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On the eastern boundary of the distribution of *Zygaena ephialtes* (Linnaeus, 1767) (Lepidoptera: Zygaenidae, Zygaeninae)

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Abstract

In the contemporary maps of the distribution of *Zygaena ephialtes* (Linnaeus, 1767) there is a large gap between the Ural Mountains and points in the surroundings of Omsk in western Siberia (to the East of Omsk). Our investigation of the historical material collected by S. M. Tshugunov and now deposited in the Omsk State Agrarian University named after P. A. Stolypin shows that the determination of specimens of "*Zygaena ephialtes*" from the surroundings of Omsk are based on misidentifications of *Zygaena cynarae* (Esper, 1789) and *Zygaena centaureae* Fischer von Waldheim, 1832.
Keywords: Lepidoptera, Zygaenidae, *Zygaena ephialtes*, distribution, eastern boundary.

Sobre el límite oriental de la distribución de *Zygaena ephialtes* (Linnaeus, 1767) (Lepidoptera: Zygaenidae, Zygaeninae)

Resumen

En los mapas contemporáneos de la distribución de *Zygaena ephialtes* (Linnaeus, 1767) existe un gran vacío entre los montes Urales y los puntos de los alrededores de Omsk, en Siberia occidental (al este de Omsk). Nuestra investigación del material histórico recogido por S. M. Tshugunov y ahora depositado en la Universidad Estatal Agraria de Omsk que lleva el nombre de P. A. Stolypin demuestra que la determinación de los especímenes de "*Zygaena ephialtes*" de los alrededores de Omsk se basa en identificaciones erróneas de *Zygaena cynarae* (Esper, 1789) y *Zygaena centaureae* Fischer von Waldheim, 1832.
Palabras clave: Lepidoptera, Zygaenidae, *Zygaena ephialtes*, distribución, límite oriental.

Introduction

Clarifying the distributions of biological species is an actual task in studying the Zygaenidae family (Can Cengiz et al. 2018; Efetov et al. 2015a, 2015b, 2018, 2019a, 2019b; Efetov & Tarmann, 2016; Razov et al. 2017; Subchev et al. 2016). In the works of Naumann et al. (1984) and Hofmann & Tremewan (2020) the eastern boundary of the distribution of *Zygaena ephialtes* (Figures 1, 2) is situated in western Siberia to the East of Omsk (now in the Novosibirsk Region). These most eastern localities were mentioned by Meinhard (1905) and Tshugunov (1911) and later cited by Holik & Sheljuzkho (1958). However, as there is a large gap in the distribution points between the Ural Mountains and the Novosibirsk Region, we decided to find and examine the original material.

Results and discussion

Holik & Sheljuzhko (1958, p. 249) wrote on *Zygaena ephialtes*: "Siberian territory. So far, the species has only been recorded in the Baraba Steppe in Tomsk Governorate. According to Meinhard (1905, p. 171), in the Lepidoptera collection of Tomsk University there were two specimens of f. *medusa* Pall., one specimen of

f. *athamanthae* Esp. and one specimen of f. *peucedani* Esp. For f. *medusa* Pall. only the designation of origin "Baraba Steppe, June 1899" is indicated. In f. *peucedani* Esp. it is noted: "Captured on 28 June at the station Tatarskaya (Baraba)". Tshugunov (1911, p. 341), from whom the latter piece is taken, notes the discovery of eight specimens of f. *athamanthae* Esp. near Tatarskaya and Zabulga in 1907. According to these data, it must be assumed that a predominantly five-spotted red-peucedanoid population flies in the Baraba steppe, but that it also has a certain percentage of six-spotted and ephialtoid individuals."

