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BENTHIC INVERTEBRATE FAUNA OF HIGH MOUNTAIN STREAMS IN THE CAUCASUS

1. HISTORICAL OUTLINES OF FAUNISTIC INVESTIGATIONS IN THE WATERS OF THE CAUCASUS

The Caucasus and the Transcaucasian area belong to the most interesting territories of the USSR as for as nature in concerned. On a relatively small area a great variety of landscape forms are found, starting from the snow-capped tops of the Great Caucasus (Photo 1) to the sub-tropical lowlands of Kolchida and Lenkoran. There also occur all

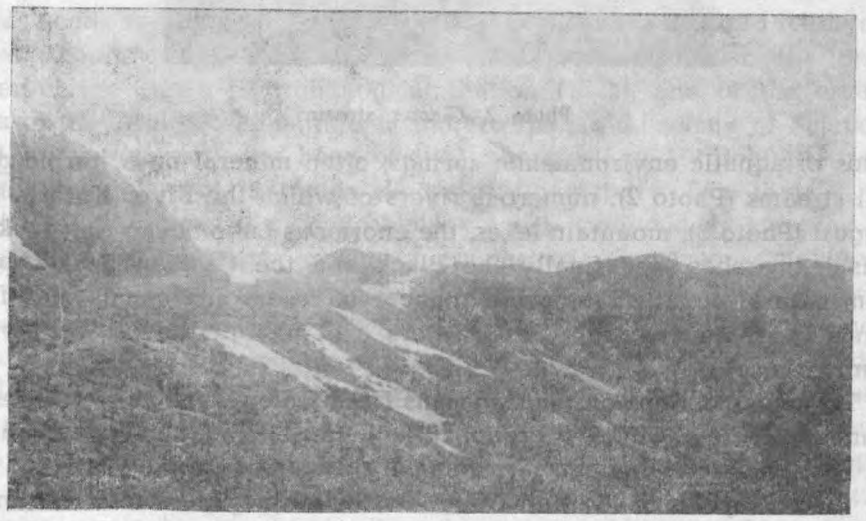

Photo 1. Peak of Kazbek

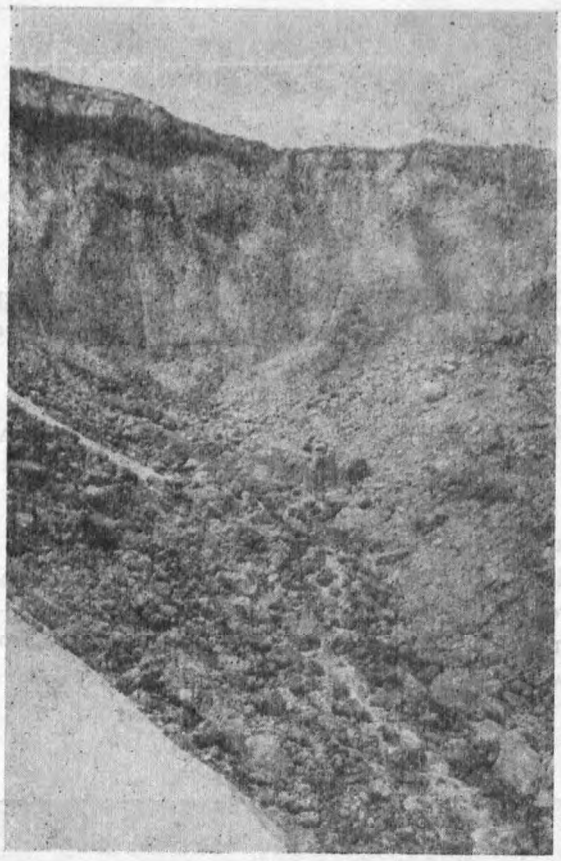

Photo 2. Glacier stream

kinds of aquatic environments: springs, often mineral ones, turbid glacial streams (Photo 2), numerous rivers of which the River Kura is the biggest (Photo 3), mountain lakes, the enormous Lake Sevan, salty lakes, seaside marshes, and finally the Black and the Caspian Seas. Apart from natural aquatic biotopes a number of reservoirs, canals, and fish ponds were built there. These waters are inhabited by a very rich faunistic world.

The first mentions on the Caucasus fresh water fauna can be already found in ancient works (Herodot, Elian), those of Arabic geographers (Al-Istachri, Ibn-al-Fakich), Armenian historians (Kagankatvaci) and later in the reports of Russian travellers. In these papers information is found mostly on occurence of some fish species in the Caucasus waters and the Transcaucasian area. In the 19th century, the Caucasus was visited by numerous naturalists; their papers contain, among others, data on aquatic organisms and fish species of that region.

