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Zbiorowiska glonów w dolnej części potoku Rogoźnik — Communities of algae in the lower part of the Rogoźnik stream

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The waters of the Dunajec basin are not very well known from the microfloristic and microfaunistic point of view. Many streams and rivers still await investigation and study. This is the more urgent as industrial investments planned in the Podhale (submontane region of the Tatras) may entirely alter the biological structure of these waters. This was the reason which induced the Chair of Hydrobiology of the Jagellonian University and the Laboratory of Water Biology of the Polish Academy of Sciences to undertake systematic investigations of the flora and fauna of the whole Dunajec basin. The present work is a small contribution to the cognition of the flora of algae in this terrain. Its aim was the investigation of communities of algae settled in the lower part of the Rogoźnik stream.

Characteristics of the stream

The Rogoźnik stream is an affluent of the Czarny Dunajec. It flows out from the slope of the Gubałówka ridge (995 m above sea level). The Gubałówka ridge extends between two streams, the Biały Dunajec and Czarny Dunajec and is composed of easily destructible Eocene sands and flish slate. The surface is covered with a thin layer of clay and therefore the waters of the Rogoźnik basin are characterised by a small retention of rainwater. The springs of the Gubałówka ridge form small streams which join together into two streams: the Bystry, 13 km long, and the Cichy with a length of 13.5 km. These in turn unite, forming the Rogoźnik Wielki, 11.9 km long. The Rogoźnik Wielki flows through the northern slopes of the Gubałówka ridge, whence it collects rainwater and its affluent, the 16.8 km long Rogoźnik Mały, 2 km above the locality Ludzimierz (600 m above sea level) where it falls into the Czarny Dunajec. The basin of the Rogoźnik is a part of the Czarny Dunajec basin, belonging to that of the Wisła river.

The surface of the basin of Rogoźnik Wielki is 184.86 km² with a density of the river net amounting to 1.55 km/km (F i g u ł a 1961). The fall in profile is 395 m, the gradient 15.5‰, mean gradients of affluents of the Rogoźnik are contained within the range 45 and 21‰, the bed being 0.3—10 m broad and 0.1 to 0.9 m deep at normal water level. The rapidity of the current fluctuates between 0.15—0.56 m/sec, the normal flow being 0.59 m/sec. The minimum current rapidity is 0.34 m/sec, the maximum 1.46 m/sec. The mean figure of precipitation in the area of the Rogoźnik basin is 800—900 mm and increases with altitude. The monthly disposition of precipitation shows a maximum during the summer months, in July and sometimes in June (134—141 mm) and a minimum (46—52 mm) in December (F i g u ł a 1961). The highest water level occurs during summer, the lowest — in winter. The annual fluctuations of the water level are high and amount to 0.8 m. This results from considerable precipitations the small retentiveness of the substratum (7.6 per cent of annual precipitation) and relatively large gradients (T u r k i e w i c z, C h r u p k o w a 1953).

The temperature of the water in the stream is more than 10°C in summer and subject to considerable fluctuations depending on the temperature of the air. The temperature of the air during July, the warmest month, fluctuates from 13 to 19°C, and in January, the coldest month, it is 3 to 6°C. The mean annual temperature of the air is 5.9°C (Z i e m o ń s k a, W i t 1960).

The relation of the lotic zone to the lenitic one in the upper regions of the stream is 1 : 5, in the lower parts 1 : 3.

The bottom in the source parts consists of solid rock or of great boulders and flat stones with dimensions reaching sometimes a diameter of 0.5 m. In further parts of stream their size diminishes and they become more rounded.

The terrain of the basin is overgrown in higher situated parts with fir and mixed forest (about 14 per cent), pastures and arable prevail in lower parts.

The waters of the Rogoźnik and of its affluents are clean and very well oxidated.

The development of Rogoźnik Wielki amounts to 1.2, that of the Cichy stream to 1.13, that of Rogoźnik Mały to 1.1, and of the Bystry stream to 1.04. This means that Rogoźnik Wielki has the most winding banks. those of the Bystry stream being the least tortuous.

The banks of the stream are steep or gentle in places, partly overgrown by trees (willow, alder, fir tree, ash). The banks are not regulated, sometimes only reinforced with stones.

The chemical properties of the water were investigated in the scope of 3 elements: pH, alkalinity, and general hardness. The mean pH value for the Rogoźnik in the investigated terrain amounts to 7.8, the general hardness is 10.8 (in German degrees), and alkalinity 3.4 mval.

Localities and method of investigation

Investigations were carried out in the lower course of the Rogoźnik stream in two localities about 500 m distant from each other (Fig. 1). In each locality sectors 300—500 m long were studied. Locality 1 is situated below the railway bridge. The banks of this part of the stream

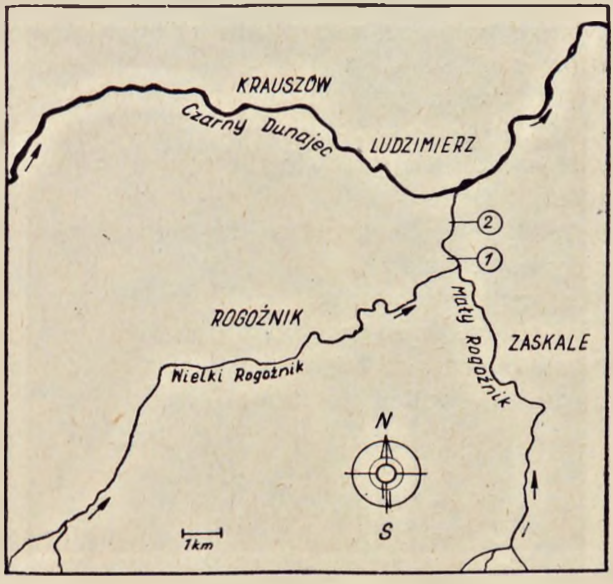


Fig. 1. Localization of stands in the lower course of the Rogoźnik stream

are partly overgrown by shrubs. Traces of regulation are visible. The height of the left bank amounts to 0.7 m. The river is 9 m broad and 30 cm deep. Stones and gravel cover the bottom. Locality 2 was chosen above the bridge, near the highway leading to Ludzimierz. The banks have no vegetation. The height of the left bank is of about 60 cm. The river with its uncovered stony bed is nearly 30 m wide. The bottom is covered with stones of medium size. The gradient of the stream in the investigated sector amounts to 2.2‰.

