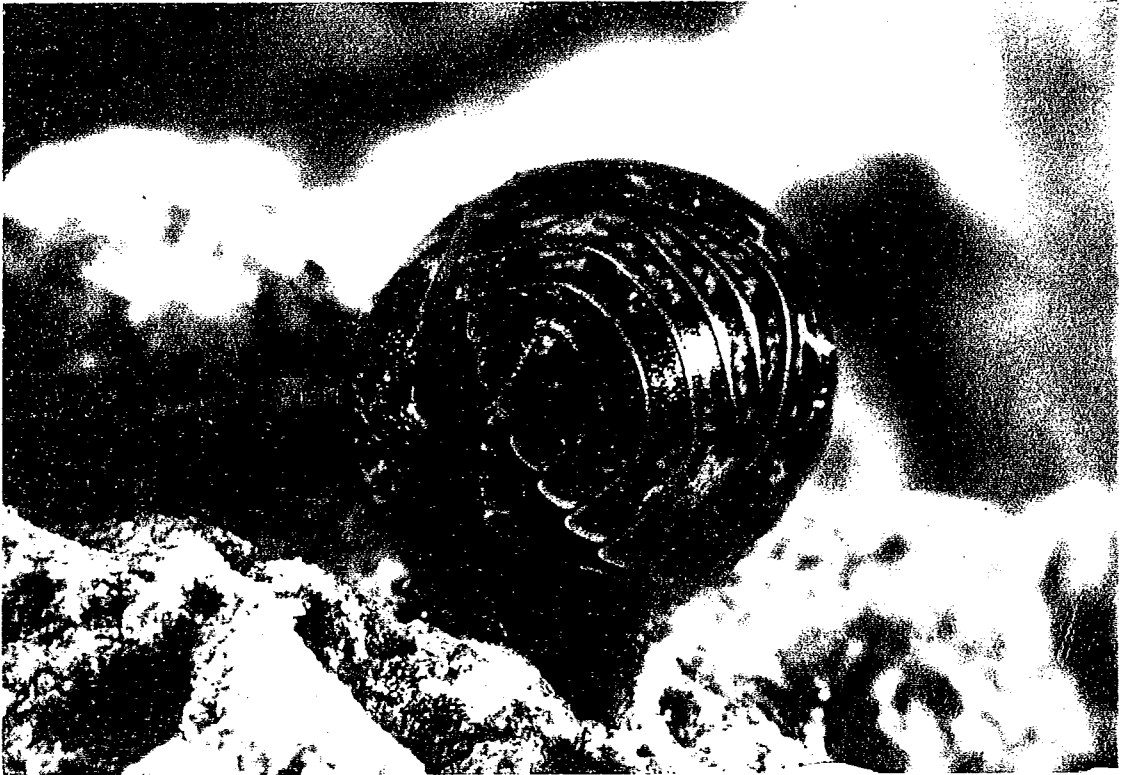


SPECIMEN
COPY ONLY

ISOPODA



VOLUME 3 (1989)

ISSN 0950-2130

Price £3.00

CONTENTS

The woodlouse sermon	1
M. THORNTON	
The occurrence of Asellidae in the British Isles.	
Part 1. <u>Asellus cavaticus</u>	5
P.T. HARDING	
Names for terrestrial isopods in Japan	9
T. UDAGAWA	
<u>Armadillidium pictum</u> Brandt in Yorkshire	13
D.T. RICHARDSON	
<u>Ligia baudiniana</u> (Isopoda, Ligiidae) on the Gulf coast of the United States	15
W.F. RAPP & J.L.C. RAPP	
Themes and variations : broodpouch cotyledons in Australian Oniscidea	19
F. LEWIS	
'Albino' woodlice : do they exist?	29
S.P. HOPKIN	

NOTES FOR CONTRIBUTORS

Isopoda is published annually in the Spring. Articles and reviews on any aspect of the biology of isopods (and terrestrial 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
 School of Animal & Microbial Sciences
 University of Reading
 PO Box 228
 Whiteknights
 READING RG6 2AJ

COVER PHOTOGRAPH

The photograph is of Armadillidium pictum Brandt (7 mm in length) collected from a site in the Black Mountains, South Wales. The species is the subject of an article by D.T. Richardson in this volume of Isopoda. Photograph by Steve Hopkin.

THE WOODLOUSE SERMON

MARTIN THORNTON
Canon-Chancellor, Truro Cathedral

I am very fond of woodlice: isopoda armadillidiidae. All the best cathedral sermons have a bit of superfluous Latin, it raises the tone of the thing and makes everyone feel learned, although curiously enough we shall see that this bit of latinity is not wholly irrelevant.

They are catholic little creatures because their habitat is universal, they are found under various sub-species in pretty well every country in the world. Many such foreign species have somehow got themselves imported into this country and have established themselves in company with the native British variety, which conversely have managed to get themselves established in most other countries: quite Anglican in fact.

So I feel some friendly rapport with the woodlouse, and was considerably upset one winter morning when I collected the last of my heap of logs, exposing a startled colony of them. They behaved characteristically; some attempted a flight to the wilderness, and I so much hope that many reached it. Others formed themselves into close little communities for what protection they could find, I tried to help them find a more suitable abode but regrettably without much success. There were others who rolled themselves up into little balls, as is their wont, for protection against predators, yet seemingly accepting martyrdom with uncomplaining fortitude.

How different was their response to that of an anthill under similar circumstances; a disturbed anthill degenerates into a solid mass of feverish activity which gets the ants nowhere. Ants are not only essentially Pelagian, but also exponents of the coarser aspects of the protestant ethic: work hard for material success and the Lord will reward you. Disturb other creatures, like hares, and they will rush off all alone, proudly rejecting assistance from any quarter. Ants have to be in community, the wrong sort of little communists, loyal to the system but utterly incapable of personal initiative: an ant never comes up with an original idea. Hares are loners, not because they are of unique genius but because they are incapable of creative relationship: then comes March and they go mad.

But woodlice have got it all: community interplay, creative dialogue, yet always capable of going in search of the wilderness, of running a risk and taking a chance; even to the extent of rolling themselves up in little balls, hoping for the best and willing to cope with the worst. They have the supreme gift of being able to give in.

So the last log disturbed me as well as them. It was so cold, and I would willingly have given up my lovely wood fire if that would have meant happiness and satisfaction for a single woodlouse. But the damage having been done, simply replacing the last log would have achieved nothing. So what could I do to put things right? I could see answers to the problem; a few feet away there was a big stone slab, suitably damp and dank, probably a better place than the original log. I could lift it and shoo the woodlice under it, but they would not be shooed. Force was of no use, for even a rubber spatula would be too rough to avoid damaging them. So I gave up. Then horror of horrors; sitting morosely by the fire a woodlouse emerged from a smouldering crevice. I tried to rescue it from the flames but again without success. The tragedy was that it could easily have saved itself by taking a certain direction, along the log and down a piece of kindling wood that had not yet caught fire; first left and there was the safety of the hearth. This woodlouse would not have been happy on the warm stone, they like damp cold and dark places, but at least this one would have been safe.

What can I do to help them over circumstances in which they cannot help themselves? I have tried talking to them, but they cannot understand; I have tried gently, ever so gently, to prod them into a happier environment, but all to no avail. I am fond of woodlice, I have even supplied them with very young luscious seedlings which they like to eat, but they still seem to prefer to go their own way in their own good time. Yes I am fond of them, but they offer little response; perhaps I am giving way to sentimentality? Perhaps after all they are not worth all the trouble? Let them stew in their own juice. But no, I cannot but be concerned, how can I show my love for them?

It is an utterly fantastic idea, but suppose I could somehow manage to enter into direct communication with them? Could I pretend to be a woodlouse? In fact could I actually become a woodlouse? Then I could talk to them in their own language, demonstrate a better way, but what would that entail? Could I, or would I, give up my humanity, forego for ever perhaps the joys of human culture, no more art, music or literature? No more robust physical pleasures like eating partridge and drinking claret, no more family life with a humanly loving wife and family, for woodlice are hermaphrodite. All this sacrifice in an analogical way is roughly what theology means by kenosis; a total self-emptying on behalf of an infinitely inferior species. Do I really love woodlice as much as that? Would I freely make such a sacrifice on their behalf? In the famous words of Eliza Doolittle: 'not bloody likely'. Not least because I have a hunch that with all the goodwill in the world, the experiment would turn out to be bloody. Yes woodlice are charming little creatures, clean and wholesome, doing harm to nobody and nothing, but I doubt if they would accept me. I doubt if they would understand my good intentions, and I doubt if they would really understand objective love. There would be every chance that they would reject my advice and object to my

interference; they would turn on me and push me into an heretical ant-hill, to be torn apart and crucified.

The analogy hardly needs translation, except to add that to turn me into a woodlouse is an infinitely small step compared with turning God into man. For, returning to St Thomas Aquinas, humans and woodlice are on the same strata in the hierarchy of creation, we are both in the third division of the league, while God is creator of the total league, infinitely above and beyond the universe. Let us maintain at all costs the transcendental element, and yet there is the corresponding immanental side of things.

There are scores of analogies which attempt, never with complete success, to explain the doctrine of the one, holy and undivided Trinity, and there are all sorts of devotional techniques which attempt to give mystical insight into what is beyond the rational, like the contemplation of the clover leaf with three lobes, or a triangle, or intersecting circles, or the star of David. There is a tiny country church in Cornwall in which the roof of the sanctuary is decorated with sixteen different signs or mandala of the holy Trinity, the contemplation of any of which may give deeper insight into this intimate mystery than to come upon to come of academic reasoning. Not that such studies are superfluous; discursive consideration of the first portion of the Quicumque Vult, the so-called Athanasian creed, is a good, even essential prolegomena to the contemplation of mandala.

