An Introduction to Millipedes

Paul Richards
British Myriapod and Isopod Group

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OPAL EXPLORE NATURE

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Introduction

- This publication is designed as part of a series of stand-alone introductions to the study of invertebrates. It can be used as a taught presentation or as a self-study guide.

- A further ebook, "An Introduction to Myriapods and Centipedes", precedes this one. It would be helpful if that were viewed first, though some key points will be reiterated here in order to provide an inclusive presentation.

- These publications can be used for self study by simply proceeding through the presentation at your own pace. The full text is included within the slides.

- They are also designed as a text and image resource for group training. Numerous images are included, to offer as comprehensive a selection of species and features as possible.

Outline

This presentation provides:

- A basic introduction to the *Diplopoda* or millipedes
- An introduction to the morphology and main identification features of the most common British species
- How to find out more
- Details of general myriapod classification, ecology, collection and recording are found in part 1, "An Introduction to Myriapods and Centipedes"

What is a Millipede? (1)

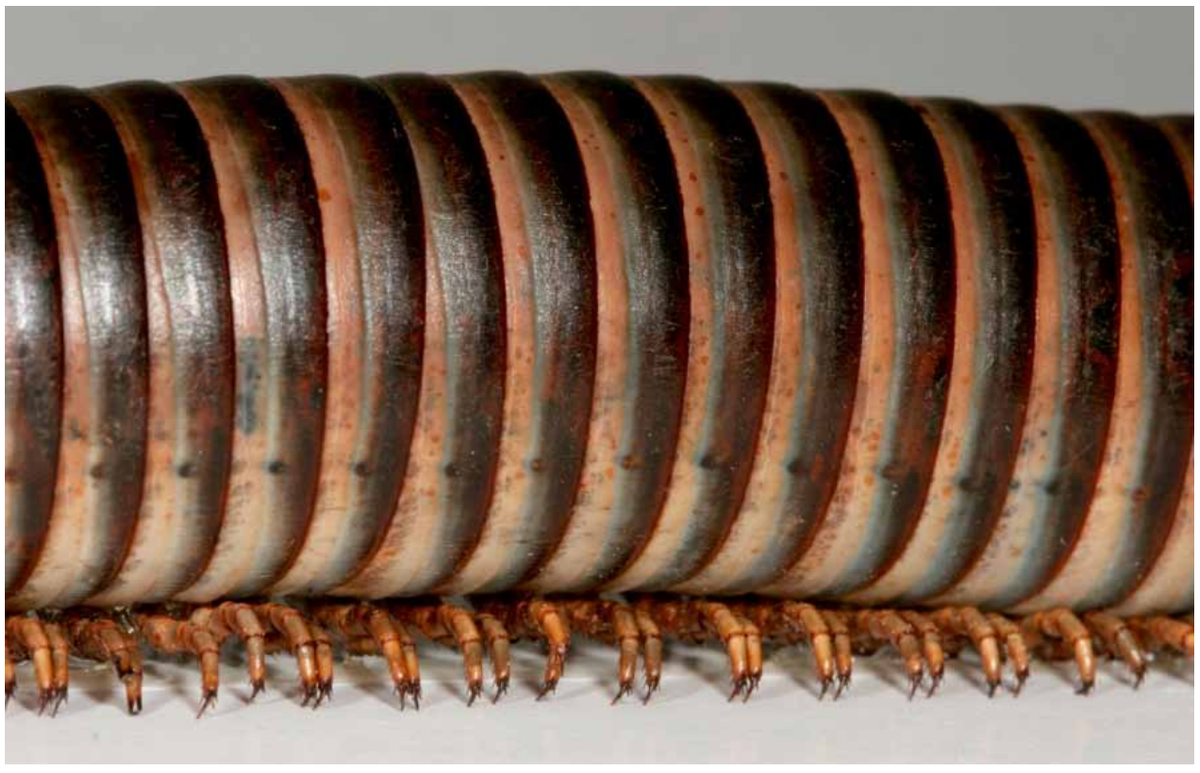
- Millipedes belong to the Class DIPLOPODA
- As arthropods they sit within the Myriapoda, alongside the Centipedes or *Chilopoda* and the less well known *Symphyla* and *Pauropoda*. The term myriapoda is now variously used as a 'Sub-phylum' level taxon or as a general term for multi-legged arthropods.

Centipede

Symphylan

What is a Millipede? (2)

- To a greater or lesser extent, millipedes have calcified exoskeletons, jointed legs and a segmented body, in common with other arthropods.



What is a Millipede? (3)

- As the name suggests, all “DIPLO” – “PODA” have generally **two** pairs of **legs** per body segment. Certain segments may appear to support only one leg pair where the others have become modified into other structures, such as genitalia.

- The second pair of jaws are fused to form a lower lip.

What is a Millipede? (4)

- The body is not divided into thorax and abdomen but consists of numerous leg-bearing "diplo-segments". The number of legs may be anything between six (in newly hatched individuals) and 750 (in *Illacme plenipes*).

What is a Millipede? (5)

- Millipedes are entirely detritivorous, with robust mandibles for eating dead vegetation (detritus). Certain unusual species are known to have carnivorous habits, but this is rare. Other species may also be found to eat living plants or seedlings, though this is usually in response to reduced humidity levels or out of necessity due to population explosions.

Occurrence

- The British fauna comprises around 60 species. Many of these are restricted to milder southern areas. In the north of Britain there might be as many as 33 species of millipede found inland. Coastal areas support additional species. Areas of chalk and limestone have a particularly rich millipede fauna.

- New species frequently turn up in Britain and Ireland, while other previously known species are threatened or already extinct. Two recently discovered species:

Haplopodoiulus spathifer

Cylindrodesmus hirsutus

Occurrence (2)

- Six Orders of the Class Diplopoda are represented outdoors in Britain.
- Worldwide there may be 10,000 species.
- This makes for a huge variety of forms, within which it is hard to generalise.

Morphology (1)

- All millipedes are primarily adapted for pushing. The large number of legs enables them to give greater force to the push. The large first tergite or COLLUM in many species is used as a wedge to deliver the full force of the push between soil particles and leaf litter layers. The whole of the back is used in the same way in the flat-backed species, while the rigid interlocking segments prevent the body from shortening or buckling under stress (Manton 1954).

Morphology (2)

- For simplicity the millipedes are often roughly divided according to shape into ‘bristly, pill, snake and flat-backed’ forms. While other variations between these forms occur, these categories serve as good generalisations.

Bristly

Snake

Pill

Flat-backed

Morphology (3)

- The bristly millipede, *Polyxenus lagurus* is uniquely covered in hollow, serrated bristles called TRICHOMES and unlike other millipedes, has a soft exoskeleton.

- Snake millipedes have a more or less cylindrical cross-section and may roll into a planar or helical spiral to protect the underside and head.

- "Pill" millipedes are capable of rolling into a tight sub-spherical ball, like an armadillo.

- The remaining species have lateral projections (or PARANOTA) and a generally flattened dorsal surface giving a flat-backed appearance.

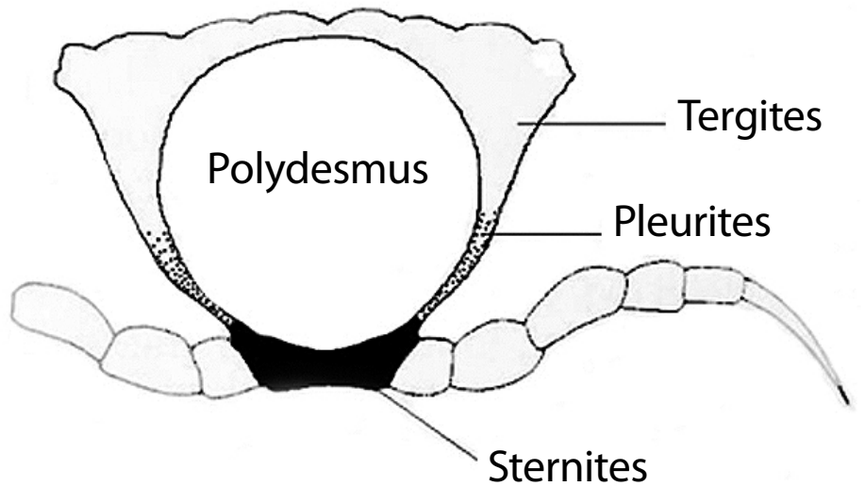
Morphology (4)

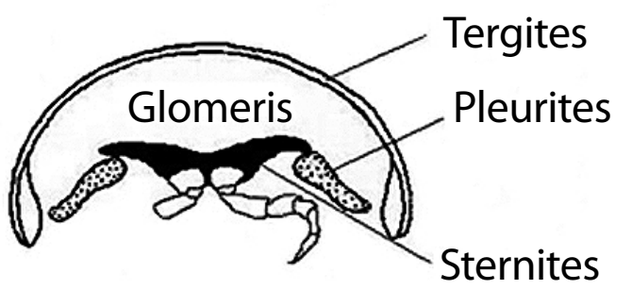
In Britain a further arched 'shape' of millipede is represented by the very rare species, *Polyzonium germanicum*.

This species is only found in the extreme south-eastern corner of England.

Morphology (5)

From a taxonomic point of view, millipede families can be arranged according to the degree of fusion there is between the various parts of the exoskeleton.

