10.1515/botlit-2017-0015

DE GRUYTER OPEN

BOTANICA LITHUANICA
ISSN 2029-932X

2017, 23(2): 130–138

DIVERSITY OF GREEN ALGAE IN KAMANOS RAISED BOG (NW LITHUANIA) WITH THE ASPECT OF LONG-TERM CHANGES IN DESMIDS

Judita Koreivienė*, Jūratė Kasperovičienė

Nature Research Centre, Institute of Botany, Akademijos Str. 2, Vilnius LT-08412, Lithuania
*Corresponding author. E-mail: judita.koreiviene@botanika.lt

Abstract

Koreivienė J., Kasperovičienė J., 2017: Diversity of green algae in Kamanos raised bog (NW Lithuania) with the aspect of long-term changes in desmids. – Bot.Lith., 23(2): 130–138.

In Kamanos raised bog, the green algae community was represented by 160 taxa distributed into eight Chlorophyceae orders. The diversity of desmids (93 taxa) that are an essential algal component of raised bogs was most relevant. Chlorococcales comprised 30 taxa and Ulotrichales – 15 taxa. Representatives from the rest green algae groups were scarce. Higher variety of habitats in Lake Kamanos and the pools supported more diverse flora of green algae (151 taxa) compared to black hollows (61 taxa). *Actinotaenium cucurbita* was the single species found in all studied water bodies of Kamanos raised bog. *Characium ornitocephalum*, *Asterococcus superbus*, *Cosmarium amoenum*, *Micrasterias truncata*, *Spondylosium pulchellum*, *Netrium digitus* were found in the lake and all pools, whereas *Cosmoastrum scabrum*, *Tetmemorus laevis* – in all hollows. In the current study, the composition of desmid taxa recorded in Kamanos raised bog in two research periods was compared. The first reports on desmids were published by Vilkaitis (1937, 1940). He found 129 Desmidiales (18 genera) and 10 Zygnematales species (4 genera). Fifty five species identified by V. Vilkaitis were found repeatedly during the current investigation. In 2005, 42 species were newly recoded in Kamanos raised bog, and of these, 17 taxa were new to desmid flora of Lithuania. A numerous rare species recorded by Vilkaitis (1937) were not observed repeatedly probably due to long-term changes that had occurred in the peat bog and not enough comprehensive study that represented only part of Kamanos wetland. Some new rare desmid species (e.g. *Micrasterias jenneri*, *Cosmarium cymatonotophorum*, *Desmidium cylindricum*, *Actinotaenium cucurbitinum*, *Xanthidium bifidum*) have recently been found at Kamanos sites.

Keywords: desmids, diversity, green algae, Lithuania, peat bog.

INTRODUCTION

Wetlands such as bogs are recognized as a unique habitat type, which provide important environment for plants and wildlife, and serve as a resource for biological diversity and productivity. Unsustainable management, for instance farming, building and recreation let the diminishing of these fragile ecosystems all over the world (Haslam, 2003). According to Taminskas et al. (2012), the area occupied by mires and peatlands covers 6460.4 km^2, which makes up 9.9% of the territory of Lithuania. To maintain these particular ecosystems, about eleven percent of the bogs in Lithuania have been declared as areas under protection. One of these is the Kamanos State Strict Nature Reserve, which was established in 1979. It is designated as a Wetland of International Importance under the United Nations Ramsar Convention, and Natura 2000 territory.

The major ecological disturbance of the bog was proved to be the change in water regime (Kunskas, 2005). Hydrology of Kamanos raised bog was heavily affected by digging of draining canals in the early and mid- 20th century, which led to changes in water level. Open water areas in the bog have diminished significantly. The decrease of groundwater level has caused a rapid overgrowth of open raised bogs and degradation of certain particularly valuable habitats.

To date, the overall length of drainage ditches is more than 12 km. Recently, in some places, the canals have been dammed up in order to restore former water level.

The first large-scale study on hydrology, stratigraphy, water chemistry and botany of Kamanos raised bog was performed in 1935–1936. The investigations into the algal flora mainly focused on taxonomic studies. Vilkaitis (1937, 1940) analysed 195 samples of desmid algae collected from the margins of the lake and pools, or in squeezed out *Sphagnum* and plant samples.

The aim of this study was to analyse green algae flora and discuss long-term changes in desmids in the water bodies of Kamanos raised bog.

Study area

Kamanos is the largest (total area 2396 ha) wetland complex in northern Lithuania (Fig. 1). It has formed in the watershed of the Venta River and its tributary Vadakstis during the last glacial period (Aleksa et al., 2004; Sinkevičius, 2001). Kamanos wetland complex includes a large raised bog, fens, transition mires, Lake Kamanos and small pools. The raised bog occupies 44% of the wetland. Plant communities belong to two phytocenological classes *Oxycocco–Sphagnetea* Br.-Bl et R. Tx. 1943 and the alliance *Rhynchosporion albae* W. Koch 1926. Large wet forests (total area 1 687 ha) surround the wetland complex. The Kamanos Reserve is surrounded by agricultural areas. The waters of Kamanos raised bog altogether make up 21.5 ha. There are more than 120 pools with surface area less than 0.4 ha dispersed in 12 sloughs. The only relict Lake Kamanos is located in the northern part of Kamanos raised bog (Švažas et al., 2000).

