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Morphology and ecology of *Microchironomus deribae* (Freeman, 1957) (Diptera, Chironomidae) from the saline rivers of the Elton lake basin (Russia)

Морфология и экология *Microchironomus deribae* (Freeman, 1957) (Diptera, Chironomidae) из солёных рек бассейна оз. Эльтон (Россия)

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Key words: Diptera, non-biting midge, *Microchironomus deribae*, morphology, saline rivers, abiotic factors.

Key words: Diptera, хирономиды, *Microchironomus deribae*, морфология, солёные реки, абиотические факторы.

Abstract. Morphology and ecology of *Microchironomus deribae* (Freeman, 1957) was examined by material collected in the saline rivers of the Elton Lake basin (Volgogradskaya Oblast, Russia). The species is redescribed and illustrated on the basis of three metamorphic stages (larva, pupa and adult male). Information on distribution and ecology of *M. deribae* from the saline rivers (total mineralization 4.0–41.4 g/l) of the Elton Lake basin is given too. *Microchironomus deribae* is a common inhabitant of mesohaline rivers, where larvae prefer silty-sand biotopes. The frequency of occurrence of *M. deribae* in the Khara, Lantsug, Bolshaya Samoroda Rivers is 25.8–40.4 %. On the basis of modern samplings *M. deribae* appears to be very abundant in saline eutrophic rivers. *Microchironomus deribae* accounted for 19–65 % of total abundance of chironomids in benthic communities of rivers with salinity up to 28.6 g/l.

Резюме. Изучена морфология и экология *Microchironomus deribae* (Freeman, 1957) из солёных рек бассейна оз. Эльтон (Волгоградская область, Россия). Вид переописан и проиллюстрирован на основе трёх стадий метаморфоза (личинка, куколка, имаго самец). Приведены данные о распространении и экологии *M. deribae* из солёных рек (общая минерализация 4,0–41,4 г/л) бассейна оз. Эльтон. *Microchironomus deribae* — обычный обитатель мезогалинных рек, личинки которого предпочитают илисто-песчаные биотопы. Встречаемость *M. deribae* в реках Хара, Ланцуг, Большая Саморода составляет 25,8–40,4 %. Судя по современным сборам, *M. deribae* довольно многочислен в солёных эвтрофных реках. На него приходилось 19–65 % от общей численности хирономид в донных сообществах рек с солёностью до 28,6 г/л.

Introduction

The diversity of the family Chironomidae is mainly characteristic of freshwater reservoirs; however, few species of chironomids can also live in water with high salinity [Parma, Krebs, 1977; Krebs, 1982; Hassel et al., 2006; Matěna et al., 2016]. *Microchironomus deribae* (Freeman, 1957) are a common species of brackish water such as saline rivers of the giperhaline Elton Lake basin. These rivers are characterized by a large range of salinity. This indicates that *M. deribae* can tolerate important variations of miniralization.

Up to this study, larvae of *M. deribae* were found in the highly mineralized Tuzlukkol River (under conditions of a mineralization gradient from 4 to 80 g/l), Orenburg region (Southern Urals) [Shaikhutdinova, 2019].

As a result of our research, the morphology and ecology of *M. deribae* was examined from material collected in the saline rivers of the Elton Lake basin. Larvae were identified as *M. deribae* on the basis of their morphology. The reared imago and morphology of larvae were obtained from larvae of the same population. Information on distribution and ecology of *M. deribae* from the saline rivers the Khara, Lantsug and the Bolshaya Samoroda Rivers of the Elton Lake basin is also given.

Data on ecological traits of this species, including distribution, limits of tolerance and population density, seasonal variations is very important for environmental management especially in low-productive regions, such as arid steppes. However, the insects in general and the chironomids in particular are neglected groups in this respect. In this paper for the first time we give details information on distribution and ecology of *M. deribae* in the saline rivers of the giperhaline Elton Lake basin.

Material and methods

Studied area

Three saline rivers, the Lantsug and the Bolshaya Samoroda and the Khara Rivers, flow into a closed basin of hypersaline Elton Lake, located in the region of the Caspian lowland (49º07'30" N, 46º30'40' E), of the Volgogradskaya Oblast in Russian Federation (Fig. 1). Saline rivers are distinguished by size and the spatial dynamics of hydrological, hydrochemal and hydrophysical characteristics; they have a high mineralization gradient ranging from 4.0 to 41.4 g/l. These rivers have a permanent flow in the middle and lower reaches, whereas the flow is intermittent at the upper reaches, especially during dry years. The climate in the area is arid; air temperature in summer is up to 41.1C [Vodnobolotny.., 2005; Zinchenko, Golovatyuk, 2010]. During the sampling period, the water temperature ranged from 12.0 to 33.1 °C. Values for the main physical and chemical parameters of the rivers are given in Table 1. Bottom sediments are black silt, silty sand and plant debris. Water flows of the rivers are regulated by both underground and rain water [Zinchenko, Golovatyuk, 2010]. The area is characterized by extreme living conditions, is a source of the formation of organic-mineral mud with high balneological value [Zinchenko et al., 2017a, b; 2021]. Banks and mouths of the rivers are important landing sites for abundant migratory birds. Waterbirds feed primarily on chironomid larvae [Kasatkina, Shubin, 2012].

Reared material and its analysis; male, pupa and larva

Males were reared in cages from pupae collected together with the larvae. For morphological studies, the chitinized parts of larvae, pupae, and males were transferred to For-Berlese fluid. Morphological terminology and abbreviations follow Sæther [1980]. The measurements are given as the range.

Male: AR — length of apical flagellomere 11 to length flagellomeres 1–10; R, R_1, R_{4+5} — veins of the wing, VR — length of Cu to length of M; P_{1-3} — legs, Fe — femura, Ti — tibia, Ta_{1-5} — tarsomeres, LR — length of tarsomere 1 to length tibia, SV — length femur plus tibia to tarsomere 1, BV — length of femur, tibia and tarsomere 1 divided by tarsomere 2–5, BR — longest seta of tarsomere 1 divided by minimum width of tarsomere 1; HR — length of gonocoxite to length of gonostylus. Pupa: DC_{1-4} — dorcocentrals; L, LS — lateral setae. Larva: W/L — wide/length; AR — ratio of length of basal antennal segment to combined length of remaining segments; ROR — length of basal segment of antenna to distance between base of basal segment and ring organ; VmPR — width of ventromental plate to its length; VmPSR — mean width of two ventromental plates to distance between them; S 1–9 — cephalic setae; S I–IV — labral setae.