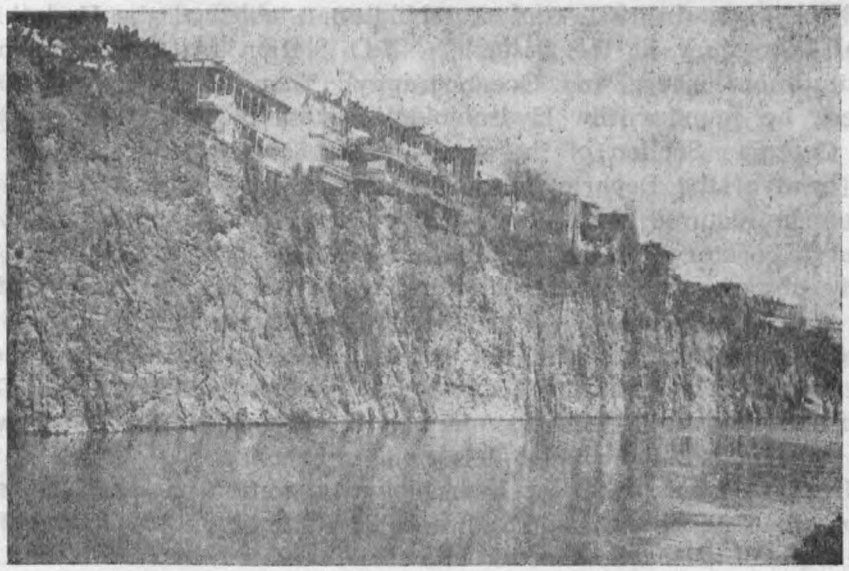

Photo 3. Kura River in the Tbilisi

Systematic hydrobiological investigations carried out in the Caucasus began in 1912 when professor A. N. Derzhavin organized Ichthyological Laboratory in Baku. Professor Derzhavin was also the organizer of the Sevan Hydrobiological Station (1923), one of the organizers of the Zoological Institute of the Azerbaijan Academy of Sciences, and for many years the head of the Laboratory of Hydrobiology and Ichthyology in that Institute. His scientific activity, like that of the majority of pioneers of hydrobiology, was many-sided. He was an outstanding systematist, expert in crustacea *(Cumacea, Amphipoda)* of which he described a number of species from the Transcaucasian area; he was also an eminent ichthyologist. He initiated complex investigations of the lower course of the River Kura. At present his hydrobiological activity is carried on by his pupils, among others professor A. G. Kasymov. Together with a large team of scientists they continue the ichthyological and hydrobiological investigations initiated by professor Derzhavin in the lower River Kura and in the two dam reservoir i.e. the Mingiechaurski and the Varvarynski, built on it; they also carry investigations in lakes and streams. Recently investigations have been focussed on the influence of petrol pollutions on the biocenoses of the Caspian Sea.

The beginnings of hydrobiology in Georgia date bask to the thirties of our century and are connected with the name of professor V. N. Nikityn. In 1931, professor Nikityn established the Hydrobiological Laboratory at the Batumi VNIRO Station (All-Union Scientific Institute of Fishery and Oceanography). Then he moved to Tbilisi where he founded the Hydrobiological-Ichthyological Laboratory at the Georgian Section of the Academy of Sciences and then became the head of the Department of Zoology of the University of Tbilisi where he lectured also on hydrobiology. The Hydrobiological-Ichthyological Laboratory (of the Institute of Zoology of the Georgian Academy of Sciences), for many years headed by professor A. Sadowski — a Pole by origin — carried out investigations in the upper and middle course of the River Kura and its Caucasian tributaries, in mountain lakes, in mountain and submountain dam reservoirs. The Georgian Division VNIRO in Batumi concentrates its interest mainly of fish ponds.

In the Armenian SSR the hydrobiological station on the Lake Sevan is of greatest importance. The works of its staff on the unique flora and fauna of that lake are world known.

In Northern Osetia, in Ordzhonikidze, the Hydrobiological Station of the Agricultural Institute, directed by professor D. A. Tarnogradski, has been carrying scientific activity for many years.

As a result of activities carried out by the above mentioned hydrobiological centers and due to Soviet researches, among them professors V. I. Zhadin, A. L. Bening, K. R. Fortunatov, 2319 species and forms of fresh water fauna were recorded in the waters of the territories beyond the Caucasus (K a s y m o v 1972).

