii.–ix. 1926. WICKLOW: Deputies Pass, 12. vi. 1933. ROSCOMMON: L. Key, 19–27. vi. 1913.

From the Continent I have seen examples from France, Switzerland and Slovakia.

The nymph of this species shows some preference for the larger fast, stony streams and rivers.

Imagines taken in the autumn are decidedly smaller than the spring hatch.

Ecdyonurus torrentis, sp. n. (Figs. 2 T, 3 T, 5.)

Ecdyonurus venosus auct., partim.

♂ (dried).—Eyes black. Notum of thorax dark reddish-brown. Dorsum of abdomen reddish-brown, segments

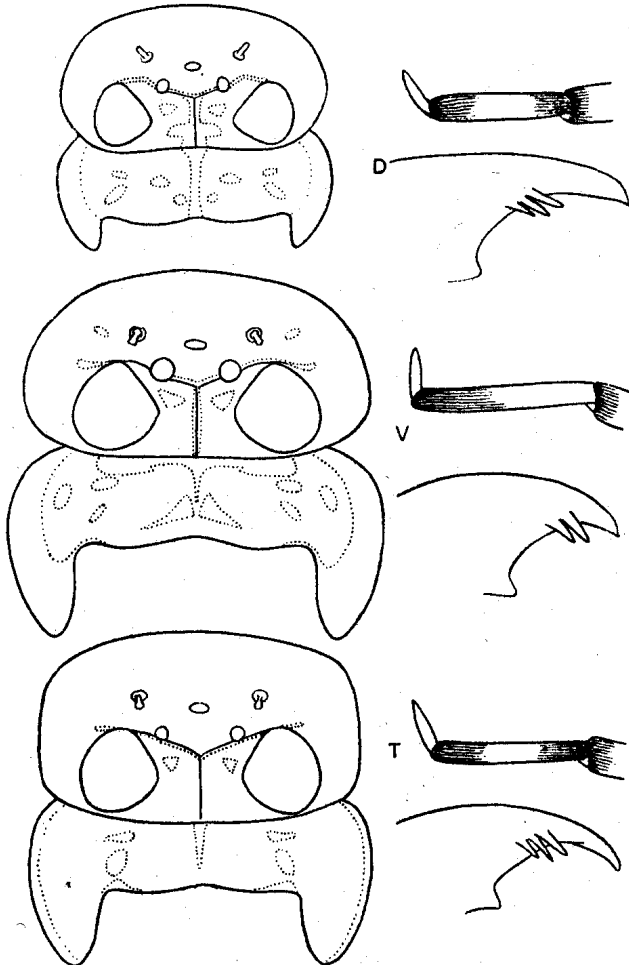
2-8 each with an oblique reddish-purple stripe arising at the spiracle and directed tailward and upward. Base of segment above stripe with a pale yellowish area, pleuræ also yellowish. Segments 9-10 dark reddish- or purplish-brown dorsally. Sternites paler than the tergites, without markings. Forceps dark brown, proportions of the segments somewhat variable, darker than the forceps-base, which bears a small but distinct tooth on the apical margin at each side. This tooth is usually smaller than in *E. dispar* and is not incurved as in that species. Lobes of the penis outspread, boot-shaped, somewhat blunter than in *E. venosus*. The outer sclerite does not overhang the basal in the form of a beak, and the inner apical sclerites do not project noticeably tailward. Outer apical margin of the basal sclerite rounded, not subacute and thickened into a rim as in *venosus*, but armed with a few setæ, some of the inner ones being set on small conical bases, but not definitely toothed as in *forcipula*. Denticulation of the inner apical sclerites variable, either a few teeth or numerous small bristles. Setæ fuscous, becoming slightly paler apically, indistinctly annulate with fuscous. Fore leg dark fuscous or piceous, basal segment of tarsus of normal proportions (about half as long as the second), tarsus about 1.8 times as long as the tibia (in *venosus* about 1.5 times as long). Middle and hind legs yellowish- or reddish-brown, femora with a small blackish streak on the outer surface at the apex. Wings vitreous, almost colourless, costal and subcostal areas not or very faintly suffused with yellowish; pterostigma fuscous, usually distinct. Venation piceous. Thickened area at base of anal veins in fore wing fuscous, not yellowish.