Material for investigation was collected during a single period of vegetation on May 20, June 24, August 14 and October 24, 1962. The algae were scraped off the substratum with a spoon and a small brush and the size of the surface on which they grew was noted. Samples were preserved on the spot in a 4 per cent solution of formalin. The collected material was analysed from the qualitative and numerical point of view. For investigating diatoms a part of the material was treated with a mixture of sulphuric acid and a saturated solution of potassium bichromate in the proportion 3 : 1. It was then washed out on a centrifuge and permanent preparations embedded in pleurax were made.

For estimating the number and size and calculating stability and spatiality the scales and formulas proposed by Profesor K. Starmach (in manuscript) were used.

Quantitative estimation was conducted according to a scale of 6 degrees on the basis of revising 3 preparations and at least 100 or more fields of vision according to the magnification in use:

+ — the given organism appears singly and not in every preparation;

1 — the given organism is seen to the amount of 1—6 individuals in one preparation;

2 — the given organism is found to the amount of 7—16 individuals in one preparation;

3 — the given organism appears to the amount of 1—3 specimens in nearly all microscopic fields;

4 — the given organism is found to the amount of 4—6 individuals in nearly all microscopic fields;

5 — the given organism dominates positively and appears in a number greater than 6 individuals in every microscopic field.

The size was estimated also on the basis of a scale of 6 degrees, the figures of which had the following values:

+	organisms	with	a	diameter	of	0,1 4 μ	conversion coefficient	0.1
1	„	„	„	„	„	4—40 μ	„ „	1
2	„	„	„	„	„	40—100 μ	„ „	3
3	„	„	„	„	„	100—200 μ	„ „	7
4	„	„	„	„	„	200—300 μ	„ „	11
5	„	„	„	„	more	than 300 μ	„ „	16.

The size of the filamentous algae was estimated on the basis of sections visible in the microscopic field. It was assumed that a filament as long as the diameter of the microscopic field corresponds:

at	a	width	of	1—5 μ	to scale	1
„	„	„	„	5—20 μ	„ „	2
„	„	„	„	2—40 μ	„ „	3
„	„	„	„	40—60 μ	„ „	4
„	„	„	„	60—80 μ	„ „	5.

Threads shorter than half the diameter of the microscopic field receive directly a lower degree.

A determined number of quantity, multiplied by the conversion coefficient for separate degrees of the scale of size gives the covering index. This index corresponds more or less to the conception of quantity in the sociology of higher plants and stresses better the position of the species in a community in relation to its companions. It also gives a certain idea of the joint mass of individuals belonging to the same species in relation to individuals of another species.

Results of the investigation

147 species were indentified altogether, among which *Bacillario phyceae* of the *Pennatae* prevailed. They formed 78.2 per cent of the total number of determined species. *Chlorophyta* formed 14.2 per cent, *Cyanophyta* 5.4 per cent, *Euglenophyta* 1.5 per cent and *Rhodophyta* 0.7 per cent.

The majority of the determined diatoms are common in various freshwater reservoirs. Some of them, however, deserve attention (Plate I).

Species appearing in mountain streams:

Diatoma hiemale (L y n g b.) H e i b. var *mesodon* (E h r. G r u n. Length 27.5 μ, breadth 9 μ. This is a northern Alpine species appearing in rapidly flowing mountain streams.

Fragilaria virescens R a l f s. var. *mesolepta* S c h ö n f. Length 48.25 μ, breadth 6 μ, 15 striae in 10 μ. It appears mostly in northern areas, in stagnant and slowly flowing waters.

Achnanthes linearis (W. S m.) G r u n. (Fig. 4). Length 16.5 μ, breadth 4.5 μ, 20 striae in 10 μ. Appears mostly in mountain waters.

Pinnularia borealis E h r. Length 37.5 μ, breadth 9 μ, 5 striae in 10 μ. A northern Alpine species appearing in the high parts of mountains, often in snow pools.

Species of brackish waters:

Navicula mutica K ü t z. var. *binodis* H u s t. Length 28.5 μ, breadth 6 μ, striae in 10 μ. Appears in rivers, lakes, river mouths, etc. In normally or strongly alkaline waters (Z a b e l i n a 1961).

N. hungarica G r u n. var. *capitata* C l. Length 21.5 μ; breadth 7 μ; 8 striae in 10 μ. Widespread in alkaline waters.

Stauroneis Smithii G r u n. Length 27 μ; breadth 7.5 μ; Found in the benthos of different types of waters.

Nitzschia palea (K ü t z.) W. S m. var. *capitata* W i s ł. e t P o r e t z k y (Fig. 25). Length 30 μ; breadth 4,5 μ.

Other species deserving attontion:

Navicula Grimmei K r a s s k e (Fig. 16). Length 21 μ; breadth 6 μ; 25 striae in 10 μ. A freshwater species seldom found. Z a b e l i n a (1961) states that it is characteristic for alkaline waters.

Cymbella affinis K ü t z. forma (Fig. 9). Differs from the typical form by an indentation on the ventral side of the cell. All other characters as in the typical form. This form always accompanies the typical form but appears in much smaller numbers.

