

New and interesting records of Auchenorrhyncha (Homoptera) in European Russia

Новые и интересные находки цикадовых (Homoptera: Auchenorrhyncha) в Европейской России

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КЛЮЧЕВЫЕ СЛОВА: Цикадовые, Auchenorrhyncha, новые находки, Европейская Россия, биологические инвазии.

ABSTRACT. Data on new and interesting records of 36 species of Auchenorrhyncha in European Russia are presented. For 30 species, photos of habitus and/or male genitalia are provided, for three species, male calling signal oscillograms are given. Almost all species can be classified into three groups: species found in European Russia on the western or eastern borders of their ranges, cryptic species recently revealed due to bioacoustic investigations, and invasive species introduced to European Russia with cultivated plants.

РЕЗЮМЕ. Приведены данные о новых и интересных находках 36 видов цикадовых в европейской части России. Для 30 видов приведены фотографии внешнего вида и/или гениталий самца, для трёх видов даны осциллограммы призывных сигналов самцов. Почти все виды можно отнести к одной из трёх групп: виды, встречающиеся в европейской части России на западной или, наоборот, восточной границе ареала, криптические виды, недавно выявленные в результате биоакустических исследований, и инвазивные виды, завезённые в европейскую Россию с культурными растениями.

Introduction

The only general work on Auchenorrhyncha (Homoptera) of European Russia was the first volume of the Keys to insects of the European part of the USSR published almost 60 years ago [Emelyanov, 1964]. All subsequent works on the fauna of Auchenorrhyncha of this region were annotated lists of species of certain territories (mostly, oblasts) or nature reserves. Most of

them were published in little-known local issues, conference proceedings, collections of articles, etc., and for this reason are hardly accessible even for Russian readers. Among rare exceptions are annotated lists of Auchenorrhyncha of Voronezh Oblast [Dmitriev, 2001], the Bashkir Nature Reserve [Anufriev, 2006a] and the lowlands of the Trans-Volga forest zone [Anufriev, Smirnova, 2009].

In addition, the main part of almost every faunistic article is a list of widespread common species, the presence of which in an area considered is obvious and does not need special confirmation. The few interesting records are not always properly highlighted in a list and are often not discussed. Also, such lists usually do not contain drawings of the genitalia and other diagnostic traits; therefore it is impossible to verify identifications of closely related or poorly known species. Only V.N. Logvinenko regularly provided drawings of genitalia of Auchenorrhyncha in her faunistic articles, but they concern the fauna of Auchenorrhyncha of Ukraine (e.g., Talitskiy, Logvinenko [1966]; Logvinenko [1984]). On the other hand, reliable records confirmed by genitalia drawings and/or male calling signal oscillograms are scattered in numerous taxonomic and bioacoustic articles and often remain unnoticed (e.g., Benediktov, Mikhailenko [2017]; Tishechkin [2019]).

This situation inspired us to summarize new and interesting both unpublished and recently published records of 36 species of Auchenorrhyncha from European Russia confirmed by male calling signal recordings, insect photos, or genitalia drawings. For 30 species photos of habitus and/or male genitalia are provided. For three species male calling signal oscillograms are given.

Material and methods

Leafhopper vibrational signals were recorded by means of portable recording equipment consisting of a piezocrystal gramophone cartridge GZP-311 connected to the microphone input of a cassette recorder Elektronika-302 (before 2005), minidisk recorder Sony Walkman MZ-NH900 (2005–2016), or Roland R-05 wave/mp3 recorder (since 2017) via a custom-made matching amplifier. For recording, a stem of the host plant about 10–15 cm in length was attached to the cartridge by a rubber ring with the cartridge needle slightly touching the stem. Then a nylon cage containing a male treehopper was put on the twig. After some time, the male usually sat on the twig and started singing.

Oscillograms of signals were produced with Cool Edit Pro 2.1 software.

Digital images of male genitalia were obtained with a Micromed 3 LED M microscope equipped with a MICHROME 5 Pro camera (Tucsen).

Materials studied are deposited in the collection of the Zoological Museum of M.V. Lomonosov Moscow State University.

Annotated list of species

Family Meenoplidae

1. *Nisamia fumigata* (Mityaev, 1971) Figs 1–5.

DISTRIBUTION. A rare species known only from a few localities in southern Kazakhstan and Central Asia.

RECORD. Astrakhan Oblast, western shore of the Lake Baskunchak, from *Phragmites australis* (Cav.) Trin. ex Steud. First record of this species and of the family Meenoplidae in European Russia.

REMARKS. Was described in brief terms in the keys to species of Auchenorrhyncha of Kazakhstan [Mityaev, 1971]. Density of local populations, apparently, fluctuates considerably from year to year. Possibly, this is caused by fires in the reed beds where this species lives [Mityaev, 2002].

Family Achilidae

2. *Cixidia lapponica* (Zetterstedt, 1828)

DISTRIBUTION. Northern and central parts of Eastern Europe, forest zone of Russia from European part to the Russian Far East, Mongolia; apparently, is fairly common.

RECORD. Moscow Oblast, Pirogovo Forest Park north of Mytishchi, coniferous forest. First record in Moscow Oblast.

REMARK. Like all representatives of this genus, lives under the bark of dead coniferous trees and feeds on fungi growing on rotten wood; thus, it is almost impossible to find this species using traditional methods of collecting leafhoppers. For this reason, it is represented in collections by single specimens, and data on its distribution are very incomplete.

Family Aphrophoridae

3. *Poophilus costalis* (Walker, 1851) Figs 6–10, 21–24.

Poophilus nebulosus (Lethierry, 1876) (synonymy by Mozaffarian, Wilson, 2015)

DISTRIBUTION. Widely distributed across Asia from Iran to China and Korea, northwards reaches the deserts of Kazakhstan; also, found in almost all African countries [Mozaffarian, Wilson, 2015].

RECORD. Astrakhan Oblast, environs of Dosang, ca. 60 km north of Astrakhan, from *Alhagi pseudalhagi* (M. Bieb.) Fisch. in sand desert. The first record of *P. costalis* in Russia and the northwesternmost known point of its range.

REMARK. Signals of 3 males from the environs of Dosang recorded on 6.VII.2005 at 27 °C; signals of 6 males recorded on 28–29.VI.2010 at 29–30 °C. Calling signal consists of short variable elements (phrases) following each other with irregular intervals up to 10–20 s and more (Figs 21–24).

Family Cicadidae

4. *Cicadetta cantilatrix* Sueur et Puissant, 2007

DISTRIBUTION. Was recently described from France and recorded from several countries of Western and Central Europe [Sueur, Puissant, 2007].

RECORD. Signals of males from Serebryanye Prudy District, the southernmost part of Moscow Oblast were described by Benediktov and Mikhailenko [2017]; this is the first record of *C. cantilatrix* in Russia and the easternmost known point of its range.

REMARK. The discovery of this species in Moscow Oblast suggests that it is widespread in European Russia but was apparently confused with *C. montana* (Scopoli, 1772).

Family Membracidae

5. *Stictocephala bisonia* Kopp et Yonke, 1977

DISTRIBUTION. North American invasive species that has spread widely throughout the south of the Palearctic from Europe to Central Asia and the Far East.

RECORDS. Several localities in the southern and central parts of Moscow Oblast. The northernmost record of this species in European Russia.

REMARK. The discovery of *S. bisonia* in Moscow Oblast suggests further northward expansion of its range.

6. *Gargara stepposa* Tishechkin, 2005

RECORDS. Reliable records of this species based on male calling signal recordings include Rostov Oblast (env. Oblivskaya), Saratov Oblast (env. Dyakovka), Ciscaucasia (Chechnya, env. Grozny), and Orenburg Oblast (env. Guberylya). Records of *G. stepposa* from the semideserts of the southeast of European Russia and from Central Asia in Tishechkin [2005] refer to *G. genistae* (Fabricius, 1775) [Tishechkin, 2022].