♀ (dried).—Notum of thorax yellowish- or reddish-brown. Abdomen yellowish-brown, with reddish-purple lateral stripes much as in the male. Subanal plate produced, somewhat variable in shape, its apex angular and each side with a very obtuse angle about midway. Setæ reddish- or yellowish-brown, paler apically, often with fairly distinct smoky annulations. Fore legs dark reddish-brown, middle and hind legs yellowish-brown. Wings vitreous, much as in male, but pterostigma less marked; thickened area at base of anal veins less distinct.

Subimago (dried).—Membrane of wings colourless or very pale grey, venation dark brown, cross-veins bordered with

dark brown, coloration tending to spread out over membrane in certain areas and to form well-marked transverse bands, particularly in the apical half of the

Fig. 2.



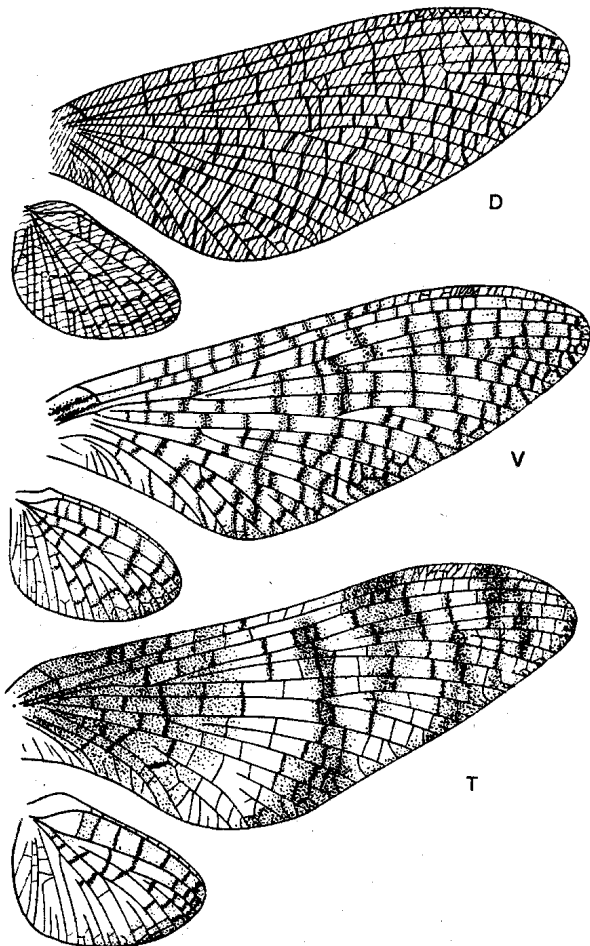
Ecdyonurus dispar, *venosus* and *torrentis*. Female nymphs, head, pronotum, fore tarsus, and tarsal claw.

wing. In *venosus*, the cross-veins are also bordered with brownish, but the coloration does not form transverse

bands, but produces a mottled effect. The abdominal oblique stripes can usually be seen quite clearly.

Nymph.—Similar in general appearance to *venosus*; the head of the full-grown nymph is more quadrate, the

Fig. 3.



E. dispar, *venosus* and *torrentis*. Subimagonal wing-pattern.

sides being somewhat flattened. Tarsi usually dark at base and apex, with a pale band between; tarsal claw generally with three small teeth ventrally before apex.

Length of anterior wing : ♂ 13-14, ♀ 14-15 mm.

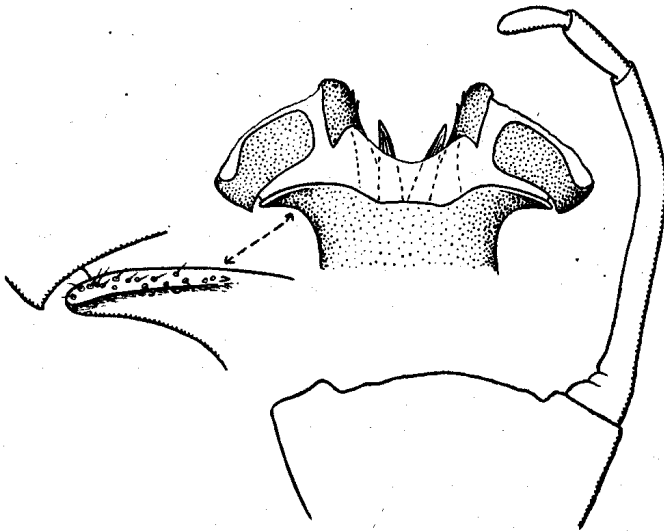
Length of seta : ♂ 32-35, ♀ 22-25 mm.

