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Freshwater *Gastrotricha* of Poland. I. *Gastrotricha* from the Tatra and Karkonosze Mountains

[With 2 figures and 4 tables]

Abstract. Results of the research on gastrotrichan fauna of the Tatra and Karkonosze Mountains. 39 species were recorded, solely of the family *Chaetonotidae*. Out of the identified 33 species, 3 species (*Chaetonotus sudeticus, Aspidiophorus tatraensis* and *A. tetrachaetus*) are new to science, *Ch. formosus* is new to the fauna of Europe, while *Ch. uncinus* and *A. ophiodermus* are new to the fauna of Poland.

INTRODUCTION TO THE SERIES OF PAPERS

The present paper heads a series of works examining freshwater gastrotrichs of Poland. This paper deals with the fauna of mountain water bodies, while the successive ones discuss the fauna of seaside lakes, forest water bodies, fish ponds, alder woods, astatic water bodies overgrown with rush vegetation and small, extremely eutrophicated water bodies.

As compared to the foreign literature, the studies dealing with freshwater fauna of *Gastrotricha* of Poland are fairly profuse. STEINECKE (1924) carried out studies on Warmia and the Mazurian Lakeland, where he recorded 4 species. LUCKS (1909) noted 3 species on the Otomino Swamps near Gdańsk. ROSZCZAK (1935, 1968) conducted a long-term research on gastrotrichs in Great Poland, recording, all together, 49 species. This author (1971) also described a new genus and species from the almost freshwater Vistula Lagoon. KISIELEWSKI (1974, 1979) recorded 14 species while examining small eutrophic water bodies. This author also published (1981) findings of long-term faunistic and ecological studies carried out on raised and transitional peatbogs all over Poland. In this paper, dealing with 58 species, three assemblages

of freshwater gastrotrichs were distinguished and their domination structure was provided. Moreover, it supplied estimations of gastrotrichan numbers in peat-mosses. KISIELEWSKA (1981, 1982) studied the fauna of gastrotrichs in some peat-hags in the eastern part of Poland. The 1982 research, dealing with 31 species, presented, apart from traditional qualitative analyses, also quantitative data, estimated by means of a new, simple method of examinations of gastrotrichs living in sludge. Furthermore, the paper in question supplied the results of the analysis of dynamics of gastrotrichan number in a year-long cycle. In the course of all the studies mentioned above, 97 species were recorded to occur in Poland, out of which 85 belonged to the family *Chaetonotidae*, 9 — to *Dasydytidae* and 3 — to *Neogosseidae*. The only paper which, among others, provided data on gastrotrichs of Polish mountains and highlands (KISIELEWSKI 1981), reported 9 species, 5 coming from the Karkonosze Mountains (studies were not carried out in the Tatra Mountains). Notwithstanding intensive studies on *Gastrotricha* in the last twenty years, these animals have not been examined thoroughly enough yet. There still is a lack of data on their occurrence in various water environments. As it has already been stated above, quantitative data were estimated for two environments only; information on domination structure in particular communities is, indeed, very scanty. The series headed by the present paper aimed at filling in the existing information gap and at providing sufficient scientific bases to a monographic description of freshwater *Gastrotricha* fauna of Poland.

All the successive studies described in the present series were carried out in alike manner. For this reason a detailed account of the applied research methods has been given in this paper only, while the remaining ones will only mention certain modifications, if any, of the methods employed. Similarly, in the present paper the survey of particular species has been complemented with characteristics of their general occurrence. In the subsequent papers characteristics of this kind will be given only for species not dealt with in the preceding parts of the series.

Freshwater gastrotrichs are a difficult object for faunistic studies due to their minute body dimensions, often smaller than the size of detritus concentrations among which the animals are frequently found. Furthermore, they are very sensitive to all the changes in conditions, which are a natural consequence of every sampling. The greatest hindrance, however, is the necessity of examining solely live material. On account of this, the studies in sites distant from standing laboratories must be conducted in some off-hand field labs and with the use of inferior optical equipment, providing these studies are meant to supply data on the natural state of fauna. Due to a usually small number of gastrotrichs sampled, much time-consuming manner of analyses and also short life of the sampled material, the findings are rather scanty, especially in the case of data on the domination structure, the estimated value of the general diversity index H', and the number of specimens. All the authors of the papers

published in the present series are painfully conscious of a limited representativeness of these data; however, they are of opinion that scanty as they are, nonetheless, the data in question are more illustrative than a traditional qualitative analysis and that they increase the comparative value of the presented material.

METHODS

In easily accessible and shallow places samples were taken by hand to a container of 0.6 dm^3 in volume. The samples from mountain lakes were taken by means of a dredge cast several dozen meters off the shore and hauled ashore along the bottom with a rope.

Bottom slime and gravel were scanned off-hand, not employing any methods of animal extraction, while the fauna of moist mosses was examined in water tightly squeezed off the substrate.

Only live material was subject to analyses, which were carried out during the field research exactly on the day of sampling or on the day following the sampling, at the very latest. In order to obtain more accurate data on species composition, several samples of a larger volume (10–50 dm^3) were collected and subsequently taken to the laboratory. These samples parented some aquarium cultures, which were subsequently subject to long-termed analyses, much longer than those carried out in situ. The data coming from the laboratory analyses were not taken into consideration while examining domination structure or while estimating the number of gastrotrichs, as they did not reflect the actual state of natural fauna. It should be stressed that the number of aquarium-bred specimens was rather small in case of the present research; however, there were instances (see the subsequent papers of the series) when the aquarium cultures considerably increased the number of identified species.

The material placed on a dish was thoroughly examined so as to extract all the gastrotrichs, thus the obtained data genuinely reflects the actual domination structure. Individual domination (D) was calculated as the ratio of the number of specimens of a given species to the number of all the specimens recorded in a distinct site or in a group of sites, the value of the ratio being expressed in per cent.

Only the samples containing slime were subject to quantitative analyses by methods described by KISIELEWSKA (1982), i. e. by examining on several dishes equal amounts of slime, usually amounting in total to 1 cm^3. In order to obtain more representative data, 3–5 sub-samples were taken from a site, and the same quantities of slime coming from every sample were analyzed, the individual counts being subsequently summed up. The abundance values (A) estimated in the present work express the number of *Gastrotricha* specimens per 1 cm^3 of bottom slime. The values of mean abundance of a given locality or of a group of localities are supplied in Table IV. Actually there are two values supplied there, the first presenting the results of both the positive and negative samples, the other reflecting the results solely of the positive samples, i.e. those in which gastrotrichs were found. Moreover, Table IV supplies the comparative, highest abundance values. General diversity index H' was estimated on the basis of SHANNON formula (PEET 1975), i.e.

$$H' = \sum P_i \ln P_i,$$

where P_i denotes individual domination of particular species expressed in fraction. This index was applied for the first time to analyse the freshwater gastrotrichs by KISIELEWSKI (1981). In the papers of the present series, the index in question was used, beside abundance, in order to compare a "degree of attractiveness" of particular environments to gastrotrichs. The higher were the values of the index, the greater number of species popu-

lated the examined biotope and the more level was their domination structure. Domination and the general diversity index were estimated only for localities of somewhat ampler fauna (highly eutrophicated water bodies). As regards oligotrophic lakes, where gastrotrichs occurred in small numbers, the data in question were calculated in form of the sum total for each mountain massif, due to a homogenous character of the biotopes. The data obtained from analyses of the remaining environments were too scanty to present them in the manner described above.

MATERIAL AND STUDY AREA

The research was carried out on water bodies of the highest massifs of the Polish parts of the Carpathians (Tatra) and the Sudeten (Karkonosze). The field studies were accomplished in the Tatra Mountains in September 1977 and in the Karkonosze Mountains in September 1978. In May 1978 samples were taken from both of the massifs to be subsequently used for parenting aquarium cultures.

The Tatra Mountains

The massif was uplifted mainly in miocene and pliocene, however, its present form resulted from changes brought about by the latest glaciation and the withdrawal of the glacier (Passendorfer 1962). Among the lakes, conventionally termed as ponds of the Tatra Mountains, the prevailing are deep oligotrophic lakes found mainly above the level of the subalpine spruce forests, in the dwarf mountain pine zone (1500–1800 m alt.). In lower sites (about 1000–1200 m alt.) a few more fertile lakes are located, of acid water and more or less abundant in humic substances. All of them are of glacial origin (Wit-Jóźwikowa and Ziemońska 1962). A more detailed characteristic of the twelve lakes from which the samples were taken, is given in Table I.

