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Additional data on Aphidiinae (Hymenoptera, Braconidae) fauna of Kyrgyzstan, with description of a new species

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Abstract

Here we present additional data on the Aphidiinae fauna of Kyrgyzstan. We identified 18 Aphidiinae species. One species new to science (*Trioxys depressus* **sp. nov.**) is described, while 11 species are reported for the first time: *Aphidius avenae* Haliday, *A. ervi* Haliday, *A. matricariae* Haliday, *A. salicis* Haliday, *A. urticae* Haliday, *Ephedrus cerasicola* Starý, *E. niger* Gautier, Bonnamour & Gaumont, *Lysiphlebus cardui* (Marshall), *L. confusus* Tremblay & Eady, *Monoctonus crepidis* (Haliday), and *Praon yomenae* Takada. Current knowledge of Kyrgyz Aphidiinae is summarized and discussed.

Keywords

Aphid parasitoids, checklist, Kyrgyz Republic, *Trioxys depressus* sp. nov.

Introduction

Kyrgyz Republic is a landlocked, mountainous country in Central Asia, with 94% of its territory situated higher than 1,000 m, while 40% is above 3000 m (Farrington 2005). The landscape is dominated by the mountains of the Tien-Shan and Pamir-Alai ranges. Although relatively small in territory, Kyrgyz Republic is characterized with wide variation in landscapes and ecosystems, from high mountains, to lowland fertile

plains and large freshwater systems (Chemonics International Inc. 2001). Twenty different classes of ecosystems support very high species diversity with high percentages of endemism. The majority of ecosystem and species diversity is found in the mountain landscapes which represent a central part of the Mountains of Central Asia Biodiversity Hotspot (Critical Ecosystem Partnership Fund 2017).

Aphid parasitoids (Braconidae, Aphidiinae) have never been systematically investigated in Kyrgyz Republic and thus current knowledge on this fauna is very limited. Previous records of Aphidiinae are scarce and were published in studies covering much broader areas such as former U. S. S. R. (Starý 1965; Davidian 2016, 2017, 2018, 2019) or Central Asia (Starý 1979). In total, 23 Aphidiinae species belonging to 10 genera have been recorded in Kyrgyz Republic so far (Starý 1979; Davidian 2016, 2017, 2018, 2019). The majority of published records were collected during the 1960s, while the most recent record is more than 35 years old (Davidian 2016).

Here we present additional data on the Aphidiinae fauna of Kyrgyz Republic and describe one species new to science.

Material and methods

Aphidiinae specimens from Kyrgyz Republic deposited at Biologiezentrum Linz´s collection were examined. There were 277 Aphidiinae specimens collected by sweeping during 1994–2001, with the majority of them collected in the year 2000. Specimens were dry preserved (glued on cardboards). Several specimens, including type material of the new species, were dissected and slide mounted with Berlese medium. External structure of specimens was inspected with NIKON SMZ745T stereoscopic microscope (Nikon Instruments Inc., Tokyo, Japan) and Zeiss Discovery V8 stereo microscope (Carl Zeiss Microscopy GmbH, Jena, Germany). Measurements of relevant morphological characters were undertaken with LEICA LS phase-contrast microscope (Leica Microsystems GmbH, Wetzlar, Germany) and ImageJ software (Schneider et al. 2012). Parasitoids were identified using relevant identification keys for Europe and Asia: Starý (1965, 1979), Gärdenfors (1986), Chen and Shi (2001), Davidian (2005), Tomanović et al. (2009, 2018, 2021), Mitrovski-Bogdanović et al. (2014), Kavallieratos et al. (2016), Jamhour et al. (2016), Čkrkić et al. (2019), Rakhshani et al. (2019). The terminology regarding diagnostic characters follows Sharkey and Wharton (1997).

Results

Total of 18 Aphidiinae species were identified, out of which one species is new to science (described below) and 11 species are reported from Kyrgyz Republic for the first time, namely *Aphidius avenae* Haliday, *A. ervi* Haliday, *A. matricariae* Haliday, *A. salicis* Haliday, *A. urticae* Haliday, *Ephedrus cerasicola* Starý, *E. niger* Gautier, Bonnamour & Gaumont, *Lysiphlebus cardui* (Marshall), *L. confusus* Tremblay & Eady, *Monoctonus*

crepidis (Haliday), and *Praon yomenae* Takada. A number of Aphidiinae specimens (especially males) could not be reliably identified to species level because of missing data on their biology (e.g. host aphid) and taxonomic problems. Those specimens are listed under their genus.

