

## THE KEY




This key is designed so that adult insects of all but a few aberrant species can be assigned to their correct group. It is based on wing structure, but also makes use of feet, antennae, and a few other features, all of which are easily seen with the aid of a lens. Winged specimens will always be adults, but wingless ones can be adults or young. Nymphs of exopterygote insects, such as bugs and grasshoppers, can usually be tracked down through the key because they resemble the adults, but the larvae of beetles and other endopterygotes are not included. If you suspect that your specimen is a larva (other than a caterpillar, for which see pp 110-82), turn to the range of larvae pictured on pp 294-7. Some aquatic nymphs are also illustrated on these pages. Some insect orders occur more than once in the key, because they contain both winged and wingless species or because they cover two or more rather distinct groups: groundhoppers and grasshoppers, for example, are distinct groups within the order Orthoptera.



### [1] INSECTS WITH WINGS

(This includes the beetles and other insects with hard and smooth forewings, although these might appear wingless at first sight)


#### [2] All wings membranous

##### \* One pair of wings

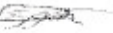

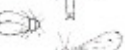
-  Grasshopper-like, with long back legs: pronotum extends back over the abdomen. **Groundhoppers** p. 46
-  2 or 3 long 'tails' at end of abdomen; wings held vertically at rest; very small antennae. **Mayflies** (some families) p. 18
-  Minute insects (<5mm long) with only one forked vein in the wing; one or more short 'tails'; antennae much longer than the head; rare. **Scale Insects** (males) p. 96

-  Large fan-shaped hindwings: forewings in the form of twisted clubs (halteres). **Stylopids** (males) p. 255
-  Forewings normal; hindwings in the form of tiny, pin-like structures (halteres), although these may be hidden under flaps in the stouter species; antennae often short and bristle-like. **True Flies** pp. 190-217


##### \*Two pairs of membranous wings


-  Minute insects with feathery wings which are usually folded tightly over the body. **Thrips** p. 98


##### \*\*Wing membrane clothed with minute scales or hairs

-  Wings clothed with scales, often very colourful; usually a coiled proboscis for sipping nectar. **Butterflies and Moths** pp. 110-182
-  Wings hairy, usually yellow, brown, or black, and held roofwise over the body at rest with antennae pointing forward; few cross-veins; hindwing normally broader than forewing; no coiled proboscis. **Caddis Flies** pp. 183-9
-  Wings hairy and all alike; front tarsi swollen; (more often seen in wingless form). **Web-spinners** p. 66
-  Tiny insects clothed with white powder. **White Flies** p. 97
-  Wings held roofwise at rest. **Lacewings (Family Coniopterygidae)** p. 107


\*\*Wing membrane without a noticeable coating of hairs or scales, although veins may be hairy; usually colourless and transparent, but may be coloured


-  All wings alike, very flimsy and  $\pm$  veinless; usually in swarms; southern Europe. **Termites** p. 66


-  Head extended downwards to form a stout beak; wings usually mottled and  $\pm$  alike; males mostly with upturned, scorpion-like abdomen. **Scorpion Flies** p. 109

-  Hindwings similar to or broader than forewings; wings held flat or rolled round body at rest; often 2 fairly stout 'tails', no longer than the body and usually much shorter. **Stoneflies** p. 36


\*\*\*Wings with many cross-veins forming a dense network


-  2 or 3 'tails', as long as or longer than the body; antennae minute; wings held vertically at rest; hindwing much smaller than forewing. **Mayflies** (some families) p. 18


-  Antennae short and bristle-like (shorter than width of head); body at least 25mm long, often very slender; wings never held roofwise over body. **Dragonflies** pp. 28-37


-  Antennae relatively long, sometimes clubbed; wing veins usually fork at the margins; wings held roofwise over the body at rest; flight slow in most species except ascalaphids. **Ant-lions, Lacewings, Alder Flies etc** pp. 102-9