Streams are marked for being much inclined (e.g. the Kościeliski Potok 40.6‰), a high oxygen content and usually low water temperatures. For instance, the highest water tem-

Table I. Characteristics of the studied lakes in the Tatra (after Wit-Jóźwikowa and Ziemońska 1962).

Locality No	Name	Altitude (m)	Surface (ha)	Depth	
				max.	mean
1	Smreczyński Staw	1226	0.8	5.3	1.8
8	Staw Toporowy Niżni	1089	0.6	5.7	1.9
11	Litworowy Staw	1618	0.5	1.1	0.6
12	Dwoisty Staw Wschodni	1657	1.4	9.2	3.4
13	Zielony Staw Gąsienicowy	1618	3.8	15.1	6.8
14	Staw Kurtkowiec	1686	1.5	4.8	1.4
15	Czarny Staw Gąsienicowy	1620	17.9	51.0	21.1
18	Wielki Staw	1665	34.4	79.3	37.7
20	Mały Staw z Pięciu Stawów Polskich	1668	0.2	2.1	1.0
22	Przedni Staw z Pięciu Stawów Polskich	1668	7.7	34.6	14.6
24	Morskie Oko	1393	34.9	50.8	28.4
25	Czarny Staw nad Morskim Okiem	1580	20.6	76.4	37.6

perature of the Kościeliski Potok at the altitude of the Hala Ornak amounted to 7.5 °C (Gieysztor 1962). The samples were taken from four streams.

The four examined Tatra springs were either of typical rheocrene character or were headed by small marginal stagnant basins. Apart from the large natural water bodies, samples were also taken from two quagmires of lavish vegetation and from a man-made eutrophicated barrier lake.

The list of localities in the Tatra Mountains is given below (Fig. 1). In all the samples the substrate was the bottom slime, unless marked otherwise.

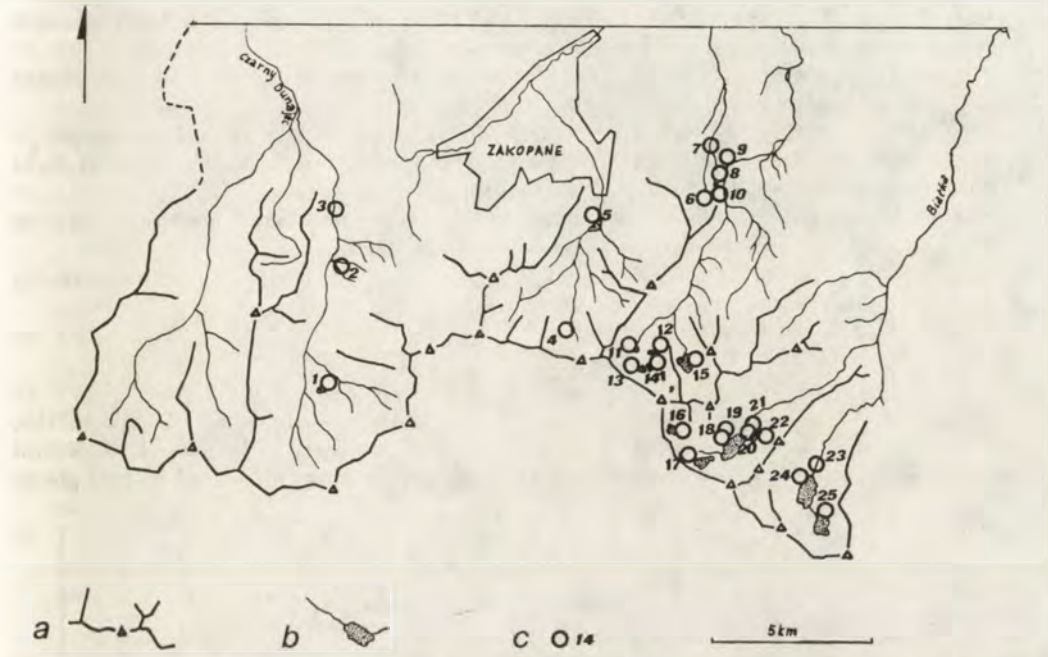

Fig. 1. Distribution of localities in the Tatra Mountains: a — mountain ridges and summits, b — lakes and streams, c — localities.

1. Smreczyński Staw. A dystrophic lake. 1 positive sample.
2. Lodowe Źródło. The spring issuing from a small stagnant water body. 1 positive sample out of 3 taken.
3. A little spring at the Kościeliski Potok, below the Hala Ornak. 1 positive sample.
4. Wywierzysko Bystre. Rheocrene. 2 negative samples.
5. Man-made barrier lake at Kuźnice. 1 positive sample.
6. Wywierzysko Olczyskie. Rheocrene. 1 positive sample out of 2 taken.
7. Olczyski Potok. A stream. 1 negative sample.
8. Staw Toporowy Niżni. More fertile, shallow pond of certain features of a dystrophic lake. 4 positive samples out of 5 taken.
9. Quagmire at Staw Toporowy Niżni. A shallow, overgrown, stagnant water body. 1 negative sample.
10. The stream issuing from Staw Toporowy Wyżni (transitional peat-bog). 1 positive sample.
11. Litworowy Staw. A shallow, oligotrophic basin in the dwarf mountain pine zone. 1 positive sample.
12. Dwoisty Staw Wschodni. An oligotrophic lake. 1 positive sample.
13. Zielony Staw Gąsienicowy. An oligotrophic lake. 1 positive sample.

14. Staw Kurtkowiec. A rather shallow, oligotrophic lake in the dwarf mountain pine zone. 1 positive sample.
15. Czarny Staw Gąsienicowy. An oligotrophic lake. 1 positive sample.
16. The stream issuing from Zadni Staw of the Pięć Stawów Polskich. 1 positive sample out of 3 taken at about 1580 m alt.
17. The stream flowing into Czarny Staw of the Pięć Stawów Polskich. 1 positive sample.
18. Wielki Staw. An oligotrophic lake. 1 negative sample.
19. A slope overgrown with moist moss at Wielki Staw. 1 negative sample (water rinsed off the moss).
20. Mały Staw of the Pięć Stawów Polskich. A shallow, oligotrophic water body situated above the spruce tree range. 1 positive sample.
21. A quagmire in the vicinity of Mały Staw of the Pięć Stawów Polskich. A shallow peated puddle, 1 negative sample.
22. Przedni Staw of the Pięć Stawów Polskich. An oligotrophic lake. 1 positive sample.
23. Rybie Oka, just below the hospice at Morskie Oko. Fairly fertile flooded areas at Rybi Potok, overgrown with sedges. 4 positive samples.
24. Morskie Oko. An oligotrophic lake. 2 positive samples out of 3 taken, containing bottom slime. 1 negative sample containing gravel rich in detritus.
25. Czarny Staw at Morskie Oko. An oligotrophic lake. 1 positive sample out of 3 containing bottom slime. 1 negative sample containing gravel with detritus.

The Karkonosze Mountains

Like the entire Sudeten, this mountain range is geologically much older than the Tatra Mountains, however, its actual form was moulded, similarly as in case of the Tatral during the latest glaciation and the withdrawal of the glacier. Deep, oligotrophic, post-glacia

Fig. 2. Distribution of localities in the Karkonosze Mountains: a — mountain ridges and summits, b — lakes and streams, c — localities.

lakes are also found here, out of which three were studied during the present research. Furthermore, as regards stagnant waters, studies were carried out on more fertile water bodies,

both natural (locality No 31) and man-made (locality No 30). The streams, out of which 3 were studied, are marked for an inclination smaller than in the Tatra. Three springs were also examined. Similarly as the streams, these environments are noted for a less rapid, on average, water issue than in the Tatra Mountains, due to a much smaller degree of the area inclination.

The Karkonosze Mountains are characteristic for a big number of peat-bogs, both in their summit as well as in lower areas. This character is by far less marked in the Tatra Mountains.

The list of the localities is given below (Fig. 2). In all the samples the substrate was the bottom slime, unless marked otherwise.

