Species of Orthosia Ochsenheimer, 1816 and Anorthoa Berio, 1980 genera (Lepidoptera, Noctuidae) in Western Transbaikalia

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Abstract. We report for the first-time occurrence of three species from the genus Orthosia – O. ariuna Hrebl., O. askoldensis Stre.; O. ella Butl., and a species Anorthoa munda Den. et Schiff on the territory of Western Transbaikalia. The faunas of these spring species are similar between Western and Eastern Transbaikalia (70%) and close to the fauna of the Far East (50%).

1. Introduction
Orthosia Ochs. is a large (more than 80 species) Holarctic genus of lepidopterans (Lepidoptera) from the Noctuidae family. The majority of the genus inhabits a temperate zone of Eastern and South-Eastern Asia [1, 2]. It is divided into several subgenera. Recently, one of them (Anorthoa Berio) was recognized as a separate genus [3]. In Eurasia, Orthosia species are primarily localized in the coastal ocean areas. The majority of species live in rainforests. In the Far East, they live in broadleaved, cedar-broadleaved, and mixed forests [1]. Another particular feature of these insects is early adult activity: the second part of April and May. In Transbaikalia, it is observed in the first decade of June in cold years. Few specimens of the second generation of O. gothica L. can be active at the end of July – the beginning of August. In Russia, there are 22 species of Orthosia genus and only 2 species of Anorthoa genus. Fourteen of them are spread in the Far East [4, 5]. Three Western Palearctic species (O. cerasi F., O. opima Hbn., O. populeti F.) were found in Siberia not further than Prebaikalia. To date, 5 species from this genus (O. ariuna Hrebl., O. ella Butl., O. gothica L., O. incerta Hbn., O. gracilis Den. et Schiff) [5-9] were found in the whole region of Transbaikalia. In Western Transbaikalia, were known only 3 last species. We aimed to study faunas of Orthosia and Anorthoa inhabiting Western Transbaikalia in more detail.

2. Materials and Methods
The material of the Lepidoptera genus stored in the collection of the Laboratory of Ecology and Systematics of Animals (LESA) of the Institute of General and Experimental Biology SB RAS was examined. The field surveys were conducted in April-May 2012-2021 in forests of the southern coast of Lake Baikal, Ulan-Burgasy Mountain range, and the Selenga Midmountain area. Specimens were collected with standard sweep nets and ultraviolet lamps, including light traps. The insects were placed on cotton pads or in entomological boxes. Before 2000, the material used in the study was primarily collected by T V Vlasova (Gordeeva). After 2000 and up to date, the material has been collected by S Yu Gordeev. The reference list for insect findings below contains only the names of other collectors. The species identification of insects was conducted according to [1, 3, 10], for which the genitalia
preparations were made with binocular Stemi 2000-C equipped with a video-ocular AxioCam E Rc 5s. These preparations were stored in Eppendorf vials filled with glycerin together with specimens. The species were classified according to the system accepted in recent publications [2, 5]. The comparison of the Orthosia faunas was based on species lists from the ‘Catalogue of the Lepidoptera of Russia’ [5] and our data. The analysis of the similarities in the compared faunas was made with BIODIV software. Of all the similarity measure indexes, the Kulczynski index was the most representative [11] because it gives more weight to shared characters maintaining the total number of characters. The clusters were established with the method of Unweighted Pair Group Average.

The research places are listed below:

