

## Long form of *Pachymerium ferrugineum* (C.L. Koch, 1835) recorded from the Channel Islands (Geophilomorpha: Geophilidae)

Anthony D. Barber<sup>1</sup>, Steve J. Gregory<sup>2</sup> and Andy Marquis<sup>3</sup>

<sup>1</sup> 7 Greenfield Drive, Ivybridge, Devon PL21 0UG, UK.

E-mail: [abarber159@btinternet.com](mailto:abarber159@btinternet.com)

<sup>2</sup> 4 Mount Pleasant Cottages, Church Street, East Hendred, Oxfordshire, OX12 8LA, UK.

E-mail: [stevejgregory@btopenworld.com](mailto:stevejgregory@btopenworld.com)

<sup>3</sup> Laurel Cottage, Camp du Roi, St Sampsons, Guernsey, GY2 4XG.

E-mail: [andymarquis@hotmail.com](mailto:andymarquis@hotmail.com)

### Abstract

The long form of the centipede *Pachymerium ferrugineum* C.L. Koch is reported from the Channel Islands, the first record for the British Isles. Information about microsites inhabited and associated species is given. A female specimen with 57 leg bearing segments is briefly described and figured, with a revision of current identification works (Barber, 2008; 2009). We present a review of the ‘long’ and ‘short’ forms of this species occurring in neighbouring France and throughout its wide global range. We conclude that further study, including genetic and biochemical studies, would be useful to ascertain whether the two forms are cryptic subspecies or species.

### Introduction

One of us (AM) collected a large centipede, 60mm in length, with 57 leg bearing segments (LBS) from a beach on Guernsey, Channel Islands, which did not readily key out using Barber (2009). The specimen (Fig. 1) was collected from beneath a stone at the top of a shingle and pebble beach just below some low mud cliffs (<1m high) at La Croix Bay, Vale (49.50098N -2.50446W; WV360834) (Figs. 5A, B) on 24<sup>th</sup> March 2019. Images of the specimen, including close ups of key features required for determination (Figs. 2A-D), were posted on BMIG’s *Isopods and Myriapods of Britain and Ireland* group (Marquis, 2019a) where it was provisionally identified as *Pachymerium ferrugineum* (C.L. Koch, 1835) by SJG (and others). However, specimens collected previously in Britain have had just 43 or 45 LBS and were typically 30-35mm (exceptionally to 50mm) in length (Eason, 1964; Barber, 2009). Thus, it was forwarded to SJG for examination, who confirmed the identification as a female *P. ferrugineum*.

On 7<sup>th</sup> April AM collected a second female from the same site, 43mm in length and also with 57 LBS. Images of this were also posted online (Marquis, 2019b). Associated species included the Scaly Cricket *Pseudomogoplistes vicentae* Gorochov (Orthoptera) and the woodlice (Isopoda: Oniscidea) *Ligia oceanica* (Linnaeus), *Halophiloscia couchii* (Kinahan), *Philoscia muscorum* (Scopoli), *Porcellio scaber* Latreille, *Porcellionides cingendus* (Kinahan), *Armadillidium vulgare* (Latreille) and a male specimen of *Chaetophiloscia cellaria* (Dolfuss), a woodlouse new to the British Isles (Gregory & Marquis, 2019).

The Channel Islands are an archipelago of relatively small islands located about 30km west of Normandy, France (Fig. 3) with Guernsey some 65km<sup>2</sup> in area. They were, however, linked by land to the French mainland to a much later date than Great Britain. Guernsey, with Alderney, Herm and Sark, had separated from the mainland by about 7,000BC (Johnston, 1981). The Islands have several plant and animal species such as the Jersey orchid (*Anacamptis laxiflora*) and the wall and green lizards (*Podarcis muralis*, *Lacerta viridis*) which do not occur as natives in mainland Britain. The islands are British Crown Dependencies and, traditionally, are included within many biological recording schemes and, therefore, many published distribution atlases for the British Isles, including that for Centipedes (Barber & Keay, 1988).

