ACTA ZOOL. CRACOV. | 29 | 21 | 501—586 | KRAKÓW, 30. IV. 1986

Bronisław Szczęsny

Caddisflies *(Trichoptera)* of running waters in the Polish North Carpathians

[With 12 text-figs]

Chruściki *(Trichoptera)* wód bieżących w polskich Karpatach Północnych

Abstract: *Trichoptera* of the Polish North Carpathians were studied. Materials (larvae, pupae and imagines) were collected in the years 1965—1981 in all kinds of aquatic biotops, particular attention being paid to running waters caddisflies.

210 caddisfly species were found to live in the North Carpathians (including published data after verification). 162 of them inhabit the Polish part of the mountains. 8 endemic species were found to exist there (including *Allogamus starmachi* Sz., an endemic Tatra species).

Running waters are inhabited by 106 species; the most abundant ones are as follows: *Hydropsyche pellucidula* (Curt.), *Psychomyia pusilla* (Fabr.), *Rhyacophila nubila* (Zett.), *Allogamus auricollis* (Pict.).. The most abundant species were generally found to be the most common.

Eight caddisfly communities were distinguished by means of a statistical method. They inhabited successive stream reaches. Community S was found to be restricted to Tatra streams exclusively. Communities A and B were observed to inhabit high-mountain streams of the Tatras and the Babia Góra Mtn. The remaining ones (C, D, E, F, G) colonise the streams of the Beskidy Mts which are of medium height. The Tatra endemic species dominates in community S while the remaining Carpathian endemic species mostly participate in community C ("spring" community).

Running waters caddisflies were grouped into functional feeding groups according to Cummins (1973). Percentage of the groups in the communities was commented upon.

Life cycles of 15 species were followed. The species were classed into three groups according to the way of life cycle completion: I — univoltine species with a very synchronous moulting pattern, II — semivoltine species, III — poorly synchronous univoltine species.

An analysis of the main adaptation trends of the North Carpathian *Trichoptera* proved the species to adapt mainly to cold running waters; attached algae or detritus appeared to be their main diet components.

Absence of endemic species from stagnant waters of the North Carpathians was discussed.

CONTENTS

I. INTRODUCTION

Caddisflies of the North Carpathians, in Polish literature usually referred to as the West Carpathians, have been studied since the middle of the last century. However, the studies have been mostly of faunistic type, have dealt with imagines and have included only a limited area; more often than not it has been the Tatra Mts. Numerous though fragmentary observations of this group of aquatic insects which have been made since, have confirmed the well-known fact that the aquatic fauna and flora of the mountains abound in rare species or in those whose range is limited as well as in species highly diversified with regard to their ecological and biological features.

The paper aims to present a critical summary of the knowledge of the North Carpathian caddisflies and to verify the species quoted so far in confrontation with the latest achievements of taxonomy and with the results of the author's systematic and methodically uniform studies which included the whole area of the Polish North Carpathians. During ecological studies, most attention was paid to running waters.

The paper is intended to be another step on the way towards a more comprehensive knowledge of the most important groups of invertebrates which inhabit the aquatic enivronment of the North Carpathians; previous report dealt with the mayflies (Sowa 1975).

During field studies, I received much help from R. SOWA, E. DRATNAL and M. OLECHOWSKA, while H. MALICKY from Austria aided me with his knowledge in solving some taxonomic problems; I wish, hereby, to express my gratitude to them.

II. A HISTORY OF STUDIES ON THE NORTH CARPATHIAN CADDISFLIES

The author of the first paper on the caddisflies of the Polish North Carpathians was M. NOWICKI (1865) of the Jagiellonian University. The paper contained an inventory of insect species (including 19 *Trichoptera* species collected in the Tatras and Pieniny Mts and identified by F. BRAUER of Vienna) presented by the author to the Dzieduszycki Museum in Lvov.

Other papers on caddisflies, mainly those of the Tatras, soon followed: DZIĘDZIELEWICZ (1867, 1889), NOWICKI (1867, 1968, 1869, 1870) and WIERZEJSKI (1883). Collection of faunistic data necessitated their systematization which was undertaken by MAJEWSKI (1882, 1885) and DZIĘDZIELEWICZ (1891). At that time, 44 species of caddisflies of the North Carpathians were known.

In the years 1891—1892, DZIĘDZIELEWICZ (1895) carried out first systematic studies on caddisflies (and also on the mayflies and stoneflies) of the Tatras and, as a result, was able to find out that the insects were distributed zonally along the length of streams. He then distinguished, basing on adults only, a group of species captured near Tatra springs and at the outflows from the springs, a separate group of species from upstream sections of streams originating from the springs as well as other groups from midstream and downstream sections. To my knowledge, these were the earliest studies in the world on zonation of the invertebrates in running waters.

In the following years, caddisflies of the Beskid Sądecki Mts were studied by SCHILLE (1902, identified by DZIĘDZIELEWICZ), of the Babia Góra Mtn and the vicinity of Myślenice by DZIĘDZIELEWICZ (1911) and of the Tatra lakes by MINKIEWICZ (1914).

That period of studies was closed by DZIĘDZIELEWICZ'S (1919, 1920) critical review and summary of the results available until then of studies on Polish caddisflies (including 102 species from the North Carpathians which were known at that time).

During the 20 years that followed, only two publications on North Carpathian caddisflies appeared. Their authors were MIKULSKI (1931) and RACIĘCKA (1933) and the number of familiar caddisfly species from the area was increased to 113.

In the postwar period, studies on *Trichoptera* of the mountain region commenced at the beginning of the 1960s parallel with a development of studies on the Carpathian waters biocenosis. Beside faunistic works of RIEDEL (1960, 1961, 1962) and TOMASZEWSKI (1961), the first ecological work appeared written by

KAMLER and RIEDEL (1960) which treated caddisflies as a component of stream benthos.

TOMASZEWSKI (1965) summed up the available data on Polish caddisfly species (within the new Polish borders) including the North Carpathian ones. In his catalogue, the author listed 137 caddisfly species and subspecies for the North Carpathians (some from his unpublished data).

The following years witnessed an increase in works on Carpathian caddisflies. Until 1981, there appeared faunistic and faunistic- ecological papers by the following authors: ZAĆWILICHOWSKA (1964, 1969), BOTOSANEANU (1965), SZCZĘSNY (1965, 1966a, 1966b, 1970, 1975, 1980), RIEDEL (1972, 1978), KLIMA (1981). Ecological works were also published by KOWNACKA and KOWNACKI (1965a, 1965b, 1968), KRZANOWSKI et al. (1965), ZAĆWILICHOWSKA (1968), KOWNACKA (1971), SZCZĘSNY (1974a), KOWNACKI (1977), DRATNAL et al. (1979). Some works on taxonomy of the North Carpathian caddisflies were also published by SZCZĘSNY (1967, 1974b, 1978a, 1978b).

Despite the history of almost 120 years of studies on the North Carpathian caddisflies, surprisingly few new species of the region were described. There were only three of them (SZCZĘSNY 1967) and verification proved it to be only one: *Allogamus starmachi* SZCZĘSNY, an endemic species for the Tatras.

From the final years of the past century, the North Carpathian caddisflies from the Slovak part of the mountains were dealt with by KLAPALEK F., MOCSARY A., PONGRACZ A., FEKETE G. and MAYER K. Just before the outbreak of World War II, the latter summed up the available data of that time (MAYER, 1939) listing 186 caddisfly species of the Slovak North Carpathians with detailed bibliography. After the war, other species were added to the list by BOTOSANEANU (1961), SEDLAK (1962), SYKORA (1962), NOVAK and BOTOSANEANU (1965), NOVAK and OBR (1966), HELAN et al. (1973).

III. STUDY AREA

Investigations were made in the North Carpathians within the Polish frontiers and included the area from the Silesian-Moravian Gate (the Brama Śląsko-Morawska) in the west to the Dukla Pass in the east. Several lowest stations, on the rivers: Vistula, Skawa, Raba and Wisłoka lay outside the area in the adjacent Basins: the Oświecimska and the Sandomierska, north of the North Carpathians.

The North Carpathians (also referred to as the West Carpathians) form the northern part of the wide range of the Carpathians which are relatively young mountain systems formed during Alpine orogenesis. A significant feature of this part of the Carpathians, which has been stressed by authors of numerous works on the region, is a great diversity of geographical environment that is manifested in relief (STARKEL 1960), geology (KSIĄŻKIEWICZ, SAMSONOWICZ

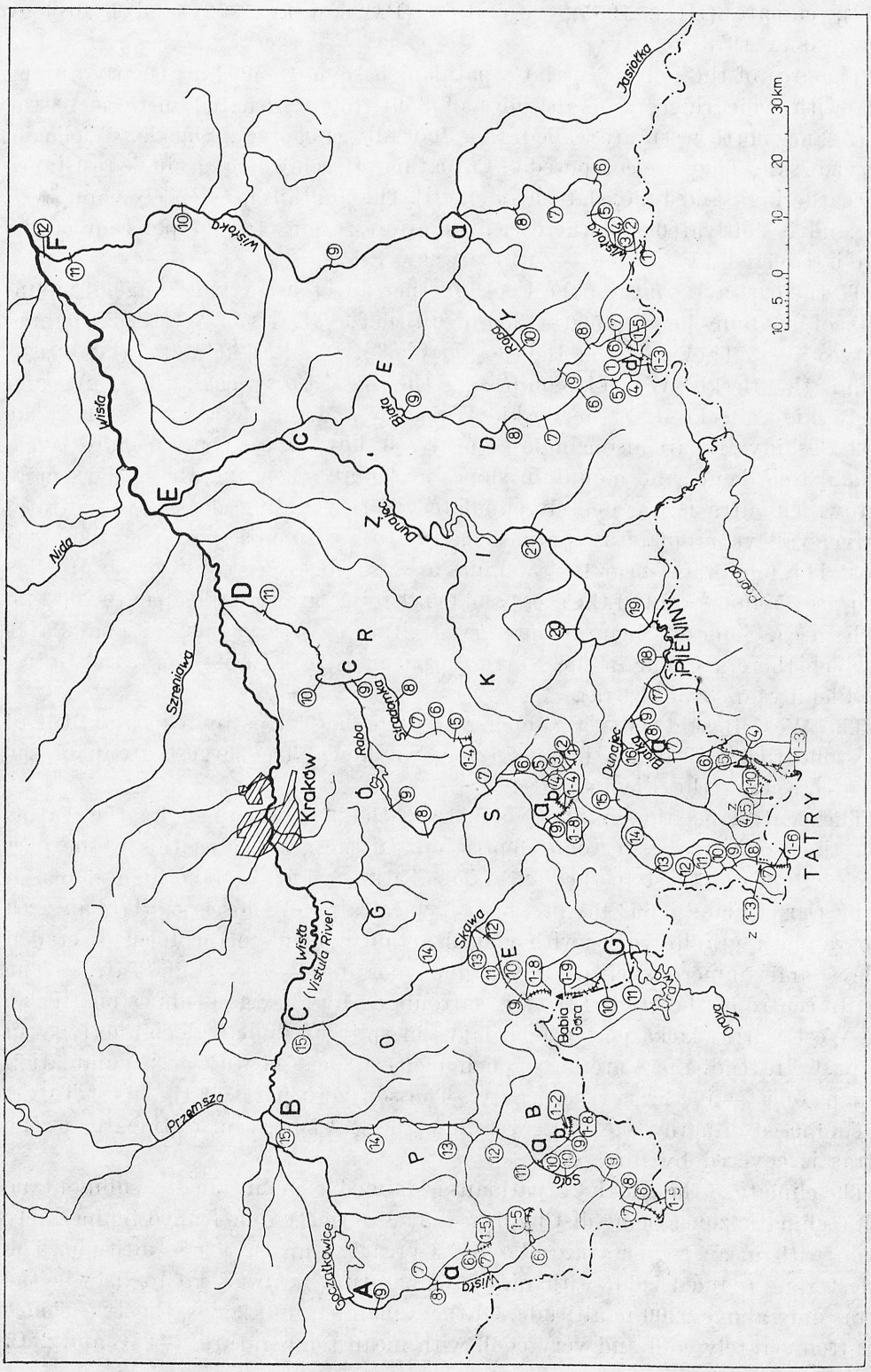

Fig. 1. Map of North Carpathian river network with marked sample sites

1952), climate (Hess 1965), vegetation (Pawłowski 1972) and hydrology (Ziemońska 1973).

The area of the Polish North Carpathians is some 16 500 km^2. Gently sloping hills with wide ridges and altitudes of 350—400 m situated farthest to the north and north-west are called the Foothills (Pogórze): Śląskie, Wielickie, Strzyżowskie. They are composed of Carpathian flysch which has little resistance to weathering (sandstone, slate, loam, marl). The Foothils are densely populated, the land is cultivated and there is little afforestation (10—17 per cent of the area is covered by forests — Zabierowska 1967).

To the east and south of the Foothills there stretches a wide range of mountains of medium height, 500—1300 m altitude, called the West (Zachodnie) Beskidy Mts. They include: the Beskid Śląski, the Beskid Mały, the Beskid Średni, the Beskid Wysoki (comprising the Beskid Żywiecki, the Gorce and the Beskid Sądecki Mts), the Beskid Wyspowy and the Beskid Niski Mts. The West Beskidy Mts are also composed of flysch, however, it contains hard layers of sandstone hence the mountain slopes are more steep and the valleys more narrow. The area is less densely populated, house-building clearly concentrates in river valleys, cropland is confined mainly to less steep slopes and valley bottoms. The mountains near the summits are usually covered by forests (forests comprise 35-40 per cent of the area) and dense forest groups take up even 260 km^2 of the area. Some of them are preserved either as reserves or National Parks of which there are four in the North Carpathians (the Babia Góra, the Gorce, the Pieniny and the Tatra).

The West Beskidy Mts are separated from the Tatras by a narrow belt of limestone rock called the Pieniński Pas Skałkowy. The largest group of the rocks comprises the Pieniny Mts.

The central position in the North Carpathians is occupied by the Tatras with the Podtatrze, a tectonic depression. In the study area this is the part which extends farthest to the south. The Tatras, which are the highest massif in the Carpathians (2663 m) present a typical alpine landscape. It is an area of bare sheer granite rocks with glacial action evident in the form of eroded valleys and numerous cirque lakes and moraines — the High Tatras. The granite centre of the High Tatras is surrounded by a range of limestone rocks. The West Tatras lacks post glacial lakes in spite of similar glacial activity in the past. Instead, there are karst phenomena associated with an accumulation of limestones — in the northern parts. The southern parts of the West Tatras are composed of hard slate and crystalline gneiss. 67 per cent of the area of the Tatras is covered by forests.

The climate of the North Carpathians is defined as mountain and submontane with 6 climatic zones being distinguished. The warmest zone (called temperately warm, with mean temperature above 8°C) reaches up to 750 m altitude. The coldest zone (named cold, with mean temperature below —4°C) exists in the Tatras only above 2200 m altitude. Of the remaining four zones, the two colder ones (temperately cold and very cool, with mean temperatures —2°C and 2°C,

respectively) are also confined exclusively to the Tatras and those parts of the Beskid Wysoki Mts which are over 1400 m altitude. For every 100 m of altitude mean temperature drops by 0.5°C.

The highest precipitation, over 1500 mm, occurs in the Tatras. Vegetation is connected with the climate of the region and 6 vegetation zones are distinguished, corresponding roughly to the range of the climate zones.

III. 1. Hydrology

Nearly the whole of the study area lies in the Vistula basin, only a small part is drained by the river networks of the Odra (western slopes of the Beskid Śląski Mts) and the Danube (southern slopes of the Babia Góra Mtn and part of the Podtatrze).

Hydrology of the area is closely connected with the elements of geographic environment which were mentioned above (ZIEMOŃSKA 1973).

On the whole, density of sources is quite high here, e. g. in the Beskidy Mts there are a dozen or so sources sper sq. km, in the Pogórze upland the sources are less numerous. Their yield of water is generally low (mostly below 0.3 l/s), subjected to seasonal fluctuation and showing a marked response to precipitations. Highly efficient sources (above 1000 l/s occur only in the Tatras.

Table I

Some features of the North Carpathian rivers

River	Profile	Length of river km	Catchment area sq. km	Mean annual discharge $m^3 \times 10^6$
Vistula	Skoczów	33 (from sources)	295	173.4
Soła	mouth	82	1375	715.9
Skawa	mouth	79	1188	441.5
Raba	mouth	137	1528	520.3
Dunajec	mouth	251	6798	2680.6
	(Nowy Sącz)	(139)	(4630)	(1870.0)
Wisłoka	mouth	164	4096	1072.2

River network is relatively dense: from 0.94 km/sq. km in the Tatras to 1.5—4.0 km/sq. km in the Beskidy Mts. Its characteristic features are high longitudinal gradients, simplified course of channels as well as great diversity of discharges and water levels. Unitary gradients of the main Tatra streams range from 40 to 187‰, while those of their tributaries are up to 400‰. Unitary gradients of the Beskidy streams exceed 200‰ only in upstream sections.

Fluctuation of water levels in the Tatra streams does not exceed 2 m, whereas that for the Beskidy streams of the same size is up to 3 m or even 4 m in larger

streams. In large Carpathian Vistula tributaries, fluctuations near 10 m and mean maximum discharge can be 1—5 thousand times greater than mean minimum (ZIEMOŃSKA 1973). Major North Carpathian rivers and some of their features are presented in Table I.

Greatest discharges occur in the summer (mainly in July and August) and are connected with torrential rains which are frequent in the Carpathians during this period. During heavy floods, within 24 hrs, water level rises by 1 m and 5 m in the Tatra and Beskid streams, respectively. Summer floods differ from the spring ones (caused by snowmelt) since stream waters are more turbid and contain much suspended matter which increases their specific gravity and their transporting ability.

In the Tatras, the Podhale and the Pieniny Mts there is also a periodical river network which disappears in late autumn and winter.

III. 2. North Carpathian streams — their appearance

Despite intense economical activity of man in the North Carpathians, the majority of streams, especially the minor ones, have preserved their completely natural character, e. g. the streams in the National Parks.

The upstream sections of the Beskid streams usually flow in narrow ravines with steep slopes, are generally surrounded by forests and shaded. They are often inaccessible due to a large number of rotting trees which lie across them.

Table II

Some thermal features of the North Carpathian rivers according GOŁEK (1961)

	Distance from source km	Altitude m	Range of monthly means °C	Highest observed °C	Annual means °C
Vistula	33	280	1.1—17.3	23.0	8.9
Soła	36	350	1.5—16.8	23.8	8.6
Skawa	42	300	1.0—16.5	22.2	8.0
Dunajec	51	560	0.3—15.6	23.8	7.2
Dunajec	139	283	0.3—17.5	28.0	8.3

Stream beds are formed of stones and boulders of different shape and size, often covered with moss (*Fontinalis* spp.) and sticking out of the water. Rotting tree branches and smaller parts of trees are deposited among them as coarse vegetal debris. In autumn fallen laeves accumulate there in considerable quantities and evidently inhibit the flow in small streams. Cascades on the streams are frequent.

The midstream sections of the streams are less shaded since the valleys grow wider and the trees less numerous. Stream beds are made up of stones

and boulders of different size, large cobbles (15—25 cm in diameter) being prevalent. Moss overgrows only the largest stones. Still many stones stick out of the water across the stream bed and fine detritus accumulates among them.

The downstream sections of the streams (especially the big ones) generally get little shading due to a considerable distance between the banks. They flow

Table III

Temperatures (°C) of karst sources (the Lodowe Źródło and at the Hala Pisana) and moraine source (at the Hala Ornak) in the Kościeliska Valley (the West Tatras) during sampling time

	Altitude m	25. X. 77	20. IV. 78	20. VI. 79	4. XII. 79
Lodowe Źródło	970	4.3	5.0	5.0	4.3
At Hala Pisana	1000	7.5	7.9	9.0	7.2
At Hala Ornak	1100	5.5	4.2	—	4.7

Table IV

Temperatures of the Poniczanka stream during sampling time (examples)

Altitude m	28. VI. 74	13. VI. 75	16. VII. 75	20. IX. 75
900 (sources)	11.0	10.5	14.0	12.2
850	10.0	11.0	13.5	12.0
800	10.0	11.0	14.0	11.9
750	11.0	—	—	—
700	11.0	11.0	15.0	—
650	12.0	—	17.5	—
600	13.0	13.0	—	—
550	16.5	—	21.0	—
500	18.0	—	22.0	—

Table V

Temperatures (°C) of the Poniczanka head tributary (examples)

Altitude m	16. VIII. 75	20. IX. 75	15. XI. 75	10. IV. 76
865 (source)	7.0	7.4	6.8	5.0
800	9.8	11.6	4.5	—
750	10.5	12.0	4.0	—
707	11.5	12.4	4.0	—

over stony area formed of cobbles and pebbles loosely lying on one another. Stretches of rapid current — riffles are interspersed with those of quieter and deeper water. Stones stick out of water only in riffles or near the banks; usually a fresh layer of silt is deposited among them. Stream edges in the midstream and upstream sections, often also in the downstream section, are overgrown with herbs, *Petasites* spp. being dominant.

The upstream and midstream sections of the High Tatra streams differ from the Beskidy Mts ones not only in having higher gradients but also in beds which are formed mostly of boulders and irregular rock blocks 0.4—1.5 m in diameter while small and medium stones are not numerous. This makes benthos sampling particularly difficult.

Downstream stretches of the North Carpathian streams are often regulated by means of weirs, especially in inhabited areas. They are also polluted to a greater or lesser degree by sewage effluents. However, the pollution is rarely severe enough to cause withdrawal of sensitive animals from stream biocenosis whereas the effect of enrichment of stream with organic particles is often visible.

III. 3. Water temperature, total hardness, pH and oxygen

Temperature

There are no works in Polish literature on detailed thermal characteristics of rivers to discuss the whole length of a river from spring to mouth. GOŁEK's work (1961), the only more extensive one, discusses only midstream and downstream sections of some major Polish rivers including the North Carpathian ones: the Vistula, the Soła, the Skawa, the Dunajec (Table II). Annual mean temperatures of the rivers correspond to distribution of annual mean temperatures of the air in the area. It must be mentioned that the table values are based on one measurement of water temperature daily. Results of diurnal observations are not available with the exception of temperatures taken by SOWA (1975) on the Soła on August 16—17. 1961; water temperature at altitude 300 m ranged between 14.7 and 19.0°C while that at 400 m ranged between 14.2—19.8°C.

Thermal data for head tributaries to these rivers are random; temperatures were taken occasionally during chemical, hydrological or hydrobiological investigations. Most of the available data concern the Tatra waters.

Temperature of the Tatra sources, acc. to ZIEMOŃSKA (1960) range between 1.9 and 10°C. As many as 80% of the sources fall within the temperature range of 4—8°C. Sources whose temperatures are below 3°C occur sporadically at higher altitudes. Decrease in source temperature is 0.45—0.55°C for 100 m of altitude, the exception to the rule being some karst sources, e. g. the Lodowe and the source in Hala Pisana (Table III).

Probably the majority of Beskid springs which remain active throughout the year fall within the same temperature range, e. g. the springs (rheocrene) of the Żabnica at 1200 m altitude 4.5°C (June 30 and Sept. 1, 1978) and 6.5°C (Aug. 31, 1978) at 1000 m; the source (rheocrene) of the Racza at 1100 m

6.6°C (Oct. 11, 1979); the source (rheocrene) of the Przywarówka at 1620 m 3.8°C in summer (SOWA, SZCZESNY 1970) and 4.2°C (Table VI). Periodical springs have higher temperatures (Table IV).

Tatra stream waters are characterized by low temperatures and little diurnal and seasonal fluctuation. Diurnal fluctuations of temperature in the downstream sections of the streams at the foot of the Tatras do not exceed 4°C, in summer, they are rarely heated to 10°C (WIT-JÓŹWIKOWA, ZIEMOŃSKA 1962). E. g. during the very hot period, at 13—14 hrs on July 18, 1977, the temperatures of Kościeliski and Chochołowski streams at the entry to the Czarny Dunajec were, respectively, 10°C and 13°C while that of the Czarny Dunajec 0.5 km downstream was 11.5°C. At that time, the temperatures of the Kościeliski stream were 6.5°C at 1200 m and only 4°C at 1400 m.

Equally low temperatures of the Beskidy streams occur in summer only in upstream reaches of streams flowing at higher altitudes. E. g. temperatures of the Przywarówka on the southern slope of the Babia Góra did not exceed 10°C at 800 m even during hot periods (Table VI). In summer, temperatures of streams which originate below 1000 m do not exceed 10°C in upstream stretches, except for short reaches near sources (Table IV, V).

Table VI

Total hardness, pH and temperature of the streams Przywarówka—Lipnica during sampling in 1980

Altitude m	10. VI.			11. VII.	27. VIII.
	total hardness G.d.	pH	°C		
1620	—	—	—	—	4.2
1500	—	—	—	—	4.6
1400	—	—	—	4.5	5.0
1300	—	—	—	—	6.5
1200	—	—	—	6.5	6.9
1100	—	—	—	7.0	7.1
1000	—	—	—	8.0	7.8
900	3.8	7.0	9.0	9.3	9.0
800	3.9	7.2	10.0	—	—
700	9.9	8.0	14.1	—	—
620	11.2	9.0	15.5	—	—

A frequent phenomenon noted in the Beskidy streams is a reversal of typical thermal pattern in their upstream reaches (SOWA 1965). In summer, temperatures near springs are observed to be higher than in the lower sections (Table IV). The phenomenon is often accompanied by a decrease in yield or even by disappearance of sources during drier periods.

Total hardness, pH, oxygen

Total hardness of running waters of the area depends to a great extent on geological substratum and basin character. Lowest values, below1G.d. , are shown by streams with crystalline substratum in the High Tatras. Values for the other Tatra streams are 2—3.5G.d. (OLEKSYNOWA, KOMORNICKI 1965). Values for the Soła and its tributaries are 1.9—9.0G.d. (BOMBÓWNA 1960) and in the Raba basin values of 4.7—12.1G.d. prevail (BOMBÓWNA 1969).

Stream waters have pH values of 6.3—9.0. In upstream section of streams pH is around 7.0. Downstream it grows an exceeds 8 nearing 9.0 in downstream stretches surrounded by farmland and developments area (Table VI).

Unless a stream is polluted, oxygen concentration is always high, up to 100% saturation. Supersaturation is not a rare event.

IV. METHODS

Larvae, pupae and adult caddisflies were collected with varying frequency from 1965 till 1981. Principal sampling periods were those of 1974—1975 and 1978—1980. Apart from these, the already published data were included after another taxonomic verification of species lists of: the Dunajec river (SZCZĘSNY 1965, DRATNAL et al. 1979), the streams of the Babia Góra Mtn (SOWA, SZCZĘSNY 1970), the Raba river (SZCZĘSNY 1975) and the Rybi Potok stream (KOWNACKI 1977).

All the major North Carpathian Vistula tributaries were studied, i. e. the Brynica and Leśnica, the Soła, the Skawa, the Raba, the Dunajec, the Wisłoka as well as the Vistula up to the Goczałkowice reservoir. Besides, streams of different type and size were selected from among the tributaries of higher order to get as complete a picture of caddisfly larvae distribution as possible. An attempt was made to include in the studies the streams where human activity was the least marked.

A general rule was an altitudinal distance of not more than 100 m and less than 50 m between the sampling stations, considering local conditions.

Adults were collected with a net and preserved in alcohol. Aquatic forms were gathered from benthic samples which were taken by means of samplers — square metal frames, with a net of 300 μm mesh size. During sampling time 6—9 quantitative samples were taken at a station, from 5 dcm² of bottom surface each. Numbers of qualitative samples varied and so did the bottom surface from which samples were taken to include all possible substrata at a station. Samples were combined. Total area of sampling was usually 0.6—0.8 m² of stream bottom. It was smaller in springs — 0.4 m². Sampling for particular streams and even for particular sections of streams varied, for reasons indepen-

Table VII

Sampling sites in the upper Vistula basin (A), upstream of the Goczałkowice reservoir

	1	2	3	4	5	6	7
A1 Biała Wiselka source	1000	48.1	0.3	< 2.	0.1	rock chips	coniferous forest
A2 Biała Wiselka	900	47.7	0.7—0.9	< 10	waterfolls	rock, rock chips	coniferous forest
A3 Biała Wiselka	800	47.0	1.5—2.0	15—20	1.4	big and medium stones	coniferous forest
A4 Biała Wiselka	700	46.0	2.5—3.5	20—30	1.3	big stones	mixed forest
A5 Biała Wiselka	600	44.0	4—6	30—40	1.2	cobbles and boulders	mixed forest
A6 Wisła in Czarne	500	40.5	6—7	30—50	1.1	cobbles	leafy trees, meadow; downstream of the dam in Czarne
A7 Wisła	400	30.5	8—10	30—60	1.0	big cobbles, silt	bushes, polluted stream
A8 Wisła	300	12.0	12	40—60	1.1	big and medium cobbles	trees, regulated and polluted stream
*A9 Wisła	261	5.5	10—15	50—80	1.0	medium cobbles, gravel	cropland, regulated stream
A1a Leśnica, source	750	19.1	0.3—0.4	< 5	0.2	sand, rock chips	mixed forest
A2a Leśnica	730	10.0	0.4—0.6	< 8	0.6	small stones, gravel	mixed forest
A3a Leśnica	670	18.5	0.7—1.0	10—20	1.3	big and medium stones	mixed forest
A4a Leśnica	590	17.5	1.5—2.0	15—30	1.3	big and medium stones	mixed forest
A5a Leśnica	490	15.0	3—4	20—30	1.3	big stones and boulders	conifers, pasture
A6a Leśnica	400	10.0	7—9	30—40	1.0	big and medium cobbles	trees, pastures
A7a Brennica	310	0.8	9—10	40—60	1.0	big and medium cobbles	trees, bushes, partly regulated stream

Column symbols: 1 — altitude (m); 2 — distance (km) of the station from...; 3 — stream width (m); 4 — mean depth (cm) of stream; 5 — maximum current velocity (m); 6 — main component of substratum; 7 — immediate surrounding of bed, other remarks. Distance of the stations A1—A9 is measured to the bridge in Strumień, of the stations A1a—A7a to the stream outlet to the Vistula river. Stations outside the Carpathians have been marked by an asterisk

Table VIII

Sampling stations in the Soła basin (B)

	1	2	3	4	5	6	7
B1 Racza, source	1100	42.7	0.3	< 15	0.1	sand, rock chips	highland meadow, rheocrene
B2 Racza	1070	42.6	0.3—0.4	< 5	0.2	small rock fragments	beech forest
B3 Racza	1000	42.4	0.4—0.5	5—10	0.4	large stones	mixed forest
B4 Racza	900	41.9	1.0—1.5	10—20	0.8	large stones	mixed forest
B5 Racza	800	40.3	1.5—2.0	20—30	0.9	large stones and boulders	mixed forest
B6 Racza	750	39.5	2.0—2.5	25—35	0.9	big cobbles and boulders	mixed forest
B7 Racza	700	38.0	2.5—3.0	20—40	0.9	big cobbles and boulders	conifers, pasture
B8 Rycerka	600	34.0	4—5	20—50	1.4	big and medium cobbles	leafy trees, bushes
B9 Rycerka	500	26.0	10—15	30—40	1.5	big and medium cobbles	regulated stream, trees
B10 Soła	450	18.0	12—16	30—70	1.2	medium and big stones	trees, bushes, cropland
B11 Soła	400	12.0	15—20	40—80	1.4	big cobbles, boulders	trees, bushes, oropland
B12 Soła	353	3.0	17—25	40—70	1.3	medium and big cobbles	bushes, pastures
B1a Żabnica, source	1200	12.2	1.5	< 10	0.2	big rock chips, detritus	coniferous forest, rheocrene
B2a Żabnica	1160	12.1	0.3—0.4	< 15	0.4	sand, rock chips	coniferous forest
B3a Żabnica	1070	11.9	0.3—0.5	< 15	0.4	sand, rock chips	herbs, coniferous forest
B4a Żabnica source	990	11.5	2	< 5	0.4	medium and big rock chips	highland meadow, rheocrene
B5a Żabnica	900	11.3	0.4—0.5	5—15	0.8	medium and big rock chips	mixed forest
B6a Żabnica	800	11.0	0.7—1.2	10—20	1.0	medium and big rock chips	mixed forest
B7a Żabnica	700	10.3	1.0—1.5	15—25	1.0	large stones	young spruce trees
B8a Żabnica	650	9.0	2.0—2.5	20—30	1.1	large cobbles, boulders	trees, pastures
B9a Żabnica	600	8.0	3.5—5.5	30—40	1.4	boulders, big cobbles	trees, bushes, pastures

Tabl. VIII cont.

