

## Lepidopteran invasions in the Amur River basin in Khabarovskii Krai of Russia during 2005–2023

### О проникновениях чешуекрылых (Lepidoptera) в Среднее Приамурье Хабаровского края России в 2005–2023 гг.

V.V. Dubatolov  
В.В. Дубатолов

Institute of Systematics and Ecology of Animals, Siberian Branch of Russian Academy of Sciences, Frunze Str. 11, Novosibirsk 630091 Russia; Federal State Institution «Zapovednoe Priamurye», Yubileinaya Str. 8, Khabarovskii Krai, Bychikha 680502 Russia. E-mail: vvdubat@mail.ru. Институт систематики и экологии животных СО РАН, ул. Фрунзе 11, Новосибирск 630091 Россия; ФГУ «Заповедное Приамурье», ул. Юбилейная 8, Хабаровский край, Бычиха 680502 Россия.

**Key words:** invasion, Lepidoptera, Amur Region, Khabarovskii Krai, new records.

**Ключевые слова:** инвазия, Lepidoptera, Приамурье, Хабаровский край, новые находки.

**Abstract.** For 19 years (2005–2023), 26 lepidopteran species have invaded the southern regions of Khabarovskii Krai of Russia, of which 10 species established sustainable populations; 8 species, *Teliphasa amica* (Butler, 1879) (Crambidae), *Micromelalopha vicina* Kiriakoff, 1963 (Notodontidae), *Zanclognatha lui* Han et Park, 2005, *Lophomilia polybapta* (Butler, 1879), *Catocala nivea* Butler, 1877 (Erebidae), *Negritothripa hamponi* (Wileman, 1911), *Siglophora sanguinolenta* (Moore, 1888) (Nolidae) and *Diarsia ruficauda* (Warren, 1909) (Noctuidae) have achieved this by natural means, and 2 species, *Gelastocera eminentissima* Bryk, 1948 (Nolidae) and *Dysmilichia gemella* (Leech, 1889) (Noctuidae) can be considered as successfully introduced, but their local populations have not been studied. Invasions by the 16 unestablished species were either singular (7 species) or accidental (9 species).

**Резюме.** В течение последних 19 лет (2005–2023) на юге Хабаровского края наблюдались 26 инвазий среди Lepidoptera, из них более трети (10 видов) оказались успешными, основавшими существующие в настоящее время популяции: *Teliphasa amica* (Butler, 1879) (Crambidae), *Micromelalopha vicina* Kiriakoff, 1963 (Notodontidae), *Zanclognatha lui* Han et Park, 2005, *Lophomilia polybapta* (Butler, 1879), *Catocala nivea* Butler, 1877 (Erebidae), *Negritothripa hamponi* (Wileman, 1911), *Siglophora sanguinolenta* (Moore, 1888) (Nolidae) и *Diarsia ruficauda* (Warren, 1909) (Noctuidae). По двум видам: *Gelastocera eminentissima* Bryk, 1948 (Nolidae) и *Dysmilichia gemella* (Leech, 1889) (Noctuidae) наблюдений пока недостаточно. Более четверти (7 видов) инвазий были неуспешными, а ещё одна треть (9 видов) — случайными залётами.

## Introduction

The Macroheterocera fauna of the middle reaches of Amur River was studied well in 19–20th century. Up to the beginning of the 21st century, many papers on moths have been published: from Graeser [1888–1892] and Staudinger [1892] to modern paper by Dubatolov [2009–2022], Dubatolov, Dolgikh [2007–2011] and

Dubatolov et al. [2012–2014], with a common species assemblage having been more or less revealed. Since 2005, there has been an ongoing survey and monitoring of the Lepidoptera species occurring in and around the Bolshoi Khekhtsyur Nature Reserve that has resulted in a series of publications cited above. In the Anui Natural Park, such investigations began in 2017 [see Dubatolov, 2020–2023]. Several invasions by Macroheterocera species into the Amur River valley have been recorded during these surveys, although only a few have been successful. These invasions are discussed in the present paper.

## Materials and methods

Moths were collected almost every night during the warm season by means of the lamp DRV-160W, 220V on a wall of the reserve's homestead in Bychikha village (48°17'56" N, 134°49'18" E), from April or May (sometimes from June) to September or late October. Several times during the warm season, Jalas light traps were used to collect moths within various protected areas of the reserve [Dubatolov, 2012]. Moths were also collected using a screen with a 160W DRW lamp in the reserve's guardhouse near the mouth of Chirki River in the Ussuri River valley.

During such long period of time, many thousands of moths have been collected and/or observed. In 2023, a total number of the Lepidoptera species recorded from the Khekhtsyur Mts. and its vicinities reached 2480 species in 76 families in the Bolshoi Khekhtsyur Nature Reserve, and 1131 species in 47 families in the Anuiskii National Park.

