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BULLETIN of the BRITISH MYRIAPOD GROUP

Edited for the Group by
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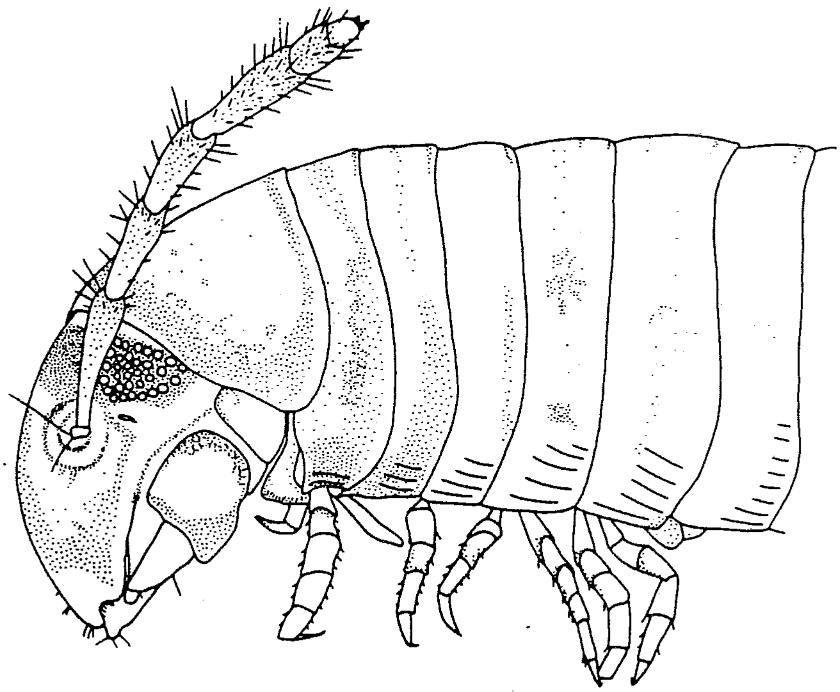

Volume 10

April 1994

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EDITORIAL

The first issue of "Bulletin of the British Myriapod Group" appeared for the Manchester Congress in 1972. By that time the group had had two field meetings, one in North Devon when *Chalandea pinguis* was first recorded for Britain, the second in Herefordshire. The Bulletin comprised 48 pages and a photograph of Canon Brade-Birks, President of the Congress was included.

For a while there were no more annual meetings; pressure of work and other commitments intervened. However the recording of centipedes and millipedes, agreed at the first meeting, was encouraged by The Biological Records Centre. In due course new members joined the group, field meetings, soon to be jointly with the British Isopod Study Group restarted and a group newsletter was produced. By this time the Bulletin had been advertised in a bookseller's catalogue as volume 1 (only volume produced).

In January 1985 in a plain white cover with a rather poor silhouette of a lithobiid, volume 2 appeared - partly, perhaps to confound the statement made a while before that the Bulletin was dead. There had been a draft for a volume 2 with various articles in it. Des Kime's European Myriapod Survey report and Wolfgang Dohle's rhymes were amongst the things that appeared in the "new" volume 2.

From then on roughly a volume a year has been produced. Variable in quality of production and with a mixture of different items they were on occasions, so it seemed, written by the same two or three people. They have, however, especially more recently covered a diversity of topics likely to be of interest to British myriapodologists. Certainly we felt free to cross the Channel for reports on Normandy and Brittany, aspects of systematics, ecology, distribution were looked at, Pauropoda and Symphyla got a look in (one paper on each), congresses were reviewed. Miscellanea offered an opportunity for single paragraph reports. The Bulletin was aimed to be accessible to myriapodologists and others who were not necessarily professional biologists, to provide a forum for articles which were not appropriate to more formal publications, to report things such as structural abnormalities or county distributions which would not otherwise necessarily see the light of day and yet at the same time maintain a credible level of scientific content.

The present issue is different in two ways from most of its predecessors. Firstly it is longer by more than a third. Sometimes we have had difficulty reaching 50 pages; this time some material has been deliberately held back and there is, as yet, no report on the last International Congress. Secondly, it is more "international" in flavour. Working from the premise that we should include matters likely to be of relevance or interest to British workers we include an article by a Spanish colleague on structural abnormalities, an account of Tasmanian Myriapodes by Bob Mesibov and Helen Read and Sergei Golovatch's report on Central Asia species after their recent expedition.

Once again, thanks to all contributors and to everyone who has contributed to the previous nine issues.

Bulletin of the British Myriapod Group 10 (1994)

SUFFOLK MILLIPEDES.

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INTRODUCTION

Many aspects of the natural history of the county of Suffolk have been well studied in the past. This has enabled the identification of sites within the county which have a national or even international importance for wildlife. The bird reserves of Minsmere and Havergate Island and the flora of the Brecklands are obvious examples but equally the spiders of Lopham and Redgrave Fens and the mollusca of Carlton Marshes are testimony to the richness of the invertebrate fauna of Suffolk. In view of this history of recording and fieldwork it is surprising that so little was known of the millipede fauna until recently.

This paper summarises current knowledge of the Suffolk millipede fauna. The species of millipede recorded from the county up until April 1993 are listed and their known distribution within the county, using the OS 10km grid squares, are given. The information is based mainly on fieldwork surveys conducted during the three years from April 1990 to April 1993 but records have also been extracted from literature sources and data banks.

THE GEOGRAPHY OF SUFFOLK

For the purposes of this work the boundaries of Suffolk are taken to be those of the Watsonian vice-counties 25 and 26. The county has a land area of 380 020 ha and parts of it lie within 58 different 10km grid squares. Two of these grid squares contain less than 1 sq.km of land considered to be within Suffolk and so have been ignored in fieldwork. The remaining 56 grid squares comprise: TL64, TL65, TL66, TL68, TL74, TL75, TL76, TL77, TL78, TL83, TL84, TL85, TL86, TL87, TL88, TL93, TL94, TL95, TL96, TL97, TL98, TM03, TM04, TM05, TM06, TM07, TM13, TM14, TM15, TM16, TM17, TM23, TM24, TM25, TM26, TM27, TM28, TM33, TM34, TM35, TM36, TM37, TM38, TM39, TM44, TM45, TM46, TM47, TM48, TM49, TM57, TM58, TM59, TG40 AND TG50.

Suffolk is still basically an agricultural area although land is being lost to urbanisation and leisure developments at an increasing rate. Upland habitats are obviously absent in a county which only reaches a maximum 128m above sea level but excepting this a wide range of natural and semi-natural habitats can still be found within its borders albeit in some cases only as small pockets within the agricultural deserts.

Agricultural practises have largely denuded the county of its forest cover. Almost a third of the extant woodland is conifer plantation and patches of truly ancient broadleaved woodland are few and far between. In this environment hedgerows and shelter belts provide important refuges for wildlife. Agriculture has also destroyed many fens and flood meadows by drainage and still threatens much of the valuable fenland which remains in the north of Suffolk. By comparison sandy heathlands are still relatively common in the Breckland to the northwest of the county and along the eastern coastal strip while more calcareous grassland occurs in small patches especially around Newmarket.

The 80km of Suffolk's coastline are indented by half a dozen large estuaries and provide a varied range of maritime habitats including sandy beaches, shingle, mud flats, saltmarshes and unstable soft earth cliffs. Natural hard rock features are absent but the harbour walls and concrete sea defences provide an apparently acceptable alternative for a range of marine organisms.

HISTORICAL RECORDS

William Kirby of Barham, near Ipswich, appears to have made the first recorded observation of a millipede in Suffolk. *Polydesmus complanatus* (=*P.angustus*) was noted by Kirby as a pest of carrot and parsnip crops in the county in his "Introduction to Entomology". Morley (1933a) quotes from an 1859 edition of the book by Kirby and Spence while Brade-Birks (1929) refers to the original paper by Kirby (1823) but notes that it is thus unclear as to whether this record of a Suffolk millipede dates from the first or second half of the last century but in either case it is certainly the earliest record I know of.

By the end of the century the only other species recorded was *Glomeris marginata* noted as being seen "about Ipswich occasionally since 1894" (Morley, 1931). This was the first millipede record published by Claude Morley who dominated Suffolk natural history during the first half of this century. Morley was an entomologist but collected and recorded a variety of other groups of organisms. In the same note in which he mentioned *Glomeris* at Ipswich he also announced that "the Revd.S.Graham Brade-Birks" was willing "to determine the *Centipeds* and *Millipeds* of Suffolk" and offered to forward specimens collected by members of the Society for identification. Later Morley (1932) complains of the postal services restricting knowledge of Suffolk myriapods by reducing "tubes and their contents [sent to Brade-Birks] to the condition of the Augean Stables!" A sentiment no doubt echoed by many modern collectors.

In 1929 Morley added three new species to the county list, namely *Proteroiulus fuscus*, *Blaniulus guttulatus* and *Ommatoiulus sabulosus* (Morley, 1943). The last of these was one of the specimens identified by Brade-Birks (Morley, 1932). The next decade saw the number of published records of Suffolk millipedes triple, not surprising when there were only 5 pre-1930 records but indicative of Morley's activity and desire to get naturalists involved in working on the "smaller orders". The species list was also extended with *Polyxendus lagurus* recorded from Monks Soham (Morley, 1931: 1935: 1936), *Julus albipes* (=*Tachypodoiulus niger*) from Monks Soham (Morley, 1933b) and *Brachydesmus superus* from Tuddenham Fen (Morley, 1932), the latter again identified by Brade-Birks. Two other species were noted during this period but the names are not attributable to any one species recognised today. *Julus terrestris* is noted from Monks Soham and West Stow and *Julus albilineatus* from Bentley Woods and Westleton Heath (Morley, 1943). Morley continued to publish records of millipedes in the 1940's but with less regularity than in the previous decade and his last record is of *Julus terrestris* (probably *Tachypodoiulus niger* in this case) from Monks Soham (Morley, 1946). He did add a further species to the county list during this period namely, *Cylindroiulus luscus* (=*C.britannicus*) from Knettishall Heath (Morley, 1941).

The only records from the next decade were made in 1950 (*Nemasoma varicorne*, *Ommatoiulus sabulosus*, *Tachypodoiulus niger* and *Ophyiulus pilosus*) and in 1951 (*Cylindroiulus latestriatus*). With the exception of *O.sabulosus* (Ellis, 1951) these specimens were all collected by O.Gilbert of the Suffolk Naturalists' Society and identified by J.G.Blower. The records were then submitted to BRC when the millipede recording scheme was established. Thus by this time the species list for Suffolk stood at twelve.

In 1962 P.D.Gabbutt collected a number of specimens from Thorpeness. These were identified by Blower and included a specimen of *Julus scandinavius* recorded for the first time from Suffolk. Blower himself added *Archiboreoiulus pallidus* in 1966, a species which has not been seen in the county since.

The great majority of records from the 1970s were collected by P.T.Harding. These included seven species recorded for the first time in Suffolk (*Craspedosoma rawlinsii*, *Nanogona polydesmoides*, *Cylindroiulus punctatus*, *Brachyiulus pusillus*, *Polydesmus inconstans*, *P.gallicus* and *P.denticulatus*) and were collected mainly from just two sites; Haughley Agricultural Research Station and Staverton Park (Harding, 1974). An eighth new species, *Choneiulus palmatus*, was collected from Butley by P.C.Tinning and identified by D.T.Richardson. This is also a sole record for the county.

The East Anglian Fen Survey conducted by D.Procter and A.Foster at the end of the 1980s produced a number of millipede specimens which were identified by R.E.Jones. These included specimens of *Craspedosoma rawlinsii* from a second Suffolk location, Wangford Carr near Lakenheath (R.E.Jones, pers.comm.). Despite this survey and further work by Harding and others no new species were added to the county list during this decade.

THE PRESENT SURVEY

The bulk of the records of millipedes from Suffolk, 84% (see

Table 1), are from the current decade. The task of collecting these records was begun in April 1990 at BMG annual meeting based at Thornham Magna. This task has been continued out of personal interest since that time.

Table 1: Total number of millipede records made in Suffolk in each decade.

Time period	pre-1900	1900-19	1920-29	1930-39	1940-49	1950-59	1960-69	1970-79	1980-89	1990-93
Number of records	2	0	3	16	4	8	11	67	40	782

It was recognition of the paucity of records from the area that led to the BMG meeting being held at Thornham Magna. During the course of one weekend the efforts of BMG members increased to twenty eight the number of species recorded from Suffolk with the addition of *Stygioglomeris crinata*, *Thalassisobates littoralis*, *Cylindroiulus caeruleocinctus*, *C.parisorum*, and *Macrosternodesmus palicola* to the fauna.

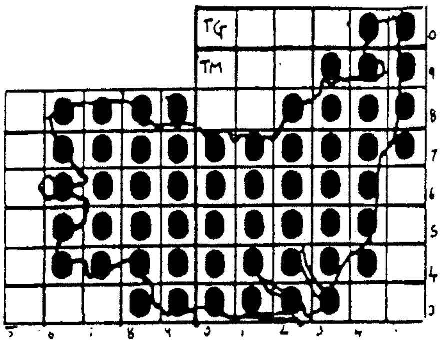
On taking up residence in Lowestoft immediately following the BMG weekend, my first aim was to complete the work begun there and provide a comprehensive picture of the millipede fauna of Suffolk and its distribution on the basis of the OS 10km grid squares. In the course of the present survey all 56 squares have been visited on at least one occasion. The sites visited initially depended on field meeting venues of the Lowestoft Field Club, the Suffolk Naturalists' Society and Conchological Society of Great Britain & Ireland. Later, sites were specifically selected for visits. These sites tended to be nature reserves, easily accessible woodlands with public footpaths and roadside hedges. As an independent effort to gain records of synanthropic species a garden survey was initiated in 1992 resulting in records from fourteen gardens to date (Lee, 1993).

The great majority of records have been made as a result of searching suitable microsites and collecting specimens by hand. Tüllgren extraction of animals from moss and leaf litter samples has provided a few records and pitfall trapping even fewer. All records have been submitted to the National Recording Scheme and copies will also be held by Suffolk BRC at Ipswich Museum. Specimens collected in the course of the survey have been lodged with Ipswich Museum in most cases. Where this is not so the specimens are in my own personal collection.

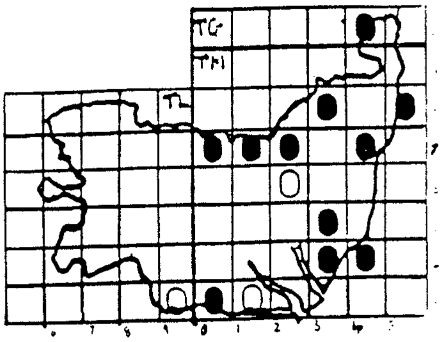
As a result of this personal effort the species list for Suffolk now stands at thirty one with *Brachychaeteuma bradeae*, *Ophiodesmus albonanus* and *Stosatea italica* being added since April 1990.

Table 2: Species list for Suffolk showing details of the frequency with which each species is recorded.

