

Journal of the British Dragonfly Society

Volume 1
Number 2

November
1983



Edited
by
R. Merritt



affiliated to the Societas Internationalis Odonatologica



Observations on the ecology and distribution of *Orygaster curtisii* (Dale)

- D.G. Chelmick

Of all the European dragonfly fauna, the Emeralds (family : Corduliidae) have always held a particular fascination for me, and no species more so than that most elusive of British insects : the Orange-spotted Emerald, *Orygaster curtisii*. Longfield's (1949) account of the habits of this rarity has all the ingredients of nature's high drama, and it was from this account that my initial enthusiasm was fired. There followed many years of fruitless search in Britain until I eventually succumbed to the lure of foreign parts, where I eventually tracked down my quarry. This paper is an account of my search for this insect, both at home and abroad, with some personal views on its ecology and distribution.

British Distribution

My first task was to communicate with someone who the insect alive. This proved to be more difficult than one might imagine, as my first contact, Cyrell Hammond, informed me that he had never seen the living insect. All his specimens had been given to him by Colonel F.C. Fraser who had died some years previously. I then contacted that doyenne of British odonatologists, Cynthia Longfield, who was able to provide me not only with first-hand information but also an excellent summary of the insect's history in this country.

Orygaster curtisii has the distinction of having been first discovered in England - by J.C. Dale on 29th June 1830 at Parley Heath near Bournemouth on the Dorset/Hampshire border. For reasons best known to Dale, he did not describe the insect until 1834. In fact, he was almost beaten to the mark by the then celebrated entomologist J.F. Stephens, who named the species *Cordulia compressa* in 1829. However, as Stephens failed to publish any description, Dale's later name is valid. The locality stated by Stephens was for Brockenhurst in the New Forest, some ten miles from the Parley Heath locality.

Following Dale's capture, a number of records appear until the early 1830s - one of which, accredited to a Mr. Cocks, was from an entirely new area, namely Brainton Burrows.

was found again, although Henry Doubleday, the Essex entomologist, thought he saw the insect near Epping in 1871. The discovery of *O. curtisii* in 1878 at Pokesdown (now a suburb of Bournemouth) was within a few miles of the original locality. It was certainly not an isolated record since the captor, one H. Goss, returned to the locality four years later and took four more specimens. This fifty-year gap between records is something of a mystery as there was no shortage of entomologists during this period.

The J.J.F.X. King collection of British Odonata contains 13 specimens of *O. curtisii* all from Bournemouth, Hampshire - presumably from the same locality as previous records. Unfortunately, there are no dates for the captures, although circumstantial evidence indicates that they were collected between the year 1872-1899. Killington, in his paper "Palaenoptera (Odonata) of Hampshire and the Isle of Wight", records fairly regular sightings up to 1905. Another gap occurs until the early 1920s when Colonel F.C. Fraser began taking the insect regularly, until the late 1930s, on the Moors River somewhat to the north of Dale's original locality (Cynthia Longfield, pers. comm.). In 1946, and subsequently until the final record in 1951, Cynthia Longfield and the late Eric Gardner reported the presence of *O. curtisii* on the Moors River, upstream from Fraser's 1930s sightings.

I was lucky enough to have the opportunity of discussing *Orygaster* with Eric Gardner shortly before his death, and his account of the insect throws some light on its elusive nature. Weather conditions for successful observation had to be per-

less - hot still days when the adults would be seen flying in a conspicuous figure of eight pattern. Although *G. curtsi* is y ch, the eventually managed to capture one female from which he collected eggs which he then successfully reared in his breeding tanks. He always felt that the construction of the sewage works on the Moors River upstream from the main locality was one of the reasons for the extinction of the insect in Britain.

What about other localities in the 20th century? Cynthia Longfield wrote to me of her delight in 1946 when she opened a small package, sent to her at the British Museum, containing a single imago female *Grygaster* sent by a Mr. O.G. Watkins of Plymouth. Mr. Watkins' discovery, of three individuals of *G. curtsi* was on the River Tamar just north of Gunnislake. The River Tamar here looks to be an ideal habitat for *Grygaster*, but despite extensive searches by many observers, including myself, no further records have been forthcoming.

World Distribution

For a short period following Dale's publication of his description of *G. curtsi*, it was thought that the species was endemic to Britain. This illusion was soon shattered by the discovery that a specimen from France, described in 1837 as *Grygaster* by Boyer de Fonscolombe, was in fact the s

Longfield (1949) describes *Grygaster* as only being at all common in Spain and Portugal. My opinion, and that of other workers on the French Odonata, is that *Grygaster* is a very common insect throughout Southern and Central France, even occurring well to the north of the 48th degree of latitude quoted by Lucas (1900). Apart from France, the only other country where it appears to breed regularly is Spain. The species has been reported irregularly from several neighbouring European countries, and from Morocco.

Ecological Observations

One of my major regrets, in writing this paper, is that I am unable to report first-hand observation of this insect in Britain, despite many years of searching. My experiences are based upon two trips made to France in 1979 and 1980. The 1979 trip, during the last two weeks of July, are situated to the south of the Dordogne region. This visit was blessed with superb weather throughout. Alas, the same cannot be said for the 1980 tour, which took place slightly earlier in the year. Due to the poor weather conditions, very little work was carried out on the Lot/Cele in 1980, but useful sightings were made on the rivers Hérault and Viz in the Montpellier area of southern France.

Time of Appearance: On our first trip, *Grygaster* was first seen on the 14th July, judging by the numbers of adults and the condition of the exuviae found, the insect had already been on the wing for some time. On the rivers Lot and Cele, its numbers appeared to decline dramatically after the 23rd July. On the second trip, we found a few exuviae on the banks of the Cele on the 28th June, but saw no adults - the weather at this time being cool and wet. In the Montpellier area, we saw good numbers of adults holding territory and ovipositing on the 5th July. Returning to the Lot/Cele, we observed sparse populations of adults. No further observations were made after this date due to a further deterioration in the weather.

Few conclusions can be drawn from this brief picture except that I suspect a *Gomphus*-like synchronised emergence. This would account for the fairly rapid disappearance of the insect in late July. In my experience, the rivers on which *Grygaster* is common are positively schizophrenic in their nature - changing overnight from peaceful sluggish streams to raging torrents. Since riparian Odonata have to adapt to this, the adult insects are almost impossible.

