

REVISED FIELD KEY TO THE INVERTEBRATE FAUNA OF STONY HILL STREAMS

By MARGARET REDFERN (Mrs. R. A. D. Cameron)
(formerly at Preston Montford Field Centre*)

This illustrated key to the macroscopic invertebrates of small stony hill streams, based on those in the Long Mynd, Shropshire, includes all those likely to be met in streams of the same type elsewhere in Britain. It deals only with characters observable in the field and it is a revision of an earlier key by the same author published in *Fld. Studies*, 3, pp. 185-192, in 1969.

INTRODUCTION

The justification for the present work is that it deals with a specific habitat and is based entirely on characters which can be seen with a hand-lens ($\times 10$ or $\times 15$) and so helps to conserve these habitats, since the majority of specimens can be examined on the spot and then returned to the stream alive.

Small stony and rocky hill streams constitute a specialized type of habitat whose fauna varies relatively little from place to place. The choice of characters used in the key is seldom original and much use has been made of Macan (1959), several Freshwater Biological Association keys by various authors (see References), Hickin (1967), and Johannsen (1934-37).

Because this type of habitat grades variously into others, the choice of species for inclusion here is somewhat arbitrary. Animals characteristic of more sluggish streams, whether muddy (e.g. *Asellus*) or stony (e.g. leeches), and those associated with vegetation in very weedy streams are omitted, as are the restricted types found in higher mountain streams and lakes. However, animals from tributary shallow trickles and mossy flushes, where the current may be very gentle and the substrate fine mud, have been included as they are part of the stream ecosystem; very often larvae living in the main stream spend the pupal stage in the tributaries.

The Diptera section in the 1969 version has been extensively revised and expanded and should now include most families likely to be encountered. Apart from this, two species have been added and those originally included as notes beneath couplets have been incorporated into the main body of the key.

The key does not, of course, deal with fish or amphibia, nor with organisms less than about 0.5 mm. long (e.g. water fleas: Ostracoda), nor with terrestrial animals which have fallen into the stream by accident.

EXAMINING AND IDENTIFYING SPECIMENS

Free-living specimens (especially small ones) are best examined in the field by holding the animal in a drop of water in the cupped hand or in a white plastic teaspoon, within which reflected light gives better background colour and illumination for dark-coloured specimens. The teaspoon is also useful for picking specimens out of the sorting dish. For handling even smaller specimens, a wide-mouthed pipette is used.

* Present address: 1 Chestnut Close, Norton, Stourbridge, Worcs.

Not all stream animals are free-living: some oligochaete worms and chironomid midge larvae live in tubes of mud or fine sand or material secreted by the animal and attached to the bottom; these animals must be removed from their tubes for proper examination. The larvae of many species of caddis fly (Trichoptera) build cases of "foreign" material such as stones, sand or plant fragments. Most members of this group are difficult to identify and, although each species or genus tends to build a distinctive type of case, identification cannot safely be based on characters of the case alone.

The key takes identification as far as it is safe to go on macroscopic characters. This is usually to genus but sometimes only to family or even larger groups where field determination is difficult (e.g. water mites). Where determination is taken to the species level, only one species of its genus is likely to be found in this habitat. In those cases in which identification to species level may be of considerable ecological interest (e.g. *Leuctra*), collected specimens will have to be examined with a microscope and the appropriate key.

USING THE KEY

The key is of orthodox dichotomous type leading via a number in the right-hand margin to the next relevant couplet.

Mention is sometimes made of the taxonomic group reached at a particular separation, but the final destination is always printed in **bold type: italics** for genera and species, **upright** for families and subfamilies and **SMALL CAPITALS** for higher groups.

Most technical and anatomical terms (e.g. pronotum, maxillary palp) are made clear by the illustrations. The diagrams are, in fact, an integral part of the key. The scale lines represent 1 mm. but are, of course, only approximate. Numbers in brackets in the key refer to the relevant figure.

