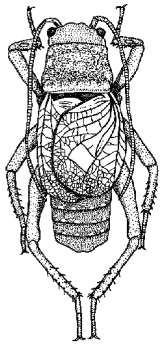

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AEROPEDELLUS REUTERI (MIRAM, 1907) (ORTHOPTERA: ACRIDIDAE: GOMPHOCERINI) – A RARE GRASSHOPPER FROM SOUTH SIBERIA

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Summary. The very rare grasshopper *Aeropedellus reuteri* (Miram, 1907) was described from the southern parts of the Krasnoyask Region (Krai) in Russia. The type localities of this species are the vicinities of Minusinsk (53.73°N, 91.67°E, one male) and Ajeshka (54.93°N, 90.81°E, two males). It is also distributed in the Republic of Khakassia and the Irkutsk Region (Oblast) (Russia). The general distribution of *A. reuteri* is mapped and several ecologo-geographic models of the species distribution are generated by the Maxent algorithm for the first time. Some possible changes of the species range are discussed for the future periods (2021–2040 and 2041–2060).

Key words: fauna, new record, range, modelling, climate change, Siberia, Krasnoyarsk Krai, Irkutsk Oblast.

М. Г. Сергеев, В. Д. Жарков, В. В. Молодцов *Aeropedellus reuteri* (Miram, 1907) (Orthoptera: Acrididae: Gomphocerini) – редкое саранчовое из Южной Сибири // Дальневосточный энтомолог. 2025. N 519. С. 1-11.

Резюме. Сибирская копьеноска *Aeropedellus reuteri* (Miram, 1907) была описана с территории современного Красноярского края. Типовые местонахождения – окрестности Минусинска (53.73°N, 91.67°E – самец, синтип) и Аёшка (54.93°N, 90.81°E – 2 самца, синтипы). Вид также распространен в Республике Хакасия и Иркутской области. Картирован современный ареал вида и с использованием алгоритма Maxent впервые сгенерированы эколого-географические модели его распространения. Обсуждаются возможные изменения ареала вида в будущем для 2021–2040 и 2041–2060 гг.

INTRODUCTION

The species *Aeropedellus reuteri* was described as *Gomphocerus reuteri* by Miram (1907) from the southern parts of the modern Krasnoyarsk Region (Krai). The type series included 3 males (syntypes), one from the vicinities of Minussink (Minusinsk) (53.73°N, 91.67°E) and two from Ajeschenskaja (now Ajeshka) (54.93°N, 90.81°E). Later Ikonnikov (1911) described *Gomphocerus simillimus* from the vicinities of Minusinsk as well (male and female, 10.VI 1902) and Malyshevka in the modern Irkutsk Region (Oblast) (female, 3–12.VI 1898) (53.73°N, 103.37°E). Tarbinsky (1930) synonymized *G. simillimus* with *G. reuteri*. Later, he tried to synonymize both with *Dasyhippus variegatus* (F.d.W.) (= *Aeropedellus variegatus* (F.d.W.)) (Tarbinsky, 1931). Hebard (1935) erected the genus *Aeropedellus* for *Gomphocerus clavatus* (Thomas) and *G. variegatus* (F. d.W.) and synonymized *G. reuteri* and *G. simillimus* with *G. variegatus* as well. Mistshenko (1951) resurrected the independent status of *Aeropedellus reuteri.* Thereafter, ortopterists commonly followed him (Ivanova, 1967, 1968; Harz, 1975; Sergeev, 1986; Sergeev *et al*., 2020; Cigliano *et al*., 2025).

Although this grasshopper was mentioned as the pest species of the crop fields in the Chulym-Yenisey Intermountain Basin, mainly in the Republic of Khakassia (Mistshenko, 1972), it is reliably known from the several localities only and remains one of the rarest species of Orthoptera in the steppes of South Siberia (Sergeev, 2021). In the present article, we describe the actual data on its distribution and discuss the main results of the ecologo-geographic modelling of its possible distribution in Eurasia.

