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RESEARCH ARTICLE

On the systematics of the genus *Synanthedon* Hübner, 1819 sensu lato (Lepidoptera, Sesiidae). Part II. *Thamnosphecia* Spuler, 1910

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Abstract

The genus *Thamnosphecia* Spuler, 1910 is restored from synonyms of the polyphyletic genus *Synanthedon* Hübner, 1819: *Thamnosphecia* Spuler, 1910, **stat. rev.** The genus includes ten Holarctic species, which superficially can be divided into two species groups, viz. "red-banded" and "yellow-banded". A morphological description and differential diagnosis are provided. It is indicated that the host plants of the larvae of the genus are representatives of 11 botanical families.

Keywords

Clearwing moths, Holarctic realm, Lepidoptera, new combination, Synanthedonini, systematics, taxonomy

Introduction

This publication is the second in a series of planned works on the generic systematics of the polyphyletic genus *Synanthedon* Hübner, 1819 (Gorbunov 2024) and the next in my studies of the generic taxonomy of Sesiidae (Arita and Gorbunov 1998;

Gorbunov and Arita 1999, 2000; 2005; Gorbunov and Gurko 2017; Gorbunov 2018, 2020, 2021a–b, 2023a–b). It is dedicated to the taxon *Thamnosphecia* Spuler, 1910.

In his work "Die Schmetterlinge Europas" Spuler (1910), unlike his contemporaries (Hofmann 1894; Staudinger 1901; Bartel 1902), used the generic name *Trochilium* Scopoli, 1777 for species that are currently included in the genus *Synanthedon* s.l. However, in a footnote for *Trochilium* he pointed out that *Trochilium* Scopoli, 1777 and *Aegeria* Fabricius, 1807 may have a common type species, which is correct, and then "Dann wäre *Aegeria* F. mit *Trochilium* Sc. synonym und für unser Genus müßte ein neuer Name gegeben werden, …" (Spuler 1910: 308). This new name, *Thamnosphecia* with the type species *Sphinx culiciformis* Linnaeus, 1758, was also proposed there by Püngeler. Thus, Spuler only validated the generic name *Thamnosphecia*, but did not use it. Subsequently, among entomological taxonomists, only Engelhardt (1946) used *Thamnosphecia* as a generic name for 13 species of North American clearwing moths. The vast majority of researchers indicated this name as a synonym of *Aegeria* Fabricius, 1807 or *Synanthedon* Hübner, 1819, but some North American scientific practitioners used this generic name for particularly dangerous pests (Foxlee 1948; Woodside 1952; Pless 1963; Ayers 1966; Pless and Stanley 1967; Coleman 1968; Heichel and Turner 1973; etc, etc).

Having studied in detail the external morphology and structure of the genitalia of both males and females, I agree with Engelhardt and restore the genus *Thamnosphecia* from junior synonyms of the genus *Synanthedon* Hübner, 1819: *Thamnosphecia* Spuler, 1910, **stat. rev.**

I include the following ten species in the genus *Thamnosphecia* Spuler, 1910, **stat. rev.**, viz. *Th. culiciformis* (Linnaeus, 1758), **comb. nov.**, *Th. pyri* (Harris, 1830), **comb. nov.**, *Th. fulvipes* (Harris, 1839), **comb. nov.**, *Th. scitula* (Harris, 1839), **comb. nov.**, *Th. refulgens* (H. Edwards, 1881), **comb. nov.**, *Th. rubrofascia* (H. Edwards, 1881), **comb. nov.**, *Th. sigmoidea* (Beutenmüller, 1897), **comb. nov.**, *Th. talischensis* (Bartel, 1906), **comb. nov.**, *Th. pseudoscoliaeformis* (Špatenka et Arita, 1992), **comb. nov.**, and *Th. pamphyla* (Kallies, 2003), **comb. nov.**

As for the other species that Engelhardt (1946) included in the genus *Thamnosphecia*, due to the lack of collection material and high-quality images of the genitalia, I will leave them in the genus *Synanthedon* for now, where they are currently placed.

The representatives of the genus are quite diverse in appearance, but they can be grouped by the colour of the stripes on the abdomen into traditional "red-" and "yellow-banded" ones.

Questions regarding the systematic position of the remaining Palaearctic species of the genus *Synanthedon* s.l. in the modern sense will be discussed in upcoming publications.

