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Analysis of bee species of the genus *Lasioglossum* Curtis, 1833 (Hymenoptera, Halictidae) of the Caucasus

Анализ фауны пчёл рода *Lasioglossum* Curtis, 1833 (Hymenoptera, Halictidae) Кавказа

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Key words: Anthophila, biodiversity, geographical range, biotopic distribution, Palaearctic region.

Ключевые слова: Anthophila, биоразнообразие, ареал, ландшафтное распределение, Палеарктика.

Abstract. A faunistic analysis of the genus *Lasioglossum* (Curtis, 1833) in the Caucasus was performed based on previously obtained original and literary data. As a result, seven groups of geographical ranges were revealed for the Caucasian species of the *Lasioglossum* (Curtis), namely: I — extending beyond the West Palaearctic (18 species); II — widely distributed in the West Palaearctic (30 species); III — widely distributed in Europe (26 species); IV — Mediterranean-Irano-Turanian (5 species); V — Mediterranean-Levantine-Caucasian (22 species); VI — Irano-Turanian (21 species); and VII — Levantine-Caucasian and Caucasian (12 species). Thus, the *Lasioglossum* fauna in the Caucasus is complex, being almost equally determined by species with wide West Palaearctic ranges and European species, as well as elements of the Mediterranean and Irano-Turanian fauna. Species with narrower, more endemic ranges are represented to a slightly lesser extent. While most *Lasioglossum* species in the Caucasus fauna are not confined to a specific landscape type, the greatest diversity occurs in various steppe areas (82 % of species). Around half of the species (54 %) are found in forest landscapes and the fewest species have been recorded in the most arid (semi-desert and desert) areas (33 %), as well as in the subalpine meadow zone (28 %).

Резюме. На основании полученных ранее оригинальных и литературных данных произведён фаунистический анализ пчёл рода *Lasioglossum* Curtis, 1833 Кавказа. В результате для кавказских видов рода *Lasioglossum* Curtis выявлено 7 групп ареалов: I — выходящие за пределы Западной Палеарктики (18 видов), II — широко Западнопалеарктические (30), III — широко европейские (26); IV — Средизнемноморско-Ирано-Туранские (5), V — Средиземноморско-Переднеазиатско-Кавказские (22), VI — Ирано-Туранские (21), VII — Переднеазиатско-Кавказские и Кавказские (12). Таким образом, фауна рода Кавказа является комплексной и почти равнозначно определяется видами с широкими Западнопалерктическими ареалами, европейскими видами, а также элементами Средиземноморской и Ирано-Туранской фауны. Лишь в немного меньшей степени представлены виды с узкими и эндемичными ареалами. Большинство видов *Lasioglossum* Curtis в фауне Кавказа не приурочены к определённому типу ландшафта, но наибольшее разнообразие фауны приходится на различные степные участки (82 % видов). В лесных ландшафтах встречается примерно половина видов (54 %), а наименьшее число видов было зарегистрировано в наиболее аридных участках полупустынь и пустынь (33 %) и в зоне субальпийских лугов (28 %).

Introduction

The Caucasus is a mountainous region located between the Black Sea and the Caspian Sea. It is considered the natural border between Europe and Asia. It is usually considered part of Western Asia and borders north-eastern Turkey and north-western Iran.

The northern part of the region is known as Ciscaucasia and encompasses most of the Greater Caucasus Range, also known as the Greater Caucasus Mountains. This range is located in southern Russia, northern Georgia and northern Azerbaijan. The southern part of the region, known as Transcaucasia, is bordered by Russia to the north, the Black Sea and Turkey to the west, Iran to the east, and the Caspian Sea to the south. Transcaucasia encompasses the Caucasus Mountains and the surrounding lowlands. The South Caucasus region encompasses Armenia, Azerbaijan (excluding the northern regions) and Georgia (excluding the northern regions).

With more than 1,800 described species worldwide, *Lasioglossum* Curtis, 1833 is the most numerous genus

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within the family Halictidae. Most of *Lasioglossum* species inhabit the Holarctic region. At least 450 species are found in the Palaearctic region [Astafurova et al., 2025].

