

Supplemental information for:
Effects of organic substrates on growth rate parameters of a boreal
cyanolichen

by
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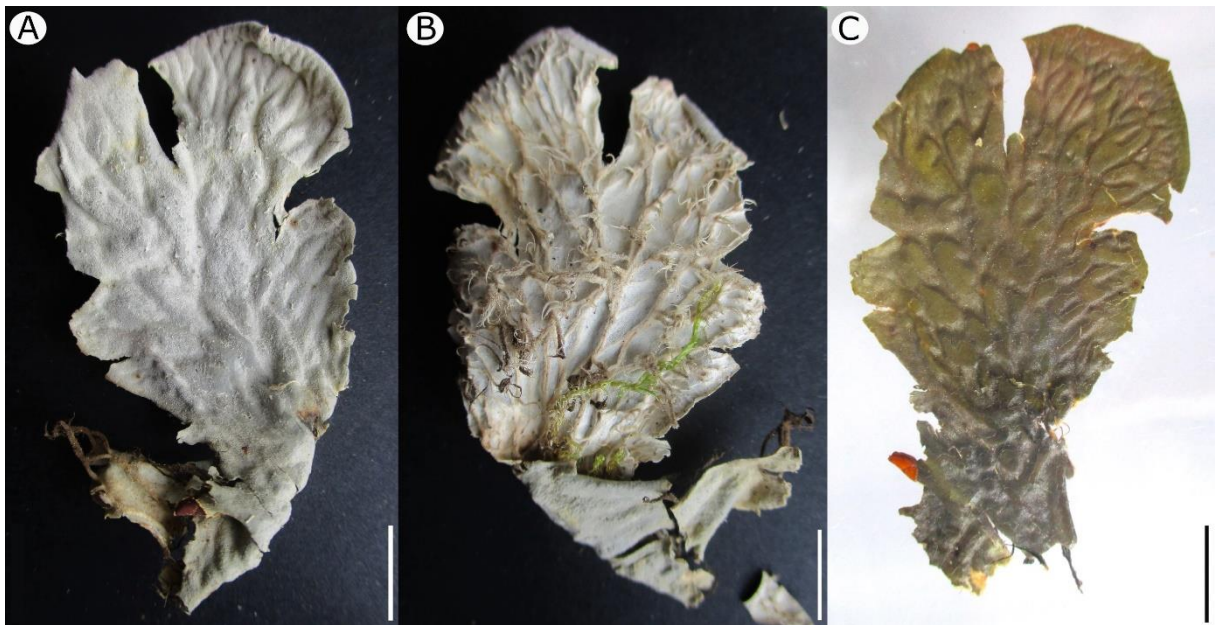


Figure S1. The upper (A) and lower surface (B) of a dry specimen of the foliose macrolichen *Peltigera membranacea* (Ach.) Nyl. Some substrate is still adhered to the lower surface. (C) The same specimen after being moistened and placed between two glass sheets to take photographs for area measurements. Scales: 1 cm.

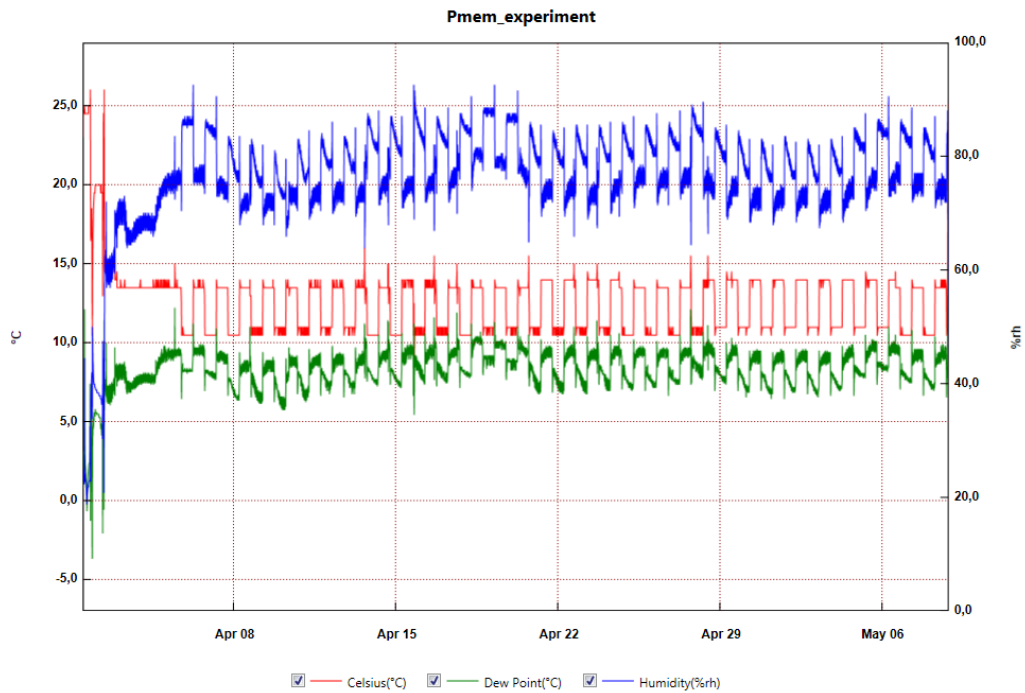


Figure S2. Plant growth chamber parameters from April 1, 2015 to May 8, 2015. The growth experiment started April 2, 2015 and lasted for 28 days. The measured units were relative humidity (%; blue line), temperature (°C; red line) and dew point (°C; green line).