2. FAUNISTIC CHARACTERISTICS OF HIGH MOUNTAIN STREAMS

A very interesting faunistic world inhabits the mountain streams and rivers of the Caucasus. Elaboration of the benthic fauna of the River Bakurianka made by M u r v a n i d z e (1949) was a classical one. The papers by B e n i n g and P o p o v a (1947) give a hydrobiological elaboration of the River Zanga from its springs to Erivan. K a k a u r i d z e (1946) gives a description of the benthic fauna of the stream Dabakhan, which crosses the botanical garden in Tbilisi. Some minor mentions on the benthic fauna in some streams of the Great Caucasus can be found in professor D. A. Tarnogradski's algological publications (T a r n o g r a d s k i, P o p o v 1932/1933). In his

study dealing with fresh water fauna of the Caucasus Kasymov (1972) presents the results of investigations carried out in 29 rivers and streams of the Great Caucasus and Small Caucasus in their lower and middle course. Zosidze (1973), Kownacki, Zosidze (1980) give in their papers characteristics of the benthic fauna of the Adzhar ASSR rivers and streams, whereas, Kownacka, Kownacki (1971) elaborated such characteristics of some streams of the Great Caucasus in the Kazbek and Svanetskiy regions. Nevertheless, the Caucasus fauna of streams and rivers has not been fully determined as yet, and requires further investigations.

In 1970 hydrobiological investigations were carried out in some high mountain streams and rivers of the Great Caucasus. Investigations covered the left side tributaries of the River Alazani: Kishchay, Kurmukhchay, Talachay, Katekhchay, and Belakanchay in the territory of Azerbaijan and the upper course of the River Terek and its glacial tributaries Suatisi, Mnaisidon, Chkheri flowing down from the southern and eastern slopes of the Mt. Kazbek in the territory of Georgia. These investigations aimed at presenting the invertebrate fauna composition, zonal distribution of faunistic associations, and attempted at elucidating the origin of this fauna in the streams of the Great Caucasus.

In the investigated streams larvae of insects, specially *Diptera* of the family *Chironomidae*, are the main components of the invertebrata fauna. Their share usually exceeds 50 per cent of the total fauna and even in some sectors of streams they are the only representatives of invertebrates. From other groups the larvae of mayflies, stone-flies, and *Diptera* of the family *Simuliidae* (Fig. 1) are fairly numerous in some streams. In these streams about 100 taxons of invertebrates can be found what is relatively little. In the best recognized mountain rivers of Europe i.e. the River Fulda and the River Raba, over 500 species were found (Marten 1984, Lehmann 1971, Kownacki 1975). It should be, however, remembered that in the Caucasus only the highest sectors of streams were investigated, whereas, in the above mentioned rivers their whole course was determined.

The fauna of particular catchment areas and even particular stations within the stream is very differentiated. Four types of zoocenoses were distinguished. The most frequent type encountered in the investigated streams is the high mountain zoocenose in which *Chironomidae*, with larvae of the genus *Diamesa*, constitute the main element. Sometimes larvae of *Simuliidae* occur along with them in fairly large numbers, whereas, participation of mayfly and stone-fly larvae is relatively small. In the second type of zoocenoses larvae of *Chiro-*