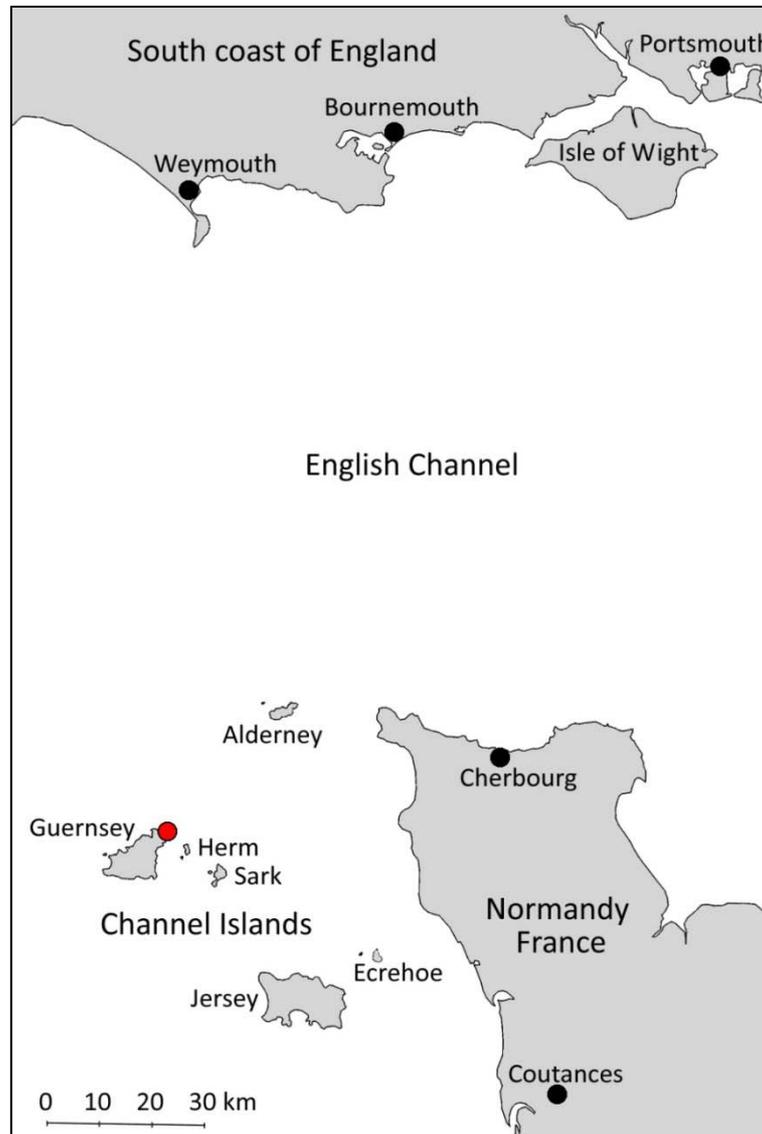


**Figure 1:** *Pachymerium ferrugineum* female. Live specimen c. 60 mm in length with 57 LBS (image © Andy Marquis).



**Figure 2:** *Pachymerium ferrugineum* female. Live specimen with 57 LBS, from Guernsey. A) Head and forcipular tergite, dorsal view; B) Forcipules, ventral view; C) Dorsal coxal pores; D) Ventral coxal pores (images © Andy Marquis).

These are the first recorded occurrences of *Pachymerium ferrugineum* from the Channel Islands, where it was not recorded by Barber (2006) in his account of myriapoda of the archipelago. Verhoeff (1902) had distinguished a subspecies *P. ferrugineum insulanum* from the eastern Mediterranean, which was larger than the typical *P. ferrugineum ferrugineum* and had more LBS (49-61). The discovery of a “long form” (as we will term it for the present) of *P. ferrugineum* with 57 LBS from Guernsey prompted us to review the occurrence of the forms of this species occurring in neighbouring France and throughout its global range.