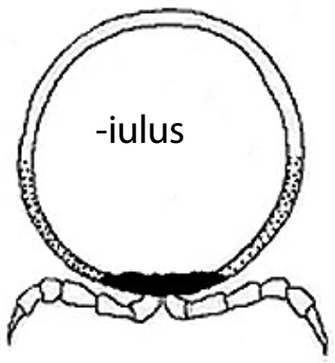


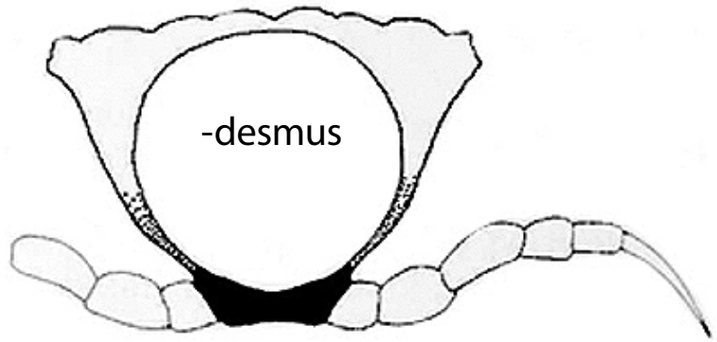


Morphology (6)

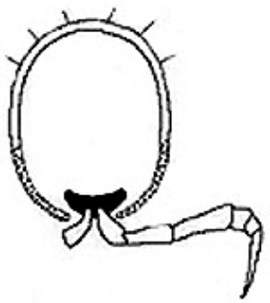
The STERNITES, PLEURITES and TERGITES are fused to form a single ring in MONOZONIAN families, while there is progressively more articulation between these units in the TRIZONIA and PENTAZONIA.

MONOZONIA

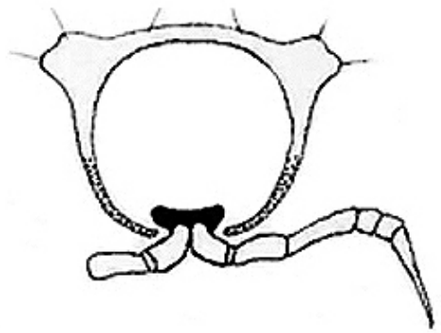




TRIZONIA



Melogona



Nanogona

Brachychaeteuma

PENTAZONIA

Glomeris

Polyzonium

After Blower 1985

Pause for thought…

What are the four main morphological types of British millipede?

Morphology (7)

There are a number of particular features which are useful in distinguishing between species. Size, colour and shape are a remarkably straightforward means of diagnosis.

The defence glands (OZADENES) form 'spots' along the side of the body and may be variously coloured orange, blood red, dark brown or even greenish.

Morphology (8)

All millipedes can be divided according to whether the first tergite (COLLUM) overlaps the head or whether this first segment seems to fit into the back of the head.

Collum overlapping head

Collum at the back of the head

Also, usually with enlarged ‘cheeks’

Morphology (9)

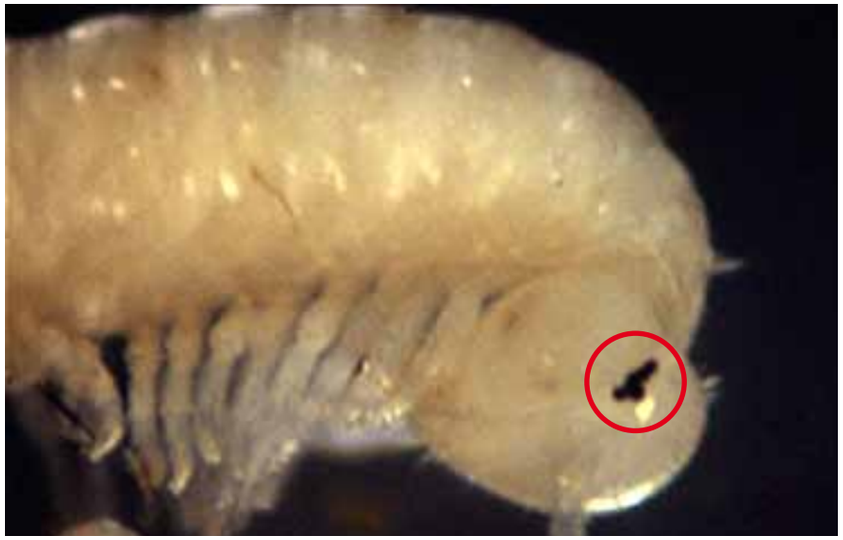
Those snake-like forms with the overlapping collum can further be divided depending on the extent of the longitudinally engraved striae (grooves) which are found on each segment. In some small species these are confined to the lower half of each ring. In others the grooves are present over the whole arch of the segment.

Ommatoiulus sabulosus with striae over the upper part of the body segments

Boreoiulus tenuis with striae on the lower part of the body segments only

Morphology (10)

A most distinctive feature is the presence or absence of eyes or the number and pattern of OCELLI of which the eyes are comprised. As an individual grows, the number of ocelli per eye increases and can be a helpful guide as to the age (or STADIUM) of the specimen.



Morphology (11)

The last segment or TELSON may possess a characteristically-shaped tail projection or even tiny spinnerets for producing silk which can easily be seen with a hand lens.

Genitalia (1)

As with most invertebrate groups, secondary sexual characters and genitalia structure are very specific diagnostic features.

Often such structures are held within the cuticle and need to be dissected out to see them properly.

However, in many male millipedes these can be seen quite clearly behind the sixth or seventh pair of legs.

In the *Polydesmus* species these are particularly large and obvious.

Even the females have external sculpturing (EPIGYNES) behind the second pair of legs which is distinctive.

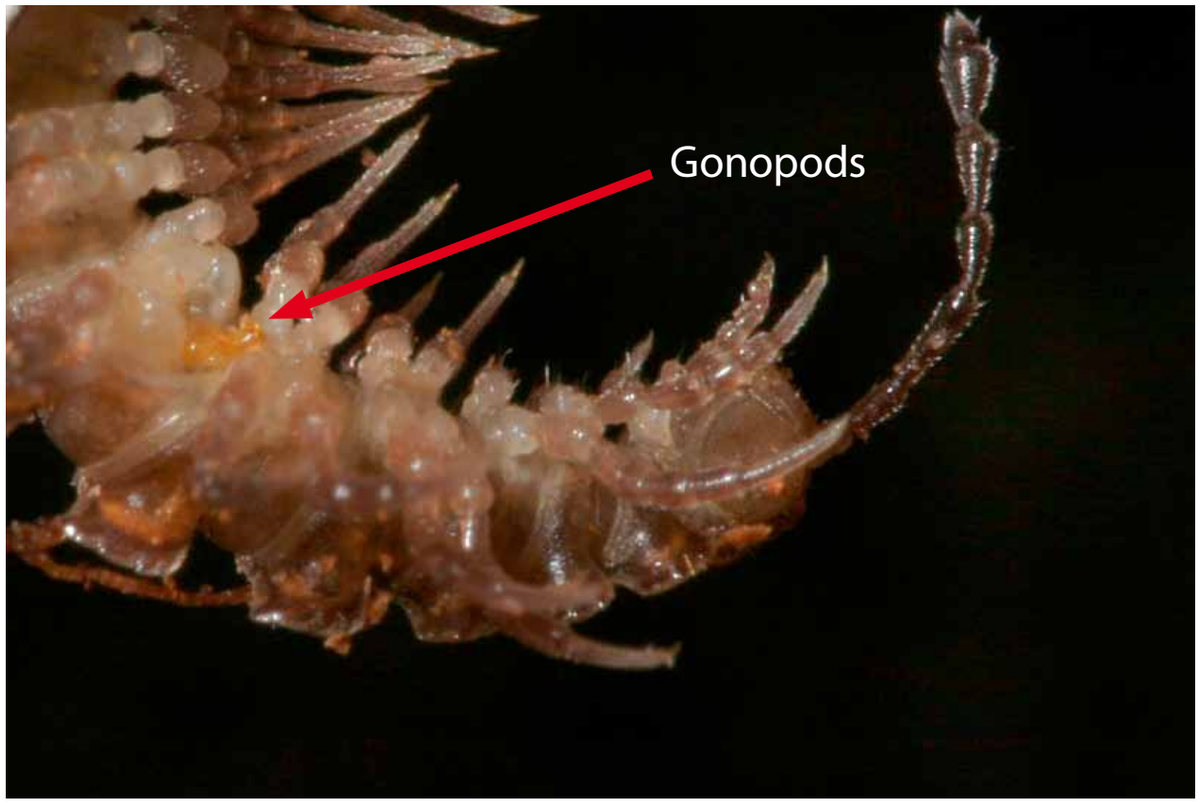
Genitalia (2)

Secondary sexual modifications often mean that certain leg pairs appear to be absent in adult millipedes. This feature is helpful in determining the sex of a millipede. The genitalia of all Diplopods are found in the third body ring and open just behind the second pair of legs.

In the bristly millipede, sperm is indirectly transferred to the female via a web of silk threads spun on a nearby surface.

Genitalia (3)

All other male millipedes transfer sperm via modified limbs known as GONOPODS.
These reproductive organs are not strictly 'genitalia' but will often be referred to as such.



Polydesmus coriaceus

Isolated gonopod of *Polydesmus coriaceus*

In the pill millipede, *Glomeris marginata,* the gonopods are formed by the last three pairs of legs and sperm is transferred to the female via a small pellet of soil.

Genitalia (4)

In all other Diplopod orders the gonopods are formed from the eighth or ninth pair of legs on ring seven. This means that it is relatively straightforward to determine the sex of adult millipedes according to whether there is a gap (due to a missing leg) around ring seven in males. In females there is only a gap after the second pair of legs.

Gonopods of *Oxidus gracilis* in gap after seventh leg pair

Gap only after second pair of legs in female *Nemasoma varicorne*

Genitalia (5)

In some millipedes further characters help to demonstrate the gender, such as small modified first legs in some male snake millipedes or more robust legs in male flat-backs.

