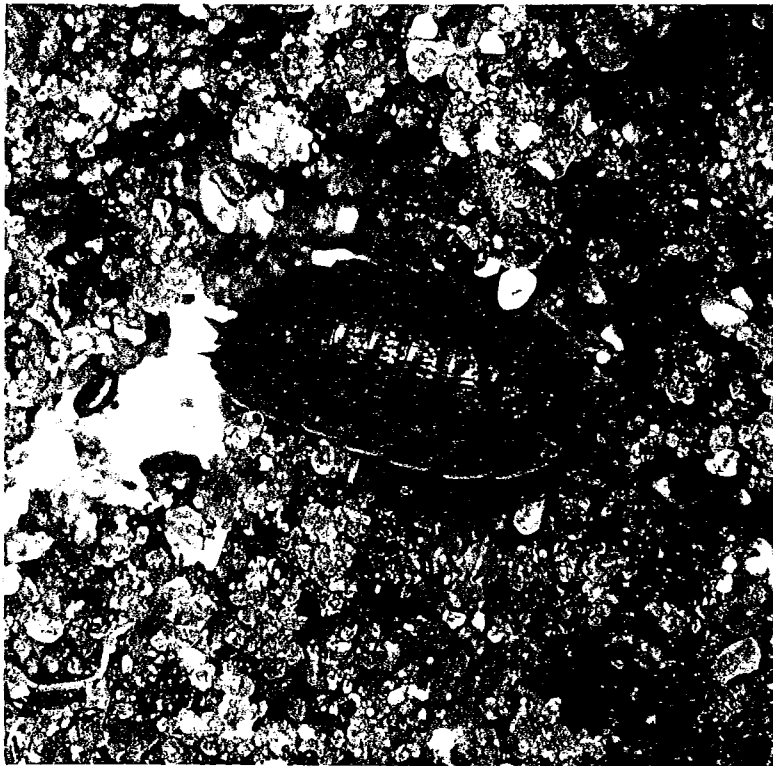


SPECIMEN COPY

ISOPODA



VOLUME 2 (1988)

ISSN 0950-2130

Price £3.00

40/30 EUROPE 88 U.S.A.

154g

CONTENTS

Brood pouch mortality in <u>Trichoniscus pusillus</u>	1
G.D. FUSSEY	
The spread of the terrestrial amphipod <u>Arcitalitrus dorrieni</u> in Britain and Ireland : watch this niche!	7
P.T. HARDING and S.L. SUTTON	
New sites for <u>Trachelipus rathkei</u> in England	11
P.F. WHITEHEAD	
<u>Trachelipus rathkei</u> in North America	15
W.F. RAPP	
Woodlice in the cultural consciousness of modern Europe	21
A.O. CHATER	
The 'Reading Woodlouse Watch 1987'	41
S.P. HOPKIN	

NOTES FOR CONTRIBUTORS

Articles and reviews on any aspect of the biology of terrestrial and freshwater isopods and amphipods will be considered for publication in Isopoda. Contributions from non-professional zoologists are particularly welcome. Style should follow that of the current issue. Further details concerning Isopoda, and the Non-Marine Isopod Survey Scheme can be obtained from:

Dr. S.P. Hopkin
Department of Pure & Applied Zoology
University of Reading
PO Box 228
Whiteknights
READING RG6 2AJ

COVER PHOTOGRAPH

The photograph is of Trachelipus rathkei (10 mm in length) collected from a disused rubbish tip in Reading. The species is the subject of two articles in this volume of Isopoda. Photograph by Steve Hopkin.

BROOD POUCH MORTALITY IN TRICHONISCUS PUSILLUS

G.D. FUSSEY

Department of Biology, Queen's Schools, Eton College,
Windsor, SL4 6EW

INTRODUCTION

Woodlice have proved to be ideal organisms for modelling population dynamics for two main reasons, namely the close relationships between growth rate and temperature, and the number of embryos carried in the brood pouch of a female and her size. In any set of equations used to model population growth, mortality factors acting at particular times in the life cycle are bound to be included. Brood pouch mortality (BPM), whereby a proportion of eggs in the marsupium fail to develop into well-developed embryos subsequently capable of independent existence, is one such factor.

BPM in terrestrial isopods has been recorded by a number of authors. Brereton (1956) estimated 18% BPM in Porcellio scaber, basing this value on the difference between the mean numbers of well-developed embryos and mean numbers of early stage embryos carried by females of the same size. More direct measures have been carried out by a number of workers by counting the number of undeveloped embryos in brood pouches carrying well-developed embryos (Table 1).

Table 1 : Previous estimates of Brood Pouch Mortality (BPM) in terrestrial isopods.

<u>Species</u>	<u>Estimate of BPM</u>	<u>Authors</u>
<u>Philoscia muscorum</u>	3.6% to 4.6%	Sunderland <u>et al.</u> (1976)
<u>Philoscia muscorum</u>	0.8%	Sutton (1968)
<u>Porcellio scaber</u>	2.8% to 5.7%	Davis (1978)
<u>Armadillidium vulgare</u>	7.4%	Paris & Pitelka (1962)
<u>Armadillidium vulgare</u>	6.0%	Al-Dabbagh & Block (1981)
<u>Armadillidium vulgare</u>	2.4% to 3.3%	Lawlor (1976)

As Sunderland & Hassall (1976) commented, "it would seem that brood pouch mortality can vary both between species and between populations of the same species". These authors found that late breeding groups in Philoscia muscorum had higher BPM than early breeding groups, a finding repeated by Davis (1978) for Porcellio scaber. Sunderland et al. (1976) stated that BPM was independent of brood size in Philoscia muscorum, but Lawlor (1976) working with Armadillidium vulgare came to the conclusion that "BPM is more closely related to fecundity than to either female size or age".

In Trichoniscus pusillus, the situation regarding BPM has been less well-defined. Standen (1963) found no difference between numbers of embryos in well-developed broods compared to numbers in early stage broods when plotted against female size (measured, as in many isopod studies, by head width). She stated that "examination of brood pouches revealed larvae only or eggs only all of which appeared to be similar". Later, Sutton (1968) stated that BPM was "very low" and Standen (1973) assumed it to be "negligible".

The present study analyses BPM in a field population of Trichoniscus pusillus and examines the levels of BPM in ovigerous females transferred from the field to gestate in a laboratory incubator.

METHOD AND RESULTS

Trichoniscus pusillus were collected from a mixed deciduous woodland at Parlington Hollins, W. Yorks. (Ordnance Survey grid reference SE 415 353) by pooter during 1979-80. The population was wholly composed of the parthenogenetic form (Trichoniscus pusillus f. pusillus) as indicated by the fact that of 940 animals collected, only one was male (which was identified by the shape of the pleopods to be one of the rare parthenogenetic males).

In the laboratory, the head width of females carrying well-developed embryos (showing elongation and segmentation) was measured (one head width unit = 0.0056 mm) and the number of embryos per female counted. The numbers of undeveloped embryos (i.e. showing BPM) were scored for these females and are shown in Table 2. Females carrying embryos at an early stage of development were placed in pots for two weeks in incubators with a 9 hour dark/15 hour light regime at 15 °C. The head width of females surviving this treatment which had not released their broods was determined, numbers of embryos were counted and BPM was measured as described above. Results of this study are given in Table 3.

G.D. Fussey - Brood Pouch Mortality

Table 2 : Brood pouch mortality in a field population of Trichoniscus pusillus

	<u>Date</u>			<u>TOTAL</u>
	<u>6.6.79</u>	<u>26.6.79</u>	<u>6.6.80</u>	
No. of ovigerous females with well-developed embryos	51	38	14	103
No. of females showing BPM	15	2	2	19
% females showing BPM	29.4%	5.3%	14.3%	18.4%
Total no. of embryos	471	266	104	841
No. of undeveloped embryos	25	2	4	31
% embryo mortality	5.3%	0.8%	3.8%	3.7%
% embryo mortality in affected females	17.7%	13.3%	22.2%	17.8%

Table 3 : Brood pouch mortality in Trichoniscus pusillus in the laboratory

	<u>Date</u>			<u>TOTAL</u>
	<u>6.6.79</u>	<u>26.6.79</u>	<u>6.6.80</u>	
No. of females at start of experiment	33	38	45	116
No. of females at end of experiment retaining brood	29	24	34	87
No. of females showing BPM	13	5	22	40
% females showing BPM	44.8%	20.8%	64.7%	46.0%
Total no. of embryos	253	161	280	694
No. of undeveloped embryos	18	8	51	77
% embryo mortality	7.1%	5.0%	18.2%	11.1%
% BPM for affected females	21.1%	22.9%	28.8%	25.6%

A composite plot of embryo number against female head width for all three groups of incubated females is shown in Fig. 1. A least squares regression line was fitted to the data which gave the equation:

$$\text{No. of embryos} = 0.198 \times \text{headwidth} - 12.81$$

Points which lie above and to the left of this line represent females with above average numbers of embryos for their size. By chi squared analysis of the contingency (Table 4), it is clear that "over-endowed" females are not more liable to BPM than the "less well-endowed" females (chi squared = 0.087, with one degree of freedom, not significant at 5% level).

Table 4 : Chi squared contingency table for female Trichoniscus pusillus (see text for explanation)

	No. of females showing BPM	No. of females not showing BPM
Females with above average numbers of embryos for their size	25	21
Females with below average numbers of embryos for their size	18	19

Similar findings were obtained from an analysis of data from those animals collected in the field with well-developed embryos.

DISCUSSION

The finding that BPM in Trichoniscus pusillus collected in the field occurs at a level of 3.7% (range 0.8% to 5.3%) is in accord with results for other terrestrial isopods. However, because of the much smaller brood sizes in Trichoniscus pusillus, the effect of BPM on individual mothers is much more marked (an average 17.8% loss of embryos to those affected). The treatment of ovigerous females in incubators increases BPM to 11.1% (range 5.0% to 18.2%) with a 25.6% loss of embryos to those females affected. The percentage of females suffering some BPM rose from 18.4% in the field to 46.0%, providing convincing evidence that environmental factors can affect BPM. This is also suggested by the variability in the levels of BPM shown in the three field samples.

Perhaps more important is the fact that the animals used in the present study are parthenogenetic. Since all the embryos in a female's brood pouch are, therefore, almost certain to be genetically identical, we can look elsewhere for explanations of the variable viability shown within broods. Observations made by the author suggested that embryos were much more likely to show BPM at the anterior end of the brood pouch and this might repay further investigation.

ACKNOWLEDGEMENTS

This work was carried out during the tenure of a NERC studentship supervised by Dr. S.L. Sutton in the Department of Pure and Applied Zoology at Leeds University. I am grateful to him and also to Dr. R.I. Willows, who made helpful suggestions concerning the literature.

REFERENCES

- AL-DABBAGH, K.Y. & BLOCK, W. (1981). Population ecology of a terrestrial isopod in the Breckland grass heaths. J. Anim. Ecol., 50, 61-77.
- BRERETON, J.L.G. (1956). A study of some factors controlling the population of some terrestrial isopods. PhD Thesis, University of Oxford.
- DAVIS, R.C. (1978). Ecological studies of Isopoda and Diplopoda in dune grassland. PhD Thesis, University of Leeds.
- LAWLOR, L.R. (1976). Parental and offspring fitness in the terrestrial isopod Armadillidium vulgare (Latr.) (Crustacea: Oniscoidea). Evolution, 30, 775-785.
- PARIS, O.H. & PITELKA, F.A. (1962). Population characteristics of the terrestrial isopod Armadillidium vulgare in California grassland. Ecology, 43, 229-248.
- STANDEN, V. (nee Healey) (1963). Studies on the ecology of Trichoniscus pusillus pusillus Brandt, 1883. PhD Thesis, University of Manchester.
- STANDEN, V. (1973). The life cycle and annual production of Trichoniscus pusillus pusillus (Crustacea: Isopoda) in a Cheshire wood. Pedobiologia, 13, 273-291.
- SUNDERLAND, K.D., HASSALL, M. & SUTTON, S.L. (1976). The population dynamics of Philoscia muscorum (Crustacea: Oniscoidea) in limestone grassland. J. Anim. Ecol., 37, 425-444.

THE SPREAD OF THE TERRESTRIAL AMPHIPOD ARCITALITRUS DORRIENI
IN BRITAIN AND IRELAND : WATCH THIS NICHE!

PAUL T. HARDING

Biological Records Centre, NERC Institute of Terrestrial
Ecology, Monks Wood Experimental Station, Abbots Ripton,
Huntingdon PE17 2LS

and

STEPHEN L. SUTTON

Department of Pure & Applied Biology, University of Leeds,
Leeds LS2 9JT

INTRODUCTION

Terrestrial amphipods are distributed almost exclusively in the tropics and the southern hemisphere. One species Arcitalitrus dorrieni, was described as new to science from Britain (Hunt 1925), but has subsequently been found to be native to Australia (New South Wales and Southern Queensland) and to have been introduced to Norfolk Island, New Zealand and the British Isles (Friend & Richardson 1986). Detailed information on its biology and reproduction in Britain was given by Richardson (1980) and Moore & Spicer (1986).