The present work is registered in ZooBank (www.zoobank.org) under LSID urn:lsid:zoobank.org:pub:48685093-3332-494B-992E-1E6DFA42A83F

## Annotated list of lepidopteran species successful, accidental and unsuccessful invasions recorded in the Amur River basin in Khabarovskii Krai of Russia during 2005–2023 years

### SUCCESSFUL INVASIONS

#### Crambidae, Epipaschiinae *Teliphasa amica* (Butler, 1879)

Fig. 3.

**Material.** *Bychikba*: by light, 3–4.VIII.2011, 18–28.VII.2014; 20–30.VII, 9–10.VIII.2015, 9–10.VII.2016, 16–25.VII.2017, 25–28.VII.2018, 8–9.IX.2020 — 39♂♂, 17♀♀, 1 visual observation.

**Distribution.** Russia: the south part of Khabarovskii Krai, Maritime Territory, Sakhalin [Sinev et al., 2019]; Japan (Hokkaido, Honshu, Shikoku, Kyushu, Tsushima), Korea, China, including Taiwan, South-East Asia [Yamanaka, 2013].

**Remarks.** In the Khabarovsk suburbs, the species was first recorded from Bychikha in 2011, and after 2014 it has been observed nearly each year, but there were no records in 2022–2023. Before this invasion, its presence in Maritime Territory was questionable, and the species was not included in the Russian Lepidoptera Catalogue [Sinev, 2008].

#### Notodontidae

##### *Micromelalopha vicina* Kiriakoff, 1963

*Micromelalopha vicina* Kiriakoff, 1963: Dubatolov et al., 2012: 37, Pl. I, Fig. 9, 2013: 170.

**Material.** **Western edge of the Bolshekhkhtsyrskii Nature Reserve, Chirki:** guardhouse and its vicinities, by light and light traps, 20–21.VII, 25–26.VIII.2011, 25–26.VI, 14–15.VIII.2012, 10–12.VI, 7–8.VIII.2013, 20–21.VII.2017, 12–13.VII.2018, 23–24.VII, 11–12.VIII.2020 — 37♂♂, 4♀♀; Kurkunikha rivulet, by light trap, 21–22.VIII 2023 — 1♂; **Northern edge of the Bolshekhkhtsyrskii Nature Reserve, Kazakevitsbevo:** by light, 26–27.VIII.2012, 18–23.VII.2014 — 3♂♂; **river Sosninskii valley:** by light traps, 17–18.VII.2012, 24–25.VII.2017, 29–30.VII.2020 — 3♂♂, 1♀; **Bychikba:** by light, 28.V–15.VI, 28–29.VIII, 4–6.VI, 22–23.VII, 22–23.VIII.2014, 19–20.VI, 20.VII–16.VIII.2015, 18.VII–25.VIII.2016, 8–9.VI, 18–27.VI, 26–27.VII.2017, 5–6.VI, 3–4.VII, 22.VII–1.VIII.2018, 25–26.VI, 22.VII–14.VIII.2020, 24–25.VI, 22–23.VII.2021, 10–11.VII, 31.VII–2.VIII.2022, 20.VIII–3.IX.2023 — 61♂♂, 5♀♀; **Bolshei Ussuriiskii Island:** 48°24.328'N 134°53.162'E, mesophyte meadow, by light trap, 23–24.VII.2012 — 1♂. **Eastern edge of the Bolshekhkhtsyrskii Nature Reserve:** -2 km W from Chirki village, mixed forest, by light trap, 15–16.VI.2017 — 1♂

**Distribution.** In the past, the species was known from Maritime Territory of Russia, Korea, and North-East and East China [Matov, Dubatolov, 2008; Schintlmeister, 2008]. Since 2011, it has been observed in Khabarovskii suburbs [Dubatolov et al., 2012, 2013].

**Remarks.** In 19–20th centuries, the species was never recorded from the Amur River basin. It was first observed at the western part (located near the border with China) of the Nature Reserve, near Chirki: guardhouse, in 2011 [Dubatolov et al., 2012], and since then it has been recorded every year till 2022. From 2012, it was common in the northern part of the Reserve, and from 2013 the species has reached its eastern border. After the cold and snowless winter in 2018/2019

and the cold winter in 2021, the species was not observed in 2019, but later it was recorded at low abundances, no more than 2–3 specimens per year (while its average in 2011–2022 was about 10). There are two generations per year, the first flying in late May–June, the second — from mid-July to early September.

#### Erebidae, Herminiinae

##### *Zanclognatha lui* Han et Park, 2005

*Zanclognatha lui* Han et Park, 2005: Dubatolov, 2018: 172–174, Fig. 1: 2, Fig. 2: 1; Dubatolov, 2020a: 332; Dubatolov, 2021: 144–145.