MATERIAL AND METHODS

We studied specimens caught during our field trips in 1995 and 2012 and stored in the collections of the Institute of Systematics and Ecology of Animals (Novosibirsk), Novosibirsk State University (especially from the expedition in 1970), and the Zoological Institute of the Russian Academy of Sciences (St. Petersburg). The samples collected in 1995 were also used for molecular phylogenetic studies (Chapco & Contreras, 2011) and for description of the species egg-pod (Chernyakhovskii, 2006).

Maps were produced by MapInfo 15.2.4. A Lambert conformal conic projection was used as the basic map. The maximum entropy approach (Maxent 3.4.4) (Phillips *et al.,* 2006) and 19 standard annually averaged bioclimatic variables at the 30 arcsecond spatial resolution ("Historical climate data") (Fick & Hijmans, 2017; WorldClim, 2022) were used to model the species distribution with the following parameters: features – auto, output format – cloglog, regularization multiplier = 1. The global climatic model CNRM-ESM2-1 (Séférian, 2018) for the 3–7.0 Shared Socioeconomic Pathway (Meinshausen *et al*., 2020) was selected to predict possible changes of the species distribution in the future.

Accuracy of modelling was estimated by using the AUC (the area under the receiver operating characteristic curve) for sets of 13 replicates with cross-validation, and the significances of bioclimatic variables were assessed by their predictive contributions and Jackknife tests.

NEW RECORDS

***Aeropedellus reuteri* (Miram, 1907)**
Fig. 1, 2

Gomphocerus reuteri Miram, 1907: 6–7; Tarbinsky, 1930: 186.
Gomphocerus simillimus: Ikonnikov 1911: 98–99; Rubtsov, 1932: 54.
Dasyhippus variegatus (part.): Tarbinsky, 1931: 143; 1940: 27.
Aeropedellus variegatus (part.): Hebard, 1935: 187.
Aeropedellus reuteri: Mistshenko, 1951: 485; 1972: 90; Harz, 1975: 793; Sergeev, 1986: 206; Sergeev *et al*., 2020: 4–5.

Fig. 1. *Aeropedellus reuteri* (male, left fore leg). (Photo M. Sergeev)

MATERIAL EXAMINED. **Russia**: Republic of Khakassia: eastern (right) side of Bely Iyus River, upstream of the mouth of Cherny Iyus River, S Kopyevo, 54.92°N, 89.85°E, southern slopes and upper terraces, dry steppes, 26–27.VII 1995, 5♂, 70♀ (A.M. Gusachenko, A.I. Lee, D.C. Stepanova, M.G. Sergeev); Batenevskiy Range, S Pervomayskoye, 54.56°N, 90.8°E, southern slope, dry steppe, 17.VII 2012, several adults observed (Sergeev); near Fyrkal Lake, 54.62°N, 89.79°E, steppes, 21.VI–14.VIII 1970, 24♂, 47♀; Ust-Fyrkal, 54.64°N, 89.76°E, steppes, 09.VII 1970, 14♂,

23♀; 1.5 km E Fyrkal settlement, 54.64°N, 89.87°E, steppes, 26.VI 1970, 7♂, 4♀, 2 larvae; 1–1.5 km S Solionoozernoe (the former Forpost), 54.71°N, 89.88°E, steppes, 24.VI–24.VII 1970, 4♀; 4 km W Dzhirim, near Krasnen'koe Lake, 54.80°N, 90.32°E, steppes, 29.VI 1970, 1♂, 4♀; near Bele Lake, 54.62°N, 90.17°E, steppes, 29.VI 1970, 2♂, 1♀; near Itkul Lake, 54.49°N, 90.06°E, steppes, 1969, 11♂, 11♀.

REMARKS. Almost simultaneously Tarbinsky (1931) and Hebard (1935) tried to synonymize *Ae. reuteri* with *Ae. variegatus*. Hebard supposed that the specific form of fore tibiae of *Ae. reuteri* (Fig. 1) is associated with some physiological peculiarities of individual development. However, molecular data show that the studied species of the genus *Aeropedellus* form one well supported clade (Chapco & Contreras, 2011), but *Ae. reuteri* is well separated from other species studied (*A. variegatus* and two North-American grasshoppers, namely *Ae. arcticus* Hebard and *Ae. clavatus* (Thomas)).

