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Distribution and Habitat in British Centipedes
(Chilopoda)

by

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Abstract: More than 15,000 species/site/location records of Chilopoda were obtained from the British myriapod survey scheme up until 1985 of which more than 11,000 contain at least some habitat information. These were used to produce the Provisional Atlas of British Centipedes. Further analysis of certain aspects of the data is here carried out in relation to major habitat types, maritime and urban species and other data. Some features of distribution are discussed and it is suggested that the present apparently discontinuous distribution of some species may reflect a former more extensive range.

1. *Introduction:*

The British Myriapod Group recording scheme for centipedes started in 1970 parallel to that for millipedes (Diplopoda) and using a similar pattern to that for terrestrial and freshwater Isopoda (BARBER & FAIRHURST 1972, HARDING & SUTTON 1985). The schemes included provision for the recording of habitat as well as distribution data and in the present case pre-1970 records both published and unpublished, as available and considered reliable, were included to give a total of 15,932 species/location/site reports of which, for various reasons, only 776 related to Ireland. More than 300 recorders, both professional and amateur contributed at various times.

A new style of record card was introduced in 1985 and detailed information from the new ones is not incorporated here except insofar as certain important, uncommon or local species records are utilised. A provisional atlas was published in 1988 incorporating both distribution maps (based on 10 km squares of the British and Irish National Grid) and habitat information (BARBER & KEAY 1988). An earlier paper (BARBER 1985) discussed various aspects of the distribution patterns based on the then available data.

In the provisional atlas habitat data was presented both in crude numerical form and on a weighted basis (referred to as "standardised"). Various aspects of the data were discussed at the time; further aspects of this are now examined.

It is important to recognise that the very nature of the process of collection of records places limitations on the data available. It was important that the record card should be usable by non-specialist recorders and those whose main interest was elsewhere and it was therefore a compromise between these requirements and the need for data of any value. A number of problems subsequently emerged with the card and the new version takes into account certain of these.

Another limitation has been that surveys carried out for distribution data or site registers for conservation tend to be in rural areas, reflected in the fact that the data available for rural, suburban/village, urban was in the ratio 19.1: 3.8: 1. In recent years collectors have been encouraged to examine urban sites and a number have done so, spurred on by the chance of finding unusual species.

The nature of most collecting tends to favour large and conspicuous species and those from superficial microsites so that smaller and soil dwelling species tend to be under-recorded especially by workers who are taking Chilopoda as part of a general invertebrate site survey.

Identifications of species for new recorders were checked so that a high degree of reliability may be placed upon these being correct. An interesting situation, however, exists with the species named as *Geophilus carpophagus* LEACH in that there is a distinct form of this, larger, more greyish and with a larger number of pediferous segments recorded from buildings and urban sites whilst forms from moorland and woodland are more reddish brown and generally smaller. It is possible that these may represent the extremes of a range of variation or alternatively that they represent two distinct forms or subspecies (EASON 1979, LEWIS 1985, BLOWER 1987). There was no attempt to collect data relating to the range of segments numbers in the survey scheme although recorders are now being encouraged to do so. Information relating to *G. carpophagus* should be considered in the light of this.

2. The Data Set:

Of the 44 species of chilopods collected out of doors in the British Isles since 1950, 11 had more than 400 records available whilst 18 have less than 40. In the latter category are some species that have been reported from one or a very small number of locations. Subsequent to the preparation of the atlas a few more records have been made for species in this latter category. Included in the 18 are two small geophilomorphs described as new to science (*Arenophilus peregrinus* JONES, 1988; *Nothogeophilus turki* LEWIS, JONES et KEAY, 1988) and one lithobiid, *Lithobius lapidicola* MEINERT new to an outdoor site. There are also several species recorded on a few occasions from glasshouses and other buildings but not, as yet, from outdoors. No attempt at habitat analysis of the rarer species is possible except in the form of crude numerical data.

The RA 14 record card used (see e.g. BARBER & KEAY 1988) broke the data into various categories and, depending upon the detail available, information was available in various of these.

The main categories, other than place and date, were:

Vice county : The Watson-Praeger vice county was used both as a check on grid reference and as a means of grouping data on a regional basis

Altitude: this was grouped for analysis

Coastal/Inland: based on 15 km from the sea

Urban/suburban or village/rural

First order habitats: i.e. major habitat types

Second order habitats: certain specialised types of habitat

Microsite: i.e. actual location of the animals in the habitat

Habitat qualifiers: including more detail on buildings and on littoral sites

Light level: of very limited value since almost all data except that from pitfalls, trapping or extraction was from daytime collecting

Soil/litter details: of value in the case of woodland and for details of litter types and soil characteristics as available.

Location: detail of the position of the animal in relation to soil level.