We studied the original publication of Meinhard (1905) and found that Holik & Sheljuzhko made a mistake. Meinhard (1905, pp. 172, 173) wrote that there are three specimens of *Zygaena ephialtes* in the collection of the Zoological Museum of the Emperor's Tomsk University, two specimens "ab. Medusa" (38 mm) "Barabinskaya steppe, June 1899" and one specimen "ab. Peucedani" (30 mm) "28th June 1899 near station Tatarskaya (Baraba)". Holik & Sheljuzhko (1958, p. 249) erroneously mentioned "one specimen of f. *athamanthae* Esp." The term "ab. Athamanthae Esp." in the text of Meinhard refers to the figures in the book by Ernst Hofmann "Die Grossschmetterlinge Europa's. 2-te Auflage, Taf. 20, fig. 5 b.". Moreover, in the introduction to his paper Meinhard (1905, p. 107) wrote that the entomological material of 1899 in the Barabinskaya steppe (Baraba steppe) was collected by S. M. Tshugunov and his son M. S. Tshugunov. It means that the two specimen of *Z. ephialtes* morph *medusa* must have been collected by Tshugunov.

In the paper by Tshugunov (1911) the author wrote about the whole material of *Zygaena ephialtes* collected by him in 1899 and also later in 1907. However, from 1899 he mentioned only one specimen of *Z. ephialtes* "ab. *peucedani*" collected on 28th June 1899 and wrote nothing about two specimens of *Z. ephialtes* "ab. *medusa*". We also did not find these two specimens in the Omsk State Agrarian University named after P. A. Stolypin where the collection of Tshugunov is now deposited. Most probably these two specimens of "*medusa*" did not exist, and this was a mistake by Meinhard. We studied the entomological collection in the Tomsk State University and found the box with the materials mentioned by Meinhard. There are labels on the bottom of this drawer "Ephialtes L. ab. *Medusa* Pall." (handwritten with printed text "Ephialtes L.") and "*Ephialtes* L. ab. *pseucedani* [sic] Esp." (completely handwritten), but among the specimens of different *Zygaena* species in this box the material of *Zygaena ephialtes* is absent.

The full text of Tshugunov (1911) on page 15 is as following: "ab. *peucedani* Esp. - 28-VI-[18]99, 1 specimen. - ab. *athomanthae* [sic] Esp. - 24-30-[VI], 1-VII-[19]07 near station Tatarskaya and 7-15-VII-[19]07, Zab[ulga]. - 8 specimens".

In the collection of the Omsk State Agrarian University, we found seven specimens collected in 1907 and mentioned by Tshugunov. All of them are determined as *Zygaena ephialtes*. The list of these specimens is presented below.

Three specimens with pin-label "Zabulga":
Male of *Z. centaureae* "15-VII-[19]07",
Male of *Z. centaureae* "7-VII-[19]07",
Female of *Z. cynarae* "7-VII-[19]07".

Four specimens with pin-label "Tatarskaya":
Female of *Z. cynarae* "25-VI-[19]07",
Male of *Z. cynarae* "24-VI-[19]07",
Male of *Z. cynarae* "30-VI-[19]07",
Female of *Z. cynarae* "28-VI-[19]07".

All this material is determined as "*Zygaena ephialtes* L. ab. *athamanthae* Esp." by the label fixed under the vertical row of these seven *Zygaena* specimens on the bottom of the drawer (Figures 3-4). The localities Zabulga, Baraba and Tatarskaya are now situated in the Novosibirsk Region, approximately 140 km to the East of Omsk.

It should be noted that there are some other misidentifications in the material of Tshugunov. For example, the specimen of *Zygaena loti* ([Denis & Schiffermüller], 1775) is determined as "*Z. meliloti* Esp. v. *confusa* Stgr.".

After Meinhard, Tshugunov and Holik & Sheljuzhko the information on the distribution of *Zygaena ephialtes* in the southern part of western Siberia appeared in many publications (e.g. Naumann et al. 1984; Efetov, 2005 [with the mark "?"]; Hofmann & Tremewan, 2020). While studying the Zygaenidae fauna of the Omsk Region (Knyazev et al. 2015a, 2015b) *Z. ephialtes* was not included in the list of possible species in this territory.