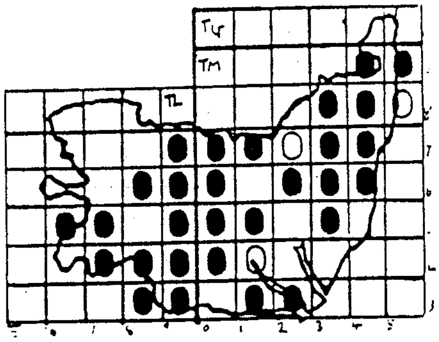
Species name	Total number of records	Number of 10km sqs	% of 10km sqs
Polyxenus lagurus	25	14	25
Glomeris marginata	64	33	59
Stygioglomeris crinata	1	1	2
Craspedosoma rawlinsii	2	2	4
Nanogona polydesmoides	44	28	50
Brachychaeteuma bradeae	3	2	4
Thalassisobates littoralis	1	1	2
Nemasoma varicorne	23	17	30
Proteroiulus fuscus	102	36	64
Choneiulus palmatus	0	1	2
Nopoiulus kochi	2	2	4
Blaniulus guttulatus	13	8	14
Archiboreoiulus pallidus	1	1	2
Ommatoiulus sabulosus	37	22	39
Tachypodoiulus niger	142	43	77
Cylindroiulus caeruleocinctus	6	4	7
C.punctatus	190	53	95
C.latestriatus	35	19	35
C.brittanicus	3	3	5
C.parisiorum	2	2	4
Julus scandinavius	29	19	34
Ophyiulus pilosus	21	18	32
Brachyiulus pusillus	17	11	20
Polydesmus angustus	82	34	61
P.inconstans	10	3	5
P.gallicus	11	2	4
P.denticulatus	15	11	20
Brachydesmus superus	53	25	45
Macrosternodesmus palicola	8	7	13
Ophiodesmus albonanus	2	1	2
Stosatea italica	1	1	2



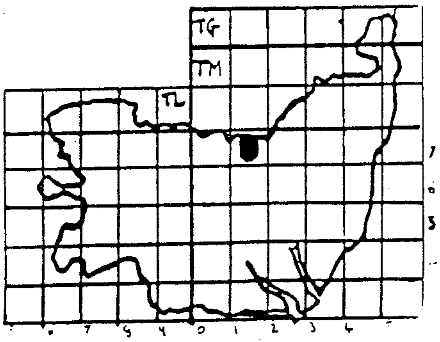
MAP 1. Suffolk millipede records



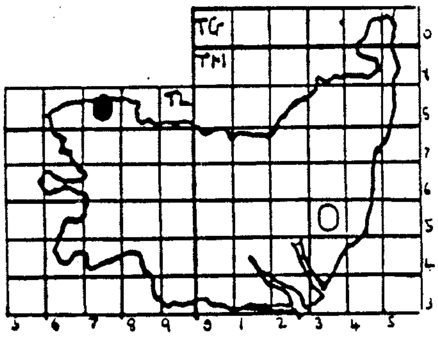
MAP 2. *Polyxenus lagurus*



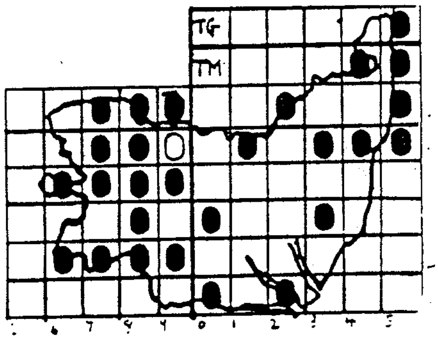
MAP 3. *Glomeris marginata*



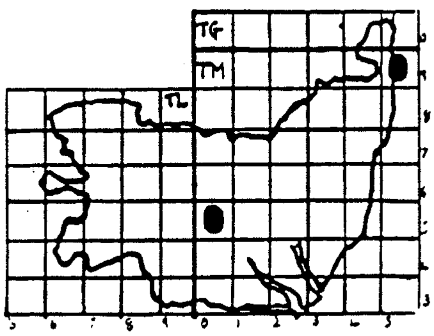
MAP 4. *Stygioglomeris crinata*



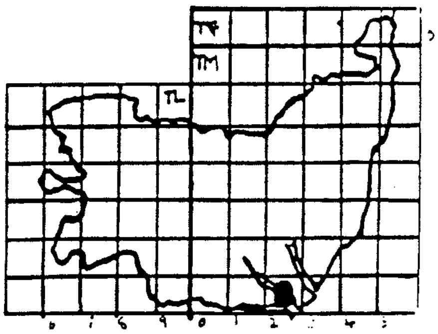
MAP 5. *Craspedosoma rawlinsi*



MAP 6. *Nanogona polydesmoides*



MAP 7. *Brachychaeteuma bradeae*



MAP 8. *Thalassisobates littoralis*

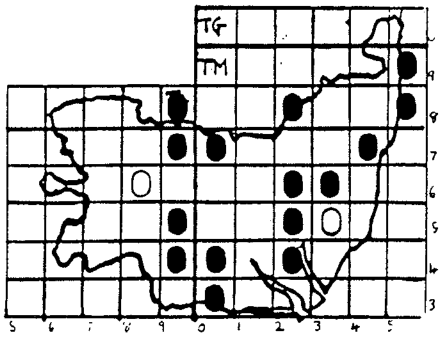
DISCUSSION

The twenty commonest British species of millipede are all found within Suffolk and their relative abundances here are similar to the national pattern (British Myriapod Group, 1988). The most obvious deviations involve *Polyxenus lagurus* (ranked 20th nationally but 10th in Suffolk), *Cylindroiulus britannicus* (15th nationally, 21st in Suffolk), and perhaps *Ophyiulus pilosus* (7th nationally, 13th in Suffolk). However it must be stressed that the Suffolk figures are based on a relatively small sample and just a handful of new records could easily alter the position of any of these species. The distribution maps must also be treated with caution in view of the small number of records involved. However there do seem to be a few interesting patterns emerging which are worthy of comment.

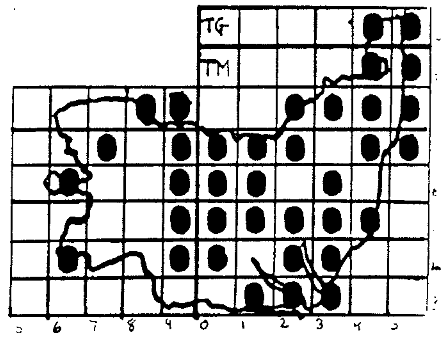
Polyxenus lagurus owes its apparent abundance in Suffolk to collector bias. The peculiar nature of the species attracted the interest of the early Suffolk naturalists leading to no less than seven records by Morley mostly from his home at Monk Soham. A further intensive period of collecting by Dr.C.J.B.Hitch whilst recording lichens in 1982 produced another ten records. The species is widespread in East Suffolk (see Map 2) and will probably prove to be so in the west when an intensive survey of suitable sites is carried out. It has been found in all the microsites noted by Blower (1985) with old walls and lichens being the commonest due to Morley and Hitch respectively. Morley also writes of finding large numbers amongst the roots of heather at the lip of a gravel pit (Morley, 1936).

Stygioglomeris crinata (see Map 4) has only once been recorded, from Thornham Magna in 1990. It is probably far more widespread than this suggests but its small size and soil dwelling habits mean that a specialised survey is likely to be necessary in order to map its true distribution. In contrast *Glomeris marginata* (see Map 3) is widespread in Suffolk except that it is apparently absent from the Brecklands of the north-west. This area has been popular with naturalists in general in the past and in the last three years the area has been visited on more occasions than anywhere in the rest of West Suffolk so recording bias seems an unlikely explanation. The acidic nature of the litter in the coniferous plantations of this area may be the reason for this restriction in distribution but further work is needed to establish the reality or otherwise of this pattern.

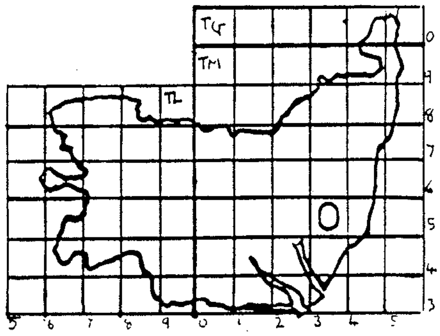
Harding (1974) recorded *Craspedosoma rawlinsii* (see Map 5) from Staverton Park since which there has been only one other site discovered at Wangford Carr. This species might be expected to occur more widely in the woodlands of the Breckland and parts of central south Suffolk and in some of the fens of the Waveny and Little Ouse valleys. *Nanogona polydesmoides* (see Map 6) is widespread and will no doubt be found on every 10km square. Its presence in the Brecklands despite being commoner on base rich soils (Blower, 1985) only adds to the difficulty of explaining the distribution of *Glomeris marginata*.



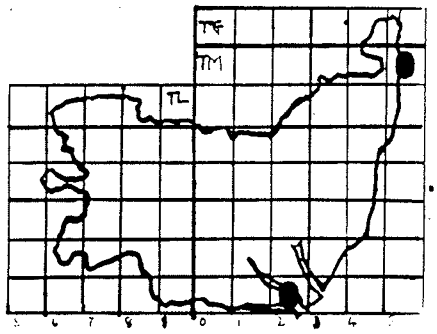
MAP 9. *Nemasoma varicorne*



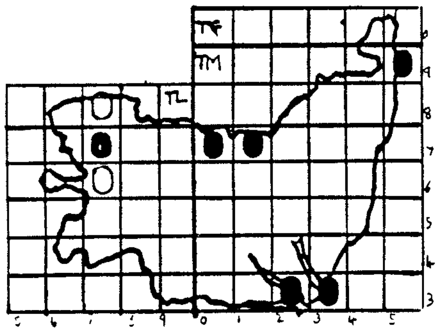
MAP 10. *Proteroiulus fuscus*



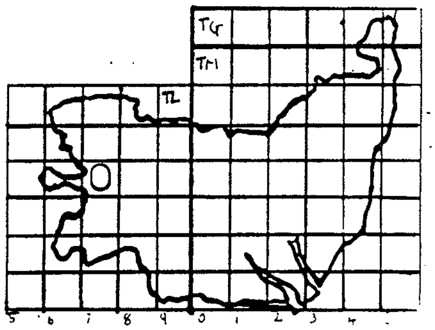
MAP 11. *Choneiulus palmatus*



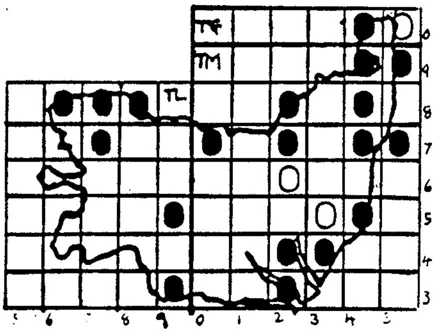
MAP 12. *Nopoiulus kochii*



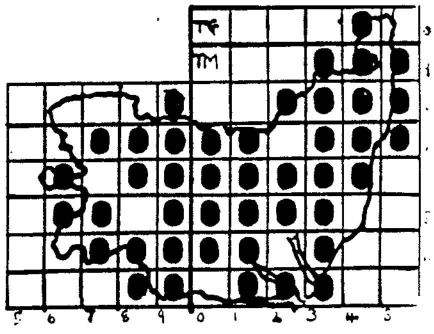
MAP 13. *Blaniulus guttulatus*



MAP 14. *Archiboreoiulus pallidus*



MAP 15. *Ommatoiulus sabulosus*



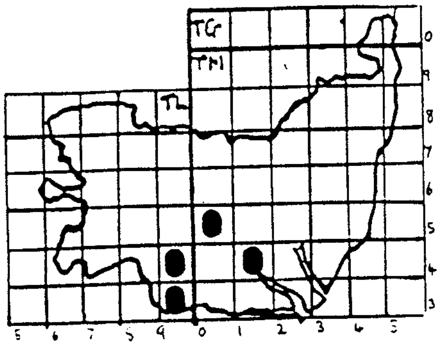
MAP 16. *Tachypodoiulus niger*

A rarity, *Brachychaeteuma bradeae* has been recorded from just two Suffolk gardens (see Map 7). As millipedes have been collected from only fourteen gardens so far and only four of these were visited at suitable times of year to find *B.bradeae* this suggests the species may well turn out to be more widespread than currently thought.

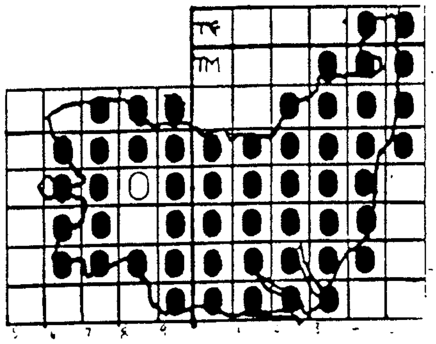
The coastal species *Thalassisobates littoralis* has only been recorded from Felixstowe Docks (see Map 8). However there seems to be no reason why it should not be present at other sites along the coast. *Nemasoma varicorne* has been widely recorded in East Suffolk (see Map 9). It appears to be restricted to the extreme east of West Suffolk but this distribution is most likely an artifact and further recording will prove it to be widespread across both vice-counties.

Of the Blaniulidae *Proteroiulus fuscus* is easily the most common and widespread (see Map 10). It is currently the third most frequently recorded species in the county and will probably be found in every 10km square. With the exceptions of the national rarities *Nopoiulus kochii* and *Choneiulus palmatus* it is the scarcity of the remaining species in this family which is surprising. Considering the attention which has been paid to domestic gardens as a myriapod habitat (Lee, 1993) the number of records of *Blaniulus guttulatus* (see Map 13) indicate the species may be more uncommon in Suffolk than initially thought. The absence of records of *Boreoiulus tenuis* from anywhere in the county is even more unexpected and probably does not represent the true situation when one considers its distribution in the rest of East Anglia. Still, the gardens of Lowestoft have been well worked and these would appear to be prime habitat! *Nopoiulus kochii* has been recorded from both Felixstowe and Lowestoft in the last three years (see Map 12). Two records of this rarity in a relatively short time suggest it may be found at other sites in the near future. The remaining two species, *Choneiulus palmatus* and *Archiboreoiulus pallidus*, have not been seen in the county since the original records. *Choneiulus palmatus* (see Map 11) was recorded from Staverton by Harding (1974) and it is perhaps not surprising it has not been seen since. *Archiboreoiulus pallidus* (see Map 14) on the other hand seems long overdue for another appearance. Blower's original record was made way back in 1966!

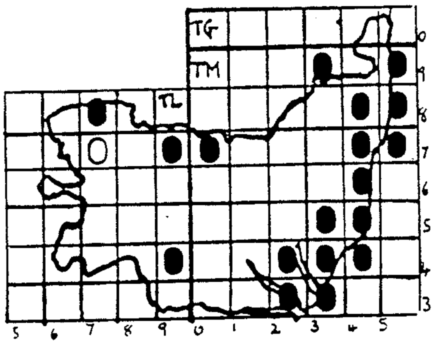
The Suffolk Julidae include the two commonest millipedes within the county, *Cylindroiulus punctatus* (see Map 18) and *Tachypodoiulus niger* (see Map 16). Both are widespread although *T.niger* like *Glomeris marginata* appears to be absent from large areas of the Breckland. Blower (1985) notes that *T.niger* is more frequent in base rich sites so, as for *G.marginata*, the acidity of the conifer plantations may account for its scarcity in Breckland. Exactly the opposite is true for *Ommatoiulus sabulosus* which, although less common than *T.niger*, is also widespread and occurs most frequently on the sandy soils of the coastal strip and in the Brecklands (see Map 15). Of the remaining Julids only *Julus scandinavius* and *Ophyiulus pilosus* are widespread. *Julus scandinavius* also shows the pattern of absence from the



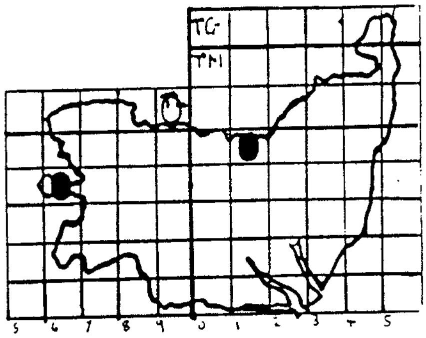
MAP 17. *Cylindroiulus caeruleocinctus*



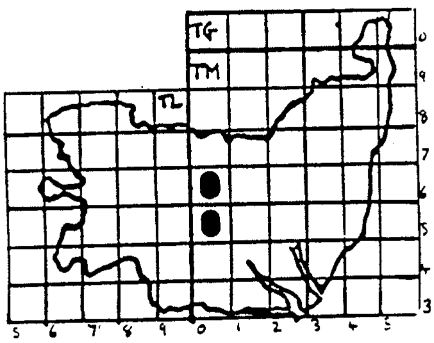
MAP 18. *Cylindroiulus punctatus*



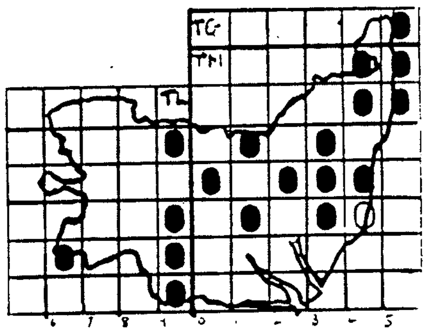
MAP 19. *Cylindroiulus latestriatus*



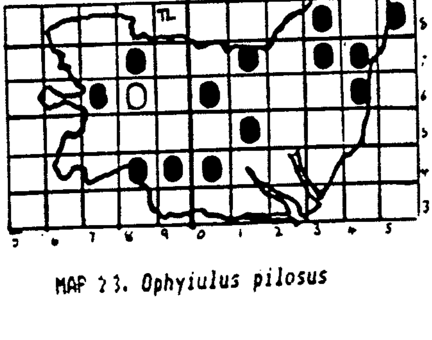
MAP 20. *Cylindroiulus britannicus*



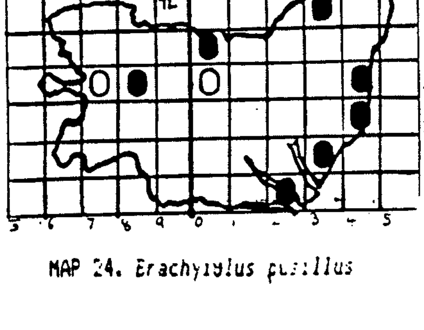
MAP 21. *Cylindroiulus parisiorum*



MAP 22. *Julus scandinavius*



MAP 23. *Ophyiulus pilosus*



MAP 24. *Brachyiulus pusillus*

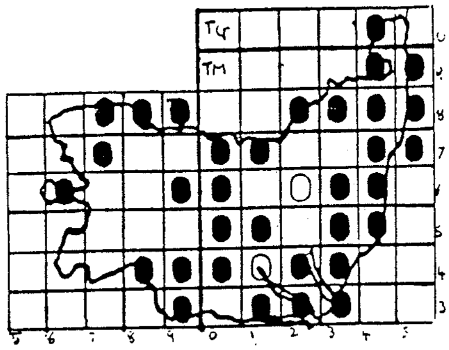
Brecklands (see Map 22) although this may well be a result of the relatively small number of records to date. Again there appear to be contradictions in the distributions as *Julus scandinavius* is reported to have a preference for acidic sites whereas *Ophyiulus pilosus* favours moderate to base rich sites (Blower, 1985) but is found in the Brecklands (see Map 23).

