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Braconid wasps of subfamily Alysiinae (Hymenoptera: Braconidae) as endoparasitoids of *Selachops flavocinctus* Wahlberg, 1844 (Diptera: Agromyzidae) in the Central Urals, Russia

TATIANA S. KOSTROMINA[1], ALEXANDER V. TIMOKHOV[2] & SERGEY A. BELOKOBYLSKIJ[3,4]

[1]*Sverdlovsk Regional Museum of Local Lore, Gorky Street, 4, Yekaterinburg 620151, Russia. E-mail: Kostromina_TS@mail.ru*
[2]*Department of Entomology, M.V. Lomonosov Moscow State University, Vorobyevy Gory, Moscow 119991, Russia. E-mail: atimokhov@mail.ru*
[3]*Zoological Institute, Russian Academy of Sciences, St. Petersburg 199034, Russia; Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw 00–679, Poland. E-mail: doryctes@gmail.com*
[4]*Corresponding author*

Abstract

The Agromyzidae fly *Selachops flavocinctus* Wahlberg, 1844 as host of the Alysiinae genera *Asyntactus* Marshall, 1898 (Alysiini) and *Protochorebus* Perepechaenko, 1997 (Dacnusini) is recorded for the first time. A new species from Central Urals, *Protochorebus pervushini* **sp. nov.**, is described and illustrated. The new material for *Asyntactus rhogaleus* Marshall, 1898 is studied. A key to *Protochorebus* species is provided. Description of puparium of *Selachops flavocinctus* and new data on its life history are published for the first time.

Key words. Hymenoptera, Braconidae, Alysiinae, Diptera, Agromyzidae, endoparasitoid of fly, mining larva, puparium, new host, new species, Central Urals

Introduction

Braconid wasps of the subfamily Alysiinae are exclusively endoparasitoids of different dipteran families with adults emerging from the fly's puparium. The subfamily consists of two large tribes, Alysiini and Dacnusini, separated by diagnostic characters such as the presence or absence of the second radiomedial (r-m) vein in fore wing and in many cases the small (3) or large (4–6) number of the mandibular teeth. At present, a modern reclassification of subfamily Alysiinae is needed (Wharton, 1994; Perepechaenko, 2000) because several intermediate taxa are known in both tribes, and because new valuable information about composition and morphological characters of taxa has arisen during last several dozens of years, as well as published molecular phylogenetic studies (Gimeno *et al.*, 1997; Wharton *et al.*, 2006).

Members of the tribe Alysiini have a very wide range of hosts from 29 families of cyclorrhaphous Diptera, predominantly from the families Agromyzidae (more often from the genera *Agromyza* Fallen, 1810, *Cerodontha* Rondani, 1961, *Liriomyza* Mik, 1894 and *Phytomyza* Fallen, 1810), Anthomyiidae (mainly *Delia* Robineau-Desvoidy, 1830 and *Pegomya* Robineau-Desvoidy, 1830), Calliphoridae (often *Calliphora* Robineau-Desvoidy, 1830), Drosophilidae (especially *Drosophila* Fallen, 1823), Muscidae (often *Musca* Linnaeus, 1758), Phoridae (predominantly *Megaselia* Rondani, 1856), Sarcophagidae (mainly *Ravinia* Robineau-Desvoidy, 1863), and Tephritidae (often *Anastrepha* Schiner, 1868) (Yu *et al.*, 2012). On the other hand, the Dacnusini taxa have only been reared from 13 families of Diptera and mainly from the members of the mining dipterous family Agromyzidae (many species from the genera *Agromyza*, *Amauromyza* Hendel, 1931, *Cerodontha*, *Chromatomyia* Hardy, 1849, *Liriomyza* and *Phytomyza*), Chloropidae and Ephydriidae (mainly from the genus *Hydrellia* Robineau-Desvoidy, 1830) (Yu *et al.*, 2012).

In this paper we record two alysiine taxa, *Asyntactus rhogaleus* Marshall, 1898 (Alysiini) and *Protochorebus*

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pervushini **sp. nov.** (Dacnusini), which were reared for the first time from sedge tussock infested by mining dipterous larvae of *Selachops flavocinctus* Wahlberg, 1844 (Agromyzidae) in the Urals. Also, we publish for the first time information about the immature stages of the rare agromyzid species *Selachops flavocinctus* Wahlberg, 1844.

Material and methods

The study of host-parasitoid interactions is based upon field investigations which were augmented by laboratory observations. For the most part insects were collected by sweeping on shore vegetation (Fig. 1), mainly on sedge in May 2008–2015. To breed mining flies and their parasitoids, tussocks of sedge *Carex acuta* Linnaeus, 1753 were dug out. Each sedge tussock, including remnants of basal vegetative plant parts of last season with part of the root system and the clod of earth (1–3 L), was put into individual 50 L plastic bags and placed into a cool room at 10 ± 5°C. Tussocks, including culms, blades and roots of sedge and surrounding soil, were carefully examined for any dipteran puparia, which were sorted in accordance with their size and characters. Each puparium was placed into an individual 50 mL glass jar lined with moist filter paper and covered with cotton cloth enabling ventilation.

FIGURE 1. View of spring shore vegetation aspect on Verkh-Isetsk pond (Yekaterinburg City).

Parasitoids of both *Asyntactus rhogaleus* and *Protochorebus pervushini* were reared only from the dipteran puparia of a certain morphotype (Fig. 37) belonging to agromyzid flies, *Selachops flavocinctus*.

Some *Selachops* puparia were preserved in 70% ethanol. Their ultrastructures were subsequently examined under a Jeol JSM-6380 scanning electron microscope (SEM) after critical point drying (Hitachi HCP-2) of the specimens and sputter coating with gold (Giko JSM-6380).

The terminology employed for morphological features and measurements follows Belokobylskij & Maetô (2009). Wing venation nomenclature follows Belokobylskij & Maetô (2009), with van Achterberg's (1993) terminology shown in parentheses. The system suggested by Perepechaenko (2010) was used for designation of mandible teeth in Alysiinae.

Photographs were taken with a Leica IC 3D digital camera mounted on a Leica® MZ16 microscope and using the Leica Application Suite® imaging system (Museum and Institute of Zoology PAN, Warsaw, Poland).

The holotype and most paratypes of the new species are preserved in the Zoological Institute of the Russian

Academy of Sciences (St Petersburg, Russia, ZISP), several paratypes are in the collection by T.S. Kostromina (TK).

Taxonomy

Order Hymenoptera

Family Braconidae

Subfamily Alysiinae

Asyntactus Marshall, 1898

Asyntactus Marshall, 1898: 240; Shenefelt, 1974: 982; Tobias, 1986: 157; Belokobylskij & Kostromina, 2011: 90; Yu *et al.*, 2012.
Type species: *Asyntactus rhogaleus* Marshall, 1898.

This is rare monotypic Western Palaearctic genus of the tribe Alysiini which is recorded in several Western European countries (Yu *et al.*, 2012) and only recently (Belokobylskij & Kostromina, 2011) was found in the Central Urals. Study of a large amount of material from the local population allowed us to discover significant variation of sculpture and colouration in *A. rhagoleus* Marshall, 1898, and as result we synonymized *Asyntactus sigalphoides* Marshall, 1898 with the type species of this genus (Belokobylskij & Kostromina, 2011). The agromyzid fly *Selachops flavocinctus* Wahlberg, 1844 is host record for this genus for the first time.

