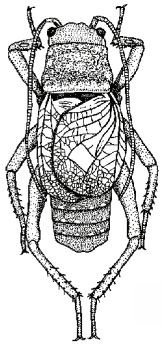

Far Eastern Entomologist

Дальневосточный энтомолог

Journal published by Far East Branch of the Russian Entomological Society and Laboratory of Entomology, Federal Scientific Center of the East Asia Terrestrial Biodiversity, Vladivostok

Number 505: 1-10 | ISSN 1026-051X (print edition) ISSN 2713-2196 (online edition) | August 2024

https://doi.org/10.25221/fee.505.1
https://elibrary.ru/yujbmu
https://zoobank.org/References/51F9FF7B-C87E-4586-843C-881A3830A5E7

NEW DATA ON DISTRIBUTION OF *UVAROVINA DAURICA* (UVAROV, 1928) (ORTHOPTERA: TETTIGONIIDAE) IN RUSSIA

M. G. Sergeev[1,2*)], V. V. Molodtsov[1)] , S. Yu. Storozhenko[3)]

1) *Novosibirsk State University, Novosibirsk, 630090, Russia. *Corresponding author, E-mail: mgs@fen.nsu.ru*

2) *Institute of Systematics and Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, 630091, Russia.*

3) *Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, 690022, Russia.*

Summary. The rare Dauruian bush-cricket *Uvarovina daurica* (Uvarov, 1928) is described from the Zabaykalsky Krai in Russia. It is also distributed in the Republic of Buryatia (Russia), NE Mongolia, and NE China. The type localities of this species are Nerchinsky Zavod (51.29°N, 119.63°E – holotype and one paratype) and the vicinities of Nizhny Tsasuchey (50.52°N, 115.08°E – other paratypes). The general distribution of *U. daurica* is mapped and several ecologo-geographic models of the species distribution are generated by the Maxent and 'ellipsenm' algorithms for the first time as well. Some possible alterations of the species range in the future are discussed.

Key words: Bergiolini, fauna, new record, range, modelling, climate change, Siberia, Dauria.

М. Г. Сергеев, В. В. Молодцов, С. Ю. Стороженко. Новые данные о распространении *Uvarovina daurica* (Uvarov, 1928) (Orthoptera: Tettigoniidae) в России // Дальневосточный энтомолог. 2024. N 505. С. 1-10.

Резюме. Редкий даурский кузнечик *Uvarovina daurica* (Uvarov, 1928) описан с территории современного Забайкальского края. Вид также распространен в Республике Бурятия, в Северо-Восточной Монголии и Северо-Восточном Китае. Его типовые местонахождения – голотип и один паратип: Нерчинский завод (51.29°N, 119.63°E) и остальные паратипы – окрестности Нижнего Цасучея (50.52°N, 115.08°E). Картирован современный ареал вида и с использованием алгоритмов Maxent и 'ellipsenm' впервые сгенерированы эколого-географические модели его распространения. Обсуждаются возможные изменения ареала вида в будущем.

INTRODUCTION

The Daurian bush-cricket *Uvarovina daurica* was described as *Bergiola daurica* by Sir B. Uvarov (1928) from the Transbaikal Region (Dauria). The holotype (male) and one paratype (female) are originated from Nerchinsky Zavod (51.29°N, 119.63°E) in the easternmost part of the modern Zabaykalsky Krai (Russia), two other paratypes (females) have been collected near Nizhny Tsasuchey (50.52°N, 115.08°E) in the southern part of this krai. In 1939, W. Ramme (1939) erected the new genus *Uvarovina* for two species, namely *U. daurica* (as the type species) and *U. chinensis* Ramme from China (Shantung), and included it in the so-called *Drymadusa* group. Later, this genus and it relatives were usually included in the tribe Drymadusini Uvarov, 1924 (Sergeev, 1986, 1993, 1995; Heller & Korsunovskaya, 2008; Heller & Liu, 2016; Cigliano *et al*., 2024) or rarely in Platycleidini (Storozhenko, 1986; Rentz & Colles, 1990). However, G. Bey-Bienko (1951) wrote about the separate *Bergiola* generic group containing *Bergiola* Stshelkanovzev, *Scotodrymadusa* Ramme, *Lithoxenus* Bey-Bienko, *Ammoxenulus* Bey-Bienko, *Eulithoxenus* Bey-Bienko, and *Uvarovina.* The genera *Tadzhikia* Mistshenko and *Bienkoxenus* Čejchan should be also added to this group (Mistshenko, 1954; Sergeev *et al*., 2018). Afterward, Storozhenko (1994) mentioned the tribe Bergiolini, but incorrectly assigned this name to Uvarov (1928) instead of Bey-Bienko (1951), and subsequently included *Uvarovina* in this tribe (Storozhenko, 2004).

