



## What is concealed under the name *Lochmaea crataegi* (Coleoptera: Chrysomelidae)?

## Что скрывается под именем *Lochmaea crataegi* (Coleoptera: Chrysomelidae)?

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**Abstract.** Until now, *Lochmaea crataegi* (Forster, 1771) was considered a transpalaeartic species, while the closely related species *L. machulkai* Roubal, 1926 was known only from the Caucasus and adjacent regions. The present study establishes that *L. crataegi* is found exclusively in Western, Central, and Southern Europe, while *L. machulkai* is distributed in Crimea, the central and southern regions of European Russia, the Caucasus, northern Iran, eastern Turkey, and western Middle Asia. A new species, *L. sergeevi* sp. nov., is described from Asian Russia, specifically from the Urals to the Far East. The males of *L. sergeevi* sp. nov. differ from those of *L. crataegi* and *L. machulkai* in the aedeagus, which is much wider than that of *L. crataegi*, with the maximum width located closer to the apex than in *L. machulkai* (in dorsal view), and significantly less curved than in both compared species (in lateral view), and in the metatibia which is curved near the mid-length, whereas it is curved closer to the base in both of the compared species. The diagnostic characters of the *L. crataegi* species-group, as well as those of *L. crataegi* and *L. machulkai*, are revised. Colour photographs of the diagnostic characters and a distribution map of all species are provided.

**Резюме.** До сих пор *Lochmaea crataegi* (Forster, 1771) считался транспалеарктическим видом, а близкий вид *L. machulkai* Roubal, 1926 был известен только с Кавказа и сопредельных регионов. В настоящей работе установлено, что *L. crataegi* населяет только Западную Европу, *L. machulkai* встречается в Крыму, средней полосе и на юге европейской части России, на Кавказе, в северном Иране, восточной Турции и на западе Средней Азии. Описан новый вид *L. sergeevi* sp. nov. из азиатской части России, с территории от Урала до Дальнего Востока. Самцы *L. sergeevi* sp. nov. отличаются от таковых *L. crataegi* и *L. machulkai* эдеагусом: намного более широким, чем у *L. crataegi*, с максимальной шириной ближе к вершине, чем у *L. machulkai* (при рассмотрении с дорзальной стороны), и гораздо менее изогнутым, чем у обоих сравниваемых видов (при рассмотрении сбоку), задними голеньями, изогнутыми у середины длины, в то время как у обоих сравниваемых видов они изогнуты ближе к основанию. Скорректированы диагностические признаки группы видов *L. crataegi*, а также видов *L. crataegi* и *L. machulkai*. Даны цветные фотографии диагностических признаков и карта распространения всех видов.

**Key words:** leaf beetles, hawthorn leaf beetle, systematics, distribution, Coleoptera, Chrysomelidae, Galerucinae, *Lochmaea*, *Lochmaea crataegi* species-group, new species

**Ключевые слова:** жуки-листоеды, боярышниковый листоед, систематика, распространение, Coleoptera, Chrysomelidae, Galerucinae, *Lochmaea*, группа видов *Lochmaea crataegi*, новый вид

**ZooBank Article LSID:** 8DBEC936-FA54-42C0-8D30-23AC8346DC1E

## Introduction

*Lochmaea* Weise, 1883 is a genus of leaf-beetles distributed throughout the Palaearctic region, ranging from North Africa, Spain, and the Near East to the Russian Far East, Mongolia, China, and Nepal, as well as in the Oriental Region (India) (Kimoto, 1979; Takizawa, 1990; Beenen, 2024). The diagnosis of the genus was provided by Weise (1883), Laboissière (1912, 1934), Ogloblin (1936); Gressitt & Kimoto (1963), Mohr (1966), Medvedev (1992), Kimoto & Takizawa (1994, 1997), Warchałowski (2003), Bieńkowski (2004), Medvedev & Sprecher-Uebersax (2005), and Yang et al. (2015). The genus *Lochmaea* currently includes 15 recognised species (Lee, 2019). The subgeneric classification has not been developed. Bezděk (2004) established the *L. crataegi* species-group, which encompasses *L. crataegi* (Forster, 1771), *L. limbata* Pic, 1898, *L. machulkai* Roubal, 1926, and *L. setulosa* (Sahlberg, 1913).

For a long time, *L. crataegi* was considered widespread in Europe and Asia, with several names recognised as its synonyms (e.g., Ogloblin, 1936; Warchałowski, 2003). Bezděk (2004) found that *L. crataegi* is not present in eastern Turkey, Iran, or the Caucasus, and the distinct species *L. machulkai* is distributed in the Russian Caucasus, Georgia, Armenia, Azerbaijan, northern Iran, and eastern Turkey. Additionally, two other species, *L. limbata* and *L. setulosa*, inhabit Turkey, Israel, Jordan, and Iran. Gök et al. (2006) synonymised *L. limbata* and *L. setulosa*. Ghahari & Beenen (2020) expanded the range of *L. limbata* to include Syria.

In Kazakhstan, Siberia, the Far East, China, and Mongolia, the *L. crataegi* species-group is believed to be represented solely by *L. crataegi* (Medvedev, 1982, 1992; Medvedev & Dubeshko, 1992; Warchałowski, 1994; Lopatin, 2010; Yang et al., 2015). This species-group is not found in Korea, Japan, and Taiwan (Kimoto & Takizawa, 1994; Lee & An, 2001; Lee, 2019).

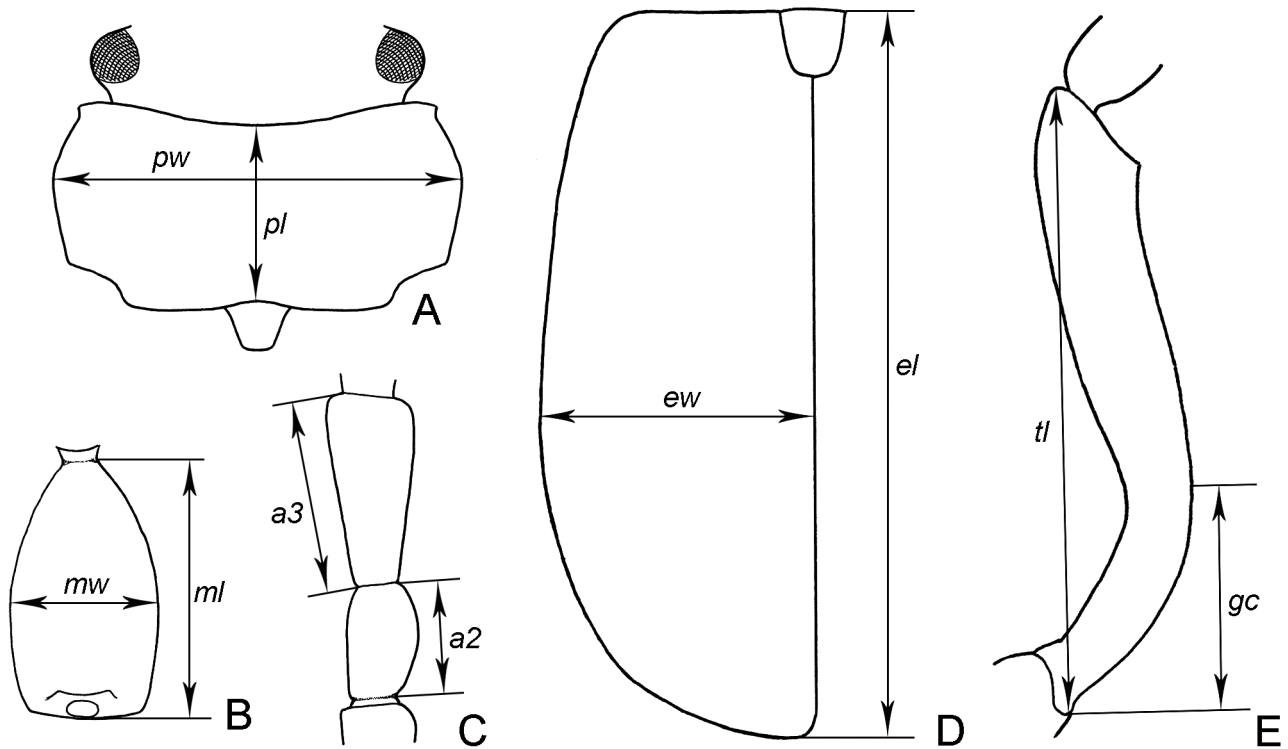
The present study continues the taxonomic examination of the *L. crataegi* species-group, which was initiated by Bezděk (2004) and Gök et al. (2006). I will not consider *L. limbata* in this study, as this species has a limited distribution in Asia Minor and the Near East and has been thoroughly investigated recently (Gök et al., 2006), and will

focus on the other species that inhabit Europe, the Caucasus, Siberia, and the Far East.

