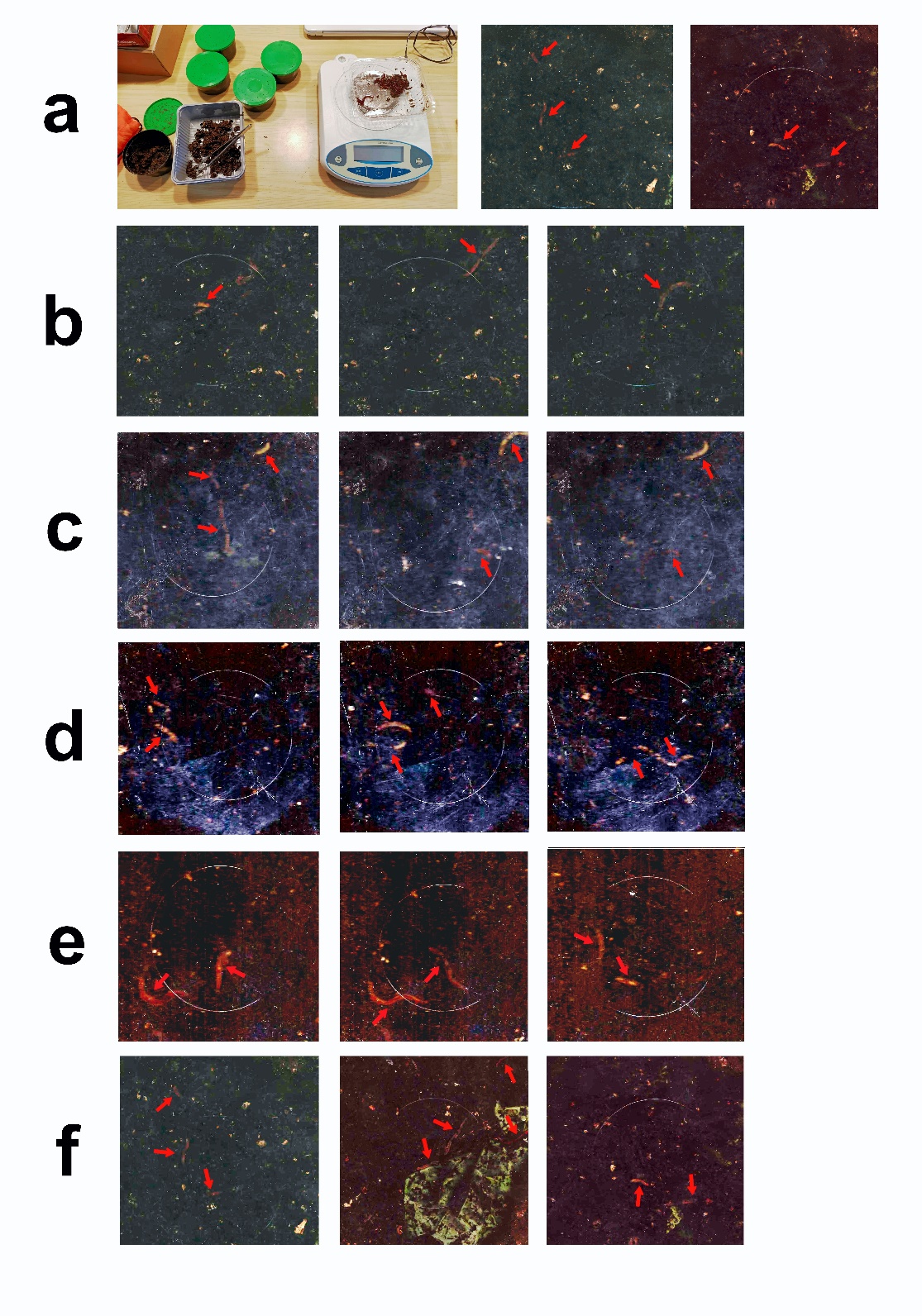
**Supplementary materials**

**Supplementary Table S1.** Soil pH, soil organic carbon (*SOC*), soil total nitrogen (*STN*), litter organic carbon (*LOC*), litter total nitrogen (*LTN*), tea bag organic carbon (*TOC*) and tea bag total nitrogen (*TTN*) in green and red tea bags measured at the beginning of the trial (28 November). Each value represents the mean (± SD) from four measurements (*n* = 4).

