First records of Lithobius (Lithobius) forficatus (Linnaeus 1758) (Chilopoda: Lithobiomorpha: Lithobiidae) from mainland Hokkaido, Japan

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Abstract — The lithobiomorph centipede Lithobius (Lithobius) forficatus (Linnaeus 1758) is here reported for the first time in mainland Japan. All specimens were collected in Obihiro City, eastern Hokkaido, Japan. This species has a rather widely morphological variation and seems to inhabit synanthropic areas. The present study is the first record of indoor invasion of lithobiomorph species in Japan.

Key words — habitat, indoor invasion, lithobiomorph centipedes, morphological variation, synanthropic area

Introduction

The order Lithobiomorpha Pocock 1895 (Chilopoda) is widespread worldwide. Up to the present, about 1,500 described species have been recorded in the world (Andersson 2005) including about 60 species in Japan (Tanabe 2001). Lithobiomorph centipedes mostly prefer humid locations, living especially in leaf litter and under bark (Tanabe 2001; Voigtländer & Reip 2013).

One lithobiomorph species, Lithobius (Lithobius) forficatus (Linnaeus 1758), is native to Europe and has spread all over the world due to human activity (Nefediev et al. 2016; Dyachkov, 2019). However, L. forficatus was recorded only from Mongolia and Iturup Island, Kuriles in East Asia (Zaleskaja 1978; Eason 1996). The species generally tends to prefer synanthropic areas (Blackburn et al. 2002). In the present paper, we report for the first time L. forficatus from mainland Hokkaido, Japan.

Materials and Methods

All specimens used in the present study were collected in Obihiro City (42°N, 143°E, about 40 m above sea level: Fig. 1), eastern Hokkaido, Japan in 2019–2020. The live specimens were collected by hand and preserved in 70 % ethanol. Dry dead specimens found in a house were also collected. We considered as mature male individuals with two articles of gonopod and female individuals with three articles of gonopod and well-developed spurs on the gonopod. Morphological variations in the mature specimens were investigated.

The terminology for external anatomy follows that of Bonato et al. (2010). Body length was measured from the anterior margin of the cephalic plate to the posterior end of the postpedal tergite. Body length, sex, number of ocelli, number of rows in which they were arranged, number of antennal articles, number of teeth at the forcipular coxosternite, number of coxal pores at trunk segments XII, XIII, XIV, and XV, and localities where they were found were recorded for each specimen. Arrangement of spurs on the legs as in Table 1. The following abbreviations are used in text: C, coxa; t, trochanter; P, prefemur; F, femur; T, tibia; V, ventrally; D, dorsally; a, anterior; m, median; p, posterior.

Specimens were photographed using digital cameras (Stylus TG-3 and TG-5 Tough, Olympus) and a digital microscope (ADSM 301, Koolertron) and were observed using a biological microscope (ECLIPSE Ni-U, Nikon) and a stereomicroscope (SMZ800, Nikon). Voucher specimens are deposited in the Natural History Museum and Institute, Chiba (CBM), Japan.

Taxonomy

Lithobius (Lithobius) forficatus (Linnaeus 1758)

[Japanese name: Ochairo-ishimukade]

(Fig. 2)

For synonym list, see Chilobase (Zapparoli 2006)

Specimens examined. 1♂, Obihiro, 4. VIII. 2019, N. Hirakizawa leg. (CBM-ZU 761); 2♂, Obihiro, 13. VIII. 2019, N. Hirakizawa leg. (CBM-ZU 762-763); 1♀, Obihiro, 16. I. 2020, A. Sogawa leg. (CBM-ZU 766); 1♀, Obihiro, 17. X. 2019, N. Hirakizawa leg. (CBM-ZU 764); 1♀, Obihiro (inside a house), 30. X. 2019, T. Yamauchi leg. (CBM-ZU 765); 1♂, Obihiro, 16. I. 2020, A. Sogawa leg. (CBM-ZU 766); 1♀, 1♂, 1ex., Obihiro (inside a house), 1. IV. 2020, T. Yamauchi leg. (CBM-ZU 767-768); 2♀, 1♂, Obihiro, 7. V.
Diagnosis. Body length 15–28 mm. Body color pale brown in alcohol (Fig. 2A), reddish brown when alive (Fig. 2B). Tergites IX, XI, and XIII with large posterior triangular projections (Fig. 2C). Antenna composed of 35–44 articles. Each side of head with 1 large and up to 20–32 small ocelli in 4–6 rows. Tömösváry’s organ small, round, equal in size to or slightly larger than neighboring ocellus (Fig. 2D).