Moreover, the second author has studied Zygaenidae specimens in the collections of the Siberian

Zoological Museum of the Institute of Systematics and Ecology of Animals of the Siberian Branch of the Russian Academy of Sciences (Novosibirsk, Russia), of the Zoological Museum of the Russian Academy of Sciences (Saint Petersburg, Russia) as well as in private collections of Siberian entomologists. *Zygaena ephialtes* from the territory of Siberia is absent in all of them.

Conclusion

The material of so-called "*Zygaena ephialtes* ab. *athamanthae*" collected by Tshugunov in 1907 and mentioned in his paper in 1911 is a result of misidentification of *Z. centaureae* and *Z. cynarae*. The information of the publication of Meinhard (1905) on *Z. ephialtes* is also doubtful. It means that the confirmed eastern limit of the distribution of *Zygaena ephialtes* lies much further to the west and most likely coincides with the Ural Mountains. For example, there are data from the western side of Southern Urals (Holik & Sheljuzhko, 1958; Hofmann & Tremewan, 2020).

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Conflict of Interest

The authors declare that they have no known financial interest or personal relationship that could have influence the work presented in this article.

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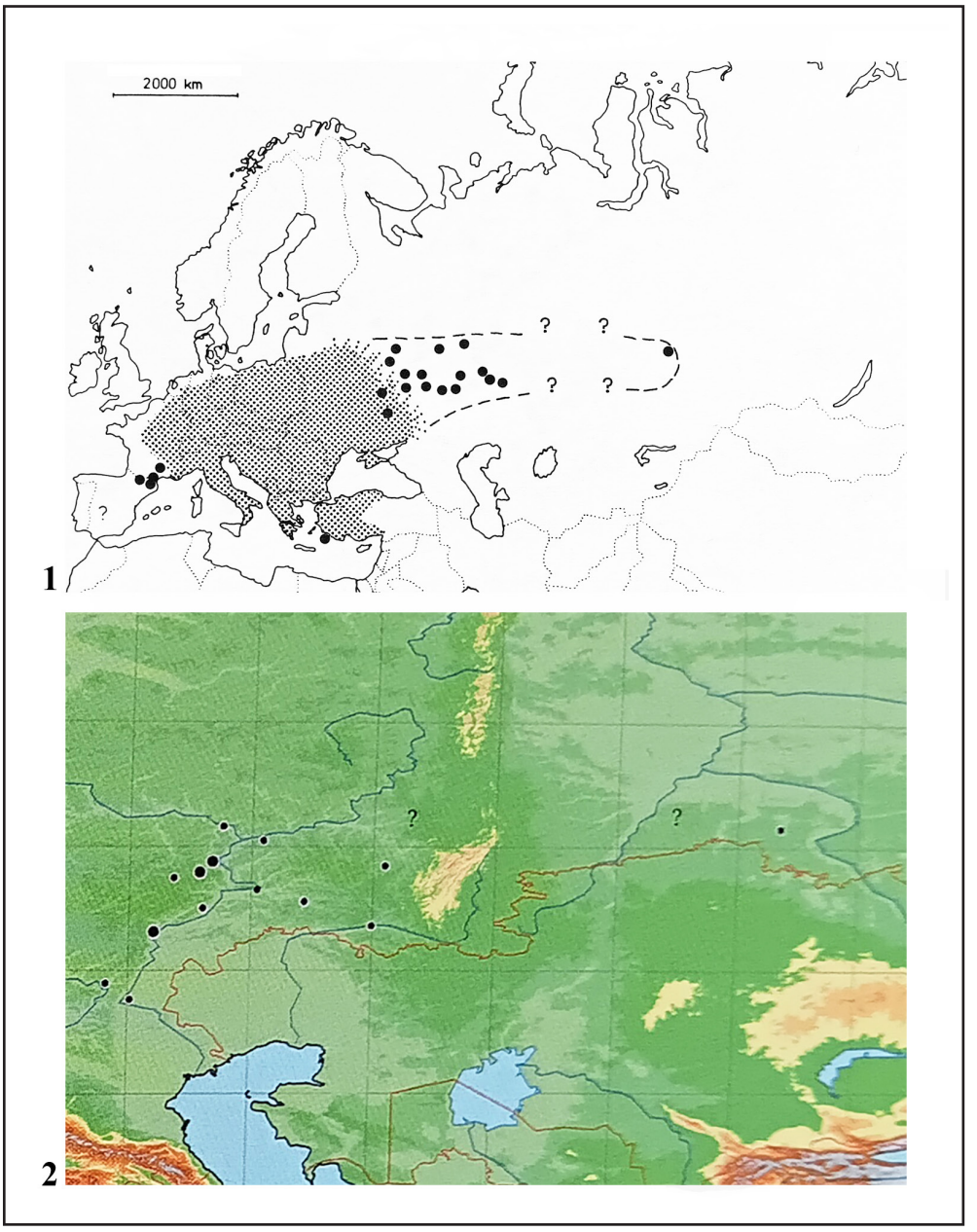
Figures 1-2. Maps of distribution of *Zygaena ephialtes* from different literature sources. **1.** Ex Naumann et al., 1984. **2.** Ex Hofmann & Tremewan, 2020 (eastern part of distribution).