For first order habitats 11,712 species records were collected from Great Britain, representing 73.5 % of total records. The only other categories for which comparable values were obtained were for coastal/inland and urban/suburban or village/rural.

The data can be analysed on either a "habitat" basis examining species composition for habitat type or on a "species" basis examining the ecology of individual species. Comparison of weighted data and ordination can be used for first order habitats but is more limited value for most other categories.

Maritime species represent a special category and are best treated separately. This is true also to some extent for species of houses and gardens.

Nomenclature is as used in the provisional atlas (BARBER & KEAY 1988) unless indicated otherwise.

3. Species of Buildings and Gardens and Urban Sites:

Certain species have only been recorded in Britain from buildings (including glasshouses) and in some cases not for a number of years. Most have been recorded only once or a small number of times and are clearly introductions from other parts of the world. These are the mecistocephalids *Dicellophilus carniolensis* (C.L. KOCH) (BAGNALL 1913 a, b) and *Tygarrup javanicus* (ATTEMS) (LEWIS & RUNDLE 1988), *Brachyschendyla monoeci* (BROLEMANN) (TURK 1944), two lithobiomorphs from hothouses at the Royal Botanic Gardens, Edinburgh (coll. C.P. Rawcliffe, det. E.H. Eason), *Lithobius micropodus* MATIC and *Lamyctes africana* (PORAT), *Scutigera coleoptrata* (L.) (EVANS 1907, BLOWER 1955) and a species of *Lamyctes* (*L. albipes* POCOCK ?) recently collected from a nursery in Norfolk (coll. A.D. Barber, det. E.H. Eason). In addition, *Lithobius lapidicola* MEINERT also from Edinburgh has only recently been recorded out of doors from a single Kent site.

A number of common species are, however, frequently recorded from buildings (including ruins) (Table 1) and gardens (Table 2).

Table 1: Records of the 12 commonest Chilopoda species from buildings.

Species	Total records from buildings, etc.	Weighted % of records for species	weighted % of records for habitat
Lithobius forficatus	60	10,6	27,8
Lithobius melanops	33	19,1	15,3
Cryptops hortensis	27	18,5	12,5
Lithobius microps	22	8,3	10,2
Geophilus carpophagus	21	12,3	9,7
Haplophilus subterraneus	9	7,7	4,2
Lithobius crassipes	9	6,0	4,2
Lithobius pilicornis [1])	8	38,9	3,7
Brachygeophilus truncorum	8	6,0	3,7
Necrophloeophagus flavus	5	3,7	2,3
Lithobius variegatus	5	1,8	2,3
Cryptops parisi [2])	5	13,6	2,3

[1]) Mostly southwestern; [2]) Mostly southern Britain.

Buildings and the vicinity of these clearly offer a specialised habitat offering both warmth and a food supply based on scavenging insects, etc. and conditions which are tolerable to a fairly wide range of native species as well as exotics.

Table 3 shows available data for species from urban and rural sites as recorded by the scheme and indicates not only the relative importance of such sites in the ecology of the species but also the most commonly collected centipedes in such sites. There is not necessarily a close correlation between the data for gardens and allotments and a bias towards urban as opposed to rural sites. Some species which are common in gardens may, in fact, occur in a wide spectrum of habitats both urban and rural as, for instance, is the case with *Lithobius microps* in SE England.

4. Species from Maritime Sites:

There are four distinctly seashore and estuarine species which do not appear to occur elsewhere. These are *Strigamia maritima* (LEACH), *Schendyla peyerimhoffi* BROLEMANN et RI-

Table 2: Records of the 15 commonest Chilopoda species from gardens and allotments.

Species	Total records from gardens etc.	Weighted % of records for species	Weighted % of records for habitat	Weighted % of species records for buildings and gardens, etc.
Lithobius forficatus	199	9,4	24,6	20,0
Lithobius microps	96	9,7	11,7	18,0
Lithobius subterraneus	91	20,8	11,3	28,5
Necrophloeophagus flavus	73	14,6	9,0	18,3
Cryptops hortensis	64	11,8	7,9	30,3
Lithobius melanops	61	9,4	7,4	28,5
Schendyla nemorensis	26	8,5	3,2	10,9
Geophilus carpophagus	25	3,9	3,1	16,2
Lithobius variegatus	22	2,1	2,7	3,9
Geophilus insculptus	21	19,4	2,6	29,8
Geophilus electricus	19	41,4	2,4	50,5
Brachygeophilus truncorum	15	4,1	1,9	12,2
Lithobius crassipes	12	2,1	1,5	8,1
Lithobius pilicornis	10	12,8	1,2	51,7
Strigamia crassipes	9	10,2	1,1	14,8

BAUT, *Hydroschendyla submarina* (GRUBE) and *Geophilus fucorum seurati* BROLEMANN. In addition, all the few British records of *Geophilus pusillifrater* VERHOEFF and *Pachymerium ferrugineum* (C.L. KOCH) are coastal and *Nothogeophilus turki*, a probable introduction, seems more or less so.