## Material and methods

Material, including the type specimens, has been examined from the following museums (with the names of curators in brackets) and private collections:

- BC – author's collection, Zelenograd, Russia;
- EIC – E.V. Il'ina collection, Makhachkala, Russia;
- FSC – Federal Scientific Centre for Biodiversity of Terrestrial Biota of East Asia, Vladivostok, Russia (M.E. Sergeev);
- IFAPA – Instituto Andaluz de Investigación y Formación Agraria y Pesquera, Málaga, Spain (J.M. Vela);
- IGEB – Institute of General and Experimental Biology, Ulan-Ude, Russia (S.G. Rudykh);
- ISE – Institute of Systematics and Ecology, Novosibirsk, Russia (A.A. Legalov);
- ISU – Irkutsk State University, Irkutsk, Russia (V.G. Shilenkov);
- KC – A. Kopetz collection, Erfurt, Germany;
- KU – Kiel University, Kiel, Germany (M. Kuhlmann);
- KZM – Kaunas Tadas Ivanauskas Zoological Museum, Kaunas, Lithuania (V. Tamutis);
- LS – Linnean Society of London, London, United Kingdom (A. Deneau);
- MC – S.A. Mosyakin collection, Simferopol, Crimea;
- NHM – Natural History Museum, London, United Kingdom (M. Geiser and D. Tel'nov);
- OC – N.V. Okhrimenko collection, Krasnodar, Russia;
- RC – P.V. Romantsov collection, St Petersburg, Russia;
- RIC – R.N. Ishin collection, Tambov, Russia;
- SC – E.V. Sergeeva collection, Tobolsk, Russia;
- VNIIKR – All-Russian Centre for Plant Quarantine (VNIIKR) (S.A. Kurbatov);
- YuFU – Yuzhnyy Federal University, Rostov-on-Don, Russia (E.A. Khachikov);
- ZIN – Zoological Institute of the Russian Academy of Sciences, St Petersburg, Russia (A.G. Moseyko);
- ZMMU – Zoological Museum of Moscow State University, Moscow, Russia, (V.Yu. Savitsky).



**Fig. 1.** *Lochmaea crataegi* species-group, male, measurements. **A**, pronotum; **B**, first metatarsomere; **C**, second and third antennomeres; **D**, left elytron; **E**, left metatibia. Abbreviations: *a2* – length of second antennomere, *a3* – length of third antennomere, *ew* – width of elytron, *el* – length of elytron, *gc* – distance from base to point of greatest curvature, *ml* – length of metatarsomere, *mw* – width of metatarsomere, *pl* – length of pronotum along middle, *pw* – width of pronotum, *tl* – length of metatibia.

The studied material for each species is listed alphabetically by the names of countries and regions.

All available males and several females were dissected, and their genitalia were mounted and examined. The terminology for female genitalia follows Li & Liang (2018).

Microscopic photographs were obtained using a Hitachi TM4000 scanning electron microscope.

To search for external diagnostic characters of the species, I selected both characters that exhibited significant variation during the preliminary examination of the material and those noted by Bezděk (2004) as distinguishing characters for *L. crataegi* and *L. machulkai*.

**External morphological characters.** Metric characters (1–7) were examined under a stereomicroscope equipped with a measuring eyepiece. The measurements are presented in Fig. 1. The scale division value for characters 3, 4, 6, and 7 is 0.01 mm, while for the other measurements, it is 0.10 mm.

1. The body length is measured from the anterior margin of the clypeus to the apex of the elytra. This measurement is less precise than the length of the elytra itself, as it is influenced by the relative positions of the head, pronotum, and elytra.

2. Body elongation is defined as the ratio of the body length to the maximum width of both elytra in dorsal view.

3. The length ratio of antennomere 3 to antennomere 2. Antennomere 2 is measured from the apical margin to the basal constriction. Antennomere 3 is measured along the outer side, which is slightly longer than the inner side.

4. The shape of the pronotum is characterised by its width-to-length ratio. Length is measured along the middle from the anterior margin to the posterior margin, while width is measured at the widest part of the pronotum.

5. Elytron elongation is defined as the ratio of the length along the suture to the maximal width of both elytra. The length is measured from the base to the apex.

6. The distance from the base of the metatibia to the point of greatest curvature in relation to the total length of the tibia.

7. The shape of the first metatarsomere 1 (length-to-width ratio) is characterised by measuring the length of the tarsomere without including the basal articulation.

8. Colour of antennomeres 2–11: (1) antennomeres 2–4 (or 2–5) are red, while antennomeres 5–11 (or 6–11) are black; (2) antennomeres 2–5 (or 2–6) are black with a red base, and antennomeres 6–11 (or 7–11) are black.

9. The colour of the pronotum: (1) red; or (2) red with a black pattern.

10. The colour of the scutellum: (1) light red; (2) dark red; or (3) black.

11. The colour of the elytron: (1) red; (2) red with diffuse darkening; (3) red with a distinct black stripe on the disc; or (4) red with a distinct black stripe on the disc and a short, narrow black stripe near the scutellum.

12. The colour of the metafemur: (1) red; or (2) black.

13. The colour of the metatibia: (1) red; (2) red in the basal half and black in the apical half; or (3) black.

## Results and discussion

Order **Coleoptera**

Family **Chrysomelidae**

Subfamily **Galerucinae**

Genus ***Lochmaea*** Weise, 1883

***Lochmaea crataegi*** species-group

**Diagnosis** (after Bezděk, 2004, modified). Head, pronotum, scutellum, and elytra covered with sparse, short (0.05 mm), adpressed white setae. Pronotum with rounded lateral margins, elytral epipleura pubescent at whole surface. Male first metatarsomere slightly or moderately broadened, 1.33–2.50 times as long as broad. Aedeagus asymmetrical, narrow, narrowed at approximately midlength.

**Notes.** Recent authors (Brovdiy, 1973; Medvedev, 1992; Medvedev & Dubeshko, 1992; Warchałowski, 1994; Kimoto & Takizawa, 1997; Bieńkowski, 2004; Lopatin, 2010; Yang et al.,

2015) indicate the glabrous dorsal surface of the body as a diagnostic character of the genus *Lochmaea*. In fact, the dorsal surface is entirely covered with very short, sparse setae, which become clearly visible under high magnification (approximately 50×). On the pronotum, the seta is situated in the centre of each puncture (Fig. 5D); on the elytron, it is positioned on the anterior edge of each puncture (Fig. 5E). In keys, it is more accurate to state that “dorsum appearing glabrous at low magnification”, rather than simply “dorsum glabrous”.

The study of the aedeagus revealed the presence of three distinct morphological forms within the *Lochmaea crataegi* species-group, distributed across Eurasia, extending from Western Europe to the Far East. These forms can be clearly distinguished by characters whose range of variability does not overlap (Fig. 3). Consequently, these forms should be classified as separate species. The available material allows me to consider these forms as allopatric taxa (Fig. 6). The first species is known exclusively from Western, Central, and Southern Europe (Fig. 3A–C). I examined male specimens from Germany, the United Kingdom, Austria, Italy, Czechia, and Lithuania. All specimens from Crimea, the Donets upland (Veliko-Anadol’ forestry), the Caucasus, the central and southern regions of European Russia, and western Middle Asia belong to the second species (Fig. 3D–F). The third species is found in the Southern Ural, Siberia, and the Russian Far East (Fig. 3H–J).

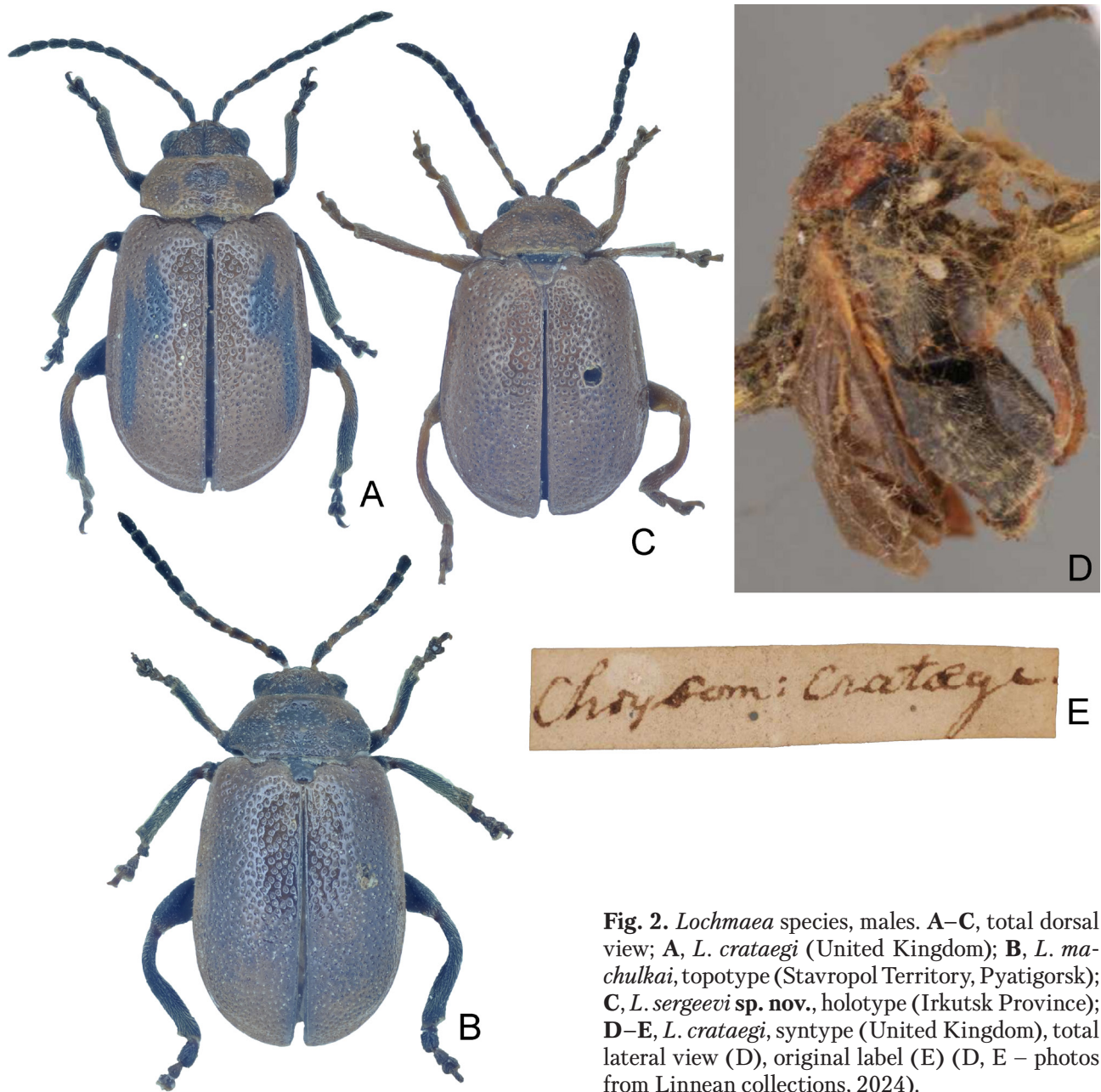
To clarify the nomenclatural status of the three aforementioned taxa, an analysis of the nominal taxa was conducted. The valid names, along with their chresonyms listed below according to Weise (1924), Bezděk (2004) Gök et al. (2006), and Beenen (2024), are arranged chronologically, and the type localities are cited in their original spelling.

