Acta Biologica Sibirica
Vol 9 (2023): Acta Biologica Sibirica , 885–914
Articles

The checklist of geometrid moths (Lepidoptera) of Altai Krai with new regional records and tree pest overview

Artem E. Naydenov — Altai State University, 61 Lenin Ave., Barnaul, 656049, Russia; Sukachev Institute of Forest, Siberian Branch of the Russian Academy of Sciences, Federal Research Center "Krasnoyarsk Science Center SB RAS", 50/28 Akademgorodok, Krasnoyarsk, 660036, Russia

Yurij E. Perunov — Forest protection center of Altai Krai, 61 Proletarskaya str., Barnaul, 656056, Russia

Here we provide the checklist of geometrid moths for Altai Krai compiled based on original data, published records and exploration of the Geometridae collection stored in the Zoological Institute of the Russian Academy of Sciences (St Petersburg). The checklist accounts 262 species discovered in Altai Krai in 1897–2023. Among them, nine species collected during our field trips are documented for the region for the first time: *Eilicrinia cordiaria* (Hübner, 1790), *Charissa* (*Dysgnophos*) *turfosaria* (Wehrli, 1922), *Jankowskia bituminaria* (Lederer, 1853), *Apocheima hispidaria* ([Denis & Schiffermüller], 1775), *Macaria* (*Speranza*) *halituaria* (Guenée, 1858), *Scopula dignata* (Guenée, [1858]), *Cyclophora pendularia* (Clerck, 1759), *Eupithecia orphnata* W.Petersen, 1909 and *Eupithecia thalictrata* (Püngeler, 1902). Overall, 42 out of 262 geometrid species (i.e. 16%) from 29 genera are known as tree pests enabling to cause significant damage to their host plants in the region and beyond.

Acta Biologica Sibirica 9: 885–914 (2023) doi: 10.5281/zenodo.10083633

Corresponding author: Artem E. Naydenov (naydenov.24@mail.ru)

Academic editor: R. Yakovlev | Received 14 September 2023 | Accepted 4 October 2023 | Published 8 November 2023

http://zoobank.org/19C802D8-6EE5-48ED-8813-F32C13B0F77B

Citation: Naydenov AE, Perunov YuE (2023) The checklist of geometrid moths (Lepidoptera) of Altai Krai with new regional records and tree pest overview. Acta Biologica Sibirica 9: 885–914. https://doi.org/10.5281/zenodo.10083633

Keywords

Insects, Lepidoptera, Geometridae, geometrid moths, fauna, Altai, Siberia, Russia

Introduction

Geometridae is one of the largest families of Lepidoptera (Van Nieukerken et al. 2011). In Russia, particularly in Siberia, the geometrid fauna remains fragmentally studied with scarce new records and species descriptions appearing in literature (Vasilenko 2011, 2012; Erlacher and Erlacher 2016; Knyazev et al. 2017; Vasilenko et al. 2017). In term of geometrid knowledge, the Baikal region and Omsk Oblast are the most explored regions in Siberia, with 361 and 252 species

documented, respectively (Knyazev 2020; Makhov and Lukhtanov 2021). In 2011, 103 species of geometrid moths were found solely in the State Nature Reserve “Tigireksky” (West Altai) (Volynkin et al. 2011). In 2016, a new species *Gnophopsodos sabine* S. Erlacher & J. Erlacher, 2016 was described in the highlands of the Tigirek Range (Erlacher and Erlacher 2016). In 2018, the Geometridae list of the reserve was supplemented with other 17 species (Naydenov and Yakovlev 2018). In 2016, 22 species of geometrid moths were registered in the protected area “Belokurikha Natural Park“ (Vasilenko et al. 2016). In 2017, three species were discovered for the fauna of Altai Krai: *Crypega bajaria* ([Denis & Schiffermüller], 1775); *Limeria macraria* Staudinger, 1892 and *Trichopteryx polycommata* ([Denis & Schiffermüller], 1775) (Perunov 2017a). In 2019, a list comprising 318 species of geometrid moths was compiled for the territory of the Pre-Altai region (Kemerovo Oblast, Novosibirsk Oblast (right bank of the Ob River), Altai Krai (without the Kulunda steppe)) and provided in the Catalogue of the Lepidoptera of Russia (Beljaev and Mironov 2019).

Here we continue exploring the territory of Altai, and provide the checklist of geometrid moths of Altai Krai based on the material collected during our expeditions, studied museum specimens and early published records from this administrative region.

Materials and methods

Altai Krai is located in the central part of Eurasia in the south of Western Siberia (Fig.1A). Territory of the region is situated at an altitude of 100–150 m to 2300–2400 m and covers an area of about 168,000 km^2. Most of the region's territory belongs to the West Siberian Plain. The flat part is presented by steppe and forest steppe, including a ribbon forest. The mountain part is located on the eastern and southern sides: Salair Ridge and the Altai Mountains. The mountain area is characterized by the presence of the dark coniferous forests, subalpine woodlands, subalpine and alpine meadows and alpine tundra.

The study is based on the material, which we collected in Altai Krai in the period of 1973–2023, as well as the specimens received from other collectors: M.N. Perunova, A.A. Kostomarov, M.V. Burmistrov, R.V. Yakovlev, V.V. Rudoi, L.S. Snigireva, K.E. Naydenova and P.A. Pavlova. Additionally, the Geometridae collection of the Zoological Institute, Russian Academy of Sciences (St. Petersburg, Russia) was researched. Finally, the faunistic publications on Lepidoptera of the Altai Krai published in 2011–2018 were checked (Volynkin et al. 2011; Erlacher and Erlacher 2016; Vasilenko et al. 2016; Perunov 2017a; Naydenov and Yakovlev 2018).

Overall, the studied material originated from 116 localities in Altai Krai, including 107 localities visited during our expeditions (mainly expeditions by Yu.E. Perunov) (Fig. 1B). Collecting localities given from literary sources are indicated by references. Most of them were caught at night using a lamp arc mercury-tungsten lamp and ultraviolet lamp; day-species were caught mowing with a butterfly net. Images of imago were taken by the camera of Canon EOS 70D illuminated in Lightbox and camera of Olympus DP74. The genitalia slides were examined with Olympus SZX16 microscope. The taxonomy is accepted according to the Lepidoptera Catalog of Russia (Sinev 2019).

In the checklist, the sampled localities are abbreviated for easy use. The new species for Altai Krai are marked by the symbol *.

Abbreviations of localities used in the text:

A – Aleysk, 52°29'N 82°46'E: (a) 03.06.1992; (b) 03.06.2002;

Alt1 – Altaisky district, Komarovsky pass, 51°39'N 85°22'E, 22.06.1997;

Alt2 – Altaisky district, near of Nizhny Komar vill., Krivaya Sosnovka river, 51°44'N 85°18'E,

28.05.1986;

Alt3 – Altaisky district, Beloe vill., 51°37'N 85°20'E: (**a**) 05.08.1986; (**b**) 23.09.1987; (**c**) 28.07.1988; (**d**) 22.07.1989; (**e**) 10-12.07.1992; (**f**) 28.07.1993; (**g**) 09-10.06.1994; (**h**) 10.06.1995; (**i**) 07.06.1996; (**j**) 25.06.1997;

Alt4 – Altaisky district, Valley of Peschanaya river, 51°49'42.8"N 084°47'55.8"E, 21.07.−1.08.2015 (Vasilenko et al. 2016);

B – Barnaul, 53°21'N 83°46'E: (**a**) 19.05.[18]98; (**b**) 14-17.05.1899; (**c**) 15.06.1913, leg. Maslov & Luri; (**d**) 26.06.1973; (**e**) 11.06.1975; (**f**) 01.08.1980; (**g**) 12-28.06.1981; (**h**) 19.07.1981; (**i**) 31.08.1981; (**j**) 05.06.1982; (**k**) 09.06.1983; (**l**) 18.07.1983; (**m**) 11.05.1984; (**n**) 15.05.1987; (**o**) 29.08.1987; (**p**) 05.09.1987; (**q**) 21-23.04.1990; (**r**) 04.05.1990; (**s**) 18-20.06.1992; (**t**) 16.04.1995; (**u**) 18.07.2003; (**v**) 06.06.2006; (**w**) 22.06.2013;

B1 – Barnaul, airport, 53°21'N 83°33'E, 02.07.[19]81, leg. Prasolov V.;

B2 – Barnaul, Lebyazhye vill., 53°14'N 83°39'E: (**a**) 16-25.05.1980; (**b**) 18.08.1980; (**c**) 16-17.05.1981; (**d**) 19.06.1981; (**e**) 16.05.1982; (**f**) 25.05.1991; (**g**) 03.05.1992; (**h**) 16.05.1992; (**i**) 31.05-13.06.1992; (**j**) 28.05.1994; (**k**) 10-15.06.1994; (**l**) 25.05.1996; (**m**) 23.06.1996; (**n**) 04-14.06.2004;

B3 – Barnaul, Nauchny Gorodok vill., 53°25'N 83°32'E: (**a**) 12.05.1987; (**b**) 12.05.1991; (**c**) 02-07.06.1991; (**d**) 24.05.1992; (**e**) 24.04.1997;

B4 – Barnaul, horticulture “Trud”, 53°16'04"N 83°44'36"E, 05.05.1984;

B5 – Barnaul, horticulture “Energetic”, 53°15'53"N 83°44'59"E, 10.08.1979;

B6 – Barnaul, Yuzhny settlement, 53°15'N 83°41'E: (**a**) 14.05.1981; (**b**) 05-07.06.1981; (**c**) 20.08.1981; (**d**) 20.08.1995;

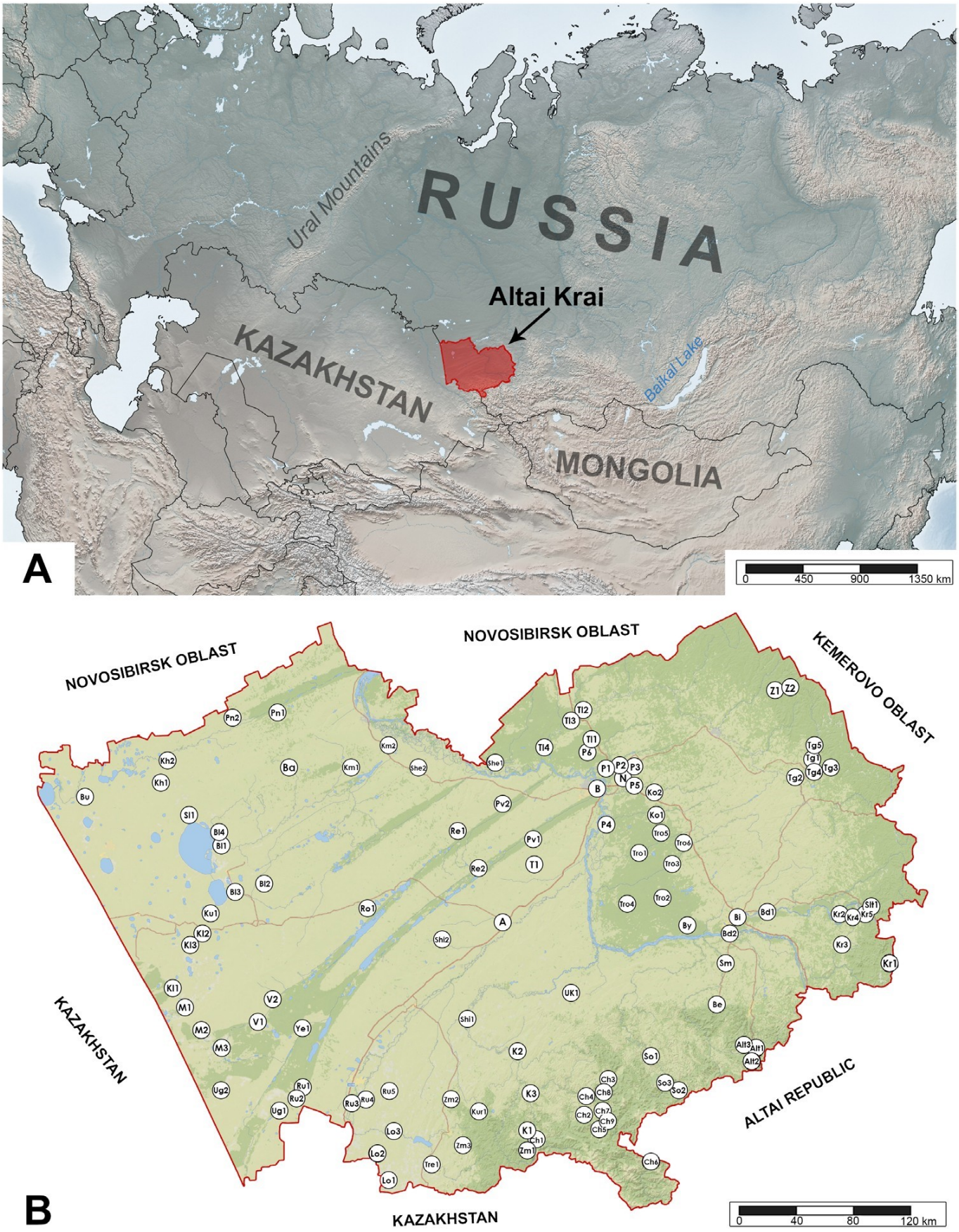

Figure 1. *The location of Altai Krai (A) and sampled localities (B). Full names of indicated localities are provided in the paper text (see Material and methods).*

B7 – Barnaul, M. A. Lisavenko arboretum; 53°17'30.1"N 83°46'09.1"E 200 m., 18.06.2023, leg. Naydenov A.E.;

Ba – Baevsky district, Chumanka vill., 53°30'N 80°28'E, 06.07.1989;

Bd1 – Biysky district, Maloeniseiskoe, 52°34'N 85°30'E, 21.08.2007;

Bd2 – Biysky district, lake Kanonerskoye, 52°28'N 85°11'E, 2-6.08.2006, leg. Krivohatskiy V.;

Be – Belokurikha, 51°60'N 84°59'E, 24.07.2015;

Bi – Biysk, 52°30'N 85°09'E: (**a**) 21.05.1897; (**b**) 1897, leg. Gauvalt; (**c**) 10.06.1916, leg. Varaksina; (**d**) 11-12.05.2011; (**e**) 06.04.2016;