REMARKS. *G. stepposa* is a cryptic species indistinguishable from a widespread *G. genistae* in external appearance and genitalia shape. Still, these two species distinctly differ from each other in the calling signal patterns and, partially, in host preferences.

G. genistae lives on different species of leguminous shrubs (Fabaceae). It was collected from *Genista tinctoria* L. and *Chamaecytisus ruthenicus* (Fisch. ex Woloszcz.) Klásk. in the forest and steppe zones of European Russia and on *Halimodendron halodendron* (Pall.) Voss in the semideserts of the Trans-Volga part of Astrakhan Oblast; also, it dwells on cultivated *Caragana arborescens* Lam. throughout all European Russia. *G. stepposa* also can live on Fabaceae (*Ch. ruthenicus*, *Caragana frutex* (L.) K. Koch), however, unlike *G. genistae*, it often shifts to Rosaceae and was found on wild *Malus* sp. in the environs of Grozny City and on *Prunus spinosa* L. in the steppes of European Russia. Remarkably, in



Figs 1–20. 1–5 — *Nisamia fumigata*; 6–10 — *Poophilus costalis*; 11–12 — *Anaceratagallia camphorosmatis*; 13–14 — *A. fragariae*; 15–16 — *A. ribauti*; 17–20 — *Macropsis illota*: 1 — male, habitus, lateral view; 2 — same, female; 3 — male genitalia, lateral view; 4 — anal tube, dorsal view; 5, 8, 18 — style; 6 — habitus, dorsal view; 7 — pygofer, anal tube, and subgenital plates, lateral view; 9, 11, 13–17 — aedeagus, lateral view; 10 — same, back view; 12 — male anal collar appendage; 19–20 — male abdominal apodemes of the 2nd tergite. On Figs 14 and 16 the width of aedeagus stem at the base is shown by arrows.

Rostov Oblast, where *G. genistae* was not found, *G. stepposa* lived on *P. spinosa* and *Ch. ruthenicus*, but in Saratov Oblast, where both species occurred, *G. stepposa* lived only on *P. spinosa*, whereas *G. genistae* lived on *Ch. ruthenicus*. As a result, these two species, if sympatric, apparently, are segregated due to host differences.

Thus, identification of *Gargara* species from the steppes of European Russia and South Urals is difficult. If insects were collected from Rosaceae, it is safe to say that they belong to *G. stepposa*. Identification of specimens from leguminous shrubs presently is impossible without calling signal analysis.

Family Cicadellidae

Subfamily Ulopinae

7. *Utecha trivialis* (Germar, 1821)

DISTRIBUTION. Western Europe, southern half of European Russia, Caucasus, Transcaucasia, northwestern Kazakhstan.

RECORD. Oscillograms of calling signals of males from Moscow Oblast, Voskresensk District, environs of Beloozerskiy Town are given in Tishechkin [2018]. This is the first record of *U. trivialis* in Moscow Oblast and the northernmost record in European Russia.

Subfamily Megophthalminae, tribe Agalliini

8. *Anaceratagallia camphorosmatis* (Emelyanov, 1964)

Figs 11–12.

DISTRIBUTION. Bulgaria, Southern Ukraine, Crimea, Lower Volga Region, Transcaucasia (Armenia), Kazakhstan, Central Asia [Tishechkin, 2020a].

RECORD. Drawings of genitalia and oscillograms of calling signals of males from Saratov Oblast, environs of Dyakovka are given in Tishechkin [2020a]. This is the first record of *A. camphorosmatis* in Russia.

REMARKS. Apparently, *A. camphorosmatis* is widely distributed in the steppe zone of European Russia. Belongs to the *A. laevis* (Ribaut, 1935) species group. Differs from all members of the group in the shape of aedeagus and male anal collar appendages.

9. *Anaceratagallia fragariae* Mityaev, 1971

Figs 13–14.

DISTRIBUTION. Ukraine, European Russia, Kazakhstan, Kyrgyzstan [Mityaev, 2002; Tishechkin, 2020a].

RECORD. Drawings of genitalia and oscillograms of calling signals of males from Moscow Oblast, Voskresensk District, environs of Beloozerskiy Town are given in Tishechkin [2020a]. This is the first record of *A. fragariae* in Russia.

REMARKS. Records of this species from European Russia and Ukraine [Tishechkin, 2020a] suggest its wide distribution in Eastern Europe.

A. fragariae belongs to the *A. ribauti* (Ossiannilsson, 1938) species group. Similar to *A. ribauti* (Figs 15–16) and differs from it only in somewhat wider aedeagus stem in lateral view (cf. Figs 13–14 and 15–16; differences between two species in the aedeagus width are shown by arrows on

Figs 14 and 16). Also, these two species distinctly differ in the male calling signal patterns [Tishechkin, 2020a].

Subfamily Eurymelinae, tribe Macropsini

10. *Macropsis illota* (Horváth, 1899)

Figs 17–20, 25–28.

DISTRIBUTION. Natural range of this species includes eastern Transbaikalia, Mongolia, southern part of the Russian Far East, northern China, and Japan. Was introduced to Central Asia, Kazakhstan, South Urals, and the southern half of European Russia with ornamental *Ulmus pumila* L. [Dmitriev, 1999, 2001; Anufriev, 2006b; Tishechkin, 2020b].

RECORD. Moscow Oblast, Voskresensk District, environs of Beloozerskiy Town, from cultivated *U. pumila*. First record in Moscow Oblast and the northernmost record in European Russia.

REMARKS. The discovery of *M. illota* in Moscow Oblast suggests further northward expansion of its range.

In the shape of abdominal apodemes and genitalia, males from Moscow Oblast are indistinguishable from males collected from wild-growing trees of *U. pumila* in Transbaikalia.

Calling signals of 3 males from Moscow Oblast recorded on 25.VII.2021 at 22 °C. Signal patterns in males from Moscow Oblast and Transbaikalia are almost identical (Figs 25, 27 and 26, 28).

11. *Macropsis mulsanti* (Fieber, 1868)

Figs 34–35.

DISTRIBUTION. Natural range of this species includes Europe (Alps), North Caucasus, and mountains of southern Kazakhstan and Central Asia.

RECORDS. Was first recorded from Moscow Oblast by Tishechkin [2002]. Was introduced to European Russia with its host, *Hippophae rhamnoides* L. and presently, is common on this plant throughout all the territory of Moscow Oblast.

REMARKS. In the shape of abdominal apodemes, genitalia, and in the calling signal pattern, males from Moscow Oblast, Northern Caucasus, and Central Asia are indistinguishable.

Distinctly differs from other European *Macropsis* species in coloration.

12. *Macropsis elaeagni* Emelyanov, 1964

Fig. 36.