In modern taxonomy, *Lasioglossum* and *Evylaeus* Robertson, 1902 are considered as a single genus *Lasioglossum*. This genus is divided into several subgenera, of which 35 are currently recognised. However, the subgenus classification of some species is still unclear or controversial.

The genus *Lasioglossum* has been poorly studied in the Caucasus until recently. In some regions it was known only from records of few species or was not recorded at all. Notable studies include H. Date's publication on the fauna of Teberda in Karachay-Cherkessia, in which 21 species of this genus were identified [Dathe, 1980]. Yury Pesenko's paper on Palaearctic *Lasioglossum* species in the Caucasus identified an additional 20 species [Pesenko, 1986]. Aliyev with colleagues identified a further 20 species in the Nakhichevan Autonomous Republic of Azerbaijan [Aliyev et al., 2007]. Elena Chenikalova [2005] listed 44 species for the Stavropolskii Krai (Russia), but the reliability of her identifications is questionable and six of this species were excluded from the Caucasian list [Astafurova, Proshchalykin, 2025]. Isabella Schirtladze [1981] noted some common species for Georgia. Ferdinand Morawitz identified 16 species mainly from Dagestan (Russia) [Morawitz, 1873, 1877]. Paul Blüthgen and Andreas Ebmer listed many species for the Caucasus in a number of taxonomic publications [Blüthgen, 1923–1925, 1931, 1935; Ebmer, 1972, 1978, 1982, 1988, 1995, 1997, 2000, 2014; Ebmer, Sakagami, 1985].

In recent years significant progress has been made towards a better knowledge of species of *Lasioglossum* from the Caucasus and adjacent territories [Astafurova et al., 2024a, b; Astafurova, Proshchalykin, 2023–2025]. These data enabled us to conduct a faunistic analysis of *Lasioglossum* bees in the Caucasus, clarify the ranges of individual Palaearctic species and identify features of their landscape distribution in the region.

Materials and methods

This paper analyses the data obtained during our study of *Lasioglossum* bees in the North Caucasus (Russia) and Azerbaijan [Astafurova et al., 2024a, b; Astafurova, Proshchalykin, 2025], as well as numerous literary sources containing records of *Lasioglossum* species in the Caucasus, including Georgia and Armenia.

For compiling the types of geographical ranges, we have used the terminology and a combined zone-sectoral (for wide ranges) and a provincial approaches [Emel'yanov, 1974]. The analyses of the species distribution has been based on Pauly's [2016] maps and the summarised data presented in our previous publications on the Caucasus [Astafurova et al., 2024a, b; Astafurova, Proshchalykin, 2025].

The Table 1: Types of geographical ranges of species of the genus *Lasioglossum*, recorded in the fauna of the Caucasus is presented in the Appendix 1 (p. 1–2).

The present work is registered in ZooBank (www.zoobank.org) under urn:lsid:zoobank.org:pub:18EBF67B-76BF-49BD-91A8-81254D290452

Results and discussion

To date, a total of 134 *Lasioglossum* species from eight subgenera have been recorded in the Caucasian fauna: 92 in the North Caucasus and 121 in Transcaucasia [Astafurova, Proshchalykin, 2025]. This list does not include several unidentified species that may be new to science. This issue will be addressed in future taxonomic studies. The Caucasus's fauna list is smaller than those of Europe (182 species), Turkey (168 species) and Iran (145 species). However, it is notable that more than half of the species found in Russia (163 species) are in the North Caucasus, which covers only 1.5 % of Russia's territory. The most studied and abundant species in the Caucasus are found in the fauna of Dagestan (72 species) and the Nakhchivan Autonomous Republic of Azerbaijan (56 species). By contrast, the first data on the *Lasioglossum* fauna in some regions of the North Caucasus (Ingushetia, Kabardino-Balkaria, Chechnya and North Ossetia republics) were obtained through our research [Astafurova, Proshchalykin, 2025].

The Caucasus lies at the intersection of the sub-boreal and subtropical zones, boasting a variety of landscapes ranging from alpine meadows to deserts. This diversity of landscapes determines the heterogeneous composition of the *Lasioglossum* fauna in the region, which includes both boreal and subtropical species, as well as elements of the Central Asian, Irano-Turanian and Middle Eastern faunas, including endemic species.