Spatula-like coxal processes between second pair of legs of male *Julus scandinavius*. (In *Julus* the first pair of legs are so reduced that there appear to be only six legs prior to the gap)

Robust legs and gap after seventh leg pair in male *Polydesmus coriaceus*

Pause for thought…

In general, how can you tell the difference between male and female millipedes?

Reproduction (1)

Reproduction requires a damp place to lay vulnerable eggs. Species of millipede exhibit seasonal variations as to where they are found within the soil. This reflects the levels of moisture in the soil layers and the availability of suitable egg laying sites.

Millipedes lay their eggs in nests of faecal material or silk. The eggs begin to mature immediately and hatch into a legless 'PUPOID' which moults to produce the first stadium with six legs.

Reproduction (2)

Young stages possess a small number of legless rings at the rear; the‘proliferation zone’. A succession of moults occur and further legs are acquired until the individual attains its full complement. The frequency and number of moults varies between species but may be anything up to 15.

Very young stadium and hatching eggs of *Archispirostreptus gigas*

Young stadium of *Nanogona polydesmoides* with *Androniscus dentiger* woodlouse

Reproduction (3)

It is difficult to generalise regarding rates of maturity across the whole Diplopoda, as some species may live short annual lives, while others live for several years, passing through various growth, maturity and post-reproductive stages. Mature individuals of different species can be found at any time of the year.

PARTHENOGENESIS is known in some millipede species. This is where reproduction takes place in the absence of males. For example, males of *Geoglomeris subterranea* have never been found.

Growth (1)

The age of a specimen can be estimated by counting the segments or by the number of eyes which are also increased with each moult.

Some millipedes have a specific number of segments in the adult while others are variable.

Each moult takes place in a special chamber constructed rather like the egg nest.

Although some species mature within a year, most take between one and a half and four years before they can reproduce.

Some species continue to reproduce for a number of years, some die soon after mating, while in others it is only the male that dies. This leads to interesting population dynamics throughout the year where there may be periods with no adults or few males around.

Growth (2)

An unusual feature of some snake millipede species (*Ommatoiulus, Tachypodoiulus Blaniulus* etc.) is that sexual maturity occurs in males before the final stadium (growth stage).

A sexually mature male may undergo a further moult to produce an individual which may be reproductively non-functional. These secondarily 'immature' adults are known as INTERCALARY stages.

Such an individual may then possibly moult again to produce a further subsequently mature form.

Pause for thought…

What time of year would be best to find adult millipedes?

Key (1)

The following key acts as an introduction only. It was originally written with Yorkshire in mind, however it should help to identify the majority of commonly found inland species. It does exclude a number of coastal species and others which are more frequent in southern parts of Britain. Where appropriate, reference will be made to identification features peculiar to some excluded species.

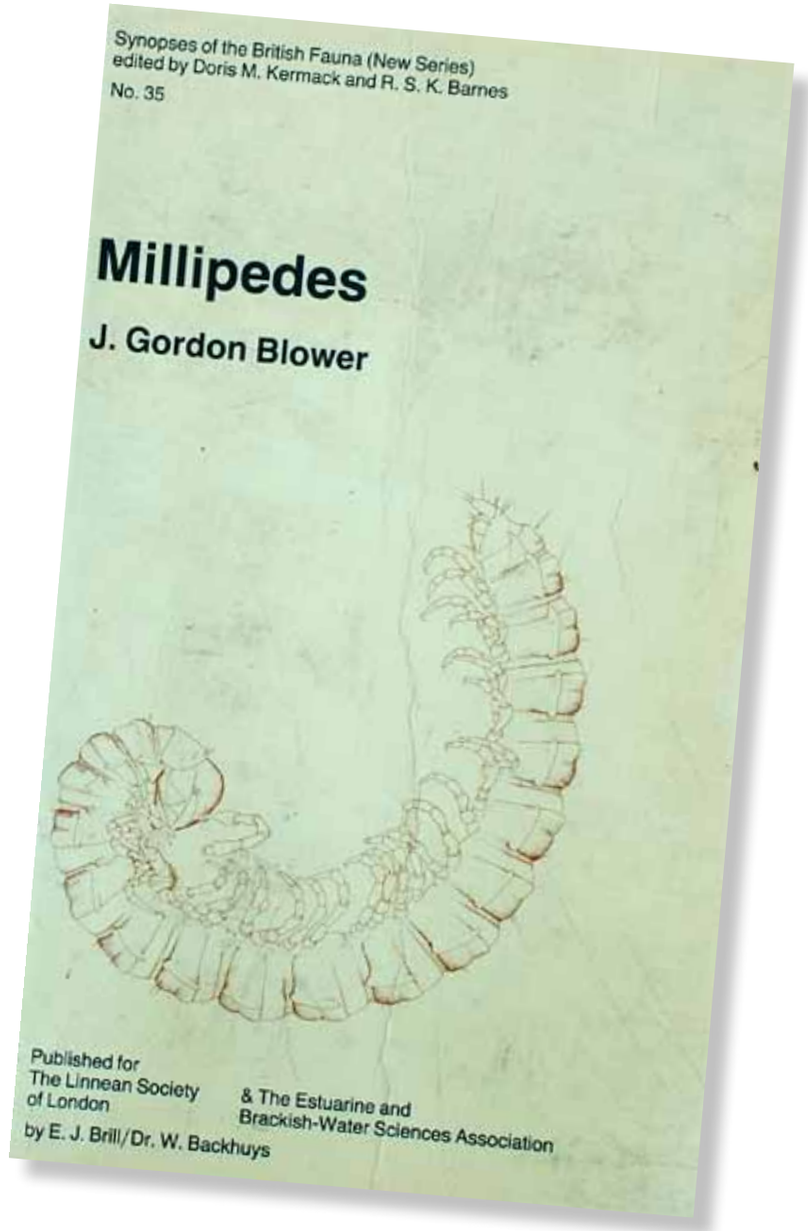
(Key modified from "Key to species of millipede found in Yorkshire", D.T. Richardson, 1980)

A full list of British species is appended at the end of this presentation.

Key (2)

Females and immature stadia of certain species may prove unidentifiable using this key but may be possible by reference to Blower (1985). Even then, males may be required for absolute confirmation (e.g. *Brachychaeteuma* spp.).

Unless otherwise stated, measurements refer to total body length (L). Where number of segments is given this refers to all body rings including collum and telson (tail).



Key

1a. Soft bodied. Pale amber coloured with tufts along sides (trichomes) and two brushes at the back. 2–3mm. Very distinctive.

Bristly millipede *Polyxenus lagurus*

1b. Hard bodied. *No tufts*.

➜2

Key

2a. Can roll into a tight, spherical ball when disturbed. ➜3

2b. Cannot roll into a tight ball (may roll into a spiral). ➜5

Key

3a. *Seven pairs of legs*. Several small segments at end of body. NOT a millipede.

Woodlouse species
e.g. *Armadillidium* sp.

3b. *Seventeen to nineteen pairs of legs*. Smooth, shiny (black, brown or white). A single large last body segment.

Pill millipede

→4

Key

4a. *Larger* (7mm+) *with eyes*. Usually dark with lighter markings at edges of body segments or in patches along the back.

Glomeris marginata*

4b. *Very small* (2–3mm) *without eyes*. Virtually colourless, often with darker gut contents showing through.

Geoglomeris subterranea*

Key

4c * Other rare, *small* species that could key out here include ***Trachysphaera lobata*** (with eyes) and ***Adenomeris gibbosa*** (without eyes).

Trachysphaera lobata

Adenomeris gibbosa

Key

5a. *Snake-like* with cylindrical cross section (Figures 1 & 2). ➜14

5b. *Flat-backed* or with rounded humps on sides of body segments (Figures 3 to 5).
May be difficult to see in *Brachychaeteuma* (Figure 3). ➜6

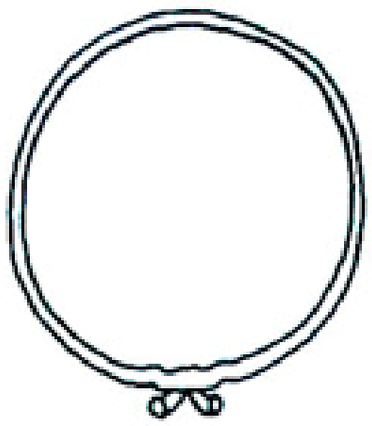


Figure 1.

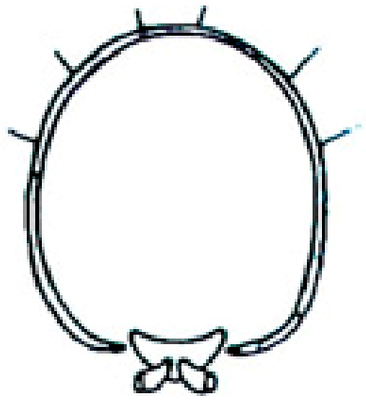


Figure 2.

Figure 3.

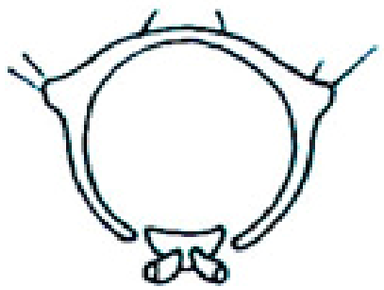


Figure 4.