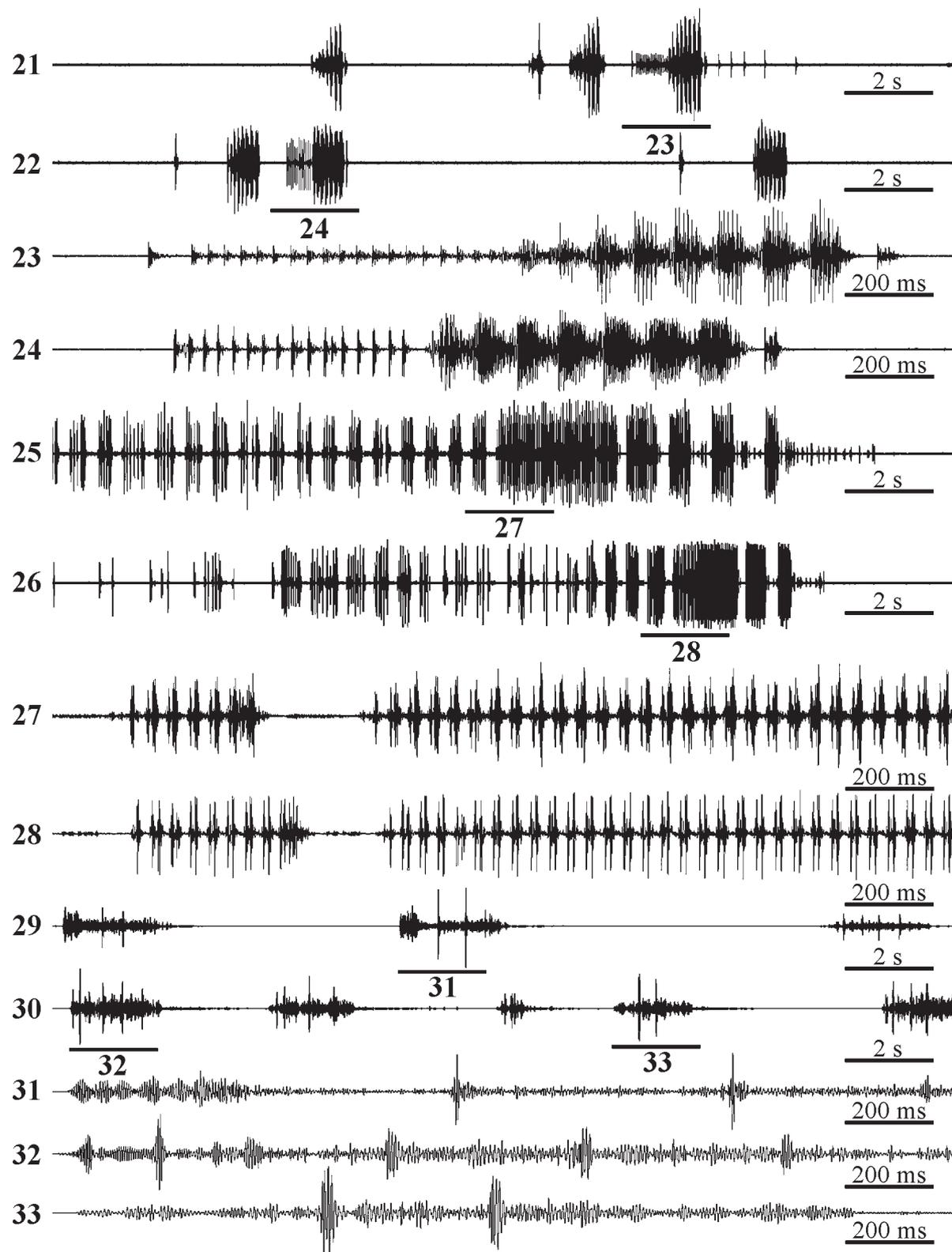
DISTRIBUTION. Western Europe, the southern half of European Russia, the South Urals, Kazakhstan, Central Asia. Probably, originally is the Central Asian species, widely introduced with ornamental *Elaeagnus angustifolia* L. far beyond natural range which is hardly possible to reconstruct now.

RECORD. Was first recorded from Moscow by Tishechkin [2002]. This is the northernmost record of *M. elaeagni* in European Russia.

REMARKS. In the shape of abdominal apodemes, genitalia, and in the calling signal pattern, males from Moscow are indistinguishable from males from the southern regions of European Russia, Kazakhstan, and Central Asia [Tishechkin, 2002, 2015a].

The only European *Macropsis* species feeding on *E. angustifolia*. Distinctly differs from other European *Macropsis* species in uniform whitish pale green coloration.

Рис. 1–20. 1–5 — *Nisamia fumigata*; 6–10 — *Poophilus costalis*; 11–12 — *Anaceratagallia camphorosmatis*; 13–14 — *A. fragariae*; 15–16 — *A. ribauti*; 17–20 — *Macropsis illota*: 1 — самец, внешний вид, сбоку; 2 — то же, самка; 3 — гениталии самца, сбоку; 4 — анальная трубка, сверху; 5, 8, 18 — стилус; 6 — внешний вид, сверху; 7 — пифофор, анальная трубка и генитальные пластины, сбоку; 9, 11, 13–17 — эдеагус, сбоку; 10 — то же, сади; 12 — отросток анальной трубки самца; 19–20 — аподемы второго брюшного тергита самца. На рис. 14 и 16 ширина основания эдеагуса показана стрелками.



Figs 21–33. Oscillograms of male calling signals of Auchenorrhyncha: 21–24 — *Poophilus costalis*; 25–28 — *Macropsis illota*; 29–33 — *Schizandrasca ussurica*. Faster oscillograms of the parts of signals indicated as “23–24”, “27–28”, and “31–33” are given under the same numbers.

Рис. 21–33. Осциллограммы призывных сигналов самцов Auchenorrhyncha: 21–24 — *Poophilus costalis*; 25–28 — *Macropsis illota*; 29–33 — *Schizandrasca ussurica*. Фрагменты сигналов, обозначенные цифрами “23–24”, “27–28” и “31–33”, представлены на осциллограммах под такими же номерами.

The genus *Hephathus* Ribaut, 1952

In Russia and adjacent countries, the genus is represented by three species similar in the shape of male genitalia, but differing from each other in black pattern on face and in the calling signal temporal structure. The use of bioacoustic traits for species identification has led to a revision of all data on their distribution [Tishechkin, 1999, 2015b].

13. *Hephathus nanus* (Herrich-Schäffer, 1835)
Figs 40–45.

DISTRIBUTION. Southern parts of Western Europe and European Russia eastwards to the South Urals.

RECORDS. Many localities in the southern part of European Russia from Crimea to Orenburg Oblast [for details see Tishechkin, 1999, 2015b].

REMARKS. Investigation of male calling signals showed that all records of *H. nanus* from northern and central regions of European Russia refer to *H. achilleae* [Tishechkin, 1999, 2015b]. Despite this fact, afterwards, only *H. nanus* was mentioned in the faunistic lists even from the forest zone, where its occurrence is highly doubtful [Anufriev, Smirnova, 2016].

Differs from *H. achilleae* and *H. freyi* in the black pattern on face. The most characteristic traits are well-developed black stripes along eyes even in the most light-colored specimens and the light area in the middle of the lower half of face even in the darkest ones.

14. *Hephathus achilleae* Mityaev, 1967
Figs 46–51.

DISTRIBUTION. Northern part of Western Europe, European Russia, northern and eastern Kazakhstan, the southern part of Western Siberia [Tishechkin, 1999, 2015b].

RECORDS. Many localities in the central and southern parts of European Russia [for details see Tishechkin, 1999, 2015b].

REMARKS. In the steppes of southeastern regions of European Russia, often was found in the same biotopes with *H. nanus* or *H. freyi* (Fieber, 1868).

Differs from *H. nanus* and *H. freyi* in strongly developed black pattern on face. Two round black spots in the upper part of the face almost always merge with other elements of black pattern, the lower half of the face always black in the middle, the light areas along eyes comparatively narrow.

15. *Hephathus freyi* (Fieber, 1868)
Figs 52–57.

H. unicolor (Lindberg, 1926) (synonymy by Tishechkin, 1999)

H. tshakaranus Dlabola, 1957 (synonymy by Tishechkin, 2015b)

DISTRIBUTION. Mediterranean (Spain, southern France, North Africa), Southern Ukraine, southeastern regions of European Russia, Transcaucasia, Iran, Kazakhstan, Central Asia.

RECORDS. Many localities in Rostov, Saratov, Volgograd, and Astrakhan Oblasts [for details see Tishechkin, 1999, 2015b].

REMARKS. In spite of the fact that *H. freyi* is widespread and fairly common in the Lower Volga Region, we did not find records of this species from European Russia in the faunistic lists.

Specimens of *H. freyi* from Russian populations differ from *H. achilleae* and *H. nanus* in light upper part of face and wide light areas along eyes. Specimens with strongly developed black pattern are known only from Central Asia [Tishechkin, 2015b].

Subfamily Typhlocybinae

16. *Schizandrasca ussurica* (Vilbaste, 1968)
Figs 29–33, 37–39.

DISTRIBUTION. Southern part of the Russian Far East-ern, China, Korea [Qin et al., 2011].

