

OCCURRENCE AND ABUNDANCE LEVEL OF *KELLICOTTIA BOSTONIENSIS* (ROUSSELET, 1908) IN LAKES OF THE NIZHNIY NOVGOROD REGION

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By the moment two species of rotifers of genus *Kellicottia* inhabit the lakes of Nizhniy Novgorod region: native representative of this genus – *Kellicottia longispina* (Kellicott, 1879) and the American invader – *Kellicottia bostoniensis* (Rousselet, 1908). The North American rotifer *K. bostoniensis* is found in the west and the southwest of the Nizhniy Novgorod region. Rotifers of this genus successfully develop mainly in deep reservoirs of different trophic status with waters of a small mineralization. *K. longispina* does not sustain a competition to the invader. The situation is aggravated with affinity of requirements to environmental conditions of these species.

Key words: *Kellicottia bostoniensis*, *K. longispina*, Nizhniy Novgorod region, alien species, zooplankton, lakes.

The Nizhniy Novgorod region is located in the centre of the East European plain, on the upper and average a watercourse of the Volga. Nizhny Novgorod is situated at the meeting of the Oka and Volga rivers. The region shares a border with the regions of Kostroma, Vladimir, Ivanovo, Ryazan and Kirov as well as with the republics of Mordovia, Chuvashia and Mari-El.

Material and methods

Since the aims of the investigations utilized herein are different, sampling has not been uniform. Samples have been taken in different seasons throughout the year. Zooplankton was collected with a small Juday net for quantitative sampling (nylon gauze 0.114 mm) with a 12-cm aperture, which was drawn throughout the water column. Samples were taken in the pelagial zone. In Elovoe Lake zooplankton samples were taken with Ruttner bathometer (3 L) from surface to bottom (an interval of 2 m). Samples were processed by conventional methods [Metodicheskie recommendatsii..., 1984], using a random counting chamber.

Transparency was measured with a Secchi disc (30 cm in diameter) to an accuracy of 5 cm. Temperature oxygen content was measured using an “Mark-302E” thermooxymeter. The concentration of chlorophyll "a" was determined in accordance with GOST 17.1.04.02.90. [GOST..., 1990].

By the moment two species of rotifers of genus *Kellicottia* inhabit the lakes of Nizhniy Novgorod region (Fig.): native representative of this genus – *Kellicottia longispina* (Kellicott, 1879) and the American invader – *Kellicottia bostoniensis* (Rousselet, 1908).

The first report of *K. bostoniensis* from Europe was from Sweden in Lake Ekholmssjon, where B. Carlin found it in 1943 and later it was found in several other locations in southern Sweden [Arnemo et al., 1968]. The history of the dispersal of *K. bostoniensis* from North America to Sweden is not clear. Ballast fresh water has been put forward as one possibility [Arnemo et al., 1968]. In Finland *K. bostoniensis* was found in phytoplankton samples from Lake Tarjannevesi (in the northern part of the Kokemaenjoki River