***Lochmaea crataegi*** Forster, 1771

*Chrysomela crataegi* Forster, 1771: 28 [type locality: Anglia].

**Type specimens and deposition.** According to Forster (1771), the taxon was described based on specimens from various localities in England; however, a holotype was not designated. The whereabouts of J.R. Forster’s collection remains unknown (Horn & Kahle, 1935–1937). The material from





**Fig. 2.** *Lochmaea* species, males. **A–C**, total dorsal view; **A**, *L. crataegi* (United Kingdom); **B**, *L. machulkai*, topotype (Stavropol Territory, Pyatigorsk); **C**, *L. sergeevi* sp. nov., holotype (Irkutsk Province); **D–E**, *L. crataegi*, syntype (United Kingdom), total lateral view (**D**), original label (**E**) (**D**, **E** – photos from Linnean collections, 2024).

Forster's collection has not been studied by anyone since and is considered lost. Nevertheless, it is known that in 1772, Forster sent some specimens of the species he described to C. Linnaeus. These specimens are regarded as types of Forster's taxa (Day & Fitton, 1977). One specimen in the Linnaeus collection (LS), obtained from Forster, can be considered as a syntype of *Chrysomela crataegi* (LINN 6853; Linnean collections, 2024). This specimen is a male, as indicated by the arc-shaped metatibia, which is characteristic of males (Fig. 2D, E). It corresponds to the original description,

which is unusually detailed for the 18th century (Forster, 1771).

**Note.** It was not possible to obtain permission to dissect the syntype. However, the external morphology of this male (characterised by the metatibiae that are strongly curved in the basal half and a body coloration that is red with a black pattern, including a spot on the pronotum, a stripe on the elytra, and black markings on the sternites of the thorax and abdomen, as well as on the femora and tibiae excluding their bases) suggests that it is the sole representative of the *L. crataegi* species—

group, which is found in Western, Central, and Southern Europe (Figs 2A, 3A–C). All records from these regions, including original photographs and drawings of aedeagi, pertain to this taxon (Cobos, 1955; Mohr, 1966; Beenen, 1996; Lompe, 2002; Warchałowski, 2003; Bezděk, 2004).

*Crioceris sanguinea* Fabricius, 1775: 119 [type locality: Halae Saxonum].

*Type specimens and deposition.* Fabricius (1775) indicated the deposition as “Dom. Schaller.” Schaller’s collection is now lost (Horn & Kahle, 1935–1937). Zimsen (1964) lists a specimen labeled *C. sanguinea* in the Fabrician collection in Kiel; however, this specimen does not match the original description. It has black elytra adorned with three yellow spots (M. Kuhlmann [KU], pers. comm.). No additional specimens of *C. sanguinea* are found in the Fabrician collection in Kiel.

*Note.* The original description by Fabricius (1775) is very brief and does not allow for the definitive identification of *C. sanguinea* as a certain species within the *L. crataegi* species-group: “ovata, rufa, antennis oculisque nigris”; “Abdomen nigrum, pedes cinerei”. However, the designation of a neotype is unnecessary, as the only recognised taxon, *L. crataegi*, is known to occur in Western and Central Europe, including Germany.

*Chrysomela sanguineo-rubra* Goeze, 1777: 326 [type locality: Environs de Paris (Geoffroy, 1762)].

*Type specimens and deposition.* The collection by L.E. Geoffroy is housed in the Muséum National d’Histoire Naturelle in Paris, France (Horn & Kahle, 1935–1937).

*Note.* The new name was proposed by Goeze (1777) without a description, but with the indication: “Geoffr. Ins. Tom. 1. p. 253. Galeruca 2. La Galeruca sanguine.” This refers to the name *Galeruca sanguineo-rubra* Geoffroy, 1762. Therefore, the name *Ch. sanguineorubra* Goeze, 1777 is available according to Article 12.2.1 of the International Code of Zoological Nomenclature (ICZN, 1999), despite the fact that the species rank names in Geoffroy (1762) are rejected for nomenclatural purposes (ICZN, 1954).

The description provided by Geoffroy (1762) is very brief. It primarily includes colour characters (dorsum red, eyes and ventral side black) and does not allow for the definitive identification of *Ch. sanguineorubra* as a specific taxon within the *L. crataegi* species-group. However, this taxon is clearly conspecific with *L. crataegi*, which is the only valid taxon within the *L. crataegi* species-group, known from Western Europe, including France.

*Galleruca binotata* Duftschmid, 1825: 222 [type locality: Wien (Duftschmid, 1825)].

*Type specimens and deposition.* The collection by C. Duftschmid has been integrated into the Linz Museum (Austria); however, the type specimens cannot be located within this collection due to the loss of the original labels (Gusenleitner, 1984). The designation of a neotype is unnecessary because the specimens from Austria, as well as those from across Central Europe, belong to *L. crataegi*.

*Galleruca femoralis* Duftschmid, 1825: 225 [type locality: Wien].

*Type specimens and deposition* (see *Galleruca binotata*).

*Galleruca tibialis* Duftschmid, 1825: 224 [type locality: Wien].

*Type specimens and deposition* (see *Galleruca binotata*).

*Adimonia pallida* Joannis, 1865: 77 [type locality: Banat, Mehadia; junior secondary homonym of *Crioceris pallida* Herbst, 1783 (junior subjective synonym of *Lochmaea caprea* Linnaeus, 1758)].

*Type specimens and deposition.* The current deposition of the beetles collected by L. de Joannis is unknown.

*Note.* The original description by Joannis (1865) includes a combination of characters that allow this taxon to be considered conspecific with *L. crataegi*: antennomeres are black in the apical half and red in the basal half, and the metatibiae are strongly curved in the basal third.

*Lochmaea crataegi* var. *nigronotata* Pic, 1912: 90 [type locality: Italie].

*Type specimens and deposition.* The syntypes are deposited in the Muséum National d’Histoire Naturelle (Paris, France).