Of these species, *S. maritima* is by far the most frequently recorded with 200 records and is often found in very large numbers in sea shore sites both under stones, in shingle and in rock crevices; it probably occurs all round the British Isles in suitable sites. *H. submarina*, somewhat similar superficially is far less frequently reported (18 records) probably, at least in part, due to its habit of occurring in rock crevices, often intertidally. The comparative ecology of these two species was examined by LEWIS (1962).

G. fucorum seurati, first collected from the Isle of Man, has been reported fairly frequently in recent years from English, Welsh and Scottish sites (21 records in total) and is also known from Ireland. *S. peyerimhoffi* is known from a number of sites along the coasts of south and west England and Wales and from the Isle of Man. It appears to be a characteristically Atlantic species, not known from the Mediterranean (*BARBER 1987*). Both these species are widespread in SW England; one of the most characteristic locations being under flat stones in muddy estuaries.

Although the preceding are apparently confined to maritime sites a number of other species are also frequently found there (Table 4). There is always a chance of odd individuals of species occurring lower down the shore than usual and the location in the three zones reported may not always be easily determined by the recorder but a total of 23 species have been reported at various times from the splash zone of the coast.

5. Analysis of Data for first Order Habitats:

Habitats and species preferences are analysed on the basis of the procedure for ordination by COTHAM, GOFF & WHITTAKER (1973) for plant communities. The data for percentages of

Table 3: Chilopoda species from urban and rural areas, weighted percentages. A... % for species, B... % for habitat.

Species	urban		suburban/village		rural	
	A	B	A	B	A	B
Lithobius pilicornis	67,4	3,5	26,9	1,4	5,7	0,3
Haplophilus subterraneus	51,4	12,3	33	7,9	15,7	3,7
Cryptops hortensis	48,1	9,8	37,1	7,5	14,7	3
Henia vesuviana	47,6	1,2	35,8	0,9	16,6	0,4
Lithobius melanops	41,4	6,8	33,7	5,6	25,2	4,2
Geophilus insculptus	38,8	2,9	40,6	3,1	20,7	1,6
Lithobius forficatus	38,1	27,1	34,5	24,5	27,4	19,5
Schendyla nemorensis	37,6	4,3	30	3,4	32,4	3,7
Geophilus electricus	35,5	0,8	51,9	1,1	12,5	0,3
Necrophloeophagus flavus	30,8	5,1	39,4	6,5	29,8	4,9
Lithobius microps	24,4	13,5	28,4	11,4	50,2	10,5
Lamyctes fulvicornis	24,4	0,6	28,4	0,8	50,2	1,4
Strigamia crassipes	16	0,4	34	0,5	50,1	1,2
Geophilus carpophagus	13,6	1,4	26,3	2,8	60,1	6
Brachygeophilus truncorum	9,8	0,1	30,9	3	59,3	5,9
Lithobius crassipes	8,1	1	23,3	2,8	68,6	8,3
Strigamia acuminata	7,6	0,2	24,3	0,6	68,1	1,7
Lithobius muticus	0	0	37,4	0,5	62,6	0,9
Lithobius borealis	0	0	14,7	0,3	85,3	1,8
Lithobius calcaratus	0	0	8,3	0,1	91,7	1,2

habitat records or for species records is first double standardised and similarities calculated. Differences are then plotted using polar co-ordinates in two dimensions to give a scatter diagram showing similarities.

Using differences between habitats based on percentages of records for different species in those habitats for 11 habitats and the 11 species with more than 400 records, garden/acid heath represent the greatest differences whilst sand dune and scrub are used for second markers resulting in Fig. 1. Garden, waste ground and maritime cluster as do buildings and sand dunes, representing, perhaps, in the first instance an open, disturbed habitat whilst in the second an instance of a site that remains warm overnight (due to heat storage in the case of sand dune).

Using the percentages of species records (i.e. the habitat spectra for individual species) gives Fig. 2. *Lithobius melanops* NEWPORT and *Cryptops hortensis* LEACH, commonly synanthropes represent one extreme whilst *Lithobius variegatus* LEACH, *L. crassipes* L. KOCH and *Brachygeophilus truncorum* (BERGSØE et MEINERT), very much animals of rural sites are the other. *Lithobius forficatus* (L.) and *L. microps* MEINERT, synanthropes as well as occurring in rural sites are somewhat between these.