ARCITALITRUS DORRIENI IN BRITAIN AND IRELAND

The occurrence of Arcitalitrus dorrieni in the British Isles was summarised by Richardson (1980), Welch (1981) and Moore & Spicer (1986). We have traced records from over 90 localities in Britain and Ireland, all of which are now held on computer file at the Biological Records Centre. A summary of the records are given in Fig. 1. Some localities have not been examined for many years (e.g. St. Agnes and Bryher in the Isles of Scilly, and Abbotsbury in Dorset). Several new localities have been found in recent years (e.g. in 1986 at Wimborne in Dorset and in 1987 at Ivybridge and Sharpitor in Devon).

Arcitalitrus dorrieni reproduces successfully in several parts of the British Isles and from information given in Moore & Spicer (1986) seems capable of movement of up to 30 to 40 metres per night. Despite these facts, most records have been of small isolated populations with evidence of only limited spread over several years. Many of the records have been from ornamental gardens and nurseries. Richardson (1980) suggested that some unknown climatic or biotic factors severely limit the distribution of Arcitalitrus dorrieni. For example, "innoculations" into new sites may be repeatedly reduced to low numbers by harsh winter weather so that further spread is slow.

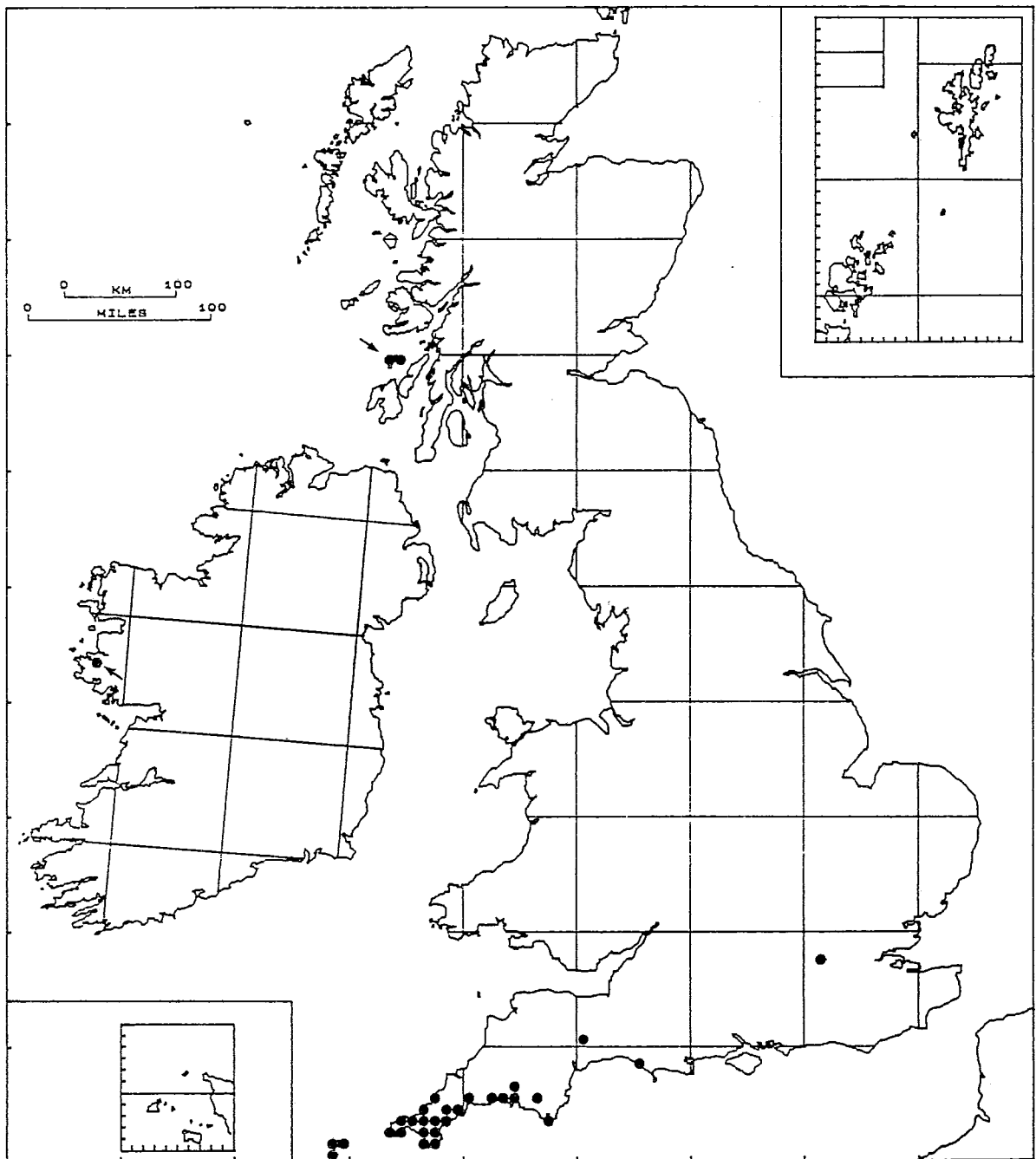
Prolonged frost has been suggested as a factor in limiting spread, but several of the long-established sites are known to have occasional severe winter conditions. A climatic factor, such as cold winter weather, would seem to be a plausible explanation of the very restricted, but long-persisting, occurrence in Ireland (see below). One of the largest populations so far observed is at Budshead Wood (see below) in Plymouth, an area which regularly experiences winter frosts and snow cover.

Arcitalitrus dorrieni has been known from Ireland for more than 50 years since it was discovered by Professor Orton in 1936 at Kylemore Lough, Co Galway (Rawlinson 1937). Nearby is the late 19th century Kylemore Abbey, the grounds of which include many acres of reclaimed bogland planted with shrubs. There seem to have been no subsequent records from this area until 1982 when Dr. J.P. O'Connor found it at the adjacent Pollacappul Lough. On 28 April 1987, Dr. D.C.F. Cotton found it in the same area. He described the site thus: "under a slab of stone beside a small stream just above the lime kiln, between Benbaun and Knockbrack mountains in the Connemara National Park (altitude c. 170 m)". Costello (1987) noted that it was abundant in this area in July 1987.

In Budshead Wood, a rather disturbed valley woodland in the suburbs of Plymouth, Arcitalitrus dorrieni is abundant. The woodland is a mixture of oak, ash, sycamore and hornbeam on shallow, acid to neutral clay soils over Devonian shales. The wood has, on its eastern boundary, a garden centre (Woodvale Nurseries) which has been operating since the early 1970's. The nursery obtains plant stock from many parts of Britain including the Truro area and the Isles of Scilly (both areas with long-standing colonies of Arcitalitrus dorrieni). The abundance of this species at Budshead Wood means that it must be taking a significant role in the consumption of leaf litter, a role normally associated with earthworms, woodlice and millipedes. It would be interesting to assess the effect of the introduction of this species on a natural population of detritivores.

CONCLUSIONS

Fig. 1 shows that Arcitalitrus dorrieni is widely spread in the west and south of Cornwall and along the southern coasts of Devon and Dorset. Further populations of this species almost certainly remain to be discovered within this range and possibly elsewhere (c.f. records from Colonsay, Galway and Kew Gardens). Any records of this species, or specimens for identification, should be sent to PTH at Monks Wood (address above).



Arcitalitrus dorrieni (Hunt)

Fig. 1 Recorded distribution of Arcitalitrus dorrieni in 10 km squares in Britain and Ireland to April 1988.

ACKNOWLEDGEMENTS

We are grateful to the following persons who supplied information on, or records of, Arcitalitrus dorrieni in the British Isles. A.D. Barber, Dr. D.C.F. Cotton, Dr. D. Morrill, Dr. J.P. O'Connor, Dr. A.M.M. Richardson, C.M. Sherriff and Mrs. S.M. Turk and the staff of the Cornish Biological Records Unit. We are also grateful to Dr. R.J. Lincoln and Ms. J.P. Ellis for allowing access to the collections of the British Museum (Natural History).

REFERENCES

- COSTELLO, M.J. (1987). Alien amphipod species in Ireland. Porcupine Newslett., 4, 3-7.
- FRIEND, J.A. & RICHARDSON, A.M.M. (1986). Biology of terrestrial amphipods. Ann. Rev. Entomol., 31, 25-48.
- HUNT, O.D. (1925). On the amphipod genus Talitrus with a description of a new species from the Scilly Isles, T. dorrieni n. sp. J. mar. biol. Ass. U.K., 13, 854-869.
- MOORE, P.G. & SPICER, J.I. (1986). On the status of Arcitalitrus dorrieni (Crustacea : Amphipoda) on the island of Colonsay, Inner Hebrides. J. nat. Hist., 20, 667-680.
- RICHARDSON, A.M.M. (1980). Notes on the occurrence of Talitrus dorrieni Hunt (Crustacea Amphipoda: Talitridae) in south-west England. J. nat. Hist., 14, 751-757.
- WELCH, R.C. (1981). Talitroides dorrieni (Hunt) (Crustacea; Amphipoda) in the Royal Botanic Gardens, Kew, Surrey. Lond. Nat., 60, 43-44.

NEW SITES FOR TRACHELIPUS RATHKEI IN ENGLAND

P.F. WHITEHEAD

Moor Leys, Little Comberton, Pershore, Worcs. WR10 3EP

INTRODUCTION

The mapped distribution of Trachelipus rathkei, centered as it is on Northamptonshire and Huntingdonshire with a southern extension through to the Home Counties into Kent has, in the past, been difficult to explain (Harding & Sutton 1985). In this paper, new sites are described from which Trachelipus rathkei has been collected since the publication of the distribution map in Hopkin (1987). In addition to my own recent records, the map (Fig. 1) includes all records for Trachelipus rathkei submitted to the Isopod Survey Scheme up to April 1988.

NEW SITES

In these descriptions, various species of invertebrates other than Trachelipus rathkei are listed. They are used to provide "ecological hallmarks" for the habitat of the isopod in the same way as vegetation is used. The lists are not exhaustive. The invertebrate fauna from the Bredon's Hardwick site is important and extensive. The fauna from the Broadway site includes a number of localised taxa.

Bishop's Cleeve (16.5.86; 32/993267; Alt. 42m)

Trachelipus rathkei occurs under stones and in deep fissures on a 15 metre northeast-facing bank of unvegetated tipped clay and rubble resting on heavy wet pasture with Juncus. The slope provides a mosaic of habitats and the fauna includes species of open ground (Calathus fuscipes (Goeze), Harpalus affinis (Sk.), Xantholinus glabratus (Grav.) - all beetles), wetter conditions (Stenolophus mixtus (Hbst.), Stenus fulvicornis (Ste.) and very large numbers of smooth newts (Triturus vulgaris (L.)). The beetle Leistus spinibarbis (Fab.) is also present together with the molluscs Milax budapestensis (Hazay) and Boettgerilla pallens (Simroth) which benefit from human activity. Isopods associated with Trachelipus rathkei were Platyarthrus hoffmannseggii with the ant Lasius niger, Oniscus asellus and Armadillidium vulgare.

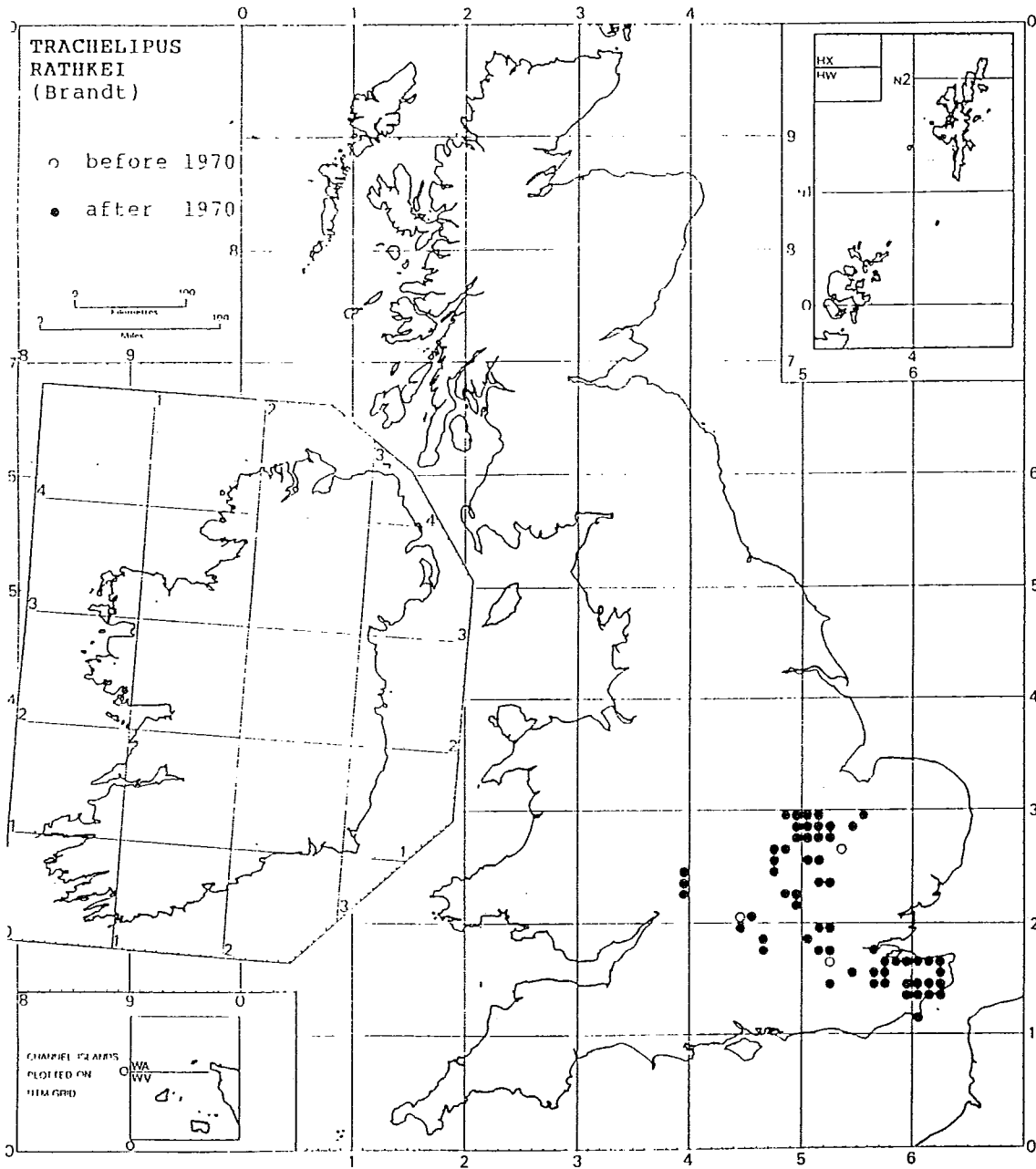


Fig. 1 : Trachelipus rathkei. Recorded occurrence in Britain in 10 km squares up to April 1988.