DISTRIBUTION. Russia (Republic of Khakassia, the southern parts of Krasnoyarsk Krai, and Irkutsk Oblast) (Fig. 2). The species was also mentioned for Mongolia (Gankhuyag *et al.*, 1971), but these data should be checked (see: Chogsomzhav, 1972; Baturina *et al*., 2024a).

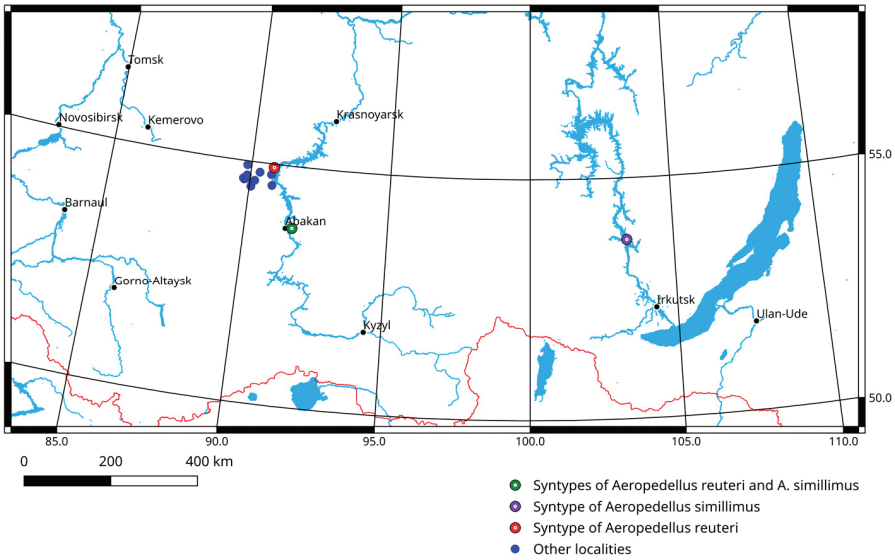


Fig. 2. Known localities of *Aeropedellus reuteri.*

ECOLOGICAL PREFERENCES

Our observations show *Aeropedellus reuteri* prefers different dry steppes, often stony, with dense but short vegetation with dominance of diverse grasses and forbs (Fig. 3). The abundance of this species is relatively low, but sometimes it may be very common. *Myrmeleottetix palpalis* (Zub.) and *Stenobothrus nigromaculatus* (H.-S.) are usual dominants in such habitats.

Fig. 3. *Aeropedellus reuteri* (female) in the dry steppe on the southern slope (Khakassia). (Photo M. Sergeev)

ECOLOGO-GEOGRAPGICAL MODELS OF DISTRIBUTION

The model of the current species distribution explicitly corresponds with the known findings in the Republic of Khakassia and the southern parts of the Krasnoyarsk Region (Fig. 4). However, the optimal area stretches out northwestward across the Achinsk-Mariinsk forest-steppe. In addition, some isolated areas suitable for this species are distributed in the southern parts of the taiga in West Siberia, in the central and eastern parts of Mongolia, and in North-East China.

The model performance is perfect, because the AUC value is 0.987 (Fig. 5). Precipitations of the wettest month is the most important factor (contribution – 31.9%), precipitations of the warmest quarter (27.6%), mean temperatures of the wettest quarter (21.2%), and mean temperatures of the driest quarter (10.2%) are also distinguished. The Jackknife test allows to add some other variables, such as annual mean temperatures and mean temperatures of the coldest quarter.

