

# Old and new records of *Petrobius brevistylis* Carpenter, 1913 (Archaeognatha, Machilidae) in North Norway

ROBERT BERGERSEN, ARNE C. NILSSEN & PER STRAUMFORS

Bergersen, R., Nilssen, A.C. & Straumfors, P. 2014. Old and new records of *Petrobius brevistylis* Carpenter, 1913 (Archaeognatha, Machilidae) in North Norway. *Norwegian Journal of Entomology* 61, 1–7.

The apterygote insect species *Petrobius brevistylis* is here reported for the first time from the Arctic, as defined by the July <10°C isotherm. It is found to be common along the coast all over North Norway, but appears to be scarce in the northeast area towards Russia. This area, as well as the Atlantic islands and Greenland, should be investigated in late August or early September when the juveniles are most conspicuous. The habitat preference, with occurrence in fishing ports and man-made structures such as piers and breakwaters, indicates spread to new localities by man.

Key words: Jumping bristletails, Archaeognatha, Machilidae, *Petrobius brevistylis*, North Norway.

Robert Bergersen, Tromsø University Museum, University of Tromsø, NO-9037 Tromsø, Norway.  
E-mail: robert.bergersen@uit.no.

Arne C. Nilssen, Tromsø University Museum, University of Tromsø, NO-9037 Tromsø, Norway.  
E-mail: arnec.nilssen@uit.no.

Per Straumfors, Sykehusgt. 51, NO-8613 Mo i Rana, Norway. E-mail: per.straumfors@gmail.com.

## Introduction

The occurrence of the jumping bristletail *Petrobius* Leach, 1809 in North Norway is known from four previous publications. Per Brinck (1961) wrote that it occurred “up to North Cape” but without giving any references. Reidar Mehl (1977) collected insects in Nordland (but not Troms and Finnmark) 1966–1973 and reported *Petrobius* from three localities. Wim Vader (1983) observed *Petrobius* in Nordland, whereas Arne Fjellberg (1984) reported two records from Troms and one from Finnmark (Figure 1).

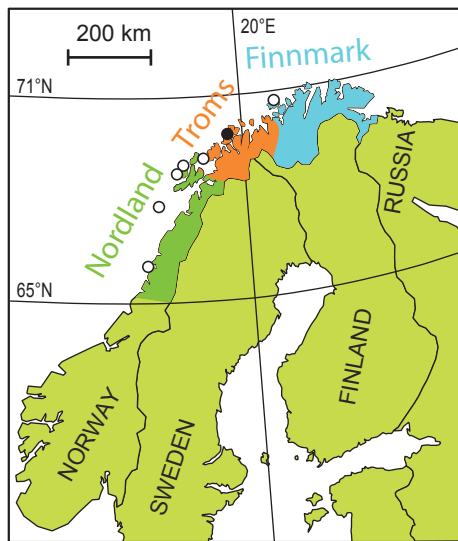
In 2008, a jar labeled “Eph.” (Ephemeroptera) was found in the insect collection of Tromsø Museum. It contained vials of *Petrobius* collected by Jacob Sparre Schneider (one locality in Troms 1884) and Tron Soot-Ryen (3 localities in Nordland 1936 and 1941, 2 localities in Troms 1925 and 1934). These records had not been published.

The district museum in Mo i Rana, Nordland, the *Helgeland Museum* (previously Rana Museum), also had a collection of *Petrobius*. The specimens had been collected in Nordland in 1967 and 1977–1993, mainly by Per Straumfors, and were made available for new studies in 2009. Inspired by these finds, the first and second author started a pilot study in 2009 in Nordland and Troms, in which several new locations of the species were found.

It was then hypothesized that *Petrobius* might actually be common but overlooked. In 2010 we therefore decided to cover the most easily accessible parts of the whole of North Norway (Nordland, Troms and Finnmark counties).

## Material and methods

The main bulk of the material was collected in 2011



**FIGURE 1.** Nordland, Troms and Finnmark counties (North Norway) with earlier records of *Petrobius* Leach, 1809. Closed circle: specimens published in Fjellberg (1984); open circles: observations published in Mehl (1977), Vader (1983) and Fjellberg (1984).

(15 localities) and 2012 (60 localities). In 2011 it was thought to be sufficient to visit northern Troms and western Finnmark (in August) to find northern localities. In 2012, after a visit to eastern Finnmark (in early July), more was learnt about habitat preferences (see Results), and collection trips were made to Troms and northern Nordland (August and September). One last trip was made to easternmost Finnmark in June 2013. The study area, with the previously published records of *Petrobius*, is shown in Figure 1.

