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RESEARCH ARTICLE

A new species of bristletails of the genus *Silvestrichilis* (Archaeognatha: Machilidae) from the Krasnodar Province (Russia)

Новый вид щетинохвосток рода *Silvestrichilis* (Archaeognatha: Machilidae) из Краснодарского края (Россия)

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Abstract. *Silvestrichilis markotchiensis* **sp. nov.** is described from the northwestern Caucasus (Markotkh Mountain Range). This species is characterised by the two-coloured compound eyes, which are gray with brown spots. Based on this character, it belongs to a group of species that includes *S. caucasica* Kaplin, 2015, *S. golovatchi* Kaplin, 1990, *S. polinae* Kaplin, 2018, *S. stepposa* Kaplin, 2022, and *S. zazimkoi* Kaplin, 2007. Members of this group display activity during the morning, evening, and twilight hours. *Silvestrichilis markotchiensis* **sp. nov.** is distinguished from other species in this group by the longest cerci, the narrowest paired ocelli, the ratio of lengths of the apical and preapical segments of the maxillary palps, the presence of numerous long, thin setae on the segments of the labial palps and on the fore and middle femora, the structure of the sensory field on the fore femur, and the ratio of the lengths of the urostyli and urocoxites VIII and IX in males.

Резюме. *Silvestrichilis markotchiensis* **sp. nov.** описан с северо-западного Кавказа (Маркотхский горный хребет). Он имеет двуцветные, серые с коричневыми пятнами, фасеточные глаза и относится к группе видов, включающей *S. caucasica* Kaplin, 2015, *S. golovatchi* Kaplin, 1990, *S. polinae* Kaplin, 2018, *S. stepposa* Kaplin, 2022 и *S. zazimkoi* Kaplin, 2007, с утренне-вечерней и сумеречной активностью. *Silvestrichilis markotchiensis* **sp. nov.** отличается от других видов этой группы наибольшей длиной церок, наиболее узкими парными глазками, соотношением длин апикального и преапикального члеников нижнечелюстных щупиков, многочисленными длинными тонкими щетинками на нижнегубных щупиках, передних и средних бедрах ног, строением сенсорного поля на передних бедрах, соотношением длин грифельков и кокситов на VIII и IX брюшных сегментах у самцов.

Key words: Northwestern Caucasus, Markotkh Mountain Range, taxonomy, morphology, new species

Ключевые слова: Северо-Западный Кавказ, Маркотхский горный хребет, таксономия, морфология, новый вид

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Introduction

The South Palaearctic genus *Silvestrichilis* Wygodzinsky, 1950 comprises 20 species that inhabit open mountain areas characterised by sparse woody-shrubby and meadow-steppe vegetation across the Western and Eastern Mediterranean, the Caucasus, Iran, and Central Asia (Kaplin, 2018, 2022, 2023). Two species, *S. confucius* (Silvestri, 1906) and *S. chinensis* Kaplin, 2019, have

been described from Northeast and Southwest China (Shaanxi and Sichuan provinces) (Mendes et al., 2000; Kaplin, 2019).

During the study of bristletails collected near the village of Kabardinka in the Krasnodar Province of Russia, four males of a new species belonging to the genus *Silvestrichilis* were discovered. The description of this species is provided below.

Material and methods

Bristletails were collected in 75% alcohol. The holotype (male) and one paratype of the new species were dissected and mounted on glass microscope slides using Berlese fluid. Illustrations were created with a microscope and drawing tools.

The types of the new species are deposited in the collection of the All-Russian Institute of Plant Protection, St Petersburg – Pushkin, Russia (VIZR).

Taxonomy

Order **Archaeognatha** Börner, 1904

Family **Machilidae** Grassi, 1888

Subfamily **Machilinae** Grassi, 1888

Genus ***Silvestrichilis*** Wygodzinsky, 1950

Type species*: Dilta heterotarsus* Silvestri, 1942

***Silvestrichilis markotchiensis* sp. nov.**
(Figs 1–12)

Holotype. Male (mounted on slide), **Russia**, *Krasnodar Prov.,* Markotkh Mountain Range, near Kabardinka Vill., 44°39′N 37°56′E, 450–500 m a.s.l., under stones, 9.V.2024, V. Kaplin leg. (VIZR).