Could further symbolism add anything to our understanding? Perhaps, perhaps not. I sincerely hope that the following will not prove offensive to any reader; it might even be deemed impious, of going too far, but I take the risk. What trinitarian pattern emerges from the contemplation of a woodlouse?

As with the Athanasian creed, or similar formula, we have to begin with a few doctrinal facts, which is where our cathedral sermon custom of using a bit of Latin comes into its own. Biologically speaking a woodlouse, isopoda armadillidiidae looks as if it has a family resemblance with a beetle, or a centipede or some similar creature, but no. The woodlouse is not coleopterous or cheilopoda but isopoda, and its nearest relation, believe it or not, is a lobster. A further characteristic of a woodlouse is that its bodily waste products are converted into ammonia and exhaled as a gas through its whole body. What is called sulphate of ammonia in agriculture is a basic nitrogenous fertilizer supplying the most elemental and essential plant nutrient, so the gaseous exhalation from the woodlouse into the atmosphere unleashes nitrogen which sustains the vegetable kingdom and maintains soil fertility upon which all earthly life depends. Woodlice exhale life-giving properties. Dig up a broad bean plant and you will probably find two things: nodules that smell of ammonia and woodlice. Beans, peas, clover and all leguminosae share this characteristic with woodlice: they both give life-giving nutrient to soil and

atmosphere rather than absorbing it for their own self-centred purposes.

So where is our analogy now? C.S. Lewis was accused of impiety or worse by looking through the eyes of Screwtape and seeing God as the enemy. Yet the blessed Trinity is often described in terms of cold unfeeling geometry: triangles and leaves of clover and so on. Is it going too far, with due recognition of all the pitfalls of analogical reasoning, to think of God-the-Father-Lobster, the woodlouse Incarnate, and the all-pervading, immanent, life-giving Spirit of Ammonia-Nitrogenous gas which - or rather who - proceeds from them? After all the Lobster and the Woodlouse are of one substance - isopoda - and in this context we need not get all that stewed up about the filioque clause.

If I am not blowing my own trumpet too loudly there must be something in an analogy which schoolgirls, listening to a cathedral sermon by compulsion rather than choice, can remember after several years. How they interpret it is another question, yet we are taught to believe in the ultimate redemption, the christification (in Teilhard de Chardin's terminology) of all created things. It is possible that some are led to affective devotion of Jesus in his passion when they see a woodlouse caught in the flames; they might even think of the all-pervading Spirit when they see woodlice and broad beans giving off life-giving, sanctifying nitrogen.

It might prove to be a little more memorable, a bit more exciting, than triangles and clover leaves. And what is wrong in recollecting the love of our heavenly Father while we enjoy a lightsome lobster on Fridays in Lent?

- * * * -

© Monica Thornton, reproduced by kind permission of the Society for the Promotion of Christian Knowledge from 'A Joyful Heart' by Martin Thornton (1987, SPCK, £2.95, ISBN 0-281-04266-7).

Editors note : I have reproduced Martin Thornton's text exactly as printed. Some isopodologists might quibble with the accuracy of the Latin but not, I'm sure, with the spirit of eulogy to woodlice which this article represents. Martin Thornton sadly died in June 1986. Irrespective of one's religious beliefs, his book makes delightful reading and is thoroughly recommended.

THE OCCURRENCE OF ASELLIDAE IN THE BRITISH ISLES. PART 1.

ASELLUS CAVATICUS

PAUL T. HARDING

Institute of Terrestrial Ecology, Monks Wood Experimental
Station, Abbots Ripton, Huntingdon, Cambs. PE17 2LS.

INTRODUCTION

The distribution of Asellidae (freshwater isopods, waterlice or hoglice) in the British Isles was reviewed by Moon & Harding (1981, 1982). Since these publications, further records of Asellidae have been submitted to the Non-marine Isopoda Recording Scheme. In a series of short papers, of which this is the first, the occurrence of the four species of waterlice recorded in the British Isles will be updated.

ASELLUS CAVATICUS IN THE BRITISH ISLES

Asellus cavaticus is eyeless and devoid of pigment. All waterlice occurring underground and with little or no colour, should not be assumed to be Asellus cavaticus without first checking the distinguishing features given by Gledhill et al. (1976) because almost colourless specimens of Asellus aquaticus and Asellus meridianus have occurred.

Asellus cavaticus has been recorded mainly from underground streams, pools and wet surfaces in limestone caves and mines, and from where underground waters issue on the surface, such as springs and the water sources of watercress beds, and also from wells and boreholes. There was an active phase of biological recording in caves and mines, mainly in the 1950's and 1960's, when most of the 80 records of Asellus cavaticus in Britain were made. Collecting biological specimens is no longer popular with cavers, or is not properly co-ordinated, so that few records have been made since 1970.

The distribution map (Fig. 1) summarises all records of Asellus cavaticus received to the end of 1988. The species was recorded for the first time in Britain from a well at Ringwood, Hampshire. Subsequently, it has been found at watercress beds and a spring in Dorset, cave systems in South Wales, a spring and river gravels in mid Wales, mines in Wiltshire and Oxfordshire, and a well in Kent. The majority of records are from carboniferous limestone cave systems in the Mendip Hills and in South Wales, especially Brecknock. Despite surveys of similar cave systems in Derbyshire and North Yorkshire, Asellus cavaticus has not been recorded in these northern caves. The most recent records, both by Steve Ormerod, are also the most northerly. Ormerod & Walter (1984) described the site at which

Harding - Asellus cavaticus

it was found on the Hiranant River in 1982, but gave an incorrect grid reference. In 1985, Ormerod found Asellus cavaticus at Nant Esgair Garn at 50 cm depth in gravel.

Moon & Harding (1981) noted the loss of contact with underground waters which has resulted from the abandonment of domestic wells in favour of piped water supplies. No records have been received from bore-holes supplying water for domestic use. Any opportunity to sample underground waters for Asellus cavaticus, or for the equally interesting species of subterranean amphipods, should be eagerly followed up. More information on these animals is needed, especially now that pollution of groundwaters by pesticides and fertilizers is believed to be a serious problem in some areas. The fact that ground waters are being much more intensively used to supply domestic water requirements may also pose a threat to some populations of Asellus cavaticus and subterranean amphipods. The insecticide Permasect W.T. is marketed to water authorities to control invertebrates in water for public supply, particularly 'Asellus'.

Concern about human impacts on subterranean crustacea in Belgium has been expressed by Fiers & Wouters (1985). In particular, they noted the effects of eutrophication on groundwaters and general disturbance in cave systems open to the public. In Britain, the Nature Conservancy Council has recently sought information on cave faunas, including Asellus cavaticus (Harding & Greene 1988). Additional information on the occurrence of Asellus cavaticus, subterranean amphipods, and the other species of Asellidae would be most welcome. Records and specimens should be sent to me at the above address.

REFERENCES

- FIERS, F. & WOUTERS, K. (1985). Human impacts on the crustacean stygiofauna. Proceedings of the Conference - Debat Invertebres menacants, Invertebres menaces. Gembloux: Faculte des Sciences Agronomiques de l'Etat.
- GLEDHILL, T., SUTCLIFFE, D.W. & WILLIAMS, W.D. (1976). Key to British Freshwater Crustacea : Malacostraca. Sci. Publ. Freshwater Biol. Assoc., No. 32.
- HARDING, P.T. & GREENE, D.M. (1988). Computerization of data on cave fauna in Britain. CSD Report No. 886). Peterborough : Nature Conservancy Council.
- MOON, H.P. & HARDING, P.T. (1981). A preliminary review of the occurrence of Asellus (Crustacea : Isopoda) in the British Isles. Abbots Ripton : Biological Records Centre.
- MOON, H.P. & HARDING, P.T. (1982). The occurrence of Asellus (Crustacea : Isopoda) on offshore islands in the British Isles. Naturalist, 107, 67-68.
- ORMEROD, S.J. & WALTERS, B. (1984). Asellus cavaticus Schiodte (Crustacea : Isopoda) from a hillstream in north Breconshire. Nature in Wales, (1983), 2, 109.

