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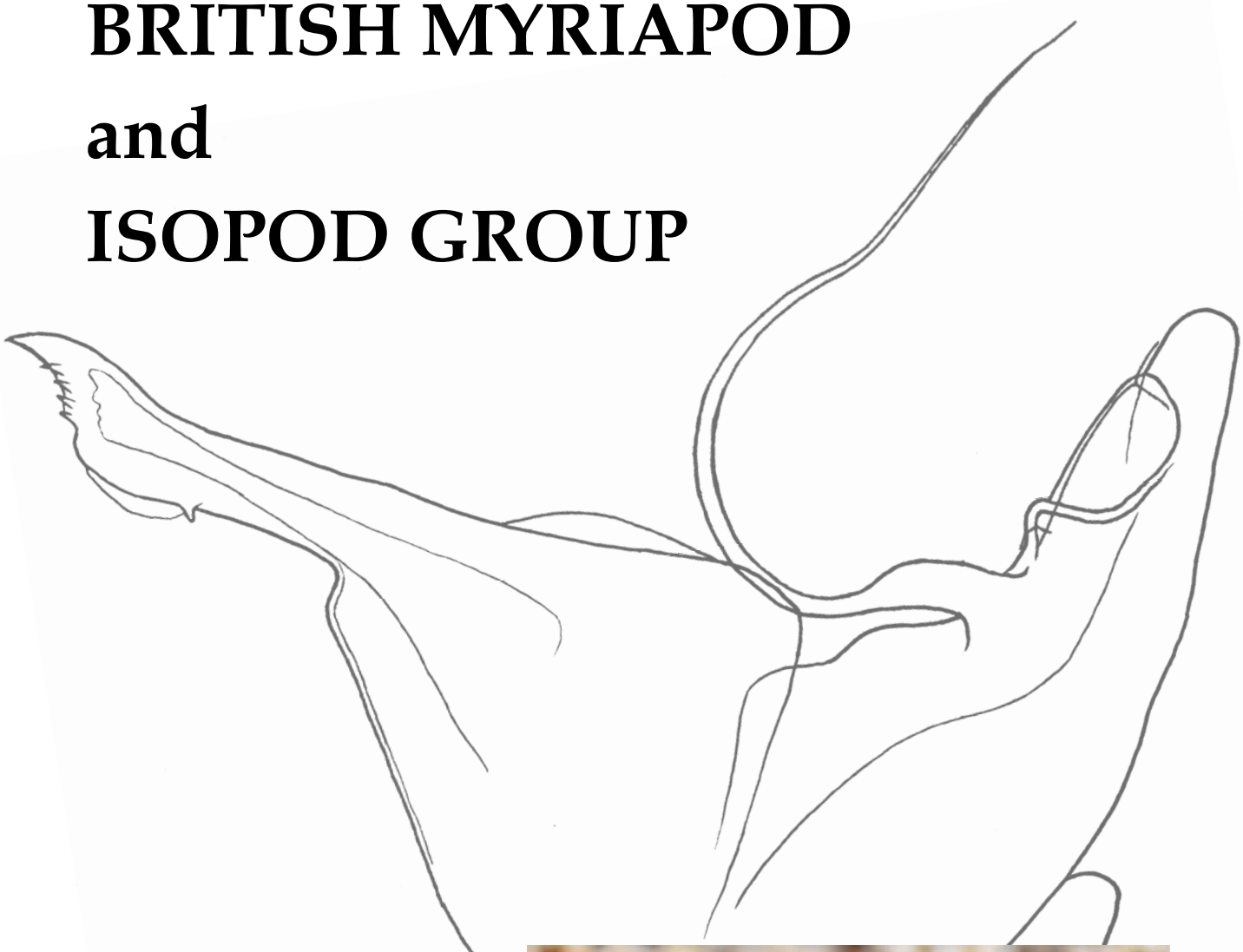
Bulletin of the BRITISH MYRIAPOD and ISOPOD GROUP



Volume 31 (2019)

Bulletin of the British Myriapod & Isopod Group: Volume 31 (2019)

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Editors: S.J. Gregory, H.J. Read & A.D. Barber
c/o Helen J. Read; email helen@helen-read.co.uk

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EDITORIAL

Looking through some papers recently I found the volume containing the papers read at the first International Myriapod Congress in Paris in 1968. Britain was represented amongst others by Gordon Blower, Ted Eason and Colin Fairhurst, all sadly no longer with us. Amongst other familiar or unfamiliar names we also find Jean-Marie Demange (France), Otto Kraus (Germany) and Stefan Negrea (Romania) who, along with Rowland Shelly (USA) and Wolfram Dunger (Germany), are remembered in this volume. From the congress emerged the Centre International de Myriapodologie and the succession of international congresses which continue to this day.

In 1970 Gordon Blower, Colin Fairhurst and John Lewis (who had also been at the first congress) organised a meeting in North Devon of people interested in myriapods which led to the formation of the then British Myriapod Group and the establishment of centipede and millipede recording schemes. After a second meeting the following year in the English-Welsh Borders, a third meeting was subsumed in the second international congress which took place in Manchester in 1972. For this, Gordon Blower prepared a 48-page duplicated *Bulletin of the British Myriapod Group* Volume 1. Although active recording continued there were no more BMG meetings in the next few years and Volume 2 of the *Bulletin* did not appear. Indeed Volume 1 appeared in one booksellers list as "only volume published". However, thanks to the efforts of Gordon Blower and Ron Daniel, a BMG meeting was organised at the then Plymouth Polytechnic in 1982, then a joint one with BISG in 1983. The *Bulletin* was finally revived in 1985.

Parallel to and slightly preceding BMG, new interest in woodlice and water-lice studies led to the formation of the British Isopod Study Group of which Steve Sutton and Paul Harding were significant members. BISG were interested in a recording system which included habitat as well as geographical data and working with Colin Fairhurst and Gordon Blower of BMG produced the first version of a record "card" which led to the BRC record cards and their various categories of habitat information.

BISG & BMG continued with joint field meetings, now annually, and for several years a sister and parallel publication to the BMG Bulletin, *Isopoda*, was published by Steve Hopkin. In 2000, the inevitable fusion of the two organisations took place and the British Myriapod & Isopod Group (BMIG) was inaugurated. The 2001 volume of the *Bulletin* (Volume 17), renamed the *Bulletin of the British Myriapod & Isopod Group* was published containing articles on both myriapods & woodlice. Volume 18 reported the death of Gordon Blower & its editorial commented that our best memorial to him was to keep BMIG & the Bulletin going for many years to come. As evidenced by this issue, it still continues, published approximately annually, now on-line, and this is Volume 31, 34 years since its revival in 1982 and 47 years since Volume 1 appeared. Continuing to be committed to publishing reports on the British & Irish myriapod and isopod fauna and items of interest to British & Irish workers, each volume tends to have a different emphasis from the last and each has a diversity of articles relating to these animals.

In this volume, as well as the obituaries already referred to, we have a spectrum of papers reflecting our interests in the myriapod & terrestrial isopod groups. In terms of the isopods are accounts of woodlice new to the Channel Islands (*Chaetophiloscia cellaria*), to North Wales, to Ireland (*Philoscia affinis*) and to Belarus (*Armadillidium pulchellum*). Representing millipede interests we have reports on particular species (*Cylindroiulus sagittarius*, *Geoglomeris*), on fossil millipedes and on a fungus parasite. Centipede reports cover the phenomenon of filial cannibalism in *Scolopendra cingulata* in Spain and issues involved in distinguishing the two British centipedes *Lithobius melanops* and *L .tricuspis.*

Volume 1 had reports on the first two BMG field meetings and we try to continue to include such reports as representing a focus on a specific area and, as in that volume we include one here, this time

on the 2016 Juniper Hall gathering. Inevitably there is always a slight (or longer) delay in getting these written and bringing them together for the three groups with appropriate comments and we would encourage everyone who attends and collects material to send in their own reports of what they found. So please, if you were at the Morecambe, Longtown or Newton Stewart meetings, can you get your reports in as soon as you can. At the same time, we are, as always, looking for articles for the next *Bulletin* – and subsequent ones, of course!

CYLINDROIULUS SAGITTARIUS (BRÖLEMANN, 1897) NEW FOR THE UK (DIPLOPODA, JULIDA: JULIDAE) AND A NEW HOST FOR *RICKIA LABOULBENIOIDES* (LABOULBENIALES)

Steve J. Gregory[1] & Christian Owen[2]

[1] 4 Mount Pleasant, Church Street, East Hendred, Oxfordshire, OX12 8LA, UK.
E-mail: stevejgregory@btopenworld.com

[2] 75 Lewis Street, Aberbargoed, Bargoed, South Glamorgan CF81 9DZ, UK.
E-mail: christianowen158@yahoo.com

ABSTRACT

The millipede *Cylindroiulus sagittarius* (Brölemann) is recorded new for the UK. It was discovered in woodland near Wyllie in the Sirhowy Valley, Monmouthshire in December 2017 and has been shown to be distributed along at least a 6 km length of the valley. A description with figures is provided to enable identification. Comparison is made with *C. punctatus*, a species of similar appearance and habitat preferences. Information is provided about habitats and micro-sites inhabited and associated species. Given the coal mining heritage of the Sirhowy Valley it is considered most probable that *C. sagittarius* is an accidental introduction.

Key words: Diplopoda, Julidae, *Cylindroiulus sagittarius*, new for UK, identification, habitats.

INTRODUCTION

The genus *Cylindroiulus* Verhoeff, 1894 (Diplopoda, Julida: Julidae) displays high species diversity with over 100 described species occurring widely across Europe (Kime & Enghoff, 2017). In Britain and Ireland this is the most species diverse millipede genus. Lee (2006) lists nine species of *Cylindroiulus*, with two additional species recently added to the UK list; *C. apenninorum* (Brölemann) from southern England and northern Ireland (Barber & Read, 2016; Anderson, 2018) and *C. pyrenaicus* (Brölemann) from south Wales (Gregory, Owen, Jones & Williams, 2018).

During a series of recent collecting trips by CO to several woodland sites in the Sirhowy Valley (south Wales) specimens of *Cylindroiulus sagittarius* (Brölemann, 1897) were collected. Details of its discovery and a description based on material collected from south Wales is provided below.

DISCOVERY

On 3rd December 2017 CO collected a '*Cylindroiulus'* millipede that seemed to bear a projecting, but pointed, telson from woodland near the village of Wyllie in the Sirhowy Valley, Monmouthshire (ST177943, VC 35). Initially this was thought to be *Cylindroiulus punctatus* (Leach) with a damaged telson, but when numerous additional examples were found specimens were collected for closer examination. Dissection of a male confirmed that these were not aberrant *C. punctatus*, but a different species. The following day CO collected additional specimens from woodland south of Wyllie, from both sides of river Sirhowy, and at Craig y Prisiad, near Ynysddu, some ¾ km and 2 km downstream of the initial record, respectively. On 14th December CO discovered an additional site at Sirhowy Valley Country Park (ST203909, VC 35) a further 4 km downstream. A male and female specimen were forwarded to SJG who named them as *Cylindroiulus sagittarius* (Brölemann, 1897). This determination was confirmed by Hans Reip from images of male gonopods.

These are the first British occurrences of *Cylindroiulus sagittarius* (Brölemann, 1897). Details of these records are listed in Table 1. Additional specimens were collected by SJG in March 2018 during the BMIG field meeting to south Wales.

TABLE 1: The first British records of *Cylindroiulus sagittarius* in chronological order
Recorders: CO – Christian Owen; SJG – Steve Gregory; *Material examined for this paper

Locality	Grid Ref	VC	Number of specimens	Date of collection	Leg.
Wyllie Wood, north of Wyllie	ST 177 943	35	2♂, 5 ♀*	03.xii.2017	CO
Wyllie Wood, south of Wyllie	ST 176 936	35	Few ♂♀	04.xii.2017	CO
Craig y Prisiad, near Ynysddu	ST 177 926	35	Few ♂♀	04.xii.2017	CO
Sirhowy Valley Country Park	ST 211 913	35	Few ♂♀	14.xii.2017	CO
Sirhowy Valley C.P., Quarry Mawr	ST 204 909	35	2♂♂, 3♀♀*	23.iii.2018	SJG

IDENTIFICATION

Taxonomy

ORDER Julida Brandt, 1833
FAMILY Julidae Leach, 1814
TRIBE Cylindroiulini Verhoeff, 1930
GENUS *Cylindroiulus* Verhoeff, 1894
***Cylindroiulus sagittarius* (Brölemann, 1897)**
syn. *Iulus sagittarius* Brölemann, 1897
syn. *Cylindroiulus hispanicus* Ceuca, 1974

Diagnosis

Cylindroiulus sagittarius is a darkly pigmented brown millipede, lacking frontal setae and bearing a projecting telson that tapers to a bluntly pointed tip. Male gonopod diagnostic in lateral or mesal view.

In Bower (1985) this species will most likely key to *Cylindroiulus* (now *Allajulus*) *nitidus* (Verhoeff), a less well pigmented species with conspicuous body setae. Confusion is also possible with *Cylindroiulus punctatus*, but this species bears a characteristic bulbous (club-shaped) tip to the projecting telson.

Description

This description is based on recently collected material (as indicated in Table 1) preserved in 75% IDA.

Size

The three males examined are between 14-15 mm in length by 1.1-1.2 mm in diameter. The four females are between 15-17 mm in length by 1.2-1.4 mm in diameter. This is similar to the lower end of the dimensions given for *C. punctatus* by Blower (1985).

Figure 1: *Cylindroiulus sagittarius* from at Wyllie Wood, December 2017
A) Live female specimen, habitus (image © Keith Lugg); B) Male posterior body rings, showing apododous segments and projecting telson; C) Male gonopods (cleared in euparal), mesal view.

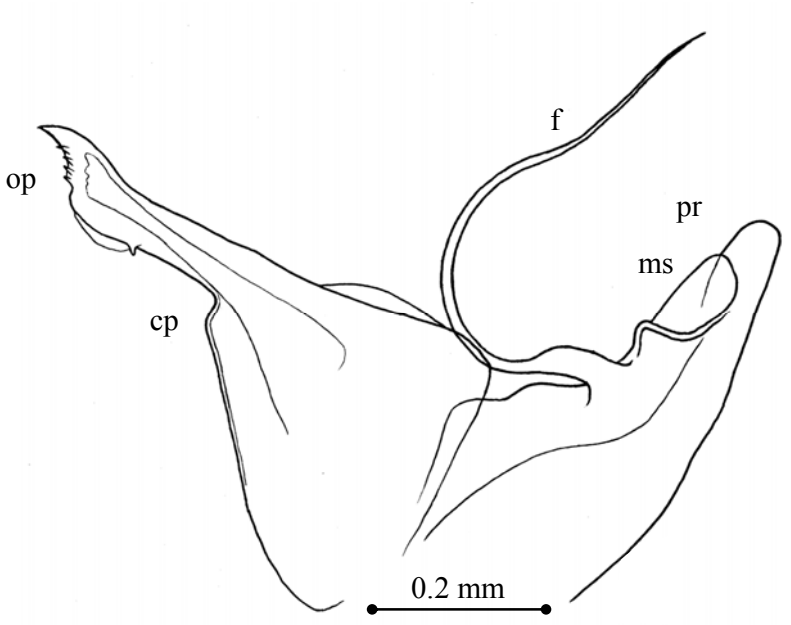

Figure 2: *Cylindroiulus sagittarius* from at Wyllie Wood, male gonopods, mesal view
op – opisthomerite; cp - coxal projection; f - flagellum; ms - mesomerite; pr – promerite

Colour

Fresh specimens are brown mottled with white giving an overall medium-brown colouration (Fig. 1A). Ozopores a reddish-brown colour. The head, collum, anal ring and legs are noticeably paler.

This colouration is more akin to that of *C. britannicus* (Verhoeff) and is noticeably darker than seen in typical *C. punctatatus*, which typically 'straw to light-brown' (Blower, 1985).

Body rings

Specimens examined had between 45-50 body rings (including collum and telson), all with three apodous posterior body rings. Eyes comprise well pigmented ocelli arranged in a rounded trapezoid. The ocelli are indistinct and it is not easy to observe rows and hence to determine the stadia.

Metazonites bear relatively deep and closely set longitudinal striae (similar to seen in *C. punctatus*). In common with other *Cylindroiulus* species frontal setae on head and fringing setae on metazonites are absent and the ozopores lie on the suture between prozonites and metazonites.

Telson is produced into a stout caudal projection that is slightly is slightly swollen mid way along its length, but then tapers into in a rounded and slightly down-turned tip (Fig. 1B). This contrasts with *C. punctatus* where the 'club-shaped' telson is widest towards its tip. The sub-anal scale is not projecting and closely adpressed to the ventral edge of the anal valves. Anal valves each bear three pairs of setae (as seen in *C. punctatus*).

Male: gonopods (leg pairs 8 and 9)

Male gonopods in mesal view are of characteristic shape (Fig. 1C & Fig. 2). Promerite (p) noticeably longer than mesomerite (m). Base of opisthomerite (op) well developed, broad, but narrows abruptly into a long slender mid-section which expands into a sub-triangular terminal structure (thus narrower at the mid-point than apically). The paracoxal process (cp) is reduced to a small rounded bump. Flagellum (f) well developed and elongated into a fine point.

This general shape of the opisthomerite is similar to that seen in *C. punctatus* (see Blower, 1985, pg. 153, Fig. 47D), but this later species differs in having a slender elongated paracoxal process, bearing a hooked tip, almost as long as opisthomerite.

Male: secondary sexual characters

In keeping with other species of the genus the stipetes of mature males are expanded ventrally and leg pair 1 considerably reduced in size and modified into a pair of hook-shaped structures.

Female characters

Female vulvae were not examined.

DISTRIBUTION AND HABITATS

Occurrence in South Wales

Currently *C. sagittarius* has been recorded from several woodland sites along a 6 km length of the Sirhowy Valley between the former mining communities of Wyllie (near Blackwood) and Crosskeys (near Risca). Specimens have been collected from deciduous woodland; including Alder *Alnus glutinosa* carr on the flood plain of the River Sirhowy and within Oak *Quercus* sp., Beech *Fagus sylvatica* and Hazel *Corylus avenula* dominated stands on the valley sides. The underlying geology at all sites is coal-bearing carboniferous limestone.

In December 2017 *C. sagittarius* appeared to be the dominant millipede within dead wood and was readily found beneath logs and branches, including those partially embedded in silt on the river bank. Specimens were also recorded from dead wood lying on the free draining embankments of a disused railway line. Few other millipedes were found associated; mainly *Polydesmus angustus* Latzel, and the occasional *C. punctatus* and *Ophyiulus pilosus* (Newport). In mixed deciduous/conifer woodland areas specimens of *C. sagittarius* were only found associated with deciduous logs and branches.

It was not found by searching through leaf litter, where *Melogona gallica* (Latzel)*, M. scutellaris* (Ribaut) and *Chordeuma proximum* Ribaut were the most dominant species. Neither was it found in conifer plantations, where its congers *C. punctatus* and *C. britannicus* (Verhoeff) were found instead.

The fact that good numbers of *C. sagittarius* were found associated with dead wood on the river bank suggests that it may have been dispersed considerably further downstream of the currently known 6km length of the Sirhowy Valley.

Foreign distribution and habitats

The known range of *Cylindroiulus sagittarius* is mainly centred on the western Pyrenees of France and Spain, but it is also known from the Cantabrian Mountains of northern Spain (Kime & Enghoff, 2017). It is typically associated with Montane forest, often on limestone, including Beech and Oak, and also Alder woodland along streams. It occupies a similar 'dead-wood' niche to *C. punctatus*, which it replaces at higher altitudes in the mountains, between 550–2000 m asl. In addition to being found beneath bark and within rotting wood, it has also been recorded from among leaf-litter and moss.

These habitats and associated microsites are in keeping with observations of this species in south Wales.

Native or Introduced?

The Sirhowy Valley has a strong industrial heritage due to the discovery of coal in the early 19th century (https://en.wikipedia.org/wiki). In the Crosskeys area coal mining was established in the 1830s when the community was built to serve the Black Vein and subsequently the New Risca coal mines. The village of Wyllie was later established further north up the valley in 1926 to house miners working for Tredegar Iron and Coal Company. This colliery closed in 1968.

Given the extent of former coal mining and steel production industries in the Sirhowy valley it is quite likely that *C. sagittarius* has been unintentionally introduced to this valley through importation of goods associated with these industries.

A NEW HOST FOR *RICKIA LABOULBENIOIDES* (LABOULBENIALES)

One male *Cylindroiulus sagittarius* collected by CO from Wyllie Wood on 3rd December 2017 was found to be infected with a Laboulbeniales fungus, which was confined to the anterior legs close to the head. This was identified by Henrik Enghoff as *Rickia laboulbenioides* De Kesel *et al*, 2013.

