THE BRITISH ISOPODA STUDY GROUP

Newsletter of the Isopoda Survey Scheme

No. 17 January, 1984

BISG/BMG MEETING AT LANCASTER, 15-17 APRIL, 1983

We have become accustomed in recent years to an Easter weekend sortie after isopods, and last year was no exception. Such meetings present a marvellous opportunity to meet fellow isopodologists, to exchange views on searching and handling techniques, to hear of current progress in various ventures and to see new species in situ: this year, there was the added bonus of a number of myriapodologists, and together this healthy amalgam of cryptozoologists was an irresistible combination. It is a pleasure to thank Douglas Richardson and Paul Harding for their organisation of a very stimulating weekend with much of interest in lab. and field.

PER ISOPODA AD ASTRA

The first-ever International Symposium on Terrestrial Isopods was held under the auspices of the Zoological Society of London in early July this year. It attracted seventy or so participants from all parts of the world, including Japan, USA and Australia. The strongest overseas contingent was from W. Germany, reflecting the broad spectrum interest in woodlice in that country. There were 28 verbal contributions, a number of poster presentations and two evening workshop sessions, which provided an excellent opportunity to air various points of view in the mildly bizarre surroundings of the Swiss Cottage Hotel, where we were all staying.

A recurrent theme emerging from the meeting was the value of woodlice as model systems for research in a number of different disciplines, for example neurobiology and genetics. In particular, it emerges that woodlice share a number of viral afflictions with insects and may prove useful vehicles for the development of biological control methods for insect pests.

The international flavour of the occasion was emphasised by the fact that 21 of the 28 papers were given by overseas speakers. Prof. V Storch of Heidelberg University spoke about his work on the nutritional biology of woodlice on the World Service of the BBC, and a nice *coda* to the proceedings was the unveiling of Arthur Chater's delightful treatise on 'Woodlice in the Cultural Consciousness of Modern Europe' which the delegates fell upon with uninhibited enthusiasm.

S L Sutton

THE DISTRIBUTION OF *METOPONORTHUS CINGENDUS*

Metoponorthus cingendus has one of the more interesting distributions of British woodlice, and recording for the Atlas has in general confirmed that it is a Lusitanian or Atlantic species. In Ireland it occurs widely inland and on the coast but only in the southern half. In England and Wales it is confined to the south-west where it is predominantly coastal, but there are outlying stations in the Isle of Man and south-east England. A number of plant species have very similar distributions, and it would seem worthwhile trying to define the distribution more precisely, and also to search for the species in areas where it has hitherto not been expected.

In Wales the most northerly site is at 22/602384, just south of the Dyfi estuary. It has been searched for in vain further north, especially on the Llŷn peninsula and on Bardsey, and its absence here is all the more surprising in view of its occurrence in the Isle of Man. In spite of its general coastal bias in south-west England and Wales, it is found as far as 13.5 km inland at 22/367410 in the Teifi valley, not far from its northern limit. This inland site, Llanfairorllwyn churchyard, is otherwise remarkable for being the only site in Wales and England for *Taraxacum hibernicum*, a dandelion otherwise confined to Ireland and two sites in extreme south-west Scotland. This churchyard is also only 1.3 km from the most northerly site in Wales and England for both *Sibthorpia europaea*, the Cornish moneywort, and *Cryphaea lamyana*, a moss occurring only at one other site 9 km down the Teifi and in Devon. *Metoponorthus cingendus* thus clearly seems to be following a distinctive distribution pattern shared with other species in this particular area.