Amphora ovalis K ü t z forma (Fig. 6). Besides the typical form a form with slightly different dimensions and structure was found. In order to stress the differences I note the dimensions of both observed forms: *A. ovalis* length 33 μ; breadth 17.25 μ; 11 striae in 10 μ. *A. ovalis* fo. — length 30 μ; breadth 15 μ; 13 striae in 10 μ. After H u s t e d t (1930).

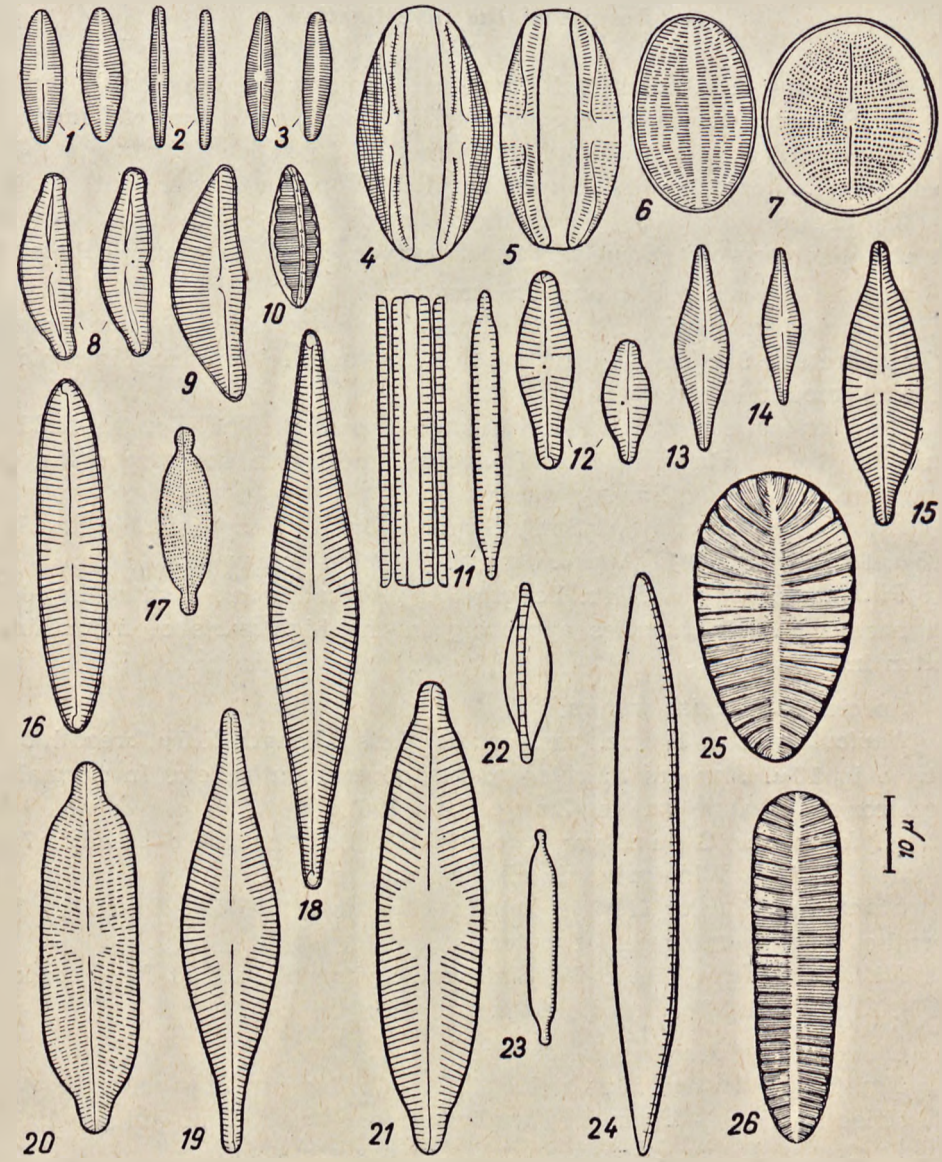


Plate I. Fig. 1—26 1. *Achnanthes linearis* (W. Sm.) Grun. 2. *A. microcephala* (Kütz.) Grun., 3. *A. minutissima* (Kütz.), 4. *Amphora ovalis* (Kütz.), 5. *A. ovalis* (forma?), 6. *Cocconeis placentula* var. *euglypta* (Ehr.) Cl., 7. *C. pediculus* Ehr., 8. *Cymbella affinis* (Kütz.), 9. *C. ventricosa* (Kütz.), 10. *Denticula tenuis* var. *crassula* (Näg.) Hust., 11. *Fragilaria intermedia* Grun., 12. *Gomphonema angustatum* (Kütz.) Rabenh., 13. *Navicula cryptocephala* (Kütz.), 14. *N. cryptocephala* var. *intermedia* Grun., 15. *N. exigua* (Greg.) O. Müll., 16. *N. gracilis* Ehr., 17. *N. Grimmei* Krasske, 18. *N. radiosa* (Kütz.) 19. *N. rhynchrocephala* (Kütz.), 20. *N. tuscula* (Ehr.) Grun., 21. *N. viridula* Kütz., 22. *Nitzschia dissipata* (Kütz.) Grun., 23. *N. palea* var. *capitata* Wisł. et Poretzky, 24. *N. recta* Hantzsch., 25. *Surirella ovata* Kütz., 26. *S. ovata* var. *pinnata* (W. Sm.) Hust.

Amphora ovalis is 20 to 140 µ long, 17 to 63 µ broad and has 10 — 13 striae in 10 µ. Differences of structure are presented in fig. 5.6. This form appears in smaller quantities than the typical specimens.