Asyntactus rhogaleus Marshall, 1898
(Figs 2–9)

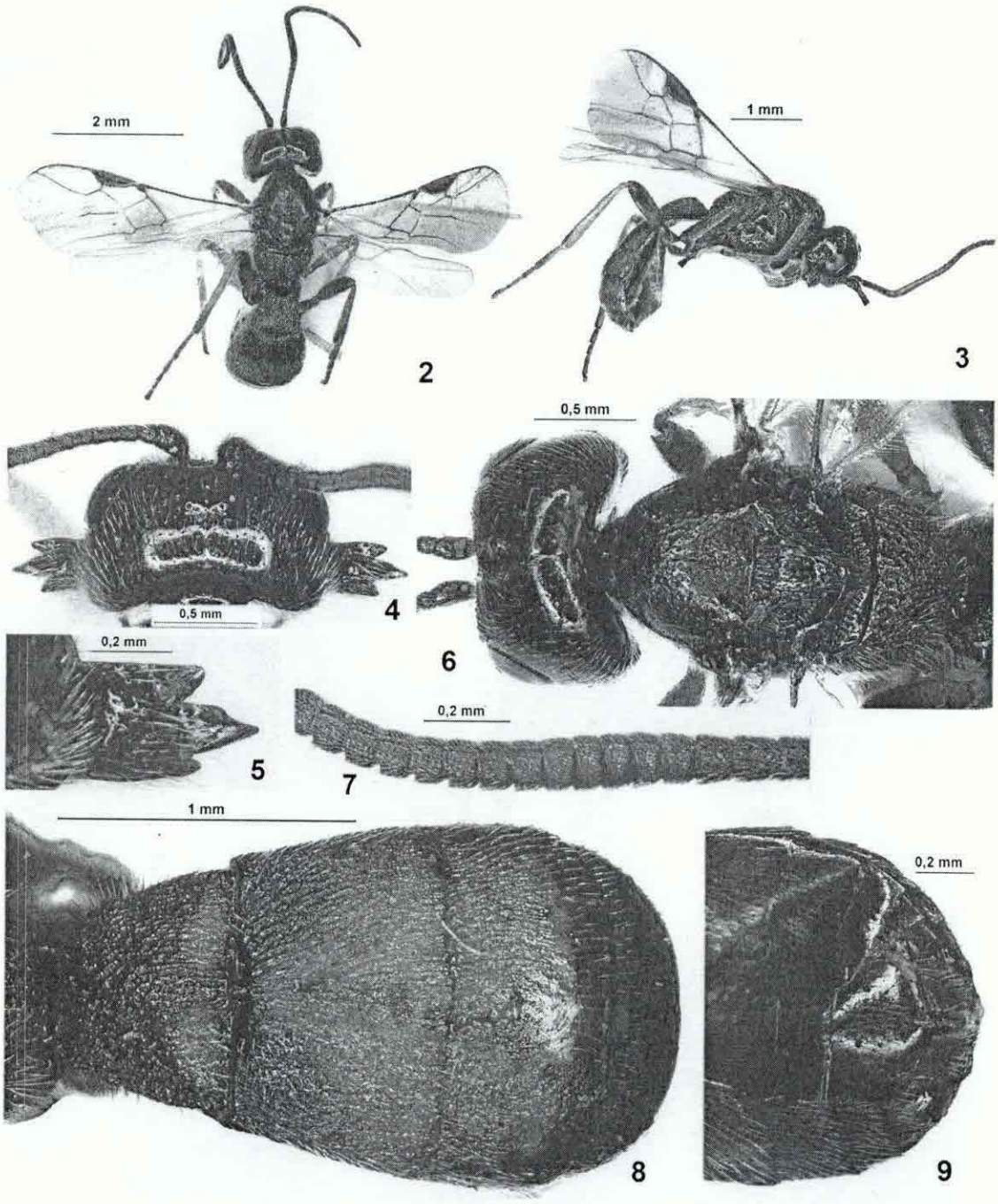
Asyntactus rhogaleus Marshall, 1898: 240; Fischer, 1971: 72; Shenefelt, 1974: 982; Tobias, 1986: 157; Belokobylskij & Kostromina, 2011: 90; Yu *et al.*, 2012.
Asyntactus sigalphoides Marshall, 1898: 241; Fischer, 1971: 74; Shenefelt, 1974: 982; Belokobylskij & Kostromina, 2011: 90 (as synonym); Yu *et al.*, 2012.

Material examined. Russia: 4 males, Middle Urals, Yekaterinburg City, outskirts of Verkh-Isetsk pond, Baran I., sweeping on shore vegetation, mainly on sedge, 11.V.2008 (T. Kostromina); 36 females, 115 males, same locality, sweeping on tussock of sedge, 11–19.V.2009 (T. Kostromina); 1 female, 23 males, same locality, on tussock of sedge (young caules with blades), 11–14, 19.V.2009 (T. Kostromina); 7 females, 26 males, same locality, sweeping on sedge, 10–15.V.2011 (T. Kostromina); 4 females, 4 males same label, but 18.V.2011; 1 female, "Russia, Middle Urals, Yekaterinburg City outskirts, Verkh-Isetsk pond, Baran Island, T. Kostromina, A. Pervushin", "Rearing from tussock of *Carex* 7.05.2013"; 1 male, same first label, "[1] Rearing from tussock of *Carex* 6.05.2013"; 1 female, 1 male, same first label, "[1] Rearing from tussock of *Carex* 7.05.2013"; 1 male, same first label, "[2] Rearing from tussock of *Carex* 6.05.2013"; 1 female, same first label, "[3] Rearing from tussock of *Carex* 6.05.2013"; 1 male, same first label, "[4] Rearing from tussock of *Carex* 6.05.2013"; 1 male, "Russia, Middle Urals, Yekaterinburg City outskirts, Verkh-Isetsk pond, Baran Island, T. Kostromina, A. Timokhov", "[7] Rearing from tussock of *Carex* 12.05.2014. Tussock collected 30.04.2014."; 1 male, same first label, "[9] Rearing from tussock of *Carex* 8.05.2014. Tussock collected 30.04.2014"; 1 female, same first label, "[11] Rearing from tussock of *Carex* 8.05.2014. Tussock collected 30.04.2014"; 1 female, 1 male, same first label, "[12] Rearing from tussock of *Carex* 8.05.2014. Tussock collected 30.04.14"; 1 female, same first label, "[17] Rearing from pupa of *Selachops flavocinctus* (Agromyzidae) 6.05.2014"; 1 male, same first label, "[27–3]. Tussock collected 1.05.2014" (no rearing, but parasitoid was discovered after puparium opening); 1 male, same first label, "[3–2] Rearing from pupa of *Selachops flavocinctus* (Agromyzidae) 6.05.2015"; 1 female, same first label, "[4–2] Rearing from pupa of *Selachops flavocinctus* (Agromyzidae) 8.05.2015"; 1 male, same first label, "[9–2]. Tussock collected 3.05.2015" (no rearing, but parasitoid was discovered after puparium opening); 1 male, same first label, "[7–3]. Tussock collected 3.05.2015." (no rearing, but parasitoid was discovered after puparium opening); 1 female, 1 male, same

first label, "parasitoid was discovered after puparium opening found in sedge culm, collected 13.09.2015, T. Kostromina".