The present work is registered in ZooBank (www.zoobank.org) under LSID urn:lsid:zoobank.org:pub:BC141599-03B4-40AC-97BA-27798B03A95A.

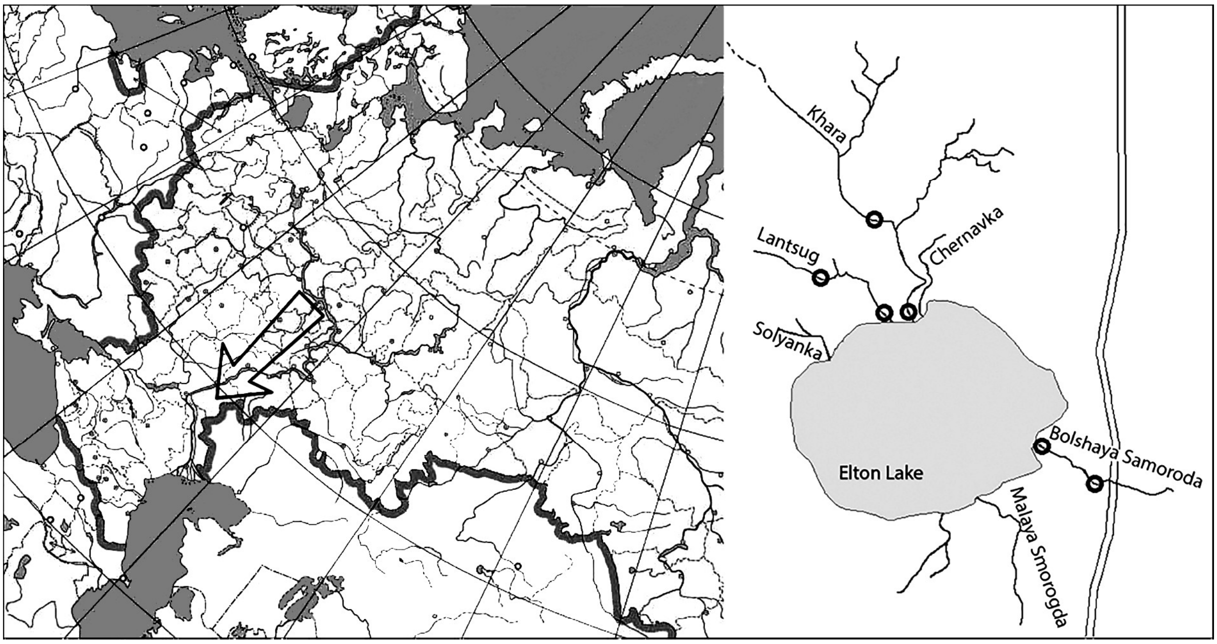


Fig. 1. The scheme of the research area. The places of detection of *Microchironomus deribae* are indicated.
Рис.1. Схема района исследования. Кружками указаны места сбора *Microchironomus deribae*.

Results

Chironomidae Newman, 1834
Chironominae Newman, 1834
Chironomini Zavřel, 1917
Microchironomus Kieffer, 1918
Microchironomus deribae (Freeman, 1957)
Figs 4–20.

Chironomus (*Cryptochironomus*) *deribae* Freeman, 1957: 395, Fig. 12c;

Leptochironomus deribae (Freeman, 1957): Ringe, 1970: 315–317, Fig. 3; Kugler, 1971: 344, Fig. 12; Albu, 1980: 145, Fig. 102;

Microchironomus deribae (Freeman, 1957): Dejoux, 1971: 88, Figs 1–13; Krebs, 1979: 144; Sæther, 1977: 101; Wang et al., 1991: 10; Harrison, 1996: 62, Figs 67–77; Wang, 2000: 645; Yan, Wang, 2006: 56, Fig. 2; Langton, Pinder, 2007: 108, Fig. 217B; Moller Pillot, 2009: 149; Vallenduuk, 2019: 179, Figs 94–95, 117;

Cryptochironomus chlorostolus (Kieffer, 1912): Wang et al., 1977 (misidentification sensu Yan, Wang, 2006: 59);

Tendipes (*Parachironomus*) *nigronitens* Edwards, 1929: Kruseman, 1933: 191, Fig. 52 (misidentification);

Leptochironomus paraderibae Laville et Tourenq, 1967: 185.

Material. **Russia, *Volgogradskaya* Oblast:** 2 adult ♂♂, 2 pupae, 2 larvae (rearing) — estuary of the Khara River, 25.VIII.2011, leg. L.V. Golovatyuk.

Redescription. Adult male **(n = 2).** Total length 3.5–4.0 mm. Wing length 1.89–1.93 mm. Total length/wing length 1.81–2.12. *Coloration.* Scape brown; ground color of thorax pale yellow, mesonotal stripes and postnotum brown; abdomen yellowish brown; legs yellowish brown, proximal parts of FeP_1 and Ta_1P_1 lighter, Ta_{1-5} gradually darken towards the end. *Head.* Frontal tubercles small, length and width 7–19 µm (Fig. 4). AR 2.43–2.55. Ultimate flagellomere 672–680 µm. Temporal setae 8–13. Clypeus with 20–22 setae. Maxillary palpomeres 2–4 combined 483–540 µm long, their individual lengths (in µm): 51–24; 112–119; 143–153; 177–214. Palp segment 5th/3rd 1.58–1.79. *Thorax*. Antepronotals 7–10, acrostichals 12–16, dorsocentrals 11–14, prealars 5–7. Scutellum with 10–11 setae. *Wing*. Length 14.89–1.93 µm, width 0.63 µm. VR 1.05. R with 4–8 setae, R_1 without setae, R_{4+5} with 1–2 setae at the apex. Brachiolum with 2–3 setae. Squama with 15–28 setae.*Legs*. Spurs of middle tibia 14–20 µm long; spurs of hind tibia 24–27 µm long. BR_{P1} 6.25, BR_{P2} 3.5, BR_{P3} 3.21. Middle ta_1 with 14 sensilla chaetica. The lengths (in µm) and the proportions of the legs are given in Table 2. *Hypopygium* (Figs 5–8). Anal tergite bands V-shaped, not jointed in the middle. Tergite IX with 2 projections bearing 3–4 long setae and microtrichia. Laterosternite IX with 3–6 setae. Anal point spatulate, rounded apically, 98.6–115 µm long and 24 µm wide at the apex, in the basal part with a V-shaped ridge bearing 3–4 median and 8–10 lateral setae and microtrichia. Superior volsella digital, 44–54 µm long, 7–10 µm wide at the apex, with 3–4 setae, without microtrichia. Transverse sternapodeme 88–102 µm long. Phallapodeme 143–153 µm long. Gonocoxite 136 µm long, with 4–6 strong setae along the inner margin. Gonostylus 197–204 µm long, strongly incurved and with the basal half strongly swollen (65–71 µm wide), bearing 14–16 setae along the inner margin, and with an apical tooth 10–14 µm long. HR 0.67–0.69.