	1	2	3	4	5	6	7
B10a Żabnica	410	0.3	8—10	20—40	1.3	big cobbles	houses, regulated stream
B1b tributary of Żabnica, source	750	0.5	0.2—0.3	< 5	0.2	big and medium rock chips	edge of coniferous forest
B2b tributary of Żabnica	670	0.2	0.3—0.4	< 10	0.4	medium and small rock chips	meadow

Details as to the stations B13—B15 can be found in Sowa's paper (1975). Denotations as in the Table VII. Distance of the stations B1—B12 is measured from the railway bridge in Żywiec, of the stations B1a—B10a from the outlet to the Soła, of the stations B1b—B2b from the outlet to the Żabnica

dent of the author, and ranged between 1 and 13. Sampling dates are presented in tables with dominant species in particular streams (Tables XX—XXXV).

List of sampling stations and their description is presented in the tables VII—XIV.

V. A LIST OF THE NORTH CARPATHIAN CADDISFLIES

V. 1. The Polish North Carpathians

The following list comprises species quoted for the North Carpathians until the year 1981 which, in my opinion, occur in the area without doubt as well as those found in the area during the present investigations.

Most species for the area also are listed by Tomaszewski (1965) together with data on their synonymy as well as their distribution in the Carpathians. He also provided a list of relevant literature. That's why the data included in his catalogue have been omitted from the present paper which only adds to them verified and updated synonymes for each species, new literature and some facts which had been omitted from Tomaszewski's catalogue.

Information on each species has been arranged as follows:

— earlier findings are arranged in chronological sequence with bracketed generic or specific name used by author, if it was different from the currently used (changes in taxonomy or mistake in identification);

Table IX

Sampling stations in the drainage of the Babia Góra Mtn: the Skawa (C, the Vistula catchment) the Lipnica (G, the Danube catchment)

	1	2	3	4	5	6	7
C1 Suchy, source	1380	80.8	0.3—0.7	< 6	0.3	small and medium rock chips	herbs, rheocrene
C2 Suchy	1300	80.5	0.4—0.6	< 10	0.4	rock chips, sand, detritus	coniferous forest
C3 Suchy	1200	80.2	0.5—0.8	10—20	0.7	medium and large rock chips	deep ravine, coniferous forest
C4 Suchy	1000	79.6	0.7—1.0	10—30	1.0	big stones and boulders	herbs
C5 Suchy	900	79.1	1.0—1.5	20—30	1.2	big stones and boulders	coniferous forest
C6 Suchy	820	78.4	1.5—2.0	30—40	1.5	boulders, big cobbles	ravine, mixed forest
C7 Stonów	700	76.7	4—5	30—60	1.0	big cobbles, boulders	young coniferous trees
C8 Jaworzyna	650	73.5	4—7	30—60	1.3	big cobbles, boulders	leafy trees
C9 Skawica	600	71.5	6—9	30—70	1.1	boulders, big cobbles	trees, bushes, pastures
C10 Skawica	550	69.0	6—10	40—70	1.2	big cobbles	trees, bushes, pastures
C11 Skawica	500	66.0	7—11	30—60	1.3	big cobbles	trees, bushes, pastures
C12 Skawica	400	58.0	10—15	40—70	1.3	big cobbles	trees, pastures
C13 Skawa	350	53.0	15—20	40—80	1.5	big cobbles	pastures, cropland
C14 Skawa	300	36.0	20—25	40—100	1.4	medium and big cobbles	osier bed
*C15 Skawa	220	2.0	20—30	60—150	1.6	cobbles, gravel	meadow, bushes
G1 Przywarówka, source	1620	17.0	0.3—0.4	< 10	0.3	small rock chips	herbs, grass, rheocrene
G2 Przywarówka, source	1500	16.6	0.6—0.8	10—30	0.4	sand, gravel	herbs, rheolimnocrene
G3 Przywarówka	1400	16.2	0.3—0.5	5—20	0.6	rock fragments, sand	herbs, dwarf mountain pine

Tabl. IX cont.

	1	2	3	4	5	6	7
G4 Przywarówka	1300	15.9	0.8—1.5	5—20	0.7	big rock fragments	herbs, dwarf mountain pine
G5 Przywarówka	1200	15.7	1.0—1.5	< 10	0.5	medium rock fragments	herbs, coniferous forest
G6 Przywarówka	1100	15.4	0.8—1.2	10—20	0.7	big stones, boulders	herbs, coniferous forest
G7 Przywarówka	1000	15.0	1.0—1.5	10—20	0.8	boulders, big cobbles	herbs, coniferous forest
G8 Przywarówka	900	14.5	1.5—2.0	15—30	1.2	boulders, big cobbles	coniferous forest
G9 Przywarówka	800	13.0	2.0—2.5	20—30	1.0	big cobbles	mixed forest, bushes
G10 Przywarówka	700	9.5	3—4	30—40	1.1	big and medium cobbles	trees, bushes, cropland
G11 Lipnica	620	1.3	4—6	30—50	1.1	pebbles, gravel	osier bed

Denotations as in the Table VII. Distance of the stations: C1—C15 is measured from the outlet to the Vistula, G1—G11 from backwater of the Orawa reservoir

— data from the author's own studies are arranged as follows: number of adults and time interval over which they were captured; number of larvae according to frequency classes: I (1—9 specimens captured), II (10—99), III (100—999), IV ($\geqslant$ 1000); habitats and remarks on the occurrence in the study area; list of stations at which the species was found.

* — marks species not listed in TOMASZEWSKI's catalogue for the North Carpathians.

• — marks species which have not been quoted for the Slovak part of the North Carpathians.

Taxonomic arrangement has been adopted after BOTOSANEANU and MALICKY (1978).

1. *Rhyacophila fasciata* HAGEN, 1852.

— ZAĆWILICHOWSKA 1964, 1968 i 1969 *(R. septentrionis)*; BOTOSANEANU 1965; KRZANOWSKI et al. 1965 *(R. septentrionis)*; SZCZĘSNY 1965 *(R. septentrionis)*, 1970, 1974a, 1975, 1980; TOMASZEWSKI 1965 *(R. septentrionis)*; KOWNACKA 1971; RIEDEL 1972, 1978; KOWNACKI 1977; KLIMA 1981;

Table X

Sampling stations in the Raba basin (D)

	1	2	3	4	5	6	7
D1a Poniczanka, sources	900	10.1	0.2—0.3	2—5	30	small rock fragments, sand	coniferous forest
D2a Poniczanka	850	9.8	0.3—0.4	3—6	40	medium rock fragments	mixed forest, herbs
D3a Poniczanka	800	9.5	0.3—0.5	5—10	50	medium rock fragments	herbs, mixed forest
D4a Poniczanka	750	9.1	0.6—0.8	7—12	100	medium and large stones	mixed forest
D5a Poniczanka	700	8.3	1.3—1.7	12—15	80	medium and large cobbles	mixed forest
D6a Poniczanka	650	7.8	1.5—1.8	14—18	80	medium and large cobbles	conifers, meadows
D7a Poniczanka	600	7.0	2.0—2.5	15—20	100	medium and large cobbles	trees, bushes
D8a Poniczanka	550	5.0	2.5—3.0	25—30	100	large and medium cobbles	trees, bushes, pastures
D9a Poniczanka	500	1.5	4—5	30—40	120	large and medium cobbles	leafy trees, pastures
D1b tributary to the Poniczanka, source	865	1.0	1.2	3—6	30	small chips, detritus	mixed forest, rheocrene
D2b the tributary	810	0.8	0.4—0.5	8—10	70	fine chips, sand	mixed forest
D3b the tributary	750	0.6	0.5—0.8	10—12	100	large rock fragments	mixed forest
D4b the tributary	707	0.1	1.0—1.2	12—15	110	medium and large stones	mixed forest
D1c Stradomka, source	690	39.9	0.2—0.4	5	40	moss-covered rock (Fontinalis spp.)	mixed forest, rheocrene

Tabl. X cont.

	1	2	3	4	5	6	7
D2c Stradomka	600	39.6	0.5—0.8	5—15	100	large rock fragments	herbs, mixed forest
D3c Stradomka	550	39.0	0.6—0.8	10—20	90	medium rock fragments	mixed forest
D4c Stradomka	500	38.5	2.3—3.0	20—25	100	medium and large stones	single trees, pastures
D5c Stradomka	400	36.0	4—6	20—40	110	small and medium cobbles	trees, bushes, cropland
D6c Stradomka	350	33.0	5—7	30—40	120	medium and large cobbles	trees, bushes, cropland
D7c Stradomka	300	26.0	6—7	30—50	100	medium and large cobbles	trees, bushes, cropland
D8c Stradomka	250	17.0	4—7	30—100	100	gravel, pebbles, sand	trees, bushes, cropland
D9c Stradomka	212	0.5	10—15	40—70	80	pebbles, gravel	trees, bushes, cropland

Details as to the stations D1—D11 (along the streams: Olszowy — Koninka — Porębianka — Raba) can be found in Sowa's paper (1975). Distance of the stations D1a—D9 aand D1c—D9c is measured from the outlet to Raba, D1b—D4b from the outlet to the Poniczanka. Denotations as in the Table VII

— 87 ♂♂, 27 ♀♀, 27. V—29. X; III, streams below 1500 m altitude; A: 5—6, 4a; B: 4—5, 7, 5a — 7a; C: 4—6, 11; D: 4, 7, 5a, 7a — 9a, 2c, 4c — 6c; E: 5, 7, 11, 2a, 4a — 5a, 8b, 2c — 4c; F: 2—4, 3a — 6a; G: 5—8.

2. *Rhyacophila glareosa* McLachlan, 1867.

— Szczęsny 1966b, 1970, 1975; Kownacka 1971;

— 68 ♂♂, 26 ♀♀, 3. VII—25. X; III, upstream sections of streams in the Tatras, the Babia Góra and the Gorce Mts; C: 2—6; D: 2—4; E: 1—5, 7—8, z 2, z 5, 1a, 4a, 3b — 8b, 10b; G: 4—8.

3. **Rhyacophila mocsaryi* Klapalek, 1898.

— Botosaneanu 1965; Tomaszewski 1965 (*R. torrentium*, pro parte); Szczęsny 1966b, 1970, 1974a, 1975, 1980; Kownacka 1971; Klima 1981;

Table XI

Sampling stations in the Dunajec basin (E), along the streams: Pyszniański — Kościeliski — Czarny Dunajec — Dunajec

	1	2	3	4	5	6	7
E1 Pyszniański	1680	248.6	< 0.3	3—10	water falls	rock, rock fragments	highland meadow
E2 Pyszniański	1600	248.3	0.4—0.5	< 20	water falls	rock fragments, rock	highland meadow
E3 Pyszniański	1500	247.9	0.7—1.0	10—25	40	rock fragments rock	dwarf mountain pine, herbs
E4 Pyszniański	1400	247.5	1.5—2.0	20—30	120	boulders, rock fragments	herbs, dwarf mountain pine
E5 Pyszniański	1300	247.0	1.0—1.5	10—30	water falls	rock fragments, rock	herbs, coniferous forest
E6 Pyszniański	1200	246.5	1.5—2.0	15—30	100	boulders, large stones	coniferous forest
E7 Kościeliski	1100	245.0	3—5	20—35	90	large cobbles, boulders	coniferous forest
E8 Kościeliski	1000	241.5	4—5	30—50	120	large cobbles, boulders	coniferous forest
E9 Kościeliski	900	236.0	5—8	30—60	150	large cobbles, boulders	coniferous forest, leafy trees
E10 Czarny Dunajec	850	232.5	6—15	40—70	120	large cobbles, boulders	conifers, leafy trees
E11 Czarny Dunajec	800	227.0	10—20	40—80	130	large cobbles, boulders	alders, bushes, pastures
E12 Czarny Dunajec	750	224.0	10—15	40—100	140	medium and large cobbles	alders, bushes, pastures
E13 Czarny Dunajec	700	219.0	30	30—50	70	medium cobbles, gravel	stage of fall, trees, bushes

Tabl. XI cont.

	1	2	3	4	5	6	7
E14 Czarny Dunajec	650	214.0	10—20	30—80	120	medium and-large cobbles	osier bed, pastures
E15 Czarny Dunajec	600	204.0	15—25	40—80	130	medium and large cobbles	osier bed, pastures
E16 Dunajec	550	191.0	30—40	60—100	140	large cobbles boulders	bushes, pastures
E17 Dunajec	500	187.0	50—60	60—120	130	boulders, large cobbles	trees, bushes,
E18 Dunajec	455	178.0	30—50	70—120	150	boulders, large cobbles	trees, bushes, pastures
E19 Dunajec	420	150.0	30—60	40—100	170	boulders, large cobbles	bushes, pastures
E20 Dunajec	350	120.0	30—50	50—120	170	large cobbles, boulders	pastures
E21 Dunajec	300	110.0	40—60	60—130	150	large cobbles, boulders	bushes, pastures
Ez1 Source at Hala Ornak	1100	—	0.3—0.5	5—15	30	rock fragments and chips	herbs, coniferous forest, rheocrene
Ez2 Source at Hala Pisana	1000	—	4—5	5—20	30	rock fragments	herbs, coniferous forest, rheocrene
Ez3 Lodowe Źródło source	970	—	2—3	30—50	70	boulders, rock fragments	herbs, coniferous forest, rheocrene

Denotations as in the Table VII. Distance of the stations is measured from the outlet to the Vistula

— 25 ♂♂, 12 ♀♀, 12. VI—3. VII; III, midstreams sections of streams below 900 m altitude; A: 4—6, 4a — 5a; B: 6—8, 9a; C: 7—11; D: 4—6, 5a — 7a, 4c — 5c; E: 9—14, 4a, 6a — 9a, 2c — 5c: F: 4; G: 8—10.

4. *Rhyacophila nubila* (Zetterstedt, 1840).

— Zaćwilichowska 1964, 1968, 1969; Botosaneanu 1965; Kownacka, Kownacki 1965b; Krzanowski et al. 1965; Szczęsny 1965, 1970, 1974a, 1975, 1980; Kownacka 1971; Krzyżanek 1971; Kownacki 1977; Riedel 1978; Dratnal et al. 1979;

Table XII

Sampling stations in the Dunajec basin (E), the streams: Rybi Potok, Białka Tatrzańska, Waksmundzki

	1	2	3	4	5	6	7
E1a Brook	1398	0.01	0.5—0.8	20—25	100	large rock fragments	outflow from the Czarny Staw lake, herbs, dwarf mountain pine
E2a Rybi Potok	1390	39.0	4—6	30—40	110	boulders, rock chips	outflow from the Morskie Oko lake, dwarf mountain pine
E3a Rybi Potok	1170	36.5	4—5	40—70	water falls	boulders, rock chips	herbs, coniferous forest
E4a Białka T.	990	33.0	6—10	40—60	120	boulders, large cobbles	young coniferous forest
E5a Białka T.	950	29.5	10—12	50—80	130	boulders, large cobbles	coniferous forest
E6a Białka T.	800	23.0	10—12	50—90	160	boulders, large cobbles	coniferous forest
E7a Białka T.	700	14.3	10—40	40—80	150	boulders, large cobbles	trees, bushes, herbs
E8a Białka T.	600	7.2	10—15	40—60	160	large cobbles, boulders	pastures, coniferous forest
E9a Białka T.	530	0.8	10—20	40—60	130	large cobbles, boulders	pastures, conifers
E1s Old river bed	950	—	< 10	30—40	20	large cobbles, gravel	herbs, coniferous forest
E2s Old river bed	700	—	6—10	20—30	20	large cobbles, gravel, detritus	herbs, bushes
E1b Waksmundzki	1900	4.7	1.0—1.5	< 20	60	large rock chips, boulders	scree, grass, moss, lichen
E2b Waksmundzki	1800	4.3	1.0—1.5	30—40	100	boulders, large rock chips	scree, rocks, moss, grass
E3b Waksmundzki	1700	3.9	1.0—1.5	20—60	100	boulders, large rock chips	rocks, grass, dwarf mountain pine

Tabl. XII cont.

	1	2	3	4	5	6	7
E4b Waksmundzki	1600	3.6	1.5—2.0	20—40	100	boulders, large rock chips	grass, dwarf mountain pine
E5b Waksmundzki	1500	3.2	1.5—2.0	30—40	120	boulders, rock blocks	grass, dwarf mountain pine
E6b Waksmundzki	1400	2.8	2.0—2.5	40—60	130	boulders, rock blocks	grass, herbs, boulders
E7b Waksmundzki	1300	2.2	2.0—4.0	60—80	170	boulders, rock blocks	herbs, conifers
E8b Waksmundzki	1200	1.5	2—4	50—90	160	boulders, large cobbles	herbs, coniferous forest
E9b Waksmundzki	1090	0.8	2—3	30—90	160	boulders, large cobbles	coniferous forest
E10b Waksmundzki	1020	0.5	2—3	20—60	140	boulders, large cobbles	herbs, coniferous forest
Ez4 Source	1700	—	0.3—0.4	< 30	40	rock chips covered with moss (*Fontinalis* spp.)	dwarf mountain pine, herbs, rheocrene
Ez5 Source	1300	—	0.6—1.0	< 30	50	rock chips, detritus, boulders covered with moss	coniferous forest, herbs, rheocrene

Denotations as in the Table VII. Distance of the station E1a is measured from the outlet to the Morskie Oko lake, of the stations E2a—E9a from the outlet to the Dunajec, of the stations E1b—E10b from the outlet to the Białka Tatrzańska

— 24 ♂♂, 17 ♀♀, 7. VI—31. X; IV, one of the most abundant species in midstream and downstream sections of streams and rivers, occasional in outflows of the Tatra lakes; A: 5—6, 8—9, 5a — 7a; B: 6—14, 8a — 10a; C: 8—15; D: 5—10, 6a — 9a, 4c — 9c; E: 10—21, 2a, 4a, 6a — 9a, 2s, 3c — 9c; F: 4—8, 4a — 10a; G: 10—11.

5. *Rhyacophila obliterata* Mclachlan, 1865.

— Szczęsny 1965, 1970, 1974a, 1975; Zaćwilichowska 1968, 1969; Kownacka 1971; Kownacki 1977; Riedel 1978;

Table XIII

Sampling stations in the Dunajec basin (E), the Biała Tarnowska river

	1	2	3	4	30	6	7
E1c Biała Tarn. source	750	92.5	< 0.6	< 7	30	small rock fragments	herbs, mixed forest, rheocrene
E2c Biała Tarn.	700	91.8	0.4—0.6	< 20	70	large and medium stones	herbs, leafy forest
E3c Biała Tarn.	600	89.3	1.5—2.0	20—30	80	medium and large stones	herbs, bushes, trees
E4c Biała Tarn.	550	87.3	2.0—2.5	20—40	70	medium and small stones	trees, bushes, pastures
E5c Biała Tarn.	500	83.6	2.5—3.5	20—40	80	large and medium stones	trees, bushes, pastures
E6c Biała Tarn.	400	76.1	5—8	30—60	120	medium stones, boulders	trees, herbs
E7c Biała Tarn.	350	71.3	6—10	30—60	130	large and medium stones	trees, cropland
E8c Biała Tarn.	300	62.8	12—15	30—60	120	medium and large cobbles	trees, pastures
E9c Biała Tarn.	250	40.5	12—15	60—100	80	cobbles, pebbles, gravel	trees, cropland regulated stream
E1d Tributary of the Biała Tarn.	750	—	< 0.5	< 10	30	small rock fragments	herbs, bushes, meadow

Denotations as in the Table VII. Distance of the stations is measured from the outlet to the Dunajec river

— 872 ♂♂, 86 ♀♀, 21. VIII—16. IX; III, midstream and downstream sections of streams; A: 4—6, 4a — 5a; B: 5, 7a, 9a; D: 4, 4a — 7a, 1c — 4c; E: 7—8, 10—11, 14, 17, 2a, 6a — 7a, 2c — 5c; F: 3—4, 4a.

6. *Rhyacophila philopotamoides orientis* SCHMID 1970.

— ZAĆWILICHOWSKA 1964, 1968, 1969; BOTOSANEANU 1965; KOWNACKA,

Table XIV

Sampling stations in the Wisłoka basin (F)

	1	2	3	4	5	6	7
F1 Wisłoka	585	167.0	0.5	< 10	30	small rock fragments	peaty area, stream beginning
F2 Wisłoka	570	166.5	1.0—1.5	< 20	50	rock chips, sand	herbs, leafy forest
F3 Wisłoka	500	163.0	1.5—2.0	20—40	80	medium stones, gravel, sand	bushes, leafy trees, meadow
F4 Wisłoka	450	161.0	3—4	30—80	80	large and medium stones	bushes, leafy trees, meadow
F5 Wisłoka	400	153.0	4—5	30—50	70	large cobbles	bushes, trees, meadow
F6 Wisłoka	350	144.5	5—8	20—60	120	large cobbles	bushes, pastures
F7 Wisłoka	300	133.0	15—20	20—40	100	large and medium cobbles	pastures, bushes
F8 Wisłoka	250	119.8	18—22	30—50	110	medium cobbles, gravel	bushes, pastures, cropland
F9 Wisłoka	206	77.0	20—30	40—70	100	cobbles, gravel	bushes, cropland
* F10 Wisłoka	182	35.8	40—50	20—40	80	cobbles, pebbles, gravel	cropland, regulated stream
* F11 Wisłoka	151	6.2	30—35	60—150	80	gravel, sand	meadows, regulated stream
* F12 Wisłoka	150	0.1	30—40	50—110	60	sand	osier bed, trees, regulated stream
F1a Ropka source	735	77.0	0.3—0.4	< 10	30	stones covered with moss *Fontinalis* spp.	herbs, mixed forest, rheocrene
F2a Ropka	700	76.6	0.5—0.7	< 20	80	medium and large rock chips	mixed forest, herbs
F3a Ropka	650	76.2	1.0—1.5	10—26	100	medium and large stones	mixed forest, herbs
F4a Ropka	600	75.7	1.0—1.5	15—30	80	medium and small stones	bushes herbs
F5a Ropka	550	74.6	1.5—2.0	20—40	80	medium stones, sand	bushes, herbs
F6a Ropka	500	73.0	2.0—3.0	25—40	100	medium and large stones	bushes, trees

Tabl. XIV cont.

	1	2	3	4	5	6	7
F7a Ropa	430	67.0	4—6	30—60	120	large stones	trees, bushes
F8a Ropa	400	62.0	6—10	30—60	130	large cobbles, boulders	trees, bushes, pastures
F9a Ropa	360	55.0	10—14	40—100	110	large and medium cobbles	pastures, cropland
F10a Ropa	300	39.0	12—20	30—60	120	medium and large cobbles	osier bed, regulated stream

Denotations as in the Table VII. Distance of the stations F1—F12 is measured from the outlet to the Vistula river, of the stations F1a—F10a from the outlet to the Wisłoka river

Kownacki 1965b; Krzanowski et. al. 1965; Szczęsny 1970, 1974a, 1975; Kownacka 1971; Kownacki 1977;

— 179 ♂♂, 52 ♀♀, 5. VI—23. X; III, upstream and midstream sections of streams; A: 1, 4, 2a — 3a; B: 2—7, 2a—6a, 2b; C: 3—6; D: 1—6, 1a—6a, 9a, 1b—4b, 1c—2c, 4c; E: 1—2, 4—5, z1, z2, z5, 1a, 3a, 6a, 3b, 7b, 1c—2c; F: 1, 2a — 3a; G: 3, 5—8.

7. *Rhyacophila polonica* Mclachlan, 1879.

— Botosaneanu 1965, Tomaszewski 1965 (also *R. hageni*); Szczęsny 1970, 1974a, 1975, 1980; Kownacka 1971; Riedel 1972, 1978;

— 648 ♂♂, 83 ♀♀, 15. VIII—28. X; III, midstream and upstream sections of streams; A: 3a; B: 5a — 7a; C: 4; D: 3—4, 2a — 6a, 4b, 1c — 4c; E: 5, 7—10, z2, 1a, 4a — 5a, 8b — 10b, 2c; F: 2a — 4a; G: 5, 8—9.

8. **Rhyacophila pubescens* Pictet, 1834.

— Riedel 1978;

— 6 ♂♂, 1 ♀, 9. VIII; II, downstream sections of calcium rich streams in the Pieniny Mts; the Pieniński Potok, the Homole.

9. *Rhyacophila tristis* Pictet, 1834.

— Zaćwilichowska 1964, 1968, 1969; Kownacka, Kownacki 1965b, 1968; Szczęsny 1965, 1970, 1974a, 1975, 1980; Kownacka 1971; Riedel 1972, 1978; Kownacki 1977; Klima 1981;

— 97 ♂♂, 50 ♀♀, 12. VI—15. IX; IV, streams; A: 4—5, 3a — 5a; B: 4—7, 11, 5a — 9a; C: 4, 6—8; D: 3—8, 1a — 7a, 3b — 4b, 1c — 5c; E: 4, 8—13, z2, 2a—8a, 7b — 8b, 1c — 5c; F: 3—4, 2a — 4a, 7a; G: 5—9.

10. *Rhyacophila vulgaris* Pictet, 1834.

— Kownacka, Kownacki 1965b (pro parte); Szczęsny 1965, 1970, 1974a, 1975, 1980; Tomaszewski 1965 *(R. aurata)*; Zaćwilichowska 1968, 1969; Kownacka 1971; Kownacki 1977; Klima 1981;

— 25 ♂♂, 28 ♀♀, 18. V—26. X; III, midstream and upstream sections of

major streams; A: 4—5, 4a; B: 5, 7, 9a; C: 2—9; D: 3—5; E: 5, 7—9, 2a — 6a, 9b; G: 4.

11. *Glossosoma boltoni* CURTIS, 1834.

— SCHILLE 1902; KOWNACKA, KOWNACKI 1965b *(G. vernale)*; TOMASZEWSKI 1965 (pro parte, only specimens quoted by SCHILLE and collected on the Poprad in Rytro); RIEDEL 1978; DRATNAL et al. 1979 *(Synafophora intermedia)*;

— 3 ♂♂, 2 ♀♀, 18. V, 10. X; III, downstream sections of major streams; A: 4a — 7a; B: 11, 13, 10a; C: 12; E: 13—14, 17—18, 8a — 9a, 4c.

12. *Glossosoma conformis* NEBOISS, 1963.

— ZAĆWILICHOWSKA 1964, 1969 *(G. boltoni)*; KOWNACKA, KOWNACKI 1965b *(G. boltoni)*; SZCZĘSNY 1965 *(G. boltoni)*, 1970, 1975, 1980; TOMASZEWSKI 1965 (pro parte); KOWNACKA 1971; RIEDEL 1972, 1978; DRATNAL et al. 1979;

— 23 ♂♂, 24 ♀♀, 2. VII—25. IX; IV, streams and upstream sections of rivers; A: 6, 4a — 5a; B: 5—7, 12, 7a — 9a; C: 7—12; D: 3—5, 3a, 5a —7a, 4b, 1c; E: 8—11, 4a — 9a; F: 4a, 7a; G: 8—11.

13. *Glossosoma intermedium* (KLAPALEK, 1892).

— RIEDEL 1962 *(G. vernale)*; SZCZĘSNY 1965 *(G. vernale)*, 1970, 1974a, 1975 *(Synafophora intermedia)*; TOMASZEWSKI 1965 *(G. vernale)*; KOWNACKA, KOWNACKI, 1968 *(Mystrophorella intermedia)*; KOWNACKA 1971 *(S. intermedia)*; DRATNAL et al. 1979 *(S. intermedia)*; KLIMA 1981;

— 44 ♂♂, 56 ♀♀, 7. V—22. VIII; IV, midstream sections of streams, mainly in the Tatras; B: 5—7, 7a, 9a; C: 5—8; D: 3—4, 5a; E: 9—15, 3a — 9a, 2s, 7b — 9b; G: 8.

14. **Synagapetus armatus* (MCLACHLAN, 1879).

— SZCZĘSNY 1975;

— 2 ♂♂, 3 ♀♀, 27. VI—16. VII; III, Beskidy streams near sources; A: 1a; B: 2—3, 3a — 4a, 1b — 2b; D: 1b — 3b, 1c; F: 1a — 2a.

15. **Synagapetus iridipennis* MCLACHLAN, 1879.

— SZCZĘSNY 1970, 1974a;

— 5 ♂♂, 9 ♀♀, 6. VII—18. X; III, small head streams in the Beskidy Mts; B: 5a — 6a; D: 3b — 4b, 2c — 3c.

16. **Agapetus delicatulus* MCLACHLAN, 1884.

— KOWNACKA, KOWNACKI 1965b *(A. comatus)*; DRATNAL et al. 1979 *(A. fuscipes)*;

— 1 ♀, 3. VIII; I, rivers; B: 11; E: 16, 18.

17. **Agapetus fuscipes* CURTIS, 1834.

— ZAĆWILICHOWSKA 1968, 1969; SZCZĘSNY 1970, 1975, 1980; KOWNACKA 1971; RIEDEL 1972;

— 176 ♂♂, 51 ♀♀; 25. VI — 26. VII, 30. VIII—4. XII; III, some warmer sources and streams; emergence flight from sources occurs in autumn and from streams in spring; A: 5a — 7a; B: 9a, 2b; C: 11—12; D: 5; E: z2, 6a, 2s.

18. *Agapetus laniger* (PICTET, 1834).

— ZAĆWILICHOWSKA 1969 *(A. comatus)*; RIEDEL 1972, 1978;

— 10 ♂♂, 6 ♀♀, 30. VIII (leg. W. Zaćwilichowska); II, downstream sections of major Beskidy streams and rivers; B: 14—15; D: 9c; F: 6.

