DEGRADATION OF SYNTHETIC POLYMERS BY EPYPHYTIC FUNGI FROM HIGH CANOPY OF THE TROPICAL RAIN FOREST

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In the second half of the 20 century, our society developed new technologies and processes for the mass production of quality products. The technological explosion of knowledge in the petrochemical industry and the resulting synthesis of diverse plastics has had a profound effect on humankind. Polyesters such as Terylene or Dacron are used in textile industry; Mylar is most frequently used for building insulation; drinking water and beverages are packed in convenient plastic bottles made of poly(ethylene terephthalate), or PET. This ubiquitous material is the fourth most common plastic in the world today, following polyethylene, polypropylene and polyvinyl chloride. Along with numerous advantages, such as low-cost production, versatility, lightweight and ease to shape, the important property of most suitable plastics is their resistance to biodegradation. However, it is linked to the acute ecological threat of the utilization of plastic waste. Nowadays our society faces the massive amount of plastic waste accumulated in the environment [1, 2].

Some synthetic polymers such as PET and many others have a structural resemblance to the natural polyester polymer cutin, a wax that covers aerial parts of plants and consists of interlinked omega hydroxy acids. Thus, it is possible to assume that microorganisms living on cutin-rich parts of plants may also be capable of biological degradation of plastic waste [3]. The phyllosphere, or aerial parts of plants, is an ecosystem that hosts a vast and diverse microbial community. Such microbiomes are especially rich in canopies of tropical rain forests where trees do not shed leaves annually. The adaptation of epiphytic and/or endophytic microorganisms to their habitat requires the development of such specialized functions as an efficient attachment to the leaf surface, resistance to oxidative stress and survival in the oligotrophic environment. To solve these challenges, phyllosphere microorganisms produce enzymes that hydrolyze not only lignocellulose but also cutin [4].

In this study, we identified and tested 300 of epi- and endophytic fungi isolated from the high canopy of a tropical rainforest and detected at least a dozen of strains that are capable of degrading polycaprolactone, a biodegradable polyester that has numerous biomedical and industrial applications. Many active strains are known as plant pathogens (*Lasiodiplodia theobromae*, *Fusarium* sp., *Clonostachys* sp., *Colletotrichum acutatum*), but there are also common generalists (*Trichoderma guizhouense*, *Pestalotiopsis* sp. and *Penicillium* sp.). Strains were tested for the activity of their cutinases and ability to degrade lignocellulose. For *Trichoderma* and Fusarium, the expression analysis revealed the set of most potent enzymes putatively involved in polycaprolactone degradation.

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