Trying to catch the bristletails by hand was unsuccessful, and the insect net was difficult to handle. The best method was to use a white plastic box about the size of 19 x 19 x 8 cm. The animals were collected as they jumped into the box that had been filled with some water and held under the edge of overturned stones. This is similar to Davies and Richardson's (1973) method of "raising stones and moving an empty specimen tube under the bristle tails until they dropped into it."

The nomenclature follows Davies (1990) and Friedrich & Makings (1990). The *Petrobius*

collected during 2009–2013 are deposited in ethanol at Tromsø University Museum.

## Results

In August 2011 (northern Troms and western Finnmark) and July 2012 (eastern Finnmark), specimens of *Petrobius* were successfully collected in about one of four places visited. By inexperience, search took place in natural habitats only: rock crevices and among boulders about 1–2 meters above the high water mark. Specimens were collected in 19 localities in Finnmark, including the northernmost locality at Skarsvåg (71°7'N). Specimens were collected east of Skarsvåg (Figure 2), in the Arctic region as defined by the July <10°C isotherm.

On 28 August 2012 the only mass occurrence was observed at Skjomnes (68°24'N), south of Narvik. Before reaching the destined locality, a rock outcrop further ahead, *Petrobius* were seen swarming on stones and boulders below the E6 road (Figure 3). From then on, attention was paid to man-made structures. *Petrobius* proved to be common in road fillings above the high water mark, and in breakwaters, unless these had been newly constructed. Although proving abundant in the old fishing ports (piers, breakwaters, trafficked areas), members of the public in the localities in question had not seen this insect before.

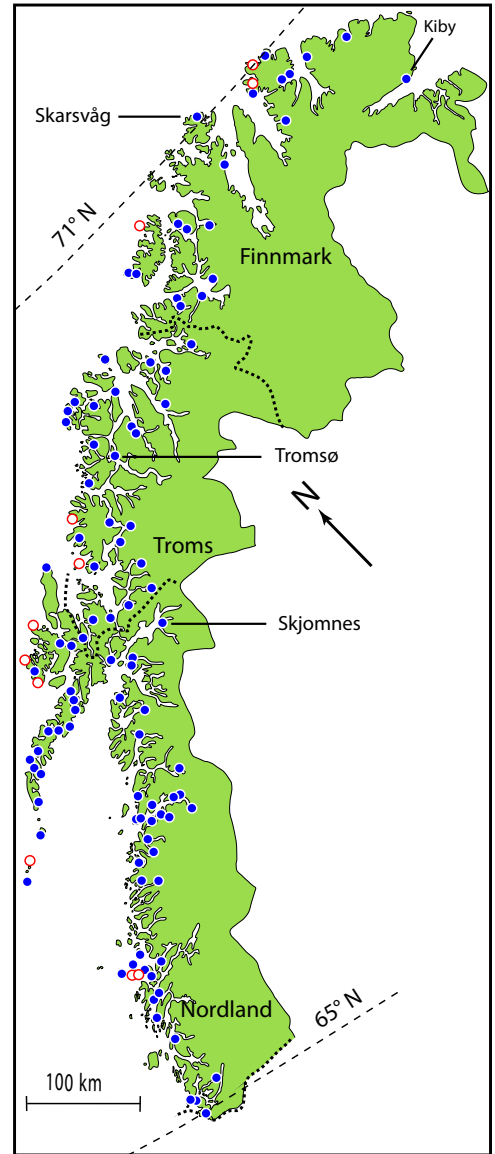
In easternmost Finnmark (along the Varanger fjord), *Petrobius* were collected in only one locality (Kiby, 70°3'46"N, 29°49'15"E) (Figure 4). In 2013, a search in man-made structures was conducted, but still not found, not even in the ports of Vardø and Kirkenes. Also around the fjords of Balsfjord and Malangen (Troms), which were easily accessible, no specimens were encountered. In areas where *Petrobius* were found, there were exuviae underneath the first raised stones. The insects were slow at lower temperatures (4–8°C) (cf. Makings 1973), and more easy to catch.

All specimens were identified as *Petrobius brevistylis* Carpenter, 1913 (Figure 5). They feed on tiny Chlorophyceae (Larink 1968), and the preserving fluid (75% ethanol) often turned greenish.

## Records

The abbreviations RB, ACN and PS in the list below refer to the author names.