This fungus, originally described from *Cylindroiulus latestriatus* (Curtis), has been widely, albeit rarely, reported from *C. punctatus* (Leach) in the UK, and recently confirmed from *C. pyrenaicus* (Brölemann) and *C. britannicus* (Gregory *et al*., 2018; Storey, 2019). Here we formally add *Cylindroiulus sagittarius* as a host for *R. laboulbenioides.*

ACKNOWLEDGEMENTS

We thank Hans Reip (Senckenberg Research Institute) for confirming the identity of *Cylindroiulus sagittarius* and for providing relevant literature and Henrik Enghoff (Natural History Museum of Denmark, Copenhagen) for confirmation of its associated *Rickia laboulbenioides* fungus.

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THE FIRST RECORD OF THE DWARF PILL MILLIPEDE *GEOGLOMERIS SUBTERRANEA* VERHOEFF, 1908 IN WESTERN GERMANY (DIPLOPODA, GLOMERIDA) AND THE ASSOCIATED MYRIAPODA FAUNA OF THE QUIRRENBACH (SIEBENGEBIRGE, NRW)

Thomas Wesener[1,*], Nils Behr[1], Leif Moritz[1]

[1] Zoologisches Forschungsmuseum Alexander Koenig, Leibniz Institute for Terrestrial Biodiversity, Section Myriapoda, Adenauerallee 160, D-53113 Bonn, Germany.

* Corresponding author: t.wesener@leibniz-zfmk.de

ABSTRACT

The Quirrenbach, a forest site at the eastern edge of the Siebengebirge nature region in the southern part of North Rhine-Westphalia, Germany, is covered by an alluvial forest with slopes upwards towards a street. From 2011 to 2017 the site was subject to yearly spring excursions by the arthropod class taught at the Museum Koenig, Bonn, where myriapods were hand-collected and soil samples were extracted via the Berlese method. The site yielded specimens of all classes of the Myriapoda: Symphyla, Pauropoda, Chilopoda and Diplopoda, with one species of Pauropoda, 16 species of Chilopoda and 15 species of Diplopoda being determined to species-level in 2017. In addition to the presence of the pauropod *Trachypauropus cordatus* (Scheller, 1974) in the state, the mainly parthenogenetic dwarf pill millipede *Geoglomeris subterranea* Verhoeff, 1908 was recorded in Berlese samples for the first time. In Germany, less than a handful of old records of the species exist outside of southern Germany. Here we record *G. subterranea* for the first time from Germany's second largest and most populous state, North Rhine-Westphalia. Micro-CT scans were taken to illustrate the species. The small size, cryptic habits, and special collection methods needed to record *Geoglomeris* makes it highly likely that the species is much wider distributed than previously thought.

INTRODUCTION

The knowledge regarding the diversity of the Myriapoda in Germany varies greatly depending on the region, as already pointed out by Decker and Hanning (2011). Thus, species checklists only exist for Eastern Germany (Dunger, 2005), Baden-Württemberg, Bavaria (Spelda, 2006), Thuringia (Reip & Voigtländer, 2009) and North Rhine-Westphalia (Decker & Hanning, 2011; Decker *et al*., 2015). So far 123 species of Myriapoda (41 Chilopoda, 9 Symphyla, 9 Pauropoda, 64 Diplopoda) are known from North Rhine-Westphalia (NRW) (Decker *et al*. 2015). Here we present a checklist of the Myriapoda found at the Quirrenbach in the Siebengebirge (NRW), including one species new to NRW.

The acquisition of the Drachenfels, which forms the most iconic part of the Siebengebirge, by King Friedrich-Wilhelm III in 1836, to preserve its nature, was the first act of governmental nature conservation in Germany. In 1923 the Naturpark Siebengebirge gained an official conservation status, which made it to the oldest nature reserve in NRW and one of the first nature parks established in Germany (Kottrup, 2016). Today the region is a highly touristic and recreational area. At the eastern border of the Siebengebirge lays the Quirrenbach, which has been sampled since 2011 during the course of a student excursion of the Rheinische Friedrich-Wilhelms University Bonn in corporation with the Zoological Research Museum A. Koenig (ZFMK). The Quirrenbach originates at 260 m above sea level and leads to the Pleißbach after ca. 6 km. Although the Quirrenbach mainly runs through agricultural areas, in some sections it is lined by *Fagus*- and mixed forests. In the past the Quirrenbach has been object to several zoological investigations, which mainly focused on limnic organisms (e.g. Schöll,

1985; Pawlowsky, 1984) but not on the surrounding terrestrial ecosystem, let alone the Myriapoda. Thus, the only Myriapoda recorded previously for the Quirrenbach is *Glomeris tetrasticha* Brandt, 1833, also found during the above mentioned student excursions (Decker & Hanning, 2011). For the Siebengebirge 17 species of Diplopoda and 20 species of Chilopoda were reported by Brocksieper (1973).

The tiny pill millipedes belonging to the genus *Geoglomeris* Verhoeff, 1908 reach a length of 1.5 - 2.5 mm and are characterized by the presence of 10 tergites as opposed to the usual 11 in Glomerida, which are covered with hairs and show micro-sculpturing. Of the six known *Geoglomeris* species only the widespread *G. subterranea* Verhoeff, 1908 is known from Germany, while all other representatives are restricted to France and Italy and show a patchy distribution. The majority of the populations seem to be parthenogenetic and males are only known from three occasions. *G. subterranea* has a number of distribution records in southern France and England, with a handful of sites also known from Ireland, Belgium, Luxemburg, Switzerland, Austria, the Czech Republic and Germany (see Kime & Enghoff, 2011). Only the British populations seem to be reasonably well-researched (e.g. Bocock *et al*., 1973). Bocock *et al*. (1973) did not only discover that these tiny pill-millipede need several years to mature, but also that they carry very few, just 4 or 5, eggs each year.

From Germany's second largest and most populous western state, NRW, no records exist (Decker & Hannig, 2012; Decker *et al*, 2015). The only recent findings of *G. subterranea* come from southern Germany (Spelda *et al*., 2011), as well as from Schengen, Luxemburg, a few meters from the German border (Decker *et al*., 2015).

Here we report the species for the first time from NRW and use the opportunity to utilize micro-CT scans to study the morphology of such miniscule dwarf pill millipedes.

MATERIAL AND METHODS

From 2011 to 2017 the same area at the Quirrenbach, a small patch of forest at the intersection of Nonnenbergerstraße (L-143) and Humperdinkstraße (50°41'13.6"N 7°17'55.6"E) was sampled by hand-collecting and Berlese extractions. For Berlese extraction leaf-litter and soil were sieved and filled in the Berlese apparatus. All specimens were fixed in 95% ethanol and deposited as vouchers at the Zoological Research Museum A. Koenig.

A µCT-Scan of *G. subterranea* was performed with a SKYSCAN 1272 in 95% ethanol with the following parameters: source voltage = 40 kV, source current = 200 µA, exposure = 2928 ms, rotation of 180° in rotation steps of 0.1°, pixel-size = 1 µm, frame averaging = 7, random movement = 15, flat field correction on, geometrical correction on, no filter. Volume-rendering for habitus-pictures was performed in Drishti (Limaye, 2012).

The geographical distribution was mapped with ArcGIS 10.2.2, using records listed by Reip *et al*. (2012), Decker *et al*. (2015), Desmond Kime (pers. comm., October 11, 2009) and the present study.

RESULTS

Specimens of *G. subterranea* were found in the first soil samples of 2017 after three days of Berlese extraction. A total of three females were found. A second search by hand collecting did not yield any specimens from the same square meter from which the previous soil sample was taken. An additional batch of >40 liters of sieved leaf litter and soil taken from the site yielded after Berlese extraction an additional four female specimens (Figs 1A-C).

From 2011–2017 a single species of Pauropoda, 16 of Chilopoda, and 15 of Diplopoda could be identified at the Quirrenbach site (Table 1). Further specimens of all Myriapod classes were collected but could not be determined to species level.

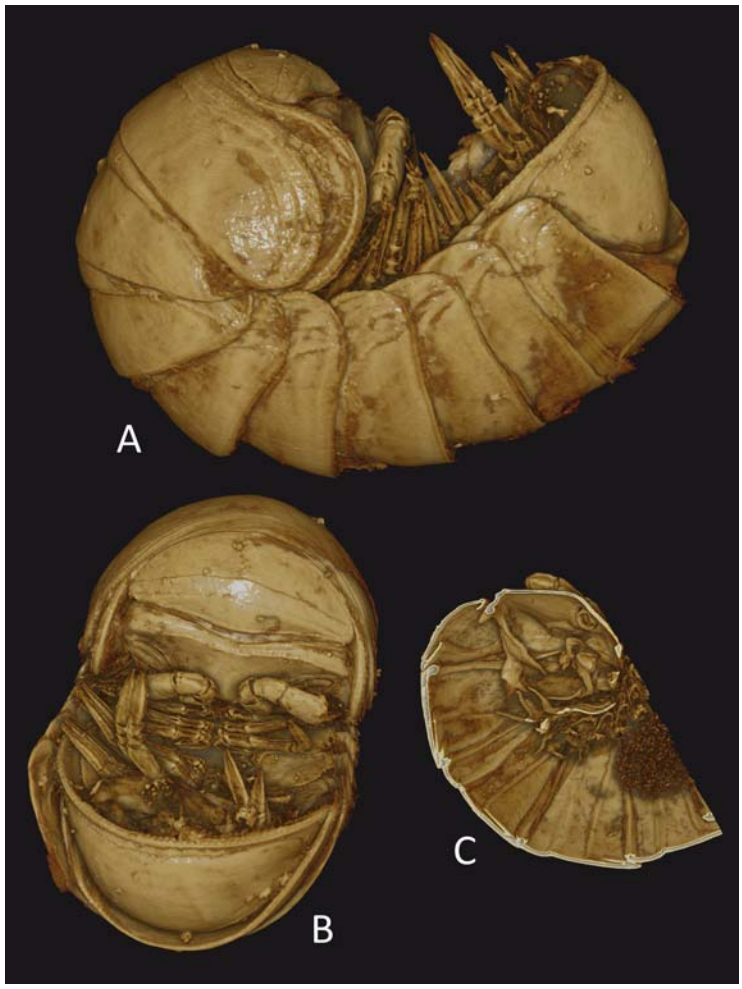

Figure 1: *Geoglomeris subterranea* Verhoeff, 1908 volume-rendering based on µCT-data.
A) Habitus, lateral view; B) Ventral view; C) Saggital section.

DISCUSSION

In Germany, the few records of *Geoglomeris* in central and eastern Germany are mainly historic with several unsuccessful recollection attempts (Reip *et al*., 2012). The only known localities where specimens have been found in the last 25 years are in southern Germany. In eastern Germany *G. subterranea* is only known from its type locality (Verhoeff, 1908), where it could never be recollected despite numerous attempts (Reip *et al*., 2012, own observation by TW). From western Germany only two older records are known: a dubious one from a farming area north of Frankfurt (Klinger, 1992), and several findings in a *Fagus* forest on calcareous soil next to Göttingen (Sprengel, 1986; Scheu, 1990).

Our finding of *G. subterranea* in the area of Bonn and the Siebengebirge area (Fig. 2) is surprising, as the area is one of the best-explored for Diplopoda in the state, recording 61 species of millipedes and centipedes (Decker *et al*., 2015). At least two PhD theses have been conducted, explicitly dealing with the Myriapoda fauna of the area (Brocksieper, 1976; Fründ & Ruszkowski, 1989), additionally several yearly spring excursions to the area of Quirrenbach, including the taking of Berlese samples, have not yielded any *Geoglomeris* previously.

Table 1: Species of Myriapoda found at Quirrenbach, with corresponding collection number.
MYR = Myriapoda collection of the Research Museum A. Koenig: Only a single voucher number is given for each species, although numerous samples exist.

Pauropoda (1)		
Trachypauropus cordatus (Scheller, 1974)	MYR2515	Only in Berlese samples
Chilopoda (16) **Geophilomorpha**		
Strigamia crassipes (Koch, 1835)	MYR1054	
Strigamia acuminata (Leach, 1815)	MYR1126	
Schendyla nemorensis (Koch, 1835)	MYR1834	
Geophilus flavus (De Geer, 1778)	MYR1832	
Lithobiomorpha		
Lithobius aeruginosus Koch, 1862	MYR1864	
Lithobius agilis Koch, 1857	MYR3297	
Lithobius crassipes Koch, 1862	MYR1862	
Lithobius curtipes Koch, 1847	MYR5352	
Lithobius forficatus (Linnaeus, 1758)	MYR1050	
Lithobius macilentus Koch, 1862	MYR5347	
Lithobius melanops Newport, 1845	MYR1861	
Lithobius microps Meinert, 1882	MYR1121	
Lithobius piceus Koch, 1862	MYR1848	
Lithobius tricuspis Meinert, 1872	MYR2527	
Scolopendromorpha		
Cryptops parisi Brolemann, 1920	MYR1122	
Cryptops hortensis (Leach, 1815)	MYR1844	
Diplopoda (15) **Glomerida**		
Glomeris intermedia Latzel, 1884	MYR1824	
Glomeris marginata Villers, 1789	MYR1365	
Glomeris tetrasticha Brandt, 1833	MYR622	
Geoglomeris subterranea Verhoeff, 1908	MYR6163	Only in Berlese samples
Polydesmida		
Brachydesmus superus Latzel, 1884	MYR1867	
Polydesmus denticulatus Koch, 1847	MYR2222	
Polydesmus angustus Latzel, 1884	MYR2532	
Polydesmus inconstans Latzel, 1884	MYR6160	
Chordeumatida		
Chordeuma sylvestre Koch, 1847	MYR5346	
Julida		
Allajulus nitidus (Verhoeff, 1891)	MYR1677	
Cylindroiulus punctatus (Leach, 1815)	MYR1722	
Julus scandinavius Latzel, 1884	MYR1714	
Tachypodoiulus niger (Leach, 1814)	MYR1716	
Ophyiulus pilosus (Newport, 1842)	MYR1718	
Proteroiulus fuscus (Am Stein, 1857)	MYR6221	

This highlights the patchy distribution of *Geoglomeris* species, apparently being restricted to a few square meters.

Hand-collecting by skilled pill millipede collectors did not yield any specimens, despite their known presence in the area. The small size (<2 mm diameter) combined with their cryptic colour (brown) and patchy distribution records make it highly likely that this species was overlooked in a large part of their range. A point further highlighted by the fact that all records in Germany since the 1970s were from Berlese samples, and that the species was not recorded for Austria until 1985 (Gruber, 1985) and the Czech Republic until 2017 (Kocourek *et al*., 2017).

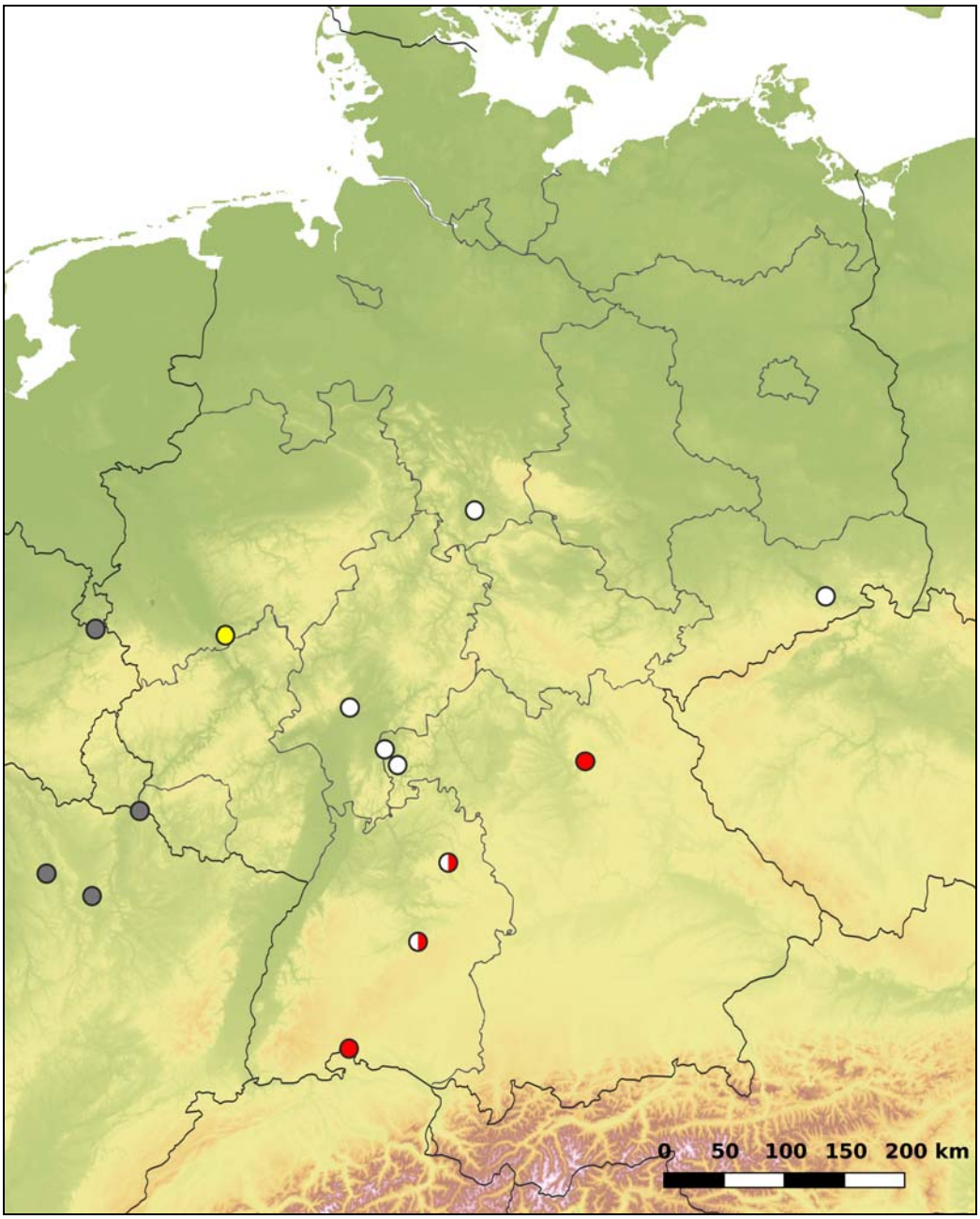

Figure 2: Geographical distribution of *Geoglomeris subterranea* Verhoeff, 1908 in Germany and surrounding areas. The collection site of the present study (Quirrenbach site) is shown in yellow. Records after 1990 are shown in red and previous records in white, while collection sites in neighbouring countries are marked in grey.

ACKNOWLEDGEMENTS

Many thanks to the assistant of the Myriapoda section at the ZFMK, Thorsten Klug, who sorted, collected and identified numerous of the Myriapoda specimens collected at the Quirrenbach site. Bernhard Huber first started excursions to the Quirrenbach site and was a participant of most of the student excursions. Jan Philip Oeyen conducted the second batch of Berlese extractions. Furthermore, we thank the students, who participated in the excursions since 2011 and collected numerous millipede specimens.

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RICKIA LABOULBENIOIDES DE KESEL (LABOULBENIALES) ON *CYLINDROIULUS BRITANNICUS* (VERHOEFF) (JULIDA: JULIDAE)

Malcolm Storey

6 Brackenhill Road, Wimborne, BH21 6LT, UK.
E-mail: malcolm.storey@dsl.pipex.com

Rickia laboulbenioides is the only laboulbeniomycete fungus recorded from millipedes in the British Isles (Wier, 1996) where it was long misidentified as *Rickia dendroiuli* (de Kesel *et al.*, 2013; as reported in Enghoff & Reboleira, 2015).

In the UK the fungus is mainly found on *Cylindroiulus punctatus* (Leach) (Figs. 1A, 1B), but was originally described from *C. latestriatus* (Curtis) in the Netherlands (de Kesel *et al*., 2013). The tiny thalli (technically ascomata/ascocarps; fruitbodies) appear on the first few legs, especially the second pair (de Kesel *et al*., 2013; Santamaria, *et al.* 2016) but are by no means confined to these.

Figure 1: *Cylindroiulus punctatus.*
A) Ascocarps (thalli) on anterior legs of male; B) The clubbed telson of the above specimen confirming *Cylindroiulus punctatus.*

On 6th October 2017 I found a single Cylindroiuline millipede, under a piece of fallen wood at SU410023, by Exbury Road, New Forest, South Hants. Laboulbeniomycete thalli could be seen on the fore legs under the 20x hand lens (Fig. 2A). At the time the host was assumed to be *Cylindroiulus punctatus*, but this was corrected to *Cylindroiulus britannicus* (Verhoeff) by Steve Gregory when he saw my photographs. It was a male and I've since dissected the specimen to confirm (Fig. 2B). The immature thalli on this specimen are shown in Figs. 3A-C.