MATERIALS AND METHODS

Green algae were sampled in the lake, six bog pools (area 0.2–0.4 ha) and five 'black' wet hollows (Fig. 1–2). The studied water bodies were dispersed in the northern and central parts of the raised bog (Nimfėjos, Skendenis, Berželiai and Medial sloughs). Altogether, more than 70 samples were collected from the surface water layer using plankton net and Ruttner sampler, and from different submerged surfaces, by squeezing tufts of *Sphagnum* in spring, summer and autumn 2005. The samples were preserved by adding formaldehyde to reach a 2% concentration in the final sample.

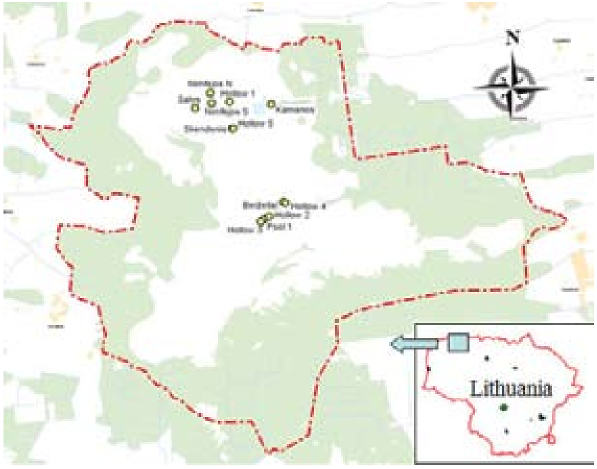

Fig. 1. Location of sampling sites in Kamanos raised bog

Fig. 2. The studied Salos pools and 'black' hollow in Kamanos raised bog

Both live and preserved material was studied using a light microscope (magnification ×600). The main manuals used for green algae identification were as follows: Kossinskaja (1960), Teiling (1967), Starmach (1972), Komárek & Fott (1983), Palamar-Mordvinceva (1982, 2003, 2005), Moshkova & Gollerbach (1986), Ettl & Gärtner (1988), Tsarenko (1990). Filamentous algae from Oedogoniales, Zygnematales and Chaetophorales were identified to genus level. In the current paper, the general taxonomic system follows Parker (1982). However, the former green algae were separated into two different clades Chlorophyta and Streptophyta in the recent phylogenetic systematics that is based on multi-marker and genome scale phylogenetic analysis (Leliaert et al., 2012).

Water temperature, pH and conductivity were measured *in situ* using portable universal meter Mul-

Table 1. Location, morphometric and physical-chemical data of the studied water bodies in the Kamanos Reserve

Water body	Location	Surface area*, ha	Depth*, m	pH	Conductivity, µS/cm
Lake Kamanos	56°18 ′33.2″ N 22°37′31.9″ E	5.95	4.4	4.67–4.82	37–38
Pools					
Nimfėjos Southern pool	56°18′33.1″ N 22°37′28.5″ E	4.06	2.1	5.34–5.54	21–24
Nimfėjos Northern pool	56°18′39.2″ N 22°37′26.7″ E	3.23	2.0	5.34–5.48	21–24
Salos	56°18′30.2″ N 22°37′10.8″ E	2.05	1.5	4.64–4.82	31
Pool in the Medial slough	56°17′25.1″ N 22°38′25.7″ E	< 2	1.5	4.34–5.28	19–29
Skendenis	56°18′18.3″ N 22°37′50.6″ E	< 2	1.5	5.04–5.35	21–27
Berželiai	56°17′35.5″ N 22°38′46.5″ E	< 2	1.2	4.25–4.99	34–43
Hollows					
Hollow 1	56°18′34.3″ N 22°37′47.3″ E	–	–	5.09	140
Hollow 2	56°17′26.9″ N 22°38′32.0″ E	–	–	3.9	66
Hollow 3	56°17′23.7″ N 22°38′23.2″ E	–	–	4.39–4.41	30–75
Hollow 4	56°17′35.1″ N 22°38′49.2″ E	–	–	4.49	72
Hollow 5	–	–	–	4.42	89

* after Brunza (1937); „–“ no data.

tiLine F/Set-3. The coordinates of sampling sites, morphometric characteristics of water bodies and physical–chemical data are presented in Table 1.

Cluster analysis was performed using STATISTIKA’99 software package. Weighted pair average of the counted Pearson index was used for the comparison of floras based on the presence/absence of the species data.