Until 1982 the only record from anywhere in England other than the south-west was a 1972 record made by Stephen Sutton from a fen, Fyning Common, 41/812233, by the Rother in West Sussex, where, rather surprisingly, it was associated with *Ligidium* in *Carex paniculata* tussocks. In 1982 I revisited this site and found *M. cingendus* abundant in a variety of sites in the fen, and in wet alder carr it was actually mixed with *Ligidium* in damp litter on waterlogged ground. I also found it in four other 10 km squares in the Rother valley, mostly in oak or other tree leaf litter covered with vegetation on dry banks or verges, usually accompanied by *Philoscia*, and all, like the Fyning Common site, on Lower Greensand. Also in 1982 Adrian Rundle found it on the chalk just west of Box Hill. Then, in January and February 1983, I found it on the chalk in a beech wood in Arundel Park, and also in six 10 km squares connecting the Rother valley squares with the Rundle one, and extending eastwards to Worth near Crawley. In these latter squares it proved very easy to find on any sheltered, south-facing bank or slope with at least 10 cm depth of litter (chiefly oak or beech) partially covered by grasses, brambles, honeysuckle, etc., on roadside banks, at the edges of woods or under hedges. The squares in south-east England where it is now known are: 41/72, 41/82, 41/92, 51/00, 51/01, 51/02, 51/04, 51/12, 51/13, 51/14, 51/15, 51/23, 51/33.

It is indeed surprising that *M. cingendus* has not been recorded before from this area, as it is both widespread and abundant. It must undoubtedly occur elsewhere in the south-east and doubtless extends across the Weald at least as far as Tunbridge Wells. It has not yet been found anywhere on the coast. It would also be useful to know whether this area of distribution really is an outlier. Adrian Rundle has recorded the species at 40/555909, Firestone Copse, Isle of Wight, and it may be elsewhere along the south coast.

A number of plants, predominantly Atlantic in distribution, also have outliers of their distribution in the Weald and adjacent parts of the south-east, notably *Dryopteris aemula, Hymenophyllum tunbrigense, Sibthorpia europaea* and *Wahlenbergia hederacea.* (*Viola lactea* and the snail *Cochlicella acuta* both have much in common with *M. cingendus* in distribution, but the south-east area is not so separate.) Two papers concerned with plants discuss the reappearance in the south-east of species otherwise mainly Atlantic in distribution, and provide information that may be useful in explaining the distribution of *M. cingendus.*
D A Ratcliffe, "An ecological account of the Atlantic bryophytes in the British Isles", *New Phytologist* 67: 365-439 (1938) considers that as the climate becomes increasingly dry going eastwards in southern England, there is a general lack of suitable habitats for moisture-loving species, with the notable exception of the Wealden area of Kent and Sussex. Here the topography locally provides the necessary degree of atmospheric humidity, notably in areas of wooded sandstone outcrops and glens.
F Rose, "'Atlantic' species in the flora of the Weald", *South-Eastern Naturalist and Antiquary* 57: 18-23 (1952) lists a number of relevant plants. He comments that the usual explanation of the Atlantic distribution is that these plants require a fairly humid atmosphere as well as freedom from intense cold; in the High Weald three types of habitat produce the more extreme Atlantic plants, firstly massive sandstone rock outcrops, secondly deep, wooded ghylls with streamlets, and thirdly damp heathy woodland originally dominated by sessile oak, birch and beech.

M. cingendus, like these plant species, may also be in south-east England not simply because of any general climatic parameters but rather because of the particular presence of suitable habitats. Even though it occurs in a great variety of habitats, it may well depend on these damp, sheltered, mild sites for survival in extreme seasons; it may well not always be as widespread and abundant as it was in the winter of 1982/83. J J Legrand, "Contribution à l'étude des Isopodes terrestres de la Bretagne", *Bull. Soc. Zool. France* 74: 60 (1949) observes that in France, as well as in England and Ireland, the eastern limit of *M. cingendus* is near the +5°C January mean isotherm, but this is unsatisfactory as an explanation as the species does extend into a colder zone in the south-east, and the absence from north Wales and south-west Scotland remains unexplained. Other parameters, such as absolute minimum temperature, rainfall, atmospheric humidity, etc., go no further towards explaining the distribution as we now see it.

M. cingendus, judging from the distribution of other similarly Atlantic species, should be looked for not only in other parts of the south-east, but also in south-west Scotland and even the Outer Hebrides. It should still be looked for in north Wales (especially in Anglesey which is the only part of north Wales where *Viola lactea* occurs). Records on the new cards, with a brief description of both the microsite and the general habitat if possible, especially from areas other than south Ireland, south-west England and south-west Wales, would be welcomed.