Parasitoid species are listed in alphabetical order, along with number of specimens, collecting locality and date.

Review of species

***Aphidius avenae* Haliday, 1834**

1 ♀ 2 ♂, Alay Range 50 km A. Galtska, 07. VI 2000, leg. V. Gurko.

***Aphidius ervi* Haliday, 1834**

1 ♀, Alay Range, 50 km A. Galtska, 07. VI 2000, leg. V. Gurko; 1 ♀, Alay Range Ikizyak, Kok-Suu river basin, VII 2000, leg. V. Gurko; 2 ♀, Ala-Archa river, Malinovka (alt. 1600 m), VII 2000, leg. V. Gurko; 2 ♀, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 1 ♂, Chong-Aryk, IV 2000, leg. V. Gurko; 3 ♀, Chong-Aryk, VI 2000, leg. V. Gurko; 1 ♀, Bishkek region, Malinovka (alt. 1500 m), VI 1998, leg. V. Gurko; 1 ♂, Bishkek botanical garden, V 2000, leg. V. Gurko; 1 ♂, Osh area, 25 km A. Osh Aravan, VI 2000, leg. V. Gurko.

***Aphidius matricariae* Haliday, 1834**

1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata), Pistacea forest, VIII 2000, leg. V. Gurko; 1 ♀, Fergana range, Alash-Too Ridge, Alash forest, VIII 2000, leg. V. Gurko; 1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1200 m), 01. VIII 2001, leg. V. Gurko; 1 ♀, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 2 ♀, Osh area, 25 km N Osh, Aravan, VI 2000, leg. V. Gurko.

***Aphidius salicis* Haliday, 1834**

1 ♀, Chong-Aryk, VI 2000, leg. V. Gurko.

***Aphidius urticae* Haliday, 1834**

1 ♀, Fergana range, Alash-Too Ridge, Alash forest, VIII 2000, leg. V. Gurko; 1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1200 m), 01. VIII 2001, leg. V. Gurko; 1 ♀, Ala-Archa river, Malinovka (alt. 1600 m), V 2000, leg. V. Gurko; 3 ♀, Ala-Archa river, Malinovka (alt. 1600 m), VII 2000, leg. V. Gurko; 1 ♀, Ala-Archa, Ooru-Say (alt. 1650 m), 24. VI 2000, leg. V. Gurko; 3 ♀, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 2 ♀ 1 ♂, Bishkek botanical garden, 05. V 2000, leg. V. Gurko.

***Aphidius* spp.**

10 ♀ 32 ♂, Alay Range, 50 km A. Galtska, 07. VI 2000, leg. V. Gurko; 2 ♂, Trans-Alay Range , Bordaba (alt. 3500 m), VII 2000, leg. V. Gurko; 3 ♀ 5 ♂, Alay Range, Ikizyak, Kok-Suu river basin, VII 2000, leg. V. Gurko; 4 ♂, Fergana range, Toskol-Ata (Kochkor-Ata), Pistacea forest, VIII 2000, leg. V. Gurko; 2 ♂, Fergana range, Alash-Too Ridge, Alash forest, VIII 2000, leg. V. Gurko; 1 ♀ 1 ♂, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1200 m), 01. VIII 2001, leg. V. Gurko; 5 ♀, Ala-Archa river, Malinovka (alt. 1600 m), V 2000, leg. V. Gurko; 9 ♀ 3 ♂, Ala-Archa river, Malinovka (alt. 1600 m), VII 2000, leg. V. Gurko; 1 ♀ 1 ♂, Ala-Archa, Ooru-Say (alt. 1650 m), 24. VI 2000, leg. V. Gurko; 1 ♀ 9 ♂, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 7 ♂, Chong-Aryk, IV 2000, leg. V. Gurko; 1 ♀ 1 ♂, Chong-Aryk, VI 2000, leg. V. Gurko; 1 ♀ 1 ♂, Ala-Archa river Valley. (alt. 1650 m), 17. VIII 2000, leg. V. Gurko; 5 ♀ 1 ♂, Bishkek region, Malinovka (alt. 1500 m), VI 1998, leg. V. Gurko; 4 ♂, Bishkek botanical garden, 05. V 2000, leg. V. Gurko; 2 ♂, Bishkek botanical garden, V 2000, leg. V. Gurko; 1 ♂, west from Kizil-kiya, 15. V 1994, leg. Ma. Halada; 7 ♂, Ala-Archa river, Kashasi, 02. X 1999, leg. V. Gurko; 1 ♀ 1 ♂, Ala-Archa river (alt. 1600 m), VI 1997, leg. V. Gurko; 1 ♂, S-Issyk-kul Kara-Kul lake, 18. VII 1998, leg. V. Gurko; 5 ♀ 15 ♂, Osh area, 25 km A. osh Aravan, VI 2000, leg. V. Gurko.