Cylindroiulus latestriatus (see Map 19) is a common millipede of the sandy coastal area but it appears to be uncommon away from this stronghold. If this is the case then the closely related *C.britannicus* (see Map 20) does not appear to be filling the vacant ecological niche in central and western parts and does appear to be truly uncommon in Suffolk as a whole. By comparison *Cylindroiulus parisiorum* (see Map 21) could be said to be unexpectedly common with recent records from Barking churchyard and Northfield Wood, Stowmarket. A third site for the species has been reported from Thrandeston (Read, pers.comm.) but it was not refound here when the site was visited in 1990. *Cylindroiulus caeruleocinctus* has been found in one natural site and several gardens all in the south of the county (see Map 17). The national distribution suggests it should be present right across the county therefore it is surprising it has not yet been found in the gardens of Lowestoft. The only other julid recorded from Suffolk is *Brachyiulus pusillus* (see Map 24). This species is generally associated with agricultural activity and coastal sites (Blower, 1985). Most Suffolk records are from one or other of these habitats, the agricultural research station at Haughley providing the bulk of them. However one recent record was from a garden in Trimley St.Mary.

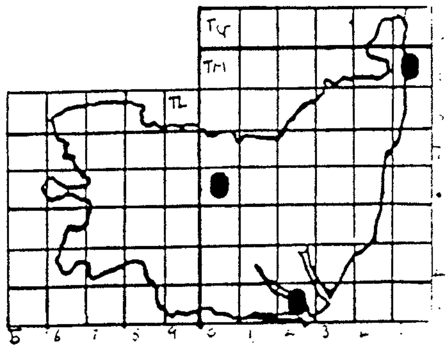
Of the flat-backs only *P.angustus* (see Map 25) and *Brachydesmus superus* (see Map 29) are widespread and common. *P.gallicus* (see Map 27) and *P.inconstans* (see Map 26) have both proved elusive in Suffolk with the majority of the records coming from Haughley Agricultural Research Station. In contrast to the national pattern *P.denticulatus* (see Map 28) seems to be more common than either of them. The garden survey (Lee, 1993) has produced a number of records of the rarer species, indeed *Macrosternodesmus palicola* (see Map 30) no longer appears to be such a rarity and will probably turn out to be present right across the county. *Ophiodesmus albonanus* on the other hand has been recorded from just two gardens, both in Lowestoft (see Map 31). The most recent addition to the county list is *Stosatea italica* found near Assington in October, 1992 (see Map 32). This represents the most northerly record for the species in the east of the country although it has reached further northwards in the west (R.E.Jones, pers.comm.).

THE FUTURE

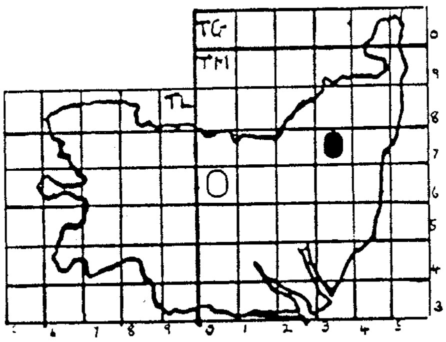
With the initial aim achieved the survey is entering a second phase. In common with the recording of better known groups of organisms in Suffolk, the distribution of the millipedes is now being plotted on the basis of the 1089 tetrads which make up the county. Records have been obtained from just 196 (18%) of these



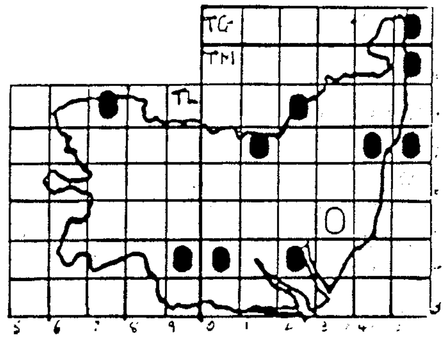
MAP 25. *Polydesmus angustus*



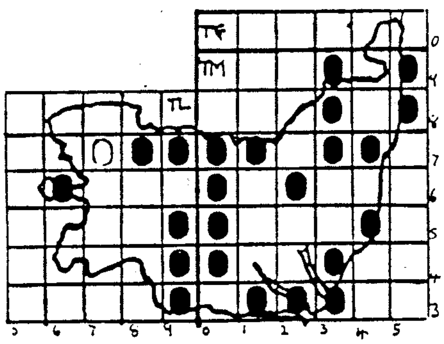
MAP 26. *Polydesmus inconstans*



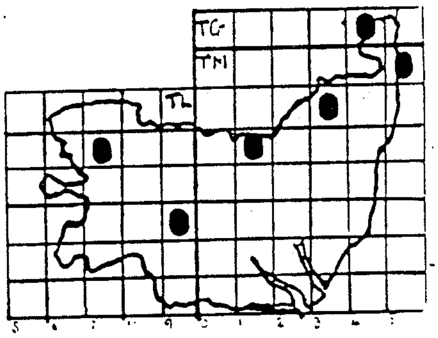
MAP 27. *Polydesmus gallicus*



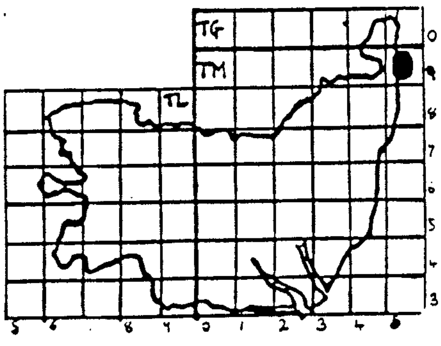
MAP 28. *Polydesmus denticulatus*



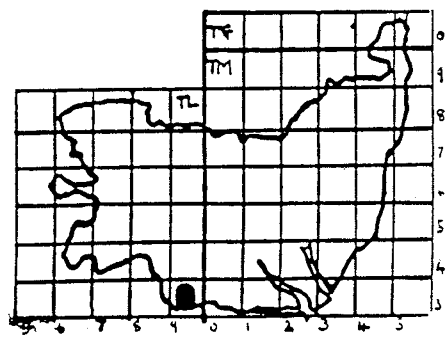
MAP 29. *Brachydesmus superus*



MAP 30. *Macrosternodesmus palicola*



MAP 31. *Ophiodesmus albonanus*



MAP 32. *Stosatea italica*

tetrads to date and there is obviously a long way still to go.

There is still the possibility of adding species to the county list. Perhaps *Boreoiulus tenuis* is the most likely candidate but *Cylindroiulus nitidus* and *C.londinensis* will probably be found here in time and even some of the Chordematidae may turn up. Such possibilities add spice to the ongoing accumulation of data on the commoner species.

A number of unanswered questions have also raised in this paper. In particular the apparent restrictions in distribution of species such as *Glomeris marginata* and *Julus scandinavius* need confirming or otherwise. The tetrad survey will be important here but for other species such as *Stygioglomeris crinata* and *Thalassisobates littoralis* specialised surveys of particular habitats and microsites are needed.

ACKNOWLEDGEMENTS

I would like to thank Eric Parsons, Howard Mendel and Martin Sanford for their invaluable encouragement and help with the survey over the last three years. Martin at Suffolk BRC and Paul Harding at BRC, Monks Wood kindly supplied most of the pre-1990 data. Much of the recording in West Suffolk has been made possible by a bursary from the Suffolk Naturalists Society defraying travelling expenses.

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Bulletin of the British Myriapod Group 10 (1994)

THE OCCURRENCE OF *CRASPEDOSOMA RAWLINSII* LEACH (DIPLOPODA) IN EAST ANGLIA.

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Craspedosoma rawlinsii is a comparatively large and distinctive species which has been recorded at widely scattered localities throughout Britain and Ireland. It was recorded in the atlas (British Myriapod Group 1988) from only 35 10km squares and was ranked 27th in order of frequency: since then, 22 new localities have been added and two removed (one was a species of Anthogona (Gregory et al. in press and the other probably Nanogona polydesmoides (F.A.Turk pers. comm.).

Recent notes by Morgan (1988,1989) highlighted the close association of this species, in Dyfed, with woodlands, especially wet areas such as flushes. Blower (1985) also noted an association with woods, watercourses and areas of natural drainage. In this note we examine the occurrence of *C.rawlinsii* in East Anglia (Cambridgeshire, Essex, Norfolk and Suffolk) to assess whether there are similar associations. There are only 15 known localities for *C.rawlinsii* in East Anglia, and these fall into major habitat types: woodland and fen/carr.

WOODLAND SITES

The woodland sites, Swanton Novers NNR, Barney Wood NR, Staverton Thicks and Thompson Water, are all mixed deciduous woods on light, generally free-draining, acid to neutral soils. Specimens were collected in dead wood (above ground), in leaf litter and in pitfall traps. At three of these sites the species was recorded in April and one in November. A fifth woodland site is a popular plantation at Lynford which is on the regularly flooded banks of the little Ouse River. At this site it was recorded in March, April and October, in dead wood and leaf litter.

FEN/CARR SITES

The Lynford site has some features in common with the carr sites at Woodwalton Fen, Blackborough Fen and the Woodbastwick area of the Bure Marshes NNR which are alder or willow carr on peat soils. At Blackborough and Woodbastwick, specimens were collected in dead alder wood in late March and in mid October respectively. At Woodwalton they were extracted, using heat, from leaf litter in February.

A survey of East Anglia fens, by the then Nature Conservancy Council in 1988 to 1990, resulted in further records from Woodbastwick and from seven additional localities (Table 1). All these records are from pitfall trap catches. They show markedly different seasonal occurrences to the woodland and earlier fen/carr records, with almost all being from summer and early autumn (Table 1).

Table 1: Localities and months/years of occurrence of *C.rawlinsii* from the NCC survey of East Anglian fens

Buxton Heath	9/1989				
Catfield Fen	12/1988	8/1989	8/1990		
Chippenham Fen	6/1990	7/1990			
Strumpshaw Fen	6/1989	6/1990			
Sutton Fen	8/1990				
Upton Fen	6/1990	8/1990			
Wangford Carr	6/1988	9/1988			
Woodbastwick	6/1989	7/1989	8/1989	6/1990	8/1990

DISCUSSION

Although there is clearly an association with tree cover (woodland and carr) in East Anglia, the sites differ markedly to those recorded by Morgan (1988,1989). The woodland sites become very dry in a normal summer although in deep litter humidity would be retained in the litter or in the soil beneath. *C.rawlinsii* is well adapted to burrowing in the light soils of these woods. Blower (1985) noted that most records were from the winter months (when soil/litter humidity would be at its highest) and this point is supported by the woodland and some of the fen/carr records from East Anglia. However, the most recent records from pitfall traps in fens show that most of these records (presumably of surface active specimens) are from June to September. Although these summer occurrences are undeniable, the specimens from the NCC surveys examined by one of us (REJ) were almost exclusively from the summer months, so that any possible winter occurrences were not sampled.

Why *C.rawlinsii* is apparently so uncommon in East Anglia remains unexplained. Ancient woodlands on acid to neutral soils, such as those listed above, are scattered but widespread, particularly in East Suffolk, in the Brecklands and in some river valleys. This apparent scarcity may be totally artificial because few suitable sites have been surveyed under the most favourable conditions.

ACKNOWLEDGEMENTS

We are grateful to the recorders whose records, together with our own, have been summarised here: Keith Alexander, Dave Bilton, Eric Duffey, Andy Foster, Andy Keay, Deb Procter & Adrian Rundle.

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Bulletin of the British Myriapod Group 10 (1994)

ON A CASE OF ABNORMAL SEGMENTATION IN *LITHOBIUS VARIEGATUS* LEACH (CHILOPODA: LITHOBIOMORPHA).

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Minelli and Pasqual (1986) described eight structurally abnormal centipedes and listed the previously recorded cases. They distinguished three principal types of abnormality, namely spiral segmentation (helicomerism), homeotic mutations (the mutation of one structure into another, such as that of an insect wing into a haltere) and schistomely (the bifurcation of appendages). The term spiral segmentation appears to be applied to any abnormality in segmentation. Lewis (1987, 1989 and 1990) has described abnormalities in the number of coxal pores, the forcipular (prehensorial) coxosternum and gonopods of *Lithobius* spp. and an abnormal forcipular coxosternum in *Cryptops parisi* Brölemann. Some of these abnormalities he suggested were developmental, others due to regeneration after damage.

On 9 February 1993 a further abnormal specimen was collected during routine sampling by pupils of Taunton School at Muchcare Wood, Lydeard Hill, Somerset (Grid Reference ST182339). It is a male, second post-larval stadium *Lithobius variegatus* Leach, body length 11mm. This specimen shows an abnormality in segmentation and leg number.

Viewed from the dorsal side the specimen shows the normal number of tergites and, on the right hand side, the normal number of legs (15) but on the left hand side there are only 14 legs, one of the last three is missing completely (Fig. 1).

The ventral parts of the last four leg-bearing segments (12-15) show a considerable degree of disorganisation (Fig. 2). Sternite 11 is normal but sternite 12 is divided longitudinally into two widely separated parts, here termed hemisternites, that on the left being far larger than that on the right which is vestigial. The coxae of each side show three gland pores, characteristic of the twelfth pair of legs of post-larval stadium 2 *L.variegatus*. Legs 13-15 have 2 coxal pores in this stadium (Eason, 1964). There are only two rather than three more legs on the left-hand side each associated with a large hemisternite. On the right-hand side legs 13-15 are present, each associated with a small hemitergite. The hemitergites of each side are separated by a wide strip of delicate, seta-free cuticle. A damaged area, sealed with brown secretion, is indicated by stipple in Fig. 2.

Remarks

It seems most likely that the condition seen in this specimen is the result of a developmental abnormality. The suppression is the result of a leg markedly affecting the sternites but not the tergites suggesting that the development of legs and sternites are linked not that of legs and tergites.

ACKNOWLEDGEMENTS

I am very grateful to Dr D. J. Stradling and The Royal Society and Association for Science Education Research in Schools Committee for advice and support. Mr W. H. G. Warmington kindly gave his permission for pupils of Taunton School to collect in Muchcare Wood.

