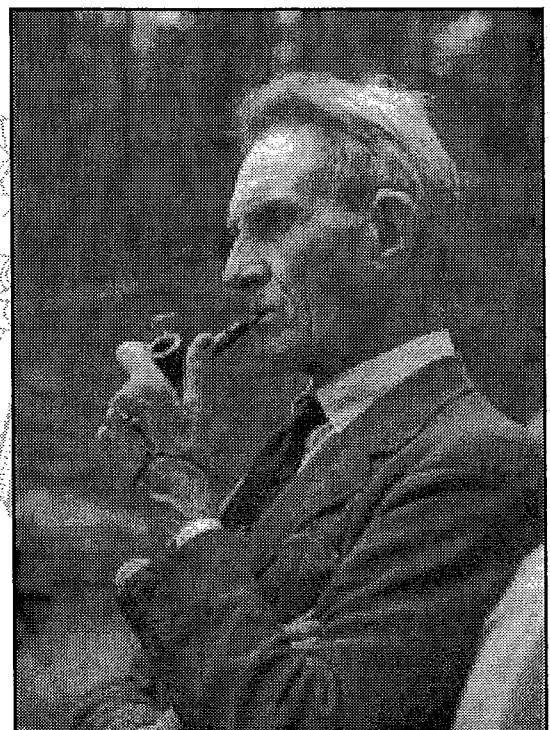
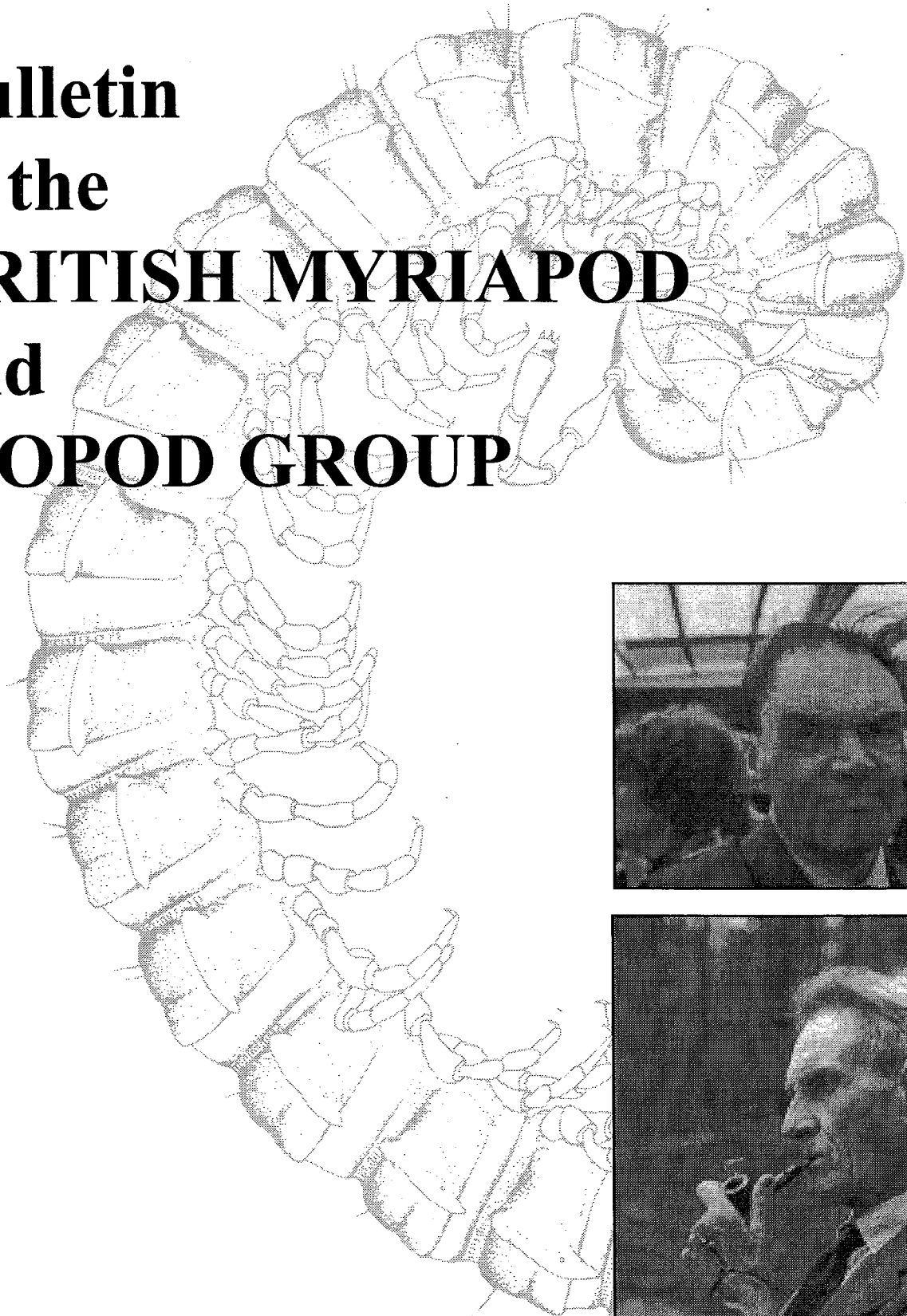


**Bulletin
of the
BRITISH MYRIAPOD
and
ISOPOD GROUP**



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EDITORIAL

This special volume of the Bulletin stems from the Memorial Meeting in Manchester on 25th of April 2003 to celebrate the lives and contributions to myriapod studies of E.H. (Ted) Eason and J. Gordon Blower. Thanks to the work of Helen Read and the other organisers and the contributions of many colleagues from both the UK and elsewhere, the meeting was judged to be an outstanding success by those present.

A series of papers on millipedes and centipedes by Gordon Blower culminating in those two milestones in British myriapod studies, the two editions of the Linnean Society Synopsis, *British Millipedes*, and outstanding work on millipede ecology and lifecycles inspired generations of workers both students of the "Manchester School" and elsewhere to take an interest in the taxonomy and ecology of diplopods. Of course the other factor in this was the personality of Gordon himself, gently helping and supporting others in their studies as well as being the founder of the British Myriapod Group where both professional and amateur workers found themselves welcome.

Parallel to this was the work of Ted Eason, who, from studies of myriapods in his local Cotswolds, went on to become internationally recognised for his outstanding work on Lithobiomorpha seen in a long series of papers listed elsewhere. For British (and other) students of chilopods, *Centipedes of the British Isles* in 1964 provided both a foundation and a standard of work to be aimed at. At the same time, Ted was an assiduous correspondent and his prompt and helpful letters followed any enquiry, however trivial. He had also made his contributions to BMG meetings including that first one near Lynton where *Chalandea pinguis* was first recorded in Britain.

To have had two such contributors to myriapod studies in Britain, publishing such outstanding work but at the same time being so open and supportive to others must be unique.

The articles in this volume derive from both papers and posters presented to the meeting together with a report by Desmond Kime held over from a previous volume but which related to centipedes identified by Ted from various European countries. We apologise to subscribers for the lateness of this 2003 special volume.

J. GORDON BLOWER – ANAMORPHOSES AND ANAGRAMS

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This paper is intended to commemorate Gordon Blower's contribution to progress, endeavour and projects in myriapodological research over the last decades. It is mainly based on my personal experience and recollection.

When re-reading Gordon's papers and his letters, I realised more than before that he had led an exemplary life, with his dedication to science, his affection for his family, his friends and colleagues, with its highlights and its tragedies. Everything was more pronounced than in an ordinary life. When he thought about a problem, when he weighed his words, when he made suggestions, and even when he applied dots to his meticulous drawings, he was more careful than anyone else whom I have ever met.

Therefore, I decided not to separate the scientific and the personal aspects, but to try to cast a glance on part of Gordon's life from the viewpoint of a foreigner who was happy enough to come into contact with his world and his circle from time to time. Most of Gordon's qualities and contributions are so well-known to many of the myriapodologists and have been stressed in several obituaries that I will not extend too much on these, but will concentrate on some traits which are probably not familiar to everybody and have partly passed unrecognised. The paper may also give evidence as to the influence which Gordon Blower exerted outside Britain.

I met Gordon for the first time in Paris in 1968 on the occasion of the 1st International Congress of Myriapodology. During the welcome party in the large Hall of the Musée national d'Histoire naturelle, someone looked closely at my name-tag and said: "O, *Glomeris*-Dohle" and gave me a dig in the ribs. This was Gordon Blower. My thesis on the embryology of *Glomeris* and other millipedes had been unwisely published in German, but Gordon had studied it. Some will not be aware of this, but Gordon could read and even write German though some of his German letters are rather peculiar. Despite this proficiency, he sometimes asked me to translate some paragraphs of Verhoeff. However, Verhoeff had not only made several impossible countings of segment numbers and leg pairs, but had also constructed impossible sentences, so I was no great help. Gordon also understood some French, and Jean-Jacques Geoffroy mentions that he wrote letters to his French colleagues in a sort of French "very close to surrealism".

To come back to Paris, this Congress was a very important event, for Gordon, for the British group, for myriapodology in general. It was held in conjunction with the Congress of Arachnology. Indeed, it was the first step of emancipation and consolidation of the myriapodologists. Up to that time, people doing research in myriapods had mostly worked separately, now the threads and the persons came together, ideas and reprints were exchanged.

In Paris, Gordon gave a summary of the investigations on the life-histories of some British Julida which had been elaborated in Manchester by him and his working group (Blower 1969/70). Gordon had left behind him his first commitment to cuticular structure, epidermal glands and histology (Blower 1950, 1951, 1952). I never saw him handle a microtome. Nevertheless, he was continuously interested in everything concerning morphology and histology, and he appreciated the facts and details as only someone can do who has experienced the difficulties and imponderabilities of histological work.

Gordon had also crowned his previous faunistic and taxonomic work by the first synopsis on millipedes in Britain (Blower 1958). The ecological and life-cycle project had arisen out of these early studies. It had already been launched some 15 years before the Congress. At first, ideas and methods had been developed independently from other researchers. Stages had been separated mainly on the ground of measurements of length and width and by plotting this data on probability paper. The method proved reliable for early stadia

but was not sensitive enough for the latest stadia. In 1964, when Gordon published his paper on the millipedes of a Devon oak wood together with Peter Gabbutt (Blower & Gabbutt 1964), the papers of Vachon (1947), Saudray (1952, 1961) and Sahli (1955, 1958) on the characterisation of stadia by the number of rows of ocelli were unknown to him. As soon as Gordon became aware of this method, he and Colin Fairhurst reworked their whole material to see whether the results of the two methods agreed (Blower & Fairhurst 1968). Gordon later informed me that Charles Brookes (Brookes 1963) had elaborated the defence gland method independently of Ritva Halkka (Halkka 1958) though Charles began his work one year after the publication of Halkka's paper.

In Paris, a new frame had been set for the mutual information and communication, and all participants made use of it. But as I said, this was only the first step.

Everybody knows that at normal Congresses there is always a lot of competition, of intrigues, of vanity, of hierarchies. The Myriapodological Congresses are quite different. Everybody is accepted, is listened to, is encouraged and supported. Well, there are critical discussions, but they are never derogatory. When did the myriapodologists become such a great and supportive family? This was clearly during the second Congress which was held in Manchester in 1972.

In Paris, it had been decided to organise the next Congress in Brno, Czechoslovakia. But soon afterwards, when the Prague spring was crushed by tanks this option was no longer tenable. Gordon offered to host the Congress instead.

After 1968, I had switched to investigations into crustacean embryology and had no intention of doing further work on millipedes. But Gordon asked me to give a lecture on segmentation and chair a general discussion on phylogenetic relations. He brought all sorts of people together. He must have written letters day and night. He persuaded Sidnie Manton to give a talk on the segmentation of Symphyla, Chilopoda and Pauropoda in relation to phylogeny. He induced the almost 85-year-old Reverend Canon Brade-Birks to preside over the Congress and open it in three languages. He urged Charles Brookes to present the results of his Thesis for the first time.

Gordon and his staff really took care of everything. The Gabbutts, The Brookes's, the Fairhursts, the Millers and the Rounds were engaged, made us feel at home. One of the highlights was, of course, an excursion to the Lake District.

But what was most amazing besides all the organisational work was the presentation of their own contributions. The Manchester group gave several lectures on life-cycles, growth and production, sympatry and competition of millipede species. They introduced their efforts in establishing a distribution map. Gordon gave a talk on the positive correlation between the distribution of millipedes and homesteads of collectors. Most of this work has been fully appreciated and has been extended later. But I think there was one contribution by Gordon (Blower 1974b) which was more outstanding than the others and has never been surpassed. Gordon had reared *Ophiulus pilosus* on non-nutritional agar from egg to maturity! He had measured consumption quantitatively throughout the whole lifespan. He had checked weight increase and production on a fortnightly basis over 2 years. This was and still is a big step forward in evaluating the role of millipedes in the food-web. Nobody has had the patience and the nerve to repeat that work in other species in the same way.

That Congress was a great success and it established a standard for further meetings. Everybody can still sense the atmosphere and the flavour by reading the Congress proceedings (Blower 1974a). In his modest way, Gordon wrote in his foreword: "To some extent this collection of contributions indicates the present state of knowledge". I have never experienced such careful editing. Even the discussions had been taped, transcribed, when necessary translated. This was not repeated in later Congresses.

One year later, in 1973, Gordon spent several months in Sierra Leone. One of the results of this venture was a paper on a jumping millipede, written with Glyn Evans and published in "Nature" (Evans & Blower 1973).

When he got back, I travelled to Scotland and made a stopover. And during that visit Gordon proposed that I should spend some time at the Zoological Department to work upon some pressing questions which had been discussed during the Congress: How is the segmentation of the millipede body? Are the anterior segments simple or are they cryptic or reduced double segments? Is the gnathochilarium composed of 1 or 2 pairs of maxillae? These questions had been addressed in *Glomeris*. But was the answer valid for ring-forming millipedes as well? Gordon paved the way for me. He made reservations in Hulme Hall and organised a lab in the attic of the Zoology Building. I mention this, as my case is not exceptional. Many others enjoyed his hospitality, Francois Sahli, Erwin Meyer, Maija Rantala. Gordon had a secret manner of stimulating ideas and provoking investigations which is a rare gift.

I must confess that scientifically speaking, my stay was no great success. We did not proceed further than we had been before. In retrospect, I would say that we lacked the methods which were developed later: fluorescent dyes, antibody staining, in situ hybridization. Even Scanning Electron Microscopy was not yet available for everybody. So we did not really solve the problems. It is just nowadays that these questions are being addressed in an adequate way, in the labs of Tom Kaufman in Bloomington and of Diethard Tautz in Cologne. I am sure Gordon would be delighted to see the latest results, on expression patterns of the segmentation genes *engrailed*, *wingless* and *cubitus interruptus* in the millipede germ band, on the role of Notch and Delta during the invagination of nerve cells in the ganglia (Dove & Stollewerk 2003).

During my entire stay in Manchester, Gordon was engaged in teaching. At noon, he had tea together with his colleagues, Glyn Evans, Dick Askew, Derek Yalden, John Dalingwater and others talking about the present practical courses and recapitulating on the 3rd year's students from courses several years before. I have never met a staff which cared so much about the students and their progress.

I am going to skip over the next years and Congresses, 1975 in Hamburg, 1978 in Italy and move on to 1979, when I visited Gordon in January. We took a long walk through six foot drifts of snow between Tegs Nose and Chapel Forest. During that walk, we first talked about a joint project, a review summarising and evaluating all available information about anamorphosis in millipedes.

In 1980, I passed through Manchester on a journey to Scotland. Gordon helped me to hire a car, and my wife and I went off. North of Perth, we had a head-on collision. As soon as Gordon heard about that he came up to visit me in hospital, to cheer me up and to arrange things for me. I never expected that, and I was very moved. There are many other occasions which testify how much Gordon cared about people who were close to him.

I must mention 1981, as in that year his book "Estimating the size of animal populations" was published which was written together with his colleagues Lawrence Cook and James Bishop and which summarises their efforts and experiences in quantitative population biology, with a stress on mark, release and recapture (MRR) methods. I have often recommended that book to my students as it is not only theoretically sound, but is based on profound practical experience. Also in 1981, the Myriapodological Congress took place in Radford/Virginia. Gordon, now 57, went there together with his last but one research student, Henk Littlewood. Gordon had the honour of acting as President of that meeting.

I am going to jump forward two other essential years, 1984 and 1985. In 1984, the Myriapodological Congress took place in Amsterdam. Gordon came and enjoyed himself. It was the first time that he made no contribution, at least not officially. However, at the end, when the farewell dinner came nearer, he and Colin Fairhurst and I sat together, I think whisky played a certain role, and we thought about something not too serious. I proposed taking a German nursery song about the bird's wedding. All of us contributed some verses, but some of the best stanzas (and also the most vicious one) came from Gordon. I admit that was a rare occasion. Most people knew Gordon as being very serious, very thoughtful, never making a cutting remark. But he could be cheerful, he could be funny, he could even be sarcastic. The ditty was reproduced in the *Liste des Travaux parus et sous presse* en 1984. Colin and I took over the responsibility.

The following year was crammed with activities. Gordon suggested to commemorate Charles Hilary Brookes by a memorial lecture and he asked me to give a talk about "Myriapods and the ancestry of

insects". This shows that he was still deeply interested in evolution and phylogenetics. I made a blueprint and went to Prestbury to discuss it with him. I came just in time to see the proofs of the "Synopsis of the British fauna: Millipedes" and had the privilege of having a look at them. This book (Blower 1985a) which only on the surface is the second edition of the 1958 synopsis is a real milestone in several respects. It presents concise and condensed information about all aspects of the British species: Morphology, life history, habitat preference, distribution. Nearly all the drawings are original, not simply redrawn from literature but from material which was mostly collected by himself. Hopefully, the original drawings will be well preserved.

1985 was also the year of Gordon's formal retirement. During a field course in Woodchester Park, he was presented with a volume on "Case studies in population biology" dedicated to him by his former colleagues and students. He wrote: "I was quite overwhelmed by the compliment and have only partly recovered". The same year saw the edition of Volume 2 of the Bulletin of the British Myriapod Group with an important paper on the British Chordeumatidae (Blower 1985b). And we always had the anamorphosis paper in our minds though there was not much progress. Letters went to and fro. We exchanged information, asked questions, invented riddles (Figure 1) and ended up in writing anagrams (Figure 2). Looking back, that time was rather happy-go-lucky.

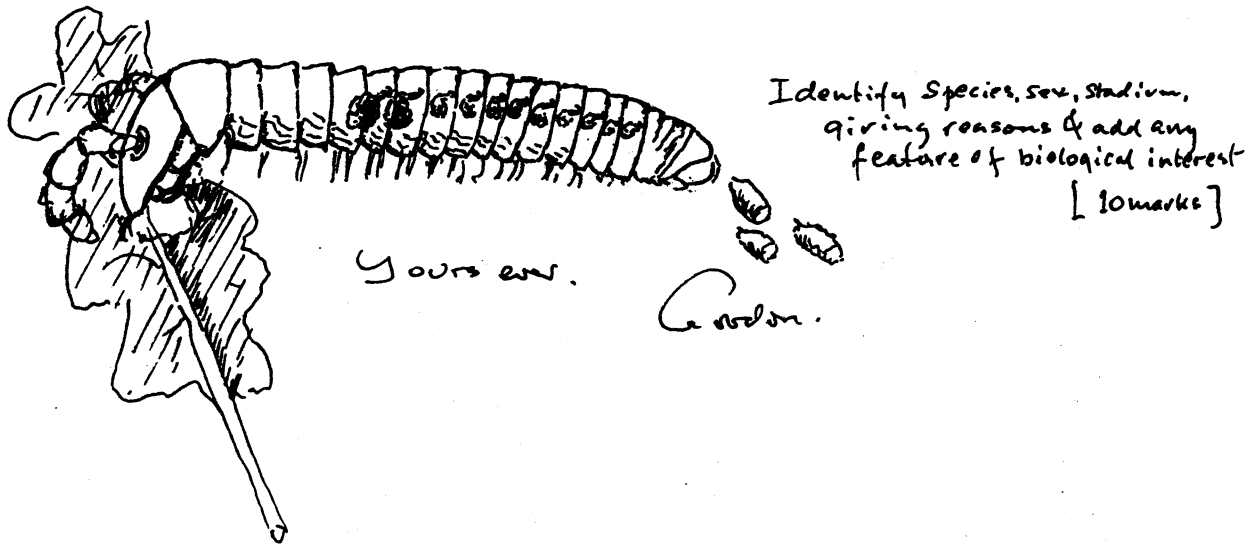


Figure 1. Part of a letter from Gordon Blower, 4th August 1985. The figure represents a juvenile *Boreoiulus tenuis* stadium IV. Reason: 2 primary defence glands which is unique in Julidae. Source of information: PhD thesis of C.H. Brookes.

My only question this time is one which my granddaughters gave to me — and I, English speaking (?) found difficult.

Q. What is an ANAGRAM of MONDAY?
(It's a common English word and it's the same in German)

thwi tseb hewiss,

Crylsein,

Gordon.

Figure 2. Part of a letter from Gordon Blower. 5th December 1985.

Four years later, in 1989, Gordon's wife Mary died. He had already had several personal blows. In 1983, Charles Brookes, his first research student who had completed his Ph.D. Thesis twenty years previously and who was his close friend, died in a rail accident. In 1987, the wife of his eldest son John died. The death of Mary with whom he had a most affectionate relationship was very serious indeed and we feared that he would not get over it.

I think it was partly his love of nature and of science which helped him. He bought a house in the Lake District. He went to the Dordogne and collected *Lithobius*. He attended the Congress in Innsbruck in Austria. And he came back to the idea of writing a review of the anamorphosis of millipedes. In 1990 he wrote: "...I feel in the swim again – there's a danger of letting things slip until I become involved again". He was now actively engaged in summarising all the life history data on the Juliformia.

As Henrik Enghoff had agreed to co-author the paper and had taken upon himself the task of driving the project and collecting and typing the bits and pieces, we finally met in Copenhagen in 1991 for nearly one week to discuss the manuscript sentence by sentence. In the Museum, we were confined to a room without windows and we said jokingly after that week that now the grey smoke has emerged. The paper was published in the Zoological Journal of the Linnaean Society and comprised 131 pages (Enghoff, Dohle & Blower 1993). Of course, it was not only an accumulation of old and some new data but we tried to discuss the variations and the peculiarities in a developmental and a phylogenetic frame.

We invented new names: euanamorphosis, teloanamorphosis, terms which must be an offence to a linguist's ears. We radically transformed previous countings, stadia, rings and segments where necessary. We discussed at length the so-called "law of anamorphosis" and especially its non-existence in several orders which must have upset several colleagues. We tried to find formulations to which all three of us could consent.

There were some parts where opinions were at first divided. The old question of elongation and contraction which had preoccupied Gordon since the sixties (Blower & Fairhurst 1968, Blower 1969/70) was discussed using cladistic methods. Gordon had been very much influenced by the views of Sidnie Manton who favoured a more intuitive approach on the ground of functional requirements. This influence was quite comprehensible. Sidnie Manton had not only profited from Gordon's myriapodological expertise, she had made an excursion to Sicily with him collecting specimens for her monumental work on sceleotomuscular design of millipedes. Gordon often told about their joy having found the overlength *Dolistenus savii*.

Manton had several times given her precious cats into Gordon's care, and she had dedicated her authoritative book on "*The Arthropoda – Habits, functional morphology and evolution*" (Manton 1977) "to J. Gordon Blower". Manton had come to the conclusion that most arthropod groups must have a polyphyletic origin. In the seventies, this was nearly unanimous conviction especially in the English-speaking countries. Only much later the wind turned once more, and most researchers have come back to the belief that Arthropoda are monophyletic. I had many discussions with Gordon about the impact of the principles of phylogenetic systematics regarding this question. He listened attentively and patiently, but was never really convinced. Now, at the end of our discussions on the anamorphosis paper he said: "My colleagues will be surprised that I have now jumped on the phylogenetic bandwagon".

The anamorphosis paper was the last of his publications. The bolt was shot. In 1992, during a visit to Levens we took a long walk, and he told me more about the marrows in his allotment and his activities in the village than about millipedes. I remember that we had a look over a plain speckled with small limestone mounds, and I said that it would be worthwhile to have a closer look at these ecological islands whether all of them have the same or probably different populations. He found the idea interesting but never got into this or another project.

In 1993, he did not attend the Congress in Paris, 25 years after the first one. In 1996, there were two different occasions, and I hoped very much to draw him out of his corner. By then, he was not frail, he was, as far as he wrote, "in good health". The first occasion was a Symposium in London under the heading "Arthropod relationships". Many people working on arthropods made contributions. From

Manchester, Jason Dunlop and Paul Selden read a paper and - to take the millipede men - Bill Shear, Otto Kraus and myself gave a talk. Geoffrey Fryer from the University of Lancaster, one of Gordon's old friends presented "A defence of arthropod polyphyly". The symposium and the proceedings were dedicated "To the memory of Sidnie Manton, 20 years on from the publication of *The Arthropoda*" (Forty & Thomas 1997). I informed Gordon long before and sent him a provisional and later the final programme. But he wrote: "In a way I would have very much liked to attend, to see you and others – but I cannot due to commitments here in Levens + with my family".

One month after that symposium, I made another attempt and asked him to come to Copenhagen and attend the Myriapodological Congress that same year, Copenhagen where we had spent many hours in the Museum and after work in a pub called Lumskebuksen. But there was no chance.

There remained a large gap in our correspondence. After a longer stay in Tasmania, I wrote in January 2001, but by then many bad blows had hit him: An aortic aneurism had whisked him to hospital, he had partly lost his voice, he had to take sheltered accommodation in Kendal, Nicholas House was being sold "which is sad" as he commented. His reply ends: "I shall look forward eagerly to your talking on your scientific aims". So I wrote another rather long letter but never got a reply.

The gap which Gordon Blower leaves is big. It is not only his personal contribution to the knowledge of life-cycles, of faunistics and distribution which we will miss. It is even more his ability to open the eyes for a wider scope and especially his gift to get people involved. He created an atmosphere of interest and encouragement which was invaluable. I am an extant witness of this. Without Gordon, I would not have much cared about millipedes during the last 35 years. I am very glad to have met Gordon, to have experienced his friendship and to have shared his knowledge and his ideas.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the British Myriapod and Isopod Group and especially to Helen Read for inviting me to give a talk at the occasion of a special meeting in Manchester on Friday, 25th April 2003.

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TED EASON, GORDON BLOWER & THE C.I.M.: SOME PERSONAL REMINISCENCES

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INTRODUCTION

In conversation with John Lewis and Helen Read during a trip to the South African Congress of Myriapodology, I was persuaded to prepare a lecture devoted to historical aspects of the CIM and the role Gordon Blower and Ted Eason played in its development for the special day conference at Manchester.

This was my initial intention but the contribution evolved into personal recollections of some of the human and scientific features of two very fascinating characters that I was pleased and honoured to meet.

WHAT IS THE CIM?

Created at Paris in 1968, the Centre International de Myriapodologie brings together myriapodologists of the whole world. The secretariat of the CIM is located in the "Muséum National d'Histoire Naturelle de Paris" (MNHN). Its mission is to rapidly inform myriapodologists - and other zoologists and biologists - of works which are in progress or published in all the fields of myriapodology (Myriapoda & Onychophora), from the macromolecular level to the study of ecosystems and autecology.

Each year, members of the CIM receive a questionnaire asking them to provide a list of papers published during the year, as well as research work in progress or projected. It also asks for information of general interest to researchers whose work involves Myriapoda or Onychophora. The CIM Bulletin is sent to every member in April-May, sometimes a little later, depending on any special events during the year. The information is also available on the web-site of the CIM, hosted at the MNHN Paris on <http://www.mnhn.fr/assoc/myriapoda/INDEX.HTM>

Apart from its wider role in providing information and communication, the CIM helps in the formal co-organization of the international congresses of myriapodology which takes place every three years. The first of these was in Paris in 1968. The Board is assisted by an International Committee, including founding members of the CIM, organizers of international congresses and several members appointed by the plenary international sessions of myriapodologists. This Committee included Gordon Blower from the very beginning (Appendix 1).