Harding - Asellus cavaticus

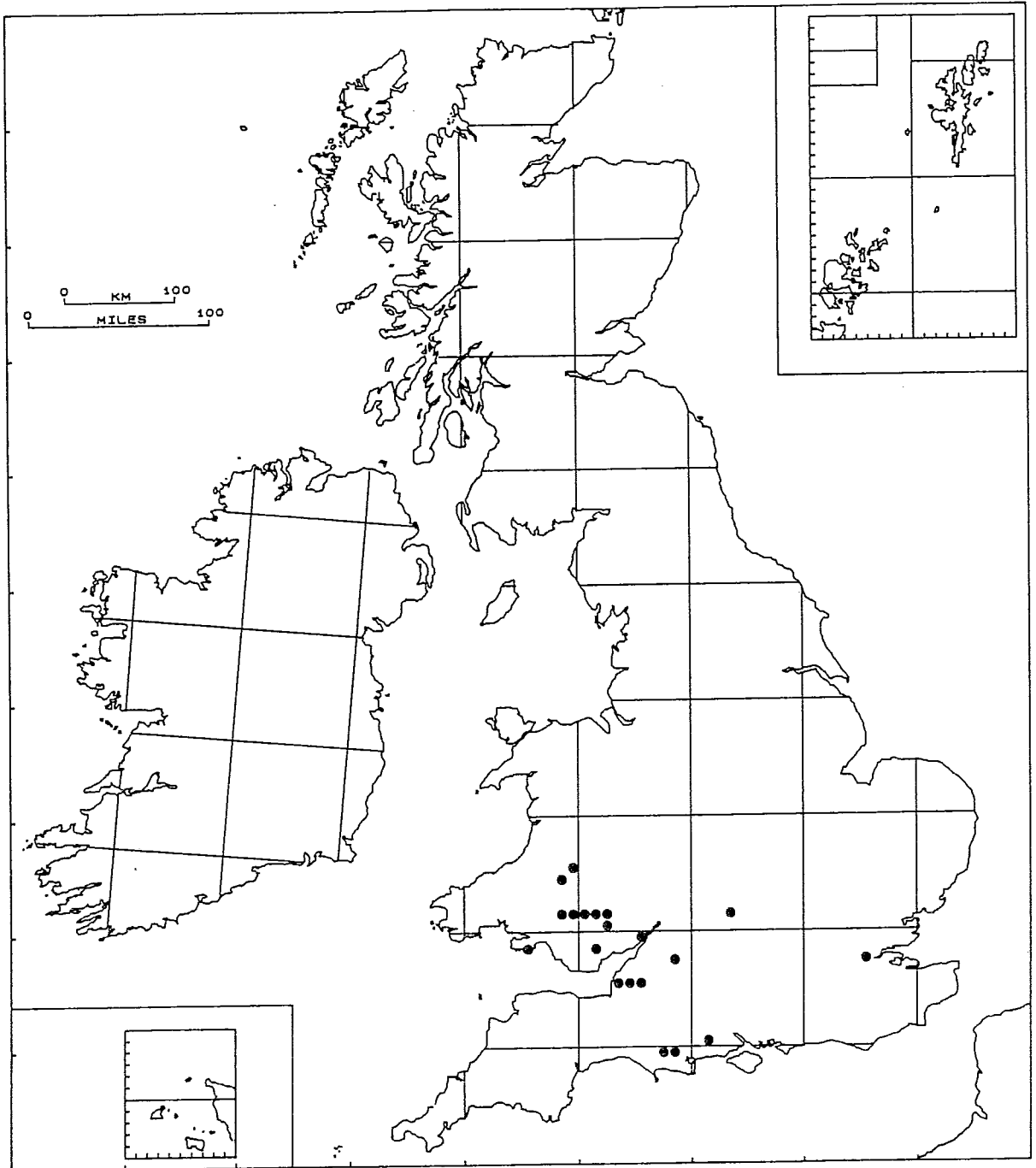


Fig. 1 : Asellus cavaticus. Recorded occurrence in Britain in 10 km squares up to December 1988.

NAMES FOR TERRESTRIAL ISOPODS IN JAPAN

TORU UDAGAWA

Department of Zoology, Faculty of Agriculture, Hokkaido
University, Sapporo 060, Japan

INTRODUCTION

Sutton (1980) remarked that woodlice, being common everyday creatures, have been given local names in many parts of Britain. In some areas, one name is used to cover all types but in others, different groups of woodlice have been given different names - 'slater' and 'pillbug' for example.

A similar situation pertains in Japan. In this short article, I will describe a few of the names which are currently used throughout my country. I am researching local names but reporting of these will have to wait for a subsequent article.

JAPANESE NAMES FOR DIFFERENT TYPES OF TERRESTRIAL ISOPODS

Schmalzfuss (1984) divided terrestrial isopods into five 'ecomorphological' categories based on their skeletal construction: the runners; the clingers; the rollers; the spiny forms; the creepers (plus a sixth group - the non-conformists). In the Japanese language, there are special words to describe the first three categories: the runners (epigeal, smooth, narrow, very mobile with long pereopods); the clingers (epigeal, slow, flat and broad); the rollers (conglobating, with all transitional forms from clingers to completely smooth and perfectly round balls). These are as follows :-

1. **Runners** - 'Funa-musi'. The word 'Funa' is a modified form of 'Fune', a noun used as an adjective. The English word for 'Fune' is 'a boat', 'a ship' or 'a vessel'. 'Musi' is 'a bug'.
2. **Clingers** - 'Warazi-musi'. 'Warazi' means 'sandals or flat shoes made from rice stems (kept on by cords over the top of the foot)'.
3. **Rollers** - 'Dango-musi'. 'Dango' is 'a small ball of cooked paste'.

These three common Japanese words for terrestrial isopods are further defined in Koozi-en (3rd edition, edited by Niimura 1983), one of the most authoritative Japanese dictionaries, as follows :-

'Funa-musi': an arthropod of the Order Isopoda, Crustacea. The body has a long egg-like form, is coloured yellow-brown and

is about 4 cm long. The second antennae is long. They run in groups over rocks and the floors of ships, using their strong thoracic legs. They are distributed along every coast in Japan.

'Warazi-musi': an arthropod of the Order Isopoda, Crustacea. The body is about 1 cm long, coloured grey-brown and has an egg-like form. They are like 'Dango-musi' but flat. They are distributed all over the world and are common in dark and wet places, e.g. spaces under stones, spaces under house floors, cellars etc. They are also called 'Zi-situ', or 'Ome-musi'.

'Dango-musi': an arthropod of the Order Isopoda, Crustacea. The body length is about 1 cm. The body is made of many segments, bent round in the back, coloured dark grey-brown. When their enemies attack them, they make their body like the form of 'Dango'. They are common under stones and so on in fields and gardens, and are pests of plants. They are widely distributed in Japan and other countries. The related species 'Hama-dango-musi' occur among small stones in coasts.

In the above descriptions, three Japanese words 'Zi-situ', 'Ome-musi' and 'Hama-dango-musi' appear which need some explanation. 'Zi' is a modified form of 'Ti', which refers to 'the earth' or 'the land' and it is used as an adjective. 'Situ' is 'a louse'. 'Ome' is an adjectival form of 'Omu' which roughly translates as 'fear', 'be afraid of' or 'be scared of'. 'Zi-situ' and 'Ome-musi' are relatively old words and are not now used frequently in Japan. 'Hama' roughly means 'coast' or 'seashore'.

Koozi-en's descriptions of the names for woodlice, which include some details of their biological features, must give readers the impression that there are only three species in Japan. However, this is clearly not the case as Nunomura's recent work on the distribution of terrestrial isopods in Japan (1983, 1984, 1986a, 1986b, 1987) has shown. Table 1 summarizes Japanese names for terrestrial isopods, Chinese-Japanese characters ('Kanji'), Japanese sound signs ('Kana') and includes some representative genera.

ACKNOWLEDGEMENT

I am grateful to Steve Hopkin for giving me the chance to write this article and for correcting and checking the English.

REFERENCES

IWANAMI SHOTEN (1983). Koozi-en. 3rd edition. Ed. I. Niimura. Tokyo, Iwanami Shoten Publishers.

T. Udagawa - Names for Japanese isopods

- NUNOMURA, N. (1983). Studies on the terrestrial isopod Crustacea in Japan. I. Taxonomy of the Families Ligiidae, Trichoniscidae and Olbrinidae. Bull. Toyama Sci. Mus., 5, 23-68.
- NUNOMURA, N. (1984). Studies on the terrestrial isopod Crustacea in Japan. II. Taxonomy of the Family Scyphacidae. Bull. Toyama Sci. Mus., 6, 1-43.
- NUNOMURA, N. (1986a). Studies on the terrestrial isopod Crustacea in Japan. III. Taxonomy of the Families Scyphacidae (continued), Marinoniscidae, Halophilosciidae, Philosciidae and Oniscidae. Bull. Toyama Sci. Mus., 9, 1-72.
- NUNOMURA, N. (1986b). On pill bugs and related groups. Insectarium, 23, 12-16. (In Japanese).
- NUNOMURA, N. (1987). Studies on the terrestrial isopod Crustacea in Japan. IV. Taxonomy of the Families Trachelipidae and Porcellionidae. Bull. Toyama Sci. Mus., 11, 1-76.
- SCHMALFUSS, H. (1984). Eco-morphological strategies in terrestrial isopods. Symp. zool. Soc. Lond. No. 53, 49-63.
- SUTTON, S.L. (1980). Woodlice. Oxford, Pergamon Press.

Table 1

THE RUNNER:	①	船	虫
	②	ふな	むし
	③	Funa	— musu
	④	<i>Ligia, Ligidium, Porcellionides</i>	
THE CLINGER:	①	草鞋	虫
	②	わらじ	むし
	③	Warazi	— musu
	④	<i>Porcellio, Nagrus</i>	
	①	億	虫
	②	おめ	むし
	③	Ome	— musu
	①	地	虱
	②	じ	しつ
	③	Zi	— situ
THE ROLLER:	①	団子	虫
	②	だんご	むし
	③	Dango	— musu
	④	<i>Armadillidium, Armadillo, Tylos</i>	

Table 1: Japanese names for different types of terrestrial isopods which are written in ① "Kanji", ② "Kana", and ③ Roman Alphabet. Representative Genera included in each type are shown in ④.