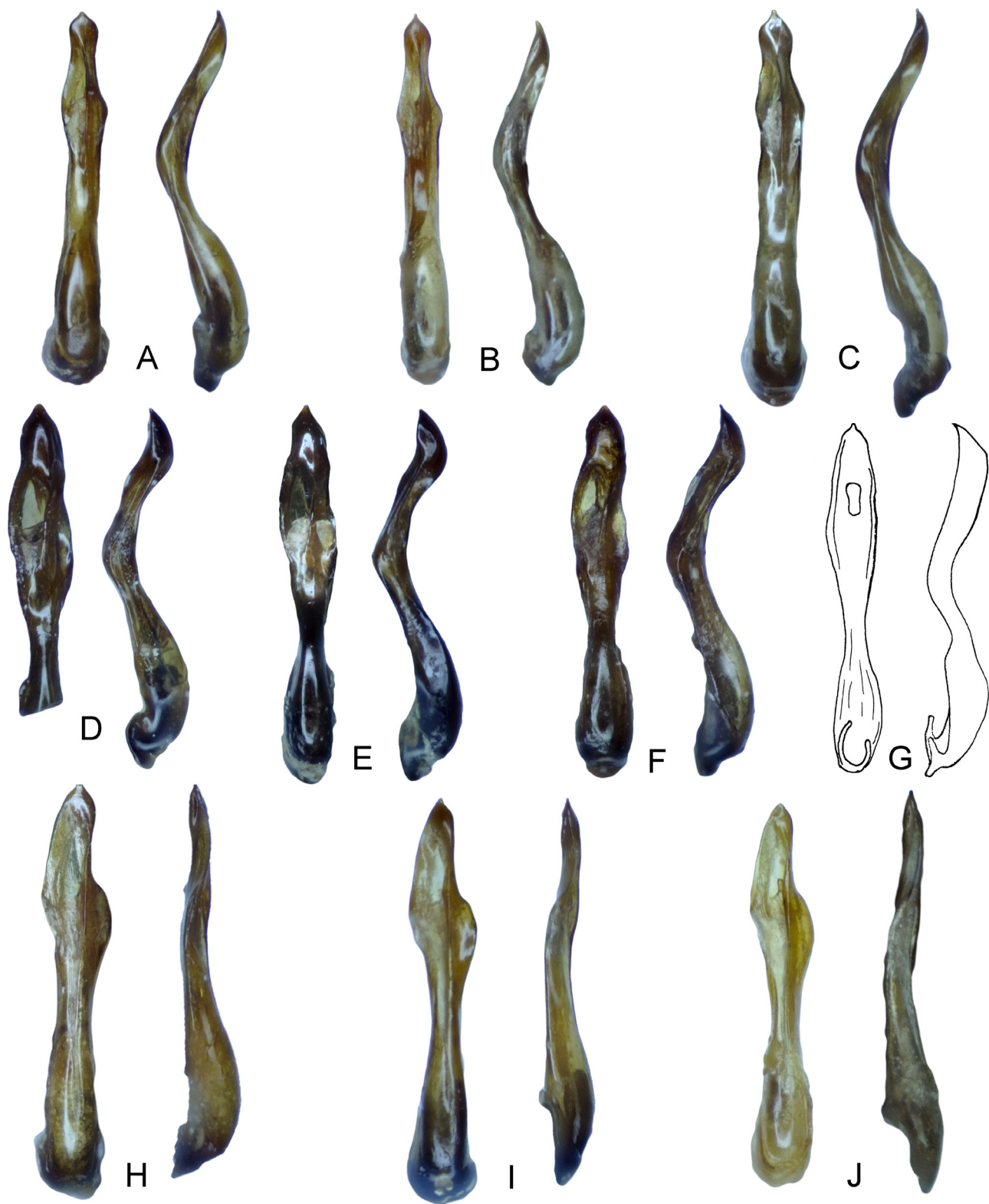
*Note.* The original description by Pic (1912) includes colour characters (each elytron with two black stripes), which allow for the consideration of this taxon as conspecific with *L. crataegi*.

*Lochmaea crataegi* var. *orientalis* Weise, 1924: 80 [new name for *Adimonia pallida* Joannis, 1865, nec *Crioceris pallida* Herbst, 1783].

*Lochmaea crataegi* var. *lineata* Pic, 1927: 7 [type locality: France: Riom].

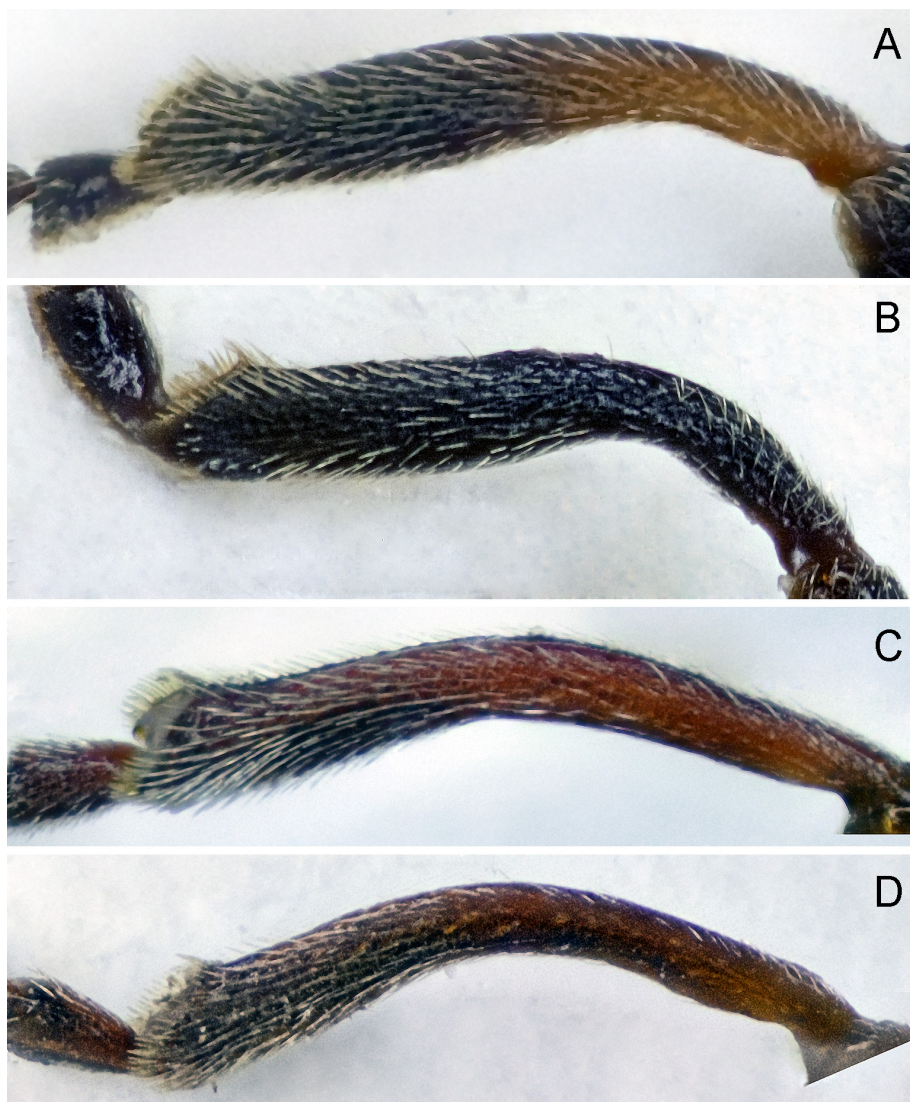
*Type specimens and deposition.* The syntypes are deposited in the Muséum National d’Histoire Naturelle (Paris, France).

*Note.* The original description by Pic (1927) includes colour characters, specifically that each elytron has one abbreviated black stripe, which al-



**Fig. 3.** *Lochmaea crataegi* species-group, aedeagus in dorsal and lateral views. **A**, *L. crataegi* (Austria); **B**, *L. crataegi* (United Kingdom); **C**, *L. crataegi* (Germany); **D**, *L. machulkai*, topotype (Stavropol Territory, Pyatigorsk); **E**, *L. machulkai* (Lipetsk Province); **F**, *L. machulkai* (Rostov Province); **G**, *L. machulkai*, after Iablokoff-Khnzorian (1966) under the name *L. crataegi*; **H**, *L. sergeevi* **sp. nov.**, holotype (Irkutsk Province); **I**, *L. sergeevi* **sp. nov.**, paratype (Yakutia); **J**, *L. sergeevi* **sp. nov.**, paratype (Southern Ural).





**Fig. 4.** *Lochmaea crataegi* species-group, male metatibia. **A**, *L. crataegi* (United Kingdom); **B**, *L. machulkai*, topotype (Stavropol Territory, Pyatigorsk); **C**, *L. sergeevi* sp. nov., paratype (Southern Ural); **D**, *L. sergeevi* sp. nov., holotype (Irkutsk Province).

low for the consideration of this taxon conspecific with *L. crataegi*.

*Lochmaea crataegi* ab. *obscura* Laczó, 1928: 8 [type locality: Bratislava; unavailable name].

*Type specimens and deposition.* Unknown to me.

*Note.* This name was originally published specifically for the infrasubspecific entity, using the term “aberration”, and is therefore unavailable according to Article 45.6.2 of the International Code of Zoological Nomenclature (ICZN, 1999). The unavailability of this name was noted by Beenen (2024).

*Lochmaea crataegi* ab. *flavus* Donisthorpe, 1934: 231 [type locality: United Kingdom: New Forest, Windsor Forest; unavailable name].

*Type specimens and deposition.* The holotype was not designated in the original publication (Donisthorpe, 1934). The collection by Donisthor-

pe, which includes the type specimens of the taxa he described, is deposited at the NHM.

*Note.* This name was originally published specifically for the infrasubspecific entity, using the term “aberration”, and is therefore unavailable according to Article 45.6.2 of the International Code of Zoological Nomenclature (ICZN, 1999). Wilcox (1971) synonymised it with *L. crataegi*. The unavailability of this name was noted by Beenen (2024).

### ***Lochmaea limbata* Pic, 1898**

*Lochmaea limbata* Pic, 1898: 93 [type locality: Syrie: Akbès (Pic, 1898)].

*Type specimens and deposition.* The type material is deposited in the Muséum National d’Histoire Naturelle (Paris, France) and is significantly damaged (J. Bezděk, pers. comm.).



*Galerucella setulosa* J.R. Sahlberg, 1913: 76 [type locality: in vicinitate Hierosolymorum].

*Type specimens and deposition.* The taxon was originally described from a single female (Sahlberg, 1913). The holotype is deposited in the Zoological Museum at the University of Helsinki, Finland, and was examined by Bezděk (2004).

### ***Lochmaea machulkai* Roubal, 1926**

*Lochmaea machulkai* Roubal, 1926: 246 [type locality: Pjatigorsk and Teberda (as per the original description by Roubal, 1926); Pjatigorsk (following the lectotype designation by Bezděk, 2004)].