According to Emel'yanov's [1974] biogeographical zoning scheme for the Palaearctic region, the Caucasus's main territory is divided between two zoogeographical provinces: the Euxine Mountain Province (European Region) and the Kuro-Araxine Mixed Province (Irano-Turanian Subregion). It also extends partially into the Caspian Plain Province (Irano-Turanian Subregion) and the Western Black Sea Plain Province (Scythian Region) in the north.

A zoogeographical analysis of the fauna revealed that approximately 17 % (23 species) are widely distributed north of the subboreal zone of the Palaearctic, exhibiting boreal and boreo-subtropical distribution patterns. Most species found in the Caucasus do not extend beyond the subboreal zone in the north (southern or predominantly subtropical distribution patterns).

All the geographical ranges identified were combined into seven groups (Table 1 in Appendix). The first group includes species with the broadest distribution, extending beyond the Western Palaearctic. There are a few such species in the Caucasian fauna (18 species, or 13 %), most of which are distributed as far north as the euboreal zone. The second group comprises species with broad Western Palaearctic distribution (Western, Western Pan-continental and Western Euro-continental types of range; 30 species, 22 %). The third group comprises species whose ranges mostly cover Europe (Pan-Atlantic and Western Transcontinental types; 26 species, 19 %).

The remaining three groups comprise species that are elements of the Mediterranean or Irano-Turanian fauna, together making up a third of the Caucasian fauna. A small group (5 species, 4 %) includes species distributed from the eastern Mediterranean to Central Asia or north-eastern China (Mediterranean-Iranian-Turanian ranges). The remaining two large groups include species distributed from the Mediterranean to the Caucasus (Mediterranean-Levantine-Caucasian ranges; 22 species, 16 %), and species representative of the Irano-Turanian or Irano-Turanian-Gobi fauna (21 species, 17 %).

The final group comprises species with narrow, endemic ranges (Levantine-Caucasian and Caucasian types), accounting for a relatively small proportion of the Caucasian fauna (12 species, 9 %).

Thus, the Caucasus fauna is complex, being almost equally determined by species with broad West Palaearctic ranges, European species and elements of the Mediterranean and Irano-Turanian fauna. Species with narrower, more endemic ranges are less well represented. This pattern aligns well with the geographical location of the Caucasus, which lies at the intersection of four zoogeographical regions: the European, Scythian, Seti and Gispari regions. The Caucasus has a variety of landscapes, arranged in a mosaic pattern in the mountainous regions due to the complex topography [Beruchashvili, 1995]. The largest area of the Caucasus is covered by various steppe landscapes, the majority of which are located in the North Caucasus on the plains and in the middle mountains. Desert and semi-desert landscapes are mainly found in the Caspian and Araks lowlands, as well as in intermountain basins with a dry continental climate. Forest landscapes are characteristic of the mountainous and foothill regions and are often found on river floodplains.

Analysis showed that 19 species are mainly confined to the mountainous and foothill forest/forest-steppe landscapes of the Caucasus, where they inhabit open areas, glades and forest edges: *L. apricarium, L. costulatum, L. elatum, L. fratellum, L. fulvicorne, L. kussariense, L. minutulum, L. parvulum, L. pallens, L. picipes, L. quadrinotatulum, L. reinigi, L. rhynchites, L. rufitarse*, *L. scirpaceum, L. semilucens, L. sexstrigatum, L. talyschense* and *L. tungusicum.*

Thirty species were recorded in both forest and steppe landscapes: *L. ageratum*, *L. albipes*, *L. anguliceps*, *L. bicallosum*, *L. bluethgeni*, *L. clypeare*, *L. corvinum*, *L. cristula*, *L. elegans*, *L. euboeense*, *L. intermedium*, *L. laevigatum*, *L. laticeps*, *L. lativentre*, *L. leucopus*, *L. lineare*, *L. lissonotum*, *L. malachurum*, *L. morio*, *L. nigripes*, *L. nitidulum*, *L. pauxillum*, *L. peregrinum*, *L. punctatissimum*, *L. puncticolle*, *L. quadrinotatum*, *L. quadrisignatum*, *L. salinum*, *L. villosulum* and *L. xanthopus.*