Material and methods

The morphological examinations were made using a Leica EZ4 stereomicroscope with LED illumination. All images of the specimens were taken with a Sony® α450 DSLR camera equipped with a Minolta® 50 mm f/2.8 Macro lens. The figures of heads are taken with a Keyence® VHX-1000 Digital Microscope. The genitalia figures are taken with a Keyence® BZ-9000 Biorevo Fluorescence Microscope. The genitalia were photographed using a Keyence® BZ-9000 Biorevo Fluorescence Microscope. The processing of all illustrations was finalized using Adobe® Photoshop® CC2020 software.

All pictures of specimens are labelled with a number, consisting of letters and digits: name of the family, two consecutive digits separated by an n-dash and a year following the m-dash (e.g. SESIIDAE pictures №№ 0115-116–2024). These letters and digit codes correspond to the numbering system of the figured specimens in the author's archive. Each preparation of the genitalia is stored in a microtube with glycerol pinned under the specimen. The dissected genitalia are equipped with the corresponding number placed in the microtube. This number as a label (e.g. Genitalia preparation № OG–011-2024) is pinned under the specimen and listed in the author's archive.

The material studied or mentioned herein is stored in the collection of the A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia (COGM).

The names of plants were verified with the WFO (2024).

Results

Genus *Thamnosphecia* Spuler, 1910, stat. rev.
Figs 1–19

"… *Thamnosphecia* …" – Spuler 1910: 308. Type-species: *Sphinx culiciformis* Linnaeus, 1758, by original designation.

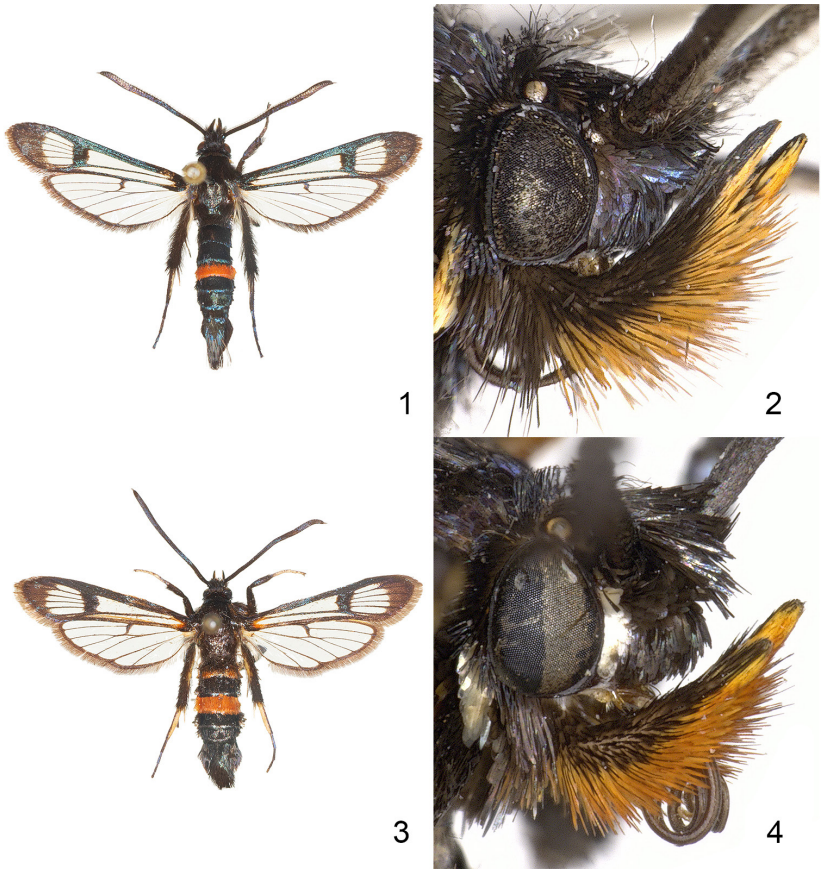
= *Aegeria* auct. sensu Curtis, 1825. Type-species: *Sphinx culiciformis* Linnaeus, 1758, nominal species not originally included in *Aegeria* Fabricius, 1807, and not linked with one of the originally included nominal species.

= *Synanthedon* auct. nec *Synanthedon* Hübner 1819. Type-species: *Sphinx oestriformis* Rottemburg, 1775 [= *Sphinx vespiformis* Linnaeus, 1761], by subsequent designation of Newman (1840: 89).