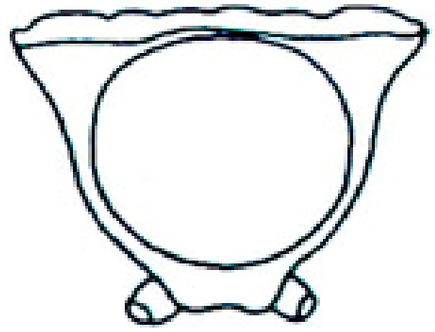


Figure 5.

Key

6a. *With eyes* (may be difficult to see in *Brachychaeteuma*).
Each segment with six hairs (Figures 3 and 4).

➜7

6b. *Without eyes*

➜10

Key

7a. *Flat-backed* appearance, with distinct paranota. Evenly coloured, light brown (Figure 4).

Nanogona polydesmoides

7b. *More rounded*, with smoother humps along side of body (Figure 3). ➜8

Key

8a. Larger (over 15mm L). Obviously with eyes. Deep reddish brown with light mottling.

Craspedosoma rawlinsii

8b. Small (less than 9mm). Cream to white. Eyes/ocelli may be barely visible or up to six well pigmented. ***Brachychaeteuma*** sp.

→9

Key

9a. Up to three barely visible eyes/ocelli. Males required for certain identification of species.

Brachychaeteuma bradeae/bagnalli

9b. Up to six well-pigmented ocelli in an irregular line.

Brachychaeteuma melanops

Key

10a. Larger (more than 8mm L). Brown or cream with obvious flat back. Back elaborately sculptured with bumps and tubercles. ➜11

10b. Tiny (less than 5mm). Creamy white/colourless. ➜12

Key

11a. Larger animals (more than 10mm). Brown. Adults with 20 segments. ***Polydesmus*** species. ➜13

Polydesmus (left), *Brachydesmus* (right)

11b. Smaller (8–10mm). Light brown to off-white. Short hairs on back. Adults with **19** segments.

Brachydesmus superus

Key

12a. Tiny (3–4mm L, 0.3–0.4mm W). Colourless (dark gut seen through cuticle). Back is rough textured and dull. The sides of each segment have three tiny teeth (Figure 6). ***Macrosternodesmus palicola***

Macrosternodesmus palicola with *Ommatoiulus sabulosus*

12b. Small (4.5–5mm L, 0.5–0.8mm W). Ivory white. Back smooth and shiny with three rows of hairs across each segment (Figure 7). Edges not toothed. ***Ophiodesmus albonanus***

Figure 6.

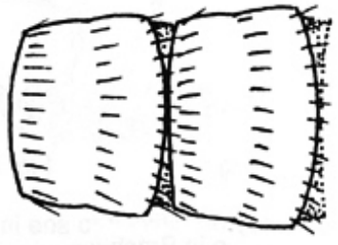


Figure 7.

Brachychaeteuma spp. may key out here if the eyes have been overlooked. Sides with rounded humps rather than flat back 5–8mm.

Key

12 (continued).
Does not curl up.

Macrosternodesmus palicola



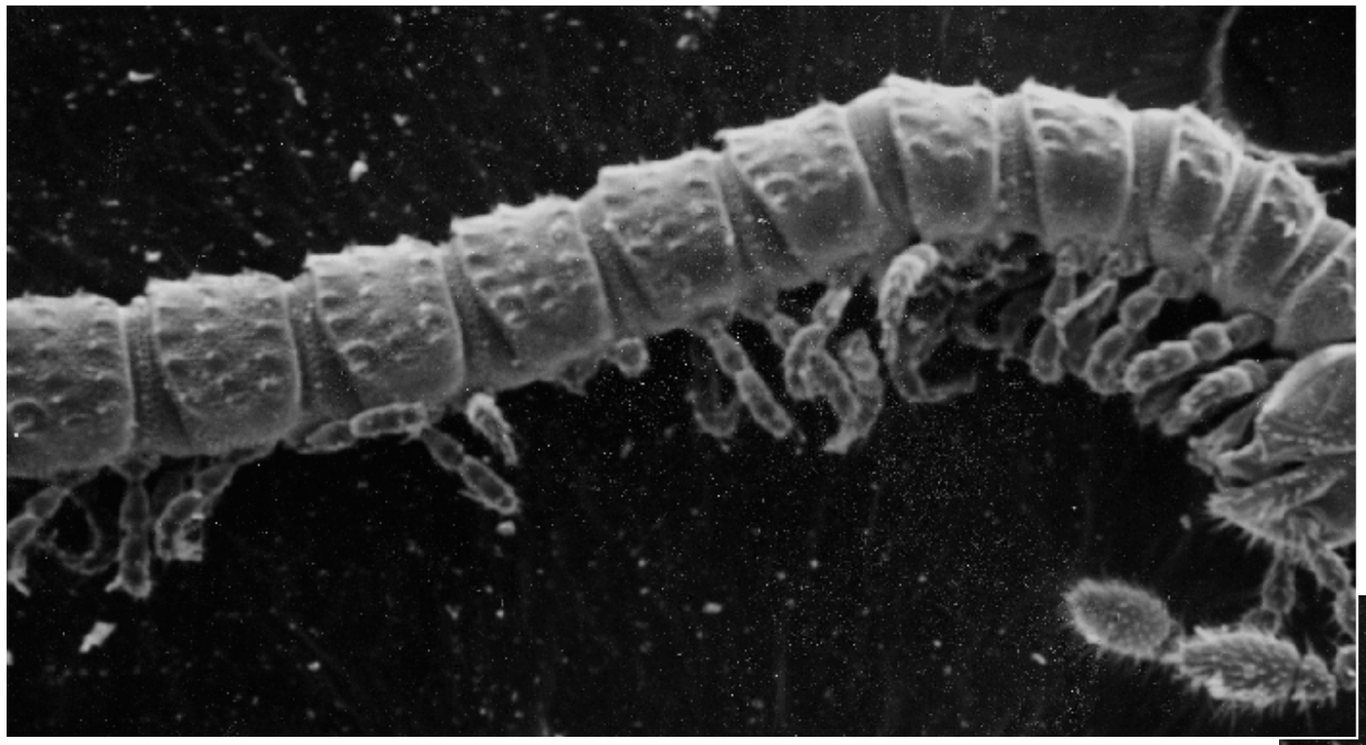
Curls into a tight spiral.

Ophiodesmus albonanus

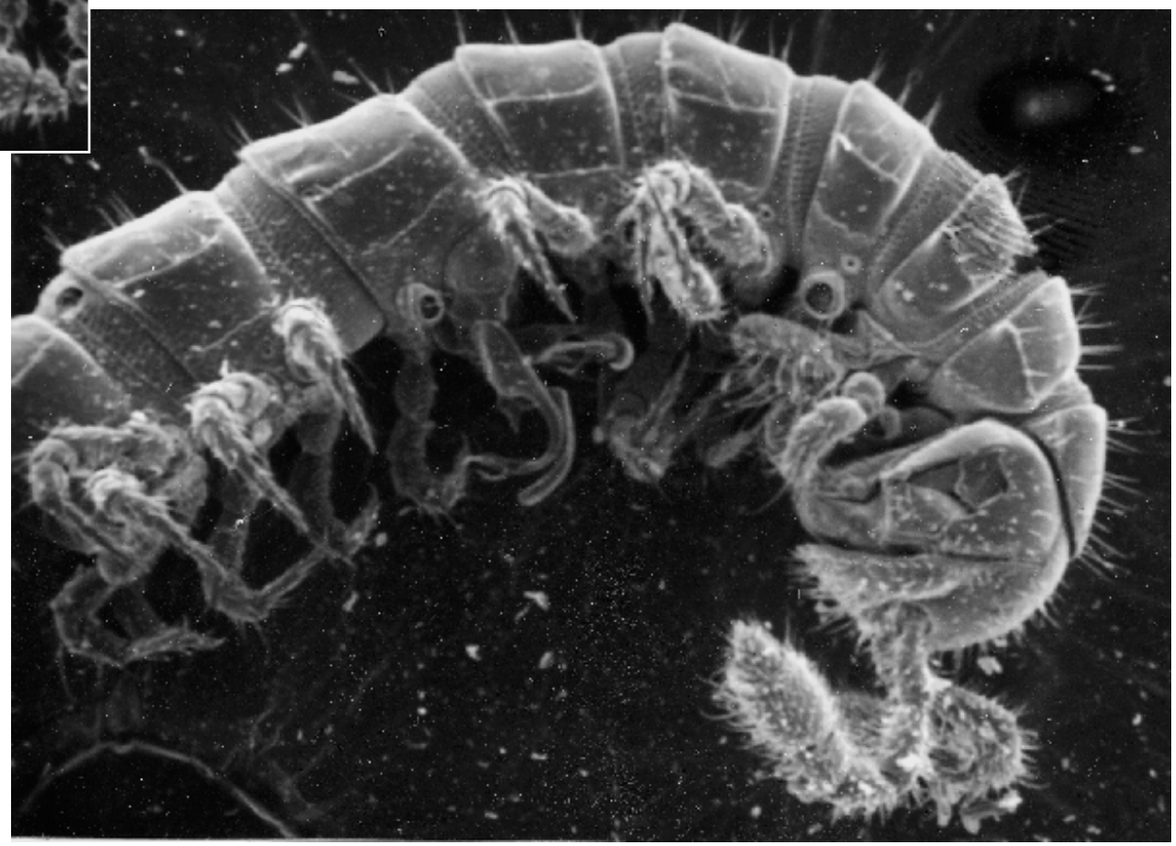


Key

12 (continued).
Scanning electronmicrographs of ***Macrosternodesmus palicola*** ...