26. Śnieżny Stawek (larger). A small oligotrophic lake. 1 negative sample.
27. Wielki Staw (1225 m alt.). Oligotrophic lake of the area of about 8 ha and of 25 m maximum depth. 2 positive samples.
28. Mały Staw (1183 m alt.). Oligotrophic lake of about 3 ha in area and of 6 m maximum depth. 2 positive samples.
29. Łomnica Stream. 1 positive sample.
30. The barrier lake in Karpacz. A considerably eutrophicated and shallowed man-made water body. 2 positive samples.
31. A little pond in Karpacz, at the Ecological Station of the University of Wrocław. The basin lavishly overgrown with vascular plants. 2 positive samples.
32. The springs of Łomniczka Stream. A helocrene of *Sphagnum* bog character, numerous stagnant basins. 2 positive samples.
33. The Łomniczka Stream. 2 positive samples.
34. The springs of Skałka Stream. A rheocrene with a fairly abundant flora of the phylum *Bryophyta*. 2 negative samples, out of which 1 contained water rinsed off the moss.
35. A small, slowly flowing water course between Budniki and Szeroki Most. 1 negative sample.
36. The spring of Malinka Stream. The spring with an abundant flora of the phylum *Bryophyta* and herbaceous plants. 1 negative sample (the slime from beneath the moss plots).

THE SURVEY OF SPECIES

Out of the 39 recorded forms, 33 were denoted and listed in the survey supplied below. The remaining 6 species, presumably new, belonging to the genus *Chaetonotus* EHRENBERG had not been studied sufficiently enough; they have only been mentioned in the Table III. The numbers of localities are provided in brackets following the names of environemts while describing individual species.

Genus *Chaetonotus* EHRENBERG

1. *Ch. armatus* KISIELEWSKI, 1981

Material. Tatra Mts: 1 sample, 2 specimens (from the aquarium culture only). Oligotrophic lake (24).

The species was described on the basis of specimens coming from peat-bogs in Poland. It occurs on lowlands, mainly on transitional peat-bogs. It also was recorded on a raised peat-bog of the subalpine type on Równia below Śnieżka in the Karkonosze Mountains, at the altitude of about 1400 m (KISIELEWSKI 1981).

2. *Ch. disiunctus* GREUTER, 1917

Material. Tatra Mts: 3 localities, 5 samples, 20 specimens. Oligotrophic lake (locality No 14), spring (2) and a highly eutrophicated environment (23). Karkonosze Mts: 1 locality, 2 samples, 66 specimens (out of which 25 coming from the aquarium culture). A highly eutrophicated environment (30).

Described from Switzerland. Moreover it was recorded in Italy (BALSAMO 1978), Romania (RUDESCU 1967), Germany (VOIGT 1958), the Soviet Union (the vicinity of Moscow; PREOBRAŽENSKAJA 1926) and Japan (SAITO 1937). It occurs in various environments. In Poland recorded for the first time by ROSZCZAK (1968) in lakes and ponds of the central Great Poland, then by KISIELEWSKI (1981) in transitional peat-bogs, where it is rather common.

3. *Ch. heideri* BREHM, 1917

Material. Tatra Mts: 1 specimen. A highly eutrophicated environment (8).

Described from Czechoslovakia, then recorded in the Soviet Union (the vicinity of Moscow; PREOBRAŽENSKAJA 1926), Romania (RUDESCU 1967) and Italy (BALSAMO 1978, 1981). Recently found in the United States (EMBERTON 1981). It is bound mainly to *Sphagnum* peat-bogs. In Poland recorded by KISIELEWSKI (1981) as a species common on lowland transitional peat-bogs.

4. *Ch. heteracanthus* REMANE, 1927

Material. Tatra Mts: 2 localities, 2 samples, 2 specimens. Oligotrophic lake (13), highly eutrophicated environment (23).

Described from an eutrophic water body near Berlin, subsequently noted in Romania as a rare species (RUDESCU 1967). In Poland it was recorded in an extremely eutrophicated forest pond in the Wielkopolski National Park (KISIELEWSKI 1974) and in peat-hags near Siedlce (KISIELEWSKA 1982), where it occurred regularly and even was one of dominants in a midfield complex of peat-hags.

5. *Ch. maximus* EHRENBERG, 1830

Material. Tatra Mts: 7 localities, 8 samples, 35 specimens (out of which 7 came from the aquarium cultures). Oligotrophic lakes (13, 14, 20), spring (6), streams (16, 17), much eutrophicated environment (23).

Ch. maximus is one of the most popular gastrotrichan species. It has been sampled in numerous localities all over Europe; also noted on other continents, yet many records, the earlier ones in particular, should be verified. Apparently a eurytopic species; apart from fresh waters of various types and peat-bogs, it also was observed to occur in litter (VARGA 1960). In Poland noted by ROSZCZAK (1968) in numerous water bodies of various fertility. KISIELEWSKI (1981) found one specimen in the Białowieża Forest, while KISIELEWSKA (1982) recorded this species in a peat-hag near Siedlce.

6. *Ch. oculifer* KISIELEWSKI, 1981

Material. Tatra Mts: 5 localities, 6 samples, 8 specimens. Oligotrophic lake (24), dystrophic lake (1), water course connected with transitional peat-bog (10), much eutrophicated

environments (8, 23). Karkonosze Mts: 4 localities, 4 samples, 20 specimens. Oligotrophic lake (27), spring (32), stream (29), much eutrophicated environment (31).

The species was described from raised and transitional peat-bogs in Poland, where it is one of the most common and most numerous species of gastrotrichs. It may be found all over lowlands of Poland as well as on mountain peat-bogs in Sudeten. In the Karkonosze Mts the species was noted on two peat-bogs, including Równia below Śnieżka, on the altitude of 1400 m (KISIELEWSKI 1981).

7. *Ch. polyspinosus* GREUTER, 1917

Material. Tatra Mts: 2 localities, 3 samples, 13 specimens. Much eutrophicated environments (8, 23).

Described from Switzerland, where it was noted by GREUTER (1917) on several alpine localities among *Sphagnum*. Subsequently recorded in Germany (REMANE 1927), the Soviet Union (PREOBRAŽENSKAJA 1926), France (D'HONDT 1967), Romania (RUDECSU 1967) and Italy (BALSAMO 1983a). The last two records come from highland areas, where the species occurs on peat-bogs. In Poland recorded for the first time by ROSZCZAK (1968) in three localities in Great Poland. KISIELEWSKI (1981) considered this species to be one of the most common and most numerous gastrotrichs of transitional peat-bogs. It was also found in peat-hags near Siedlce (KISIELEWSKA 1982).

8. *Ch. poznaniensis* KISIELEWSKI, 1981

Material. Tatra Mts: 1 sample, 3 specimens. Much eutrophicated environment (23).

The species was described as scarce from three transitional peat-bogs of lowland Poland (KISIELEWSKI 1981).

9. *Ch. rafalskii* KISIELEWSKI, 1979

Material. Tatra Mts: 1 specimen. Much eutrophicated environment (8).

The species was described from a much eutrophicated forest pond in Great Poland and from an alder wood on Łęczyńsko-Włodawskie Lakeland in eastern Poland (KISIELEWSKI 1979). Also stated by KISIELEWSKA (1982) in peat-hags near Siedlce. The species has been so far observed to occur most numerously in winter, while neither in summer nor in early autumn has it ever been found.

10. *Ch. similis* ZELINKA, 1889

Material. Tatra Mts: 1 locality, 2 samples, 2 specimens (including 1 specimen from the aquarium culture). Oligotrophic lake (24). Karkonosze Mts: 2 localities, 4 samples, 15 specimens (including 1 specimen from the aquarium culture). Oligotrophic lake (28), much eutrophicated environment (31).

The species occurs in various environments and is wide-spread in Europe. Also noted on other continents, yet some of these records should remain subject to verification. In Poland observed by LUCKS (1909) in Otomino Swamps near Gdańsk, by ROSZCZAK (1935, 1968) in some water bodies in Great Poland and by KISIELEWSKI (1981) in transitional peat-bogs.

11. *Ch. sphagnophilus* KISIELEWSKI, 1981

Material. Tatra Mts: 1 specimen. Fairly eutrophicated environment (23). Karkonosze Mts: 1 sample, 4 specimens. Fairly eutrophicated environment (31).

Described from peat-bogs in Poland. Frequently and numerously occurs on lowland raised and transitional peat-bogs. Some specimens were also found on a forest raised peat-bog near Szklarska Poręba in the Karkonosze Mountains (KISIELEWSKI 1981).

12. *Ch. zelinkai* GRÜNSPAN, 1908

Material. Tatra Mts: 4 localities, 4 samples, 6 specimens (out of which 1 specimen from the aquarium culture). Oligotrophic lake (15), water course at a transitional peat-bog (10), fairly eutrophicated environments (8, 24).