Stanway (25.5.87; 42/060328; Alt. 106 m)

Trachelipus rathkei occurs under bark debris beneath mature standard oaks (Quercus robur) on heavy pasture. The somewhat limited invertebrate fauna is essentially eurytopic but includes the opilionid Nelima gothica (Simon). Isopods present were Philoscia muscorum, Porcellio scaber, Androniscus dentiger and Trichoniscus pusillus.

Bredon's Hardwick (15.3.87; 32/903355; Alt. 10 m)

Trachelipus rathkei occurs on heavy flood plain pasture subject to annual inundation, grazed by sheep and Bewick's Swans. It was located amongst drifted timber. Characteristic associated hygrophilous beetles included Agonum albipes (Fab.), Agonum obscurum (Hbst.), Badister unipustulatus (Bonelli), Metabletus obscuroguttatus (Dufts.), Stenus bimaculatus (Gyll.), Stenus canaliculatus (Gyll.) and Stenus guttulata (Müller). Also present were the millipede Enantiulus armatus (Ribaut), the opilionid Rilaena triangularis (Hbst.), and a jet-black form nigrum of the slug Deroceras reticulatum (Müller) known locally from other wet sites. Associated isopods were Oniscus asellus (including a rare bright orange form) and Trichoniscus pusillus.

Birlingham (26.3.87; 32/942419; Alt. 11 m)

Trachelipus rathkei occurs rarely at flood level drift on heavy wet short-grazed pasture. It is associated with a characteristic assemblage of beetles Bembidion dentellum (Th.), Bembidion guttulata (Fab.), Bembidion harpaloides (Serville), Agonum albipes, Agonum obscurum, Pterostichus macer (Msh.), Pterostichus strenuus (Panzer), Pterostichus nigrita (Payk.), Stenus bimaculatus, Stenus latifrons (Er.), Stenus providus (Er.) and the heteropteran Scolopostehthus thomsoni (Reuter). The isopods Oniscus asellus, Trichoniscus pusillus were also present. On the river-side bluff, a distinct form of Oniscus asellus also occurs which is very similar to Trachelipus rathkei both in dorsal pattern and shape.

A further site for Trachelipus rathkei has also been found at Birlingham at 32/945423 (12.7.87) on Lower Lias clay exposed by the side of Berwick Brook and recent recording (to April 1988) has shown the species to be generally distributed from Tewkesbury to Great Comberton on the topographical flood plain. The distinct form of Oniscus asellus bearing a strong resemblance to Trachelipus rathkei, has also been found on the clay shore of a man-made lake at Pinvin (32/947485; 6.8.87).

Broadway (1.6.87; 42/087379; Alt. 74 m)

Trachelipus rathkei occurs on wet or seasonally-inundated rough rabbit-grazed grassland otherwise with tall herbs. The collembolan Isotomurus palustris (Müller) occurs frequently, and

molluscs include the amphibious Lymnaea truncatula (Müller) with Cochlicopa lubrica (Müller) and Vitrea crystallina (Müller). Beetles include the wet-loving Bembidion assimile (Gyll.), Bembidion biguttatum (Fab.), Philonthus quisquiliarius (Gyll.), Agonum obscurum, Badister unipustulatus, Agonum fuliginosum (Panzer), Ochthebius minimus (Fab.) and Cercyon marinus (Th.) with Atheta graminicola (Grav.) and Atheta aquatica (Th.). The heteropteran Scolopostethus thomsoni occurs with a ground-hopper Tetrix subulata (L.). Associated isopods were Platyarthrus hoffmannseggi with the ant Myrmica rubra, Philoscia muscorum, Oniscus asellus, Porcellio scaber, Androniscus dentiger, Trichoniscus pusillus, and Armadillidium vulgare in drier microhabitats.

Beckford (1.8.87; 32/977361; Alt. 40 m)

At this site, Trachelipus rathkei was found amongst humanly transported material on exposed impervious clay sediment deposited during the last glacial period.

DISCUSSION

It is clear that at these new sites, Trachelipus rathkei is acting as a hygrophile. The number of sites is small and it is virtually certain that the species is present more widely in the southwest Midlands. At the Broadway site it is, however, a new colonist and there is an indication that the species is spreading locally. It is clear that, in these cases, and regardless of altitude, the species is tied closely to the geological formation of Jurassic Lower Lias Clay, and it may well be a true calciphile. Such an interpretation clearly rationalises its known distribution which, broadly following the Jurassic scarp, makes south-western and north-eastern range extensions predictable.

ACKNOWLEDGEMENTS

I am grateful to Mr. T. Eccles and Professor J.A. Owen for helpful advice with regard to Atheta spp. and to Dr. P.D. Hillyard for authenticating Nelima gothica.

REFERENCES

- HARDING, P.T. & SUTTON, S.L. (1985). Woodlice in Britain and Ireland : Distribution and Habitat. Abbots Ripton, Institute of Terrestrial Ecology.
- HOPKIN, S.P. (1987). Biogeography of woodlice in Britain and Ireland. Isopoda, 1, 21-36.

TRACHELIPUS RATHKEI IN NORTH AMERICA

WILLIAM F. RAPP
430 Ivy Avenue, Crete, Nebraska 68333, U.S.A.

INTRODUCTION

This paper is based primarily upon field work done by the author in United States and Canada during the last 20 years. Vandel (1962) stated that Trachelipus rathkei (Brandt) is widely distributed in the holarctic faunal region. However, based upon this statement, we can not assume that this species can be found in all the ecological regions which comprise the Holarctic Realm. When one compares the distribution in England (Harding & Sutton 1985; Hopkin 1987; Whitehead 1988) to North America, one finds major differences.

NORTH AMERICA

In North America, Trachelipus rathkei (often referred to as Tracheoniscus, but see discussion of priority of Trachelipus in Vandel, 1962) is widely distributed east of the grassland biome in eastern deciduous woodlands, but has not been found in the southeast (Carolinas, Georgia, Florida). It is found west of the grassland biome where it is limited to the wooded floodplains along major streams. To the north it is common in the oak woodland of southern Canada. In the interior United States, Trachelipus rathkei has been taken as far south as Louisiana. It also occurs in the Pacific Northwest.

Hatch (1947) stated that Trachelipus rathkei is the "commonest oniscoid in north-eastern North America". Hatchett (1947) described it as the "predominant terrestrial isopod in the lower peninsula of Michigan" and Eberly (1954) said that Trachelipus rathkei was "perhaps the commonest isopod of Indiana". However, the above statements must be considered to be very general as specimens can not be collected in every 10 km square!.

Fieldwork carried out by the author in Nebraska, Iowa, Illinois and Ontario, suggests that Trachelipus rathkei is a deciduous woodland species. However, it does not appear to be specific to any ecological niche within the woodland. Although Nebraska, Iowa and Illinois are considered to be in the grassland biome of North America, there are sufficient woodlands along the streams to support large populations of Trachelipus rathkei. However, it can not exist in the true grassland or prairie areas. In southern Ontario, Canada, where I have collected Trachelipus rathkei, it is common in the oak woodlands, but is not found in the coniferous areas. Yet, when logging has removed the coniferous trees and deciduous trees are

allowed to repopulate the cut-over areas, Trachelipus rathkei moves rapidly in to the area.

ECOLOGICAL FACTORS

There appear to be three ecological factors which control the distribution of Trachelipus rathkei in North America, temperature, moisture and soil type.

Temperature

It is questionable whether high and low temperatures (Table 1) have any major effect on Trachelipus rathkei although extreme minima may reduce the overwintering populations. Likewise, extreme high temperatures, together with a lack of moisture, may have an effect on the breeding population. What may be more important are the mean January and July temperatures. It should be noted that the Pacific NorthWest (Washington) population, which is isolated from the main North American population by the Rocky Mountains, lives under a different temperature regime compared to the populations east of the Great Plains.

Table 1 : Extreme maximum (Max) and minimum (Min) and mean January and July temperatures (degrees Celsius), and mean annual rainfall (R, cm) recorded from 1900 to 1940 in areas in which Trachelipus rathkei is found (from Hambridge 1941).

<u>Station</u>	<u>Max</u>	<u>Min</u>	<u>Jan</u>	<u>July</u>	<u>R</u>
Nebraska, Saline Co., Crete	42	-32	-4	26	67
Vermont, Caledonia Co., St. Johnsbury	38	-43	-14	28	83
Michigan, Iron Co., Stambaugh	40	-47	-11	28	100
Louisiana, Natchitoches Parish, Robeline	43	-20	10	28	120
Washington, King Co., Seattle	39	-15	4	18	80

Moisture

From the rainfall information in Table 1, it can be observed that Trachelipus rathkei has its largest population in areas which receive a fair amount of moisture. Field observations in eastern Nebraska have shown that during periods of drought, Trachelipus rathkei are very difficult to find. However, within 24 hours following rain, they are back in their normal habitats. McQueen (1976), working in southern Ontario,

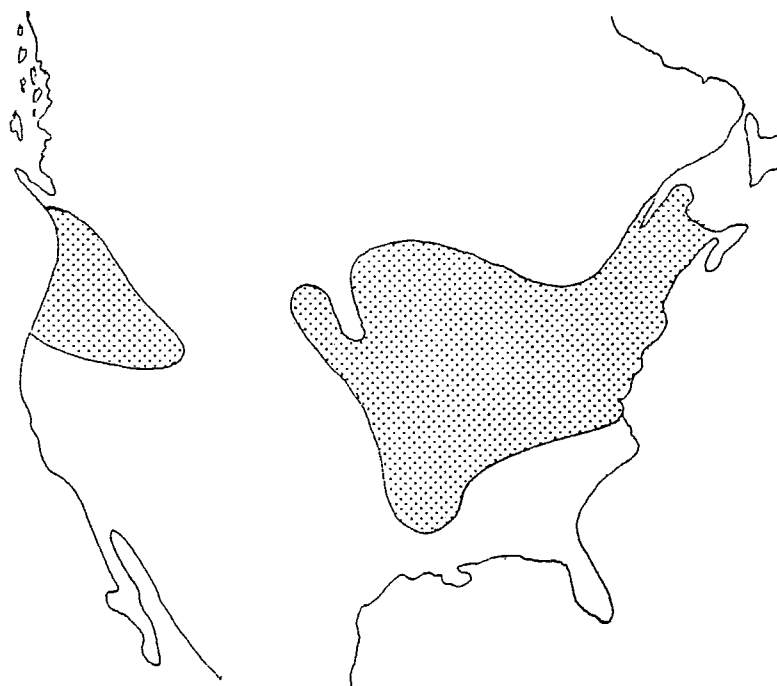


Fig. 1 : Distribution of Trachelipus rathkei in North America

found that Trachelipus rathkei required near 100% relative humidity and that if this condition was not met, mortality would occur. However, McQueen (1976) in his field work, used artificial field sites in which 30 cm x 30 cm boards were used as a surface ground cover. It is difficult to compare this habitat with the humus layer one finds in a typical deciduous forest.

Soil type

For the purpose of this discussion, we will include humus. There are a number of soil types where Trachelipus rathkei can not be found. For example, they are not found in acid soils such as one finds in coniferous woodlands. In areas with soils having a high clay content or sand content, one seldom finds this species. Humus appears to play a major role in the development of isopod populations. Different types of humus support different sized populations. For example, Oak (Quercus sp.) - Hickory (Carya) forests with up to 5 cm of humus support large populations of Trachelipus rathkei. Large populations are also found in beech (Fagus) - Maple (Acer) forests which have thick humus layers. On the other hand, under trees such as Willows (Salix) and Cottonwoods (Populus) which tend to grow on sandy soils where little or no humus develops, isopods are not found.

White (1968) studied the effect of Trachelipus rathkei on humus composition in a deciduous woodland in east-central Illinois. This woodland contained five major species of trees which were the important contributors to humus formation. These trees were Sugar Maple (Acer saccharum), Hackberry (Celtis occidentalis), Red Oak (Quercus rubra), and Bur Oak (Quercus macracarpa). Pawpaw (Asimina tribola) was predominant in the relatively dense understory in White's study. Based upon laboratory feeding tests, he concluded that Pawpaw leaves were the preferred food source. However, he states: "It should not be inferred that in nature woodlice seek Pawpaw (leaves) to the exclusion of other kinds, for these animals are omnivorous". This statement is very important because although Pawpaw is widely distributed in eastern United States, it is not abundant in many areas. Actually, Pawpaw distribution occupies only a small area of the total Trachelipus rathkei distribution.