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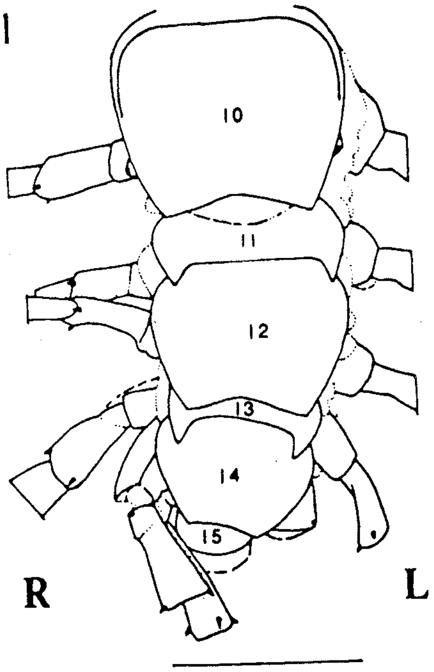

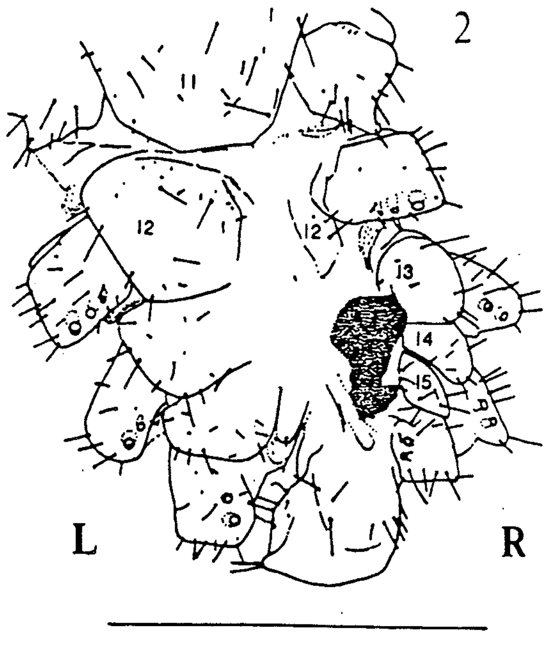

Figures 1-2 Lithobius variegatus, Muchcare Wood.
Fig 1) Dorsal view of last six trunk segments of abnormal *L. variegatus*. Tergites 10-15 are numbered. Setae are not shown.
Fig 2) Ventral view of the last five trunk segments. Sternites 11-15 are numbered. Scale line = 1mm.

Bulletin of the British Myriapod Group 10 (1994)

LOCAL DIFFERENCES IN AGE STRUCTURE OF POPULATIONS OF THE CENTIPEDE *LITHOBIUS VARIEGATUS* LEACH IN THE QUANTOCK HILLS, SOMERSET.

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INTRODUCTION

Eason (1964) described the post-larval stadia of *Lithobius variegatus*. In the first post-larval stadium there are two pores on each coxa of the twelfth pair of legs and one pore on each coxa of leg pairs 13,14 and 15. This is denoted 2.1.1.1. In the second post-larval stadium there are 3.2.2.2 pores, in the third 4.3.3.3 and in the fourth 5.4.4.4. The two adult stadia, 5 and 6, almost invariably have 6.5.5.5 and 7.6.6.6 coxal gland pores. This regular increment in the number of coxal gland pores means that the stadia are very easy to distinguish thus rendering *L.variegatus* suitable for life history studies.

Successive groups of Sixth Form pupils at Taunton School have collected data on the succession of post-larval stadia of *L.variegatus* in Muchcare Wood at Lydeard Hill, near Taunton, Somerset.

The survey, begun in January 1987, showed similar successions of stadia in successive years until the autumn of 1990 when there was a sudden increase in the numbers of post-larval stadium 2 individuals. They represented 60-80 per cent of the entire post-larval stadia between October 1990 and February 1991 as compared with 10-30 per cent during this period in the previous year (Lewis, unpublished data).

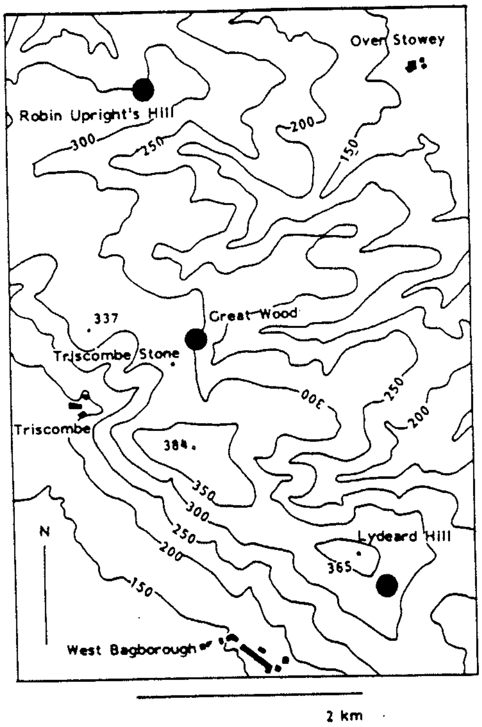
In an attempt to ascertain whether this was a local effect, two other populations in the Quantocks were sampled for comparative data.

THE LOCALITIES

Muchcare Wood is on the gentle SE facing slope of Lydeard Hill (grid ref. ST 183339) at an altitude of 320-330m.

It is a mature stand of beech (*Fagus sylvatica* L.). A sample of 42 *L.variegatus* was collected here, mainly from beneath stones, on 26 February 1991 (Fig.1).

A second sample, of 48 specimens, was collected from Great Wood near Triscombe Stone (Grid ref. ST 166361) at an altitude of 300m, some 5.5km NW of Muchcare Wood on 7 March 1991. The



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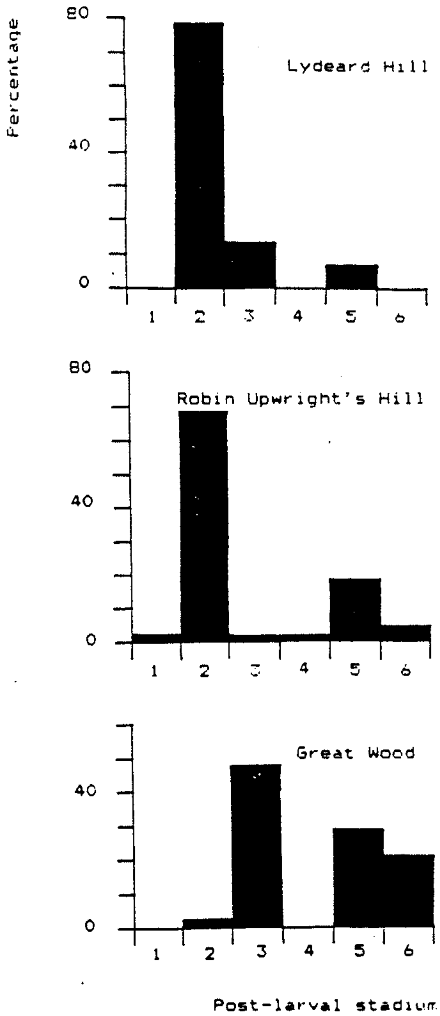

2

Fig 1) Map of an area of the Quantock Hills to show the localities sampled.

Fig 2) The percentage occurrence of the post-larval developmental stadia in three samples of *L.variegatus* from the Quantock Hills.

specimens were collected from beneath logs and stones. The site was on an ESE facing slope in beech and sessile oak (*Quercus petraea* (Mattuschka) Lieblein) wood bordering upon a Norway Spruce (*Picea abies* (L.)) plantation.
The third sample, of 42 specimens, was collected from Robin Upright's Hill (Grid ref. ST 162383), at an altitude of 300m, some 10km NW of Muchcare Wood also on 7 March 1991. The specimens were collected from beneath bark, mainly of standing dead trees. The site is on a NNW facing slope. It is a wood of stunted sessile oak with some downy birch (*Betula pubescens* Ehrh.) and ground cover bilberry (*Vaccinium myrtillus* (L)).

RESULTS

Table 1 shows the numbers of each stadium of *L.variegatus* collected at the three sites. The percentage composition is shown in Table 1 and Figure 2.

Table 1. The number of the various post-larval stadia of *L.variegatus* in three samples from The Quantock Hills.

Stadium	Lydeard Hill	Robin Upright's Hill	Great Wood
1	0	1	0
2	33	23	1
3	6	1	29
4	0	1	0
5	3	8	14
6	0	2	10
Sample Size	42	42	48

The populations from Muchcare Wood and Robin Upright's Hill were similar in that the predominant post-larval stadium was stadium 2. The X^2 test showed that these two populations were significantly different ($p>0.05$). The Great Wood population differed markedly from the other two. The predominant post-larval stadium was stadium 3. The X^2 test showed that the Great Wood population very significantly different ($p>0.001$) from the other two.

DISCUSSION

This investigation was undertaken to determine whether the change in the pattern of succession of post-larval stadia in a frequently sampled population of *L.variegatus* was paralleled in other local populations. The population was similar to one and markedly dissimilar from a second nearby population.

The data revealed major differences in the two populations that had not been previously sampled, those from Robin Upright's Hill and Great Wood. Had such differences in developmental phenology been recorded from widely separated localities, they could have been attributed to macroclimatic geographical or clinal genetic variation. Differences between developmental phenologies between specimens from widely separated localities, for example the north and south west of England, should therefore not be interpreted as necessarily being due to some factor or factors relating to their wide geographical separation. Similar differences could occur locally.

ACKNOWLEDGEMENTS

My thanks are due to Dr.D.J.Stradling for the helpful advice and discussion and the Royal Society and Association for Science Education Research in Schools Committee for its support. Mr W.H.G.Warmington kindly gave his permission for members of the Sixth Form of Taunton School to collect in Muchcare Wood. My thanks are also due to Mr J.G.Gillard who advised on statistics.

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Bulletin of the British Myriapod Group 10 (1994)

ON SOME CASES OF STRUCTURAL ABNORMALITY IN *LITHOBIUS* (CHILOPODA, LITHOBIOMORPHA).

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ABSTRACT

Structural abnormalities in several species of *Lithobius* are described and commented on.

RESUMEN

Diversos casos de estructuras anormales en *Lithobius* (Chilopoda, Lithobiomorpha).
Se describen y comentan conformaciones anomalas en varias especies de *Lithobius*.

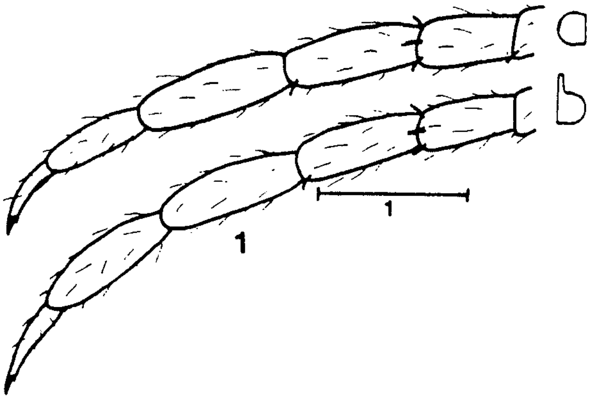
INTRODUCTION

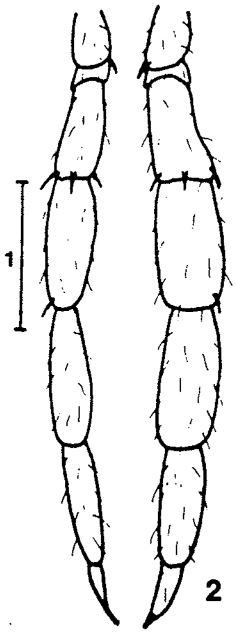
Among centipedes collected in the Iberian Peninsula in recent years, we have found some specimens with malformed structures. Minelli & Pasqual (1986) distinguished three principal types of abnormality shown in centipedes. Although Lewis (1987) remarked that not all cases of malformed structures in centipedes can be included in those listed by Minelli & Pasqual. In most cases the malformed structures are due to some developmental problem or possible regeneration after having suffered some damage.

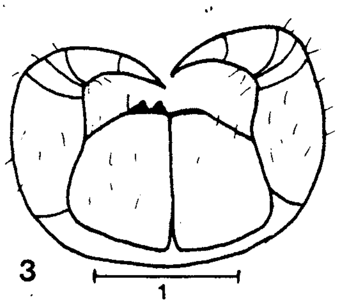
DESCRIPTION OF STUDIED CASES

A: Abnormalities in the last pair of legs in *Lithobius borealis* Meinert (1868)
A female *Lithobius borealis* was collected on 3/5/1990 from a field at Cebreros (Province of Avila), we can see that the legs of the last pair were of different sizes (Figure 1).
The two legs have all the telopodites, but the left leg is smaller than the right one; the tarsus and pretarsus of the left leg are smaller than those of the right.
We think that the small size of the tarsus and pretarsus of this leg is due to developmental abnormality, because there is no obvious sign that this specimen had been damaged.

B: Abnormality in the last pair of legs in *Lithobius castaneus* Newport, 1844.







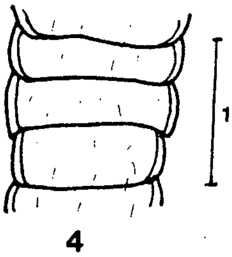


Fig. 1) Last pair of legs of a *Lithobius borealis* Meinert.
a. Lateral view exterior of left leg.
b. Lateral view interior of right leg.

Fig. 2) Dorsal view of last pair of legs of a *Lithobius castaneus* Newport.

Fig. 3) Forcipular coxsternite of a *Lithobius quadarramus* Matic.

Fig. 4) Dorsal view of segments XI to XIII of a *Lithobius inermis* (Meinert).

A female of *Lithobius castaneus* was collected on 14/5/1988 from a pine-tree at Puerto de Navacerrada (Province of Segovia), we can see the last pair of legs were of different appearances although the same length (Figure 2).
The telopodites of the fifteenth pair of right legs are larger in all cases than those of the left.
Until now we have not found any reference to centipedes with a malformed structure like this. We think that it is due to developmental abnormality.

C: Abnormal forcipular coxosternite in *Lithobius quadarramus* Matic, 1968.
A female *Lithobius quadarramus* collected on 6/4/1993 from a meadow at Rascafria (Province of Madrid) shows the anterior border of the left forcipular coxosternite almost straight, without teeth (Figure 3).
Lewis (1987) reported a similar case in a female *Lithobius borealis*. Like him, we think this a developmental abnormality.

D: Abnormal segmentation in *Lithobius inermis* (Meinert, 1872).
A female *Lithobius inermis* collected on 20/4/1991 from a field at Almargo (Province of Ciudad Real), shows tergite XII of smaller size than normal; it is the same size as the contiguous ones, i.e. XI and XIII. It also showed two small projections on the posterior border of this tergite, an abnormal occurence in Lithobiomorpha (Figure 4).
We have not found any reference in the literature to a feature such as this.
We think that it is due to developmental abnormality.

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AN INVESTIGATION INTO THE EFFECT OF ENVIRONMENT ON THE NUMBER OF PEDIFEROUS SEGMENTS IN *HAPLOPHILUS SUBTERRANEUS* SHAW - SOME PRELIMINARY RESULTS.

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INTRODUCTION

Dr.E.Eason's paper of 1979 discussed the effect of environment on the number of trunk segments in the Geophilomorpa with special reference to *Geophilus carpophagus* Leach. His study was carried out on British specimens of *G.carpophagus* from two habitat types, natural and urban/domestic derived from Mortlake (london), Bourton Far Hill and numerous natural sites. It is suggested that the phenotype in *G.carpophagus* is flexible and that this flexibility becomes manifest under environmental pressure by the appearance of a different number of trunk segments: the genotype remains unchanged, merely dictating the flexibility of the phenotype and that the phenotype should therefore revert to its former state once the environmental pressure is removed.

Further, *G.carpophagus* is almost certainly a European species which, when faced with the British climate lost some of its trunk segments and has only regained them on entering the relatively protected environment provided by urban/domestic habitats.

The present investigation into *H.subterraneus* Shaw was prompted by Dr.Eason's paper as this species is also a European species which is relatively common in urban/suburban and natural sites in the south of Britain.

MATERIAL

The material examined so far in this investigation has been collected from urban/suburban sites from the north of Surrey and from natural sites in Surrey and Sussex. A total of 121 specimens have been examined and have exhibited pediferous segment counts of 77 - 83. There have been no instances of male specimens with in excess of 81 pediferous segments, nor have there been any instances of female specimens with fewer than 79 pediferous segments.

Table 1 Numbers of male/female specimens collected from each environmental type.

	Males	Females
Synanthropic sites	30 (38%)	49 (62%)
Natural sites	21 (50%)	21 (50%)

It is of note that *H.subterraneus* appears to be found at a greater density in synanthropic sites than in natural sites and that females are more commonly found than males in such sites.