*Type specimens and deposition.* The lectotype and two paralectotypes were designated by Bezděk (2004) and are deposited in the Slovak National Museum (Bratislava, Slovakia).

*Note.* The original figure by Iablokoff-Khnzorian (1966: fig. 4A), titled “*L. crataegi*” and apparently based on material from Armenia, actually pertains to *L. machulkai*.

## **Interpretation of the names**

A valid name for the species inhabiting Western, Central, and Southern Europe is *L. crataegi*. The name of this taxon is the senior synonym of the names of all other taxa described from these regions: *Adimonia pallida*, *Chrysomela sanguine-orubra*, *Crioceris sanguinea*, *Galleruca binotata*, *G. femoralis*, *G. tibialis*, *Lochmaea crataegi* var. *lineata*, *L. crataegi* var. *nigronotata*, and *L. crataegi* var. *orientalis*.

All the type specimens of *L. machulkai* are females. They are morphologically indistinguishable from the females of *L. crataegi*; these taxa differ solely in the characters of the males (Bezděk, 2004). However, across the entire Caucasus region, including the type locality of *L. machulkai* (Pyatigorsk city), males of only one taxon of the *L. crataegi* species-group are known, which can therefore be identified as *L. machulkai*; all known males from Crimea, the Donets upland, the central and southern regions of European Russia, and western Middle Asia belong to this same taxon (Figs 3D–F, 4B).

No taxon from the *L. crataegi* species-group has been described from the Asian part of Russia. Only one taxon, *Adimonia caprea* var. *cribrata* Solsky 1872, has been described from Siberia, presumably from the vicinity of Lake Baikal (Solsky,

1872), which is currently classified under the genus *Lochmaea*. This taxon is presently regarded (Beenen, 2024) as a junior synonym of *L. caprea*. The type specimens have been lost from ZIN, where S. Solsky's collection was housed (A.G. Moseyko, pers. comm.). The original description of *A. caprea* var. *cribrata* is very brief, but includes a notable colour character: only the apices of the femora are rufous (Solsky, 1872). It is evident that the femurs, except for the apices, are black, which is typical of *L. caprea*. In contrast to *L. caprea*, all available males and females of the *L. crataegi* species-group from the Asian part of Russia exhibit legs that are entirely rufous.

Taxa belonging to the genus *Lochmaea*, described from China [*L. huanggangana* (Yang et Wang, 1998)], Taiwan (*L. lesagei* Kimoto, 1996, *L. smetanai* Kimoto, 1996, *L. cheni* Lee, 2019, *L. jungchani* Lee, 2019, and *L. tsoui* Lee, 2019), India (*L. maculata* Kimoto, 1979 and *L. singalilaensis* Takizawa, 1990), Nepal (*L. nepalica* L. Medvedev, 2005), exhibit distinct differences from the members of the *L. crataegi* species-group (Kimoto, 1979, 1996; Takizawa, 1990; Yang et al., 1998; Medvedev, 2005; Lee, 2019).

Therefore, all specimens of the *L. crataegi* species-group from the Southern Ural, Siberia, and the Russian Far East belong to a new species, which is described below. The holotype of the new species is deposited in ZIN.

## **Description of the new species**

### ***Lochmaea sergeevi* sp. nov.**

(Figs 2C, 3H–J, 4C, D, 5A–C)

*Holotype.* Male, **Russia**, *Irkutsk Prov.*, Padun Vill. at Verkhnyaya Tunguska River [presently, Padun is a district of Bratsk city; Verkhnyaya Tunguska is an old name for the lower reaches of Angara River], 1867, A. Czekanowski leg. (ZIN).

*Paratypes.* **Russia:** *Altai Terr.*, Barnaul, 23.V.1923, E.G. Rodd leg., 1 male (ZIN); Oirot-Tura [Gorno-Altaysk], 10.V.1940, 1 male (ZIN); *Altai Republic*, environs of Teletskoye lake, birch-aspen forest, 23.V.1970, M.M. Dolgin leg., 1 male (ISE); *Amur Prov.*: Blagoveshchensk, 1 male (ZIN); Blagoveshchensk Distr., Natal'ino Vill., on *Betula* and *Salix*, 5.VI.1975, V.N. Kuznetsov leg., 1 male (FSC); 100 km W of Svobodny, Samodon, 4.VIII.1959, I.M. Kerzhner leg., 1 male (ZIN); same locality, *Ulmus propingua* forest, 7.VIII.1959, Zi-

**Table 1.** Metric characters of the males of *Lochmaea* spp.

Characters		Species		
		<i>L. crataegi</i> n = 10	<i>L. machulkai</i> n = 46	<i>L. sergeevi</i> sp. nov. n = 55
1. Body length (mm)	min–max	3.60–5.30	4.50–5.80	4.10–5.40
	mean value ± standard error	4.50±0.10	5.00±0.10	4.70±0.10
2. Body elongation (length / width)	min–max	1.70–2.00	1.60–2.00	1.50–2.00
	mean value ± standard error	1.80±0.10	1.80±0.10	1.70±0.10
3. Length ratio: antenno- meres 3 / 2	min–max	1.64–2.00	1.50–2.00	1.33–1.93
	mean value ± standard error	1.79±0.03	1.79±0.02	1.68±0.02
4. Shape of pronotum (width / length).	min–max	1.94–2.16	1.87–2.19	1.91–2.18
	mean value ± standard error	2.03±0.03	2.06±0.01	2.03±0.01
5. Elytron elongation (length / width)	min–max	1.30–1.50	1.30–1.60	1.20–1.60
	mean value ± standard error	1.40±0.10	1.40±0.10	1.40±0.10
6. Distance from base of metatibia to point of greatest curvature / total length of tibia	min–max	0.33–0.40	0.30–0.41	0.44–0.61
	mean value ± standard error	0.38±0.01	0.36±0.01	0.50±0.01
7. Shape of first metatar- somere (length / width)	min–max	1.27–1.67	1.33–2.00	1.50–2.50
	mean value ± standard error	1.45±0.04	1.60±0.02	1.91±0.03

noviev leg., 1 male (ZIN); 100 km W of Svobodny, Korsakovo, 25.VII.1959, I.M. Kerzhner leg., 1 male (ZIN); same locality, on *Malus*, 25.VII.1959, Zinoviev leg., 1 male (VNIKR); *Republic of Buryatia*, Kabansky Distr., environs of Bolshoye Kolesovo Vill., 52°06'29"N 106°33'15"E, on *Padus*, 11.VI.1971, A. Mikhailov leg., 2 males (IGEB); *Chelyabinsk Prov.*: Miass, directorate of Il'mensky Nature Reserve, on *Padus*, 9.VIII.2000, P.V. Rudoiaskatel' leg., 1 male (BC); *Irkutsk Prov.*, Irkutsk, V. Jakovlev leg., 1 male (ZIN); Irkutsk, Kayskaya Gora, 25.VII.1912, Kine leg., 1 male; Irkutsk, 9.VI.1912, S. Rodionoff leg., 1 male (ZIN); same locality, 23.VI.1912, S. Rodionoff leg., 1 male (ZIN); same locality, 28.VIII.1916, S. Rodionoff leg., 1 male (ZIN); same locality, 4.VI.1917, S. Rodionoff leg., 1 male (ZIN); same locality, collector unknown, 1 male (ZIN); Irkutsk, city park [Gagarin Boulevard], on *Crataegus*, 13.V.1941, V. Tomilova leg., 3 males (ISU); Irkutsk, botanical garden, on *Crataegus*, 13.V.1941, V. Tomilova leg., 1 male (ISU); Irkutsk, Leninsky city distr., on *Crataegus*, 6.VIII.1974, Epova leg., 2 males (ISU); Irkutsk Distr., Kashtak Vill., 7.VIII.1916, S. Rodionoff leg., 1 male (ZIN); Padun Vill. at Verkhnyaya Tunguska River [see data for holotype], 1867, Czekanowski leg., 3 males (ZIN); Shelekhov city, on *Crataegus*, 29.VII.1974, Parshina leg., 1 male (ISU); *Jewish Autonomous Prov.*, Dichun Vill., 10.V.1974, 1 male (BC); *Khabarovsk Terr.*: Amur River valley,

48°N 131°E, 6.V.1974, S. Alekseev leg., 1 male (ZMMU); Nikolaevskiy Distr., Ozerpakh Vill., Amur River estuary, 13.VI.1915, Chernavin leg., 1 male (ZIN); same locality, 14.VI.1915, Chernavin leg., 1 male (ZIN); *Krasnoyarsk Terr.*, Shushenskiy Distr., Lensk Vill., forest edge, 18.V.1980, 1 male (ISU); *Primorskiy Terr.*: Vladivostok, IX.1876, Khristoff leg., 1 male (ZIN); Vinogradovka Vill., 14.V.1929, Djakonov & Filipjev leg., 1 male (ZIN); Odarkovskiy Zavod [Spasskoe Vill.], 26.IV.1911, A. Czerski leg., 2 males (ZIN); Partizansk Distr., Tigrovoy Vill., 320–367 m a.s.l., 43°10'44"N 132°52'59"E – 43°9'30"N 132°51'20"E, 29.VII.2022, P.V. Romantsov leg., 1 male (RC); Shkotovo Distr., environs of Anisimovka Vill., 260 m a.s.l., 43°10'52"N 132°45'50"E – 43°11'13"N 132°45'06"E, 23.VII.2022, A.S. Prosvirov leg., 3 males (RC); Terney Distr., 30 km NE from Plastun, Kynaleyka River floodplain, 4.V.2023, M.E. Sergeev leg., 2 males (FSC); Chernigovka Distr., 10 km E of Chernigovka Vill., 17.V.1974, A.S. Lelei leg., 1 male (FSC); Suputinskiy Reserve [Ussuriyskiy Reserve], 13.V.1948, 1 male (FSC); *Zabaykalskiy Terr.*: environs of Chita, 8.VI.1925, Vinogradov leg., 1 male (ZIN); environs of Shilka City, Shilka River floodplain, 31.V.1959, collector unknown, 1 male (ZIN); *Tyumen' Prov.*, Tobolsk, 33,58°09'65"N 68°17'04"E, 20.V.2018, E.V. Sergeeva leg., 1 male (SC); *Republic of Sakha (Yakutia)*: Yakutsk, 17.VI.1927, Moskvina leg., 1 male (ZIN); same locality,

**Table 2.** Colour characters of the males of *Lochmaea* spp. (percentages of specimens within a sample of each species, that exhibit the corresponding state of the character).