Type ♂, N. Lancs., Blelham Fishpond Beck, 20. v. 1941
(*D. E. Kimmins*). Allotype ♀, same locality, 12. vi. 1941
(*D. E. Kimmins*).

Type and paratypes in the collections of the British
Museum (Nat. Hist.).

Distribution.—I have seen this species from ten British
counties, and it is probably widespread wherever there
are suitable streams. The nymph seems to have some

Fig. 4.



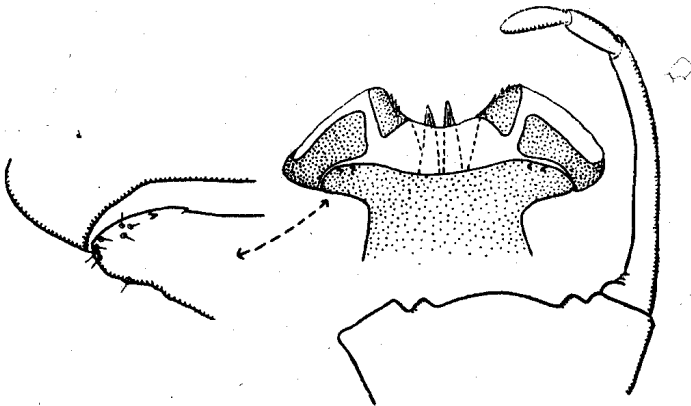
E. venosus, male. Forceps-base and right clasper, ventral; penis
lobes, dorsal, more enlarged; outer portion of basal sclerite,
further enlarged.

preference for the smaller stony becks rather than the
fast stony rivers. DEVON : Braunton, vi. 1930 ; R.
Otter, 26. vi. 1918 ; Newton Abbott, 14. vi. 1931.
DORSET : Glanville's Wootton, 5. vi. 1868. SURREY :
Witley ; Dorking district, 28. v. 1935. STAFFS. : Coombe
Valley, 27. v. 1939. BRECON : Talybont-on-Usk, 7-12. vi.
1929, 6-15. vi. 1930, 16. v.-3. vi. 1931. LANCs. : Pendle
Water, Roughlea, 7. vi. 1931. YORKS. : R. Ribble,
Gisburn, 12. v. 31 ; R. Wharfe, Hebden, 20-24. v. 1933 ;
R. Wharfe, Bolton Abbey, 4-14. v. 1921 ; R. Aire, above

Gargrave, 6. vi. 1925; Robin Hood's Bay, Mill Beck, 1. vi. 1925. WESTMORLAND & N. LANCs.: R. Kent vi. 1929, 22. vi. 1941; Hawkshead, Vicarage Beck, 5. vi. 1941, 23. vi. 1941; Blelham Fishpond Beck, 15. v.-12. vi. 1941; R. Winster, 8. vi. 1941; Nor Moss Beck, 3. v. 1941. PERTSHIRE: vi. 1922. ARGYLL: Portson-achan, 21. vi. 1935. DERRY: Moneymore, 5. vi. 1933.

I have not seen any examples of this species from the Continent, where it appears to be replaced by a closely allied species, *E. forcipula* (Pict.). In general appearance, *E. torrentis* is rather less heavily built than *venosus*, the fore legs of the male being noticeably longer. As far as

Fig 5.



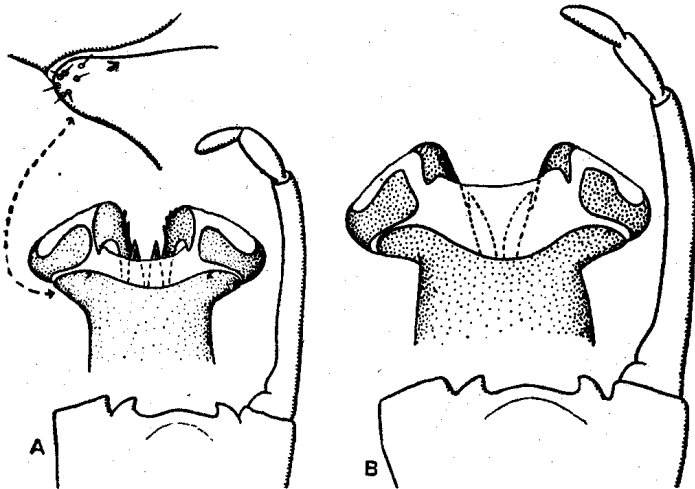
E. torrentis, male. Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

present records go, it occurs only in May and June. Many of the smaller becks which it frequents in the Lake District either dry up or become very low during the summer, and this may perhaps prevent the development of a second brood in the autumn. Typical subimagines offer no difficulty in determination, but there are in the British Museum collection some subimagines from Talybont-on-Usk whose identity must remain somewhat doubtful in the absence of authentic imagines. I think there may be a tendency for the banding to fade a little after death or to become yellowish-brown.