RESULTS AND DISCUSSION

The algal floras of acidic lakes in wetlands are determined by multiple abiotic stressors, which become notably evident in the correlation between species and pH (Coesel, 1983; Nixford et al., 2003). Nutrient amount also seems to be important factor in species distribution. Most desmid taxa are confined to a low nutrient state of the habitat (Coesel, 1998). Water bodies in Kamanos raised bog constitute good conditions for the development of rich algal flora, especially desmids. Altogether green algae community was represented by 160 taxa distributed into eight Chlorophyceae orders. Chlorococcales comprised 30 taxa and Ulotrichales – 15 taxa. The diversity of desmids (93 taxa) that are an essential algal component of peat bogs was most relevant (Fig. 3, A). The genera *Closterium* (17 taxa), *Cosmarium* (15) and *Staurastrum* (10) were most abundant in species. The present investigation also demonstrated that species-specific ecological demands in Kamanos raised bog may differ considerably from those in other parts of Europe. Green algae flora in Kamanos raised bog showed high similarity (54 shared species) with the algal flora of boggy localities in Vigry National Park (Poland) (Tomaszewicz, 1996). High number of the same species (61 taxa) has been found in Lake Kävsjön and Store Mosse (Sweden) (Flensburg, 1967). Much less shared species (about 20) have been found in the subalpine bogs of the Czech Republic (Nováková, 2002; Neustupa et al., 2002), also in slightly alkaline Bulgarian eutrophic peat bog (10 shared taxa) (Valchanova & Stoyneva, 2000).

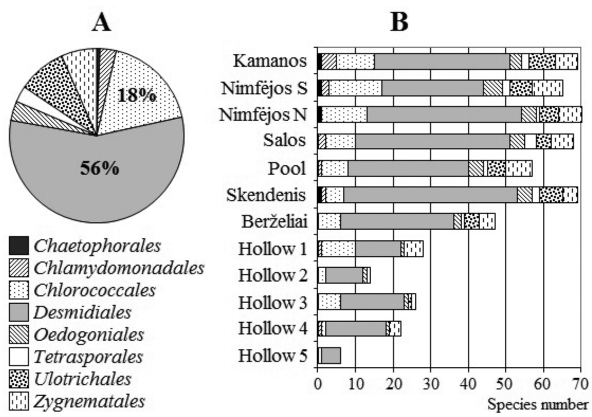

Fig. 3. Taxonomic spectrum of the Chlorophyceae in Kamanos raised bog (A) and species distribution in Kamanos water bodies (B)

Green algae taxa were irregularly distributed in the studied water bodies of Kamanos raised bog. Higher variety of habitats in the lake and pools supported more diverse green algae flora (151 taxa) compared to the 'black' hollows (61 taxa). A*ctinotaenium cucurbita* (Bréb.) Teiling was the single species found in all studied waters of Kamanos raised bog. Six species were found in the lake and all pools: *Characium ornitocephalum* A. Braun, *Asterococcus superbus* (Cienkow.) Scherf., *Cosmarium amoenum* Bréb., *Micrasterias truncata* (Corda) Bréb., *Spondylosium pulchellum* Arch., *Netrium digitus* (Ehr. ex Bréb.) Itzigs. et Rothe. Of the 15 taxa recorded in the hollows, only *Cosmoastrum* cf. *scabrum* (Bréb.) Pal.-Mordv. and *Tetmemorus laevis* (Kütz.) Ralfs were found in all hollows studied. About 30% of the green algae species recorded were found only in a single water body.

According to Nováková (2002), differences in the species composition in Krkonoše Mts. bogs have been caused by the character of pools – size, depth and shading. Composition of the green algae in Kamanos raised bog showed reliance on size and depth of the water body, too (Table 1). Shallow, temporarily wet peaty hollows fall into group I together with Berželiai shallow pool based on algal species composition (Fig. 4). The lowest pH (pH < 5) and the highest conductivity (30–140 µS/cm) values (Table 1), and also the smallest number of algal species (Fig. 3, B) were distinguishing features for those water bodies as compared to other studied water bodies. Some species such as *Botryosphaerella sudetica* (Lem.) Silva, *Eremosphaera eremosphaeria* (G.M. Smith) R.L. Smith & Bold, *Actinotaenium cucurbitinum* (Biss.) Teiling, *Euastrum* cf. *subalpinum* Messik. and *Micrasterias jenneri* Arch. were found only in the hollows.

Small and relatively deep pool Skendenis and the

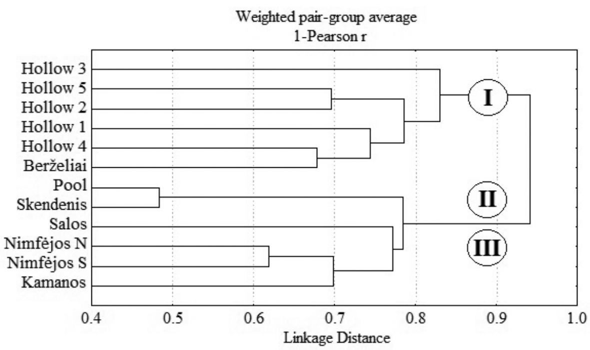

Fig. 4. Similarity of water bodies in Kamanos raised bog based on green algae species composition

pool in the Medial slough showed the highest similarity and were included into the group II (Fig. 4). Forty four species were found in both pools. Specific species of this group were: *Scenedesmus spinosus* Chodat, *Elakatothrix parvula* (Arch.) Hindák, *Closterium cynthia* De Not., *Hyalotheca mucosa* (Mert.) Ehr., *Micrasterias denticulata* Bréb., *Pleurotaenium minutum* (Ralfs.) Delp., *Staurodesmus* cf. *spencerianus* (Mask.) Teil. Lake Kamanos and the largest, deepest pools located in the northern part of the raised bog were included into group III. Seven specific species such as *Ankistrodesmus falcatus* (Corda) Ralfs, *Monoraphidium contortum* (Thur.) Komárk.-Legn., *Cosmarium contractum* Kirch., *Euastrum binale* var. *binale* f. *sectum* Turn., *Staurastrum furcatum* (Ehr.) Bréb., *Cylindrocystis crassa* de Bary, *Stigeoclonium* sp. were characteristic of this group.