Characters		Species		
		<i>L. crataegi</i> n = 10	<i>L. machulkai</i> n = 46	<i>L. sergeevi</i> sp. nov. n = 55
8. Antennomeres 2–11	2–4 (or 2–5) red, 5–11 (or 6–11) black	–	–	65%
	2–5 (or 2–6) black with base red, 6–11 (or 7–11) black	100%	100%	35%
9. Pronotum	red	20%	30%	65%
	red with black pattern	80%	70%	35%
10. Scutellum	light red	40%	20%	96%
	dark red	30%	14%	4%
	black	30%	66%	–
11. Elytron	red	20%	75%	96%
	red with diffuse darkening	–	25%	4%
	red with distinct black stripe on disc	20%	–	–
	red with distinct black stripe on disc and short narrow stripe near scutellum	60%	–	–
12. Metafemur	red	–	11%	100%
	black	100%	89%	–
13. Metatibia	red	–	14%	100%
	red in basal half, black in apical half	100%	14%	–
	black	–	72%	–

Yurinsky leg., 1 male (ZIN); same locality, 1901, Olenin leg., 1 male (ZIN); same locality, collector unknown, 1 female (ZIN); environs of Yakutsk, Tabaginskiy Cape, floodplain larch forest, 30.V.1974, V.N. Kuznetsov leg., 5 males, 4 females (ZIN); mouth of Aldan River, Khomurgan forestry, Arbyn, 63°22'N 129°38'E, 1.VII.1926, L. Biachi leg., 2 males; *uncertain localities*: W Siberia, Kolb leg. (A.P. Semenov-Tian-Shanskij coll.), 1 male (ZIN); Siberia, 1888, 1 male (ZIN); SW Altai, 1.VI.1930, 1 male, 1 female (ZIN).

**Description.** *Male (holotype)* (Fig. 2C). Body rufous including legs, with black eyes, antennomere 1 dorsally, antennomeres 2–5 apically, antennomeres 6–11 entirely, prosternum, prothoracic hypomeron (partly), ventral sides of meso- and metathorax, coxae, abdominal sternites 1–3 entirely, sternite 4 laterally. Body 4.5 mm long, 1.65 times as long as wide, shining dorsally, without microreticulation. Head, pronotum, scutellum

and elytra covered with sparse, short (0.05 mm), adpressed white setae; each seta beginning from funnel-shaped puncture. Frontal tubercles convex, triangular, smooth, shining, separated from each other by narrow deep furrow. Vertex covered with very dense, large (0.05 mm) punctures, with intervals five times narrower than punctures. Antennomere 3 1.57 times as long as antennomere 2.

Pronotum 2.07 times as wide as long, with arcuate lateral margins. Anterior and posterior angles projecting, with long seta. Lateral impressions wide, deep; medial impression narrow, shallow. Pronotum covered with dense, large (0.06 mm), unevenly distributed punctures. Anterior coxal cavities opened posteriorly.

Each elytron 2.62 times as long as wide, with large, projecting humeral callus, with narrow longitudinal convexity along lateral margin. Elytron



covered with dense, irregular, large (0.05–0.06 mm) punctures, being distributed more or less evenly, with intervals approximately equal to diameter of punctures at disc. Elytral epipleura completely covered with dense setae.

Hind wings of normal length.

Metatibia strongly curved at mid-length (Fig. 4D). Ratio of distance from base to point of greatest curvature to total length of tibia 0.54. Mesotibia with short apical spur (Fig. 5A), others without spur.

Metatarsomere 1 narrow, 1.64 times as long as wide. Tarsal claws bifid.

Last abdominal sternite with large rounded discal impression.

Aedeagus 2.1 mm long, asymmetrical in dorsal view, with elongated apex. In dorsal view, maximum width of aedeagus at distance of 0.3 length from apex. In lateral view, aedeagus slightly S-shaped, almost straight (Fig. 3H).

**Variability.** Males (paratypes) 4.1–5.4 mm long.

**Female (paratypes)** 4.9–5.3 mm long, with metatibia almost straight, abdominal sternites 1–3 or 1–4 black, last sternite convex, without discal impression, with slightly emarginate apical margin. All tibiae without apical spur. Female genitalia: spermatheca as on Fig. 5B, abdominal sternite 8 with spiculum gastrale (Fig. 5C, sg) and ovipositer sclerites (Fig. 5C, os).

**Comparison.** The males of the new species differ from those of *L. crataegi* and *L. machulkai* in the structure of the aedeagus (Fig. 3H–J): in dorsal view, it is significantly wider than in *L. crataegi* (Fig. 3A–C), with the maximum width located closer to the apex compared to *L. machulkai* (Fig. 3D–G); in lateral view, it is much less curved than in both of the compared species (Fig. 3). In the males of the new species, the metatibia is curved near the middle of the length (Fig. 4C, D; Table 1), whereas in both of the compared species, it is curved closer to the base (Figs 2A, B, 4A, B; Table 1). Other external characters do not exhibit an interspecific hiatus; however, the new species consistently displays completely rufous femora and tibiae, while *L. machulkai* often has black femora and *L. crataegi* always has black femora and partially black tibiae (Table 2).

The results of the study on the external morphology of the male specimens are presented in Tables 1 and 2.

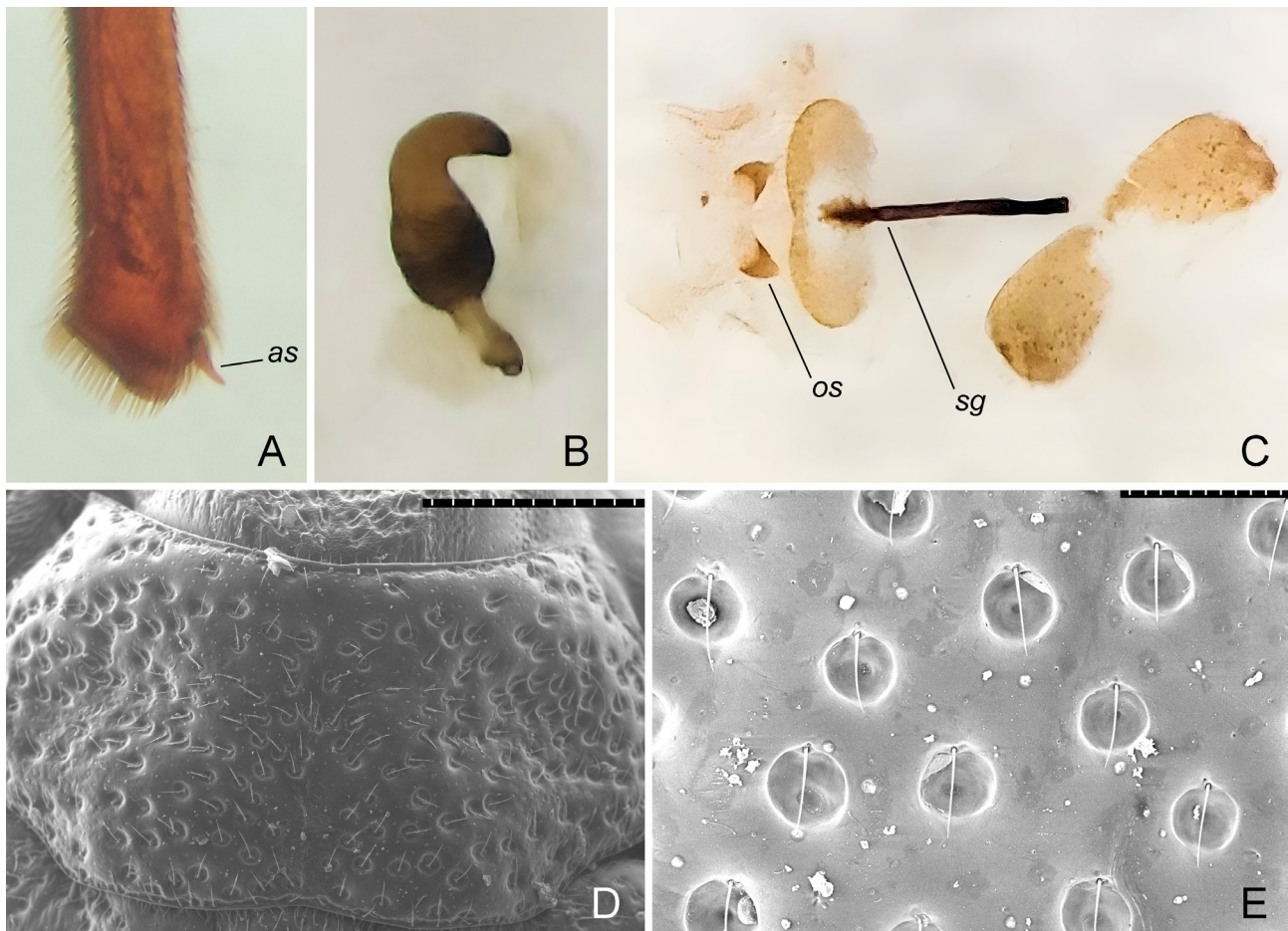
**Metric characters** (Table 1). Among the examined metric characters, the point of greatest curvature along the length of the tibia (character 6) shows distinct differences without overlapping the variability limits of *L. machulkai* and *L. crataegi* on one hand, and *L. sergeevi* sp. nov. on the other. In *L. machulkai* and *L. crataegi*, the greatest curvature is situated in the basal half of the tibia, whereas in *L. sergeevi* sp. nov., it is found near the middle of its length.

