

ELECTROGENA AFFINIS (EATON, 1885) (EPHEMEROPTERA,
HEPTAGENIIDAE), A MAYFLY NEW TO BRITAIN

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INTRODUCTION

The family Heptageniidae is currently represented in Britain by eleven species in five genera, although two species, *Arthroplea congena* Bengtsson and *Heptagenia longicauda* (Stephens) may no longer occur here.

The genus *Electrogena* was erected by Zurwerra & Tomka (1985) and comprises those species previously included in the *Ecdyonurus lateralis*-group, of which the sole British representative was *E. lateralis* (Curtis, 1834). This species retains the name *Heptagenia lateralis* (Curt.) in the current FBA key to nymphs (Elliott, Humpesch & Macan, 1988). A morphological key to the genera of the Heptageniidae is provided by Tomka & Zurwerra (1985) and enables both nymphs and imagines of *Electrogena* to be identified. Subsequent enzyme electrophoresis studies have revealed the phylogenetic relationships within the Heptageniidae and have further validated the erection of the genus *Electrogena* (Zurwerra, Metzler & Tomka, 1987).

Nymphs and adults of a second British species in the genus have recently been identified from a site on the River Derwent in Yorkshire.

METHODS

A series of pond-net samples taken in July 1988 from the River Derwent at Norton, Yorkshire (SE 790715), contained nymphs of a mayfly superficially resembling *Heptagenia lateralis*. The nymphs keyed out at this species using the most recent key to British species (Elliott, Humpesch & Macan, 1988) but the location, just 15 metres above sea level, and habitat at the site seemed atypical for *H. lateralis*. The samples were taken from an area of deep, slack marginal water with much emergent vegetation (*Glyceria maxima*) and also from submerged midstream vegetation (*Potamogeton* spp.) in faster-flowing but also deep water. The preferred habitat of *H. lateralis* is chiefly fast-flowing, stony streams and rivers or stony lake shores and it generally occurs at high altitudes (Elliott, Humpesch & Macan, 1988). Further detailed examination revealed a number of consistent differences between these nymphs and specimens of *H. lateralis* from several locations in Britain. A search of European works on the Heptageniidae (Belfiore, 1981, 1994; Hefti & Tomka, 1989; Landa, 1969; Landa & Soldan, 1982) provided sufficient information to identify the nymphs as *Electrogena affinis* (Eaton).

In August 1994 many fully grown nymphs were collected from the site at Norton, of which a number were successfully reared to the adult stage.

These were identified as *E. affinis* using the key in Landa & Soldan (1982).

To facilitate detailed examination of the legs, gills and mouthparts of the nymphs, specimens were dissected and the relevant structures mounted on glass slides in polyvinyl lactophenol. A magnification of at least 100× was required to see the detail of the diagnostic features.

IDENTIFICATION

Nymphs

The following features of the legs, illustrated in fig. 1 and used in the separation of *Heptagenia lateralis* from *H. sulphurea* (Retzius) and *H. fuscogrisea* (Müller) in the FBA key (Elliott, Humpesch & Macan, 1988), should be sufficient to confirm the generic identification of *Electrogena*:

1. The long, fine hairs forming the fringe on the dorsal edge of the femur are at least half as long as the width of the femur in *Electrogena*. In *Heptagenia*, the hairs are shorter and interspersed with stronger spines, these being as long as the hairs in *H. sulphurea* but shorter in *H. fuscogrisea*, where the hairs are sparse and confined to the distal half of the femur.
2. The pattern of dark markings on the anterior face of the femur produces the effect of a pale central cross-shaped mark in *Electrogena* but one of alternate, irregular, light and dark bands in *Heptagenia*.

The following features of the mouthparts may also be used to distinguish the two genera:

1. Both mandibles of *Electrogena* have several (4-7) strong prosthecal setae below the incisor but no fringe of short, fine setae. In *Heptagenia*, there are no prosthecal setae on the right mandible and only one on the left but there is a dense fringe of short, fine setae present between the incisor and molar regions on both mandibles (cf. figs 2a,b).
2. The maxillae of *Heptagenia* have a distinct, well-defined row of setae on the ventral face of the galea lacinia. In *Electrogena*, the setae are scattered over a large area of the ventral face (cf. figs 2c,d).
3. The paraglossae of the labium of *Electrogena* are extended laterally and the glossae are rounded both externally and internally (knob-shaped). The paraglossae of *Heptagenia* are not extended laterally and the glossae of the two British species are either concave (*H. sulphurea*) or straight (*H. fuscogrisea*) (cf. figs 2f,g,h,i).
4. The lateral lobes of the hypopharynx are greatly extended and recurved in *Electrogena*, features that are less pronounced in *Heptagenia* (cf. figs 2j,k,l,m).