After an analysis of some old publications (Fischer de Waldheim, 1839, 1846–1849), Storozhenko (2004) assumed that the very short and unclear description of *Peltastes venosus* Fischer de Waldheim from Dauria (Fischer de Waldheim, 1839) might be associated with *U. daurica.* In "Entomographia Imperii Rossici", G. Fischer de Waldheim (1846–1849) published more detailed description of this taxon (as *Pterolepis venosa*) and emphasized that the species had been collected in Dauria ("Daourie aux environs d'Irkoutsk. M. Sédakof" – p. 213). However, the published figures of this taxon (Fischer de Waldheim, 1839, Tab. III, 1846–1849, Tab. XX) completely match the Caucasian species, namely *Psorodonotus venosus* (Fischer de Waldheim) (Heller & Liu, 2016). Nevertheless, the situation with *Pterolepis venosa* remains unclear, because according Fischer de Waldheim the type specimens had been originated from Dauria (in the first half of the 19th century, the part of the Irkutsk Governorate), far away from the Caucasus where *Psorodonotus venosus* occurs

actually. Moreover, Vasiliy Sedakov, the collector of this species, was the prominent naturalist and enthusiast who worked and travelled just across the former Irkutsk Governorate.

In any case, the Daurian bush-cricket is one of the rarest species of Orthoptera in the eastern parts of the Eurasian steppes (Sergeev, 2021). Therefore, our knowledge about *Uvarovina daurica* remains very limited. In the present paper, we characterize the actual data on its distribution and describe the main results of the ecologo-geographic modelling of its possible distribution across its range.

MATERIAL AND METHODS

We study specimens caught during our field trips in 1982, 2007 and also stored in the collections of the Institute of Systematics and Ecology of Animals (Novosibirsk), Novosibirsk State University, the Federal Scientific Center of the East Asia Terrestrial Biodiversity (Vladivostok), and the Zoological Institute of the Russian Academy of Sciences (St. Petersburg).

Two completely different methods of the species distribution modelling, namely the maximum entropy modelling (Maxent 3.4.4) based on the machine-learning technique (Phillips *et al.,* 2006, 2017; Elith *et al*., 2011), and the 'ellipsenm' that generates multidimensional ellipsoid envelopes of ecological niches (Cobos *et al*., 2023) were applied. The open resources of WorldClim 2 ("Historical climate data" (19 standard annually averaged bioclimatic variables at the 30 arcsecond spatial resolution) (Fick & Hijmans, 2017; WorldClim, 2022) were used. To produce the Maxent model we used the full sets of variables and the parameters: features – auto, output format – cloglog, regularization multiplier = 1. Accuracy of modelling was estimated by using the AUC (the area under the receiver operating characteristic curve) for sets of 23 replicates with cross-validation, and assess significances of bioclimatic variables by their predictive contributions and Jackknife tests. The 'ellipsenm' models were produced on the basis of 6 variables only, namely annual mean temperatures, maximal temperatures of the warmest month, minimal temperatures of the coldest month, annual precipitations, precipitations of the warmest quarter, and precipitations of the coldest quarter. The average values for 23 replicates were counted as well. The 'covmat' method was used to create ellipsoids. Maps of species distribution were generated with QGIS 3.18.3. A Lambert conformal conic projection was chosen as the basic map.

NEW RECORDS

***Uvarovina daurica* (Uvarov, 1928)**
Fig. 1

Bergiola daurica Uvarov, 1928: 249–250, figs 2, 6 (holotype: male, Russia: Nertchinsky Zavod, Stretensk district, Transbaicalia [=Nerchinsky Zavod, Zabaykalsky Krai], 12.IX 1925; paratypes: one female with the same label, 2 females – Tsassuchei, Borzinsky district, Transbaicalia [=Nizhny Tsasuchey, Zabaykalsky Krai], 23.VIII 1925). The holotype and two paratypes are kept in the Zoological Institute (St. Petersburg) and one female paratype is stored in the British Museum of Natural History (London).