19. *Agapetus ochripes* Curtis, 1834.

— Tomaszewski 1965 *(A. comatus)*; Szczęsny 1970; Riedel 1972, 1978;

— 1 ♂, 1 ♀, 3—5. VII; I, downstream sections of streams, rivers; B: 8a—9a.

20. *● *Ptilocolepus granulatus* (Pictet, 1834).

— Szczęsny 1970; Riedel 1972;

— 4 ♂♂, 4 ♀♀, 25. VI—6. VII; I, stream sections near sources; D: 1c.

21. *Orthotrichia costalis* (Curtis, 1834).

— Tomaszewski 1965 (*O. tetensi*, after Mikulski 1931).

22. *● *Ithytrichia lamellaris* Eaton, 1873.

— Krzanowski et al. 1965; Szczesny 1975;

— I, among rooted vegetation of midstream and downstream sections of rivers and major streams; D: 9—10, 9c.

23. **Hydroptila forcipata* (Eaton, 1873).

— Schille 1902 *(H. sparsa)*; Dziędzielewicz 1919 *(H. sparsa)*; Kownacka, Kownacki 1965b *(Agraylea multipunctata, H. femoralis)*; Krzanowski et al. 1965 *(H. femoralis)*; Szczęsny 1965 *(H. femoralis, H. maclachlani, H. sparsa)* 1974a, 1975, 1980; Tomaszewski 1965 *(H. sparsa)*; Zaćwilichowska 1969 *(H. sparsa, H. tineoides)*; Riedel 1972, 1978; Dratnal et al. 1979;

— IV, midstream and downstream sections of rivers and major streams; A: 8; B: 10—12, 14; C: 14; D: 6—11, 5c — 7c, 9c; E: 16—21; F: 7, 9a

24. *● *Hydroptila lotensis* Mosely, 1930.

— Szczęsny 1975;

— 3 ♂♂, 1 ♀ (pupae), VI; III, downstrem sections of rivers and streams; D: 7—11, 9c.

25. **Hydroptila occulta* (Eaton, 1873).

— Szczęsny 1980;

— 35 ♂♂, 30 ♀♀ (pupae), VI; II, downstream sections of streams and rivers; D: 6c — 9c; F: 7.

26. **Hydroptila vectis* Curtis, 1834.

— Szczęsny 1974a;

— 1 ♂, 1 ♀ (pupae), III; the Kryniczanka stream near source.

27. *Allotrichia pallicornis* (Eaton, 1873).

— Riedel 1978.

28. *Philopotamus ludificatus* McLachlan, 1878.

— Botosaneanu 1965; Kownacka, Kownacki 1965b; Zaćwilichowska 1968; Szczęsny 1970, 1975, 1978b, 1980; Kownacka 1971; Riedel 1972, 1978; Kownacki 1977;

— 407 ♂♂, 168 ♀♀, 17. V—20. VIII and 25. IX—11. X; IV upstream and midstream sections of streams; autumn flight occurs near some sources in the Tatras; A: 3, 5, 2a — 4a; B: 3—6, 4a — 7a; C: 4—7; D: 3—5, 1a — 7a, 1b — 4b, 1c — 4c; E: z2, 2a, 6a, 1c — 2c; F: 1, 1a — 4a; G: 5—8.

29. *Philopotamus montanus* (DONOVAN, 1830).

— ZAĆWILICHOWSKA 1964, 1968, 1969; SZCZĘSNY, 1970, 1978b, 1980; RIEDEL 1972, 1978; KLIMA 1981;

— 10 ♂♂, 4 ♀♀, 30. V—29. X; III, midstream sections of streams; A: 2a — 3a, 5a; B: 3—4, 7, 7a; D: 2c — 3c, 6c; E: 6a — 7a, 2c — 3c; F: 1a, 3a — 4a.

30. *Philopotamus variegatus* (SCOPOLI, 1763).

— SZCZĘSNY 1970, 1975, 1978b, 1980;

— 43 ♂♂, 30 ♀♀, 18. V—22. VII; II, streams; D: 1a — 2a, 4a — 6a, 3b — 4b, 1c — 3c; E: 2c.

31. *Wormaldia copiosa* (MCLACHLAN, 1868).

— BOTOSANEANU 1965; SZCZĘSNY 1970, 1975, 1980; RIEDEL 1972;

— 42 ♂♂, 14 ♀♀, 2. VII—25. IX; II, streams; D: 2a — 7a.

32. *Wormaldia occipitalis* (PICTET, 1834).

— SCHILLE 1902 *(Tinodes palescens)*; DZIĘDZIELEWICZ 1911 *(Wormaldia triangulifera)*; TOMASZEWSKI 1965 *(W. triangulifera)*; RIEDEL 1972 *(W. triangulifera)*, 1978; SZCZĘSNY 1970, 1975, 1980;

— 227 ♂♂, 45 ♀♀, 24. VI—29. X; III, streams, mainly upstream sections; B: 2a — 3a, 6a, 2b; D: 3, 3a — 5a, 2b, 1c — 2c; E: 2c, 1d; F: 1—2.

33. ● *Wormaldia pulla* (MCLACHLAN, 1878).

— SZCZĘSNY 1970, 1975, 1980; RIEDEL 1972;

— 17 ♂♂, 6 ♀♀, 16. VII—28. VIII; midstream and upstream sections of the Poniczanka in the Gorce Mts.

34. *Hydropsyche angustipennis* (CURTIS, 1834).

— TOMASZEWSKI 1965 (pro parte, after DZIĘDZIELEWICZ 1911 — only specimens collected at the foot of the Babia Góra Mtn, 30. VII. 1909); SZCZĘSNY 1980; all the data on occurrence of species from genus *Hydropsyche* in the North Carpathians collected before TOBIAS' (1972) and MALICKY'S (1977) monographical work appeared require verification;

— II, the Vistula at the inlet to the Goczałkowice reservoir; A: 9, the station is situated outside the Carpathians however the species should be quite abundant in some warmer streams of the North Carpathians (the Pogórze).

35. ● *Hydropsyche bulbifera* MCLACHLAN, 1978.

— SZCZĘSNY 1965 *(H. angustipennis)*, 1974b, 1975, 1980;

— 8 ♂♂, 2 ♀♀, 18. V—2. VI; IV, downstream sections of streams, rivers; A: 8—9; B: 10—15; D: 5—11, 5c — 9c; E: 15—16, 19—21, 6c, 8c — 9c; F: 6, 8—10, 12, 7a — 8a, 10a.

36. * ● *Hydropsyche bulgaromanorum* MALICKY, 1977.

— SZCZĘSNY 1980.

37. * ● *Hydropsyche contubernalis* MCLACHLAN, 1865.

— SZCZĘSNY 1965 *(H. ornatula)*, 1974b, 1975;

— II, downstream and midstream sections of Beskidy rivers; B: 13—15; D: 9—11; F: 10—12.

38. *Hydropsyche fulvipes* (CURTIS, 1834).

— SZCZĘSNY 1970; RIEDEL 1978;

— 11 ♂♂, 5 ♀♀ (?), 27. VI—30. VIII; III, prefers small head streams; B: 1b — 2b; D: 3a, 5a, 4b, 3c — 4c; E: 4c, 1d; F: 3a — 4a.

39. *Hydropsyche instabilis* (CURTIS, 1834).

— KOWNACKA, KOWNACKI 1965b *(H. angustipennis)*; SZCZĘSNY 1970, 1974a, 1975; KOWNACKA 1971; RIEDEL 1972;

— 23 ♂♂, 1 ♀ (?), 16. VII—25. IX; IV, midstream and downstream sections of streams; A: 6a — 7a; B: 7—10, 7a — 10a; C: 10—14; D: 5—7, 9, 6a — 9a, 3c — 7c; E: 8a, 3c — 6c; F: 3—8, 4a — 10a; G: 10.

40. **Hydropsyche ornatula* MCLACHLAN, 1878.

— SZCZĘSNY 1980.

41. *Hydropsyche pellucidula* (CURTIS, 1834).

— KOWNACKA, KOWNACKI 1965b; SZCZĘSNY 1965, 1974b, 1975; ZAĆWILICHOWSKA 1968, 1969; RIEDEL 1972, 1978; DRATNAL et al. 1979;

— 120 ♂♂, 200 ♀♀ (?), VI—VIII; IV, rivers and downstream sections of streams; A: 5—9, 5a — 7a; B: 7—13, 8a, 10a; C: 10—15; D: 5—11, 6c — 9c; E: 11, 13—21, 4a, 7a — 9a, 4c — 9c; F: 4—12, 7a — 10a; G: 10.

42. *Hydropsyche saxonica* MCLACHLAN, 1884.

— ZAĆWILICHOWSKA 1968; SZCZĘSNY 1970, 1974b, 1975, 1980;

— III, midstream and upstream sections of streams; A: 5—6; B: 6; C: 7; D: 5, 6a — 7a, 3c — 6c; E: 7a, 3c — 6c; F: 3—4, 4a — 6a.

43. *● *Hydropsyche siltalai* DOEHLER, 1963.

— III, downstream sections of streams and rivers west of the Soła river; it is a new species in the fauna of Poland; A: 7—9, 6a — 7a; B: 11.

44. *Cheumatopsyche lepida* (PICTET, 1834).

— SZCZĘSNY 1965; RIEDEL 1972, 1978; DRATNAL et al. 1979;

— 1 ♀, 28. VIII; IV, downstream sections of streams and rivers in the Beskidy Mts; B: 12; D: 7c; E: 17—21, 9c; F: 6—8, 9a — 10a.

45. *Plectrocnemia brevis* MCLACHLAN, 1871.

— SZCZĘSNY 1980;

— 1 ♂, 2. VII; the Poniczanka stream near source, the Gorce Mts.

46. *Plectrocnemia conspersa* (CURTIS, 1834).

— ZAĆWILICHOWSKA 1964, 1969; SZCZĘSNY 1970, 1974a *(P. geniculata)*, 1975, 1980; RIEDEL 1972, 1978; KOWNACKI 1977; KLIMA 1981;

— 3 ♂♂, 3 ♀♀, 16. VII—1. IX; III, streams, sources; A: 1, 1a —3a; B: 5a — 7a, 1b; C: 4, 6; D: 3—4, 1a — 7a, 9a, 1b, 4b, 1c, 3c — 4c, 6c; E: 2a, 2c, 1d; F: 1—2, 4, 2a — 4a; G: 6.

47. **Plectrocnemia geniculata* MCLACHLAN, 1871.

— ZAĆWILICHOWSKA 1968;

— I, upstream section of the Brennica stream; A: 3a, 5a — 6a.

48. *Polycentropus flavomaculatus* (PICTET, 1834).

— ZAĆWILICHOWSKA 1964, 1968, 1969; BOTOSANEANU 1965; KOWNACKA, KOWNACKI 1965b; KRZANOWSKI et al. 1965; SZCZĘSNY 1965, 1970, 1974a, 1975, 1980; TOMASZEWSKI 1965 (also as *P. multiguttatus* for the Carpathians); KRZYŻANEK 1971; RIEDEL 1972, 1978; KOWNACKI 1977; DRATNAL et al. 1979;

— 22 ♂♂, 1 ♀, 5. VI—5. IX; IV, common in the Beskidy Mts, absent only from some Tatra streams; A: 6—9, 6a — 7a; B: 8—13, 15; C: 10, 13—14; D: 5—11, 9a, 3c — 9c; E: 10, 12—13, 15—21, 2a — 3a, 8a — 9a, 3c — 9c; F: 4—9, 5a — 6a, 8a — 10a.

49. **Polycentropus schmidi* Novak, Botosaneanu, 1965.

— Dzięndzielewicz 1911 and Tomaszewski 1965 *(P. flavomaculatus*, pro parte — concerns 1 ♂ collected by Dzięndzielewicz in Zawoja at the foot of the Babia Góra Mtn, 27. VII. 1909); Szczęsny 1975, 1980;

— II, downstream sections of major Beskidy streams, midstream sections of rivers; D: 6—8, 8a, 6c; F: 8.

50. *Cyrnus trimaculatus* (Curtis, 1834).

— Riedel 1972, 1978; Szczęsny 1975, 1980;

— 1 ♂, 5. VI; II, midstream and downstream sections of rivers; A: 8—9 D: 11; E: 8c; F: 7.

51. *Psychomyia pusilla* (Fabricius, 1781).

— Zaćwilichowska 1964, 1968, 1969; Botosaneanu 1965; Kownacka, Kownacki 1965b: Krzanowski et al. 1965; Szczęsny 1965,1975, 1980; Krzyżanek 1971; Riedel 1972, 1978; Dratnal et al. 1979;

— 38 ♂♂, 27 ♀♀, 4. VI—3. VIII; IV, downstream sections of major streams and rivers; B: 11—12, 14; C: 12, 15; D: 5—11, 6c — 9c; E: 13—21, 8a — 9a, 6c, 8c — 9c; F: 6—8, 8a — 10a.

52. **Lype phaeopa* (Stephens, 1836).

— Szczęsny 1970, 1975;

— 1 ♀, 22. VI; I, midstream sections of some Beskidy streams; D: 5.

53. *Tinodes rostocki* McLachlan, 1878.

— Kownacka 1971; Riedel 1972, 1978; Szczęsny 1974a, 1975, 1980;

— 2 ♂♂, 5 ♀♀, 3. VII—28. VIII; II, upstream sections of streams; B: 6a; D: 4, 5a, 4b, 4c; E: 2c, 4c; F: 5.

54. *Tinodes waeneri* (Linnaeus, 1758).

— Riedel 1978.

55. *Agrypnia obsoleta* (Hagen, 1858).

— Szczęsny 1980.

56. *Agrypnia varia* (Fabricius, 1793).

— Szczęsny 1980.

57. *Phryganea bipunctata* Retzius, 1783.

— Tomaszewski 1965 *(P. striata)*; Szczęsny 1980.

58. *Phryganea grandis* Linnaeus, 1761.

— Szczęsny 1980.

59. **Oligotrichia lapponica* (Hagen, 1864).

— Botosaneanu, Malicky 1978 (wrote only: "the High Tatras" — without more detailed data).

60. *Oligotricha striata* (Linnaeus, 1758).

— Tomaszewski 1965 *(O. ruficrus)*; Szczęsny 1970;

— 10 ♂♂, 6 ♀♀, 27. V—2. VII; stagnant waters.

61. **Oligostomis reticulata* (Linnaeus, 1767).

— Wierzejski 1883 *(Neuronia reticulata)*, Swoszowice at Kraków (Pogórze Wielickie); Szczęsny 1970, 1980;

— 14 ♂♂, 1 ♀, 27. V—22. VI; stagnant waters and slow flowing streams.

62. **Brachycentrus montanus* Klapalek, 1891.

— Kownacka, Kownacki 1965b (also *B. subnubilus*); Szczęsny 1965 *(B. subnubilus)*, 1970 (also *B. subnubilus*); Zaćwilichowska 1968, 1969; Kownacka 1971;

— 1 ♂, 5. VI; IV, midstream sections of streams; A: 4—6, 4a — 5a; B: 7—9, 9a; C: 8, 10; E: 19—20, 6a — 7a, 9a; G: 9.

63. *Brachycentrus subnubilus* Curtis, 1834.

— Szczęsny 1980;

— I, mouth sections of rivers; D: 11.

64. **Oligoplectrum maculatum* (Fourcroy, 1785).

— Kownacka, Kownacki 1965b; Szczęsny 1965; Riedel 1978; Dratnal et al. 1979;

— III, downstream section of the Białka Tatrzańska as well as upstream and midstream sections of the Dunajec; E: 17—19, 21, 8a — 9a.

65. **Micrasema minimum* McLachlan, 1876.

— Kownacka, Kownacki 1965b; Szczęsny 1965, 1975; Zaćwilichowska 1969 *(Paraoecetis struckii)*; Kownacka 1971;

— 36 ♂♂, 33 ♀♀, 24. VI—16. VII; IV, midstream and downstream sections of major streams; A: 5, 4a — 5a; B: 7, 7a — 10a; D: 3—6; E: 6a — 7a.

66. *Apatania carpathica* Schmid, 1954.

— Botosaneanu 1965; Szczęsny 1966b, 1970, 1975; Zaćwilichowska 1969 *(A. fimbriata)*; Klima 1981;

— 119 ♂♂, 89 ♀♀, 19. VII—12. X; III, sources and adjacent stretches of streams; B: 1, 3, 4a — 5a; C: 2—4; D: 1—3, 1a — 2a, 1b, 1c, 4c; E: 4—5, 7, 1c — 2c; F: 1a — 2a.

67. *Apatania fimbriata* (Pictet, 1834).

— Botosaneanu 1965; Tomaszewski 1965 (also *A. wallengreni*); Szczęsny 1970, 1980; Kownacki 1977;

— 241 ♂♂, 27 ♀♀, 8. VIII—26. X; III, sources and adjacent stretches of streams in the Tatras and Babia Góra Mtn, as well as the Tatra lakes; C: 1; E: z1, z5, 1a, 2a, 7b — 8b; G: 1—3

68. *Drusus annulatus* (Stephens, 1837).

— Botosaneanu 1965; Szczęsny 1970, 1975, 1978a, 1980; Kownacka 1971; Riedel 1972, 1978; Klima 1981;

— 37 ♂♂, 32 ♀♀, 29. VI—9. IX; III, upstream sections of streams; A: 3, 2a — 3a; B: 5a; D: 3—4; E: 7—8, 1a, 6b — 8b, 10b, z5; G: 8.

69. *Drusus biguttatus* (Pictet, 1834).

— Kownacka, Kownacki 1965b *(Potamorites biguttatus)*; Szczęsny 1965, 1978a, 1980; Tomaszewski 1965 (also *D. mixtus*); Kownacka 1971;

— 30 ♂♂, 98 ♀♀, 30. VI—30. VIII; IV, midstream and downstream sections of the Tatra streams, occasionally in some streams of the Babia Góra Mtn; C: 6; E: 7—11, 4a — 6a, 1s.

70. **Drusus brunneus* KLAPALEK, 1898.

— SZCZĘSNY 1975 (*D. muelleri* — larvae), 1978a; RIEDEL 1978;

— 4 ♀♀, 14. VII—26. VIII; II, source sections of streams in the Gorce and Beskid Niski Mts; D: 1—2; F: 1a — 2a.

71. **Drusus carpathicus* DZIĘDZIELEWICZ, 1911.

— SZCZĘSNY 1966a, 1966b, 1970, 1975, 1978a;

18 ♂♂ 16 ♀♀, 6. IV—27. V; III, sources and adjacent sections of streams; B: 1, 1a — 2a, 4a; C: 1; D: 1—2, 1b; E: 5, z1, z2; F: 1a; G: 1—3.

72. *Drusus discolor* (RAMBUR, 1842).

— KOWNACKA, KOWNACKI 1965b, 1968; SZCZĘSNY 1965, 1970 (also *D. muelleri*), 1975 (also *D. muelleri* — adults), 1978a, 1980; TOMASZEWSKI 1965 (also *D. destitutus* and *D. muelleri*); KOWNACKA 1971; KOWNACKI 1977;

— 39 ♂♂, 41 ♀♀, 22. VI—30. VIII; IV, streams and rivers; A: 3—5, 4a — 5a; B: 6—7, 2a, 4a; C: 2—7; D: 2—5, 7, 5a, 2b — 4b, 1c — 4c; E: 1—2, 4—5, 7—11, z2, z5, 1a, 3a — 7a, 6b — 10b; G: 3—9.

73. *Drusus monticola* MCLACHLAN, 1876.

— SZCZĘSNY 1966b, 1970, 1978a; KOWNACKA 1971; KLIMA 1981;

— 2 ♂♂, 1 ♀, 27. V—5. VI; IV, upstream sections of streams in the Tatras and the Babia Góra Mtn; C: 1—3; E: 1—5, z1, z3; G: 1—5.

74. *Drusus trifidus* MCLACHLAN, 1868.

— KOWNACKA, KOWNACKI 1965b; SZCZĘSNY 1965, 1975, 1978a, 1980; KLIMA 1981;

— 100 ♂♂, 36 ♀♀, 7. VI—17. X; III, sources and head areas; A: 5a; E: z1, z2, 6a, 2s.

75. *Ecclisopteryx dalecarlica* KOLENATI, 1848.

— KOWNACKA, KOWNACKI 1965b *(Stenophylax nigricornis)*; SZCZĘSNY 1965 *(Potamophylax nigricornis)*, 1970, 1975 *(Drusus biguttatus)* 1978a, 1980; TOMASZEWSKI 1965 (also as *E. guttulata guttulata* for the Carpathians); KOWNACKA 1971 *(P. nigricornis)*; RIEDEL 1972, 1978 *(E. guttulata)*; DRATNAL et al. 1979;

— 2 ♂♂, 11 ♀♀, 12. VI—31. X; IV, midstream and downstream sections of streams; A: 4—6, 5a — 6a; B: 6—9, 8a — 10a; C: 7, 10; D: 5—6, 5a — 7a; E: 9—14, 18, 4a, 6a — 9a, 2s.

76. *Ecclisopteryx madida* (MCLACHLAN, 1867).

— ZAĆWILICHOWSKA 1964, 1968 *(Stenophylax nigricornis)*, 1969 *(Potamophylax nigricornis)*; SZCZĘSNY 1970, 1974a, 1975, 1978a, 1980; KOWNACKA 1971; KOWNACKI 1977; KLIMA 1981;

— 11 ♂♂, 19 ♀♀, 19. VII—24. IX; IV, streams; A: 4a; B: 3—5, 5a — 6a; C: 4; D: 3—4, 1a — 7a, 3b — 4b, 1c — 4c; E: 8—11, 3a, 5a — 6a, 2c; F: 2—3, 2a — 4a, 6a; G: 8—9.

77. *Limnephilus affinis* CURTIS, 1834.

— KOWNACKA, KOWNACKI 1965b; SZCZĘSNY 1970, 1975, 1980.

78. *Limnephilus auricula* CURTIS, 1834.

— SZCZĘSNY 1970, 1974a;

— 6 ♂♂, 6 ♀♀, 18. V—18. X; at the Beskid streams.

79. *Limnephilus centralis* CURTIS, 1834.

— SZCZĘSNY 1974a, 1980.

80. *Limnephilus coenosus* CURTIS, 1834.

— SZCZĘSNY 1970, 1980;

— 2 ♂♂, 2. VII, 16. IX; stagnant waters of the Tatra and Babia Góra Mts.

81, *Limnephilus decipiens* (KOLENATI, 1848).

— SZCZĘSNY 1980.

82. *●*Limnephilus dispar* MCLACHLAN, 1875.

— DZIĘDZIELEWICZ 1911 (*L. extricatus*, pro parte); SZCZĘSNY 1980.

83. *Limnephilus extricatus* MCLACHLAN, 1865.

— SZCZĘSNY 1970, 1974a, 1980; RIEDEL 1978; KLIMA 1981;

— 2 ♂♂, 10—28. VIII; the Kamienica valley.

84. *Limnephilus flavicornis* (FABRICIUS, 1787).

85. **Limnephilus fuscicornis* RAMBUR, 1842.

— RIEDEL 1978.

86. *Limnephilus griseus* (LINNAEUS, 1758).

— KOWNACKA, KOWNACKI 1965a; ZAĆWILICHOWSKA 1969; SZCZĘSNY 1970, 1974a, 1980;

— 3♂♂, 3 ♀♀, 10. VIII—19. X; near streams.

87. *Limnephilus hirsutus* (PICTET, 1834).

— RIEDEL 1972, 1978.

88. *Limnephilus ignavus* MCLACHLAN, 1865.

— SZCZĘSNY 1970, 1980; RIEDEL 1978;

— 2 ♂♂ 1 ♀♀, 16. IX—29. X; at the Ropka stream.

89. *Limnephilus lunatus* CURTIS, 1834.

— KOWNACKA, KOWNACKI 1965b; SZCZĘSNY 1970, 1980.

90. *Limnephilus nigriceps* (ZETTERSTEDT, 1840).

91. *Limnephilus rhombicus* (LINNAEUS, 1758).

— I, marginal pools in the streams and rivers; F: 5.

92. *Limnephilus sparsus* CURTIS, 1834.

— SZCZĘSNY 1970, 1980; RIEDEL 1978;

— 6 ♂♂, 4 ♀♀, 16. VII—20. X; near the Ropka and Poniczanka streams.

93. **Limnephilus stigma* CURTIS, 1834.

— KOWNACKA, KOWNACKI 1965b.

94. *Limnephilus vittatus* (FABRICIUS, 1798).

— SZCZĘSNY 1970, 1974a.

95. *Grammotaulius nigropunctatus* (RETZIUS, 1783).

— TOMASZEWSKI 1965 *(G. atomarius)*; SZCZĘSNY 1970 *(G. atomarius)*, 1980.

96. ●*Anabolia furcata* Brauer, 1857.

— Szczęsny 1980.

97. *Anabolia laevis* (Zetterstedt, 1840).

— Tomaszewski 1965 *(A. soror)*; Szczęsny 1974a *(A. soror)*, 1974.

98. *Rhadicoleptus alpestris alpestris* (Kolenati, 1848).

— 7 ♂♂, 3 ♀♀, 10. VI; II, in moss *(Sphagnum)* of peat- bog in nature reserve „Bór na Czerwonem" near Nowy Targ.

99. ●*Potamophylax carpathicus* (Dziędzielewicz, 1912).

— Szczęsny 1966b, 1970;

— 17 ♂♂, 9 ♀♀, 10. VI—2. VII; III, sources and adjacent sections of streams, semiterrestrial larvae; B: 3a, 5a; D: 1a — 3a, 1b — 2b, 1c; F: 1a — 2a.

100. *Potamophylax cingulatus* (Stephens, 1837).

— Szczęsny 1965, 1970 *(P. latipennis)*; Tomaszewski 1965 *(P. latipennis)*;

— 83 ♂♂, 61 ♀♀, 12. VI—14. X; IV, streams; A: 4a — 5a; B: 5a, 7a, 9a; C: 5—7, 9, 11; D: 3—5, 2a — 8a, 3b — 4b, 1c — 6c; E: 7—11, 2a, 4a — 7a 2c — 5c; F: 2—4, 2a — 6a; G: 8—9.

101. *Potamophylax latipennis* (Curtis, 1834).

— Tomaszewski 1965 *(P. stellatus)*; Szczęsny 1970, 1974a, 1975 *(P. stellatus)*; Riedel 1972, 1978;

— 9 ♂♂, 4. VIII—17. IX; IV, midstream sections of streams; A: 6, 6a; B: 11, 10a; C: 8—11, 13; D: 3c, 5c; E: 9—13, 6a — 9a, 2s, 3c — 5c; F: 2—7, 5a — 9a.

102. *Potamophylax luctuosus* (Piller, 1783).

— Zaćwilichowska 1968; Szczęsny 1970, 1974a;

— 3 ♂♂, 1 ♀, 22, VI—6. VII; III, midstream sections of streams; A: 6—7, 4a — 5a; B: 6—7, 9a; C: 8, 11; D: 6a, 8a, 6c; E: 4a, 2s, 2c; F: 4, 4a — 6a; G: 8—9.

103. *Potamophylax nigricornis* (Pictet, 1834).

— Szczęsny 1970, 1974a, 1975, 1980; Riedel 1978;

— 14 ♂♂, 4 ♀♀, 10. VI — 16. VII; III, sources and adjecent stretches of streams; A: 1a — 3a; B: 2, 3a, 1b — 2b; D: 2, 1b; E: z1; z2, 2s; F: 1—2.

104. **Potamophylax rotundipennis* (Brauer, 1857).

— Szczęsny 1974a;

— II, midstream and downstream sections of streams easily heated in the summer; F: 2, 6—8.

105. *Acrophylax vernalis* Dziędzielewicz, 1912.

— Szczęsny 1966b, 1970, 1975; Kownacka 1971;

— 41 ♂♂, 15 ♀♀, 4. IV—22. VI; III, upstream sections of streams up to sources; C: 1—6; D: 3; E: 5, 7—9, z1, 4a, 6a, 8b; G: 3—8.

106. *Acrophylax zerberus* Brauer, 1867.

— Szczęsny 1966b, 1970, 1980; Kownacka, Kownacki 1968; Kownacka 1971;

— 70 ♂♂, 19 ♀♀, 6. IV—30. VIII; IV, sources and upstream sections of

streams of the Tatras and Babia Góra Mtn; C: 1—4; E: 1—9, z1, z3, z5, 4a, 1b, 3b — 10b; G: 1—5 8.

107. *Halesus digitatus* (SHRANK, 1781).

— ZAĆWILICHOWSKA 1969; SZCZĘSNY 1970;

— 13 ♂♂, 26 ♀♀, 7—28. X; II, in marginal pools of streams and rivers; A: 7, 9, 4a — 7a; B: 8a — 9a; C: 9, 11, 13—14; D: 5a, 4c — 6c; E: 8a, 2s, 6c, 9c; F: 2—3, 5—7, 12, 4a — 9a; G: 10.

108. *Halesus radiatus* (CURTIS, 1834).

— KOWNACKA, KOWNACKI 1965b, TOMASZEWSKI 1965, SZCZĘSNY 1970, 1974a *(H. interpunctatus)*;

— 2 ♂♂, 1 ♀, 17. IX—11. X; I. occasionally in marginal pools of streams and rivers; D: 7a; E: 11—13, 2s.

109. *Halesus rubricollis* (PICTET, 1834).

— SZCZĘSNY 1970, 1975, 1980; KOWNACKA 1971; KLIMA 1981;

— 4 ♂♂, 10 ♀♀, 30. VII—9. IX; III, upstream and midstream sections of streams; C: 3—4; D: 3—4; E: 5, 7—10, z2, z3; 1a, 4a, 8b, 10b; G: 6—8.

110. *Melampophylax nepos* (MCLACHLAN, 1880).

— SZCZĘSNY 1970, 1975; KOWNACKA 1971;

— 323 ♂♂, 175 ♀♀, 16. IX—19. XI; IV, upstream sections of streams particularly those becoming dry or freeze in winter; B: 3a; C: 1—4; D: 1—3, 2c; E: 5—8, z1, z2, 4a — 5a, 1s, 8b — 10b; G: 3, 5—7, 8.

111. *Parachiona picicornis* (PICTET, 1834).

— SZCZĘSNY 1970, 1975; RIEDEL 1978; KLIMA 1981;

— 115 ♂♂, 16 ♀♀, 6. V—1. VIII; II, sources, head peaty area; D: 1 3a; E: z1.

112. *Stenophylax permistus* MCLACHLAN, 1895.

— SZCZĘSNY 1970; RIEDEL 1978;

— 8 ♂♂, 8 ♀♀, 17. IX—7. X; I, head peaty area of the Wisłoka river; F: 1—2.

113. **Micropterna lateralis* (STEPHENS, 1837).

— SZCZĘSNY 1970 (*Stenophylax lateralis*, but only for the Babia Góra, not for the Tatras — it is a printing error in the table);

114. *Micropterna nycterobia* MCLACHLAN, 1875.

— SZCZĘSNY 1970 *(Stenophylax nycterobius)*; KLIMA 1981.

115. *Micropterna testacea* (GMELIN, 1788).

— SZCZĘSNY 1970 *(Stenophylax testaceus)*; RIEDEL 1978.