\*\*\*Wings with few cross-veins

-  Very small insects, often with hairy wing veins and sometimes with a few scales on the wing membrane: venation characteristic; wings held roofwise at rest; relatively long antennae with at least 12 segments. **Psocids** (booklice and barklice) p. 98

-  Very small insects, often pear-shaped, with a slender, needle-like beak; wings normally held roofwise at rest, but sometimes flat; antennae never with more than 10 segments; often in masses on plants. **Aphids** p. 94

-  Stout-bodied insects with a clear, shiny, and quite stiff wing membrane; wings held roofwise at rest; a long, slender beak for sucking sap from trees and shrubs; antennae short and bristle-like. **Cicadas** p. 88

-  Minute to quite large insects with hindwing very much smaller than forewing and linked to it by a row of microscopic hooks; wings typically with a small number of large cells, but venation is much reduced in many of the smaller species; wings never held roofwise.

With a distinct 'waist'. **Bees, Wasps, Ichneumons, etc** pp. 226-53

Without a 'waist'. **Sawflies** pp. 222-5

[2] Forewings at least partly horny or leathery; hindwings membranous (sometimes absent)

\*Forewings veinless and meeting in the mid-line without overlap



Forewings short and square, leaving most of the abdomen uncovered: pincers at the rear. **Earwigs** p. 68



Forewings often very hard and usually covering all of the abdomen, although some abdominal segments may be exposed (see p. 260). **Beetles** pp. 254-91

\*Forewings with veins and normally overlapping to some extent at rest or else held distinctly roofwise



Forewings with membranous tips and laid flat over body at rest; a slender piercing beak for sucking plant and animal fluids. **Heteropteran Bugs** pp. 72-87



Forewings of uniform texture throughout and usually opaque, although not always much tougher than the hindwings; held roofwise at rest; a slender beak for sucking plant juices; insects often leap when disturbed.

**Homopteran Bugs: Leafhoppers** (p. 92) and **Psyllids** p. 96



Body bullet-shaped, with wings wrapped tightly around it at rest; hind legs enlarged for jumping.

**Grasshoppers and Crickets** pp. 38-59



All 3 pairs of legs long and spiky; fast-running; wings laid flat over body at rest; pronotum broad and almost covering the head.

**Cockroaches** p. 60



Front legs enlarged and very spiny for catching prey; head very mobile on a long neck.

**Mantids** p. 62

[1] INSECTS WITHOUT WINGS OR WITH JUST VERY SMALL FLAPS

\*Free-living insects, on vegetation or in soil and leaf litter



Body long and stick-like. **Stick Insects** p. 64



Body bullet-like, often with small wing flaps just behind the head; hind legs enlarged for jumping.

**Grasshoppers and Crickets** pp. 38-59

Insects with long, slender 'tails' at the rear



Small soil-dwelling creatures with 2 'tails'. **Diplurans (Family Campodeidae)** p. 16



3 'tails'; body usually clothed with shining scales; often found indoors. **Bristletails** p. 16

Insects with pincers at the rear

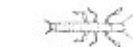


Slender, pale soil-dwelling insects with just one tarsal segment. **Diplurans (Family Japygidae)** p. 16



Stouter, often dark brown insects with 3 tarsal segments; often under stones. **Earwigs** p. 68

Insects with short 'tails' or none at all



Slender, soft-bodied soil-dwellers with 2 short tails; front tarsi swollen. **Web-spinners** p. 66



Pale, slender soil-dwellers with 2 short tails; front tarsi not swollen. **Diplurans (Family Projapygidae)** p. 16



Flattened insects with spiky legs and a broad pronotum almost covering the head; 2 stumpy tails usually visible.