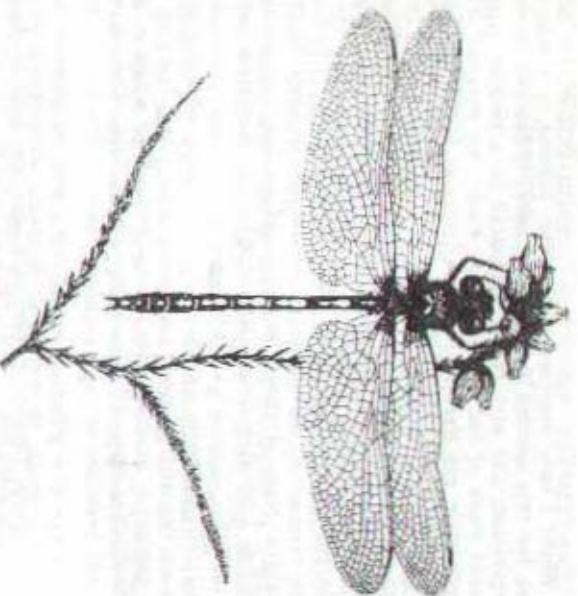


Fig. 4.

male *Zygocorybe dorsalis* (illustrated by R.H. Dunn)

Appearance and behaviour: In the hand, the yellow abdominal spots (and they are yellow, rather than orange as the English vernacular name implies) are easy to see, but in flight they are inconspicuous. Some individuals, mainly females, have very much reduced yellow markings, with just a few yellow spots on the anterior part of the abdomen. In flight *Zygocorybe* is reminiscent of *Cordulia canis*, having none of the lustrous iridescence of the latter. On hot sunny days, the adult males spend much time flying low over the water searching for females and chasing off other males. Territories appear to be ill-defined, although, on the shadier parts of the River Cele, the males would take possession of small patches of sunlight hitting the water and defend these against all-comers, rather like Speckled Wood butterflies on a woodland path.

In common with other "Emeraids", females are more difficult to find. They come to the water only to mate and oviposit, the latter taking place unaccompanied and somewhat furtively amongst the roots of overhanging bushes. Ovipositing females are best detected by the rustling of their wings in the restricted space amongst the tree roots, and careful search may reveal the insect occasionally dipping her ovipositor into the water to lay the eggs.

Zygocorybe dorsalis is a relatively easy creature to approach and therefore to photograph. However, since it has been disturbed, you do not get a second chance. It wanders noticeably distances away from water and can be often found roosting and feeding in woodland and scrub many miles from its riparian home.

Habitat: Whilst I have observed *Oxygastra oviposita* in a lake on one occasion, the main habitat for this species, in my experience, is lowland rivers with little or no emergent vegetation, and with banks dominated by a tangled growth of trees and scrub with exposed roots at the water's edge. From his detailed study of the behaviour of *C. curtipalpi* in the Eastern Pyrenees, Heymer (1964) considered it to be a species tied in running water.

Oxygastra appears to be oblivious to obvious forms of pollution, being as common around small villages where raw sewage discharges directly into the river, as in clean unpolluted water. On the River Lur, considerable industrial development exists including large scale mineral extraction operations. In addition to this, the river has been considerably "tamed" at intervals along its length. None of these developments appears to have adversely affected this obviously highly adaptable insect, which occurs in prodigious numbers along the river.

Unlike other "Emeralds" found in Britain, in which the exuviae are usually found less than 50 cms from the ground/water surface (less than 15 cms in the case of *Symphyla arctica*), exuviae of *O. curtipalpi* may be found at elevations of up to 2-3 metres - favoured emergence sites being exposed tree trunks by the water's edge, and the trunks and branches of overhanging trees.

Conclusion

It is 32 years since *Oxygastra curtipalpi* was last seen in the British Isles. However, I do not think that this constitutes grounds for pessimism - after all, it was thought that *Cotus dryas* had become extinct in Britain, yet its rediscovery this year in Essex and Kent suggests that it had been merely overlooked.

Oxygastra is an elusive insect, favouring those parts of lowland rivers which, by their shady nature, may well be passed over by odonatologists. I hope that some of you, reading this paper, may be stimulated by some of the enthusiasm that I have always had for this creature, and that more concentrated observation on the lowland rivers of southern England will result in *Oxygastra* being rediscovered once again.

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Observations of Wood-mice (*Apodemus sylvaticus*) and Hobby (*Falco subbuteo*) feeding on dragonflies.

- R.J. Khan.

Most people with an interest in dragonflies will have noticed the number of insects which have bent abdomens or twisted wings soon after emergence. Much of this damage, as I have observed on a number of occasions, is caused by these body parts becoming entangled in vegetation during the "drying out" period.

However, dragonflies can meet with other problems during this particularly vulnerable stage of their life cycle.

In Haddon Forest, near Exeter, where I am employed as a warden and wildlife consultant by the Forestry Commission, we have a small man-made pond about 20 metres in diameter situated on a south facing hillside, and overlooked by a wooden cat-walk so that the public may view without disturbing the pond life. During the last three years, I have come across the wings of damselflies and Aeshna dragonflies lying neatly beside the empty larval cases, and, on a number of occasions, have found the partially eaten bodies of *Anax imperator* and *Aeshna cyanea* with their wings bitten off at the base.

Early one morning in June 1981, I was watching a newly-emerged *Anax imperator* drying out on its empty case attached to a stem of *Juncus*, when I became aware of small rodent moving along the pond's edge towards the dragonfly. Using my binoculars I identified the rodent as a Wood Mouse (*Apodemus sylvaticus*). Within seconds it located the dragonfly, gripped the insect in its jaws and pulled it off the *Juncus* stem. I had a perfect view of the mouse as it gnawed off the wings and then devoured the body. The sound was clearly audible as it munched away at the meal.

At dusk, when it has been too dark to see clearly, I have heard small rodents feeding in a similar way, and found clear evidence of the wing remains in the morning. The lack of any exuviae in proximity to the discarded wings has led me to believe that adult dragonflies had been eaten. No doubt their body temperature was too low to enable them to take flight and evade capture.

I believe that the Water Shrew (*Neomys fodiens*) takes similar prey, but I have not found this small mammal in the vicinity of my pond. It would be interesting to receive comments from other readers on this subject.

In June 1981, I was observing many newly-emerged *Anax imperator* making their maiden flights from the pond, when a Hobby (*Falco subbuteo*) spotted the rising insects and proceeded to consume a large number, catching them one by one in its talons and then transferring the prey to its bill, after discarding the dragonfly's wings. This action took place 30 metres above the pond.