116. *Allogamus auricollis* (PICTET, 1834).

— SZCZĘSNY 1965, 1970, 1974a, 1975, 1980; KOWNACKA 1971; KLIMA 1981;

— 119 ♂♂, 406 ♀♀, 30. VIII—15. XI; IV, midstream of the streams; A: 4a — 6a; B: 8a — 10a; C: 7—14; D: 3—6, 5a — 7a; E: 7—13, 4a — 8a, 2s, 8b; G: 9.

117. *● *Allogamus starmachi* SZCZĘSNY, 1967.

— SZCZĘSNY 1967 (also as *A. lazarei* SZCZ. and *A. tatricus* SZCZ.); KOWNACKA 1971; BOTOSANEANU, MALICKY 1978;

— 317 ♂♂, 184 ♀♀, 17. IX—19. XI; III, postglacial relic, endemic species for the Tatras (absent from the Lower Tatras), larvae inhabit sections of streams which become dry or freeze in winter; E: 6—7, 4a, 4b, 9b — 10b, z4.

118. *Allogamus uncatus* (Brauer, 1857).

— Szczęsny 1970, 1975, 1980; Kownacka 1971;

— 327 ♂♂, 309 ♀♀, 30. VIII—17. XI; III, upstream sections of streams; A: 2a — 5a; B: 1a — 3a, 6a; C: 1—4; D: 2—4, 1a — 5a, 2b, 1c; E: 1, 3—8, z1, 1a, 2a — 5a, 1s, 4b, 6b — 8b, 10b; G: 2—4, 6—7.

119. *Chaetopteryx fusca* Brauer, 1857.

— Krzanowski et al. 1965 *(C. villosa)*; Tomaszewski 1965 (also as *C. villosa* — only for the West Beskidy Mts); Szczęsny 1970, 1975, 1980; Krzyżanek 1971 *(C. villosa)*;

— 117 ♂♂, 54 ♀♀, 15. IX—1. I; III, streams and rivers in lentic areas; A: 5a — 6a; B: 6a — 9a; C: 7; D: 4, 6, 8, 5a, 7a, 4c — 5c; E: 14, z2, 6a — 7a, 9a, 2s, 3c — 4c, 1d; F: 1—4, 4a — 6a.

120. *Chaetopteryx polonica* Dzięndzielewicz, 1889.

— Szczęsny 1966b, 1970, 1974a;

— 233 ♂♂, 136 ♀♀, 17. IX—5. XII; III, upstream sections of streams up to sources; A: 2a; B: 1a — 3a, 5a — 6a; C: 1—4; D: 1—3, 1a, 1b, 1c — 2c; E: 2—5, 8, z1, z2, z5, 3b — 9b, 1d; F: 1a — 2a; G: 1, 3—7, 9.

121. *● *Chaetopteryx sahlbergi* McLachlan, 1876.

— Tomaszewski 1965 (*C. villosa* for the Tatras only?);

— 16 ♂♂, 17 ♀♀, 24—26. X; collected adults from Tatra lakes (det. H. Malicky).

122. *● *Chaetopteryx subradiata* Klapalek, 1907.

— 1 ♀, 20. X., leg. et det. H. Malicky; I, source section of the Ropka stream (the Wisłoka basin) in the Beskid Niski Mts; F: 1a — 2a.

123. **Psilopteryx psorosa carpathica* Schmid, 1955. [1]

— Szczęsny 1966b (only Beskid specimens), 1970, 1975;

— 83 ♂♂, 49 ♀♀, 1. X—15. I; III, upstream sections of Beskidy streams up to sources; A: 3a — 4a; B: 1a — 3a, 5a — 6a; C: 1—4; D: 1—4, 1a — 4a, 1b — 2b, 1c — 2c, 4c; F: 1a — 4a; G: 1, 3—7.

124. ● *Psilopteryx psorosa psorosa* (Kolenati, 1860).

— Szczęsny 1966b (*P. carpathica*, specimens from the Tatras only), 1970; Kownacki 1977 *(P. psorosa carpathica)*;

— 59 ♂♂, 32 ♀♀, 19. IX—8. XII; II, Tatra streams only; E: 4—8, z1, 4a — 5a.

125. **Pseudopsilopteryx zimmeri* (McLachlan, 1876).

— Szczęsny 1966b, 1970, 1975; Kownacka 1971;

— 386 ♂♂, 69 ♀♀, 19. IX—21. XI; III, upstream sections of streams; A: 2a; B: 3a, 6a; C: 3—7; D: 2, 4, 3a, 5a, 2b; E: 4a, 6a, 10b, 1s; G: 3, 3—7.

126. **Chaetopterygopsis maclachlani* Stein, 1874.

[1] According to Mey and Botosaneanu (1985, Dtsch. ent. Z., N.F. 32, 109—127) it does not live in the North Carpathians.

— 17 ♂♂, 12 ♀♀, 11. X—8. XI; I, midstream sections of the Czarny Dunajec and the Białka Tatrzańska; E: 6a.

127. *Annitella obscurata* (McLachlan, 1876).

— Dratnal et al. 1979 *(Micropterna nycterobia)*;

— 46 ♂♂, 30 ♀♀, 13. X—29. XI; II, downstream sections of streams, rivers; D: 9a, 5c; E: 11, 14, 16, 7a — 9a, 2s; F: 4a.

128. * *Annitella thuringica* (Ulmer, 1909).

— Szczęsny 1970; Kownacka 1971;

— 122 ♂♂, 80 ♀♀, 25. IX—8. XI; III, midstream sections of large streams in the Podhale, particularly abundant in the Białka Tatrz.; E: 14, 6a — 8a, 2s.

129. *Goera pilosa* (Fabricius, 1775).

— Krzanowski et al. 1965; Zaćwilichowska 1969; Riedel 1972, 1978 Szczęsny 1975, 1980; Dratnal et al. 1979;

— II, rivers and downstream sections of low situated streams; C: 15; D: 9, 11, 9c; E: 15, 18, 8c; F: 7—8.

130. *Lithax niger* Hagen, 1859.

— Kownacka, Kownacki 1965b *(Silo piceus)*; Szczęsny 1970, 1975; Kownacka 1971; Riedel 1978; Klima 1981;

— 54 ♂♂, 49 ♀♀, 10. V—22. VI; III, sources and adjacent sections of streams; A: 5, 1a — 3a; B: 1—3, 2a — 5a; C: 2—4; D: 1, 3—4, 1a — 3a, 5a — 6a, 1b — 4b, 1c — 2c; E: 4—5 z1, z5, 4a, 7b, 1c — 2c; F: 1a — 2a; G: 3—7.

131. *Lithax obscurus* (Hagen, 1859).

— 1 ♂, 5. VI; II, head peaty area of the Wisłoka river; F: 1.

132. *Silo nigricornis* (Pictet, 1834).

— Zaćwilichowska 1968, 1969; Szczęsny 1974a, 1980; Riedel 1978; Klima 1981;

— 1 ♂, 1. VI; I, the Brennica stream; A: 5a — 6a.

133. *Silo pallipes* (Fabricius, 1781).

— Zaćwilichowska 1964, 1968, 1969; Kownacka, Kownacki 1965b; Szczęsny 1970, 1974a, 1975, 1980;

— 13 ♂♂, 11 ♀♀, 24. VI—1. IX; III, midstream sections of streams; A: 6, 4a — 6a; B: 6a — 9a, 1b — 2b; C: 7—8; D: 5—6, 5a — 6a, 3c — 7c; E: 11, 14, 6a, 4c; F: 2, 3a — 7a; G: 9.

134. *Silo piceus* (Brauer, 1857).

— Botosaneanu 1965; Szczęsny 1965, 1970, 1974a, 1980; Zaćwilichowska 1968, 1969; Riedel 1972, 1978; Dratnal et al. 1979;

— 1 ♂, 5. IX; II, downstream sections of streams; C: 10—12; D: 6c — 7c; E: 18, 3c — 4c; F: 4—6, 7a.

135. *Lepidostoma hirtum* (Fabricius, 1781).

— Krzanowski et al. 1965; Szczęsny 1965, 1980; Zaćwilichowska 1969; Riedel 1978;

— II, downstream sections of streams; D: 5c — 7c; E: 19; F: 6—7, 8a — 9a.

136. *Lasiocephala basalis* (Kolenati, 1848).

— KOWNACKA, KOWNACKI 1965b; ZAĆWILICHOWSKA 1969; DRATNAL et al. 1979; SZCZĘSNY 1980;

— I, midstream section of the Dunajec; E: 15.

137. *Crunoetia irrorata* (CURTIS, 1834).

— ZAĆWILICHOWSKA 1964; BOTOSANEANU 1965; SZCZĘSNY 1970, 1975, 1980; RIEDEL 1972, 1978;

— 10 ♂♂, 12 ♀♀, 6. VII—22. VIII; II, upstream sections of streams up to sources; A: 1a — 2a, 5a; B: 3, 2a, 4a; D: 1a — 6a, 1b — 4b, 1c, 3c; F: 2a; G: 7 .

138. *Athripsodes albifrons* (LINNAEUS, 1758).

— SZCZĘSNY 1965 *(Leptocerus albifrons)*, 1975 (also *A. aterrimus*); RIEDEL 1972, 1978;

— II, downstream sections of streams, rivers; D: 6—7, 10—11; E: 18—21; F: 5—7, 8a — 9a.

139. **Athripsodes bilineatus* (LINNAEUS, 1758).

— SZCZĘSNY 1965 *(Leptocerus bilineatus)*; RIEDEL 1978.

140. *Athripsodes commutatus* (ROSTOCK, 1873).

— SZCZĘSNY 1975: RIEDEL 1978.

141. *Ceraclea alboguttata* (HAGEN, 1860).

— RIEDEL 1978 *(Athripsodes alboguttatus)*.

142. **Ceraclea annulicornis* (STEPHENS, 1836).

— RIEDEL 1978;

— I, the Soła river near Oświęcim; B: 14.

143. ● *Ceraclea aurea* (PICTET, 1834).

144. **Ceraclea dissimilis* (STEPHENS, 1836).

— RIEDEL 1972, 1978, SZCZĘSNY 1975 *(Athripsodes dissimilis)*.

145. *Mystacides azurea* (LINNAEUS, 1761).

— SZCZĘSNY 1975, 1980;

— I, rivers; D: 9.

146. **Mystacides longicornis* (LINNAEUS, 1758).

— SZCZĘSNY 1975.

147. *Mystacides nigra* (LINNAEUS, 1758).

— SZCZĘSNY 1980.

148. *Triaenodes conspersus* (RAMBUR, 1842).

149. *● *Triaenodes simulans* TJEDER, 1929.

— DZIĘDZIELEWICZ 1911 *(T. conspersa)*; TOMASZEWSKI 1965 *(T. conspersa*, pro parte); SZCZĘSNY 1980.

150. *Oecetis ochracea* (CURTIS, 1825).

— RIEDEL 1978; SZCZĘSNY 1980.

151. *Adicella filicornis* (PICTET, 1834).

— SZCZĘSNY 1970; RIEDEL 1972, 1978;

— 18 ♂♂, 11 ♀♀, 22. VI—6. VII; sources at the foot of the Babia Góra Mtn.

152. *Notidobia ciliaris* (LINNAEUS, 1761).

— SZCZĘSNY 1970, 1975, 1980; KOWNACKA 1971;

— 21 ♂♂, 27. V—5. VI; I, in some streams which warm up easily in summer; F: 7.

153. *Oecismus monedula* (HAGEN, 1859).

— RIEDEL 1972; SZCZĘSNY 1974a, 1980.

154. *Sericostoma flavicorne* SCHNEIDER, 1845.

— TOMASZEWSKI 1965 *(S. turbatum)*; SZCZĘSNY 1966b *(S. timidum)*; KOWNACKA 1971;

— 9 ♂♂, 3 ♀♀ (?), 18. V—22. VII; at the Żabnica stream.

155. *Sericostoma personatum* KIRBY et SPENCE, 1862.

— SZCZĘSNY 1965 *(S. pedemontanum)*, 1970, 1974a, 1975; TOMASZEWSKI 1965 (also *S. pedemontanum*); ZAĆWILICHOWSKA 1968 *(S. pedemontanum?)*, 1969; RIEDEL 1978;

— 26 ♂♂, 18 ♀♀, 27. VI—16. VII; at the Żabnica and Poniczanka streams. The larvae of *O. monedula* + *S. flavicorne* + *S. personatum* (so far indistinguishable) have been considered as *Sericostoma* spp. They are the most common of all the *Trichoptera* larvae inhabiting the running waters of the North Carpathians and especially of the Beskidy Mts; they are often dominant in source sections and upstream sections of Beskid streams; A: 3, 5—8, 1a — 7a; B: 4, 7—12, 3a, 5a — 10a, 1b — 2b; C: 6—9, 11—14; D: 1—7, 1a — 7a, 1b — 4b, 1c — 6c; E: 10—11, 13—19, z2, 2a, 6a — 9a, 2s, 8b, 2c — 6c, 1d; F: 2—7, 2a — 9a; G: 3, 7—9.

156. *Beraea maurus* (CURTIS, 1834).

— BOTOSANEANU 1965; SZCZĘSNY 1970; RIEDEL 1972, 1978;

— 9 ♂♂, 13 ♀♀, 6. VII—15. VIII; head streams at the foot of the Babia Góra Mtn.

157. *Beraea pullata* (CURTIS, 1834).

— SZCZĘSNY 1970; RIEDEL 1972, 1978;

— 14 ♂♂, 4 ♀♀, 10—30. VI; I, upstream sections of streams; B: 3a, 2b; D: 1a, 3a, 1c.

158. *Ernodes articularis* (PICTET, 1834).

— SZCZĘSNY 1970, 1980; RIEDEL 1972, 1978;

— 44 ♂♂, 25 ♀♀, 25. VI—5. IX; I, head streams; B: 2b; D: 3, 1c.

159. **Ernodes vicinus* MCLACHLAN, 1879.

— SZCZĘSNY 1970; RIEDEL 1978;

— 7 ♂♂, 2—16. VII; I, occasionally in streams; F: 1.

160. **Bereamyia hrabei* MAYER, 1936.

— RIEDEL 1971, 1972;

— II, in small Beskid streams; A: 4a; D: 3c — 4c; F: 5, 3a, 5a.

161. *Odontocerum albicorne* (SCOPOLI, 1763).

— ZAĆWILICHOWSKA 1964, 1968, 1969; BOTOSANEANU 1965; KRZANOWSKI et al. 1965; SZCZĘSNY 1970, 1974a, 1975, 1980; RIEDEL 1978; KLIMA 1981;

— 11 ♂♂, 4 ♀♀, 16. VII—1. IX; III, upstream sections of streams; A: 2a — 4a; B: 4, 6—7, 6a — 9a; C: 6—8, 11; D: 4—6, 2a — 7a, 3b — 4b, 1c — 4c; E: 2c, 5c, 1d; F: 2—4, 2a — 5a; G: 8.

162. *Molannodes tinctus* (ZETTERSTEDT, 1840).
— SZCZĘSNY 1980.

Apart from these, several other *Trichoptera* species have been found to live in the Vistula river (upstream of the Goczałkowice reservoir) and in its North Carpathian tributaries at the sampling stations situated outside the Carpathian area. These are:

163. *Hydropsyche contubernalis masovica* MALICKY, 1977.
— I; D: 11; F: 12.
164. *Hydropsyche modesta* NAVAS, 1925.
— II; A: 9; B: 15; D: 11; F: 11—12.
165. *Polycentropus irroratus* (CURTIS, 1835).
— I; D: 11.
166. *Lype reducta* (HAGEN, 1860).
— I; D: 11.

V. 2. The Slovak side

A list of *Trichoptera* species quoted from the Slovak side of the North Carpathians according to MAYER (1939) with supplements: BOTOSANEANU (1961), SEDLAK (1962), SYKORA (1962), NOVAK, BOTOSANEANU (1965), NOVAK, OBR (1966), HELAN et al. (1973) includes also: 1. *Oxyethira falcata* MORTON, 2. *Hydroptila tineoides* DALMAN, 3. *Agraylea sexmaculata* CURTIS, 4. *Chimarrha marginata* L., 5. *Neureclipsis bimaculata* (L.), 6. *Polycentropus irroratus* (CURTIS), 7. *Holocentropus dubius* (RAMBUR), 8. *H. picicornis* (STEPHENS), 9. *H. stagnalis* (ALBARDA), 10. *Cyrnus crenaticornis*(KOLENATI), 11. *C. flavidus* (MCLACHLAN), 12. *Lype reducta* (HAGEN), 13. *Tinodes dives* (PICTET), 14. *T. pallidulus* MCLACHLAN, 15. *T. unicolor* (PICTET), 16. *Ecnomus tenellus* (RAMBUR), 17. *Trichostegia minor* (CURTIS), 18. *Agrypnia pagetana* CURTIS, 19. *Micrasema setiferum* PICTET, 20. *Limnephilus algosus* (MCLACHLAN), 21. *L. binotatus* CURTIS, 22. *L. bipunctatus* CURTIS, 23. *L. politus* MCLACHLAN, 24. *L. sericeus* (SAY), 25. *Grammotaulius nitidus* (MUELLER), 26. *Glyphotaelius pellucidus* (RETZIUS), 27. *Phacopteryx brevipennis* (CURTIS), 28. *Halesus tesselatus* (RAMBUR), 29. *Micropterna sequax* MCLACHLAN, 30. *Hydatophylax infumatus* (MCLACHLAN), 31. *Athripsodes aterrimus* (STEPHENS), 32. *A. cinereus* (CURTIS), 33. *Ceraclea fulva* (RAMBUR), 34. *C. nigronervosa* (RETZIUS), 35. *C. riparia* (ALBARDA), 36. *C. senilis* (BURM.), 37. *Triaenodes bicolor* (CURTIS), 38. *T. reuteri* MCLACHLAN, 39. *Oecetis furva* (RAMBUR), 40. *O. lacustris* (PICTET), 41. *O. notata* (RAMBUR), 42. *O. tripunctata* (FABRICIUS), 43. *Setodes punctatus* (FABRICIUS), 44. *S. viridis* (FOURCROY), 45. *Leptocerus interruptus* (FABRICIUS), 46. *L. tineiformis* CURTIS, 47. *Beraeodes minutus* (L.), 48. *Mollana angustata* CURTIS.

V. 3. Dubious reports

They can be classified into three groups: I — species incorrectly identified, II — probably incorrect identified, III — quoted by mistake or without a detailed place of collecting. An asterisk means — earlier literature (before 1963) in which the species was cited for the Polish North Carpathians can be found in TOMASZEWSKI'S catalogue (1965); the developmental stage which was used for species identification is given in brackets (im. — imago, la — larva):

I — **Rhyacophila aurata* BRAUER, (im.); range of the species and of the next two from the genus does not include the North Carpathians;

**Rhyacophila dorsalis* (CURTIS), (im.); ZAĆWILICHOWSKA 1968 (*R. obtusidens* — a.), 1969 (la.);

**Rhyacophila torrentium* PICTET, (im.);

**Synagapetus insons* MCLACHLAN, (*Pseudoagapetus insons* — im.); a West European species;

**Stactobia fusicornis* SCHNEIDER, (im.); a Sicilian endemic species;

**Wormaldia triangulifera* MCLACHLAN, (im.); the species inhabits South—West Europe;

Anabolia nervosa CURTIS; RIEDEL 1978 (la.); a West-European species;

**Chaetopteryx villosa* (FABRICIUS), (im., la.), ZAĆWILICHOWSKA 1964, 1968 and 1969 (la.); the species lives to the north and west of the North Carpathians whereas the North Carpathians are inhabited by *C. fusca*, a vicarious species.

Apart from these, the following species have been quoted to occur on the Slovak side of the North Carpathians:

Rhyacophila evoluta MCLACHLAN — a West European species;

Chionophylax czarnohoricus (DZIĘDZIELEWICZ) as *Acrophylax* — endemic species of the East Carpathians.

II — **Rhyacophila pubescens* PICTET, (la.), all data for the Tatras;

Hydroptila sparsa CURTIS: ZAĆWILICHOWSKA 1968 (la.);

**Hydroptila tineoides* DALMAN, (im.); ZAĆWILICHOWSKA 1964 and 1968 (*H. femoralis* — la.); RIEDEL 1972 (im.);

Hydroptila vectis CURTIS: ZAĆWILICHOWSKA 1968 and 1969 (*H. maclachlani* — la.);

**Hydropsyche angustipennis* CURTIS, (im.); ZAĆWILICHOWSKA 1964 and 1969 (la.);

**Hydropsyche guttata* PICTET, (im.); RIEDEL 1972 and 1978 (im.);

**Cheumatopsyche lepida* PICTET, (im.), for the Tatras;

**Neureclipsis bimaculata* LINNAEUS, (im.);

Drusus biguttatus PICTET: ZAĆWILICHOWSKA 1968 (*Potamorites* — la.), 1969 (la.);

Grammotaulius nitidus MUELLER: SZCZĘSNY 1975 (uncertain identification on the basis of ♀);

Potamophylax cingulatus STEPHENS: ZAĆWILICHOWSKA 1964 and 1968 (*Stenophylax latipennis* — la.), 1969 (*P. latipennis* — la.);

Potamophylax rotundipennis BRAUER: KOWNACKA, KOWNACKI 1965b (*Stenophylax* — la.);

Halesus digitatus SCHRANK: KOWNACKA, KOWNACKI 1965b (la. — the Rybi potok in the Tatras above 1000 m altitude);

Halesus tesselatus RAMBUR: ZAĆWILICHOWSKA 1968 and 1969 (la.);

**Mesophylax impunctatus* MCLACHLAN (la.); ZAĆWILICHOWSKA 1968 and 1969 (la.);

Hydatophylax infumatus (MCLACHLAN): ZAĆWILICHOWSKA 1969 (la.);

**Lithax obscurus* (HAGEN), (im. — for the Tatras);

**Adicella reducta* (MCLACHLAN), (im.);

Notidobia ciliaris LINNAEUS: KOWNACKA, KOWNACKI 1965b (la.).

Apart from these, the following species have been quoted to occur on the Slovak side of the North Carpathians:

Hydropsyche nervosa KLAPALEK,

Drusus doehleri MAYER,

Potamophylax millenii KLAPALEK, quoted as *Stenophylax.*

III — **Tinodes pallidulus* MCLACHLAN, (im.); PONGRACZ (1919) quoted Galicia as a place of finding, which does not necessarily refer to the North Carpathians;

Brachycentrus subnubilus CURTIS: SZCZĘSNY 1970 (la. — for the Tatras), probably labels on samples have been misplaced;

Micropterna sequax MCLACHLAN: TOMASZEWSKI 1965, quotes it for the Tatras after MAJEWSKI (1885) who, however does not quote the species; SZCZĘSNY (after TOMASZEWSKI 1965).

V. 4. General remarks

A list of Polish caddisfly species by TOMASZEWSKI (1965) up till the year 1963 proved the group to be relatively well examined in the North Carpathian area in comparison with other regions of Poland. He lists 137 taxa for the area whereas the numbers for the Sudety Mts, the Krakowsko-Częstochowska Upland and the Masurian Lake District are 72, 37 and 125 respectively. Continuation of studies in the following years resulted in identification of further 47 taxa (including an endemic species of the Tatras). At the same time, many specific names used so far disappeared as progress was made in taxonomy of this insect group. The number of the Polish North Carpathian species increased to 162. Together with the species quoted for the Slovak region, the North Carpathians now have 210 specis. Probably the number is not final since new species are expected to be added to the list, e. g. those inhabiting the lowland areas around the Carpathians (even though some of the already quoted species might be veri ied).

A comparison of lists of North Carpathian species for Poland and Slovakia shows the latter to contain more items — 193 as opposed to 162. Only 17 of the species found in the Polish Carpathians have not been discovered so far in

the Slovak Carpathians (findings published until 1981) whereas as many as 48 species found in the Slovak Carpathians have not been discovered in the Polish area.

Judging by ecological requirements of the larvae, it seems that all the 17 forms from the northern slopes of the North Carpathians can be found on the southern side of the border. However, not all of the 48 Slovak species can be found in the Polish area. The main reason seems to be unsuitable living conditions on the northern slopes of the Carpathians such as lower temperatures of waters which matter very much for the so called south European elements (some species of the genus *Tinodes*). However, most of the 48 species are sure, as time goes by, to be included in the Polish list, particularly after stagnant or sluggish waters, which are their main habitats, have been examined, e. g. old river beds, ponds, peatbogs. These are numerous in the Polish Carpathians and are yet to be investigated in detailed.

VI. ZOOGEOGRAPHICAL REMARKS

At present, 210 caddisfly species are known for the North Carpathians, whereas the number for the whole of the Carpathians, the Alpes and the Pyrenees are 291, 323 and 204 respectively (BOTOSANEANU, MALICKY 1978, MALICKY 1983).

North Carpathian caddisflies can be classed into the following zoogeographical groups: I — holarctic species (10 taxa); II — palearctic species (15); III — species distributed outside Europe (58): IV — species distributed in Europe or slightly beyond European area (127).

Group III includes: A — elements inhabiting areas outside Europe to the east as far as Siberia or even Japan (23 species), B — elements inhabiting areas outside Europe to the south-east as far as Asia Minor or even farther south (35 species).

Group IV includes: A — species distributed more or less over the whole Europe (93), B — species with very limited distribution, restricted to the mountains of central Europe or to a part of the mountains in central and southern Europe (the Balkans) or only to the Carpathians (34). Thus the dominant group consists of European species whose number is much greater than that of other species.

There were 8 endemic species of the Carpathians (group IV B) which constituted 3.8% of all the species found in the North Carpathians. So far, 34 endemic species have been discovered in the whole Carpathians. The area of the Carpathians is 209 thousand km^2; 33% of this is occupied by the North Carpathians. It follows, that 23.5% endemic species inhabit 33% of the northern edge of the Carpathians. Thus density of endemic species increases to the east and south of the Carpathians.

The endemic species of the North Carpathians include those inhabiting the area along the whole range of the Carpathians *(Drusus brunneus, Acrophylax vernalis, Chaetopteryx polonica, Psilopteryx psorosa carpathica)*, those confined to the north-eastern part of the Carpathian range *(Drusus carpathicus, Potamophylax carpathicus, Chaetopteryx subradiata)* and one restricted only to the Tatras — *Allogamus starmachi*, an endemic species of the Tatras. Thus the North Carpathians are inhabited by only one endemic species which does not live outside the area; in the East Carpathians there are 8 such species and in the South Carpathians 9.

Chaetopteryx sahlbergi is a boreal-mountainous element which lives in the Arctic zone and in the Carpathians (in the East Beskidy Mts and in the Tatras).

VII. CADDISFLIES OF THE RUNNING WATERS

VII. 1. A general description

In samples collected from the bottom of North Carpathian rivers and streams at the altitudes of 150—1900 m, some 80 thousand larvae and pupae were found. Only some 70 thousand specimens were identified to the species level. The remaining specimens, i. e. 13% could not be so identified mainly due to difficulties in recognizing early larval stages or some specimens just after moulting whose taxonomic features were not sufficiently developed.

The identified specimens represented at least 111 taxa; at stations within the Carpathians there were 106 taxa. Similar results were obtained by DECAMPS (1967) in similar studies on caddisflies of the Pyrenees where 66 000 specimens collected from various aquatic habitats at altitudes 420—2500 m represented 108 species.

51 species quoted from the Polish North Carpathians and identified on the basis of the adults were not found in the running waters in larval or pupal stages. Most of them do not inhabit running waters although single specimens might appear in streams, e. g. some species of the genus *Limnephilus*.

At least 9 of the 51 species live permanently in lotic habitats: *Wormaldia pulla, Plectrocnemia brevis. Oecismus monedula, Hydropsyche angustipennis, H. bulgaromanorum, H. ornatula* and species of the *Micropterna* genus. The larvae of the former three species might have been collected but could not have been identified since they are not known. *H. angustipennis* was found to live in lowest stretches of major Carpathian rivers just outside the Carpathians. *H. bulgaromanorum* and *H. ornatula* whose single adults were collected in the Pieniny area (SZCZĘSNY 1980) over a hundred years ago might still be living there but they might also have withdrawn due to changes in ecological conditions of aquatic environment in the area. Species of the *Micropterna* genus inhabit small brooks, often periodical ones, usually in areas which abound in caves, e. g. in area of limestone rocks, since their adults are a typical component

of cave fauna. Adults of the genus have never been captured in great numbers in the North Carpathians so the larvae are probably not very numerous here, either.

VII. 2. Most abundant and common species

Of the 10 most abundant caddisfly species living in the running waters of the North Carpathians, *Hydropsyche pellucidula* and *Psychomyia pusilla* are clearly in the lead (Table XV) since differences in percentage of collected specimens in relation to other species are several per cent. The two species constitute almost 26% of the total number of collected (and identified) specimens while the

Table XV

Most abundant caddisfly species collected in the North Carpathian running waters

	Number of specimens	%	Number of stations	%
Hydropsyche pellucidula	11 015 (134)	15.9	67 (6)	37.6
Psychomyia pusilla	6 933 (33)	10.1	35 (2)	19.7
Rhyacophila nubila	4 105 (12)	6.0	82 (1)	64.1
Allogamus auricollis	3 467	5.0	36	20.2
Drusus biguttatus	2 800	4.1	10	5.6
Hydropsyche instabilis	2 281	3.3	48	27.0
Micrasema minimum	2 207	3.2	14	7.9
Drusus discolor	2 096	3.0	59	33.1
Glossosoma intermedia	1 935	2.8	31	17.4
Glossosoma conformis	1 887	2.7	41	23.0
Total	38 726 (179)	56.0		
All identified	69 112 (468)	100.0		

Values in brackets refer to stations outside the Carpathians

10 most numerous constitute only 56% of the whole. Frequency distribution could thus be considered as even, the more so that differences between other species in the list do not exceed 1%.

None of the taxa found in the area occurred at all the 178 sampling stations; the most common one — *Rhyacophila nubila* occurred only at 82 stations, *H. pellucidula* at 67, *Rhyacophila tristis* at 65, etc. (Fig. 2).

10 most common caddisfly species occurred at 30—40% of all the stations. Nearly half of the species occurred only at some stations while 2/3 of them were found at only 11% of the stations (Table XVI). Such a distribution might prove a great ecological diversity of habitats and of caddisfly fauna inhabiting them.

Among the 10 most common caddisfly species of the North Carpathian running waters there were only four whose representatives were most abundant: *R. nubila*, *H. pellucidula*, *Drusus discolor* and *Hydropsyche instabilis*. However, a general regularity can be observed — the more common species (collected at more stations) are the most abundant (Table XVI) as well. First two of the four species mentioned above inhabit downstream sections of streams and rivers, *H. instabilis* inhabits downstream sections of streams while *D. discolor* inhabits midstream and upstream sections of streams up to outflows from sources. Al

Table XVI

Frequence of caddisfly species at 178 sample sites on North Carpathian running waters; percentage of most numerous species (Tab. XV) in each group are given in brackets

Number of sites	Number of species	%	%
1—9	51	45.1	(—)
10—19	23	20.4	(8.7)
20—49	32	28.3	(15.6)
50—82	7	6.2	(42.9)
Total	113	100.0	

the four, however, have some features in common — they are adjusted to life in strong and very strong current and none of them is a scraper.