Pupa **(n = 2, males).** Total length 5.1–5.3 mm. *Cephalothorax* (Fig. 9). Cephalic tubercle conical, 136–204 µm long and 71–102 µm wide. Frontal setae 68–85 µm long. Precorneals 2–3, antepronotals 2 (1 median and 1 lateral), dorsocentrals 4 (Dc_1 75–85 µm long, Dc_2 119 µm long, Dc_3 58–68 µm long, Dc_4 78– 95 µm long); distance between Dc_1–Dc_2 58–82 µm, Dc_2–Dc_3 119–160 µm, Dc_3–Dc_4 17–58 µm. Wing sheath 204–214 µm long and 58–65 µm wide. Granulose prealar tubercles present. *Abdomen* (Figs 10–15) 3.3–3.4 mm long. Tergite II with posteromedian patch of shagreen. Hook row interrupted medially, each part 204 µm wide with 23–30 spines. Tergites III–VI with median shagreen, the spines gradually increases toward the posterior margin. Tergite VII with anteromedian patch of shagreen. Tergite VIII with paired patches of very fine shagreen in proximal part. Pleura of segments II–III, III–IV and IV–V in one of the specimens with lateral setae (Fig. 15). Sternites I with pair patch of shagreen in proximal part; sternites II with a transverse patch of long spines in the proximal part; sternite III anteromedially with patch of shagreen and laterally with longitudinal bands of

Fig. 2. The middle course of the Lanzug River. Place of collection of *Microchironomus deribae*.

Рис. 2. Среднее течение р. Ланцуг. Место сбора *Microchironomus deribae*.

Fig. 3. The lower reaches of the Khara River. Place of collection of *Microchironomus deribae*.

Рис. 3. Нижнее течение р. Хара. Место сбора *Microchironomus deribae*.

Table 1. Values of the geographical, physical and chemical parameters in the Khara, Lantsug, Bolshaya Samoroda Rivers in the summer low water periods in the basin of Lake Elton (2006–2019)

Таблица 1. Значения географических и физико-химических показателей рек Хара, Ланцуг, Большая Саморода в периоды летней межени в бассейне оз. Эльтон (2006–2019 гг.)

Parameter *	River		
	Khara	Lantsug	Bolshaya Samoroda
Coordinates (upper reaches)	49°19' N, 46°31' E	49°13' N, 46°37' E	49°06' N, 46°53' E
Slope (‰)	0.91	2.06	1.77
Length (km)	47.0	19.9	24.3
Depth (m)	0.05–2.7	0.05-1.6	0.05–0.07
Water catchment area (km^2)	177.0	126.0	130.0
Current velocity (m/s)	0.01–1.1	0.04–0.23	0.03–0.25
pH	6.8–10.0	6.9–8.9	7.4–8.8
O_2 (mg/l)	3.4–15.9	1.8–12.5	6.2–15.5
Water temperature (°C)	12.0–33.0	14.9–22.3	12.3–31.1
Total mineralization (g/l)	6.6–41.4	4.6–30.0	4.0–26.3
Na^++K^+ (g/l)	1.71–12.31	1.19–9.07	1.12–5.50
Ca^{2+} (g/l)	0.16–1.20	0.20–0.80	0.18–0.60
Mg^{2+} (g/l)	0.15–1.59	0.13–1.17	0.04–2.60
Cl^-, (g/l)	1.78–22.40	2.06–18.64	1.48–15.98
SO_4^{2-} (g/l)	1.72–12.11	0.55–4.27	0.41–4.02
HCO_3^- (g/l)	0.02–3.81	0.16–0.44	0.34–0.72
PO_4^{3-}-P (mg/l)	0.003–2.412	0.002–2.773	0.318–1.995
NH_4^+-N (mg/l)	0.18–13.31	0.42–10.63	0.18–2.33
NO_3^-- N (mg/l)	0.01–2.14	0.01–1.13	0.06–1.06
Fe (mg/l)	0.22–13.0	0.4–2.6	0.1–3.87
Chlorophyll a (mg/l)**	23.4–341.0	10.5–220.0	4.5–49.8
Bottom substrate	G, S, B	P, G, B	G, S, B, P

small spines; IV–VIII anterolaterally with patches of shagreen. Lateral margin of segment VIII with 0–1 anal spur (Fig. 14). Segments II–IV with 3 L seta, V–VII with 4 LS, VIII with 5 LS setae (in one specimen the 5th seta is weak). Anal lobes 323–340 µm long and 374–398 µm wide, each with 53–72 lamelliform setae.