Bl1 – Blagoveshchensky district, W of Shimolino vill., Kulundinskoye lake, 52°60'N 79°56'E, 15.08.1983;

Bl2 – Blagoveshchensky district, Gladen vill., 52°46'N 80°15'E, 25.06.1992;

Bl3 – Blagoveshchensky district, Nizhny Kuchuk, 52°42'N 79°56'E, 22-23.06.1992;

Bl4 – Blagoveshchensky district, 15 km SSW of Nizhnyaya Suyetka vill., 53°05.347’N, 79°47.377’E, h=100 m, 10–12.05.2020, leg. Naydenov A.E.;

Bu – Burlinsky district, Burla vill., 53°20'N 78°20'E, 12.07.1990;

By – Bystroistoksky district, between Sokolovo and Akulikha vill., 52°28'N 84°40'E, 28.05.2004;

Ch1 – Charyshsky district, 4km SSE Tigirek vill., 51°06'N 83°02'E, h=1000 m, 05.07.2016, leg. Naydenov A.E.;

Ch2 – Charyshsky district, Berezovka vill., 51°16'N 83°36'E: (**a**) 26-29.06.1986; (**b**) 29.06.1988; (**c**) 28.06.2016; (**d**) 14.09.2019;

Ch3 – Charyshsky district, Maly Bashchelak vill., 51°29'N 83°49'E: (**a**) 26.06.1986; (**b**) 21.07.2004;

Ch4 – Charyshsky district, Charyshskoe vill., 51°23'N 83°34'E: (**a**) 27.07.1992; (**b**) 06.06.2002; (**c**) 01.08.2019; (**d**) 11.09.2019;

Ch5 – Charyshsky district, Sentelek vill., 51°12'N 83°45'E: (**a**) 02.08.1992; (**b**) 22.07.2004;

Ch6 – Charyshsky district, 3 km from Kumir river mouth, 50°59'N 84°17'E, 25.07.1998;

Ch7 – Charyshsky district, Aba vill., 51°17'N 83°48'E, 10.07.1992;

Ch8 – Charyshsky district, Borovlyanka vill., 51°24'N 83°45'E, 06.09.1992;

Ch9 – Charyshsky district, vicinity of the village Sentelek, 5 km SW of the village Mashenka, the basin of the river Charysh, 51°14'28.2"N 83°48'51.3"E, h=624,8 m, dry meadows, 30.05.2020, leg. Yakovlev R.V. & Rudoi V.V.;

K1 – Krasnoshchekovsky district, Tigirek vill., 51°08'45"N 83°02'11"E, h=484 m: (**a**) 15-17.05.2001, leg. Perunov Yu.E.; (**b**) 16.05.2002, leg. Perunov Yu.E.; (**c**) 14- 24.07.2004, leg. Burmistrov M.V.; (**d**) 03-04.08.2004, leg. Burmistrov M.V.; (**e**) 04- 08.08.2005, leg. Perunov Yu.E.; (**f**) 15.07.2006, leg. Perunov Yu.E.; (**g**) 29.06.2006, leg. Nedoshivina S.V.; (**h**) 04-07.08.2008, leg.

Perunov Yu.E.; (**i**) 25-29.06.2013, leg. Sinev S.Yu.; (**j**) 12.07.2013, leg. Krugova T.M.; (**k**) 7-12.07.2014, leg. Sinev S.Yu.; (**l**) 02-05.07.2016, leg. Naydenov A.E.;

K2 – Krasnoshchekovsky district, Kharlovo vill., 51°41'N 82°51'E, 15.05.2001;

K3 – Krasnoshchekovsky district, Charysh river valley, 3 km WNW of Ust'-Chagyrka vill., 51°26.296'N, 83°04.230'E, h=330 m, 18–20.05.2020, leg. Naydenov A.E (Fig. 2A);

Kl1 – Klyuchevsky district, Pokrovka vill., 52°02'N 79°21'E: (**a**) 06-07.06.2008; (**b**) 15.06.2012; (**c**) 16.05.2012; (**d**) 22.09.2022;

Kl2 – Klyuchevsky district, Zelenaya Polyana vill., 52°24'N 79°38'E, 20.06.1993;

Kl3– Klyuchevsky district, S of coast of lake Shukyrtuz, 3 km E of Istimis vill., 52°21.736'N, 79°21.080'E, h=130 m, 12–13.05.2020, leg. Naydenov A.E. (Fig. 2B);

Km1– Kamensky district, Vetrenno-Teleutskoe vill., 53°27'N 81°10'E, 30.07.1989;

Km2 – Kamensky district, Gonokhovo vill., 53°38'N 81°32'E, 03.09.1989;

Kh1– Khabarsky district, Protasovo vill., 53°25'N 79°10'E, 11.06.1988;

Kh2– Khabarsky district, Novoilinka vill., 53°33'N 79°15'E, 13.06.1988;

Kr1 – Krasnogorsky district, 30 km SE Kaltash vill., 52°12'N 86°42'E: (**a**) 13- 14.05.2004; (**b**) 25-27.07.2005;

Kr2 – Krasnogorsky district, Frunze vill., 52°35'N 86°20'E: (**a**) 11-12.05.2004; (**b**) 25.07.2005; (**c**) 30.05.2012;

Kr3 – Krasnogorsky district, Chapsha river, 52°21'N 86°18'E, 14.06.2001;

Kr4 – Krasnogorsky district, Makaryevkoe vill., 52°33'N 86°27'E, 17.08.2004;

Kr5 – Krasnogorsky district, Balyksa vill., 52°32'N 86°33'E, 26.07.2007;

Ko1 – Kosikhinsky district, 2 km W of Lake Krasilovo vill., 53°10'N 84°20'E: (**a**) 19.07.1990; (**b**) 01.07.1996; (**c**) 10.08.2010; (**d**) 17-23.06.2014, leg. Snigireva L.S.;

Ko2 – Kosikhinsky district, Malakhovo vill., 53°21'N 84°24'E, 22.07.1979;

Ku1 – Kulundinsky district, Ekaterinovka vill., 52°34'N 79°36'E, 26.06.1990;

Kur1 – Kur'insky district, 7.5 km W of Kolyvan village, Loktevka river basin, N 51°18'08.5", E 82°29'05.3" h=416,7 m, willow-birch forest and meadow glades, 01.06.2020, leg. Yakovlev R.V. & Rudoi V.V.;

Lo1 – Loktevskiy district, Zolotukha vill., 50°48'N 81°31'E, 15.07.1987;

Lo2 – Loktevskiy district, Gornyak, 50°59'N 81°27'E, 11.07.1987;

Lo3 – Loktevskiy district, Aley river valley, 1 km N of Ust'yanka vill., 51°09.793'N, 81°35.764'E, h=330 m: (**a**) 17–18.05.2020, leg. Naydenov A.E.; (**b**) 01.06.2020, leg. Yakovlev R.V. & Rudoi V.V. (Fig. 2C);

M1 – Mikhailovsky district, Nikolaevka vill., 51°55'N 79°24'E: (**a**) 19-28.06.1980; (**b**) 19-25.07.1980;

M2 – Mikhailovsky district, 8 km SW Mikhailovskoe vill., 51°46'13"N 79°39'32"E: (**a**) 20-21.07.2012; (**b**) 26.07.2013;

M3 – Mikhailovsky district, N of coast of lake Yodnoe, 2 km NNE of Malinovoe Ozero vill., 51°41.852'N, 79°47.899'E, h=160 m, 13-14.05.2020, leg. Naydenov A.E.;

N – Novoaltaysk, 53°25'N 83°56'E, 23.06.1915, coll. Schuko;

P1 – Pervomaisky district, Mylnikovo vill., 53°27'50.5"N 83°46'33.1"E, h=146 m: (**a**) 18-19.04.2020, leg. Naydenov A.E. & Naydenova K.E.; (**b**) 19-24.05.2021, leg. Naydenov A.E. & Naydenova K.E.; (**c**) 13.07.2019, leg. Naydenov A.E. & Naydenova K.E.; (**d**) 28.08.2021, leg. Naydenov A.E. & Naydenova K.E. (Fig. 2D);

P2 – Pervomaisky district, 3 km NE Novoaltaysk, 53°25'49"N 83°58'11"E, leg. Naydenov A.E.: (**a**) 11.06.2014; (**b**) 14-25.07.2014; (**c**) 15.05.2015; (**d**) 05.06.2015; (**e**) 28.08.2016

P3 – Pervomaisky district, station Ukladochnaya, 15 km NE Novoaltaysk, 53°28'N 84°06'E: (**a**) 29.04.1997; (**b**) 05.05.2001; (**c**) 09.07.2002; (**d**) 13-29.06.2005; (**e**) 19.06.2006; (**f**) 08.05.2006; (**g**) 07.08.2007; (**h**) 02-12.07.2008; (**i**) 13-23.07.2008; (**j**) 01-08.08.2008; (**k**) 30.08-06.09.2008; (**l**) 03.10.2008; (**m**) 24.04.2009; (**n**) 01-08.05.2009; (**o**) 15-29.05.2009; (**p**) 12.06.2009; (**q**) 21-26.06.2009; (**r**) 10-17.07.2009; (**s**) 21.08.2009; (**t**) 04-12.09.2009; (**u**) 05.05.2010; (**v**) 06.06.2010; (**w**) 10-26.06.2010; (**x**) 30.06-14.07.2010; (**y**) 21-30.07.2010; (**z**) 06.08.2010; (**aa**) 20-27.08.2010; (**ab**) 10.09.2010; (**ac**) 02.10.2010; (**ad**) 16-23.04.2011; (**ae**) 20-28.05.2011; (**af**) 02-17.06.2011; (**ag**) 18-30.06.2011; (**ah**) 06.08.2011; (**ai**) 03.09.2011; (**aj**) 20.04.2012; (**ak**) 10-15.06.2012; (**al**) 05-09.07.2012; (**am**) 27.07.2012; (**an**) 17.08.2012; (**ao**) 06-13.07.2013; (**ap**) 15-29.05.2015; (**aq**) 05-16.06.2015; (**ar**) 19-28.06.2015; (**as**) 04-11.07.2015; (**at**) 17-31.07.2015; (**au**) 20-23.04.2016; (**av**) 14.05.2016;

P4 – Pervomaisky district, Bobrovka vill., 53°10'N 83°52'E, 11.06.1983;

P5 – Pervomaisky district, Berezovka vill., 53°24'N 84°00'E, 13.07.1983;

P6 – Pervomaisky district, Kislukhinsky Reserve, 53°38'N 83°39'E, 05.07.1990;

Pv1 – Pavlovsky district, Kolyvanskoye vill., 53°02'N 82°53'E: (**a**) 22.08.1993; (**b**) 25.05.2004;

Pv2 – Pavlovsky district, Rogozikha vill., 53°15'N 82°46'E: (**a**) 14.08.1980; (**b**) 18.05.2004;

Pn1 – Pankrushikhinsky district, Pankrushikha vill., 53°49'N 80°20'E: (**a**) 01- 03.07.1988; (**b**) 02.07.2015;

Pn2 – Pankrushikhinsky district, Uryvaevo vill., 53°47'N 79°56'E, 01.08.1988;

Re1 – Rebrikhinsky district, Rebrikha vill., 53°04'N 82°20'E, 02.07.2014;

Re2 – Rebrikhinsky district, Chernyavka vill., 52°53'38"N 82°33'56"E, 14.09.1980;

Ro1 – Romanovsky district, Guseletovo vill., 52°33'N 81°22'E, 10.06.1987;

Ru1 – Rubtsovsky district, Rakity vill., 51°26'N 80°41'E, 15.06.1984;

Ru2 – Rubtsovsky district, Bolshaya Shelkovka vill., 51°25'N 80°38'E, 08.06.1984;

Ru3 – Rubtsovsky district, Novoaleksandrovka vill., 51°22'N 81°09'E, 20.06.1984;

Ru4 – Rubtsovsky district, Samarka vill., 51°22'N 81°16'E, 10.06.1984;

Ru5 – Rubtsovsky district, Kiziha river valley, 4 km W of Nazarovka vill., 51°25.843'N, 81°36.111'E, h=270 m, 15–16.05.2020, leg. Naydenov A.E.;

T1 – Topchikhinsky district, 7 km N Topchiha vill., 52°53'07.0"N 83°05'52.7"E, leg. Naydenov A.E.: (**a**) 04-05.07.2012; (**b**) 04.05.2014; (**c**) 7.08.2015; (**d**) 20.07.2021;

Tl1 – Talmensky district, Ozerki station, 53°40'N 83°41'E: (**a**) 06.07.2003; (**b**) 15.05.2006; (**c**) 02.06.2006; (**d**) 18.10.2006 (larvae); (**e**) 09.07.2007; (**f**) 19-25.07.2007;

Tl2 – Talmensky district, Talmenka vill., 53°48'N 83°33'E: (**a**) 15.06.1986; (**b**) 04.07.1986;

Tl3 – Talmensky district, Staroperunovo vill., 53°46'N 83°27'E, 31.07.1981;

Tl4 – Talmensky district, Yazovo vill., 53°35'N 83°10'E, 10.07.1991;

Tre1 – Tretyakovsky district, 5 km NW of Ekaterininskoe vill., 50°56'12"N 81°57'20"E, h=320–375 m, 01.05.2021, leg. Naydenov A.E. & Rudoi V.V.;

Tro1 – Troitsky district, Ozero-Petrovskoe vill., 52°57'N 84°18'E: (**a**) 14.08.1982; (**b**) 26.05.2015;

Tro2 – Troitsky district, Borovlyanka vill., 52°38'N 84°26'E: (**a**) 02.07.2005; (**b**) 04.06.2006; (**c**) 23.09.2006; (**d**) 30-31.07.2014; (**e**) 08.10.2014 (larvae);

Tro3 – Troitsky district, Zagainovo vill., 52°52'N 84°31'E, 19.06.2019;

Tro4 – Troitsky district, Chervanka vill., 52°36'N 84°04'E 11.07.2019;

Tro5 – Troitsky district, Zavodskoye vill., 53°04'N 84°25'E: (**a**) 10.08.2010; (**b**) 04.06.2014;