VII. 3. Caddisfly communities

It is assumed that a caddisfly community is a definite set of caddisfly species with particularly high values ($\geqslant 0.247$) of concurrence coefficient — $\varnothing_c$ (see below) in the study area.

It has been agreed upon to call macrohabitat a section or sections of streams inhabited by definite community.

Value of species domination is determined by percentage of its specimens in relation to all the caddisfly specimens collected at a station. Domination is expressed in terms of the following scale: at least 5% specimens — dominant species, 2—4.9% — subdominant, less than 2% specimens — adominant.

In order to distinguish caddisfly communities, a method similar to that used by DECAMPS (1967) in studies on the Pirenees caddisflies was applied with slight modifications as regards principles of species selection for statistical operations and the final stage of distinguishing communities where CZEKANOWSKI'S table was used.

Selection of a species for calculations was decided on the basis of its high value of domination at a station rather than in a single sample, i. e. not less than 10% at one station at least.

This rather high threshold value was adopted to diminish mistakes resulting from great differences in sampling, both as regards dates and number of samples. It enabled us to reduce total number of species for calculations to 66, i. e. 59%. The final argument for adopting 10% as threshold value of domination were the results obtained from computing the coefficient $\varnothing_c$; not numerous species (below 10% of domination) had low values of $\varnothing_c$, usually less than 0.2, which eliminated them from CZEKANOWSKI'S table (which comprises values of + 0.2 at least).

Concurrence coefficient $\varnothing_c$ was calculated by a statistical method acc. to the following formula (after DECAMPS 1967) with YATES' correction:

$$\varnothing_c = \frac{(C-P)N-N/2}{\sqrt{A(N-A)B(N-B)}}$$

where A — number of stations where X species occurred,
B — number of stations where Y species occurred,
C — number of stations common for X and Y,
N — total number of stations,
P — statistical probability of concurrence of species X and Y at N stations, $P = \frac{AB}{N}$

The method, based on the x^2 method, makes it possible to obtain from calculations the value which shows how far any two species meet in a given area (when the value grows from 0 to 1) or avoid each other (when the value decreases from 0 to −1). Values approximating zero mean that concurrence of two species at a number of stations is accidental, i. e. it is in agreement with random distribution.

The obtained values were arranged in CZEKANOWSKI'S table (Fig. 2). For practical reasons and to simplify the table species which occurred at less than 10 stations were omitted from the table (they are listed below). Values smaller than 0.2 were also omitted. It ought to be noted that the value 0.247 corresponds to the probability 10^{-3} while the value 0.301 to 10^{-4}.

The advantage of applying CZEKANOWSKI'S table to the above method lies in the fact, that in this way, a more complete visual picture is obtained of statistical relations between species. The best way would be to obtain a spatial picture.

It can be seen from Fig. 2 that the highest values $\varnothing_c$ for particular pairs of species are arranged in seven more or less distinct groups denoted by letters A—G. Each group comprises a number of species which make up a particular community:

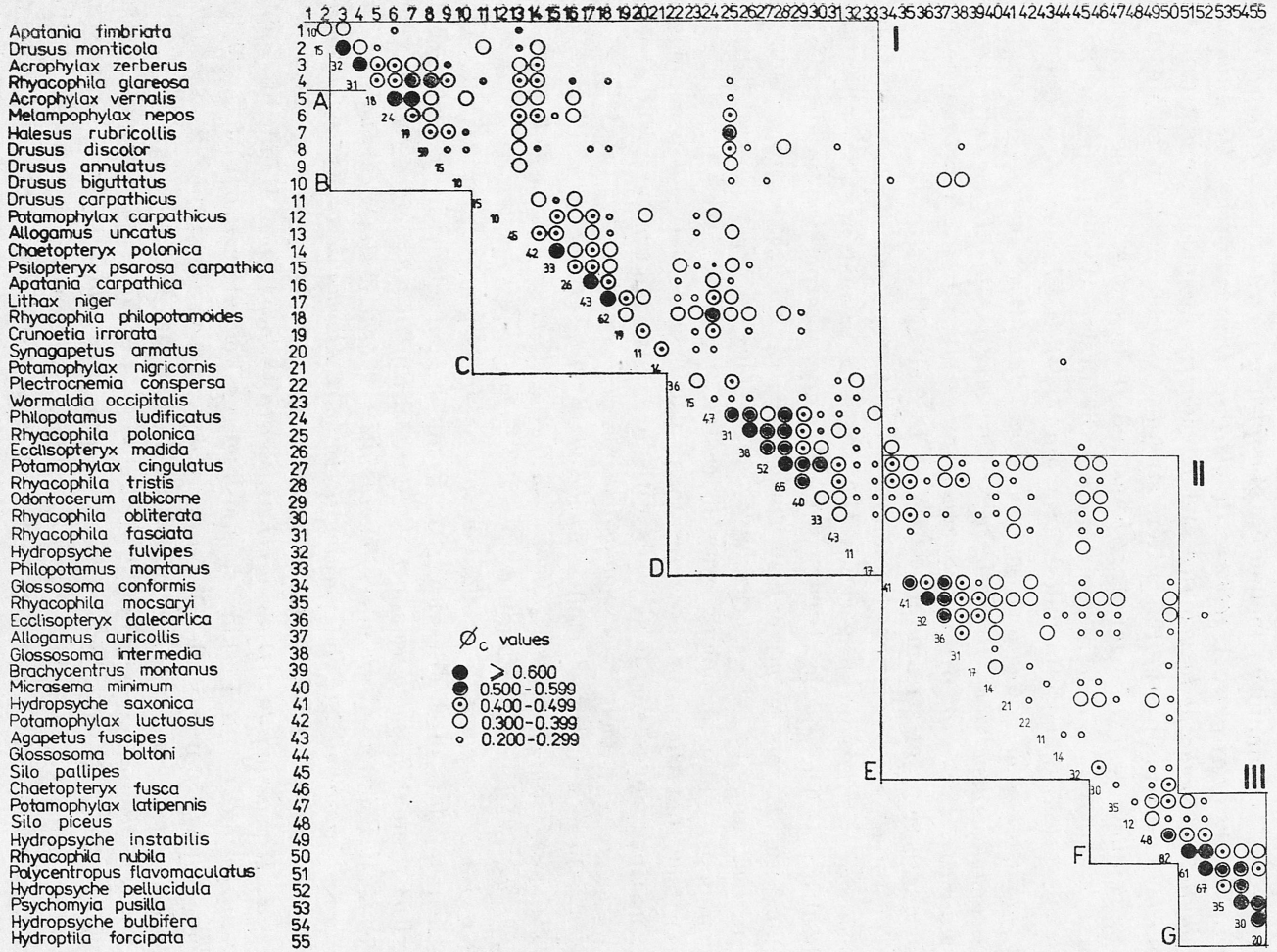

Fig. 2. Dominant *Trichoptera* species in North Carpathian streams ordered into CZEKANOWSKI's Table according to concurrence coefficient $\varnothing_c$

A — this community includes: *Drusus monticola*, *Acrophylax zerberus*, *Apatania fimbriata* and *Rhyacophila glareosa*. It inhabits sections of the Tatra and Babia Góra streams at altitudes higher than 1300 m;

B — this community includes: *Acrophylax vernalis*, *Melampophylax nepos*, *Halesus rubricollis*, *A. zerberus*, *R. glareosa*, *Drusus discolor*, *D. annulatus*, *D. biguttatus*, *Rhyacophila polonica* and *R. vulgaris*. It inhabits midstream sections of the Tatra and the Babia Góra streams (over 900 m altitude). Members of the community, except for *A. zerberus* and *D. biguttatus* cohabit with members of C and D communities but only in the Beskid Wysoki streams.

C — this community includes: *Apatania carpathica*, *Lithax niger*, *Rhyacophila philopotamoides*, *Chaetopteryx polonica*, *Psilopteryx psorosa carpathica*, *Potamophylax carpathicus*, *P. nigricornis*, *Allogamus uncatus*, *Drusus carpathicus*, *D. brunneus*, *Crunoetia irrorata*, *Synagapetus armatus*. It inhabits sources and adjacent sections of streams in the West Beskidy Mts.

The three above mentioned communities are connected by *A. uncatus* and *C. polonica*, very frequent species in the North Carpathian aquatic habitats at high altitude. The species concur with *P. psorosa carpathica* (in the Beskid streams) and *P. psorosa psorosa* (in the Tatra streams) making up a seemingly separate community. The species have many biological and ecological features in common (similar phenology, way of feeding and a diet). This is manifested in the fact that their larvae aggregate in places where detritus accumulates, i. e. in lentic zones, marginal pools with low water temperature. The species are often accompanied by *Pseudopsilopteryx zimmeri*.

D — the community includes: *Rhyacophila tristis*, *R. polonica*, *R. fasciata*, *R. obliterata*, *Synagapetus iridipennis*, *Ecclisopteryx madida*, *Potamophylax cingulatus*, *Philopotamus ludificatus*, *P. montanus*, *Odontocerum albicorne*, *Plectrocnemia conspersa*, *Wormaldia occipitalis*, *Hydropsyche fulvipes*. It inhabits upstream sections of the Beskidy streams and is connected with B and C communities through *R. polonica* and *P. ludificatus*, *R. philopotamoides*, respectively.

E — the community includes: *Rhyacophila mocsaryi*, *Ecclisopteryx dalecarlica*, *Glossosoma conformis*, *G. intermedia*, *G. boltoni*, *Allogamus auricollis*, *Brachycentrus montanus*, *Potamophylax luctuosus*, *Micrasema minimum*, *Agapetus fuscipes*, *Drusus trifidus*, *Hydropsyche saxonica*, *Silo pallipes*. It inhabits midstream sections of the Beskidy streams and the Podhale sections of the Tatra streams below 850 m altitude. The community is often accompanied by *Annitella obscurata* but *A. thuringica* in major streams of the Podhale region.

F — the community includes: *Hydropsyche instabilis*, *Chaetopteryx fusca*, *Potamophylax latipennis*, *Silo piceus*, *Rhyacophila nubila*. The community is not clearly marked maybe because it inhabits downstream sections of the Beskidy streams which are very much exposed to intensive human activity; many of these stream sections are regulated and surrounded by cropland and housing estates.

G — the community includes: *Hydropsyche pellucidula*, *H. bulbifera*, *H. siltalai* (only streams in the western part of the West Beskidy Mts), *H. contu-*

bernalis contubernalis, *R. nubila*, *Polycentropus flavomaculatus*, *Psychomyia pusilla*, *Hydroptila forcipata*, *H. lotensis*; it inhabits downstream sections of major streams and midstream sections of Beskidy rivers. The group containing *P. pusilla*, *H. contubernalis*, *H. bulbifera*, *H. forcipata* and *H. lotensis* shows a certain individual feature since it is more often met in Beskid streams farther to the east and is usually accompanied by *Cheumatopsyche lepida*.

S — the community not presented in CZEKANOWSKI'S table includes: *Allogamus starmachi* and *M. nepos* often accompanied by *A. zerberus* and *A. uncatus*; it is present in specific habitats of periodical Tatra streams.

The S community was distinguished on the basis of the exclusive occurrence of *A. starmachi*, an endemic species, in a rather specific habitat of certain periodical streams or sections of streams in the Tatras over 1000 m altitude. Those streams cease to flow at the end of autumn and in winter, i. e. when soil (water-bearing layer of the basin) freezes and feeding of the streams diminishes. Number of specimens of other species in this habitat depends on the time which passes until the flow is renewed and on the distance from the part of the stream where water flows throughout the year.

Distinguishing 8 caddisfly communities would prove the existence of at least 8 different types of habitats — macrohabitats — recurrent in the North Carpathian running waters. Some of the communities are restricted to the Tatra streams only or the Tatra and Babia Góra ones, the range of the others is wider.

The Tatra communities (S, A, B) are well separated. The fact is underlined by presence of species: *A. fimbriata*, *D. monticola*, *A. zerberus* which can be met outside the Tatras only at higher altitudes of the Babia Góra and first of all, by *D. biguttatus* which abounds almost exclusively in major Tatra streams (900—1100 m altitude) and *P. psorosa psorosa* as well as *A. starmachi*, an endemic species of the Tatras.

VII. 3. 1. Relations between communities

While the communities are quite clearly marked in Fig. 2 they are not so clearly separated from one another. The communities are related through particular pairs of species, especially the more common ones but the relations are the less numerous the greater the distance between the community positions in the table; the most distant communities such as A and G have no relations. The macrohabitats the above mentioned communities occupy are also very much different from each other from ecological point of view; A community inhabits a high-mountain stream with high gradient and very low water temperature in summer, G community inhabits a mountain river with moderate gradient and high water temperature in summer (20—25°C). Position of the communities in the table (and in relation to one another) reflects in a general way a definite situation in the area, i. e. altitudinal distribution of the communities and their longitudinal zonation in streams.

Increased $ø_c$ values are arranged in 3 larger groups denoted by the Roman numbers I, II, III (Fig. 2). Grouping I comprises the greatest number of species included in the communities, A, B, C, D and S — which is not listed in the table. Communities of the grouping are very closely connected due to high values of $ø_c$ between specific pairs even though they are not adjacent in the table (e. g. the community B is connected with D through *R. polonica*).

Grouping I comprises species which inhabit the Tatra streams and upstream sections of the Beskidy streams with sources. They are thus ecologically connected with aquatic environment of low temperature where the current not necessarily strong. Some of the grouping I species, mainly those inhabiting upstream sections of the Beskidy streams are also included in grouping II.

Grouping II is formed of species whose habitats are generally streams with rapid current and low temperature, rarely exceeding 10°C in summer.

Grouping III consists of a small number of species inhabiting downstream sections of major streams and rivers of the Beskidy Mts where current might be of considerable strength but summer temperatures are often much more than 10°C.

VII. 3. 2. Altitudinal distribution and longitudinal zonation of communities

Of the 8 caddisfly communities distinguished which inhabit the North Carpathian streams, three (A, B, S) could be defined as the Tatra ones, although the definition is not too precise since the communities A and B occur also at the highest altitudes of the Beskid Wysoki Mts.

Community A inhabits sections of the Tatra and Babia Góra streams at the highest altitude. The altitudinal range of the community is determined by the zone of *Drusus monticola* occurrence which ranges between 1300—1700 m altitude (in the Babia Góra Mtn, only 1620 m). Surprisingly, the community has been found at 970 m altitude in the Źródło Lodowe source in the Kościeliska Valley. *D. monticola* domination increases with altitude, e. g. in the initial section of the Pyszniański Potok stream, at 1600 m altitude it exceeds 80% (Tab. XXIX).

In the High Tatra streams *D. monticola* does not participate in A community. In many streams the community might not develop fully as caddisfly fauna is very sparse i. e. in stretches at higher altitude (above 1400 m), particularly in those streams which do not flow through lakes (Tab. XXXI). Below 1400 m altitude, B community is found in those streams.

Community B inhabits the Tatra streams at 900—1350 m altitude and only short sections of those in the Babia Góra area at 1200—1300 m altitude.

In the West Tatra streams, the beginning of community B (starting from sources) is determined by *Halesus rubricollis* domination whereas in the High Tatras by *Drusus annulatus* domination. The range of the community at the Tatra foothills is marked by *Drusus biguttatus* domination.

Community S inhabits the Tatra streams which cease to flow in autumn —

winter. Its range, determined by dominance of *Allogamus starmachi* and *Melampophylax nepos*, varies but never falls below 1000 m altitude.

Of the remaining ones, the communities: C, D, E, F inhabit sources and small stream rather while G community lives in rivers in the Beskidy Mts.

The C community has generally been called a "spring" one since the species it includes could be captured mainly in sources. However, none of those species was connected exclusively with sources (Tab. XIX—XXXIV). Moreover, the species often defined in literature as crenobiontic ones showed maximum domination values in stream stretches away from sources e. g. *Potamophylax nigricornis* — in a tributary of the Żabnica stream (Tab. XXIII), *Lithax niger* — in a tributary of the Poniczanka (Tab. XXVII) and in the Pyszniański stream (Tab. XXIX), *D. carpathicus* — in the Żabnica stream (Tab. XXII), *Synagapetus armatus* — in the Żabnica and Soła (Tab. XXI).

The C community was generally found at altitude below 1200 m in initial sections of streams, i. e. in springs and outflows from springs. However the initial sections of streams were not always inhabited by the community, especially as regards the streams which did not originate from sources, e. g. the Poniczanka stream. On the other hand, some well developed sources at moderate altitude in the Tatras were not always inhabited by the community C, cf. the sources in the Kościeliska Valley.

The D community inhabits upstream sections of the Beskidy streams, often up to their initial parts unless a stream has a clearly marked spring. In the higher parts of the West Beskidy Mts, the community develops in streams at above 700 m altitude and rarely crosses the altitude of 1000 m whereas in the lower parts of the Mountains it can be observed at altitudes above 600 m. The streams where the community develops are similar in character: they flow on steep and afforested slopes and are shaded.

The features of the D community are also shared by the caddisfly fauna which inhabits the Tatra streams at outflows from lakes; *Rhyacophila tristis* dominates here (Tab. XXX) although the remaining dominant species belong to other communities: *Apatania fimbriata* to A, *Polycentropus flavomaculatus* to F, G.

The E community inhabits streams at the foot of the mountains. In the Podhale sections of the Tatra streams the upper limit of the community range slightly exceeds 850 m altitude while in the streams of the Beskid Wysoki Mts it does not exceed 800 m altitude. In the remaining Beskidy streams, except for the Beskid Wyspowy and the Beskid Niski ones where the community E has not been observed, the community range falls in the altitude of 500—700 m. The streams inhabited by the community are well insolated and have bottoms formed mostly of large-sized stones.

The F community inhabits downstream sections of streams at low altitude, usually between 350—550 m. The community is not clearly marked in the streams of the Beskid Śląski and the Beskid Wysoki Mts or is altogether absent

from them. It develops in stream sections of considerable length in the Beskid Wyspowy and Beskid Niski Mts.

The G community inhabits the Beskidy rivers. The upper limit of the community range was found to be some 700 m altitude in the Dunajec river, 600 m in the Białka Tatrzańska, 500 m in the Soła and 300 m in the Skawa. The lower limit of the community range generally corresponds to the borderline of the Carpathians.

The running waters sections where the communities F and G develop, lie in the zone of intensive human economic activity.

It appears from the above review of communities distribution in the North Carpathian streams that their most frequent succession pattern is as follows: in a Tatra stream A — B — E — G with the community D not clearly marked; in a Beskidy stream it is different C — D — E — F — G and sometimes community F is absent from the streams of the Beskid Śląski and the Beskid Wysoki Mts (or it is poorly developed there) whereas the E community has not been observed in the streams of the Beskid Wyspowy and the Beskid Niski Mts.

VII. 3. 3. Caddisfly communities in European high mountains

During studies on caddisflies of the South Carpathians in the massifs: Retezat (high mts) and Banat (medium height mts), BOTOSANEANU (1959) distinguished 9 communities inhabiting 9 zones in the tributaries of the Danube. Three of these communities were restricted to the Retezat only. Basing on the results of his studies, BOTOSANEANU (ILLIES et BOTOSANEANU 1963) distinguished in the Carpathian running waters caddisfly communities of high mountains and of medium height mountains.

The high mountain communities (the Tatra ones) and those of the medium height mountains (the Beskidy ones) were also distinguished in the North Carpathians (cf. the previous chapter). Yet the specific lists of the communities from the two opposite parts of the Carpathian range differ considerably from one another, particularly as regards the high-mountain communities. None of the species from the Tatra communities (A, B, S) is listed in the Retezat communities (I, II, III) which are composed mainly of the South Carpathian endemic species (BOTOSANEANU 1959). Moreover, some species e. g. *Melampophylax nepos* or *Drusus trifidus* inhabit opposite stream reaches in the south of the Carpathians compared to those in the north.

Communities of medium height mountains have more species in common but combinations of species which constitute particular communities differ very much from one another even though the latest version of respective lists (BOTOSANEANU 1979, the present paper) is taken into consideration.

In BOTOSANEANU'S (1979) opinion, there is no longitudinal zonation of running waters in the high mountains, above 1500—1800 m altitude. The possible combinations of *Trichoptera* species reflect only ecological differences in aquatic habitats. This is why the waters above the forest line are treated as

a whole; the list of species which live here includes almost exclusively the endemic ones.

Similar *Trichoptera* distribution pattern was noted in the Pyrenees by DECAMPS (1967) who distinguished two species groupings: one comprises stenothermal species which inhabit sources and cold streams in high mountain zone with considerable percentage of endemic species (among 15 species, there were 4 endemic ones of the Pyrenees), the other consists of eurythermes which inhabit streams at low and medium altitudes and only outflows from lakes at higher altitudes. Among the North Carpathian caddisflies three groupings were distinguished (I, II, III, cf. Chapter VII. 3. 1).

Of a dozen or so species which constitute the high-mountain grouping (sources and cold streams) in the Pyrenees, only every third occurs in the North Carpathians. A greater number of species common for the running water communities of the Pyrenees and the North Carpathians is observed at medium and low altitudes.

DECAMPS distinguished the following caddisfly communities in the first grouping: of high mountain sources (2) and streams (1); in the other: of sources (1) and streams (2) at medium altitudes, of streams (1) at low altitudes, of midstream (1) and downstream (1) sections of rivers, of outflows from high-mountain lakes (1) and from peat-bogs (1) as well as communities inhabiting specific habitats.

The feature the caddisfly faunas of the running waters of the Pyrenees and the North and South Carpathians have in common is presence of high-mountain communities. In the Pyrenees and the South Carpathians the communities include mainly endemic species of the most restricted geographical ranges. The only North Carpathian endemic species *(A. starmachi)* is also a member of a high-mountain community (the Tatra one). In the North Carpathians, however, the Beskidy Mts community ("spring" — C) shows the highest percentage of Carpathian endemic species (the ones whose range is wider than the North Carpathians) although this is a community of medium height mountains.

VII. 4. Functional feeding groups

CUMMINS (1973), MERITT and CUMMINS (1978) distinguish 4 trophic categories of the North American aquatic insects. These are: shredders, collectors, scrapers/grazers and predators which are functional feeding groups in the stream ecosystem. The larvae belonging to particular groups are characterized by similar feeding habits:

— shredders feed on small portions cut off from large particles of detritus, living vascular plants and filamentous algae;
— collectors feed on fine organic particles and organisms loosely deposited on the bottom or filtered from the suspended matter transported by the current;

— scrapers feed on attached microphytes;
— predators feed on live animal prey.

The above classification of North American caddisflies was adopted by WIGGINS and MACKAY (1978) who considered their ecological diversity and evolutionary adaptation to food resources partitioning. According to the authors

Table XVII

Percentage of functional feeding groups in caddisfly communities of North Carpathian running waters

Functional feeding groups	Communities						
	A	B	C	D	E	F	G
shredders	25.0	20.0	50.0	7.7	—	40.0	—
collectors	—	10.0	—	30.8	15.4	20.0	44.0
scrapers	50.0	40.0	41.7	15.4	76.9	20.0	33.0
predators	25.0	30.0	8.3	46.1	7.1	20.0	22.0
Number of species	4	10	12	13	13	5	9

North American *Trichoptera*, in comparison with the *Odonata*, *Ephemeroptera* and *Plecoptera* of the area are better adapted to various aquatic habitats and to partitioning of resources in a more specialized way. In the authors' opinion this was due mainly to their silk producing abilities.

Basing on mandibles shape of larvae and on the published data concerning biology and habits of the species as well as on the author's own observations, the dominant species of the North Carpathian streams were classed into particular functional feeding groups as follows:

— shredders: *Potamophylax carpathicus*, *P. cingulatus*, *P. latipennis*, *P. nigricornis*, *Acrophylax zerberus*, *Halesus rubricollis*, *Allogamus starmachi*, *A. uncatus*, *Chaetopteryx fusca*, *C. polonica*, *Psilopteryx psorosa carpathica*, *Crunoetia irrorata*, total number 12;

— collectors: net-spinning filter-feeders — *Philopotamus ludificatus*, *P. montanus*, *Wormaldia occipitalis*, *Hydropsyche bulbifera*, *H. fulvipes*, *H. contubernalis*, *H. instabilis*, *H. pellucidula*, *H. saxonica*, *H. siltalai*; filter-feeders (predators?) — *Brachycentrus montanus*, *Drusus discolor*, total number 12;

— scrapers: *Glossosoma boltoni*, *G. conformis*, *G. intermedia*, *Synagapetus armatus*, *S. iridipennis*, *Agapetus fuscipes*, *Hydroptila forcipata*, *H. lotensis*, *Psychomyia pusilla*, *Micrasema minimum*, *Apatania carpathica*, *A. fimbriata*, *Drusus annulatus*, *D. biguttatus*, *D. brunneus*, *D. carpathicus*, *D. monticola*, *D. trifidus*, *Ecclisopteryx dalecarlica*, *E. madida*, *Potamophylax luctuosus*, *Acrophylax vernalis*, *Melampophylax nepos*, *Allogamus auricollis*, *Lithax niger*, *Silo pallipes*, *S. piceus*, total number 27;

— predators: *Rhyacophila glareosa*, *R. fasciata*, *R. mocsaryi*, *R. nubila*, *R. obliterata*, *R. philopotamoides*, *R. polonica*, *R. tristis*, *R. vulgaris*, *Odontocerum*

albicorne; net-spinning predators — *Plectrocnemia conspersa*, *Polycentropus flavomaculatus*, total number 12;

After a more detailed study of the diet of some species their membership

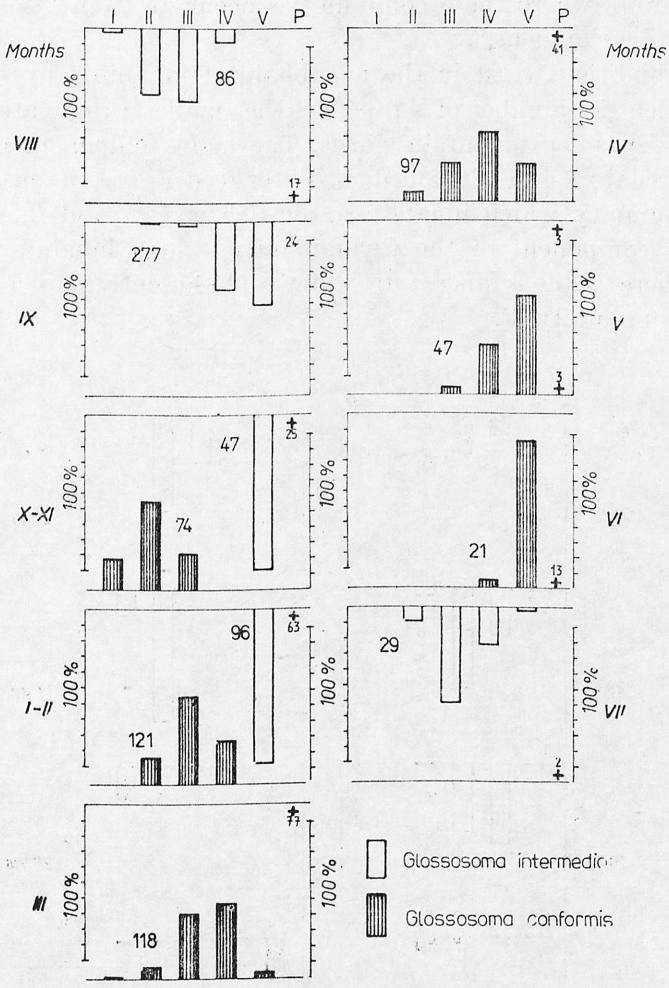

Fig. 3. Life cycles of *Glossosoma intermedia* and *G. conformis* in the Białka Tatrzańska stream; figures at diagrams and crosses denote the numbers of specimens caught (larvae and pupae, respectively); I—V (above diagrams) — larval instars; P — pupae

of functional feeding group might change, e. g. *P. carpathicus* has been shifted from shredders to scrapers, *A. auricollis* vice versa.

Of the 63 species abundant in the streams of the North Carpathians, the greatest number (27) fall into the category of scrapers, i. e. a group of species feeding on attached algae, other groups are less numerous, each comprising 12 species. The prevalence of scrapers well reflects the lotic character of the aquatic environment of the North Carpathians where algae constitute the main resource of food, detritus, seston and animal food being less important.

VII. 4. 1. Caddisfly communities versus functional feeding groups

It can be seen from Table XVII that the A, B, E communities consist mainly of scrapers which also constitute a large part of the communities C and G. All the macrohabitats where these communities occur are well insolated and this favours algal development.

No such conditions exist in the macrohabitat inhabited by the D — community in which the number of scrapers is the smallest; these are small shaded forest streams in steep mountain slopes. The main component of the D-community are predators and filter-feeders. Filter-feeders are the main component of the G-community which inhabits seston-rich rivers. And finally, shredders are the main component of the C-community, which inhabits head sections of streams where water temperature is low and the current is not very strong and of the community F.

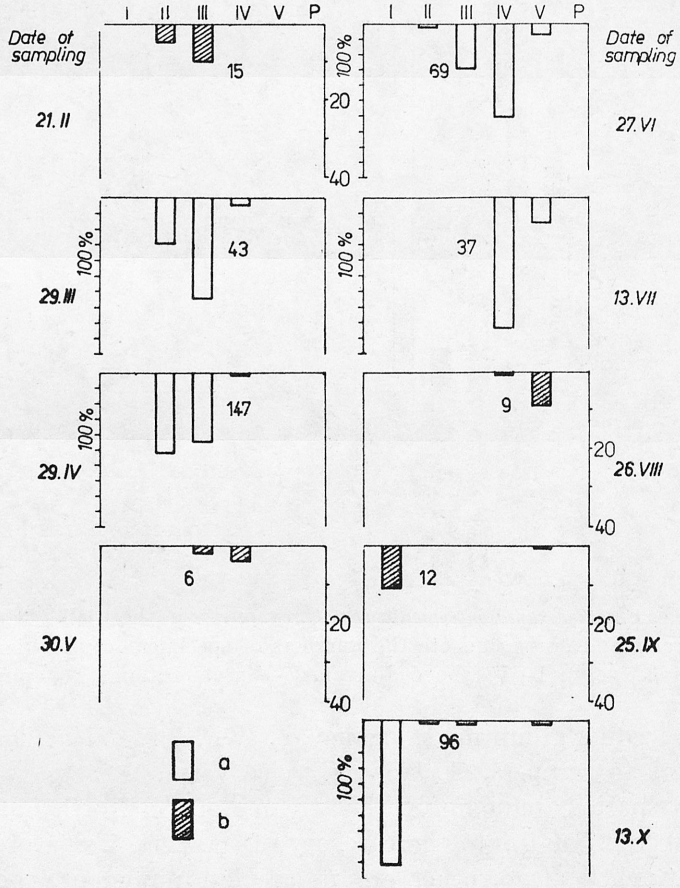

Fig. 4. Life cycle of *Drusus annulatus* in the Waksmundzki Potok brook in the High Tatras; a — percentage; b — number of collected specimens; figures under diagrams denote the total number of specimens caught; other denotations as in fig. 3

Both species which form the community S, *Melampophylax nepos* and *Allogamus starmachi*, feed on algae although *A. starmachi* was initially included in the group of shredders (because of mandibles shape); B. KAWECKA found *A. starmachi* to be feeding on algae, with considerable amount of blue-green algae (personal information).