Abbreviations are explained below:

2x	twice as	ant.	anterior	post.	posterior
>	more than	app.	appendage(s)	pr.	pair, pairs of
<	less than	c.	circa,	pu.	pupa(e)
±	more or less		approximately	seg(s).	segment(s)
abd.	abdomen, abdominal	la.	larva(e)	thor.	thorax, thoracic
ad.	adult	ny.	nymph(s)	us.	usually

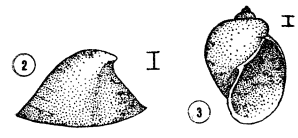
KEY

- 1. Animal with shell secreted by body, resembling mussel, limpet or snail
MOLLUSCA 2
- Animal not like mussel, limpet or snail (but may be in a protective case) 5
- 2. Shell-valves 2 (1) LAMELLIBRANCHIATA: SPHAERIIDAE pea mussels 3
- Shell in one piece GASTROPODA 4



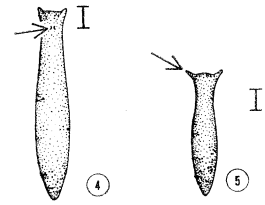
- 3. With 2 siphons (extended in living animal while feeding) **Sphaerium**
- With 1 siphon **Pisidium**

- 4. Shell ± conical and limpet-like, with hooked top (2) river limpet
Ancylus fluviatilis
- Shell spirally coiled with large body whorl and small spire (3) wandering snail **Limnaea peregra**



- 5. Body unsegmented and flattened, with ear-like lobes at ant. end; glides slowly over substrate PLATYHELMINTHES: TRICLADIDA flatworms 6
- Body segmented (segs. may be hard to see); never "gliding" 7

- 6. Eyes 2, close to midline; body dark or pale (4) **Crenobia alpina**
- Eyes numerous round ant. margin; body black or brown (5) **Polycelis felina**

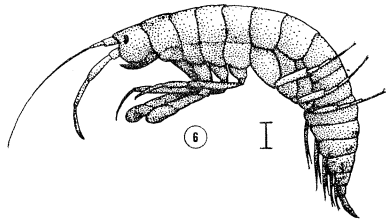


- 7. Soft-bodied worm with >14 segs., without distinct head region, often redblooded, no macroscopic app. ANNELIDA: OLIGOCHAETA true worms
Lumbriculidae, Tubificidae or Naiadidae

- Us. firmbodied and with jointed limbs, but if wormlike (and sometimes also redblooded) then with <14 segs. and with distinct head region and/or app. (false legs, mouthbrushes) ARTHROPODA 8

- 8. 4 pr. or more jointed thor. legs 9
- 3 pr. jointed thor. legs, or none 10

- 9. >4 pr. legs; body laterally compressed, swims on side (6) CRUSTACEA: AMPHIPODA freshwater shrimp **Gammarus pulex**



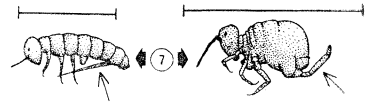
- 4 pr. legs; body globose, small, swims on front ARACHNIDA watermites **HYDRACARINA**

- 10. 3 pr. jointed thor. legs; animal may be in case of sand, stones or vegetable matter 11
- No jointed thor. legs (unjointed prolegs may be present on thorax); animal may be in case of mud, sand, fibrous material or hardened silk threads DIPTERA la. and pu. 50

- 11. Animal skates or jumps on water surface 12
- Animal lives under water 13

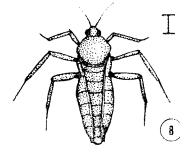
12. Animal 2 mm. or less long, jumping by forked ventral organ (7) springtails

COLLEMBOLA



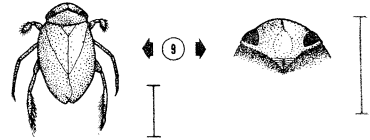
Animal >2 mm. long, skating; ad. has 2 orange stripes along abd. (8) HETEROPTERA: VELIDAE ny. and ad. water cricket

Velia caprai



13. Head a characteristic triangular shape; legs flattened and fringed with hairs to form paddles (9); animal an active swimmer HETEROPTERA: CORIXIDAE ny. and ad.

Micronecta poweri

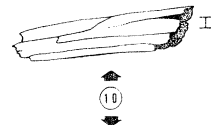


Head not of this shape; animal crawls or swims.