Figures 3-5. 3. View of Tshugunov collection with wrong determinations of different *Zygaena* species as *Zygaena ephialtes* ab. *athamanthae* Esp. **4.** Determination label from Tshugunov collection "*Z. ephialtes* L. ab. *athamanthae* Esp.". **5.** Male of *Zygaena cynarae* from Tshugunov collection determined as "*Z. ephialtes* L. ab. *athamanthae* Esp.", with pin label "Tatarskaya 24-VI-[19]07". (All photos by S. A. Knyazev).

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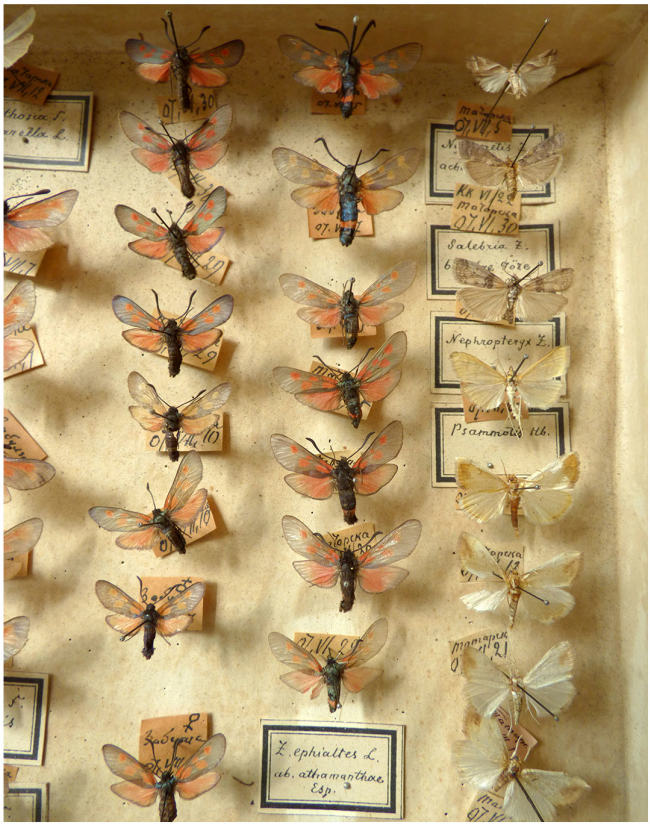

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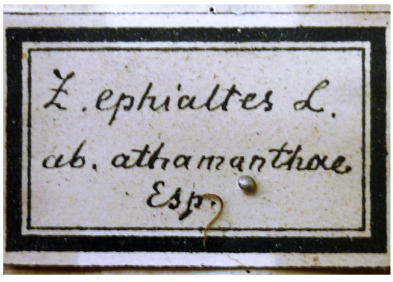

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