Variation. Lithobius forficatus is a rather widely varying species (Williams 1903; Farzalieva & Esyunin 2008). The number of teeth of forcipular coxosternite and coxal pores grow with an increase in size of specimens. As Farzalieva & Esyunin (2008) noted, variation in shape of coxal pores was also found in the present study: pores mainly round or oval in young specimens, and slit-shaped in large ones. Variation in arrangement of spurs on the legs occurs within species in Lithobiomorpha (Lewis 1981). In the present study, the following variations were observed (n = 30): 1DPamp (11 specimens) and 1DTap (20 specimens), 2DPamp (27 specimens), 8VPamp (9 specimens), 9VPamp (13 specimens), 11DCa (3 specimens), 12VTrm (4 specimens), 13DTap (11 specimens), and 15DTp (4 specimens). Variation in the number of joints of antennae was observed. As Williams (1903) stated, the number also differed on both sides of the same in-
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Fig. 2. Lithobius (Lithobius) forficatus (Linnaeus 1758): A, adult male, dorsal view (CBM-ZU 795); B, live adult; C, tergites IX, XI, and XIII, dorsal view (CBM-ZU 795); D, ocelli and Tömösiváry’s organ (Tö) (CBM-ZU 785); E, coxosternal teeth and prodonts, ventral view (CBM-ZU 780); F–I, coxal pores of XII–XV, ventral view (CBM-ZU 795); J, gonopod of male, ventral view (CBM-ZU 786); K, gonopod of female, lateral view (CBM-ZU 772); L, gonopod of female, dorsal view (CBM-ZU 772). Scales = 5 mm (A, C); 0.5 mm (D, E); 1 mm (F–I); 0.1 mm (J–L).
individual. In the present study, the largest difference between the right and left side was 47 joints on the right side and 39 on the left.

**Remarks.** The morphological characteristics of the individuals examined agree with the descriptions of *L. forficatus* provided by Zalesskaja (1978: 69–71, Fig. 27 and Table 18), Andersson (2005: 125), Farzalieva & Esyunin (2008: 602–604, Fig. 3 and Table 1), Prado et al. (2018: 560–563, Figs. 1–5 and Table 1) and Dyachkov (2019: 14 and 16, Figs. 43–47). *Lithobius forficatus* can be distinguished from all other *Lithobius* in Japan by the combination of morphological characteristics where tergites IX, XI, and XIII have large posterior triangular projections and forcipular coxosternites have with more than 5+5 teeth.

**Distribution.** *Lithobius forficatus* is distributed in Europe, West Asia, North Africa, the European part of Russia, the Asian part of Russia (known only from the Tyumen Area and Iturup Island, Kuriles), Mongolia, North and South America, Greenland, Australia, and New Zealand (Nefediev et al 2016; Prado et al. 2018; Dyachkov 2019). In East Asia, *Lithobius forficatus* was recorded only from Mongolia and Iturup Island, Kuriles (Zalesskaja 1978; Eason 1996). In the present paper, *L. forficatus* was recorded for the first time from the mainland Hokkaido, Japan (Fig. 1).

**Discussion**

*Lithobius forficatus* was commonly collected from spring to fall in Obihiro City. On the other hand, in the middle of January, we found it outside behind buildings where there was no snow cover. Obihiro City has a subarctic climate, and the winter temperature drops below 0° Celsius, so this species may be resistant to low temperatures.

*Lithobius forficatus* is quite a common species, found in many different habitats, most often in open man-made habitats in northern Europe (Andersson 2005). In the present study, *L. forficatus* was not found in natural forests but was collected only in residential areas, near university buildings and a small maintained grove. Therefore, as pointed out in previous studies (e.g., Blackburn et al. 2002), the centipede seems to inhabit synanthropic areas in Hokkaido.

Some centipedes are considered to be indoor house pests. Andersson (2005) described *L. forficatus* found indoors, and it was one of the most common centipedes in greenhouses. As far as we know, a case of indoor invasion of Lithobiomorpha has never been reported in Japan. However, in the present study, many *L. forficatus* examples were found in houses. In Obihiro City, *L. forficatus* can be considered a house pest because the species could be often found in synanthropic areas and collected indoors.

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