***Aphidius* (*Euaphidius*) sp.**

1 ♂, Ala-Archa river, Kashka-Suu, VII 2000, leg. V. Gurko.

***Binodoxys acalephae* (Marshall, 1896)**

1 ♀, Ala-Archa river, Kashka-Suu (alt. 1650 m), V 2000, leg. V. Gurko.

***Binodoxys angelicae* (Haliday, 1833)**

7 ♀ 1 ♂, Alay Range, 50 km A. Galtska, 07. VI 2000, leg. V. Gurko; 1 ♀ 1 ♂, Fergana range, Alash-Too Ridge, Alash forest, VIII 2000, leg. V. Gurko; 1 ♀, Ala-Archa, Ooru-Say (alt. 1650 m), 24. VI 2000, leg. V. Gurko; 4 ♀, Bishkek botanical garden, V 2000, leg. V. Gurko.

***Binodoxys* spp.**

3 ♀ 1 ♂ Alay Range, 50 km A. Galtska, 07. VI 2000, leg. V. Gurko; 3 ♂, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1200 m), 01. VIII 2001, leg. V. Gurko; 1 ♂, Bishkek region, Malinovka (alt. 1500 m), VI 1998, leg. V. Gurko; 1 ♀, Fergana range, Kok-Jangak, VI 2000, leg. V. Gurko.

***Ephedrus cerasicola* Starý, 1962**

1 ♀, Alamedin river (alt. 1700 m), VIII 2000, leg. V. Gurko.

***Ephedrus lacertosus* (Haliday, 1833)**

1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata), Pistacea forest, VIII 2000, leg. V. Gurko; 1 ♀, Bishkek botanical garden, 05. V 2000, leg. V. Gurko; 1 ♀, Bishkek botanical garden, V 2000, leg. V. Gurko; 1 ♀, Ala-Archa river, VI 1997, leg. V. Gurko.

***Ephedrus niger* Gautier, Bonnamour & Gaumont, 1929**

2 ♀, Ala-Archa river, Malinovka (alt. 1600 m), VII 2000, leg. V. Gurko; 1 ♂, Ala-Archa, Ooru-Say (alt. 1650 m), 24. VI 2000, leg. V. Gurko; 1 ♀, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 3 ♀, Bishkek region, Malinovka (alt. 1500 m), VI 1998, leg. V. Gurko.

***Ephedrus plagiator* (Nees, 1811)**

1 ♀, Ala-Archa river, Malinovka (alt. 1600 m), VII 2000, leg. V. Gurko; 4 ♂, Ala-Archa, Ooru-Say (alt. 1650 m), 24. VI 2000, leg. V. Gurko; 1 ♂, Ala-Archa river, Kashka-Suu (alt. 1650 m), V 2000, leg. V. Gurko; 1 ♂, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 1 ♂, Chong-Aryk (alt. 900 m), VI 1999, leg. V. Gurko; 1 ♀ 1 ♂ Ala-Archa river, Uzun-Bulak (alt. 1800 m), VI 2000, leg. V. Gurko; 3 ♀, Bishkek region, Malinovka (alt. 1500 m), VI 1998, leg. V. Gurko; 1 ♂, Bishkek botanical garden, 05. V 2000, leg. V. Gurko; 1 ♂, Ala-Archa river, Kashasi, 02. IX 1999, leg. V. Gurko; 1 ♀, Ala-Archa river, Kashasi, VI 1999, leg. V. Gurko.

***Ephedrus* spp.**

1 ♂, Fergana range, Toskol-Ata (Kochkor-Ata), Pistacea forest, VIII 2000, leg. V. Gurko; 1 ♀, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 1♂, Bishkek region, Malinovka (alt. 1500 m), VI 1998, leg. V. Gurko.