A similar procedure is adopted for the 13 commonest lithobiomorphs (40 or more records) (Fig. 3) and the same for geophilomorphs (Fig. 4). The lithobiids represent a fairly closed related group of species and it is interesting to note their differences. *Lithobius muticus* C.L. KOCH, *L. piceus* L. KOCH and *L. curtipes* C.L. KOCH are all woodland species whilst at the other extreme L. calcaratus C.L. KOCH is a characteristic animal of habitats such as grassland and heath. *L. pilicornis* NEWPORT and L. melanops NEWPORT, especially the former are synanthropes whilst the other pole represents a more distinctly rural element.

Table 4: The 15 most frequently recorded maritime Chilopoda species. Numbers of times recorded.

	Intertidal	Splash zone	Splash zone to 100 m
Total species reported	11	23	25
Species with 5 - 9 records	2	12	13
Species with 10 or more records	1	10	9
Commonest species:			
Strigamia maritima	45	64	4
Haploschendyla submarina	8	0	0
Geophilus fucorum	4	11	1
Lithobius forficatus	3	35	64
Lithobius microps	3	10	29
Haplophilus subterraneus	2	27	28
Lithobius melanops	2	22	20
Necrophloeophagus flavus	2	7	12
Henia vesuviana	1	4	6
Geophilus insculptus	1	2	3
Clinopodes linearis	1	0	0
Lithobius variegatus	0	18	47
Schendyla nemorensis	0	12	14
Cryptops hortensis	0	11	24
Schendyla peyerimhoffi	0	11	1
Geophilus carpophagus	0	6	23

In the geophilomorphs, a somewhat mixed group of species taxonomically, it is interesting to note the way in which the three *Geophilus* species, *G. carpophagus* LEACH, *G. insculptus* ATTEMS and *G. electricus* (L.) show wide differences in habitats, *G. carpophagus* is a species of woodland, moorland, etc. (apart from large synanthropic forms) whilst *G. electricus* is very definitely an animal of gardens and similar sites. The cluster of species in the centre of the diagram are animals of a variety of habitats. There are marked geographical differences between *Necrophloeophagus flavus* (DE GEER) and *Haplophilus subterraneus* (SHAW), the latter being mostly western (synanthropic in east and north) whilst the former is mostly eastern.

It is interesting to compare these results with those of ANDERSSON (1985) who used a dendrogram to represent habitat similarities for centipedes on the Norrland area of Sweden. His species list is somewhat different; he contrasts *L. forficatus* with *L. curtipes* in terms of occurrence in man influenced habitats, a similar pattern, as far as we can see to that in Britain but here we have *L. crassipes* and *L. variegatus* as the commonest "rural" species of lithobiid.

6. Other Data:

In the provisional atlas (BARBER & KEAY 1988) an attempt is made to analyse data of various other categories.

6.1. Time of Year:

The dates at which species are recorded tends to show a scatter throughout the year with little significant variation (life history stages were not recorded). The most notable exception to this is

