Supplementary Materials

Materials and Methods

pH and conductivity

pH and conductivity measurements were carried out using a portable multiparameter instrument (HQ40D, Hach Company, Loveland, CO, USA), calibrated with buffer solutions of pH 4.01, 7.00, and 10.01, and NaCl conductivity standard of 1000 µS cm^{-1}. A suspension was prepared by combining 20 g of soil with 50 mL of milli-Q water, which was mechanically stirred for 5 minutes and then left undisturbed for one hour. After this settling period, the corresponding electrode was immersed in the supernatant to record the measurements.

Soil moisture

The water content of the contaminated soil was assessed using the gravimetric method. A 10 g soil sample placed in a tared crucible was oven-dried at 105°C for 2 hours and subsequently cooled to room temperature in a desiccator. The moisture percentage was calculated based on the weight difference recorded before and after drying.

Soil organic matter

Organic carbon was analyzed through a gravimetric approach involving the volatilization of all organic carbon forms present in the sample. First, 10 g of soil in a tared crucible were dried at 105°C for 24 hours to eliminate moisture. The sample was then subjected to calcination in a muffle furnace at 550°C for 4 hours. The organic carbon content was obtained by dividing the organic matter (weight loss) by 1.724 [41].

Soil ammonium and organic nitrogen

Nitrogen content in the soil was quantified in accordance with EN 13342 and DIN ISO 11261 standards [32]. Samples were pre-treated by drying at 105°C and grinding with a mortar. A 0.5 g soil sample was then digested with 8 mL of sulfuric acid (98%) and Kjeldahl tablets (11057980, BÜCHI Labortechnik AG, Flawil, Switzerland) in a KjelDigester K-449 (BÜCHI). The digested samples were subsequently distilled in a KjelMaster K-375/K-376 system (BÜCHI) using 32% NaOH and titrated against a 2% boric acid solution. Method quality control was ensured through the analysis of urea standards and ultrapure water blanks.

Results

Table S1. Number of replicates (microcosms) per treatment. Each replicate is an independent microcosm

Treatment	*n*
C0	3
C60	3
NC	6
PC	6
T1	6
T2	5
T3	6
T4	6
T5	4
T6	6
T7	6
T8	6
T9	6

Table S2. Analytical quality control (LOQ, method blanks, surrogate and spiked soil recoveries). LOQ: Limit of quantification; n.d.: not determined.

Analyte (method)	LOQ	Method blank	Surrogate recovery (%)	Spiked-soil recovery (%)
TPH C_8–C_{40} (GC-FID, EPA 8015D)	50 mg kg^{-1}	<LOQ	*o*-terphenyl: 75.2 ± 2.7 (*n* = 63)	98 (1 000 mg kg^{-1}), 98.6 (10 000 mg kg^{-1})
TPH gravimetric (EPA 1664B)	50 mg kg^{-1}	<LOQ	n.d.	97 (500 mg kg^{-1}) 97.9 (5000 mg kg^{-1})
Pyrene (GC-MS, EPA 8270E)	0.1 mg kg^{-1}	<LOQ	n.d.	n.d.
Ergosterol (HPLC)	1 µg g^{-1}	<LOQ	n.d.	69 (0.01 g kg^{-1}) 76 (0.05 g kg^{-1})

Table S3. Ergosterol concentrations and soil organic carbon and TPH (GC-FID and gravimetric) values used to calculate the carbon mass balance for each treatment.

Sample	Organic C (%)	Ergosterol (g $kg^{-1}_{dry\ mass}$)	TPH C_8-C_{40} (g $kg^{-1}_{dry_mass}$)	TPH gravimetric (g $kg^{-1}_{dry_mass}$)
Soil d0	7	0.004	8.5	32.3
Soil d60	6	0.004	7.2	20.0
NC d60	14	0.104	5.5	14.6
PC	11	0.079	3.6	9.0
T1	11	0.093	3.1	9.1
T2	11	0.122	2.2	7.7
T3	10	0.076	2.8	8.3
T4	11	0.090	2.9	7.1
T5	11	0.082	2.3	7.2
T6	10	0.163	2.6	7.5

