Young Scientist Special Session

Fungal biofilms are supported by extracellular polymeric substances and protective pigments in their substrate attachment and desiccation tolerance

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Rock-inhabiting fungi are known to colonise air-exposed substrates like minerals, photovoltaic panels building facades and monuments, withstanding the various stresses these extreme habitats are known for. Here we show how both colonisation and stress resistance are linked to the properties of the fungal cell surface. By deleting genes involved in the synthesis of melanin and carotenoid pigments of the model rock-inhabiting fungus *Knufia petricola* via CRISPR-Cas and comparing the behaviour of the gene-deletion mutants with the wild type (WT), we studied the role of these genes in mineral colonisation and stress sensitivity. The extracellular polymeric substances (EPS) of biofilms of the WT and mutants were extracted, quantified and chemically characterised. We observed that the absence of melanin affected the quantity and composition of the produced EPS: melanin-deficient mutants synthesised more EPS containing fewer pullulan-related glycosidic linkages. Moreover, in mineral dissolution experiments, these mutants showed a lower ability to colonise the mineral olivine. We hypothesise that not melanin, but the pullulan-related linkages enabled the melanin-producing strains to attach more strongly to the mineral. Moreover, ICP-OES analysis of the aqueous mineral-derived solutes showed that biofilms of the *K. petricola* mutants which could attach were able to dissolve the olivine faster than those that could not. The same mutants were also characterised by their sensitivity to desiccation stress: only the mutant deficient in both melanin and carotenoid synthesis was more sensitive to desiccation compared to the WT, indicating that a combination of both pigments is critical to withstand desiccation. Overall, these results show the critical role of the cell surface in the specific capacities of rock-inhabiting fungi.