Arthur Chater

(Since this article was written Steven Jones has produced numerous records from Cornwall, thus confirming one of Arthur's predictions.)

Ed.

MIKTONISCUS PATIENCEI IN SCOTLAND

This small supralittoral species has been recorded from several sites on the south coast of England and Ireland, on the north Kent coast and on Guernsey. It is fully described and illustrated in P G Oliver & S L Sutton, *Journal of Natural History* 16: 201-208 (1982). In September 1982 I found it near Muchalls, 15 km south of Aberdeen, and this very considerable extension of range suggests that it is worth looking for the species all round our coasts. The Muchalls site was at 37/898907, in an uninhabited rocky bay where a narrow strip of salt marsh has developed. *Miktoniscus* was mixed with *Trichoniscoides saeroeensis* and *Trichoniscus pusillus*, 10-30 cm down in dark, fibrous, gravelly and sandy soil with stones, in a slightly eroded crevice in *Festuca rubra* sward at the top of the salt marsh, within 1 m of high water mark. The animal is readily distinguished from *T. saeroeensis* and our other small species in being very pure, dead white, with the blackish contents of the gut showing through clearly, and in having solitary, black ocelli; there is no trace of pink or yellow in the body. My specimens were identified by Graham Oliver.

Arthur Chater

HEAVY METALS IN WOODLICE AND CENTIPEDES

For the past ten years, a succession of researchers in the Departments of Botany and Zoology of the University of Bristol, have been studying the effects of aerial emissions, from a primary lead-zinc-cadmium smelting works at Avonmouth, on the flora and fauna of woodlands in the Bristol area. About three years ago, I began to study the dynamics of heavy metals in woodlice because of the important role they play in the decomposition of leaf litter. In addition, work by Wieser and his co-workers had shown that terrestrial isopods were able to store very large amounts of copper in the body with no apparent ill effects.

The concentrations of zinc, cadmium, lead and copper were determined initially in the hepatopancreas, gut and a pooled sample of the rest of the body tissues of *Oniscus asellus* collected from eight sites in the UK contaminated to different degrees with heavy metals. The hepatopancreas is by far the most important storage organ of heavy metals, particularly cadmium, and at each site contains a mean of at least 89% of the total body load of this element despite the fact that it only constitutes about 7% of the dry weight of the animal. Specimens of *Oniscus asellus* from contaminated sites may contain concentrations of zinc, cadmium, lead and copper in the hepatopancreas of about 1%, 0.5%, 2.5% and 3.0% of the dry weight respectively which are the highest so far recorded in the soft tissues of any terrestrial animal.

The hepatopancreas contains two types of intracellular granule. The first type, in the S cells, are spherical granules which contain copper, sulphur and calcium. In woodlice from contaminated sites, these 'copper' granules also contain zinc, cadmium and lead. The second type, in the B cells, are flocculent deposits which contain iron. In woodlice from contaminated sites, these 'iron' granules also contain zinc and lead. 'Copper' and 'iron' granules could have evolved as storage sites in the hepatopancreas for essential metals to be utilised when demand from the other body tissues exceeds that supplied in the food. Woodlice in contaminated sites may be able to 'de-toxify' potentially harmful amounts of essential and non-essential elements by storing them in a relatively insoluble form within these granules.

The work has recently been carried a stage further by examining the assimilation of heavy metals in centipedes as representatives of the next trophic level in the food chain. Specimens of *Lithobius variegatus* collected from a contaminated deciduous woodland 3 km downwind of the smelting works, and a similar but uncontaminated site were fed hepatopancreas tissue from *Oniscus asellus* containing known amounts of zinc, cadmium, lead and copper. The extent to which zinc, cadmium and copper are assimilated or lost from the tissues of centipedes depends on the concentrations of these elements in the food and the degree of contamination of the site from which they are collected. Lead is not assimilated by *Lithobius variegatus*.

Centipedes from the contaminated site survive longer than centipedes from the uncontaminated site when both populations are fed on the hepatopancreas of woodlice in which the concentrations of metals are very high. This information, together with a consideration of the levels of metals in the animals at the end of the experiment, suggests that the midgut cells of centipedes from the contaminated site are able to tolerate higher intra-cellular concentrations of cadmium than those of centipedes from the uncontaminated site.