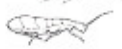
**Cockroaches** p. 60



Elongate insects with large spiny front legs for catching prey; long neck; 2 short tails usually visible. **Mantids** pp. 62-5



Small leaping insects with vestigial wings and head extending downwards to form a stout beak. **Snow Fleas** p. 108



Small leaping creatures with no sign of wings; a forked 'spring' at the rear (usually tucked under body); mainly in soil and leaf litter. **Springtails** p. 16

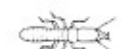


Body clothed with scales or flattened hairs; wing vestiges present. **Moths** (some females) pp. 124-82



Body with a marked 'waist', often bearing small lobes or scales, at front of abdomen; antennae often elbowed.

**Ants** (p. 234) and some other **Hymenoptera** p. 220



Slender, soft-bodied and pale insects, normally with 4 tarsal segments; usually in colonies in dead wood; southern Europe only. **Termites** p. 66



Small, pear-shaped insects with head much narrower than body; a needle-like beak under the head; often a pair of tubular outgrowths near the rear end; on growing plants.

**Aphids** p. 94



Flattened insects with relatively broad head; antennae long and slender; hind femur often broad; commonly found indoors among dried materials. **Psocids** (booklice) p. 98

\*Parasitic insects living on birds and mammals

\*\* Insects flattened laterally



Jumping insects with long back legs; flattened from side to side; usually brown. **Fleas** p. 101

\*\* Insects flattened dorso-ventrally

\*\*\* Head partly sunk into thorax



Antennae more or less concealed in grooves; legs relatively stout, usually with 2 strong claws to grip host; a piercing beak, although not always obvious.

**True Flies** (some families) p. 214



Antennae clearly visible; legs more slender and claws less prominent; a slender, piercing beak.

**Heteropteran Bugs** (some families) p. 80

\*\*\* Head not sunk into thorax



Very small, oval or elongate insects; head nearly as wide as body; prothorax distinct; tarsi with 1 or 2 claws; biting mouths.

**Biting Lice** p. 100



Very small, pear-shaped insects; head much narrower than body; thoracic segments fused into one unit; tarsi each with 1 large claw; sucking mouths

**Sucking Lice** p. 100



A proturan

The insects on this page are all primitive, wingless species belonging to the sub-class Apterygota (= without wings). There is virtually no metamorphosis during the life cycle. The microscopic proturans (Order Protura) are soil-living creatures with neither eyes nor antennae. (See also p. 11).

### BRISTLETAILS Order Thysanura

Shuttle-shaped insects with 2 long cerci and a central 'tail' known as the epiproct - making 3 'tails' in all, each fringed with minute bristles. Bristletails have biting jaws and are clothed with scales.

- ▲ **Petrobius maritimus** Machilidae. Antennae as long as or longer than body. Eyes large, with angular outer margin. Ocelli long and slit-like. Lives as scavenger among coastal rocks in splash zone. ▲ **P. brevistylis** is almost identical
- ▲ **Dilta hibernica**. Antennae shorter than body. Eyes rectangular. Commonest of several similar species on ground in densely vegetated places.
- ▲ **Silverfish** *Lepisma saccharina* Lepismatidae. Body flattened. Eyes small and separated. Abundant in houses, feeding on starchy materials including spilled flour, paper, etc. Mainly nocturnal and prefers a slightly moist environment.
- ▲ **Ctenolepisma lineata**. Less shiny than *Lepisma* and with antennae as long as the body. 'Tails' also very long. Indoors and outside. S & C.
- ▲ **Firebrat** *Thermobia domestica*. Browner and more bristly than *Lepisma* and with longer appendages. Body hairs in distinct patches. Prefers warmer places: always indoors and very common in bakeries and heating ducts.

### TWO-TAILED BRISTLETAILS Order Diplura

Two cerci, of variable form, but no epiproct. Thoracic segments clearly separated, unlike Thysanura. Mostly very small, soil-dwelling scavengers and carnivores. Eyes absent.