T7	11	0.045	3.6	11.4
T8	12	0.098	2.5	6.6
T9	12	0.135	2.5	7.9

Table S4. Pairwise differences in TPH C_8-C_{40} removal

A	B	Difference	95% CI	*p*
C60	NC	0.8	-25.9 to 27.4	1.000
C60	PC	-26.4	-53.1 to 0.2	0.054
C60	T1	-36.3	-62.9 to -9.6	0.001
C60	T2	-49.3	-76.9 to -21.8	< 0.001
C60	T3	-40.4	-67.0 to -13.7	< 0.001
C60	T4	-37.9	-64.5 to -11.2	0.001
C60	T5	-48.2	-77.0 to -19.4	< 0.001
C60	T6	-43.8	-70.5 to -17.2	< 0.001
C60	T7	-27.4	-54.1 to -0.8	0.038
C60	T8	-45.6	-72.2 to -18.9	< 0.001
C60	T9	-46.1	-72.7 to -19.4	< 0.001
NC	PC	-27.2	-48.9 to -5.4	0.004
NC	T1	-37	-58.8 to -15.3	< 0.001
NC	T2	-50.1	-72.9 to -27.3	< 0.001
NC	T3	-41.1	-62.9 to -19.4	< 0.001
NC	T4	-38.6	-60.4 to -16.9	< 0.001
NC	T5	-48.9	-73.3 to -24.6	< 0.001
NC	T6	-44.6	-66.4 to -22.8	< 0.001
NC	T7	-28.2	-49.9 to -6.4	0.003
NC	T8	-46.3	-68.1 to -24.5	< 0.001
NC	T9	-46.8	-68.6 to -25.1	< 0.001
PC	T1	-9.8	-31.6 to 11.9	0.920
PC	T2	-22.9	-45.7 to -0.1	0.049
PC	T3	-13.9	-35.7 to 7.8	0.566
PC	T4	-11.4	-33.2 to 10.3	0.813
PC	T5	-21.7	-46.1 to 2.6	0.122
PC	T6	-17.4	-39.2 to 4.4	0.239
PC	T7	-1	-22.8 to 20.8	1.000
PC	T8	-19.1	-40.9 to 2.6	0.137
PC	T9	-19.7	-41.4 to 2.1	0.113
T1	T2	-13.1	-35.9 to 9.8	0.722
T1	T3	-4.1	-25.9 to 17.7	1.000
T1	T4	-1.6	-23.4 to 20.2	1.000
T1	T5	-11.9	-36.2 to 12.4	0.874

T1	T6	-7.6	-29.3 to 14.2	0.988
T1	T7	8.8	-12.9 to 30.6	0.961
T1	T8	-9.3	-31.0 to 12.5	0.946
T1	T9	-9.8	-31.6 to 12.0	0.923
T2	T3	9	-13.9 to 31.8	0.969
T2	T4	11.5	-11.4 to 34.3	0.854
T2	T5	1.2	-24.1 to 26.4	1.000
T2	T6	5.5	-17.3 to 28.3	1.000
T2	T7	21.9	-0.9 to 44.7	0.071
T2	T8	3.8	-19.0 to 26.6	1.000
T2	T9	3.2	-19.6 to 26.1	1.000
T3	T4	2.5	-19.3 to 24.3	1.000
T3	T5	-7.8	-32.1 to 16.5	0.994
T3	T6	-3.5	-25.2 to 18.3	1.000
T3	T7	12.9	-8.8 to 34.7	0.672
T3	T8	-5.2	-26.9 to 16.6	1.000
T3	T9	-5.7	-27.5 to 16.0	0.999
T4	T5	-10.3	-34.6 to 14.0	0.948
T4	T6	-6	-27.7 to 15.8	0.998
T4	T7	10.4	-11.3 to 32.2	0.887
T4	T8	-7.7	-29.4 to 14.1	0.986
T4	T9	-8.2	-30.0 to 13.6	0.977
T5	T6	4.3	-20.0 to 28.7	1.000
T5	T7	20.7	-3.6 to 45.1	0.166
T5	T8	2.6	-21.7 to 27.0	1.000
T5	T9	2.1	-22.2 to 26.4	1.000
T6	T7	16.4	-5.4 to 38.2	0.319
T6	T8	-1.7	-23.5 to 20.1	1.000
T6	T9	-2.2	-24.0 to 19.5	1.000
T7	T8	-18.1	-39.9 to 3.6	0.192
T7	T9	-18.7	-40.4 to 3.1	0.161
T8	T9	-0.5	-22.3 to 21.2	1.000

Table S5. Reduction of the light, medium and heavy windows relative to NC, with Dunnett's test. Light (C_8–C_{16}), medium (>C_{16}–C_{24}, o-terphenyl subtracted) and heavy (>C_{24}–C_{40}) windows; values are % of the NC window area (mean ± SE). Dunnett's test compared each fungal treatment with NC on replicate-level areas (NC $n = 6$). Across fungal treatments (linear mixed-effects model, treatment as random effect; Satterthwaite df): light $p = 0.028$, medium $p = 0.002$, heavy $p = 0.065$.