*Museum material from Nordland* (Figure 2):  
 NSY, Bindal: Osen 31 July 2009 1♂1juv. leg. RB, Holm 1 August 2009 1♂ leg. RB; Brønnøy: Lande 9 July 1979 3♀♀ leg. PS; Sømna: Skårffjellet (Vennesund) 13 September 1985 1♀ leg. Stig Lundmo & Willy Hjelmseth; Vevelstad: Vassvika 8 July 1979 2♀♀1♂ leg. PS; Alstahaug: Hånestangen (Sandnessjøen) 28 May 1967 2♀♀3♂♂2juv. leg. Johan K. Johansen, Alstahaug 7 July 1979 3♀♀ leg. PS; Dønna: Lauvøya 4 June 1978 1♂ leg. PS, Tranøya 27 June 1993 1♀ leg. PS; Nesna: Dilra (Handnesøya) 19 June 1980 1♂ leg. PS, Husby (Tomma) 6 June 1977 2♀♀1♂ and 14 June 1978 2♀♀ leg. PS, Tommeidet (Tomma) 18 July 1980 1♂ leg. PS; Lurøy: Lovund 20 June 1979 1♀ leg. PS, Hestvika 28 June 1979 2♀♀1♂ leg. PS, Sleneset 12 August 2012 5juv. leg. Karl Frafjord; Meløy: Glommen 8 September 2012 49juv. leg. RB, Ørnes 8 September 2012 9juv. leg. RB; Gildeskål: Novika-Rekvika 8 September 2012 1♀3♂♂22juv. leg. RB, Breivika 8 September 2012 4juv. leg. RB, Nygårdsjøen 8 September 2012 21juv. leg. RB; Bodø: Vågan 7 September 2012 1♂45juv. leg. RB, Nordstranda 7 September 2012 3♀♀1♂10juv. leg. RB, Festvåg 7 September 2012 1♀4♂♂60juv. leg. RB, Hunstadmoen 8 September 2012 1♂12juv. leg. RB, Godøy 8 September 2012 3juv. leg. RB; NSI, Bodø: Høgset (Misvær N) 8 September 2012 6juv. leg. RB, Sand 8 September 2012 13juv. leg. RB; Saltdal: Dalmovika (Rognan N) 29 August 2012 1♂35juv. leg. RB; Fauske: Leivset 29 August 2012 1♀1♂16juv. leg. RB, Tørresvik 7 September 2012 1♀10juv. leg. RB; NNV, Røst: Skomvær 8 July 1936 1♀3♂♂ leg. T. Soot-Ryen; Værøy: Måstadsanden 13 July 1936 1♂ leg. T. Soot-Ryen; Moskenes: Å 1 September 2012 6♀♀5♂♂8juv. leg. RB; Flakstad: Nusfjord 1 September 2012 1♀1♂7juv. leg. Z. C. Bergersen, Bø 1 September 2012 3♀♀1♂16juv. leg. RB, Vikten 1 September 2012 4♀♀6♂♂12juv. leg. RB; Vestvågøy: Offersøya 31 August 2012 6♀♀6♂♂ leg. RB, Sundklakk 1 September 2012 1♀1♂8 juv. leg. RB; Vågan: Laupstad 31 August



**FIGURE 2.** Records of *Petrobius brevistylis* Carpenter, 1913 in North Norway. The northernmost (Skarsvåg, 71°7'N) and easternmost (Kiby, 29°49'15"E) locality is named, as is the one with mass occurrence (Skjomnes). Closed circles: voucher specimens; open circles: observations.

2012 1♀6juv. leg. RB, Vaterfjord 31 August 2012 3juv. leg. RB, Lyngvær 31 August 2012 1♀ leg. RB, Kabelvåg 1 September 2012 1♂20juv. leg. RB; Hadsel: Hattneset 31 August 2012 6juv. leg. RB; Lødingen: Hjertholmen 31 August 2012



**FIGURE 3.** Man-made habitat below the E6 road at Skjomnes ( $68^{\circ}24'N$ ), northern Nordland, on 22 May 2013.



**FIGURE 4.** Natural sandstone habitat at Kiby ( $70^{\circ}3'46''N$ ,  $29^{\circ}49'15''E$ ), eastern Finnmark, on 8 July 2012.



**FIGURE 5.** Adult female *Petrobius brevistylis* Carpenter, 1913. The species is a master in camouflage and hiding itself. When disturbed, it jumps until it finds a proper place. Here it has found a narrow crevice where it stays motionless. It is, as here, often found upside down. Photo: A. C. Nilssen.