Ecdyonurus dispar (Curtis, 1834). (Figs. 2 D, 3 D, 6, 7.)1834. *Baëtis dispar* Curtis, Lond. & Edinb. Phil. Mag. ser. iii. p. 120.1836. *Baëtis subfusca* Stephens, Ill. Brit. Ent. Mand. vi. p. 64.1871. *Heptagenia longicauda* Eaton (*nec* Steph.), Trans. Ent. Soc. Lond. p. 152, pl. 6, fig. 25.1887. *Ecdyurus venosus* Eaton (*partim*), Trans. Linn. Soc., Zool. (2) iii. pp. 283-286.1929. ? *Ecdyonurus fluminum* Ulmer (*nec* Pict.), Tierw. Mitteleur. iv. p. 32, fig. 119.1930. *Ecdyonurus longicauda* Blair, Ent. Mon. Mag. lxvi. p. 56.1930. ? *Ecdyonurus fluminum* Schoenemund (*nec* Pict.), Tierw. Deutschl. xx. pp. 22-23, fig. 25.

♂ (dried).—Notum of thorax dark fuscous. Dorsum of abdomen fuscous, somewhat darker apically, from the side with the pleuræ and an area at the base of each segment above the spiracles paler and semi-transparent.

Fig. 6.



E. dispar, male. A, Arran, September; B, Windermere, June. Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

No apparent oblique stripe or triangle as in the previous species. Sternites a little paler, with the impressed dots semi-transparent. Forceps dark brown, darker than the forceps-base, which bears on each side of the apical margin a strong tooth, somewhat incurved. Penis-lobes outspread, shorter and triangular rather than boot-shaped. Outer sclerite rounded at its apex. Inner apical sclerites

not projecting, either simple or armed with two or three teeth. Outer apical margin of the basal sclerite rounded, with a few bristles at the apex and sometimes also a small, inwardly-directed tooth. Setæ dark fuscous, becoming paler apically. Fore leg fuscous, basal segment of tarsus of normal proportions, tarsus about 1·8 times as long as tibia. Middle and hind legs reddish-brown, tarsi darker apically. Wings vitreous, almost colourless, costal and subcostal areas very slightly suffused with yellowish-brown, cross-veins in these areas usually weaker and paler than elsewhere. Cross-veins in the stigmal area thickened as in other species, pterostigma somewhat brownish, not very distinct. Venation and thickened area at base of anal veins in fore wing fuscous.

♀ (dried).—Notum of thorax reddish-brown. Abdomen bright reddish-brown, with rather indistinct purplish-red stripes arising obliquely from the spiracle on segments 2-8; pleuræ and an area at the base of each segment above the spiracle paler and translucent. Subanal plate much as in the other species. Setæ dark fuscous at base, paler apically, with indistinct annulations. Wings vitreous, with fuscous venation, costal and subcostal areas almost colourless, stigma indistinct. Costal and subcostal cross-veins before the stigma weak.

Subimago (dried).—Membrane of wings greyish-yellow, venation pale fuscous, the cross-veins very narrowly bordered with fuscous, but not to such an extent as to break up the uniformity of the ground-colour.

Nymph.—Similar in general appearance to *venosus*; the head of the mature nymph with the sides rounded, not quadrate. Produced hind angles of pronotum possibly shorter in proportion than in *venosus*. Setæ greenish- or yellowish-brown. Tarsi and tarsal claw much as in *torrentis*.

This nymphal description is based on material from Lake Windermere; I have no authentic material from streams, but I have taken nymphs from two localities, Scandale Beck and Stock Ghyll, both near Ambleside, which appear to be this species. The nymphs were at an earlier stage of development than *venosus* nymphs taken about the same date, and some of them would probably not be ready for emergence until the late summer.

Length of anterior wing : ♂ 10-13, ♀ 10-15-mm.

Length of seta : ♂ 22-30, ♀ 18-22 mm.

