DECOMPOSITION DYNAMICS OF AQUATIC MACROPHYTES IN THE AREA OF LAKE BALATON AND KIS-BALATON WETLAND

Szabina Simon, Brigitta Simon, Angéla Anda, Tamás Kucserka*

University of Pannonia, Department of Meteorology and Water Management

Keszthely 7 Festetics Str H-8360 Hungary

*simonszabina95@gmail.com

Abstract

Decomposition of aquatic macrophytes in water influences metabolic processes, so its investigation has a major priority. In an experiment at Lake Balaton and Kis-Balaton Wetland between 22 September 2017 to and 17 November 2017, the decomposition rates of *Myriophyllum spitatum* and *Ceratophyllum demersum* were investigated with the commonly used litter bag technique in water. We used two mesh size of litter bags (large - ø = 3 mm and small - ø = 900 μm). The aquatic macrophytes were classified to the fast decomposition category in Lake Balaton and Kis-Balaton Wetland.

Keywords: *Myriophyllum spitatum*, *Ceratophyllum demersum*, Lake Balaton, Kis-Balaton Wetland, litter bag technique

Összefoglalás

A vízi makrofiton vízben történő lebomlása befolyásolja az anyagcsere folyamatokat, így a vizsgálata kiemelt fontosságú. 2017. szeptember 22. és 2017. november 17. között kísérletet végeztünk a Balaton és Kis-Balaton területén, ahol a *Myriophyllum spitatum* és *Ceratophyllum demersum* hínárfajok lebontási ütemét vizsgáltuk avarzsákos módszerrel. Két lyukbőségű avarzsákot alkalmaztunk (nagy - ø = 3 mm és kicsi - ø = 900 µm). A hínárnövényeket mind a Balatonban, mind a Kis-Balatonban a gyors lebontási kategóriába soroltuk.

Kulcsszavak: *Myriophyllum spitatum*, *Ceratophyllum demersum*, Balaton, Kis-Balaton, avarzsákos módszer

Introduction

Aquatic macrophytes are a very important part of the life of a lake and wetland. It has an impact on lake-wide regulations, such as breaking the waves, thus reducing mixing, and stabilizing sediment, thereby increasing sedimentation (Vári, 2012). Aquatic plants floating in the water and rooted in sediment take up nutrients during their lifetime and are returned to the environment after they die. Many studies consider aquatic macrophytes are key factors in water quality regulation (Dobson and Frid, 1998). At the international level, there is a great interest in measuring and explaining the variability of aquatic plant decomposition in lake ecosystems. In this study, the decomposition rates were investigated in the Keszthely Bay of Lake Balaton and Ingói Bay of Kis-Balaton Wetland using dominant aquatic marophytes.

Materials and Methods

The study was conducted at Lake Balaton (Keszthely-Bay) and Kis-Balaton Wetland (Ingói Bay). The decomposition of the dominant aquatic macrophytes (Lake Balaton – *Myriophyllum spicatum*, Kis-Balaton Wetland – *Ceratophyllum demersum*) were analysed with the litter bag technique (Bärlocher et al., 2005). The plant material was collected in September 2017 from the area of sampling sites. Samples were air dried at room temperature to a constant weight. 10-10 g sample was transferred into litter bags with two mesh sizes: large litter bag ø = 3 mm (LLB) small litter bag ø = 900 μm (SLB). The litter bags were positioned on 22 September 2017 at 1 m below the surface in the littoral zone. Three replicates of the sample bags were collected 1, 2, 7, 14, 28, 42 and 56 days after the start of the experiment. The litter bags were transported to the laboratory and washed with water and were air dried to a constant weight. Mass losses were compared using t-test (Microsoft Office 2016). Litter decomposition rates were calculated according to the exponential formula (Jenny et al., 1949; Olson, 1963; Petersen and Cummins, 1974; Bärlocher et al., 2005).

$$W_t = W_0 e^{-kt}$$

where t is the time (d), W_t the litter dry matter remaining at time t relative (g), W_0 the initial litter dry matter at time 0 (g), e the base of natural logarithm and k is the decomposition rate coefficient (d^{-1}).

Results and Discussion

After 56 days of incubation, the average remaining dry mass for *M. spicatum* ranged from 42 (LLB) to 51% (SLB) of the initial dry mass in Lake Balaton (Figure 1a). The mass loss followed a negative exponential pattern.