<u>Table 2</u> Number of individuals by number of pediferous segments.

	77	79	81	83
Synanthropic sites	2	16	43	18
Natural sites	12	13	14	3

Clearly there are differences in the number of pediferous segments between the two habitat types. This becomes even clearer when comparisons are made between each sex at habitat level :-

<u>Table 3</u>

	Male				Female			
Leg count	77	79	81	83	77	79	81	83
Synanthropic sites	2	13	15	0	0	3	28	18
Natural sites	12	6	3	0	0	7	11	3

A two way Contingency table was constructed from the data in Table 2 above to compare the frequency with an "expected" value for leg count across the data.

<u>Table 4</u> 2- way Contingency table

	Site type	-	Synanthropic	Natural
Leg count	frequency	77	2	12
	expected		9.1	4.9
Leg count	frequency	79	16	13
	expected		18.9	10.1
Leg count	frequency	81	43	14
	expected		37.2	19.8
Leg count	frequency	83	18	3
	expected		13.7	7.3

The above table displays significant variation between the frequency and expected values and therefore the data is not "normally" distributed with regard to an "even" spread of numbers of pediferous segments per habitat.

DISCUSSION

Although the data above gives an indication that specimens of

H.subterraneus found in synanthropic sites are likely to have a greater number of pediferous segments than are those from natural sites, this is a difficult hypothesis to prove. What is a "natural" site? I ask this because there are very few sites which have been unaffected by the activities of man over the centuries.

Possibly what we can intimate is that close association with man may provide the environmental pressure required to force the upward variation in pediferous segments.

The specimens used in this survey were collected from a relatively small geographical area and therefore there may be genetic involvement in distortion of the data. It is therefore my intention to continue this study by collecting further data on this species from a greater geographical area - any assistance with collecting *H.subterraneus* from synanthropic/natural sites would be welcome.

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ON THE TRUE IDENTITY OF *GEOPHILUS SORRENTINUS* ATTEMS (CHILOPODA: GEOPHILOMORPHA).

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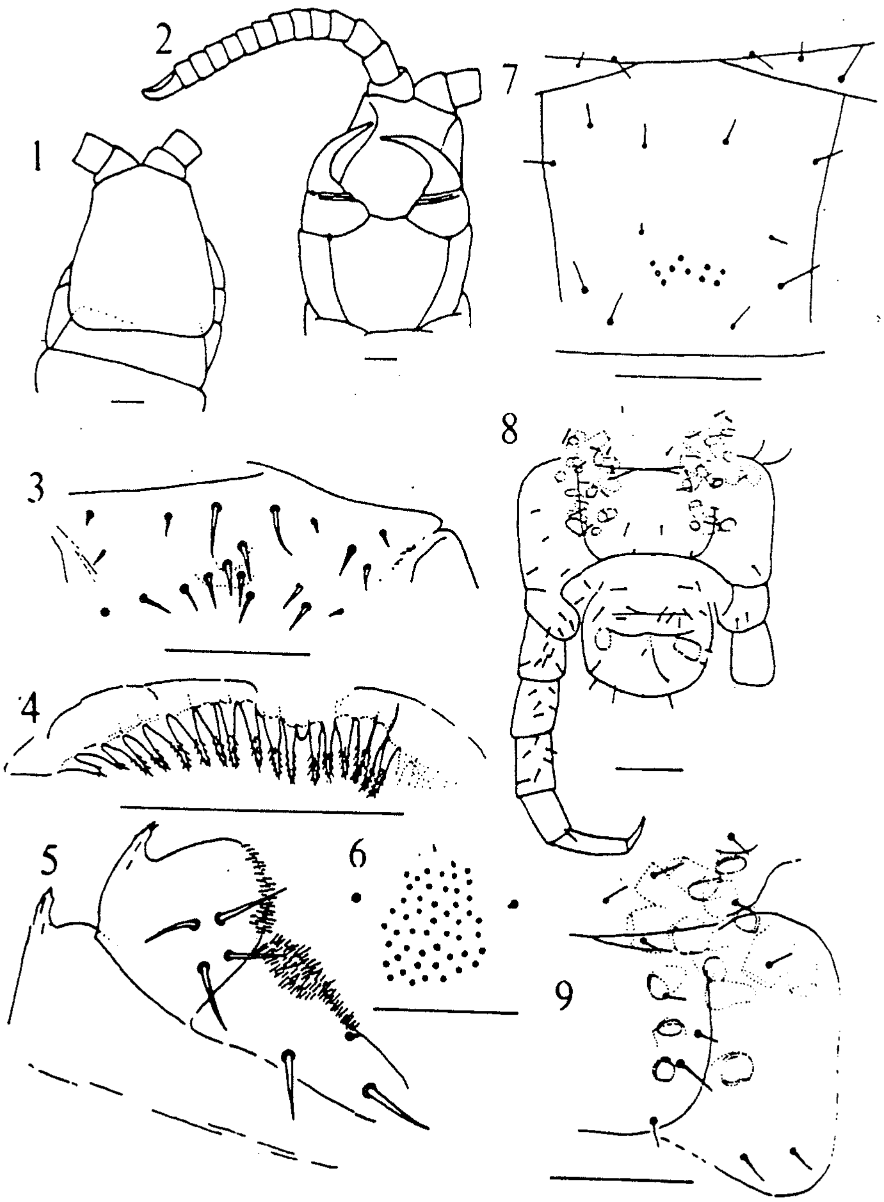
In 1905 Attems described a new species of *Geophilus* from Mte. Faito on the Sorrento Peninsula in Italy. It appears to have been recorded only once.

The type was re-examined as the result of the collection in Surrey of what appeared to be a second specimen of the species (Lewis and Keay, 1994). The type is housed in the Naturhistorisches Museum, Vienna and is in two parts, the head and anterior 53 segments in a vial of ethanol and the posterior 6 segments mounted on a slide.

Attems' description is brief. A translation is given here:
Geophilus sorrentinus Attems, 1903. *Zool. Jahrb. Syst.* **18**:228.
Colour yellowish white, head yellow.
Length 22mm, 59 pairs of legs (1 ♀).
Head capsule as long as wide, no frontal suture.
Antennae short, last antennomere with deep spoon-shaped concavity. The closed forcipules not reaching the anterior border of the head capsule. Chitin lines complete. Anterior wall of coxosternum, inner margin of other segments and of claw without teeth. Inner edge of claw smooth.
Tergites with paramedian sutures. Ventral pores very difficult to see, in a round group towards the posterior margin of the first to the penultimate segment.
Last sternite wide, lateral walls parallel, posterior corners rounded.
Coxae of last legs with about 15 pores, united into poorly defined groups along the anterior and lateral margins of the sternite. End leg with well-developed terminal claw.
2 anal pores present.
Locality: Mte. Faito on the sorrentine peninsula.

Comments on the type.

1. The head capsule has its anterior lateral edges turned under (Figs.1 & 2).
2. The spoon-shaped concavity on each terminal antennomere (Fig. 2) is probably due to collapse and not a valid character. Attems omitted it from the description in his 1929 monograph.
3. Attems gave no details of the clypeus, labrum or maxillae even though they are clearly visible. The clypeus (Fig.3) has irregular 4 transverse rows of setae, 20 in all. The labrum is indistinctly divided into 3 parts, the mid-piece with fringed fimbriae like those of the side-pieces and a median



Figures 1-9 The type specimen of *Geophilus sorrentinus* Attems
1) Dorsal view of head capsule and forcipular segment. 2) Ventral view of the same. 3) Clypeus. 4) Labrum. 5) First maxilla, left. 6) Pore field, sternite 17. 7) Sternite 58. 8) Terminal segments, ventral view. 9) Detail of coxal pores, right terminal leg. (Scale line = 0.1mm).

tooth (Fig. 4). About 22 fimbrae in all (the right hand end of the labrum is obscured). First maxilla (Fig.5) with two pairs of palps.

4. Ventral pore fields are single on the anterior segments (Fig. 6) as far as segment 23 beyond which they are not visible. On the slide of the posterior segments the pore field of segment 54 can be seen to be double, those of segments 55-58 are single (Fig.7).
5. Attems accurately described the arrangement of pores on the coxopleura of the last pair of legs but failed to note that the anterior group, (12-11) open into a groove at the base of the coxosternum (Figs.8 and 9). The pores (7-5) opening along the lateral borders of the sternite do not appear to open onto the surface but a pit cannot be detected.

In the light of the new information, the specimen was re-identified. It runs down to *Clinopodes linearis* (C.L.Koch) in Attems' (1929) key. The leg number (59) is intermediate between that of *C.l.linearis* (63-79) and *C.l.abbreviatus* (Verhoeff) (55-57). *C.l.linearis* is widely distributed in Europe. *C.l.abbreviatus* is recorded from Corpo di Cava on the Sorrento peninsula and Ferrania, Liguria. Minelli (1991) restored *linearis* to the genus *Geophilus* commenting that it "seems much closer to *Geophilus* Leach 1814 than to the type species of *Clinopodes* i.e. *Clinopodes flavidus* C.L.Koch 1847...it forms a fairly well-defined group with the so-called *G.linearis abbreviatus* Verhoeff 1925 (probably a good species) and *G.romanus* Silvestri 1896." Attems (1929) described the coxal pores of *C.linearis* as numerous as did Eason (1964). His figure shows about 9 pores opening into a pit under the sternite and 18 opening near the base of the coxa. Brölemann (1930) shows 9 and 34 respectively. The numbers of pores in *G.sorrentius* are considerably lower. This, plus the small size of the specimen (22mm). Brölemann giving the maximum for females as 50mm, suggest that this is an adolescens specimen. The specimen is here assigned to *Geophilus linearis*. The status of *G.linearis abbreviatus* is uncertain.

ACKNOWLEDGEMENTS

My thanks are due to Dr.Jürgen Gruber of the Naturhistorisches Museum Wien for the loan of the type specimen. I also wish to thank the Royal Society and the Association for Science Education Research in Schools Committee and Dr.D.J.Stradling for their support and encouragement.

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THE CHARACTERISTICS OF AN ADOLESCENS STADIUM *GEOPHILUS LINEARIS* C.L. KOCH (=*CLINOPODES LINEARIS*) (CHILOPODA: GEOPHILOMORPHA).

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A single specimen of a small bright red geophilomorph was taken under dead wood from Scratch Wood near Woodmansterne (Grid ref. 51271592) by A. N. K. on 19th May 1993. It appeared to be a species of *Geophilus* quite unlike any other species in the British fauna. It ran down to *G.sorrentinus* Attems in Attems (1929) key. Subsequent examination of the type of *sorrentinus* by Lewis (1994) showed it to be an adolescens stadium *Geophilus linearis* (=*Clinopodes linearis*). Eason (1964) stated that the adolescens stadia of *C.linearis* were unknown and Barber and Keay (1988) reported that smaller specimens of the species could be mistaken for several species of geophilomorphs. The British specimen is also an adolescens *Geophilus linearis* and as its identification proved such a problem it is here described in detail.

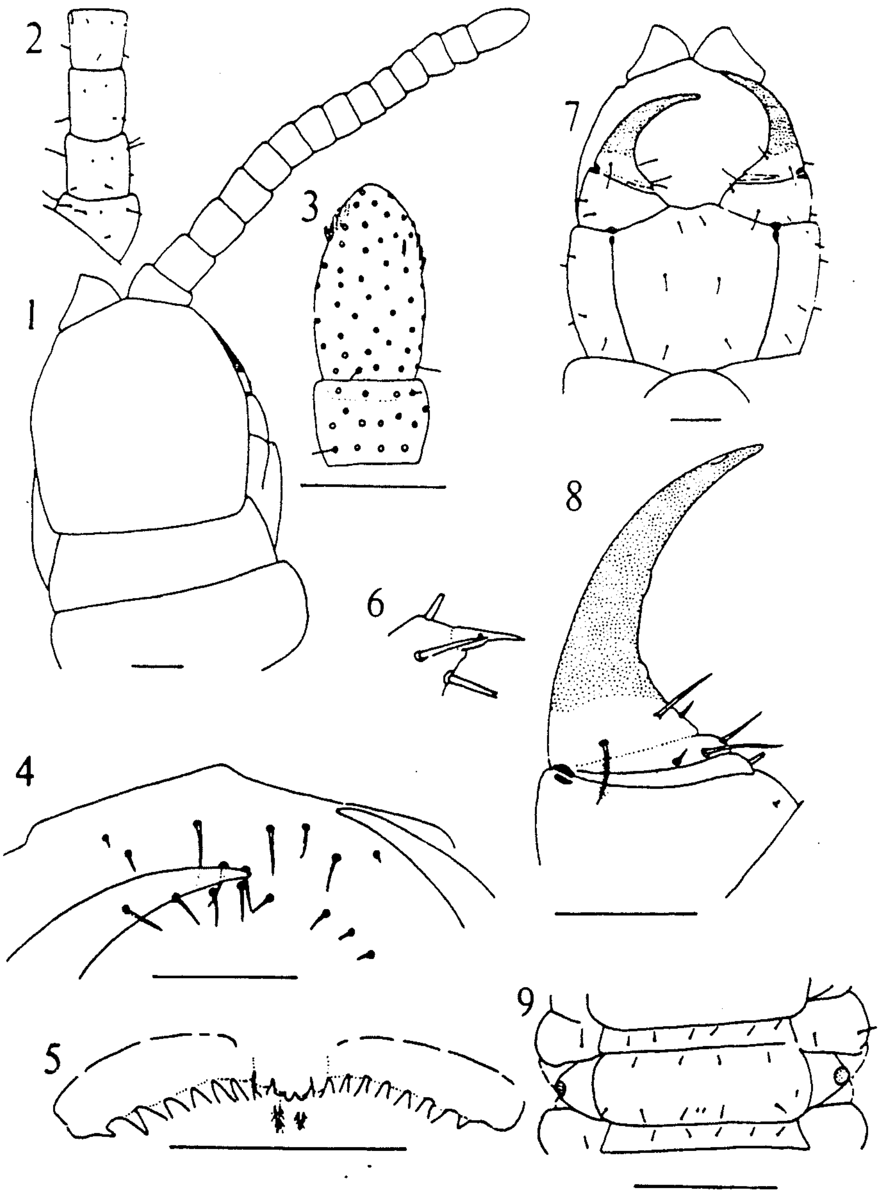
Description of British specimen.

Female, length 18mm. 73 pairs of pediferous segments. Body not markedly attenuated anteriorly. Live colouration bright red, colouration mounted in Euparal: head capsule brownish orange, trunk apricot.

Antennae twice as long as the head capsule (Fig. 1). The antennomeres relatively short and broad and sparsely setose (Fig. 2). The terminal antennomere with anterior and posterior distal groups of basiconic sensilla (Fig. 3) with about 10 in each group. Antennomeres 5, 9 and 13 without thick-walled sensilla. Head capsule (Fig. 1) sparsely setose, slightly longer than wide (ratio 1.06:1). The posterior border slightly excurved, lateral edges excurved, frontal suture absent. Clypeus, which is partially obscured by the poison claws, with four irregular rows of clypeal setae totalling about 18 in all. (Fig. 4).
Labrum tripartite (Fig. 5) but side-pieces not clearly demarcated from mid-piece. Mid-piece with 5 processes, the central one tooth-like, the one on each side just discernible as fringed fimbriae. Apices of lateral processes obscured by the mandibles.

There are 19 processes.

First maxillae partially obscured. Coxosternum, with small lappets. Telopodite undivided, covered distally with fine setae and well-developed lappets. Medial lobes conical and distally



Figures 1-9 *Geophilus linearis*, Scratch Wood.
1) Dorsal view of head capsule. 2) Basal 4 antennomeres of the right antenna. 3) Antennomeres 13 & 14 of right antenna. 4) Clypeus. 5) Labrum. 6) Apical claw of second maxillary telopodite. 7) Ventral view of head showing forcipules. 8) Left forcipules telopodite. 9) Dorsal view segment 20. (Scale line = 0.1mm).

setose. Second maxillae: coxosternum undivided, with scattered spine-like setae. Metameric pores slit-like with well sclerotised rim. Telopodite of three articles, the terminal claw tapered to a needle-point (Fig. 7).

Forcipular segment: coxosternum wider than long, the anterior border weakly concave (Fig. 7). Chitin lines complete. Telopodite of four articles, without teeth. Poison claws not reaching anterior head margin, concavity smooth but with a slight bump midway along on left poison claw (Fig. 8). Poison claw calyx situated at distal end of femuroid.