The separation of *E. lateralis* and *E. affinis* may be achieved by examination of the tarsal claws and the femora (cf. figs 1a,b):

1. *E. affinis* has at least two (up to five) narrow auxillary spines on the tarsal claw. The tarsal claw of *E. lateralis* has only one, rather broad, auxillary spine.
2. The ventral edge of the femur of *E. affinis* has a fringe of fine setae. Only a few isolated fine setae are present in *E. lateralis*.
3. The spines on the anterior face of the femur of *E. affinis* are generally strongly tapered to a fine point, although some may have blunt tips. The spines of *E. lateralis* usually taper less strongly and have blunt tips; some may be almost columnar, with truncated ends.

Examination of the mouthparts provides additional features for distinguishing between the two species. In general, the mouthparts of *E. affinis* have longer, finer and more numerous setae on a number of

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1. The basal segment of the maxillary palps, particularly the inner face (cf. figs 2d,e).
2. The basal segment of the labial palps (cf. figs 2h,i).
3. The tips of the lateral lobes of the hypopharynx (cf. figs 2l,m).

The following features may also be useful in the identification of mature, live or freshly-preserved nymphs:

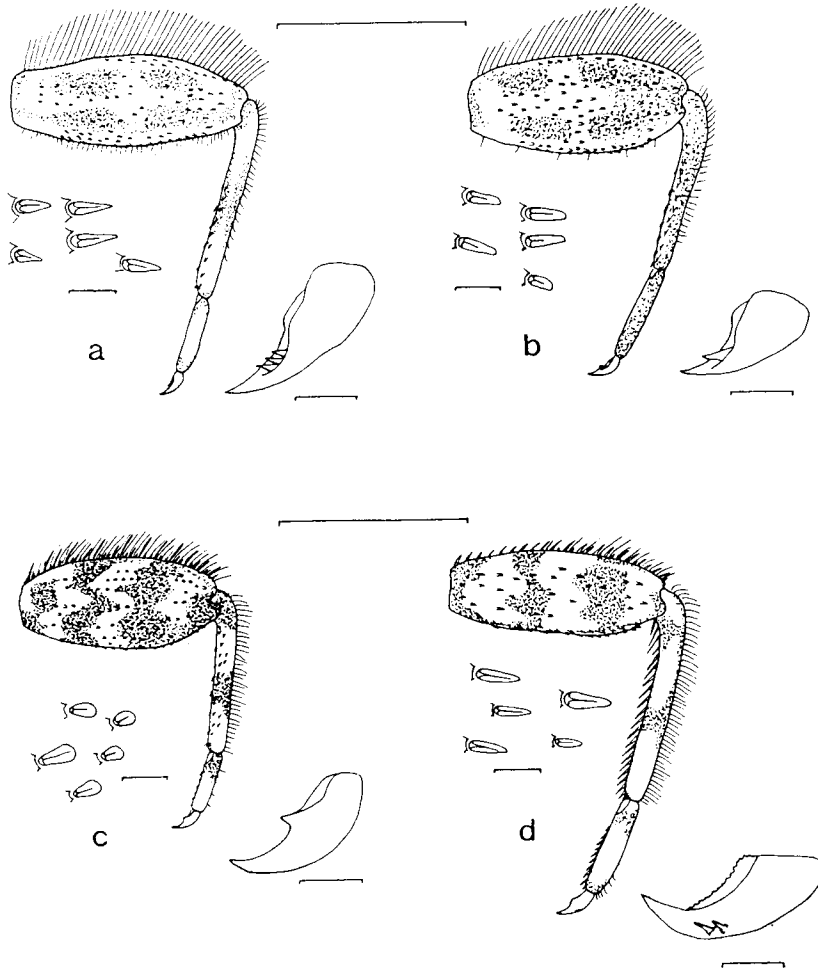


Fig. 1. — Hind legs and details of tarsal claws and spines on anterior faces of femora of: a, *Electrogena affinis*; b, *E. lateralis*; c, *Heptagenia sulphurea*; d, *H. fuscogrisea*. (Scale lines: legs 2 mm; tarsal claws 0.1 mm; femoral spines 0.05 mm).

1. The overall coloration and patterning of *E. affinis* is stronger than in *E. lateralis*. In particular, the dorsum of the thorax has a strongly contrasting pattern of chestnut and cream markings on a light brown background. There is much less contrast in the pattern on the dorsum of *E. lateralis*.
2. In *E. lateralis* the thoracic ganglia are clearly visible ventrally as three dark, purple-brown, circular marks showing through the thoracic sternites. No such marks are visible through the sternites of *E. affinis*.
3. The gill plates of *E. affinis* have conspicuous, dark tracheation not apparent in *E. lateralis* and the filaments are longer, usually extending beyond the plate margin (cf. figs 3a,b). In fresh specimens, a dark spot may be visible in the centre of each gill plate of *E. affinis* but not of *E. lateralis*.