There's one previous probable record on this host, an unidentified Laboulbeniales reported by Irwin (1989), (cited in Gregory *et al.*, 2018 who also provide the full host list). However, this is the first confirmed record of *Rickia laboulbenioides* using *Cylindroiulus britannicus* as a host.

Figure 2: *Cylindroiulus britannicus.*
A) Thalli on anterior legs, dry. (Stack of 83 frames using Zerene Stacker); B) Dissection confirming identification, dry. (Stack of 109 frames using Zerene Stacker).

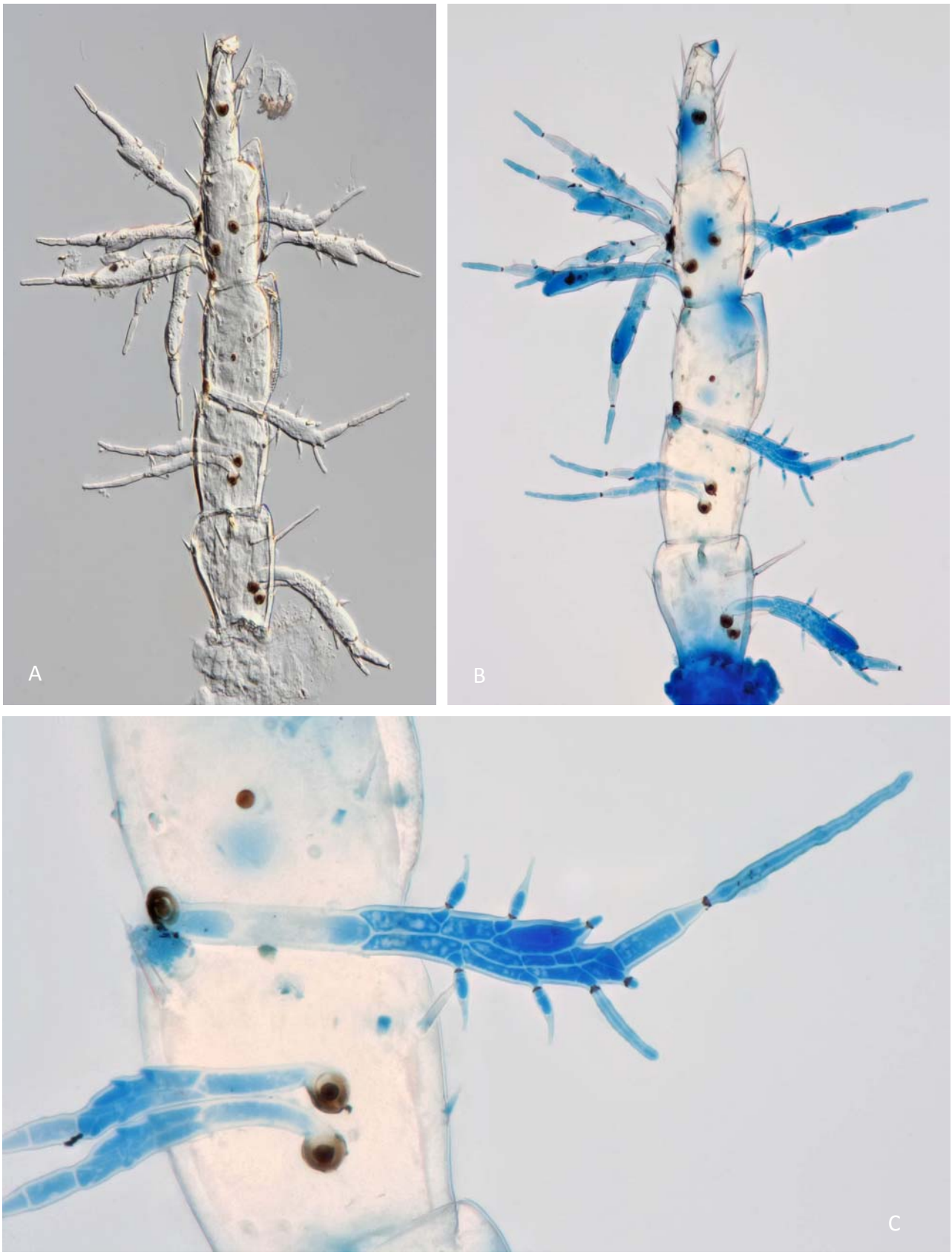

Figure 3: Immature thalli on leg of *Cylindroiulus britannicus*, microscope preparations.
A) Decalcified in lactophenol, differential interference contrast (DIC); B) and C) Stained and decalcified in lactophenol cotton blue. All images stacked using Zerene Stacker and colour of excess stain digitally removed.

All photos online at:

https://www.bioimages.org.uk/html/Rickia_laboulbenioides.htm

https://www.bioimages.org.uk/html/Cylindroiulus_britannicus.htm

https://www.bioimages.org.uk/html/Cylindroiulus_punctatus.htm

ACKNOWLEDGMENTS

Thanks to Henrik Enghoff for confirming the identification of *Rickia laboulbenioides* and pointing out that the thalli are immature. Thanks also to Steve Gregory for correcting my hasty identification of the millipede and tutoring me through the dissection.

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THE LATEST ON THE OLDEST

Paul A. Selden

Paleontological Institute and Department of Geology, University of Kansas, Lawrence, Kansas 66045, USA and The Natural History Museum, London SW7 5BD, UK.

Email: selden@ku.edu

INTRODUCTION

In 2008, Helen Read and I wrote a short piece for the *Bulletin* about the discovery of the oldest fossil myriapod (and the oldest demonstrably air-breathing animal), the millipede *Pneumodesmus newmani* Wilson, 2004, from mid-Silurian strata (*c*. 427 Ma) of Stonehaven, Scotland (Selden & Read, 2008). Last year, a team of geochronologists from the University of Texas at Austin restudied the evidence for the age of the rocks at Stonehaven, using radioisotope data from zircon crystals in the beds surrounding those containing the millipedes, and concluded that they were rather younger than previously thought: early Devonian (*c*. 414 Ma) in age, or some 13 million years younger (Suarez *et al*., 2017). This finding removes the title of oldest myriapod from *Pneumodesmus*. So what, now, is the oldest known myriapod and the oldest air-breathing animal?

STONEHAVEN

First, some background. The intertidal rocks exposed on the shore at Cowie Harbour, north of Stonehaven, Aberdeenshire, consist of a series of conglomerates, sandstones, and siltstones, dipping steeply (in some place overturned), and closed by faults and igneous dykes. The millipede fossils occur in the so-called Cowie Harbour Fish Bed, part of the Cowie Harbour Siltstone Member, in the middle of the foreshore (Figs. 1, 2). The Stonehaven sequence lies about 500 m south of the great Highland Boundary Fault, which runs from here, south-west across Scotland, through Loch Lomond, across the middle of the Isle of Arran, and thence to Ulster and Connemara. Unsurprisingly, the age of this isolated patch of contorted rocks has been disputed for many years.

The Stonehaven sequence, which forms the lowest part of the Old Red Sandstone sequence in Scotland, was originally thought to be latest Silurian (Přídolí) age, based on the aquatic arthropod and fish fossils found there and correlation with similar faunas in Norway (Campbell, 1913). Later work on the Norwegian faunas, however, suggested that both these and the Stonehaven succession might be older, middle Silurian in age (Hanken & Størmer, 1975). A mid-Silurian age was later confirmed by palynological studies (Marshall, 1991; Wellman, 1993) on plant spores from inland sites thought to be part of the Stonehaven Group. So, when Wilson & Anderson (2004) described *Pneumodesmus*, with its clearly visible spiracles, from the Cowie Harbour Fish Bed, it had good claim to be the oldest known land animal, and oldest myriapod. Wilson & Anderson (2004) actually described three millipedes from the Cowie Harbour Fish Bed: *Albadesmus almondi*, *Pneumodesmus newmani* and *Cowiedesmus eroticopodus*, but only *Pneumodesmus* could be demonstrably shown to be an air-breather, and hence the oldest land animal.

That was until last year, when a team at the University of Texas at Austin led by Danny Stöckli investigated the radiometric age of tiny zircon crystals found in the strata either side of the fish bed (Suarez *et al*. 2017). Using U-Pb Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS), they measured the ratio of ^{238}U-^{206}Pb isotopes, and found that they gave dates of 413.7±4.4 Ma for a volcanic ash below the fish bed and 414.3±7.1 Ma for the sandstone immediately overlying the

Figure 1: General view of Cowie Harbour, Stonehaven, Aberdeenshire, looking north-east. The Devonian Cowie Harbour Group form the foreshore exposures, beyond which the cliffs of Slug Head to Garron Point are composed of the older Highland Border Complex which abut the Highland Boundary Fault.

Figure 2: Cowie Harbour foreshore looking east. Information board giving details of the fossil bed and its millipedes. The fossil bed lies just beyond the inlet.

fish bed. These dates equate to the Lower Devonian (Lochkovian). They pointed out that the palynological samples of Marshall (1991) and Wellman (1993) come from outcrops isolated from Cowie Harbour by faults, so might not be equivalent.

Since the new dating was published, Shillito & Davies (2017) described some new trace fossils (shallow burrows) from Cowie Harbour, in beds below the Cowie Harbour Siltstone Member which contains *Pneumodesmus*. The burrows were not attributed to millipedes, and the trace fossil assemblage is typical of those found in terrestrial sediments of Siluro-Devonian times after the initial terrestrialization of arthropods but prior to the Devonian radiation of land animals as shown by trace fossil diversity (Buatois *et al*., 1998; Minter *et al*., 2017). Hence, Shillito & Davies (2017) suggested that the inland exposures near Stonehaven dated by palynology represent an older, unrelated, formation, and that the fossil-bearing strata exposed in Cowie Harbour were deposited during early Lochkovian times.

THE OLDEST MYRIAPOD

Now that *Pneumodesmus* appears to have lost its title to the oldest land animal in the fossil record, what is the oldest, and what is the oldest myriapod? We can discount the enigmatic fossil *Cambropodus* Robison, 1990 from the Cambrian of Utah. This specimen is more likely to be a lobopod rather than an arthropod, if it is an animal at all. Regarding land animals, the problem is that they need to show some sort of terrestrial adaptation; for all we know, the oldest myriapod might have been aquatic. Fossil trackways indicating that aquatic animals hauled themselves out of the water and across subaerially exposed sediments date back to the latest Cambrian (*c*. 488 Ma: MacNaughton *et al*., 2002), but whether these animals were habitually terrestrial or were aquatic animals sprinting from one pool to another to survive desiccation is not clear. Moreover, evidence for the sediment being exposed to the air (e.g. mud cracks) does not necessarily tell us whether the tracks were made under water and then exposed, or the mud was already drying and cracking when the trackway was made (Braddy, 2004). Nevertheless, a Cambro-Ordovician origin of terrestrial animals was suggested by Rota-Stabelli *et al*. (2013) using molecular clock analyses of extant Ecdysozoa. Many of the early Paleozoic trackways have been ascribed to myriapod-like animals, but it would be unwise to accept them as explicit evidence for the existence of myriapods as we know them. It is conceivable that there were other extinct arthropods around at this time with multiple limbs capable of leaving such impressions (see reviews in Wilson, 2006; Dunlop *et al*., 2013). Another kind of trace fossil, coprolites, occur in rocks of late Silurian age near Ludlow, Shropshire, which have been attributed to detritivorous animals, probably millipedes (Edwards *et al*., 1995).

Body fossils of terrestrial animals include scorpions from rocks of middle and late Silurian age (*c*. 430–420 Ma), e.g. *Dolichophonus loudonensis* Laurie, 1899 from the Pentland Hills near Edinburgh, is the oldest known arachnid (Wolfe *et al*., 2016), and is about the same age as the Stonehaven fossils were before they were shown to be younger. However, there is some discussion about whether early scorpions were aquatic or terrestrial (see discussions in Selden & Jeram, 1989; Scholtz & Kamenz, 2006; Kühl *et al*., 2012) because some early scorpion fossils show features of aquatic relatives such as eurypterids (sea scorpions), e.g. digitigrade tarsi. So, the earliest fossils which show book lungs and other features which are unequivocally related to terrestrial life are from the locality of Ludford Lane, Shropshire, in rock of late Silurian (Přídolí) age (Jeram *et al*., 1990). This fauna includes scutigerimorph centipedes and eoarthropleurid millipedes (Selden, 2016).

However, while they do not show air-breathing spiracles, the oldest known myriapods do still come from mid-Silurian rocks in Scotland (Wilson, 2005). In this paper, Wilson described two new genera and species of Palaeozoic millipedes, *Zosterogrammus stichostethus* and *Casiogrammus ichthyeros*,

from the Upper Carboniferous locality of Mazon Creek, Illinois, and the Hagshaw Hills (Middle Silurian: Wenlock) of Scotland, respectively. Together with *Purkynia lata* Frič, 1899, from the Upper Carboniferous locality of Nýřany, Czech Republic these millipedes, were placed in the new order Zosterogrammida, which are characterized by trunk rings consisting of an arched diplotergite, a pair of free ventral diplopleurites, and a pair of free ventral sternites (Wilson, 2005). The oldest of these millipedes, *Casiogrammus ichthyeros*, was used as a calibration point in a phylogenomic analysis of the Myriapoda Tree of Life in a recent paper by Férnandez *et al*. (2018). *Casiogrammus* (Fig. 3) was first mentioned as a possible millipede by Rolfe (1980), and it is recognized as such simply for possessing a regular series of similar tergites. It somewhat resembles the rather short, broad polyzoniids.

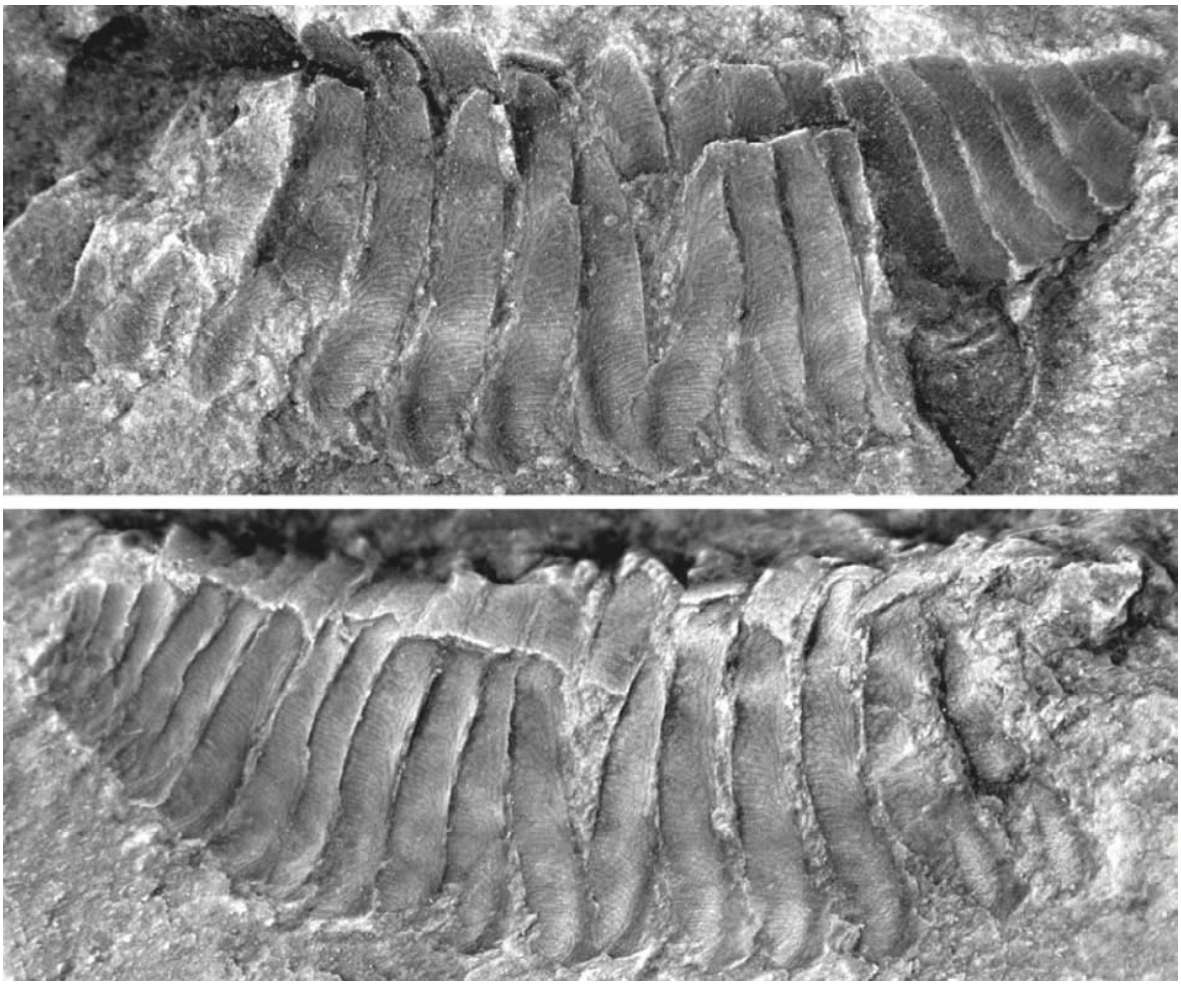

Figure 3: The oldest known myriapod, *Casiogrammus ichthyeros* Wilson, 2005.
Top: part; bottom: counterpart.

The Hagshaw Hills, south-west of Glasgow in Lanarkshire, consist of an inlier of older, harder Silurian rocks poking through the younger, softer surrounding Carboniferous strata of the Midland Valley of Scotland. The Fish Bed Formation in the Hagshaw Hills is dated by palynology to early Wenlock (*c*. 430–433 Ma) age (Wellman & Richardson, 1993), and is famous for its diverse fauna of non-marine jawless fish together with eurypterids; apart from the millipede, no other terrestrial arthropods are known from the formation, though some plant fragments occur (Rolfe, 1961, 1992; Ritchie, 1968). The beds were most likely deposited in a relatively permanent lacustrine setting (Wellman & Richardson, 1993).

While *Pneumodesmus newmani* might have lost its status as the oldest myriapod, it remains the oldest known animal showing spiracles for air breathing. Moreover, the oldest known land animal (probably, even though it lacks spiracles), *Casiogrammus*, is also a millipede. These records will remain until more fossils are discovered or the ages of the strata in which they are found are revised. Watch this space!

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FIRST OBSERVATION OF FILIAL CANNIBALISM IN *SCOLOPENDRA CINGULATA* LATREILLE, 1829 (CHILOPODA: SCOLOPENDROMORPHA: SCOLOPENDRIDAE)

David Cabanillas[1], Álvaro Albatros[2], Andrés García-Ruiz[3] & Francisco Rodríguez-Luque[4]

[1] Asociación Fotografía y Biodiversidad. C/ Nicolás Salmerón, 41, 2ºB (Madrid, Spain).
E-mail: cabanillas.entomologia@gmail.com

[2] Departamento de Zoología y Antropología Física. Facultad de Ciencias Biológicas. Universidad Complutense de Madrid. C/ José Antonio Novais, 12 (Madrid, Spain).
E-mail: alvpin01@ucm.es

[3] Departamento de Didácticas Específicas. Facultad de Formación de Profesorado y Educación. Universidad Autónoma de Madrid. C/ Francisco Tomás y Valiente, 3 (Madrid, Spain).
E-mail: andres.garcia.ruiz@uam.es

[4] Asociación Fotografía y Biodiversidad. C/ Almería, 40, 3ºB (Roquetas de Mar, Almería, Spain).
E-mail: correofaluke@gmail.com

ABSTRACT

Filial cannibalism is recorded for the first time in *Scolopendra cingulata* Latreille, 1829 in a natural environment in Almería (Andalusia, Southern Spain). A female was found exhibiting parental care of 2nd stadia juveniles and after checking possible ways of escape from the brood-chamber, she started to devour her brood and a total of five juveniles were consumed. A detailed description of filial cannibalism in *S. cingulata* is given and a new account of this phenomenon is documented. In addition, comparisons with filial cannibalism among other taxa are given and possible factors causing this in *S. cingulata* are discussed.

KEYWORDS: Filial cannibalism, *Scolopendra cingulata*, breeding behaviour, recording, Andalusia, Spain.