**Material.** *Chirki:* guardhouse, by light traps, 20–21.VII.2017, 11–12.VIII.2010 — 15♂♂, 5♀♀; Kurkunikha rivulet, by light trap, 21–22.VIII 2023 — 1♂; **river Sosninskii valley:** by light traps, 24–25.VII.2017, 29–30.VII, 12–13.VIII, 27–28.VIII.2020, 8–9.VIII.2023 — 16♂♂, 4♀♀; **Bychikba:** by light, 30.VII–1.VIII.2018, 23–25.VIII.2019, 30.VII–28.VIII.2020, 1–6.VIII.2021, 31.VII–1.IX.2022, 8–22.VIII.2023 — 88♂♂, 15♀♀; **Eastern edge of the Bolshekhkhtsyrskii Nature Reserve:** -2 km W from Chirki village, mixed forest, by light trap, 9–10.VIII 2023 — 18♂♂.

**Distribution.** North Korea, North-East China; Russia (Khabarovsk suburbs only) [Han, Park, 2005; Dubatolov, 2018, 2020, 2021].

**Remarks.** Described recently from the border between Korea and China [Han, Park, 2005], and never recorded from Russia before 2017. The species was first recorded from the western border of Khekhtsyr, at the Chirki guardhouse in 2017 [Dubatolov, 2018], and later (2018) it expanded along the northern border of Nature Reserve towards Bychikha. In 2017–2023, it was recorded annually (about 18 observations per year) at western, northern and eastern borders of the Reserve. A single generation has been recorded, from late July to early September.

#### Hypeninae

##### *Lophomilia polybapta* (Butler, 1879)

*Lophomilia polybapta* (Butler, 1879): Dubatolov, 2015: 263, Colour plt.IV, Fig.7, Colour plt.V, Fig.20; 2021: 144, Fig.4.

**Material.** *Bychikba:* by light, 25–26.VII.2015, 10–11.VII.2018, 17–18.VII, 22–23.VII.2019, 16–17.VII.2020, 29–30.VI.2022 — 5♂♂, 1♀; **Nature Reserve Bolonskii:** Kirpu, by light, 6–7.VII.2016 — 1♂.

**Distribution.** Originally recorded from North China, Korea and Japan (Honshu, Shikoku, Kyushu, Tsushima). In the 80th (1987), the species was first collected in Maritime Territory: Shumny in Chuguevskii distr., 3 km N of Barabash-Levada and Mineralnoe in Pogranichny distr. [Kononenko, Behounek, 2009]. In 2015, it was first observed in Khekhtsyr, and in 2016 — in the Bolonskii Nature Reserve.

**Remarks.** Now the species is rare in Khekhtsyr, but is observed nearly each year, except for 2016–2017 and 2021 when it was not collected. It seems that its local population has been successfully established.

#### Catocalinae

##### *Catocala nivea* Butler, 1877

*Catocala nivea*, Dubatolov, Dolgikh, 2009: 150, pl.VII, fig.5.

**Material.** *Chirki:* guardhouse, by light, 16–17.IX.2017 — 2♂♂; **Kazakevitsbevo:** by light, 11–12.IX.2008 — 1 spm.; **Bychikba:** by light, 1–2.IX.2013, 5–7.IX.2015, 4–9.IX.2016, 14–15.IX.2017, 24–26.VIII.2019, 23–29.VIII.2020, 31.VIII–1.X.2021, 31.VIII–1.IX.2022, 6–7.IX.2023 — 13♂♂, 3♀♀.

**Distribution.** Formerly known only from Maritime Territory of Russia; it is also known from North India (Sikkim), Nepal, China (including Taiwan), Korea, Japan (Hokkaido, Honshu, Shikoku, Kyushu) [Sviridov, 2003; Kononenko, 2010; Ishizuka, 2011].

**Remarks.** One of the largest Underwings in Russia that was never recorded from the River Amur valley in 19–20th centuries. It was first observed in Kazakevitshevo and near Bikin in 2008 [Dubatolov, Dolgikh, 2009], but since 2013 has become common both at the western and northern borders of the Nature Reserve. It was recorded in 2015–2017 and 2019–2023. Observations were solitary, no more than 2–4 specimens per year, but the presence of a local population is unquestionable. One generation is recorded, from late August to mid-September.

### Nolidae

#### *Siglophora sanguinolenta* (Moore, 1888)

*Siglophora sanguinolenta* (Moore, 1888): Dubatolov, 2021: 145–146, Fig. 6.

**Material.** *Bychikha*: by light, 13–14.VIII, 27–28.VIII.2020, 25–26.VI, 5–6.IX.2021, 21–22.VI, 27–28.VI, 3–5.VIII.2022, 8.VIII–5.IX.2023 — 11♂♂, 5♀♀, 2 visual observations.

**Distribution.** Widely distributed in Asian tropics and subtropics from Northern India via China to Korea (including northern provinces), Taiwan and Philippines [Kononenko et al., 1998].