Tergites wide and sparsely setose. Tergite 20 (Fig. 9) almost three times as long as wide. Tergite 45 three times as long as wide.

Sternites weakly areolate along margins and sparsely setose (Fig. 11). Sternites 1-31 with median posterior pore fields. (Fig. 10 & 11). Pore fields divided from sternites 71 and 72 (the antepenultimate and penultimate sternites) (Fig. 16 & 17). These posterior pore groups are irregular and there could be specimens in which it was not clear whether to score them as single or double.

Last pediferous segment: pretergite wide, fused without sutures to pleurites (Fig. 19). Tergite trapeziform, wider than long. Sternite more or less rectangular, wider than long, lateral margins slightly excurved, posterior corners rounded, posterior border straight (Fig. 18). Coxopleura with 17-19 glands, 7-8 opening along or under the lateral margin of the sternite. 11-11 pores open into groove between coxopleuron and penultimate pediferous segment.

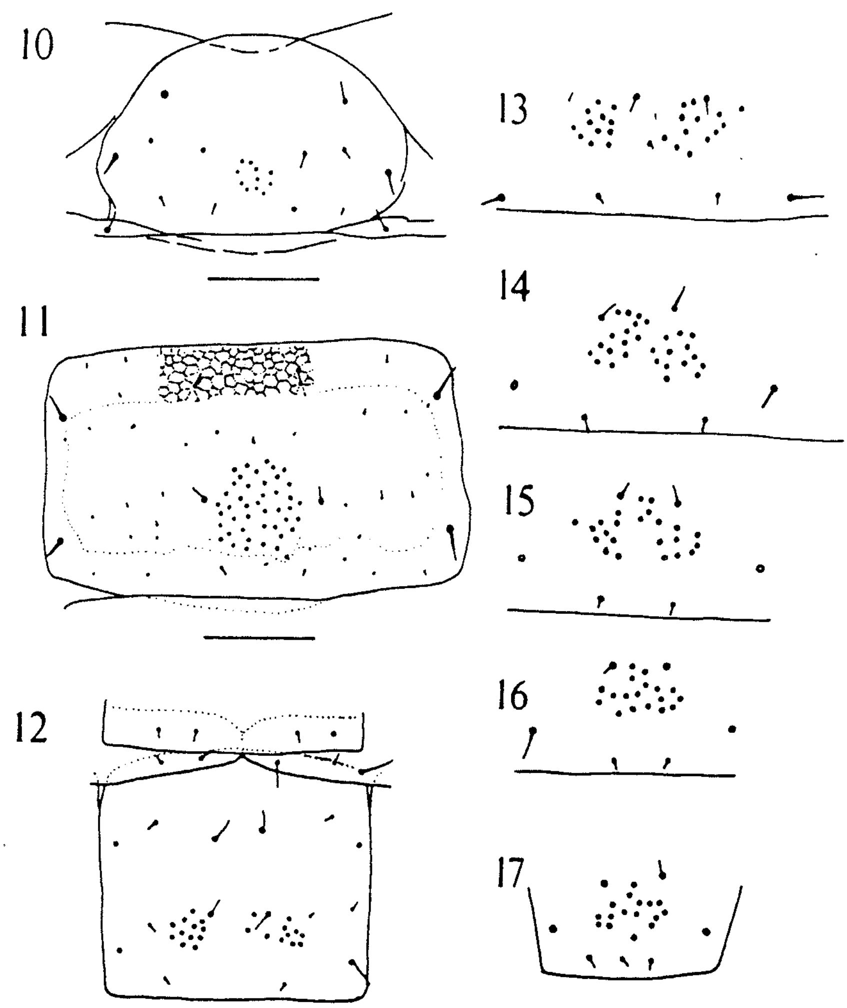
Last pair of legs relatively slender in female, more setose ventrally, with well-developed apical claw (Fig. 20).
Anal pores present.

Remarks

Eason (1964) described British *Clinopodes linearis* as usually 20-30mm long with 69 trunk segments in males, 73 in females. The Surrey specimen is 18mm long and has 73 segments. He described the colour as yellow with the forcipular segment darker. The Surrey specimen, being bright red, is very unusual.

The labrum of Eason's British specimens have about 30 fimbriae and no teeth as compared to about 19 and one tooth in the Surrey specimen and the sternal pore groups are single from the fourth from last segment (third from last in Surrey specimen).
The small size, low number of coxopleural pores suggest that the specimen is a late adolescens stadium. The early adolescens stadia are yet to be described.

This specimen was difficult to identify as it had been mounted on a slide. Most importantly the labrum is partly obscured and the pit opening under the sternite of the last leg-bearing



Figures 10-17 *Geophilus linearis*, Scratch Wood.
10) Sternite 1. 11) Sternite 20. 12). Sternite 54. 13-17) Ventral pore groups of sternites 68-72 respectively. (Scale line = 0.1mm).

segment, if present, is not visible. Although it may often be advantageous to make permanent slide preparations of specimens the procedure may make the subsequent examination of some characters impossible. It is advisable to leave specimens of doubtful identity in 70 per cent ethanol or isopropanol, which leaves them more flexible, until the identification is confirmed.

ACKNOWLEDGEMENTS

J.G.E.L. wishes to thank the Royal Society and the Association for Science Education Research in Schools Committee and Dr D.J. Stradling for their support and encouragement.

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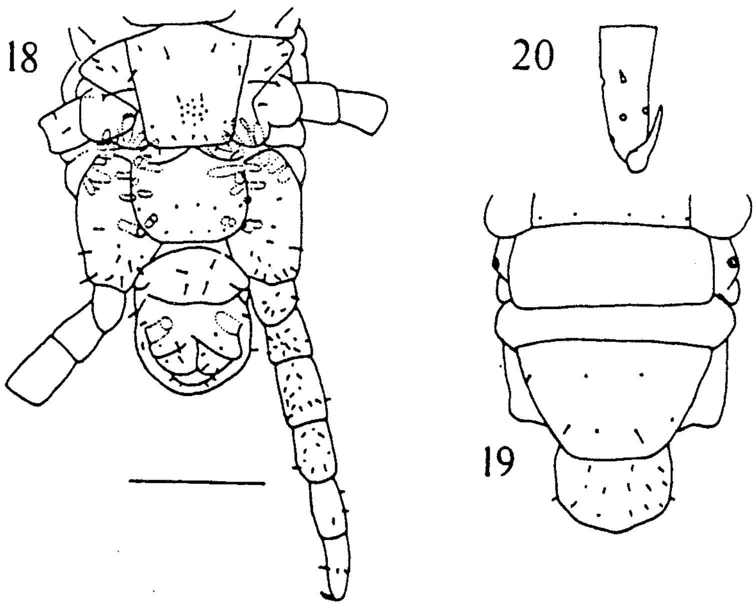

Figures 18-20 *Geophilus linearis*, Scratch Wood.
18) Ventral view of terminal segments. 19) Dorsal view of terminal segments. 20) Apical claw of terminal leg. (Scale line = 0.1mm).

LITHOBIUS QUADRIDENTATUS MENGE, 1851, THE SENIOR SYNONYM OF *L.PICEUS* L.KOCH, 1862.

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In 1851 A.Menge recorded four species of *Lithobius* from the neighbourhood of Danzig (Gdansk) on the Baltic coast of Poland. He mistakenly ascribed *L.forticatus* (Linné, 1758) to Leach and described three new species, *L.octops*, *L.pleonops* and *L.quadridentatus*. The first two of these have been synonymised by Haase (1880) with *L.calcaratus* C.L.Kock, 1844 and *L.erythrocephalus* C.L.Koch, 1847 respectively and thus become junior synonyms. The third new species, *L.quadridentatus*, has received little mention by subsequent authors.

Menge's description of *Lithobius quadridentatus*, as well as mentioning a length of six lines (12.5mm), nine ocelli, 42 antennal articles and 4 + 4 prosternal teeth says "*An der Innenseite der Oberschenkel der beiden letzten Fusspaare ein Kleiner Vorsprung mit einem Dorn auf demselben*". If we take *Oberschenkel* to mean the prefemur this seems to refer to the prominent distomedial extremity of the 15th prefemur bearing the spine DpP which is very prominent in *L.piceus* L.Koch, 1862 (Brölemann 1930, fig.480; Eason 1964, fig.342). I have little doubt that *L.quadridentatus* was based on a pseudomaturus or small adult of *L.piceus* which is the only species recorded from Poland (Kaczmareti, 1979) fitting Menge's description and likely to be found so far north.

This synonymy was foreshadowed by Fanzago (1876) who described a specimen from northern Italy and identified it correctly as *Lithobius quadridentatus* Menge. But Fedrizzi (1877) re examined this specimen and finding it had 16 ocelli (as opposed to 9) and was violet (as opposed to reddish-yellow) which is often the case in recently moulted examples, made it the basis of a new species, *L.vidaceus* Fedrizzi. Cantoni (1880) mentioned that *L.violaceus* seemed to be close to Latzel's description of *L.piceus* and Eason & Minelli (1976) gave *L.violaceus* as a definite synonym of *L.piceus* but failed to notice the identity of *L.quadridentatus*.

Name changes are tedious, specially for well-known species, and I have asked the International Commission on Zoological Nomenclature to use its plenary powers to suppress the specific name *quadridentatus* Menge in order to validate the name piceus L.Koch. This will be published in the Bulletin of Zoological Nomenclature in the fairly near future. We can therefore still refer to this widespread European species which is quite common in parts of southern England as *Lithobius piceus*.

To those who are not taxonomists, establishment of the identity of *Lithobius quadridentatus* may seem a rather pointless exercise: but it clears up one of the loose ends of lithobiid taxonomy involving a British species.

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TASMANIA AND ITS MYRIAPODS

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INTRODUCTION

In common with other southern temperate lands, Tasmania has a rich litter fauna in which myriapods figure prominently. Perhaps 80% of the Tasmanian myriapod species remain undescribed, a proportion about the same as that for temperate parts of mainland Australia.

Pauropods and symphylans are common here but very little studied. Chamberlin (1920) described the symphylan *Tasmaniella hardyi* from Tasmania and in an unpublished 1989 report, Simone Rushton distinguished several additional symphylan species from rainforest patches around the island.

I recently summarised the available information on Tasmanian centipedes in an illustrated popular guide (Mesibov, 1986). Several new species have subsequently been discovered (see below) and there are many more locality records. Names are available for seven of the perhaps 30 native species.

I hesitate to guess how many species of millipedes are native to Tasmania, but judging from the rate at which new forms have been recognised since C.A.W. Jeekel published an overview (1981), the total is probably greater than 150. Only 20 have names.

In what follows I review current knowledge of Tasmanian centipedes and millipedes. Readers interested in particular groups are welcome to write to me for additional information.

GEOGRAPHICAL OVERVIEW

I begin with a geographical introduction to Tasmania.

Tasmania is a State within the Commonwealth of Australia (Fig. 1) and consists of a main island and several smaller islands with a total area of *c*.68 000 sq.km.

Physiography of the main island is complex, with numerous mountains, high plateaux, coastal and inland plains, lakes and a dense drainage network of rivers and streams. The highest peaks reach *c*.1600m and much of the island's centre is an extensive plateau over 900m in elevation.
Tasmania has a marine temperate climate with westerly winds prevailing. Annual mean daily temperatures in coastal locations

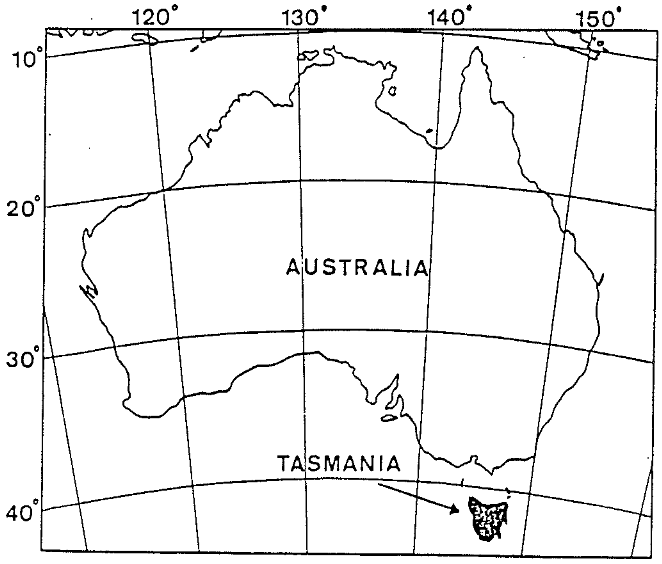

Figure 1. Location of Tasmania.

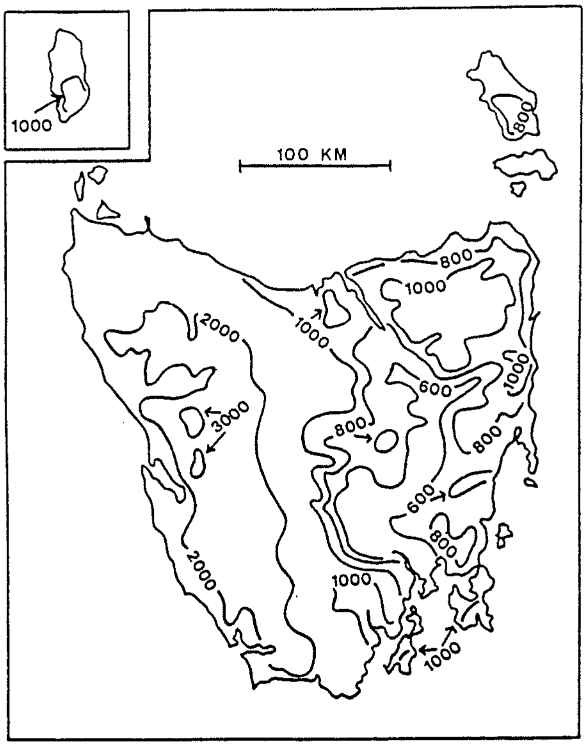

Figure 2. Annual rainfall. Isohyets in millimetres.

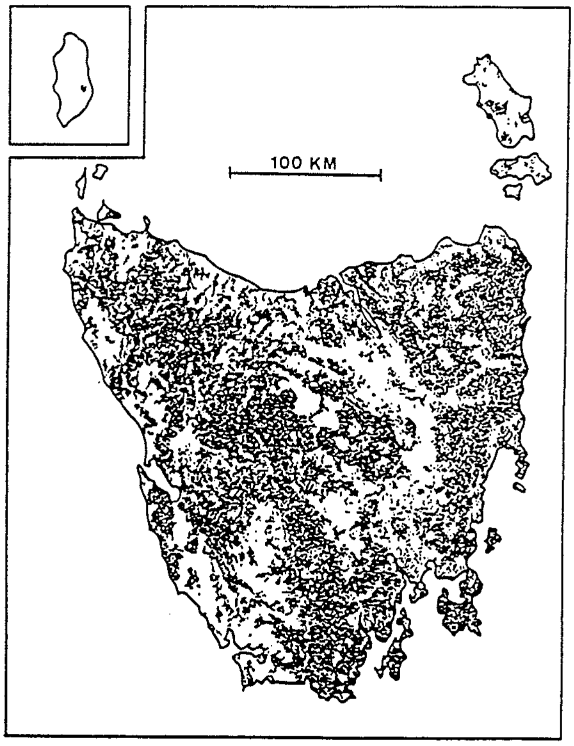

Figure 3. Distribution of forest and woodland. Non-stippled areas include low scrub, heath, moor, cleared land and lakes. After Kirkpatrick & Brown (1991).

are in the range 6-10°C for minima and 13-18°C for maxima. Annual rainfall (Fig.2) ranges from 500-600 mm in the east to *c*.3500mm in the west, with 70% of the State recording at least 800 mm/yr. Over most of Tasmania rainfall has a pronounced winter maximum. Prolonged dry spells are infrequent.

The natural vegetation of Tasmania is a complex mosaic of *Nothofagus* rainforest, wet and dry eucalypt forest and dry eucalypt woodland, with scrub, heath and moor at both high and low elevations. Forest and woodland cover is extensive (Fig. 3).

