Supplementary Material

A black vinyl tape was used as a background in optical chamber method. The top side of the tape (red dots and line) was a background for broadleaves and, possible re-absorption of transmitted and re-absorbed photons is negligible. The bottom side (black dots and line) was the side to which needles were attached. Because tape constitutes a significant share of needles measurements field of view (approx. 75% in 1N and no less than 50% in 3N), its optical performance was tested. We measured tape following a protocol for ChlF (dots) and treated the data the same way in the analysis, i.e. corrected it against baseline (lines). The REF3 (grey dots), same as used in real samples correction, was also used here. After correction, the tape showed barely any ChlF signal in the range of interest, and, therefore, we assume that it did not affect the ChlF measurements of our samples.

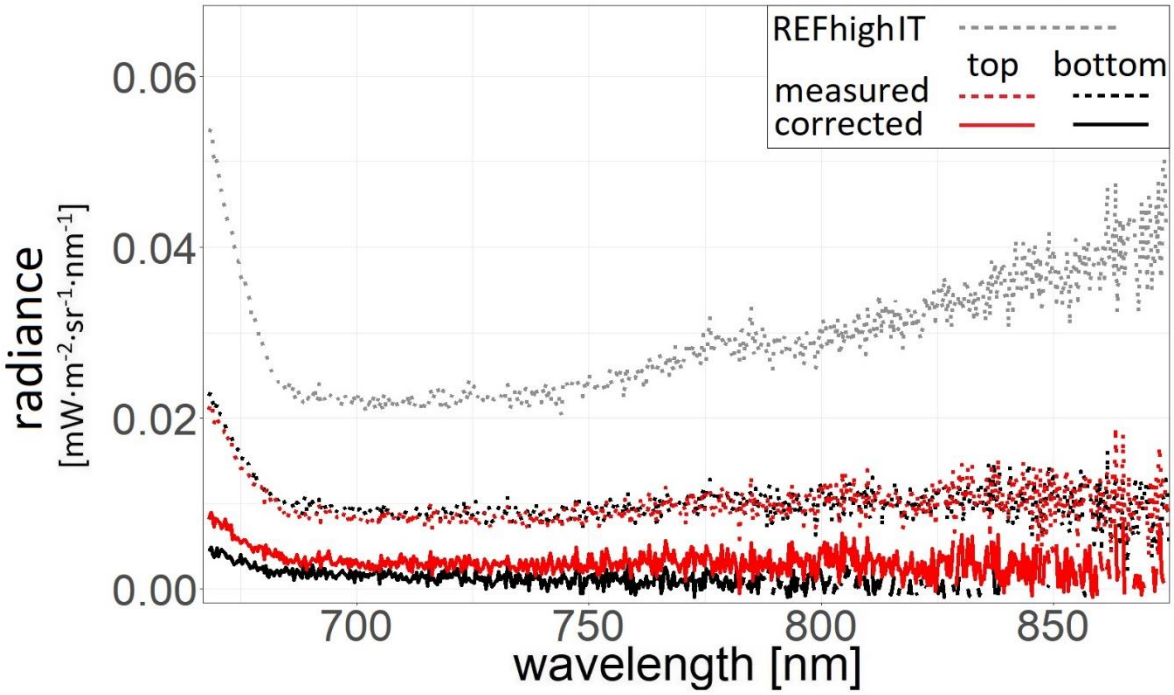

Figure S1. Signal arising from black tape top side (without glue, red) and bottom side (with glue, black) in IT = 300 ms, before (dotted lines) and after baseline correction (solid lines). Reference for the same IT is marked as a grey dotted line.