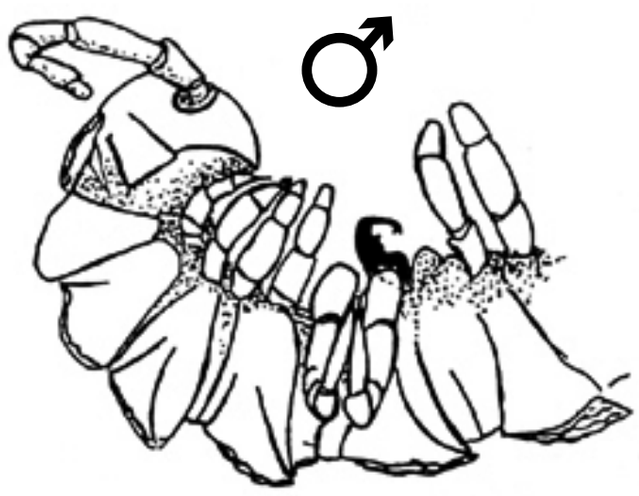
... and ***Ophiodesmus albonanus***

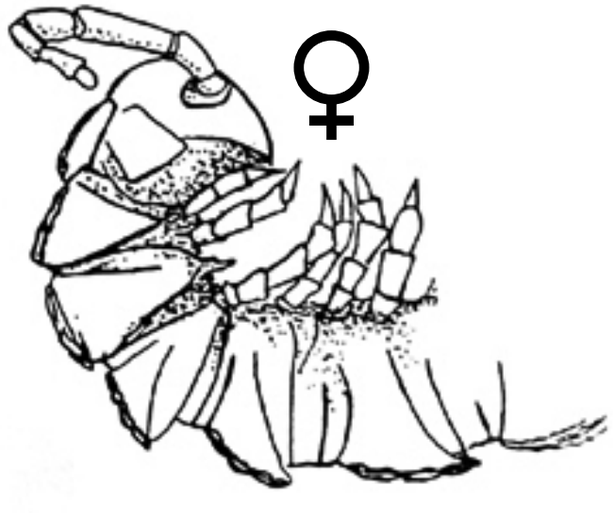


Key

13. Polydesmus species are identified by differences in their genitalia structure. Male gonopods are found where the eighth pair of legs would be. Female epigynes are located on the front edge of the third segment, behind the second pair of legs.

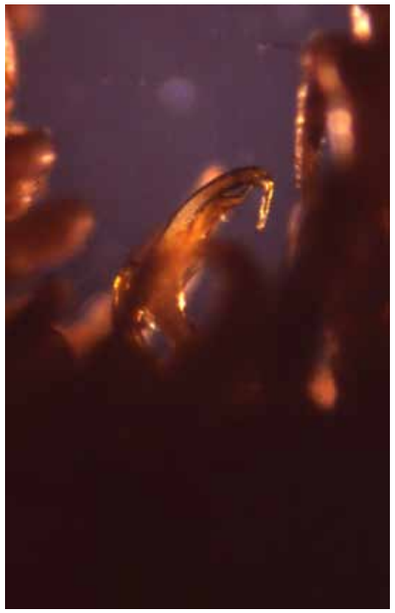
Side view of male *Polydesmus angustus*



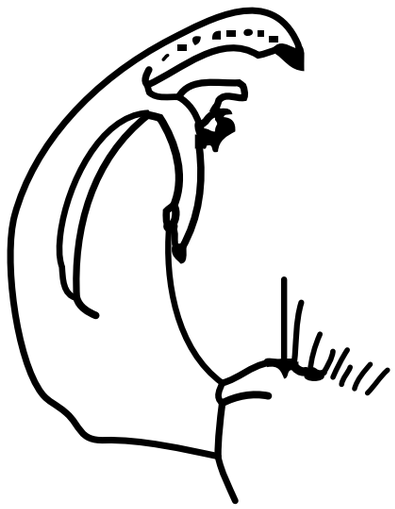


Key

13 (continued). Side view of isolated *Polydesmus* gonopods.



P. angustus



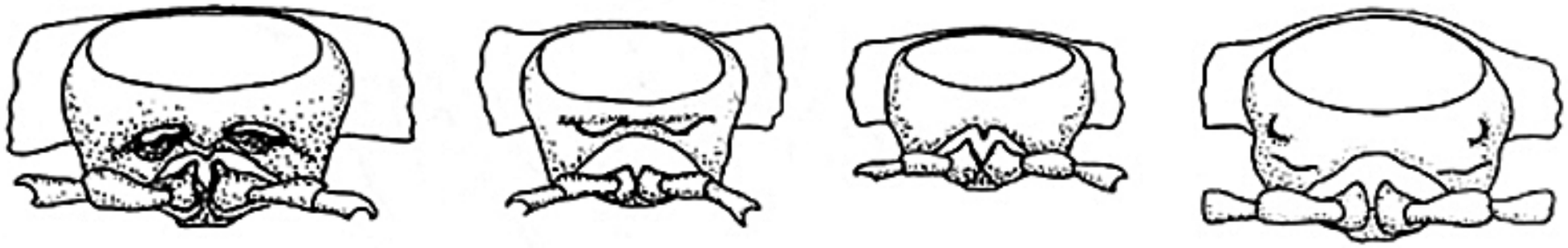
P. denticulatus

P. inconstans

P. coriaceus
(= *gallicus*)

Key

13 (continued).
View of female *Polydesmus epigynes* from underneath



P. angustus | *P. denticulatus* | *P. inconstans* | *P. coriaceus* (= *gallicus*)

Key

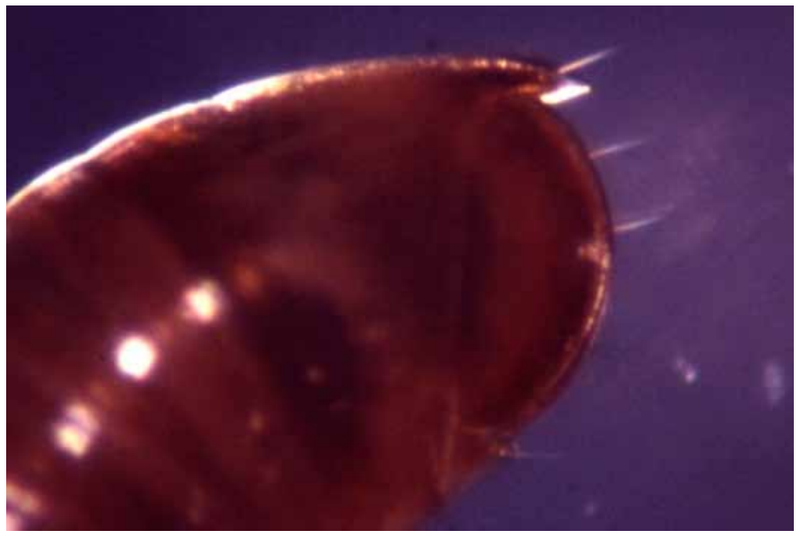
14a. *Without eyes*. Yellow, orange or red spots along body. Collum overlapping the head. ➜15

14b. *With eyes*. ➜17

Key

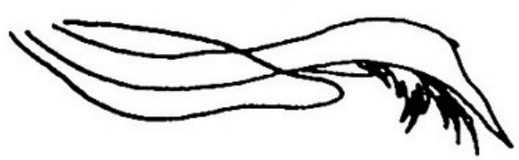
15a. Longitudinal grooves only on lower parts of body segment. Very thin (less than 1mm wide). **➜16**

15b. Longitudinal grooves extend all around body segment. Larger (more than 1mm wide). With short pointed tail.
Cylindroiulus vulnerarius



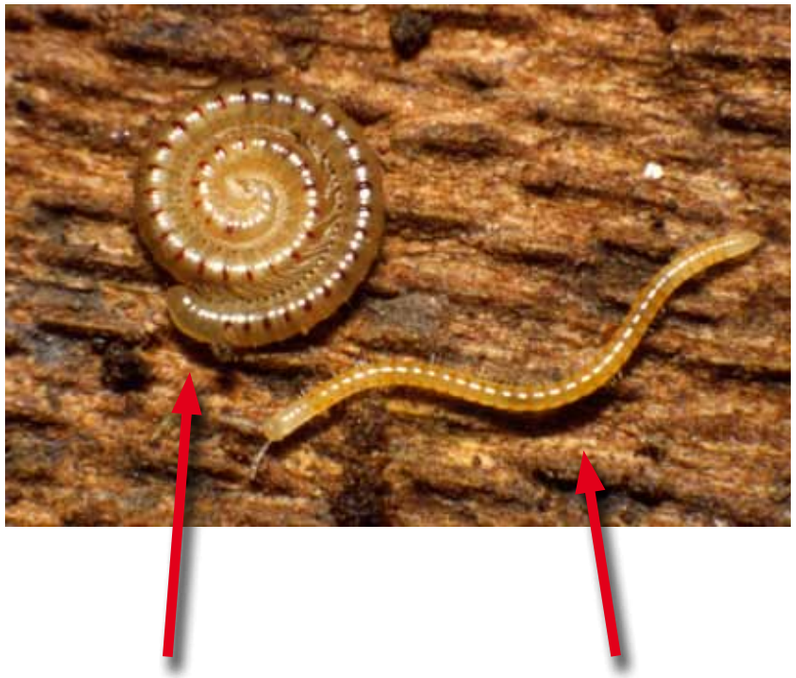
Key

16. Three species for which microscopic examination is required for certain identification. The main differences are summarised here.

Hairs on body ring	Colour of spots	Gonopods	
a. Very long	Yellow to orange	Pear-shaped 	***Archiboreoiulus pallidus***
b. Long	Bright blood red	Parallel-sided 	***Blaniulus guttulatus***
c. Very short indeed	Yellow to orange	Distinctive 	***Boreoiulus tenuis***

Key

16 (continued).