Tro6 – Troitsky district, Troitskoe vill., 52°59'N 84°40'E, 10.08.1997;

Tg1 – Togulsky district, 13 km N Togul vill., 53°35'N 85°49'E, 25.07.2002;

Tg2 – Togulsky district, Titovo vill., 53°24'N 85°45'E, 06-11.07.2011;

Tg3 – Togulsky district, reserve “Togulsky”, 53°31'N 86°11'E, 06.07.2011;

Tg4 – Togulsky district, Togul vill., 53°28'N 85°54'E, 12.09.1992;

Tg5 – Togulsky district, 7.5 km N Shumikha vill., 53°41'N 85°59'E, 05-09.06.2023, leg. Pavlova P.A.;

Sl1 – Slavgorodsky district, Znamenka vill., 53°09'N 79°28'E: (**a**) 20.07.2011; (**b**) 24.04.2012;

She1 – Shelabolikhinskiy district, Inya vill., 53°26'N 82°36'E: (**a**) 30.06.2004; (**b**) 07.07.2005;

She2 – Shelabolikhinskiy district, Krutishka vill., 53°27'N 81°49'E: (**a**) 14-16.08.1984; (**b**) 09.09.1984; (**c**) 17.08.1989;

Shi1 – Shipunovsky district, Eltsovka vill., 51°54'N 82°23'E, 13-21.08.1983;

Shi2 – Shipunovsky district, Bobrovka vill., 52°24'N 82°07'E, 10.08.1983;

So1 – Soloneshensky district, Soloneshensky vill., 51°39'N 84°19'E, 16.05.1991;

So2 – Soloneshensky district, near Tog-Altai village, Denisova Cave, 51°23'53.0"N 84°40'30.9"E, h=610 m, 29.05.2020, leg. Yakovlev R.V. & Rudoi V.V.;

So3 – Soloneshensky district, near Topol'noye vill., 51°27'N 84°29'E, H=570-1000 m, 15-20.08.2018, leg. Naydenov A.E. & Yakovlev R.V.;

Slt1 – Soltonsky district, Saydyp vill., 52°34'N 86°34'E, 21.04.2007;

Sm1 – Smolensky district, Peschanaya river, 52°16'N 85°03'E, 26.07.2015;

Sm2 – Smolensky district, near Belokurikha city, 51°55'21.4"N 84°59'14.1"E, 21.07.−1.08.2015 (Vasilenko et al. 2016);

Ug1 – Uglovsky district, Krugloe vill., 51°17'N 80°26'E, 06.06.2009;

Ug2 – Uglovsky district, Pavlovka vill., 51°23'N 79°47'E, 24.05.2016;

UK1 – Ust-Kalmansky district, Kalmanka river, 52°54'N 83°34'E, 03.06.2002;

V1 – Volchikhinsky district, Bychye lake, 51°52'N 80°13'E, 21.07.1980;

V2 – Volchikhinsky district, Volchikha vill., 52°01'N 80°21'E, 21.10.2013 (larvae);

Ye1 – Yegoryevsky district, Novosovetsky vill., 51°49'N 80°38'E, 27.07.2013;

Z1 – Zarinsky district, 10 km W Tyagun, 53°56'N 85°30'E: (**a**) 12.06.2004; (**b**) 04.08.2011; (**c**) 05-15.07.2013; (**d**) 11.08.2016; (**e**) 28.06.2017; (**f**) 26.08.2020 leg. Naydenov A.E. (Fig. 2E);

Z2 – Zarinsky district, Togulenok station, 53°57'N 85°47'E: (**a**) 20.06.1980; (**b**) 19- 20.07.1980; (**c**) 20.06.2002; (**d**) 14.07.2011; (**c**) 16-17.08.2016;

Zm1 – Zmeinogorsky district, 12 km SSW Tigirek vill., Tigiretsky ridge, 51°02'N 82°58'E, h=1470 m: (**a**) 16–19.07.2012, leg. Volynkin A. (Erlacher and Erlacher 2016); (**b**) 8-10.07.2016, leg. Naydenov A.E. (Fig. 2F);

Zm2 – Zmeinogorsky district, 5.5 km NE of Savvushka, 51°23'03"N 82°12'30"E, h=340-360 m: (**a**); 25.07.2014, leg. Naydenov A.E. (**b**) 03.05.2021, leg. Naydenov A.E. & Rudoi V.V.;

Zm3 – Zmeinogorsky district, Lazurka vill., 51°05'N 82°22'E, 15-16.07.1996.

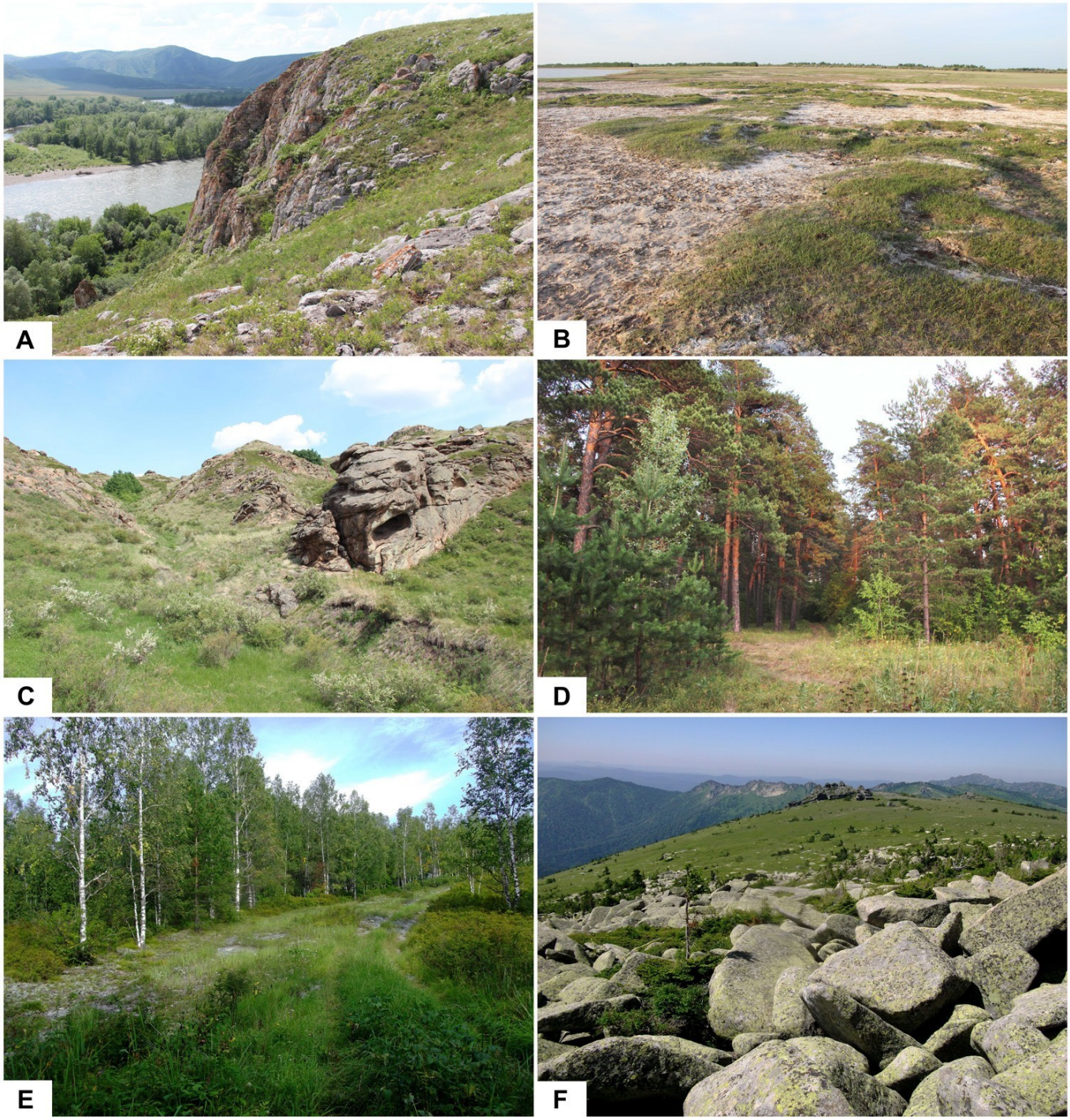

Figure 2. *The collected biotopes in Altai Krai:* ***A.*** *Charysh river valley, 3 km WNW of Ust'- Chagyrka vill.;* ***B.*** *S coast of the lake Shukyrtuz, 3 km E of Istimis vill.;* ***C.*** *Aley river valley, 1 km N of Ust'yanka vill.;* ***D.*** *Pervomaisky district, near Mylnikovo vill.;* ***E.*** *Zarinsky district, near Tyagun station;* ***F.*** *Tigiretsky ridge, 12 km SSW Tigirek vill.*

Result

I. Novel regional records

On the territory of Altai Krai, overall 262 species of geometrid moths have been documented. Among them, following nine species represented new regional records.

1. Eilicrinia cordiaria (Hübner, 1790) (Fig. 3A)

Distribution. West-Palaearctic. In Europe, from easternmost Austria, southern Slovakia and the Balkans through Ukraine, Crimea, southern Russia and Crimea to southern Urals. Outside Europe, the species occurs in Turkey, Caucasus region, northern Iran and Central Asia (Skou and Sihvonen 2015).

Hostplants. *Salix* (Salicaceae) (Fajčik 2003; Szekely 2011).

Remarks. A.V. Kulak (2017) recorded the species range expansion to the north in Central and Eastern Europe due to desiccation of floodplain ecosystems where quick and significant rising of annual average temperature take place.

2. Charissa (*Dysgnophos*) *turfosaria* (Wehrli, 1922) (Fig. 3B)

Distribution. Siberian-Far Eastern, boreomontane. Middle Ural, Yamalo-Nenets Autonomous Okrug, Republic of Altai, Irkutskaya Oblast, Buryatia, Transbaikalia, Yakutia, Chukotka, Magadanskaya Oblast, southern part of Khabarovsky Krai, Primorsky Krai, and Northern Mongolia (Makhov 2021).

Hostplants: Brassicaceae (Burnasheva, 2011).

3. Jankowskia bituminaria (Lederer, 1853) (Fig. 3C)

Distribution. Siberian-Far Eastern, subboreal. Southern part of Western Siberia, southern part of Krasnoyarsky Krai, southern Altai, Khakassia, Tuva, Irkutskaya Oblast, Buryatia, Transbaikalia, Amurskaya Oblast, southern part of Khabarovsky Krai, Primorye. Outside Russia, in Northern China, Northern Korea (Makhov 2021).

Hostplants. *Spiraea aquilegifolia* (Rosaceae), *Ribes nigrum*, *R. uvacrispa* (Grossulariaceae) (Gordeeva and Gordeev 2007, Beljaev 2016).

4. Apocheima hispidaria ([Denis & Schiffermüller], 1775) (Fig. 3D)

Distribution. West-Palaearctic. In Europe, from the Urals to Great Britan and northern Portugal and from southern Scandinavia to the Mediterranean (Müller et al. 2019). Outside Europe, in the Caucasus region, Turkey, East Kazakhstan and South Siberia.

Hostplants. In Europe, *Quercus* (Fagaceae), *Salix aurita* (Salicaceae), *Carpinus betulus* (Betulaceae), *Malus domestica*, *Prunus avium*, *P. spinosa* (Rosaceae), *Populus tremula* (Salicaceae), *Castanea*, *Fagus* (Fagaceae), and *Ulmus* (Ulmaceae) (Müller et al. 2019).

5. *Macaria* (*Speranza*) *halituaria* (Guenée, 1858) (Fig. 3E)

Distribution. Central-Palaearctic. Altai Mountains, northwestern China, Tian Shan and Pamir Mountains (Viidalepp 1988).

Hostplants. Unknown.

6. *Scopula dignata* (Guenée, [1858]) (Fig. 3F)

Distribution. Siberian-Far Eastern, subboreal. Southern Siberia and Russian Far East. In Asia: Mongolia, Northern China, Korea (Makhov 2023).

Hostplants. Unknown.

7. *Cyclophora pendularia* (Clerck, 1759) (Fig. 3G)

Distribution. West-Palaearctic, temperate. Europe, Urals and West Siberia.

Hostplants. *Salix* (Salicaceae), *Alnus* (Betulaceae) (Hausmann 2004).

8. *Eupithecia orphnata* W.Petersen, 1909 (Fig. 3H)

Distribution. West-Palaearctic, temperate. In Europe, locally in Western, Central and Southern Europe, southern Scandinavia. In Asia, in Turkey, Kazakhstan, Tajikistan, Kyrgyzstan, Armenia, and Azerbaijan. In Russia, in south of European part, South Ural, and south of Western Siberia.

Hostplants. The larvae polyphagous. Flowers, seeds and leaves mainly of Asteraceae, leaves of *Quercus robur* (Fagaceae) (Mironov 2003).

9. *Eupithecia thalictrata* (Püngeler, 1902) (Fig. 3I)

Distribution. Transeurasiatic, temperate. In Europe locally in France, Switzerland, Italy, Austria, Poland, Lithuania, and Estonia. In Russia, in European part, South Ural, South Siberia, Russian Far East. Asia: Northern Kazakhstan, China, Mongolia, and Japan (Hokkaido).

Hostplants. Flowers and seeds of *Thalictrum* (Ranunculaceae) (Mironov 2005).