INTRODUCTION

Filial cannibalism (*sensu* Klug & Bonsall, 2007) consists of the consumption of offspring by the parental generation. In recent years, this behaviour has been considered an adaptive trade-off between current and future reproductive success (Manica, 2004; Miller & Zink, 2012). The predominant hypothesis about filial cannibalism claims that it is an adaptive strategy in which the parental generation obtains energy by ingesting its brood, thus ensuring their own reproductive success (Trivers, 1972; Rohwer, 1978; Sargent, 1992). On the other hand, it has also been suggested that filial cannibalism may be a mechanism to ensure the survival of a greater number of descendants. Hence, this behaviour is likely to appear when the filial generation is too numerous and parents do not have the capacity to provide them with full protection (Manica, 2002; Payne *et al*., 2002; Klug *et al*., 2006). It has also been proposed that filial cannibalism would be a result of avoiding fierce competition when food availability is low and may endanger either the survival of the filial or parental generation (O'Connor, 1978; Thomas & Manica 2003). In other circumstances parents may turn to filial cannibalism to make the breeding period shorter, for hygienic reasons when either non-viable eggs are produced or juveniles have been infected or parasitised (Thomas & Manica 2003; Miller & Zink, 2012; Lehtonen & Kvarnemo, 2015; Vallon *et al*., 2016a). Nevertheless, filial cannibalism occurs when environmental conditions are adverse due to a lack of resources leading to a compromise between the viability of

parents and their brood (Klug & Bonsall, 2007) or due to a stress response caused by an anthropogenic disturbance (Chardine & Morris 1983, Gilbert *et al*., 2005).

Infanticide is a common behaviour pattern among many animals but filial cannibalism has been documented less frequently and it often occurs amongst those with parental care (Elgar & Crespi, 1992). In vertebrates, this phenomenon has been observed among birds (Gilbert *et al*., 2005; Solaro & Sarasola, 2012), rodents (Elwood, 1992; Klemme *et al*., 2006), primates (Dellatore *et al*., 2009; Fowler & Hohmann, 2010), marsupials (Pires *et al*., 2010), reptiles (Lourdais *et al*., 2005; Cooper Jr. *et al*., 2015) and amphibians (Solano, 1987), although most researchers focus on many fish groups (Smith & Reay, 1992; Manica, 2002; Mehlis *et al*., 2009; Vallon *et al*., 2016b). In invertebrates, some cases are known among cephalopods (Ibáñez & Keyl, 2009), but this behaviour has been documented to a greater extent in arthropods such as insects (Bartlett, 1987, Thomas & Manica 2003, Miller & Zink, 2012, Takata *et al*., 2013), arachnids (Anthony, 2003; Wise, 2006) or myriapods (Lawrence, 1984). In chilopods, records of filial cannibalism are scarce and restricted to the order Scolopendromorpha and the family Scolopendridae, more specifically to the species *Cormocephalus westwoodi anceps* Porat, 1871 (Brunhuber, 1970), *Otostigmus (Otostigmus) spinosus* Porat, 1876 (Siriwut *et al*., 2014) and *Otostigmus (Parotostigmus) scabricauda* (Humbert & Saussure, 1870) (Machado, 2000). The results obtained by Siriwut *et al*. (2014) in the breeding behaviour of a female of *O. spinosus* are worth noting. After mating and building the brood chamber, a female deposits her eggs and takes care of her brood after hatching. The researchers observed a particular behaviour pattern among this species when the mother suffered disturbance, generally by predators or other external agents. If a mother is apparently calm when observed and finds a way to escape and to return to the brood chamber, she rejoins her offspring and parental care proceeds normally. On the other hand, when the mother is apparently disturbed, she leaves the brood chamber and abandons her brood indefinitely. However, there is an additional possibility when a stressed mother cannot find a way to escape. In this scenario, filial cannibalism occurs.

Although *O. spinosus* has been studied in depth, there is still much to know about breeding behaviour in other species and thus increase current ethological knowledge in the class Chilopoda. Hence the main aim of this report is to describe the first observation of filial cannibalism in *Scolopendra cingulata* Latreille, 1829 in a natural environment located in Almería (Southern Spain) and to compare the observed behaviour with the results obtained by Siriwut *et al*. (2014). In addition, possible causes and external factors underlying the phenomenon of filial cannibalism are discussed.

MATERIAL AND METHODS

Studied species

S. cingulata is a species of the order Scolopendromorpha, family Scolopendridae and it is widely distributed in the Mediterranean region of Europe, North Africa and East Asia (Bonato *et al*., 2016) (Fig. 1A). In Spain, *S. cingulata* occurs abundantly in almost the whole of the Iberian Peninsula, except for the Eurosiberian region, where it is restricted (Fig. 1B). *S. cingulata* is a thermophilic, anthropophilic, silvicolous and praticolous species (García-Ruiz, 1997), in which female uni-parental care has been registered (Heymonds, 1901; Radl, 1992). Parental care in general maximises reproductive success by increasing the chances of the brood success but this behaviour may sometimes put the survival of the mother or her brood in jeopardy (Thomas & Manica 2003; Klug *et al*., 2006). Once females have reached sexual maturity (it takes at least 3 years), they look for a mate during the spring months. After mating, they then seek a well-conditioned breeding chamber and lay between 10 and 49 eggs (Fig 2B). This takes place between May and June. Approximately 20 days after egg-laying, the 1st stadium adolescents hatch and remain motionless with the mother curled around them. After

approximately 17 days, the 2nd adolescent stadium is reached and juveniles are able to move but cannot feed (Fig. 2C-D). 10 days later, the juveniles reach the 3rd adolescent stadium and are able to feed themselves. A few days later, the mother leaves the chamber and finally abandons her brood.

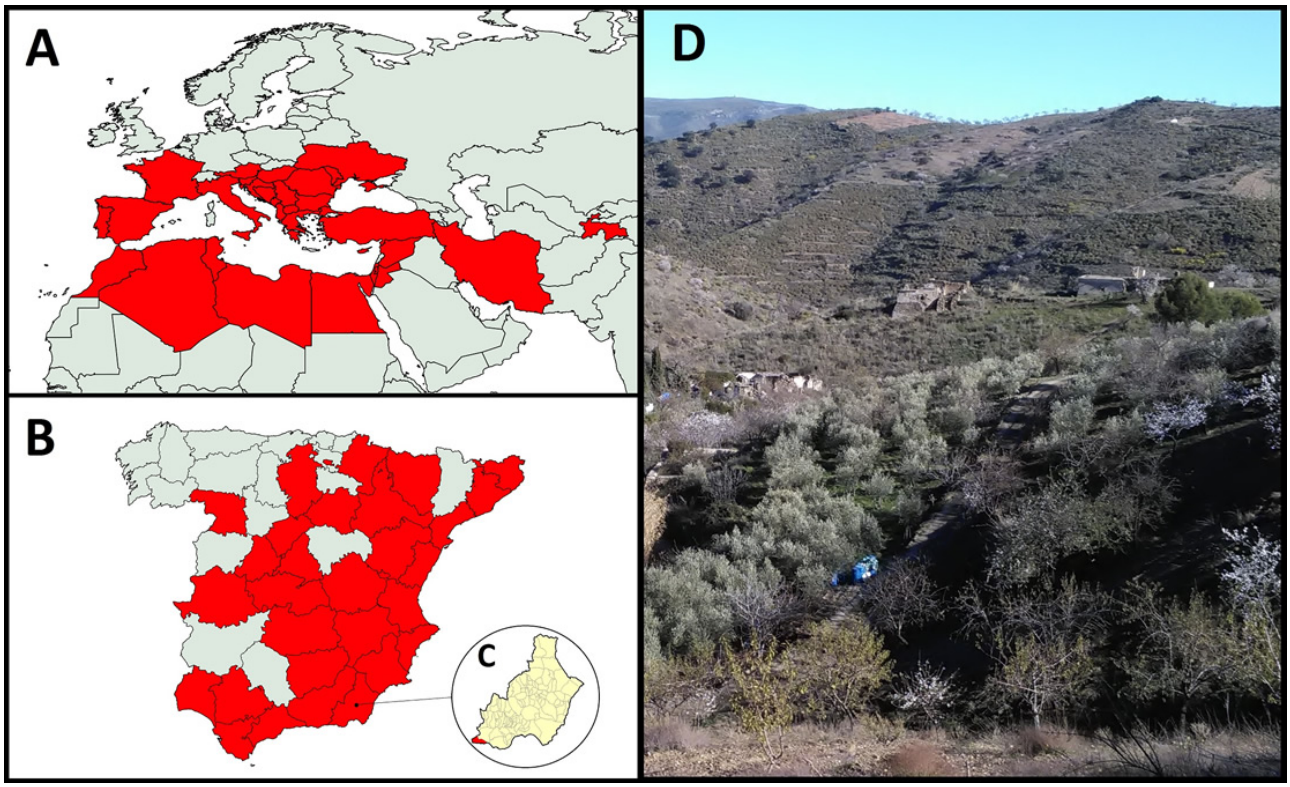

Figure 1: Distribution and area of breeding of *Scolopendra cingulata*.
A) Worldwide distribution; B) Distribution in mainland Spain; C) Municipality of Adra in Almería province (Andalucía); D) Mediterranean habitat and fields of cultivation of *Olea europea* and *Prunus dulcis*.

Area of the study

Observations took place in the municipality of Adra, in the province of Almería, located near the Mediterranean coast of southern Spain (Fig 1C). The area is located in the vicinity of fields of cultivation of *Olea europea* L. and *Prunus dulcis* (M.), in a terrain dominated by Mediterranean scrubland and the dispersed presence of *Quercus ilex* L. (Fig. 1D). The zone is characterised by the absence of precipitation during the warmer season and daytime maxima temperatures in September oscillate between 28 and 30ºC, which confers xeric properties to the land.

Characteristics of the brood chamber

Initially, the brood chamber was discovered during maintenance work under a heavy rainwater collection tank (Fig. 2A). The inside of the chamber comprised a compact rocky substratum without galleries or apparent cavities on the sides although possible ways to escape above were seen. Parental care in *S. cingulata* had already been noted in this site about 3 years ago (Fig. 2B). Hence, this environment must have formed a microhabitat that undoubtedly offered good conditions for breeding as the animals had found a humid, sheltered and undisturbed place to settle in. Unfortunately, the water tank had to be moved and from then on was replaced by a large stone to properly cover the brood chamber.

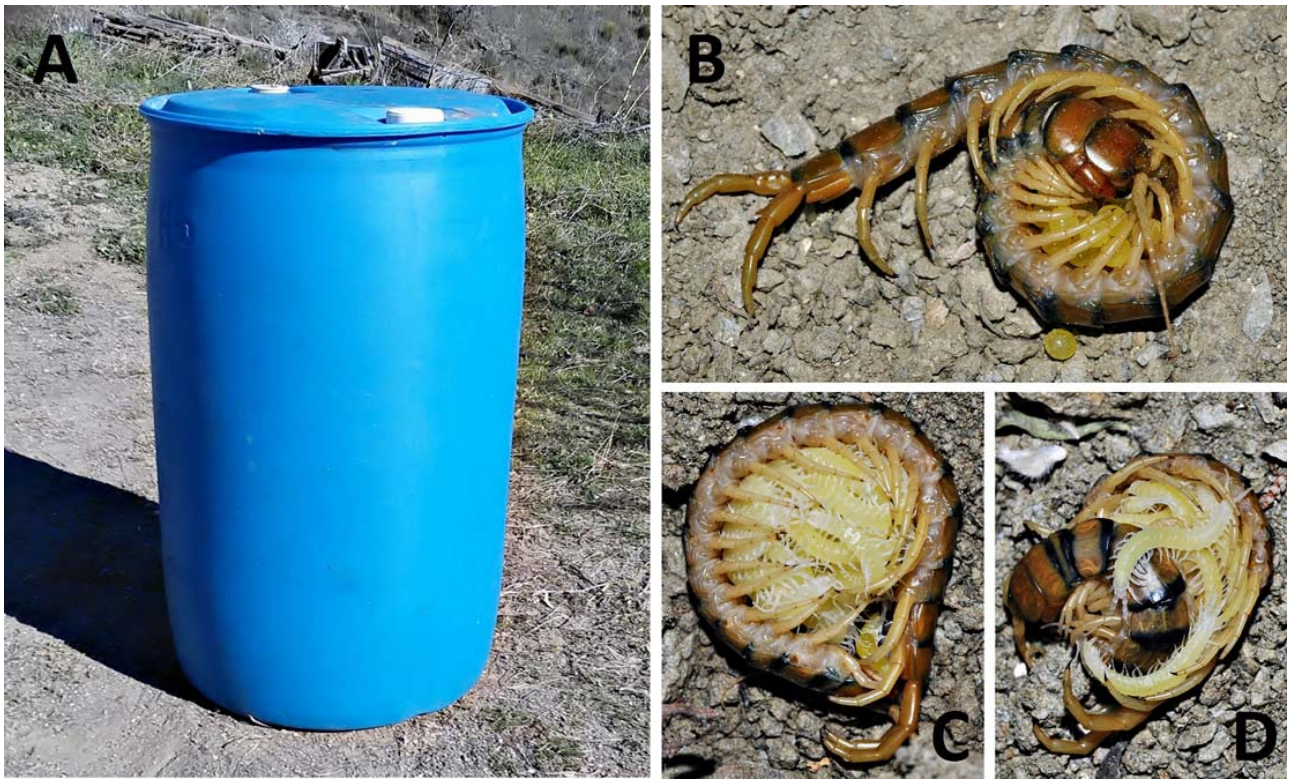

Figure 2: Parental care in *Scolopendra cingulata*.
A) Rainwater collection tank that initially covered the brood chamber; B) View of female uni-parental care underneath the collection tank in 2015; C) First observation of parental care in 2018; D) Second observation of parental care in 2018, prior to filial cannibalism.

RESULTS AND SHORT DISCUSSION

Filial cannibalism

The first observation of the female caring for 2nd stadium juveniles was on 19th September 2018. When the rainwater collector tank was removed, the mother and her offspring were found to be there in a manner characteristic of scolopendrid species (Siriwut *et al*., 2014): she was curled up around her brood, forming the typical protective position for the juveniles who were moving around each other (Fig. 2C-D). The second observation took place on 28th September 2018 and a few minutes after uncovering the stone, filial cannibalism was seen. At the start of both the first and second periods of observation their behaviour was apparently normal. In the daylight, while photographs were being taken and video recordings were being made (Rodríguez-Luque, 2018), the mother started to move in a disturbed manner several times (Fig. 3A). When so disturbed, she released the brood, possibly trying to find a way to escape from the brood chamber (Fig. 3B), from which several possible escape routes had been noted by the authors but despite this the mother remained in the brood chamber and then circled around the young a few times. Then she grasped the juveniles again, which were still mostly assembled in a group, by leaning on them and finally started to eat some of them (Fig. 3C). Three of the juveniles were devoured during recording (Fig. 3C-F) and none of them attempted to escape; only the third victim slightly increased its speed. Furthermore, the members of the brood who were not attacked behaved as normal, apparently indifferent to the filial cannibalism. After the recording, the mother was observed eating two more juveniles before cannibalism came to an end. 10 days after this, neither the mother nor her offspring were found in the brood chamber.

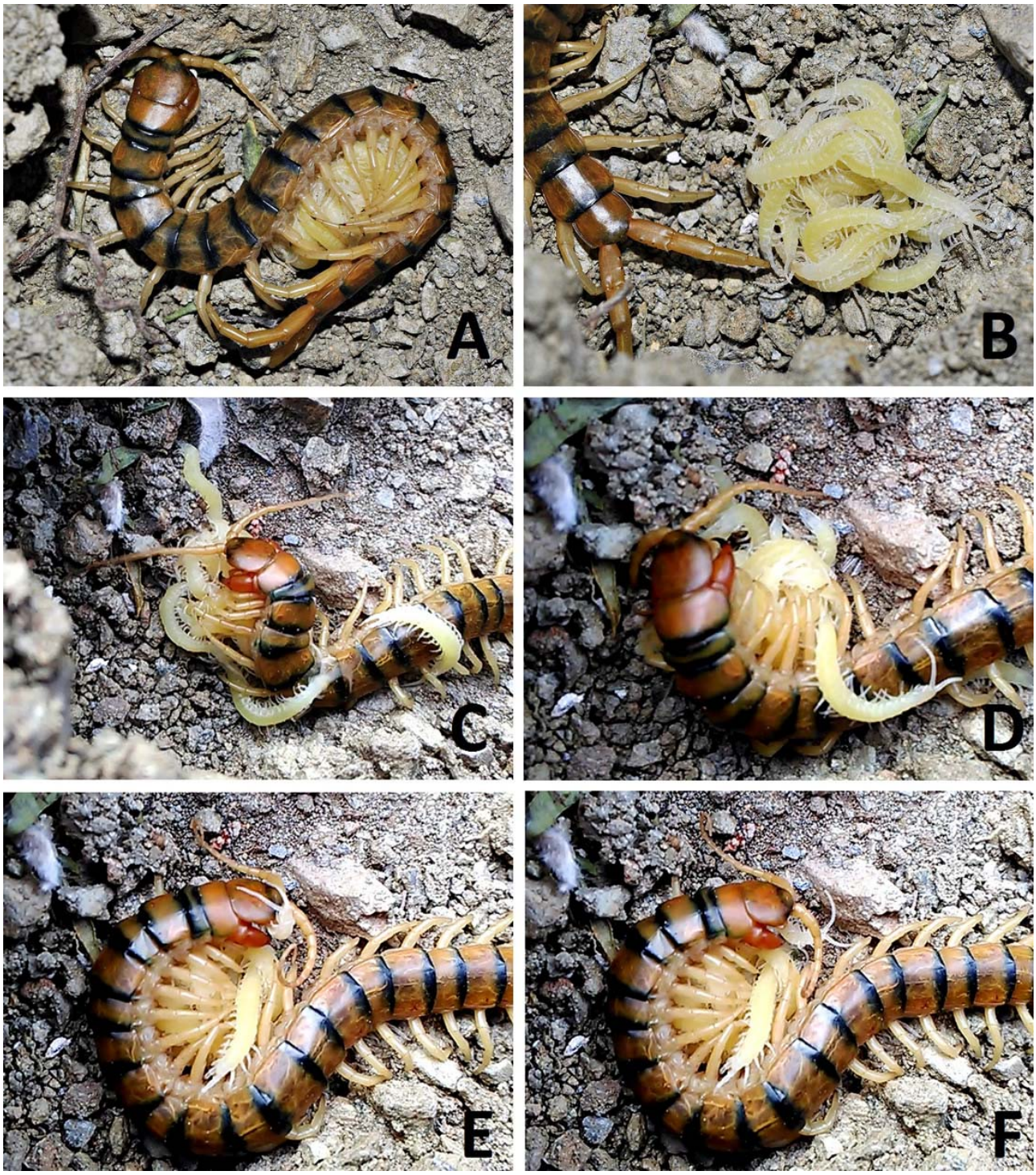

Figure 3: Filial cannibalism in *Scolopendra cingulata*.
A) Mother starting to feel "nervous" and exposed; B) Mother abandoning her brood; C) Beginning of filial cannibalism and first juvenile consumed; D) Second juvenile ingested by the mother; E-F) Consumption of the third juvenile.

This sequence follows the pattern described for *O. spinosus* breeding behaviour (Siriwut *et al.*, 2014) with the difference that possible ways to escape were available but not used. That circumstance drove the subject into the cannibalistic behaviour predicted in this model, which could have several possible explanations. One of these could be that the female had not detected possible ways of escape, which would imply a low level of perception, since there were several cases of juveniles moving in different

directions. Further studies should be oriented towards how these observations relate to normal perceptive capacity in *S. cingulata* and whether high levels of stress have implications for its ability to assess its surroundings. However, this could be contrasted with the female's apparent tranquility whilst devouring her offspring. Another relevant idea to test is if the stress level gradually decreased after the initial shock she had when the rock was lifted up. Abruptness of movements could be good stress indicators in these animals and contrary to the initial behaviour of releasing the offspring and fast circling around them, after grasping them back her movements became less violent again. The offsprings' reaction was similar to that of their undisturbed mother, even though some of their siblings were eaten alive. This may support the idea of low perception in analysing the surroundings, at least among young individuals. As has seen in other animals such as rodents (Elwood, 1992), bonobos (Fowler & Hohmann, 2010) and spiders (Anthony, 2003), filial cannibalism could represent a sacrifice of a part to save the whole. Eliminating five members of the clutch of offspring would relieve the female's responsibility for taking care of a large brood and, moreover, using them as an energy resource rather than leaving them to possible predators would increase her own chances of survival (Rohwer, 1978). Consequently, the remainder of the brood would have better chances of survival and, in an extreme case of sacrificing the whole brood, the healthy mother could survive to produce a new set of offspring (Klug & Bonsall, 2007).