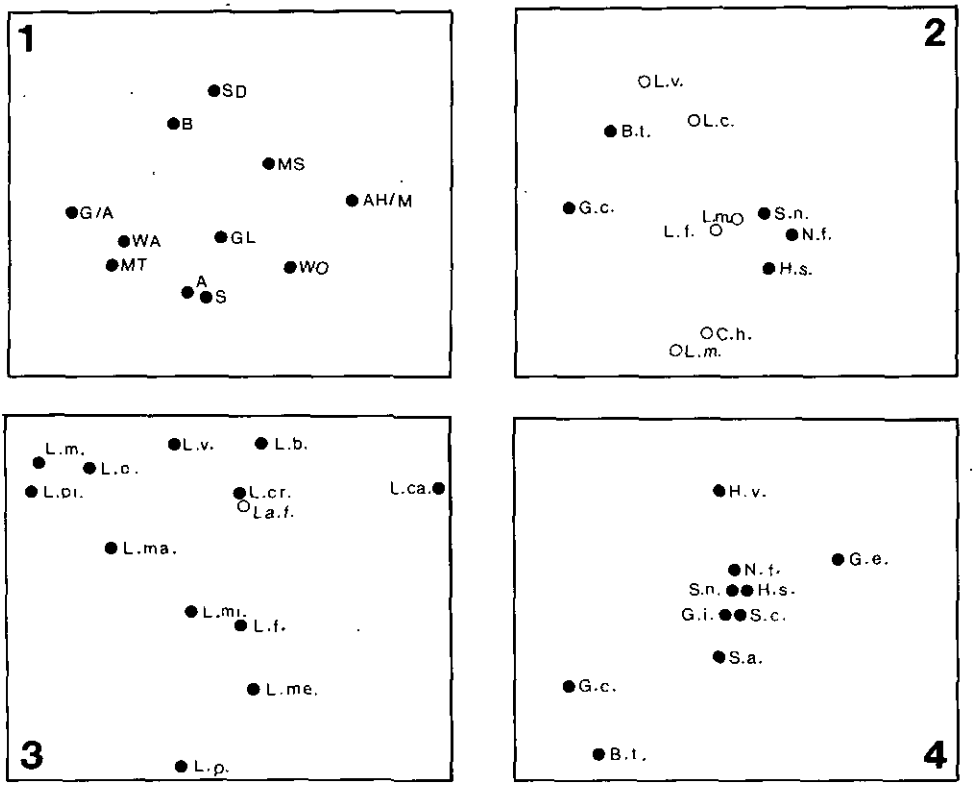

Fig. 1: The main First Habitat types ordinated on the basis of the 11 commonest species of chilopod: A arable, AH/M acid heath/moor, B buildings, G/A garden/allotment, GL grassland, MS marsh, S scrub, SD sand dunes, MT maritime, WA waste, WO woodland.

Fig. 2: The 11 commonest Chilopods ordinated on the basis of the 11 main First Order Habitat types: B.t. *Brachygeophilus truncorum*, C.h. *Cryptops hortensis*, G.c. *Geophilus carpophagus*, H.S. *Haplophilus subterraneus*, L.c. *Lithobius crassipes*, L.f. *L. forficatus*, L.m. *L. melanops*, L.mi. *L. microps*, L.v. *L. variegatus*, N.f. *Necrophloeophagus flavus*.

Fig. 3: Lithobiomorpha with more than 40 records ordinated on main habitat types: La.fu. *Lamyctes fulvicornis*, L.b. *Lithobius borealis*, L.c. *L. curtipes*, L.ca. *L. calcaratus*, L.cr. *L. crassipes*, L.f. *L. forficatus*, L.m. *L. muticus*, L.ma. *L. macilentus*, L.me. *L. melanops*, L.mi. *L. microps*, L.p. *L. pilicornis*.

Fig. 4: The commoner Geophilomorpha (excluding exclusively maritime species) ordinated on main habitat types: B.t. *Brachygeophilus truncorum*, G.c. *Geophilus carpophagus*, G.e. *G. electricus*, G.i. *G. insculptus*, H.s. *Haplophilus subterraneus*, H.v. *Henia vesuviana*, N.f. *Necrophloeophagus flavus*, S.a. *Strigamia acuminata*, S.c. *S. crassipes*, S.n. *Schendyla nemorensis*.

Lamyctes fulvicornis MEINERT which is markedly summer/autumn:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Total records	9	1	9	7	5	7	32	41	38	17	2	0
Weighted %	19.3	1.7	7.0	1.9	2.3	3.7	19.6	20.8	24.5	16.0	4.2	0

This species has a number of interesting aspects to its ecology including the fact that generally only scattered individuals are found, often several at one place, but analysis of pitfall traps from a Welsh river gravel site (coll. A.P. Fowles, 1987) showed very large numbers of specimens over a

period of time. ZULKA (1992) has described its occurrence in inundated sites in a European flood plain; eggs hatch and a four week life cycle leads to further eggs which remain dormant until the following year. This, he remarks, is also characteristic of animals from non inundated sites. Such a life pattern provides a good explanation of its seasonality. Presumably records from other seasons represent animals without such a lengthy egg stage.

6.2. Coastal and Inland Data:

This was difficult to assess, not least because of the fact that many areas of Britain are more or less coastal i.e. within 15 km of the sea. The most significantly coastal species was *Henia vesuviana* (NEWPORT) with 97.5 % (weighted) records from "coastal" locations. This southern European animal is very much a species of the south, presumably because of climatic factors.

Of the most distinctly inland species, *Lithobius piceus* (100 %) and L. muticus (92 %) are both mainly animals of woodland in SE England where much woodland is away from the coast. *Strigamia acuminata* (76.6 % inland) contrasts with *S. crassipes* (49.8 %) but whether there is any significance to this is not clear. *Lithobius crassipes* shows a high value for "inland" (76.8 %) possibly due to its relative scarcity in parts of southern England, an area from which many "coastal" records have been made.

6.3. Microsite:

Microsite data is not easy to weigh because of the small number of records in some categories. The largest number of records for such unusual sites as dung and carrion are *Necrophloeophagus flavus* and *Lithobius forficatus* (both 31.5 % of microsite records) whilst for bracket fungi, *Schendyla nemorensis* (36 %) and *Brachygeophilus truncorum* (20 %) are commonest and for bird/mammal nests, *L. forficatus* (42.8 %).

6.4. Soil Types:

Soil types have been analysed but these are as much a reflection of vegetation type as in the case of peat where some species (*Geophilus insculptus, Lithobius microps,* etc.) are rare. The commonest type from sandy soils is *L. melanops* (44.2 % weighted % of species records) with *Schendyla nemorensis* second (36.7 %). Little significance appears to attach to calcareous/non-calcareous nature of the substrate in most cases.