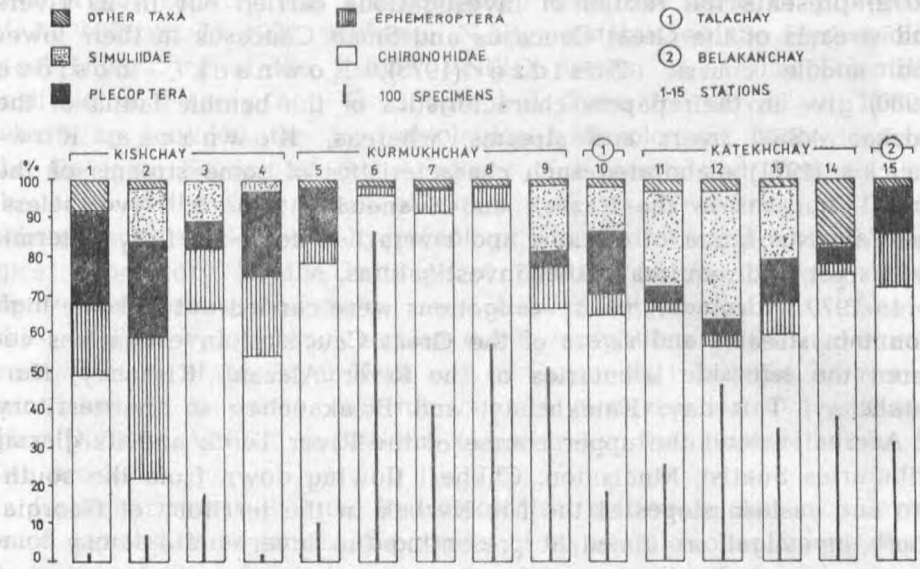

Fig. 1. Total number of macroinvertebrates and percentage distribution of different taxa at sampling sites in the Caucasus streams: Kishchay, Kurmukhchay, Talachay, Katekchay, Belakanchay (Azerbaijan SSR)

nomidae — Orthocladius (Euorthocladius) rivicola and stone-flies dominate. Mayflies of the genus *Baetis* and *Epeorus* are an important element in this zoocenose. In the third group of zoocenoses *Chironomidae — Eukiefferiella cyanea* are the dominating forms. The least common is the association where mayflies, caddis-flies, stone-flies, and *Tricladidae* dominate. This type is encountered in small forest tributaries of main streams.

Observations of the fauna distribution along the course of stream permit to distinguish some associations differing both in number of individuals and special composition as well as in dominating characteristic species. In the upper course of the River Terek and its high mountain tributaries the following distribution of the fauna was found (Fig. 2). In the stream, just below the glacier, no representatives of the fauna were reported, though numerous *Chironomidae* of the genus *Diamesa* and stone flies *Protonemura alticola* were seen flying above the stream. But already 50 m below the glacier individual, very young larvae of the genus *Diamesa* were encountered. At a distance of 500 m from the glacier a characteristic association, consisting mainly of *Dia-*

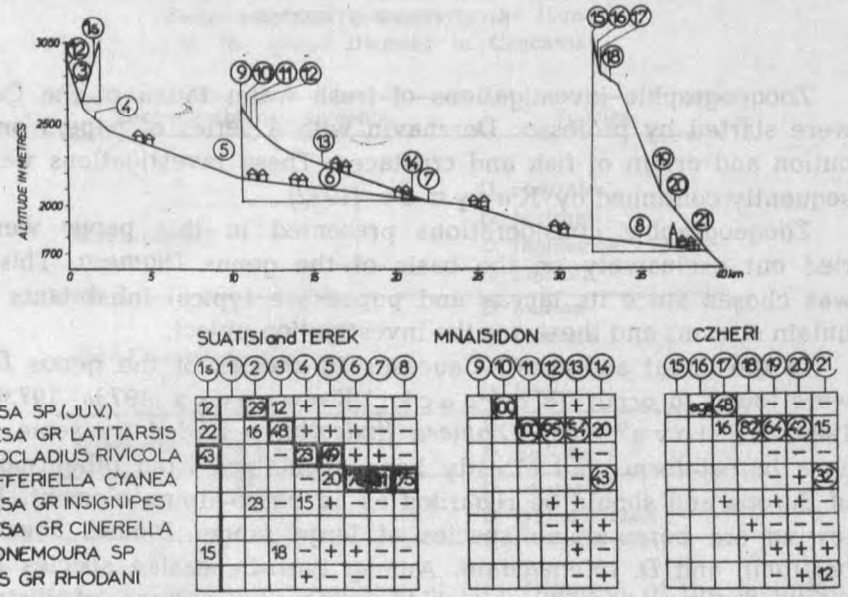

Fig. 2. Distribution of bottom fauna communities in the Caucasus streams: Terek, Suatisi, Mnaisidon and Chkheri (= Czheri) (Georgian SSR). The communities are composed according to the index of dominance; number in circle = first dominant, + = subdominant, — = adominant, s. = spring streams

mesa larvae, was found. These were hard to identify but on the basis of specimens collected at least three species were found to occur: *Diamesa caucasica, D. tskhomelidzei, D. sakartvella.* This association developed in the streams Mnaisidon and Chkheri along their whole course. In the stream Suatisi formed by merging of some glacial and spring streams the above mentioned association developed only in glacial streams. In the spring stream the first dominant were larvae of *Orthocladius rivicola.* This species dominated also along the whole length of the stream Suatisi from the place where all the streams join. This proves a marked influence of spring streams and the numerous springs situated on the river bank on the character of biocenoses. Whereas, in the investigated sector of the River Terek (at the altitude of 1700 to 2200 m) mainly an association consisting of larvae of *Eukiefferiella cyanea develops.* This species dominates also in the tributaries of the River Terek in all sectors close to the estuary.