In general terms, filial cannibalism behaviour in *S. cingulata* concurs with the results presented by Siriwut *et al.* (2014) for *O. spinosus*. The fact that the mother was clearly disoriented at the beginning may suggest that stress was too severe for her to find a way to escape and filial cannibalism in this scenario could take place with a stressed mother who could not find an escape route from the brood chamber when being observed and so, innately driven to consume her brood, as in *O. spinosus*. However, further ethological studies are needed to investigate the trigger for filial cannibalism in *S. cingulata*.

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IDENTIFICATION OF *LITHOBIUS MELANOPS* (NEWPORT) & *LITHOBIUS TRICUSPIS* (MEINERT)

A.D. Barber[1] and Steve J. Gregory[2]

[1] 7 Greenfield Drive, Ivybridge, Devon, PL21 0UG, UK.
E-mail: abarber159@btinternet.com

[2] 4 Mount Pleasant, Church Street, East Hendred, Oxfordshire, OX12 8LA, UK.
E-mail: stevejgregory@btopenworld.com

One of the best ways of distinguishing the common *Lithobius melanops* from the much more restricted *Lithobius tricuspis* is to examine a female and check the gonopod spurs (Barber, 2009), which are usually 2+2 in the former and 3+3 in the latter (hence its name). However, in two recent volumes of the BMIG Bulletin (Robinson & Barber, 2014; Barber & Owen, 2015), a female *L. melanops* with 3+3 spurs and a female *L. tricuspis* with 2+2 were described. Here we report another example of a female *L. melanops* with 3+3 gonopod spurs (Fig. 1). This specimen was collected by Nicola Garnham on 20.i.2019 from under tree bark in a copse near Arkholme, Lancashire (SD 572 706, VC 60).

Figure 1: *Lithobius melanops* female from Lancashire showing 3+3 gonopod spurs
Note that these seem to fit the description "conical" (*L. melanops*) better than "spinous" (*L. tricuspis*) (Barber, 2019) (Image Nicola Garnham)

Although not included in *Centipedes of the British Isles* (Eason, 1964), curiously, as the same author points out (Eason, 1965), Brölemann (1930) included "Grande-Bretagne" in his description of *L. tricuspis*. When the species was first definitively described as British by Ted Eason (Eason, 1965), he described features that also help to distinguish the two species (including males) such as the appearance

of the forcipular coxosternite, differences in spinulation and differences of tergite shape. It seems that it might be useful to try to summarise some of these differences.

Occurrence in Britain: *L. melanops* is widespread from the Channel Islands and Scilly to Shetland and similarly in Ireland from Cork and Kerry to Donegal and is recorded from all but three British and Irish vice-counties. The original discovery of *L. tricuspis* in the UK was made in the Dartmoor area and most subsequent records have been from a limited area in South Devon. It has also been reported from the Isle of Wight (specimen and details no longer available), probably incorrectly from Dorset and from a cave in Somerset (specimen not checked). In the light of both the somewhat doubtful nature of these latter records, the relative difficulty in separating males of the two species and what we now know about the occasional presence of 3+3 female gonopod spurs in *L. melanops*, these latter records are at best to be treated with caution. More recently a second area of occurrence, in South Wales, was discovered by Christian Owen. It is therefore possible that it might be found elsewhere in south west Britain such as in Somerset or Gloucestershire. It has also been recorded from the Channel Islands and is widespread in France.

Habitats: *L melanops* was first described from a garden and gardens and disturbed sites (as well as upper shore and sand dunes) are typical of it, but it does seem to favour a variety of situations. *L. tricuspis* was first found in oak litter & under stones in a rural situation and its apparent (restricted) area of occurrence here suggests an animal of rural areas. Although typically found in woodland it is apparently not confined to this.

Appearance in the field: Whereas many of our *Lithobius* species are a medium or dark chestnut brown in colour, *L. melanops* is typically quite a light brown colour but with a broad darker longitudinal stripe along its body. *L. tricuspis* is typically a uniform medium to dark brown colour. The two species are of comparable size (up to 17 mm in *L. melanops*, 14 mm in *L. tricuspis*), both have posterior projections on tergites 9, 11 and 13 and both have a double claw on the last legs.

Forcipular coxosternite: In *L.melanops* this has relatively small teeth and very prominent lateral shoulders. In *L. tricuspis* it has rather robust teeth and lacks these definite shoulders lateral to the paradontal spines.

Shape of tergites: Eason (1965) described the shape of the tergites as a useful differential diagnosis. Broad blunt projections on T9 and generally more concave posterior borders and more rounded angles of the larger tergites in *L. melanops.* This compares with sharper projections on T9 and generally less concave posterior borders and more angulated posterior angles in *L. tricuspis*. He did, however, qualify this with the fact that this applies to British examples and the fact that the tergites of French specimens were variable in this respect.

Female genitalia: *L. melanops* usually has two (sometimes three on one or both sides) conical spurs on each side whereas *L. tricuspis* is described as having 3+3 somewhat slender, gently tapered, spinous spurs; the internal being smaller than the others and often partly hidden by the intermediate spur when examined from the underside. The gonopod claw of *L. melanops* is described as "trifid" with a larger dorsal and slightly smaller denticle on each side. In the case of *L. tricuspis*, Eason (2005) refers to the dorsal denticle being distinct or reduced and there being no ventral denticle i.e. it is more or less distinctly bifid or more or less single. He also discusses variability in the species and a number of named forms that have been described by various authors including some with two distinct denticles on the female genital claw. Brölemann (1930) describes forms with one or both denticles but his picture is of an animal with a simple claw. It does seem, at the present time, that it would not be wise to put too much reliance on structure of the gonopod claw alone as the only way of separating the two species.

Spinulation: Eason (1965) discusses spinulation in *L. tricuspis* and notes that one of his specimens lacks the spine 15VaC (which is not present in *L. melanops*). However, Brölemann (1930) in his key to lithobiomorphs and, more recently, Iorio & Labroche (2015) & Iorio & Voigtländer (2019) use the presence of this spine as a key character separating *L. tricuspis* / *L. agilis* from *L. macilentus* / *L. melanops* etc. It may, therefore, be best to regard the presence of 15VaC as a good indicator of *L. tricuspis* but maybe its absence should not rule that species out altogether.

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FIRST RECORD OF *CHAETOPHILOSCIA CELLARIA* (DOLLFUS, 1884) FROM THE CHANNEL ISLANDS (ISOPODA: ONISCIDEA: PHILOSCIIDAE)

Steve J. Gregory[1] & Andy Marquis[2]

[1] 4 Mount Pleasant, Church Street, East Hendred, Oxfordshire, OX12 8LA, UK.
E-mail: stevejgregory@btopenworld.com

[2] Laurel Cottage, Camp du Roi, St Sampsons, Guernsey, GY2 4XG.
E-mail: andymarquis@hotmail.com

ABSTRACT

The woodlouse *Chaetophiloscia cellaria* (Dollfus) is reported for the first time from Guernsey, Channel Islands. A brief description with illustrations is provided to enable identification and information is given about habitats and microsites inhabited and associated species. *C. cellaria* appears to be undergoing an expansion of range into north-west Europe and is probably a recent colonist of the Channel Islands, aided by human activity. It may be just a matter of time before it is found on the south coast of England.

Key words: Isopoda, Oniscidea, *Chaetophiloscia cellaria*, Channel Islands, identification, habitat.

INTRODUCTION

Three species of *Chaetophiloscia* Verhoeff 1908 are known from France (Séchet & Noël, 2015). All three originate for the Mediterranean basin (Vandel, 1962). The 'expansive' *C. elongata* (Dolfuss) has long been known to occur as far north Brittany (Vandel, 1962), but in recent decades both *C. cellaria* (Dollfus) and *C. sicula* Verhoeff also have expanded their ranges northwards (Noël *et al*., 2014; Séchet & Noël, 2007; 2015). None of these species have been reported as being naturalised in the UK.

Jones & Pratley (1987) report the collection of two female specimens of a *Chaetophiloscia* species from the outdoor ornamental gardens on Tresco, Isles of Scilly (SV81) in 1985 and 1986. The whereabouts of these specimens is uncertain and no further collections have been made since that date so it has not been possible to name this species. More recently, *C. sicula* has been collected inside the Mediterranean Biome of the Eden Project in Cornwall in 2005 and 2010 (Gregory, 2014), but it has not become naturalised outside.

The Channel Islands are British crown dependencies located about 30 miles (48 km) west of Normandy, France. Traditionally, biological recording schemes for the British Isles have included the Channel Islands which are included within many published distribution atlases, including that for Woodlice and Waterlice (Gregory, 2009).

DISCOVERY

In January 2019, while looking through photographs taken the previous year, AM encountered images of an unfamiliar woodlouse. This specimen was photographed in May 2018 in a domestic garden in St. Sampsons on the Island of Guernsey (49.47978N -2.55769W). The images were posted on the *Isopods and Myriapods of Britain and Ireland* group for identification, where it was provisionally identified as *Chaetophiloscia cellaria* (Dollfus, 1884) on the basis of body pigmentation patterns. This determination was promptly confirmed by Franck Noël (pers. comm. to SJG). On 17th February 2019 a second specimen, a female, was hand sorted by AM from leaf-litter collected from the same garden. Then, on

24th March a male specimen was collected from the upper shoreline at La Croix Bay, Vale (49.50098N -2.50446W), about 4.5km to the north east. This individual was discovered on the underside of a rock at the top of a shingle and stone beach. It didn't move when disturbed (unlike the associated *Halophiloscia couchii* Kinahan) so it was collected for a closer examination.

These latter two specimens were forwarded to SJG for examination. These are the first recorded occurrences of *C. cellaria* from the Channel Islands, or indeed the British Isles. Details of the records are listed in Table 1.

TABLE 1: Records of *Chaetophiloscia cellaria* from Guernsey

* Material examined in this paper

Locality	Habitat	Lat/Long	Number of specimens	Date of collection
Camp du Roi, St Sampsons	Domestic garden	49.47978N -2.55769W	Image only	May 2018
			1♀*	17.ii.2019
			1♀	18.iv.2019
			1♂	18.v.2019
La Croix Bay, Vale	Shingle beach, upper shore	49.50098N -2.50446W	1♂*	24.iii.2019

IDENTIFICATION

Taxonomy

Section Crinocheta

Family Philosciidae

Chaetophiloscia cellaria (Dollfus, 1884)

= *Philoscia cellaria* Dollfus, 1884

= *Chaetophiloscia italica* (Verhoeff, 1901)

= *Neophiloscia magnopunctata* Strouhal, 1929

= *Chaetophiloscia pallida* Verhoeff, 1928

= *Chaetophiloscia piligera* Verhoeff, 1908

Diagnosis

Chaetophiloscia cellaria is a relatively well pigmented, fast running, woodlouse, with a strongly discontinuous (stepped) pereion-pleon body outline and an antennal flagellum composed of three articles. Thus, it is reminiscent of *Philoscia* sp., and indeed the speckled brown head could cause confusion with *Philoscia affinis* Verhoeff. However, the conspicuous orange corners to the posterior angles of the last pereionite (most obvious in live specimens) are characteristic of *C. cellaria*. The shape of male first pleopod is diagnostic.

Details of how to differentiate the three French species of *Chaetophiloscia* is given by Séchet & Noël (2007) and Noël & Séchet (2007).

Description

This brief description is based on a male and female specimen collected from Guernsey freshly preserved in 95% ethanol (Table 1; Figs. 1A-C; 2A-C).

Figure 1: *Chaetophiloscia cellaria*, habitus of three specimens from Guernsey
A) Specimen photographed May 2018; B) Female collected 17.ii.2019; C) Male collected 24.iii.2019.

Figure 2: *Chaetophiloscia cellaria* from Guernsey.
A) Peon and telson (arrowed), and orange 'patch' on 7th pereionite (arrowed); B) Head and ommatidia; C) Antennal flagellum of three articles; D) Male 1st endopods; E) Male, tip 1st endopod.

The male examined (Fig. 1C) is 4.5 mm in length by 2.1 mm wide; the female (Fig. 1B) is 5.5 mm in length by 2.3 mm wide. Séchet & Noël (2007) give a range 5-8 mm for specimens collected from north-west France and consider *C. cellaria* to be relatively broader that it's congeners, notably *C. elongata*. The cephalon bears feebly developed median and lateral lobes. The eye comprises about 15 well pigmented ommatidia (Fig. 2B) (*C. elongata* and *C. sicula* have c. 25) and the antennal flagellum comprises three elongated articles (Fig. 2C).

The dorsal surface is smooth, but bears numerous scattered short 'hairs' (Fig. 1A). The cephalon, pereionites and pleon are brown with conspicuous pale mottling and a hint of a darker central longitudinal stripe where the gut shows through. In the male specimen, which is less well pigmented, this mottling is noticeably orange across the central areas of pereionites 1 to 3. In addition each pereionite bears a distinct oval white spot close to the lateral margin and a conspicuous (in life) orange spot occupies the posterior angle of the last (7th) pereionite (Fig. 2A, arrowed). This latter feature is considered diagnostic of *C. cellaria* (Séchet & Noël, 2007), but in the two specimens examined it appears to fade upon preservation in alcohol. It should also be noted that some populations inhabiting subterranean habitats may exhibit depigmentation, to a greater or lesser extent (*ibid*).

The pleon is much narrower than pereion, producing a strongly stepped body outline, which is typical of Philosciids in general. Each pleonite bears a feeble, barely discernible, backward projecting 'tooth' at its lateral-posterior corner, typical of *Chaetophiloscia* sp. in general. The telson has a characteristically rounded tip (Fig. 2A, arrowed) (other species of *Chaetophiloscia* and *Philoscia* have a more angular, distinctly pointed, tip to the telson).

The male first pleopod (Figs. 2D & 2E) characteristically tapers to a sharp point, which, in the single specimen examined, bears a row prominent denticulations on its inner and outer edges. According to Vandel (1962) these prominent 'teeth' are most prevalent in specimens from the Mediterranean area.

DISTRIBUTION AND HABITATS

Channel Islands

Currently, *Chaetophiloscia cellaria* has been recorded from two sites on Guernsey, albeit in contrasting habitats; a domestic garden at St Sampsons and the upper shore of a shingle beach at La Croix Bay, Vale, some 4.5 km apart.

The domestic garden contains mostly native plant species, with no plants having been imported within the last four years. However, there is evidence of a possible glasshouse on the site perhaps dating to back to before 1970. The first female *C. cellaria* was hand sorted from bag of leaf-litter collected from a dark damp corner behind a garden shed. Subsequently (Table 1), a second female was also found in the same location, but beneath an old refugia, and a male specimen from beneath an old dry log sitting on gravel in a different part of the garden. Other woodlice present in the garden include the ubiquitous species *Trichoniscus pusillus* agg., *Philoscia muscorum* (Scopoli), *Porcellio scaber* Latreille and *Armadillidium vulgare* (Latreille), but also *Haplophthalmus danicus* Budde-Lund, *Platyarthrus hoffmannseggii* Brandt, *Porcellionides pruinosus* (Brandt), *P. cingendus* (Kinahan) and the occasional *Oniscus asellus* (Linné).

The second site, a shingle and stone beach is being surveyed for Scaly Cricket *Pseudomogoplistes vicentae* Gorochov with pitfall traps in the shingle and hand searches under rocks. Above the beach are low mud cliffs (<1m high) with evidence of erosion from storm surges gouging deep holes (<1m) into these. Land above consists of pasture with typical coastal grasses at the edges, currently grazed by horses. The single male *C. cellaria* was found under a stone at the top of the beach at the base of the low

cliffs. Associated woodlice were *Ligia oceanica* (Linné)*, Halophiloscia couchii, P. muscorum, P. scaber, A. vulgare* and *P. cingendus*. The centipede *Pachymerium ferrugineum* (C.L.Koch) was also collected.

The pseudoscorpion *Chthonius (Ephippiochthonius) tetrachelatus* (Preyssler) was recorded at both sites.

Elsewhere in Europe

Although once considered a species of the northern Mediterranean basin (e.g. Vandel, 1962), *Chaetophiloscia cellaria* seems to be undergoing a northwards expansion of range within France (Séchet & Noël, 2015) and now occupies many areas in north of the country, both on the coast and inland. The INPN database (Muséum National d'Histoire Naturelle, 2003-2019) includes several records from coastal areas of the départements of Manche (in Normandy) and Finistère and Morbihan (further west in Brittany). There is also a recent record from the département of Ille-et-Vilaine in Brittany (pers. comm., F. Noël).

In the south of France *C. cellaria* is often epigeal occurring under stones or among leaf-litter and detritus, but also inhabiting limestone screes and may be found many tens of metres inside caves (Séchet & Noël, 2015). It is thought to have spread northwards along the coast aided by human activity. In north-west France (Armorican Massif) it is typically found in cellars (under debris or on walls), in the entrances of underground cavities or within dwellings (i.e. relatively dark and damp places), but also among debris in gardens and greenhouses (Séchet & Noël, 2007). In such synanthropic locations it is often associated with *C. elongata* and *C. sicula* (Séchet & Noël, 2015).

These habitats and associated microsites are in keeping with observations of this species on Guernsey.

CONCLUSION

Given the close proximity of recently discovered sites for *Chaetophiloscia cellaria* on the northern coast of France then its occurrence on Guernsey is not unexpected. It also should be expected to occur on other Channel Islands, such as Jersey, both in coastal habitats and synanthropic sites, such as gardens. In light of its documented northward spread, it is perhaps just be a matter of time before it is discovered on the south coast of England, and associated islands.

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OBSERVATIONS ON TWO WOODLOUSE SPECIES (ISOPODA; ONISCIDEA) NEW TO NORTH WALES: *METATRICHONISCOIDES CELTICUS* OLIVER & TREW, 1981 AND *PHILOSCIA AFFINIS* VERHOEFF, 1908

Thomas D. Hughes
E-mail: td.hughes@yahoo.com

ABSTRACT

The terrestrial woodlice *Metatrichoniscoides celticus* Oliver & Trew, 1981 and *Philoscia affinis* Verhoeff, 1908 are reported as new to North Wales. *M. celticus* is recorded at its 5th confirmed location in Britain from heathland surrounding Mariandyrys NNR, Anglesey. All previously known records of this elusive endemic are restricted to the south coast of Wales. *P. affinis* is also recorded at its 7th British site in woodland on Roman Camp, Bangor, Gwynedd, after being discovered new to Britain in 2017. A description with illustrations is provided for both, as well as an updated discussion of habitat preferences based on these new observations.

INTRODUCTION

Woodlice are considered to be the most successful group of terrestrial crustaceans, occupying most of the world's land masses and ecoregions (Schmalfuss, 2004). Although species richness appears to decrease at higher latitudes within Europe (Sfenthourakis & Hornung, 2018), the United Kingdom still boasts c.40 native and naturalised woodlouse species (Gregory, 2009). Despite this relatively high diversity, there is still a considerable lack of records for many parts of the UK, especially from more remote regions.

One such area is North Wales, which is comprised of six counties: Anglesey, Conwy, Denbighshire, Flintshire, Gwynedd and Wrexham. Since the beginning of woodlouse recording in the UK, only one comprehensive survey of the area has ever been conducted. This study took place in Bangor, Gwynedd in 1985 by the British Isopoda Study Group (BISG) and recorded a total of 17 native species (Hopkin, 1985). Further sources confirmed the presence of *Armadillidium depressum* (Clements & Alexander, 1987), *A. nasatum* (Larwood, 1920), *A. pulchellum* (Fussey, 1980), *Porcellio dilatatus* (Fussey, 1981) and *Trichoniscoides saeroeensis* (Loxton, 2008), bringing the current North Wales species list to 22.

Surprised by the lack of modern records, random sampling was undertaken by the author at different locations around Bangor, Gwynedd starting in October 2018 to update and provide new records for the area. As a result, two notably significant and under-recorded species; *Metatrichoniscoides celticus* and *Philoscia affinis,* are described as new to North Wales.

DESCRIPTION

Family Trichoniscidae

Metatrichoniscoides celticus Oliver & Trew, 1981

On 24.ii.2019, one male and one female blind Trichoniscoid woodlouse were found under embedded limestone blocks, alongside *Haplophthalmus mengii* (Zaddach) and *Trichoniscus pygmaeus* Sars in heathland around the Mariandyrys NNR (SSSI) (SH 6019 8102) in the south east of Anglesey, 0.8 km from the coast. Both individuals were collected and examined under dissection microscope and were provisionally identified as a *Metatrichoniscoides spp.* Vandel, due to the lack of ommatidia and the coarsely tuberculate body (Figs. 1A, 1B).

