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Of turf, trees and air quality: does roadside moss trap more particulate matter than leaves?

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Abstract

Plants in urban areas interact with air quality in numerous ways. Firstly, pollutants from industry, vehicular and residential sources can be detrimental to plant growth. Secondly, plants sometimes contribute to poor air quality, for instance by emitting allergens such as pollen, or by trapping pollutants in street canyons and thirdly, with appropriate placement some species improve air quality through phytoremediation. A common urban pollutant is particulate matter (PM - small particles of solid or liquid). While this is of concern to human health, less well known is its effect on vegetation and while moss is commonly studied as a biomonitor, there is little research on how it is affected by urbanisation. Our objective was to measure PM entrapment by roadside moss turfs and compare it to leaves of a common Australian tree species, Pittosporum undulatum on an urban gradient.,,

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Both GlcCers and GIPCs have proven difficult to study due to the technical challenges of extracting amphipathic lipids, and genetic challenges posed by the fact that GlcCer- and GIPC-deficient mutants are either lethal or have severely impaired development. The model bryophyte *Physcomitrella patens* is an appealing system for the study of sphingolipid metabolism, as mutant phenotypes may be easier to interpret within its relatively minimalist developmental program compared to the conventional angiosperm model *Arabidopsis thaliana*. Further, a model bryophyte presents an opportunity to study the most ancestral functions of complex sphingolipids in land plants. We have profiled the sphingolipid composition of *Physcomitrella patens* by ultra-performance liquid chromatography coupled to mass spectrometry (UPLC-MS/MS). Unlike other plant species in which GIPCs are highly abundant, *Physcomitrella patens* accumulates a high level of GlcCers, while GIPCs are barely detectable. We identified candidate genes associated with both GlcCer and GIPC biosynthesis in the *Physcomitrella patens* genome based on homology to *Arabidopsis thaliana*. We are confirming these annotations with biochemical assays, and by generating and characterizing loss-of-function mutants. We generated a *ceramide glucosyl transferase* (*cgt*) mutant by homologous recombination; this mutant lacks GlcCers entirely, and accumulates ceramides. The mutant has abnormal growth, and appears unable to produce caulonema in a dark-growth experiment. Single and higher-order *inositol phosphorylceramide synthase* (*ipcs*) mutants are being generated using CRISPR/Cas9. This work sheds light on the evolution of the metabolism of an enigmatic class of lipids, and contributes to our understanding of their cellular and developmental functions.

PO-20

Of turf, trees and air quality: does roadside moss trap more particulate matter than leaves?

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Plants in urban areas interact with air quality in numerous ways. Firstly, pollutants from industry, vehicular and residential sources can be detrimental to plant growth. Secondly, plants sometimes contribute to poor air quality, for instance by emitting allergens such as pollen, or by trapping pollutants in street canyons and thirdly, with appropriate placement some species improve air quality through phytoremediation. A common urban pollutant is particulate matter (PM - small particles of solid or liquid). While this is of concern to human health, less well known is its effect on vegetation and while moss is commonly studied as a biomonitor, there is little research on how it is affected by urbanisation. Our objective was to measure PM entrapment by roadside moss turfs and compare it to leaves of a common Australian tree species, *Pittosporum undulatum* on an urban gradient. We also wished to compare stress levels on this gradient using chlorophyll fluorescence (F_v/F_m). We sampled nine sites in the coastal city of Wollongong, NSW, three in each of three levels of urbanisation: low, medium, and high according to road type (freeway, suburban road, quiet peri-urban road). At one site of each urban class we measured $PM_{2.5}$ over a two-week period using a mobile monitor. PM of three size fractions was isolated by filtration and washing with both water and chloroform. Site averages for moss turfs were much higher than leaves: between 5.60 and 33.00 mg per g dry weight for total PM (moss) compared to between 2.15 and 10.24 mg per g dry weight (tree). Moss appears to be more sensitive to increasing urbanisation in terms of photosynthetic stress, with moss F_v/F_m declining by a site average of 40% from low to high urban "class" (0.76 to 0.45). We also found increased wax deposition in moss with urbanisation, raising the hypothesis that it is a defence mechanism in these environments. Our study highlights the stressors potentially limiting moss persistence in cities and quantifies moss turf ability to trap PM.