Literature. Bartel 1912: 376 (as a synonym of *Synanthedon* Hübner, 1819); Dalla Torre and Strand 1925: 8 (as a synonym of *Synanthedon* Hübner, 1819); Engelhardt 1946: 6 (key), 111 (as a distinct genus); Naumann 1971: 29, 100 (as a synonym of

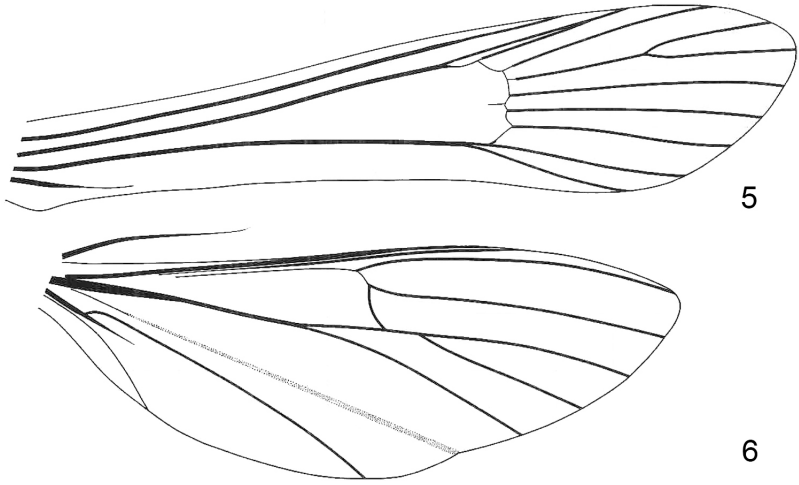
Aegeria Fabricius, 1807 sensu Curtis, 1825); Duckworth and Eichlin 1977: 31 (as a synonym of *Synanthedon* Hübner, 1819); Naumann 1977: 27, 101 (as a synonym of *Aegeria* Fabricius, 1807 sensu Curtis, 1825); Heppner and Duckworth 1981: 29 (as a synonym of *Synanthedon* Hübner, 1819); Fletcher and Nye 1982: 160; Špatenka et al. 1993: 93 (as a synonym of *Synanthedon* Hübner, 1819); de Freina 1997: 62 (as a synonym of *Synanthedon* Hübner, 1819); Špatenka et al. 1999: 118 (as a synonym of *Synanthedon* Hübner, 1819); Pühringer and Kallies 2004: 22 (as a synonym of *Synanthedon* Hübner, 1819).

Redescription. Medium- or even large-sized *Synanthedon*-like clearwing moths with alar expanse 20–31 mm (Figs 1, 3, 7–14).