Figure 1: Male *Metatrichoniscoides celticus* from Mariandyrys, Anglesey
A) Habitus, dorsal view; B) Habitus, ventral view; C) Pleopod 1, distal articles of endopodite and exopodite; D) Pleopod 2, with distal articles of both endopodites.

There are two confirmed members of the genus *Metatrichoniscoides* in Britain; *M. celticus,* which is a British endemic and is found at four localities along the south coast of Wales (Oliver & Trew, 1981; Chater, 1986), and *M. leydigii* (Weber)*,* known from three localities: a garden centre in Oxfordshire (Gregory & Campbell, 1995), an ornamental garden in Derbyshire (Richards, 2016) and a single male collected from the seminatural banks of the River Medway, Kent (Gregory, 2012). *M. leydigii* is also widespread in Northern Europe, occurring in France, Belgium, the Netherlands and Germany (Schmalfuss, 2004).

The male specimen from Mariandyrys was sent to Steve Gregory within days of discovery for dissection, and was identified as *M. celticus* due to the male genital characteristics.

Appearance

Adult size varies between 0.9-2.3 mm, with males typically being smaller (Oliver & Trew, 1981) - The male specimen from Mariandyrys (Figs. 1A, 1B) measured 1.75 mm. The entire body is off-white and translucent, with some longitudinal opaque white subcuticular patterning near the dorsoventral region. The dorsum is also noticeably covered with course tubercles, and the ommatidia is entirely lacking.

Male Sexual Characteristics

Pleopods 1 and 2 match those figured in Oliver & Trew (1981). The exopodites of pleopod 1 are terminated with distal processes ('tails') of uneven lengths. The shorter distal region of the endopodites are spearhead shaped with tightly packed outwardly facing bristles (Fig. 1C). The endopodites of pleopod 2 are tipped with hooks and the exopodites are greatly reduced (Fig. 1D).

Distribution

Confirmed males of *M. celticus* have only been known from four sites along the south coast of Wales; in the Vale of Glamorgan between Ogmore-by-the-sea and Nash Point, as well as in an abandoned limestone quarry in Crwbin, 50 km west from the type locality (Oliver & Trew, 1981; Chater, 1986). Due to this limited distribution range (only 63 km), as well as its elusiveness and small population size, *M. celticus* has been listed as Vulnerable by the IUCN (Griffiths, 1996).

Therefore the male specimen confirmed here drastically extends the known range by a further 170 km from its closest known location at Crwbin. A further female *Metatrichonisoides* was also found on 17.ii.2019 by the author at the Great Orme, Llandudno, Conwy (SH76628296) 16 km North East from Mariandyrys and is highly likely to represent another record for this species due to its close proximity.

Habitat

M. celticus was originally referred to as a supra-littoral species, being found under deeply embedded boulders on the upper shore where exposed humus-rich soil erodes from grassy or un-vegetated banks (Oliver & Trew, 1981). Although this is true of the type localities, the specimens found inland at Crwbin were underneath large semi-embedded limestone boulders in stony soil, suggesting a much broader habitat preference (Chater, 1986).

Female representatives that are believed to be *M. celticus* have also been found at St Bees Head in Cumberland (Hopkin, 1987), and Giant's Causeway, Co. Antrim, Ireland (Irwin, 1992). But due to their unconfirmed identification, it may be unwise to factor them in to determine habitat choice. There is however, considerable similarity between the geology of all confirmed records of *M. celticus* in Wales. Those of the type locality between Ogmore-by-the-sea and Nash point are situated on an extensive area of Limestone of the Portkerry Member (Lias Group) (BGS, 2017). The Crwbin quarry record is nestled directly on a very narrow band of the Pembroke Limestone Group which runs from North East to South

West towards the coast at Kidwelly (BGS, 2017). The new records from Mariandyrys is situated on the Loggerheads Limestone Formation which outcrops on the South Eastern tip of Anglesey, and the unconfirmed female representative from the Great Orme is found on Cefn Mawr Limestone Formation which makes up the headland and closely surrounding peaks of Llandudno (BGS, 2017). It is therefore possible to speculate that *M. celticus* has a preference for calcareous geology with alkaline-humus rich soil, on or near the coast.

Further efforts to locate this species in the United Kingdom, or even the northern coastlines of France and Spain, could be focused on regions with shallow calcareous bedrock.

Family Philoscidae

Philoscia affinis Verhoeff, 1908

While sampling for woodlice at Roman Camp, Bangor (SH58087270) on 24.xi.2018, a large number of *Philoscia spp.* Latreille, were found in acidic, mixed, predominantly oak (*Quercus spp*.) and birch (*Betula spp.)* woodland amongst leaf litter and under logs, alongside *Oniscus asellus, Porcellio scaber* and *Trichoniscus pusillus agg.*. Several individuals were taken for examination (Fig. 2) to determine the possibility of these being the recently discovered British native *P. affinis*, as opposed to the widespread and ubiquitous *P. muscorum* (Scopoli).

Specimens were confirmed without difficulty to be *P. affinis* after examination of the male 7th pereiopod under dissection microscope.

Appearance

Figs. 2 & 3. Five males from Roman Camp were measured with an average length of 6 mm. The females typically varied extensively in size but did not exceed a length greater than 11 mm. The body of *P. affinis* has a stepped outline and is entirely smooth, lacking tuberculation or hairs. Pleopodal lungs are entirely absent and the flagella segments of the antennae are divided into three. The head colouration is typically pigmented with two shades of brown, with the lighter being distributed as a mosaic pattern, the head is also non-distinct from the colouration of the rest of the body and typically lacks the yellow spot on the rear edge of the head usually seen in *P. muscorum. P. affinis* also appears to have a white stained dot on the lower frontal edge of each epimeron, however this isn't always present in some of the reddish brown or yellow colour variants.

Figure 2: Male and female *P. affinis* from Roman Camp, Bangor, Gwynedd

Figure 3: Female *P. affinis* from Bangor Mountain, Bangor, Gwynedd
A) Dorsal view; B) Ventral view

Figure 4: 7th male pereiopod with the erect spur of the merus arrowed

Male Sexual Characteristics

P. affinis can be identified by the erect spur on the lower joint of the merus of the 7th male pereiopod in lateral view (Fig. 4) (Vandel, 1962; Segers & Boeraeve *et al*., 2018).

Distribution

Since its initial discovery in 2017 from old museum specimens collected in south east England in 1985 (Segers *et al*., 2018), 6 further confirmed sites have been made across the UK from Western Scotland down to South West England. Although there are currently few records it is likely this species is widespread, with what seems to be a south westerly distribution trend.

Therefore, the Roman Camp observation fills a gap in the current records. *P. affinis* has since been found by the author at several adjacent woodlands in the Bangor area, including Bangor Mountain (SH58301 71988) on the 7.ii.2019 (female Fig. 3) as well as being found among coastal shingle on the 9.ii.2019 at the Spinnies Aberogwen (SH6172272453).

Habitat

Vandel (1962) found that *P. affinis* frequented damp forests in France, and recent records from Belgium suggested that it may favour moderately damp oak woodland (Boeraeve *et al*., 2017). Specimens collected by Segers, *et al.* (2018) from Houghton, West Sussex were situated on lime-rich soil over chalk and limestone, amongst beech trees (*Fagus sylvatica*). *P. affinis* collected by Garnham (2019) from several sites across Cumbria show similar habitat trends. Records include: Warton Crag, Carnforth from mixed woodland including ash (*Fraxinus excelsior*), oak, hazel (*Corylus avenula*), yew (*Taxus baccata*), holly (*Ilex aquifolium*), hawthorn (*Crataegus monogyna*) and blackthorn (*Prunus spinosa*). Lords Lot, Carnforth from oak, beech and scot's pine (*Pinus sylvestris*) woodland and at Trowbarrow NR, Carnforth from mixed woodland containing sycamore (*Acer pseudoplatanus*), yew, oak and ash. The specimens from Roman Camp, Bangor, were collected from an east facing hillside in oak and birch dominated woodland, with occasional ash, yew and holly trees on moderately damp soil over the Llanberis Slates (BGS, 2017). In comparison, the individual encountered at Spinnies, Aberogwen, occurred in a seemingly uncharacteristic environment compared to the later records. However, the north-facing coastal shingle they were collected from backed immediately onto mixed woodland, containing oak, beech and hawthorn, where leaf litter material of the respective trees had congregated between the pebbles.

The records with accessible habitat data above suggest *P. affinis* prefers relatively damp mixed woodland, dominated by either oak, beech or a mix of the two, with rock type appearing to have little influence.

Although no significant inland records have been made so far within Britain, it is likely that coastal woodlands should (according to current records) be favoured to search for this species.

OVERVIEW OF RECORDS

Metatrichoniscoides celticus: Mariandyrys, Anglesey, Wales: SH60198102, 24.ii.2019, 1♂, 1♀**,** Thomas Hughes leg., Steve Gregory, det.

Metatrichoniscoides cf. celticus: Great Orme, Llandudno, Conwy, Wales: SH76628296, 17.ii.2019, 1♀**,** Thomas Hughes leg./det.

Philoscia affinis: Roman Camp, Bangor, Gwynedd, Wales: SH58087270, 24.xi.2018, 5♂, 8♀**,** Thomas Hughes leg./det.

Philoscia affinis: Bangor Mountain, Penrhyn Arms Wood, Bangor, Gwynedd, Wales: SH58301 71988, 7.ii.2019, 2♂, 4♀**,** Thomas Hughes leg./det.

Philoscia affinis: Spinnies Aberogwen, Bangor, Gwnedd, Wales: SH6172272453, 9.ii.2019, 2♂, Thomas Hughes leg./det.

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PHILOSCIA AFFINIS VERHOEFF, 1908 (ISOPODA: PHILOSCIIDAE) NEW TO IRELAND

Roy Anderson

1 Belvoirview Park, Belfast BT8 7BL, Northern Ireland (UK).
E-mail: roy.anderson@ntlworld.com

Segers *et al.* (2018) reported the first confirmed finds of *Philoscia affinis* Verhoeff for the UK, in Greater London and West Sussex. Since then the species has been confirmed from near Oban, western Scotland and from Slapton Ley, South Devon (Gregory, 2018).

Steve Gregory contacted me in February 2018 to suggest that I look for *P. affinis* in Ireland. My searches got off to a slow start and it wasn't until I was asked to survey some rich fen sites in Co. Down in September that progress was made. Males in a collection taken from fen margins and planted oak woodland at Turmennan (J48525004) east Co. Down on 12 September were all of the *P. affinis* type with a hooked outstanding spine at the base of the merus of the seventh pereiopod. Both males and females showed pigmentation typical of *P. affinis* with mottled brownish shades predominating especially on the head and with a lack of brighter, reddish stripes on the pereion. However, within a 400m radius of Turmennan, away from the fen margins, specimens were found with a colour pattern more typical of the *muscorum* type including dark heads and brighter pereion margins but which nevertheless had distinct spines on the merus of males.

In addition, specimens of *Philoscia* were collected during October and November from several sites in and around Belfast and produced some interesting results. Collections from the site of a megalithic monument, the Giant's Ring (J32686778), in artificially maintained grassland, the Harbour Estate in Belfast (J37357822) among wooden planks on basaltic infill, and Morelands Meadow, a grazed fenny meadow beside the River Lagan west of Belfast (J33786986), were examined. The specimens from these sites possessed typical *P. muscorum* colouration with uniformly dark heads and splashes of reddish on the pereion margins. However, males at all three sites had curved spines on the merus of the last pereiopod. At first I thought that these must be *P. affinis* but in discussion with Steve Gregory and a German specialist Jörg Spelda of the Zoologische Staatssammlung München, it transpired that although the literature suggests that the meral spine in *P. muscorum* is depressed into the body of the merus the distinction may be more due to orientation of the spine than any other factor.

The difference in orientation of the meral spine became obvious when comparing specimens of *P. affinis* with *P. muscorum* in my possession. Thus, males in the sample of *P. affinis* from Turmennan Fen had a meral spine which jutted out conspicuously from the merus *when viewed from the side of the animal*. But males from the other three sites plus the area away from the edge of Turmennan Fen with typical *muscorum* coloured individuals showed no such outstanding spines when viewed from the side. My initial confusion arose from viewing these specimens *from below* when the meral spines could be clearly seen but were projecting inwards towards the mid-line of the animal. These are almost invisible from side view in *P. muscorum*. Their presence nevertheless led me to initially misinterpret the situation, not being aware that the mere possession of open meral spines is inconclusive. The last (7^{th}) pereiopod in specimens being examined should always be viewed from the side to see the diagnostic spines, rather than from below (which I did) as the latter viewpoint will reveal inward jutting spines in specimens of *P. muscorum* that may cause confusion.

Further sites for *P. affinis* have now come to light. The first of these, visited on 23 November, is McArt's Fort (J32487958) a Stone Age mounded fort on Cave Hill which overlooks the city and stands

at about 1200 feet in altitude. This is significant because of the altitude and the rather peaty upland heath in which it is situated. The population here showed typical *P. affinis* colouration i.e. pale mottling in shades mainly of brown, which correlated with a meral hook in males which could clearly be seen on the seventh pereiopod viewed from the side. A second fen site, Corbally Ponds Fen SAC (J451386) in Co Down, has since been visited and found to have a population of *Philoscia affinis*. This fen is rather more alkaline than Turmennan and has a large population of the endangered Desmoulin's whorl snail *Vertigo moulinsiana* (Dupuy). While surveying for Desmoulin's snail, individuals of *P. affinis* were found at the roots of vegetation and moss along the full length of a 600 m transect on the fen, varying in abundance from occasional to frequent (17 October, 11 December 2018).

DISCUSSION

It is clear that that the form of the meral spine is indeed a reliable feature which can distinguish between *Philoscia affinis* and *P. muscorum*. But it should be remembered that the orientation of the spine is important and differs between the species. The way that specimens are viewed therefore becomes critical for identification.

The three sites from which *P. affinis* is so far known in Ireland comprise undisturbed wetland habitat ranging from montane heath to lowland transition fen. It appears to be absent from more disturbed or 'managed' grassland sites and has not so far been found in ancient woodland. Though probably a natural part of the Irish fauna it is too early to define its exact habitat requirements.

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ARMADILLIDIUM PULCHELLUM (ZENKER, 1798), A NEW RECORD OF PILL WOODLOUSE (CRUSTACEA: ISOPODA: ONISCIDEA) FOR THE FAUNA OF *BELARUS*

Artsiom Ostrovsky

Gomel State Medical University, Lange str. 5, Gomel, 246000 Republic of Belarus.
E-mail: Arti301989@mail.ru

Key words: Isopoda, Oniscidea, Armadillidiidae, *Armadillidium pulchellum*, new record, Republic of Belarus.

ABSTRACT

Findings of *Armadillidium pulchellum* (Zenker, 1798), a new species of woodlouse of the family Armadillidiidae for the fauna of Belarus, are analyzed. The material was collected in August 2007 in Minsk Region. Data on distribution of the species are given.

INTRODUCTION

Among the edaphic organisms, terrestrial isopods are fundamental representatives of the soil fauna, playing an important role in decomposition of leaf litter and in mineralizing organic matter (Sutton, 1980). Despite the fact that representatives of this group are extremely widespread and well visible, they are rather poorly studied in our country. Until now, 2 publications reported about Belorussian woodlice. Maximova (2005) mentioned only 4 species of woodlice from Belarus; Kuznetsova & Gongalsky (2012) published data about 8 species from different localities, two of which are now considered to be synonymous, which leaves 7 species. The Fauna Europaea database (Boxshall, 2013) contains a single species of terrestrial isopod – *Oniscus asellus* Linnaeus, 1758. However, these check-lists are not based on known publications or collections and their presence should be evaluated as doubtful or anticipated. This implies that the full species composition of woodlice of Belarus has not been clarified to yet.

RESULTS

Section CRINOCHETA

Family ARMADILLIDIIDAE Brandt, 1833

Armadillidium pulchellum (Zenker, 1798)

Material examined

Fig. 1. 2♀♀ mars., Republic of Belarus, Minsk Region, vill. Goncharovka, 22.viii.2007, O.R. Aleksandrowicz leg., A.M. Ostrovsky det., 2018. The samples treated above have been deposited in the author's collection.

Distribution

Fig. 2. Europe except the Mediterranean and southeastern regions (Schmalfuss, 2003). Currently known from Belgium, British Isles, Czech Republic, Danish mainland, Finland, French mainland, Germany, Ireland, Latvia, Lithuania, Luxembourg, Northern Ireland, Norwegian mainland, Poland, Sweden, Switzerland, The Netherlands, Kaliningrad Region of Russia and Zhytomyr Region of Ukraine [Spungis, 2008; Šatkauskienė, 2017; Tuf *et al*., 2014; Vilisics *et al*., 2012a, 2012b; Hopkin, 1991; Harding, Sutton, 1985; Riedel *et al*., 2009; Vandel, 1962; Vilisics & Terhivuo, 2009; Štrichelová & Tuf, 2012; Khaynatska & Garbar, 2015; Weber, 2013; Séchet & Noël, 2015; Noël & Séchet, 2007;

Alexander, 2000; Berg, 1997; Berg & Wijnhoven, 1997; Gruner, 1966; Wouters *et al*., 2000; Jedryczkowski, 1981; Urbański, 1952; Malinkova, 2009].

Remarks

The family Armadillidiidae, the genus Armadillidium Brandt, 1831, as well as the widespread, often introduced *A. pulchellum* (Zenker, 1798), are new to the woodlice fauna of Belarus, currently reported from anthropogenic habitats. The finding of *A. pulchellum* is probably evidence of the continued spread of this species into the east of Europe. Its colonisation into new habitats is possible, for example, with the soil brought with planting material.

Figure 1: *Armadillidium pulchellum* (Zenker, 1798), from Belarus, general view.

CONCLUSIONS

The family, genus and species of the Pill Woodlouse are formally new to Belorussia's list: Armadillidiidae, *Armadillidium* Brandt, 1831, and *Armadillidium pulchellum* (Zenker, 1798). This species is probably introduced through human activity.

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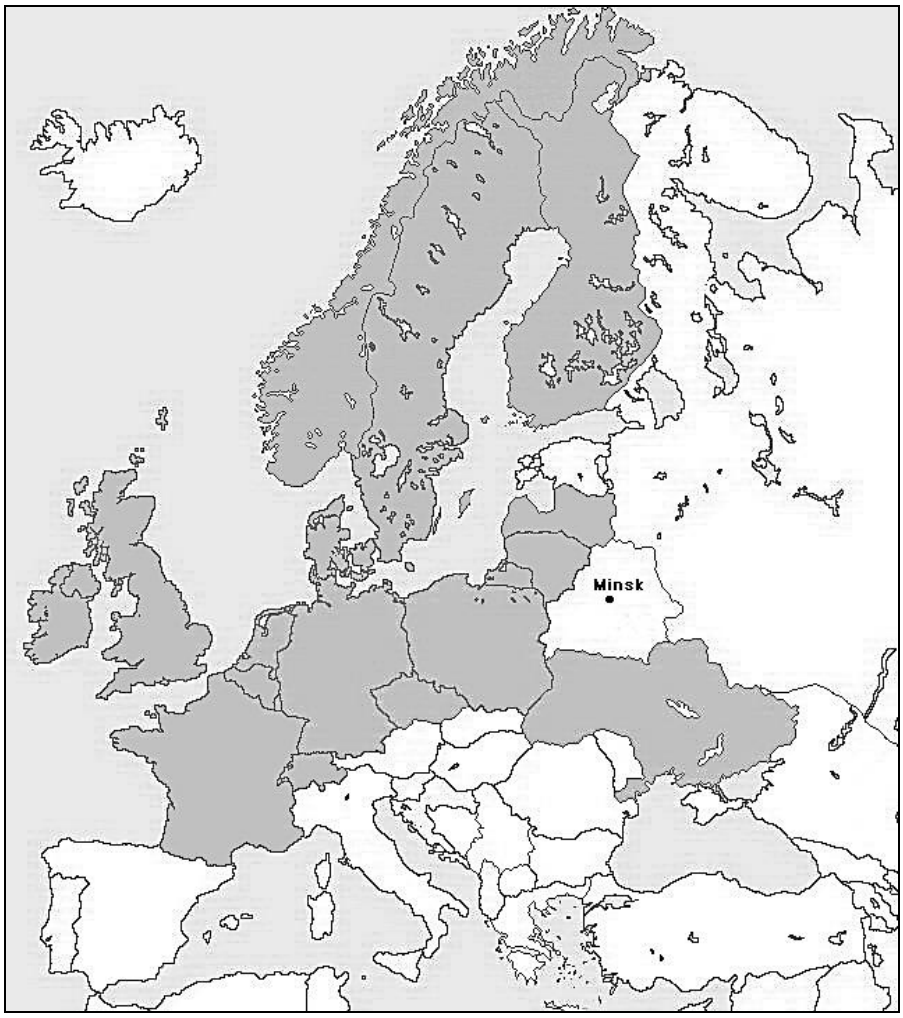

Figure 2: Distribution map of *Armadillidium pulchellum* (Zenker, 1798) in West Palaearctic region with new date from Belarus (grey – species present; white – absent; black dot – new record)

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OBITUARIES

In the last few years several eminent Myriapodologists have passed away.