Recorded in water bodies of various character and in peat-bogs almost all over Europe. Also noted in Japan (SAITO 1937). In Poland found by ROSZCZAK (1968) in water bodies of various fertility in Great Poland. Also stated by KISIELEWSKI (1981) in transitional peat-bogs and considered to be one of the most common gastrotrichan species in this environment.

13. *Ch. novenarius* GREUTER sensu BALSAMO 1983b

Material. Tatra Mts: 1 specimen. Farily eutrophicated environment (8).

The species has been recorded for the first time from the Polish raised and transitional peat-bogs under the name *Ch. ?anomalus* BRUNSON, 1950 (KISIELEWSKI 1981). The description of BALSAMO (1983b) corresponds closely to the Polish specimens. Thanks to Dr Maria BALSAMO the first author of this paper had the opportunity of seeing the photographical documentation and permanent mounts of Italian material which confirmed additionally the identity of both forms. The presence of two lateral denticles one after another on each of the long spines on the dorsal side is a permanent character of this species and thus one may doubt whether the Polish and Italian specimens belong to the same species described by GREUTER as *Ch. novenarius* as this author in his description mentions only one lateral denticle. Also one can not be sure whether the Polish and Italian specimens belong to the same species described by BRUNSON (1950) as *Ch. anomalus* because its description is not a full one (see KISIELEWSKI 1981). Thus for the Polish form the temporary name *Ch. novenarius* sensu BALSAMO 1983b is used as the description by Dr M. BALSAMO of this form is the fullest one.

14. *Ch. hystrix* MEČNIKOV, 1865.

Material. Tatra Mts: 3 localities, 4 samples, 13 specimens (including 9 specimens from the aquarium cultures). Oligotrophic lake (20), spring (6), fairly eutrophicated environment (23).

Ch. hystrix is one of the more common gastrotrichs in Europe; it has been recorded almost on the entire continent. Also noted in Japan (SAITO 1937) and Paraguay (DADAY 1905), however, the correctness of identification in the latter of the quoted papers is much questionable. *Ch. hystrix* was found

in various water bodies and peat-bogs. It seems that its biotope comprises live water vegetation rather than bottom sediments. In Poland it was first recorded by STEINECKE (1924) in Warmia, and then by ROSZCZAK (1968) in numerous water bodies in Great Poland. *Ch. hystrix* is also a common species of lowland transitional and raised peat-bogs (KISIELEWSKI 1981).

15. *Ch. macrochaetus* ZELINKA, 1889

Material. Tatra Mts: 5 localities, 7 samples, 18 specimens. Oligotrophic lakes (12, 14, 24), fairly eutrophicated environments (8, 23). Karkonosze Mts: 3 localities, 3 samples, 8 specimens. Oligotrophic lake (28), spring (32), fairly eutrophicated environment (31).

Recorded in stagnant waters of various types, in flowing waters and in peat-bogs all over Europe. Also noted in the United States (ROBBINS 1973). In Poland observed by LUCKS (1905) in Pomerania, STEINECKE (1924) on the Mazurian Lakeland and by ROSZCZAK (1968) in numerous stagnant water bodies and in a peat-bog in Great Poland as well as by KISIELEWSKI (1981) in *Sphagnum* peat-bogs of all types on the entire area of Poland, in the latter environment being a common and numerous gastrotrichan species. KISIELEWSKI (1981) also recorded this species in one locality on a raised peat-bog in the Sudeten.

16. *Ch. persetosus* ZELINKA, 1889

Material. Tatra Mts: 2 localities, 2 samples, 2 specimens. Water course issuing from a transitional peat-bog (10), fairly eutrophicated environment (8).

Described from Austria, and subsequently reported from Bulgaria (KONSULOFF 1913), Germany (REMANE 1927), Romania (RUDESCU 1967), Italy (BALSAMO 1983b) and Japan (SAITO 1937). Its primary biotope is water vegetation. In Poland it was recorded by ROSZCZAK (1968) in five water bodies in Great Poland and by KISIELEWSKI (1981) in seven transitional peat-bogs.

17. *Ch. acanthodes* STOKES, 1887

Material. Tatra Mts: 1 sample, 4 specimens. Fairly eutrophicated environment (8). Karkonosze Mts: 2 localities, 2 samples, 5 specimens. Oligotrophic lake (28), fairly eutrophicated environment (31).

Described from the United States, where it was found among peat-mosses. In Europe it was recorded in peat-bogs in Romania (RUDESCU 1967) and Finland (KISIELEWSKI 1981). In Romania also observed to occur in mountains. In Poland first reported by LUCKS (1909) in Otomino Swamps near Gdańsk. It is one of the most common species on Polish raised and transitional peat-bogs. Also noted on a forest raised peat-bog near Szklarska Poręba in the Karkonosze Mountains (KISIELEWSKI 1981).

18. *Ch. uncinus* VOIGT, 1904

Material. Tatra Mts: 1 specimen. Fairly eutrophicated environment (23).

Described from Germany, then recorded in the vicinity of Moscow, the Soviet Union (PREOBRAŽENSKAJA 1926), in Italy (MOLA 1932), Hungary (VARGA 1959) and Romania (RUDESCU 1967). The species is new to the fauna of Poland.

19. *Ch. sudeticus* KISIELEWSKI, 1984

Material. Karkonosze Mts: 1 sample, 9 specimens. Fairly eutrophicated environment (30).

The species, described in a separate paper, is known only from the locality mentioned above. It was found only in one of four examined sub-samples, where its estimated abundance amounted to 22.5 specimens/cm³ of slime. The only accompanying species was *Ch. disiunctus*, whose abundance in the same sub-sample amounted to 90 specimens/cm³.

20. *Ch. formosus* STOKES, 1887

Material. Tatra Mts: 1 specimen. Fairly eutrophicated environment (23).

The species was described from the United States, yet no picture was provided. The description was supplemented and the pictures were provided by CORDERO (1918) on the basis of specimens sampled in South America and by BRUNSON (1950) after having re-recorded the species in the United States. *Ch. formosus* was also reported by DADAY (1910) from East Africa, yet the description he supplied did not correspond to the two redescriptions.

The specimen sampled in the Tatra Mountains matches the description by CORDERO as regards main diagnostic features. The species is new to European gastrotrichan fauna.

Genus *Heterolepidoderma* REMANE

21. *H. macrops* KISIELEWSKI, 1981

Material. Tatra Mts: 1 sample, 9 specimens. Fairly eutrophicated environment (8).

The species was described on the basis of one specimen sampled on peat-bog overgrown with spruce trees in north-eastern Poland (KISIELEWSKI 1981), and subsequently also recorded by KISIELEWSKA (1982) as a scarce species in peat-hags near Siedlce.

22. *H. majus* REMANE, 1927

Material. Tatra Mts: 1 sample, 3 specimens. Fairly eutrophicated environment (8). Karkonosze Mts: 1 sample, 10 specimens. Fairly eutrophicated environment (31).

The species was described from an eutrophic water body, and was subsequently found in Japan, where it occurred in a fertile water body among vegetation (SAITO 1937). *H. majus* commonly occurs on transitional peat-bogs in lowland Poland, displaying a tendency to penetrate fairly eutrophicated non-peat-bog environments (KISIELEWSKI 1981).

23. *H. ocellatum* (MEČNIKOV) sensu KISIELEWSKI 1981

Material. Tatra Mts: 2 localities, 2 samples, 8 specimens. Dystrophic lake (1), fairly eutrophicated environment 18). Karkonosze Mts: 4 localities, 4 samples, 8 specimens. Oligotrophic lake (27), spring (32), streams (29, 33),

KISIELEWSKI (1981) recorded this species as one of the most common gastrotrichs in all types of raised and transitional peat-bogs in Poland. The author noted this species to occur in peat-bogs overgrown with spruce trees

in Sudeten near Duszniki Zdrój. A single specimen of *H. ocellatum* was also sampled by KISIELEWSKA (1982) in a peat-hag near Siedlce. Numerous records reported by former authors are not referred to in the present paper as their identity with the species in question is questionable (KISIELEWSKI 1981).

24. *H. ocellatum* (MEČNIKOV) f. *sphagnophilum* KISIELEWSKI, 1981

Material. Tatra Mts: 1 specimen. Dystrophic lake (1).

The species was reported from peat-bogs in Poland as one of the most numerous gastrotrichan species of this environment. Its most numerous occurrence was recorded in all types of raised peat-bogs, where it was the prevailing form of gastrotrichan community typical for this peat-bog group. It is the most common gastrotrichan species of mountain peat-bogs, where it was regularly sampled both in Carpathians and in Sudeten (KISIELEWSKI 1981).