In the Caucasus, 31 species have been recorded only in the steppes: *L. adaliae*, *L. annulipes, L. argaeum*, *L. buccale*, *L. daglariense*, *L. damascenum*, *L. denislucum*, *L. duckei*, *L. epipygiale*, *L. equestre*, *L. erraticum*, *L. euxanthopus*, *L. euxinicum*, *L. hethiticum*, *L. hilare*, *L. imbecillum*, *L. interruptum*, *L. laeve*, *L. laevidorsum*, *L. longirostre*, *L. minutissimum, L. muganicum*, *L. nakhchivanicum*, *L. obscuratum*, *L. podolicum*, *L. setulosum*, *L. sexnotatum*, *L. subaenescens*, *L. subfasciatum*, *L. tauricum* and *L. trichopygum.*

Twenty-three species are associated with dry steppe and semi-desert landscapes: *L. acephaloides*, *L. aegyptiellum*, *L. anellum*, *L. brevicorne*, *L. crassepunctatum*, *L. edessae*, *L. fallax*, *L. haesitans*, *L. hyalinipenne*, *L. leucopymatum*, *L. limbellum*, *L. ordubadense*, *L. pistorium*, *L. popovi*, *L. sociorum* and *L. stolidum*, including those found only in the flat landscapes of the dry steppes and semi-deserts of the Caspian Lowland: *L. adabaschum*, *L. ciscapum*, *L. ekaterinae*, *L. maculipes*, *L. mandibulare*, *L. niveocinctum* and *L. pallidum*.

There are 17 species of polyzonal species that inhabit the forest, steppe and desert landscapes of the Caucasus: *L. calceatum*, *L. caspicum*, *L. clypeiferellum*, *L. convexiusculum*, *L. discus*, *L. glabriusculum*, *L. griseolum*, *L. leucozonium*, *L. lucidulum*, *L. marginatum*, *L. medinai*, *L. mesosclerum*, *L. nitidiusculum*, *L. politum*, *L. pygmaeum*, *L. truncaticolle* and *L. zonulum.*

Data on *Lasioglossum* species from the alpine zone of the Caucasus Mountains are limited. Three species have been recorded exclusively in the alpine and subalpine zones (high-mountain steppes and meadows) of the Caucasus: *L. quadrinotatiforme*, *L. subfulvicorne*, and *L. transitorium*.

The following species have been recorded in the subalpine zone (more than 2,000 m a.s.l.): *L. capsicum*, *L. convexiusculum*, *L. glabriusculum*, *L. griseolum*, *L. leucozonium*, *L. lucidulum*, *L. marginatum*, *L. nitidiusculum*, *L. politum*, *L. pygmaeum* (a polizonal species), *L. aeratum*, *L. laevigatum*, *L. laticeps*, *L. lativentre*, *L. leucopus*, *L. lineare*, *L. malachurum*, *L. morio*, *L. pauxillum*, *L. puncticolle*, *L. quadrinotatum, L. quadrisignatum*, *L. xanthopus* (a forest-steppe species), *L. euxinicum*, *L. imbecillum*, *L. laeve*, *L. muganicum*, *L. obscuratum*, *L. setulosum* and *L. subaenescens* (predominantly steppe species) and *L. costulatum* (predominantly forest species).

Thus, most *Lasioglossum* species in the Caucasus fauna are not confined to a specific landscape type, mainly because many species in this genus are polylectic and find food plants in various biotopes. However, the greatest diversity of fauna is found in steppe habitats, where around 82 % of species have been recorded. Around half of the fauna species (54 %) are found in forested landscapes, while the fewest species have been recorded in the semi-desert and desert areas (33 %), as well as in the subalpine meadow zone (28 %). Several species that were only recorded once or based on literature data were excluded from the analysis as their landscape preference was difficult to assess, namely: *L. araxanum*, *L. mose*, *L. persicum*, *L. prasinum*, *L. prunellum*, *L. setulellum*, *L. scorikovi* and *L. tarsatum*.