ARMADILLIDIUM PICTUM Brandt IN YORKSHIRE

DOUGLAS T. RICHARDSON
5 Calton Terrace, Skipton, North Yorkshire, BD23 2AY

INTRODUCTION

Armadillidium pictum was discovered on a wooded slope at Catrigg Force, Stainforth (34 832 761) in 1917 by F. Rhodes of the Yorkshire Naturalists' Union (YNU). The specimens form part of the Larwood Collection housed at the British Museum (Natural History). Rhodes, in fact, gave the location as Catrick Force, Ribbleshead, an error which caused confusion in the years to come - in fact the only Catrick in Yorkshire is the military complex of that name in the N.E. of the county, a non-limestone area in which no respectable A. pictum would dare to be found!

REDISCOVERY OF A. PICTUM AT CATRIGG FORCE

P.T. Harding, S.L. Sutton and others were determined that some effort should be made to try and re-find the Yorkshire A. pictum and the initiative was taken by the YNU when a joint meeting of their 'Other Arthropods' and Conchological sections was mounted at Catrigg Force on 11th May 1985. Low and behold, there was A. pictum in quantity in more or less the same place as described by Rhodes almost 70 years previously. Specimens were collected, their identity confirmed and deposited in Leeds City Museum.

A SECOND SITE FOR A. PICTUM in YORKSHIRE

The 'Other Arthropods' section of the YNU had been keeping an eye out for A. pictum for a number of years without success. However, on 3rd September 1988 when on another joint meeting with the Conchological Section, a single male A. pictum (confirmed D.T. Richardson) was picked up by A. Norris from under stones at the base of a limestone outcrop on upland limestone grassland with hawthorn scrub at Skythorns near Grassington (34 973 645). Further extensive searching proved unfruitful. This is only the second site for A. pictum in Yorkshire (Fig. 1).

However, a mystery still remains. Rhodes (1916) reported A. pictum as being taken by R. Sanderson at Ling Gill, Horton-in-Ribblesdale (34 800 785) on 1st November 1915. Unfortunately, no voucher specimens exist so it has not been possible to validate this record. Visits to Ling Gill in recent years have failed to find A. pictum but it's a wild place so perhaps we may be lucky one day.

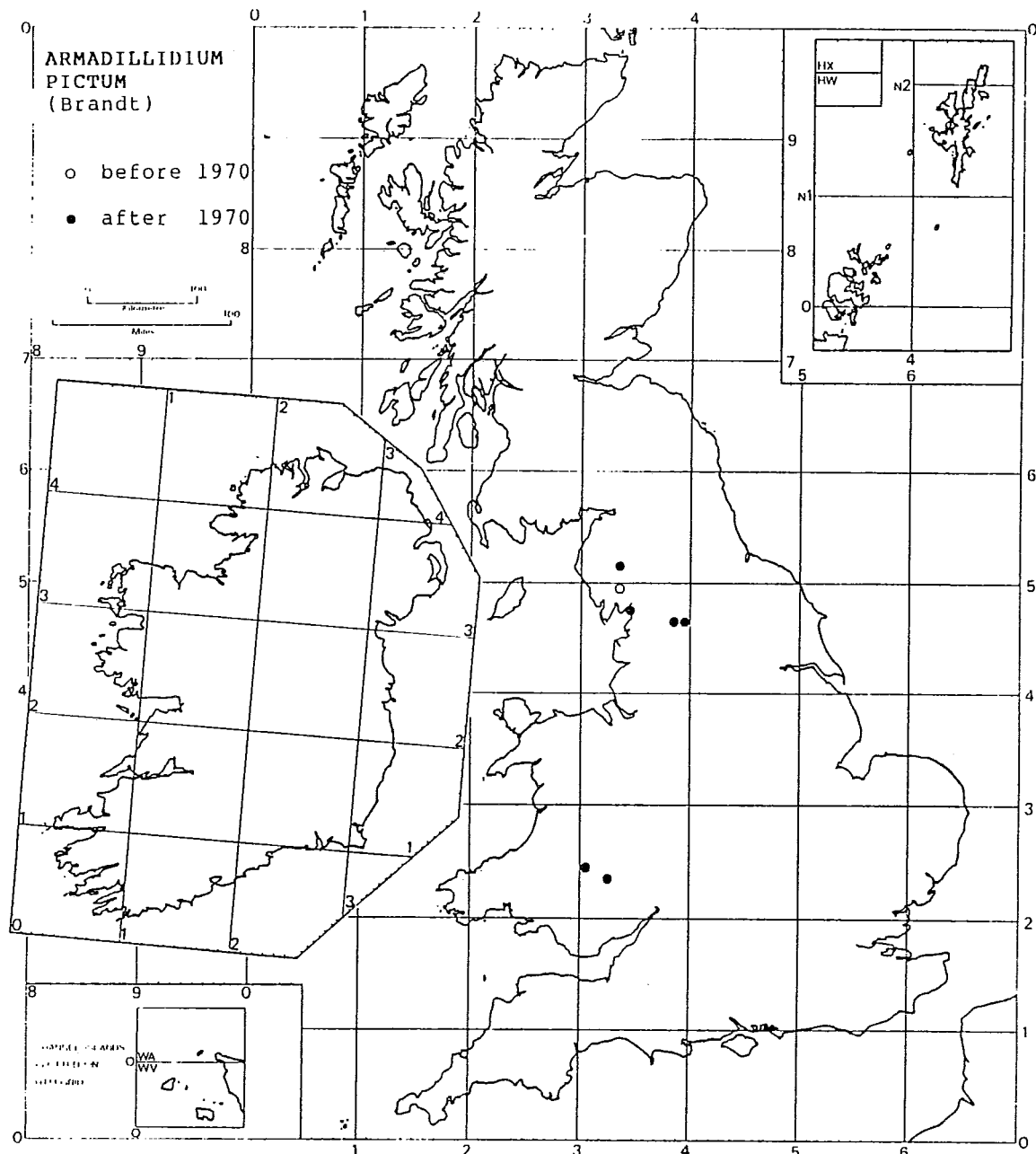


Fig. 1 : Armadillidium pictum. Recorded occurrence in Britain in 10 km squares up to April 1989.

REFERENCE

RHODES, F. (1916). The terrestrial Isopoda (woodlice) of Yorkshire. Naturalist, 99-102, 121-123.

LIGIA BAUDINIANA (ISOPODA, LIGIIDAE) ON THE GULF COAST OF THE
UNITED STATES

WILLIAM F. RAPP & JANET L.C. RAPP
430 Ivy Avenue, Crete, Nebraska 68333, U.S.A.

INTRODUCTION

The authors first became acquainted with Ligia baudiniana in February 1946 when they observed literally thousands at night on the sea wall at Pass Christian, Mississippi. This is the north shore of the Gulf of Mexico (Caribbean Sea). In checking the two standard works on North American isopods (Richardson 1905 and Van Name 1936), they found only generalized statements relating to the distribution of these species.

Ligia baudiniana Milne-Edwards is one of the larger species of Oniscidea and belongs to the family Ligiidae whose members are found on the shores of the oceans throughout the world. Most workers consider them to be primitive members of the Oniscidea. They may represent a group intermediate between marine and terrestrial isopods. The genus Ligia was last revised by Jackson (1922) who recognised 15 species. Verhoeff (1926) divided the genus into a number of genera which have not been accepted by modern workers. Ligia baudiniana may be separated easily from other members of the genus by the comb on the long setae on the carpus and merus of the first leg (Fig. 1A) and by the shape of the posterior border of the telson (Fig. 1B).

ECOLOGY

Ligia baudiniana occupies an ecological niche at the upper end of the littoral zone. This area is affected by both runoff from the land and by the influx of new material being deposited every high tide. Large populations are found on stone breakwaters and sea walls. Although most active at night, they can be observed at almost any time of the day. In spite of the fact that they are gill breathers, they appear to have the ability to rest on the surface of rocks above the high tide mark for long periods. Upon being disturbed, they run rapidly into the water where they burrow into the sand where they can stay for long periods. Small numbers may be found also under debris on tidal mud flats. We have observed Ligia baudiniana in such a habitat on Galveston Island and Shultz (1974) has reported this species from similar sites from several islands in the south Caribbean. In summary, Ligia baudiniana occurs along the shore of the Gulf of Mexico from Florida to Texas and on islands in the Atlantic Ocean and the Caribbean Sea.

Unfortunately, few weather stations on the Gulf Coast

collect data on water temperatures. The U.S. Coast and Geodetic Survey (U.S. Department of Commerce) has a reading station at Pensacola, Escambia County, Florida, which has recorded water temperatures since 1923. Based on data obtained by this station, it would appear that the mean annual water temperature along the northern Gulf Coast is about 20 °C. Based on our observations, Ligia baudiniana is well-adapted to live in this environment and appears to remain active throughout the year.

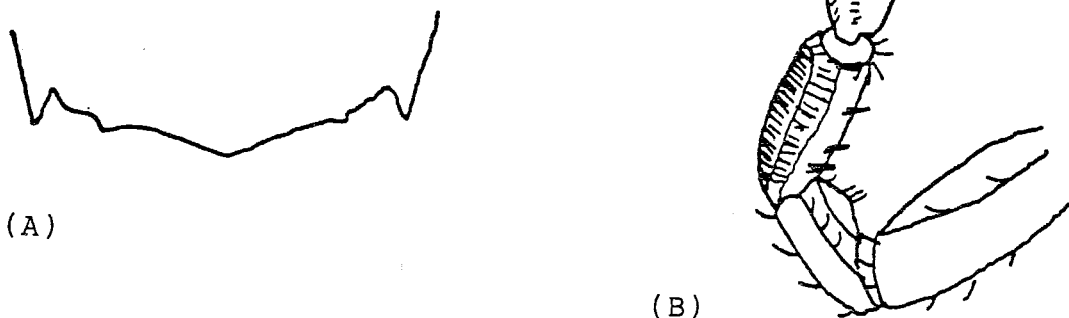


Fig. 1 : Distinguishing features of Ligia baudiniana. (A) telson, (B) first leg of male.