Genus *Lepidodermella* BLAKE

25. *L. minus* (REMANE, 1936)

Material. Tatra Mts: 2 localities, 2 samples, 2 specimens (out of which one came from the aquarium cultures). Fairly eutrophicated environment (8, 23).

The species was described from Germany, yet the locality and the environment were not stated. The only one later record of its occurrence included one specimen sampled on a transitional peat-bog in Great Poland (KISIELEWSKI 1981).

26. *L. squamatum* (DUJARDIN, 1841)

Material. Tatra Mts: 3 localities, 4 samples, 7 specimens. Oligotrophic lakes (14, 22, 24).

Undoubtedly a cosmopolitan and eurytopic species. In Poland it was recorded in numerous water bodies in Great Poland (ROSZCZAK 1968); its smaller numbers were noted in transitional peat-bogs all over lowland (KISIELEWSKI 1981) and in peat-hags in eastern Poland (KISIELEWSKA 1982).

Genus *Aspidiophorus* VOIGT

27. *A. ophiodermus* BALSAMO, 1983

Material. Karkonosze Mts: 1 locality, 2 samples, 7 specimens. Fairly eutrophicated environment (31).

The species has been recently described from lakes in Appenines. The specimens found in Poland are described in a separate paper (KISIELEWSKI 1986).

28. *A. oculifer* KISIELEWSKI, 1981

Material. Tatra Mts: 1 locality, 2 samples, 2 specimens. Fairly eutrophicated environment (8). Karkonosze Mts: 2 localities, 2 samples, 3 specimens. Oligotrophic lakes (27, 28).

The species was described from transitional peat-bogs of lowland Poland. It displays a tendency to penetrate fairly eutrophicated environments (KISIELEWSKI 1981).

29. *A. polonicus* KISIELEWSKI, 1981

Material. Tatra Mts: 1 specimen. Fairly eutrophicated environment (23).

The species was described as rare from three transitional peat-bogs in lowland Poland (KISIELEWSKI 1981).

30. *A. tatraensis* KISIELEWSKI, 1986

Material. Tatra Mts: 1 sample, 3 specimens. Fairly eutrophicated environment (23).

The species is described in a separate paper. So far it has been recorded only in the locality mentioned above, where it occurred in small numbers along with other 9 species, the most numerous having been *Chaetonotus disiunctus*, *Ch. macrochaetus* and *Ch. oculifer*.

31. *A. tetrachaetus* KISIELEWSKI, 1986

Material. Karkonosze Mts: 1 locality, 2 samples, 12 specimens (including 8 from the aquarium cultures). Oligotrophic lake (27).

The species is described in a separate paper. So far it has been recorded solely in the locality mentioned above, where its abundance amounted to 2.1 specimens/cm³ of slime. The sample where it was found contained three other species (*Chaetonotus oculifer*, *Heterolepidoderma ocellatum* and *Aspidiophorus oculifer*), the first being the most numerous (8.2 specimens/cm³).

Genus *Ichthydium* EHRENBERG

32. *I. ?maximum* GREUTER, 1917

Material. Tatra Mts: 1 sample, 2 specimens. Fairly eutrophicated environment (8).

The species was described from Switzerland, subsequently reported from Romania (RUDESCU 1967) and Japan (SAITO 1937). It occurs in water body slime and among peat-mosses on peat-bogs. In Poland recorded by ROSZCZAK (1968) at two localities in central Great Poland.

33. *I. palustre* KISIELEWSKI, 1981

Material. Tatra Mts: 1 sample, 2 specimens. Fairly eutrophicated environment (8).

The species was described from lowland transitional peat-bogs in Poland, where it occurs regularly, though in small numbers (KISIELEWSKI 1981). KISIELEWSKA (1982) also reported it from peat-hags near Siedlce.

CHARACTERISTICS OF OCCURRENCE

General remarks

Out of the 33 denoted forms belonging to 32 species, 30 were recorded in the Tatra and 11 in the Karkonosze Mountains. Three new taxa were identified, i. e. *Aspidiophorus tatraensis* in the Tatra Mountains and *A. tetrachaetus* and *Chaetonotus sudeticus* in the Karkonosze Mountains. 3 other species were reported as new to the fauna of Poland (*Chaetonotus uncinus*, *Ch. formosus*

and *Aspidiophorus ophiodermus*). All the recorded species belonged to the family *Chaetonotidae*. Most puzzling is the absence of other families, the family *Dasydytidae* in particular, whose representatives occur regularly at the majority of environments in lowland Poland, and, according to KISIELEWSKA (1982), prevail among other families in some peat-hags near Siedlce during the entire year-long cycle. Attention should also be paid to the fact that the present research did not record any representatives of the genus *Polymerurus* REMANE, though, alike the family *Dasydytidae*, specimens belonging to this genus were regularly found in lowland Poland. It should be emphasized that in the course of his studies on mountain peat-bogs in Sudeten and Carpathians, KISIELEWSKI (1981) reported the absence of representatives of the family *Dasydytidae* and the genus *Polymerurus*. Other species not found in mountain waters though commonly and numerously occurring in lowland Poland, was *Heterolepidoderma gracile* REMANE.

Characteristics of fauna of particular environments

Out of the three types of the examined substrates, only bottom slime contained gastrotrichs. Examinations of a few samples containing gravel and moss gave negative results. As it has been mentioned above, the research sites included mainly primarily oligotrophic lakes situated in higher mountain parts, pure mountain springs and streams and much eutrophicated water bodies located at lower altitudes. The characteristics of gastrotrichan occurrence in these environments as well as in those less thoroughly examined, is supplied in Tables II–IV.

Table II. Occurrence of different species in the studied environments (abbreviations: T – Tatra, K – Karkonosze).

No	Species	Oligotrophic lakes		Springs		Streams		Eutrophicated water bodies		Dystrophic lake	Stream from transitional peat-bog
		T	K	T	K	T	K	T	K	T	T
1	2	3	4	5	6	7	8	9	10	11	12
1	*Chaetonotus armatus*	+									
2	*Ch. disiunctus*	+		+				+	+		
3	*Ch. heideri*							+			
4	*Ch. heteracanthus*	+						+			

Table II – cont.

1	2	3	4	5	6	7	8	9	10	11	12
5	*Ch. maximus*	+		+		+		+			
6	*Ch. oculifer*	+	+		+		+	+	+	+	+
7	*Ch. polyspinosus*							+			
8	*Ch. poznaniensis*							+			
9	*Ch. rafalskii*							+			
10	*Ch. similis*	+	+						+		
11	*Ch. sphagnophilus*							+			
12	*Ch. zelinkai*	+						+			+
13	*Ch. novenarius*							+			
14	*Ch. hystrix*	+		+				+			
15	*Ch. macrochaetus*	+	+		+			+	+		
16	*Ch. persetosus*							+			+
17	*Ch. acanthodes*		+					+	+		
18	*Ch. uncinus*							+			
19	*Ch. sudeticus*								+		
20	*Ch. formosus*							+			
21	*Heterolepidoderma macrops*							+			
22	*H. majus*							+	+		
23	*H. ocellatum*		+		+		+	+		+	
24	*H. ocellatum* f. *sphagnophilum*									+	
25	*Lepidodermella minus*							+			
26	*L. squamatum*	+									

Table II — cont.

1	2	3	4	5	6	7	8	9	10	11	12
27	*Aspidiophorus ophiodermus*								+		
28	*A. oculifer*		+					+			
29	*A. polonicus*							+			
30	*A. tatraensis*							+			
31	*A. tetrachaetus*		+								
32	*Ichthydium maximum*							+			
33	*I. palustre*							+			
		10	7	3	3	1	2	26	8	3	3
		14		6		3		29		3	3

The most abundant gastrotrichan fauna was found in much eutrophicated waters, where 29 forms were recorded out of 33 denoted. In oligotrophic lakes, as well as in springs and streams, all together 14 species occurred, out of which all were found in lakes, but only 6 in springs and streams.

Oligotrophic lakes

Among all the species found in this environment, three (*Chaetonotus armatus* and *Lepidodermella squamatum* in the Tatra and *Aspidiophorus tetrachaetus* in the Karkonosze Mountains) were not recorded to occur in other environments under studies. The first of the distinguished species is bound to lowland peat-bogs, while in the Karkonosze Mountains it was previously reported from a highland oligotrophic peat-bog of the subalpine type (KISIELEWSKI 1981). As recorded in the present studies, the occurrence of 2 specimens only in the aquarium culture and a long time after sampling at that, does not point to any tight connection of this species to oligotrophic lakes. *L. squamatum* seemed to be a typical element of the Tatra oligotrophic lakes, as it was found in three of them. As regards species which occurred also in fairly eutrophicated waters under studies, *Chaetonotus maximus* and *Ch. macrochaetus* seem to be bound to oligotrophic lakes rather than to more fertile waters.