Uvarovina daurica: Ramme, 1939: 92; Čeichan, 1968: 11; Storozhenko, 1986: 254; Sergeev, 1986: 179; Jin & Xia, 1994: 31; Dubatolov & Sergeev, 1999: 46; Heller & Liu, 2016: 108–110.

Uvarovina venosa (nec Fischer de Waldheim): Storozhenko, 2004: 128–130; Storozhenko, 2008: 8; Sergeev, 2021: 5.

Fig. 1. *Uvarovina daurica* (female). (Photo S. Storozhenko).

TYPE MATERIAL EXAMINED. **Russia**: Transbaicalia: Stretensk District, Nertchinsky Zavod (Zabaykalsky Krai: Nerchinsky Zavod), 51.29°N, 119.63°E, 12.IX 1925, 1♂ (holotype), leg. V.M. Engelhardt.

OTHER MATERIAL EXAMINED. **Russia**: Zabaykalsky Krai: southern (right) side of Shilka River, S Priiskovy, 51.88°N, 116.61°E, southern slope, upper part, steppe, 18.VII 1982, 1♂ (Sergeev); eastern (right) side of Onon River, 7 km NE Olovyannaya, 51°N, 115.64°E, northern slope, short meadows and steppe, 12.VII 1982, 6♂, 2♀, 1 nymph ♂, 8 nymphs ♀ (Sergeev, Bugrov); Nerchinsky Zavod, Serebryanka River, 51.36°N, 119.65°E, meadow, 6.VIII 1997, 1♂ (Dubatolov, Berezina, Kosterin); Olovyanninsky district, near Edinenie, 51.17°N, 115.87°E, steppe, 21.VII 2004, 1♂ (Korsun); Daurian Nature Reserve, Adob-Chelon Range, 50.55°N, 16.19°E, steppes, 2–9.XI 2004, 1♂, 2♀ (Akulova); "Tsasuchey Pine Forest" Zakaznik, 50.50°N, 115.12°E, pine forest, 16.VIII 2005, 1♂, 6.IX 2005, 1♂, 1♀ (Akulova); Argunskiy Range, 50.1°N, 118.63°E, northern slope, shrubs and forbs, 4.VIII 2006, 1♂ (Akulova); Argunskiy Range, foothills, 49.77°N, 117.82°E, steppe, 7.VIII 2006, 1♂ (Akulova). Republic of Buryatia: Selenga River, Kyakhtinsky Disrict, vicinity of Naushki Station, forest-steppe, 50.39°N, 106.09°E, 30.VII 2007, 1♂, 2♀ (Storozhenko).

REMARKS. Some details of the species distribution are described by Dubatolov & Sergeev (1999) and Heller & Liu (2016). However, we validated the published geographic coordinates of some points where the species was caught, because sometimes they are based on misinterpretation (e.g., the species type locality is Nerchinsky Zavod – 51.29°N, 119.63°E, not Nerchinsk – 51.98°N, 116.58°E; there are about 225 km between).

DISTRIBUTION. Russia (Republic of Buryatia and Zabaykalsky Krai), North-East Mongolia, and China (Inner Mongolia and Shanxi, probably only its northernmost part) (Fig. 2).