Host. *Selachops flavocinctus* Wahlberg, 1844 (Diptera: Agromyzidae) (**first record**).

Distribution. Austria, Finland, Germany, Poland, Russia (Urals Mts), Switzerland.



FIGURES 2–9. *Asyntactus rhogaleus* Marshall (female). 2. Habitus, dorsal view. 3. Habitus, lateral view. 4. Head, dorsal view. 5, Mandible. 6. Head and mesosoma, dorsal view. 7. Median segments of antenna. 8. Metasoma, dorsal view. 9. Apical part of metasoma and ovipositor, ventral view.

Protochorebus Perepechayenko, 1997

Perepechayenko, 1997: 94; Tobias, 1998: 411; Yu *et al.*, 2012.
Type species: *Protochorebus kasparyani* Perepechayenko, 1997.

This previously monotypic genus with type species *P. kasparyani* Perepechayenko, 1997, has been recorded from the south-east of Ukraine (Donetsk and Lugansk Provinces) (Perepechaenko, 1997, 2000), Eastern Siberia of Russia (Zabaykal'sk Territory) (Perepechaenko, 1997; Tobias, 1998) and Mongolia (Papp, 2004). A second species of this genus from the Central Urals is described here. The agromyzid fly *Selachops flavocinctus* Wahlberg, 1844 is a host record for this genus for the first time.

Protochorebus pervushini sp. nov.

(Figs 10–23)

Type material. Holotype: female, Middle Urals, Ekaterinburg City outskirts, Verkh-Isetsk pond, Baran Island, sweeping on sedge, 25.V.2015, T. Kostromina coll. (ZISP).

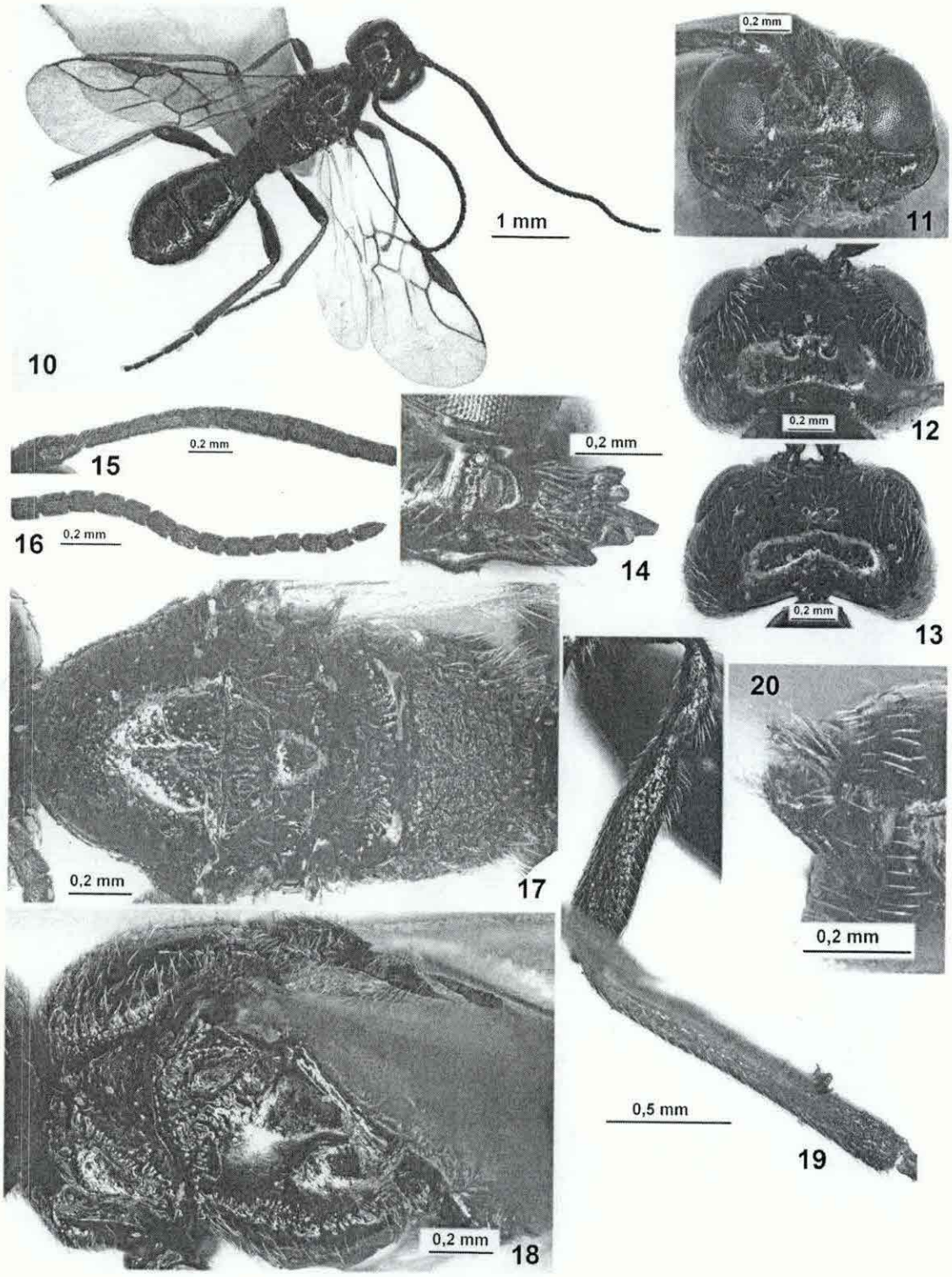
Paratypes. 1 female, 5 males, same label as holotype (ZISP, TK); 1 male, same locality, 14.V.2009 (ZISP); 1 female, 13 males, same locality, 19.V.2009 (ZISP, TK); 1 female, 4 males, same locality, 10–15.V.2011 (ZISP, TK); 1 male, same locality, reared from sedge tussock infested by *Selachops flavocinctus* (Agromyzidae), 7.V.2013 (ZISP); 2 females (one damaged), same locality, from sedge tussock infested by *Selachops flavocinctus* (Agromyzidae), collected 30.IV.2014, reared 12.V.2014 (ZISP); 1 male, same locality, from sedge tussock infested by *Selachops flavocinctus* (Agromyzidae), collected 1.V.2014, reared 11.V.2014 (ZISP); 1 male, same locality, "[9–8] Reared from pupa of *Selachops flavocinctus* (Agromyzidae) 12.05.2015, sedge tussock collected 3.V.2015" (TK).

Description. Female (Fig. 10). Body length 3.3–4.7 mm; fore wing length 3.0–3.6 mm.