OTTO KRAUS

1930–2017

Distinguished authority on zoological systematics, particularly of arachnids and myriapods, Professor Dr Otto Kraus died on 24 October 2017, at the age of 87. Born in Frankfurt am Main on 17 May 1930, his involvement in zoology began during his studies at the University of Frankfurt in the 1950s. He volunteered at the Senckenberg Museum, where he learnt a great deal about systematics and collections. After obtaining his PhD on spiders and myriapods from El Salvador, he gained employment in the newly established Arachnology Section at the Senckenberg Museum (Grasshoff & Jäger, 2005). He headed the section for invertebrates at the Senckenberg Museum between 1963 and 1969, and received his habilitation in zoology in 1965 on the biogeography of Myriapoda. In 1969, Professor Kraus moved to Hamburg to take up the position of director of the Zoological Institute and Zoological Museum of the University of Hamburg (he became emeritus in 1995), in which city he remained for the rest of his life.

As well as his museum work, Professor Kraus taught a wide range of course in zoology, including biodiversity, systematics, evolution, and biogeography, with an emphasis, of course, on arthropods. He edited the journals of the *Naturwissenschaftlicher Verein in Hamburg* (now in its 180th year), and was its president from 1970 to 1974. He used the journals to publish the proceedings of numerous conferences, many of which he organized. For example, the 3rd International Congress on Myriapodology was held in Hamburg in 1975 and its papers were published in *Abhandlungen und Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg*. The 20th *Phylogenetische Symposion*, held in Hamburg in 1975 (theme: Co-evolution), was published as a special volume (Sonderband) of the society, the 21st *Phylogenetische Symposion* in Göttingen 1976 (theme: Phylogeny of Arthropods) was published in the *Abhandlungen*, and *Zoologische Systematik in Mitteleuropa* was published as a Sonderband. Kraus was three times president of the Joachim-Jungius-Gesellschaft der Wissenschaften in Hamburg: 1978–1982, 1996–1997, and 1998–1999. Professor Kraus served as a commissioner 1963–1995 and as president 1989–1995 of the International Commission on Zoological Nomenclature (ICZN), after which he served as a trustee of the International Trust for Zoological Nomenclature. During his time at ICZN, he oversaw the 4th edition of the Code, and was the driving force behind translating it into German.

The myriapodological work of Otto Kraus began early in his career: some of his first publications were on myriapods from South and Central America, which formed a large part of his doctoral dissertation. He also had interests in the African fauna, and published some works on myriapods from that continent. Later publications became more reflective upon general features of the myriapods: where they fit in the scheme of invertebrate phylogeny, and the fossil history of the Myriapoda. Otto Kraus was involved in

the organization of European myriapodology from its beginning. He attended the First International Congress of Myriapodology, which was held in the Natural History Museum in Paris on 8th–13th April 1968, concurrently with the Fourth International Congress of Arachnology. It was at this meeting that the Centre International de Myriapodologie was established. Professor Kraus hosted the Third International Congress of Myriapodology in Hamburg in 1975.

Professor Kraus's scientific work ranged widely across systematics, morphology, evolution, and beyond. We remember him particularly for his insightful contributions to congress proceedings, usually on fundamental problems in arthropod groups. The British Arachnological Society hosted the 17th European Colloquium of Arachnology in Edinburgh in 1997, at which Professor Kraus gave an invited presentation on phylogenetic systematics versus cladistic techniques, and he contributed a seminal work on Palaeozoic Diplopoda to the Second International Congress of Myriapodology in Manchester 1972. Otto Kraus contributed to the famous German encyclopaedia *Grzimeks Tierleben*, and translated Ernst Mayr's 1969 *Principles of Systematic Zoology* into German. He was also active against creationism, and edited the volume *Evolutionstheorie und Kreationismus—ein Gegensatz*. From 1977 to 1980 he was editor of the journal *Zoomorphology*. Among his approximately 190 publications (listed in Jäger *et al*. 2018), he wrote not only on his favourite Araneae and Diplopoda, but also on other arachnid orders, Chilopoda, insects, fossils, and even molluscs and mastodons.

Professor Kraus was honoured by a number of organizations, including nomination as a corresponding member of the Senckenberg Gesellschaft für Naturforschung in 1970. He was an honorary member of the Naturwissenschaftlicher Verein in Hamburg, the International Society of Myriapodology, the British Arachnological Society, Arachnologische Gesellschaft, the International Society of Arachnology, and Societas pro Fauna et Flora Fennica (Finland). In 2006 he was appointed to the Akademie Gemeinnütziger Wissenschaften zu Erfurt, and was awarded the Ehrenbrief by that society in 2011. As Vertrauensdozent of the Studienstiftung des Deutschen Volkes, Otto Kraus supported and advised many high-flying students. He was an advocate of traditional scientific illustration and published a short note about it.

Professor Kraus was laid to rest in Frankfurt in the family grave. He is survived by his wife, Dr Margarete Kraus, who shared his life for 62 years, and their daughter Dr Beate Kraus.

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Paul A. Selden
Paleontological Institute and Department of Geology, University of Kansas, 1457 Jayhawk Boulevard, Lawrence, KS 66045, USA
and Natural History Museum, Cromwell Road, London SW7 5BD, UK
Email: paulselden@mac.com

JEAN-MARIE DEMANGE

1922–2017

JMD, Muséum Paris 1968 (1st ICM)

Jean-Marie Demange was born on August 2nd, 1922 in the city of Epinal, French Vosges. He passed away on Sunday October 22, 2017 in the city of Niort, Charente-Maritime. He was 95 years old. He had one son, two grand-daughters and one great-grandson.

Amongst many activities, Jean-Marie Demange became a specialist of historical antique oil lamps, old time-keeping devices and ancient clocks with very complicated mechanisms. But above all, he became a specialist of a particular group of arthropods, the myriapods, and more precisely the predatory centipedes and the saprophagous millipedes.

Jean-Marie Demange devoted his scientific career as a zoologist. to centipede and millipede biology, in the laboratory 'Zoologie-Vers et Crustacés', then laboratory 'Zoologie-Arthropodes' of the *Muséum National d'Histoire Naturelle* of Paris (MNHN). He worked under the successive directorships of Professor Louis Fage, then Professor Max Vachon and finally Professor Yves Coineau. He was also very active in scientific societies, particularly the 'Société Zoologique de France'.

In 1967 he defended a thesis entitled *Recherches sur la segmentation du tronc des chilopodes et des diplopodes chilognathes (Myriapodes)*, published in the 'Mémoires du Muséum National d'Histoire Naturelle'.

He published many taxonomic descriptions and biological results in papers, monographs and books, related to different aspects of myriapods including anatomy, development, locomotion, and venom. This last aspect was initiated and developed during the lecture courses given at the MNHN, which is still on-going today.

In collaboration with Jean-Paul Mauriès (MNHN, Paris) and Professor Otto Kraus (University of Hamburg, Germany), Jean-Marie Demange was the founding member of the Centre International de Myriapodologie (the **CIM**), created in 1968 in Paris (France). This scientific society, now CIM - International Society for Myriapodology, continues to promote Internationally the study of myriapodology including organising regularly international congresses of myriapodology. Jean-Marie Demange was the CIM Treasurer for many years and was deeply involved in myriapod bibliography.

I met him personnally for the first time in 1974, when I was a student in population ecology and systematics in Professor Maxime Lamotte's laboratory. I began to learn how to walk with myriapods and I have never regretted this choice.

The making, writing, printing and mailing of the annual CIM Questionnaire and CIM Bulletin, gave me opportunities to work with him, as well as Jean-Paul Mauriès and Monique Nguyen. We spent time together fighting against reluctant stencils and roneo machines, looking for bibliographic references and sticking stamps on envelopes to be sent all over the world to colleagues. This image of the past is not a melancholy one - times are changing, evolving and improving. We keep in our memory moments of friendship.

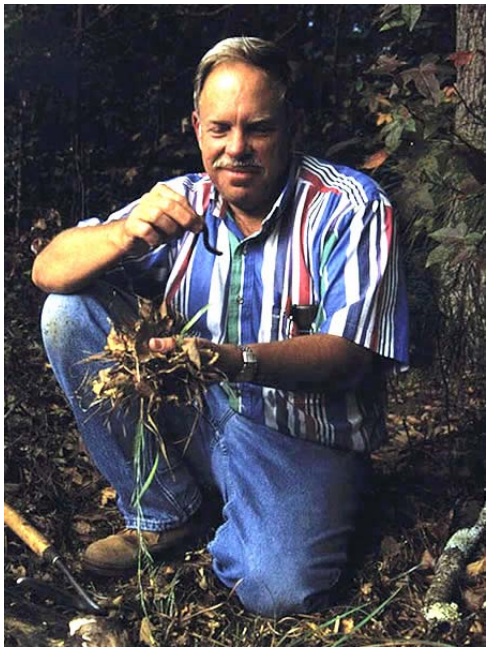
JMD, Laboratory of Zoology-Arthropods, MNHN, Paris
1977 (left); 1993 (right)

A comprehensive list of publications by Jean-Marie Demange is available on request from Jean-Jacques Geoffroy jean-jacques.geoffroy@mnhn.fr.

Jean-Jacques Geoffroy, Brunoy-Paris, October 2018
Muséum National d'Histoire Naturelle, Département Origines et Évolution
Site MNHN de Brunoy
jean-jacques.geoffroy@mnhn.fr

ROWLAND M. SHELLEY

1942–2018



Dr. Rowland M. Shelley, former Curator of Invertebrates at the North Carolina Museum of Natural Sciences and internationally renowned authority on millipedes (Class Diplopoda) died November 11, 2018, in Raleigh, North Carolina. The cause of his death was pneumonia, following surgery for a knee replacement. He is survived by his wife of 38 years, Lourdes O. Shelley, son Stephen, stepson Demian Hardister, three grandchildren and a sister.

Dr. Shelley was born in Raleigh, North Carolina, on September 9, 1942, and was a graduate of Broughton High School (1960), The University of North Carolina (BS, 1964) and North Carolina State University (PhD, 1970). He was employed by the North Carolina Museum of Natural Sciences for 44 years, until his retirement in 2015. Even after retiring, he continued to work from a home laboratory and to publish significant scientific papers. He was Adjunct Professor in the Department of Entomology and Planat Pathology at the University of Tennessee, the Virginia Museum of Natural History and the Florida State Collection of Arthropods and an Adjunct Associate Professor of Zoology at North Carolina State University.

Dr. Shelley published more than 300 papers (some forthcoming posthumously) on the systematics and biogeography of millipedes, centipedes, scorpions, leeches, mussels and several other taxa.

His research was supported by the National Science Foundation, the National Geographic Society and the Smithsonian Institution, among others. Among his important achievements were a monograph on the scolopendromorph centipedes of North America, a revision and biogeographical treatise on the xystodesmid millipede genus *Sigmoria* and a world-wide survey (with colleague Sergei Golovatch) of the distribution of millipede orders. A few months prior to his death, he published a revised classification of the important millipede family Xystodesmidae that included numerous innovations. He was a diligent and dedicated field worker and travelled over much of the North American continent in search of materials for his research, as well as visiting virtually every museum in the United States and Canada with a significant millipede collection; in many cases he reorganized the collections he found. He was the author of one millipede family (Hoffmanobolidae Shelley, 2001) two subfamilies, 11 tribes and subtribes, 38 genera and 210 species. The millipede genus *Shelleyomorpha* Golovatch, 1997 was named for him, as were four millipede species, one opilionid, one nematode and a fossil centipede. At the time of his death, he was engaged in a decades-long effort to revise the millipede family Parajulidae, probably the most abundant and diverse family of millipedes in North America.

On a personal level, Dr. Shelley and his wife Lourdes enjoyed travel, particularly if it involved trains. Their international travel encompassed 50 countries. He had become an avid golfer in recent years.

Bill Shear

WOLFRAM DUNGER

9 OCTOBER 1929–24 JANUARY 2019

Wolfram Dunger in 2004 at the Myriapoda in Europe Habitats and Biodiversity, St.Marienthal nr Görlitz

Prof. Dr Wolfram Dunger died on January 24, 2019 at the age of 89 in Görlitz. In his person we have lost one of our most important soil zoologists and one of the founders of this branch of science in the German-speaking world, an outstanding taxonomist, ecologist and museologist. For many years he acted as director of the State Museum (today: Senckenberg Museum) of Natural History Görlitz, an institution he initiated, managed for more than 35 years and brought to an international reputation.

Dunger studied and gained his doctorate at the University of Leipzig. For political reasons he was denied a classical academic career at the university, and instead was appointed to the small provincial museum of Görlitz on the eastern border of the GDR, where he became director in 1959. In keeping with his scientific interests, Dunger here established the soil zoology as a main topic of research, starting with the creation of curatorial areas for soil fauna (soil macrofauna/Myriapoda, 'Apterygota'/Collembola, and soil mites (Oribatida and Gamasina)), and further consistently also orientated the other research areas of the museum on this focus of investigation. During his tenure he successfully increased the number of museum's scientists fivefold. As an essential prerequisite for this, Dunger succeeded in keeping the museum subordinated to the GDR's Ministry of Higher and Technical Education against severe political obstacles and, after the Peaceful Revolution, having the museum transferred into the responsibility of the State Ministry of Science and Art of the Free State of Saxony.

A substantial number of scientific projects provided the basis for the expansion of research capacity, out of which we name one here that may exemplify Dunger's holistic research approach: he and the Görlitz museum became internationally known through his worldwide unique long-term "field experiment" on the soil fauna on opencast mining sites in the post-mining landscape, a study he pursued from its beginnings for more than 50 years. The focus of this research was on the immigration and colonisation of soil organisms and the further development of their populations in interaction with the respective habitat site conditions. Altogether twelve soil organism taxon groups were included in this study, together with data from plant sociology and soil science.

Besides his research on soil zoology and ecology, Dunger also achieved worldwide recognition as an expert on the Collembola. He initiated the publication of a large-scale critical review of the current knowledge of systematics, ecology, distribution and applied ecology of all Palaearctic Collembola species so far described. These "Synopses on Palaearctic Collembola", written by top experts and including two volumes by himself, are known worldwide as "Dunger's blue books", and present a comprehensive overview of this important soil organism group.

However, his second scientific passion was with myriapods. He was one of the first members of the Centre International de Myriapodologie when it was founded in 1968, but was, for political reasons, not allowed to attend their congresses prior to 1989. Despite such adversities he maintained an intense written exchange with many of his colleagues. In 1979 he established the soil macrofauna department at

the Görlitz museum and delegated the Myriapoda curation to the first author (K.V.). However, a large number of individual myriapodological publications and the regular inclusion of the Myriapoda in his 'general' works indicate he never lost his interest in this group of organisms.

With great interest Dunger observed the activities of the British Myriapod Group (later British Myriapod and Isopod Group) and their successful initiatives to build a large network of professional and amateur researchers. Already in 1979 he drew the attention of the first author to an article by A. D. Barber and C. P. Fairhurst (1974) on a habitat and distribution recording scheme for myriapods and other invertebrates, which he proposed to be used as a role model for her future work as curator of the Myriapoda collection. Based on the British example, Dunger intended to set up a German working group and was significantly involved in an advisory role in the founding of the Association of German-speaking Myriapodologists and its journal "Schubartiana" in 2004. He followed the work of both group and journal with interest and professional advice until the end of his life.

Dunger dedicated himself to the tasks of a museum director with the same commitment as to his research: to collection management, development of exhibitions, organisation of lecture series and educational offers for citizens as well as events within the framework of teacher training. He developed the soil zoological collections as an indispensable foundation of museum research, regarding collections not only as a taxonomic reference but as an archive for the soil and its inhabitants in space and time. He fulfilled a dream of bringing "Life in Soil" closer to an interested audience with the travelling exhibition of the same name, presented in several museums throughout Europe.

An outstanding achievement in the field of popular science deserves special mention: The Görlitz Nature Researchers Society, founded 1811, was no longer permitted in this form after the Second World War. Dunger saw the responsibility to maintain regional research, and thus started to organize regular "Symposia on Scientific Research in Upper Lusatia" at the Görlitz museum from 1961. For many years he sought to revive the old society, and on his initiative, in 1990 the Naturforschende Gesellschaft der Oberlausitz was (re-)founded, where he held the chair and, later, the honorary chair of the society.

Dunger was not only an active author with about 230 published original articles, reviews, textbook contributions and monographs, but also acted for 40 years as chief editor of the "Abhandlungen und Berichte des Naturkundemuseums Görlitz" (today "Soil Organisms"), and for almost 20 years of the "Berichte der Naturforschenden Gesellschaft der Oberlausitz". His popular scientific book "Tiere im Boden" (Animals in the soil) fascinated and inspired many prospective scientists to dedicate themselves more closely to studies of life in soil.

His former employees and colleagues admired Dunger's enthusiasm and competence as well as his strategic talent as a manager. His visionary work, his specialist knowledge and his outstanding personality have made the Görlitz Research Museum of Natural History what it is today.

Karin Voigtländer & Ulrich Burkhardt

STEFAN NEGREA

9 NOVEMBER 1930–20 FEBRUARY 2019)

Stefan Negrea was a leading taxonomist and biospeleologist in Romania, working most of his career as a researcher at the "Emil Racovita" Institute of Speleology and leading the biospeleology department prior to his retirement. Alongside the other participants at the First International Congress of Myriapodology (Paris, France, 1968), Stefan Negrea was a contributor to the creation of CIM.

During his activity, he described 30 centipede species and subspecies, from Romania, Cuba, Spain and Israel, but he never abandoned cladocerans. Together with his wife Alexandrina Negrea (23 August 1930 – 2 May 2011), he visited and researched over 200 caves in Romania, publishing not only taxonomy papers but also studies in the domains of speleology, ecology and zoogeography.

Many myriapodologists recall talking with him at various congresses and he remained very active even when he could no longer travel, willing to dive into the biology world, so he attended zoology congresses in Bucharest, his home town. His rich library is now a great support for biologist from the Institute of Speleology.

Mihaela Ion

FIELD MEETING REPORTS

REPORT ON THE BMIG FIELD MEETING AT JUNIPER HALL 2016

Paul Lee[1], A. D. Barber[2] and Steve J. Gregory[3]

[1] Little Orchard, Bentley, Ipswich, Suffolk IP9 2DW, UK.
E-mail: arachne2222@aol.com

[2] 7 Greenfield Drive, Ivybridge, Devon PL21 0UG, UK.
E-mail: abarber159@btinternet.com

[3] 4 Mount Pleasant, Church Street, East Hendred, Oxfordshire OX12 8LA, UK.
E-mail: stevejgregory@btopenworld.com

INTRODUCTION

The 2016 BMIG field weekend, held from 31st March to 3rd April, was based at Juniper Hall Field Studies Centre, near Dorking in Surrey (VC17). During the weekend sites in East Sussex (VC14), North Hampshire (VC12) and West Sussex (VC13) as well as Surrey were visited. The meeting had two key aims. The first of these was to check on the status of the centipede *Lithobius piceus,* first found in central southern England in 1958 (VC11). Barber (1969) described the centipede as 'well-established in southern Surrey and neighbouring areas.' However, the area had not been well surveyed in recent years and the date of the last record from the four vice-counties seems to be from Epsom Common in 2013. The second aim was to investigate the current distribution of the millipede *Haplopodoiulus spathifer* in the area. *H. spathifer* was first recorded in Britain from Kew Gardens (VC17) in 1976 and then later from Bedgebury, Kent (VC16) in 1988 and Wakehurst Place, East Sussex (VC14) in 1990 (Corbet and Jones, 1996). It was expected that the millipede would have spread to other large gardens across the survey area.

BACKGROUND

Although Kime (1995) noted that there were very few records of millipedes from central southern England before 1967, the Victoria County History (Pocock, 1902) listed eight species each of millipede and centipede, mainly collected 'at Kew Gardens by Mr Nicholson, at Weybridge by Mr W.R. Ogilvie-Grant, and at Kingston-on-Thames by Mr Lucas.' In the same volume, Stebbing (1902) records eight species of woodlouse collected variously from Copthorne, Reigate, Weybridge, Headley Common and Frith Park by the author, his niece and sister-in-law. The glasshouses at Kew were already recognised as places of great interest to myriapodologists at the start of the twentieth century and Pocock (1902) names an additional three millipedes and three centipedes collected by Nicholson from the tropical houses there but notes that there is no evidence of these importations breeding there. He comments that these six exotic forms are the 'most noticeable' implying that further species were known. All species mentioned in the Victoria County History are shown in Table 1.