The abundance of gastrotrichs in the discussed biotope was very little. Its mean values amounted to 5.3 specimens/cm^3 of slime in the Tatra and 7.3 in the Karkonosze Mountains, never exceeding 13.0 and 13.8 respectively. The estimated values were at least two times lower than those calculated for

the majority of more eutrophicated environments under studies, both as regards the mean and the highest estimated values.

If the oligotrophic lakes of each of the two massifs were considered to be a homogenous environment and the sampled material was examined jointly, then the general fauna diversity index would total $H' = 1.63$ for the Tatra and 1.68 for the Karkonosze Mountains. The value of this index is markedly lower than that calculated for evenly developing more eutrophicated waters of the same area (localities No 23 and 31). The present values are also lower than those estimated for fertile *Sphagnum* peat-bogs. The value of the H' index calculated by KISIELEWSKI (1981) in total for the entire biotope of transitional peat-bogs amounted to 2.64 and to 1.98 for raised peat-bogs of the Baltic type. The values calculated for oligotrophic lakes approximate those estimated for much eutrophicated peat-hags in lowland Poland (KISIELEWSKA 1982)[1].

Springs and streams

Among the six recorded species occurring in the environment group, the most common was *Chaetonotus maximus* in the Tatra and *Heterolepidoderma ocellatum* in the Karkonosze Mountains. The environments in question were noted for the greatest number of quantitative samples which contained no *Gastrotricha* specimens at all, i. e. the "void" samples accounted for 58% in springs and for 38% in streams. The abundance values were the lowest ever recorded in quantitative studies on freshwater *Gastrotricha*, amounting in springs to average 1.1 specimens/cm³ of slime in the Tatra and to 0.7 in the Karkonosze, while in streams they amounted to 2.9 and 1.8 respectively.

Stagnant much eutrophicated water bodies

As it has been mentioned above, this heterogenous as regards their character, group of environments was most abundant in gastrotrichan species. The following species were recorded solely in the fairly eutrophicated basins under studies: *Chaetonotus heideri*, *Ch. polyspinosus*, *Ch. poznaniensis*, *Ch. rafalskii*, *Ch. sphagnophilus*, *Ch. novenarius*, *Ch. uncinus*, *Ch. sudeticus*, *Ch. formosus*, *Heterolepidoderma macrops*, *H. majus*, *Aspidiophorus polonicus*, *A. tatraensis*, *Ichthydium? maximum* and *I. palustre*.

The range of abundance values was wide. In strongly man-affected barrier basins these values amounted to 2.1 specimens/cm³ in the Tatra (locality No

[1] The value of H' index was not calculated in the quoted paper, yet it may be easily estimated on the basis of data on domination structure in May through October. Thus the value of this index for particular months in the meadow complex (termed as A complex) ranged 1.32–1.72 (1.46 the mean value) and in the afforested B complex – 1.28–1.69 (1.45 the mean value). A relatively high contribution of unidentified specimens betokens actually somewhat greater values than the calculated ones.

Table III. Structure of dominance (in per cent).

No	Species	Oligotrophic lakes		Eutrophicated water bodies			
				Tatra		Karkonosze	
		Tatra tot.	Karkonosze tot.	loc. 8	loc. 23	loc. 30	loc. 31
1	2	3	4	5	6	7	8
1	*Chaetonotus disiunctus*	2.3			40.9	82.0	
2	*Ch. heideri*			1.9			
3	*Ch. heteracanthus*	2.3			2.3		
4	*Ch. maximus*	38.6			4.5		
5	*Ch. oculifer*	2.3	43.2	3.7	6.8		4.7
6	*Ch. polspinosus*			20.4	4.5		
7	*Ch. poznaniensis*				6.8		
8	*Ch. rafalskii*			1.9			
9	*Ch. similis*	2.3	13.5				16.3
10	*Ch. sphagnophilus*				2.3		9.3
11	*Ch. zelinkai*	4.5		3.7			
12	*Ch. novenarius*			1.9			
13	*Ch. hystrix*	4.5			2.3		
14	*Ch. macrochaetus*	25.0	10.8	5.6	13.6		2.3
15	*Ch. persetosus*			1.9			
16	*Ch. acanthodes*		5.4	7.4			7.0
17	*Ch. uncinus*				2.3		
18	*Ch. sudeticus*					18.0	
19	*Ch. formosus*				2.3		
20	*Ch.* sp. 1	2.3					
21	*Ch.* sp. 2			1.9			
22	*Ch.* sp. 3			1.9			
23	*Ch.* sp. 4				2.3		
24	*Ch.* sp. 5						14.0
25	*Ch.* sp. 6						7.0
26	*Heterolepidoderma macrops*			16.7			

Table III — cont.

1	2	3	4	5	6	7	8
27	*H. majus*			5.6			23.3
28	*H. ocellatum*		8.1	13.0			
29	*Lepidodermella minus*			1.9			
30	*L. squamatum*	15.9					
31	*Aspidiophorus ophiodermus*						16.3
32	*A. oculifer*		8.1	3.7			
33	*A. polonicus*				2.3		
34	*A. tetrachaetus*		10.8				
35	*A. tatraensis*				6.8		
36	*Ichthydium ?maximum*			3.7			
37	*I. palustre*			3.7			
	tot.	100.0	99.9	100.5	100.0	100.0	100.2

5) and 34.4 in the Karkonosze Mountains (locality No 30). The values calculated for the more evenly developing water bodies of a more natural character, varied within a much narrower range, amounting to 9.8–17.6 specimens/cm^3 of slime (localities No 8, 23 and 31). The only environment which had been subject to quantitative studies carried out in an alike manner, were peat-hags in lowland Poland (KISIELEWSKA 1982). The values estimated by the quoted author were notably higher in both of the examined groups of peat-hags, amounting to average 39.0 and 61.4 respectively for each of the two complexes in April through December.

The value of the general diversity index H' in evenly developing fairly eutrophicated water bodies was high, ranging 2.03–2.54 for particular basins. The greatest value was estimated for the Staw Toporowy Niżni in the Tatra (locality No 8) and approximated the higest values of H′ ever recorded during earlier studies on other environments, i. e. those calculated by KISIELEWSKI (1981) for transitional peat-bogs and amounting to $H' = 2.64$ (for all the fauna in total). It should be emphasized that the fauna of the gastrotrichan community *Heterolepidoderma majus*, distinguished by KISIELEWSKI (1981) and widespread in transitional peat-bogs, also occurred in the Staw Toporowy Niżni. Out of eight species considered by KISIELEWSKI as characteristic for this community, six were found in the studied Tatra water body. Hence it may be concluded that the community *H. majus* may also occur in fertile water bodies which do not rank among *Sphagnum* peat-bogs.

A dystrophic lake

In the only one typical dystrophic lake (Smreczyński Staw, the Tatra, locality No 1), the three following forms were found to occur: *Chaetonotus oculifer*, *Heterolepidoderma ocellatum* and *H. ocellatum* f. *sphagnophilum*. All of them were reported as characteristic for *Sphagnum* peat-bogs (KISIELEWSKI 1981). Their occurrence in a dystrophic lake was certainly conditioned by the presence of peat-generating vegetation skirting the lake shores.

A water course issuing from a transitional peat-bog

The three following species were recorded to occur in one of the samples taken from this environment (locality No 10, the Tatra), namely, *Chaetonotus oculifer*, *Ch. zelinkai* and *Ch. persetosus*. All of them had been previously reported from *Sphagnum* peat-bogs (KISIELEWSKI 1981).

Other environments

Apart from the above-discussed biotopes, individual samples were also taken from two other environments in the Tatra Mountains. They included a quagmire (locality No 9) and a slope overgrown with moist mosses (locality No 19). In none of the environments gastrotrichs were found.

DIFFERENCES BETWEEN THE TATRA AND KARKONOSZE FAUNA

30 denoted forms were recorded in the Tatra and 11 in the Karkonosze Mountains. A considerably greater number of gastrotrichan species recorded in the Tatra was caused by the fact that the studies conducted there included the examination of two fairly eutrophicated water bodies abounding in species (localities No 8 and 23).