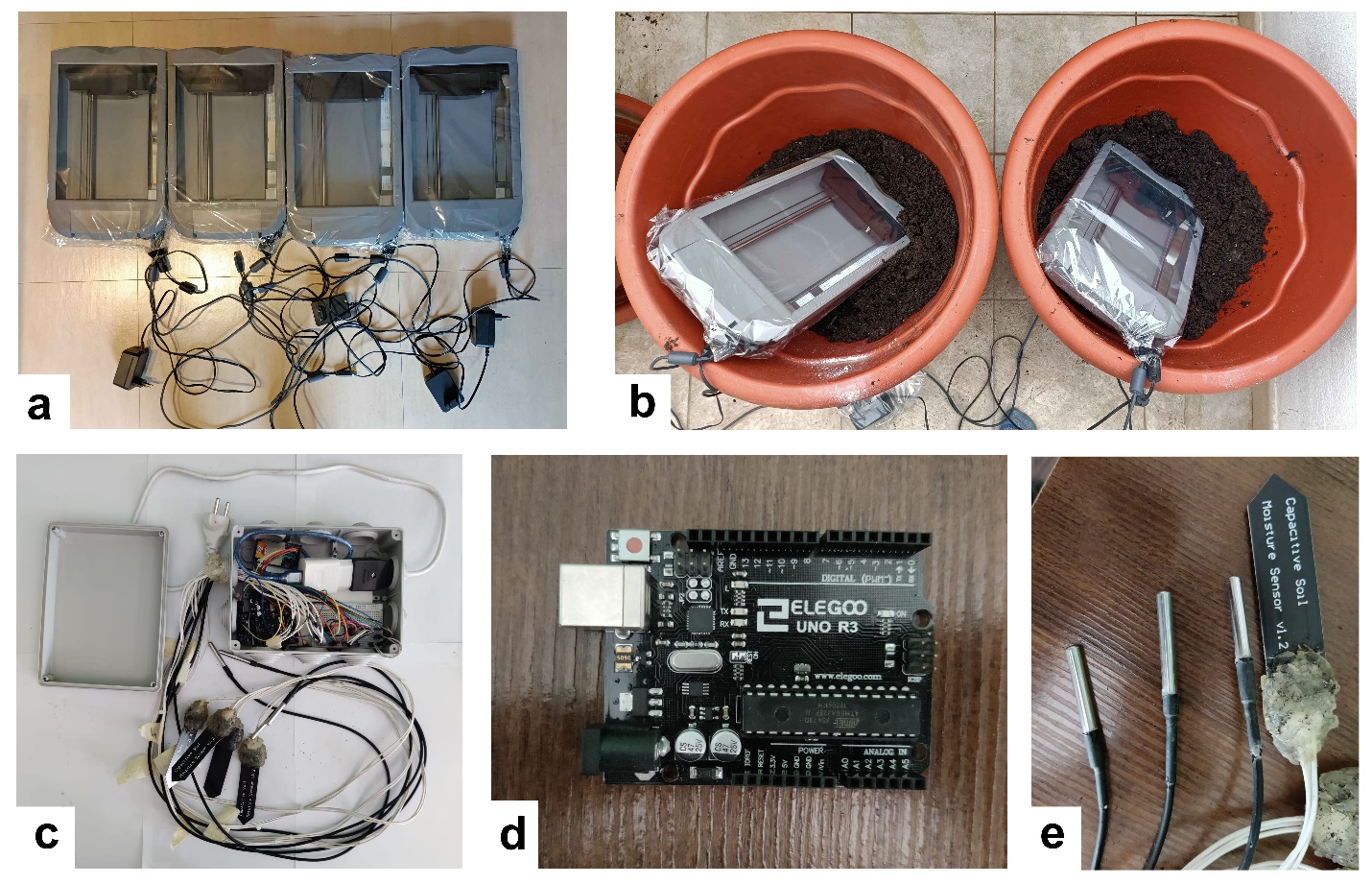
|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Soil pH** | ***SOC***  **(g kg‒1)** | ***STN***  **(g kg‒1)** | ***LOC***  **(g kg‒1)** | ***LTN***  **(g kg‒1)** | ***TOC*green**  **(g kg‒1)** | ***TTN*green**  **(g kg‒1)** | ***TOC*red**  **(g kg‒1)** | ***TTN*red**  **(g kg‒1)** |
| 7.40 ± 0.03 | 43.3 ± 0.21 | 1.45 ± 0.02 | 40.8 ± 2.39 | 5.27 ± 0.87 | 39.7 ± 1.01 | 2.76 ± 0.09 | 43.0 ± 1.17 | 0.71 ± 0.02 |

