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TEA DECOMPOSITION IN MUKHRINO FIELD STATION: THE RESULTS OF SHORT-TERM EXPERIMENT

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Despite the importance of using native litter types in decomposition experiments, this approach does not allow comparison across the sites and hence hamper the identification of the key drivers of litter decomposition at the global scale. An approach of standard litter decomposition was implemented in several global decomposition studies (Didion et al., 2016; Keuskamp et al., 2013) and would be important to complement the native litter decomposition studies conducted earlier in West Siberian peatlands (Вишнякова и др., 2012; Миронычева-Токарева и др., 2013; Вишнякова, Миронычева-Токарева, 2014). In this context, Mukhrino field station joined recently started Global Litter Decomposition Study, TeaComposition, within the International Long Term Ecological Research (ILTER). The initiative aims to study the long-term litter C dynamics and its key drivers at the present and predicted climate scenarios worldwide by using standard substrate (tea).

Our long-term goal was to study key drivers of litter decomposition in peatland ecosystems in the taiga zone of West Siberia, e.g. compare decomposition rate constants (*k*) between different peatland ecosystems and coniferous forests using standard substrate (tea) and native litter substrates, and additionally under experimental “climate change” conditions (temperature rise using Open Top Chambers in peatland ecosystems).

The first results of short-term (3 months) decomposition of standard substrate (tea) have been already received and discussed in the present report.

The general scheme of TeaComposition project was implemented in the study (Keuskamp et al., 2013). Two plots (200 m^2) (1 – waterlogged graminoid-*Sphagnum* lawn and 2 – relatively dry pine-dwarf shrubs-*Sphagnum* treed bog) differing mainly in water regime and associated vegetation composition were within the raised bog. The third plot was located in well-drained dark coniferous-deciduous mixed forest 1 km apart from the bog plots. At each site two replicas were established with 32 tea bags from each type buried inside a square 4 m^2 for incubation over the period of 3 years with the retrieval time after 3, 12, 24, and 36 months. The tea was incubated in the aerated acrotelm layer at the two bog sites and under the litter layer at the forest site, in June 2016. Additionally to the tea bags, 11 types of native litters (*Sphagnum fuscum*, *S. balticum*, *Chamaedaphne calyculata*, *Ledum palustre*, *Rubus chamaemorus*, *Carex limosa*, *Eriophorum vaginatum*, *Scheuchzeria palustre*, *Populus tremula*, *Betula pendula*, *Pinus sibirica*) were packed into the litter bags (mesh size 0.2 mm) and installed in a similar way in October 2016 due to the lack of shed leaves in the beginning of vegetation season. Therefore, these data could not be considered in present publication. Finally, the decomposition of standard substrate in experimental “climate change” conditions will be started in May 2017 following the same protocol of TeaComposition described above.

After 3 months of incubation the first 8 bags from each plot were collected, cleaned from earth and roots, dried in an drying oven at 70ºC for 48 hours (using a Memmert universal oven, model UFE 400), and weighed on 4 decimal places (using an Electronic Analytical Balance Mettler Toledo, model AX205).

The calculation of *k* (decomposition constant), S (stabilization factor) and $a_{r/g}$ (decomposable fraction of rooibos or green tea) was made as described in (Keuskamp et al., 2013). The significance