14

14. Animal lives in a case of foreign material (see Introduction) TRICHOPTERA la. (part) cased caddis

15



Animal not in a case (but may be in silken net)

19

15. Case of vegetable matter: leaves, stems, etc. (10) some

Limnephilidae



Case of stones or sand

16

16. Case of sand grains or small stones, streamlined, ± cylindrical and tapering to post. end (11)

17



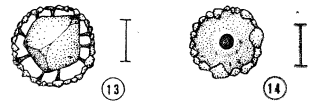
Case of stones, not streamlined; oval or hemispherical with lower surface flat (12) GLOSSOSOMATIDAE

18



17. Post. opening of case ± blocked by a single stone (13); head pale brown with dark markings ODONTOCERIDAE

Odontocerum albicorne



Post. opening sealed with larval secretion except for central hole (14); head dark brown SERICOSTOMATIDAE

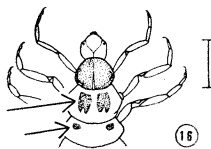
Sericostoma personatum



(Many limnephilids have smooth curved cylindrical cases of small stones, e.g. *Potamophylax* (15))

18. Case of full-grown la. < 8 mm. long; meso- and metanotum with sclerotized patches (16)

Agapetus



Case of full-grown la. > 8 mm. long; meso- and metanotum without sclerotized patches (18) *Rhyacophila* pu. is greenish in brown cocoon within stony case; for its caseless la., see 21)

Glossosoma

19. La. with pr. hooks at post. end TRICHOPTERA la. (part) caseless caddis

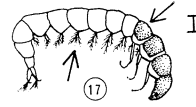
20

La. or ny. without post. hooks, or ad. beetle

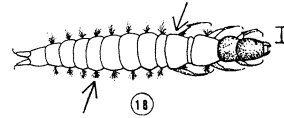
23

20. With abd. gills 21
 Without abd. gills 22

21. Gills beneath abd. segs.; meso- and metanotum sclerotized (17); animal brownish **Hydropsychidae**

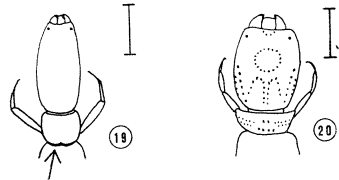


- Gills on sides of abd. segs.; meso- and metanotum soft (18); animal greenish RHYACOPHILIDAE **Rhyacophila**
 (for its pu. see 18)



22. Head long and narrow, yellow-brown without dark markings; post. margin of pronotum conspicuously darkened (19) PHILOPOTOMIDAE **Philopotamus montanus**

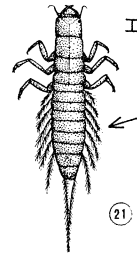
- Head and pronotum broad, dull green or brown with black dots (20) **Polycentropidae**



23. Body with 1, 2 or 3 long hairlike processes, $> \frac{1}{3}$ body length, at post. end 24

- Body without long hairlike processes at post. end COLEOPTERA beetles 44

24. 1 process at post. end; feathery gills on abd. (21) MEGALOPTERA: SIALIDAE la. alder fly **Sialis fuliginosa**



- 2 or 3 processes at post. end; gills, if present, of various types 25

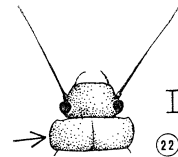
25. 2 processes at post. end PLECOPTERA ny. stoneflies 26

- 3 processes at post. end EPHEMEROPTERA ny. mayflies 37
 (caution: one or more processes may be broken off)

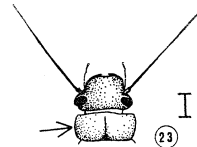
26. Whitish tufted gills on thor. at base of all 3 pr. legs PERLIDAE 27
 (full-grown nymphs are the largest common invertebrates in stony streams)

- No gills at base of legs, or gill bunches ant. to first pr. only 28

27. Pronotum $> 2x$ wide as long (22); last abd. seg. dark above **Dinocras cephalotes**



- Pronotum $< 2x$ wide as long (23); last abd. seg. yellow above **Perla bipunctata**