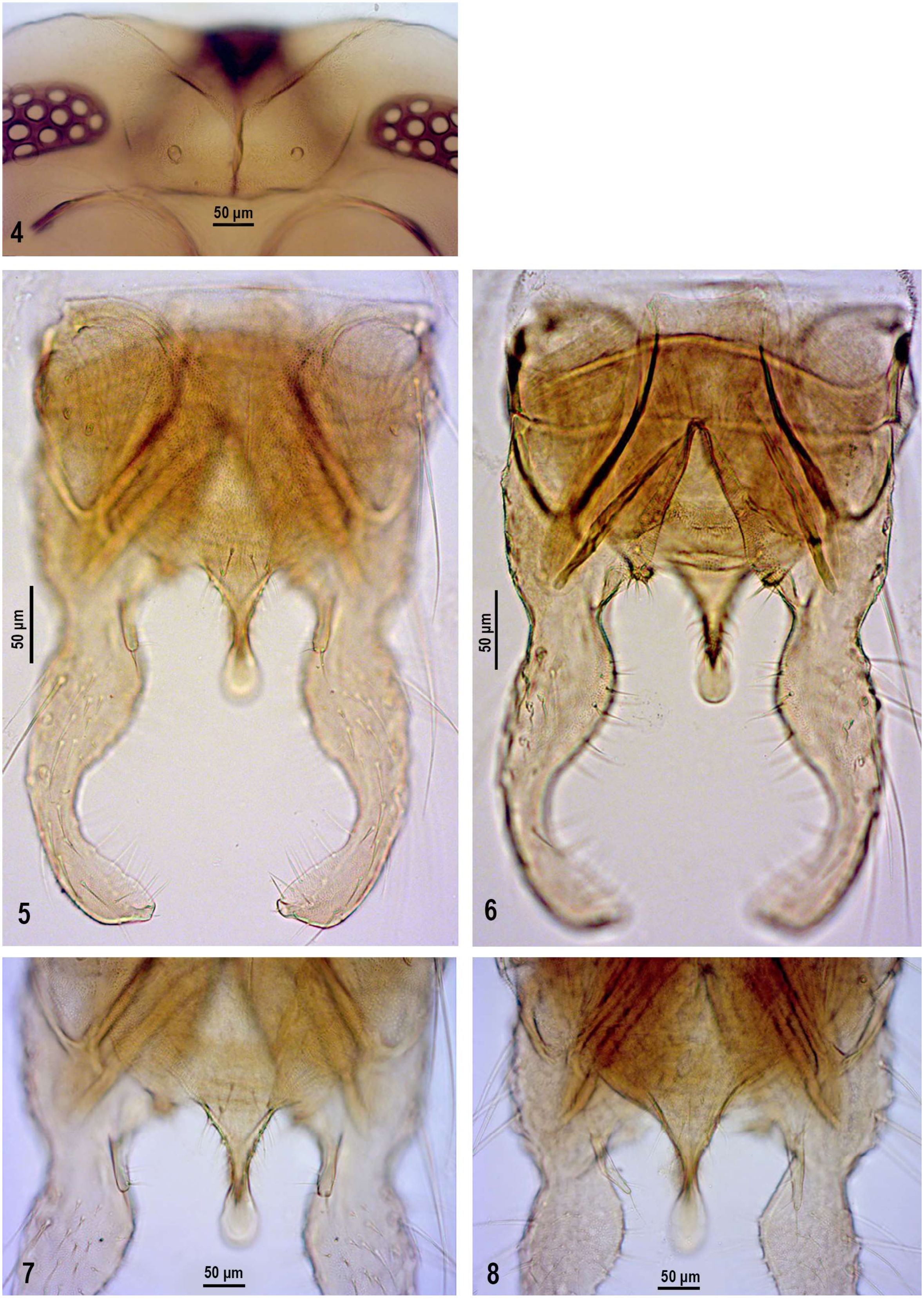
***Fourth instar larva* (n = 2).** Head (Figs 16–20) yellowish, length 0.4 mm, width 0.3 mm, cephalic index (W/L) 0.75. Frontoclypeal apotome 340–374 µm long, 92–105 µm maximal wide. Sclerite 2 length 51 µm, in apical part 24–31 µm wide, in the middle 27–29 µm wide, in distal part 51 µm wide. Distance between setae S1–S1 24–27 µm, S2–S2 68 µm, S3–S3 48 µm, S4–S4 58 µm, S5–S5 75–85 µm. Antenna 95–102 µm, length of each segment (in µm): 51–58; 14–17; 5.1; 6.8; 3.4–5.1. AR 1.67–1.79. Maximal width of basal segment 20.4–24.0 µm; ring organ distribute in the proximal 1/3 basal segment; distance from ring organ to base of antenna 17–24 µm; ROR 2.14–3.2. Blade 27 µm long, reached to the segment 3; accessory blade 14 µm. S I 27–34 µm long, S II 41–48 µm long, S III 17 µm long, S IVA 10 µm S IVB 17 µm long. Pecten epipharyngis 14 µm wide, with 4 teeth. Premandible 82–88 µm long, with 2 apical and 2–3 basal teeth; premandibular seta simple 17–27 µm long. Mandible 153–167 µm long; with dark brown apical and 2 inner teeth; length apical tooth 17–20 µm (Fig. 18). Seta subdentalis 20 µm long. Maxillary palp 24–3 µm long, 20 µm wide; ring organ distribute in the middle; distance from ring organ to base of maxillary palp 12–15 µm. Mentum 143–153 µm wide; central tooth conical 14 µm wide, without a small accessory tooth; median trifid tooth 34 µm wide (Figs 19–20); distances between first lateral teeth 58 µm; distance between second lateral teeth 78 µm. Ventromental plate 136–150 µm long and 54 µm wide. Distance between ventromental plates 61–65 µm. Ventromental plates with 20–25 striae. VmPR 0.39–0.40. VmPSR 0.87–0.92.

Remarks. A comparative analysis of the morphometric parameters of the males of *M. deribae* from different countries is given in Table 3. There is a slight variation in the coloration of the thorax and forelegs of males from yellowish to brown, as well as chaetotaxy of thorax. Thus, males from Russia and France have more setae on thorax; while specimens from China and Africa are smaller. The body indexes and other parameters are approximately the same (see Table 3).

Table 2. Lengths (in µm) and proportion of leg segments of *Microchironomus deribae* (n = 2)

Таблица 2. Длина члеников ног (мкм) и их индексы самца *Microchironomus deribae* (n = 2)

P	Fe	Ti	Ta_1	Ta_2	Ta_3	Ta_4	Ta_5	LR	SV	BV
P_1	728–760	560–600	760–784	464	344–352	224–250	136	1.31–1.36	1.69–1.73	1.73–175
P_2	720–760	720	328–360	200–208	168–176	112–120	104	0.46–0.50	4.11–4.39	2.99–3.07
P_3	800–840	840–880	528–560	320–328	280–288	160–168	120–128	0.63–0.64	3.07–3.11	2.38–2.58



Figs 4–8. Adult male of *Microchironomus deribae*. 4 — head; 5 — hypopygium, dorsal view; 6 — hypopygium, ventral view; 7, 8 — superior volsella.

Рис. 4–8. Имаго самец *Microchironomus deribae*. 4 — голова; 5 — гипопигий, дорсальный вид; 6 — гипопигий, вентральный вид; 7, 8 — верхний придаток.