Tasmania experienced several highland glaciations during the Pleistocene. Evidence for human occupation dates back *c*.30 000 years, well before the last glaciation, and aboriginal Tasmanians lived in most parts of the main island when European colonists arrived in 1802. The Tasmanians were hunter-gatherers and are thought to have frequently burned dry forest, woodland, heath and moor. The resulting fresh green growth attracted and supported large populations of game.

Today about 60% of Tasmania is public land devoted mainly to forestry or nature conservation. Of the 40% in private hands, *c*.9000 sq.km. are cropland and sown pasture. Forestry plantations total *c*.1000 sq.km, mainly on private land.

CENTIPEDES

Scutigeromorpha

Our only species is the introduced *Scutigera coleoptrata*, which is strictly anthropophilic and largely unknown outside the larger towns. As in England, *S. coleoptrata* prefers the damper parts of heated buildings.

Lithobiomorpha

The Lithobiidae are represented in Tasmania by two introduced species, *Lithobius microps* Meinert and *L. peregrinus* Latzel. Both are anthropophilic although there is a credible record of *L. peregrinus* from eucalypt forest near a fishing shack settlement in the east of the State.

By far the most common and widespread lithobiomorph in both southeastern Australia and New Zealand is the henicopid *Henicops maculatus* Newport (see Anonymous, 1982 for name). In Tasmania this species or species complex can be found in every habitat from coastal dunes to rocky mountaintops and from native grassland to dense rainforest. Although extremely fast-running and hard to collect by hand, *H.maculatus* is trap-mad and invariably dominates the centipede component of Tasmanian pitfall collections.

In my 1986 guide I called another native henicopoid '*Wailamyctes* sp.' because of its resemblance to New Zealand members of that genus. Peter Johns subsequently wrote to me pointing out that he had synonymised *Wailamyctes* with *Haasiella* more than 20 years earlier (Johns, 1964). I also mistakenly reported that our native *Haasiella* was restricted to rainforest in western river valleys. More recent collecting has shown that the species is widely distributed in forest in the north and west of the State. I stand, however, by my 1986 claim that this centipede is 'extremely elusive'. It prefers very deep litter and large rotting logs and has usually zoomed off to a safer hiding place by the time you uncover its micro-shelter.

In 1990 I discovered a third Tasmanian henicopid, which like the previous two species is brown, c. 15mm long and very fast. Known only from a single site in northwest Tasmania, this third species fits neatly within the southern hemisphere genus *Paralamyctes*.

Tasmania is also home to the cosmopolitan *Lamyctes* species which in the U.K is called *fulvicornis* and in New Zealand *emarginatus*. Chamberlin (1920) named Tasmanian specimens *tasmanianus*, but parochialism of this kind is patently silly. In Tasmania *Lamyctes* is known only from farms, gardens, quarries, roadsides and marram grass plantings on unstable dunes.

In addition to the above four henicopine henicopids, the Tasmanian lithobiomorph fauna includes at least two species of Anopsobiinae, both undescribed. Having collected and examined Chilean and New Zealand anopsobiines, I have become an enthusiast for the promotion of Anopsobiinae to Anopsobiidae and stand ready to assist anyone brave enough to attempt a revision of this group. The tiny Tasmanian forms are very abundant in leaf litter and bryophytes.

Craterostigmomorpha

To say that *Craterostigmus tasmanianus* Pocock is bizarre is to fairly summarise the growing morphological literature on this species. What I would like to stress here for the benefit of non-Tasmanian readers is that there is nothing obviously weird and wonderful about *Craterostigmus* to be seen in the field. It is a large and locally abundant centipede occurring in forest throughout Tasmania from sea level to at least 1300m. It tolerates considerable habitat disturbance. Despite a published report to the contrary (Manton, 1965), the species is easily maintained in captivity.

Craterostigmus biology would make a lovely topic for a University honours thesis, but to date University of Tasmania zoology students have been less than keen on centipedes. Female *Craterostigmus* can be found brooding their eggs as early as September and their young as late as April. Females mature relatively early (body length 25 mm as compared to 50 mm in older specimens) and a clutch size of 50-60 eggs is not unusual. The anamorphically 12-leg-paired young are abundant in leaf litter throughout the austral winter and early spring.

Scolopendromorpha

The colourful scolopendrine *Cormocephalus westwoodi* (Newport) is familiar to most Tasmanians from its habit of lurking under the bark of eucalypt firewood logs. It is neither aggressive nor particularly venomous, nor is it an impressively large member of its subfamily, specimens rarely exceeding 50 mm in body length. It is nevertheless feared and is generally executed by homeowners for the crime of being a centipede. Fortunately, *C.westwoodi* is abundant in northern and eastern Tasmania. According to Koch (1983), the same species is found in mainland Australia, New Guinea, New Zealand, South Africa, Madagascar and Sri Lanka.

The only other Tasmanian scolopendromorphs are *Cryptops* species. The introduced *C.hortensis* Leach prefers gardens while the native species, all undescribed but closely resembling New Zealand forms, are rarely seen outside native forest. Two of the four known native *Cryptops* are widespread and broadly sympatric, occasionally being found together in the same rotting log. A third species appears to be geographically restricted and is on my 'worry list' for invertebrate conservation.

Geophilomorpha

For years I have carefully avoided thinking too much about the taxonomy of the southern hemisphere Geophilomorpha. Life, after all, is short and there are many more tractable myriapodological problems to brood over. You can imagine my delight when Dick Jones wrote recently to ask for the loan of Tasmanian material. The Queen Victoria Museum quickly forwarded 1000-odd specimens before Dick could reconsider his request.

Broadly speaking, there are two widespread and abundant genera of Tasmanian geophilomorphs which may or may not be congeneric with other southern hemisphere geophilomorphs. The family placement is uncertain. There are also intertidal geophilomorphs which may or may not be introduced. Introduced, anthropophilic geophilomorphs in Tasmania appear to be species of *Schendyla* and *Necrophloeophagus*. For more information, contact Dick Jones in Norfolk!

MILLIPEDES

Polyxenida and Polyzoniida

These two orders are currently under investigation by Dennis Black at La Trobe University in Melbourne. No species have been described.

Polyxenida are uncommon in Tasmania and apparently restricted to the coastal zone and adjacent islands.

Polyzoniida are relatively common in forests and modestly diverse. At least one large species (30mm long) is known to brood its eggs. Another occurs in aggregations on or under eucalypt bark.

Chordeumatida

Three Tasmanian species have been described by Golovatch (1986). Work in progress by Bill Shear in Virginia suggests that there are more than 10 species in the Tasmanian fauna, representing at least two families. Chordeumatida are widespread and abundant in Tasmanian forests but until recently were very poorly represented in collections, perhaps because of their size (5-12mm).

Sphaerotheriida

Procyliosoma leae and *P. tasmanicum* were described from Tasmania by Silvestri (1917). Both are widespread. A much larger, still undescribed sphaerotheriid occurs in Tasmania's eastern highlands. All forms prefer deep forest litter and the spaces beneath loose-lying stones.

Spirostreptida

Jeekel (1981) suggests that all Tasmanian spirostreptidans are Iulomorphidae. There are four described species (Brölemann, 1913; Chamberlin, 1920; Verhoeff, 1944) but the taxonomy of this group in Tasmania needs re-examining. The spirostreptidans are phenomenally abundant in forest habitats and typically account for one-third or more of handpicked and pitfall millipede specimens. The larger species secrete copious amounts of quinonoid material when disturbed.

Polydesmida

Both in diversity and abundance the Polydesmida dominate the Tasmanian millipede fauna.

Paradoxosomatids are abundant in coastal, near-coastal and dry habitats. Only one species has been described (*Notodesmus scotius* Chamberlin), but C.A.W. Jeekel is currently investigating other forms. Several species are day-active and one northeastern species 'swarms' in dry woodland during the late spring.

For the past two years I have been looking closely at Tasmanian representatives of the Dalodesmidae, a family prominent on the southeast Australian mainland as well as in New Zealand. There are at least 25 species in *Lissodesmus*, of which five are named (Jeekel, 1984), six in *Gasterogramma*, with one named (Jeekel, 1982), three in two genera, and several in genera shared with New Zealand. Three of the dalodesmid genera have strong-smelling defensive secretions which alert the educated nose to the presence of particular species.

There is also a bewildering assortment of 'little litter millipedes' in the Tasmanian Polydesmida of uncertain family placement. Two of these are mentioned by Jeekel (1984).

My most recent work has been a mapping exercise with *Lissodesmus*.

The genus is nearly ubiquitous in Tasmania and constitutes what Shelley (1990) calls an 'allopatric/parapatric mosaic complex of species.' From a conservation point of view, I am concerned by the number of geographically restricted *Lissodesmus* species revealed by my surveys, and I am beginning to wonder whether comparable mapping studies in other millipede genera would generate similar conservation headaches.

Introduced millipedes

Several anthropophilic, introduced species are in Tasmanian collections awaiting firm identification, among them what I presume is *Ommatoiulus morelettii* Lucas.

CONCLUSION

As far as I know, there are only two myriapodological investigations currently active in Australia: Dennis Black and myself. Between us we hope to shed some light on the taxonomy and biology of small portions of the Tasmanian millipede fauna. The 'offshore' myriapodologists mentioned above will also make contributions, but it is likely that most Tasmanian centipede and millipede species will remain unnamed and unstudied for many years to come. Tasmania, however, is unusually well-worked compared to the Australian mainland, whose thousands of species persist (some precariously, in the face of continuing habitat destruction) in a myriapodological near-vacuum. The same is true for many other arthropod groups. In Jeekel's words, 'one may wonder whether Australia, with its large territory and small population, will ever produce the broad scale of specialists needed for simply taking stock of the arthropod fauna of the continent' (Jeekel, 1981; p.2).

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A REVIEW OF THE CENTRAL ASIAN MILLIPEDE FAUNA.

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INTRODUCTION

Central Asia is a vast area mostly lying within the former Soviet Union and comprising the southern part of Kazakhstan, all of Kirghizia, Turkmenistan, Uzbekistan and Tajikistan (Map 1). The region is famous for its mountain systems (Kopetdagh, Tien-Shang, Ghissar-Darvaz and Pamirs-Alai) as well as deserts (Karakum, Kyzylkum, etc.). An excellent account of the natural conditions of Central Asia can be found in a recent work devoted to a revision of the regional fauna of the spider family Linyphiidae (Tanasevitch, 1989).

Despite a long history of diplopodological studies (Silvestri, 1895, 1896; Attems, 1904; Lignau, 1929; Verhoeff, 1930, 1931; Lohmander, 1931, 1932; Gulicka, 1963, 1973; Golovatch, 1976a, 1976b, 1978, 1979a, 1979b, 1982; Enghoff, 1985; Jeekel, 1988), the millipede fauna of Central Asia can be generously termed as poorly-known. Less than 40 millipede species have previously been reported or described from the region concerned. The present review will provide a rough outline of this fauna based on both published and unpublished material. The work has been enhanced by our recent joint expedition to Central Asia during May and June 1993.

Although this review is of a preliminary nature, it provides a general view of the millipede fauna of one of the globe's very important and interesting regions. The authors' personal field experience in the Tien-Shang coupled with their current taxonomic activities in a number of Central Asian diplopod genera are an excellent basis for such an attempt. Recent reviews of millipede zoogeography of the regions immediately south of Central Asia (Golovatch, 1991) have also been undertaken which help with the understanding of this area. The previous review of the Central Asian millipede fauna (Golovatch, 1979b) is now somewhat out of date and in addition has been published in Russian, therefore not being readily available for a Western reader.

THE 1993 EXPEDITION TO CENTRAL ASIA

The Tien Shan mountains in Kirghizia provided the focus for the expedition which consisted of an international team of zoologists. Kirghizia became independent from the Soviet Union

Map 1. The location of Kirghizia. A - Afghanistan, K - Kirghizia, KA - Kazakhstan, M - Mongolia, P - Pakistan, T - Tajikistan, TU - Turkmenistan, U - Uzbekistan.

in 1991 and is predominantly mountainous, the highest peak being over 7400m. In area it is approximately the same size as England and Scotland combined but the population is only just over 4 million, the majority of which live in the capital Bishkek. The land is cultivated at lower altitudes with cotton, rice, mulberries for silk worms and subsistence farming. At higher altitudes there are pastures, some very high and alpine in character, where the traditional nomadic practices are still carried out. Large numbers of sheep and cattle are herded to higher altitudes during the summer and back downwards for the winter. Horses are widely used for transport, draught animals and also for milk. Although much of the natural woodland has disappeared through deforestation there are still patches of native walnut forest which is now semi-cultivated and often heavily grazed beneath, especially with cattle. On steeper slopes at higher altitudes there are still pockets of native *Picea* forest.

The expedition started in Bishkek and travelled south to Osh and across the Ferghana valley, then back northwards to Alma-Ata (Kazakhstan). A variety of different research stations and nature reserves were visited, mostly close to woodland but encompassing a range of habitats and altitudes. In addition, stops were made at suitable places whilst travelling. Millipedes were collected mostly by hand sorting, searching under logs and stones and sieving litter. Winkler apparatus was also used to extract animals from litter. Pitfall traps were laid at one locality but did not yeild many specimens.

SPECIES FOUND IN 1993 (See Table 1 and Map 2)

Locality	1	2	3	4	5	6	7	8	9	10
Polyxenus sp.							*			
Hyleoglomeris					*	*	*			
Orinisobates			*	*	*	*	*	*		*
Cylindroiulus ferganus				*	*	*	*	*		
Brachyiulus lusitanus				*	*		*			
Elongeuma sp. 2							*			
Elongeuma sp. 3					*					
Tianella sp.								*		
Schizoturanius sp. 1								*		
Schixoturanius sp. 2					*	*				
Turanodesmus inermis				*			*			
Turanodesmus expressus									*	
Turanodesmus sp.	*	*								*
Turanodesmus ♀ & juv.			*							

Key to localities: 1 - South of Sosnovka, 2 - Susamyr Valley, 3 - Chichkan Valley, 4 - Arslanbob, 5 - Yarodar, 6 - South of Alash, 7 - Sary Chelek, 8 - Kara-Goy, 9 - Alma-Atinka, 10 - Ak-Su.

At least 12 species were found during the course of the expedition including several new to science. They encompass a wide range of orders, probably all those which could be reasonably expected.

Polyxenida

A single species of this order was found at Sary Chelek. Despite several members of the party searching specifically for pseudoscorpions in the type of habitat which could be expected to yield this group of millipede no further specimens were found. It appears to be genuinely rare in the area.

Map 2. The location of the collecting sites, numbers as in Table 1. UZ. - Uzbekistan.

Hyleoglomeris kirghisica Golovatch 1976 Glomerida

This species was described by Golovatch in 1976 from Sary Chelek and in 1993 was found to be reasonably abundant in parts of the reserve. It was also discovered at Yarodar and Alash but nowhere else and seems to be confined to the central mountainous area of Kirghizia. It has a preference for deep leaf litter, predominantly of deciduous trees but was also found in *Picea* litter.

Tianella sp. Chordeumatida

Despite being rather early in the year for this genus to be mature, some adults were found at Karagoy, at high altitudes, under stones. They are possibly a new species.

Elongeuma sp. Chordeumatida

Two new species of this genus were found one at high altitudes at Karagoy and one in the Chichkan Valley. Presumably these species are confined to relatively small areas.

Orinisobates khasakstanus, Lohmander 1933 Julida

This species is widespread and apparently common, especially under bark and in wood where it is generally the only species to be found. It was discovered in most of the reserves visited, sometimes in quite large numbers and at a range of altitudes but always in association with trees.

Brachyiulus lusitanus, Verhoeff 1898 Julida

Very few specimens of *Brachyiulus* were found and all males could be asigned to *B. lusitanus*. It seems to be sparcely distributed in the area and is probably introduced.

Cylindroiulus ferganus, Lohmander 1933 Julida

Cylindroiulus was one of the genera of particular interest, thus a specieal effort was made to take comprehensive collections. *C. ferganus* was found at four localities all to the western side of Kirkhizia. No *Cylindroiulus* were found in Kazakhstan or round the Issyk-Kul area. The species shows a definite preference for deep leaf litter, primarily from deciduous trees although specimens were taken several times from *Picea* litter. At Karagoy where trees were rather more sparcely distributed *C. ferganus* was found in a wider range of situations, for example under stones close to the river, where leaf litter was not so abundant. The specimens from this area were also slightly different in terms of relative dimensions. *Hyleoglomeris* the other predominantly litter dwelling species was absent from Karagoy, thus possibly allowing the *Cylindroiulus* to expand its niche.