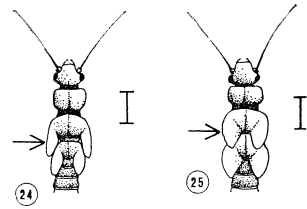


28. Elongate ny. with wing-buds \pm parallel to body; hind legs when stretched back alongside abd. not reaching its tip 29

- Wing-buds set obliquely to body; hind legs when stretched back alongside abd. reaching beyond its tip 30

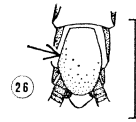
- 29. Wing-buds parallel-sided (24)
LEUCTRIDAE
- Wing-buds convex in outline (25)
CHLOROPERLIDAE

Leuctra
Chloroperla

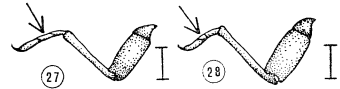


- 30. Ventral view of abd. shows 9th sternum extended backwards to cover last 2 segs. (26); each seg. of tarsus longer than preceding seg. (27) TAENIOPTERYGIDAE *Brachyptera risi*

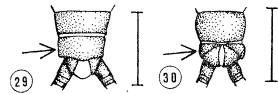
Ventral view of abd. not as above; 2nd seg. of tarsus shorter than 1st seg. (28) 31



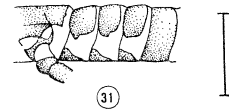
- 31. Last. seg. of abd. completely encircled by a ring of chitin of same width all round (29); mandibles elongate; swims by moving whole abd. from side to side; distinct light and dark pattern on head and thor. PERLODIDAE 32



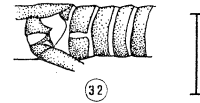
Last seg. of abd. encircled by incomplete ring of chitin which is broad on top but narrows at sides to 2 points beneath (30); mandibles short, stout; swimming movement laboured NEMOURIDAE. 34



- 32. Chitinous rings round first 4 abd. segs. have clear gap between dorsal and ventral halves (31); body not densely hairy *Perlodes microcephala*

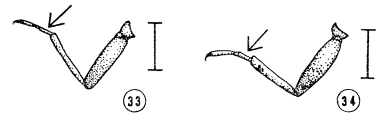


Chitinous rings round only first 2 abd. segs. divided (32) 33



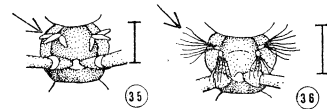
- 33. Body sparsely clothed with black hairs *Isoperla grammatica*

Body with occasional bristles only *Diura bicaudata*

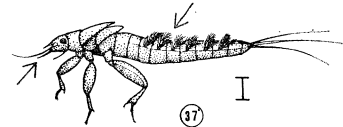


- 34. No gills just behind head 35
- Gills present on underside just behind head 36

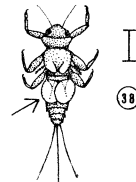
- 35. Segs. 1 and 3 of hind tarsus nearly equal in length (33) *Nemurella picteti*
- Seg. 1 of hind tarsus shorter than seg. 3 (34) *Nemoura*



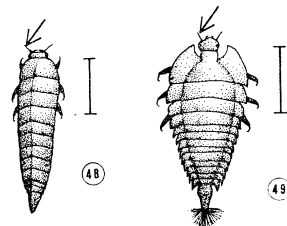
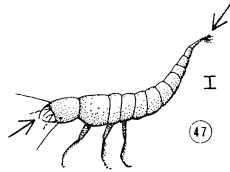
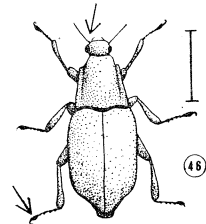
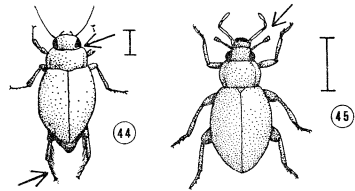
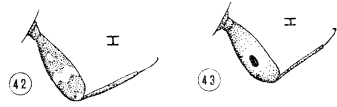
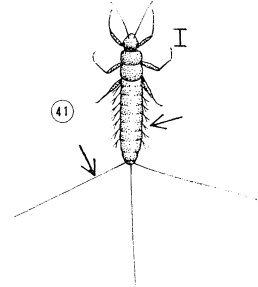
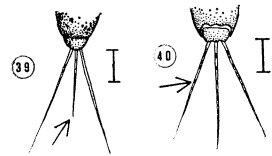
- 36. 3 sausage-shaped gills on either side of midline (35) *Protonemura*
- 2 bunches of 5-8 filaments on either side of midline (36); body often coated with detritus *Amphinemura sulcicollis*