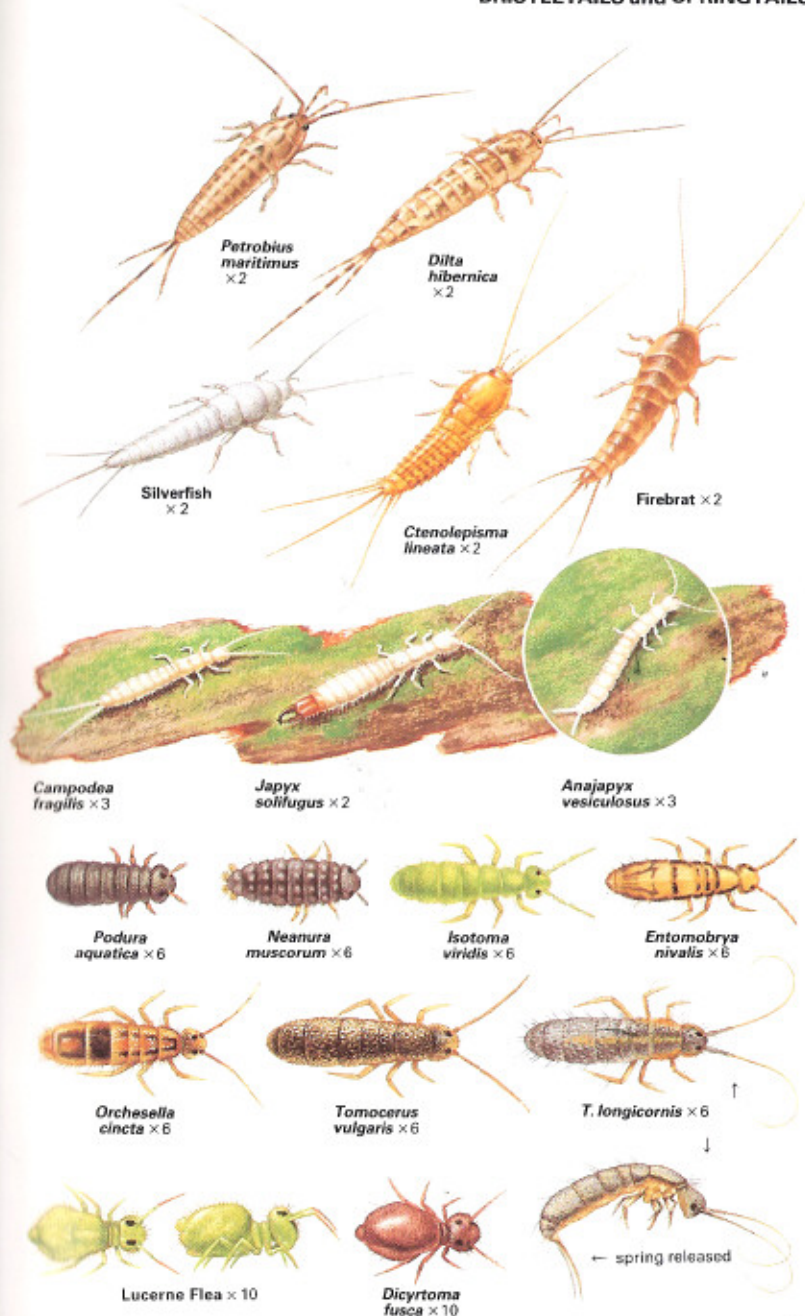
- ▲ **Campodea fragilis** Campodeidae. One of several very similar species abundant in compost heaps and other decaying vegetation.
- ▲ **Japyx solifugus** Japygidae. Tunnels under stones and among fallen leaves, catching prey with pincer-like cerci. S & C, but rarely seen.
- ▲ **Anajapyx vesiculosus** Anajapygidae. Relatively stout cerci are tubular and discharge secretions from abdominal glands. A scavenger. Known only from Italy.