For the 2021–2040 and 2041–2060, evident declining of species distribution is foretold inside the contemporary range, i.e. in the Republic of Khakassia and the southern parts of the Krasnoyarsk Region (Fig. 6). On the contrary, suitability of conditions may significantly increase in regions between Baikal Lake and the Great

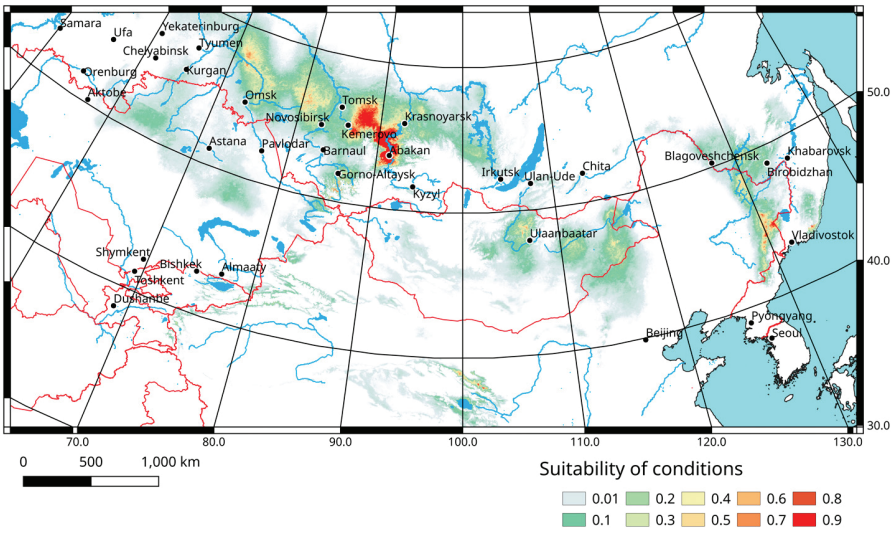


Fig. 4. Predicted probabilities of suitable conditions for *Aeropedellus reuteri* according the Maxent model (all distribution data and bioclimatic variables for 1970–2000; point-wise mean for 13 replicates).

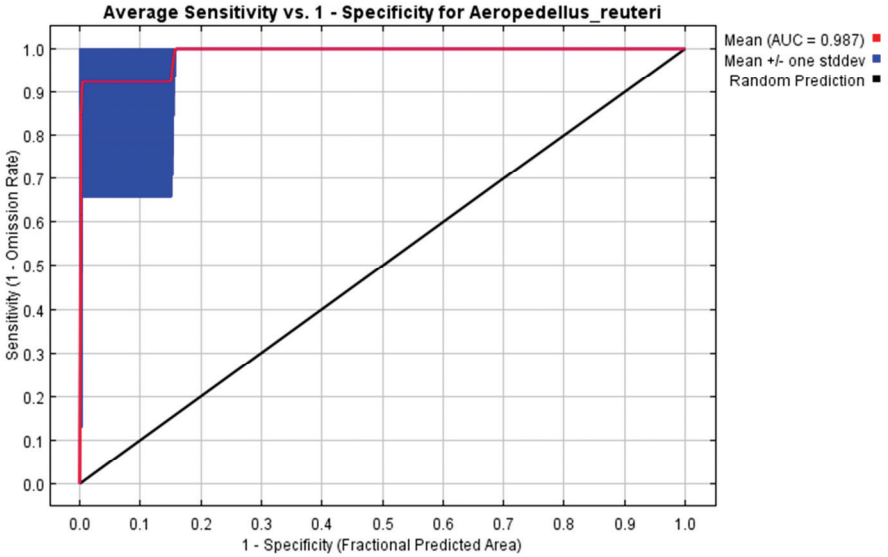
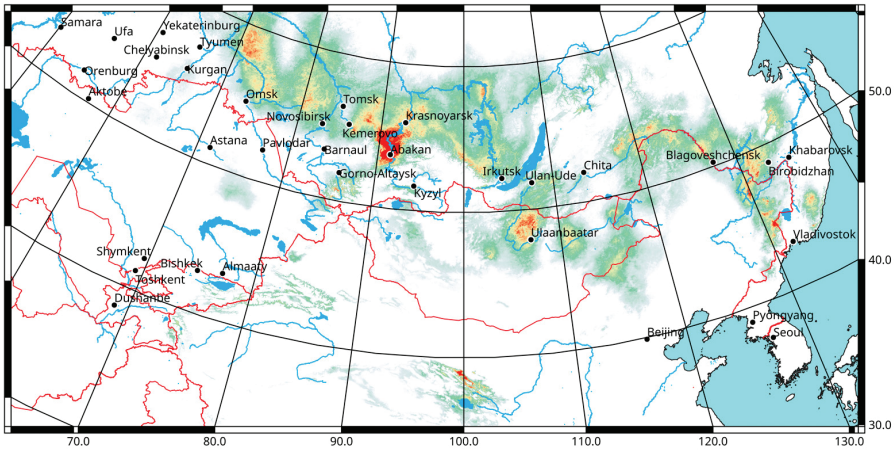
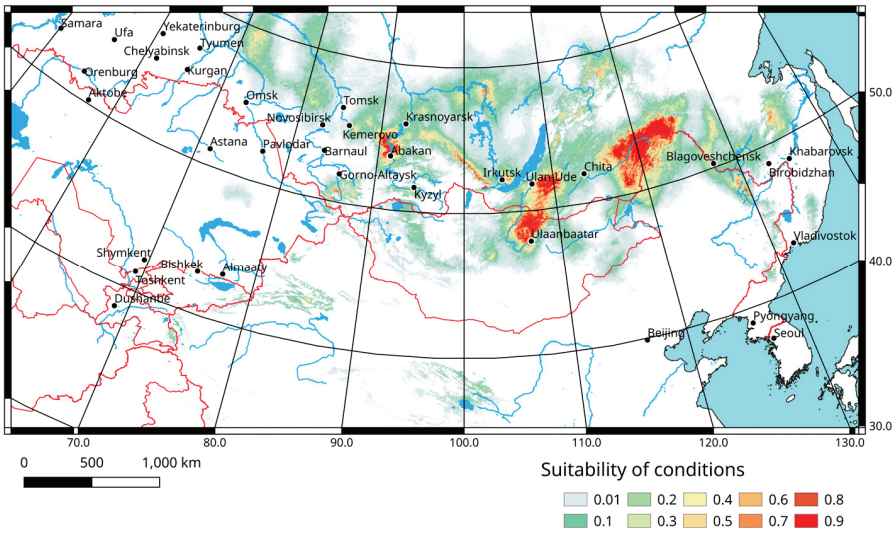