3. ZOOGEOGRAPHIC REMARKS ON THE FAUNA OF HIGH MOUNTAIN STREAMS

Zoogeographic investigations of fresh water fauna of the Caucasus were started by professor Derzhavin with a series of papers on distribution and origin of fish and crustacea. These investigations were subsequently continued by Kasymov (1972).

Zoogeographic considerations presented in this paper were carried out exclusively on the basis of the genus *Diamesa*. This genus was chosen since its larvae and pupae are typical inhabitants of mountain streams and these are the investigation object.

In the Great and Small Caucasus 13 species of the genus *Diamesa* were found to occur (Kownacki, Kownacka 1973a, 1973b, 1974, 1980, Shilova 1968). *Diamesa lindrothi*, regarded by some authors as a boreal form, had already been sygnalized from other mountains of Europe and should be regarded as an boreo-alpine element. The following are boreo-alpine species of large range: *Diames aberrata*, *D. bertrami*, and *D. thienemanni*. Among Euro-Caucasian species *D. martae* and *D. modesta* have an Alpine-Caucasian type of distribution *D. lavillei* Pyrenesian-Caucasian type of distribution, whereas, *D. vaillanti* and *D. thomasi* a mountain type of large range both in the geographical and vertical sense. Subponto-Mediterranean species are: *Diamesa sakartvella* and *D. kasymovi* found in the Caucasus and in the mountains of Small Asia (the mountain of Lebanon — Moubayed, Laville 1983) as well as species found, so far, in the Caucasus i.e. *Diamesa caucasica* and *D. tskhomelidzei* (Tab. 1).

It can be seen from the above presented data that in fauna of *Diamesa* of the Caucasus the participation of boreo-lpine species in relatively small when compared with other mountains of Europe. Let us take for example the Tatra Mts where for 14 species of the genus *Diamesa* 7 show a boreo-mountain distribution (Kownacki 1986). In the fauna of the Caucasus, on the other hand, Euro-Caucasian and subponto-Mediterranean species prevail. It should, thus, be assumed that the period of the Qarternary glaciations, which markedly influenced the fauna of *Diamesa* of the Tatra Mts did not play such an important role there. In spite of it there is evident concurrence between the mountain fauna of Europe and that of the Caucasus. For 13 species of *Diamesa* from the Caucasus only 4 have not yet been found in the mountains of Europe. Hence, there was a permanent exchange of species between the Caucasus and the mountains of Europa, whereas connections between the Caucasus and the other mountains of Asia

Table 1

Zoogeographical elements in the fauna of the genus *Diamesa* in Caucasus

Zoogeographical elements	Species
Boreo-Alpine	D. *aberrata*
	D. *bertrami*
	D. *thienemanni*
	D. *lindrothi*
Euro-Caucasian	D. *martae*
	D. *modesta*
	D. *thomasi*
	D. *lavillei*
Subponto-Mediterranean	D. *sakartvella*
	D. *kasymovi*
Caucasian	D. *caucasica*
	D. tskhomelidzei

are considerably looser. As a matter of fact *Diamesa* of the mountains of Asia are not well recognized hitherto, nevertheless some conclusions can already be drawn on the basis of the existing data. For example in the whole Himalayas, 11 species of *Diamesa* were found but only 1 species, i.e. *Diamesa aberrata*, is a species common to the Himalayas, the Caucasus, and the mountains of Europe.

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BIBLIOGRAPHY

Behning A. L., Popova A. N., *Materialy po gidrobiologii r. Zangi ot istoka do g. Eryvana*, Trudy sevan. gidrobiol. Stanc., 7, 1947.

Kakauridze T. G., *Raspredelenie bentičeskoi fauny v gornoi reke Dabakhana*, Trudy Inst. Zool., Tbilisi, 12, 1946.

Kasymov A. G., *Presnovodnaja fauna Kavkaza*, Izd. E. L. M., 1972.

Kownacka M., Kownacki A., *Vertical distribution of zoocenoses in the streams of the Tatra, Caucasus and Balkans Mts.*, Verh. Internat. Verein. Limnol., 18, 1972.

Kownacki A., *River Raba and its biocenoses (Scientific guide)*, II Symp. na temat Ephemeroptera, 1975.

Kownacki A., *Ecology and biogeography of Diamesinae (Chironomidae, Diptera) from Poland*, Acta Univ. Lodz., Folia limnol., 2, 1986.