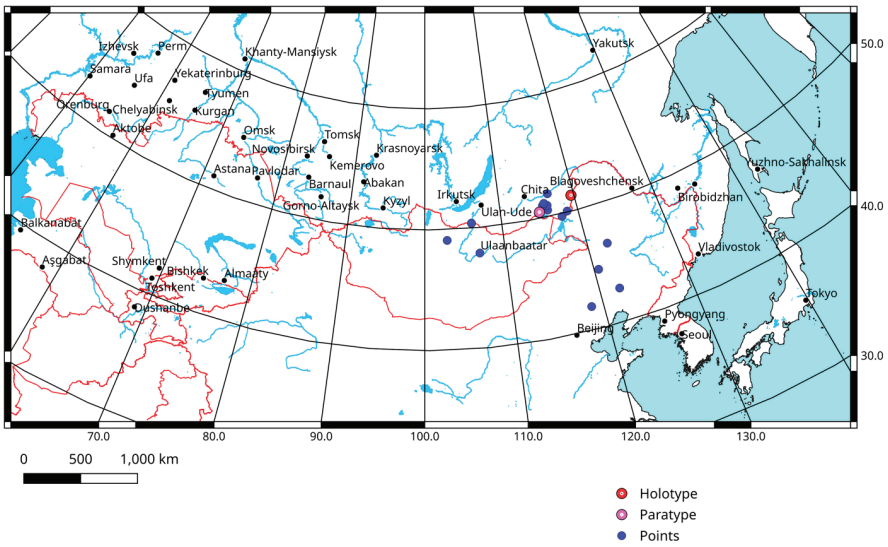

Fig. 2. Known localities of *Uvarovina daurica.*

ECOLOGICAL PREFERENCES

Uvarovina daurica prefers different steppes with dense but relatively short vegetation with dominance of diverse grasses and forbs. Sometimes it can be observed on agriculture fields. The abundance of this species is relatively low and varies commonly between 18–24 per hour in the steppe life zone and is about 5–6 per hour in some local dry habitats of the forest-steppe zone.

ECOLOGO-GEOGRAPGICAL MODELS OF DISTRIBUTION

The models for the current species distribution based on both the maximum entropy and multidimensional ellipsoid envelope approaches show evident correspondence with the known localities' arrangement (Fig. 3). The Maxent model performance is perfect (especially taking into account a few samples), because the AUC

value for 23 replicates equals 0.990 (Fig. 4). According the Maxent model, the precipitation seasonality is the most important factor (contribution — 46.5%), the temperature seasonality (11.9) and precipitations of the warmest quarter (9.8) are also substantial. The Jackknife test allows to add some other variables, such as precipitations of the coldest quarter, precipitations of the driest quarter, and precipitations of the driest month. Interestingly, the seasonality (variation levels of

