

The first record of *Jordanita (Solaniterna) subsolana* (Staudinger, 1862) from Kazakhstan (Lepidoptera: Zygaenidae, Procridinae)

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Abstract

Jordanita (Solaniterna) subsolana (Staudinger, 1862) was discovered in eastern Kazakhstan using the sex attractant EFETOV-2 (2-butyl 2-dodecenoate) synthesised in the Crimean Federal University. This is the first record of *J. (S.) subsolana* from Kazakhstan. As this species is now found on the border of Kazakhstan and China, most probably that *J. (S.) subsolana* is also present in China. An overview of the Zygaenidae fauna of Kazakhstan is presented.

KEY WORDS: Lepidoptera, Zygaenidae, Procridinae, *Jordanita (Solaniterna) subsolana*, fauna, sex attractant, EFETOV-2, Kazakhstan, China.

El primer registro de *Jordanita (Solaniterna) subsolana* (Staudinger, 1862) de Kazajstán (Lepidoptera: Zygaenidae, Procridinae)

Resumen

Jordanita (Solaniterna) subsolana (Staudinger, 1862) fue descubierta en el este de Kazajstán usando el atrayente sexual EFETOV-2 (2-butil 2-dodecenoato) sintetizado en la Universidad Federal de Crimea. Este es el primer registro de *J. (S.) subsolana* de Kazajstán. Como esta especie se ahora se ha encontrado en la frontera de Kazajstán y China, es más que probable que *J. (S.) subsolana* esté también presente en China. Se presenta una visión general de la fauna de Zygaenidae de Kazajstán.

PALABRAS CLAVE: Lepidoptera, Zygaenidae, Procridinae, *Jordanita (Solaniterna) subsolana*, fauna, atracción sexual, EFETOV-2, Kazajstán, China.

Introduction

New data on the biology, morphology, karyology and DNA barcoding of Zygaenidae species, which have been obtained over the past 20 years, have significantly increased our knowledge on this family and stimulated numerous systematic changes in it (EFETOV, 1999; EFETOV *et al.*, 2006, 2014a, 2014b, 2015a; EFETOV & SAVCHUK, 2009; EFETOV & TARMANN, 2014, 2016, 2017b; EFETOV & KNYAZEVA, 2014; KNYAZEVA *et al.*, 2015a, 2015b). As a consequence, the Zygaenidae family now includes five subfamilies: Inouelinae Efetov & Tarmann, 2017; Procridinae Boisduval, 1828; Chalcosiinae Walker, 1865; Callizygaeninae Alberti, 1954; and Zygaeninae Latreille, 1809 (EFETOV *et al.*, 2014b; EFETOV & TARMANN, 2017a). According to previous publications the Zygaenidae fauna of Kazakhstan is represented by two subfamilies: Procridinae (12 species) and Zygaeninae (13 species) (EFETOV, 1995, 1997, 2001, 2004; EFETOV & TARMANN, 1999; HOFMANN & TREMEWAN, 1996; MOLLET, 2008). New data presented in this paper on the distribution of zygaenids in Kazakhstan became possible due to the field experiments with attractant baits. It is well known that sex pheromones and sex attractants play an increasingly important role in

faunal investigations of Lepidoptera, because they allow researchers to discover new species, detect populations of pest or rare species, monitor and control the seasonal flight of moths (SUBCHEV *et al.*, 2012, 2013, 2016; RAZOV *et al.*, 2017; CAN CENGIZ *et al.*, 2018; CAN *et al.*, 2019; EFETOV *et al.*, 2010, 2011, 2015b, 2019; TARMANN *et al.*, 2019; VRENOZI *et al.*, 2019).

In this study, the fauna of Zygaenidae in Kazakhstan was investigated using the attractant EFETOV-2 (2-butyl 2-dodecenoate). Its property as a sex attractant for the males of some Procridae species has been proved in our field experiments earlier (EFETOV *et al.*, 2016, 2018, 2019, 2020; EFETOV & KUCHERENKO, 2020).