**Remarks.** First recorded in Russia in August 2020, both in Khekhtsyrsy [Dubatolov, 2021] and Bikin distr. of Khabarovskii Krai [Koshkin, 2021]. In 2021, after successful overwintering, the species became frequent in Bikin distr. [Koshkin, 2021] and rather common in Khekhtsyrsy. In both localities, it has two generations, in late June, and in late July–early September. In 2022–2023, its numbers continued to grow: in 2020 — 2 specimens, in 2021 — 2 specimens, in 2022 — 4 specimens, in 2023 — 8 specimens and 2 visual observations.

#### *Gelastocera eminentissima* Bryk, 1948

*Gelastocera eminentissima* Bryk, 1948: Dubatolov et al., 2012: 171, Colour plt.IV, Fig.26; Dubatolov, 2021: 145, Fig.5.

**Material.** *Chirki*: guardhouse, by light, 14–15.VIII.2012 — 1♀; *Bychikha*: by light, 26–27.VII.2019, 5–6.VIII.2020 — 1♂, 1♀.

**Distribution.** Formerly known from the southern part of Maritime Territory of Russia, and Korea [Kononenko, 2010].

**Remarks.** The first specimen was recorded from the western part of Bolshoi Khekhtsyrsy in 2012, two others were observed later at the northern part of Khekhtsyrsy [Dubatolov et al., 2013; Dubatolov, 2021]. It is likely that this species has established a local population in Khekhtsyrsy now, but is very rare.

#### *Negritothripa hampsoni* (Wileman, 1911)

*Negritothripa hampsoni* (Wileman, 1911): Dubatolov, 2020: 332, Fig.3.

**Material.** *Botchinskii Nature Reserve*: Mulpa River valley, arm of Kamenisty Ridge, 23–24.VII.2016 — 1♀; *Bychikha*: by light, 7–9.VII.2019, 7–8.VII.2020, 2–3.IX, 10–11.IX.2021, 5–6.VII.2022 — 3♂♂, 3 visual observations.

**Distribution.** Middle Amur (probably, from Jewish AO); Maritime Territory of Russia; China, Korea, Japan (Honshu, Shikoku, Tsushima) [Kononenko, 2010; Kishida, 2011].

**Remarks.** The species was previously known from Maritime Territory of Russia; the record from the Middle Amur was unproven. Surprisingly, in 2016, it was collected from the east slope of Sikhote-Alin Mts., in the Botchinsky Nature Reserve [Dubatolov, 2016]. Three years later, the species appeared in Khekhtsyrsy Mts. [Dubatolov, 2020], and since then it has been recorded annually, but rarely.

#### *Dysmilichia gemella* (Leech, 1889) — перилловая совка

*Dysmilichia gemella* (Leech, 1889): Dubatolov, 2015: 263, Colour plt.IV, Fig.12; Dubatolov, 2021: 146.

**Material.** *Chirki*: SE edge of the Khekhtsyrsy Nature Reserve, the lower reaches of River, an edge of a small wood between meadows, by light trap, 30–31.VII.2015 — 1♂; *Bychikha*: by light, 10–11.VIII.2020, 3–4.VIII.2022 — 2 visual observations.

**Distribution.** The southern part of Maritime Territory [Filipjev, 1927; Kurentzov, 1946]; China, Korea, Japan (Hokkaido, Honshu, Kyushu, Tsushima, Yaku) [Kononenko, 2003; Eda, Shikata, 2011]. More than ten years ago the species was discovered near Blagoveshchensk (Amurskaya Oblast) [Barbarich, 2012; Barbarich, Dubatolov, 2012].

**Remarks.** In Khekhtsyrsy, the species was recorded from its SE border in 2015 [Dubatolov, 2015]; in 2020 and 2022 (but not in 2023), it was also observed in Bychikha [Dubatolov, 2021].

### Noctuidae

#### *Diarsia ruficauda* (Warren, 1909)

*Diarsia ruficauda* (Warren, 1909): Dubatolov, 2015: 264, Colour plt.IV, Fig.17.

**Material.** *Chirki*: guardhouse, by light trap, 31.V–1.VI.2018 — 4♂♂, 2♀♀; -2 km W from the village, mixed forest, by light trap, 15–16.VI, 26–27.VI.2017 — 3♂♂, 3♀♀; *river Sosninskii valley*: by light traps, 18–19.VI.2015, 3–4.VI, 10–11.VI, 11–12.VIII, 29–30.VIII.2016, 5–6.VI, 13–14.VI, 22–23.VI.2017, 30–31.V.2018, 25–26.VI.2020, 21–22.VI.2021 — 39♂♂, 5♀♀; *Bychikha*: by light and bait traps, 18–24.VI, 4.VIII–4.IX, 4–5.X.2015, 29.V–15.VI, 3.VIII–6.IX, 2–3.X.2016, 4–29.VI, 16.VIII–1.IX.2017, 19.V–11.VI, 26–27.VI.2018, 14–15.VI, 24–26.VIII, 28–29.IX.2019, 22.VI–2.VII, 12.VIII–3.IX.2020, 14–26.VI, 2.VIII–1.IX.2021, 30.V–24.VI, 31.VII–5.VIII.2022, 28.V–27.VI, 7.VIII–7.IX.2023 — 134♂♂, 42♀♀, 27 visual observations.