***Lysiphlebus cardui* (Marshall, 1896)**

1 ♀, Alay Range, 50 km A. Galtska, 07. VI 2000, leg. V. Gurko.

***Lysiphlebus confusus* Tremblay & Eady, 1978**

1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1200 m), 01.VIII 2001, leg. V. Gurko.

***Lysiphlebus fabarum* (Marshall, 1896)**

2 ♂, Alay Range, 50 km A. Galtska, 07. VI 2000, leg. V. Gurko; 1 ♂, Fergana range, Alash-Too Ridge, Alash forest, VIII 2000, leg. V. Gurko; 1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1200 m), 01. VIII 2001, leg. V. Gurko; 2 ♀, Bishkek botanical garden, 05. V 2000, leg. V. Gurko; 1 ♀, Bishkek botanical garden, V 2000, leg. V. Gurko.

***Monoctonus crepidis* (Haliday, 1834)**

1 ♂, Alay Range, 50 km A. Galtska, 07. VI 2000, leg. V. Gurko.

***Monoctonus* sp.**

1 ♂, Chong-Aryk, IV 2000, leg. V. Gurko.

***Pauesia* spp.**

2 ♂, Fergana range, Toskol-Ata (Kochkor-Ata), Pistacea forest, VIII 2000, leg. V. Gurko.

***Praon volucre* (Haliday, 1833)**

1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata), Pistacea forest, VIII 2000, leg. V. Gurko; 3 ♀, Fergana range, Alash-Too Ridge, Alash forest, VIII 2000, leg. V. Gurko; 1 ♂, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1200 m), 01. VIII 2001, leg. V. Gurko; 1 ♂, Ala-Archa, Ooru-Say (alt. 1650 m), 24. VI 2000, leg. V. Gurko; 1 ♂, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 1 ♂, Ala-Archa river Valley. (alt. 1650 m), 17. VIII 2000, leg. V. Gurko; 1 ♂, Bishkek botanical garden, 05. V 2000, leg. V. Gurko; 2 ♀ 1 ♂, Bishkek botanical garden, V 2000, leg. V. Gurko.

***Praon yomenae* Takada, 1968**

1 ♀, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 1 ♀, Bishkek botanical garden, 05. V 2000, leg. V. Gurko.

***Praon* spp.**

1 ♂, Fergana range, Alash-Too Ridge, Alash forest, VIII 2000, leg. V. Gurko; 1 ♀, Fergana range, Toskol-Ata (Kochkor-Ata) (alt. 1500 m), 29. VII 2000, leg. V. Gurko; 1 ♂, Ala-Archa river, Malinovka (alt. 1600 m), VII 2000, leg. V. Gurko; 1 ♀, Alamedin riv. (alt. 1700 m), VIII 2000, leg. V. Gurko; 1 ♂, Ala-Archa river, Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko; 1 ♂, Ala-Archa river, Uzun-Bulak (alt. 1800 m), VI 2000, leg. V. Gurko; 1 ♀ 1 ♂, Bishkek botanical garden, 05. V 2000, leg. V. Gurko.

Trioxys depressus **Petrović & Tomanović, sp. nov.**
http://zoobank.org/C1E522A0-BEA2-44E1-A237-3F9C3751FB77
Fig. 1

Diagnosis. *Trioxys depressus* sp. nov. can easily be separated from all congeners by the set of unique characters: propodeum with prominent medial depression along the whole length (Fig. 1E), specific antennae which are in-between filiform and clavate with 10 antennomeres, and very elongated terminal flagellomere (F8) (Fig. 1B), maxillary palps with 3 palpomeres, and labial palps with 2 palpomeres.

Type material. ***Holotype*****:** 1 ♀. Kyrgyz Republic, Alai Mts. 50 km A. Galtska, 7.VI 2000, leg. V. Gurko, slide mounted. ***Paratype*****:** same data as holotype, 1 ♀, slide mounted. Holotype deposited at Biologiezentrum Linz´s collection, Austria; paratype deposited at the Institute of Zoology, Faculty of Biology, University of Belgrade.