The first reports on desmids in Kamanos raised bog have been published by Vilkaitis (1937; 1940). He has found 129 Desmidiales (from 18 genera) and 10 Zygnematales (from 5 genera) species (Table 2). In the present study, significant changes were observed in the composition of desmid flora. Only fifty five species identified by V. Vilkaitis were found during the current investigation, whereas 42 taxa were new to Kamanos raised bog, and 17 species new to the desmid flora of Lithuania (Table 2). The largest number (52–75%) of species provided by V. Vilkaitis belong to the genera *Closterium*, *Cosmoastrum*, *Penium* and *Tetmemorus*, the lowest (11–19%) – to the *Cosmarium* and *Euastrum* (Fig. 5).

Due to a decreasing water level in the raised bog, some places as lag-zone and small pools have completely dried out or overgrew. Therefore, the study in 2005 was carried out in the northern and central parts of Kamanos raised bog, whereas half of the recently non-recorded desmid species (especially from the genera *Cosmarium* and *Euastrum*) Vilkaitis (1937) has found on the bog boundary zone (Table 2), where he has noted higher values of acidity (pH 5.73–6.36) as compared to those in the central parts (pH 3.9–5.1). Most of *Cosmarium* species show clear preference to slightly acidic (~ pH 5) or circumneutral waters (Tomaszewicz, 1994; Kostkeviciene et al., 2003) and richer in nutrients (Flensburg, 1967; Gerrath, 2003). Preference to rich or poor environment in the genus *Euastrum* depends on particular species (Flensburg, 1967).

Table 2. The list of desmid species in Kamanos raised bog after VILKAITIS (1937, 1940) and the data of investigations carried out in 2005

Genus	Species found in 1937-1940	Species found in 2005	Species found in both studies
Actinotaenium	*A. cruciferum* (De Bary) Teil.; *A. curtum* (Bréb. ex Ralfs) Teil.; *A. palangula* (Bréb. ex Ralfs) Teil.	*A. cucurbitinum* (Bisset) Teil.	*A. cucurbita* (Bréb. ex Ralfs) Teil.
Bambusina			***B. brebissonii*** Kütz.
Closterium	*C. abruptum* West; ***C. closterioides*** (Ralfs) Louis et Peeters; ***C. costatum*** Corda ex Ralfs; *C. didymotocum* Corda ex Ralfs; ***C. kuetzingii*** Bréb.; ***C. leibleinii*** Kütz. ex Ralfs; ***C. parvulum*** Nägeli; *C. pusillum* Hantzsch, ***C. ralfsii* var. *hybridum*** Rabenhorst; *C. rostratum* Ehr. ex Ralfs; *C. turgidum* Ehr. ex Ralfs	*C. baillyanum* (Bréb. ex Ralfs) Bréb.; **C. baillyanum* var. *alpinum* Viret; *C.* cf. *exiquum* W. et G.S. West; *C. jenneri* Ralfs	*C. aciculare* T. West; ***C. acutum*** Bréb.; *C. acutum* var. *linea* (Perty) W. et G.S. West; *C. acutum* var. *variabile* (Lemm.) W. Krieg.; ***C. cynthia*** De Not.; ***C. dianae*** Ehr. ex Ralfs; ***C. intermedium*** Ralfs.; *C. lineatum* Ehr. ex Ralfs; *C. lunula* Ehr et Hemprich ex Ralfs; *C. navicula* (Bréb.) Lütkem; ***C. pronum*** Bréb.; ***C. striolatum*** Ehr. ex Ralfs; ***C. ulna*** Focke ex W.B. Turner
Cosmarium	***C. annulatum*** (Näg.) de Bary; *C. botrytis* var. *mediolaeve* West; ***C. connatum*** Bréb. ex Ralfs; *C. conspersum* Ralfs.; ***C. debaryi*** W. Archer; *C. exiquum* W. Archer; *C. globosum* Bulnheim; *C. humile* Nord. ex De Toni. ***C. inconspicuum*** W. et G.S. West; *C. margaritiferum* Menegh. ex Ralfs; ***C. meneghinii*** Bréb. ex Ralfs; *C. moniforme* Ralfs; ***C. nasutum* f. *granulata*** Nord.; ***C. ochthodes*** Nordst; ***C. pachydermum*** Lund.; *C. portianum* W. Archer; ***C. pygmaeum*** W. Archer; *C. pyramidatum* var. *angustatum* West; ***C. quadratum*** Ralfs ex Ralfs; ***C. quadrum*** Lund.; ***C. taxichondrum*** Lund.; *C. tetraophthalmum* Bréb. ex Ralfs; *C. tinctum* Ralfs; ***C. ungerianum*** (Näg.) de Bary; ***C. venustum* var. *minus*** (Wille) W. Krieg.	*C. abbreviatum* Racib.; *C. angulosum* Bréb.; **C. cymatonotophorum* West; *C. contractum* Kirch.; **C.* cf. *depressum* var. *reniforme* W. et G.S. West; **C. depressum* var. *planctonicum* Riverdin; **C. regnellii* var. *pseudoregnellii* (Messik.) W. Krieg.; *C. sphagnicola* W. et G.S. West; **C. subquadrans* W. et G.S. West	*C. amoenum* Bréb. ex Ralfs; *C.botrytis* Menegh. ex Ralfs; *C. obliquum* Nordst; ***C. pyramidatum*** Bréb. ex Ralfs; *C. pseudopyramidatum* Lund.; *C. subtumidum* Nord.
Cosmoastrum	***C. muticum*** Bréb. ex Ralfs; *C. polytrichum* (Perty) Palm.-Mordv.	**C. dispar* (Bréb.) Palm.-Mordv.; **C. hirsutum* (Ehr.) Pal.-Mordv.; **C. pyramidatum* (West) Pal.-Mordv.; **C. scabrum* (Bréb.) Pal.-Mordv.	*C. dilatatum* (Ehr. ex Ralfs) Pal.-Mordv. ex Petlovany; ***C. orbiculare* var. *depressum*** (J. Roy et Biss.) Palm.-Mordv.; *C. punctulatum* (Bréb.) Pal.-Mordv.; *C. teliferum* (Ralfs) Pal.-Mordv.
Cylindrocystis			*C. brebissonii* (Ralfs) De Bary; *C. crassa* De Bary
Desmidium	*D. swartzii* C. Agardh ex Ralfs	**D. cylindricum* Greville	
Euastrum	***E. ansatum*** Ehr. ex Ralfs; ***E. bidentatum*** Näg.; ***E. binale* var. *hians*** (West) W. Krieg.; ***E. dubium*** Näg.; ***E. elegans*** Ralfs; ***E. insulare*** (Wittrock) J. Roy; ***E. oblongum*** Ralfs.; ***E. verrucosum*** Ehr. ex Ralfs	*E. binale* f. *sectum* W.B. Turner; *E. subalpinum* Messikommer	***E. binale* f. *gutwinskii*** Schmidle
Gonatozygon	*G. brebissonii var. minutum* W. et G.S. West; *G. brebissonii* De Bary.		