- Ulan-Ude (51°50′00″ N, 107°37′00″ E). A city on the junction of the Selenga and Uda rivers within hollow, bunchgrass steppes of Daurian type;
- Onokhoy (51°55′16″ N, 108°2′43″ E). 30 km to WSW of Ulan-Ude. A large settlement located partly in the valley of the Uda river and partly on the southern terraces occupied by pine woods;
- Onokhoy-Shibir (52°0′34″ N, 108°0′16″ E). 11 km to the north of Onokhoy settlement. Pinewood on the slope and the larch-birch forest with pines in the valley nearby;
- Doboyonkhor (Dodo-Yonkhor) (52°0′43″ N, 108°9′13″ E). 15 km to the north-east of Onokhoy settlement. Elm woods in the intermountain lowlands and on the southern slopes with meadow steppe near mixed forests that grow near the brook;
- Khara-Atsagat (52°6′30″ N, 108°6′59″ E). 22 km to the north-east of Onokhoy settlement. Mixed forests with larch, fir, spruce, Siberian pine, birch, Scots pine, and aspen trees. Sometimes, only aspen woods;
- Tapkhar (51°44′30″ N, 107°20′7″ E). 20 km to WSW of Ulan-Ude. Elm woods, Spiraea aquilegifolia, bearwoods on stone slopes;
- Khorinsk (52°8′9″ N, 109°41′12″ E). 7 km to the south-west of the Khorinsk village. Fragmented pine woods, willow bushes in the floodplain of the Uda river;
- Barykino (51°8′56″ N, 107°6′44″ E). 10 km to SSW of Barykino village, 110 km to SSW of Ulan-Ude. Stony steppe slopes (elm, Spiraea aquilegifolia, apricot, buckthorn);
- Bolshaya Rechka (51°58′33″ N, 106°19′37″ E). 88 km to ESE of Ulan-Ude. Aspen and birch forests with Siberian pine, larch, willow, and riverside forests;
- Nikitikino (52°0′39″ N, 106°22′56″ E). 5 km to north-east of Bolshaya Rechka locality. Birch trees with narrow areas of sedge hill-rock areas near the northern edge of lake Nikitikino;
- Jirga (54°49′40″ N, 111°18′7″ E). Frontier on the territory of Dzherginsky Nature Reserve. Small-leaved woods with pines near grass meadows.

3. Results
The following abbreviations are used: m – male; f – female (figure 1).

1. Orthosia ariuna Hreblay, 1991

Material: Onokhoy, May 4-27, 1999, 2mm, 4ff; May 9, 2000, 1m, May 1-16, 2009, 7mm, 5ff, May 14-15, 2012, 1m, May 1 – June 2, 2013, 2mm, 7ff, April 23-24, 2018, 1m, May 21-22, 2019, 1m, April 27-29, 2020, 8mm, 9ff, May 10-11, 2021, 1m, 1f; Khorinsk, April 21, 2019, 1m; Barykino, May 6-7, 2018, 1m.

In the Western Transbaikal Region it was studied for the first time. Earlier, it was observed in Northern Mongolia, Onon Dauria, Primorye. It differs from a close species O. incerta Hfn. by the peculiarities of the male genitalia: narrow uncus, long vinculum, and long and narrow pollex [10]. In the region, lepidopterans are active from the end of April to the beginning of June. The species was observed only in the steppe belt of the Selenga Midmountain area.
2. *Orthosia incerta* (Hufnagel, 1766)

Jirga, May 25, 1996, 1m, 1f [9]; Baikal'sky Nature Reserve, 1981-2012, 236 specimens [12].

Material: Ulan-Ude, May 3-9, 1999, 1m, 3ff, S.G. Rudykh; Onokhoy, April 17, 1997, 1m, May 4 – June 9, 1999, 2mm, May 1-10, 2000, 3mm, 1f, May 1-5, 2009, 1m, 1f, May 5 – June 3, 2012, 5mm, May 1-6, 2013, 2mm, 4ff, May 21-23, 2019, 4mm, 1f, April 27-29, 2020 - 3mm; Onokhoy-Shibir May 2013, 3mm, 3ff; Dobo-Yonkhor, May 5-26, 2009, 10mm, 8ff; Khara-Atsagat, May 2017, 6mm, May 6-7, 2021, 1m; Tapkhar, April 23-24, 2018, 1m; Bolshaya Rechka, May 1-2, 2019, 2mm; Nikitkino, May 19-20, 2021, 20mm, 11ff.

In the northern part of the Selenga Midmountain area, this species is the most common *Metaheterocera* of early spring [13]. It was observed within the steppe, forest-steppe, and taiga belts.

![Figure 1. Adults and genitalia of *Orthosia-Anorthoa*.](image-url)
3. Orthosia askoldensis (Staudinger, 1892)
   Material: Barykino, May 6-7, 2018, 3mm.
   The species was observed in Transbaikal Region only in Tugnuiskaya Valley (Tugnuiskie poles). It also inhabits the Far East and Northern Mongolia. It differs from a close species O. gothica L. by a wide uncus and short processes of the lower fultura [1]. Moths were collected in the dry steppe belt near stone slopes.