Table 3. Comparative morphological characteristics of the males of *Microchironomus deribae* from different places of collection

Таблица 3. Сравнительная морфологическая характеристика самцов *Microchironomus deribae* из разных мест сбора

Microchironomus deribae								
Source	Freeman, 1957	Harrison, 1996 (n=2)	Laville, Tourenq 1967 (n = 3–50)	Ringe, 1970	Krebs, 1979 (n = 9–10)	Albu, 1980 (n = 5)	Yan, Wang, 2006 (n = 9)	our data (n = 2)
Country	Africa		France	Germany	Netherlands	Romania	Chine	Russia
Characters								
Total length, mm	–	–	3.5–3.9	4.7–4.9	4.3–5.3		3.80–4.38	3.5–4.0
Wing length, mm	2.5	1.7–2.3	1.9–2.4	2.3	2.2–2.5	1.89–2.19	1.53–2.13	1.89–1.93
Color of thorax	mesonotal stripes and postnotum brown	–	ground color of thorax pale yellow, mesonotal stripes and postnotum brown	–	–	ground color of thorax pale yellow, mesonotal stripes and 2/3 postnotum brown	dark brown, with black vittae	ground color of thorax pale yellow, mesonotal stripes and postnotum brown
Color of fore legs	–	–	brown	–	–	Fe yellowish, dorsal brown, Ti brown, distal darker, Ta_1 brown	Fe and proximal 1/3 of Ta_1 yellowish green, remaining parts dark brown	yellowish brown, proximal parts of Fe and Ta_1 lighter
AR	~2.5	3.0	2.4–3.4	2.66–2.95	2.63–3.10	2.39–2.82	2.41–2.69	2.43–2.55
Frontal tubercles	absent	minute	present	–	–	3–4 μm in diameter	rounded, 4–8 μm in diameter	length and width 7–19 μm
Clypeus	–	–	14–16	–	–	–	11–24	20–22
Aps	–	4	6	–	–	–	0–4	7–10
Ac	–	–	8–14	–	–	7–9	0–6	12–16
Dc	–	9	10–12	–	–	8–11	4–9	11–14
Pa	–	3	–	–	–	3–5	2–4	5–7
Scts	–	4	10–14	–	–	8	1–4	10–11
Squama	–	30	18–23	–	–	12–20	16–22	15–28
LR_{P1}	1.3	1.36	1.30–1.45	1.26–1.35	–	1.25–1.40	1.30–1.44	1.31–1.36
LR_{P2}	–	0.5	0.51	–	–	0.46–0.51	0.45–0.49	0.46–0.50
LR_{P3}	–	0.68	0.67	–	–	0.60–0.64	0.61–0.67	0.63–0.64
BR_{P1}	–	–	5 (on ta_3)	2.45–3.3	–	–	–	6.25

The pupae of *M. deribae* exhibit a variation in the shape of the shagreen on tergite VII (see Table 4). Thus, some pupae have two patches of shagreen [Laville, Tourenq, 1967; Harrison, 1996], while others have a medial patch of shagreen [Dejoux, 1971]. Russian pupae have longer frontal setae and fewer hooked spines on one of the hook rows, and may also lack an anal spur.

Larvae of *M. deribae* from different collection sites do not show significant differences (see Table 5). The larvae from the Elton Lake flagellum is slightly shorter, AR higher than indicated by Vallenduuk [2019]. In addition, frontal apotome and clypeus in larvae from Lake Elton are fused, while Harrison [1996] writes in his paper that the frontal apotome and clypeus are fused.

Distribution. *Microchironomus deribae* is widely distributed in Afro-tropical region, Oriental region and Palaearctic (North Africa, West Europe, Chine, Mongolia) [Wang, 2000; Hayford, 2005; Shcherbina, Zelentsov, 2008; Sæther, Spies, 2013]. In Russia *Microchironomus deribae* recorded from Volgogradskaya Oblast in the Elton Lake Basin [Zinchenko et al., 2017 a, b, 2021; Golovatyuk et al., 2020], Orenburg region (Southern Urals) in the Tuzlukkol River [Shaikhutdinova, 2019] and the Verkhne-Iremel Reservoir (Republic of Bashkortostan) [Zelentsov et al., 2014].

