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VILNIUS UNIVERSITY
NATURE RESEARCH CENTRE

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# Taxonomy and phylogeny of the genus *Antocha* Osten Sacken, 1860

**DOCTORAL DISSERTATION**

Natural Sciences,
Zoology N 014

VILNIUS 2023

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VILNIAUS UNIVERSITETAS
GAMTOS TYRIMŲ CENTRAS

Radvilė Markevičiūtė

# Genties *Antocha* Osten Sacken, 1860 taksonomija ir filogenija

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Gamtos mokslai,
Zoologija N 014

VILNIUS 2023

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**CONTENTS**

# INTRODUCTION

The genus *Antocha* Osten Sacken, 1860 consists of 162 species and four subspecies and includes three subgenera *Antocha* (s. str.) Osten Sacken, 1860 (116 species, two subspecies), *Orimargula* Mik, 1883 (41 species, two subspecies), and *Proantocha* Alexander, 1919 (5 species).

This genus is recorded from all zoogeographic regions except Antarctica (Oosterbroek, 2023). Most species occur in the Oriental (82 species and two subspecies) and the Eastern Palaearctic (53 species and four subspecies) regions. Twenty-one species occur in the Afrotropics, seven in the Nearctic region and five are known in the West Palaearctic region. Only one species is known in the Neotropics and three in the Australasian/Oceanian region (Oosterbroek, 2023).

The preimaginal stages of these crane flies develop specifically in fast-running waters and frequently form a large part of a river's benthos (Fuller & Hynes, 1987). They could be used for biomonitoring of rapidly flowing rivers, but regrettably the preimaginal stages are known in only five species of the genus and, due to this lack of information, it is difficult to use this group of insects for monitoring.

The imago of the genus *Antocha* is recognized by its specific wing venation and the anal angle of the wing, which is almost square-shaped (Osten Sacken, 1860). This genus's division into three subgenera was based only on morphological characters. However, phylogenetic analysis of species of *Antocha* has never been performed, so the taxonomy of this genus remains unclear. Genital structures in males and females provide an essential set of characters for phylogenetic analysis and taxonomic identification. Unfortunately, these characters are insufficiently described and illustrations are often inexact or not included. Some species have been described only from single specimens with the females unknown or, in other cases, species are known only from the unique female holotypes. These problems create difficulties for species-level identification and phylogenetic analysis is almost impossible. This genus has been chosen as the main object of this work to attempt to solve some of these scientific issues. Due to negative ecological activities by humans, we are witnessing a biodiversity crisis – the sixth mass extinction (Fukurai, 2022). We do not know when most species will go extinct, nor do we know the diversity of many groups of organisms that are described and still undescribed (Naggs, 2017). Consequently, all knowledge about biodiversity is particularly relevant. This research focuses on taxonomic and systematic revision, phylogenetic reconstruction and

morphological character systems in the genus *Antocha*. During this research, type and non-type specimens were examined and illustrated. Results provide the basis for future research of the genus *Antocha* fauna in the world.

## OBJECTIVE AND MAIN TASKS OF THE STUDY

This research aimed to accomplish a taxonomic and phylogenetic review of the genus *Antocha* Osten Sacken, 1860, and to gain new knowledge about this insufficiently investigated group of insects.

The following tasks were set to achieve the objective:

1. To investigate type and non-type specimens of different species to create tools for species identification;
2. To analyse morphological characters and mtDNA cytochrome c oxidase subunit I sequences for phylogenetic analysis;
3. To perform phylogenetic analysis and to divide the species of the genus *Antocha* into species groups.

## STATEMENTS TO BE DEFENDED

1. The genus *Antocha* Osten Sacken, 1860, consists of three subgenera.
2. The inner structures of male genitalia effectively divide species into groups.
3. *Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940 and *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830) are different species.
4. *Antocha* (*Antocha*) *brevistyla* Alexander, 1924 belongs to the subgenus *Proantocha*, not *Antocha* (s. str.).

## NOVELTY OF THE STUDY

1. Phylogenetic analysis of the genus *Antocha* Osten Sacken, 1860, was conducted for the first time.
2. Twenty-five species groups were found after phylogenetic analysis, of which twenty-two are mentioned for the first time.
3. According to morphological characters and phylogenetic analysis, *Antocha* (*Antocha*) *brevistyla* Alexander, 1924 belongs to the subgenus *Proantocha*.
4. Two new species of *Antocha* were described and characterized molecularly: *Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019 and *Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021.
5. A new species for the Chinese fauna *Antocha* (*Antocha*) *quadrifurca* Alexander, 1971 was discovered and characterized molecularly.
6. Sequences of 17 species of the genus *Antocha* mtDNA cytochrome c oxidase subunit I were supplied to the GenBank for the first time.

7. It was found that *Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940 and *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830) are different species.

# 1. LITERATURE OVERVIEW

## 1.1. General morphology of the genus *Antocha*

### 1.1.1. Imago

Adult insects of the genus *Antocha* are small to medium-sized with body lengths ranging from 2.6 mm (*Antocha* (*Antocha*) *basivena* Alexander, 1936) to 9 mm (*Antocha* (*Antocha*) *shansiensis* Alexander, 1954) and with wings ranging from 3.0 mm (*Antocha* (*Antocha*) *basivena* Alexander, 1936) to 11.0 mm (*Antocha* (*Antocha*) *unicollis* Alexander, 1968). Species are brown to brownish-yellow or grey to nearly black. According to Savchenko (1985), general morphology is similar to species of the family Limoniidae.

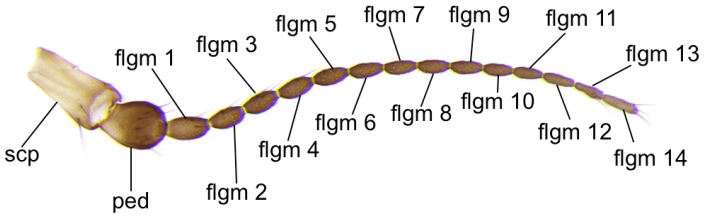


**Figure 1.** Antenna of *A.* (*A.*) *pulchra* Markevičiūtė & Podenas, 2021. Abbreviations: flgm – flagellomere; ped – pedicel; scp – scape.

The antenna (Fig. 1) consists of a cylindrical scape, an oval pedicel and 14 flagellomeres (McAlpine, 1981), which are usually subglobular. The last flagellomere is elongated (Osten Sacken, 1860). The antenna with rounded flagellomeres is short (longer than the head, but not reaching the base of the wing). However, there are species in the subgenus *Orimargula* in which the flagellomeres are very long and cylindrical, so the antenna is also very long (when bent backward, extending to about the fifth abdominal segment) (Alexander, 1921). The flagellomeres have short setae, the male antennae are more thickly clothed with them and the verticils are short (Osten Sacken, 1860). Palpi are shorter than the head, the first segment elongated, the second and third shorter, and the fourth elongated (Osten Sacken, 1860).

According to McAlpine (1981), the pleuron of the body is membranous, but where greater rigidity is required, strengthening sclerites develop, these sclerites together with the tergal and sternal plates in the thorax form a box-like structure with precisely limited capacity for distortion.

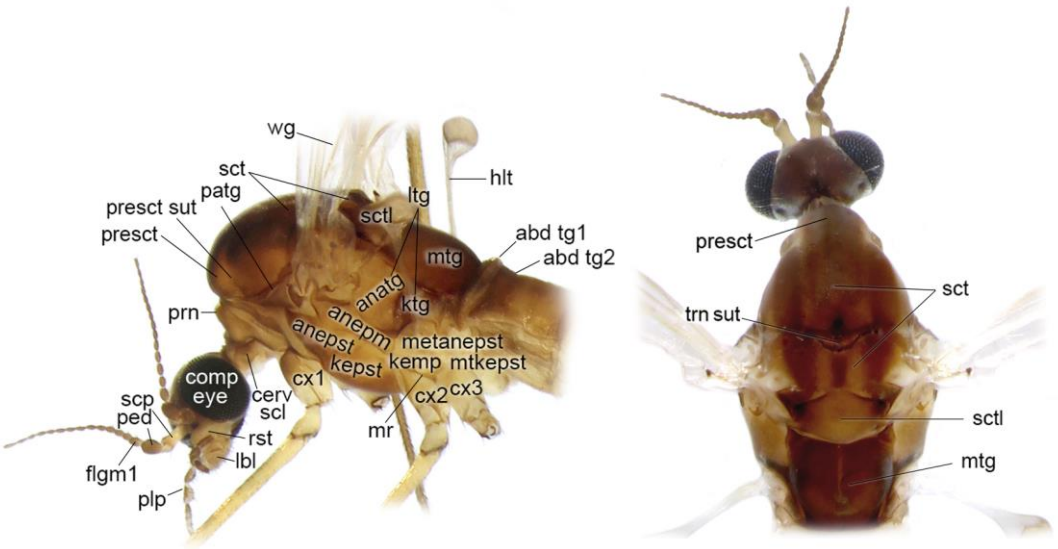


**Figure 2.** Head, thorax and base of abdomen of *A.* (*A.*) *pulchra* Markevičiūtė & Podenas, 2021. Abbreviations: abd tg – abdominal tergite; anatg – anatergite; anepm – anepimeron; anepst – anepisternum; cerv scl – cervical sclerite; comp eye – compound eye; cx – coxa; flgm – flagellomere; hlt – halter; kepm – katepimeron; kepst – katepisternum; ktg – katatergite; lbl – labellum; ltg – laterotergite; mr – meron; metanepst – metanepisternum; mtg – mediotergite; mtkepst – metakatepisternum; patg – paratergite; ped – pedicel; plp – palpus; presct – prescutum; presct sut – prescutal suture; prn – pronotum; rst – rostrum; scp – scape; sct – scutum; sctl – scutellum; trn sut – transverse suture; wg – wing.

The cervix or neck is the part where the head is joined to the thorax by a membranous area of the prothorax, and it bears cervical sclerites (Cumming & Wood, 2017). Usually, the cervix in the genus *Antocha* is short, but there are species of the subgenus *Orimargula* with elongated and thin cervix (Alexander, 1963). The dorsal part of the prothorax is the pronotum (Cumming & Wood, 2017). The scutum, essentially the dorsal surface of the mesothorax, is between the pronotum and the scutellum, separated into a small prescutum and the true scutum, which is in turn divided by the transverse suture into a presutural and a postsutural area (Cumming & Wood, 2017). In front of the prescutal suture is the prescutum, the anterior portion of the mesonotum (Cumming & Wood, 2017). The prescutum can be with broad dark stripes (Alexander, 1919). The paratergite laterally borders the notum. The postnotum, which lies posteroventrally of the scutellum, is divided into a dorsal mediotergite and two laterotergites (anatergite and katatergite). The pleural part of the mesothorax, the mesopleuron, is divided

laterally by the pleural suture into an anterior episternum and a posterior epimeron. In turn, the episternum is divided into a ventral katepisternum and a dorsal anepisternum, while similarly, the epimeron is divided into a ventral katepimeron and a dorsal anepimeron. Posteroventrally of the latter lies the meron (Cumming & Wood, 2017), which in the genus *Antocha* is reduced. The metathorax is reduced, and its dorsum, the metanotum, is scarcely visible externally (Cumming & Wood, 2017). The metanotum connects the mesothoracic postnotum to the first abdominal tergite and is a narrow, transverse band extending from the base of one halter to the other (Cumming & Wood, 2017). Laterally the metapleural suture extends from the coxa to the halter and separates the metapleuron into the metepisternum anteriorly and the metepimeron posteriorly (Cumming & Wood, 2017). The colour of these sclerites can be important in species identification, so these structures are described (Markevičiūtė et al., 2021).

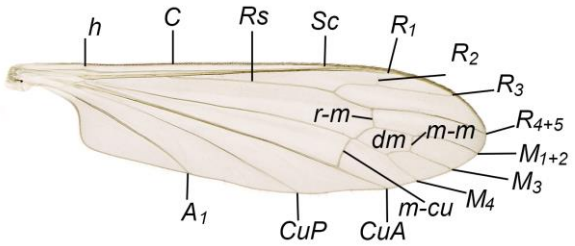


**Figure 3.** Wing venation of *A.* (*A.*) *pulchra* Markevičiūtė & Podenas, 2021. Abbreviations: $A_1$ – first branch of anal vein; *C* – costal vein; *CuA* – anterior branch of cubital vein; *dm* – discal cell; *h* – humeral crossvein; M – medial vein; $M_{1+2}$ – first and second branch of media; $M_3$ – third branch of media; $M_4$ – fourth branch of media; *m–cu* – medial–cubital crossvein; *m–m* – medial crossvein; $R_1$ – anterior branch of radius; $R_2$ – upper branch of second branch of radius; $R_3$ – lower branch of second branch of radius; *Rs* – radial sector; *Sc* – subcostal vein.

The wing (Fig. 3) is generally wide with a large, nearly right-angled anal angle and has a peculiar milky-whitish tinge (Osten Sacken, 1860). Vein *Sc* is very close to vein *R*, and *Sc* ends close to the branching point of *Rs*; $R_1$ is elongated but very close to the frontal wing margin; $R_2$ is situated beyond $R_1$ tip but is very light; the radial sector (*Rs*) is long and straight, usually starts before the middle of the wing; discal cell (*dm*) small, sometimes absent due to reduction of cross-vein *m-m*; vein $A_1$ straight and relatively short (Podenas and Byun, 2013; de Jong, 2017). Arculus is not distinguished and the humeral crossvein is very pale. The halter base of the stem is usually pale yellowish, and the remaining part of the stem and knob is pale brownish (Markevičiūtė et al., 2019).

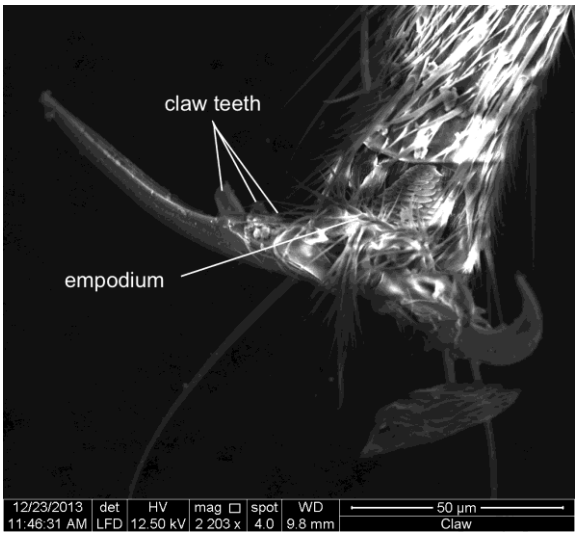


**Figure 4.** A claw of *A.* (*A.*) *vitripennis* (Meigen, 1830).

The colour of the coxae, trochanters, femora, tibiae, and tarsi are used in species descriptions (Markevičiūtė et al., 2019). Usually, the legs with coxae are yellow, the bases of the fore and middle pairs darker, the remainder of the legs pale brown, and the outer tarsal segments slightly darker (Alexander, 1973). In *Antocha*, an empodium of the claw (Fig. 4) consists of several microtrichiae, but an arolium is absent (Friedemann et al., 2014). The claws bear four pronounced claw teeth, and at the base of each is a field with a group of long microtrichiae (Friedemann et al., 2014). In the genus *Antocha*, the legs are long and slender, covered with short semi-erect setae (Podenas, Byun, 2013). In the subgenus *Proantocha*, opposable tubercles at the tip of the femur and base of the tibia on hindlegs are visible (Alexander, 1919), while the subgenus *Antocha* has none of them (Podenas and Poinar, 2009).

Tergite 1 is shortened, and sternite 1 is reduced. The genital opening is located anteroventrally to the anus in both sexes (McAlpine, 1981). The female genital opening is between sternites 8 and 9. The aedeagus arises behind sternite 9, and tergite l0 in the male is reduced (McAlpine, 1981). Male genitalia (Fig. 5) consists of: tergite 9, sternite 9, gonocoxite with two gonostyli (or one inner gonostylus (Alexander, 1955, 1953)), parameres, a reduced tergite 10, aedeagus.

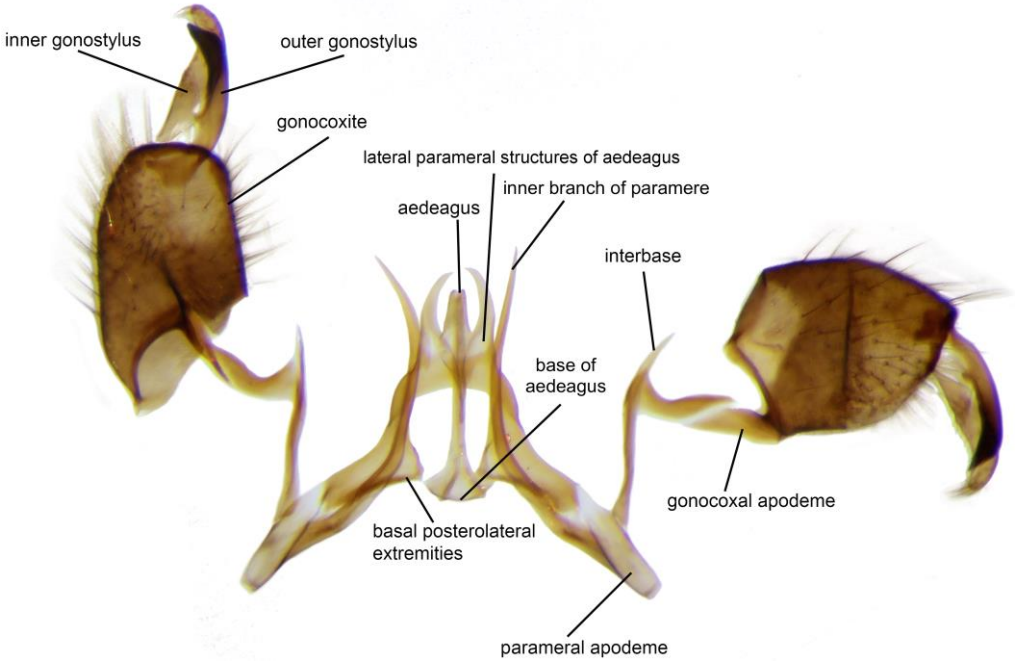


**Figure 5.** Male genital structures of *A.* (*A.*) *opalizans* Osten Sacken, 1860.

Tergite 9 is narrowly transverse. Sternite 9 is reduced and widely separated from tergite 9 (Savchenko, 1985). Gonocoxite (according to Alexander (1971) basistyle) is usually oblong in the subgenus *Proantocha* with a small setiferous lobe (Alexander, 1940). The outer gonostylus (according to Alexander (1971) dististyle) is usually strongly sclerotized, and the inner one is usually wider than the outer. The base of the paramere (according to Alexander (1971) gonapophyses) articulates with the basal posterolateral extremities of the aedeagus and with the base of the gonocoxal apodeme arising from the proximal dorsomedial rim of the gonocoxite, each paramere is subtended by an internal parameral apodeme for muscle attachment (McAlpine, 1981). The inner branches of parameres serve as accessory structures for supporting and directing the aedeagus and perhaps also for protecting the aedeagus while it is not used (Cumming & Wood, 2017). Generally, in Tipuloidea and the genus *Antocha*, the dorsolateral portion of the paramere, which connects to the gonocoxal apodeme, is referred to as the interbase (Cumming & Wood, 2017). The aedeagus develops from tissues behind sternite 9, and most authors regard it as a derivative of segment 10. Its primary function is to transfer sperm to the female reproductive system (McAlpine, 1981). Aedeagus is a tubular intromittent organ generally possessing a single external opening

(phallotrema) (Cumming & Wood, 2017). Usually, the aedeagus appears as a rod-shaped organ (McAlpine, 1981), which is covered by the edeagal sheath. The aedeagal sheath is the structure into which the aedeagus is inserted and forms the ventral connection between the parameres (Ribeiro, 2008). The degree of development of the aedeagal sheath is variable and may or may not bear lateral processes (Ribeiro, 2008). These processes were called gonapophyses by Alexander (Ribeiro, 2008). In some species of *Antocha*, the aedeagus is surrounded by the phallus, formed by the fusion of the aedeagal sheath and the aedeagus it encircles to produce a composite structure (Cumming & Wood, 2017).

In females, the genital opening is between segments 8 and 9, leading to a genital (McAlpine, 1981). The terminalia of the female (Fig. 6) includes the genital and anal segments of the abdomen posterior to the preabdomen that are modified for oviposition and copulation (Cumming & Wood, 2017). Segment 8 is referred to as the gynium; thus, in the genus *Antocha* as in the Tipulidae at least, its tergite and sternite are called the epigynium and the hypogynium respectively (Cumming & Wood, 2017). The cercus is one of a pair of terminal appendages on either side of the anus derived from the proctiger. The hypogynial valve is one of a pair of lateral processes arising from sternite 8 (Cumming & Wood, 2017).

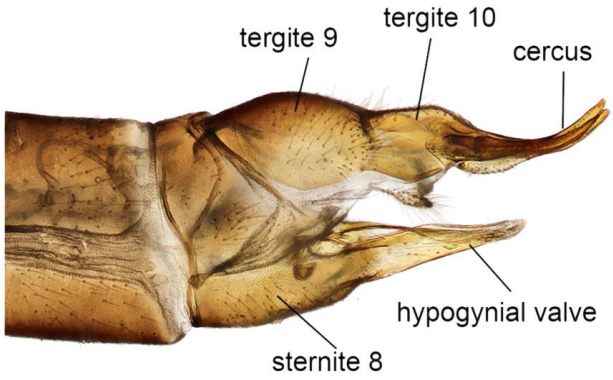


**Figure 6.** Female terminalia of *A.* (*A.*) *bella* Markevičiūtė & Podenas, 2021.

### 1.1.2. Preimaginal stages

Insects of the genus *Antocha* are aquatic and the larval stages do not have spiracles, while the pupa has spiracular gills or breathing horns which vary in the number of branches. The maximum number of such branches or filaments is eight (Alexander, 1920). The first account of the early stages in this genus was by Alexander, 1920, based on *A.* (*A.*) *saxicola* Osten Sacken,

1860, from the Eastern Nearctic region. Bangerter (1929) briefly discussed the immature stages of the subgenus type of *Orimargula* (*A.* (*O.*) *alpigena* (Mik, 1883)) in Central Europe. In a series of three outstanding papers, Hinton (1957, 1965, 1966) described the spiracular gill in three different species: *A.* (*A.*) *vitripennis* (Meigen, 1830) from Europe, *A.* (*A.*) *bifida* Alexander, 1924 from Eastern Asia and *A.* (*O.*) *australiensis* Alexander, 1922 from Eastern Australia.


**Figure 7.** Larva of *A.* (*A.*) *vitripennis* (Meigen, 1830): A – ventral view; B – lateral view; C – dorsal view.

*Antocha* larvae are apneustic, totally lack spiracles and the entire respiration is carried out through anal papillae, the body surface and tracheal gills.

Due to the tracheal system being genuinely closed and representing the maximum specialization in the reduction in size and final loss of the spiracles (Alexander, 1920), the larvae do not have to return to the surface for oxygen (Fuller & Hynes, 1987).

Both larvae and pupae spend their entire lives in cases (Fig. 8) on stones in the water – usually in fast-running and well-aerated water (Alexander, 1920; Fuller & Hynes, 1987). The larvae construct silken cases in crevices and grooves in stone (Novak & Estes, 1974) or located in tiny crevices in rocks and are found on the lateral sides and upper surfaces of rocks as opposed to the undersides (Fuller & Hynes, 1987). The silken, mud- or silt-covered case is delicate and laterally fimbriated with the young larva. The case becomes much firmer, thicker and more compact with the older larva and pupa (Alexander, 1920). This larval case is open at both ends, and the larva can pass forward and backward freely. Considerable agility is shown when the larva is disturbed (Alexander, 1920). The pupa has two powerful

hooks at its caudal end to fasten itself to the case, and in most cases, the pupa hangs with the current, head downstream (Alexander, 1920).

Because only a few larvae have been described, a larval key for species does not exist (Hirabayashi et al., 2019).

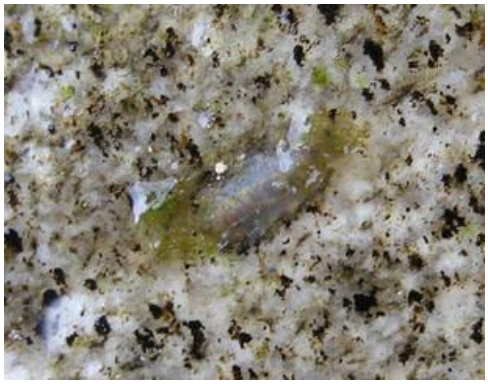

**Figure 8.** *Antocha* larva in a silken case (illustration: http://blog.naver.com/PostView.nhn?blogId=nstdaily&logNo=150018643335&redirect=Dlog&widgetTypeCall=true&directAccess=false).

The total length of the *Antocha* larva (Fig. 7) is about 9.5–10.5 mm (Alexander, 1920). The length of caudal lobes alone is 1.1–1.2 mm, and the diameter of the body is 1–1.1 mm; the body colour from whitish (*A.* (*A.*) *vitripennis*, *A.* (*A.*) *bifida*) to light greenish-brown, clearer greenish ventrally (*A.* (*A.*) *saxicola*); The larvae are elongated and tapering behind, the surface of the body is covered by a dense, appressed pubescence and scattered erect setae (Alexander, 1920).

The head capsule (Fig. 9 B) of *Antocha* is moderate in size (Alexander, 1920). The lateral plates are thin and double, the inner one is the longest, the outer one forming the mental plate (Alexander, 1920). The dorsal plate is broad in front, narrowed behind, the posterior margin bluntly notched; in front of this plate, there are two broad plates, somewhat widely separated medially, presumably belonging to clypeus (Alexander, 1920). Labrum broad, cephalic margin and ventral face with transverse rows of short setae (Alexander, 1920). The mentum (Fig. 9 D, I) is conspicuous, deeply split behind, but not entirely divided, an outer flattened, circular median lobe whose outer face is covered with small, scale-like roughening; behind (dorsad of) this outer lobe is the mentum proper, roughly triangular in outline, conspicuous, margin with a broad, blunt, median tooth which is sometimes bilobed to form two subequal apical teeth; besides this median tooth, some lateral teeth, the outermost one broad with its lateral angle

rounded (Alexander, 1920). The antenna elongate, cylindrical, chitinized, apex pale, with two long sensory setae and a few papillae (Alexander, 1920). Mandible (Fig. 9 C, F) strong, flattened, with two powerful bristles on the back; inner face concave, tip ending in a long tooth, dorsal of apex a single smaller tooth, ventral cutting edge with four gradually smaller teeth, beyond the last of which the margin is crenulated into four or five indistinct carunculations; viewed from inside, lateral teeth appearing blunt (Alexander, 1920). Maxilla (Fig. 9 C) large, consisting of two elongate-oval lobes, the inner one with densely pubescens; palpus, borne at the tip of the outer lobe on the ventral face, shaped like one-half of a cylinder split lengthwise, several tiny hyaline sense pegs at apex; laterad of palpus and nearer base of the outer lobe, a small elongate sensory tubercle with setae at apex; inner lobe of maxilla subequal in size and length to outer lobe; at base of the maxilla, a long, slender arm with setiferous punctures at apex; setae of this arm very long and delicate (Alexander, 1920). The hypopharynx (Fig. E) forms a ring in which ducts of salivary glands open; the anterior part, somewhat resembling the mentum in shape, is a narrow blade with an anterior margin having teeth; the posterior part is a transverse, arcuated band with an anterior margin having teeth (Alexander, 1920).

The prothorax is long and narrowed in front, and the anterior orifice is margined with dense, fine pubescence; the sides of the prothorax are covered by numerous long, erect, pale setae (Alexander, 1920). The mesothorax and metathorax are indistinctly divided into two approximately equal annuli; the anterior annulus has a few lateral setae (Alexander, 1920). The first segment of the abdomen is short (Alexander, 1920). From the second to seventh abdominal segments, each indistinctly divided into two annuli by a transverse constriction, the anterior ring is about half the length of the posterior ring and bearing medially a transverse elongate-oval (dorsal) to short-oval (ventral) welt, which is covered with microscopic hooks; ventral welts are very convex and swollen; abdominal segment eighth with some setae situated at the base of the anal papillae (Alexander, 1920).

The spiracular lobes are reduced, the spiracular field is rectangularly shaped, fringed with short firm setae, not covered with setae or sclerites (Alexander, 1920). Spiracle is small and elongated (Alexander, 1920). The distance between spiracles is less than the width of the spiracle (Alexander, 1920). Three long setae (length of each seta almost equal to the width of anal division), one short seta on the posterior end of an anal division, four long setae on the side (closer to the posterior end), and one medium long seta on the side near the anterior end of the anal division (Alexander, 1920). Anus surrounded by twelve white, fleshy, finger-shaped equal-sized anal papillae

(Alexander, 1920). The length of each papilla is almost equal to the width of the anal division – a long seta at the base of the anal papillae (Alexander, 1920). The anal field comprises four elongate, white, subequal anal papillae (Alexander, 1920). The terminal segment bears two elongated caudal ventral lobes with scattered setae along the whole length (Alexander, 1920). There are no spiracles (Alexander, 1920).

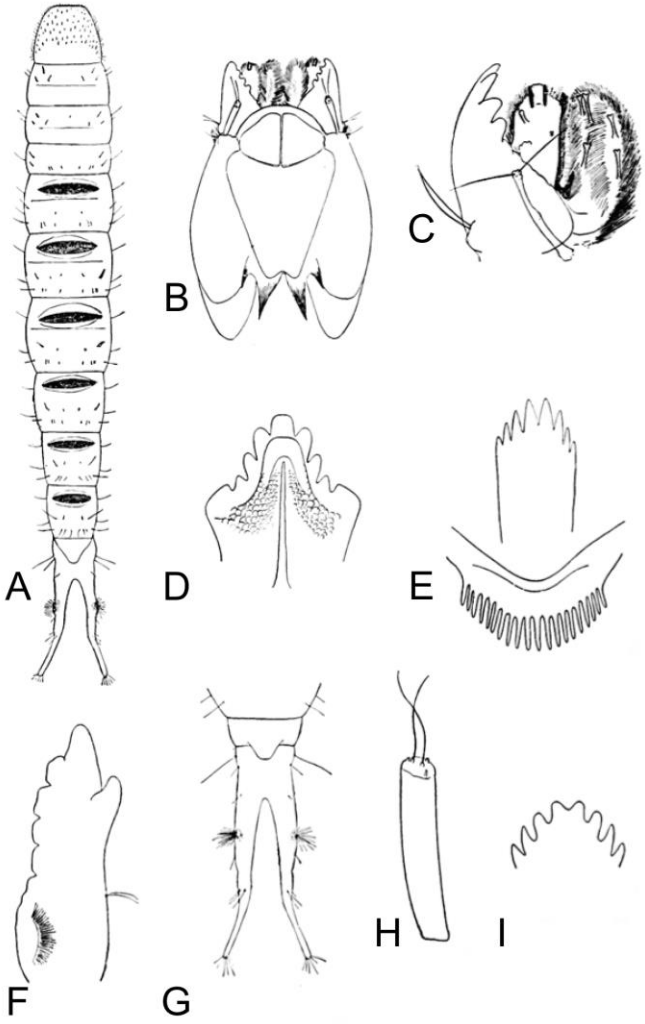


**Figure 9.** Body parts of *A.* (*A.*) *saxicola* Osten Sacken, 1860 larval stage (illustrated by Alexander, 1920: 1051–1053 p.): A – general, dorsal view; B – head capsule, dorsal view; C – mandible and maxilla, ventral view; D – mentum; E – hypopharynx; F – mandible; G – spiracular disk; H – antenna; I – mentum.

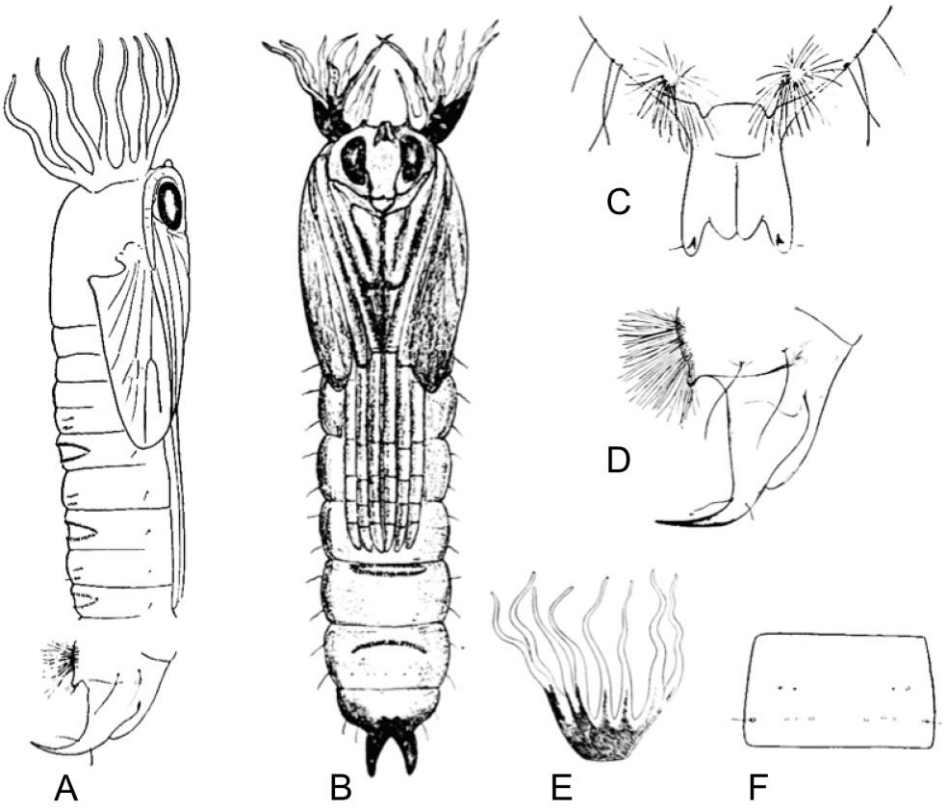


**Figure 10.** Body parts of *A.* (*A.*) *saxicola* Osten Sacken, 1860 pupal stage (illustrated by Alexander, 1920: 1051–1053 p.): A – general, lateral view; B – general, ventral view; C – cauda, dorsal view of male; D – cauda, lateral view of female; E – pronotal breathing horns or spiracular gills, lateral view; F – fifth abdominal segment, dorsal view.

The pupa (Fig. 10) is about 6.2–6.8 mm long, 1.4–1.5 mm wide (Alexander, 1920). The head, thorax and sheaths of appendages are dark brown in fully coloured individuals; the abdomen is pale yellowish white; the terminal hooks of the abdomen are heavily chitinized (Alexander, 1920).

The head is on the margin above the eyes with a blunt median lobe and a small but prominent tubercle on either side, gena gibbous (Alexander, 1920). The compound eyes are large, semicircular in outline – the front between eyes with margins almost parallel (Alexander, 1920). Labrum with apex truncated or indistinctly bilobed (Alexander, 1920). Labial lobes are broad, appearing subtriangular (Alexander, 1920). Sheaths of maxillary palpi are not greatly elongated, slender, or cylindrical (Alexander, 1920). Pronotal breathing horns or spiracular gills, flattened at base, each arcuated basally

behind, bending lateral to form a concave hollow in front; base dark brown, chitinized, branched into five (in *Orimargula*) (Hinton, 1965) or eight (in *Antocha* (s.str.)) (Hinton, 1966) long, pale filaments which are grouped more or less in pairs; the two ventral and the four dorsal filaments arising from a short common base, the other two being separate for their entire length; these filaments as long as, or longer than, antennal sheaths, varying in length from relatively short to a more extended type (Alexander, 1920).

The thoracic dorsum is broad, ample, feebly wrinkled transversely (Alexander, 1920). Leg sheaths with all the tarsi are long and slender, reaching almost the end of the fifth abdominal segment (Alexander, 1920). Wing sheaths are comparatively narrow, reaching the base of the third abdominal segment; anal angle sharp, venation reasonably distinct (Alexander, 1920).

Abdomen pale, intermediate abdominal segments divided into two annuli, the posterior ring much the larger; dorsal part of third to sixth segments and sternum of the sixth segment, each with basal annulus tumid and with two transverse rows of tiny hooks converging at the ends to inclose a linear depressed area; these areas capable of contraction so that the hooks of each row are united or approximated with those of the opposite row; on seventh segment, a darkened, transversely rectangular area bearing setiferous punctures in two broken rows (Alexander, 1920). The pleural area is pale, from the second to eighth segments, with along, delicate seta on each annulus (Alexander, 1920). Dorsum of the eighth segment with a sizeable setiferous tubercle on either side, this tubercle densely covered with hairs that are longest behind and shorter in front; caudad of these large, blunt knobs, a slender, setiferous tubercle (Alexander, 1920).

The terminal segment with tergal valves is chitinized, elongated, extreme posterior margin rounded medially and feebly bilobed, lateral angles produced caudad and dorsad into powerful curved, heavily chitinized hooks; a few setae at about midlength of these hooks. Sternal valves are shorter and slightly bilobed medially (Alexander, 1920).

In the genus *Antocha*, the pupal-adult moult always occurs before the larval-pupal ecdysis, so the pupal spiracular gills do not function in the pupal stage (Hinton, 1965) and gas exchange effects cutaneously (Pritchard, 1982). Before it sheds the pupal cuticle, the young adult (the pharate adult) remains within the pupal cuticle, which is mechanically connected for a week or a little more (Hinton, 1966). The spiracular gills are particularly important as the respiratory organs satisfy the oxygen requirements and sometimes function as a tissue reservoir, repairing damage to the gill walls (Hinton, 1957). It is mentioned that sometimes the most significant part of the entire

adult life may be spent as a pharate adult within the pupal cuticle (Hinton, 1966).

Hinton noticed that the number of branches of the two spiracular gills differs between the subgenera *Antocha* (s. str.) and *Antocha* (*Orimargula*). In the species *A.* (*A.*) *saxicola*, *A.* (*A.*) *vitripennis* and *A.* (*A.*) *bifida*, the number of branches on each of the two spiracular gills is eight (Hinton, 1966), while it is five in *A.* (*O.*) *australiensis* (Hinton, 1965). Other important structures are the tissue reservoirs, which are present in the spiracular gills in *Antocha* (s. str.) and absent in *Antocha* (*Orimargula*) (Hinton, 1966). Also important structures are the plastron lines extending diagonally towards the apex from their origins on the dorsal side so that distally each gill branch has numerous plastron lines across all surfaces (Hinton, 1966). In *A.* (*O.*) *australiensis*, the plastron lines are short and the whole of each plastron line is effective in respiration (Hinton, 1965). In *A.* (*A.*) *vitripennis* and *A.* (*A.*) *bifda*, the plastron lines are much longer (Hinton, 1966).

### 1.2. A review of the taxonomy of the genus *Antocha*

Taxonomy:

Subfamily Limoniinae Speiser, 1909

Limoniinae Kuntze, 1920: 371; Lackschewitz, Pagast, 1940: 3. – Limoniini; Edwards, 1938: 18; Coe, 1950: 22, 23; Alexander, 1966: 297; Alexander, 1967: 70, 71. – Limnobiinae Kertesz, 1902: 155; Meijere, 1919: 65; Alexander, 1919: 890; Pierre, 1924: 18, 68; Lackschewitz, 1928: 195; Alexander, 1920: 792, 793; Hennig, 1950: 425, 426; Crisp, Lloyd, 1954: 293; Lindner, 1958: 115; Lindner, 1959: 243; Krivosheina, 1964: 698, 700; Brindle, 1967: 171, 186.

Tribe Antochini Wulp, 1877

Wulp, 1877: 337, 338; Savchenko, 1989: 272, 273; Alexander 1919: 890, 897; Pierre, 1924: 69, 87; Czizek, 1931: 12, 53; Enderlein, 1936: 17, 18; Lackschewitz, Pagast, 1940: 3, 4; Lackschewitz, Pagast, 1942: 55.

Genus *Antocha* Osten Sacken, 1860

Osten Sacken, 1860: 219; Lackschewitz, Pagast, 1940: 6; Savchenko & Krivolutskaya, 1976: 111; Alexander, 1968: 94; Savchenko, 1983: 106; Geiger, 1986: 26; Torii, 1992: 157; Podenas & Byun, 2013: 169; Podenas & Young, 2015: 524; Taphrophila Rondani, 1856: 185; Edwards, 1938: 46; Lackschewitz & Pagast, 1942: 56; Tjeder, 1958: 162; Hutson & Vane-Wright, 1969: 239; Markevičiūtė et al., 2019: 119.

Type species: *Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860: 219.

The genus *Antocha* was described by Osten Sacken in 1860. The author of this genus provided a diagnosis in which it is claimed that “Mediastinal vein indistinct, being closely applied to the subcostal vein. Komediastinal cross-vein apparent. Petiole is not arcuated near its origin but straight and forms an acute angle with the subcostal vein. The anal angle of the wing is almost square, and consequently, the subaxillary area is nearly triangular. Excepting these peculiarities, the neuration is like that of *Dicranomyia* Sleph. There is one radial area, a discal, and no petiolate areolet. Antennae 16-jointed, short (longer than the head, but not reaching the base of the wing); joints of the flagellum subglobular; last joint elongated; all joints beset with short hairs, the male antennae being more thickly clothed with them; verticils short. Proboscis short. Palpi was shorter than the head, the first joint elongated, the second and third shorter, and the fourth elongated. Tibia without spurs at the tip and without distinct pulvilli. Ungues with two small teeth near the base. The forceps of the male show more analogy to the type of *Limnophila* nob. Then to that of *Limnobia* nob” (Osten Sacken, 1860). Also, it is mentioned that “the name of the genus is derived from its principal character, the proximity of the mediastinal and subcostal veins” (Osten Sacken, 1860).

Only one synonym of *Antocha* is known, named *Taphrophila* by Rondani in 1856 (Oosterbroek, 2022). The author characterized the genus *Taphrophila* as having longitudinal veins *Sc* and $R_1$ running together, especially towards their ending, a character sufficient for recognizing and agreeing with Osten Sacken's description of *Antocha* (Hutson, Vane-Wright, 1969). The other character provided was that there is no transverse vein between $R_{2+3}$ and the costa or $R_1$ (the radial cross vein, *r*) (Hutson, Vane-Wright, 1969). Rondani named the type-species of *Taphrophila* as *Limnobia inusta* Meigen, 1818, but that was a misidentification since the true *inusta* Meigen (species of *Limonia*) in no way agrees with Rondani's characters for *Taphrophila* (Hutson, Vane-Wright, 1969). The genus *Antocha* was described as a new genus by Osten Sacken with *A.* (*A.*) *saxicola* and *A.* (*A.*) *opalizans* as included species. According to Hutson and Vane-Wright (1969), Osten Sacken states, "*Taphrophila*, as I ascertained from a specimen in Mr. Bigot's collection, labelled by Rondani, is the same as *Antocha*" but he rejects Rondani's name on the grounds of insufficient data for its recognition in the original description and misidentification of the type-species (Hutson, Vane-Wright, 1969). According to Edwards (1938) "The

genotype of *Taphrophila* was given by Rondani as *inusta* Mg., but this was an obvious misidentification. Osten-Sacken (1887) reported seeing a *vitripennis* Mg. specimen in Bigot's collection labelled as *Taphrophila inusta* by Rondani. Hence, there can be no doubt that *Taphrophila* is the same as *Antocha*, and as it has priority, it is adopted here. The name *Taphrophila* ('foam-loving') is particularly appropriate to the species of this genus" (Edwards, 1938). Hutson and Vane-Wright (1969) also claimed, "A great deal of confusion has resulted from the use of both *Taphrophila* Rondani, 1856, and *Antocha* Osten-Sacken, 1859, for congeneric species. *Antocha* was used universally until Edwards (1938: 46), with good reason, revived *Taphrophila*. Since then, it has been used by some (European) workers, while others have continued to use *Antocha*. Recently, however, we have seen one of Bigot's specimens (studied by Osten-Sacken), an examination of which lends support to the opinion that *Taphrophila* is the correct name" (Hutson, Vane-Wright, 1969).

Hutson and Vane-Wright (1969) mentioned that they had discussed this at some length in the hope that some stability and uniformity of the nomenclature of this genus would be reached. According to these authors, “Situations in which the type-species of a genus was originally misidentified are to be referred to the International Commission on Zoological Nomenclature; the authors propose to present a case to the Commission concerning *Taphrophila* vs. *Antocha*, in due course” (Hutson, Vane-Wright, 1969).

Alexander (1967), in his work “A new species of crane fly from Ghana (Diptera, Tipulidae)” helped to solve the problem of genus name “I am using the name *Antocha* rather than *Taphrophila* Rondani which was reinstituted in 1938 by Edwards. Osten Sacken proposed *Antocha* in 1859, basing it on a new species, *saxicola,* from eastern North America. Rondani included *Taphrophila* in the first volume of his Prodromus Dipterologicae Italicae, 1856, but it was not discussed further in the subsequent volumes. Osten Sacken (1887. Berl. ent. Z., 31: 230-233) discussed the status of these Rondani names as they concerned the Tipulidae and indicated the reasons for not accepting certain of them, including *Taphrophila*. The type was designated as *Limnobia inusta* Meigen, which is a well-known species in the genus *Limonia.* A primary reason for accepting *Antocha* as being the valid name for this genus of flies was the recently adopted emendation to the Law of Priority in the 1961 edition of the International Code of Zoological Nomenclature, where under Article 23(B) it was stated that “A name that has remained unused as a senior synonym in the primary zoological literature for more than fifty years is to be considered a forgotten name (nomen

oblitum)"… "*Antocha* was the only name in use for this group of flies for more than 75 years and certainly should be retained"" (Alexander, 1967).

The Catalogue of the Craneflies of the World summarizes that the genus name *Taphrophila* is based on a misidentification, and the description of *Taphrophila* refers to *Antocha* (Oosterbroek, 2023). In this case, a subsequent type designation is required. Accepting the original, misidentified type-species is not recommended because *Taphrophila* would become a senior synonym of the genus *Atypophthalmus* (Oosterbroek, 2023).

There are three subgenera of the genus *Antocha*: *Antocha* (s. str.) (116 species, two subspecies), *Orimargula* Mik, 1883 (41 species, two subspecies) and *Proantocha* Alexander, 1919 (five species) (Oosterbroek, 2023). The most distinctive features of the subgenus *Proantocha* are the opposable tubercles at the tip of the femur and the base of the tibia on the hindlegs (Alexander, 1919). Also, in some works, it is mentioned that the male gonocoxite has a setiferous lobe mesally at the base (Torii, 1992). *Antocha* (s. str.) has none of these features. According to Alexander (1924), females of the subgenus *Proantocha* have a serrated ventral margin of the cercus and females of the subgenus *Antocha* (s. str.) have a smooth ventral margin of the cercus. The subgenus *Orimargula* is characterized by an open discoidal cell, which is closed in *Antocha* (s. str.) (Podenas & Young, 2015) and subgenus *Proantocha* (Torii, 1992).

One of the most significant scientists who described the highest number of species was the American entomologist Charles Paul Alexander (1889–1981). He described the subgenus *Proantocha* and 125 species, with four subspecies of the genus *Antocha* (Oosterbroek, 2023).

An English entomologist Frederick Wallace Edwards (1888–1940) described seven species, of which three species belong to the subgenus *Antocha*: *A.* (*A.*) *fusca* Edwards, 1928, *A.* (*A.*) *nebulosa* Edwards, 1928 and *A.* (*A.*) *retracta* Edwards, 1933 and four species to the subgenus *Orimargula*: *A.* (*O.*) *brevivena* (Edwards, 1928), *A.* (*O.*) *gracilicornis* (Edwards, 1925), *A.* (*O.*) *intermedia* (Edwards, 1928) and *A.* (*O.*) *maculipleura* Edwards, 1933. These species were found in Borneo (Sabah) (Oosterbroek, 2023).

Lithuanian entomologist, Professor Sigitas Podėnas, has conducted other fundamental research on the genus *Antocha*. This scientist has described six species of the subgenus *Antocha*: *A.* (*A.*) *chonsaniana* Podenas, 2015 from North Korea, *A.* (*A.*) *koreana* Podenas & Byun, 2014, *A.* (*A.*) *yeongwola* Podenas, 2016 from South Korea, *A.* (*A.*) *taiwanensis* Podenas & Young, 2015 from China (Taiwan), *A.* (*A.*) *bella* Markevičiūtė & Podenas, 2019 and *A.* (*A.*) *pulchra* Markevičiūtė & Podenas, 2021 from China (Sichuan). Some of these species were described with coauthors: the South

Korean entomologist Hye-Woo Byun, the Ph.D. student from Lithuania Radvilė Markevičiūtė and the American entomologist Chen Wen Young, who also has described one species belonging to the subfamily Orimargula – *A.* (*O.*) *possessiva* Young, 1994 (Oosterbroek, 2023). Moreover, because of Professor Sigitas Podėnas and Hye-Woo Byun's research efforts, it was suggested to move three species (*A.* (*P.*) *integra* Alexander, 1940, *A.* (*P.*) *latistilus* Torii, 1992, and *A.* (*P.*) *sagana* Alexander, 1932) of the subgenus *Antocha* to the subgenus *Proantocha* because females of these species have serrated cerci (Podenas, Byun, 2013).

Carl Robert Osten-Sacken (1828–1906) was a Russian diplomat and entomologist (Osten-Sacken, 1903). He described the genus *Antocha* and two species: *A.* (*A.*) *saxicola* Osten Sacken, 1860 (as a type-species) and *A.* (*A.*) *opalizans* Osten Sacken, 1860 which are distributed in Canada and USA (Oosterbroek, 2023).

Czech entomologist Josef Mik (1839–1900) described *Orimargula* as a genus with a type-species *A.* (*O.*) *alpigena* Mik, 1883, which is distributed in Westpalaearctic (Oosterbroek, 2023). Osten-Sacken (1903) noted that "*Orimargula* is nothing but an *Antocha* with an open discal cell". Now *Orimargula* is classified as a subgenus of the genus *Antocha* (Oosterbroek, 2023).

Also, significant scientific works on crane flies were done by Ukrainian entomologist Evgeniy Nikolaevich Savchenko (1909–1994) (Lantsov, 2009). This scientist described three species of *Antocha*: *A.* (*A.*) *biacus* Savchenko, 1981 from Tajikistan, *A.* (*A.*) *hirtipes* Savchenko, 1971 from Georgia and *A.* (*A.*) *ramulifera* Savchenko, 1983 from Russia (Primorskiy kray) (Oosterbroek, 2023).

Enrico Adelelmo Brunetti (1862–1927) was a British musician and entomologist specializing in the Diptera and working for many years in India (Smart, 1945). He described three species of *Antocha* from India: *A.* (*A.*) *indica* Brunetti, 1912, *A.* (*A.*) *triangularis* (Brunetti, 1912) and *A.* (*A.*) *unilineata* Brunetti, 1912 (Oosterbroek, 2023).

Japanese entomologist Takashi Torii described three species of *Antocha* from Japan, of which one belongs to subgenus *Proantocha* – *A.* (*P.*) *latistilus* Torii, 1992 and two species belong to subgenus *Antocha* (s. str.): *A.* (*A.*) *mitosanensis* Torii, 1992 and *A.* (*A.*) *tuberculata* Torii, 1992 (Oosterbroek, 2023).

Johann Wilhelm Meigen (1764–1845) was a German entomologist famous for his pioneering work on Diptera (Forster, 1974). One species, *A.* (*A.*) *vitripennis* (Meigen, 1830), which is distributed in Europe, was described by this author (Oosterbroek, 2023).

Erwin Lindner (1888–1988) was a German entomologist interested in Diptera. He described one *Antocha* species of subgenus *Orimargula* – *A.* (*O.*) *pedekiboana* Lindner, 1958, which was collected in Tanzania (Oosterbroek, 2023).

Another German entomologist Max Paul Riedel (1870–1941), also described one *Antocha* species of subgenus *Orimargula* – *A.* (*O.*) *delibata* Riedel, 1914, from Kenya and Tanzania (Oosterbroek, 2023).

Johannes Cornelis Hendrik de Meijere (1866–1947) was a Dutch zoologist and entomologist. This scientist described *A.* (*A.*) *turkestanica* de Meijere, 1921, which is distributed in Kazakhstan, Turkmenistan, Tajikistan and Afghanistan (Oosterbroek, 2023).

Danish librarian and entomologist Peder Kristian Nielsen (1893–1975) described one species of *Antocha* – *A.* (*A.*) *lindneri* (Nielsen, 1963) from Afghanistan (Oosterbroek, 2023).

Two entomologists, Alain G. B. Thomas and A. Dia, described one *Antocha* species – *A.* (*A.*) *phoenicia* Thomas and Dia, 1982 from Lebanon (Oosterbroek, 2023).

Paul Lackschewitz (1865–1936) was a Latvian botanist and entomologist. This scientist described one species – *A.* (*A.*) *libanotica* Lackschewitz, 1940 (Oosterbroek, 2023).

There are eight described species which have synonyms:

1) A synonym of *A.* (*A.*) *alexanderi* Oosterbroek, 2009 is *A.* (*A.*) brevifurca Alexander, 1974 (Oosterbroek, 2023). It was preoccupied with the senior primary homonym *A.* (*O.*) *brevifurca* Alexander, 1970, from India (Oosterbroek, 2009).
2) One known synonym of *A.* (*A.*) bifida Alexander, 1924 is *A.* (*A.*) *pallida* Lackschewitz, 1964 (Oosterbroek, 2023).
3) A junior synonym of *A.* (*A.*) *brevinervis* Alexander, 1924 is *A.* (*A.*) *spicata* Alexander, 1936 (Torii, 1992).
4) A synonym of *A.* (*A.*) dentifera Alexander, 1924 is *A.* (*A.*) *subdentifera* Alexander, 1969. According to Torii (1992) "*A.* (*A.*) *subdentifera* Alexander, 1969 distributed in Japan (Honshu), USSR far east (Sakhalin, Kuril Isl.) cannot be told from *A.* (*A.*) *dentifera* Alexander, 1924 distributed in Japan (Honshu) definitely because the two species are different from each other mainly in quantitative characters, and differences in holotypic permanent slides of the two species are considered to be artifact".
5) *A.* (*A.*) *neoflavella* Alexander and Alexander, 1973 was chosen as a new name for *A.* (*A.*) *flavella* Edwards, 1928.

6) *A.* (*A.*) *turkestanica* de Meijere, 1921 has two synonyms: *A.* (*A.*) *libitina* Alexander, 1960 and *A.* (*A.*) *afghana* (Nielsen, 1962).
7) Synonyms of *A.* (*A.*) vitripennis (Meigen, 1830) are *A.* (*A.*) *obscura* Strobl, 1906 and *A.* (*A.*) *fulvescens* Lackschewitz, 1940.
8) Synonyms of *A.* (*P.*) *spinifer* Alexander, 1919 are *A.* (*P.*) *serricauda* Alexander, 1924 and *A.* (*P.*) *quadrivittata* (Alexander, 1932).

### 1.2.1. Fossil findings of the genus *Antocha*

According to Savchenko (1985), the genus *Antocha* was considered a young group from the Neogene, which is related to Alpine orogeny. Unfortunately, little published information is available relating to fossils of the genus *Antocha*. Two fossil species of possible ancestors of *Antocha* have been described: one from Oligocene deposits in North America (Evenhuis, 1994) and the other, placed preliminarily in this genus, from Early Cretaceous Burmese amber (Podenas and Poinar, 2009). One species *Antocha succinea* Meunier, 1906 from Baltic amber was made the junior synonym of *Helius pulcher* (Loew, 1850) by Alexander in 1931 (Krzeminski, 1993). Scudder (1894), in his work "Tertiary Tipulidae, with Special Reference to those of Florissant, Colorado", claims that four genera and a dozen species of the tribe *Rhamphidini* were known in a fossil state, all the genera but one, *Antocha*, being found in amber. This author described the new fossil species *Antocha principialis* Scudder, 1894 and noticed that even Osten Sacken wrote, "It is not at all impossible that my genera *Antocha* and *Dicranoptycha* will be found as fossils in Prussian amber." The present illustration almost fulfilled this partial prophecy (Scudder, 1894). The age range of this species is 37.2 to 33.9 Ma (Alroy, 2021). According to Alexander (1920), "*Rhamphidia* is found in amber, and *Antocha* has been described from the Florissant Miocene by Scudder; the latter record, however, seems very doubtful to the writer, judging from Scudder's figure and description". Another fossil species ?*Antocha* (?subgen.) *lapra* Podenas & Poinar, 2009 was described by Podenas and Poinar from Burmese amber (Podenas, Poinar, 2009). The age range of this species is 99.7 to 94.3 Ma (Alroy, 2021).

### 1.2.2. Phylogenetic relationships of the genus *Antocha* and other genera

Relationships between *Antocha* and other genera of the family Limoniidae are not well clarified. Petersen et al. (2010) provided cladograms, which were interpreted based on phylogenetic sketches and classifications proposed by the authors. According to Alexander's data, the sister taxa of *Antocha* is

the genus *Atarba* (Petersen et al., 2010). In Oosterbroek, Theowald and Savchenko cladograms, the genus *Antocha* belongs to the tribe *Antochini*, which is the sister group of the cluster (*Limonia* + *Metalimnobia* + *Geranomyia* + *Libnotes* + *Dicranomyia*) (Petersen et al., 2010).

In the work of Petersen et al. (2010), it was shown that members of the two tribes Antochini (*Antocha*) and Limoniini (*Limonia*, *Libnotes*, *Geranomyia*, *Metalimnobia*, *Dicranomyia*) were not consistently recovered as monophyletic groups. Placement of *Antocha* was not consistent among analyses, either joining Limoniini based on morphological analysis (characters: ninth tergite and ninth sternite as separate segments, separation of dorsal parameres from aedeagus present, shape of pupal, creeping welts elliptical) or with Lipsothrix based on molecular and combined evidence analysis (Petersen et al., 2010).

According to Oosterbroek and Theowald (1991), the genus *Antocha* belongs to the subfamily Limoniinae by its pupae, which are in silken cocoons, and larvae, which are in tubes or cases. The pupal creeping welts are elliptical. The sister group of *Antocha* is (*Thaumastoptera* + *Orimarga*) + ((*Eliptera*) + (*Atypophthalmus* + *Limonia* + *Rhipidia* + *Libnotes* + *Metalimnobia* + *Geranomyia* + *Discobola*)) (Oosterbroek, 1991).

It is considered that despite still not solved phylogenetic problems, the genus *Antocha* belongs to the tribe Antochini. Generally, the subfamily Limoniinae has 34 genera and, based on adult characters, it is divided into two tribes – Antochini (antennae is 16-segmented) and Limoniini (antennae is 14-segmented) (Podeniene et al., 2017). According to Podenas & Byun (2013), the tribe Antochini is also described by these features: simple and not branched flagellomeres; the prescutum is without tubercular pits and hardly expressed pseudosutural foveas; the tibiae is without spurs; the wings are usually well developed longer than the body; the membrane of the wing is without macrotrichiae, squama hairless; venation of wing is characterized by comparatively long vein *Sc*, reaching beyond base of *Rs*; radial sector is with two branches; cell $m_1$ is absent; discal cell present or absent; ninth sternite of male terminalia is membranous, reduced and widely separated from ninth tergite, or in rare cases fully developed as in most other Limoniinae crane flies; the gonocoxite is with one or two gonostyli (Podenas & Byun, 2013). There are five genera in the tribe Antochini: *Thaumastoptera* Mik, 1866, *Orimarga* Osten Sacken, 1869, *Elliptera* Schiner, 1863, *Antocha* Osten Sacken, 1860 (Savchenko, 1985) and *Limnorimarga* Alexander, 1945 (Podeniene et al., 2017).

### 1.2.3. Phylogenetic relationships inside the genus *Antocha*

Three subgenera of the genus *Antocha* are known: *Antocha* (s. str.) Osten Sacken, 1860, *Antocha* (*Orimargula*) Mik, 1883 and *Antocha* (*Proantocha*) Alexander, 1919. This division into three subgenera was based on some morphological characters, but no phylogenetic analysis has ever been published. It is known that the most distinctive feature of the subgenus *Proantocha* are opposable tubercles at the tip of the femur and the base of the tibia on the hindlegs (Alexander, 1919). According to Alexander (1924), females of the subgenus *Proantocha* have a serrated ventral margin of the cercus, and females of the subgenera *Antocha* (s. str.) and *Orimargula* have a smooth ventral margin of the cercus. The subgenus *Orimargula* is characterized by an open discoidal cell, which is closed in *Antocha* (s. str.) (Podenas & Young, 2015) and the subgenus *Proantocha* (Torii, 1992).

In the 21th International Congress of Entomology, Takashi Torii presented the phylogenetic analysis of 18 *Antocha* species recorded from Korean Peninsula, Japan and the far east of Russia. In total, 30 imago male and female terminalia and wing venation characters were used for the cladistic analysis (Torii, 2000). The results were given: "1) Sixteen species are arranged in one clade showing dichotomous branchings; the relationship among the clade and the other two species is left trichotomous; 2) The subgenus *Proantocha* is monophyletic, while the subgenus *Antocha* is paraphyletic" (Torii, 2000).

Characters which were mentioned and were analysed in the Torii (1992) article are: the tip of outer gonostylus which can be paddle-like (apomorphic feature) or rod-like (plesiomorphic feature); a setiferous lobe at the basal-mesal part of the gonocoxite can be present (apomorphic feature) or absent (plesiomorphic feature); a pair of processes at the medio-caudal margin of the ninth tergite can be present (apomorphic feature) or absent (plesiomorphic feature); the caudal half of the ninth sternite can be trilobed (apomorphic feature), round (plesiomorphic feature) or squarish; the hindleg can be long and very stout (apomorphic feature) or regular (plesiomorphic feature); dense spinules or short spinous setae of hindleg can be developed (apomorphic feature) or absent (plesiomorphic feature); opposable pointed tubercles at the tip of the femur and base of the tibia of the hindleg can be present (apomorphic feature) or absent (plesiomorphic feature); the ventral margin of the cercus can be serrated (apomorphic feature) or smooth (plesiomorphic feature) the ventro-apical angle of cercus can be present (apomorphic feature) or absent (plesiomorphic feature); latero-caudal processes of sternite 8 can be present (apomorphic feature) or absent

(plesiomorphic feature).

### 1.3. Ecology of the genus *Antocha*

#### 1.3.1. Seasonal dynamics, life cycle, and diet

The whole life cycle of *Antocha* may require a year (Alexander, 1920), and it is bivoltine (Fuller & Hynes, 1987; LeSage & Harrison, 1981) with an autumn-winter-spring generation and a shorter summer generation (Fuller & Hynes, 1987). The females lay their eggs (Fig. 11) in slow or rapid waters (Alexander, 1920). The eggs are deposited by dipping down to the water's surface, one or more eggs being deposited on each descent (Alexander, 1920). There are four larval instars, which are typical of Tipulidae (Pritchard, 1983). It is known that the first instars of *A.* (*A.*) *saxicola* are found from June through to August and again in October (Fuller & Hynes, 1987). Most of the first instars from June and early July grow to the fourth instar by August and still have sufficient time for pupation and emergence (Fuller & Hynes, 1987). In August, pupae and adults are found in large numbers (Fuller & Hynes, 1987). From September to November, larval growth is relatively rapid, indicated by the movement of larvae from one instar to the next until most of the population is in the third and fourth instars (Fuller & Hynes, 1987). Growth continues, but the rate is much lower throughout the winter and spring (Fuller & Hynes, 1987). These periods overlap or follow the peak flight periods for adults (Fuller & Hynes, 1987), which is why at a single time, and even on a single rock, the sizes of larvae vary from very small to almost fully grown, and this probably explains the long flight-period of the imago (Alexander, 1920). Also, *Antocha* can overwinter in the egg stage and survive the scouring of ice, but these insects, which overwinter in this stage, have shorter life cycles (Bradt & Wieland, 1981).

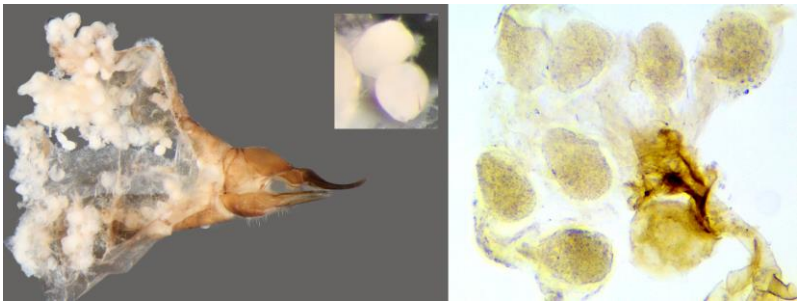

**Figure 11.** Ovipositor and eggs of *A.* (*A.*) *vitripennis* (Meigen, 1830).

The larvae and pupae are wholly aquatic and are found on the sides and upper surfaces of rocks in riffle areas (Fuller & Hynes, 1987). Larvae make silken cases, usually in tiny crevices in the rocks (Fuller & Hynes, 1987). Insects of this genus are described as collector-gatherers and indiscriminate feeders, sweeping all materials from around their case. Hence, the diet consists mainly of detritus and diatoms, with significant quantities of inorganic matter ingested (Fuller & Hynes, 1987). The diet depends on the season. During summer, filamentous algae appear on the rocks and thus filamentous algal forms can be observed in *Antocha* guts (Fuller & Hynes, 1987). Animal material that occurs only in the fourth instars of *Antocha* guts from May through to September consists exclusively of early instar chironomids when their abundance is high; this probably reflects incidental ingestion and not a shift to a more predacious food habit by *Antocha* (Fuller & Hynes, 1987). Diatoms appear to be reduced in the autumn and increase in the spring (Fuller & Hynes, 1987). Detritus increases during the autumn (Fuller & Hynes, 1987). Also, in March, a snow-melt spate usually sources the substrates. At that time, a part of the gut contents comprises detritus, whereas inorganic material and diatoms are the major component of the diet (Fuller & Hynes, 1987).

It is noticed that emerging adults of *Antocha* show a significant seasonal change in body size, which decreases steadily from spring to summer and increases again in autumn (Hirabayashi et al., 2004). Also, the values of annual secondary production differ greatly depending on the pattern of the floods that occur in the same river and in the same season (Hirabayashi et al., 2019).

Larvae pupate directly in the water and pupal existence is passed in the silk case (Alexander, 1920). The duration of the pupal stage could not be determined ideally, but according to Bangerter (1929), the duration from larvae pupation to imago emergence was about nine days (Bangerter, 1929). However, it is known that it can be delayed. The metamorphosis of the pupa into the adult occurs, without exception, an appreciable amount of time before the pupa cuticle is shed (Hinton, 1957). Thus, when the pupal cuticle is shed, the adult is some hours, days or months old (Hinton, 1957). This early part of the adult stage enclosed within the pupal cuticle is called the pharate adult stage (Hinton, 1957).

The emergence of the strictly aquatic *Antocha* has not been observed, but it must be practically instantaneous, as in Blephariceridae (Alexander, 1920). Because the wings of Blephariceridae develop to full size within the pupal case and merely unfold during emergence, adults can fly immediately upon reaching the water surface via an air bubble (Courtney, 2017). Another

aquatic group of insects which emerge in this way is the Simuliidae (De Moor, 2017). Emerged adults are found in most significant numbers in vegetation along stream margins (Fuller & Hynes, 1987) and take refuge in grass and bushes where they mate (LeSage & Harrison, 1981). It is suggested that the adult life span is relatively short (about one week) (Fuller & Hynes, 1987). It was established that adults of *A.* (*A.*) *vitripennis* males live up to eight days, whereas no live females were found after three days (R. Markevičiūtė, unpublished data).

### 1.3.2. Reproductive behaviour

In polyandrous insects, multiple matings lead to sperm competition in which the last male to mate has the greatest likelihood of fertilizing the ova (Parker, 1970; Adler & Adler, 1991). When the sex ratio at sites with receptive females is significantly skewed toward males, selecting the last male to mate with will be particularly strong (Thomhill and Alcock, 1983; Adler & Adler, 1991). Postcopulatory guarding has been interpreted as one means of gaining last-male advantage and ranges in expression from genital linkage to distant surveillance (Thomhill and Alcock, 1983; Parker, 1984; Adler & Adler, 1991). Insects of *Antocha* mate in grass and bushes (LeSage & Harrison, 1981) along stream margins (Fuller & Hynes, 1987) and lay eggs in moist habitats, often associated with fast-flowing streams (Adler & Adler, 1991). Usually, males flutter sideways in an irregular zigzag pattern, and this behaviour is interpreted as mate searching because males invariably attempt to mate upon contact with a female (Adler & Adler, 1991). During searching, males periodically rest (Adler & Adler, 1991). Sometimes, longer interactions between males result not from attempted coupling but prolonged leg contact, possibly by means of mate recognition (Adler & Adler, 1991). Males attempt to mate immediately, but are less efficient in locating the genitalia of the female (Adler & Adler, 1991).

After uncoupling, females of *Antocha* resume oviposition while males remain astride and generally parallel with the female (Adler & Adler, 1991). Guarding males maintain close contact with their mates by sweeping their legs inward against those of the female and by gently bobbing against the female's dorsum (Adler & Adler, 1991). It is considered that the legs and claws of these crane flies play an essential role in guarding (Adler & Adler, 1991). All three legs in males are significantly longer than in females (Adler & Adler, 1991). The distal tarsomere in males is prehensile and slightly grooved, allowing application to the penultimate segment (Adler & Adler, 1991). The hind claw of the male is significantly longer than the female's (Adler & Adler, 1991). When a rival contacts a guarding male, the guard immediately recouples with the female or uses its abdomen to keep the genitalia of the rival from the female and recouples when possible (Adler &

Adler, 1991). A guarding male, aided by its prehensile tarsi, always maintains contact with the female during the interaction (Adler & Adler, 1991). After the defeated male departs, the winner remains coupled, then resumes guarding (Adler & Adler, 1991). Females have large, thin-walled, unpigmented and expandable spermathecae (Adler & Adler, 1991). In the genus *Antocha*, the two spermathecae have a short common duct and lie dorsally and in tandem (Adler & Adler, 1991).

Intense sperm competition probably results from highly promiscuous females (Adler & Adler, 1991). Because elongated spermathecae tend toward high sperm displacement by the most recent male, the two oblong spermathecae and the packing of sperm within suggest a last-male advantage for these crane flies (Adler & Adler, 1991).

Unusual mate-clasping behaviour was observed in *A.* (*O.*) *possessiva* (Young, 1994). When a male contacts a female, he would mount her dorsally on the thorax between the wings, their bodies oriented in the same direction (Young, 1994). The male would bend his abdomen ventrally alongside the female's abdomen and then curl it dorsally to clasp the pleural region of the fifth abdominal segment of the female from the ventral side (Young, 1994). After a male clasped a female, the male remained mounted on the female and tenaciously retained her possession through firm nongenital contact (Young, 1994). Coupled pairs could not fly and, if disturbed, would drop to the ground (Young, 1994).

Male-male contact was also observed, resulting in brief coupling attempts by both males and quickly ending with one or both males dislodging the other (Young, 1994). A solitary male contacted a male already clasping a female (Young, 1994). The rival male attempted to dislodge the guarding male and gain access to the fifth abdominal segment of the female (Young, 1994). Rival males have never been observed attempting genitalic copulation with a female (Young, 1994).

### 1.2.3. Parasites

There are several known internal and external parasites of *Antocha*. Some Trichomycetes species are internal parasites of insects in this genus (Strongman & Xu, 2006). Trichomycetes live in the guts of arthropods, mostly in the immature stages of insects in aquatic systems (Strongman & Xu, 2006). Two species *Smittium chinliense* Strongman et Shengquan Xu, 2006 and *Caudomyces japonicus* Lichtw., Kobayasi, Indoh, 1988 were collected in the hindguts of *Antocha* sp. larva (Strongman & Xu, 2006). About 50 larvae from a waterfall site were dissected with no fungi present in the hindgut (Strongman & Xu, 2006). Three specimens of another *Antocha* sp. larvae were collected from a stream, one of which had thalli of a *Smittium chinliense* (Strongman & Xu, 2006).

Adults of *Antocha* are parasitized by water mites *Sperchon plumifer* Thor, 1902, whereby larvae attach to the insect's abdomen (Hirabayashi & Fukunaga, 2007). The hydrachnellid water mite species pass through an ectoparasitic larval stage on insect hosts of various aquatic or semiaquatic insects (Hirabayashi & Fukunaga, 2007). Of 22204 adult individuals of *A.* (*A.*) *bifida* investigated, 2113 individuals were parasitized by the water mite larvae *Sperchon plumifer* (Hirabayashi & Fukunaga, 2007). The most significant number recorded from an individual host was 40 on a female and 36 on a male (Hirabayashi & Fukunaga, 2007).

### 1.3.4. Importance

*Antocha* species can dominate (LeSage & Harrison, 1981) and, as other crane flies, are essential food sources for various animals. It is known that some species of birds, amphibians, pisces, arachnids and predatory insects feed on crane flies (Alexander, 1920). *Antocha* larvae have been found in the stomach, and intestinal contents of fishes like *Alburnoides bipunctatus*, *Gobio gobio*, *Barbus petenyi* and *Orthrias barbatulus* (Nicoara et al., 2006).

Macroinvertebrates are used as bioassessment indicators to determine a water body's environmental quality (Xu et al., 2014). By comparison with chemical water quality grading, taxa-specific indicators for various water pollution levels have been found (Xu et al., 2014). In coarse particle substrates, *Antocha* sp. is the taxa-specific indicator for very good or good water quality (Xu et al., 2014).

# 2. METHODS AND MATERIALS

## 2.1. Methods

Examined specimens were dried or preserved in 70% ethanol. An end of the abdomen of the adult insect was removed and boiled in 5% NaOH solution for at least 15 minutes (depending on the specimen condition), then cleaned in distilled water and 96% ethanol. The inner structures of the male genitalia, antenna and wing were put into to a drop of euparal and slide mounted. Insects were studied with an Olympus SZX10 dissecting microscope and photographs were taken with the digital camera Canon EOS 80D and Canon MP-E 65 mm macro lens. Slides of genital structures were studied with a Nikon Eclipse Si-L microscope and photographs were taken with the camera Lumenera Infinity 1. Photographs were stacked using Zerene Stacker (PMax algorithm). The author of this work created all illustrations.

The terminology of adult morphological features generally follows that of Cumming & Wood (2017) and wing venation after de Jong (2017). The general distribution of species is given according to Oosterbroek (2023).

Identified specimens were compared with type and nontype specimens from the United States National Museum of Natural History, Smithsonian Institution, Washington DC, USA, and the Natural History Museum, London, UK.

## 2.2. Materials

Material (1358 specimens) for this research was acquired while visiting foreign museums and through loans from different institutions or scientists.

Part of the used material was collected during expeditions in South Korea by Dr. S. Podėnas, Dr. T. A. Klein and Dr. H.-C. Kim, in China by S. Saldaitis, R. Butvila and A. Floriani, and in Lithuania by R. Markevičiūtė. Dr. P. Starkevič provided some specimens.

The Natural History Museum, London, UK, was visited from 27 September – 22 October 2021.

Material was acquired through loans from:

NHMUK – the Natural History Museum, London, UK;

USNM – the United States National Museum of Natural History, Smithsonian Institution, Washington DC, USA;

CNC – the Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Canada;

MNHV – the Museum of Natural History Vienna, Austria;

RMNH – the Naturalis Biodiversity Center, Leiden, Netherlands;

NIBR – the National Institute of Biological Resources, Incheon, South Korea;
ANSP – the Academy of Natural Sciences in Philadelphia, USA;
NRC – the Nature Research Centre, Vilnius, Lithuania.

### 2.3. DNA extraction and PCR

The total deoxyribonucleic acid (DNA) from the piece of the insect abdomen was extracted using an ammonium acetate extraction method (Richardson et al., 2001). The insect-specific primers LCO1490 and HCO2198 were used to amplify a cytochrome oxidase subunit I (COI) fragment of mitochondrial DNA (Folmer et al., 1994). All Polymerase chain reactions (PCR) were performed in a thermal cycler (Eppendorf) in 25 µl reactions with 2µl of total genomic DNA, 12.5 µL of DreamTag Master Mix (0.4 mM of each nucleotide, 4 mM MgCl2, 2 Dream Taq buffer, Dream Taq DNA Polymerase) (Thermo Fisher Scientific, Lithuania), 8.5 µL nuclease-free water and 1 µL of 10 µM of each primer.

All amplifications were evaluated by running 3 µl of the final PCR products on a 2% agarose gel. The amplification success was evaluated using a MultiNa electrophoresis system (Shimadzu, Japan). One negative control (nuclease-free water) and one positive control (*A.* (*A.*) *vitripennis* DNA) were used in every seven samples to control false amplification.

PCR products from all positive amplifications were precipitated with ammonium acetate and 95% ethanol and sequenced twice with corresponding primers for both strands. Sequencing reactions were performed using the Big-Dye® Terminator v3.1 Cycle Sequencing Kit and the 3500 Genetic Analyzer (Applied Biosystems, Foster City, CA, USA) according to the manufacturer's recommendations. The obtained sequences were aligned and analysed using BioEdit 7.2. software.

The author of this work did DNA extraction, PCR, electrophoresis and sequence alignment.

### 2.4. Phylogenetic analysis

The phylogenetic analysis was based on 93 morphological characters and one character based on the distribution of 123 species. Winclada v.100 (Kevin C. Nixon) was used to assemble the character matrix and arrange and review cladograms. NONA v.2.0 (P. A. Goloboff, 1993) was used to search the most parsimonious tree using equal weights (EW). Character coding was performed according to Sereno's (2007) paper "Logical basis for morphological characters in phylogenetics". Character polarities were found

through outgroup comparison. A heuristic search option and tree bisection and reconnection algorithm was used. The settings were set as: hold1000, mult*50, mult*max*. A strict consensus tree was created. Four species were used as the outgroup: *Limonia phragmitidis* (Schrank, 1781), *Thaumastoptera* (*Thaumastoptera*) *calceata* Mik, 1866, *Orimarga* (*Orimarga*) *arabica* Hancock, 2011, and *Elliptera zipanguensis zipanguensis* Alexander, 1924.

A Bayesian phylogeny was constructed using 25 COI gene sequences (567 bp) and the mrBayes 3.1.2 software (Ronquist and Huelsenbeck, 2003). The General Time Reversible Model (GTR) was suggested by the mrModeltest 2.2 (software available from http://www.abc.se/~nylander/mrmodeltest2/MrModel-block). Two simultaneous runs were conducted with a sampling frequency of every 100th generation over 1 million generations. The average standard deviation of split frequencies was 0.017426. Before constructing a majority consensus tree, 25% of the initial trees in each run were discarded as burn-in periods. The phylogenies were visualized using FigTree v1.4.3. (software available from http:// http://tree.bio.ed.ac.uk/software/figtree/).

Also, analyses for species delimitation were done: Bayesian Poisson Tree Process (bPTP) (Zhang et al., 2013; Kapli et al., 2017) using the web server (https://species.h-its.org/ptp/); and Assemble Species by Automatic Partitioning (ASAP) online version (Puillandre et al., 2020) using the Kimura K80 substitution model (ts/tv=2.0) (https://bioinfo.mnhn.fr/abi/public/asap). The genetic distances among the sequences of investigated specimens were analysed.

A world map was generated in R version 4.2.2 (R Core Team, 2022) using the ggplot2 (Wickham, 2016) and modified using Adobe Photoshop Version: 14.0.

The author of this work performed all analyses.

# 3. RESULTS AND DISCUSSION

## 3.1. Phylogenetic analysis of the genus *Antocha*

### 3.1.1. Analysis of morphological characters

1. Antenna when bent backward:
(0) reaching frontal margin of prescutum;
(1) reaching abdomen.

2. Number of segments of antenna:
(0) 14;
(1) 16.

3. Shape of flagellomeres:
(0) ovoid (Fig. 12 A);
(1) fusiorm (Fig. 12 B);
(2) dilated ventrally (Fig. 12 C);
(3) tubular (Fig. 12 D).


**Figure 12.** A – antenna with ovoid flagellomeres (*Antocha* (*Antocha*) *quadrifurca* Alexander, 1971); B – antenna with fusiform flagellomeres (*Antocha* (*Antocha*) *hyperlata* Alexander, 1968); C – antenna with ventrally dilated flagellomeres (*Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019); D – antenna with oblong and cylindrical flagellomeres (*Antocha* (*Orimargula*) *brevifurca* Alexander, 1970).

Ovoid (Fig. 12 A) and fusiform (Fig. 12 B) flagellomeres are specific to most *Antocha* Osten Sacken, 1860 species, but there are some species like *A.* (*A.*) *bella* Markevičiūtė & Podenas, 2019, *A.* (*A.*) *streptocera* Alexander, 1949, or *A.* (*A.*) *indica* (Edwards, 1926), that have ventrally dilated flagellomeres (Fig. 12 C). Tubular flagellomeres (Fig. 12 D) are specific to some species of the subgenus *Orimargula* Mik, 1883 such as *A.* (*O.*) *tanycera* Alexander, 1963, *A.* (*O.*) *almorae* Alexander, 1970, *A.* (*O.*) *brevifurca* Alexander, 1970 and some other.

4. Nearly right-angled anal angle of wing:
(0) absent (Fig. 13 A);

(1) present (Fig. 13 B).

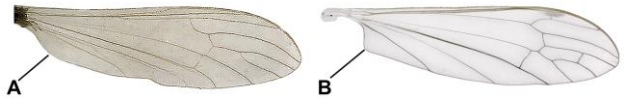


**Figure 13.** A – not nearly right-angled anal angle of the wing (*Elliptera hungarica* Madarassy, 1881); B – the nearly right-angled anal angle of the wing (*Antocha* (*Antocha*) *constricta* Alexander, 1932).

The nearly right-angled anal angle of the wing (Fig. 13 B) is one of the most important distinguishing characteristics of the genus *Antocha* Osten Sacken, 1860. Other species of the subfamily Limoniinae, like *Elliptera* Schiner, 1863 (Fig. 13 A), do not have this character.

5. Pterostigma:
(0) absent (Fig. 14 A);
(1) present (Fig. 14 B).

6. Clouds on the wing veins:
(0) absent (Fig. 14 A);
(1) present (Fig. 14 B).

7. Vein darkening:
(0) all uniformly darker (Fig. 14 A);
(1) transverse and some longitudinal (Fig. 14 B);
(2) transverse (Fig. 14 C).


**Figure 14.** A – all veins of the wing are uniformly darkened (*Antocha* (*Antocha*) *subconfluenta* Alexander, 1930); B – transverse and some longitudinal veins of the wing are darkened (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); C – transverse veins of the wing are darkened (*Antocha* (*Antocha*) *alexanderi* Oosterbroek, 2009).

8. Discoidal cell (*dm*) of wing:

(0) present (Fig. 14 B);
(1) absent (Fig. 14 A).

The discoidal cell (*dm*) is absent in the subgenus *Orimargula* and in some outgroup species, but it is present in the subgenus *Antocha* (Fig. 14 B, C) (except *Antocha* (*Antocha*) *subconfluenta* Alexander, 1930, *Antocha* (*Antocha*) *confluenta* Alexander, 1926, *Antocha* (*Antocha*) *macrocera* Alexander, 1970) and subgenus *Proantocha* Alexander, 1919.

9. Position of vein $R_2$:
(0) after or at the same level of the base of cell *dm* (Fig. 15 B);
(1) before the level of the base of cell *dm* (Fig. 15 A).

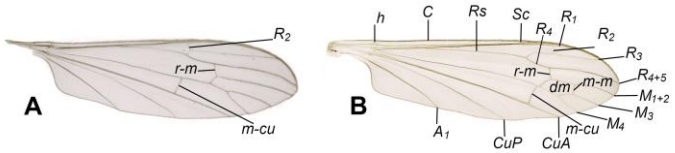


**Figure 15.** A – the vein $R_2$ is before the level of the base of cell *dm* (or open cell *dm*), vein m-cu is shorter than the distance between it and the base of cell *dm* (or open cell *dm*) (*Antocha* (*Orimargula*) *melina* Alexander, 1957); B – the vein $R_2$ is after the level of the base of cell *dm*, vein m-cu is longer than the distance between it and the base of discoidal cell (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021).

10. Length of vein *m-cu*:
(0) longer than the distance between it and the base of cell *dm* (or open cell *dm*) (Fig. 15 B);
(1) shorter than the distance between it and the base of cell *dm* (or open cell *dm*) (Fig. 15 A).

11. Length of vein *Rs*:
(0) more than 2.5 times longer than vein $R_4$ (Fig. 16 C);
(1) 2.5 times or less longer than vein $R_4$ (Fig. 16 B);
(2) shorter than vein $R_4$ (Fig. 16 A).

**Figure 16.** A – vein *Rs* is shorter than the vein $R_4$ (*Antocha* (*Orimargula*) *brevisector* Alexander, 1970); B – the vein *Rs* 2.5 times or less longer than the vein $R_4$ (*Antocha* (*Orimargula*) *kraussi* Alexander, 1955); C – the vein *Rs* more than 2.5 times longer than the vein $R_4$ (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021).

12. Opposable tubercles at the tip of the femur and base of tibia on hindlegs:
(0) absent (Fig. 17 A);
(1) present (Fig. 17 B).

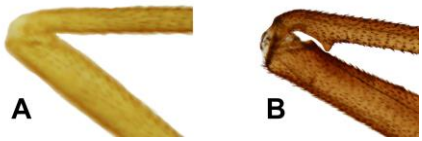


**Figure 17.** A – tubercles are absent (*Antocha* (*Orimargula*) *kraussi* Alexander, 1955); B – opposable tubercles at the tip of the femur and the base of the tibia on the hindlegs are present (*Antocha* (*Proantocha*) *uyei* (Alexander, 1928)).

In the subgenus *Antocha* and *Orimargula*, tubercles on the legs are absent, only some members of the subgenus *Proantocha* have opposable tubercles at the tip of the femur and the base of the tibia on the hindlegs.

13. Shape of sternite 9:
(0) rounded (Fig. 18 A);
(1) squared (Fig. 18 B).

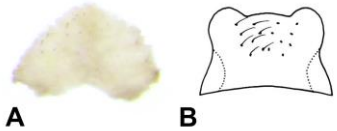


**Figure 18.** A – sternite 9 is wide, rounded at apex (*Antocha* (*Antocha*) *opalizans* Osten Sacken, 1860); B – sternite 9 is squared (illustrated by Torii, 1992: 183) (*Antocha* (*Proantocha*) *sagana* Alexander, 1932).

14. Sternite 9 and tergite 9:
(0) fused;
(1) separated.

15. Not sclerotized spot on apex of sternite 9:
(0) absent (Fig. 19 A);

(1) present (Fig. 19 B).

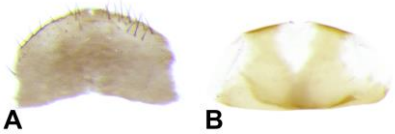


**Figure 19.** A – not sclerotized spot on the apex is absent (*Antocha* (*Antocha*) *constricta* Alexander, 1932); B – not sclerotized spot on the apex is present (*Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860).

16. Bump on sternite 9:
(0) absent (Fig. 20 A);
(1) present (Fig. 20 B).

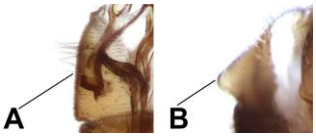


**Figure 20.** A – a bump on the sternite 9 is absent (*Antocha* (*Antocha*) *quadrifurca* Alexander, 1971); B – a bump on the sternite 9 is present (*Antocha* (*Antocha*) n. sp.).

17. Position of sulcus of tergite 9:
(0) two sulci are vertical and separated (Fig. 21 A);
(1) reaches the middle part of tergite 9 (Fig. 21 B);
(2) along tergite 9, does not reach the end of the caudal margin (Fig. 21 C);
(3) two crossed sulci (Fig. 21 D);
(4) forked near base of tergite 9 to inverted Y-shaped (Fig. 21 E);
(5) along tergite 9, reaches the caudal margin (Fig. 21 F).


**Figure 21.** A – two sulci are vertical and separated (*Elliptera zipanguensis zipanguensis* Alexander, 1924); B – sulcus reaches the middle part of tergite 9 (*Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019); C – sulcus is along tergite 9, does not reach the end of the caudal margin (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); D – sulci are crossed (*Antocha* (*Antocha*) *constricta* Alexander, 1932); E – sulcus is forked near the base of tergite 9 (*Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963); F – sulcus is along tergite 9, reaches the caudal margin (*Antocha* (*Orimargula*) *papuensis* Alexander, 1953).

18. Shape of gonocoxite:
(0) oval (Fig. 22 A);
(1) cylindrical, oblong (Fig. 22 B);
(2) oblong, conical (Fig. 22 C);
(3) oval, widened before apex (Fig. 22 D);
(4) cylindrical (Fig. 22 E);
(5) conical, short (Fig. 22 F);
(6) rounded (Fig. 22 G);
(7) angled (Fig. 22 H).


**Figure 22.** A – gonocoxite is oval (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021); B – gonocoxite is cylindrical, oblong (*Antocha* (*Orimargula*) *philippina* (Alexander, 1917)); C – gonocoxite is oblong, conical (*Antocha (Antocha) lacteibasis* Alexander, 1935); D – gonocoxite is oval, widened before the apex (*Antocha* (*Antocha*) *dilatata* Alexander, 1924); E – gonocoxite is cylindrical (*Antocha* (*Orimargula*) *salikensis* Alexander, 1958); F – gonocoxite is conial, short (*Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938); G – gonocoxite is nearly spherical (*Antocha* (*Antocha*) *angustiterga* Alexander, 1949); H – gonocoxite is angled (*Antocha* (*Proantocha*) *integra* Alexander, 1940).

19. Not sclerotized parts of gonocoxite:
(0) at apex (Fig. 23 A);
(1) along gonocoxite (Fig. 23 B).

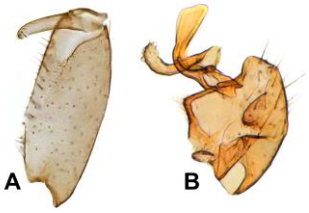


**Figure 23.** A – not sclerotized part of gonocoxite is at the apex (*Antocha* (*Orimargula*) *kraussi* Alexander, 1955); B – not sclerotized part of gonocoxite is along the gonocoxite (*Antocha* (*Proantocha*) *integra* Alexander, 1940).

20. Apex of gonocoxite:
(0) not elongated (Fig. 24 A);
(1) elongated (Fig. 24 B).

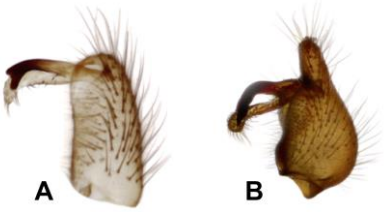


**Figure 24.** A – The apex of gonocoxite is not elongated (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021); B – The apex of gonocoxite is elongated (*Antocha* (*Antocha*) *fortidens* Alexander, 1933).

21. Setiferous lobe on the base of gonocoxite:
(0) absent (Fig. 25 A);
(1) present (Fig. 25 B).

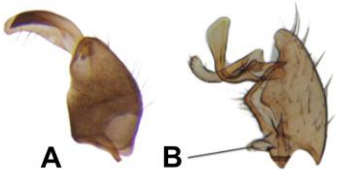


**Figure 25.** A – a small setiferous lobe on the base of gonocoxite is absent (*Antocha* (*Antocha*) *quadrifurca* Alexander, 1971); B – a small setiferous lobe on the base of gonocoxite is present (*Antocha (Proantocha) integra Alexander, 1940*).

The small setiferous lobe on the base of gonocoxite is absent in subgenus *Antocha* (*Orimargula*) Mik, 1883 and *Antocha* (*Antocha*) Osten Sacken, 1860. The small setiferous lobe is well developed in members of subgenus *Antocha* (*Proantocha*) Alexander, 1919.

22. Outer gonostylus:
(0) present (Fig. 26 A, B);
(1) absent (Fig. 26 C).

23. Width of outer gonostylus relative to inner gonostylus:
(0) wider or a similar width (Fig. 26 A);
(1) thinner (Fig. 26 B).

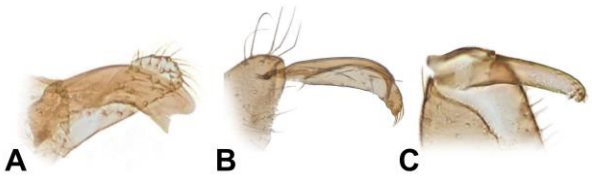


**Figure 26.** A – the outer gonostylus is a similar width or wider than the inner one (*Antocha* (*Antocha*) *alexanderi* Oosterbroek, 2009); B – the outer gonostylus is thinner than the inner gonostylus (*Antocha* (*Antocha*) *javanensis* Alexander, 1915); C – the outer gonostylus is absent (*Antocha* (*Orimargula*) *kraussi* Alexander, 1955).

24. Curvature outer gonostylus:
(0) slightly curved (Fig. 27 A);
(1) strongly arched near the end (Fig. 27 B);
(2) bent (Fig. 27 C);
(3) arched (hook-like) (Fig. 27 D).


**Figure 27.** A – slightly curved outer gonostylus (*Antocha* (*Antocha*) *setigera* Alexander, 1933); B – the outer gonostylus is strongly arched near the end (*Antocha* (*Orimargula*) *almorae* Alexander, 1970); C – the outer gonostylus is bent ((*Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938)). C – the outer gonostylus is strongly curved (*Antocha* (*Antocha*) *dentifera* Alexander, 1924).

25. Additional structures on outer gonostylus:
(0) absent (Fig. 28 A);
(1) present (Fig. 28 B).


**Figure 28.** A – the outer gonostylus is without any structures (*Antocha* (*Orimargula*) *nigristyla* Alexander, 1956); B – the outer gonostylus is with a lateral spine (*Antocha* (*Antocha*) *dentifera* Alexander, 1924).

26. Length of the inner branch of paramere relative to the aedeagus:
(0) very short, fused (Fig. 29 A);

(1) longer or a little longer than the middle part (Fig. 29 B);
(2) short, below the middle part (Fig. 29 C).

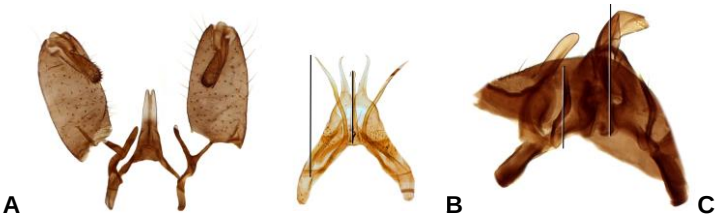


**Figure 29.** A – the inner branch of paramere is fused (*Antocha* (*Orimargula*) *transvaalia* (Alexander, 1921)); B – the inner branch of paramere is longer than the aedeagus (*Antocha* (*Antocha*) *capitella* Alexander, 1941); C – the inner branch of paramere is shorter than the aedeagus (*Antocha* (*Orimargula*) *pauliani* Alexander, 1953).

27. Shape of tip of inner branch of paramere:
(0) blunt (Fig. 30 A);
(1) acute (Fig. 30 B);
(2) bifurcated (Fig. 30 C);
(3) wavy (Fig. 30 D).

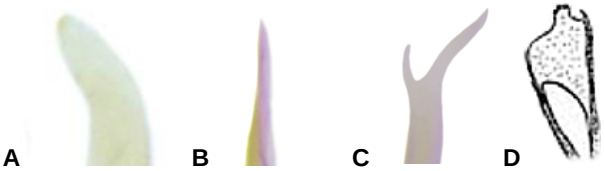


**Figure 30.** A – the apex of inner branch of paramere is blunt (*Antocha* (*Antocha*) *setigera* Alexander, 1933); B – the apex of inner branch of paramere is acute (*Antocha* (*Antocha*) *globulosa* Alexander, 1973); C – the apex of inner branch of paramere is bifurcated (*Antocha* (*Antocha*) *constricta* Alexander, 1932); D – the apex of the inner branch of paramere is wavy (illustrated by Hancock, 2011: 689 p.) (*Orimarga* (*Orimarga*) *arabica* Hancock, 2011).

28. Shape of the inner branch of paramere with acute apex, longer or as long as aedeagus:
(0) narrow, needle-like (Fig. 31 A);
(1) narrow, the base is flattened (Fig. 31 B);
(2) filiform (Fig. 31 C);
(3) ribbon-like, flat, acute at apex (Fig. 31D);
(4) ribbon-like, gradually narrows to acute point (Fig. 31 E);

(5) slightly narrows to acute point (Fig. 31 F);
(6) wide with the spine at apex (Fig. 31 G);
(7) strongly widened before the apex (Fig. 31 H);
(8) curved at apex (Fig. 31 I);
(9) twisted into spiral (Fig. 31 J).


**Figure 31.** A – the inner branch of paramere is narrow, needle-like (*Antocha (Antocha) pulchra* Markevičiūtė & Podenas, 2021); B – the inner branch of paramere is narrow, the base is flattened (*Antocha* (*Antocha*) *koreana* Podenas and Byun, 2014); C – the inner branch of paramere is filiform (*Antocha* (*Antocha*) *perattenuata* Alexander, 1971); D – the inner branch of paramere is ribbon-like, flat, acute at apex (*Antocha* (*Antocha*) *yatungensis* Alexander, 1963); E – the inner branch of paramere is ribbon-like, gradually narrowed to acute point (*Antocha* (*Antocha*) *dafla* Alexander, 1969); F – the inner branch of paramere is slightly narrowed to acute point (*Antocha* (*Antocha*) *dentifera* Alexander, 1924); G – the inner branch of paramere is wide with the spine at apex (*Antocha* (*Antocha*) *alpigena* (Mik, 1883)); H – the inner branch of paramere is strongly widened before the apex (*Antocha* (*Antocha*) *monticola* Alexander, 1917); I – the inner branch of paramere is curved at apex (*Antocha* (*Antocha*) *neoflavella* Alexander and Alexander, 1973); J – the inner branch of paramere is twisted into a spiral (*Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019).

29. Shape of blunt apex, longer or as long as the aedeagus inner branch of paramere:
(0) narrowly blunt, flat ribbon (Fig. 32 A);
(1) rounded at apex, straight stick (Fig. 32 B).


**Figure 32.** A – the inner branch of paramere is narrowly blunt, flat ribbon (*Antocha (Antocha setigera* Alexander, 1933); B – the inner branch of

paramere is rounded at apex, straight stick (*Antocha* (*Antocha*) *attenuata* Alexander, 1969).

30. Shape of shorter than aedeagus inner branch of paramere:
(0) narrow, straight, blunt at apex (Fig. 33 A);
(1) narrow, straight, wider before the apex (Fig. 33 B);
(2) very narrow, straight, blunt at apex (Fig. 33 C)
(3) wide, oval (Fig. 33 D);
(4) wide with acute point (Fig. 33 E);
(5) narrow, a little curved blunt at apex (Fig. 33 F);
(6) gradually narrows to blunt apex (Fig. 33 G)


**Figure 33.** A – the inner branch of paramere is narrow blunt at the apex (*Antocha* (*Orimargula*) *multispina* Alexander, 1956); B – the inner branch of paramere is narrow, wider before the apex (*Antocha* (*Orimargula*) *almorae* Alexander, 1970); C – the inner branch of paramere is very narrow, straight, blunt at the apex (*Antocha* (*Orimargula*) *australiensis* (Alexander, 1922)); D – the inner branch of paramere is wide, oval (*Antocha* (*Orimargula*) *brevifurca* Alexander, 1970); E – the inner branch of paramere is wide with acute point (*Antocha* (*Antocha*) *bifida* Alexander, 1924); F – the inner branch of paramere is narrow, a little curved blunt at the apex (*Antocha* (*Proantocha*) *sagana* Alexander, 1932); G – the inner branch of paramere gradually narrows to a blunt apex (*Antocha* (*Antocha*) *dilatata* Alexander, 1924).

31. Length of the interbase relative to the outer gonostylus:
(0) longer (Fig. 34 A);
(1) shorter but longer than the middle part of it (Fig. 34 B);
(2) shorter than the middle part (Fig. 34 C).


**Figure 34.** A – the interbase is longer than the outer gonostylus (*Antocha* (*Orimargula*) *simplex* Alexander, 1970); B – the interbase is shorter than the

outer gonostylus but longer than the middle part of it (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021); C – the interbase is shorter than the middle part of outer gonostylus (*Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938).

32. Shape of apex of the interbase:
(0) angled (Fig. 35 A);
(1) obtuse (Fig. 35 B);
(2) acute (Fig. 35 C);
(3) bifurcted (Fig. 35 D).

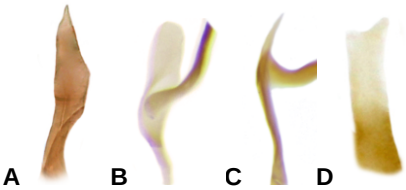


**Figure 35.** A – the apex of the interbase is angled (*Antocha* (*Orimargula*) *brevifurca* Alexander, 1970); B – the apex of the interbase is blunt (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021); C – the apex of the interbase is acute (*Antocha* (*Antocha*) *capitella* Alexander, 1941); C – the apex of the interbase is bifurcted (*Antocha* (*Antocha*) *angusticellula* Alexander, 1969).

33. Shape of the interbase:
(0) flat leaf (Fig. 36 A);
(1) cylindrical (Fig. 36 B);
(2) consists of two oblong parts of which one shorter (Fig. 36 C);
(3) loop-like (Fig. 36 D);
(4) patch-like (Fig. 36 E);
(5) needle-like (Fig. 36 F);
(6) rod-like (Fig. 36 G);
(7) paddle-like (Fig. 36 H);
(8) sword-like (Fig. 36 I);
(9) triangular (Fig. 36 J).

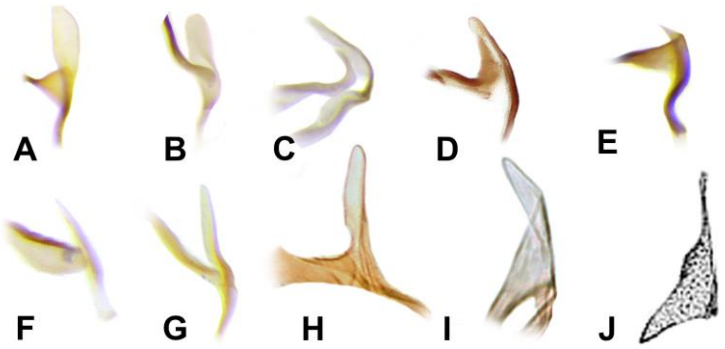


**Figure 36.** A – the shape of the interbase is flat leaf (*Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860); B – the shape of the interbase is cylindrical (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021); C – the interbase consists of two oblong parts of which one is shorter (*Antocha* (*Antocha*) *koreana* Podenas and Byun, 2014); D – the shape of the interbase is loop-like (*Antocha* (*Antocha*) *dafla* Alexander, 1969); E – the shape of the interbase is patch-like (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); F – the shape of the interbase is needle-like (*Antocha* (*Antocha*) *bifida* Alexander, 1924); G – the shape of the interbase is rod-like (*Antocha* (*Proantocha*) *sagana* Alexander, 1932); H – the shape of the interbase is paddle-like (*Antocha* (*Orimargula*) *sparsissima* Alexander, 1974); I – the shape of the interbase is sword-like (*Antocha* (*Orimargula*) *simplex* Alexander, 1970); J – the shape of interbase is triangular (illustrated by Hancock, 2011: 689 p.) (*Orimarga* (*Orimarga*) *arabica* Hancock, 2011).

