



Mass occurrences and swarming behaviour of millipedes (Diplopoda: Julidae) in Eastern Germany

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Abstract

Observations of the well-known phenomenon of mass occurrences and swarming behaviour of Julidae are supplemented by seven new reports from Eastern Germany (1994 to 2002). Most of these records refer to *Ommatoiulus sabulosus*, while some also concern *Cylindroiulus caeruleocinctus*, *Julus scandinavicus*, *Julus scanicus*, and *Ophiulus pilosus*. For the three latter species, mass occurrences were observed for the first time.

1. Introduction

The phenomenon of mass occurrences and swarming of millipedes has been known for a long time. Many observations of different species showing this behaviour and special situations exist all over the world (e.g. Ohio: Morse 1903; India: Mitra 1976; Australia: Baker 1978; Japan: Saki 1934, Nijima & Shinohara 1988; Romania: Ceuca 1982). More summarising works can be found in Schubart (1940), Cloudsley-Thompson (1949), Korsós (1998), and Hopkin & Read (1992). Fairhurst (1969) has carried out experiments to estimate the influence of environmental factors.

New records have accumulated in Germany during the last 10 years. Some invasions persisted only for a short time, but some over several years. Therefore, people were very irritated and millipedes got a dubious reputation. The causes of the phenomenon of mass occurrences and wanderings were not clear until now. But only collecting as many data as possible provides evidence to explain this spectacular behaviour. For this reason the new records of mass occurrences and their attendant circumstances are summarised.

Tab. 1 Examples for mass occurrences and swarming behaviour of Julidae observed in Europe during the last two centuries.

Species	author	country
<i>Megaphyllum unilineatum</i> (C. L. Koch, 1838)	Paszlavszy (1878a, b) Tömösváry (1878) Kadocsa (1911) Ćurčić & Makarov (1995) Korsós (1998)	Hungary Romania Hungary Northern Yugoslavia Hungary
<i>Megaphyllum projectum kochi</i> (Verhoeff, 1907)	Jawłowski (1936) Stojałowska (1961)	Poland Poland
<i>Cylindroiulus caeruleocinctus</i> (Wood, 1864)	Becker (1929) Lindgren (1942) Thaler (1989)	Latvia Sweden Austria
<i>Cylindroiulus londinensis</i> (Leach, 1814)	Chater (2004)	Great Britain
<i>Julus terrestris</i> (Porat, 1889)	Tömösváry (1878)	Romania
<i>Ommatoiulus sabulosus</i> (Linné, 1758)	Verhoeff (1900) Demange (1960) Sahli (1996) Verhoeff (1938) Helb (1975) Haacker (1968) Ehrnsberger (2002) Stojałowska (1949) Dziadosz (1966) Stojałowska & Staręga (1974) Kania & Tracz (2005)	France France France Germany Germany Germany Germany Poland Poland Poland Poland
<i>Tachypodoiulus niger</i> (Leach, 1814)	Omerod, E. A. (1890) Scott (1958a, b)	Great Britain Great Britain
<i>Unciger foetidus</i> (C. L. Koch, 1838)	Thaler (1989)	Austria

2. New records from East Germany

2.1. *Ommatoiulus sabulosus* (Linné, 1758)

- a) Rothenburg, about 20 km N of Görlitz (federal state of Saxony), in the direct vicinity of a small airport at the northern periphery of the town. Observation date: 22 May 2001
Since 1994, every May/June huge mass migrations were observed by the residents. The swarming reached a culmination in 2001. Then radical pest controls brought it to an end.

A building next to a small airport was especially »attacked«. The specimens were concentrated at the walls of the houses, on which they climbed up to approx. 6 m high. The millipedes also swarmed in large amount on light-coloured stepping stones. The high number of dead individuals laying nearby the walls was very conspicuous.

The building attacked by thousands of millipedes was situated directly adjacent to a pine-plantation, where the millipedes seemed to come from. Many of them were also observed on the open grassland of the airport.

Comments: A random number of individuals were taken off to establish their developmental stages (defence gland method, podal and apodal rings, size analyses). All specimens belong to the last premature (VIII) and to the adult stages IX, X, XI and XII (Fig. 1). In all stages females preponderate.

Till now (2005), a new mass occurrence or a swarming has not been observed.

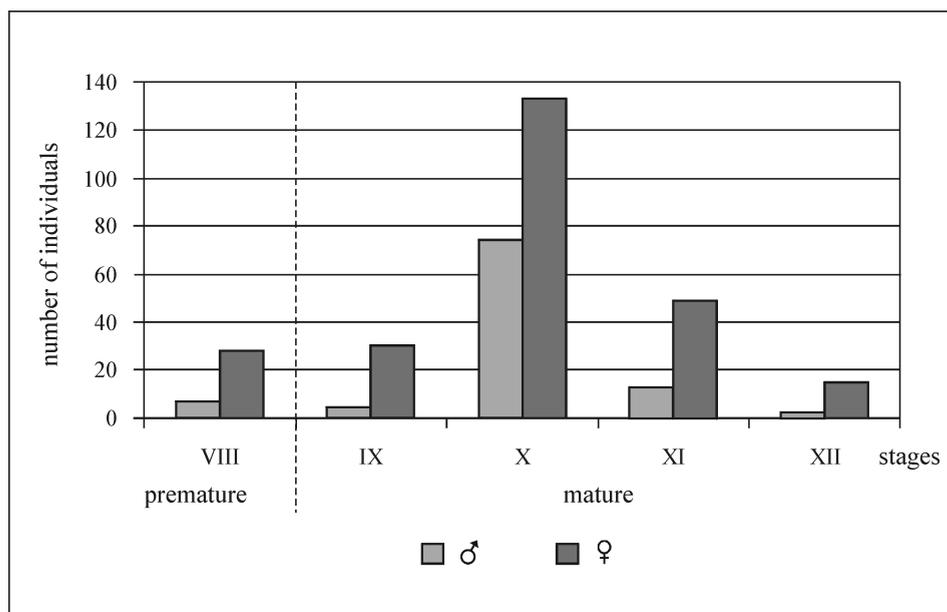


Fig. 1 Developmental stages of *Ommatoiulus sabulosus* (n=354) in Rothenburg.