Paratypes. 3 males (one mounted on slide, two kept in 75% ethanol), with same data as for holotype (VIZR).

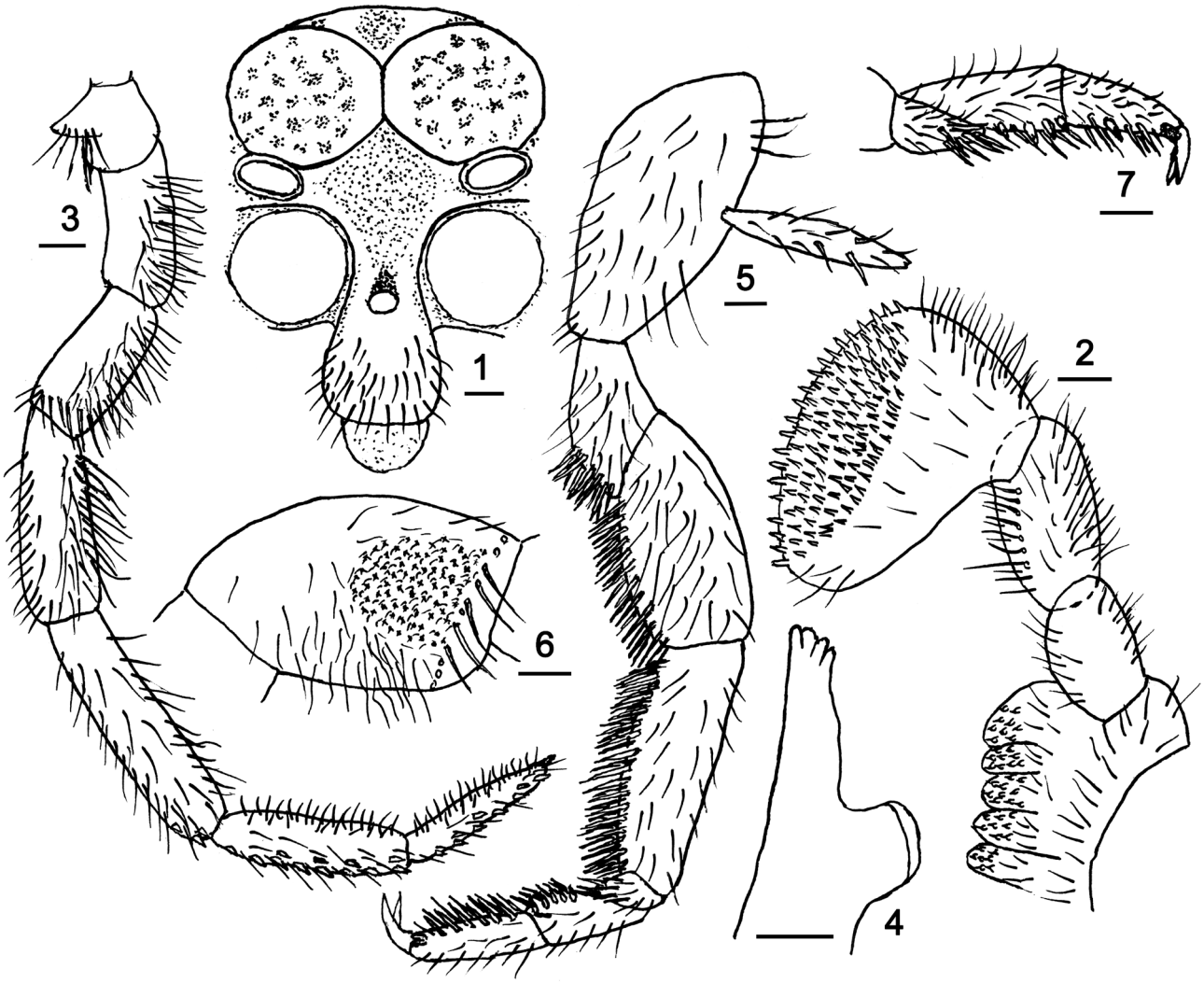
Description. *Male*. Body length 9.3–9.5 mm, width 2.2–2.4 mm. General body colour reddish brownish, with hypodermal pigment. Antennae, frons, maxillae, cerci, caudal filament covered with almost black scales. Scales dark brown or brownish on dorsal side of body and legs, brown on ventral side of body, light on clypeus. Posterior part of mesonotum with relatively wide transverse stripe of dark brown and narrow stripe of white scales. Antennae slightly shorter than body. Distal chain of flagellum consisting of nine segments. Clypeus covered with long, light bristles. Cerci about 0.65–0.75 times as long as body. Apex of each cercus with one short lateral spike.