DISTRIBUTION

As was stated earlier, published distribution data is very general. Van Name (1936, p.59), the most recent general publication on American isopods, gives the following: "Atlantic Gulf and Caribbean Sea coasts from Florida to Brazil and in the West Indies". In spite of the fact that the type locality is San Juan d'Ulloa, near Veracruz, Mexico, no locations are given for the Gulf of Mexico. It is interesting to note that Van Name (1936) does not list this species as occurring on the Gulf Coast of the United States.

Schultz (1974) adds the following locations: Florida (Coot Bay Pond, Everglades National Park; Bahamas (North Bimini);

Virgin Islands; Tobago; Trinidad; Bonaire; Aruba and the east coast of Panama.

The authors have collected or examined specimens of Ligia baudiniana from the following locations:-

Bahamas

Clarence Town, Long Island - 24 July 1936, collected by Russell & McLean, Museum of Comparative Zoology, Harvard University (= 'MCZ' below).

Simm's, Long Island - 7 July 1936 (MCZ).

Bermuda

The MCZ has two collections of this species which unfortunately have no data. Both collections were examined by Harriet Richardson and these data were probably utilized in her 1905 Monograph.

Florida

Key West, Monroe County - no date (MCZ).

Little Torch Key - 14 April 1968 (four specimens, females with eggs, University of Kansas collection).

Miami, Dade County - 14 March 1898, collected by Mrs. A.J. Slosson (MCZ).

Yankeetown, Levy County - 24 June 1978, stone breakwater, west of Yankeetown, on Withlacoochee Bay, Gulf of Mexico - very abundant, approximately 100 per square metre.

Mississippi

Bay Saint Louis, Hancock County - 5 October 1975 and 27 March 1977, on breakwater leading to a fishing pier, 75 to 100 per square metre.

Biloxi, Harrison County - 5 October 1975, common on the breakwater, 75 to 100 per square metre.

Gulfport, Harrison County - 5 October 1975, common on the breakwater, 100 to 125 per square metre.

Long Beach, Harrison County - 5 October 1975, common on the breakwater, 75 to 100 per square metre.

Pass Christian, Harrison County - 15 February 1946. At this time there was a concrete sea wall approximately three miles long which at night, had thousands of Ligia baudiniana resting on it. It was destroyed by the hurricane of 1958.

Pass Christian, Harrison County - 3 October 1975 and 27 March 1977. On both these dates, large numbers were observed on the breakwater of the yacht basin at a density of about 100 per square metre.

Waveland, Hancock County, Buccaneer State Park - 27 March 1977, common on breakwater, 75 to 100 per square metre.

Texas

Corpus Christi, Nueces County - 12 May 1975, found under rocks

at shore line (R.E. Beer, University of Kansas Museum).
Galveston Island, Galveston County - 11 October 1980, under
debris on mud flats, uncommon.

In summary, it appears that Ligia baudiniana is more widely distributed along the shores of the Gulf of Mexico and the Caribbean Sea than earlier published records indicate. There is no question that much additional fieldwork is needed, especially on the Caribbean coast of Mexico, Central and South America.

DISCUSSION

One of the major questions which arises from a study of this species on the Gulf Coast of the United States is 'where did this species live prior to the construction of stone breakwaters?'. Today, the vast majority of stone breakwaters along the Gulf Coast are supporting large populations. In fact, it is difficult to find this species in large numbers except on these man-made structures. When one is fortunate to find this species under debris on mud flats, only one or two specimens are found.

It is safe to state that probably the earliest stone breakwaters were constructed not more than 150 years ago! In fact the breakwaters which support the highest populations are made of broken concrete and probably were constructed within the past 75 years. If we assume that the natural habitat of Ligia baudiniana was under various types of debris on mud flats located within the tidal zone, can we assume that this species had a far lower population than we have today? Based upon our observations, it appears that this species has, in a short period of years (<100?), been able to adapt to and colonise a totally man-made habitat.

REFERENCES

- JACKSON, H.G. (1922). A revision of the isopod genus Ligia (Fabricus). Proc. zool. Soc. Lond., (1922), 683-702.
RICHARDSON, H. (1905). A monograph of the isopods of North America. Bull. U.S. Natl. Mus., 54, 1-727.
SCHULTZ, G.A. (1974). Terrestrial isopod crustaceans (Oniscoidea) mainly from the West Indies and adjacent regions. I. Tylos and Ligia. Studies on the Fauna of Cucacoo and other Caribbean Islands, 45, 162-173.
VAN NAME, W.G. (1936). The American land and freshwater isopod Crustacea. Bull. Am. Mus. Nat. Hist., 71, 1-525.
VERHOEFF, K.W. (1926). Isopoda Terrestria von Neu-Caledonein und den Loyalty-Inseln. Nova Caledonia, Zool., 4, 243-366.

THEMES AND VARIATIONS : BROODPOUCH COTYLEDONS IN
AUSTRALIAN ONISCIDEA

FIONA LEWIS

School of Biological Sciences, Macquarie University, NSW 2109,
Australia

INTRODUCTION

The Oniscidea, commonly known as woodlice, slaters or pillbugs, are a well-recognised part of garden fauna and have a worldwide distribution in all climatic zones with the exception of the polar regions.

Australia has members from 14 (Table 1) of the 34 families currently established (Holdich *et al.* 1984), thus the group is well-represented here. This is suprising considering that Australia is the driest continent (after Antarctica) on earth with over 2/3 of the area classified as semi arid (Fig. 1), and that the oniscids have often been considered as ill-adapted for terrestrial life.

Until recently, little has been written about the broodpouch cotyledons, outgrowths of the thoracic intersegmental membrane. Vandel (1925) mentions the discovery and naming of the cotyledons by Treviranus in 1816. Verhoeff (1920) mistakenly thought their development was linked to fertilisation, while it is in fact, associated with the presence of eggs in the pouch (Vandel 1925). Finally, their structure was described and it was suggested that their function was to produce broodpouch fluid (Hoese 1984).

No explanation has been given, however, for the variation in numbers and arrangements of cotyledons in different species. It is suggested here that the cotyledon number of a particular species may be a reflection of its taxonomic position and/or its adaptation to aridity, as cotyledons have not been found on marine isopods.

STRUCTURE AND FUNCTION OF COTYLEDONS (Fig. 2)

Cotyledons are finger-like extensions of the ventral intersegmental membrane, and are usually found on pereion segments 2-5, developing after a brooding moult. They have been described as partly hollow and containing haemolymph lacunae, and it has been suggested that they may secrete the broodpouch fluid (Hoese 1984). This fluid is a reflection of the oniscideans ancestral link with marine isopods and their characteristic of laying soft-shelled eggs requiring a fluid medium for development. Akahira (1956) found a mucous mass surrounding the embryos and suggested that the cotyledons may store this. The lengths of the cotyledons vary with the species and the age of the brood.

NUMBER AND ARRANGEMENT OF COTYLEDONS

Cotyledons are not present in all families. They are missing in the 'inferior oniscoids', and are not always found in the more evolved families, and vary in number between species (Vandel 1925). In most Australian specimens examined, cotyledons, if present, are found on segments 2-5, and range in number from four to 28 per animal. In most species, each segment has the same number.

In species with cotyledons, the least number found is four, with one cotyledon placed centrally on each of segments 2-5. This is described as the 'basic' pattern (Fig. 3A). Cotyledons may be found singly (Fig. 3B), or in groups of two or three (Fig. 3C) along the soft ridge of the intersegmental membrane. Those with 12 cotyledons are the next most common, usually having one cotyledon on each side and one placed centrally on each of segments 2-5 (Fig. 3D). Some have groups of three cotyledons placed centrally (Fig. 2). Those with larger numbers all have central and side groups (Fig. 3E) with one exception, a species of Merulaninae, where the six cotyledons per segment lie in a straight line along the intersegmental membrane (Fig. 3F).

EVOLUTIONARY RANKING AND HABITAT

The families found in Australia, including the three introduced ones, are listed in Table 1, and are ranked from primitive to advanced (A.J.A. Green, personal communication). The terms 'primitive' and 'advanced', although often a cause of much dissension, are used here to indicate the increased loss of marine isopod characteristics, and/or the gain of characteristics of adaptive value to increasing terrestriality.

It was stated earlier that in most cases, cotyledons are only found on segments 2-5 and that the number per segment is constant within a species. However, there are exceptions. Four species do not have equal numbers on each of segments 2-5. Armadillidium vulgare (an introduced species) has one cotyledon on segment 2, and three cotyledons on each of segments 3-5, giving a total of ten; a species of Philosciidae has the same arrangement; two species of Australiodillinae have three cotyledons on each of segments 3-5 but only one or two on segment 2. The other exception, an undescribed species possibly belonging to the Trachelipidae, has one cotyledon on segment 1 as well as three on each of segments 2-5.