Genus	Species found in 1937-1940	Species found in 2005	Species found in both studies
Hyalotheca	*H. neglecta* Raciborski	*H. dissiliens* f. *tridentula* Nord.; *H. dissiliens* var. *bidentula* (Nord.) Boldt; *H. mucosa* Ralfs	*H. dissiliens* Bréb. ex Ralfs
Mesotaenium	*M. endlicherianum* Näg.; *M. endlicherianum* var. *grande* Nord.		
Micrasterias	*M. apiculata* Menegh. ex Ralfs; ***M. brachyptera*** Lund.; ***M. crux-melitensis*** Ralfs; *M. fimbriata* Ralfs.; *M. papillifera* Bréb. ex Ralfs; *M. truncata var. bahusiensis* Wittrock	*M. rotata* f. *evoluta* Turner; *M. jenneri* Ralfs; **M. truncata* var. *cristata* Roll; *M. thomasiana var. notata* (Nord.) Grönblad; *M. thomasiana* W. Archer	***M. denticulata*** Bréb. ex Ralfs; ***M. rotata*** Ralfs.; *M. truncata* Bréb. ex Ralfs
Netrium	***N. interruptum*** (Bréb. ex Ralfs) Lütkemüller; *N. oblongum* (De Bary) Lütkemüller		***N. digitus*** (Bréb. ex Ralfs) Itzigsohn et Rothe; *N. digitus* var. *lamelosum* (Bréb.) Grönbl.
Penium	*P. margaritaceum* Bréb.; *P. polymorphum* (Perty) Perty	**P. cylindrus* var. *attenuatum* Raciborski	*P. cylindrus* Bréb. ex Ralfs; *P. silvae-nigrae* f. *paralellum* (W. Krieg.) Kossinsk.; *P. spirost-riolatum* J. Barker; *P. spirostriolatum* var. *amplificatum* M. Schmidt
Pleurataenium	***P. trabecula*** Näg.; *P. tridentulum* (Wolle) West; ***P. truncatum*** (Bréb. ex Ralfs) Näg.		*P. minutum* (Ralfs) Hilse
Raphidiastrum			*R. simonyi* (Heimeri) Pal.-Mordv.
Roya	*R. obtusa* (Bréb.) W. et G.S. West		
Spirotaenia	*S. condensata* Bréb.		
Spondylosium	*S. pulchellum var. bambusinoides* (Wittrock) Lund.		*S. pulchellum* (W. Archer) W. Archer
Staurastrum	*S. cyrtocerum* Bréb.; ***S. cristatum*** (Näg.) W. Archer; *S.* ***dejectum*** Bréb.; ***S. dilatatum*** Ehr. ex Ralfs; *S. gracile* Ralfs ex Ralfs; ***S. margaritaceum var. coronulatum*** West; ***S. margaritaceum var. hirtum*** Nord.; ***S. pilosum*** Bréb.; *S. retusum var boreale* W. et G.S. West; *S. spongiosum* Bréb. ex Ralfs; ***S. spongiosum* var. *griffitshianum*** (Näg.) Lagerh.	*S. aciculiferum* (West) Andersson; *S. anatinum* f. *paradoxum* A.J. Brook; **S. formosum* C. Bernard.; **S. vestitum* var. *subanatinum* W. et G.S. West	*S. brachiatum* Ralfs ex Ralfs; *S. furcatum* Bréb.; ***S. margaritaceum*** Menegh. ex Ralfs; *S. paradoxum* Meyen ex Ralfs; ***S. polymorphum*** Bréb.
Staurodesmus		**S. boergesenii* (Messik.) Croas.; *S. extensus* (Andersson) Teil.; **S. megacanthus* (Lund.) Thunmark; *S.* cf. *phimus* (V.B. Turner) Thomasson; *S.* cf. *spencerianus* (Nord.) Teil.; *S. triangularis* (Lagerh.) Teil.	*S. dejectus* var. *apicularis* (Bréb.) Teil.; *S. incus* (Hassal ex Ralfs) Teil.
Teilingia		*T. excavata* (Ralfs ex Ralfs) Bourrelly	
Tetmemorus	*T. laevis* var. *minutus* (De Bary) W. Krieg.		*T. brebissonii* Ralfs.; ***T. granulatus*** Bréb. ex Ralfs; *T. laevis* Ralfs ex Ralfs
Xanthidium	***X. fasciculatum*** Ehr. ex Ralfs; ***X. fasciculatum var. oronense*** West; *X. trispinatum* (W. et G.S. West) Pal.-Mordv.; *X. cristatum* var. *uncinatum* Bréb. ex Ralfs	*X. armatum* Bréb. ex Ralfs; *X. bifidum* (Bréb.) Deflandre	*X. antilopaeum* Kütz.; *X. antilopaeum* var. *triquetrum* D.B. Williamson; *X. smithii* var. *octocorne* (Ehr.) Pal.-Mordv.