Using the Independent Samples T-Test demonstrates the reliability of the differences in mean values at a significance level of 0.05 for *L. machulkai* and *L. sergeevi* sp. nov. in the following characters: 1 (body length), 3 (length ratio: antennomere 3/2), 4 (pronotum width/length), and 7 (first metatarsomere length/width). However, the variability limits overlap, indicating that these characters cannot be used to distinguish between the two species. For the characters 2 (body length/width) and 5 (elytron length/width), no significant differences in mean values were observed.

According to Bezděk (2004), the males of *L. crataegi* and *L. machulkai* exhibit differences in the ratio of the lengths of their antennomeres. Specifically, the third antennomere is 1.5–1.6 times the length of the second in *L. crataegi*, while in *L. machulkai*, it is 1.7–2.0 times as long. However, this character is variable among *L. crataegi*, *L. machulkai*, and *L. sergeevi* sp. nov., and therefore does not serve as a distinguishing feature among these species.

**Colour characters** (Table 2). Among the colour characters, the most significant differences between *L. machulkai* and *L. sergeevi* sp. nov. are found in the coloration of the scutellum, metafemora, and metatibiae. However, none of these colour characters provide a definitive distinction between the species. In contrast, a clear difference between *L. crataegi* and *L. sergeevi* sp. nov. is observed in the coloration of the metafemora and metatibiae.

Medvedev (1992) and Medvedev & Dubeshko (1992) observed that the legs of males identified as *L. crataegi* from Siberia and the Far East, with the exception of the bases of the tibiae, are black. This observation is cited from Ogloblin's (1936) redescription of *L. crataegi*. However, this characterisation is inaccurate for all males within the *L. crataegi* species-group that inhabit Siberia and



**Fig. 5.** *Lochmaea sergeevi* sp. nov. (A–C) and *L. machulkai* (D–E). **A**, male, paratype (Irkutsk Province), apex of mesotibia; **B**, female, paratype (Yakutia), spermatheca; **C**, female, paratype (Yakutia), genitalia; **D**, pronotum; **E**, elytron. Abbreviations: *as* – apical spur, *os* – ovipositer sclerites, *sg* – sternite 8 with spiculum gastrale. Scale bars: 500 µm (D) and 100 µm (E).

the Far East, specifically those belonging to *L. sergeevi* sp. nov., which exhibit completely rufous legs. In contrast, the legs of males from the European and Caucasian populations of *L. crataegi* and *L. machulkai* are predominantly or entirely black.

**Etymology.** The new species is named in honor of the Russian entomologist Maxim E. Sergeev (Vladivostok), a specialist in leaf beetles, who provided significant assistance in my study of materials from Siberia and the Far East.

**Distribution.** Southern Ural, Siberia, the Russian Far East (Fig. 6).

**Host plants.** Table 3 presents the corrected data on the host plants for the *L. crataegi* species-group. Since *L. crataegi*, *L. machulkai*, and *L. sergeevi* sp. nov. are found to be allopatric, the data on the host plants must be adjusted to reflect the

regions where these species were observed. The available data indicate that all three species primarily feed on woody and shrubby members of the family Rosaceae, particularly *Crataegus* Tourn. ex L. and *Malus* Mill.

**Comments.** For Asian Russia, *L. sergeevi* sp. nov. was previously identified by Medvedev (1992) and Medvedev & Dubeshko (1992) as *L. crataegi*. The male of *L. sergeevi* sp. nov. was illustrated by Ogloblin (1936) under the name *L. crataegi* (the curved metatibiae at mid-length is a distinguishing feature of *L. sergeevi* sp. nov., which is not present in *L. crataegi* or *L. machulkai*). It is likely that *L. sergeevi* sp. nov. was also recorded under the name *L. crataegi* from northern and eastern Kazakhstan (Lopatin & Kulenova, 1986; Lopatin, 2010). However, the collection by I.K. Lopatin at

**Table 3.** Host plants of *Lochmaea* species.

Region	Species	Host plants	References
Great Britain	<i>L. crataegi</i>	<i>Crataegus oxyacantha</i>	Forster (1771)
Germany	<i>L. crataegi</i>	<i>Crataegus</i>	Reitter (1913)
Germany	<i>L. crataegi</i>	<i>Sorbus aucuparia</i>	Schmidt (1989)
Moldova	<i>L. crataegi</i> ? <i>L. machulkai</i> ?	<i>Crataegus, Malus, Prunus</i>	Calestru (2006)
Ukraine	<i>L. crataegi</i> ? <i>L. machulkai</i> ?	<i>Crataegus oxyacantha</i> , <i>Prunus moldavica</i> , <i>P. spinosa</i> , <i>P. stepposa</i>	Brovdiy (1971, 1973)
Crimea	<i>L. machulkai</i>	<i>Prunus stepposa</i>	Brovdiy (1971, 1973)
Crimea	<i>L. machulkai</i>	<i>Prunus spinosa</i>	S.A. Mosyakin, pers. comm.
N Caucasus	<i>L. machulkai</i>	<i>Prunus divaricata</i>	Dobrovolsky (1951)
Azerbaijan	<i>L. machulkai</i>	<i>Prunus domestica</i> , <i>P. spinosa</i> , <i>Rubus idaeus</i>	Samedov (1963)
Urals	<i>L. sergeevi</i> sp. nov.	<i>Malus</i>	Bogacheva & Zamshina (2017)
Siberia	<i>L. sergeevi</i> sp. nov.	<i>Crataegus</i>	Dubeshko & Medvedev (1989)
Altay Territory	<i>L. sergeevi</i> sp. nov.	<i>Malus baccata</i> , <i>M. prunifolia</i>	Bassel (1929)
Zabaykalskiy Territory	<i>L. sergeevi</i> sp. nov.	<i>Crataegus</i>	Korsun (2012)
Amur Province	<i>L. sergeevi</i> sp. nov.	<i>Crataegus, Malus</i>	Zaitsev & Medvedev (1974)

ZIN and the National Museum of Natural History (Washington, A.S. Konstantinov, pers. comm.) does not contain any specimens of the *L. crataegi* species-group from Kazakhstan. Additionally, there is no material from this species-group in the collection of the National Academy of Sciences of the Republic of Kazakhstan (S.V. Kolov, pers. comm.). Medvedev (1982) recorded *L. crataegi* from Mongolia (Eastern aimak, Numergin-Gol River) with reference to an article by Medvedev (1978). However, the mentioned article does not include a record of *L. crataegi*. I do not have any material from the *L. crataegi* species-group from Mongolia, and it is also absent from the collection of L.N. Medvedev (ZIN).