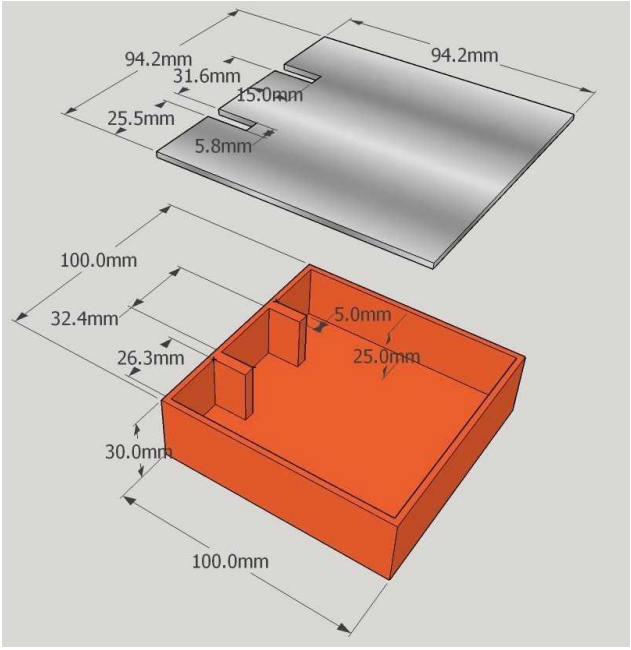

Figure S2. 3D optical chamber printed in PLA plastic (orange) and a metal stainless steel plate for attaching leaf samples.

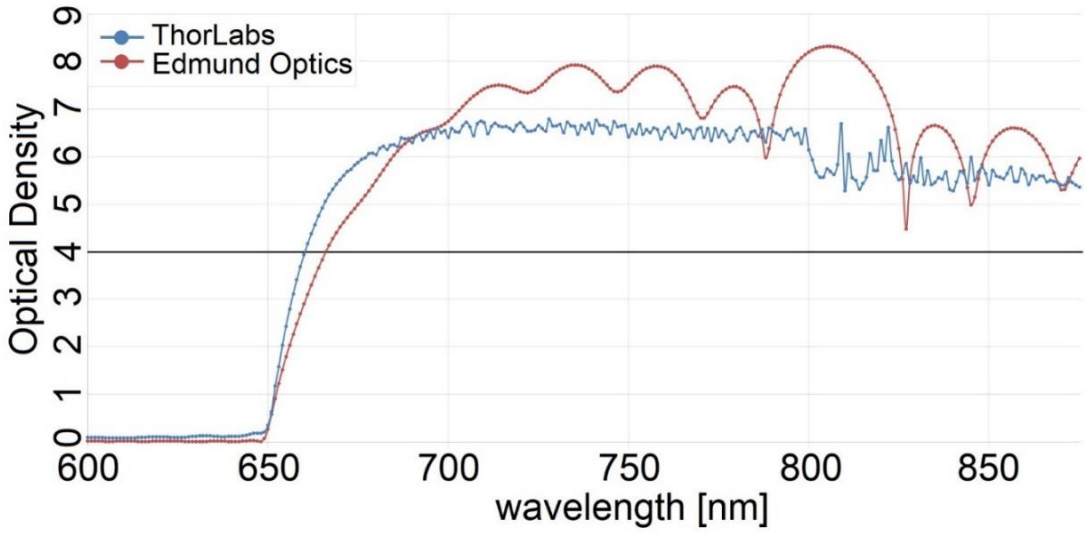

Figure S3. Optical density of the Thorlabs® filter used in OC and IS (blue) and the Edmund Optics® filter used in FW (orange) across wavelengths, according to the manufacturer data.

An additional test of different light sources was carried out for birch leaves. ChlF spectra were measured (dotted lines) according to FW protocol. The aim of this test was to validate our baseline correction method. The main difference between light sources was that halogen emits light in the range of ChlF (wavelengths: 650–900 nm), while LED shows only small emission in NIR (above 700 nm). The test showed, that irrespectively of the used light source, baseline correction can be successfully applied. In case of LED, this correction will be weaker while compared to halogen. The test also proved, that if leaf-specific REF3 is recorded (as it was here, but not in the main experiment), the baseline performs better, and red tail of ChlF spectra can be fully or nearly fully recovered.