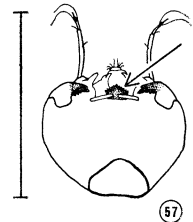
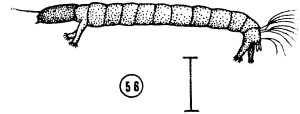
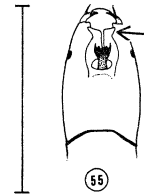
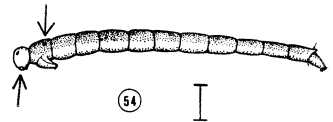
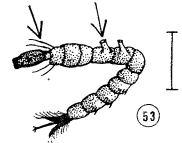
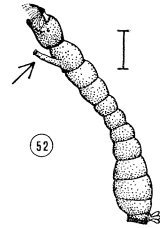
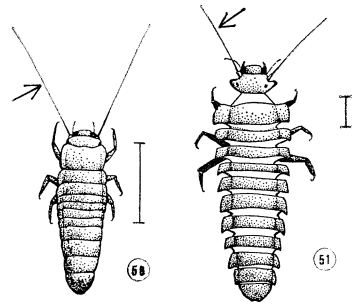
- 37. Animal living in bottom sediment (silt, mud. etc.); gills either of feathery filaments or hidden by covers 38
- Animal swimming, crawling or clinging to stones; gills neither feathery nor hidden by covers 39



38. Animal large (up to 25 mm.), with fringed gills held over back; mandibles with long projecting points used for burrowing (37)
 EPHEMERIDAE *Ephemera danica*
 Animal small (up to 10 mm.), with flap-like gill covers on back (38)
 CAENIDAE *Caenis*
39. Middle post. process shorter than 2 lateral ones (39) BAETIDAE *Baetis*
 Middle post. process not shorter 40
40. 3. post. processes and legs have alternate pale and dark bands not coinciding with seg. junctions (40)
 EPHEMERELLIDAE *Ephemerella ignita*
 3 post. processes without pale and dark bands 41
41. Body not flattened; 3 post. processes as long as body and held at wide angle; gills of narrow filaments (41) LEPTOPHLEBIDAE
Paraleptophlebia submarginata
 Body dorsiventrally flattened; 3 post. processes not at wide angle; gills of a plate and bunch of filaments ECDYONURIDAE 42
42. Body with post. projections on pronotum; light and dark W-shaped marks on each femur (42) *Ecdyonurus*
 No projections on pronotum; femur not as above 43
43. Single dark spot on each femur (43)
Rhithrogena semicolorata
 Femur with irregular markings but no dark spot *Heptagenia lateralis*
44. Adult beetle with hard wing-covers over membranous wings 45
 La. with no trace of wings or wing-covers 48
45. Head sunk into thor. so front of body has smooth outline; hind legs us. flattened with fringing hairs (44); active swimmer Dytiscidae
 Head not sunk into thor., front of body less streamlined; legs not flattened or with fringing hairs; us. found clinging to plants or stones 46
46. Antennae club-tipped, us. shorter than maxillary palps (45) Hydrophilidae
 Antennae filiform, longer than maxillary palps; last tarsal seg. of leg swollen (46) ELMINTHIDAE 47

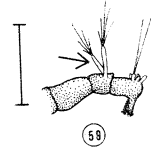
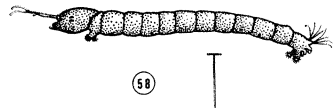