**Figure 3: Location of the Channel Islands in relation to France and England**

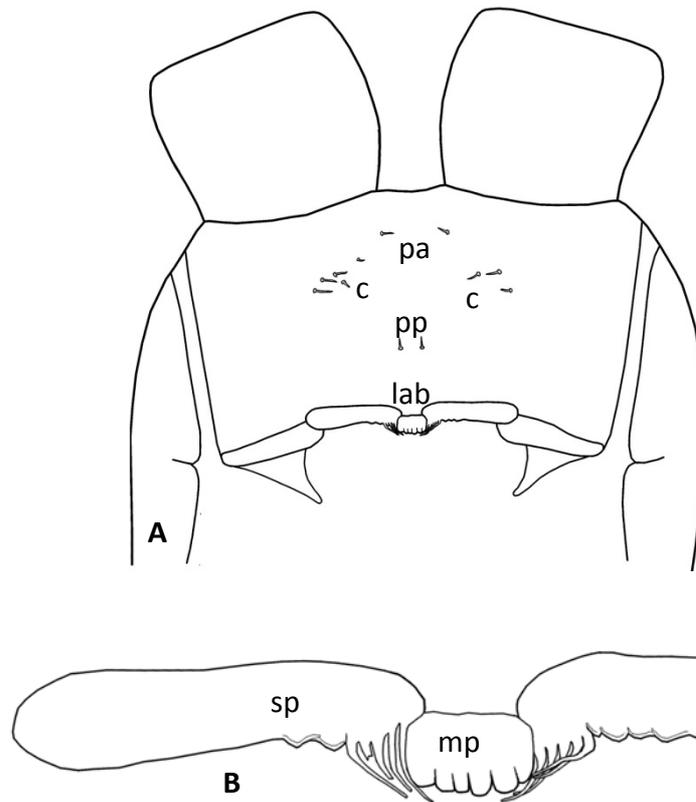
● Indicates *Pachymerium ferrugineum* record reported herein.

## Identification

The first specimen, a female with 57 LBS and 60mm in length, was examined by SJG. It matches the description of *Pachymerium ferrugineum* given in Barber (2009, pp 110-111), with the exception of the number of LBS (57 vs 43-45) and body length (60mm vs exceptionally to 50mm).

The clypeus and labrum were examined by removing the forcipules and maxillae and cleared in situ on a temporary mount using clove oil (Figs. 4A, B). The labral mid-piece bears six blunt-tipped tubercles,

but lacks the c. three lateral fimbriae figured in Eason (1964, fig. 140, p. 103). Each side-piece bears about five prominent fimbriae, with a small number of less prominent ones that are curved and obscured from view. Overall, the structure of the labrum (Fig. 4B) does not comply with that figured in Eason (1964), but is very similar to that figured by Brolemann (1932, fig. 186, p. 136) of a female of the “long form” (with 55 LBS) from the Alpes Maritimes, France. The labrum of form *insulanum* (“long form”) figured by Kaczmarek (1969, fig. 1E, p. 264) appears somewhat intermediate between the two.



**Figure 4: *Pachymerium ferrugineum*, female with 57 LBS collected from Guernsey.** A) Cephalic shield, ventral view, showing clypeus with clypeal setae (c), post-antennary pair of setae (pa), posterior pair of setae (pp) and labrum (lab); B) Labrum, showing mid-piece (mp) and side-piece (sp).

Using the dichotomous key in the Linnean Society Synopsis (Barber, 2009, p. 20), which is essentially the same in the AIDGAP key (Barber, 2008), both the “short form” and “long form” will readily key to *P. ferrugineum*. The insertion of an additional couplet (5A below) will readily separate the two forms:

- Couplet 1 → Couplet 2 (coxal pores over entire surface of coxae of last legs)
- Couplet 2 → Couplet 3 (coxal pores small and very numerous, distributed over both dorsal and ventral surfaces of coxae)
- Couplet 3 → Couplet 5 (head longer than broad, fewer than 73 pairs of legs)  
(*Pachymerium ferrugineum* is a “rare inhabitant of coastal shingle”)
- Couplet 5 → First option (claw on last legs, posterior end of forcipular tergite about the same breadth as the head and  $\frac{3}{4}$  breadth of next tergite: fig. 22 in Synopsis)  
.....*Pachymerium ferrugineum*: 5A
- Couplet 5A 41-47 leg pairs.....*Pachymerium ferrugineum* “short form”  
or 55-59 or more leg pairs.....*Pachymerium ferrugineum* “long form”

Using the tabular key in the Linnean Society Synopsis (Barber, 2009, pp.34-35), essentially the same in the AIDGAP key (Barber, 2008), the two forms can be inserted separately into their respective places in the key as there is no overlap in LBS. See table below.