Pestiferous geometrid species

Overall, 42 out of 262 geometrid species (i.e. 16%) are known as pests of trees and shrubs, some of them can provide regular outbreaks in nature. Among them, there are the representatives of following genera: genus *Eulithis* Hübner, 1821 (4 species), genera *Macaria* Curtis, 1826 and *Eupithecia* Curtis, 1825 (by 3 species each), genera *Lomographa* Hübner, 1825, *Plagodis* Hübner, 1823, *Biston* Leach, 1815, *Lycia* Hübner, 1825, *Hypomecis* Hübner, 1821, and *Abraxas* Leach, 1815 (by 2 species each), and genera *Odontopera* Stephens, 1831, *Selenia* Hübner, 1823, *Apeira* Gistl, 1848, *Ennomos* Treitschke, 1825, *Opisthograptis* Hübner, 1823, *Angerona* Duponchel, 1829, *Ascotis* Hübner, 1825, *Bupalus* Leach, 1815, *Cryopega* Dumont, 1925, *Erannis* Hübner, 1825, *Apocheima* Hübner, 1825, *Ematurga* Lederer, 1853, *Geometra* Linnaeus, 1758, *Mesoleuca* Hübner, 1825, *Pelurga* Hübner, 1825, *Venusia* Curtis, 1839, *Rheumaptera* Hübner, 1822, *Operophtera* Hübner, 1825, *Trichopteryx* Hübner, 1825, *Pasiphila* Meyrick, 1883 (by 1 species each). On the territory of Altai Krai, the following pestiferous species were documented:

1. Lomographa bimaculata (Fabricius, 1775)

The larvae can damage *Prunus*, *Padus*, *Sorbus*, *Crataegus* (Rosaceae); they can also develop on *Betula*, *Carpinus*, (Betulaceae), *Tilia* (Malvaceae), *Fagus*, *Quercus* (Fagaceae) (Mironov 1999).

2. Lomographa temerata ([Denis & Schiffermüller], 1775)

The larvae can damage *Malus*, *Prunus*, *Crataegus*, *Padus*, *Rosa* (Rosaceae); they can also develop on *Quercus*, *Fagus* (Fagaceae), *Acer* (Sapindaceae), *Salix* (Salicaceae), *Betula* (Betulaceae), and *Impatiens* (Balsaminaceae) (Mironov 1999).

3. Odontopera bidentata (Clerck, 1759)

The larvae can damage *Betula* (Betulaceae), *Populus*, *Salix* (Salicaceae) in forests on Altai Krai (Perunov 2017b).

4. Selenia tetralunaria (Hufnagel, 1767)

The larvae can damage *Malus*, *Prunus*, *Crataegus*, *Padus*, *Rosa* (Rosaceae); they can also develop

on *Betula*, *Alnus* (Betulaceae), *Salix* (Salicaceae), *Quercus* (Fagaceae), *Tilia* (Malvaceae) and *Fraxinus* (Oleaceae) (Mironov 1999).

5. Plagodis dolabraria (Linnaeus, 1767)

The species has been noted as a tree pest in Altai Krai (Perunov 2017b). The larvae can damage various shrubs and trees: *Lonicera* (Caprifoliaceae), *Crataegus*, *Sorbus*, *Rubus*, *Prunus* (Rosaceae), *Ulmus* (Ulmaceae), *Salix* (Salicaceae), *Betula* (Betulaceae) (Beljaev 2016).

6. Plagodis pulveraria (Linnaeus, 1758)

The larvae can damage *Sorbus*, *Prunus* (Rosaceae), *Lonicera* (Caprifoliaceae), *Vaccinium* (Ericaceae); they can also develop on *Quercus* (Fagaceae), *Betula*, *Alnus* (Betulaceae), and *Salix* (Salicaceae) (Mironov 1999).

7. Apeira syringaria (Linnaeus, 1758)

The caterpillars can develop on *Lonicera*, *Symphoricarpos* (Caprifoliaceae), *Syringa*, *Ligustrum* (Oleaceae), *Spiraea* (Rosaceae) (Beljaev 2016; Burnasheva 2011; Mironov 1999).

8. Ennomos autumnaria (Werneburg, 1859)

The larvae can damage *Malus*, *Pyrus*, *Prunus* (Rosaceae), *Ribes* (Grossulariaceae), *Vaccinium* (Ericaceae); they can also develop on *Betula*, *Alnus* (Betulaceae), *Quercus* (Fagaceae), *Ulmus* (Ulmaceae), *Tilia* (Malvaceae) (Mironov 1999). In urban forest plantations in Moscow damage has been noted by this species (Belov 2011).

9. *Opisthograptis luteolata* (Linnaeus, 1758)

The larvae can damage *Malus*, *Pyrus*, *Prunus*, *Sorbus*, *Rosa* (Rosaceae), *Ribes* (Grossulariaceae), *Lonicera* (Caprifoliaceae), *Betula* (Betulaceae), *Salix* (Salicaceae), *Quercus* (Fagaceae) (Mironov 1999).

10. *Angerona prunaria* (Linnaeus, 1758)

The larvae can damage *Prunus*, *Crataegus*, *Sorbus*, *Rubus*, *Rosa* (Rosaceae), *Ribes* (Grossulariaceae), *Lonicera* (Caprifoliaceae), *Vaccinium* (Ericaceae); they can also develop on *Corylus*, *Betula*, *Alnus*, *Carpinus* (Betulaceae), *Salix*, *Populus* (Salicaceae), *Fagus* (Fagaceae), *Frangula* (Rhamnaceae), *Sambucus* (Adoxaceae), *Aralia* (Araliaceae), *Calluna*, *Ledum* (Ericaceae), *Plantago* (Plantaginaceae) and *Taraxacum* (Asteraceae) (Mironov 1999).

11. *Ascotis selenaria* ([Denis & Schiffermüller], 1775)

The larvae can damage *Malus*, *Pyrus*, *Prunus*, *Rosa* (Rosaceae), and *Ribes* (Grossulariaceae) (Mironov 1999).

12. *Bupalus piniaria* (Linnaeus, 1758)

The species can notably damage trees in forest as well as in ornamental coniferous plantations (Vorontsov 1982). The larvae can damage *Pinus sylvestris* and other conifers: *Picea*, *Abies* (Pinaceae) etc. (Beljaev 2016). Outbreaks occur regularly in various parts of the species vast range (Palnikova and Yagunov 2011). On the territory of Western Siberia, its outbreaks covered about 400 thousand hectares of forest plantations from Novosibirsk to Kazakhstan (Kolomiets 1977).

13. *Cryopega bajaria* ([Denis & Schiffermüller], 1775)

The larvae can damage *Malus*, *Prunus*, *Crataegus* (Rosaceae); they can also develop on *Acer* (Sapindaceae), *Betula* (Betulaceae), *Ligustrum* (Oleaceae), *Rosa* (Rosaceae) and *Robinia pseudoacacia* (Fabaceae) (Mironov 1999).

14. *Erannis jacobsoni* (Djakonov, 1926)

A typical pest of *Larix* (Pinaceae) capable to outbreak (Rozhkov et al. 1966).

15. *Biston betularia* (Linnaeus, 1758)

The species is able to outbreak in *Betula* (Betulaceae) forests in Western Siberia (Kolomiets and Artamonov 1985) and Kazakhstan (Kazansky 1958). The species plays a dominant role in the formation foci in Altai Krai forests (Perunov 2017b). Also, the larvae can damage *Malus*, *Prunus*, *Sorbus*, *Rubus* (Rosaceae), *Lonicera* (Caprifoliaceae) (Mironov 1999).

16. *Biston strataria* (Hufnagel, 1767)

The species has been noted as a tree pest in Altai Krai. The larvae predominantly feed on leaves of *Populus* (Salicaceae) and *Betula* (Betulaceae) (Perunov 2017b); they can also damage *Malus* (Rosaceae) (Mironov 1999).

17. *Lycia hirtaria* (Clerck, 1759)

The larvae can damage many cultivated trees and bushes: *Malus*, *Prunus*, *Cydonia*, *Sorbus*, *Rosa* (Rosaceae). Also, they can develop on *Betula* (Betulaceae), *Salix*, *Populus* (Salicaceae), *Acer* (Sapindaceae), *Fraxinus* (Oleaceae), *Quercus* (Fagaceae), *Tilia* (Malvaceae), *Ulmus* (Ulmaceae) (Mironov 1999). The species has been noted as a tree pest in Altai Krai (Perunov 2017b).

18. *Lycia pomonaria* (Hübner, 1790)

The larvae can damage *Betula* (Betulaceae), *Populus*, *Salix* (Salicaceae), *Prunus*, *Spiraea* (Rosaceae) (Beljaev 2016).

19. *Apocheima hispidaria* ([Denis & Schiffermüller], 1775)

The larvae can damage leaves of *Malus* and *Crataegus* (Rosaceae), *Quercus* (Fagaceae) and *Ulmus* (Ulmaceae) (Mironov 1999).

20. *Hypomecis punctinalis* (Scopoli, 1763)

The species has been noted as a tree pest in Altai Krai (Perunov 2017b). The larvae can damage leaves of cultivated plants: *Malus*, *Pyrus*, *Prunus* (Rosaceae), *Berberis* (Berberidaceae), *Hippophae* (Elaeagnaceae), *Vaccinium* (Ericaceae). Also, they can develop on *Betula* (Betulaceae), *Salix*, *Populus* (Salicaceae), *Tilia* (Malvaceae), *Quercus* (Fagaceae), *Acer* (Sapindaceae), *Fraxinus* (Oleaceae), *Picea*, *Abies*, *Pinus* and *Larix* (Pinaceae) (Mironov 1999).

21. *Hypomecis roboraria* ([Denis & Schiffermüller], 1775)

The larvae can damage *Malus* (Rosaceae), *Betula* (Betulaceae), *Ulmus* (Ulmaceae), and *Salix* (Salicaceae) (Beljaev 2016; Mironov 1999).

22. *Ematurga atomaria* (Linnaeus, 1758)

The species has been noted as a tree pest in Altai Krai causing damage to *Betula* (Betulaceae), *Populus*, *Salix* (Salicaceae) (Perunov 2017b). The larvae can also develop on different deciduous trees, shrubs, herbaceous plants: *Artemisia*, *Centaurea* (Asteraceae), *Vicia*, *Lotus* (Fabaceae), *Vaccinium uliginosum*, *Ledum palustre* (Ericaceae) (Beljaev 2016; Burnasheva 2011).

23. *Abraxas grossulariata* (Linnaeus, 1758)

The species is a serious pest of *Ribes* (Grossulariaceae) in Europe and Siberia; they can also develop on *Spiraea* (Rosaceae), *Ulmus* (Ulmaceae), *Vaccinium* (Ericaceae), *Larix*, *Abies* (Pinaceae) etc. (Mironov 1999).

24. *Abraxas sylvata* (Scopoli, 1763)

This species can be especially damaging on *Prunus padus* in some years; they can also develop on *Prunus* (Rosaceae), *Ribes* (Grossulariaceae), *Corylus*, *Betula* (Betulaceae), *Fagus* (Fagaceae), and *Ulmus* (Ulmaceae) (Mironov 1999).

25. *Macaria brunneata* (Thunberg, 1784)

The larvae can damage *Pyrus* (Rosaceae), *Salix* (Salicaceae), *Vaccinium*, and *Ledum* (Ericaceae) (Mironov 1999).

26. *Macaria notata* (Linnaeus, 1758)

The species has been noted as a tree pest in Altai Krai damaging *Betula* (Betulaceae), *Salix* (Salicaceae) (Perunov 2017b).

27. *Macaria wauaria* (Linnaeus, 1758)

The larvae can damage *Prunus* (Rosaceae), *Ribes* (Grossulariaceae) (Mironov 1999).

28. *Geometra papilionaria* (Linnaeus, 1758)

The larvae can damage *Frangula* (Rhamnaceae), *Corylus*, *Betula*, *Alnus* (Betulaceae), *Salix* (Salicaceae), *Tilia* (Malvaceae) (Mironov 1999).

29. *Mesoleuca albicillata* (Linnaeus, 1758)

The larvae can damage *Rubus* (Rosaceae) (Mironov 1999).

30. *Pelurga comitata* (Linnaeus, 1758)

The larvae can damage *Ribes* (Grossulariaceae) (Mironov 1999).

31. *Eulithis mellinata* (Fabricius, 1787)

The larvae can damage *Ribes* (Grossulariaceae) (Mironov 1999).

32. *Eulithis prunata* (Linnaeus, 1758)

The larvae can damage *Ribes* (Grossulariaceae), *Sorbus*, *Crataegus* (Rosaceae); they can also develop on *Quercus* (Fagaceae), *Salix* (Salicaceae) and other deciduous trees (Mironov 1999).

33. *Eulithis populata* (Linnaeus, 1758)

The larvae can damage *Ribes* (Grossulariaceae); they can also develop on *Salix*, *Populus* (Salicaceae), *Vaccinium* (Ericaceae), and *Chamaenerion* (Onagraceae) (Mironov 1999).

34. *Eulithis pyropata* (Hübner, 1809)

The larvae can damage *Ribes* (Grossulariaceae) (Mironov 1999).