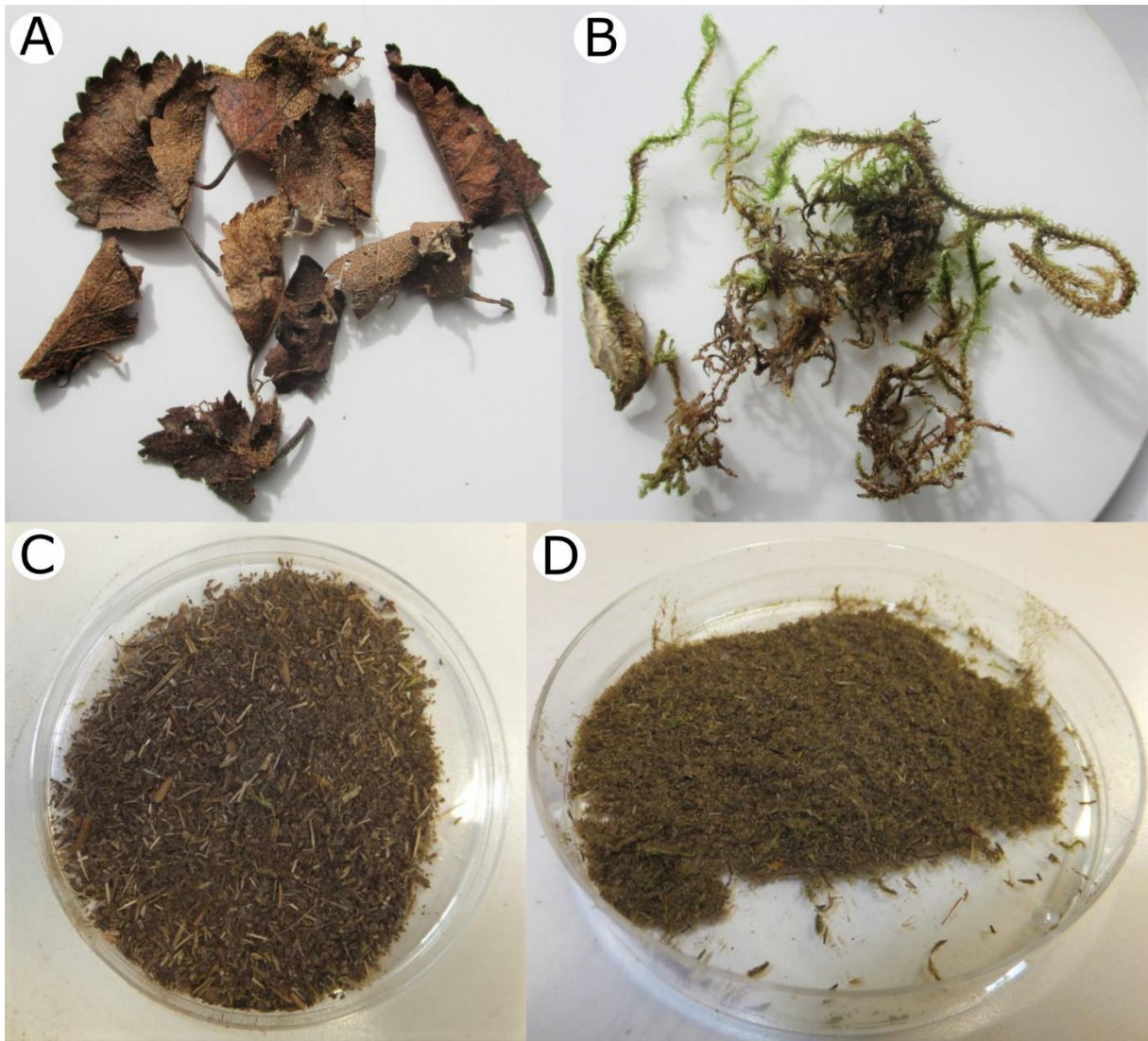


Figure S3. Fallen leaves (*Betula pubescens* Ehrh. and *Sorbus aucuparia* L.) (A) and bryophytes (*Hylocomiadelphus* sp. and *Rhytidiadelphus* sp.) (B) were collected from the same site as the *Peltigera membranacea* specimens and were used as organic substrates in the growth experiment. Leaves and bryophytes were air-dried and ground. A third of the lichens from both the dark and the light-dark treatments were grown on 2 g of pulverised leaf litter (C), the second third was grown on 2 g of pulverised bryophytes (D), and the remaining third served as a control group with the specimens growing in empty Petri dishes without any substrate (not shown).