47. Body < 3 mm. long (46) . . . **Elmis aenea**
 (*Helmis maugeri*)
 Body 3 mm. or more in length **Lathelmis volkmari**
48. Jaws conspicuous, sickle-shaped;
 body tapering with 2 spiracle-bearing processes at post. end (47)
Dytiscidae or **Hydrophilidae**
 Jaws inconspicuous; body often flattened dorsiventrally, with or without a tuft of hairs at post. end. . . . 49
49. Antennae as long as head, < $\frac{1}{4}$ length of body; body flattened, cylindrical or triangular in cross section (48) . **Elminthidae**
 (e.g. *Elmis aenea* (49))
 Antennae > $\frac{1}{4}$ length of body; body flattened (50) (51) . . . **Helodidae**
 (ad. terrestrial)
50. La. without swollen wing cases on thor.; if in a case, it is never $\frac{1}{2}$ -conical of hardened silk threads Pu. . . . 51
 with swollen wing cases on thor.; if in a case, it may be $\frac{1}{2}$ -conical of hardened silk threads NEMATOCERA . . . 64
51. La. with distinct head, not retractile into thor.; animal may be in a case NEMATOCERA . . . 52
 La. (may be hard and dark brown) with reduced head, \pm retractile into thor.; animal not in a case . . . 58
52. With prolegs on thor. and/or abd. . . . 53
 Without prolegs 57
53. 1 pr. fused prolegs on first thor. seg.; body narrow-waisted and swollen at post. end (52); us. attached to substrate but never in a tube SIMULIIDAE buffalo gnat . . . **Simulium**
 2 pr. prolegs (each may be fused); if only 1 pr., it is on last abd. seg.; body not swollen at post. end; free-swimming or in a mud, sand or fibrous tube 54
54. Prolegs on 1st and 2nd abd. segs., bristles on 1st thor. seg.; U-shaped when at rest (53); never in a tube DIXIDAE dixia midge . . . **Dixa**
 Prolegs on first thor. (occasionally lacking) and last abd. segs.; characteristic figure-of-8 movement; may be in a tube 55



55. Mouthparts held below head; with spiracles on prothorax; both pr. prolegs completely fused (54)
 Mouthparts held in front of head; no spiracles on prothorax; post. prolegs not fused and ant. prolegs separate, fused or lacking CHIRONOMIDAE

Thaumaleidae



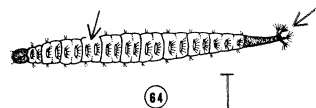
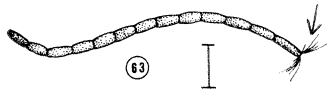
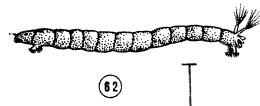
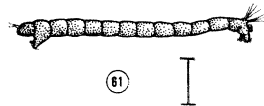
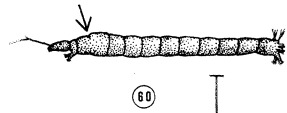
56

56. Antennae retractile into head; ventral ant. margin of head (hypostomium) not a darkened toothed plate (55) (the toothed glossa is well developed but lies behind the hypostomium); animal may be pink but is never deep red (56)
 Antennae not retractile into head; hypostomium typically a darkened toothed plate (57) . . . other

Tanypodinae

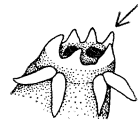
Chironomidae

(typically red and tubulous; Tanytarsini have long antennae (58)—**Chironominae**; stalks of dorsal preanal brushes > 5x long as broad (59)—**Podominae**; 2nd and 3rd thor. segs. fused; antennae long (60)—**Corynoneurinae**; typically white or yellowish (61)—**Diamesinae**; typically greenish, sometimes brown, violet or banded (62)—**Orthocla-diinae**)



57. Head elongate, us. >2x long as wide; post. seg. us. with whorl of hairs; no plates on dorsal surface of body (63); characteristic eel-like movement . . .

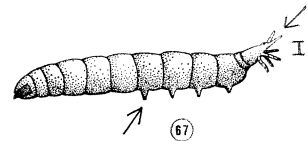
Ceratopogonidae
(Bezzia-type)



Head <2x long as wide; post. seg. with a tubular breathing siphon bearing 2 pr. hairy sclerotized processes; dorsal surface of body bearing plates (often obscured by debris) (64); movement not eel-like . . .