Type locality. Kyrgyz Republic, Alay Range. A more precise locality cannot be determined with certainty from the label. We could not find the locality A. Galtska in Kyrgyzstan, and it might be that "Galtska" is a misspelling of "Gulcha", which is the capital of the Alay district located 50 km North of the Alay Range.

Description. Female. ***Head*** (Fig. 1A). Eyes oval, medium sized, sparsely setose. Tentorial index 0.3–0.45. Clypeus oval with 13 setae. Maxillary palps with 3 palpomeres, labial palps with 2 palpomeres. Antennae in-between filiform and clavate with 10 antennomeres. Setae on flagellomeres semierect, subequal to flagellomere diameter (Fig. 1B). Flagellomere 1 (F1) 2.9 times as long as wide, F2 2.1 times as long as wide. Both flagellomeres without longitudinal placodes (Fig. 1C). F1 1.25 times longer than F2. Flagellomeres F3, F4 and F5 with 2, 2 and 3 longitudinal placodes, respectively. Terminal flagellomere (F8) very elongated, 3.3 times as long as wide, and 2–2.5 times longer than any other flagellomere (Fig. 1B). F8 with 10 longitudinal placodes.

Mesosoma. Mesoscutum without notaulices, dorsal surface smooth with sparse setae (Fig. 1D). Head width/mesoscutum width ratio 1.1. Propodeum with prominent medial depression along its whole length (Fig. 1E). Medial depression, which divides the propodeum into halves, is a unique character among Aphidiinae. It is narrow in the middle and widens anteriorly and posteriorly. Upper halves of propodeum both with 4–5 long setae close to medial depression and with 1 seta more laterally. Lower halves with 1 long seta.

Fore wing (Fig. 1H). Wing length 1.3–1.4 mm, width 0.6 mm. Pterostigma triangular, 2.6–2.8 times as long as wide and 1.7–1.9 times as long as distal abscissa of R1. Wing venation reduced, fused r and RS (r&RS) visible, reaching distally as far as R1 or shorter. Fore wing densely pubescent, with lower marginal setae longer than those on the fore wing surface.

Metasoma. Petiole 2.2–2.3 times as long as wide at spiracles (Fig. 1F). Dorsal disc smooth, with 2–3 long setae on each side (Fig. 1F). Ovipositor sheath slightly curved downwards, length/width ratio 2.5–2.7. Prongs straight, length 0.2 mm, with 3 dorsal hairs and one claw-like apical bristle (Fig. 1G).