Gomphonema angustatum (K ü t z.) R a b e n h. (Fig. 13). A considerable variability of this species was observed. Short specimens were found 16.5 µ long; 6 µ broad with 12 striae in 10 µ, as well as long specimens with a length of 27.75 µ, a breadth of 7.5 µ, with 12 striae in 10 µ; in both the central field reached unilaterally the margin of the valve.

H u s t e d t (1930) and Z a b e l i n a (1961) observed as a characteristic feature of this species a central field which does not reach the margin of the valve. According to C l e v e - E u l e r (1953) (Vol. IV, p. 179, fig. 1270) specimens may appear sometimes in which the unilateral central field extends to the margin of the valve. All other characters quite conform to the description of *G. angustatum*. No typical specimens of *G. angustatum* were found in the preparation although it is a common species in fresh water, but forms with a central field reaching the margin of the valve were frequently found. C l e v e - E u l e r (Vol. IV, p. 187, fig. 1283 d) describes a form very similar in shape to *G. intricatum* (K ü t z.) a *genuinum* (M a y.) fo. *semiaperta*, though it has 8 to 10 striae in 10 µ.

Short specimens could be recognized as *G. tergestinum* as their shape is characteristic for this species (especially a club-like cephalic end) and the dimensions are in accordance with the diagnosis (H u s t e d t 1930). It is, however, a species seldom found. C l e v e - E u l e r describes a similar form as *G. intricatum* K ü t z. var *dichotoma* fo. *semipura* (Vol. IV, p. 189, fig. 1283 t). Since short specimens as well as long specimens were found together in the investigated material it is possible that both belong to *G. angustatum*.

Communities of algae

In both localities two types of stands were conspicuous: with the current i.e. lotic stands and lenitic ones with no current. Samples were collected separately from the two stands. In the lotic stands 113 species were found, containing 97 diatoms and 16 species belonging to other groups of algae, in the lenitic stands there were 128 species, of which 120 were diatoms. In the current stand the algae grew on stones washed by rapidly flowing water, while in the stand with no current a layer of fine slime settled on the stones. The *Diatomaceae* formed yellow and brown deposits on the surface of the slime.

In Table I the algae from the two types of stands are ranged according to their domination. In accordance with the indications of Professor K. S t a r m a c h (manuscript) species which appear in 60—100 per cent of sociological records (or samples) are considered as dominants;

those seen in 20—60 per cent of records as subdominants, while those which appear in 1—20 per cent of records are adominants.

The values for conversion coefficients are given in separate columns for lotic and lenitic stands. The conversion coefficient (p) was calculated according to the formula $p = \frac{n}{s}$, where s = the sum of covering for a given species (i.e. the sum of specimens n assumed according to the previously presented scale, multiplied by the conversion coefficient for size); n = the number of sociological records (number of investigated samples collected from the given stand).

In lotic stands 22 dominating species were distinguished, the sum of their covering indexes amounting to 37.1. In lenitic stands 41 dominating species were found, and the sum of their covering indexes amounting to 70.6.

A further 40 accompanying species (subdominants) were distinguished in the lotic stand and 52 accidental species. In the lenitic stand 38 accompanying species and 48 accidental ones were distinguished.

In both seemingly dissimilar stands a large number of dominant species are present. There are 22 of them in the lotic stands and as many as 41 in the lenitic ones. In the latter stands a considerable amount of dominants, nearly twice as great as in the current stands, can be ascribed to the sedimentation of diatoms carried by the water current. In lenitic stands where the water movement is slow, a sedimentation of suspensions takes place and a fine slime is formed on the surface of the stones. It is probable that diatoms broken off or washed out in places with a rapid current settle down here.

The dominating species give a characteristic mark to a collection (association) where among a considerable number of dominants, as found in this case, some are more clearly distinctive. These are the species with the highest covering indexes. Here belong: *Navicula tuscula, N. gracilis, N. rhynchocephala, N. viridula, Achnanthes minutissima, A. linearis.* They are numerous species, having simultaneously the highest covering indexes in the lotic as well as in the lenitic environment. On the other hand, the following species are especially characteristic for the lenitic environment; *Nitzschia palea* var. *capitata* and *Fragilaria intermedia* (Tab. II). They can be considered as specific for the lenitic environment. The very great number of species which the two environments possess in common give rise to the fact, however, that in the lower course of the Rogoźnik stream in an association of algae, which could be named *Naviculeto-Achnathidietum rivulare* after the formula of Symoens (1954), the faciae with and without current are not very prominent.

Mean number (A) and mean coverage index (B) of algae growing on stones in the Rogoźnik stream