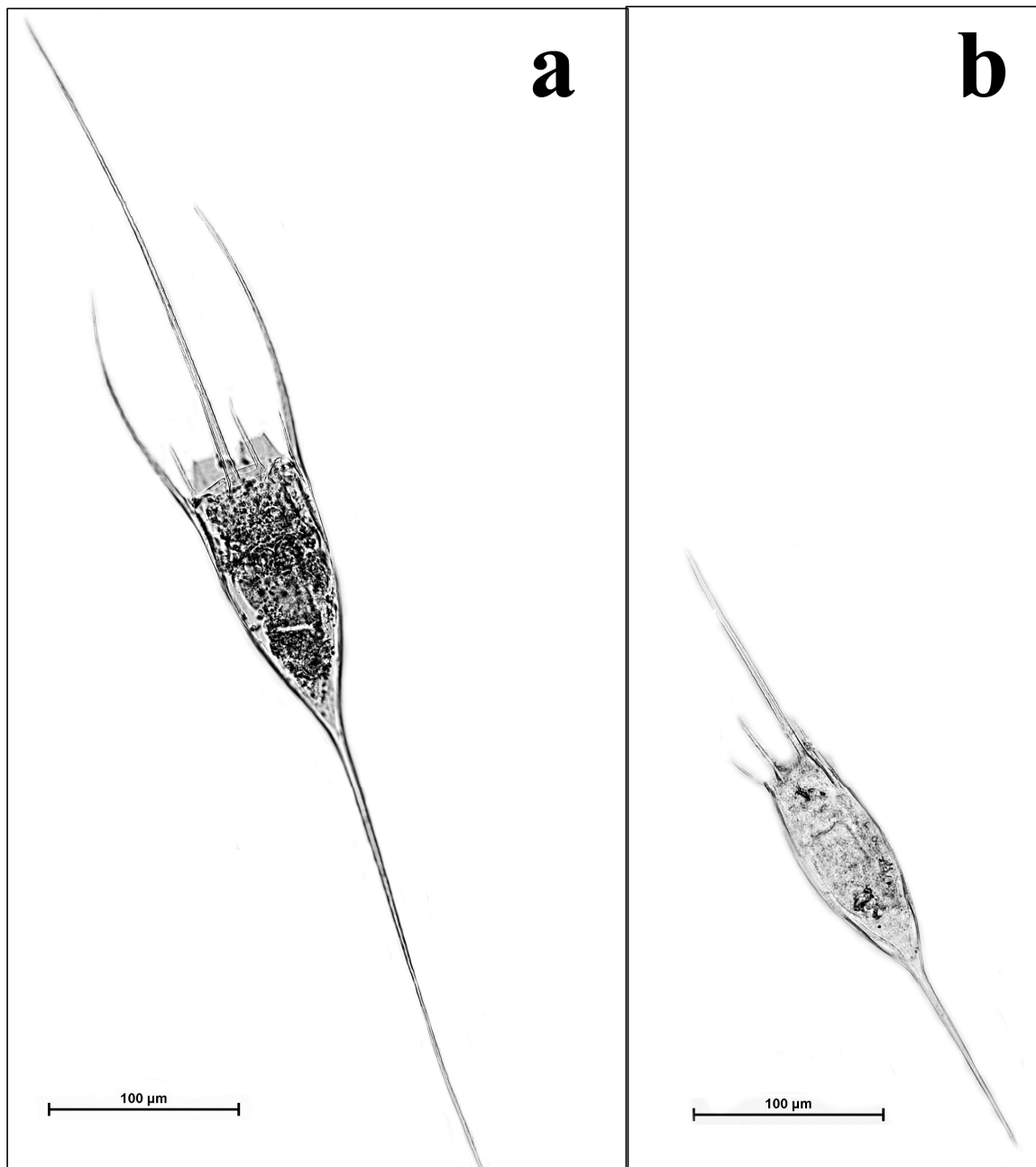


Fig. *Kellicottia longispina* (a) from lake Bolshoe and *K. bostoniensis* (b) from the lake Elovoe Nizhniy Novgorod region (photo by S. Zhdanova, IBIW RAS).

basin) in summer 1987. How the species has spread to Finland is an open question [Eloranta, 1988]. In Russia the species has been found in two lakes of Leningrad region [Ivanova, Telesh, 2004].

The North American rotifer *K. bostoniensis* is found in the west and the southwest of the Nizhniy Novgorod region in the lakes: Elovoe (Volodarsky district), Svyatoye Dedovskoye (Navashinsky district), Bolshoye (Pustynnoye) and Komsomolskoye (Pionerskoye) (Ardatovskiy district), Rodionovo and Roy (Sosnovskiy district),

and also in lake Svyatoye (Arzamas district). Everywhere rotifer is observed along with the native representative of this genus – *K. longispina*. However, the share of invader varies between lakes that can testify to prescription of introduction.

These lakes represent deep enough reservoirs of a karstic genesis with waters of a low mineralization. The coordinates, some morphometric and hydrochemical characteristics of the lakes are shown in the Table 1.