ECOLOGICAL NICHES

If one is in a deciduous woodland, where does one find Trachelipus rathkei? Usually large aggregations can be found under partly rotten logs, under loose bark on dead trees, or under rocks. They prefer a moist area sheltered from the direct sun. As a rule, they seem to prefer woodlands where there is a good forest canopy which keeps the humus from drying. During the summer of 1987, the author collected a series of one square metre Oak humus samples from a large woodland near Garland, Seward County, Nebraska. These were extracted with a Tullgren

funnel and six of the samples contained immature specimens of Trachelipus rathkei. The mean density was 6.7 per square metre (variance = 4). This translates to a theoretical population of 66,000 per hectare.

DISCUSSION

In North America, Trachelipus rathkei is a deciduous woodland species. Vandell (1962) and Harding & Sutton (1985) state that this species is found in grasslands, wetlands and agricultural areas in England and Europe. This raises the question, are we dealing with sibling species? (Mayr 1942). There is no question that European and North American specimens are allopatric forms which are morphologically very similar. Perhaps by using biochemical techniques such as serology or paper chromatography, a physiological difference between the two populations can be established.

REFERENCES

- EBERLY, W.R. (1954). The terrestrial isopods (Oniscoidea) of Indiana. Proc. Indiana Acad. Sci., 63, 272-277.
- HAMBRIDGE, G. (1941). Climate and Man. Yearbook of agriculture, U.S. Department of Agriculture, Washington, D.C.
- HARDING, P.T. & SUTTON, S.L. (1985). Woodlice in Britain and Ireland : Distribution and Habitat. Abbots Ripton, Institute of Terrestrial Ecology.
- HATCH, M.H. (1947). The Chelifera and isopods of Washington and adjacent regions. University of Washington Publications in Biology, 10, 155-274.
- HATCHETT, S.P. (1947). Biology of the Isopoda of Michigan. Ecol. Monogr., 17, 46-79.
- HOPKIN, S.P. (1987). Biogeography of woodlice in Britain and Ireland. Isopoda, 1, 21-36.
- MAYR, E. (1942). Systematics and Origin of Species. New York, Columbia University Press.
- MCQUEEN, D.G. (1976). The influence of climatic factors on the demography of the terrestrial isopod Tracheoniscus rathkei Brandt. Can. J. Zool., 54, 2185-2199.
- VANDEL, A. (1962). Isopodes Terrestres (Deuxieme Partie). (Faune de France no. 66). Paris: Lechevalier.
- WHITE, J.J. (1968). Bioenergetics of the woodlouse Tracheoniscus rathkei Brandt in relation to litter decomposition in a deciduous forest. Ecology, 49, 694-703.
- WHITEHEAD, P.F. (1988). New records for Trachelipus rathkei in England. Isopoda, 2, 11-14.

WOODLICE IN THE CULTURAL CONSCIOUSNESS OF MODERN EUROPE

A.O. CHATER

6 Charmouth Court, Kings Road, Richmond, Surrey, TW10 6EW

INTRODUCTION

Zoologists studying elephants, fleas or scorpions have some idea of how the non-scientific public view the creatures they work on, but I suspect that those working on woodlice have no very clear impression of the common attitude to these animals. In the present climate of political opinion, scientific research needs to be seen to be relevant to the immediate needs of society, and thus to be able to hold its own in the market place, and scientists must continually place their work in the wider human context. The present brief exercise in 'cloportisme' (see below) seeks to improve the image of oniscologists by reviewing the ways in which the creative minds of modern European civilisation have treated woodlice in their works.

To set what follows in a historical context, it should be explained that ancient interest in woodlice, as in most groups of invertebrates, was primarily medicinal. One of the best and certainly the most attractive of the sources is Philipp Fraundorffer, Oniscographia Curiosa (1700), a very rare small octavo book of 132 pages with an engraved frontispiece (probably by J.C. Laidig) showing about 18 woodlice on an old wall. It quotes from 99 earlier authors, ancient and modern, and gives an immense range of medicinal uses and other information. A copy is in the Banks collection in the British Library.

Woodlice are little-used medicinally now, but they are, and have been for at least a century, used gastronomically. Vincent M. Holt, Why Not Eat Insects? (1885, but reprinted in 1967 by E.W. Classey Ltd.) gives a recipe for woodlouse sauce and has a menu starting with "Snail Soup, Fried Soles with Woodlouse Sauce, Curried Cockchafters" and ending with "Moths on Toast". A Larousse Gastronomique of c. 1960-1970 gives a very similar recipe for "Sauce aux Cloportes", also used with fish. Much has been published on the etymology of the various names for woodlice in European languages, as well as on the rich variety of local names. "Cloporte", the standard French word for woodlouse, is in particular of much-debated etymology.

Medicinal uses, gastronomy, etymology and various other topics such as woodlice in advertisements and in the newspapers, as well as references to woodlice in other parts of the world (a print Shubi no Matsu Pine Forest, by the Japanese artist Utagawa Kuniyoshi, has a prominent Ligia on a rock in the foreground), are outside the scope of the present paper, but extensive study of them would throw considerable further light on the nature of human attitudes towards woodlice. What follows here is an

extensive revision of an article originally privately circulated in 1983. The examples and discussions are arranged under a series of conceptual headings in an attempt to bring order to this hitherto little-regarded and sparsely distributed series of occurrences.

THE WOODLOUSE USED TO EVOKE ATMOSPHERE

Many writers assume that their readers will know that woodlice are found in damp, dark, decaying and deserted and depressing situations and accordingly use them to enhance their descriptions. The Russian novelist Andrei Bely (1880-1934) in his novel Petersburg (1916) uses woodlice on several occasions to indicate the squalid nature of the garret lodgings of one of his characters, the university student Alexander Ivanovich Dudkin. The floor is strewn with earth for better insulation and he watches woodlice ("sow bugs" in the translation by R.A. Maguire and J.E. Malmstad, 1983, pp. 63, 170 and 210) crawl across damp patches on the wallpaper and clearly thinks of them as no more than an inevitable part of his surroundings (a more pointed but superficially similar Russian reference, from Maxim Gorky, is given later in this paper).

Ruth Rendell (b. 1930) in her crime novel No More Dying Then (1971) has, at the end of chapter 7, Chief Inspector Wexford searching for a child victim's body in the fountain cistern of a country house. The first cistern he raised the slab of was "...quite empty. Dry, he thought, for half a century. Not even a spider or a woodlouse had penetrated its stone fastness".

Adrian Mitchell (b. 1932) in his poem The Beggar (1954) writes:

One wooden leg and one bad eye.
Then I danced, but now I flick
The woodlouse from my shaggy thigh.

John Cowper Powys (1872-1963) in his enormous historical novel of Dark Age Wales, Porius (1951), chapter 3, The Stranger, has one of his characters, Rhun, in a dark, misty wood "occupied in flicking into the leaves no less than three small creatures, namely a centipede, a woodlouse and a dazed semi-hibernating moth". Thomas Hood (1799-1845) in his long poem, The Haunted House (first published in Hood's Monthly Magazine, January 1844), tells no story but builds up a prolonged and deliberately partly absurd evocation of an old, deserted mansion. Stanza 16 of Part 2 reads:

The woodlouse dropped and rolled into a ball,
Touch'd by some impulse occult or mechanic;
And nameless beetles ran along the wall
In universal panic.

Alan Brownjohn (b. 1931) in a children's poem Woodlouse, in

Brownjohn's Beasts (1970), has his creatures in exactly the same situation:

I hear a key rattling in a lock.
So I, a woodlouse living in a huge empty mansion up
For sale for twenty thousand pounds, have a job to do!

I have to sprint along the wainscot with a message
for all my companions, if I hear someone opening
the great front door. I have to shout:

'Vanish! - scatter! - roll up into little balls, men!
- find yourselves other lumps of rotting wood.
Someone seems to be thinking of buying this place!'

The accompanying illustration by Carol Lawson (Fig. 1B) shows the scene, the participants being unmistakably, though improbably for this indoor habitat, a species of Armadillidium.

Gustave Flaubert (1821-1880), as will appear in a later section, must be considered the presiding genius of woodlice in literature. Here, though, we can quote him from Madame Bovary (1857). In Part 1, chapter 9, Emma Bovary, married to the dull country doctor, desperately bored and indulging in romantic dreams, is described as going out into the garden on fine days, when the dew is on the cabbages: "No birds could be heard, everything seemed asleep, the straw-covered espalier and the grape-vine like a great sick serpent under the coping of the wall, where one saw, as one approached, many-legged woodlice crawling" ("se trainer des cloportes à pattes nombreuses"). We may question Flaubert's famous powers of observation here, for we would not expect the woodlice to be out in daylight, but as he mentions that the vine is under a coping, and that there is dew, he may be justified. The atmosphere evoked, however, is not just incidental to this particular scene, but is clearly intended to suffuse the whole novel. Edmond de Goncourt in his Journal for 17 March 1861 reports Flaubert as saying that "in Madame Bovary I have had just the idea of expressing a tone, this colouration of mustiness of the state of being of woodlice" ("je n'ai eu que l'idée de rendre un ton, cette couleur de moisissure de l'existence des cloportes.").

Jean-Paul Sartre (1905-1980), himself obsessed by Flaubert in his later years, will also appear again, but uses "cloporte" in a vivid colloquialism in his play Huis Clos (1944), about three characters tormenting each other in Hell. Garcin asks if the two women mind him taking off his coat. Estelle asks him not to, as she loathes men in shirt-sleeves. Garcin puts on his coat again and says: "All right. (A short pause.) Myself, I used to spend my nights in the newspaper editorial offices. It was always woodlouse-hot. (A pause. In the same tone as before.) It is woodlouse hot. It's night now." ("Il y faisait toujours une chaleur de cloporte.... Il y fait une chaleur de cloporte...."). There is no equivalent in English, and in his translation Stuart Gilbert (1946) understandably circumlocutes the woodlice, in two

Bite, frost bite! You roll up a... way from the

p *leggiero*

light The blue wood-louse, And the

plump dor-mouse And the bees are

Fig. 1A : From Alfred Tennyson and Arthur Sullivan, The Window, 1897 (see p. 28).

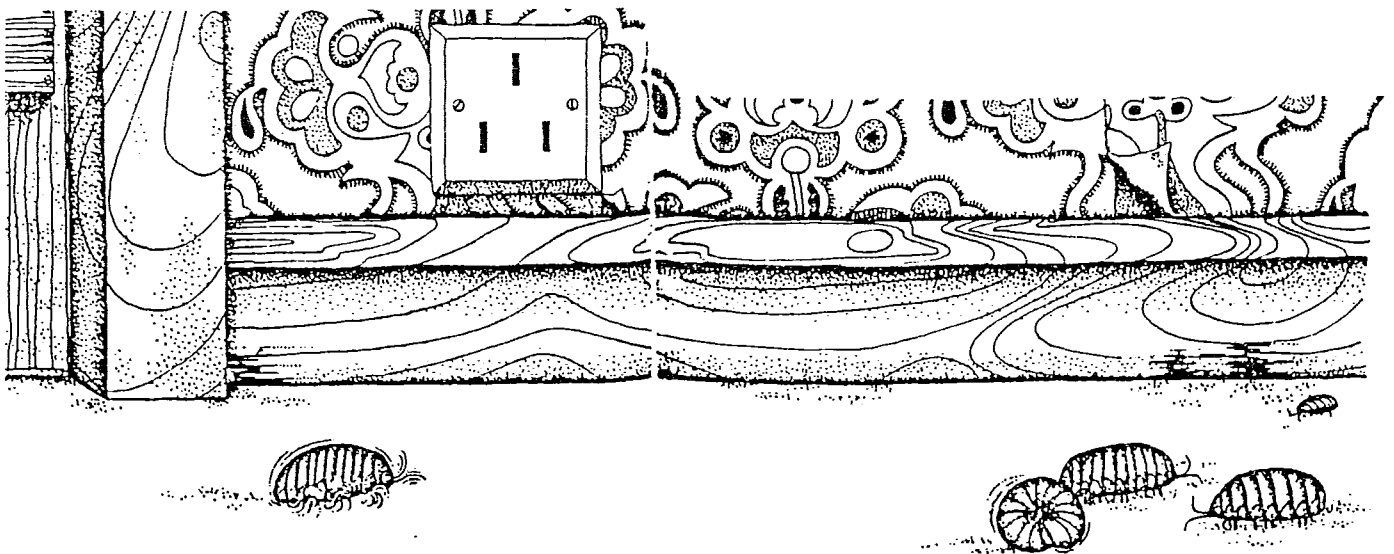


Fig. 1B : Detail of an illustration by Carol Lawson from Alan Brownjohn, Brownjohn's Beasts, Macmillan, 1970. Reproduced by permission of the author (see p. 23).

different ways; "It was a regular Black Hole....stifling, that it is."