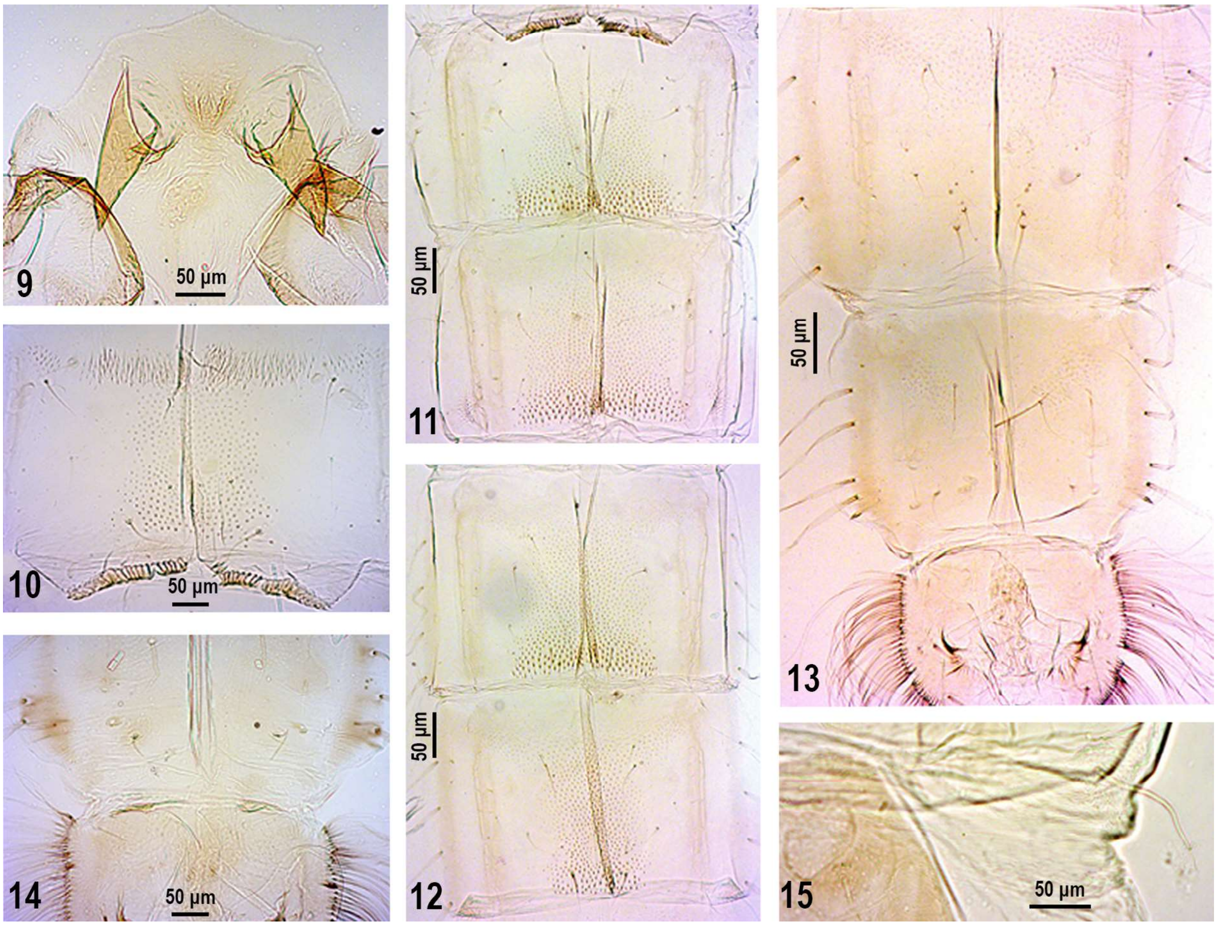
Ecological studies

The Diptera in the saline rivers are represented by 41 taxa, 25 of which belong to Chironomidae. The chironomids of the bottom communities were represented by eurybiont halotolerant species. Among the benthic organisms of the highly mineralized rivers flowing into hypersaline Elton Lake, chironomid larvae predominate in terms of both abundance and biomass [Zinchenko, Golovatyuk, 2010; Zinchenko et al., 2014, 2017a, b, 2019].

Microchironomus deribae is a common species in the Khara, the Lantsug, the Bolshaya Samoroda Rivers (Fig. 1) from the Elton Lake basin. The larvae inhabit the black and grey sandy mud and in sand sediments, occur between dense vegetation on depths of 0.05–1.1 m, at the velocity of 0.02–0.25 m/s (Table 1). The larvae live in the various saline rivers, T — 12–33°C and concentra-

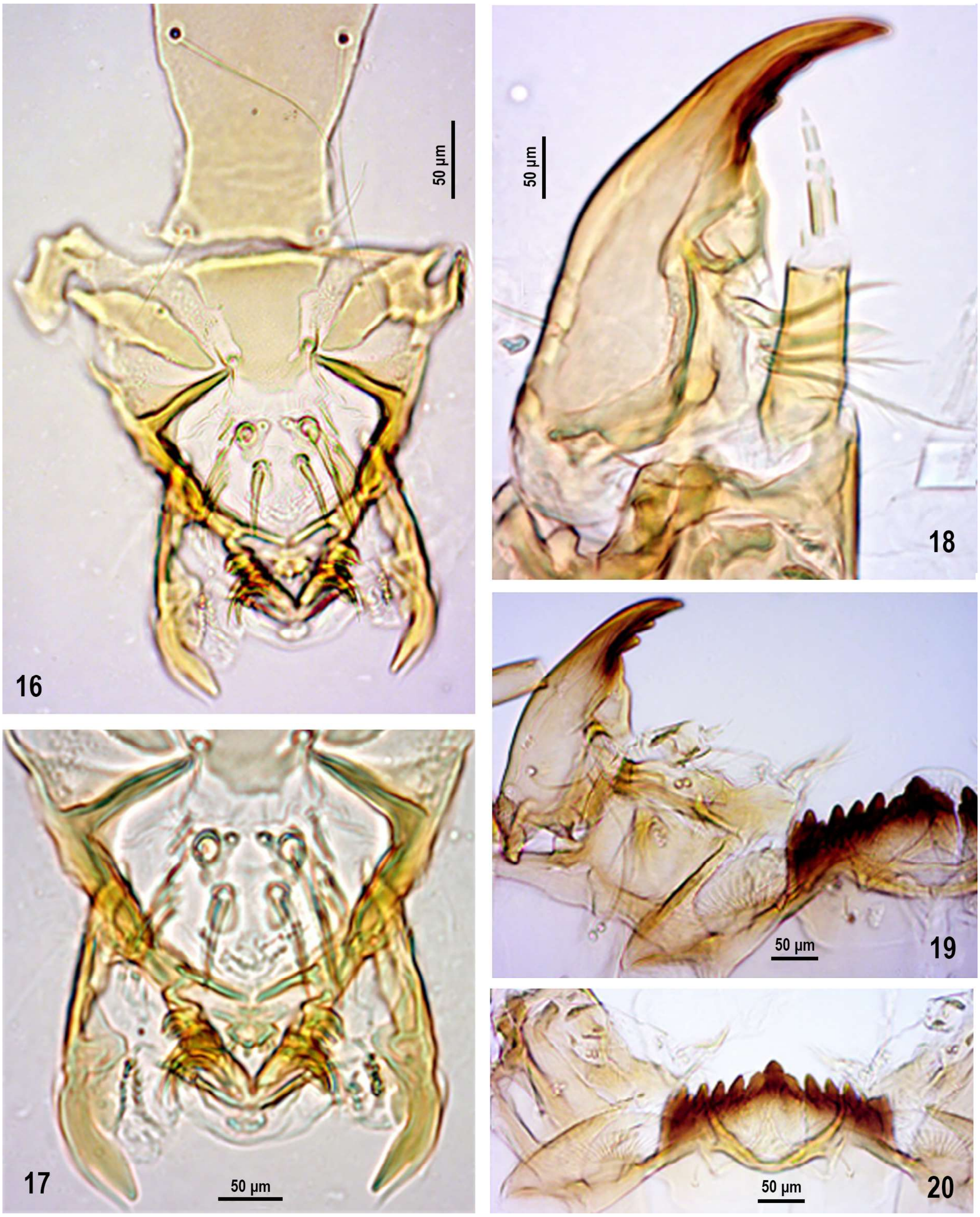
Table 4. Comparative morphological characteristics of the pupae of *Microchironomus deribae* on the basis of literature data
Таблица 4. Сравнительная морфологическая характеристика куколок *Microchironomus deribae* на основе литературных данных