Species	LBS	Coxal pores		Claw on last leg	Basal node, poison claw	Carpo-phagus structure	Sternal pore groups	Other features	Max. length
		No.	Position						
<i>P. f.</i> “long form”	55-59	∞	Dorsal / ventral	✓	✓	no	✓	Coastal, rare	70mm
<i>P. f.</i> “short form”	41-47	∞	Dorsal / ventral	✓	✓	no	✓	Coastal, rare	50mm

**Note:** Specimens with much more than 59 leg pairs are known from some Mediterranean locations e.g. Greece (S. Simaiakis, pers. comm.)

There may be other details separating the two forms.

**Occurrence:** Short form, south & east coasts of England; Long form: Channel Islands.

## Discussion

### A global species

*Pachymerium ferrugineum*, first described from Germany, is probably one of the most widely distributed centipedes in Europe and occurs as an introduction across much of the globe. Indeed, Nefediev, *et al.* (2017) describe it as “a trans Palaearctic polyzonal species”. It has been found across Eurasia from Macaronesia to Central Asia and Siberia as well as in the Russian Far East, Taiwan and Japan. It is also found across North America as far as Alaska and the Pribilof Islands and from Mexico, Chile, Juan Fernandez, Hawai’i and Easter Island. It is also known from Asia Minor, Caucasus, North Africa, The Azores, Canary Islands and Madeira.

In northern and western Europe its distribution is interesting. It is known from Norway, Sweden, Finland and Denmark, and from the White Sea coast as well as inland in north-east Europe. In Eastern Fennoscandia records include from under stones, in decaying *Fucus* and other debris on seashores as well as from dry terrestrial sites (Palmen, 1949). Meidell (1979) drew attention to the fact that this species and *Strigamia maritima* (Leach) form an “east-west pair of species” with *S. maritima* occurring along the western coast and *P. ferrugineum* along the eastern coast of southern Norway and a zone of overlap in both the north and south ( see also Simaiakis *et al.*, 2010). All records from the Netherlands and Belgium appear to be from inland sites (Berg *et al.*, 2008; Lock, 2000, 2009). It has described as widely distributed in France and Corsica and favouring the seashore “without being strictly halobiontic or highly halophilous” (Geoffroy & Iorio, 2009). From France there are records from about 30 départements, both inland and coastal including Finistère, Loire-Atlantique, Morbihan and Vendée. It is often thought of as an exclusively coastal species but this is certainly not necessarily the case - it has a wide ecological range and has been found up to 2,800m in the Hoggar Mountains in the Sahara (Palmen & Rantala, 1954).

### Means of dispersal

Geophilomorph centipedes, both terrestrial and littoral have been shown to be tolerant of immersion (more so than lithobiomorphs) (Hennings, 1903; Plateau, 1890). Schubart (1929) found that submerged specimens of *P. ferrugineum* from Germany survived 7-68 days at room temperature (16-18°C) whilst Suomalainen (1939) reported 24-95 days at 19-27°C and 68-178 days at 6-12°C for Finnish animals. Given this characteristic it is possible to speculate that, amongst possible modes of accidental dispersal,



**Figure 5: La Croix Bay, Guernsey.** A) View of bay. Specimens of *P. ferrugineum* were collected from among shingle at top of beach near top-centre of image; B) Close up of shingle and low mud cliff behind (images © Andy Marquis).

that by rafting, such as on plant debris (hydrochory), is a likely dispersal mechanism for animals. Littoral species are in an optimum situation or this, both in terms of being accidentally carried away and of establishing themselves when they arrive at a suitable destination. Suomalainen had, indeed, reported *P. ferrugineum* floating on sea water for as long as 31 days before sinking and long survival when submerged in such water (Barber, 2011). The varied nature of coasts would be likely to break up species into isolated local populations which could favour genetic divergence and dispersal across oceans and to islands would accentuate this effect. This may be reflected in variations in characters between populations at different sites, for instance variation of numbers of leg-bearing segments.