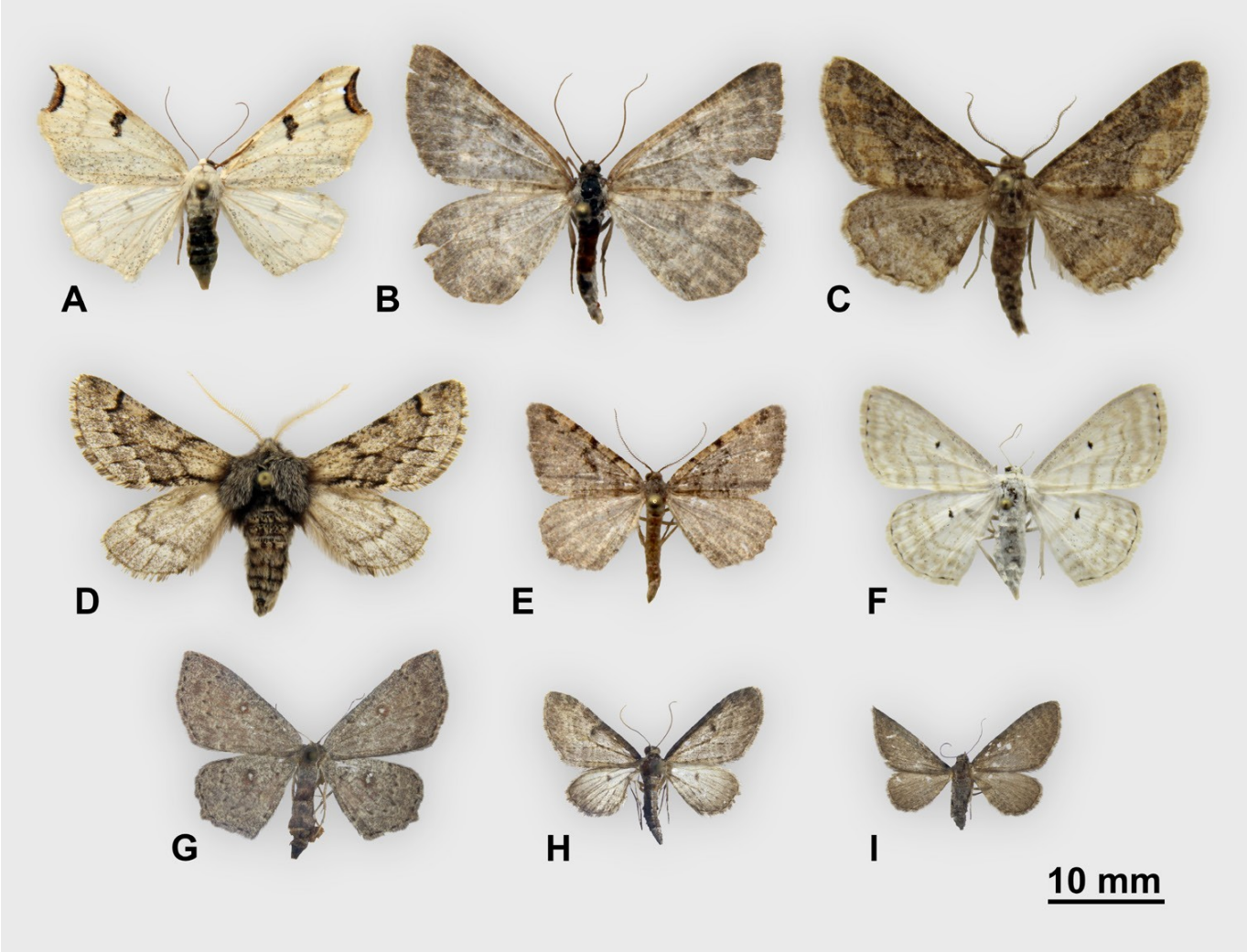

Figure 3. *Geometrid moths new for Altai Krai fauna:* ***A.*** *Eilicrinia cordiaria (Hübner, 1790), male, Loktevskiy district, Aley river valley, 1 km N of Ust'yanka vill., 17–18.05.2020;* ***B.*** *Charissa (Dysgnophos) turfosaria (Wehrli, 1922), male, Krasnoshchekovsky district, Charysh river valley, 3 km WNW of Ust'-Chagyrka vill., 18–20.05.2020;* ***C.*** *Jankowskia bituminaria (Lederer, 1853), male, Loktevskiy district, Aley river valley, 1 km N of Ust'yanka vill., 17–18.05.2020;* ***D.*** *Apocheima hispidaria ([Denis & Schiffermüller], 1775), male, Slavgorodsky district, Znamenka vill., 24.04.2012;* ***E.*** *Macaria (Speranza) halituaria (Guenée, 1858), male, Loktevskiy district, Aley river valley, 1 km N of Ust'yanka vill., 01.06.2020;* ***F.*** *Scopula dignata (Guenée, [1858]), male, Charyshsky district, Charyshskoe vill., 01.08.2019;* ***G.*** *Cyclophora pendularia (Clerck, 1759), male, Togulsky district, Titovo vill., 06-11.07.2011;* ***H.*** *Eupithecia orphnata W. Petersen, 1909, male, Pervomaisky district, station Ukladochnaya, 12.06.2009;* ***I.*** *Eupithecia thalictrata (Püngeler, 1902), male, Zarinsky district, 10 km W Tyagun, 05-15.07.2013.*

35. *Venusia cambrica* Curtis, 1839

The larvae can damage buds and leaves of *Lonicera* (Caprifoliaceae) (Mironov 1999).

36. *Rheumaptera hastata* (Linnaeus, 1758)

The species has been noted as a tree pest in Altai Krai damaging *Betula* (Betulaceae) (Perunov

2017b).

37. *Operophtera brumata* (Linnaeus, 1758)

The larvae can damage *Pyrus*, *Malus*, *Prunus* (Rosaceae) and other deciduous trees: *Tilia* (Malvaceae), *Quercus* (Fagaceae), *Ulmus* (Ulmaceae), *Corylus* (Betulaceae), *Fraxinus* (Oleaceae) etc. (Mironov 1999).

38. *Trichopteryx polycommata* ([Denis & Schiffermüller], 1775)

The larvae can damage buds and leaves of *Lonicera* (Caprifoliaceae) (Mironov 1999).

39. *Pasiphila rectangulata* (Linnaeus, 1758)

The larvae can damage flowers of *Malus*, *Pyrus*, *Prunus*, *Cydonia* (Rosaceae) (Mironov 1999).

40. *Eupithecia exiguata* (Hübner, [1813])

The larvae can damage leaves and fruits of *Berberis* (Berberidaceae), *Crataegus*, *Prunus*, *Sorbus* (Rosaceae), *Ribes* (Grossulariaceae), *Frangula* (Rhamnaceae), *Fraxinus* (Oleaceae), *Viburnum* (Adoxaceae), *Cornus* (Cornaceae), *Salix* (Salicaceae), and *Acer* (Sapindaceae) (Mironov 1999).

41. *Eupithecia assimilata* Doubleday, 1856

The larvae can damage *Ribes* (Grossulariaceae) and *Humulus* (Cannabaceae) (Mironov 1999).

42. *Eupithecia innotata* (Hufnagel, 1767)

The larvae can damage *Sorbus*, *Crataegus*, *Prunus*, *Cotoneaster*, *Rosa* (Rosaceae), *Hippophae* (Elaeagnaceae); they can also develop on *Fraxinus* (Oleaceae), *Salix* (Salicaceae), *Alnus* (Betulaceae), *Sambucus* (Adoxaceae), *Frangula* (Rhamnaceae), *Lonicera* (Caprifoliaceae), *Tamarix* (Tamaricaceae) and *Artemisia* (Asteraceae) (Mironov 1999).

The checklist of geometrids of Altai Krai

Subfamily ARCHIEARINAE

1. *Archiearis notha* (Hübner, [1803]) – Kr2(a), P1(b)

2. *Archiearis parthenias* (Linnaeus, 1761) – B(q, r), B2(d), B3(e), Kr2(a), P3(a, b, ad), Zm2(b)

Subfamily ENNOMINAE

3. Cabera exanthemata (Scopoli, 1763) – K1(Volynkin et al. 2011), P3(g, h, j, x, af, ar), Ru5, She1, Tg2, Tg5

4. Cabera leptographa Wehrli, 1936 – P1(c)

5. *Cabera pusaria* (Linnaeus, 1758) – B2(i, m, n), Ch1, K1(Volynkin et al. 2011), K1(l), P3(aq, ar), V1, Z1(c), Zm1(b)

6. **Eilicrinia cordiaria* (Hübner, 1790) – Lo3(a)

7. *Lomographa bimaculata* (Fabricius, 1775) – B2(i), Kl3, Kr1(a), P3(o, af, aq, ar, av), Tg5

8. *Lomographa temerata* ([Denis & Schiffermüller], 1775) – K1(Volynkin et al. 2011), K1(a, e, i), P3(af, aq), Tg5, Tro5(b), Zm1(b)

9. *Odontopera bidentata* (Clerck, 1759) – K1(Volynkin et al. 2011), So2, Tg5

10. *Crocallis elinguaria* (Linnaeus, 1758) – Ch4(d), Z1(d)

11. *Petrophora chlorosata* (Scopoli, 1763) – K1(Volynkin et al. 2011), K3, Kr1(a), Kr2(a, c), P3(w), Tg5

12. *Selenia dentaria* (Fabricius, 1775) – B(k), Kr2(a), P3(ae), Ru5

13. *Selenia tetralunaria* (Hufnagel, 1767) – B(e), B2(a), Bl4, K1(Volynkin et al. 2011), P3(n, y), Tg5

14. *Cepphis advenaria* (Hübner, 1790) – B2(k), P3(ak), Tg5, Tl1(d), Tro3, Z1(e)

15. *Plagodis dolabraria* (Linnaeus, 1767) – P3(w, ag, af, ak, ar), Tg5

16. *Plagodis pulveraria* (Linnaeus, 1758) – B(k), B2(a), Bi(d), K3, Kr2(c), P1(a, b), Tg5

17. *Pseudopanthera macularia* (Linnaeus, 1758) – Alt3(g), B2(i), K1(Volynkin et al. 2011), K1(a), P3(d, o), So2, Tro3, Uk1, Z2(b), Zm1(b)

18. *Epione repandaria* (Hufnagel, 1767) – Kr1(b), Tro5(a)

19. *Epione vespertaria* (Linnaeus, 1767) – Alt4, Sm1

20. *Apeira syringaria* (Linnaeus, 1758) – K1(Volynkin et al. 2011), P3(q, w), T1(c), Tg2, Z1(c, e)

21. *Opisthograptis luteolata* (Linnaeus, 1758) – B(a, g, k), K1(Volynkin et al. 2011), Ko1(d), P2(a), P3(o, w, ae)

22. *Ennomos autumnaria* (Werneburg, 1859) – Bd2, Km2, Kr4, P3(k, t, ai), Re2, She2(a), So3, T1(c)

23. *Ourapteryx sambucaria* (Linnaeus, 1758) – B(l)

24. *Hylaea fasciaria* (Linnaeus, 1758) – Alt4, K1(Volynkin et al. 2011), K1(c, e), She1(a)

25. *Perconia strigillaria* (Hübner, 1787) – Alt3(g), K1(Volynkin et al. 2011), Kl1(b), Ug2

26. *Gnophopsodos ravistriolaria* (Wehrli, 1922) – Zm1(a) (Erlacher and Erlacher 2016)

27. *Gnophopsodos sabine* S.Erlacher & J.Erlacher, 2016 – Zm1(a) (Erlacher and Erlacher 2016)

28. **Charissa* (*Dysgnophos*) *turfosaria* (Wehrli, 1922) – K3, Kur1

29. *Charissa* (*Kemtrognophos*) *ambiguata* (Duponchel, 1830) – Ch9, Kur1

30. *Angerona prunaria* (Linnaeus, 1758) – B(d, g), Ch2(a), K1(Volynkin et al. 2011), Lo3(b), T1(a), Z2(b), Zm1(b)

31. *Chariaspilates formosaria* (Eversmann, 1837) – K1(Volynkin et al. 2011), K1(c, l)

32. *Hypoxystis pluviaria* (Fabricius, 1787) – Alt2, B(n), B2(e, f, h, l), B3(b), Bi(c), K1(Volynkin et al. 2011), K1(b), Kr1(a), P3(ap), So1

33. *Synopsia sociaria* (Hübner, 1799) – Kl1(a), Lo3(a), P3(j, k)

34. *Synopsia strictaria* Lederer, 1853 – K1(Volynkin et al. 2011), K1(i)

35. *Aspitates* (*Megaspilates*) *mundataria* (Stoll, 1782) – Alt3(e), Bl2, K1(l), Ku1

36. *Aspitates* (*Napuca*) albaria (Bartel, 1903) – Lo3(a)

37. *Siona lineata* (Scopoli, 1763) – Alt1, Alt3(h), B2(i), Ch3(a), Ch4(b), Ch9, K1(Volynkin et al. 2011), K1(i), Kh1, Kr3, Kur1, P3(a, r), So2

38. *Cleora cinctaria* ([Denis & Schiffermüller], 1775) – B(m, n), B2(g), B3(d), Bi(b), K1(Volynkin et al. 2011), K1(a), Kr2(a), P1(b), P2(c), P3(n, u, ap, au, av), Ru5, T1(b), Tro2(e)

39. *Ascotis selenaria* ([Denis & Schiffermüller], 1775) – B(l), B6(b), K1(Volynkin et al. 2011), K1(c), P3(af, aq, at)

40. *Ectropis crepuscularia* ([Denis & Schiffermüller], 1775) – Alt3(h), B2(n), K1(Volynkin et al. 2011), K3, Ko1(d), Kr1(a), Kr2(c), P3(n, w, ae, ar), Pv1(b), Ru3

41. *Parectropis similaria* (Hufnagel, 1767) – B2(m), P3(d, x, af, ar, aq)

42. *Aethalura punctulata* ([Denis & Schiffermüller], 1775) – B2(a), K1(Volynkin et al. 2011), K1(a), Kr2(c), P3(n, o, w, ap), Tro1(b)

43. *Arichanna melanaria* (Linnaeus, 1758) – Alt3(f), Alt4, K1(Volynkin et al. 2011), K1(c)

44. *Bupalus piniaria* (Linnaeus, 1758) – B2(i), B6(b), By, Ko1(d), P3(aq), Tl1(b)

45. *Cryopega bajaria* ([Denis & Schiffermüller], 1775) – P3(ac)

46. *Erannis jacobsoni* (Djakonov, 1926) – Alt3(b), Tro2(c)

47. *Biston betularia* (Linnaeus, 1758) – K1(Volynkin et al. 2011), K1(c, i), Ko2, P1(c), P2(b), P3(r, as), T1(a), Tg2

48. *Biston strataria* (Hufnagel, 1767) – B(m), B4, P1(a), Slt1, V2

49. **Jankowskia bituminaria* (Lederer, 1853) – Lo3(a, b)

50. *Lycia hirtaria* (Clerck, 1759) – B(t, q), B4, B6(a), K1(Volynkin et al. 2011), K1(b), Kr1(a), P1(a), P2(c), P3(ae, ap), Sl1(b)

51. *Lycia pomonaria* (Hübner, 1790) – P3(m)

52. *Phigalia djakonovi* Moltrecht, 1933 – Bi(e), P3(m, aj)

53. **Apocheima hispidaria* ([Denis & Schiffermüller], 1775) – Sl1(b)

54. *Hypomecis punctinalis* (Scopoli, 1763) – B(g), K1(Volynkin et al. 2011), P2(d), P3(h, w, x, af), Tro2(e)

55. *Hypomecis roboraria* ([Denis & Schiffermüller], 1775) – K1(Volynkin et al. 2011), P3(ag, aq, ar), She1(a), Sm2

56. *Ematurga atomaria* (Linnaeus, 1758) – A(b), Alt3(g), B1(f), B2(c, h, k, m), B3(c), K1(Volynkin et al. 2011), K1(a), Kh1, Kh2, Kr3, P3(at), Pn1(a), Ro1, So2, Zm1(b)

57. *Deileptenia ribeata* (Clerck, 1759) – Kr1(b), Kr2(b), Zm1(b)