34. Length of the parameral apodema relative to the aedeagus:
(0) longer or at the same length (Fig. 37 A);
(1) shorter, but longer than the middle part (Fig. 37 B);
(2) shorter than the middle part (Fig. 37 C).


**Figure 37**. A – the parameral apodema is long (*Antocha* (*Antocha*) *quadrifurca* Alexander, 1971); B – the parameral apodema is medium in length (*Antocha* (*Antocha*) *satsuma* Alexander, 1919); C – the parameral apodema is short (*Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938).

35. Shape of the basal posterolateral extremite:
(0) short, narrow, rounded at apex (Fig. 38 A);
(1) broad, tapering at the apex (Fig. 38 B);
(2) triangular (Fig. 38 C)
(3) long and narrow (Fig. 38 D);
(4) strongly curved (Fig. 38 E);
(5) long, narrow, rounded at apex (Fig. 38 F);
(6) fused into flat or rounded structure (Fig. 38 G);
(7) connected with aedeagal sheath in straight line (Fig. 38 H);
(8) ingrown into phallus film (Fig. 38 I).

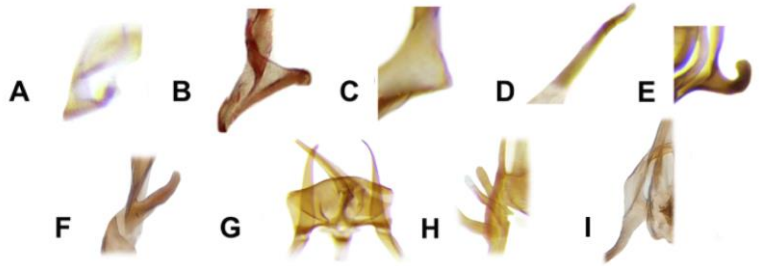


**Figure 38.** A – the basal posterolateral extremite is short, narrow, rounded at apex (*Antocha* (*Antocha*) *bifida* Alexander, 1924); B – the basal posterolateral extremite is broad, tapering at the apex (*Antocha* (*Antocha*) *dafla* Alexander, 1969); C – the basal posterolateral extremite is triangular (*Antocha* (*Antocha*) *opalizans Osten* Sacken, 1860); D – the basal posterolateral extremite is long and narrow (*Antocha (Antocha) pulchra* Markevičiūtė & Podenas, 2021); E – the basal posterolateral extremite is strongly curved (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); F – the basal posterolateral extremite is long, narrow, rounded at apex (*Antocha* (*Antocha*) *constricta* Alexander, 1932); G – the basal posterolateral extremite is fused into a flat or rounded structure (*Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860); H – the basal posterolateral extremite is connected with aedeagal sheath in straight line (*Antocha* (*Proantocha*) *sagana* Alexander, 1932); I – the basal posterolateral extremite is ingrown into the phalus (*Antocha* (*Orimargula*) *venosa* Alexander, 1964).

36. Shape of parameral structures:
(0) cover apex of aedeagus and appear as two wide ribbons (Fig. 39 A);
(1) form aedeagal sheath (Fig. 39 B);
(2) reduced to small aedeagal sheath, which does not fully cover aedeagus (Fig. 39 C);

(3) form aedeagal sheath, which fuses to aedeagus and forms phallus (Fig. 39 D);
(4) tips are connected with tip or middle part of the aedeagus (Fig. 39 E);
(5) long and slender, ribbon-like (Fig. 39 F);
(6) simple, slender, rod-like structure connected with aedeagus (Fig. 39 G);
(7) form rounded, branched or twisted structures connected with aedeagus (Fig. 39 H).

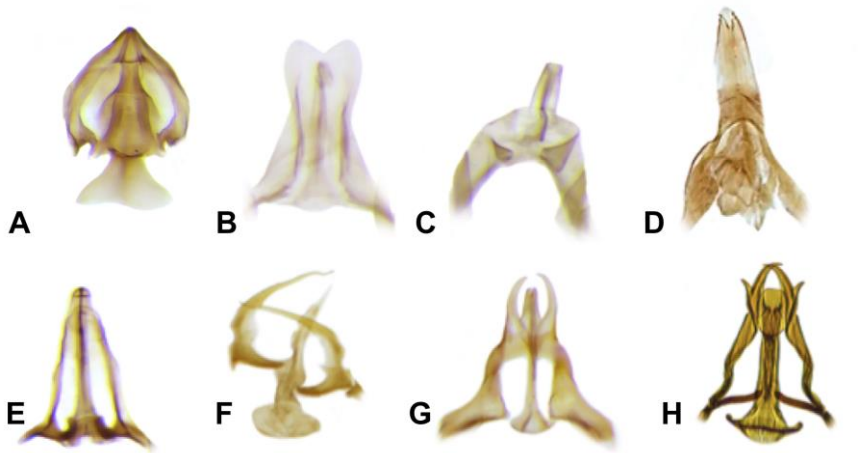


**Figure 39.** A – parameral lateral structures cover the apex of aedeagus and appear as two wide ribbons (*Elliptera zipanguensis zipanguensis* Alexander, 1924); B – parameral lateral structures form an aedeagal sheath (*Antocha* (*Antocha*) *vitripennis* (Meigen, 1830)); C – parameral lateral structures form an aedeagal sheath, which is very small (*Antocha* (*Antocha*) *koreana* Podenas and Byun, 2014); D – the aedeagal sheath is fused to the aedeagus, forms phallus (*Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963); E – the end of parameral lateral structure is connected with the end of the aedeagus (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); F – parameral lateral structures are long and slender, not connected with the aedeagus (*Antocha* (*Antocha*) *quadrirhaphis* Alexander, 1971); G – parameral lateral structures are simple, slender, rod-like connected with the aedeagus (*Antocha* (*Antocha*) *capitella* Alexander, 1941); H – parameral lateral structures are branched or twisted (*Antocha* (*Antocha*) *quadrifurca* Alexander, 1971).

37. Shape of the phallus:
(0) short, straight (Fig. 40 A);
(1) narrow (Fig. 40 B);

(2) long, sinuous (Fig. 40 C);
(3) wide (Fig. 40 D);
(4) long, straight or curved tube, wide at base (Fig. 40 E);
(5) short tube, wide at base, slightly narrowed at end (Fig. 40 F);
(6) straight narrow tube (Fig. 40 G);
(7) flat, short, rounded (Fig. 40 H);
(8) widened at base, middle part narrower than base and upper part (Fig. 40 I).

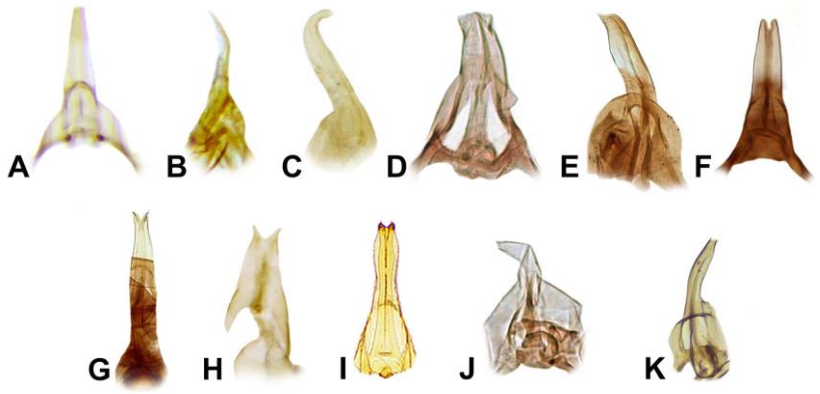


**Figure 40.** A – the phallus is short, straight (*Antocha* (*Antocha*) *dilatata* Alexander, 1924); B – the phallus is narrow (*Antocha* (*Antocha*) *perattenuata* Alexander, 1971); C – the phallus is long, sinuous (*Antocha* (*Antocha*) *yatungensis Alexander, 1963*); D – the phallus is wide (*Antocha* (*Orimargula*) *almorae* Alexander, 1970); E – the phallus is long, straight or curved tube, wide at the base (*Antocha* (*Orimargula*) *multispina* Alexander, 1956); F – the phallus is short tube, flat at the base slightly narrowed at the end (*Antocha* (*Orimargula*) *transvaalia* (Alexander, 1921)); G – the phallus is cleft into small curved tips at the apex (*Antocha* (*Orimargula*) *prefurcata* Alexander, 1950); H – the phallus is wide, short, cleft into small curved tips at apex (*Antocha* (*Antocha*) *setigera* Alexander, 1933); I – the phallus is widened at the base, the middle part is narrower than the base and the upper part of this structure (illustrated by Kolcsar et al., 2017: 50 p.) (*Limonia phragmitidis* (Schrank, 1781)); J – the phallus is narrowed at the apex (*Antocha* (*Orimargula*) *simplex* Alexander, 1970); K – the phallus is long, the middle part is narrowed (*Antocha* (*Orimargula*) *possessiva* Young, 1994).

38. Shape of not fused to aedeagal sheath or phallus parameral lateral structures:

(0) wide ribbon-like, connected at apex of aedeagus (Fig. 41 A);
(1) ribbon-like, connected near the middle part of aedeagus (Fig. 41 B);
(2) thin and curved structures (Fig. 41 C);
(3) connected at apex of aedeagus, with a bump between two acute structures (Fig. 41 D);
(4) connected near the curved apex of aedeagus with two acute structures (Fig. 41 E);
(5) connected near apex of aedeagus, acute at apex (Fig. 41 F);
(6) thin, connected at apex of aedeagus (Fig. 41 G);
(7) fragmented into two incurved arms, which can be branched (Fig. 41 H);
(8) fragmented into two twisted structures (Fig. 41 I).

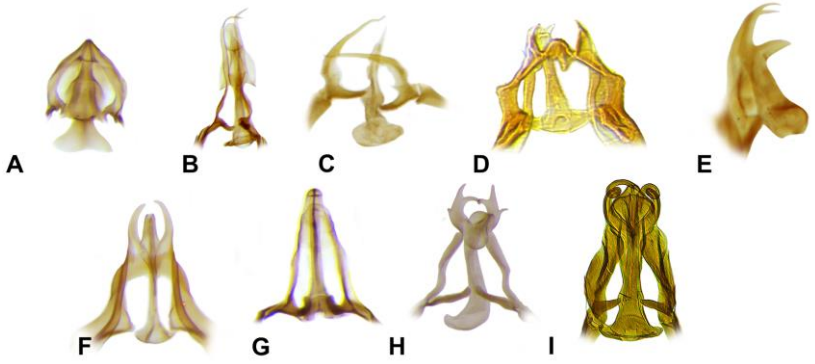


**Figure 41.** A – parameral lateral structures are wide ribbon-like, connected at the apex of the aedeagus (*Elliptera zipanguensis zipanguensis* Alexander, 1924); B – the ends of parameral lateral structures are ribbon-like, connected near the middle part of the aedeagus (*Antocha* (*Antocha*) *gracillima* Alexander, 1924); C – parameral lateral structures are thin and curved (*Antocha* (*Antocha*) *quadrirhaphis* Alexander, 1971); D – parameral lateral structures are connected at the apex of the aedeagus, with a bump between two acute structures (*Antocha* (*Antocha*) *hyperlata* Alexander, 1968); E – parameral lateral structures are connected near the curved apex of the aedeagus with two acute structures (*Antocha* (*Antocha*) *shansiensis* Alexander, 1954); F – parameral lateral structures are connected near the apex of the aedeagus, acute at apex (*Antocha* (*Antocha*) *opalizans* Osten Sacken, 1860); G – parameral lateral structures are thin, connected at the apex of the aedeagus (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); H – parameral lateral structures are connected at the apex of aedeagus and fragmented into two incurved arms, which can be branched (*Antocha* (*Antocha*) *constricta* Alexander, 1932); I – parameral lateral structures are connected at the apex of the aedeagus and fragmented into two twisted structures (*Antocha* (*Antocha*) *aegina* Alexander, 1970).

39. Length of the aedeagus relative to gonocoxite:
(0) shorter;
(1) at the same length or longer.

40. Shape of the aedeagus:
(0) half widened (Fig. 42 A);
(1) straight tube (longer than outer gonostylus) (Fig. 42 B);
(2) straight, acute (Fig. 42 C);
(3) curved (Fig. 42 D);
(4) widened (Fig. 42 E);
(5) straight, twisted/wavy before apex (Fig. 42 F);
(6) straight with two filose structures (Fig. 42 G);
(7) appears as long, sinuous tube (Fig. 42 H);
(8) appears as short (not longer than outer gonostylus), straight tube (Fig. 42 I).


**Figure 42.** A – the aedeagus is half widened (*Elliptera zipanguensis zipanguensis* Alexander, 1924); B – the aedeagus is straight tube (longer than the outer gonostylus) (*Antocha* (*Antocha*) *tuberculata* Torii, 1992); C – the aedeagus is straight, filose (*Antocha* (*Antocha*) *attenuata* Alexander, 1969); D – the aedeagus is curved (*Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019); E – the aedeagus is widened before the apex (*Antocha* (*Antocha*) *aegina* Alexander, 1970); F – the aedeagus is straight, twisted before the apex (*Antocha* (*Antocha*) *globulosa* Alexander, 1973); G – the aedeagus is straight with two filose structures (illustrated by Alexander, 1968: 46 p.) (*Antocha* (*Antocha*) *ophioglossodes* Alexander, 1968); H – the aedeagus appears as long, sinuous tube (*Antocha* (*Antocha*) *pallidella* Alexander, 1933); I – the aedeagus appears as short (not longer than the outer gonostylus), straight tube (*Antocha (Antocha) bifida* Alexander, 1924).

41. Size of the parameral plate:
(0) very small (Fig. 43 A);
(1) small but wide (Fig. 43 B);
(2) large, very wide (Fig. 43 C).

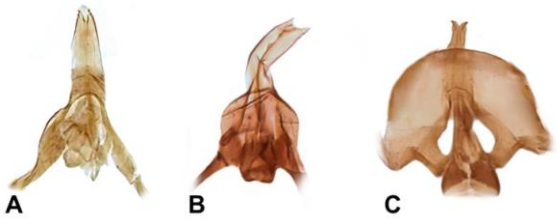


**Figure 43.** A – the parameral plate is very small (*Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963); B – the parameral plate is small, but wide (*Antocha* (*Orimargula*) *australiensis* (Alexander, 1922)); C – the parameral plate is large and very wide (*Antocha* (*Orimargula*) *brevifurca* Alexander, 1970).

42. Ventral margin of female cercus:
(0) smooth (Fig. 44 A);
(1) toothed (Fig. 44 B).

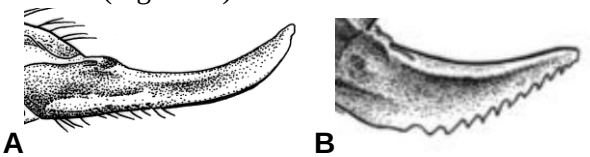


**Figure 44.** A – a ventral margin of the female cercus is smooth (illustrated by Podenas, 2016: 3 p.) (*Antocha* (*Antocha*) *dilatata* Alexander, 1924); A – a ventral margin of the female cercus is toothed (illustrated by Podenas, 2013: 173 p.) (*Antocha* (*Proantocha*) *integra* Alexander, 1940).

43. Distribution:
(0) Asia;
(1) Europe (or the southwest part of Asia);
(2) North America;
(3) Africa;
(4) Australia.

44. Trapezoidal shape of tergite 9 (Fig. 45 A):
(0) absent;
(1) present.

45. One or two rounded median lobes on the caudal margin of tergite 9 (Fig. 45 B, C):
(0) absent;
(1) present.

46. Two triangular inwardly directed lobes on the caudal margin of tergite 9 (Fig. 45 D):
(0) absent;
(1) present.

47. One small, rounded lobe on the caudal margin of tergite 9 (Fig. 45 E):
(0) absent;
(1) present.

48. Two small, rounded lateral lobes on the caudal margin of tergite 9 (Fig. 45 F):
(0) absent;
(1) present.


**Figure 45.** A – trapezoidal shape of tergite 9 (*Antocha* (*Antocha*) *obtusa* Alexander, 1925); B – two rounded median lobes on the caudal margin of tergite 9 (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); C – one rounded median lobe on the caudal margin of tergite 9 (*Antocha* (*Antocha*) *arjuna* Alexander, 1969); D – two triangular inwardly directed lobes on the caudal margin of tergite 9 (*Antocha* (*Proantocha*) *integra* Alexander, 1940); E – one small, rounded lobe on the caudal margin of tergite 9 (*Antocha* (*Orimargula*) *longicornis* (Alexander, 1921)); F – two small, rounded lateral lobes on the caudal margin of tergite 9 (*Antocha* (*Antocha*) *pallidella* Alexander, 1933).

49. Apex of dark outer gonostylus obliquely truncated (Fig. 46 A):
(0) absent;
(1) present.

50. Apex of dark outer gonostylus truncated (Fig. 46 B):
(0) absent;
(1) present.

51. Apex of light and wide outer gonostylus narrowly obtuse (Fig. 46 C):
(0) absent;
(1) present.

52. Apex of outer gonostylus darkened and obtuse (Fig. 46 D):
(0) absent;
(1) present.

53. Spine and small bump at apex of outer gonostylus (Fig. 46 E):
(0) absent;
(1) present.

54. Deep split of apex of outer gonostylus (Fig. 46 F):
(0) absent;
(1) present.

55. Apex of light, long and narrow outer gonostylus blunt (Fig. 46 G):
(0) absent;
(1) present.

56. Apex of light outer gonostylus widened (Fig. 46 H):
(0) absent;
(1) present.

57. Apex of outer gonostylus light, cleft (Fig. 46 I):
(0) absent;
(1) present.

58. Outer gonostylus darkened and strongly bent (Fig. 46 J):
(0) absent;
(1) present.

59. Outer gonostylus light, very thin narrows to cut apex (Fig. 46 K):
(0) absent;
(1) present.

60. Outer gonostylus light, wide at base, narrows to acute point (Fig. 46 L):
(0) absent;
(1) present.

61. Outer gonostylus light, obliquely narrowed to cut apex (Fig. 46 M):
(0) absent;
(1) present.

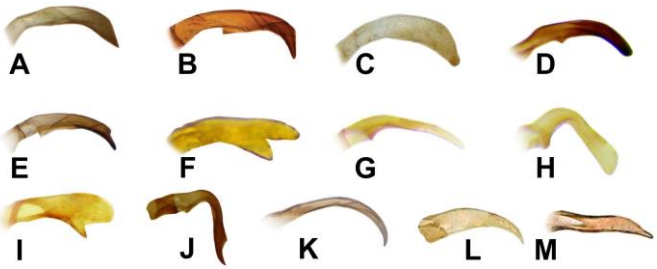


**Figure 46.** A – the apex of the dark outer gonostylus is obliquely truncated (*Antocha* (*Antocha*) *multidentata* Alexander, 1932); B – the apex of the dark outer gonostyle is truncated (*Antocha* (*Antocha*) *capitella* Alexander, 1941); C – the apex of the light and wide outer gonostylus is narrowly obtuse (*Antocha* (*Antocha*) *microcera* Alexander, 1974); D – the apex of the outer gonostylus is darkened and obtuse (*Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019); E – the apex of the dark outer gonostylus has a spine and a small bump (*Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940); F – the apex of the outer gonostylus has a deep split (*Antocha* (*Antocha*) *mysorensis* Alexander, 1974); G – the apex of the light, long and narrow outer gonostylus is blunt (*Antocha* (*Antocha*) *tuberculata* Torii, 1992); H – the apex of the light outer gonostylus is widened (*Antocha* (*Proantocha*) *sagana* Alexander, 1932); I – the apex of the outer gonostylus is light and cleft (*Antocha* (*Proantocha*) *spinifer* Alexander, 1919); J – the outer gonostylus is darkened and strongly bent (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); K – the outer gonostylus is light, very thin and narrows to a cut apex (*Antocha* (*Orimargula*) *longicornis* (Alexander, 1921)); L – the outer gonostylus is light, wide at the base, narrowed to an acute point (*Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963); M – the outer gonostylus light, obliquely narrowed to a cut apex (*Antocha* (*Orimargula*) *philippina* (Alexander, 1917)).

62. Two wide rounded lobes of aedeagal sheath (Fig. 47 A):
(0) absent;
(1) present.

63. Three small lobes or wide aedeagal sheath (Fig. 47 B):
(0) absent;
(1) present.

64. Apex of wide aedeagal sheath is narrow (Fig. 47 C):
(0) absent;

(1) present.

65. Horn-like structures or narrow, rounded, small lobes of wide aedeagal sheath (Fig. 47 D):
(0) absent;
(1) present.

66. Aedeagal sheath very small and rounded (Fig. 47 E):
(0) absent;
(1) present.

67. Aedeagal sheath reduced to flattened or rounded structure (Fig. 47 F):
(0) absent;
(1) present.

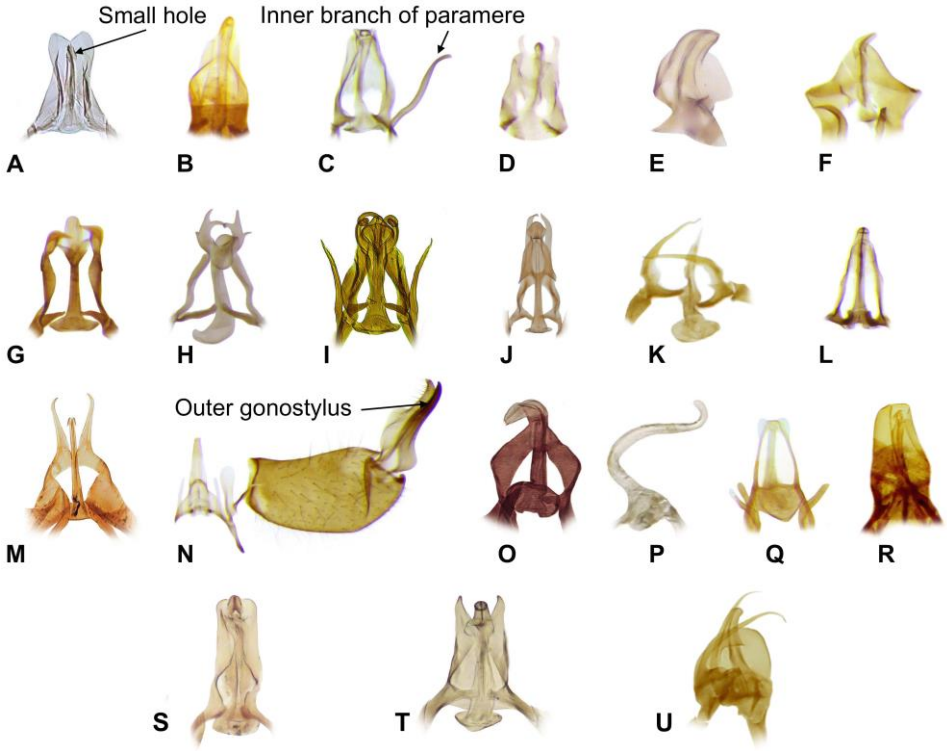


**Figure 47.** A – there are two wide rounded lobes of the aedeagal sheath (*Antocha* (*Antocha*) *vitripennis* (Meigen, 1830)); B – the aedeagus is straight, thin tube surrounded by the wide aedeagal sheath (*Antocha* (*Antocha*) *brevinervis* Alexander, 1924); C – the apex of wide aedeagal sheath is narrow, the inner branch of paramere is S-shaped (*Antocha* (*Antocha*) *dentifera* Alexander, 1924); D – the aedeagus is curved, rounded

at apex and surrounded by horn-like structures of the wide aedeagal sheath (*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021); E – the aedeagal sheath is very small, rounded, and the aedeagus is strongly curved (*Antocha* (*Antocha*) *indica* Brunetti, 1912); F – the aedeagal sheath is reduced to a flattened or rounded structure (*Antocha* (*Antocha*) *obtusa* Alexander, 1925); G – small horns of parameral structures are connected to the aedeagus (*Antocha* (*Antocha*) *incurva* Alexander, 1968); H – branched parameral structures are connected to the aedeagus (*Antocha* (*Antocha*) *constricta* Alexander, 1932); I – twisted into spiral parameral structures are connected to the aedeagus (*Antocha* (*Antocha*) *aegina* Alexander, 1970); J – the aedeagal sheath has two ribbon-like structures, which are connected to the aedeagus (*Antocha* (*Antocha*) *bidens* Alexander, 1932); K – separated parameral structures are ribbon-like with the narrow aedeagus, which can be covered by a membranic parameral structure (*Antocha* (*Antocha*) *quadrirhaphis* Alexander, 1971); L – two thin parameral structures are connected at the apex of the aedeagus (*Antocha* (*Antocha*) *fortidens* Alexander, 1933); M – two parameral structures are strongly sclerotised, and connected at the middle part of the aedeagus (*Antocha* (*Antocha*) *capitella* Alexander, 1941); N – the aedeagus is tube-like, not longer than the outer gonostylus (*Antocha* (*Antocha*) *dilatata* Alexander, 1924); O – the aedeagus is at similar length as the outer gonostylus, strongly curved before the apex, the middle part is connected to two wide parameral structures (*Antocha* (*Antocha*) *pterographa* Alexander, 1953); P – the aedeagus is sinuous, tube-like, longer than the outer gonostylus (*Antocha* (*Antocha*) *pallidella* Alexander, 1933); Q – two small, rounded lobes of the aedeagal sheath are connected to the straight, thin aedeagus (*Antocha* (*Proantocha*) *sagana* Alexander, 1932); R – two small lobes at the apex of the aedeagus (*Antocha* (*Proantocha*) *uyei* (Alexander, 1928)); S – the aedeagal sheath is cylindrical (*Antocha* (*Antocha*) *scutella* Alexander, 1973); T – two acute lobes of the aedeagal sheath (*Antocha* (*Antocha*) *libanotica* Lackschewitz, 1940); U – two separated filiform lateral parameral structures of the aedeagus (*Antocha* (*Antocha*) *amblystyla* Alexander, 1963).

68. Shape of base of aedeagus or phallus:
(0) hemispherical (Fig. 48. A);
(1) plate (Fig. 48. B);
(2) spherical (Fig. 48. C);
(3) saucer (Fig. 48. D);
(4) conical (Fig. 48. E);
(5) angular (Fig. 48. F);

(6) oblong (Fig. 48. G).

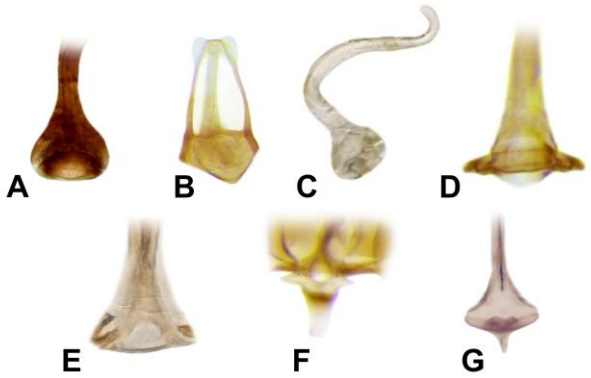


**Figure 48.** A – the shape of the base of the phallus is hemispherical (*Antocha* (*Orimargula*) *prefurcata* Alexander, 1950); B – the shape of the base of the aedeagus is plate (*Antocha* (*Proantocha*) *sagana* Alexander, 1932); C – the shape of the base of the aedeagus is spherical (*Antocha* (*Antocha*) *pallidella* Alexander, 1933); D – the shape of the base of the aedeagus is saucer (*Antocha* (*Antocha*) *gracillima* Alexander, 1924); E – the shape of the base of the aedeagus is cone (*Antocha* (*Antocha*) *javanensis* Alexander, 1915); F – the shape of the base of the aedeagus is angular (*Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860); G – the shape of the base of the aedeagus is oblong (*Antocha* (*Antocha*) *ophioglossa* Alexander, 1954).

69. Small horns (Fig. 47 G) or branched (Fig. 47 H) parameral structures connected with aedeagus:
(0) absent;
(1) present.

70. Trilobed structure inside apex of aedeagus (Fig. 47 I):
(0) absent;
(1) present.

71. Aedeagal sheath with two ribbon-like structures connected with the aedeagus (Fig. 47 J):
(0) absent;
(1) present.

72. Aedeagus narrow, can be acute or covered by membranous parameral structure at apex (Fig. 47 K):
(0) absent;
(1) present.

73. Small hole of aedeagal sheath (Fig. 47 A):
(0) absent;
(1) present.

74. Two lateral parameral structures of aedeagus sclerotized and connected at the middle part of aedeagus (Fig. 47 M):
(0) absent;
(1) present.

75. Aedeagus tube-like, not longer than outer gonostylus (Fig. 47 N):
(0) absent;
(1) present.

76. Lateral parameral structures of aedeagus appearing as large incurved lobes on either side to form bridge across mid-line of aedeagus. (Fig. 47 O):
(0) absent;
(1) present.

77. Strongly curved aedeagus (Fig. 47 E):
(0) absent;
(1) present.

78. Aedeagus curved and rounded at apex (Fig. 47 D):
(0) absent;
(1) present.

79. Sinuous tube-like aedeagus longer than outer gonostylus (Fig. 47 P):
(0) absent;
(1) present.

80. S-shaped inner branches of paramere (Fig. 47 C):
(0) absent;
(1) present.

81. Aedeagus straight, thin tube surrounded by wide aedeagal sheath (Fig. 47 B):
(0) absent;
(1) present.

82. Aedeagal sheath cylindrical (Fig. 47 S):
(0) absent;
(1) present.

83. Two small rounded lobes of aedeagal sheath connected with straight, thin aedeagus (Fig. 47 Q):
(0) absent;
(1) present.

84. Two small lobes at the apex of aedeagus (Fig. 47 R):
(0) absent;
(1) present.

85. Two curved lobes at the apex of phallosomic tube (Fig. 40 G):
(0) absent;
(1) present.

86. Apex of phallosomic tube narrowed (Fig. 40 J):
(0) absent;
(1) present.

87. Apex of phallosomic tube cleft (Fig. 40 F):
(0) absent;
(1) present.

88. Narrowed middle part of long phallosomic tube (Fig. 40 K):
(0) absent;
(1) present.

89. Apex of long phallosomic tube slightly curved and obliquely cut (Fig. 40 E):
(0) absent;
(1) present.

90. Apex of phallosomic tube with small lobes (Fig. 40 D):
(0) absent;
(1) present.

91. Two fully separated lateral parameral structures of aedeagus (Fig 47 K):

(0) absent;
(1) present.