### Occurrence in Britain

Despite the wide distribution of *P. ferrugineum* and its apparent potential distribution by rafting, in the UK it is known from just five coastal shingle sites in southern and eastern England (Sussex, Suffolk, Isle of Wight, Dorset & Essex) (Lewis, 1960; Barber, 2009) and is designated Nationally Rare (Lee, 2015).

The first records were of ten specimens found by John Lewis between August 1957 and May 1958 at Cuckmere Haven (Lewis, 1960) during the course of sampling for *Strigamia maritima* (Leach) when some 1,500 specimens of the latter were taken between autumn 1956 and summer 1959 (Lewis, 1961). Subsequent records were “one-offs”, except those from Essex, which were a series of reports from March 2012 to June 2015 by Keith Lugg from Colne Point (pers. comm.) and there was some evidence of a possibly well-established colony there. Clearly *P. ferrugineum* is very much on the edge of its range on the British coast and it is difficult to be certain whether the species is well-established (but either difficult to find or genuinely rare) or whether these records derive from animals that are recent colonists and may, perhaps, have only a transitory existence here.

### Variation in LBS and ecology

The numbers of leg bearing segments (LBS) in each sex, as in all but one family of geophilomorphs, are variable. In Palmen's (1949) study in Eastern Fennoscandia they ranged between 41-45 in males and 43-47 in females and in a more recent study by Simaiakis *et al.* (2010) modal values for Scandinavia (Sweden & Finland) were 41/43 LBS in males and 45 in females. The latter also demonstrated a north-south temperature cline in segment numbers. If one looks through the literature, numbers like 41-55/41-57 (France; Brolemann, 1932, copied by Demange, 1981), 41-55/43-57 (Scandinavia: Andersen *et al.*, 2005), 41-55/43-57 (Austria; Koren, 1986), 41-57 (Central Europe, Schubart, 1964), 41-55/43-57 (Netherlands: Berg & Evenhuis, 2001), 43-57 (Cyprus: Simaiakis *et al.*, 2013) so clearly there is a wide range.

Verhoeff (1902) had distinguished a subspecies *P. ferrugineum insulanum* from the Greek islands of Syros, Aegina and Naxos and also from Herzegovina, Dalmatia, Tunisia and Cilicia (Turkey) which was larger than the typical *P. ferrugineum ferrugineum* and had more LBS (49-61). Details for this form were also given by Kaczmarek (1969) who reported *insulanum* from Bulgaria, from the Black Sea coast, whereas the typical form was found in the central part of the country. She had actually looked at only 28 specimens from 5 locations and she gave LBS numbers as 57-59. A number of other characters, mostly head features, were given by both authors and Verhoeff mentioned a colour difference, *heller gelb* ('lighter yellow'), compared with the *mehr orangegelb* ('more orange-yellow') of *P. ferrugineum ferrugineum*.

English specimens that had been found had 43 or 45 LBS and were typically 30-35mm (exceptionally 50mm) in length (Eason, 1964; Barber, 2009). In the five Cuckmere Haven specimens examined (Lewis, 1960) the number of clypeal hairs corresponded fairly closely with Verhoeff's description of *P. ferrugineum ferrugineum*, but the number of labral teeth varied over the range given for both types (5 to 7+1 transitional) and in the adolescens was even lower (3) than that given for either. It was also noted

by Lewis that Ribaut (1915) had described a specimen from Algeria which, whilst otherwise having the characters of *insulanum* had only 5 labral teeth.

On the island of Crete Simaiakis & Mylonas (2003) reported the occurrence of two distinct forms of *P. ferrugineum*: a “short form” with 41-47 LBS, which occurs on the main island (except on the coast), and a “long form” with 55-59 LBS (which they called *P. ferrugineum f. insularum*), which occurred mainly on small satellite islands and on the coast. There is no overlap in the range of LBS. In a subsequent paper Simaiakis *et al.* (2004) revealed some interesting ecological information about the two forms:

*P. ferrugineum ferrugineum* was very common from western to eastern Crete, up to 2,000 m asl but mainly between 1,000 and 2,000m. Females occurred from late autumn to early spring whilst males were found in late autumn and early winter. It was said to be quite common in habitats modified by man, in *Pinus brutia* forests, in phryganic and maquis ecosystems with *Coridothymus capitatus*, *Sarcopoterium spinosum*, *Pistacia lentiscus* and *Nerium oleander* as well as in mountainous areas dominated by *Quercus coccifera*, in subalpine and alpine phrygana.