Season	Spring				Summer				Autumn			
Zone	lotic		lenitic		lotic		lenitic		lotic		lenitic	
Number of phytosociological records	4		5		11		10		5		7	
	A	B	A	B	A	B	A	B	A	B	A	B
Dominants												
Achnanthes microcephala (Kütz.) Grun.	1,2	1,2	1,0	1,0	0,9	0,9	1,3	1,3	2,6	2,6	2,3	2,3
- minutissima Kütz.	4,5	4,5	4,6	4,6	2,9	2,9	1,7	1,7	2,8	2,8	2,7	2,7
- lanceolata (Breb.) Grun.			1,2	1,2			0,2	0,2			1,3	1,3
- linearis (W.Sm.) Grun.	3,5	3,5	4,6	4,6	2,7	2,7	1,8	1,8	2,6	2,6	2,7	2,7
Amphora ovalis Kütz.			0,4	0,4			0,8	0,8			1,1	1,1
- - var. pediculus Kütz.			0,5	0,5			0,7	0,7			0,4	0,4
- ovalis (forma?)			0,3	0,3			0,6	0,6			0,7	0,7
Cymbella affinis Kütz.	2,7	2,7	3,2	3,2	2,7	2,7	2,3	2,3	3,0	3,0	2,1	2,1
- lata Grun. var. minor Mölder			0,8	0,8			0,6	0,6			1,4	1,4
- naviculiformis Auersw.			0,3	0,3			0,3	0,3			0,8	0,8
- prostrata (Berkeley) Cl.			0,5	0,5			0,5	0,5			0,2	0,2
- turgida (Greg.) Cl.			0,4	0,4			0,6	0,6			1,6	1,6
- ventricosa Kütz.	1,2	1,2	3,2	3,2	2,8	2,8	2,3	2,3	2,8	2,8	2,1	2,1
Cocconeis placentula Ehr. var. euglypta (Ehr.) Cl.	0,5	0,5	1,1	1,1	0,9	0,9	1,2	1,2	1,0	1,0	1,3	1,3
- pediculus Ehr	0,7	0,7	1,0	1,0	0,9	0,9	1,3	1,3	1,2	1,0	1,0	1,0
Denticula tenuis Kütz. var. crassula (Näg.) Hust.			0,8	0,8	0,7	0,7	1,8	1,8	1,2	1,2	1,6	1,6
Fragilaria intermedia Grun.			0,6	1,8			0,7	2,1			1,7	5,1
- virescens Ralfs. var. mesolepta Schönf.			0,4	1,2			0,5	1,6			1,7	5,1
Gomphonema angustatum (Kütz.) Rabenh.	1,7	1,7	1,4	1,4	1,9	1,9	1,5	1,5	1,2	1,2	1,6	1,6
- intricatum Kütz. var. pulvinatum (A.Braun.) Grun.			0,8	0,8			1,1	1,1			0,4	0,4
- olivaceum (Lyngb.) Kütz.			1,6	1,6			1,3	1,3			1,0	1,0
Navicula cryptocephala Kütz.	1,0	1,0	1,0	1,0	1,0	1,0	0,9	0,9	1,0	1,0	1,1	1,1
- - var. intermedia Grun.	1,0	1,0	1,2	1,2	1,3	1,3	1,1	1,1	1,2	1,2	1,1	1,1
- - var. veneta (Kütz.) Grun.					0,9	0,9			1,2	1,2		
- exigua (Greg.) O.Müll.	0,7	0,7	1,2	1,2	2,1	2,1	2,4	2,4	1,6	1,6	1,7	1,7
- gracilis Ehr.	1,4	3,7	1,4	4,2	1,4	3,8	1,4	4,2	1,0	3,0	0,9	2,7
- hungarica Grun. var. capitata Cl.							0,7	0,7			1,0	1,0
- radiosa Kütz.	0,3	0,7	0,6	2,0	0,6	1,9	1,3	4,0	1,2	3,6	1,7	5,1
- rhynchocephala Kütz.	0,7	1,7	1,2	3,6	0,7	2,3	1,0	3,0	1,2	3,6	1,1	3,3
- tuscula (Ehr.) Grun.	0,4	1,6	0,5	0,5	0,6	1,8	1,2	3,6	0,6	2,0	2,3	6,8
- viridula Kütz.	0,4	1,5	0,3	1,0	0,7	2,1	1,3	4,0	1,0	3,0	1,3	3,8
Neidium dubium (Ehr.) Cl.			0,5	0,5			0,2	0,3			0,6	0,4
Nitzschia dissipata (Kütz.) Grun.	0,4	0,7	0,7	0,7	0,8	0,8	1,0	1,0	1,2	1,2	1,1	1,1
- Heufleriana Grun.			0,8	2,4			0,6	1,5			0,7	2,1
- palea (Kütz.) W.Sm. var. capitata Wisl. et Poretzky			0,8	2,4			1,1	3,3			1,1	3,4
- recta Hantzsch	0,3	1,0	0,2	0,6	0,5	1,6	0,7	2,1	0,6	1,8	1,1	3,4
Synedra ulna (Nitzch.) Ehr.			0,2	0,2			0,3	0,8			1,0	3,0
- - var. amphirynchus (Ehr.) Grun.			0,6	0,6			0,7	0,7			0,7	2,6
- - var. danica (Kütz.) Grun.			0,2	0,2			0,1	1,0			0,7	5,0
Surirella ovata Kütz.	1,0	1,0	2,8	2,8	0,7	0,7	1,6	1,6	1,0	1,0	1,4	1,4
- - var. pinnata (W.Sm.) Hust.	0,08	0,4	1,2	3,7	0,4	1,3	0,5	1,7	1,2	1,2	1,1	3,4
- angustata Kütz.			1,6	1,6			0,6	0,6			1,1	1,1
Total	23,68	31	44,7	59,5	28,1	37,9	41,9	62,5	32,1	42,6	52,4	90,0
Subdominants												
Chamaesiphon polonicus Hansg.	0,7	0,75	0,4	0,4	0,5	0,5	0,8	0,8			0,2	0,2
Homoeothrix varians Geitl.	0,7	0,75			1,7	1,7			0,8	0,8		
Lyngbya fontana (Kütz.) Hansg.	0,7	0,75			1,0	1,0						
Achnanthes delicatula (Kütz.) Grun.			0,02	0,02			0,1	0,1			0,03	0,03
- lanceolata (Bréb.) Grun. var. elliptica Cl.	0,3	0,25			0,02	0,02	0,1	0,1	0,2	0,2	0,03	0,03
- - var. capitata O. Müll.	3,0	3,0	0,6	0,6	0,1	0,1			0,2	0,2	1,0	1,0