Species in **Bold** were found by V. Vilkaitis (1937, 1940) in the boundary zone of Kamanos raised bog; * - species new to Lithuania; “–" - no data

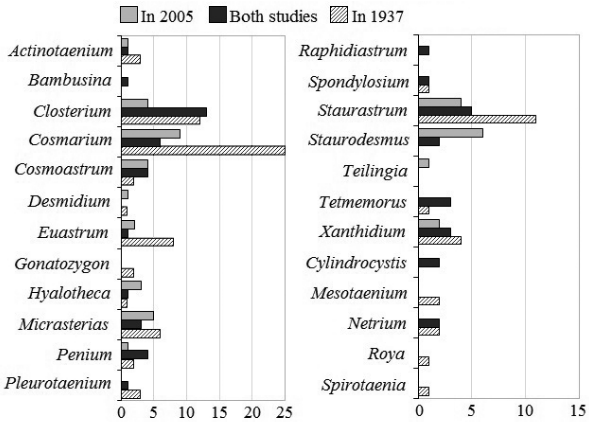

Fig. 5. The number of Desmidiales species of different genera found by Vilkaitis (1937), in 2005 and during both studies

The representatives of the genera *Gonatozygon*, *Mesotaenium*, *Roya* and *Spirotaenia* found by Vilkaitis (1937) were not recorded in the present study (Fig. 5). The species number of the genus *Staurodesmus*, which shows preference to slightly acidic (Gerrath, 2003; Kostkeviciene et al., 2003) environment, poor in nutrients (Rosen, 1981; Willen, 1992), increased from two to eight taxa.

Based on the results of physico-chemical analyses, it is concluded that the water bodies in Kamanos raised bog are distinctly acidophilic and nutrient-low biotopes (Table 1). The frequent occurrence of several acidophilic desmids, including *Actinotaenium cucurbita*, *Cosmarium scabrum*, *Hyalotheca dissiliens*, *Micrasterias truncata* etc. in distinctly acidic water is remarkable. In addition, according to the ranges of conductivity, as recorded in the present study, these desmids also appear to be well-adapted at the investigated sites of Kamanos raised bog.

Species diversity and rareness (rarity does not include geographical distribution data), in connection with ecosystem maturity and replaceability, are important and commonly accepted parameters in ecosystem assessment (Coesel, 2001). Based on the observed changes in desmid taxa composition, it can be concluded that rare and ecologically most sensitive species characteristic of undisturbed habitats predominate in Kamanos raised bog. Some generally rare desmid species (e.g. *Micrasterias jenneri*, *Cosmarium cymatonotophorum*, *Desmidium cylindricum*, *Actinotaenium cucurbitinum*, *Xanthidium bifidum*), recently found at Kamanos sites, prove their ecological preference to acidic, oligotrophic habitats.