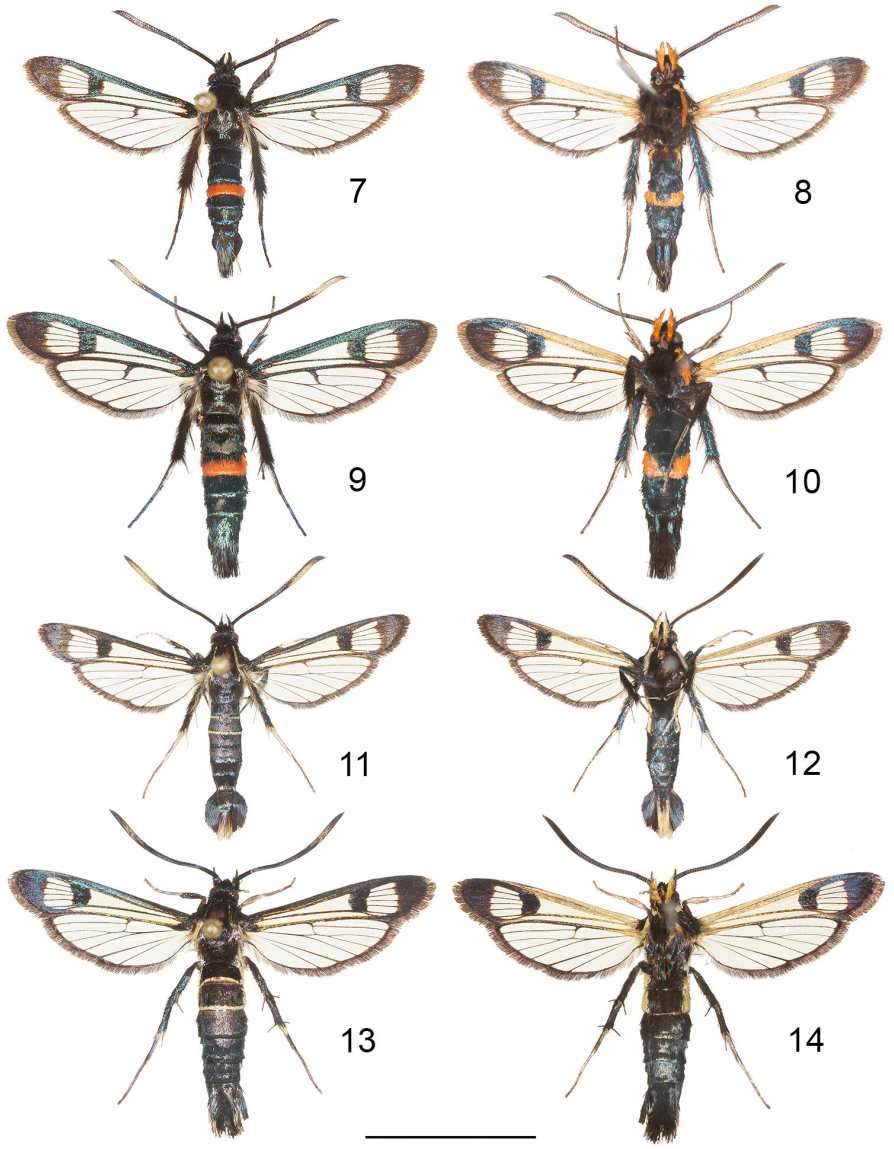
Figures 1–4. *Thamnosphecia* spp. **1–2** – *Th. talischensis* (Bartel, 1906), **comb. nov.**, ♂, Azerbaijan, Lenkaran Distr., 11 km SW Lenkaran, 38°40.26′N, 048°46.02′E, 95 m, 10.XI.1984, ex l., O.G. Gorbunov leg. Sesiidae picture No. 0109–2024. **3–4** – *Th. culiciformis* (Linnaeus, 1758), **comb. nov.**, ♀, Germany. Sesiidae picture No. 0111–2024. **1**, **3** – dorsal view; **2**, **4** – head laterally.

Head with antenna slightly clavate, shortly ciliate in male and without cilia in female; frons covered with slightly protruding scales; labial palpus turned-up, slightly exceeding upper margin of frons, basal and mid palpomeres ventrally covered with elongated seta-like scales; proboscis well-developed, long, functional (Figs 2, 4); vertex smooth-scaled, hanging slightly over frons. Thorax smooth-scaled, both metepimeron and metameron with long hair-like scales posteriorly. Abdomen smooth-scaled, with red, orange or yellow bands, anal tuft well-developed. Forewing with transparent areas well-developed, but in females of *Th. rubrofascia* (H. Edwards, 1881), **comb. nov.** it completely opaque; veins R_1 and R_2 fused distally, veins R_4 and R_5 stalked for about half of their length; distance between bases of veins R_3–M_3 approximately same (Fig. 5). Hindwing transparent, discal spot present; vein M_2 arising from costal third of cross-vein; vein M_3 arises from vein CuA1 visibly distal of cross-vein; vein CuP slightly sclerotized basally; vein 1A well-sclerotized, emerging approximately from middle of vein 2A; vein 3A extremely thin, about twice as long as vein 2A (Fig. 6).