Distribution.—**CORNWALL** : St. Gennys, viii. 1932.
DEVON : R. Taw, vi. 1912 ; Braunton, ix. 1929. **SOMERSET** : Luccombe, 8. viii. 1935. **HANTS.** : Blackwater, New Forest, 30. v. 1923, 3. viii. 1919. **SURREY** : R. Mole, Leatherhead, 9. vi. 1925 ; Mickleham, 6. vi. 1930.
HEREFORD : R. Teme, Leintwardine, 16. viii.-24. ix. 1920 ; R. Monnow, 1913. **BRECON** : Talybont-on-Usk, 31. vii.-10. x. 1931. **DERBY** : R. Dove, 4. x. 1913. **YORKS.** : R. Ribble, Gisburn, viii. 1931 ; R. Wharfe, Hebden, viii., ix. 1931. **NORTHUMBERLAND** : Chollerford, 29. viii. 1936.
WESTMORLAND & N. LANCS. : L. Windermere, vi. 1929, 29. vii.-4. viii. 1932, 7. vi.-1. x. 1941 ; R. Crake, 30. viii. 1941 ; R. Brathay, 2. ix. 1941 ; Troutbeck, 21. ix. 1941 ; Blelham Beck, 26. ix. 1941. **CUMBERLAND** : Ullswater, viii. 1929, 27. vii.-16. ix. 1931. **LANARK** : Carluke, 18. ix. 1885. **PERTH** : L. Awe, viii. 1922 ; L. Tay, ix. 1923. **ARGYLL** : Glen Lonan, 25. viii. 1929. **ARRAN** : Slidery, viii.-ix. 1926. **GALWAY** : 3-9. viii. 1926.

I have seen very little material of this species from the Continent, the only examples in the British Museum collections being from the Pyrenees.

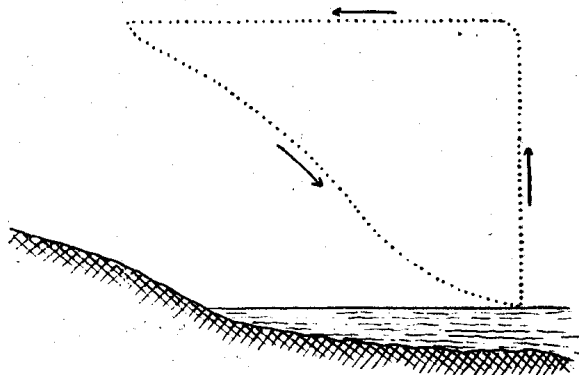
As *E. longicauda*, this species has been generally supposed to be a late summer and autumn insect, whereas on Windermere the main hatch of *dispar* is in June. The flight periods, however, overlap, as I have seen examples of *longicauda* from several streams in June, and there is a secondary hatch of *dispar* on Windermere in September, although the species occurs sporadically throughout the season from early June to the beginning of October. This secondary hatch, which was smaller both in numbers and in size of individuals, suggests that the species may be two-brooded, as in the form of *E. venosus* studied by Miss Rawlinson on the R. Alyn. Early summer examples of *dispar* from streams are not common in the material at my disposal, and it may be that in streams there is only a partial spring brood, the main hatch being in the autumn, the reverse of what appears to be the position in Windermere. Such early specimens from streams that I have seen are larger than the autumn ones, as is the case with the Windermere specimens.

The suggestion has been made that the August Dun is a seasonal form of the False March Brown (*E. venosus* F.). The capture of both forms on the wing on the same day on the same stretch of the Troutbeck in September appears to me to be good evidence to the contrary.

The nymph of this species inhabits the stony shores of lakes such as Windermere and Ullswater, and also streams, usually fast and stony.

The flight of the male *dispar* is very steady, much more so than in that of *H. lateralis*, which is frequently on the wing with *dispar*. They fly head-on to any slight breeze, their fore legs extended and closely pressed together, setæ divergent. The wings are in rapid and continuous

Fig. 7.