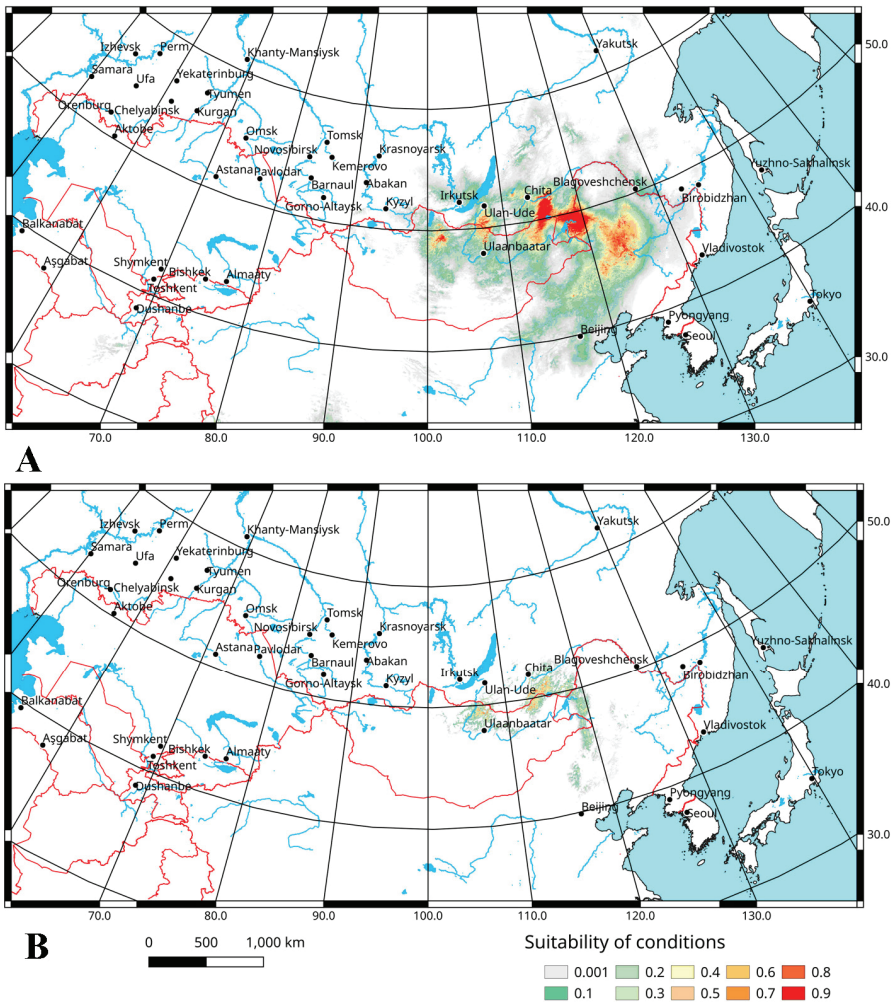

Fig 3. Predicted probabilities of suitable conditions for *Uvarovina daurica*: A –according the Maxent model (all distribution data and bioclimatic variables for 1970–2000; point-wise mean for 23 replicates); B – according the ellipsoid envelope model (all distribution data and selected bioclimatic variables for 1970–2000; means for 23 replicates).

both precipitations and temperatures) looks like very important for the species distribution. The forecasts for the 2021–2040 and 2041–2060 display evident opportunities of species distribution declining, especially relative to the most suitable areas (Fig. 5).

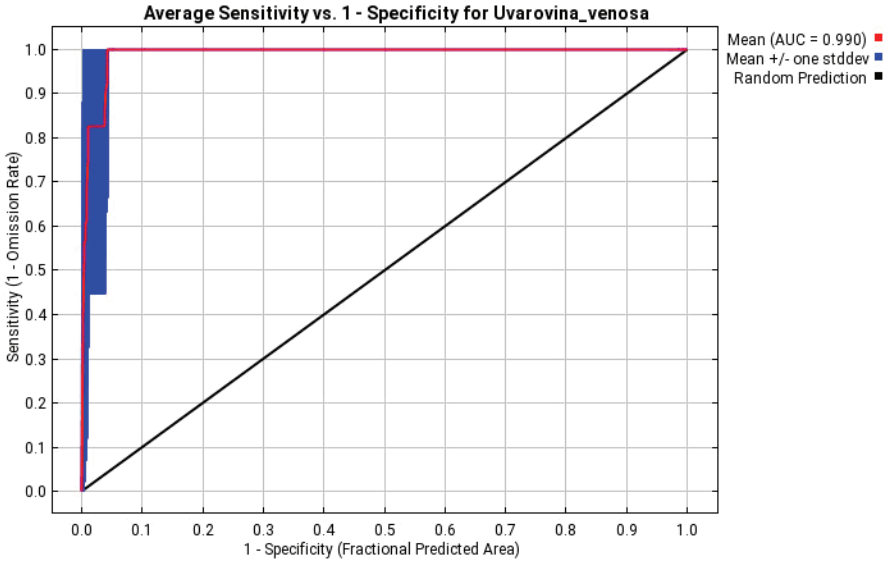

Fig. 4. Reliability test for *Uvarovina daurica* (Maxent distribution model based on 19 bioclimatic variables for 1970–2000; 23 replicates with cross-validation).

CONCLUSION

The Daurian bush-cricket *Uvarovina daurica* remains one of the rarest orthopteran species in the steppes of the temperate Asia, because about 50–60 specimens were collected since 1925 until now. Besides, the species is mainly associated with limited diversity of habitats, mainly with some temperate grasslands. The whole range of *Uvarovina daurica* occupies about 1,500,000 km^2 (Fig.1) and is limited by the northern boundaries of the forest-steppes on the north and southern boundaries of the steppe on the south, the Khangai Mts on the west and the central parts of Northeast China (Songliao) Plain on the east. The species is brachypterous. This means its dispersal possibilities are limited. The number of its local insular populations can be assessed as at least 25–35. Concerning its conservation status, the species may be characterized as Data Deficient (DD) (IUCN, 2001). It is not included in the Federal and regional Red Books, but its populations occur in the Daursky (Daurian) State Nature Biosphere Reserve and the "Tsasuchey Pine Forest" State Zakaznik (administratively the part of the former).

