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DEGRADATION OF 3FLUOROPHENOL AND SODIUM TRIFLUOROACETATE BY ECTOMYCORRHIZAL FUNGI

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Introduction and Aims

Due to the high persistence of pollutant organic compounds in soil and natural environments, enhancement of their remediation has gained interest over the last decades. Fluorinated compounds are important soil and water pollutants, since they are mainly used in the manufacture of pharmaceuticals and agrochemical products. The increasing restriction of the disposal of contaminated soils and the need to clean up potentially valuable agricultural sites helped developing rhizosphere remediation. Although the degradation of pollutant compounds by bacteria and some fungal groups has been addressed, little is known on the degradation of such compounds by ectomycorrhizal fungi.

The aim of this study was to assess the potential of ectomycorrhizal (ECM) fungi potential for degrading fluorinated organic compounds, namely 3-fluorophenol (FP3) and sodium trifluoroacetate (TFA). Toxicological tests were used as a screening tool to evaluate ECM fungal growth and symbiosis with *Betula pubescens* under stress conditions. To determine if the degradation of TFA and FP3 by ECM fungi occurs, batch liquid growing cultures were established.

Methods

1) Toxicity screening tests: *Pisolithus tinctorius* PT3, *P. tinctorius* B, *Rhizopogus* spp. III, *Amanita muscaria* AM, *A. rubecens* AR, *Suillus bovinus* SB3, *Suillus* spp. C115, *Suillus* spp. C117 *Xerocomus* spp. C113 growth and resistance to different concentrations of TFA (5, 10, 25 and 60 ppm) and FP3 (10 and 25 ppm) were used. Fungal growth was evaluated over a period of 30 days in solid media supplemented with glucose (0.5 g/L) and controls with no toxic were also made.

2) ECM fungal symbiosis: ECM species capacity to form symbiosis with *B. pubescence* on agar medium with different toxics were tested.

3) Degradation of FP3 and TFA: Batch liquid growing cultures were established. FP3 degradation were monitored using HPLC and fluoride release was detected using electrode sensitive method. Possible secondary metabolites detected were identified by screening against known fluorinated compounds.

Results and Discussion

1) *Toxicity tests*

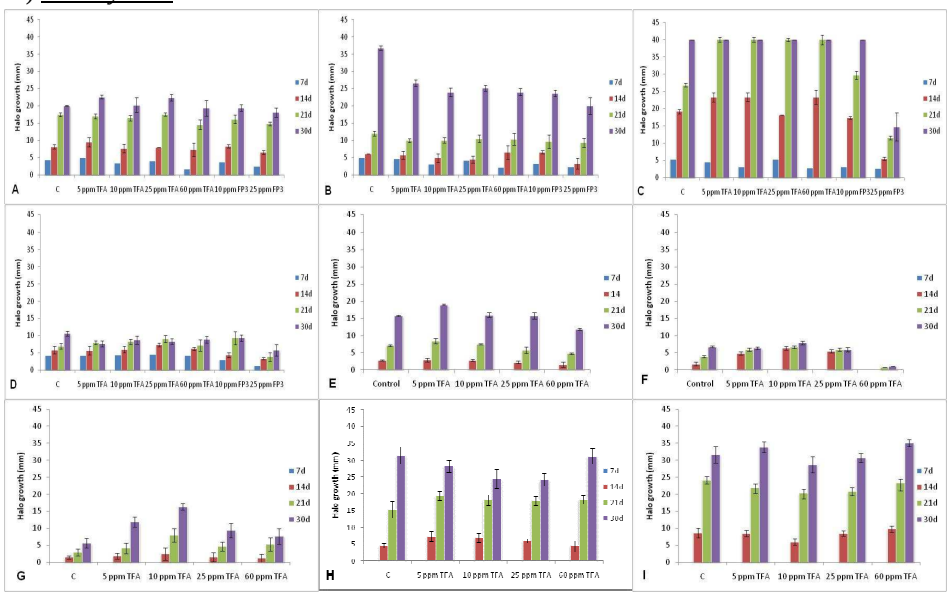

Figure 1: ECM fungal growth and resistance to different concentrations of TFA (5, 10, 25 and 60 ppm) and FP3 (10,and 25 ppm). Halo growth was recorder 7, 14, 21 and 30 days (d). Legend: *Pisolithus tinctorius* PT3 (A), *Rhizopogon* spp. III (B), *P. tinctorius* B (C), *Suillus bovinus* SB3 (D), *Amanita muscaria* AM (E), *A. rubecens* AR (F), *Xerocomus* spp. C113 (G), *Suillus* spp. C115 (H), *Suillus* spp. C117 (I). Controls (C) were also established without toxic.

- Results showed that FP3 inhibited up to 50% of fungal growth. However, TFA was able to promote up to 20% fungal mycelium growth;
- Results suggest that some ECM fungal species may be able to use fluorinated compounds as a carbon source.

2) *ECM fungal symbiosis*

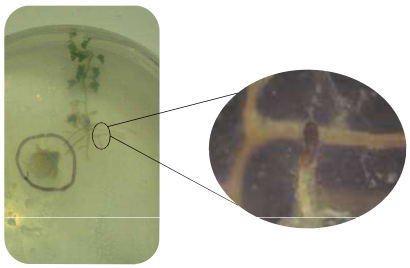

Figure 2: Example of ECM symbiosis between *B. pubescens* and *P. tinctorius.*

- ECM fungal species used on the toxicological screening tests were able to establish successful symbiosis with *B. pubescens*, on different TFA and FP3 concentrations;
- Results suggest that ECM + host plant are able to tolerate different toxic concentrations under anoxic conditions;

3) *Degradation of FP3 and TFA*

- FP3 degradation and formation of Catechol and 3-Fluorcatechol were detected. However, no free Fluor was detected on the liquid medium;
- Attempts are under way to identify other metabolites formed during degradation;
- TFA degradation studies are still ongoing.

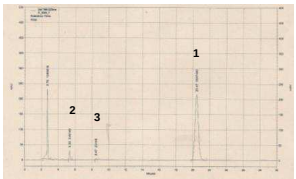

Figure 3: FP3 (1) degradation by *P. tinctorius* and formation of Catechol (2) and 3-Fluorcatechol (3).

Future work

- The contribution and role ectomycorrhizal fungi may play on the degradation of fluorinated organic compounds on polluted soils still need to be assessed.
- The present study has demonstrated that ECM fungi to and are resistant may degrade fluorinated compounds.

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