### Additional species examined

***Lochmaea crataegi*** (Forster, 1771)  
(Figs 2A, D, 3A–C, 4A)

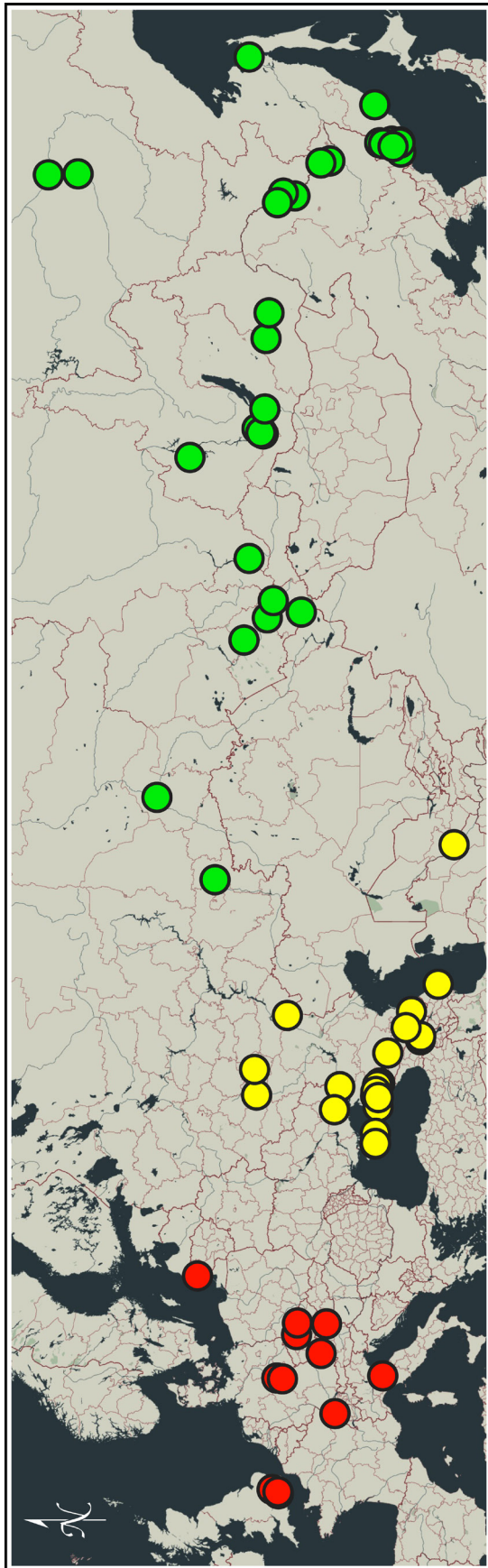
*Material examined. Syntype. United Kingdom*, 1 male (by photos, *Chrysomela crataegi* LINN 6853) (LS). *Non-type material. Austria*, without certain

locality, Müller leg., 1 male (ZIN). **Czech Republic:** *E Bohemia*: Chotovice, 13.IV.2000, J. Pelikán leg., 1 male (IFAPA); Žamberk, V.1951, Marek leg., 1 male (VNIKR). **Germany**: without certain locality, 1 male (ZMMU); *Baden-Württemberg*, Landkreis Lörrach, Istein, 4.V.1967, Gfeller leg., 1 male (ZIN); *Lower Bavaria*, Passau, J. Walzl leg., 1 male (ZIN); *Thuringia*: Erfurt, Schwellenburg, 7.V.1959, Marstaller leg., 1 male (KC); Kyffhäuser, Falkenburg, 8.V.1959, Marstaller leg., 1 male (KC). **United Kingdom: Essex**, Epping Forest, 11.IV.1948, A. Sculthorpe leg., 1 male (NHM); *Surrey*: Bookham, 6.V.1972, Russell & Ridout leg., 1 male (NHM); Chipstead, 51°18'26.2"N 0°10'47.6"W, 13.IV.2019, K. Matsumoto leg., 1 male (NHM). **Italy, Emilia-Romagna**, Bologna, Sasso Marconi city, Palazzo Rossi, 31.III.1994, L. Colacurcio leg., 1 male (IFAPA). **Lithuania, Klaipėda County**, environs of Palanga, Kunigiškiai, 55°59'22"N 21°5'49"E; 9.V.2001, Romas Ferenc leg.: 1 male (KZM).

***Lochmaea machulkai*** Roubal, 1926  
(Figs 2B, 3D–G, 4B)

*Material examined. Azerbaijan*, without certain locality, 15.V.1942, V. Romanova leg., 1 male (YuFU).





**Georgia:** *Kvemo Kartli*: Manglisi, 1880, G. Sivers coll., 9 males (ZIN); same locality, 24.VII.1881, G. Sivers coll., 1 male (ZIN); *Tbilisi*, Kodzhori, 6.V.1881, G. Sivers coll., 3 males (ZIN). **Russia:** *Republic of Adygea*: Maykop, Yuzhnye Sady, 25.IV.1925, V. Petrova leg., 1 male (YuFU); Teuchezhskiy Distr., Vochevshy Vill., 17.IV.1974, B.A. Korotyaev leg., 1 male (ZIN); *Chechen Republic*, environs of Itum-Kali Vill., VII.1989, G.M. Abdurakhmanov leg., 1 male (EIC); *Republic of Dagestan*, Tsudakhar, botanical garden of Russian Academy of Sciences, 16.VII.2014, E.V. Il'ina leg., 1 male (EIC); *Krasnodar Terr.*: Afipskiy Vill., Afips River valley, 26.VI.1971, V. Vorontsova leg., 1 male (OC); Belorechensk, VI.1951, collector unknown, 1 male (ZIN); same locality, 26.VI.1951, 3 males (ZMMU); Novorossiysk, 1 male (ZMMU); environs of Krasnodar, Krepostnaya Vill., 2.VII.2005, N.V. Okhrimenko leg., 1 male (OC); *Lipetsk Prov.*: Zadonskiy Distr., 30 km E Elets, Morozova Gora Forerstry, Don River valley, on *Prunus spinosa*, 30.VII.2004, A.O. Bieńkowski leg., 2 males (BC); same locality, on *P. spinosa*, 24.IV.2000, M.N. Tsurikov leg., 2 males (BC); *Rostov Prov.*, Schepkinskiy Forestry, 5.V.1990, E.A. Khachikov leg., 1 male (YuFU); *Saratov Prov.*, Krasnyy Kut Distr., D'yakovka Vill., Eruslan River valley, 7.VII.2004, A.S. Ukrainsky leg., 1 male (BC); *Stavropol Terr.*, Pyatigorsk, on *Cornus*, 2.IV.1934, A.N. Stepanov leg., 1 male (ZIN); *Tambov Prov.*, Tambov, 8.IV.2001, R.N. Ishin leg., 1 male (RIC). **Turkmenistan**, *Lebap velayat*, Farab railway station, 10.VI.1911, N. Zarudny leg., 1 male (ZIN). **Crimea**: Simferopol, 4.V.1927, Pollak coll., 1 male (ZMMU); Otuzy Vill., 10.VI.1901, A.N. Kiritschenko coll., 1 male (ZIN); Salgir River valley, reservoir bank, 22.III.1983, S.A. Mosyakin leg., 8 males (MC); Salgir River valley, Lozovoe Vill., 20.III.1983, S.A. Mosyakin leg., 2 males (MC); *Donetsk region*: Veliko-Anadol' forestry, on *Crataegus*, 16.IV.1906, collector unknown, 1 male (ZIN).

## General conclusions and prospects for further research

(1) *Lochmaea crataegi* is found exclusively in Western, Central, and Southern Europe, extending to Lithuania in the east. *Lochmaea machulkai* inhabits the central and southern regions of European Russia, Crimea, the Caucasus, and western Middle Asia. *Lochmaea sergeevi* sp. nov. is found in the Southern Ural, Siberia, and the Russian Far

**Fig. 6.** Distribution of the species of the *Lochmaea crataegi* species-group, based on the examined material. Red circle – *L. crataegi*; yellow circle – *L. machulkai*; green circle – *L. sergeevi* sp. nov.

East. All three species exhibit distinct differences in the structure of the aedeagus.

(2) Further research is essential to investigate the geographical boundaries of the areas inhabited by *L. crataegi*, *L. machulkai*, and *L. sergeevi* **sp. nov.** Are these species truly allopatric? Which species are found in Romania, Moldova, right-bank Ukraine, Belarus, western European Russia (including the Belgorod Province, from which only females have been recorded), Kazakhstan, southeastern European Russia (including the Volgograd Province, from which only females are known), Mongolia, and China?

(3) It is essential to investigate the morphological differences among females of *L. crataegi*, *L. machulkai*, and *L. sergeevi* **sp. nov.** Identifying these females will facilitate a more precise exploration of distribution areas of these species.

(4) The example of the *L. crataegi* species-group highlights the necessity of revising the identification of species found in Russia that were originally described from other regions. This revision should consider a comparative analysis of specimens from Russia alongside those from the type localities of the respective species.

## Acknowledgements

I would like to express my gratitude to the following curators: M. Geiser and D. Tel'nov (NHM), E.A. Khachikov (YuFU), S.A. Kurbatov (VNIICR), A.A. Legalov (ISE), A.G. Moseyko (ZIN), S.G. Rudykh (IGEB), V.Yu. Savitsky (ZMMU), M.E. Sergeev (FSC), V.G. Shilenkov (ISU), V. Tamutis (KZM), and J.M. Vela (IFAPA) for their generosity in allowing me to borrow materials from their museums and institutions, as well as for providing photographs of the specimens. I also extend my thanks to E.V. Il'ina, R.N. Ishin, A. Kopetz, S.A. Mosyakin, N.V. Okhrimenko, P.V. Romantsov, and E.V. Sergeeva their loan of specimens and for providing photographs. Special thanks to Yu.A. Lovtsova for the electron microscope photographs, and to A.G. Moseyko for assistance in finding rare literature. I appreciate the valuable comments, suggestions, and discussions on the manuscript provided by R. Beenen, J. Bezděk, S.V. Dedyukhin, D.A. Gapon, and O.L. Nesterova. Additionally, I am grateful to A. Deneau, S.V. Kolov, A.S. Konstantinov, M. Kuhlmann, A.G. Moseyko, and S.A. Mosyakin for sharing important unpublished information. Lastly, I would like to thank my youngest son, Stanislav, for his help with the computer processing of the map and photographs.

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Received 21 April 2024 / Accepted 11 September 2024. Editorial responsibility:  
A.G. Moseyko (Guest Editor) & D.A. Gapon