Fig. 5. Reliability test for *Aeropedellus reuteri* (Maxent distribution model based on 19 bioclimatic variables for 1970–2000; 13 replicates with cross-validation).

Khingan Mts. (mainly in the Republic of Buryatia and Zabaykalsky Region (Krai)) and also along the northeastern foothills of the East Sayan Mts. Moreover, for the middle of the 21st century, small areas with applicable environments are forecasted over some southern parts of the taiga in West Siberia, in North-East China and in the Qilian Mts. (N China). However, all these terrains are located far beyond the known range of *Ae. reuteri*.



A



B

Fig. 6. Predicted probabilities of suitable conditions for *Aeropedellus reuteri* (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 13 replicates).

CONCLUSION

The genus *Aeropedellus* Hebard is distributed across two continents, Eurasia and North America, and includes more than 20 described species (Cigliano *et al.*, 2025). A few species are widely distributed in the northern parts of the Holarctic Region (Sergeev, 2011) and penetrate the tundra life zone. However, the main part of species is associated with dry grasslands of Inner Asia (Sergeev, 2021) and their distribution is usually limited. Despite the fact that researchers have large series of *Ae. reutei* at their disposal, the species remains one of the rarest acridid species in the steppes of the temperate Asia, because it is validly known only from about 15 localities. Moreover, in 2024, some attempts to find it near Solionoozernoe in Khakassia turned out to be unsuccessful, notwithstanding *Ae. reuteri* was cought in this area in 1970.

The whole known range of *Ae. reuteri* is limited by the Chulym-Yenisey and Minusinsk Intermountain Basins (depressions) and also by the so-called Balagansk Steppe near the Angara River. Perhaps, it includes the Achinsk-Mariinsk forest-steppe as well (Figs 2, 4). Its predicted range occupies about 72,330 km^2. However, the models generated for 2021–2040 and 2041–2060 show its possible contractions up to 53,530 and 26,680 km^2 respectively (inside the region between the Ob River and Baikal Lake).