After allowing the Hobby to feed for some fifteen minutes, I stood up and gently moved the falcon away. I have a great love of birds of prey, but I am also very protective towards my dragonflies!

SCARCE SPECIES STATUS REPORT

2. A review of *Coenagrion hastulatum* (Charpentier) in Britain. - P.R. Marren and R. Merritt.

Coenagrion hastulatum was first added to the British list in 1900. A number of Scottish Odonata collected that year by Colonel T.W. Verburly were given to Robert McLachlan, who identified *C. hastulatum* from a single aberrant male, labelled 'Aviemore, June 28th'. His identification was confirmed by N.J. Morton, who was acquainted with *C. hastulatum* in Norway. The discovery was published in the Entomologist's Monthly Magazine (McLachlan 1900), but quite too late for inclusion in W.J. Lucas's British Dragonflies (1900).

In 1903, J.F.X. King visited the Aviemore site and refound the species (Lucas 1910). Shortly afterwards, it transpired that the Aviemore specimen was not the first British *C. hastulatum*, although it was almost certainly the first time it had been recognised. Lucas (1904) wrote that "Mr. C.W. Dale informs me he has a specimen of *Agrion hastulatum* taken by Mr. Richard Weaver in Sutherlandshire in 1842." However, when Lucas published his paper (1909) on the dragonflies in the 'Dale Collection', he wrote that "Richard Weaver's captures apparently were made in Sutherland in 1842 (in litt. C.W. Dale 3rd Feb. 1904)", so suggesting that Dale's original statement may have been based on circumstantial evidence.

J.F. Stevens had also listed *C. hastulatum* as British in the early nineteenth century, but McLachlan (1900) regarded this as an error.

For many years, the 'classic' locality 'near Aviemore' was the only known site in Britain, and *C. hastulatum* remained a little known species to most British entomologists. Of the leading authorities on British Odonata, neither Lucas nor Morton had first-hand knowledge of it (Lucas 1930), and even Cynthia Longfield (1948, 1949) wrote that she did not know "the habits of this exceedingly rare Damselfly", although she records it from an unnamed locality in Argyll as well as "a few localities in the county of Inverness". However, in the distribution maps published by Longfield (Corbet, Longfield and Moore, 1960), Argyll is not shown to possess *C. hastulatum*, although the species is shown for both West and East Inverness. In view of this discrepancy regarding Argyll, and the lack of any subsequent, published information, or museum specimens, to substantiate the claim for West Inverness, the occurrence of *C. hastulatum* in these two vice-counties must, for the moment, be considered questionable.

In June 1949, a Scottish entomologist, G.G. Blackwood, found the species in abundance at a low site near Elsdom in Perthshire (Blackwood 1949).

In 1978, larvae were found in a loch in Deeside, Aberdeenshire, which were provisionally identified as *C. hastulatum* by M.R. Young of Aberdeen University. In June the following year, adult males of the same loch were found in a different part of the same loch.

In May 1981, P.S. Corbet obtained two final instar larvae of *C. hastulatum* from a loch in Inverness-shire that falls within the Watsonian vice-county of Elgin. One of the larvae subsequently emerged.

The status of this species in Britain may be summarised as follows:-

Table 2.

| Vice-County | Total number of sites from which <i>C. hastulatum</i> has been reported | Number of sites at which <i>C. hastulatum</i> was present 1978-83 |
|-------------------------------|---|---|
| Mid-Perth (V.C.88) | 4 | 4 |
| South Aberdeen (V.C.92) | 4 | 4 |
| Elgin (V.C.95) | 1 | 1 |
| East Inverness (V.C.96) | 6 | 5 |
| ? West Inverness (V.C.97) | 1? | 0 |
| ? Main Argyll (V.C.98) | 1? | 0 |
| ? Sutherland (V.C.107 or 108) | 1? | 0 |
| TOTAL | 15 (18?) | 14 |

N.B.:-

a) the exact location of the site(s) labelled 'Aviemore', from the early part of this century, is not known. It is assumed that 'Aviemore' relates to the general area of Aviemore - not necessarily the immediate vicinity of the village itself - and as such the site(s) may have been either in V.C.95 or V.C.96, or both. The site, which is not included in the figures given in the Table above, may have been one of those that were subsequently discovered in the area.

b) the vice-counties are taken from the 'Watsonian Vice-counties of Great Britain', published by The Ray Society, London (1969).

The range of habitats in which *C. hastulatum* is found in Britain is best exemplified by briefly describing three typical sites:-

- 1) extensive acid basin mire comprising peaty pools containing *Potamogeton pectinatus*, *Carex rostrata* and *Sphagnum*; less wet areas with *Sphagnum* lawns and *Briza media*, *Erica tetralix*, *Erica tetralix*, *Erica tetralix* and *Erica tetralix*; and drier peaty hummocks with *Calluna*, *Erica tetralix* and *Erica tetralix*. Surrounded by conifer plantations/open birch woodland. Altitude 300 metres.
- 2) small, sheltered lochan with *Hydrocharis* in the open water; marginal vegetation consisting of *Juncus effusus*, *Hydrocharis* and *C. rostrata*; and an area of *Sphagnum* bog; and surrounded by extensive *Calluna* and *Myrica gale* with scattered, regenerating Scots pine and birch scrub. Altitude 225 metres.
- 3) large loch with extensive areas of *Phragmites* and *Carex lasiocarpa*/*C. rostrata* sedgeswamp; peaty pools with *Sphagnum* and *Erica tetralix*; and surrounded by areas of *Calluna*, *Myrica gale* and alder, birch and sallows. Altitude 150 metres.

The known localities of *C. hastulatum* all lie within the 0.6°C February minimum isotherm and the 2.5°C January mean, which is the coldest part of Britain, and the area where open waters are frozen for the longest period. They are also within the relatively warm 14°C - 14.5°C July mean, and are thus within the continental rather than the oceanic parts of northern Scotland. It is interesting to note that parts of Sutherland, such as Strath Oykel, fall within the broad climatic limits of the known localities.