Table 1. Locations and some limnological characteristics of the lakes of the Nizhniy Novgorod region where *Kellicottia bostoniensis* was found (Rousselet, 1908)

Lake	District	Latitude, Longitude	Area, ha	Depth max., m	Transparency, m	Conductivity, $\mu\text{S}/\text{cm}$	pH	Chl <i>a</i> , $\mu\text{g}/\text{dm}^3$	O ₂ , mg/dm^3
Elovoe	Volodarsky	56° 21' 16" N 42° 46' 10" E	1.8	17.3	3.7	17–19	5.7–5.8	7.5	$\frac{9.6-9.8}{0.1-0.2}$
Roy	Sosnovsky	55° 43' 21" N 43° 09' 08" E	74.2	20.0	1.5	24–85	6.3–7.2	15.6	$\frac{5.5-9.5}{0.05-0.1}$
Rodionovo	Sosnovsky	55° 42' 33" N 43° 07' 11" E	10.8	17.0	3.5	25–26	5.6–7.0	7.0	$\frac{8.6-9.8}{2.5}$
Svyato	Arzamas	55° 40' 26" N 43° 35' 20" E	21.9	14.6	1.3	70	7.0	–	$\frac{10.5-11.3}{0.0}$
Svyatoye Dedovskoye	Navashinsky	55° 38' 43" N 42° 18' 45" E	136.0	14.0	3.0	50	6.1	–	–
Komsomolskoye	Ardatovsky	55° 32' 19" N 43° 08' 39" E	6.4	8.0	3.0	26–32	5.9–6.8	–	$\frac{3.0-9.5}{0.1-0.4}$
Bolshoye	Ardatovsky	55° 30' 15" N 43° 11' 16" E	44.0	21.6	2.5	26–40	5.6–5.7	17.8	$\frac{9.0-10.6}{0.1-0.2}$

Note: Numerator – surface, denominator – benthic layers.

Table 2. Abundance of *Kellicottia bostoniensis* and *Kellicottia longispina* in lakes

Lake	Elovoe	Svyatoye Dedovskoye	Bolshoye	Komsomolskoye	Rodionovo	Roy		Svyato
<i>Date</i>	<i>6.08.11</i>	<i>25.08.11</i>	<i>6.06.10</i>	<i>7.06.10</i>	<i>11.07.10</i>	<i>7.06.10</i>	<i>11.07.10</i>	<i>10.07.11</i>
$N_{K. bost.}$, ind./m ³	365320	260	192	26370	1700	255	1770	4250
$N_{K. long.}$, ind./m ³	655	4290	11800	295	37755	315	27940	2655
$N_{tot.}$, ind./m ³	440330	33370	80900	47060	55600	35130	123200	89200
$\frac{N_{K. long.}}{N_{K. bost.}}$	1 : 558	1 : 0.06	1 : 0.02	1 : 90	1 : 0.05	1 : 0.8	1 : 0.06	1 : 1.6
$(\frac{N_{K. bost.}}{N_{K. long.}}) / \frac{N_{K. bost.}}{N_{tot.}} \times 100\%$	83.1	13.7	14.8	56.7	71.0	1.6	24.1	7.7
$\frac{N_{K. bost.}}{N_{tot.}} \times 100\%$	83.0	0.8	0.2	56.0	3.1	0.7	1.4	4.8

Notes: N – number of organisms of one species;

$N_{tot.}$ – the total number of organisms of zooplankton.

The data on population density of both *Kellicottia* species are presented in Table 2. Apparently the greatest shares of invader are more evident for Elovoe Lake. It is near the border with Vladimir region and from Kshchara Lake, where *K. bostoniensis* has been found in mass quantity all through the water column [Zhdanova, Dobrynin, 2008]. In the Elovoe Lake this species also occupies the whole water column. The number of *K. bostoniensis* exceeds that of *K. longispina* almost 50 times. Invader essentially prevails over a native species and in the lake