6.5. Horizon:

Horizon data (i.e. location of animal in relation to soil level; Table 5) reveals an interesting pattern. Lithobiomorphs, as expected, are mainly animals of superficial locations whilst geophilomorphs are mostly below surface. However the three reddish brown geophilomorphs, *Strigamia crassipes, S. acuminata* and *Geophilus carpophagus* and the commonly sub-cortical *Brachygeophilus truncorum* are relatively less common in the deeper layers.

6.6. Altitude:

There are clear differences in altitude preferences but this probably is a reflection of land use/vegetation type than anything else. Little land in Britain is more than 1000 m high.

7. Distribution Patterns:

A number of comments on these were made earlier (BARBER 1985) and distribution maps for the British Isles were given in the provisional atlas. Some additional comments may be appropriate for certain species.

Table 5: Horizons in which Chilopoda species were found. Weighted percentages for species. Based on BARBER & KEAY (1988).

	Above ground	Surface	Litter	Below surface
Haplophilus subterraneus	5,3	20	31,4	43,3
Schendyla nemorensis	10,3	21,7	15	53
Henia vesuviana	15,8	18	24,6	41,6
Strigamia crassipes	27,4	14,8	45,8	12
Strigamia acuminata	7	13,5	61	18,5
Geophilus carpophagus	31,6	20,1	29,7	18,6
Geophilus electricus	0	22,1	14,1	63,7
Geophilus insculptus	7,1	32,4	27,5	33
Necrophloeophagus flavus	10,3	21,7	15	53
Brachygeophilus truncorum	30,9	20	32,4	16,7
Cryptops hortensis	18,4	22,1	20,2	39,3
Lithobius variegatus	36,7	27,7	30,8	4,9
Lithobius forficatus	28,9	35,3	15,7	20,1
Lithobius piceus	9	41,3	41,9	7,9
Lithobius melanops	59,1	18,5	9,3	13,1
Lithobius borealis	56,6	20,2	21,1	2,2
Lithobius pilicornis	43,2	31,6	14,4	10,8
Lithobius calcaratus	13	44,6	25,3	17,1
Lithobius muticus	0	12,7	87,3	0
Lithobius crassipes	23,8	36	24,9	15,3
Lithobius microps	7,1	25,7	29,6	37,7
Lamyctes fulvicornis	14,5	33,5	26,7	25,3

7.1. Species with less than 20 records:

Apart from the rarer maritime species which may well be under-recorded because of difficulty in sampling their sites and clearly introduced species from buildings there are a number of species which have been reported 20 or fewer times from the British Isles. Some of these are probably, if not certainly, introductions which have succeeded in maintaining themselves in a limited area, others may be genuinely rare for some reason (e.g. a declining population) or be very restricted in their British distribution. It is not easy to indicate the status in several cases.

Brachyschendyla dentata (BROLEMANN et RIBAUT) is a small, presumably parthenogenetic, soil dwelling species recorded from 7 widely scattered sites in southern England. Almost all sites are from the vicinity of buildings; its small size and habits would favour its distribution with plants but equally well makes it difficult to record.

Henia brevis SILVESTRI has been recorded 20 times, almost always from gardens or similar sites and is presumably on the edge of its European range.

Pachymerium ferrugineum (C.L. KOCH), a large and conspicuous species, was originally recorded from a Sussex coastal locality from shingle and has recently been found twice more, in Suffolk (CORBET 1989) and the Isle of Wight (KEAY 1989). It is widespread in Europe but not the French Atlantic Coast; it may be that these chance findings represent the extreme edge of its range.

Geophilus pusillifrater VERHOEFF is another small and inconspicuous species recorded from three coastal locations.

Geophilus proximus C.L. KOCH has only been reported once from Britain, from the Shetland Islands, which with much of northern Britain, is a poorly studied area. Possibly it represents a north European element in the British fauna.

Chalandea pinguis (BROLEMANN) is known only from N. Devon and from the Alps and Pyrenees.

Arenophilus peregrinus JONES, probably introduced, is recorded only from the Scilly Isles.

Lithobius peregrinus LATZEL, a Balkan species occurs in one urban site in SE England to which it has almost certainly been introduced.

Lithobius lapidicola MEINERT has been recently recorded from a Kent coastal site and *Lithobius tenebrosus* MEINERT has been found at a Welsh location (KEAY 1989) although there is an older Cornish record.

7.2. Parthenogenetic Species:

Lithobius macilentus L. KOCH, unlike the situation in France, appears to be entirely parthenogenetic in Britain, a characteristic which would favour its survival in any site into which it has been introduced. Since first being recorded from Cumbria (EASON 1953) it has now been found more than 50 times from a wide area of Britain except the southwest (Fig. 5). It is sometimes found as the predominant small lithobiid in woodland in parts of the English-Scots border country.