*P. ferrugineum insularum* was very common in the southernmost areas of Crete (altitudinal range effectively around 0m). It was found on the small satellite islands and on almost every coastal area around Crete. Adults occurred in the spring as well as late autumn and early winter. It preferred coastal phryganic areas and sand dunes. It was also collected on a plateau dominated by *Berberis cretica*, *Genista acanthoclada*, *Sarcopoterium spinosum*, *Phlomis sp.*, and some *Quercus coccifera* and *Acer sempervirens*.

In Greece, LBS numbers vary from 41/43 up to 63/65 with, apparently, not continuous variation, but a clear geographical separation of the “short” and “long forms” (S. Simaiakis, pers. comm.).

In France *P. ferrugineum* does favour the seashore, being widespread along the Mediterranean and Atlantic coasts, but is not considered to be strictly halobiontic or highly halophilous (Geoffroy & Iorio, 2009). There are also records from western and southern Brittany and scattered records inland (Iorio, 2014). Interestingly, an apparently similar condition to the Cretan one appeared to occur in an area of north west France where Iorio & Tiberghien (2007) report 43 and 45 LBS for two females collected inland on the mainland (at Saint-Rémy-la-Varenne and Brézé) and 53, 55 and 57 LBS for three females collected from a small off-shore island (Île de Groix). However, Blower (1987) found 3 large females with 55 LBS at Pointe de Benodet and an immature with 51 LBS at Beg Miel in south Finistère whilst Iorio (2014) reports on the species (without detail of LBS) at Penmarc’h. All these latter three sites were on the mainland of the département.

Clearly the pattern of occurrence of the two forms in France is especially of interest in relation to the Channel Islands. Etienne Iorio (pers. comm.) has kindly made available some of his data and offered comments about the French situation where there is both a “short form” with 41-49 LBS and a “long form” with 51-57. Although these seem to form a continuum, apparently specimens of both forms with 49 LBS and 51 LBS are rare (as are the “long form” ones with 59) and there appears to be no difficulty in separating the two forms. Ecologically the two forms are distinct with the “long form” being exclusively a species of sea-beaches (Mediterranean and Atlantic) as a halobiont, found up to 10m above the strandline (lower than this in Greece), and records of the “short form” include habitats described as river banks, alder wood, salt marsh, alluvial wood, humid wood and mixed wood on river bank. It seems that “island” vs “mainland” is less determining than habitat with mainland beaches having the “long form”. One location, the beach of an island, was seemingly unusual in having single animals with 45 and 55 LBS. Salt marshes, such as those of Hérault, an “intermediate habitat”, tend to have the “short form”.

## Conclusion

In addition to different maximum body lengths and non-overlapping distributions of LBS, the ecological information regarding the two forms in both Crete and France does certainly suggest that we might be looking at distinct or incipiently distinct subspecies or species. Apart from obviously much needed laboratory studies on the two forms from recognisably distinct “form” populations and more data both in general about the variation within *P. ferrugineum* populations in Europe, microscopical examination of the features used by Verhoeff and Kaczmarek to separate *P. ferrugineum ferrugineum* from *P. ferrugineum insulanum* in specimens from different “forms” and locations as well as genetic and biochemical studies are desirable. Unfortunately, the British Isles are probably not the best place to do this latter!

## Acknowledgements

Stelios Simaiakis for confirming the sex of the Guernsey specimens and for many valuable comments and information relating to the species, Etienne Iorio for most useful information about the habits and occurrence of the two “forms” of *Pachymerium ferrugineum* in France and Antoine Racine for his data & comments.