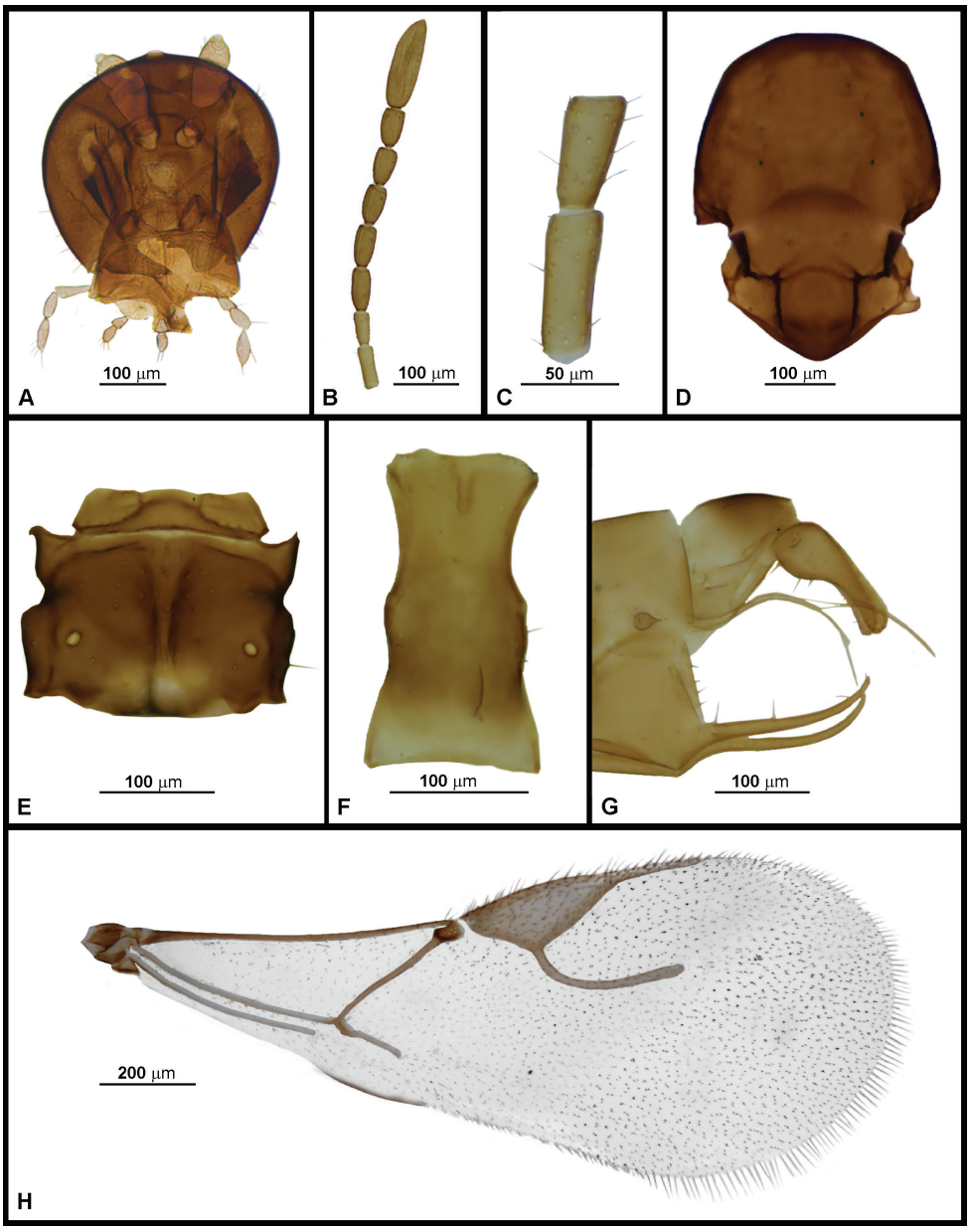

Figure 1. *Trioxys depressus* sp. nov., female: **A** head **B** antenna **C** flagellomeres 1–2 **D** mesoscutum **E** propodeum **F** petiole **G** ovipositor sheath and prongs **H** fore wing.

Colour. Head brown, eyes brown, mouthparts yellow. Scapus, pedicel, F1 and F2 yellow, remainder of antenna brown. Mesonotum and propodeum brown, legs light brown. Wings hyaline, with brown venation. Petiole and rest of metasoma, including ovipositor sheaths, light brown.

Male. Unknown

Etymology. The name of the new species refers to the medial depression on the propodeum.

Host aphid. unknown

Distribution. Kyrgyz Republic, Alay Range.

***Trioxys* sp.**

2 ♀, Ala-Archa river Kashka-Suu (alt. 1650 m), VII 2000, leg. V. Gurko.

Checklist of Aphidiinae (Hymenoptera, Braconidae) from Kyrgyzstan

With the current study, number of Aphidiinae species in Kyrgyzstan has risen to 35. All species are listed below together with the reference. Species reported in this study are marked with an asterisk.

Adialytus ambiguus (Haliday, 1834) (Davidian 2017)
*Aphidius avenae**
*Aphidius ervi**
*Aphidius matricariae**
*Aphidius salicis**
*Aphidius urticae**
*Binodoxys acalephae** (Davidian 2016)
*Binodoxys angelicae** (Davidian 2016)
Binodoxys brevicornis (Haliday, 1833) (Davidian 2016)
Binodoxys heraclei (Haliday, 1833) (Davidian 2016)
Diaeretiella rapae (M'Intosh, 1855) (Starý 1979; Davidian 2017)
*Ephedrus cerasicola**
Ephedrus helleni Mackauer, 1968 (Davidian 2018)
*Ephedrus lacertosus** (Starý 1979; Davidian 2018)
*Ephedrus niger**
Ephedrus persicae Froggatt, 1904 (Starý 1979; Davidian 2018)
*Ephedrus plagiator** (Davidian 2018)
Lipolexis gracilis Foerster, 1862 (Davidian 2016)
*Lysiphlebus cardui**
*Lysiphlebus confusus**
Lysiphlebus desertorum Starý, 1965 (Davidian 2017)
*Lysiphlebus fabarum** (Davidian 2017)
*Monoctonus crepidis**
Monoctonus tianshanensis Starý, 1978 (Davidian 2016)
Pauesia infulata (Haliday, 1834) (Davidian 2017)
Pauesia goidanichi Starý, 1966 (Davidian 2017)
Pauesia hazratbalensis Bhagat, 1981 (Davidian 2017)