14juv. leg. RB; Bø: Husvågen 1 September 2012 2♀♀ leg. RB; Sortland: Jennestad 1 September 2012 1♂5juv. leg. RB, Strand 2 September 2012 1♀1♂7juv. leg. RB; Andøy: Andenes 26 July 1941 1♂ leg. T. Soot-Ryen; NNØ, Sørfold: Megården 31 August 2012 6juv. leg. RB; Steigen: Bjørsvik 23 June 1982 3♀♀2♂♂ leg. S. Lundmo; Hamarøy: Steinbakken (Innhavet S) 31 August 2012 1♂7juv. leg. RB, Tømmeråsen 12 August 2009 1juv. leg. ACN; Tysfjord: Grønnstranda (Skarberget E) 28 August 2012 1♂3juv. leg. RB; Ballangen: Ånepollen 7 September 2012 1juv. leg. RB; Narvik: Skjomnes 28 August 2012 1♀2♂♂50juv., 7 September 2012 55juv., 22 May 2013 5♀♀5♂♂11juv. and 22 June 2013 5♀♀13♂♂51juv. leg. RB.

*Museum material from Troms* (Figure 2): **TRY**, Kvæfjord: Forøysæter 2 September 2012 2♂♂7juv. leg. RB, Straumen 2 September 2012 4♀♀1♂12juv. leg. RB; Harstad: Sørvika (Sandtorg) 2 September 2012 18juv. leg. RB; Dyrøy: Mohamn 9 September 2012 3juv. leg. RB; Tranøy: Grønvika 10 June 2012 20♀♀6♂♂ leg.

Anders Klemetsen; Torsken: Sifjord 9 September 2012 1♀5♂♂129juv. leg. RB; Lenvik: Godlia (Grasmyr N) 9 September 2012 1♂1juv. leg. RB; Tromsø: Skulsfjord 3 June 1984 5♀♀4♂♂ leg. Arne Fjellberg, Telegrafbukta 4 September 2009 1♂ leg. ACN, Store Sommarøya 4 August 2012 9♀♀14♂♂ leg. RB, Nebbejord (Oldervik S) 5 August 2012 2♀♀5♂♂14juv. leg. Z. C. Bergersen; Karlsøy: Sør-Fugløy 1 August 1934 1juv. leg. T. Soot-Ryen, Bukkhattøy 2 August 1934 1♀1juv. leg. T. Soot-Ryen, Måkeskjær 6 September 1931 2♀♀, Vatnan (Dåfjorden) 25 August 2012 1♀2juv. leg. RB, Karlsøya 6 July 1925 6♀♀1♂ leg. T. Soot-Ryen, Nord-Fugløy 18 July 1884 1♀ leg. J. S. Schneider; Skjervøy: Sandvågen 16 August 2011 2♀♀1♂ leg. RB; Nordreisa: Klubbenes 16 August 2011 1♀2juv. leg. RB; **TRI**, Skånland: Grov (Astafjord) 2 September 2012 20juv. leg. RB; Gratangen: Elvenes (Gratangsbotn) 2 September 2012 2♀♀18juv. leg. RB; Salangen: Sjøvegan 9 September 2012 2♀♀22juv. leg. RB; Sørreisa: Sørreisa 9 September 2012 1juv. leg. RB; Tromsø: Breivikeidet 16 September 2012

1♀10juv. leg. Z.C. Bergersen; Kåfjord: Djupvik 20 August 2011 4♀♀4♂♂ leg. Z.C. Bergersen; Kvænangen: Bankenes 20 August 2011 1♀1juv. leg. RB.