Materials and methods

Field observations were carried out in eastern and northern Kazakhstan in VI-VII-2018. To prepare the baits, the substance EFETOV-2 (2-butyl 2-dodecenoate) was used. This attractant was synthesised in the Crimean Federal University as described in EFETOV *et al.* (2014c). For this study, the sex attractant was applied onto grey rubber vial caps in dose of 200 µl. The baits were prepared in 2014, wrapped singly in aluminium foil and stored in a freezer for the first year and then at room temperature until the date of the fieldwork. In study biotopes the lures were hung on bushes at a height 0.5-1.0 m above the ground. The attracted specimens were collected by netting them near the lure. All moths were determined by genitalia examination.

The map (Fig. 1) is compiled by the BioOffice software, Tiroler Landesmuseen, Ferdinandeum, Hall in Tirol, Austria.

Results and discussion

Jordanita (Solaniterna) subsolana (Staudinger, 1862) is the type species of the subgenus *Solaniterna* Efetov, 2004. In 2018 this species was collected for the first time in Kazakhstan. This became possible due to an application of the sex attractant EFETOV-2. One male of this species was attracted to the bait with EFETOV-2 in Zaysan District, 19 km S of Zaysan, Saur Mountains, 47°17'50,07" N, 84°48'28,54" E, 1100 m, 1-2-VII-2018, S. Knyazev leg. (Figs 1-4). This species was recorded (EFETOV, 1990) from the Russian Altai (Fig. 1), but until now, there was no information about the presence of *J. (S.) subsolana* in eastern Kazakhstan based on original material. The known distribution of *J. (S.) subsolana* outside of Kazakhstan: Morocco (Rif), Spain, France, Belgium, Germany, Switzerland, Austria, Italy (including Sicily), Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Albania, North Macedonia, Greece, Czech Republic, Slovakia, Hungary, Romania, Bulgaria, Ukraine, Moldova, Russia (European part including Crimea, Northern Caucasus, southern Siberia), Georgia, Armenia, Azerbaijan, and Turkey (EFETOV, 2004; BioOffice database, Tiroler Landesmuseen, Ferdinandeum, Hall in Tirol, Austria). Moreover, as this species is now found on the border of Kazakhstan and China, most probably that *J. (S.) subsolana* is also present in China.

The list of the Zygaenidae fauna of Kazakhstan includes 26 species which are listed below.

Procridae:

1. *Rhagades (Rhagades) pruni* ([Denis & Schiffermüller], 1775)
2. *Adscita (Procriterna) subtristis* (Staudinger, 1887)
3. *Adscita (Procriterna) subdolosa* (Staudinger, 1887) (EFETOV, 1995)
4. *Adscita (Adscita) statices* (Linnaeus, 1758)
5. *Jordanita (Roccia) budensis* (Speyer & Speyer, 1858)
6. *Jordanita (Roccia) paupera* (Christoph, 1887)
7. *Jordanita (Roccia) volgensis* (Möschler, 1862)
8. *Jordanita (Roccia) naufocki* (Alberti, 1937)
9. *Jordanita (Roccia) almatiensis* Mollet, 2008
10. *Jordanita (Tremewania) splendens* (Staudinger, 1887)
11. *Jordanita (Jordanita) chloros* (Hübner, 1813) (EFETOV, 1997)

12. *Jordanita (Solaniterna) subsolana* (Staudinger, 1862)
13. *Jordanita (Solaniterna) solana* (Staudinger, 1887) (EFETOV, 1995)

Zygaeninae:

14. *Zygaena (Mesembrynus) purpuralis* (Brünnich, 1763)
15. *Zygaena (Mesembrynus) cynarae* (Esper, 1789)
16. *Zygaena (Mesembrynus) centaureae* Fischer von Waldheim, 1832
17. *Zygaena (Mesembrynus) laeta* (Hübner, 1790)
18. *Zygaena (Agrumenia) truchmena* Eversmann, 1854
19. *Zygaena (Agrumenia) sogdiana* Erschoff, 1874
20. *Zygaena (Agrumenia) separata* Staudinger, 1887
21. *Zygaena (Agrumenia) carniolica* (Scopoli, 1763)
22. *Zygaena (Agrumenia) exulans* (Hohenwarth, 1792)
23. *Zygaena (Agrumenia) viciae* ([Denis & Schiffermüller], 1775)
24. *Zygaena (Lictoria) loti* ([Denis & Schiffermüller], 1775)
25. *Zygaena (Zygaena) osterodensis* Reiss, 1921
26. *Zygaena (Zygaena) lonicerae* (Scheven, 1777)

The systematic position of two taxa, viz. *Jordanita (Roccia) scintillosa* Zolotuhin, 2020, and *Jordanita (Roccia) smaragdonna* Zolotuhin, 2020, both mentioned recently for Kazakhstan (ZOLOTUHHIN, 2020), needs verification. *J. scintillosa* and *J. smaragdonna* have no genitalia differences from *J. paupera*. Moreover, the colour and shape of wings and colour and length of proboscis mentioned by Zolotuhin (2020) as important characters are variable even in *J. paupera* in Turkmenistan, from where the latter species had been described. In this publication we consider *J. scintillosa* and *J. smaragdonna* as the synonyms (**syn. n.**) of *J. paupera*. These two taxa of Zolotuhin will be discussed in a separate publication (EFETOV & TARMANN, in prep.).

It is known that (2*R*)-butyl 2-dodecenoate, named as EFETOV-S-2, is a very effective sex attractant for the detection of *J. (S.) subsolana* in different biotopes (EFETOV *et al.*, 2020). However, males of this species also actively respond to the attractant EFETOV-2 (2-butyl 2-dodecenoate). Previously, this was shown in the Crimea (Russia) (EFETOV *et al.*, 2016) and in the Thrace Region (European Turkey) (CAN CENGİZ *et al.*, 2018). It is interesting that the baits with the attractant EFETOV-2 used in this study were prepared in 2014. This means that EFETOV-2 retains its attractive properties for several years. Of course, evaporation from rubber caps occurs, but the remaining dose is sufficient to attract and accordingly to detect *J. (S.) subsolana* in biotopes. We reported about a long duration of the activity of EFETOV-2 lures, but only during one season (three months) (VRENOZI *et al.*, 2019). Now we have the proof for a much longer activity. This is convenient because we can use attractive baits for a long time without the need to change dispensers. Moreover, it is cost-effective.

In addition, one more species, viz. *Adscita (Adscita) statices* (Linnaeus, 1758), was attracted to EFETOV-2 lures in Kazakhstan by the second author in 2018. Totally 17 males of *A. (A.) statices* were caught: 1 ♂ - eastern Kazakhstan, Katon-Karagay District, Southern Altai Ridge, bank of Kara-Kaba River, 49°01'42.96" N, 86°01'04.44" E, 1653 m, 28-VI-2018; 11 ♂♂ - eastern Kazakhstan, Markakol District, 1.5 km N of village Urunkhaika, eastern bank of Markakol Lake, 48°48'24.83" N, 86°02'00.19" E, 1450 m, 29-VI-2018; 5 ♂♂ - northern Kazakhstan, North Kazakhstan Region, Taiynshinsky District, 6 km. SE of village Akkudyk, 53°37'58.64" N, 70°42'47.80" E, 145 m, 08-VII-2018. This result was expected and confirmed our data obtained in Turkey (CAN CENGİZ *et al.*, 2018). Besides this, *A. (A.) statices* males were also attracted to the sex attractant EFETOV-S-2 (mentioned above) in Russia (EFETOV & GORBUNOV, 2016) and Italy (EFETOV *et al.*, 2020).

Conclusions

The males of two Procridinae species, viz. *A. (A.) statices* and *J. (S.) subsolana*, were attracted to

the lures with the sex attractant EFETOV-2 in Kazakhstan. *J. (S.) subsolana* is reported for Kazakhstan for the first time.

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