Pauesia juniperorum (Starý, 1960) (Davidian 2017)
Praon abjectum (Haliday, 1833) (Davidian 2019)
Praon flavinode (Haliday, 1833) (Davidian 2019)
*Praon volucre** (Starý 1979; Davidian 2019)
*Praon yomenae**
Trioxys asiaticus Telenga, 1953 (Davidian 2016)
Trioxys depressus sp. nov.*
Trioxys longicaudi Starý, 1978 (Davidian 2016)

Faunistic complexes of the parasitoids

Almost all Aphidiinae parasitoids recorded in Kyrgyzstan can be classified into five faunistic complexes (after Starý 1970 and Tomanović et al. 2021). At present, species *Trioxys depressus* sp. nov. and *Trioxys longicaudi* could not be classified due to the lack of knowledge concerning their ecology and biology.

1) Eurasian deciduous forest
Adialytus ambiguous, *Aphidius salicis*, *A. urticae*, *Binodoxys angelicae*, *B. heraclei*, *Ephedrus cerasicola*, *E. helleni*, *E. lacertosus*, *E. persicae*, *E. plagiator*, *Monoctonus crepidis*, *Praon abjectum*, *P. flavinode*, *P. volucre*.

2) Eurasian steppes
Aphidius avenae, *A. ervi*, *A. matricariae*, *Binodoxys acalephae*, *B. brevicornis*, *Diaeretiella rapae*, *Ephedrus niger*, *Lipolexis gracilis*, *Lysiphlebus cardui*, *L. confusus*, *L. fabarum*, *Praon yomenae*.

3) Eurasian coniferous forest
Pauesia infulata, *P. goidanichi*, *P. hazratbalensis*, *P. juniperorum*.

4) Central asian desserts
Lysiphlebus desertorum and *Trioxys asiaticus*.

5) Deciduous mesophytic mountain forest of Central Asia
Monoctonus tianshanensis.

Discussion

Starý (1979) summarized the knowledge about Aphidiinae of the Central Asian Area, providing valuable information about their distribution and biology. Interestingly, in this comprehensive study only four species were recorded in Kyrgyz Republic, which is the smallest number for all countries in the region (Starý 1979). Additional data were published in the last five years by Davidian (Davidian 2016, 2017, 2018, 2019) where

she provided historical data (from museum collections) for 19 more species from Kyrgyz Republic. Although our study increases the number of species by more than 50% (to 35 species), the Aphidiinae fauna of Kyrgyzstan can be treated as unexplored. The whole Central Asia region with about 80 recorded species (Starý 1979) could be treated as poorly explored, although there are numerous studies dealing with Aphidiinae of Tajikistan, Uzbekistan and Kazakhstan (summarized in Starý 1979). In fact, Kyrgyzstan is the least explored of all Central Asian countries. In comparison, 38 Aphidiinae species were recorded in the neighboring Republic of Tajikistan (Starý 1979) which is considerably smaller in area. Considering the high ecosystem diversity (Critical Ecosystem Partnership Fund 2017), the expected number of species is several times higher, both in Kyrgyzstan and Central Asia. Countries with well-studied Aphidiinae fauna, like Czech Republic or Serbia, have a much higher number of recorded species (130–140, and 121, respectively), although both are more than twice smaller in area than Kyrgyzstan (Starý 2006; Tomanović et al. 2021). These expectations are also supported with high diversity of plants, which represent the first trophic level in a plant-aphid-parasitoid trophic cascade. In total, there are almost 4,000 plant species recorded in Kyrgyzstan (Chemonics International Inc. 2001), out of which more than 500 are considered endemic for the Tian-Shan mountain ranges (spanning China, Kazakhstan, Uzbekistan, Tajikistan and Kyrgyzstan), while at least 225 are national endemics (Tojibaev et al. 2020). Kyrgyzstan fauna is also characterized with a very high level of endemism, especially among invertebrates, with 25% of species treated as endemic (SAEPF 2013). The currently known Aphidiinae fauna of Kyrgyzstan does not follow this trend, and only two species can be considered as endemic or subendemic, *Monoctonus tianshanensis* (distributed in Uzbekistan and Kyrgyzstan) and the newly described species *Trioxys depressus* sp. nov. *Trioxys depressus* sp. nov. is currently known only from Kyrgyzstan (Alay Mountains) and it possesses some unique morphological characters. A prominent medial depression along the whole length of propodeum (Fig. 1E) was previously unknown within Aphidiinae, and it represents a clear apomorphic character. The specific shape of antennae (in-between filiform and clavate) (Fig. 1B) is also an apomorphic character, and it is very unusual within the subfamily. Additional apomorphies are number of maxillary or labial palpomeres.