THE CIM: A THIRTY-FIVE YEAR OLD HISTORY

The present CIM is the result of a thirty-five year history. Immediately after its original creation at Paris in it evolved rapidly to a European and International level and international congresses were regularly organized throughout the world. However this efficient but informal organization needed to have stronger structures and rules. The constitution of a formal international society was agreed at Copenhagen in 1996 during the 10th ICM. In 1999 at Bialowieza (Poland) it was formally constituted as an International Society with a board and statutes. The proposed Constitution and By-Laws were submitted to the members, discussed and definitively adopted in 2002 during the 12th ICM at Mtuzini (South-Africa).

Jean-Paul Mauriès was the first President during the transitory period 1999-2002 (Figure 1). Since 2002, the President of the



Figure 1. Jean-Paul Mauriès: Founding member and former President of the CIM. Barbizon (Fontainebleau Forest), 9th ICM excursion 1993. Photograph by Zoltán Korsós.

CIM has been our colleague John Lewis (Figure 2) and a Council and Board have been constituted during the general assembly held at Mtuzini in August 2002. The Council & Board (see Appendix 2) reflect very well the international nature of our society. In 2005, during our next International Congress and General Assembly in Bergen, a new Council will be elected. Since the very beginning of the story, some 720 people from 63 countries have been active members of the CIM. In 2003, we have more than 200 members and we hope a new generation will soon be appearing.

FOUNDERS AND PIONEERS

The main organizers of the founding meeting in Paris (which took place at the same time as the first International Congress of Arachnology) were the young Jean-Marie Demange (Figure 3) and Jean-Paul Mauriès. They were the ‘CIM fathers and godfathers’. The idea was originally strongly supported by Otto Kraus (Figure 4), who contributed to the creation of the CIDA as well. They were immediately joined by Gordon Blower, present at Paris, who offered to organize the second international congress of Myriapodology at Manchester in 1972 when it became evident that it was not possible to hold it in Czechoslovakia..

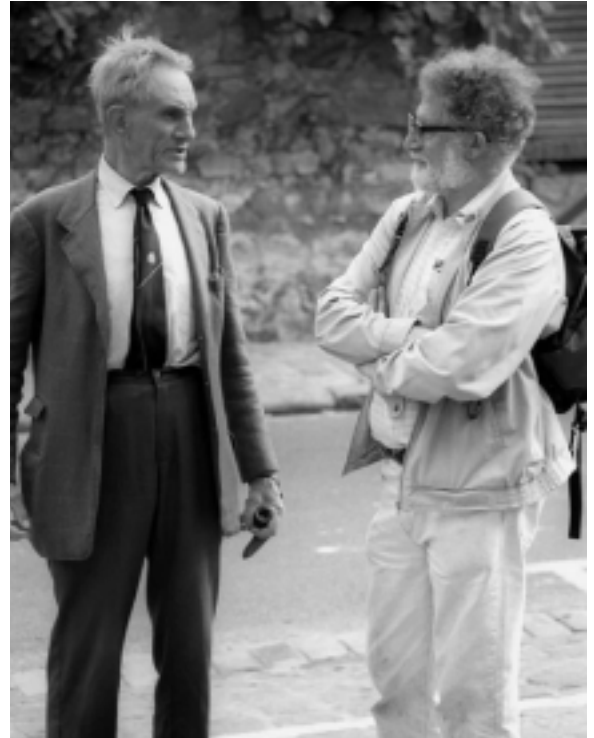


Figure 2. John G. E. Lewis, President of the CIM (right) with E. H. Eason (left). Barbizon (Fontainebleau Forest), 9th ICM excursion 1993. Photograph by Zoltán Korsós.



Figure 3. Jean-Marie Demange: Founding member of the CIM. 1st ICM, Paris 1968. Photograph CIM.

To my eyes, these four will be remembered as the ‘musketeers of the CIM’. Can’t we recognize Kraus as smart Athos, Mauriès as jovial Porthos, Demange as elegant Aramis and, the last but not the least, Blower as adventurous D’Artagnan.

FIRST ENCOUNTERS

During the beginning of my work on the population ecology and systematics of soil myriapods, my very first encounter with Gordon Blower’s work was his book ‘*Estimating the size of animal populations*’ published in collaboration with Cook and Bishop (Blower, Cook & Bishop 1981) and one major paper dealing with forest millipede populations and life-cycles, ‘The Millipedes of a Cheshire Wood’ (Blower 1970). Later on, I had the opportunity to deeply appreciate the amazing quality of his *Millipedes* (Synopsis of the British Fauna, 35) published in 1985, a completely updated revision of Blower 1958.

In 1981, I was lucky to contribute to the 5th International Congress of Myriapodology held in USA at Radford, Virginia. For the first time, I met Prof., Dr or Mr J. Gordon Blower (then president of the congress) himself. Emotion and shy hesitation: I was prepared to meet a walking textbook and a soil animal life-history legend. Actually, I met a very nice man and I rapidly discovered his so captivating talk and likeable personality, hair in the wind and special cross of



Figure 4. Otto Kraus: Founding member of the CIM. 1st ICM, Paris 1968. Photograph CIM.

the legs. During the Radford Congress, Gordon kindly took a picture of an American Spirobolid creeping on my arm, he sent to me just after the meeting (Figure 5).

GORDON & TED’S CONGRESSES

Ted and Gordon contributed their presence, papers and discussions to most of the international congresses of myriapodology from 1968 to 1993. Often both were present; sometimes, one was missing.

Attendance of Gordon and Ted at the International Congresses of Myriapodology

- 1968 (Paris, France) GORDON & TED
- 1972 (Manchester, UK) GORDON & TED [organization]
- 1975 (Hamburg, Germany) GORDON, Ted missing
- 1978 (Gargnano, Italy) GORDON & TED
- 1981 (Radford, Virginia, U.S.A.) GORDON & TED
- 1984 (Amsterdam, The Netherlands) GORDON & TED
- 1987 (Vittorio Veneto, Italy) TED, Gordon missing
- 1990 (Innsbruck, Austria) GORDON & TED
- 1993 (Paris, France) TED, Gordon missing
- 1996 (Copenhagen, Denmark) —
- 1999 (Bialowieza, Poland) —
- 2002 (Mtuzini, South Africa) VIRTUAL PRESENCE



Figure 5. Jean-Jacques Geoffroy and an American spirobolid. Radford, Virginia, 5th ICM 1981. Photograph by J. Gordon Blower.



Figure 6. Ted Eason: Lord of the Pipe. Fontainebleau Forest, 9th ICM excursion 1993. Photograph by Zoltán Korsós.

The last contribution by Gordon was at Innsbruck in 1990. The last contribution by Ted was in Paris 1993 but their influence was strongly felt during the recent congress at Mtuzini.

One of the greatest regrets of my life was not to have had the opportunity to welcome Gordon Blower to Paris during the 9th International Congress I helped to organize in 1993 in collaboration with Jean-Paul Mauriès and Monique Nguyen Duy-Jacquemin. Fortunately, Ted was present (Figure 6). By this time, I had learned enough of how to interpret his delicious words mumbled through the pipe and the contribution of the Eason family during the congress excursion was significant. We decided to have a trip in the Fontainebleau Forest, one of the major natural sites in the Paris area, and a good place for myriapod investigations.

Ted was accompanied by his daughter and his grandson, a very active and lively youngster. I remember the efforts of myriapodologist friends to convince the boy that his grandfather was an important man, highly respected by many scientists in the world. During the walk in the forest and rocky sites, we had a stop near the famous and beautiful ‘pigeon pond’. While I was occupied with people wanting to collect animals in the soil, the young one decided to fall in the dark waters of the pond. Nevertheless, as organizer, I was not supposed to let any young English gentlemen drown. We rapidly dried off, thanks to the sunny weather. Ted Eason stoically mumbled some comments in his pipe and the walk went on.

We suddenly realized at this moment that the tribe Zapparoli had totally disappeared among the rocky pathways with two members of the staff who were supposed to know the way perfectly. The presence of Marzio Zapparoli at the Manchester meeting in 2003 let us know that this tragedy too had a happy ending. This was my last adventure with Ted Eason and I am very grateful for those delicious moments of real life.

THE NETHERLANDS MEETING

Amsterdam, The Netherlands, April 1984: 6th International Congress of Myriapodology. This was my Second International Congress of Myriapodology after introductions during the North American Congress in Virginia and, for the second time, I was ready to meet Mr Gordon Blower. Pleasure and leisure time for conversation. After two minutes, we were debating the position and status of *Geoglomeris subterranea* vs *Stygioglomeris crinita* and *Geoglomeris jurassica*, a point still argued today between myriapodologists and, I hope, approaching a final solution. Two days later, we had a secret meeting together in the cafeteria, making very secret plans to very secretly escape from the congress session and go to downtown, looking very secretly for flowers and gifts for the Congress organizers and staff. While walking along the streets, side by side, I wondered ‘Why me? - Gosh, do you realize what’s happening to you?’ It was too late, fortunately, to get free from the delicious trap Gordon Blower had let me fall in. Clever man! Certainly at this very moment, I decided to become deeply involved in the CIM scientific and social organization. A new vocation was born.

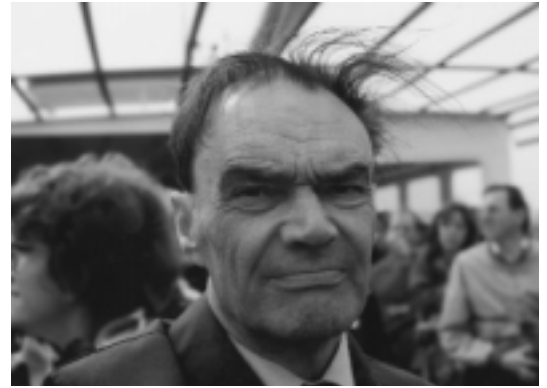


Figure 7. J. Gordon Blower: A portrait. 6th ICM Boat trip, Amsterdam 1984. Photo by Jean-Jacques Geoffroy.

On a boat, during the Congress trip, I took one of my favourite pictures, a portrait of Gordon Blower’s face, still in a prominent place in my photograph album (Figure 7).

FRIENDLY COMMUNICATION

I met Gordon again at Innsbruck during the 8th International Congress and we used to communicate over the years by letter. As you may know, my English is something very approximate, but to read a letter written in French by Gordon Blower was really an amazing adventure very close to surrealism. He always made the effort to write to his colleagues in France in his incredible and wonderful French, another kind aspect of his character. He used to send us very pleasant postcards such as an incredibly kind myriapod waiting for busy Father Christmas.

Every personal document received either from Gordon Blower or Ted Eason is preserved in the CIM library.

But now it’s time to say Good Bye, Mister Blower. We wish you a very nice last trip to Causey Pike in the Lake District.

“Fare thee well, Ted & Gordon, CIM will remember you for ever.”

ACKNOWLEDGEMENTS

I would like to sincerely acknowledge Helen Read’s kind help during my stay in England at Reaseheath College and Manchester. I am very grateful to John Lewis and Tony Barber for attention to the English manuscript and to Zoltán Korsós for some of the photographs. Many thanks to my friends Monique Nguyen Duy-Jacquemin and Jean-Paul Mauriès for many and constructive discussions dealing the functioning of CIM.

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APPENDIX 1

ORGANISING COMMITTEE FOR INTERNATIONAL CONGRESSES

J.M. DEMANGE (Paris, France); J.P. MAURIES (Paris, France); O. KRAUS (Hamburg, Germany); † J.G. BLOWER (Levens, UK); R.L. HOFFMAN (Martinsville, Virginia, U.S.A.); C.A.W. JEEKEL (Oisterwijk, The Netherlands); A. MINELLI (Padova, Italy); H. ENGHOFF (Copenhagen, Denmark); E. MEYER (Innsbruck, Austria); M. NGUYEN DUY-JACQUEMIN (Paris, France); J.J. GEOFFROY (Brunoy, France); J. WYTWER (Warsawa, Poland); M. HAMER (Petermaritzburg, South Africa).

APPENDIX 2

C.I.M. OFFICERS, COUNCIL & BOARD

John Lewis (UK) - President

Michelle Hamer (South-Africa)- Vice-President

Jean-Jacques Geoffroy (France)- Secretary

Monique Nguyen Duy-Jacquemin (France)- Treasurer

Henrik Enghoff (Denmark), Zoltán Korsós (Hungary), Bjarne Meidell (Norway), Luis Pereira (Argentina) Helen Read (UK), Rowland Shelley (USA), Karel Tajovsky (Czech Republic)

AN APPRECIATION OF THE CONTRIBUTION OF J. GORDON BLOWER TO THE STUDY OF LIFE-CYCLES OF MILLIPEDES

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INTRODUCTION

I first met Gordon Blower in Hamburg in April of 1975, at the 3rd International Congress of Myriapodology. As a young PhD student I was delighted with the friendly and familiar atmosphere among Myriapodologists. At that time I was starting my work on millipedes in the Central Alps of Austria, having read the papers of Blower & Gabbutt (1964), and Blower (1970) on the post embryonic development and life cycles of British millipedes. I soon entered into conversation with Gordon Blower and Colin Fairhurst and was very happy to receive a spontaneous invitation to spend some weeks in Manchester and Salford learning to determine stadia in Julida and Chordeumatida and working on the life cycles and ecology of millipedes. I am very grateful for that time where I gained valuable experiences personally and scientifically.

POST-EMBRYONIC DEVELOPMENT AND DETERMINATION OF STADIA

Millipedes develop by anamorphosis. With each moult certain features (numbers of segments, defence glands and ocelli) change, as well as overall size and weight. In their detailed study on the millipedes of a Devon oak wood Blower & Gabbutt (1964) critically discussed and summarized the knowledge on post-embryonic development and determination of stadia in the Julidae. At that time it had been usual to quote defence glands or the overall number of body rings. Blower & Gabbutt (1964) introduced a much more sensible new method of presenting this information by giving the number of podous rings followed by the number of apodous rings. Additionally they suggested characterising the stadia by measuring the length of each animal and analysing the measurements on arithmetic probability paper. It should be noted that in none of the works of previous authors was there a separation of stadia with overlapping numbers of segments, nor were the data related to field occurrences.

Blower (1970) extended his method to determine stadia by including the number and arrangement of ocelli in the ocular field, a method of stadium determination described by Vachon (1947). The stadium number is obtained by adding one to the number of rows. Since Blower's work many authors have produced similar tables on the anamorphosis in several species. A tabular comparison of anamorphosis in British species is summarized in his best known book, published in the synopses of the British Fauna series (Blower 1985).

Being able to accurately determine the stadia of a particular species, to know the stadium and the chronological age in which maturity is first achieved and to know if the species is semelparous (breeding once) or iteroparous (breeding more than once) one may then continue to try to describe the whole life cycle and further ecological parameters of the population. The characters used in the various studies are outlined in the Table 1.

TABLE 1**THE LIFE HISTORY CHARACTERS IN MILLIPEDES AS USED BY J. GORDON BLOWER IN HIS STUDIES**

- Anamorphosis
 - Variation in the increments of new segments
 - Number of podous and apodous rings
 - Dimensions (length) of each stadium
 - Growth of the ocular field
 - Determination of stadia
 - Stadium in which maturity is first achieved
 - The chronological age at which maturity is first achieved
 - Single breeding (semelparity) or repeated breeding (iteroparity)
-

LIFE-CYCLES AND ECOLOGY

To determine the life cycle it is necessary to follow the sequential changes in the proportions of different stadia, that is to translate the stadial age into true age. Based on quantitative field data Blower & Miller (1974) gave the most comprehensive and detailed description of the anamorphosis, life-cycle, fecundity and survival, vertical distribution, standing crop, consumption and production of a millipede species (*Ophiulus pilosus*) in Britain. This paper was directional for numerous others as the results were based on intensive field work, taking samples at monthly intervals throughout the year.

Blower (1969) also gave attention to the ecological significance of the strategies such as semelparity and iteroparity and its relation to activity and dispersion. He noted that the aggregation of iteroparous species is greater than semelparous species, semelparous species are more numerous and more evenly dispersed. Blower & Fairhurst (1968) have suggested that repeated broods in successive years in *Tachypodoiulus niger* adapt the species to disperse to widely scattered habitats.

By describing the entire millipede fauna of certain woodland sites Blower (1979) took tentative steps towards defining and understanding some principles governing the structure of millipede associations, such as abundance, age structures and life-cycle characteristics.

In my mind Gordon Blower is remembered for his guiding, comprehensive and thorough work on the life histories and ecology of millipedes. In this field he was an international authority.

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J.GORDON BLOWER AS INSPIRATION FOR LOCAL DISTRIBUTION MAPPING OF MILLIPEDES: A PERSONAL VIEW

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INTRODUCTION

In 1995, I published, *The Millipedes, Centipedes and Woodlice of the Sheffield Area* through the Sorby Natural History Society of Sheffield, South Yorkshire (Richards 1995). This publication presented an introduction for beginners to the three groups, with identification keys to all 70 species known locally at that time, plus distribution maps for each species at a 1km grid square level.

The published mapping area consisted of fifteen 10km squares centred on Sheffield. The maps were based on data gathered across the recording area of the Sorby Society (Figure 1).



Figure 1. The area covered by the Sorby Natural History Society

This area included many sites to the east of Manchester frequented by Gordon Blower in which several of his students also undertook research projects on millipedes. Subsequent results also contributed data to this mapping scheme. An example would be the records of *Melogona scutellare* from Derbyshire dales (Figure 2).

The Millipedes, Centipedes and Woodlice of the Sheffield Area could not have been produced without the help and inspiration of Gordon Blower and other members of the (then) British Myriapod Group (BMG). This combined contribution derives from 3 main areas of influence:

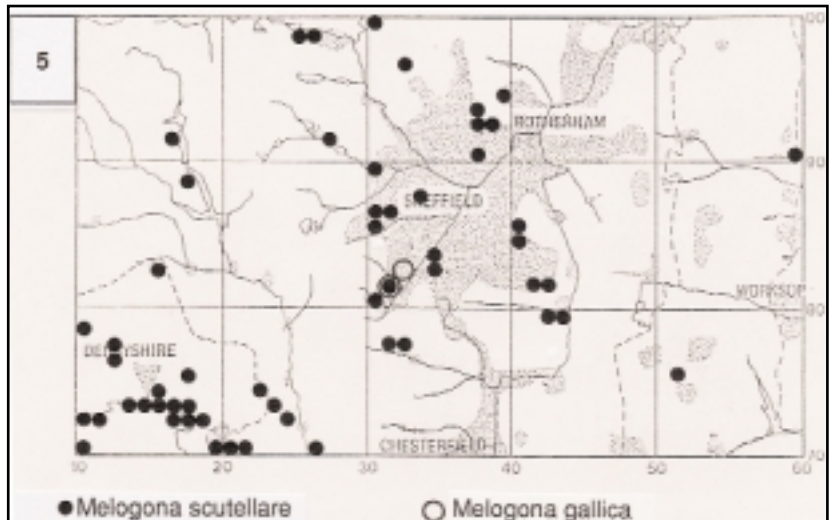


Figure 2. Distribution of *Melogona* species in the Sorby area

1. The development of identification skills through patient mentoring
2. The essential role of the monograph, “*Millipedes*” By Gordon Blower (1985) for identification
3. The identification or checking of specimens

DEVELOPMENT OF SKILLS

During 1984, I undertook an introductory field course on millipede identification at Warwickshire Museum, led by Douglas Richardson, the national recorder for these animals and a long standing member of the BMG. Using a key compiled by Adrian Rundle and reduced for use in the Yorkshire area only, Douglas introduced the joys of studying a readily identified group of largely overlooked, but fascinatingly varied animals. So many new county records were found in one weekend, that it dawned very quickly that this was a group in which real discoveries could easily be made. They also provided a very obvious collecting “niche” for anyone wishing to move on from the more obvious vertebrates and insects of popular natural history. Motivation for collecting was therefore not an issue. Problems with identification were restricted to a small number of species and *all* data would make a noticeable contribution to current knowledge. The Yorkshire key also became the basis for the Sheffield identification guide when it was re-written with new illustrations.

Later, Douglas Richardson invited me to attend the annual field meeting of the BMG where I first met Gordon Blower. These meetings more than anything else established my interest in millipedes. Without exception, every member of this informal group was (and still is) most welcoming and eager to share their knowledge with a novice. The sharing of field skills and techniques and the experience of learning direct identification of living animals was invaluable and also unavailable elsewhere.

I made a point of attending these meetings annually and continued to be taught not only about millipedes but also about all aspects of ground invertebrate zoology. Any knowledge I have of centipedes and woodlice also derives entirely from these occasions. The changing venues meant that on each occasion I was introduced to a slightly different fauna, without the number of new species being overwhelming. Again, members were always happy to bring unusual species to my attention to add to my repertoire.

SYNOPSIS 35

Blower’s 1985, completely updated and expanded re-write of his 1958 *British Millipedes* is essential for the accurate identification of the British Diplopod fauna. Without this to guide enthusiasts through the intricacies of millipede genitalia, there would be no recording scheme at all. The foundations of the Sheffield database were records drawn from local surveys of the mid-1980s after the publication of Synopsis 35. The few previous records were provided via the “Yorkshire key” which in turn derived from the original 1958 synopsis.

Additionally, Gordon Blower's 1985 work was the source of many of the illustrations included in the Sheffield atlas. He kindly gave permission to use re-drawn illustrations for use within the keys and introductory sections.

TELL ME I'M WRONG!

The role of BMG members was particularly critical in the confirmation of identifications. The reassurance that my interpretation of Blower's text was accurate enabled the compilation of a reliable reference collection. This not only provided a reference for my own work, but as part of Sheffield Museum's collections, provides a lasting voucher resource for a wider community of future researchers.

Over an initial period of two or three years, Douglas Richardson probably checked every specimen I ever collected. He always took the time to write detailed explanations of where I might have gone wrong and included off-prints and papers that would add to my knowledge.

After some correspondence regarding the number of ocelli in *Brachychaeteuma* species, Gordon Blower was particularly helpful in establishing my ability to identify these troublesome and somewhat dubious species. With alternating sips of tea and a glance down a microscope he guided me around their morphology.

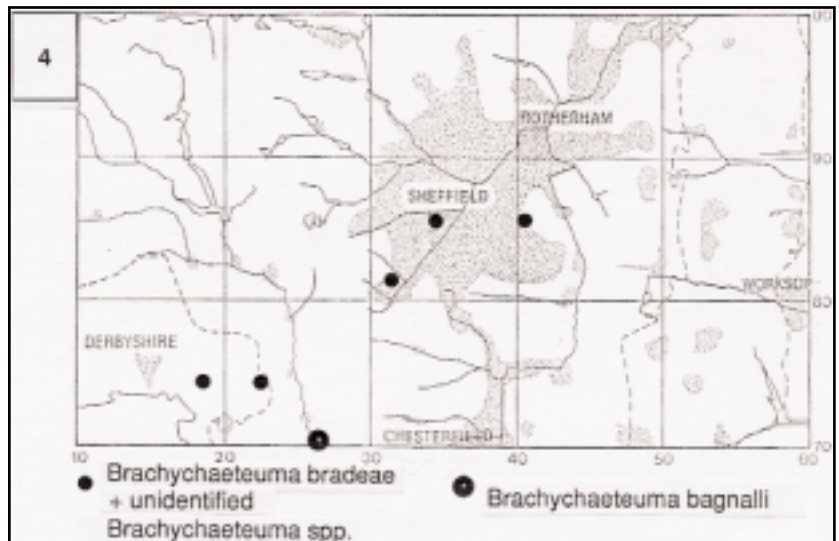


Figure 3. Distribution of *Brachychaeteuma* in the Sorby area

MILLIPEDES: THE NEW LEPIDOPTERA!

Millipedes may never quite hold the popularity of birds or dragonflies, but their raised profile is in no small part attributable to Gordon Blower. His many years of collecting and research culminated in the publication of the first standard British work on the subject (Blower 1958). This and subsequent spin off keys and guides have established a firm launch pad for the ongoing recording and study of these animal. This places the British Isles as one of the most well recorded countries in the world for millipedes and other associated groups.

The British Myriapod Group, founded by Gordon and for which he edited the "Bulletin", provided another tier of support for the budding myriapodologist. As an organisation and as individuals this provided the greatest stimulus for recording effort and is responsible for untold influence in subsequent environmental research.

The trail of influence concludes at a local level for me through the derived ability to further popularise the subject with a layman's guide to the fauna of my own region. The result of this sequence of events is that in Sheffield at least, there are over 12,000 new records for not only millipedes, but centipedes, woodlice, pseudoscorpions and harvestmen as well. These consequences can also be traced to many other places and indicate something of the enormous influence that Gordon's knowledge and enthusiasm has had.

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THE PRESENT KNOWLEDGE ON THE EUROPEAN FAUNA OF LITHOBIOMORPHA (CHILOPODA)

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INTRODUCTION

Lithobiomorpha is an order of centipedes of about 1100 species, distributed in all the continents except the Antarctic, from sea level up to 4000 m (Lewis, 1981). Although they mainly inhabit forest habitats, where they are one of the most important components of soil fauna, their habitat preferences are rather wide and also include open habitats, dry areas, caves and anthropogenic habitats.

This paper aims to give a general picture of the present knowledge about the fauna of these arthropods in Europe. The area examined (10,522,176 square km wide) can be considered as the most studied from the faunistic point of view, not only as regards lithobiomorphs but also as regards myriapods in general. The number of specialists who have studied its fauna is quite large and, as a consequence, the data available is considerable, even though sometimes fragmentary and in need of reviewing and updating.

HISTORICAL BACKGROUND

The principal historical phases regarding the study of the fauna of Lithobiomorpha in Europe have been synthesised by Negrea (1989). Further information can be found in Manfredi (1981), Hopkin (1996) and Stagl (2000). From these contributions it is clear that the study of European lithobiomorphs is strictly related to the progress of the research on centipedes in general and on their systematics in particular. These studies began as early as the second half of the 18th century when Linné (1758) published the 10th edition of "*Systema Naturae*". In this fundamental work – in which under the genus *Scolopendra* Linné, *Lithobius forficatus* (Linné) is described as the first lithobiomorph species – besides laying the foundations of zoological classification, the connection between systematics and faunistics is evidenced for the first time as notes on the geographic distribution of each named species are given.

The monographs on the classification of Myriapoda by England's greatest authority on crustaceans William Elford Leach (1790-1836) and the entomologist George Newport (1803-1854), were published about fifty years later. Together with the paper later published by Reginald Innes Pocock (1863-1919) at the end of the 19th century, these works lay the foundations of present day classification of centipedes and in addition the first lithobiomorph species from the British Isles, the Iberian peninsula and Italy, were described (Leach, 1814; Newport, 1844, 1845, 1856, Pocock, 1895).

Further data were published by the German arachnologists and myriapodologists Carl Ludwig Koch (1778-1857) and his son Ludwig Carl Christian Koch, who described many species from S. Germany, Austria, as well as N. Italy and insular Greece (e.g.: C.L. Koch, 1844, 1847, 1863; L. Koch, 1862). Other species have been described by the Danish myriapodologist Frederik Vilhelm August Meinert (1833-1912), from scattered areas such as Spain, Germany, Austria and Italy (Meinert, 1872).

In the second half of the 19th century the first faunistic monographs began to be published. These works are often the results of specific research, more detailed and more continuative than those carried out before. Among these papers the most important is that of the Austrian myriapodologist Robert Latzel (1845-1919) "*Die Myriopoden der österreichisch-Ungarischen Monarchie*", the part dealing with centipedes was published in 1880 (Latzel, 1880). Other papers that merit a mention are those on the Italian fauna by Filippo Fanzago and Giacinto Fedrizzi (1850-1878), the pioneers of myriapodology in Italy, and by Jenő Daday (1855-1920) on the Hungarian fauna (Fanzago, 1874; Fedrizzi, 1877; Daday, 1889). A prominent figure in this period was Antonio Berlese (1863-1927), Italian entomologist of world-wide fame. Among the numerous works he published, of particular interest is "*Acari, Myriapoda et Scorpioles hucusque in Italia reperta*" (Berlese, 1882-1903), with plates drawn by Berlese himself, in which all the species so far known in Italy were depicted for the first time.

