Title: “ENDEGRADE” – Endophytic bacteria for improving phytoremediation

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Phytoremediation of polluted soils is often constrained by toxic levels of organic pollutants, as well as their breakdown products. This can often result in impaired remediation capacity, or death, of the plant. “ENDEGRADE”, EU funded, multidisciplinary research project, is addressing these problems in a unique way. Our aim was to identify the bacteria, found within the plant xylem sap (endophytes) of plants used in phytoremediation applications that are capable of degrading key pollutants. Endophytic bacteria with either inherent degradative potential (i.e., “endegraders”) were screened for, or degradation genes (pTOM, TOL) introduced by gene transfer, into strains that were observed to efficiently colonise the plants. Re-inoculated plants were tested for enhanced degradation of pollutants, transported from the roots to the leaves, thus reducing phyto-toxicity and volatilisation, and inferring phyto-protection by the “endegrader” bacteria. In this way, the efficacy and regulatory appeal of phytoremediation can be improved as *in situ* degradation is increased and off site losses are reduced (Patent Applied For[1]).

Poplar (*Populus trichocarpa x deltoides var.* Hoogvorst/Hazendans) and Willow (*Salix alba*) trees were studied, as representative model plants for phytoremediation, due to their perennial nature, fast rates of transpiration and growth and deep rooting. Xylem sap was extracted aseptically from stems, the endophytic bacterial communities were characterised by cultivation-dependent, as well as cultivation-independent analyses, and isolates were selected for further work. Seasonal endophytic community dynamics were assessed, to provide information for field-scale re-inoculation.

A number of partnerships of plant and bacteria have been developed which confer toxicity protection to the plant and, in some cases, enhance degradation by the plant. At the field scale, phytoremediation has recently been shown to halt a BTEX plume on an industrial site in Belgium. It is anticipated that further basic understanding of “endegrader” bacterial diversity, movement, ecophysiology and metabolism will lead to novel and improved phytoremediation of contaminated land.

[1] US Patent No 60/291,344. D. Van der Lelie, S. D’Haene, D.N. Dowling, U. Karlson, E.R.B. Moore, S. Taghavi, S.A.J. Trapp, J. Vangronsveld. "Method for improving phytoremediation treatment of a contamincated medium". Application U.S. Patent office, 16 May, 2001.