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Phytoplankton dynamics in the Skroblus River longitudinal section (South East Lithuania)

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This paper presents studies on the phytoplankton dynamics in the Skroblus River longitudinal section during different seasons: spring (1998), summer (1996–1998) and autumn (1997). The members of *Bacillariophyceae* and *Chlorophyceae* were dominating, representing 49% and 29% of all recorded taxa, respectively. Phytoplankton species number and cell density varied from 30 to 79 and from 1800 cells l⁻¹ to 358,000 cells l⁻¹, respectively, in different localities during different seasons. Phytoplankton development dynamics could be described as seasonal changes of three dominating groups of algae – *Bacillariophyceae*, *Chlorophyceae* and *Chrysophyceae* and their most abundant species.

Key words: phytoplankton, dynamics, seasonal variations, longitudinal section, the Skroblus River, Lithuania

INTRODUCTION

During the last decade river phytoplankton has been intensively studied in Lithuania [1]. Many studies were aimed to describe phytoplankton species composition, as till the 1990 knowledge about river phytoplankton structure was sparse. However, only a few data have been accumulated about phytoplankton development and dynamics in lotic ecosystems [2–4].

The phytoplankton species composition of the Skroblus River has been described in detail in our previous paper [5]. The aim of the present study was to investigate phytoplankton dynamics and seasonal variations along the Skroblus River in 1996–1998.

MATERIALS AND METHODS

The Skroblus River flows in the centre of the sandy South East Plain of Lithuania, where it meets the Merkys River (Fig. 1). The Skroblus River is a short (17.3 km), fast flowing (3.0–5.0 m s⁻¹) third order river with constantly cold water (4.9–15.0 °C) and sixteen small, spring-type tributaries which start from the healing or in low-lying marshy places. Underground water and rainfall mainly determine the hydrological regime of the river. The mean water discharge is 0.68 m³ s⁻¹ [6].

Phytoplankton investigations in the longitudinal section of the Skroblus and in three ponds located

in the drainage area were carried out in spring (1998), summer (1996–1998) and autumn (1997). Phytoplankton samples were collected from the 9 sampling points (Fig. 1).

RESULTS AND DISCUSSION

During the study period, totally 230 taxa of algae were registered. The taxonomical spectrum of the phytoplankton was presented in the earlier paper [5]. As in many other Lithuanian rivers [1], *Bacillariophyceae* and *Chlorophyceae* were the most species-rich taxonomic groups. They comprised 49% and 29%, respectively, of all recorded taxa. Representatives of other algae groups such as *Euglenophyceae* (8%), *Cyanophyceae* (7%), *Chrysophyceae* (2%), *Cryptophyceae* (1%), *Xanthophyceae* (1%) and *Dinophyceae* (1%) were significantly less abundant in species.

The species number varied markedly during the different seasons. The summer period was characterised by the highest species diversity (152 species). The minimum number of species (111) was identified in late spring. A comparison of species numbers in different localities also shows great variation (30–79), with a tendency to increase slightly down the stream (Fig. 2). Only a few species such as *Amphora ovalis* (Kütz.) Kütz., *Closterium acerosum* (Schrank) Ehrenb., *C. moniliferum* (Bory) Ehrenb., *Cocconeis placentula* Ehrenb., *Cyclotella meneghiniana* Kütz., *Diatoma hyemalis* (Roth) Heib.,

