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Three New *Minotetrastichus* (Hymenoptera: Eulophidae) Species Records from Transcaucasia

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ABSTRACT

Up to this report, only *Minotetrastichus platanellus* (Mercet, 1922) had been recorded from Georgia and Transcaucasia. We now report *Minotetrastichus frontalis* (Nees, 1834), *Minotetrastichus loxotoma* (Graham, 1961) and *Minotetrastichus treron* Graham, 1987 as new to Georgia and Transcaucasia, bringing the number of species of *Minotetrastichus* Kostjukov, 1977 in Georgia up to four. Diagnostic characters for distinguishing this genus from other genera belonging to subfamily Tetrastichinae are provided.

Key words: Georgia, Transcaucasia, Tetrastichinae, Diagnosis, *Minotetrastichus*, Kostjukov.

INTRODUCTION

The Lagodekhi Protected Areas, established in 1912 is one of the world's best-preserved areas of mixed forest with a diversity of natural landscapes. It is located in Lagodekhi, in the extreme north-eastern part of the southern slopes of the Caucasus and extends across an altitudinal range of 590-3500 m. The Lagodekhi Protected Areas includes Lagodekhi Nature Reserve (19749 ha) and Managed Reserve (4702 ha) (APA 2016).

Kostjukov (1977), based on the results of a comparative morphological study of the subfamily Tetrastichinae, founded 17 subgenera within *Tetrastichus* Haliday, including *Minotetrastichus*, with the type species *Cirrospilus ecus* Walker. Later Graham (1987) revised genera of the European Tetrastichinae; 28 genera were recognized as valid, including *Minotetrastichus* as a distinct genus. *Minotetrastichus* currently includes ten species: *M. citriscapus* (Kostjukov), *M. curtiventris* (Kostjukov) (Kostjukov and Kosheleva, 2006), *M. frontalis* (Nees), *M. loxotoma* (Graham), *M. napomyzae* (Domenichini), *M. pallidocinctus* (Gahan), *M. platanellus* (Mercet), *M. prolongatus* Graham, *M. treron* Graham and *M. zeasmi* Narendran (Noyes, 2016).

Species of *Minotetrastichus* are parasites of leaf-mining Lepidoptera, Coleptera and Hymenoptera.

This study represents a taxonomic analysis of part of the insect material collected in the Lagodekhi protected areas using Malaise traps during the entire growing season of 2014.

MATERIAL AND METHODS

Malaise traps in the Lagodekhi protected areas were set in the following vertical zonal sites: 1. Low zone of forest (450-750m), 2. Middle zone of forest (750-1250m), 3. High zone of forest (1250-1800m), 4. Subalpine forest (1800-2000m), 5. Subalpine fields and shrublands (2000-2500m), 6. Alpine zone (above 2500m). Malaise traps were obtained from BandN Entomological services (Fres and Fibms, 2017) Containers were filled with 80% ethanol and were checked and replaced every ten days. Collecting started on April 2, 2014 and lasted until November 7, 2014, although in alpine and subalpine areas collecting started later (subalpine 5 May 2014; alpine 23 May 2014) and completed earlier (6 October 2014) due to poor climatic conditions. Material was collected every 10 (±2) days then it was transferred to the laboratory and was critical point dried following Noyes (2016) and mounted on cards. Identification was undertaken by the second author, using modern keys and papers of original descriptions, and the collections of the Zoological Institute of the Russian Academy of Sciences (St. Petersburg) and All-Russian Research Institute of Biological Plant Protection (Krasnodar). All voucher specimens are deposited to the Entomological collection of the Agricultural University of Georgia, Tbilisi, Georgia.

Information about synonymy and biology is given in Graham (1987) and the Universal Chalcidoidea Database (Noyes, 2016). Therefore we did not add these data to our paper, unless absent from Graham (1987) and Noyes (2016).

RESULTS

Diagnosis of genus (Table 1)

Female:

Length: 1.0-1.9 mm

Anterior margin of clypeus truncated or with a pair of low, rounded lobes. Propodeum with spiracles very small or minute, circular or nearly so, separated from hind edge of metanotum by their diameter or more. Antenna with funicle and clava each with three segments. Mid lobe of mesoscutum usually without a median line. The two longer setae of each cercus usually subequal in length, pale straight or slightly curved (in *loxotoma* and *prolongatus* longest seta is 1.6x times longer than next longest seta). Mesoscutum convex. Body with at least weak metallic tints, but in some mainly yellow forms of *platanellus* metallic tints are lacking.

