

## Sexual activity of males and distribution of *Stygioides colchicus* (Herrich-Schäffer, 1851) (Lepidoptera: Cossidae)

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**ABSTRACT.** The attraction of males of *Stygioides colchicus* (Herrich-Schäffer, 1851) (Cossidae) to the sex attractant for males of *Synanthedon andrenaeformis* (Laspeyres, 1801) (Sesiidae) was clearly recorded for the first time. This attractant turned out to be a mixture of (3E, 13Z)-octadeca-3,13-dienyl acetate and (2E, 13Z)-octadeca-3,13-dienyl acetate in a ratio of 1:1. The use of this sex attractant made it possible to discover new localities of *S. colchicus* in Russia. The nomenclatural history of this species is discussed in detail. How to cite this article: Gorbunov O.G., Efetov K.A. 2024. Sexual activity of males and distribution of *Stygioides colchicus* (Herrich-Schäffer, 1851) (Lepidoptera: Cossidae) // Invert. Zool. Vol.21. No.1. P.109–117. doi: 10.15298/invertzool.21.1.08

**KEY WORDS:** Lepidoptera, Cossidae, *Stygioides colchicus*, new records, Crimea, Volgograd Region, sex attractants.

## Половая активность самцов и распространение *Stygioides colchicus* (Herrich-Schäffer, 1851) (Lepidoptera: Cossidae)

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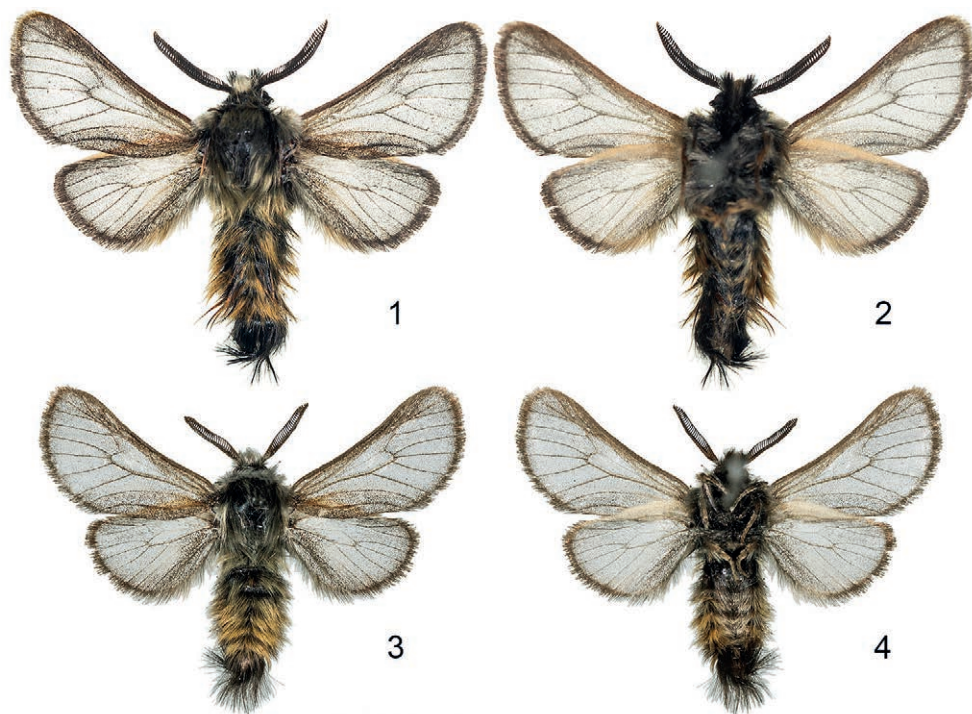
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**РЕЗЮМЕ.** Впервые чётко зафиксирован прилёт самцов *Stygioides colchicus* (Herrich-Schäffer, 1851) (Cossidae) на половой аттрактант для самцов стеклянницы *Synanthedon andrenaeformis* (Laspeyres, 1801) (Sesiidae). Этим аттрактантом оказалась смесь (3E, 13Z)-октадец-3,13-диенил ацетата и (2E, 13Z)-октадец-3,13-диенил ацетата в отношении 1:1. Использование полового аттрактанта позволило выявить новые местонахождения *S. colchicus* в России. В деталях рассмотрена номенклатурная история этого вида.

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**КЛЮЧЕВЫЕ СЛОВА:** Lepidoptera, Cossidae, *Stygioides colchicus*, новые находки, Крым, Волгоградская область, половые аттрактанты.