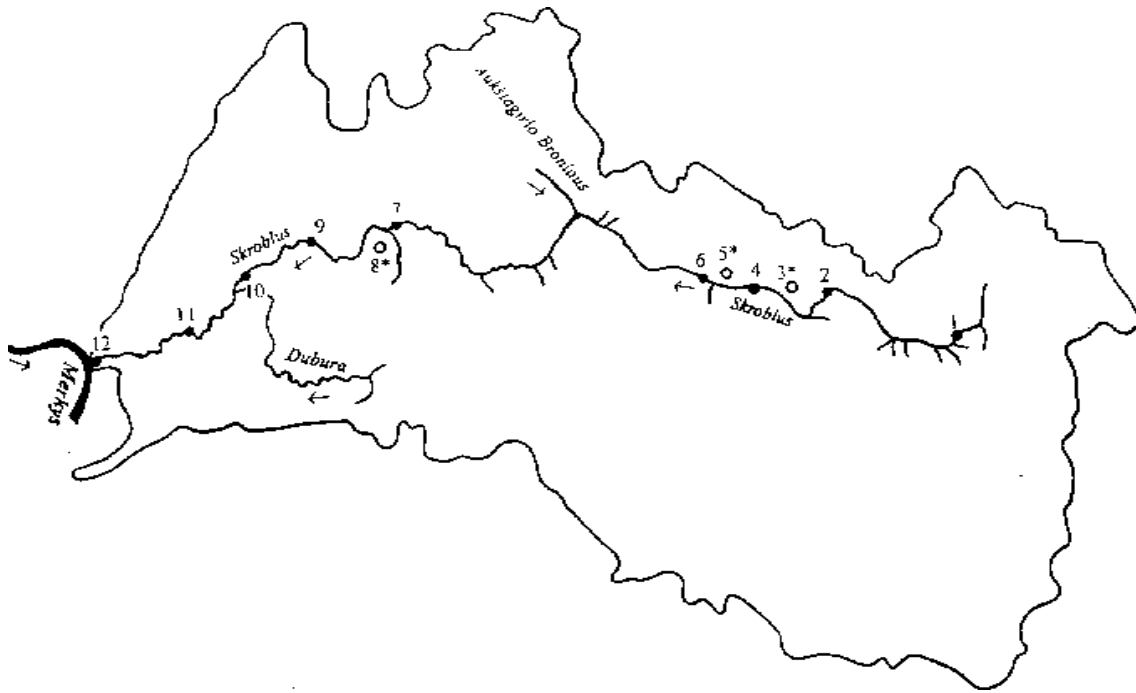


Fig. 1. Map of the Skroblus River basin with location of the study sites (•) and ponds (*o)

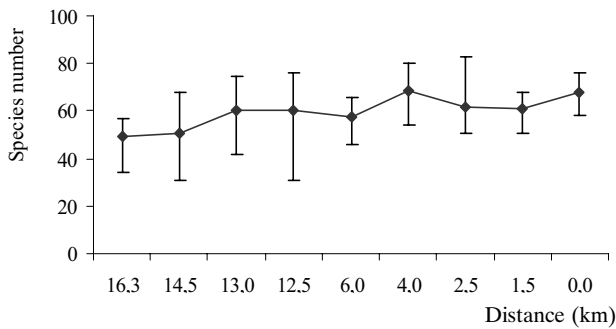


Fig. 2. Variation of phytoplankton species number along the Skroblus River (mean values of 1996–1998, with minimum and maximum)

Melosira varians C. Agardh, *Meridion circulare* (Grev.) C. Agardh, *Monoraphidium griffithii* (Berk.) Komárk.–Legen., *Nitzschia acicularis* (Kütz.) W. Sm.,

Scenedesmus obliquus (Turpin) Kütz., etc. lived in plankton along the river. However, they comprised an insignificant part (19%) of the phytoplankton. This quite a large variation of species number in a short length of the river could be explained by the high percentage of sporadic species (60–70%) characteristic of the Skroblus River as well as of other lotic ecosystems [1, 5].

The phytoplankton density of the Skroblus River was not very abundant and varied in the river longitudinal section from 6 783 to 357 708 cells l⁻¹ (Fig. 3). In comparison with other rivulets [7], phytoplankton in the Skroblus is very sparse. Variations in phytoplankton abundance mainly were determined by the density of phytoplankton population in ponds and marshy lands located in the river drainage area.

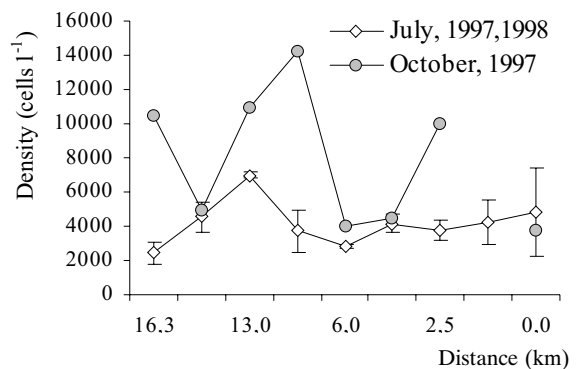
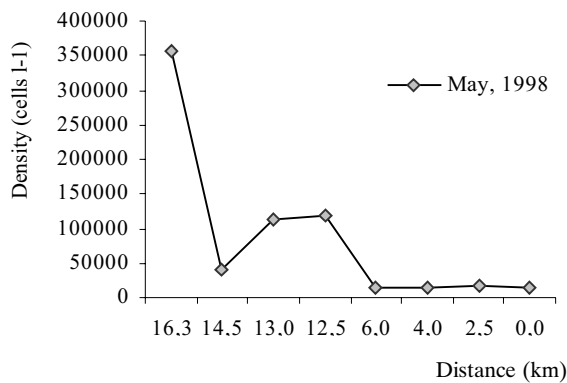