Diagram of egg-laying flight of *E. dispar*, ♀.

motion, with no pause during the descending flight. In early June numbers were on the wing over the shore of Windermere near Wray Castle between 4.30 and 5.30 P.M. G.M.T. Later in the evening, about 7.30 P.M. G.M.T., some males were seen flying much higher (10–20 ft.) around the trees. In mid-June some males were seen flying out over the lake as late as 9 P.M. G.M.T. Females were not often seen on the wing, being more frequently found hiding amongst foliage during the day-time, as also were the subimagines. A female was observed ovipositing one afternoon in September at the edge of the lake. She came gliding down from a height of about twelve feet, alighted on the surface for a moment and

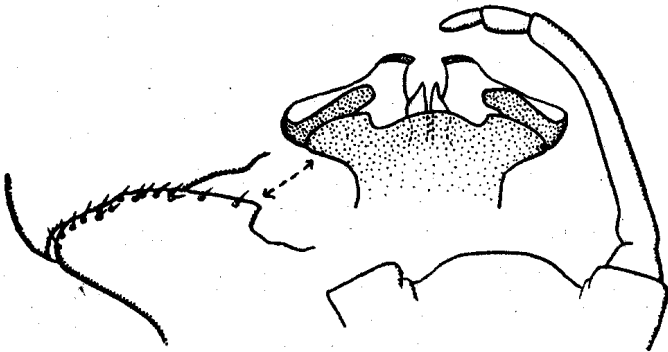
then rose vertically to about the original height, flew back over the land and repeated the glide (fig. 7). This procedure was repeated four times, after which the female flew away inland.

Ecdyonurus insignis (Eaton, 1870). (Fig. 8.)

1863. *Baëtis montana* Hagen (*nec* Pict.), Ent. Ann. 1863, p. 26.
 1870. *Heptagenia insignis* Eaton, Trans. Ent. Soc. Lond. pp. 7-8.
 1871. *Heptagenia insignis* Eaton, *op. cit.* p. 153, pl. 6, figs. 26, 26 a, b.
 1887. *Ecdyurus insignis* Eaton, Trans. Linn. Soc., Zool. (2) iii. pp. 288-9, pl. 24, fig. 46 d.
 1909. *Ecdyurus insignis* Klapálek, Süßwasserf. Deutschl. viii. p. 26, figs. 38-39.
 1910. *Ecdyurus rhenanus* Neeracher, Rev. suisse de Zool. xviii. p. 566, fig. 8.
 1929. *Ecdyonurus insignis* Ulmer, Tierw. Mitteleur. iv. pp. 30-31, figs. 112-113.
 1930. *Ecdyonurus insignis* Schoenemund, Tierw. Deutschl. xix. pp. 22-23, 140-141.

♂ (dried).—Notum of thorax medium fuscous. Abdomen pale cream or ivory-white, rather translucent, segments 9-10 yellowish-brown. Segments 2-8 each with a piceous stripe on the side, starting at the spiracle, extending obliquely backward to the apical margin, becoming somewhat dilated, and continuing over the dorsum as a narrow apical band to meet the opposite stripe. Sternites ivory-

Fig. 8.



E. insignis, male. Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

white, each with a median basal spot, a pair of divergent lines and pair of small dots piceous. Forceps fuscous, forceps-base convex at its apical margin, not toothed.

Penis-lobes outspread, sub-triangular, outer sclerites rounded at apex. Inner apical sclerites slightly incurved, with acute apices. The out-turned portion of the basal sclerite moderately broad, its apex bearing a number of short setæ. Caudal setæ fuscous, paler apically. Fore leg fuscous, middle and hind legs yellowish-brown. Wings vitreous, colourless, costal and subcostal areas very faintly suffused with yellowish, pterostigma pale fuscous, slightly darker at its proximal end. Venation reddish-fuscous, cross-veins in costal, subcostal and radial areas narrowly bordered with dark fuscous or piceous. Base of anal veins in fore wing colourless.

♀ (dried).—Very similar in appearance to the male.

Subimago (dried).—Membrane of the wings pale greyish, venation fuscous, cross-veins bordered with fuscous, showing clearly against the background. Costal and subcostal cross-veins more heavily marked as in imago. Abdomen pale fuscous with piceous markings as in imago.

Nymph.—I have not met with the nymph of this species, which is apparently not found within the limits of the Lake District. According to Schoenemund, it is easily distinguished by the presence of abdominal branchiæ under each of the seven pairs of lamellæ. The other species have them under the first six pairs only.

Length of anterior wing : ♂ 10, ♀ 11–12 mm.

Length of seta : ♂ 30, ♀ 22 mm.

