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The first record of a new alien species *Limnodrilus cervix* Brinkhurst, 1963 (Annelida, Clitellata) in the Vistula Lagoon (southern Baltic Sea)

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Abstract

The present work reports the first record of *Limnodrilus cervix* in the south-eastern part of the Baltic Sea. A specimen of this North American species was found in 2010 in the Vistula Lagoon, near the village of Piaski (Poland). The distribution of other Nearctic *Limnodrilus* species in Europe is also presented.

1. Introduction

Some species in the genus *Limnodrilus* have a cosmopolitan distribution (*L. hoffmeisteri*, *L. claparedeianus*, *L. udekemianus*) but others are known

from restricted areas, for example, Chinese rivers (He et al. 2010) or Lake Baikal (Semernoy 2004). There are also several species characteristic of the Nearctic region, such as *Limnodrilus silvani* Eisen, *L. rubripenis* Loden, *L. cervix* Brinkhurst, *L. maumeensis* Brinkhurst & Cook and *L. tortilipenis* Wetzel (Kathman & Brinkhurst 1998). The presence of the last three species has been confirmed in Europe, especially in the north and west (van Haaren & Soors 2013).

Many alien species from different taxonomical groups have been found in the Vistula Lagoon (henceforth VL), which is part of the southern Baltic Sea (Ezhova et al. 2005, Jabłońska-Barna et al. 2013). Some of them are invasive, e.g. the amphipods *Gammarus tigrinus*, *Pontogammarus robustoides* and *Obesogammarus crassus* (Jażdżewski et al. 2004). Among Annelida, the invasive polychaetes *Marenzelleria neglecta* and *Alkmaria rominji* were found there (Żmudziński 1996, Ezhova & Polunina 2011). According to Ezhova & Polunina (2011) alien oligochaetous clitellates – *Potamothrix moldavensis*, *P. bavaricus*, *P. vejdovskyi*, *Paranais frici* and *P. botniensis* – were found in the eastern, Russian part of VL. These authors considered all of these species to be of Ponto-Caspian origin. *Limnodrilus cervix*, originally a North American species, was found for the first time in VL during investigations of the benthic fauna in its western, Polish part.

2. Material and methods

Situated in the southern part of the Baltic Sea, the Vistula Lagoon is divided into two parts by the Polish-Russian border. It has an area of 838 km^2, 388 km^2 of which belong to Poland. The lagoon is a shallow (mean depth 2.7 m), brackish water basin with a connection to the open sea through the Baltiysk Strait. The annual water temperature dynamics is stimulated by solar heating. Active wind mixing results in a mostly homogeneous temperature structure in the lagoon (Chubarenko 2008).

This study is based on samples of macroinvertebrates collected in June 2010 in the VL.

The field studies carried out to biomonitor alien species were a continuation of the observations in VL in 2006–2009 (Jabłońska-Barna et al. 2013). Samples were taken at 24 stations on six occasions from May to September 2010 (Figure 1) using a core tube sampler (sampling area 40.7 cm^2, penetration depth 30 cm). Five replicate samples were taken at each station. The contents of the sampler were passed through a 0.5 mm sieve and the residue preserved in 4% formaldehyde. Oligochaete specimens were placed in Amman's lactophenol and determined using the keys by Timm (2009) and Kathman & Brinkhurst (1998).