92. Aedeagus at similar length as outer gonostylus, strongly curved before apex (Fig 47 O):
(0) absent;
(1) present.

93. Two acute lobes of aedeagal sheath (Fig. 47 T):
(0) absent;
(1) present.

94. Two separated filiform lateral parameral structures of aedeagus (Fig. 47 U):
(0) absent;
(1) present.

## 3.1.2. Matrix of characters

**Table 1.** A matrix of characters values. Symbols: (?) – character state unknown, (-) – character is not applicable.

```
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[2.arabica      010000010100010??0?00000013?--10?0?38-00-0000000000000000000000000000000000000000000000000000000
[3.zipanguensis 010000010000010000000000010-0-21?1008000-0000000000000000000000000000000000000000000000000000000
[4.aegina       010100000000010030000000014--113057-814-1000000000000000000000000000030100000000000000000000000
[5.spiralis     010100000000010130000000012---113057-814-?0000000000000000000000000030100000000000000000000000000
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[7.scutifera    010100000000010030000000012---113157-714-?0000001000000000000000000031000000000000000000000000000
[8.multidentata 010110000000010030000000012---113057-714-?0000001000000000000000000031000000000000000000000000000
[9.quadrifurca  010110000000010030000000012---113057-714-?0000001000000000000000000031000000000000000000000000000
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[13.gracillima  010111100000010032000000014--113016-111-0000000000000000000000000030010000000000000000000000000
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**Table 1** (continued). A matrix of characters values. Symbols: (?) – character state unknown, (-) – character is not applicable.

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### 3.1.3. Discussion of phylogenetic analysis

Phylogenetic analysis was performed and one cladogram of one thousand parsimonious trees was found by strict consensus (L=588, Ci=30, Ri=82) (Figs. 49, 50, 51, 52, 53, 54, 55).

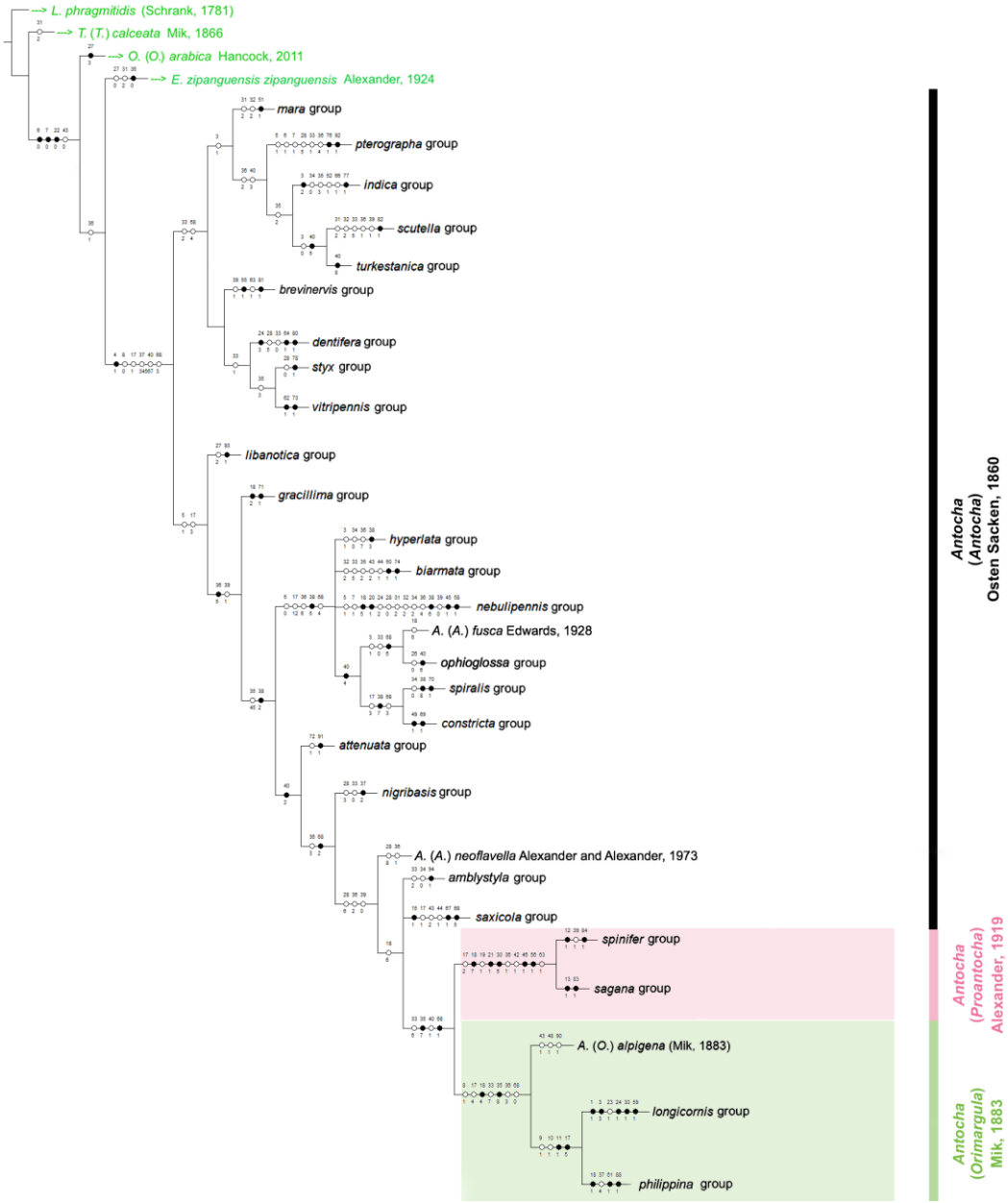


**Figure 49.** A simplified strict consensus scheme with species groups. Black circles – apomorphies, open circles – homoplastic synapomorphies. Digits above circles – numbers of the characters, below – state of the character.

Phylogenetic analysis of all subgenera of the genus *Antocha* has never been performed or published. Only Takashi Torii has presented the phylogenetic analysis of 18 *Antocha* species recorded from the Korean Peninsula, Japan and far-east Russia. Torii noticed that the subgenus *Proantocha* is monophyletic, while the subgenus *Antocha* is paraphyletic (Torii, 2000).

According to the phylogenetic analysis presented in this work, the genus *Antocha* consists of three subgenera: *Antocha* (s. str.) Osten Sacken, 1860, *Orimargula* Mik, 1883 and *Proantocha* Alexander, 1919. The subgenus *Orimargula* consists of two species groups, *Proantocha* is divided into two species groups and the subgenus *Antocha* (s. str.) is divided into 21 species groups. The genus *Antocha* is distinguished by one apomorphy – a nearly right-angled anal angle of the wing, which is absent in the outgroup and other genera of the subfamily Limoniini. It is known that a nearly right-angled anal angle of the wing is found in the families Blephariceridae and Simuliidae, which also develop in fast-running water. It is thought that the nearly right-angled anal angle of the wing is related to the imago's ability to rapidly leave the water after the aquatic pupal stage.

Not used in this phylogenetic analysis, some important morphological characters also characterise the preimaginal stages and these – characters of the larvae and pupae of the genus *Antocha* are unique among other genera of Limoniidae. The ecology of preimaginal stages is also unique because these insects are fully aquatic during their preimaginal stages. Unfortunately, these stages have been found and mentioned in the literature in only five species. Hence, this information is not included in the analysis due to the lack of data.

According to Oosterbroek and Theowald (1991), the genera of Limoniinae are divided into two tribes, Antochini and Limoniini. *Limonia phragmitidis* (Schrank, 1781) belongs to the tribe Limoniini and is used in the phylogenetic analysis as an outgroup. Other species of the outgroup belong to tribe Antochini, one of them is *Thaumastoptera* (*Thaumastoptera*) *calceata* Mik, 1866, whose clade is supported by one homoplastic synapomorphy, namely (31.2) the interbase is shorter than the middle part of the outer gonostylus. The next clade of *T.* (*T.*) *calceata* is supported by three apomorphies: (6.0) clouds on the wing veins are absent, (7.0) veins of the wing are uniformly darker and (22.0) the outer gonostylus is present, and one homoplastic synapomorphy, namely (43.0) the distribution of the species in this clade is in Asia. Also in this clade is *Orimarga* (*Orimarga*) *arabica* Hancock, 2011, supported by one apomorphy, specifically (27.3) the tip of the inner branch of paramere is wavy. The second clade of *O.* (*O.*) *arabica* is

supported by one homoplastic synapomorphy, i.e. (36.1) structures of the inner branch of paramere forming an aedeagal sheath. In this clade, the last species of the outgroup is *Elliptera zipanguensis zipanguensis* Alexander, 1924, which is supported by one apomorphy, (36.0) parameral structures covering the apex of the aedeagus and appearing as two wide ribbons, and two homoplastic synapomorphies: (27.0) the tip of the inner branch of paramere is blunt and (31.2) the interbase is shorter than the middle part of outer gonostylus. Another clade of *E. zipanguensis zipanguensis* belongs to the genus *Antocha*, supported by one apomorphy (4.1), a nearly right-angled anal angle of wing, and five homoplastic synapomorphies. This clade is divided into two clades. The first one is supported by two homoplastic synapomorphies: (33.2) the interbase is cylindrical, and (68.4) the base of the aedeagus is conical. The first clade is supported by one homoplastic synapomorphy, (3.1) the shape of the flagellomeres is fusiform. There are five monophyletic species groups: the *mara* group, the *pterographa* group and the *indica* group, and two sister groups, the *scutella* and the *turkestanica*. In the next clade, there are four monophyletic species groups: the *mitosanensis* group, the *dentifera* group, and two sister groups: the *styx* and the *vitripennis*.

Another large clade in this phylogenetic reconstruction is supported by two homoplastic synapomorphies: (5.1) the pterostigma is distinct, and (17.3) there are two crossed sulci of the ninth tergite. The first species group in this clade is the *libanotica*, which is supported by one homoplastic synapomorphy, (27.2) the tip of the inner branch of paramere is acute, and one apomorphy, (93.1) there are two acute lobes of the aedeagal sheath. The next clade is supported by one apomorphy, (36.5) parameral structures that are long and slender, ribbon-like, and one homoplastic synapomorphy, (39.1) the aedeagus is at the same length or longer than the gonocoxite. This clade is divided into two clades. The first one is the *gracillima* group, which is supported by two apomorphies (18.2): the gonocoxite is oblong, conical, and (71.1) the aedeagal sheath is with two ribbon-like structures connected with the aedeagus. Another clade is supported by one homoplastic synapomorphy, (35.4,5) a basal posterolateral extremite that is strongly curved or long, narrow, rounded at apex and one apomorphy, (38.2) not fused to aedeagal sheath or phallus parameral lateral structures are thin and curved. This clade is divided into two clades. The first clade is supported by one autapomorphy, (38.5) not fused to the aedeagal sheath, parameral lateral structures are connected near the apex of the aedeagus and acute at the apex. Four homoplastic synapomorphies exist: (5.0) the pterostigma is absent, (17.1,2) the sulcus of the ninth tergite reaches the middle part of ninth tergite or is

along the ninth tergite, and does not reach the end of the caudal margin, (36.6) parameral structures are simple, slender, rod-like, connected with the aedeagus, and (68.4) the base of the aedeagus is conical. This clade has six species groups: the *hyperlata* group, the *biarmata* group, the *nebulipennis* group, the *ophioglossa* group, and two sister groups: the *spiralis* and the *constricta*.

The next clade is supported by one apomorphy, namely (40.2) the aedeagus is straight and acute, the first species group in this clade is *attenuata*, which is supported by one apomorphy, (91.1) two fully separated parameral structures are present and one homoplastic synapomorphy, (72.1) separated parameral structures, ribbon-like with a narrow aedeagus, which can be covered by a membranous parameral structure. The second clade is supported by one homoplastic synapomorphy, (36.3) parameral structures forming an aedeagal sheath, which is fused to the aedeagus and forms a phallus and one apomorphy, (68.2) the base of the aedeagus is spherical. The first in this clade is the *nigribasis* group, which is supported by one apomorphy (37.2), a phallus that is long, sinuous and two homoplastic synapomorphies, (28.3) the inner branch of paramere is longer or as long as the aedeagus and ribbon-like, flat, acute at the apex, and (33.0) the interbase looks like a flat leaf. The next clade is supported by three homoplastic synapomorphies, (28.6) the inner branch of paramere with an acute apex that is longer or as long as the aedeagus, wide with the spine at the apex, (36.2) parameral structures reduced to the small aedeagal sheath, which not fully covers the aedeagus, (39.0) the aedeagus is shorter than the gonocoxite. The first species in this clade is *A.* (*A.*) *neoflavella* Alexander and Alexander, 1973, which is supported by two homoplastic synapomorphies, (28.8) the inner branch of paramere has an acute apex, which is longer or as long as the aedeagus and curved at the apex, and (36.1) parameral structures form an aedeagal sheath. Another clade is branched into three clades and is supported by one homoplastic synapomorphy – (18.6) the gonocoxite is rounded. The first clade is the *amblystyla* group, which is supported by one apomorphy, (94.1) the lateral parameral structures are separated and filiform, and two homoplastic synapomorphies, (33.2) an interbase consisting of two oblong parts of which one is shorter, (34.0) the parameral apodeme is longer or at the same length as the aedeagus. The second clade is the *saxicola* group, which is supported by three homoplastic synapomorphies, (17.1) the sulcus of the ninth tergite reaches the middle part of this tergite, (43.2) distribution is in North America, (44.1) the ninth tergite is trapezoidal. There are three apomorphies: (15.1) there is a spot on the apex of the ninth sternite which is not sclerotized, (67.1) the aedeagal sheath is reduced to a flattened or

rounded structure, (68.5) the base of the aedeagus is angular. The third clade is supported by two apomorphies – (35.7) a basal posterolateral extremite is connected with the aedeagal sheath in a straight line (68.1), the base of the aedeagus is a plate-like structure, and two homoplastic synapomorphies, (33.6) the interbase is rod-like, (40.1) the aedeagus is a straight tube (longer than the outer gonostylus). This third clade is divided into two clades: the first one belongs to the subgenus *Proantocha*, and the second one to the subgenus *Orimargula*.

The clade of the subgenus *Antocha* (*Proantocha*) Alexander, 1919 is supported by five apomorphies: (18.7) the gonocoxite is angled, (21.1) there is a setiferous lobe on the base of the gonocoxite, (30.5) the inner branch of paramere is narrow, a little curved, blunt at apex, shorter than the aedeagus (46.1) two triangular inwardly directed lobes on the caudal margin of the ninth tergite are present, (56.1) the apex of the light outer gonostylus is widened, and five homoplastic synapomorphies: (17.2) the sulcus of the ninth tergite is along the tergite, does not reach the end of the caudal margin, (19.1) not sclerotized part of gonocoxite is along this structure, (36.1) parameral structures form the aedeagal sheath, (42.1) the ventral margin of the female cercus is toothed, (63.1) there is a wide aedeagal sheath or three small lobes at the apex of the aedeagal sheath. There are two sister species groups in this subgenus: the *spinifer* and the *sagana*.

The clade of the subgenus *Antocha* (*Orimargula*) Mik, 1883 is supported by five homoplastic synapomorphies: (8.1) the discoidal cell (*dm*) is open, (17.4) the sulcus of the ninth tergite is forked near the base (33.7) the interbase is paddle-like, (36.3) parameral structures form an aedeagal sheath, which is fused to the aedeagus and forms a phallus (68.0) the base of phallus is hemispherical. There are two apomorphies: (18.4) the gonocoxite is cylindrical (35.8) a basal posterolateral extremite is ingrown into the phallus. This clade is divided into two clades, the first one is the species *A.* (*O.*) *alpigena* (Mik, 1883), which is supported by three homoplastic synapomorphies: (43.1) distribution is in Europe (or the southwest part of Asia), (48.1) two small, rounded lobes on the caudal margin of the ninth tergite are present, (90.1) the apex of the phallosomic tube is with small lobes. Another clade is supported by two homoplastic synapomorphies: (9.1) vein $R_2$ is before the level of the base of cell *dm*, (10.1) vein *m-cu* is shorter than the distance between it and the base of the open cell *dm* and two apomorphies: (11.1) vein *Rs* is 2.5 times or less longer than vein $R_4$, (17.5) the sulcus of the ninth tergite is along the tergite, reaches the caudal margin. This clade has two species groups: the *longicornis* and the *philippina*.

### 3.1.4. Overview of species groups

Based on the results of phylogenetic analysis, the genus *Antocha* is divided into 25 species groups. Three groups were mentioned by Alexander and are based only on morphology – *nigribasis* (Alexander, 1974), *spiralis* (Alexander, 1970), and *vitripennis* (Alexander, 1936). All other groups were distinguished for the first time. Species not included in the phylogenetic analysis were assigned to the appropriate species groups based on the original illustrations and descriptions.

***Antocha* (s. str.) Mik, 1883**

The type species of this subgenus is *Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860. According to Podenas and Byun (2013), species belonging to the subgenus *Antocha* (s. str.) are characterized by the combination of the following characteristics: wide wing with large, nearly right-angled anal angle of the wing and closed cell *dm*, legs always long and slender, covered with short semi-erect setae, cercus of ovipositor with a smooth lower margin. However, after phylogenetic analysis, it was discovered that these features are not unique to this subgenus. For example, there are species in *Antocha* (s. str.) like *A.* (*A.*) *subconfluenta* Alexander, 1930, *A.* (*A.*) *confluenta* Alexander, 1926 and *A.* (*A.*) *macrocera* Alexander, 1970 with open cell *dm*.

It is thought that characters of the preimaginal stages could better reveal phylogeny, but because of a lack of information about larval and pupal stages, these characters were not used. Moreover, significant structures are related to these insects' ecology. It is known that females of *Antocha* (s. str.) lay their eggs in slow or rapid waters and have a smooth lower margin of the cerci. The eggs are deposited by dipping down to the water's surface, one or more eggs being deposited at each descent (Alexander, 1920). Larval stages of only three species of this subgenus are known: *A.* (*A.*) *saxicola*, *A.* (*A.*) *vitripennis* and *A.* (*A.*) *bifida*. The *Antocha* larval stage is unique among other Limoniidae species. It lacks spiracles, the entire respiration is carried out through tracheal gills and the rich tracheal development in the elongated caudal lobes. Another important feature is the ability of the larvae to construct silken cases in crevices and grooves in stone. Moreover, the number of branches of each of the two spiracular gills of the pupa is different between the subgenera *Antocha* (s. str.) and *Antocha* (*Orimargula*). In species *A.* (*A.*) *saxicola*, *A.* (*A.*) *vitripennis*, and *A.* (*A.*) *bifida*, the number of branches on each of the two spiracular gills is eight (Hinton, 1966).

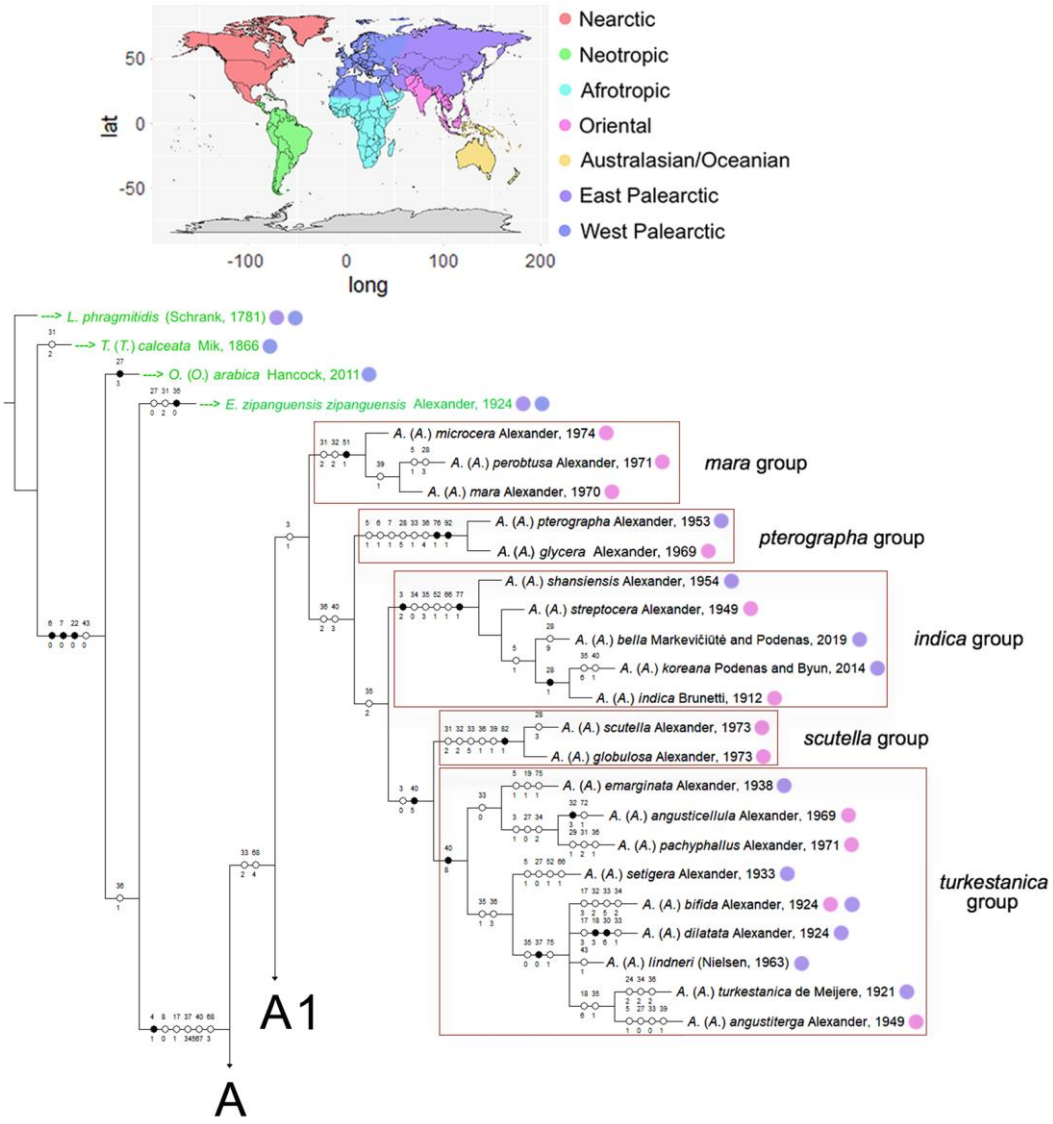


**Figure 50.** The strict consensus cladogram of the 1000 most parsimonious cladograms acquired by EW. Black circles – apomorphies, open circles – homoplastic synapomorphies. Digits above circles – numbers of the characters, below – state of the character.

**1. *mara* group** (Fig. 50) **–** all species have one apomorphic character, (51.1) the apex of light and wide outer gonostylus is narrowly obtuse. Other familiar characters to all species of this group are: the interbase is short and acute at the apex; the apex of the aedeagus is obliquely truncated; the inner branch of paramere is long and slender, acute at apex. Two species, *A. mara*

and *A. perobtusa*, have small lateral bumps on the caudal margin of the ninth tergite. All these species are distributed in the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *mara* Alexander, 1970

*Antocha* (*Antocha*) *microcera* Alexander, 1974

*Antocha* (*Antocha*) *perobtusa* Alexander, 1971

In this species group, *A.* (*A.*) *microcera* differs from the other species by the smooth caudal margin of the ninth tergite. The main difference between *A.* (*A.*) *perobtusa* and *A.* (*A.*) *mara* is the apex of the aedeagus – in *A.* (*A.*) *perobtusa* this structure opens very widely and in *A.* (*A.*) *mara* less wide. All these species were found in India (Assam).

**2. *pterographa* group** (Fig. 50) **–** these species have two apomorphic characters: (76.1) lateral parameral structures appearing as a large incurved lobe on either side to form a bridge across the mid-line of the aedeagus, and (92.1) the aedeagus is at similar length as the outer gonostylus, and strongly curved before the apex. These species can also be recognised by the wings, which are heavily and conspicuously patterned with brown. The outer gonostylus is gently curved and obtuse at the apex; the apex of the interbase is obtuse; the inner branch of paramere is long and obtuse at apex. These species are distributed in the Palearctic zoogeographical region and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *pterographa* Alexander, 1953

*Antocha* (*Antocha*) *glycera* Alexander, 1969

These species are very similar. *A.* (*A.*) *pterographa* is distributed in China, whereas *A.* (*A.*) *glycera* has been found in India. Also, it is known that *A.* (*A.*) *pterographa* is grey and *A.* (*A.*) *glycera* is buffy yellow.

**3. *indica* group** (Fig. 50) – these species have two apomorphic characters: (3.2) the flagellomeres of the antenna are dilated ventrally (the antenna of *A.* (*A.*) *rectispina* are unknown), (77.1) the aedeagus is strongly curved. Species of this group are recognized by the apex of the outer gonostylus, which is rounded. The caudal margin of the ninth tergite is smooth, the sulcus of the ninth tergite is branched in the middle. These species are distributed in the East Palearctic and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019

*Antocha* (*Antocha*) *indica* Brunetti, 1912

*Antocha* (*Antocha*) *koreana* Podenas and Byun, 2014

*Antocha* (*Antocha*) *rectispina* Alexander, 1954

*Antocha* (*Antocha*) *shansiensis* Alexander, 1954

*Antocha* (*Antocha*) *streptocera* Alexander, 1949

The inner branch of paramere can help identify some of these similar species. In *A.* (*A.*) *bella*, the inner branch of paramere is strongly sclerotized and twisted into a spiral. In *A.* (*A.*) *indica*, the inner branch of paramere is shorter than the gonocoxite. The inner branch of paramere in *A.* (*A.*) *streptocera* is longer than the gonocoxite, whereas *A.* (*A.*) *shansiensis* is identified by the aedeagus, which has a pair of slender curved rod-like structures. Two species, *A.* (*A.*) *koreana* and *A.* (*A.*) *rectispina*, can be distinguished by the apex of the outer gonostylus, which is widened before the narrowly obtuse apex in *A.* (*A.*) *koreana* and *A.* (*A.*) *rectispina* the apex of this structure is obtuse. Two species, *A.* (*A.*) *indica* and *A.* (*A.*) *streptocera*, are distributed in the Oriental region, while the other species in the East Palearctic.

**4. *scutella* group** (Fig. 50) – these species have one apomorphic character, (82.1) the aedeagal sheath is cylindrical. In this group of two species, the apex of the aedeagus is slightly sinuous or weakly coiled. The inner branch of paramere is long and slender, slightly widened near the outer end or in the middle part. The outer gonostylus is not darkened. The interbase with the free outer part is reduced to subatrophied. The pterostigma of the wing is absent. These species are distributed in the Oriental zoogeographical region.

Species of this group:

*Antocha* (*Antocha*) *globulosa* Alexander, 1973

*Antocha* (*Antocha*) *scutella* Alexander, 1973

These two very similar species differ by the outer gonostylus, which in *A.* (*A.*) *scutella* is more obtuse than in *A.* (*A.*) *globulosa*.

**5. *turkestanica* group** (Fig. 50) – these species have one apomorphic character, (40.8) the aedeagus appears as a short (not longer than the outer gonostylus) straight tube. Also, the pterostigma of the wing in this group is very pale. These species are distributed in the East Palearctic zoogeographical region and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *angusticellula* Alexander, 1969

*Antocha* (*Antocha*) *angustiterga* Alexander, 1949

*Antocha* (*Antocha*) *bifida* Alexander, 1924

*Antocha* (*Antocha*) *dilatata* Alexander, 1924

*Antocha* (*Antocha*) *emarginata* Alexander, 1938

*Antocha* (*Antocha*) *lindneri* (Nielsen, 1963)

*Antocha (Antocha*) *pachyphallus* Alexander, 1971

*Antocha (Antocha*) *setigera* Alexander, 1933

*Antocha* (*Antocha*) *turkestanica* de Meijere, 1921

One of the best characters in species identification is the outer gonostylus, which in *A.* (*A.*) *dilatata* is wavy and acute at the apex. In *A.* (*A.*) *lindneri*, the outer gonostylus is slightly widened before the apex and obliquely narrowed to an acute point. In *A.* (*A.*) *emarginata*, the apex of outer gonostylus is truncated in *A.* (*A.*) *angustiterga*, gradually narrowing to the acute point, whereas in two species, *A.* (*A.*) *bifida* and *A.* (*A.*) *turkestanica*, the apex of the outer gonostylus is cleft, and in one species, *A.* (*A.*) *pachyphallus*, it is obtuse. The ninth tergite of *A.* (*A.*) *bifida* is with a deep U-shaped median notch between two tooth-like structures, while the caudal margin of the ninth tergite of *A.* (*A.*) *turkestanica* is with two lobes. Some species of this group can be distinguished by the cleft apex of the aedeagus and the inner branch of paramere, which is flattened, ribbon-like and blunt at apex. The apex of the interbase of *A.* (*A.*) *angusticellula* is irregularly bilobed while in *A.* (*A.*) *setigera*, it is rounded.

**6. *brevinervis* group** (Fig. 51) – these species have two apomorphic characters: (55.1) the light, long, narrow outer gonostylus is blunt at apex, and (81.1) the aedeagus is a straight, thin tube surrounded by a wide aedeagal sheath. These species have a long, narrow outer gonostylus, which is not darkened. The apex of the inner branch of paramere in this species group is acute. The caudal margin of the ninth tergite is smooth. These species are distributed in the East Palearctic zoogeographical region.

Species of this group:

*Antocha* (*Antocha*) *brevinervis* Alexander, 1924

*Antocha* (*Antocha*) *mitosanensis* Torii, 1992

*Antocha* (*Antocha*) *platyphallus* Alexander, 1935

*Antocha* (*Antocha*) *tuberculata* Torii, 1992

Two species, *A.* (*A.*) *tuberculata* and *A.* (*A.*) *brevinervis*, have a tubercle on the base of the gonocoxite, which is absent in *A.* (*A.*) *mitosanensis* and *A.* (*A.*) *platyphallus*. The main difference between two species is the outer gonostylus, which in *A.* (*A.*) *brevinervis* is narrow but not narrower than the inner gonostylus, while *A.* (*A.*) *tuberculata* has a narrower outer gonostylus than the inner one. *A.* (*A.*) *platyphallus* has three small lobes of the apex of the aedeagus with the aedeagal sheath, which is absent in *A.* (*A.*) *mitosanensis*. These species are distributed only in Japan.

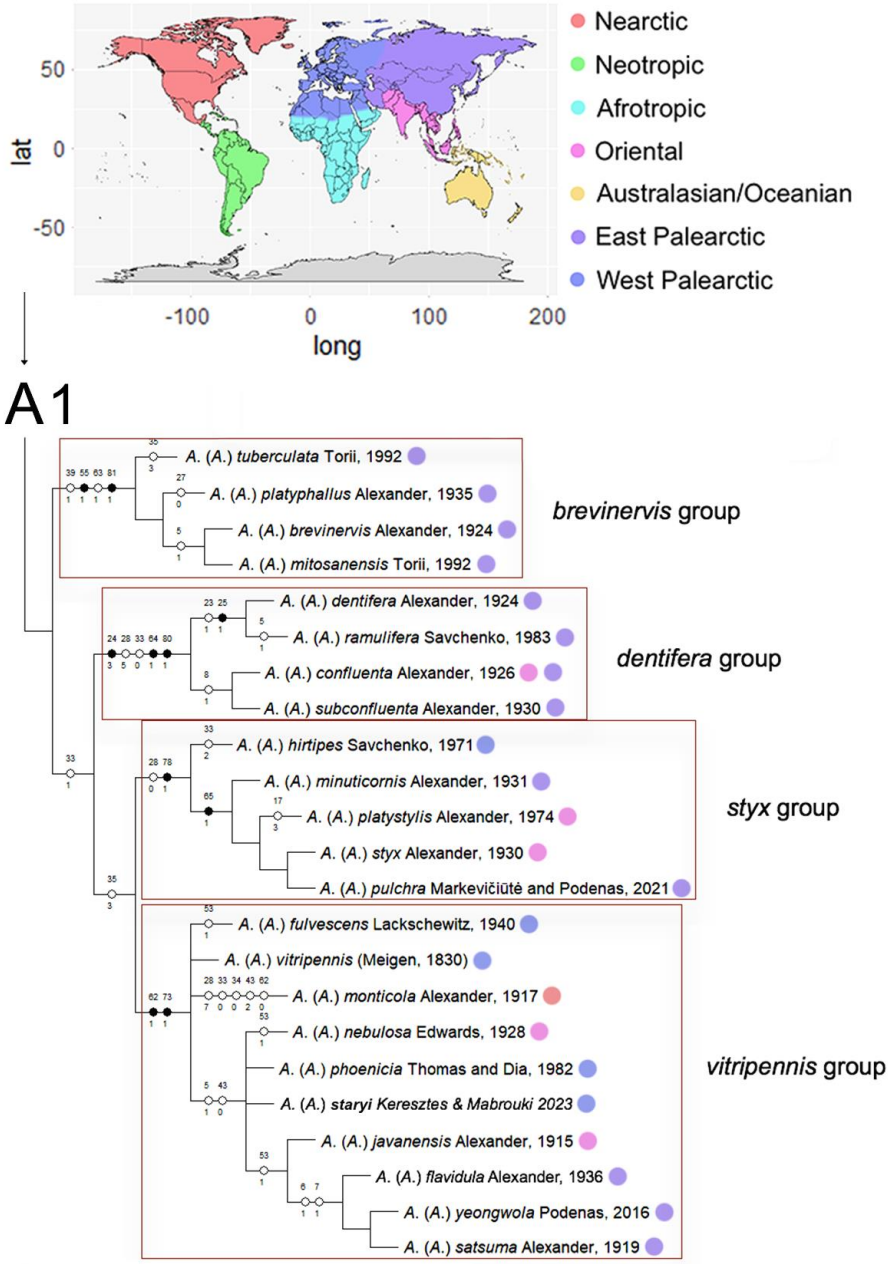


**Figure 51.** The strict consensus cladogram of the 1000 most parsimonious cladograms acquired by EW. Black circles – apomorphies, open circles – homoplastic synapomorphies. Digits above circles – numbers of the characters, below – state of the character.

**7. *dentifera* group** (Fig. 51) – these species have three apomorphic characters: (24.3) the outer gonostylus is strongly arched (hook-like), (64.1)

the apex of the wide aedeagal sheath is narrow, (80.1) the inner branches of paramere are S-shaped. All species of this group have barely indicated pterostigma, and the outer gonostylus is not darkened at apex. The cerci of the ovipositor are with ventro-apical angles. These species are mostly distributed in the East Palearctic zoogeographical region, but *A.* (*A.*) *confluenta* is also known in the Oriental zoogeographical region.

Species of this group:

*Antocha* (*Antocha*) *confluenta* Alexander, 1926

*Antocha* (*Antocha*) *dentifera* Alexander, 1924

*Antocha* (*Antocha*) *ramulifera* Savchenko, 1983

*Antocha* (*Antocha*) *subconfluenta* Alexander, 1930

Two species, *A.* (*A.*) *dentifera* and *A.* (*A.*) *ramulifera*, have a tooth on the outer gonostylus, which is absent in *A.* (*A.*) *confluenta* and *A.* (*A.*) *subconfluenta*, but these species differ from *A.* (*A.*) *dentifera* and *A.* (*A.*) *ramulifera* by their open cell *dm*. The main difference between *A.* (*A.*) *confluenta* and *A.* (*A.*) *subconfluenta* is in the caudal margin of the ninth tergite, which in *A.* (*A.*) *confluenta* is weakly trilobed, while it is smooth in the other species.

**8. *styx* group** (Fig. 51) – these species have one apomorphic character, (78.1) the aedeagus is curved and rounded at apex. All species in this group have a wide aedeagal sheath, which widely covers the aedeagus. The inner branch of paramere in this group is needle-like, acute at the apex. The interbase is cylindrical, obtuse at the apex. The pterostigma of the wing is indistinct or missing. These species are distributed in the Palearctic zoogeographical region and the Oriental zoogeographical region.

Species of this group:

Antocha (Antocha) hirtipes Savchenko, 1971

*Antocha* (*Antocha*) *minuticornis* Alexander, 1931

*Antocha* (*Antocha*) *platystylis* Alexander, 1974

*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021

*Antocha* (*Antocha*) *styx* Alexander, 1930

An aedeagal sheath with horn-like structures is found in *A.* (*A.*) *pulchra* and in *A.* (*A.*) *platystylis*, but these species can be identified by the apex of the outer gonostylus. In *A.* (*A.*) *platystylis*, this structure is widely obtuse and in *A.* (*A.*) *pulchra* it is unequally bifid. The apex of the outer gonostylus of *A.* (*A.*) *minuticornis* is obliquely obtuse, while it is acute in *A.* (*A.*) *styx* and rounded in *A.* (*A.*) *hirtipes*. One species, *A.* (*A.*) *hirtipes*, is distributed in Georgia, *A.* (*A.*) *pulchra* and *A.* (*A.*) *minuticornis* are distributed in China, *A.* (*A.*) *styx* was found in Taiwan and *A.* (*A.*) *platystylis* in India.

**9. *vitripennis* group** (Fig. 51) – these species have two apomorphic characters: (62.1) two wide rounded lobes of the aedeagal sheath, (73.1) the apex of the aedeagus comes out through a small hole in the aedeagal sheath. The species of this group were described as the *vitripennis* group by Alexander. This species group's inner branch of paramere is long and gradually narrows to a sharp point. These species are distributed in the Holarctic zoogeographical region and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *flavidula* Alexander, 1936

*Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940

*Antocha* (*Antocha*) *javanensis* Alexander, 1915

*Antocha* (*Antocha*) *monticola* Alexander, 1917

*Antocha* (*Antocha*) *nebulosa* Edwards, 1928

*Antocha* (*Antocha*) *phoenicia* Thomas and Dia, 1982

*Antocha* (*Antocha*) *satsuma* Alexander, 1919

*Antocha* (*Antocha*) *staryi* Keresztes & Mabrouki, 2023

*Antocha* (*Antocha*) *vitripennis* (Meigen, 1830)

*Antocha* (*Antocha*) *yeongwola* Podenas, 2016

*A.* (*A.*) *fulvescens* is known as a synonym of *A.* (*A.*) *vitripennis*, but because of apparent differences between the apex of the outer gonostylus *A.* (*A.*) *fulvescens* should be restored from a synonym to a valid species. The apex of the outer gonostylus in *A.* (*A.*) *vitripennis* gradually narrows to an acute point, while it consists of a small bump and a long spine in *A.* (*A.*) *fulvescens* and it is obtuse in *A.* (*A.*) *monticola*. The inner branch of paramere is long, acute at apex in all species, but in *A.* (*A.*) *monticola*, it is widened before the apex and darkened, while in *A.* (*A.*) *fulvescens* and *A.* (*A.*) *vitripennis* it gradually narrows to an acute point. *A.* (*A.*) *fulvescens* and *A.* (*A.*) *vitripennis* are distributed in European countries and *A.* (*A.*) *monticola* in Canada, USA and Mexico. All the rest of the species in this group have pterostigma of the wing, except *A.* (*A.*) *phoenicia* and *A.* (*A.*) *staryi*, which is also distinguished by the outer gonostylus's apex. In all species, the apex of the outer gonostylus consists of a small bump and a spine, but in *A.* (*A.*) *phoenicia* and *A.* (*A.*) *staryi*, it is not cleft. Four species, *A.* (*A.*) *yeongwola*, *A.* (*A.*) *satsuma*, *A.* (*A.*) *nebulosa*, and *A.* (*A.*) *flavidula*, have clouds on the wing, but the wing is not clouded in *A.* (*A.*) *phoenicia*, *A.* (*A.*) *staryi* and *A.* (*A.*) *javanensis*,. Two species, *A.* (*A.*) *javanensis* and *A.* (*A.*) *nebulosa*, are distributed in the Oriental region. One species, *A.* (*A.*) *phoenicia*, is known from Lebanon, *A.* (*A.*) *staryi* is known from the Middle Atlas Mountains, Morocco, and *A.* (*A.*) *yeongwola*, *A.* (*A.*) *satsuma*, and *A.* (*A.*) *flavidula* are distributed in the East Palearctic zoogeographical region.

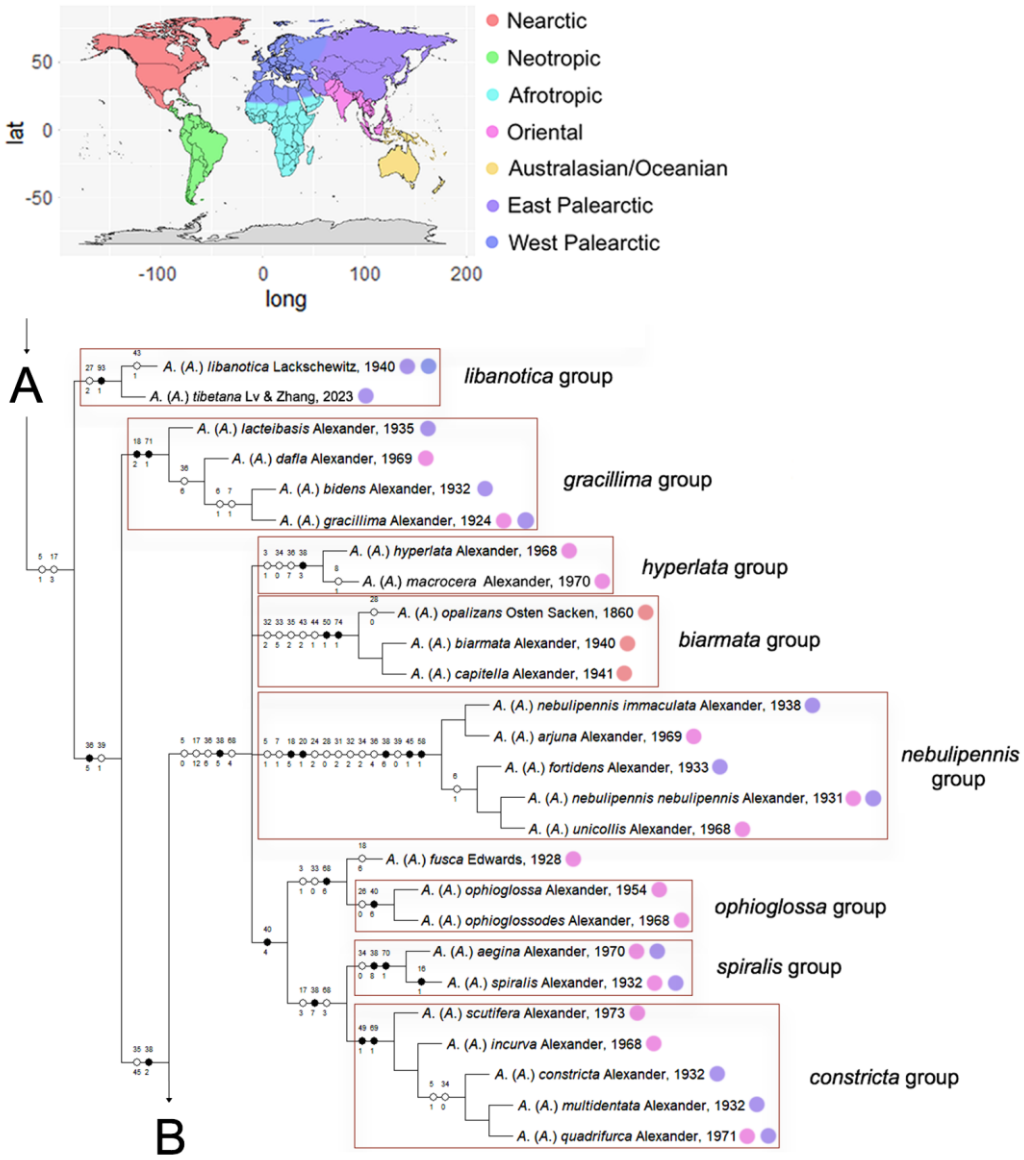


**Figure 52.** The strict consensus cladogram of the 1000 most parsimonious cladograms acquired by EW. Black circles – apomorphies, open circles – homoplastic synapomorphies. Digits above circles – numbers of the characters, below – state of the character.

**10. *libanotica* group** (Fig. 52) – these species have one apomorphic character, (93.1) two acute lobes of the aedeagal sheath. Species in this group have a wide aedeagal sheath, which widely covers the aedeagus. The

inner branch of paramere is bifid at the apex. The interbase is loop-like. The pterostigma of the wing is pale brown. These species are distributed in the Palearctic zoogeographical region.

Species of this group:

*Antocha* (*Antocha*) *libanotica* Lackschewitz, 1940

*Antocha* (*Antocha*) *tibetana* Lv & Zhang, 2023

The main difference between these two species is distribution – *A.* (*A.*) *tibetana* was found only in Tibet, while *A.* (*A.*) *libanotica* is known from Georgia, Armenia, Azerbaijan, Cyprus, Lebanon, Iran, Turkmenistan, Tajikistan and Afghanistan.

**11. *gracillima* group** (Fig. 52) – these species have two apomorphic characters: (18.2) the gonocoxite is oblong conical, (71.1) the aedeagal sheath with two ribbon-like structures connected with the aedeagus. Also, the upper half of the aedeagus is covered by an aedeagal sheath. The inner branches of parameres look like the parameral lateral structures of the aedeagus, appear ribbon-like and are acute at apex structures. The interbase is loop-like. These species are distributed in the East Palearctic zoogeographical region and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *bidens* Alexander, 1932

*Antocha* (*Antocha*) *dafla* Alexander, 1969

*Antocha* (*Antocha*) *gracillima* Alexander, 1924

*Antocha* (*Antocha*) *lacteibasis* Alexander, 1935

The best structure which helps to separate these similar species is the apex of the outer gonostylus. The apex of the outer gonostylus in *A.* (*A.*) *gracillima* is bifid into a small stouter tooth and a bump. In *A.* (*A.*) *bidens*, this structure is bifid into two small teeth, whereas in *A.* (*A.*) *lacteibasis* it is acute and in *A.* (*A.*) *dafla* it is rounded.

**12. *hyperlata* group** (Fig. 52) – these species have one apomorphic character, (38.3) the parameral lateral structures are connected at the apex of the aedeagus, with a bump between two acute structures. Oblong fusiform flagellomeres distinguish species of this group. These species are distributed in the Oriental zoogeographical region.

Species of this group:

*Antocha* (*Antocha*) *hyperlata* Alexander, 1968

*Antocha* (*Antocha*) *macrocera* Alexander, 1970

These species are extremely similar, but *A.* (*A.*) *macrocera* differs from *A.* (*A.*) *hyperlata* by the lack of vein *m-cu*.

**13. *biarmata* group** (Fig. 52) – these species have two apomorphic characters: (50.1) the apex of the dark outer gonostylus is truncated, and

(74.1) two parameral structures are strongly sclerotized. They are connected at the middle part of the aedeagus. The inner branch of paramere of these species is long, flattened and gradually narrows to an acute point. The interbase is reduced to a rod-like structure. The aedeagus is long, cleft at the apex and connected with parameral lateral structures. The pterostigma of the wing is not distinct. All these species are distributed in the Nearctic region.

Species of this group:

*Antocha* (*Antocha*) *biarmata* Alexander, 1940

*Antocha* (*Antocha*) *capitella* Alexander, 1941

*Antocha* (*Antocha*) *opalizans* Osten Sacken, 1860

The main differences between these three very similar species are the parameral lateral structures, which are very short and appear as spine-like structures in *A.* (*A.*) *biarmata*. In *A.* (*A.*) *capitella*, these structures are long and well developed, and their tips reach the level of tips of inner branches of parameres, while in *A.* (*A.*) *opalizans*, these structures are shorter, and their tips are lower than the tips of inner branches of parameres.

**14. *nebulipennis* group** (Fig. 52) – these species have five apomorphic characters: (18.5) the gonocoxite is conical, short, (20.1) the apex of gonocoxite is elongated, (38.6) the parameral lateral structures are thin and connected at the apex of aedeagus, (45.1) there are one or two rounded median lobes on caudal margin of the ninth tergite, (58.1) the outer gonostylus is darkened and strongly bent. The short parameral apodeme can also distinguish this group of these species. The interbase is reduced to a small one with an acute apex structure. The inner branch of paramere is shorter than the aedeagus and needle-like. These species are distributed in the East Palearctic zoogeographical region and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *arjuna* Alexander, 1969

*Antocha* (*Antocha*) *fortidens* Alexander, 1933

*Antocha* (*Antocha*) *nebulipennis nebulipennis* Alexander, 1931

*Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938

*Antocha* (*Antocha*) *unicollis* Alexander, 1968

One species, *A.* (*A.*) *fortidens*, and two subspecies, *A.* (*A.*) *nebulipennis nebulipennis* and *A.* (*A.*) *nebulipennis immaculata*, have a ninth tergite with two median lobes, while *A.* (*A.*) *arjuna* and *A.* (*A.*) *unicollis* have one median lobe. A highly elongated apex of the gonocoxite appears in *A.* (*A.*) *fortidens*, while in *A.* (*A.*) *nebulipennis nebulipennis* and *A.* (*A.*) *nebulipennis immaculata*, this structure is shorter. Darker patterns are visible on *A.* (*A.*) *nebulipennis nebulipennis* wings, while these patterns are not clear in *A.* (*A.*) *nebulipennis immaculata*. The apex of the outer gonostylus of *A.* (*A.*) *arjuna*

is narrowed to a sharp point whereas it is widened and truncated in *A.* (*A.*) *unicollis.*

**15. *ophioglossa* group** (Fig. 52) – these species have one apomorphic character, (40.6) the aedeagus is straight with two filose structures. Species of this group have oblong fusiform flagellomeres of the antennae. The gonocoxite is relatively short. The interbase is short and rounded at the apex. The pterostigma of the wing is indistinct. These species are distributed in the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *ophioglossa* Alexander, 1954

*Antocha* (*Antocha*) *ophioglossodes* Alexander, 1968

Two very similar species, *A.* (*A.*) *ophioglossa* and *A.* (*A.*) *ophioglossodes*, are distinguished by two filose structures at the apex of aedeagus. These filose structures are shorter than half of the aedeagus in *A.* (*A.*) *ophioglossa*, while they are very long, approximately as long as the aedeagus, in *A.* (*A.*) *ophioglossodes.*

**16. *spiralis* group** (Fig. 52) – these species have two apomorphic characters: (38.8) the parameral lateral structures are fragmented into two spirals, and (70.1) a trilobed structure inside the apex of the aedeagus is present. In this group of species, the aedeagus is widened before the apex. Also, a loop-like interbase and long parameral apodemes are found in this group. These species are distributed in the East Palearctic zoogeographical region and in the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *aegina* Alexander, 1970

*Antocha* (*Antocha*) *spiralis* Alexander, 1932

Autapomorphy of *A.* (*A.*) *aegina* is the inner branch of paramere, which appears as a long slender spine that narrows very gradually into a long point, with several pale erect setulae before the tip. The inner branch of paramere of *A.* (*A.*) *spiralis* is bifurcated. The main difference between these species is also the apex of the outer gonostylus – it is obtuse and black in *A.* (*A.*) *spiralis* and it is narrowed and brown in *A.* (*A.*) *aegina*.

**17. *constricta* group** (Fig. 52) – These species have two apomorphic characters: (49.1) the apex of the dark outer gonostylus is obliquely truncated, and (69.1) small horns or branched parameral structures are connected with the aedeagus. This species group is recognized by the inner branch of paramere which is unequally bifurcated. The interbase appears as a loop-like structure. The aedeagus at the apex appears as a rounded plate connected with parameral lateral structures. These species are distributed in the East Palearctic region and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *constricta* Alexander, 1932

*Antocha* (*Antocha*) *incurva* Alexander, 1968

*Antocha* (*Antocha*) *multidentata* Alexander, 1932

*Antocha* (*Antocha*) *quadrifurca* Alexander, 1971

*Antocha* (*Antocha*) *scutifera* Alexander, 1973

Two similar species are *A.* (*A.*) *incurva* and *A.* (*A.*) *scutifera*. The main difference between these species is in the lateral parameral structures of the aedeagus, which are small and not branched in *A.* (*A.*) *incurva*; whereas in *A.* (*A.*) *scutifera*, these structures appear as two not branched, incurved arms that form a shield-shaped area. In other species, these shield-shaped structures are branched: there are two branches of the parameral lateral structure of the aedeagus, in *A.* (*A.*) *multidentata,* of which the outer branch is very short, narrowed to the acute point. In *A.* (*A.*) *quadrifurca*, this structure also has two branches, of which the outer one is approximately three times shorter than the inner branch, while in *A.* (*A.*) *constricta*, one lateral structure of the aedeagus consists of three branches. Also, a dark pterostigma of the wing is found in all these species, except *A.* (*A.*) *incurva* and *A.* (*A.*) *scutifera*.

**18. *attenuata* group** (Fig. 53) – These species have one apomorphic character, (91.1) two fully separated parameral lateral structures of the aedeagus. This group of similar species is also identified by two acute at apex, ribbon-like inner branches of parameres. These species are distributed in the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *aciculifera* Alexander, 1974

*Antocha* (*Antocha*) *attenuata* Alexander, 1969

*Antocha* (*Antocha*) *exilistyla* Alexander, 1969

*Antocha* (*Antocha*) *gladiata* Alexander, 1974

*Antocha* (*Antocha*) *hyperlata* Alexander, 1968

*Antocha* (*Antocha*) *quadrirhaphis* Alexander, 1971

*Antocha* (*Antocha*) *stenophallus* Alexander, 1974

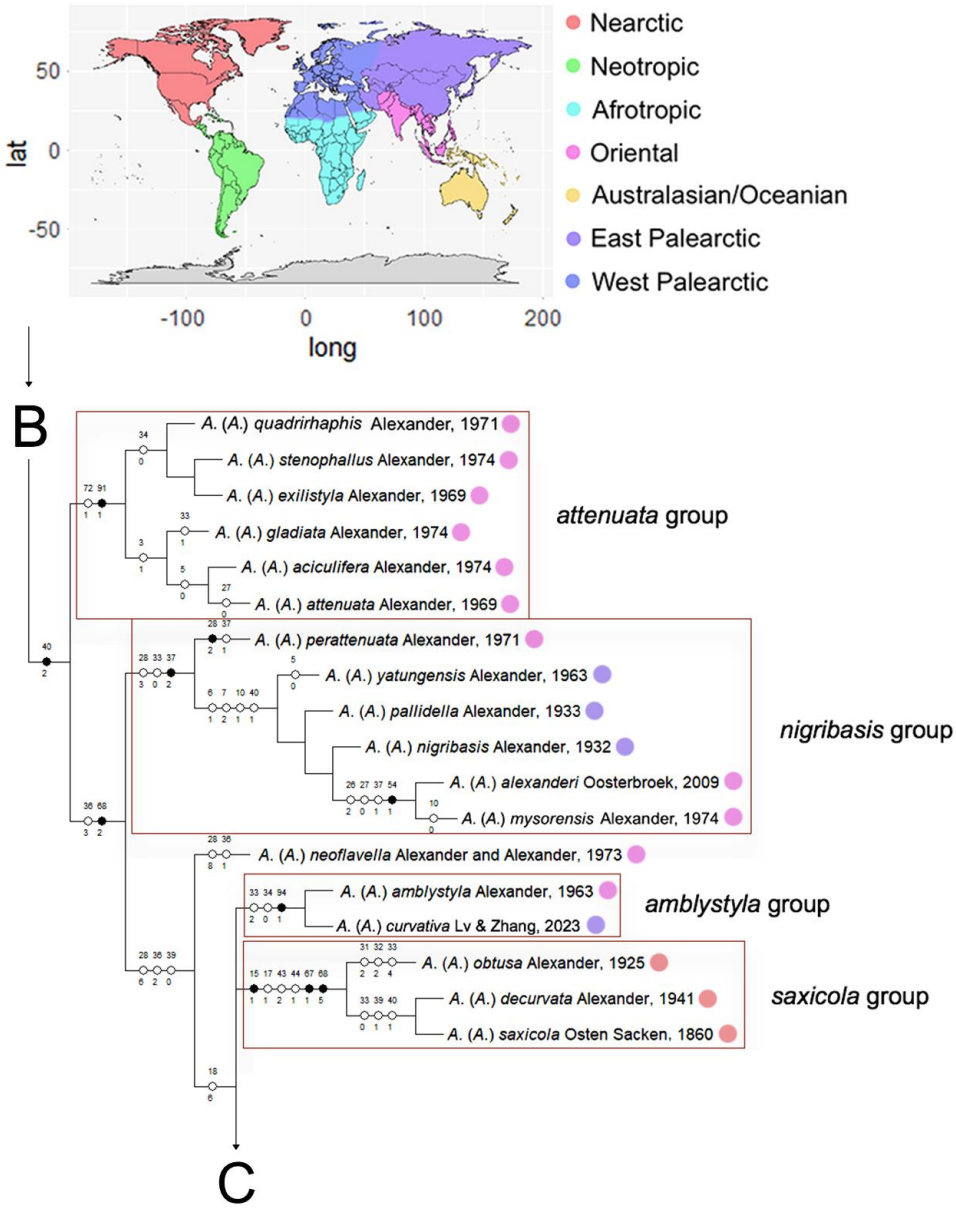


**Figure 53.** The strict consensus cladogram of the 1000 most parsimonious cladograms acquired by EW. Black circles – apomorphies, open circles – homoplastic synapomorphies. Digits above circles – numbers of the characters, below – state of the character.

The best structure in these species for identification is the apex of the aedeagus, which is very narrow, almost filiform, in *A.* (*A.*) *attenuata*, and relatively narrow, with a lateral branch near the outer end in *A.* (*A.*)

*exilistyla*. The apex of the aedeagus of *A.* (*A.*) *stenophallus* is covered by a narrow membranous aedeagal sheath, which is obtuse at the apex. The apex of the aedeagus in *A.* (*A.*) *gladiata* is covered by a narrow membranous aedeagal sheath, which is acute at the apex. In *A.* (*A.*) *hyperlata,* the apex of the aedeagus is connected with the lateral structures of the aedeagus. Very similar to *A.* (*A.*) *gladiata* is *A.* (*A.*) *aciculifera*, in which the outer gonostylus is gently curved at midlength, narrowed outwardly, terminating in a sharp point, while in *A.* (*A.*) *gladiata* the outer gonostylus is obliquely subacute. The apex of the aedeagus of *A.* (*A.*) *quadrirhaphis* is acute without the aedeagal sheath.

**19. *nigribasis* group** (Fig. 53) – these species have one apomorphic character, (37.2) a long and sinuous phallus. According to Alexander (1936), this group is recognized by the wing venation. Vein $R_2$ is before the level of the base of cell *dm,* and vein *m-cu* is similar in length or shorter than the distance between it and the base of cell *dm.* The interbase is flat and rounded at the apex. These species are distributed in the East Palearctic zoogeographical region and the Oriental region.

Species of this group:

*Antocha* (*Antocha*) *alexanderi* Oosterbroek, 2009
*Antocha* (*Antocha*) *basivena* Alexander, 1936
*Antocha* (*Antocha*) *khasiensis* Alexander, 1936
*Antocha* (*Antocha*) *latifurca* Alexander, 1969
*Antocha* (*Antocha*) *mysorensis* Alexander, 1974
*Antocha* (*Antocha*) *nigribasis* Alexander, 1932
*Antocha* (*Antocha*) *pallidella* Alexander, 1933
*Antocha* (*Antocha*) *perattenuata* Alexander, 1971
*Antocha* (*Antocha*) *prolixistyla* Alexander, 1971
*Antocha* (*Antocha*) *scelesta* Alexander, 1936
*Antocha* (*Antocha*) *sparsipunctata* Alexander, 1936
*Antocha* (*Antocha*) *yatungensis* Alexander, 1963

Darker patterns on transversal veins distinguish species of this group, except *A.* (*A.*) *basivena, A.* (*A.*) *scelesta,* and *A.* (*A.*) *perattenuata.* The veins of these species are lightly patterned or are without patterns. The apex of the outer gonostylus of *A.* (*A.*) *scelesta* is acute at the apex, in *A.* (*A.*) *basivena* it is obtuse, and *A.* (*A.*) *perattenuata* differs by the cleft apex of the outer gonostylus. The main differences between *A.* (*A.*) *latifurca* and *A.* (*A.*) *alexanderi* are the apex of aedeagus, which in *A.* (*A.*) *latifurca* is narrowed, arched into a curved spine, while in *A.* (*A.*) *alexanderi* and A. (A.) *mysorensis* it gradually narrows to the acute tip. Two similar species, *A.* (*A.*) *alexanderi* and *A.* (*A.*) *mysorensis,* differ in the length of the the vein *m-cu*,

which is similar to or longer than the distance between it and base of cell *dm* in *A.* (*A.*) *mysorensis* and shorter than the distance between it and the base of cell *dm* in *A. (A.) alexanderi*. Also, the outer gonostylus differs in this group and is helpful as a character in species identification. Unusually slender outer and inner gonostyli are in *A.* (*A.*) *prolixistyla,* while the apex of the outer gonostylus is broadly obtuse, slightly decurved in *A.* (*A.*) *yatungensis.* In *A.* (*A.*) *sparsipunctata* and *A.* (*A.*) *khasiensis*, the outer gonostylus is widened before the obtuse apex, but in *A.* (*A.*) *sparsipunctata*, it is slender. The main differences between *A.* (*A.*) *nigribasis* and *A.* (*A.*) *pallidella* is in the ninth tergite. It is gently emarginate and weakly crenulate in *A.* (*A.*) *nigribasis* and nearly straight between two small bumps in *A.* (*A.*) *pallidella.* Regarding distribution, *A.* (*A.*) *alexanderi*, *A.* (*A.*) *mysorensis*, *A.* (*A.*) *perattenuata*, *A.* (*A.*) *basivena*, *A.* (*A.*) *khasiensis*, *A.* (*A.*) *latifurca*, *A.* (*A.*) *prolixistyla*, *A.* (*A.*) *scelesta*, *A.* (*A.*) *sparsipunctata* were found in India and *A.* (*A.*) *nigribasis*, *A.* (*A.*) *pallidella*, *A.* (*A.*) *yatungensis* were found in China.

**20. *amblystyla* group** (Fig. 53) – These species have one apomorphic character, (94.1) two separated filiform parameral lateral structures of the aedeagus. Also, the inner branch of the paramere is obtuse at the apex. The outer gonostylus is broad and obtuse at the apex. The interbase is rounded at the apex. The pterostigma is absent. These species are distributed in the East Palearctic zoogeographical region and the Oriental zoogeographical region.

Species of this group:

*Antocha* (*Antocha*) *amblystyla* Alexander, 1963

*Antocha* (*Antocha*) *curvativa* Lv & Zhang 2023

The best structure in these species for identification is the gonocoxite, which is longer than the inner branch of paramere in *A.* (*A.*) *curvativa*, while a similar length as the inner branch of paramere is in *A.* (*A.*) *amblystyla*.

**21. *saxicola* group** (Fig. 53) – these species have three apomorphic characters: (15.1) not sclerotized spot on the apex of the ninth sternite, which is present, (67.1) the aedeagal sheath is reduced to a flattened or rounded structure, (68.5) the base of the aedeagus is angular. Also, the shape of the ninth tergite in this group of species is trapezoidal. The gonocoxite is short. The apex of the outer gonostylus is strongly sclerotized, black. The pterostigma of the wing is missing. All these species are distributed in the Nearctic region.

Species of this group:

*Antocha* (*Antocha*) *decurvata* Alexander, 1941

*Antocha* (*Antocha*) *obtusa* Alexander, 1925

*Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860

An interbase which is almost reduced and acute at apex is found in *A.* (*A.*) *obtusa,* while in *A.* (*A.*) *saxicola* and in *A.* (*A.*) *decurvata*, it is well developed and rounded at apex. The inner branch of paramere is very short and curved in *A.* (*A.*) *obtusa,* but in *A.* (*A.*) *saxicola* and in *A.* (*A.*) *decurvata*, it is longer and flattened. In *A.* (*A.*) *saxicola*, the inner gonostylus is very slender and narrows to the apex, while in *A.* (*A.*) *decurvata* the inner gonostylus is wider than the outer gonostylus, and the apex is obtuse.

***Antocha* (*Proantocha*) Alexander, 1919**

Two species were assigned to this monophyletic subgenus by the serrated ventral margin of the cercus in females and opposable tubercles at the tip of the femur and base of the tibia on the hindlegs of males (Alexander, 1919). Later, three females of different species with serrated cerci were found, but the tubercles on the legs of the males of these species were absent. After phylogenetic analysis in this work, it was found that the most important feature in this subgenus is a small setiferous lobe on the base of gonocoxite, which is found in all males of this subgenus. Also, the shape of the inner branch of paramere is specifically short and very similar to the interbase.

Based on these results, one species – *Antocha* (*Antocha*) *brevistyla* Alexander, 1924 – should be moved to the subgenus *Proantocha*, even though the female was not found.

The preimaginal stages of this subgenus species are unknown. The cercus of the female ovipositor in the subgenus *Proantocha* is serrated. In contrast, the cercus in the subgenus *Antocha* (s. str.) is smooth and in most *Orimargula* species, an extremely slender cercus is found. It is assumed that the ovipositor with serrated cerci is adapted to laying eggs deep in a hard substrate in shallow mountainous streams. All species of the subgenus *Proantocha* are distributed in the East Palearctic zoogeographical region. Two species groups of this subgenus were found: the *spinifer* and the *sagana* groups.

**22. *spinifer* group** (Fig. 54) – in this group of two species, the most important apomorphic characters are: (12.1) the opposable tubercles at the tip of the femur and the base of the tibia on the hindlegs; (84.1) the apex of the aedeagus is with small lobes and a wide aedeagal sheath covers the aedeagus. These species are distributed in Japan.

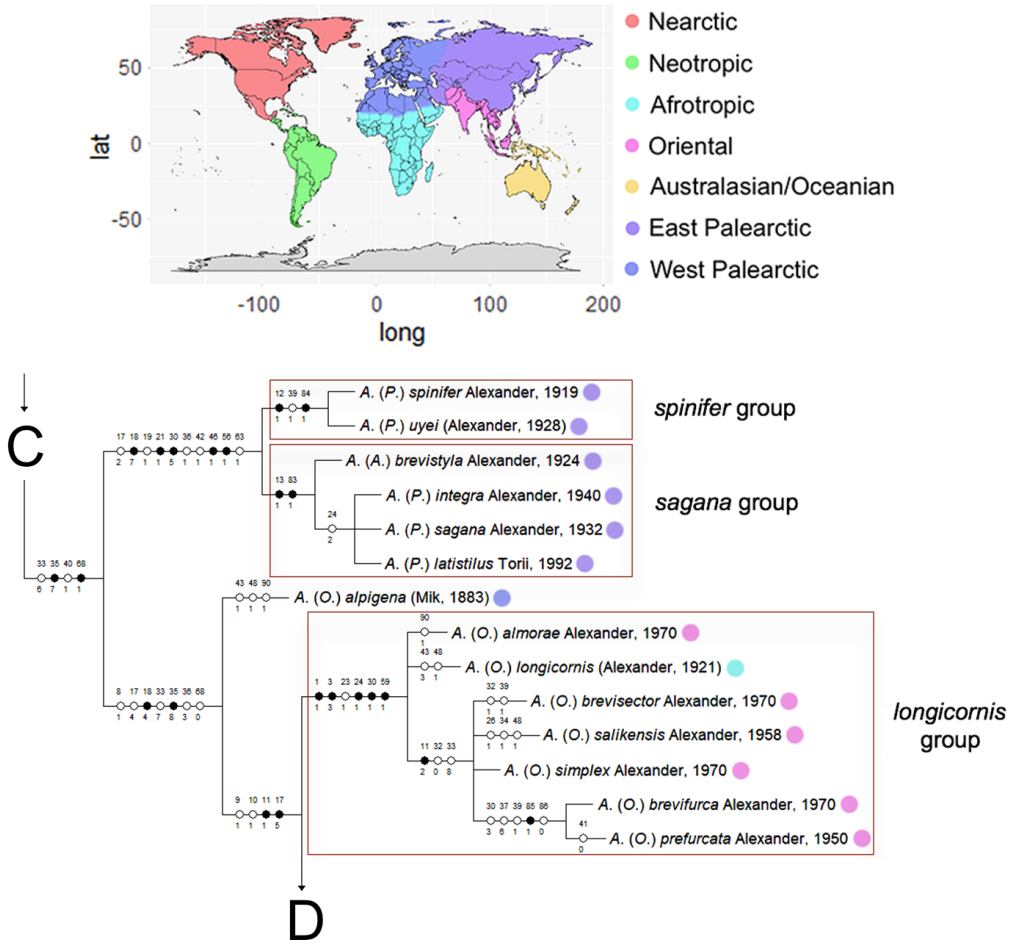


**Figure 54.** The strict consensus cladogram of the 1000 most parsimonious cladograms acquired by EW. Black circles – apomorphies, open circles – homoplastic synapomorphies. Digits above circles – numbers of the characters, below – state of the character.

Species of this group:

*Antocha* (*Proantocha*) *spinifer* Alexander, 1919

*Antocha* (*Proantocha*) *uyei* (Alexander, 1928)

The main difference between *A.* (*P.*) *uyei* and *A.* (*P.*) *spinifer* is the tibia: in *A.* (*P.*) *uyei*, it is widened, and in *A.* (*P.*) *spinifer* it is stout but not widened.

**23. *sagana* group** (Fig. 54) – these species have two apomorphic characters: (13.1) the ninth sternite is squared, (83.1) two small rounded lobes of the aedeagal sheath are connected with a straight, thin aedeagus. One species, *A.* (*P.*) *integra*, is distributed in Russia, North Korea and South

Korea, *A.* (*A.*) *brevistyla* is distributed in the Kuril Islands and Japan, the other two species are known only in Japan.

Species of this group:

*Antocha* (*Antocha*) *brevistyla* Alexander, 1924

*Antocha* (*Proantocha*) *integra* Alexander, 1940

*Antocha* (*Proantocha*) *latistilus* Torii, 1992

*Antocha* (*Proantocha*) *sagana* Alexander, 1932

Two species have an expanded and obliquely truncated apex of the outer gonostylus. The main difference between these species is the width of the aedeagal sheath – it is wider in *A.* (*P.*) *sagana* than in *A.* (*P.*) *integra*. The apex of the outer gonostylus in *A.* (*P.*) *latistilus* and *A.* (*A.*) *brevistyla* is uniquely clefted, and these species also differ by the width of the apex of the aedeagal sheath, which in *A.* (*A.*) *brevistyla* is wider than in *A.* (*P.*) *latistilus*.

***Antocha* (*Orimargula*) Mik, 1883**

The wing venation described this subgenus. The most important character is the open cell *dm* (Mik, 1883). The type species of this subgenus is *Antocha* (*Orimargula*) *alpigena* (Mik, 1883). After phylogenetic analysis, it was found that all species of this subgenus have gonocoxite that can be long or short, but specifically cylindrical. The interbase is quite long, paddle-like or sword-like.

Larval stages of *A.* (*O.*) *australiensis* and *A.* (*O.*) *alpigena* have been found. *A.* (*O.*) *alpigena* larvae are also aquatic, but have been found to live deep in moss and mud (Bangerter, 1929). It is supposed that the extremely slender cerci of the female ovipositors are related to the ability to lay eggs in soft substrate. Also, it is known that in the pupal stage number of branches in *A.* (*O.*) *australiensis* in one of two spiracular gills is five (Hinton, 1966).

Three species of this subgenus are distributed in the Australasian/Oceanian region, 15 species in the Oriental region, 21 in the Afrotropic region, one species with two subspecies in the East Palaearctic region, one species in the West Palaearctic region.

**24. *longicornis* group** (Fig. 54) – these species have five apomorphic characters: (1.1) the antenna, when bent backward, reaches the abdomen, (3.3) the flagellomeres of the antenna are tubular, (24.1) the outer gonostylus is strongly arched near the end, (30.1) the inner branch of paramere is shorter than aedeagus, narrow, straight, and wider before the apex, (59.1) the outer gonostylus is light, very thin narrows to a cut apex. Species of this group are identified by the gonocoxite, which is cylindrical. Also, the vein $R_2$ is before the level of the base of open cell *dm*. The length of vein *Rs* is shorter than the vein $R_4$ or longer, but less than 2.5 times. The vein *m-cu* is shorter than the distance between it and the base of open cell *dm*. These species are

distributed in the Oriental region, except *A.* (*O.*) *longicornis* which is distributed in the Afrotropical region.

Species of this group:

*Antocha* (*Orimargula*) *almorae* Alexander, 1970
*Antocha* (*Orimargula*) *longicornis* (Alexander, 1921)
*Antocha* (*Orimargula*) *salikensis* Alexander, 1958
*Antocha* (*Orimargula*) *brevisector* Alexander, 1970
*Antocha* (*Orimargula*) *simplex* Alexander, 1970
*Antocha* (*Orimargula*) *brevifurca* Alexander, 1970
*Antocha* (*Orimargula*) *prefurcata* Alexander, 1950
*Antocha* (*Orimargula*) *brevivena* (Edwards, 1928)
*Antocha* (*Orimargula*) *gracilicornis* (Edwards, 1925)
*Antocha* (*Orimargula*) *intermedia* (Edwards, 1928)
*Antocha* (*Orimargula*) *mesocera* Alexander, 1931
*Antocha* (*Orimargula*) *tanycera* Alexander, 1963

An important structure in these species for identification is the apex of the aedeagus. In *A.* (*O.*) *almorae*, it is with two small lobes, in *A.* (*O.*) *prefurcata* and *A.* (*O.*) *brevifurca*, this structure is cleft. In other species, it can be opened as a tube. The main differences between *A.* (*O.*) *prefurcata* and *A.* (*O.*) *brevifurca* is in the parameral plate, which is strongly sclerotized in *A.* (*O.*) *brevifurca* and membranous in *A.* (*O.*) *prefurcata*. In both *A.* (*O.*) *simplex* and *A.* (*O.*) *brevisector*, the inner branch of paramere is longer than the outer gonostylus, but a membranous structure that is connected with the phallosomic tube in these species is is very wide in *A.* (O.) simplex, whereas it is narrower in *A.* (*O.*) *brevisector*. Other similar species are *A.* (*O.*) *salikensis* and *A.* (*O.*) *longicornis*, but these species differ from each other by the length of the inner branch of paramere, which is shorter than the outer gonostylus in *A.* (*O.*) *longicornis* and longer in *A.* (*O.*) *salikensis*. The other five species (*A.* (*O.*) *brevivena*, *A.* (*O.*) *gracilicornis*, *A.* (*O.*) *intermedia*, *A.* (*O.*) *mesocera*, *A.* (*O.*) *tanycera*) were not included in phylogenetic analysis because slides of the genitals were absent. However, these species were included in this group because of the long antenna and the wing venation.

**25. *philippina* group** (Fig. 55) – species of this group have three apomorphic characters: (18.1) the gonocoxite is cylindrical, oblong, (61.1) the outer gonostylus is light, obliquely narrowed to a cut apex, (88.1) the middle part of long phallosomic tube is narrowed. Species of this group have rounded flagellomeres of the antennae and the parameral apodemes are very short. The phallosomic tube is long, longer than the outer gonostylus.

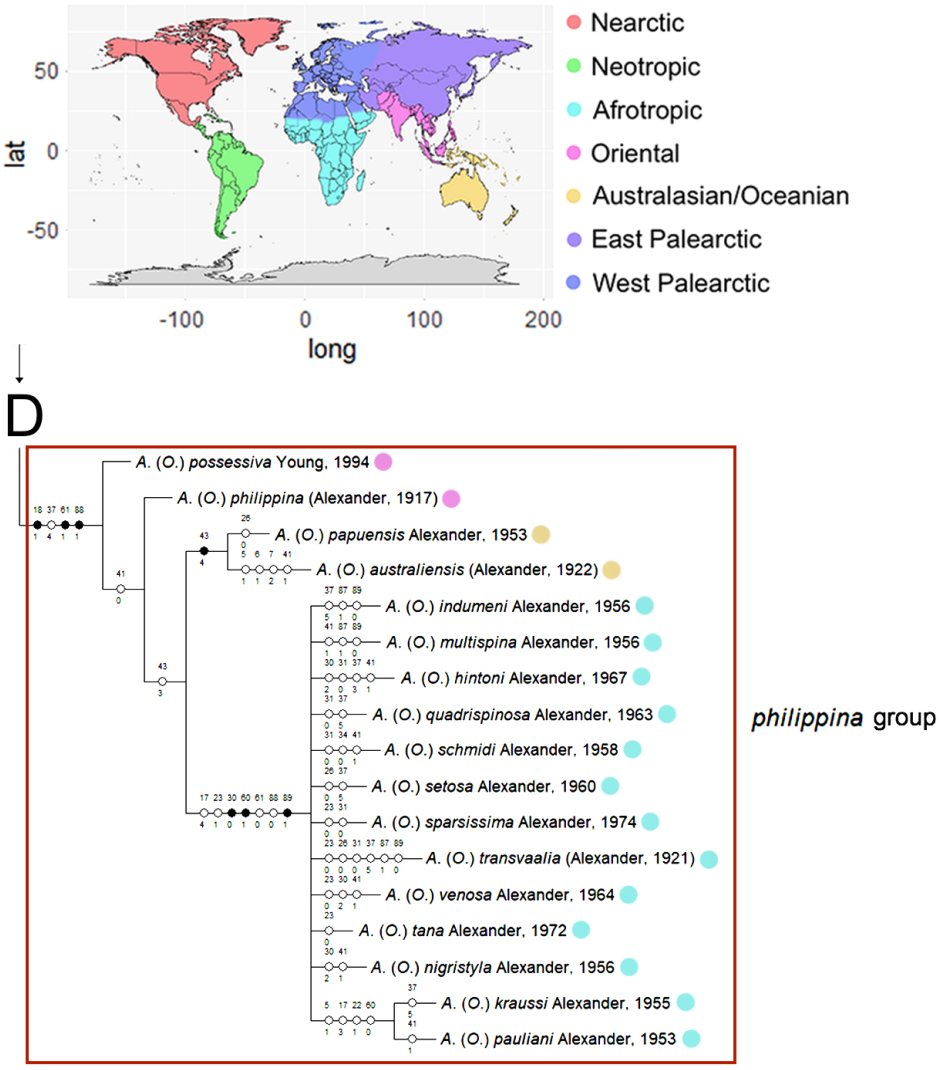


**Figure 55.** The strict consensus cladogram of the 1000 most parsimonious cladograms acquired by EW. Black circles – apomorphies, open circles – homoplastic synapomorphies. Digits above circles – numbers of the characters, below – state of the character.

Species of this group:
*Antocha* (*Orimargula*) *australiensis* (Alexander, 1922)
*Antocha* (*Orimargula*) *brevicornis* Alexander, 1960
*Antocha* (*Orimargula*) *hintoni* Alexander, 1967
*Antocha* (*Orimargula*) *indumeni* Alexander, 1956
*Antocha* (*Orimargula*) *kraussi* Alexander, 1955
*Antocha* (*Orimargula*) *melina* Alexander, 1957

*Antocha* (*Orimargula*) *minuscula* Alexander, 1963
*Antocha* (*Orimargula*) *multispina* Alexander, 1956
*Antocha* (*Orimargula*) *nigristyla* Alexander, 1956
*Antocha* (*Orimargula*) *papuensis* Alexander, 1953
*Antocha* (*Orimargula*) *pauliani* Alexander, 1953
*Antocha* (*Orimargula*) *pedekiboana* Lindner, 1958
*Antocha* (*Orimargula*) *philippina* (Alexander, 1917)
*Antocha* (*Orimargula*) *possessiva* Young, 1994
*Antocha* (*Orimargula*) *praescutalis* Alexander, 1936
*Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963
*Antocha* (*Orimargula*) *schmidi* Alexander, 1958
*Antocha* (*Orimargula*) *setosa* Alexander, 1960
*Antocha* (*Orimargula*) *sparsissima* Alexander, 1974
*Antocha* (*Orimargula*) *tana* Alexander, 1972
*Antocha* (*Orimargula*) *tasmanica* (Alexander, 1928)
*Antocha* (*Orimargula*) *transvaalia* (Alexander, 1921)
*Antocha* (*Orimargula*) *venosa* Alexander, 1964

Two similar species, *A.* (*O.*) *kraussi* and *A.* (*O.*) *pauliani*, are distributed in Madagascar. The absence of the outer gonostylus distinguishes these species, which differs in their inner branch of paramere: the inner branch of paramere is about two times shorter than the interbase in *A.* (*O.*) *kraussi*, while the length of the inner branch of paramere is similar to the interbase in *A.* (*O.*) *pauliani*. Species that have one vertical sulcus along the ninth tergite are *A.* (*O.*) *papuensis*, *A.* (*O.*) *philippina*, *A.* (*O.*) *possessiva*, *A.* (*O.*) *australiensis* and *A.* (*O.*) *tasmanica*. A dark pterostigma of the wing is found in *A.* (*O.*) *australiensis* and in *A.* (*O.*) *tasmanica*. The dark pterostigma is absent in the other three species (*A.* (*O.*) *papuensis*, *A.* (*O.*) *philippina*, *A.* (*O.*) *possessiva*). *A.* (*O.*) *tasmanica* differs from *A.* (*O.*) *australiensis* in its larger size and heavily spotted wings. A long inner branch of paramere, but not shorter than the outer gonostylus is found in *A.* (*O.*) *possessiva*, while it is fused with a phallosomic tube in *A.* (*O.*) *papuensis* and it is shorter than the outer gonostylus in *A.* (*O.*) *philippina*. Other examined species have a Y-shaped sulcus of the ninth tergite, and the number of stripes on the thorax is particularly important in the identification of these species. A brownish grey prescutum with two nearly confluent intermediate brown stripes vaguely separated by a pale line is found in *A.* (*O.*) *nigristyla*. One dark stripe on the prescutum is found in *A.* (*O.*) *tana* and in *A.* (*O.*) *quadrispinosa*. These species differ from each other by the outer gonostylus, which in *A.* (*O.*) *tana* is almost straight and curved only at apex, while it is slightly curved and gradually narrows to a sharp point in *A.* (*O.*) *quadrispinosa*. A prescutum

with three darker stripes is found in *A.* (*O.*) *multispina* and in *A.* (*O.*) *venosa*. An important feature in these species identification is the width of the aedeagus – half of the phallosomic tube is broad in *A.* (*O.*) *multispina* and less than half of the phallosomic tube is broaden *A.* (*O.*) *venosa*. Stripes of the prescutum are absent in *A.* (*O.*) *indumeni, A.* (*O.*) *hintoni, A.* (*O.*) *setosa, A.* (*O.*) *sparsissima, A.* (*O.*) *transvaalia and A.* (*O.*) *schmidi*. Cross vein *m-cu* is more than two times shorter than the distance between it and the base of the opened cell *dm* in *A.* (*O.*) *transvaalia, A.* (*O.*) *schmidi* and *A.* (*O.*) *setosa*. The outer gonostylus is narrower than the inner gonostylus in *A.* (*O.*) *schmidi* and *A.* (*O.*) *setosa,* but it is as wide as the inner gonostylus in *A.* (*O.*) *transvaalia.* Two species, *A.* (*O.*) *schmidi,* and *A.* (*O.*) *setosa,* differ by the length of gonocoxite, which is approximately 1.9 times longer than the phallus in *A.* (*O.*) *schmidi* and approximately 1.3 times longer than the phallus in *A.* (*O.*) *setosa*. Cross vein *m-cu,* which is less than two times shorter than the distance between it and the base of opened cell *dm,* is in *A.* (*O.*) *indumeni, A.* (*O.*) *hintoni* and *A.* (*O.*) *sparsissima*. The apex of the aedeagus opens as an obliquely truncated tube in *A.* (*O.*) *hintoni* and in *A.* (*O.*) *sparsissima,* while it is rounded with small clefts in *A.* (*O.*) *indumeni*. An important feature in the identification of these species is the outer gonostylus which is narrow along all its length and acute at the apex in *A.* (*O.*) *hintoni,* but gradually narrows to an acute apex in *A.* (*O.*) *sparsissima.* Genital structures are unknown in the other five *Orimargula* species: *A.* (*O.*) *brevicornis, A.* (*O.*) *melina, A.* (*O.*) *minuscula, A.* (*O.*) *pedekiboana* and *A.* (*O.*) *praescutalis*, but it was decided that these species belong to the *philippina* group due to their short antenna.

### 3.1.5. Species of unknown position

*Antocha* (*Antocha*) *biacus* Savchenko, 1981 was described from 16 males and four females. This species is distributed in Tajikistan. Due to inexact illustrations however, this species was not examined in the phylogenetic analysis. According to Savchenko (1981), *A.* (*A.*) *biacus* is similar to *A.* (*A.*) *lindneri*. This species has a phallus and probably belongs to *turkestanica* group.

*Antocha* (*Antocha*) *bidigitata* Alexander, 1954 was described from one male. This species is distributed in Japan. Due to inexact illustrations and artefacts of the slide of the holotype, this species was not included to the phylogenetic analysis. According to Alexander (1954), *A.* (*A.*) *bidigitata* is similar to *A.* (*A.*) *brevinervis* and *A.* (*A.*) *dilatata*. These species belong to

different groups, so the position of *A.* (*A.*) *bidigitata* in the phylogenetic tree remains unclear.

*Antocha* (*Antocha*) *biobtusa* Alexander, 1968 was described from one male and it is distributed in India. According to Alexander (1968), this species is similar to other regional species, but due to inexact illustrations and description, the position of *A.* (*A.*) *biobtusa* in the genus phylogeny is not known.

*Antocha* (*Antocha*) *chonsaniana* Podenas, 2015 was described from two males and three females, it is distributed in North Korea. According to Podenas (2015), this species is similar to *A.* (*A.*) *dilatata* and probably belongs to the *turkestanica* group, but not all characters important for phylogenetic analysis are visible in the illustrations and thus this species was not included in the analysis.

*Antocha* (*Antocha*) *decussata* Alexander, 1973 was described from one male. This species is distributed in India. This species was not included in phylogenetic analysis due to inexact illustrations and description. According to Alexander (1973), *A.* (*A.*) *decussata* is similar to *A.* (*A.*) *bifida, A.* (*A.*) *dafla and A.* (*A.*) *turkestanica*. These species belong to different groups, so the position of *A.* (*A.*) *decussata* in the phylogenetic tree remains to be determined.

*Antocha* (*Antocha*) *flavidibasis* Alexander, 1938 was described from one female and it is distributed in China. According to Alexander (1938), this species is similar to *A.* (*A.*) *nebulipennis*, but because of unknown male characters of the genital structures, the position of this species remains unclear.

*Antocha* (*Antocha*) *longispina* Alexander, 1969 was described from one male and it is distributed in India. According to Alexander (1969), this species is similar to *A.* (*A.*) *perstudiosa*, but due to the inexact description and illustrations, the position of *A.* (*A.*) *longispina* in the genus phylogeny is not known.

*Antocha* (*Antocha*) *madrasensis* Alexander, 1970 was described from one male. This species is distributed in India. Because of the inexact description and artefacts in the slide of the male genitalia, this species was not included in the phylogenetic analysis. According to Alexander (1970), there is no close relative known.

*Antocha* (*Antocha*) *pachyphallus* Alexander, 1971 was described from one male and it is distributed in India. According to Alexander (1971), this species is similar to *A.* (*A.*) *angusticellula* and probably belongs to the *setigera* group, but because not all characters important for the phylogenetic

analysis are visible in the illustrations, this species was not included in the analysis.

*Antocha* (*Antocha*) *parvicristata* Alexander, 1971 was described from three males. This species is distributed in India. Due to inexact illustrations and description, this species was not included in phylogenetic analysis, so the position in the phylogenetic tree remains unclear.

*Antocha* (*Antocha*) *peracuta* Alexander, 1971 was described from one male. This species is distributed in India. Due to inexact illustrations and description, this species was not included in the phylogenetic analysis and the position of *A.* (*A.*) *peracuta* in the phylogenetic tree remains unclear.

*Antocha* (*Antocha*) *perstudiosa* Alexander, 1958 was described from two males from Nepal. According to Alexander (1958), this species is similar to *A.* (*A.*) *studiosa*, but because of inexact illustrations and description, the position of *A.* (*A.*) *perstudiosa* in the genus phylogeny is not known.

*Antocha* (*Antocha*) *pictipennis* Alexander, 1949 was described from one female and it is distributed in China. According to Alexander (1949), this species is closely related to *A.* (*A.*) *khasiensis* and *A.* (*A.*) *nigribasis*. Probably this species belongs to the *nigribasis* group.

*Antocha* (*Antocha*) *picturata* Alexander, 1936 was described from two females and is distributed in China. As both the male and characters of the genital structures are unknown, the position of this species remains unclear.

*Antocha* (*Antocha*) *plumbea* Alexander, 1936 was described from one female and it is distributed in Indonesia. According to Alexander (1936), this species is most generally similar to *A.* (*A.*) *javenensis* and probably belongs to *javanensis* group, but as the male is unknown, this species was not included in the phylogenetic analysis.

*Antocha* (*Antocha*) *postnotalis* Alexander, 1974 was described from one female and it is distributed in India. According to Alexander (1974), this species is similar to *A.* (*A.*) *perstudiosa* and belongs to the *nigribasis* group, but because the male is unknown, this species was not included in phylogenetic analysis.

*Antocha* (*Antocha*) *retracta* Edwards, 1933 was described from one male and one female and is distributed in Malaysia. According to Edwards (1933), this species is similar to *A.* (*A.*) *thienemanni*, but because of a lack of illustrations and lack of information in the description, this species was not included in the phylogenetic analysis.

*Antocha* (*Antocha*) *scapularis* Alexander, 1968 was described from seven males and is distributed in India. According to Alexander (1968), this species is similar to *A.* (*A.*) *turkestanica* and probably belongs to

*turkestanica* group, but because not all characters important the phylogenetic analysis are visible in the illustrations, this species was not included in analysis.

*Antocha* (*Antocha*) *studiosa* Alexander, 1951 was described from one male and two females. It is distributed in India. According to Alexander (1951), this species is similar to *A.* (*A.*) *basivena*, but due to inexact illustrations and description, the position of *A.* (*A.*) *studiosa* in the genus phylogeny is not unknown.

*Antocha* (*Antocha*) *taiwanensis* Podenas and Young, 2015, was described from two males and it is distributed in Taiwan. According to Podenas and Young (2015), this species is similar to *A.* (*A.*) *bidigitata*, but because not all characters important for phylogenetic analysis are visible in the illustrations, this species was not included in the analysis.

*Antocha* (*Antocha*) *thienemanni* Alexander, 1931 was described from one female and it is distributed in Indonesia. According to Alexander (1931), this species is similar to *A.* (*A.*) *flavella*, but because the male is unknown, this species was not included in the phylogenetic analysis and the position in the genus *Antocha* is unclear.

*Antocha* (*Antocha*) *triangularis* (Brunetti, 1912) was described from one female and is distributed in India. Because of the unknown male, this species was not included in the phylogenetic analysis, and its position in the genus *Antocha* remains unclear.

*Antocha* (*Antocha*) *unilineata* Brunetti, 1912 was described from one female and is distributed in India. As the male is unknown, this species was not included in the phylogenetic analysis and the position in the genus *Antocha* is unknown.

*Antocha* (*Orimargula*) *flavella flavella* (Alexander, 1926) was described from one female and is distributed in China. As the male is unknown, it was not included in the phylogenetic analysis and its position in the genus *Antocha* remains unknown.

*Antocha* (*Orimargula*) *flavella fuscolineata* (Alexander, 1926) was described from one male and one female. This subspecies is distributed in China. Due to inexact illustrations and description, this subspecies was not examined in the phylogenetic analysis.

*Antocha* (*Orimargula*) *gracilipes* (Alexander, 1927) was described from one female and is distributed in India. As the male is unknown, this species was not included in the phylogenetic analysis, but because of the long antenna, it should belong to the *longicornis* group.

*Antocha* (*Orimargula*) *griseipennis* (Alexander, 1920) was described from three females and is distributed in Ethiopia. The male is unknown, so

this species was not included in the phylogenetic analysis and its position in the phylogenetic tree remains unclear.

*Antocha* (*Orimargula*) *maculipleura* Edwards, 1933 was described from one female and it is distributed in Malaysia. As the male is unknown, this species was not examined in phylogenetic analysis, but because of its short antenna, it should belong to the *philippina* group.

### 3.1.6. Results of species delimitation

In modern taxonomy, it is accepted that the use of multiple lines of evidence are more effective in the diagnosis, delimitation and even the description of species (Valdez-Mondragón, 2020). Molecular methods have provided a new way to resolve species delimitation problems by using the infraspecific genealogical information in DNA markers, which provide objective implementation of modern species concepts (Valdez-Mondragón et al., 2019). The molecular delimitation methods using mitochondrial markers have not been used in the genus *Antocha* so far.

The analysed matrix of CO1 includes 63 terminals. Specimens used in this analysis, BoldSystems (Ratnasingham & Hebert, 2007) accession numbers and countries of the samples used are listed in Fig 56. The multiple molecular methods together with the morphology of the sexual structures, traditionally used for identification and delimitation at the species level in *Antocha*, help to separate the species.

PTP uses substitution calibrated (not ultrametric) trees to avoid the potential flaws in constructing time-calibrated phylogenies, as was proposed by Zhang et al. (2013). In this work, the Bayesian variant of the method (bPTP) was employed, which was also concordant with morphology and the other molecular methods, recovering a total of 23 species (Fig. 56). The ASAP is a species delimitation method that proposes partitions of species hypotheses using genetic distances, which are calculated between DNA sequences (Puillandre et al., 2020) (Fig. 56). This method uses cursive partitioning with a range of prior intraspecific divergence and relative gap width, which is used to estimate the threshold between intra- and interspecific variation, producing species level groupings (Valdez-Mondragon & Cortez-Roldan, 2021). This method also recovers the new species *A.* (*A.*) n. sp. (Fig. 56). The ASAP method was discordant with the other method the number of total number of species, which is shown, is 22 while results of bPTP (ML, IB) shows 23 species (Fig. 56).

Two species, *A.* (*A.*) *fortidens* and *A.* (*A.*) *nebulipennis immaculata*, were shown as the same species after ASAP analysis. However, according to

genital structures and analysis of the bPTP (ML, IB) method, it is shown that these species are different.

Results of the used methods revealed that one species, *A.* (*A.*) *vitripennis*, is divided into two species, which helps to prove the hypothesis that there are not one, but two species in the subgenus *Antocha* (s. str.) in Europe. Two similar species were described *A.* (*A.*) *vitripennis* and *A.* (*A.*) *fulvescens*, but later *A.* (*A.*) *fulvescens* was synonymized as *A.* (*A.*) *vitripennis*. The main differences between these species are the apex of the outer gonostylus and distribution. In the Northern Europe, the apex of the outer gonostylus in *A.* (*A.*) *vitripennis* gradually narrows to the acute point, while it is clefted and consists of a small bump and a longer spine in individuals from Southern Europe. In species delimitation analyses, *A.* (*A.*) *vitripennis* from Lithuania, Finland, Norway, the United Kingdom and France were used, showing that specimens from France do not belong to *A.* (*A.*) *vitripennis*, while the other specimens belong to this species.

Additionally, two very similar species, *A.* (*A.*) *satsuma* and *A.* (*A.*) *yeongwola*, were shown as belonging to the same species by the results of ASAP and bPTP (ML, IB) analyses. The main differences between these species are body colour and the number of stripes on the prescutum. According to Podenas (2016), *A.* (*A.*) *satsuma* has a brown body and three longitudinal stripes on the prescutum, while *A.* (*A.*) *yeongwola* has a yellow body and one longitudinal stripe on the prescutum. It is known that *A.* (*A.*) *satsuma* is distributed in South Korea and Japan, while *A.* (*A.*) *yeongwola* has been found only in South Korea.

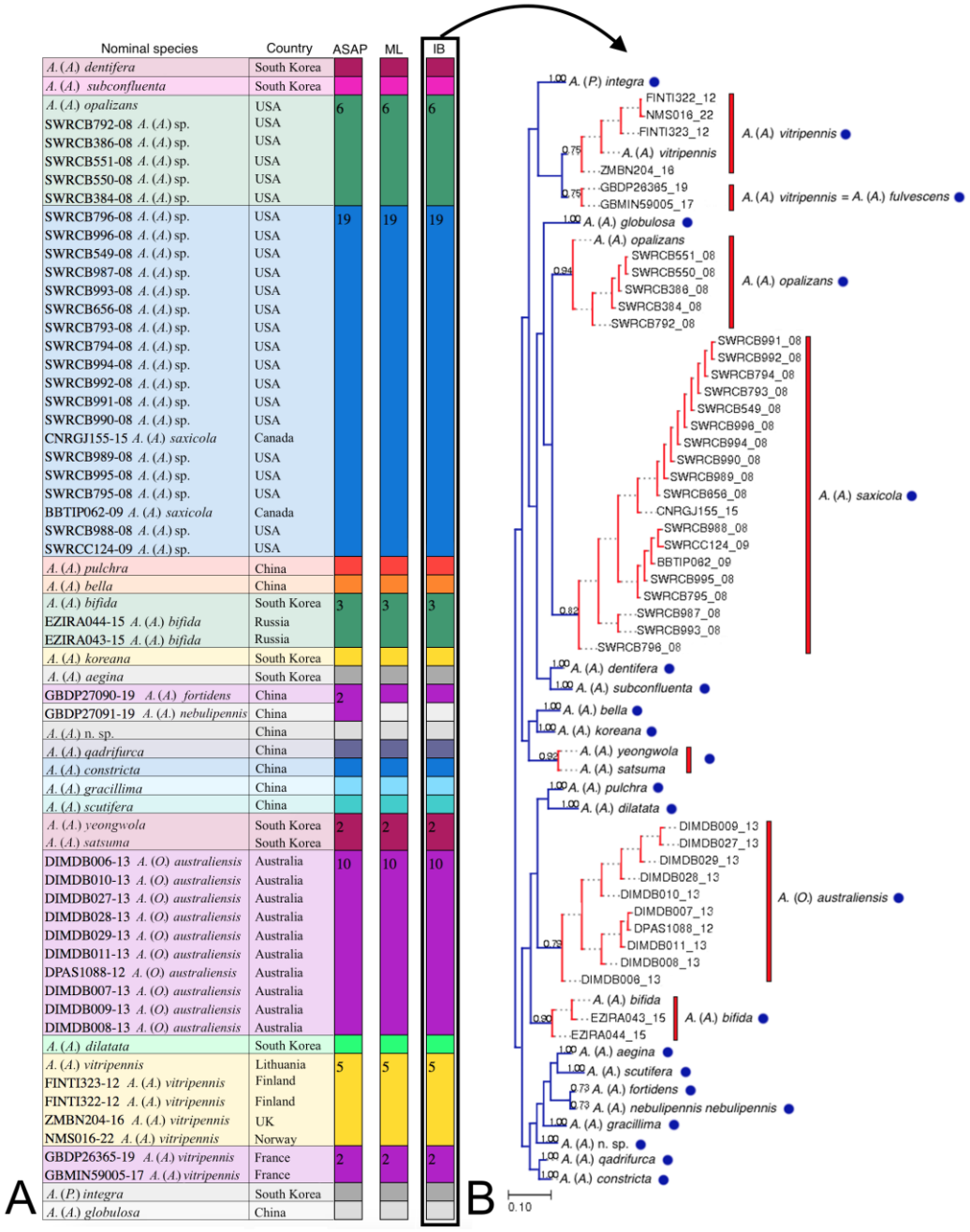


**Figure 56.** A – results of the ASAP, bPTP (ML, IB) species delimitation analyses. Numbers within bars and colours represent the number of samples of the same species contained within each partition; B – the phylogenetic tree is the highest Bayesian supported solution by the bPTP species delimitation analyses. Blue dots represent the species. Red lines represent

the different samples of the same species. Bayesian posterior probabilities are shown when ≥ 0.50, respectively

### 3.1.7. Results of COI gene analysis

Molecular analysis (Fig. 57) has shown that morphology-related species are also close in their nucleic acid sequences of COI. Not all species and their groups in the morphological phylogenetic tree match the phylogenetic tree of COI.

Clade A includes species characterized by well-developed parameral lateral structures of the aedeagus, which are connected with the aedeagus. The genetic distance between *A.* (*A.*) *quadrifurca* and *A.* (A.) *constricta* is 4.59%; morphologically, these species are distinguished by the number and shape of branches of the parameral lateral structures of the aedeagus, and the apex of the aedeagus looks like a lyrate plate. The genetic distance between *A.* (*A.*) *scutifera* and *A.* (*A.*) *aegina* is 9.7%. According to Alexander (1973), *A.* (*A.*) *scutifera* resembles *A.* (*A.*) *quadrifuca*, but the genetic distance between these species is higher (11.11%). *A.* (*A.*) *scutifera* and *A.* (*A.*) *aegina* are morphologically distinguished by a loop-shaped interbase. *A.* (*A.*) *aegina* is also close to the undescribed species *A.* (*A.*) sp. (the genetic distance is 7.94%), these species have twisted ends of the prolonged parameral lateral structures of the aedeagus. *A.* (*A.*) *gracillima* is inserted between *A.* (*A.*) sp. and *A.* (*A.*) *aegina* + *A.* (*A.*) *scutifera*. The genetic distance between *A.* (*A.*) *gracillima* and *A.* (*A.*) sp. is 10.6% and between *A.* (*A.*) *gracillima* and *A.* (*A.*) *scutifera* is 11.21%. The genetic distance between the COI gene fragments of *A.* (*A.*) *nebulipennis immaculata* and *A.* (*A.*) *fortidens* is 2.47%. These two species are characterized by two lobes on the caudal margin of the ninth tergite, and the tip of the aedeagus is without any additional structures. As in morphological phylogenetic tree, these two species are grouped in the same clade. All mentioned species are distributed in Asia. *A.* (*A.*) *gracillima* in the morphology-based phylogenetic tree belongs to the *gracillima* group. In the next clade are the other species: *A.* (*A.*) *scutifera*, *A.* (*A.*) *quadrifurca*, and *A.* (*A.*) *constricta* belong to the *constricta* species group. Morphologically very similar species *A.* (*A.*) *aegina* and *A.* (*A.*) sp. belong to the *spiralis* group, *A.* (*A.*) *nebulipennis immaculata*, and *A.* (*A.*) *fortidens* belong to the *nebulipennis* group.

Clade B includes species characterized by the phallus except for *A.* (*A.*) *pulchra*, which is distinguished by a wide aedeagal sheath with four horn-like structures. The sister clade of *A.* (*A.*) *bifida* is (*A.* (*O.*) *australiensis* (*A.* (*A.*) *dilatata* + *A.* (*A.*) *pulchra*). *A.* (*A.*) *bifida* has a reduced inner branches of

parameres and a bidentate ninth tergite; this species is distributed in Asia. One species of the subgenus *Orimargula* is inserted between species of the subgenus *Antocha* (s. str.). The genetic distance between *A.* (*O.*) *australiensis* and *A.* (*A.*) *dilatata* is 12.72%. Species that are grouped together are *A.* (*A.*) *pulchra* and *A.* (*A.*) *dilatata*. The genetic distance between the COI gene fragments of these species is 10.60%. Most of these species are distributed in Asia, while *A.* (*O.*) *australiensis* is distributed in Australia. *A.* (*A.*) *bifida* and *A.* (*A.*) *dilatata* are observed to belong to the same clade, the *turkestanica* group, in both phylogenetic trees, while the other species are grouped differently: *A.* (*A.*) *pulchra* belongs to the *styx* group and *A.* (*O.*) *australiensis* belongs to the *philippina* group.

Clade C includes six species. Two species, *A.* (*A.*) *dentifera* and *A.* (*A.*) *subconfluenta*, are morphologically very similar and are found in South Korea. The genetic distance between these species is 8.11%. *A.* (*A.*) *dentifera* has a spine on the outer gonostylus, which is not found in *A.* (*A.*) *subconfluenta*. Compared with the morphological phylogenetic tree, *A.* (*A.*) *saxicola* and *A.* (*A.*) *opalizans* morphologically are not similar and belong to different species groups, but both of these species are distributed only in the USA, and the genetic distance between them is 10.23%. Only one common character between *A.* (*A.*) *globulosa* and *A.* (*P.*) *integra* is a distribution. Both species are found in Asia. The genetic distance between *A.* (*A.*) *globulosa* and *A.* (*P.*) *integra* is high – 14.51%. Comparing the morphological tree and molecular phylogenetic tree, two species, *A.* (*A.*) *dentifera* and *A.* (*A.*) *subconfluenta*, belong to the same clade, the *dentifera* group. *A.* (*A.*) *saxicola* belongs to the *saxicola* group and *A.* (*A.*) *opalizans* belongs to the *biarmata* group. *A.* (*P.*) *integra* belongs to the subgenus *Proantocha* and *sagana* group.

Clade D includes species characterized by the aedeagal sheath, it is reduced only in *A.* (*A.*) *bella* and *A.* (*A.*) *koreana* (the genetic distance between these species is 9.7%). The genetic distance between *A.* (*A.*) *yeongwola* and *A.* (*A.*) *satsuma* is very low – 0.53%, but these species differ in longitudinal stripes on the mesonotal prescutum. All species are distributed in Asia.

Clade E includes two species, *A.* (*A.*) *vitripennis* and *A.* (*A.*) *fulvescens*. These species are distributed in Europe and the genetic distance between these species is 2,29%. *A.* (*A.*) *vitripennis*, *A.* (*A.*) *fulvescens*, *A.* (*A.*) *yeongwola* and *A.* (*A.*) *satsuma* morphologically are very similar and belong to the *vitripennis* species group, while *A.* (*A.*) *bella* with *A.* (*A.*) *koreana* are also grouped together in the *indica* group.

According to posterior probabilities, this molecular phylogenetic tree has disadvantages in species grouping, which probably are caused by a lack of sequences of more species.

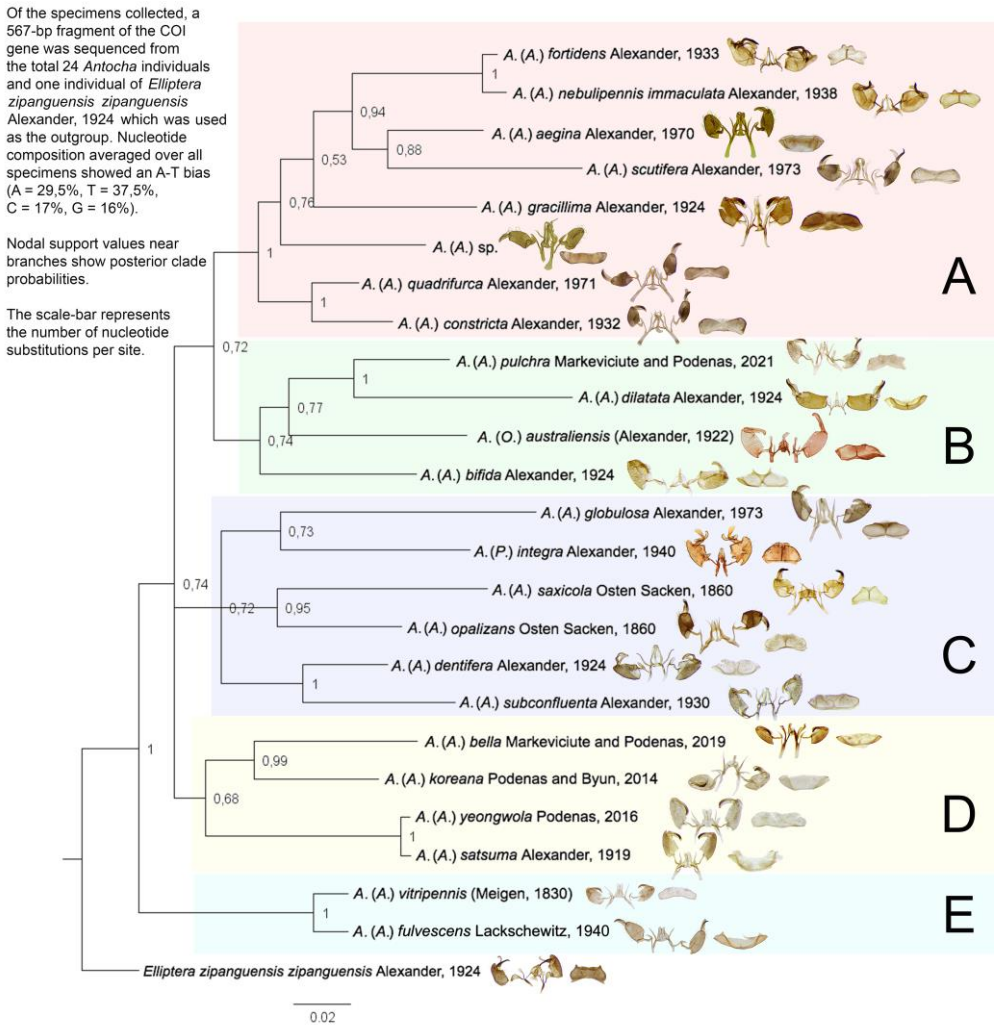


**Figure 57.** Bayesian phylogenetic tree constructed using 567 bp mitochondrial cytochrome c gene sequences of 24 genus *Antocha* species and one *Elliptera zipanguensis zipanguensis* Alexander, 1924 used as the outgroup. Posterior probabilities > 0.5 are indicated in the tree. Morphological structures and species names are given. Colorful boxes indicate different clades of grouped species.

## 3.2. A review of taxonomic changes in the genus *Antocha*

### 3.2.1. New species

Two new species of the genus *Antocha* (s. str.) were described *A.* (*A.*) *bella* Markevičiūtė & Podenas, 2019 and *A.* (*A.*) *pulchra* Markevičiūtė & Podenas, 2021.

***Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019**

"**Diagnosis.** Medium-sized brown species with light brownish white wing, pterostigma light brown; gonocoxite cylindrical; outer gonostylus arched, rounded apex, inner gonostylus as wide as outer gonostylus; interbase oblong, rounded at apex; aedeagus oblong with curved apex, inner branch of paramere spiral-shaped.

**Type material. HOLOTYPE** male (in ethanol): China, W. Sichuan, Road Daocheng/Litang, altitude 4100 m, N29°36.788′, E100°19.825′, 2016.V.11, coll. Floriani & Saldaitis (NRC). **PARATYPES:** 1 male, 4 females (in ethanol), topotypic (NIBR)."

"**Etymology.** The word "bella" comes from Italian and Latin languages and means "beautiful". This word was chosen because of inner branches of parameres twisted into decorative spirals.

**Elevation range in China.** Specimens were collected at 4100 m.

**Habitat.** Small streams surrounded by mountainous mixed forest dominated by various conifer trees, bushes and Rhododendron.

**Distribution.** Known only from Sichuan, China.

**Remarks.** Some features of *A.* (*A.*) *bella* morphology are similar to other species: *A.* (*A.*) *streptocera* Alexander, 1949 known from China and Taiwan; *A.* (*A.*) *indica* Brunetti, 1912 known from India, China and Malaysia; *A.* (*A.*) *shansiensis* Alexander, 1954 known from China; *A.* (*A.*) *spiralis* Alexander, 1932 known from India and China; *A.* (*A.*) *aegina* Alexander, 1970 known from India. The male genitalia of *A. bella* are unique in that the inner branch of paramere is twisted into a spiral and its tip extends a little below the tip of the aedeagus. Usually, the aedeagus in *Antocha* is a more or less complicated, curved or flattened structure, but in *A.* (*A.*) *bella* it is simple, oblong and curved at the apex. The inner branch of paramere is complicated structure, with the tip in most *Antocha* above or below the tip of the aedeagus. Similar twisted into a spiral structure of the aedeagus also occur in *A.* (*A.*) *spiralis* and *A.* (*A.*) *aegina*, but these species have differently shaped other structures of the aedeagal complex. In *A.* (*A.*) *spiralis* the inner branch of paramere is very slender, with a subterminal spine on the outer margin that is much smaller and weaker than the lateral

structures of the aedeagus. The aedeagus is simple, very slender, with lateral structures before the apex twisted into a complete spiral turn. In *A.* (*A.*) *bella* the inner branches of parameareares wider than the lateral structures of the aedaegus in *A.* (*A.*) *spiralis*. The outer gonostylus in both *A.* (*A.*) *spiralis* and *A.* (*A.*) *bella* is blunt tipped. In *A.* (*A.*) *aegina* the lateral structures of the aedeagus are twisted into a single tight spiral before the long terminal spine, the inner branch of paramere is a long, slender, simple spine that narrows very gradually into a long point, with several pale erect subapical setulae. In *A.* (*A.*) *bella* one pair of inner branches of parameres is twisted into a single stocky spiral before a short apex. The antenna of *A.* (*A.*) *bella* has oval flagellar segments wider ventrally, with apical two segments cylindrical. Similar shaped antennae are found in *A.* (*A.*) *streptocera*, *A.* (*A.*) *indica* and *A.* (*A.*) *shansiensis*, but these species have different structures of the aedeagal complex."

***Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021**

"**Diagnosis.** Medium-sized, greyish brown species with subhyaline, milky wing, pterostigma absent; gonocoxite cylindrical; outer gonostylus arched, unequally bifid at apex; inner gonostylus as wide as outer gonostylus; interbase oblong, rounded at apex; inner branch of paramere needle-like, narrowed to acute point; aedeagus oblong, rounded at apex and covered by aedeagal sheath with four horn-like structures.