### SPRINGTAILS Order Collembola

The largest group of apterygotes, with about 1500 known species. Body has fewer segments than the other groups. Named for the springing organ (furcula) at rear of most species. Like a minute tuning fork, it is clipped under the abdomen at rest, but released on disturbance to shoot the animal forward through the air. All species are very small and often clothed with scales or hair. No compound eyes. Most live in leaf litter, feeding on fungi and decaying plant matter. The ventral tube on underside of abdomen is characteristic of this order.

- ▲ **Podura aquatica** Poduridae. Abundant on and around still water, especially where there is a good covering of duckweed. Spring reaches ventral tube when folded.
- ▲ **Neanura muscorum** Hypogastruridae. Grey or purplish black with very short limbs. Spring does not reach ventral tube. Insect hardly jumps. Abundant in woodland.
- ▲ **Isotoma viridis** Isotomidae. Spring white. Abundant in damp leaf litter and mosses.
- ▲ **Entomobrya nivalis** Entomobryidae. A distinctive pattern. Abundant in mosses.
- ▲ **Orchesella cincta**. Pale orange to deep brown or black, but 3rd abdominal segment always black. Very hairy, but no scales. Common under woodland mosses.
- ▲ **Tomocerus vulgaris** Tomoceridae. Body clear with silvery reflections: ciliated at hind end. One of the largest European springtails and a good jumper. Under stones and rotten wood. ▲ **T. longicornis** is identified by very long antennae. Pale yellow body colour shows through if scales are rubbed off. Legs very hairy.
- ▲ **Lucerne Flea** *Sminthurus viridis* Sminthuridae. Prefers living plants: often abundant on legumes, including garden peas. Mainly on mosses in winter.
- ▲ **Dicyrtoma fusca**. Brick red to deep brown; very hairy. One of the smallest springtails (1mm long). Abundant in woodland leaf litter and under loose bark.

### BRISTLETAILS and SPRINGTAILS



## MAYFLIES Order Ephemeroptera

Delicate, weak-flying insects with 2 or 3 long 'tails' at hind end. Front legs very long, especially in males, which can be recognised by a pair of claspers at the hind end. Usually 2 pairs of wings with complex venation: hind pair always much smaller than forewings and sometimes missing. Wings held vertically above body at rest or partly open: cannot be folded back along the body. Antennae minute. Eyes larger in male than in female and sometimes much expanded to form turrets well above the rest of the head (turbinate condition). Adults do not feed. Mainly crepuscular or nocturnal and rarely found far from the water in which they grow up.

Nymphs (p. 296) include burrowing, crawling, and free-swimming forms and feed mainly on organic debris: some are partly carnivorous. Mayflies are unique in moulting again after attaining the fully-winged state. Adults emerging from the nymphal skins are rather dull and hairy and are called duns or sub-imagines, but within hours (sometimes within minutes) they shed another very fine skin and emerge as shiny imagines, generally known as spinners. Females can sometimes be seen with egg-masses protruding from their bodies, ready to be dropped or washed into the water.

There are about 2500 known species, with some 200 in Europe. Colours fade after death and identification depends largely on the venation: a good lens is essential.

***Palingenia longicauda*** Palingeniidae. 2 tails. Wings smoky brown throughout: hardly transparent. The largest European mayfly. Female does not shed sub-imaginal skin. Breeds in large rivers. C (mainly eastern).

***Oligoneuriella rhenana*** Oligoneuriidae. 3 tails. Venation greatly reduced in both wings. Breeds mainly in large, clear rivers. Adults form enormous swarms over the water 7-8, usually in late afternoon or evening. S & C (mainly eastern).

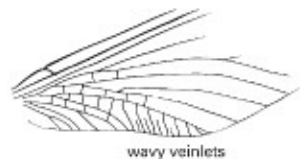
***Metretopus norvegicus*** Metretopodidae. 2 tails. Hindwing markedly oval. Forewing with 2 short (intercalary) veins between the last 2 long veins. 7-8. Nymph swims freely in clear, well-vegetated streams. N.

