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Pre-compatibility test at lab scale of soil-dwelling earthworms (*L. terrestris*) and microbial consortiums with polymer degrading and probiotics capabilities (PMC)

José A. Sáez[1], Zbigniew Emil Blesa Marco[1], Jesús Salinas[2], Encarnación Martínez Sabater[1], F.J. Andreu-Rodríguez[1], Victor Carpena[2], María Ángeles Bustamante[1], María J. López[2] , Raúl Moral[1]

[1] Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH), Universidad Miguel Hernández, Carretera de Beniel Km 3,2, Orihuela, Alicante 03312, Spain.
[2]Area de Microbiología, Departamento de Biología and Geología, CITE II-B, Campus de Excelencia internacional y Agroalimentaria, CeiA3, CIAIMBITAL, Universidad de Almeria,04120
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Introduction

Earthworms are natural bioreactors, interacting with soil microorganisms to create a symbiotic and synergistic interaction and potentially reduce contaminants such as plastic debris. The purpose of the bioassay is to study the pre-compatibility of *Lumbricus terrestris* with selected microorganism consortia (ENDO, EXO and MIX-PMC). The selection is based on degrading activity capacities, potential persistence, and dominance in the earthworm gut-microbiome. The EXO was selected from the soil for their polymer degrading capabilities, and the ENDO had probiotic capacities (identified and isolated from the gut of earthworms exposed to agri-food plastic waste-APW).

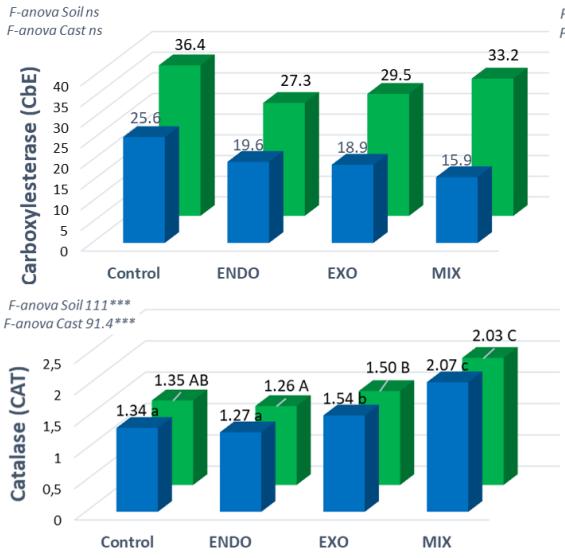
Experimental

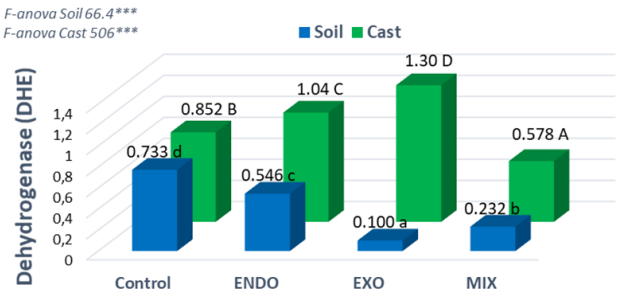
The bioassay was carried out with 1400 g of synthetic soil (granulometric distribution of 66% sand, 12% silt and 22% clay, and an organic matter content of 0.66%, pH 7.02 and CE 0.78 dS/m). and two citellated individuals of *L. terrestris*. Different treatments were incubated in triplicate (n=3) under controlled conditions (20ºC and darkness) for 360 hours in zip-plastic bags (V = 2L). The treatment consisted in 1) ENDO, 2) EXO with inoculum concentration in media of 8 x 10^7 CFU and MIX of both (ENDO+EXO) with 4.5 x 10^7 CFU. The analysis of the effect of different inoculum on *L. terrestris* morphological effect as well as soil physicochemical evolution and enzymatic response was conducted to identify possible interactions, synergetic or negative effects.

Results and Discussion

The survival during 360h of test was not affected by the presence of microbiome. On the other hand, we find a significant positive effect on the morphological response in ENDO> MIX with an increase in body weight of 30-40%. It is possible that prebiotics obtained from earthworms exposed to APW lead to a synergetic action that facilitates earthworm feeding. While, the Control treatment and EXO consortia achieved statically similar value.

Regard to enzymatic activity, CbE levels in presence of PMC were significantly lower than in the control, both in the soil and in the cast (Fig.1). This fact may be indicative of a better health status since this enzyme played a significant role as a molecular scavenger for toxic metabolites. In the response of CAT activity found significantly higher levels of CAT in the EXO and MIX treatments. This could be because the EXO inoculum allows to improve antioxidant reactions. Regarding DHE levels, used as an index of overall aerobic microbial activity, we found significant differences in the presence of PMC. At the end of the bioassay (in cast) has determined significantly higher DH values compared to the control (indicative of stimulation of aerobic microbial activity). We found the opposite effect in the soil: DHE levels decreased with the PMC. This fact could indicate that the PMC remains active inside the digestive tract of *L. terrestris*.





PMC	CbE (µmol h^{-1} g^{-1} dry soil)		DHE (µmol INTF h^{-1} g^{-1} dry soil)		CAT (mmol H_2O_2 consumed h^{-1} g^{-1} dry soil)	
	Soil	*Cast*	*Soil*	*Cast*	*Soil*	*Cast*
Presence	18,2 a	30,0 a	0,293 a	0,974	1,63	1,6
Absence	25,6 b	36,4 b	0,773 b	0,852	1,34	1,35
F-anova	6,19*	5,52*	15,5**	ns	ns	ns

Fig1. Enzymatic activity (Catalase, Carboxylesterase and Dehydrogenase) determined in soil and cast of different treatment.

Conclusions

The pre-compatibility test demonstrated the positive interaction and synergetic effect of the microbiome inoculated with native microbiome soil and gut-associated microorganisms. Produce an increment in body weight variation and non-mortality of *L. terrestris* during the bioassay. The EXO improved the degradation capacities of the earthworms, as seen in their enzymatic activity. ENDO maintained its prebiotic function throughout the bioassay.

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Biography

Jose Saez Tovar: Postdoc researcher of MIguel Hernandez University, mainly focused in composting, vermicomposting and environmental implications of circular economy solutions