RECORD. Moscow Oblast, Voskresensk District, environs of Beloozerskiy Town, on cultivated *Schisandra chinensis* (Turcz.) Baill. First record in European Russia.

REMARKS. Apparently, was introduced to European Russia with its host plant.

Signals of 8 males from Moscow Oblast recorded on 17.VII.2021 at 26 °C. Calling signal consists of short variable elements following each other with intervals from 2–3 up to 8–10 s in our recordings (Figs 29–33).

Subfamily Aphrodinae

The *Aphrodes bicincta* (Schrank, 1776) species group

Leafhoppers of the *A. bicincta* species group are widespread throughout the Palearctic. In European Russia, these are common insects on grass vegetation. Investigation of the male calling signals of species of this group in central regions of European Russia proved conclusively that three forms, *A. bicincta*, *A. makarovi* Zachvatkin, 1953, and *A. diminuta* Ribaut, 1952 = *A. centrorossica* Zachvatkin, 1953 are good species that differ in the signal temporal patterns [Tishechkin, 1998].

Comprehensive morphological, acoustic, and molecular investigation of this species complex in Western Europe was performed by Bluemel et al. [2014]. Based on numerous specimens from many localities they confirmed that *A. bicincta*, *A. makarovi*, *A. diminuta*, and the West European *A. aestuarina* (Edwards, 1908) are good species and provided a key for their identification based on morphological traits.

Recently we published data on calling signals, taxonomy, and distribution of the members of this group in Eastern Palearctic [Tishechkin, 2017].

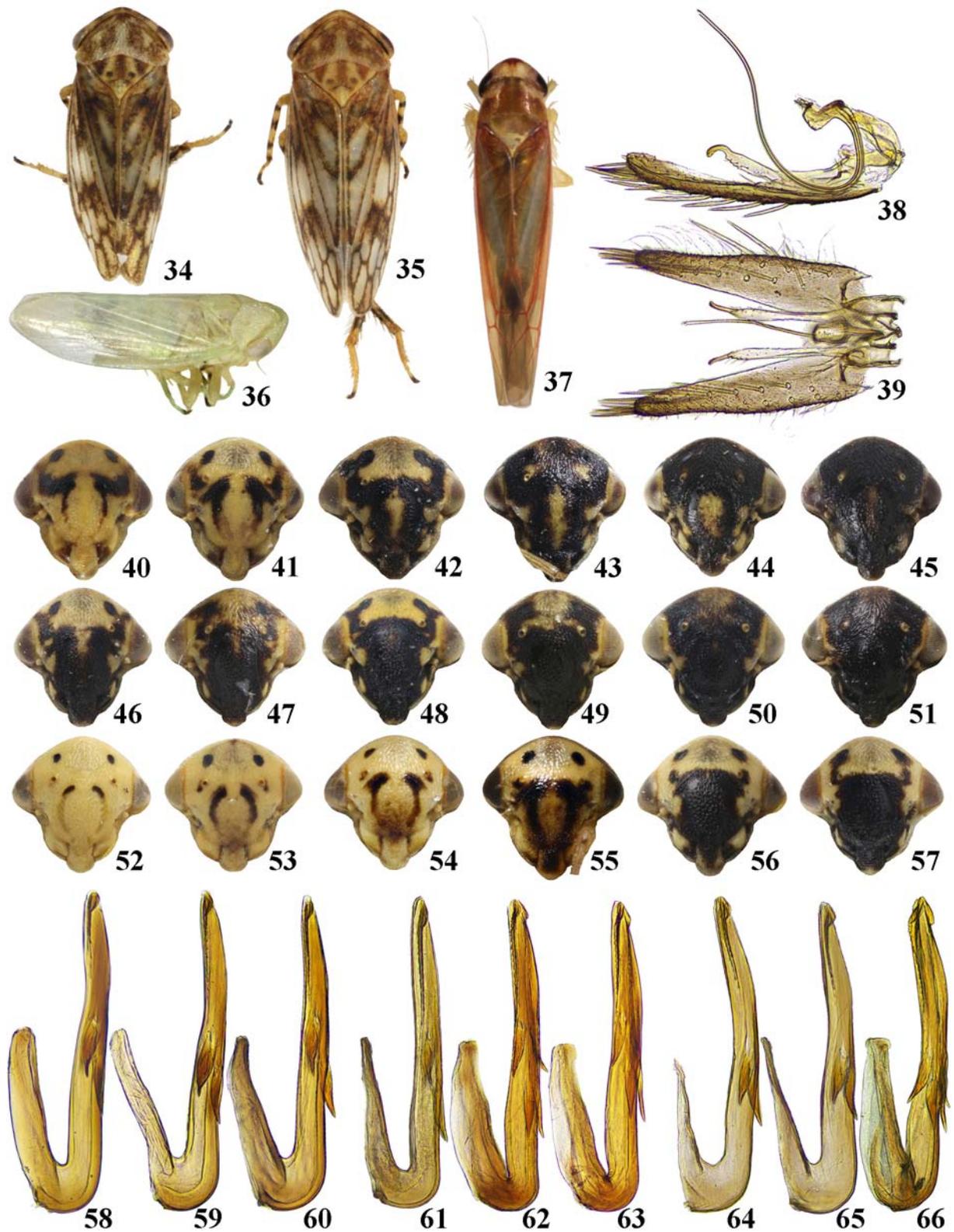
However, these data were ignored by the authors of faunistic lists. Despite the fact that in the forest zone of European Russia all three species often can be found in the same locality, in most lists only *A. bicincta* is recorded. *A. diminuta* is a most widespread member of this group; it was found in many localities from Western Europe to Sakhalin [Tishechkin, 1998, 2017; Bluemel et al., 2014]. Still, in faunistic lists, we did not find records of this species even from wet habitats, where it replaces *A. bicincta* [e. g., Galinichev, Anufriev, 2012]. For this reason, below we provide brief information on the distribution, biotopic preferences, and diagnostic traits of these species.

17. *Aphrodes bicincta* (Schrank, 1776)
Figs 58–60.

DISTRIBUTION. Widespread from Western Europe to Kazakhstan and Central Asia. So far was not found in Siberia and in the Russian Far East [Tishechkin, 2017].

RECORDS. Reliably known from the central and southern regions of European Russia [Tishechkin, 1998, 2017].

REMARK. Prefers dry open habitats, usually feeds on different Fabaceae. In the forest zone lives on dry meadows, in the steppes of European Russia and Kazakhstan and in the arid mountains of Central Asia also occurs in rather wet biotopes along streams and rivers.



Figs 34–66. 34–35 — *Macropsis mulsanti*; 36 — *M. elaeagni*; 37–39 — *Schizandrasca ussurica*; 40–45 — *Hephathus nanus*; 46–51 — *H. achilleae*; 52–57 — *H. freyi*; 58–60 — *Aphrodes bicincta*; 61–63 — *A. diminuta*; 64–66 — *A. makarovi*. 34 — male, habitus, dorsal view; 35 — same, female; 36 — habitus, lateral view; 37 — same, dorsal view; 38 — male genitalia, pygofer removed, lateral view; 39 — same, ventral view; 40–57 — face; 58–66 — aedeagus, lateral view.

18. *Aphrodes diminuta* Ribaut, 1952

Figs 61–63.

A. centrorossica Zachvatkin, 1953 (synonymy by Bluemel et al., 2014)

DISTRIBUTION. Transpalearctic [Tishechkin, 1998, 2017; Bluemel et al., 2014].

RECORDS. Reliably known only from the forest zone of European Russia. In steppes and semideserts, occurs only in river valleys and other wet habitats.

REMARK. Lives in different natural and anthropogenic rather wet biotopes, mainly on Fabaceae.

19. *Aphrodes makarovi* Zachvatkin, 1953

Figs 64–66.

DISTRIBUTION. Western Europe, central regions of European Russia. So far was not found in Central Asia, Siberia, and the Russian Far East [Tishechkin, 1998, 2017; Bluemel et al., 2014].

RECORDS. Reliably known only from the central part of European Russia.