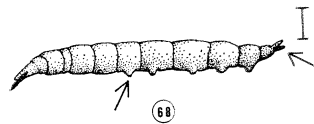


Psychodidae



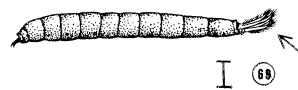
58. Abd. with 4-5 pr. prolegs, or without prolegs but spiny ridges (welts) and post. spiracles ringed by 5-6 lobes (in addition to gills) (65)
 NEMATOCERA: TIPULIDAE . . .

59

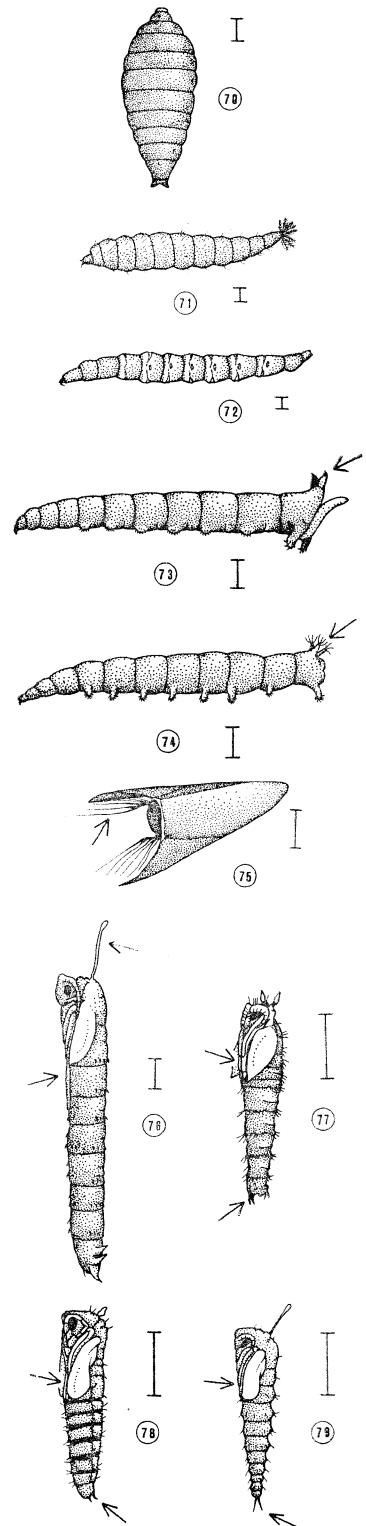


Abd. with 7-8 pr. prolegs, may be reduced to welts; or without these but body hairy with tuft of hairs at post. end (71); or body a hard, dark brown puparium (70) CYCLO-RRHAPHA . . .

61



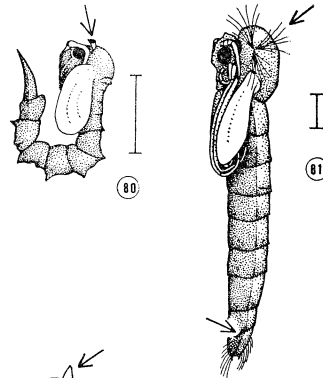
59. Spiracular disc with 6 anal lobes (65) (66) **Tipulinae**
 Spiracular disc with 5 or fewer anal lobes **LIMONIINAE** 60
60. Anal seg. with 1 pr. long tapering lobes; ventral surface of abd. with: 4 welts **Trichyphona**
 4 pr. prolegs (67) **Pedicia**
 5 pr. prolegs (68) **Dicranota**
 6 welts **Taphrophila**
 Anal lobes >2 (69) or else not long and tapering other **Limoniinae**
61. Puparium without hairs, prolegs or welts; body hard and brown containing a pupa (70) **Cyclorrhapha**
 Larva hairy or with prolegs or welts; body dirty-white 62
62. With or without welts on abd., none enlarged into proleg other **Cyclorrhapha**
 (e.g. **Stratiomyidae** (71)
Tabanidae (72))
- Prolegs ± prominent at least on last abd. seg. 63
63. All prolegs except post. pr. ± reduced to spiny mounds; post. seg. with 1 pr. breathing siphons dorsally (73) **MUSCIDAE** **Limnophora**
 Prolegs well-developed especially post. pr.; post. seg. with hairy processes dorsally (74) **EMPIDIDAE** **Clinocera**
64. Covered by ½-conical case fixed to substrate; often with pr. breathing tufts projecting from ant. opening (75) **SIMULIIDAE** **Simulium**
 Not in ½-conical case (but may be in mud, sand or fibrous tube); with pr. breathing horns or tufts on thor. 65
65. Leg sheaths straight, extending beyond wing cases; breathing organs tubular horns (76) **Tipulidae**
 Leg sheaths straight or folded back at tips, not, or barely, extending beyond wing cases; breathing organs horns or tufts 66
66. Leg sheaths straight; abd. us. spiny with 2 stronger spines at post. end; breathing horns tubular or expanding to tip (77) **Psychodidae**
 (78) **Thaumaleidae**
 (79) **Ceratopogonidae**
 Leg sheaths folded back at tips; abd. us. not spiny except for fringing hairs on post. segs.; with breathing horns or tufts 67