Treatment	***n***	**Light (%)**	***p***	**Medium (%)**	***p***	**Heavy (%)**	***p***
PC	6	14.6 ± 3.0	0.015	31.5 ± 6.0	0.008	3.6 ± 7.6	1.000
T1	6	17.1 ± 1.5	0.003	36.5 ± 3.8	0.001	14.1 ± 5.2	0.417
T2	5	21.7 ± 1.3	< 0.001	41.2 ± 3.1	< 0.001	34.0 ± 2.3	0.001

T3	6	13.6 ± 2.2	0.027	34.4 ± 4.4	0.003	23.6 ± 3.7	0.034
T4	6	14.0 ± 1.7	0.021	33.4 ± 3.6	0.004	22.3 ± 3.4	0.051
T5	4	19.7 ± 0.9	0.002	37.4 ± 2.0	0.004	30.9 ± 1.4	0.008
T6	6	17.8 ± 2.4	0.002	39.3 ± 4.7	< 0.001	30.0 ± 4.0	0.003
T7	6	1.7 ± 4.6	1.000	14.6 ± 9.7	0.512	9.9 ± 6.4	0.789
T8	6	18.6 ± 2.8	< 0.001	39.5 ± 5.8	< 0.001	26.0 ± 5.5	0.015
T9	6	21.0 ± 1.7	< 0.001	40.0 ± 3.3	< 0.001	31.4 ± 2.9	0.002

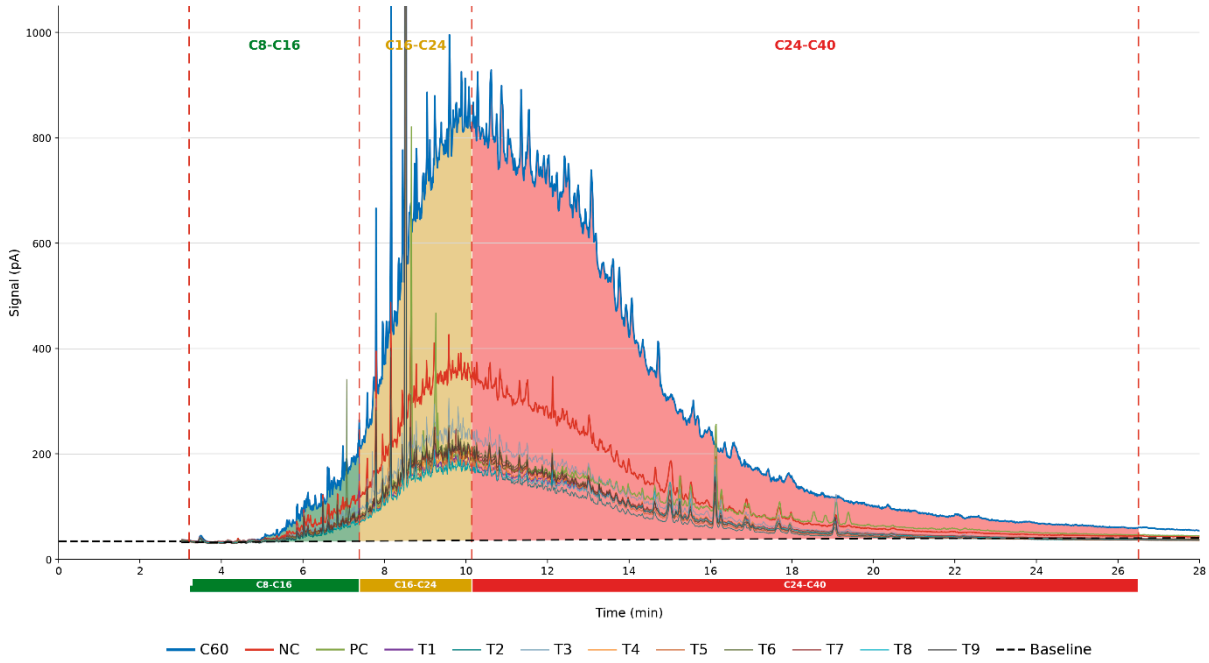


Figure S1. Overlaid GC-FID chromatograms of the residual C_8–C_{40} fraction per treatment (raw, non-normalized responses). *o*-terphenyl internal areas (retention time: 8.51 min) were consistent across samples (RSD= 3.6%), confirming reproducible recovery and injection. As inoculated treatments and controls contained 30 g of growth substrate that was absent in C60, their matrices are diluted relative to C60; absolute areas should thus be interpreted with caution. Chain-length windows were non-overlapping, with inclusive upper boundaries: light= C_8–C_{16} fraction, medium= >C_{16}–C_{24} fraction, heavy= >C_{24}–C_{40} fraction. The solvent front (<3 min) was excluded from integration and is not shown.