The use of woodlice by Thomas Mann (1875-1955) reveals a curious crux. In Der Junge Joseph (1934), the second part of Joseph und seine Brüder, Mann's immense elaboration of the Joseph story from the book of Genesis, the hero is thrown into the pit, a disused well, by his jealous brothers and lands (in H.T. Lowe-Porter's translation (1954), Part 5, Chapter 5) "among the rubbish at the bottom, to the discomfiture of all sorts of beetles, wood-lice and other crawling things" ("...zum Schrecken von allerhand Käfern, Rasseln und Kellergewürm"). "Rasseln" means "rattles" or "rattlings" and must be an error, as, between two words for animals, it is quite out of place. Clearly Mann intended "Asseln", the standard German word for woodlice. "Kellergewürm" is a neologism, meaning, literally, cellar-vermin or cellar creepy-crawlies; the most similar existing German word is "Kellerwurm" which is another word for woodlouse. Although Mann failed to say woodlice, it is quite clear that woodlice were in his mind when he wrote the episode. Mrs Lowe-Porter, not for the only time, has clarified the original.

For a structural as well as an evocative use of woodlice in the novel we turn to William Golding (b. 1911). In chapter 2 of Lord of the Flies (1954) the stranded boys start making their first bonfire in the hope of attracting attention: "Trees, forced by the damp heat, found too little soil for full growth, fell early and decayed Most of the wood was so rotten that when they pulled it broke up into a shower of fragments and woodlice and decay" Much later, in chapter 6, the twins, Eric and Sam, are squatting by their small fire of brushwood and leaves: "Eric watched the scurrying wood-lice that were so frantically unable to avoid the flames, and thought of the first fire - just down there, on the steeper side of the mountains, where now was complete darkness. He did not like to remember it, and looked away at the mountain top." Golding is here using the woodlice as a miniature Leitmotiv, connecting back to the earlier episode (like, for example, the wasp used in a similar way by E.M. Forster in A Passage to India (1924)).

THE WOODLOUSE AND NOSTALGIA

One of the most vivid invocations of the woodlouse is in the long autobiographical poem, Summoned by Bells (1960) by John Betjeman (1906-1984). In chapter 1, he remembers his childhood at 31 West Hill, Highgate, in North London:

Sometimes, thank God, they left me all alone
In our small patch of garden in the front,
With clinker rockery and London Pride
And barren lawn and lumps of yellow clay
As mouldable as smelly Plasticene.
I used to turn the heavy stones to watch
The shiny red and waiting centipede

Which darted out of sight; the woodlouse slow
And flat; the other greyish-blue kind
Which rolled into a ball till I was gone
Out of the gate to venture down the hill.

The synopsis at the head of the chapter mentions "centipedes and glomeridae", but is surely in error with the latter, as "greyish-blue" must refer to Armadillidium and not Glomeris. No other writer discussed here mentions more than one kind of woodlouse, but Betjeman mentions three. In another poem, Greenaway, published in A Few Late Chrysanthemums (1954) and reprinted in Collected Poems (1958), he places Ligia oceanica ecologically at exactly the right zone of the shore, setting the scene in a comfortable recollection of the path down to the shingle beach, before the nightmare that ends the poem:

I know so well this turfy mile,
These clumps of sea-pink withered brown,
The breezy cliff, the awkward stile,
The sandy path that takes me down.

To cracking layers of broken slate
Where black and flat sea-woodlice crawl
And isolated rock pools wait
Wash from the highest tides of all.

In Der Zyklon (1913), one of a number of short stories by Hermann Hesse (1877-1962) that are at least partially autobiographical in inspiration, the hero in an early paragraph describes how he decides to go fishing. There is throughout a general mood of ennui and frustration and a strong impression of nostalgia. In Ralph Manheim's translation (1974): "In the hope of finding worms, I eagerly rolled a few stones away from the border of the path, but instead of worms swarms of gray, dry woodlice came scurrying out and fled frantically in all directions" ("... es krochen nur Scharen von grauen, trockenen Mauerasseln hervor und flüchteten verstört nach allen Seiten"). The memory is curiously reminiscent of Betjeman's though the latter's woodlice differed (and are indeed unusual in literature) in being slow. Perhaps even as a child Betjeman was a notably unalarming person.

THE WOODLOUSE IN SIMILE

The same image as Hesse's is used by Iris Murdoch (b. 1919) in her first novel Under the Net (1954): "all about us, like a nest of disquieted woodlice, policemen were crawling from underneath pieces of boarding". A completely different simile appeared in the Sunday Times of 14th December 1958 in a review by Cyril Connolly (1903-1974) of A History of Orgies by Burgo Partridge. Complaining that the author relies too much on second-hand authorities, Connolly says: "But if only he had visited a few Saturnalia, if he had seen the drunken couples in bedraggled fancy dress curled up like woodlice in the shadows

of their pleasure-domes".

The satirist and dramatist, Georges Courteline (1858-1929) has, in Les Linottes (1912), a quite repulsive simile: "The fag-ends of cigarettes, spat out at random, bizarrely and leprously spattered the walls with an invasion of huge, motionless woodlice" ("....d'énormes cloportes immobiles"). Very different again is a simile used by T.F. Powys (1875-1953) (the reclusive genius and brother of J.C. Powys) in chapter 20 of Mr Weston's Good Wine (1927). Mr. Vosper is speaking to Mr. Weston about his wife, whose vicarious interest in the love affairs of the younger villagers of Folly Down is one of the chief elements in the allegory: "She be only interested in what all maids do like to do since world first rolled into a ball like a pig's louse."

THE WOODLOUSE IN WHIMSY AND CONCEIT

T.F. Powys's view of Armadillidium is certainly various and gets a rather disconcerting expression in chapter 20 of another of his novels, Unclay (1931). He describes a summer evening in the village of Dodder, with much emphasis on mortality, including the following: "The tiny pigs-louse that lived in the grass upon Madder Hill ate its prey. Then it rolled up into a ball to sleep near an anthill, and was eaten itself."

Lost Love, an early poem by Robert Graves (1895-1985), reprinted in Collected Poems (1948), begins: "His eyes are quickened so with grief, / He can watch a grass or leaf / Every instant grow". He later embroiders the conceit:

Across two counties he can hear
And catch your words before you speak.
The woodlouse or the maggot's weak
Clamour rings in his sad ear,
And noise so slight it would surpass
Credence - drinking sound of grass,
Worm talk, clashing jaws of moth
Chumbling holes in cloth

He is unlikely to have known then (even if he later discovered it in his long residence in Majorca) that Armadillo officinalis, a Mediterranean woodlouse, when rolled up, emits (according to Verhoeff (1908) and Vandel (1962)) a clearly audible rasping sound, produced by movements of the fourth and fifth pereopods rubbing together the scales around the base of these appendages. Verhoeff (1908, pp. 381-383) gives a vivid account of how he first heard these sounds and discovered their origin.

THE WOODLOUSE FOR ITS OWN SAKE (DIE ASSEL AN SICH)

Few, it seems, have had the impulse to present a woodlouse for its own sake as a decorative object or as a satisfactory

creature in its own right; all too often it is loaded with significance. Stephen Sutton in his Woodlice (1972) has pointed out that the Flemish painter Jan van Kessel (1626-1679) depicted woodlice. A small still-life in oil on copper (9 x 13 cm) by him (Fig. 2A) is in the Ashmolean Museum, Oxford, and is illustrated as no. 40 in the Museum's Catalogue of the Collection of Dutch and Flemish Still-Life Pictures bequeathed by Daisy Linda Ward (1950) and on Plate 58b in Ralph Warner, Dutch and Flemish Flower and Fruit Painters of the XVIIth and XVIIIth Centuries (1978). It shows, at about natural size, various insects and four woodlice, one of which is clearly an Armadillidium and another probably a Philoscia. Van Kessel produced numerous paintings of this kind and others may well be found to contain woodlice (one, 11 x 15.5 cm, no. A493, rather inadequately reproduced on p. 314 of P.J.J. van Thiel et al., All the Paintings of the Rijksmuseum in Amsterdam (1976), seems to show a woodlouse).

In literature, Tennyson (1809-1892) seems unique in using the woodlouse as an image of contentment in adversity, even allying it with the dormouse - and one could not go further than this in recommending the woodlouse to the English reader. In The Window, a cycle of 12 short lyrics he wrote in 1866 for Sullivan to set to music, the fourth poem, Winter, begins:

Bite, frost, bite!
You roll up away from the light
The blue wood-louse, and the plump dormouse,
And the bees are still'd, and the flies are kill'd,
And you bite far into the heart of the house,
But not into mine.

The setting of these words to music, by Arthur Sullivan (1842-1900), in the song cycle of the same title published in 1871, is the only appearance of the woodlouse in music that I am aware of (Fig. 1A).

Penelope Lively (b. 1933) at the end of her novel Next to Nature, Art (1982), has Jason, the rather pointedly detached child of one of the organisers of the Framleigh Creative Studies Centre, declining to join his friend Kevin in going home, and absorbing himself inscrutably in his own affairs. "Jason shakes his head. He has decided, suddenly, to catch some of the wood-lice that live under the stones on the terrace and put them in the lily-pond and see if wood-lice can swim. Kevin goes. Jason squats, turning stones over". Perhaps there is a suggestion here that woodlice are private, helpless and far from the normal concerns of adult, fallible mankind, but there are clearly no overtones of disapproval or invocation of uncongenial atmosphere and such a reference would, as we shall see, be unthinkable in a French novel.

Penelope Lively furthermore has a young woodlouse, Nat, as hero in three of the episodes in her children's book A House Inside Out (1987), concerning the secret lives of various

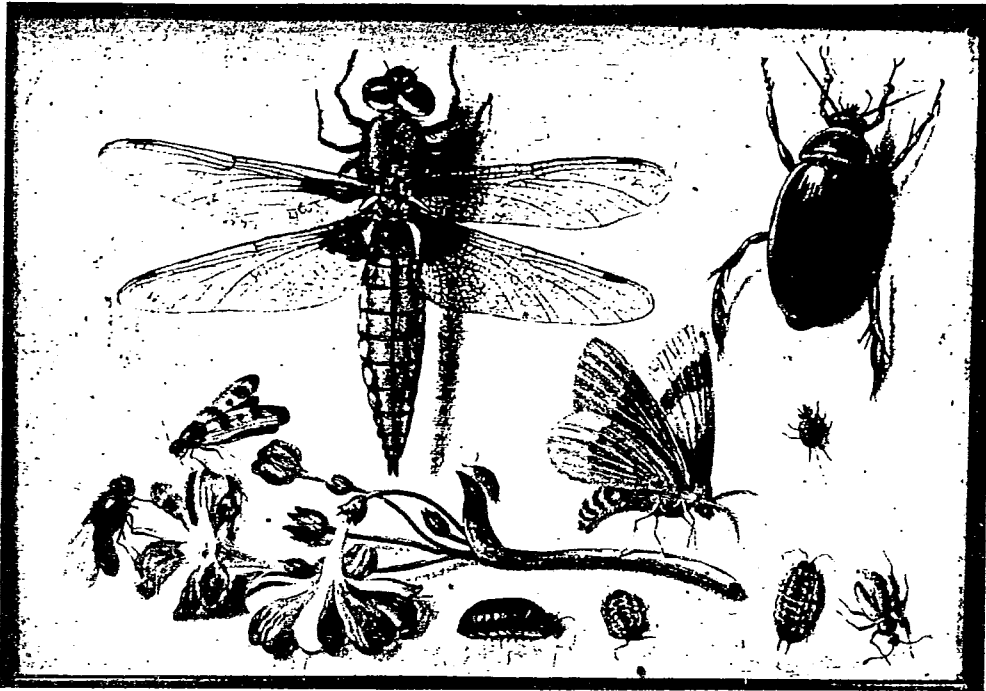


Fig. 2A : Jan van Kessel, Still Life. Reproduced by permission of the Ashmolean Museum, Oxford (see p. 28).