Figs 1–4. Males of *Stygioides colchicus* (Herrich-Schäffer, 1851): 1–2 — Russia, Crimea, Belogorsk, Alan-Kyr Mt., 45.097600°N, 34.750440°E, 253 m, 17.VI.2023, O. Gorbunov & K. Efetov leg. Alar expanse 17.8 mm, *Heterocera varia* pictures Nos 0007-0008–2023; 3–4 — Russia, Volgograd Region, Ol'khovka District, Mikhaylovka, 49°47'N, 44°24'E, 2.VI.2015, O. Gorbunov leg. Alar expanse 15.8 mm, *Heterocera varia* pictures Nos 0439-0440–2015. 1, 3 — dorsal view; 2, 4 — ventral view.

Рис. 1–4. Самцы *Stygioides colchicus* (Herrich-Schäffer, 1851): 1–2 — Россия, Крым, Белогорск, гора Алан-Кыр, 45.097600° с.ш., 34.750440° в.д., 253 м, 17.VI.2023, О. Горбунов, К. Ефетов. Размах крыльев 17.8 мм, *Heterocera varia* снимки №№ 0007-0008–2023; 3–4 — Россия, Волгоградская область, Ольховский район, Михайловка, 49°47' с.ш., 44°24' в.д., 2.VI.2015, О. Горбунов. Размах крыльев 15.8 мм, *Heterocera varia* снимки №№ 0439-0440–2015. 1, 3 — сверху; 2, 4 — снизу.

## Introduction

*Stygioides colchicus* (Herrich-Schäffer, 1851) is one of the least studied carpenter moths not only in Russia, but also in those countries where it is noted in faunal lists. It is small, up to 20–22 mm in wingspan, wood borer with translucent wings and diurnal activity (Figs 1–5). In appearance it resembles some species of bagworm moths (Psychidae). Unlike other cossid taxa, aphagia and diurnal activity are the main obstacles to collecting species of the genus *Stygioides* Bruand, 1853, and hence their rarity in collections. The host plants of the larvae are not known with certainty, but Korb (1910) suggested that they could live in the roots of *Echium* sp. or *Cynoglossum* sp. (Boraginaceae).

The established ability of males to be attracted to artificial sex attractants should not only help in replenishing collection material, but also significantly increase our knowledge of the distribution of species of this unique genus.

## Material and methods

The specimens were attracted to artificial sex attractants produced by PHEROBANK®, Wijk bij Duurstede, the Netherlands. All images of the specimens and their biotopes were taken with a Sony Alpha DSLRα-450 camera equipped with a Minolta 50 mm f/2.8 macro lens. The processing of all illustrations was finalized using Adobe Photoshop CC 2020 software.

The specimens examined or mentioned herein are deposited in the following collections abbreviated in the text as follows: the collection of A.N. Zamesov,



Fig. 5. Male of *Stygioides colchicus* (Herrich-Schäffer, 1851). Ukraine, Crimea, Staryy Krym, Agarmysh Mt., 45°02'N, 35°04'E, 500 m, 9.V.2012, O. Gorbunov leg. Рис. 5. Самец *Stygioides colchicus* (Herrich-Schäffer, 1851). Украина, Крым, Старый Крым, гора Агармыш, 45°02' с.ш., 35°04' в.д., 500 м, 9.V.2012, О. Горбунов.

Moscow, Russia (CAZM); the collection of K.A. Efetov, Simferopol, Russia (CKES); the collection of A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia (COGM); the collection of R.V. Yakovlev, Barnaul, Russia (CRYB); the collection of the Institute of Zoology, Russian Academy of Sciences, Sankt Petersburg, Russia (ZISP); Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany (ZMHB).

### Nomenclatural history

The original description of this species is a watercolor drawing of a male found on the second plate of the second volume of the famous “Systematische Bearbeitung der Schmetterlinge von Europa ...” by Herrich-Schäffer (1843–1855). A verbal morphological description, including information about the type locality and the name of the collector (A. Kinderman), but as *Stygia amasina*, was published in the sixth volume of

this work. According to Heppner (1982), the second table of the second volume was published in 1851, and the page with the description in the sixth volume was published in 1852. A year later, Bruand (1853) transferred this species to the family Psychidae and named it *Typhonia stygiella*, justifying this is because the name “colchica” is unfortunate, since the area where it was collected (Amasya Province in Turkey) is not a part of ancient Colchis. Therefore, according to Art. 33.2.3. ICZN (ICZN, 1999) the name *Typhonia stygiella* Bruand, 1853, is an unjustified emendation of *Stygia colchica* Herrich-Schäffer, 1851. In addition, Bruand indicated that Kinderman collected only a single male.