Compound eyes two-coloured, grey with brownish spots (in alcohol). Ratio length to width of compound eye about 0.9; ratio of line of contact to length of eyes 0.25–0.31. Paired ocelli sublateral, oval, reddish brown with white borders, 2.7–3.0 times as wide as long. Distance between inner margins of ocelli about 0.45–0.58, between their outer margins 0.88–0.92 times total width of compound eyes (Fig. 1).

Apical segment of maxillary palp 0.84–0.86 times as long as preceding segment. Dorsal surfaces of segments 7, 6, and 5 of maxillary palps with 9–10, 11–12, and 2–3 hyaline spines, respectively. Lower surface of segments 2 to 4 of maxillary palps and upper surface of segments 2 and 3 of labial palps covered with relatively numerous, long, thin setae (Figs 2, 3). Lower and upper surfaces of segments 6 to 7 of maxillary palps covered with relatively numerous, shorter setae. Apical segment of labial palp triangularly oval, ratio of its length to width 0.74–0.83. Mandibles with four distal teeth (Fig. 4).

Fore femur and tibia widened. Ratio of length to width of femur, tibia and tarsus as shown in Table 1. Middle legs shorter than fore ones. Hind legs longest. Fore tarsi 1.04, hind ones 1.18 times as long as middle tarsi. Fore and middle femur and trochanter covered with numerous, long, thin setae. Lower surface of femora, tibiae and tarsi covered with long spinelike setae; on tarsi, some of these setae erect, thickened and shortened. Ratio of length of tarsomere 3 of hind tarsus to total length of tarsus 0.45–0.48. Number of spinelike setae as shown in Table 1. Middle and hind legs with coxal styli. Length of styli 0.58–0.70 mm. Ratio of length of styli to width of middle and hind coxae about 1.5–1.6 (Figs 5, 6).