58. *Paradarisa consonaria* (Hübner, 1799) – K1(Volynkin et al. 2011), K1(a), Kr2(a)

59. *Alcis deversata* (Staudinger, 1892) – Alt3(f), Alt4, B(u), B7, Ch5(a, b), Ch6, Ch7, Ch9, Ch9K1(Volynkin et al. 2011), K1(c, e, f, l), Kr1(b), Kr2(b), Kr5, P3(h, i, j, af, ar, at), P6, Pn1(b), Sm2, So3, Tg2, Tl1(e, f), Z1(b)

60. *Alcis extinctaria* (Eversmann, 1851) – Alt4, K1(Volynkin et al. 2011), Lo3(b), So2

61. *Alcis jubata* (Thunberg, 1788) –Be, Sm2, Z1(c)

62. *Xerodes semilutata* (Lederer, 1853) – K3, Kr2(a), So1

63. *Abraxas grossulariata* (Linnaeus, 1758) – B(e, g), Tl2(a), Ye1, Z1(c), Z3

64. *Abraxas karafutonis* Matsumura, 1925 – K1(l)

65. *Abraxas sylvata* (Scopoli, 1763) – Alt3(g), B2(d), Ch2(a), Ch4(b), K1(Volynkin et al. 2011), M1(a), P1(c), T1(a), Tl2(b), Z2(a), Z3

66. *Stegania cararia* (Hübner, 1790) – P3(aq, ap), Sm2, Z1(e)

67. *Stegania dalmataria* (Guenée, 1858) – Kl3, Ru3, Ug2

68. *Lomaspilis marginata* (Linnaeus, 1758) – A(b), Alt3(h), B2(i, k), K1(Volynkin et al. 2011), Ch9, K1(e, l), Lo3(a), M1(b), P2(d), P3(i, af, ar, as, aq), Sm2, Tg2, Tg5, Z2(a)

69. *Lomaspilis nigrita* Heydemann, 1936 – K1(e), P3(x, ar, aq), Tg5

70. *Heliomata glarearia* ([Denis & Schiffermüller], 1775) – Ba, Bl2, Ch2(b), Ch4(b), K1(Volynkin et al. 2011), K1(c, i, l), Kh1, Kl1(a), Kur1, Lo3(a), M1(a), P3(u, af, ap, ar), She1(a)

71. *Isturgia arenacearia* ([Denis & Schiffermüller], 1775) – Ch4(b), Kur1, P1(c), P2(d), P3(w, af, aq), Ru4, Ru5, Tg2

72. *Isturgia murinaria* ([Denis & Schiffermüller], 1775) – B1, B3(c), K1(Volynkin et al. 2011), K1(e), K2, Kh1, M1(b), Lo1, Shi1, P2(d), P3(j, af, av), Sl1(b), Tg2, She1(a), Tl1(f), Kl1(a)

73. *Narraga fasciolaria* (Hufnagel, 1767) – M3

74. *Narraga tessularia* (Metzner, 1845) – She1(a), M2(a, b)

75. *Digrammia rippertaria* (Duponchel, 1830) – M2(b)

76. *Macaria* (*Macaria*) *alternata* ([Denis & Schiffermüller], 1775) – B2 (m), Bd2, K1(Volynkin et al. 2011), K3, Kl3, Lo3(a, b), P3(aa, ak, aq, ar, as, at), Ru5, She1(a), Tg5, Z1(c)

77. *Macaria* (*Macaria*) *liturata* (Clerck, 1759) – P2(d), Pn1(a), Pv1(b), She1(a)

78. *Macaria* (*Macaria*) *notata* (Linnaeus, 1758) – B2(n), K1(Volynkin et al. 2011), Kh2, P3(h, q, aq, ar, at), Tg5

79. *Macaria* (*Macaria*) *shanghaisaria* Walker, 1861 – K1(l), P2(d), P3(r)

80. *Macaria* (*Macaria*) *signaria* (Hübner, 1809) – Tg5, Z1(c)

81. *Macaria* (*Speranza*) *brunneata* (Thunberg, 1784) – K1(Volynkin et al. 2011), K1(l)

82. **Macaria* (*Speranza*) *halituaria* (Guenée, 1858) – Lo3(b)

83. *Macaria* (*Speranza*) *wauaria* (Linnaeus, 1758) – B(g), Ru4, Z1(c)

84. *Chiasmia clathrata* (Linnaeus, 1758) – Alt3 (g, h), B2(c), Bd2, Bl4, Ch2(c), Ch4, Ch9, K1 (Volynkin et al. 2011), K1(c, e), Kl1(a), Kr1(a), Kr3, Ko1(b), Kur1, P1(b), P3 (d, u, av), Pn1 (a), Ru5, Sm2, So2, T1(a), Tg1, Tg5, Zm3

85. *Chiasmia saburraria* (Eversmann, 1851) – K3, Lo3(b)

Subfamily DESMOBATHRINAE

86. *Gypsochroa renitidata* (Hübner, 1817) – P3(h, x, ag, ak)

Subfamily GEOMETRINAE

87. *Geometra papilionaria* (Linnaeus, 1758) – K1(Volynkin et al. 2011), Ko1(a), M1(a), She1(a), Sm2, Tro2(a), P1(c), P3(w)

88. *Thetidia smaragdaria* (Fabricius, 1787) – Bl2, K1(l), M1(a), P3(x), Pn1(a), Pn2, She1(a)

89. *Hemistola chrysoprasaria* (Esper, 1795) – B7, K1(c, f, l)

90. *Hemistola zimmermanni* (Hedemann, 1879) – K1(Volynkin et al. 2011)

91. *Hemithea aestivaria* (Hübner, [1799]) – B(g), K1(Volynkin et al. 2011), P3(j, x), Z1(c)

92. *Jodis putata* (Linnaeus, 1758) – P3(w, ao), She1(a), Tg5, Z2(b)

93. *Thalera fimbrialis* (Scopoli, 1763) – K1(Volynkin et al. 2011), M1(a), P3(h, x)

94. *Dyschloropsis impararia* (Guenée, [1858]) – K1(Volynkin et al. 2011), Lo3(b)

95. *Chlorissa cloraria* (Hübner, [1813]) – K3, Ru5, Tg5

96. *Chlorissa viridata* (Linnaeus, 1758) – A(b), B(b, k), K1(Volynkin et al. 2011), Kh1, Kh2, Kl1(a), P3(w, af)

Subfamily STERRHINAE

97. *Cleta filacearia* (Herrich-Schäffer, 1847) – Lo3(a), M3

98. *Idaea aureolaria* ([Denis & Schiffermüller], 1775) – Bl3, K1(I, j), Kl2, M1(a), P3(d, r, w, x), Ug2

99. *Idaea aversata* (Linnaeus, 1758) – Bd2, K1(Volynkin et al. 2011), K1(h), Kr2(b), P3(h, i, j, x, ak), Ru4, Z1(c)

100. *Idaea biselata* (Hufnagel, 1767) – B2(b), K1(Volynkin et al. 2011), K1(e, l), Kr1(b), Kr2(b), Kr5, P1(d), Sm2, Z1(c)

101. *Idaea descitaria* (Christoph, 1893) – B(j), M3

102. *Idaea dimidiata* (Hufnagel, 1767) – Ch3(b), Tg2

103. *Idaea emarginata* (Linnaeus, 1758) – K1(Volynkin et al. 2011), P3(j), Tro2(d)

104. *Idaea mancipiata* (Staudinger, 1871) – T1(d), Zm(a)

105. *Idaea muricata* (Hufnagel, 1767) – Alt3(j), K1(Volynkin et al. 2011), K1(c), P3(ar), Pv2(a)

106. *Idaea pallidata* ([Denis & Schiffermüller], 1775) – A(a), K3, P3(w, ak)

107. *Idaea rusticata* ([Denis & Schiffermüller], 1775) – Ku1, M1(a), Ru4, She1(a), T1(d)

108. *Idaea sericeata* (Hübner, [1813]) – Ru1

109. *Idaea serpentata* (Hufnagel, 1767) – Alt3(a, d, f), Bi(b), K1(e), Kr1(b), Lo1, She1(b)

110. *Idaea straminata* (Borkhausen, 1794) – Bl2, P3(i, j, x, z, aa)

111. *Idaea sylvestraria* (Hübner, [1799]) – M2(a), P3(j, x, y, am)

112. *Limeria macraria* Staudinger, 1892 – M2(a)

113. *Scopula beckeraria* (Lederer, 1853) – Bl4, Kl3, Lo3(a), M1(b), M2(a, b), M3, Pn1(a), Ru2, Ru5

114. *Scopula decorata* ([Denis & Schiffermüller], 1775) – K1(l), K3, Kl1(a, d), Lo3(b), M2(a, b), Ru1

115. **Scopula dignata* (Guenée, [1858]) – Ch4(c)

116. *Scopula floslactata* (Haworth, 1809) – B(g), B2(k), Ch1, P3(d, h, aq), Tg2, Tg5, Tro3

117. *Scopula frigidaria* (Möschler, 1860) – K1(Volynkin et al. 2011)

118. *Scopula immorata* (Linnaeus, 1758) – B2(I, m, n), Kr4, P3(q, w, x), P4

119. *Scopula immutata* (Linnaeus, 1758) – K1(l), K1(Volynkin et al. 2011), P3(h, ag)

120. *Scopula incanata* (Linnaeus, 1758) – Alt3 (h, j), K1(e), K3, Lo3(a), Z2(c)

121. *Scopula marginepunctata* (Goeze, 1781) – Alt4, Lo3(a), Ru5, Tre1, Zm2(b)

122. *Scopula nemoraria* (Hübner, [1799]) – K1(l)

123. *Scopula nigropunctata* (Hufnagel, 1767) – K1(Volynkin et al. 2011), P3(h, x, ag), Tro4

124. *Scopula ornata* (Scopoli, 1763) – K1(Volynkin et al. 2011), K1(a, e), K3, Lo2, M2(a), P3(i, j, ae), So3, Tl1(f), Ru3

125. *Scopula rubiginata* (Hufnagel, 1767) – Bd2, K1(Volynkin et al. 2011), K1(d, e, l), Kn2, Kr2(b), Lo3(a), P3(e, j, q, w, aa, ag, ak), Pn2, Zm2

126. *Scopula subpunctaria* (Herrich-Schäffer, 1847) – Alt3(e, g), B(h), Ch5(b), K1(c), P3(j, al), Sm2, Tl1(f), Tg2, Z1(f)

127. *Scopula tessellaria* (Boisduval, 1840) – K3, Lo3(b)

128. *Scopula umbelaria* (Hübner, [1813]) – M1(a), P3(af, ar, as)

129. *Scopula virginalis* (Fourcroy, 1785) – Bd1, K1(Volynkin et al. 2011), P3(x), Tg2

130. *Scopula virgulata* ([Denis & Schiffermüller], 1775) – Alt3(a, e), Ba, K1(Volynkin et al. 2011), K1(c, f), P3(r, w, aa, ag), Tl1(f), She1(a)

131. *Rhodostrophia jacularia* (Hübner, [1813]) – K1(l)

132. *Rhodostrophia vibicaria* (Clerck, 1759) – Alt3(e), B(c), Bl3, Ch2(a), Lo3(b), M1(a), P3(h), She1(a), Ru1, Zm1(b)

133. *Cyclophora albipunctata* (Hufnagel, 1767) – P3(j, z, ae, at), Tg2, Z1(c)

134. **Cyclophora pendularia* (Clerck, 1759) – Bd2, Tg2

135. *Timandra comae* Schmidt, 1931 – Alt3(j), B(i, g), K1(e, f), Lo1, P3(j, k, ai, ah), Tl1(f), Tg2, Shi2

136. *Timandra recompta* (Prout, 1930) – K1(Volynkin et al. 2011)

137. *Casilda antophillaria* (Hübner, [1813]) – M2(b)

138. *Lythria cruentaria* (Hufnagel, 1767) – B(a), B2(a, h), Kh1

139. *Lythria purpuraria* (Linnaeus, 1758) – B(c), M1(b), Bl1, Ru1, Pn1(a), K1(e), Kl1(a), Ug1, P3(j), Ye1

Subfamily LARENTIINAE

140. *Cataclysme riguata* (Hübner, [1813]) – Ch9, K1(Volynkin et al. 2011), Lo3(a)

141. *Phibalapteryx virgata* (Hufnagel, 1767) – B3(b), K1(Volynkin et al. 2011), K1(f), Kl1(c), Kur1, M2(b), P3(j, ae), Ru5

142. *Scotopteryx chenopodiata* (Linnaeus, 1758) – Alt4, B(g), Ch3(b), Ch5(b), K1(Volynkin et al. 2011), K1(c, e), Km1, Kr1(b), P1(c), P3(h, j, aa, al), Tg2, Zm2(a)

143. *Costaconvexa polygrammata* (Borkhausen, 1794) – B(p), Bl4

144. *Catarhoe cuculata* (Hufnagel, 1767) – K1(Volynkin et al. 2011), K1(i), M2(b), P3

145. *Catarhoe rubidata* ([Denis & Schiffermüller], 1775) – P3(h, x)

146. *Camptogramma bilineata* (Linnaeus, 1758) – B(a), Ko1(c)

147. *Ochyria quadrifasiata* (Clerck, 1759) – K1(Volynkin et al. 2011), K1(c, e), P1(c), P3(r, x, al), Tg2, Tl1(f)

148. *Orthonama vittata* (Borkhausen, 1794) – P3(s), Shi1

149. *Xanthorhoe biriviata* (Borkhausen, 1794) – K1(l), Kr1(a), Kr2(a), So1, Tg2, Tg5, Tro3

150. *Xanthorhoe ferrugata* (Clerck, 1759) – B7, Bd2, K1(i, l), P3(q, ar)

151. *Xanthorhoe fluctuata* (Linnaeus, 1758) – B(v), Ch3(b), K1(Volynkin et al. 2011), Lo3(a), P2(c), P3(j, o, u, w, aa, ae, af, ah), Tl1(f), Tro2(b), Z1(b)

152. *Xanthorhoe montanata* ([Denis & Schiffermüller], 1775) – Alt1, Alt3(a, d, h), Ch2(a), K1(Volynkin et al. 2011), K1(i, f, l), N, P3(d), Z(b)