- - laterostrata Hust.	0,5	0,5	0,6	0,6	0,02	0,02	0,4	0,4	0,6	0,6	0,1	0,1
Amphora ovalis Kütz.	0,3	0,2			0,2	0,2			0,1	0,1		
- ovalis (forma ?)	0,02	0,03			0,2	0,2			0,4	0,4		
- - var. pediculus Kütz.	0,2	0,25			0,2	0,2			0,2	0,2		
Caloneis amphisbaena (Bory) Cl.			0,02	0,02			0,1	0,3			0,2	0,5
- silicula (Ehr.) Cl. var. truncatula Grun.			0,2	0,6			0,04	0,04			0,1	0,2
- - var. ventricosa (Ehr.) Donk.			0,2	0,6							0,2	0,5
Cymbella aegualis W.Sm.			0,02	0,02			0,03	0,03			1,0	1,0
- microcephala Grun.	1,5	1,5	3,0	3,0	0,2	0,2	0,1	0,1	0,4	0,4	1,0	1,0
- cistula (Hemp.) Grun.					0,005	0,005			0,6	0,6		
- helvetica Kütz.	0,7	2,3	1,6	4,8	0,5	0,5	0,02	0,02	4,2	4,2	0,8	2,6
- lanceolata (Ehr.) V.H.	0,8	2,3	0,04	0,04	0,03	0,03	0,1	0,3	0,4	1,2	0,2	0,4
- lata Grun. var. minor Mölder.	0,02	0,025			0,3	0,3		0,2	0,2			
- prostrata (Berkeley) Cl.	0,05	0,05			0,3	0,5		0,6	0,6			
- turgida (Greg.) Cl.					0,1	0,1		0,6	0,6			
Cocconeis placentula Ehr.			0,2	0,2			0,01	0,01			0,04	0,04
Diatoma anceps (Ehr.) Kirchn.	1,0	1,0	0,4	0,4	0,02	0,02	0,04	0,04	1,4	1,4	1,0	1,0
- hiemale (Lyngb.) Heib.var. mesodon (Ehr.) Grun.	0,3	0,5	0,5	0,6	0,09	0,09	0,6	0,6	0,6	0,6	0,03	0,03
- vulgare Bory	0,3	0,75	0,4	0,6	0,005	0,005	0,3	0,3	0,6	1,8	1,3	1,3
- - var. productum Grun.			0,4	1,2							0,8	2,1
Fragilaria capucina Desm.							0,2	0,6			1,3	3,8
- intermedia Grun.	3,0	3,0			0,5	1,6			1,4	4,2		
- leptostauron (Ehr.) Hust.											0,07	0,07
- virescens Ralfs. var. mesolepta Schönf.					0,2	0,55			1,4	4,2		
Frustulia vulgaris Thw.			0,02	0,02			0,2	0,2			0,04	0,04
Gomphonema angustatum (Kütz.) Rabenh.var.productum Grun.	0,025	0,025	0,2	0,2	0,02	0,02	0,1	0,1	0,2	0,2	0,4	0,4
- intricatum Kütz. var. pulvinatum Grun.	1,0	1,0		0,8	0,8			0,6	0,6			
- - var. pumilum Grun.			0,8	0,8	0,2	0,2	0,1	0,1	0,4	0,4	0,03	0,03
- olivaceum (Lyngb.) Kütz.	0,5	0,5			0,4	0,4			0,2	0,2		
- - var. calcareum Cl.			0,8	0,8			0,04	0,04			0,2	0,2
Gyrosigma acuminatum (Kütz.) Rabenh.			0,2	1,4			0,4	0,04			0,2	0,2
Meridion circulare Ag.			0,8	0,8			0,3	0,3				
Navicula cryptocephala Kütz. var. veneta (Kütz.) Grun.			0,02	0,02			0,5	0,5			0,4	0,4
- hungarica Grun. var. capitata Cl.					0,05	0,05			0,1	0,1		
- laterostrata Hust.			0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,2	0,4	0,4
- meniculus Grun.	0,05	0,05	0,02	0,02	0,3	0,2	0,4	0,4	0,6	0,6	0,4	0,4
- mutica Kütz. var. binodis Hust.							0,2	0,2			0,1	0,1
- pupula Kütz.					0,02	0,02			0,6	0,6		
Neidium affine (Ehr.) Cl.			0,02	0,02			0,02	0,02			0,04	0,04
- dubium (Ehr.) Cl.	0,05	0,05			0,1	0,1			0,6	0,6		
Nitzschia acicularis W.Sm.	0,3	0,8			0,03	0,03	0,4	1,2	1,4	4,2	1,3	3,8
- angustata (W.Sm.) Grun.									0,8	3,6		
- Heufleriana Grun.	0,05	0,05							1,8	1,8		
- - var. elongata Pant.			0,6	0,6			0,4	1,2			1,3	3,8
- palea (Kütz.) W.Sm. var. capitata Wisl. et Poretzky	0,3	0,8			1,4	0,5			0,4	1,8		
- sigmoidea (Ehr.) W.Sm.	0,4	1,8	0,2	1,4	0,1	0,6	0,3	1,7	0,8	8,4	1,3	9,0
Pinnularia viridis (Nitzsch.) Ehr.var.sudetica Hilse Hust.			0,04	0,04							0,4	1,3
Synedra acus Kütz.					0,02	0,02	1,1	8,00	0,6	4,4	1,1	8,0
- amphicephala Kütz.							0,02	0,02			0,03	0,03
- ulna (Nitzsch) Ehr.	0,05	0,05			0,1	0,3			0,4	1,8		
- - var. amphirynchus (Ehr.) Grun.					0,04	0,04			0,8	2,4		
- vaucheriae Kütz.					0,2	0,2	0,4	0,4	0,8	1,2	1,0	1,0
Surirella angustata Kütz					0,06	0,06			1,0	1,0		
Stauroneis Smithii Grun.			0,02	0,02			0,01	0,01			0,06	0,06
Total	17,01	23,05	13,04	20,04	9,33	11,93	7,38	20,51	27,2	58,1	18,8	51,41