**Type material. HOLOTYPE** ♂ (in ethanol): CHINA, Sichuan, Emei Mt., N29.583720, E103.286880, H-1311 m, 2018.VII.12, leg. Starkevich (NRC). **PARATYPE** ♂ (in ethanol) CHINA, Sichuan, Emei Mt., N29.583720, E103.286880, H-1311 m, 2018.VII.12, leg. Starkevich (NIBR)."

"**Etymology.** The word "pulchra" comes from Latin and means "beautiful". This word was chosen because of the beautiful shape of the aedeagal sheath with horn-like structures, which covers the aedeagus.

**Elevation range in China.** Specimens were collected at 1311 m altitude.

**Habitat.** Mountainous mixed forest near Lengshui river.

**Distribution.** Sichuan, China.

**Remarks.** Some structures of the male genital complex *A.* (*A.*) *pulchra* are unique in comparison to other species of this genus. While the aedeagus in *Antocha* has a relatively complicated, curved or flattened structure, *A.* (*A.*) *pulchra* is simple, oblong, rounded at apex. The parameral structures are simple or complex, appearing to be connected with the aedeagal lateral structures or cover the aedeagus as a wide aedeagal sheath. In *A.* (*A.*)

*pulchra* the aedeagus is covered by a unique aedeagal sheath, which has four horn-like structures. The inner branch of paramere in this genus is also a complex structure with twisted, bifurcated, acute blunt or subacute apex, but in *A. pulchra* it is a simple needle-like structure.

The morphology of some features like the outer gonostylus, inner branche of paramere and aedeagal sheath of *A.* (*A.*) *pulchra* sp. nov. is similar to other species of *Antocha* (s. str) such as: *A.* (*A.*) *alexanderi* Oosterbroek, 2009, *A.* (*A.*) *platystylis* Alexander, 1974, *A.* (*A.*) *studiosa* Alexander, 1951, *A.* (*A.*) *latifurca* Alexander, 1969, *A.* (*A.*) *perattenuata* Alexander, 1971, *A.* (*A.*) *longispina* Alexander, 1969, *A.* (*A.*) *mysorensis* Alexander, 1974 found in India and *A.* (*A.*) *perstudiosa* Alexander, 1958 from Nepal. *A.* (*A.*) *platystylis* is similar to *A.* (*A.*) *pulchra* on basis of the structure of the simple aedeagus and inner branch of paramere, but the outer gonostylus and tergite 9 of the former species are shaped differently. Also, the aedeagal sheath in *A.* (*A.*) *pulchra* has four horn-like structures and in *A.* (*A.*) *platystylis* this structure appears as a subtending plate, which is pale to nearly hyaline outwardly, with outer angles extended into two acute pale points. The outer gonostylus of *A.* (*A.*) *pulchra* is sclerotised, slightly arched and unequally bifid at the apex. A very similar outer gonostylus is found in species like *A.* (*A.*) *alexanderi*, *A.* (*A.*) *studiosa*, *A.* (*A.*) *latifurca*, *A.* (*A.*) *perattenuata*, *A.* (*A.*) *longispina*, *A.* (*A.*) *mysorensis*, *A.* (*A.*) *perstudiosa*, but these species have different structures of the aedeagal complex."

### 3.2.2. New species to the Chinese fauna

The Chinese fauna of *Antocha* is richly represented with 34 species (included new species) and four subspecies. A new species *Antocha* (*Antocha*) *quadrifurca* Alexander, 1971 was found by A. Saldaitis in Sichuan province in 2017 and published by R. Markevičiūtė et al. in 2021.

"***Antocha* (*Antocha*) *quadrifurca* Alexander, 1971**: 170–171 (description), 168 (illustration)

**Diagnosis.** Dark brownish grey species; antenna black, flagellar segments oblong, oval; wing subhyaline, milky, pterostigma pale brown; tergite 9 narrowly transverse without lobes; sternite 9 large, posterior border strongly convex; gonocoxite oblong, rounded; outer gonostylus short, stout, apex obliquely truncate; interbase oblong, rounded at apex; inner branch of paramere forked at apex; apex of aedeagus flattened into lyrate plate with two small bumps; lateral structures branched, connected at apex of aedeagus, inner branch approximately three times longer than outer branch.

**Material examined.** 1 ♂ (in ethanol): CHINA, W. Sichuan, road Yaan/Kangding Erlang Shan Mt., H-2161 m, N29.87340, E102.30970, 2017.IX.11–12, leg. A. Saldaitis (NRC).

**Elevation range in China.** Specimens were collected at 2161 m altitude.

**Habitat.** Small streams surrounded by mountainous mixed forest.

**Distribution.** The species was known previously only in India (Assam), and is herein newly recorded from China (Sichuan)."

### 3.2.3. Synonym or two species?

One species *Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940 became a synonym of *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830) (Geiger, 1985). According to Geiger (1985), variations in the shape of the apex of the outer gonostylus among *A.* (*A.*) *vitripennis* individuals were the main reason for synonymizing this species. 108 individuals of *A.* (*A.*) *vitripennis* were examined in the Natural History Museum, London, UK, as well as four individuals obtained from the Museum of Natural History Vienna, Austria and more than 200 individuals collected in Lithuania. Of all studied specimens, 43 were belonged to *A.* (*A.*) *fulvescens*. The examined specimens of *A.* (*A.*) *vitripennis* were collected in Lithuania, the United Kingdom, Ireland and Finland. Specimens of *A.* (*A.*) *fulvescens* were collected in Spain, Austria, Hungary, Greece and France. It was established that the apex of outer gonostylus in *A.* (*A.*) *vitripennis* gradually narrows to acute point in Northern Europe, while it is clefted and consists of a small bump and a longer spine in Southern Europe.

After analysis of mitochondrial cytochrome c gene sequences (Fig. 58), it was found that the genetic distance between *A.* (*A.*) *vitripennis* and *A.* (*A.*) *fulvescens* is 2.29%, it was accepted that it is different species as *A.* (*A.*) *fortidens* Alexander, 1933 and *A.* (*A.*) (*nebulipennis*) *immaculata* Alexander, 1938, whose genetic distance is 2.47%. The genetic distance between *A.* (*A.*) *vitripennis* from Finland and Scotland is very low, 0.53%, so these individuals belong to the same species. Species delimitation results show that *A.* (*A.*) *vitripennis* and *A.* (*A.*) *fulvescens* are different species. Due to the results of species delimitation, the genetic distance between *A.* (*A.*) *vitripennis* and *A.* (*A.*) *fulvescens* and the apparent differences between the apex of the outer gonostylus, *A.* (*A.*) *fulvescens* should be restored to a valid species.

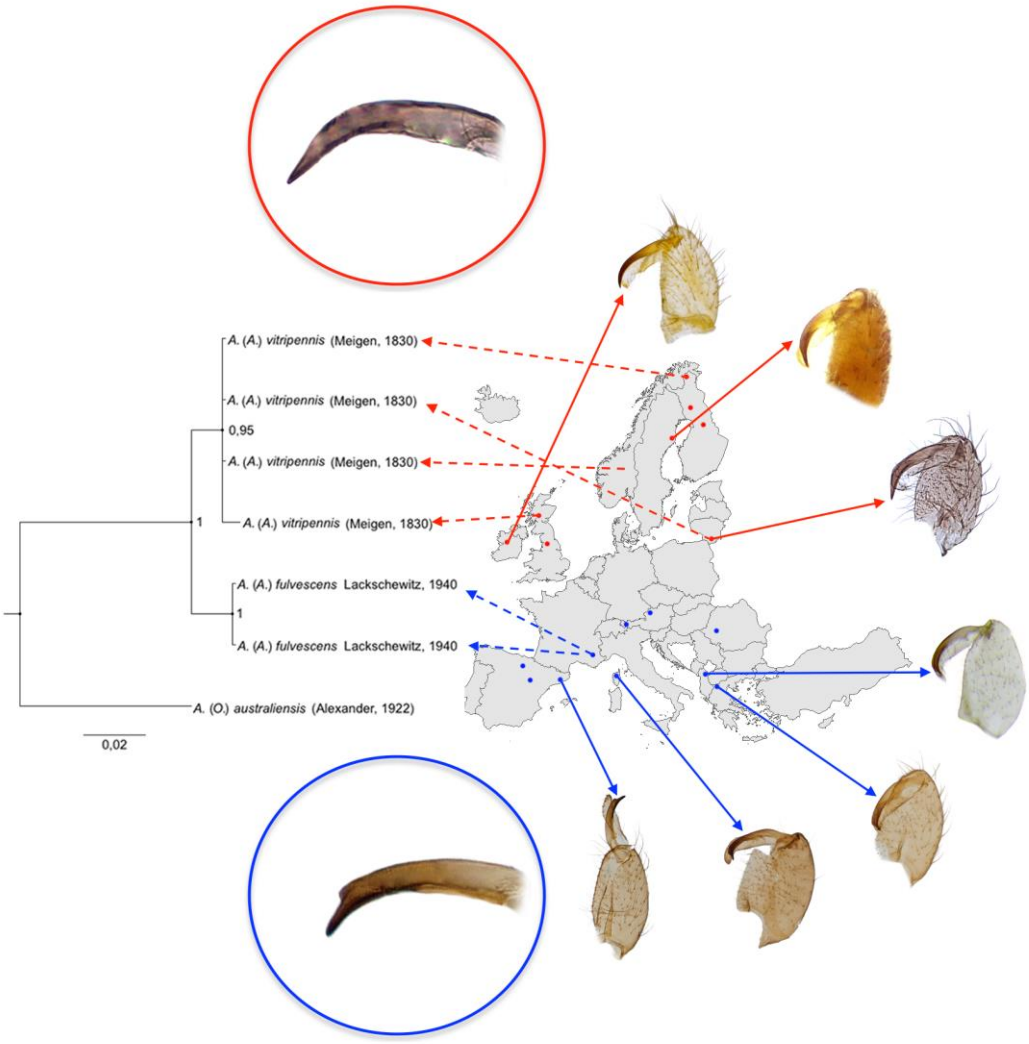


**Figure 58.** Bayesian phylogenetic tree constructed using 567 bp mitochondrial cytochrome c gene sequences of *A.* (*A.*) *fulvescens* Lackschewitz, 1940 and *A.* (*A.*) *vitripennis* (Meigen, 1830) species and one *A.* (*O.*) *australiensis* (Alexander, 1922) used as the outgroup. Posterior probabilities > 0.95 are indicated in the tree. Differences of morphological structures and distribution are shown.

# CONCLUSIONS

1. Genus *Antocha* is a monophyletic group with three subgenera: *Antocha* (s. str.), *Orimargula* and *Proantocha*.
2. Based on the performed analysis, 25 species groups were found in the genus *Antocha*, and 22 species groups were described for the first time.
3. One species – *Antocha* (*Antocha*) *brevistyla* Alexander, 1924 belongs to the subgenus *Proantocha* due to apomorphic characters: a small lobe on the gonocoxite, the specific shape of the ninth sternite, the inner branch of paramere and the gonocoxite.
4. Inner genital structures (the basal posterolateral extremite, the parameral apodeme, the sulcus of the ninth tergite) that were not investigated and illustrated earlier by other scientists allow the identification of the species groups.
5. Two species *Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019 and *Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021 from China – were described as scientifically novel.
6. *Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940 should be restored from *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830) synonym to a valid species.

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# Appendix

Subgenus *Antocha* (*Antocha*) Osten Sacken, 1860

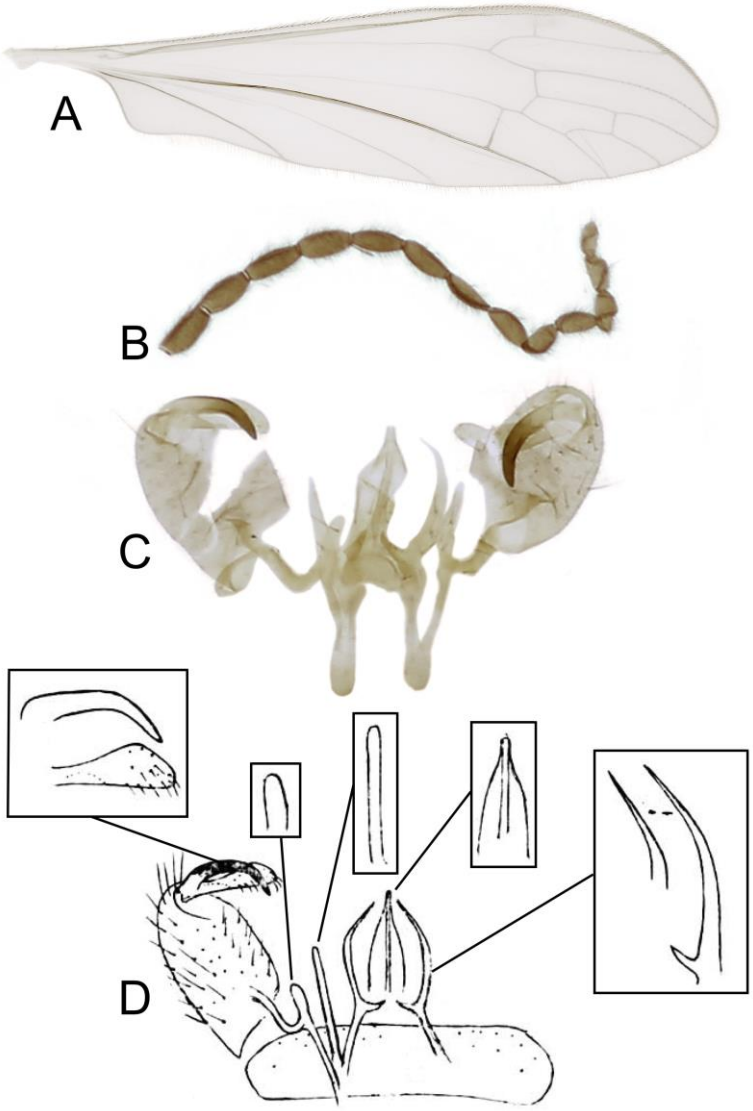


**Figure 59.** *Antocha* (*Antocha*) *aciculifera* Alexander, 1974. A – male wing, holotype; B – male antenna, holotype; C – male genital structures and aedeagus, dorsal view, holotype; D – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1974: 9 p.).

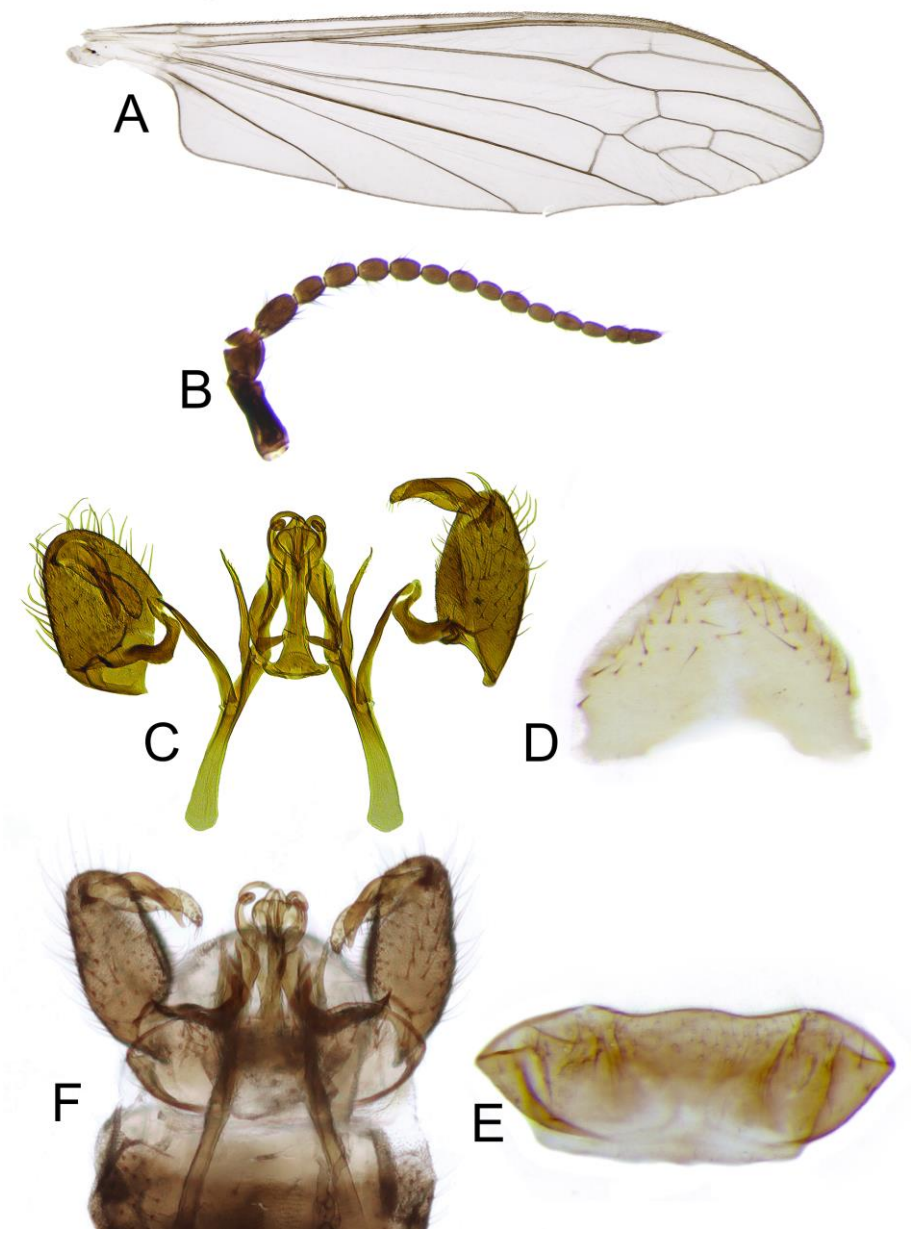


**Figure 60.** *Antocha* (*Antocha*) *aegina* Alexander, 1970. A – male wing; B – male antenna; C – male genital structures and aedeagus, dorsal view; D – male sternite 9; E – male tergite 9; F – male genitalia general, dorsal view.

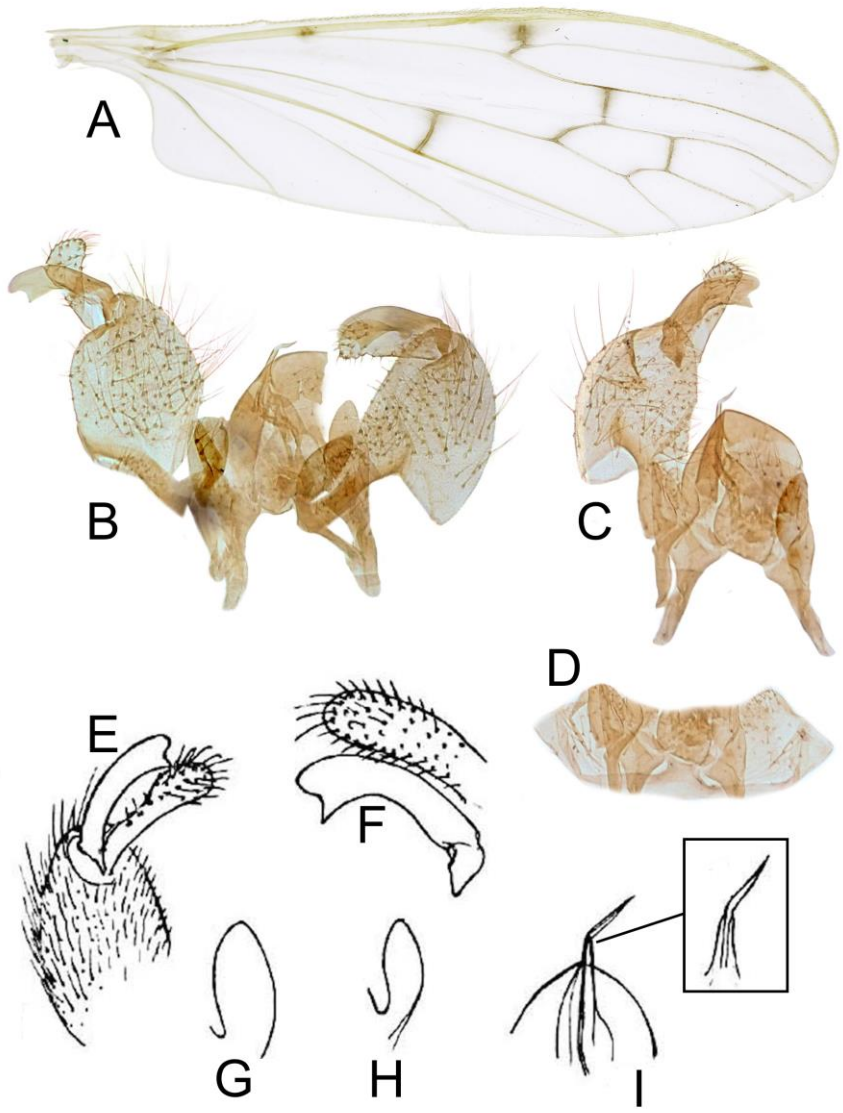


**Figure 61.** *Antocha* (*Antocha*) *alexanderi* Oosterbroek, 2009. A – male wing, holotype; B – male genital structures and aedeagus, dorsal view, paratype; C – male genital structures and aedeagus, dorsal view, holotype; D – male tergite 9, holotype; E – male gonocoxite and gonostyli (illustrated by Alexander, 1974: 9 p.); F – male inner and outer gonostyli (illustrated by Alexander, 1974: 9 p.); G, H – interbase (illustrated by Alexander, 1974: 9 p.); I – aedeagus, dorsal view (illustrated by Alexander, 1974: 9 p.).

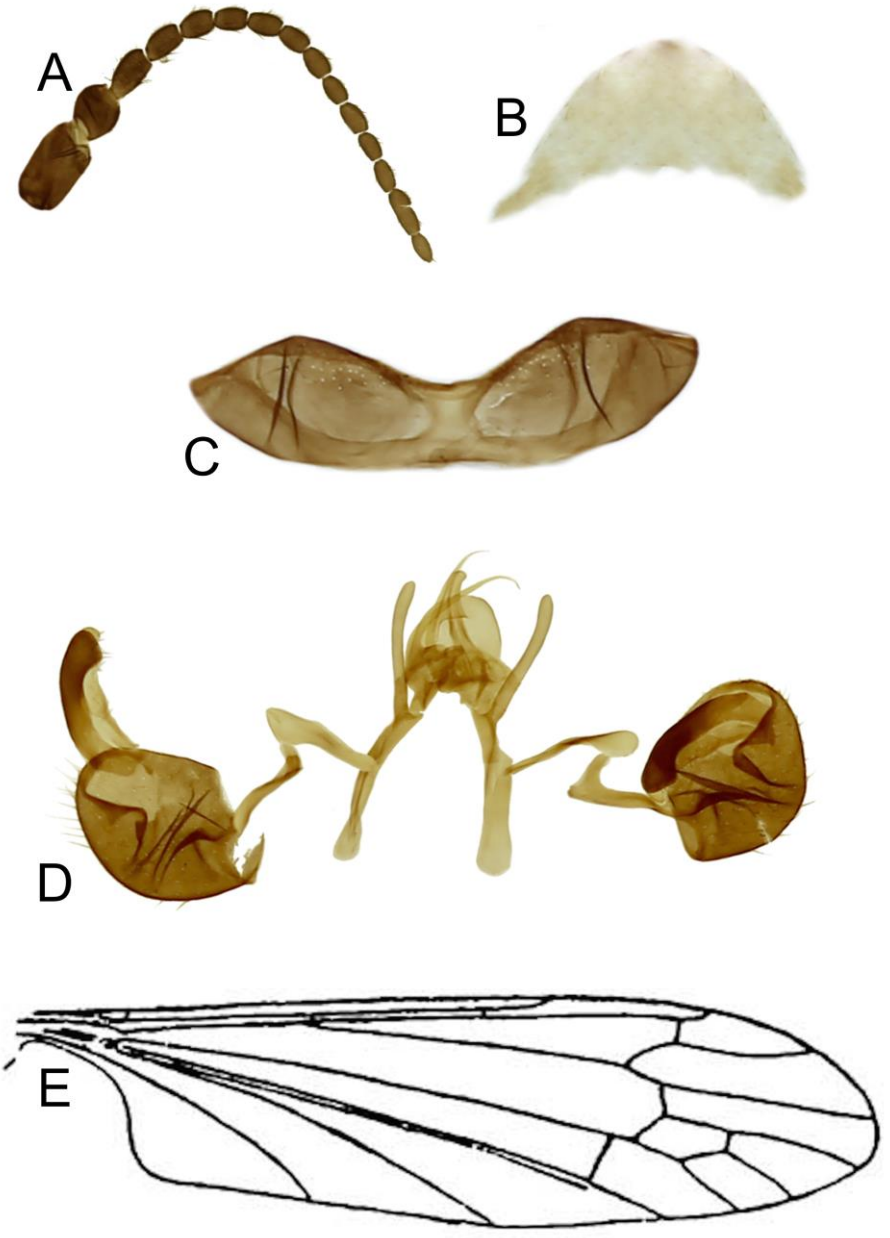


**Figure 62.** *Antocha* (*Antocha*) *amblystyla* Alexander, 1963. A – male antenna, holotype; B – male sternite 9, holotype; C – male tergite 9, holotype; D – male genital structures and aedeagus, dorsal view, holotype; E – male wing (illustrated by Alexander, 1963: Plate 1, 13 fig.).

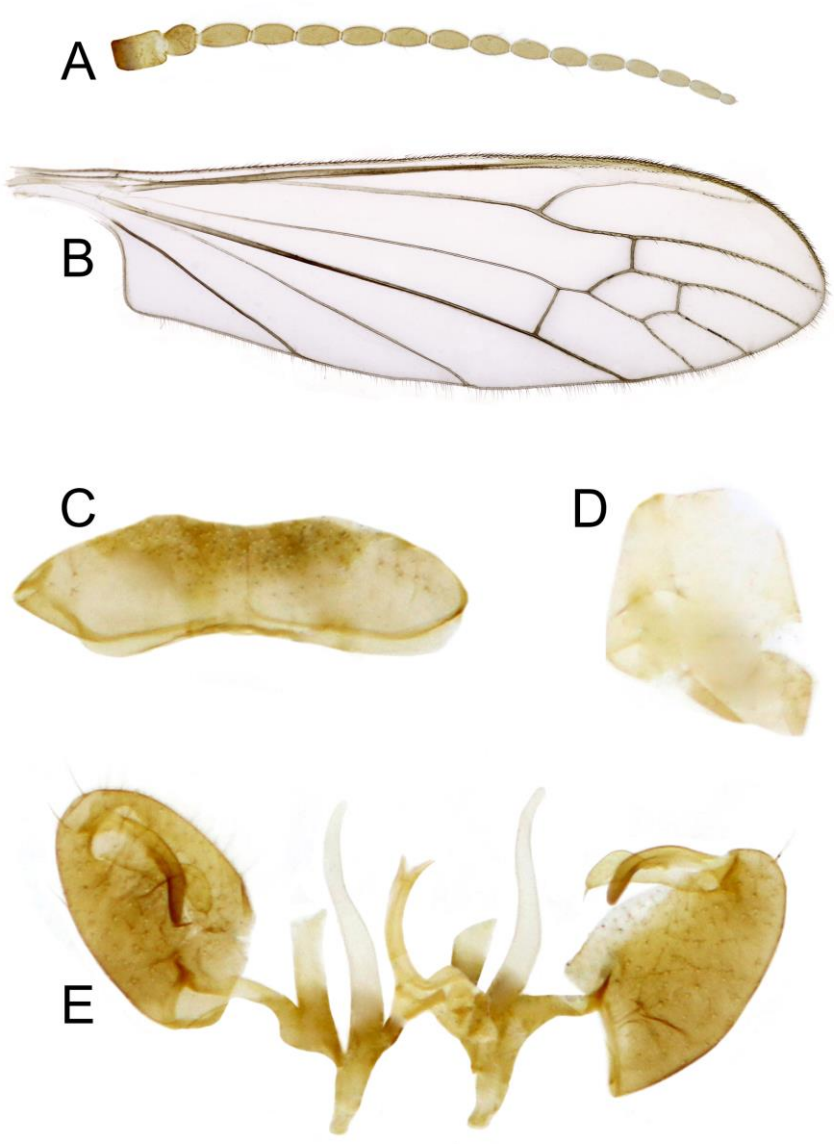


**Figure 63.** *Antocha* (*Antocha*) *angusticellula* Alexander, 1969. A – male antenna, holotype; B – male wing, holotype; C – male tergite 9, holotype; D – male sternite 9, holotype; E – male genital structures and aedeagus, dorsal view, holotype.

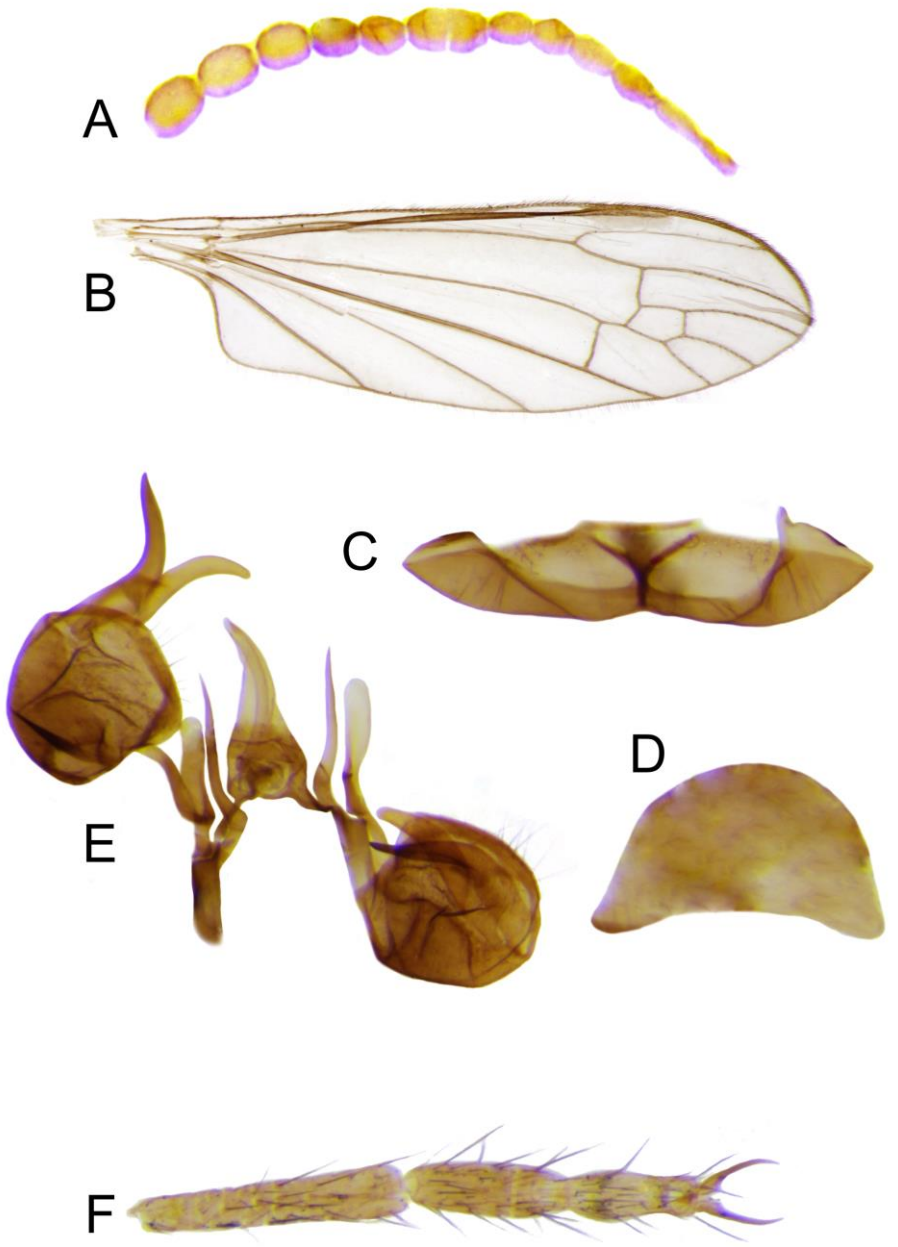


**Figure 64.** *Antocha* (*Antocha*) *angustiterga* Alexander, 1949. A – male antenna, holotype; B – male wing, holotype; C – male tergite 9, holotype; D – male sternite 9, holotype; E – male genital structures and aedeagus, dorsal view, holotype; F – male tarsus, holotype.

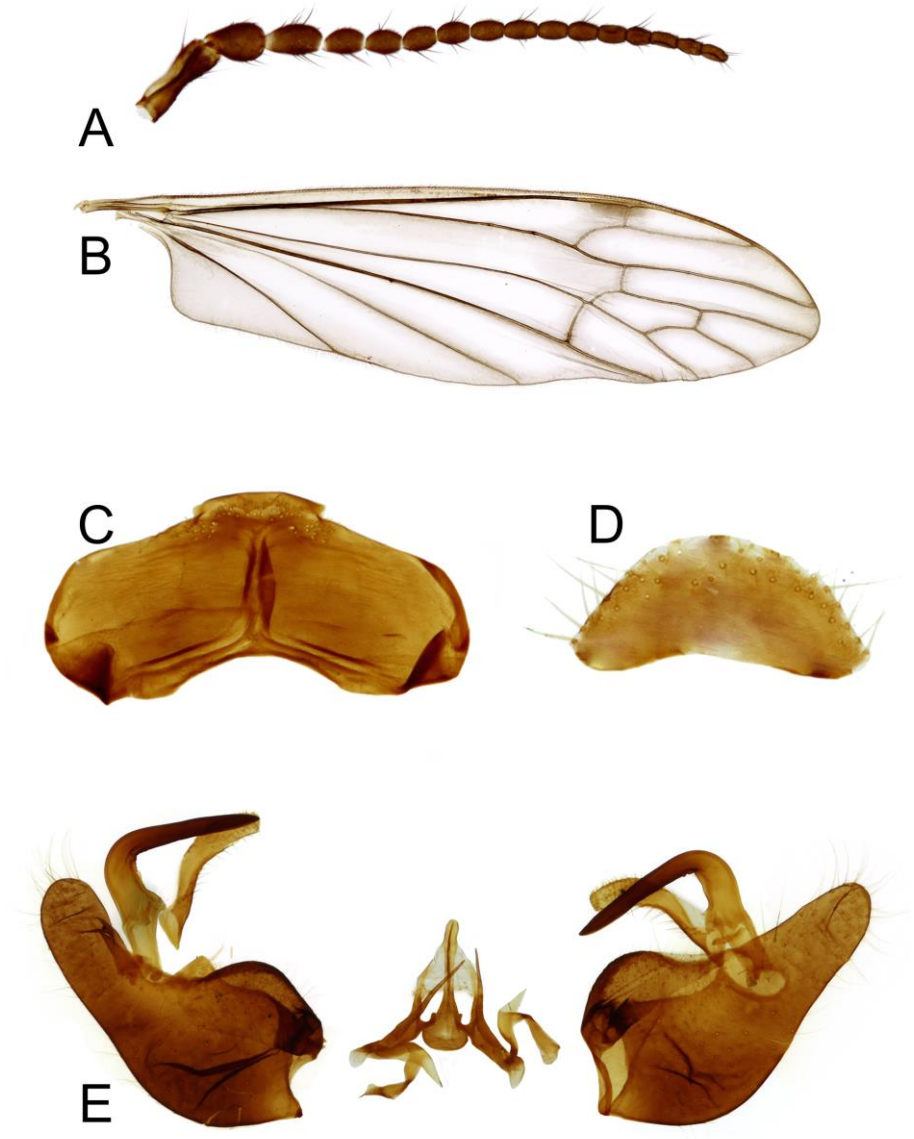


**Figure 65.** *Antocha* (*Antocha*) *arjuna* Alexander, 1969. A – male antenna, holotype; B – male wing, holotype; C – male tergite 9, holotype; D – male sternite 9, holotype; E – male genital structures and aedeagus, dorsal view, holotype.

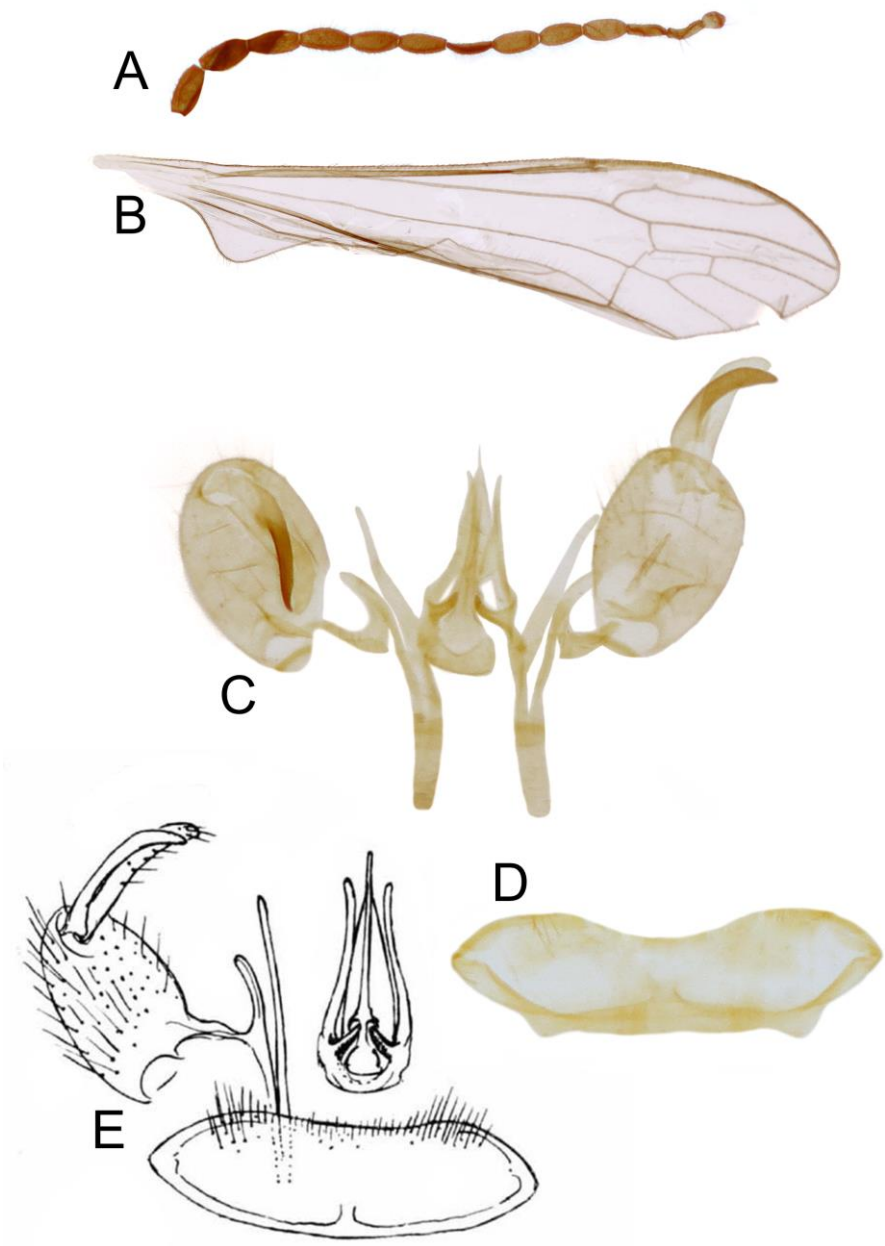


**Figure 66.** *Antocha* (*Antocha*) *attenuata* Alexander, 1969. A – male antenna, holotype; B – male wing, holotype; C – male genital structures and aedeagus, dorsal view, holotype; D – male tergite 9, holotype E – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1993: 35 p.).

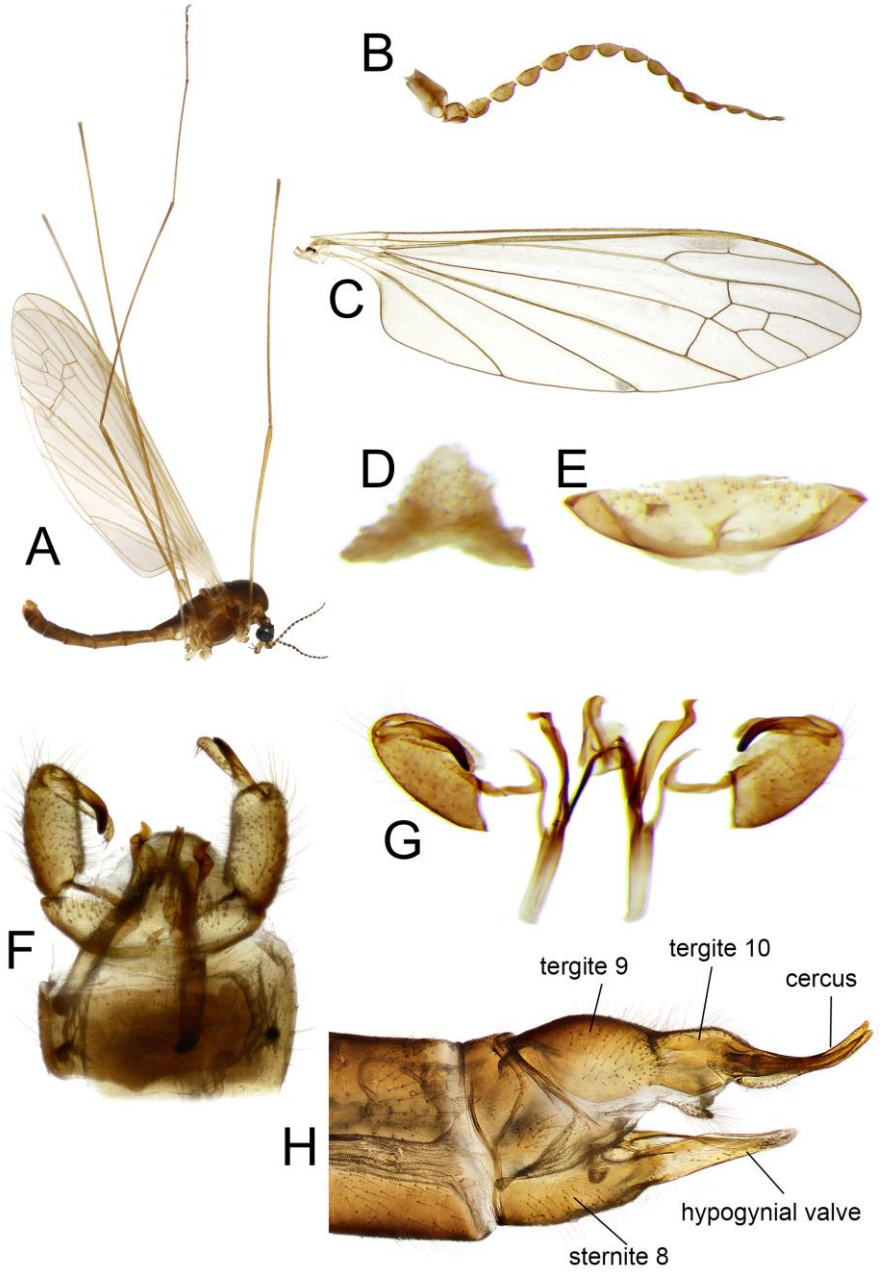


**Figure 67.** *Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019. A – male habitus, holotype; B – male antenna, paratype; C – male wing, paratype; D – male sternite 9, paratype; E – male tergite 9, paratype; F – male genitalia, dorsal view, paratype; G – male genital structures and aedeagus, dorsal view, paratype; H – female ovipositor, lateral view, paratype.

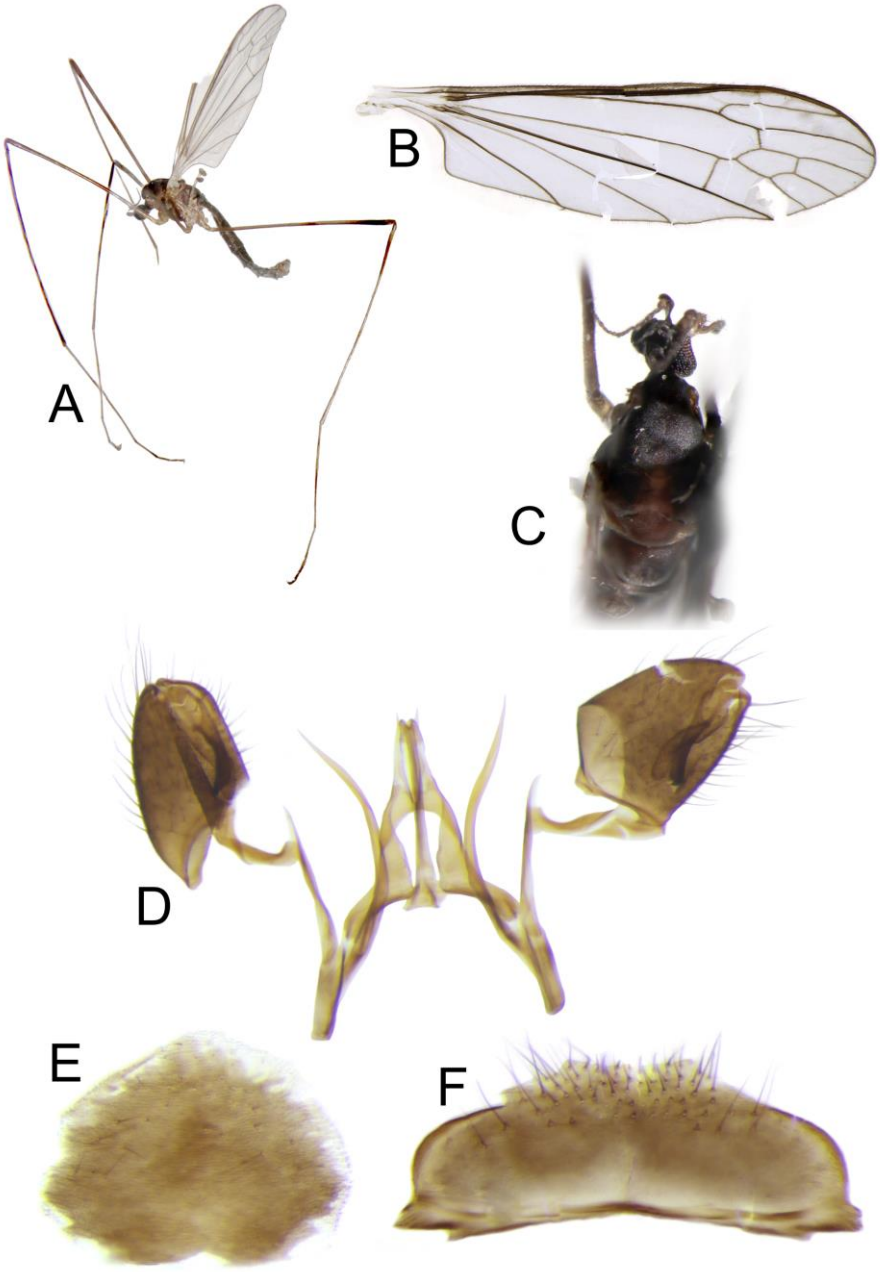


**Figure 68.** *Antocha* (*Antocha*) *biarmata* Alexander, 1940. A – male habitus; B – male wing; C – male thorax, dorsal view; D – male genital structures and aedeagus, dorsal view; E – male sternite 9; F – male tergite 9.

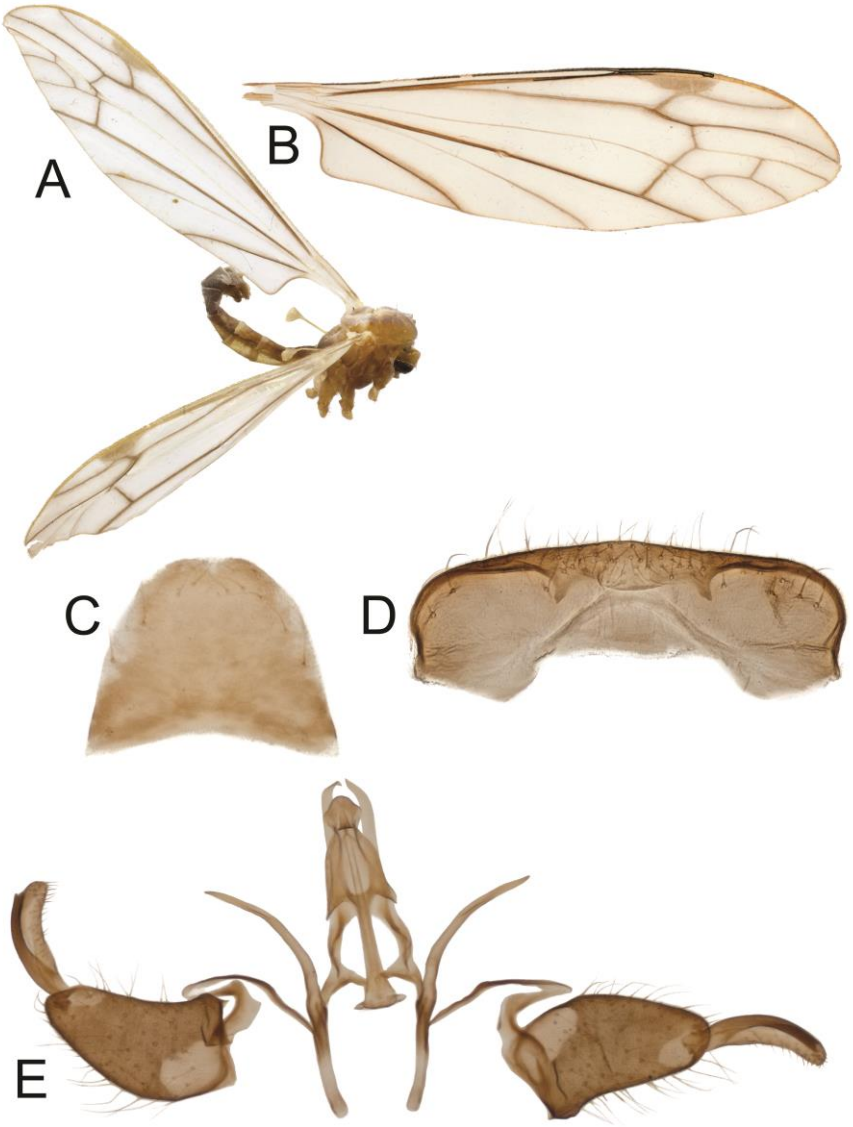


**Figure 69.** *Antocha* (*Antocha*) *bidens* Alexander, 1932. A – male habitus; B – male wing; C – male sternite 9; D – male tergite 9; E – male genital structures and aedeagus, dorsal view.

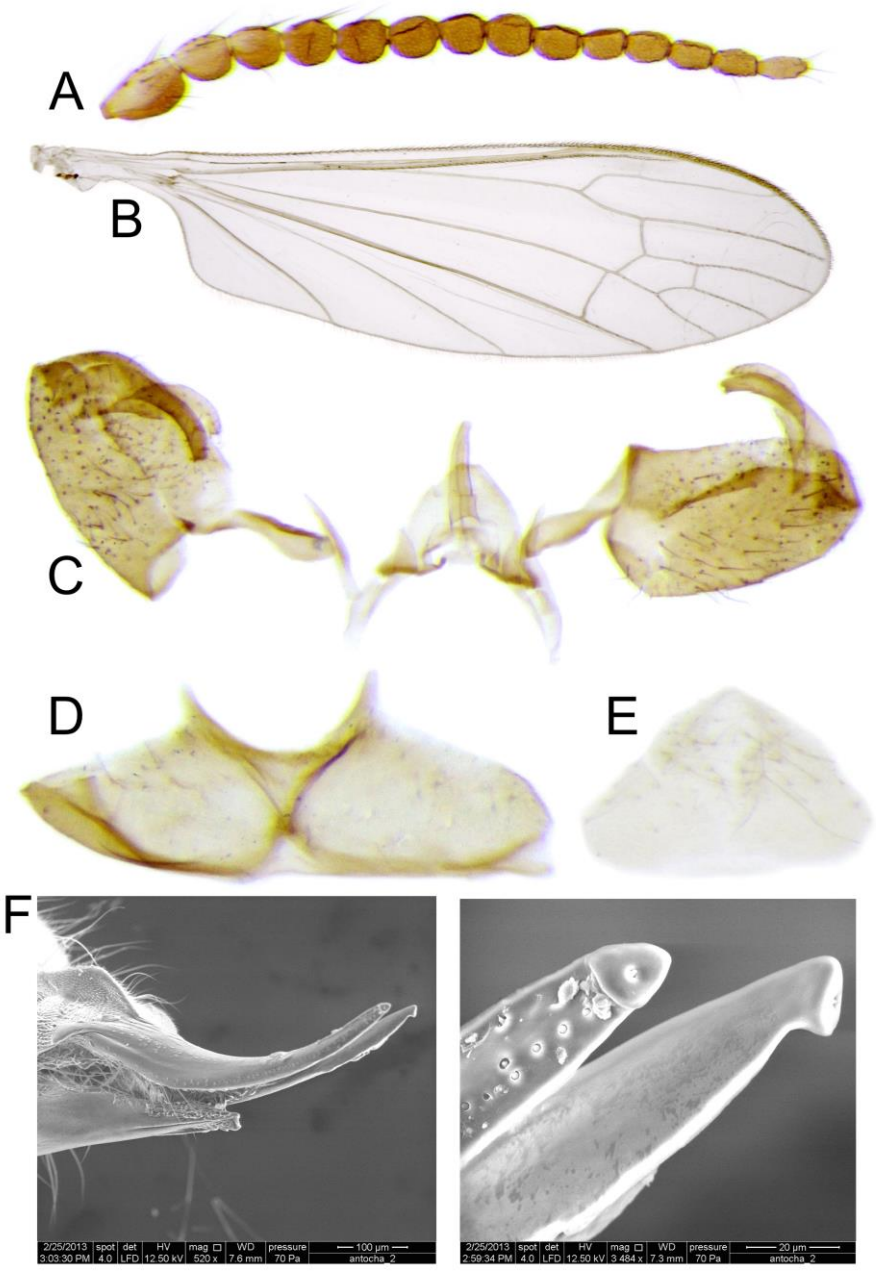


**Figure 70.** *Antocha* (*Antocha*) *bifida* Alexander, 1924. A – male antenna; B – male wing; C – male genital structures and aedeagus, dorsal view; D – male tergite 9; E – male sternite 9; F – female ovipositor, lateral view.

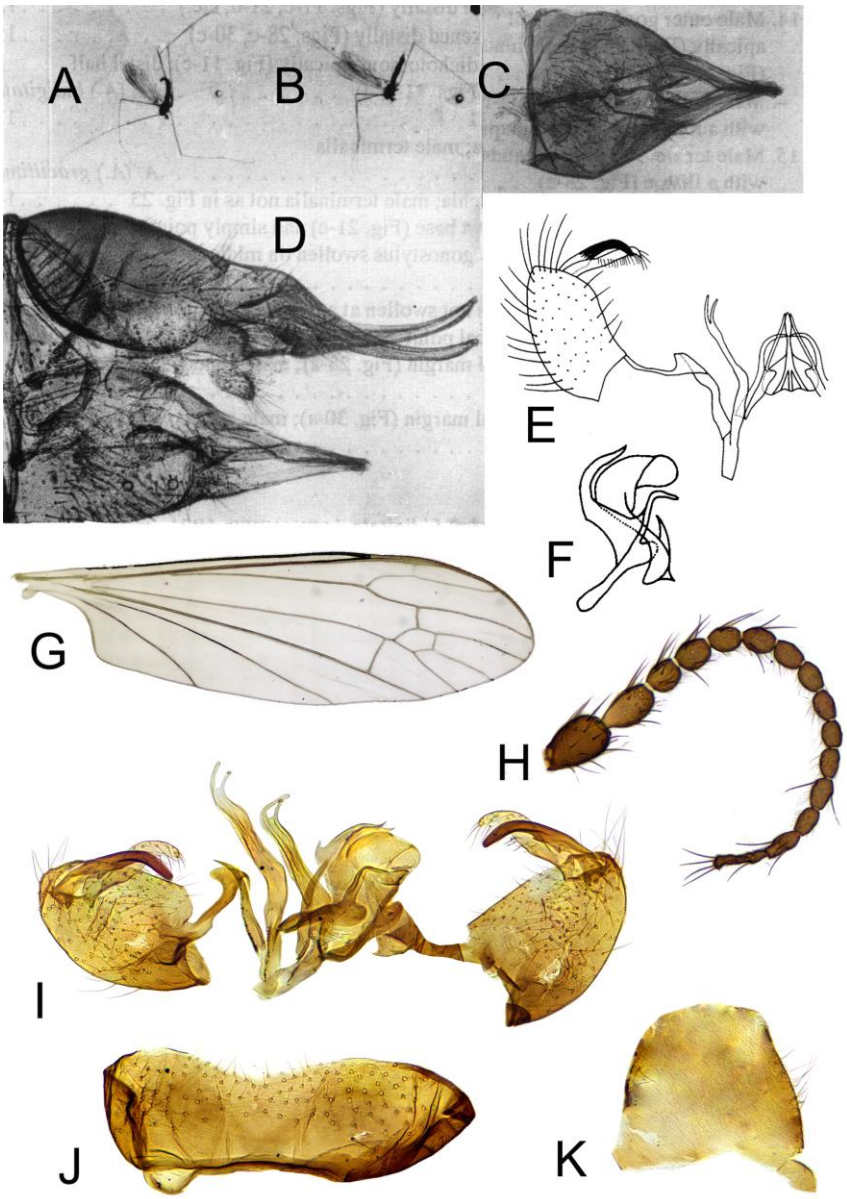


**Figure 71.** *Antocha* (*Antocha*) *bidigitata* Alexander, 1954. A – male habitus (illustrated by Torii, 1992: 166 p.); B – female habitus (illustrated by Torii, 1992: 166 p.); C – female ovipositor, dorsal view (illustrated by Torii, 1992: 166 p.); D – female ovipositor, lateral view (illustrated by Torii, 1992: 166 p.); E – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 166 p.); F – male aedeagus, lateral view (illustrated by Torii, 1992: 166 p.); G – male wing, holotype; H – male antenna, holotype; I – male aedeagus, dorsal view, holotype; J – male tergite 9, holotype; K – male sternite 9, holotype.

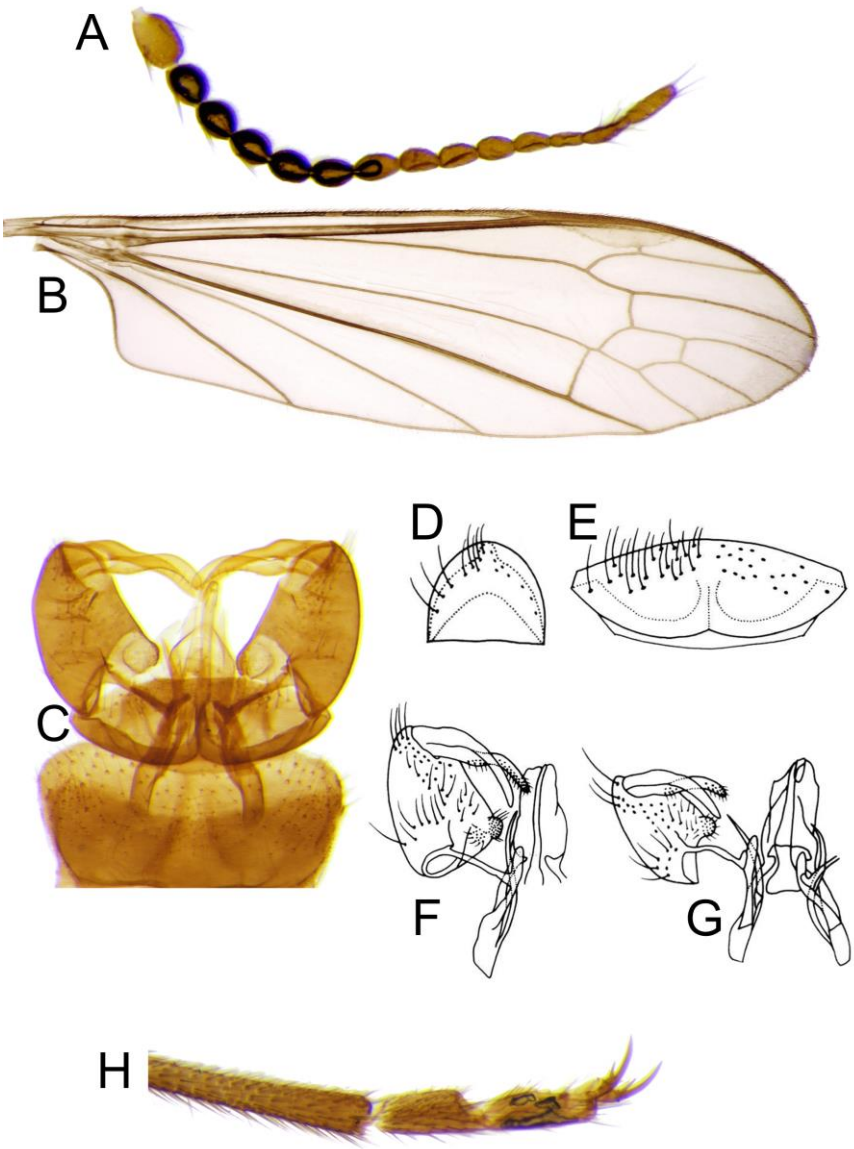


**Figure 72.** *Antocha* (*Antocha*) *brevinervis* Alexander, 1924. A – male antenna, holotype; B – male wing, holotype; C – male genitalia, dorsal view, holotype; D – male sternite 9 (illustrated by Torii, 1992: 170 p.); E – male tergite 9 (illustrated by Torii, 1992: 170 p.); F, G – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 170 p.); H – male tarsus, holotype.

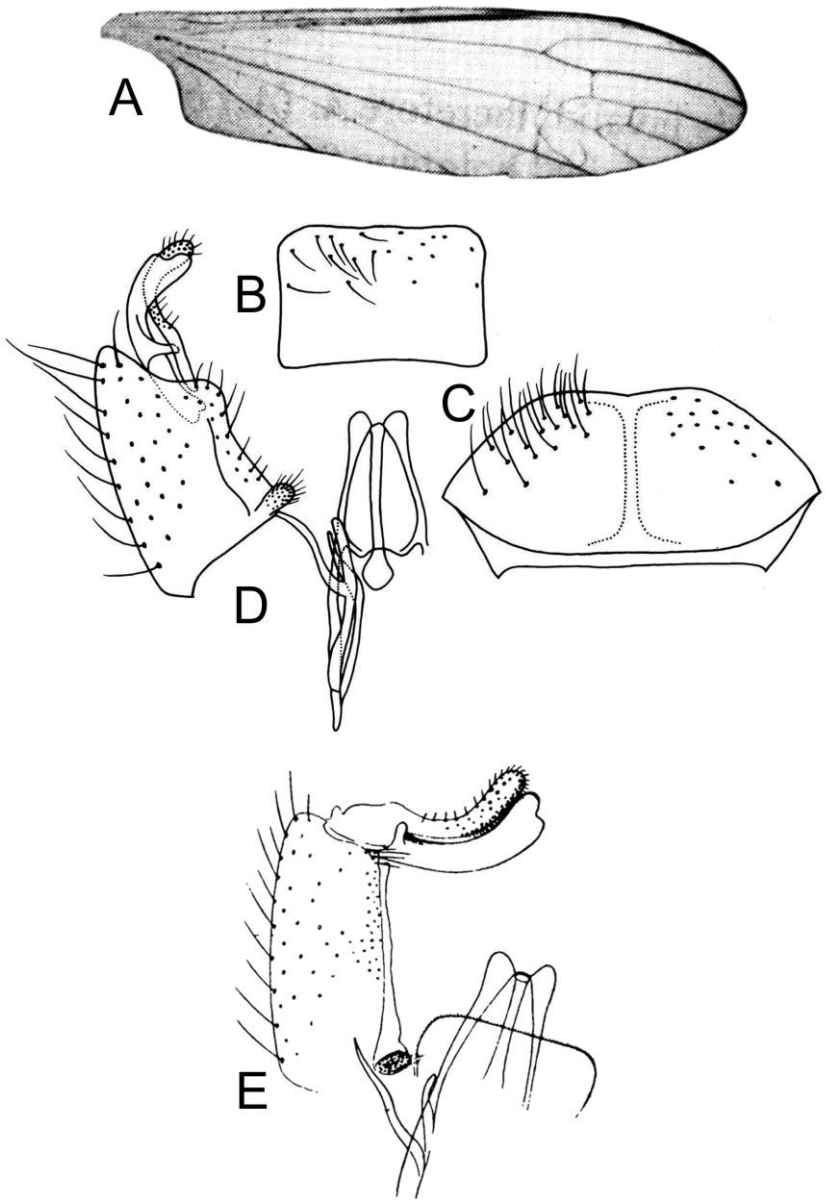


**Figure 73.** *Antocha* (*Antocha*) *brevistyla* Alexander, 1924. A – male wing (illustrated by Torii, 1992: 172 p.); B – male sternite 9 (illustrated by Torii, 1992: 172 p.); C – male tergite 9 (illustrated by Torii, 1992: 172 p.); D – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 172 p.); E – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1924: Plate 2, fig. 11).

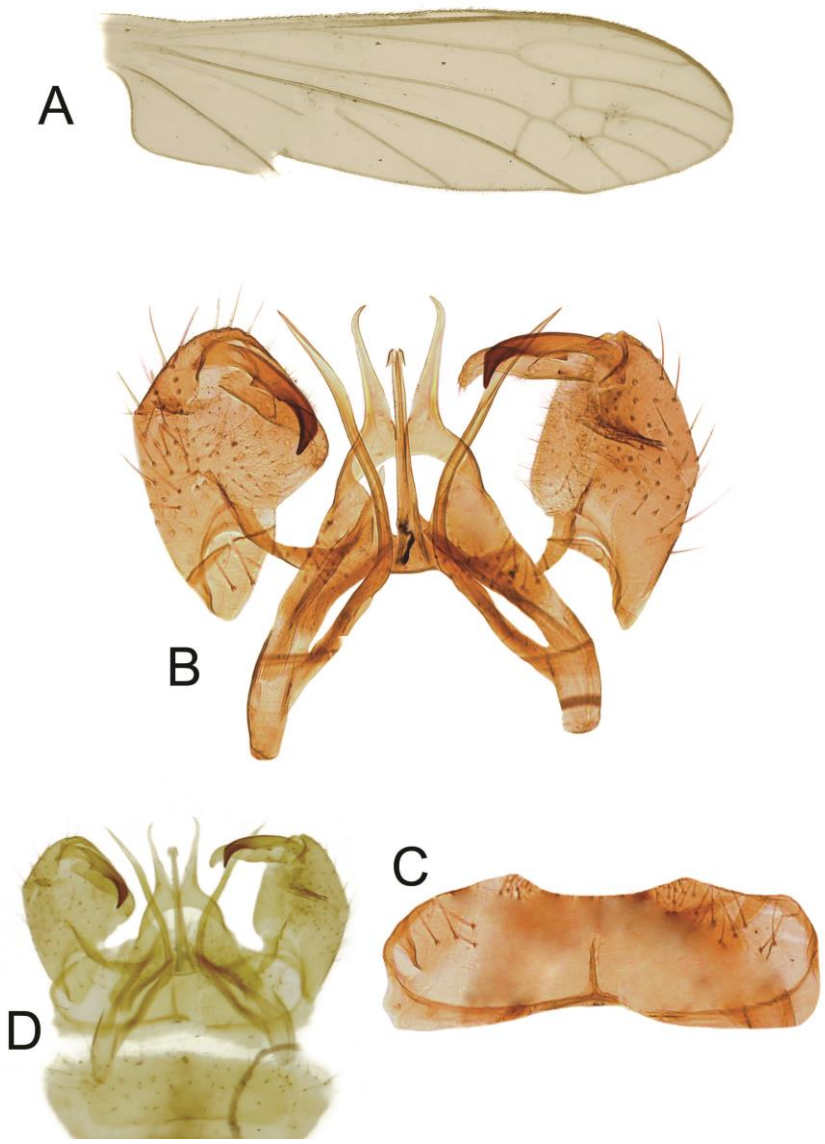


**Figure 74.** *Antocha* (*Antocha*) *capitella* Alexander, 1941. A – male wing, paratype; B – male tergite 9, paratype; C – male genital structures and aedeagus, dorsal view, paratype; D – male genitalia, dorsal view, paratype.

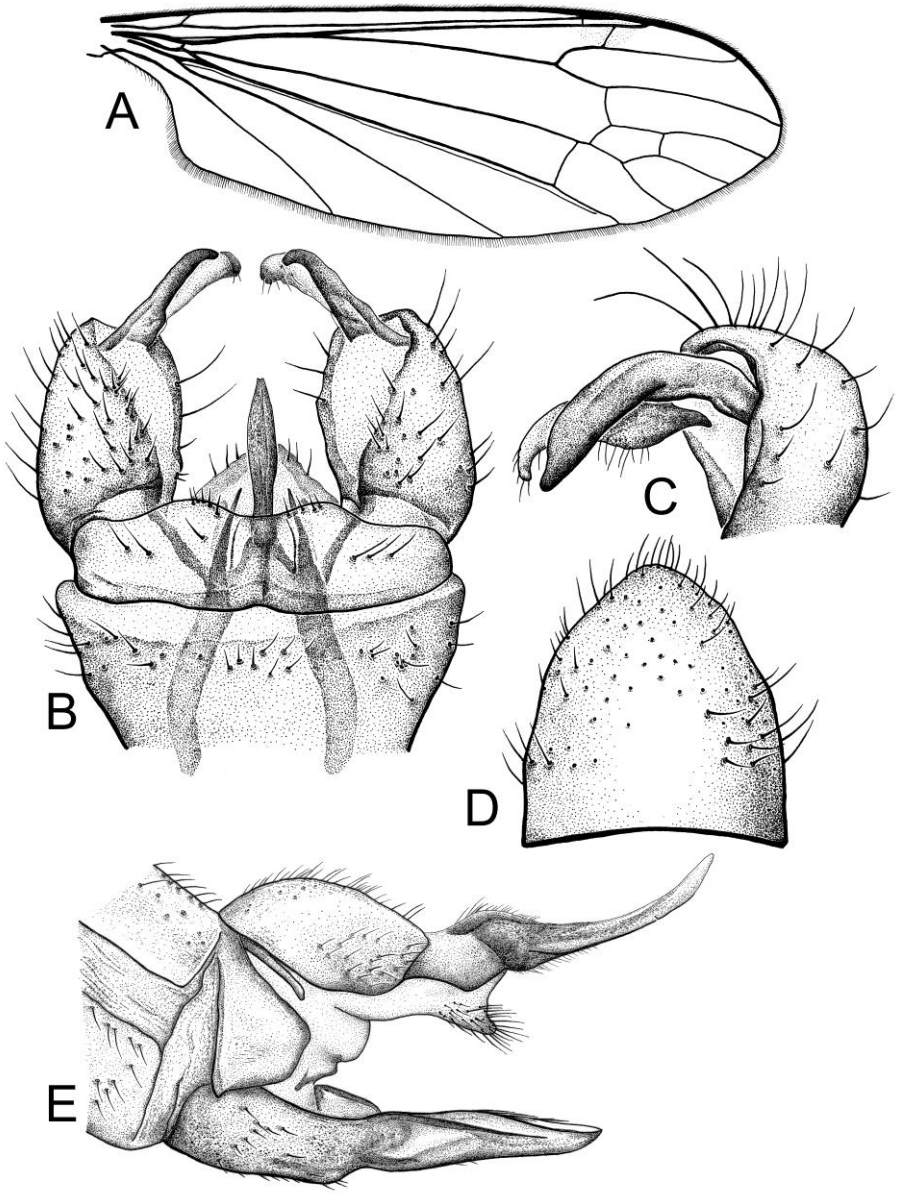


**Figure 75.** *Antocha* (*Antocha*) *chonsaniana* Podenas, 2015. A – female wing, paratype (illustrated by Podenas, 2015: 5 p.); B – male genitalia, dorsal view, holotype (illustrated by Podenas, 2015: 5 p.); C – gonostyles, holotype (illustrated by Podenas, 2015: 5 p.); D – ninth sternite, holotype (illustrated by Podenas, 2015: 5 p.); E – female ovipositor, lateral view, paratype (illustrated by Podenas, 2015: 5 p.).

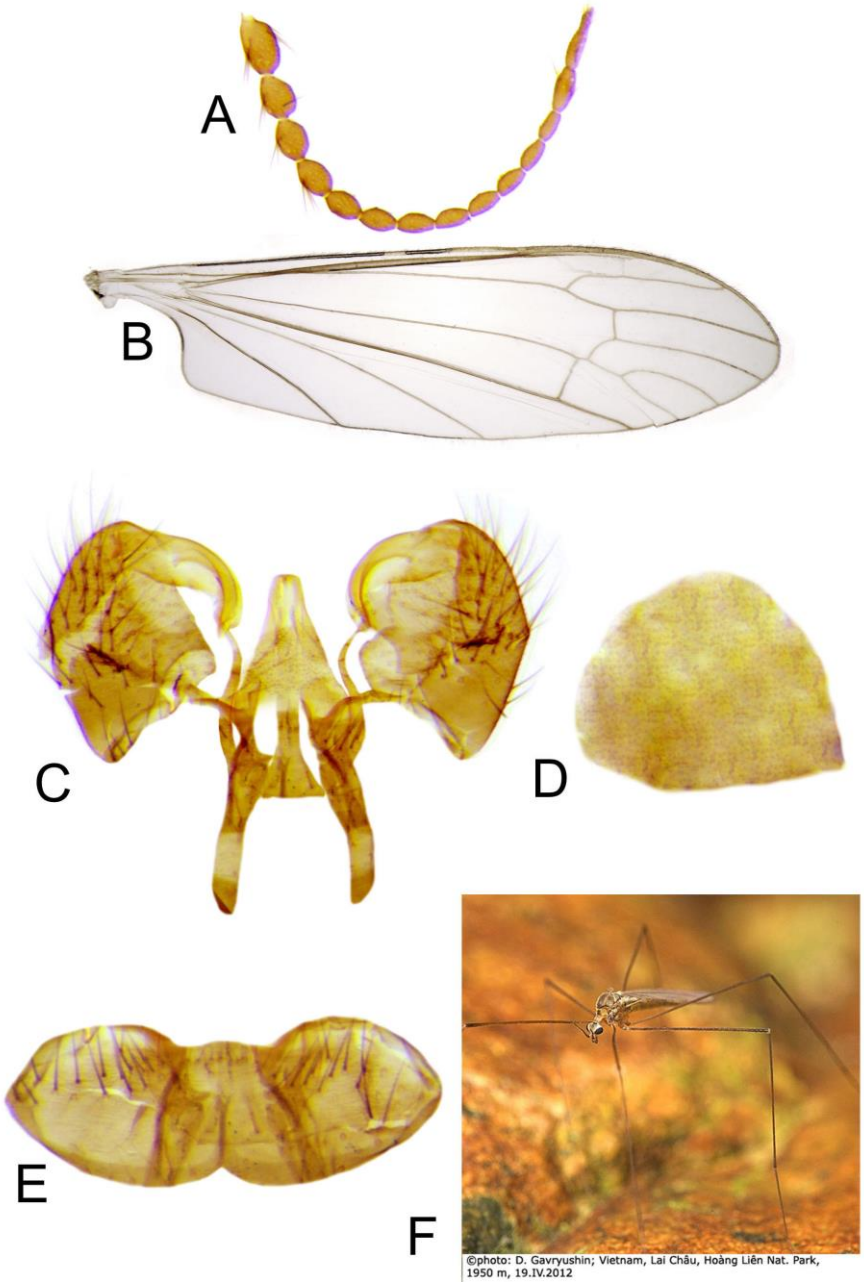


**Figure 76.** *Antocha* (*Antocha*) *confluenta* Alexander, 1926. A – male antenna; B – male wing; C – male genital structures and aedeagus, dorsal view; D – sternite 9; E – tergite 9; F – male habitus.

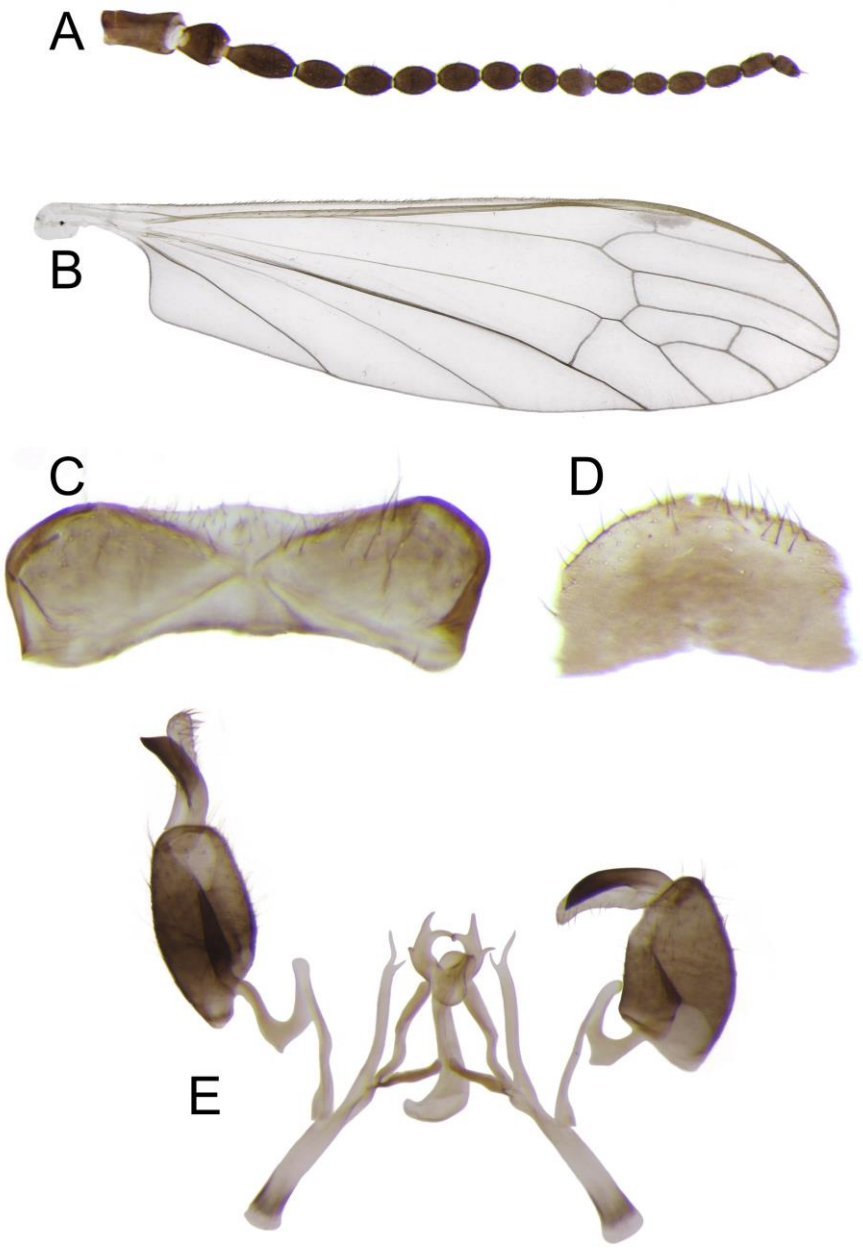


**Figure 77.** *Antocha* (*Antocha*) *constricta* Alexander, 1932. A – male antenna; B – male wing; C – male tergite 9; D – male sternite 9; E – male genital structures and aedeagus, dorsal view.

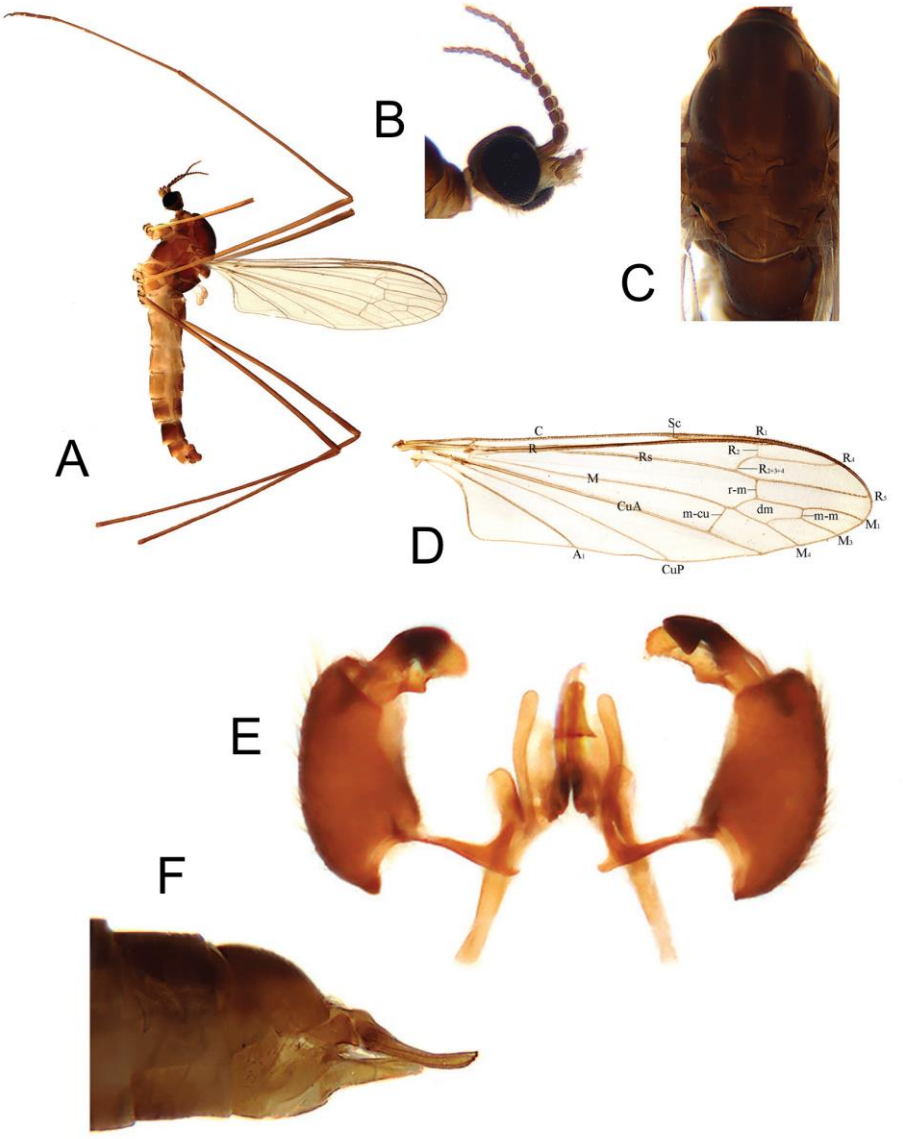


**Figure 78.** *Antocha* (*Antocha*) *curvativa* Lv & Zhang 2023. A – male habitus (illustrated by Lv & Zhang 2023: 59 p.); B – head and antenna (illustrated by Lv & Zhang 2023: 59 p.); C – thorax (illustrated by Lv & Zhang 2023: 59 p.); D – wing venation (illustrated by Lv & Zhang 2023: 59 p.); E – male genital structures and aedeagus, dorsal view (illustrated by Lv & Zhang 2023: 59 p.); F – female ovipositor, lateral view (illustrated by Lv & Zhang 2023: 59 p.).

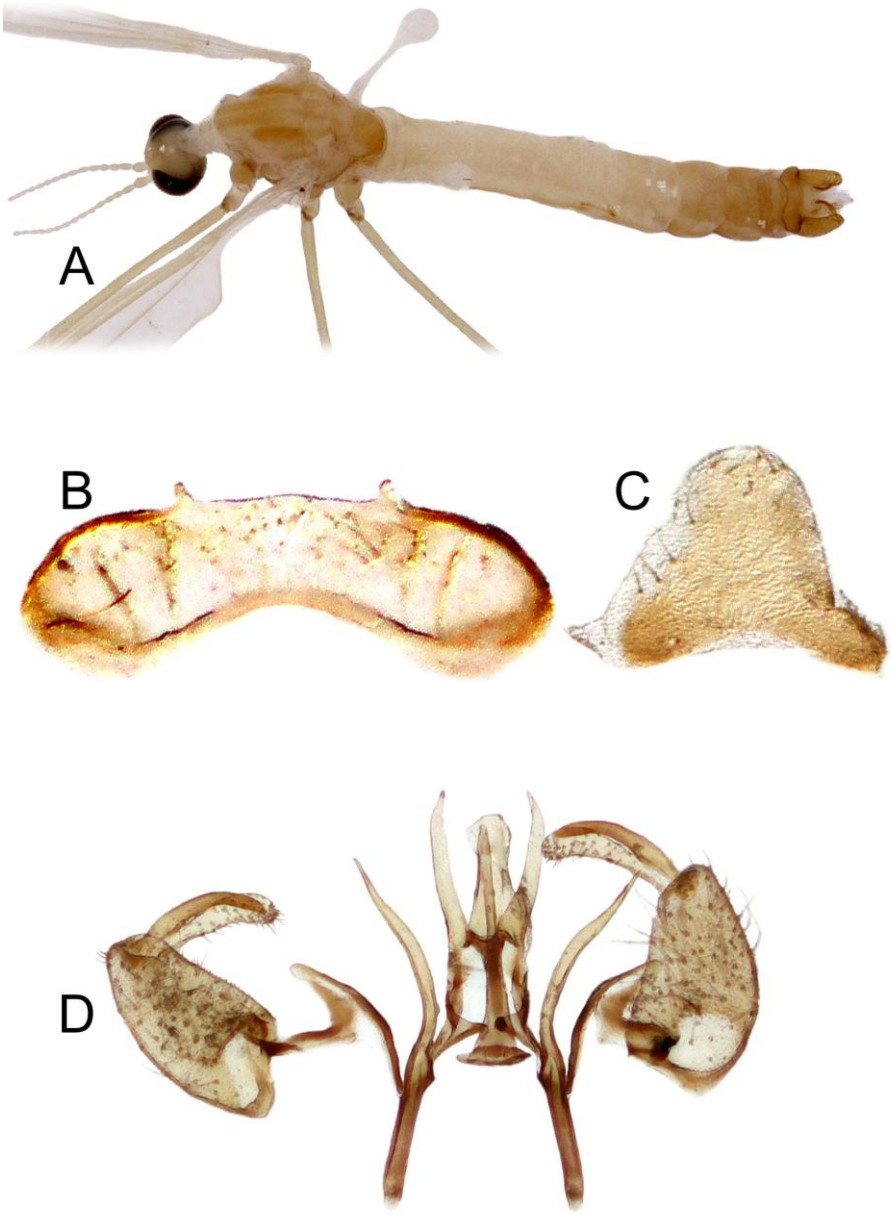


**Figure 79.** *Antocha* (*Antocha*) *dafla* Alexander, 1969. A – male habitus; B – male tergite 9; C – male sternite 9; D – male genital structures and aedeagus, dorsal view.

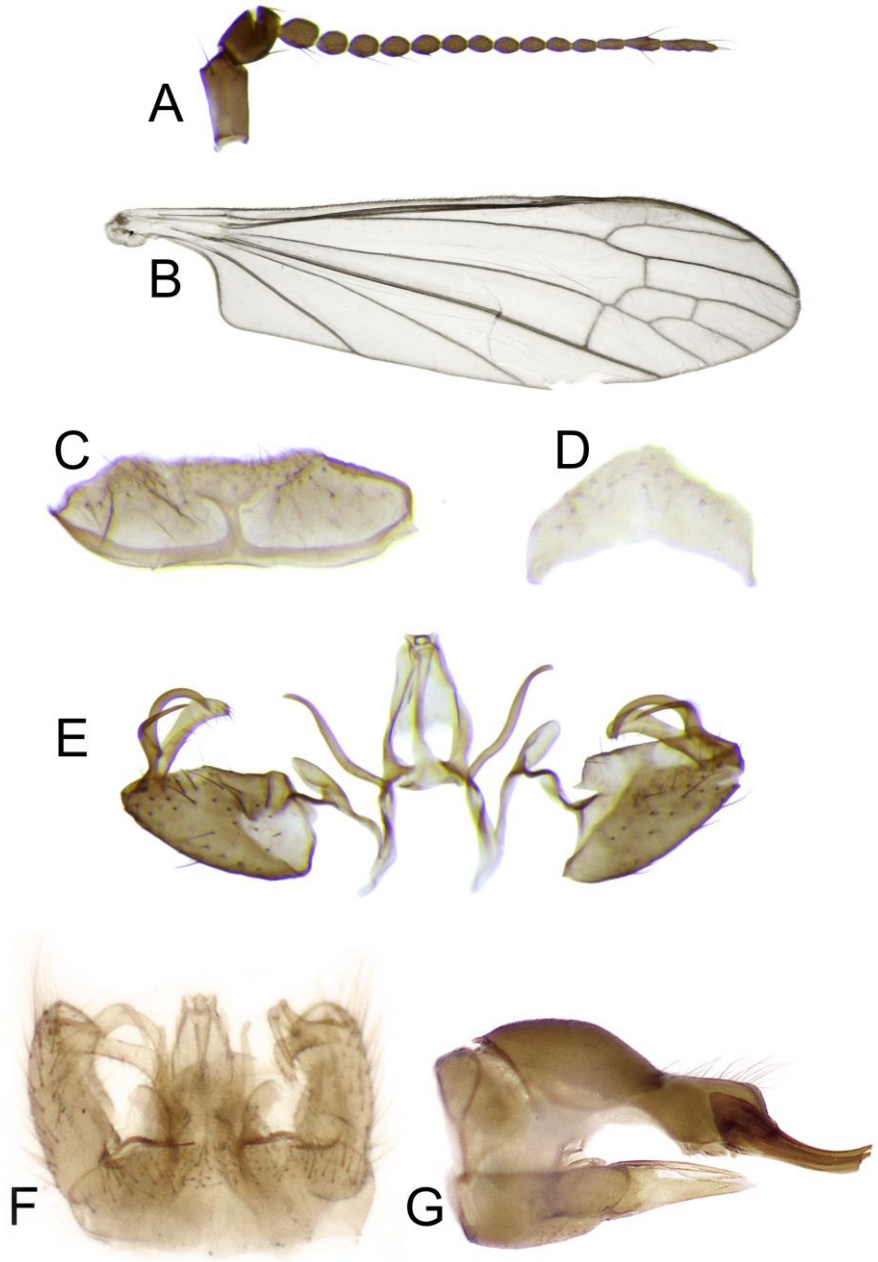


**Figure 80.** *Antocha* (*Antocha*) *dentifera* Alexander, 1924. A – male antenna; B – male wing; C – male tergite 9; D – male sternite 9; E – male genital structures and aedeagus, dorsal view; F – male genitalia, dorsal view; G – female ovipositor, lateral view.

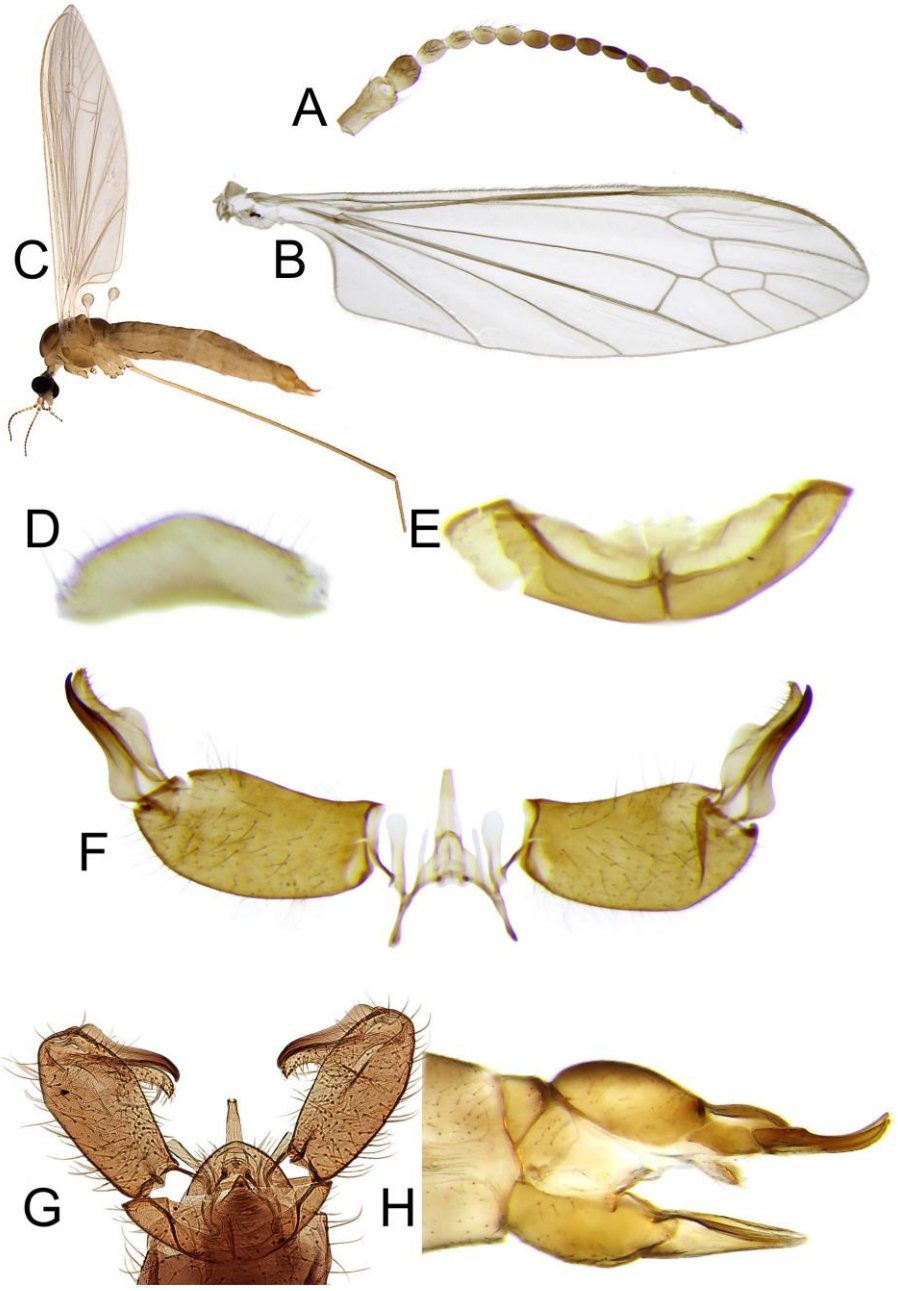


**Figure 81.** *Antocha* (*Antocha*) *dentifera* Alexander, 1924. A – male antenna; B – male wing; C – female habitus; D – male sternite 9; E – male tergite 9; F – male genital structures and aedeagus, dorsal view; G – male genitalia, dorsal view; H – female ovipositor, lateral view.

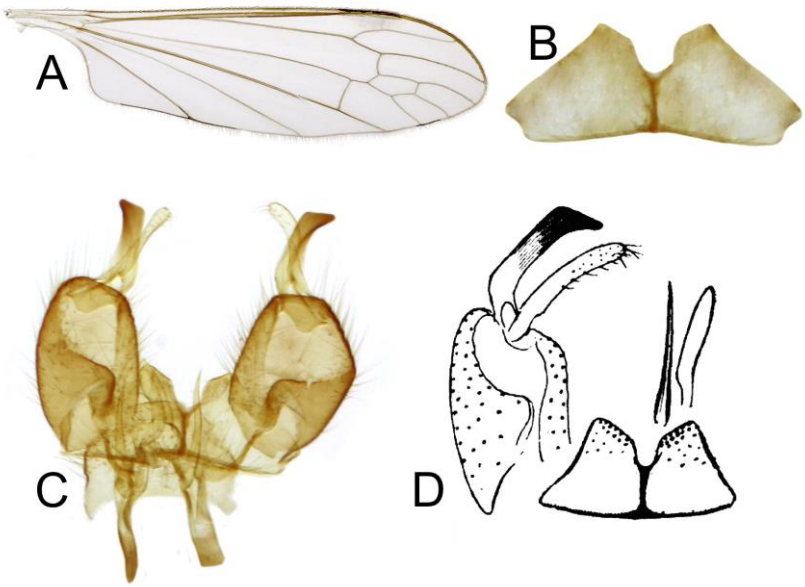


**Figure 82.** *Antocha* (*Antocha*) *emarginata* Alexander, 1938. A – male wing; B – male tergite 9; C – male genital structures and aedeagus, dorsal view; D – male genital structures, dorsal view (illustrated by Alexander, 1938: Plate 4, 44 fig.).

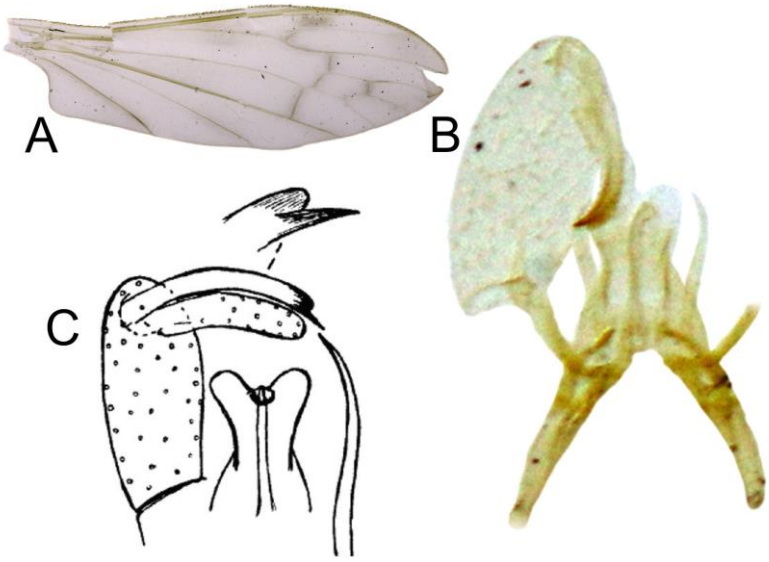


**Figure 83.** *Antocha* (*Antocha*) *flavidula* Alexander, 1936. A – male wing; B – male genital structures and aedeagus, dorsal view; C – male genital structures, dorsal view (illustrated by Alexander, 1936: Plate 2, 26 fig.).

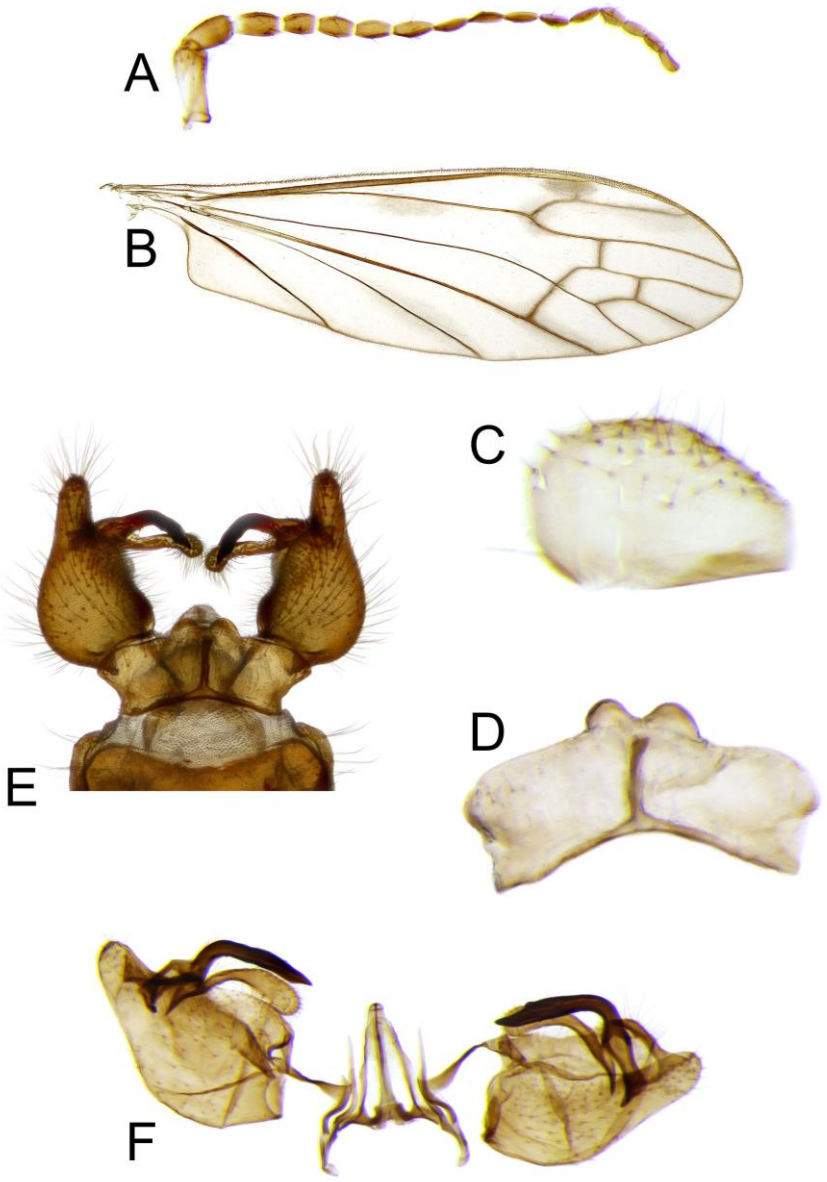


**Figure 84.** *Antocha* (*Antocha*) *fortidens* Alexander, 1933. A – male antenna; B – male wing; C – male sternite 9; D – male tergite 9; E – male genitalia, dorsal view; F – male genital structures and aedeagus, dorsal view.

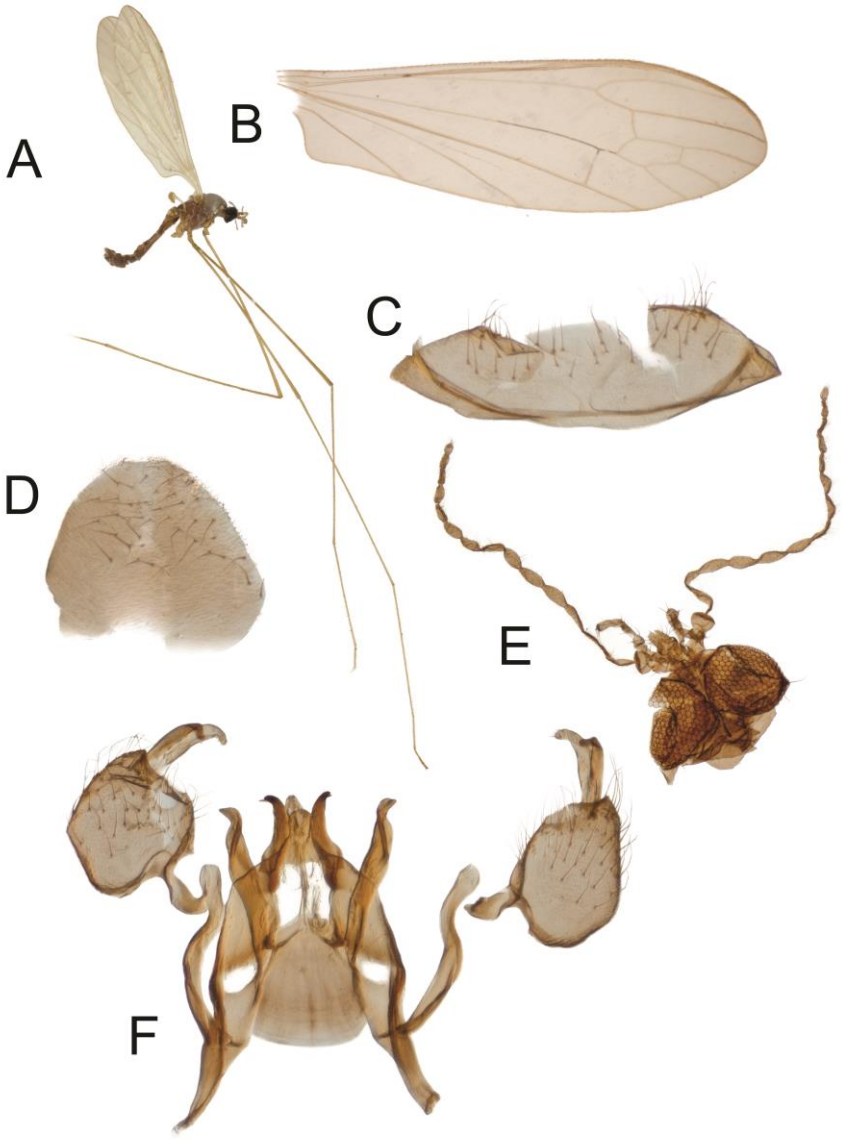


**Figure 85.** *Antocha* (*Antocha*) *fusca* Edwards, 1928. A – male habitus; B – male wing; C – male tergite 9; D – male sternite 9; E – male head and antenna, dorsal view; F – male genital structures and aedeagus, dorsal view.

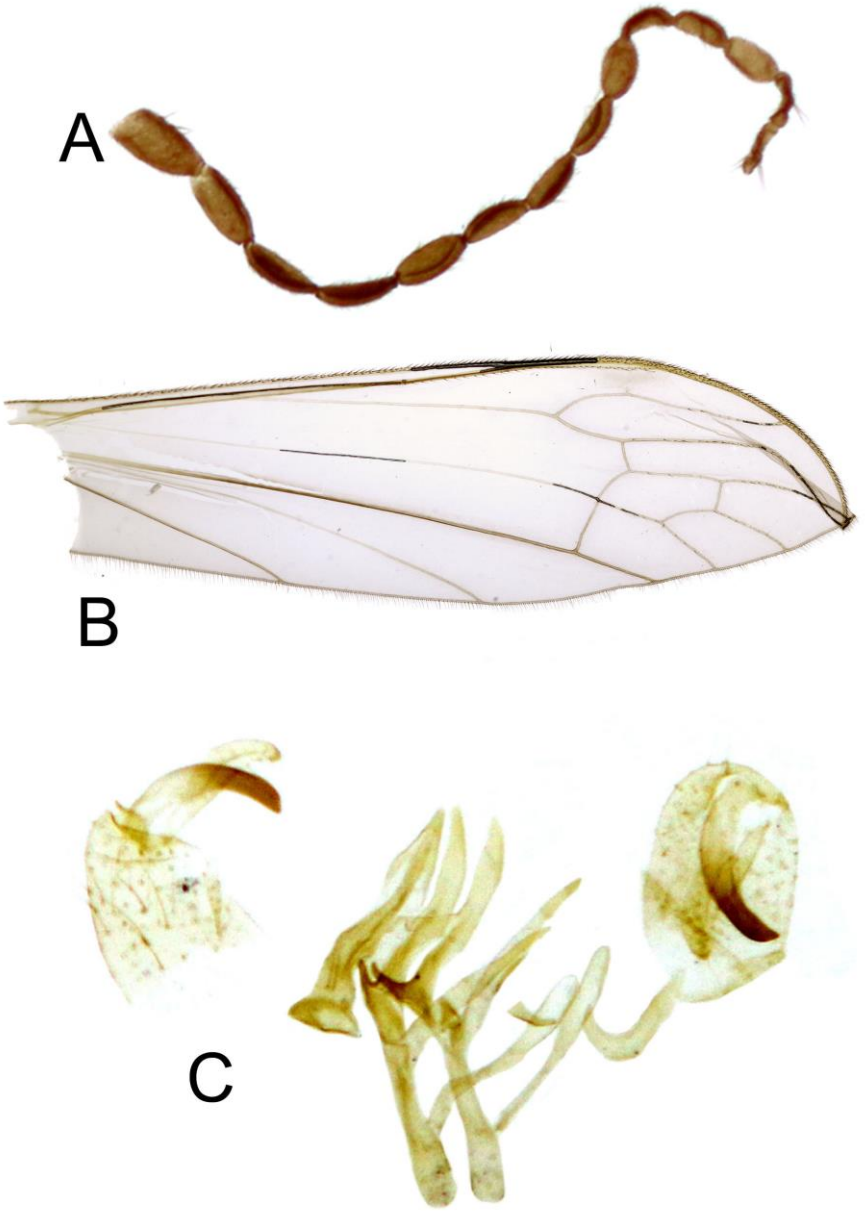


**Figure 86.** *Antocha* (*Antocha*) *gladiata* Alexander, 1974. A – male antenna; B – male wing; C – male genital structures and aedeagus, dorsal view.

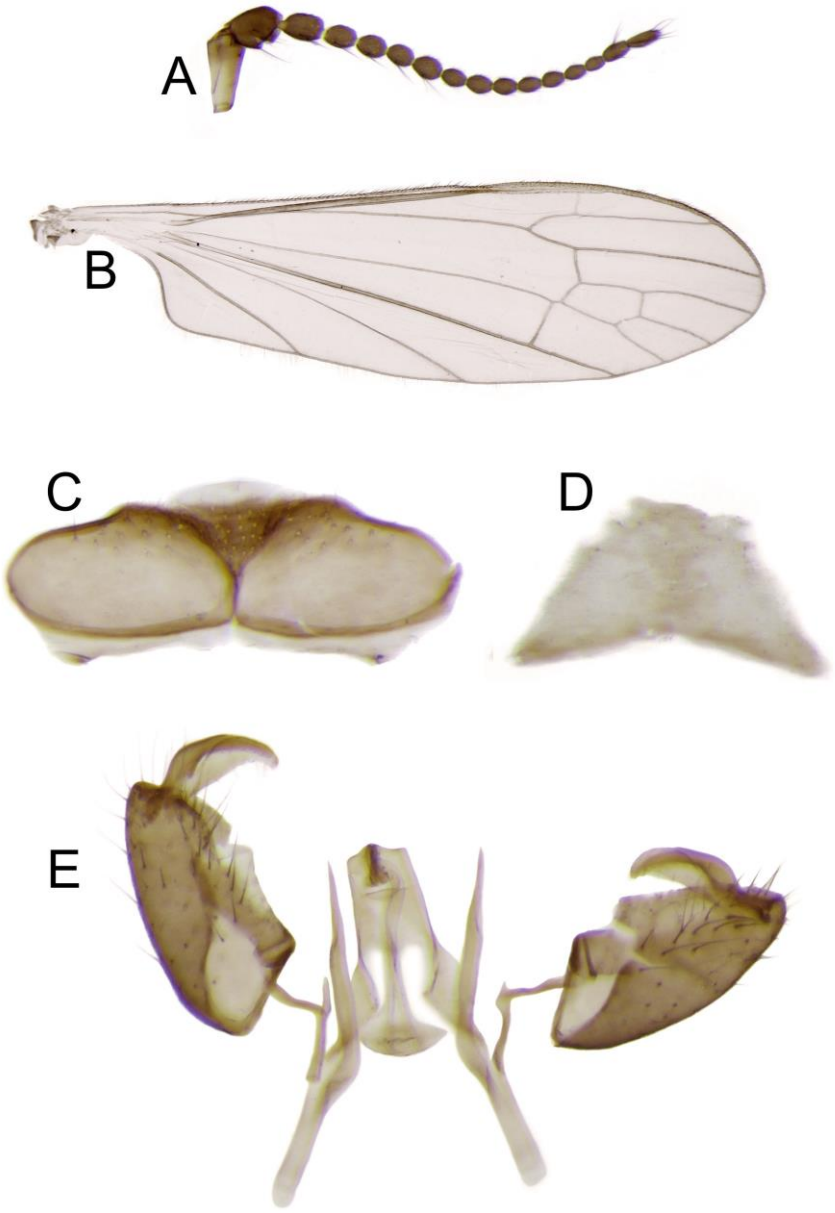


**Figure 87.** *Antocha* (*Antocha*) *globulosa* Alexander, 1973. A – male antenna; B – male wing; C – male tergite 9; D – male sternite 9; E – male genital structures and aedeagus, dorsal view.

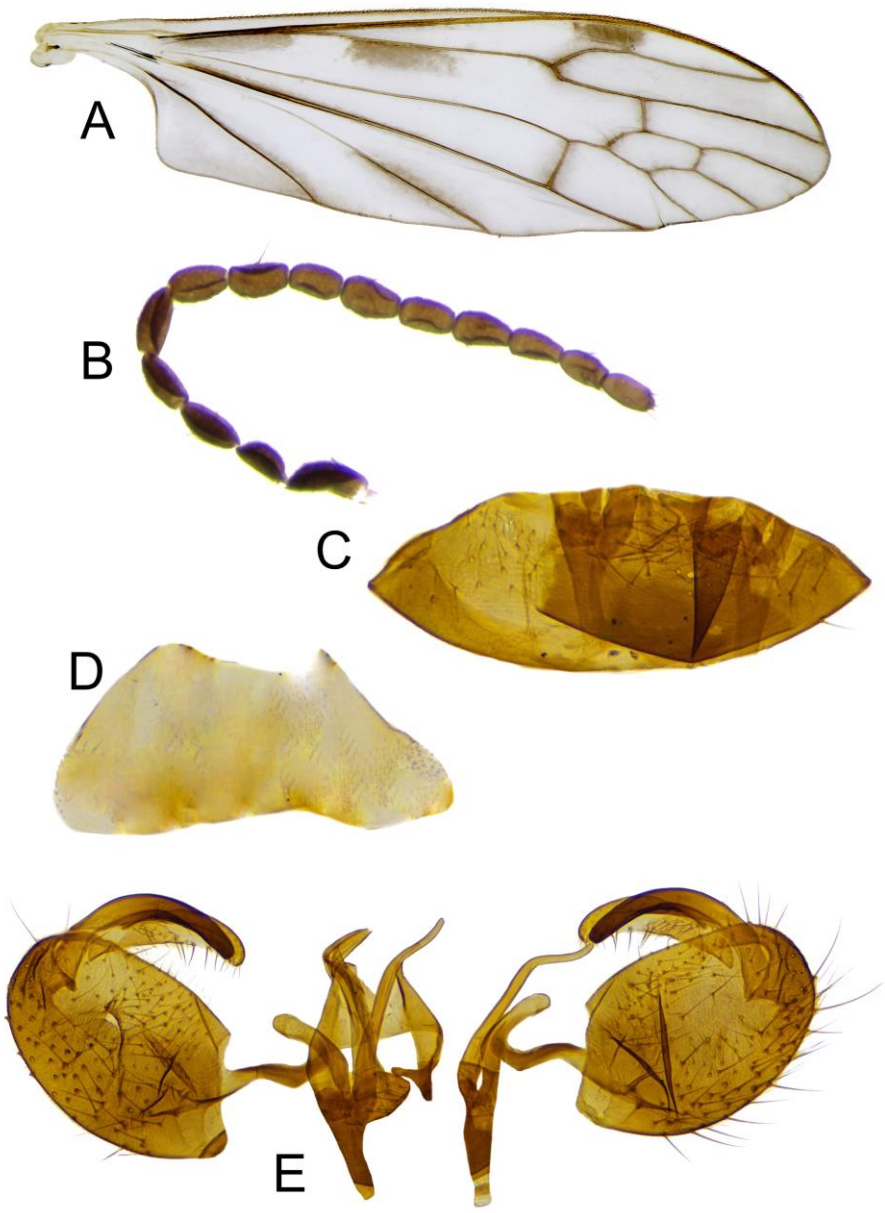


**Figure 88.** *Antocha* (*Antocha*) *glycera* Alexander, 1969. A – male wing, paratype; B – male antenna, paratype; C – male tergite 9, paratype; D – male sternite 9, paratype; E – male genital structures and aedeagus, dorsal view, paratype.

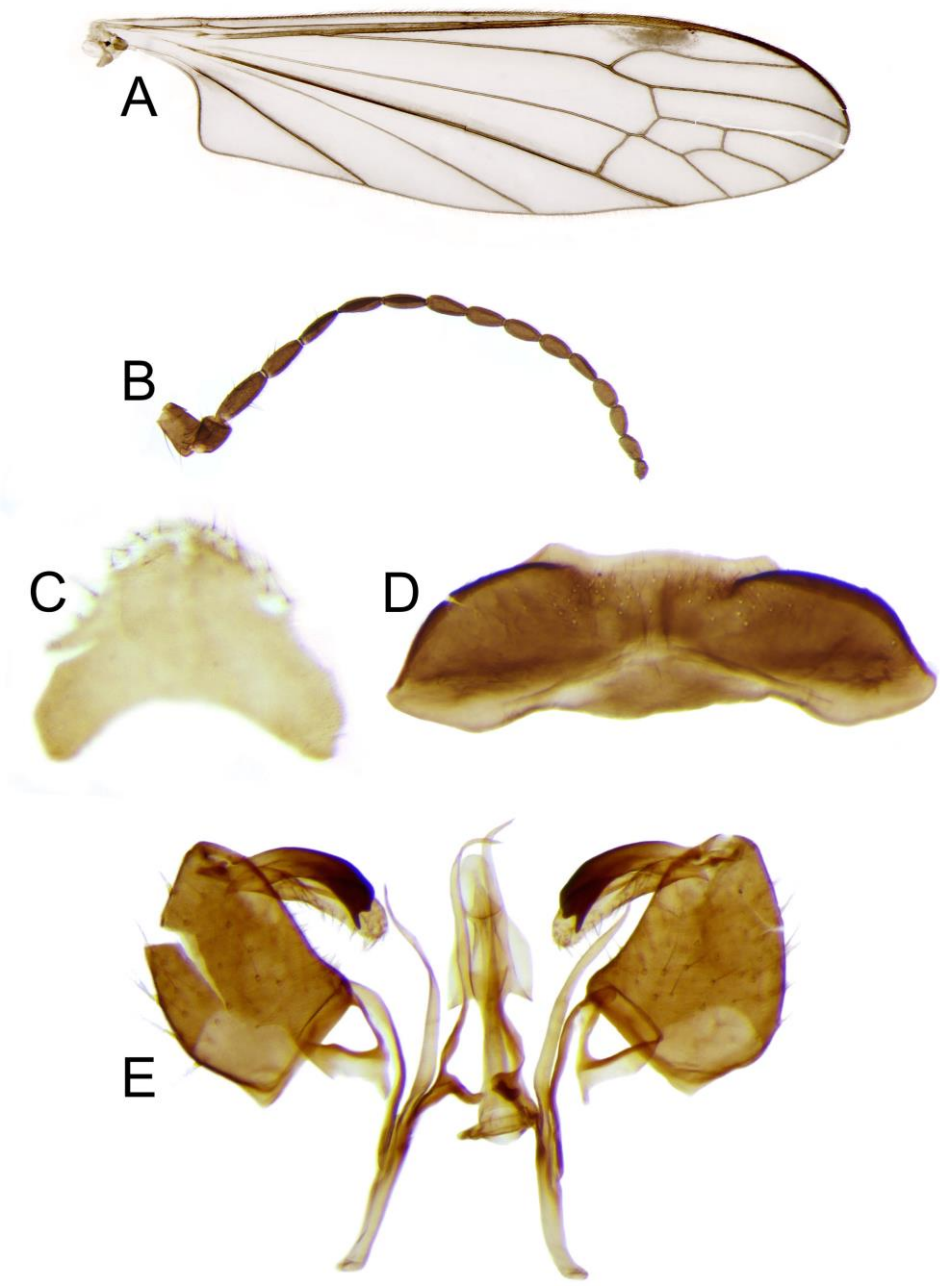


**Figure 89.** *Antocha* (*Antocha*) *gracillima* Alexander, 1924. A – male wing; B – male antenna; C – male sternite 9; D – male tergite 9; E – male genital structures and aedeagus, dorsal view.

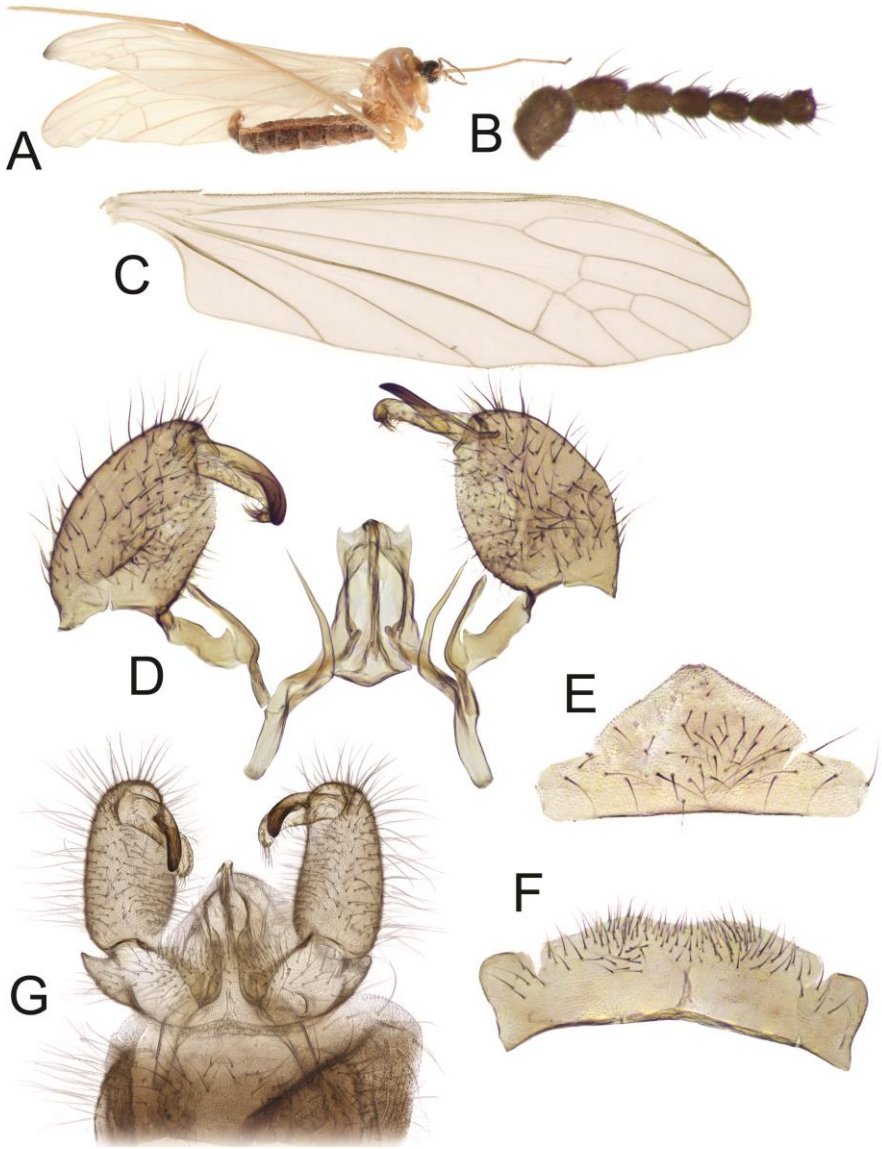


**Figure 90.** *Antocha* (*Antocha*) *hirtipes* Savchenko, 1971. A – male habitus; B – male antenna; C – male wing; D – male genital structures and aedeagus, dorsal view; E – male sternite 9; F – male tergite 9; G – male genitalia, general, dorsal view.

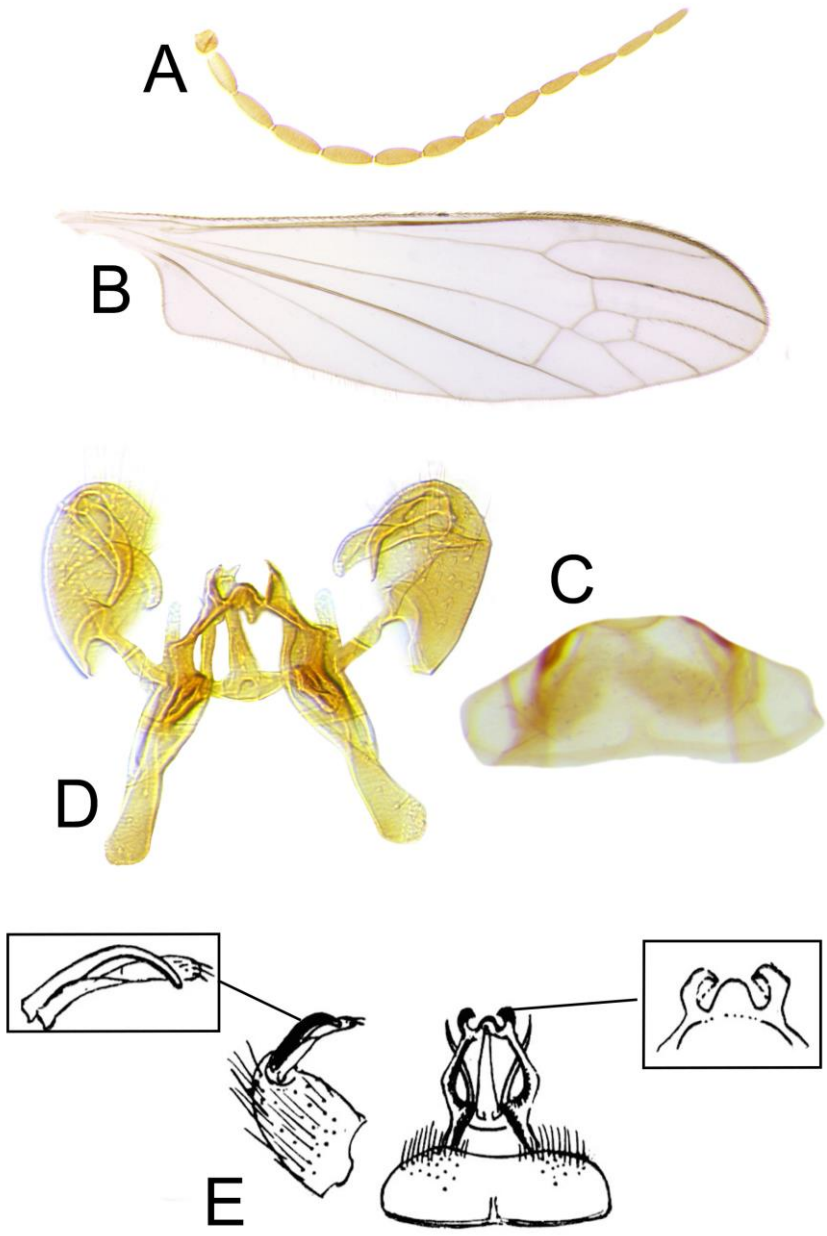


**Figure 91.** *Antocha* (*Antocha*) *hyperlata* Alexander, 1968. A – male antenna; B – male wing; C – male tergite 9; D – male genital structures and aedeagus, dorsal view; E – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1968: 46 p.).

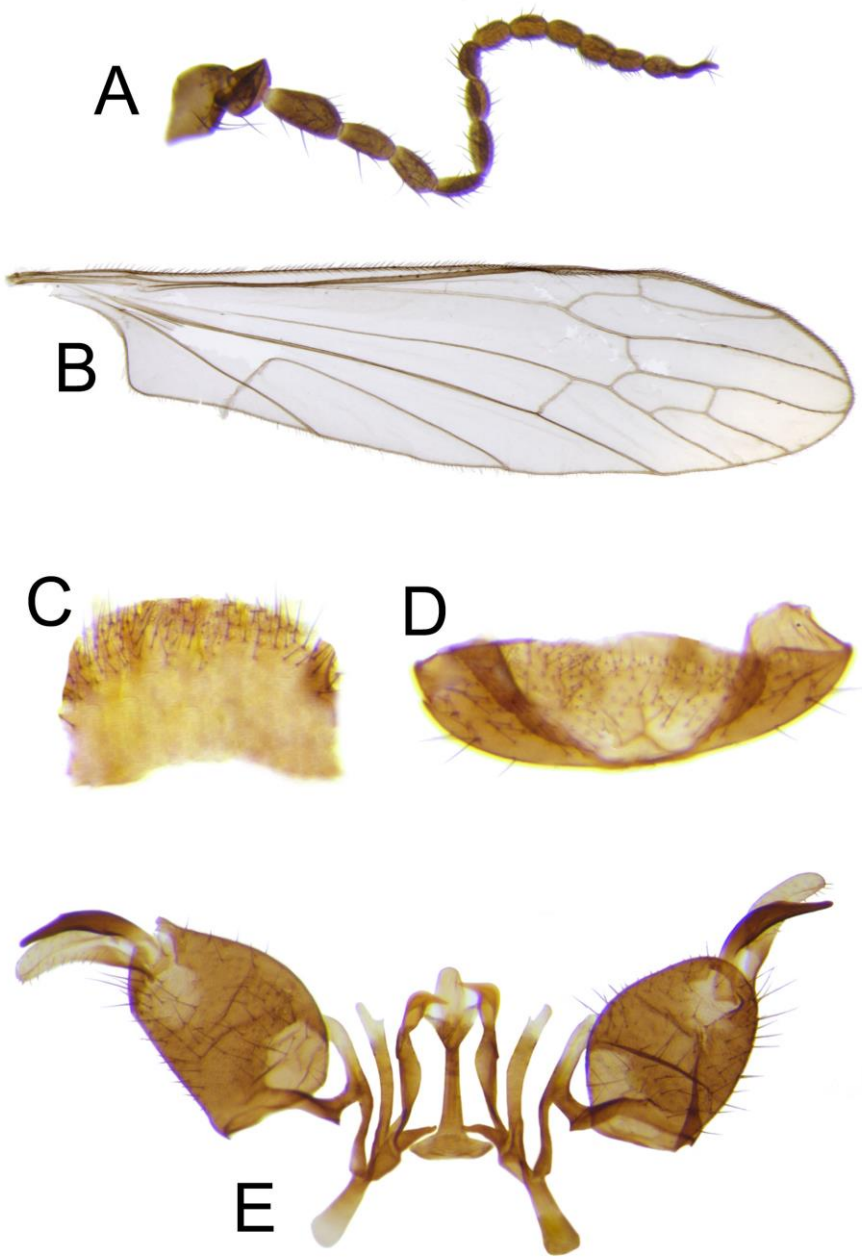


**Figure 92.** *Antocha* (*Antocha*) *incurva* Alexander, 1968. A – male antenna; B – male wing; C – male sternite 9; D – male tergite 9; E – male genital structures and aedeagus, dorsal view.

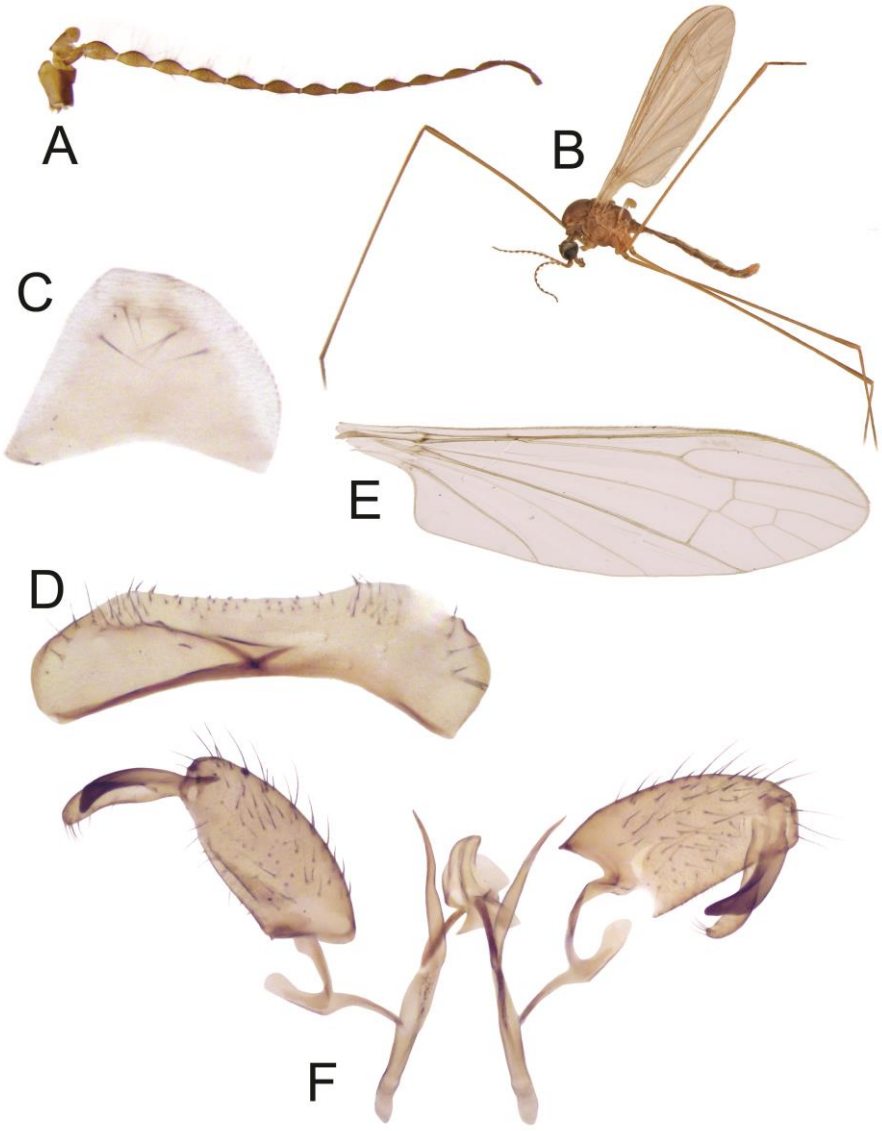


**Figure 93.** *Antocha* (*Antocha*) *indica* Brunetti, 1912. A – male antenna; B – male habitus; C – male sternite 9; D – male tergite 9; E – male wing; F – male genital structures and aedeagus, dorsal view.

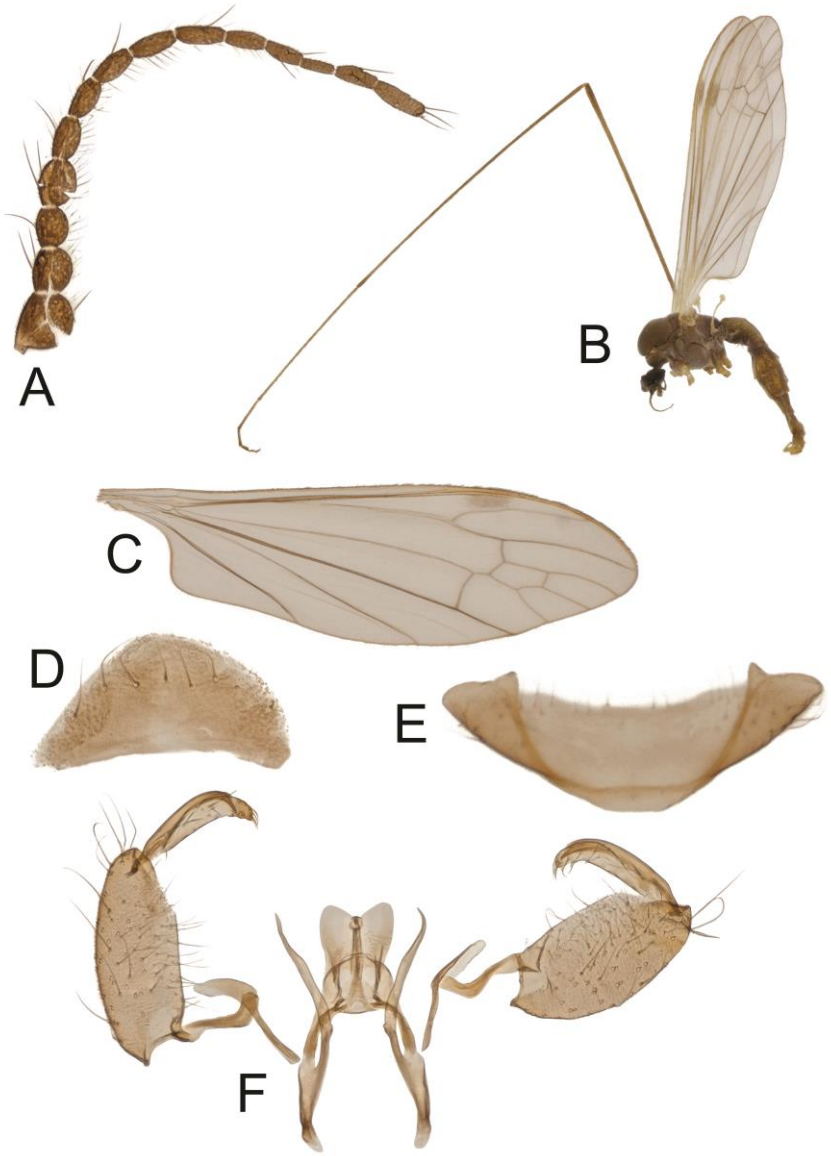


**Figure 94.** *Antocha* (*Antocha*) *javanensis* Alexander, 1915. A – male antenna; B – male habitus; C – male wing; D – male sternite 9; E – male tergite 9; F – male genital structures and aedeagus, dorsal view.

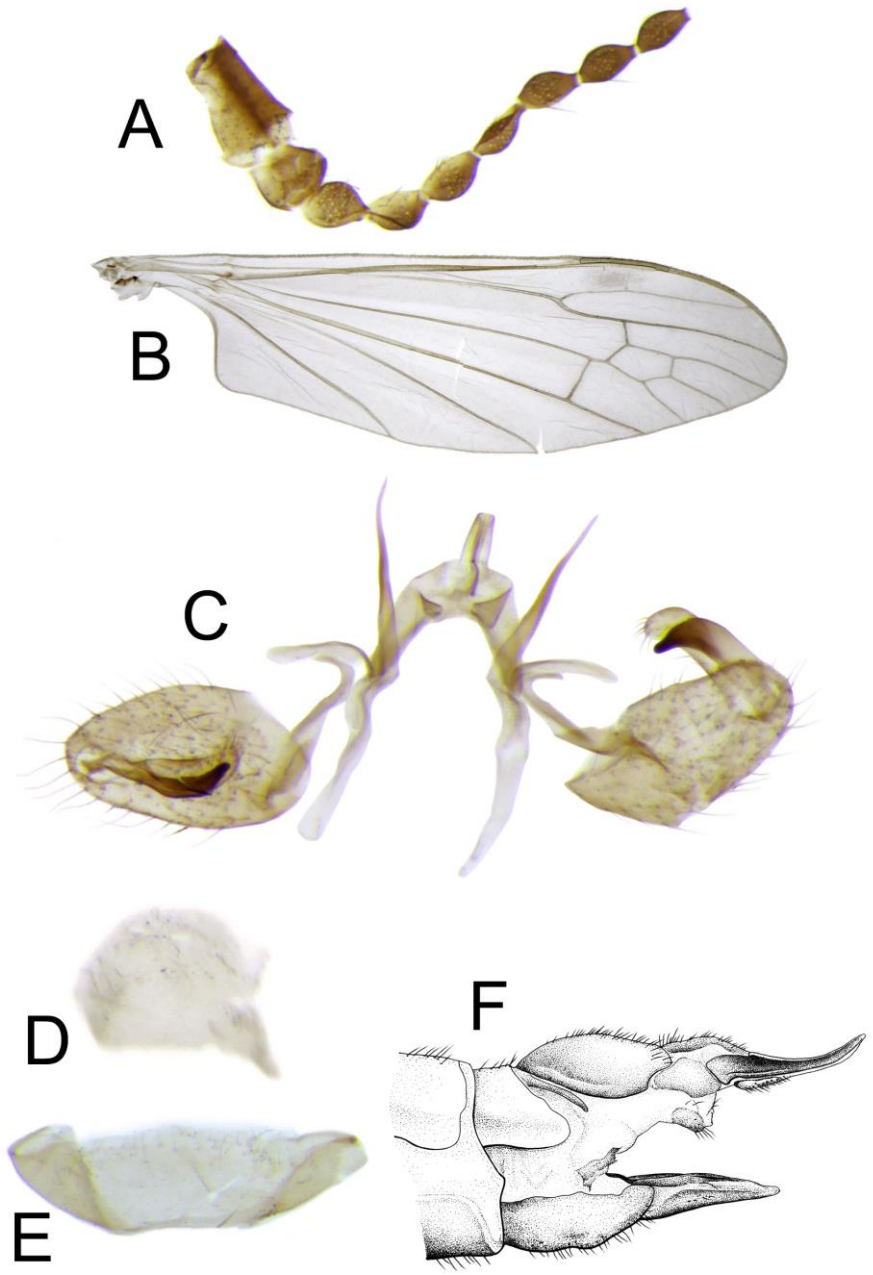


**Figure 95.** *Antocha* (*Antocha*) *koreana* Podenas and Byun, 2014. A – male antenna; B – male wing; C – male genital structures and aedeagus, dorsal view; D – male sternite 9; E – male tergite 9; F – female ovipositor, lateral view (illustrated by Podenas, 2014: 120 p.).

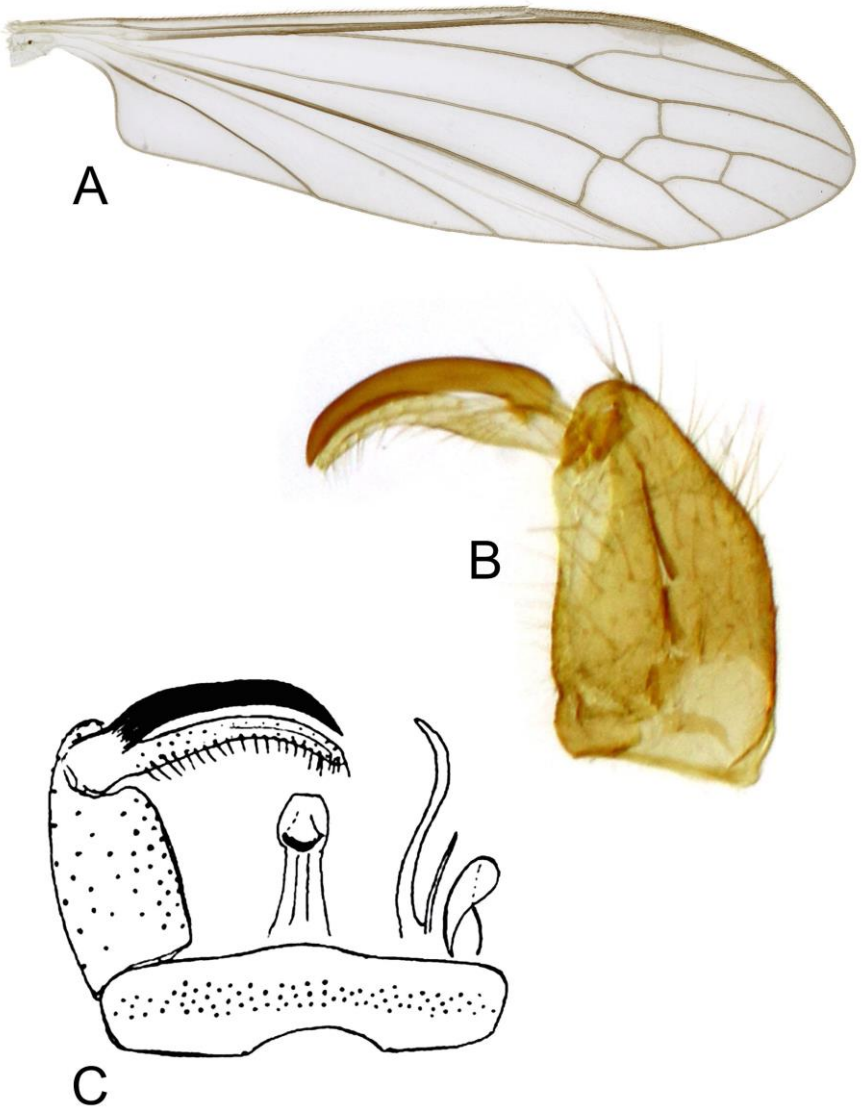


**Figure 96.** *Antocha* (*Antocha*) *lacteibasis* Alexander, 1935. A – male wing, paratype; B – male gonocoxite with outer and inner gonostyli, paratype; C – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1935: Plate 3, 35 fig.).

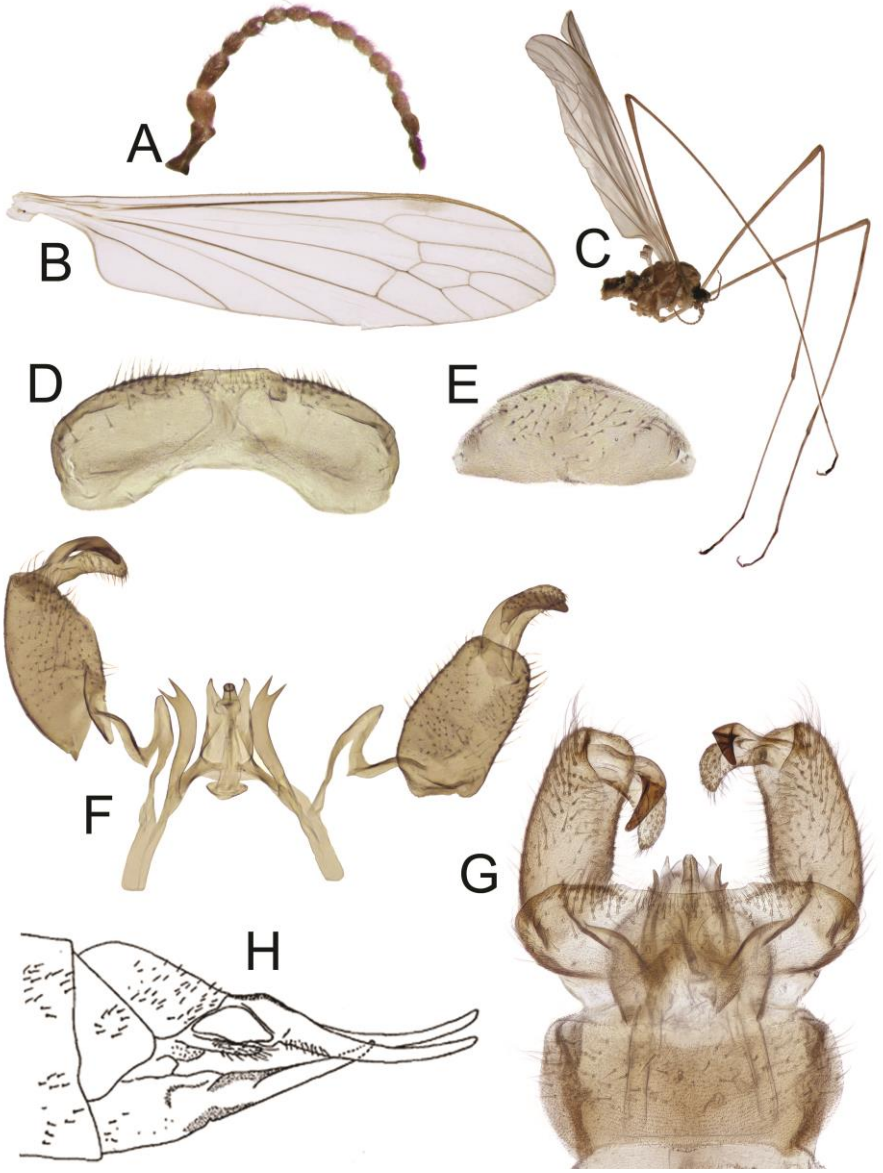


**Figure 97.** *Antocha* (*Antocha*) *libanotica* Lackschewitz, 1940. A – male antenna; B – male wing; C – male habitus; D – male tergite 9; E – male sternite 9; F – male genital structures and aedeagus, dorsal view; G – male genitalia, dorsal view; H – female ovipositor, lateral view (illustrated by Thomas and Dia, 1982).

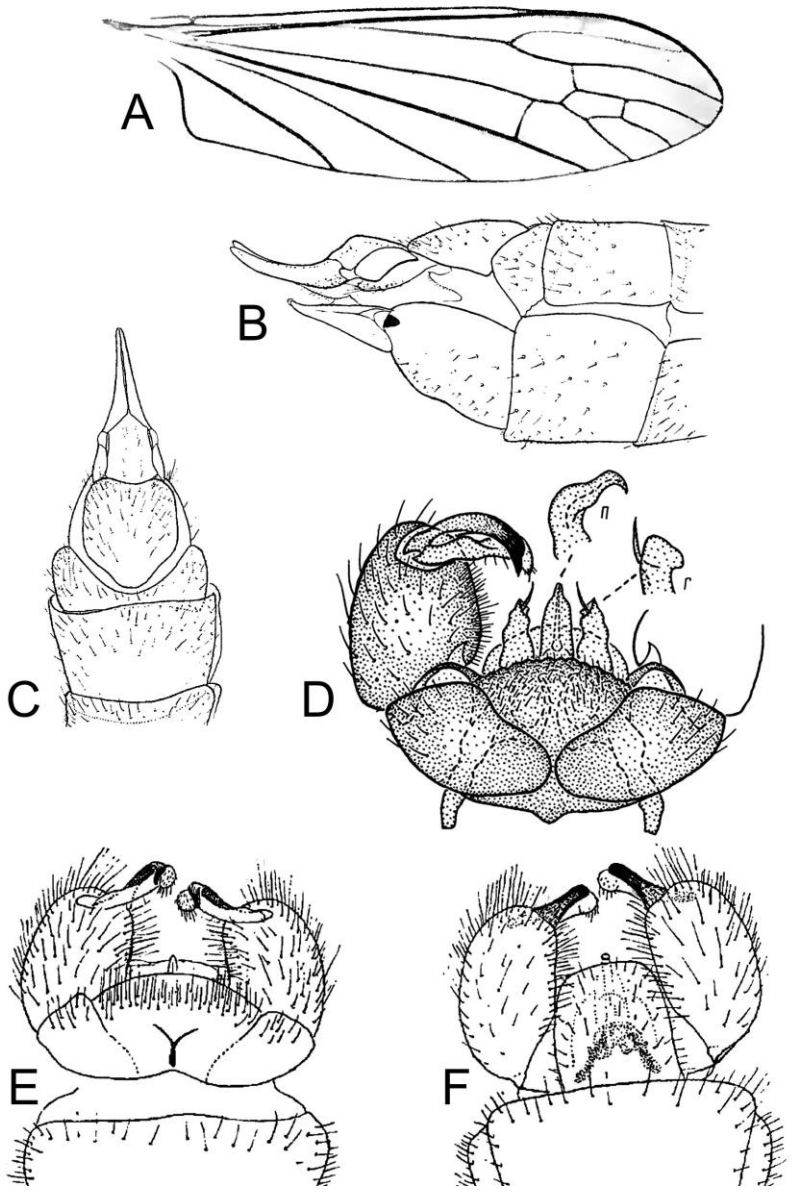


**Figure 98.** *Antocha* (*Antocha*) *lindneri* (Nielsen, 1963). A – male wing (illustrated by Nielsen, 1963: 3 p.); B – female ovipositor, lateral view (illustrated by Nielsen, 1963: 3 p.); C – female ovipositor, dorsal view (illustrated by Nielsen, 1963: 3 p.); D – male genital structures and aedeagus, dorsal view (illustrated by Savchenko, 1981); E – male genitalia, dorsal view (illustrated by Nielsen, 1963: 2 p.); F – male genitalia, ventral view (illustrated by Nielsen, 1963: 2 p.).

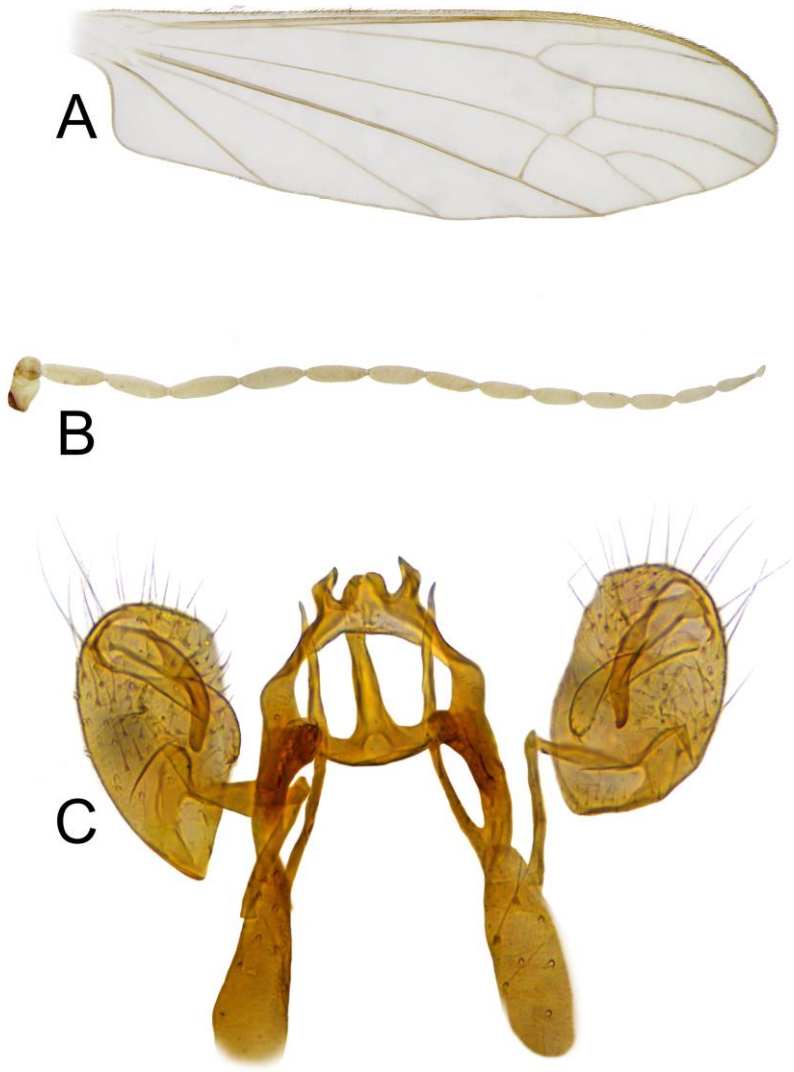


**Figure 99.** *Antocha* (*Antocha*) *macrocera* Alexander, 1970. A – male wing, paratype; B – male antenna, paratype; C – male genital structures and aedeagus, dorsal view, paratype.

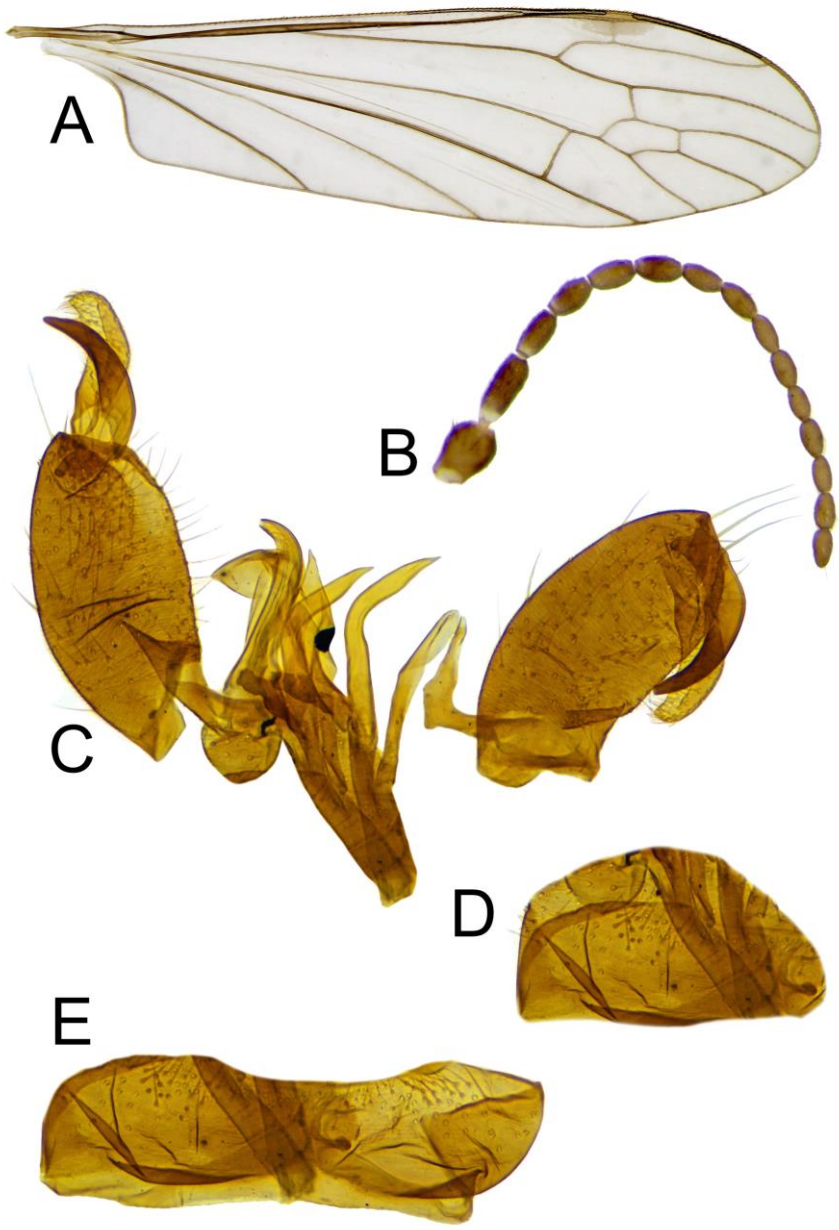


**Figure 100.** *Antocha* (*Antocha*) *madrasensis* Alexander, 1970. A – male wing, paratype; B – male antenna, paratype; C – male genital structures and aedeagus, dorsal view, paratype; D – male sternite 9, paratype; E – male tergite 9, paratype.

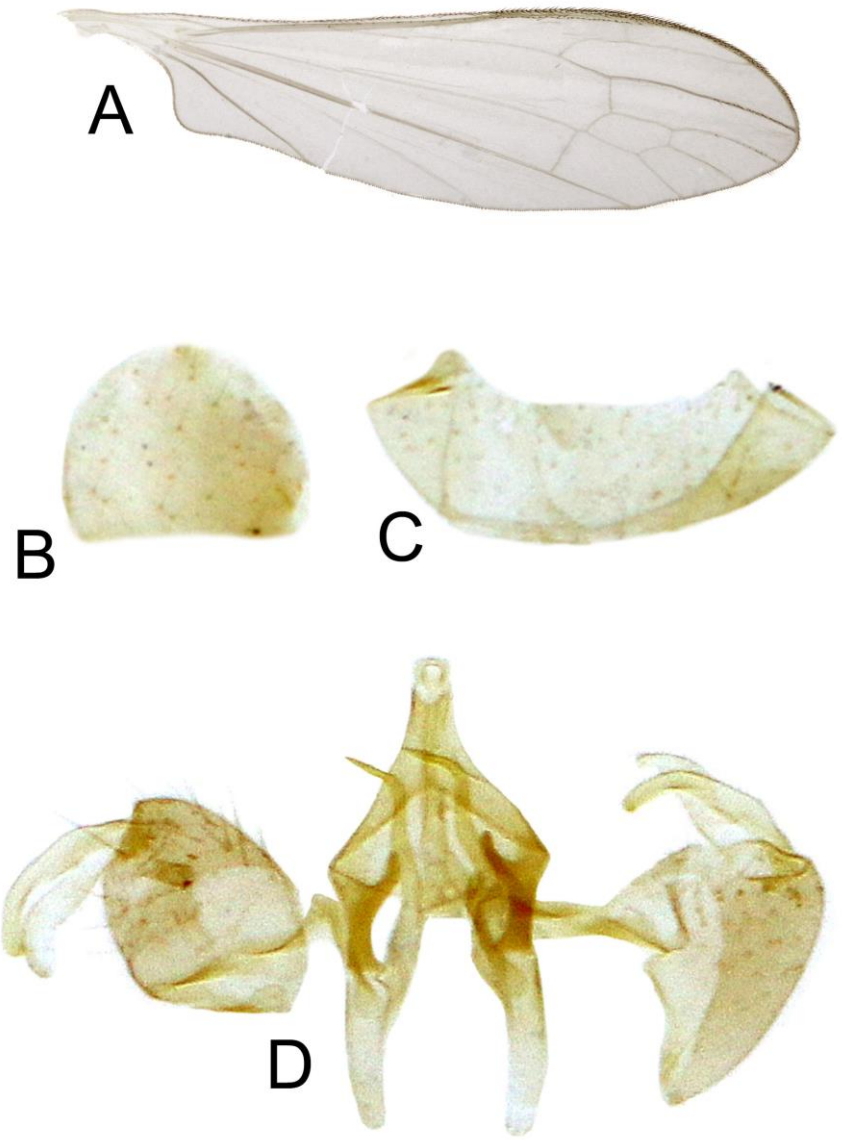


**Figure 101.** *Antocha* (*Antocha*) *mara* Alexander, 1970. A – male wing, holotype; B – male sternite 9, holotype; C – male tergite 9, holotype; D – male genital structures and aedeagus, dorsal view, holotype.

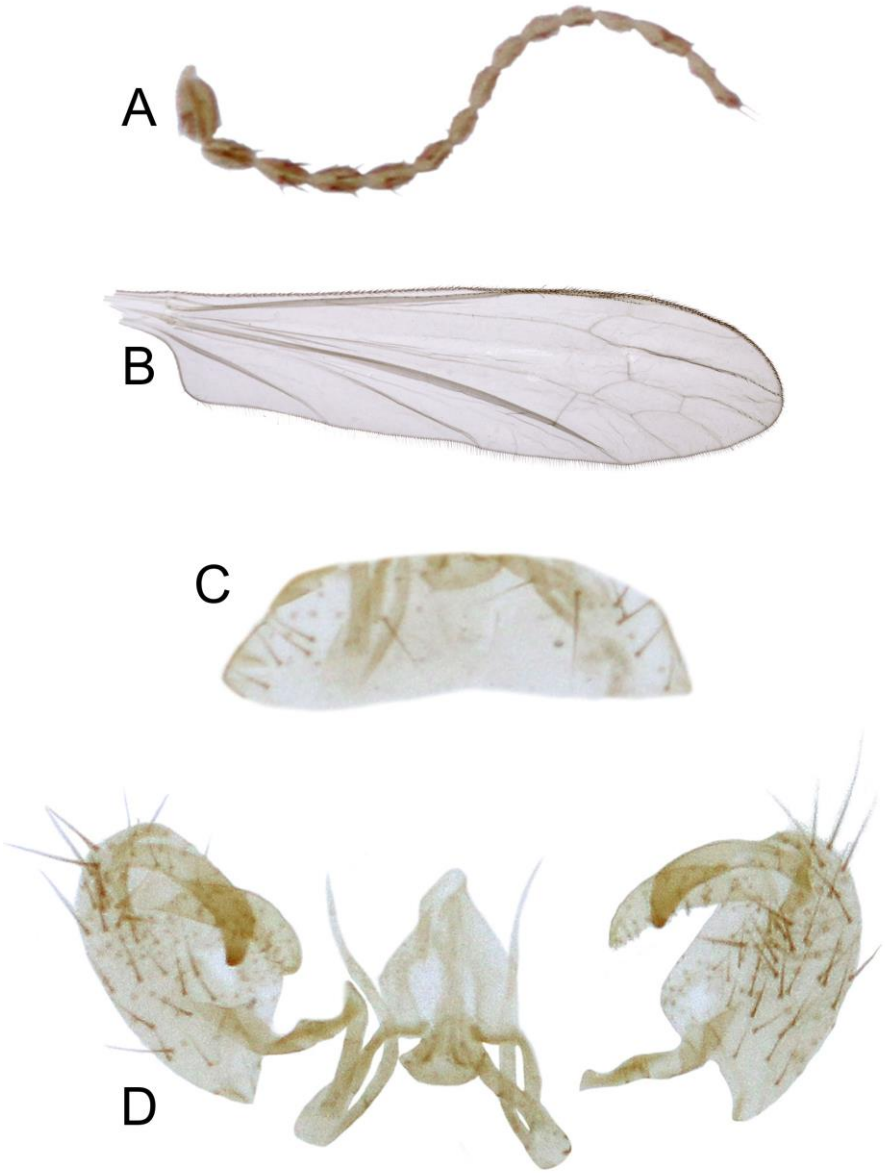


**Figure 102.** *Antocha* (*Antocha*) *microcera* Alexander, 1974. A – male antenna, holotype; B – male wing, holotype; C –male tergite 9, holotype; E – male sternite 9, holotype; F – male genital structures and aedeagus, dorsal view, holotype.

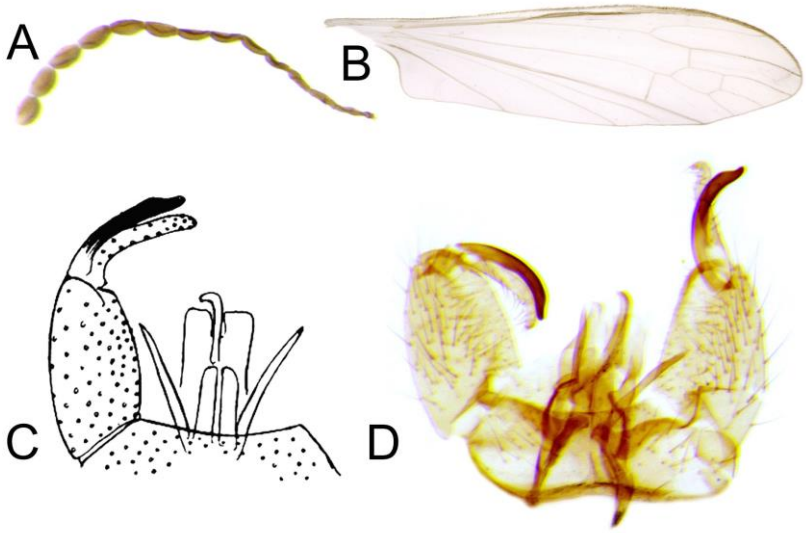


**Figure 103.** *Antocha* (*Antocha*) *minuticornis* Alexander, 1931. A – male antenna, holotype; B – male wing, holotype; C – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1931: Plate 2, 40 fig.); E – male genital structures and aedeagus, dorsal view, holotype.

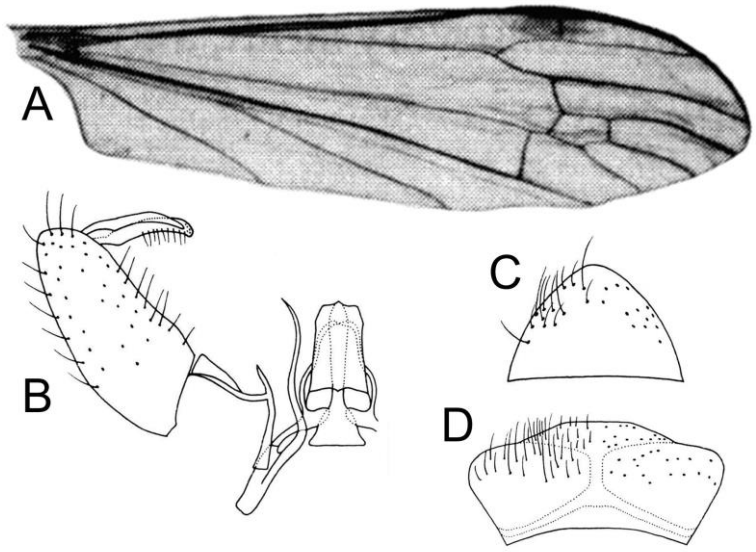


**Figure 104.** *Antocha* (*Antocha*) *mitosanensis* Torii, 1992. A – male wing (illustrated by Torii, 1992: 181 p.); B – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 181 p.); C – male sternite 9 (illustrated by Torii, 1992: 181 p.); D – male tergite 9 (illustrated by Torii, 1992: 181 p.).

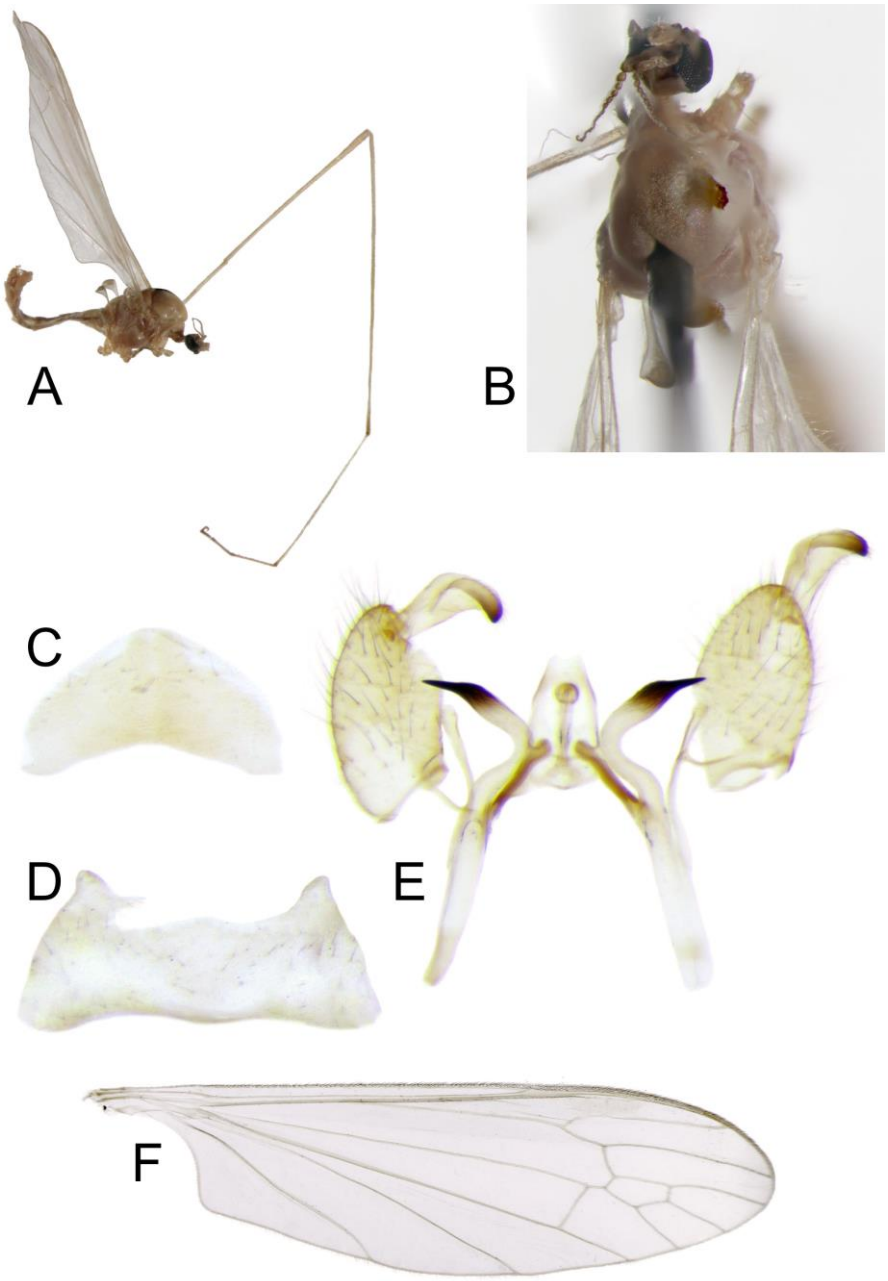


**Figure 105.** *Antocha* (*Antocha) monticola* Alexander, 1917. A – male habitus; B – male thorax, dorsal view; C – male sternite 9; D – male tergite 9; E – male genital structures and aedeagus, dorsal view; F – male wing.

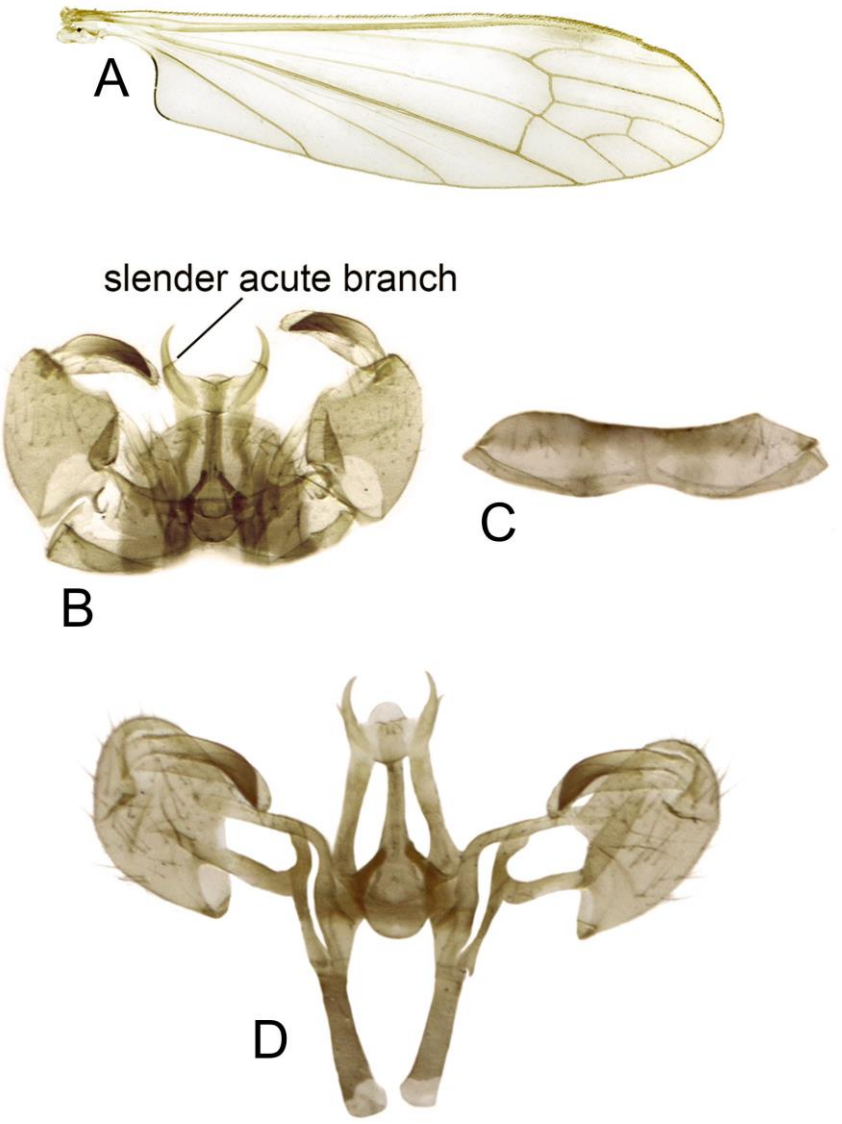


**Figure 106.** *Antocha* (*Antocha*) *multidentata* Alexander, 1932. A – male wing, holotype; B – male genitalia, dorsal view, holotype; C – male tergite 9, metatype; D – male genital structures and aedeagus, dorsal view, metatype.

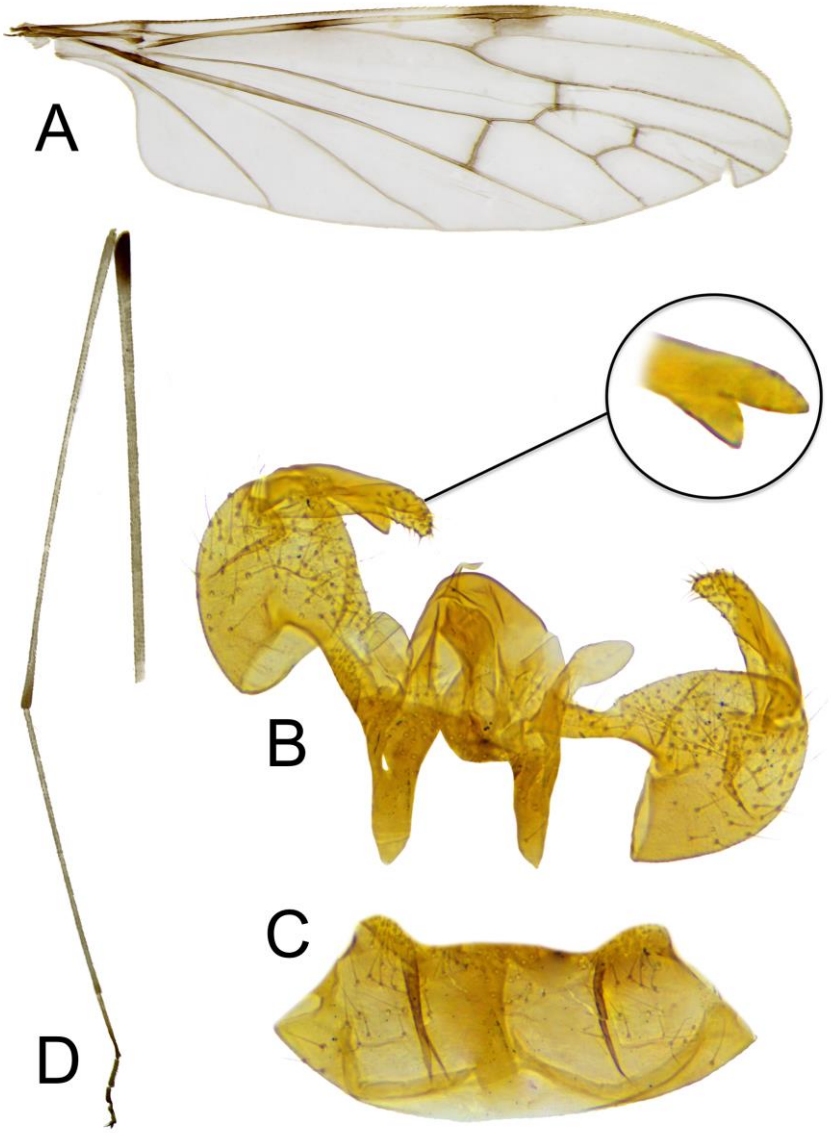


**Figure 107.** *Antocha* (*Antocha*) *mysorensis* Alexander, 1974. A – male wing, paratype; B – male genitalia, dorsal view, paratype; C – male tergite 9, paratype; D – male leg, paratype.

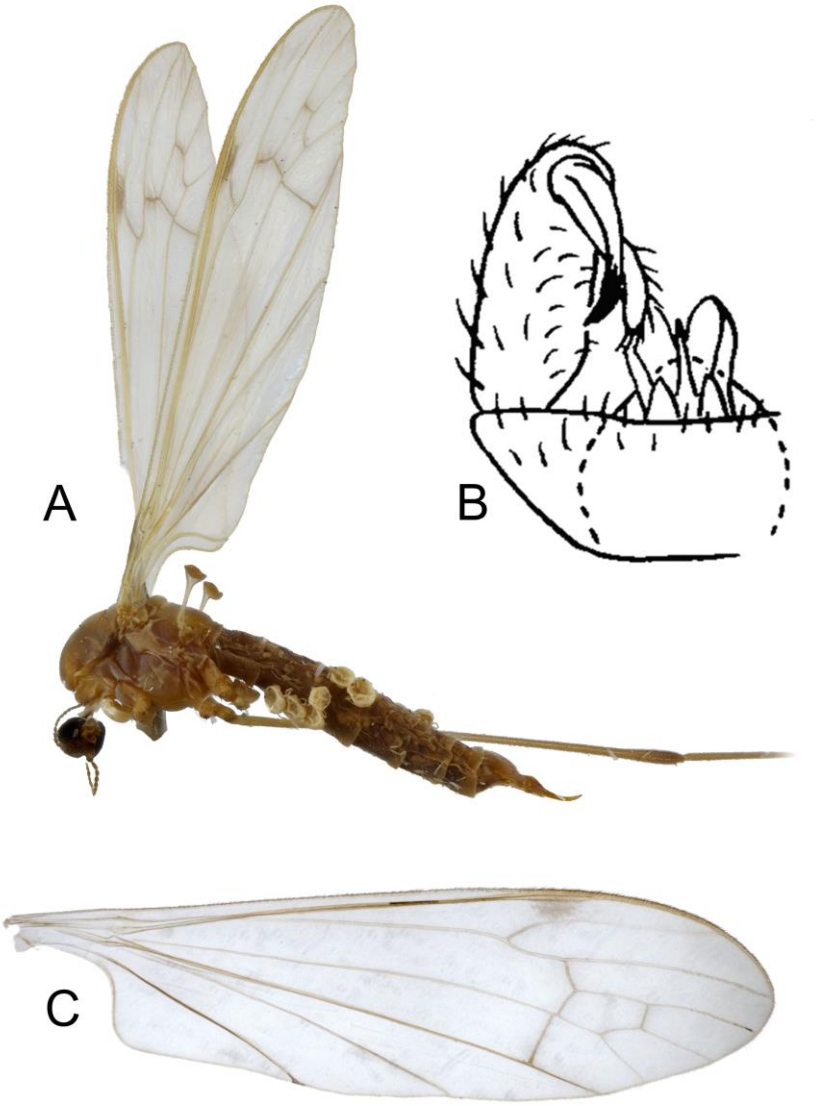


**Figure 108.** *Antocha* (*Antocha*) *nebulosa* Edwards, 1928. A – female habitus, syntype; B – male genitalia, dorsal view (illustrated by Edwards, 1928: Plate 2, 44 fig.); C – male wing, syntype.

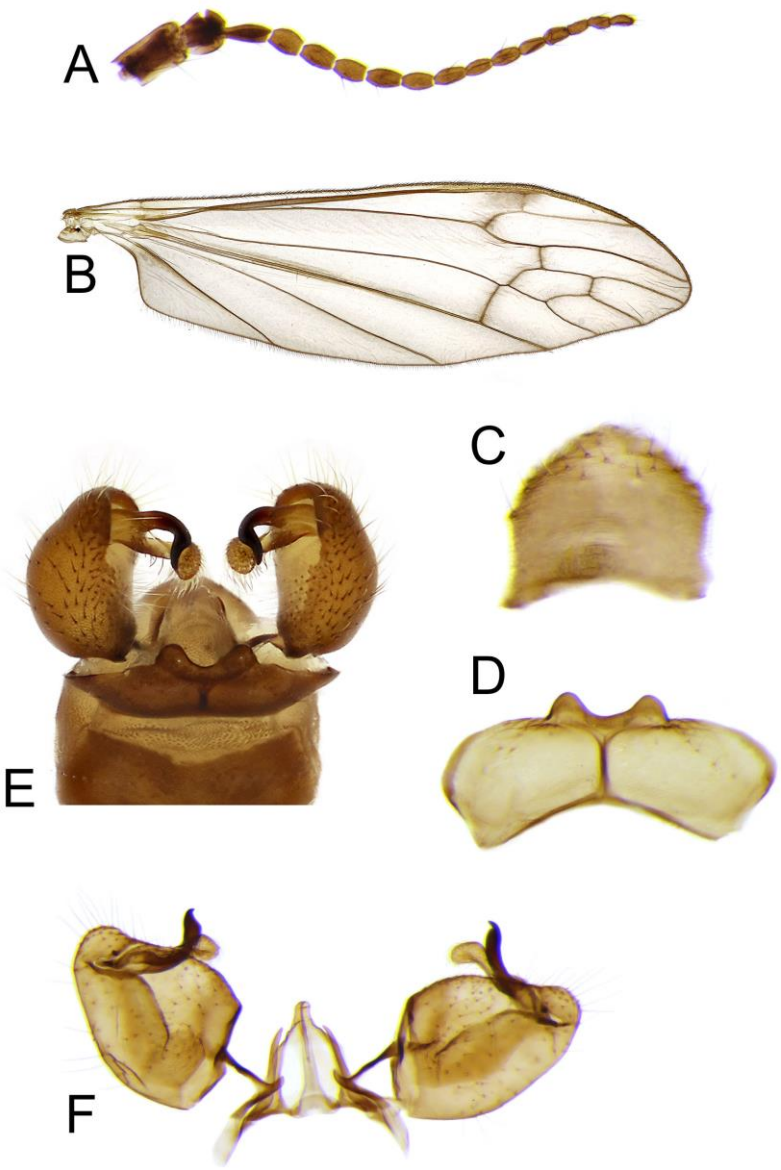


**Figure 109.** *Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938. A – male antenna; B – male wing; C – male sternite 9; D – male tergite 9; E – male genitalia, general, dorsal view; F – male genital structures and aedeagus, dorsal view.

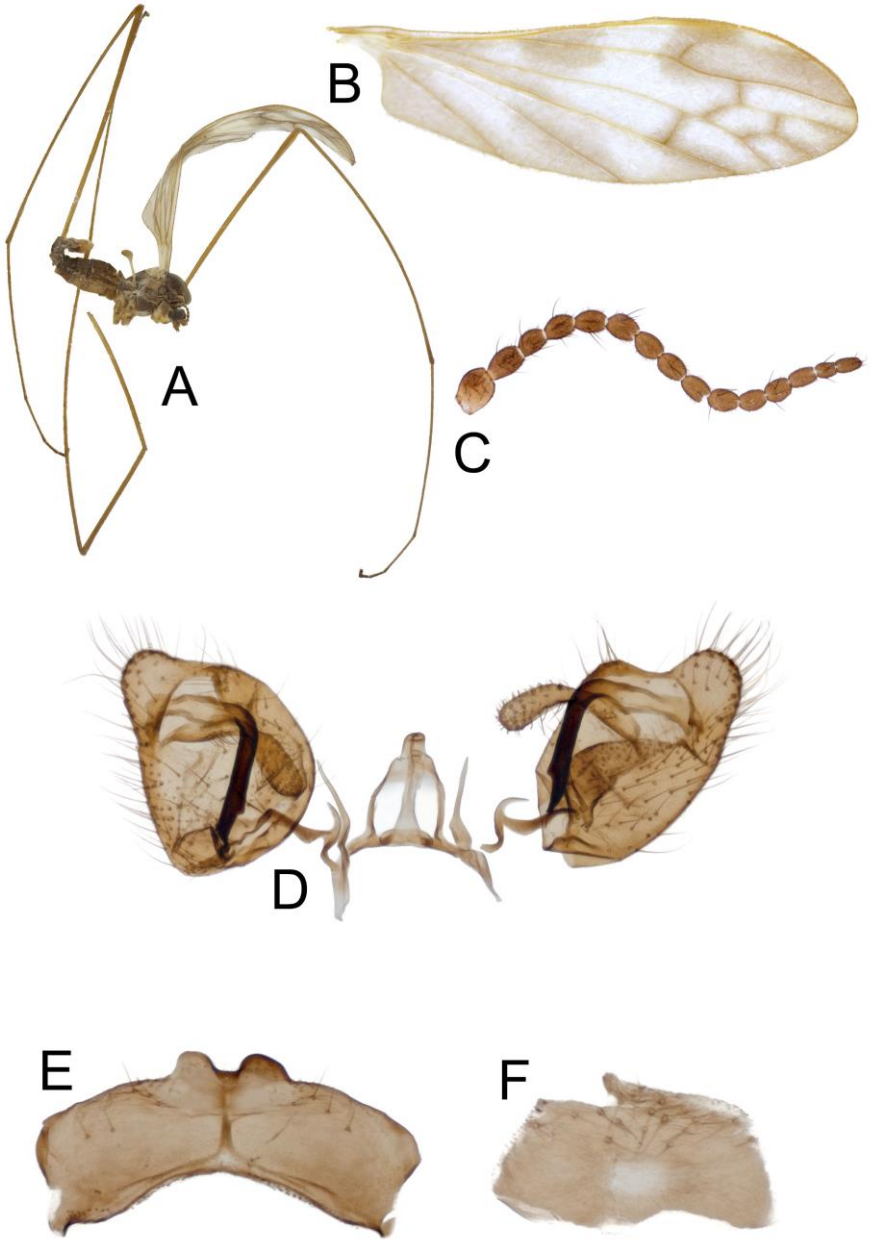


**Figure 110.** *Antocha* (*Antocha*) *nebulipennis nebulipennis* Alexander, 1931. A – male habitus; B – male wing; C – male antenna; D – male genital structures and aedeagus, dorsal view; E – male tergite 9; F – male sternite 9.

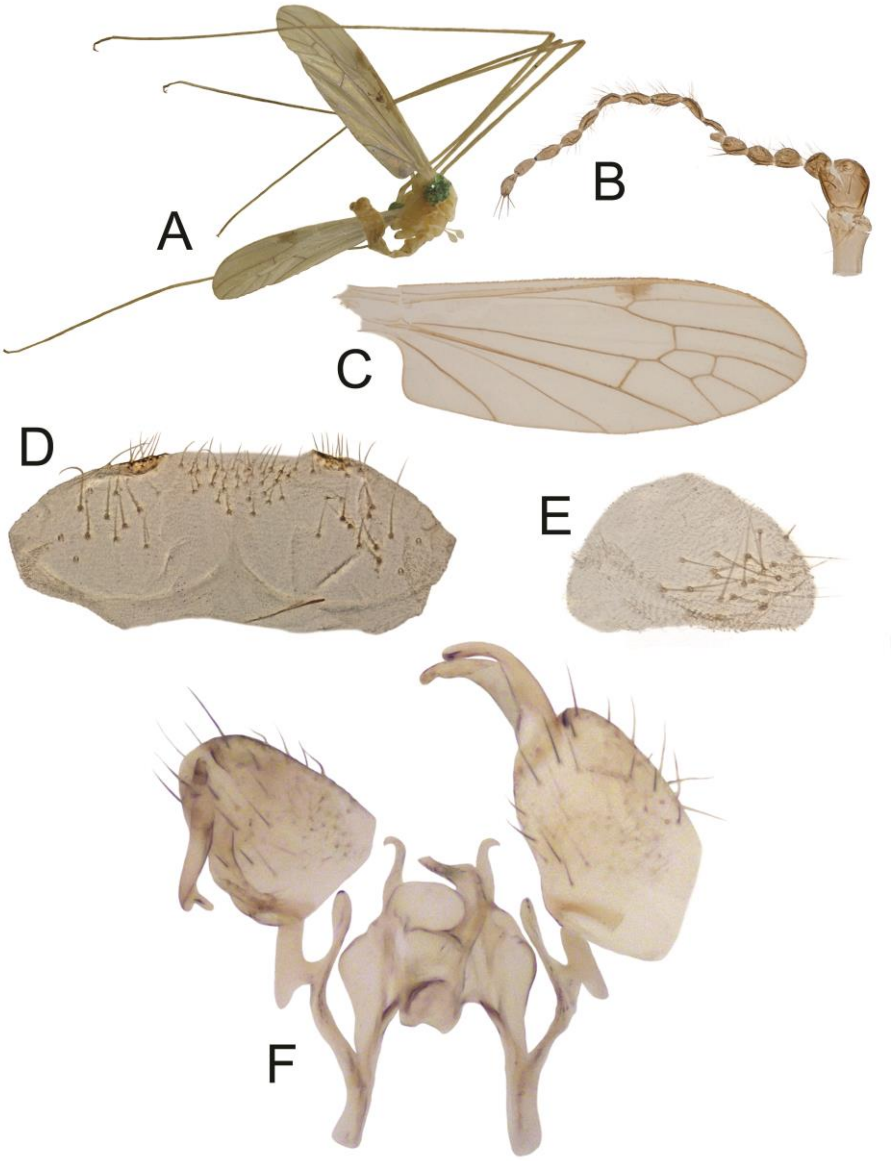


**Figure 111.** *Antocha* (*Antocha*) *neoflavella* Alexander and Alexander, 1973. A – male habitus; B – male antenna; C – male wing; D – male tergite 9; E – male sternite 9; F – male genital structures and aedeagus, dorsal view.

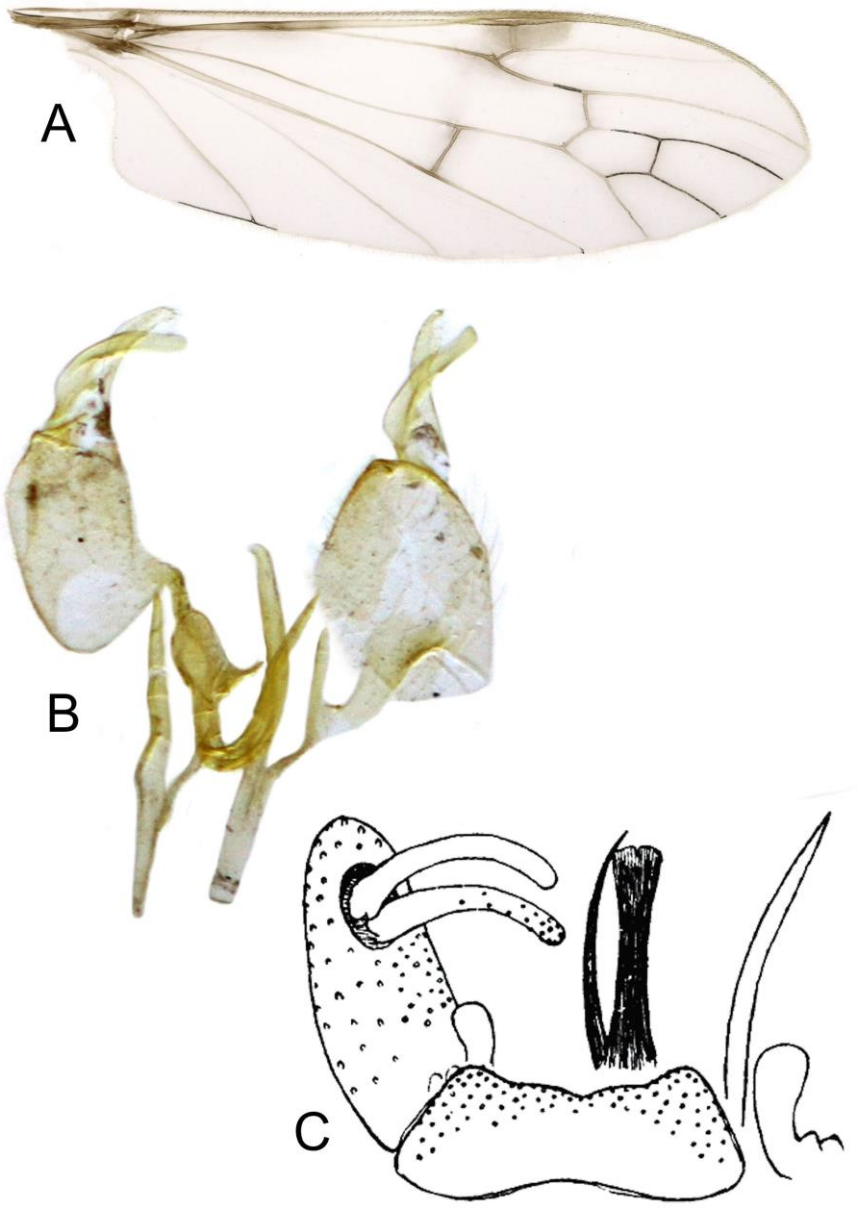


**Figure 112.** *Antocha* (*Antocha*) *nigribasis* Alexander, 1932. A – male wing, paratype; B – male genital structures and aedeagus, dorsal view, paratype; C – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1932: Plate 3, 42 fig.).

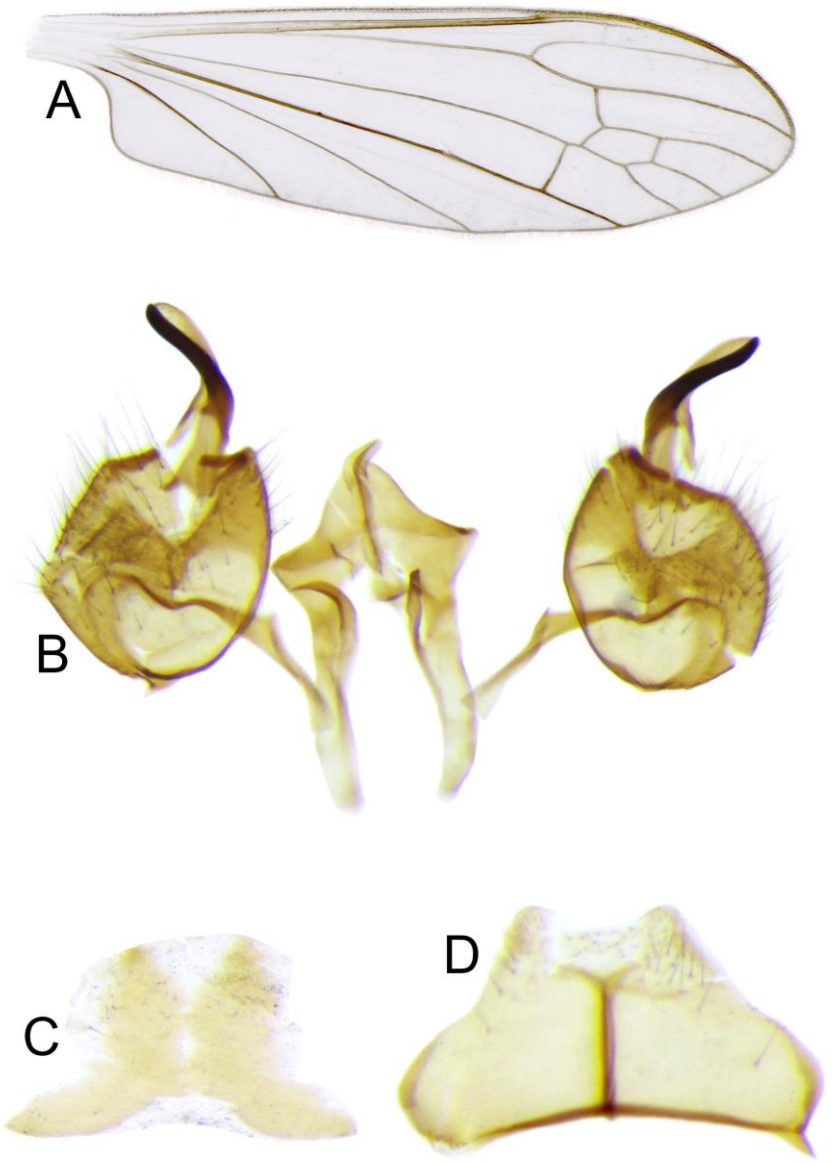


**Figure 113.** *Antocha* (*Antocha*) *obtusa* Alexander, 1925. A – male wing; B – male genital structures and aedeagus, dorsal view C – male sternite 9; D – male tergite 9.

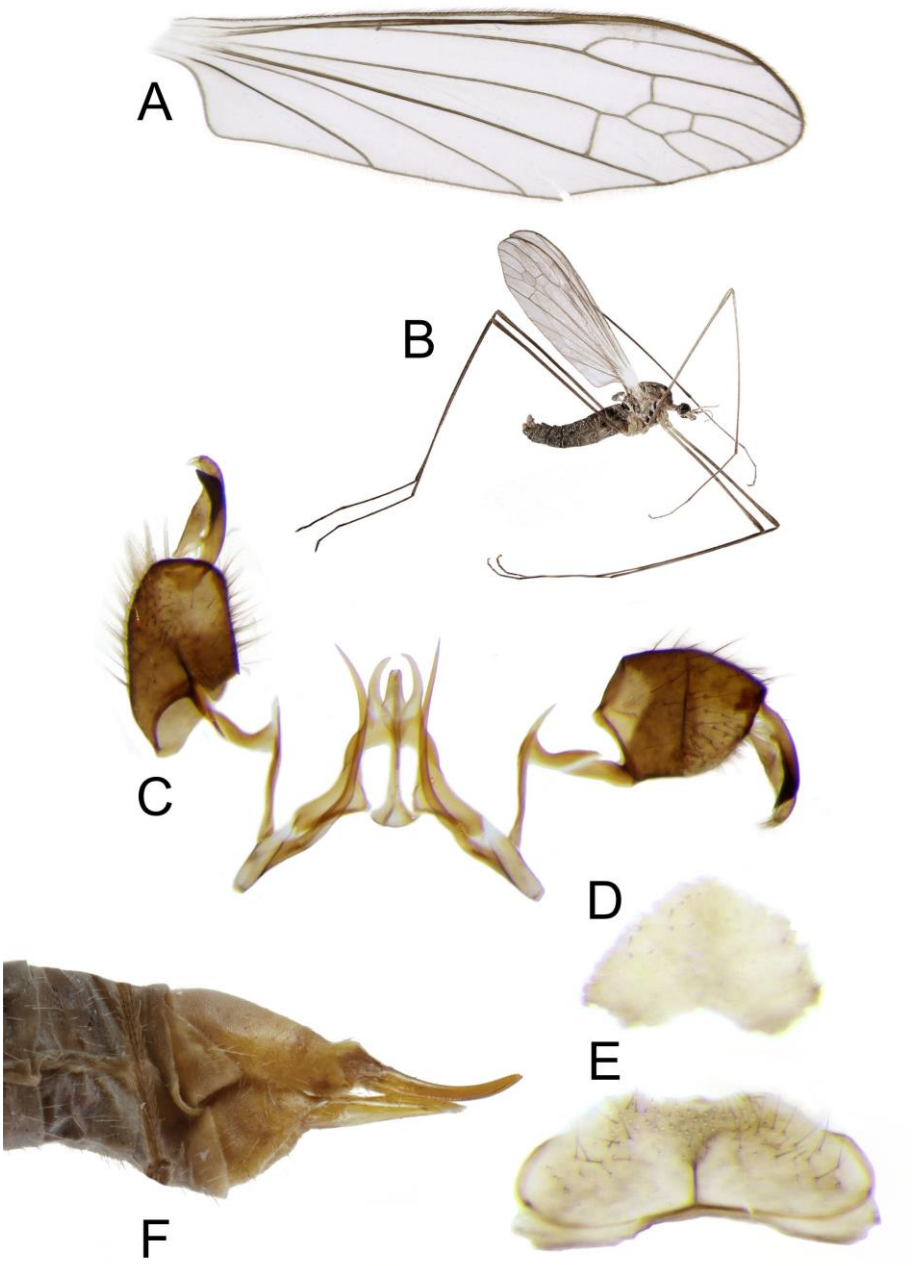


**Figure 114.** *Antocha* (*Antocha*) *opalizans* Osten Sacken, 1860. A – male wing; B – male habitus; C – male genital structures and aedeagus, dorsal view; D – male sternite 9; E – male tergite 9; F – female ovipositor, lateral view.

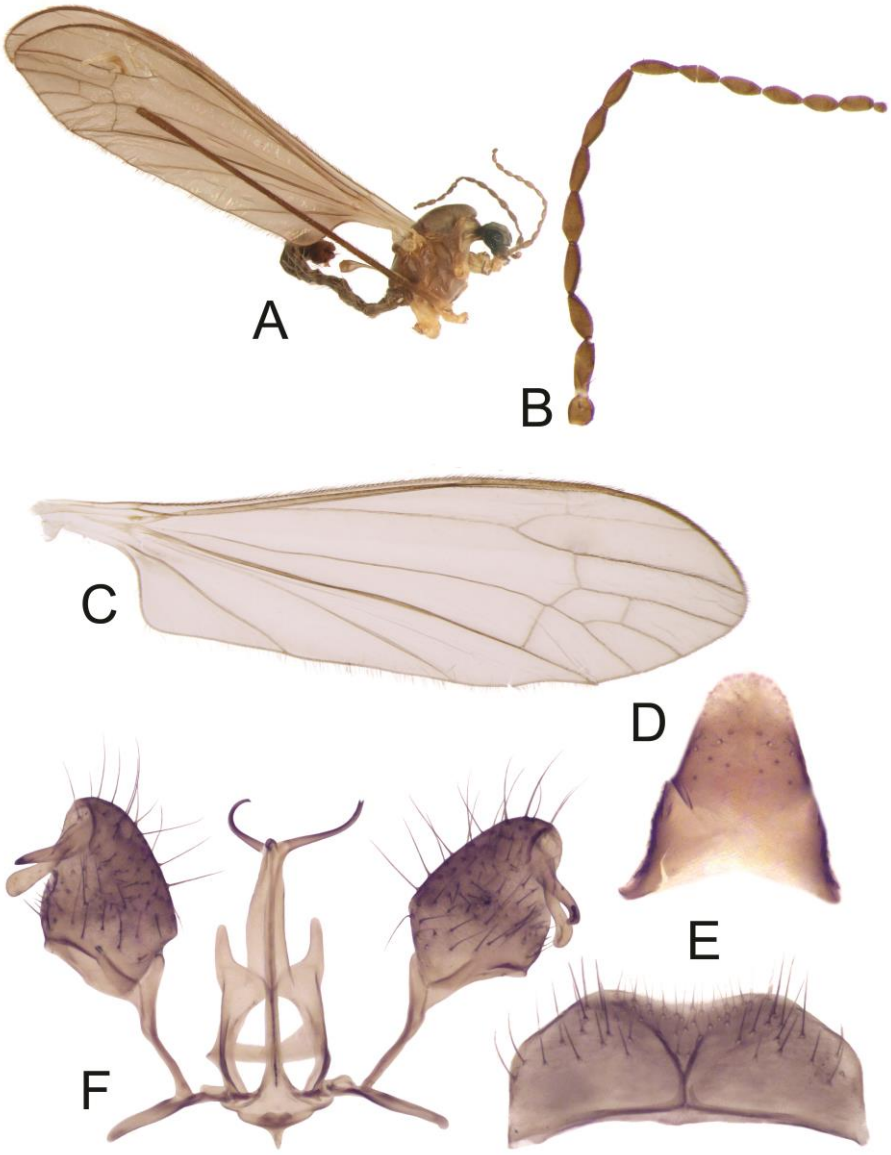


**Figure 115.** *Antocha* (*Antocha*) *ophioglossa* Alexander, 1954. A – male habitus; B – male antenna; C – male wing; D – male sternite 9; E – male tergite 9; F – male genital structures and aedeagus, dorsal view.

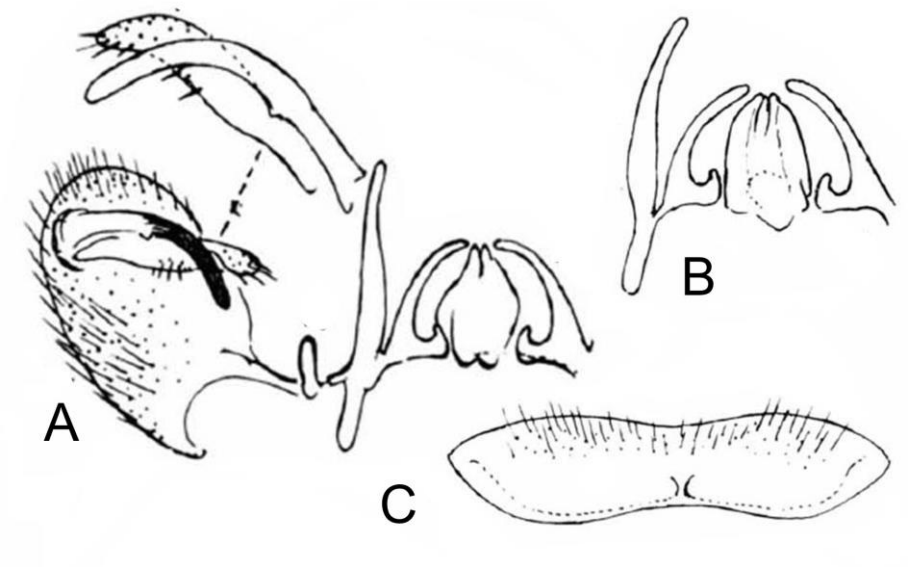


**Figure 116.** *Antocha* (*Antocha*) *pachyphallus* Alexander, 1971. A – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1932: 163 p.); B – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1932: 163 p.); C – male tergite 9 (illustrated by Alexander, 1932: 163 p.).

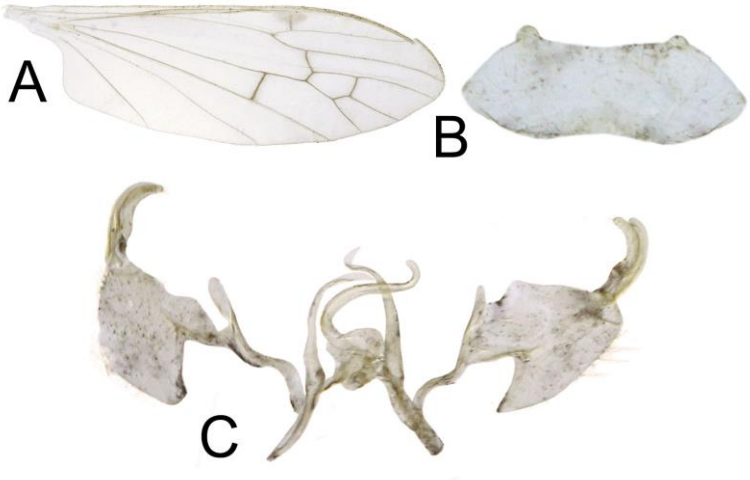


**Figure 117.** *Antocha* (*Antocha*) *pallidella* Alexander, 1933. A – male wing, holotype; B – male tergite 9, holotype; C – male genital structures and aedeagus, dorsal view, holotype.

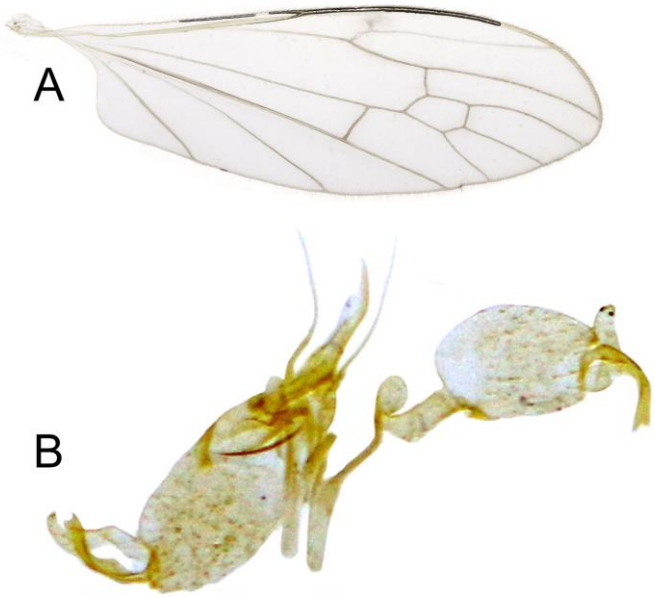


**Figure 118.** *Antocha* (*Antocha*) *perattenuata* Alexander, 1971. A – male wing, holotype; B – male genital structures and aedeagus, dorsal view, holotype.

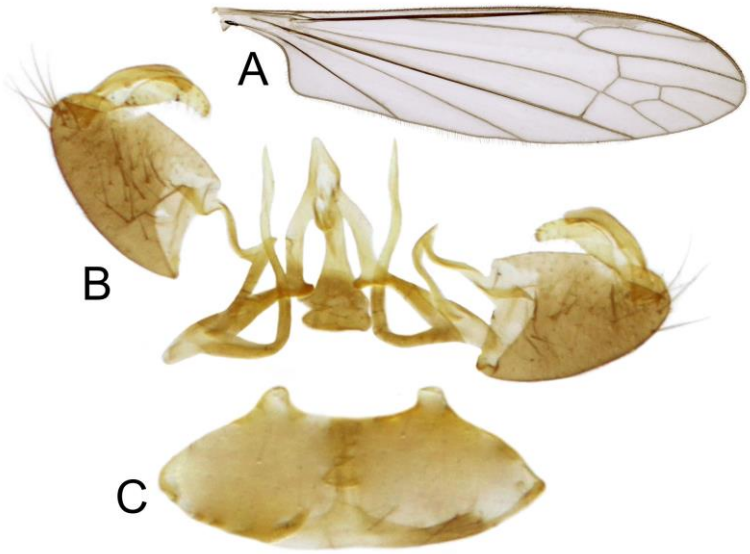


**Figure 119.** *Antocha* (*Antocha*) *perobtusa* Alexander, 1971. A – male wing, holotype; B – male genital structures and aedeagus, dorsal view, holotype; C – male tergite 9, holotype.

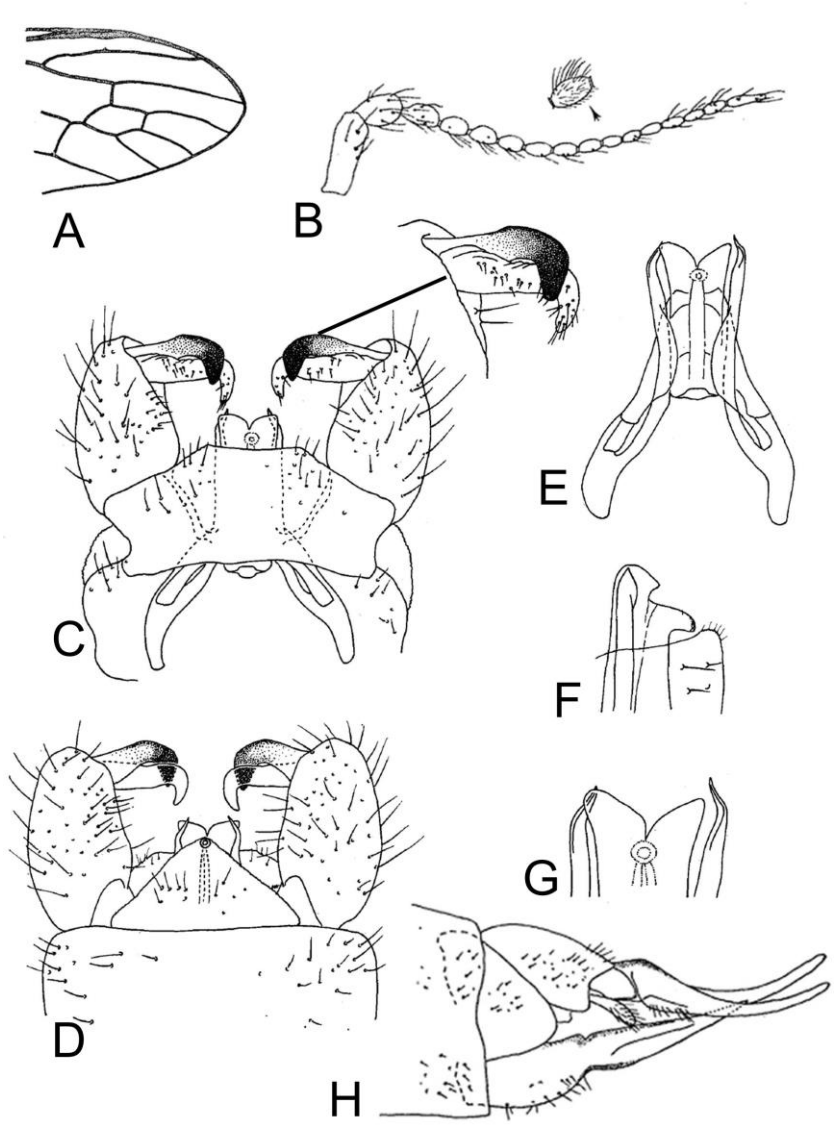


**Figure 120.** *Antocha* (*Antocha*) *phoenicia* Thomas and Dia, 1982. A – male wing venation (illustrated by Thomas and Dia, 1982: 2 p.); B – male antenna (illustrated by Thomas and Dia, 1982: 2 p.); C – male genitalia, dorsal view (illustrated by Thomas and Dia, 1982: 6 p.); D – male genitalia, ventral view (illustrated by Thomas and Dia, 1982: 6 p.); E – male aedeagus, dorsal view (illustrated by Thomas and Dia, 1982: 6 p.); F – male aedeagus, lateral view (illustrated by Thomas and Dia, 1982: 6 p.); G – end of male aedeagus, dorsal view (illustrated by Thomas and Dia, 1982: 6 p.); H – female ovipositor, lateral view (illustrated by Thomas and Dia, 1982: 4 p.).

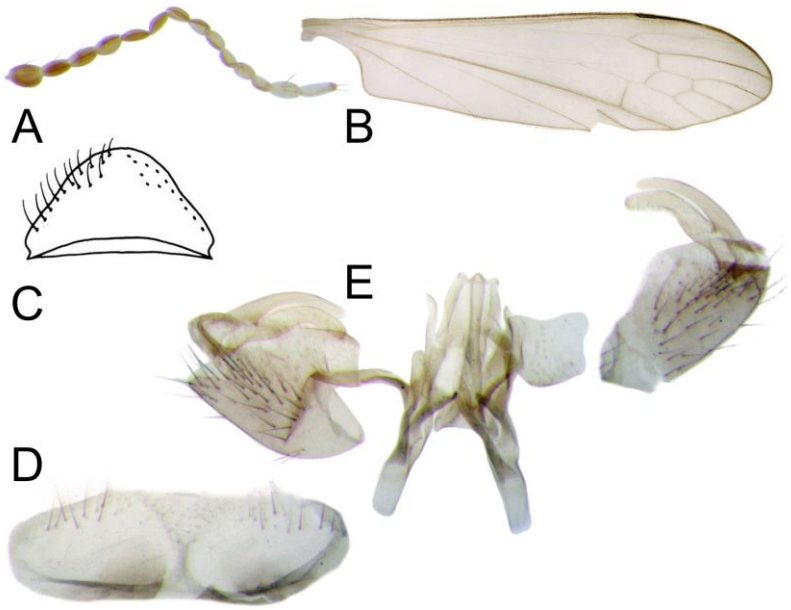


**Figure 121.** *Antocha* (*Antocha*) *platyphallus* Alexander, 1935. A – male antenna, holotype; B – male wing; C – male sternite 9 (illustrated by Torii, 1992: 182 p.); D– male genital structures and aedeagus, dorsal view.

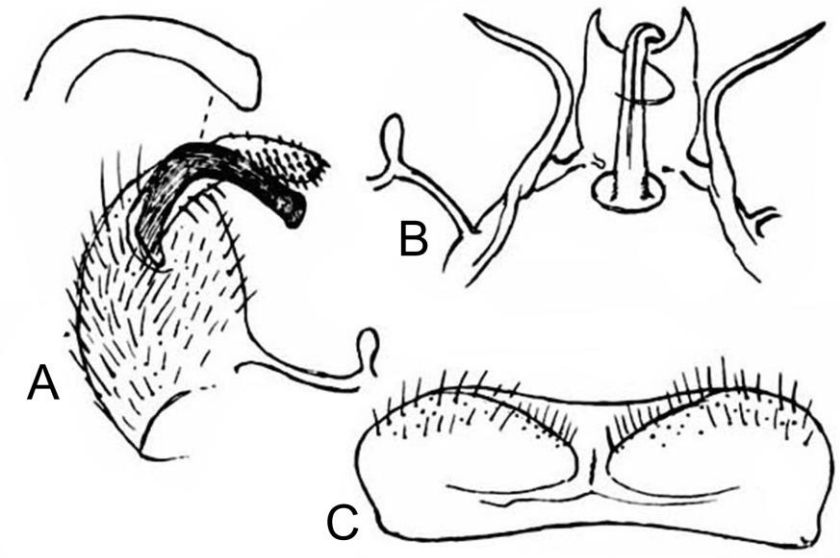


**Figure 122.** *Antocha* (*Antocha*) *platystylis* Alexander, 1974. A – male gonocoxite with inner and outer gonostyli (illustrated by Alexander, 1974: 9 p.); B – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1974: 9 p.); C – male tergite 9 (illustrated by Alexander, 1974: 9 p.).

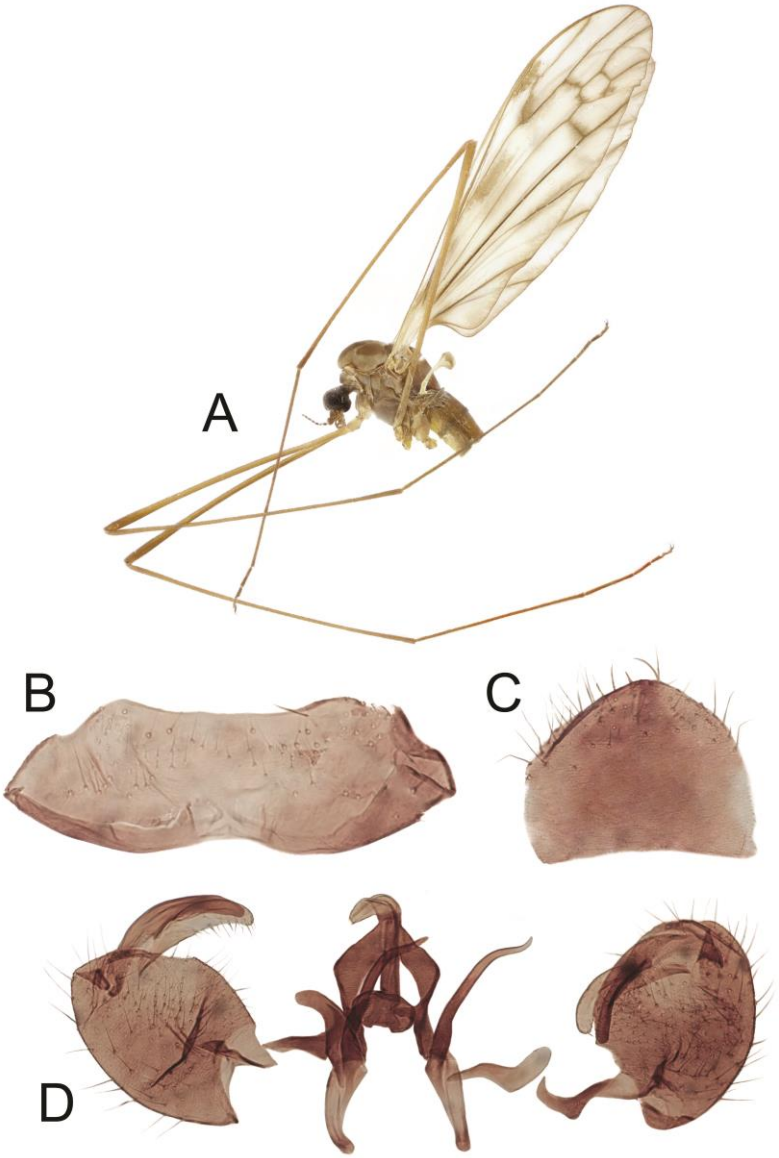


**Figure 123.** *Antocha* (*Antocha*) *pterographa* Alexander, 1953. A – male habitus, holotype; B – male tergite 9, holotype; C – male sternite 9, holotype; D – male genital structures and aedeagus, dorsal view, holotype.

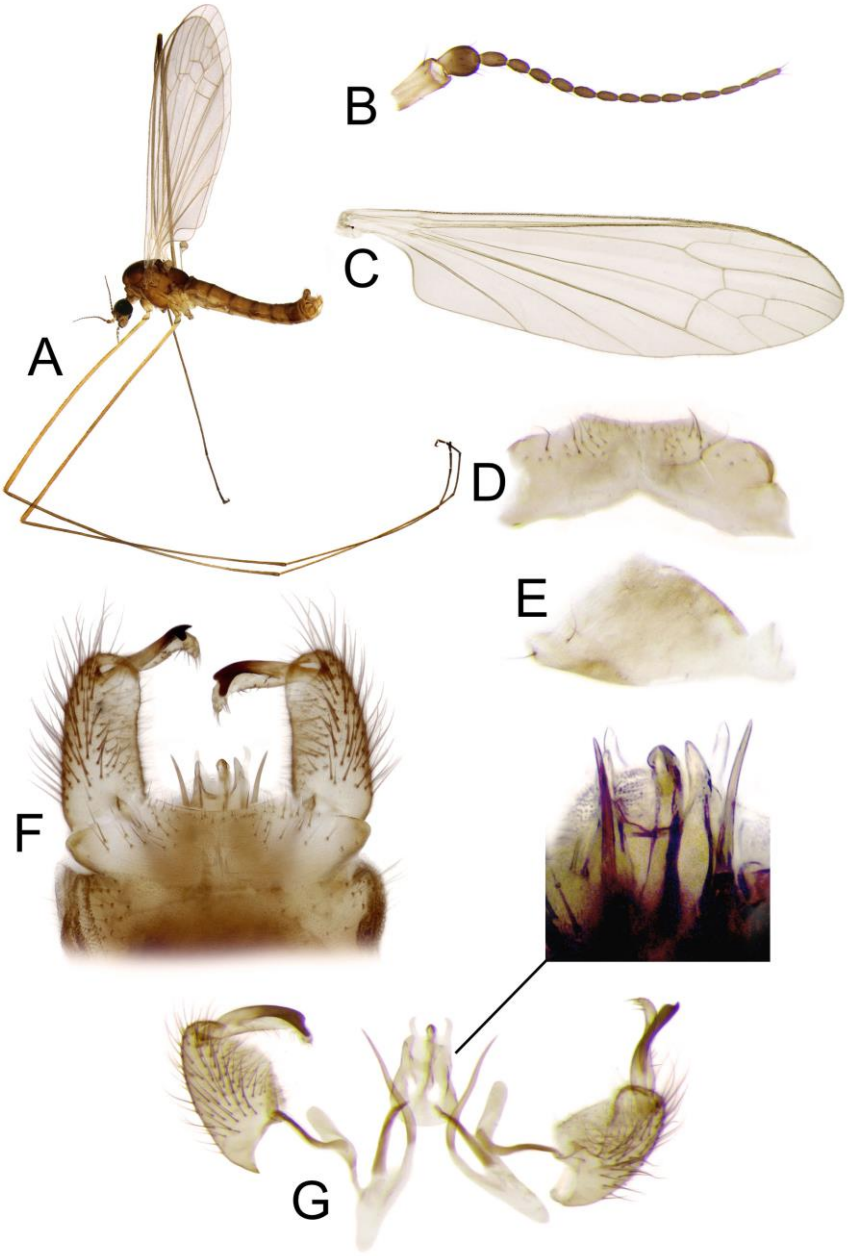


**Figure 124.** *Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021. A – male habitus, holotype; B – male antenna, paratype; C – male wing, paratype; D – male tergite 9, paratype; E – male sternite 9, paratype; F – male genitalia, dorsal view, paratype; G – male genital structures and aedeagus, dorsal view, paratype.

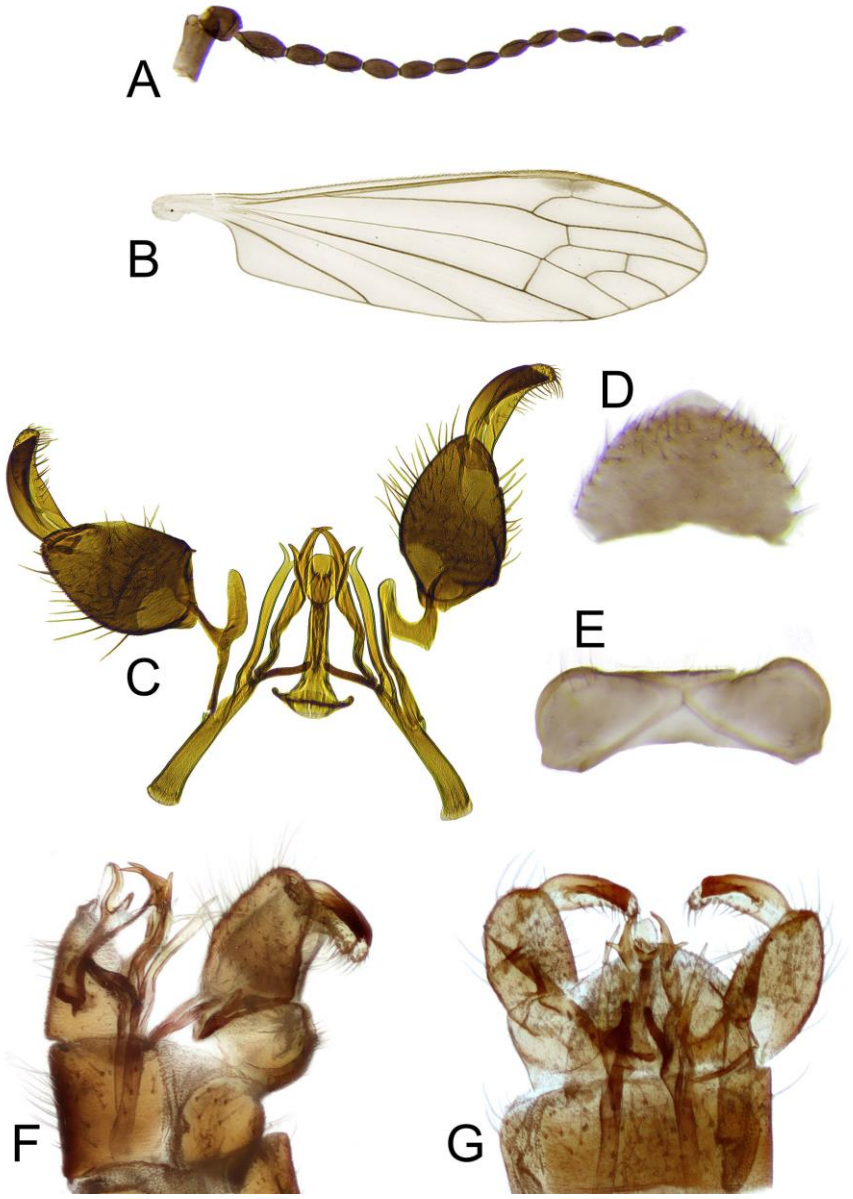


**Figure 125.** *Antocha* (*Antocha*) *quadrifurca* Alexander, 1971. A – male antenna; B – male wing; C – male genital structures and aedeagus, dorsal view; D – male sternite 9; E – male tergite 9; F – male genitalia, lateral view; G – male genitalia, dorsal view.

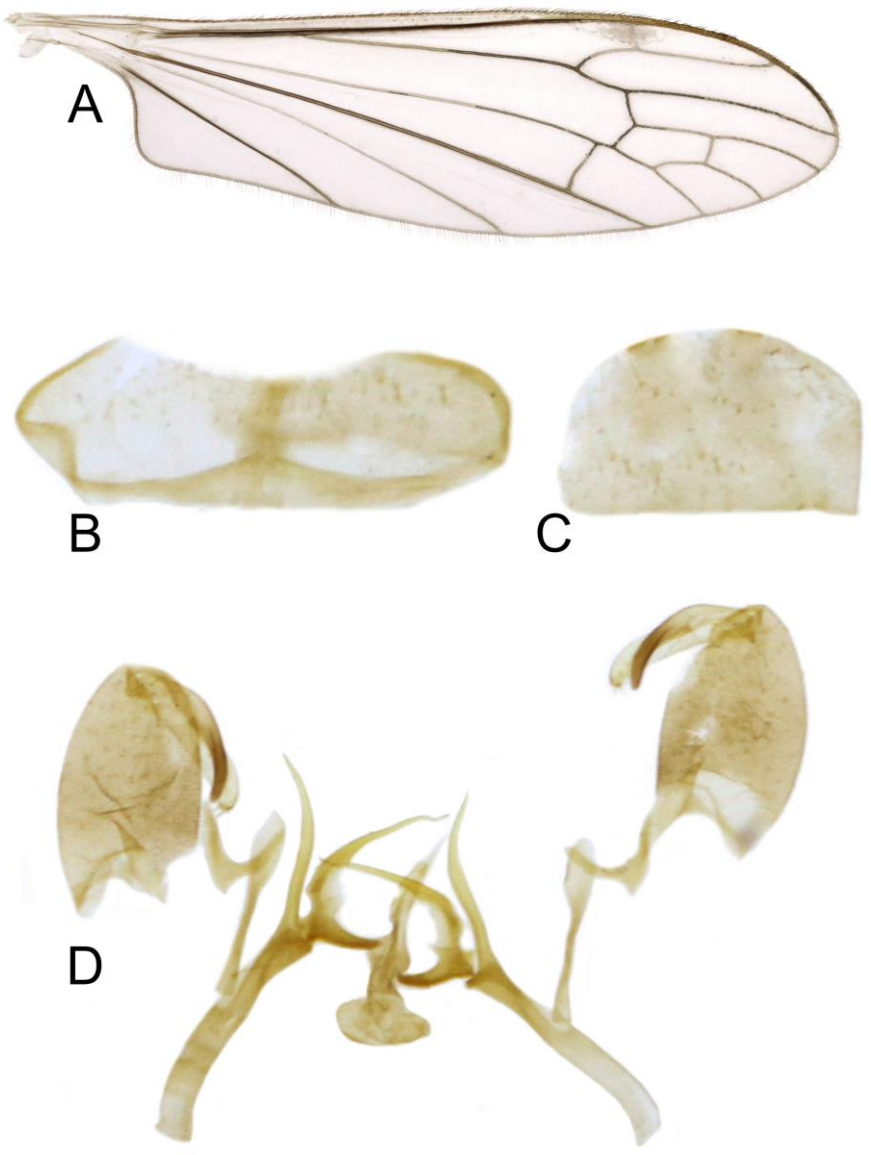


**Figure 126.** *Antocha* (*Antocha*) *quadrirhaphis* Alexander, 1971. A – male wing, holotype; B – male tergite 9, holotype; C – male sternite 9, holotype; D – male genital structures and aedeagus, dorsal view, holotype.

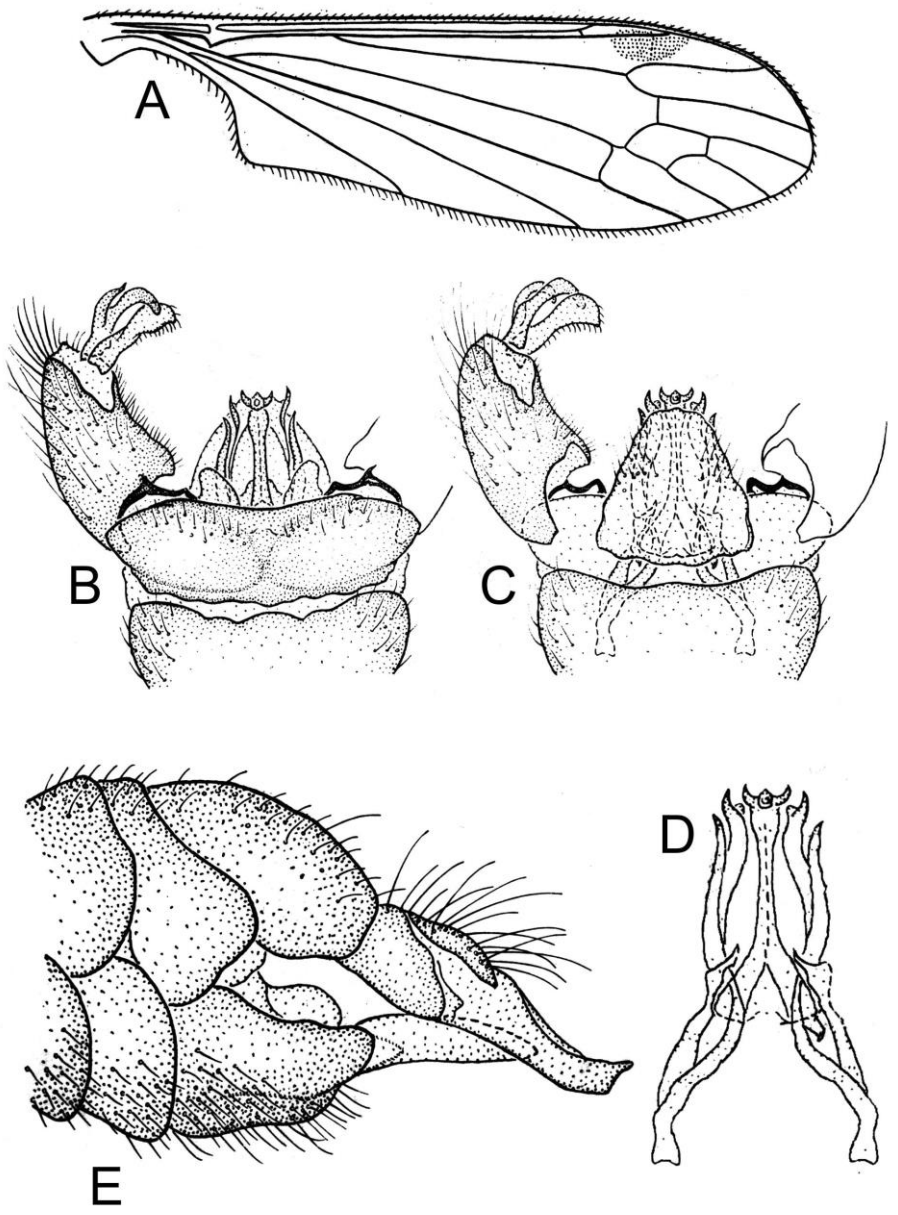


**Figure 127.** *Antocha* (*Antocha*) *ramulifera* Savchenko, 1983. A – male wing (illustrated by Savchenko, 1983: 40 p.); B – male genitalia, dorsal view (illustrated by Savchenko, 1983: 40 p.); C – male genitalia, ventral view (illustrated by Savchenko, 1983: 40 p.); D – male aedeagus, dorsal view (illustrated by Savchenko, 1983: 40 p.); E – female ovipositor, lateral view (illustrated by Savchenko, 1983: 40 p.).

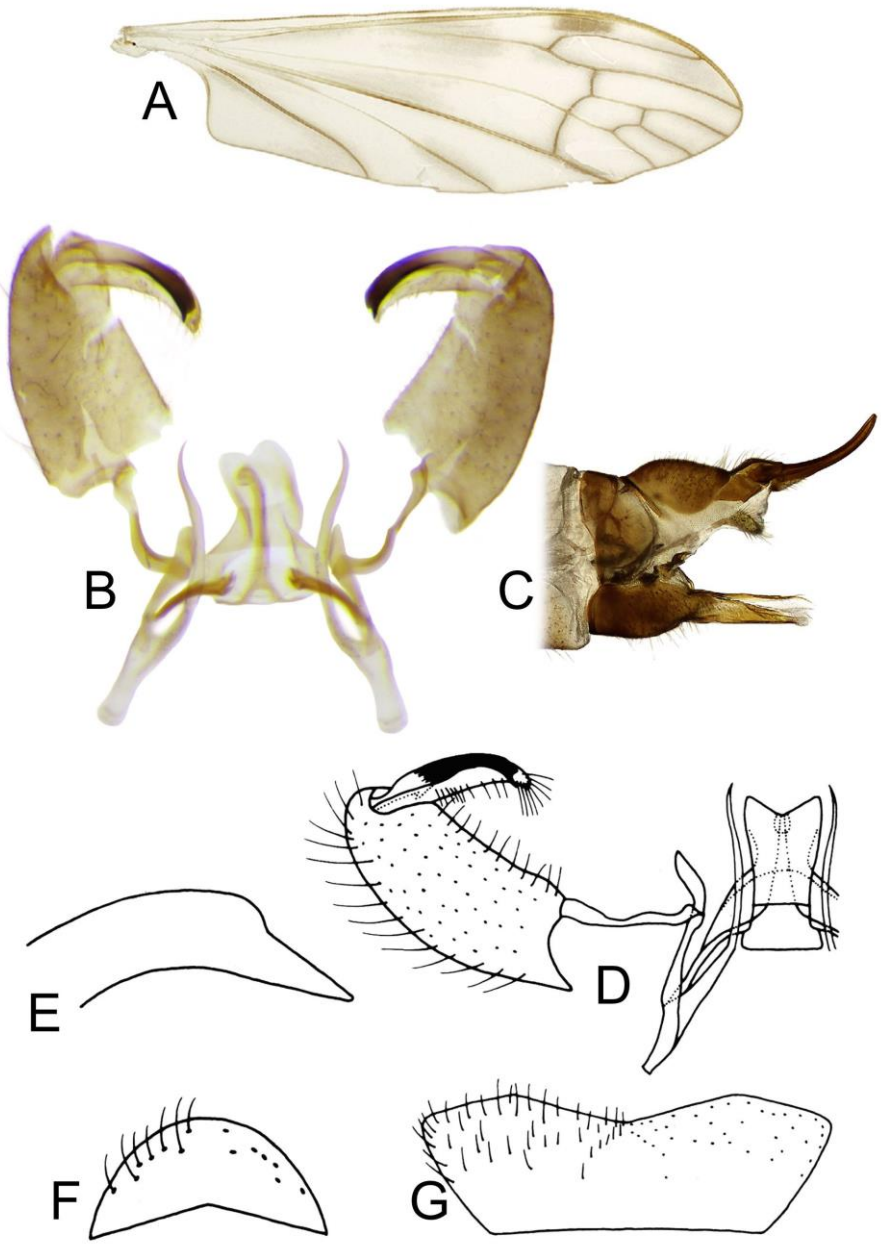


**Figure 128.** *Antocha* (*Antocha*) *satsuma* Alexander, 1919. A – male wing; B – male genital structures and aedeagus, dorsal view; C – female ovipositor, lateral view; D – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 185 p.); E – male outer gonostylus (illustrated by Torii, 1992: 185 p.); F – male sternite 9 (illustrated by Torii, 1992: 185 p.); G – male tergite 9 (illustrated by Torii, 1992: 185 p.).

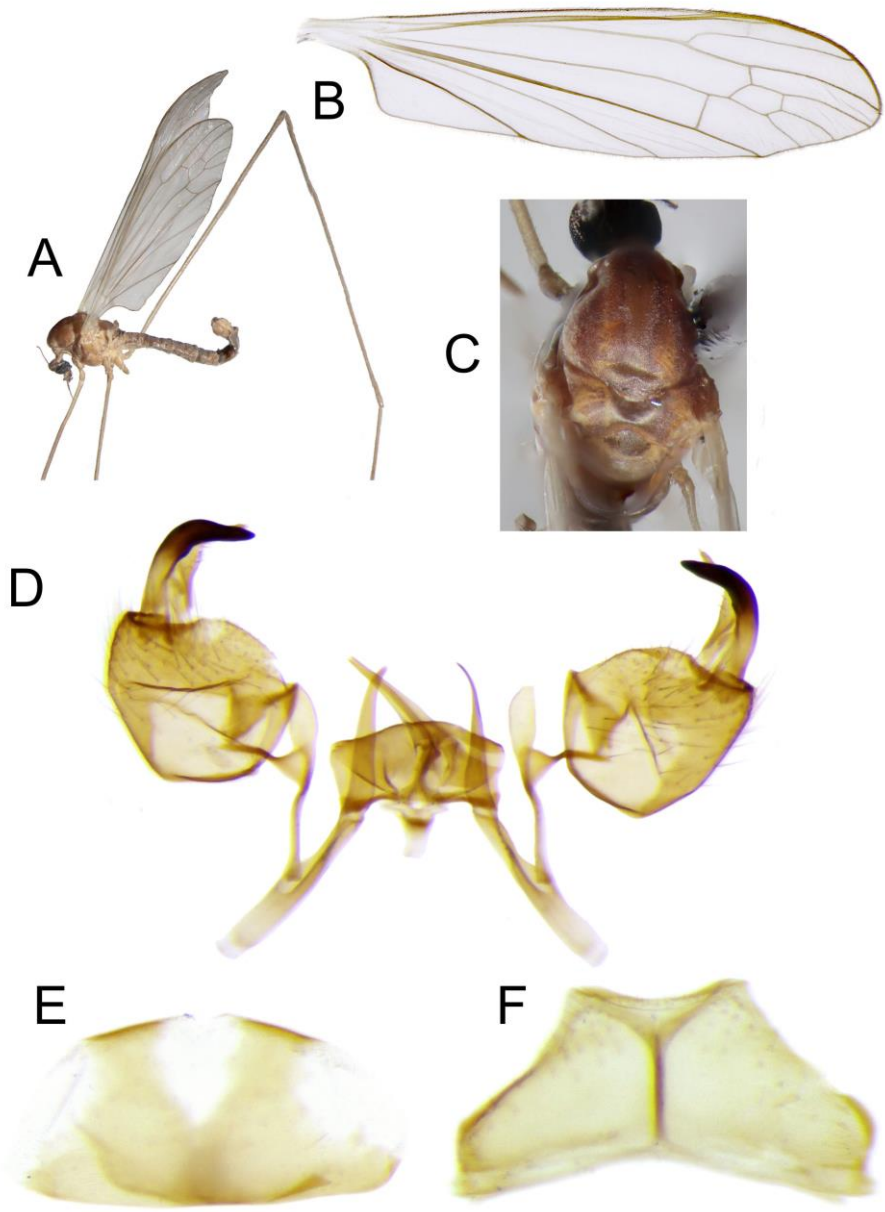


**Figure 129.** *Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860. A – male habitus; B – male wing; C – male thorax, dorsal view; D – male genital structures and aedeagus, dorsal view; E – male sternite 9; F – male tergite 9.

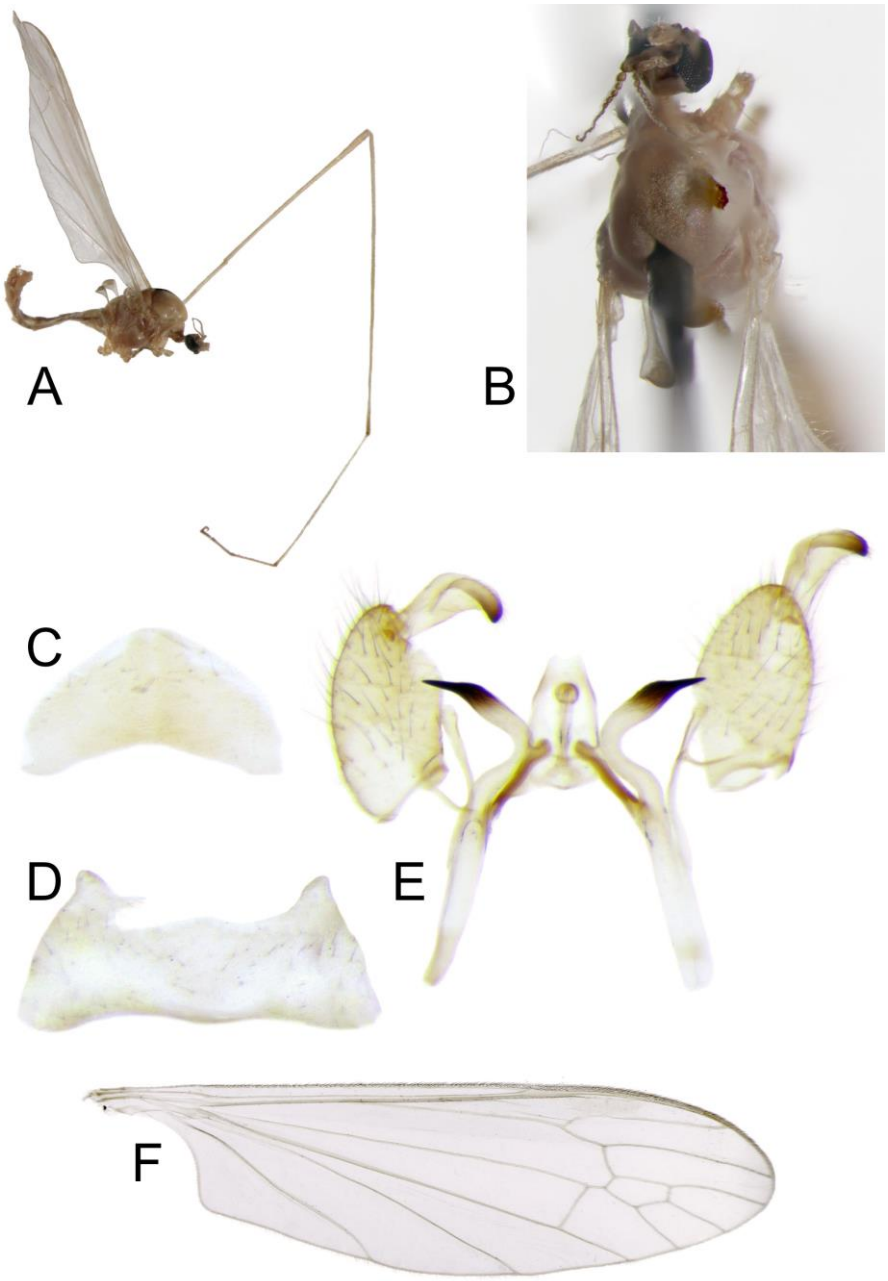


**Figure 130.** *Antocha* (*Antocha*) *monticola* Alexander, 1917. A – male habitus; B – male thorax, dorsal view; C – male sternite 9; D – male tergite 9; E – male genital structures and aedeagus, dorsal view; F – male wing.

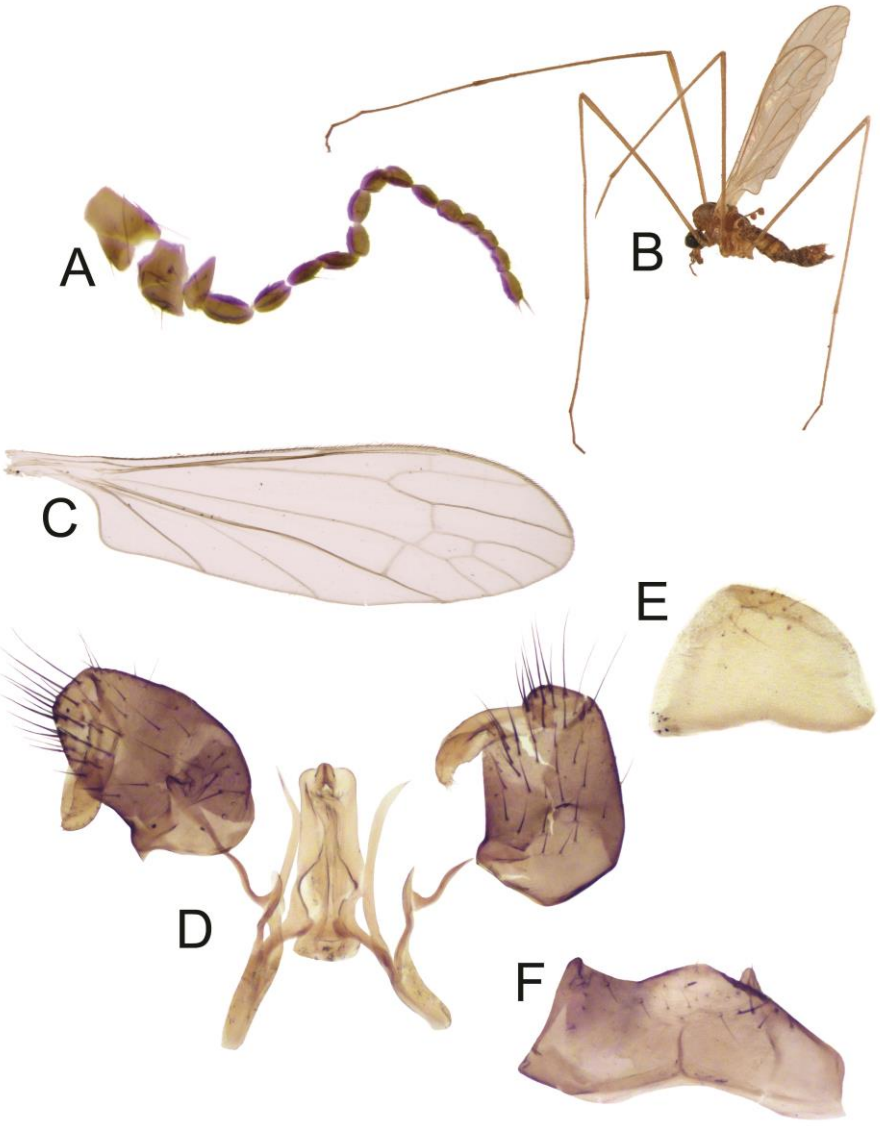


**Figure 131.** *Antocha* (*Antocha*) *scutella* Alexander, 1973. A – male antenna; B – male habitus; C – male wing; D – male genital structures and aedeagus, dorsal view; E – male sternite 9; F – male tergite 9.

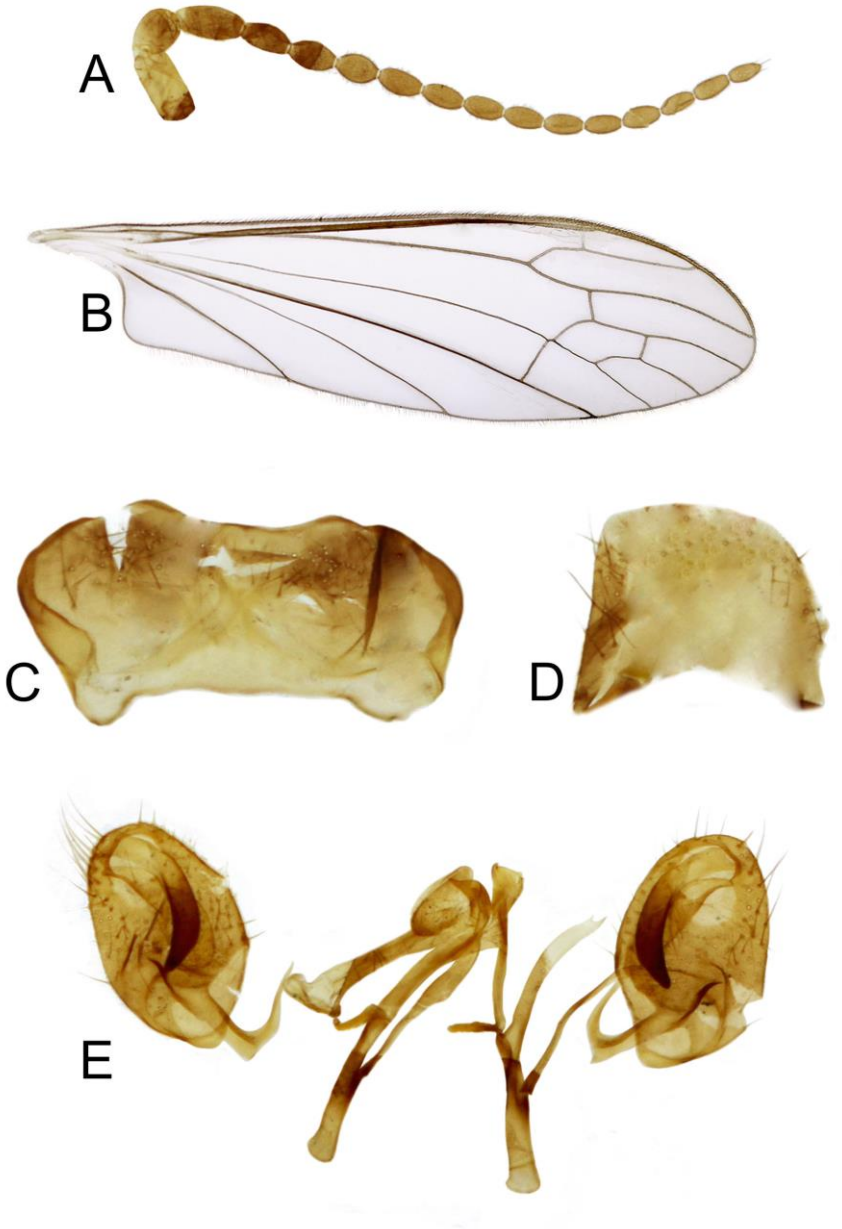


**Figure 132.** *Antocha* (*Antocha*) *scutifera* Alexander, 1973. A – male antenna, paratype; B – male wing, paratype; C – male tergite 9, paratype; D – male sternite 9, paratype; E – male genital structures and aedeagus, dorsal view, paratype.

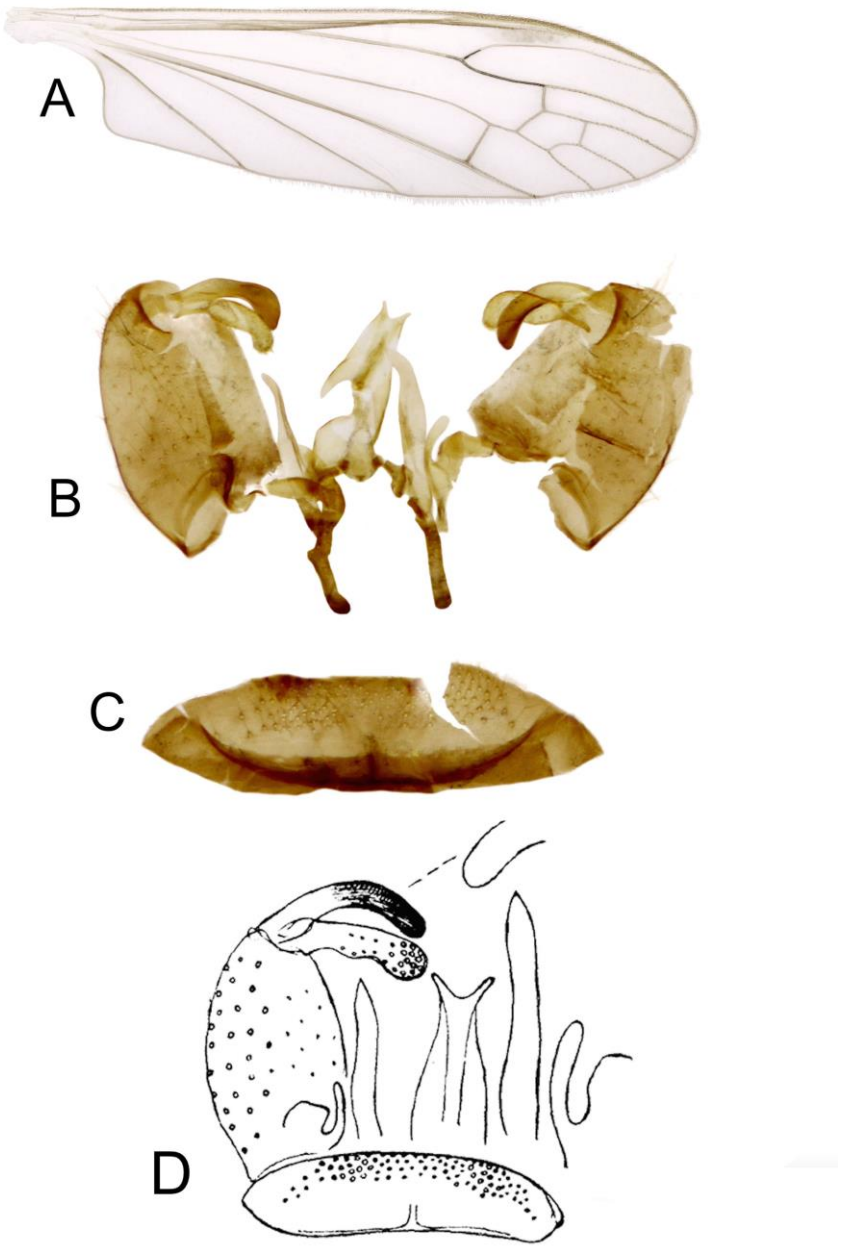


**Figure 133.** *Antocha* (*Antocha*) *setigera* Alexander, 1933. A – male wing, holotype; B – male genital structures and aedeagus, dorsal view, paratype; C – male tergite 9, paratype; D – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1933: Plate 3, 38 fig.).

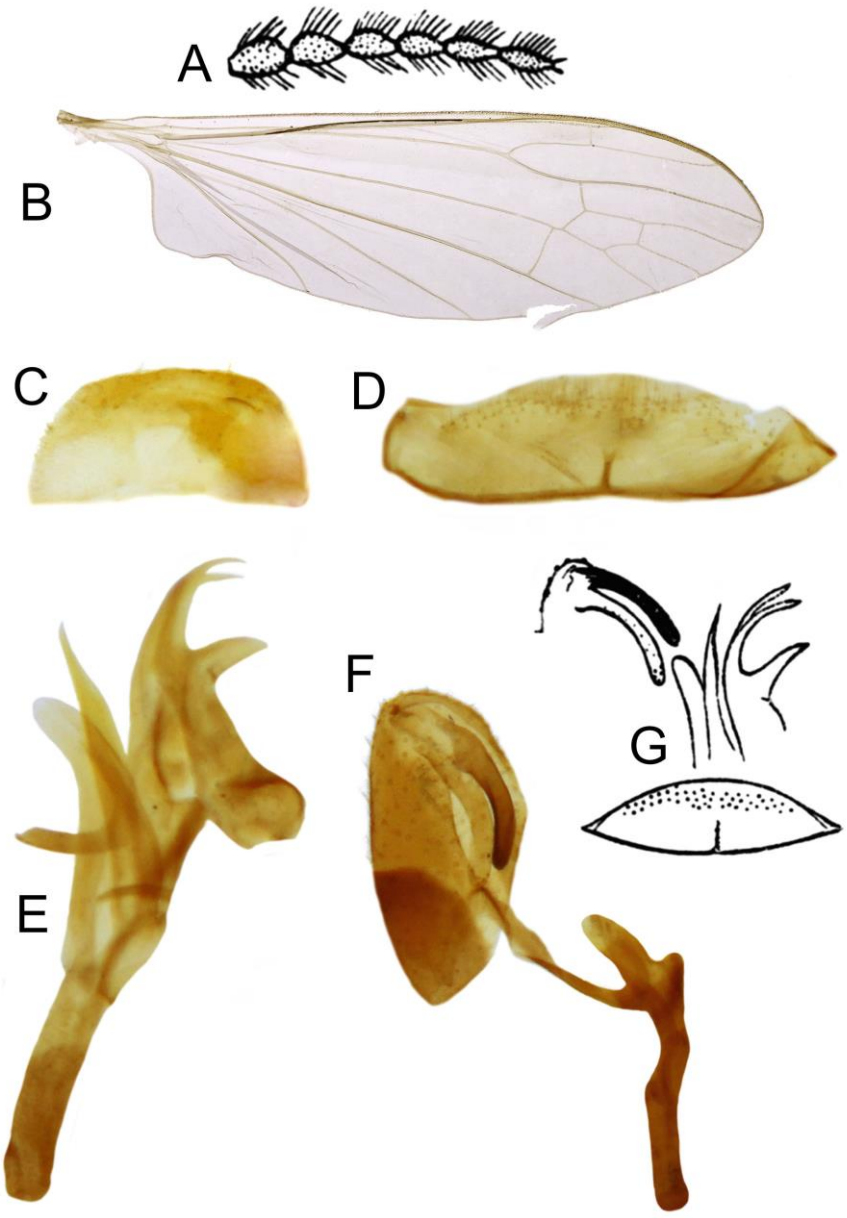


**Figure 134.** *Antocha* (*Antocha*) *shansiensis* Alexander, 1954. A – male antenna (illustrated by Alexander, 1954: 25 p.); B – male wing, paratype; C – male sternite 9, paratype; D – male tergite 9, paratype; E – male genital structures and aedeagus, lateral view, paratype; F – male genital structures gonocoxite with inner and outer gonostyli and interbase, dorsal view, paratype; G – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1954: 25 p.).

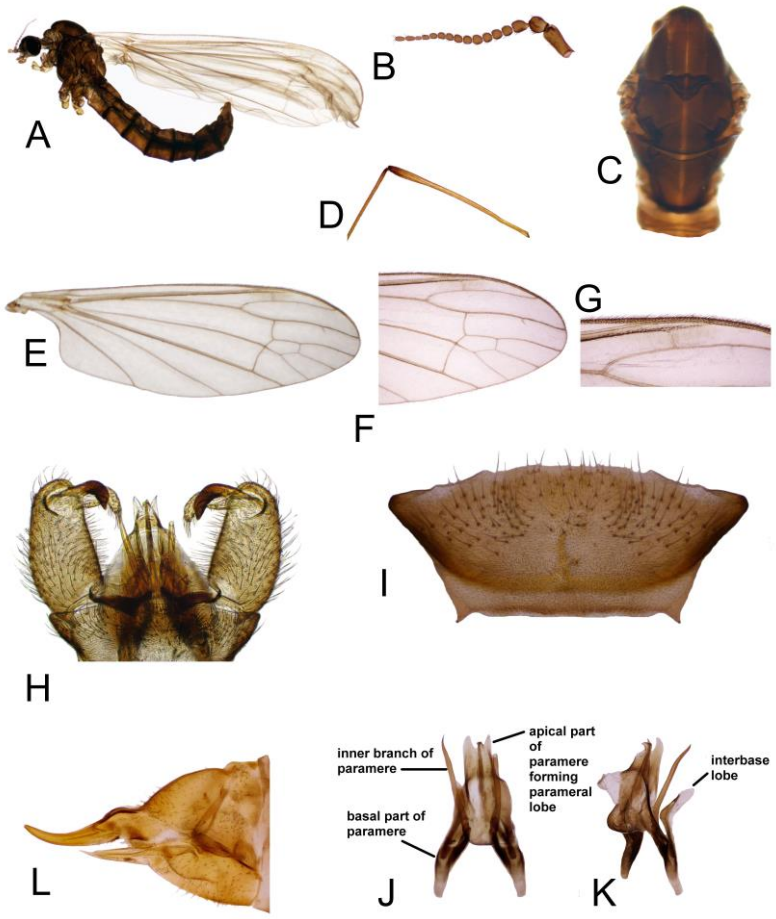


**Figure 135.** *Antocha* (*Antocha*) *staryi* Keresztes & Mabrouki, 2023. A – male habitus (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); B – antennae (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); C – thorax (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); D – femur and part of tibiae, third left leg (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); E – wing (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); F – tip of the right wing (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); G – stigma on the right wing (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); H – male genitalia general, dorsal view (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); I – tergite 9 (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); J – aedeagus with parameres dorsal view (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); K – aedeagus with parameres, lateral view (illustrated by Keresztes & Mabrouki, 2023: 3 fig.); L – female terminalia with cercus and hypovalvae lateral view (illustrated by Keresztes & Mabrouki, 2023: 3 fig.).

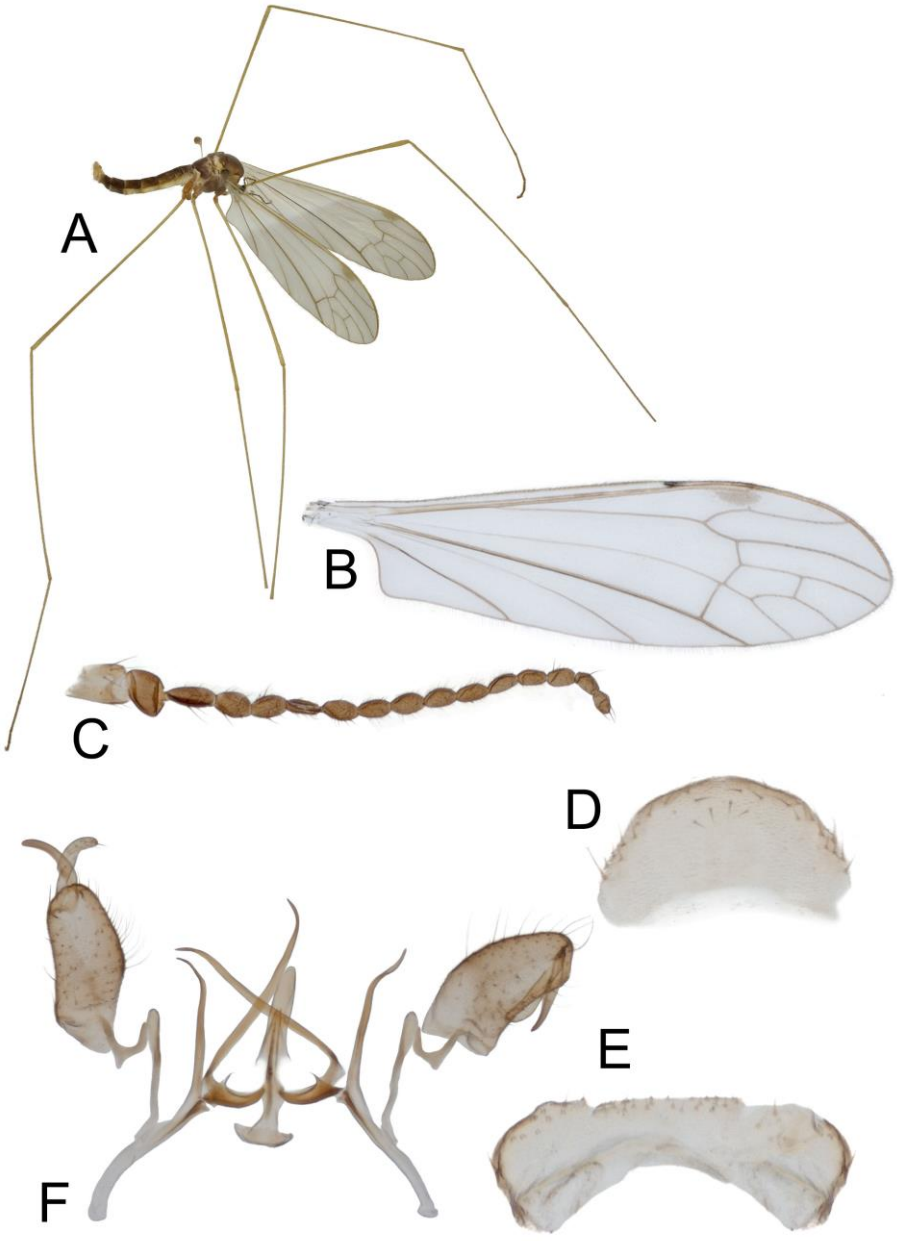


**Figure 136.** *Antocha* (*Antocha*) *stenophallus* Alexander, 1974. A – male habitus; B – male wing; C – male antenna; D – male sternite 9; E – male tergite 9; F – male genital structures and aedeagus, dorsal view.

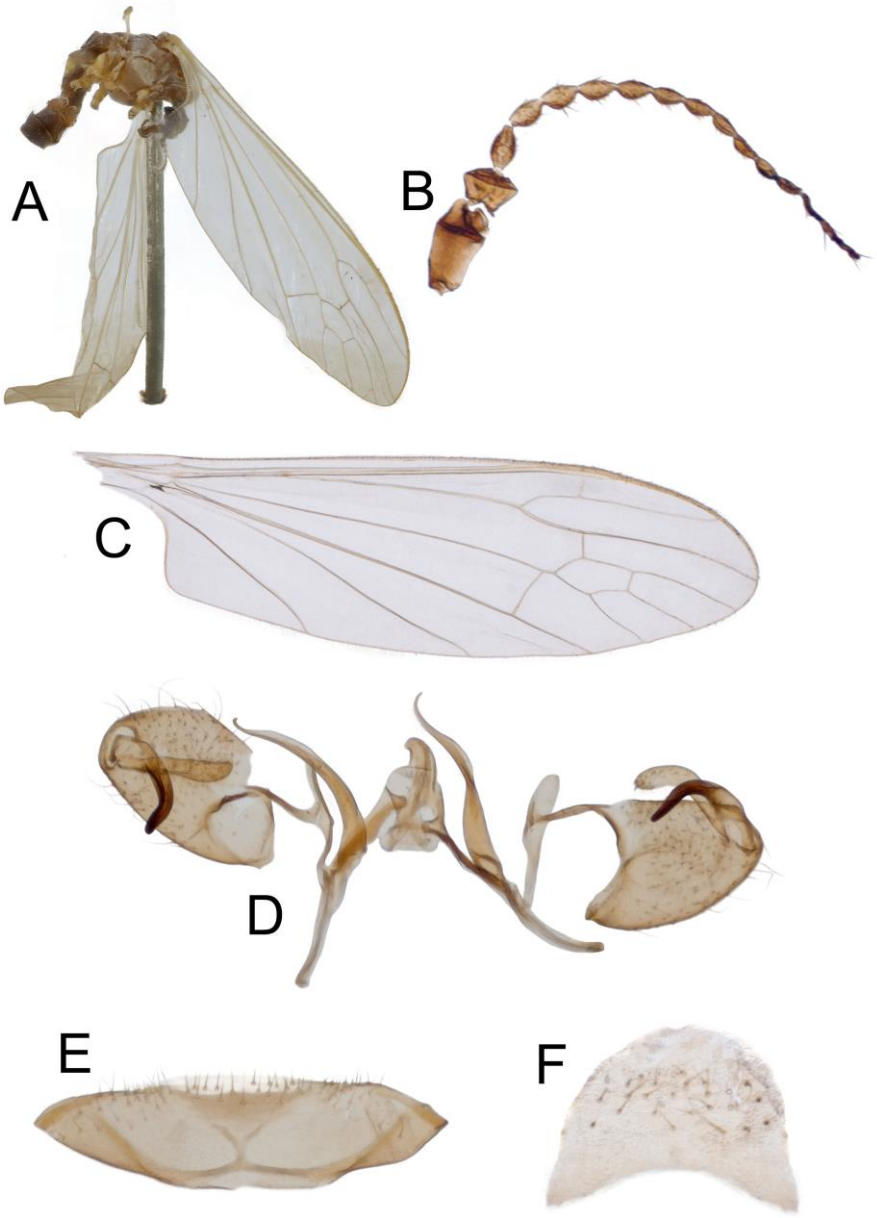


**Figure 137.** *Antocha* (*Antocha*) *streptocera* Alexander, 1949. A – male habitus; B – male antenna; C – male wing; D – male genital structures and aedeagus, dorsal view; E – male tergite 9; F – male sternite 9.

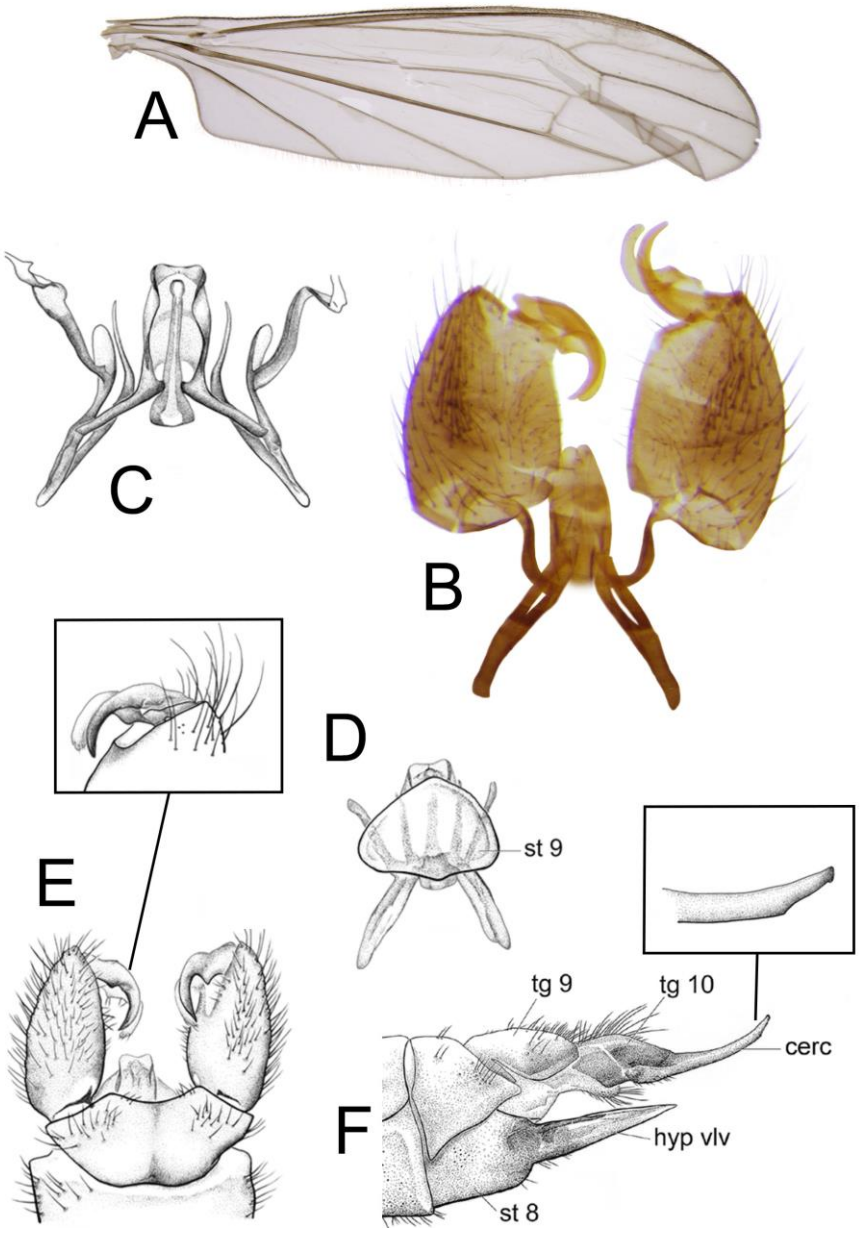


**Figure 138.** *Antocha* (*Antocha*) *styx* Alexander, 1930. A – male wing, paratype; B – male genital structures and aedeagus, dorsal view, paratype; C – male genital structures and aedeagus, dorsal view (illustrated by Podenas and Young, 2015: 531 p.); D – male sternite 9 (illustrated by Podenas and Young, 2015: 531 p.); E – male genitalia, dorsal view (illustrated by Podenas and Young, 2015: 531 p.); F – female ovipositor, lateral view (illustrated by Podenas and Young, 2015: 531 p.).

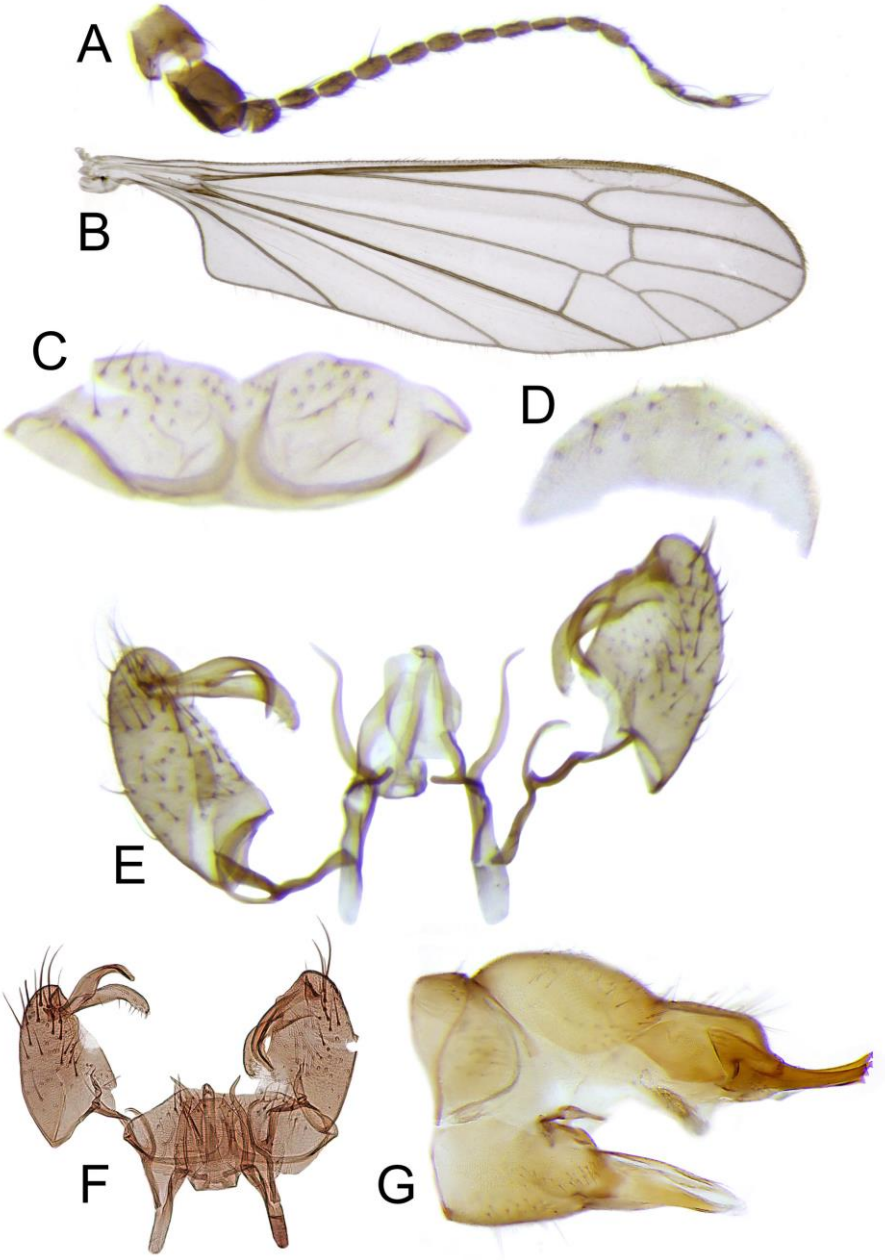


**Figure 139.** *Antocha* (*Antocha*) *subconfluenta* Alexander, 1930. A – male antenna; B – male wing; C – male tergite 9; D – male sternite 9; E – male genital structures and aedeagus, dorsal view; F – male genitalia, dorsal view, metatype; G – female ovipositor, lateral view.

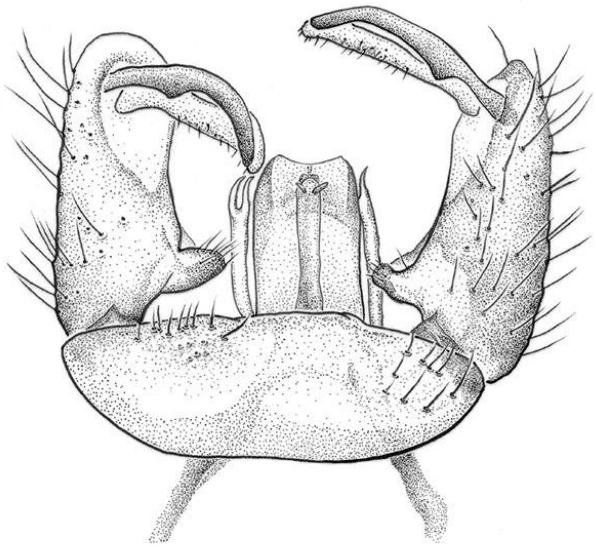

**Figure 140.** *Antocha* (*Antocha*) *taiwanensis* Podenas and Young, 2015. Male genitalia, dorsal view (illustrated by Podenas and Young, 2015: 529 p.).

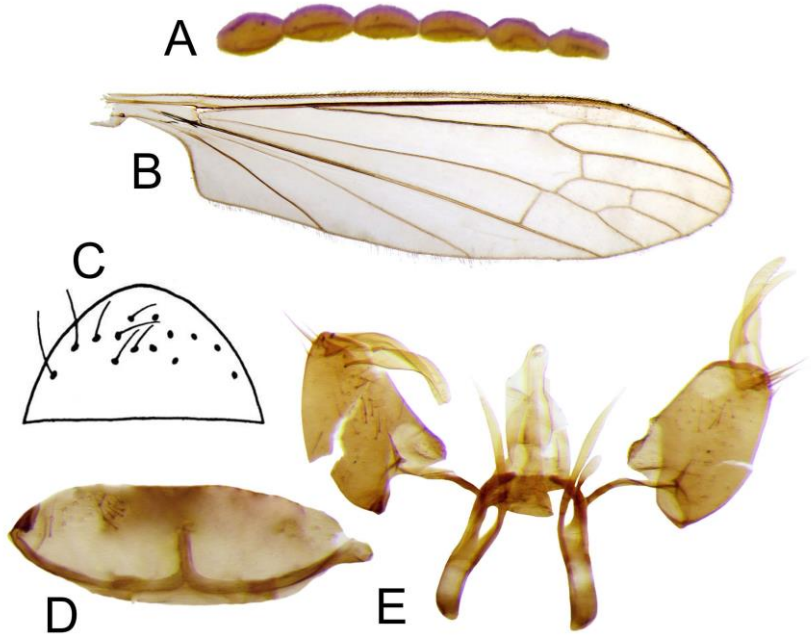


**Figure 141.** *Antocha* (*Antocha*) *tuberculata* Torii, 1992. A – male antenna; B – male wing; C – male sternite 9 (illustrated by Torii, 1992: 187 p.); D – male tergite 9; E – male genital structures and aedeagus, dorsal view.

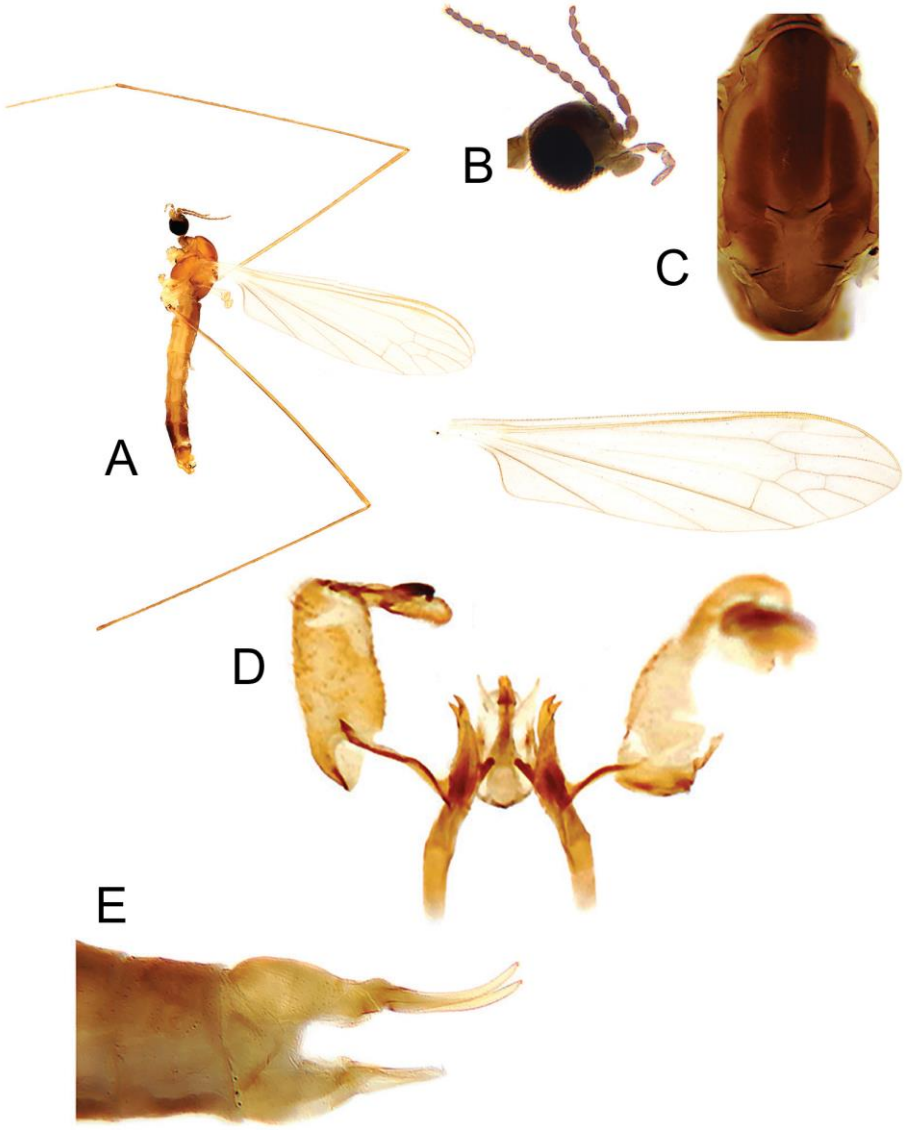


**Figure 142.** *Antocha* (*Antocha*) *tibetana* Lv & Zhang 2023. A – male habitus (illustrated by Lv & Zhang 2023: 66 p.); B – head and antenna (illustrated by Lv & Zhang 2023: 66 p.); C – thorax (illustrated by Lv & Zhang 2023: 66 p.); D – wing venation (illustrated by Lv & Zhang 2023: 66 p.); E – male genital structures and aedeagus, dorsal view (illustrated by Lv & Zhang 2023: 66 p.); F – female ovipositor, lateral view (illustrated by Lv & Zhang 2023: 66 p.).

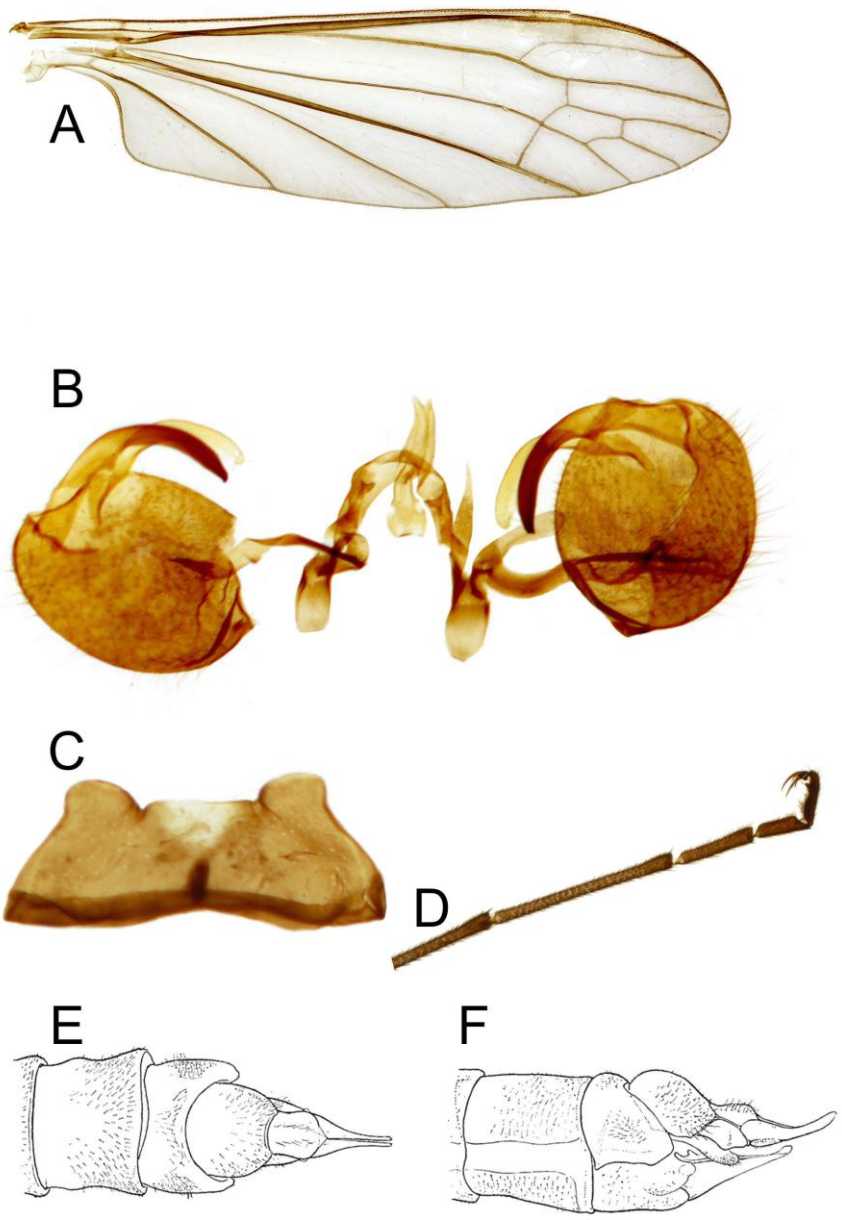


**Figure 143.** *Antocha* (*Antocha*) *turkestanica* de Meijere, 1921. A – male wing, paratype; B – male genital structures and aedeagus, dorsal view, paratype; C – male tergite 9, paratype; D – male tarsus, paratype; E – female ovipositor, dorsal view (illustrated by Nielsen, 1963: 118 p.); F – female ovipositor, lateral view (illustrated by Nielsen, 1963: 118 p.).

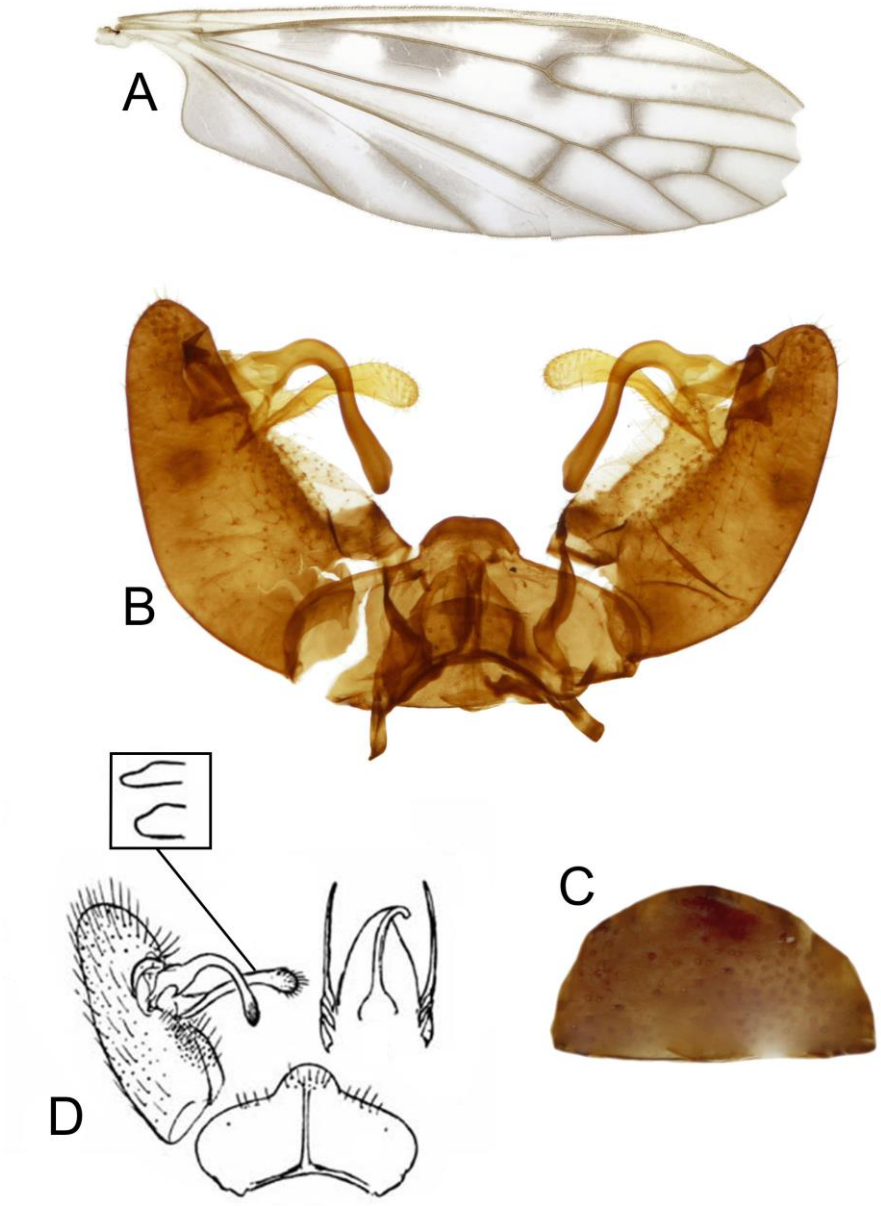


**Figure 144.** *Antocha* (*Antocha*) *unicollis* Alexander, 1968. A – male wing, paratype; B – male genitalia, dorsal view, paratype; C – male sternite 9, paratype, paratype; D – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1968: 93 p.).

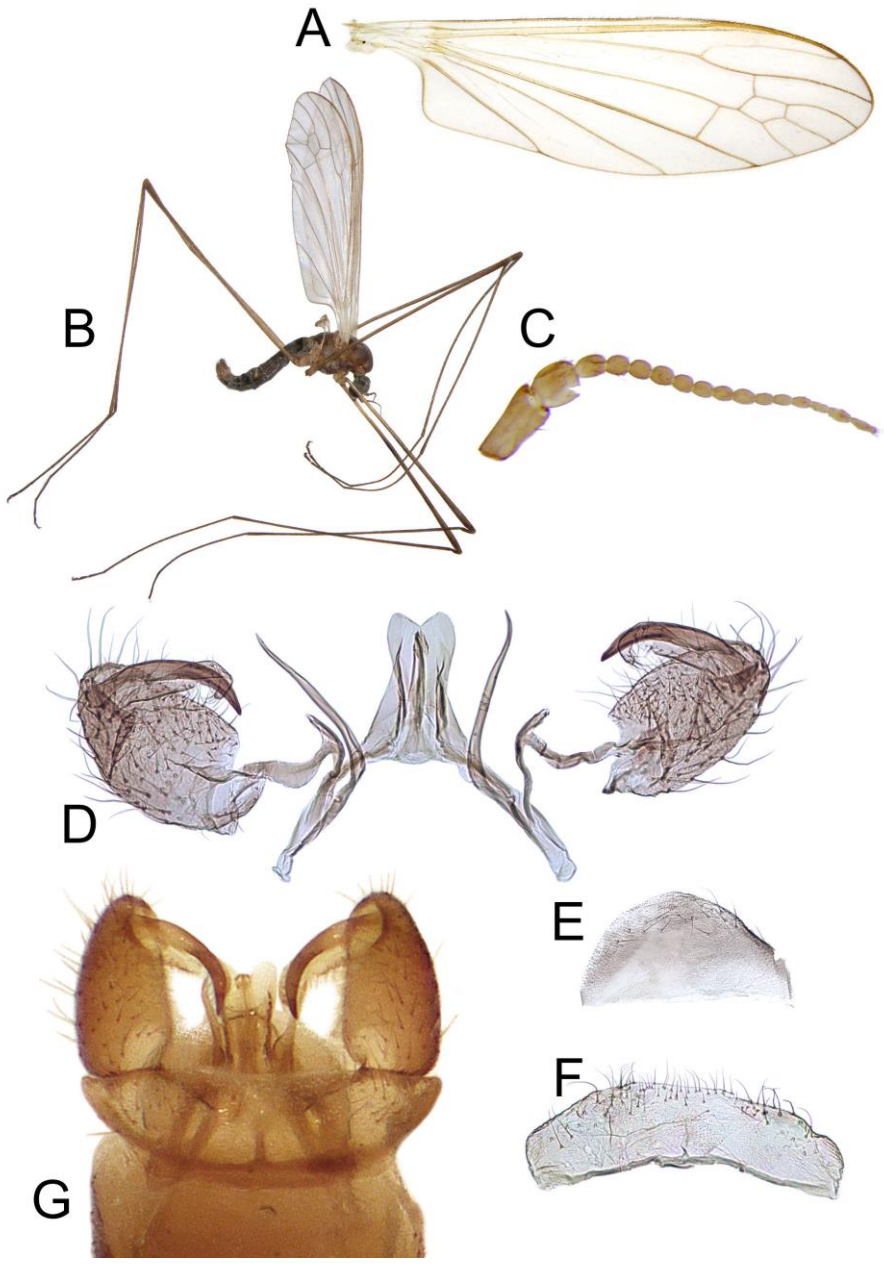


**Figure 145.** *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830). A – male wing; B – male habitus; C – male antenna; D – male genital structures and aedeagus, dorsal view; E – male sternite 9; F – male tergite 9; G – male genitalia, dorsal view.

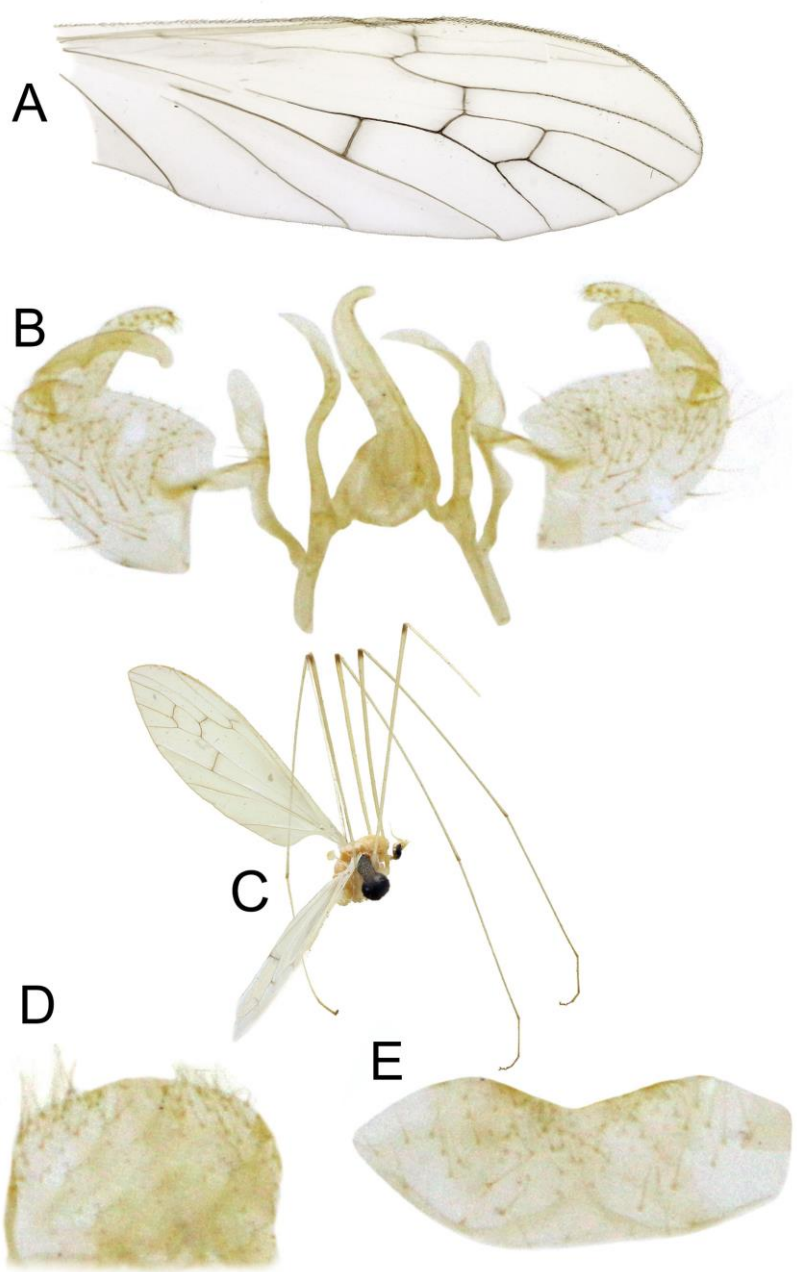


**Figure 146.** *Antocha* (*Antocha*) *yatungensis* Alexander, 1963. A – male wing; B – male genital structures and aedeagus, dorsal view; C – male habitus; D – male sternite 9; E – male tergite 9.

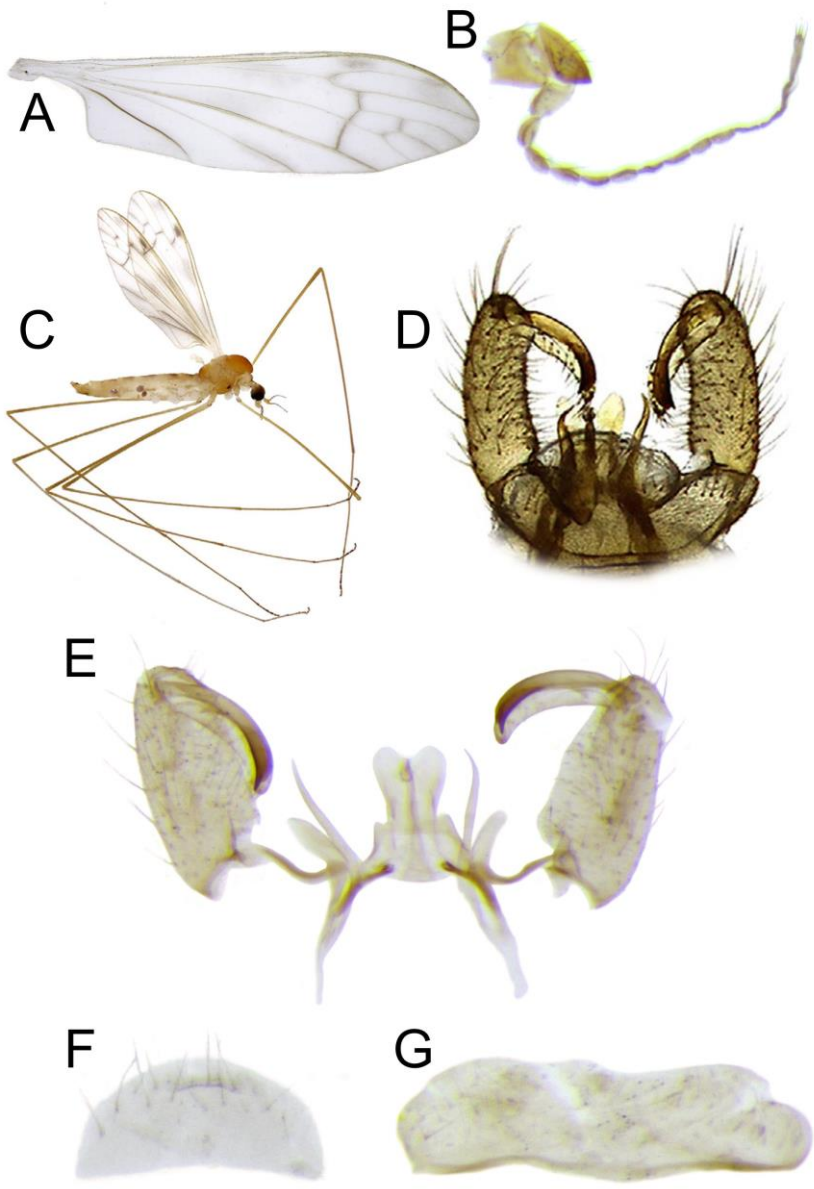


**Figure 147.** *Antocha* (*Antocha*) *yeongwola* Podenas, 2016. A – male wing; B – male antenna; C – male habitus (by Podenas, 2016: 4 p.); D – male genitalia, dorsal view (by Podenas, 2016: 4 p.); E – male genital structures and aedeagus, dorsal view; F – male sternite 9; G – male tergite 9.

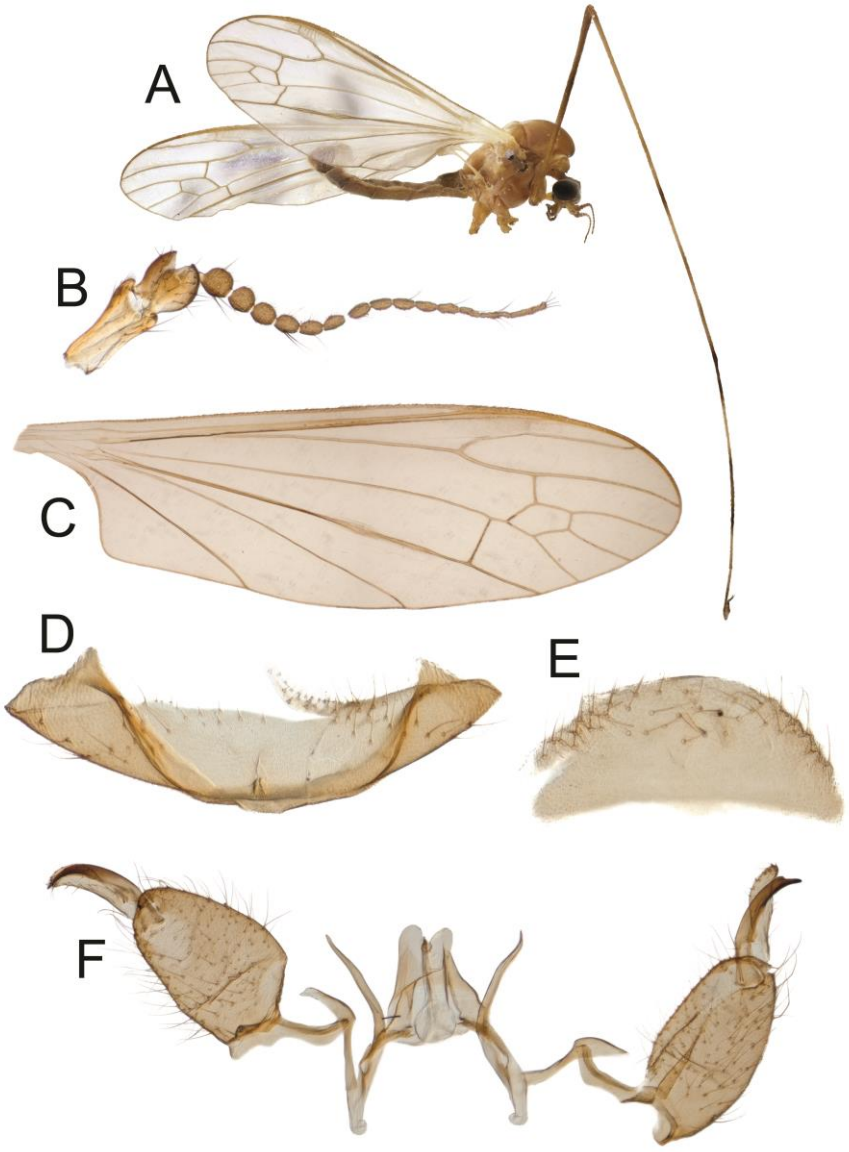


**Figure 148.** *Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940. A – male habitus; B – male antenna; C – male wing; D – male tergite 9; E – male sternite 9; F – male genital structures and aedeagus, dorsal view.

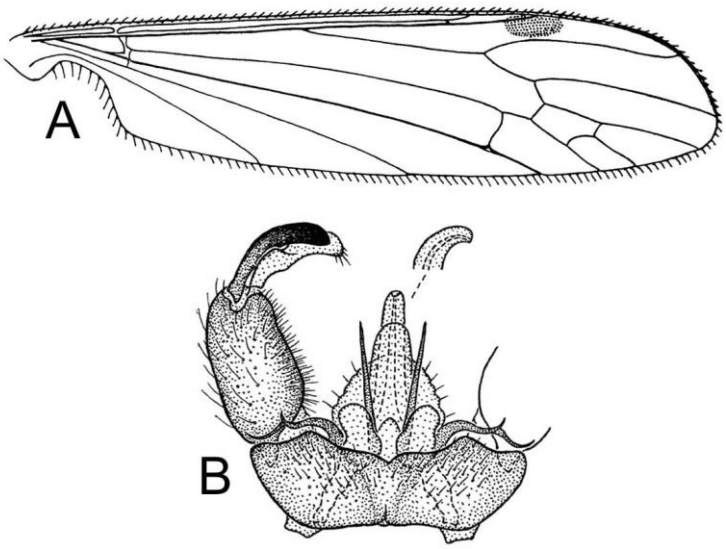


**Figure 149.** *Antocha* (*Antocha*) *biacus* Savchenko, 1981. A – male wing (illustrated by Savchenko, 1981: 27 p.); B – male genitalia and aedeagus, dorsal view (illustrated by Savchenko, 1981: 27 p.).

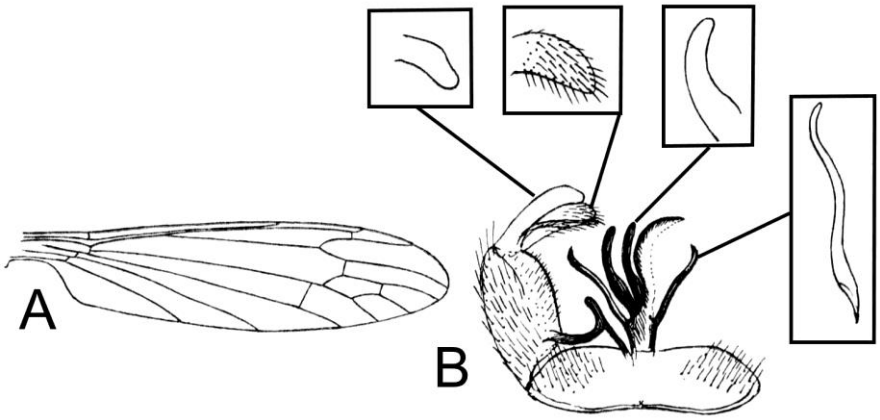


**Figure 150.** *Antocha* (*Antocha*) *biobtusa* Alexander, 1968. A – male wing (illustrated by Alexander, 1968: 46 p.); B – male genital structures and aedeagus, dorsal view (illustrated by Alexander, 1968: 46 p.).

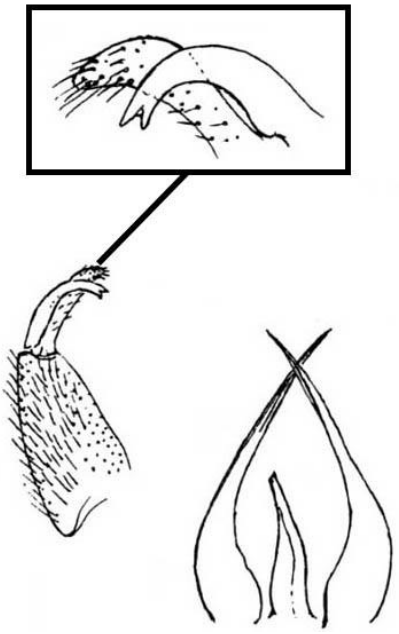

**Figure 151.** *Antocha* (*Antocha*) *decussata* Alexander, 1973. Male genital structures, dorsal view (illustrated by Alexander, 1973: 5 p.).

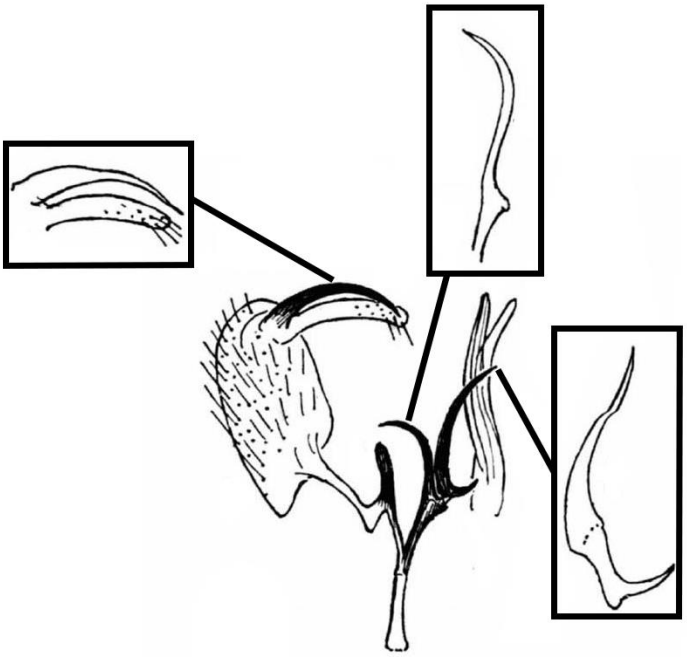

**Figure 152.** *Antocha* (*Antocha*) *exilistyla* Alexander, 1969. Male genital structures, dorsal view (illustrated by Alexander, 1969: 37 p.).

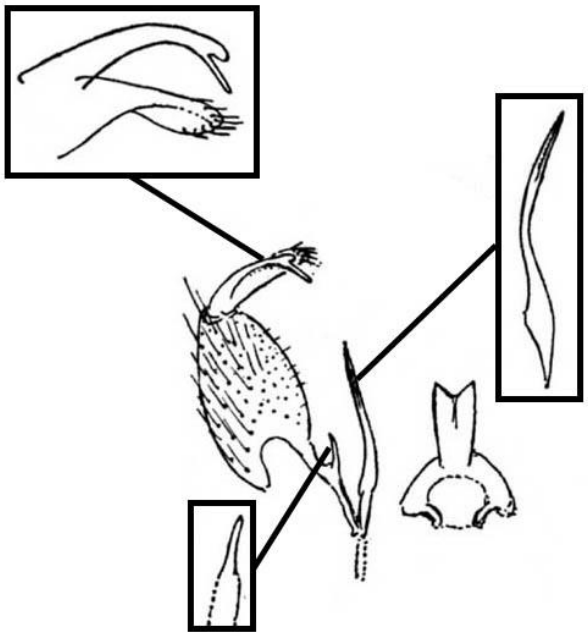

**Figure 153.** *Antocha* (*Antocha*) *longispina* Alexander, 1969. Male genital structures, dorsal view (illustrated by Alexander, 1969: 37 p.).

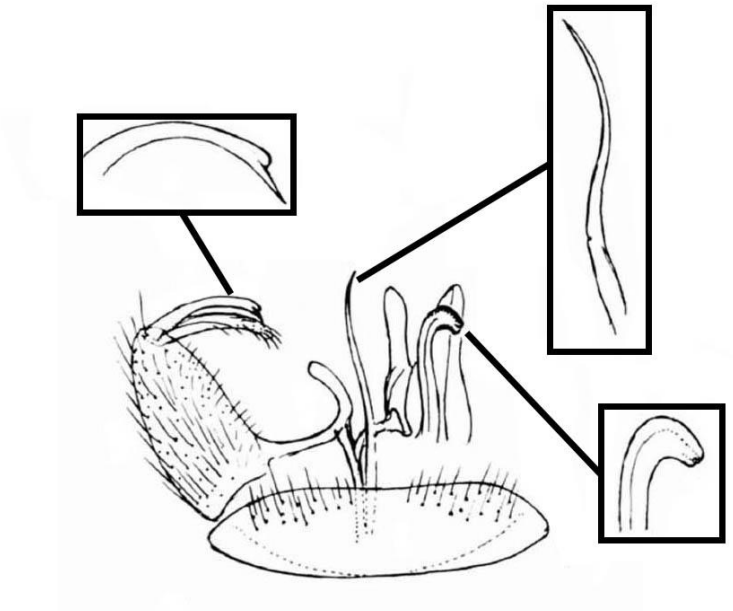

**Figure 154.** *Antocha* (*Antocha*) *parvicristata* Alexander, 1971. Male genital structures, dorsal view (illustrated by Alexander, 1971: 165 p.).

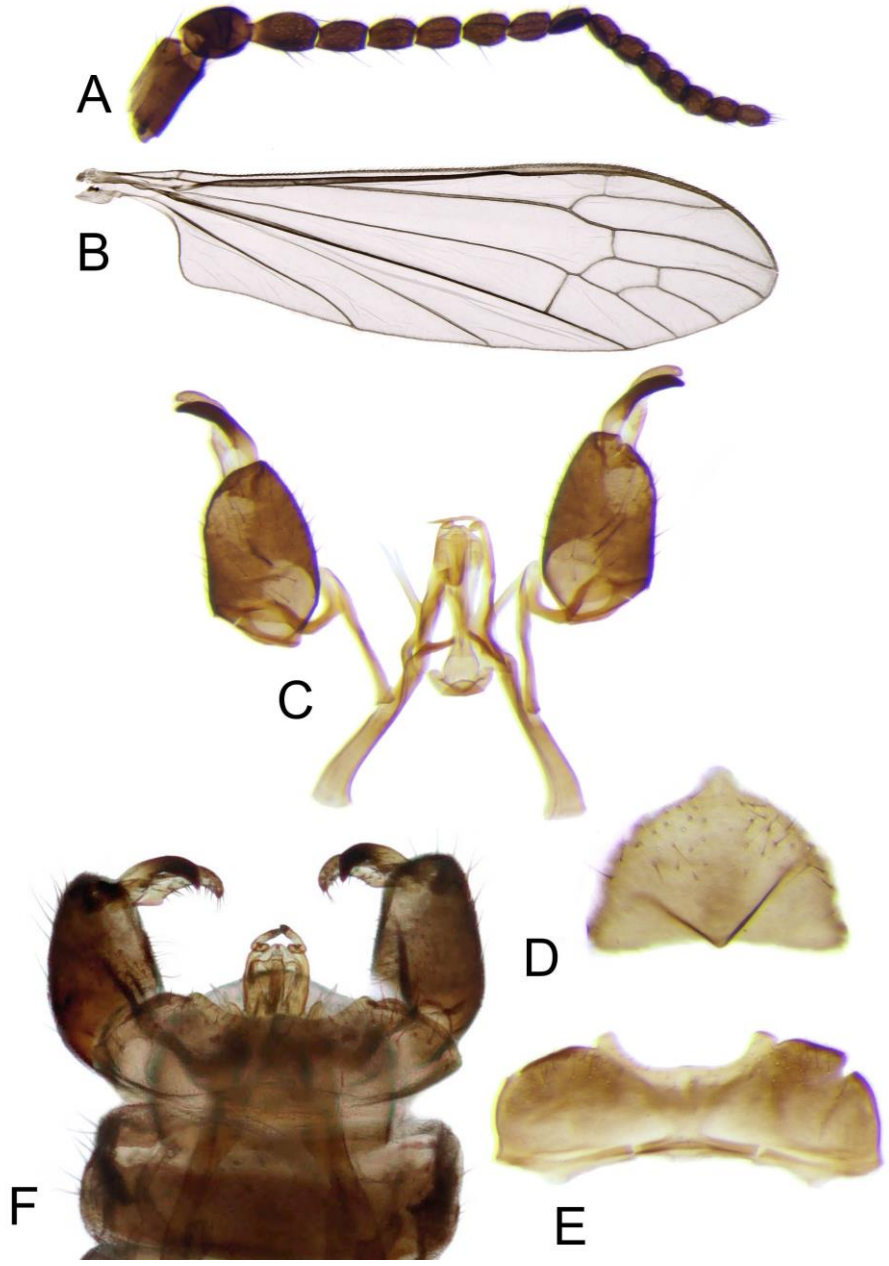


**Figure 155.** *Antocha* (*Antocha*) *spiralis* Alexander, 1932. A – male antenna; B – male wing; C – male genital structures and aedeagus, dorsal view; D – male sternite 9; E – male tergite 9; F – male genitalia, dorsal view.

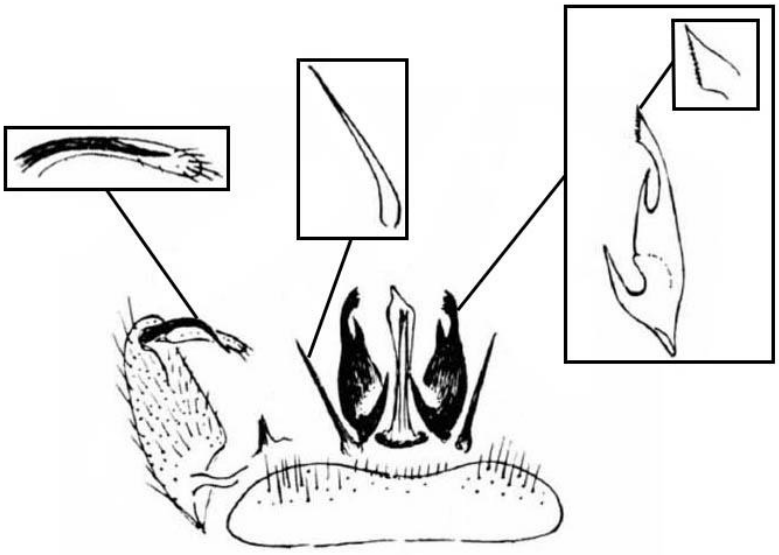

**Figure 156.** *Antocha* (*Antocha*) *peracuta* Alexander, 1971. Male genital structures, dorsal view (illustrated by Alexander, 1971: 165 p.).

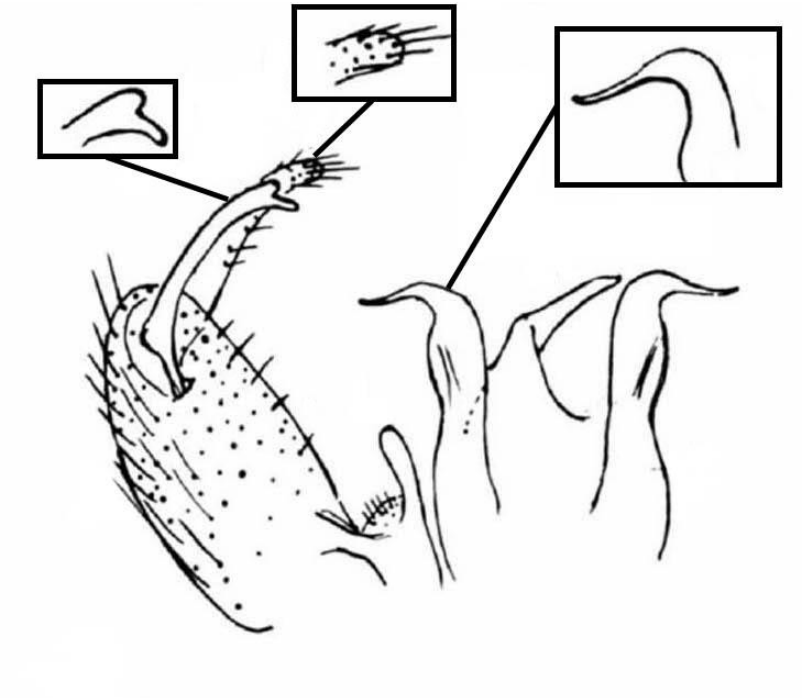

**Figure 157.** *Antocha* (*Antocha*) *perstudiosa* Alexander, 1958. Male genital structures, dorsal view (illustrated by Alexander, 1957: 154 p.).

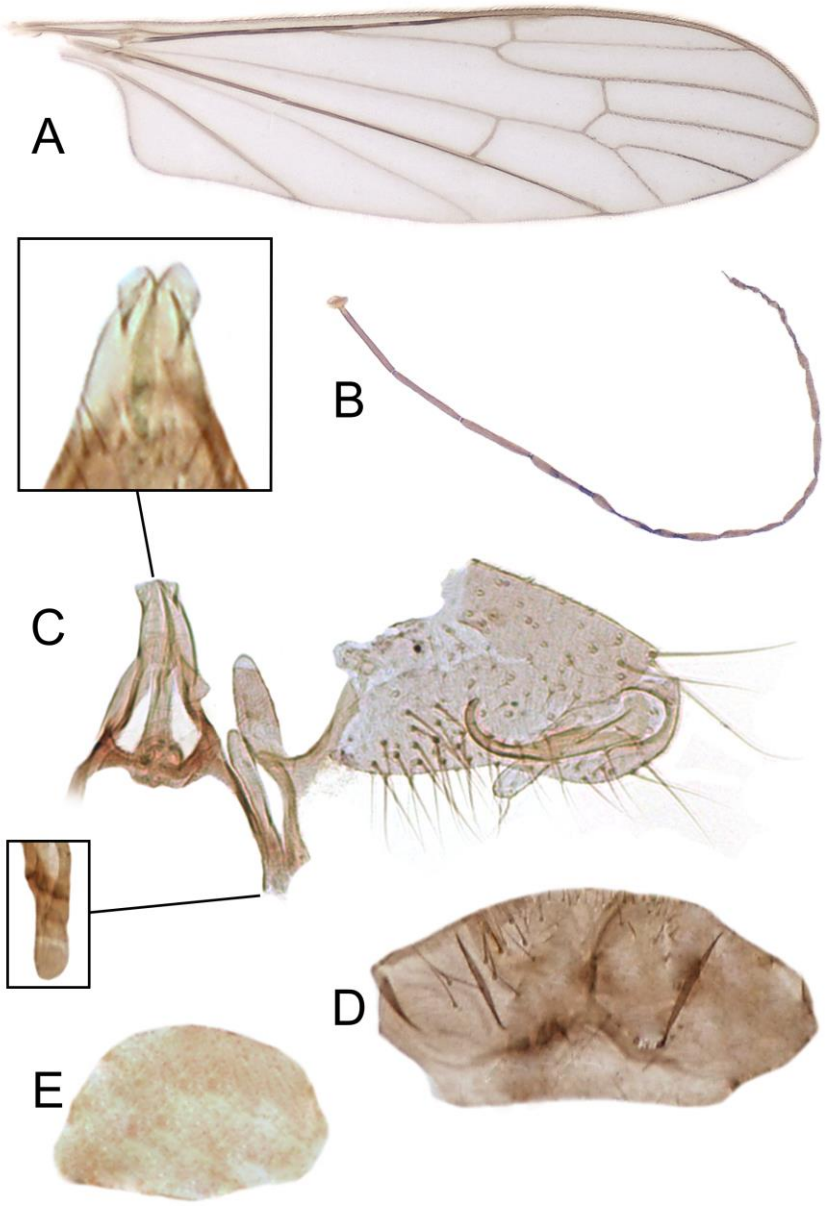


**Figure 158.** *Antocha* (*Orimargula*) *almorae* Alexander, 1970. A – male wing, holotype; B – male antenna, metatype; C – male genital structures and aedeagus, dorsal view, metatype; D – male tergite 9, metatype; E – male sternite 9, metatype.

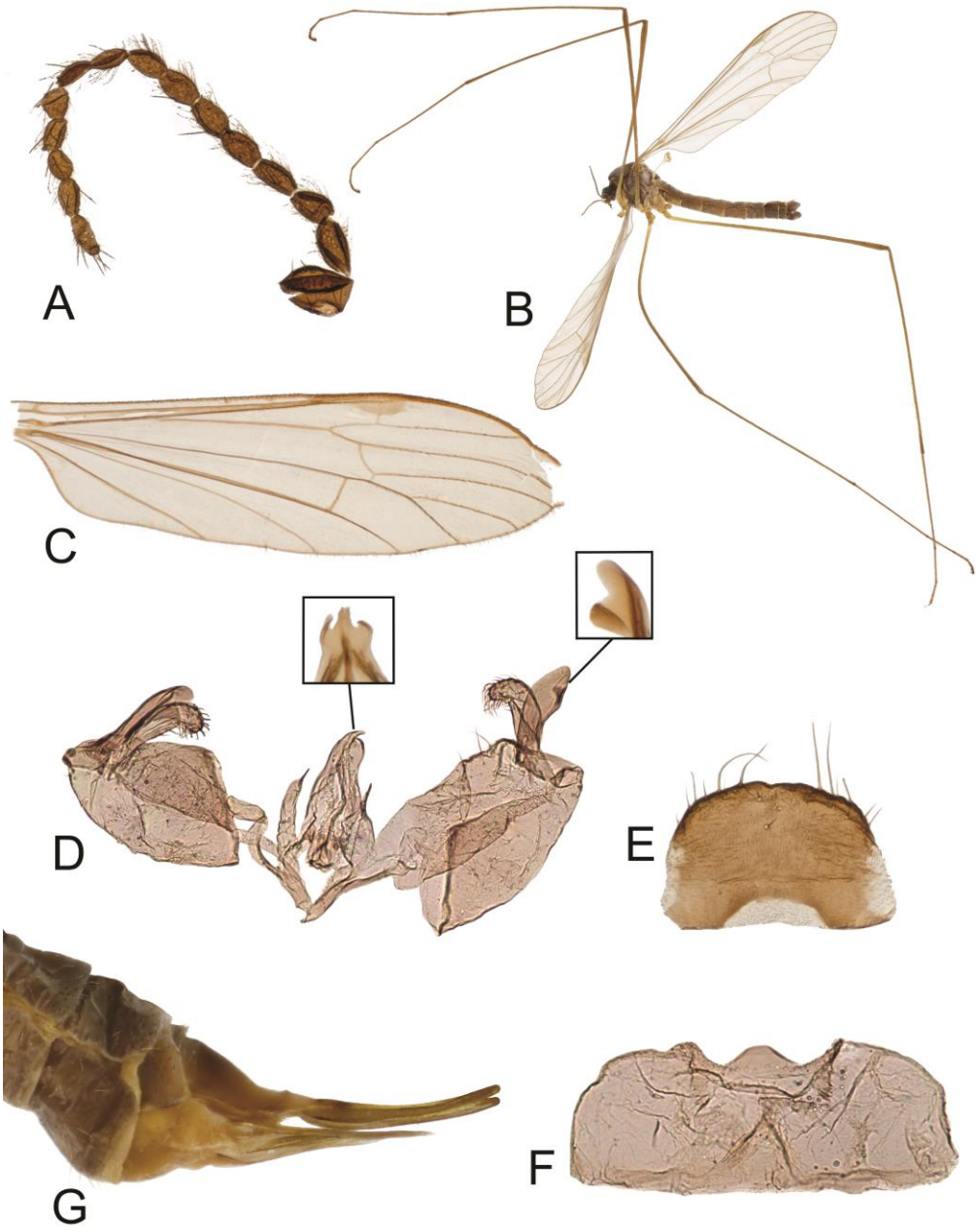


**Figure 159.** *Antocha* (*Orimargula*) *alpigena* (Mik, 1883). A – male antenna; B – male habitus; C – male wing; D – male genital structures and aedeagus, dorsal view; E – male sternite 9; F – male tergite 9; G – female ovipositor, lateral view.

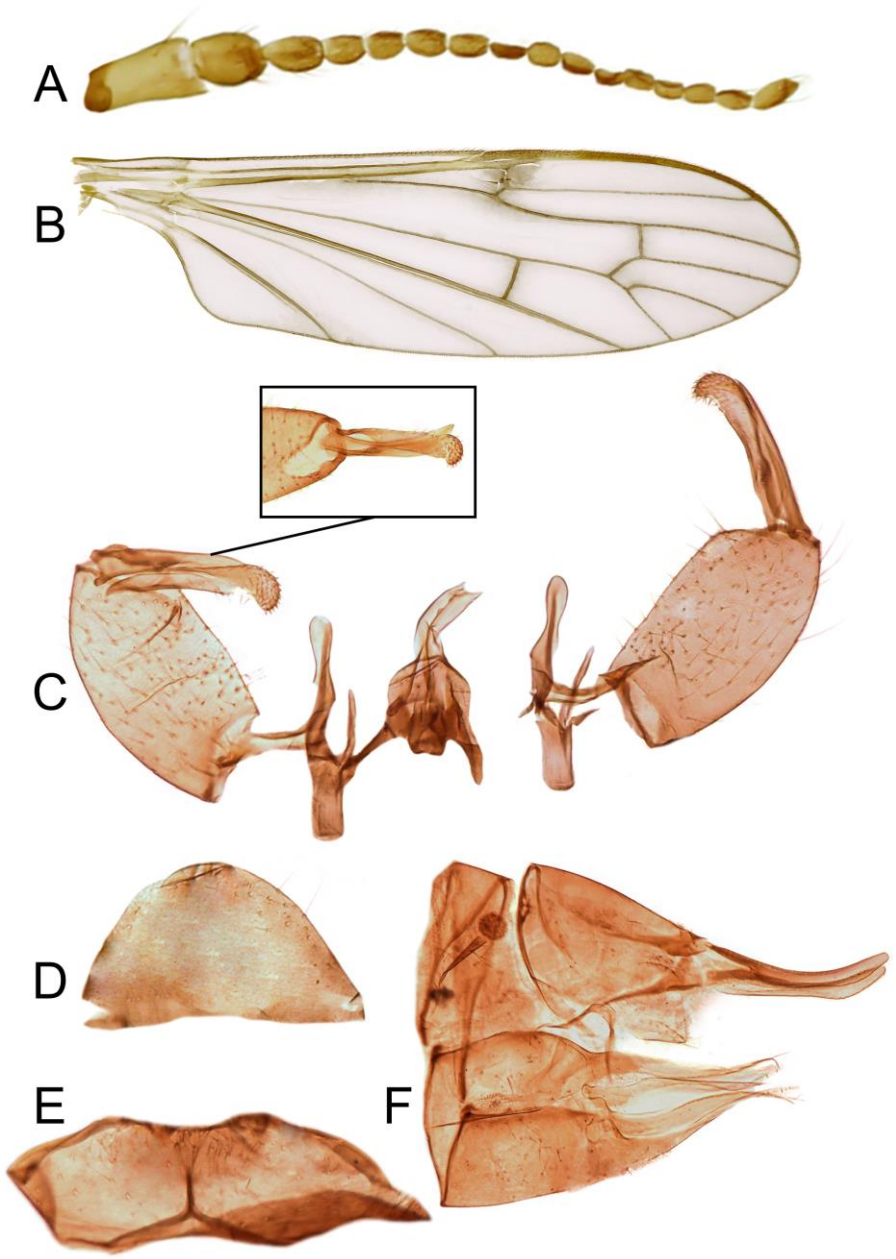


**Figure 160.** *Antocha* (*Orimargula) australiensis* (Alexander, 1922). A – male antenna, metatype; B – male wing, metatype; C – male genital structures and aedeagus, dorsal view, metatype; D – male sternite 9, metatype; E – male tergite 9, metatype; F – female ovipositor, lateral view, metatype.

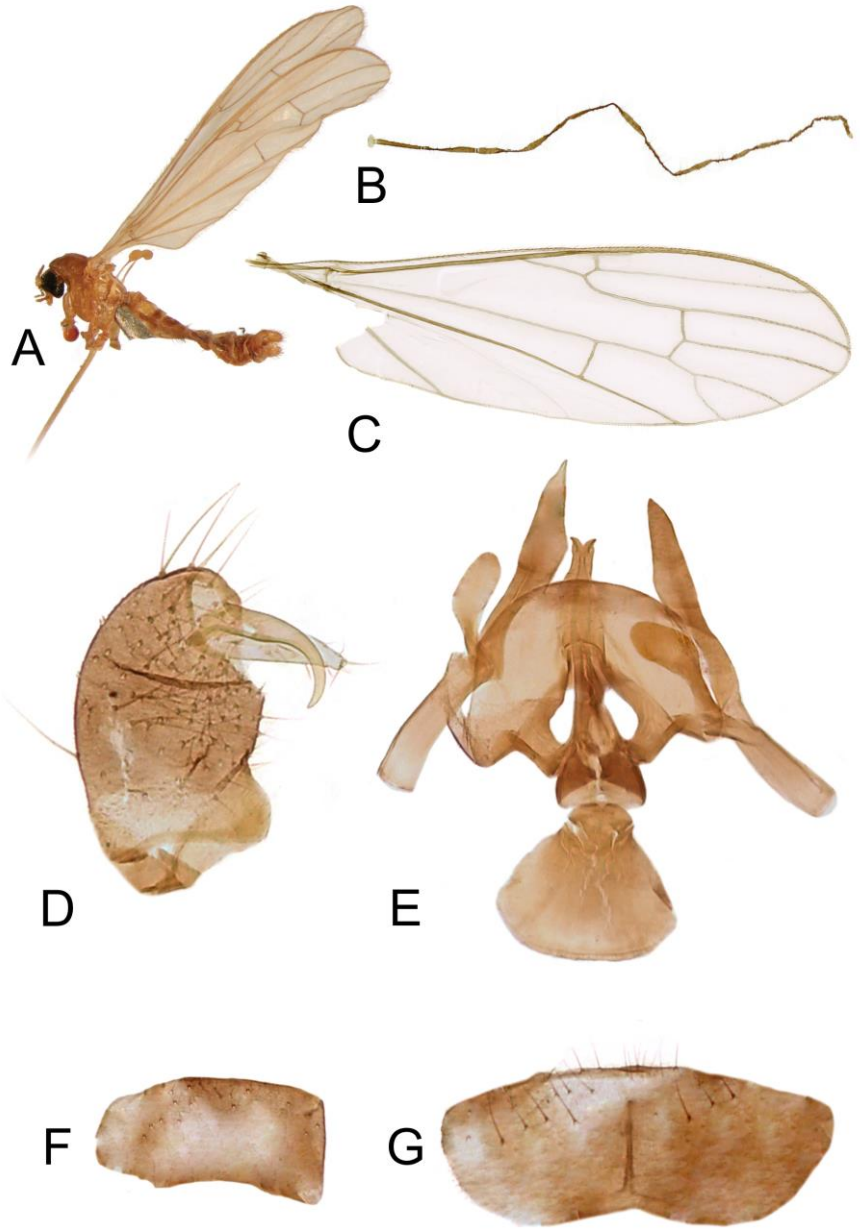


**Figure 161.** *Antocha* (*Orimargula*) *brevifurca* Alexander, 1970. A – male habitus; B – male antenna, holotype; C – male wing, holotype; D – gonocoxite with inner and outer gonostyli, paratype; E – male genital structures and aedeagus, dorsal view male, paratype; F – sternite 9, paratype; G – male tergite 9, paratype.

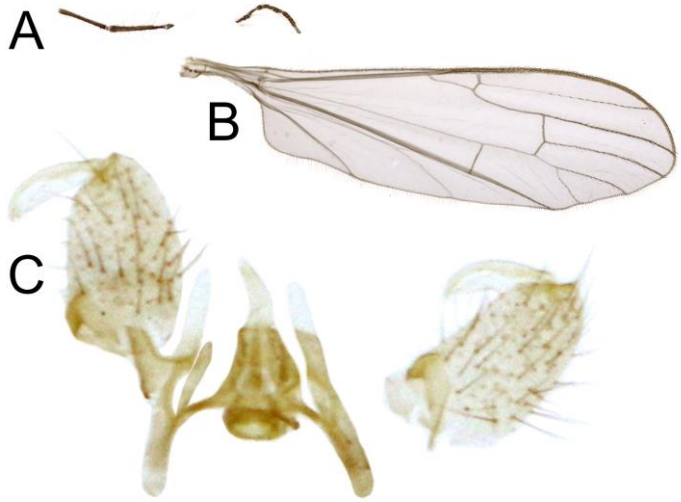


**Figure 162.** *Antocha* (*Orimargula*) *brevisector* Alexander, 1970. A – male antenna, holotype; B – male wing, holotype; C – male genital structures and aedeagus, dorsal view, holotype.

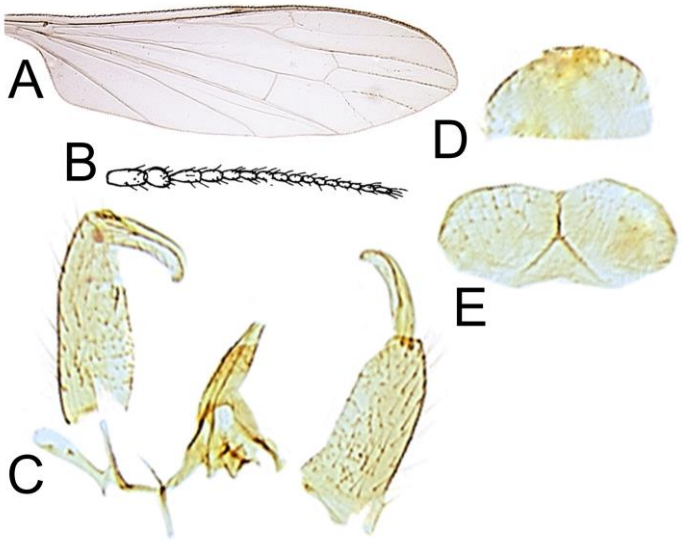


**Figure 163.** *Antocha* (*Orimargula*) *hintoni* Alexander, 1967. A – male wing, holotype; B – male antenna (by Alexander, 1967: 128 p.); C – male genital structures and aedeagus, dorsal view, holotype; D – sternite 9, holotype; E – male tergite 9, holotype.

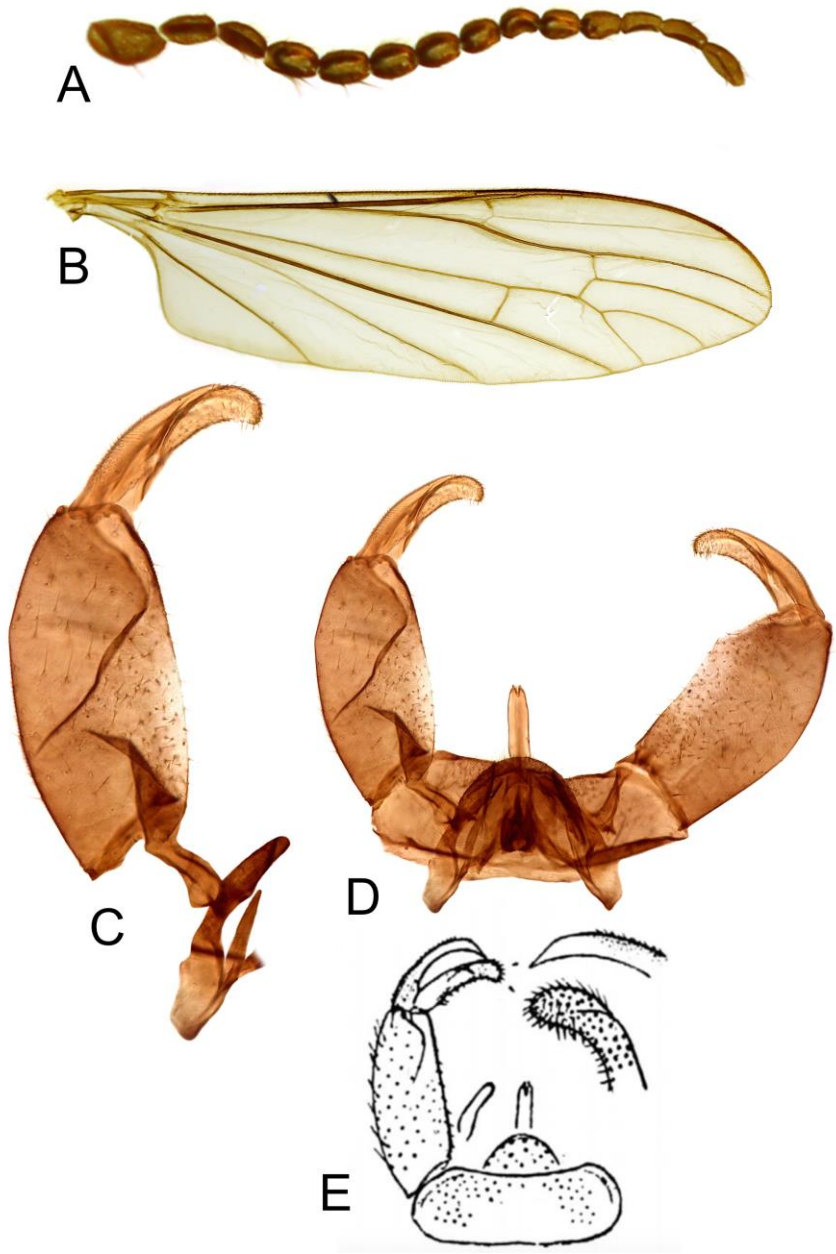


**Figure 164.** *Antocha* (*Orimargula*) *indumeni* Alexander, 1956. A – male antenna, paratype; B – male wing, paratype; C – gonocoxite with inner and outer gonostyli, interbase and inner branch of paramere, paratype; D – male genital structures and aedeagus, dorsal view, paratype; E – male genital structures (illustrated by Alexander, 1956: 405 p.).

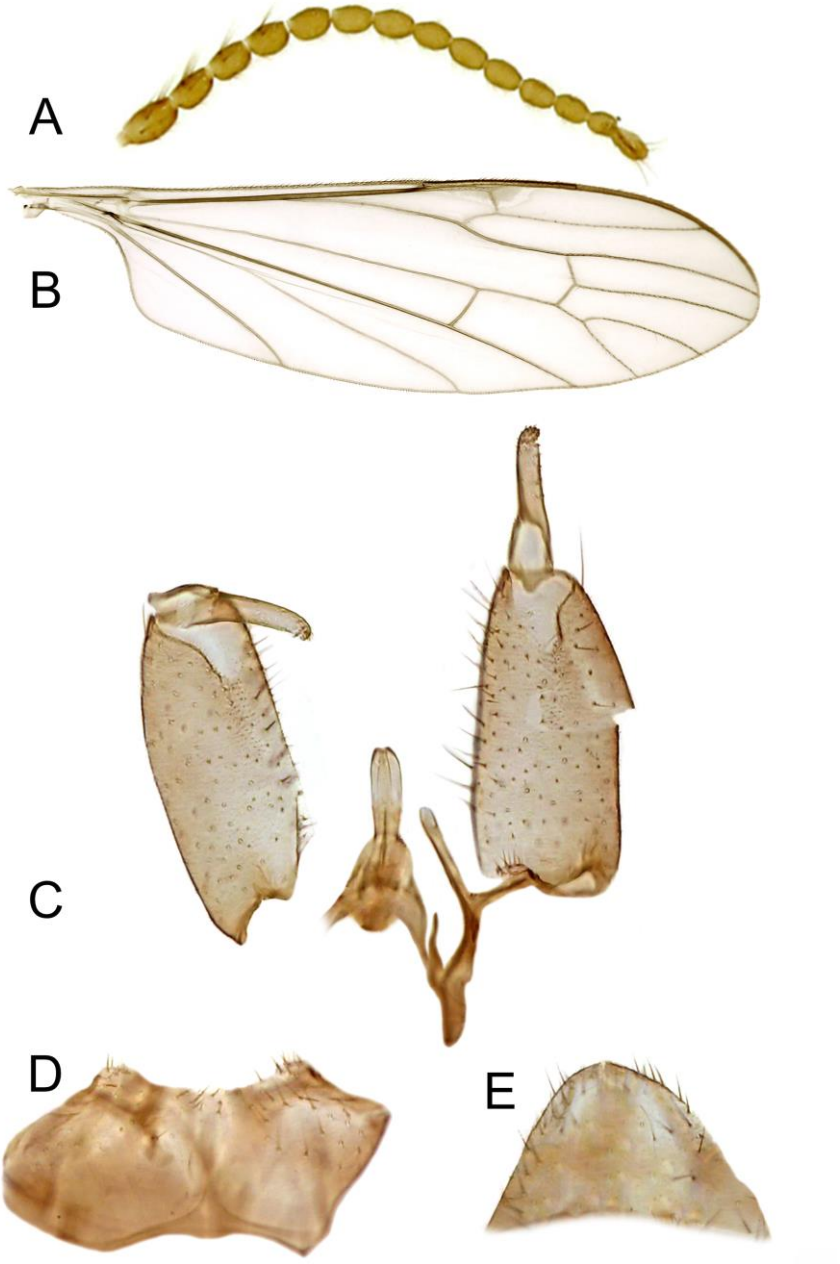


**Figure 165.** *Antocha* (*Orimargula*) *kraussi* Alexander, 1955. A – male antenna, holotype; B – male wing, holotype; C – male genital structures and aedeagus, dorsal view, holotype; D – tergite 9, holotype; E – sternite 9, holotype.

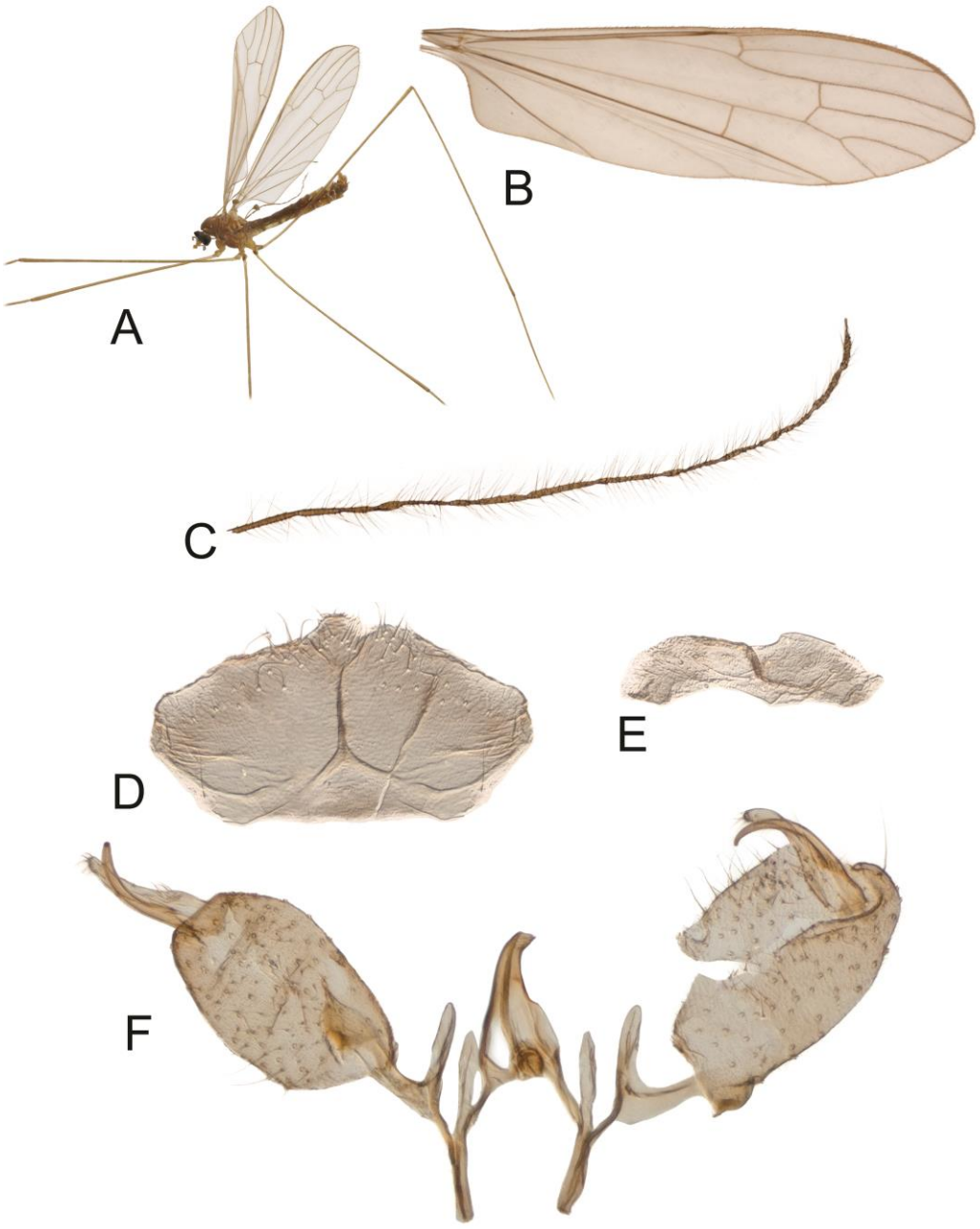


**Figure 166.** *Antocha* (*Orimargula*) *longicornis* (Alexander, 1921). A – male habitus; B – male wing; C – male antenna; D – male tergite 9; E – male sternite 9; F – male genital structures and aedeagus, dorsal view.

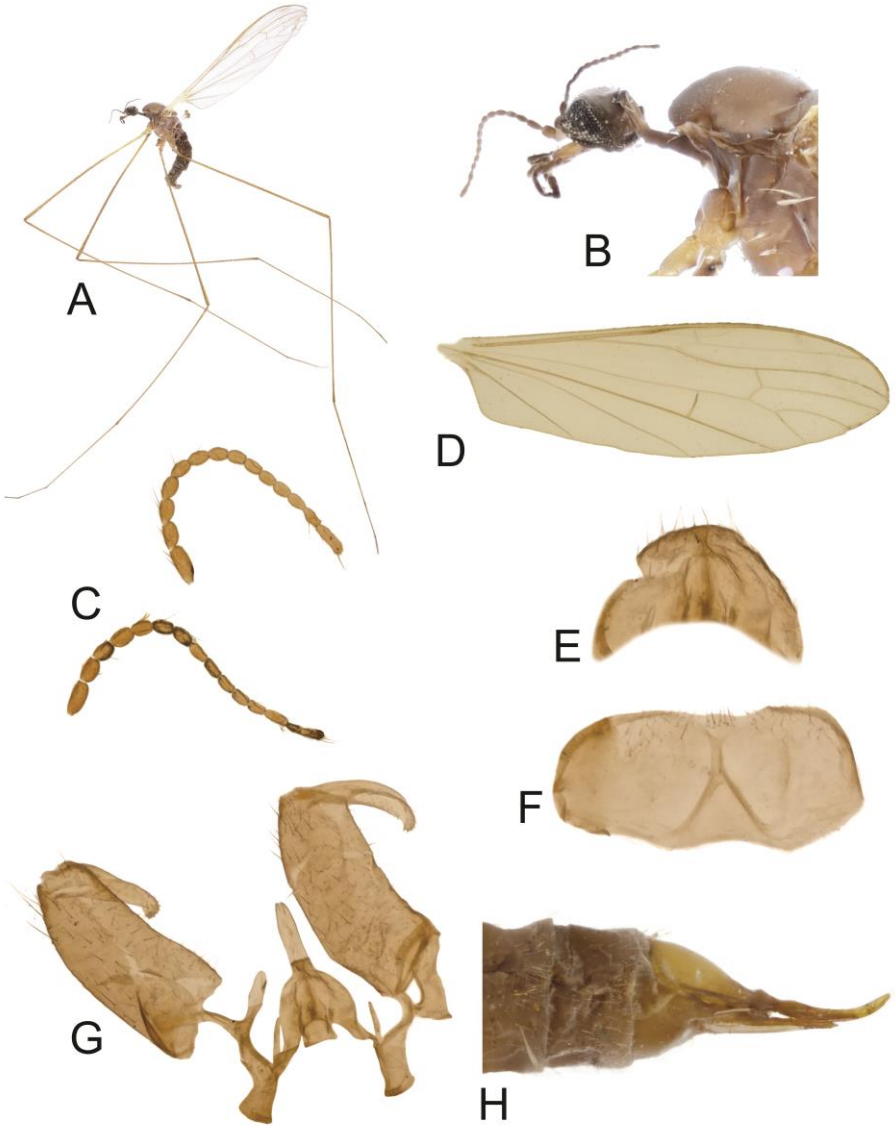


**Figure 167.** *Antocha* (*Orimargula*) *multispina* Alexander, 1956. A – male habitus; B – male head, lateral view; C – male antennae; D – male wing; E – male sternite 9; F – male tergite 9; G – male genital structures and aedeagus, dorsal view; H – female ovipositor, lateral view, holotype.

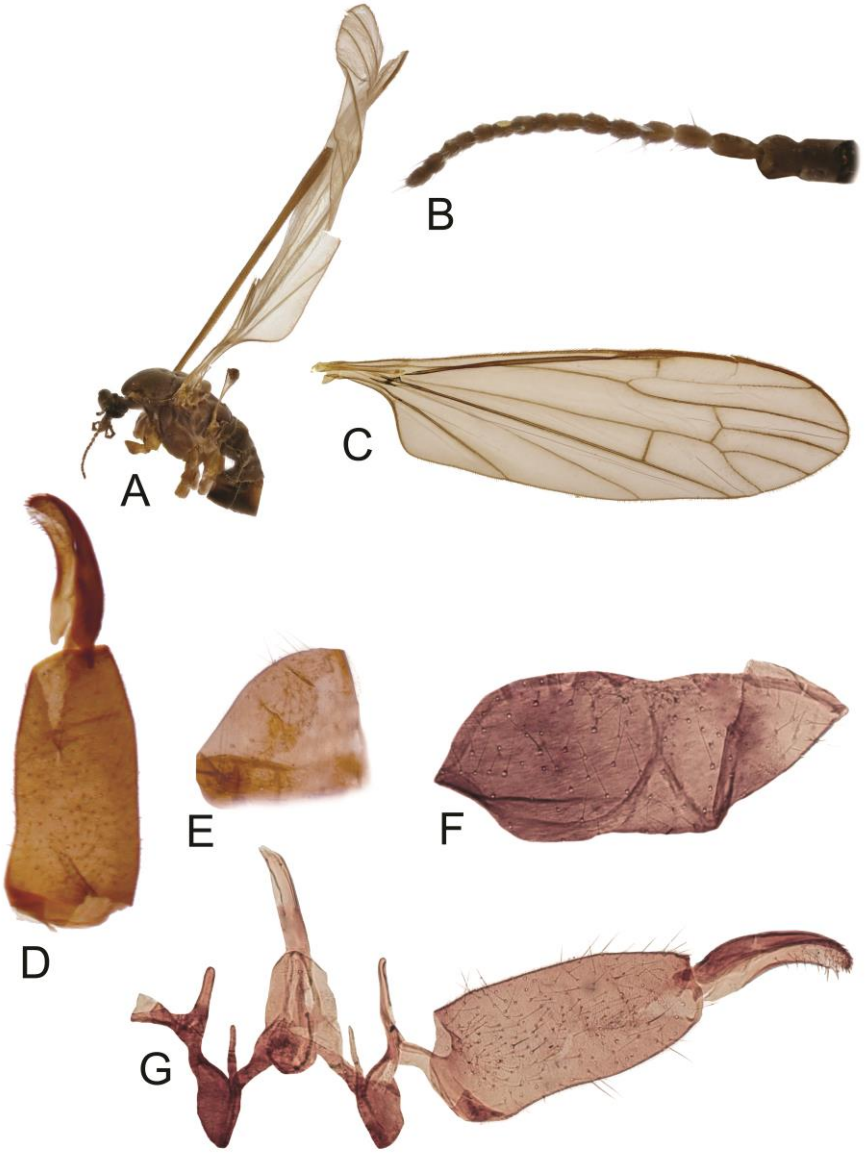


**Figure 168.** *Antocha* (*Orimargula*) *nigristyla* Alexander, 1956. A – male habitus, holotype; B – male antenna, holotype; C – male wing, holotype; D – gonocoxite, with inner and outer gonostyli, holotype; E – male sternite 9, holotype; F – male tergite 9, holotype; G – male genital structures and aedeagus, dorsal view, holotype.

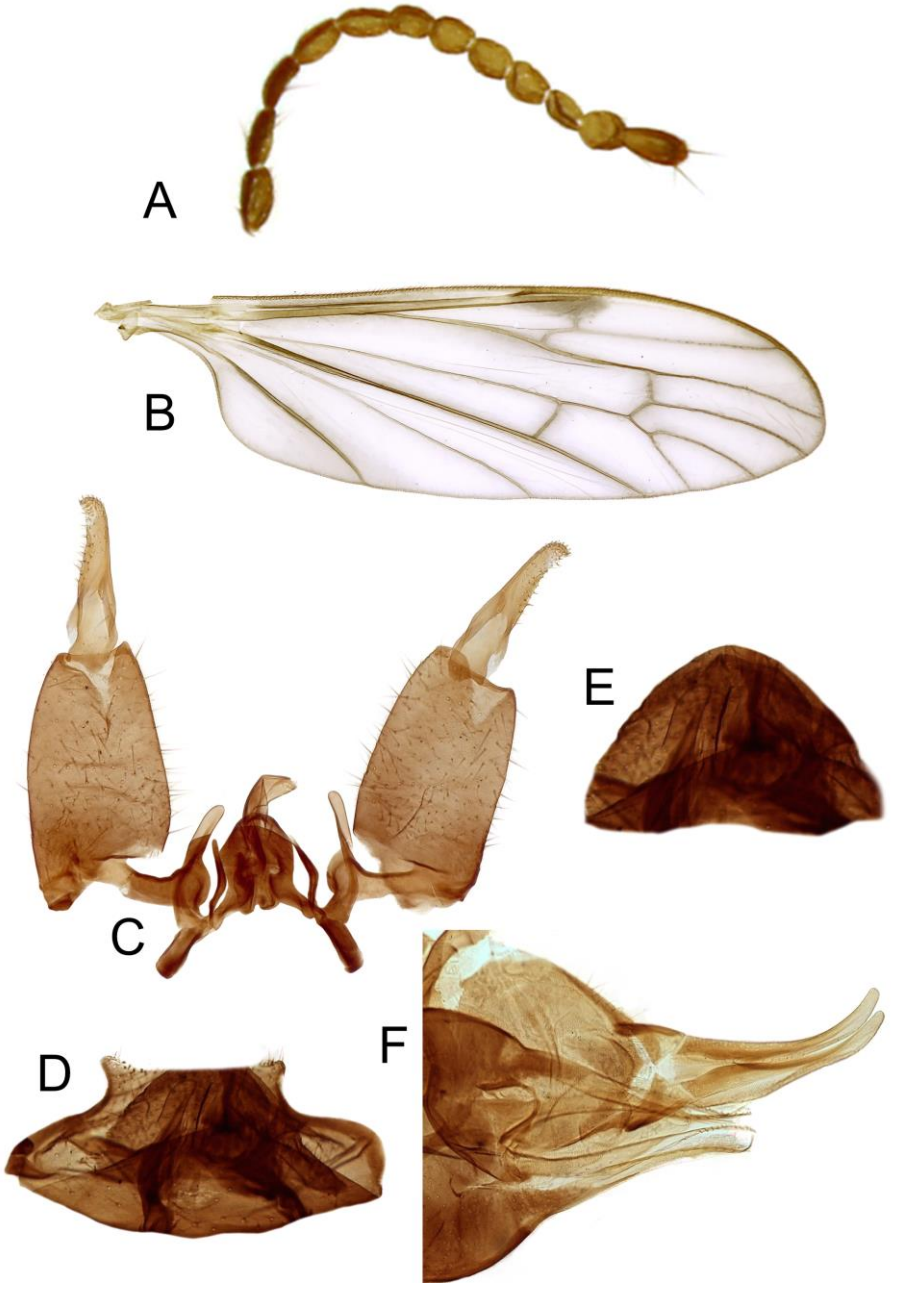