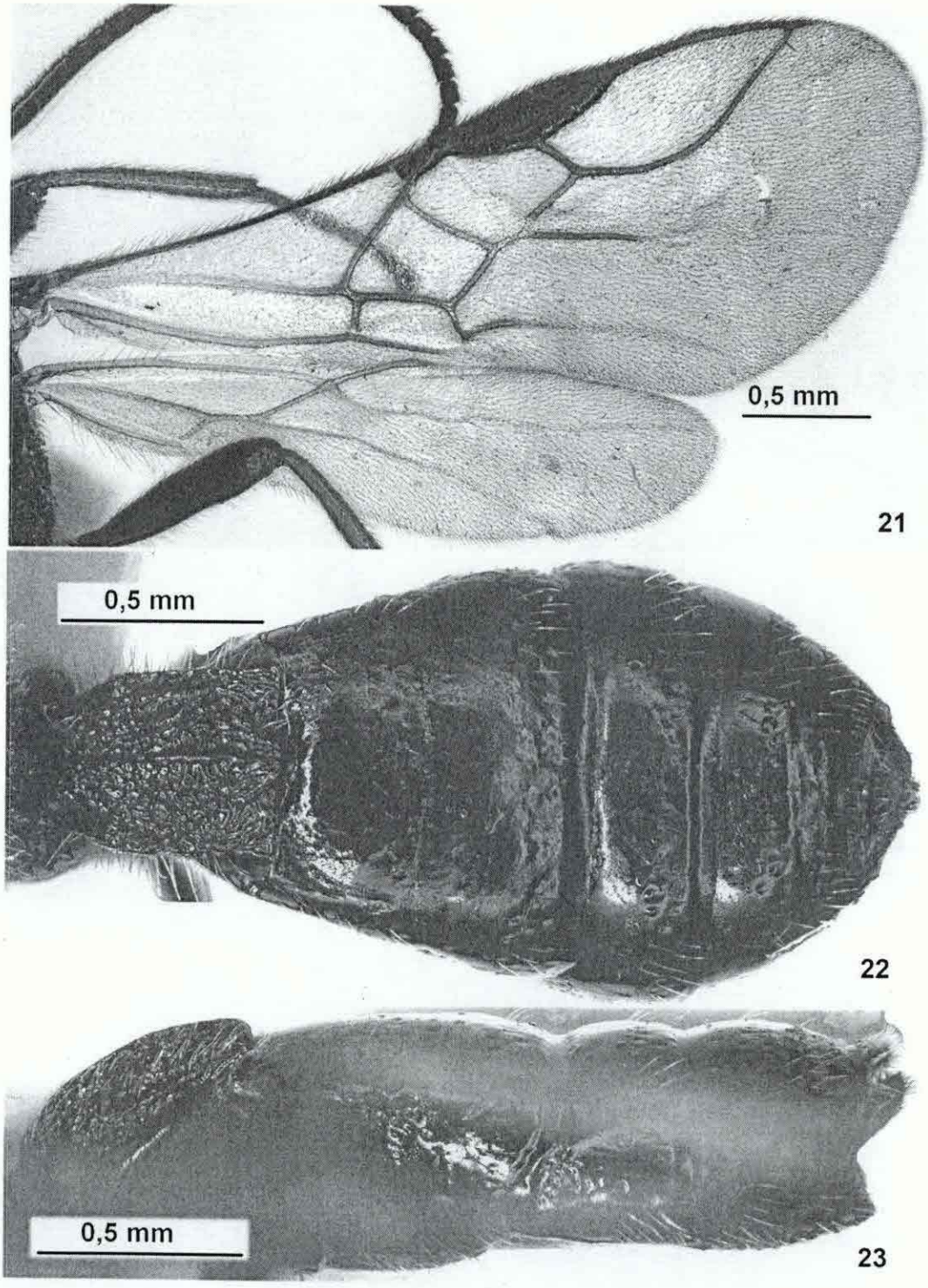
Head (Fig. 12) behind eyes (dorsal view) evenly and more or less distinctly widened anteriorly, roundly narrowed posteriorly, 1.7–1.8 × as wide as median length, about 1.5 × as wide as maximum length, 1.40–1.45 × as wide as mesoscutum. Occiput medially distinctly concave. Frons with shallow and rather wide median longitudinal furrow in posterior half. Temple 1.1 × as long as transverse diameter of eye (1.3 × if measured in a straight line). Ocelli arranged in almost equilateral triangle. POL 1.5–1.6 × OD, 0.3–0.4 × OOL. Eyes glabrous, 1.2–1.3 × as high as broad. Face (Fig. 11) width equal to height of eye, 1.5–1.7 × median height of face. Width of clypeus 2.5 × its median height. Mandible (Fig. 14) weakly widened towards subapex, its median length 1.5–1.7 × maximum subapical width; with five teeth, formula of its teeth 1b+2b+3 (three main teeth and two, lower first and lower second, additional teeth). Upper tooth rather short, wide, weakly outstanding, subrectangular, apically with distinct median excavation dividing apex into two obtuse teeth. Median tooth long, rather narrow, almost straight, (sub)pointed apically, slightly direct outward, submedially with small obtuse additional ventral tooth. Excision between upper and median teeth not deep and narrow. Lower tooth short, rather wide, slightly direct outward, subpointed.

Antenna (Figs 15, 16) rather thick but narrowed apically, weakly fusiform in basal one-third and here with transverse segments, with subsquare or weakly elongate segments in apical half, 42-segmented, about 0.9 × as long as body. Scape 1.6–1.8 × longer than its maximum width. First flagellar segment 2.0–2.3 × longer than its apical width, 1.3–1.4 × longer than second segment. Transverse flagellar segments situated in basal third (dorsal view) 1.3–1.4 × wider medially that their length. Penultimate segment 1.3–1.4 × longer than wide, 0.4 × as long as first flagellar segment, 0.7 × as long as apical segment. Last (apical) segment more or less pointed apically but without spine.

Mesosoma (Figs 17, 18) 1.5–1.6 × longer than height. Pronotum with deep pronope. Mesonotum with distinct median longitudinal and weakly crenulate depression in posterior half, 0.85–0.90 × as long as maximum width. Notauli deep and crenulate in anterior 0.3–0.4, shallow submedially, absent in posterior half. Prescutellar depression deep, coarsely crenulate (with five to six carinae), 0.3–0.4 × as long as the convex scutellum. Metanotum with distinct median longitudinal carina (dorsal view) transformed posteriorly in short, wide and obtuse tooth (lateral view). Precoxal sulcus (sternaulus) (Fig. 18) wide, deep, sinuate, strongly rugose-crenulate, reaching anterior and posterior margins of mesopleuron. Subalar depression rather shallow, wide, coarsely striate. Metapleural flange wide, short and obtuse. Propodeal spiracles very small and subround.



FIGURES 10–20. *Protochorebus pervushini* **sp. nov.** (10–12, 14–20, female, holotype; 13, male, paratype). 10. Habitus, dorsal view. 11. Head, front view. 12, 13. Head, dorsal view. 14, Mandible. 15. Basal segments of antenna. 16. Apical segments of antenna. 17. Mesosoma, dorsal view. 18. Mesosoma, lateral view. 19. Hind femur and tibia. 20. Ovipositor, lateral view.



FIGURES 21–23. *Protochorebus pervushini* **sp. nov.** (female, holotype). 21. Fore and hind wings. 22. Metasoma, dorsal view. 23. Metasoma, lateral view.