4. Orthosia gothica (Linnaeus, 1758)
   Jirga, May 25, 1996, 1 specimen, May 28, 1996, 1 specimen [9]; Baikalsky Nature Reserve, 1981-2012, 420 specimens [12].
   Material: Ulan-Ude, June 7, 1998, 5mm, 1f, May 6-9, 1999, 1m, 1f, S.G. Rudykh; Onokhoy, May 17-25, 1996, 2mm, May 5-25, 1999, 2mm, May 10, 2000, 2mm, May 1-24, 2009, 3mm, May 31, 2012, 1m, May 22-23, 2019, 7mm, 3ff, April 29, 2020, 1m; Onokhoy-Shibir May 2013, 1m; Dobo-Yonkhor, May 2-26, 2009, 5mm; Khara-Atsagat, May 2017, 20mm, 10ff; Tapkhar, July 19, 1996, 1m, S.G. Rudykh; Bolshaya Rechka, May 1-2, 2019, 3mm; Nikitkino, May 19-20, 2021, 3mm, 6ff.
   The species is common in the northern part of the Selenga Midmountain area [8]. Earlier, it was found in the south of Baikal coast and Barguzin basin. The peculiarities of the spatial distribution of this species and O. askoldensis in the southern part of the Selenga Midmountain area require further studies.

5. Orthosia gracilis ((Denis & Schiffermüller), 1775)
   Jirga, May 26, 1996, 1f [Rudykh, Vlasova, 1997].
   Material: Onokhoy, May 25, 1998, 1f, May 7, 2000, 1m; Ulan-Ude, June 2, 1998, 2ff, June 15, 1998, 2ff; Khara-Atsagat, May 1, 2017, 1f.
   Earlier, a single female specimen was found in Buryatia in the Barguzin basin [9]. The image of the female genitalia, taken by T V Gordeeva, is stored in the records of LESA. Revision of the material showed that this species is frequently observed in the northern part of the Selenga Midmountain area (Ulan-Ude, Onokhoy settlement). One specimen was found in the wet forests of the Ulan-Burgasy Mountain range. This Euro-Siberian species may access the valleys of the rivers Selenga and Uda via this area.

6. Orthosia ella (Butler, 1878)
   Material: Bolshaya Rechka, May 1-2, 2019, 1m.
   The species is found in the Far East and the Eastern Transbaikal. It is systemically close to the Euro-Siberian species O. gracilis and hardly distinguishable from it by appearance. However, there are evident differences in the anatomy of the male and female genitalia [3]. The habitat in the eastern part of Europe needs to be verified [3]. In the region, it was known no further than the eastern part of the South-Eastern Transbaikal Region [6]. It should be noted that during the study period, this species was not found once in the northern part of the Selenga Midmountain area.

7. Anorthoa munda ((Denis & Schiffermüller), 1775)
   Material: Bolshaya Rechka, May 1-2, 2019, 10mm, 1f.
   Eurasian species that is not found in some regions of Eastern Siberia. This is the first time it is observed in the Transbaikal Region. Some moths were collected on the southern-western Baikal coast near the Bolshaya Rechka settlement.

4. Conclusions
   The four new species of the Orthosiini group were found as a result of studies carried out during the spring seasons in Western Transbaikalia. They are Palearchearctic species Orthosia ella, O. ariuna, O. askoldensis, and Western Palearctic Anorthoa munda. It is more than half of the earlier known Orthosia-Anorthoa fauna from this region. The fauna of Orthosia Och. observed in the Prebaikalia is enriched with western species and become closer to the faunas of Europe, Western and Central Siberia (57% of similarity). The faunas of Orthosia in Western and Eastern Transbaikalia are quite close to each other (67%) and similar to the fauna of the Far East (50%) (figure 2). It is associated with the presence of Paleararchearctic species O. ella, O. ariuna, and O. askoldensis. Western Transbaikalia is a transitional region between the heterogeneous zoogeographical regions. Due to this geographical position, the region contains elements of the Euro-Siberian and Far Eastern faunas.
Figure 2. The similarity of the Russian Federation regions by the faunas of Orthosia-Anorthoa. Regions are numbered according to the ‘Catalogue of the Lepidoptera of Russia’ [5].
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