67. Tergites (dorsal surfaces) of abd. segs. angled or ridged; breathing horns open and expanding to tip; body bent into U-shape (80); not in a tube DIXIDAE

Tergites of abd. not angled; breathing organs closed, either horns or tufts; body not us. U-shaped; may be in a tube CHIRONOMIDAE

Dixa



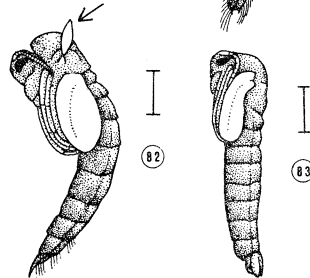
68

68. With feathery breathing tufts (may be reduced to one or a few slender filaments), never lacking; post. end of abd. with spur ant. to lateral fringe of hairs (81)

Breathing organs tubular or ovate (occasionally lacking); abd. without a spur but tip may have lateral hairs

Chironominae

(82) Tanypodinae
(83) Orthocladiinae
and other Chironomidae



ACKNOWLEDGEMENTS

The 1969 version of the key owed much to Dr. T. T. Macan and Faith Arnold (Mrs. Farnham) and I should like to thank them and Mr. Charles Sinker for helpful advice and criticism. Past and present members of the staff of Preston Montford and other field centres have repeatedly tested and amended the key at various stages. I am grateful to Dr. R. H. L. Disney for his considerable help in constructing the amended section on Diptera.

REFERENCES

ARNOLD, F. N., and MACAN, T. T. (1969). Studies on the fauna of a Shropshire hill-stream. *Fld. Stud.*, **3**, 157-184.
 EDINGTON, J. M. (1964). Taxonomy of British Polycentropid larvae (Trichoptera). *Proc. Zool. Soc. Lond.*, **143**, 281-300.
 HICKIN, N. E. (1967). *Caddis Larvae*. Hutchinson, London.
 JOHANNSEN, O. A. (1934-1937). *Aquatic Diptera*. Ithaca, New York.
 MACAN, T. T. (1959). *A Guide to Freshwater Invertebrate Animals*. Longmans, London.
 REDFERN, M. (1969). Field key to the invertebrate fauna of a small stony hill-stream. *Fld. Stud.*, **3**, 185-192.
Freshwater Biological Association Scientific Publications:
 No. 8. KIMMINS, D. E. (1962). Keys to the British species of aquatic Megaloptera and Neuroptera.
 No. 13. MACAN, T. T. (1960). A key to the British fresh- and brackish-water gastropods.
 No. 16. MACAN, T. T. (1956). A revised key to the British water bugs (Hemiptera-Heteroptera).
 No. 17. HYNES, H. B. N. (1958). A key to the adults and nymphs of British stoneflies (Plecoptera).
 No. 19. GLEDHILL, T. G., SUTCLIFFE, D. W., and WILLIAMS, W. D. (in press). A key to the British species of Crustacea: Malacostraca occurring in freshwater.
 No. 20. MACAN, T. T. (1961). A key to the nymphs of the British species of Ephemeroptera.
 No. 23. REYNOLDSON, T. B. (1967). A key to the British species of freshwater triclads.