BROODPOUCHES IN GENERAL

There are other broodpouch characteristics that should be mentioned here. All the volvational or 'rolling' families, with one exception, have an extension to the pouch area (Fig. 4A, B) formed by the posterior invagination of the sternal epithelium of the sixth and seventh segments. Mead (1963) describing Helleria brevicornis Ebner, calls this an 'internal sac'. This recess is not present in the two Australian species of

Actaeciidae, but has been found in a species of Philosciidae, a non-roller. The other characteristic, again only present in rollers, is the dorsal displacement of eggs and embryos (Fig. 4C). This is possibly an adaptation to allow the animal to roll up. In non-rollers, the pouch extends ventrally to contain the enlarging brood (Fig. 4D), and this could hinder the rolling action (Barnard 1932).

DISCUSSION

When the two proposals linking cotyledon number to taxonomic position and habitat humidity are considered, a clear correlation appears (Table 1). Those with none or few cotyledons are mostly species from the more primitive families, the members of which are generally confined to supralittoral or reliably moist habitats. Those with the most cotyledons are species of the Armadillidae, the most advanced family which includes almost half of the described Australian oniscids, in particular the arid zone species.

Animals living in arid habitats could have a problem with loss of broodpouch fluid due to dehydration. This might be overcome in two ways. First, the cotyledons could secrete more fluid or second, the number of cotyledons could be increased. Species from six of the eight Australian subfamilies of Armadillidae can be found in the arid, semi-desert areas, and these species have the most cotyledons.

A question now arises regarding the species with no cotyledons. Where does their broodpouch fluid come from? The answer is possibly from the external water conducting system of the type present in species from moist environments, and from secretion by the female from the ventral integument (Hoese 1984).

Two of the three families lacking cotyledons are supralittoral and are generally considered primitive. These are the Tylidae and the Ligiidae. The Styloniscidae, although not halophilic, are also considered to be primitive and are usually found in very moist leaf litter where there are free water droplets. The other supralittoral, primitive family, the Scyphacidae, provides an anomaly. Four species of Alloniscus, one of the three genera of Scyphacidae, have been found with 12 cotyledons. This seems a large number for a primitive family (aquatic species do not have any cotyledons) and for one from a consistently humid habitat. Possibly their behaviour, when compared with that of other beach species, necessitates this large number of cotyledons. No breeding specimens from the other two genera have yet been found for comparison.

The Actaeciidae, although supralittoral, are considered an advanced family. As yet, no breeding specimens have been collected. However, many females examined have two unusual characteristics. First, they do not have a recess under segments 6 and 7 in common with all other rollers and second, where oostegites are present, they do not enclose the pouch area and can only be described as 'stunted'. It may be that they have a pre egg-laying moult and that the full oostegites will develop

at the next moult when the eggs are laid. If this is so, this sequence has not been noted for any other oniscid. Possibly they have what has been called a 'basket-like pouch' (Hoese 1984), typical of marine isopods. In which case, why are they ranked so high?

Haloniscus searlei is an anomaly in any terms. It is found in inland salt lakes yet is classified as an oniscid, a terrestrial isopod. It is considered to be secondarily aquatic (Chilton 1920), and it may be that adaptation to extreme aridity on land enabled it to survive the equally dehydrating effect of high salinity. It has an upper salinity tolerance of 159 parts per thousand (Bayley & Williams 1966). The function of the 12 cotyledons in this species has yet to be determined. It could be different from those in non-aquatic environments.

Four species of Trachelipidae have been collected from arid areas. All have only four cotyledons but were found in ant nests where the humidity is relatively high and constant, so lessening the problems of dehydration of the broodpouch fluid.

The second family found consistently in arid areas is the Armadillidae, the most advanced family. The largest numbers of cotyledons are found in armadillid species.

It is the exceptions to the emerging patterns relating cotyledon numbers to humidity and evolutionary ranking, that are of particular interest. Further study of these species continues, particularly the situations where species from different families and with much variation in cotyledon numbers, share the same habitat. The problem of evaluating the differences in microhabitats within a common macrohabitat will be studied, and the interactions in terms of time and space between different species within a common habitat will be examined to determine if differences in behaviour also relate to differences in cotyledon number.

(A note regarding the names of Australian species is necessary. Many of the species collected are previously unrecorded and undescribed. I have found ten species novelle this year including two from a family and two from a genus both new to Australia. At least six other species may also be new, but the early type descriptions are often vague, and the illustrations, if present, are inadequate for positive identification. For the purposes of this study, classification to generic level is acceptable, therefore no species names, with the exceptions of Armadillidium vulgare and Haloniscus searlei have been used.)

ACKNOWLEDGEMENTS

I wish to thank Sue Doyle for her help with the scanning electron microscope, those of my colleagues who have read and commented on this paper, and Miss A.J.A. Green of the Tasmanian Museum for help with the identification of specimens.

REFERENCES

- AKAHIRA, Y. (1956). The function of thoracic processes found in females of the common wood-louse Porcellio scaber. J. Fac. Sci. Hokkaido Univ., Series 6, Zoology, 12, 493-498.
- BARNARD, K.H. (1932). Contributions to the crustacean fauna of South Africa. No. 11. Ann. S. Afr. Mus., 30, 179-388.
- BAYLY, I.A.E. & WILLIAMS, W.D. (1966). Chemical and biological studies on some saline lakes of south-east Australia. J. Mar. Freshw. Res., 17, 177-228.
- CHILTON, C. (1920). On a new isopodan genus (family Oniscidae) from Lake Corangemite, Victoria. Proc. Linn. Soc. New South Wales, 44, 723-734.
- DAVEY, K. (1983). Our Arid Environment : Animals of Australias Desert Region. A.H. Reed & A.W. Reed, P/L.
- HOESE, B. (1984). The marsupium of terrestrial isopods. Symp. zool. Soc. Lond. No. 53, 65-76.
- HOLDICH, D.M., LINCOLN, R.J. & ELLIS, J.P. (1984). The biology of terrestrial isopods : terminology and classification. Symp. zool. Soc. Lond. No. 53, 1-6.
- MEAD, F. (1963). Sur l'existence d'une cavité incubatrice complexe chez l'Isopodes terrestre Helleria brevicornis Ebner. C. R. Acad. Sci. Paris, 257, 775-777.
- VANDEL, A. (1925). Recherches sur la sexualité des Isopods les conditions naturelle de la reproduction chez les Isopodes terrestres. Bull. Biol. France Belgique, 59, 317-371.
- VERHOEFF, K.W. (1920). Zur Kenntnis der Larven, des Brutsackes und der Bruten der Oniscoidea. 28. Isopoden - Aufsatz. Zool. Anz., 51, 169-189.

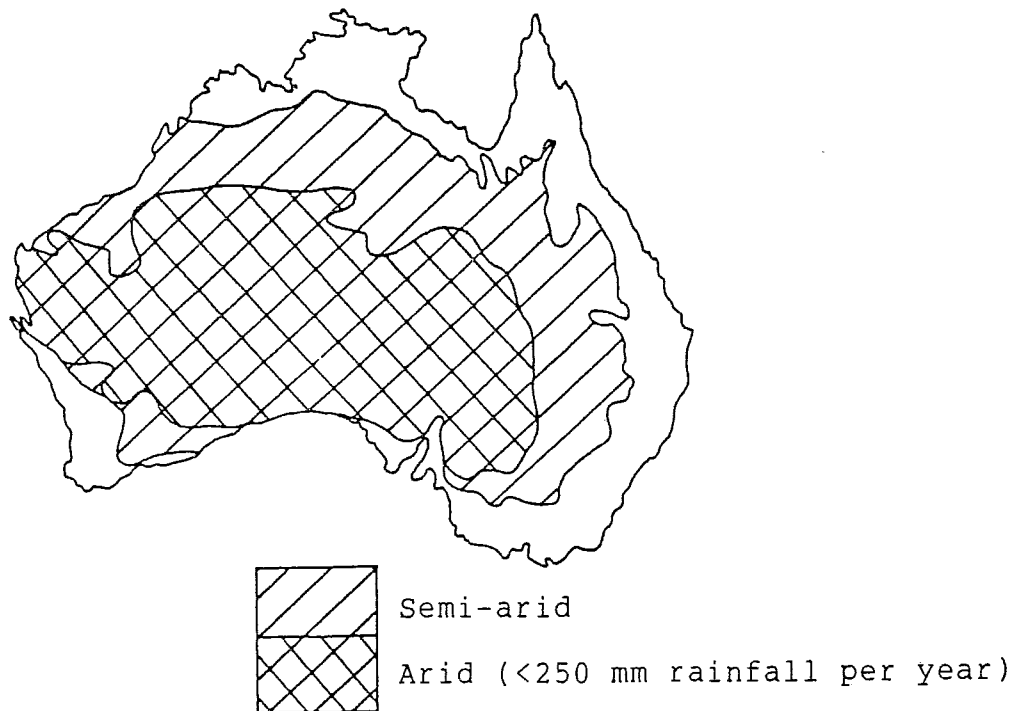


Fig. 1 : Arid areas of Australia (after Davey 1983).