The dispersal capacities of these grasshoppers are limited, because they are brachypterous. The number of the species local populations can be assessed as at least 15–20. Concerning its conservation status, the species may be characterized as Data Deficient (DD) (IUCN, 2001). Its populations are protected in the Khakassia State Nature Reserve (perhaps almost all steppe sites). However, some eastern populations of *Ae. reuteri* could be eliminated as the result of the construction of the Bratsk Dam and subsequent flooding of the local flood-plains and low terraces.

The comparative analysis of the models produced for *Ae. reuteri* and another relatively rare member of the genus, namely *Ae. baliolus* Mistsh., shows quite similar trends as significant reductions in the areas of optimal habitats. The comparable pattern was revealed for the rare Daurian bush-cricket *Uvarovina daurica* (Uvarov) (Sergeev *et al.*, 2024). However, the models generated for other orthopteran species studied, both rare and abundant, often display very different patterns. For instance, the models generated for the bush-crickets *Bicolorana bicolor* (Philippi) (Baturina *et al*., 2024b), *Montana striata* (Kittary) (Sergeev & Molodtsov, 2022), and *Miramiola pusilla* (Miram) (Sergeev & Molodtsov, 2024), the grasshoppers *Oedaleus decorus* (Germar) (Popova *et al*., 2022), *Asiotmethis jubatus* (Uvarov) and *Mesasippus arenosus* (Bey-Bienko) (Baturina *et al.*, 2024a) show some opportunities of the northward shifts of the regions with very suitable conditions. Paradoxically, but the models created for two common species widely distributed across the Siberian steppes, namely *Angaracris barabensis* (Pallas) (Pashkova *et al*., 2024) and *Celes skalozobovi* Adel. (Allayarova *et al.*, 2024), allow to forecast some opposite trends for each species: suitability decreasing in the western parts of their ranges and its increasing or inalterability in the central and eastern parts.

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REFERENCES

Allayarova, E.R., Molodtsov, V.V., Popova, K.V., Sergeev, M.G. & Storozhenko, S.Yu. 2024. *Celes skalozubovi* Adelung (Orthoptera: Acrididae) as a model object for ecological and geographic research. *Amurian Zoological Journal*, 16(3): 645–657. [In Russian] DOI: 10.33910/2686-9519-2024-16-3-645-657

Baturina, N.S., Kim-Kashmenskaya, M.N., Molodtsov, V.V., Popova, K.V. & Sergeev, M.G. 2024a. Endemic grasshoppers (Orthoptera, Acridoidea) of the steppes of West Siberia and North-East Kazakhstan: How can we estimate their future? *Acta Biologica Sibirica*, 10: 819–834. DOI: 10.5281/zenodo.13379288

Baturina, N.S., Molodtsov, V.V., Shamychkova, A.A., Storozhenko, S.Yu. & Sergeev, M.G. 2024b. The distribution patterns of the two-coloured bush-cricket *Bicolorana bicolor* (Philippi, 1830) (Orthoptera: Tettigoniidae) across the Asian part of its range. *Russian Entomological Journal*, 33: 153–162. DOI: https: 10.15298/rusentj.33.2.02

Chapco, W. & Contreras, D. 2011. Subfamilies Acridinae, Gomphocerinae and Oedipodinae are "fuzzy sets": a proposal for a common African origin. *Journal of Orthoptera Research*, 20(2): 173–190. DOI: 10.1665/034.020.0205

Chernyakhovskii, M.E. 2006. New and little known egg-pods of acridids (Orthoptera, Acrididae) of the fauna of Russia and adjacent countries. *Entomological Review*, 86: 635–637. DOI: 10.1134/S0013873806060030

Chogsomzhav, L. 1972. Acridoidea and Tettigonioidea of the Mongolian People's Republic. *Nasekomje Mongolii,* 1: 151–198. [In Russian]

Cigliano, M.M., Braun, H., Eades, D.C. & Otte D. 2025. *Aeropedellus reuteri* (Miram, 1907). *Orthoptera Species File*. Available from: http://orthoptera.speciesfile.org/otus/812925/overview (accessed on 25 January 2025)