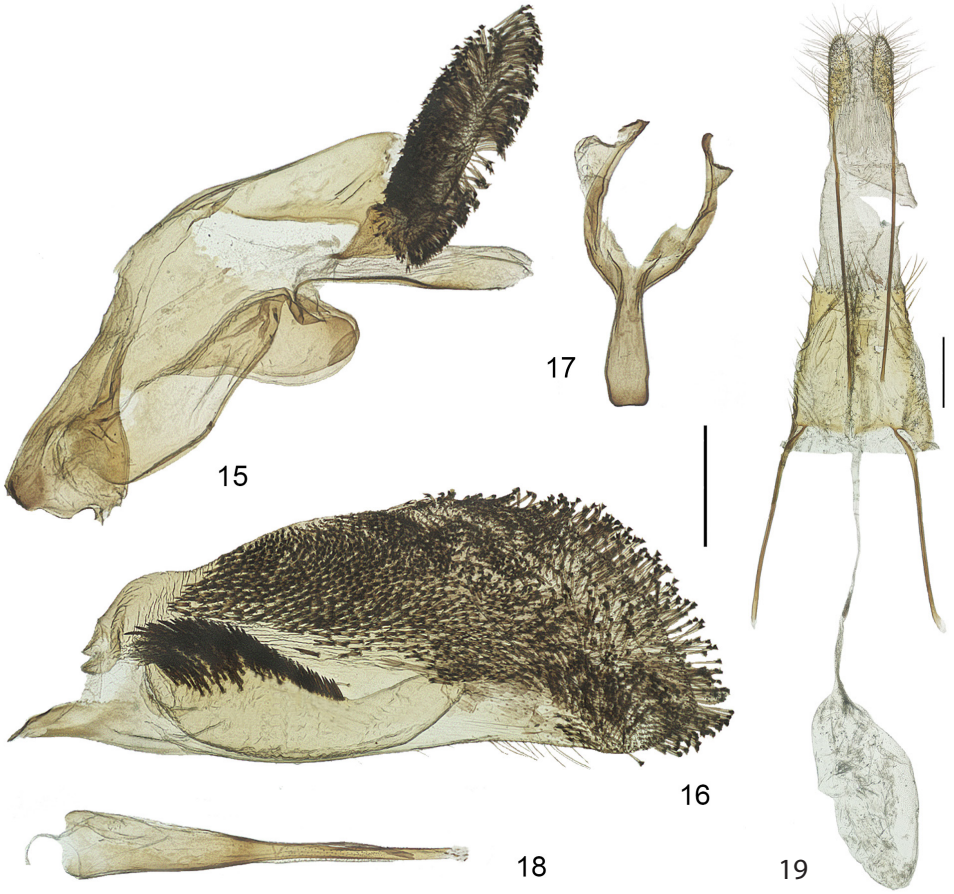
Figures 5–6. Wing venation of *Thamnosphecia culiciformis* (Linnaeus, 1758), **comb. nov.** **5** – forewing. **6** – hindwing.

Male genitalia (*Th. culiciformis*, **comb. nov.**; genital preparation № OG–011-2024) (Figs 15–18). Tegumen-uncus complex relatively broad; scopula androconialis well-developed, about 0.5 times as long as tegumen-uncus complex (Fig. 15); crista gnathi medialis long and narrow, crista gnati lateralis subcordiform, short and broad, about 0.5 times as long as crista gnathi medialis (Fig. 15); valva (Fig. 16) trapezoid-ovoid with crista sacculi pocked-shaped, broad anteriorly and narrower posteriorly, covered with strong pointed setae; saccus (Fig. 17) narrow, slightly broadening at base, short, slightly shorter than vinculum; aedeagus (Fig. 18) rather thin, about 0.6 times as long as valva; vesica with numerous minute cornuti (Fig. 18).



Figures 7–14. *Thamnosphecia* spp. **7–10** – *Th. talischensis* (Bartel, 1906), **comb. nov.** **7–8** ♂, Azerbaijan, Lenkaran Distr., 11 km SW Lenkaran, 38°40.26′N, 048°46.02′E, 95 m, 10.XI.1984, ex larvae from a trunk of *Alnus subcordata* (Betulaceae). Moth emerged IV.1985, O.G. Gorbunov leg. Sesiidae pictures Nos 0109-0110–2024. **9–10** – ♀, same locality and date, O.G. Gorbunov leg. Sesiidae pictures Nos 0115-0116–2024. **11–14** – *Th. pseudoscoliaeformis* (Špatenka et Arita, 1992), **comb. nov. 11–12** – ♂, Japan, Honshu, Aichi-ken, Asukecho, Wachihara, 16.IV.1995, ex pupae from a trunk of *Alnus serrulatoides* (Betulaceae), moth emerged 20.IV.1995, O. Gorbunov & K. Fukuzumi leg. Sesiidae pictures Nos 0113-0114–2024. **13–14** – ♀, same locality, 06.III.1995, ex larvae from a trunk of *Alnus serrulatoides* (Betulaceae), moth emerged 28.III.1995, O. Gorbunov, H. Nakano & F. Igari leg. Sesiidae pictures Nos 0117-0118–2024. **7**, **9**, **11**, **13** – dorsal view; **8**, **10**, **12**, **14** – lateral view. Scale bar: 10.0 mm.