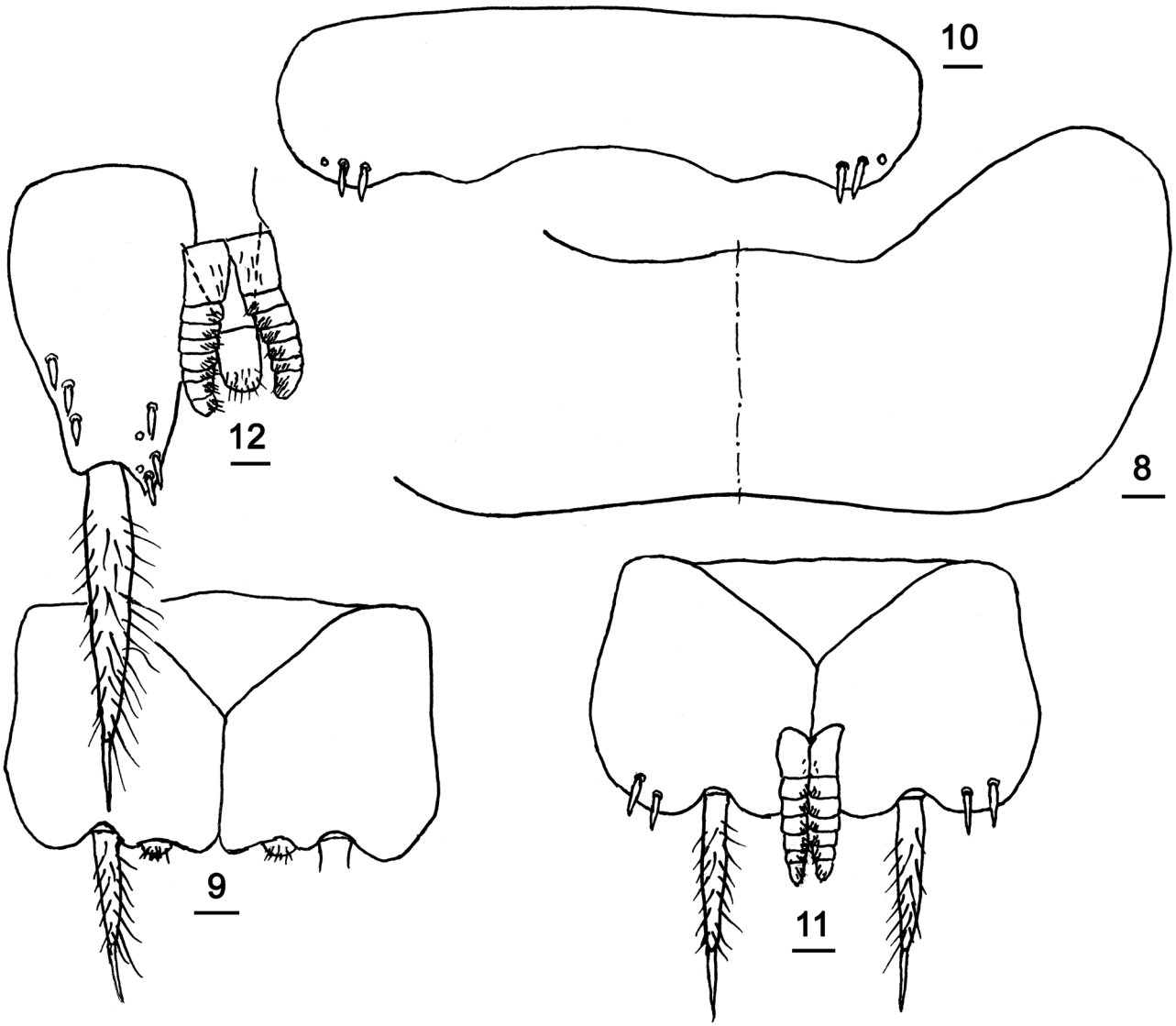
Fore femur with well-developed sensory field, including about 70 rosette-shaped sensilla of different sizes. Sensory fields open, reaching transverse row of large bristles in anterior part of femur (Fig. 6). Quantitative characters of sizes and locations of sensory field on femora in males of *Silvestrichilis markotchiensis* **sp. nov.** are given in Table 2.



Figs 1–7. *Silvestrichilis markotchiensis* **sp. nov.**, (male, holotype). **1**, eyes, ocelli, frons, clypeus, labrum and bases of antennae; **2**, labial palp; **3**, maxillary palp; **4**, anterior part of mandible; **5**, hind leg; **6**, femur of fore leg; **7**, tarsus of fore leg. Scale bars: 0.1 mm.

Table 1. Morphometric characters of the legs of *Silvestrichilis markotchiensis* **sp. nov.**

Characters	Segments	Pair of legs		
		fore	middle	hind
Ratio of length to width of main leg segments	Tarsus	3.75	3.60	4.47
	Tibia	1.94	1.78	2.46
	Femur	1.62	1.66	1.89
Number of elongated, needle-shaped macrochaetae and (+) shortened erect macrochaetae	Tarsomere 1	4–6	4–8	6–10
	Tarsomere 2	5–8 + 3–5	8–10 + 3–5	10–12 + 4–5
	Tarsomere 3	4–6 + 1	6–8	8–10
	Tibia	8–10	22–28	32–36
	Femur	0–2	16–20	22–26



Figs 8–12. *Silvestrichilis markotchiensis* **sp. nov.** (male). **8**, pronotum; **9**, urosternite and urocoxites of urite VII; **10**, urotergite X; **11**, urosternite and urocoxites (with parameres) of urite VIII; **12**, male genitalia and abdominal coxite IX. Holotype (8, 10, 12) and paratype (9, 11). Scale bars: 0.1 mm.