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Table 1. Types of geographical ranges of species of the genus *Lasioglossum*, recorded in the fauna of the Caucasus
Таблица 1. Типы географических ареалов видов рода *Lasioglossum*, зарегистрированных в фауне Кавказа

I. Ranges extending beyond the Western Palaearctic		
Holarctic, boreal-subtropical		*L. leucozonium* (Schrank, 1781), *L. villosulum* (Kirby, 1802), *L. zonulum* (Smith, 1848)
Transpalearctic	predominantly boreal	*L. fratellum* (Pérez, 1903), *L. fulvicorne* (Kirby, 1802), *L. leucopus* (Kirby, 1802), *L. subfulvicorne* (Blüthgen, 1934), *L. rufitarse* (Zetterstedt, 1838)
	boreal-subtropical	*L. albipes* (Fabricius, 1781), *L. calceatum* (Scopoli, 1763)
	southern	*L. politum* (Schenck, 1853)
Superatlantic	predominantly boreal	*L. lucidulum* (Schenck, 1861), *L. quadrinotatulum* (Schenck, 1861)
	boreal-subtropical	*L. xanthopus* (Kirby, 1802)
	southern	*L. costulatum* (Kriechbaumer, 1873), *L. discus* (Smith, 1853), *L. subaenescens* (Pérez, 1895)
Continental, predominantly boreal		*L. tungusicum* Ebmer, 1978
II. Wide Western Palaearctic ranges		
Western, boreal-subtropical		*L. aeratum* (Kirby, 1802), *L. morio* (Fabricius, 1793), *L. nitidiusculum* (Kirby, 1802), *L. semilucens* (Alfken, 1914), *L. sexnotatum* (Kirby, 1802)
Western and Western pancontinental, southern		*L. brevicorne* (Schenck, 1868), *L. buccale* (Pérez, 1903), *L. clypeare* (Schenck, 1853), *L. crassepunctatum* (Blüthgen, 1923), *L. cristula* (Pérez, 1895), *L. elegans* (Lepeletier, 1841), *L. griseolum* (Morawitz, 1872), *L. laeve* (Kirby, 1802), *L. limbellum* (Morawitz, 1876), *L. lineare* (Schenck, 1868), *L. malachurum* (Kirby, 1802), *L. mandibulare* (Morawitz, 1866), *L. marginatum* (Brullé, 1832), *L. medinai* (Vachal, 1895), *L. mesosclerum* (Pérez, 1903), *L. minutissimum* (Kirby, 1802), *L. nigripes* (Lepeletier, 1841), *L. nitidulum* (Fabricius, 1804), *L. obscuratum* (Morawitz, 1876), *L. pauxillum* (Schenck, 1853), *L. puncticolle* (Morawitz, 1872), *L. pygmaeum* (Vachal, 1905), *L. quadrinotatum* (Kirby, 1802), *L. truncaticolle* (Morawitz, 1877)
Western Euricontinental, southern		*L. fallax* (Morawitz, 1873)
III. Wide European ranges		
Pan-Atlantic, boreal-subtropical		*L. lativentre* (Schenck, 1853), *L. parvulum* (Schenck, 1853), *L. punctatissimum* (Schenck, 1853)
Pan-Atlantic и Western Transitional	predominantly boreal	*L. tarsatum* (Schenck, 1868)
	southern	*L. bicallosum* (Morawitz, 1873), *L. bluethgeni* Ebmer, 1971, *L. convexiusculum* (Schenck, 1853), *L. corvinum* (Morawitz, 1877), *L. duckei* (Alfken, 1909), *L. euboeense* (Strand, 1909), *L. glabriusculum* (Morawitz, 1872), *L. intermedium* (Schenck, 1868), *L. interruptum* (Panzer, 1798), *L. laevigatum* (Kirby, 1802), *L. laticeps* (Schenck, 1868), *L. lissonotum* (Noskiewicz, 1926), *L. minutulum* (Schenck, 1853), *L. pallens* (Brullé, 1932), *L. podolicum* (Noskiewicz, 1925), ?*L. prasinum* (Smith, 1848), *L. quadrisignatum* (Schenck, 1853), ?*L. setulellum* (Strand, 1909), *L. setulosum* (Strand, 1909), *L. sexstrigatum* (Schenck, 1868), *L. subfasciatum* (Imhoff, 1832), *L. trichopygum* (Blüthgen, 1923
IV. Mediterranean-Irano-Turanian ranges		
Eastern Mediterranean-Euxine-Iranian-Turanian		*L. adaliae* (Blüthgen, 1923), *L. aegyptiellum* (Strand, 1909), *L. hilare* Ebmer, 1972, *L. longirostre* (Morawitz, 1876),
Eastern Mediterranean-Irano-Turanian		*L. clypeiferellum* (Strand, 1909)
V. Mediterranean-Levantine-Caucasian ranges		
Mediterranean-Levantine-Euxine and Mediterranean-Levantine-Curoaraxian		*L. euxinicum* Ebmer, 1972, *L. laevidorsum* (Blüthgen, 1923), ?*L. mediterraneum* (Blüthgen, 1926), *L. peregrinum* (Blüthgen, 1923), *L. transitorium* (Schenck, 1868)
Mediterranean-Levantine-Euxinian-Black Sea		*L. anellum* (Vachal, 1905), *L. damascenum* (Pérez, 1910)