**Figure 169.** *Antocha* (*Orimargula*) *pauliani* Alexander, 1953. A – male antenna, paratype; B – male wing, paratype; C – male genital structures and aedeagus, dorsal view, paratype; D – male tergite 9, paratype; E – male sternite 9, paratype; F – female ovipositor, lateral view, metatype.

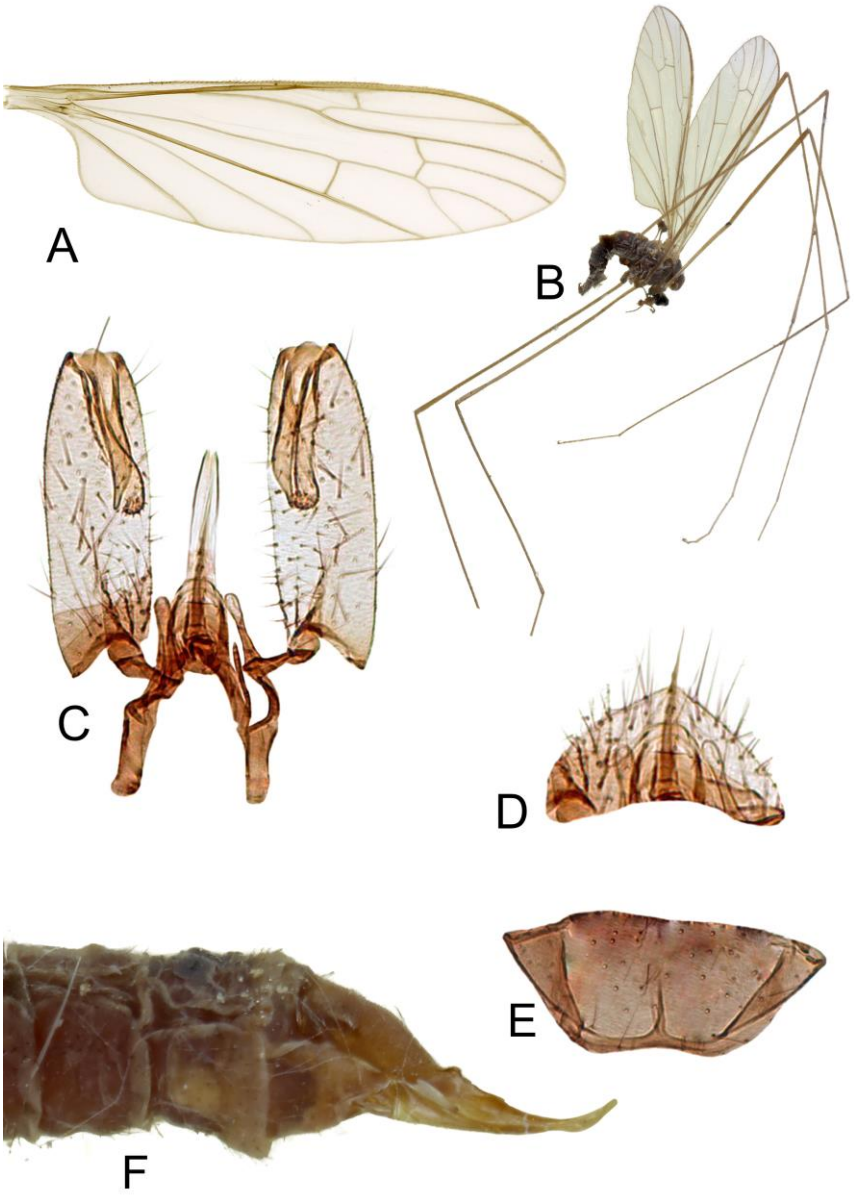


**Figure 170.** *Antocha* (*Orimargula*) *philippina* (Alexander, 1917). A – male wing; B – male habitus; C – male genital structures and aedeagus, dorsal view, holotype; D – male sternite 9, holotype; E – male tergite 9, holotype; F – female ovipositor, lateral view.

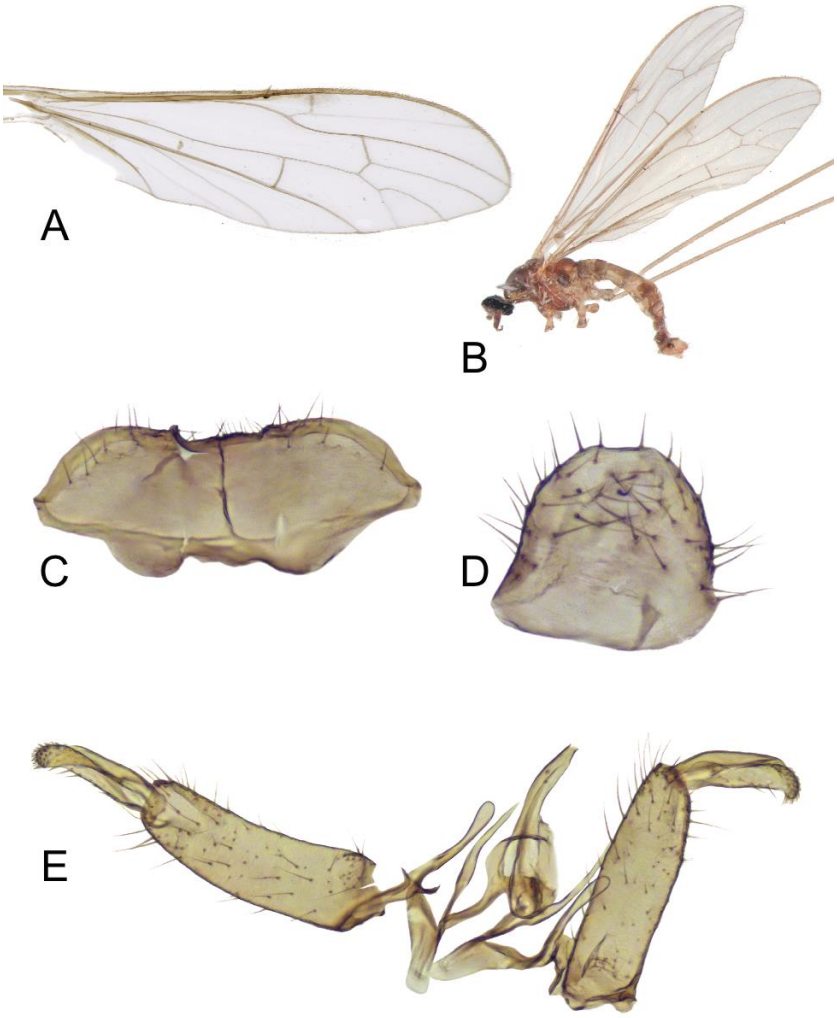


**Figure 171.** *Antocha* (*Orimargula*) *possessiva* Young, 1994. A – male wing; B – male habitus; C – male tergite 9; D – male sternite 9; E – male genital structures and aedeagus, dorsal view.

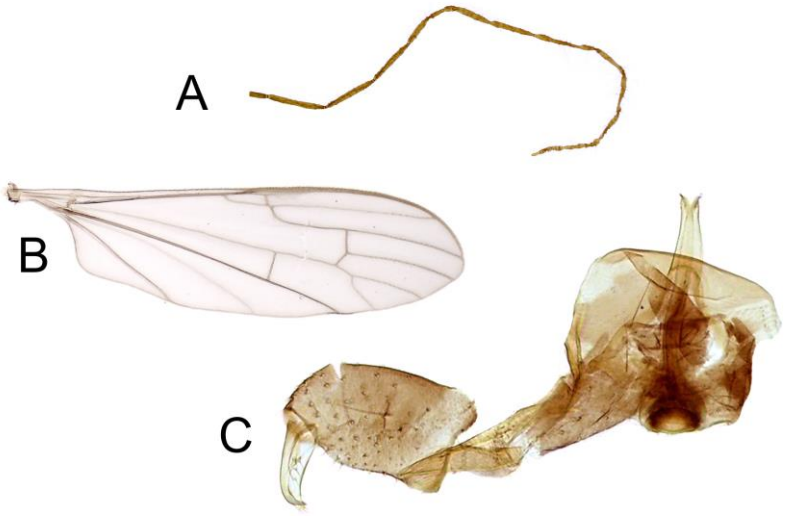


**Figure 172.** *Antocha* (*Orimargula*) *prefurcata* Alexander, 1950. A – male antenna, holotype; B – male wing, holotype; C – male genital structures and aedeagus, dorsal view, holotype.

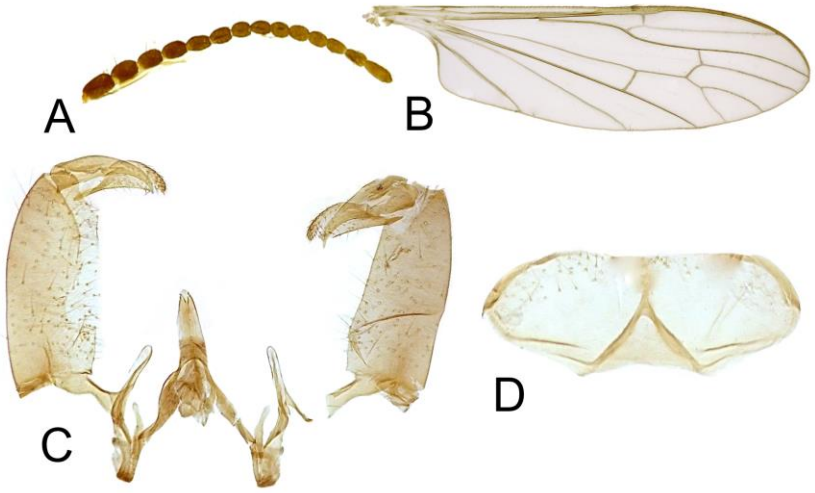


**Figure 173.** *Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963. A – male antenna, paratype; B – male wing, paratype; C – male genital structures and aedeagus, dorsal view, paratype; D – male tergite 9, paratype.

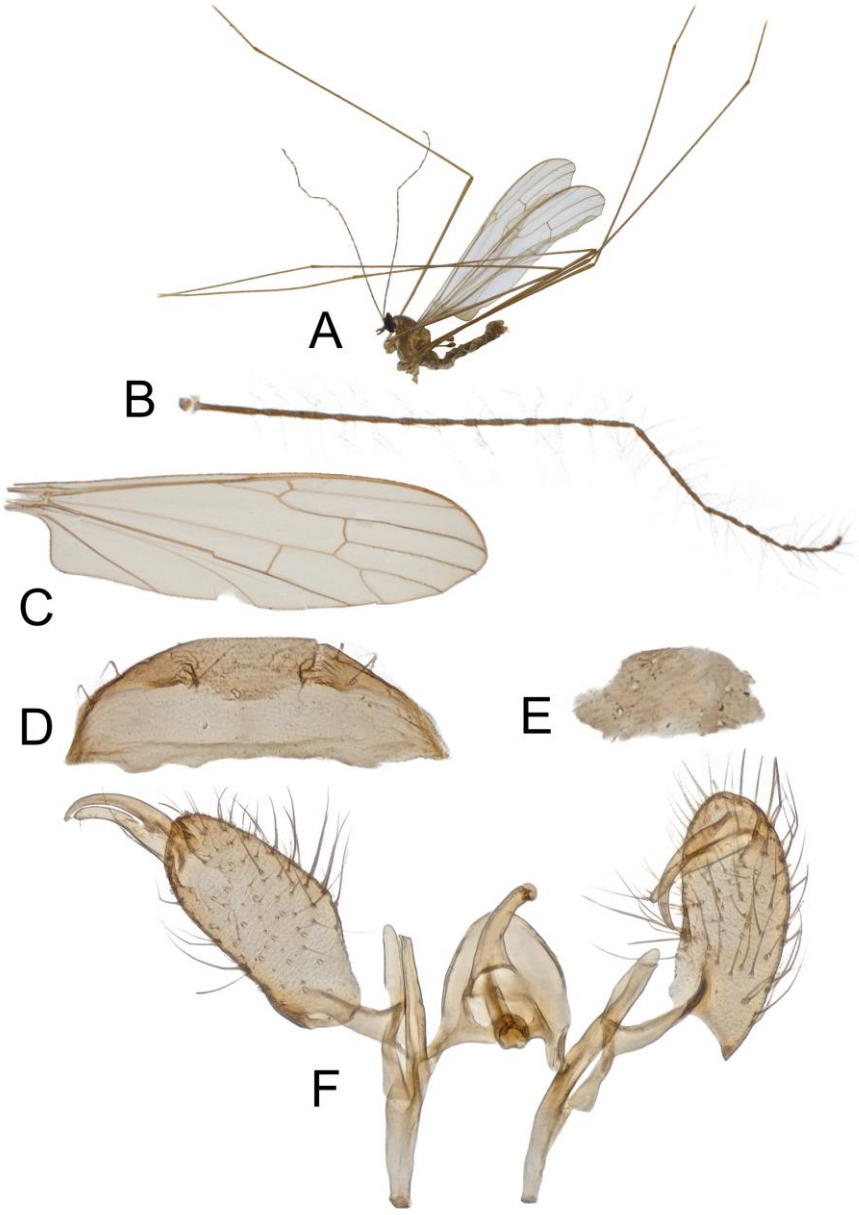


**Figure 174.** *Antocha* (*Orimargula*) *salikensis* Alexander, 1958. A – male habitus; B – male antenna; C – male wing; D – male tergite 9; E – male sternite 9; F – male genital structures and aedeagus, dorsal view.

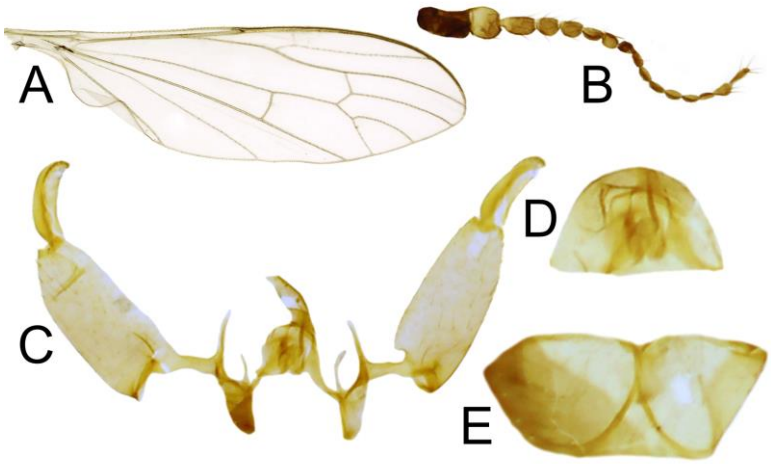


**Figure 175.** *Antocha* (*Orimargula*) *schmidi* Alexander, 1958. A – male wing, metatype; B – male antenna, metatype; C – male genital structures and aedeagus, dorsal view, metatype; D – male tergite 9, metatype; E – male sternite 9, metatype.

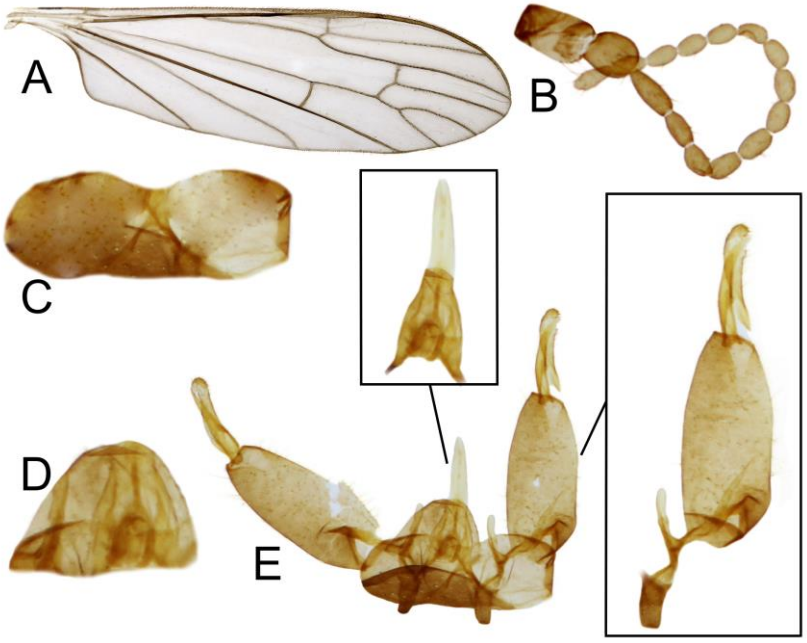


**Figure 176.** *Antocha* (*Orimargula*) *setosa* Alexander, 1960. A – male wing, paratype; B – male antenna, paratype; C – male tergite 9, paratype; D – male sternite 9, paratype; E – male genital structures and aedeagus, dorsal view, paratype.

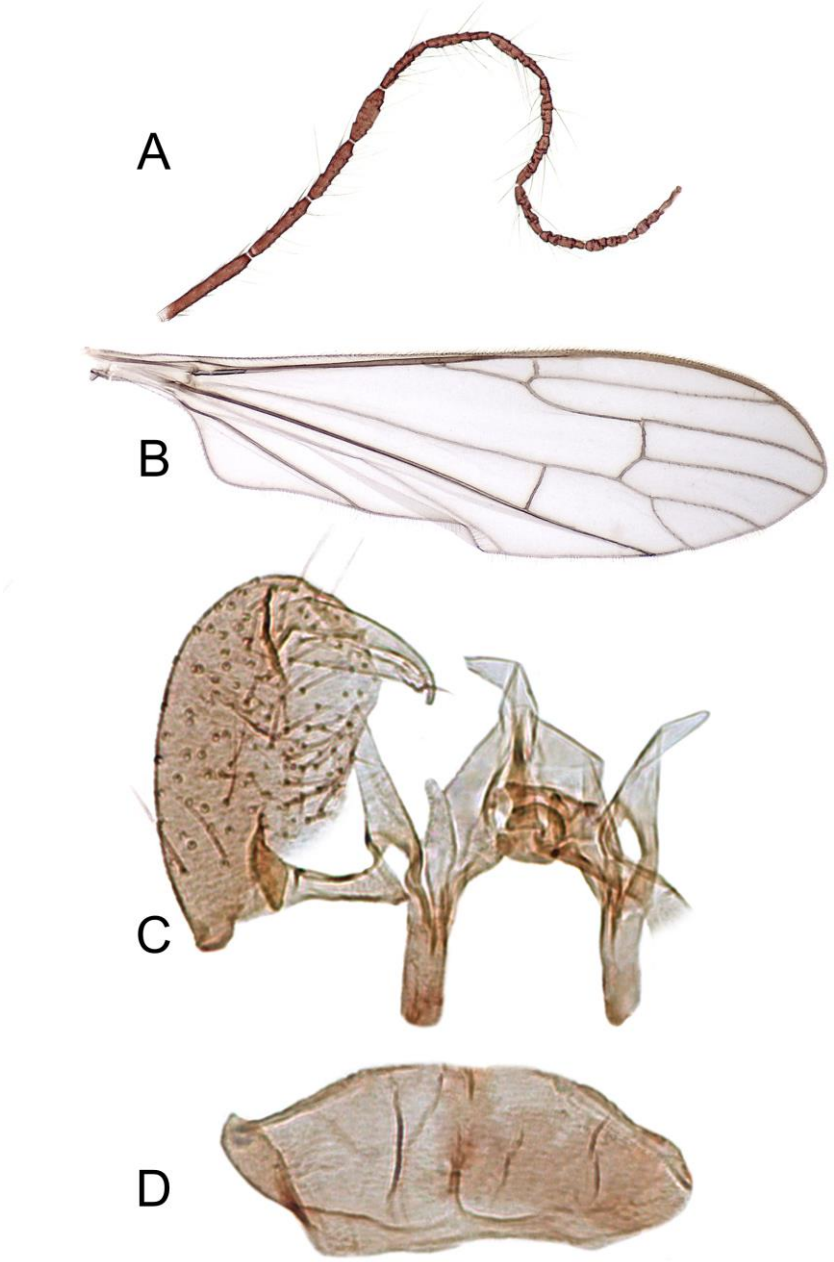


**Figure 177.** *Antocha* (*Orimargula*) *simplex* Alexander, 1970. A – male antenna, holotype; B – male wing, holotype; C – male genital structures and aedeagus, dorsal view, holotype; D – male tergite 9, holotype.

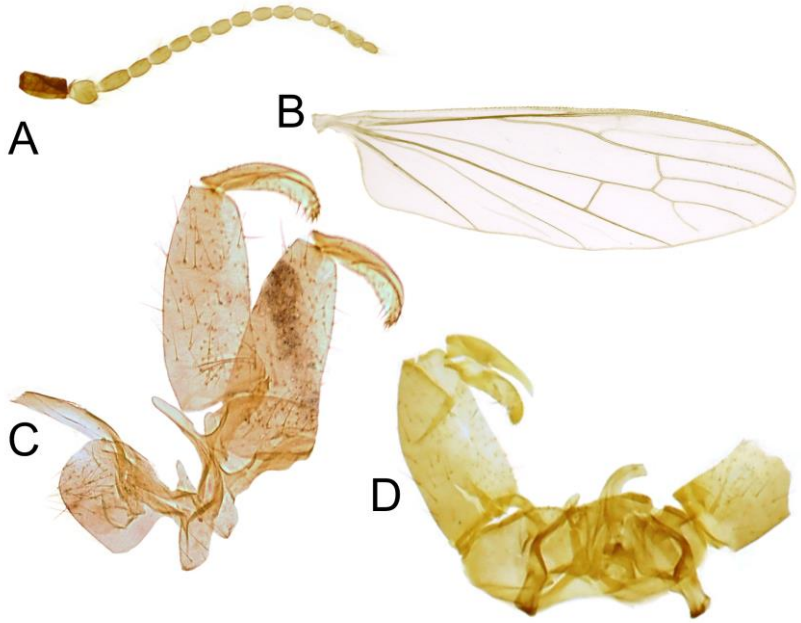


**Figure 178.** *Antocha* (*Orimargula*) *sparsissima* Alexander, 1974. A – male antenna, holotype; B – male wing, holotype; C – male genital structures and aedeagus, lateral view, paratype; D – male genital structures and aedeagus, dorsal view, holotype.

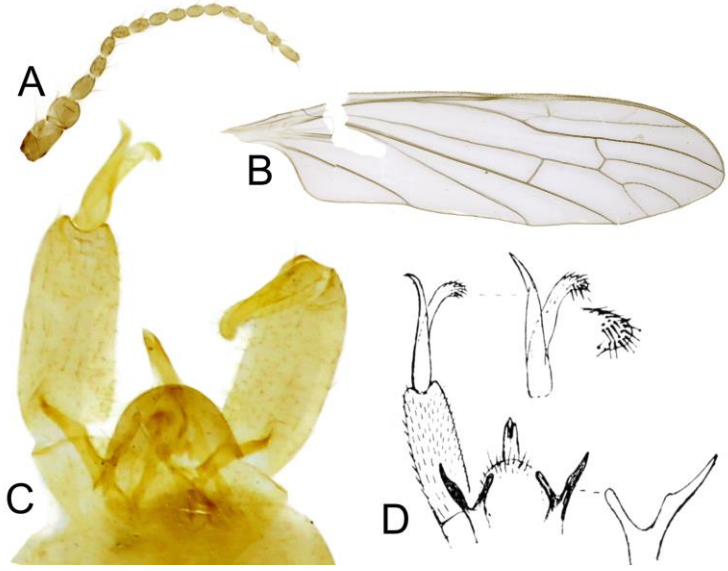


**Figure 179.** *Antocha* (*Orimargula*) *tana* Alexander, 1972. A – male antenna, holotype; B – male wing, paratype; C – male genital structures and aedeagus, dorsal view, paratype; D – male genital structures (illustrated by Alexander, 1972: 397 p.).

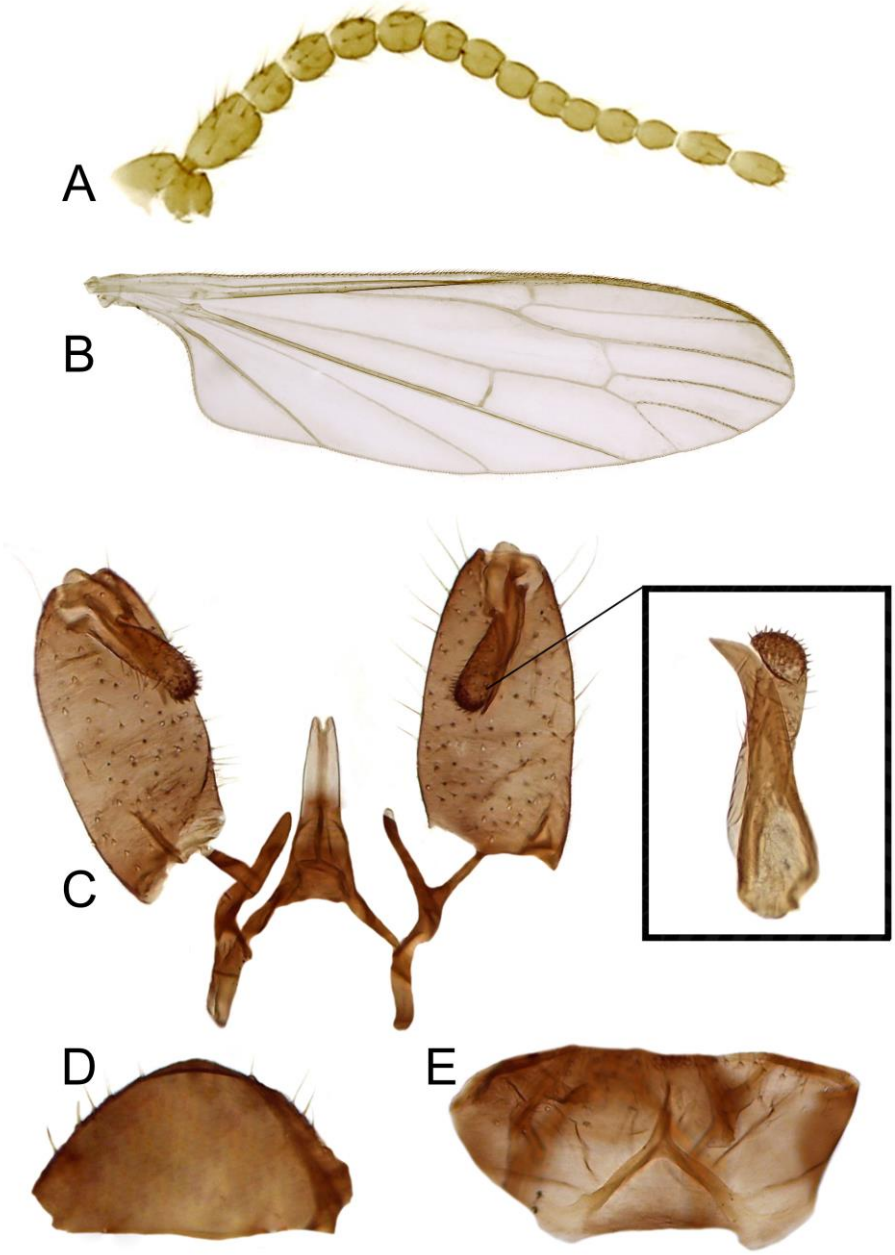


**Figure 180.** *Antocha* (*Orimargula*) *transvaalia* (*Alexander, 1921*). A – male antenna, metatype; B – male wing, metatype; C – male genital structures and aedeagus, dorsal view, metatype; D – sternite 9, metatype; E – tergite 9, metatype.

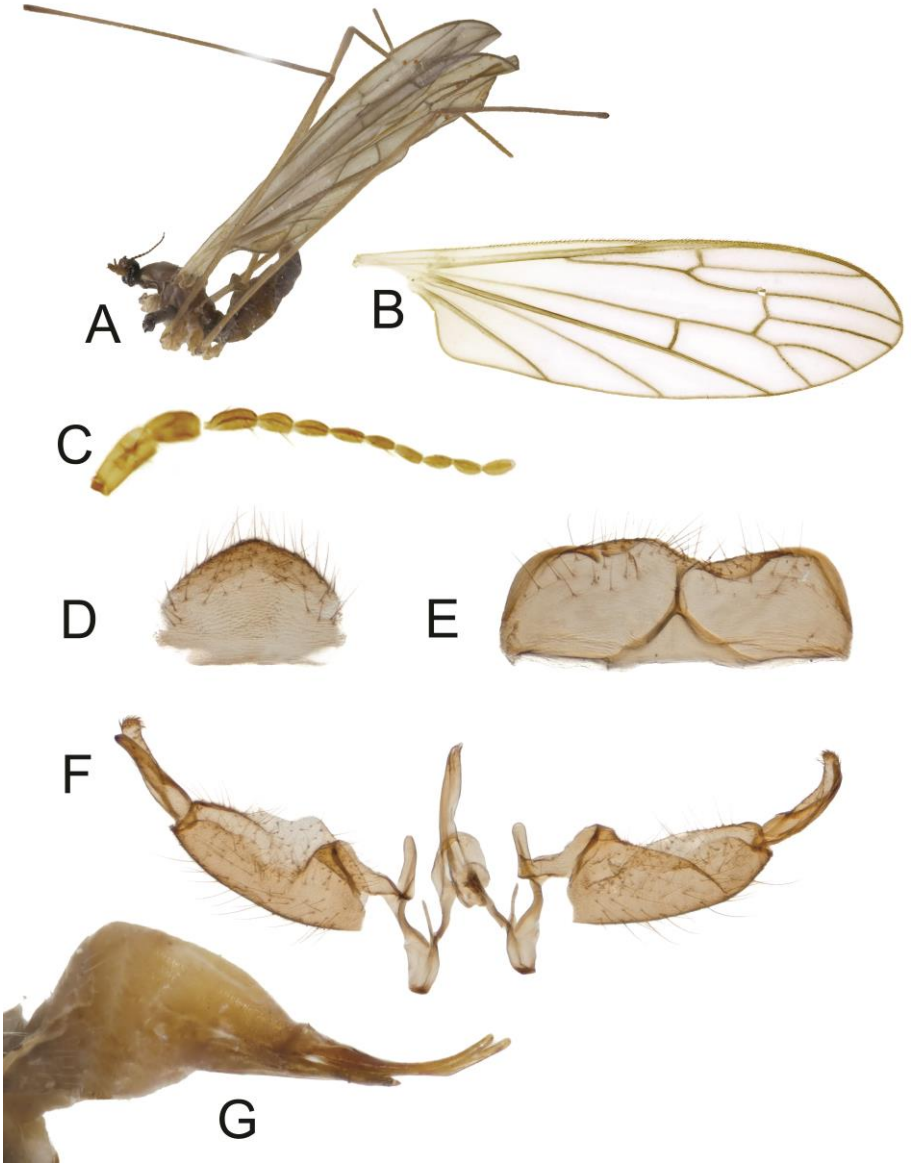


**Figure 181.** *Antocha* (*Orimargula*) *venosa* Alexander, 1964. A – male habitus; B – male wing; C – male antenna; D – male sternite 9; E – male tergite 9; F – male genital structures and aedeagus, dorsal view; G – female ovipositor, lateral view.

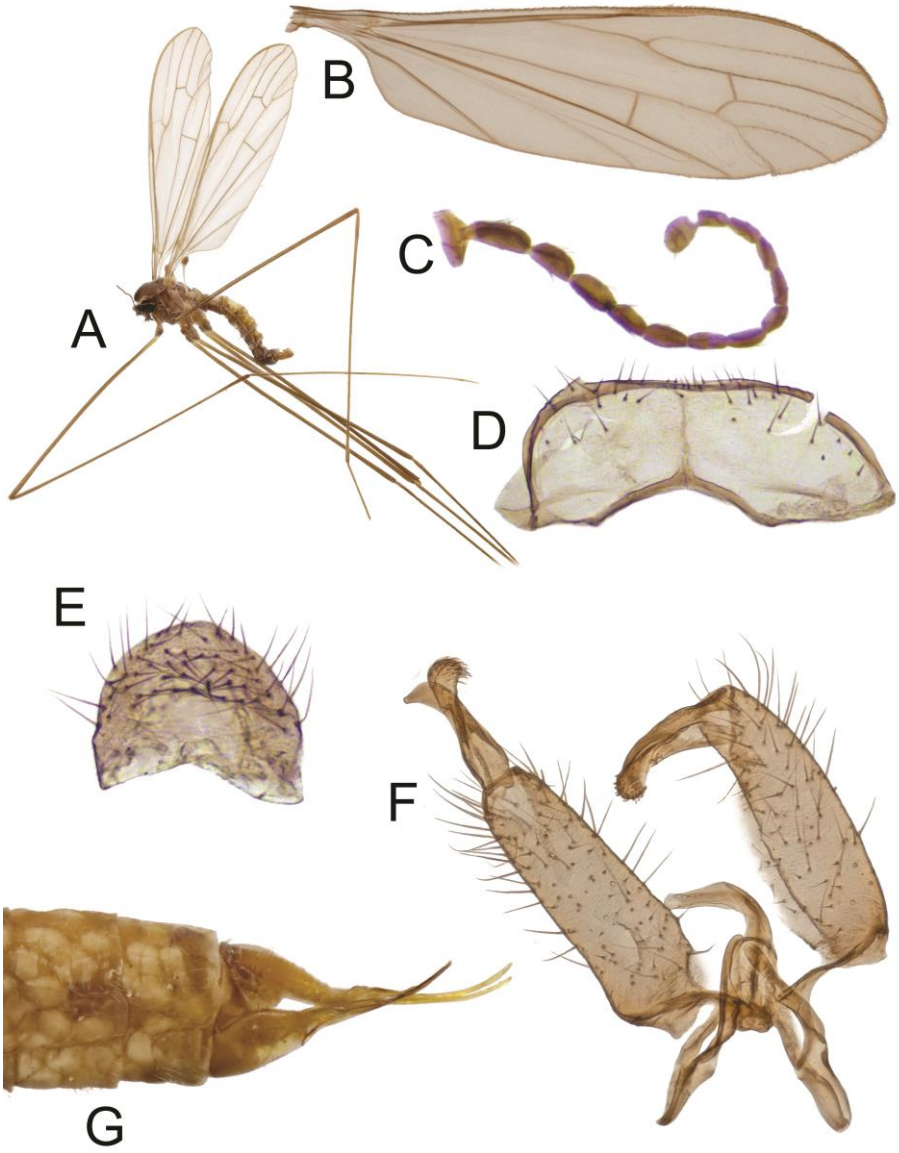


**Figure 182.** *Antocha* (*Orimargula*) *papuensis* Alexander, 1953. A – male habitus; B – male wing; C – male antenna; D – male tergite 9; E – male sternite 9; F – male genital structures and aedeagus, dorsal view; G – female ovipositor, lateral view.

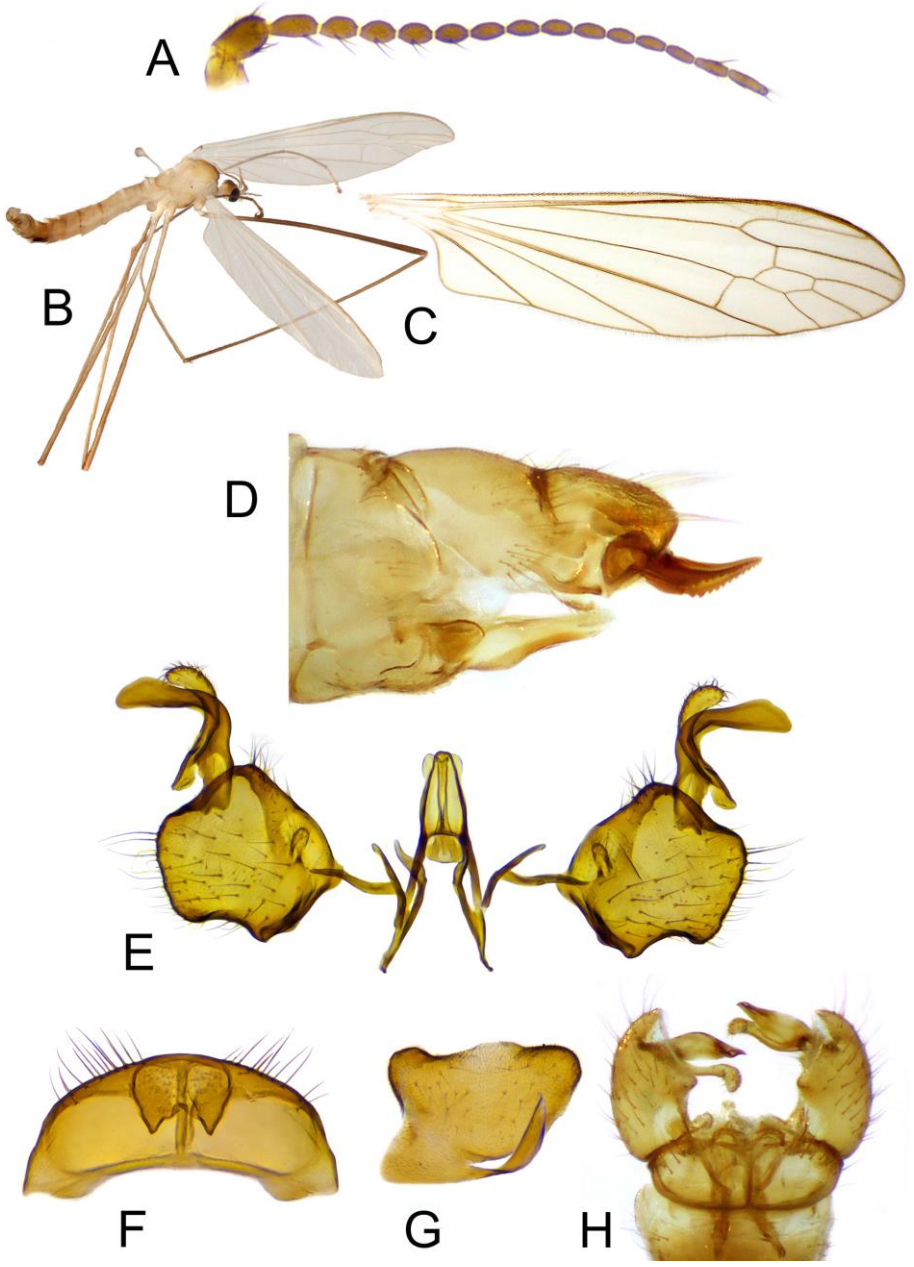


**Figure 183.** *Antocha* (*Proantocha*) *integra* Alexander, 1940. A – antenna; B – male habitus; C – male wing; D – female ovipositor, lateral view; E – male genital structures and aedeagus, dorsal view; F – male tergite 9; G – male sternite 9; H – male genitalia general view.

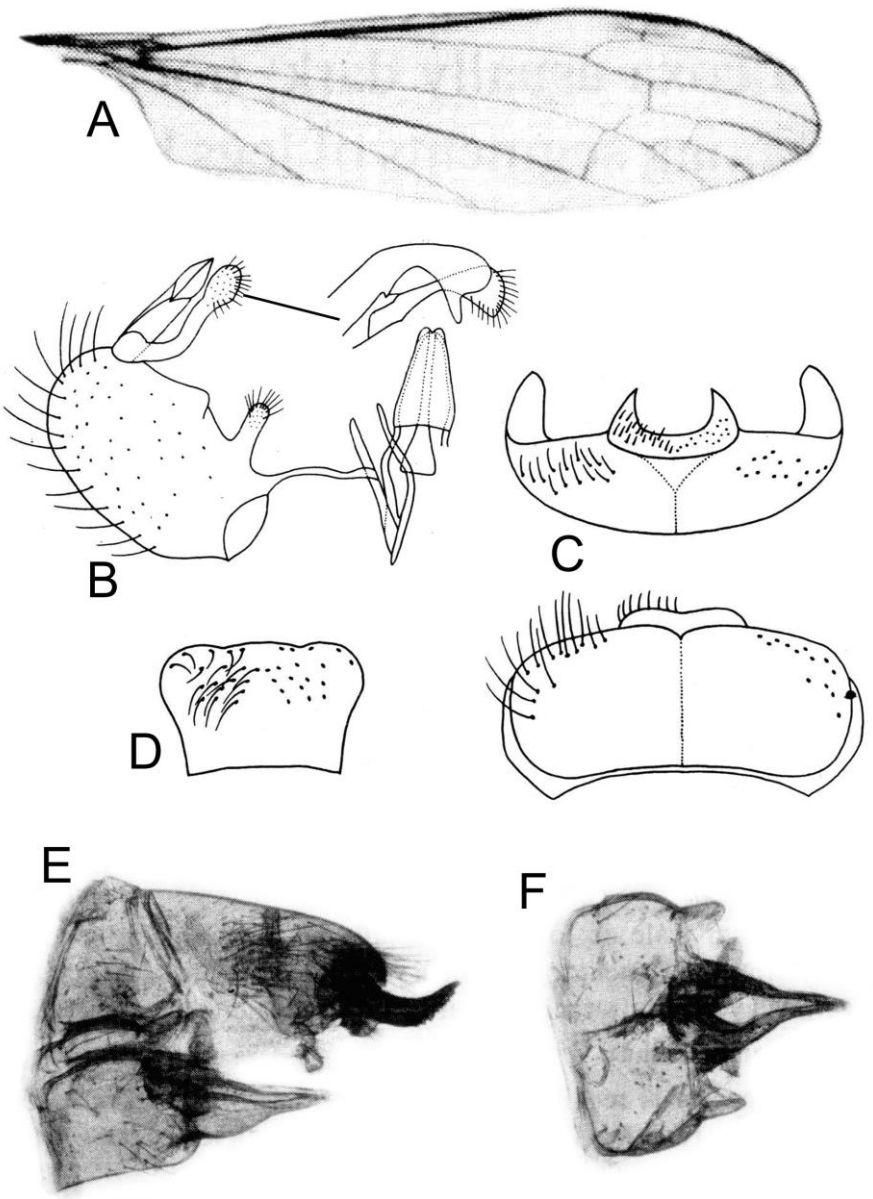


**Figure 184.** *Antocha* (*Proantocha*) *latistilus* Torii, 1992. A – male wing (illustrated by Torii, 1992: 179 p.); B – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 179 p.); C – male tergite 9 (illustrated by Torii, 1992: 179 p.); D – male sternite 9 (illustrated by Torii, 1992: 179 p.); E – female ovipositor, lateral view (illustrated by Torii, 1992: 179 p.); F – female ovipositor, dorsal view (illustrated by Torii, 1992: 179 p.).

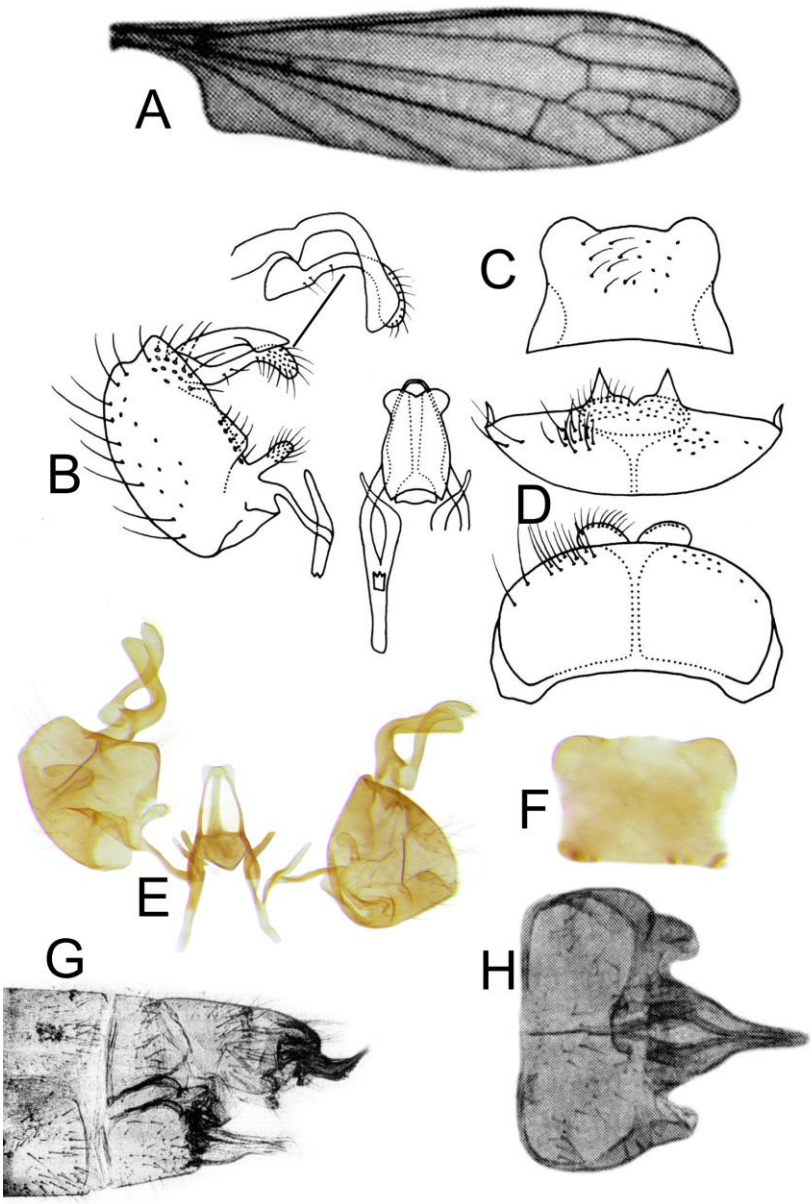


**Figure 185.** *Antocha* (*Proantocha*) *sagana* Alexander, 1932. A – male wing (illustrated by Torii, 1992: 183 p.); B – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 183 p.); C – male sternite 9 (illustrated by Torii, 1992: 183 p.); D – male tergite 9 (illustrated by Torii, 1992: 183 p.); E – male genital structures and aedeagus, dorsal view; F – male sternite 9; G – female ovipositor, lateral view (illustrated by Torii, 1992: 183 p.); F – female ovipositor, dorsal view (illustrated by Torii, 1992: 183 p.).

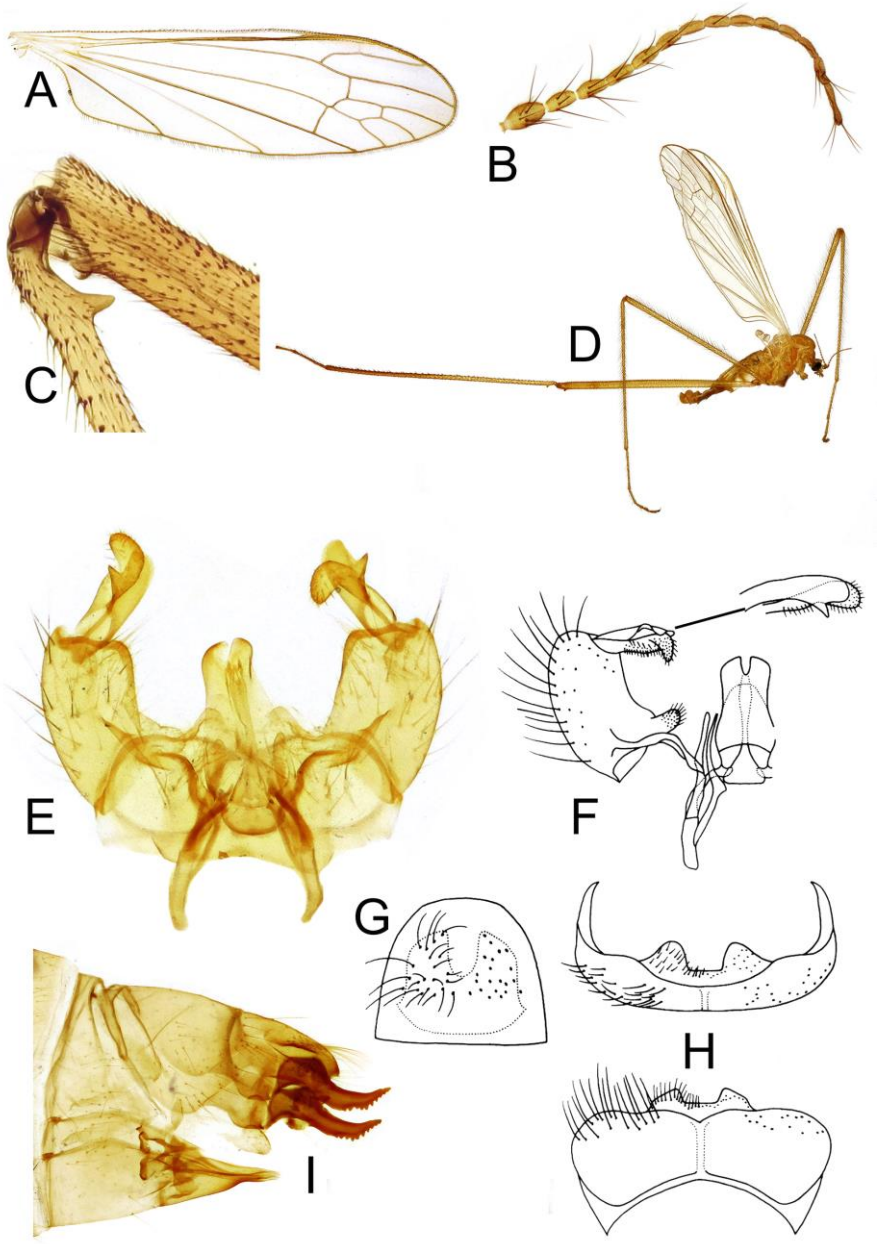


**Figure 186.** *Antocha* (*Proantocha*) *spinifer* Alexander, 1919. A – male wing; B – male antenna; C – male end of femur and base of tibia of hind leg; D – male habitus; E – male genital structures and aedeagus, dorsal view; F – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 160 p.); G – male sternite 9 (illustrated by Torii, 1992: 160 p.); H – male tergite 9 (illustrated by Torii, 1992: 160 p.); I – female ovipositor, dorsal view.

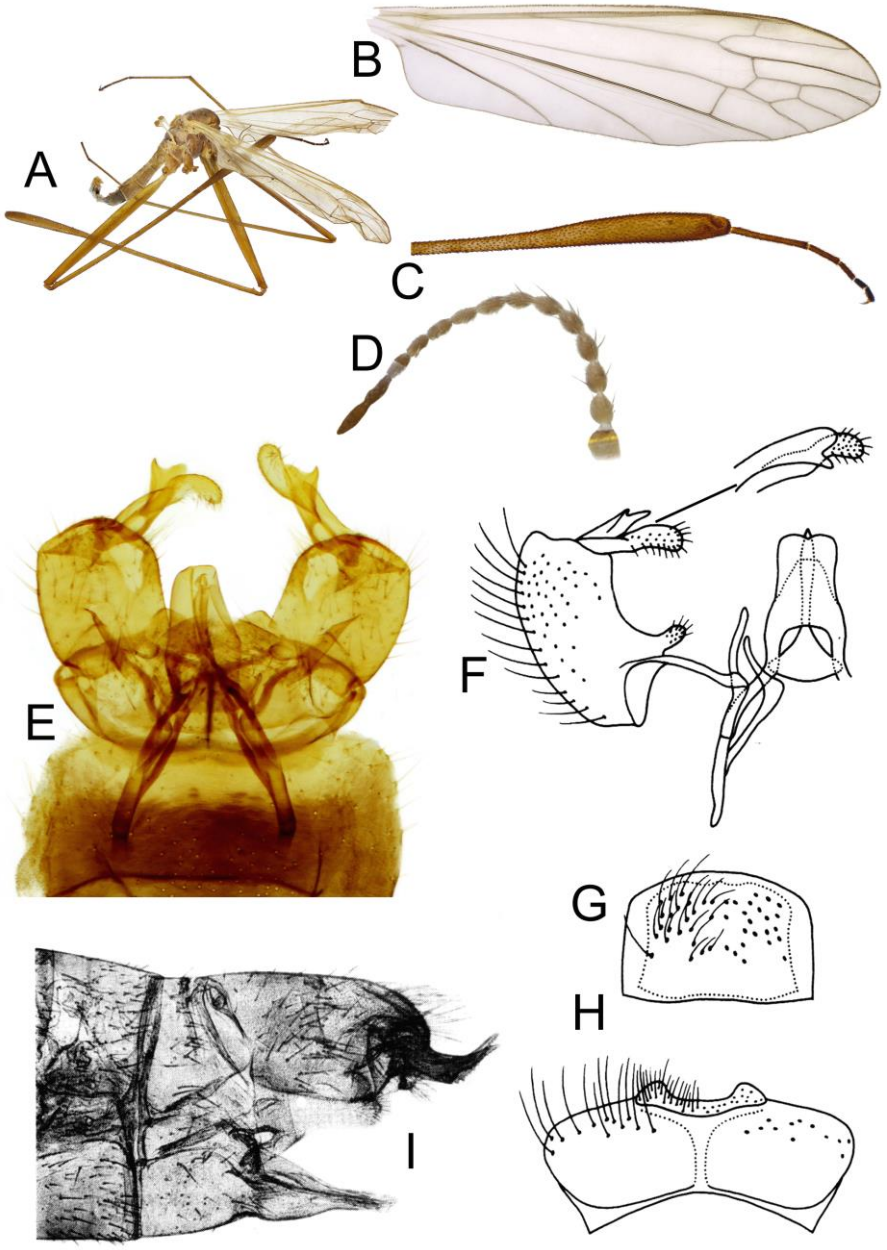


**Figure 187.** *Antocha* (*Proantocha*) *uyei* (Alexander, 1928). A – male habitus; B – male wing; C – male end of tibia of hind leg; D – male antenna; E – male genital structures and aedeagus, dorsal view; F – male genital structures and aedeagus, dorsal view (illustrated by Torii, 1992: 163 p.); G – male sternite 9 (illustrated by Torii, 1992: 163 p.); H – male tergite 9 (illustrated by Torii, 1992: 163 p.); I – female ovipositor, dorsal view (illustrated by Torii, 1992: 163 p.).

## KEY TO SPECIES OF THE GENUS *ANTOCHA* (MALES)

1 Cell *dm* present . . . . . 2
– Cell *dm* absent. . . . . 103
2 Small setiferous lobe on gonocoxite present . . . . . 3
– Setiferous lobe on gonocoxite absent or only a bump presented . . . . . 8
3 Hindleg with opposable tubercles at tip of femur and base of tibia . . . . . 4
– Hindleg without opposable tubercles at tip of femur and base of tibia. . . . 5
4 End of hindleg tibia expanded; distributed in Japan . . . . . ***Antocha* (*Proantocha*) *uyei* (Alexander, 1928)**
– End of hindleg tibia stout but not expanded; distributed in Eastpalaearctic . . . . . ***Antocha* (*Proantocha*) *spinifer* Alexander, 1919**
5 Outer gonystylus splits into two bumps or bump and spine-like structures. . . . . .6
– Outer gonystylus expanded, smooth . . . . . 7
6 Outer gonostylus with acute spine-like structure and a bump; distributed in Japan. . . . . ***Antocha* (*Proantocha*) *latistilus* Torii, 1992**
– Outer gonostylus with two obtuse bumps of which one smaller; distributed in Japan and Kuril Islands. . ***Antocha* (*Antocha*) *brevistyla* Alexander, 1924**
7 Outer gonostylus much longer than inner gonostylus; distributed in Eastpalaearctic. . . . . ***Antocha* (*Proantocha*) *integra* Alexander, 1940**
– Outer gonostylus a little longer than inner gonostylus; distributed in Japan . . . . . .***Antocha* (*Proantocha*) *sagana* Alexander, 1932**
8 Vein $R_2$ before level of base of cell *dm* . . . . . 9
– Vein $R_2$ after or at the same level of base of cell *dm*. . . . . 16
9 Apex of outer gonostylus cleft. . . . . 10
– Apex of outer gonostylus blunt, not cleft . . . . . 14
10 Crossvein m-cu of wing as long as or longer than distance between it and base of cell *dm*. . . . . .11
– Crossvein m-cu of wing shorter than distance between it and base of cell *dm*; distributed in India. .***Antocha* (*Antocha*) *alexanderi* Oosterbroek, 2009**
11 Veins of wing not clouded . . . . . .13
– Veins of wing clouded. . . . . 12
12 Aedeagus hook-like before short apical point narrowed and arched into curved spine; distributed in India . . . . . ***Antocha* (*Antocha*) *latifurca* Alexander, 1969**
– Aedeagus narrow, curved, but not hook-like; distributed in India . . . . . ***Antocha* (*Antocha*) *mysorensis* Alexander, 1974**
13 Inner branch of paramere wide, curved at apex; distributed in Malaysia. . . . . .***Antocha* (*Antocha*) *neoflavella* Alexander and Alexander, 1973**
– Inner branch of paramere thin, filiform; distributed in India . . . .***Antocha* (*Antocha*) *perattenuata* Alexander, 1971**
14 Apex of outer gonostylus broadly obtuse, not decurved . . . . . .15
– Apex of outer gonostylus broadly obtuse, slightly decurved; distributed in China . . . . . ***Antocha* (*Antocha*) *yatungensis* Alexander, 1963**

15 Caudal margin of tergite 9 nearly straight between two small bumps; distributed in China . . . . . ***Antocha* (*Antocha*) *pallidella* Alexander, 1933**
– Caudal margin of tergite 9 gently emarginate and weakly crenulate, without two small bumps; distributed in China . . . . . ***Antocha* (*Antocha*) *nigribasis* Alexander, 1932**
16 Caudal margin of tergite 9 with additional structures like bumps, tooth or large lobes . . . . . .17
– Caudal margin of tergite 9 without additional structures . . . . . 30
17 Caudal margin of tergite 9 with tooth-like structures or with two tooth-like structures between lateral bumps . . . . . .18
– Caudal margin of tergite 9 with one bump, two bumps or two lobes . . . . 21
18 Apex of outer gonostylus rouded, not bifid . . . . . 19
– Apex of outer gonostylus bifid . . . . . 20
19 Caudal margin of tergite 9 with tooth-like structures between lateral bumps; distributed in Eastpalaearctic and in Oriental . . . . . ***Antocha* (*Antocha*) *scapularis* Alexander, 1968**
– Caudal margin of tergite 9 with tooth-like structures, without lateral bumps; distributed in Oriental. . . . . .***Antocha* (*Antocha*) *dafla* Alexander, 1969**
20 Interbase loop-like; caudal margin of tergite 9 smooth between two tooth-like structures; distributed in China . . . . . ***Antocha* (*Antocha*) *bidens* Alexander, 1932**
– Interbase rood-like structure; caudal margin of tergite 9 with deep u-shaped median notch between two tooth-like structures; distributed in Eastpalaearctic, Oriental . . . . . ***Antocha* (*Antocha*) *bifida* Alexander, 1924**
21 Caudal margin of tergite 9 with two large lobes. . . . . 22
– Caudal margin of tergite 9 with one bump or two bumps. . . . . 23
22 Apex of outer gonostylus obliquely truncated; distributed in China . . . . . .***Antocha* (*Antocha*) *emarginata* Alexander, 1938**
– Apex of outer gonostylus clefted; distributed in Eastpalaearctic . . . . . .***Antocha* (*Antocha*) *turkestanica* de Meijere, 1921**
23 Caudal margin of tergite 9 with lateral bumps . . . . . 24
– Caudal margin of tergite 9 with median bumps or one bump. . . . . 26
24 Inner branch of paramere light, gradually narrows to acute point; apex of outer gonostylus light. . . . . 25
– Inner branch of paramere expanded before apex, dark; apex of outer gonostylus dark; distributed in Nearctic, Neotropic. . . . . ***Antocha* (*Antocha*) *monticola* Alexander, 1917**
25 Opening of end of aedeagus wide; wing pterostigma distinct; distributed in India. . . . . .***Antocha* (*Antocha*) *perobtusa* Alexander, 1971**
– Opening of end of aedeagus not wide; wing pterostigma indistinct; distributed in India . . . . . ***Antocha* (*Antocha*) *mara* Alexander, 1970**
26 Caudal margin of tergite 9 with two median bumps. . . . . 27
– Caudal margin of tergite 9 with one median bump. . . . . 29
27 Apex of gonocoxite broadly rounded . . . . . 28

– Apex of gonocoxite narrowly elongated; distributed in China . . . . . .
. . . . . .***Antocha* (*Antocha*) *fortidens* Alexander, 1933**
28 Outer gonostylus strongly bent and longer than inner gonostylus; distributed in Eastpalaearctic, Oriental . . . . . ***Antocha* (*Antocha*) *nebulipennis nebulipennis* Alexander, 1931**
– Outer gonostylus arched, not bent, not longer than inner gonostylus; distributed in China, Myanmar . . . . . ***Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938**
29 Apex of outer gonostylus broad and blunt; distributed in Nepal . . . . . .
. . . . . ***Antocha* (*Antocha*) *unicollis* Alexander, 1968**
– Apex of outer gonostylus narrows to acute point; distributed in India . . . . .
. . . . . .***Antocha* (*Antocha*) *arjuna* Alexander, 1969**
30 Middle flagellomeres of antenna dilated ventrally . . . . . 31
– Middle flagellomeres of antenna oval or fusiform, not dilated ventrally. .35
31 Inner branch of paramere straight or sinuous . . . . . 32
– Inner branch of paramere twisted into spiral; distributed in China . . . . . .
. . . . . ***Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019**
32 Aedeagus without additional processes . . . . . .33
– Aedeagus with two separated processes; distributed in China. . . . . .
. . . . . .***Antocha* (*Antocha*) *shansiensis* Alexander, 1954**
33 Outer gonostylus gradualy narrows to obtuse point . . . . . 34
– Outer gonostylus expanded before apex, strongly narrows to obtuse point; distributed in South Korea . . . . . ***Antocha* (*Antocha*) *koreana* Podenas and Byun, 2014**
34 Inner branch of paramere shorter than aedeagus; distributed in Eastpalaearctic, Oriental . . . . . .***Antocha* (*Antocha*) *indica* Brunetti, 1912**
– Inner branch of paramere longer than aedeagus; distributed in China . . . . .
. . . . . ***Antocha* (*Antocha*) *streptocera* Alexander, 1949**
35 Inner branch of paramere divides into two branches before apex . . . . . .36
– Inner branch of paramere not branched . . . . . .44
36 Length of branches of inner branch of paramere equal . . . . . .37
– One branche of inner branch of paramere longer than another one . . . . . 38
37 Aedeagal sheath with two horn-like structures; distributed in Westpalaearctic, Eastpalaearctic . . . . . ***Antocha* (*Antocha*) *libanotica* Lackschewitz, 1940**
– Aedeagal sheath without horn-like structures; distributed in China and Taiwan . . . . . .***Antocha* (*Antocha*) *taiwanensis* Podenas and Young, 2015**
38 Aedeagus connected with twisted into spiral lateral parameral structures; distributed in China and India. . . . . ***Antocha* (*Antocha*) *spiralis* Alexander, 1932**
– Lateral parameral structures of aedeagus are not twisted into spiral . . . . .39
39 Apex of outer gonostylus obliquely truncated . . . . . .40
– Apex of outer gonostylus blunt, not obliquely truncated; distributed in Japan . . . . . ***Antocha* (*Antocha*) *bidigitata* Alexander, 1954**

40 Parameral lateral structures longer than end of aedeagal plate. . . . . 41
– Parameral lateral structures shorter than end of aedeagal plate; distributed in India . . . . . ***Antocha* (*Antocha*) *incurva* Alexander, 1968**
41 Lateral structure of aedeagus consists of two or three small branches . . 42
– Lateral structure of aedeagus not branced; distributed in India . . . .***Antocha* (*Antocha*) *scutifera* Alexander, 1973**
42 Lateral structure of aedeagus consists of two branches . . . . . .43
– Lateral structure of aedeagus consists of three branches; distributed in China . . . . . .***Antocha* (*Antocha*) *constricta* Alexander, 1932**
43 Outer branch of parameral lateral structure of aedeagus approximately three times in length smaller than inner branch; distributed in China and India . . . . . ***Antocha* (*Antocha*) *quadrifurca* Alexander, 1971**
– Outer branch of parameral lateral structure of aedeagus very short, narrowed to acute point; distributed in China . . . . . ***Antocha* (*Antocha*) *multidentata* Alexander, 1932**
44 Outer gonostylus with additional tooth-like structure . . . . . 45
– Outer gonostylus without additional tooth-like structure . . . . . 46
45 Tooth of outer gonostylus longer than one-fourth of outer gonostylus itself; distributed in Russia (Primorskiy kray) . . . . . ***Antocha* (*Antocha*) *ramulifera* Savchenko, 1983**
– Tooth on near midlength of outer gonostylus short, approximately one-fourth of outer gonostylus itself; distributed in Russia (Sakhalin, Kuril Islands), South Korea, Japan (Honshu) . . . ***Antocha* (*Antocha*) *dentifera* Alexander, 1924**
46 Aedeagus connected with twisted into spiral lateral parameral structures . . . . . .***Antocha* (*Antocha*) *aegina* Alexander, 1970**
– Lateral parameral structures of aedeagus absent or not twisted into spiral. . . . . .47
47 Apex of aedeagus with two filose structures . . . . . .48
– Apex of aedeagus without two filose structures . . . . . 49
48 Terminal filaments of aedeagus approximately three times shorter than aedeagus; distributed in Myanmar . . . . . ***Antocha* (*Antocha*) *ophioglossa* Alexander, 1954**
– Terminal filaments of aedeagus approximately as long as aedeagus; distributed in India . . . . . ***Antocha* (*Antocha*) *ophioglossodes* Alexander, 1954**
49 Apex of aedeagus bifid or with two bumps . . . . . .50
– Apex of aedeagus not bifid . . . . . 53
50 Apex of outer gonostylus not bifid . . . . . 51
– Apex of outer gonostylus unequally bifid; distributed in India . . . ***Antocha* (*Antocha*) *longispina* Alexander, 1969**
51 Apex of aedeagus splits into two acute points . . . . . .52
– Apex of aedeagus splits into two small bumps; distributed in India . . . . . ***Antocha* (*Antocha*) *pachyphallus* Alexander, 1971**

52 Apex of interbase rounded; distributed in China . . . . . ***Antocha* (*Antocha*) *setigera* Alexander, 1933**
– Apex of interbase irregularly bilobed; distributed in India . . . . . ***Antocha* (*Antocha*) *angusticellula* Alexander, 1969**
53 Apex of outer gonostylus broad, edge smooth . . . . . 54
– Apex of outer gonostylus rounded, acute or cleft, not broad . . . . . 55
54 Apex of inner branch of paramere acute; distributed in India . . . ***Antocha* (*Antocha*) *platystylis* Alexander, 1974**
– Apex of inner branch of paramere blunt; distributed in India . . . . ***Antocha* (*Antocha*) *amblystyla* Alexander, 1963**
55 Outer gonostylus truncated at apex . . . . . .56
– Apex of outer gonostylus any form, obliquely truncated into obtuse apex, but not obliquely truncated into acute apex . . . . . 58
56 Lateral parameral structures longer than aedeagus . . . . . 57
– Lateral parameral structures appears as two short spines; distributed in Nearctic . . . . . ***Antocha* (*Antocha*) *biarmata* Alexander, 1940**
57 Lateral parameral structures much longer than apex of aedeagus; distributed in Nearctic . . . . . ***Antocha* (*Antocha*) *capitella* Alexander, 1941**
– Lateral parameral structures a little longer than apex of aedeagus; distributed in Nearctic . . ***Antocha* (*Antocha*) *opalizans* Osten Sacken, 1860**
58 Apex of outer gonostylus cleft . . . . . .59
– Apex of outer gonostylus not cleft. . . . . .70
59 Apex of outer gonostylus cleft into obtuse bumps of which one smaller or cleft into bump and spine . . . . . 60
– Apex of outer gonostylus cleft into two acute parts; distributed in India . . . . . ***Antocha* (*Antocha*) *decussata* Alexander, 1973**
60 Apex of outer gonostylus unequaly bifid, both points obtuse at tips. . . .61
– Apex of outer gonostylus bifid one point obtuse, anoter one acute . . . . . 63
61 Aedeagus not covered by wide aedeagal sheath with horn-like structures, apex narrowed . . . . . .62
– Aedeagus covered by wide aedeagal sheath with four horn-like structures; distributed in China . . . . . ***Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021**
62 Inner branch of paramere wide strongly curved and narrowed at apex; distributed in Nepal . . . . . ***Antocha* (*Antocha*) *perstudiosa* Alexander, 1958**
– About half inner branch of paramere wide another part is narrow, slightly curved at apex; distributed in India . . . . . ***Antocha* (*Antocha*) *studiosa* Alexander, 1951**
63 Wing clouded or transverse, veins tinged . . . . . 64
– Vein of wing not clouded or tinged. . . . . 67
64 General coloration light yellow, clouds on veins of wing visible by transmitted light, distributed in South Korea, Japan or China . . . . . 65
– General coloration dull redish ochreous, clouds on veins of wing not visable by transmitted light, but transverse veins tinged, distributed in Malaysia. . . . . ***Antocha* (*Antocha*) *nebulosa* Edwards, 1928**

65 Abdomen dark brownish grey or yellow with blackish spots on tergites; distributed in South Korea and Japan . . . . . .66
– Abdomen yellow; distributed in China . . . . . .***Antocha* (*Antocha*) *flavidula* Alexander, 1936**
66 Prescutum with three brown longitudinal stripes, distributed in South Korea, Japan . . . . . .***Antocha* (*Antocha*) *satsuma* Alexander, 1919**
– prescutum with one longitudinal stripe, distributed in South Korea . . . . . .***Antocha* (*Antocha*) *yeongwola* Podenas, 2016**
67 Pterostigma distinct . . . . . .68
– Pterostigma indistinct; distributed in Westpalaearctic . . . . . .***Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940**
68 Lateral parameral structures indistinct or blunt; outer gonostylus narrower than outer gonostylus . . . . . 69
– Lateral parameral structures longer than aedeagus, apex narrows to acute point; outer gonostylus wider than outer gonostylus; distributed in Eastpalaearctic, Oriental . . . . . .***Antocha* (*Antocha*) *gracillima* Alexander, 1924**
69 Aedeagus covered by wide aedeagal sheath with two rounded structures; distributed in Indonesia, Malaysia . . . . . .***Antocha* (*Antocha*) *javanensis* Alexander, 1915**
– Aedeagal sheath splits into lateral parameral structures of aedeagus with rounded apex; distributed in India . . . . . .***Antocha* (*Antocha*) *parvicristata* Alexander, 1971**
70 Veins of wing clouded . . . . . .71
–Veins of wing without clouds . . . . . .72
71 Distributed in India . . . . . .***Antocha* *(Antocha) glycera Alexander, 1969***
– Distributed in China . . . . . .***Antocha* (*Antocha*) *pterographa* Alexander, 1953**
72 Apex of inner branch of paramere blunt or acute . . . . . 73
– Inner branch of paramere with spine-like structure at apex; distributed in Afghanistan . . . . . .***Antocha* (*Antocha*) *lindneri* (Nielsen, 1963)**
73 Gonocoxite with setiferous bump . . . . . 74
– Gonocoxite without setiferous bump . . . . . .75
74 Outer gonostylus as wide as inner gonostylus; distributed in Japan . . . . . .***Antocha* (*Antocha*) *brevinervis* Alexander, 1924**
– Outer gonostylus thinner than inner gonostylus; distributed in Japan . . . . . .***Antocha* (*Antocha*) *tuberculata* Torii, 1992**
75 Parameral lateral structures of aedeagus are connected with apex of aedeagus . . . . . 76
– Parameral lateral structures of aedeagus are not connected with apex of aedeagus, fused into aedeagal sheath or phalus, or split into separated structures . . . . . .77

76 Parameral lateral structure of aedeagus consists of small bump and spine; apex of outer gonostylus curved, obtuse; distributed in Malaysia . . . ***Antocha* (*Antocha*) *fusca* Edwards, 1928**

– Parameral lateral structure of aedeagus appears as small horn-like structure; apex of outer gonostylus acute; distributed in India . . . ***Antocha* (*Antocha*) *hyperlata* Alexander, 1968**

77 Caudal margin of tergite 9 narrow . . . . . 78

– Caudal margin of tergite 9 wide . . . . . 80

78 Outer gonostylus narrows at apex; interbase rounded at apex . . . . . 79

– Apex of outer gonostylus obtuse; interbase very small acute at apex; distributed in Nearctic . . . . . ***Antocha* (*Antocha*) *obtusa* Alexander, 1925**

79 Inner gonostylus wider than outer gonostylus, rounded at apex; distributed in Nearctic . . . . .***Antocha* (*Antocha*) *decurvata* Alexander, 1941**

– Inner gonostylus as wide as outer gonostylus, narrows at apex; distributed in Nearctic . . . . . ***Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860**

80 Lateral parameral structures of aedeagus present . . . . . 81

– Lateral parameral structures of aedeagus absent eadeagus covered only by phallosomic tube or wide aedeagal sheath . . . . . .89

81 Lateral parameral structures of aedeagus simple ribbon or rod-like structures . . . . . .82

– Lateral parameral structures of aedeagus flattened plate, divided into shorter inner spine and longer more flattened outer blade, its apex with microscopic points; distributed in India . . . . . ***Antocha* (*Antocha*) *peracuta* Alexander, 1971**

82 Outer gonostylus not obliquely truncated, obtuse or acute at apex . . . . .83

– Outer gonostylus broad, obliquely truncated and obtuse at apex; distributed in India . . . . . ***Antocha* (*Antocha*) *biobtusa* Alexander, 1968**

83 Apex of aedeagus narrowed or covered by oblong membranous structure. . . . . .84

– Apex of aedeagus covered by membranous structure that looks round; distributed in China . . . . . ***Antocha* (*Antocha*) *lacteibasis* Alexander, 1935**

84 Aedeagus without lateral branche . . . . . 85

– Aedeagus with lateral branche; distributed in India . . . . . ***Antocha* (*Antocha*) *exilistyla* Alexander, 1969**

85 Apex of aedeagus acute or filose . . . . . .86

– Apex of aedeagus obtuse covered by oblong membranous structure; distributed in India . . . . . ***Antocha* (*Antocha*) *stenophallus* Alexander, 1974**

86 Aedeagus acute at apex . . . . . 87

– Aedeagus slender, filiform at apex; distributed in India . . . . . .***Antocha* (*Antocha*) *attenuata* Alexander, 1969**

87 Aedeagus covered by membranous structure . . . . . 88

– Aedeagus not covered by membranous structure; distributed in India . . . . . ***Antocha* (*Antocha*) *quadrirhaphis* Alexander, 1971**

88 Outer gonostylus thinner than inner gonostylus; distributed in India . . . . . . . . . . . . . . . . . . . . . . . . . ***Antocha* (*Antocha*) *aciculifera* Alexander, 1974**
– Outer gonostylus as wide as inner gonostylus; distributed in India . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ***Antocha* (*Antocha*) *gladiata* Alexander, 1974**
89 Inner branch of paramere reaches middle part of aedeagus or shorter . . 90
– Inner branch of paramere longer than middle part of aedeagus . . . . . 91
90 Middle part of inner gonostylus with bump; distributed in Eastpalaearctic . . . . . ***Antocha* (*Antocha*) *dilatata* Alexander, 1924**
– Middle part of inner gonostylus without bump; distributed in North Korea . . . . . ***Antocha* (*Antocha*) *chonsaniana* Podenas, 2015**
91 Aedeagus covered by wide aedeagal sheath . . . . . 93
– Aedeagus in phallosomic tube . . . . . .92
92 Apex of outer gonostylus obtuse; distributed in Tajikistan . . . . . ***Antocha* (*Antocha*) *biacus* Savchenko, 1981**
– Apex of outer gonostylus acute; distributed in China . . . . . ***Antocha* (*Antocha*) *angustiterga* Alexander, 1949**
93 Aedeagus covered by wide aedeagal sheath with two rounded bumps at apex . . . . . .94
– Aedeagus covered by wide aedeagal sheath without rounded bumps at apex, or with three bumps at apex . . . . . 96
94 Apex of outer gonostylus acute . . . . . .95
– Apex of outer gonostylus blunt; distributed in Lebanon . . . . . ***Antocha* (*Antocha*) *phoenicia* Thomas and Dia, 1982**
95 Outer gonostylus strongly curved; distributed in China, Taiwan . ***Antocha* (*Antocha*) *styx* Alexander, 1930**
– Outer gonostylus slightly curved; distributed in Westpalaearctic, Eastpalaearctic . . . . . ***Antocha* (*Antocha*) *vitripennis* (Meigen, 1830)**
96 Apex of aedeagal sheath wide. . . . . 97
– Apex of aedeagal sheath narrowed; distributed in India. . . . ***Antocha* (*Antocha*) *microcera* Alexander, 1974**
97 Apex of outer gonostylus narrows to acute point . . . . . 98
– Apex of outer gonostylus obtuse. . . . . 100
98 Aedeagus straight. . . . . .99
Aedeagus twisted before apex; distributed in India . . . . . ***Antocha* (*Antocha*) *globulosa* Alexander, 1973**
99 Interbase loop-like, inner branch of paramere wide; distributed in India. . . . . ***Antocha* (*Antocha*) *madrasensis* Alexander, 1970**
– Interbase not loop-like, inner branch of paramere narrow; distributed in Japan . . . . . ***Antocha* (*Antocha*) *mitosanensis* Torii, 1992**
100 Apex of outer gonostylus blackened. . . . . 101
– Apex of outer gonostylus not blackened. . . . . 102
101 Apex of outer gonostylus obliquely narrows to obtuse point; distributed in China . . . . . ***Antocha* (*Antocha*) *minuticornis* Alexander, 1931**

– Apex of outer gonostylus widely rounded; distributed in Georgia . . . . . .
. . . . . .***Antocha* (*Antocha*) *hirtipes* Savchenko, 1971**
102 Apex of aedeagal sheath and aedeagus consists of three bumps; distributed in Japan . . . . .***Antocha* (*Antocha*) *platyphallus* Alexander, 1935**
– Apex of aedeagus in aedeagal sheath appears as one bump; distributed in India . . . . . ***Antocha* (*Antocha*) *scutella* Alexander, 1973**
103 Vein $R_2$ after or at same level as vein *r-m* . . . . . 104
– Vein $R_2$ before vein *r-m* . . . . . .107
104 Outer gonostylus strongly arched, not darkened . . . . . .105
– Outer gonostylus slightly arched, darkened; distributed in India . . ***Antocha* (*Antocha*) *macrocera* Alexander, 1970**
105 Caudal margin of tergite 9 trilobed . . . . . 106
– Caudal margin of tergite 9 gently concave; distributed in South Korea, Japan . . . . . ***Antocha* (*Antocha*) *subconfluenta* Alexander, 1930**
106 Apex of outer gonostylus subacute; distributed in China, Vietnam . . . . .
. . . . . ***Antocha* (*Antocha*) *confluenta* Alexander, 1926**
– Apex of outer gonostylus splits into two lobes; distributed in Westpalaearctic . . . . . ***Antocha* (*Orimargula*) *alpigena* (Mik, 1883)**
107 Flagellomeres of antenna cylindrical, antenna long (reaching base of abdomen or beyond, if bent backward) . . . . . 108
– Flagellomeres of antenna oval, antenna short (reaching only frontal margin of prescutum, if bent backward) . . . . . .114
108 Apex of aedeagus bifid or opens as a simple tube . . . . . .109
– Apex of aedeagus with small rounded lobes; distributed in India . .***Antocha* (*Orimargula*) *almorae* Alexander, 1970**
109 Apex of aedeagus opens as tube . . . . . 111
– Apex of aedeagus bifid . . . . . 110
110 Aedeagus connected with large plate; distributed in India . . ***Antocha* (*Orimargula*) *brevifurca* Alexander, 1970**
– Aedeagus not connected with large plate; distributed in India . . . . ***Antocha* (*Orimargula*) *prefurcata* Alexander, 1950**
111 Aedeagus without rounded plate, but surrounded by membranous structure . . . . . 112
– Aedeagus connected with rounded plate; distributed in Sri Lanka. ***Antocha* (*Orimargula*) *salikensis* Alexander, 1958**
112 Phallosomic tube surrounded by not flat membranous structure . . . . 113
– Phallosomic tube surrounded by flat membranous structure; distributed in India . . . . . ***Antocha* (*Orimargula*) *simplex* Alexander, 1970**
113 Interbase approximately as long as outer gonostylus; distributed in India . . . . . ***Antocha* (*Orimargula*) *brevisector* Alexander, 1970**
– Interbase shorter than outer gonostylus; distributed in Cameroon, Kenya . .
. . . . . .***Antocha* (*Orimargula*) *longicornis* (Alexander, 1921)**
114 Outer gonostylus absent. . . . . 115
– Outer gonostylus present. . . . . 116

115 Aedeagus gradually narrows at apex; wing with dark pterostigma, veins tinged; distributed in Madagascar . . . . . ***Antocha* (*Orimargula*) *pauliani* Alexander, 1953**

– Aedeagus does not gradually narrows at apex; wing with light pterostigma, veins not tinged; distributed in Madagascar . . . . . ***Antocha* (*Orimargula*) *kraussi* Alexander, 1955**

116 Sulcus along tergite 9 not branched . . . . . .117

– Sulcus along tergite 9 branched . . . . . .120

117 Inner branch of paramere indistinct or short, shorter than interbase . . . . . .118

– Inner branch of paramere long, longer than interbase; distributed in Indonesia . . . . . ***Antocha* (*Orimargula*) *possessiva* Young, 1994**

118 Wing without pterostigma . . . . . .119

– Wing with dark pterostigma; distributed in Australia . . . . . ***Antocha* (*Orimargula*) *australiensis* (Alexander, 1922)**

119 Inner branch of paramere not visable, fused with phallus; distributed in Papua New Guinea . . . . . ***Antocha* (*Orimargula*) *papuensis* Alexander, 1953**

– Inner branch of paramere present; distributed in Philippines . . . . . ***Antocha* (*Orimargula*) *philippina* (Alexander, 1917)**

120 Darker stripes on prescutum present . . . . . 121

– Darker stripes on prescutum absent . . . . . .125

121 Prescutum with one or three darker stripes . . . . . 122

– Prescutum brownish grey with two nearly confluent intermediate brown stripes vaguely separated by pale line; distributed in Kenya . . . ***Antocha* (*Orimargula*) *nigristyla* Alexander, 1956**

122 Prescutum with one darker stripe . . . . . .123

– Prescutum with three darker stripes . . . . . .124

123 Outer gonostylus almost straight, at apex curved; distributed in Ethiopia . . . . . ***Antocha* (*Orimargula*) *tana* Alexander, 1972**

– Outer gonostylus slightly curved, gradualy narrows to acute point; distributed in Angola . . . . . ***Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963**

124 Half of phallomic tube broad; distributed in Tanzania, Uganda. . . . . ***Antocha* (*Orimargula*) *multispina* Alexander, 1956**

– Less than half of phallomic tube broad; distributed in South Africa . . . . . ***Antocha* (*Orimargula*) *venosa* Alexander, 1964**

125 Cross vein *m-cu* more than 2 times shorter than distance between it and base of opened cell *dm* . . . . . 126

– Cross vein *m-cu* less than 2 times shorter than distance between it and base of opened cell *dm* . . . . . 128

126 Outer gonostylus very narrow, narrower than inner gonostylus . . . . .127

– Outer gonostylus as wide as inner gonostylus; distributed in South Africa, Zimbabwe . . . . . ***Antocha* (*Orimargula*) *transvaalia* (Alexander, 1921)**

127 Gonocoxite approximately 1,9 times longer than aedeagus; distributed in Guinea, Nigeria . . . . . .***Antocha* (*Orimargula*) *schmidi* Alexander, 1958**
– Gonocoxite approximately 1,3 times longer than aedeagus; distributed in Mozambique, Tanzania . . . .***Antocha* (*Orimargula*) *setosa* Alexander, 1960**
128 Apex of aedeagus opens as oblequently truncateted tube . . . . . .129
– Apex of aedeagus rounded with small cleftness; distributed in South Africa . . . . . ***Antocha* (*Orimargula*) *indumeni* Alexander, 1956**
129 Outer gonostylus narrow throw all its length and acute at apex; distributed in Ghana . . . . . ***Antocha* (*Orimargula*) *hintoni* Alexander, 1967**
– Outer gonostylus gradually narrows to acute apex; distributed in Nigeria . . . . . .***Antocha* (*Orimargula*) *sparsissima* Alexander, 1974**

***Antocha* (*Antocha*) *aciculifera* Alexander, 1974**: Holotype ♂, INDIA: Chumzomoi Choka, Sikkim, in *Rhododendron* association, 11800 feet, 8.vii.1959 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *aegina* Alexander, 1970**: Holotype ♂, INDIA: Gery, Pauri Garhwal, Kumaon, 6800 feet, 16.viii.1958 (F. Schmid) (USNM); Paratype 1♂, 1 ♀, INDIA: Dakwani, Pauri Garhwall, 9300-11.00 ft, 5.VIII.1958 Pauri Garhwai Fernand Schmid (NHMUK). Other specimens: 1♂, CHINA, NW, Yunnan Nu Jiang valley, Near Gongshan Dulong valley, H-1800 m, 2019.03.07, leg. A. Saldaitis (NRC); 1♂, CHINA, NW, Yunnan Nu Jiang valley, S. from Gongsham, 2100-2400 m, N27°43.42", E98°45.15", 2018.05.15-16, leg. Butvila & Saldaitis (NRC).

***Antocha* (*Antocha*) *alexanderi* Oosterbroek, 2009**: Holotype ♂, INDIA: Swamp Hill, Madras, 7300 feet, 10.xii.1961 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *amblystyla* Alexander, 1963**: Holotype ♂, INDIA: West Bengal, Kurseong, altitude 5,455 feet, September 5, 1958 (Camilleri) (USNM).

***Antocha* (*Antocha*) *angusticellula* Alexander, 1969**: Holotype ♂, INDIA: Bilo La, Kameng, North East Frontier Agency, 5800 feet, 10.vi.1961 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *angustiterga* Alexander, 1949**: Holotype ♂, CHINA: Fukien, Ta-chu-lan, altitude 4500 feet, May 30, 1948 (Joseph Fu) (USNM).

***Antocha* (*Antocha*) *arjuna* Alexander, 1969**: Holotype ♂, INDIA: Dakwani, Pauri Garhwal, Kumaon, 9300-11000 feet, 7.viii.1958 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *attenuata* Alexander, 1969**: Holotype ♂, INDIA: Sirhoi Kashong, Manipur, Assam, 7500 feet, 11.vii.1960 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *biarmata* Alexander, 1940**: 1♂, CANADA: N.S., CBHNt. Pk. Lone Shieling PG731861 28.VI.1983. Swept along fast rocky stream J. R. Vockeroth (CNC).

***Antocha* (*Antocha*) *bidens* Alexander, 1932**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 3500 feet, August 17, 1931 (Franck) (USNM); Paratype 1♂, CHINA: Sichuan, Mount Omei, altitude 3500 feet, August 17, 1931 (Franck) (USNM); Paratype 1♂, 1♀, CHINA: Sichuan, Mount Omei, altitude 3500 feet, August 17, 1931 (Franck) (NHMUK). Other specimens: 1♂, N. E. BURMA: Kambaiti, 7000 ft., 30.IV.1934, R. MALAISE (NHMUK); 1♀, N. E. BURMA: Kambaiti, 7000 ft 5.V.1934, R.

MALAISE (NHMUK); 1♀, N. E. BURMA: Kambaiti, 7000 ft 23.V.1934, R. MALAISE (NHMUK); 1♂, 1♀, N. E. BURMA: Kambaiti, 7000 ft 30.IV.1934, R. MALAISE (NHMUK).

***Antocha* (*Antocha*) *bifida* Alexander, 1924**: Paratype 2♂, Gifu, Japan October 10, 1920, K. Takeuchchi (NHMUK); Paratype 1♂, Shishito, 25.V.1917, Col. T. Shiraki (NHMUK); Paratype 2♀, Gifu, Japan, October 1-2, 1920, K. Takeuchchi (NHMUK). Other specimens: 11♂, 4♀, CHINA, Shaanxi, H-1480 m., N from Foping, N33°42.546", E107°56.418", 2016.08.03-05, Floriani and Saldaitis (NRC); 1♂, 10♀, CHINA, Shaanxi, H-1480 m., N from Foping, N33°42.546", E107°56.418", 2016.08.03-05, Floriani and Saldaitis (NRC); 1♂, 1♀, S. KOREA, Gyeonggi-do, Dongducheon, Tapdong-dong, Casey, N37.878447, E127.145661, alt. 503 m, 2019.06.26, T. A. Klein, H.-C. Kim, NJ trap (NRC); 2♂, S. KOREA, Gyeonggi-do, Dongducheon-si, Gwangam-dong, Hovey, N37.90044, E127.10319, alt. 353 m, 2019.05.20, NJ trap, coll. T. A. Klein, H.-C. Kim (NRC); 3♂, S. KOREA, Gyeonggi-do, Paju-si, Jindong-mveon, 1417 Dongpa-ri, Bonifas, N37.92582, E126.77410, alt. 19 m, 2017.07.25 T.A. Klein, H.-C. Kim, NJ trap (NRC); 12♂, 3♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2017.06.21, NJ trap coll. T. A. Klein, H.-C. Kim (NRC); 9♂, 4♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2019.05.20-06.25, NJ trap coll. T. A. Klein, H.-C. Kim (NRC); 1♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2019.05.20, NJ trap coll. T. A. Klein, H.-C. Kim (NRC); 1♂, 1♀, S. KOREA, Gyeongsangnam-do, Hadong-gun, Hwagae-myeon, Daeseong-ri, N35.29953, E127.63350, alt. 547 m, 2019.06.27 (4), S. Podenas (NRC); 28♂, 3♀, S. KOREA, Gyeongsangnam-do, Hadong-gun, Hwagae-myeon, Daeseong-ri, N35.29990, E127.63451, alt. 558 m, 2019.06.28 (3*), S. Podėnas (NRC); 98♂, 133♀, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N35.26586, E127.58090, alt. 448m, 2019.06.24 (2), coll. S. Podenas, at light (NRC); 7♂, 19♀, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N35.26586, E127.58090, alt. 448m, 2019.06.25 (3), coll. S. Podenas, at light (NRC); 181♀, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N35.26586, E127.58090, alt. 448m, 2019.06.28 (4), coll. V. Podeniene, at light (NRC); 1♂, 2♀, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N35.26586, E127.58090, alt. 448m, 2019.06.28 (4), coll. V. Podeniene, at light (NRC); 8♂, 2♀, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley,

N35.26586, E127.58090, alt. 448m, 2019.06.29 (4), coll. V. Podėnienė (NRC); 1♀, S.KOREA, Seoul, Youngsan-gu, Yongsandong 5(o)-ga, Yongsan (US Army Garrison), N37.52633, E126.97136, alt. 27 m, 2019.05.29, NJ coll. T. A. Klein, H.-C. Kim (NRC).

***Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019**: Holotype ♂, CHINA, W. Sichuan, Road Daocheng/Litang, altitude 4100 m, N29°36.788′, E100°19.825′, 2016.V.11, coll. Floriani & Saldaitis (NRC); Paratypes: 2♂, 3♀, CHINA, W. Sichuan, Road Daocheng/Litang, altitude 4100 m, N29°36.788′, E100°19.825′, 2016.V.11, coll. Floriani & Saldaitis (NIBR).

***Antocha* (*Antocha*) *brevinervis* Alexander, 1924**: Holotype ♂, JAPAN: Sapporo, June 25, 1921 (S. Kuwayama) (USNM).

***Antocha* (*Antocha*) *capitella* Alexander, 1941**: Paratype 1♂, Tennessee, Allardt, Fentress Country, July 22, 1924 (J. S. Rogers) (USNM).

***Antocha* (*Antocha*) *confluenta* Alexander, 1926**: Paratype 1♂, CHINA: Che-kiang, hills south of Ning-po, May 1, 1925 (E. Suenson) (USNM and NHMUK).

***Antocha* (*Antocha*) *constricta* Alexander, 1932**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 7000 feet, July 17, 1931 (Franck) (USNM); Paratype 1♂, CHINA: Sichuan, Mount Omei, altitude 7000 feet, July 17, 1931 (Franck) (USNM). Other specimens: 2♂, 2♀, CHINA, W. Sichuan, road Baoxing/Dawe Xiling Shan Mt., H-2600 m, N30.50440, E102.45170, 2019.10.25, leg. A. Saldaitis (NRC); 12♂, 6♀, CHINA, W. Sichuan, Road Yann/Kangding Erlang Shan Mt., H-2000 m, N29°87.340", E102°30.970", 2019.10.19, leg. A. Saldaitis (NRC); 21♂, 9♀, CHINA, W. Sichuan, road Yann/Kangding Erlang Shan Mt., H-2000 m, N29°87340", E102°30970", 2019.10.24, leg. A. Saldaitis (NRC).

***Antocha* (*Antocha*) *dentifera* Alexander, 1924**: Holotype ♂, JAPAN: Honshiu, Mt. Takao, Musashi-no-kuni, altitude 1000-2000 feet, May 7, 1922 (T. Esaki) (USNM). Other specimens: 1♂, 2♀, S. KOREA, Gyeonggi-do, Yangpyeong, Cheongun-myeon, Dowon-ri, N37.54507, E127.79483, alt. 224 m, 2017.05.28 (1) coll. S. Podenas (NRC); 1♂, S. KOREA, Gyeongsangnam-do, Hadong-gun, Hwagae-myeon, Daeseong-ri, N35.29990, E127.63451, alt. 558 m, 2019.06.28 (3*), S. Podėnas (NRC); 1♂, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N35.26586, E127.58090, alt. 448m, 2019.06.24 (2), coll. S. Podenas, at light (NRC).

***Antocha* (*Antocha*) *dilatata* Alexander, 1924**: Metatype 1♂, JAPAN: Shikoku, Iwai, mt. Imanoyama – 200 m. 4.V.1951 (I. Ito); Paratype 1♂, Kami Otoineppu, Hokkaido, VIII-24-1922, Teiso Esaki (NHMUK);

Paratype 1♀, Kami Otoineppu, Hokkaido, VIII-25-1922, Teiso Esaki (NHMUK). Other specimens: 1♂, CHINA, Fujian, Yong'an, 1940.07.01, light, coll. Xiufu Zhao; 2♀, S. KOREA, Gyeongsangnam-do, Hadong-gun, Hwagae-myeon, Daeseong-ri, N35.29953, E127.63350, alt. 547 m, 2019.06.27 (4), S. Podenas; 6♂, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N35.26586, E127.58090, alt. 448m, 2019.06.24 (2), coll. S. Podenas, at light; 1♂, S. KOREA, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N35.26586, E127.58090, alt. 448m, 2019.06.25 (3), coll. S. Podenas, at light.