This trait could be exploited in applications relating to urban greening or air quality and should be further explored.

PO-21
Bryophytes of Myanmar. Inventory, characteristics and affinities.

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Indochina is bryologically one of the least known regions in Asia. Especially the flora of Myanmar (Burma) is still insufficiently known. It lies between latitudes 9° and 29°N, and longitudes 92° and 102°E, situating in the monsoon region of Asia. It also extends from the mangrove forests and coral reefs of the Andaman Islands in the south to the snow-capped peaks of Mt. Kakaboradzi (5881 m) in the north. The situation in the surrounding area suggests that there is incredible floral diversity in Myanmar. The National Museum of Nature and Science, Japan, together with the Forest Research Institute, Myanmar, embarked the international joint inventory research project to collect the materials for a "Flora of Myanmar" under the MoU since 2016. This study aims to present a preliminary report of the results of our field surveys, intending to highlight the characteristics and affinities of the bryophytes of Myanmar. Field surveys were conducted on Tanintharyi Nature Reserve (elevation lower than 250 m) of southern part in January, 2017, and on the montane area of Chin State (elevation 1200-2600 m) of western part in November, 2017. A total of ca. 550 bryophyte specimens were collected in both field surveys. The bryophytes recognized in Tanintharyi Nature Reserve mainly consist of the species of Calymperaceae, Fissidentaceae, Sematophyllaceae, Lejeuneaceae, etc., which are similar to those of lowlands of subtropical or tropical regions of Asia. On the other hand, the bryophytes recognized in montane area of Chin State are mainly composed of the species of Brachytheciaceae, Dicranaceae, Hylocomiaceae, Meteoriaceae, Neckeraceae, Thuidiaceae, Lepidoziaceae, Plagiochilaceae, etc., which are similar to those of the forests of temperate regions of Asia.

PO-22
Knock-down of essential subunits of SCM5/6 complex in *Physcomitrella patens*

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SMC5/6 complex participates in many vital cell processes including DNA repair and most of its eight subunits are essential. In haploid *Physcomitrella patens* mutations of essential genes leading to loss-of-function are lethal and their study requires rather attenuation of transcription or expression that allows partial viability of mutant than hard knock-out. We used two different techniques - RNA interference (RNAi) and CRISPR/dCas9 interference (CRISPRi) - to knock-down essential genes of SMC5/6 complex for generation of lines manifesting deficiency of protein of interest, but still viable. RNAi was performed by transformation of plasmid expressing short hairpin RNA (shRNA) targeted to *SMC6* mRNA and produced stably transformed lines with decreased levels of *SMC6* transcript and strong phenotype. Nevertheless, the RNAi effect disappeared after 3-4 cycles of subcultivation of primary transformants. The loss of *SMC6* gene silencing was most probably caused by methylation and subsequent transcriptional inactivation of shRNA construct. To gain lines with stably silenced subunits of *SMC5/6* complex, plasmid expressing catalytically dead Cas9 (dCas9) and gRNA targeted near to START codon of *NSE1* or *NSE4* was introduced into protoplasts of *Physcomitrella.* Recovered CRISPR/dCas9 lines were screened by qRT-PCR for transcript levels of *NSE1* or *NSE4* and the lines with decreased level of *NSE1*, *NSE4* mRNA were tested for their sensitivity/resistance to acute DNA damage induced by radiomimetic drug bleomycin. Although only mild reduction (20-30%) of NSE1 and NSE4 mRNA levels was detected the CRISPRi lines manifested clear