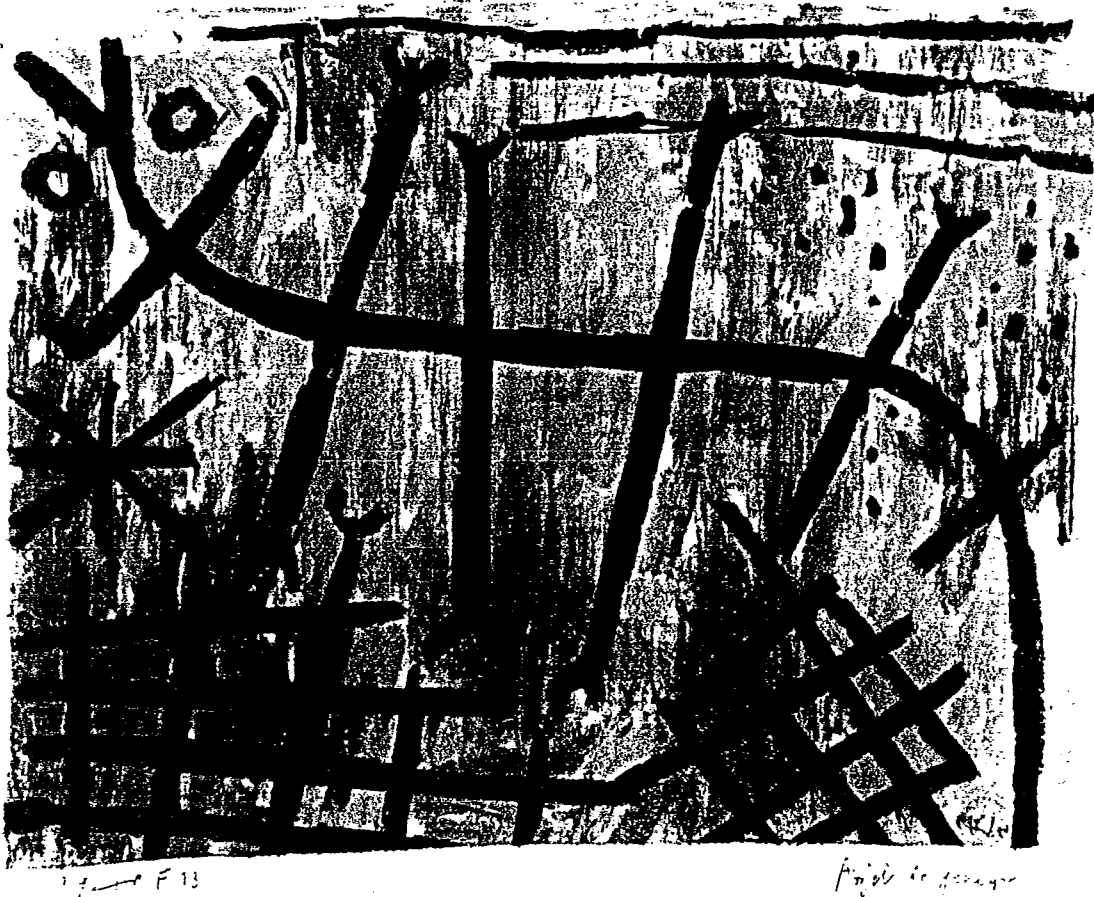


Fig. 2B : Paul Klee, Assjel im Gehege (Woodlouse in the Enclosure), 1940. Reproduced by permission of Paul Klee Foundation, Kunstmuseum, Bern. Copyright by COSMOPRESS, Geneva, and DACS, London, 1988 (see p. 32).

creatures wild and tame in the Dixon's house at Fifty-four Pavilion Road. In "Nat and the great bath climb", the hero is three weeks old - "which in human terms is about eighteen years" - and is helped through his initiation test by a friendly spider. The point of the test is (in an echo of Beauvard et Pécuchet, see below) that the aspirant will fail, gloriously, but Mrs. Lively consolidates her position as the anti-Flaubert of oniscological fiction by making Nat a woodlouse of independent spirit and considerable tact. We learn that "wood-lice colonies are governed by Chief Wood-lice, who are stern and ancient creatures with whiskers of immense length." The youngsters are allowed to attend colony meetings "as soon as their whiskers were three millimetres long, which meant that they were grown up." In "Nat and the spider battle", the question of whether woodlice can swim arises again and is about to become critical, but Nat is rescued by the spider and goes on to be shown the spider's larder and to witness a territorial battle. Finally in "The spider and the pearl", Nat is able to repay his debt to his friend. The ingenious illustrations by David Parkins show Nat as a rather broad-bodied, bug eyed Porcellio scaber. These delightful stories can be safely recommended to oniscologists as well as to their children, and should do much to lead the younger generation to look on woodlice as perfectly valid animals in their own right with no need for special pleading.

Phoebe Allen in Garden Pests (1903) instructs the reader in the effects of numerous pests by means of a series of ingenious and entertaining court cases conducted under the avian Justice Blackcap. In the case of "The Oak versus The Goat-moth and Grub", "Mr. Slater, otherwise Wood-lice" is called by the Grub as a witness in his defence. "Thereupon a queer little object, encased in a dull leaden suit of armour, with some whitish spots on it, came running forward with all his legs (he had about twenty) and jumped into the witness-box." When he declares that the Grub in the Oak is as harmless and respectable as he is himself, he is denounced from the back of the court by a Lettuce who asks rhetorically who it is then if not he who comes by night to make havoc amongst his fellow Lettuces. "The little wild warrior of the woods promptly made himself scarce, and the blatant Caterpillar looked round vainly for his small champion in plate armour". Although Phoebe Allen considers woodlice to be pests (and later describes a particularly diabolical woodlouse-trap), and although Mr. Slater does not come out of this episode well, the ringing phrase "little wild warrior of the woods" betrays a depth of admiration that may make us wonder whether she is not perhaps unique among authors in overestimating not only the number of legs but also some other attributes of the woodlouse.

The poet and drama critic Jean Kenward (b. 1920) in a poem, Woodlice, in the Autumn 1978 issue of The Countryman, gives the most sympathetic account I know of what we may feel to be the general plight of terrestrial isopods. The author has kindly restored the poem to its original form, which was slightly

altered in its 1978 publication:

Deep in a crumbling
darkness, crisply armoured
against attack,
grey woodlice are assembled, dry and silent,
cushioned in cleft and crack.

Cold, spherical,
steelhard, they fold their tiny
bodies so tight
as to allow
no entry to the summer's
pervasive light;

Only - at a brief
raising of the curtain -
in sudden, wild hysteria, they run
this way and that,
unrolling, unprotected,
unloosed, undone,

certain that without
any word or warning,
each one must brace
himself to bear
the bird-infested morning,
and the sun's face.

The poet Alasdair Maclean (b. 1926), in the epilogue to his autobiographical Night Falls on Ardnamurchan (1984), has the nearest thing to a positive eulogy of the woodlouse that I am aware of in literature. The setting is the outside lavatory of his house at Kirkcaldy: "I am proud of my lavatory but I do not allow myself to become too proprietorial about it, for I am by no means its sole user. Others indeed are residential rather than merely casual. Among them is a colony of woodlice, those ancient humble creatures. I am very fond of woodlice. They are inoffensive and engaging little animals, troubling no one and of a lineage going back in a direct line to the primal seas. They watched Gondwanaland disperse. I come across them often in my lavatory, sometimes halfway up a wall, on a fantastic and perilous journey in search of food and dampness. If you touch them they curl up like plated hedgehogs but I do not touch them if I can help it, except perhaps now and then out of friendship; every creature has a right not to be poked and prodded."

THE WOODLOUSE AS A SIGN

Maxim Gorky (1868-1936) in My Childhood (1913), Part 1 of his autobiography, recounts a conversation with his grandmother, who was the chief influence on his upbringing. In Isidor Schneider's translation (1953): "Why are you so scared of cockroaches?" I asked her. "I don't know myself", she answered

unconcernedly. "Maybe it's the way the loathsome things crawl about. God made other vermin signify something. Woodlice signify dampness; bed-bugs are a sign of dirty walls; and everyone knows that when lice are seen they prophesy an illness; but these things! Who knows what their power is or even what they feed on!"

Gorky's grandmother was quite right about woodlice. But the maker of a small quatrefoil of stained glass in the west wall of the south porch of St Mary's Church, Shrewsbury, was quite wrong. The glass (which appears quite old, although it seems to have escaped the various commentators on the stained glass for which this church is famous) bears the words "Sol in cancro" and must represent Cancer, the Crab, as the sign of the zodiac. The creature depicted, however, is not a crab but a woodlouse. It has seven legs on the side where they are visible, two prominent antennae, two eyes and a ridged and tuberculate back. I can offer no explanation of this amazing ecclesiastical isopod, and I should be grateful for any suggestions as to how it came about. It is illustrated in colour on the front cover of Isopoda 1.

There are persistent reports of woodlice carved on a late 14th century misericord in All Saints church, Hereford (Bond 1910; Anderson 1935; Bottomley 1978), but in spite of careful searching, I have been unable to find them. The presence of carved woodlice suggested the possibility of a misprint, but Anderson specifically mentions the rarity of invertebrates on such carvings and also cites weevils at All Saints which I have been unable to locate.

Among the last works by Paul Klee (1879-1940), done in March - May 1940, are two much-reproduced pictures of woodlice. Assjel im Gehege (Woodlouse in the Enclosure), 31.3 x 41.5 cm, a pastel (Fig. 2B), is in the Kunstmuseum, Bern, and Assel, 29.4 x 41.8 cm, a gouache, is in the private collection of Rolf Bürgi, Bern. Both show a single woodlouse as a fishbone-like structure of heavy black lines, filling most of the picture space, against a reddish or orange background. Articulation and movement are strongly suggested in both cases. In Assjel im Gehege, heavy black gratings are also depicted, and the woodlice themselves, to some extent, resemble gratings. The colouring and the undeniable intensity of these paintings, as with many that Klee did in these final three months of painting, invoke death and the transmutation of life. Willi Grohmann (1954), who reproduces both pictures on p. 306, says on p. 359 that the images of gratings and enclosures and of the woodlice "suggest both stricture and free passage, threat and hope". Richard Verdi (1984), says on p. 69 "it is hard not to see these late lice as harbingers of doom, with their menacing black bodies resembling prison grating and their blood-red surroundings, an open wound", and suggests that they had come to symbolise for the artist "the insidious forces which were slowly sapping his own vital juices and preparing him for an eternal confinement". Related paintings include one of plant-lice and a Schlamm-Assel-Fisch (mud-louse

fish). Other interpretations of these paintings have been offered, for example by J. Glaesemer (1976) and by N. Ponente (1960). Whatever Klee intended his woodlice to symbolise, few if any other invertebrates have been made the subjects of such widely-discussed and substantial paintings.

THE WOODLOUSE AS A METAPHOR OF MORAL CONTEMPTIBILITY

This deeply discreditable section is largely based on French sources. Shrewsbury is not alone in having ecclesiastical woodlice, for Octave Mirbeau (1850-1917) in Le Journal d'une Femme de Chambre (1900), a work of strong social satire, speaks of "the slimy and grovelling manners of the clerical woodlice" ("les manières visqueuses et rampantes des cloportes ecclésiastiques"). Anatole France (1844-1924) in La Rotisserie de la Reine Pédauque (1893), which mocks belief in the occult, remarks that "your theologians and your philosophers reason like the woodlice of Versailles or the Tuilleries who believe that the dampness of the caverns is made for them and that the rest of the castle is not fit to live in". The ecclesiastical metaphor appears in a non-French context, in a television dramatised documentary, Martin Luther - Heretic, by William Nicholson, broadcast on BBC 1 on 8 November 1983. Luther describes how Rome quivered like a dead tree and all the spiders and woodlice came out to spit at him; these words in fact come from Nicholson (pers. comm.) and woodlice were never used by Luther himself in this way.

The woodlouse to the French represents all that is most despicable in human nature. Edmond de Goncourt (1822-1896), in his Journal for 1860, refers to a "vie de cloporte" meaning a life totally self-centred and turned in on itself. Eugène Labiche (1815-1888) has a character in his farce Mon Isménie! (1847) saying to his daughter in the presence of her unwelcome and unctuous admirer: "Mon Isménie! ... ma fleur! Un cloporte s'est promené sur ma fleur!" ("My Isménie! ... my flower! A woodlouse has walked over my flower!").

Such was the resonance of the word "cloporte" that the neologism "cloportisme" arose. It is first noted in 1891 when it was used by J.K. Huysmans (1848-1907), the novelist of decadence and the occult, in Là-Bas: "The whole school of naturalism, in so far as it still exists, reflects the appetites of a frightful period. With it, we have reached an art so grovelling and so flat that I shall willingly call it 'cloportisme'."

An undoubtedly uncomplimentary reference occurs in an English detective story Clouds of Witness (1926) by Dorothy L. Sayers. In chapter 13, Lord Peter Wimsey realises a parallel between the case in question and the Abbé Prevost's Manon Lescaut and exclaims to the puzzled Detective Inspector Charles Parker: "But Manon. Manon! Charles, if I'd had the grey matter of a woodlouse that book ought to have told me the whole story. And think of what we'd have been saved!". Yet this exclamation

by the vastly cultured Lord Peter is made as he is conscious only of the revelation of a masterpiece of French literature, and this surely explains his momentarily un-English reference to a woodlouse and his adoption of the French mode. (In another detective story Death at the Bar (1939), Ngaio Marsh (1899-1982) expresses a much less condemnatory and rather more English attitude, seeing the woodlouse simply as helpless and insignificant. Superintendent Harper, commenting on a suspect, says: "He's no murderer. He's too damned silly to kill a woodlouse except he treads on it accidental".)

Sartre once more refers to woodlice in his play Les Mouches (1943), based on the story of Orestes. In Act 1, Jupiter, whose cynical power stands for the Nazi authority in occupied France, is trying to impress Orestes. Picking on and terrifying an old woman in black hurrying through the public square in Argos he says: "Vous voyez cette vieille cloporte, là-bas, qui trotte de ses petites pattes noires, en rasant les murs, c'est un beau spécimen de cette faune noire et plate qui grouille dans les lézardes." It says much for the fair play of the English that the word "woodlouse" would carry none of the overtones that Sartre summons up with "cloporte". Stuart Gilbert's translation (1946) has to revert to "beetle" to suggest the same effect: "See that old creature over there, creeping away like a beetle on her little black feet, and hugging the walls. Well, she's a good specimen of the squat black vermin that teems in every cranny of this town." Sartre seems to have found all non-human life, both animal and vegetable, tiresome and slightly disturbing. According to Simone de Beauvoir in La Cérémonie des Adieux (1981) he described how he found crustaceans particularly disgusting as food: they had, like insects, a dubious consciousness that he found irksome, they seemed to belong to another world, and their white flesh seemed stolen from another universe. Woodlice would certainly have been expected to appeal to him even less than they did to the generality of French writers.