Accidental species

Lotic zone: Meriamopedia glauca Näg., M. punctata Meyen., Phormidium favosum (Bory.) Gom., Pseudoanabena crassa Voznenn., Closterium moniliferum(Bory)Gom., C.dianae Ehrenb., C. Leiblainii Kütz., Cosmarium sp., C. undulatum Corda var. minimum Wittr., C. impressurum Elf., Achnanthes nodosa A.Cl., A. delicatula (Kütz.) Grun., Amphipleura pellucida Kütz., Caloneis amphisbaena (Bory)Cl., C. silicula (Ehr.) Cl., C. silicula var. gibberula (Kütz.) Grun., C. silicula var. truncatula Grun., C. silicula var. ventricosa (Ehr.) Donk Cocconeis placentula Ehr., Cymbella aspera (Ehr.)Cl., C. aegualis W.Sm., C. naviculiformis Auersw., C. sinuata Greg., Cymatopleura elliptica (Bréb.) W.Sm., C. solea (Bréb.) W.Sm., Diatoma vulgare Bory var. productum Grun., Frustulia vulgaris Thw., Gomphonema constrictum Ehr., G. intricatum Kütz., G. longiceps Ehr. var. subclavatum Grun., G. olivaceum (Lyngb.) Kütz. var calcareum Cl., G. parvulum (Kütz.)Grun., G. parvulum var. lagenulum (Kütz.?Grun.) Hust., Gyrosigma acuminatum (Kütz.) Rabenh., Meridion circulare Ag., Navicula bacillum Ehr., N. binodis Ehr., N. cuspidata Kütz. var. ambigua (Ehr.) Grun., N. mutica Kütz. var. binodis Hust., Neidium affine (Ehr.) Cl., Nitzschia Heufleriana Grun. var. elongata Pant., Pinnularia viridis (Nitzsch.) Ehr. var. sudetica (Hilse) Hust., Stauroneis Smithii Grun., S. anceps Ehr., Synedra amphicephala Kütz., S. ulna (Nitzsch.) Ehr. var. danica (Kütz.) Grun., Gongrosira sp., Microspora sp., Ulothrix zonata Kütz., Zygnema sp. Chantransia pygmea Kütz.

Lenitic zone: Homoeothrix varians Geitl., Meriamopedia glauca Näg., M. punctata Meyen., Phormidium ambiguum Gom., P. favosum (Bory.) Gom., Closterium acerosum(Schrank) Ehrenberg. var. subangustum Klebs., C.dianae Ehrenb., C. Leiblainii Kütz., C. moniliferum (Bory.) Ehrenb. Cosmarium sp., Achnanthes nodosa A. Cl., Amphipleura pellucida Kütz., Anomoeoneis exilis (Kütz.) Cl., Caloneis silicula (Ehr.) Cl., Ceratoneis arcus (Ehr.) Kütz., Cyclotella sp., Cymbella aspera (Ehr.) Cl., C. cistula (Hemp.) Grun., C. heteropleura Ehr. var. minor Cl., Cymatopleura elliptica (Bréb.) W.Sm., C. solea (Bréb.) W.Sm., Denticula elegans Kütz., Diploneis elliptica (Kütz.) Cl., Eucocconeis flexella Kütz., E. laponica Hust., Fragilaria pinnata Ehr., Hantzschia amphioxys (Ehr.) Grun., Gomphonema constrictum Ehr., G. intricatum Kütz., G. longiceps Ehr. var. subclavatum Grun., G. parvulum (Kütz.)Grun., G. parvulum var. lagenulum (Kütz ? Grun.) Hust., Nitzschia angustata (W.Sm.) Grun., Pinnularia borealis Ehr., Synedra parasitica (W.Sm.) Hust., Cladophora glomerata (L.) Kütz., Mougeotia sp., Spyrogyra sp., Scenedesmus acuminatus Chodat., S. arvernensis Chodat , Ulothrix zonata Kütz., Zygnema sp

Seasonal development of dominating diatom species in the lower course of the Hugoźnik stream