From the end of the 19th and through the first half of the 20th century three great specialists, namely H.W. Brölemann, K.W. Verhoeff and C.G. Attems contributed more than anyone else to the knowledge of these arthropods publishing mainly systematic and faunistic papers on the European fauna. The French myriapodologist Henry W. Brölemann (1860-1933) worked especially on the W. Mediterranean fauna. In the framework of the "Faune de France" series he published his important monograph on centipedes (Brölemann, 1930). The German zoologist Karl Wilhelm Verhoeff (1867-1945), well known also as a specialist of isopods, mainly studied the Central European fauna as well as that of Italy and of the Balkans (eg., Verhoeff, 1943). Among the most important papers published, one may remember "*Zur Kenntnis der Lithobiiden*" (Verhoeff, 1937). Other significant papers are those by Verhoeff (1925, 1934). The Austrian myriapodologist Carl Graf Attems (1868-1952), curator of the Natural History Museum in Wien from 1910 up to his death in 1952, is probably the most important specialist of myriapods so far. Although Attems published more than 130 papers on myriapods, his studies on the European fauna are few and they concern mainly Spanish, Eastern Alps and Balkan fauna (e.g., Attems, 1895, 1929, 1949, 1954, 1959).

In the same period an important role was played by Filippo Silvestri (1876-1949). A world-famous entomologist, he not only studied myriapods but also many groups of insects. As far as centipedes are concerned, although he mainly studied tropical and subtropical faunas, his early works were devoted to the Mediterranean fauna (Manfredi, 1981). Another Italian specialist that should be mentioned is Paola Manfredi (1889-1989), the doyen of the European myriapodologists. Of the papers she published the majority deal with epigeic and cave fauna of Italy and other Mediterranean countries.

In recent years the leading figure in Eastern Europe was the Rumanian Zachiu Matic (1924-1994), who studied the centipede fauna of his country as well as those of other Southern European areas (Negrea, 1989; Zapparoli & Minelli, 1995). Other myriapodologists that worked on the Eastern European fauna were the Czech Božena Folkmanová (1903-1960) and Ludek Dobroruka.

Lastly, some contemporary myriapodologists should be mentioned, such as the French Jean Marie Demange, who chiefly studied the cave fauna of the Pyrenees (e.g., Demange, 1958, 1959b; Demange & Serra, 1978); the Dutch Casimir A.W. Jeekel, with his accounts on the genus *Eupolybothrus* Verhoeff and on the Central European fauna (e.g., Jeekel, 1967, 1977); Bjarne A. Meidell and Goran Andersson, who have both studied the Scandinavian centipedes (eg. Meidell, 1979; Andersson, 1983, 1985); Stefan Negrea, who directed his studies mainly on the Balkan cave fauna; Nadezda Zalesskaja, who devoted her studies on the Lithobiomorpha of the former Soviet Union (Zalesskaja, 1978, 1990; Zalesskaja & Golovatch, 1998); Antoni Serra, who largely studied the Iberian fauna (e.g., Serra, 1982, 1983); Pavel Stoev, whose research is mainly on the Balkan fauna (e.g., Stoev, 1997, 2002).

Centipedes are a rather difficult group to study from the systematic and faunistic point of view. Many species have been described in the past in a very concise way and on unstable characters. This has led to considerable problems in the identification of the species and both taxonomy and nomenclature have become more and more chaotic. As a consequence, it is difficult to define the range of some taxa and the studies on the local faunas are problematic. In order to be able to use centipedes not only in the faunistic and zoogeographic research but also in auto- or syn-ecological studies, both basic or applied, the taxonomic identity of the species obviously has to be stated exactly. As far as concerns Lithobiomorpha, one must pay tribute to Edward Holt Eason (1916-1999) with his precise work of revision directed to the definition of the taxonomic identity of the species described by many of the older Authors. A world specialist, from the fifties, he devoted many of his papers to the critical re-examination of the diagnostic characters so far used and re-described the type specimens of most of the species and subspecies of C.L. Koch, L. Koch, Newport, Meinert, Porat, Pocock, Stuxberg, Verhoeff, Fanzago and Fedrizzi (Eason, 1970a, 1970b, 1972a, 1972b, 1974b, 1981, 1982, 1983, 1992a; Eason & Minelli, 1976). Through these revisions it has been possible to better define the range of many species and genera and on this subject Eason presented a lecture here in Manchester in 1972 during the 2nd International Congress of Myriapodology, organised by Gordon Blower (Eason, 1974a), and another at the International Congress in Innsbruck (Eason, 1992b). Dr. Eason carried out extensive studies on the taxonomy of European Lithobiomorpha and his work forms an important point of reference for future research as many species still need to be critically examined.

STUDY AREA AND METHODS

The area considered in this paper partially overlaps that of the “Fauna Europaea” database, a research project supported by the European Commission (e.g., Los et al., 2000), to which I contributed the sections on Lithobiomorpha and Scutigermorpha. I shall here examine the geographic Europe up to the Ural Mountains including European Turkey, excluding Kazakhstan, the Russian Caucasian republics and territories, the independent Transcaucasian republics and Asian Turkey. The Macaronesian islands (excl. Cape Verde Is.) are here included.

In the “Fauna Europaea” project are also included some geopolitical units, such as the S. Sporades and Cyprus, whose fauna is biogeographically closer to that of Anatolia and the Middle East rather than that of Europe. Lithobiomorpha of Anatolia and Middle East as well as N. Africa are not discussed in this paper, except for those species whose natural range also includes these areas as well as Europe. However, it should be noted that the Maghreb, and Near and Middle East all represent areas of a great zoogeographic interest in understanding the Europaeian fauna.

The following considerations are partly based on the data I have collected in the framework of the “Fauna Europaea” project. These data are based on a critical review of the main literature reports as well as some unpublished material recently studied. Available information about the habitat preferences of the species, mainly deduced from studies recently carried out in Central and Southern Europe, have been also taken into consideration (e.g., Minelli & Iovane, 1987; Spelda, 1999; Wytwer, 2000; Stoev, 2002; Zapparoli, 2002). The classification scheme for families and subfamilies follows Eason (1992b).

FAUNISTICS AND DIVERSITY

About 310 species/subspecies of Lithobiomorpha, divided in eight genera, five belonging to Lithobiidae, three to Henicopidae, have been so far recorded in Europe (Table 1). However, in spite of the revisions and faunistic research to-date published, the number of the species present in the area is still difficult to define since the taxonomic identity of a number of these is uncertain and many areas have not been much explored. For instance, of the about eighty species so far recorded in Italy, the taxonomic identity of a fifth of them is unreliable (cf. Foddai et al., 1995).

Table 1

Family, genera and species/subspecies numbers for Lithobiomorpha in Europe.

Families	Genera	Species/subspecies
Henicopidae	<i>Lamyctes</i> Meinert	3
	<i>Lamyctinus</i> Silvestri	1
	<i>Rhodobius</i> Silvestri	1*
Lithobiidae	<i>Eupolybothrus</i> Verhoeff	22
	<i>Lithobius</i> Leach	261
	<i>Harpolithobius</i> Verhoeff	18
	<i>Pleuroolithobius</i> Verhoeff	2
	<i>Hessebius</i> Verhoeff	2
Total		310

* Only in Is. Rhodos (Greece, S. Sporades).

In order to give a comparative account of the global diversity of Lithobiomorpha, Table 2 lists the number of species so far known in some continental or sub-continental areas. The number of species recorded in Europe seems comparable only with that recorded in N. America (U.S. only, 9,372,614 square kms). However, it must be pointed out that the N. American fauna, intensely studied until the sixties, the last studies being those by Ralph V. Chamberlin and Ralph E. Crabill, has never been revised. Therefore, the picture of the actual diversity could be very different from that here presented.

Table 2

World Lithobiomorpha: Continental/subcontinental areas, approximate number of species/subspecies (n) and main sources.

Areas	n	References
Europe	310	FaEu Project
North Africa (Maghreb)	14	Brölemann, 1921
Eastern ex-USSR	58	Zalesskaja, 1978
China	47	Wang & Mauries, 1996
Nepal	11	Eason, 1989
Thailand	8	Eason, 1986
Australia	>18	Edgecombe, 2001a
North America (U.S.A.)	376	Crabill, unpublished
Central America	?	-
South America	?	-
Anatolia	73	Zapparoli, 1999
Caucasus	48	Zalesskaja, 1978; Zapparoli, unpublished
Middle East	10	Zapparoli, unpublished
South Africa	15	Lawrence, 1955

The number of species so far known in other extra-European areas is much smaller. This could be partly due to the lack of knowledge of the fauna as well as to the fact that in tropical and subtropical areas the number of species of lithobiomorphs tends to decrease. It is however obvious that very heterogeneous data are compared here, due to the different sizes of the areas considered, the different intensity of the research and its level of updating. The extra-European areas for which modern check-lists are available are very few. Whereas many revisions have been published for the W. Palearctic and, at least partly, for the E. Palearctic and Oriental fauna, almost nothing has been done so far for the Nearctic, Neotropical and Afrotropical fauna. A revision of the Australasiatic Lithobiomorpha has been started only in the last years by Edgecombe (2001b).

Table 3 lists the European geopolitical units and their approximate number of species/subspecies of Lithobiomorpha. Most of the species/subspecies have been recorded from the Mediterranean and the adjacent areas. In the European countries that look on the Mediterranean basin (Spain, France, Italy, Slovenia, Croatia, Albania, Greece) about 200 species in all, equal to 65% of the whole fauna, have been recorded. Among these countries, Italy shows the higher diversity value. Apart from Sardinia and Sicily, in mainland Italy nearly 70 species are known, about 23% of the European species. Of these, 55 have been recorded from northern regions (Alps and Po Plain), 47 from central and southern regions (Foddai et al., 1995). From a general faunistic and biogeographic point of view, the Italian peninsula represents an area of special significance. The terrestrial fauna hosts a higher number of species than all the other European countries. Moreover, the Italian fauna is characterised by a higher number of endemic species, about a third of the total as far as Lithobiomorpha are concerned. The richness and variety of this fauna is mainly due to the highly composite paleogeographic structure of the Italian territory and by its extreme present day environmental diversity (La Greca, 1995).

Table 3

European Lithobiomorpha: Geopolitical units, approx area (in square kms), approx. number of species/subspecies (n) and main sources.

Geopolitical units	Area	n	References
Albania	28.748	27	Stoev, 2000
Austria	83.853	35	Würmli, 1972; Eason, 1982
Azores Is., Portugal	2.247	8	Eason, 1985; Eason & Ashmole, 1992
Balearic Is., Spain	5.014	11	Verhoeff, 1924; Demange, 1959a; Matic et al., 1967; Negrea & Matic, 1973; Eason, 1975; Serra, 1983a
Belarus	207.600	4	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Belgium	30.514	16	Lock, 2000
Bosnia-Herzegovina	51.129	37	Kos, 1992; Stoev, 1997
Britain	230.709	14	Eason, 1964
Bulgaria	110.994	61	Stoev, 2002
Canary Is., Spain	7.242	15	Eason & Enghoff, 1992; Zapparoli & Oromi, 2001
Corsica, France	8.682	12	Foddai et al., 1996
Crete, Greece	8.258	9	Zapparoli, 2002
Croatia	56.538	38	Kos, 1992; Stoev, 1997
Cyclades Is., Greece	2.572	6	Zapparoli, 2002
Cyprus	9.251	4	Turk, 1952
Czech Republic	78.864	42	Tajovsky, 2001
Danish mainland	43.077	14	Enghoff, 1983
Dodecanese Is., Greece	2.714	14	Zapparoli, 2002
Estonia	45.100	-	-
Faroe Is., Denmark	1.399	4	Meidell, 1990
Finland	338.127	9	Palmén, 1948
Franz Josef Land, Russia	16.100	-	-
French mainland	542.818	54	Geffroy, 2000
Germany	356.974	36	Effenberg, 1945; Jeekel, 1964; Eason, 1982; Spelda, 1991, 1999
Greek mainland	114.210	40	Zapparoli, 2002
Hungary	93.032	30	Daday, 1889; Loksa, 1955
Iceland	102.829	4	Eason, 1967
Ireland	70.284	7	Eason, 1964
Italian mainland	251.480	73	Foddai et al., 1994
Latvia	64.600	4	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Liechtenstein	160	27*	-
Lithuania	65.200	4	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Luxembourg	2.586	16	Remy & Hoffman, 1959; D. Kime pers. com., 2003
Macedonia, FYR of	25.713	15	Stoev, 2001a
Madeira Is., Portugal	790	6	Eason, 1985
Malta	316	3	Matic et al., 1967
Moldova, Republic of	33.700	8	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
The Netherlands	40.844	19	Jeekel, 1977
North Aegean Is., Greece	3.900	2	Zapparoli, 2002
Northern Ireland	14.120	5	Eason, 1964
Norwegian mainland	262.225	10	Meidell, 1978, 1979
Novaya Zemlya, Russia	90.650	-	-
Poland	312.677	33	Wytwer, 1997
Portuguese mainland	88.790	10	Machado, 1952; Serra, 1988
Romania	237.500	58	Matic, 1966
Russia, Central European	851.600	13	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Russia, East European	777.500	5	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Russia, North European	1.466.300	9	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Russia, NW European	195.200	6	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992

Geopolitical units	Area	n	References
Russia, South European	435.100	5	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Sardinia, Italy	24.090	18	Foddai et al., 1994
Selvagens Is., Portugal	4,4	-	-
Sicily, Italy	25.708	14	Foddai et al., 1994
Slovakia	49.036	37	Országh, 2001
Slovenia	20.251	38	Kos, 1992; Stoev, 1997
Spanish mainland Serra,	492.526	51	Matic et al., 1967; Demange & Serra, 1978; Eason & 1981, 1986; Serra, 1977a, 1977b, 1979, 1980a, 1980b, 1981a, 1981b, 1982, 1983b, 1986, 1987
Svalbard Is., Norway	62.050	-	-
Sweden	449.964	16	Andersson, 1981, 1983, 1985
Switzerland	41.293	33	Eason, 1982; Schatzmann, 1990
Turkey, European side	23.764	15	Zapparoli, 1999
Ukraine	603.700	32	Zalesskaja, 1978; Golovatch & Zalesskaja, 1992
Yugoslavia (Serbia, Kosovo, Voivodina, Montenegro)	102.173	24	Kos, 1992; Stoev, 1997

* = n. of species in common between Austria, Switzerland and SW Germany.

In the south-westernmost areas of the European continent almost equivalent diversity values have been recorded in the Iberian peninsula (51 species) and France (54 species). However, it should be noted that whereas a check-list of the French centipedes has been recently published (Geoffroy, 2000) and the knowledge of this area is quite updated, it is not possible to say the same for the Iberian peninsula, although a number of papers devoted to its fauna have been recently published (cf. Table 3). Moreover, the Portuguese fauna, although we can assume that it is not very rich, is poorly known, since only ten species have been so far been recorded (Machado, 1952).

Another region showing high values of diversity is the Balkan peninsula. In this territory at least one hundred species have been recorded. The Balkans also represent an area of particular zoogeographic interest, where endemic elements of ancient origin are present, especially in the cave fauna. Although many taxonomic revisions, as well as faunistic surveys, check-lists and local catalogues have been published in the last years (cf. Table 3), the present knowledge of this fauna is still incomplete. Detailed and updated information is available for Slovenia, Albania, Makedonia, Greece and Bulgaria.

With regards to the large Mediterranean islands, those of the western sector (Balearic Isl., Corsica, Sardinia and Sicily) are the richer in number of species and endemics. These areas have been longer and repeatedly explored, especially Sardinia, which has the highest number of species and endemics. Much poorer is the fauna of the eastern Mediterranean islands (Crete, Cyprus), but the faunistic knowledge on these areas is still lacking. As far as the Atlantic islands, the fauna of the Canary Islands is quite well known and shows diversity values higher than those of the Azores and Madeira.

Central Europe (Switzerland, Austria, Germany, Belgium, the Netherlands) is an area which has been studied for a long time and therefore its fauna is comparatively well known. Moreover, the identity of most of the species has been recently revised (cf. Eason, 1982). The Alpine regions are the richest, with 33-35 species known to occur in Switzerland and Austria respectively. Going northwards the number of species tends to decrease: from 29 species recorded in SW. Germany (e.g., Spelda, 1991, 1999), to 16-18 species in Belgium and the Netherlands (cf. Jeekel, 1977; Lock, 2000).

The number of species/subspecies in the Carpathians-Danubian region (Czech Republic, Slovakia, Hungary, Romania) is seemingly comparable with that recorded in Central Europe, with 30-37 species in Hungary and Slovakia respectively and about 40 in Czech Republic. The taxonomic identity of some of these species is however uncertain, thus the actual diversity values are likely to be lower than those here

indicated. Whereas for Czech Republic and Slovakia a synthesis of the knowledge has been recently published (Országh, 2001; Tajovsky, 2001), the most recent studies on the Hungarian fauna date from the eighties (cf. Table 3). A higher number of species has been recorded in Romania (58), but the most recent studies date from the end of the sixties (Matic, 1966) and need to be updated.

The Lithobiomorpha of the Russian Plain has been the subject of some recent in-depth research (Zalesskaja, 1978, 1990, Zalesskaja & Golovatch, 1996). These investigations, beside describing the composition of the local fauna have also elucidated the main patterns of distribution of the species. The better known areas are Ukraine, which seems to host the highest number of species (32), and Central European Russia (13). Lower is the diversity in some peripheral zones, such as those now included within the Belarus and Baltic Republics boundaries. Although the fauna of these countries is not well known, we may assume that it is not richer and different than that of S. Finland and E. Poland (cf. Palmén, 1948; Wytwer, 1997, 2000). In European Russia a gradual decrease in the number of the species from the more central sectors southwards, where steppe habitats dominate, and northwards, where taiga and tundra prevails, is noted. A similar trend is also observed going from west to east, from Carpathians and Moldova towards the Urals (Zalesskaja & Golovatch, 1996).

Northern Europe (Iceland, Scandinavia, Denmark, British Isles) is the poorest area, 7-14 species have been recorded in the British Isles, 14 in Denmark, 9-16 in Scandinavia, only four in Iceland. 25-30% of the species recorded in these areas are synanthropic as they have been mostly collected indoors (e.g., Meidell, 1979, Barber, 1985; Andersson, 1985). In Scandinavia only four species extend beyond the Polar Circle (*Lithobius erythrocephalus* C.L. Koch, *L. forficatus* (L.), *L. curtipes* C.L. Koch, *Lamyctes emarginatus* (Newport)) (Palmén, 1948; Meidell, 1979). No data are known for the northernmost subarctic insular areas, such as Svalbard, Novaja Zemlja and Franz Josef Land.

The picture of the diversity of the European Lithobiomorpha is completed by comparing the number of species recorded in the Maghreb and in SW. Asia (Table 2). Although in these cases the knowledge is also fragmentary, the richest areas are the Anatolia and the Caucasus (Zapparoli, 1999 and unpublished). The number of species known at present in the Middle East and in the Maghreb is quite low (Brölemann, 1921; Zapparoli, 1991; Negrea & Matic, 1996). However, in addition to being poorly known faunistically, the habitats in both regions are not very suitable to Lithobiomorpha.

DISTRIBUTION PATTERNS

In order to define the main zoogeographic components of the European fauna, the distribution pattern (chorotypes, cf. Vigna Taglianti et al., 1992, 1999) of some of the most significant species, selected from those whose taxonomic identity and geographic distribution is better known, are discussed here for each genus or subgenus.

About 83% of the European lithobiomorphs belong to the large genus *Lithobius* Leach s.l., whose natural range includes the Holarctic and Oriental Regions. This is a rather heterogeneous group, divided into some subgenera but whose identity is controversial (e.g. Eason, 1974a, 1992b). Besides the nominotypical subgenus, five other taxa have been recorded in Europe, *Monotarsobius* Verhoeff, *Sigibius* Chamberlin, *Dacolithobius* Matic, *Tracholithobius* Matic and *Porobius* Porat.

Lithobius s. str. represents about 60% of the European Lithobiomorpha. Apart from a few species whose distribution is peripheral to the study area, such as *L. carinatus* L. Koch, a species ranging mainly in the Near and Middle East and which in Mainland Greece reaches its western limit, *L. skelicus* Zalesskaja, a troglobitic species probably with SW. Asiatic affinities (Caucasian or Iranian), only known in Crimea, and *L. proximus* Sselivanoff, a Sibero-European species not recorded westwards of the Volga flow, the rest of the fauna is represented by species mostly ranging in Europe.

A European pattern is shown by those species widespread in Europe, with possible extensions to Anatolia, Caucasus, Macaronesia and Maghreb. The species showing this pattern are few (8%). Generally, they are epigeic elements, with rather wide habitat preferences. Among these are some eurieic elements, such as *L. melanops* Newport recorded from European Russia to Macaronesia; *L. melanops* in the Azores is represented by an endemic subspecies, *L. m. borgei* Eason & Ashmole.

A wide European distribution is also shown by the polymorphous *L. erythrocephalus* C.L. Koch, although the range and the taxonomic identity of some subspecies is still uncertain. *L. erythrocephalus* s.l. ranges in Central and South-Eastern Europe, Anatolia, Middle East and Caucasus where it inhabits forest as well as open and steppe habitats; records from Sardinia and N. Africa are uncertain. Restricted to the Balkans is *L. e. borisi* Verhoeff, a good species according to Stoev (2002), mainly inhabiting alpine habitats. *L. e. cronebergii* is known from Georgia and Russian plain (Zalesskaja, 1978; Zalesskaja & Golovatch, 1996), but this taxon has been also recorded from Mainland Greece (Zapparoli, 2002) and from Arabian Peninsula (Sana'a), where it was probably introduced (Eason in Lewis, 1996). Closely related to *L. erythrocephalus* are *L. schuleri* Verhoeff, spread in Central and Eastern Europe, inhabiting open montane habitats; *L. stygius* Latzel, widely spread in the Balkan caves; *L. sexustumidus* Eason & Serra, restricted to the Iberian peninsula, but its habitat preferences are unknown.

Among the species with a wide European distribution pattern we may include *L. forficatus* (L.), ranging also along the Pontus and in the Caucasus. This eurieicous species easily settles in anthropogenic habitats, therefore its European range has been probably heavily influenced by man who also introduced this species in many extra-European areas (e.g., N. Africa, St. Helena, N. America, S. America).

A Central European pattern is shown by those species ranging mainly from Southern Scandinavia to the Po Plain, and from the Rhine river basin, east to Ukraine (Sarmatian plain and the Don river basin); extensions are possible to S Europe, the British Isles and N Caucasus. This group represents about a fifth of the European *Lithobius* s.str. and is chiefly represented by epigeic, forest dweller species, mainly inhabiting broadleaved deciduous forests but sometimes also in coniferous woods. Many of these species are more or less common under mesophilous conditions (e.g., *L. mutabilis* C.L. Koch, *L. dentatus* C.L. Koch, *L. tricuspis* Meinert, *L. macilentus* L. Koch, *L. tenebrosus* Meinert, *L. nodulipes* Latzel), others are mostly related to more thermophilous habitats (e.g. *L. muticus* C.L. Koch). However, some of these species are also able to settle in habitats other than woodlands such as caves, open habitats or urban ecosystems. Some other species show a seemingly disjunct range. Besides a more or less continuous Central European main range, isolated populations are also known to occur in some southernmost areas, as in *L. agilis* C.L. Koch, with scattered records from Sardinia, Greece, Anatolia and Crete, or in *L. subtilis* Latzel, also recorded from the Caucasus. Some cave-dwellers and epigeic species restricted to the Alps, mainly in the western or in the southern slopes, such as *L. fagniezi* Ribaut, *L. scotophilus* Latzel and *L. alpicosiensis* Matic, are of uncertain central or southern European affinities.

A S. European pattern is shown by those species more or less widespread in S Europe, north to the Loire River basin, the Alps and the Carpathians; extensions may be possible to Central Europe, the British Isles and the Caucasus. A more or less southern European distribution pattern is shown by about half (55%) of the European *Lithobius* s.str. species. Among these are, for instance, those of the *L. piceus* group. This group ranges from the Caucasus to the N. Iberian peninsula, across the Middle East, Anatolia, the Balkans and Central Europe. It includes about ten species/subspecies (*L. p. piceus* L. Koch, *L. p. verhoeffi* Demange, *L. p. unguiridens* Serra, *L. p. tabacarui* Negrea & Matic, *L. peregrinus* Latzel, *L. viriatus* Sselivanoff, *L. romanus* Meinert, *L. cretaicus* Matic, *L. nigripalpis* L. Koch), whose taxonomic identity and geographic distribution have been recently revised, especially for the eastern species/subspecies. Some species endemic to the Sardinian caves (*L. aligherus* Manfredi, *L. doderoi* Silvestri) may also belong to the *L. piceus* species group.

Other common S. European species are *L. punctulatus* C.L. Koch s.l. and *L. castaneus* Newport. The former shows a disjunct range including the main European and SW. Asiatic mountain systems, from the Caucasus to the Pyrenees, mostly inhabiting broadleaved or coniferous woodlands, rarely above the tree line, often in caves. Morphological differences may exist between populations and some subspecies or closely related species have been described, but their status is uncertain. *L. castaneus* is a very common woodland species, mostly recorded in the more thermophilous forest habitats. It is known from the NW. Balkans to the Iberian peninsula, across peninsular Italy, Corsica, Sardinia, Sicily and N. Africa, easternmost records from Bulgaria are uncertain; the absence of records from Balearic Islands as well as from S. France is noteworthy.

Although it is not always possible to state their affinities exactly as more data on distribution and taxonomy as well as ecology are necessary, some of the species endemic to the Pyrenees, the Apennines, the Balkans, Corsica, Sardinia, and Crete are here tentatively referred to the S. European pattern. As in other Lithobiidae genera/subgenera some species of the Balkan fauna also range in N. Anatolia. Although some epigeic species are also known (*L. mucronatus* Verhoeff, *L. decui* Matic & Negrea, *L. dimitrescui* Matic & Negrea, *L. silvivagus* Verhoeff), the Balkan endemics mostly belong to the cave fauna and a number of species more or less adapted to this habitat have been described. *L. matulici* Verhoeff, a troglobitic species of the Dinaric karst is one of the most specialized; closely related to *L. matulici* are a number of cave species described from the same area, such as *L. sketi* Matic & Darabantu, *L. troglomontanus* (Folkmanová) and *L. jugoslavicus* (Hoffer), but their identity is uncertain.

Lithobius decapolitus Matic, Negrea & Prunescu is a common species in the S. Carpathian caves and morphologically close is *L. rushovensis* Matic, known from Bulgarian caves (Stoev, 2001b). A *Lithobius* s.str. close to *L. rushovensis* has been recorded from the Pontus range (Zapparoli, 1999 sub *L. beschkovi* Matic & Golemansky).

Of special interest is the cave fauna of the Pyrenees and N. Spain, where the main part of the cave Lithobiomorpha so far known in the world is found (Negrea & Minelli, 1994). In this area about twenty species/subspecies have been recorded, but some of these need a careful revision. Species with different degrees of cave adaptation are present both in the French (e.g., *L. cavernicolus* Fanzago, *L. allotyphlus* Silvestri, *L. jeanneli* Matic, *L. racovitzai* Matic) and in the Spanish side of the Pyrenees (e.g., *L. typhlus* Latzel, *L. lorioli* Demange, *L. anophthalmus* Matic, *L. jorbai* Serra). Distinctive of the Pyrenees are also some species group, e.g. *L. troglodytes* Latzel s.l., *L. crypticola* Ribaut s.l. and *L. derouetae* Demange s.l., each including species/subspecies of uncertain status, both epigeic and cave-dwellers, but the latter not highly adapted to this habitat.

Few endemic species are known for other mainland and insular S. European areas. *L. cassinensis* Verhoeff and *L. tylopus* Latzel are the most common *Lithobius* s.str. species in the Apennines, the former restricted to the Central regions and in xerothermophilous habitats, the latter in a wider range of forest habitats of the whole peninsular Italy. As regards the large Mediterranean islands, among the endemic *Lithobius* s.str. species of Sardinia, the most distinctive is *L. sbordonii* Matic, a troglobitic species only known from the karst of the east side of the island. The identity of the supposed endemic species from Corsica (*L. aidonensis* Verhoeff, *L. blanchardi* Léger & Duboscq, *L. brandensis* Verhoeff, *L. remyi* (Verhoeff)) needs to be revised. Besides the above mentioned *L. cretaicus* Matic, only one species is known for Crete (*L. creticus* Dobroruka).

A few species seem to show a W. European pattern (about 13%), ranging in the western part of Europe approximately from Scandinavia to the Iberian peninsula. Among the most distinctive species is the polymorphous, mostly nemoral, *L. pilicornis* Newport, distributed with a number of subspecies (*pilicornis* Newport, *hexodus* Brölemann, *doriae* Pocock, *luridus* Serra) from the Central Alps to the Atlantic coast of W. Europe and SW. Britain, westward to the Iberian peninsula. *L. pilicornis* has also been recorded in Macaronesia, where it was probably introduced; quotations from N. Africa are uncertain.