*Museum material from Finnmark* (Figure 2): **FV**, Loppa: Seistrand 17 August 2011 2juv. leg. RB, Moloveien (Øksfjord) 16 August 2011 3♀♀ leg. RB; Alta: Innervika (Kviby) 19 August 2011 2♀♀5juv. leg. RB, Svahella (Talvik) 20 August 2011 2♂♂1juv. leg. RB; Hasvik: Sørvær 17 August 2011 2♂♂2juv. leg. RB, Breivik 17 August 2011 2♂♂ leg. RB; Hammerfest: Rypefjord 18 August 2011 1♂4juv. leg. RB; Kvalsund: Skjåholmen 18 August 2011 2♂♂ leg. RB, Gorahat 18 August 2011 1♀1♂ leg. RB; Nordkapp: Skarsvåg 19 August 2011 2♀♀ leg. RB; **FN** Porsanger: Ytre Sortvik 19 August 2011 1♂ leg. RB; Lebesby: Bekkarfjord 6 July 2012 1♀ leg. RB, Dyfjord 6 July 2012 5♀♀1♂ leg. RB; Gamvik: Hopseidet E 5 July 2012 2♂♂ leg. RB, Nyheim 5 July 2012 4♀♀1♂1juv. leg. RB, Sandfjord 5 July 2012 1♂ leg. RB; Berlevåg: Store Molvik 7 July 2012 3♀♀3♂♂2juv. leg. RB; Båtsfjord: Båtsfjord 7 July 2012 6♀♀9♂♂ leg. RB; Vadsø: Kiby 8 July 2012 2♀♀2♂♂3juv. leg. RB.

*Observations* (open circles in Figure 2): **NSY**, Lurøy: Trolløya 1 August 2010 photo K. Frafjord; **NNV**, Bø: Nykvåg (Vader 1983); Øksnes: Stav (= Stø) (Vader 1983); **TRY**, Tranøy: Hallwardsøy 7 August 1984 (Fjellberg 1984); Berg: Bøvær July 2009 obs. Torstein Pedersen; **FV**, Hammerfest: Store Kamøya 30 June 1984 (Fjellberg 1984); **FN**, Lebesby: Kjøllefjord 6 July 2012 obs. RB; Gamvik: Mehavn 5 July 2012 obs. RB. In addition (material unavailable), three dots (**NSY** and **NNV**) on the map in Mehl (1977).

## Discussion

The present study shows that *Petrobius brevistylis* is commonly present in many localities along the coast of northern Norway, i. e. in its northernmost distributional area. The few previous reports can have numerous reasons. 1) They are flightless insects which hide in the ground (or rock crevices) when approached. The first author never noticed them as a child, despite stepping on their stony

habitat almost every day. In other words, certain skills and experience are needed to find and catch this insect. 2) They have become more common over recent decades due to climate changes and mild winters. This is reasonable, but would require that humans or others aided the spread. One would not expect these flightless insects to spread quickly over long distances by themselves. 3) Few entomologists have searched for them. The area has had few professionals in this field.

Of the three possibilities mentioned above, the second (i. e. climate adaptation) is the most likely one. Since *Petrobius* lay the eggs in rock crevices (Delany 1957, 1959), transportation of stones would be an aid. Farmers and fishermen used (or use) ballast stones for boats, and they built breakwaters, stone fences (for the boat house, or to protect farmland from erosion) and piers. Old breakwaters were even sometimes dismantled and transported to new location. For a description of natural (incl. screes) and man-made (incl. cleits) habitats on Hirta (Outer Hebrides, Scotland), see Davies & Richardson (1973).

The occurrence of *Petrobius* in road fillings (along the sea) cannot be explained by direct transport, however, when the material comes from stone quarries. These fillings are habitats for Chlorophyceae and its herbivores like *Petrobius*. How is *Petrobius* able to colonize new sites like this and quickly? The apparent absence in certain fjords is hard to explain. It is our impression that fjords without *Petrobius* had few natural habitats, and hence longer distance between those and man-made structures, but perhaps not so in easternmost Finnmark. As an example of a man-made habitat, see Figure 3.

Despite two trips to the Varanger area, eastern Finnmark, *Petrobius* was found in only one locality, Kiby (Figure 4). This has a subarkose sandstone (NGU 2013), probably ideal for *P. brevistylis* (habitats: see Delany 1959, Davies & Richardson 1970). However, the southern side of Varanger fjord is made of gneissic rocks (NGU 2013) that may be less suitable. In Britain, the congeneric *P. maritimus* (Leach, 1809) prevailed in areas with metamorphic and igneous rocks (Davies & Richardson 1970). *P. brevistylis* was expected to be recorded in the Varanger fishing

ports (June 2013), and another try should be done in late August, at the time when the juveniles are numerous and conspicuous.