Wings (Fig. 21). Fore wing 2.5–2.7 × longer than wide. Pterostigma short and wide, 3.5–4.0 × longer than its maximum width. Radial (marginal) cell distinctly shortened, finishing far from apex of wing. Metacarp (1-R1) 0.85–0.90 × as long as pterostigma, 1.9–2.0 × longer than distance from apex of radial (marginal) cell to apex of wing. Radial (r) vein arising somewhat before or nearly middle of pterostigma; inner anterior margin of pterostigma 0.9 × as long as its inner posterior margin. Second radial abscissa (SR1+3-SR) evenly curved, almost straight in posterior third. First radial abscissa (r) 0.2 × as long as second abscissa (SR1+3-SR) (if measured on straight line). Recurrent (m-cu) vein strongly antefurcal. First abscissa of longitudinal anal vein (1-1A) weakly evenly curved submedially. Distance between basal vein (1-M) and nervulus (cu-a) 0.6 × nervulus (cu-a) length. Brachial (first subdiscal) cell weakly widened to apex, widely open apically. Parallel vein (CU1a) arising behind middle of apical margin of brachial (first subdiscal) cell. Hind wing 3.8–4.0 × longer than its maximum width. First costal abscissa (C+SC+R) 0.8–0.9 × as long as second abscissa (1-SC+R). First abscissa of mediocubital vein (M+CU) 3.0–3.7 × longer than second abscissa (1-M).

Legs. Hind femur (Fig. 19) 3.8–4.4 × longer than its maximum width. Hind tarsus 0.85–0.90 × as long as hind tibia. Hind basitarsus 0.55–0.60 × as long as second-fifth segments combined. Second segment of hind tarsus 0.6 × as long as hind basitarsus, 1.3–1.4 × longer than hind fifth segment (without pretarsus).

Metasoma (Figs 22, 23) more or less elongated, weakly depressed, 2.6–2.8 × longer than its maximum width, 0.9–1.0 × as long as head and mesosoma combined. First tergite distinctly widened from base to spiracles, then almost parallel-sided, with wide dorsope, with distinct dorsal carinae fused basally and medially following till apex of tergite as single carina. Length of first tergite 1.3–1.5 × its apical width; apical width 1.6–1.9 × its basal width. Second tergite medially 0.5 × as long as basal width, 0.8–0.9 × as long as third tergite. Median length of second and third tergites 1.0–1.4 × its basal width, 0.7–1.0 × its apical width. Second suture very weak. Second-sixth tergites without separated laterotergites. Ovipositor sheath (Fig. 20) very short, usually not or sometimes weakly protruding behind tip of metasoma, about as long as third segment of hind tarsus.

Sculpture and pubescence. Head mainly smooth, face finely punctate, clypeus almost smooth. Mesoscutum mainly smooth, finely rugulose-punctate anteriorly, sometimes partly with very fine granulation. Scutellum entirely smooth. Mesopleuron mainly smooth. Propodeum coarsely and densely rugose-reticulate with additional dense and fine granulation, with high median longitudinal carina. First tergite entirely densely rugose-reticulate with additional fine granulation. Remaining tergites smooth. Vertex entirely and mesoscutum almost entirely covered by dense pale short setae. Propodeum, metapleuron and first metasomal tergites almost entirely covered by long and rather dense pale setae. Hind coxa dorsally in long and rather dense pale setae not forming bunch. Third to sixth tergites with two-three lines of transverse pale setae in their posterior thirds. Sheath of ovipositor with cluster of dense setae apically.

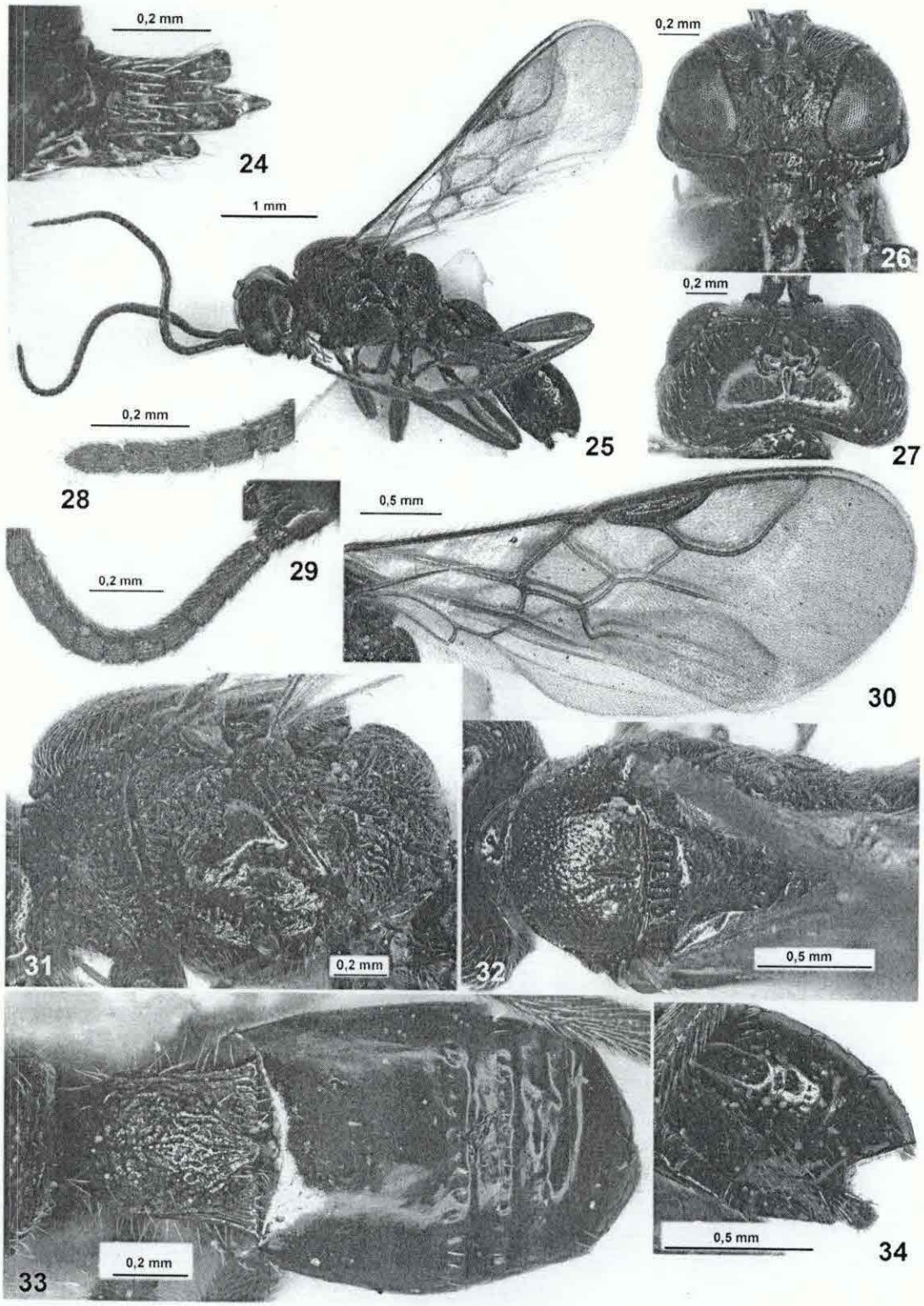
Colour. Body mainly black, metasoma partly with reddish tint, its sternites reddish brown on wide areas. Mandible reddish brown to dark reddish brown, almost black basally. Palpi reddish yellow, darker basally. Antenna mainly black, two basal segments reddish brown to dark reddish brown. Tegula almost black. Fore leg light reddish brown, fore coxa and trochanter brown to black; middle coxa, trochanter, trochantellus and basal half of femur dark brown to black, apical half of femur, tibia and tarsus (except dark apical segment) light reddish yellow with infuscation; hind coxa, trochanter and femur black, trochantellus and tibia mainly light reddish brown or reddish brown, apex of hind tibia and tarsus dark reddish brown. Fore wing faintly infuscate; veins brown to dark brown, but basally mainly brownish yellow or yellow. Pterostigma entirely dark brown.