This brief analysis gives clear indications of basic food resources in the North Carpathian streams and of their significance for species composition of caddisfly fauna.

VII. 4. 2. Altitudinal distribution of functional feeding groups

In West Tatra streams above the forest line (at more than 1500 m altitude) and the Babia Góra streams (at more than 1300 m alt.) scrapers dominate side by side with shredders (also predators in the Tatras) while net-spinning filter-feeders are absent altogether.

Scrapers are absent from the highest reaches of the High Tatra streams (the Waksmundzki Potok stream at more than 1400 m altitude) and sparse

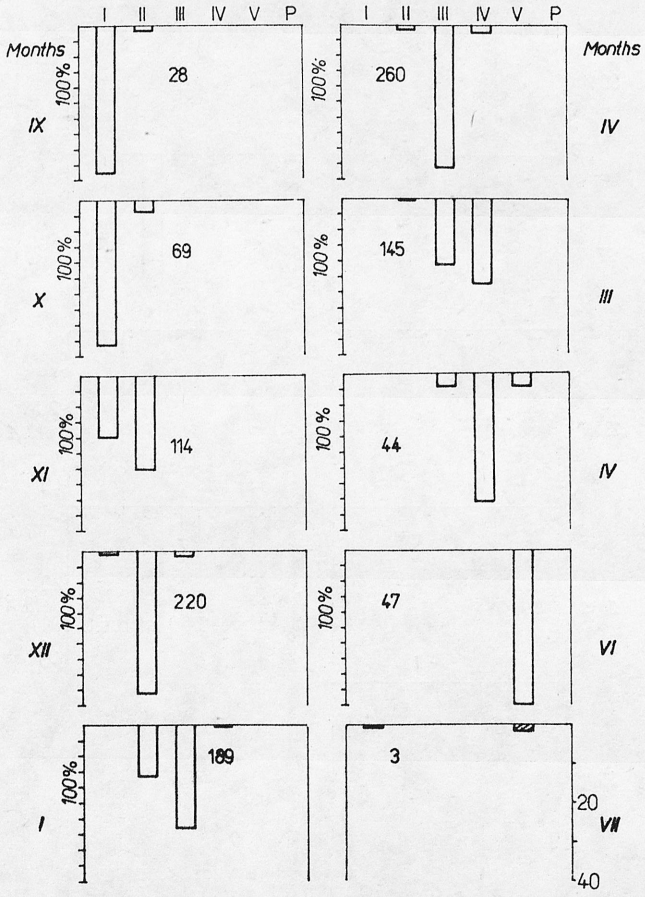

Fig. 5. Life cycle of *Ecclisopteryx madida* in the Poniczanka stream. Denotations as in figs 3—4

caddisfly fauna is represented by shredders and predators only. There is poor algal flora — food for scrapers — due to long-lasting snow cover and low content of mineral salts (this is an area of crystalline rocks).

In streams of the upper mountain forest zone in the Tatras and the Beskid Wysoki Mts two functional feeding groups of caddisflies predominate, these being scrapers and shredders whose proportion depends on local conditions. Net-spinning filter-feeders are not numerous while collectors are represented by a semi-predatory type of filter-feeder *Drusus discolor* which gets food both

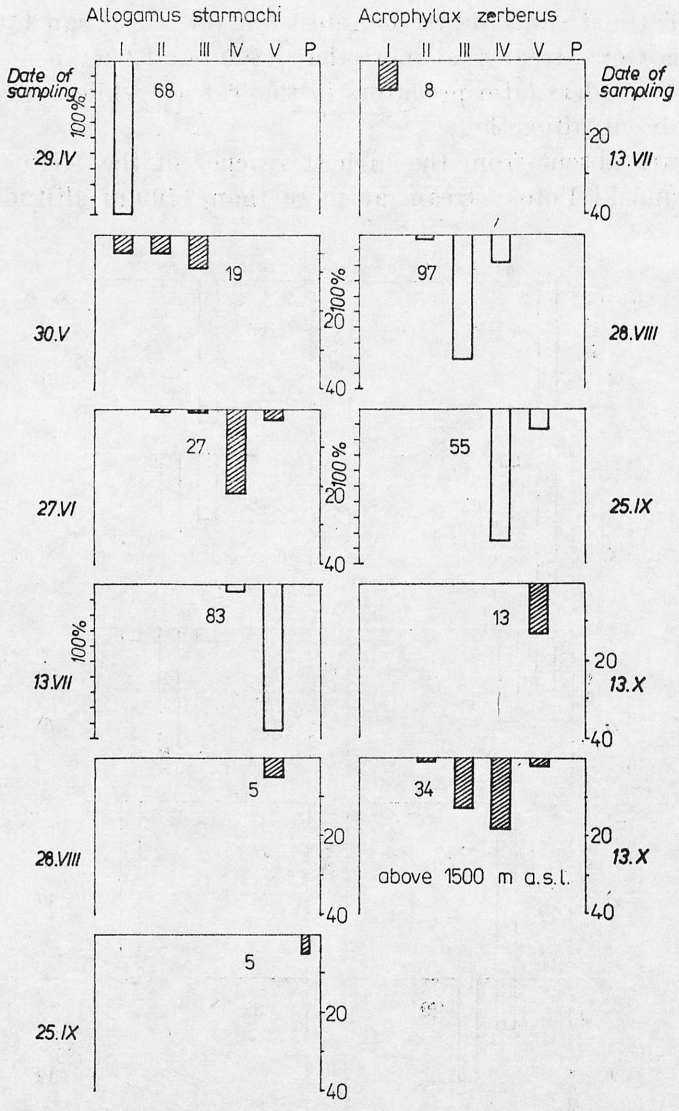

Fig. 6. Life cycles of *Allogamus starmachi* and *Acrophylax zerberus* in the Waksmundzki Potok brook in the High Tatras. Denotations as in figs 3—4

by filtering (by means of legs) or by entraping algae-feeding animals (BOHLE 1983).

In upstream reaches of streams of the lower mountain forest zone particular functional feeding groups of caddisflies occur in more equal proportion to one another although scrapers tend to give way to net-spinning filter-feeders *(Philopotamidae)* which is clearly marked in small streams or in the ones of moderate longitudinal gradient.

Shredders are either sparse in or absent from midstream and lowstream reaches of all streams whereas scrapers dominate alongside with net-spinning filter-feeders. In the latter group an exchange occurs; representatives of the family *Philopotamidae* which abound in the forest zone are replaced by those of *Hydropsychidae* in the cropland zone.

In some streams, *Hydropsychidae* are very abundant and often constitute more than 80% of all the caddisfly larvae. It happens mainly in the stream reaches where human influence is clearly marked, e. g. the Dunajec (at 500—600 m altitude, i. e. downstream of Nowy Targ), the Vistula stretch downstream of Wisła and Ustronie (300—400 m altitude), the Soła (350—500 m alt.), the Stradomka (200—500 m alt.), etc. Such great dominance of filter-feeders might result from disturbances in the natural ecosystem of the stream caused by a large supply of organic particles of allochthonous origin e. g. from sewage effluents or farmland. It could be a good indicator of moderately stressed stream ecosystem.

VIII. LIFE CYCLES

At the present stage of rather limited taxonomic knowledge of larval stages of caddisflies it is very difficult or altogether impossible to determine their life cycles basing on field observations, i. e. without laboratory breeding. There is a possibility of avoiding, to a certain extent the taxonomic barrier with regard to larval stages, e. g. by collecting a species from the habitat where there are no related species it could be confused with, but this, in turn requires good knowledge of their distribution. Besides, a reliable description of life cycle must be based on a large number of specimens of particular larval instrs collected at short time intervals throughout the year which involves considerable technical difficulties and the need to apply an appropriate sampling method.

The data collected during the present studies made possible to follow life cycles of relatively few species. These are: *Rhyacophila mocsaryi*, *R. nubila*, *Glossosoma conformis*, *G. intermedia*, *Philopotamus ludificatus*, *Psychomyia pusilla*, *Hydropsyche pellucidula*, *Drusus annulatus* *D. carpathicus*, *D. monticola*, *Ecclisopteryx madida*, *Acrophylax zerberus*, *Melampophylax nepos*, *Allogamus starmachi*. Basing on older larval instars inferences were drawn as to life cycles of *Potamophylax carpathicus*, *P. cingulatus*, *Allogamus uncatus*, *Chaetopteryx fusca*, *C. polonica*, *Psilopteryx psorosa carpathica* and *Pseudopsilopteryx zimmeri*.

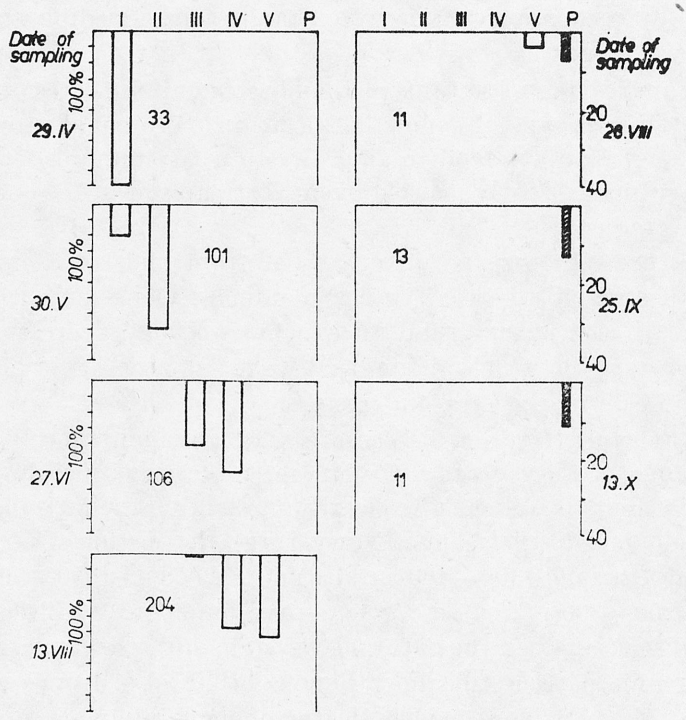

Fig. 7. Life cycle of *Melampophylax nepos* in the Waksmundzki Potok brook in the High Tatras. Denotations as in figs 3—4

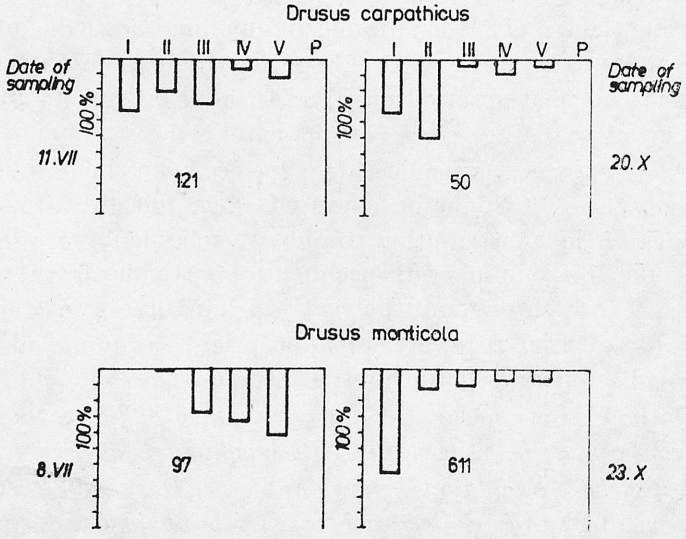

Fig. 8. *Drusus carpathicus* and *D. monticola*, percentage of larval instars during estival and autumnal sampling time. Denotations as in figs 3—4

The species listed can be grouped into three categories according to their life cycles completion: I — univoltine species with a very synchronous moulting pattern regardless of macrohabitat type, these are: *R. mocsaryi*, *G. conformis* and *G. intermedia* (Fig. 3), *D. annulatus* (Fig. 4), *E. madida* (Fig. 5), *A. starmachi* and *A. zerberus* (Fig. 6), *M. nepos* (Fig. 7), During sampling time one larval instar is only dominant and it is accompanied by no more than two adjacent ones, i. e. nearest younger and nearest older.

Life cycles of *G. conformis* and *G. intermedia* (Fig. 3) are shifted in time by half a year in relation to each other. Maximum food demand (algae) of each of the populations occurs at a different season of the year which eliminates competition and therefore they can abound in the same stream reach despite similar ecological requirements.

Life cycle of *A. zerberus* is similar in the Waksmundzki Potok stream in the High Tatras at 1200—1300 m a. s. 1. and in the Przywarówka stream of the Babia Góra Mtn at 1200—1400 m a. s. 1. The larvae hatch probably in June and July. In August, third instar predominates (the larvae are identifiable at

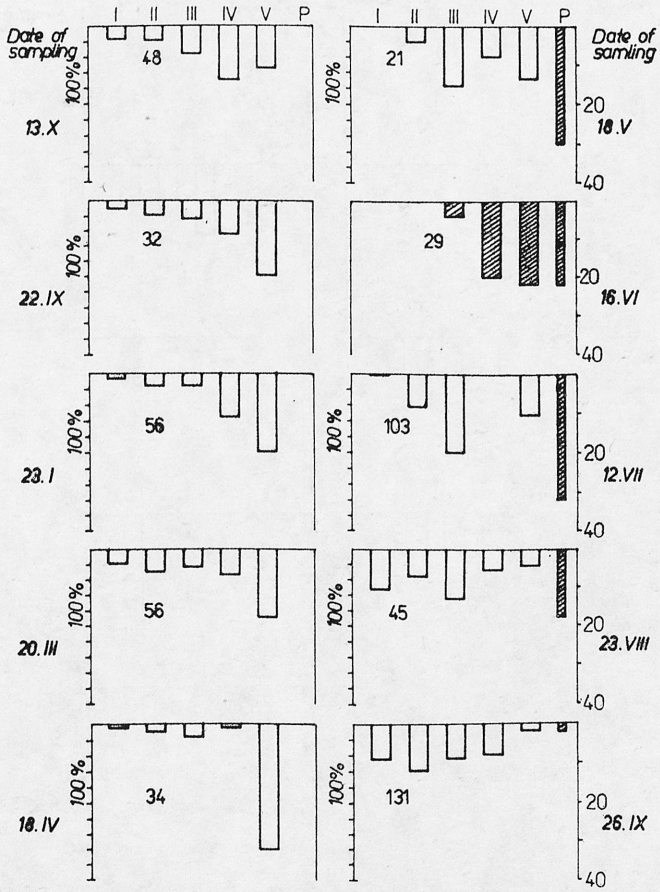

Fig. 9. Life cycle of *Rhyacophila nubila* in the Dunajec river. Denotations as in figs 3—4.

second instar); by the end of autumn most larvae reach fifth instar; in winter there is no marked retardation in larval growth and moulting, and imagines emerge in spring. At higher altitudes, a clear retardation in larval development is observed in the Waksmundzki Potok; by the end of autumn, fourth or third instar predominates (Fig. 6). It can be assumed that a delay in emergence will occur in the following year and adults will appear in mid-summer rather than in spring. This phenomenon has so far been confirmed by observation of adults flight in the whole of the Tatras.

The larvae of *M. nepos* and *A. starmachi* hatch in April (with first spring thaws). The eggs were laid in autumn and must apparently have undergone winter diapause. In June, larval development is obviously accelerated; no summer diapause is observed. The adults start to emerge in the second decade of September.

Eggs survive winter diapause under rather specific conditions, viz. at the frozen stream bottom. These are the stretches where stream ceases to flow in

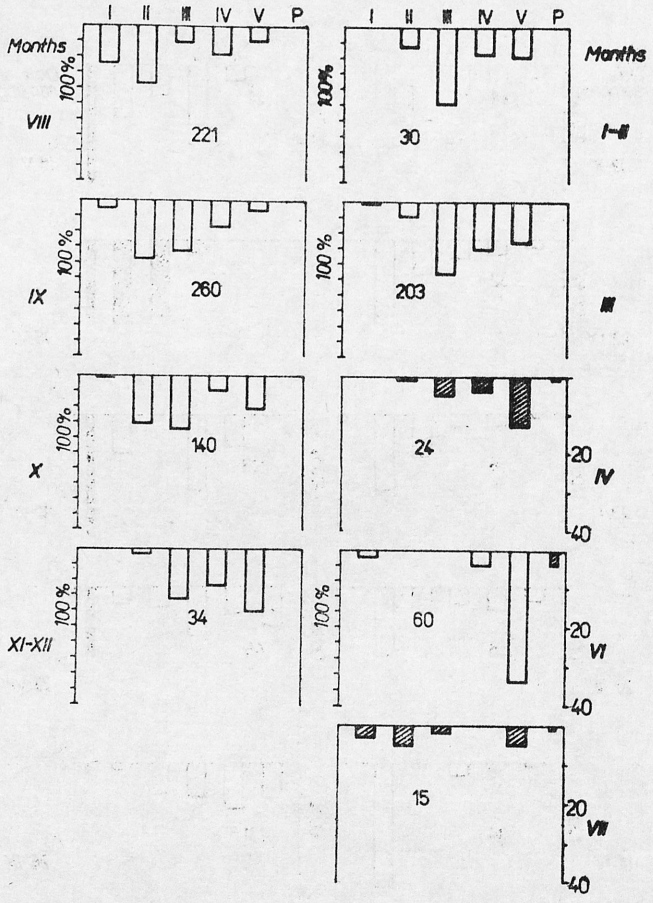

Fig. 10. Life cycle of *Philopotamus ludificatus* in the Poniczanka stream. Denotations as in figs 3—4

autumn and winter. *M. nepos* and *A. starmachi* are thus adapted to surviving such a period at the stage of egg resistant to freezing.

Basing on the data collected in the Poniczanka stream, it is assumed that the life cycles of: *P. carpathicus*, *P. cingulatus*, *A. uncatus*, *C. fusca*, *P. psorosa carpathica* and *P. zimmeri* are one year long so they might be included in this group. The identifiable larval instars of these species appeared as follows: *P. carpathicus* — third instar in July, in August fourth instar predominates beside the third one, in September fifth instar beside fourth, in October only fifth instar; *P. cingulatus* — third instar in November and it predominates until March the following year inclusive, however, already in April, fifth instar predominates and in June, all the larvae reach the final one (flights in July and August); *A. uncatus*, *C. fusca*, *P. psorosa carpathica* and *P. zimmeri* — the only identifiable fourth and fifth lrval instars were captured in June, in July only final instars were caught (flights in autumn).

II — a group of semivoltine species: *D. carpathicus*, a "spring" species and *D. monticola* (Fig. 8) a high-mountain one. All the larval instars of these species live side by side almost throughout the year, while in October first and second instars dominate beside fourth and fifth.

III — a group of poorly synchronous univoltine species: *R. nubila* (Fig. 9), *P. ludificatus* (Fig. 10), *P. pusilla* (Fig. 11), *H. pellucidula* (Fig. 12). All the larval instars of these species live side by side for most of the year.

By the end of autumn, only a part of the species population is found to be in the final larval instar and after early spring pupation adults emerge at the end of May and in June. The remaining larvae and the ones hatched by the autumn, winter and early spring finish their development in summer, the imagines emerge by the end of the summer; successive generation will fly out supposingly also by the end of summer next year. It is quite likely that, a part of species population accelerates their larval development when summer is warm (becoming bivoltine) or delay it when summer is cool (becoming semivoltine). Further studies on the life cycle of such species seem to be necessary.

C. polonica life cycle is not clear. It seems to be univoltine in the Beskidy Mts streams since larvae of fourth instar were captured in June, and those of the fifth one in the following months but not later than September. On the other hand, larvae of fifth instar were caught in the Beskidy Mts sources both at the end of October and at the beginning of April which would suggest a semivoltine cycle. The life cycle of this species in the Waksmundzki Potok stream (at more than 1400 m above see level) is at least two-years' long since third, fourth, fifth instars were caught together in October.

Generally speaking, none of the species of the North Carpathian streams seems to have two generations a year (although it is not impossible). The life cycle of most of the species is one year long; only few species which live in the Beskidy Mts springs and at higher altitudes of the Tatras, have a life cycle of two years.

IX. MAIN ADAPTATION TRENDS OF THE NORTH CARPATHIAN CADDISFLIES

At present, only one species lives exclusively in the North Carpathians; it is an endemic species of the Tatras which can be defined as a post-glacial relic. 8 and 9 endemic species are known to live in the East Carpathians and the South Carpathians respectively.

Table XVIII presents the observed relations between geographical range of the North Carpathian species and their habitat preference expressed also

Table XVIII

Geographical range and lotic habitat preference of the North Carpathian *Trichoptera*

Zoogeographical categories	Number of species		
	total	living in streams	abundant in streams
I	10—100%	2—20%	1 —10%
II	15—100%	1—7%	—
IIIA	23—100%	3—13%	1—4%
IIIB	35—100%	18—52%	9—26%
IVA	93—100%	79—85%	31—33%
IVB	34—100%	33—97%	27—79%

For explanation of zoogeographical categories see chapter VI. 6

in terms of relative size of their populations. There is a distinct relation here reflected in the fact that the percentage of species connected with streams in each zoogeographical group is inversly proportional to its range. This relation is very clearly marked also in percentage of species whose populations are very abundant, e. g. percentage of species of the group IVB (the most restricted ranges) is nearly 2.5 times greater than that of IVA (European range). All the endemic species which live in the North Carpathians fall into the group of species which inhabit streams and have abundant populations (except for *Chaetopteryx subradiata* which was found at one station only). This means that these species find best living conditions in streams.

All the endemic caddisflies found in the North Carpathians inhabit cold waters, e. g. they participate in the high-mountain and "spring" communities (B, S and C).

The endemic species represent only two types as regards morphological adaptation of mandibles to specific diet, i. e. shredders *(Potamophylax carpathicus, Allogamus starmachi, Chaetopteryx polonica, C. subradiata* and *Psilopteryx psorosa carpathica)* and scrapers *(Drusus brunneus, D. carpathicus, Acrophylax vernalis)*. However, preliminary observations of *P. carpathicus* (by the author) and of *A. starmachi* (by B. KAWECKA) suggest the species to be feeding mainly on algae although they are morphologically adapted to detritus diet.

Adaptation of the species to utilising detritus as source of food suggests that it originated from forest biome, not necessarily from lotic habitats. Its present preference of microphytes diet might suggest a deviation of its adaptation towards streamy biome.

There are no major natural reservoirs of standing water in the Beskidy Mts; occasionally some small ones appear here and there but they are short-lived. There are lakes in the Tatras but their age, estimated at about 10 000 years seems to be too short a period in the history of evolution to make them exert any influence on evolving of separate species. During the last glaciation, the Tatra lakes were filled by glaciers. Therefore none of the species inhabiting high-mountain lakes (e. g. *Chionophylax czarnohoricus* in the East Carpathians) could survive in them. Absence of endemic species connected only with standing waters of the North Carpathians results from hydrological history of the area.

During glaciation (or during deglaciation) time many mountain species extended their geographical range to adjacent monutains. As climate was growing milder altitudinal ranges of the species populations extended. Areas freed from glaciers, such as high-mountain stream reaches, post-glacial lakes,

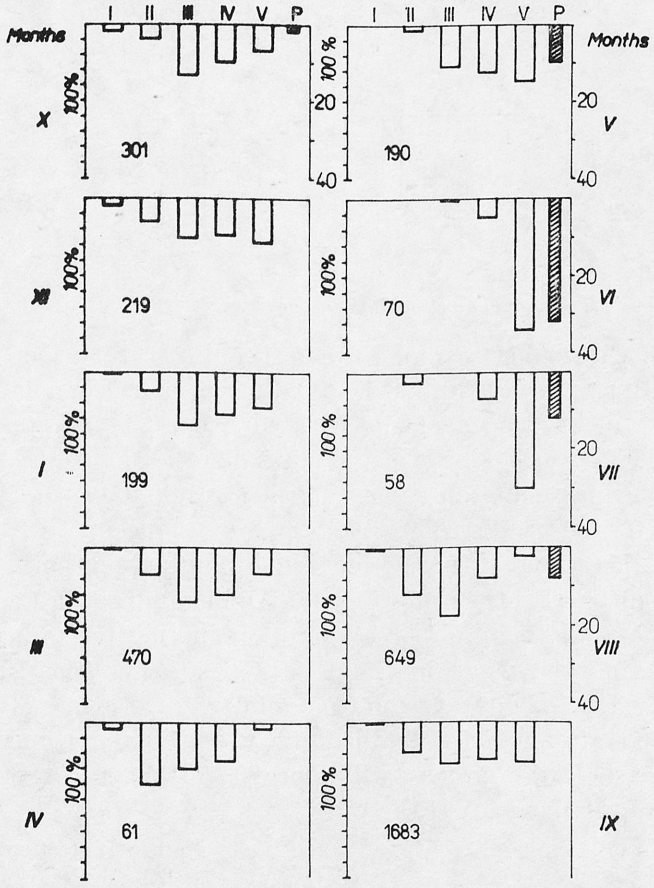

Fig. 11. Life cycle of *Psychomyia pusilla* in the Dunajec river. Denotations as in figs 3—4.

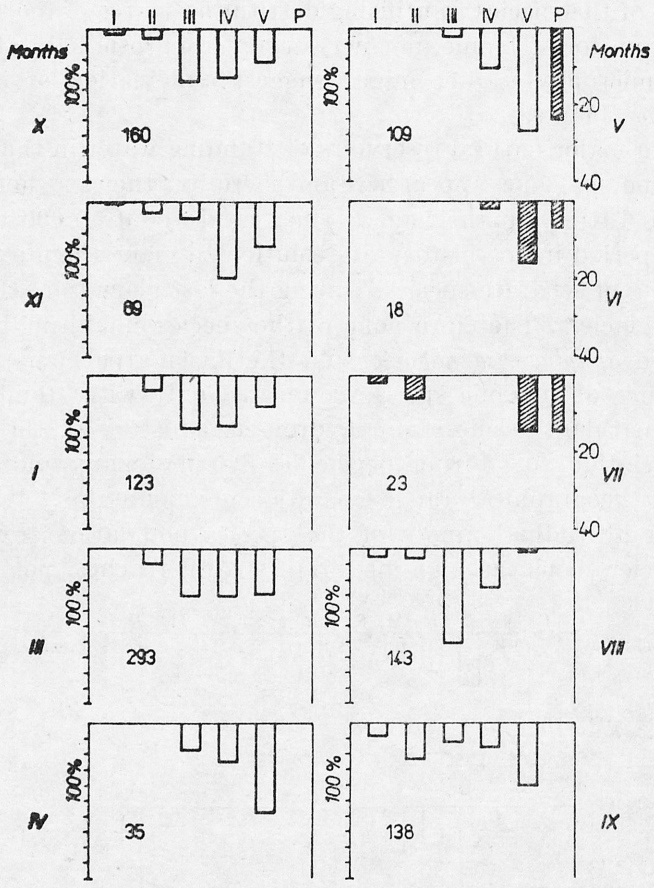

Fig. 12. Life cycle of *Hydropsyche pellucidula* in the Dunajec river. Denotations as in figs 3—4

were colonised. On further warming up of the climate, ranges of high-mountain species populations were disrupted. Isolated geographical populations appeared.

The process of speciation of the isolated North Carpathian populations of some species which was taking place in climatic conditions different from those in the neighbouring mountain ranges already resulted in some morphological or ecological differences. Thus *Acrophylax zerberus* specimens from Carpathian population are bigger than those from the Alpine population. *Melampophylax nepos* genitals differ slightly from those of Alpine and South Carpathian specimens. *Chaetopteryx sahlbergi*, a boreo-mountain species lives in cold Tatra lakes of high-mountain type while in the East Carpathians (the Bieszczady Mts) it inhabits warm, i. e. downstream and midstream reaches of streams. It is quite likely that after a more detailed study of the above mentioned species populations the speciation process will appear to have gone far enough for them to create separate taxa.