Lithobius calcaratus C.L. Koch is probably a W. European species, although its range, besides Germany, France and N. Iberia, also includes S. Scandinavia, Britain and N. Apennines, and recent Slovakian records are also known. This species has also been recorded in Austria and Corsica, but these data need confirmation. *L. calcaratus* is known as a thermophilous species mostly in forest habitats.

Other *Lithobius* s.str. species are more or less spread in the western part of Europe but their range also includes N. Africa. Among these species is *L. variegatus* Leach, discontinuously distributed with a northern subspecies, *L. v. variegatus*, found in the British Isles, Brittany and N. Iberia, and a southern one, *L. v. rubriceps* Newport, spread in Central and S. Iberia and N. Africa; old records from Sicily and S. Italy are also known but they need to be confirmed. Close to *L. variegatus* s.l. is the cave-dweller *L. nuragicus* Zapparoli, from S. Sardinia.

Another species whose natural range includes Western Europe (Iberian peninsula) and N. Africa is *L. obscurus* Meinert, but it has also spread in many areas of the world due to trade. This species is also present in Macaronesia from where two cave adapted subspecies have been described in the Azorean lava tubes (*L. o. azoreae* Eason & Ashmole, *L. o. mediocris* Eason & Ashmole).

The *L. inermis* species group, including *Lithobius* s. str. species with a latero-internal furrow on 15th or on 14th and 15th legs, also belongs to the W. European fauna. Besides *L. inermis* L. Koch, distributed in the Iberian peninsula, N. Africa, Sardinia and Sicily, this group also includes both epigeic (*L. pyrenaicus* Meinert, *L. gadarramus* Matic, *L. longiscissus* Serra) and cave species (*L. schubarti* Demange, *L. pedisulcus* Serra) endemic to the Iberian peninsula. Closely related to the *inermis* species group seem some species from the S. Balkans and Pontus areas showing the same character on the last legs, such as *L. lakatnicensis* Verhoeff, *L. ergus* (Chamberlin) and a few others, mostly recorded from caves but also from epigeic sites.

Among the western species should be also included *L. lusitanus* Verhoeff, widespread in the Iberian peninsula and N. Africa, and the closely related cave species *L. fagei* Demange, endemic to the Balearic Islands. Besides the nominotypical subspecies, two others have been described under *L. lusitanus*, namely *L. l. valesiacus* Verhoeff, from Central Europe, but good species in Spelda's (1999) opinion, and *L. l. tataricus* Folkmanová & Dobroruka, from Central European Russia, but of uncertain identity according to Zaleskaja & Golovatch (1996). Another western European species/subspecies group, whose range also includes the Maghreb, is that of *L. microdon* Latzel. It includes *L. m. microdon*, found in Iberian peninsula and N. Africa, *L. m. clarki* Eason and *L. vivesi* Serra, both endemic to the Balearic Islands, the former epigeic, the latter from caves, and the epigeic *L. trinacrius* Verhoeff, only known from Sicily.

The widespread Euro-Asiatic subgenus *Monotarsobius* includes about 25-30 species in Europe. A few of these species show wide distribution patterns, Sibero-European (*L. crassipes* L. Koch), Centralasiatic-European (*L. curtipes* C.L. Koch, *L. ferganensis* (Trotzina)), Central European (*L. aeruginosus* L. Koch, *L. austriacus* (Verhoeff)). They are all epigeic and quite common species, especially in the eastern and northern European countries, fairly well known from the taxonomic point of view. Their habitat preferences are heterogeneous, *L. curtipes* and *L. crassipes* seem rather euriecious; *L. ferganensis*, is recorded from open montane habitats, *L. aeruginosus* and *L. austriacus* are mainly related to mesophilous forests.

Most European *Monotarsobius* are species whose range is restricted to three main areas of Southern Europe. About ten of them have been described from the Balkans, five are from Italy, only two occur in mainland Spain. Moreover, five species are known from Madeira and Canary Islands, each one endemic to an individual island. In all the above mentioned cases, the species are poorly known, mostly recorded from very few sites. Many species are epigeic, mainly from more or less thermophilous forest as well as open habitats, but some are known only from caves. Their affinities are still uncertain, probably Asiatic or European, but taxonomic identity needs to be confirmed in some cases.

The subgenus *Sigibius* includes about thirty species/subspecies and is largely confined to Italy, the Balkans and the Near East (Eason, 1992b). The habitat preferences of these species are poorly known, although they seem mostly related to forest habitats or euriecious; cave species are also included. Although the taxonomic identity of some species has been recently reviewed, the whole subgenus needs to be re-examined. The most common species in Europe are *L. microps* Meinert and *L. micropodus* Matic, but their range is not well stated since *L. microps* has been often confused with *L. micropodus* by the older Authors (Eason, 1974b). Both species are however certainly present in Southern Europe and in Anatolia. Although they were recorded from a wide range of habitats, *L. microps* seems more frequent in the thermophilous ones. *L. microps* has been quoted also from N. Europe, but only in anthropogenic habitats.

Quite widespread in the Carpathians and in the Balkans is the *L. burzenlandicus* species group, including *L. b. burzenlandicus* Verhoeff, *L. b. wardaranus* (Verhoeff), *L. b. euxinicus* Prunescu and other related taxa now considered as endemic to the Balkans. The taxonomic value of these subspecies is however uncertain and, since the range of *burzenlandicus* and *wardaranus* somewhat overlaps, they should be considered as good species (Stoev, 2002).

Another interesting, but problematic, species group is that of *L. reiseri*, including *L. reiseri* Verhoeff, *L. apfelbecki* Verhoeff, *L. electrinus* (Verhoeff), *L. orghidani* Matic & Negrea, *L. paucicollatus* (Matic & Laslo) and *L. subterraneus* Matic. Although this group as a whole shows a rather wide S. European distribution, the above mentioned species are known from a few scattered localities in the Toros (Anatolia), the Balkans, the southern slopes of the Alps and the Pyrenees.

Among the species of *Sigibius* whose taxonomic status is quite clear and with a more restricted range, *L. trebinjanus* Verhoeff, known from Herzegovina, Albania and Macedonia (FYROM), and *L. jurinici* Matic & Golemansky, so far only known from Pontus and Rodopi Mts, should be mentioned, both being epigeic.

In the Balkan area two small and little known subgenera, *Thracolithobius* and *Dacolithobius* whose taxonomy is somewhat uncertain, are also present. *Thracolithobius* includes two species endemic to the Carpathia-Danubian region, *L. inspectatus* Matic, epigeic, and *L. dacicus* Matic, troglobitic; a third species, *L. remyi* Jawlowski, was described from a Serbian cave. *Dacolithobius* includes only one species, *L. domogledicus* Matic, epigeic, known only from a very restricted area of the Carpathian-Danubian region.

In the most peripheral SE. European areas the representatives of two species groups (or subgenera) of *Lithobius* s.l., the subgenus *Porobius* Porat and the *L. elegans* Sseliwanoff species group, are also present. The pattern of distribution of both groups is SW. Asiatic, and in the E. Mediterranean region, they respectively reach their westernmost and southernmost limit. *Porobius* is mainly distributed in the Middle East, westward along the Toros up to the S. Sporades, southward up to Cyprus, and it includes only *L. parvicornis* Porat and *L. pamukkalensis* (Matic) (Zapparoli, 1999 and unpublished), both inhabiting arid Mediterranean or submediterranean habitats. The *L. elegans* species group occurs mainly in the Caucasus but it extends westward up to the Crimea and southward, across Turkish Armenia and the Toros (Zapparoli, 1999), up to Cyprus (Zapparoli, unpublished). This group includes a dozen of species/subspecies whose habitat preferences range from forest habitats in the north to open habitats in the south, and probably form an undescribed subgenus close to the Oriental *Australobius* Chamberlin (Eason, 1992b; Zapparoli, 1999).

The genus *Harpolithobius* Verhoeff shows a disjunct range extending from the Caucasus, to the Middle East, in Anatolia along the Pontus and the Toros, in SE. Europe through the Carpathians, the Balkans, the Alps, westwards up to the Ligurian Apennine (Figure 1).

The species of this genus are mostly related to mesophilous broadleaved montane or submontane woods; some species also inhabit caves. About thirty species/subspecies are recognised in all, fifteen in Europe and ten in Anatolia and in the Caucasus respectively (e.g., Zaleskaja, 1978; Stoev, 1997; Zapparoli, 1999). The taxonomy of this genus is however chaotic, many species have been described on morphological characters whose variation is still unknown and the number of species/subspecies really present in the



Figure 1. Range of the genus *Harpolithobius* Verhoeff.

different areas is probably lower than those above mentioned. The most common species is *H. anodus* (Latzel), whose distribution largely overlaps that of the genus, but the identity of the SW. Anatolian records must be confirmed. Owing to the uncertain taxonomy of the genus, it is difficult to emphasise the endemic species, especially in the Balkans from where many species/subspecies have been described. Of some interest is however *H. oltenicus* Negrea, a troglobitic species only known from some caves of the Transilvanic Alps (Romania), the only cave species of this genus in Europe. Besides this, the only other two troglobitic *Harpolithobius* so far known are *H. birsteini* Zaleskaja, from the southern slopes of the W. Caucasus, and *H. vignatagliantii* Zapparoli, from the W. Toros.

The genus *Pleuroolithobius* Verhoeff shows a range mainly including W. Anatolia, S. Balkans and S. Italy. *P. patriarchalis* (Berlese) and *P. orientis* (Chamberlin), whose identity has been recently discussed (Zapparoli & Minelli, 1993), are the only two representatives of this genus. *P. orientis* is recorded from the Bosphorus area, Central Greece and S. Sporades. *P. patriarchalis* ranges from W. Anatolia, S. Balkans and S. Italy, but it was also recorded from Cyrenaica and in some Thyrrenian islands where it may have been introduced. Both species are mainly thermophilous, their habitat preferences includes Mediterranean open and sclerophyllous forest habitats as well as mixed broadleaved thermo-mesophilous woodlands.

The genus *Hessebius* Verhoeff ranges from Central Asia (Kirghizistan, Tagikistan, Turkmenistan, Kazakistan), across Southern Russia, Middle East (Iran, Iraq, Armenia, Syria, Palestine), westward up to Anatolia (Toros, including S. Sporades), Cyprus and NE. Africa (Egypt, Libya) (Zaleskaja, 1978; Zapparoli, 1999). It includes about ten species, some of which, especially those from Central Asia, recorded only from few localities. The habitat preferences of the representatives of this genus are poorly known, but they are probably related to open Mediterranean habitats as well as steppes, deserts or sub-deserts. *Hessebius* is marginally present in Europe where only two species are known to occur. *H. multicalcaratus* Folkmanová, whose distribution extends from Southern European Russia to the eastern part of Ukraine (Zaleskaja, 1978; Golovatch & Zaleskaja, 1996: Figure 2), and *H. barbipes*, a common species known from Iran to the E. Mediterranean region, where it reaches its eastern limit (Figure 2) (Zapparoli, 1999).



Figure 2. W. Palearctic range of the genus *Hessebius* Verhoeff.

Hessebius is marginally present in Europe where only two species are known to occur. *H. multicalcaratus* Folkmanová, whose distribution extends from Southern European Russia to the eastern part of Ukraine (Zaleskaja, 1978; Golovatch & Zaleskaja, 1996: Figure 2), and *H. barbipes*, a common species known from Iran to the E. Mediterranean region, where it reaches its eastern limit (Figure 2) (Zapparoli, 1999).

Ethopolinae are represented in Europe only by the genus *Eupolybothrus* Verhoeff. This genus so far includes 22 species and ranges from Central and S. Europe (incl. Sicily, Sardinia and Crete), to W. Anatolia, Middle East (incl. Cyprus) and Maghreb; records from Spain (Attems, 1927, 1952) need to be confirmed (Figure 3). *Eupolybothrus* species are mostly nemoral, mainly related to broadleaved as well as montane coniferous woods; some species are also cave-dwellers. Only two species, *E. litoralis* (L. Koch) and *E. nudicornis* (Gervais), show preferences for warmer habitats and their range extends out of Europe, the former eastward in Anatolia and in the Middle East, and the latter southward and westward in N. Africa.

Although the subgeneric classification of the genus and the identity of a number of species has been recently investigated by modern Authors (e.g., Jeekel, 1967; Eason, 1970b, 1972a, 1972b, 1982, 1983; Eason & Minelli, 1976; Zapparoli, 1984, 1995, 1998), some taxonomic and faunistic problems still affect the group. For instance, the taxonomic identity of some species, especially from the Balkans (e.g., *E. spiniger* (Latzel), *E. macedonicus* (Verhoeff), *E. walkanovi* (Kaczmarek), *E. sketi* Matic), needs to be re-examined. Moreover, although their taxonomic identity has been revised (Eason, 1970b), the SE. European range of three of the most common species, *E. grossipes* (C.L. Koch), *E. litoralis* (L. Koch) and *E. fasciatus* (Newport), all closely related one to another and often confused by older authors, is still not precisely known.



Figure 3. Range of the genus *Eupolybothrus* Verhoeff s.l.

The most interesting area from a faunistic and biogeographic point of view is the Balkans. This area harbours about two thirds of the European *Eupolybothrus* species. More than half of the Balkan *Eupolybothrus* is represented by species with more or less restricted ranges. Among these at least three are cave species, *E. gloriastigis* (Absolon), *E. leostygis* (Verhoeff) (Herzegovina, Montenegro) and the troglobitic *E. andreevi* Matic (Bulgaria, W. Stara Planina Mts.). Other endemic representatives are the epigeic *E. dolops* Zapparoli, *E. wernerii* (Attems), *E. caesar* (Verhoeff), *E. herzegovinensis* (Verhoeff).

Few *Eupolybothrus* species are restricted to the Alps. *E. excellens* (Silvestri), for example, is known in W. Italy where it has been mainly recorded from caves as well as from epigeic sites. *E. obrovensis* (Verhoeff), a troglobitic species, is endemic to the karst of Istria. Another species with a restricted range but poorly known is *E. verrucosus* (Sselivanoff), from Moldova.

Henicopidae, a family essentially confined to the tropics and the southern hemisphere, is represented in Europe by few species without any particular interest from the faunistic or biogeographic point of view, since they were probably all introduced by man. The commonest species are the cosmopolitan *Lamyctes emarginatus* (Newport) and *Lamyctinus coeculus* Brölemann both always recorded from artificial habitats. They are known to occur in natural habitats only in the Canary Islands, where two other *Lamyctes* Meinert, both probably widely spread by man in the tropics and subtropics, have also been recorded from natural habitats. Finally, a monobasic Anopsobiinae genus of uncertain identity (*Rhodobius* Silvestri, *R. lagoi* Silvestri) is known from orchards in Rhodos (S. Sporades, Greece).

CONCLUSION

Some concluding remarks should be made:

1. Although the number of species is comparatively small, centipedes are of great interest in faunistic, biogeographic and ecological studies due to their close relationship with the ecosystems, their low dispersal power and their apical position in the ecological chains. Nonetheless the results of such studies will not be reliable without a valid and stable classification system of the group.
2. As far as lithobiomorphs are concerned, the European species has been the subject of both systematic and faunistic research for a long time. The data collected so far highlights the presence in this area of a rich and complex fauna, to which both historical and ecological factors have contributed.
3. The picture however is not yet complete and a number of taxonomic problems on the identity and classification of some genera/subgenera (e.g., *Thracolithobius*, *Dacolithobius*), as well as of individual species (e.g., in *Lithobius* s.str., *Sigibius*, *Monotarsobius*, *Harpolithobius*) need to be solved. In order to give more details on the local distribution of the species, intensive faunistic surveys need to be carried out, especially in some areas where knowledge is still patchy, such as the Iberian peninsula, the Balkans, Eastern Europe, the Mediterranean macro and micro-insular systems, as well as other areas, such as Central Europe, only apparently well known.
4. The zoogeographical studies on the European fauna cannot give satisfactory results without taking into account the fauna of the adjacent areas, especially Anatolia, Caucasus and the Middle East. These regions are however poorly known, both from systematic and faunistic points of view, and further data is necessary.
5. Although some centipedes have a wide range of habitat preferences, a large number of species show rather precise preferences, and auto- and syn-ecological information could be very useful in taxonomical, faunistic and zoogeographical studies.

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SUMMARY

After a short history of the systematic and faunistic research highlighting the contribution of Dr. E.H. Eason (1916-1999), a synthesis of the present day knowledge on the lithobiomorph fauna of Europe (geographic Europe, incl. Macaronesia) based on literature and unpublished data examined by the author is presented. About 310 species/subspecies, mostly represented by Lithobiidae (genera *Lithobius* Leach s.l.,

Hessebius Porat, *Harpolithobius* Verhoeff, *Pleuroolithobius* Verhoeff, *Eupolybothrus* Verhoeff s.l.), have been recorded so far. Only 4-5 probably introduced species of Henicopidae are known as present in the study area (genera *Lamyctes* Meinert, *Lamyctinus* Silvestri, *Rhodobius* Silvestri). The number of the species present in Europe is however difficult to define since the taxonomic identity of a number of these is uncertain and many areas have not been much explored. The majority of the European lithobiomorpha fauna occurs in the southernmost mainland areas (Iberian Peninsula, Italy, Balkans) and a general pattern of species richness decreasing from south to north is noted. In order to give a zoogeographic picture of the fauna the distribution patterns of some of the most significant species are discussed for each genus or subgenus: a larger number of species widely spread in Europe (mainly S. European) in addition to a small component of species widely spread in the whole Palearctic Region (Sibero-European, Centralasiatic-European, SW. Asiatic), are represented in the fauna.

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EDWARD HOLT EASON: HIS ARCHIVES AND COLLECTION IN THE HOPE ENTOMOLOGICAL COLLECTIONS

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THE ARCHIVE

This archive (Figure 1) was acquired from the daughter of the late Dr. Eason in 2000. It mostly relates to the taxonomy of the Lithobiidae and is sorted into categories of general correspondence, and by notes, manuscripts, illustrations and correspondence relating to particular published works, or by zoogeographic region. It comprises 25 boxes:



Figure 1. The complete archive

- Box 1:** A copy of Eason's obituary Correspondence 1948-1974.
- Box 2:** Correspondence 1975-1986.
- Box 3:** Correspondence 1987-1995.
- Box 4:** Correspondence 1996-1999 and collated letters from Turk, Matsakis and Blower.
- Box 5:** Manuscript for: *Centipedes of the British Isles*. London: Frederick Warne, 1964.
- Box 6:** Two proof copies of: *Centipedes of the British Isles* (one annotated)
- Box 7:** Myriapoda of the British Isles: Notes, manuscripts, illustrations and correspondence.
- Box 8:** British Myriapod Group; British Myriapod Survey: Notes and correspondence.
- Boxes 9-11:** Lithobiidae: Notes, manuscripts, illustrations and correspondence.
- Box 12:** Lithobiidae of Europe and NW Europe in particular: Notes, manuscripts, illustrations and correspondence.
- Box 13:** Lithobiidae of Southern Europe: Notes, manuscripts, illustrations and correspondence.
- Box 14:** Lithobiidae of the Canary Islands, Madeira, the Azores and the Cape Verde Islands (Macaronesia): Notes, manuscripts, illustrations and correspondence.
- Box 15:** Lithobiidae of Siberia, Kamchatka and the Kurile Islands, Afghanistan and Sri Lanka: Notes, manuscripts, illustrations and correspondence.
- Box 16:** Lithobiidae of Nepal: Notes, manuscripts, and correspondence.
- Box 17:** Lithobiidae of Oceania, Tasmania, Thailand, the Falkland Islands and the Nearctic Region, etc.: Notes, manuscripts, illustrations and correspondence; and printed items for international congresses.
- Boxes 18-21:** Notebooks.
- Box 22:** Sorribes, Antoni Serra (1980) *Contribución de conocimiento de los Lithobiomorpha (Chilopoda) de la Península Ibérica*. [PhD. thesis], Universidad de Barcelona. Facultad de Biología.
- Boxes 23-25:** Illustrations for published papers, mostly for: *Centipedes of the British Isles*. London: Frederick Warne, 1964.

The archive contains many examples of Easons' work from start to finish. For example a series of correspondence and drafts shows the original contact of Zumeta to Eason, through the early draft text and figures, to the resulting paper.

It archive also contains many notes on odd bits of paper such as a scrap of paper from the British Horse Society, giving a glimpse of Easons' passion for horse riding.

THE COLLECTION

His daughter, Marian Waters presented the E. H. Eason collection (Figure 2) to The Hope Entomological Collections (HEC) in 2000. The collection is preserved in 75% alcohol, and is contained in some 60 jars. The collection remains in Easons' original arrangement, and although it has been conserved, the collection has as yet not been completely catalogued and checked. The majority of the material held in the HEC is British, with some mainland European specimens, mostly of *Lithobius* species. The vast majority of the non-British material of Eason was presented to the Natural History Museum, London during his lifetime, with material also being presented to various other institutions.

A tentative list of the British species contained in the collection is given below:



Figure 2. The Eason collection

Chilopoda:

Geophilomorpha: *Haplophilus subterraneus* (Shaw); *Hydroschendyla submarina* (Grube); *Schendyla nemorensis* (C.L. Koch); *Schendyla peyerimhoffi* Brolemann & Ribaut; *Strigamia crassipes* (C.L. Koch); *Strigamia acuminata* (Leach); *Geophilus electricus* (Linné); *Geophilus carpophagus* Leach; *Geophilus proximus* C.L. Koch; *Geophilus insculptus* Attems; *Geophilus osquidatum* Brolemann; *Necrophloeophagus flavus* (De Geer); *Brachygeophilus truncorum* (Bergsö & Meinert); *Chalandea pinguis* (Brolemann)

Scolopendromorpha: *Cryptops anomalans* Newport; *Cryptops hortensis* (Donovan)

Lithobiomorpha: *Lithobius variegatus* Leach; *Lithobius forficatus* (Linné); *Lithobius peregrinus* Latzel; *Lithobius macilentus* L. Koch; *Lithobius erythrocephalus* C.L. Koch; *Lithobius lapidicola* Meinert; *Lithobius pilicornis* Newport; *Lithobius calcaratus* C.L. Koch; *Lithobius crassipes* C. L. Koch; *Lithobius curtipes* C.L. Koch; *Lithobius microps* Meinert; *Lamyctes fulvicornis* Meinert

Diplopoda:

Polyxenus lagurus (Linné); *Glomeris marginata* (Villers); *Nanogona polydesmoides* (Leach); *Melogona scutellare* (Ribaut); *Nemasoma varicorne* C.L. Koch; *Bianiulus guttulatus* (Fabricius); *Archiboreoiulus pallidus* (Brade-Birks); *Ommatoiulus sabulosus* (Linné); *Tachypodoiulus niger* (Leach); *Cylindroiulus punctatus* (Leach); *Cylindroiulus latestriatus* (Curtis); *Cylindroiulus britannicus* (Verhoeff); *Julus scandinavus* Latzel; *Brachyiulus pusillus* (Leach); *Unciger foetidus* (C.L. Koch); *Polydesmus angustus* Latzel; *Polydesmus gallicus* Latzel; *Polydesmus denticulatus* C.L. Koch; *Brachydesmus superus* Latzel; *Macrosternodesmus palicola* Brölemann; *Ophiodesmus albonanus* (Latzel); *Stosatea italica* (Latzel)

The collection contains a few specimens of non-British material as below:

Chaetechylene vesuviana ?; *Clinopodes linearis* Koch; *Lithobius ?stramineus* ; *Lithobius ?toruanue* ; *Lithobius erythrocephalus* Koch; *Lithobius forficatus* (Linn); *Lithobius fulvicornis* Meinert; *Lithobius hispanicus* Meinert; *Lithobius lapidicola* Meinert; *Lithobius lucifugus* Koch; *Lithobius lusitanus valesiacus* Verhoeff; *Lithobius melanops* Newport; *Lithobius mutabilis* Koch; *Lithobius pelidnus* Haase; *Lithobius tylopus* Latzel; *Lithobius variegatus* Leach; *Scolopendra canidens oraniensis* Lucas; *Scutigera coleoptrata* (Linné)

ACCESS TO THE ARCHIVES AND COLLECTION

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Figure 3. Lord Zuckerman presenting Ted Eason with the Stamford Raffles award for 1980. (Courtesy of Mrs M. Waters).



Figure 4. Ted Eason in his study, at home in Moreton-in-the-Marsh. (Courtesy of Mrs. M. Waters).

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Many thanks to Marian Waters for the photographs of Ted Eason. Also thanks to Nancy Wilkinson for assistance with the curation of the Eason collection

SOME UNPUBLISHED RECORDS OF CENTIPEDES IDENTIFIED BY DR. E. H. EASON.

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INTRODUCTION

I dedicate this paper to the memory of “Ted” Eason, an outstanding and unforgettable figure, a pre-eminent myriapodologist with a singular and engaging personality. I first met him in 1970 at the inaugural field meeting of the British Myriapod Group held at Brendon in North Devon: from then until 1997 we met many times, both at meetings and privately, and communicated regularly by letter. I was privileged to count him as a friend.

After I had come to work on the Continent in 1974 he identified or confirmed the identification of many centipedes that I had collected and helped me to set up a reference collection. To a large degree the data thus accumulated have not previously been published; they are mainly occasional occurrences of common species in a number of different countries which did not seem to merit special publication at the time. However, there were some interesting discoveries and some observations made to me by Ted Eason which certainly should be published. I am therefore presenting a mixture of data and his observations which were essentially about taxonomy, occasionally about ecology and distribution.

RECORDS

For the benefit of mapping projects I am listing the localities and UTM grid references of the centipede records which were confirmed. These are presented in the form of tables on a country by country basis: each table is followed by relevant observations. Those data that have been published already are not included, except in a few instances when they gave rise to significant comments by Dr. Eason.

Records from Belgium

Almost all of these have been incorporated into the recently published atlas by Koen Lock (2000). There are, however, a few more that have come to light as I have re-examined all my files and letters for this article. In addition there is one site, Mont Rigi, that I have intended to write about for some time.

Locality	Province	Date	UTM 10km sq.	Species
Transinne	Luxembourg	13.5.1986	FR54	<i>Lithobius crassipes</i> , <i>L. macilentus</i> .
Ligneuville	Liège	20.3.1988	KA98	<i>Lithobius crassipes</i> , <i>L. curtipes</i> <i>L. macilentus</i> <i>L. pelidnus</i>
		27.11.1988		<i>L. curtipes</i> , <i>L. pelidnus</i> <i>L. tricuspis</i> .
Mt. Rigi Robertville	Liège	1977/1978	KA99	<i>Lithobius calcaratus</i> , <i>L. crassipes</i> , <i>L. curtipes</i> , <i>L. dentatus</i> , <i>L. forficatus</i> , <i>L. macilentus</i> , <i>L. microps exarmatus</i> , <i>L. tenebrosus</i> , <i>L. tricuspis</i> , <i>Lamyctes emarginatus</i> , (as <i>fulvicornis</i>).

Observations

The locality in Transinne is a forest in the northern Ardennes on leached siliceous soil at about 450m above sea level. The two species found are common in such sites.

The forest at Ligneuville is in the eastern Ardennes at an altitude of approximately 400m. The precise locality is designated "A la Haye" and is noteworthy because in June, 1979, some immature specimens of a craspedosomid (stadium VII) resembling the genus *Haasea* (Mauriès, pers. comm.) were taken from an oakwood. Whatever this species was, it would have been new for Belgium. I subsequently made a number of attempts to find adults of the millipede, but without success. Then, much of the area was clear felled during the 1980s. I did at least locate the lithobiids listed above. The record of *Lithobius pelidnus* was the first for Belgium. I did not find it again until examining samples taken from a stand of spruce in 1999. This was at Epioux in the southern Ardennes (420m, UTM FR61).