Male. Body length 3.7–5.1 mm; fore wing length 3.4–4.1 mm. Temple (Fig. 13) 1.2–1.3 × longer than transverse diameter of eye (1.4–1.7 × if measured on straight line). Antennae thickened, weakly setiform, 45–52-segmented, 1.0–1.1 × as long as body. Submedian antennal segments about as long as their maximum width. Mesoscutum sometimes with longitudinal striation in submedian area. Pterostigma 4.2–5.3 × longer than its maximum width. First radial abscissa 0.8–1.0 × as long as first radiomedial vein. Hind femur 4.0–4.3 × longer than its maximum width. Metasoma narrow, sometimes second and third tergites brownish. First tergite often weakly narrowed from spiracular tubercles towards apex or subparallel, its apical width 0.85–1.2 × width at level of spiracles, 1.4–1.8 × minimum width; length 1.5–1.6 × its apical width. Otherwise similar to female.

Etymology. This species is named in honour of Artem A. Pervushin (Yekaterinburg), who prematurely passed away, and who helped very much during Braconidae study of the first author.

Host. *Selachops flavocinctus* Wahlberg, 1844 (Diptera: Agromyzidae).

Distribution. Russia (Middle Urals).



FIGURES 24–34. *Protochorebus kasparyani* Perepechaenko (female, holotype). 24. Mandible. 25. Habitus, dorsal view. 26. Head, front view. 27. Head, dorsal view. 28. Apical segments of antenna. 29. Basal segments of antenna. 30. Fore and hind wings. 31. Mesosoma, lateral view. 32. Mesosoma, dorsal view. 33. Metasoma, dorsal view. 34. Apex of metasoma and ovipositor, lateral view.

Comparative diagnosis. The differences between new species *P. pervushini* **sp. nov.** and type species of this genus, *P. kasparyani* Perepechaenko (Figs 24–34), are shown in the key below:

1. Upper (first) tooth of mandible compound, with additional distinct tubercle below (Fig. 14). Mesoscutum of female partly finely punctate, its median posterior furrow rather long (Fig. 17). Dorsal tooth of metanotum (lateral view) short (Fig. 18). Recurrent vein (m-cu) of fore wing less strongly antefurcal, about 2.0 × longer than second abscissa of medial vein (2-SR+M) (Fig. 21). Second radial abscissa (SR1+3-SR) of fore wing not sinuate in apical half (Fig. 21). Hind femur black (Fig. 19). Body length 3.3–5.1 mm ..... *P. pervushini* **sp. nov.** (Figs 10–23)
   Upper (first) tooth of mandible simple, without additional tubercles (Fig. 24). Mesoscutum of female mainly distinctly punctate, its median posterior furrow rather short (Fig. 32). Dorsal tooth of metanotum (lateral view) long (Fig. 31). Recurrent vein (m-cu) of fore wing strongly antefurcal, 1.3–1.5 × longer than second abscissa of medial vein (2-SR+M) (Fig. 30). Second radial abscissa (SR1+3-SR) of fore wing more or less distinctly sinuate in apical half (Fig. 30). Hind femur light reddish brown (Fig. 25). Body length 4.2–4.4 mm ..... *P. kasparyani* Perepechaenko, 1997 (Figs 24–34)

Based on the shape and structure of mandibles, *P. pervushini* **sp. nov.** resembles *Chorebus* (*Pentalexis*) *mysteriosus* Perepechaenko, 2004, described from two males from Zabaykal'skiy Territory of Russia and separated in the new subgenus mainly on the basis of mandible structure (Perepechaenko, 2004). The differences between these species are shown in the following key:

1. Eyes less strongly convergent below and without setae (Fig. 11). Face distinctly transverse (Fig. 11). Antennal segments in basal third distinctly widened, transverse (Fig. 15). Mesosoma 1.6 × longer than high (Fig. 18). Dorsal tooth of metanotum (lateral view) short (Fig. 18). Metapleuron without oval sculptured area. Hind coxa dorsally without tuft of setae. Radial vein (r) of fore wing arising almost from middle of pterostigma (Fig. 21) ..... *P. pervushini* **sp. nov.**
- Eyes strongly convergent below, with short and sparse setae. Face subsquare. Antennal segments in basal third distinctly narrow, elongate. Mesosoma about twice longer than high. Dorsal tooth of metanotum (lateral view) long. Metapleuron with large oval sculptured area. Hind coxa dorsally with more or less distinct tuft of setae. Radial vein (r) of fore wing arising distinctly before middle of pterostigma ..... *Chorebus* (*Pentalexis*) *mysteriosus* Perepechaenko, 2004