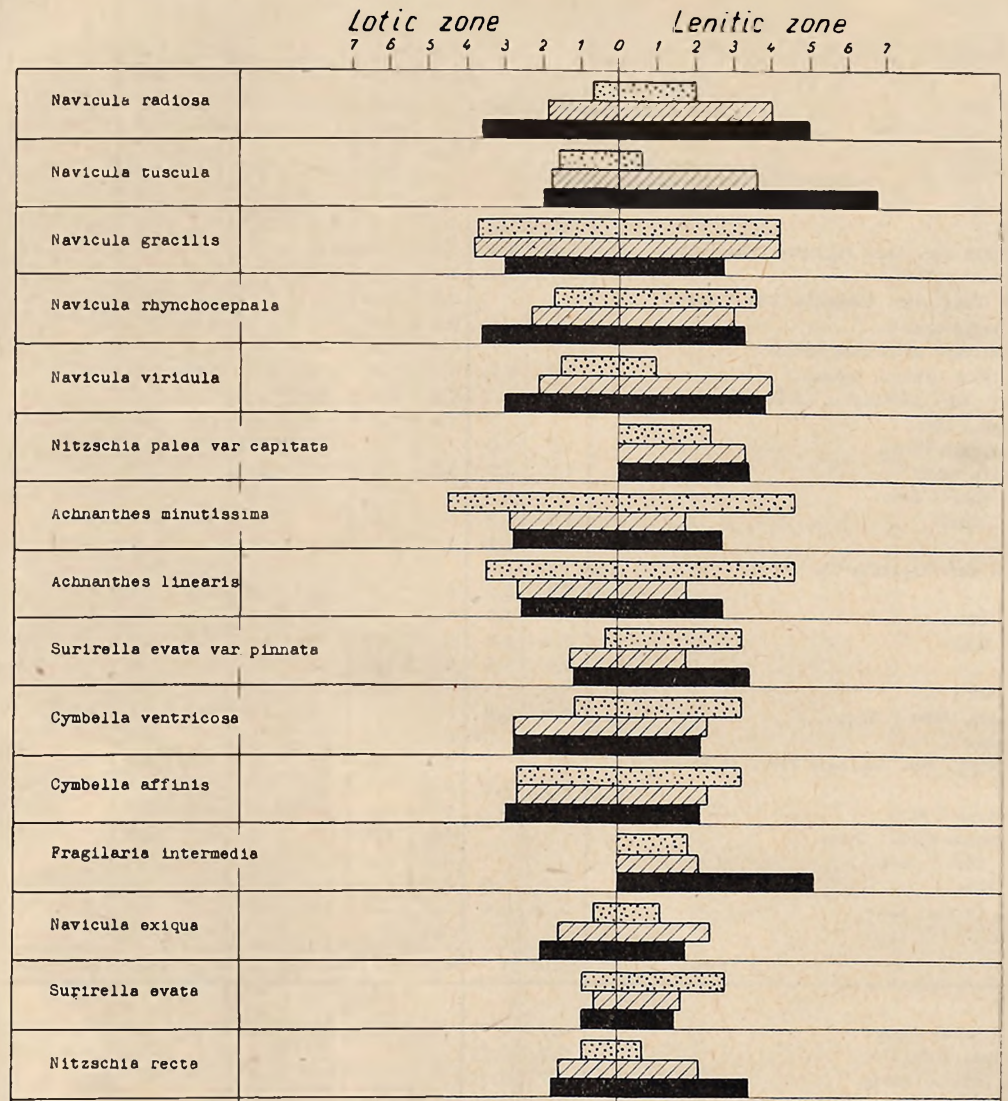
Spring

Summer

Autumn

Numbers indicate the coefficient of cover

$p = \frac{s}{n}$, where s is the sum of coefficients of cover, n the number of records



Seasonal differences

Amidst the diatoms appearing on both types of stands, species seen during the whole period of investigation, in spring, summer and autumn can be distinguished as being the most numerous, and species which do not appear in all seasons of the year. It was not possible, however, to differentiate species common to both stands belonging exclusively to a determined season. Species which appear only in autumn on one stand may be seen on a second stand also in other seasons. Quantitative differences exist, however, for individual species in spring, autumn, and summer. These differences can be distinctly seen on the diagram (Tab. II). executed on the basis of the sum of coefficients of cover from all spring, summer, and autumn samples, separately for each season. The coefficient of cover for particular species was calculated in a simplified manner: $p = \frac{s}{n}$, where s represents the sum of coefficients of cover for a given species and n the number of tests or phytosociological records. The coefficient of cover is a relative measure of the development of a species in community and illustrates approximately its mass. It appears thus from the diagram that some species, such as *Navicula radiosa*, develop the most considerably in autumn, and others, such as *Achnanthes minutissima*, in spring. It can also be seen that on both stands the development of individual species has a different quantitative course, while preserving a similar seasonal rhythm.

In general, the lenitic stand is more favourable for the development of diatoms. The overall coefficient of cover for a lenitic environment amounts to 59.5 in spring. 62.5 in summer and 90.0 in autumn; 212 in total (Tab. I).

Corresponding numbers for the lotic environment are the following: spring 31.0; summer 37.9; autumn 42.6; 111.5 in total (Tab. I).

In both stands, therefore, the mass of diatoms increased from spring to autumn. This can be explained by the fact that spring is not a favourable season for development in mountain streams, and it was particularly unfavourable in 1961. The protracted winter, and repeated floods washed out stones in places with and without current. Only when the water level became stabilised in summer and still more in autumn did a period of unhindered development of algae covering the stones begin. This phenomenon is quite clearly represented in the above analysis of algae communities in the investigated stream.

STRESZCZENIE

Zbadano glony osiadłe na dwóch wyznaczonych stanowiskach w dolnym biegu potoku Rogoźnik (Ryc. 1). Wśród 147 oznaczonych gatunków przeważały okrzemki

z podgrupy *Pennales*, stanowiły one 78,2% ogólnej ilości gatunków. Pozostałe to zielenice 14,2%, sinice 3,4%, eugleniny 1,5% i krasnorosty 0,7%.

Wyróżnione dwa siedliska: lenityczne, czyli bezprądowe i lotyczne, czyli prądowe, w których rozwinęło się wprawdzie to samo zbiorowisko (socjacja) jednak w nieco odmiennym wykształceniu.

Zbiorowisko glonów rozwinięte w dolnym biegu potoku Rogoźnik nazwano *Naviculetum rivulare*. Charakteryzują go bowiem przede wszystkim gatunki dominujące z rodzaju *Navicula*. Odpowiednio do dwóch odmiennych siedlisk, wyróżniono jeszcze: *facies rheobenthicum* rozwiniętą na bystrym prądzie i *facies pelobenthicum* panującą w wodzie słabo płynącej. Spośród gatunków dominujących charakterystyczne były dla pierwszej facji: *Navicula gracilis* i *Achnanthes minutissima*, dla drugiej: *Navicula radiosa* i *N. tuscula*.

Skład florystyczny zbiorowiska przedstawiony został w tabeli I, w której zostały wyszczególnione gatunki dominujące, towarzyszące (subdominanty) i przypadkowe (adominanty). Obok tego przedstawiono w tabeli II różnice ilościowe wśród dominantów wiosną, latem i jesienią.

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