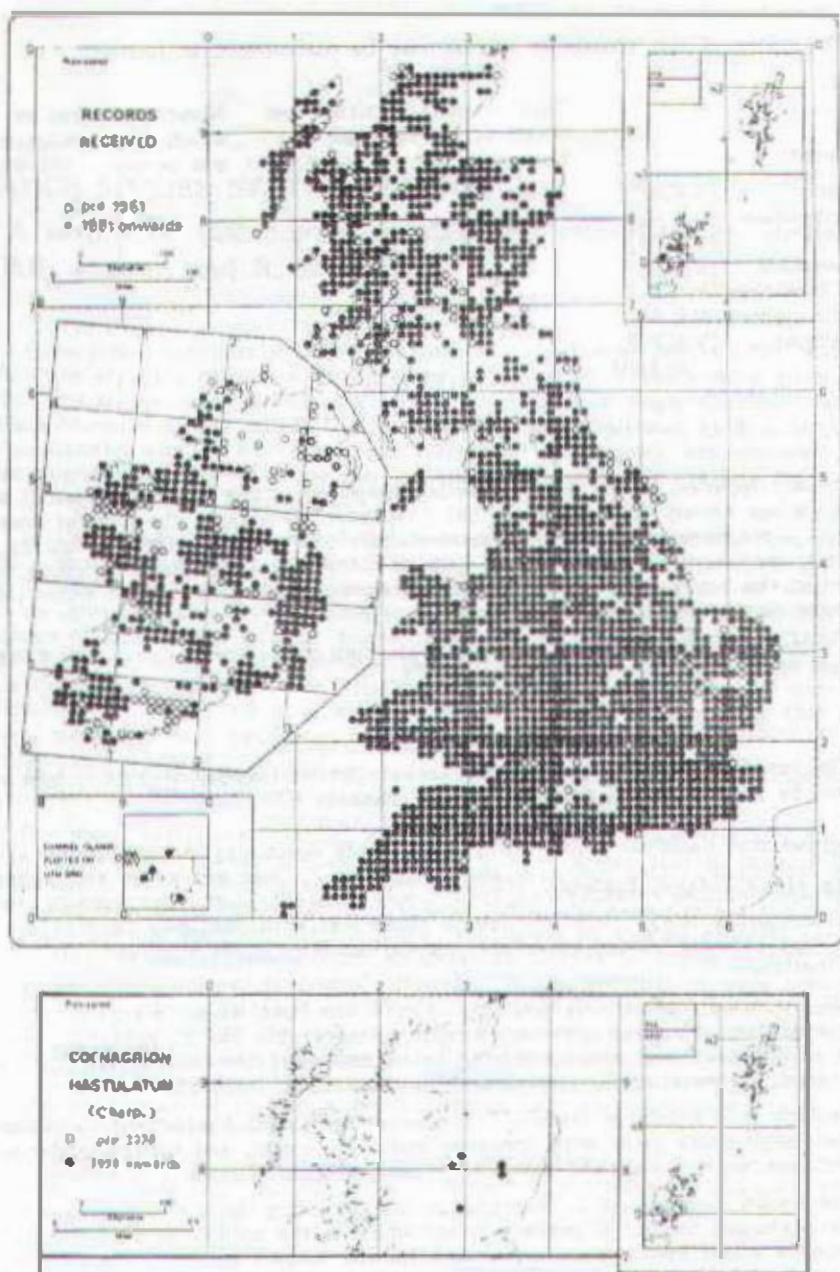


Fig. 5.

Distribution maps, based on 10Km, square units, showing records received for all dragonfly species (top), and for *C. haspulatum* (bottom). Kindly supplied by B.R.C., Monks Wood Exp. Station.

The flying period of *C. hastulatum* is usually from early June to early August, with maximum numbers in early July. However, at one Deeside locality in 1982, *C. hastulatum* males were abundant on May 28th, whilst in 1983 both sexes were still flying in the second week of August.

Oviposition is similar to other *Coenagrion* species. Blackwood (1940) observed that females usually settled on vegetation, appearing to insert the eggs in the cuticle of a leaf petiole just beneath the surface of the water, though occasionally some eggs were laid in flight - the female dipping the tip of her abdomen in the peaty, liquid mud. Robert (1958) listed the following plants in which *C. hastulatum* had been observed to lay its eggs on the Continent: *Potamogeton*, *Stratiotes*, *Olyceria*, *Nuphar*, *Hydrocharis*, *Ceratophyllum* and *Montia*. Ander (1926) considered that the species was 'not fastidious' in its egg-laying habits.

The nymph was first described by Ander (1926) from Sweden, and was figured for the first time in British entomological literature by Lucas (1930). Gardner bred the species in captivity in 1951. Corbet et al (1960) indicated that, on the basis of work carried out by Gardner, *C. hastulatum* is probably univoltine, i.e. completes one generation in a single year.

C. hastulatum is clearly a rare species in Britain, but in most of its few localities it is relatively plentiful, it has been seen "in hundreds" at sites in Perthshire and Inverness-shire, whilst at one Deeside locality it was the most abundant species of Odonata in 1983. The majority of its haunts seem reasonably safe from drainage, enrichment and pollution, and several are situated within nature reserves. Thus the species is in no way endangered in Britain, though any adverse environmental changes could have a serious effect in view of the small number of localities from which it is known.

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Coenagrion mercuriale (Charpentier) on the flood plains of the River Itchen and River Test in Hampshire.

- M.C.A. Mayo and A.R. Welstead

Merrill (1983) refers to old records which indicate the former presence of *Coenagrion mercuriale* on two "chalk rivers" in Hampshire - at one site on the River Test in 1927, and at two sites, at least, on the River Itchen between 1920 and 1951. During 1983, an attempt was made to determine whether this species was still present on these two rivers. Although access was restricted, mainly by fishing rights, several possible sites were examined.

Three major breeding populations were located: two along the Itchen Valley flood plain and one associated with the River Test. At each location, *C. mercuriale* occurred on well vegetated channels, remnants of former water meadows, receiving a steady supply of water from the main river. Emergent vegetation was dominated by reed grasses (*Phalaris arundinacea* and *Glyceria maxima*), with rich Water-cress (*Rorippa nasturtium-aquaticum*) and Fool's Water-cress (*Apium nodiflorum*) abundant in mid-channel on a gravel/silt bed. Water Mint (*Mentha aquatica*), Water Dock (*Rumex hydroclaparium*) and Gipsywort (*Lythrum europaeum*) were also present.

