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New records on the distribution of the Kamchatka shrew (*Sorex camtschaticus* Yudin, 1972) in North-East Asia

Nikolai E. Dokuchaev

ABSTRACT. The northeastern limits of the Kamchatka shrew distribution were found to extend much further and include the northeastern territories of the Koryak upland. The new capture points indicate a shift in the range of the species to the east by 500 km from the previously known ones. A distance of only 130 km separates the nearest catching sites of the Kamchatka and Portenko's shrews.

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KEY WORDS: Kamchatka shrew, *Sorex camtschaticus*, distribution, North-East Asia.

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Новые данные о распространении камчатской бурозубки (*Sorex camtschaticus* Yudin, 1972) на северо-востоке Азии

Н.Е. Докучаев

РЕЗЮМЕ. Установлено, что северо-восточные пределы распространения камчатской бурозубки простираются гораздо дальше и включают северо-восточные территории Корякского нагорья. Новые места отлова сдвигают ареал вида на восток на 500 км от ранее известных границ. Ближайшие точки отлова камчатской бурозубки и бурозубки Портенко разделяет дистанция лишь в 130 км.

КЛЮЧЕВЫЕ СЛОВА: камчатская бурозубка, *Sorex camtschaticus*, распространение, Северо-Восточная Азия.

Introduction

Shrews of the subgenus *Otisorex* are of American origin (Findley, 1955; George, 1988, Fumagalli *et al.*, 1999). In North-East Asia (NEA) there are three such species: *Sorex camtschaticus* Yudin, 1972, *S. leucogaster* Kuroda, 1933, and *S. jacksoni* Hall et Gilmore, 1932 (Pavlinov *et al.*, 2002; Andreev *et al.*, 2006; Zaitsev *et al.*, 2014; Lissovsky *et al.*, 2019). The latter is represented in the NEA by the subspecies *S. jacksoni portenkoi* Stroganov, 1956 – Portenko's shrew (van Zyll de Jong, 1982; Dokuchaev, 1994, 1997, 1999).

In the collection of the Zoological Museum of the Moscow State University (ZMMU, Moscow, Russia) I found three specimens of shrews. They were collected by V.A. Dolgov in 1983 during his rafting on the Khatyrka River. This is the territory of the south-eastern limits of the Chukot Autonomous District, Russia. V.A. Dolgov classified these shrews as *Sorex cinereus*. At that time, shrews of the subgenus *Otisorex* from the mainland territory of the NEA were considered to be subspecies of *S. cinereus* (Stroganov, 1956, 1957; Hoffmann & Peterson, 1967; Yudin, 1969, 1971, 1972, 1973, 1975, 1989; Yudin *et al.*, 1976; Okhotina, 1977, 1984; Gromov & Baranova, 1981; Chrnyavsky, 1984; Dolgov, 1985; Ivanitskaya & Kozlovski, 1985; Anisimov & Dolgov, 1996). In 2019, a specimen of a shrew caught in soil traps of entomologists near the village of Meynypilgyno (62.5388° N, 177.0492° E) arrived at the Zoological Museum of Moscow State University. This new site is located 100 km north of the mouth of the Khatyrka River.

All four specimens (three from Khatyrka and one from Meynypilgyno) belonged to the Kamchatka shrew for all features. The new sites significantly (by 500 km) shifted the distribution of *S. camtschaticus* to the east from the previously known its capture sites in the Penzhina River basin (Ayanka Village; 63.7261° N, 167.5842° E). The aim of the study was to conduct a comparative analysis of shrews captured in the Khatyrka River basin and near Meynypilgyno Village with other mainland species of the subgenus *Otisorex* from North-East Asia to confirm their species affiliation.

Material and methods

The skulls and flat skins of three shrews from Khatyrka (ZMMU S-193645, S-193646, S-193647) were examined. Only one specimen had external dimensions. Two measurements were taken from the skulls of these shrews: condylobasal length of the skull and the width of the cranium. A shrew from Meynypilgyno (ZMMU S-203625) was fixed in ethanol. Only measurements of the tail and hind foot were taken from it.

A comparative analysis of *S. camtschaticus* and *S. jacksoni portenkoi* was conducted on the basis of external and craniometrical dimensions of shrews from collections at the Zoological Museum of Moscow State University, the Zoological Institute of the Russian Academy of Sciences (ZIN, Saint Petersburg, Russia), and personal collections. Measurements were taken only from young shrews. Pregnant females and animals in the process of moulting were excluded, as the weight of such animals increases significantly (Dokuchaev, 1990). External parameters were taken from 29 specimens of *S. camtschaticus* and the same number of *S. jacksoni portenkoi*.