Blaniulus guttulatus

Boreoiulus tenuis

Boreoiulus tenuis

Blaniulus guttulatus

Key

16 (continued).

Male

Boreoiulus tenuis

Male

Archiboreoiulus palidus

Key

17a. *Collum not overlapping head*. Shorter than 14mm. No longitudinal grooves on segments. Adults with 28–30 segments.

→18

17b. *Collum overlapping head*. Longer than 9mm. Usually more than 30 segments in adult. Longitudinal grooves extend all around body segment.

→19

Key

18a. *Small* (to 8mm L). White to yellowish. Adults with *28* segments. Eyes of up to 12 ocelli.

Melogona scutellaris

Key

18b. Larger (up to 10mm L.) Cream to dark amber. Adults with 30 segments. Eyes of up to 18 ocelli.

Melogona gallica

M. gallica with Macrosternodesmus palicola

Gonopods holding a dark green spermatophore

18c. Larger (10–14mm L.) Dark brown above, lighter below. Adults with 30 segments and equilateral triangular eyes of up to 29 ocelli.

Chordeuma proximum/Chordeuma sylvestre*

*Detailed examination of male specimens required to confirm identification

Key

19a. Last body segment produced into a distinct tail or projection which may have a transparent tip.

➜20

19b. Last body segment without a distinct projecting tail.

➜27

Key

20a. Tail distinctly clubbed. →21

20b. Tail with pointed tip. →22

Key

21a. Smaller (to 18mm). Light brown with darker brown bands and spots (ozadenes) along body.

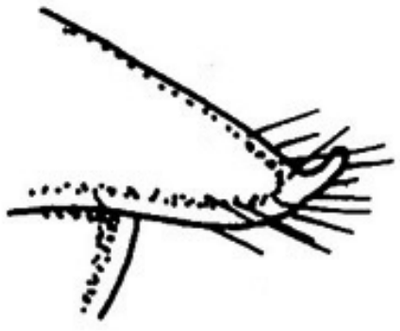
Cylindroiulus punctatus

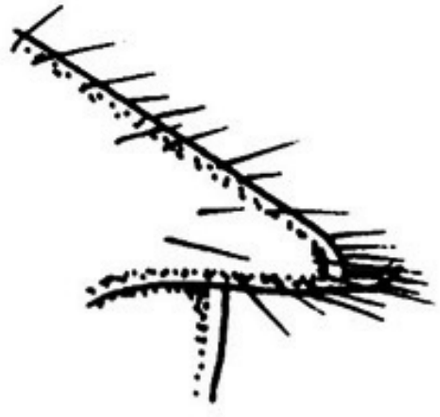
21b. Larger (up to 50mm). Dark brown-black with brassy metallic rings.

Cylindroiulus londinensis

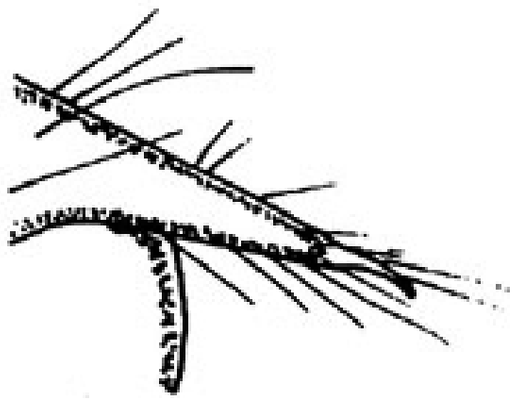
Key

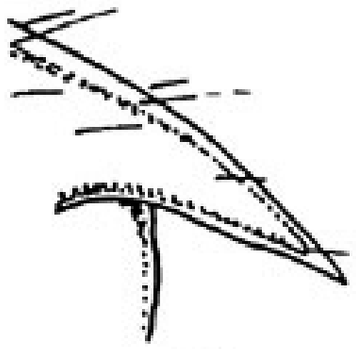
22a. Tip of tail curved upwards. ➜23





22b. Tail or tail-tip down-turned. ➜24





Key

23a. Dark brown with two orange stripes along whole length of body. No hairs on body segments except tip of tail (40–52 segments in adults). ***Ommatoiulus sabulosus***

(+ smaller *brachyiulus pusillus*)

Key

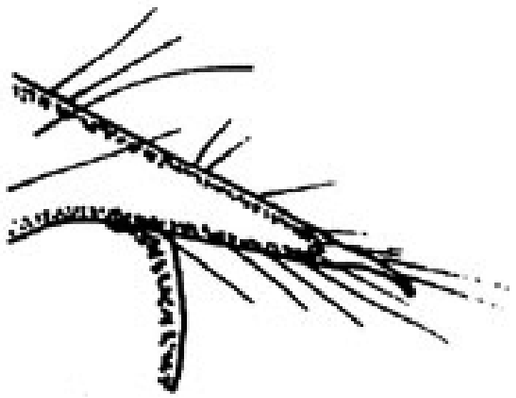
23b. Black with white legs. Hairs on rear edges of all body segments and along length of tail.

Tachypodoiulus niger

Key

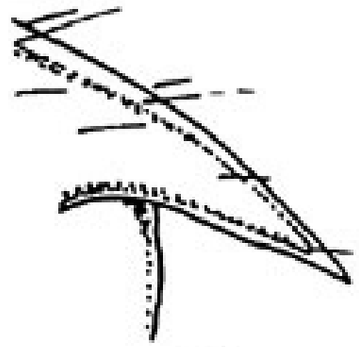
24a. Tail straight with underside of tip concave, appearing to turn downwards. Darkly coloured, brown or black.

➜25



24b. Whole tail bends downwards. Lightly pigmented, brown, lilac or greenish.

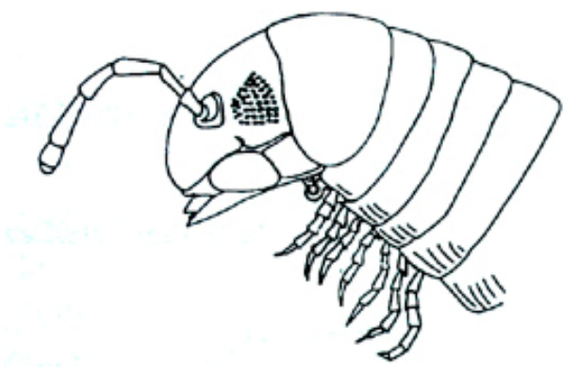
Allajulus nitidus



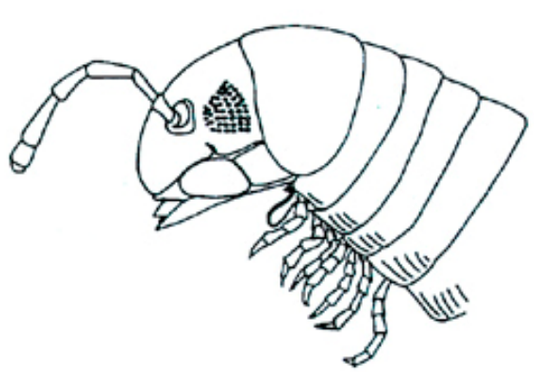
Key

25. ***Ophyiulus pilosus*/*Julus scandinavius*/*Leptoiulus* sp†**a.** Gap behind second pair of legs. **Females.** Require microscopic examination, beyond the scope of this guide.
b. Gap behind seventh pair of legs. **Males.** ➜26

26a. First pair of legs sharply sickle-shaped. ***Ophyiulus pilosus***



Ophyiulus



Julus

26b. First pair of legs almost absent. Second pair with blade-like projection. ***Julus scandinavius***

Key

26 (continued).
Ophyiulus pilosus First pair of legs sickle-shaped.

Julus scandinavius Second pair of legs with blade-like projection.

Key

26c. †Two rarer species also key out here.

Leptoiulus belgicus Large (to 19mm L) and hairy. Adults of both sexes often with a pale longitudinal central stripe. Lower half of body paler than upper. Male has bluntly rounded hook-shaped first pair of legs.

Leptoiulus kervillei Smaller, slender and hairy. Males have a distinctive paddle-shaped lobe at the base of the second pair of legs, in addition to the hook-shaped first pair. No central stripe.

Key

27a. Small(7–13mm L). Brown with two creamy-yellow stripes along length of body. Appears tailless, but has a very short, roof-like projection. 27–31 segments in adults. ***Brachyiulus pusillus***

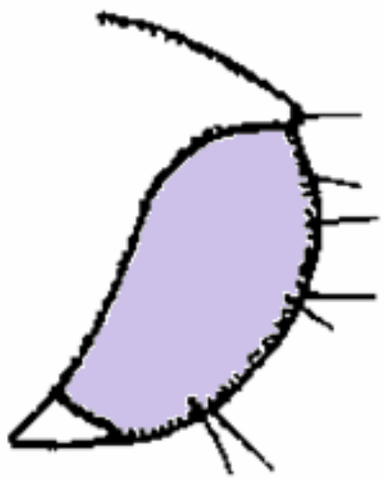
With larger ***O. sabulosus***

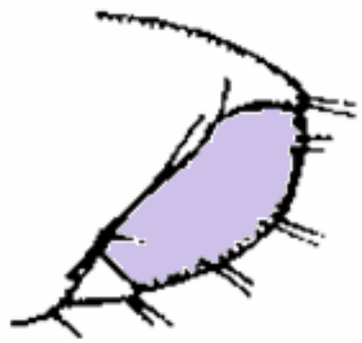
27b. Without cream-yellow stripes

→28

Key

28a. Moderately stout to large (more than 8.5mm L & 0.8mm W). Tip of tail rounded, but not projecting. Three hairs on each anal valve (shaded). ➜29



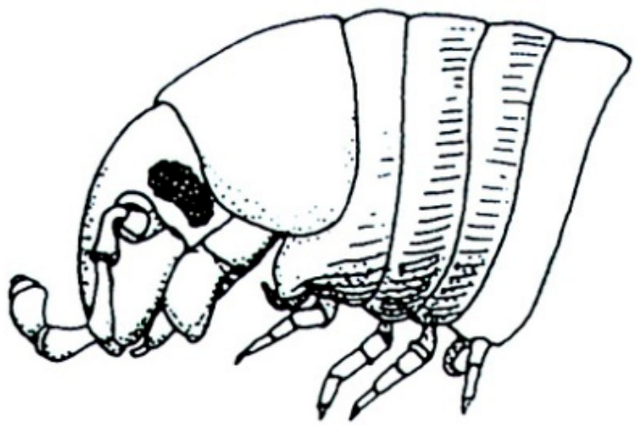


28b. Very thin. Brown with dark spots along sides of body (less than 13mm L and 0.8mm W). Longitudinal grooves only on lower parts of segments. ➜30

Key

29a. Large (20–30mm L). Eye patch kidney shaped. Brown-black with brassy edges to segments.