C. mercuriale was prevalent in a mixed population which included *Caloteryx splendens*, *Coenagrion puella*, *Ischnura elegans* and, less frequently, *Perrhotopia amphibia*, *Enallagma cyathigerum* and *Symphetrum scissellum*. The "mercury" mark on the second abdominal segment of male *C. mercuriale* (Fig. 6: A,B) was noticeably different from the versions that we have encountered in the New Forest in Hampshire (Fig. 6: C,D). The reduced marking (Fig 6: B) more closely resembled the "Spanish form" figured by Aguesse (1968).

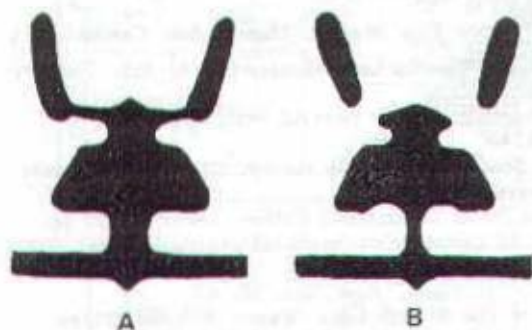
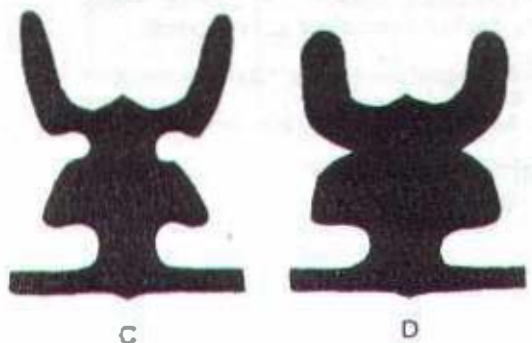


Fig. 6.

Second abdominal segment markings
on male *C. mercuriale*.



A and B - River Itchen/River Test
C and D - New Forest

These Hampshire chalk rivers have high concentrations of calcium, and are classified as eutrophic (Doherty and Pilkington, 1983). They provide an interesting contrast to the New Forest where the streams drain mainly from acidic soils and are oligotrophic. However, the New Forest streams that drain the calcareous clays of the Healdon Beds - which, in places, underlay the acidic gravel deposits - are mesotrophic in nature (Doherty and Pilkington, 1983), and it is at these locations that *C. mercurialis* is most usually found (Merritt 1983). Chemical data is sparse for these mesotrophic sites, but at a heathland site in Devon *C. mercurialis* was present on boggy snags and runnels where the chemical environment was low in nitrate (0.15 p.p.m.), but relatively base enriched (CaCO_3 levels of about 20 p.p.m.) compared with nearby still-water bogs (Merritt - pers. comm., 1982).

Table 3. Analytical data for Hampshire *C. mercurialis* streams and feeder rivers. (Kindly supplied by the Southern Water Authority).

| Average values 1982 | Rivers Test & Itchen | Crickford Stream (New Forest) |
|-----------------------------------|----------------------|-------------------------------|
| pH | 6.0 | 7.3 |
| Calcium as p.p.m. CaCO_3 | 111 | Not available |
| Nitrate as p.p.m. N | 5.0 | 0.6 |
| Phosphate as p.p.m. P | 0.1 | 0.03 |

The Hampshire chalk rivers and streams are fed from water reserves held within the chalk of the Hampshire Downs, from which there is very little surface run-off. The supply remains steady throughout the year, with only small variations in temperature (Tubbs 1978). Similarly, the large, "virgin" bogs of the New Forest have good water retaining properties and provide a stable supply to their associated streams.

On present evidence, the breeding habitat for *C. mercurialis* in Britain could be characterised as 'well vegetated channels with a stable supply of calcareous water.'

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Notes and observations on *Gomphus vulgatissimus* (Linnaeus) on the River Severn and River Thames.

- R.C. Kemp and G.S. Vick

In Britain, *Gomphus vulgatissimus* is confined to the midland and southern counties, breeding in a handful of moderate to slow-moving river systems, the depositional nature of which provides the substrate in which the larvae burrow. At present, *Gomphus* is known to breed on the rivers Severn, Thames and Wye, including some of their tributaries, with an outpost on the River Arun in Sussex.

This paper is confined to our observations of this species on the River Severn and the River Thames.

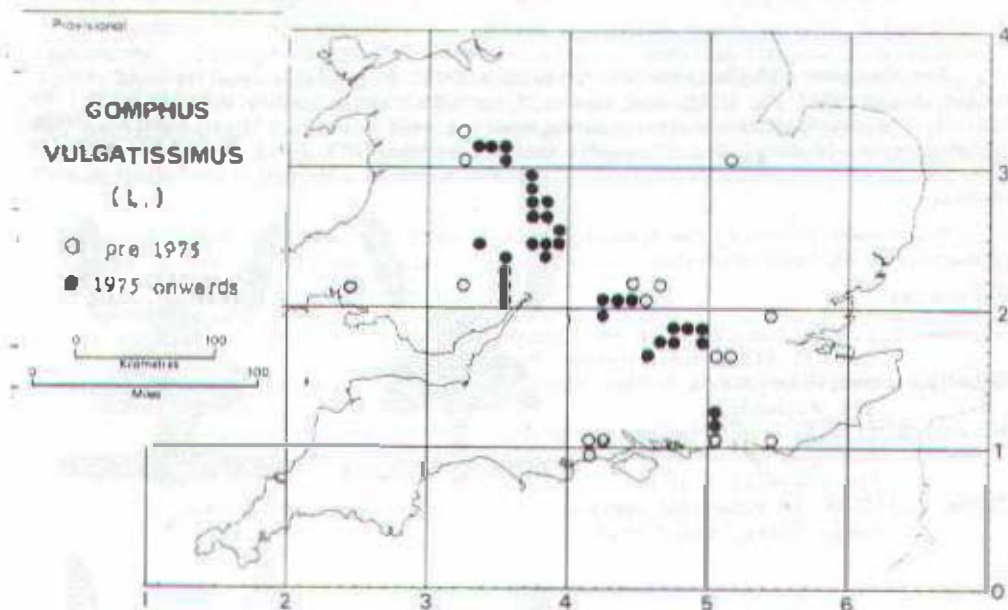


Fig. 7. Distribution map, based on 10K.m. square units, showing records received for *Gomphus vulgatissimus*. Kindly supplied by B.R.C., Monks Wood Exp. Station.