As regards primeval oligotrophic environments of two mountain massifs, i. e. mountain lakes, streams and springs, they significantly differed in their species composition. Out of 14 species recorded to occur in oligotrophic lakes only three were common for the two studied massifs, i. e. *Chaetonotus oculifer*, *Ch. similis* and *Ch. macrochaetus*. The difference was even more pronounced in case of springs and streams, i. e. among the 6 species reported from this environment group, three occurred only in the Tatra (*Chaetonotus disiunctus*, *Ch. maximus* and *Ch. hystrix*) and the remaining three were found only in the Karkonosze Mountains (*Chaetonotus oculifer*, *Ch. macrochaetus* and *Heterolepidoderma ocellatum*). It is worth mentioning that the species composition of the Karkonosze lakes, springs and streams much resembled the *Sphagnum* peat-bog fauna. Out of the 7 species recorded in the Karkonosze Mountains one (*Chaetonotus macrochaetus*) is characteristic for the *Heterolepidoderma ocellatum* f. *sphagnophilum* community, while three others (*Chaetonotus oculi-*

Table IV. Number of species, abundance and diversity index of the *Gastrotricha* in the studied environments (in parentheses: number of samples, in square brackets: number of localities).

No	Environment	Mountain group	Locality No	No of species and forms	Abundance (specimens/cm³)			H'
					mean of all samples	mean of positive samples	max.	
1	2	3	4	5	6	7	8	9
1	Oligotrophic lakes	Tatra	11	1	5.5 (1)	5.5 (1)	5.5	
			12	1	5.0 (1)	5.0 (1)	5.0	
			13	2	4.4 (1)	4.4 (1)	4.4	
			14	4	13.0 (1)	13.0 (1)	13.0	
			15	1	2.0 (1)	2.0 (1)	2.0	
			18	0	0.0 (1)	—	—	
			20	2	12.0 (1)	12.0 (1)	12.0	
			22	1	6.0 (1)	6.0 (1)	6.0	
			24	4	4.0 (2)	4.0 (2)	5.4	
			25	1	1.2 (1)	1.2 (1)	1.2	
			tot. mean	8	5.3 [10]	5.9 [9]	13.0	1.63
		Karkonosze	26	0	0.0 (1)	—	—	
			27	4	13.8 (1)	13.8 (1)	13.8	
			28	4	8.1 (1)	8.1 (1)	8.1	
			tot. mean	7	7.3 [3]	11.0 [2]	13.8	1.68
2	Springs	Tatra	2	1	0.5 (3)	1.5 (1)	1.5	
			3	1	2.0 (1)	2.0 (1)	2.0	
			4	0	0.0 (2)	—	—	
			6	2	2.0 (2)	4.0 (1)	4.0	
			tot. mean	4	1.1 [4]	2.5 [3]	4.0	?
		Karkonosze	32	3	2.0 (2)	2.0 (2)	2.0	
			34	0	0.0 (1)	—	—	
			36	0	0.0 (1)	—	—	
			tot. mean	3	0.7 [3]	2.0 [1]	2.0	?
3	Streams	Tatra	7	0	0.0 (1)	—	—	
			16	1	3.8 (3)	11.4 (1)	11.4	
			17	1	5.0 (1)	5.0 (1)	5.0	
			tot. mean	1	2.9 [3]	8.2 [2]	11.4	?
		Karkonosze	29	2	1.2 (1)	1.2 (1)	1.2	
			33	1	2.5 (2)	2.5 (2)	2.5	
			tot. mean	2	1.8 [2]	1.8 [2]	2.5	?
4	Eutrophicated water bodies	Tatra	5	1	2.1 (1)	2.1 (1)	2.1	?
			8	17	9.8 (4)	13.1 (3)	20.0	2.54
			23	13	17.6 (4)	17.6 (4)	29.1	2.08
		Karkonosze	30	2	34.4 (1)	34.4 (1)	34.4	0.47
			31	7	14.3 (1)	14.3 (1)	14.3	2.03

Table IV — cont.

1	2	3	4	5	6	7	8	9
5	Dystrophic lake	Tatra	1	3	3.5 (1)	3.5 (1)	3.5	?
6	Stream from transitional peat-bog	Tatra	10	3	3.0 (1)	3.0 (1)	3.0	?

fer, *Ch. acanthodes* and *Heterolepidoderma ocellatum*) are the species characteristic for the *Ichthydium forficula* community. The two communities in question commonly occur in *Sphagnum* peat-bogs and in their more oligotrophic types in particular (KISIELEWSKI 1981). The similarity of the gastrotrichan fauna of the Karkonosze water bodies to that of peat-bogs results from a pronouncedly peaty character of the studied mountain area. Notwithstanding considerable differences in the species structures of both of the compared mountain massifs, the estimated values of gastrotrichan abundance in oligotrophic environments were approximately the same, similarly as the values of the general diversity index H' calculated for the studied lakes of the two mountain complexes.

REFERENCES

BALSAMO M. 1978. Prime ricerche sui Gastrotrichi dulciacquicoli italiani. Atti Soc. tosc. Sci. nat., B, Pisa, **84**: 87–150.

BALSAMO M. 1981. Gastrotrichi della Toscana: il Lago di Sibolla. Mem. Mus. civ. Stor. nat., Verona, **7**: 547–571.

BALSAMO M. 1983a. Three new gastrotrichs from a Tuscan-Emilian Apennine lake. Boll. Zool., Torino, **49**: 287–295.

BALSAMO M. 1983b. Gastrotrichi (*Gastrotricha*). Guide per il riconoscimento delle specie animali della acque interne Italiane, **20**. Verona, 92 pp.

BREHM V. 1917. Ergebnisse einiger im Franzensbader Moor unternommener Exkursionen. Arch. Hydrobiol., Stuttgart, **11**: 306–363.

BRUNSON R. B. 1950. An introduction to the taxonomy of the *Gastrotricha* with a study of eighteen species from Michigan. Trans. Amer. micr. Soc., Menasha, **69**: 325–352, 10 tt.

CORDERO E. H. 1918. Notes sur les Gastrotriches. Physis, Buenos Aires, **4**: 241–255.

DADAY E. 1905. Untersuchungen über die Süsswasser-Microfauna Paraguays, 4. Kl., *Nematorhyncha*. Zoologica, Stuttgart, **18**, 44: 72–86.

DADAY E. 1910. Untersuchungen über die Süsswasser-Mikrofauna Deutsch-Ost-Afrikas. Zoologica, Stuttgart, **23**, 59.

EMBERTON K. C. 1981. First record of *Chaetonotus heideri* (*Gastrotricha*: *Chaetonotidae*) in North America. Ohio J. Sci., Columbus, **81**: 95–96.

GIEYSZTOR M. 1962. Życie zwierzęce w wodach tatrzańskich. In: Tatrzański Park Narodowy, Wydawn. pop.-nauk. PAN, Kraków, **21**: 485–522.

Greuter A. 1917. Beiträge zur Systematik der Gastrotrichen in der Schweiz. Rev. suisse Zool., Genève, **25**: 37–76.

d'Hondt J.-L. 1967. Documents sur les Gastrotriches dulcicoles des eaux françaises. Ann. limnol., **3**: 381–397.

Kisielewska G. 1981. *Chaetonotus rectaculeatus* – a new species of *Gastrotricha*. Bull. Acad. pol. Sci., Biol., Varsovie, **29**: 163–166, 2 ff.

Kisielewska G. 1982. *Gastrotricha* of two complexes of peat hags near Siedlce. Fragm. faun., Warszawa, **27**: 39–57.

Kisielewski J. 1974. Nowe dla fauny Polski gatunki brzuchorzęsków (*Gastrotricha*) słodkowodnych. Bad. fizjogr. Pol. zach., C, Poznań, **27**: 103–111.

Kisielewski J. 1979. New and insufficiently known freshwater *Gastrotricha* from Poland. Ann. zool., Warszawa, **34**: 415–435.

Kisielewski J. 1981. *Gastrotricha* from raised and transitional peat bogs in Poland. Monogr. Fauny Pol., **11**, Kraków, 143 pp.

Kisielewski J. 1984. Three new freshwater gastrotrichs of the genus *Chaetonotus* Ehrenberg (*Chaetonotida*) from Poland. Bull. Acad. pol. Sci., Biol., Varsovie, **32**: 293–301.