The Mont Rigi site is in the Hautes Fagnes region of Belgium. It consists of a mosaic of montane woodland, upland heath and peat bogs at an altitude of 650-690m. The woodland is on the whole coniferous while there are some bushy areas of heathland containing birch, willow and aspen. I was able to examine the myriapods that were caught in pitfall traps, in place from the summer of 1977 until the spring of 1978: this gave rise to the list of ten lithobiids above. It is worth pointing out that only two millipedes were found in the traps. One was *Craspedosoma rawlinsi* and the other was *Mycogona germanicum*, a Central European chordeumid confined to the montane zone. They are both cold-resistant. Millipedes common at lower altitudes such as *Tachypodoiulus niger*, *Julus scandinavus* and *Glomeris marginata* were not found at all, but this may have been due to the extreme acidity of the soil habitat. *Julus scandinavus* is common on acidic Belgian heaths however. Dr. Eason looked at the whole collection and made the following comments:

"The most surprising find is *Lithobius microps exarmatus*, known only from the Mediterranean region of Europe although I have found it in mid-Wales. Originally named as a variety of *duboscqui* (= *microps*) by Brolemann, some authors regard it as a distinct species. Apart from the total absence of spines (except small DaT 1-11) I can find nothing to separate it from *microps* and on Mt. Rigi, where it is the only form of *microps* found, it is behaving like a subspecies and not as the occasional abnormal specimen (i.e. variety). A subspecies with a markedly discontinuous distribution is known as 'polytopic' and this may be such a case. It would certainly be interesting to map the distribution of *microps* in the region surrounding Mt. Rigi to see if *microps* and *exarmatus* behave as species or subspecies."

I have to confess that I have not done this, but recently a second colony of *Lithobius microps exarmatus* has been located not far away in an oak wood close to the German border, again without finding any *L. m. microps* in the population. Brolemann (1930) cites both the Pyrenees and the Maritime Alps for *L. duboscqui* var. *exarmatus*.

There are some further comments on the Mt. Rigi specimens:

"Another curious specimen is a female *tricuspis* with simple 15th claws. I have labelled this *L. tricuspis* var. *mononyx* Latzel, so far only found in the Pyrenees. This is a variety only as it occurs in the same population as the normal form. In Brolemann's (1930) key it runs to *L. troglodytes* but is definitely *tricuspis*".

67 specimens of *L. tricuspis* were caught altogether in the fifteen trapping sites. It was by far the commonest lithobiid. This fits well with the observation by Spelda (1999) that in Baden-Wurttemberg the species does not show an altitudinal preference and occurs above the tree line.

"Yet another odd specimen is the female *L. forficatus* which has a large simple female claw. This must also be a variety as there are normal female *forficatus* from Mt. Rigi".

Eight specimens of *L. forficatus* were caught, fewer than *L. crassipes* (20) and *L. curtipes* (12) as well as

far fewer than *L. tricuspis* (67). In fact *L. forficatus* is relatively rare and indeed has not been caught at all in many of these higher forests in the Ardennes.

L. tenebrosus has been recorded only four times in Belgium (Lock, 2000); It is apparently a rare species usually confined to montane woodland (Spelda, 1999). *Lithobius dentatus* and *L. macilentus* were represented by one specimen each. These are the commonest species in most of the Ardennes forests up to altitudes of at least 560m.

Dr. Eason ends his report to me with two questions: "Is Mt. Rigi very high or is there anything special about it?" The answer to both of these in the Belgian context is yes, the area is an important nature reserve. It is situated where the Atlantic and Central European zones meet, its altitude giving it an often humid yet rather continental climate of a montane nature. It can to some degree be regarded as part of the Central European Montane zone and there are also some connections with southern alpine mountains. A millipede, *Ceratosphys amoena*, once thought to be endemic in the Pyrenees, has been found elsewhere in the Belgian Ardennes.

Records from Luxemburg

There is only one record of note from the Grand Duchy of Luxemburg. Nevertheless it may well be the most important in this article. It concerns some specimens that I sent to Dr. Eason from a national nature reserve at Oberanven, collected during a research project carried out by the National Natural History Museum in Luxemburg. The locality, by name "Aarnesch", a dry calcareous pasture on a hill with a plot of pines (UTM LA 00) was partly cut for hay, partly grazed by sheep and partly left alone during the experimental period. The centipedes found were as follows:

- Geophilus carpophagus* – one specimen in the grassland.
- Strigamia acuminata* – one specimen from the north of the grassland.
- Lamyctes emarginatus* – in the sheep pasture.
- Lithobius muticus* – one male and one female at the edge of the sheep pasture.
- Lithobius calcaratus* – in all the pastures except with sheep.
- Lithobius forficatus* – in the pines.
- Lithobius pusillus* – in the pines and the neighbouring pasture.

With respect to the last species Dr. Eason wrote:

"I have labelled these *Lithobius pusillus* Latzel (male and female) because they differ from *lapidicola* in having only six ocelli each side, with the posterosuperior the largest, completely smooth tergites with no trace of projections on T11 or 13 and very indistinct anterior tarsal articulations. In *lapidicola* the ocelli are 9-11, with the posterior the largest, always some degree of wrinkling of the tergites and at least traces of projections on T13 and often T11, and the anterior tarsal articulations less indistinct. I would have identified these as *lapidicola* had I not recently seen some specimens from Crete sent me by John Lewis which are in better condition and convince me that *pusillus* is distinct from *lapidicola* (= *pusillus pusillifrater*). I was wrong to give *pusillus* as a synonym of *lapidicola* in my 1982 paper. *L. pusillus* is common in Austria according to Latzel and there are authentic records from the Mediterranean region, but none from Western Europe proper as far as I know."

Remy & Hoffmann (1959) mention neither *L. lapidicola* nor *L. pusillus* from Luxemburg; it is a new species for the Country.

Records from France

While extending collecting activities through France in order to prepare maps of the distribution of species in areas from which there were few records, Dr. Eason suggested that I send him some samples for verification. I therefore sent him a selection of tubes containing lithobiids obtained by hand searching and sometimes Berlese extractions of forest litter. I list below the certain identifications that he made. Generally, they supposedly involve the most common species at the site and may be of some biogeographical interest.

Site	Commune	Department	UTM	Date	Species
Bois de Trélon	Trélon	Nord	ER 74	17.5.92	<i>Lithobius crassipes</i> <i>L. dentatus</i> <i>L. forficatus</i>
Bois d'Harcy	Bourg-Fidèle	Ardennes	FR 12	4.10.86	<i>Lithobius dentatus</i> <i>L. macilentus</i> <i>L. tricuspis</i>
Bois des Potées	Sévigny-la-Forêt	Ardennes	FR 02	19.10.86	<i>Lithobius curtipes</i> <i>L. dentatus</i> <i>L. macilentus</i> <i>L. microps</i>
Woodland	Fontoy	Moselle	KV 87	4.11.84	<i>Lithobius aeruginosus</i> <i>L. macilentus</i> <i>L. tricuspis</i>
Bois des Champs Gringaut	Asquins	Yonne	EN 56	3.11.85	<i>Lithobius macilentus</i> <i>L. microps</i> <i>L. tricuspis</i>
Woodland	Brosses	Yonne	EN 56	3.11.85	<i>Lithobius agilis</i>
Bois de Beauregard	St-Amand-en-Puisaye	Nièvre	EN 06	15.5.88	<i>Lithobius macilentus</i> <i>L. microps</i>
Bois de Martinières	Champagnac-de-Belair	Dordogne	CL 13	1.11.85 31.10.86	<i>Lithobius agilis</i> <i>L. macilentus</i> <i>L. microps</i> <i>L. tricuspis</i>
Gorges de la Dordogne	Neuvic	Corrèze	DL 41	3.9.92	<i>Lithobius calcaratus</i> <i>L. macilentus</i> <i>L. melanops</i> <i>L. pilicornis</i>
Woodland	Grandsaigne	Corrèze	DL 13	3.9.92	<i>Lithobius forficatus</i> <i>L. tricuspis</i>
Woodland	Le Falgoux	Cantal	DK 69	3.9.92	<i>Lithobius forficatus</i> <i>L. muticus</i> <i>L. piceus</i> <i>L. tricuspis</i>
Woodland	Laissac	Aveyron	DK 80	2.9.92	<i>Lithobius melanops</i>
Rochers de Chironne	Chamaloc	Drôme	FK 86	17.8.82	<i>Eupolybothrys</i> <i>longicornis</i>
N of Col de St. Alexis	St-Agnan-en Vercors	Drôme	FK 87	17.8.82	<i>Lithobius dentatus</i>

Records from Malta

I collected a few myriapods while on holiday in Malta in 1979. Dr. Eason identified the centipedes:

1. Woodland between Verdala Palace and Buskett Gardens. Limestone bluffs covered with pine, cypress, evergreen oak, etc. Under stones. 27.2.79.
Henia bicarinata, *Henia vesuviana*? (*Chaetechelyne* at the time)
2. Valley on north side of Gebel Cantar, between Dineli and Siggiewi. Under stones on green area beside road, on Upper Corallian limestone. 28.2.79.
Lithobius (Monotarsobius) osellai?
3. Marfa Ridge, north of Mellieha. Below stone in herbaceous roadside area. 1.3.79.
Scolopendra canidens oraniensis, *Eupolybothrus impressus*.
4. Luqa Airport. Under stones in shrubbery on globigerinous limestone. 3.3.79.
Schendyla nemorensis, *Himantarium gabrielis*.

The question marks arise from doubt about immature or damaged specimens.

Records from Portugal

These similarly arose from a collection made while on holiday.

1. South of Baragem da Bravura, near Lagos, Algarve. Nardos heath with heather, gorse, rosemary and grasses. 5.3.1981.
Lithobius hispanicus Meinert,
L. variegatus rubriceps,
Lamyctes fulvicornis Meinert,
now *emarginatus* Newport.
Scolopendra canidens oraniensis,
Cryptops trisulcatus Brolemann
Clinopodes poseidonis (Verhoeff),
Dignathodon microcephalum
Geophilus carpophagus (49 leg pairs = *G. easoni* Arthur *et al.*),
Haplophilus dimidiatus (Meinert)
2. Ferragudo, Algarve. Rosemary, heather and gorse heath with asphodels. 7.3.1981.
Scolopendra cingulata
3. Alvor, Algarve. 7.3.1981.
Haplophilus dimidiatus

Records from Tenerife

1. San Eugenio, Playa de las Americas. Under debris in temporary riverbed leading up through apartments into the desert. Near sea level. 28.12.1987
Lamyctes mauriesi Demange, 1981.
2. Playa Paraiso. In litter of shrubbery and under planks just above the beach. 3.1.1988.
Lamyctes mauriesi

This second record was published by Eason and Enghoff (1992). When Dr. Eason first wrote to me about my collection he thought that the animals that I had obtained from these two sites all resembled (*Henicops*) *Lamyctes africana* (Porat, 1871). Eason & Enghoff point out that this might prove to be the correct name for this species in the event that *L. africana*, *L. albipes* and *L. mauriesi* prove to be synonymous.

3. South of La Esperanza. Pine forest with heather and shrubs. Altitude about 900m. 30.12.1987.
Lamyctes fulvicornis, now *emarginatus*.
4. Between La Esperanza and El Portillo. Pine forest at about 1900m. 30.12.1987.
Lithobius tenerife.

Records from Spain

I have some records of *Lithobius variegatus variegatus* which I collected in the northern mountains of Spain and which add to those published in Eason & Serra (1986). In this instance only, the animals were not actually sent to Dr Eason. The sites are the following:

1. Between Pedron and Noya, La Coruña. Oak/eucalyptus copse, with *Rubus*, gorse, honeysuckle and foxgloves, 8km from Noya.
30. 3. 1978. UTM NH13.
2. Desfiladero del Cares, by road AS114, km35, Asturias. Deciduous woodland in gorge.
13. 5. 1995. UTM UN59.

3. South of Posadas, Sierra de la Demanda, Rioja. Pinewood with heather and broom.
16. 5. 1995. UTM VM97.
4. Valgañón, Rioja. Beechwood by road C111, the first woodland when descending from the Sierra de Santa Cruz eastwards from the provincial boundary with the Province of Burgos.
17. 5. 1995. UTM VM98.

Eason & Serra's paper was very significant at the time as it fully established that *Lithobius variegatus* was not endemic to Britain, Ireland and their surrounding islands.

ACKNOWLEDGEMENTS

I am entirely indebted to Ted Eason for making this paper possible, and to whom it is most respectfully dedicated. I am grateful, too, to Dr. J. G. E. Lewis for reading the article and making helpful suggestions.

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[Editors note: *Lithobius macilentus* - Unlike the situation in Britain, where only females of this species occur, both males and females were present at all localities examined here.]

WATER RELATIONS, HABITAT AND SIZE IN LITHOBIOMORPH AND GEOPHILOMORPH CENTIPEDES (MYRIAPODA; CHILOPODA)

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ABSTRACT

Centipedes show considerable variation in their resistance to desiccation and the permeability of the integument as indicated by survival on immersion in water. Geophilomorphs are generally more resistant than lithobiomorphs. The advantages of a relatively permeable cuticle may be that it allows respiratory gas exchange, excretion of nitrogen as ammonia and/or the uptake of soluble nutrients.

Although lithobiomorphs are mainly found in superficial habitats and geophilomorphs below the surface, some small lithobiomorphs are soil inhabitants and some geophilomorphs inhabitants of superficial habitats. The advantages of soil-dwelling are discussed.

The great range in segment number in geophilomorphs suggests a varied mode of life: the long forms are efficient burrowers but nothing is known of the burrowing ability of short species, and they may have undergone a secondary reduction in segment number. In most Geophilomorpha there is a correlation between size and segment number but this is not the case in the family Mecistocephalidae. The excessive length of some geophilomorphs is puzzling. It may be to provide a long gut for digestion, a long ovary for high fecundity or a large surface area for absorption of nutrients.

INTRODUCTION

The water relations and habitats of centipedes and millipedes were discussed by Blower (1955). These matters are re-examined here but only in respect to lithobiomorph and geophilomorph centipedes. Subsequent work is reviewed and the possible reasons for variation in permeability in centipedes and the great range in segment number in geophilomorphs are discussed.

WATER RELATIONS

Desiccation experiments

Blower (1955) stated that geophilomorphs, although better waterproofed, did not show an appreciably greater resistance to desiccation than lithobiomorphs notwithstanding the marked difference in the permeability of their cuticles. This, he considered, was due to the imperfect spiracle closing devices of both orders. A subsequent review of the literature (Lewis, 1981) indicated, however, that there are considerable differences between both lithobiomorph and geophilomorph species. For example Roberts (1956) showed that *Lithobius forficatus* (L.) and *L. variegatus* Leach have much greater survival times than the much smaller *L. duboscqui* (= *L. microps* Meinert). Geophilomorphs vary a great deal in their resistance to desiccation and the most desiccation resistant species are found in this order.

Immersion experiments

Blower (1955) found that geophilomorphs were able to survive immersion in water for much longer than 24 h (exact times depending on species and the amount of air in solution). Lithobiid centipedes were, however, only able to survive immersion for a few hours. There is, nevertheless, considerable variation in the survival time of species of both groups (Lewis 1981). Of particular interest in this respect are Vaitilingham's (1960) results which showed that the small lithobiids *L. microps* and *L. curtipes* C. L. Koch have a much greater survival time than large *L. variegatus* and *L. forficatus*, the reverse of Roberts (1956) findings for resistance to desiccation.

SIGNIFICANCE OF DIFFERENCES IN PERMEABILITY

The fact that large *Lithobius* spp. show greater resistance to desiccation but have lower survival times in immersion experiments than small species may be explained in terms of surface area/volume ratios. Large animals may owe their resistance to a low SA/V ratio and if cutaneous respiration were important this would account for low survival times under water. Small species with a higher SA/V ratio would desiccate more rapidly but have a relatively larger surface available for gas exchange (Lewis, 1981).

As might be expected, centipedes that live in more superficial habitats are generally more resistant to desiccation than those from below the surface (Auerbach, 1951, Roberts, 1956) but there may be advantages for those species that have a relatively permeable integument.

A relatively permeable cuticle allows an exchange of respiratory gases across the integument. This may be important during flooding and is suggested by Blower's (1955) finding that the survival time of immersed geophilomorphs was dependent on the amount of air in solution. A relatively permeable cuticle would also allow waste nitrogen to be excreted as ammonia. This is the case in woodlice and the subject was reviewed by Sutton (1972). *Porcellio scaber* Latreille and *Oniscus asellus* L. produce ammonia as a gas and this is lost (with water) through the cuticle. Hartenstein (1968) suggested that this saved energy because ammonia need not be converted into urea or uric acid. This may be true for some centipedes. In *Lithobius forficatus* and *L. variegatus* 50-60% of total soluble nitrogen is excreted as ammonia, 1-8% as uric acid (Bennett and Manton 1963). Another possibility is that in some geophilomorphs, the cuticle is involved in the uptake of soluble organic compounds (see below). Permeability may, of course, be of little importance in soil-dwelling species and a waterproof epicuticle may have been lost with little effect ecologically.

HABITAT

Eason (1964) noted that details of habitat had been largely ignored by both British and European workers but with the introduction of the British Myriapod Group recording scheme, which was started in 1970, a great deal of data accumulated. The information was presented and analysed in Barber and Keay's (1988) *Provisional Atlas of the Centipedes of the British Isles*. Barber (1992) gave a further analysis of some of the data. He pointed out that the nature of most collecting tends to favour large and conspicuous species and those from superficial microsites so that smaller and soil dwelling species tend to be under-recorded.

Geophilomorpha

Barber (1992) stated that geophilomorphs are mostly below surface dwellers, but the three reddish brown geophilomorphs *Strigamia crassipes* (C. L. Koch), *S. acuminata* and *Geophilus carpophagus* and the commonly sub-cortical *Brachygeophilus truncorum* are relatively less common in the deeper layers. Eason's (1979) two 'forms' of *Geophilus carpophagus* are in fact two species, the smaller *G. easoni* Arthur et al., the larger: *G. carpophagus* (Arthur et al, 2000). Poser (1990), working in Germany, reported that *Strigamia acuminata* increased significantly in plots with augmented litter and Fründ et al (1996) collected 10 *Strigamia acuminata* from pitfall traps and only one from soil cores as compared to two and 37 respectively for *Schendyla nemorensis* (C. L. Koch). *Strigamia chionophila* (Wood) in Michigan (USA) was commonly observed on topmost leaves of litter basking in subdued sunlight and being one of the last species to migrate down into the deeper layers of the soil as winter approaches (Johnson, 1952). It would appear that members of the genus *Strigamia* are litter rather than humus or soil inhabitants. An exception is the littoral *Strigamia maritima* (Leach) most commonly found on shingle beaches.

Lithobiomorpha

Blower's (1955) generalisation that lithobiids are neither mechanically nor physiologically adapted to life in the soil and are thus mainly confined to the litter or suitable surface retreats (under stones, beneath moss and bark etc.) appears to be true for most but not all species. All but two of the seven species of *Lithobius* studied by Roberts (1956) were restricted to the litter layer. The exceptions were *L. melanops* (confined to rotten logs) and *L. microps* which penetrates the lower litter/humus layers. He pointed out that the body width of *L. microps* was less than 1 mm and the larval stadia much smaller (0.2 mm) which explained the abundance of these stadia in the upper humus. The body width 2-3 mm and large poison claws must contribute to the limitation of *Lithobius variegatus* to the litter layers of the forest floor. Poser (1990) found that *L. crassipes* L. Koch was able to live in plots without litter and Tuf (2000) found large numbers of *L.*

mutabilis in the top 10 cm of soil in three flood plain forests in the Czech Republic. Fründ et al (1997) collected 119 *L. forficatus* from pitfall traps in German woodlands, but none from soil cores. By contrast only seven juvenile lithobiomorphs were taken in pitfall traps, whereas 44 were extracted from soil cores.

The advantages of the soil as a habitat

The advantages of being able to retreat into the soil at times of drought or low temperature are obvious but there are other possible advantages. The microclimate in the soil, with its reduction in climatic extremes, may well extend the season of growth and reproduction. An example of the latter may be Leach’s (1817) observation, probably in the West of England, of a female *Haplophilus subterraneus* (Shaw) with 26 young in garden soil in January

Soil-dwelling also reduces predation. Fründ (1992) has recorded the frequency of scars in nearly 6000 centipedes as an indicator of predation intensity. He found that there is a decrease in scar frequency in Lithobiomorpha between the F- and H-horizon. In Geophilomorpha there is no difference between F- and H-layer but the proportion of scarred individuals was higher from the uppermost L-horizon. Fründ suggested that the higher mobility of adult and subadult developmental stages of centipedes might partly explain why they exhibit higher scar frequencies than the younger stages. Moving around implies that the centipedes leave their usual shelter in the soil and are at a higher risk of encountering an ambush predator. There are clearly major differences in food sources on the surface, in litter and in the soil but there appear to be no data on this or on the chances of +infection by parasites as between surface and soil dwellers.

SEGMENT NUMBER, SIZE AND HABIT IN GEOPHILOMORPHA

Geophilomorphs are invariably described as burrowing animals and this habit is associated with the high segment number. It seems surprising, therefore that geophilomorphs show such a great range in the number of pediferous segments, namely 27 to 191 (Minelli et al 2000). This seven-fold difference between the least and the most must be reflecting differences in mode of life. In British species the range is much less: Eason (1964) gives 35 to 83. A plot of number of pediferous segments against maximum body length (Figure 1) shows that there is a reasonable correlation between the two, the smallest species having the lowest segment number. The correlation is even more obvious when the data for the much richer French fauna (Brolemann, 1930) are plotted (Figure 2).

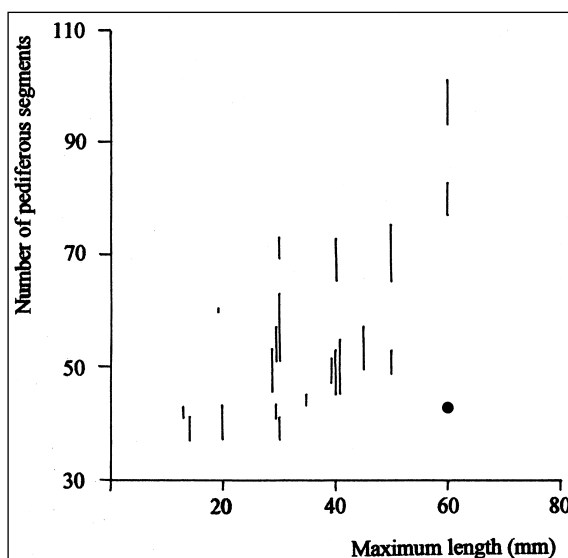


Figure 1. The relationship between the number of pediferous segments and maximum length in British geophilomorphs (data from Eason, 1964). Closed circle: *Dicelophilus carniolensis*.

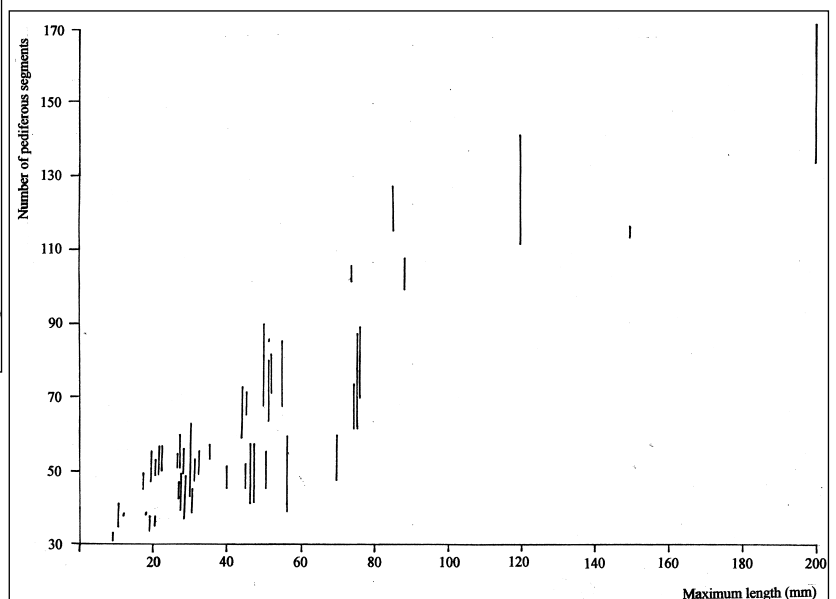


Figure 2. The relationship between the number of pediferous segments and maximum length in French geophilomorphs (data from Brolemann, 1930).

One British species, *Dicellogophilus carniolensis* (C. L. Koch), however, has a noticeably low number of pediferous segments for its length. This species is one of the two of the family Mecistocephalidae in the British Isles, both have been introduced. A plot of the number of pediferous segments against body length in the Mecistocephalidae (data from Attems, 1929) shows little correlation between leg number and maximum body length and a very considerable range in size in species with the same segment number (Figure 3).

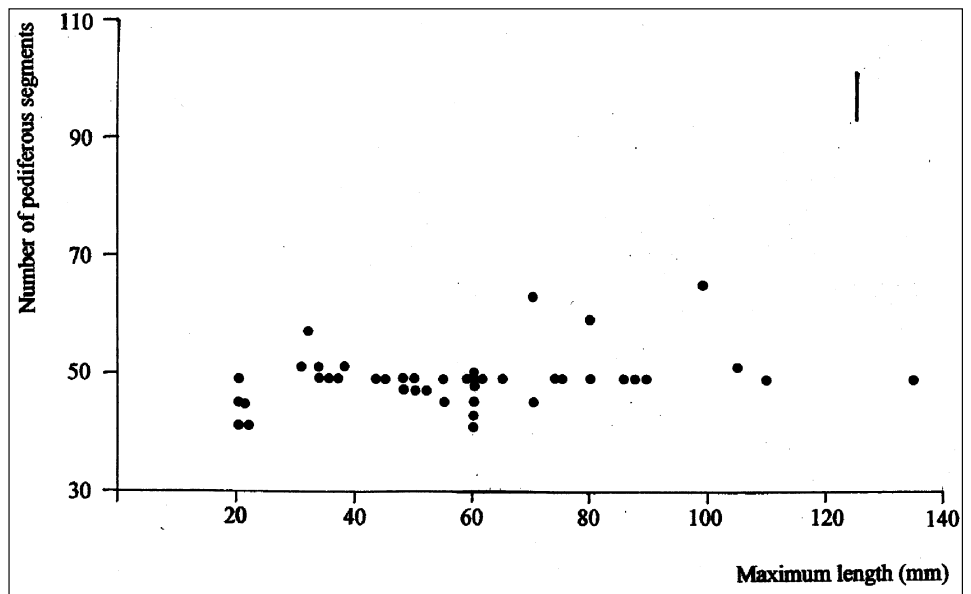


Figure 3. The relationship between the number of pediferous segments and maximum length in mecistocephalids (data from Attems, 1929). Vertical bar: range of pediferous segments in *Mecistocephalus microporus* (data from Bonato et al, 2001).

For example the maximum size of species with 49 leg-bearing segments varies from 20 mm to 135 mm. This suggests a mode of life in mecistocephalids different from that of other geophilomorphs. The Mecistocephalidae, Verhoeff's (1905-25) Placodesmata, are a sister group to all other geophilomorphs (Adesmata) (see Foddai & Minelli, 2000, Edgecombe and Giribet, 2002). Unlike other geophilomorphs, each species of mecistocephalid, with one exception, has a fixed number of pediferous segments (41-65). The exception is *Mecistocephalus micropus* Haase 1887 from the Philippines, which has an exceptionally number of pediferous, segments (93–101) (Bonato et al, 2001) which the authors' suggest is due to recent quasi-duplication.

According to Manton (1952) an animal roughly resembling a geophilomorph but with a small number of segments (about 30 to 35) and feeble powers of telescoping the sclerites and stretching the pleural region would have the possibility of developing into either a geophilomorph or a scolopendromorph. The conspicuous characteristics of the Geophilomorpha, such as the strong longitudinal musculature, well-developed intercalary tergites and sternites, the several isolated sclerites of the tergal region, and the short legs, Manton (1958) suggested, were correlated with the ability to burrow. She argued that species with high segment numbers (to some 130) would be more efficient burrowers as an increase in the number of body segments together with a decrease in their length must result in more joints being present per unit length leading to greater telescoping ability. The head and anterior third of the trunk segments (the anterior 35 segments in *Orya*) do most of the work of burrowing.

Geophilomorphs with a low number of pediferous segments ('short forms') may not be efficient burrowers and their ability to move through the soil may be due to their small size as appears to be the case with small lithobiids. There appear to be no data on locomotion in these forms. Indeed, Manton (1965) noted that "It is not easy to observe burrowing in the small British Geophilomorpha, because bright light stimulated them to shelter by running over firm soil or by pushing themselves into light soil, shifting soil particles by the force of each leg, but not burrowing by earthworm-like body movements". It may be that short forms are too short to burrow efficiently, or too small to need to. Nevertheless they show the conspicuous characteristics that Manton (1958) suggested were correlated with the ability to burrow in geophilomorphs. This may suggest two evolutionary trends in the Geophilomorpha, an initial increase in the number of pediferous segments accompanied by an increased efficiency in burrowing, followed by a secondary reduction in size and segment number in some groups.