Gomphus vulgatissimus on the River Severn

Throughout Shropshire and North Worcestershire, the Severn remains a relatively unpolluted and undisturbed river. During the summer months its flow is moderate to slow. However, as a result of its enormous catchment area, marked seasonal fluctuations in water level occur. The clay soils over which the river passes provide abundant silt, and constant erosion of the banks renders them steep and liable to subsidence. At best, emergent vegetation is confined to a narrow margin.

To date, the Shropshire and North Worcestershire stretch of the river remains unnavigable downstream as far as Stourport-on-Severn. For the greater part it flows within the close proximity of woodland, which is often adjacent to the river bank. Below Stourport, a more open, agricultural landscape begins, and management of the river is centred around the navigation of pleasure craft.

The presence of *Gomphus* on the Severn has been known since the turn of the century. Lucas (1901) cites a record from Worcester by J.H. Fletcher. Recent observations show that the Severn is extremely important as a breeding site, with a large and healthy population. Between 1978 and 1983, regular visits (by RGK) to the river confirmed that breeding occurred from Preston-Montford, near Shrewsbury, and downstream as far as the village of Ripple, close to the Worcestershire/Gloucestershire border. Breeding was confirmed through the collection of exuviae and the observation of adult behaviour.

Exuviae were observed on low vegetation and bare bankside soil. Many were found also on the trunks of bankside trees such as *Alnus* and *Salix*. It was interesting to note that the distribution, both of exuviae and of adult territorial males, took the form of local concentrations. Denser concentrations (i.e. greater abundance) of exuviae were encountered on the river-banks adjacent to woodland/scrub where the flow of water was particularly sluggish. Stretches of river-bank close to open, exposed areas of arable land and pasture also revealed exuviae, though in fewer numbers and more widely spaced apart. Below Stourport, on the navigable part of the river, exuviae were frequently seen, but in small numbers and not as concentrated in "favourable" stretches. A gradual reduction in individuals was apparent through South Worcestershire to Ripple. *Gomphus* was found on the Severn in Gloucestershire (north of Tewkesbury) in 1983 for the first time, but breeding remains to be confirmed.

The distribution of territorial adult males, like that of exuviae, is not uniform; preference being for sheltered "mill-pond" like stretches of river, where the water is slow flowing. None were seen holding sustained territory over rapids or on open stretches away from the close proximity of woodland/scrub.

The sites chosen by females to oviposit were, in the few cases seen, similar to those chosen by territorial males (i.e. over sheltered "mill-pond" stretches). Oviposition was not noted over rapids and other areas of fast flow.

Gomphus vulgatissimus on the River Thames

Unlike the Severn, the River Thames is navigable for much of its length, and used extensively by motor boats as far upstream as Lechlade. Its flow is sluggish throughout the navigable section, being regulated by 47 weirs. This ensures a reasonably constant water level throughout the year.

The variety of geological formations through which it flows imparts abundant silt. River management and wash from large motor boats restricts marginal vegetation and contributes to heavy bank erosion.

Gomphus vulgatissimus has been known on the Thames since the turn of the century. Lucas (1900) gives three sites: Reading, Bagley Wood (near Oxford) and Brighthampton. Recent work by a number of odonotologists (including G.S.V.) confirm its presence from near Lechlade to Windsor. However it is by no means uniformly distributed. Careful search for exuviae revealed a tendency for dense concentrations to occur at well spaced sites, with small numbers of exuviae occurring in between. A similar pattern was noted also with territorial males, but not necessarily the same sites were occupied by males and exuviae.

All major sites for exuviae were close to wooded hillsides: at Oxford (Wytham/Bagley Wood complex on the Corallian limestone outcrop); from Goring to Pangbourne, and Henley to Marlow (mature woodland and scrub on chalk); and from Maidenhead to Eton and Windsor.

Two factors seem to be significant:

1. Stretches of slow-flowing river with heavily silted bottoms are preferred to stretches of water passing over a rocky bed. This preference is due, presumably, to the burrowing habits of the larvae.
2. The presence of woodland/scrub in the vicinity of the river is preferred to open agricultural land.

The Importance of Woodland

During the emergence period (usually the last weeks of May/first week of June), it is particularly noticeable that the maiden flight of *Gomphus* is directed away from water. Gradually, as the population disperses, fewer individuals are seen close to the river; a factor that may have given this species the reputation of being elusive.

An abundance of woodland or scrub within easy reach of the river can provide a local source of food and shelter for adults during their maturation period. Visits to woodlands close to the banks of both the Severn and Thames invariably revealed individuals of both sexes perched or flying along the borders and sunlit sides. No individuals were seen regularly in exposed situations.

Records of individuals having been found up to 10Km from both river systems suggest that dispersal is strong. If the presence of woodland/scrub/hedges is an essential requirement, wider dispersal would be expected from open stretches of river, and, although the number of records is few, this appears to be the case. It seems reasonable to assume that, in this situation, the probability of an insect returning to breed decreases as dispersal distance increases. This may be a limiting factor governing the distribution of the species on a river, e.g. the Severn in South Worcestershire, where the river adjacent to the river is dense and *Gomphus* is fairly rare.

The relative location of breeding and emergence sites

An interesting observation was made on the Thames regarding the location of breeding and emergence sites. On this river, although flow is sluggish for most of its course, the number of sites at which actual sexual activity can be seen appears to be more limited than on the Severn. This is due, possibly, to the greater amount of human interference and to the extensive removal of tree cover along its banks. A section of river, 8Km. in length, between the weirs at Goring and Pangbourne was observed between 1979 and 1983. At Goring, the river is well sheltered by bankside trees and shrubs, and territorial males frequently occur over a stretch of about 2.5 Km. Below this, the river passes through more open land, and shelter is scarce. No sexual activity was observed on this more exposed stretch of river. Exuviae have been found all along the river bank from Goring to Pangbourne, but by far the greater number occurred at Lower Basildon, 2Km. downstream from the point at which territorial activity ceased.

It is suggested that:-

1. Larvae may be carried a short distance downstream by the river during their long development period. Robert (1958) suggests that this may be as long as three to five years.

and/or

2. Females may choose sites away from potential male interaction in order to oviposit unmolested.

It is also worth mentioning that *Gomphus vulgatissimus* ova have been described as lacking any gelatinous coating. Such a coating is possibly an adaptation, in some species, to resist being swept downstream by securing attachment to an available substrate (Robert 1958).

It is clear that the ecology of *Gomphus vulgatissimus* is complex, and it is hoped that these subjective comments may promote a more serious, quantitative, scientific investigation.