The other (presumably) parthenogenetic species are *Brachyschendyla dentata* (above) and *Lamyctes fulvicornis.*

7.3. Species apparently confined to a limited Area in the British Isles:

A number of species have a more or less restricted distribution as indicated in the provisional atlas. For instance *Geophilus osquidatum* BROLEMANN is mostly southwestern (Fig. 6) and may represent a Lusitanian element as also, perhaps, does *Lithobius variegatus* LEACH. Others have an even more restricted distribution such as that of *Chalandea pinguis* (above) which has been found in 9 10 km grid squares in a restricted area (Fig. 7). This species may be introduced but it is well established, mostly in deciduous woodland. Its European distribution remains enigmatic.

Lithobius tricuspis MEINERT and *L. piceus* L. KOCH are species widespread in southern Europe (France, etc.) but in Britain are confined to limited areas, S. Devon and Surrey/Sussex/Hampshire respectively, although there are single isolated records of *L. tricuspis* from S. Wales and the Isle of Wight, both well studied areas (Fig. 8). In the same way, the south eastern *Lithobius muticus* C.L. KOCH, another south European species has also been found in two sites in the northwest (Fig. 9). These patterns may suggest that we are looking at the relicts of a formerly more widespread distribution.

7.4. Changing Patterns in Chilopod Distribution:

At present inadequate data over a long enough period of time exists to show how distribution patterns are changing. ANDERSSON (1983) showed changes in species composition in the fauna of localities in the vicinity of Göteborg including the replacement of *Lithobius curtipes* C.L. KOCH by *L. microps* MEINERT and it seems likely that similar changes may be occurring in Britain.

It is well established that both vertebrates and invertebrates change their geographical ranges, sometimes for no obvious climatological reason nor simply because of habitat destruction. The extension of range of the collared dove, *Streptopelia decaocto* has been well recorded (e.g. FITTER & RICHARDSON 1966) and FORD (1945) quotes the interesting cases of changes in range of the butterflies *Polygonia c-album* and *Limenitis camilla* which have both reduced and then extended their range. These, being flying animals, have the capacity to spread easily into new areas but BLOWER (1985) and others evidence what does appear to be a clear extension in the range of chordeumid millipede *Chordeuma proximum* RIBAUT, discovered in Britain only in 1955 in the Forest of Dean and now widespread over much of southern and western Britain.

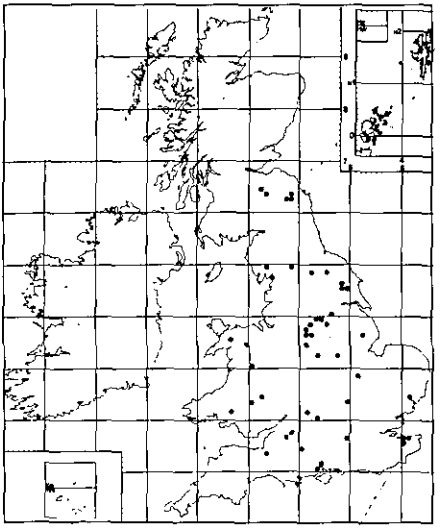

Fig. 5: *Lithobius macilentus*: 10 km distribution map for Great Britain.

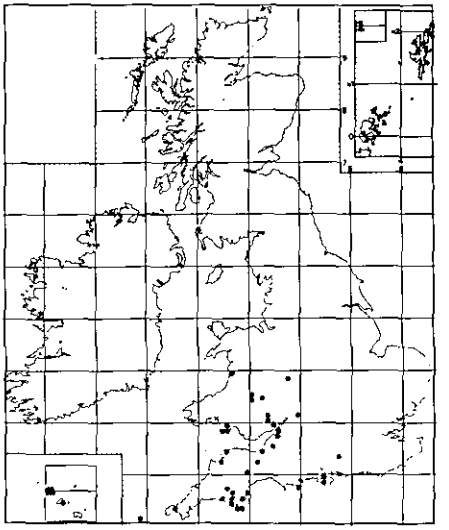

Fig. 6: *Geophilus osquidatum*: 10 km distribution map for Great Britain.

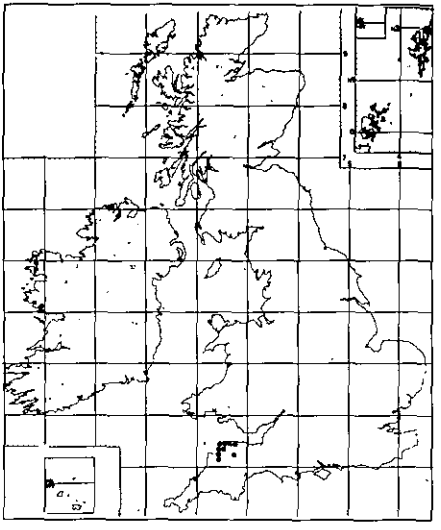

Fig. 7: *Chalandea pinguis*: 10 km distribution map for Great Britain.