Some geophilomorphs have a very high number of pediferous segments and it is difficult to see, in the light of Manton's (1958) findings, how this would increase burrowing efficiency. If excessively high segment number is not associated with burrowing efficiency then it may have some other function. One possibility is that it provides a very long gut to allow time/space for digestion. This seems unlikely as geophilomorph intestine contains little in the way of solid food (Lewis 1961). Increase in length would also

allow a higher fecundity providing more space for developing ova (they are arranged linearly). Alternatively, the length and strap-shaped trunk of species such as the Mediterranean *Himantarium gabrielis* (L.) and the Western European *Haplophilus subterraneus* Shaw give a large surface area which could be used for the absorption of nutrients from organically rich soil. This method of nutrition has not been suggested hitherto for centipedes but the small head and poison claws but a long body suggest a reduced importance of the mouthparts in nutrition.

POSTSCRIPT

Gordon Blower and Ted Eason's early work on British centipedes has provided a firm foundation for further investigations and the two men had a seminal influence on the development of the British Myriapod and Isopod Group. The Group has produced a great deal of data on the geographical distribution and habitat preferences of centipedes but there is still much to be learnt about them. In particular detailed investigations of the habitat of individual species, especially of small geophilomorphs are required. Also seasonal investigations of the species of a specific habitat would be very rewarding, not to mention behavioural and physiological investigations such as those of Blower on water relations.

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***PACHYMERIUM FERRUGINEUM* (C.L. Koch, 1835) – TWO DISTINCT FORMS IN CRETE?**

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INTRODUCTION

According to Eason (1979), it seems that geophilomorph species from cold and temperate regions tend to be smaller with fewer leg bearing segments than those from warmer regions. As pointed out by Meinert (1870), Attems (1902, 1929) and Brölemann (1930), a considerable geographical variability exists in the number of leg bearing segments (LBS) in *Pachymerium ferrugineum* (C.L. Koch, 1835). LBS vary between 41-55 in males and 43-57 in females. A rather extensive Eastern Fennoscandian material investigated by Palmén (1949) indicated that LBS seems to be considerably smaller than stated by several authors for S. European and African specimens. For instance, Meinert (1870) found the same species in N-Africa to have a modal number for females of 55 LBS. Northern European populations have 41 to 47 LBS whilst specimens from Palestine 67 or 69 LBS. Thus, according to Lewis (1981), widely distributed geophilomorphs are highly variable.

The main aim of this work is to present a preliminary study on the geographic pattern of variation in the segment number of *Pachymerium ferrugineum* (C.L. Koch, 1835) between Crete and its small satellite islands in the south.

MATERIALS AND METHODS

We present here data for *Pachymerium ferrugineum* of which we compare populations from small islands adjacent to Crete (satellite islands, such as Gavdos, Chrysi and the island group of Koufonisia), and the island of Crete (Table 1). Comparisons between populations were made using chi-square (X^2) contingency table tests (Table 2).

The examined material belongs to the centipede collection of the Natural History Museum of Crete - NHMC (University of Crete). Specimens were collected by hand or by pitfall traps and were preserved in 70% alcohol. In total, 31 sites were studied on the island of Crete and the satellite islands. Centipedes were sorted in the arthropod laboratory and were identified by the first author. The identification of the samples was based on Kanellis (1959). Maps were drawn with Arc View GIS version 3.1. and Corel Draw 9.

Map 2 presents the known distribution of *Pachymerium ferrugineum*. The bibliographic references to Crete (BIBL) are shown with flags, the studied material belonging to the NHMC with full circles.

RESULTS

Geographical distribution (Map 1): Mainland and insular Greece, Turkey, Cyprus, Albania, Bulgaria, Romania, Slovenia, Croatia, Bosnia Herzegovina, FYR Macedonia, European Russia, Palestine, Iran, Caucasus, Turkestan, Azores, Madeira, Canary Is., Tunisia, Algeria, Morocco, Central Sahara, Cyrenaica, Tripolitania, Portugal, Spain, Balearic Is., France, Corsica, Italy, Sardinia, Sicily, former Czechoslovakia, Austria, Hungary, Poland, Latvia, Finland, Norway, United Kingdom, Netherlands, Alaska, Pribilof Is (Zapparoli, 2002).

CHOROTYPE: W - PALEARCTIC (ZAPPAROLI, 2002).

Table 1.

Segment number data for Cretan populations of *Pachymerium ferrugineum*.

Males							
LBS	41	43	45	55	57	59	Total
CRETE	1	8	10	2	1	0	22
Satellite Islands	0	0	0	7	3	3	13
Total individuals	1	8	10	9	4	3	35
Females							
LBS	43	45	47	55	57	59	Total
CRETE	3	12	18	0	7	3	43
Satellite Islands	0	0	0	9	10	11	30
Total individuals	3	12	18	9	17	14	73

Table 2.

X^2 test for differences in leg bearing segments of *Pachymerium ferrugineum*.

	SEX	df	p
<i>Pachymerium ferrugineum</i>			
	Males	5	<0.001
	Females	5	<0.001

DISCUSSION

In Europe (Finland), *Pachymerium ferrugineum* was found to have 45 LBS (modal number) for females (Palmén, 1949). However, the same species in North Africa and E-Mediterranean has a greater modal number (55 LBS for females). Based on scanty information about the frequencies of the different forms of *P. ferrugineum*, Eason (1979) referred to "...a rather tentative suggestion of a geographical cline", suggesting that it would be reasonable to divide the species into subspecies along the cline. In contrast, Zapparoli (2002) believes that there is only a unique species.

Considering Crete, it seems to be that temperature is not the only environmental factor responsible for the noted difference in the number of trunk segments. Crete consists of an island formation placed between the southern (N. Africa) and the northern (Finland) extremes of the range of *P. ferrugineum*. It is noteworthy that the North-central European short form is widely distributed in the island whilst the southern satellite islands have the East Mediterranean long form. Moreover, looking through the existing ecological data, we could say that the two forms have distinct habitat preferences. *P. ferrugineum* (short form) is widespread on Crete, occurring from western to eastern places, up to 2000 m, but mainly between 1000 and 2000 m. It is collected in man-made habitats, in *Pinus brutia* forests, in mixed phryganic - maquis areas with *Corydthymus capitatus*, *Sarcopoterium spinosum*, *Pistacia lentiscus* and *Nerium oleander*, as well as in mountainous areas dominated by *Quercus coccifera*. It has been also found on subalpine and alpine phrygana with *Berberis cretica*, *Astragalus angustifolius* and *Satureja spinosa*. In contrast, the long form of *P. ferrugineum* is almost absent from Crete, only being collected from a plateau dominated by *Berberis cretica*, *Genista acanthoclada*, *Phlomis* sp. and some *Quercus coccifera* and *Acer sempervirens*. It occurs mainly at the small satellite islands on the South, preferring coastal phryganic areas, man made habitats and sand dunes.

Recent works on *Geophilus carpophagus* in United Kingdom are relevant to the findings reported here for *Pachymerium ferrugineum*. Eason (1979) found that populations of *Geophilus carpophagus* living in man made areas had higher segment numbers than those living in the wild, suggesting that the phenotypic plasticity of the LBS is caused by higher temperature. However, it has recently been shown that the form found in buildings is a distinct species (Arthur et al., 2001). In spite of the fact that the last work retracts the only apparent evidence for plasticity of segment number in geophilomorphs, Kettle et al. (2001) suspects that there will be still a small plastic effect.

Based on the distinctive geographical distribution and different ecological records of each form, we could accept that Crete and the surrounding islands constitute a unique geographic “meeting place” and “dipole” simultaneously (separating the short Cretan populations in the north from the long ones in the south). Therefore the hypothesis that there is a geographic cline in *P. ferrugineum* with segment numbers gradually increasing from north to south is partially confirmed. According to that, it would be reasonable to hypothesize that the different environmental pressure between Crete and the small surrounding islands has brought about genetic changes, or selected for one form rather than the other. Therefore, as concerns the form of selection produces this differentiation we could agree with Kettle et al. (2002), supporting that more segments give greater maneuverability, and hence prey catching and predator avoidance ability, and that in warmer and drier climates (such as on the surrounding islands of Crete) with longer periods of activity there is stronger selection for this pattern.

Nevertheless, the facts presented here suggest that the distribution and taxonomic status of these forms needs to be further investigated.

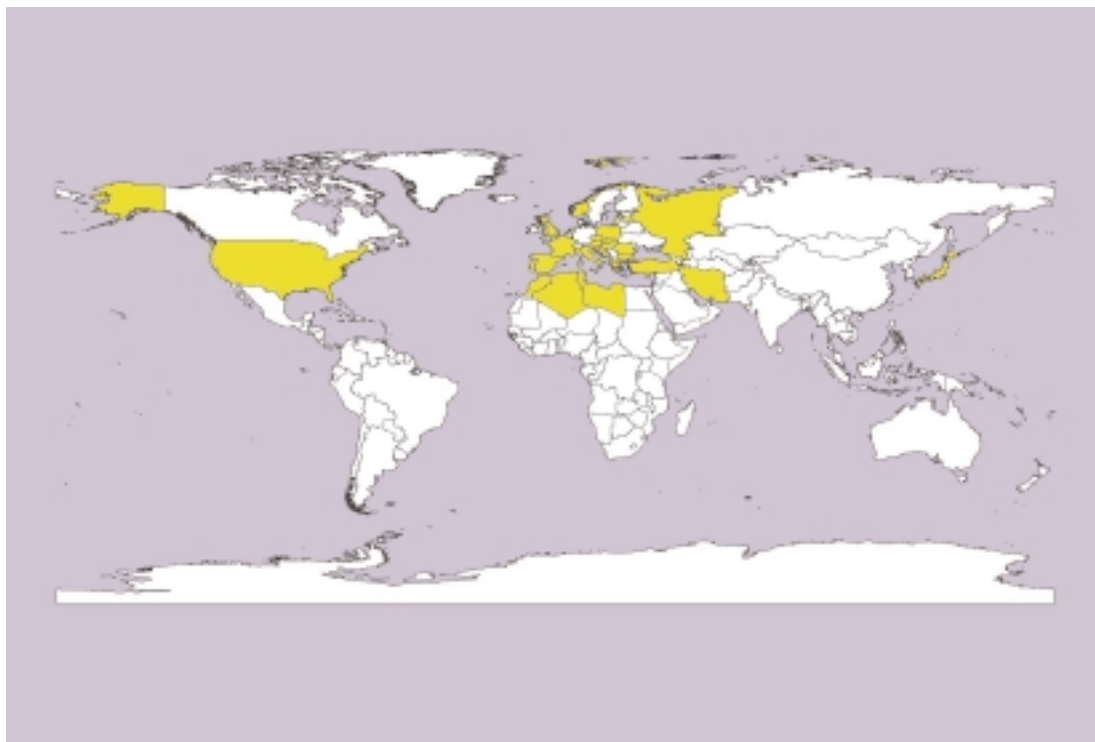
CONCLUSIONS

Pachymerium ferrugineum exists in two forms. The “short” form (*P. ferrugineum*), with 41, 43, 45 and 47 pairs of legs, is widely distributed on the island of Crete but not on the small satellite islands of the south. The “long” form (*P. f. insularum*) with 55, 57 and 59 pairs of legs is abundant on the satellite islands of the south (Gavdos island, Koufonisia islets, Chrysi islet), and in two isolated population in SW-Crete. It seems to be that temperature is not the only environmental factor responsible for the noted difference in the number of trunk segments.

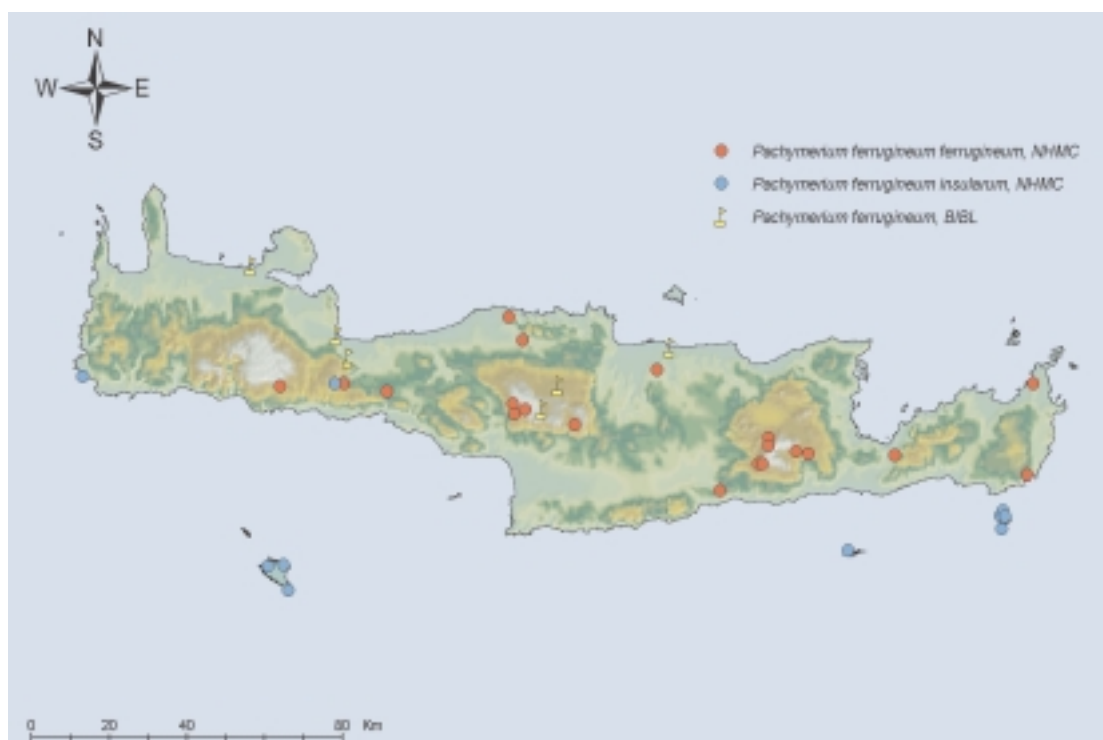
The short form has wide ecological range on Crete while the long form occurs at specific habitats mainly on the surrounding small islands.

ACKNOWLEDGMENTS

We wish to thank M. Nikolakakis for the construction of the maps (see overleaf). We also thank H. Read and an anonymous reviewer for linguistic revision of the text.



Map 1. Geographical distribution..



Map 2. Distribution in Crete.

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A NEW FOSSIL SCOLOPENDROMORPH CENTIPEDE FROM THE CRATO FORMATION OF BRAZIL

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ABSTRACT

Preliminary morphological interpretation of a new, exceptionally preserved Mesozoic scolopendromorph chilopod from the Crato Formation of the Araripe Basin, north-east Brazil is presented. The centipede is preserved in right lateral view and shows features, including a tracheal spiracle, not seen in previously described fossil scolopendromorphs from this locality. All four known fossil centipedes from this Formation are morphologically indistinguishable from modern forms and extant genera from other terrestrial invertebrate orders are known from Cretaceous fossils. Therefore, the new specimen cannot be placed in a fossil taxon on the basis of age alone. Rigorous morphological comparison with extant specimens is required before the correct taxonomic status of the specimen can be determined.

INTRODUCTION

There are 581 extant species of scolopendromorph centipedes currently placed in three families and 32 genera; 57 species in two families and 11 genera are known from the Amazonian region (Schileyko 2002). Though rare as fossils, centipedes have a long geological history. They date back to the Silurian (Shear et al. 1998) and are among the earliest known terrestrial animals (Jeram et al. 1990; Shear et al. 1998). The earliest Scolopendromorpha occur in late Carboniferous strata from Mazon Creek, Illinois (Hannibal 1997). Only three specimens of centipedes have been reported from strata of Mesozoic age, all from the early Cretaceous of Brazil (Table 1, Figure 1).

Table 1

Fossil chilopods from Brazil (all described in new extinct genera);*=holotype examined by FM.

Species	Order	Reference	Figure
* <i>Cratoraricus oberlii</i>	Scolopendromorpha	Wilson 2003	1A
* <i>Fulmenocursor tenax</i>	Scutigermorpha	Wilson 2001	1B
<i>Velocipede betimari</i>	Scolopendromorpha	Martill & Barker 1998	1C

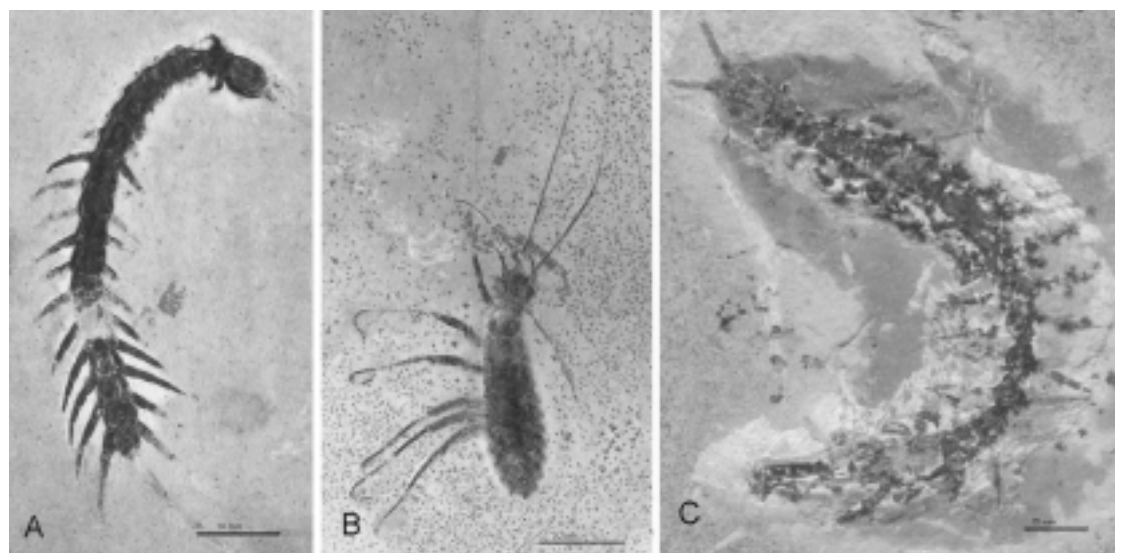


Figure 1. Holotypes and only known specimens of previously described fossil centipedes from the Crato Formation.

- A. *Cratoraricus oberlii* (SMNS 64431).
 B. *Fulmenocursor tenax* (SMNS 64275).
 C. *Velocipede betimari* (SMNK 2345 PAL).

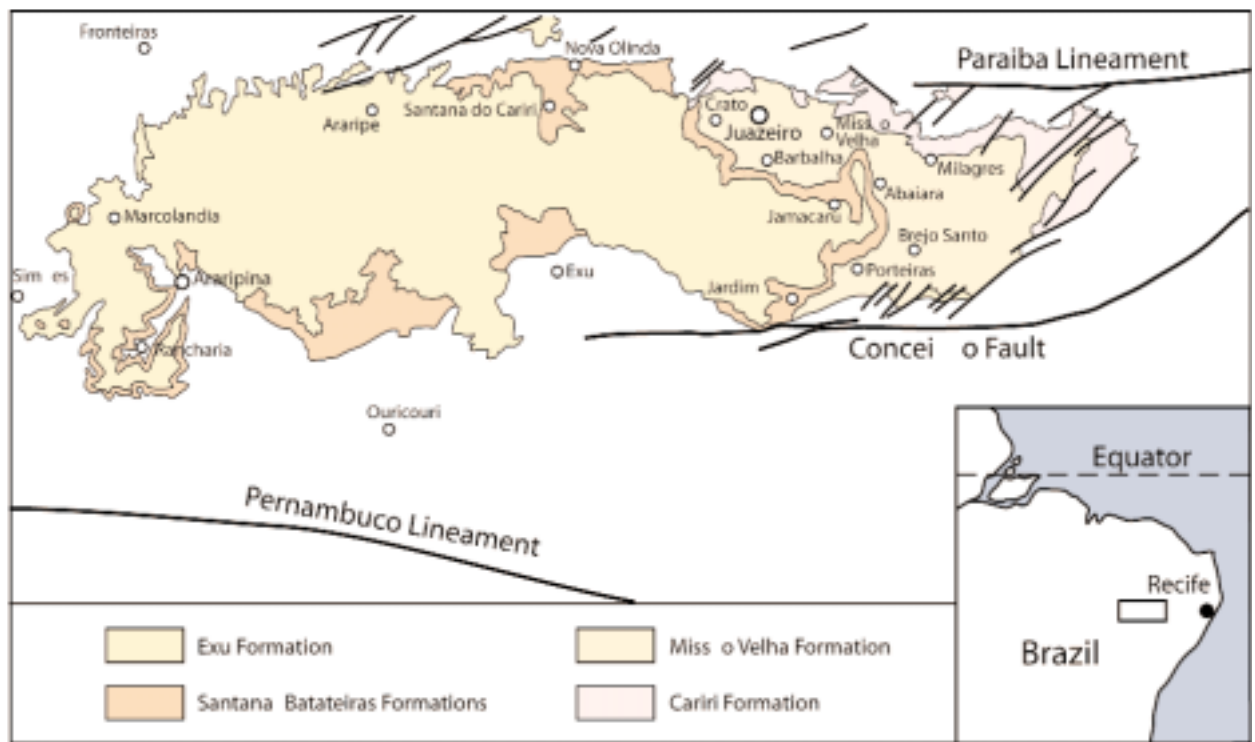


Figure 2. Locality map, geology and stratigraphy of the Chapada do Araripe.

The fossils were found in the limestone of the Crato formation, north-east Brazil (Figure 2). This formation is a series of laminated, organic-rich limestones deposited in a lagoon/lacustrine environment during the opening of the Atlantic Ocean approximately 120–115 million years ago (Albian/Aptian) and became famous following the discovery of incredibly well preserved arthropod and fish fossils (Martill 1993).

It is often the case with fossils that taxonomically important body parts are either obscured by the rock matrix or the position of the organism, and in some cases they may not be preserved. The latter is especially true for the soft parts of an organism, for example, the structure of the spiracles is useful for identification of centipedes, they are clearly visible in Recent specimens but are usually not preserved in non-amber fossils unless they are exceptionally well preserved (Figure 3A–C). However, it is clear from the Brazilian fossil centipedes that they closely resemble modern forms. Indeed, Wilson (2003) stated, “All known Mesozoic Centipedes ... are morphologically indistinguishable from extant centipedes” and this is evident from Figure 1A–C and the new specimen presented here. The geological longevity of a terrestrial invertebrate taxon, such as a species, genus or family has not been determined, but there are numerous examples of extant genera present in the Cretaceous, especially from insect and spider inclusions preserved in amber. Therefore, Cretaceous fossils should not be placed in new fossil taxa on the basis of age alone; rigorous morphological comparisons with Recent specimens are required to exclude them from extant taxa. The work presented here is preliminary, and further study, especially of the fossils in comparison with a range of modern species, will be necessary before systematic conclusions can be reached.



Figure 3. Trunk segments (T) and walking legs (L) in lateral view. A. Extant *Dimocryptops miersii* (Newport) (NHM 05.1.18.3–4 [part]) showing spiracle (Sp). B. The new fossil scolopendromorph showing that the spiracle-bearing soft tissues are usually not preserved. C. A preserved spiracle on T14, inset shows the spiracle enlarged.

MATERIAL AND METHODS.

The new specimen was collected by a quarryman in the Nova Olinda and was prepared on site prior to receipt by the authors. The exact provenance of the specimen is uncertain. It is currently held in the collections of the University of Portsmouth. Figure 4B was made by scanning the specimen directly onto a UMAX Power look II flatbed scanner at full optical resolution using UMAX MagicScan v2.3.2; Figure 4A was drawn with a camera lucida attached to an Olympus SZH stereomicroscope then scanned into Photoshop v.6.0 using a Cannon N12400 A4 scanner; Figures 3 & 4C, D were taken with a 6 megapixel D1X digital camera attached to a Wild M8 stereozoom microscope. Comparative specimens of the extant genera *Rhysidia*, *Otostigmus*, *Cryptops*, *Scolopendra*, *Cormocephalus*, *Arthrorhabdus*, *Rhoda*, *Teatops*, *Newportia*, *Dinocryptops*, *Scolopocryptops* were obtained from the Natural History Museum, London (NHM).

PRELIMINARY INTERPRETATION OF THE NEW FOSSIL

The centipede is preserved in right lateral view with much of the ventral surface visible. It consists of a head and 21 leg-bearing trunk segments; length from base of antennae to base of terminal appendage = 54 mm; length of terminal appendage = 12 mm (Figure 4A–C). As in Recent chilopods the first trunk segment bears the forcipules and is fused with the head; legs are preserved on trunk segments T2–T6, T9–T12 and T20–T22. None of the leg segments, including those of the terminal appendages bear any armature (Figure 4D); one partial claw is preserved on right leg 17 and the matrix contains a faint impression of the left terminal leg claw (Figure 4C). The body is not fully extended and many of the sternites are missing; longitudinal sternal sutures are visible on T3, 19, 21 and 22 (Figure 4D). The forcipular tergite is fused with that of T2, the first leg-bearing trunk segment (Figure 4D). There is a single, oval spiracle preserved, located on T14 (Figure 3C).



Unfortunately, the head region at the base of the antennae that would bear the eyes (if present in this species) is missing (Figure 4C). The antennae are directed forwards and are at least 16 mm long (not all the antennomeres are preserved); the basal segment is slightly wider than long, but the remaining antennomeres are at least twice as long as wide. The right forcipule shows no unusual characters, the coxosternite plate of the forcipule and the telopodite of the second maxilla are partially visible (Figure 4D).

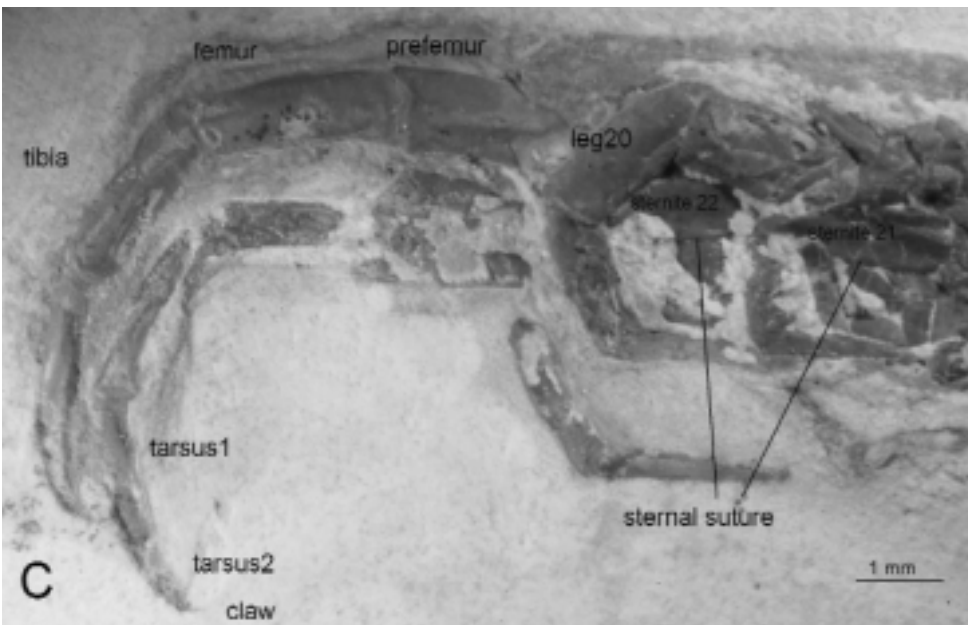
Figure 4. The recently discovered new fossil centipede.
A. Camera lucida drawing.
B. Whole specimen.
C. Close-up of head, the arrow shows the missing region where the eyes would be if they occur in this species.
D. Posterior region and terminal appendages. A, antenna; Cx, coxosternite plate of forcipule; F, forcipule; Fe, femur; H, head; L, leg; Pfe, prefemur; S, sternite; Ss, sternal suture; T2+FT, tergite of trunk segment 2 (=leg-bearing segment 1) fused with forcipular tergite (= trunk segment 1); Ta1, tarsus 1; Ta2, tarsus 2; Ti, tibia; Tmx2, telopodite of second maxilla.