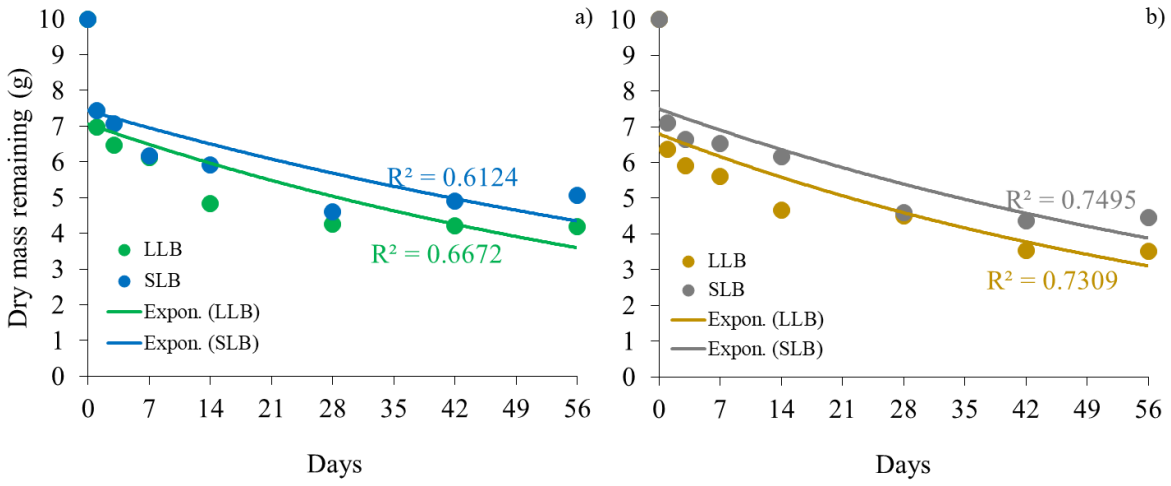

Figure 1. The remaining dry mass of M. spicatum in the area of Lake Balaton (a) and C. demersum in the area of Kis-Balaton Wetland (b) during the 56 days long experiment

The decomposition rate was the highest in the large litter bags. In the first week, the mean quantity of mass loss approximated 6.1 g in the large litterbags. There was no significant correlation between the large and small mesh size leaf litter mass losses (p=0.4676). The reduction in the dry weight was the most prominent during the first 7 days in the large (5.6 g) and small (6.5 g) litterbags of *C. demersum* in Kis-Balaton Wetland System (Figure 1b). For aquatic macrophytes, there was no significant correlation between the two litter bags (p=0.2099) in this water body. The amount of stem material remaining at the end of the experiment was greater for small litter bags (4.4 g), relative to the large litter bags (3.6 g).

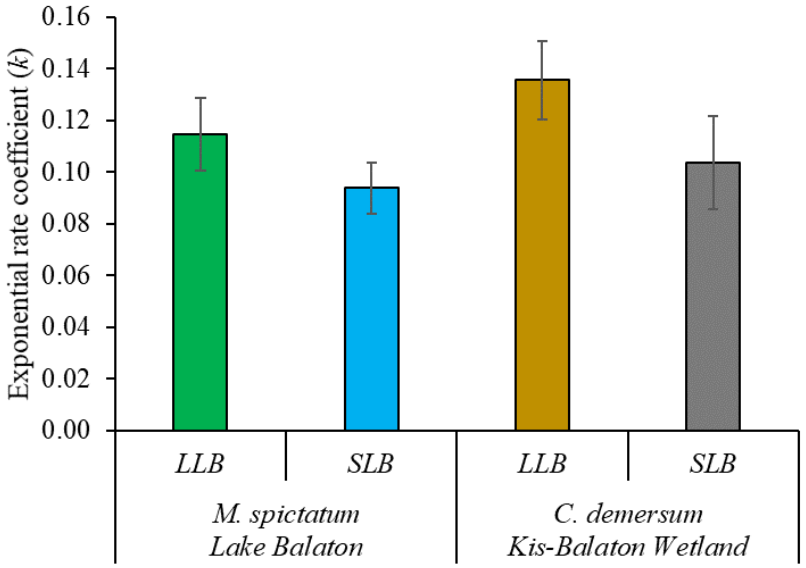

Figure 2. The decomposition coefficients (k) of aquatic macrophytes in the area of Lake Balaton and Kis-Balaton Wetland

The decomposition rates are presented in Figure 2. K-values of *M. spicatum* were high in large litter bags (k=0.1146) in Lake Balaton. The k-values of *C. demersum* were higher in the large litter bags (k= 0.1356) than that of for small litter bags (k=0.1038) in Kis-Balaton Wetland.

Banks and Frost (2017) investigated the decomposition of four species of aquatic macrophytes (*Myriophyllum heterophyllum*, *Ceratophyllum demersum*, *Typha* × *glauca* and *Potamogeton robinsii*) in a lake in southern Ontario, Canada. Their results showed that the breakdown of the four macrophytes (if examined separately) was significantly different. Their values for *Ceratophyllum* were k=0.032, for *Myriophyllum* k = 0.023, for *Potamogeton* k=0.0090, and for *Typha* k=0.0061. Carvalho et al. (2015) investigated the decomposition of two macrophyte species, *Potamogeton pectinatus* and *Chara zeylanica*, in a subtropical shallow lake in southern Brazil. According to their results, the decomposition rates of the two species

varied during the study period (*P. pectinatus* k = 0.019; *C. zeylanica* k = 0.071). These values are somewhat lower than what we calculated.

Acknowledgement

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