The climax of fame and indignity for woodlice in literature was planned, though later, for good or ill, abandoned, by Flaubert. His final, unfinished masterpiece is the novel Bouvard et Pécuchet (1881). The two heroes set out with a large fortune and the best of intentions to become successful farmers, gentlemen, archaeologists, lovers, politicians, do-gooders etc. Most of these ventures result in catastrophe, both for themselves and for those they try to help, but as the book progresses, Flaubert becomes gradually more sympathetic towards them. In an early draft of 1863, however, he intended his heroes to be entirely contemptible representatives of bourgeois stupidity. His proposed title for the novel at this date was Les Deux Cloportes (see A.J. Krailsheimer 1976, p. 8), or perhaps Histoire or Mémoires de Deux Cloportes (see J. Gautier (1903), p. 267, and especially D.L. Demorest (1931), pp. 20-21).

THE WOODLOUSE AND CENSORSHIP

Beatrix Potter (1866-1943) wrote out The Tale of Mrs. Tittlemouse in 1909 in an exercise book, complete with her watercolour illustrations, as a present for Nellie, the small daughter of her publisher, Harold Warne. In this tale Mr. Jackson, the frog, is an unwelcome visitor in Mrs. Tittlemouse's tidy home, and rudely looks for the honey he is convinced she must have. He squeezes into the pantry: "There were three wood-lice hiding in the plate-rack. two of them got away; but the littlest one he caught." As Leslie Linder in A History of the Writings of Beatrix Potter (1971) explains, Warne objected to the use of the word "wood-lice" in a children's book, and persuaded the author to change it when it was published the following year. "I can alter the text, when I get the proofs", she wrote, and "will erase the offensive word 'wood-lice'!". She did, changing it to "three creepy-crawly people". Fortunately, the illustration was not objected to, as it is a brilliant sketch of three panic-stricken woodlice, the littlest one on its back frantically trying to right itself. The unexpurgated original draft is in the Victoria and Albert Museum, and was recently published in facsimile in a limited edition.

THE WOODLOUSE IN POPULAR CULTURE

A largely incomprehensible but certainly mildly pornographic science fiction comic, The Woodlice Report (1978) by Benny'n Mark (Steven Bennett and Mark Wise), was reviewed by P.T. Harding in the Newsletter of the British Isopod Study Group No. 22 (1987). A copy can be seen in the Cambridge University Library. Most of the strip cartoon stories involve woodlice to some degree, and include episodes with woodlice in what are perhaps space capsules invading our western culture, apparently supported by a human, male, paranoid drop-out. One drawing was doubtless inspired by an encounter similar to Alasdair Maclean's, but the woodlice are seen as retributive or menacing.

In the brilliantly illustrated puzzle and quest book Masquerade (1979) by Kit Williams, an eclipse of the sun by the lovesick Lady Moon is the occasion for a variety of animals to run in terror for their lives, as well as for all the horrors of the night to come forth with a silent scream from the Moon's mouth. A Porcellio-like woodlouse is depicted fleeing in company with a slug, a snail, a wood-ant, a robin, a bat etc. Whether it is to be considered a horror or just one of the fleeing animals seems uncertain, and if it is a clue then I at least am unaware of its significance.

The Boomtown Rats, the rock band led by Bob Geldof, adopted the woodlouse in 1984 in connection with their record album In the Long Grass. One of the members of the band, Simon Crowe, painted a backcloth with a woodlouse and long grass for the promotional tour for the album in Ireland, as recounted by Sir Bob at the end of chapter 12 of his autobiography Is That It?

(1986). Robert Legg did an elegant but morphologically inexact engraving of a woodlouse which was used to best advantage on the inner sleeve for the record but was also used on posters for the band's appearances around this time. The woodlouse design continued into Geldof's famine relief projects related to Band Aid, and in September 1985, Knit Aid produced a knitting pattern featuring a large woodlouse crawling across the wearer's stomach (Anon 1985). What Klee or Sartre would have made of this image, which comes uncomfortably close to their deepest anxieties, is uncertain, but it is a notable example of the way in which the woodlouse has impinged on the wider concerns of humanity.

THE WOODLOUSE AS AN INSTRUMENT OF POLITICAL SATIRE

In 1722, William Wood, through the rather improper influence of George I's favourite duchess, obtained a patent from the English government to coin much-needed halfpence in Ireland. Jonathan Swift (1667-1745) rightly distrusted him and mounted a prolonged campaign against him in letters entitled To the whole People of Ireland and signed "M.B. Drapier", and in various poems. This campaign questioned the whole relationship between the Crown and the people of Ireland and led to civil disobedience. In 1725, the patent was revoked, Wood was given a pension, and Swift was raised to the height of popularity. A late shot in this campaign is the following poem by Swift, in which the "Filletts of Brass" clearly refer to Wood's illicit gains and the "Doublet of Stone" refers, according to Swift, to Wood being in jail for debt; the medicinal reference would have been well understood at this early date:

Wood, an Insect, Written in the Year 1725

By long Observation I have understood,
That three little Vermin are kin to Will. Wood:
The first is an Insect they call a Wood-louse,
That folds itself in itself for a House:
As round as a Ball, without Head, without Tail,
Inclos'd Cap-a-pee in a strong Coat of Mail.
And thus William Wood to my Fancy appears
In Filletts of Brass roll'd up to his Ears:
And, over these Filletts he wisely has thrown,
To keep out of Danger, a Doublet of Stone.

The Louse of the Wood for a Med'cine is us'd,
Or swallow'd alive, or skilfully bruis'd.
And, let but our Mother Hibernia contrive
To swallow Will. Wood either bruis'd or alive.
She need be no more with the Jaundice possess't;
Or sick of Obstructions, and Pains in her Chest.

The remaining lines deal with Wood-worm etc.

CONCLUSIONS

The characteristics of woodlice that most seem to attract the attention of our creative minds are, in order of frequency, their fondness for damp and dingy situations, their ability to roll into a ball, their tendency to scurry away when disturbed, and their numerous legs. The French use woodlice almost exclusively as a metaphor for the most contemptible aspects of human existence. The English, on the other hand, are very much more open-minded about woodlice, sometimes using them to evoke atmosphere (admittedly usually of decay), sometimes remembering them with nostalgia, and sometimes even regarding them with affection. The writer in English who comes nearest to casting a real slur on the woodlouse is Swift, but he, of course, was an Irishman describing an Englishman as a woodlouse. Woodlice have climbed to the highest levels of art in the late paintings of the Swiss artist, Klee, and have found niches in a great variety of novels, poems and other forms of art. They have clearly adapted well to most of the higher reaches of human behaviour. Oniscologists should thus feel encouraged to pursue their studies of these creatures with greater confidence of receiving understanding and support from the rest of the community.

ACKNOWLEDGEMENTS

I am grateful to the following for kindly providing references and for help in many other ways in the preparation of this article: Alan Brownjohn, John Cannon, William Condry, Paul Harding, L.B. Holthuis, Steve Hopkin, Germaine Hunter, Jean Kenward, Edmund Launert, Christine Leuw, Penelope Lively, Jill Lucas, William Nicholson, Chris Preston, Bill Smythies, Stephen Sutton, James Thorne, Peter Whitehead and Robert Willows. For permission to use the more substantial quotations from material still in copyright I am indebted to Alan Brownjohn, Jean Kenward, Penelope Lively, Alasdair Maclean and John Murray (Publishers) Ltd. (for the quotations from John Betjeman).

REFERENCES

- ALLEN, P. (1903). Garden Pests. London, Wells Gardner, Darton & Co.
- ANON. (1985). New Musical Express, 21 September, p. 20.
- ANDERSON, M.D. (1935). The Medieval Carver. Cambridge, Cambridge University Press.
- ASHMOLEAN MUSEUM (1950). Catalogue of the Collection of Dutch and Flemish Still-Life Pictures bequeathed by Daisy Linda Ward. Oxford, Ashmolean Museum.
- BEAUVOIR, S. DE (1981). La Cérémonie des Adieux. Paris, Gallimard.
- BELY, A. (1913). See Maguire & Malmstad (1983) below.
- BENNY'N MARK (1978). The Woodlice Report. Portsmouth, P.P.S.U.
- BETJEMAN, J. (1954). A Few Late Chrysanthemums. London, John Murray.

- BETJEMAN, J. (1958). Collected Poems. London, John Murray.
- BETJEMAN, J. (1960). Summoned by Bells. London, John Murray.
- BOND, F. (1910). Wood Carvings in English Churches, 1, Misericords. Oxford, Oxford University Press.
- BOTTOMLEY, F. (1978). The Church Explorer's Guide to Symbols and their Meaning. London, Kaye & Ward.
- BROWNJOHN, A. (1970). Brownjohn's Beasts. London, Macmillan.
- CONNOLLY, C. (1958). Review of B. Partridge, A History Orgies. The Sunday Times, 14 December.
- COURTELINE, G. (1912). Les Linottes. Paris.
- DEMAREST, D.L. (1931). À Travers les Plans, Manuscrits et Dossier de Beauvard et Pécuchet. Paris, L. Conard.
- FLAUBERT, G. (1857). Madame Bovary. Reprint (1921) in Oeuvres Complètes, 1. Paris, L. Conard.
- FLAUBERT, G. (1881). Beauvard et Pécuchet. Reprint (1923) in Oeuvres Complètes, 6. Paris, L. Conard.
- FORSTER, E.M. (1924). A Passage to India. London, E. Arnold.
- FRANCE, A. (1893). La Rotisserie de la Reine Pédauque. Paris, Calmann-Lévy.
- FRAUNDORFFER, P. (1700). Oniscographia Curiosa. Brunae.
- GAUTIER, J. (1903). Le Collier des Jours: Le Second Rang du Collier. Paris, Félix Juven.
- GELDOF, B. (1986). Is That It?. London, Sidgwick & Jackson.
- GILBERT, S. (transl.)(1946). J.-P. Sartre, The Flies - Les Mouches and In Camera - Huis Clos. London, Hamish Hamilton.
- GLAESEMER, J. (1976). Paul Klee: die farbigen Werke im Kunstmuseum Bern. Bern, Kunstmuseum.
- GOLDING, W. (1954). Lord of the Flies. London, Faber & Faber.
- GONCOURT, E. DE (1860, 1861). Journal des Goncourt - Mémoires de la Vie Littéraire, 1-9 (1888-1896). Paris, G. Charpentier.
- GORKY, M. (1913). See Schneider (1953) below.
- GRANT, M.H. (1954). Jan van Huysum. Leigh-on-Sea, F. Lewis.
- GRAVES, R. (1948). Collected Poems. London, Cassell.
- GROHMANN, W. (1954). Paul Klee. London, Lund Humphries.
- HARDING, P.T. (1987). Book Review. Newslett. Br. Iscpod Stud. Grp., No. 22, 5.
- HESSE, H. (1913). Der Zyklon. Reprint (1970) in Gesammelte Werke, 2. Frankfurt am Main, Suhrkamp.
- HOLT, V.M. (1885). Why Not Eat Insects?. London, Field & Tuer. Reprint (1967). Faringdon, E.W. Classey.
- HOOD, T. (1906). The Complete Poetical Works of Thomas Hood. London, Henry Frowde.
- HUYSMANS, J.K. (1891). Là-Bas. Paris.
- KENWARD, J. (1978). Woodlice. The Countryman, 83 (4), 154.
- KRAILSHEIMER, A.J. (1976). Introduction to G. Flaubert, Beauvard and Pécuchet. Harmondsworth, Penguin Books.
- LABICHE, E. & MICHEL, M. (1847). Mon Isménie! Comédie en un Acte. Reprint (1878) in Théâtre Complet, 3. Paris, Calmann-Lévy.
- LAROUSSE (c. 1960-1970). Larousse Gastronomique. Paris, Larousse.
- LINDER, L. (1971). A History of the Writings of Beatrix Potter. London, Frederick Warne.
- LIVELY, P. (1982). Next to Nature, Art. London, William Heinemann.