**Distribution.** Formerly known from southern regions of Maritime Territory in Russia, Central and West China, Korea and Japan (Hokkaido, Honshu, Shikoku, Kyushu) [Kononenko, 2003; Kobayashi, 2011].

**Remarks.** The species had never recorded from the River Amur valley until its first observation at the northern border of the Nature Reserve in 2015 [Dubatolov, 2015]. In the same year, it became abundant and produced two generations. Two generations are still common now, the first one fly from late May to late June (or early July), and the second — from August to early October. After the snowless but frosty winter 2018–2019, the first generation in 2019 was thin (only one specimen was recorded), but the second became more frequent (three specimens were observed). In 2022–2023, the species was back to normal.

### UNSUCCESSFUL RECORDS

#### Crambidae, Pyraustinae

##### *Loxostege sticticalis* (Linnaeus, 1761) — луговой мотыльёк

*Loxostege sticticalis* (Linnaeus, 1761): Dubatolov, Streltsov, 2007: 85; Streltsov et al., 2011: 171–172.

**Material.** *Kazakevitshevo*: 14–15.VIII.2007, 9–12.IX.2008, 2–3.IX.2010 — 1♂, 3♀♀; *Bychikha*: by light, 12.IX.2005, 15–17.VIII.2007, 31.VII–1.VIII, 17–21.VIII, 9–10.IX, 2–22.X.2008, 24–26.V, 28–29.IX.2009, 19–20.VI.2015 — 11♂♂, 17♀♀; *Chirki*: bog, 29.V.2009 — 1♂.

**Distribution.** Widespread in Russia, except for northern regions; Eurasia, also excluding northern regions, North America [Kirpichnikova, 1999].

**Remarks.** Normally, there are no continuous populations either in Khekhtsyrsy, or around Khabarovsk vicinities, and all the records were sparse [Dubatolov, Streltsov, 2007]. Usually, moths are seen occasionally in the late summer (from mid-August) and the autumn. Suddenly, during the 31.VII–

1.VIII.2008 night, many tens of thousand (!) specimens appeared in Bychikha [Streltsov et al., 2011]. Many moths were in poor condition; hence it is likely that they could have come from China. In a week, this swarm reached Komsomolsk-na-Amure (~400 km NE of Khabarovsk), where its quantity in some places reached over hundreds of specimens per m<sup>3</sup>. In August, 12–13 moths appeared at the Amur River mouth (near Nikolaevsk-na-Amure). From 2009, the species quantity has been becoming lower and lower, and finally returned to occasional records. Similar mass migrations of this species were recorded from Kazakhstan to West Siberia [Knor, 1993].

### Saturniidae

#### *Rhodinia fugax* (Butler, 1877)

Fig. 1.

*Rhodinia fuga*X.(Butler, 1877): Dubatolov, Dolgikh, 2010: 138.

**Material.** *Kazakevitshevo*: by light, 25–26.IX.2009 — 1♀.

**Distribution.** Southern regions of Khabarovskii Krai, Maritime Territory; Japan (Hokkaido, Honshu, Shikoku, Kyushu), Korea, China [Tshistjakov, 1999; Kishida, 2011].

**Remarks.** Based on an empty cocoon, the species was first recorded from the southernmost part of Khabarovskii Krai, not far from Bikin [Dubatolov, Kurenstshikov, 2006]. A similar empty cocoon was found in Lazo distr. at January, 2, 2022 by Yu.N. Kya. In 2009, a single female was collected from near Kazakevitshevo. No other records from Khabarovskii Krai are known.

### Erebidae

#### Lymantriinae

#### *Numenes disparilis* Staudinger, 1887

Fig. 2.

**Material.** *Bychikha*: by light, 14–15.VII.2022 — 1♀.

**Distribution.** Southern parts of Khabarovskii Krai, Maritime Territory; Korea, North-Eastern and North China [Kozhantshikov, 1950; Tshistjakov, 2003].

**Remarks.** For a long time, the species was known from Maritime Territory of Russia only, with the single northern record being «Bikin River», near the border between Khabarovskii and Primorskii Krai [Kozhantshikov, 1950]. The single female of this species was first discovered in Khabarovskii Krai on the western slope of Sikhote-Alin Mts., in the upper reaches of Durmin River in 2011 [Koshkin, 2011]. Eleven years later, a female was caught by light in Bolshoi Khekhtsy. Probably, a local population occurs in Khabarovskii Krai, and new record show it is expanding.