Male:

Length: 0.8-1.3 mm

Differs from female as follows: Antennal scape with a vertical plaque that is situated in upper part; antennal flagellum with a 4 segmented funicle and a 3 segmented clava.

Table 1. Characters for differentiate Minotetrastichus from other Tetrastichinae.

	The species of genus *Minotetrastichus*	The other species of subfamily Tetrastichinae
	Female and male	
1.	Length 0.8-1.9 mm	Length 0.4-4.5 mm
2.	Submarginal vein of forewing with 2-5 dorsal setae; propodeal spiracles very small subcircular or minute, separated by at least 1.5 times their diameter from hind edge of metanotum; the setae of each cercus are subequal in length	Submarginal vein of forewing with 1 dorsal seta or propodeal spiracles moderate-sized, separated from hind margin of metanotum by much less than their major diameter; if very small or minute (*Chrysotetrastichus* and *Ootetrastichus*) then one seta of each cercus is much longer than the other
3.	Anterior margin of clypeus truncate	Anterior margin of clypeus bidentate
4.	Antenna with scape usually yellow or yellowish	Antenna with scape usually black, often with metallic tints
Hosts	Leaf-mining Lepidoptera, Coleoptera and Hymenoptera	Gall-forming insects (usually Cecidomyiidae), Acari (Eriophyidae) and Nematoda; free-living larvae and eggs of insects

Species list of *Minotetrastichus* distributed in Lagodekhi reserve (Georgia)

Genus *Minotetrastichus* Kostjukov, 1977

Species *Minotetrastichus frontalis* (Nees, 1834)

Material examined: 2 ♂♂, Lagodekhi reserve, Mt Kudigora, 41˚51.351' N, 046˚17.564' E, 847 m asl (above sea level), malaise trap, 15-25.05.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 15-25.05.2014, G. Japoshvili and G. Kirkitadze; 2 ♀♀, Lagodekhi reserve, Mt Kudigora,41˚52.288 N, 046˚18.692 E, 1351 m asl, malaise trap, 4-14.06.2014, G. Japoshvili and G. Kirkitadze; 3 ♀♀, 2 ♂♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 15-25.06.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, 1 ♂, Lagodekhi reserve, Mt Kudigora, 41˚ 54.371' N, 46˚ 20.004' E, 2558m asl, malaise trap, 15-25.06.2014, Leg. G. Japoshvili and G. Kirkitadze; 4 ♀♀, 5 ♂♂, Lagodekhi reserve, Mt Kudigora,41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 25.06-5.07.2014, G. Japoshvili and G. Kirkitadze; 2 ♀♀, Lagodekhi reserve, Mt Kudigora, 41˚51.351' N, 046˚17.564' E, 847 m asl (above sea level), malaise trap, 5-15.07.2014, G. Japoshvili and G. Kirkitadze; 6 ♀♀, 6 ♂♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 5-15.07.2014, G. Japoshvili and G. Kirkitadze; 2 ♀♀, 1 ♂, Lagodekhi reserve, Mt Kudigora,41˚52.288 N, 046˚18.692 E, 1351 m asl, malaise trap, 15-25.07.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚ 51.149' N, 46˚ 17.266' E, 666 m asl (above sea level), malaise trap, 25.07-5.08.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, 1 ♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 25.07-5.08.2014, G. Japoshvili and G. Kirkitadze; 4 ♀♀, 2 ♂♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 5-15.08.2014, G. Japoshvili and G. Kirkitadze; 2 ♀♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 25.08-4.09.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, 3 ♂♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 5-14.09.2014, G. Japoshvili and G. Kirkitadze; 2 ♀♀, 3 ♂♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 15-27.09.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 27.09-6.10.2014, G. Japoshvili and G. Kirkitadze.

Distribution: Austria, Bosnia Herzegovina, Bulgaria, Canada (Alberta, British Columbia), Canary Islands, Croatia, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland (Northern and Republic of), Italy, Macedonia, Moldova,

Netherlands, Norway, Pakistan, Romania, Russia (Altai Kray, Krasnodar Kray, Stavropol Kray, Nizhniy Novgorod Oblast, Ul'yanovsk Oblast, Siberia), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Arab Emirates, UK (England), USA (Connecticut, Delaware, Maine, Massachusetts, Montana, Ohio, Wisconsin) (Noyes, 2016).