Order Diptera

Family Agromyzidae

Subfamily Phytomyzinae

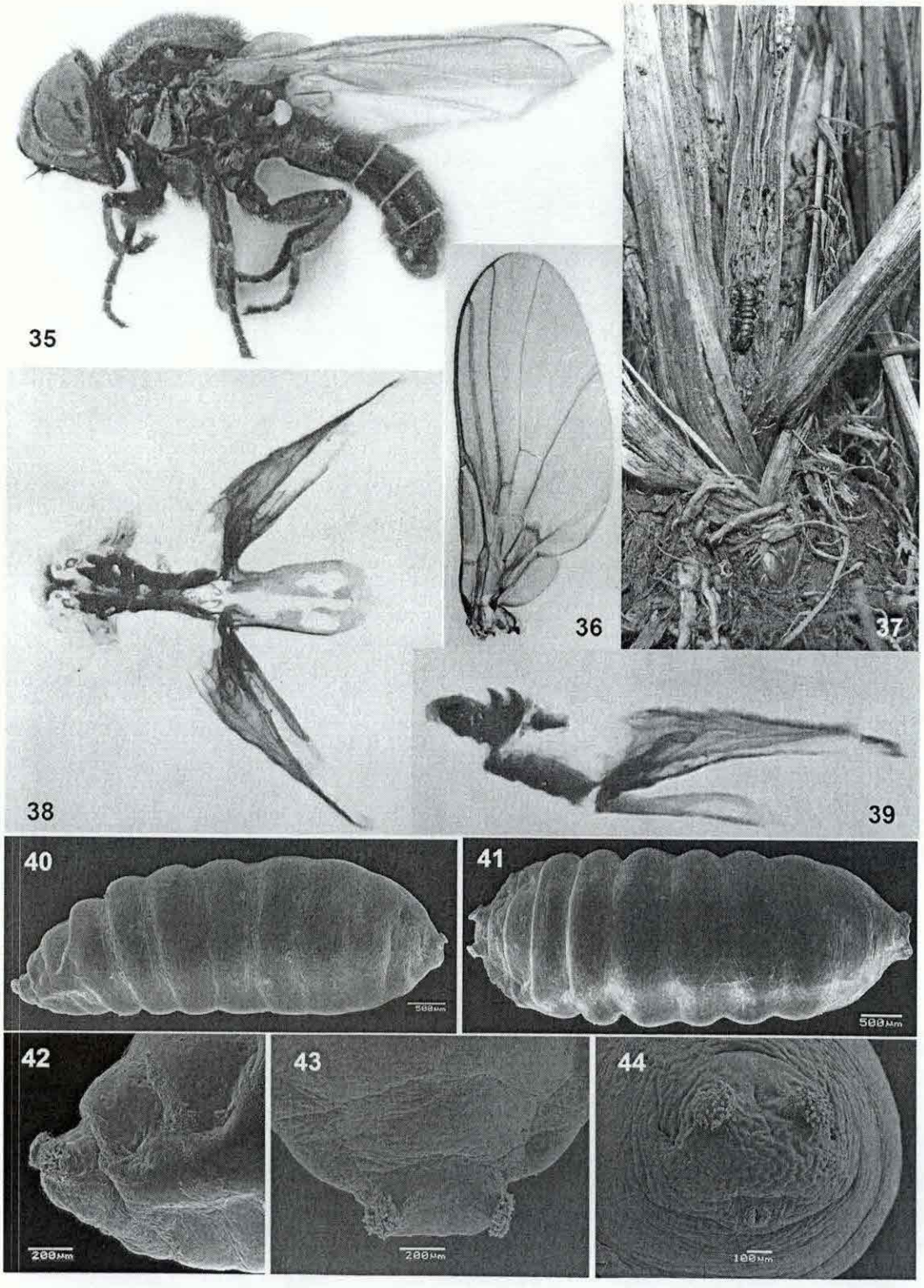
Selachops Wahlberg, 1844

Selachops Wahlberg, 1844: 67; Hendel, 1920: 115; 1936: 514; Spencer, 1969: 12; 1976: 146; Zlobin, 1983: 46.
Encoelocera Loew, 1844: 321.
Type species: *Selachops flavocinctus* Wahlberg, 1844, by monotypy.

This is rare Palaearctic genus of agromyzid subfamily Phytomyzinae type species of which, *S. flavocinctus* Wahlberg, 1844, was recorded in several European countries (Zlobin 1983). Two additional species, *S. relicta* Zlobin, 1983 and *S. intiba* Zlobin, 1983, were described from the Russian Far East. Sedge species, *Carex acuta* Linnaeus, 1753 (= *C. gracilis* Curtis, 1782), was recorded as host plant for this Agromyzidae genus in an unpublished dissertation by Dempewolf (2001). This host plant by *S. flavocinctus* is here published for the first time.

Selachops flavocinctus Wahlberg, 1844
(Figs 35–44)

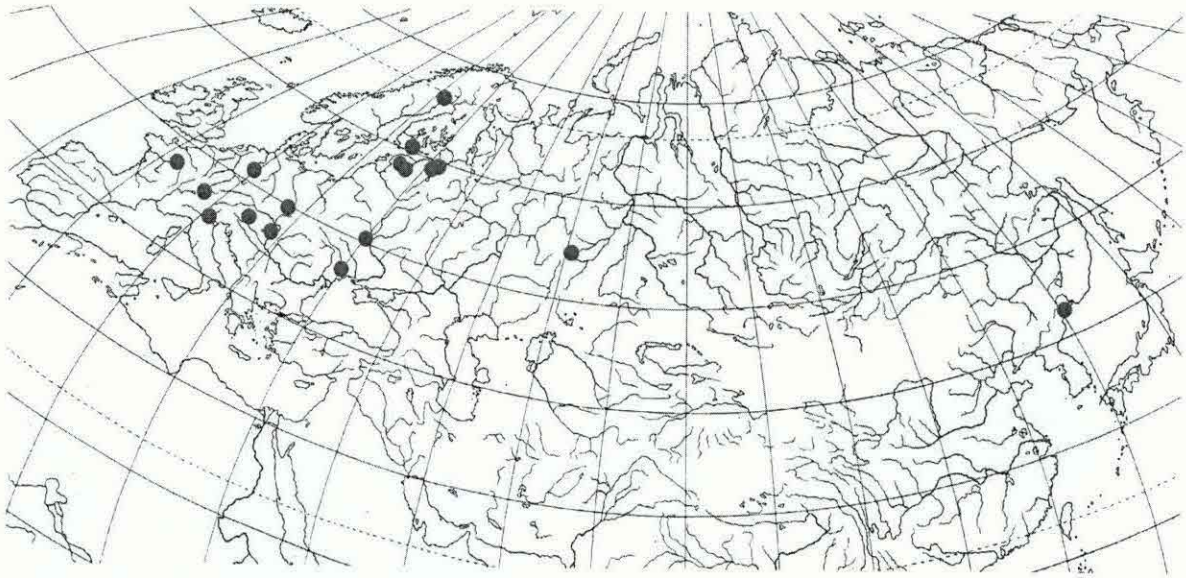
Selachops flavocinctus Wahlberg, 1844: 68; Zetterstedt, 1848: 2792; 1860: 6463; Hendel, 1920: 115; 1936: 514; Frick, 1952: 386; Spencer, 1969: 12; 1976: 146; Zlobin, 1983: 49.
Encoelocera bicolor Loew, 1844: 321.



FIGURES 35–44. *Selachops flavocinctus* Wahlberg. 35. Adult habitus, lateral view. 36 Wing. 37. Puparium within culm of *Carex acuta*. 38. Cephalopharyngeal skeleton (extracted from puparium), dorsal view. 39. Cephalopharyngeal skeleton, lateral view. 40. Puparium habitus, lateral view. 41. Puparium habitus, dorsal view. 42. Puparium, anterior end, lateral view. 43. Puparium, anterior end, dorsal view. 44. Puparium, caudal end.

Material examined (deposited in ZISP). Estonia: 1 male, Tartu, "21/5 [18]83.", "Dorpat", "sec. typ. Loewii", "849", "*bicolor* Lw / *flavocincta* Whlb"; 2 males, Tartu County, Kabina, 3.VI.1973 (Elberg). **Finland**: 1 female, Uusimaa, Nurmijärvi, 7.VI.1989 (M. Koponen). **Moldova**: 1 male, "Purcary [=Purcari], Akkerman. u. Bessarab. Tchernavin 14 IV 911". **Russia**: 2 females, Leningradskaya Province, Luga District, Yashchera, 13.VI.1957 (A. Stackelberg); 2 females, 1 male, same locality, 21.VI.1960, 13.VI.1964 and 26.VI.1966 (A. Stackelberg); 1 male, Leningradskaya Province, Tosno District, Ulianovka (= Sablino), 3.VI.1921 (V. Fridolin); 1 female, Sverdlovskaya Province, Yekaterinburg City, Verkh-Isetsk pond, Baran Island, 11.V.2008 (T. Kostromina); 1 female, 1 male, same locality, sweeping, 7.V.2013, (T. Kostromina); 1 male, Sverdlovskaya Province, Yekaterinburg City, Verkh-Isetsk pond, Baran Island, emerged 10.V.2015 ex puparium [7–1] collected 5.V.2015; 1 male, same locality, emerged 12.V.2015 ex puparium [9–5] collected 7.V.2015; 1 female, same locality, emerged 12.V.2015 ex puparium [11–2] collected 8.V.2015 (T. Kostromina, A. Timokhov); 2 females, 1 male, same locality, sweeping, 11.V.2008 and 7.V.2013 (T. Kostromina); 1 male, Primorskiy Territory, Khasan, 26.V.1979 (A. Zinoviev).