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Somatoclora arctica (Zetterstedt) in Perthshire, Scotland. P.S. Corbet, S.A. Corbet and K. Kjellström-Corbet

On 5th July 1983 we visited an area of wet peatland near Loch Rannoch in Perthshire. The peatland contains many small pools or "flushes" of typical dimensions 3-20 m long and up to 1 m wide. The pools appear shallow because *Sphagnum* mats cover most of the water area; but the *Sphagnum* is about 1.5 m thick and lies over the peat "bottom".

In 1981, on 17 and 18 July, one of us (P.S.C.) obtained larvae of *Somatoclora arctica*, *Libellula quadricollata* and *Sympetrum danae* from these pools, mainly from gaps in the *Sphagnum* where silt was exposed to the sun. During our visit on 5 July 1983 we found at the edges of these pools, up to 5 cm above the water, on fringing humus, final-stage exuviae of *S. arctica* (one) and *L. quadricollata* (six). For both species our observations correspond closely to those of Burler (1981) in northwest Scotland. In the smaller pools we usually found only one exuvia which we recognize may well constitute the total annual production of Odonata from such a water body. Very small permanent pools are uncommon habitats; in them we may expect large predators like dragonflies to compete intensely for food and perhaps to sustain a much extended larval life.

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Illustration of the variation in pigmentation of the dorsal surface of the 8-10th abdominal segments of male *Ischnura pumilio* (Charpentier) in the New Forest, Hampshire.

- A.R. Welstead and N.I. Welstead.

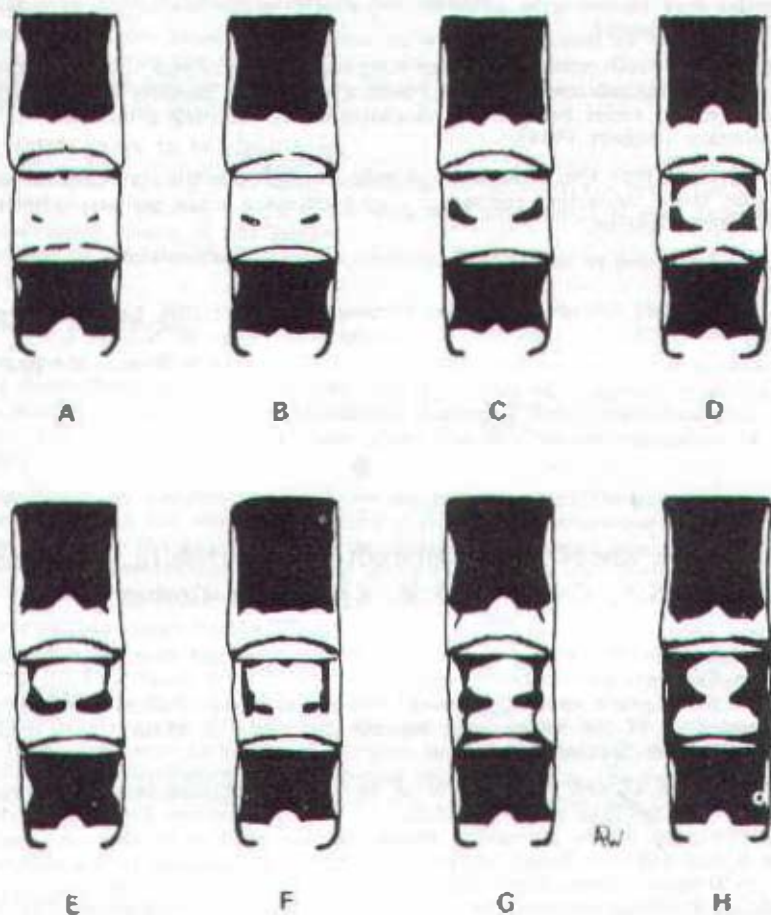


Fig. 8. A-H. *Ischnura pumilio*: variations in pigmentation of 8-10th abdominal segments in males, dorsal view.

These illustrations were drawn from 'slides' of live individuals photographed in the field, 1979-83.

On the Rediscovery of *Lestes dryas* Kirby, in Britain. - B. Benton and R.G. Payne.

One of the most exciting entomological events of 1983 was the rediscovery of *Lestes dryas*, a damselfly which was thought to have become extinct in Britain. This predominantly metallic green species is very similar in general appearance and habits to its more common congener, *Lestes sponsa*, but is broader-bodied and generally more robust, in both sexes. Mature males are distinctive in that the pale blue pruinescence on segment two of the abdomen covers the basal two-thirds of the segment, whereas in mature males of *L. sponsa*, the whole of the segment is covered. In addition, there are significant differences in the shape of the anal appendages of males, and in the size of the vulvar scale of females. (see Fig. 9).

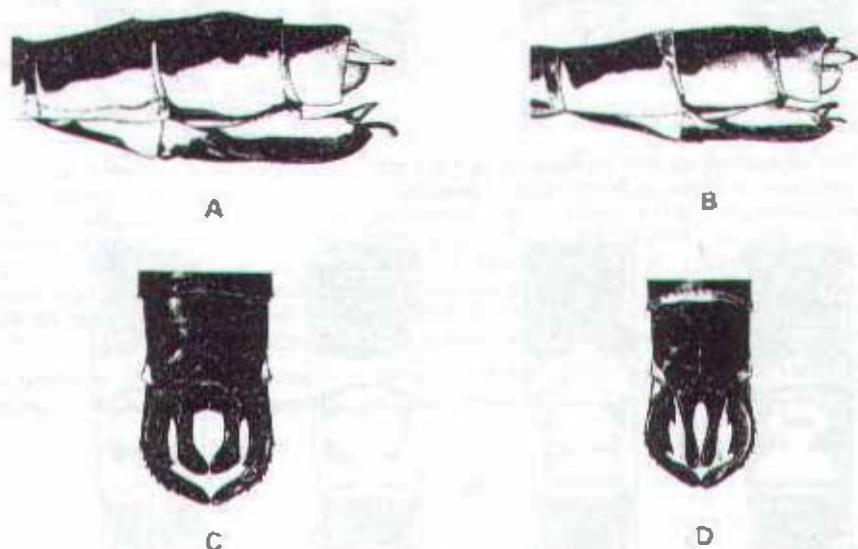


Fig. 9. end of female abdomen, lateral view: A, *Lestes dryas*; B, *L. sponsa* male appendages, dorsal view: C, *Lestes dryas*; D, *L. sponsa* (after Geijskes and van Tol, 1983)

The habitat of *L. dryas* is described as reed or grass-filled ditches, marshes or still water choked by reeds or rushes. Here it settles low down amongst the vegetation and flies weakly. It is able to breed in brackish water and may be found in semi-dry and choked-up habitats "that a couple of years of drought would easily render it extinct" (Longfield, 1937). Moore (1980) wrote that "the species seems to be associated with lowlying marshy habitats by the sea, but it is not confined to such sites".

