High-density cultivation of terrestrial Nostoc strains leads to reprogramming of secondary metabolome.

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Abstract

Terrestrial symbiotic cyanobacteria of the genus Nostoc exhibit a large potential for the production of bioactive natural products of the nonribosomal peptide, polyketide and ribosomal peptide classes, yet most of the biosynthetic gene clusters are silent under conventional cultivation conditions. In the present study, we have utilized a high-density cultivation approach recently developed for phototrophic bacteria to rapidly generate biomass of the filamentous bacteria up to a density of 400 g wet weight/L. Unexpectedly, integrated transcriptional and metabolomics studies uncovered a major reprogramming of the secondary metabolome of two Nostoc strains at high culture density and a governing effect of extracellular signals in this process. The holistic approach enabled capturing and structural elucidation of novel variants of anabaenopeptin including one congener with potent allelopathic activity against a strain isolated from the same habitat. The study provides a snapshot on the role of cell-type specific expression for the formation of natural products in cyanobacteria.Importance Terrestrial filamentous cyanobacteria are a largely untapped source of small molecular natural products. Exploitation of the phototrophic organisms is

hampered by their slow growth and the requirement of photobioreactors. The current study not only demonstrates the suitability of a recently developed two-tier vessel cultivation approach for the rapid generation of biomass of Nostoc strains but also demonstrates a pronounced up regulation of high value natural products at ultra-high culture densities. The study provides new guidelines for high-throughput screening and exploitation of small molecule natural products and can facilitate the discovery new bioactive products from terrestrial cyanobacteria.

Beteiligte Forschungseinheiten

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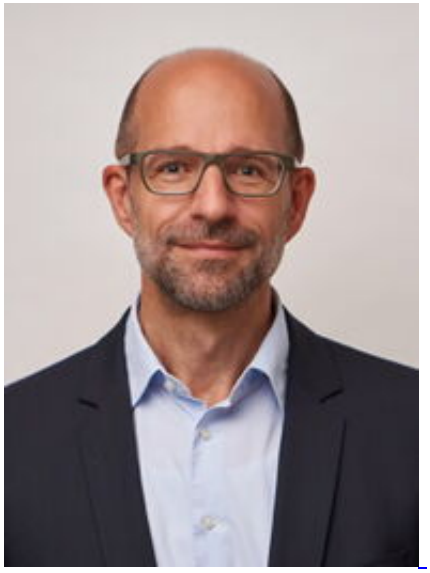

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