A. Camera lucida drawing.

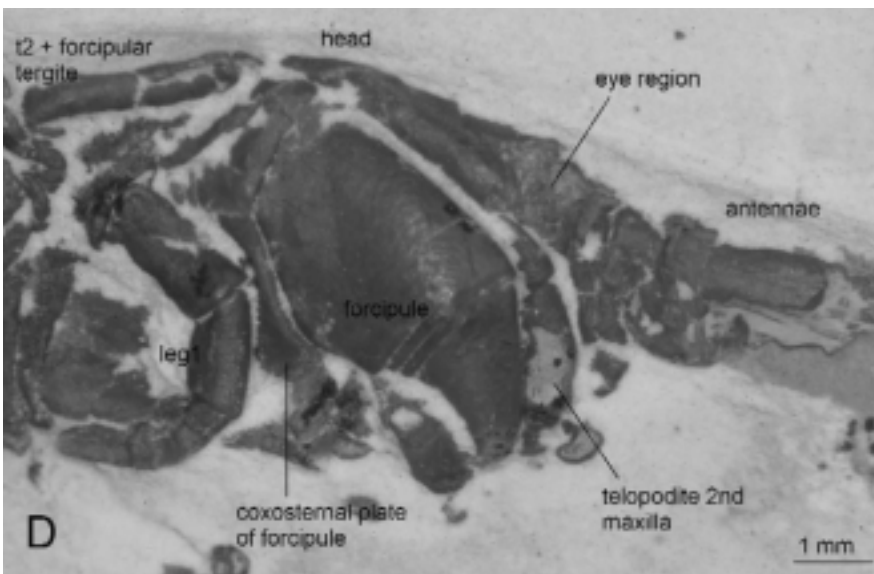
Figure 4 continued.



B. Whole specimen



C. Close-up of head, the arrow shows the missing region where the eyes would be if they occur in this species.



D. Posterior region and terminal appendages.

DISCUSSION

The new specimen differs from *Cratoraricus oberlii* Wilson 2003 (Figure 1A) in the relative proportions of the terminal leg segments and the lack of spines on the terminal prefemur. The dark spots visible on the prefemur and femur of the terminal leg in the new fossil (Figure 4C) are clots of manganese oxide crystals. They can be excluded as belonging specifically to the fossil because they are distributed randomly throughout the rock matrix (Figure 4B); also seen in the rock matrix containing the fossil *Fulmenocursor tenax* Wilson 2001 (Figure 1B). Wilson (2003) suggested that the lack of tarsal spines on the walking legs (not including the terminal appendages) of *C. oberlii* may have been a taphonomic artefact and that they may have been present in the living animal. Admittedly, these leg spines are small (Figure 3A), however there are Recent genera which lack tarsal leg spines e.g. *Cormocephalus* and *Campilostigmus* (Schileyko 2002). It is not possible to determine whether the specimen differs from *Velocipede betimari* Martill & Barker 1998 without careful comparison against the holotype, which we hope to obtain in the near future. It is not known whether the new fossil scolopendromorph or those previously described possessed eyes, and this causes problems when using keys for extant genera. Schileyko & Pavlinov (1997) undertook a cladistic analysis of the extant Scolopendromorpha and concluded that the classification of the order required complete revision. Following such a revision, we hope it will be possible to place this specimen accurately, but until such work is published, the best we can do is compare it with extant genera as currently delimited. We are currently engaged in collecting sufficient comparative Recent material for this purpose.

ACKNOWLEDGEMENTS

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FIFTY YEARS OF BRITISH MYRIAPOD STUDIES: RETROSPECT

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THE BRITISH MYRIAPODS AS KNOWN BY 1950

During the first half of the twentieth century, names associated with myriapod studies in Britain included R.I. Pocock, F.G. Sinclair, A. Randall-Jackson, R.S. Bagnall and H.K. and S.G. Brade-Birks. In his article *Myriapodology; Retrospect* in the first edition of the *Bulletin of the British Myriapod Group* (Brade-Birks, 1972), Dr S.Graham Brade-Birks described how he and his wife, Dr Hilda had taken up myriapod studies back in 1915. A long series of papers “*Notes on Myriapoda*” culminated in the 1939 *Sources for description and illustration of the British Fauna* (Brade-Birks, 1939). This paper and others of the series together with work by F.A. Turk (1944) & S.W. Rolfe (1934, etc.) provided a baseline for myriapod studies in Britain in the second half of the twentieth century.

The Brade-Birks list included some 40 chilopods and 47 diplopods including two of the former, *Lithobius muticus* and *Chaetechelyne montana* (= *Henia brevis*) against which he placed a question mark. Turk (1944) confirmed the existence of the latter in Cornwall and added a glasshouse record of *Schendyla* (*Brachyschendyla*) *monoeci* to the British list. *L. muticus*, although not based on a published record, occurs in Dr Brade-Birks notes (No. 3061, Wye, 8.10.20, teste Ribaut & Brolemann) and is actually quite widespread in SE England; it was subsequently recorded from the New Forest by H. Roberts (unpub.) and elsewhere.

Allowing for synonyms, queries and indoor records some 30 chilopod and 39 diplopod species which have been subsequently recorded by other workers are established from the 1939 paper. Question marks must remain over *Lithobius agilis*, *Lithobius piceus britannicus*, *Schendyla zonalis* and *Eumastigonodesmus bonci*, none of which have been subsequently reported from Britain or Ireland. *Lithobius piceus piceus* is now known from a variety of sites in southern Britain although from different habitats to that given for *britannicus*. In addition to these records, there is a reference to *Lithobius tricuspis* in Great Britain in Brolemann (1930) and Bagnall (1913, 1930) had reported *Lithobius microps* and *L. erythrocephalus*.

1950 - 1970

1950 saw the beginning of a new era in myriapod studies in Britain. S.M. Manton (Manton, 1950) published the first of her series of papers on Arthropod Locomotory Mechanisms (many of which referred to the myriapod groups) and the same year saw the first note by Gordon Blower of Manchester on the aromatic tanning of myriapod cuticle (Blower, 1950).

1951 saw a second, more extended, paper on chilopod and diplopod cuticle (Blower, 1951). This was also the year in which the first of many papers on centipedes by E.H.(Ted) Eason, on the Chilopoda of Warwickshire & Worcestershire (Eason, 1951). Over the next few years a series of important papers on the British myriapod fauna were published by these two authors which included descriptions of new or little known species, county lists reports and synonymy of a number of our “species”.

Meanwhile, at Southampton University H. Roberts (1956) and S. Vaitilingham (1960) were working on the ecology of chilopods in the New Forest area and had established the presence of both *Lithobius muticus* and *L. piceus* in Hampshire. Unfortunately, much of their work remains unpublished although referred to in Lewis (1981).

At about the same time John Lewis was working on the ecology and life history of *Strigamia maritima* (Lewis, 1961a) which led to the discovery of three species of centipede new to Britain, *Pachymerium ferrugineum*, *Schendyla peyerimhoffi* and *Geophilus pusillifrater* (Lewis, 1960, 1961b). Further work on littoral centipedes, on desiccation tolerance in geophilomorphs and on *Lithobius forficatus* & *L. variegatus* followed before his time in Africa where he carried out work mostly on Scolopendromorpha. Gordon Blower had been his external examiner in 1959.

In 1950 there were no identification keys or comprehensive species descriptions in English for either centipedes or millipedes. Brade-Birks' paper had included reference sources for descriptions and Brolemann's (1930) book on Chilopoda included a key and descriptions most of the British centipedes. Unfortunately, the corresponding work for Diplopoda (Brolemann, 1935) only dealt with Colobgnatha and Nematophora so was of limited use to British workers. Brade-Birks and S.W. Rolfe (1934, etc.) had published descriptions / distinguishing characteristics for certain species.

It was in 1952 that Gordon Blower's paper on *British millipedes with special reference to Yorkshire species* (Blower, 1952) appeared. This included not only a list of all the species then considered as British but also, for the first time a key to British species. The corresponding work on centipedes (Blower, 1955a) similarly set a base line for that group although, in this case, without a key (far less necessary because of the availability of that of Brolemann). He continued to publish papers on various species but at the same time was writing on ecology and life cycles starting with his account of millipedes and centipedes as soil animals (Blower, 1955b) and going on until his *Anamorphosis in Millipedes* with W.Dohle and H.Enghoff (Blower, Dohle & Enghoff, 1993).

The logical next stage was a full synopsis and key to British millipedes and this appeared under the auspices of the Linnean Society in 1958 (Blower, 1958). British workers now had an authoritative and detailed account of our species, much synonymy had been sorted out and the illustrations were of the meticulous high standard characteristic of his work. It was appropriate both to those specifically interested in myriapods or in soil/terrestrial invertebrates generally. 45 species were listed of which 39 are currently recognised as being recorded outdoors. Included in the list were *Geoglomeris jurassica* (= *Geoglomeris subterranea*), *Microchordeuma gallicum* (= *Melogona gallica*), *Leptoiulus kervillei* and *Metaiulus pratensis*. The last two species had been described as new to Britain and new to science respectively by Blower & Rolfe (1956). By the time the second edition appeared in 1985 the whole scene had changed; millipedes were being recorded nationally on a systematic basis and identification was (relatively) straightforward.

It was in 1964 that Warne published E.H. Eason's *Centipedes of the British Isles* (Eason, 1964), neither a Linnean Society Synopsis nor especially similar to that publisher's "Wayside and Woodland" books. This included comprehensive descriptions and excellent drawings with notes on known distribution and keys to each of the orders. 44 species were included with *Lithobius aulacopus* (= *L.macilentus*) and *Nesoporogaster souletina brevior* (= *Nesoporogaster brevior*) joining the Turk, Roberts, Vaitilingham and Lewis additions to the Brade-Birks list. At £3.3s (£3.15) it was relatively expensive as a "popular" book but it successfully established its value and continues to have use today (although a new centipede key is currently being prepared which will make use of the Eason drawings).

Hence by the mid 1960s identification works were available for both centipedes and millipedes. These coupled with help and encouragement given by both Ted Eason and Gordon Blower to anyone who contacted them set the stage for a wider interest in myriapod studies. Desmond Kime and the present author, who were working together at Guildford were thus drawn in to an interest in these animals. At the same time, Gordon Blower's influence at Manchester led to studies on various aspects of millipede biology by research students. Colin Fairhurst (1942-1994) emerged from this "school" of myriapod studies at Manchester, led by Gordon Blower which included also Charles Brookes (1938-83) (Blaniulidae) and Peter Miller (millipede life histories) and, in due course, Henk Littlewood (coxal glands in Lithobiomorpha) and Helen Read. Colin was to be instrumental in setting up the myriapod recording schemes as well as making his own contributions on schizophylline millipedes and other fields of zoology.

Apart from the work of Richard Bagnall, Symphyla and Pauropoda attracted little interest in 20th century Britain. However, in 1959 Clive Edwards published a synopsis of British Symphyla (Edwards, 1959). An attempt to develop further interest in the Group by Steve Hopkin in the late 1980s (Hopkin, 1988) has so far not borne fruit. Various reports and lists of pauropods from Britain have been published by P.A.Remy and Ulf Scheller and others (see Barber, Blower & Scheller, 1992).

1968 saw the First International Congress of Myriapodology in Paris, attended from Britain by Gordon

Blower, Colin Fairhurst, Joan Lewis (later Fairhurst), John Lewis and Ted Eason. This meeting led to the setting up of the Centre Internationale de Myriapodologie whose annual lists of publications on the myriapod groups and onychophorans have helped to keep the wider myriapod community in touch. The international dimension in British myriapod studies (H.K.Brade-Birks corresponded with Brolemann, Ribaut and others) continues and develops with the present ease of electronic communication.

THE BRITISH MYRIAPOD GROUP

By 1970, John Lewis had returned from Africa and Gordon Blower saw the value of forming some sort of society for those interested in myriapod studies. A meeting was called at Brendon in North Devon at the Easter of 1970. Present were Adrian Baker, Tony Barber, Gordon Blower, Charles Brookes, Ted Eason, Colin & Joan Fairhurst, Desmond Kime, John Lewis, Peter Miller, Bill Rolfe and Richard Williams (with apologies from Peter Langton and F.A.Turk). Much valuable discussion took place, a new British centipede species, *Chalandea pinguis* was found and the Millipede and Centipede recording schemes were launched. These latter were based on record cards designed by the British Isopod Study Group (see Harding & Sutton, 1985) and, a new feature compared with most recording schemes, incorporated habitat as well as distribution data. The schemes were organised in association with the British Biological Records Centre and are still in operation.

The following year there followed another enthusiastic meeting at Kington on the English-Welsh borders and in 1972 took place the Second International Congress at Manchester with Canon Brade-Birks as president. It was here that the first issue of the *Bulletin of the British Myriapod Group* appeared, including a review of current knowledge of millipede distribution in Britain by Gordon Blower, the editor. It is interesting to look through the Symposium volume of the Zoological Society (Blower, 1974) which emerged from the congress: amongst names from Britain are M.J Cotton, A. Curry, C.A. Edwards, H.J. Gough, J. Heath, S. Malcolm, S.M. Manton, J. Round, W.N. Sakwa, V. Standen, R. Turner, J.A. Wallwork and R.J. Williams as well as most of those mentioned above.

During the remainder of the 1970s there were no further meetings and apparent inactivity on the part of the group. A second volume of the Bulletin was prepared but did not emerge. However British delegates attended international symposia in Hamburg (1975), Gargnano (1978) and Radford (1981) and in 1981 John Lewis published his *Biology of Centipedes* (Lewis, 1981).

The recording schemes continued to collect data and a variety of new workers came forward. Amongst these, special mention must be made of Doug Richardson, an outspoken and enthusiastic Yorkshireman who seemed to be organising recording of all non-insect arthropod groups in his native county in the 1970s onwards, who contributed large numbers of record cards to both the isopod and myriapod recording schemes, meticulously recorded every grid square in the county (or so it seemed) and produced a variety of valuable reports. He went on to become the first editor of the BMG newsletter and in due course national organiser for the millipede recording scheme. Amongst his other contributions was the introduction of Paul Lee to myriapod studies when he attended the Manchester meeting in 1986).

Andy Keay made contact with the recording schemes in 1977 and as well as a systematic study of the myriapods of the Isle of Wight (including finding *Trachysphaera lobata* there) and enthusiastic study of *Henia vesuviana* was a regular member of group meetings and contributor of many records to the recording schemes. He played a major role in the organisation of the data used in the provisional centipede atlas (Barber & Keay, 1988).

REVIVAL & RENEWAL

In the early 1980s, Ron Daniel of what is now the University of Plymouth, had worked with Gordon Blower at Manchester whilst taking his MSc. He came back with an enthusiasm for millipedes and made contact with the present author. Largely on his own initiative and with the help of Peter Smithers he organised a myriapod group meeting in Plymouth in April 1982 and so the revival of the BMG as a group rather than just a name was initiated. Caught up in the enthusiasm, Doug Richardson organised the publication of the first newsletter in early 1983. In the absence of a Bulletin, this contained an article on *Lithobius variegatus* by Ted Eason, reports on the Plymouth meeting and material on centipede identification.

In 1983 took place the first joint meeting of the British Myriapod Group and the British Isopod Study Group at St. Martin's College, Lancaster with 28 members present according to the report of the time. The subsequent Newsletter included vice-county records for millipedes as an interim base for distribution studies (the recording schemes used the 10km grid square). These vice-county lists were to be a feature for a number of years for both centipedes and millipedes, recording progress and encouraging new searches.

The next year, at Brancaster, Norfolk (reputedly the coldest meeting so far, even compared with Scotland in the snow) was organised by Tony Irwin and Dick Jones. The latter went on to become a very active member of the group and at various times edited the newsletter (1988-98) and organised the millipede recording scheme as well as contributing many drawings to accounts of species and carrying on his own work on geophilomorph centipedes. That year, members were able to visit Dick's garden and see the only known (still) British site for *Unciger foetidus*.

In January 1985, the second volume of the *Bulletin of the British Myriapod Group* appeared despite the fact that in one bookseller's catalogue Volume 1 had been described as the "only volume published". It included reports on *Thalassiosobates littoralis* (P.T. Harding), British Chordeumatidae (J.G. Blower), *Chaetechelyne* (= *Henia*) *vesuviana* (A.N. Keay), the European Myriapod Survey (R.D. Kime) and the Millipede Recording Scheme (C.P. Fairhurst) together with obituaries and a note on three centipede species not included in *Centipedes of the British Isles* (*Brachyschendyla dentata*, *Chalandea pinguis* and *Lithobius tricuspis*). Since that time the Bulletin has appeared approximately annually and by 2002 had reached Volume 18 by which time it had become the *Bulletin of the British Myriapod and Isopod Group*.

BMG/BISG meetings took place at Bangor, North Wales (1985) and at Manchester Polytechnic (1986). The latter was the venue for the Charles Brookes memorial meeting addressed by Wolfgang Dohle on Myriapoda and the Ancestry of Insects (Dohle, 1986). At this meeting, the second edition of the millipede synopsis (Blower, 1985) became available. Much extended from the first edition, it included *Adenomeris gibbosa* (Ireland), the two species of *Chordeuma* (*C. proximum* and *C. sylvestre*), *Cylindroiulus vulnerarius* and *C. truncorum*, *Enantiulus armatus* and *Unciger*. The two species *Cylindroiulus londinensis* and *C. caeruleocinctus* were distinguished as separate species and a number of nomenclatural changes were made. *Nopoiulus minutus*, now to be known as *N. kochii* was described under the terms "There remains no evidence that *N. minutus* (= *venustus* in the sense of Schubart, 1934) has ever occurred in Britain, but there is a possibility that it may occur". The subsequent Newsletter (September 1986) records "the first specimen of *N. kochii* to be seen by extant myriapodologists and checked by H. Enghoff was collected by Steve Hopkin on waste land adjoining the University Department of Zoology". Like the occurrence of *Lithobius muticus* (considered to be a species of SE England) in Delamere Forest at the same meeting, the myriapods continued to surprise us.

Steve Hopkin went on to make a number of valuable contributions to myriapod studies including co-authorship with Helen Read of the Biology of Millipedes (Hopkin & Read, 1992). Other names recorded as making collections at that meeting were Adrian Rundle (who seemed to be able to find myriapods of interest in the most unlikely places) and Eric Philp (stalwart of biological recording in Kent).

PROGRESS

The 1987 joint meeting was at Langford in the Mendips and additional names recorded in the autumn Newsletter were Keith Alexander (National Trust, Gloucestershire), David Bilton (later to be co-ordinator for the terrestrial isopod recording scheme), John Bratton, Noel Jackson, Paul Lee, Ian Morgan (many valuable records from South Wales), Charles Rawcliffe (Edinburgh) and Helen Read. Of these, Noel was known for his singing in the bar, Paul was to become co-ordinator of the millipede recording scheme, Newsletter editor and significant contributor to myriapod recording and Helen was to become, initially informally, later formally, secretary of the British Myriapod and Isopod Group in addition to contributions to diplopod taxonomy and other important roles. Also present were Marie-Louise Célérier and Jean-Jacques Geoffroy from Paris and Maija and Martin Rantala from Finland.

For the 1988 meeting, the group visited the Mid Wales area (Newbridge on Wye); the highlight was probably Andy Keay recording *Lithobius tenebrosus* from Aberystwyth, the first "modern" record of this species. The

Newsletter recording this also refers to the finding of what turned out to be *Cylindroiulus salcivorus* from a greenhouse at the Royal Botanic Garden Edinburgh by Charles Rawcliffe (previously collected also by Adrian Rundle). Charles also, in due course, collected *Lithobius lapidicola* from a similar location.

1988 was also the year in which *Nothogeophilus turki* from the Scilly Isles (Lewis et al, 1988) was first described and named in honour of Frank Turk who had himself collected it in the islands although it had remained unidentified. It was also the year of publication of the Provisional Atlas for centipedes (Barber & Keay, 1988) and the Preliminary Atlas for millipedes (BMG, 1988). Whilst the latter showed distribution data on a 10km National Grid square basis, the former also incorporated processed habitat data, thus realising the extended role of the recording cards as planned at the start of the recording schemes.

Subsequent meetings over the next few years were at Hallsannery, North Devon (1989), Thornham Magna, Suffolk (1990), Swanage, Dorset (1991), Littledean, Forest of Dean (1991), Hassocks, West Sussex (1993) and Meigle, Perthshire (1994). All were occasions for socialisation, collecting, exchanging of ideas, help with collection and identification. By this time, Paul Richards of Sheffield and Steve Gregory from Oxford were regular members of the group. Paul continues to make important records from his area of the Sorby Natural History Society and elsewhere and wrote a useful handbook on *Millipedes, Centipedes and Woodlice of the Sheffield Area* (Richards, 1995). Steve is doing similarly valuable work on myriapods both in his area and elsewhere and has published an *Atlas of Oxfordshire Myriapoda* (Gregory & Campbell, 1996). Amongst his many other contributions is the discovery of a new species of millipede, *Anthogona britannica* n.sp. from South Devon (Gregory, Jones & Mauries, 1993).

The organisation of the two groups remained very informal with ideas for subsequent year's meetings being agreed at the current one and one or two people agreeing to organise it with possible fall-back plans for an alternative. Such a system seemed to work remarkably well most of the time although, eventually, in order to legitimise the holding of a BMG bank account, various official titles were agreed. As far as possible, the groups tried to have one meeting in the south and one in northern England / Scotland alternately.

The Meigle meeting (at which Bob Mesibov of Tasmania was present) was, in part, a reflection of another "new" member of the group, Gordon Corbet who, having retired from mammal studies at the British Museum (NH) had returned to his native country. Before doing so he had already found the second British record of *Pachymerium ferrugineum* in 1989 from the Suffolk coast and has been recording myriapods ever since, collecting both *Melogona voigti* and *Lithobius lucifugus* (an alpine species from a churchyard in Edinburgh), new to the British Isles.

1994 was also the year in which a small group (6 members) joined Zoltán Korsós of Budapest for a collecting trip in Hungary (May-June).

The Bulletin continued to be published approximately annually throughout this time, now edited by A.D. Barber & H.J. Read. Its 1996 volume (Volume 12) was notable for reporting *Anthogona britannica* and *Melogona voigti* referred to earlier together with *Haplopodoiulus spathifer* from the Royal Botanic Gardens, Kew and two of its outposts (first collected by A.J. Rundle in 1976), *Polydesmus barberii*, collected by D.E. Bolton from several Devon sites and a new Irish species, *Anamastigona pulchellum* (collected by R. Anderson from County Down). It also recorded the death of the late F.A. Turk (1911-1996).

FORMAL ORGANISATION

Meetings continued each year, with varying numbers and personalities, in the Lake District (Rowrah Hall), Dorset (Kingcome), Galloway (Dalry), West Cornwall (Chyvarloe) and Northumberland (Ford Castle). By this time, discussion about a merger of the two groups or the formation of a broad arthropod/invertebrate group were becoming more serious, largely at the instigation of Paul Harding (Isopoda & Biological Records Centre) who saw advantages in this as the way forward in terms of recognition and even possibly funding. At the Ford Castle meeting it was agreed to prepare for the formation of a joint group and at the subsequent meeting at Audley End, Essex in 2000 a constitution was adopted, officers were elected and the British Myriapod and Isopod Group was officially formed. In consequence the Bulletin was renamed and first appeared under its new title in 2001.

The Cornish meeting was marked, amongst other things, by the presence of Wallace Arthur & Chris Kettle from Sunderland University. Wallace had been attracted to geophilomorph centipedes to study segmentation and related topics and has subsequently, generally in collaboration with other authors, published a series of papers on the group. These have included the separation of the two forms of “*Geophilus carpophagus*” into two distinct species, *Geophilus carpophagus* ss (the “long” form) and *Geophilus easoni* (the “short” form) (Arthur et al, 2001). It was the late Ted Eason who (Eason, 1979) had first drawn attention to the two forms of that “species”.

Myriapod recording in Ireland over the last fifty years had involved various workers, most notably Declan Doogue with diplopods and there had been a variety of reports on species over the years and by 2000 Martin Crawley and others were recording centipedes as well as millipedes (Doogue et al, 1993, Cawley, 1997, 2001a, 2001b). The annual BMIG meeting for 2001 was planned for Dingle in the Irish Republic, postponed because of foot and mouth disease, it took place in the autumn of that year, notably due to the efforts of Derek Whitely, another Sheffield man, who also organised the meeting in Derbyshire (Youlgreave) the following year.

By the end of 2001 with the deaths of Ted Eason and Gordon Blower, the BMIG had lost the two most important British myriapod workers of the second half of the twentieth century who had through their interest and encouragement, as well as their own scholarly activities had substantially broadened the base of myriapod studies in the British Isles. Ted’s last myriapod paper was on Lithobiomorpha from Kirghizia & Kazazakhstan (Eason, 1997) whilst that of Gordon had been a joint one with Henrik Enghoff and Wolfgang Dohle on anamorphosis in millipedes (Blower et al, 1993). These topics themselves give some indication of the breadth of their respective contributions to myriapod studies.

“Biodiversity” is now a key environmental issue with a National Biodiversity Network and other organisations. Thanks to Paul Harding’s work six millipedes were placed on the BAP long list, one the common *Nanogona polydesmoides* for whom Britain is a major area of its occurrence. BMIG, now a formally constituted and functioning society, joins with others in increasing awareness of invertebrate issues, has been involved in the setting up of the Invertebrate Conservation Trust (Buglife) and has now, itself, affiliated to the British Entomological & Natural History Society. Thanks to our many recorders, both of the myriapod recording schemes continue to accumulate records and our knowledge of the distribution of our species is now far more extensive although the reasons behind some of the distribution patterns remain unclear. There is a twice yearly Newsletter, the Bulletin, a committee, meeting on a regular basis, one or more field meetings each year and, thanks to the work of Craig Slawson, a Web Site. Through the latter and by other means, a greater awareness of BMIG’s existence is occurring and contact by research students and others increases.

A species count for 2003 includes 46 centipedes and 53 millipedes confirmed from outdoor locations in Great Britain (Table 1 & 2).

Table 1.

Numbers of species (from outdoor sites) recorded by Brade-Birks (1939), Blower (1958), Eason (1964), Blower (1985) and currently.

	CHILOPODA	DIPLOPODA
Brade-Birks (1939)	31	39
Blower (1958)	-	43
Eason (1964)	36	-
Blower (1985)	-	48
Current	46	53
Ireland only	-	2
Glasshouses, etc.	3	5
Queries	3	1

Table 2

Species of Chilopoda and Diplopoda recorded as present in Great Britain or Ireland since the publication of Eason (1964) (Chilopoda) or Blower (1985) (Diplopoda).

CHILOPODA

* <i>Tygarrup javanicus</i>	Lewis & Rundle, 1988
<i>Schendyla (Brachyschendyla) dentata</i>	Barber & Eason, 1970
<i>Geophilus easoni</i>	Arthur et al, 2001
<i>Geophilus proximus</i>	Barber, 1986
<i>Chalanda pinguis</i>	Blower, 1972
<i>Arenophilus peregrinus</i>	Jones, 1989
<i>Nothogeophilus turki</i>	Lewis et al, 1988
<i>Lithobius peregrinus</i>	Barber & Eason, 1986
<i>Lithobius tricuspis</i>	Eason, 1965
<i>Lithobius lapidicola</i>	Barber, 1982
<i>Lithobius lucifugus</i>	Barber, 1993

DIPLOPODA

<i>Trachysphaera lobata</i>	Jones & Keay, 1986
<i>Anthogona britannica</i>	Gregory et al, 1993
<i>Anomastigona pulchellum</i> (Ireland)	Anderson, 1996
<i>Melogona voigti</i>	Corbet, 1996
<i>Haplopodoiulus spathifer</i>	Corbet & Jones, 1986
* <i>Cylindroiulus salicivorus</i>	Read et al, 2002
<i>Polydesmus barberii</i>	Bolton & Jones, 1996
* <i>Poratia digitata</i>	Blower & Rundle, 1986

* from glasshouses or similar

Julida represent about half of our total diplopod species whilst Geophilomorpha are the largest group of chilopods. In addition to these, two millipedes are known only from Ireland (*Adenomeris gibbosa*, *Anomastigona pulchellum*) and there are both centipedes and millipedes known only from hothouses or other indoor locations. Notable amongst the latter are the “house centipede” *Scutigera coleoptrata* recorded intermittently from various British locations, most recently from Weymouth and known to be widespread in both Jersey and Guernsey and the greenhouse millipede *Oxidus gracilis*. The status of *Schendyla zonalis*,

Lithobius piceus britannicus, *Lithobius agilis*, *Lithobius erythrocephalus* and *Eumastigonodesmus bonci* remain unsettled.