Essex has long been known as a former stronghold of *L. dryas*, which was recorded as long ago as 1891 as occurring near Leigh-on-Sea. The Gentles marshes, nearby, was a well known locality for it. (There is a pair taken in the 1950s by R.M. Payne in Southend Museum).

Longfield (1937) refers to *dryas* as a rare species with a somewhat precarious hold in a few counties in England. Moore (1980) reports that, in his survey (1978) of ten localities in south-east England which had held populations of *L. dryas* in the period 1940 - 47, none was found. A subsequent publication by the Nature Conservancy Council (Chelnick *et al.*, 1980) describes the species as having probably become extinct in Britain. Merritt's revision of Hammond, (1983), gives 1971 as the most recent British record of the species prior to 1983.

The decline of *Leestes dryas* in Britain during the last few decades is due to various factors: loss of habitat as a result of agricultural and urban development, and through natural causes (marshland representing, as it does, the last stage of a hydrosere); periods of drought, and small population numbers (Moore 1980).

In 1983, after twelve years without British records, *L. dryas* was rediscovered - in two widely separated areas in Essex (a total of eight sites) and at one site in Kent.

It was first found by R.G. Flynn and K. Rowland on 23rd June during a biological survey of the Foulness area being undertaken jointly by the natural history staff of Southend and Colchester Museums. The area comprises flat, alluvial land, with many drainage ditches, at the mouth of the River Thames estuary. The land is owned by the Ministry of Defence and is consequently a restricted area for the general public. *Leestes dryas* was found in some numbers, including copulating pairs, along a ditch almost choked by *Scirpus maritimus* (Sea Clubrush). The damselflies appeared to be strictly localised to the ditches, not wandering from them. They were not easy to see, and tended to fly below the level of the vegetation, settling frequently. Other plant species present included *Elymus pycnanthus* (Sea Couch-grass), *Juncus gerardi* (Mud Rush), *Phragmites australis* (Common Reed), *Eragrostis distans* (Reflexed Broomrape), *Salicornia* (Burreed), *Horridula* (Burreed), *Ranunculus aquatilis* (Water Crowfoot) and *Polypogon monspeliensis* (Annual Beardgrass). Of the fauna present in this habitat, there were three species of Orthoptera: *Metrioptera roosei*, *Conocephalus dorsalis*, and *Chorthippus albomarginatus*. The dragonfly *Sympetrum sanguineum* was also present, including one freshly emerged female.

Excited by this discovery, a search revealed two further sites for *L. dryas*. Both were ditches, similarly almost choked by *S. maritimus*. One ditch crossed a clowed grass verge beside a road; the other ran alongside an arable field.

A week or so after the initial discovery, and without knowledge of it, J.H.G. Williams found *S. dryas* in Kent. The site was a shallow pond in a hollow, surrounded on three sides by a wheatfield; the remaining side being close to the boundary of woodland. The pond was semi-dry in places and contained an abundance of *S. maritimus*, and several areas of *Potamogeton nodosus* (Broad-leaved Pondweed) and *Rhynchospora* spp. (Spike-rushes). Other Odonata species present were *Ischnura elegans*, *Coenagrion puella*, *Leestes sponsa*, *Libellula quadrimaculata* and *Sympetrum sanguineum*.

On the 19th July in the north-east of Essex, E. Bemon discovered another site for *L. dryas*. Upwards of one dozen specimens were seen in an almost inaccessible area, little visited by entomologists. The damselflies settled low down on the stems and leaves of marginal and emergent vegetation, with wings half open or, sometimes, particularly if the sun went in, closed over their abdomens. The dominant waterside plant was again *S. maritima*, fringing a pond and almost choking an adjacent dyke. *Potamogeton pectinatus* (Fennel-leaved Pondweed) grew in the open water of the pond. The presence of these plants, and the estuarine location of the marsh, suggested that the water in the pond and dyke may have been brackish. Other species of Odonata recorded at the site were *L. elegans*, *S. sanguineum* and *L. quadrimaculata*; the last mentioned being a very local species in Essex. Other invertebrates included the same three species of Orthoptera which were recorded at Foulness, and two moths: *Euphyas filipendulae* (Six-spot Burner Moth) and *Leucophaea salicis* (White Satin Moth).

Between 18th - 23rd July, Alan Stubbs et al from the Nature Conservancy Council found a further four sites for *L. dryas* in Essex, adjacent to the Thames Estuary. These were: a flooded bomb hole and adjacent marshy area; a pond and connecting dyke; and two dykes/ditches, one of which was almost completely choked with vegetation. *S. maritima* was present at each site, and other plants included *Sagittaria Maritima* (Reed Sweet-grass), *P. australis*, *Sparganium angustatum* (Branched Bur-reed) and *Gnaphalium obtusifolium* (Pine-leaved Water-dropwort). Among the Odonata species present, *S. sanguineum* was found at several of the sites.

Moore (1980) wrote that "neutral or slightly acid waters with extensive emergent vegetation, notably *Equisetum flavescens* (Water Horsetail), *Typha* spp. (Reedmace) and, in Ireland, *Scirpus lacustris* (Bulrush), and supporting *Sagittaria sanguinea* and/or *Ceratophyllum demersum*, appear to indicate suitable habitat for *Estes dryas*". To this, at least as regards Essex, *Scirpus maritimus* could be added.

There has been some speculation that the rediscovery of *Estes dryas* may have followed a recent immigration. However, the damselfly is an unlikely migrant, being a weak flier and very local even in its continental haunts. It is more likely that the species has been overlooked, at least so far as the Essex sites are concerned. They are not easily accessible and have been little visited by entomologists in recent years. *L. dryas* is unobtrusive and easily missed by someone not looking specifically for it.

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Front cover illustration of *Gomphus vulgatissimus*
emergence by R.H. Dunn