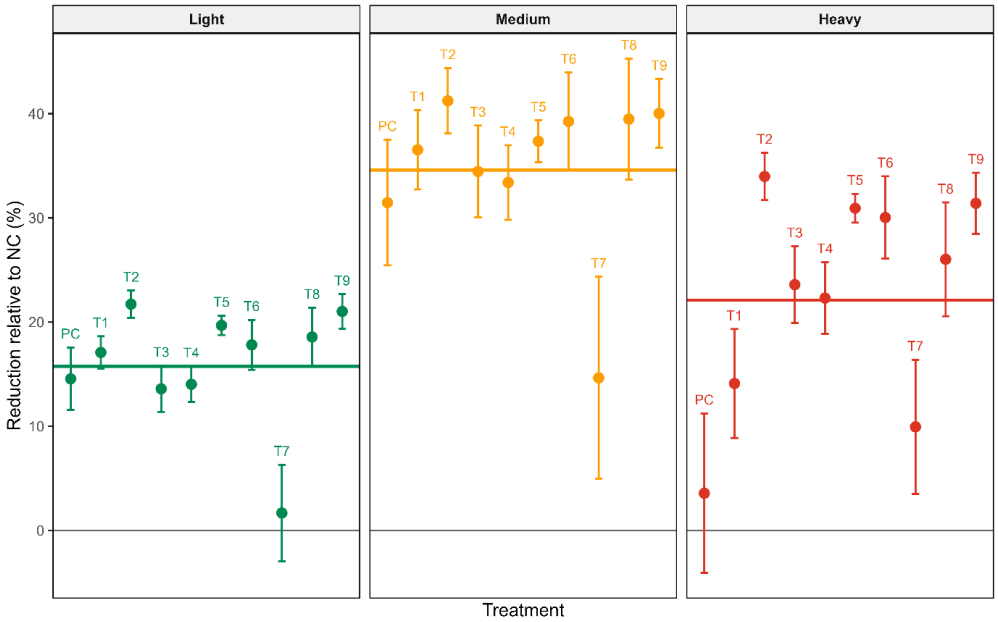


Figure S2. Reduction of the light, medium and heavy fractions (see Fig. S1) in the fungal treatments relative to the non-inoculated control with organic substrate (NC). Each point is one fungal treatment; horizontal lines show the mean across fungal treatments for each fraction. Statistical comparisons with NC (Dunnett's test) are given in Table S5.

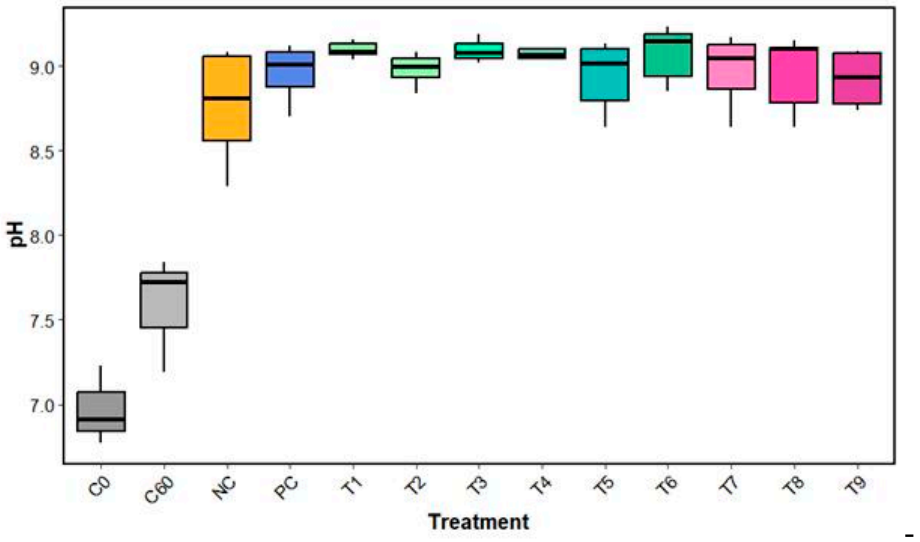


Figure S3. Soil pH before (C0) and after 60 days of treatment.