Fick, S.E. & Hijmans, R.J. 2017. WorldClim 2: New 1 km spatial resolution climate surfaces for global land areas. *International Journal of Climatology*, 37: 4302–4315. DOI: 10.1002/joc.5086

Gankhuyag, E., Dorjsuren, A., Choi, E.H. & Hwang, U.W. 2023. An annotated checklist of grasshoppers (Orthoptera, Acridoidea) from Mongolia. *Biodiversity Data Journal,* 11: e96705. https://doi.org/10.3897/BDJ.11.e96705

Harz, K. 1975. *Die Orthopteren Europas. The Orthoptera of Europe. II.* Dr. W. Junk, The Hague. 939 pp.

Hebard, M. 1935. Notes on the group Gomphoceri and a key to its genera, including one new genus (Orthoptera, Acrididae, Acridinae). *Entomological News,* 46: 184–188.

Ikonnikov, N. 1911. Beitrag zur Kenntnis der Orthopterenfauna Russlands. *Revue Russe d'Entomologie*, 11(1): 96–110.

IUCN. 2001. *IUCN Red List Categories and Criteria: Version 3.1.* IUCN Species Survival Commission, Gland and Cambridge, UK, 30 pp.

Ivanova, I.V. 1967. On the fauna of Orthoptera of the southern part of the Krasnoyarsk Region, Central Siberia. *Entomologicheskoe Obozrenie*, 46(1): 127–138. [In Russian]

Ivanova, I.V. 1968. *Grasshoppers and other Orthoptera of the southern part of the Krasnoyarsk Region (Krai)*. PhD Abstract. Leningrad–Pushkin. 16 pp. [In Russian]

Meinshausen, M., Nicholls, Z.R.J., Lewis, J., Gidden, M.J., Vogel, E., Freund, M., Beyerle, U., Gessner, C., Nauels, A., Bauer, N., Canadell, J.G., Daniel, J.S., John, A., Krummel, P. B., Luderer, G., Meinshausen, N., Montzka, S.A., Rayner, P. J., Reimann, S., Smith, S. J., van den Berg, M., Velders, G.J.M., Vollmer, M.K. & Wang, R.H.J. 2020. The shared socio-economic pathway (SSP) greenhouse gas concentrations and their extensions to 2500. *Geoscientific Model Development*, 13: 3571–3605. https://doi.org/10.5194/gmd-13-3571-2020

Miram, E. 1907. Zur Orthopteren-Fauna Russlands. *Öfversigt af Finska Vetenskaps-Societetens Förhandlingar*, 49(6): 1–9.

Mistshenko, L.L. 1951. 5. Subfamily Acridinae. Bey-Bienko, G.Ya. & Mistshenko, L.L. *Locusts and Grasshoppers of the U.S.S.R. and Adjacent Countries.* Vol. 2. USSR AS Publ., Moscow and Leningrad: 385–552. [In Russian]

Mistshenko, L.L. 1972. Orthoptera (Saltatoria). *Insects and Mites — Pests of Agriculture Crops*. Nauka Publ., Leningrad, 1: 16–115. [In Russian]

Pashkova, A.I., Molodtsov, V.V., Storozhenko, S.Yu., Baturina, N.S., Popova, K.V., Yefremova, O.V. & Sergeev, M.G. 2024. Distribution patterns of the Baraba buzzing grasshopper *Angaracris barabensis* (Pallas) (Orthoptera: Acrididae). *South of Russia: ecology, development*, 19(4): 75–89. DOI: 10.18470/1992-1098-2024-4-7

Phillips, S.J., Anderson, R.P. & Schapire, R.E. 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling*, 190: 231–259. DOI: 10.1016/ j.ecolmodel.2005.03.026

Popova, K.V., Baturina, N.S., Molodtsov, V.V., Yefremova, O.V., Zharkov, V.D. & Sergeev, M.G. 2022. The Handsome cross grasshopper *Oedaleus decorus* (Germar, 1825) (Orthoptera: Acrididae) as a neglected pest in the south-eastern part of West Siberian Plain. *Insects*, 13, 49. DOI: 10.3390/insects13010049