REMARK. In different biotopes, mainly, on *Urtica dioica* L. [Tishechkin, 1998]; also, on *Taraxacum officinale* F.H. Wigg. and some other Asteraceae [Bluemel et al., 2014].

In a typical case, these species differ quite clearly in the shape of the aedeagus and coloration, but the extreme variants of variability in different species slightly overlap. Comparative data on the *A. bicincta* species group with a key to species can be found in Bluemel et al. [2014]. For identification of species from European Russia the following key can be used.

1. Aedeagus shaft almost straight in lateral view, bases of lower spines are situated at the level of ends of upper spines or lower (Figs 61–63). Usually light brown, oblique light stripes on forewings are distinct and contrasting *A. diminuta*
- Aedeagus shaft usually more or less bent in lateral view, bases of lower spines as a rule are situated higher than the ends of upper spines (Figs 58–60, 64–66) 2
2. Bases of lower spines of aedeagus are usually situated at the level of middles of upper spines or even higher; aedeagus shaft distinctly bent in the middle in lateral view (Figs 64–66). Coloration brown with more contrasting light pattern *A. makarovi*
- Bases of lower spines of aedeagus usually are situated only slightly higher than the ends of upper spines; aedeagus shaft only slightly bent above the middle in lateral view (Figs 58–60). Coloration light brown with less contrasting light pattern *A. bicincta*

Subfamily Iassinae

20. *Iassus lateralis* (Matsumura, 1905)

Figs 67–70.

DISTRIBUTION. Southern part of the Russian Far East, Mongolia, China, Japan.

RECORDS. Was recorded in Anufriev [2006b] from Orenburg and Ulyanovsk Oblasts. Oscillograms of calling signals of males from Saratov Oblast, Dyakovka are given in Tishechkin [2010]. These are first records of this species in European Russia.

REMARKS. The Far Eastern species introduced to European Russia. Feeds on elms (*Ulmus* spp.). Further expansion of its range can be expected.

Subfamily Deltocephalinae

Tribe Opsiini

The *Neoliturus fenestratus* (Herrich-Schäffer, 1834) species group

Comparative investigation of the male calling signals made it possible to distinguish between closely related species in this group and to reveal morphological traits for their identification [Tishechkin, 2021a]. Data on biology and distribution of four members of this group from European Russia and the key for their identification are given below.

21. *Neoliturus fenestratus* (Herrich-Schäffer, 1834)

Figs 71–72, 77–79.

DISTRIBUTION. Central and southern Europe, southern half of European Russia northwards as far as the forest-steppe zone, South Urals, Transcaucasia, Kazakhstan, Central Asia.

RECORDS. Many localities in the southern half of European Russia [Tishechkin, 2021a]. Records of this species from the central regions of European Russia at least partially refer to *N. albilacustris* Tishechkin, 2021.

REMARK. Usually, on Asteraceae (*Cichorium intybus* L., *Achillea* spp., *Artemisia* spp., *Inula* spp., etc.), sometimes on herbaceous plants from other families and on elms (*Ulmus pumila*, *Ulmus* sp., Ulmaceae).

22. *Neoliturus albilacustris* Tishechkin, 2021

Figs 73–74, 80–81.

DISTRIBUTION. Bulgaria, central part of European Russia, Ukraine, northern Kazakhstan.

RECORDS. Known only from several localities in Moscow Oblast. Apparently, does not penetrate south beyond the forest-steppe zone [Tishechkin, 2021a].

REMARKS. Recently described species, which was apparently confused with the widespread *N. fenestratus*. So far was collected only from *Pilosella officinarum* F.W. Schultz & Sch. Bip. (Asteraceae). Wide range of the host plant and records from several localities remote from each other suggests its wide distribution.

23. *Neoliturus guttulatus* (Kirschbaum, 1868)

Figs 75, 82–83.

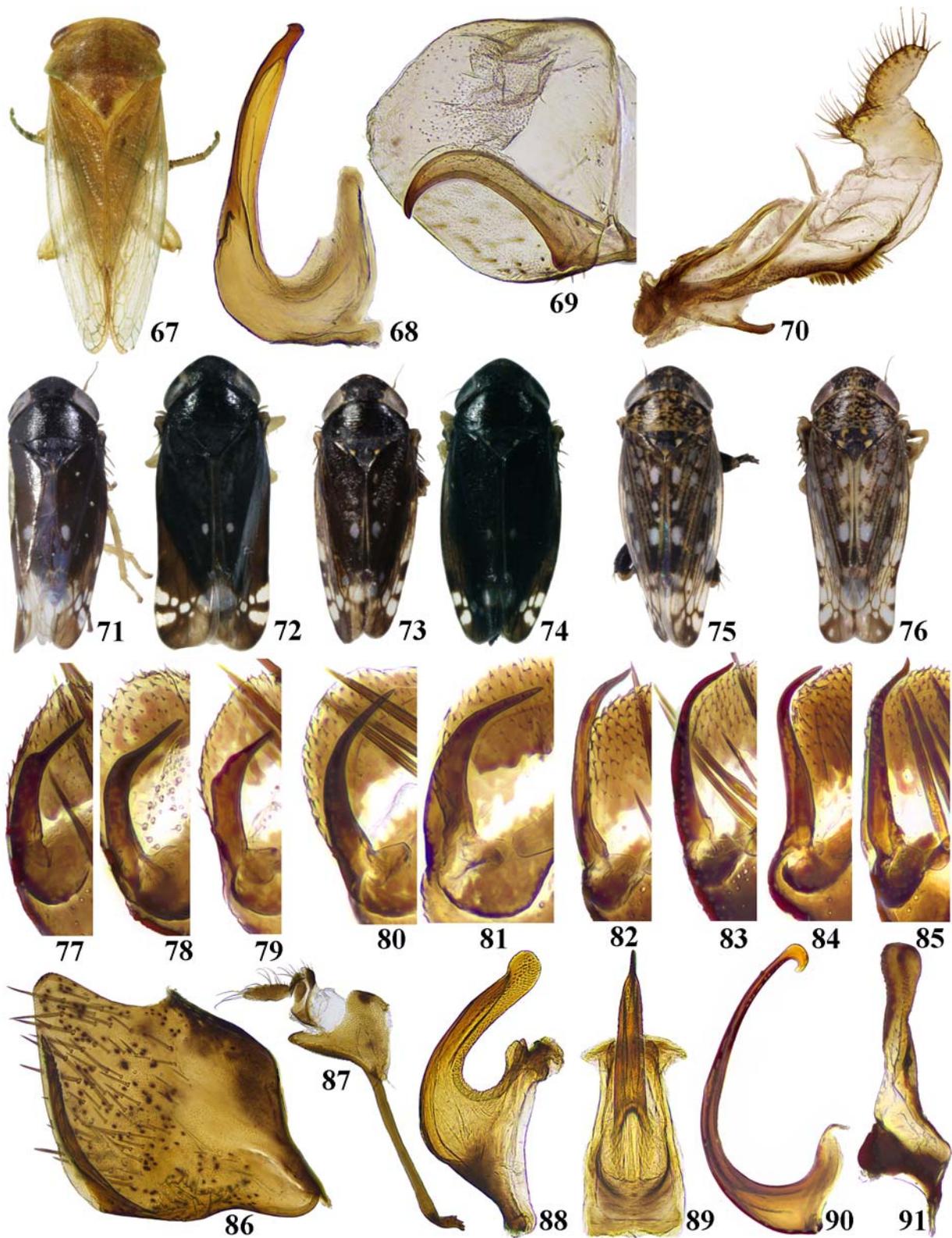
DISTRIBUTION. Western Europe, central and southern regions of European Russia southwards as far as the forest-steppe zone.

RECORDS. Reliably known from two localities in Moscow Oblast and from the environs of Khvalynsk, Saratov Oblast [Tishechkin, 2021a].

REMARKS. *N. guttulatus* was described from Germany, but since its taxonomic status remained unclear for a long time, there is no reliable information about its distribution in Western Europe.