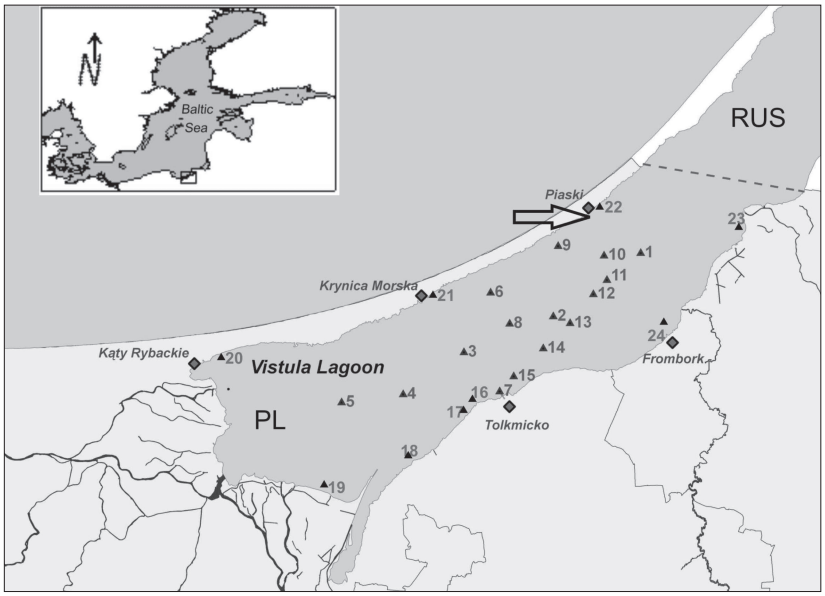

Figure 1. Location of sampling stations (1–24) in the western (Polish) part of the Vistula Lagoon (VL). The arrow indicates the spot where *Limnodrilus cervix* was found

The single, sexually mature specimen of *Limnodrilus cervix* lacking its posterior end had become slightly squashed (probably while being mounted on a microscope slide).

The physico-chemical properties of the water were measured at each sampling station prior to macroinvertebrate sampling.

3. Results

The specimen of *Limnodrilus cervix* was collected near the village of Piaski (54°26′N, 19°37′E, sampling station No. 22) from the coastal zone, beyond the range of littoral plants on the sandy bottom at a depth of 1–1.5 m. The salinity in this part of the lagoon was 2.8 ± 0.74 PSU (the average for the study period). The oxygen content in the near-bottom water was high (10 ± 0.94 mg O_2 dm^{-3}) and the pH was 7.8.

Description: Length of chaetae varied from 57 to 63 μm. The number of chaetae in the anterior dorsal bundles 4–5, rarely 6; in the ventral bundles 3–4, sometimes 5. In the anterior segments their upper tooth was only slightly longer than the lower one, but distinctly thinner; in some segments around the clitellar zone and in the postclitellar region both teeth were very similar in length. The number of chaetae per bundle did not decrease posteriorly (3–5).

The penis sheaths were very long (about 1260 μm), with distinctly bilaminate walls (Figure 2). The external layer was partially delaminated, which suggests that the specimen was damaged (it may have got squashed during slide preparation). The width of the penis sheath (in its middle part) was ca 25.5–27.5 μm, and its wall was ca 6.5–7.5 μm thick. The

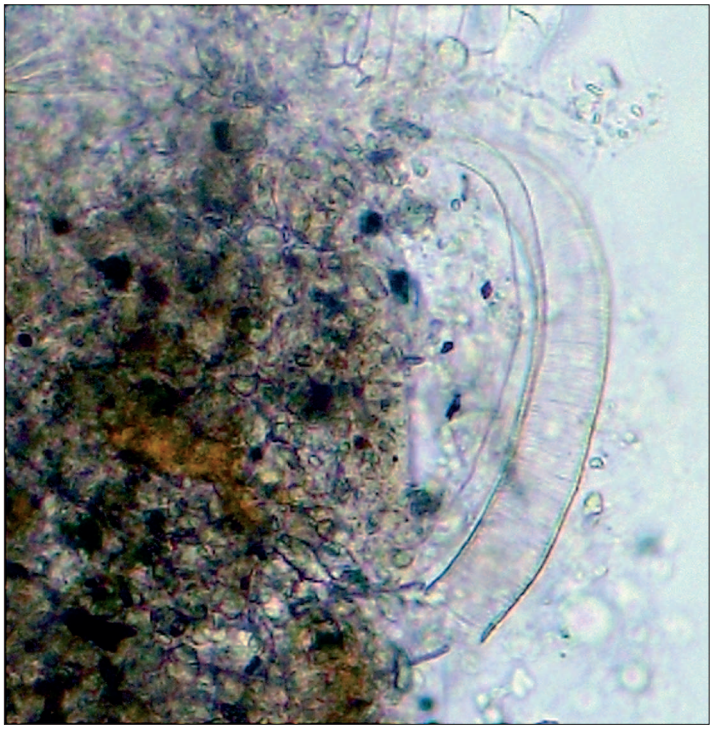

Figure 2. *Limnodrilus cervix* – middle part of the penis sheath with bilaminate wall

Figure 3. *Limnodrilus cervix* – distal part of penis sheath

thicker external layer was absent near the ectal end of the sheath; in this part the width of the sheath decreased to 23 μm. The hood of the penis sheath had an almost triangular distal part and a slightly rounded proximal part (Figure 3).