Table 1. Australian Oniscidea

INFRAORDER	SECTION	SUPERFAMILY	FAMILY	HABITAT	COTYLEDON TOTAL PER SEGMENT	RECESS	ROLLER
Tylomorpha			Tyllidae	Beach	0 0 0 0 0 0	✓	✓
Ligiamorpha	Diplocheta		Ligiidae	Beach	0 0 0 0 0 0	X	X
	Sinocheta		Styloniscidae	Moist	0 0 0 0 0 0	X	X
	Grinocheta	Oniscoidea	Scyphacidae	Beach	12 0 3 3 3 3	X	X
			Oniscidae	Terrestrial	4 0 1 1 1 1	X	X
			Haloniscus searlei	Salt Lake	12 0 3 3 3 3	X	X
			Philosciidae sp.1	Terrestrial	4 0 1 1 1 1	X	X
			sp.2		8 0 2 2 2 2	✓	X
			sp.3		10 0 1 3 3 3	X	X
			Halophilosciidae	Beach			X
			Bathytropidae	Beach			X
			Platyarthridae	Terrestrial			X
	Porcellion- oidea		Porcellionidae	Terrestrial	4 0 1 1 1 1	X	X
			Trachelipidae	Arid/ants	4 0 1 1 1 1	X	X
			Armadillidiidae	Terrestrial	13 1 3 3 3 3	X	X
			Actaeocidae	Terrestrial	10 0 1 3 3 3	✓	✓
			Armadillidae	Beach		X	✓
		(Subfamily)	Australiodillinae	Arid/ Terrestrial			✓
				3 spp.	10 0 1 3 3 3	✓	F
			Aust/Cubarinae		11 0 2 3 3 3	✓	F
			Cubarinae		12 0 3 3 3 3	✓	F
			Merulaninae	2 spp.	28 0 7 7 7 7	✓	F
			Armadillinae	5 spp.	24 0 6 6 6 6	✓	✓
			Acanthodillinae	3 spp.	24 0 6 6 6 6	✓	✓
			Lobodillinae	1 sp.	24 0 6 6 6 6	✓	✓
			Buddelundinae	2 spp.	24 0 6 6 6 6	✓	✓
				6 spp.	16 0 4 4 4 4	✓	✓
			Akermaninae		20 0 5 5 5 5	✓	✓
							X

— = no specimens or cotyledon information

F = folds, incomplete roller

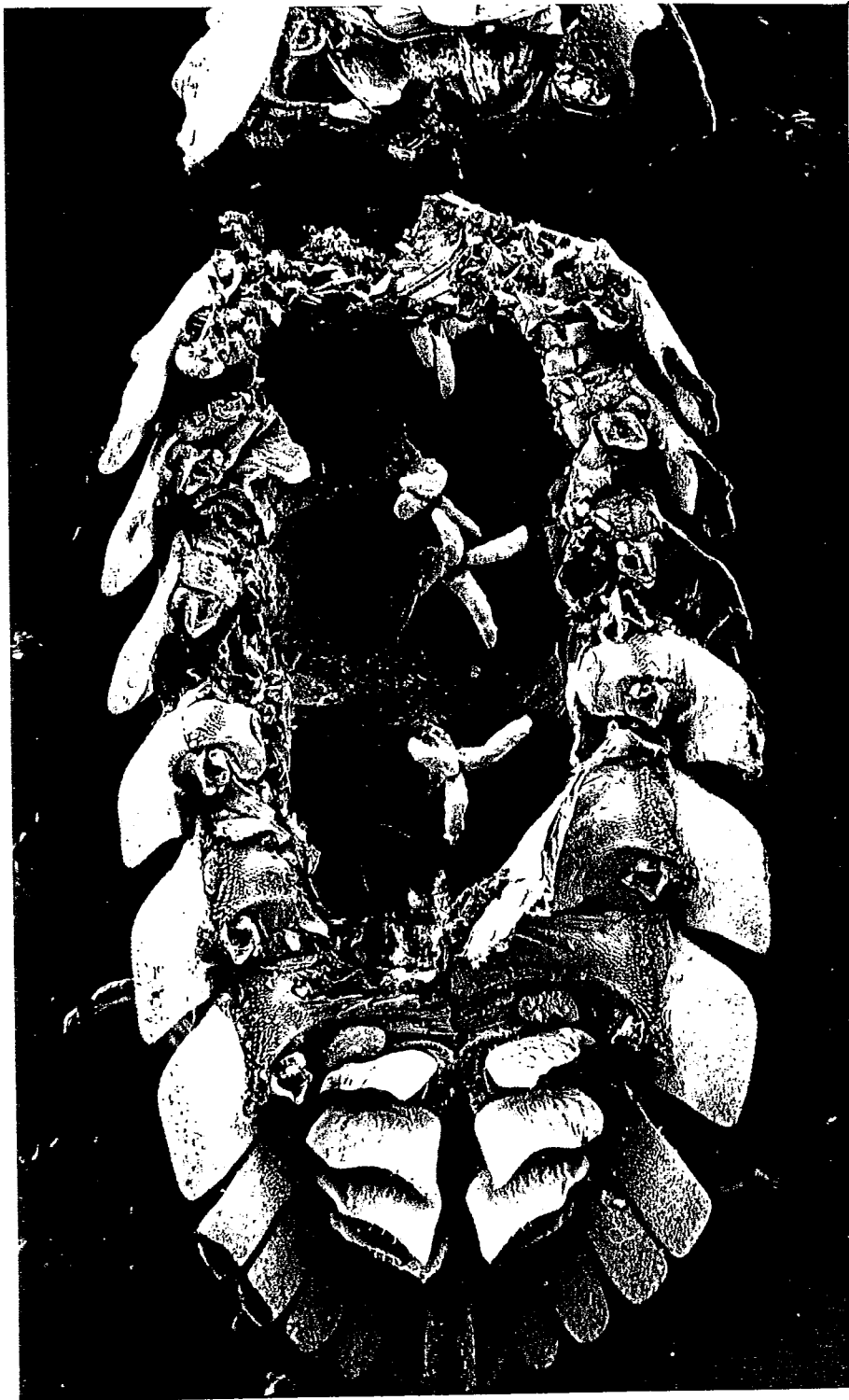
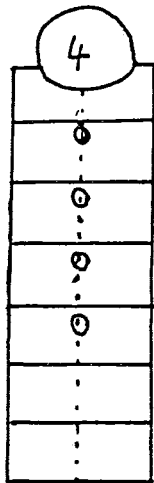
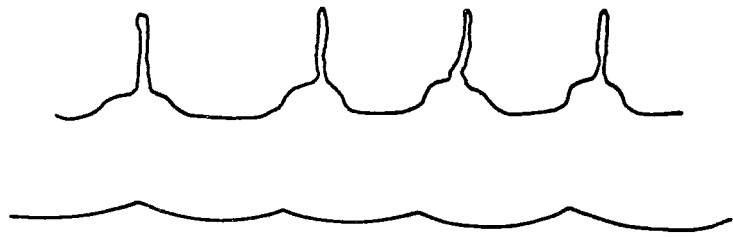


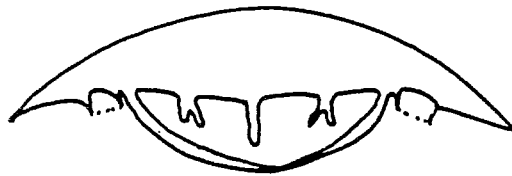
Fig. 2 : Scanning electron micrograph of broodpouch cotyledons on a species of Alloniscus (oostegites removed). Each of segments 2-5 have three cotyledons arranged in a central group. Scale bar = 1 mm.



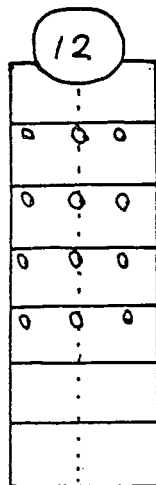
(A) Basic pattern



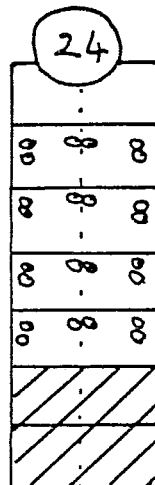
(B) L.S. through mid-line



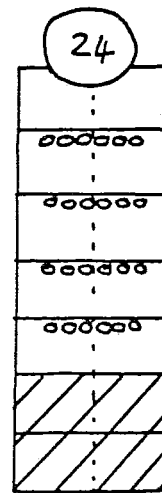
(C) T.S. through intersegmental membrane



(D)



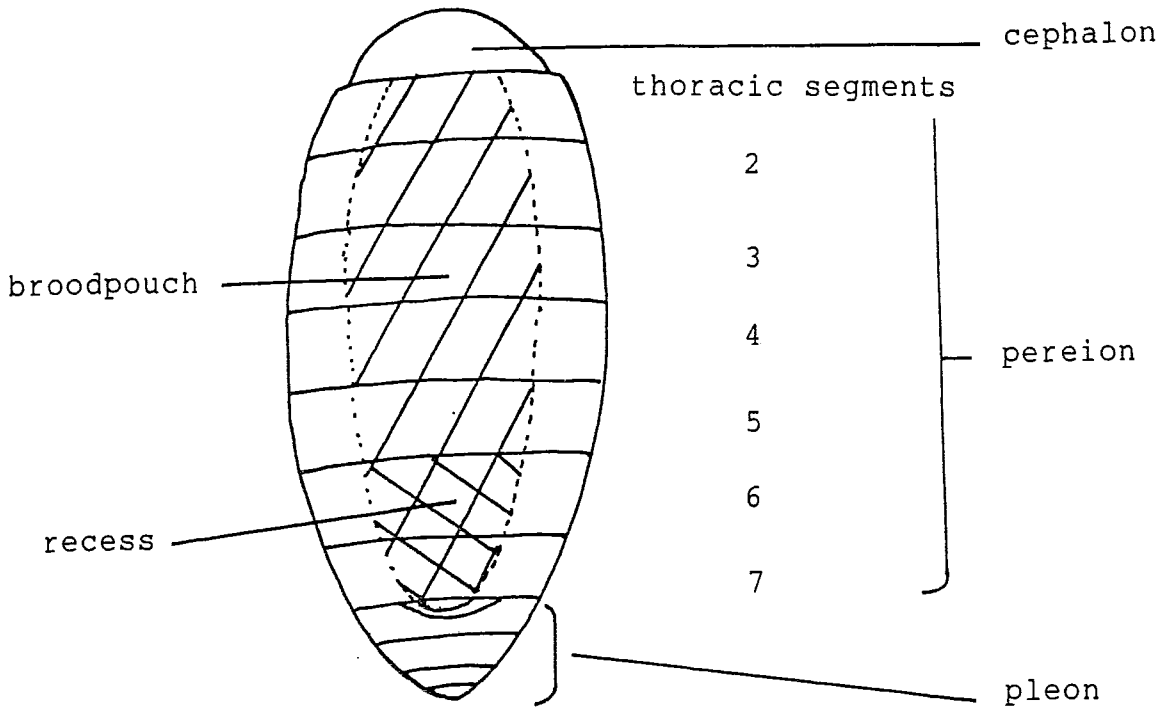
(E)