Records for both groups continue to come into the recording schemes. Some of our “new” species such as *Lithobius peregrinus* have not been found locations outside their original ones whilst others such as *Schendyla dentata* have proved to be widespread in suitable sites, at least in southern England.

For the near future, we look forward to a new version of the millipede atlas thanks to the work of Paul Lee, Paul Harding and others and then, in due course, hopefully an updated version of the centipede one. Ted Eason’s centipede book, although published nearly 40 years ago, remains the standard work with its outstanding quality of descriptions and diagrams but there has been an obvious need for an updated centipede identification key and work is in hand to produce this, making use of his original illustrations. Hopefully, species recording (important in monitoring climatic change amongst other things) will go on for the foreseeable future, the Bulletin will continue (given sufficient contributions) and the group will go forward into the new century building on the work of the last.

ACKNOWLEDGEMENTS

Many people over the years have provided help and encouragement to myriapod studies, not least Ted Eason and Gordon Blower themselves. Thanks must also be given to all those who have, at various times contributed to the recording schemes. A few are mentioned above but hundreds of names have been noted as collectors over the thirty years of the two schemes.

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ÖDÖN TÖMÖSVÁRY (1852-1884), PIONEER OF HUNGARIAN MYRIAPODOLOGY

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ABSTRACT

Ödön (=Edmund) Tömösváry (1852-1884) immortalised his name in the science of myriapodology by discovering the peculiar sensory organs of the myriapods. He first described these organs in 1883 on selected species of Chilopoda, Diplopoda and Pauropoda. On the occasion of the 150th anniversary of Tömösváry's birth, his unfortunately short though productive scientific career is overviewed, in this paper only from the myriapodological point of view. A list of the 32 new species and two new genera described by him are given and commented, together with a detailed bibliography of Tömösváry's 24 myriapodological works and subsequent papers dealing with his taxa.

INTRODUCTION

Ödön Tömösváry is certainly one of the Hungarian zoologists (if not the only one) whose name is well-known worldwide. This is due to the discovery of a peculiar sensory organ which was later named after him, and it is called Tömösváry's organ uniformly in almost all languages (French: organ de Tömösváry, German: Tömösvárysche Organ, Danish: Tömösvarys organ, Italian: organo di Tömösváry, Czech: Tömösváryho organ and Hungarian: Tömösváry-féle szerv). The organ itself is believed to be a sensory organ with some kind of chemical or olfactory function (Hopkin & Read 1992). However, although its structure was studied in many respects (Bedini & Mirolli 1967, Haupt 1971, 1973, 1979, Hennings 1904, 1906, Tichy 1972, 1973, Figures 4-6), the physiological background is still not clear today. It occurs not only in the four classes of myriapods, but also in some of the lower hexapod groups.

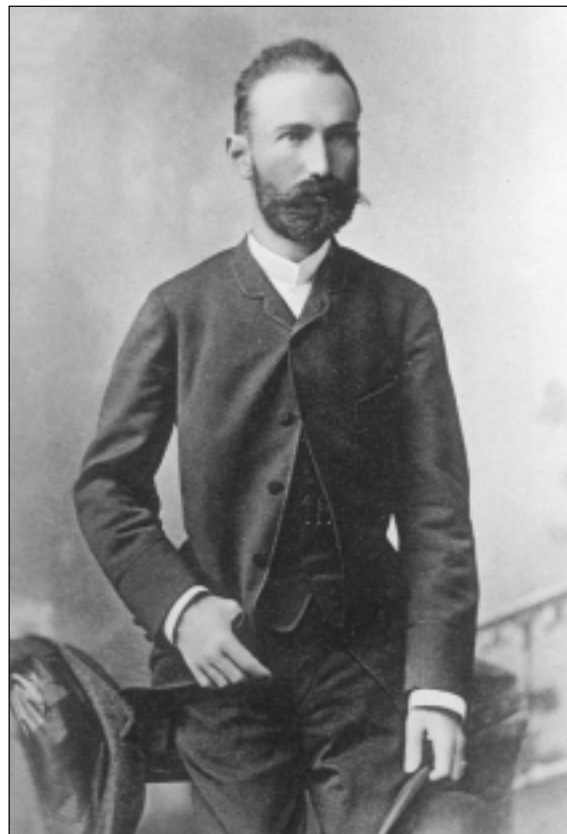


Figure 1. Ödön Tömösváry (1852-1884), and his signature (from the obituary by Herman 1885)

In Tömösváry's time, in the second half of the 19th century, myriapodologists in the world were even less in number than today. Despite the distances and technical difficulties in communication, they were in a close correspondence with each other. Tömösváry had contacts with Silvestri and others, and his described taxa were readily cited by later authors as Attems and Carl.

Life, even daily survival, and scientific career, nevertheless, was not easy for Ödön Tömösváry. He was born in a poor family, and without his supporter, Ottó Herman (1835-1914) he could never even have stepped into the gate of science. Herman was the greatest scientific polyhistor at that time, he had put down important monographs on the fish, bird, spider and insect fauna of Hungary. Starting as a curator in the natural history collection of the Hungarian National Museum, he was also an ethnographer, a historian, and later became a politician, being a representative in the Hungarian parliament. As a mentor, he 'discovered' and supported many young students, and forwarded them to the proper scientific directions. When Tömösváry died at age of 38 of tuberculosis, Herman blamed himself for not being able to help him into a longer, more successful life. He said at his funeral:

“If I was the one who lighted the fire, then it was his beloved master, Dr. Géza Entz, who gave the fuel, and his faithful supporter, Dr. Géza Horváth, helped him to find a place here and there - but what have we achieved?” ... “It seems that the period when talent was an efficient component is over; as if today it is almost impossible to find a suitable job, fitting to one's dreams and intentions, just by one word, one action, without the support of others, as I have managed it once.”
(Herman 1885).

A SHORT BIOGRAPHY

Ödön Tömösváry was born on the 12th of October 1852, at Magyaró (this small village is situated in the Hungarian-populated Transylvania, now belonging to Romania). After the secondary school in Kolozsvár (=Cluj), despite their poor conditions, his parents sent him for further studies to the university of Selmecbánya (now located in Slovakia). At the end of his university years he came to Budapest and visited Ottó Herman at the Hungarian National Museum, who immediately recognized his talent in analysing and describing zoological material. Tömösváry received further encouragement from Géza Horváth, director of the natural history collections at that time, and Géza Entz, zoology professor at the Budapest university. With these prominent teachers, he managed to finish his university studies in Budapest, and wrote his first papers on myriapods, then the doctoral thesis on the anatomical structure of the respiratory organ of *Scutigera coleoptera* (1881). Tömösváry was only 29 at this time, and he did not know that the rest of his life would almost become a continuous struggle for survival.

Despite Herman's support Tömösváry did not get the curatorial job in the National Museum, he first became a secondary school teacher in Budapest. In order to get more money, and also for the more interesting work, he accepted Herman's proposal to be the Hungarian '*Phylloxera* supervisor', to deal with the serious plant protection problem of that time. It was the same reason that sent him to the Lower Danube region, this time to study the situation of the Columbatch fly (a species of Simuliidae) which was believed to damage the crop. He became very ill here, and got tuberculosis which could never be cured. In the last year of his life, without ever being able to get a proper zoologist job for himself, he was teacher again at Kassa (=Kosice, now in Slovakia). He was then engaged to a young lady, but shortly after died, on the 15th of August, 1884, at Déva (now in Romania), close to his home village.

In his short scientific career, altogether only 6 years (1878-1884), Tömösváry wrote 57 papers (1 published posthumously). Twenty four of them are on Myriapoda, 4 on Arachnoidea (scorpions, pseudoscorpions, spiders), 4 on apterygote insects, 3 in the field of herpetology, and 22 on other, mainly insect groups, including popular papers.

His more detailed biography and the complete list of publications can be read in Herman (1885, in Hungarian).

MYRIAPODOLOGICAL ACTIVITY OF Ö. TÖMÖSVÁRY

Of Tömösváry's 57 papers, 24 (42 %) are dealing with myriapods (they are all listed in the bibliographic part of the present paper); this adequately makes him primarily to be a myriapodologist. He was the first Hungarian to publish on that group of arthropods; but he was also the first in the world who reported on the migration of certain myriapods (Tömösváry 1878a, see also Korsós 1998). In addition to the descriptions of new taxa he, for the first time, studied and characterised the microscopic structure of some of the organs such as the stigma (Tömösváry 1880b, 1881, 1883b, 1883c), weaving organ (Tömösváry 1883g, 1883h), and sensory organs (Tömösváry 1883d, 1883e).

He put on record several species of the Carpathian basin, and raised the known species of myriapods in Hungary (at that time) from 8 to 33 (Tömösváry 1878b, 1879a, 1879b, 1880a, 1880c, 1882c, 1883a). *Paradesmus* (= *Oxidus*) *gracilis* was recorded by him for the first time in Hungary, from Budapest, Margharet Island (Tömösváry 1879b). Unfortunately, later this record was completely forgotten, and the species was only included again into the Hungarian fauna by Korsós (1994).

Tömösváry described 32 new myriapod species for science, 10 of Diplopoda, 19 of Chilopoda, two of Pauropoda, and one Symphyla species. He introduced two new genera, one in Chilopoda (*Edentistoma* Tömösváry, 1882a = *Anodontastoma* Tömösváry, 1882e) and one in Pauropoda (*Trachypauropus* Tömösváry, 1882c), the latter considered to be still valid today. The exotic species, most of them from Borneo, are published only in three papers (Tömösváry 1882a, 1882e, 1885).

LIST OF MYRIAPOD TAXA DESCRIBED BY Ö. TÖMÖSVÁRY

All the taxa by Tömösváry are listed here according to the modern system (following Hoffman 1979), although they were described according to the systematic categories of that time. *Sphaeropoeus*, for instance, was allocated to glomerids, *Spirobolus* to julids, and *Siphonophora* to polyzoniids. The changes in centipedes are less considerable, the three main orders (Lithobiomorpha, Geophilomorpha, Scolopendromorpha), though on family level, were already differentiated, and the species described by Tömösváry do still belong to those. In order to give a better overview of the list, species in their original combination have been numbered consecutively from 1 to 32. They are with their most recent available status, with the original records of type locality in quotation marks.

Material of those species (nine, altogether) marked with asterisk (*) can be found in the Myriapoda Collection of the Hungarian Natural History Museum (see also Korsós 1983). The type specimens of the other species are, unfortunately, most probably lost. In some of his papers, Tömösváry mentioned the collection of the Transylvanian Museum Association as a depository for his type specimens. This collection has been dispersed in the past fifty years, only a minor fraction being deposited in the Zoological Museum of the Babes-Bolyai University, Cluj. According to the most recent information by Dr. Endre Sárkány-Kiss, biologist at the university, there is no Tömösváry-material in the collection.

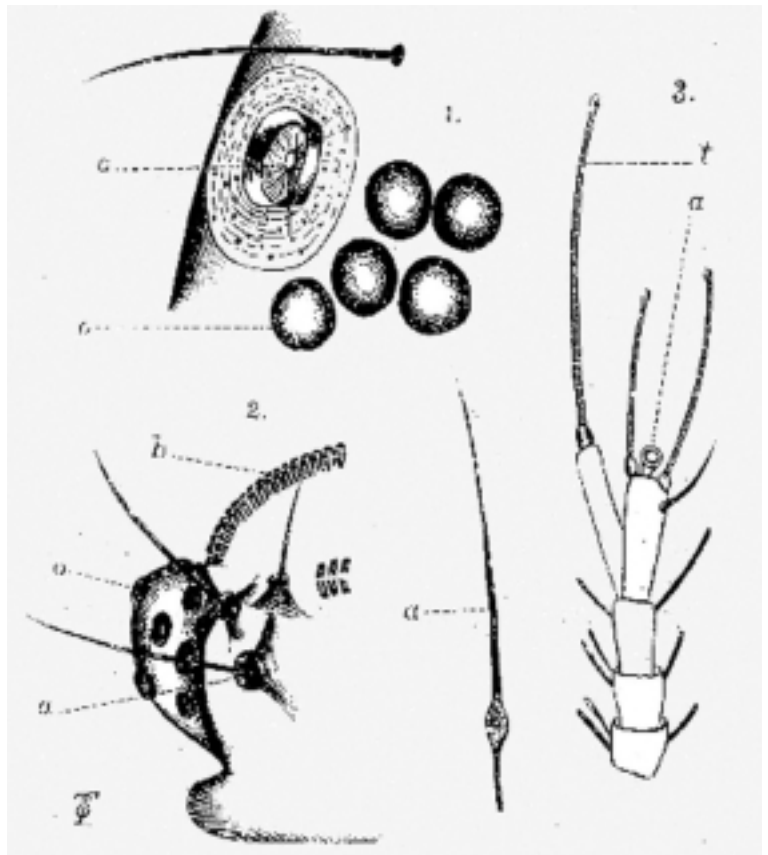


Figure 2. Original drawing by Tömösváry from his paper "Eigenthümliche Sinnesorgane der Myriopoden" (= Peculiar sensory organs of myriapods), *Mathematische und naturwissenschaftliche Berichte aus Ungarn* (Tömösváry 1883e). No. 1. shows an "organ of Tömösváry"; the other two are sensory hairs.

Tömösváry's original legend to the figures (translated from German):

1. *Lithobius forficatus*, a: "the organ itself", o: "eyes";
2. *Polyxenus lagurus*, a: "the organ itself", b: "follicles", o: "eyes";
3. *Pauropus huxleyi*, a: "the sensory organ", t: "tentacle"

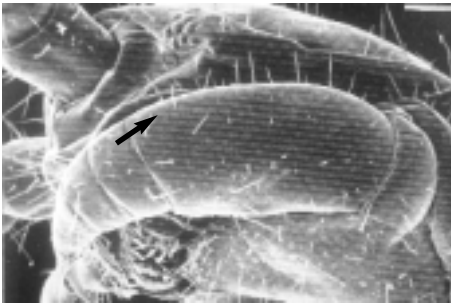


Figure 3. Head of *Lithobius forficatus*, the arrow shows the position of Tömösváry's organ (between the group of eyes and the base of left antenna). Scanning electron micrograph from Eisenbeis & Wichard (1985)

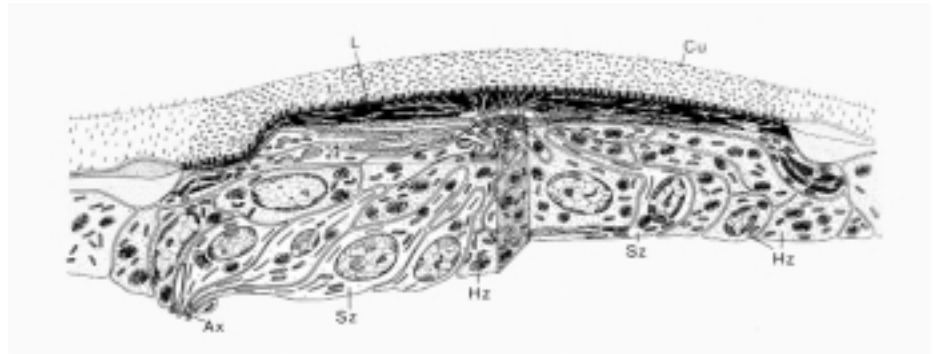


Figure 4. The structure of the Tömösváry's organ ("pseudoculus") of *Allopauropus* sp. (Pauropoda) – L: outer receptor space with dendrites, – Cu: perforated cuticle, – Ax: axon of sensory nerve cell, – Hz: epidermic cell, – Sz: sensory nerve cell (from Eisenbeis & Wichard 1985)

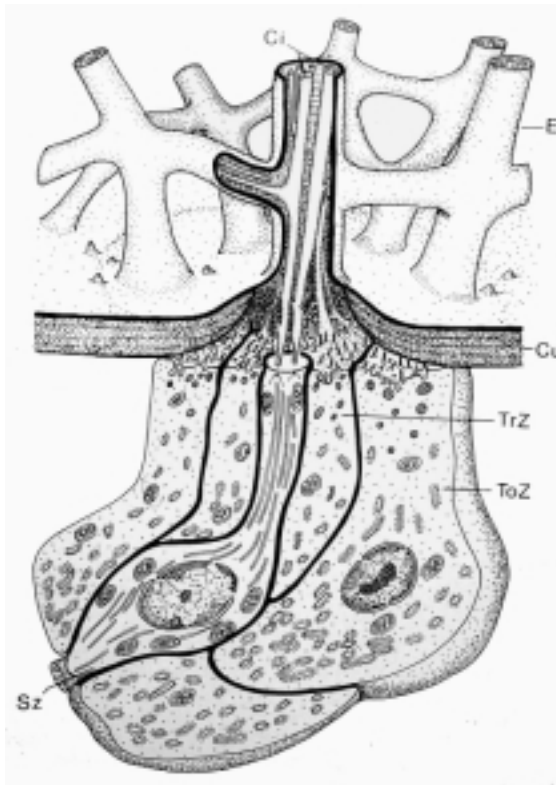


Figure 5. The structure of the Tömösváry's organ, *Scutigera immaculata* (Symphyla). – Cu: cuticle, – Ep: epicuticle, – Ci: cilium of sensory nerve cell, – TrZ, ToZ: trichogene and tormogene epidermic cells, – Sz: sensory nerve cell (from Eisenbeis & Wichard 1985)

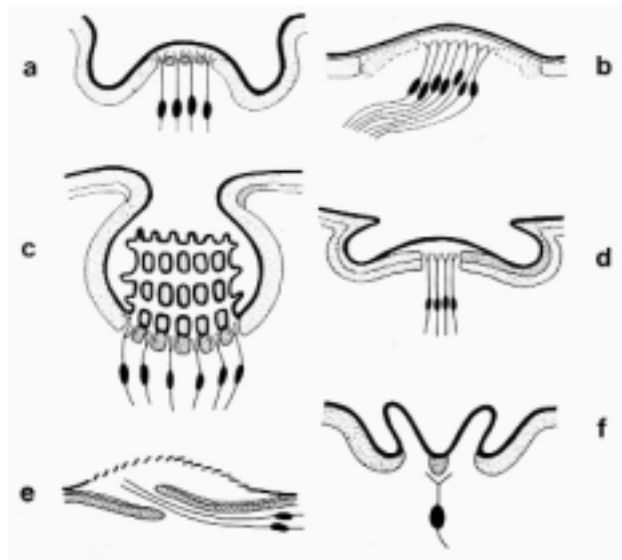


Figure 6 Tömösváry's organs of different arthropod groups.
 – a: *Glomeris* (Diplopoda),
 – b: *Allopauropus* (Pauropoda),
 – c: *Scutigera* (Symphyla),
 – d: *Lithobius* (Chilopoda),
 – e: *Fosentomon* (Collembola),
 – e: *Onychiurus* (Collembola)
 (from Eisenbeis & Wichard 1985, after Haupt 1979)

DIPLOPODA

Glomerida

1. *Glomeris albicans* Tömösváry, 1879a: Description given as a "yet unknown" *Glomeris* species in Tömösváry (1878b) – "Rogoszel" (Romania)
2. *Glomeris simplex* Tömösváry, 1880a = ? *Glomeris tyrolensis* Latzel, 1884: Daday (1889), Jermy (1942) – "Trányis" (Romania)
3. *Trachysphaera transylvanica* Tömösváry, 1880a = *Gervaisia costata* Waga var. *acutula* Latzel [= *Trachysphaera acutula* (Latzel, 1884)]: Daday (1889); "species incertae sedis": Jermy (1942) – "Oncsásza Cave" (Bihar County, Romania)

Remarks: In the absence of the type material, all these three European millipede species are presently considered as *nomina dubia*, and they are also excluded from the Fauna Europaea database (Enghoff pers. comm.).

Sphaerotheriida

4. **Sphaeropoeus falcicornis* Tömösváry, 1885 = *Castanotherium falcicorne* (Tömösváry, 1885): Silvestri (1896), Attems (1914), Jeekel (2001a) – “Borneo (Matang)”
5. **Sphaeropoeus granulatus* Tömösváry, 1885 = *Castanotherium granulatum* (Tömösváry, 1885): Silvestri (1896), Attems (1914), Attems (1936), Jeekel (2001a) – “Borneo (Matang)”

Polyzoniida

6. *Siphonophora quadrituberculata* Tömösváry, 1885 = *Pseudodesmus quadrituberculatus* (Tömösváry, 1885): Daday (1889), Silvestri (1896), Carl (1912), Attems (1914), Jeekel (2001b) – “Borneo (Matang et Sarawak)”

Spirobolida

7. *Spirobolus erythropus* Tömösváry, 1885 = *Trigoniulus erythropus* (Tömösváry, 1885): Daday (1891), Silvestri (1896), Carl (1918), Jeekel (2001c) – “Borneo (Matang et Sarawak)”

Spirostreptida

8. *Spirobolus ater* Tömösváry, 1885 – “Borneo (Matang)”
9. **Spirobolus rufo-marginatus* Tömösváry, 1885 = *Sculptulistreptus rufomarginatus* (Tömösváry, 1885): Hoffman (1982) – “Borneo (Sarawak)”

Polydesmida

10. **Oxyurus rosulans* Tömösváry, 1885 = ? *Leptodesmus rosulans* (Tömösváry, 1885): Attems (1938) – “Japonia (Nangasaki)”

Remark: According to Attems (1938), the allocation of this is quite uncertain. Dr. Richard Hoffman, during his visit to Budapest, 1981, marked the type specimens as *Riukiaria rosulans*.

CHILOPODA

Lithobiomorpha

11. *Lithobius bicolor* Tömösváry, 1879a: = *L. muticus* C. Koch, 1847: Daday (1889), Matic (1966) – “Déés, Oroszmező (Szolnok-Doboka megye)” (Romania)
12. *Lithobius dadayi* Tömösváry, 1880c = *L. mutabilis* L. Koch, 1862: Matic (1966) – “Transsylvania meridionalis” (Romania)
13. *Lithobius dubius* Tömösváry, 1880c – “Hungaria meridionalis” (Hungary?)

Remark: Unfortunately, the type material of all these three Hungarian species are lost, and their identity thus can only be judged by the original descriptions (Daday 1889). Hence two of them are synonymized by Matic (1966), but the third one remains “*nomen dubius*”.

Geophilomorpha

14. *Mecistocephalus hungaricus* Tömösváry, 1880c = *Dicellogophilus carniolensis* C. L. Koch, 1847: Attems (1929), Daday (1889), Matic (1972) – “Hungaria orientalis” (Romania)

15. *Geophilus paradoxus* Tömösváry, 1880c = *Geophilus ferrugineus* C. Koch: Daday (1889) [= *Pachymerium ferrugineum* (C. L. Koch, 1835)] – “Hungaria orientalis” (Romania)
16. *Orya xanti* Tömösváry, 1885 = *Orphnaeus brevilabiatus* (Newport, 1845): Attems (1929) – “Siam (Bangkok), Borneo (Matang), Sumatra”
17. *Mecistocephalus sulcicollis* Tömösváry, 1885 = *Mecistocephalus punctifrons* Newport, 1842 var. *sulcicollis* Tömösváry, 1885: Attems (1929) – “Borneo (Sarawak)”

Remark: All the geophilomorph species described by Tömösváry have been synonymized with already known species; even the *varietas* status of the last one (*Mecistocephalus sulcicollis*) is questionable.

Scolopendromorpha

Anodontastoma Tömösváry, 1882e

18. *Anodontastoma octosulcatum* (Tömösváry, 1882a): corrected to
**Edentistoma octosulcatum* Tömösváry, 1882a by Tömösváry (1882e) = *Arrhabdotus octosulcatus* (Tömösváry, 1882): Attems (1930) (Lewis in litt.) – “Borneo (Matang)”
19. *Scolopocryptops geophilicornis* Tömösváry, 1885 = *Otocryptops melanostomus* (Newport, 1845): Attems (1930) = *Scolopocryptops melanostomus* Newport, 1845 (Lewis in litt.) – “Java”
20. *Heterostoma albidum* Tömösváry, 1865 = *Ethmostigmus albidus* (Tömösváry, 1865): Attems (1930) (Lewis in litt.) – “Singapore”
21. **Heterostoma bisulcatum* Tömösváry, 1885 = *Ethmostigmus bisulcatus* (Tömösváry, 1865): Attems (1930) (Lewis in litt.) – “Borneo (Matang)”
22. *Branchiostoma subspinosum* Tömösváry, 1885 = *Rhysida nuda immarginata* (Porat, 1876): Attems (1930) = *Rhysida immarginata* (Porat, 1876): Koch (1985) – “Borneo (Matang)”

Remarks: Attems (1930, p. 190) gave *B. subspinosum* as a junior synonym of *Rhysida nuda immarginata* (Porat, 1876). Koch (1985, p. 22) considered that the name *immarginata* “may be applicable” to extralimital (= non-Australian) forms to which the name *nuda* had been applied, i.e. *R. nuda immarginata* should be known as *R. immarginata*. Lewis (2001, p. 46) also discussed this matter.

23. **Branchiostoma punctiventre* Tömösváry, 1885 = *Otostigmus punctiventer* (Tömösváry, 1885): Attems (1930) (Lewis in litt.) – “Borneo (Matang et Sarawak)”
24. *Branchiotrema nitidulum* Tömösváry, 1885 = *Otostigmus spinosus* Porat, 1876: Attems (1930) (Lewis in litt.) – “Borneo (Matang)”
25. *Branchiotrema longicorne* Tömösváry, 1885 = *Ototstigmus longicornis* (Tömösváry, 1885) (Lewis in litt.) – “Borneo (Matang)”
26. **Scolopendra flavicornis* Tömösváry, 1885 = *Scolopendra subspinipes subspinipes* Leach, 1815: Attems (1930) (Lewis in litt.) – “Borneo (Matang)”
27. **Scolopendra varii-spinosa* Tömösváry, 1885 = *Scolopendra subspinipes subspinipes* Leach, 1815: Attems (1930) (Lewis in litt.) – “Borneo (Sarawak)”
28. *Scolopendra aurantipes* Tömösváry, 1885 = *Scolopendra subspinipes subspinipes* Leach, 1815: Attems (1930) (Lewis in litt.) – “Borneo (Sarawak)”

29. *Scolopendra nudipes* Tömösváry, 1885 – “Singapore”

Remark: Five of the twelve scolopendrid species described by Tömösváry are still considered as valid; one (*Scolopendra nudipes*) is “*nomen dubius*”, and possibly will remain as such, since the type material cannot be found.

PAUROPODA

Trachypauropus Tömösváry, 1882c

30. *Trachypauropus glomerioides* Tömösváry, 1882c = A valid genus and species, see e.g. Scheller (1979, 2003, and in litt.) – “Déva (Hunyad megye)” (Romania)
31. *Trachypauropus margaritaceus* Tömösváry, 1883a: = “*incertae sedis*” (Scheller in litt. 2003) – “Hungaria orientalis (Pele, com. Szilágy)” (Romania)

SYMPHYLA

32. *Scolopendrella anacantha* Tömösváry, 1883f = “*species dubius*” (Scheller in litt. 2003) – “Hungaria septentrionalis et orientalis”

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IULUS SCANDINAVIUS

J. Gordon Blower

If you go down to Erncroft, be careful where you tread,
'Cos little things that creep about are possibly in bed!
I. scandinavius is about,
Poor little thing he cannot shout,
For if you step it is too late,
You'll surely him decapitate.

Have you ever stopped to think
Why populations do not sink,
In leaves each Autumn to the neck,
'Cos *scandinavius* poor old gink,
Chews up the lot to clear the deck.

The task if monstrous tho' it seems
Is not beyond his wildest dreams.
Old 'scandy' can reduce the litter
The dear delightful creeping critter.

Now *Spiroboldus marginatus* fresh sycamore he seems to spurn,
But when old ash is in his path,
He'll gobble up and then return.
His brother *Platybumus* is not a fussy chap,
There's quite a lot of things he'll eat,
If put into his lap.

The 'goings on' in Erncroft are most amazing too,
To take a girl on summer night,
Oh that would never do.
A lad would likely get besnared beyond his wildest bet,
Not by the girl as he might think,
But by a jolly hair net!

I cannot stress too much the need,
For this my warning you must heed,
If you go down to Erncroft, be careful where you tread,
'Cos little things that creep about are possibly in bed.