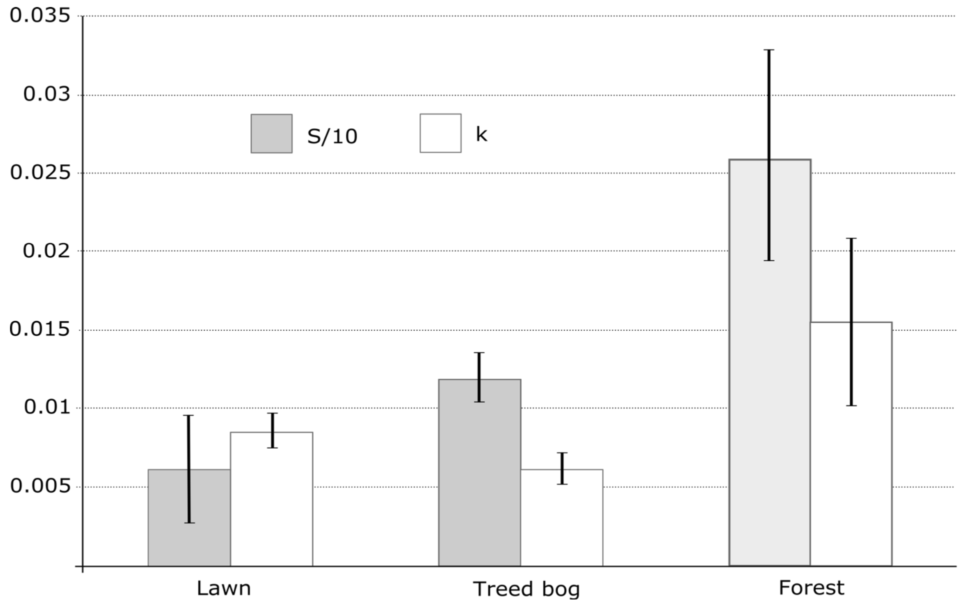

Fig. *Mean numbers of stabilization factor (S/10) and decomposition rate constant (k, day^{-1}) for three studied ecosystem types, black bars show standard deviations*

of differences between three plots were calculated by Wilcoxon rank sum test (Sharaf et al., 1986) using "ranksum" MATLAB-function.

The mass loss after 3-months incubation of green tea was significantly higher (average 72%) compared to rooibos (average 27%). With regard to the effect of the ecosystem type, there were significant differences between all three ecosystem types for green tea, and between forest/treed bog and lawn/treed bog for rooibos tea.

The stabilization factor and decomposition rate differed significantly between all three ecosystem types (fig.). The highest probability of overlap between median values was only 0.3%. The largest stabilization was in forest, intermediate in treed bog and the lowest in the lawn. The decomposition rate constant was largest in forest and lowest in the treed bog.

We hypothesized that decomposition rate constant would be higher in coniferous forests compared to peatlands. This assumption was confirmed by the calculations of decomposition rate constant which was almost twice higher in forest compared to both bog sites. The higher decomposition rate in forest compared to peatland could be explained by better aeration conditions and better nutrient content of the soil and is consistent with the general view of slow decomposition rates in peatlands. However, the forest site had also the highest stabilization factor, which is probably explained by unusually dry summer which preserved high fraction of green tea (but not rooibos tea!) in forest. It is likely that local weather conditions could significantly influence short-term decomposition rates. Regarding the differences between peatland habitats, our hypothesis was *that the waterlogged lawns would have lower decomposition constant compared to treed bog*. The calculation of decomposition constant showed the opposite: lawns had higher decomposition rate compared to treed bogs. The stabilization factor corresponded to the decomposition rate: it was low in lawns and higher in treed bogs. According to series of experiments in similar habitats in taiga zone of West Siberia the decomposition in lawns is slower compared to treed bogs due to high water level and consequently anaerobic conditions. This was shown in litter transplant experiments for several plant litters incubated in both habitats. N. Kosykh with coauthors (Косых и др., 2009) compared decomposition rates of a dwarfshrub leaves (*Chamaedaphne calyculata*) on hummocks and in lawns and showed higher decomposition rate in better aerated conditions of hummocks. The mass loss of peat samples was significantly higher on hummocks compared to hollows in peatlands in different zones of West Siberia (Коронатова, Миляева, 2013). The unusually dry summer could explain the opposite results in our case: the lawns were drier during this year which created thicker aerated layer and higher decomposition rates (and probably treed bogs were at the same time too dry for normal decomposition rate).

In summary, short-term decomposition experiment of standard litter (tea) allowed to estimate decomposition constants *k* of three ecosystem types that statistically differed between each other and the difference was consistent with the general view of slow decomposition in peatlands compared to mineral land. However, decomposition constant in treed bog was lower compared to waterlogged lawn which is unusual and could be only explained by dry summer conditions during the season. We assume therefore that the experiment should be repeated in the following years to verify the decomposition rates relative to weather conditions. The mass loss and the decomposition rate constants were close to reported earlier for similar climatic conditions and habitats. The fact that the mass loss sequences in three ecosystems varied for green and rooibos tea could be important to discuss the validity of calculation of *k* as described in (Keuskamp et al., 2013).

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