## References

- Andersson, G., Meidell, B.A., Scheller, U., Windqvist, J.-Å., Osterkamp, Madsen, M., Djursvoll, P., Budd, G. & Gärdenfors, U. (2005) *Nationalnyckeln till Sveriges flora och fauna. Mångfotingar. Myriapoda*. ArtDatabanken, SLU, Uppsala.
- Barber, A.D. (2006) Myriapoda (Centipedes & millipedes) from the Channel Islands. *Bulletin of the British Myriapod & Isopod Group* **21**: 19-39.
- Barber, A.D. (2008) *Key to the identification of British Centipedes*. AIDGAP key. Field Studies Council, Shrewsbury.
- Barber, A.D. (2009) Centipedes. *Synopses of the British Fauna (NS)* **58**. Linnean Society of London and the Estuarine and Brackish-Water Sciences Association/Field Studies Council, Shrewsbury.
- Barber, A.D. (2011) Geophilomorph centipedes and the littoral habitat. *Terrestrial Arthropod Reviews* **4**: 17- 39.
- Barber, A.D. & Keay, A.N. (1988) *Provisional atlas of the centipedes of the British Isles*. Huntingdon, Biological Records Centre, NERC.
- Berg, M., Soesbergen, M., Templeman, D. & Wijnhoven, H. (2008) *Verspreidingsatlas Nederlandse landpissebedden, duizendpoten en miljoenpoten (Isopoda, Chilopoda, Diplopoda)*. Leiden, Stichting European Invertebrate Survey, Nederland.
- Berg & Evenhuis (2001) Nederlandse faunistische mededelingen. Determinatie tabel voor de Nederlandse Duizendpoten pp 41- 77.
- Blower, J.G. (1987) More myriapods from Brittany. *Bulletin of the British Myriapod Group* **4**: 37-40.
- Brölemann, H.W. (1930) Éléments d'une Faune des Myriapodes de France, Chilopodes. *Faune de France* **25**, Imprimerie Toulousaine, 405pp.
- Demange, J-M. (1981) *Les Mille-pattes, Myriapodes*. Paris, Éditions Boubée.
- Eason, E.H. (1964) *Centipedes of the British Isles*. Warne, London.
- Geoffroy, J-J. & Iorio, E. (2009) The French centipede fauna (Chilopoda): updated checklist and distribution in mainland France, Corsica and Monaco. *Soil Organisms* **81** (3): 671-694.