Apparently, oligophagous on certain Asteraceae. In Moscow Oblast was found on *Centaurea scabiosa* L., in Saratov Oblast was collected in the steppe with *Artemisia* sp. and *Anthemis tinctoria* L.

Рис. 34–66. 34–35 — *Macropsis mulsanti*; 36 — *M. elaeagni*; 37–39 — *Schizandrasca ussurica*; 40–45 — *Hephathus nanus*; 46–51 — *H. achilleae*; 52–57 — *H. freyi*; 58–60 — *Aphrodes bicincta*; 61–63 — *A. diminuta*; 64–66 — *A. makarovi*; 34 — самец, внешний вид, сверху; 35 — то же, самка; 36 — внешний вид, сбоку; 37 — внешний вид, сверху; 38 — гениталии самца, сбоку, пигофор удален; 39 — то же, снизу; 40–57 — лицо; 58–66 — эдеагус, сбоку.



Figs 67–91. 67–70 — *Iassus lateralis*; 71–72, 77–79 — *Neoaliturus fenestratus*; 73–74, 80–81 — *N. albilacustris*; 75, 82–83 — *N. guttulatus*; 76, 84–85 — *N. argillaceus*; 86–89 — *Fieberiella septentrionalis*; 90–91 — *Taurotettix (Callistrophia) modesta*. 67, 71, 73, 75 — male, habitus, dorsal view; 72, 74, 76 — same, female; 68, 88, 90 — aedeagus, lateral view; 69, 77–86 — pygofer appendage; 70, 87 — anal tube; 89 — aedeagus, back view; 91 — style.

24. *Neotalitrus argillaceus* Mityaev, 1975

Figs 76, 84–85.

DISTRIBUTION. Southern Ukraine, Crimea, steppes of European Russia, Northern Caucasus including the Black Sea Coast, western and northern Kazakhstan, steppes of Western Siberia (environs of Novosibirsk, Southern Tyva), Mongolia.

RECORDS. Several localities in the southern part of European Russia within the steppe zone and in Ciscaucasia [Tishechkin, 2021a].

REMARK. Was found on different species of *Artemisia*.

Descriptions of species from the *N. fenestratus* group can be found in Tishechkin [2021a]. For identification of species from European Russia the following key can be used.

1. Black, shiny, forewings with milky-white translucent spots on clavus, in subapical part of forewings, and sometimes also at costal margin (Figs 71–74). Pygofer appendage comparatively short, does not extend beyond the pygofer margin (Figs. 77–81) 2
- Yellowish brown with dense dark pattern, only very rarely, almost black. Forewings semitransparent with dark veins, dark pattern in cells and in apical part, and with rounded light spots (Figs 75–76). Pygofer appendage comparatively long, reaches or slightly extends beyond the pygofer margin (Figs. 82–85) 3
2. Pygofer appendage abruptly tapered in the middle (Figs 77–79) *N. fenestratus*
- Pygofer appendage gradually tapered towards apex, crescent-shaped (Figs 80–81) *N. albilacustris*
3. Pygofer appendage slightly curved downward or almost straight in basal three quarters, smoothly bent upwards in apical one quarter (Figs 82–83) *N. guttulatus*
- Pygofer appendage straight or curved upward in basal three quarters, as a rule, more abruptly bent upwards in apical one quarter (Figs 84–85) *N. argillaceus*

Tribe Fieberiellini

25. *Fieberiella septentrionalis* Wagner, 1963

Figs 86–89.

DISTRIBUTION. Southern half of Western Europe, European Russia, Central Asia (Kyrgyzstan, Uzbekistan), China.

RECORDS. Oscillograms of calling signals of males from Moscow Oblast, Voskresensk District, environs of Belozerskiy Town are given in Tishechkin [2000]. Presently, is common in different natural and anthropogenic open habitats throughout Moscow Oblast. The northernmost record of this species.

REMARK. Apparently, this southern species recently colonized central regions of European Russia, since it was found here only at the turn of the 20th and 21st centuries [Tishechkin, 2000; Dmitriev, 2001].

Tribe Cicadulini

26. *Taurotettix (Callistrophia) modesta* (Mityaev, 1971)

Figs 90–91.

DISTRIBUTION. Southeastern part of European Russia, Kazakhstan.

RECORDS. Environs of Samara; Saratov Oblast (Dyakovka, Ozinki).

REMARKS. Photos of genitalia and oscillograms of calling signals of males from Saratov Oblast, environs of Ozinki are given in Tishechkin [2021b].

Previously was recorded from the southeastern part of European Russia as *Callistrophia elegans* (Melichar, 1900) [Emelyanov, 1964].

Tribe Limotettigini

27. *Limotettix (Scleroracus) identicus* Tishechkin, 2003

DISTRIBUTION. Eastern Europe, European Russia, Western Siberia (Altai) [Tishechkin, 2019]. Further records outside these regions are quite probable.

RECORDS. Moscow Oblast (Luzhki, Serpukhov District); Rostov Oblast (environs of Oblivskaya). Oscillograms of calling signals of males from European Russia are given in Tishechkin [2003, 2019].

REMARKS. Cryptic species indistinguishable in morphology from *L. (S.) decumanus* (Kontkanen, 1949), but differing from it in the male calling signal pattern and host. Common in the steppe zone of European Russia, lives on *Artemisia* spp. in natural habitats; in agricultural landscapes sometimes is numerous on ruderal vegetation and on alfalfa fields. Rare in the forest zone, inhabits dry meadows and slopes with xerophytic vegetation.

Unlike *L. (S.) identicus*, *L. (S.) decumanus* lives on Ericaceae (*Vaccinium myrtillus* L., *Calluna vulgaris* (L.) Hull) in dry forests, on glades, etc. Thus, these two species can be easily distinguished if the data on the biotopes where the insects were collected are available. Since Ericaceae are absent in the steppe and desert zones, for species identification sometimes it is enough to know the locality.

28. *Limotettix (Scleroracus) paradoxus* (Linnavuori, 1953)

Figs 92–93.

DISTRIBUTION. Southeastern Ukraine, central and southern regions of European Russia, Northern Urals, Kazakhstan, southern Siberia, Mongolia [Tishechkin, 2019].

RECORD. Oscillograms of calling signals of males from Moscow Oblast, Voskresensk District, environs of Belozerskiy Town are given in Tishechkin [2019]. This is the first record of this species in Moscow Oblast and the northernmost record in European Russia.

REMARKS. *L. (S.) paradoxus* feeds on *Artemisia* spp. and is fairly common in steppes and deserts, often on saline soils. Rare in the forest zone; inhabits dry open biotopes.

Similar to *L. (S.) transversus* (Fallén, 1826) and can live with it in the same biotope. In appearance, differs from it in the shape of black pattern on vertex, including black transverse stripe not reaching eyes (always reaches eyes in *L. (S.) transversus*; cf. Figs 92–93 and 94).