***Ephoron virgo*** Polymitarcidae. 2 tails on male, 3 on female. Readily identified by the milky wings. Females do not shed sub-imaginal skin. 8-9, swarming in huge numbers over large, slow-moving rivers and lakes in which it breeds. Strongly attracted to light. S & C.

▲ ***Ephemera danica*** Ephemeridae. 3 tails. Wings always spotted. Veins in basal area of forewing run sharply backwards. Abdomen cream or greyish above with darker markings towards rear. 4-9. Nymph (p. 296) lives in lakes and rivers with muddy or sandy bottoms. There are several similar species with darker abdomens.

▲ ***Siphonurus lacustris*** Siphonuridae. 2 tails. Several wavy veinlets run back from last prominent long vein to the hind margin of forewing. Hind tarsus longer than tibia: femora unbanded. 5-9, mainly in upland areas. Breeds at edges of hill streams. There are several similar species.

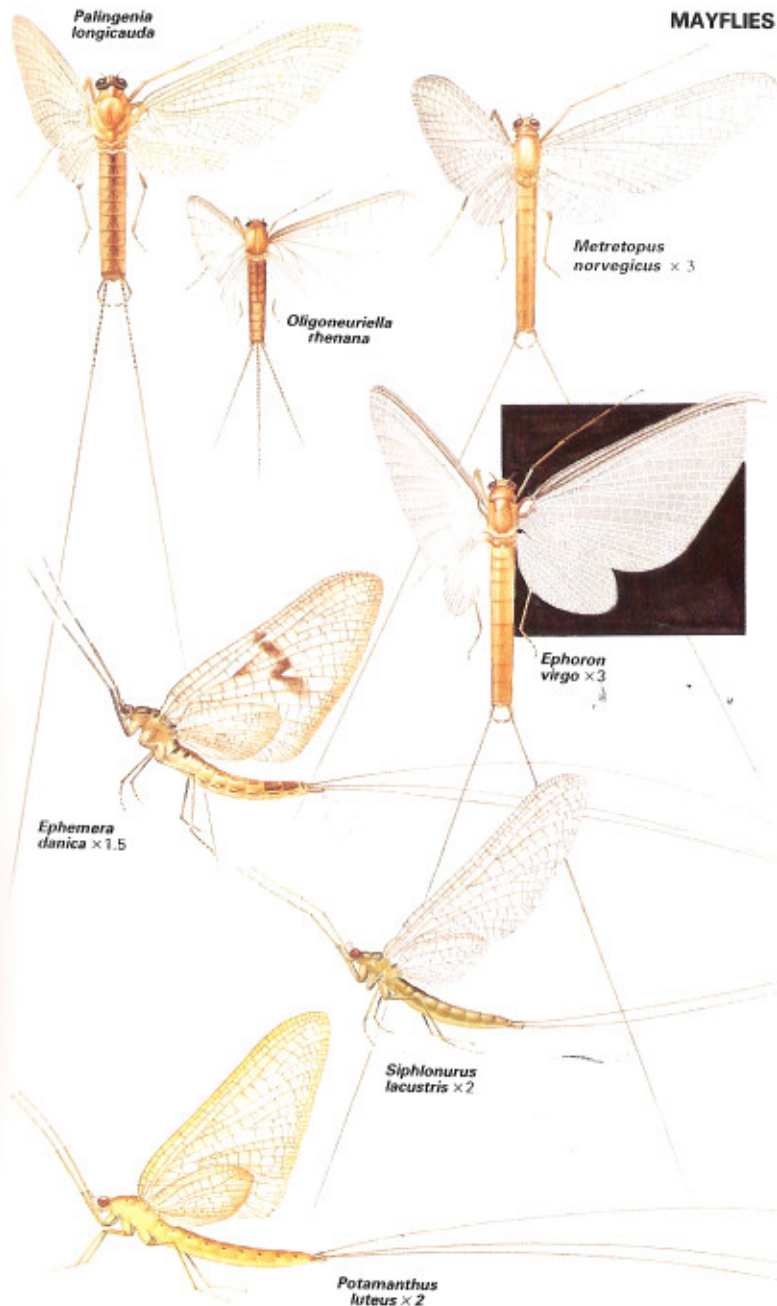
▲ ***Potamanthus luteus*** Potamanthidae. 3 tails. Venation as in *Ephemera* but wings yellowish and never spotted with brown. 6-7. Strongly nocturnal. Breeds in large, swift rivers. S & C.