In 1858, Lederer described *Stygia tricolor* from a single male collected in Damascus (Lederer, 1858), and in 1900, Grum-Grshimailo described *Stygia decretis* (Grum-Grshimailo, 1900) from a single female from Jordan. Therefore, in accordance with Art. 73.1.2 ICZN (ICZN, 1999) the nomenclatural types of these three taxa are holotypes by monotypy. Unfortunately, the location of these specimens is currently unknown. It is very likely that they were taken for research by A. Kondratyev, who disappeared without a trace in the early 90s of the last century, and, obviously, were irretrievably lost.

The systematic relationships between these three taxa have long been unclear. Thus, Staudinger in the Catalogue of the Lepidoptera of Europe indicated *S. tricolor* as a junior synonym of *S. colchica* (Staudinger, 1871), but in a few years — as a separate species, but noted a high degree of variability and the need for additional collection material to resolve the question of whether these two taxa are good species or only forms of one species: “Eine grössere Zahl von Stücken, namentlich von Weibern beider Formen wäre erwünscht, um ganz sicher zu sein, ob *Tricolor* und *Colchica* zwei gute Arten, oder doch nur Formen von einander sind” (Staudinger, 1878–1879: 346). Further, until the end of the last century, these three taxa were considered to be separate species (Staudinger, 1901; Spuller, 1910; Seitz, 1912; Daniel, 1955; Schoorl, 1990), although Daniel (1955) doubted that *S. decretis* is a good species, and not the same as *S. tricolor* (“daß *derectis* der *tricolor* gleich ist” (Daniel, 1955: 172)). The lack of collection material did not allow him to formalize this opinion in the form of a nomenclatural act of establishing a junior

synonym. Only de Freina and Witt included, but without any justification, *S. decretis* and *S. tricolor* as junior synonyms of *S. colchicus* (Freina, Witt, 1990).

In their work on the Cossidae of Lebanon, Saldaitis and co-authors agreed with the opinion of Freina and Witt about the synonymization of *S. colchicus* and *S. tricolor* (Saldaitis *et al.*, 2007). Here they firstly noted *S. decretis* as a subspecies of *S. colchicus*, widespread in the Levant. The rest of the range from Greece in the west to Western Kazakhstan in the east and the south of the Saratov Oblast in the north should be inhabited by a nominotypical subspecies, which includes *S. tricolor* as a junior synonym. However, not all researchers accepted this concept and indicate *S. tricolor* as a separate species (Schoorl, 1990; Yakovlev, 2007, 2008a–b, 2019, 2023; Yakovlev *et al.*, 2015; Anikin, 2022). Others agree with the opinion of Freina and Witt and consider *S. tricolor* a junior synonym (Beshkov, Langourov, 2004; Saldaitis *et al.*, 2007; Yakovlev, 2010a; Alipanah *et al.*, 2021). Obviously, it will be possible to solve this problem only after the designation and identifying the neotypes of all the above taxa. Such a nomenclature act will fully comply with Art. 75.3 ICZN (ICZN, 1999) and we recommend that specialists in this group of moths make this.

Currently, we consider *S. tricolor* to be a junior synonym of *S. colchicus* and propose to indicate the chresonymy of this species as follows:

### ***Stygioides colchicus* (Herrich-Schäffer, 1851)**

“*Stygia Colchica*.” [Herrich-Schäffer, 1851]—Herrich-Schäffer, 1843–1855: Tab. 2, Fig. 10. Type locality: “... aus Amasia.” (Herrich-Schäffer, 1843–1856: 40) [= Turkey: Amasia Province]. Holotype ♂ (*Stygia amasina* Herrich-Schäffer, 1852) by monotypy (ZMHB, lost).

= “*Stygia amasina* m.” [Herrich-Schäffer, 1852] — Herrich-Schäffer, 1843–1856: 39. Type locality: “... aus Amasia.” [=Turkey: Amasia Province]. Holotype ♂ by monotypy (ZMHB, lost).

= “*T[ylphonia]. stygiella*, Bruand.” — Bruand, 1853: 27, pl. 1, fig. 10. Unjustified emendation *Stygia colchica* Herrich-Schäffer, 1851.

= “*Stygia tricolor* m.” — Lederer, 1858: 143, Taf. 2, Fig. 4. Type locality: “Von Damask.” [= Syria: Damascus]. Holotype ♀ by monotypy (ZMHB, lost).

= “*Stygia decretis* sp. n.” — Grum-Grshimailo, 1900: 469. Type locality: “... in valle fl. Arnon (Wādi-el-Modshib), in Moabia, ...” [= Jordan: Arnon River, Wādi-el-Modshib]. Holotype ♀ by monotypy (ZISP, lost).