Distribution.—Eaton records the species from the rivers Dart, Kennet and Eden. I have seen examples from the following localities:—DEVON: Newton Abbot, 20. vi. 1922. DORSET: Charmouth, vii. 1924. BERKS.: Reading, vi. 1868. BRECON: Talybont-on-Usk, 30. vi.–21, vii. 1922. YORKS.: R. Dibble, Gisburn, 11. vii. 1933; Bainbridge, 28. vi. 1936. CUMBERLAND: R. Eden, Salkeld, vi.–viii. 1885. It is fairly widespread on the Continent.

The nymph apparently prefers rather large, fast streams and rivers.

Species doubtfully or incorrectly placed on the British list.

Ecdyonurus forcipula (Pictet, 1844). (Figs. 9, 10.)

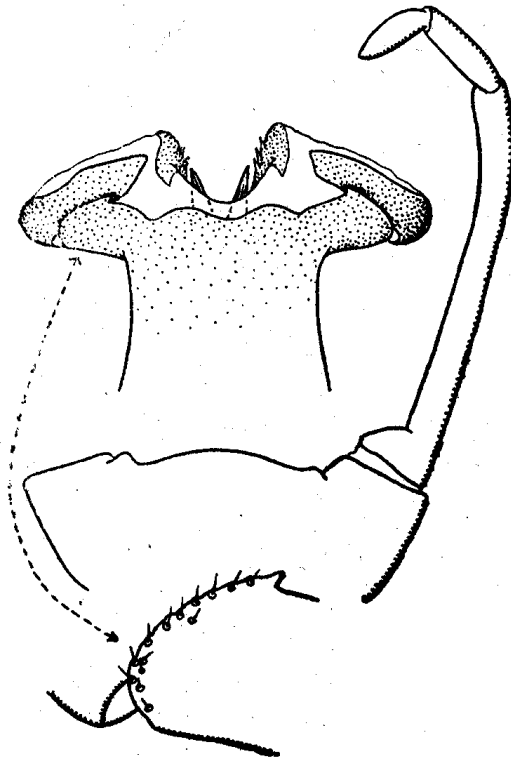
1844. *Baëtis forcipula* Pictet (Kollar MSS.), Hist. Nat. Névr. ii. Ephém. pp. 169–170.

1871. *Heptagenia venosa* var. *forcipula* Eaton, Trans. Ent. Soc. Lond. p. 152.

1887. *Ecdyurus forcipula* Eaton, Trans. Linn. Soc., Zool. (2) iii. pp. 286-7 (partim, Apennino Pistoiese).
 1909. *Ecdyurus forcipula* Klapálek, Süßwasserf. Deutschl. viii. p. 28,
 1929. *Ecdyonurus forcipula* Ulmer, Tierw. Mitteleur. iv. p. 32. fig. 120.
 1930. *Ecdyonurus forcipula* Schoenemund, Tierw. Deutschl. xix. pp. 23-24, 84, figs. 28, 142.
 1935. *Ecdyonurus forcipula* Hincks & Dibb, J. Soc. Brit. Ent. i. pp. 75-76.

The first account of this species is in the form of a note appended to the description of *Baëtis venosa* F. by Pictet,

Fig. 9.



E. forcipula, male (Italian example). Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

1844, in which he suggests that there is probably a new species confused with *venosa* in collections. He gives some characters whereby it may be distinguished, but

does not figure it nor describe it fully, as he had no material preserved in alcohol, and he believed that the description of dried material was open to grave risk of error. He concludes by pointing out that should it subsequently prove to be a new species it should bear the name *forcipula*, under which name he had received specimens from M. Kollar. Eaton (1871) refers to it as a variety of *venosa*, saying (incorrectly) that it was undescribed. In 1887 he gave a full description of *forcipula* with lists of localities. Many of his specimens are in the McLachlan collection, and a large proportion of them prove to be *Ecdyonurus helveticus* (Etn.). The remainder, from the Apennino-Pistoiese, agree well with his description, and I am accepting them as Eaton's concept of *forcipula* Pictet. I have also found further material of *forcipula* confused with *venosus* in the McLachlan collection from various continental localities.

E. forcipula has been provisionally placed on the British list on the strength of the discovery of nymphs in various localities answering to the description of *forcipula* nymphs given by Schoenemund. I have not seen any nymphs as yet which I could unhesitatingly say were *forcipula*, nor have I met with any adults of this species from Britain. The species is certainly closely allied to *E. torrentis*, and it is quite conceivable that white-spotted examples of this species might be mistaken for nymphs of *forcipula*. I have seen such white-spotted nymphs of *torrentis*, but in none was the extent of the white as great as in Schoenemund's figure. These white markings are by no means restricted to *forcipula* and *torrentis*, as I have noticed nymphs of *E. dispar* from Windermere with two white spots, one on the head and one on the thorax.