Kisielewski J. 1986. Taxonomic notes on freshwater gastrotrichs of the genus *Aspidiophorus* Voigt (*Gastrotricha, Chaetonotidae*), with descriptions of four new species. Fragm. faun., Warszawa, **30**: 139–156.

Konsuloff S. 1913. Notizen über die Gastrotrichen Bulgariens. Zool. Anz., Leipzig, **43**: 255–260.

Lucks R. 1909. Neues aus Mikrofauna Westpreussens. Ber. westpr. bot.-zool. Ver., Danzig, **31**: 136–142.

Mola P. 1932. *Gastrotricha* della aqua dolci italiane. Int. Rev. Hydrobiol., Leipzig, **26**: 397–423.

Passendorfer E. 1962. Z przeszłości geologicznej Tatr. In: Tatrzański Park Narodowy, Wydawn. pop.-nauk. PAN, Kraków, **21**: 71–104.

Peet R. K. 1975. Relative diversity indices. Ecology, Brooklyn, **56**: 496–498.

Preobraženskaja E. N. 1926. Zur Verbreitung der Gastrotrichen in den Gewässern der Umgebung zu Kossino. Arb. biol. Stat. Kossino, Moskva, **4**: 3–14.

Remane A. 1927. Beiträge zur Systematik der Süsswassergastrotrichen. Zool. Jb. Syst., Jena, **53**: 269–320.

Robbins C. E. 1973. *Gastrotricha* from Illinois. Trans. Ill. Acad. Sci., Springfield, **66**: 124–126.

Roszczak R. 1935. Brzuchorzęski (*Gastrotricha*) zbiorników wodnych okolic Poznania. Spraw. Pozn. TPN, Poznań, **24**: 109–111.

Roszczak R. 1968. Brzuchorzęski (*Gastrotricha*) Środkowej Wielkopolski. Pr. Kom. biol. Pozn. TPN, Poznań, **32**, 6, 92 pp.

Roszczak R. 1971. *Metadasydytes quadrimaculatus* g. n., sp. n. (*Gastrotricha*). Bull. Acad. pol. Sci., Biol., Varsovie, **19**: 65–66.

Rudescu L. 1967. *Gastrotricha*. Fauna Republicii Socialiste România, 2, 3. București.

Saito J. 1937. Neue und bekannte Gastrotrichen der Umgebung von Hiroshima (Japan). J. Sci. Hiroshima Univ., Hiroshima, **1**: 245–265.

Steinecke F. 1924. Die Rotatorienfauna von Ostpreussen. Schr. phys.-ökon. Ges., Königsberg. **4**, 1.

Stokes A. C. 1887. Observations sur les *Chaetonotus*. J. Microgr., Paris, **11**: 560–565.

Varga L. 1959. *Gastrotricha* – Csilloshasuak. Magyarország Állatvilága, **3**, 9. Budapest, 41 pp.

Varga L. 1960. Über die Mikrofauna der Waldstreu einiger auf Szikböden angelegter Waldtypen. Act. zool. Acad. Sci. hung., Budapest, **6**: 211–225.

Voigt M. 1904. Die Rotatorien und Gastrotrichen der Umgebung von Plön. Forschungs. biol. Stat., Plön, **11**: 126–180.

Voigt M. 1958. Gastrotrichen. Die Tierwelt Mitteleuropas, **1**, 4a, Leipzig.

Wit-Jóźwikowa K., Ziemońska. 1962. Hydrografia Tatr Polskich. In: Tatrzański Park Narodowy, Wydawn. pop.-nauk. PAN, Kraków, **21**: 125–138.
Zelinka C. 1889. Die Gastrotrichen. Eine monographische Darstellung ihrer Anatomie Biologie, und Systematik. Z. wiss. Zool., Leipzig, **49**: 209–384.

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STRESZCZENIE

[Tytuł: *Gastrotricha* słodkowodne Polski. I. *Gastrotricha* Tatr i Karkonoszy]

Autorzy przeprowadzili badania brzuchorzęsków w jeziorach oligotroficznych, potokach, źródłach, zbiornikach silniej zeutrofizowanych i innych środowiskach w Tatrach i Karkonoszach. Stwierdzili 39 gatunków należących w całości do rodziny *Chaetonotidae*, z czego oznaczyli 33. Jeden gatunek tatrzański (*Aspidiophorus tatraensis*) i dwa karkonoskie (*A. tetrachaetus* i *Chaetonotus sudeticus*) są nowe dla nauki, *Ch. formosus* jest gatunkiem nowym dla Europy, a *Ch. uncinus* i *Aspidiophorus ophiodermus* nowe dla fauny Polski.

Fauna wód oligotroficznych (jezior, potoków i źródeł) jest nieliczna gatunkowo; stwierdzono tu tylko 14 gatunków, spośród których wszystkie występowały w jeziorach oligotroficznych, a tylko 6 w źródłach i potokach. Liczebność brzuchorzęsków była najniższa w źródłach (w Tatrach średnio 1,1 osobnika /cm³ mułu, a w Karkonoszach 0,7), nieco wyższa w potokach (odpowiednio 2,9 i 1,8), a w jeziorach osiągnęła wartości odpowiednio 5,3 i 7,3. Ogólny wskaźnik różnorodności gatunkowej H' osiągnął dla jezior wartości odpowiednio 1,63 i 1,68.

Znacznie bogatsza pod względem jakościowym jest fauna wód silniej zeutrofizowanych. Autorzy stwierdzili tu 29 spośród 33 oznaczonych gatunków. Liczebność jest tu również wyższa i osiąga dla poszczególnych naturalnych zbiorników tego typu wartości średnie 9,8–17,6 osobnika/cm³ mułu. Zbiornikiem o najbogatszej faunie Gastrotricha okazał się Staw Toporowy Niżni w Tatrach. Jest on zasiedlony przez zgrupowanie *Heterolepidoderma majus*, a ogólny wskaźnik różnorodności gatunkowej H' osiąga tu wysoką wartość 2,54.

W jedynym badanym jeziorze dystroficznym występuje fauna charakterystyczna dla torfowisk sfagnowych.

Zaznacza się wyraźna różnica w składzie gatunkowym między fauną wód oligotroficznych Tatr i Karkonoszy. W wodach tych w Karkonoszach żyje wiele gatunków związanych z torfowiskami sfagnowymi, co prawdopodobnie wiąże się z dużym stopniem zatorfienia terenu.

РЕЗЮМЕ

[Заглавие: Пресноводные *Gastrotricha* Польши. I. *Gastrotricha* Татр и Карконошей]

Авторы исследовали брюхоресничных в олиготрофных озерах, потоках, источниках, значительно эвтрофных водоемах и иных биотопах в горах Татры и Карконоши. Констатировали 39 видов полностью принадлежащих к семейству *Chaetonotidae*, определили 33 вида из найденных. Один вид из Татр (*Aspidiophorus tatraensis*) и два из Карконошей (*A. tetrachaetus* и *Chaetonotus sudeticus*) являются новыми для науки, *Ch. formosus* является новым видом для Европы, а *Ch. uncinus* и *Aspidiophorus ophiodermus* новыми для фауны Польши.

Фауна олиготрофных водоемов (озера, потоки и источники) бедна видами; найдено тут только 14 видов, среди которых все встречались в олиготрофных озерах, а только 6 в источниках и потоках. Самая низкая численность брюхоресничных была отмечена в источниках (в Татрах в среднем 1,1 особи/см^3 ила, в Карконошах 0,7), несколько выше была в потоках (соответственно 2,9 и 1,8), в озерах достигала соответственно численности 5,3 и 7,3. Общий показатель видового разнообразия H' достиг для озер величины: в Татрах 1,63 и Карконошах 1,68.

Значительно богаче в качественном отношении фауны значительно эвтрофных вод. Авторы констатировали тут 29 видов из 33 определенных. Численность видов была тут также выше и достигала для отдельных природных водоемов этого типа среднюю величину 9,8–17,6 особи/см^3 ила. Наиболее богатым в представителей фауны *Gastrotricha* оказался пруд Топоровы-Нижни в Татрах. Заселяет его комплекс *Heterolepidoderma majus*, а общий показатель видового разнообразия H' достигает большой величины — 2,54.

В единственном исследованном дистрофном озере встречается фауна, характерная для сфагновых торфяников.

Наблюдается четкое различие видового состава между фауной олиготрофных вод Татр и Карконошей. В Карконошах есто много видов, связанных со сфагновыми торфяниками, что, видимо связано со значительным развитием торфяников в этом регионе.

Praca wykonana w ramach problemu MR II-3.
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