Minotetrastichus loxotoma (Graham, 1961)

Material examined: 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 5-15.07.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 5-15.08.2014, G. Japoshvili and G. Kirkitadze.

Distribution: Hungary, Norway, Russia (Primor'ye Kray), Slovakia, Sweden, UK (England), Croatia (Noyes, 2016).

Minotetrastichus platanellus (Mercet, 1922)

Material examined: 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 15-25.06.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 25.06-5.07.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, 1 ♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 15-25.07.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, 1 ♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 25.07-5.08.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 25.08-4.09.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚ 51.149' N, 46˚ 17.266' E, 666 m asl (above sea level), malaise trap, 5-14.09.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, 3 ♂♂, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 15-27.09.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 046˚18.692' E, 1351 m asl, malaise trap, 27.09- 6.10.2014, G. Japoshvili and G. Kirkitadze.

Distribution: Bulgaria, Czech Republic, France, Georgia, Germany, Greece, Hungary, Iran, Israel, Italy, Netherlands, Serbia, Slovakia, Turkey, Ukraine, UK (England) (Noyes, 2016), Russia (Kostjukov and Nagorniy, 2004; Kostjukov *et al.* 2004; Kovalenkov *et al.* 2004a; 2004b; Litvinenko, 2004; Nagornyi, 2004; 2006).

Minotetrastichus treron Graham, 1987

Material examined: 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 46˚18.692' E, 1351m asl, malaise trap, 15-25.06.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 46˚18.692' E, 1351m asl, malaise trap, 25.06-5.07.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 46˚18.692' E, 1351m asl, malaise trap, 5-15.07.2014, G. Japoshvili and G. Kirkitadze; 1 ♀, Lagodekhi reserve, Mt Kudigora, 41˚52.288' N, 46˚18.692' E, 1351m asl, malaise trap, 5-15.08.2014, G. Japoshvili and G. Kirkitadze.

Distribution: Croatia, France, Sweden (Noyes, 2016).

DISCUSSION

Four species of *Minotetrastichus* are found in Lagodekhi reserve (Georgia). Only *M. platanellus* was recorded for Georgia and Transcaucasia (Kostjukov, 1978) prior to

our study. *Minotetrastichus frontalis*, *M. loxotoma* and *M. treron* are new records for Georgia and Transcaucasia. Before our study, *M. treron* was known only from Croatia, France and Sweden, and *M. loxotoma* from Hungary, Norway, Russia, Slovakia, Sweden, UK, Croatia (Noyes, 2016). *Minotetrastichus frontalis* and *M. platanellus*, in contrast, are widely known species from Europe (Noyes, 2016) and North Caucasus (Kostjukov, 1978; Kostjukov and Nagornyi, 2004; Khomchenko and Kostjukov, 2004; Kostjukov *et al.* 2004; Kostjukov and Kosheleva, 2006; Kovalenkov *et al.* 2004a; 2004b; Litvinenko, 2004; Nagornyi 2004; 2006).

Malaise traps seem to be good means of collecting species of *Minotetrastichus* and other Tetrastichinae. About one hundred individuals of *Minotetrastichus* spp. were collected by us in our Malaise trap, about 30 individuals of genus *Tamarixia*, 2 individuals of *Neotrichoporoides* and 4 individuals for *Hyperteles.* We recommend them for future sampling of *Minotetrastichus*.

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REFERENCES

APA, 2016, Lagodekhi protected areas. http://apa.gov.ge/en/ (08.01.2016).

Fres, B. N., Fibms S. N., 2017, http://entomology.org.uk/index.htm (15.03.2017).

Graham, MWR.deV., 1961. The genus *Aprostocetus* Westwood, *sensu lato* (Hymenoptera: Eulophidae); notes on the synonymy of European species. *Entomologist's Monthly Magazine,* 97: 34-64.

Graham, M. W. R. de V., 1987, A reclassification of the European Tetrastichinae (Hymenoptera: Eulophidae), with a revision of certain genera. *Bulletin of the British Museum,* 55(1): 1-392.