***Antocha* (*Antocha*) *emarginata* Alexander, 1938**: Holotype ♂, CHINA: Sichuan, Mount Omei, Chu Lao Tong Temple, altitude 6500 feet, June 5, 1937 (Tsen) (USNM); Paratype 1♂, Chengtu, altitude 1800 feet, December 3, 1936 (Franck) (USNM).

***Antocha* (*Antocha*) *flavidibasis* Alexander, 1938**: Holotype ♀, CHINA: Sichuan, Mount Omei, White Cloud Temple, altitude 9000 feet, June 12, 1937 (Tsen) (USNM).

***Antocha* (*Antocha*) *flavidula* Alexander, 1936**: Holotype ♂, CHINA: Hainan Island, Dwa Bi, altitude about 1500 feet, July 21, 1930 (Graham) (USNM).

***Antocha* (*Antocha*) *fortidens* Alexander, 1933**: Holotype ♂, CHINA: Tibet border, Tang-Gu, altitude 14000 feet, August 3 to 6, 1935 (Gressitt) (USNM). Other specimens: 1♂, CHINA, N. Sichuan, near Barkam, Zhe Gu Shan pass, H-4100 m, 2011.07.28-29, N31°51.528", E102°40.312", Floriani and Saldaitis (NRC); 2♂, CHINA, NW, Yunnan Nu Jiang valley, Near Gongshan Dulong valley, H-1800 m, 2019.03.07, leg. A. Saldaitis (NRC); 1♂, CHINA, NW, Yunnan Nu Jiang valley, road Gongshan/Bingzhonglu, H-1570 m, 2019.03.04, leg. A. Saldaitis (NRC); 2♂, CHINA, W. Sichuan, near Xinduqiao, H-3640 m, N30°04'22", E101°24'54", 2019.10.20, leg. A. Saldaitis (NRC); 1♂, CHINA, W. Sichuan, SW slopes of Erlang Shan Mt., H-1920 m, 30 km E. from Luding, N29°29'39", E102°15'08", 2019.10.21, leg. A. Saldaitis (NRC).

***Antocha* (*Antocha*) *fusca* Edwards, 1928**: Syntype 2♂, 1♀, PAHANG, F. M. S. Lubok Tamang at light 3500 ft. March 10 1924 H. M. Pendlebury (NHMUK); Syntype 5♂, PAHANG, F. M. S. Lubok Tamang at light 3500 ft. 7 June, 1923 H. M. Pendlebury (NHMUK). Other specimens: 2♂, PAHANG, F. M. S. Cameron's High-lands. At light 4800 ft. 7-6-1935 H. M. Pendlebury (NHMUK); 2♂, PAHANG, F. M. S. Cameron's High-lands. At light 4800 ft. 6-6-1935 H. M. Pendlebury (NHMUK); 1♀, PAHANG, F. M. S. Cameron's High-lands. At light 4800 ft. 24-6-1935 H. M. Pendlebury (NHMUK); 1♂, PAHANG, F. M. S. Cameron's High-lands. At light 4800 ft.

23-6-1935 H. M. Pendlebury (NHMUK); 1♂, PAHANG, F. M. S. Cameron's High-lands. At light 3,500 ft. 27-5-1939 (NHMUK); 1♂, PAHANG, F. M. S. Cameron's High-lands. 4500-5000 ft. 17-6-1935 H. M. Pendlebury (NHMUK).

***Antocha* (*Antocha*) *gladiata* Alexander, 1974**: Holotype ♂, INDIA: Trijugi, Pauri, Garhwal, Kumaon, 7000 feet, 26.v.1958 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *globulosa* Alexander, 1973**: Holotype ♂, INDIA: Domkho, Kameng, North East Frontier Agency, Assam, 6500 feet, 8.vi.1961 (F.Schmid) (USNM). Other specimens: 1♂, CHINA, NW, Yunnan Nu Jiang valley, S. from Gongsham, H-2100-2400 m, N27°43.42'', E98°45.15'', 2018.05.15-16, leg. Butvila & Saldaitis (NRC).

***Antocha* (*Antocha*) *glycera* Alexander, 1969**: Paratype 1♂, INDIA: Sikkim, Yumthang, vi-27, 1959 (Shmid) (NHMUK).

***Antocha (Antocha) gracillima* Alexander, 1924**: Holotype ♂, JAPAN: Kiushiu, Mt. Wakasngi, Chikuzen-no-kuni, altitude 2500 feet, April 19, 1924 (H. Hori). Other specimens: 2♂, S.KOREA Jirisan National Park, Piagol valley, N35.25825, E127.58208, alt. 310 m, 2015.05.02 (2), coll S. Podenas (NRC).

***Antocha* (*Antocha*) *hirtipes* Savchenko, 1971**: 1♂, GEORGIA umg. Orlovka-Bogdanovka (alpenwiese), 6.viii.1970, E. N. Savchenko (RMNH).

***Antocha* (*Antocha*) *hyperlata* Alexander, 1968**: Holotype ♂, INDIA: Luanglong Khunou, Manipur, Assam, 2500 feet, 28.v.1960 (F.Schmid) (USNM); 1♂, Paratype 1♂, INDIA: Srinagi, Sikkim, 4920 feet, 6.iv.1959 (F.Schmid) (USNM); Paratype 1♂, INDIA: Assam, Manipur, Bongba Khullen, 2500 ft, vii-28, 1960 (F.Schmid).

***Antocha* (*Antocha*) *incurva* Alexander, 1968**: Holotype ♂, INDIA: Tsomgo, Sikkim, 12500 feet, in *Rhododendron* association, 26.viii.1959 (F.Schmid) (USNM).

***Antocha* (*Antocha*) *indica* Brunetti, 1912**: Paratype 1♂, INDIA: Assam-Bhutan Border: Mangaldai District, 26.xii.1910 S. Kemp (USNM); Syntype 2♂, INDIA: Mus. Kurseong E. Himalayas, 4700 ft., 16.iv.1911 (NHMUK). Other specimens: 1♂, INDIA: Simla, 7000 ft., 11 August 1925, (Fletcher) (NHMUK); 1♂, INDIA: Dalhousie Punjab, 23.vi.1906 (H.J.W.Barrow) (NHMUK); 1 ♀, PERAK, F.M.S. Batang Padang Jor Camp 1800 ft. October 10. 1923 H.M. Pendlebury (NHMUK); 1 ♀, INDIA: Simla, 7000 ft. 11 August 1920 (Fletcher) (NHMUK); 1♂, INDIA: Simla, Sweeping roadside x.11 (NHMUK); 1♂, SUMATRA: Mt. Kerintji, Aro Estate. Au Kayo. 1-5.iii.1954. A.H.G. Alston. B. M. 1954-414 (NHMUK); 16♂, 3♀, Gentig Tea Estate, Gentig Sembah, forest, 2000 feet 24-

27.xii.1972 (NHMUK); 1♂, W. MALAYSIA: Selangor, Gentig Tea Estate, Gentig Sembah, forest, 2000 feet 24-27.xii.1972 (NHMUK).

***Antocha* (*Antocha*) *javanensis* Alexander, 1915**: Holotype ♂, JAVA: Pelaboean Ratoe, Java; October 19, 1909 (Bryant and Palmer) (USNM). Other specimens: 1♀, JAVA W. Buitenzorg 800 ft at light 15 April 1923 H.M. Pendlebury (NHMUK); 14♂, W. MALAYSIA: Selangor, Gentig Tea Estate, Gentig Sembah, forest, 2000 feet 24-27.xii.1972 (NHMUK).

***Antocha (Antocha) koreana* Podenas, Byun, 2014**: 1♂, 2♀, S. KOREA, Gyeonggi-do, Dongdu-cheon, Tapdong-dong, Casey, N37.878447, E127.145661, alt. 503 m, 2017.06.19, T. A. Klein, H.-C. Kim, NJ trap (NRC); 2♀, S. KOREA, Gyeonggi-do, Dongdu-cheon, Tapdong-dong, Casey, N37.878447, E127.145661, alt. 503 m, 2019.06.26, T. A. Klein, H.-C. Kim, NJ trap (NRC); 1♂, 1♀, S. KOREA, Gyeonggi-do, Dongducheon-si, Gwangam-dong, Hovey, N37.90044, E127.10319, alt. 353 m, 2019.05.20-06.18, NJ trap, coll. T. A. Klein, H.-C. Kim (NRC); 2♂, 12♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2017.06.26, NJ trap coll. T. A. Klein, H.-C. Kim (NRC); 2♂, 7♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2017.06.28, NJ trap coll. T. A. Klein, H.-C. Kim (NRC); 6♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2019.05.20-06.24, NJ trap coll. T. A. Klein, H.-C. Kim (NRC).

***Antocha* (*Antocha*) *lacteibasis* Alexander, 1935**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 10800 to 11000 feet, August 18, 1934 (Graham) (USNM).

***Antocha* (*Antocha*) *latifurca* Alexander, 1969**: Holotype ♂, INDIA: Chapai, Kameng, North East Frontier Agency, 700 feet, 26.ii.1961 (F.Schmid) (USNM).

***Antocha* (*Antocha*) *libanotica* Lackschewitz, 1940**: Syntype 1♂, Nord-Libanon Becharre, 1400 m, 21-28.vi.31, Zerny (NHMUK). Other specimens: 1♂, Syria, Damascus, 6 October 1913 (R. Barada) (NHMUK). 1♂, CYPRUS Troodos mts Djeleph (Elea) bridge 7 km W PHINI 450 m 22 X 1992 P. Oosterbroek & F. M. Hartveld C10 (RMNH); 1♂, 1♀, Nord-Libanon, Becharre, 1400 m, 21-28.VI, 1931, Zerny (MNHV).

***Antocha* (*Antocha*) *mara* Alexander, 1970**: Holotype ♂, INDIA: Lifakpo, Kameng, North East Frontier Agency, 3100 feet, 15.v.1961 (F.Schmid) (USNM).

***Antocha* (*Antocha*) *microcera* Alexander, 1974**: Holotype ♂, INDIA: Bhairabkunda, Kameng, North East Frontier Agency, Manipur 700-1000 feet, 5.iii.1961 (F.Schmid) (USNM).

***Antocha* (*Antocha*) *minuticornis* Alexander, 1931**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 4500 feet, August 2, 1929 (ex Parish) (USNM).

***Antocha* (*Antocha*) *multidentata* Alexander, 1932**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 3500 feet, August 17, 1931 (Franck) (USNM). Paratype 1♂, CHINA: Sichuan, Mount Omei, altitude 3500 feet, August 16, 1931 (Franck) (USNM).

***Antocha* (*Antocha*) *monticola* Alexander, 1917**: 1♂, Cultus L., B. C. 19-X-1938, J. K. Jacob (CNC); 1♂, LIS.A. Oregon. Bend. 15.vi.1991 E. C. Zimmerman (NHMUK).

***Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938**: Holotype ♂, CHINA: Sichuan, Mount Omei, White Cloud Temple, altitude 9000 feet, June 12, 1937 (Tsen) (USNM); Metatype 1♂, Tibet: Chumbi Valley, 10000ft, 9.vi.1928. Lt. Col. F. M. Bailey (NHMUK). Other specimens: 1♂, CHINA, NW Yunnan Nu Jiang valley 42 km S. from Fugong Zhi Zi Luo city, H-2100 m, N26°32.29', E98°55.25", 2018.05.18, Butvila & Saldaitis (NRC); 11♂, 3♀, CHINA, W. Sichuan, road Baoxing/Dawe Xiling Shan Mt., H-2600 m, N30.50440, E102.45170, 2019.10.25, leg. A. Saldaitis (NRC); 1♂, CHINA, W. Sichuan, road Ya'an/Kangding, Erlang Shan Mt., N29°52.391', E102°18.593", 2010.04.10-11, Leg. A. Saldaitis (NRC); 1♂, 4♀, CHINA, W. Sichuan, road Yaan/Kangding Erlang Shan Mt., H-2161 m, N29°87.340", E102°30.970", 2017.09.11-12, leg. A. Saldaitis (NRC); 1♂, CHINA, W. Sichuan, Road Yann/Kangding Erlang Shan Mt., H-2000 m, N29°87.340", E102°30.970", 2019.10.19, leg. A. Saldaitis (NRC); 1♂, 1♀, CHINA, W. Sichuan, road Yann/Kangding Erlang Shan Mt., H-2000 m, N29°87340", E102°30970", 2019.10.24, leg. A. Saldaitis (NRC); 2♂, CHINA, W. Sichuan, Yaan/Kangding, Erlang Shan Mt,. H-2000 m, N29°87.340", E102°30.970", 2019.06.27, coll. Butvila and Saldaitis (NRC); 1♂, N. E. Burma. Adung Valley, 12000ft. 12.viii.1931. Capt. F. Kingdon Ward and Lord Cranbrook (NHMUK); 1♂, N. E. Burma. Adung Valley, 12,000ft. 5.viii.1931. Capt. F. Kingdon Ward and Lord Cranbrook (NHMUK); 1♀, N. E. Burma. Adung Valley, 12000ft. 8.viii.1931. Capt. F. Kingdon Ward and Lord Cranbrook (NHMUK); 1♀, N. E. Burma. Adung Valley, 12,000ft. 16.viii.1931. Capt. F. Kingdon Ward and Lord Cranbrook (NHMUK).

***Antocha* (*Antocha*) *nebulipennis nebulipennis* Alexander, 1931**: Holotype ♂, CHINA: Sichuan, Mupin, altitude 3,500 feet, August 17, 1931

(D. C. Graham) (USNM); Metatype 1♂, CHINA: Kina, Gansu, Kung-Tze-Tang pa, Zalok Valley, Minshau, 3000 met., vii-20, 1930 (David Hummel) (USNM). Other specimens: 1♂, INDIA: Assam Mishmi Hills, Delai Valley, Taphlogam. 11.xi.1936, altitude 4000 ft. (M. Steele) (NHMUK).

***Antocha* (*Antocha*) *nebulosa* Edwards, 1928**: Syntype 2♀, PAHANG, F. M. S. Lubok Tamang at light 3500 ft. March 10, 1924 H. M. Pendlebury (NHMUK); Syntype 1♀, PAHANG, F. M. S. Cameron Highlands at light No. 4 Camp 4800 ft. October 12, 1923 H. M. Pendlebury (NHMUK); Syntype 2♀, PAHANG, F. M. S. Lubok Tamang at light 3500 ft. 7 June, 1923 H. M. Pendlebury (NHMUK); Syntype 4♀, PAHANG, F. M. S. Lubok Tamang at light 3500 ft. June 8, 1923 H. M. Pendlebury (NHMUK); Syntype 1♀, PAHANG, F. M. S. Lubok Tamang at light 3500 ft. March 10, 1924 H. M. Pendlebury (NHMUK); Syntype 1♂, PAHANG, F. M. S. Lubok Tamang 3500 ft. March 16, 1924 H. M. Pendlebury (NHMUK).

***Antocha* (*Antocha*) *neoflavella* Alexander and Alexander, 1973**: Holotype ♀, Pahang: Cameron's Highlands, No. 4 Camp, 4800 ft., 20 June, 1923, at light (NHMUK); Paratype 1♀, Lubok Tamang, 3500 ft., 16 March, 1924, at light (NHMUK). Other specimens: 1♂, INDIA: W. Himalayas, Kasauli, viii.1927, P. J. Barraud (NHMUK); 1♂, PAHANG, F. M. S. Cameron's High-lands. At light 4800 ft. 23-6-1935 H. M. Pendlebury (NHMUK); 2♂, PAHANG, F. M. S. Cameron's High-lands. At light 4800 ft. 22-6-1935 H. M. Pendlebury (NHMUK); 1♀, PAHANG, F. M. S. Cameron's High-lands. At light 4800 ft. 14-6-1935 H. M. Pendlebury (NHMUK); 1♂, PAHANG, F. M. S. Cameron's High-lands. 4500-4800 ft. 23-6-1935 H. M. Pendlebury (NHMUK); 1♂, W. MALAYSIA: Selangor, Gentig Tea Estate, Gentig Sembah, forest, 2000 feet 24-27.XII.1972 (NHMUK).

***Antocha* (*Antocha*) *nigribasis* Alexander, 1932**: Paratype 1♂, CHINA: Sichuan, Mount Omei, altitude 4000 feet, July 14, 1931 (Franck) (USNM).

***Antocha* (*Antocha*) *obtusa* Alexander, 1925**: 1♂, Ottawa, Ont. 24.vi.1952 J. F. McAlpine (CNC); 1♂, U.S.A.: Virginia, Shenandoah Valley, nr. Luray, 4.vi.1975 (NHMUK).

***Antocha* (*Antocha*) *opalizans* Osten Sacken, 1860**: 3♂, USA, North Carolina, Hot Springs, N35°5'09.2", E82°49'53.7", alt. 1421m, April 17, 2018 S. Podenas; 1♂, Wakefield Que. 1.VII.1959, J. R. Vockeroth (NRC); 1♂, N.S., CBHNt. Pk. Lone Shieling PG731861 28.VI.1983. Swept along fast rocky stream J. R. Vockeroth (CNC); 2♂, 6♀, U.S.A Vermont Bakersfield 19-VI-1964 (NHMUK); 2♀, U.S.A Vermont Orleans Co. belong Barton R. 18-VI-64 (NHMUK); 4♀, U.S.A. Tuxedo, N. Y. VIII.1928. F. W.

Edwards. B.M. 1928-407 (NHMUK); 1♂, Brookview hy., June 5, 1923, C. P. Alexander (MNHV).

***Antocha* (*Antocha*) *ophioglossa* Alexander, 1954**: 5♂, N. E. BURMA Kambaiti 7000 ft 5.V.1934 R. MALAISE (NHMUK); 5♂, N. E. BURMA Kambaiti 7000 ft 30.IV.1934 R. MALAISE (NHMUK); 1♀, N. E. BURMA Kambaiti 7000 ft 23.V.1934 R. MALAISE (NHMUK); 1♀, N. E. BURMA Kambaiti 7000 ft 20.V.1934 R. MALAISE (NHMUK); 1♂, N. E. BURMA Kambaiti 7000 ft 2.V.1934 R. MALAISE (NHMUK).

***Antocha* (*Antocha*) *pallidella* Alexander, 1933**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 7000 feet, July 17, 1931 (Franck) (USNM).

***Antocha* (*Antocha*) *perattenuata* Alexander, 1971**: Holotype ♂, INDIA: Sirhoi Kashong, Manipur, Assam, 7500 feet, 11.vii.1960 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *perobtusa* Alexander, 1971**: Holotype ♂, INDIA: Sirhoi Kashong, Manipur, Assam, 7500 feet, 10.vi.1960 (F. Schmid) (USNM); Paratype 1♂, INDIA: Amatulla, Kameng, North East Frontier Agency, Assam 2000 feet, 10.iii.1961 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *pictipennis* Alexander, 1949**: Holotype ♂, CHINA: Fukien, Ta-chu-lan, altitude 4,500 feet, June 29, 1948 (Joseph Fu) (USNM).

***Antocha* (*Antocha*) *picturata* Alexander, 1936**: Holotype ♀, Paratype 1♀, CHINA: Sichuan, Gehang, October 5, 1934 (Franck) (USNM).

***Antocha* (*Antocha*) *platyphallus* Alexander, 1935**: Holotype ♂, JAPAN: Honshu, Yumoto, 1500 m alt., Shimotsuke, viii.5 1934, S. Issiki (USNM).

***Antocha* (*Antocha*) *plumbea* Alexander, 1936**: Holotype ♀, SUMATRA: Tandjong Sakti, Benkoelen, altitude 1,650 to 2,000 feet, June 1 to 10, 1935 (Walsh) (USNM).

***Antocha* (*Antocha*) *postnotalis* Alexander, 1974**: Holotype ♀, INDIA: Senbaganur, Madras, 5800 feet, 8.xii.1961 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *pterographa* Alexander, 1953**: Holotype ♂, TIBET, Gautsa, altitude 13000 feet, June 13, 1928 (F. M. Bailey) (USNM and NHMUK).

***Antocha* (*Antocha*) *prolixistyla* Alexander, 1971**: 1♂, 1♀, INDIA: Asaam, Nefa Kameng Lungdur, 2800 ft., 16.v.1961 (Fernand Schmid) (NHMUK).

***Antocha* (*Antocha*) *pulchra* Markevičiūtė and Podenas, 2021**: Holotype ♂ CHINA: Sichuan, Emei Mt., H-1311 m, N29.583720, E103.286880, 2018.VII.12, leg. Starkevich (NRC); Paratype 1 ♂ CHINA:

Sichuan, Emei Mt., H-1311 m, N29.583720, E103.286880, 2018.VII.12, leg. Starkevich (NIBR).

***Antocha* (*Antocha*) *quadrifurca* Alexander, 1971**: 1♂, CHINA, W. Sichuan, road Yaan/Kangding Erlang Shan Mt., H-2161 m, N29°87.340", E102°30.970", 2017.09.11-12, leg. A. Saldaitis (NRC); 1♂, CHINA, W. Sichuan, SW slopes of Erlang Shan Mt., H-1920 m, 30 km E. from Luding, N29°29'39", E102°15'08", 2019.10.21, leg. A. Saldaitis (NRC).

**Antocha (Antocha) quadrirhaphis Alexander, 1971**: Holotype ♂, INDIA: Marou, Manipur, Assam, 4000 feet, 14.viii.1960 (F. Schmid) (USNM).

***Antocha* (*Antocha*) *retracta* Edwards, 1933**: 1♂, 1♀, B.N. BORNEO. Mt. Kinabalu, Kamborangah, 7500ft. April 3-1929 (NHMUK).

***Antocha* (*Antocha*) *satsuma* Alexander, 1919**: 1♂, CHINA, Fujian, Yong'an, 1940.07.01, light, coll. Xiufu Zhao (NRC); 1♂, CHINA, Fujian, Yong'an, 1940.07.31, light, coll. Xiufu Zhao (NRC); 1♂, S. KOREA, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeongja-ri, Warrior Base Training Area, alt. 18 m, N37.917767, E126.741594, 2019.05.20, New Jersey trap, coll. T. A. Klein, H.-C. Kim (NRC); 11♂, 8♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2019.05.20-06.24, NJ trap coll. T. A. Klein, H.-C. Kim (NRC); 1♂, Kami Otoineppu, Hokkaido, VIII-24-1922, Teiso Esaki (NHMUK); 1♀, Sapporo, Hokkaido, aug.17.1922, T. Esaki (MNHV).

**Antocha (Antocha) saxicola Osten Sacken, 1860**: 1♂, St. Williams Ont. 23.v.1956 42°40', 80°25' J. R. Vockeroth (CNC); 2♂, 1♀, U.S.A. Liverpool, Pa. VIII.1928. F.W. Edvards. B.M.1928-407 (NHMUK); 1♂, Cataract, Wis. Aug. 15, 1920 Coll. T. Frison (NHMUK); 1♀, Keene Valley Essex Co N Y H Notman 13 aug 1920 (NHMUK); 1♂, U.S.A. Tuxedo, N. Y. VIII.1928. F. W. Edwards. B.M. 1928-407 (NHMUK); 1♂, U.S.A.: Pennsylvania, Paisley, nr. Carmicheal, 10.v.1975, Woods and open scrubland (NHMUK).

***Antocha* (*Antocha*) *scutella* Alexander, 1973**: 1♂, UPPER BURMA: Nam Tamai Valley, 15.viii.1938, Lat. N.27°42'. Long. E.97°54', Caught at night, R. Kaulback.B.M. 1938-741 (NHMUK); 1♂, N. E. BURMA Kambaiti 7000 ft 30.iv.1934 R. MALAISE (NHMUK); 1♂, N. E. BURMA Kambaiti 7000 ft 20.v.1934 R. MALAISE (NHMUK).

***Antocha* (*Antocha*) *scutifera* Alexander, 1973**: Paratype 1♂, INDIA: Tsomgo, Sikkim, 12500 feet, in *Rhododendron* association, 26.viii.1959 (F.Schmid) (USNM). Other specimens: 10♂, 17♀, CHINA, W. Sichuan, road Baoxing/Dawe Xiling Shan Mt., H-2600 m, N30.50440, E102.45170, 2019.10.25, leg. A. Saldaitis; 1♂, 1♀, CHINA, W. Sichuan, Road

Yann/Kangding Erlang Shan Mt., H-2000 m, N29°87.340", E102°30.970", 2019.10.19, leg. A. Saldaitis.

***Antocha* (*Antocha*) *setigera* Alexander, 1933**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 7000 feet, July 17, 1931 (Franck) (USNM); Paratype 1♂, CHINA: Sichuan, Mount Omei, altitude 3500 feet, August 16, 1931 (Franck) (USNM).

***Antocha* (*Antocha*) *shansiensis* Alexander, 1954**: Paratype 1♂, Chenhaissu-Taihuaichen, Shansi, June 4, 1942 (Yasumatsu) (USNM).

***Antocha* (*Antocha*) *sparsipunctata* Alexander, 1936**: Holotype ♂, INDIA: Assam, Khasi Hills, Cherrapunji, altitude 4000 to 5000 feet, August, 1935, at light (Sircar) (USNM).

***Antocha* (*Antocha*) *spiralis* Alexander, 1932**: Holotype ♂, CHINA: Sichuan, Mount Omei, altitude 3500 feet, August 17, 1931 (Franck) (USNM). Other specimens: 1♂, CHINA, NW, Yunnan Nu Jiang valley, S. from Gongsham, H-2100-2400 m, N27°43.42", E98°45.15", 2018.05.15-16, leg. Butvila & Saldaitis (NRC); 2♂, CHINA, NW, Yunnan Nu Jiang valley, S. from Gongsham, H-2100-2400 m, N27°43.42", E98°45.15", 2018.05.15-16, leg. Butvila & Saldaitis (NRC).

***Antocha* (*Antocha*) *stenophallus* Alexander, 1974**: 1♂, TAPLEJUNG DISTR., Sangu, Spray-splashed rocks in shallow ravine, 6200 ' 13.I.1962 (NHMUK).

***Antocha* (*Antocha*) *streptocera* Alexander, 1949**: Holotype ♂, CHINA: Fukien, Ta-chu-lan, altitude 4500 feet, May 29, 1948 (Joseph Fu) (USNM).

**Antocha (Antocha) studiosa Alexander, 1951**: Paratype 1♀ S. India Nilgiri Hills, Singara, 3400 ft. V-I-48 S. Nathan (NHMUK).

***Antocha* (*Antocha*) *styx* Alexander, 1930**: Paratype 1♂, TAIWAN: Meizi Hot Springs, foot of Hassensan, altitude 2500 feet, October 25, 1929 (S. Issiki) (USNM).

***Antocha (Antocha) subconfluenta* Alexander, 1930**: Holotype ♂, JAPAN: Kiushiu, Kosugidani, Yakushima, altitude 2500 feet, April 29, 1929 (S. Issiki) (USNM). Other specimens: 1♂, S. KOREA, Gyeongsangnam-do, Hadong-gun, Hwagae-myeon, Daeseong-ri, N35.29953, E127.63350, alt. 547 m, 2019.06.27 (2), S. Podenas (NRC).

***Antocha* (*Antocha*) *thienemanni* Alexander, 1931**: Holotype ♀, Central Java, Sarangan, on Mt. Lawu, altitude 1410 meters, December 6, 1928 (Thienemann) (USNM).

***Antocha* (*Antocha*) *turkestanica* de Meijere, 1921**: Paratype 1♂, North Afganistan, Hindukush Range, Qualatak, Salang Valley, altitude 2050 meters, October 11, 1952 (Klapperich) (USNM); Paratype 1♂, 1♀, N.

Afganistan, Hindukush, Salang Valley, Qualatak 1950 m, X-09-1952 (NHMUK).

***Antocha* (*Antocha*) *unicollis* Alexander, 1968**: Paratype 1♂, base camp (Yaral) near Pangpoche, about 3900 meters, at light, May 13, 1961 (Janetschek) (USNM).

***Antocha* (*Antocha*) *vitripennis* (Meigen, 1830)**: 5♂, LITHUANIA, Puvočiai, Varėna district, 54.115691, 24.304731, 2020.08.07, leg. R. Markevičiūtė (NRC); 22♂, 13♀, LITHUANIA, Puvočiai, Varėna district, 54.115725, 24.304816, 2019.08.08, leg. R. Markevičiūtė (NRC); 13♂, 5♀, LITHUANIA, Puvočiai, Varėna district, 54.115725, 24.304816, 2019.08.08, leg. R. Markevičiūtė (NRC); 10♂, 4♀, LITHUANIA, Varėna d., river Ūla, 54.14109, 24.439567, 2019.08.16, coll. R. Markevičiūtė (NRC); 3♂, LITHUANIA, Varėna d., river Ūla, 54.14336, 24.44125, 2019.08.16, coll. S. Podenas (NRC); 12♂, 2♀, LITHUANIA, Varėna district, Ūla Landscape Reserve, 54.129066, 24.462497, 2020.08.06, leg. R. Markevičiūtė (NRC); 3 ♂, YORKS Giggleswicke 23.VIII.1963 E. Burtt (NHMUK); 1♀, HAMPSHIRE: New Forest, Gorley, 12.VIII.1972, Cranston & Dear, B. M. 1972-386 (NHMUK); 2♂, 1♀, SCOTLAND: Invern. Invermoriston, 20.VIII.1973, J.P. & S. Dear (NHMUK); 1♀, WILTSHIRE: Salisbury 2.VI.1977, J. P. Dear (NHMUK); 1 ♂, Coverham, Yorks. 23.VI.1924. F. W. Edwards. B.M. 1924-288 (NHMUK); 1 ♂, Skirwith, Cheshire. VI.1927. H. Britten. B. M. 1928-28 (NHMUK); 1 ♂, Westmorland: Newby. VI.1929 F. W. Edwards. B. M. 1929-297 (NHMUK); 1 ♂, Argyllshire. Bonawe. Nr. Taynuilt. August 1919. J. Waterston. 1919-217 (NHMUK); 1 ♂, Argyllshire. Bonawe. Nr. Taynuilt. August 1919. J. Waterston. 1919-217 (NHMUK); 1 ♂, Glen Lochay, 3-18.VI.1932. 500-1500 ft., Perthshire Killin distr. F. W. Edwards. B. M. 1932-243 (NHMUK); 4 ♂, Glos.: Chedworth. 5.VI.1936. F.W. Edwards. B.M. 1936-457 (NHMUK); 1 ♂, Staines Middlessex 19.V.1904 E. E. Austen (NHMUK); 1♂, 1♀, Inverarn Sutherland 12.VII.86 G. H.Verrall 93.28 (NHMUK); 1♀, ABERDEENSHIRE: Balmoral Forest 24.VI.-13.VII.1951.R.L.Coe. B.M. 1951. B.M. 1951-315 (NHMUK); 2♀, Argyllshire. Bonawe. Nr. Taynuilt. August 1919. J. Waterston. 1919-217 (NHMUK); 1♂, SCOTLAND: Perthshire Ben Lawkrs 1.VII.1964. D. H. Harvey. B.M.1964 435 (NHMUK); 2♂, CORSICA: Ota. 4.V.1978, A.E.Stubbs (NHMUK); 1♂, Greece: Pisoderion. 4-5 VII.1932. A.H.G.Alston. B.M.1932-269 (NHMUK); 1♂, SPAIN: Barcelona 5 de Montrens Sant Bernat 20.X.1978 P. I. Chandler Q. Hexwds (NHMUK); 8♂, 2♀, Corsica, 10-25.iv.1928, F. W. Edwards, B. M. 1928-214 (NHMUK); 2♀, SPAIN: Zaragoza Monasterio de Piedra, 21.X.1978 P.J. Chandler wooded park (NHMUK); 1♀, SPAIN: Barcelona 5 de Montrens Sant Bernat

20.X.1978 P. I. Chandler Q. Hexwds (NHMUK); 1♂, 1♀, SPAIN: Logrono by Rio Iregua 23.X.1978 P.J. Chandler open mixed md (NHMUK); 2♀, HUNGARY: Retyezath, I,200-1,300 ft., 27-28.VII.1937, B. M. 1937-782 (NHMUK); 1♂, 1♀, AUSTRIA, W: St. Anton, 23.VII.1971 A. E. Stubbs B.M. 1972-210 (NHMUK); 1♂, 7♀, N. SPAIN: Gerona, Las Planas. 12-18.VII.1965. A.M. Hutson. B.M. 1965-632 (NHMUK); 2♂, N. SPAIN: Nr. Orol Monica O'Donnell 14.vi.1983 (NHMUK); 2♀, CORSICA: Corte, 25.iv.1978, A.E.Stubbs (NHMUK); 2♂, 1♀, CORSICA: 6km. E. Venaco, River Tavignano, 26-29.IV.1978, A.E.Stubbs (NHMUK); 1♂, CORSICA: Ota. 4.V.1978, A.E.Stubbs (NHMUK); 1♀, AUSTRIA: Tirol, Nr. Gries. 4.vii.1969. Wooded slopes and river bank (NHMUK); 1♀, AUSTRIA: Salzburg, Attelsee, Burgau, 30.vi.1973 (NHMUK); 1♀, SPAIN: Huesca, Torla Camp Sita, 3-5.VII.1973, P.S. Cranston, B.M. 1973-345. malaise trap (NHMUK); 12♂, 4♀, LITHUANIA, Varėna district, Puvočiai N54.115728, E24.304861, 2019.VIII.07, leg. R. Markevičiūtė, at light (NHMUK); 3♂, LITHUANIA, Varėna district, Puvočiai village, N54.115691, E24.304731, 2020.VIII.07, Leg. R. Markevičiūtė (NHMUK); 9♂, 1♀, LITHUANIA, Varėna district, Ūla Landscape Reserve, N54.129066, E24.462497, 2020.08.06, leg. R. Markevičiūtė (NHMUK).

***Antocha* (*Antocha*) *yatungensis* Alexander, 1963**: Holotype ♂, Tibet: Yatung, 15000ft, 10.vi.1928. Lt.Col.F.M.Bailey.B.M.1928-409 (NHMUK). Metatype 1♂, Assam-Kameng, Shumla, 7,800 ft., v-14, 1961 (F. Schmid) (USNM).

***Antocha (Antocha) yeongwola* Podenas 2016**: 3♂, 6♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.036439, E127.232261, alt. 150 m, 2017.06.20, NJ trap coll.T.A. Klein, H.-C. Kim (NRC); 6♀, S. KOREA, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N38.03644, E127.23226, alt. 150 m, 2019.05.20-06.03, NJ trap coll.T.A. Klein, H.-C. Kim (NRC).

***Antocha* (*Orimargula*) *almorae* Alexander, 1970**: Holotype ♂, INDIA: Loharket, Almora, Kumaon, 5770 feet, 19.ix.1958 (Schmid) (USNM).

***Antocha* (*Orimargula*) *alpigena* (Mik, 1883)**: 1♂, Poland, Jaworzynka Valley. 23.vi.1932. Tatra Mts. 3,000 ft., D. Aubertin, E. Trewavas. B.M. 1932-310 (NHMUK); 1♀, AUSTRIA: Karnsten, Nr. Kotschach, 3.vii.1969, Wooded slopes, B.M. 1970-152, B. H. & M. C. Cogan, R. I. & R. Vane - Wright (NHMUK); 1♂, Hills of Petrich, BULGARIA, 2-3000', P, A. BUXTON, 8.4.1935 (NHMUK); 1♀, Bulgaria - Rilaki, Monastir, 26.06.1982, leg. M. Krzeminski (NHMUK); 1♂, Poland, Jaworzynka Valley, 23.vi.1932, Tatra Mts., 3000 ft. (NHMUK); 1♀, AUSTRIA:

Karnsten, Nr. Kotschach, 3.vii.1969, Wooded slopes (NHMUK); 1♂, BULGARIA, Hills S of Petrich, 2-3000', P. A. BUXTON, 8.4.1935 (NHMUK); 1♀, Bulgaria - Rilaki Monastir, 26.06.1982, leg. M. Krzeminski (NHMUK); 2♂, Karawanken, Loibl, 670-1370 m, 5-13.VII.1934, Zerny (MNHV)

***Antocha* (*Orimargula*) *australiensis* (Alexander, 1922)**: Holotype ♂, Queensland: Cairns district (A. M. Lea) (USNM); Paratype 1♀, Australia, Queens district, A. M. Lea (NHMUK); Metatype 1♂, Queensland: Brisbane River, July 26-27, 1927 (Hemmingsen) (USNM); Metatype 1♀, Queensland: Atherton, November, 1927 (Hemmingsen) (USNM).

***Antocha* (*Orimargula*) *brevicornis* Alexander, 1960**: Holotype ♂, Gorongoza Mountain, Portuguese East Africa, 840 m., September 1957 (Stuckenberg) (USNM).

***Antocha* (*Orimargula*) *brevifurca* Alexander, 1970**: Paratype 1♂, INDIA: Leimatak, Manipur, Assam, 1300 feet, 30.v.1960 (Schmid) (USNM). Other specimen: 1♂, MALAY PENIN, KEDAH, NR. JITRA, CATCHMENT AREA, 9th April, 1928 (NHMUK).

***Antocha* (*Orimargula*) *brevisector* Alexander, 1970**: Holotype ♂, INDIA: Rumkheng, Khasi-Jaintia, Assam, 5500 feet, 25.iii.1960 (F. Schmid) (USNM).

***Antocha* (*Orimargula*) *brevivena* (Edwards, 1928)**: Holotype ♂, Perak: Batang Padang, Jor Camp, 1800 ft., 9 March, 1924, H.M. Pendlebury (NHMUK); Paratype 1♀, Perak: Batang Padang, Jor Camp, 1800 ft., 2 June, 1923, H.M. Pendlebury (NHMUK).

***Antocha* (*Orimargula*) *delibata* Riedel, 1914**: KENYA: 2 ♀, Aberdare Range, x.1934, Thomson's Falls. 7000 ft. (NHMUK).

***Antocha* (*Orimargula*) *flavella fuscolineata* (Alexander, 1926)**: Holotype ♂, CHINA: Che-kiang, hills south of Ning-po, May 1, 1925 (Suenson) (USNM).

***Antocha* (*Orimargula*) *gracilipes* (Alexander, 1927)**: Holotype ♀, South West India, Castle Rock, N. Kanara District, October 11-26, 1916 (S. W. Kemp) (USNM).

***Antocha* (*Orimargula*) *griseipennis* (Alexander, 1920)**: Paratype 1♀, Ethiopie meridionale, Abyssinia, Tchafianani, August 18, 1904 (Maurice de Rothschild) (USNM).

***Antocha* (*Orimargula*) *hintoni* Alexander, 1967**: Paratype 1 ♂, Sedumasi, Ghana, 2nd October 1966 (D. G. Gibbs) (USNM).

***Antocha* (*Orimargula*) *indumeni* Alexander, 1956**: Paratype 1 ♂, Indumeni Forest, Cathedral Peak Area, Natal, February 3, 1954 (B. Stuckenberg) (USNM).

***Antocha* (*Orimargula*) *intermedia* (Edwards, 1928)**: Syntype 1♂, Selangor F.M.S. Kuala Lumpur at light march 8.1923 H. M. Pendlebury (NHMUK). Other specimens: 1♀, PERAK, Batang Padang Jor Camp 1800 ft. light 25.VI.1923 H.M. Pendlebury (NHMUK).

***Antocha* (*Orimargula*) *kraussi* Alexander, 1955**: Holotype ♂, Madagascar, Tananarive, December 1951 (N. L. H. Krauss), foret aut Nord d'Anosibe I-1951 (R. P.) (USNM).

***Antocha* (*Orimargula*) *longicornis* (Alexander, 1921)**: Holotype ♂, Lonji, about 50 miles north of Kribi, near the Nlong River, Cameroun, April 19, 1920 (J. A. Reis). "Taken at a lamp in the evening." (USNM). Other specimen: 1♂, BELGIAN CONGO: Elisabethville, 17-31.xii.1932, C. Seydel, B.M. 1933-76 (NHMUK).

***Antocha* (*Orimargula*) *maculipleura* Edwards, 1933**: Holotype ♀, B.N. BORNEO, Mt. Kinabalu, Kenokok, 3300 ft., 26 April 1929 (NHMUK).

***Antocha* (*Orimargula*) *melina* Alexander, 1957**: Holotype ♂, Nyachowa Falls, near Umtali, Vumba Maountains, Southern Rhodesia, January 16, 1955 (Stuckenberg) (USNM).

***Antocha* (*Orimargula*) *mesocera* Alexander, 1931**: Holotype ♂, South Sumatra, Musi, Tjurup, May 6, 1929 (USNM).

***Antocha* (*Orimargula*) *multispina* Alexander, 1956**: Holotype ♂, Fort Portal, Ruwenzori Range, Uganda, 4000 ft. 31 January 1935 (Edwards) (USNM); Holotype 1♂, 1♀, Fort Portal, Ruwenzori Range, Uganda, 4000 ft. 31 January 1935 (Edwards) (NHMUK). Other specimens: 1♂, 1♀, Fort Portal, Ruwenzori Range, Uganda, 4000 ft. 31 January 1935 (Edwards) (NHMUK).

***Antocha* (*Orimargula*) *nigristyla* Alexander, 1956**: Holotype ♂, Mount Kinangop, Aberdare Range, Kenya, 8000 ft., October 1934 (Edwards) (USNM), (NHMUK).

***Antocha* (*Orimargula*) *papuensis* Alexander, 1953**: Alexander, 1953: Holotype 1♂, PAPUA: Kokoda, 1200 ft., viii-ix.1933, L. E. Cheesman, B.M. 1933-427 (NHMUK); Paratype 21♂, PAPUA: Kokoda, 1200 ft., viii.1933, L. E. Cheesman, B.M. 1933-427 (NHMUK); Paratype 8♂, 1♀, PAPUA: Kokoda, 1200 ft., viii-ix.1933, L. E. Cheesman, B.M. 1933-427 (NHMUK); Paratype 1♀, Papua: Northern Division, Sairopi, 1935, H. O. C. Zittlechild (NHMUK); Paratype 28♂, 3♀, PAPUA: Kokoda, 1200 ft., viii.1933, L. E. Cheesman, B.M. 1933-427 (NHMUK); Paratype 10♂, PAPUA: Kokoda, 1200 ft., viii-ix.1933, L. E. Cheesman, B.M. 1933-427 (NHMUK); Paratype 1♀, NEW GUINEA: Morobe Dist., Merzog Mts., Vagau, C. 4000 ft., 4-17.i.1965 (NHMUK); Paratype 1♂, Papua, Kokoda, altitude 1200 feet, viii-ix-1933 (L. E. Cheesman) (USNM).

***Antocha* (*Orimargula*) *pauliani* Alexander, 1953**: Paratype 1♂, Madagascar, Forest North of Anosibe, January 1951 (Paulian) (USNM).

***Antocha* (*Orimargula*) *philippina* (Alexander, 1917)**: Alotype 1♀, SAMAR, Loquilocon, June 22, 1924 (McGregor) (USNM). Other specimens: 1♂, 3♀, Philippine Is., Mindanao, Surigao, v.1916 (NHMUK); 1♀, Philippine Is, Mindanao, 23.iv.1920, Dr. A. Moore (NHMUK).

***Antocha* (*Orimargula*) *praescutalis* Alexander, 1936**: Paratype 1♀, Tandjong Sakti, Benkoelen, altitude 2000 feet, June 10, 1935 (Walsh) (USNM).

***Antocha* (*Orimargula*) *prefurcata* Alexander, 1950**: Holotype ♂, Cherrapunji, Khasi States, altitude 4000 feet, May 1936 (S. Sircar) (USNM).

***Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963**: Paratype 1♂, Dundo, Luachimo River, gallery forest, October 2, 1960 (Machado) (USNM).

***Antocha* (*Orimargula*) *salikensis* Alexander, 1958**: Paratype 1♂, Ceylon, Carney, altitude 900 feet, February 2, 1954 (Schmid) (USNM). Other specimens: 3♂, SRILANKA (CEYLON), Kandy distr., near Old Haloya, between Galaha and Peradeniya, 24.ii.1974, A.E. Stubbs & P.J. Chandler (NHMUK); 1♀, S of Galagahawala, between Rangala and Teldeniya, 25.ii.1974 (NHMUK); 1♂, SRILANKA (CEYLON): Mihintale, 20.ii.1974, BMNH 1974-624, A. E. Stubbs & P. J. Chandler (NHMUK).

***Antocha* (*Orimargula*) *schmidi* Alexander, 1958**: Holotype ♂, Souapiti, French Guinea, May-15, 1955 (Schmid) (USNM). Other specimen: 1♂, NIGERIA, Oyo State, Gambari Forest, 23.xii.1978, M. A. Cornes (NHMUK).

***Antocha* (*Orimargula*) *setosa* Alexander, 1960**: Holotype ♂, Alotype 1♀, Gorongoza Mountain, Portuguese East Africa, 840 m., September 1957 (Stuckenberg) (USNM).

***Antocha* (*Orimargula*) *simplex* Alexander, 1970**: Holotype ♂, INDIA: Umlangshor, Khasi-Jaintia, Assam, 4100 feet, 18.iv.1960 (F. Schmid) (USNM).

***Antocha* (*Orimargula*) *sparsissima* Alexander, 1974**: Holotype ♂, Nigeria, Bida, North West State, September 1, 1970 (Medler) (USNM). Other specimen: 1♂, ANGOLA (A25) Rio Longa, 4 mls. S. Lussusso 8.iii.1972 (NHMUK).

***Antocha* (*Orimargula*) *tana* Alexander, 1972**: Holotype ♂, Bahar Dar, Lake Tana, source of the Blue Nile, December 6, 1964 (Marion E. Smith) (USNM).

***Antocha* (*Orimargula*) *tanycera* Alexander, 1963**: Holotype ♂, Livingstone, Victoria Falls, Zambezi River, at base of falls among rocks, April 4, 1961 (Machado) (USNM).

***Antocha* (*Orimargula*) *tasmanica* (Alexander, 1928)**: Holotype ♂, Tasmania, Wilmot, January 8, 1923 (A. Tonnoir) (USNM).

***Antocha* (*Orimargula*) *transvaalia* (Alexander, 1921)**: Metatype 1♂, Cape Province, Mitchell's Pass, ii-12, 1951 (Brinck) (USNM).

***Antocha* (*Orimargula*) *venosa* Alexander, 1964**: Paratype 1♂, Natal National Park, Hostel 5000 feet, at light, April 4, 1951 (Brinck) (USNM). Other specimens: 2♂, 1♀, S. AFRICA, Cape Province, Oudtshoorn, x.1931, Miss A Mackie (NHMUK); 1♂, BELGIAN CONGO: Elisabethville, xii.1933, C. Seydel, B. M. 1936-530 (NHMUK); 1♂, ANGOLA (A25) Rio Longa, 4 mls. S. Lussusso 8.iii.1972 (NHMUK); 1♂, ABYSSINIA, Jigar Z. Iama, 22.4.33, Major Cheesman, B. M. 1933-231 (NHMUK); 1♀, N. NIGERIA: Abuja, 21.XI.1970, J. C. Deeming, u.v. light (NHMUK).

***Antocha* (*Proantocha*) *integra* Alexander, 1940**: Holotype ♂, Northern Korea, Ompo, altitude 800 feet, July 13, 1938 (Yankovsky) (USNM).

***Antocha* (*Proantocha*) *spinifer* Alexander, 1919**: Holotype ♂, Japan, (Hokkaido, Honshu, Shikoku, Kyushu), USSR far east (Skhalin) (USNM); Paratype 1♂, 2♀, Jozankei, Hokkaido, VIII-19,1922, Teiso Esaki (NHMUK).

***Antocha* (*Proantocha*) *uyei* (Alexander, 1928)**: Paratype 1♂, Yamaga (on the banks of the Yasakagawa), 70 m alt., Oita Pref., IV.22.1927, T. UYE (NHMUK); Metatype 1♂, Japan, Honshu, Osaka, Nose, iv-18, 1951 (S. Ito) (USNM); 1♂, (Kyushu) Wakasugiyama (Chikuzen), 3.v.1931, Esaki, Fujino, Hori, Hashimoto, Yasumatsu & Cho (ANSP).

# SANTRAUKA

## ĮVADAS

Gentyje *Antocha* Osten Sachen, 1860 yra aprašytos 162 vabzdžių rūšys ir keturi porūšiai. Ši gentis sudaryta iš trijų pogenčių: *Antocha* (s. str.) Osten Sacken, 1860 (116 rūšių, 2 porūšiai), *Orimargula* Mik, 1883 (41 rūšis, 2 porūšiai) ir *Proantocha* Alexander, 1919 (5 rūšys) (Oosterbroek, 2023).

Šios genties vabzdžiai paplitę visuose zoogeografiniuose regionuose, neaptinkami tik Antarktidoje (Oosterbroek, 2023). Daugiausia rūšių žinoma Orientaliniame regione (82 rūšys ir du porūšiai) ir Rytų Palearktikoje (53 rūšys ir keturi porūšiai), taip pat 21 rūšis yra žinoma Afrotropiniame regione, septynios Nearktiniame regione ir penkios Vakarų Palearktikoje. Tik viena rūšis yra žinoma Neotropiniame regione ir trys Australazijos / Okeanijos regione (Oosterbroek, 2023).

Šios genties vabzdžių preimaginalinės stadijos labai specifiškos, nes vystosi tekančiame upių ir upelių vandenyje, kuriame sudaro didžiąją dalį bentoso (Fuller & Hynes, 1987). Šie vabzdžiai tinkami greitai tekančių upių biomonitoringui, bet yra žinomos tik penkių rūšių preimaginalinės stadijos, todėl randamų individų rūšys dažnu atveju lieka neidentifikuotos, o atliekamų tyrimų rezultatai išlieka netikslūs.

*Antocha* genties suaugėliai atpažįstami pagal specifinį sparno gyslotumą ir užpakalinio sparno kampo kraštus, sudarančius beveik statų kampą (Osten Sacken, 1860). Šios genties skirstymas į tris pogentes buvo pagrįstas tik morfologiniais požymiais, tačiau filogenetinė *Antocha* genties rūšių analizė niekada nebuvo atlikta, o genties taksonomija lieka neaiški. Tiek patinų, tiek patelių genitalijų struktūros sudaro svarbų filogenetinės analizės ir taksonominio identifikavimo požymių rinkinį. Deja, šie požymiai nėra pakankamai aprašyti, o iliustracijos nėra tikslios arba jų visiškai nėra. Kai kurios rūšys buvo aprašytos, remiantis tik vienu egzemplioriumi su nežinomomis patelėmis arba rūšys buvo žinomos tik iš unikalių patelių holotipų. Visa tai sukelia sunkumų identifikuojant rūšis, o neištyrus medžiagos, pagal kurią buvo aprašytos rūšys, filogenetinė analizė yra neįmanoma.

Šioms mokslinėms problemoms spręsti ši gentis buvo pasirinkta pagrindiniu darbo objektu.

Dėl antiekologinės žmogaus veiklos esame biologinės įvairovės krizės – šeštojo masinio išnykimo – liudininkai (Fukurai, 2022). Mes nežinome, kada didžioji dauguma rūšių išnyks, taip pat neturime žinių apie daugelio aprašytų

ir dar neaprašytų organizmų grupių įvairovę (Naggs, 2017). Dėl šios priežasties, visos žinios apie biologinę įvairovę yra ypač svarbios.

Šiame tyrime pagrindinis dėmesys skiriamas *Antocha* genties taksonominei apžvalgai, filogenetinei rekonstrukcijai ir morfologinėms požymių sistemoms. Šio tyrimo metu buvo ištirti ir iliustruoti tipiniai ir netipiniai egzemplioriai. Rezultatai prisidės, kuriant pagrindą būsimiems *Antocha* genties faunos tyrimams pasaulyje.

## DARBO TIKSLAS IR UŽDAVINIAI

Šio tyrimo tikslas – atlikti genties *Antocha* Osten Sacken 1860 taksonominę apžvalgą, filogenetinę analizę ir įgyti naujų žinių apie šią nepakankamai ištirtą vabzdžių grupę.

Tikslui pasiekti buvo iškelti šie uždaviniai:

1. Ištirti *Antocha* genties rūšių tipinę medžiagą, parengti priemones rūšims identifikuoti.
2. Atlikti morfologinių požymių ir gautų mtDNR citochromo c oksidazės I subvieneto sekų analizes.
3. Atlikti filogenetinę analizę, suskirstyti *Antocha* genties rūšis į grupes, patikslinti pogenčių ribas.

## GINAMIEJI DISERTACIJOS TEIGINIAI

1. *Antocha* Osten Sacken, 1860 gentis susideda iš trijų pogenčių.
2. Patinų genitalijų vidinės struktūros leidžia efektyviai skirstyti rūšis į grupes.
3. *Antocha (Antocha*) *fulvescens* Lackschewitz, 1940 ir *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830) yra skirtingos rūšys.
4. *Antocha* (*Antocha*) *brevistyla* Alexander, 1924 priklauso *Proantocha*, o ne *Antocha* (s. str.) pogentei.

## DARBO NAUJUMAS IR JO REIKŠMĖ

1. Pirmą kartą atlikta genties *Antocha* Osten Sacken, 1860 filogenetinė analizė.
2. Atlikus filogenetinę analizę, išskirtos 25 rūšių grupės, iš kurių 22 minimos pirmą kartą.
3. Remiantis morfologinių požymių ir filogenetine analizėmis, *Antocha* (*Antocha*) *brevistyla* Alexander, 1924 priklauso pogentei *Proantocha*.

4. Aprašytos naujos mokslui *Antocha* rūšys: *Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019 ir *Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021.
5. Buvo atrasta nauja Kinijos faunai rūšis *Antocha* (*Antocha*) *quadrifurca* Alexander, 1971.
6. Pirmą kartą į GenBank duomenų bazę buvo pateikta 17 genties *Antocha* mtDNR citochromo c oksidazės I subvieneto rūšių sekų.
7. Nustatyta, kad *Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940 ir *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830) yra skirtingos rūšys.

## DISERTACIJOS APIMTIS IR STRUKTŪRA

Disertacijos apimtis – 126 puslapiai (be priedo). Baigiamasis darbas parašytas anglų kalba ir susideda iš įvado, literatūros apžvalgos, medžiagos ir metodų, rezultatų ir jų aptarimo, išvadų, literatūros sąrašo (182 šaltiniai), priedo. Disertacijoje yra 187 paveikslai ir 1 lentelė.

## 1. LITERATŪROS APŽVALGOS APIBENDRINIMAS

Literatūros apžvalgoje pateikta informacija apie bendrą *Antocha* genties morfologiją (suaugėlio, lervos ir lėliukės), taksonomiją (tyrimų istoriją, fosilinius radinius, filogenetinius ryšius) ir ekologiją (sezoninę dinamiką, gyvenimo ciklą, mitybą, poravimosi elgseną, parazitus, svarbą gamtoje).

## 2. MEDŽIAGA IR METODAI

Vabzdžiai buvo išskleisti ir išdžiovinti arba išsaugoti 70 % etanolyje. Nukirpus suaugusio vabzdžio pilvo galą, jis virtas 5 % NaOH tirpale mažiausiai 15 minučių (priklausomai nuo mėginio būklės), tada išvalytas distiliuotame vandenyje ir 96 % etanolyje. Vidinės patinų genitalijų struktūros, antena ir sparnas buvo dedami ant objektyvinio stikliuko į euparalio lašelį ir uždengti dengiamuoju stikliuku. Vabzdžiai buvo preparuojami, naudojantis mikroskopu Olympus SZX10. Nuotraukos fotografuotos sluoksniais skaitmeniniu fotoaparatu Canon EOS 80D ir makroobjektyvu Canon MP-E 65 mm ir sulietos, naudojant Zerene Stacker (PMax algoritmą). Preparatai nagrinėti, naudojant mikroskopą Nikon Eclipse Si-L, ir fotografuoti, naudojant Lumenera Infinity 1.

Šiame darbe naudojama terminija remiasi Cumming & Wood (2017), o sparno gyslotumas – de Jong (2017). Rūšių paplitimas pateiktas, remiantis Oosterbroek (2023) katalogu (https://ccw.naturalis.nl/).

Identifikuoti egzemplioriai buvo lyginami su tipiniais ir netipiniais egzemplioriais iš Jungtinių Amerikos Valstijų nacionalinio gamtos istorijos muziejaus, Smitsono instituto (Smithsonian Institution) Vašingtone, JAV ir Gamtos istorijos muziejaus Londone, Jungtinėje Karalystėje.

Medžiaga šiam tyrimui buvo gauta stažuočių į užsienio muziejus metu ir pasiskolinta iš įvairių institucijų ar mokslininkų.

Dalį panaudotos medžiagos ekspedicijų Pietų Korėjoje metu surinko dr. S. Podėnas, dr. T. A. Kleinas, dr. H.-C. Kim, ekspedicijų Kinijoje – S. Saldaitis, R. Butvila, A. Floriani ir Lietuvoje – R. Markevičiūtė. Kai kuriuos egzempliorius perdavė dr. P. Starkevič.

Stažuotė į Londono gamtos istorijos muziejų vyko 2021 m. rugsėjo 27 – spalio 22 d.

Medžiaga tyrimui buvo pasiskolinta iš šių institucijų:

NHMUK – Londono gamtos istorijos muziejus (Londonas, Jungtinė Karalystė);

USNM – Smitsono instituto nacionalinis gamtos istorijos muziejus (Vašingtonas, JAV);

CNC – Kanados nacionalinė vabzdžių, voragyvių ir nematodų kolekcija (Otava, Kanada);

MNHV – Gamtos istorijos muziejus (Viena, Austrija);

RMNH – Biologinės įvairovės centras „Naturalis“ (Leidenas, Olandija);

NIBR – Nacionalinis biologinių išteklių institutas (Inčonas, Pietų Korėja);

ANSP – Drekselio universiteto (Drexel University) Gamtos mokslų akademija (Filadelfija, JAV);

NRC – Gamtos tyrimų centras (Vilnius, Lietuva).

Išanalizavus literatūrą ir ištyrus ilgakojus uodus, iš viso atrinkti ir aprašyti 94 požymiai. Požymiams suvesti į matricą ir filogenetiniams medžiams nagrinėti naudota Winclada v.100 (Kevin C. Nixon), parsimoniškiausiam medžiui ieškoti naudota NONA v.2.0 (P. A. Goloboff, 1993). Požymių kodavimas atliktas pagal Sereno (2007) darbą „Logical basis for morphological characters in phylogenetics“. Buvo laikoma, kad visi požymiai turi vienodą svorį, be išankstinio sureikšminimo. Požymio poliariškumui nustatyti panaudotas išorinės grupės metodas. Kladogramos ieškoti naudota euristinės paieškos parinktis ir medžio padalijimo bei sujungimo (angl. *tree bisection and reconnection*) algoritmas. Parinkti nustatymai: hold1000, mult*50, mult*max*. Medis įšaknydintas (angl. *rooting*), panaudojus išorinės grupės metodą. Visi ekonomiškiausi medžiai buvo sujungti į vieną griežto konsensuso (angl. *strict consensus*) medį. Išorinei grupei panaudotos keturios rūšys: *Limonia phragmitidis* (Schrank, 1781), *Thaumastoptera* (*Thaumastoptera*) *calceata* Mik, 1866, *Orimarga*

(*Orimarga*) *arabica* Hancock, 2011, *Elliptera zipanguensis zipanguensis* Alexander, 1924.

DNR išskirta, naudojant DNR nusodinimo amonio acetatu metodą. Išskirta DNR buvo padauginta, taikant polimerazės grandininės reakcijos metodą (PGR). Sekvenavimo reakcijos buvo atliktos, naudojant Big-Dye® Terminator v3.1 Cycle Sequencing Kit ir 3500 Genetic Analyzer (Applied Biosystems, Foster City, CA, JAV) pagal gamintojo rekomendacijas. Gautos DNR sekos buvo analizuojamos, naudojant BioEdit (Hall, 1999) programinę įrangą. Filogenetiniai medžiai buvo sukurti MrBayes version 3.1 (Ronquist ir Huelsenbeck, 2003) programine įranga. Tinkamiausias evoliucijos modelis buvo parinktas, naudojant MrModeltest 2.2 programinę įrangą (Nylander, 2004). Filogenetiniai medžiai vizualizuoti, naudojant FigTree v1.4.3 programinę įrangą (Rambaut, 2009).

Taip pat buvo atliktos rūšių ribų nustatymo analizės: bayesian Poisson Tree Process (bPTP) (Zhang et al., 2013; Kapli et al., 2017) (https://species.h-its.org/ptp/); ir Assemble Species by Automatic Partitioning (ASAP) (Puillandre et al., 2020), naudojant Kimura K80 substitution model (ts/tv=2.0) (https://bioinfo.mnhn.fr/abi/public/asap). Genetiniai atstumai tarp tirtų egzempliorių sekų buvo išanalizuoti.

Pasaulio žemėlapis sudarytas, naudojant R version 4.2.2 (R Core Team, 2022), pasirinkus ggplot2 (Wickham, 2016), papildytas spalvomis, naudojant Adobe Photoshop Version: 14.0.

