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NEW DATA ON DISTRIBUTION OF *MONTANA STRIATA* (KITTARY, 1849) (ORTHOPTERA: TETTIGONIIDAE: PLATYCLEIDINI) IN THE EASTERN PART OF THE RANGE

M. G. Sergeev*, V. V. Molodtsov

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

Summary. *Montana striata* (Kittary, 1849) is recorded from the Novosibirsk (Russia) and Pavlodar (Kazakhstan) regions for the first time. The first locality (near Ozero-Karachi) is the easternmost one for the species. The ecologo-geographic model of the species distribution over the Asian part of its range is generated by the Maxent software for the first time as well.

Key words: fauna, range, modeling, new record, Nobosibirsk Region, Pavlodar Region, Siberia, Russia, Kazakhstan.

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Резюме. Впервые для фауны Новосибирской (Россия) и Павлодарской (Казахстан) областей указывается кузнечик *Montana striata* (Kittary, 1849). Местонахождение этого редкого вида в районе п. Озеро-Карачи (Барабинская лесостепь) является самым восточным из известных. Впервые с использованием пакета Maxent также создана эколого-географическая модель распространения данного кузнечика в азиатской части его ареала.

INTRODUCTION

The striated steppe bush-cricket *Montana striata* was described by Kittary (1849) from the "steppes de Kirguises" [actually from NW Kazakhstan (not from Kyrgyzstan!), type locality: vicinities of Stavka-Chana or Khanskaja Stavka, now – Khan Ordasy, or Urda settlement in the West Kazakhstan Region (near the state border between Kazakhstan and Russia in the European part of the country!) – 58°46′N, 47°26′E] as *Decticus striatus.* Later Uvarov (1924) described *Metrioptera moldavica* from "Moldavie, Val du Bêrlad, " (Val du Bârlad or Barlad Valley), actually from the eastern part of Romania. Bey-Bienko (1930), Kolossov (1932) and Umnov (1932) almost simultaneously synonymized these two taxa. Zeuner (1941) included the species in the genus *Montana* Zeuner, 1941. After that, almost all

orthopterists placed the species in this genus (Ramme, 1951; Sergeev, 1986; Storozhenko, 2004; Massa & Fontana, 2011, and other). However, in the beginning of the 21st century, some researchers tried to associate *Montana striata* with Thunberg's *Locusta striata* (Thunberg, 1815) (Massa & Fontana, 2011; Ivković *et al*., 2017; Cigliano *et al*., 2022). In fact, Thunberg (1815: 283–284) described *Locusta striata* very briefly and did not mention its type locality. However, he noted that its tegmina are equal to hind wings and are longer than an abdomen. Besides, he characterized the tegmina as brown with white stripes. This set of traits does not correspond to the traits of *Montana striata*. No wonder Kirby (1906: 204) tried to synonymize *Locusta striata* with *Chelidoptera albopunctata* (Goeze) [= *Platycleis albopunctata* (Goeze)].

Our knowledge about this species, especially in the Asian part of its range, remains very limited. In present paper, we try to characterize the actual data on its distribution and to suggest an ecologo-geographic model of its possible distribution over this territory.

METHODS

We analyzed old data collected by the expeditions of Novosibirsk State University (1966–1980) and all applicable published data (Tarbinskij, 1925; Bey-Bienko, 1926, 1927, 1930; Umnov, 1932; Nefedov & Miram, 1939). We used Google Earth Pro (©Google, 2020) to determine geographical coordinates of localities. Maps of species distribution were produced on the basis of geographic coordinates with MapInfo 15.2.4 (© Pitney Bowes Software Inc., Lanham, MD, USA; now – © Precisely, Burlington, MA, USA). A Lambert conformal conic projection (ETRS 89) was used as the basic map. We used Maxent 3.4.4 software (Phillips *et al*., 2006) to model the species distribution over the Asian part of its range. For ecomodelling, we exploited resources of WorldClim 2 (Fick & Hijmans, 2017) (19 standard annually averaged bioclimatic variables and 12 monthly averaged variables for solar radiation for 1970–2000 at the 30 arcsecond spatial resolution). We also estimated accuracy of our models by using the AUC (the area under the receiver operating characteristic curve) and producing sets of 9 replicates with cross-validation, and to estimate significance of climatic variables by their predictive contributions. We generated the models with the following parameters: features – auto, output format – cloglog, regularization multiplier = 1.