Table 2. Morphometric characters of the sensory fields on the fore femora of *Silvestrichilis markotchiensis* **sp. nov.**

Quantitative index	Sensory field on male fore femur
Number of rosette-shaped sensilla	near 70
Ratio of length to width of sensory field	1.08–1.14
Ratio of sensory field length to femur length	0.42–0.44
Ratio of sensory field width to femur width	0.68–0.72
Ratio of distance from apex of sensory field to apex of femur to its length	0.42–0.46
Ratio of distance from base of sensory field to base of femur to its length	0.10–0.12
Ratio of distance from sensory field to ventral side of femur to its width	0.20–0.24
Ratio of distance from sensory field to dorsal side of femur to its width	0.10–0.12

Table 3. Ratios of the lengths of the urosternites, urocoxites, and styli of *Silvestrichilis markotchiensis* **sp. nov.**

Urites	Ratio of urosternite to urocoxite lengths	Ratio of stylus (excluding supporting spines) to urocoxite lengths	Ratio of lengths between supporting spines and styli (without supporting spines)	Number of sublateral macrosetae on urites	
				urocoxites	urotergites
II	0.49	0.58	0.37	0	0
III	0.50	0.53	0.38	0	0 + 1
IV	0.50	0.48	0.46	1 + 1	3 + 3
V	0.52	0.48	0.43	2 + 1	4 + 3
VI	0.52	0.46	0.45	2 + 2	4 + 4
VII	0.52	0.51	0.46	2 + 2	4 + 5
VIII	0.35	0.65	0.41	2 + 2	5 + 5
IX	–	0.87	0.30	3–6 + 3–6	5 + 5
X	–	–	–	–	3 + 3

Urites I–VII with 1 + 1 eversible vesicles. Posterior angle of urosternites II–VII 90–95°, VIII 96°–98°. Ratios of lengths of urosternites, urostylus (without apical spines) and urocoxites given in Table 3.

Thoracic tergites, urosternites, urocoxites I–III, and abdominal tergites I and II without macrosetae (Figs 8–10). Number of macrosetae on urocoxites IV–IX and urotergites III–X given in Table 3.

Genitalia of male with parameres on urites VIII and IX. Penis and parameres of urite IX entirely concealed with urocoxites of urite IX. Parameres of urite VIII with 1 + 6 divisions (Fig. 11). Parameres of urite IX with 1 + 7 divisions, protruding beyond apex of penis by 0.6 times width of its apical segment, not reaching apices of coxites IX by 0.20–0.25 times their length (Fig. 12). Parameres of urite IX 1.6–1.8 times as long as those of urite VIII. Basal segment of penis 1.4 times as long as apical segment.

Comparison. Bristletails of the genus *Silvestrichilis* have a broad distribution, extending from west to east between 01°19′W (*S. cercoconica* Bach, 1979, Spain) and 108°10′E [S. confucius (Silvestri, 1906), Northeastern China], and from south to north between 27°02′N (*S. chinensis* Kaplin, 2019, Southwestern China) and 47°17′N (*S. stepposa* Kaplin, 2022, Cis-Azov region). Populations of this genus are characterised by low density throughout their range. Species of this genus have been described based on a limited number of individuals. To date, only eleven species have been described based on both male and female specimens, six species solely from females, and four species from males. This scarcity of comprehensive data complicates the comparison and identification of species within the genus *Silvestrichilis*. The only characters that are nearly identical in both males and females are the colour of the compound eyes, the location of the oval paired ocelli, the presence of erect, short, and thick bristles on the tarsus, and one pair of exertile vesicles on the II–VII urocoxitae.

Four types of eye coloration are known in ethanol-preserved specimens of the genus (Kaplin, 2018). Collected individuals of both sexes from six Caucasian species (*S. caucasica* Kaplin, 2015, *S. golovatchi* Kaplin, 1990, *S. markotchiensis* **sp. nov.**, *S. polinae* Kaplin, 2018, *S. stepposa*, and *S. zazimkoi* Kaplin, 2007) display two-coloured bluish or gray compound eyes with brownish spots. These two-coloured compound eyes were observed in species that primarily exhibit activity during the morning, evening, and twilight hours.