- Gregory, S.J. & Marquis, A. (2019). First record of *Chaetophiloscia cellaria* (Dollfus, 1884) from the Channel Islands (Isopoda: Oniscidea: Philosciidae). *Bulletin of the British Myriapod and Isopod Group* **31**: 37-43.
- Hennings, C. (1903) Zur Biologie der Myriopoden, Marine Myriopoden. *Biologisches Zentralblatt* **23**: 720-725.
- Iorio, E. (2014) Catalogue biogéographique et taxonomique des chilopods (Chilopoda) de France métropolitaine. *Mem. Soc. Linn. Bordeaux* **15**: 1-372.
- Iorio, E. & Tiberghien, G. (2007) Nouvelles données sur la morphologie et la distribution géographique des Chilopodes du Massif Armoricaïn (Chilopoda) *Bull. Soc. Linn. Bordeaux* **142**, (N.S.) n° 35 (1): 75- 86.
- Johnston, D.E. (1981) *The Channel Islands, An Archaeological Guide*. London & Chichester, Phillimore.
- Kaczmarek, J. (1969) Beiträge zur Kenntnis Bulgarischer chilopoden. 1. *Bull. Soc. Amis Sc., Poznan Sér.D*, **9**: 263-277.
- Koren, A. (1986) Die Chilopoden-Fauna von Kärnten und Osttirol. Teil 1 Geophilomorpha, Scolopendromorpha. *Carinthia II*, **43**: 1-87.
- Lee, P. (2015) *A review of the millipedes (Diplopoda), centipedes (Chilopoda) and woodlice (Isopoda) of Great Britain*. Species Status No.23. Natural England Commissioned Reports **186**.
- Lewis, J.G.E. (1960) *Pachymerium ferrugineum* (C.L.Koch, 1835) a geophilomorph centipede new to Great Britain. *Entomologists' mon. Mag.* **95**: 206- 207.
- Lewis, J.G.E. (1961) On *Schendyla peyerimhoffi* Brölemann & Ribaut, and *Geophilus pusillifrater* Verhoeff, two geophilomorph centipedes new to the British Isles. *Ann. Mag. nat. Hist.* (13) **4**: 393-399.
- Lock, K. (2000) *Voorlopige atlas van de duizendpoten van België (Myriapoda, Chlopoda) Preliminary atlas of the centipedes of Belgium (Myriapoda, Chlopoda)*. Instituut voor Natuurbehoud, Koninklijk Belgisch Instituut voor Natuurwetenschappen Rapport I.N.2000/19.
- Lock, K. (2009) Updated checklist of the Belgian centipedes (Chilopoda). *Entomologie faunistique – Faunistic Entomology* **62**(1): 35-39.
- Marquis, A. (2019a) Insects and other Invertebrates of Britain and Europe group. <https://www.facebook.com/groups/invertid/permalink/1472999356169002/>
- Marquis, A. (2019b) Insects and other Invertebrates of Britain and Europe group. <https://www.facebook.com/groups/invertid/permalink/1483044261831178/>
- Meidell, B.A. (1979) Norwegian Myriapoda: Some Zoogeographical Remarks. pp 195-201. In: Camatini, M. (ed.). *Myriapod Biology*. London, England, Academic Press. pp 456.
- Nefediev, P.S., Tuf, I.H. & Farzalieva, G.S. (2017) Centipedes from urban areas in southwestern Siberia, Russia (Chilopoda). Part 2 Geophilomorpha. *Arthropoda Selecta* **26**(1): 8-14.
- Palmen, E. (1949) The Chilopoda of Eastern Fennoscandia. *Ann. Zool. Soc. Zool. Bot. Fenn. Vanamo* **13**(4): 1-46.
- Palmen, E. & Rantala, M. (1954) On the life history and ecology of *Pachymerium ferrugineum* (C.L.Koch) (Chilopoda, Geophilidae). *Ann. Zool. Soc. Zool. Bot. Fenn. Vanamo* **16**(3): 1-44.
- Plateau, F. (1890) Les myriopodes marins et la resistance des arthropods a respiration aerienne a la submersion. *Journal de l'anatomie et physiologie normales et pathologiques de l'hommes et des animaux*. **26**: 236-269.
- Ribaut, H. (1915) Notostigmophora, Scolopendromorpha, Geophilomorpha. *Arch. Zool. exper. gén.* **55**: 323-346.

- Schubart, O. (1929) *Thalassobionte und thalassophile Myriapoda*. In: Grimpe, G. and E. Wagler (eds). *Tierwelt der Nord- und Ostsee* **11**: 1-20.
- Schubart, O. (1964) in Brohmer, P., Erhrmann, P. & Ulmer, G (eds) *Die Tierwelt Mitteleuropas* **2**(3). Leipzig, Von Quelle & Meyer.
- Simaiakis, S., Iorio, E., Djursvoll, P., Meidell, B.A., Andersson, G. & Kirkendall, L. (2010) A study of the diversity and geographical variation in numbers of leg-bearing segments in centipedes (Chilopoda: Geophilomorpha) in north-western Europe. *Biological J. Linn. Soc.*, **100**: 899–909.
- Simaiakis, S.M. & Mylonas, M. (2003) *Pachymerium ferrugineum* (C.L. Koch, 1835) – two distinct forms in Crete? *Bulletin of the British Myriapod & Isopod Group* **19**: 57-61.
- Simaiakis, S.M., Minelli, A. & Mylonas, M. (2004) The centipede fauna (Chilopoda) of Crete and its satellite islands (Greece, Eastern Mediterranean). *Israel J. Zool.* **50**: 367-418.
- Simaiakis, S.M., Zapparoli, M., Minelli, A. & Bonato, L (2013) The centipede fauna (Chilopoda) of the island of Cyprus with one new lithobiomorph species. *Zootaxa* **3647**: 279-306.
- Suomalainen, P. (1939) Zur Verbreitungskologie von *Pachymerium ferrugineum* C.Koch (Myriopoda) in finnischen Scharenhof. *Ann. Zool. Soc. Zool. Bot. Fenn. Vanamo* **7**: 10-14.
- Verhoeff, K.W. (1902) Über einige paläarktische Geophiliden. *Zool. Anz.* **25**: 557-561.