Fig. 3. Seasonal variation of phytoplankton abundance in the Skroblus River (mean values of July, 1997–1998, with minimum and maximum)

Seasonal variation of the phytoplankton structure is caused by dynamics peculiarities of the prevailing classes of algae – *Bacillariophyceae*, *Chlorophyceae* and *Chrysophyceae* and their most abundant species. The proportion of these dominating algae groups varied along the river. Diatoms known as especially good competitors during the turbulence and low temperature [8] were the most abundant in the Skroblus longitudinal section during the whole investigation. They comprised from 8% up to 99% of the total phytoplankton numbers (Fig. 4). The benthic pennates such as *Achnanthes lanceolata* (Bréb.) Grunow, *Cocconeis pediculus* Ehrenb., *Diatoma hyemalis*, *Fragilaria leptostauron* var. *martyi* (Herib.) Lange-Bert., *Meridion circulare* and some centric diatoms – *Cyclotella meneghiniana* and *Melosira varians* forms stable communities in all seasons along the Skroblus.

Spring is characterised by an intensive development of green algae and chrysophytes. The maximum density of algae (357,708 cells l⁻¹) was observed in the riverhead and was caused by the bloom of an unidentified *Volvocales* species (Fig. 4). Marshy lands and side arms could be the main inoculums of *Volvocales*. These planktonic species seem

to be sensitive to the water turbulent mixing and were quickly eliminated from the river plankton. So, their role in phytoplankton is transient. Planktonic chrysophytes formed a stable population along the Skroblus. They comprised from 4% to 30% of the total algae abundance with the dominance of *Synura uvella* Ehrenb. In the lower reaches of the river, the proportion of the dominating groups changed and diatoms started to predominate in the phytoplankton, forming up to 90% of the total cell number.

The summer period is marked by a great decrease in the abundance (1783 cells l⁻¹ to 7448 cells l⁻¹) of phytoplankton and by an increasing proportion of diatoms, which comprised up to 60–99% of total phytoplankton. Green algae were more abundant in the upper Skroblus, with the dominance of *Pediastrum duplex* var. *duplex* Meyen, *Scenedesmus acuminatus* (Lagerh.) Chodat and *S. quadricauda* (Turpin) Bréb. Large amounts of green algae and dinophytes in July 1996 were caused mainly by *Pandorina morum* (O. F. Müll.) Bory and *Peridinium* sp. these species were washed out from the first pond and formed an abundant populations. However, the influence of these species on phytoplankton structure was transient, as they formed