Female genitalia (*Th. culiciformis*, **comb. nov.**; genital preparation № OG–012-2024) (Fig. 19). Papillae anales relatively small, well-sclerotized, with numerous setae; posterior apophysis distinctly longer than anterior apophysis; tergite 8 relatively long and narrow, weakly sclerotized, with sparse setae at distal half; both lamellae antevaginalis and postvaginalis undeveloped; ostium bursae membranous, funnel-shaped, opening near posterior margin of tergite 8; antrum short, tubular, weakly sclerotized; ductus bursae thin, membranous, slightly dilating into corpus bursae; latter ovoid, without signum.



Figures 15–19. *Thamnosphecia culiciformis* (Linnaeus, 1758), **comb. nov.** Russia, Moscow Region, Ramenki Distr., Zhukovo, 140 m, 55°30′N, 038°01′E, 26.V.2021, A. Ponomaryov leg. **15–18.** Male genitalia. **15** — tegumen-uncus complex; **16** — valva; **17** — saccus; **18** — aedeagus. **19** – Female genitalia. Genitalia preparation No. OG–012-2024. Scale bar: 0.5 mm.

Differential diagnosis. Superficially, representatives of the genus *Thamnosphecia*, **stat. rev.** are very similar to some species of the genus *Synanthedon* s.l., such as *S. vespiformis* (Linnaeus, 1761), *S. spheciformis* ([Denis et Schiffermüller], 1775),

S. stomoxiformis (Hübner, 1790), *S. exitiosa* (Say, 1823), *S. mesiaeformis* (Herrich-Schäffer, 1846), *S. pictipes* (Grote et Robinson, 1868), *S. decipiens* (H. Edwards, 1881), *S. saxifragae* (H. Edwards, 1881), *S. castaneae* (Busck, 1913), *S. fukuzumii* Špatenka et Arita, 1992, etc. but they all differ well from each other in the structure of the genitalia of both the male and female (compare Figs 15–19 in this publication with corresponding figures in Engelhardt 1946; Eichlin and Duckworth 1988; Špatenka and Arita 1992; Gorbunov and Arita 1996; Špatenka et al. 1999).

Based on the structure of the crista sacculi of the male genitalia, the genus *Thamnosphecia*, stat. rev. is unique among and is clearly distinguishable from all taxa of the tribe Synanthedonini.

Life History. Trophically, species of this genus are associated with the following plants, namely, *Alnus* spp., *Betula* spp., *Corylus* spp. (Betulaceae); *Carya* spp., (Juglandaceae); *Wisteria* spp. (Fabaceae); *Cornus* spp. (Cornaceae); *Castanea* spp., *Quercus* spp. (Fagaceae); *Myrica pensylvanica* Mirb. (Myricaceae); *Nyssa sylvatica* Marshall (Nyssaceae); *Pinus* spp. (Pinaceae); *Berchemia scandens* (Hill.) K. Koch (Rhamnaceae); *Crataegus* spp., *Cydonia oblonga* Miller, *Malus* spp., *Physocarpus opulifolius* (L.) Maxim., *Prunus* spp., *Pyrus* spp., *Sorbus aucuparia* Poir. (Rosaceae); *Populus* spp., *Salix* spp. (Salicaceae) (Engelhardt 1946; Eichlin and Duckworth 1988; Gorbunov and Arita 1996; Špatenka et al. 1996, 1999). The larva lives in the wood of trees, especially in injured places or in freshly cut but still living stumps. Pupation of the larvae occurs in a cocoon, which is constructed before or after wintering.

Composition. I currently include ten species in this genus, which superficially form two groups. The following species, viz. *Th. culiciformis* (Linnaeus, 1758), **comb. nov.**, *Th. fulvipes* (Harris, 1839), **comb. nov.**, *Th. rubrofascia* (H. Edwards, 1881), **comb. nov.**, *Th. talischensis* (Bartel, 1906), **comb. nov.**, and *Th. pamphyla* (Kallies, 2003), **comb. nov.** form the "red-banded" species group, while the species, viz. *Th. pyri* (Harris, 1830), **comb. nov.**, *Th. scitula* (Harris, 1839), **comb. nov.**, *Th. refulgens* (H. Edwards, 1881), **comb. nov.**, *Th. sigmoidea* (Beutenmüller, 1897), **comb. nov.**, and *Th. pseudoscoliaeformis* (Špatenka et Arita, 1992), **comb. nov.** form the "yellow-banded" one.

Range. Holarctic Realm.

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