*Siphonurus* wing

wavy veinlets

## MAYFLIES



*Palingenia longicauda*

*Oligoneuriella rhenana*

*Metretopus norvegicus* × 3

*Ephoron virgo* × 3

*Ephemera danica* × 1.5

*Siphonurus lacustris* × 2

*Potamanthus luteus* × 2

▲ *Ecdyonurus dispar* Heptageniidae. 2 tails. Forewing has 2 pairs of short (intercalary) veins between the last 2 long veins. 6-10. Nymph (p. 296) lives in stony streams and lakes. There are several similar species.

▲ *Rhithrogena semicolorata*. 2 tails. Basal half of forewing commonly bronze or golden brown; often appearing yellow in flight. Femur has brown streak in centre. 4-9. Breeds in fast, stony streams.

▲ *Caenis horaria* Caenidae. A very small mayfly with 3 tails and no hind-wings. Forewings milky and fringed with minute hairs (lens!). First 5 or 6 abdominal segments grey on top. Female has lighter thorax. 6-9. Breeds in large lakes and rivers with plenty of vegetation and debris. There are several similar species.

▲ *Ephemerella ignita* Ephemerellidae. 3 tails. Veins Cu<sub>1</sub> and Cu<sub>2</sub> are very close at the base (lens!). 4-9. Breeds in fast streams. ▲ *E. notata* is similar but somewhat paler and with small black marks on underside of abdomen.

*Isonychia ignota* Isonychidae. 2 tails. Last long vein (Cu<sub>1</sub>) of forewing runs almost parallel to hind margin. Breeds in rivers. S & C (southern). Sometimes placed in Siphonuridae.

▲ *Baetis rhodani* Baetidae. 2 tails. Hindwing very small. Intercalary veins in forewing always paired. Male with large turbinate eyes, as in all this family. Adult most of the year, but mainly spring and autumn. Breeds in small, fast streams. One of several very similar species, very difficult to separate.

▲ *Cloeon dipterum*. 2 tails. Hindwing absent. 3-5 cross-veins in pterostigma near wing-tip. Front margin of wing yellowish brown in female. Male eyes turbinate. 5-10. Breeds in ponds and ditches and even in water butts. ▲ *C. simile* is similar but has 9-11 cross-veins in pterostigma.



head of *Centropilum* ♂ showing large eye

▲ *Centropilum luteolum*. 2 tails. Hindwing very small and strap-like, with pointed tip. Intercalary veins around edge of forewing single (not paired as in *Baetis*). Male eyes turbinate. 4-11. Breeds in stony streams and lake margins.

▲ *Leptophlebia vespertina* Leptophlebiidae. 3 tails. Rather similar to *Ephemerella* but lens shows base of vein Cu, midway between Cu<sub>1</sub> and 1A. Front edge of hindwing without a projection. 4-9. Breeds in lakes and streams, mainly in acidic regions.

▲ *L. marginata* is similar but forewing is smoky brown towards tip.

▲ *Paraleptophlebia cineta*. 3 tails. Base of vein Cu<sub>1</sub> is nearer to 1A than to Cu<sub>2</sub>. Hindwing without a projection on front margin. Male abdomen whitish and translucent at front. 5-8. Breeds in small, fast streams in alkaline areas.

▲ *Habrophlebia fusca*. 3 tails. Hindwing with strong projection on front margin. Forewing venation like *Paraleptophlebia* but with virtually no intercalary veins. 5-9. Breeds in slow, well-vegetated streams and ditches.