Craniometrical characteristics were obtained from 70 and 26 specimens of Kamchatka and Portenko's shrews, respectively. The following craniometrical characteristics were measured: condylobasal length (CBL), cranial width (CW), rostrum length (RL), which is the distance from the anterior top of the maxillary bone to the anterior border of the foramen anteorbitalia, length of molariform tooth row (P4–M3), and width across the second unicuspid teeth (U2–U2).

The statistical processing was carried out using software packages: Systat 8.0 and Microsoft Excel 2010.

Results and discussion

The ranges of *S. camtschaticus* and *S. jacksoni portenkoi* do not overlap (Fig. 1). *Sorex camtschaticus* is associated with woodland territories. It inhabits the Kamchatka Peninsula, and in the mainland part it was caught in the basins of Penzhina River and Kegali River (the right-hand tributary of the Omolon River) (Yudin, 1971, 1973, 1975, 1989; Dolgov & Reimers, 1979; Okhotina, 1984). The western limits of its distribution in the Northern Priokhothye include the Chelomdza River basin (Dokuchaev, 1990, 2019) (Fig. 1). *Sorex jacksoni portenkoi* is a tundra form. It has been obtained in a number of locations in Chukotka (Stroganov, 1956, 1957; Yudin, 1971; Dolgov & Krivosheyev, 1973; Dokuchaev, 1994; Anisimov & Dolgov, 1996). The area of distribution of Portenko's