- b) Weißwasser, about 60 km NW of Görlitz (federal state of Saxony), private gardens north-east of the town. Observation date: beginning of June 1995

Dozens of millipedes were concentrated at light-coloured house walls, cellar entrances and light-coloured tiled terraces. The specimens came from surrounding young pine forest and open grassland (*Calamagrostis epigejos*) on sand dunes.

- c) Lohsa, spoil dump 22 km N of Bautzen (federal state of Saxony). Observation date: 15 May 1981
This single observation came from at a renatured spoil dump on sandy brown soil covered by *Sambucus*, ferns and grass. A few tens of individuals wandered on the soil and up to the tops of the shrubs.
- d) Cottbus (federal state of Brandenburg), housing estate in the north-west suburban area. Observations date: 30 May 1997
Since 1996 to 1998 every May/June residents observed some hundreds of specimens concentrated at light-coloured house walls up to two metres high and other light-coloured plastered surfaces in the surroundings of the houses. Some of the millipedes were entering the houses and some were found laying dead at the walls. Nearby dry pine forests on sandy soil could be the source of migration.
In 1997 first pest controls took place, but only an additional repeat in 1998 stopped the invasion.
- e) Schlabendorf, about 35 km W of Cottbus (federal state of Brandenburg), car park outside the village. Observation date: 5 June 2002
Some hundred specimens were observed swarming at a light-coloured concrete place. They migrate from adjacent dry pine forests and open grassland (*Calamagrostis epigejos*) on sand dunes. Some dead individuals were found laying at the place among the living.

2.2. Observations of other species

- a) Zechau, about 40 km S of Leipzig (federal state of Thuringia), in direct vicinity of reclaimed spoil dumps. Observation date: June 1991
In spring and early summer mass occurrences of millipedes connected with swarming were observed in a village near Altenburg over a period of several years according to the residents. In 1991, the species were identified as *Julus scandinavus* Latzel, 1884, *Ophiulus pilosus* (Newport, 1842), and *Cylindroiulus caeruleocinctus* (Wood, 1864) by the author.
The millipedes invaded houses and gardens. Some dead individuals were found near house walls and cellar entrances.
Starting points seemed to be ruderal meadows, young poplar afforestations and sites with *Hippophaë rhamnoides*, *Tussilago farfara*, and *Calamagrostis epigejos* on loamy soils on a slope of an opencast mining area. For nutrition, the litter layer was developed to a sufficient level.
- b) Görlitz-Königshufen (federal state of Saxony), at the northern suburban area. Observation date: May 2002
Julus scandinavus was observed especially at cellar entrances and on light-coloured house walls. The buildings attacked by a few tens of individuals were located adjacent to farmland.

- c) Greifswald (federal state of Mecklenburg-Western Pomerania), at a south-western suburban area. Observation date: October 2001

Since 1998 mass occurrences of *Julus scanicus* were observed in the residential estate. The area borders on a large open grassland. This fresh meadow was cut only once a year and the grass material was left unused.

The millipedes were congregated at the angles between fundament and superstructure of the houses and other wall grooves during day time. From 8:00 p.m. the millipedes were observed to climb up the walls.

3. Discussion

Most frequently mass occurrences and migrations are known from representatives of the Julidae, especially *O. sabulosus*, *M. unilineatum* (Tab. 1). Swarming behaviour in *J. scandinavicus* and *J. scanicus* is recorded here for the first time. It is also known of *O. pilosus* (Brade-Birks 1922), but a mass occurrence of this species was observed for the first time (East Germany, Zechau).

Most records presented here were from *O. sabulosus*. Concerning this species, the circumstances of these new records correspond with observations known from literature:

- Migrations were mostly observed in spring and summer time during very hot days (Schubart 1940, Ehrnsberger 2002, Kania & Tracz 2005). An excitation by rainfall could not be proved.
- Light-coloured stone surfaces and sunlit roads were preferred (Dziadosz 1966, Ehrnsberger 2002)
- Vertical migrations (climbing grasses, bushes, trees, and walls) have been often observed (e.g. Schubart 1925, 1940, Stojakowska 1949, Haacker 1968, Kania & Tracz 2005)
- According to Verhoeff (1900, 1928), Kania & Tracz (2005) (*O. sabulosus*) and Korsós (1998) (*M. unilineatum*), only last premature and adult stages swarm. In *O. sabulosus* especially females show this behaviour.
- Areas influenced by man (fallow land, salt heap) are especially affected (Helb 1975, Chater 2004)

Many speculations exist about the causes of mass occurrences and swarming behaviour (e.g. climatic conditions, mating behaviour, looking for favourable egg-laying places, lack of food). Under suitable conditions (such as mild winters with few frosty days), a large population of *O. sabulosus* can be built up within only two to three years (own enquiry). These populations consist of adult individuals of stages IX to X predominantly (Fig. 1) that start to swarm.

Only long-term observations of one and the same population showing such phenomena could lead to substantiated answers. However, this can take a long time as is seen from the *O. sabulosus*-population in Rothenburg.

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