Five other species from the family Naididae were found at this station. The most numerous were *Potamothrix hammoniensis* (35 individuals) and *P. moldaviensis* (18 individuals). A few *Limnodrilus hoffmeisteri*, *Tubifex tubifex* and *T. blanchardi* were also present.

4. Discussion

The specimen of *Limnodrilus* found in VL was identified as *L. cervix* on the basis of the shape of its penis sheath, which is long and has evidently bilaminate walls – this last feature is diagnostic for this species (Kathman & Brinkhurst 1998, van Haaren & Soors 2013). Nevertheless some features of this specimen differ a little from the original species description by Brinkhurst (1963). *L. cervix* from VL has a smaller number of chaetae in the particular bundles.

Moreover, the lack of a proximal projection on the hood of its penis sheaths, according to Brinkhurst & Jamieson 1971 and Milbrink 1980, is characteristic of the rarely observed hybrid form *L. claparedeianus*/*cervix*.

Even if we assume that this is a hybrid form, the finding of such a form indicates the presence of *L. cervix* in VL. *L. claparedeianus* has been found at other stations in this lagoon (E. Dumnicka, I. Jabłońska-Barna & A. Rychter, unpubl.).

The alien oligochaetous clitellate species found in VL (from the genera *Potamothrix* and *Psammoryctides*) originate from the Ponto-Caspian region (Ezhova & Polunina 2011, Jabłońska-Barna et al. 2013). Milbrink & Timm (2001) thought that some species from these genera (*Potamothrix hammoniensis*, *Psammoryctides barbatus*) started to expand their range in early postglacial times, whereas the others did so in recent centuries as a result of human activities (Leppäkoski 2005, Dziubińska 2011). In favourable conditions the density of the various species in this group can reach a few thousand individuals per square metre.

Up to now, in Europe Nearctic *Limnodrilus* species have usually been found in a small number of locations, and numbers of mature specimens have been very low. Examples include *L. maumeensis* (see van Haaren 2002) and *L. tortilipenis* (see Soes & van Haaren 2007, Munts & Soes 2012) in the Netherlands. Recently, the latter species was also found in Belgium (van Haaren & Soors 2013). *L. cervix* is more widely distributed in Europe. It has been found in Great Britain (Kennedy 1965), Sweden (Milbrink 1980), the Netherlands and Romania (van Haaren 2002) and Belgium (Soors at al.

2013). Moreover, according to http://www.faunaeur.org it is known from Belarus, probably from the River Pripyat (Timm pers. comm.), but this information was not contained in a paper dealing with the distribution of aquatic alien species in that country (Semenchenko et al. 2009). In North America Kathman & Brinkhurst (1998) reported *L. cervix* as being common and widespread. It lives mainly in organically polluted waters, but these authors presume that it is less resistant to serious contamination than *L. hoffmeisteri*. Rakocinski et al. (2000) considered that this opportunistic species prefers waters of low salinity, but its presence in the Schelde estuary, at the point where the river becomes non-tidal (Soors et al. 2013), and in canals near Liverpool, U.K. (Kennedy 1965) suggest that it could survive in brackish waters.

To date, North American oligochaeteous clitellates have not been found in the Baltic Sea, although they have been reported from brackish waters in the Netherlands (van Haaren & Soors 2013). Usually it is single specimens of Nearctic *Limnodrilus* spp. that have been found in rivers and canals situated near the seashore, especially close to large ports, which allows one to conjecture that they reached European water bodies in the ballast waters of transoceanic ships (Jażdżewski et al. 2002, Dobrzycka-Krahel 2012). Only Kennedy (1965) found abundant specimens of *L. cervix* in a number of canals in England and Wales; this gave rise to the interpretation that this species could become invasive. To VL *L. cervix* could have been transported along the European sea shore in small ships from the Netherlands or Belgium, which was the case with the North American species *Rangia cuneata* (Rudinskaya & Gusev 2012), found earlier in these countries. In the 20th century rapid transoceanic shipping enabled many species to cross the Atlantic Ocean, which is why monitoring the macroinvertebrate species composition is necessary, especially in water bodies situated near the seashore.

The human impact on the distribution of aquatic species may well have started much earlier, maybe during the times of the great geographical discoveries. Opportunistic species, resistant to low oxygen concentrations, such as *L. hoffmeisteri*, *L. udekemianus* and *Tubifex tubifex* could have been transported between continents in the past. Perhaps their recent cosmopolitan distribution is a result of human shipping activities over a period of several centuries.

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