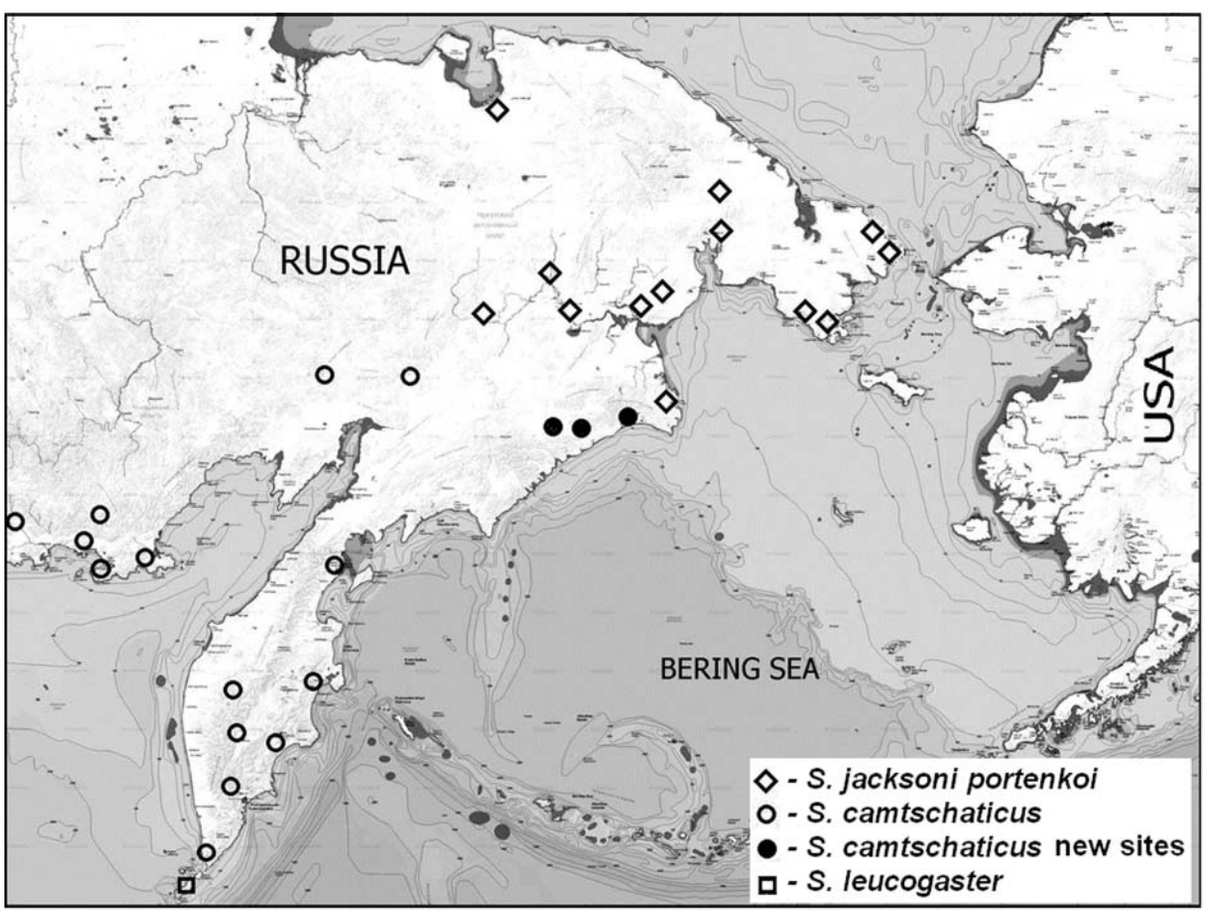

Fig. 1. The distribution (capture sites) of three shrew species of the subgenus *Otisorex* in North East Asia.

Table 1. Weight (g) and external dimensions (mm) of Kamchatka and Portenko's shrews including length of tail and hind foot of shrews from Khatyrka and Meynypilgyno.

Species	*n*	Characters			
		Weight	Body length	Tail length	Hind foot length
S. camtschaticus	29	4.4±0.06	57.3±0.48	46.5±0.63	13.5±0.12
S. jacksoni portenkoi	29	3.3±0.05	54.2±0.57	28.8±0.39	10.8±0.12
S. camtschaticus (Khatyrka)	1	–	–	40	12.5
S. camtschaticus (Meynypilgyno)	1	–	–	39.5	12.4

Table 2. Two craniometrical measurements of shrews from Khatyrka in comparison with Kamchatka and Portenko's shrews.

Species	*n*	Measurements (mm)				
		CBL	CW	RL	Pm4–M3	U2–U2
S. camtschaticus	70	16.2±0.030	7.84±0.029	7.54±0.026	3.67±0.012	1.55±0.008
S. jacksoni portenkoi	26	15.1±0.05	7.57±0.021	7.34±0.033	3.61±0.013	1.74±0.010
S. camtschaticus (Khatyrka)	3	16.1	8.03	–	–	–

shrew on the southern periphery of its range is limited by the Anadyr River and only in the south-east along the Anadyr Bay coast it reaches the vicinity of Beringovsky settlement (63.0627° N, 179.3532° E). *Sorex leucogaster* is an island form, known only from Paramushir Island.

The morphological features of *S. camtschaticus* and *S. jacksoni portenkoi* exhibit notable differences, including fur coloration, external and craniometrical measurements (Okhotina, 1977; Yudin, 1989). These species differ in body weight and particularly in tail length. The Kamchatka shrew has a tail that is 1.6 times longer than that in Portenko's shrew (Table 1). A distinctive feature of *S. camtschaticus* is the presence of a well-developed fringe of stiff hairs on the sides of both the fore and hind

Fig. 2. General view of *S. camtschaticus*. Photo by N.E. Dokuchaev.