Table 1. (continuations)
Таблица 1. (продолжение)

Eastern Mediterranean-Levantine-Kuro-Araxes and Eastern Mediterranean-Euxinian	*L. caspicum* (Morawitz, 1873), *L. denislucum* (Strand, 1909), *L. elatum* (Warncke, 1975), *L. epipygiale* (Blüthgen, 1924), *L. erraticum* (Blüthgen, 1931), *L. haesitans* (Blüthgen, 1931), *L. hethiticum* Ebmer, 1970, *L. imbecillum* Ebmer, 1974, *L. kussariense* (Blüthgen, 1925), *L. ordubadense* (Friese, 1916), *L. prunellum* (Warncke, 1975), *L. sociorum* (Blüthgen, 1924), *L. stolidum* (Warncke, 1982)
East Mediterranean-Levantine-Caspian	*L. muganicum* Ebmer, 1972
Eastern Mediterranean-Sumeria-Iranian	*L. mose* Ebmer, 1974
VI. Irano-Turanian ranges	
Irano-Turanian and Irano-Turanian-Gobi, southern	*L. adabaschum* (Blüthgen, 1931), *L. anguliceps* (Morawitz, 1893), *L. annulipes* (Morawitz, 1876), *L. ciscapum* (Blüthgen, 1931), *L. croceipes* (Morawitz, 1876), *L. debile* (Morawitz, 1893), *L. ekaterinae* Astafurova et Proshchalykin, 2025, *L. equestre* (Morawitz, 1876), *L. euxanthopus* Pesenko, 1986, *L. hyalinipenne* (Morawitz, 1876), *L. leucopymatum* (Dalla Torre, 1896), *L. maculipes* (Morawitz, 1876), *L. niveocinctum* (Blüthgen, 1923), *L. pallidum* (Radoszkowski, 1888), *L. persicum* (Cockerell, 1919), *L. picipes* (Morawitz, 1876), *L. pistorium* (Vachal, 1902), *L. popovi* (Blüthgen, 1931), *L. quadrinotatiforme* Ebmer, 1980, *L. rhynchites* (Morawitz, 1876), *L. skorikovi* (Blüthgen, 1929)
VII. Levantine-Caucasian and Caucasian ranges	
Levantine-Kuro-Araxes and Levantine-Euxinian	*L. acephaloides* (Blüthgen, 1931), *L. apricarium* (Warncke, 1982), *L. araxanum* (Blüthgen, 1923), *L. argaeum* (Blüthgen, 1931), *L. daglariense* (Warncke, 1984), *L. edessae* Ebmer, 1974, *L. salinum* (Morawitz, 1876), *L. scirpaceum* (Warncke, 1975), *L. talyschense* (Blüthgen, 1925)
Conditionally Euxinian and Kuroaraksinian	*L. nakhchivanicum* Astafurova, Proshchalykin et Maharramov, 2024, *L. tauricum* Ebmer, 1972
Kuro-Araxes-Hyrcanian	*L. reinigi* Ebmer, 1978

Remarks. ? — species with unclear status or their distribution in the Caucasus needs clarification.
Примечания. ? — виды с неясным статусом или нуждающиеся в уточнении распространения на Кавказе.