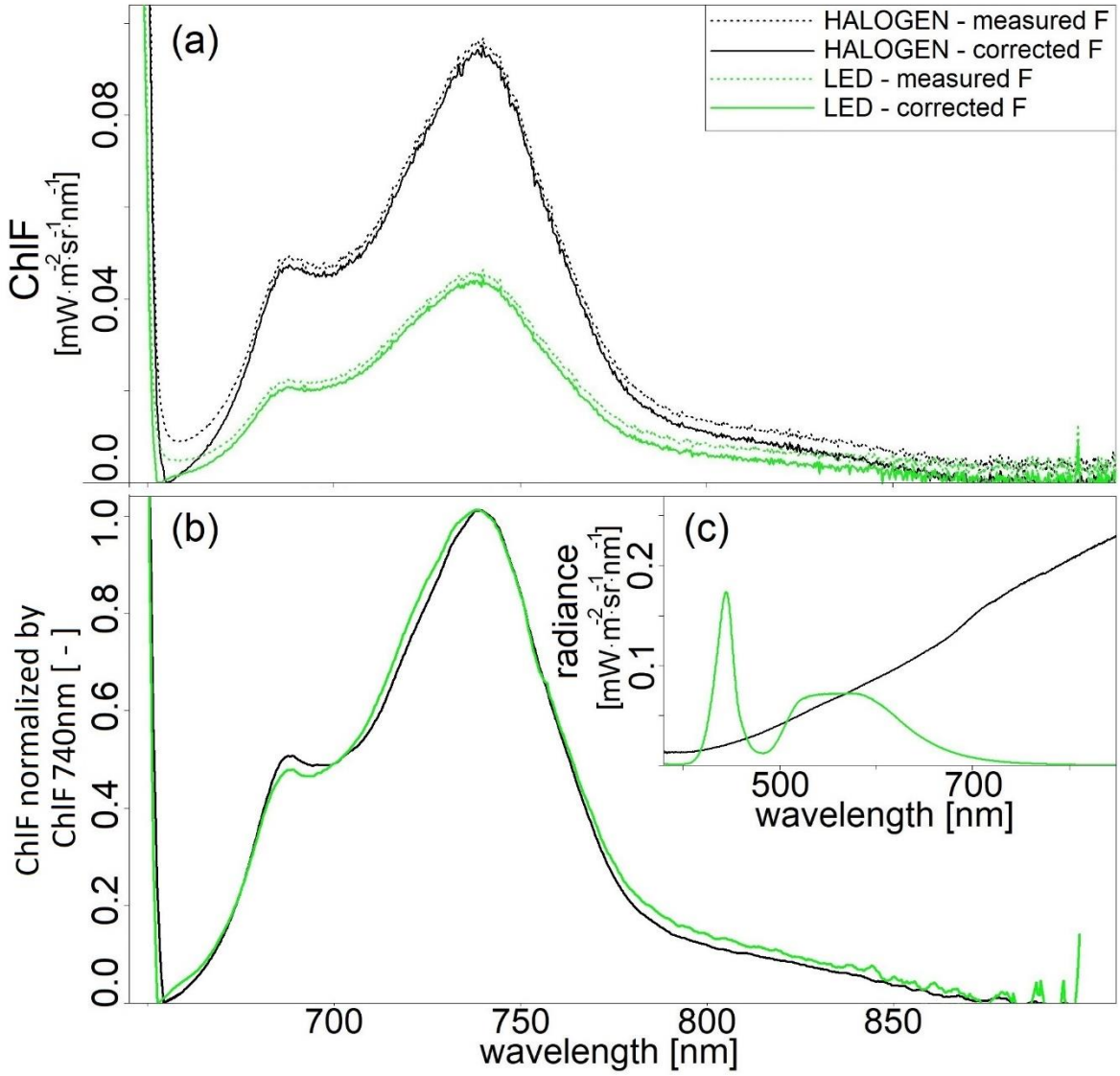

Figure S4. Chlorophyll fluorescence spectra of birch leaf measured in FW with halogen (black) and LED (green) light—(**a**) measured spectra: before (dotted lines) and after (solid lines) baseline correction; (**b**) spectra normalized to F740; and (**c**) light input delivered by the light sources, PAR ≈ 50 μmol

Reflectance spectra were recorded within all methods protocols and for each sample. In Figure S5, average of four or five replicates for broadleaves and pine needle mat are presented (variation between replicates marked as shading). Due to differences in the specific methods geometry of measurements, inconsistencies in reflectance spectra appeared. There was, in particular, a contrast between OC (black line) and the other two methods below 700 nm-rise in thin leaves of birch. Spectra remained similar above 700 nm-rise and differed only in the intensity. In particular, the needle mat showed enhanced reflectance in FW, while compared to the other two methods.