Popova, K.V., Molodtsov, V.V. & Sergeev, M.G. 2020. Rare grasshoppers (Orthoptera, Acridoidea) of the Baraba and Kulunda steppes (South Siberia). *Acta Biologica Sibirica,* 6: 595–609. DOI: 10.3897/abs.6.e59519

Rubtsov, I.A. 1932. The habitats and conditions of grasshopper's outbreaks in East Siberia. *Bulletin of Plant Protection. Ser. 1: Entomology*. 3: 33–130. [In Russian]

Séférian, R. 2018. *CNRM-CERFACS CNRM-ESM2-1 Model Output Prepared for CMIP6 CMIP Amip. Version 20211010.* Earth System Grid Federation. 2018. https://doi.org/10.22033/ESGF/CMIP6.3924

Sergeev, M.G. 1986. *Distribution patterns of Orthoptera in North Asia.* Nauka Publ., Novosibirsk. 237 pp. [In Russian]

Sergeev M.G. 1998. Conservation of orthopteran biological diversity relative to landscape change in temperate Eurasia. *Journal of Insect Conservation,* 2: 247–252. DOI: 10.1023/A:1009620519058

Sergeev, M.G. 2011. Distribution patterns of grasshoppers and their kin in the boreal zone. *Psyche,* 2011, Article ID 324130, 9 pages. DOI: 10.1155/2011/324130

Sergeev, M.G. 2021. Distribution patterns of grasshoppers and their kin over the Eurasian steppes. *Insects*, 12, 77. DOI: 10.3390/insects12010077

Sergeev, M.G., Kim-Kashmenskaya, M.N., Molodtsov, V.V., Yefremova, O.V., Popova, K.V. & Sokolova (Baturina), N.S. 2023. Mapping and ecomodeling of the distribution of rare insect species in the south of Siberia and in neighboring regions (a case study of the superfamily Acridoidea). *Geography and Natural Resources,* 5: 129–135. DOI: 10.15372/GIPR20230516 [In Russian]

Sergeev, M.G. & Molodtsov, V.V. 2022. New data on distribution of *Montana striata* (Kittary, 1849) (Orthoptera: Tettigoniidae: Platycleidini) in the eastern part of the range. *Far Eastern Entomologist*, 465: 6–11. DOI: 10.25221/fee.465.2

Sergeev, M.G. & Molodtsov, V.V. 2024. New data on distribution of *Miramiola pusilla* (Miram, 1927) (Orthoptera: Tettigoniidae). *Far Eastern Entomologist*, 496: 16–24. DOI: 10.25221/fee.496.4

Sergeev, M.G., Molodtsov, V.V. & Storozhenko, S.Yu. 2024. New data on distribution of *Uvarovina daurica* (Uvarov, 1928) (Orthoptera: Tettigoniidae) in Russia. *Far Eastern Entomologist*, 505: 1–10. DOI: 10.25221/fee.505.1

Sergeev, M.G., Storozhenko, S.Yu. & Benediktov, A.A. 2020. An annotated check-list of Orthoptera of Tuva and adjacent regions. Part 3. Suboder Caelifera (Acrididae: Gomphocerinae: Gomphocerini; Locustinae). *Far Eastern Entomologist,* 402: 1–36. DOI: 10.25221/fee.402.1

Tarbinsky, S.P. 1930. On some new and little known Orthoptera from Palaearctic Asia III. *Konowia*, 9: 177–190.

Tarbinsky, S.P. 1931. Overview of species of the genera *Gomophocerus* Thunb. and *Dasyhippus* Uv. (Acrididae). *Proceedings of the Institute of agricultural and forest pest and disease control,* 1: 127–157. [In Russian]

Tarbinsky, S.P. 1940. The Saltatorian Orthopterous Insects of the Azerbaidzhan SSR. USSR AS Publ., Moscow and Leningrad. 245 pp. [In Russian]

WorldClim. 2022. Available from: https://worldclim.org/ (accessed on 21 December 2022).