**Supplementary Table S2.** ANOVA statistics of soil and litter parameters. Soil organic carbon (*SOC*); soil total nitrogen (*STN*); litter organic carbon (*LOC*); litter total nitrogen (*LTN*); organic carbon in green tea bags (*TOC*green); total nitrogen in green tea bags (*TTN*green); organic carbon in red tea bags (*TOC*red); total nitrogen in red tea bags (*TTN*red); soil carbon to nitrogen ratio (Soil C/N); litter carbon to nitrogen ratio (Litter C/N); carbon to nitrogen ratio in green tea bags (Green tea C/N); carbon to nitrogen ratio in red tea bags (Red tea C/N); soil pH; stabilization factor of tea bags (*S*TBI); decomposition constant of tea bags (*k*TBI); percentage of litter decomposed (*d*litter).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | ***F* value - Treatment** | ***P* value - Treatment** | ***F* value -**  **Treatment × Species** | ***P* value -**  **Treatment × Species** |
| *SOC* | 33.543 | 0.00009 | 5.263 | 0.02285 |
| *STN* | 18.450 | 0.00104 | 26.351 | 0.00004 |
| *LOC* | 26.590 | 0.00024 | 8.688 | 0.00465 |
| *LTN* | 385.457 | 0.00000 | 0.416 | 0.66911 |
| *TOC*green | 23.331 | 0.00041 | 3.213 | 0.07627 |
| *TTN*green | 19.497 | 0.00084 | 70.360 | 0.00000 |
| *TOC*red | 0.997 | 0.33785 | 13.826 | 0.00077 |
| *TTN*red | 0.369 | 0.55501 | 113.303 | 0.00000 |
| Soil C/N | 0.096 | 0.76155 | 20.270 | 0.00014 |
| Litter C/N | 121.392 | 0.00000 | 4.212 | 0.04114 |
| Green tea C/N | 6.932 | 0.02186 | 10.097 | 0.00268 |
| Red tea C/N | 2.498 | 0.14001 | 86.193 | 0.00000 |
| Soil pH | 511.078 | 0.00000 | 1.284 | 0.31243 |
| *S*TBI | 7.871 | 0.01588 | 0.211 | 0.81272 |
| *k*TBI | 7.302 | 0.01923 | 0.174 | 0.84266 |
| *d*litter | 17.714 | 0.00121 | 0.098 | 0.90741 |



**Supplementary Figure S1.** (row a) Earthworm weighting at the beginning of the trial and images shot on 1 December; (row b) images shot on 3 January; (row c) images shot on 1 February; (row d) images shot on 28 February; (row e) images shot on 15 March; (row f) images shot on 30 March. Red arrows indicate earthworms.

