

Amphipods from caves of the Grand Duchy of Luxembourg

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Zusammenfassung

Von 2007 bis 2011 wurden in 82 Höhlen und künstlichen Hohlräumen des Großherzogtums Luxemburg Tiere gesammelt. Unter rund 90.000 gesammelten Tieren waren 130 Flohkrebse. 3 Arten konnten bestimmt

werden: *Niphargus schellenbergi* Karaman, 1932 war die häufigste Art, gefolgt von *Gammarus fossarum* Koch, 1836 und *Gammarus pulex* Linnaeus, 1758.

Abstract

From 2007 to 2011, animals were collected in 82 caves and artificial cavities in the Grand Duchy of Luxembourg. Of the 90,000 individuals sampled, 130 were amphipods from three identified species: *Niphargus schellenbergi*

Karaman, 1932 was the most common species, followed by *Gammarus fossarum* Koch, 1836 and *Gammarus pulex* Linnaeus, 1758.

Résumé

De 2007 à 2011, des animaux ont été récoltés dans 82 grottes et cavités artificielles du Grand-Duché de Luxembourg. Parmi les 90 000 individus récoltés, 130 étaient des amphipodes appartenant à trois espèces identifiées:

Niphargus schellenbergi Karaman, 1932 était l'espèce la plus fréquente, suivie par *Gammarus fossarum* Koch, 1836 et *Gammarus pulex* Linnaeus, 1758.

1 Introduction

The amphipod fauna of Luxembourg is rather poor, with only 14 recorded species (Heuertz 1935; Hoffmann 1962; Neitzke 1978; Neitzke & Reichling 1979; Massard & Geimer 1992; Dhur 1993; Dhur & Massard 1995; Gerecke & al. 2005; Groh & Allspach 2007): *Corophium curvispinum* Sars, 1895, *Crangonyx pseudogracilis* Bousfield, 1958, *Crangonyx subterraneus* Bate, 1859, *Echinogammarus berilloni* Catta, 1878, *Gammarus fossarum* Koch, 1836, *Gammarus pulex* Linnaeus, 1758, *Gammarus roeselii* Gervais, 1835, *Gammarus tigrinus* Sexton, 1939, *Microniphargus leruthi* Schellenberg, 1934,

Niphargus aquilex Schiödde, 1855, *Niphargus fontanus* Bate, 1858, *Niphargus schellenbergi* Karaman, 1932, *Niphargus virei* Chevreux, 1896, and *Orchestia cavimana* Heller, 1865. Among these 14 species, six (*C. curvispinum*, *C. pseudogracilis*, *E. berilloni*, *G. roeselii*, *G. tigrinus*, and *O. cavimana*) are recent additions to the local fauna (Hoffmann 1962; Dhur & Massard 1995; Massard & Geimer 1992; Dhur 1993; Gerecke & al. 2005), whereas all eight autochthonous species (*G. fossarum*, *G. pulex*, *C. subterraneus*, *M. leruthi*, *N. aquilex*, *N. fontanus*, *N. schellenbergi*, and *N. virei*) have been reported to occur occasionally or regularly in caves and artificial cavities in Luxembourg (Hoffmann 1962; Gerecke & al. 2005; Weber 2011, 2011a).

2 Frequency of amphipods in Luxembourg caves

The proportion of amphipods in the samples analyzed is modest (130 collected specimens out of ca. 90,000). Among the 82 caves studied, only 14 contain sufficient water for sieve collections but each of these 14 caves yielded amphipods: amphipods are therefore commonly observed in cave waters in Luxembourg.

3 Cave amphipod species of Luxembourg

Out of the 8 species previously reported from caves, only 3 were observed among the individuals collected in the present study: *Gammarus fossarum* (6 identified specimens), *G. pulex* (two identified specimens), *Niphargus schellenbergi* (26 identified specimens).

3.1 Crangonyctidae Bousfield, 1973

No crangonyctid was collected in the present study.

Crangonyx subterraneus Bate, 1859

This species was rarely collected in Luxembourg: Hoffman (1962) mentions five collection sites, mostly wells and spring but also in a mine near Heisdorf.

3.2 Gammaridae Latreille, 1802

Out of the 33 gammarids collected in the present study, only eight could be identified down to species level (identifications were solely based on morphology as these specimens were not preserved in a way suitable for DNA taxonomy).

Gammarus fossarum Koch, 1836

This species is widely distributed in Europe. It is predominantly found in surface waters and occurs in caves as well (Hoffmann 1962). Six collected specimens from Tunnel Huldange in the North of Luxembourg were attributed to this species. 25 additional specimens from the same location

were too small to be determined correctly but may belong to the same species.

G. fossarum is considered in the older literature as eutrogloxene (Leruth 1939; Strinati 1965; Dobat 1975; Weber 1991), but more recently as eutroglophile (Zaenker 2001; Weber 2012).