- LIVELY, P. (1987). A House Inside Out. London, André Deutsch.
- LOWE-PORTER, H.T. (transl.) (1954). T. Mann, Joseph and his Brothers. London, Secker & Warburg.
- MACLEAN, A. (1984). Night Falls on Ardnamurchan. London, Victor Gollancz.
- MAGUIRE, R.A. & MALMSTAD, J.E. (transl.) (1983). A. Bely, Petersburg. Harmondsworth, Penguin Books.
- MANN, T. (1934). Der Junge Joseph. Berlin, S. Fischer.
- MANHEIM, R. (transl.) (1974). H. Hesse, Stories of Five Decades. London, Jonathan Cape.
- MARSH, N. (1939). Death at the Bar. London, Collins.
- MIRBEAU, O. (1900). Journal d'une Femme de Chambre. Paris, Charpentier.
- MITCHELL, A. (1954). Adrian Mitchell. The Fantasy Poets, Number Twenty Four. Oxford, Oxford University Poetry Society.
- MURDOCH, I. (1954). Under the Net. London, Chatto & Windus.
- NICHOLSON, W. (1983). Martin Luther - Heretic. Dramatised television documentary. BBC 1, 8 November.
- PONENTE, N. (1960). Klee: Biographical and Critical Study. Transl. J. Emmons. Lausanne.
- POTTER, B. (1910). The Tale of Mrs. Tittlemouse. London & New York, Warne.
- POWYS, J.C. (1951). Porius. London, Macdonald.
- POWYS, T.F. (1927). Mr. Weston's Good Wine. London, Chatto & Windus.
- POWYS, T.F. (1931). Unclay. London, Chatto & Windus.
- RENDELL, R. (1971). No More Dying Then. London, Hutchinson.
- SARTRE, J.-P. (1943). Les Mouches. Paris, Gallimard.
- SARTRE, J.-P. (1944). Huis Clos. Paris, Gallimard.
- SAYERS, D.L. (1926). Clouds of Witness. London, T. Fisher Unwin.
- SCHNEIDER, I. (transl.) (1953). M. Gorky, Autobiography. London, Elek Books.
- SULLIVAN, A.S. (1871). The Window or, the Songs of the Wrens. London, Strahan.
- SUTTON, S.L. (1972). Woodlice. London, Ginn.
- SWIFT, J. (1967). Poetical Works. Oxford, Oxford University Press.
- TENNYSON, A. (1867). The Window or, the Loves of the Wrens. Canford Manor.
- THIEL, P.J.J. VAN et al. (1976). All the Paintings of the Rijksmuseum in Amsterdam. Amsterdam, Rijksmuseum.
- VANDEL, A. (1962). Isopodes Terrestres (Deuxième Partie). Faune de France no. 66, Paris, Lechevalier.
- VERDI, R. (1984). Klee and Nature. London, A. Zwemmer.
- VERHOEFF, K.W. (1908). Über Isopoden. 15. Aufsatz. Archiv. Biontologie, 2, 335-387.
- WILLIAMS, K. (1979). Masquerade. London, Jonathan Cape.

THE 'READING WOODLOUSE WATCH 1987'

S.P. HOPKIN

Department of Pure & Applied Zoology, University of Reading,
Whiteknights, PO Box 228, Reading RG6 2AJ

INTRODUCTION

This article is composed of the final results of a survey of the distribution of species of woodlice in the Reading area conducted during the Spring and Summer of 1987. The report is self-explanatory. It is presented as a practical example of what can be achieved for very little cost and (slightly more!) effort and will hopefully stimulate others to conduct similar surveys on woodlice and other invertebrates in urban areas. The rather unusual arrangement of pages is a result of the report being distributed as an A3 folded sheet which substantially reduced printing costs.

THE SURVEY

Apart from the (possibly unique) scientific information obtained on the distribution of an invertebrate group in an urban area, a number of other factors emerged on the best ways of conducting such a survey. It is vitally important to have all the literature prepared in advance so that enquiries can be responded to immediately. Be prepared to be phoned up at regular intervals to answer questions such as "this strange looking woodlouse has just appeared in our bath, would you like to come and look at it?". Answer - no, but if you bring it to me I will tell you what it is! (do not let slip your home telephone number at any cost). Enlist the help of your local Naturalists Trust who should let you put the initial circular in their mailings which saves a fortune in postage costs. The total cost of the Reading Survey was only about £50 (photocopying and postage) which was partly covered by a grant from the Reading Urban Wildlife Group.

With hindsight, I would not have bothered to produce a detailed key to all types of woodlice likely to occur in Reading since the only species found by the general public (apart from the 'Famous Five' with which they had no problem - five year old children found them easy to identify) were Androniscus dentiger and Platyarthrus hoffmannseggii which turned out to be much more common than I would have expected. The 'Famous Five' guide was a great success and I would use this again (with Androniscus and Platyarthrus added - the 'Secret Seven'? - you can tell I was brought up on Enid Blyton). The species included would, however, have to be adapted for the geographic area in question, especially further north where Armadillidium vulgare may be rare. Common names are absolutely essential and despite the

squeals of the purists, I would forget involving the general public at all unless these are used. Mine are only suggestions and it may be best to adapt names to make them more suitable for the local situation.

The final point is that the most useful result of the Survey may not have been the records (since no member of the public found species other than the Famous Five, Androniscus and Platyarthrus - all other records are my own), but an increase in awareness of the diversity of soil animals in urban areas (particularly among school children who became quite involved in hunting for "chuggy pigs") If you do decide to get involved in such a scheme, learn to smile. The local media just love woodlice!

I am happy to provide more detailed information on the finer points of the Survey on request to the address above.

Results of the Survey

The records are presented as presence or absence of a species from each 1 km square of the Survey area. Solid black shading indicates at least one record from somewhere in the square. Some squares contain up to four records for a single species. 88 of the 200 squares had at least one record, a quite respectable coverage under the circumstances.

It is clear that the most common woodlice are Armadillidium vulgare, Oniscus asellus, Philoscia muscorum, Porcellio scaber and Trichoniscus pusillus. These 'Famous Five' species were found by almost all respondents to the Survey and must be present in large numbers in every 1 km square in the Reading area.

Androniscus dentiger, Platyarthrus hoffmannseggii and Trichoniscus pygmaeus were found much more frequently than I had anticipated. These three species are also probably present throughout the Reading area although they were not recorded from as many squares as the Famous Five because they are more difficult to find.

Three more species, Ligidium hypnorum, Porcellio spinicornis and Haplophthalmus danicus, are probably fairly common in the region but were very rarely found because of their retiring habits. For example, one morning I found a single Porcellio spinicornis in my bathroom sink but despite extensive searches at night by torchlight, I have not found any further specimens of this nocturnal species either inside or outside the house.

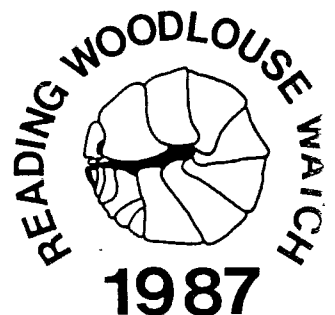
The remaining nine species are apparently very rare although they must certainly be present in several more squares than are indicated on the maps. All the sites for Armadillidium nasatum, Cylisticus convexus and Porcellionides pruinosus were synanthropic (i.e. associated with human activity) and when found, these three species were quite abundant. Trichoniscoides albidus was found in very damp habitats on the banks of the River Thames and River Pang where it was rare. Single specimens of Trachelipus rathkei and Porcellio dilatatus turned up among rubbish behind the Prospect Park Mansion House (where Porcellionides pruinosus was extremely abundant) and two Porcellio laevis and Armadillidium depressum were found in Forbury Gardens in the middle of Reading. Several of these records are 'firsts' for Berkshire. Furthermore, the north bank of the River Thames east of Goring is the only known inland site in South East England for Haplophthalmus mengei.

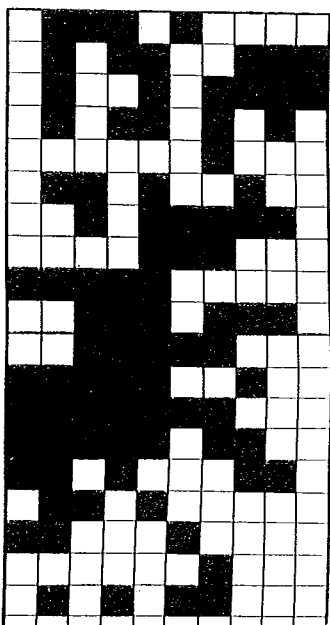
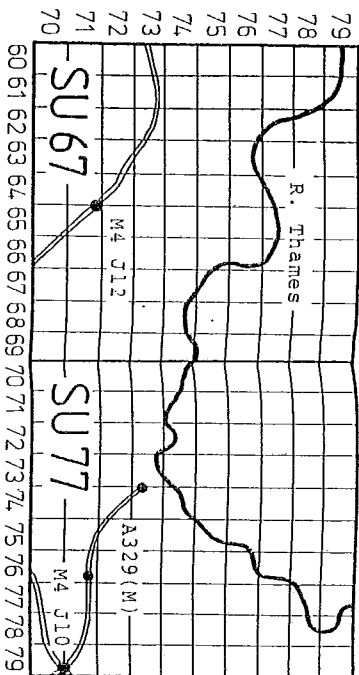
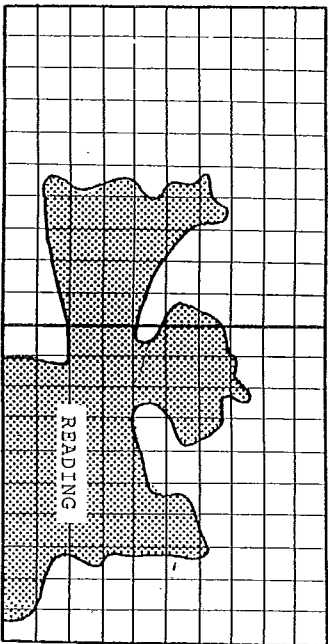
Conclusions

The four aims of the Survey have been accomplished thanks to the enthusiastic support of the Reading Urban Wildlife Group and the schoolchildren, teachers and members of the public who sent in records. It is hoped that the 'Reading Woodlouse Watch 1987' will stimulate other urban wildlife groups to conduct similar surveys of invertebrates in their own areas.

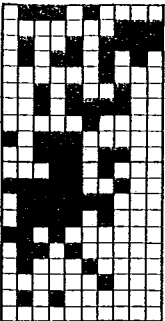
Dr. Steve Hopkin
Department of Pure & Applied Zoology
University of Reading

December 1987

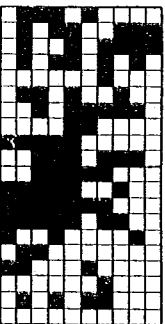




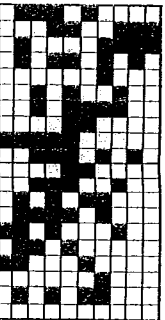
ARMADILLIDIUM
VULGARE



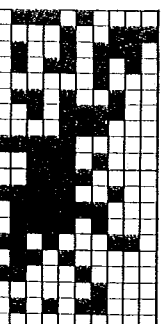
ONISCUS
ASELLUS



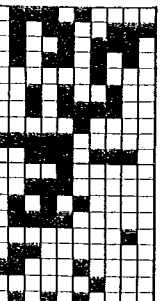
PHILOSOCIA
MUSCORUM



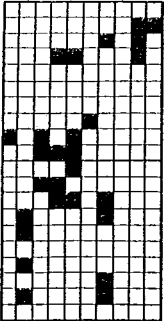
PORCELLIO
SCABER



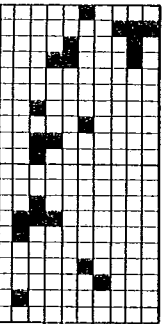
TRICHONISCUS
PUSILLUS



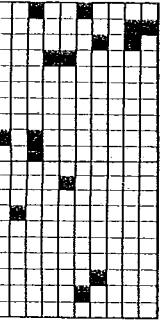
ANDRONISCUS
DENTIGER



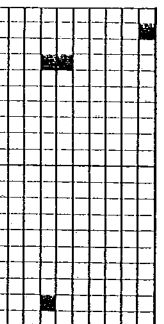
PLATYARTHURUS
HOFMANNSEGGI



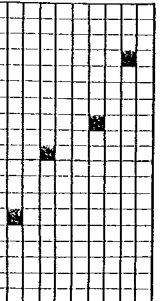
TRICHONISCUS
PYGMAEUS



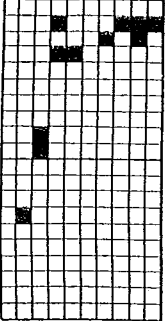
LIGIDIUM
HYPNORUM



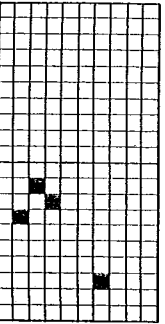
PORCELLIO
SPINICORNIS



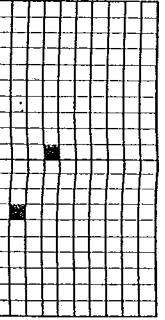
HAPLOPHTHALMUS
DANICUS



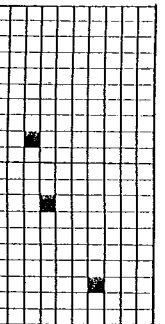
ARMADILLIDIUM
NASATUM



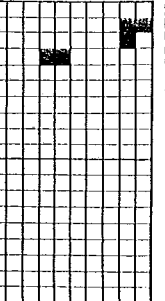
CYLISNICUS
CONVEXUS



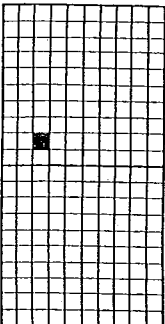
PORCELLIONIDES
PRUINOSUS



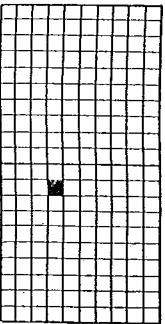
TRICHONISCOIDES
ALBIDUS



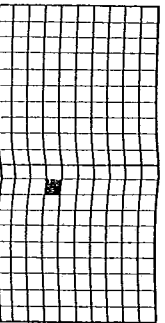
TRACHELIPUS
RATKEI



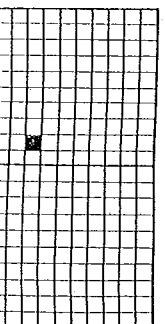
ARMADILLIDIUM
DEPRESSUM



PORCELLIO
LAEVIS



PORCELLIO
DILATATUS



HAPLOPHTHALMUS
MENGEI