Cylindroiulus caeruleocinctus



Similar to *Cylindroiulus londinensis*, which has a short clubbed tail.
C. caeruleocinctus has no tail.

29b. Smaller (8.5–16mm L).

Cylindroiulus latestriatus/britannicus*

Key

29b (continued).

Cylindroiulus latestriatus*

Cylindroiulus britannicus*

*These two species cannot be separated without close examination of the genitalia.

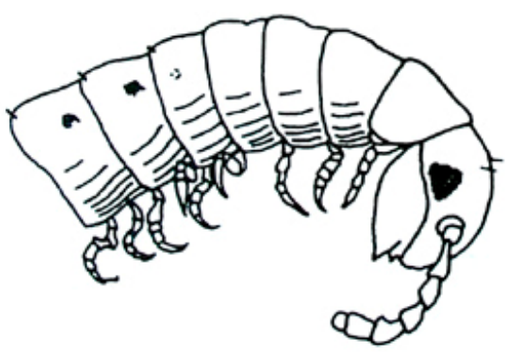
Key

30a. Eyes arranged in an equilateral triangular group. A very thin, 'thread-like' body.

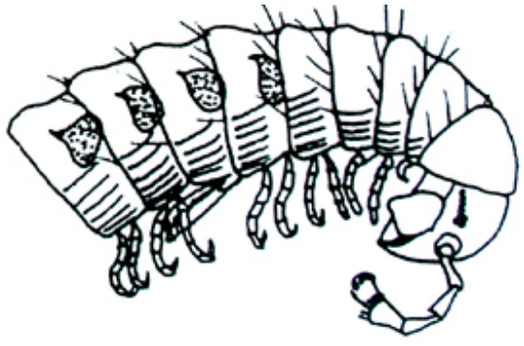
Nemasoma varicorne

30b. Eyes arranged as a very acute triangle, of eight to 10 ocelli in one row with two or three in a second row.

Proteroiulus fuscus



Nemasoma varicorne



Proteroiulus fuscus

Key

30 (continued).

Nemasoma varicorne

Nemasoma and *Proteroiulus*

Key

30 (continued).

Proteroiulus fuscus

Nemasoma and *Proteroiulus*

Pause for thought…

- Remember that the key only covers a broad selection of British species and many others may be found. Some of the species not included in the key are illustrated in the following gallery.

- Now that you are more familiar with the diagnostic characteristics it would be good to try using 'Blower (1985)' which covers all the British species.

- If you have managed to identify your specimens by working through the keys it would be useful to have your identifications confirmed. The area coordinators and local recorders for BMIG will be happy to help.

The following gallery of images shows some of the distinctive, but less frequently recorded British species, which are not included in the previous key

Rough guide to some rarer British species

Propolydesmus testaceus would key out at couplet 13. Identified by differences in genitalia, but is also generally paler and shinier than other British species, with smooth paranotal edges. Currently known only from scattered locations in Kent, South Wales, Oxford and Suffolk.

Rough guide to some rarer British species

Polyzonium germanicum Unlike any other British millipede. The key will therefore fail at couplet 5. Has a shallowly-arched 'pentazonian' body and a pointed head with eyes of three ocelli. Very rare, occuring only in Kent.

Rough guide to some rarer British species

Stosatea italica would key out at couplet 13. A medium-sized (14mm) species with smoothly-arched paranota of brown with double amber spots. Scarce; most frequently found in S-E England, but native to Italy.

Rough guide to some rarer British species

Oxidus gracilis would key out at couplet 13. A large (21mm) species frequently encountered in hothouses around the world. Smoothly arched paranota are dark brown with amber edges.

Rough guide to some rarer British species

Two of several small tropical millipedes which occur in Britain only in heated greenhouses. They are very different to other native species, but would key out around couplet 12.

Poratia digitata The edges of the paranota have very pronounced protruding tooth-like bumps, which are larger to the rear and extend all around the segment. The front paranota sweep down and forwards. The front end is slightly paler.

Cylindrodesmus hirsutus Paranota are smooth and extend down round the body. Each segment is furnished with numerous curved hairs.

Rough guide to some rarer British species

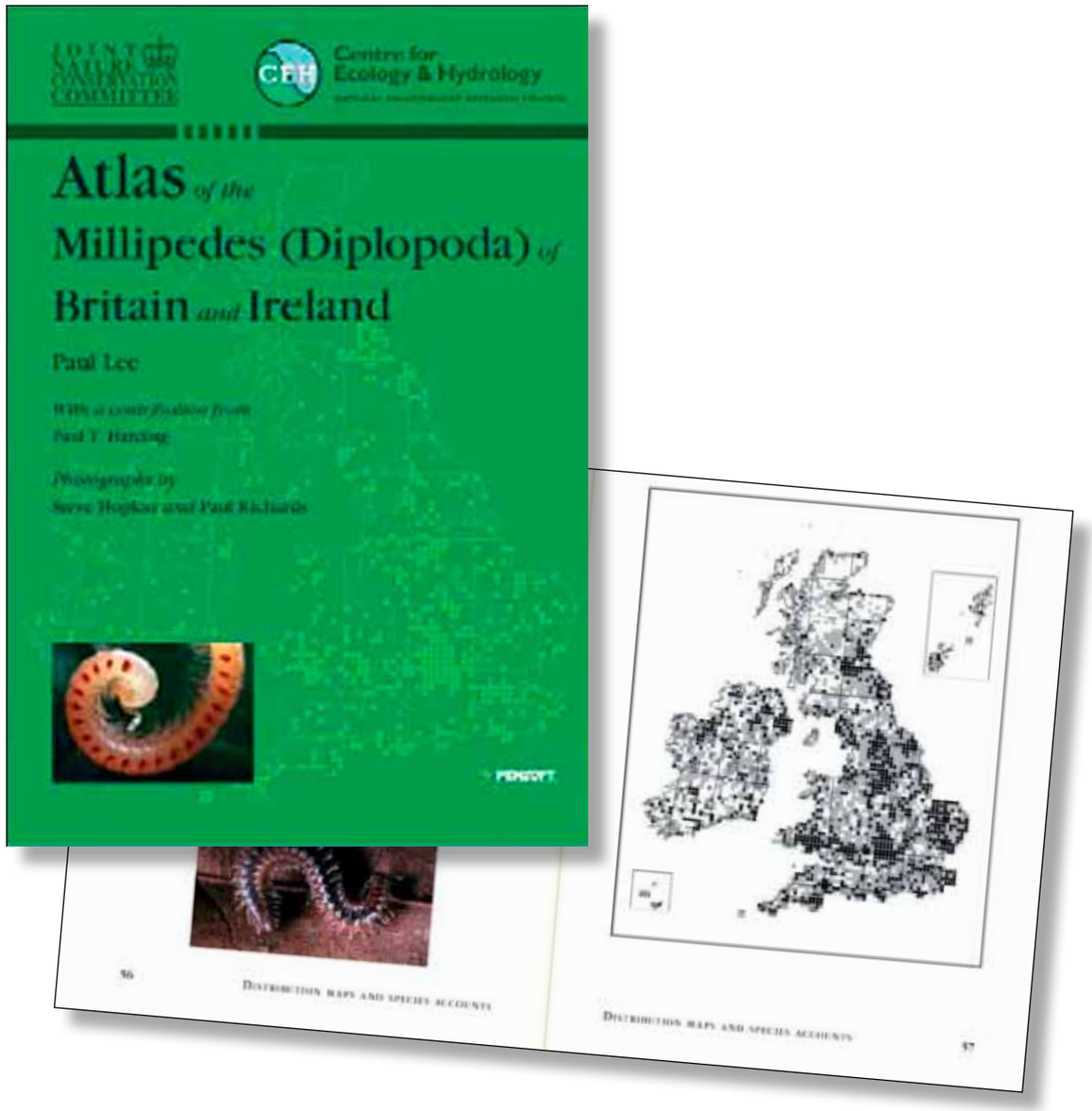
Choneiulus palmatus Would key out at couplet 30b with *Proteroiulus fuscus*, but with only a single, curved row of ocelli and more than 10 hairs fringing each body segment. Widespread but uncommon. Associated with gardens and greenhouses in the north, but also woodlands in the south.

Rough guide to some rarer British species

Metaiulus pratensis Would key out at couplet 15b, with the blind *Cylindroiulus vulnerarius*, but has no tail. The anal valves are very hairy. Small (up to 13mm) and very rare. Currently only known from Kent and Sussex.