Komsomolskoye (90 times). In lakes Svyato and Roy the parity between *K. bostoniensis* and *K. longispina* is close: invader slightly prevails in the first, in the second – a native species. In lakes Svyatoye Dedovskoye, Bolshoye, Rodionovo overwhelming advantage remained for *K. longispina*: its number exceeded by two orders that of the invader (Table 2). It can testify to comparatively not prolonged invasion of *K. bostoniensis* in these lakes. Additional evidences of the fact that *K. bostoniensis* is the recent invader in lakes of the southwest

Table 3. Distribution of rotifers *K. bostoniensis* and *K. longispina* in horizons of the water of Elovoe Lake

Depth, m	Temperature, °C	$N_{K. bost.}, \text{ ind.} \times 10^3 / \text{m}^3$	$N_{K. long.}, \text{ ind.} / \text{m}^3$	$N_{tot.}, \text{ ind.} / \text{m}^3$	$N_{K. long.} : N_{K. bost.}$	$(N_{K. bost.} + N_{K. long.}) / N_{tot.} \times 100\%$	$N_{K. bost.} / N_{tot.} \times 100\%$
02. 07. 2011							
0	26.5	0	0	155550	–	0.0	0.0
2	25.3	144	1350	210000	1 : 108	69.2	68.6
4	14.2	137.3	8000	176000	1 : 17	82.6	78.0
6	7.5	326.7	5350	385000	1 : 61	86.2	84.8
8	5.2	296.0	2000	339000	1 : 148	87.9	87.3
10	4.6	394.7	10670	456000	1 : 37	88.9	86.5
Average	13.7	216.5	4560	286900	1 : 48	69.0	81.0
06. 08. 2011							
0	23.3	0	0	51000	–	0.0	0.0
2	22.3	4.7	670	100670	1 : 7	5.3	4.6
4	18.3	26.7	0	159000	–	16.8	16.8
6	19.7	133.3	5550	339300	1 : 24	40.9	39.3
8	6.6	355.0	0	373000	–	95.2	95.2
10	5.4	0	0	36000	–	0.0	0.0
Average	15.9	103.9	1245	176500	1 : 83	59.6	58.9

of the Nizhniy Novgorod region are annual observations of zooplankton communities of Pustyn lakes (one of them – the lake Svyato) throughout last several decades by hydrobiologists of biological station of the Nizhniy Novgorod University.

Distribution of *Kellicottia* and parity between rotifers on water horizons in the lake Elovoe is shown in Table 3. In the beginning of July no strict appropriateness in distribution of each of species is observed, the increase in a share of these rotifers among zooplankton with depth, however, is traced. It is visible that the greatest density *K. bostoniensis* and *K. longispina* are common for the lower horizons, with the temperatures of 5–7 °C. Both species avoid heated-up surface water. Parity changes between two species are caused rather by *K. longispina* themselves, than by changes in the number of *K. bostoniensis*.

In the beginning of August essential increase in the number of the invader from the top horizons to lower (Table 3) is traced accurately enough. A native species to this date is already generally «gives up» to the invader, completely disappearing on some horizons, and even on lower ones that are most suitable for *K. longispina* by

temperatures. It is possible to make the assumption that the native species of genus *Kellicottia* – *K. longispina*, is still recorded in a significant amount in the first half of summer, and completely disappears from a zooplankton in the late summer and is replaced by *K. bostoniensis*.

Thus, invasion of *K. bostoniensis* to the Nizhniy Novgorod region occurs from the western direction, from outside of Vladimir region where these species, possibly, has appeared a bit earlier. Among the Nizhniy Novgorod lakes American rotifer has appeared first of all in the lakes of Volodarsky area adjoining to Vladimir region, in particular, in Elovoe Lake. The further distribution of a species on the east and the southeast has included the lakes of Navashinsky, Sosnovsky and Ardatovsky, and in the last turn, Arzamas areas.

Rotifers of this genus successfully develop mainly in deep reservoirs of different trophic status with waters of a small mineralization. The native inhabitant of Nizhniy Novgorod lakes – *K. longispina* does not sustain a competition to the invader. The situation is aggravated with affinity of requirements to environmental conditions of these species.

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