### Catocalinae

#### *Catocala musmi* (Hampson, 1913)

*Catocala musmi*, Dubatolov et al., 2014: 78, Pl.IV, Figs 8, 10.

**Material.** *Bychikha*: by light, 4–5.VII, 31.VII–4.VIII.2013, 8–17.VII.2014, 11–20.VIII.2015, 9–10.VII.2016, 19.VII–1.VIII.2018 — 9♂♂, 4♀♀.

**Distribution.** Korea, from a single male [Hampson, 1913]; Russia: Maritime Territory, Khabarovsk suburbs [Dubatolov et al., 2014].

**Remarks.** The species was first discovered in Maritime Territory of Russia in 1987, and subsequently observed on a regular basis. In the Amur basin, it was first discovered in Bychikha in 2013, and later observed in 2014–2016, and 2018, about 2.6 observations per year. From 2019 to date, the species has never been recorded and probably disappeared, but in 2013–2018, its local population was successful.

### Noctuidae

#### *Euplexia koreaeplexia* Bryk, 1948

= *Euplexia vinacea* Sugi, 1982

*Euplexia koreaeplexia* Bryk, 1948: Dubatolov, 2019: 151–152; 2020: 334, Figs 6–7.

**Material.** *Botchinskii Nature Reserve*: Tyoplyi Klyutch, by light, 5–6.VII, 12–13.VII.2017 — 2♂♂; rivulet Mokhovoi, by light trap, 18–19.VI.2018 — 1♀; *Bolshoi Khekhtsy*: Sosninskii River valley, by light trap, 13–14.VI.2017 — 1♀; *Bychikha*: by light, 30.VI–2.VII.2019 — 2♂♂.

**Distribution.** In Russia, formerly known from Maritime Territory, Sakhalin and Kunashir, but it also occurs in China, Korea and Japan (Hokkaido, Honshu) [Eda, Shikata, 2011; Kononenko, 2016].

**Remarks.** In Khabarovskii Krai, the species was first recorded in 2017, both in Bolshoi Khekhtsy and Botchinskii Nature Reserves [Dubatolov, 2019, 2020]. As records are sparse, it is currently unclear whether local populations exist or whether the specimens collected are only vagrant.

#### *Spodoptera exigua* (Hübner, [1808])

Fig. 6.

*Spodoptera exigua* (Hübner, [1808]): Dubatolov, Dolgikh, 2009: 159; 2011: 193.

**Material.** *Bychikha*: by light, 11–12.IX.2008, 4–5.IX.2010, 6–7.IX.2011, 24–27.VIII.2014, 11–13.IX.2017, 17–18.VIII.2020 — 9♂♂, 1♀.

**Distribution.** A globally migrant species; widespread in southern and temperate Eurasia [Kononenko, 2016].

**Remarks.** In Khekhtsy, the species is observed regularly [Dubatolov, Dolgikh, 2009, 2011], but only in mid-late August and the first part of September. So, it is only vagrant here.

#### *Helicoverpa armigera* (Hübner, [1808]) —

хлопковая совка

Figs 5, 8.

*Helicoverpa armigera* (Hübner, [1808]): Dubatolov, Dolgikh, 2009: 157; Dubatolov, 2019: 151.

**Material.** *Bychikha*: by light, 16–17.IX.2005, 26–27.VIII.2015, 12–13.IX.2017, 7–8.IX.2019, 25–26.VIII.2021, 18–19.IX.2023 — 4♂♂, 2♀♀; Botchinskii Nature Reserve, Tyoplyi Klyuch, 1–2.X.2012 — 1♂.

**Distribution.** Old World tropical-subtemperate migrant species [Kononenko, 2016].

**Remarks.** In Khekhtsy, the species is observed occasionally, but rarely [Dubatolov, Dolgikh, 2009]. All specimens were recorded in late August and September, while in warmer regions it flies during all the warm season. So, in Khekhtsy, it seems to be a vagrant species only, as well as in Botchinskii Nature Reserve, at its NE distributional limit.

### ACCIDENTAL INVASIONS

### Sphingidae

#### *Agrius convolvuli* (Linnaeus, 1758) —

вьюнковый бражник

*Agrius convolvuli* (Linnaeus, 1758): Dubatolov et al., 2012: 37, Colour plt.I. Fig.8; 2013: 169.

**Material.** *Kazakevitshevo*: by light, 14–15.IX.2011 — 1♂; *Bychikha*: by light, 6–7.IX, 13–14.IX.2012, 12–13.IX, 20–21.IX.2017, 1–2.X.2019 — 3♂♂, 1♀, 1 wing.

**Distribution.** Widely distributed in the Old World: Africa, Europe, South-West, Middle, South and South-East Asia, Australia, New Zealand and Oceania [Pittaway, 2023; Pittaway, Kitching, 2023].