Recording

- National and local atlases have been produced for millipedes which map species distributions.
- There is a network of local coordinators who would be very happy to help with identifications and receive records. Contact details are at the end of this presentation – or they may be presenting this to you now!



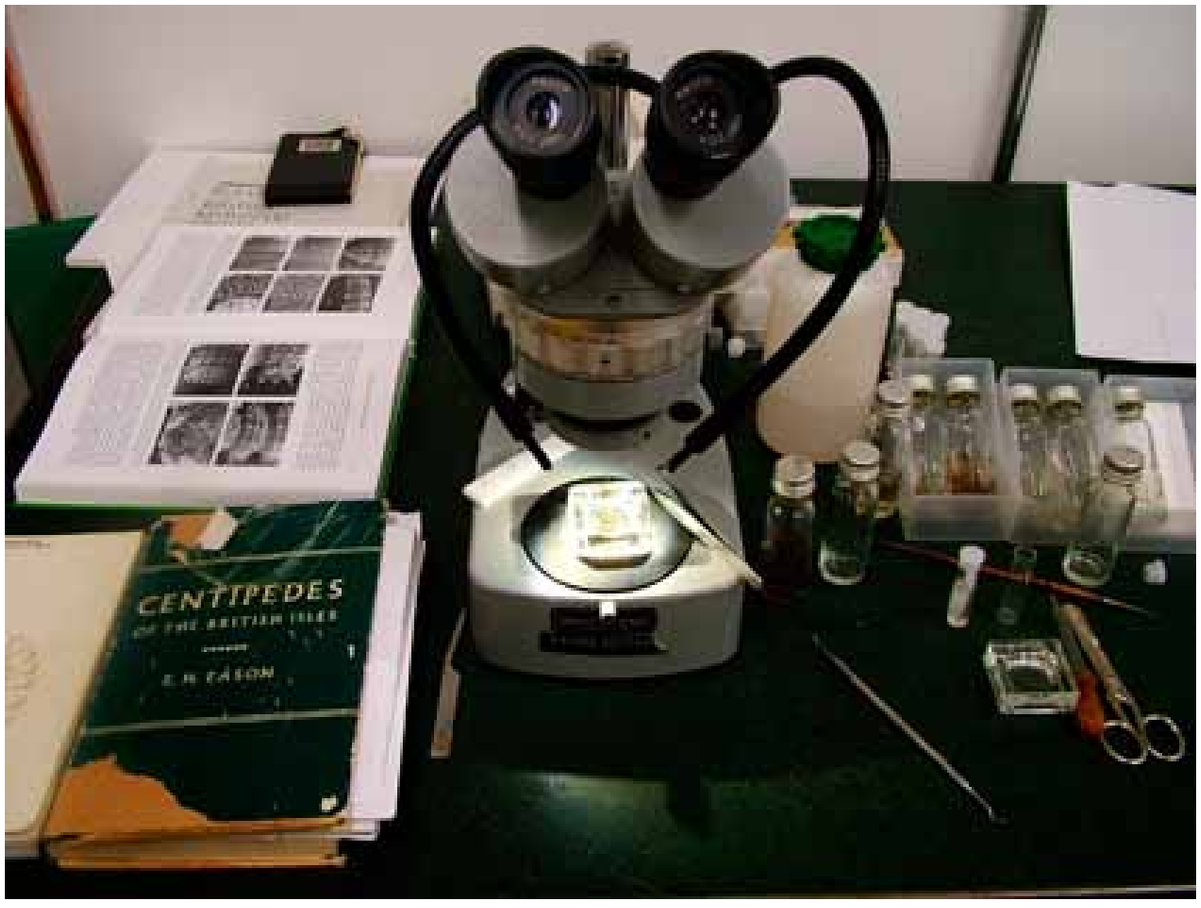
Next steps (1)

The first thing to do is to seek out suitable habitats and find some millipedes. Although this guide is primarily aimed at identifying species, it is important to begin by simply observing the creatures in life and appreciate them as components of the ecosystem rather than as objects for statistical analysis and dissection.

Unlike many plants, insects or vertebrates, millipedes are available all year round. There is no closed season, in fact the winter may be a particularly good time to find some species. Dry summer months are probably the least productive time to look.

Next steps (2)

The identification of millipedes to species takes practice, but most are fairly straightforward to determine. Most of the features described in this guide can be seen with a x10 hand lens in the field. Use of a microscope can further help to give a clear idea of the structures that are being described. Before long, familiarity with features seen under a microscope can be translated into field knowledge and species can be recognised at a glance.



Next steps (3)

- The best way to become familiar with and confident in the identification of millipedes and other ground invertebrates is to join the British Myriapod and Isopod Group. There is no charge and you will receive a bi-annual newsletter with updates, notices and news about myriapods and woodlice.

- There is an annual field meeting around Easter which changes venue to record invertebrates in the more under-recorded areas of Britain and Ireland. The meetings consist of field recording days, formal presentations, training workshops and informal display and exchange fora. These events are very welcoming and friendly social gatherings where everyone is always happy to share their experience with newcomers.

- The bulletin of the BMIG is available annually at a small charge. This is a refereed journal containing more formal papers and field reports relating to the British Myriapod and Isopod fauna.

More information

For more information contact the
British Myriapod and Isopod Group:
BMIG Secretary,
2 Egypt Wood Cottages,
Farnham Common,
Bucks.,
UK

or via the website at **www.bmig.org.uk**

For worldwide coverage of Myriapod groups, including the Onychophora (velvet worms, *Peripatus*), see:
The Centre International de Myriapodologie,
Museum National d'Histoire Naturelle,
Laboratoire de Zoologie-Arthropodes,
61 rue Buffon F-75231 Paris,
Cedex 05

http://www.mnhn.fr/assoc/myriapoda/INDEX.HTM

References and Bibliography

A full list of the major reference works is given in the following bibliography:

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Pause for thought…

In order to improve this training package, we would appreciate any feedback you can give us:

- Did you find the information useful?
- Do you feel that you now have a better understanding of millipedes?
- Was this training undertaken individually by reading the CDROM or was it presented as a PowerPoint presentation by a local coordinator?
- Was this method of training effective for you?
- Have you progressed onto the more specialised follow up packages?
- Any general comments about content or presentation?

Please send all comments to: paul.richards@sheffieldgalleries.org.uk

Thank you for your time

Millipedes of the British Isles

Polyxenus lagurus (Linnaeus 1758)
Glomeris marginata (Villers, 1789)
Geoglomeris subterranea Verhoeff, 1908
Adenomeris gibbosa Mauriès, 1960
Trachysphaera lobata (Ribaut, 1954)
Polyzonium germanicum Brandt, 1831
Craspedosoma rawlinsii Leach,1815
Nanogona polydesmoides (Leach, 1815)
Anthogona britannica Mauriès 1993
Chordeuma sylvestre C.L. Koch, 1847
Chordeuma proximum Ribaut, 1913
Melogona gallica (Latzel, 1884)
Melogona scutellaris (Ribaut, 1913)
Melogona voigti (Verhoeff, 1899)
Anamastigona pulchella Silvestri, 1898
Brachychaeteuma melanops Brade-Birks, 1918
Brachychaeteuma bradeae (Brölemann & Brade-Birks, 1917)
Brachychaeteuma bagnalli Verhoeff, 1911
Oxidus gracilis (C.L. Koch, 1847)
Stosatea italica (Latzel, 1886)
Brachydesmus superus Latzel, 1884
Polydesmus angustus Latzel, 1884
Polydesmus barberii Latzel, 1889
Polydesmus coriaceus Porat, 1871
Polydesmus denticulatus C.L. Koch, *1847*
Polydesmus inconstans Latzel, 1884
Propolydesmus testaceus (C.L. Koch, 1847)
Cylindrodesmus hirsutus Pocock, 1889
Prosopodesmus panporus Blower & Rundle, 1980
Poratia digitata Porat,1889
Macrosternodesmus palicola Brölemann, 1908
Ophiodesmus albonanus (Latzel, 1895)
Paraspirobolus lucifugus (Gervais,1836)
Choneiulus palmatus (Nemec, 1895)
Nopoiulus kochii (Gervais, 1847)
Proteroiulus fuscus (Am Stein, 1857)
Blaniulus guttulatus (Fabicius, 1798)
Archiboreoiulus pallidus (Brade-Birks, 1920)
Boreoiulus tenuis (Bigler, 1913)
Nemasoma varicorne C.L. Koch, 1847
Thalassisobates littoralis (Silvestri, 1903)
Julus scandinavius Latzel, 1884
Haplopodoiulus spathifer (Brölemann, 1897)
Ophyiulus pilosus (Newport, 1842)
Leptoiulus belgicus (Latzel, 1844)
Leptoiulus kervillei (Brölemann, 1896)
Metaiulus pratensis Blower & Rolfe, 1956
Allajulus nitidus (Verhoeff, 1891)
Cylindroiulus londinensis (Leach, 1815)
Cylindroiulus caeruleocinctus (Wood, 1864)
Cylindroiulus vulnerarius (Berlese, 1888)
Cylindroiulus punctatus (Leach, 1815)
Cylindroiulus latestriatus (Curtis, 1845)
Cylindroiulus britannicus (Verhoeff, 1891)
Cylindroiulus parisiorum (Brölemann & Verhoeff, 1896)
Cylindroiulus truncorum (Silvestri, 1896)
Cylindroiulus salicivorus Verhoeff, 1908
Enantiulus armatus (Ribaut, 1909)
Unciger foetidus (C.L. Koch, 1838)
Brachyiulus pusillus (Leach, 1815)
Ommatoiulus sabulosus (Linné, 1758)
Tachypodoiulus niger (Leach, 1815)