## **Synthetic sex attractants**

Artificially synthesized sex attractants have been used for quite a long time both in science and in practice. Here we do not need to describe all the positive aspects of using these substances to solve many problems of classical entomology. Let us focus solely on personal experience. The authors, independently of each other, began using synthetic sex attractants around the end of the 80s of the last century. Using synthetic sex attractants, we identified specific details of the distribution of some species of Zygaenidae and Sesiidae (Efetov *et al.*, 2011, 2015, 2016, 2018, 2019, 2022, 2023; Efetov, Gorbunov, 2016; Gorbunov, Efetov, 2016; Subchev *et al.*, 2016; Gorbunov, 2017, 2018a, 2021, 2022a, c; Razov *et al.*, 2017; Can Cengiz *et al.*, 2018; Can *et al.*, 2019; Vrenozi *et al.*, 2019; Efetov, Gorbunov, 2021). In addition, with the help of synthetic sex attractants, we collected and described new species of Sesiidae (Gorbunov, 2018b; 2020a–b, 2021, 2022a–b, 2023; Gorbunov, Efetov, 2018), and also found a rare species of Zygaenidae, known for a long time only based on the holotype specimen (Efetov *et al.*, 2014).

Saldaitis and co-authors were the first to indicate the attraction of a *S. colchicus decretis* male to artificial sex attractants synthesized to attract males of clearwing moths (Sesiidae) (Saldaitis *et al.*, 2007). They indicated that they collected a single male at 11:00 pm on an unspecified sex attractant in the vicinity of Aarab ei Laqlouq in Lebanon. We were able to attract *S. colchicus* males to artificial sex attractants three times. Unfortunately, twice we were unable to determine exactly which attractant attracted them, but in 2023 we were able to clearly record the arrival of males to the sex attractant for males of *Synanthedon andrenaeformis* (Laspeyres, 1801) (Sesiidae), produced by PHEROBANK®. The chemical composition of this attractant was published in the Pherobase (<https://pherobase.com>) as a mixture of (3*E*, 13*Z*)-octadeca-3,13-dienyl acetate and (2*E*, 13*Z*)-octadeca-3,13-dienyl acetate in a ratio of 1:1. Obviously, this is a sex attractant for *S. colchicus* males.

Unlike Sesiidae males, which fly in an alternating tack towards the source of the sex attractant, males of *S. colchicus* fly erratically at very high speed within a radius of up to a meter from the sex attractant. They can only be caught by sharp, blind swings of the net in the area of



Figs 6–7. Habitats of *Stygioides colchicus* (Herrich-Schäffer, 1851): 6 — Russia, Volgograd Region, Ol'khovka District, Mikhaylovka, 49°47'N, 44°24'E, 2.VI.2015; 7 — Russia, Crimea, Staryy Krym, Agarmysh Mt., 45°02.27'N, 35°03.20'E, 685 m, 9.VI.2017.

Рис. 6–7. Биотопы *Stygioides colchicus* (Herrich-Schäffer, 1851): 6 — Россия, Волгоградская область, Ольховский район, Михайловка, 49°47' с.ш., 44°24' в.д., 2.VI.2015; 7 — Россия, Крым, Старый Крым, гора Агармыш, 45°02.27' с.ш., 35°03.20' в.д., 685 м, 9.VI.2017.

the attractant. Usually several dozens of males fly up at the same time, but after active swings, only a few specimens, or even none at all, end up in the net. All males were attracted around noon local time (11:00 am – 01:00 pm).

### Distribution of *S. colchicus*

Having studied literary sources, as well as information from the Internet, we clarify the distribution of *S. colchicus*. In Europe, this species is reliably known from a single locality in Bulgaria (Beshkov, Langourov, 2004) and a couple of places from the Peloponnese Island in Greece (Freina, Witt, 1990). In the Middle East it is known from Lebanon (Saldaitis *et al.*, 2007; Lingenhöle *et al.*, 2017), Syria (Lederer, 1858) and Jordan (Grum-Grshimailo, 1900). In Turkey it is known from the following provinces: Aydın, Antalya, Konya, Adana, Amasya, Osmaniye, Sivas, Malatya, and Diyarbakır (Herrich-Schäffer, 1843–1856; Daniel, 1939, 1955; Freina, Witt, 1990). This species has recently been listed for Northern Iran (Alipanah *et al.*, 2021). The indication of the presence of this species in Israel (Yakovlev, Zhakov, 2009; Yakovlev, 2010b) is erroneous and refers to Jordan. Records of the species for Armenia (Lingenhöle *et al.*, 2017; Alipanah *et al.*, 2021) are also wrong and should be applied to Turkey.