Figs 1–8. External appearance of moths from Bolshoi Khekhtsy: (1–7) upperside; (8) underside. 1 — *Rhodinia fugax*, 2 — *Numenes disparilis*, 3 — *Teliphasa amica*, 4 — *Ctenoplusia albistriata*, 5, 8 — *Helicoverpa armigera*, 6 — *Spodoptera exigua*, 7 — *Spodoptera depravata*.  
 Рис. 1–8. Внешний вид ночных чешуекрылых с Большого Хехцира: (1–7) сверху, (8) снизу. 1 — *Rhodinia fugax*, 2 — *Numenes disparilis*, 3 — *Teliphasa amica*, 4 — *Ctenoplusia albistriata*, 5, 8 — *Helicoverpa armigera*, 6 — *Spodoptera exigua*, 7 — *Spodoptera depravata*.

Масштаб — ???

**Remarks.** It is a well-known migrating (sub)tropical species in the East Hemisphere, which is regularly recorded in the late summer and autumn across the entire Amur basin, up to the Zeiskii Nature Reserve [Dubatolov, 1982; Dubatolov et al., 2012, 2013]. The survival of a local population is impossible due to inadequate heat provision.

*Acosmeryx naga* (Moore, [1858]) —  
бражник-кобра

*Acosmeryx naga* (Moore, [1858]): Dubatolov, 2022: 275–276, Fig.1.

**Material.** *Bychikba*: by light, 27–28.VI.2021 — 1♂.

**Distribution.** Widely distributed from Western Himalayas via Indo-China and China (excluding north-western provinces) to Japan and SE Russia.

**Remarks.** First discovered in the Russian Far East in the southern part of Maritime Territory in 2002 [Beljaev, 2003], and few years later it became rather common. In 2017, it was recorded from Kunashir Island [Rybalkin, Yakovlev, 2017]. Only in 2021, the species range expanded to the Amur River basin, Khekhtsy (in late June) [Dubatolov, 2022], and the vicinity of Blagoveshchensk [Koshkin et al., 2021].

#### Notodontidae

*Phareodonta bombycina* (Oberthür, 1881)

*Phareodonta bombycina* (Oberthür, 1881): Dubatolov et al., 2013: 169, Colour plt.III, Fig. 5.

**Material.** *Bychikba*: by light, 2–3.IX.2012 — 1♂.

**Distribution.** Maritime Territory of Russia; Korea and East China [Schintlmeister, 2008].

**Remarks.** Common in southern regions of Maritime Territory, but never recorded from the Amur River valley. A single observation in Khekhtsy [Dubatolov et al., 2013] looks like accidental penetration.

#### Erebidae, Lymantriinae

*Ilema jankowskii* (Oberthür, 1884)

*Ilema jankowskii* (Oberthür, 1884): Dubatolov, 2015: 262, Colour plt.IV, Fig.2.

**Material.** The SE edge of the Khekhtsy Nature Reserve, the upper reaches of the River, an edge of a small wood between meadows, by light trap, 27–28.VIII.2015 — 1♀; *Bychikba*: by light, 16–17.VIII, 23–24.VIII.2023 — 2♂♂, 1♀.

**Distribution.** Southern regions of Maritime Territory and Korea [Kozhantshikov, 1950; Tshistjakov, 2003].

**Remarks.** Common in broad-leaved forests in southern regions of Maritime Territory. There were few observations in Khekhtsyur in 2015 at eastern edge of the Nature Reserve [Dubatolov, 2015], and in 2023 in Bychikha at northern edge, which are likely to represent accidental penetrations from neighboring China.

#### Erebinae

##### *Mocis ancilla* (Warren, 1913)

*Mocis ancilla* (Warren, 1913): Dubatolov, 2021: 144, Fig. 1.

**Material.** *Bychikha*: by light, 29–30.VI.2020 — 1♂.

**Distribution.** North and East China, including Taiwan; Korea, Japan; Russia: Maritime Territory [Kononenko, 2010].

**Remarks.** In Khabarovskii Krai (also in the Amur valley), collected only once.

#### Noctuidae

##### *Ctenoplusia albostriata* (Bremer et Grey, 1853)

Fig. 4.

*Ctenoplusia albostriata* (Bremer et Grey, 1853): Dubatolov, Dolgikh, 2011: 192.

**Material.** *Bychikha*: by light, 1–2.IX.2010 — 1♂, 21–22.VIII.2023 — 1♀.

**Distribution.** In Russia, it is known from Maritime Territory, Sakhalin [Kononenko, 2010], Kunashir [Rybalkin, 2020]; also distributed in China (including Taiwan), Korea, Japan (Hokkaido, Honshu, Shikoku, Kyushu, Ryukyu) [Kobayashi, 2011], and from SE Asia to Australia and New Zealand [Kononenko, 2016].