Nature Protection Research Centre
Polish Academy of Sciences
31-512 Kraków, Lubicz 46

Dominant Trichoptera species (≥5% at one station at least) in the Biała Wisełka (A1-A5) and the Vistula (A6-A9) upstream of the Goczałkowice reservoir

	A1	A2	A3	A4	A5	A6	A7	A8	A9[x]
Plectrocnemia conspersa	=								
Rhyacophila philopotamoides	=			2.1					
Drusus annulatus			13.5						
Philopotamus ludificatus			27.0		2.8				
Rhyacophila tristis				20.8	14.7				
Rhyacophila vulgaris				14.6	1.4				
Ecclisopteryx dalecarlica				18.7	12.3	1.9			
Rhyacophila mocsaryi				18.7	11.4	4.7			
Rhyacophila obliterata			-	6.2	2.8	3.7			
Sericostoma spp.			2.7		6.2	4.0	1.4	2.4	
Hydropsyche saxonica					1.4	18.6			
Rhyacophila nubila					4.7	33.2		12.8	13.6
Polycentropus flavomaculatus						33.6	20.3	11.5	15.1
Hydropsyche pellucidula					3.3	5.9	60.1	40.6	6.1
Hydropsyche siltalai							16.8	31.9	1.5
Hydropsyche balbifera								0.3	6.1
Hydropsyche angustipennis									33.3
Hydropsyche spp. juv.				14.6	29.4				19.7
Stenophylacini + Chaetopterygini spp. juv.			54.0						
Number of taxa	2	0	6	9	15	14	6	8	9
Number of specimens	5	0	37	48	211	322	143	382	66
Sampling dates 17.V.						+	+	+	
6.VII.									+
28.VIII.		+	+	+	+	+			
12.X.	+	+	+						

Denotations: x station outside the Carpathians, - adults present only,
= aquatic stages present.
Apart from these, the following species were found (ordered acc. to domination value 4.9-1.0%): Brachycentrus montanus, Drusus discolor, Micrasema minimum, Glossosoma conformis and Hydropsyche modesta (at site A9); and (below 1.0%): Potamophylax latipennis, P. luctuosus, Halesus digitatus, Lithax niger, Rhyacophila fasciata, Silo pallipes, Cyrnus trimaculatus

Table XX

Dominant Trichoptera species (≥3% at one station at least) in the streams: Leśnica (A1a-A6a) and Brennica (A7a)

	A1a	A2a	A3a	A4a	A5a	A6a	A7a
Synagapetus armatus	12.0						
Potamophylax nigricornis	4.0	3.8	2.1				
Lithax niger	4.0	0.8	1.4				
Crunoecia irrorata	12.0	0.8			=		
Sericostoma spp.	64.0	31.8	12.5	1.3	0.8	2.6	0.2
Philopotamus ludificatus		34.1	14.6	1.0			
Philopotamus montanus		10.7	1.4		=		
Plectrocnemia conspersa	4.0	3.8	9.0				
Drusus annulatus		2.3	41.0				
Odontocerum albicorne		0.8	3.5	2.0			
Allogamus uncatus		1.5	9.0	4.0	0.1		
Rhyacophila tristis			0.7	5.3	1.0		
Rhyacophila fasciata				3.0			
Brachycentrus montanus				41.2	37.2		
Potamophylax luctuosus				6.0	=		
Rhyacophila mocsaryi				5.0	0.6		
Glossosoma conformis				5.0	4.1		
Rhyacophila obliterata				3.3	0.3		
Drusus discolor				3.0	=		
Micrasema minimum				9.3	47.3		
Allogamus auricollis				0.3	1.4	3.5	
Glossosoma boltoni				0.7	2.2	13.1	0.6
Agapetus fuscipes					0.1	19.6	0.2
Hydropsyche pellucidula					1.5	30.1	31.0
Rhyacophila nubila					0.8	12.1	12.9
Hydropsyche instabilis						10.7	15.6
Hydropsyche siltalai						3.6	34.6
Polycentropus flavomaculatus						1.6	4.6
Number of taxa	6	13	14	22	25	16	9
Number of specimens	25	132	144	301	2070	886	480
Sampling dates 18.V.	+	+	+	+	+	+	+
27.VIII.	+	+	+	+	+	+	+

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 2.9-1.0%): Rhyacophila philopotamoides, Potamophylax cingulatus, Rhyacophila polonica, Silo pallipes; and (below 1.0%): Potamophylax latipennis, Chaetopteryx polonica, Pseudopsilopteryx zimmeri, Ecclisopteryx dalecarlica, Psilopteryx psorosa carpathica, Plectrocnemia geniculata, Silo nigricornis, Rhyacophila vulgaris, Ecclisopteryx madida, Beraeamyia hrabei, Halesus digitatus, Chaetopteryx fusca, Drusus trifidus

Dominant Trichoptera species (≥5% at one station at least) in the streams: Raoza (B1-B7) Rycerka (B8-B9), Soła (B10-B12)

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
Drusus carpathicus	48.5											
Lithax niger	45.5	=	3.8									
Apatania carpathica	3.0		46.1									
Synagapetus armatus		=	11.5									
Rhyacophila philopotamoides		=	11.5	6.1	8.6	2.0	0.3					
Philopotamus ludificatus			3.8	62.6	2.9	4.0						
Ecclisopteryx madida			15.4	15.1	17.1							
Rhyacophila tristis				3.0	22.9	6.0	2.4					
Glossosoma intermedium					11.4	26.0	4.6					
Glossosoma conformis					5.7	6.0	0.8					0.2
Potamophylax luctuosus						6.0	9.5					
Ecclisopteryx dalecarlica						16.0	20.9	10.1	0.3			
Sericostoma spp.				1.0			4.3	10.7	0.3	1.4	4.7	0.6
Brachycentrus montanus							26.4	53.7	0.8			
Rhyacophila nubila						12.0	5.4	12.1	10.5	20.0	9.7	3.2
Hydropsyche pellucidula							2.2	8.1	18.5	77.7	46.7	90.0
Rhyacophila spp. juv.					17.1	2.0	0.3					
Hydropsyche spp. juv.									64.6		24.9	
Stenophylacini + Chaetopterygini spp. juv.	3.0			5.0	5.7	6.0	10.9	4.0				
Number of taxa	4	4	8	9	10	12	18	9	7	5	11	6
Number of specimens	33	7	26	99	35	50	368	149	390	215	764	994
Sampling dates 4.VII.											+	
10.X.	+	+	+	+	+	+	+	+	+	+	+	+

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 4.9-1.0%): Polycentropus flavomaculatus, Hydropsyche instabilis, Rhyacophila mocsaryi, Philopotamus montanus, Hydropsyche saxonica, Drusus discolor, Crunoetia irrorata, Micrasema minimum, Rhyacophila fasciata, R. obliterata, R. vulgaris, Odontocerum albicorne, Psychomyia pusilla; and (below 1%): Potamophylax latipennis, P. nigricornis, Agapetus delicatulus, Hydropsyche siltalai, Glossosoma boltoni

Table XXII

Dominant Trichoptera species (≥4% at one station at least) in the Żabnica stream (B1a-B10a)

	B1a	B2a	B3a	B4a	B5a	B6a	B7a	B8a	B9a	B10a
Chaetopteryx polonica	47.8	25.0	0.9		0.6	1.3				
Allogamus uncatus	30.4	9.7	0.5			0.1				
Psilopteryx carpathica	19.6	9.7	3.7		0.9	2.0				
Drusus carpathicus	2.2	23.6		10.5						
Drusus discolor		4.2		2.6						
Crunoetia irrorata		4.2		2.6						
Melampophylax nepos			6.0							
Synagapetus armatus			69.9	7.9						
Lithax niger		1.4	0.5	31.6	7.3					
Rhyacophila philopotamoides		1.4	0.5	5.3	0.6	2.0				
Apatania carpathica				38.2	3.5					
Potamophylax carpathicus			10.6		10.7					
Drusus annulatus					4.1					
Synagapetus iridipennis					59.9	28.5				
Philopotamus ludificatus				1.3	0.3	15.2	0.8			
Plectrocnemia conspersa					0.6	6.6	2.5			
Rhyacophila tristis					0.9	10.6	5.7	2.4	0.8	
Odontocerum albicorne						0.6	4.9	0.3	0.1	
Sericostoma spp.			4.6		4.4	12.6	15.6	5.5	3.6	5.0
Rhyacophila polonica					0.9	2.6	13.1			
Silo pallipes						2.0	7.4	3.4	1.7	
Rhyacophila obliterata							21.3		0.1	
Glossosoma conformis							9.8	9.2	2.6	
Chaetopteryx fusca						4.6	0.8	6.5	0.4	
Micrasema minimum							2.5	51.4	70.5	1.7
Allogamus auricollis								2.0	7.7	0.8
Hydropsyche instabilis							6.6	15.1	4.4	41.7
Rhyacophila nubila								0.3	1.8	31.7
Potamophylax latipennis										8.3
Glossosoma boltoni										6.7
Stenophylacini + Chaetopterygini spp. juv.		19.4							0.1	0.8
Number of taxa	4	9	13	8	16	18	16	14	21	9
Number of specimens	46	72	216	76	317	151	122	292	1381	120
Sampling dates 30.VI-3.VII.	+	+	+		+	+	+	+	+	
12.VII.										+
30.VIII.		+	+	+	+	+	+		+	+

Apart from these, the following species were found (ordered acc. to domination value 3.9-1.0%): Potamophylax cingulatus, Ecclisopteryx madida, Glossosoma intermedia, E. dalecarlica, Hydropsyche pellucidula, Wormaldia occipitalis, Rhyacophila fasciata; and (below 1%): Potamophylax nigricornis, Philopotamus montanus, Pseudopsilopteryx zimmeri, Tinodes rostocki, Beraea pullata, Rhyacophila mocsaryi, Agapetus ochripes, Halesus digitatus, Brachycentrus montanus, A. fuscipes, R. vulgaris, Potamophylax luctuosus

Table XXIII

Percentage of the *Trichoptera* species in the tributary of the Żabnica stream (B1b—B2b)

	B1b	B2b
Plectrocnemia conspersa	1.1	
Synagapetus armatus	23.3	0.4
Sericostoma spp.	13.3	7.1
Hydropsyche fulvipes	57.8	37.4
Potamophylax nigricornis	2.2	20.0
Silo pallipes	2.2	11.0
Agapetus fuscipes		15.4
Wormaldia occipitalis		5.9
Beraea pullata		1.2
Rhyacophila philopotamoides		0.8
Ernodes articularis		0.4
Number of taxa	6	10
Number of specimens	90	254
Sampling dates 27. VI.	+	+
1. IX.		+

Table XXIV

Dominant Trichoptera species (⩾5.0% at one station at least) in the streams: Suchy (C1-C6), Stonów (C8), Skawica (C9-C12), Skawa (C13-C15)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15[x]
Drusus carpathicus	26.7														
Drusus monticola	20.0	1.5	1.8												
Acrophylax zerberus	16.7	9.2	7.6	2.8											
Psilopteryx carpathica	11.7	-	8.2	0.3											
Allogamus uncatus	10.0	-	5.8	1.5											
Chaetopteryx polonica	3.3	9.2	2.3	1.5											
Lithax niger		7.7	6.5	0.6											
Drusus discolor		7.7	5.8	7.1	1.8	0.6	3.1								
Rhyacophila glareosa		9.3	21.8	6.5	2.4	0.6									
Apatania carpathica		-	8.8	0.3											
Melampophylax nepos	5.0	-	1.2	12.7											
Acrophylax vernalis	5.0	-	0.6	10.2	-	1.8									
Philopotamus ludificatus				19.2	6.8	6.2	13.3								
Rhyacophila fasciata				5.6	6.1	0.6					0.3				
Pseudopsilopteryx zimmeri			0.6	6.8	-	7.1	6.2								
Glossosoma intermedia					1.2	5.9	3.5	2.5							
Potamophylax cingulatus					19.4	21.1	0.4		1.4		0.3				
Rhyacophila mocsaryi							2.7	4.0	0.3	17.3	0.6				
Glossosoma conformis							32.8	24.7	18.7	34.6	1.3	3.0			
Allogamus auricollis							10.5	54.0	60.2	8.6	79.3	37.0	33.0	0.8	
Sericostoma spp.						5.9	8.6	2.2	10.7		1.2	16.4	3.2	1.6	
Silo piceus										4.8	0.1	10.4			
Glossosoma boltoni												6.0			
Hydropsyche instabilis										2.0	8.9	9.0	18.1	8.9	
Hydropsyche pellucidula										1.0	0.3	1.5	18.1	61.0	=
Rhyacophila nubila								1.2	1.4	26.0	5.4	13.4	21.3	22.0	=
Stenophylacini + Chaetopterygini spp. juv.		53.8	25.3	7.1	55.0	40.0	2.3								
Number of taxa	9	12	15	20	10	15	16	13	9	11	15	10	8	8	4
Number of specimens	60	65	170	323	165	170	256	324	289	104	666	67	94	123	11
Sampling dates 27.V.			+				+	+	+	+	+	+	+	+	+
3,7.VII.	+		+	+,+											
14-18.VIII.	+		+	+		+	+								
10.X.	+	+	+	+	+	+	+								

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 4.9-1.0%): Silo pallipes, Rhyacophila vulgaris, Chaetopteryx fusca, R. philopotamoides, Potamophylax luctuosus, Halesus digitatus, Odontocerum albicorne, Potamophylax latipennis, R. tristis, Polycentropus flavomaculatus, R. polonica, Brachycentrus montanus, Apatania fimbriata, Hydroptila forcipata, Agapetus fuscipes, Ecclisopteryx dalecarlica; and (below 1%): Halesus rubricollis, E. madida, Plectrocnemia conspersa, Drusus biguttatus, Hydropsyche saxonica

Table XXV

Dominant Trichoptera species ($\geq$4% at one station at least) in the streams: Przywarówka (G1-G10) and Lipnica (G11)

	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11
Drusus monticola	52.7	43.5	5.5	6.5	2.4						
Apatania fimbriata	16.4	21.3	28.5								
Drusus carpathicus	2.6	2.8	8.9								
Allogamus uncatus		1.8	9.5	2.2		5.6	1.0				
Acrophylax zerberus	27.6	27.8	24.5	30.4	0.8			2.5			
Lithax niger			3.2	15.2	6.4	12.8	4.8				
Acrophylax vernalis			0.3	17.4	4.0	3.2	6.7	1.2			
Apatania carpathica			1.2	4.3	36.3	9.6		0.6			
Melampophylax nepos			2.1		4.0	2.4		0.6			
Rhyacophila philopotamoides			0.7		5.6	4.0	2.9	5.0			
Rhyacophila fasciata					4.0	2.4	1.0	3.1			
Pseudopsilopteryx zimmeri			1.1		1.6	8.8	3.8				
Rhyacophila glareosa				4.3	4.0	4.8	1.9	1.2			
Psilopteryx carpathica	0.3		8.8	4.3	10.5	11.2	28.8				
Chaetopteryx polonica	0.3		2.9	4.3	8.1	9.6	23.1		1.2		
Sericostoma spp.			0.1				11.5	8.1	1.2		
Drusus discolor			2.1	8.7	5.6	13.6	5.8	19.2	3.6		
Philopotamus ludificatus					3.2	6.4	3.8	11.8			
Rhyacophila tristis					1.6	3.2	2.9	10.6	1.8		
Halesus rubricollis						0.8	1.0	5.0			
Ecclisopteryx madida								6.8	9.0		
Glossosoma conformis								1.9	72.4	10.7	=
Brachycentrus montanus									4.8		
Allogamus auricollis										17.9	
Hydropsyche instabilis										7.1	
Rhyacophila nubila								0.6		50.0	=
Stenophylacini + Chaetopterygini spp. juv.		2.8	0.6			0.8		15.5	1.2	3.6	
Number of taxa	6	5	15	11	16	16	15	22	12	7	2
Number of specimens	311	108	650	46	124	125	104	161	167	28	11
Sampling dates 10.V.			+								
10.VI.								+	+	+	+
7.VII.		+	+			+					
11.VII.		+	+	+	+	+	+				
27.VIII.	+	+	+	+	+	+	+	+			
20.X.			+					+			

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 3.9-1.0%): Rhyacophila mocsaryi, Hydropsyche pellucidula, Halesus digitatus, R. vulgaris, Glossosoma intermedia, Drusus annulatus, Silo pallipes, Crunoetia irrorata; and (below 1%): R. polonica, Plectrocnemia conspersa, Odontocerum albicorne, Potamophylax cingulatus, P. luctuosus

Table XXVI

Dominant Trichoptera species (≥3% at one station at least) in the Poniczanka stream (D1a-D9a)

	D1a	D2a	D3a	D4a	D5a	D6a	D7a	D8a	D9a
Potamophylax carpathicus	7.7	5.6	=						
Sericostoma spp.	11.6	9.9	6.3	2.2	0.7	0.9	0.1		
Pleotrocnemia conspersa	54.5	11.5	4.0	1.6	0.2	0.9	0.5		2.7
Lithax niger	3.9	6.6	0.2		0.1	0.1			
Rhyacophila philopotamoides	6.8	8.8	7.2	6.4	1.9	0.7			2.7
Rhyacophila polonica		0.2	3.5	1.4	0.1	0.1			
Odontocerum albicorne		1.3	3.6	0.9	1.1	1.1	0.1		
Rhyacophila tristis	1.1	2.3	5.3	7.2	7.2	2.9	0.8		
Philopotamus ludificatus	1.1	14.1	22.6	44.4	8.1	3.9	0.2		
Ecclisopteryx madida	0.2	22.5	15.2	10.4	24.8	8.6	0.6		
Glossosoma conformis			0.1		32.4	17.2	10.6		
Hydropsyche saxonica						4.1	0.4		
Rhyacophila mocsaryi					4.0	3.4	4.1		
Allogamus auricollis					0.1	6.9	7.1		
Potamophylax cingulatus		0.4	1.5	9.1	7.2	5.8	3.1	28.6	
Potamophylax luctuosus						0.6		7.1	
Rhyacophila nubila						0.2	0.8	10.0	5.9
Hydropsyche instabilis						4.4	2.7	50.0	84.9
Hydropsyche spp. juv.				0.1	0.4	24.0	61.6		
Stenophylacini + Chaetopterygini spp. juv.	7.5	10.1	24.6	11.0	5.8	8.9	5.5		
Number of taxa	15	18	21	17	29	23	19	6	7
Number of specimens mean/$_m$2	83	130	198	101	331	255	380	85	92

Sampling dates 1974-75									
	29-30.III.	+	+	+	+	+	+	+	+	+
	24.IV.		+	+		+		+		
	28.29.VI.	+	+	+	+	+	+	+		
	6.VII.								+	+
	21-22.IX.	+	+	+	+	+		+		
	21.X.	+	+	+	+	+	+			
	16.XI.	+	+	+	+	+	+			
	14.XII.		+	+		+	+			
	15.I.		+	+		+		+		
	22.II.			+		+				
	16.III.	+	+	+		+	+			
	19-20.IV.	+	+	+		+	+			
	12-13.VI.	+	+	+		+	+			
	16.VII.	+	+	+		+	+			
	14-15.VIII.	+	+	+		+	+			

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 2.9-1.0%): Polycentropus schmidi, Rhyacophila fasciata, Allogamus uncatus, Ecclisopteryx dalecarlica, R. obliterata, Wormaldia copiosa, Crunoetia irrorata, Chaetopteryx polonica, Psilopteryx carpathica; and (below 1%): W. occipitalis, Philopotamus variegatus, Beraea pullata, Apatania carpathica, Drusus discolor, Polycentropus flavomaculatus, Annitella obscurata, Pseudopsilopteryx zimmeri, Halesus digitatus, Chaetopteryx fusca, H. radiatus, Hydropsyche fulvipes, G. intermedia, Silo pallipes, Tinodes rostocki, Parachiona picicornis.

Table XXVII

Percentage of the Trichoptera species in the tributary of the Poniczanka stream (D1b-D4b)

	D1b	D2b	D3b	D4b
Chaetopteryx polonica	26.3			
Potamophylax nigricornis	17.0			
Apatania carpathica	14.0			
Drusus carpathicus	6.8			
Plectrocnemia conspersa	4.7			1.7
Potamophylax carpathicus	2.5	4.6		
Psilopteryx carpathica	0.4	1.4		
Synagapetus armatus	5.5	49.6	0.6	
Crunoecia irrorata	4.7	9.5	7.6	0.3
Wormaldia occipitalis		1.4		
Allogamus uncatus		0.3		
Pseudopsilopteryx zimmeri		0.3		
Sericostoma spp.	8.5	9.2	22.3	9.6
Lithax niger	4.2	4.6	8.3	0.7
Rhyacophila philopotamoides	1.3	1.1	3.8	2.4
Drusus discolor		8.9	15.3	3.4
Synagapetus iridipennis			8.3	1.0
Ecclisopteryx madida			2.5	1.7
Philopotamus ludificatus	0.4	3.6	14.0	29.0
Odontocerum albicorne			4.5	13.6
Rhyacophila tristis			2.5	4.4
Potamophylax cingulatus			1.3	1.8
Philopotamus variegatus			1.3	1.8
Rhyacophila polonica				0.7
Hydropsyche fulvipes				0.6
Glossosoma conformis				0.3
Tinodes rostocki				0.3
Rhyacophila spp. juv.		0.3	3.2	0.3
Philopotamus spp. juv.				6.0
Stenophylacini + Chaetopteryzini spp. juv.	3.8		4.5	0.3
Number of taxa	13	12	13	17
Number of specimens	708	1041	471	879
Sampling dates 1975-76 16.VIII.	+	+	+	+
20.IX.	+	+	+	+
25.X.	+	+	+	+
15.XI.	+	+	+	+
10.IV.	+	+		
10.VI.	+	+		

Table XXVIII

Dominant Trichoptera species (≥3% at one station at least) in the Stredomka stream (D1c-D9c)

	D1c	D2c	D3c	D4c	D5c	D6c	D7c	D8c	D9c
Lithax niger	8.8	0.3							
Apatania carpathica	48.0			0.1					
Drusus discolor	13.3	2.8	0.7	0.1					
Sericostoma spp.	16.3	4.0	8.9	0.9	0.1	0.2			
Wormaldia occipitalis	0.2	3.0							
Ecclisopteryx madida	2.6	8.3	1.5	1.2					
Philopotamus ludificatus	1.1	60.3	35.5	0.1					
Odontocerum albicorne	0.3	2.7	3.3	0.1					
Rhyacophila tristis	0.6	2.3	7.9	2.8	0.1				
Potamophylax cingulatus	0.2	1.1	4.1	1.5	0.2	0.2			
Philopotamus montanus		0.3	6.6			0.2			
Hydropsyche fulvipes			3.3	0.1					
Silo pallipes			5.2	1.1	0.1	0.2	0.1		
Hydropsyche saxonica			3.1	9.0	0.4	0.7			
Hydropsyche instabilis			0.7	3.9	13.4	12.1	0.5		
Polycentropus flavomaculatus			0.4	0.1	19.8	15.7	11.0	0.7	3.2
Silo piceus						4.2	0.1		
Lepidostoma hirtum					5.2	1.7	1.3		
Rhyacophila nubila				0.1	2.8	3.2	9.5	5.4	1.2
Psychomyia pusilla						0.3	25.1	0.2	9.4
Hydropsyche bulbifera					0.2	4.2	9.3	49.2	14.1
Hydropsyche pellucidula						1.8	2.5	14.6	10.7
Hydroptila forcipata					0.1	0.3	0.4		3.2
Hydroptila occulta						0.3	0.7	1.9	5.5
Hydroptila spp. juv. (forcipata+occulta)					0.8	5.5	18.7	0.9	35.2
Hydropsyche spp. juv.		0.1	2.0	69.4	54.4	45.6	20.4	27.1	15.6
Stenophylacini + Chaetopterygini spp. juv.	1.0	4.6	6.6	0.5					
Number of taxa	25	19	21	25	17	22	13	6	13
Number of specimens	625	741	458	968	1183	597	1708	425	820
Sampling dates 29.III.	+	+	+	+	+	+	+	+	+
29.V.	+	+	+	+	+	+	+	+	+
12.VII.	+	+	+	+	+	+	+		
24.IX.	+	+	+	+	+	+	+	+	+

Apart from these, the following species were found (ordered acc. to domination value 2.9-1.0%): Potamophylax carpathicus, Rhyacophila philopotamoides, R. polonica, Philopotamus variegatus, Synagapetus armatus, Chaetopteryx fusca, Psilopteryx carpathica, R. mocsaryi, Hydroptila lotensis, R. obliterata, Allogamus uncatus, Beraeamyia hrabei, R. fasciata, Crunoecia irrorata; and (below 1%): Halesus digitatus, Plectrocnemia conspersa, Beraea pullata, Glossosoma conformis, Ptilocolepus granalatus, Ernodes articularis, Chaetopteryx polonica, S. iridipennis, Potamophylax latipennis, P. luctuosus, Polycentropus schmidi, Melampophylax nepos, Tinodes rostocki, Annitella obscurata, Cheumatopsyche lepida, Agapetus laniger, Ithytrichia lamellaris, Goera pilosa

Dominant Trichoptera species (⩾4% at one station at least) in the streams: Pyszniański Potok (E1-E6), Kościeliski Potok (E7-E9), Czarny Dunajec (E10-E15) Dunajec (E16-E21) and in the sources: at Hala Ornak (Ezi), at Hala Pisana (Ez2), Lodowe Źródło (Ez3)

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20	E21	Ez3	Ez1	Ez2
Drusus monticola	80.8	21.5	1.2	28.3	2.8																	93.5	0.9	
Rhyacophila glareosa	8.6	34.4	2.9	30.5	29.4		1.0	=																0.2
Allogamus uncatus	0.2		32.0	0.7	8.4	10.2	7.2	1.1															2.7	
Acrophylax zerberus	8.6	39.8	60.5	4.9	24.8	6.8	6.2	1.5	=													5.2	3.6	
Lithax niger				0.8	7.0																		29.9	
Drusus carpathicus					0.5																		12.1	1.4
Psilopteryx psorosa psorosa				0.1	2.3	4.5	0.7	0.1															0.4	
Melampophylax nepos					0.9	23.9	17.2	=															5.8	0.2
Allogamus starmachi						54.5	1.4																	
Acrophylax vernalis					1.4		4.8	=	0.5														0.4	
Rhyacophila vulgaris					0.5		4.8	1.1	2.8															
Halesus rubricollis					2.8		20.6	3.1	0.5	0.6												0.6		0.2
Drusus discolor	1.2	1.1		32.5	12.1		10.0	31.3	19.7	4.3	0.5													1.4
Drusus biguttatus							4.8	45.9	42.6	3.7	1.2													
Potamophylax cingulatus							0.3	1.7	4.4	1.5	2.8													
Ecclisopteryx madida								=	5.2	0.3	0.1													
Glossosoma conformis								=	=	7.3	2.2													
Rhyacophila mocsaryi									0.1	9.1	4.7	6.2	0.3	0.3										
Allogamus auricollis							10.0	12.8	16.1	17.0	24.6	8.1	1.9											
Glossosoma intermedia									5.3	26.1	26.5	4.1	5.6	2.4	0.2									
Sericostoma spp.										0.4	0.8		0.6	0.3	0.2	=	0.1	=	0.1					11.4
Ecclisopteryx dalecarlica									=	19.2	24.1	60.6	6.4	1.8				=						
Rhyacophila nubila										2.9	6.6	14.1	50.3	35.6	13.3	6.6	9.0	10.4	7.7	4.8	2.5			
Polycentropus flavomaculatus										0.1		0.6	13.6		3.7	1.1	1.7	0.2	1.7	0.6	0.9			
Glossosoma boltoni													4.4	1.5			0.1	0.1						
Annitella obscurata											0.1			6.8		=								
Chaetopteryx fusca														0.3										12.4
Hydropsyche pellucidula											0.1		3.6	47.5	81.5	84.3	60.6	17.8	52.3	52.8	22.1			
Psychomyia pusilla													11.1	3.0	0.7	6.8	23.7	59.7	31.8	30.1	55.3			
Cheumatopsyche lepida																	0.2	0.2	3.2	6.0	1.1			
Hydropsyche bulbifera															0.1	=			0.1	0.1	5.1			
Hydroptila foroipata																1.1	3.8	8.1	1.1	3.8	12.1			
Apatania fimbriata																							4.5	
Parachiona picicornis																							4.0	
Drusus trifidus																							20.1	10.1
Agapetus fuscipes																								48.6
Stenophylacini + Chaetopterygini spp. juv.					0.5		1.0			1.4	1.0	5.0			0.1		0.1					0.6	9.8	6.0
Number of taxa	6	6	5	11	17	5	18	19	16	17	19	9	13	13	9	9	10	13	12	9	9	3	14	15
Number of specimens	594	93	172	761	214	88	291	1826	1876	681	1263	320	360	168	345	689	1379	1858	1013	883	642	309	224	516
Number of sampling I.																1		1						
in particular III.								1								1		1						
months 1963 - 1980 IV.																1		1				1		
V.									1	1	1	1	1		1	1	1	1	2	1	1			
VI.								1	1					1		1		1				1	1	1
VII.		1	1	1	1	1	1	2	1	1	1					1	1	1	1	1	1			1
VIII.					1	1	1	1		1		1				1		1						1
IX.									1	1	1		1	1	1	1		1						
X.	4	2	3	2	3		2	1		1	1					1	1	1	1	1	1		2	1
XI.								1								1		1					1	
XII.							1	1	1		1		1	1	1							1	1	1

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 3.9-1.0%): Philopotamus ludificatus, Chaetopteryx polonica, Oligoplectrum maculatum, Potamophylax nigricornis, P. latipennis, Drusus annulatus, Rhyacophila philopotamoides, R. tristis, R. polonica, R. fasciata, R. obliterata, Brachycentrus montanus; and (below 1%): Athripsodes albifrons, Halesus radiatus, Annitella thuringica, Lepidostoma hirtum, Silo pallipes, Lasiocephla basalis, Goera pilosa, Agapetus delicatulus, S. piceus

Table XXX .