Characters	*M. deribae* on: Laville, Tourenq, 1967, n = 2	*M. deribae* on: Harrison, 1996, (n = 2)	*M. deribae* on: Dejoux, 1971	*M. deribae* our data, n = 2
Total length, mm	4.7	6.0–6.6	5.5	5.1–5.3
Length of cephalic tubercle, μm	140	–	140	136–204
Length of frontal setae, μm	50	–	30	68–85
Antepronotals	–	1	–	2
Precorneals	–	2	–	2–3
Hook row	45–54	–	–	23–30
Tergite VII	anterolaterally with pare patches of shagreen	anterolaterally with pare patches of shagreen	anterolaterally with median patch of shagreen	anterolaterally with median patch of shagreen
Tergite VIII	anterolaterally with pare patches of shagreen	anterolaterally with pare patches of shagreen	anterolaterally with pare patches of shagreen	anterolaterally with pare patches of shagreen
Sternite II	patch of long spines anteriorly	spines anteriorly	–	patch of long spines anteriorly
Shagreen on other sternites	–	V–VI with patches shagreen posterolaterally	–	IV–VIII anterolaterally with patches of shagreen
Anal spur	1	1–2	1–2	0–1
Fringe of anal lobe with	48–57	90	–	53–72



Figs. 9–15. Pupa of *Microchironomus deribae*. 9 — frontal apotome; 10 — tergite II; 11 — tergites III–IV; 12 — tergites V–VI; 13 — tergites VII–IX; 14 — segment VIII, distal part; 15 — pleura of segments II–III.

Рис. 9–15. Куколка *Microchironomus deribae*. 9 — фронтальная апотома; 10 — тергит II; 11 — тергиты III–IV; 12 — тергиты V–VI; 13 — тергиты VII–IX; 14 — сегмент VIII, дистальная часть; 15 — плевра сегментов II–III.



Figs 16–20. Larva of *Microchironomus deribae*. 16 — labrum and dorsal sclerites; 17 — labrum; 18 — mandible and antenna; 19 — maxillary palp, mandible, ventromental plate and mentum; 20 — mentum and ventromental plates.

Рис. 16–20. Личинка *Microchironomus deribae*. 16 — лабрум и дорсальные склериты; 17 — лабрум; 18 — мандибула и антенна; 19 — максилярный щупик, мандибула, вентроментальная пластинка и ментум; 20 — ментум и вентроментальные пластинки.

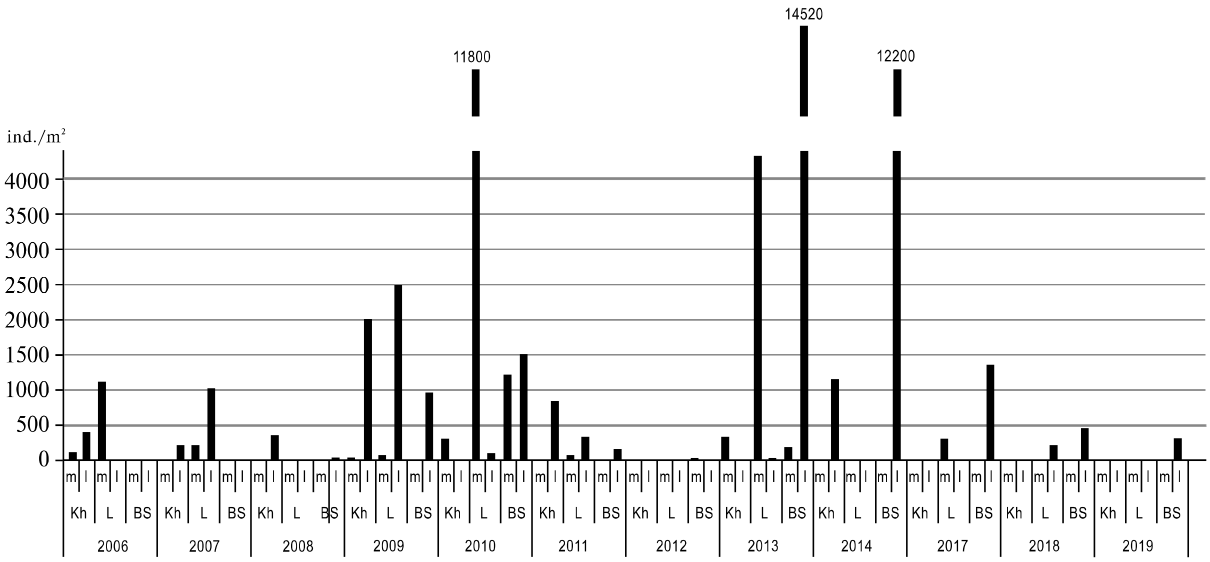


Fig. 21. Long-term dynamics of abundance of *Microchironomus deribae* in bottom communities of saline rivers in August in the middle (m) and lower (l) sections of the rivers. Rivers: Kh — Khara, L — Lantsug, BS — Bolshaya Samoroda.

Рис. 21. Многолетняя динамика численности *Microchironomus deribae* в донных сообществах солёных рек в августе в среднем (m) и нижнем (l) участках рек. Реки: Kh — Хара, L — Ланцуг, BS — Большая Саморода.

tion of dissolved oxygen of 1.8–15.9 mg/l. The larvae of *M. deribae* inhabit waters with the pH from 6.8 to 10.0. Several behavioural adaptations enable *M. deribae* larvae to live in the saline rivers on salinity 9.1–28.6 g/l.