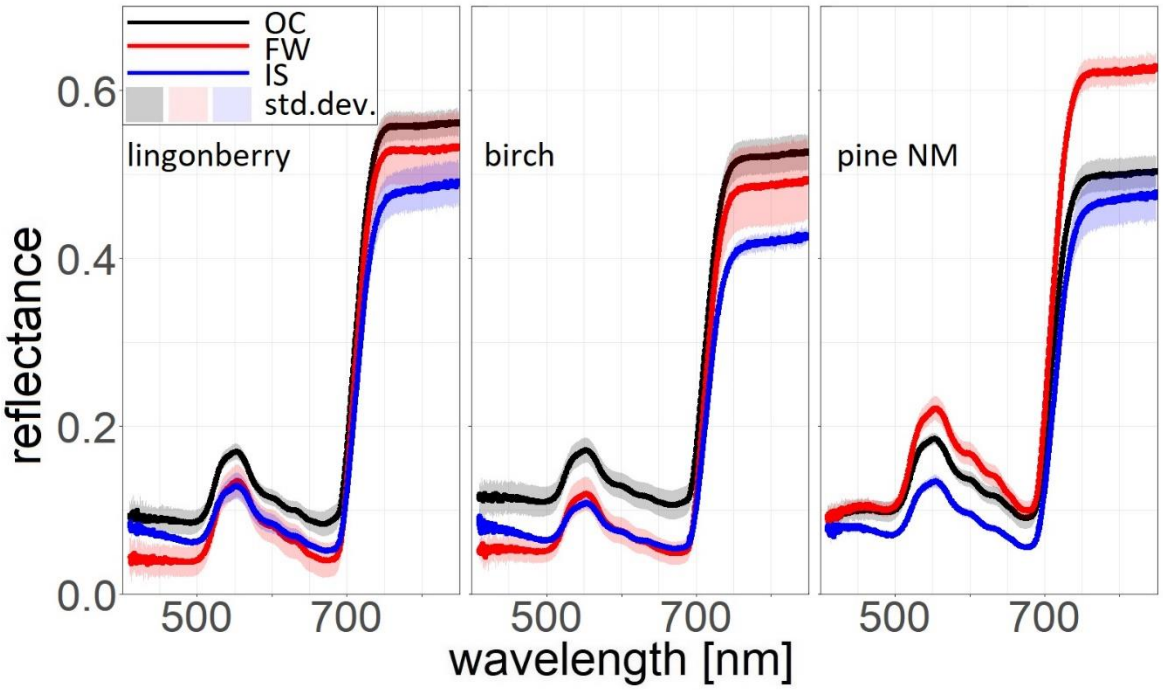

Figure S5. Average reflectance spectra for lingonberry, birch and pine needle mat in Optical Chamber (black), FluoWat (red), and Integrating Sphere (blue) methods. Standard deviation is marked as shading.

Similarly to lingonberry (Figure 5 in the main text), the most pronounced difference between the three tested methods was an intensity of received spectra: lowest for IS and highest for OC. Normalized to F740 (Figure 5b), IS (blue) showed strongly enhanced re-absorption in the red/far-red peak, while in lingonberry, OC (black) and FW (red) showed nearly identical red peak shapes in normalized spectra, for birch (Figure S6b) OC presented slightly lower re-absorption, i.e. a higher red peak.

