Characterisation of fungal lignocellulose utilisation strategies using biocalorimetry

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Fungi are important primary destructors of lignocelluloses of plant biomasses and thus play a key role in the global carbon cycle [1]. At the same time, they are also considered as promising biocatalysts with considerable potential for various (environmental) biotechnological applications. These include, for example, the conversion of lignocellulosic by-products from agriculture and forestry into valuable materials using biorefineries, as well as the potential treatment and detoxification of various wastes and environmental pollutants [2-4].

This raises the question of whether non-invasive metabolic heat flux analysis can be used to determine functional traits in free-living saprotrophic decomposer fungi and to predict fungal influences on ecosystems processes. To answer such questions, the growth of seven fungal species, including ascomycetes, basidiomycetes, and zygomycetes, was studied in a standardized laboratory environment on wheat straw as a globally relevant lignocellulosic substrate. Our study demonstrates that biocalorimetry can provide various growth-related parameters of fungal activity. These include apparent maximum growth rates (AMGR), cultivation times until the observable onset of fungal growth at AMGR (tAMGR), and heat yield coefficients ($Y_{Q/X}$); the latter indicating the degree of resource investment in fungal biomass relative to other functional properties. Particularly exciting is the quotient obtained from AMGR and tAMGR, which we refer to as competitive growth potential (CGP). All these parameters seem to be suitable to link the fungal potential for biomass production with the corresponding ecological strategy in resource utilization. Therefore, they may be considered as fungal life history traits. A close relationship observed between CGP and $Y_{Q/X}$ values suggests an interpretation in terms of fungal life history strategies [5].

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