Table S1. The mean growth rates and the standard error of the mean ($n = 23-25$) of the growth parameters measured in this study, i.e., relative growth rate (RGR), relative thallus area growth rate (RT_{AGR}), and changes in specific thallus mass (ΔSTM). Shown are the values for the six treatments 'light_leaves', 'light_bryophytes', 'light_empty', 'dark_leaves', 'dark_bryophytes', and 'dark_empty'.

samples	RGR [$\text{mg g}^{-1} \text{ day}^{-1}$]	RT_{AGR} [$\text{mm}^2 \text{ cm}^{-2} \text{ day}^{-1}$]	ΔSTM [mg mm^{-2}]
light_leaves	9.0±0.672	0.58±0.064	9.3±1.532
light_bryophytes	7.9±0.425	0.67±0.057	3.8±1.509
light_empty	2.8±0.318	0.48±0.053	-5.2±1.174
dark_leaves	-1.4±0.431	0.06±0.046	-5.4±0.948
dark_bryophytes	-2.1±0.358	0.15±0.067	-9.2±1.107
dark_empty	-2.8±0.301	-0.01±0.043	-7.1±1.012

Note: 'light_leaves' $n=24$, 'light_bryophytes' $n=24$, 'light_empty' $n=24$, 'dark_leaves' $n=25$, 'dark_bryophytes' $n=23$, and 'dark_empty' $n=25$.

Table S2. Results of the Cohen's d test for effect size. Shown are the effect sizes (effsize) and the magnitude of the effect sizes for the growth parameters relative growth rate (RGR), relative thallus area growth rate (RT_{AGR}), and changes in specific thallus mass (ΔSTM). Results are given for the categories empty vs. bryophytes, empty vs. leaves, and leaves vs. bryophytes. Only the light-dark treatments were used for this Cohen's d test, all dark-treated lichen lobes were excluded.

parameter	RGR		RT_{AGR}		ΔSTM	
	<i>effsize</i>	<i>magnitude</i>	<i>effsize</i>	<i>magnitude</i>	<i>effsize</i>	<i>magnitude</i>
light-dark treatments						
empty vs. bryophytes	2.78	large	0.71	moderate	1.35	large
empty vs. leaves	2.41	large	0.37	small	2.15	large
leaves vs. bryophytes	0.40	small	0.29	small	0.73	moderate

Table S3. Results of the post-hoc tests (TukeyHSD) which were performed to determine potential effects of light availability, substrate availability, and substrate type on lichen growth. Shown are the differences in means (diff.) and adjusted p -values (p adj.) for the growth parameters relative growth rate (RGR), relative thallus area growth rate (RT_AGR), and changes in specific thallus mass (Δ STM). Significant results are indicated with *. For more specific comparisons between light:substrate see Table 2.

light:substrate	RGR [mg g ⁻¹ day ⁻¹]		RT _A GR [mm ² cm ⁻² day ⁻¹]		Δ STM [mg mm ⁻²]	
	diff.	p adj.	diff.	p adj.	diff.	p adj.
light_leaves vs. dark_bryophytes	11.1	<0.001*	0.44	<0.001*	18.5	<0.001*
light_leaves vs. dark_empty	11.8	<0.001*	0.60	<0.001*	16.3	<0.001*
light_bryophytes vs. dark_leaves	9.3	<0.001*	0.60	<0.001*	-9.2	<0.001*
light_bryophytes vs. dark_empty	10.7	<0.001*	0.68	<0.001*	10.8	<0.001*
light_empty vs. dark_leaves	4.2	<0.001*	0.41	<0.001*	0.3	0.999
light_empty vs. dark_bryophytes	4.9	<0.001*	0.33	0.001*	4.1	0.199
light_substrate vs. light_empty	5.7	<0.001*	0.15	0.132	11.7	<0.001*
light_substrate vs. dark_substrate	10.2	<0.001*	0.52	<0.001*	13.8	<0.001*
light_substrate vs. dark_empty	11.3	<0.001*	0.64	<0.001*	13.6	<0.001*
light_empty vs. dark_empty	5.7	<0.001*	0.49	<0.001*	1.9	0.718
light_empty vs. dark_substrate	4.5	<0.001*	0.37	<0.001*	2.1	0.548
dark_substrate vs. dark_empty	1.1	0.176	0.12	0.305	-0.2	0.999

Note: Units for differences in means (diff.) for RGR = [mg g⁻¹ day⁻¹], for RT_AGR = [mm² cm⁻² day⁻¹], and for Δ STM = [mg mm⁻²].

Table S4. Results of the paired-samples t-test to test whether the raw area [mm²] and raw biomass [mg] differences are statistically significant. Area and biomass were determined before and after the growth experiment. Significant results are indicated with *.

parameter	df	change in biomass [mg]		change in area [mm ²]	
		t	p	t	p
before vs. after	144	5.31	4.11e-07*	10.01	<2.2e-16*