A comprehensive systematic study of Aphidiinae in Kyrgyzstan is necessary for at least two reasons. The first one is to uncover the actual diversity which will very likely include some undescribed species. Almost the whole territory of Kyrgyzstan is located within the Mountains of Central Asia biodiversity hotspot (Critical Ecosystem Partnership Fund 2017). Although the hotspot is predominantly defined by diversity of plants and vertebrates (Critical Ecosystem Partnership Fund 2017) it will be crucial to investigate plant-herbivorous insect-parasitoid trophic interactions, because half of the world's biodiversity is involved in it (Hawkins 1994). In general, mountains are of the greatest importance for maintenance of global biodiversity, because of the numerous unique and relict habitats which provide optimal conditions for a high number of endemic species (Critical Ecosystem Partnership Fund 2017). Diversity of subfamily Aphidiinae follows this pattern. It is determined that high mountains of South-Eastern

Europe (Kavallieratos et al. 2004; Tomanović et al. 2007), as well as of Central and South America (Zamora Mejías et al. 2010; Starý et al. 2014) represent centers of Aphidiinae diversity. Starý and González (1978) deduced that mountainous areas of Central Asia support richer Aphidiinae fauna than lowland areas. The same authors also found that the parasitoid spectrum of the same aphid species differs considerably between lowlands and mountains (Starý and González 1978). The Aphidiinae species which are characteristic for high mountains usually exhibit an insular distribution (Tomanović et al. 2007). Sometimes they can be characterized with unusual life forms and characteristics ranging from extreme (such as apterous state in both sexes in *Trioxys apterus* Gärdenfors, 1990 (South America) and *Autriquella aptera* Starý, 1988 (Africa) (Starý 1988; Gärdenfors 1990), to milder changes in morphology (such as those of propodeum and antennae in newly described *Trioxys depressus* sp. nov.).

The second reason which urges a detailed systematic study of Aphidiinae in Kyrgyzstan (and in the whole region of Central Asia) is search for novel biocontrol agents of aphids. Although the whole country area should be investigated, the unique ecosystem of walnut-fruit forests draws special attention. These relict forests represent a unique genetic fond for diverse fruit and nut trees (SAEPF 2013) belonging to genera *Prunus*, *Malus*, *Pyrus*, *Ribes*, *Crataegus*, *Berberis*, and *Pistacia* (Epple 2001). The walnut-fruit forests are marked as a source of domesticated tree crops that are now widely cultivated (Juniper et al. 1998; Harris et al. 2002; Juniper and Mabberley 2006; Orozumbekov et al. 2015). In the same time, they can be a source of some currently unknown parasitoid species or strains which can be used in biological control of aphids on those trees. Starý (1979) discussed differences in aphid and parasitoid distribution between Central Asia and the rest of the world. He determined that some parasitoid species occurring in Central Asia are absent from other parts of the host aphid areal (Starý 1979). For example, the large walnut aphid (*Panaphis juglandis* (Goeze, 1778)) is parasitized by two parasitoids (*Praon* cf. *abjectum* and *Trioxys pallidus* (Haliday, 1833)) in Central Asia, and almost free of parasitoids (sporadically parasitized by *T. pallidus*) in other parts of its distribution range. These findings on the differences in parasitoid distribution across the world highlight the importance of conservation and thorough investigation of the walnut-fruit forest biodiversity.

Considering the fact that the original area of walnut-fruit forests of Central Asia has been reduced for over 90% in the last 50 years (Djanibekov et al. 2016; Wilson et al. 2019), and having in mind the global decline of terrestrial insects (van Klink et al. 2020; Wagner et al. 2021), systematic research of Aphidiinae fauna (as well as the whole entomofauna) of Kyrgyzstan should be performed as soon as possible.

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