Mature nymphs of *E. affinis* are somewhat larger than those of *E. lateralis*. The ranges for length (front of head to tip of abdomen) are 8.5 mm to 11.0 mm for *E. affinis* and 7.0 mm to 8.5 mm for *E. lateralis*.

Imagines

Generic identification of the Heptageniidae may be made by reference to the FBA key (Elliott & Humpesch, 1983), separation being made on the basis of the relative proportions of the hind tarsal segments and by the shape of the penis lobes of the male. In *Electrogena* (referred to as *H. lateralis* in the key) the basal segment of the hind tarsus is longer than segment 2 (as it is also for *Ecdyonurus*). In *Heptagenia* segment 1 is either shorter than segment 2 (*H. sulphurea*) or equal in length to segment 2 (*H. fuscogrisea*).

The penis lobes of male *Electrogena* are simply rounded distally, those of *Heptagenia* having blunt projections, while in *Ecdyonurus* they are produced laterally, forming a T-shaped structure (see figs 23–25 in Elliott & Humpesch). Imagines of both *E. lateralis* and *E. affinis* have a bright yellow streak on the thorax running from the base of the fore wings towards the head.

Imagines of both sexes of *E. affinis* may be distinguished from *E. lateralis* by the coloration and patterning of the sides of the prothorax, the legs and the abdominal tergites. The prothorax of *E. affinis* is yellow-brown with an oblique chestnut stripe, which extends on to the otherwise yellow coxa of the fore leg. The coxae of the middle and hind legs are also yellow with a brown stripe. *E. lateralis* are uniformly brown on the sides of the prothorax and on the coxae. *E. affinis* has pale, yellow-brown femora with chestnut-brown marks. The tibiae and tarsi are also yellow. All the leg segments of *E. lateralis* are more uniform dark brown in colour, the femora lacking any conspicuous chestnut markings. In *E. affinis* the background colour of the abdomen is creamy-white, each tergite having a central dark chestnut triangular mark extending from the anterior edge to approximately midway down the segment. On each side there is a large rusty-red dorso-lateral mark occupying most of the length of each segment and extending ventrally around the sides in the anterior regions of the segments. The tergites of *E. lateralis* are a uniform brown colour with darker posterior margins.

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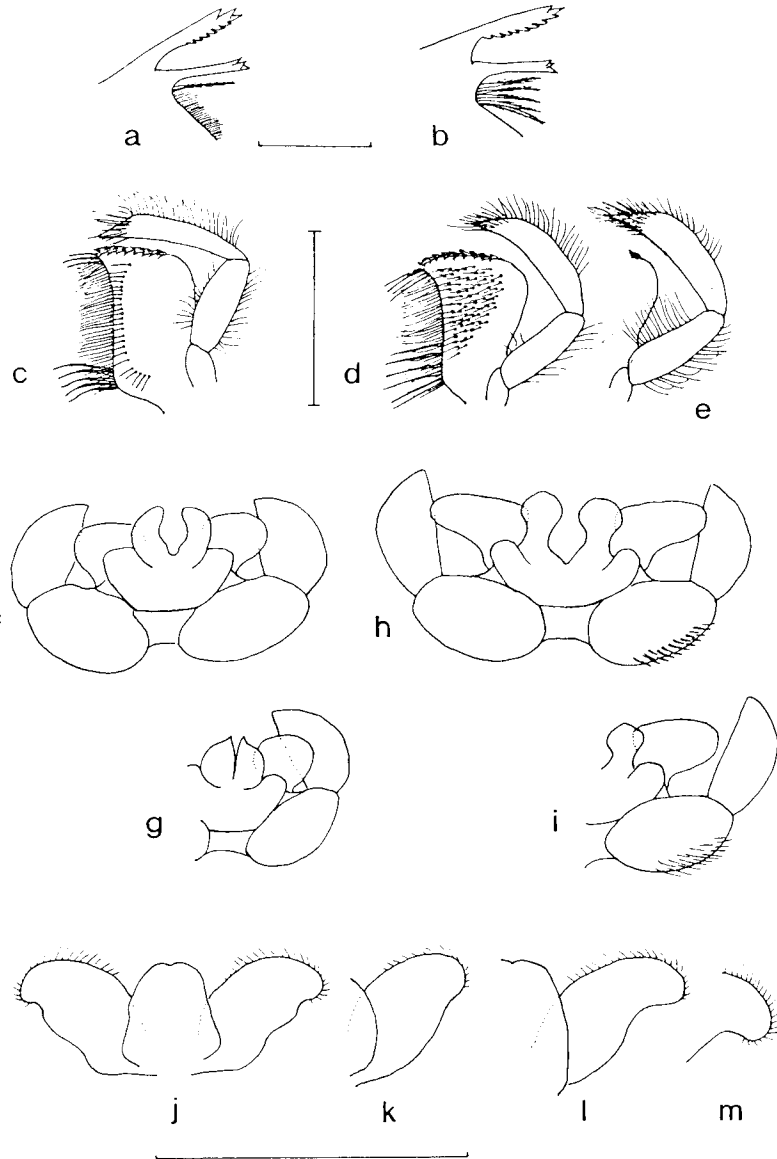