Khomchenko, E. V., Kostjukov, V. V, 2004, Chalcids (Hymenotpera, Chalcidoidea) from Krasnodar Kray and Stavropol Kray. Information I: Tetracampidae, Eulophidae, Aphelinidae, Elasmidae, Trichogramatidae. *In:* Nadykta, V., Ismailov, V., Levashova, G., Sugonjaev, E. (Eds.) Biological Plant Protection as the Basis for Agroecosystem Stabilisation. Krasnodar: 1: 71-78.

Kostjukov, V. V., 1977, Comparative morphology of chalcids of the subfamily Tetrastichinae and the systematics of the genus *Tetrastichus* Haliday 1844 (Hymenoptera, Eulophidae). *Entomologicheskoe Obozrenie,* 56(1): 177-194.

Kostjukov, V. V., 1978, Hymenoptera II. Chalcidoidea 13. Eulophidae (Tetrastichinae). *In:* Medvedev, G. S. (Ed.). *Opredeliteli Nasekomykh Evropeyskoy Chasti SSR*, 3: 430-467.

Kostjukov, V. V., Khomchenko, E. V., Kosheleva, O. V., 2004, Chalcids (Hymenoptera, Eulophidae) from Stavropolsky Kray and Kubani. *In*: Nadykta, V., Ismailov, V., Levashova, G., Sugonjaev, E. (Eds.) Biologicheskaya Zashchita rasteniy - osnova stabilizatsii agroekosistem, Krasnodar: 2: 170-181.

Kostjukov, V. V., Nagorniy, A. A., 2004, Comparative analysis of parasitoid complex of Phyllonorycter platani Stgr on Platanus sp. and Phyllonorycter blancardella Z. on Cydonia oblonga Mill. *In*: Nadykta, V., Ismailov, V., Levashova, G., Sugonjaev, E. (Eds.) Biologicheskaya Zashchita rasteniy - osnova stabilizatsii agrozkosistem, Krasnodar: 2: 189-193.

Kostjukov, V. V., Kosheleva, O. V., 2006, Taxonomic status of the species of the Tetrastichus Haliday, 1844 (S.L.) described from the territory of USSR with Trjapitzinichus gen.n. *In*: Nadykta, V., Ismailov, V., Levashova, G., Sugonjaev, E. (Eds.) Biological Plant Protection as the Basis for Agroecosystem Stabilization. Krasnodar: 4: 103-112

Kovalenkov, V. G., Kostjukov, V. V., Tjuzina, N. M., Khomchenko, E. V., 2004a, Principles and results of improvement of plant protection fruit cultivars. *In*: Nadykt,a V., Ismaiolov, V., Levashova, G., Sugonjaev, E. (Eds.) Biological Plant Protection as the Basis for Agroecosystem Stabilization. Issue Krasnodar: 1: 184-189

Kovalenkov, V. G., Kostjukov, V. V., Tjuzina, N. M., Kazadaeva, S. V., 2004b, Experience in switching from man-caused chemical tactics in orchard protection to chemical tactics in orchard protection to integrated phytosanitary situation management. *In*: Nadykta, V., Ismailov, V., Levashova, G., Sugonjaev, E. (Eds.) Biological Plant Protection as the basis for Agroecosystem Stabilization. Krasnodar: 2: 275-289

Litvinenko, E., 2004, Species of insect and acari of soybean in central part of Krasnodar Kray. In Nadykta V., Ismailov V., Levashova G., Sugonjaev E. (Eds.) Biological Plant Protection as the basis for Agroecosystem Stabilization. Krasnodar: 1: 108-116

Nogornyi, A. A., 2004, New and known chalcid species (Hymenoptera: Chalcidodiea) for fauna of Russia - parasites of leafmining Phyllonoricter (Lepidoptera) in Krasnodar Kray. *In:* Nadykta, V., Ismailov, V., Levashova G., Sugonjaev E. (Eds.) Biological Plant Protection as the basis for Agroecosystem Stabilization. Krasnodar: 1: 94-96.

Nagornyi, A. A., 2006, Types of areals of leaf-mining insect parasites in North-Western Caucasus. *In:* Nadykta, V., Ismailov, V., Levasheva, G., Sugonjaev, E. (Eds.) Biological Plant Protection as the basis for Agroecosystem Stabilization. Krasnodar: 4:112-116

Noyes, J. S., 2016, Universal Chalcidoidea Database. World Wide Web electronic publication. http://www.nhm.ac.uk/chalcidoids. (10.3.2016).

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