153. *Xanthorhoe spadicearia* ([Denis & Schiffermüller], 1775) – B(g), Kr4, Tg5

154. *Xanthorhoe stupida* (Alpheraky, 1897) – K1(Volynkin et al. 2011)

155. *Euphyia unangulata* (Haworth, 1809) – B(g), Bd2, Ch9, K1(Volynkin et al. 2011), Kr4, P2(e), P3(h, r, w, x, af), Tg5, Z1(b, e)

156. *Epirrhoe alternata* (Müller, 1764) – Alt4, B2(i), Ch3(b), K1(Volynkin et al. 2011), K1(c, e, f), M1(b), P3(o, w, x, ar, as), She1(a), Sm2, Tg2, Tg5, Tl1(f), Zm1(b), Zm2(a)

157. *Epirrhoe hastulata* (Hübner, 1790) – B2(i), P3(aq), Zm1(b)

158. *Epirrhoe pupillata* (Thunberg, 1788) – K1(Volynkin et al. 2011), P3(o, x, y, af, am, aq, as)

159. *Epirrhoe tartuensis* Mols, 1965 – K1(c), K1(Volynkin et al. 2011), P3(as)

160. *Epirrhoe tristata* (Linnaeus, 1758) – Alt3(c, h), K3

161. *Earophila badiata* ([Denis & Schiffermüller], 1775) – B(n), Bi(d), Bl4, K1(a), P3(n)

162. *Earophila kolomietsi* Vasilenko, 2003 – K1(Volynkin et al. 2011)

163. *Anticlea derivata* ([Denis & Schiffermüller], 1775) – B2(j), K1(Volynkin et al. 2011), K1(a), Kr2(a), Sl1(b)

164. *Mesoleuca albicillata* (Linnaeus, 1758) – Alt3(j), B2(g, m, n), Ch9, K1(Volynkin et al. 2011), K1(c, i), P3(x, ar), She1(a), Tro3, Z1(c), Z2(b)

165. *Pelurga comitata* (Linnaeus, 1758) – Bd2, Ch3(b), K1(Volynkin et al. 2011), K1(d, l), P1(c), P3(at), Sl1(a), Tl1(f)

166. *Pseudentephria lamata* (Staudinger, 1897) – Tg2

167. *Larentia clavaria* (Haworth, 1809) – B(o), P3(l, t, ab), She2(b)

168. *Spargania luctuata* ([Denis & Schiffermüller], 1775) – K1(l), Zm1(b)

169. *Hydriomena furcata* (Thunberg, 1784) – K1(l), Sm1, Sm2

170. *Colostygia aptata* (Hübner, [1813]) – Alt3(a), K1(Volynkin et al. 2011), K1(l)

171. *Colostygia pectinataria* (Knoch, 1781) – K1(i), Tg2, Z1(c)

172. *Colostygia turbata* (Hübner, [1799]) – Kr1(b)

173. *Electrophaes corylata* (Thunberg, 1792) – B(g), Ko1(d), P3(o, af, ag, ak)

174. *Dysstroma citrata* (Linnaeus, 1761) – Alt4, B6(c, d), Ch8, K1(e), Kr4, P3(j, aa, an), Tro6, Sm2, Z1(b, d), Z2(c)

175. *Dysstroma truncata* (Hufnagel, 1767) – K1(Volynkin et al. 2011), So3

176. *Cidaria fulvata* (Forster, 1771) – K1(Volynkin et al. 2011), K1(c, k)

177. *Thera obeliscata* (Hübner, [1787]) – Tl4

178. *Thera variata* ([Denis & Schiffermüller], 1775) – Ch1, Sm2

179. *Heterothera taigana* (Djakonov, 1926) – K1(l), Zm1(b)

180. *Eustroma reticulata* ([Denis & Schiffermüller], 1775) – Sm2, Z1(c)

181. *Eulithis achatinellaria* (Oberthür, 1880) – P3(aa), So3

182. *Eulithis mellinata* (Fabricius, 1787) – B(g), Lo3(b), M1(b), P3(h, x, ar), So3, T1(d)

183. *Eulithis prunata* (Linnaeus, 1758) – Ch4(a), K1(Volynkin et al. 2011), K1(c), Kr1(b), P3(t, aa, ah, at), T1(a), Zm2(a)

184. *Eulithis testata* (Linnaeus, 1761) – Alt4, K1(Volynkin et al. 2011), K1(e), Kr1(b), Kr4, Pv1(a), Shi1, Tl1(f), Tro1(a), P2(e), P3(aa)

185. *Gandaritis pyraliata* ([Denis & Schiffermüller], 1775) – K1(Volynkin et al. 2011), P3(z)

186. *Ecliptopera capitata* (Herrich-Schäffer, [1839]) – B(s), K1(l), Tg5

187. *Ecliptopera silaceata* ([Denis & Schiffermüller], 1775) – K1(Volynkin et al. 2011)

188. *Polythrena coloraria* (Herrich-Schäffer, 1855) – Z2(c), Zm1(b)

189. *Cosmorhoe ocellata* (Linnaeus, 1758) – K1(Volynkin et al. 2011), K1(f), P3(r, w, ag, al, as)

190. *Nebula serpentinata* (Lederer, 1853) – K1(Volynkin et al. 2011), P2(b)

191. *Lampropteryx suffumata* ([Denis & Schiffermüller], 1775) – B2(a), Kr2(a, c), So3, Tg5

192. *Epirrita autumnata* (Borkhausen, 1794) – Alt3(b), Ch2(d), Tg4

193. *Asthena amurensis* (Staudinger, 1897) – Alt3(j), B2(n), K1(Volynkin et al. 2011), Z1(c), Zm1(b)

194. *Euchoeca nebulata* (ScopoIi, 1763) – K1(Volynkin et al. 2011)

195. *Venusia blomeri* (Curtis, 1832) – B7, Ko1(d), P3(x, ag), Tg2, Tg5, Z1(c)

196. *Venusia cambrica* Curtis, 1839 – Alt3(d), Z1(c)

197. *Hydrelia flammeolaria* (Hufnagel, 1767) – B2(n), Ko1(d), P3(w, x, af, ag, ak)

198. *Hydrelia sylvata* ([Denis & Schiffermüller], 1775) – Ko1(d), P3(ag), Tro3, Z1(e)

199. *Philereme vetulata* ([Denis & Schiffermüller], 1775) – B7

200. *Rheumaptera hastata* (Linnaeus, 1758) – B(g), Tro3, Z2(b), Zm1(b)

201. *Rheumaptera subhastata* (Nolcken, 1870) – Z1(a)

202. *Rheumaptera* (*Hydria*) *undulata* (Linnaeus, 1758) – Alt3(j), B(g), K1(Volynkin et al. 2011), K1(g), Ko1(d), Kr1(b), M1(a), P3(e, r), Tg3

203. *Baptria tibiale* (Esper, 1791) – Alt3(e, g, h, i, j), P3(w)

204. *Coenocalpe lapidata* (Hübner, 1809) – So3

205. *Horisme aemulata* (Hübner, [1813]) – K1(Volynkin et al. 2011)

206. *Horisme aquata* (Hübner, [1813]) – M2(a), K3, Kur1

207. *Horisme scotosiata* (Guenée, 1858) – Alt3(f), K1(e), Zm2(a)

208. *Horisme tersata* (Denis & Schiffermüller, 1775) – Alt3(f), K1(Volynkin et al. 2011), P3(ae, ak, aq)

209. *Horisme vitalbata* (Denis & Schiffermüller, 1775) – P3(h)

210. *Melanthia procellata* (Denis & Schiffermüller, 1775) – K1(Volynkin et al. 2011), K1(e, l), Z1(e), Zm2(a)

211. *Anticollix sparsata* (Treitschke, 1828) – B(g), P3(h)

212. *Schistostege nubilaria* (Hübner, [1799]) – Alt3(d), Ch5(a), K1(l)

213. *Odezia atrata* (Linnaeus, 1758) – Alt1, Alt3(a, d, g), K1(l)

214. *Aplocera plagiata* (Linnaeus, 1758) – Lo3(a), K1(Volynkin et al. 2011),

215. *Lithostege farinata* (Hufnagel, 1767) – Bl3, K1(i, l), Kl2, M1(b), P3(d, h, i, w, ak, ar, at), Ro1, She1(a), T1(a)

216. *Lobophora halterata* (Hufnagel, 1767) – B2(f), Bl4, P3(ae, af, ak)

217. *Pterapherapteryx sexalata* (Retzius, 1783) – P3(af, ao, ar), Tg5, Z1(c)

218. *Acasis appensata* (Eversmann, 1842) – Kr2(a)

219. *Acasis viretata* (Hübner, [1799]) – Tl1(a)

220. *Trichopteryx carpinata* (Borkhausen, 1794) – B2(g), Bi(d), P3(n, ad, aj, au, av)

221. *Trichopteryx polycommata* ([Denis & Schiffermüller], 1775) – P3(au), Zm2(b)

222. *Perizoma albulata* (Denis & Schiffermüller, 1775) – Ch5(a), K1(l), K1(Volynkin et al. 2011), K1(c, d, e), P3(s, w, x, y, ag, ak, ar), Zm1(b)

223. *Perizoma alchemillata* (Linnaeus, 1758) – K1(Volynkin et al. 2011), K1(c, e), Kr2(b), P3(h, x, ag, al, as), Tg2

224. *Perizoma flavofasciata* (Thunberg, 1792) – B(g), K1(Volynkin et al. 2011), P3(w, x, ag, al), Tg2

225. *Perizoma hydrata* (Treitschke, 1829) – Alt4, K1(Volynkin et al. 2011), P3(w, af, ag, aq), Sm2

226. *Martania taeniata* (Stephens, 1831) – Bi(c)

227. *Gagitodes sagittata* (Fabricius, 1787) – K1(Volynkin et al. 2011), K1(f), P3(x)

228. *Chloroclystis v-ata* (Haworth, 1809) – Tg5, Z1(c)

229. *Pasiphila chloerata* (Mabille, 1870) – P3(ar), Tg2, Z1(c)

230. *Pasiphila rectangulata* (Linnaeus, 1758) – B7

231. *Eupithecia abietaria* (Goeze, 1781) – P3(r), Tg5

232. *Eupithecia absinthiata* (Clerck, 1759) – K1(Volynkin et al. 2011), Kl1(a), Lo3(a), P3(y, as), Z1(c)

233. *Eupithecia assimilata* Doubleday, 1856 – B(f), B5, Kh2, P3(e, r, o, q, v, af, ag, al, as), Pv2, Tg2

234. *Eupithecia biornata* Christoph, 1867 – Bu, M1(b), M2(a), Ye1

235. *Eupithecia carpophilata* Staudinger, 1897 – P3(ar, as)

236. *Eupithecia centaureata* (Denis & Schiffermüller, 1775) – K1(Volynkin et al. 2011), K1(e), Kl3, M2(b), P3(x, af, ag, ak)

237. *Eupithecia denotata* (Hübner, [1813]) – Kr2(b)

238. *Eupithecia exiguata* (Hübner, [1813]) – B7, K1(Volynkin et al. 2011), K1(i), K3, Lo3(a), Ru5

239. *Eupithecia extensaria* (Freyer, 1845) – Bl4, Kl3, Lo3(a)

240. *Eupithecia extraversaria* Herrich-Schäffer, 1852 – K1(k), K3, Ru5

241. *Eupithecia icterata* (De Villers, 1789) – K1(Volynkin et al. 2011), Kl1(a), P3(j, h, r, x, y, z, aa, ag, as), T1(d), Tg2, Ye1

242. *Eupithecia innotata* (Hufnagel, 1767) – Bl4, K1(Volynkin et al. 2011), K1(e), Kl3, Lo3(a), M3, P3(o, x, y, ag), Ru5

243. *Eupithecia jezonica* Matsumura, 1927 – B7, K1(Volynkin et al. 2011), K1(e)

244. *Eupithecia lariciata* (Freyer, 1842) – K1(j)

245. *Eupithecia laquaearia* Herrich-Schäffer, [1848] – M2(a)

246. *Eupithecia linariata* ([Denis & Schiffermüller], 1775) – Bd2, K1(k), M2(a, b), P1(d), P3(g, h, x, ag, af, as), Tg2, Tl1(f), Shi1

247. *Eupithecia ochridata* Schutze & Pinker, 1968 – K1(a), Lo3(a), Ru3

248. **Eupithecia orphnata* W.Petersen, 1909 – P3(p), Ru5

249. *Eupithecia pimpinellata* (Hübner, [1813]) – K1(j)

250. *Eupithecia plumbeolata* (Haworth, 1809) – K1(i), P3(y)

251. *Eupithecia satyrata* (Hübner, [1813]) – Alt3(h), K1(Volynkin et al. 2011), Lo3(a), P3(w, x, aq, ar)

252. *Eupithecia simpliciata* (Haworth, 1809) – M1(b), T1(d)

253. *Eupithecia sinuosaria* (Eversmann, 1848) – B(s), She2(a), T1(d)

254. *Eupithecia subbrunneata* Dietze, 1904 – K1(i, j)

255. *Eupithecia subfuscata* (Haworth, 1809) – B(g), K1(Volynkin et al. 2011), P3 (o, w, x, af, ag, al), Z1(c)

256. *Eupithecia subumbrata* ([Denis & Schiffermüller], 1775) – K1(i), P3(q, w, x, ae, af, ag, ar)

257. *Eupithecia succenturiata* (Linnaeus, 1758) – K1(Volynkin et al. 2011), K1(j), P3(h, r, x, ag, ar, ak), T1(d), Tg2

258. **Eupithecia thalictrata* (Püngeler, 1902) – P3(af), Z1(c)

259. *Eupithecia tripunctaria* Herrich-Schäffer, 1852 – K1(c), P3(q, w)

260. *Eupithecia venosata* (Fabricius, 1787) – K1(k), Re1, Tg2, P3(r, x, al)

261. *Eupithecia virgaureata* Doubleday, 1861 – K3, Ru5

262. *Eupithecia vulgata* (Haworth, 1809) – B(w), K1(Volynkin et al. 2011), P1(b), Re1

Conclusion

Altogether 262 species of geometrid moths from 6 subfamily were documented in Altai Krai: Archiearinae (2 species), Ennominae (83 species), Desmobathrinae (1 species), Geometrinae (10 species), Larentiinae (123 species), Sterrhinae (43 species). The species discovered in the Altai Krai for the first time are known in neighboring Russian regions (i.e. Omsk Oblast, Altai Republic) and Eastern Kazakhstan. New records clarify their distribution borders. Around 16% of all geometrids of the region are represented by the pestiferous species; they are from following genera: *Eulithis* Hübner, 1821 (4 species), *Macaria* Curtis, 1826 and *Eupithecia* Curtis, 1825(3 species), *Lomographa* Hübner, 1825, *Plagodis* Hübner, 1823, *Biston* Leach, 1815, *Lycia* Hübner, 1825, *Hypomecis* Hübner, 1821, and *Abraxas* Leach, 1815 (2 species), and *Odontopera* Stephens, 1831, *Selenia* Hübner, 1823, *Apeira* Gistl, 1848, *Ennomos* Treitschke, 1825, *Opisthograptis* Hübner, 1823, *Angerona* Duponchel, 1829, *Ascotis* Hübner, 1825, *Bupalus* Leach, 1815, *Cryopega* Dumont, 1925, *Erannis* Hübner, 1825, *Apocheima* Hübner, 1825, *Ematurga* Lederer, 1853, *Geometra* Linnaeus, 1758, *Mesoleuca* Hübner, 1825, *Pelurga* Hübner, 1825, *Venusia* Curtis, 1839, *Rheumaptera* Hübner, 1822, *Operophtera* Hübner, 1825, *Trichopteryx* Hübner, 1825, *Pasiphila* Meyrick, 1883 (by 1 species each).