NEW RECORDS

***Montana striata* (Kittary, 1849)**

Montana striata: Zeuner, 1941: 15; Ramme, 1951: 259; Sergeev, 1986: 181; Childebaev & Storozhenko, 2004: 217; Strorozhenko, 2004: 147–148; Massa & Fontana, 2011: 11; Ivković *et al.*, 2017: 535.
Decticus striatus: Kittary, 1849: 462–464.
Chelidoptera striata: Kirby, 1906: 210
Metriptera moldavica: Uvarov, 1924: 530; Bey-Bienko, 1926: 200–201, 1927: 99.
Metrioptera striata: Kolossov, 1932: 117; Umnov, 1932: 23–25.
Platycleis (*Montana*) *striata*: Bey-Bienko, 1964: 230; Harz, 1969: 251, 254, 255; Ragge, 1990: 9.

MATERIAL. **Russia**: Novosibirks Region, SE West-Siberian Plain, Baraba steppe, vicinities of Karachi (Ozero-Karachi) settelement, forb meadow outside small birch forest, 55º21′N, 76º58′E, 5.VII 1967, 1 ♀, 1 larva; **Kazakhstan**: Pavlodar Region, SE West-Siberian Plain, Kulunda steppe, ~ 160 km NW Pavlodar, near Lesnoye settlement, roadside, 53º28′N, 75º54′E, 13.VII 1980, 1 ♀ (A.I. Lee); the same locality and habitat, VIII 1980, 1 ♀ (A.I. Lee).

DISTRIBUTION. The species is recorded from SE Europe (Serbia, Romania, Moldova, Ukraine, S European Russia up to the Ural Mts.) (Vorontsovsky, 1911; Bey-Bienko, 1964; Harz, 1969; Ivković *et al*., 2017, Hochkirch *et al*., 2016), the forest-steppes and steppes of N Kazakhstan (Tarbinskij, 1925; Bey-Bienko, 1927; Childebaev & Storozhenko, 2004) and the southern part of W Siberia (Bey-Bienko, 1926, 1930; Nefedov & Miram, 1939; Sergeev, 1986, 1991). In the Asian part of its range, the species is known only from several localities (Fig. 1).

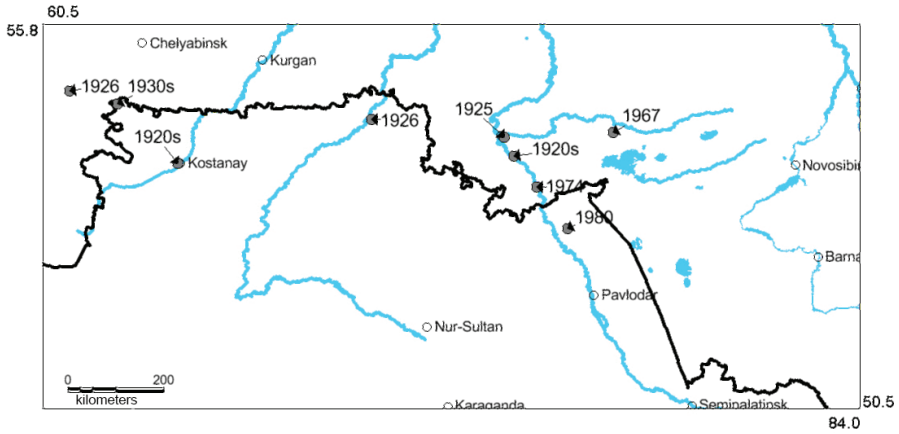

Fig. 1. Known localities and years of collecting of *Montana striata* in the Asian part of its range.