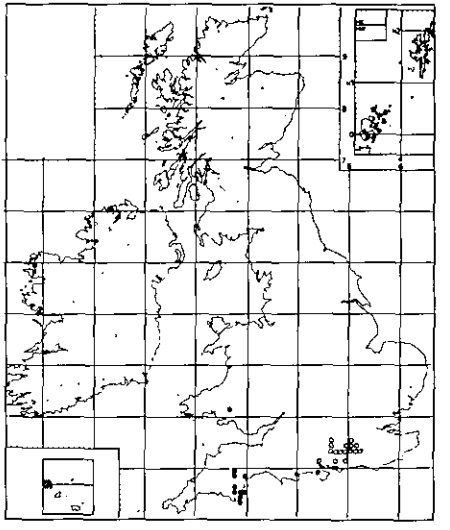

Fig. 8: *Lithobius tricuspis* (dots) and *L. piceus* (circles): 10 km distribution map for Great Britain.

Cryptops hortensis LEACH is characteristic of many sites, notably urban ones (48 % weighted) but also rural locations (14.7 %). The two other *Cryptops* species, *C. anomalans* NEWPORT and *C. parisi* BROLEMANN, known from Britain for many years have now been reported from many locations in southern Britain (Figs 10a, 10b). These are conspicuously larger and presumably more aggressive forms and there is a clear impression that they may be extending their range at least in urban sites since it is difficult to imagine them being passed over as *C. hortensis* in the past.

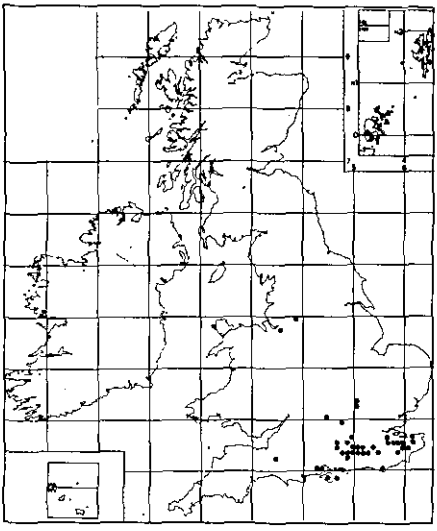

Fig. 9: *Lithobius muticus*: 10 km distribution map for Great Britain.

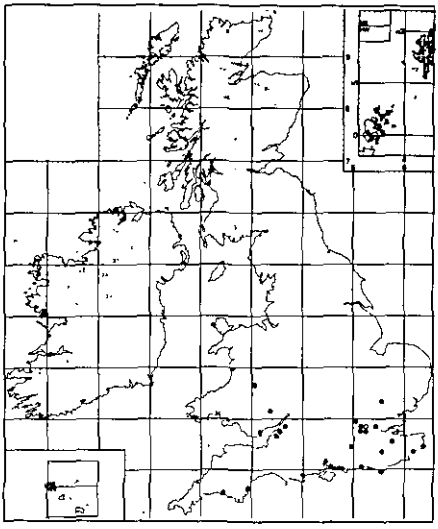

Fig. 10a: *Cryptops anomalans*: 10 km distribution map for British Isles. Pre-1964 (circles), post-1964 (dots).

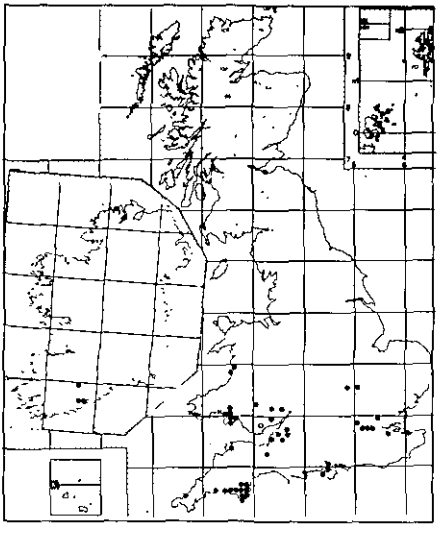

Fig. 10b: *Cryptops parisi*: 10 km distribution map for British Isles. Pre-1964 (circles), post-1964 (dots).

As suggested above, it may be that localised and discontinuously distributed species are in fact the vestiges of a more widespread distribution in Britain. This could apply to *Lithobius curtipes* thought to be an ancient woodland type (BARBER & KEAY 1988) as well to as a number of the species noted above, possibly including such types as *Lithobius tenebrosus* and *Pachymerium ferrugineum* which have only been found a very small number of times but are widespread elsewhere in Europe.

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