Despite, significant efforts devoted to compile the checklist of geometrids of Altai Krai, we admit that this list is still far to be exhaustive. Many species noted in the neighboring regions of Russia and Kazakhstan have not been found in the Altai Krai yet, but likely, they are present in the region and remain overlook. Further field studies would be required to clarify the diversity of this large and economically important group of moths in the region and, thus, clarify their modern ranges and impact to ecosystems.

Acknowledgements

The authors are grateful to M.N. Perunova, A.A. Kostomarov, M.V. Burmistrov, R.V. Yakovlev, V.V. Rudoi, L.S. Snigireva, K.E. Naydenova and P.A. Pavlova (Barnaul) for assistance in collecting material, V.G. Mironov (St. Petersburg) and S.V. Vasilenko (Novosibirsk) for help in identifying

some geometrids, and N.I. Kirichenko (Krasnoyarsk) for valuable advice on early drafts and help in polishing the text.

A.E. Naydenov was partially supported by the project of the Russian Science Foundation (grant № 22-16-00075).

References

Beljaev EA (2016) Fam. Geometridae – Pyadenitzi. In: Lelei AS (Ed.) Annotated catalogue of the insects of Russian Far East. Vol. 2. Lepidoptera. Dal’nauka, Vladivostok, 518–666. [In Russian]

Beljaev EA, Mironov VG (2019) Geometridae. In: Sinev SYu (Ed.) Catalogue of the Lepidoptera of Russia. Edition 2. St. Zoological Institute RAS, Petersburg, 235–281.

Belov DA (2011) Ekologo-troficheskie kompleksy rastitel'noyadnyh chlenistonogih v nasazhdeniyah Moskvy [Ecological-trophic complexes of herbivorous arthropods in Moscow plantings]. Lesnoy vestnik [Forestry bulletin] (4): 5–12. [In Russian]

Burnasheva AP (2011) Trophic relationships of geometrid moths (Lepidoptera, Geometridae) in the Central and South-Western Yakutia. Proceedings of the Russian Entomological Society 82: 67–76. [In Russian]

Erlacher S, Erlacher J (2016) A systematic revision of the genus *Gnophopsodos* Wehrli, 1945, with description of two new species (Lepidoptera: Geometridae). Zootaxa 4169 (3): 435–456. https://doi.org/10.11646/zootaxa.4169.3.2

Fajčik J (2003) Die Schmetterlinge Mittel-und Nordeuropas. Drepanidae, Geometridae, Lasiocampidae, Endromidae, Lemoniidae, Saturniidae, Sphingidae, Notodontidae, Lymantriidae, Arctiidae. ER-Print, Bratislava, 172.

Gordeeva TV, Gordeev SYu (2007) Family Geometridae – pyadenitzy. In: Ubugunova LL & Dubatolov VV (Eds) Lepidoptera of Buryatia. Siberian Branch of the Russian Academy of Sciences, Novosibirsk, 95–148. [In Russian]

Hausmann A (2004) Sterrhinae. In: Hausmann A (Ed.) The Geometrid Moths of Europe. Vol. 2. Apollo Books, Stenstrup, 1–600.

Kazansky AN (1958) Beryozovaya pyadenica (*Amphidasis betularia* L.) v Karagandinskoj oblasti [Birch moth (*Amphidasis betularia* L.) in the Karaganda region]. Trudy nauchno-issledovatel'skogo instituta zashchity rastenij [Proceedings of the Research Institute of Plant Protection]. Ural. obl. izdat. Uralsk (4): 152–159. [In Russian]

Knyazev SA (2020) Catalogue of Lepidoptera of Omsk Oblast (Russia). Macrolepidoptera. Families: Hepialidae, Brachodidae, Cossidae, Sesiidae, Limacodidae, Zygaenidae, Thyrididae, Drepanidae, Uraniidae, Geometridae, Lasiocampidae, Lemoniidae, Endromididae, Saturniidae, Sphingidae, Notodontidae, Lymantriidae, Arctiidae, Syntomidae, Erebidae, Nolidae, Noctuidae, Hesperiidae, Papilionidae, Pieridae, Lycaenidae, Nymphalidae, Satyridae. Acta Biologica Sibirica 6: 139–226. https://doi.org/10.3897/abs.6.e53005

Knyazev SA, Ivonin VV, Sinev SYu, Lvovsky AL, Dubatolov VV, Vasilenko SV, Ustjuzhanin PYa, Ponomaryov KB, Sal`nik AA (2017) New records of Lepidoptera from the South of West Siberian Plain. Ukrainian Journal of Ecology 7 (4): 659–667.

Kolomiets NG (1977) Zakonomernosti massovogo razmnozheniya sosnovoj pyadenicy v Zapadnoj

Sibiri i ih prakticheskoe znachenie [Patterns of mass reproduction of the pinemoth in Western Siberia and their practical significance]. Zashchita rastenij [Plant protection] (2): 61–63. [In Russian]

Kolomiets NG, Artamonov SD (1985) Cheshuekrylye vrediteli beryozovyh lesov [Lepidoptera pests of birch forests.]. Nauka, Novosibirsk, 127 pp. [In Russian]

Kulak AV (2017) European area dynamics of *Eilicrinia cordiaria cordiaria* (Hübner, [1790]) (Lepidoptera: Geometridae, Ennominae) under the present climate change. Nachrichten des Entomologischen Vereins Apollo, NF 38 (4): 212–216.

Makhov IA (2021) Geometridae (Lepidoptera) of the Baikal region: keys to species and an annotated catalogue. Part 1. Ennominae. Zootaxa 4962 (1): 1–125. https://doi.org/10.11646/zootaxa.4962.1.1

Makhov IA (2023) Geometridae (Lepidoptera) of the Baikal region: identification keys and annotated catalogue with notes to DNA barcoding. Part 2. Archiearinae, Geometrinae, Sterrhinae. Zootaxa 5294 (1): 1–120. https://doi.org/10.11646/zootaxa.5294.1.1

Makhov IA, Lukhtanov VA (2021) Geometrid moths (Lepidoptera, Geometridae) of the Baikal region: additions to the species list and results of DNA barcoding. Entomological Review 101 (8): 1154–1172.

Mironov VG (1999) Fam. Geometridae – Pyadenitzi. In: Kuznetsov VI (Ed.) Insects and mites – pests of agricultural plants. Vol. III. Lepidoptera. P. 2, Nauka, St. Petersburg, 249–267. [In Russian]

Mironov V (2003) Larentiinae II (Perizomini and Eupitheciini) In: Hausmann A (Ed.), The Geometrid Moths of Europe. Vol. 4. Apollo Books, Stenstrup, 1–463.

Mironov VG (2005) Subfam. Larentiinae (Eupitheciini). In: Ler PA (Ed.) Key to the insects of Russian Far East. Vol. V. Trichoptera and Lepidoptera. Pt 5. Dal’nauka, Vladivostok, 470–504. [In Russian]

Müller B, Erlacher S, Hausmann A, Rajaei H, Sihvonen P, Skou P (2019) Ennominae II. In: Hausmann A (Ed.) The Geometrid Moths of Europe. Vol. 6. Brill, Leiden, 1–906.

Naydenov AE, Yakovlev RV (2018) New discoveries of Geometridae on the territory of the State Nature Reserve “Tigireksky”, West Altai, Russia (Lepidoptera: Geometridae). SHILAP Revista de Lepidopterologia 46 (182): 255–261.

Palnikova YeN, Yagunov MN (2011) Analiz mnogoletnej dinamiki chislennosti sosnovoj pyadenicy v razlichnyh landshaftno-ekologicheskih usloviyah [Analysis of long-term population dynamics of the pine moth in various landscape and ecological conditions]. Hvojnye boreal'noj zony [Conifers of the boreal zone] 28(3–4): 245–251. [In Russian]

Perunov YuE (2017a) New and rare moths and butterflies (Lepidoptera: Noctuoidea, Geometroidae and Papilionoidea) from Altai krai (Russia). Altai Zoological Journal 12: 3–5. [In Russian]

Perunov YuE (2017b) Listogryzushchie nasekomye, obrazuyushchie kompleksnye ochagi v lesah na territorii Altajskogo kraya [Leaf-eating insects forming complex foci in forests in the Altai Territory]. In: Rol' Altajskogo kraya v ekologicheskom karkase Rossijskoj Federacii [The role of the Altai Krai in the ecological framework of the Russian Federation], 40–42. [In Russian]

Rozhkov AS, Raygorodskaya IA, Byalaya IV, Pleshanov AS, Verzhutsky BN, Volkova LM, Popov LV, Reimers NF, Jolova NG (1966) Vrediteli listvennitsy sibirskoy [Pests of Siberian larch]. Nauka,

Moscow, 328 pp. [In Russian]

Sinev SYu (Ed) (2019) Catalogue of Lepidoptera of Russia. Edition 2. Zoological Institute RAS, St. Petersburg, 448 pp. [In Russian]

Skou P, Sihvonen P (2015) Ennominae I. In: Hausmann A (Ed.) The Geometrid Moths of Europe. Vol. 5. Apollo Books, Stenstrup, 1–657.

Szekely L (2011) Moths of Romania 2. Geometridae 1. Archiearinae, Ennominae, Alsophilinae, Orthostixinae, Geometrinae. Disz-Tipo, Săcele/Braslov, 196 pp.

Van Nieukerken EJ, Kaila L, Kitching IJ, Kristensen NP, Lees DC, Minet J, Mitter C, Mutanen M, Regier JC, Simonsen TJ, Wahlberg N, Yen S, Zahiri R, Adamski D, Baixeras J, Bartsch D, Bengtsson BÅ, Brown JW, Bucheli SR, Davis DR, Prins J de, De Prins W, Epstein ME, Gentili-Poole P, Gielis C, Hättenschwiler P, Hausmann A, Holloway JD, Kallies A, Karsholt O, Kawahara AY, Koster J, Kozlov M, Lafontaine JD, Lamas G, Landry J, Lee S, Nuss M, Park K, Penz C, Rota J, Schintlmeister A, Schmidt BC, Sohn J, Solis MA, Tarmann GM, Warren A., Weller S, Yakovlev RV, Zolotuhin VV, Zwick A (2011) Order Lepidoptera Linnaeus, 1758. In: Zhang Z.-Q. (Ed.) Animal biodiversity: an outline of higher-level classification and survey of taxonomic richness. Zootaxa 3148: 212–221. https://doi.org/10.11646/zootaxa.3148.1.41

Vasilenko SV (2011) Interesting findings of rare geometrid species (Lepidoptera, Geometridae) in the Altai. Entomological review 91 (3): 405–409.

Vasilenko SV (2012) New species and other rare geometrid moths (Lepidoptera, Geometridae) in the Asian part of Russia. Entomological review 92: 422–426.

Vasilenko SV, Ivonin VV, Knyazev SA (2017) New records of geometrid moths (Lepidoptera, Geometridae) from the Russian Altai. Euroasian entomological journal 16 (2): 99–103. [In Russian]

Vasilenko SV, Volynkin AV, Snigireva LS, Ustjuzhanin PYa, Kuchina EA, Yakovlev RV (2016) Lepidoptera (Insecta) of proposed specially protected natural area ‘Belokurikha nature park’ (Northern Altai). First results. Biological Bulletin of Bogdan Chmelnitskiy Melitopol State Pedagogical University 6 (1): 167–176. http://dx.doi.org/10.15421/201608

Viidalepp J (1988) Fauna pyadenits gor Sredney Azii [Geometridae fauna of the central Asian mountains]. Nauka, Moscow, 231 pp.

Volynkin AV, Trilikauskas LA, Baghirov RT-O, Burmistrov MV, Byvaltsev AM, Vasilenko SV, Vishnevskaya MS, Danilov YuN, Dudko AYu, Dudko RYu, Knyshov AA, Kosova OV, Kostrov DV, Krugova TM, Kuznetsova RO, Kuzmenkin DV, Legalov AA, Lvovsky AL, Namyatova AA, Nedoshivina SV, Perunov YuE, Reschnikov AV, Sinev SYu, Solovarov VV, Tyumaseva ZI, Udalov IA, Ustyuzhanin PYa, Filimonov RV, Tshernyshev SE, Tshesnokova SV, Sheikin SD, Shcherbakov MV, Yanygina LV (2011) – [Invertebrates of the Tigirek Nature Reserve (an annotated check-list), Biota of the Tigirek Nature Reserve]. Trudy Tigirekskogo Zapovednika 4: 165–226. [In Russian]

Vorontsov AI (1982) Lesnaya entomologiya [Forest entomology]. Moscow, Vysshaya shkola, 384 pp. [In Russian]