The comparative analysis of the models produced for *U. daurica* and the similar models generated for other orthopteran species associated with the Asian temperate

steppes demonstrate evident peculiarities of the Daurian bush-cricket. Regardless of species common abundance (high or low) and taxonomic position (grasshoppers or bush-crickets), the models for all species studied, namely the abundant and widely distributed grasshopper *Oedaleus decorus* (Germar) (Popova *et al*., 2022), the bush-crickets *Bicolorana bicolor* (Philippi) (widely distributed and relatively abundant) (Baturina *et al*., 2024), *Montana striata* (Kittary) (distributed across steppes and forest-steppes from S Europe to W Siberia, rare) (Sergeev & Molodtsov, 2022), and

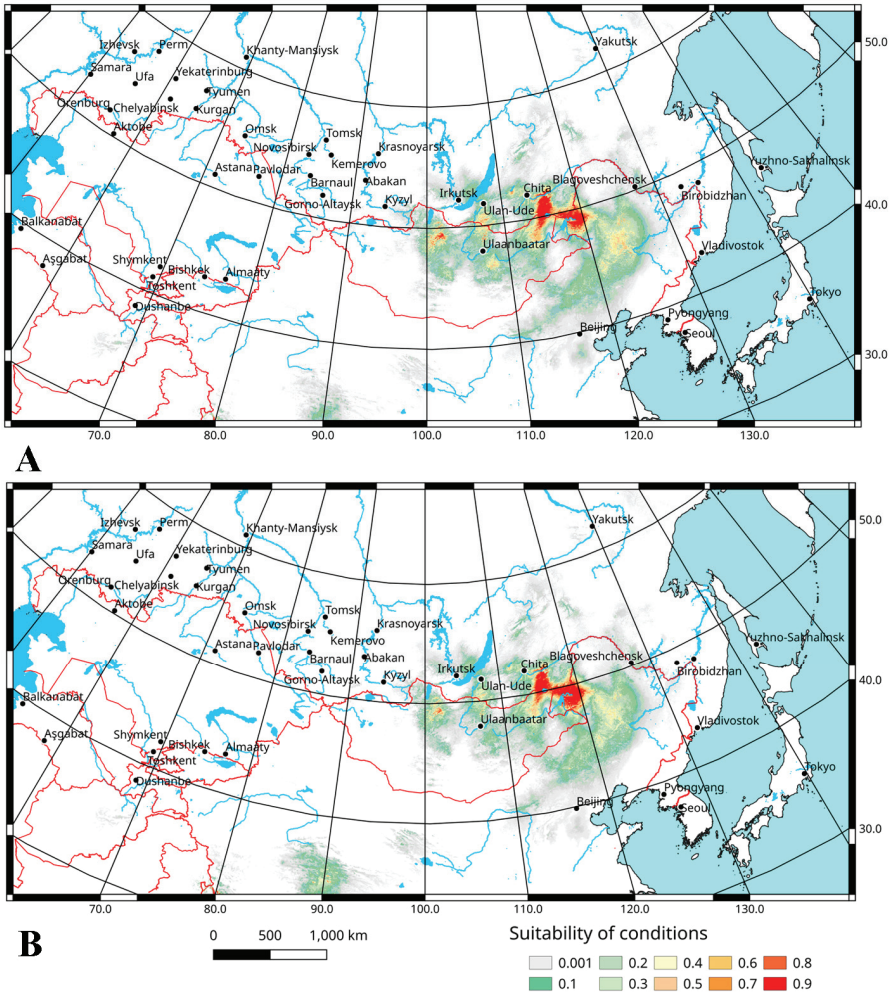

Fig. 5. Predicted probabilities of suitable conditions for *Uvarovina daurica* (forecasts of all bioclimatic variables for 2021–2040 (A) and 2041–2060 (B) according the global climate model CNRM-ESM2-1 (Séférian, 2018) and the 3–7.0 Shared Socioeconomic Pathway (Meinshausen *et al*., 2020), point-wise mean for 23 replicates).

Miramiola pusilla (Miram) (steppes and semi-deserts from SE Europe to W Siberia, rare) (Sergeev & Molodtsov, 2024) show possibilities of the typical northward shifts of the regions with very suitable conditions. On the contrary, the forecasts for *U. daurica* unveil some opportunities of range contraction.

ACKNOWLEDGEMENTS

We wish to acknowledge G.A. Akulova, A.G. Bugrov, and V.V. Dubatolov for collecting some specimens of *Uvarovina daurica*. This study was financially supported by the grant of the Russian Science Foundation No. 22-66-00031 (https://rscf.ru/en/project/22-66-00031).

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