ECOLOGICAL PREFERENCES

The species commonly prefers different variants of the dry meadows and steppes. Bey-Bienko (1970) found *Montana striata* in the Central Black Earth Nature Reserve. He collected this species in the meadow steppe and steppe habitats including some transformed plots with strictly controlled haymaking or grazing. The abundance of this species varied about 1–3/hour and the density was about 0.03–0.05/m^2. In the Troitsk Forest-Steppe Reserve, *Montana striata* was found in different meadow and steppe habitats, but prefered the forb meadow (Nefedov & Miram, 1939). Its abundance varied between 0.4 and 3.05/hour. In the southern part of Omsk Region, the bush-cricket occurred in the forb meadows on the upper terraces of the Irtysh River valley (our unpublished data). It abundance was about 3–6/hour. Besides, in the Pavlodar Region, this species was found along roadsides.

ECOLOGO-GEOGRAPGICAL MODEL OF DISTRIBUTION

Almost all known localities of *Montana striata* in the Asian part of its range are limited by the forest-steppes and the northern steppes (Sergeev, 2021). This distribution pattern fits ecological preferences of the species. However, *Montana striata* is distributed sporadically. The ecologo-geographical model shows that, in Asia, the climatically suitable habitats for this bush-cricket are distributed over almost all territory of the forest steppes and the steppes from the Ural Mts. to the western parts of both the Baraba and Kulunda steppes (Fig. 2). Besides, the species may occur in the southern parts of the taiga life-zone, probably over local dry meadows.

The model performance is relatively good (taking into account a few samples), because the AUC value for 9 replicates equals 0.747. In this model, the solar radiation in January is the most important factor (contribution — 41.8%), the mean temperature of wettest quarter (16.4), the annual precipitation (10.7), the solar radiation in April (10.5), and the precipitation of driest month (7.9) are also significant. Almost all factors are essential for development of eggs and nymphae.

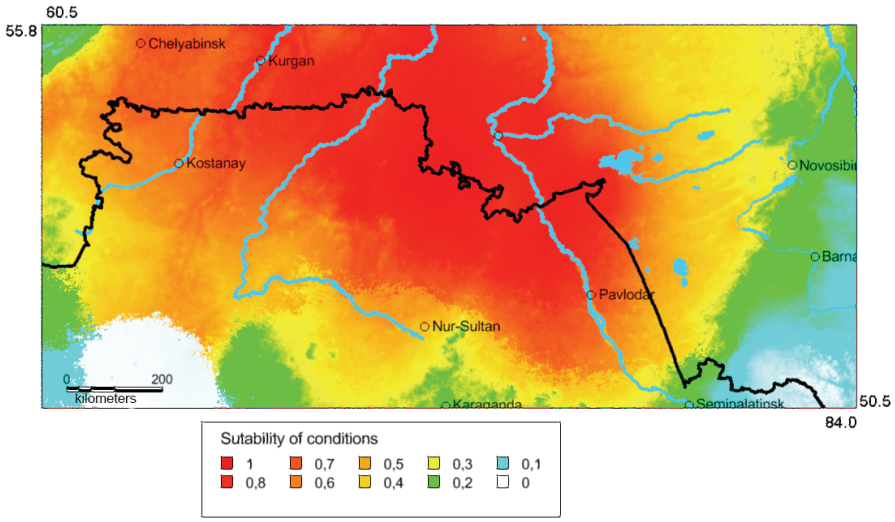

Fig. 2. Predicted probabilities of suitable conditions for *Montana striata* in the Asian part of its range (all distribution data and bioclimatic variables for 1970–2000; point-wise mean for 9 replicates).

CONCLUSION

The striated steppe bush-cricket *Montana striata* was and is one of the rarest orthopteran species in the temperate Asia. Despite more than 400 localities studied by several generations of orthopterists in the forest-steppes and the steppes of West Siberia and Kazakhstan from the end of the 19th century until now (see Sergeev, 1986; Popova *et al*., 2020, 2022) the species are known only from a few sites and their abundance are relatively low in all recognized populations. One may suggest its colonies are insular while the species prefers widely distributed natural and semi-natural habitats and sometimes occurs in transformed terrains as well. In any case, *Montana striata* is included in the IUCN Red List (Least Concern) (Hochkirch *et al*., 2016) and in the Red Book of the Omsk Region (Kassal & Kniazev, 2015), but it also may be added at least to the Red Books of the Chelyabinsk and Novosibirsk regions of Russia.

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