Gammarus pulex Linnaeus, 1758

This species is common in springs, streams and ponds in Europe and is also sometimes found at the entrance of underground passages (Hoffmann 1962). Two collected specimens from Tunnel Huldange in the North of Luxembourg were attributed to this species.

G. pulex is considered as eutrogloxene (Dobat 1978; Weber 1991, 2012).

3.3 Niphargidae Bousfield, 1977

Niphargids were found in all 14 caves that contained water. 97 specimens were observed and identified morphologically as belonging to the genus *Niphargus*. 26 specimens from 8 caves were identified down to species-level using DNA sequencing: briefly, samples preserved in 70%-96% ethanol were dissected and DNA extracted from one or two legs, then subjected to polymerase chain reaction (PCR) in order to amplify and sequence a set of taxonomically informative markers (COI, 12S, 28S; see Flot 2010 and Flot & al. 2010 for detailed descriptions of the methods). All sequenced specimens were identified as *N. schellenbergi*. Specimens from the 6 other caves either escaped during collection or were not preserved in a way suitable for DNA sequencing, but as these caves were located very close to caves where *N. schellenbergi* was present it is probable that all the individuals observed in the present study belonged to the same species.

Microniphargus leruthi Schellenberg, 1934

This very small species was only reported from one site in Luxembourg, the underground galleries of Oberwampach draining the water of the abandoned galena mine of Allerborn (Hoffmann 1962). It was not collected in the present study.

Niphargus aquilex Schiödte, 1855

This species is common in Northern Europe, including Great-Britain (Hartke & al. 2011).

Stoch in Gerecke & al. (2005) collected it only from the hyporheos but not from springs: the strong preference of this species for interstitial environments probably explains why it was not observed in the present study (Stoch, pers. comm.).

Niphargus fontanus Bate, 1858

This species is considered common in Northern Europe, including Great-Britain (Hartke & al. 2011). Hoffman (1962) reports it from several mines (notably the Langeberg iron ore mine near Dudelange), but it was not observed in Gerecke & al. (2005) nor in the present study. *N. fontanus* is difficult to distinguish morphologically from *N. schellenbergi* without dissecting mouthparts, resulting in frequent misidentification (Hartke & al. 2011): therefore, additional investigation will be required to confirm or infirm the early reports of this species in Luxembourg.

Niphargus schellenbergi Karaman, 1932

This species is very common in Northern Europe, but absent from the United Kingdom (Hartke & al. 2011). It was by far the most abundant cave amphipod observed in Luxembourg in the course of this study, with 26 identified specimens (all confirmed using DNA sequencing) from the very north to the very south of the country.

N. schellenbergi is a typical inhabitant of groundwaters, including caves, and is considered an troglobiont / eutroglobiont (Weber 1991, 1997, 2012; Zaenker 2007).

Niphargus virei Chevreux, 1896

This species is abundant in France but quite rare in Luxembourg: Hoffman (1962) reports it only from one spring and one mine (the Langeberg iron ore mine near Dudelange). It was not observed in the present study.

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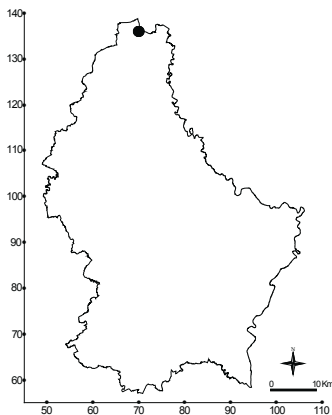


Fig. 1. Caves with *Gammarus fossarum* in Luxembourg.

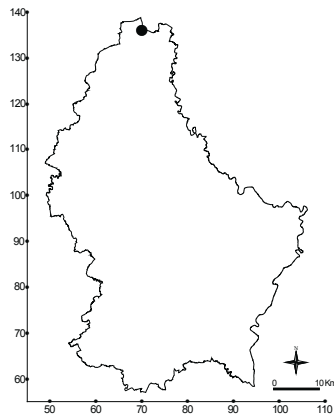


Fig. 2. Caves with *Gammarus pulex* in Luxembourg.

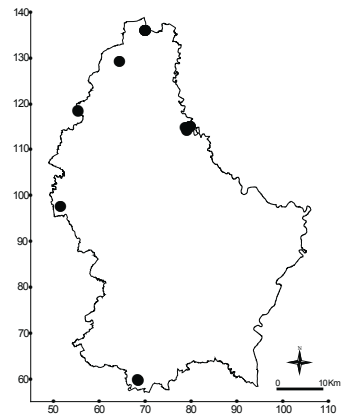


Fig. 3. Caves with *Niphargus schellenbergi* in Luxembourg.



Fig. 4: *Niphargus schellenbergi* from the Kofferminn Stolzebuerg Hauptssystem.



Fig. 5: *Niphargus schellenbergi* in the Kofferminn Stolzebuerg Hauptssystem.

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