Schizoturanius and *Turanodesmus* Polydesmida

The Polydesmids are widespread in the area and are found in a variety of situations, mostly where trees of some type are nearby. In most localities they were also abundant. Like the Chordeumatids this group is represented by several species some of which are yet to be described.

SUMMARY OF 1993 COLLECTIONS

Despite thorough searching in the areas visited only a few species were found, thus the diplopod fauna of the area seems quite impoverished in comparison with other regions. The forest in Kirghizia is quite restricted now and only occurs in small pockets, but even within these areas only a small number of species were found. At present *Cylindroiulus* and *Hyleoglomeris* seem to be confined to the western Kirghizia area. The species of *Tianella* and *Elongeuma* are associated with higher altitudes and usually in sparcely vegetated area. *Orinisobates* is distributed more widely in the Kirghizia/Kazakhstan region and is associated with bark and wood, although it was originally decribed from a high mountain pass in Kirgizia from under stones and from available material. It seems that subsequent collectors have found it in similar situations. The Polydesmids are widespread and relatively common as a group but most species seem to be confined to a relatively distinct area.

Brachyiulus lusitanus although being recorded from three localities in the north western part of the country may be introduced and/or may occur quite widely but is undoubtedly rare. The species of Polyxenida seems to be genuinely rare. Two previously recorded species *Brachydesmus proximus* and *Oxidus gracilis* were not found on this occasion, the latter was found from hot houses only. These four species are the only ones which are probably introduced and are relatively rare, thus by far the majority of the fauna is indigenous and has not yet been affected greatly by introduced species.

TAXONOMIC LIST

An updated list of millipede species encountered in Central Asia is as follows:

Order Polyxenida
- I. Genus unknown
  - 1. Unidentified sp.

Order Glomerida, Family Glomeridae.
- II. Genus *Hyleoglomeris* Verhoeff, 1910.
  - 2. *Hyleoglomeris kirgisica* Golovatch, 1976a.

Order Julida, Family Blaniulidae.
- III. Genus *Nopoiulus* Menge, 1851.
  - 3. *Nopoiulus* n.sp.

Family Nemasomatidae.
- IV. Genus *Orinisobates* Lohmander, 1932.
  - 4. *Orinisobates kasakstanus* Lohmander, 1932 (the type-species),
  - 5. *O. sibiricus* (Gulicka, 1963).

Family Julidae.
- V. Genus *Peltopodoiulus* Lohmander, 1932.
  - 6. *Peltopodoiulus schestoperovi* Lohmander, 1932 (the type-species).
- VI. Genus *Cylindroiulus* Verhoeff, 1894.
  - 7. *Cylindroiulus ajderensis* Golovatch, 1979a,
  - 8. *C. dilutellus* Golovatch, 1979a,
  - 9. *C. ferganus* Lohmander, 1932,
  - 10. *C. kuschkensis* Golovatch, 1978.
  - 11. *C.* n.sp.
- VII. Genus *Amblyiulus* Silvestri, 1896.
  - 12. *"Amblyiulus" runatus* Golovatch, 1979b.
- VIII. Genus *Brachyiulus* Berlese, 1884.
  - 13. *Brachyiulus lusitanus* Verhoeff, 1898.
- IX. Genus *Dangaraiulus* Golovatch, 1979b.
  - 14. *Dangaraiulus valiachmedovi* Golovatch, 1979b (the type-species).
- X. Genus *Parapachyiulus* Golovatch, 1979b.
  - 15. *Parapachyiulus recessus* Golovatch, 1979b (the type-species).
- XI. Genus *Turboiulus* Golovatch, 1979b.
  - 16. *Turboiulus tichomirovi* Golovatch, 1979b (the type-species).

Order Callipodida, Family Caspiopetalidae.
- XII. Genus *Bollmania* Silvestri, 1896.
  - 17. *Bollmania orientalis* (Silvestri, 1895)(the type-species),
  - 18. *B. nodifrons* Lohmander, 1931,
  - 19. *B. oblonga* Golovatch, 1979a,
  - 20. *B. serrata* Lohmander, 1931.

Order Chordeumatida, Family Haaseidae.
- XIII. Genus *Elongeuma* Golovatch, 1982.
  - 21. *Elongeuma speophilum* Golovatch, 1982 (the type-species).
  - 22. *E.* n.sp.
  - 23. *E.* n.sp.

Family Cleidogonidae.

XIV. Genus *Tianella* Attems, 1904.

24. *Tianella fastigata* Attems, 1904 (the type-species),
25. *T. ornata* Golovatch, 1979a.

Order Polydesmida, Family Paradoxosomatidae.

XV. Genus *Hedinomorpha* Verhoeff, 1934.

26. *Hedinomorpha bucharensis* (Lohmander, 1933).

XVI. Genus *Oxidus* Cook, 1911.

27. *Oxidus gracilis* C.L. Koch, 1847.

Family Polydesmidae.

XVII. Genus *Brachydesmus* Heller, 1858.

28. *Brachydesmus pereliae* Golovatch, 1976b,
29. *B. proximus Latzel*, 1889.

XVIII. Genus *Jaxartes* Verhoeff, 1930.

30. *Jaxartes zachvatkini* Verhoeff, 1930 (the type-species).

XIX. Genus *Schizoturanius* Verhoeff, 1931.

31. *Schizoturanius strongylosomides* (Attems, 1904)(the type-species),
32. *S. dzhungaricus* Golovatch, 1979a,
33. *S. kitabensis* Gulicka, 1963,
34. *S. montivagus* Lohmander, 1932.
35. *S.* n.sp.
36. *S.* n.sp.

XX. Genus *Turanodesmus* Lohmander, 1933.

37. *Turanodesmus almassyi* (Attems, 1904)(the type-species),
38. *T. elevatus* Lohmander, 1932,
39. *T. expressus* Golovatch, 1979a,
40. *T. inermis* Lohmander, 1932,
41. *T. stummeri* (Attems, 1904),
42. *T. tenuis* Golovatch, 1979a.

XXI. Genus *Usbekodesmus* Lohmander, 1932.

43. *Usbekodesmus redikorzevi* Lohmander, 1932)(the type-species).

The undescribed species from the 1993 expedition of the genera *Schizoturanius*, *Elongeuma*, *Tianella* (and *Cylindroiulus* from previous collections) will be described elswhere.

This list does not include the ubiquitous *Nopoiulus kochii* (Gervais, 1947)(Julida, Blaniulidae), reported from Afghanistan, nor a close unidentifiable genus (Julida, Parajuloidea, ?Mongoliulidae)(s. Golovatch, 1979a). A few millipedes species described from Northwest China (Verhoeff, 1934) and Northeast Iran (Attems, 1951) have also not been recorded from the area but are discussed in the zoogeographic analysis below.

It should be emphasized once again that the above list refers solely to the areas of the former Soviet Middle Asia.

ZOOGEOGRAPHIC ANALYSIS

Generally, the millipede fauna of Central Asia is not particularly diverse. This is accounted for not only by the relatively poor state of knowledge of the area, but also by the history of the region which is known to support a poor forest-dwelling biota at the expense of xerophiles (Kryzhanovsky,

1965). Millipedes, which as a group prefer humid conditions seem to confirm this pattern, although the anticipated diversity of Central Asian millipedes must be considerably higher than the above listed 43 species and 21 genera. Material accumulated since the time of the previous regional revision (Golovatch, 1979a, 1979b) and the list of Loksina & Golovatch (1979) brings the current number of Central Asian Diplopoda to a total of over 40 species.
The millipede orders Glomerida, Julida, Callipodida and the families Cleidogonidae and Polydesmidae are largely Holarctic and there is only a relatively minor representation from the Oriental region. Thus, the millipede fauna of Central Asia can be generally attributed to the Palearctic. This conclusion is in accordance with previous evidence (Kryzhanovsky, 1965; Golovatch, 1979b). What seems more surprising is the fact that the diplopod fauna of the areas immediately south of the region concerned (Hindu Kush, Hindu Raj, Karakorum, Himalaya) is dominated by oriental elements (Golovatch, 1991).

Truly Central Asian (s.l.) endemic millipede species and genera amount to ca. 90% and 70% respectively. This extremely high level of endemism is rooted in the history of the region. It was one of the Tertiary refuges within the Palearctic as a whole and the ancient Mediterranean in particular (Kryzhanovsky, 1965). The proportion of anthropogenic elements is negligible i.e. *Brachydesmus proximus*, *Oxidus gracilis*, and *Brachyiulus lusitanus* have all been found in low numbers. In contrast, endemic genera with few constituent species are quite numerous i.e. *Elongeuma*, *Dangaraiulus*, *Parapachyiulus*, *Peltopodoiulus*, *Turboiulus*, *Hedinomorpha*, *Jaxartes*, *Turanodesmus*.

It would be a mistake to regard Central Asia as sharply delimited to the south. On the contrary, several examples amongst the millipede genera demonstrate its faunal continuity with the more southerly, oriental lands. Thus, *Bollmania* species have been reported from Kopetdagh, Kuhitang-Tau, Ghissar-Darvaz, Pamir Mts., from central and southern Iran, from Badahshan and Kandahar provinces of Afghanistan and also from Punjab, Hazara and Swat provinces of Pakistan (Golovatch, 1991). A similar pattern is observed in *Usbekodesmus* and *Tianella*, each with a few species in Central Asia and several more in the Himalayas. *Usbekodesmus redikorzevi* has been encountered in the Kuhitang-Tau, Ghissar-Darvaz, Pamirs, and Maimeneh Prov. of Afghanistan; a separate species probably populates Uzbekistan; *U. swatensis* Golovatch, 1991 seems to be endemic to North Pakistan; six other described species of *Usbekodesmus* are confined to the Himalayas of Nepal. *Tianella fastigata*, together with one or two other congeners seem to be endemic to the Tien-Shang; *T. ornata* to Dzhungarsky Alatau, East Kazakhstan; other, rather numerous congeners are Himalayan. The genus *Hedinomorpha* is somewhat more restricted in distribution, comprising three species, of which two are confined to northern China, and *H. bucharensis* to the Ghissar-Darvaz and Pamir-Alai Mts.

The genus *Turanodesmus* seems strictly Central Asian, with six described and several undescribed species confined to the

Kuhitang-Tau, Tien-Shang, Ghissar-Darvaz, Pamir-Alai and Dzhungarsky Alatau Mts. The same is true of the following monospecific genera, *Peltopodoiulus* (Kopetdagh), *Parapachyiulus*, *Dangaraiulus*, *Turboiulus* (all Pamir-Alai Mts.) and *Jaxartes* (Kuhitang-Tau Mts., Tashkent). The genus *Elongeuma* with *E. speophilum* and two further undescribed congeners is confined to the Tien-Shang. Interestingly, *Elongeuma* is probably the most easterly representative of the ancient Mediterranean family Haaseidae.

Hyleoglomeris is a species-rich genus ranging from Southeast Asia and the Himalayas, where the bulk of its diversity is located, to the Caucasus, Anatolia, and the Balkans. In Central Asia, *H. kirgisica* seems to be confined to the Tien-Shang, and another, new species still to be described has been encountered in Tajikistan.

The ranges of *Peltopodoiulus*, *Cylindroiulus ajderensis* and *Brachydesmus pereliae*, are all confined to the western Kopetdagh Mts. and seem to provide excellent examples of Hyrcanian influence, with their closest allies confined to the Caucasus. Broadly speaking, they also represent ancient Mediterranean elements in the Central Asian fauna. Other *Cylindroiulus* species are *C. kuschkensis* (from Kushka, i.e. the northernmost outcrops of Hundu Kush), *C. ferganus* (southern Tien-Shang, Alai Mts.), *C. dilutellus* (western Tien-Shang), and another, yet undescribed species from Tarbagatai Mts., East Kazakhstan. The status of Central Asian "*Amblyiulus*", *A. runatus* (Tien-Shang) and another ?congener still to be described (Kuhitang-Tau Mts.), requires revision, as does the generic classification of the entire Pachyiulinae, a trans-Palearctic julid subfamily (where *Parapachyiulus* and *Turboiulus* also belong). Finally, *Dangaraiulus* seems to be the easternmost member of the ancient Mediterranean subfamily Schizophyllinae.

The genus *Schizoturanius* seems western Siberian in origin, with several species confined to West Siberia, one more to the forest-steppe belt of the East European Plain, and several further species in Central Asia: *S. dzhungaricus* in the Dzhungarsky Alatau, *S. kitabensis* in the Ghissar-Darvaz Mts., *S. montivagus* and *S. strongylosomides* in the Tien-Shang. A similar pattern of Siberio-Central Asian faunal connections is demonstrated by *Orinisobates*, with Central Asia (s.l.) serving as the westernmost outpost in the distribution pattern of this Siberio-North American genus. Moreover, the widespread Siberian *O. sibiricus* co-exists in Dzhungarsky Alatau with the purely Central Asian *O. kasakstanus* (also Tien-Shang, Alai Mts). Thus the role of the Dzhungarsky Alatau and some of the other mountain systems of East Kazakhstan is emphasized as a pathway for the penetration of Siberian elements into Central Asia (Kryzhanovsky, 1965).

Finally, an interesting case seems to be represented by the discovery of a species of the East Asian-North American superfamily Parajuloidea in the Pamirs (s. Golovatch, 1979a). However, this record is confined to the Kusavli-Sai Horticultural

Station and still requires confirmation as to identity and status. A polyxenid species (Order Polyxenida, Family ?Polyxenidae) discovered during the 1993 expedition is also of uncertain identity as is a *Nopoiulus* species from the Kopet-Dagh mountains (Enghoff pers. comm).

This brief review distinctly shows the domination of the ancient Mediterranean influence in the modern millipede fauna of Central Asia. Due to the region's subsequent devastating deforestation and glaciations, this initial influence has persisted. The Caucasus similarly an ancient Mediterranean refuge since Tertiary times although more limited in area has retained much of its forest cover and, consequently, numerous of its forest-dwellers, with over 150 millipede species among them. On the other hand, due to its central position in Asia and numerous contacts with adjacent regions, Central Asia has gained immigrants from the Caucasus, the Oriental realm, Siberia, and finally anthropogenics. Further collecting in the south eastern part of the region would be interesting and also to the south and west which politically is more difficult to explore being Uzbekistan and China.

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SWISS MILLIPEDES:

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Ariane Pedroli-Christen

Documenta Faunistica Helvetica 14, Centre Suisse de cartographie de la faune, Terreaux 14, CH-2000 Neuchatel, Switzerland. 1993. (Price SwFr 30 plus postage).

As well as her accounts of the complexities of the genus *Rhymogona*, explored through studies of genitalia and enzyme electrophoresis, the author presented a preliminary list of Swiss diplopods to the 1990 Innsbruck conference. What we have now is a most impressive 248 page account of the millipedes of Switzerland including 127 species with distribution maps. Ariane Pedroli-Christen is indeed to be congratulated on this work.

In each case there are general comments on the species and its distribution, references, distribution in Switzerland and comments on ecology. The latter range from a few lines to half a page. The annexe has 25 km square distribution maps for each species, histograms showing relative abundance by faunistic regions and altitude and the total number of records. Appendix 2 is a factorial analysis of populations by regions, vegetation, openness of habitat and type of woodland. The text is in French with much of the discussion also in German.

The Swiss fauna is of interest both because of the diversity of habitats and topography with the likelihood of isolated populations and the occurrence of montane species and also its position in relation to the fauna of the more northerly and southern areas of western Europe.

British workers will find much useful material in this account. Many of the species are those which we have in these islands and the information will provide comparisons with our knowledge of them. Other species will help us to get a better idea of the European fauna without overwhelming us with large numbers of new families and genera. For instance this account includes 15 species of Glomerida including *Geoglomeris subterranea* (=*Stygioglomeris crinita*), a species of *Trachysphaera* and our familiar *Glomeris marginata*. The latter shows up as a distinctly western species found between 270 and 1800m 'trouvé son optimum à l'étage colineen mais évité les milieux les plus chauds'. There are another 10 species/subspecies of *Glomeris* listed whereas only seven Blaniulidae & Nemasomatidae are noted, six of which have been recorded from Britain. Families unfamiliar to British collectors are Neoatractosomatidae, Mastigophyllidae and Trachygonidae (all Chordeumatida) and Callipodidae.

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A.D.Barber

(Copies may be obtained from the CSCF as above - compared with so many books these days the price seems very reasonable.)

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