Vilkaitis (1937) has observed a large number of rare desmid species, which favour acido-alkaline sites. Of the species recorded only by him, some desmids (e.g. *M. apiculata*, *M. brachyptera*, *M. fimbriata*, *H. neglecta*, *Pl. tridentulum*, *Act. palangula*, *X. fasciculatum*, *C. taxichondrum*, *C. ungerianum*) indicate their preference to rather alkaline, meso-oligotrophic habitats.

The decrease in the water level mainly influenced the habitats in the boundary zone of Kamanos raised bog. Lowering of the water level in the bog promotes aerobic mineralization processes (Kunskas, 2005), and induces changes in the species composition of vegetation as well as algae. Changes in desmid community in the central part of Kamanos raised bog did not show serious degradation. However, third part of desmid community were shifted by species preferring slightly acidic ($5 \leq pH \leq 6.6$), acidic (($pH < 5$) water and oligosaprobic conditions in the habitat. Some previously common species have disappeared. *Netrium oblongum*, *Cosmarium pygmaeum*, *Penium polymorphum* recently have not been recorded in the hollows, whilst *Mesotaenium endlicherianum*, *Roya obtusa*, *Cosmarium globosum*, *C. pygmaeum*, *C. cruciferum* in the pools.

In conclusion, the research data obtained by V. Vilkaitis and the present study report that a well-developed desmid flora occurs in the water bodies of Kamanos raised bog. The newly obtained results reveal a dynamic picture of green algae flora and provide new structural insights on algal respond to environmental changes. The studied pools and hollows represent a small part of water bodies in Kamanos raised bog. Therefore, algae have so far been insufficiently investigated, and further floristic-ecological research, analysis of species abundance will provide more complete evaluation of the species biodiversity.

ACKNOWLEDGEMENTS

The research was supported by the grant from the Lithuanian State Science and Studies Foundation, Nr. G-153. Authors are thankful to Dr V. Grigaliūnas and S. Sprainaitytė for the assistance in samples collection.

REFERENCES

Aleksa P., Grigienė A., Jusienė A., 2004: Kamanų pelkės susiformavimas ir raida – Vilnius.

Brunza K., 1937: Kamanos. Hidrografija, stratigrafija ir augalija. – Kaunas.

Coesel P.F.M., 1983: The significance of desmids as indicators of the trophic status of freshwaters. – Schweiz. Z. Hydrol., 45/2: 388–393.

Coesel P.F.M., 1998: Handleiding ter bepaling van natuurwaarden van stilstaande, zoete wateren, op basis van het desmidiaceeënbestand. – Uitgeverij.

Coesel P.F.M., 2001: A method of quantifying conservation value in lentic freshwater habitats using desmids as indicator organisms. – Biodiversity and Conservation, 10: 177–187.

Ettl H., Gärtner G., 1988: Süβwasserflora von Mitteleuropa. Chlorophyta, II(10). Tetrasporales, Chlorococcales, Gloeodendrales. – Stuttgart.

Flensburg T., 1967: Desmids and other benthic algae of Lake Kävsjön and Store Mosse, SW Sweden. – Acta Phytogeographica Suecica, 51: 1–122.

Gerrath J.F., 2003: Conjugating green algae and desmids. – In: Wehr J.D., Sheath R.G. (eds), Freshwater algae of North America: 363–365. – San Diego.

Haslam S.M., 2003: Understanding wetlands: fen, bog, and marsh. – London–New York.

Komárek J., Fott B., 1983: Chlorophyceae (Grünalgen), Ordnung Chlorococcales. Die Binnengewässer, 16/7(1). – Stuttgart.

Kosinskaja E.K., 1960: Flora sporovyx rastenij SSSR. 5. Konjugaty (II). – Moskva–Leningrad.

Kunskas R., 2005: Ežerų ir pelkių ekosistemų raida. – Vilnius.

Leliaert F., Smith D.R., Moreau H., Herron M.D., Verbruggen H., Delwiche C.F., De Clerck O., 2012: Phylogeny and molecular evolution of the green algae. *Critical Reviews in Plant Sciences*, 31: 1–46.

Matula J., Pietryca M., 2003: Algae as indicators of the degree of peat-bog degradation. – Acta Botanica Warmiae et Masuriae, 3: 113–122.

Moshkova N.A., Gollerbach M.M., 1986: Opredelitel' presnovodnyx vodoroslej SSSR. Chlorophyta: Ulotrichophyceae, Ulotrichales, 10(1). – Leningrad.

Neustupa J., Nováková S., Šejnohová L., Škaloud P., Řezáčová M., 2002: Algae from aquatic, peat bog, and aerial biotopes in the catchment area of the river Křemelná in Šumava National Park. – Czech Phycology, 2: 47–60.

Nixdorf B., Lessmann D., Steinberg C.E.W., 2003: The importance of chemical buffering for pelagic and benthic colonization in acidic waters. – Water, Air, and Soil Pollution, 3: 27–46.

Nováková S., 2002: Algal flora of subalpine peat bog pools in the Krkonoše Mts. – Preslia, 74: 45–56.

Palamar-Mordvinceva G.M., 1982: Opredelitel' presnovodnyx vodoroslej SSSR, 11(2). – Leningrad.