For Russia, *S. colchicus* was recorded many times and from many localities, but until the end of the 20th century these were only old indications of the same collections in the Sarepta (environs of Volgograd) (Hoffman, 1887; Spuler, 1910; Daniel, 1955). We completely agree with the following finds of this species on the territory of Russia: Zaporozh'ye Region (Yakovlev, Zhakov, 2009), Republic of Crimea (Efetov, Budashkin, 1990; Budashkin, 1993; Yakovlev, Zhakov, 2009), Republic of Dagestan (Yakovlev *et al.*, 2015), Volgograd Region (Hoffman, 1887; Spuler, 1910; Daniel, 1955; Yakovlev, 2007), and Saratov Region (Anikin, 2022).

### Habitat

The habitats of *S. colchicus* are quite diverse, but everywhere they are associated with open biotopes with herbaceous formations (Figs 6–8). Thus, in the Volgograd Region in the vicinity of Mikhaylovka (Fig. 6), males of this species were collected on the slopes of a large ravine

covered with various herbaceous vegetation on chalk outcrops. Trees and shrubs grow at the bottom of this ravine, and feather grass steppes recently grew on the watershed, which are now almost completely plowed and sown with wheat.

In Crimea, on the Agarmysh mountain massif, males of this species were attracted in the southeastern part of this massif (Fig. 7). Here the slopes are covered with oak-juniper open forests with fairly extensive clearings with steppe herbs.

On the Alan Kyr Mountain near Belogorsk in Crimea, *S. colchicus* inhabits a slightly different biotope: small clearings with meadow vegetation in a small-leaved forest (Fig. 8).

Of course, all these biotopes are connected by the presence of open areas with steppe or meadow vegetation. As we noted above, there was an indication of possible larvae feeding in the roots of *Echium* sp. or *Cynoglossum* sp. (Boraginaceae) (Korb, 1910). We have repeatedly attempted to detect lepidopteran larvae in the roots of various Boraginaceae, including *Echium* sp. and *Cynoglossum* sp., but unfortunately, only the larvae of longicorns were found in the roots.

### Material

1 ♂ USSR, Crimea, Sudak, environs of Vesoloye, 6.VI.1987, K. Efetov leg. (CKES); 1 ♂, Ukraine, Crimea, Staryy Krym, Agarmysh Mt., 45°02'N, 35°04'E, 500 m, 9.V.2012, O. Gorbunov leg. (Cossidae pictures Nos 329-330–2013) (COGM); 3 ♂♂ Russia, Volgograd Region, Ol'khovka District, Mikhaylovka, 49°47'N, 44°24'E, 2.VI.2015, A. Zamesov leg. (CAZM); 11 ♂♂, with same locality, 4.VI.2015, O. Gorbunov leg. (Heterocera varia pictures Nos 0289-0296–2015, 0429-0440–2015) (COGM); 2 ♂♂, with same locality, 4.VI.2015, O. Gorbunov leg. (CRYB); 8 ♂♂ Russia, Crimea, Staryy Krym, Agarmysh Mt., 45°02.27'N, 35°03.20'E, 685 m, 9.VI.2017, O. Gorbunov leg. (COGM); 2 ♂♂ with same locality and date, A. Zamesov leg. (CAZM); 4 ♂♂, Russia, Crimea, Belogorsk, Alan-Kyr Mt., 45.097600°N, 34.750440°E, 253 m, 17.VI.2023, O. Gorbunov & K. Efetov leg. (Heterocera varia pictures Nos 0003-0008–2023) (COGM).

### Conclusion

It is appropriate to note here that the use of that synthetic sex attractant for catching males of *S. colchicus* will make it possible to replenish scientific collections, clarify the distribution of this remarkable species, and also solve taxonomic problems in the taxonomy of the genus *Stygioides*



Fig. 8. Habitat of *Stygioides colchicus* (Herrich-Schäffer, 1851). Russia, Crimea, Belogorsk, Alan-Kyr Mt., 45.097600°N, 34.750440°E, 253 m, 17.VI.2023.

Рис. 8. Биотоп *Stygioides colchicus* (Herrich-Schäffer, 1851). Россия, Крым, Белогорск, гора Алан-Кыр, 45.097600° с.ш., 34.750440° в.д., 253 м, 17.VI.2023.

Bruand, 1853. It is very likely that with a help of this or similar sex attractants for clearwing moths, other species of cossids can be collected.

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