**Remarks.** In southeastern Russia, the species is migrant [Kononenko, 2010]. In Bolshoi Khekhtsyur (as well as the entire Amur River basin), it has been observed only twice in 2010 [Dubatolov, Dolgikh, 2011] and in 2023.

##### *Acontia (Olivacontia) olivacea* (Hampson, 1891)

*Acontia (Olivacontia) olivacea* (Hampson, 1891): Dubatolov, 2018: 174, Fig. 4.

**Material.** *Bychikha*: by light, 3–4.VII.2016 — 1♂, 10–11.VII.2016 — 1♀.

**Distribution.** Known from Maritime Territory of Russia, North India, Nepal, China (including Taiwan), Thailand, Korea, Japan (Honshu), the Philippines, Indonesia [Kononenko, 2010].

**Remarks.** Only two specimens were recorded in July, 2016 from the entire Amur River valley [Dubatolov, 2018], which probably were migrant specimens.

##### *Spodoptera depravata* (Butler, 1879)

Fig. 7.

**Material.** *Bychikha*: by light, 30–31.VIII.2022 — 1♂.

**Distribution.** In Russia, the species is known from Maritime Territory only [Kononenko, 2016], but also distributed in China, Korea, and Japan (Hokkaido, Honshu, Shikoku, Kyushu, Tsushima) [Kononenko, 2016].

**Remarks.** A single migrant specimen was collected in late August, 2022 in Khekhtsyur. The species was identified by the male genitalia observed in a fresh specimen, without dissection.

##### *Athetis lapidea* Wileman, 1911

*Athetis lapidea* Wileman, 1911: Dubatolov, 2020: 334, Fig. 1: 5.

**Material.** *Kordon Chirki*: by light trap, 12–13.II.2018 — 1♂.

**Distribution.** Formerly known only from Maritime Territory in Russia; but also from China, Korea and Japan (Hokkaido to Kyushu, Tsushima) [Eda, Shikata, 2011; Kononenko, 2016].

**Remarks.** In the entire Amur River valley, the species was observed only once [Dubatolov, 2000], so this record is likely to have resulted from a migration event.

## Results and discussion

Several types of the species invasions have been observed: successful, unsuccessful, and accidental.

Of all the aforementioned 26 lepidopteran invasions, 34.6 % are occasional, 38.5 % — successful, forming sustainable local populations. This is a very high number. The remaining invasions seem to be regular but unsuccessful. Thus, in 18 years of observations, ten invasions, *Teliphasa amica*, *Micromelalopha vicina*, *Zanclonathia lui*, *Lophomilia polybapta*, *Catocala nivea*, *Negritothripa hamptoni*, *Siglophora sanguinolenta*, *Diarsia rufidicauda*, and probably, *Gelastocera eminentissima*, and *Dysmilichia gemella*, have resulted in the establishment of local populations. Yet, *Catocala musmi* had existed in Khekhtsyur for five years, but later disappeared.

To the above-mentioned moth invasions w two studied penetrations of Orthoptera (Acrididae) to Khekhtsyur should be added: *Locusta migratoria* Linnaeus, 1758 in 2018 and 2023 (both unsuccessful) and *Trilophidia annulata* (Thunberg, 1815) (successful) [Sergeev, Dubatolov, 2022]. For all such invasions, the presumed source could be the territory of North and North-East China. This territory is climatically warmer than the Ussuri River valley at the same latitude, which is corroborated by the existence of northern range limits for a number of species found in North-East China, but absent from even the southern part of Maritime Territory: *Papilio demetrius* Cr., *P. macilentus* Jans. (Papilionidae), *Eurema hecabe* L. (Pieridae), *Hestina assimilis* L. (Nymphalidae) [Kurentzov, 1970], *Cretonotos transiens* Wlk. [Dubatolov, 2010]. The same range type includes *Ypthima multistriata* Butler, 1883, which is widespread in East Asia, including Japan, but in Russia it is found only in Khekhtsyur and in a few other localities near Khabarovsk [Dubatolov, 2006], being completely absent from Maritime Territory even in the south.

In our opinion, one of the main factors contributing to successful invasions of the Russian Amur Region might to be climate warming, but similar local invasions took place 100 years ago in Southern Primorye also: *Acherontia styx* (Westwood, 1848) as *A. atropas* L. (!), *Erebus macrops* (Linnaeus, 1768) (Erebidae) [Moltrecht, 1929; Kononenko, 2010]. With the existence of a migration corridor both along the Ussuri River valley and in a west-eastern direction (from Manchuria to the lower Ussuri River) for numerous (tens!) of already recorded invasions, new invasions are to be expected in the future. Yet, future infestations by quarantine species and other pests cannot be ruled out either. Therefore, insect invasions in the Amur region should be monitored continuously.

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