Dominant Trichoptera species (≥4% at one station at least) in the streams: Czarny Staw outflow (E1a), Rybi Potok (E2a-E3a), Białka Tatrzańska (E4a-E9a)

	E1a	E2a	E3a	E4a	E5a	E6a	E7a	E8a	E9a
Halesus rubricollis	9.7			0.4					
Allogamus uncatus	59.7	2.0	0.5	0.7	0.1				
Apatania fimbriata	14.5	18.5							
Rhyacophila obliterata		4.1				0.5	0.3		
Polycentropus flavomaculatus		24.8	0.5					=	0.1
Drusus discolor	3.2		24.1	5.5	0.2	5.5	0.1		
Rhyacophila tristis		25.6	48.3	1.5	0.6	13.8	0.3	0.2	
Ecclisopteryx madida			5.9		0.1	0.1			
Rhyacophila vulgaris		1.4	1.5	7.0	1.9	2.1			
Melampophylax nepos				7.0	0.1				
Drusus biguttatus				42.3	61.7	6.7			
Allogamus auricollis				6.2	26.2	1.1	23.7	5.8	
Glossosoma intermedia			1.5	17.6	0.4	26.8	26.6	18.0	0.4
Glossosoma conformis				0.4	5.8	24.2	1.3	2.0	0.6
Sericostoma spp.		1.6				1.7	8.4	1.3	6.3
Annitella thuringica						1.0	9.4	0.1	
Rhyacophila nubila		0.5		0.2		1.3	11.0	42.2	29.3
Ecclisopteryx dalecarlica				0.2		1.0	10.6	15.3	4.2
Hydropsyche pellucidula				0.2			0.5	8.1	42.8
Glossosoma boltoni								2.7	8.1
Oligoplectrum maculatum								0.4	5.6
Rhyacophila spp. juv.		13.9	12.8	2.8	1.3	1.3			
Number of taxa	8	12	8	25	14	28	20	18	15
Number of specimens	62	158	406	544	1334	1565	1588	974	1171
Sampling months I.		+	+			+			
1977-80 II.						+			
III.		+	+	+	+	+			
IV.						+			
V.	+	+	+	+	+,+	+	+	+	+
VI.		+	+			+			
VII.		+	+	+	+				
VIII.				+	+	+	+	+	+
IX.		+	+	+		+	+	+	+
X.		+	+						
XI.				+		+	+	+	+
XII.		+	+						

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 3.9-1.0%): Philopotamus ludificatus, Potamophylax cingulatus, Drusus annulatus, Rhyacophila philopotamoides, Micrasema minimum, Pot. latipennis, R. glareosa, R. polonica, Plectrocnemia conspersa, Psilopteryx psorosa, D. trifidus, Brachycentrus montanus, Pseudopsilopteryx zimmeri, Psychomyia pusilla, R. moosaryi; and (below 1%): R. fasciata, Agapetus fuscipes, Acrophylax zerberus, A. vernalis, Hydropsyche instabilis, Pot. luctuosus, Annitella obscurata, Chaetopteryx fusca, Allogamus starmachi, Lithax niger, Silo pallipes, Chaetopterygopsis maclachlani. Ph. montanus, H. saxonica, Halesus digitatus

Table XXXI

Percentage of the Trichoptera species in the Waksmundzki Potok stream (E1b-E10b) and in sources (Ez4, Ez5)

	E1b	E2b	E3b	E4b	E5b	E6b	E7b	E8b	E9b	E10b	Ez4	Ez5
Acrophylax zerberus	=		46.3	=	=	22.7	7.2	21.8	4.9	0.1		3.4
Rhyacophila philopotamoides			4.9				2.3					5.6
Chaetopteryx polonica			34.1	=	=	34.1	4.1	0.2	1.6			48.9
Rhyacophila glareosa			14.6	=	=	27.3	18.5	12.9		0.2		15.0
Drusus annulatus						2.3	44.5	33.7		0.6		6.4
Lithax niger							1.5					2.6
Apatania fimbriata							1.1	0.0				10.9
Rhyacophila tristis							0.4	0.2				
Allogamus uncatus				=		11.4	8.0	17.2		0.1		
Acrophylax vernalis								5.1				
Rhyacophila fasciata								0.2				
Allogamus auricollis								0.1				
Sericostoma spp.								0.1				
Drusus discolor						2.3	9.8	5.4	16.4	1.9		1.9
Glossosoma intermedia							0.7	0.1	11.5			
Rhyacophila polonica								0.3	6.6	5.4		
Rhyacophila vulgaris									3.3			
Allogamus starmachi					=				11.5	22.3	=	
Melampophylax nepos								0.7	41.0	62.4		
Halesus rubricollis								0.9		5.0		
Pseudopsilopteryx zimmeri										0.4		
Rhyacophila spp. juv.							0.4	0.2	3.3	1.3		2.8
Stenophylacini + Chaetopterygini spp. juv.							1.5	0.1	0.1	0.1		2.3
Number of taxa	1	0	4	4	4	6	11	16	8	10	1	8
Number of specimens	1	0	41	18	11	44	265	890	61	885	15	266
Sampling dates 21.II.								+				
1977-80 29.III.								+				+
29.IV.						+	+	+	+	+		+
(14),30.V.						+		+	(+),	+		+
27.VI.							+	+		+		+
13.VII.							+	+		+	+	
28.VIII.								+		+		
25,27.IX.						+,+	+	+		+		+,+
1,(13),X.	+	+(+)	+(+)	(+)	(+)	+(+)	+(+)	+(+)	+	(+)		+
24.X.		+	+	+	+						+	
28.XI.					+	+				+		+

Denotations as in the Table XIX

Table XXXII

Dominant Trichoptera species (≥4% at one station at least) in the Biała Tarnowska (E1c-E9c) and one of its tributaries (E1d)

	E1c	E2c	E3c	E4c	E5c	E6c	E7c	E8c	E9c	E1d
Apatania carpathica	60.9	3.6								
Rhyacophila tristis	29.6	7.1	5.0	0.5	0.2					
Lithax niger	3.5	4.8								
Rhyacophila philopotamoides	1.7	5.9								
Philopotamus ludificatus	4.3	21.4								
Potamophylax luctuosus		9.5								
Plectrocnemia conspersa		4.8								3.7
Rhyacophila polonica		4.8								
Wormaldia occipitalis		1.2								7.4
Odontocerum albicorne		1.2			0.7					14.8
Philopotamus montanus		8.3	12.1							
Rhyacophila moesaryi		4.8	5.6	2.1	2.5					
Hydropsyche saxonica			15.1	3.2	2.0	0.8				
Polycentropus flavomaculatus			17.7	11.1	0.7	0.4	1.5	1.3	2.0	
Hydropsyche fulvipes				1.1						40.7
Sericostoma spp.		3.6	8.6	11.6	29.6	1.3				25.9
Potamophylax latipennis			14.1	6.3	21.1					
Hydropsyche instabilis			8.1	1.1	15.7	13.7				
Rhyacophila nubila			3.0	4.2	14.7	25.3	12.7	2.6	2.0	
Hydropsyche bulbifera						9.3		4.4	2.0	
Hydropsyche pellucidula				6.3	2.2	41.8	85.8	89.7	91.5	
Rhyacophila spp. juv.		4.8								
Hydropsyche spp. juv.			5.6	39.7	8.2	6.7				
Number of taxa	5	19	14	18	12	9	3	7	7	7
Number of specimens	115	84	198	189	402	237	197	387	295	27
sampling dates 15.VI.			+		+	+				
20.VIII.		+	+	+	+	+	+	+	+	
1.IX.	+	+								+

Apart from these, the following species were found (ordered acc. to domination value 3.9-1.0%): Chaetopteryx polonica, C. fusca, Ecclisopteryx madida, Potamophylax cingulatus, Rhyacophila fasciata, R. obliterata, Glossosoma boltoni, Philopotamus variegatus. Tinodes rostocki, Psychomyia pusilla, Silo piceus; and (below 1%): Goera pilosa, S. pallipes, Cyrnus trimaculatus, Halesus digitatus, Cheumatopsyche lepida

Table XXXIII

Dominant Trichoptera species (⩾4% at one station at least) in the Wisłoka river (F1-F12)

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10x F11x	F12x
Lithax obscurus	5.3										
Wormaldia occipitalis	25.7	0.8									
Plectrocnemia conspersa	21.8	1.6		0.1							
Chaetopteryx fusca	20.4	26.4	1.4	0.2							
Ecclisopteryx madida		7.8	1.0								
Potamophylax cingulatus		26.4	13.6	0.1							
Potamophylax rotundipennis		4.7				0.1	0.2	1.2			
Rhyacophila fasciata		9.3	12.2	0.2							
Odontocerum albicorne		0.8	5.1	1.6							
Potamophylax latipennis		3.1	55.4	32.1	47.8	7.0	0.4				
Sericostoma spp.		2.3	1.0	12.6	10.6	1.7	0.1				
Hydropsyche saxonica			2.4	3.1							
Hydropsyche instabilis			3.4	5.2	1.4	1.7	0.2	1.2			
Silo piceus				0.5	6.8	0.5					
Psychomyia pusilla						34.9	63.0	1.2			
Cheumatopsyche lepida						4.9	5.2	2.5			
Hydroptila forcipata							0.8				
Hydroptila occulta							0.5				
Rhyacophila nubila				9.3	9.7	9.7	8.9	12.3			
Polycentropus flavomaculatus				4.6	3.9	5.8	8.0	29.6	=		
Hydropsyche pellucidula				4.4	8.2	18.4	5.0	29.6	=	35.5	27.3
Hydropsyche bulbifera						0.1		18.5	=	12.8	3.6
Hydropsyche contubernalis										19.3	12.7
Hydropsyche modesta										32.2	52.7
Hydroptila forcipata + occulta						6.4	4.1				
Hydropsyche spp. juv.				19.7	7.2	6.7					
Stenophylacini + Chaetopterygini spp. juv.	23.8	2.3			1.4						
Number of taxa	9	15	12	17	13	17	17	10	3	4	5
Number of specimens	206	129	294	867	207	657	1107	81	4	31	55
Sampling dates 4.IV.	+	+	+	+	+	+	+	+	+	+	+
5.VI.	+	+	+	+	+	+	+	+	+		
7.VII.	+	+	+	+							

Denotations as in the Table XIX.
Apart from these, the following species were found (ordered acc. to domination value 3.9-1.0%): Potamophylax nigricornis, Rhyacophila philopotamoides, P. luctuosus, Athripsodes albifrons, Goera pilosa, Halesus digitatus, R. obliterata, Silo pallipes, Polycentropus schmidi, Ernodes vicinus, R. tristis, Tinodes rostocki, Hydropsyche contubernalis masovica (out of the Carpathians); and (below 1%): Cyrnus trimaculatus, Stenophylax permistus, R. moosaryi, Philopotamus ludificatus, Limnephilus rhombicus, Beraeamyia hrabei, Lepidostoma hirtum, Agapetus laniger, Notidobia ciliaris

Table XXXIV

Dominant Trichoptera species (≥4% at one station at least) in the streams: Ropka (F1a-F6a) and Ropa (F7a-F10a)

	F1a	F2a	F3a	F4a	F5a	F6a	F7a	F8a	F9a	F10a
Potamophylax carpathicus	42.6	0.4								
Synagapetus armatus	22.0	7.2								
Drusus brunneus	5.7	2.1								
Chaetopteryx subradiata	4.3	1.3								
Psilopteryx carpathica	12.0	8.5	1.9	1.8						
Lithax niger	2.1	6.4								
Apatania carpathica	0.7	31.9								
Philopotamus ludificatus	2.8	14.0	25.5	1.8						
Sericostoma spp.		13.6	25.5	2.3	7.1	1.4	1.4	1.3	0.6	
Hydropsyche fulvipes			19.3	0.9						
Philopotamus montanus	3.5		4.3	16.7						
Rhyacophila polonica		1.3	0.6	5.6						
Potamophylax cingulatus		3.0	2.5	21.8	1.2	0.9				
Rhyacophila fasciata			1.2	8.3	0.6	1.8				
Chaetopteryx fusca				9.7	33.5	0.2				
Hydropsyche saxonica				5.1	10.0	6.9				
Potamophylax latipennis					17.1	14.1	3.4	2.5	0.3	
Hydropsyche instabilis				2.8	17.6	46.5	35.1	21.4	9.2	2.9
Rhyacophila nubila				0.5	5.3	10.4	52.0	28.3	30.4	45.7
Polycentropus flavomaculatus					2.9	8.6		32.7	20.8	8.6
Hydroptila forcipata									21.7	
Hydropsyche pellucidula							2.0	8.2	9.8	31.4
Psychomyia pusilla								0.6	1.8	5.7
Philopotamus spp. juv.	1.4			6.5		0.2				
Hydropsyche spp. juv.			10.6	1.8		6.5				
Number of taxa	11	18	15	22	14	14	11	11	12	7
Number of specimens	141	235	161	216	170	432	148	159	336	35
Sampling dates 16.V.				+		+	+	+	+	
6.VI.	+	+	+	+	+	+	+	+	+	+
12.IX.	+	+	+	+						
19.X.	+									

Apart from these, the following species were found (ordered acc. to domination value 3.9-1.0%): Cheumatopsyche lepida, Hydropsyche bulbifera, Rhyacophila obliterata, R. philopotamoides, Silo pallipes, R. tristis, Halesus digitatus, Drusus carpathicus, Odontocerum albicorne, Ecclisopteryx madida, Annitella obscurata, Potamophylax luctuosus, Silo piceus, Plectrocnemia conspersa, Athripsodes albifrons, Lepidostoma hirtum, Beraeamyia hrabei; and (below 1%): Crunoetia irrorata, Chaetopteryx polonica, Glossosoma conformis

REFERENCES

Bohle H. W. 1983. Driftfang und Nahrungserwerb der Larven von *Drusus discolor (Trichoptera, Limnephilidae)*. Arch. Hydrobiol., Stuttgart **97**: 455—470.

Bombówna M. 1960. Hydrochemiczna charakterystyka rzeki Soły i jej dopływów. Acta hydrobiol., Kraków, **2**: 175—200.

Bombówna M. 1969. Hydrochemical characteristics of the river Raba and its tributaries. Acta hydrobiol., Kraków, **11**: 479—504.

Botosaneanu L. 1959. Cercetari asupra trichopterelor din massivul Retezat si Muntii Banatului. Bibl. Biol. Animala, Bucarest, **1**: 1—165.

Botosaneanu L. 1961. Materiaux pour servir à la connaissance des Trichoptères d'Europe Orientale et Centrale. Folia ent, hungarica, Ser. nov., Budapest, **14**: 11—91.

Botosaneanu L. 1965. Neue trichopterologische Fänge in Polen, Rumänien und Bulgarien. Latvijas Entomol., Riga, **10**: 53—60.

Botosaneanu L. 1979. Quinze années de recherches sur la zonation des cours d'eau: 1963—1978. Revue commentée de la bibliographie et observations personelles. Bijdragen tot de Dierkunde, Amsterdam, **49**: 109—134.

Botosaneanu L., Malicky H. 1978. *Trichoptera*. In: Illies J. (ed.). Limnofauna Europaea. Stuttgart, Fischer, 333—359.

Cummins K. W. 1973. Trophic relations in aquatic insects. An Rev. Entomol., **18**: 183—206.

Cummins K. W. 1974. Structure and function of stream ecosystems. Bioscience, **24**: 631—641.

Décamps H. 1967. Ecologie des Trichoptères de la Vallee d'Aure (Hautes-Pyrenees). Anns limnol., Toulouse, **3**: 399—577.

Dratnal E., Sowa R., Szczęsny B. 1979. Zgrupowania bezkręgowców bentosowych Dunajca na odcinku Harklowa-Sromowce Niżne. Ochrona Przyr., Kraków, **42**: 183—215.

Dzięndzielewicz J. 1867. Wykaz owadów siatkoskrzydłych. Spraw. Kom. Fiz., Kraków, **1**: 158—165.

Dzięndzielewicz J. 1889. Nowy dodatek do fauny owadów siatkoskrzydłych. Spraw. Kom. Fiz., Kraków, **23**: 112—118.

Dzięndzielewicz J. 1891. Przegląd fauny krajowej owadów siatkoskrzydłych *(Neuroptera — Pseudo-neuroptera)*. Spraw. Kom. Fiz., Kraków, **26**: 26—151.

Dzięndzielewicz J. 1895. Zestawienie zapisków o owadach siatkoskrzydłych w Tatrach podczas pobytu w latach 1891 i 1892. Spraw. Kom. Fiz., Kraków, **30**: 1—40.

Dzięndzielewicz J. 1911. Owady siatkoskrzydłe *(Neuropteroidea)* zebrane w zachodnich Karpatach w roku 1909. Spraw. Kom. Fiz., Kraków, **45**: 39—44.

Dzięndzielewicz J. 1919. Owady siatkoskrzydłe ziem Polski *(Insecta neuropteroidea* Poloniae terrarum*)*. Rozpr. Wiad. Muz. Dzieduszyckich, Lwów, **3** (1917): 105—168.

Dzięndzielewicz J. 1920. Owady siatkoskrzydłe ziem Polski (*Insecta neuropteroidea* Poloniae terrarum). Rozpr. Wiad. Muz. Dzieduszyckich, Lwów, **4** (1918): 1—72.

Gołek J. 1961. Termika rzek polskich. Prace PIHM, Warszawa, z. 62: 1—79.

Helan J., Kubiček F., Losos B., Sedlák E., Zelinka M. 1973. Production conditions in the trout brooks of the Beskidy mountains. Fol. Fac. Scien. Nat. UJEP Brunensis, Brno, **14**: 1—105.

Hess M. 1965. Piętra klimatyczne w Polskich Karpatach Zachodnich. Zesz. nauk. UJ, Prace geogr., Kraków, **12**: 1—258 (engl. summary).

Illies J., Botosaneanu L. 1963. Problèmes et methodes de la classification et de la zonation écologique des eaux courantes, considerées surtout du point de vue faunistique. Mitt. Int. Ver. Limnol., Stuttgart, **12**: 1—57.

Kamler E., Riedel W. 1960. The effect of Drought on the Fauna of *Ephemeroptera, Plecoptera* and *Trichoptera* of a Mountain Stream. Pol. Arch. Hydrobiol., Warszawa, **8**: 87—94.

Klima F. 1981. Köcherfliegen aus der polnischen Tatra *(Trichoptera)*. Entomol. Nachrichten, Leipzig, **5**:72—76.

Kownacka M. 1971. The bottom fauna of the stream Sucha Woda (High Tatra Mts) in the annual cycle. Acta hydrobiol., Kraków, **13**: 415—438.

Kownacka M., Kownacki A. 1965a. Fresh water invertebrates of Stawki Mnichowe pools in the Tatra Mts. Kom. Zagosp. Ziem Górskich PAN, Kraków, 11: 81—90.

Kownacka M., Kownacki A. 1965b. The fauna of the river Białka and of its Tatra tributaries the Rybi Potok and Potok Roztoka. Kom. Zagosp. Ziem Górskich PAN, Kraków, **11**: 129—151.

Kownacka M., Kownacki A. 1968. Wpływ pokrywy lodowej na faunę denną potoków tatrzańskich. Acta hydrobiol., Kraków, **10**: 95—102.

Kownacki A. 1977. Biocenosis of a high mountain stream under the influence of tourism. 4. The bottom fauna of the stream Rybi Potok (the High Tatra Mts). Acta hydrobiol., Kraków, **19**: 293—312.

Krzanowski W., Fiedor E., Kuflikowski T. 1965. Fauna denna kamienisto-prądowych siedlisk dolnych odcinków Białego Dunajca, Rogoźnika i Lepietnicy. Zesz. nauk. UJ, Prace zool., Kraków, **9**: 43—60.

Krzyżanek E. 1971. Bottom fauna in the Tresna dam reservoir in 1966. Acta hydrobiol. Kraków, **13**: 335—342.

Książkiewicz M., Samsonowicz J. 1952. Zarys geologii Polski. PWN, Warszawa, 160 pp,

Majewski E. 1882. *Insecta Neuroptera polonica*. Systematyczny wykaz owadów żyłkoskrzydłych polskich. Warszawa, 42pp.

Majewski E. 1885. Owady żyłkoskrzydłe *(Neuroptera polonica)*. Systematyczny wykaz krajowych siecarek i prasiatnic. Warszawa, 48pp.

Malicky H. 1977, Ein Beitrag zur Kenntnis der *Hydropsyche guttata* — Gruppe *(Trichoptera — Hydropsychidae)*. Zeitschr. Arbeitsgem. Österr. Entomol. Wien. **29**: 1—28.

Malicky H. 1983. Atlas of European *Trichoptera*. Junk, The Hague — Boston—London, 298 pp.

Mayer K. 1939. Chrostici bývalé Československé Republiky. Trichopteren der ehemaligen Tschechoslovakischen Republik. Entomol. listy (Folia entomol.), Praha, **2**: 24—36.

Meritt R. W., Cummins K. W. 1978. An introduction to the aquatic insects of North America Kendall-Hunt, Dubuque, Iowa USA.

Mikulski J. 1931. Przyczynek do znajomości fauny doliny Popradu w okolicy Muszyny: *Ephemeroptera, Trichoptera* i *Neuroptera*. Spraw. Kom. Fiz., Kraków, **65**: 81—92.

Minkiewicz S. 1914. Przegląd fauny jezior tatrzańskich. Spraw. Kom. Fiz., Kraków, **48**: 114—137.

Novak K., Botosaneanu L. 1965. *Polycentropus schmidi* n. sp. *(Trichoptera)* des Carpates de Slovaquie. Acta entomol. bohemoslov., Praha, **62**: 139—140.

Novak K., Obr S. 1966. Beitrag zur Kenntnis der Kocherfliegen *(Trichoptera)* in der Slowakei. Ac. Rev. Natur. Mus. Nat. Slov., Bratislava, **2**: 33—43.

Nowicki M. 1865. *Insecta* Heliciae Musei Dzieduszyckiani. Cracovia, 87pp.

Nowicki M. 1867. Zapiski z fauny tatrzańskiej. Spraw. Kom. Fiz., Kraków, **1**: 179—206.

Nowicki M. 1868. Zapiski z fauny tatrzańskiej. Spraw. Kom. Fiz., Kraków, **2**: 77—91.

Nowicki M. 1869. Zypiski faunicze. Spraw. Kom. Fiz., Kraków, **3**: 145—152.

Nowicki M. 1870. Zapiski faunicze. Spraw. Kom. Fiz., Kraków, **4**: 1—28.

Oleksynowa K., Komornicki T. 1965. The chemical composition of water in the polish Tatra Mountains and the problem of variation in time. Kom. Zagosp. Ziem Górskich PAN, Kraków, **11**: 91—111.

Pawłowski B. 1972. Szata roślinna gór polskich. In: Szafer W., Zarzycki K. (red.), Szata roślinna Polski. PWN, Warszawa, 189—240.

Racięcka M. 1933. Przyczynek do znajomości chróścików *(Trichoptera)* ziem Polski Pol. Pismo ent., Lwów, **12**: 17—27.

Riedel W. 1960. Nowe dla Polski gatunki chruścików *(Trichoptera)*. Fragm. faun., Warszawa, **8**: 315—319.

Riedel W. 1961. Materiały do znajomości rozmieszczenia chruścików *(Trichoptera)* Polski. Fragm. faun., Warszawa, **9**: 11—20.

Riedel W. 1962. Chruściki *(Trichoptera)* Tatr. Fragm. faun., Warszawa, **9**: 417—438.

Riedel W. 1971. Uzupełnienie do znajomości chruścików *(Trichoptera)* Bieszczadów. Fragm. faun., Warszawa, **17**: 357—364.

Riedel W. 1972. Materiały do znajomości rozmieszczenia chruścików *(Trichoptera)* w Polsce, II. Fragm. faun., Warszawa, **18**: 245—256.

Riedel W. 1978. Chruściki *(Trichoptera)* Pienin. Fragm. faun., Warszawa, **22**: 247—264.

Schille F. 1902. Materiały do fauny owadów siatkoskrzydłych i szarańczaków doliny Popradu. Spraw. Kom. Fiz., Kraków, **36**: 77—85.

Sedlák E. 1962. Několik nálezů chrostiku *(Trichoptera)* z Nizkých Tater. Publ. Fac. Sci. Univ. J. E. Purkyně, Brno, 444: 287—292.

Sowa R. 1965. Ecological characteristics of the bottom fauna of the Wielka Puszcza stream. Acta hydrobiol., Kraków, **7**, suppl. 1: 61—92.

Sowa R. 1975. Ecology and biogeography of mayflies *(Ephemeroptera)* of running waters in the Polish part of the Carpathians. 1. Distribution and quantitative analysis. Acta hydrobiol., Kraków, **17**: 223—297.

Starkel L. 1960. Rozwój rzeźby Karpat fliszowych w holocenie. Prace geogr. IG PAN, Warszawa, 22.

Sýkora J. 1962. Some Remarks on the Distribution of the Genus *Tinodes* in Czechoslovakia and Description of *Tinodes kimminsi* sp. n. Acta faun. Ent. Mus. Nat. Pragae, Praha, **72**: 87—90.

Szczęsny B. 1965. Caddisflies *(Trichoptera)* of the Dunajec. In: Dratnal E. Szczęsny B. Benthic fauna of the Dunajec River. Kom. Zagosp. Ziem Górskich PAN, Kraków, **11**: 190—195.

Szczęsny B. 1966a. *Drusus carpathicus* Dz. — nowy dla fauny Polski gatunek chruścika (*Trichopteria*). Acta hydrobiol., Kraków, 8: 15—16.

Szczęsny B. 1966b. Nowe i rzadkie w faunie Polski gatunki chruścików (Trichoptera). Acta hydrobiol., Kraków, **8**: 341—346.

Szczęsny B. 1967. Notes sur quelques especes d'*Allogamus (Trichoptera, Limnephilidae)* dans les Tatra. Bull. Acad. Pol. Sci., Warszawa, **15**: 479—482.

Szczęsny B. 1970. Chruściki *(Trichoptera)*. In: Sowa R., Szczęsny B. Widelnice *(Plecoptera)* i chruściki *(Trichoptera)* Babiej Góry. Ochr. Przyr., Kraków, **35**: 221—268.

Szczęsny B. 1974a. The effect of sewage from the town Krynica on the benthic invertebrates communities of the Kryniczanka stream. Acta hydrobiol., Kraków, **16**: 1—29.

Szczęsny B. 1974b. Larvae of the genus *Hydropsyche (Insecta, Trichoptera)* from Poland. Pol. Arch. Hydrobiol., Warszawa, **21**: 387—390.

Szczęsny B. 1975. Caddis-flies *(Trichoptera)* of the River Raba. Acta hydrobiol., Kraków, **17**: 35—51.

Szczęsny B. 1978a. Larvae of *Drusinae (Insecta: Trichoptera)* from polish part of the Carpathian Mts. Acta hydrobiol., Kraków, 20: 35—53.

Szczęsny B. 1978b. Larvae of the genus *Philopotamus (Insecta: Trichoptera)* from Poland. Acta hydrobiol., Kraków, **20**: 55—61.

Szczęsny B. 1980. Caddis-flies *(Trichoptera)* in the collection of the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences in Cracow. Acta zool. cracov., Kraków, **24**: 449—486.

Tobias W. 1972. Zur Kenntnis europäischer *Hydropsychidae (Insecta: Trichoptera)* I, II, III. Senckenbergiana biol., Frankfurt a. M., **53**: 59—89, 245—268, 391—401.

Tomaszewski C. 1961. *Rhyacophila polonica* McLach. *(Trichoptera)* — nowy gatunek dla fauny Polski oraz kilka nowych gatunków chruścików dla fauny polskich Karpat. Fragm. faun., Warszawa, **9**: 23—26.

Tomaszewski C. 1965. Chruściki *(Trichoptera)*. Katalog Fauny Polski. PWN, Warszawa, **28**: 5: 1—104.

Wierzejski A. 1883. Dodatek do fauny sieciówek *(Neuroptera)*. Spraw. Kom. Fiz., Kraków, **17**: 253—255.

Wiggins G. B., Mackay R. J. 1978. Some relationships between systematics and trophic ecology in nearctic aquatic insects, with special reference to *Trichoptera*. Ecology, Ithaca, **59**: 1211—1220.

Wit-Jóźwikowa K., Ziemońska Z. 1962. Hydrografia Tatr Polskich. In: Szafer W. (ed.) Tatrzański Park Narodowy. Zakł. Ochr. Przyr. PAN, Kraków, **21**: 125—138.

Zabierowska D. 1967. Analiza użytkowania ziemi w karpackim regionie górskim. Kom. Zagosp. Ziem Górskich PAN, Kraków, **2**: 59—104.

Zaćwilichowska K. 1964. Chruściki *(Trichoptera)* potoku Wielka Puszcza. Acta hydrobiol., Kraków, **6**: 139—154.

Zaćwilichowska K. 1968. Bottom fauna in the basin of the River Kamienica Nawojowska. Acta hydrobiol., Kraków, **10**: 319—341.

Zaćwilichowska K. 1969. *Trichoptera* in the basin of the River Soła. Acta hydrobiol., Kraków, **11**: 285—300.

Ziemońska Z. 1960. Związek temperatury źródeł morenowych z wysokością ich występowania na północnych stokach Tatr Zachodnich. Przegl. geogr., Warszawa, **32**: 3—6.

Ziemońska Z. 1973. Stosunki wodne w polskich Karpatach Zachodnich. Prace geogr. IG PAN, Warszawa, z. 103: 1—124.

STRESZCZENIE

Opracowano chruściki *(Trichoptera)* Karpat Północnych w oparciu o zweryfikowane dane z literatury oraz materiały własne. Materiały te (larwy, poczwarki, imagines) zbierano w latach 1965—1981 uwzględniając wszystkie rodzaje siedlisk wodnych; szczególną uwagę poświęcono wodom bieżącym (tab.: VII—XIV, XIX—XXXIV).

Z Karpat Północnych, po obu stronach granicy polsko-czechosłowackiej znanych jest dotychczas 210 gatunków chruścików, z całych Karpat 291. Faunę chruścików północnokarpackich tworzą następujące grupy zoogeograficzne: I — gatunki o rozsiedleniu holarktycznym (10 taksonów); II — gatunki o rozsiedleniu palearktycznym (15): III — gatunki o rozsiedleniu wykraczającym poza Europę (58); IV — gatunki o rozsiedleniu europejskim lub nieznacznie tylko wykraczającym poza granice Europy (127). W skład grupy IV wchodzą m. in. endemity karpackie, których jest 8, w tym jeden endemit tatrzański — *Allogamus starmachi* — będący glacjalnym reliktem.

W Karpatach Północnych po stronie polskiej znaleziono dotąd 162 gatunki. W wodach bieżących żyje ich co najmniej 106; najliczniej reprezentowane przedstawia tab. XV. Stwierdzono pewną prawidłowość, że gatunki najliczniejsze były też najpospolitszymi (tab. XVI).

Z zastosowaniem metody statystycznej oraz tabeli CZEKANOWSKIEGO wydzielono 8 zgrupowań chruścików (ryc. 2) zasiedlających kolejne odcinki potoków. Jedno z tych zgrupowań (S) żyje wyłącznie w potokach tatrzańskich, dwa (A, B) w potokach o charakterze wysokogórskim w Tatrach i na Babiej Górze, pozostałe zgrupowania (C, D, E, F, G) rozwijają się w potokach Beskidów — gór o średniej wysokości.

Dla każdego zgrupowania podano zestaw gatunków przewodnich; endemit tatrzański *(A. starmachi)* jest gatunkiem przewodnim dla zgrupowania S zasiedlającego odcinki potoków tatrzańskich zanikających w zimie. Pozostałe endemity karpackie wchodzą w skład głównie zgrupowania "źródlanego" C *(Chaetopteryx polonica, Psilopteryx psorosa carpathica, Potamophylax carpathicus, Drusus carpathicus, D. brunneus)* w Beskidach, ponadto w skład zgrupowania B *(Acrophylax vernalis)* zasiedlającego dolne odcinki potoków tatrzańskich. Ósmy endemit — *Chaetopteryx subradiata* — znaleziony został tylko w źródłach potoku Ropka (dorzecze Wisłoki). W skład zgrupowania A, zasiedlającego najwyżej położone odcinki potoków tatrzańskich (zwłaszcza zachodniotatrzańskich), nie wchodzi żaden endemit karpacki.

Z pozostałych zgrupowań, zgrupowanie D zasiedla górne odcinki potoków beskidzkich płynących po stromo nachylonych i zalesionych zboczach; zgrupowanie E rozwija się w potokach u podnóża gór; zgrupowanie F żyje w dolnych odcinkach niedużych potoków, a zgrupowanie G w rzekach beskidzkich.

Najczęstszy przebieg sukcesji zgrupowań z biegiem potoku, w potoku tatrzańskim jest następujący: A — B — E — G, a w potoku beskidzkim: C — D— E — F — G, przy czym, na ogół, w potokach Beskidu Śląskiego i Beskidu Wysokiego zgrupowanie F zaznacza się słabo lub go brak, natomiast w potokach Beskidu Wyspowego i Niskiego nie stwierdza się zgrupowania E.

Dominujące gatunki chruścików poprzydzielano do tzw. grup funkcjonalnych (w sensie CUMMINSA 1973): rozdrabniaczy, zbieraczy, zdrapywaczy i drapieżców. Zdrapywaczy, czyli gatunków, których larwy odżywiają się glonami porośłowymi, było 27, w pozostałych grupach było po 12 gatunków. Udział procentowy grup funkcjonalnych w zgrupowaniach chruścików przedstawia tab. XVII.

Prześledzono cykle życiowe 15 (ryc. 3—12), a wnioskowano o cyklach życiowych 6 gatunków. Wydzielono wśród nich 3 grupy o podobnym przebiegu cyklu życiowego: I — grupa gatunków o wyraźnie jednorocznym cyklu życiowym przebiegającym w sposób stabilny i zwarty *(Rhyacophila mocsaryi, Glossosoma conformis, G. intermedia, Drusus annulatus, Ecclisopteryx madida, Acrophylax zerberus, Melampophylax nepos, Allogamus starmachi)*; II — gatunki o dwuletnim cyklu życiowym *(Drusus carpathicus, D. monticola)*; III — gatunki o plastycznym cyklu życiowym *(Rhyacophila nubila, Philopotamus ludificatus, Psychomyia pusilla, Hydropsyche pellucidula)*.

Zaobserwowano powiązania pomiędzy zasięgiem geograficznym gatunków, a ich preferencją siedliskową wyrażającą się tym, że odsetek gatunków związanych z potokami w każdej z wydzielonych grup zoogeograficznych jest

odwrotnie proporcjonalny do jej zasięgu (tab. XVIII). Zależność ta uwidacznia się wyraźnie także w odsetkach gatunków osiągających liczne populacje w potokach.

Zaobserwowano różnice morfologiczne bądź ekologiczne pomiędzy osobnikami z populacji północnokarpackich; *A. zerberus*, *M. nepos*, *Chaetopteryx sahlbergi* w stosunku do osobników tych gatunków pochodzących z populacji z innych regionów górskich. Przypuszcza się, że różnice te są wynikiem izolacji geograficznej oraz odmiennie przebiegającego procesu specjacji w innych warunkach klimatycznych.

Redaktor pracy: doc. dr hab. A. Szeptycki