The main morphological differences between *Silvestrichilis markotchiensis* **sp. nov.** and the related species *S. caucasica*, *S. golovatchi*, *S. polinae*, *S. stepposa*, and *S. zazimkoi*, which possess two-coloured compound eyes, are summarised in Table 4. The new species is distinguished from its congeners within this group by the following

characters: the longest cerci, the narrowest paired ocelli, the ratio of lengths of the apical and preapical segments of the maxillary palps, the presence of numerous long, thin setae on the segments of the labial palps and on the fore and middle femora, the structure of the sensory field on the fore femur, and the ratio of the lengths of the urostyli and urocoxites VIII and IX in males.

Etymology. The specific name is derived from the name of the Markotkh Mountain Range (Мэркlотх in Adyghe), where the species was collected.

Table 4. Main morphological differences between *Silvestrichilis markotchiensis* **sp. nov.** and clocely related species of the genus.

Morphological characters		*S. markotchiensis* male	*S. zazimkoi*	*S. polinae*	*S. golovatchi*	*S. caucasica* female	*S. stepposa* female
Ratio of cerci to body lengths		0.65–0.75	0.35–0.37	0.40–0.42♂ 0.36–0.38♀	0.37–0.38	0.30–0.35	0.34–0.35
Ratio of compound eye length to width		0.90	0.81–0.84	0.84–0.92	0.84–0.89	0.86–0.91	0.90–0.94
Ratio of contact line and eye lengths		0.25–0.31	0.16–0.18	0.28–0.30	0.28–0.34	0.25–0.30	0.25–0.30
Ratio of paired ocelli width to length		2.7–3.0	2.3–2.4	2.0–2.3	2.0	2.5–2.6	2.2–2.4
Ratio of lengths of apical and preapical segments of maxillary palps		0.84–0.86	0.67 ♂ 1.00 ♀	1.00 ♂ 1.14 ♀	1.2 ♂ 1.4 ♀	1.0	0.90–0.95
Ratio of length to width of apical segment of labial palpus		0.74–0.83	0.86 ♂	0.79 ♂ 1.33 ♀	1.04	1.0	1.3–1.4
Number of hyaline dentiform spines on dorsal surface of segments of maxillary palps	6–7th	9–12	14–20	12–14	12–15	10–14	17–19
	5th	2–3	4–6	3–4	2–3	4	5–7
Numerous long, thin setae on lower surface of segments of maxillary palps in male		2–4th	2–4th	absent	absent	–	–
Numerous long, thin setae on upper surface of segments of labial palps in male		2–3th	absent	absent	absent	–	–
Numerous long, thin setae at fore and middle femora in male		+	no	no	no	–	–
Sensory fields with rosette-shaped sensilla at femora in male		fore femora	fore and middle femora	fore femora	absent	–	–
Number of rosette-shaped sensilla at femora		about 70	more than 60	about 10	absent	–	–
Ratio of sensory field length to femur length		0.42–0.44	0.60	0.26–28	–	–	–
Ratio of sensory field width to femur width		0.68–0.72	0.75	0.38–0.40	–	–	–
Posterior angle of urosternites II–VI, degrees		89–95	78–88	80–84	82–90	82–90	90–100
Ratio of lengths of urostylus to urocoxites VIII and IX (excluding apical spines)	VIII	0.65	0.7 ♂ 0.8 ♀	0.5 ♂ 0.8 ♀	0.57 ♂ 0.80 ♀	0.7	0.79–0.80
	IX	0.87	1.0 ♂ 0.7 ♀	0.9 ♂ 0.7 ♀	0.75 ♂ 0.66 ♀	0.7	0.76–0.79
Distribution		Russia, Krasnodar Territory (Kabardinka)	Russia, Krasnodar Territory (Novorossiysk)	South Ossetia (Tskhinvali)	Nagorno-Karabakh, Lesser Caucasus (Martakert)	Russia, Stavropol Territoкн (Kislovodsk)	Cis-Azov region, Khomutovskaya steppe

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