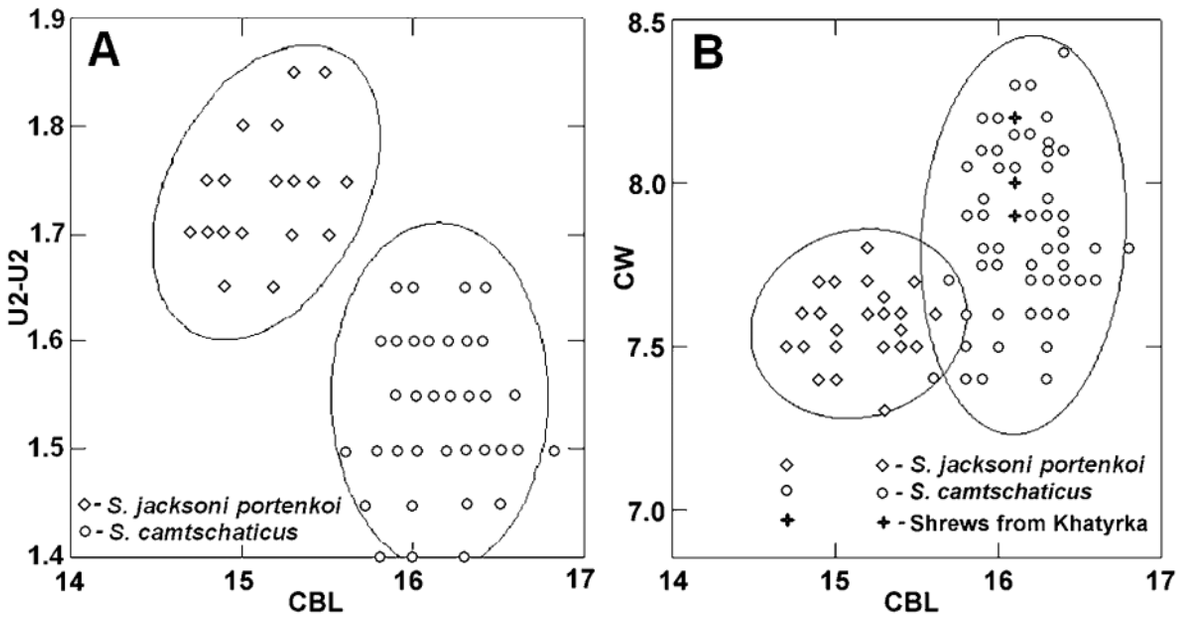

Fig. 3. Scatterplot of *S. camtschaticus* and *S. jacksoni portenkoi* samples by condylobasal length and rostrum width across the second unicuspids (A), and by condylobasal length and width of the skull, including three specimens from Khatyrka (B). (Here and on next figure ellipses with 95% confidence).

feet (Yudin, 1973; Okhotina, 1977) (Fig. 2). There are also significant differences between these species in cranial dimensions (Fig. 3A). In particular, Portenko's shrew by a smaller skull size has a broader rostrum (width across U2–U2) (Table 2). The dispersal "clouds" of *S. camtschaticus* and *S. jacksoni portenkoi* specimens exhibit no overlap in external features (Fig. 4). The specimens from Khatyrka and Meynypilgyno are identified as belonging to the Kamchatka shrew. Also, three specimens from Khatyrka belong to the Kamchatka shrew based on craniometrical characters (Fig. 3B).

Previously, van Zyll de Jong (1982, 1991) showed that the Kamchatka and Portenko's shrews are clearly separated in morphological parameters in multivariate space. Our data are in full agreement with his results. At the same time, it should be noted that with such significant morphological differences between *S. camtschaticus* and *S. jacksoni portenkoi* at the molecular level, these species appear to be very close (Demboski & Cook, 2003; Ohdachi *et al.*, 2006; Bannikova *et al.*, 2018).

Available data indicate that all four specimens of shrews captured in the Khatyrka River basin and near the Meynypilgyno village belong to *S. camtschaticus*. This finding suggests that the eastern limit of the distribution of the Kamchatka shrew has been shifted by 500 kilometers. Previously, the ranges of the Kamchatka and Portenko's shrews were thought to be far apart. Now they are separated by only 130 km (the distance between the settlements of Meynypilgyno and Beringovsky). Since the headwaters of the Khatyrka River are close to those of the Velikaya River, it is likely that *S. camtschaticus* inhabits this river basin as well. This is also true for the Main River basin.

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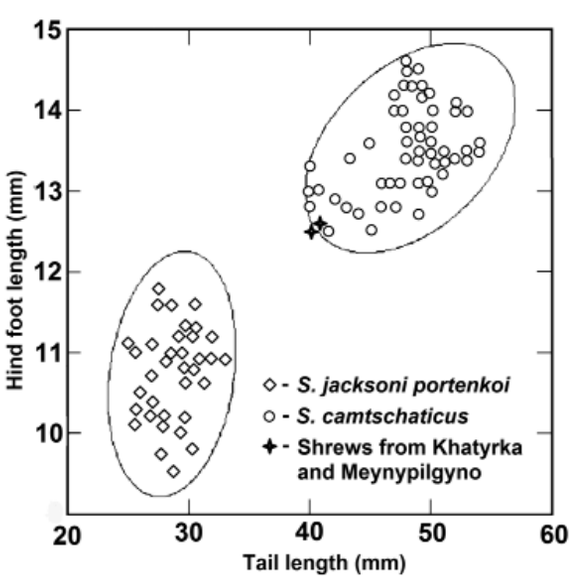

Fig. 4. Scatterplot of *S. camtschaticus* and *S. jacksoni portenkoi* samples by the tail and hind foot length and two shrew specimens from Khatyrka and Meynypilgyno.

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