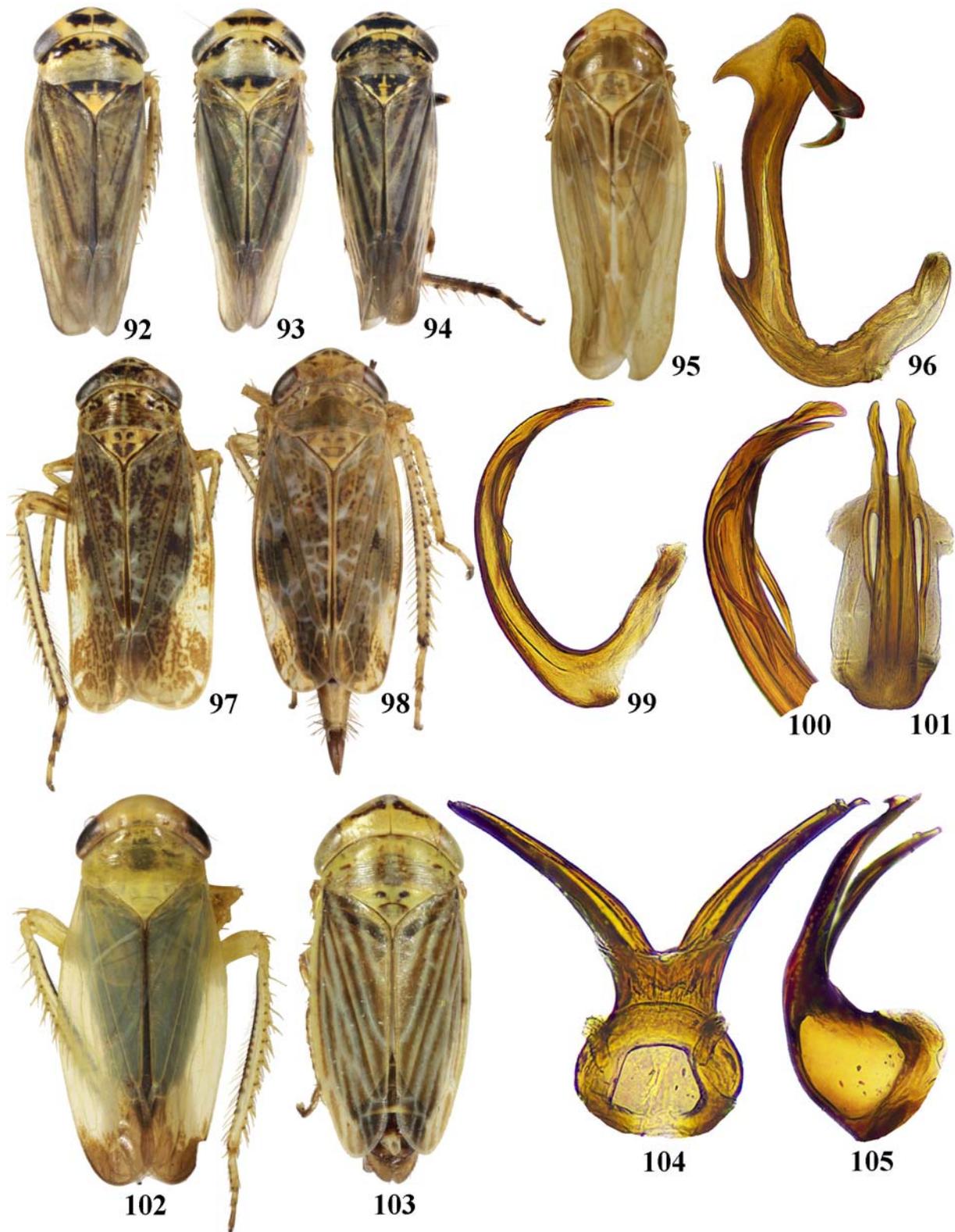
Tribe Athysanini

29. *Thamnotettix (Loepotettix) exemtus* Melichar, 1896

Figs 95–96.

DISTRIBUTION. Southern Europe, Turkey, Transcaucasia (Georgia).

RECORD. Plain part of Dagestan, Makhachkala. First record in Russia and the easternmost record of this species.



Figs 92–105. 92–93 — *Limotettix (Scleroracus) paradoxus*; 94 — *L. (S.) transversus*; 95–96 — *Thamnotettix (Loepotettix) exemtus*; 97–101 — *Mimallygus lacteinervis*; 102 — *Laburrus similis*; 103–105 — *Handianus potanini*. 92–95, 97, 102–103 — male, habitus, dorsal view; 98 — same, female; 96, 99, 105 — aedeagus, lateral view, 100 — same, apical part, frontal and lateral view; 101, 104 — same, back view.

Рис. 92–105. 92–93 — *Limotettix (Scleroracus) paradoxus*; 94 — *L. (S.) transversus*; 95–96 — *Thamnotettix (Loepotettix) exemtus*; 97–101 — *Mimallygus lacteinervis*; 102 — *Laburrus similis*; 103–105 — *Handianus potanini*. 92–95, 97, 102–103 — самец, внешний вид, сверху; 98 — то же, самка; 96, 99, 105 — эдеагус, сбоку, 100 — то же, вершинная часть, сбоку-спереди; 101, 104 — то же, сзади.

REMARK. Was included in the keys to Auchenorrhyncha of the European part of the USSR [Emelyanov, 1964], but was known only from Carpathians [Logvinenko, 1961] and Moldova [Talitskiy, Logvinenko, 1966].

30. *Mimallygus lacteinervis* (Kirschbaum, 1868)
Figs 97–101.

DISTRIBUTION. Western Europe; also, was recorded from Belarus [Borodin, 2004].

RECORDS. Ryazan Oblast, ca. 75 km east of Ryazan, Okskiy Nature Reserve, from *Salix rosmarinifolia* L., July 1945 (males and females); Mytishchi at the northeastern boundary of Moscow, from cultivated *S. purpurea* L. in the park (only females). First record in Russia.

REMARK. On cultivated willows in the park, undoubtedly is an introduced species. However, a finding in a natural biotope in 1945, before the start of the mass introduction of ornamental trees and shrubs into Russia, indicates that this species originally lived in European Russia, but remained unnoticed.

31. *Laburrus similis* Vilbaste, 1965
Fig. 102.

DISTRIBUTION. South Urals (Guberlya Mountains), Southern Siberia from Altai to Transbaikalia, southern regions of the Russian Far East.

RECORD. Oscillograms of calling signals of males from the northern part of Volgograd Oblast, Kamyshin District, environs of Scherbakovka are given in Tishechkin [2009]. This is the first record of *L. similis* in European Russia.

REMARK. In the shape of the male genitalia is similar to *L. impictifrons* (Boheman, 1852), which is widespread in European Russia, Kazakhstan, and northern Kyrgyzstan. Differs from it in the calling signal pattern, greenish coloration (yellowish in *L. impictifrons*) and widely darkened apical parts of the forewings (with only narrow dark margins in *L. impictifrons*) [Tishechkin, 2009].

32. *Handianus potanini* (Melichar, 1900)
Figs 103–105.

DISTRIBUTION. Southern Siberia, Mongolia, China.

RECORD. A large series of specimens with labels “Bashkiria, Podlubovo, ca. 40 km south of Ufa, 1.VIII.1934, from *Stipa* sp., A. Zakhvatkin” is deposited in the collection of the Zoological Museum of Moscow State University. This is the first record of *H. potanini* in European Russia.

33. *Handianus fertilis* Mityaev, 1975
Figs 106–110.

DISTRIBUTION. A rare species, known from several localities in the steppes of northwestern Kazakhstan [Mityaev, 1975] and from the extreme southeast of Russia.

RECORDS. Saratov Oblast, Ozinki; Astrakhan Oblast, Baskunchak. Oscillograms of calling signals of males from Ozinki are given in Tishechkin [2000, 2010]; this is the first record of *H. fertilis* in European Russia.

REMARK. Lives on *Eurotia ceratoides* (L.) C.A. Mey.

Tribe Paralimnini

34. *Paralimnus elegans* Emelyanov, 1964
Figs 111–114.

DISTRIBUTION. Kazakhstan, Kyrgyzstan, Southern Siberia (Tyva).

RECORD. Oscillograms of calling signals of males from Ozinki, Saratov Oblast are given in Tishechkin, Burlak [2013]; this is the first record of *P. elegans* in European Russia.

35. *Calamotettix taeniatus* (Horváth, 1911)
Figs 115–119.

DISTRIBUTION. Widely distributed throughout Europe eastwards to the Urals, but a rare species.

RECORDS. Saratov Oblast, Ozinki; Astrakhan Oblast, Baskunchak. These are the southeasternmost records of this species. Oscillograms of calling signals of male from the Baskunchak Lake are given in Tishechkin, Burlak [2013].

REMARK. So far, was not found in Kazakhstan [Mityaev, 2002], still, its occurrence there is highly likely, since both localities abovementioned are situated on the boundary with Kazakhstan.