## 3. REZULTATAI IR JŲ APTARIMAS

### 3.1. *Antocha* genties filogenetinė analizė

Išnagrinėjus literatūrą ir *Antocha* genties vabzdžių tipinę ir netipinę medžiagą, filogenetinei analizei buvo atrinkti 94 požymiai. Į matricą (disertacijoje 1 lentelė) įtrauktos 123 rūšys, iš kurių išorinei grupei priklauso: *Limonia phragmitidis* (Schrank, 1781), *Thaumastoptera* (*Thaumastoptera*) *calceata* Mik, 1866, *Orimarga* (*Orimarga*) *arabica* Hancock, 2011 ir *Elliptera zipanguensis zipanguensis* Alexander, 1924.

Požymių būsenos:

1. **Anteną atlenkus atgal**: (0) siekia priekinį *prescutum* kraštą; (1) siekia pilvelį.
2. **Antenos segmentų skaičius**: (0) 14; (1) 16.
3. **Antenos segmento forma**: (0) ovali; (1) verpstės; (2) ovali, išsiplėtusi apatinėje dalyje; (3) vamzdžio.
4. **Beveik status užpakalinio sparno kampas**: (0) nėra; (1) yra.
5. **Pterostigma**: (0) nėra; (1) yra.
6. **Dėmės ant sparno gyslų**: (0) nėra; (1) yra.

7. **Sparno gyslų spalvos tono pasiskirstymas**: (0) tolygus ant visų gyslų; (1) dalis skersinių ir išilginių gyslų tamsesnės; (2) tik skersinės gyslos tamsesnės.
8. **Sparno diskoidalinis narvelis (*dm*)**: (0) yra; (1) nėra.
9. **Gyslos $R_2$ padėtis**: (0) už arba tame pačiame lygyje kaip ir diskoidalinio narvelio (*dm*) pamatas; (1) prieš diskoidalinio narvelio pamatą (*dm*).
10. **Gyslos *m-cu* ilgis**: (0) gysla ilgesnė negu atstumas tarp jos ir diskoidalinio narvelio (*dm*) pamato; (1) gysla trumpesnė negu atstumas tarp jos ir diskoidalinio narvelio (*dm*) pamato.
11. **Gyslos *Rs* ilgis**: (0) daugiau negu 2,5 kartus ilgesnė už gyslą $R_4$; (1) 2,5 kartus ar mažiau ilgesnė už gyslą $R_4$; (2) trumpesnė už gyslą $R_4$.
12. **Ant užpakalnės kojos šlaunies galo ir blauzdos pamato esantys gumbai**: (0) nėra; (1) yra.
13. **Devinto sternito forma**: (0) ovalus; (1) kvadratiškas.
14. **Devintas sternitas ir devintas tergitas**: (0) suaugę; (1) atskiri.
15. **Nesklerotizuotos dėmės ant devinto sternito**: (0) nėra; (1) yra.
16. **Gumbas ant devinto sternito**: (0) nėra; (1) yra.
17. **Devinto tergito vagelės padėtis**: (0) dvi vertikalios vagelės atskiros; (1) siekia tik vidurinę dalį; (2) išilgai devinto tergito, bet nesiekia užpakalinio krašto galo; (3) X formos viduryje; (4) apversto Y formos viduryje; (5) išilgai per vidurį siekia kraštą.
18. **Gonokoksito forma**: (0) ovalus; (1) išilgintai cilindriškas; (2) pailgai kūgiškas; (3) ovalus, viršūnėje išsiplėtęs; (4) cilindriškas; (5) trumpas, kūgiškas; (6) apvalus; (7) kampuotas.
19. **Nesklerotizuota gonokoksito dalis**: (0) viršūnėje; (1) išilgai gonokoksito.
20. **Gonokoksito viršūnė**: (0) neišilgėjusi; (1) išilgėjusi.
21. **Šeriuota gonokoksito skiltis**: (0) nėra; (1) yra.
22. **Išorinis gonostilis**: (0) yra; (1) nėra.
23. **Išorinio gonostilio plotis, lyginant su vidiniu gonostiliu**: (0) platus arba panašaus pločio; (1) plonesnis.
24. **Išorinio gonostilio lenktumas**: (0) truputį lenktas; (1) lenktas ties galu; (2) stipriai sulenktas; (3) išlenktas per visą ilgį, kablio formos.
25. **Papildomos struktūros ant išorinio gonostilio**: (0) nėra; (1) yra.
26. **Vidinės paramero atšakos ilgis, lyginant su edeagusu**: (0) labai trumpa, vos įžiūrima, susiliejusi su paramero pamatu; (1) ilgesnė arba šiek tiek ilgesnė už vidurinę dalį; (2) trumpa, žemiau vidurinės dalies.
27. **Vidinės paramero atšakos viršūnės forma**: (0) buka; (1) smaili; (2) skelta į dvi dalis; (3) banguota.
28. **Ilgesnės už edeagusą, smailia viršūne vidinės paramero atšakos forma**: (0) siauros adatos; (1) ištempto trikampio (platus ties pamatu, siauras viršūnėje); (2) siūlo; (3) kaspino, plati viršūnėje ir staigiai nusmailėjanti; (4) kaspino, palaipsniui nusmailėjanti; (5) kaspino, tolygaus pločio per ilgį ir tik viršūnė smaili; (6) plati su spygliuku

viršūnėje; (7) tolygaus storio, viršūnė primena paukščio galvą; (8) riesta viršūne kaspino; (9) susisukusio į spiralę kaspino.

29. **Ilgesnės arba tokio pat ilgio kaip edeagusas vidinės paramero atšakos su buka viršūne forma**: (0) plokščio kaspino, siaurai buka viršūne; (1) tiesios lazdos, suapvalinta viršūne.
30. **Trumpesnės už edeagusą vidinės paramero atšakos forma**: (0) tolygiai siaura, tiesi; (1) siaura, tiesi, viršūnėje išplatėjusi; (2) labai siaura spyglio formos buku galu; (3) plati, ovali; (4) plati, trikampiška; (5) siaura, truputį kreiva; (6) tiesi, tolygiai nusiaurėja į buką viršūnę.
31. **Interbazės ilgis, lyginant su išoriniu gonostiliu**: (0) ilgesnė; (1) trumpesnė, bet ilgesnė už vidurinę dalį; (2) trumpesnė nei vidurinė dalis.
32. **Interbazės viršūnė**: (0) kampuota; (1) apvali; (2) smaili; (3) skelta.
33. **Interbazės forma**: (0) plataus lapo; (1) apvalia viršūne cilindro; (2) iš dviejų pailgų dalių, iš kurių viena trumpesnė sudėto trikampio; (3) kilpos; (4) smailia viršūne skiautės; (5) adatos; (6) pagaliuko; (7) siauro irklo; (8) kalavijo; (9) trikampio.
34. **Paramero apodemos ilgis, palyginus su edeagusu**: (0) ilgesnis arba tokio pat ilgio; (1) trumpesnė, bet ilgesnė už vidurinę dalį; (2) trumpesnė nei vidurinė dalis.
35. **Paramero pamatinės posterolateralinės ataugos forma**: (0) trumpa, siaura, viršūnėje apvali; (1) plati, smailėjanti viršūnėje; (2) trikampiška; (3) ilga ir siaura, pagaliuko formos; (4) stipriai užriesta; (5) ilga, siaura, viršūnėje apvali; (6) horizontaliai suaugusi su paramero dangalu; (7) vertikaliai suaugusi su paramero dangalu; (8) plėvelės.
36. **Paramero struktūros**: (0) dengia edeaguso viršūnę ir atrodo kaip dvi plačios juostelės; (1) sudaro apvalkalą, visiškai dengiantį edeagusą; (2) sudaro mažą apvalkalą, dengiantį apatinę edeaguso dalį; (3) sudaro parameralinį apvalkalą, kuris formuoja falosomą; (4) dvi juostelės, kurių galai yra sujungti su edeaguso galu arba vidurine jo dalimi; (5) ilga, plona, kaspino formos, nesijungia edeaguso viršūnėje; (6) ilga, plona, pagaliuko formos, jungiasi edeaguso vidurinėje dalyje ar vos aukščiau; (7) formuoja apvalią, šakotą arba susisukusią į spiralę struktūrą.
37. **Falo forma**: (0) trumpo, tiesaus vamzdžio; (1) siaura, smailia viršūne; (2) ilgo vingiuoto vamzdžio; (3) plataus ir trumpo vamzdžio su keliomis skiltimis viršūnėje; (4) ilgo, tiesaus arba šiek tiek išlenkto, įstrižai nupjauto viršūnėje vamzdžio; (5) siauro ir trumpo vamzdžio su skelta viršūne; (6) siauro ir ilgo vamzdžio, viršūnėje suskilusio į mažus, išlenktus galiukus; (7) plataus ir trumpo vamzdžio su skelta viršūne; (8) prie pagrindo išsiplėtęs, vidurinė dalis siauresnė už pagrindą ir viršutinę dalį.
38. **Paramero šoninės struktūros, kurios nesusiliejusios į edeagusą dengiantį apvalkalą, išvaizda**: (0) platus kaspinas, susijungia edeaguso viršūnėje; (1) kaspino formos, susijungia prie vidurinės edeaguso dalies; (2) plonos ir lenktos struktūros; (3) susijungia edeaguso viršūnėje, su gumbu tarp dviejų smailių struktūrų; (4) dvi smailios struktūros

atsišakoja nuo užlinkusio edeaguso; (5) dvi smailios pagaliuko formos struktūros atsišakoja nuo tiesaus edeaguso; (6) plonos, sujungtos edeaguso viršūnėje struktūros; (7) susijungia edeaguso viršūnėje ir susiskaido į struktūras, kurios gali būti šakotos; (8) susijungia edeaguso viršūnėje ir susiskaido į susisukusias spirales.

39. **Edeaguso ilgis, lyginant su gonokoksitu**: (0) trumpesnis; (1) tokio pat ilgio arba ilgesnis.
40. **Edeaguso forma**: (0) iki pusės išplatėjęs; (1) ilgo (ilgesnio už išorinį ir vidinį gonostilį), tiesaus vamzdžio; (2) tiesaus vamzdžio su smailia viršūne; (3) riestas (lateraliai primena paukščio snapą); (4) išplatėjęs ties viršūne; (5) mazgo formos arba banguotas viršuje; (6) tiesus su dviem siūlų formos ataugomis; (7) ilgo banguoto vamzdžio; (8) trumpo (trumpesnio už išorinį ir vidinį gonostilius), tiesaus vamzdžio.
41. **Paramero plokštė**: (0) labai maža; (1) maža, bet plati; (2) didelė, plati.
42. **Ventralinis patelės cerkų kraštas**: (0) lygus; (1) dantytas.
43. **Paplitimas**: (0) Azija; (1) Europa (arba pietvakarinė Azijos dalis); (2) Šiaurės Amerika; (3) Afrika; (4) Australija.
44. **Trapecijos formos devintas tergitas**: (0) nėra; (1) yra.
45. **Viena arba dvi apvalios skiltys ant kaudalinio devinto tergito krašto**: (0) nėra; (1) yra.
46. **Dvi trikampės, į vidų nukreiptos skiltys ant užpakalinio devinto tergito krašto**: (0) nėra; (1) yra.
47. **Viena maža ir apvali skiltis ant kaudalinio devinto tergito krašto**: (0) nėra; (1) yra.
48. **Dvi mažos, apvalios skiltys ant kaudalinio devinto tergito krašto**: (0) nėra; (1) yra.
49. **Įstrižai nukirsta, tamsi išorinio gonostilio viršūnė:** (0) nėra; (1) yra.
50. **Stačiai nukirsta, tamsi išorinio gonostilio viršūnė:** (0) nėra; (1) yra.
51. **Siaurai buka šviesaus ir plataus išorinio gonostilio viršūnė**: (0) nėra; (1) yra.
52. **Patamsėjusi ir buka išorinio gonostilio viršūnė**: (0) nėra; (1) yra.
53. **Smailus ir bukas iškilimai ant išorinio gonostilio viršūnės**: (0) nėra; (1) yra.
54. **Gilus įskilimas ant išorinio gonostilio viršūnės**: (0) nėra; (1) yra.
55. **Buka ir šviesi ilgo, ir siauro išorinio gonostilio viršūnė**: (0) nėra; (1) yra.
56. **Išplatėjusi šviesaus išorinio gonostilio viršūnė**: (0) nėra; (1) yra.
57. **Skelta šviesaus išorinio gonostilio viršūnė**: (0) nėra; (1) yra.
58. **Tamsaus išorinio gonostilio užlinkimas**: (0) nėra; (1) yra.
59. **Šviesaus, labai plono išorinio gonostilio nusmailėjimas į nukirstą viršūnę**: (0) nėra; (1) yra.
60. **Šviesaus išorinio gonostilio tolygus nusmailėjimas į smailią viršūnę**: (0) nėra; (1) yra.
61. **Šviesaus išorinio gonostilio įstrižas nusmailėjimas į nukirstą viršūnę**: (0) nėra; (1) yra.

62. **Dvi plačios, apvalios edeaguso apvalkalo skiltys**: (0) nėra; (1) yra.
63. **Trys mažos apvalios edeaguso apvalkalo skiltelės**: (0) nėra; (1) yra.
64. **Edeaguso apvalkalo nusmailėjimas**: (0) nėra; (1) yra.
65. **Ragelių formos struktūros arba dvi siauros apvalios edeaguso apvalkalo skiltys**: (0) nėra; (1) yra.
66. **Apvalus ir mažas edeaguso apvalkalas**: (0) nėra; (1) yra.
67. **Edeaguso apvalkalas redukuotas į suplotą arba apvaliai iškilią struktūrą**: (0) nėra; (1) yra.
68. **Edeaguso arba falo pagrindo forma**: (0) pusrutulio; (1) plokštelės; (2) sferos; (3) lėkštės; (4) kūgio; (5) kampuota; (6) pailga.
69. **Pora smulkių ragelių arba šakotos struktūros, sujungtos su edeaguso viršūne**: (0) nėra; (1) yra.
70. **Triskiltė struktūra edeaguso viduje**: (0) nėra; (1) yra.
71. **Kaspino formos struktūros sujungtos su edeaguso apvalkalu**: (0) nėra; (1) yra.
72. **Siauras edeagusas, viršūnėje gali būti smailus arba apgaubtas membranine struktūra**: (0) nėra; (1) yra.
73. **Maža skylutė edeaguso apvalkale**: (0) nėra; (1) yra.
74. **Dvi sklerotizuotos smailios šoninės paramero-edeaguso struktūros, prisijungusios prie vidurinės edeaguso dalies**: (0) nėra; (1) yra.
75. **Edeagusas vamzdelio formos, bet ne ilgesnis negu išorinis gonostilis**: (0) nėra; (1) yra.
76. **Dvi plačios šoninės paramero-edeaguso struktūros, prisijungusios prie vidurinės edeaguso dalies ir sudarančios tiltelį**: (0) nėra; (1) yra.
77. **Stipriai per visą ilgį užsirietęs edeagusas**: (0) nėra; (1) yra.
78. **Viršutinėje dalyje edeagusas užlinkęs ir apvalus**: (0) nėra; (1) yra.
79. **Edeagusas vingiuotas, ilgesnis už išorinį gonostilį**: (0) nėra; (1) yra.
80. **„S“ formos šoninės paramero atšakos**: (0) nėra; (1) yra.
81. **Platus edeaguso apvalkalas, gaubiantis tiesų vamzdelio formos edeagusą**: (0) nėra; (1) yra.
82. **Cilindriškas edeaguso apvalkalas**: (0) nėra; (1) yra.
83. **Dvi mažos ir apvalios edeaguso apvalkalo struktūros sujungtos su edeagusu**: (0) nėra; (1) yra.
84. **Pora skiltelių edeaguso viršūnėje**: (0) nėra; (1) yra.
85. **Dvi išlenktos skiltys falo viršūnėje**: (0) nėra; (1) yra.
86. **Smailėjanti falo viršūnė**: (0) nėra; (1) yra.
87. **Skelta falo viršūnė**: (0) nėra; (1) yra.
88. **Vidurinės ilgo falosominio vamzdelio dalies susiaurėjimas**: (0) nėra; (1) yra.
89. **Ilgo falo viršūnė šiek tiek lenkta ar įstrižai nukirsta**: (0) nėra; (1) yra.
90. **Pora skiltelių falo viršūnėje**: (0) nėra; (1) yra.
91. **Kaspino formos struktūros nesujungtos su edeaguso apvalkalu**: (0) nėra; (1) yra.
92. **Edeagusas panašaus ilgio kaip išorinis gonostilis, viršūnėje užsilenkęs**: (0) nėra; (1) yra.

93. **Dvi smailios edeaguso apvalkalo struktūros**: (0) nėra; (1) yra.
94. **Dvi siūliškos šoninės paramero atšakos**: (0) nėra; (1) yra.

### 3.2. Filogenetiniai ryšiai ir rūšių grupės

Atlikus kladistinę analizę, iš viso gauta 1000 parsimoniškiausių medžių, kurių ilgis L=588 žingsniai (Ci=30, Ri=82). Griežto konsensuso supaprastinta schema pateikta 49 disertacijos paveiksle, o detali schema pateikta 50–55 disertacijos paveiksluose.

Visos genties filogenetinė analizė niekada nebuvo atlikta ir publikuota, vienintelis autorius Takashi Torii, išanalizavęs 18 *Antocha* Osten Sacken, 1860 genties rūšių, paplitusių Pietų Korėjoje, Japonijoje ir Rusijos Tolimuosiuose Rytuose, išskyrė 10 požymių. Remdamasis savo rezultatais, T. Torii teigė, kad *Proantocha* pogentė yra monofiletinė, o *Antocha* pogentė (s. str.) parafiletinė, nes nėra apomorfijų šiai pogentei pagrįsti (Torii, 1992). *Orimargula* Mik, 1883 pogentės filogenija nebuvo analizuota.

Remiantis šiame darbe atlikta filogenetine analize ir gauto filogenetinio medžio topologija, *Antocha* gentis susideda iš trijų pogenčių: *Antocha* (s. str.), *Orimargula* ir *Proantocha*. *Orimargula* pogentė sudaryta iš dviejų rūšių grupių, *Proantocha* pogentėje taip pat matomos dvi rūšių grupės, o *Antocha* (s. str.) pogentė yra pati įvairiausia ir sudaryta iš 21 rūšių grupės. Pagrindinė visos *Antocha* genties apomorfija – tai beveik status užpakalinis sparno kampas, kuris neaptinkamas išorinėje grupėje ir kitose Limoniini pošeimio tribose.

Žinoma, kad beveik status užpakalinis sparnų kampas yra Blephariceridae ir Simuliidae šeimose, kurios kaip ir *Antocha* gentis vystosi greitai tekančiame vandenyje. Daroma prielaida, kad šis požymis yra susijęs su suaugėlio gebėjimu staigiai palikti vandenį po vandenyje besivystančios lėliukės stadijos.

Svarbūs požymiai, kurie nebuvo įtraukti į filogenetinę analizę, yra preimaginalinių stadijų. *Antocha* genties lervų ir lėliukių morfologija ir ekologija yra unikali, nes šie vabzdžiai prisitaikę vystytis greitai tekančiose upėse po vandeniu, tačiau literatūroje aprašomos tik penkios šių stadijų rūšys, todėl lervos ir lėliukės nebuvo įtrauktos į filogenetinę analizę.

Limoniinae pošeimyje yra dvi tribos: Antochini ir Limoniini (Oosterbroek ir Theowald,1991). *Limonia phragmitidis* (Schrank, 1781) priklauso Limoniini tribai ir yra naudojama filogenetinėje analizėje kaip išorinė grupė. Kitos išorinės grupės rūšys priklauso Antochini tribai, viena iš jų yra *Thaumastoptera* (*Thaumastoptera*) *calceata* Mik, 1866, kurios klada remiasi vienu požymiu – (31.2) interbazė trumpesnė negu išorinio gonostilio vidurinė dalis. *T.* (*T.*) *calceata* seserinę kladą palaiko trys apomorfijos: (6.0)

dėmių ant sparno gyslų nėra, (7.0) sparno gyslų spalvos tono pasiskirstymas tolygus, (22.0) yra išorinis gonostilis ir vienas sinapomorfinis požymis – (43.0) šios rūšys paplitusios Azijoje. Šioje kladoje yra *Orimarga* (*Orimarga*) *arabica* Hancock, 2011, kurią palaiko viena apomorfija (27.3) – vidinės paramero atšakos viršūnės forma banguota. Seserinė *O.* (*O.*) *arabica* klada yra paremta vienu apomorfiniu požymiu (36.1) – paramero struktūros sudaro apvalkalą, visiškai dengiantį edeagusą.

Šioje kladoje paskutinė išorinės grupės rūšis yra *Elliptera zipanguensis zipanguensis* Alexander, 1924, kurią palaiko viena apomorfija (36.0) – paramero struktūros dengia edeaguso viršūnę ir atrodo kaip dvi plačios juostelės.

Remiantis filogenetinės analizės rezultatais, *Antocha* gentis skirstoma į tris pogentes ir 25 rūšių grupes. Tris grupes – *nigribasis* (Alexander, 1974), *spiralis* (Alexander, 1970) ir *vitripennis* (Alexander, 1936) – pirmasis savo darbuose paminėjo Alexander, kuris grupes išskyrė, remdamasis tik morfologija be filogenetinės analizės. Visos kitos grupės buvo išskirtos pirmą kartą. Rūšys, kurios nebuvo įtrauktos į filogenetinę analizę, pagal originalias iliustracijas ir aprašymus buvo priskirtos atitinkamoms rūšių grupėms.

***Antocha* (s. str.) Mik, 1883 pogentė**

Šios pogentės tipinė rūšis yra *Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860. Remiantis Podėnu ir Byun (2013), rūšims, priklausančioms *Antocha* pogentei, būdingas šių požymių derinys: sparnas platus su dideliu, beveik stačiu užpakaliniu sparno kampu ir uždaru diskoidaliniu narveliu (*dm*), kojos visada ilgos ir lieknos, padengtos trumpais, pusiau stačiais šereliais, patelės kiaušdėčio cerkas su lygiu apatiniu kraštu. Atlikus filogenetinę analizę, buvo nustatyta, kad šie požymiai nėra unikalūs tik šiai pogentei. Pavyzdžiui, yra rūšių, kaip *A.* (*A.*) *subconfluenta* Alexander, 1930, *A.* (*A.*) *confluenta* Alexander, 1926 ir *A.* (*A.*) *macrocera* Alexander, 1970, su atviru diskoidaliniu narveliu (*dm*). Ši pogentė ypač turtinga požymių variacijų ir filogenetiniame medyje susiskaido į 21 rūšių grupę.

**1. *mara* grupė:**

*Antocha* (*Antocha*) *mara* Alexander, 1970

*Antocha* (*Antocha*) *microcera* Alexander, 1974

*Antocha* (*Antocha*) *perobtusa* Alexander, 1971

Grupei priklauso trys rūšys, turinčios vieną apomorfinį požymį – (51.1) išreikštą siaurai buką šviesaus ir plataus išorinio gonostilio viršūnę.

**2. *pterographa* grupė:**

*Antocha* (*Antocha*) *pterographa* Alexander, 1953

*Antocha* (*Antocha*) *glycera* Alexander, 1969

Šios dviejų rūšių grupės rūšys turi du apomorfinius požymius: (76.1) išreikštos dvi plačios šoninės paramero-edeaguso struktūros, prisijungusios prie vidurinės edeaguso dalies ir sudarančios tiltelį, ir (92.1) edeagusas panašaus ilgio kaip išorinis gonostilis, viršūnėje užsilenkęs.

**3. *indica* grupė:**

*Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019
*Antocha* (*Antocha*) *indica* Brunetti, 1912
*Antocha* (*Antocha*) *koreana* Podenas and Byun, 2014
*Antocha* (*Antocha*) *rectispina* Alexander, 1954
*Antocha* (*Antocha*) *shansiensis* Alexander, 1954
*Antocha* (*Antocha*) *streptocera* Alexander, 1949

Šioje grupėje yra šešios rūšys, turinčios du apomorfinius požymius: (3.2) antenos flagelomerai ventraliai išsiplėtę (nežinoma tik *A. (A.) rectispina* antena) ir (77.1) stipriai per visą ilgį užsirietęs edeagusas.

**4. *scutella* grupė:**

*Antocha* (*Antocha*) *globulosa* Alexander, 1973
*Antocha* (*Antocha*) *scutella* Alexander, 1973

Ši dviejų rūšių grupė paremta vienu apomorfiniu požymiu (82.1) – edeaguso apvalkalas cilindriškas.

**5. *turkestanica* grupė:**

*Antocha* (*Antocha*) *angusticellula* Alexander, 1969
*Antocha* (*Antocha*) *angustiterga* Alexander, 1949
*Antocha* (*Antocha*) *bifida* Alexander, 1924
*Antocha* (*Antocha*) *dilatata* Alexander, 1924
*Antocha* (*Antocha*) *emarginata* Alexander, 1938
*Antocha* (*Antocha*) *lindneri* (Nielsen, 1963)
*Antocha (Antocha*) *pachyphallus* Alexander, 1971
*Antocha (Antocha*) *setigera* Alexander, 1933
*Antocha* (*Antocha*) *turkestanica* de Meijere, 1921

Šiai devynių rūšių grupei būdingas vienas apomorfinis požymis – (40.8) edeagusas trumpo (trumpesnio už išorinį ir vidinį gonostilius arba tokio paties ilgio), tiesaus vamzdžio formos.

**6. *brevinervis* grupė:**

*Antocha* (*Antocha*) *brevinervis* Alexander, 1924
*Antocha* (*Antocha*) *mitosanensis* Torii, 1992
*Antocha* (*Antocha*) *platyphallus* Alexander, 1935
*Antocha* (*Antocha*) *tuberculata* Torii, 1992

Šiai keturių rūšių grupei būdingi trys apomorfiniai požymiai: (55.1) buka ir šviesi ilgo ir siauro išorinio gonostilio viršūnė ir (81.1) platus edeaguso apvalkalas, gaubiantis tiesų vamzdelio formos edeagusą.

**7. *dentifera* grupė:**

*Antocha* (*Antocha*) *confluenta* Alexander, 1926

*Antocha* (*Antocha*) *dentifera* Alexander, 1924

*Antocha* (*Antocha*) *ramulifera* Savchenko, 1983

*Antocha* (*Antocha*) *subconfluenta* Alexander, 1930

Ši keturių rūšių grupė yra palaikoma trijų apomorfijų: (24.3) išorinis gonostilis išlenktas per visą ilgį, kablio formos, (64.1) edeaguso apvalkalo nusmailėjimas ir (81.1) platus edeaguso apvalkalas, gaubiantis tiesų vamzdelio formos edeagusą.

**8. *styx* grupė:**

*Antocha (Antocha) hirtipes* Savchenko, 1971

*Antocha* (*Antocha*) *minuticornis* Alexander, 1931

*Antocha* (*Antocha*) *platystylis* Alexander, 1974

*Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021

*Antocha* (*Antocha*) *styx* Alexander, 1930

Šioje grupėje yra penkios rūšys, kurioms būdingas vienas apomorfinis požymis – (78.1) viršutinėje dalyje edeagusas užlinkęs ir apvalus.

**9. *vitripennis* grupė:**

*Antocha* (*Antocha*) *flavidula* Alexander, 1936

*Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940

*Antocha* (*Antocha*) *javanensis* Alexander, 1915

*Antocha* (*Antocha*) *monticola* Alexander, 1917

*Antocha* (*Antocha*) *nebulosa* Edwards, 1928

*Antocha* (*Antocha*) *phoenicia* Thomas and Dia, 1982

*Antocha* (*Antocha*) *satsuma* Alexander, 1919

*Antocha* (*Antocha*) *staryi* Keresztes & Mabrouki, 2023

*Antocha* (*Antocha*) *vitripennis* (Meigen, 1830)

*Antocha* (*Antocha*) *yeongwola* Podenas, 2016

Šioje grupėje yra 10 rūšių, kurios filogenetiniame medyje išsiskiria pagal du apomorfinius požymius: (62.1) yra dvi plačios, apvalios edeaguso apvalkalo skiltys ir (73.1) išreikšta maža skylutė edeaguso apvalkale.

**10. *libanotica* group:**

*Antocha* (*Antocha*) *libanotica* Lackschewitz, 1940

*Antocha* (*Antocha*) *tibetana* Lv & Zhang, 2023

Šios dvi rūšys išsiskiria vienu apomorfiniu požymiu – (93.1) išreikštos dvi smailios edeaguso apvalkalo struktūros.

**11. *gracillima* grupė:**

*Antocha* (*Antocha*) *bidens* Alexander, 1932

*Antocha* (*Antocha*) *dafla* Alexander, 1969

*Antocha* (*Antocha*) *gracillima* Alexander, 1924

*Antocha* (*Antocha*) *lacteibasis* Alexander, 1935

Grupėje yra keturios rūšys, kurios išsiskiria dviem apomorfiniais požymiais: (18.2) pailgai kūgiškos formos gonokoksitu, (71.1) kaspino formos struktūros sujungtos su edeaguso apvalkalu.

**12. *hyperlata* grupė:**

*Antocha* (*Antocha*) *hyperlata* Alexander, 1968

*Antocha* (*Antocha*) *macrocera* Alexander, 1970

Ši dviejų rūšių grupė išsiskiria vienu apomorfiniu požymiu – (38.3) paramero šoninės struktūros, nesusiliejusios į edeagusą dengiantį apvalkalą, susijungia edeaguso viršūnėje, su gumbu tarp dviejų smailių struktūrų.

**13. *biarmata* grupė:**

*Antocha* (*Antocha*) *biarmata* Alexander, 1940

*Antocha* (*Antocha*) *capitella* Alexander, 1941

*Antocha* (*Antocha*) *opalizans* Osten Sacken, 1860

Grupėje esančios trys rūšys išsiskiria dviem apomorfiniais požymiais: (50.1) stačiai nukirsta, tamsi išorinio gonostilio viršūnė, (74.1) dvi sklerotizuotos smailios šoninės paramero-edeaguso struktūros, prisijungusios prie vidurinės edeaguso dalies.

**14. *nebulipennis* grupė:**

*Antocha* (*Antocha*) *arjuna* Alexander, 1969

*Antocha* (*Antocha*) *fortidens* Alexander, 1933

*Antocha* (*Antocha*) *nebulipennis nebulipennis* Alexander, 1931

*Antocha* (*Antocha*) *nebulipennis immaculata* Alexander, 1938

*Antocha* (*Antocha*) *unicollis* Alexander, 1968

Šiai dviejų porūšių ir keturių rūšių grupei būdingi keturi unikalūs apomorfiniai požymiai: (18.5) gonokoksitas trumpas, kūgiškas, (20.1) išilgėjusi gonokoksito viršūnė, (38.6) paramero šoninės struktūros, nesusiliejusios į edeagusą dengiantį apvalkalą, yra plonos, sujungtos edeaguso viršūnėje, (45.1) yra viena arba dvi apvalios skiltys ant kaudalinio devinto tergito krašto, (58.1) išreikštas tamsaus išorinio gonostilio užlinkimas.

**15. *ophioglossa* grupė:**

*Antocha* (*Antocha*) *ophioglossa* Alexander, 1954

*Antocha* (*Antocha*) *ophioglossodes* Alexander, 1968

Ši dviejų rūšių grupė išsiskiria viena apomorfija – (40.6) edeagusas tiesus su dviem siūliškomis ataugomis.

**16. *spiralis* grupė:**

*Antocha* (*Antocha*) *aegina* Alexander, 1970

*Antocha* (*Antocha*) *spiralis* Alexander, 1932

Šiai dviejų rūšių grupei būdingi du apomorfiniai požymiai: (38.8) paramero šoninės struktūros, nesusiliejusios į edeagusą dengiantį apvalkalą, susijungia edeaguso viršūnėje ir susiskaido į susisukusias spirales ir (70.1) išreikšta triskiltė struktūra edeaguso viduje.

**17. *constricta* grupė:**

*Antocha* (*Antocha*) *constricta* Alexander, 1932
*Antocha* (*Antocha*) *incurva* Alexander, 1968
*Antocha* (*Antocha*) *multidentata* Alexander, 1932
*Antocha* (*Antocha*) *quadrifurca* Alexander, 1971
*Antocha* (*Antocha*) *scutifera* Alexander, 1973

Šią penkių rūšių grupę išskiria du apomorfiniai požymiai: (49.1) įstrižai nukirsta, tamsi išorinio gonostilio viršūnė, (69.1) išreikšta pora smulkių ragelių formos arba šakotos struktūros, sujungtos su edeaguso viršūne.

**18. *attenuata* grupė:**

*Antocha* (*Antocha*) *aciculifera* Alexander, 1974
*Antocha* (*Antocha*) *attenuata* Alexander, 1969
*Antocha* (*Antocha*) *exilistyla* Alexander, 1969
*Antocha* (*Antocha*) *gladiata* Alexander, 1974
*Antocha* (*Antocha*) *hyperlata* Alexander, 1968
*Antocha* (*Antocha*) *quadrirhaphis* Alexander, 1971
*Antocha* (*Antocha*) *stenophallus* Alexander, 1974

Šią septynių rūšių grupę nuo kitų išskiria vienas apomorfinis požymis – (91.1) kaspino formos struktūros nesujungtos su edeaguso apvalkalu.

**19. *nigribasis* grupė:**

*Antocha* (*Antocha*) *alexanderi* Oosterbroek, 2009
*Antocha* (*Antocha*) *basivena* Alexander, 1936
*Antocha* (*Antocha*) *khasiensis* Alexander, 1936
*Antocha* (*Antocha*) *latifurca* Alexander, 1969
*Antocha* (*Antocha*) *mysorensis* Alexander, 1974
*Antocha* (*Antocha*) *nigribasis* Alexander, 1932
*Antocha* (*Antocha*) *pallidella* Alexander, 1933
*Antocha* (*Antocha*) *perattenuata* Alexander, 1971
*Antocha* (*Antocha*) *prolixistyla* Alexander, 1971
*Antocha* (*Antocha*) *scelesta* Alexander, 1936
*Antocha* (*Antocha*) *sparsipunctata* Alexander, 1936
*Antocha* (*Antocha*) *yatungensis* Alexander, 1963

Ši rūšių grupė su filogenetiniame medyje matomomis penkiomis rūšimis yra palaikomos vieno apomorfinio požymio – (37.2) falo forma ilgo vingiuoto vamzdžio. Likusios rūšys šiai rūšių grupei priskirtos, remiantis literatūra.

**20. *amblystyla* group**:

*Antocha* (*Antocha*) *amblystyla* Alexander, 1963

*Antocha* (*Antocha*) *curvativa* Lv & Zhang, 2023

Šios dvi rūšys palaikomos vieno apomorfinio požymio – (94.1) išreikštos dvi siūliškos šoninės paramero atšakos.

**21. *saxicola* grupė:**

*Antocha* (*Antocha*) *decurvata* Alexander, 1941

*Antocha* (*Antocha*) *obtusa* Alexander, 1925

*Antocha* (*Antocha*) *saxicola* Osten Sacken, 1860

Šią trijų rūšių grupę išskiria trys apomorfiniai požymiai: (15.1) ant devinto sternito esančios nesklerotizuotos dėmės, (67.1) edeaguso apvalkalas redukuotas į suplotą arba apvaliai iškilią struktūrą, (68.5) edeaguso pagrindas kampuotas.

***Antocha* (*Proantocha*) Alexander, 1919 pogentė**

*Proantocha* pogentė išskirta, remiantis penkiais apomorfiniais požymiais: (18.7) gonokoksitas kampuotas, (21.1) yra šeriuota gonokoksito skiltis, (30.5) trumpesnė už edeagusą vidinė paramero atšaka siaura, truputį kreiva, (46.1) yra dvi trikampės, į vidų nukreiptos skiltys ant užpakalinio devinto tergito krašto, (56.1) šviesaus išorinio gonostilio viršūnė yra išplatėjusi.

**22. *spinifer* grupė:**

*Antocha* (*Proantocha*) *spinifer* Alexander, 1919

*Antocha* (*Proantocha*) *uyei* (Alexander, 1928)

Šiai dviejų rūšių grupei būdingas vienas apomorfinis požymis – (12.1) ant užpakalinės kojos šlaunies galo ir blauzdos pamato esantys gumbai, (84.1) edeaguso viršūnėje yra pora skiltelių.

**23. *sagana* grupė:**

*Antocha* (*Antocha*) *brevistyla* Alexander, 1924

*Antocha* (*Proantocha*) *integra* Alexander, 1940

*Antocha* (*Proantocha*) *latistilus* Torii, 1992

*Antocha* (*Proantocha*) *sagana* Alexander, 1932

Ši keturių rūšių grupė išsiskiria dviem apomorfiniais požymiais: (13.1) devintas sternitas kvadratiškas, (83.1) išreikštos dvi mažos ir apvalios edeaguso apvalkalo struktūros sujungtos su edeagusu.

***Antocha* (*Orimargula*) Mik, 1883 pogentė**

Ši pogentė išskirta, remiantis dviem apomorfiniais požymiais: (18.4) gonokoksitas cilindriškas ir (35.8) paramero pamatinės posterolateralinės ataugos plėviškos.

**24. *longicornis* grupė:**

*Antocha* (*Orimargula*) *almorae* Alexander, 1970

*Antocha* (*Orimargula*) *longicornis* (Alexander, 1921)
*Antocha* (*Orimargula*) *salikensis* Alexander, 1958
*Antocha* (*Orimargula*) *brevisector* Alexander, 1970
*Antocha* (*Orimargula*) *simplex* Alexander, 1970
*Antocha* (*Orimargula*) *brevifurca* Alexander, 1970
*Antocha* (*Orimargula*) *prefurcata* Alexander, 1950
*Antocha* (*Orimargula*) *brevivena* (Edwards, 1928)
*Antocha* (*Orimargula*) *gracilicornis* (Edwards, 1925)
*Antocha* (*Orimargula*) *intermedia* (Edwards, 1928)
*Antocha* (*Orimargula*) *mesocera* Alexander, 1931
*Antocha* (*Orimargula*) *tanycera* Alexander, 1963

Ši grupė grindžiama penkiais apomorfiniais požymiais: (1.1) anteną atlenkus atgal, ji siekia pilvelį, (3.3) antenos segmento forma pailgo vamzdžio, (24.1) išorinis gonostilis ties galu specifiškai lenktas, (30.1) trumpesnė už edeagusą vidinė paramero atšaka siaura, tiesi, viršūnėje išplatėjusi, (59.1) išreikštas šviesaus, labai plono išorinio gonostilio nusmailėjimas į nukirstą viršūnę**.** Filogenetiniame medyje matomos septynios rūšys, likusios penkios šiai rūšių grupei priskirtos, remiantis literatūra.

**25. philippina grupė:**

*Antocha* (*Orimargula*) *australiensis* (Alexander, 1922)
*Antocha* (*Orimargula*) *brevicornis* Alexander, 1960
*Antocha* (*Orimargula*) *hintoni* Alexander, 1967
*Antocha* (*Orimargula*) *indumeni* Alexander, 1956
*Antocha* (*Orimargula*) *kraussi* Alexander, 1955
*Antocha* (*Orimargula*) *melina* Alexander, 1957
*Antocha* (*Orimargula*) *minuscula* Alexander, 1963
*Antocha* (*Orimargula*) *multispina* Alexander, 1956
*Antocha* (*Orimargula*) *nigristyla* Alexander, 1956
*Antocha* (*Orimargula*) *papuensis* Alexander, 1953
*Antocha* (*Orimargula*) *pauliani* Alexander, 1953
*Antocha* (*Orimargula*) *pedekiboana* Lindner, 1958
*Antocha* (*Orimargula*) *philippina* (Alexander, 1917)
*Antocha* (*Orimargula*) *possessiva* Young, 1994
*Antocha* (*Orimargula*) *praescutalis* Alexander, 1936
*Antocha* (*Orimargula*) *quadrispinosa* Alexander, 1963
*Antocha* (*Orimargula*) *schmidi* Alexander, 1958
*Antocha* (*Orimargula*) *setosa* Alexander, 1960
*Antocha* (*Orimargula*) *sparsissima* Alexander, 1974
*Antocha* (*Orimargula*) *tana* Alexander, 1972

*Antocha* (*Orimargula*) *tasmanica* (Alexander, 1928)
*Antocha* (*Orimargula*) *transvaalia* (Alexander, 1921)
*Antocha* (*Orimargula*) *venosa* Alexander, 1964

Filogenetiniame medyje vaizduojama 17 rūšių, priklausančių šiai rūšių grupei, kitos šešios priskirtos, remiantis literatūroje pateiktais požymiais. Ši rūšių grupė išsiskiria trimis apomorfiniais požymiais: (18.1) gonokoksitas išilginto cilindro formos, (61.1) išreikštas šviesaus, išorinio gonostilio įstrižas nusmailėjimas į nukirstą viršūnę, (88.1) išreikštas vidurinės ilgo falosominio vamzdelio dalies susiaurėjimas.

### 3.3. COI geno analizės rezultatai

Molekulinų požymių analizė, kuri vaizduojama 57 disertacijos paveiksle parodė, kad rūšys, kurios yra tarpusavyje panašios morfologiškai, taip pat yra artimos ir pagal COI geno sekas. Dėl duomenų trūkumo pastebima, kad ne visos rūšys ir jų grupės morfologiniame filogenetiniame medyje sutampa su molekuliniais duomenimis grįstu filogenetiniu medžiu.

Genetinis atstumas tarp A kladoje esančių dviejų morfologiškai panašių rūšių *A.* (*A.*) *nebulipennis immaculata* ir *A.* (*A.*) *fortidens* yra 2,47 %. Morfologiniame filogenetiniame medyje šios rūšys taip pat grupuojamos kartu ir priklauso *nebulipennis* rūšių grupei.

Genetinis atstumas tarp kitų morfologiškai labai panašių rūšių *A.* (*A.*) *quadrifurca* ir *A.* (*A.*) *constricta* yra 4,59 %. Genetinis atstumas tarp *A.* (*A.*) *scutifera* ir *A.* (*A.*) *aegina* yra 9,7 %. Nors Alexander (1973) teigia, kad *A.* (*A.*) *scutifera* yra panašesnė į *A.* (*A.*) *quadrifuca*, genetinis atstumas tarp šių rūšių yra didesnis (11,11 %). *A.* (*A.*) *aegina* yra artima dar neaprašytai rūšiai *A.* (*A.*) sp. (genetinis atstumas 7,94 %), šios dvi rūšys labai panašios ir morfologiškai. Genetinis atstumas tarp *A.* (*A.*) *gracillima* ir *A.* (*A.*) sp. yra 10,6 %, o tarp *A.* (*A.*) *gracillima* ir *A.* (*A.*) *scutifera* – 11,21 %. Visos A kladoje esančios rūšys, išskyrus *A.* (*A.*) *gracillima*, morfologiniais požymiais pagrįstame medyje taip pat matomos toje pačioje kladoje. *A.* (*A.*) *gracillima* pagal morfologiją priklauso *gracillima* grupei, *A.* (*A.*) *scutifera*, *A.* (*A.*) *quadrifurca* ir *A.* (*A.*) *constricta* priklauso *constricta* rūšių grupei. Morfologiškai labai panašios rūšys *A.* (*A.*) *aegina* ir *A.* (*A.*) sp. priskirtos *spiralis* grupei.

Tarp kladoje B esančių rūšių *A.* (*O.*) *australiensis* ir *A.* (*A.*) *dilatata* genetinis atstumas yra 12,72 %. Tarp kartu grupuojamų rūšių *A.* (*A.*) *pulchra* ir *A.* (*A.*) *dilatata* genetinis atstumas yra 10,60 %.

Kladoje C esančios *A.* (*A.*) *dentifera* ir *A.* (*A.*) *subconfluenta* yra morfologiškai labai panašios, o genetinis atstumas tarp šių rūšių yra 8,11 %,

pagal morfologinius požymius šios rūšys priklauso *dentifera* grupei. Nors dvi rūšys *A.* (*A.*) *saxicola* ir *A.* (*A.*) *opalizans* morfologiškai labai skiriasi, abi paplitusios Šiaurės Amerikoje, o genetinis atstumas tarp šių rūšių yra 10,23 %. Dvi rūšys *A.* (*A.*) *globulosa* ir *A.* (*P.*) *integra*, nors paplitusios Azijoje, morfologiškai nėra panašios, o genetinis atstumas tarp šių rūšių taip pat didelis – 14,51 %.

Genetinis atstumas tarp kladoje D esančių morfologiškai panašių rūšių *A.* (*A.*) *bella* ir *A.* (*A.*) *koreana* yra 9,7 %, pagal morfologinius požymius abi rūšys priskiriamos *indica* rūšių grupei. Genetinis atstumas tarp *A.* (*A.*) *yeongwola* ir *A.* (*A.*) *satsuma* yra labai mažas – 0,53 %. Visos šios klados rūšys yra paplitusios Azijoje.

Genetinis atstumas tarp kladoje E esančių dviejų labai panašių ir Europoje paplitusių rūšių *A.* (*A.*) *vitripennis* ir *A.* (*A.*) *fulvescens* yra 2,29 %. Nors *A.* (*A.*) *fulvescens* yra *A.* (*A.*) *vitripennis* sinonimas, po atliktos rūšių ribų nustatymo analizės (56 pav.) pastebėta, kad tai skirtingos rūšys, turinčios skirtumų morfologijoje ir paplitime (58 pav.). *A.* (*A.*) *yeongwola, A.* (*A.*) *satsuma, A.* (*A.*) *vitripennis* ir *A.* (*A.*) *fulvescens* pagal morfologinius požymius priklauso *vitripennis* rūšių grupei.

### 3.4. Naujos mokslui rūšys

Rengiant šį darbą, buvo atrastos ir aprašytos dvi naujos mokslui rūšys: *A.* (*A.*) *bella* Markevičiūtė & Podenas, 2019 ir *A.* (*A.*) *pulchra* Markevičiūtė & Podenas, 2021. Taip pat buvo atrasta ir nauja Kinijos faunai rūšis *Antocha* (*Antocha*) *quadrifurca* Alexander, 1971.

## IŠVADOS

1. Remiantis atlikta filogenetine analize nustatyta, kad gentis *Antocha* – tai grupė, turinti tris pogentes: *Antocha* (s. str.), *Orimargula* ir *Proantocha*.
2. Gentis *Antocha* suskirstyta į 25 rūšių grupes, iš kurių 22 aprašytos pirmą kartą.
3. Nustatyta, kad *Antocha* (*Antocha*) *brevistyla* Alexander, 1924 dėl apomorfinių požymių: nedidelės šeriuotos skilties ant gonokoksito pamato, specifinės paramero ir gonokoksito formos, priklauso pogentei *Proantocha*.
4. Vidinės genitalijų struktūros (pamatinės paramero posterolateralinės ataugos, paramero apodema, devinto tergito vagelė), kurios anksčiau nebuvo tirtos ar iliustruotos, leidžia identifikuoti rūšių grupes.

5. Aprašytos dvi naujos mokslui genties *Antocha* rūšys iš Kinijos: *Antocha* (*Antocha*) *bella* Markevičiūtė & Podenas, 2019 ir *Antocha* (*Antocha*) *pulchra* Markevičiūtė & Podenas, 2021.
6. Rūšių ribų nustatymo metodu išsiaiškinta, kad *Antocha* (*Antocha*) *fulvescens* Lackschewitz, 1940 ir *Antocha* (*Antocha*) *vitripennis* (Meigen, 1830) priklauso atskiroms rūšims, o ne vienai, kaip manyta anksčiau.

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## LIST OF PUBLICATIONS ON THE DISERTATION TOPIC

Publications in journals with an impact factor and referred in the Clarivate Analytics Web of Science database:

1. Markevičiūtė, R., Podenas, S., Saldaitis, A., Bernotienė, R., 2019. A new species of *Antocha* Osten Sacken, 1860 (Diptera: Limoniidae) from Sichuan, China. *Zootaxa* 4661: 118-132. ISSN 1175-5326 (print edition), ISSN 1175-5334 (online edition). DOI: 10.11646/zootaxa.4661.1.5.
2. Markevičiūtė, R., Podenas, S. & Saldaitis, A., 2021. New *Antocha* Osten Sacken (Diptera: Limoniidae) from Sichuan, China. *Zootaxa* 4969 (2): 280–292, ISSN 1175-5326 (print edition), ISSN 1175-5334 (online edition). DOI: 10.11646/zootaxa.4969.2.3.

## LIST OF CONFERENCE PRESENTATIONS ON THE SUBJECT OF THE DISSERTATION

1. Markevičiūtė, R., 2017. Šeimos Limoniidae (Diptera: Nematocera) įvairovė Lietuvoje. *XI-oji nacionalinė mokslinė konferencija „Lietuvos biologinė įvairovė: būklė, struktūra, apsauga“*. Vilnius, Lietuva.
2. Markevičiūtė, R., 2018. Biodiversity of family Limoniidae (Diptera: Nematocera) in Lithuania and genus *Antocha* Osten Sacken, 1860. *2nd International Conference SmartBio*. Kaunas, Lithuania.
3. Markevičiūtė, R., 2020. A new species of *Antocha* Osten Sacken, 1860 (Diptera: Limoniidae) from Sichuan, China. *The 62nd International Scientific Conference of Daugavpils University*; Daugavpils, Latvia.
4. Markevičiūtė, R., Podėnas S., 2020. Genties *Antocha* Osten Sacken, 1860 (Diptera, Limoniinae) rūšinė įvairovė. *13-oji Jaunųjų mokslininkų konferencija "BIOATEITIS: gamtos ir gyvybės mokslų perspektyvos"*. 4 Gruodžio 2020, Vilnius.
5. Markevičiūtė, R., 2021. New to science species of the genus *Antocha* Osten Sacken, 1860 (Diptera: Limoniidae). *International conference of life science The (Extra)ordinary COINS 2021*; Vilnius, Lithuania.
6. Markevičiūtė, R., 2021. Species of the genus *Antocha* Osten Sacken, 1860 (Diptera: Limoniidae) in Sichuan (China). *64th International Scientific Conference for Students of Physics and Natural Sciences*; Vilnius, Lithuania.

## AWARDS

1. Research council of Lithuania. Scholarship for academic achievements: 2020 (award no. P-DAP-20-113).
2. European Commission, SYNTHESYS+ project. Internship at the Natural History Museum, London: 2020 (award no. GB-TAF-8233).

# CURRICULUM VITAE

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**2022 – 2023** Methodologist, Department of Natural and Ecological Education, Lithuanian Centre of non-formal youth education, Vilnius, Lithuania.
**2023 – Present** Lecturer, Life Sciences Center, Vilnius University.
**2023 – Present** Researcher at "Divaks" company Vilnius, Lithuania.

**Main Research Areas**
Investigation of morphological features of the genus *Antocha* for comparative morphology, taxonomic and phylogenetic analysis; examination of type and non-type specimens, crane flies identification based on PCR methods.

**Scholarships**
**2020** Scholarship for High Academic Achievements from Research Council of Lithuania.

**Internships**
**2020.09.27 – 2020.10.22** Natural History Museum, London: revision, systematics, and phylogenetic analysis of the museum's genus *Antocha* Osten Sacken, 1860 (Diptera: Limoniidae) specimens.

**Language Proficiency**
Lithuanian (native), English (fluent).

**Scientific Publications**
Markevičiūtė, R., Rintala, T., 2015. New species of plant bugs (Heteroptera, Miridae) in Lithuanian fauna, registered in 2014–2015. *New and Rare for Lithuania Insect Species*. *Records and Descriptions of 2015*. 27:15–17.

Markevičiūtė, R., 2015. Panevėžio rajono Žaliosios girios žolblakių (Heteroptera: Miridae) rūšys. *Lietuvos Biologinė įvairovė: būklė, struktūra, apsauga IV tomas, mokslo straipsnių rinkinys*. Lietuvos edukologijos universiteto leidykla, Vilnius, 2016: 63–70.
Markevičiūtė, R., 2016. Plant bug *Bryocoris pteridis* (Heteroptera: Miridae) new species in Lithuanian fauna. *New and Rare for Lithuania Insect Species. Records and Descriptions of 2016*. 28: 19–20.
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Markevičiūtė, R., 2019. *Idiocera* (*Idiocera*) *sziladyi* (Lackschewitz, 1940) (Diptera: Limoniidae) – new species in Lithuanian fauna. *Bulletin of the Lithuanian Entomological Society* 3(31): 105–107.
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Markevičiūtė, R., 2021. A new record of the *Cymus melanocephalus* Fieber, 1861 (Heteroptera: Cymidae) from Lithuania. *Bulletin of the Lithuanian entomological society*, 5, 17–19.

**External Professional Activities**
**2015 – Present** Member of Lithuanian Entomological Society.

GYVENIMO APRAŠYMAS

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**Išsilavinimas**
**2017–2023 m.**, doktorantūros studijos – zoologija, Gamtos tyrimų centras ir Vilniaus universitetas, Vilnius, Lietuva.
**2015–2017 m.**, magistrantūros studijos – zoologija, Gamtos mokslų fakultetas, Vilniaus universitetas, Vilnius, Lietuva.
**2011–2015 m.**, bakalauro studijos – biologija, Gamtos mokslų fakultetas, Vilniaus universitetas, Vilnius, Lietuva.

**Darbo patirtis**
**2015–2022 m. –** biologė, Entomologijos laboratorija, Gamtos tyrimų centras, Vilnius, Lietuva.
**2022–2023 m. –** metodininkė, Gamtinio ir ekologinio ugdymo skyrius, Lietuvos mokinių neformaliojo švietimo centras, Vilnius, Lietuva.
**2023 m. – iki dabar** lektorė, Gyvybės mokslų centras, Vilniaus universitetas, Vilnius, Lietuva.
**2023 m. – iki dabar** – mokslo darbuotoja, UAB „Divaks“, Vilnius, Lietuva.

**Pagrindinės tyrimų sritys**
Vabzdžių morfologinių požymių analizė, filogenetinė analizė, taksonomija, tipinių ir netipinių egzempliorių tyrimai, rūšių identifikavimas pagal morfologiją ir molekuliniais metodais.

**Stipendijos**
**2020 m. –** Lietuvos mokslo tarybos skatinamoji stipendija už akademinius pasiekimus.

**Mokslinės stažuotės**
**2020.09.27–2020.10.22** Londono gamtos istorijos muziejus.Genties *Antocha* Osten Sacken,1860 (Diptera: Limoniidae) egzempliorių peržiūra, sistematika ir filogenetinė analizė.

**Kalbos mokėjimas**
Lietuvių kalba (gimtoji), anglų kalba (laisvai).

**Mokslinės publikacijos**
Markevičiūtė, R., Rintala, T., 2015. New species of plant bugs (Heteroptera, Miridae) in Lithuanian fauna, registered in 2014–2015. *New and Rare for Lithuania Insect Species*. *Records and Descriptions of 2015*. 27:15–17.
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(Heteroptera: Miridae) rūšys. *Lietuvos Biologinė įvairovė: būklė, struktūra, apsauga IV tomas, mokslo straipsnių rinkinys*. Lietuvos edukologijos universiteto leidykla, Vilnius, 2016: 63–70.
Markevičiūtė, R., 2016. Plant bug *Bryocoris pteridis* (Heteroptera: Miridae) new species in Lithuanian fauna. *New and Rare for Lithuania Insect Species. Records and Descriptions of 2016*. 28: 19–20.
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**Papildoma profesinė veikla**
**2015 m. – iki dabar –** Lietuvos entomologų draugijos narė.

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