Kownacki A., Kownacka M., *Chironomidae (Diptera) from the Caucasus. Diamesa Waltl group steinboecki*, Bull. Acad. pol. Sci., Cl. II, Ser. Sci. biol., 21, 1973a.

Kownacki A., Kownacka M., *Chironomidae (Diptera) from the Caucasus. II. Diamesa Waltl group latitarsis*, Bull. Acad. pol. Sci., Cl. II, Ser. Sci. biol., 21, 1973b.

Kownacki A., Kownacka M., *Relation of Chironomidae from Tatra and Caucasus Mts.*, Ent. Tidskr., Suppl. 95, 1974.

Kownacki A., Kownacka M., *Diamesa martae sp. n. (Diptera: Chironomidae) and geographical distribution of the species of Diamesa latitarsis group*, Acta Hydrobiol., 22, 1980a.

Kownacki A., Zosidze R., *Taxocens of Chironomidae (Diptera) in some rivers and streams of the Adzhar ASSR (Little Caucasus Mts)*, Acta Hydrobiol., 22, 1980b.

Lehmann J., *Die Chironomiden der Fulda. Systematische, ökologische und faunistische Untersuchungen*, Arch. Hydrobiol., Suppl., 37, 1971.

Marten M., *The macrozoobenthos of the river Fulda: faunistics, longitudinal zonation and changes in the last 30 years*, Verh. Internat. Verein. Limnol., 22, 1984.

Murvanidze D. I., *Materialy k gydrobiologii r. Bakurianki*, Trudy Inst. Zool. Akad. Nauk Gruz. SSR, 8, 1949.

Shilova A. I., *Nova nakhodka Diamesa lavillei (Diptera, Chironomidae) v faune Sovetskogo Soyuza*, Zool. Zh., 57, 1978.

Tarnogradsky D. A., Popov K. K., *K biologii i rasprostraneniju peredatchika fascioleza Limnea trunkulata Müll. na Sev. Kavkaze*, Pab. Sev.-Kavk. gidrobiol. st., 1, 4, 1932/1933.

Zosidze R. Sh., *Bentofauna rek Adzharskoi ASSR*, Avtoref. Diss. Izd. Tbilisk. Univ., Tbilisi 1973.

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FAUNA BEZKRĘGOWCÓW W WYSOKOGÓRSKICH POTOKACH KAUKAZU

W potokach Kaukazu głównym składnikiem fauny bezkręgowców są larwy owadów, a zwłaszcza muchówki z rodziny *Chironomidae* (rys. 1). Obserwując rozmieszczenie fauny wzdłuż biegu potoków wyróżniono kilka zespołów różniących się zarówno ilością osobników, składem gatunkowym, jak i charakterystycznymi gatunkami dominującymi (rys. 2). W potokach lodowcowych u wrót lodowca nie znaleziono przedstawicieli fauny. Ale już poniżej lodowca w odległości około 50 m spotykano pojedyncze młode larwy *Chironomidae* z rodzaju *Diamesa*. W odległości 500 m od lodowca rozwija się charakterystyczny zespół złożony głównie z larw kilku gatunków *Diamesa*. Natomiast w potokach biorących początek ze źródeł dominowały larwy *Orthocladius* (E.) *rivicola*. Po połączeniu się wszystkich większych potoków powstaje duża wysokogórska rzeka, w której rozwija się głównie zespół złożony z larw *Eukiefferiella cyanea*.

Ponieważ gatunki z rodzaju *Diamesa* są typowymi mieszkańcami wysokogórskich potoków Wielkiego Kaukazu, starano się wyjaśnić sprawę ich pochodzenia. Stwierdzono występowanie 13 gatunków z rodzaju *Diamesa* (tab. 1). Tylko 7 ga-

tunków ma rozmieszczenie boreo-alpejskie. Pozostałe to gatunki euro-kaukaskie i subponto-medyterraneńskie oraz dwa uznane chwilowo za endemity kaukaskie. Na 13 gatunków *Diamesa* z Kaukazu tylko 4 nie zostały dotychczas stwierdzone w górach Europy. Istniała zatem stała wymiana gatunków pomiędzy Kaukazem a górami europejskimi. Natomiast znacznie mniejsze są powiązania pomiędzy Kaukazem a pozostałymi górami Azji. Przykładowo w całych Himalajach stwierdzono 11 gatunków *Diamesa*, ale tylko *Diamesa aberrata* jest wspólna dla Himalajów, Kaukazu i gór Europy.