In a report on the fauna & flora of Kew Gardens (Pocock, 1906), additional centipede species listed included *Geophilus electricus*, *Geophilus flavus* and *Haplophilus subterraneus*. A further *Geophilus* 'apparently not identifiable with any British species' was noted also. Additional millipedes listed included *Brachydesmus superus* and the exotics *Orthomorpha coarctata*, *Anadenobolus monilicornis* and *A. vincenti*. A further species of *Typhloiulus* was not identified. Scourfield (1906) gave the woodlouse *Androniscus dentiger* and the water slater *Asellus aquaticus* as additions in the same report.

Between 1906 and 1946 the woodlice of Kew gardens continued to be widely collected with 21 species recorded from the gardens and glasshouses (Holthuis, 1946) including three species new to science: *Miktoniscus linearis* (Patience), "*Setaphora*" *patiencei* (Bagnall) and *Burmoniscus meeusei* (Holthuis).

Table 1: Species of Myriapoda and Isopoda recorded from Surrey before 1902

Centipedes	**Millipedes**	**Woodlice**
Haplophilus subterraneus	*Glomeris marginata*	*Ligidium hypnorum*
Strigamia crassipes	*Oxidus gracilis*	*Trichoniscus pusillus s.l.*
Geophilus carpophagus s.l.	*Polydesmus angustus*	*Philoscia muscorum*
Geophilus flavus	*Blaniulus guttulatus*	*Oniscus asellus*
Cryptops anomalans	*Ophyiulus pilosus*	*Porcellio dilatatus*
Cryptops hortensis	*Cylindroiulus caeruleocinctus*	*Porcellio scaber*
Lithobius forficatus	*Cylindroiulus punctatus*	*Porcellionides pruinosus*
Lithobius variegatus	*Tachypodoiulus niger*	*Armadillidium vulgare*
Species from heated glasshouses at Kew Gardens		
Mecistocephalus punctifrons	*Chondromorpha kelaarti*	
*Scolopendra morsitans**	*Spirobolellus* sp.	
Scolopendra subspinipes	*Trigoniulus goesi*	

* given as *S. morsicans* by Pocock (1902)

A short paper published almost fifty years after the Victoria County History and based on field courses held at Juniper Hall added just one species of centipede, *Lithobius microps*, and one millipede, *Polyxenus lagurus*, to the Surrey fauna (Arthur *et al.,* 1951). This same paper does mention a further millipede, *Polyzonium germanicum,* from grassland on Box Hill. The record is based on a fragment of cast skin collected by J.H.P. Sankey and its identity confirmed as 'undoubtedly this species' by F.A. Turk on the basis of one of the paragonopods remaining attached. However, the species had never been collected from Box Hill, or anywhere else in Surrey, prior to or since this find. Indeed, the chalky grassland described by Sankey seems a most unsuitable habitat when compared with the wet woodlands and wet acid heath where the millipede was found to be most abundant in Kent by BMIG in 2011 (Lee *et al.*, 2015).

In the late 1960's Des Kime and Tony Barber provided a boost to myriapod recording in the area when they were both working at the Royal Grammar School, Guildford. Kime (1968) reported the addition of the millipede *Stosatea italica* to the Surrey fauna and went on to summarise the 31 millipede species recorded from his work in Hampshire, Surrey and West Sussex (Kime, 1978). Meanwhile, Barber summarised the distributions of 24 species of centipede in Surrey (Barber, 1969) and later considered the fauna of South East England listing 25 species from Surrey, 21 from Sussex and 19 from Hampshire (Barber, 1972). In another paper (Barber & Eason, 1970), *Brachyschendyla dentata* (now *Schendyla dentata*) was added to the Surrey (and British) list from the Haslemere and Guildford areas. Later in that decade, Ted Eason (Eason, 1979) in a paper on *Geophilus carpophagus* distinguished two forms, a long one from urban/domestic sites and a shorter one from rural ones. Some of the long-form animals used in the study were derived from a site at Mortlake (coll.A.J.Rundle). The two forms were subsequently recognised as separate species, *Geophilus carpophagus* (s.s.) and *Geophilus easoni* (Arthur *et al*, 2001).

Most of the records of *G. carpophagus* in the 1969 study (Barber, 1969) were from rural sites & most, if not all, were of the *G. easoni* form.

In 1988 *Tygarrup javanicus* was described from hothouses at Kew having been collected there by Adrian Rundle in 1967 (Lewis & Rundle, 1988). However, apart from this exotic introduction, it was another two decades before further updates on these myriapod faunas were published as vice-county lists (Jones, 1993; Keay, 1993b). At the same time the BMG/BISG visited West Sussex for their annual field meeting. Most of the sites surveyed were close to the south coast and none corresponded with those visited in 2016 but amongst the 24 species of woodlice, 29 species of millipedes and 25 species of centipedes collected was *Lithobius piceus*, recorded from three of the sites (Daws, 1993; Keay, 1993a). During this meeting one of the last reported sightings in the UK of the much-declined woodlouse *Porcellio laevis* (in a disused barn) was made and a new county record (VC 14) for *Buddelundiella cateractae* was reported from the coast. Kime collated the millipede records of other workers, including those from the BMG/BISG meeting in an update of his earlier report, mapping the distributions of the 35 species of millipede known from central southern England at the time (Kime, 1995).

BMIG began the new millennium with a number of visits to Royal Horticultural Society's gardens at Wisley between 2002 and 2005 recording a total of 13 species of millipede (Read, 2008). A further visit in October 2008 was attended by only four members and reported 8 species of woodlice, 6 species of centipedes and 15 species of millipedes, all of which had previously been recorded at the gardens (Read *et al*., 2010). Staff at Wisley generated further records from their Plants for Bugs project which ran from 2009 to 2014. Most significantly, the millipede *Anamastigona pulchella* was collected by pitfall trapping in 2011 (Gregory, 2012; Gregory *et al*., 2015).

In summary, Table 2 shows the number of centipede, millipede and woodlouse species recorded from North Hampshire (VC 12), West Sussex (VC 13), East Sussex (VC 14) and Surrey (VC 17) (ignoring the pre 1902 records and the doubtful *Polyzonium germanicum*) prior to the BMIG meeting in 2016.

Table 2: Summary of number of species of centipede, millipede and woodlice recorded prior to 2016 from vice-counties of central southern England

	VC 12	VC 13	VC 14	VC 17
Centipedes*	22	24	32	29
Millipedes	25	27	32	39
Woodlice	20	29	32	25

* based on unpublished BRC (2018) data.

Note: VCs 13 and 14 have coastline and the number of species listed includes littoral/coastal forms.

METHODS AND SITES

The meeting was not organised as a systematic search for the target species, *Haplopodoiulus spathifer* and *Lithobius piceus*, but most of the sites visited were selected as being likely to support one or other of them.

A summary of the 14 sites visited and the sub-locations within these sites is shown in Table 3. Only a single site was visited in each of Hampshire and East Sussex, two sites were in West Sussex with the remaining ten in Surrey. Further details of the species records for each site are summarised in Tables 4

(centipedes), 5 (woodlice, etc) and 6 (millipedes).

RESULTS

Ten Nationally Scarce species were recorded during the weekend, namely the centipedes *Henia brevis*, *Henia vesuviana* and *Lithobius muticus,* the millipedes *Brachychaeteuma melanops, Choneiulus palmatus, Nopoiulus kochii, Allajulus nitidus, Cylindroiulus londinensis* and *Leptoiulus kervillei* and the woodlouse *Porcellio laevis.* This assemblage of species contains a strong synanthropic element reflective of many of the sites visited. The three locations with the highest species richness, Juniper Hall (13 centipedes, 14 millipedes, 12 woodlice), RHS Wisley (11 centipedes, 21 millipedes, 9 woodlice plus landhopper) and Sheffield Park (12 centipedes, 11 millipedes, 9 woodlice plus landhopper), were large ornamental gardens, again a reflection of the synanthropic nature of the fauna.

Table 3: List of sites visited.

Recorders: TB - Tony Barber; KC - Kevin Clements; JF – Jim Flanagan; SG - Steve Gregory; PL - Paul Lee; AL – Angela Lidgett; HR - Helen Read; PR - Paul Richards; DW - Derek Whiteley.

Site no.	Site name	Grid Reference	VC	Date	Recorders
1	Noar Hill	SU7431	12	03/04/2016	SG
2	Guildford, Pavillion	SU999497	17	01 & 03/04/2016	JF, PR, DW & SG
3	Guildford, Pavillion	TQ000498	17	03/04/2016	SG
4	Chinthurst Hill	TQ0145	17	01/04/2016	AB, HR
5	Chinthurst Hill	TQ0146	17	01/04/2016	PL, HR
6	The Mens	TQ0223	13	02/04/2016	AB, PL, HR
7	St Martha's Hill	TQ0248	17	01/04/2016	SG, PR, DW
8	St Martha's Hill	TQ0349	17	01/04/2016	PR
9	Chobham M25 services	TQ1157	17	03/04/2016	PR
10	St Mary & St Nicholas Church, Leatherhead	TQ1656	17	03/04/2016	PR
11	Juniper Hall	TQ1752	17	31/03/2016 to 03/04/2016	TB, KC, SG, PR, DW
12	Pilgrims Way, Brockham	TQ1850	17	02/04/2016	PR, DW
13	Pilgrims Way, Brockham	TQ1950	17	02/04/2016	PR, DW
14	Box Hill High Street	TQ194514	17	02/04/2016	PR
15	Brockham Limeworks	TQ196510	17	02/04/2016	PR, DW
16	RHS Wisley, gardens	TQ0658	17	01/04/2016	TB, SG, AL, PL, HR, PR, DW
17	RHS Wisley, Glasshouse	TQ0658	17	01/04/2016	SG, HR, PR, DW
18	RHS Wisley, gardens	TQ0659	17	01/04/2016	TB, PL, HR
19	Sheepleas	TQ0851	17	01/04/2016	AL
20	Sheffield Park, Wildlife Haven	TQ407231	14	02/04/2016	SG
21	Sheffield Park, gardens	TQ4123	14	02/04/2016	SG, AL
22	Sheffield Park, gardens	TQ4124	14	02/04/2016	TB, AL, PL, HR
23	Eridge Rocks	TQ5535	14	02/04/2016	AL

CENTIPEDES

A total of 19 species overall were collected (Table 4), 8 from VC12, 3 from VC13 and 13 from VC17. Despite searches at a number of sites where *Lithobius piceus* had been recorded previously, the species was not found in 2016. Of the hundred or so records of *L. piceus* reported, about two-thirds were made over the period 1965 – 1969 following its discovery on the North Downs in Surrey. Subsequent to this time, a period of fairly intense collecting, there was limited work on myriapods in the area. A number of records were reported through the 1970s and 1980s, although it was never found in Kent, a generally well recorded county. The Provisional Centipede Atlas (Barber & Keay, 1988) showed it as recorded from 16 hectads (10km grid squares) in quite a limited area. Very little subsequent work had taken place until the present meeting. As to why it was not found in 2016 is difficult to suggest – possibly local weather conditions at the time or, in fact, a decline in population or range or maybe just chance. Collections were certainly made in areas and habitats where it might be expected (generally rural and woodland). It is similar in appearance to *L. forficatus* in the field but sufficiently distinct under magnification to distinguish.

Of the remaining species, *Tygarrup javanicus* being found at Wisley (Fig. 1) was not unexpected as it has been found a number of times in heated glasshouses elsewhere in Britain, including nearby at Kew, and in mainland Europe. Its relatively small size and apparently parthenogenetic habit would facilitate its transfer with plant or compost material.

Figure 1: *Tygarrup javanicus* from RHS Wisley (Image © Keith Lugg)

Some other species are known for their synanthropic habits in our area, including the two species of *Henia* (probably less so in *H. vesuviana*), *Stenotaenia linearis*, *Haplophilus subterraneus* (somewhat), *Cryptops anomalans* (very definitely) and *C. parisi* (in regions outside the south-west). *C. hortensis*, although often synanthropic, is, like *L. microps* in the South-East, sometimes found in quite rural woodland. *L. forficatus* is not only large and fairly conspicuous and therefore frequently collected, it is found in gardens and disturbed sites where it is fairly ubiquitous and sometimes in more rural ones and is the most commonly recorded centipede in Britain. Correspondingly, *L. variegatus* is more confined to

undisturbed and rural sites but very common there. *L. melanops* favours gardens & disturbed areas but is not confined to them. Of the remaining geophilomorphs, all are widespread species; *Geophilus electricus* might have been expected to be found as it is generally rather synanthropic in its habits. Given that the immediate garden area of Juniper Hall, as well as Wisley and Sheffield Park, the centre of Guildford, a motorway service area, and a lime-works were amongst locations visited, the species spectrum is not altogether unexpected. *Lithobius muticus* was thought at one time to be more or less confined to south east England in a broad sense but has now been found elsewhere. It is generally a rural animal so, again, it is surprising that it has not been recorded in the current collection except for in mature oak woodland at Sheffield Park.

Notably not found but not so surprisingly, were *L. crassipes*, *L. curtipes* and *L. macilentus,* all of which have been found in Surrey. The former two are by no means the common small lithobiids there and the latter has a very patchy distribution. Neither of our two non-marine *Strigamia* species were found but their occurrence always seems somewhat unpredictable. *Lamyctes emarginatus* was collected at RHS Wisley in October 2008 but was not re-found in April 2016. This was no surprise considering the season.

MILLIPEDES

A total of 33 species were collected (Table 6). During the 2016 meeting only single sites in North Hampshire (VC 12) and East Sussex (VC 13) were visited. Collecting there produced just five and four common species respectively, none of which were new to the vice-county fauna. The large number of sites visited in Surrey (VC 17) was reflected by the fact that of the 33 species recorded over the weekend, 31 were recorded from at least one site in VC 17. *Anamastigona pulchella* and *Rhinotus purpureus* (Fig. 2) were re-found at RHS Wisley and the gardens produced records of three species new to Surrey. As was anticipated, *Haplopodoiulus spathifer* was collected and was present in at least two areas of woodland. Around the glasshouses *Nopoiulius kochii* and *Cylindroiulus truncorum* were new also to Surrey. Most of the millipede records in West Sussex (VC 14) came from Sheffield Park. *Haplopodoiulus spathifer* was well established here and *Leptoiulus kervillei* was new to VC14.

Figure 2: *Rhinotus purpureus* from RHS Wisley (Image © Paul Richards)

WOODLICE

During the course of the weekend 20 species of woodlice were recorded in addition to the landhopper *Arcitalitrus dorrieni* from three sites (Table 5). This is a respectable number of species considering that coastal habitats were not visited and reflects the general species richness of the south-east. However, no new county records were made.

Seventeen species were recorded from Surrey (VC 17), reflecting the fact that 15 sites were visited. This total included *Armadillidium depressum, Porcellio dilatatus* and *P. laevis* from Guildford (this latter species is discussed further below), *Trachelipus rathkii* from a motorway service station and *Armadillidium nasatum* from Juniper Hall and RHS Wisley. Although only two sites were visited in West Sussex (VC14), *Porcellionides cingendus* was collected in the gardens at Sheffield Park and *Ligidium hypnorum* and *Trichoniscoides albidus* in the Wildlife Haven area.

Perhaps the most unexpected find of the meeting was the discovery of *Porcellio laevis* in Guildford (an account of its discovery is given by Flanagan, 2016). This large and distinctive woodlouse (Fig. 3), once recorded widely in Britain and Ireland, has been recorded in a decreasing number of localities, possibly due to the progressive loss of suitable synanthropic sites (Harding, 2016). Until this observation in Guildford, the most recent records were from Margate, Kent in 2007, Glasgow in 1996 and the Wirral in 1995.

Figure 3: *Porcellio laevis* male from Guildford (Image © Jim Flanagan)

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Table 4: Summary of species of centipede recorded during the BMIG meeting in Surrey.

Location:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**Total**
Tygarrup javanicus																	X							1
Haplophilus subterraneus	X	X		X							X				X	X			X		X	X		9
Schendyla nemorensis	X					X					X	X			X	X					X		X	8
Henia brevis											X													1
Henia vesuviana																X					X			2
Geophilus carpophagus s.str.		X	X							X	X		X			X					X			7
Geophilus easoni				X			X											X	X				X	5
Geophilus flavus	X	X								X	X					X						X		6
Geophilus alpinus						X					X		X									X		4
Geophilus truncorum	X	X		X		X										X		X						6
Stenotaenia linearis											X													1
Cryptops anomalans		X									X													2
Cryptops hortensis		X		X	X	X				X	X				X	X	X					X	X	11
Cryptops parisi						X																		1
Lithobius forficatus	X	X	X	X	X			X	X		X		X							X	X	X		12
Lithobius melanops	X	X					X				X			X		X			X	X	X			9
Lithobius microps	X	X	X		X	X	X				X			X					X		X	X		11
Lithobius muticus																					X	X		2
Lithobius variegatus	X			X	X	X					X				X	X			X		X	X	X	11

Table 5: Summary of species of woodlouse and landhopper recorded during the BMIG meeting in Surrey.

Location:	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16	18	19	20	21	22	23	Total
Woodlice																						
Asellus aquaticus															X				X			2
Ligidium hypnorum	X																	X				2
Androniscus dentiger	X	X	X							X				X	X							6
Haplophthalmus danicus	X					X				X			X		X							5
Trichoniscoides albidus																		X				1
Trichoniscus provisorius	X									X												2
Trichoniscus pusillus agg.	X	X	X		X	X		X		X				X	X		X	X	X		X	13
Trichoniscus pygmaeus		X	X					X	X	X				X								6
Platyarthrus hoffmannseggii									X	X	X			X								4
Philoscia muscorum	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	18
Oniscus asellus	X	X	X	X	X	X	X			X		X	X	X	X		X	X	X	X	X	17
Porcellio dilatatus		X																				1
Porcellio laevis		X																				1
Porcellio scaber	X	X	X	X	X	X	X		X	X				X	X	X	X	X	X	X	X	17
Porcellionides cingendus																			X			1
Porcellionides pruinosus		X								X												2
Trachelipus rathkii								X														1
Armadillidium depressum		X	X																			2
Armadillidium nasatum										X					X							2
Armadillidium vulgare	X	X	X		X		X	X	X	X	X	X			X	X	X		X		X	15
Landhopper																						
Arcitalitrus dorrieni									X						X				X	X		4

Table 6: Summary of species of millipede recorded during the BMIG meeting in Surrey.

Location:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
Millipedes																								
Polyxenus lagurus							X					X	X											3
Glomeris marginata	X			X		X	X	X							X	X		X	X			X	X	11
Rhinotus purpureus																	X							1
Brachychaeteuma melanops											X				X					X	X			4
Nanogona polydesmoides														X										1
Melogona scutellaris											X													1
Oxidus gracilis																	X							1
Brachydesmus superus	X							X			X					X					X	X		6
Polydesmus angustus					X						X	X			X	X		X					X	7
Polydesmus coriaceus				X	X			X	X		X			X		X					X	X		9
Polydesmus inconstans						X												X						2
Cylindrodemus hirsutus																	X							1
Macrosternodesmus palicola		X									X													2
Ophiodesmus albonanus		X									X		X						X					4
Choneiulus palmatus																X	X							2
Nopoiulus kochii																	X							1
Proteroiulus fuscus				X	X	X	X								X	X	X							7
Blaniulus guttulatus		X	X							X	X			X	X									6
Boreoiulus tenuis														X	X									2
Haplopodoiulus spathifer																X		X			X	X		4
Julus scandinavius																X								1
Ophyiulus pilosus											X			X	X	X			X		X			6
Leptoiulus kervillei											X												X	2

Millipedes (cont.)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**Total**
Allajulus nitidus																X								1
Cylindroiulus britannicus		X	X	X							X					X	X	X			X	X		9
Cylindroiulus caeruleocinctus		X		X						X	X		X	X	X	X		X			X			10
Cylindroiulus latestriatus							X										X	X						3
Cylindroiulus londinensis																							X	1
Cylindroiulus punctatus	X	X	X	X	X	X		X		X	X		X	X	X	X		X	X		X	X	X	18
Cylindroiulus truncorum																	X							1
Cylindroiulus vulnerarius		X																						1
Brachyiulus pusillus	X																			X				2
Tachypodoiulus niger	X			X	X			X			X	X			X	X					X	X		10

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Editors: S.J. Gregory, H.J. Read & A.D. Barber
c/o Helen J. Read; email helen@helen-read.co.uk

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