36. *Sorhoanus (Emeljanovianus) magnus*
(Mityaev, 1969)
Figs 120–122.

DISTRIBUTION. Widely distributed in Kazakhstan; in European Russia was recorded from Chuvashia [Anufriev, Kirillova, 1988], Voronezh and Lipetsk Oblasts [Dmitriev, 2001, 1999].

RECORDS. Saratov Oblast: the northern forest-steppe part (environs of Khvalynsk) and southeasternmost Trans-Volga regions (Dyakovka, Ozinki).

REMARK. Findings of this species throughout the Saratov Oblast from the dry steppes in the Trans-Volga regions on the border with Kazakhstan to the forest-steppe zone in the north suggests its wide ecological preferences and wide distribution in the southern half of European Russia.

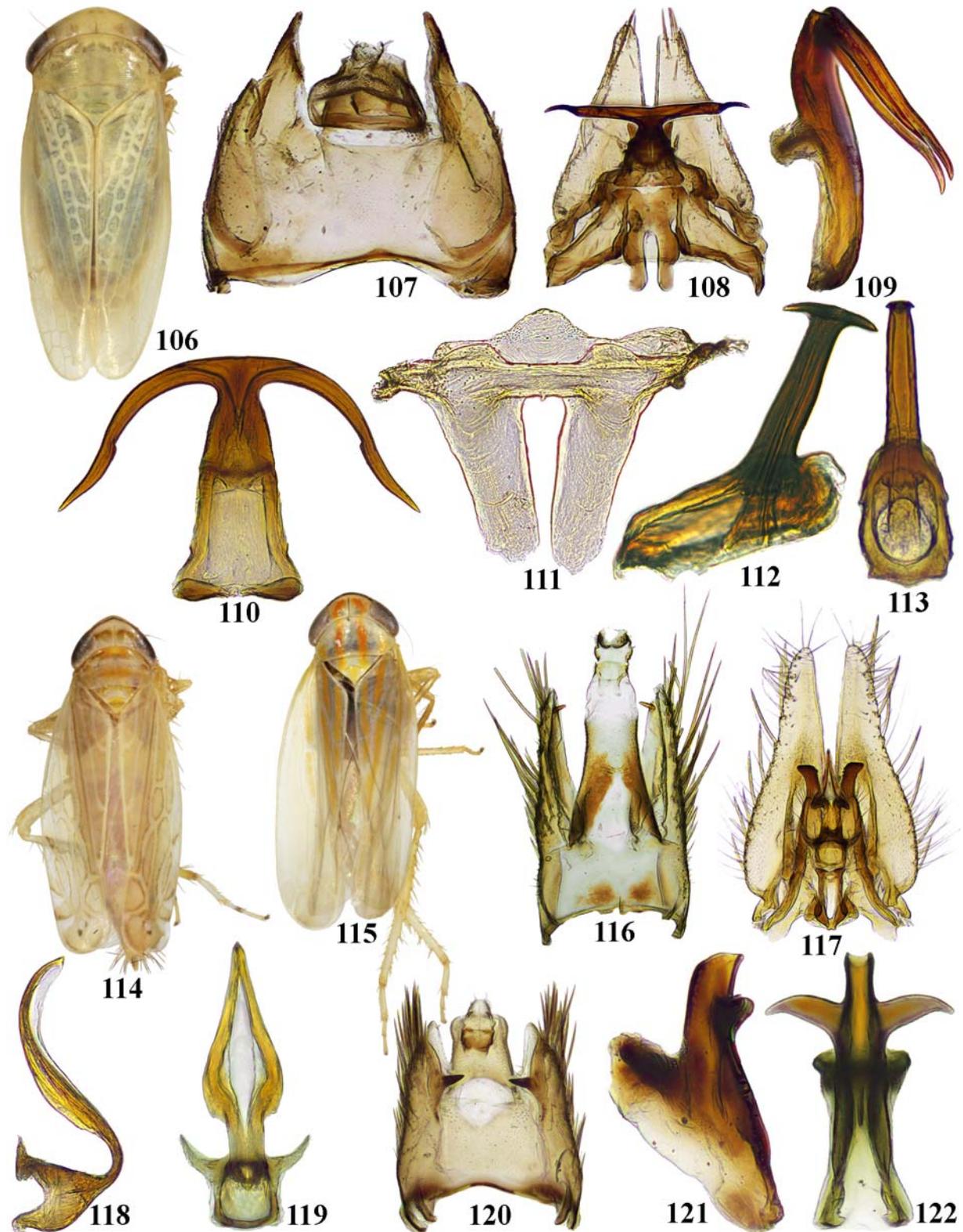
Conclusions

Almost all species discussed above can be classified into three groups.

The first group includes species found in European Russia on the western or, more rarely, eastern borders of their ranges.

Most of these species are of Central Asian origin and were described from Kazakhstan. Some species occur only in the steppes or semi-deserts of the Lower Volga region and, apparently, do not penetrate further west (for example, *Nisamia fumigata*, *Poophilus nebulosus*, *Handianus fertilis*). Others appeared to be widespread throughout the steppe zone and even reach the forest-steppe and forest zones (*Limotettix (Scleroracis) paradoxus*, *Sorhoanus (Emeljanovianus) magnus*). It is possible that some of these species penetrated here recently due to climate change (for example, *Fieberiella septentrionalis*), but it is much more likely that most of findings are due to the fact that the fauna of many insect taxa in the southeastern regions of European Russia is still poorly studied.

On the opposite, *Thamnotettix (Loepotettix) exemptus*, *Mimallygus lacteinervis*, and *Calamotettix taeniatus* are known from many localities in Western Europe, but there are few if any data on their distribution in European Russia. Since they do not feed on cultivated plants (*Th. (L.) exemptus* and *C. taeniatus*) or are found on them only occasionally (*M. lacteinervis*), it can be supposed that they originally occurred in this region but remained unnoticed by specialists.



Figs 106–122. 106–110 — *Handianus fartilis*; 111–114 — *Paralimnus elegans*; 115–119 — *Calamotettix taeniatus*; 120–122 — *Sorhoanus (Emeljanovianus) magnus*. 106, 114–115 — habitus, dorsal view; 107, 116, 120 — pygofer and anal tube, ventral view; 108, 117 — male genitalia, pygofer removed, dorsal view; 109, 112, 118, 121 — aedeagus, lateral view; 110, 113, 119, 122 — same, back view; 111 — male abdominal apodemes.

Рис. 106–122. 106–110 — *Handianus fartilis*; 111–114 — *Paralimnus elegans*; 115–119 — *Calamotettix taeniatus*; 120–122 — *Sorhoanus (Emeljanovianus) magnus*. 106, 114–115 — внешний вид, сверху; 107, 116, 120 — пигофер и анальная трубка, снизу; 108, 117 — гениталии самца, сверху, пигофер удален; 109, 112, 118, 121 — эдеагус, сбоку; 110, 113, 119, 122 — то же, сзади; 111 — брюшные аподемы самца.

The second group includes cryptic species recently revealed due to bioacoustic investigations of complexes of taxa of unclear status. In some cases, this resulted in a revision of distribution data (for example, in the genus *Hephathus* and in the *Aphrodes bicincta* species group). Sometimes new species were described in such groups; occasionally, they were found even in the regions that were considered well-studied, for example, in Moscow Oblast (*Neoliturus albilacustris*, *Limotettix (Scleroracicus) identicus*).

The third group includes invasive species introduced to European Russia with cultivated plants. These are species associated with trees, shrubs or woody lianas, which are planted not with seeds, but with seedlings. Since dendrobiont leafhoppers lay their eggs under the bark of twigs, these species can spread far and wide outside natural ranges with seedlings of cultivated plants. In new regions, monophagous species remain on their natural hosts (for example, *Macropsis* spp. and *Schizandrasca ussurica*), whereas polyphagous ones (*Stictocephala bisonia*, *Fieberiella septentrionalis*) demonstrate a strong invasive potential and became common not in only anthropogenic, but also in natural habitats.

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