Distribution (Fig. 45). Austria, Czech Republic, Estonia, Finland, France, Germany, Hungary, Italy (Fauna Europea, 2016), Moldova (**new record**), Russia (Leningradskaya (Zlobin, 1983) and Sverdlovskaya Provinces, Primorskiy Territory (**new records**)), Sweden, Switzerland (Kahanpää, 2014, Fauna Europea, 2016), Ukraine (Korneyev, 2002).



FIGURES 45. Map of distribution of *Selachops flavocinctus* Wahlberg.

Host plant. *Carex acuta* Linnaeus, 1753 (Poales: Cyperaceae).

Remarks. There is very little information on the immature stages of the genus *Selachops*. Dempewolf (2001) gave the description of the *S. flavocinctus* puparium in an unpublished PhD dissertation. Herein a redescription of the puparium providing additional characteristics and new data on life history of *S. flavocinctus* are published for the first time.

Description. Puparium (Fig. 37, 40–44). Length 5.4–6.1 mm, width 2.2–2.3 mm. Black, mat. Integument corrugated with conspicuous intersegmental constrictions. Cephalic end (segments I–III) (Figs 42, 43) dorsoventrally flattened, tapering gradually to anterior end (lateral view), with lateral flanges. Caudal end (Fig. 44) slightly broadened, almost evenly rounded, twelfth segment with small depression mediodorsally. Anterior and posterior spiracles rather similar, with numerous distinct papillae. Anterior spiracles retained as conspicuous projections at anterolateral margin of dorsal cephalic cap. Distance between anterior spiracles 2.4–2.8 × their diameters. Posterior spiracles slightly projected dorsolaterally, distance between posterior spiracles 1.2–1.5 × their diameters. Anal plate almost round; anal opening conspicuous, slit-shaped, surrounded with numerous minute spines.

Cephalopharyngeal skeleton (extracted from puparium). Length 0.65 mm. Paired mouthhooks (mandibular sclerites) notably separate from each other, stout, about 1.5 × as high as maximum length. Each mouthhook

bifurcated anteriorly in its upper third into two teeth which are notably downturned, lower teeth slightly smaller, laterad to upper teeth. Mouthhooks joined ventrally by two sclerites forming V-like structure, and articulated posteriorly with front of hypostomal sclerite. Hypostomal sclerite elongate, 3.0 × longer than height, 1.9 × longer than its maximum width, distinctly narrowed medially (dorsal view). Pharyngeal sclerite appearing continuous with hypostomal sclerite, enlarged, with two dorsal and two ventral cornua. Dorsal cornu wide, elongate, almost twice as long as ventral cornu, its apical part sharply tapering, with elongate slit-like open fenestra. Ventral cornu distinctly widened, with closed fenestra.

Life history. Late instar larvae feed as stem miners in culms of *Carex acuta*. Most of the burrows produced in the culm lie below the level of the soil surface. The burrow always extends as far downward as the culm base. Pupation is within a culm (no puparia were found outside sedge culms) on height 1.5–4.0 cm above the culm base; pupa vertical, always orientating head up (Fig. 37). Flies overwinter in pupal stage. In the Central Urals, adults begin to emerge about middle of May.

Discussion

Both braconid parasitoids were collected in the second half of Spring (end of April – May) on a pond shore, mainly on littoral vegetation. The hosts of *Asyntactus* (Alysiini) and *Protochorebus* (Dacnusini) were unknown since their descriptions which perhaps can be accounted for by rarity of these taxa known from only a few Palaearctic localities (Perepechaenko, 1997; Belokobylskij & Kostromina, 2011). Discovery of the rich population of *A. rhogaleus* in the vicinity of Yekaterinburg City (Central Urals) and long-term searching for its possible hosts and their food plants finally resulted in rearing *A. rhogaleus* as well as *P. pervushini* **sp. nov.** from one of the largest Palaearctic Agromyzidae flies *Selachops flavocinctus* Wahlberg. This is the first record of the hosts for such rare alysiine genera as *Asyntactus* and *Protochorebus*. As well, *S. flavocinctus* is recorded for the first time as Alysiinae host among large numbers of already known Agromyzidae hosts in this parasitoid subfamily.

Selachops flavocinctus is an exceptionally large agromyzid species. Considering possible close relations of the genus *Selachops* to another agromyzid genus *Metopomyza* Enderlein, 1936, Spencer (1990) proposed that *S. flavocinctus* feeds on a monocotyledon and probably in the root, in view of its large size. This assumption is mainly proved correct.

The problem of identifying the host-parasite relationships is associated with the concealed mode of life of the *S. flavocinctus* larvae. The larvae of this dipterous species develop on *Carex acuta*, which is not common for other agromyzid flies, most of them produce mines or galls on cereals (Gramineae). Therefore, at the initial stage of the investigation it was important to determine the host plant. After careful analysis of plant material, several morphotypes of puparia were identified and their locations within sedge culms were revealed.

Selachops flavocinctus pupate at the base of culms of *C. acuta* (up to 4.0 cm above the roots), puparia always orientating head up within the culms. Perhaps young *S. flavocinctus* larvae developed basically as miners of blades of sedges and only later penetrate into the culms.

Grown larva of *A. rhogaleus* weaves a thin cocoon within host remnants before pupation. At eclosion, *A. rhogaleus* gnaws in the host puparium the round exit hole with ragged edges. Two pharate imago of parasitoid species were discovered in the host puparia within sedge culms in September before wintering – they were already fully formed and pigmented. Nevertheless some individuals of *A. rhogaleus* might overwinter inside host puparia at pupal stage. *Asyntactus rhogaleus* emerges at the end of April – first half of May, some days before its agromyzid host, *S. flavocinctus*. *Protochorebus pervushini* **sp. nov.** also developing in *S. flavocinctus* puparia gnaws an exit hole with jagged edges.

One of the parasitoid species discussed here, *P. pervushini* **sp. nov.**, is described as a new species. The other Alysiinae parasitoid, *A. rhogaleus*, as well as their dipterous host, *S. flavocinctus*, have been considered rare species. Taking into account their wide distribution, it is presumed that rarity of these latter species is generally attributed to their local biotopic confinement. However to a great extent the rarity can also be accounted for by their unusual phenology: both parasitoids and dipterous host emerged late Spring and with a relatively short lifespan. On this basis, these species are not assumed to be so rare and are expected to be recorded in some other regions of the Palaearctic in the future.

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