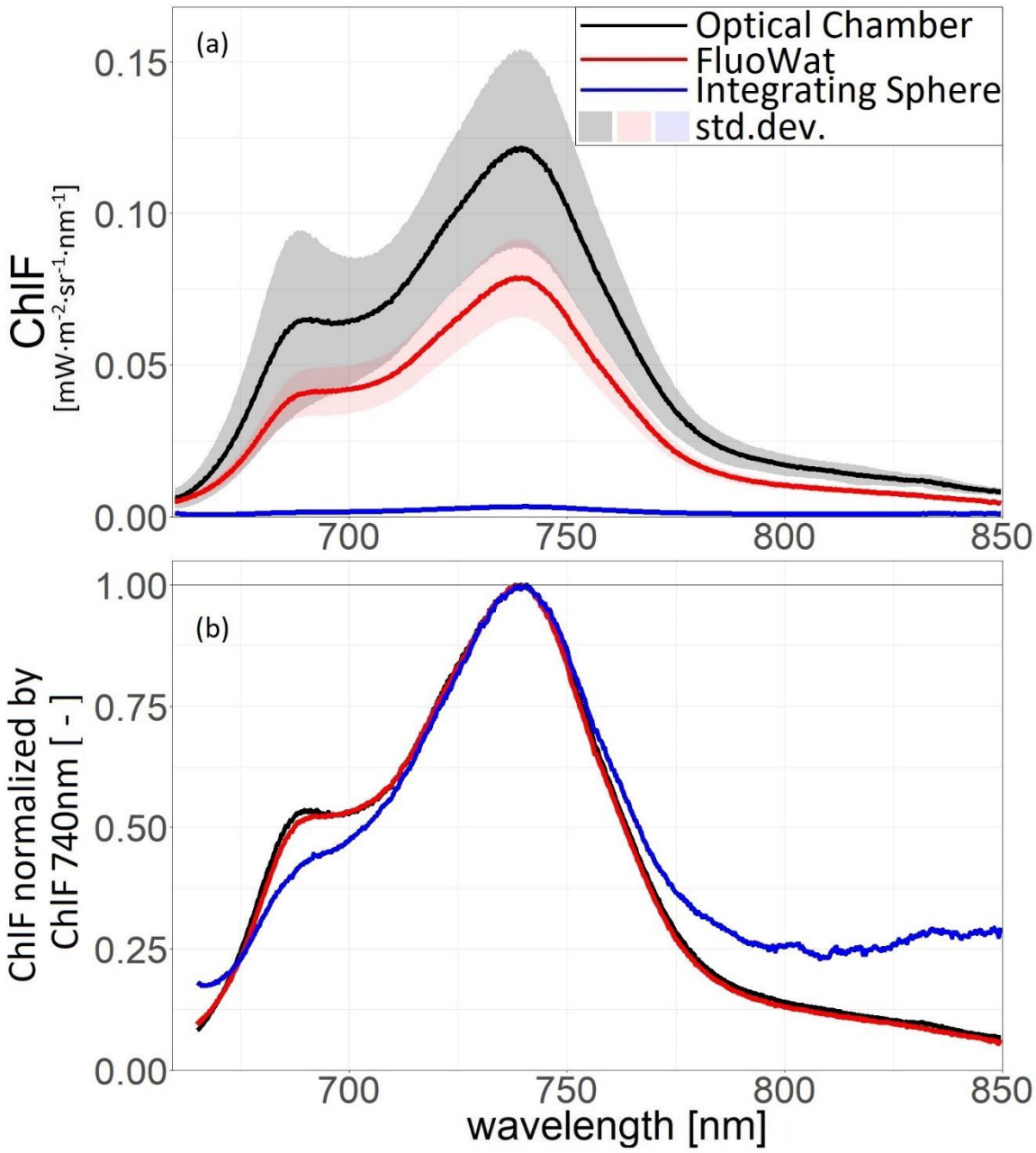

Figure S6. Chlorophyll fluorescence spectra of birch in Optical Chamber (black), FluoWat (red), and Integrating Sphere (blue) method. (**a**) real spectra, standard deviations marked as shadings; and (**b**) normalized to F740.