General appearance of adult much as in *torrentis*. The abdomen is more yellowish-brown, and the lateral markings are triangles rather than stripes. Pleuræ and sternites are pale yellowish-brown. Forceps and genitalia much as in *torrentis*, the outer portion of the basal sclerite of the penis broader and with more numerous bristles. Proportions of anterior male tarsus as in *torrentis*. Middle and hind legs yellowish-brown, hind femora usually without any dark streak at apex of outer surface. Wings much as in *torrentis*, costal and subcostal areas sometimes lightly shaded with yellowish.

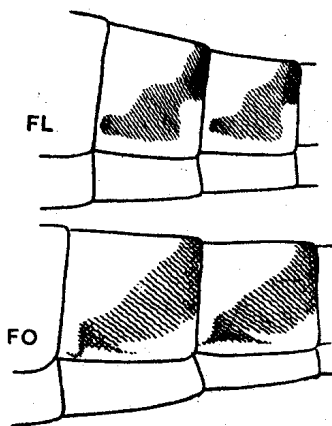
Distribution on the Continent : Germany, Switzerland, France, Italy, according to material which I have been able to examine.

Ecdyonurus fluminum (Pictet), 1844. (Fig. 10.)

1844. *Baëtis fluminum* Pictet, Hist. Nat. Névr. ii., Ephém. pp. 164-169, pls. xvi.-xix.
 1845. *Baëtis fluminum* Imhoff & Labram, Ins. d. Schw. iv. (an unnumbered plate and descriptive matter).
 1871. *Heptagenia fluminum* Eaton, Trans. Ent. Soc. Lond. p. 146.
 1887. *Ecdyurus fluminum* Eaton, Trans. Linn. Soc., Zool. (2) iii. pp. 289-291, pl. lxi. (partim, examples from Genthod and Evian).

This species was placed in the synonymy of *E. longicauda* (Steph.) by Blair (1929) on the recommendation of Dr. G. Ulmer. I have not been able to examine Pictet's types (which according to a MS. note by Eaton are

Fig. 10.



E. fluminum and *forcipula*, males. Pattern of 6th and 7th abdominal segments (Swiss examples).

subimagines), but study of McLachlan's collection raises doubts whether Ulmer was correct in sinking *fluminum* as a synonym of *longicauda*. Eaton, when dealing with *fluminum* in his Revisional Monograph, mentions a dark and a light variety of the species. Both these forms are present in McLachlan's collection, and I consider the light

variety to be a distinct species. There is an error in Eaton's description of the adult. The piceous or black stripe extending from the tegulæ to the fore coxæ is present in the light form and not in the dark form, as stated by Eaton. There are no examples in the McLachlan collection from the actual type-locality, but specimens from Genthod, Lake Lemán, and two females from Evian agree very well with the original description. Examples from Basle and Aix-les-Bains appear to belong to yet a third species.

E. fluminum appears to be very like *E. forcipula*, the male penis-lobes being almost identical. The forceps-base is perhaps less strongly toothed, and there seems to be some difference in the pattern of the abdominal tergites, but I have not sufficient material of *fluminum* to discover whether this is constant (fig. 10). The pterostigma is rarely shaded with brown, and *C*, *Sc*, and *R* are pale yellowish-brown, not dark brown.

Baëtis fluminum Brauer (1871, *Neur. Austr.* p. 26) cannot be this species, or even this genus, if the description is correct, Brauer declaring that the first and second tarsal segments of the fore leg were of equal length.

Ecdyurus fluminum Klapálek (1909, *Süsswasserf. Deutschl.* viii. p. 28) may be conspecific with *fluminum* Pict., but in his figure the penis-lobes appear too thin (more as in the examples from Basle and Aix-les-Bains). *Ecdyonurus fluminum* Ulmer (1929) has very definite teeth on the forceps-base, but his figure 118 *b* agrees very well as regards pattern. Fig. 118 *a* shows a pattern more like Eaton's pale variety, and I suspect that he has confused more than one species, especially as British examples of *dispar* sent to him by Dr. Blair were returned as *fluminum*. Schoenemund (1930) also appears to have confused two species, as his figure of the anal appendage recalls those of *dispar* and the abdominal marking is of the pattern found in the pale variety, though from his description it is a darker brown insect.

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