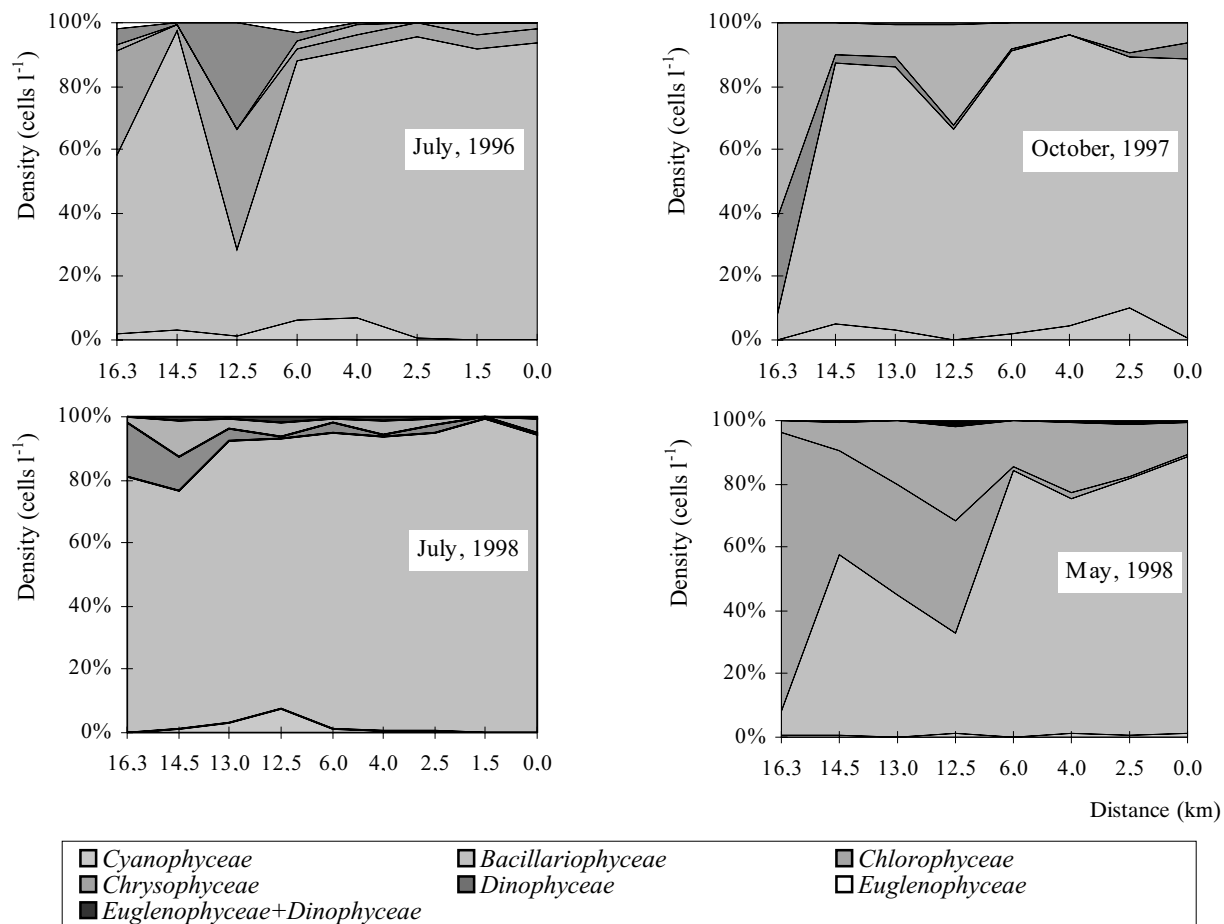


Fig. 4. Percentage of different algal groups to total phytoplankton numbers in the Skroblus River

fast-decreasing populations in the river flow. The reasons for allochthonous algae elimination could be a rather fast flow of the Skroblus and turbulent water mixing.

The fall period is characterised by a qualitative reversal to the spring situation with intensive development of chrysophytes and green algae. Phytoplankton was dominated mainly by the same species as in spring, only *Synura uvella* was replaced by *Dinobryon divergens*. The total abundance of algae was still reduced (from 3733 to 14219 cells l⁻¹).

It seems that ponds and marshy lands located in the riverhead have some influence on the phytoplankton species composition, abundance and dynamics. Unfortunately, these data are insufficient and require more detail investigations.

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FITOPLANKTONO DINAMIKA IŠILGINIAME SKROBLAUS UPELIO PJŪVYJE

S a n t r a u k a

Fitoplanktono tyrimai buvo atlikti 1996–1998 m. išilginiame Skroblaus upelio pjūvyje bei trijose upės baseine esančiose nuotakiose kūdrose. Tyrimų metu iš viso identifiukuota 230 dumblių taksonų. Didžiausia rūšių įvairovė pasižymėjo *Bacillariophyceae* (49%) ir *Chlorophyceae* (29%) dumblių klasės. Bendras fitoplanktono rūšių skaičius bei gausumas buvo nepastovus ir svyravo išilginiame upelio pjūvyje skirtingais tyrimų sezonais nuo 30 iki 79 ir nuo 1800 ląst./l iki 358 000 ląst./l. Rūšių kiekis ir gausumas didėjo žiočių link. Skroblaus upelio sezoninę dinamiką lemia vyraujančių dumblių klasių *Bacillariophyceae*, *Chlorophyceae* ir *Chrysophyceae* bei jų gausiausių rūšių kaitos ypatumai.