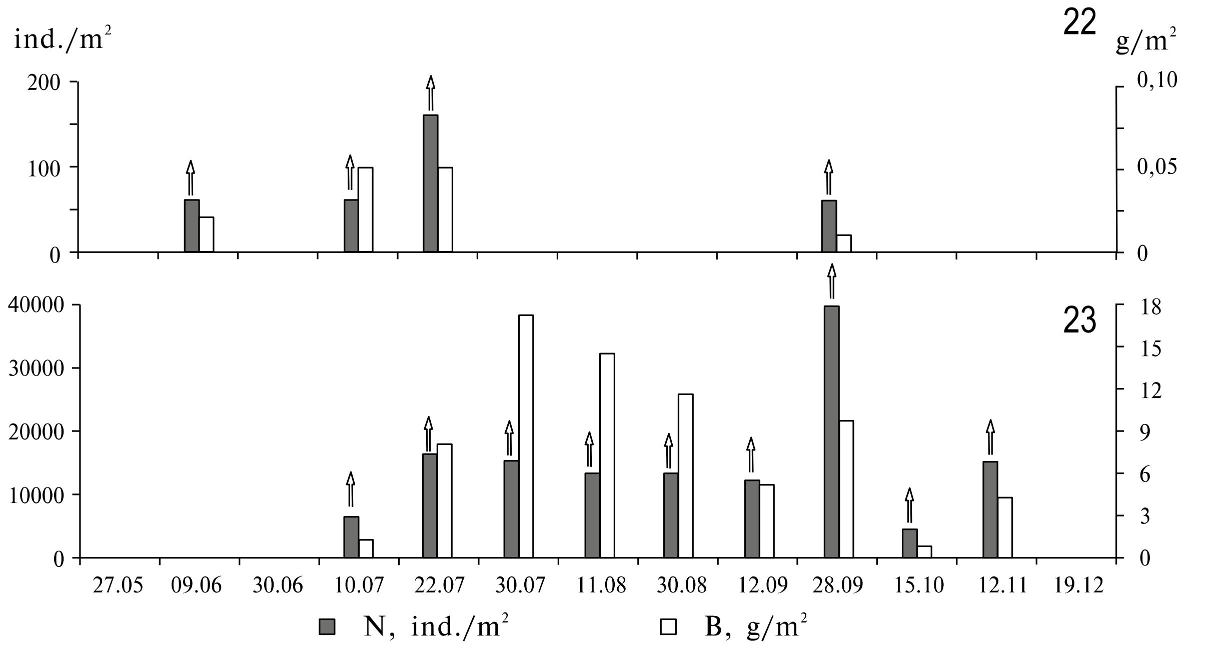
In terms of abundance the *M. deribae* larvae represented 19–65 % of the total chironomid's fauna collected in some years in the saline rivers (2006–2019). Frequency (% of samples) in the Lantsug River — 27.9 %, Bolshaya Samoroda River — 40.4 %, Khara River — 25.8 %. In some years, larvae of *M. deribae* accounted for up to 49–66 % of the total zoobenthos abundance in some sections of the lower reaches of the rivers with salinity up to 28.6 g/l.

The generalization of the long-terms dynamics (2006–2019) of the abundance of halotolerant *Microchironomus deribae* shows that the population density in rivers with different salinity levels in various sections of rivers varies in a wide range without clearly pronounced regularities (Fig. 21). For example, in the Lantsug River (August 2010) at a salinity level of 8.7 g/l, the peak abundance 11800 ind./m^2 is determined by the development of the population chironomids *M. deribae* in the middle reaches of the river. In the mouth reaches of the B. Samoroda river at a high salinity level 25.8 g/l the larvaes density in August 2013 was provided by the larvae of chironomids *M. deribae* (14520 ind./m^2).

Table 5. Comparative morphological characteristics of the larvae of *Microchironomus deribae* on the basis of literature data

Таблица 5. Сравнительная морфологическая характеристика личинок *Microchironomus deribae* на основе литературных данных

Characters	*M. deribae* (on: Vallenduuk, 2019)	*M. deribae* (on: Dejoux, 1971)	*M. deribae* (our data, n=2)
Total length, mm	9	8	–
Head width, mm	0.35–0.38	–	0.30
Frontal apotome and clypeus	fused	–	fused
Width of basal antennal segment, µm	22.5	–	20.4–24.0
Length of basal antennal segment, µm	43–60	60	51–58
Length of antennal segment 2	12.5–20	20	14–17
Length of antennal segment 3	–	5	5.1
Length of antennal segment 4	–	10	6.8
Length of antennal segment 5	–	2	3.4–5.1
Blade of antenna	–	reached to the segment 4	reached to the segment 3
Length of flagellum, µm	35–40	37	30.6–32.3
AR	1.23–1.50	1.62	1.67–1.79
Width of mentum, µm	125–145	–	143–153
Length of VmP, µm	135–150	–	136–150



Figs 22–23. Seasonal dynamics of abundance (N ind./m^2) and biomass (B g/m^2) of *Microchironomus deribae* at stations. 22 — in the middle reaches; 23 — in the lower reaches of the Bolshaya Samoroda River, 2013.

Рис. 22–23. Сезонная динамика численности (N экз./м^2) и биомассы (B г/м^2) *Microchironomus deribae* на станциях. 22 — среднее течение; 23 — нижнее течение реки Большая Саморода в 2013 г.

It should be noted that the larvae of *Microchironomus deribae* (Freeman, 1957) in the estuarine sections of the rivers flowing into Elton Lake, occurs in biocenoses together with halophilic larvae *Cricotopus* (*Cricotopus*) *salinophilus* Zinchenko, Makarchenko, Makarchenko, 2009, *Chironomus aprilinus* Meigen, 1918, *Glyptotendipes salinus* Michailova, 1987.

The spatial and seasonal dynamics of chironomid abundance and biomass is exemplified by the distribution of the larvae of *M. deribae* in the middle and upper reaches of the river Bolshaya Samoroda from May 2013 into December of that year. Sampling stations differed in the degree of overgrowth, stream velocity, pH, mineralization, biotope type, soil particle size, etc. So, in the middle course, a few larvae of *M. deribae* were recorded only in June and July and September. The number of larvae did not exceed 160 ind./m^2 at a salinity level of 6.0–11.0 g/l and temperature of 23–26 °C (Figs 22–23). However, in the mouth reach of the Bolshaya Samoroda river larvae *M. deribae* prevailed in abundance July to November 2013. For example, the abundance of 37300 ind./m^2 represented in the Bolshaya Samoroda River (28.IX.2013) appeared to be a maximum population value for larvae of this species [Zinchenko et al., 2019].

Pronounced polyvoltinity is characteristic of populations of chironomids of mass species living in the mouth areas of saline rivers. Analyzing the age composition of *M. deribae* populations, it can be stated that adult emergence occurs at intervals of approximately 15–18 days. In the life cycle, larvae of II–IV instars and pupae are recorded during the growing season. Autumnal emergence of adults was recorded in September when water temperatures dropped drastically to 5–10 °C. Thus, the seasonal dynamics of the most abundant multivoltine populations of chironomids is mostly determined by changes in the environmental conditions of saline rivers and by the mineralization gradient. The timing of the emergence of adults during the growing season can be shifted, changed in the habitat of larvae with frequent changes in the level of mineralization under conditions of surge phenomena and the influx of salt water from the hyperhaline Elton Lake in the mouth sections of the rivers Khara, Lantsug and B. Samoroda [Zorina, Zinchenko, 2009; Zinchenko, Golovatyuk, 2010]. *Microchironomus deribae* populations of the river Bolshaya Samoroda are resident taxa, i.e., species that are permanently present in the region as self-sustaining populations.

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