Palamar-Mordvinceva G.M., 2003: Flora vodoroslej kontinental'nyx vodojomov Ukrainy (Gonatozygaceae, Peniaceae, Closteriaceae, Desmidiaceae), I. – Kiev.

Palamar-Mordvinceva G.M., 2005: Flora vodoroslej kontinental'nyx vodojomov Ukrainy (Desmidiaceae), II. – Kiev.

Parker S.P. (ed.), 1982: Synopsis and classification of living organisms. I, II. – New York.

Rosen G., 1981: Phytoplankton indicators and their relations to certain chemical and physical factors. – Limnologica, 13(2): 263–290.

Starmach K., 1972: Flora słodkowodna. Chlorophyta, X(3). Zielenice nitkowate: Ulotrichales, Ulvales, Prasiolales, Sphaeropleales, Cladophorales, Chaetophorales, Trentepohliales, Siphonales, Dichotomosiphonales. – Warszawa–Kraków.

Švažas S., Drobelis E., Balčiauskas L., Raudonikis L., 2000: Svarbiausios Lietuvos pelkės ir seklūs vandenys. – Vilnius.

Taminskas J., Pileckas M., Šimanauskienė R., Linkevičienė R., 2012: Wetland classification and inventory in Lithuania. – Baltica (Vilnius), 25(1): 33–44.

Teiling E., 1967: The desmid genus *Staurodesmus*. A taxonomic study, 6(11). – Stockholm.

Tomaszewicz G.H., 1994: Abundance and composition of the desmid flora in a series of pits in relation to pH and some other habitat parameters. – Biologia (Bratislava), 49(4): 519–524.

Tomaszewicz G.H., 1996: Flora glonów Wigerskiego Parku Narodowego. – Fragm. Flor. Geobot. Ser. Polonica, 3: 239–259.

Tsarenko P.M., 1990: Kratkij opredelitel' xlorokokkovyx vodoroslej Ukrainskoj SSR. – Kiev.

Valchanova M.P., Stoyneva M.P., 2000: Phytoplankton of the peat bog Tschoklovo (South-Western Bulgaria). – Annual of Sofia University „St. Kliment Ohridski“, 91: 87–103.

Vilkaitis V., 1937: Kamanų desmidiacėjos. – Žemės ūkio akademijos metraštis, 10(3–4): 256–265.

Vilkaitis V., 1940: Galintėnų ežerėlio desmidiacėjos. – Kosmos, 1–3: 129–142.

Willén E., 1992: Planktonic green algae in an acidification gradient of nutrient-poor lakes. – Arch. Protistenkd., 141: 47–64.

KAMANŲ PELKĖS ŽALIADUMBLIŲ ĮVAIROVĖ IR ILGALAIKIAI DVYNIEČIŲ BENDRIJOS POKYČIAI

Judita Koreivienė, Jūratė Kasperovičienė

Santrauka

Atliktų algologinių tyrimų metu 2005 m. Kamanų pelkėje buvo identifikuota 160 žaliadumblių rūšių ir vidurūšinių taksonų, priskiriamų aštuonioms Chlorophyceae eilėms. Didžiausia įvairove išsiskyrė pelkėms būdingi dvyniečiai (93 rūšys). Kokoidinių žaliadumblių (Chlorococcales) aptikta 30, o Ulothrichales – 15 rūšių. Buveinių įvairovė Kamanų ežere ir pelkės akyse nulėmė ženkliai didesnę (151 rūšis) žaliadumblių įvairovę juose lyginant su juodaisias duburiais (61 rūšis). Visuose tirtuose aukštapelkės vandens telkiniuose aptikta tik viena *Actinotaenium cucurbita* rūšis. *Characium ornitocephalum*, *Asterococcus superbus*, *Cosmarium amoenum*, *Micrasterias truncata*, *Spondylosium pulchellum*, *Netrium digitus* vystėsi ežere ir visose pelkės akyse, o *Cosmoastrum scabrum*, *Tetmemorus laevis* – visuose juoduose duburiuose. Straipsnyje lyginama Kamanų aukštapelkės dvyniečių taksonominė struktūra su ankstesniais V. Vilkaičio (1937, 1940) atliktų tyrimų rezultatais. V. Vilkaitis aptiko 129 Desmidiales rūšis ir vidurūšinius taksonus, priskiriamus 18 genčių, ir 10 *Zygnematales* rūšių, priskiriamų 4 gentims. Tyrimų 2005 m. metu aptiktos 55 dvyniečių rūšys V. Vilkaičio identifikuotos pelkėje daugiau nei prieš šešis dešimtmečius. Keturiasdešimt dvi rūšys buvo naujos Kamanų aukštapelkei, iš jų 17 – naujos Lietuvos žaliadumblių florai. Didelė dalis retų dvyniečių rūšių nebuvo rastos galimai dėl ilgalaikių aplinkos pokyčių aukštapelkėje ar dėl nepakankamai išsamių tyrimų. Kita vertus, buvo aptiktos naujos retos rūšys (pvz. *Micrasterias jenneri, Cosmarium cymatonotophorum, Desmidium cylindricum, Actinotaenium cucurbitinum, Xanthidium bifidum*), rodančios aukštapelkės unikalumą.