The concentrations of cadmium and copper in the midgut increase considerably when centipedes are fed on the hepatopancreas of woodlice from their 'own' site. This suggests that adult *Oniscus asellus* do not form a major proportion of the diet of *Lithobius variegatus* in deciduous woodlands.

Further reading

HOPKIN, S.P. & MARTIN, M.H. (1982). The distribution of zinc, cadmium, lead and copper within the woodlouse *Oniscus asellus* (Crustacea, Isopoda). *Oecologia (Berl.)*, 54, 227-232.

HOPKIN, S.P. & MARTIN, M.H. (1982). The distribution of zinc, cadmium, lead and copper within the hepatopancreas of a woodlouse. *Tissue and Cell*, 14, 703-715.

HOPKIN, S.P. & MARTIN, M.H. (1983). Heavy metals in the centipede *Lithobius variegatus* (Chilopoda). *Environmental Pollution Series B*, in press.

HOPKIN, S.P. & MARTIN, M.H. (in preparation). The assimilation of zinc, cadmium, lead and copper by the centipede *Lithobius variegatus* (Chilopoda).

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Steve Hopkin

WOODLOUSE SEX RATIOS: EARLIER WORK

In the two volumes of 'Isopodes Terrestres' in the 'Faune de France' series, Vandel (1960, 1962) presents data, together with the work of Arcangeli and Meinertz, concerning the sex ratios of many isopods. These sex ratios should be treated with caution because they seem likely to be aggregate values derived from a number of pooled samples from various localities and years. However, in view of the large numbers involved the figures do have some value and at least indicate the kinds of ratios to be found in our terrestrial isopods. Overall, there seems to be a slight female bias in the sex ratios although 1:1 ratios are not uncommon. Such a bias could arise from differences in viability, behaviour or ecology between the sexes. As well as sex ratios of most British species, the number of embryos carried by an ovigerous female is given.

	Sample size (if given)	Percentage of males %	Number of embryos carried		Source
			mean	range	
Androniscus dentiger	1341 -	43.7 35.0	-	- 16-17	Vandel = V Arcangeli = A
Armadillidium depressum	373 -	50.0 36.0	- -	- -	V A
A. nasatum	- - -	48.3 57.2 58.1	- - -	- 14-122 -	A V Meinertz = M
A. pictum	418 -	38.0 42.8	- -	- -	V M
A. pulchellum	-	26.0	-	-	M
A. vulgare	- - -	45.2 48.8 42.2	- - 125	- up to 316 -	M A V
Cylisticus convexus	- - 218	43.7 36.3 45.0	- - -	15-73 - -	A M V
Eluma purpurascens	201	43.5	-	-	V
Haplophthalmus danicus	1789	40.0	6.7	-	V
H. mengei	385	39.5 39.3	- 5.7	- -	V
Ligia oceanica	589	28.7	52	32-67	Gibelin

	Sample size (if given)	Percentage of males %	Number of embryos carried		Source
			mean	range	
Ligidium hypnorum	398 -	22.6 30.5	- -	6-21 -	V M
Metoponorthus cingendus	41	32.0	-	15-60	V
M. pruinosus	- - -	43.7 41.1 43.7	 - -	- - -	V M A
Oniscus asellus	936 -	38.0 40.5	- -	- -	V M
Oritoniscus flavus	1321	27.0	14	6-21	V
Philoscia muscorum	535 -	30.0 30.6	- -	- -	V M
Platyarthrus hoffmannseggi	1104 -	23.4 25.9	- 5.6	2-9 -	V M
Porcellio dilatatus	610 - -	46.0 45.0 36.7	- 29.0 -	- - -	V M A
P. laevis	- - -	27.3 28.6 33.2	- 55.5 -	- - 48-112	A M V
P. scaber	- - -	29.0 39.2 41.0	- 52.5 -	- 12-90 -	A M V
P. spinicornis	298	39.0 29.7	- 36.5	- -	V M
Trichoniscus pygmaeus	561 319	52.6 51.4	- -	- 6-7	M V

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