The mass occurrence at Skjomnes in August marked the beginning of a trip with *Petrobius* found in almost every location. When exuviae or juveniles were first found, one could search more to find adults. During the field work, the terms Small (juveniles), Medium (1-year-olds) and Large (>2-year-olds) were used. The first juveniles were seen on June 22, and apparently they had hatched a few weeks earlier. In south England, eggs were laid in October–November (Delany 1959). Probably eggs are laid in autumn, also by 1-year-olds, but a separate study is needed to verify this. Other apterygote species, such as the silverfish *Lepisma saccharina* Linnaeus, 1758, have egg diapause (Nishizuka et al. 1998), and egg diapause in *P. brevistylis* is likely. In addition, some authors believe that parthenogenesis is involved (Wygodzinsky & Schmidt 1980). Specific investigations are required to unveil the longevity, overwintering strategies and other parts of the life cycle strategy.

*Petrobius brevistylis* has an amphiatlantic distribution, with occurrences in New Brunswick, Nova Scotia and northeastern USA (Wygodzinsky & Schmidt 1980), the Faroes, and Iceland (Ólafsson 2009). No data exist for Jan Mayen, Bear Island, Hopen and Svalbard. Its presence in Greenland and northern Russia is also unknown.

**Acknowledgements.** We thank Per Ole Syvertsen, Helgeland Museum, Mo i Rana, for loan of material, and Zenaida Cortes Bergersen for help in the field (2011–2013). Robert T. Barrett, Tromsø University Museum, improved the English.

## References

- Brinck, P. 1961. *Fjällborstsvansar, Thysanura*. Pp. 351–357 in Hanström, B. (ed.), *Djurens Värld*. Band 2. Rygggradslösa Djur. 2. Förlagshuset Norden, Malmö.
- Carpenter, G. H. 1913. The Irish species of *Petrobius*. *The Irish Naturalist* 22, 228–233.
- Davies, L. 1990. Distribution and habitat requirements in Britain and Ireland of *Petrobius brevistylis*

Carpenter and *P. maritimus* (Leach), with a new separating character (Archaeognatha: Machilidae). *The Entomologist* 109(1), 24–34.

- Davies, L. & Richardson, J. 1970. Distribution in Britain and habitat requirements of *Petrobius maritimus* (Leach) and *P. brevistylis* Carpenter (Thysanura). *The Entomologist* 103, 97–114.
- Davies, L. & Richardson, J. 1973. Occurrence of the two *Petrobius* spp. (Thysanura) in different habitat types on Hirta, St. Kilda. *The Entomologist* 106, 16–22.
- Delany, M. J. 1957. Life histories in the Thysanura. *Acta Zoologica Cracoviensia* 2(3), 61–90.
- Delany, M. J. 1959. The life histories and ecology of two species of *Petrobius* Leach, *P. brevistylis* and *P. maritimus*. *Transactions of the Royal Society of Edinburgh* 63(3), 501–533.
- Fjellberg, A. 1984. Nordlige funn av steinspretten *Petrobius brevistylis*. *Fauna* 37, 166.
- Friedrich, M. & Makings, P. 1990. Supplementary taxonomic characters for the discrimination of *Petrobius brevistylis* Carpenter from *P. maritimus* (Leach) in both sexes (Microcoryphia, Machilidae). *The Entomologist* 109(4), 231–239.
- Larink, O. 1968. Zur Biologie des küstenbewohnenden Machiliden *Petrobius brevistylis* (Thysanura, Insecta). *Helgoländer wiss. Meeresuntersuchungen* 18, 124–129.
- Makings, P. 1973. Activity of the sea-shore bristle-tail (*Petrobius maritimus*) (Leach) (Thysanura) at low temperatures. *Journal of Animal Ecology* 42(3), 585–598.
- Mehl, R. 1977. Steinspretten, *Petrobius brevistylis*. *Fauna* 30, 12–19.
- NGU 2013. *Berggrunn. Nasjonal berggrunnsdatabase*. Available from <http://geo.ngu.no/kart/berggrunn/> (Accessed: October 2013).
- Nishizuka, M., Azuma, A. & Masaki, S. 1998. Diapause response to photoperiod and temperature in *Lepisma saccharina* Linnaeus (Thysanura: Lepismatidae). *Entomological Science* 1(1), 7–14.
- Ólafsson, E. 2009. Kampaskrotta - *Petrobius brevistylis*. Available from <http://www.ni.is/poddur/flokkun/stokkaskottur> (Accessed: October 2013).
- Vader, W. 1983. Har steinspretten nordgrense i Vesterålen? *Fauna* 36, 35–36.
- Wygodzinsky, P. & Schmidt, K. 1980. Survey of the Microcoryphia (Insecta) of the northeastern United States and adjacent provinces of Canada. *American Museum Novitates* 2701, 1–17.

Received: 11 November 2013

Accepted: 20 February 2014