Fig. 2. — Mouthparts. a–b, incisor region of left mandible of: a, *Heptagenia sulphurea*; b, *Electrogenia lateralis*; c–d, maxillae of c, *H. sulphurea*; d, *E. lateralis*; e, maxillary palp of *E. affinis*; f–i, labium of: f, *H. sulphurea*; g, *H. fuscogrisea*; h, *E. lateralis*; i, *E. affinis*; j–m, hypopharynx and lateral lobes of: j, *H. sulphurea*; k, *H. fuscogrisea*; l, *E. lateralis*; m, *E. affinis*. (Scale lines: mandibles 0.25 mm; maxillae 1 mm; labium & hypopharynx 2 mm).



Fig. 3. — Fourth gills of: a, *Electrogena lateralis*; b, *E. affinis*. (Scale line 1 mm).

As with mature nymphs, the imagines and sub-imagines of *E. affinis* are conspicuously larger than those of *E. lateralis*. Length ranges for *E. affinis* are 8.5 mm (males) to 11.0 mm (females), and for *E. lateralis* 7.0 mm (males) to 8.5 mm (females).

HABITAT, BEHAVIOUR AND FLIGHT PERIOD

To date, in Britain, *E. affinis* has only been recorded from the lowland section of the River Derwent, a large river with an alkaline water chemistry. Just prior to emergence, the mature nymphs may be found clinging to the underside of floating aquatic plants in and close to the main stream of the river. In contrast, the normal habitat for *E. lateralis* is the stony substrate of upland sections of fast-flowing rivers having acidic or neutral water chemistry. Nymphs do not utilise aquatic plants and move to rocky side pools just prior to emergence. These may be extremely small, containing just enough water to cover the nymphs. Both species are univoltine in the British Isles, *E. lateralis* having a flight period from May to September (Elliott & Humpesch, 1983) with the peak emergence from mid to late June. The emergence period for *E. affinis* at Norton appears to be between late July and mid August.

DISCUSSION

There are currently approximately twenty species belonging to the genus *Electrogena* described from the Holarctic, Oriental and Ethiopian regions. Of these, only three species are widespread in Western Europe, many of the others having been recently described and/or having restricted ranges (Landa & Soldan, 1982; Belfiore, 1994). *E. affinis* occurs in rivers of the Low Countries and northern Germany, extending into the eastern European lowlands (Puthz, 1978). In view of its distribution, it is not surprising that this species should occur in a lowland section of a large river on the eastern side of England. So far, the River Derwent at Norton is the only site in Britain from which *E. affinis* has been recorded but it is anticipated that it will be found more extensively in the River Derwent and in other similar rivers in the catchment of the River Ouse. Indeed, it could occur at any suitable location on large lowland rivers, where it may have been overlooked or mis-identified, as transpired recently with the

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discovery of *Caenis pseudorivulorum* Kieffermüller at this same site on the River Derwent and, subsequently, at several different, widespread locations (Gunn & Blackburn, 1997).

ACKNOWLEDGEMENTS

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May 31st, 1996.

Rhynchium oculatum (F.) (Hym., Eumenidae) found at Nottingham, England. — Recently Dr Sheila Wright passed to me a large brown-coloured mason wasp with darkened wing tips. A visit to the Natural History Museum in London showed the specimen to be *Rhynchium oculatum* (F., 1781), and its colour form indicated it could have originated in Spain. The male mason wasp was found by Mrs Nightingale feeding on *Sedum* in her garden at Arnold, Nottingham (SK 597457) on 20.ix.1997. This is the first record of this species in England. *R. oculatum* is mainly found in countries bordering the Mediterranean: southern Europe, north Africa, Syria and Aden. The species probably nests in pre-existing holes in wood and paralyzes caterpillars of Pyralididae (Lepidoptera) to serve as food for its own larvae. — MICHAEL E. ARCHER, 17 Elmfield Terrace, Malton Road, York YO3 0EH: October 21st, 1997.