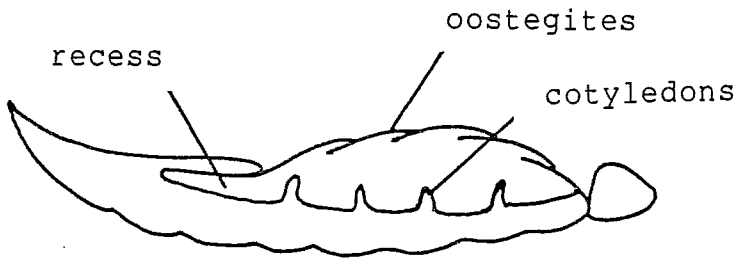
(F)

//// = Recess

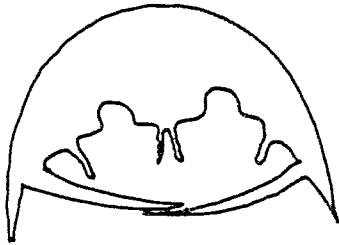
Fig. 3 : Patterns and structure of broodpouch cotyledons in terrestrial isopods.



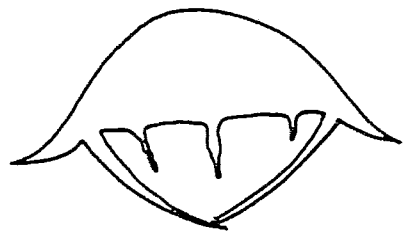
(A) Schematic ventral view of a 'roller'



(B) L.S. through mid-line of a 'roller'



(C) T.S. through broodpouch of a 'roller'



(D) T.S. through broodpouch of a 'non-roller'

Fig. 4 : Broodpouch structure in 'rollers' and 'non-rollers'.

'ALBINO' WOODLICE : DO THEY EXIST?

STEPHEN P. HOPKIN

School of Animal & Microbial Sciences, University of Reading,
PO Box 228, Whiteknights, Reading, RG6 2AJ

INTRODUCTION

Collins English Dictionary defines an albino as a 'person with congenital absence of pigmentation in the skin, eyes, and hair' or 'any animal or plant that is deficient in pigment'. The term is derived from the Latin albus meaning 'white'. The Penguin Dictionary of Biology extends the definition and describes albinism as 'Failure of development of skin pigments. In mammals, including man, commonly due to a single recessive gene.'

There are major selective pressures against the conservation of the gene which produces albinism. Humans with complete albinism are blind, although in this modern age, notwithstanding their blindness, albinos are able to lead an active normal life (Johnny Winters, the well-known West Coast electric guitarist of the 1960's and 1970's, famous for his lightening speed on the fretboard, springs to mind).

In animals, the major disadvantage conveyed by a lack of normal pigmentation, so the argument goes, is the reduction in camouflage. Albino vertebrates are soon 'picked off' by predators. Absence of colouration may also result in complete or partial albinos being shunned by the opposite sex. In invertebrates, however, I would like to put forward the argument that under certain circumstances, the evolution of albinism has been a distinct advantage in enabling some groups to colonise environments where a lack of pigmentation is beneficial. The examples I shall use to support this argument will be British woodlice.

FACTORS CONTROLLING THE COLOURS OF WOODLICE

The appearance of woodlice in natural light is due to a combination of factors. These include reflection of light waves from the surface and subsurface of the dorsal cuticle, and refraction of light through structures on and in the cuticle.

Differences in the colour of heavily pigmented species such Philoscia muscorum (which has 'yellow', 'green' and 'red' forms - see Plate 6 in Sutton, 1980) are due presumably to differences in the colour and arrangement of the pigments themselves. Others, such as the common littoral species Ligia oceanica, are able to change the shade of the cuticle by expanding or contracting melanophores in response to the darkness of its background. The surface of Porcellionides pruinosus has a plum-like 'bloom' due to the presence of millions of tiny spheres which reflect the light in an as yet undiscovered way

(Holdich 1984).

In contrast, the colour of some species may be due partially or wholly to reflection of light from structures under the cuticle. Androniscus dentiger, for example, which is normally a rich rose-red or pink in life (see Plate 1 in Sutton 1980) has a broad yellow median stripe, through which the dark-coloured gut contents are visible, giving the impression that there is also a dark dorso-median stripe' (Harding & Sutton 1985, the cover of which illustrates a photograph by Dick Jones of this striking woodlouse).

Refraction of light by the cuticle of woodlice has, as far as I am aware, been seen only in species affected by an iridovirus. Infected animals have a violet sheen produced by the interaction of light with the virus particles. Federici (1984) reported that Armadillidium vulgare, Cylisticus convexus, Porcellio dilatatus, Porcellio laevis, Porcellio scaber, Porcellionides pruinosus and Trachelipus rathkei have been observed to have the virus. To this list can be added four additional species collected by BISG members, Ligidium hypnorum (Arthur Chater, BISG Newsletter No. 24), Oniscus asellus and Trichoniscus pusillus (Arthur Chater again, BISG Newsletter No. 21), and Philoscia muscorum (Paul Whitehead, BISG Newsletter No. 24).

ALBINO WOODLICE

Of course, all species of terrestrial isopods are white when they are released as juveniles from the brood pouch (although their eyes, if present, are usually pigmented). Indeed, the cuticle is so transparent that certain digestive processes can be observed directly through the dorsal cuticle (Hames & Hopkin 1989). The adult compliment of pigments accumulates as they mature. However, several species on the British list are completely, or almost completely, white as adults. These include the 'ant woodlouse' Platyarthrus hoffmanseggi, soil-dwelling species such as Trichoniscoides sarsi and the three species in the genus Haplophthalmus, and littoral species such as Miktoniscus patiencei and Trichoniscoides saeroeensis. Consequently, I would suggest that we reserve the term 'albino' for white individuals of a species which is normally heavily pigmented.

Under this definition, albino woodlice do exist. I collected a specimen of Porcellio scaber from Most Southerly Point on the Lizard in Cornwall in September 1983 which was completely white, including the ocelli in which there was no trace of pigment. I have also turned up completely white Oniscus asellus in a disused chalk quarry near Henley, Oxfordshire on a couple of occasions. In addition, Arthur Chater collected an albino specimen of Porcellionides cingendus on the BISG Field Meeting in North Devon in April 1989.

These isolated specimens suggest that the incidence of albinism in woodlice is very low. However, if white forms are subjected to greater predation, then the proportion of the population which possess this phenomenon may be much greater in

juveniles than in adults.

THE SELECTIVE ADVANTAGE OF ALBINISM

Now the speculative bit! It is generally accepted that there is a strong selective pressure for cave-dwelling and deep soil-dwelling animals to lose their colour because those individuals which do not expend energy on manufacturing and laying down pigments, have more energy to spend on growth and reproduction instead. Thus, a heavily-pigmented species in which a proportion of the population are white, may be 'preadapted' for the colonisation of permanently dark environments such as caves.

A possible example of this is Androniscus dentiger which occurs in a complete range of colours from pure white to deep rose-red. In my experience, the rose-red form is dominant in gardens and other moderately stable synanthropic sites. However in more 'difficult' habitats, the white form is much more prevalent. Collectors at the BISG Field Meeting in Manchester in April 1986, for example, turned up a large population of white Androniscus dentiger in the accumulated wind-blown dust and rubbish at the base of a flyover of one of the city's busiest motorways. Perhaps the white form has a greater propensity for exploratory migrations! The white form is certainly found frequently in caves (Harding & Sutton 1985).

More research is required on the subject of albinism in woodlice and I would be grateful to receive specimens of, or accounts of, poorly-pigmented woodlice which readers of Isopoda may have come across in the past.

REFERENCES

- FEDERICI, B.A. (1984). Diseases of terrestrial isopods. Symp. zool. Soc. Lond. No. 53, 233-245.
- HAMES, C.A.C. & HOPKIN, S.P. (1989). The structure and function of the digestive system of terrestrial isopods. J. Zool. Lond., 217, 599-627.
- HARDING, P.T. & SUTTON, S.L. (1985). Woodlice in Britain and Ireland : Distribution and Habitat. Abbots Ripton. Institute of Terrestrial Ecology.
- HOLDICH, D.M. (1984). The cuticular surface of woodlice : a search for receptors. Symp. zool. Soc. Lond. No. 53, 9-48.
- SUTTON, S.L. (1980). Woodlice. Oxford. Pergamon Press.