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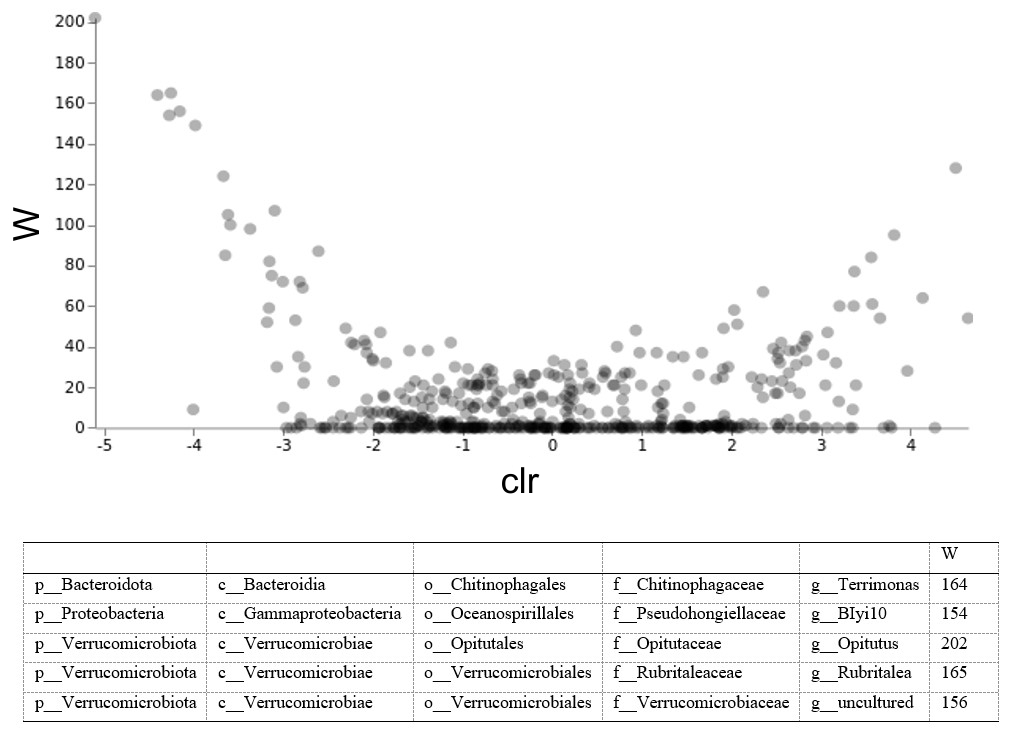
**Supplementary Figure S2.** (a) The four image scanners used and sealed; (b) two image scanners placed inside the pots; (c) the datalogger used for the measurement of soil temperature and soil water content; (d) board with integrated microcontroller; (e) temperature and capacitive sensors.

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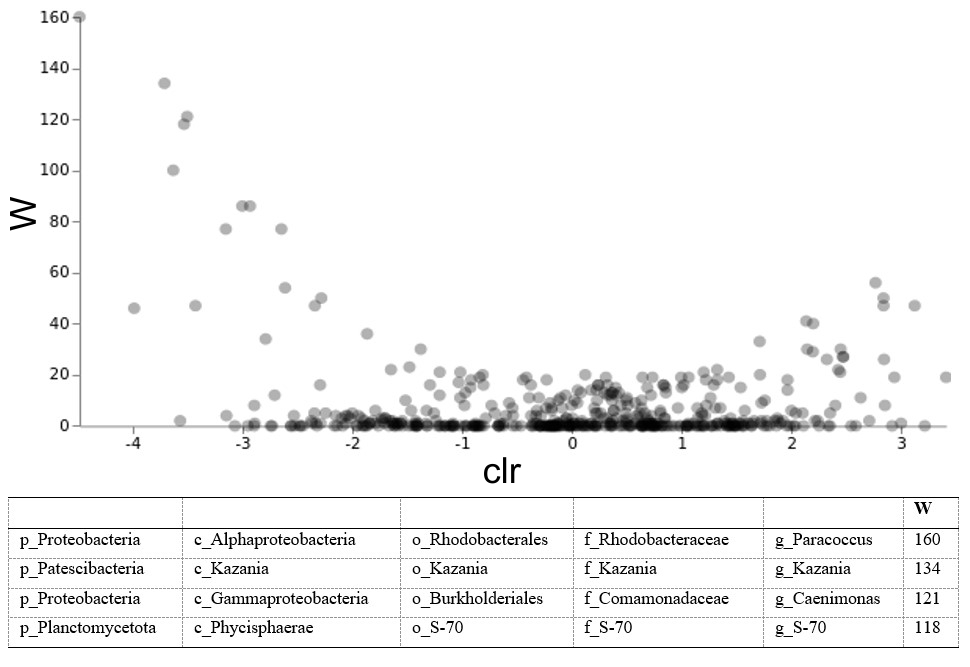
**Supplementary Figure S3.** Relative abundance (> 1%) of bacterial families in soils under different treatments, consisting of broccoli with earthworms (*BR*earth), faba bean with earthworms (*FB*earth), broccoli without earthworms (*BR*no-earth), and faba bean without earthworms (*FB*no-earth). Ward's clustering method, using Euclidean distance, was used to estimate the distance among all bacterial families in response to the soil treatments. The measures within each treatment are in triplicate.

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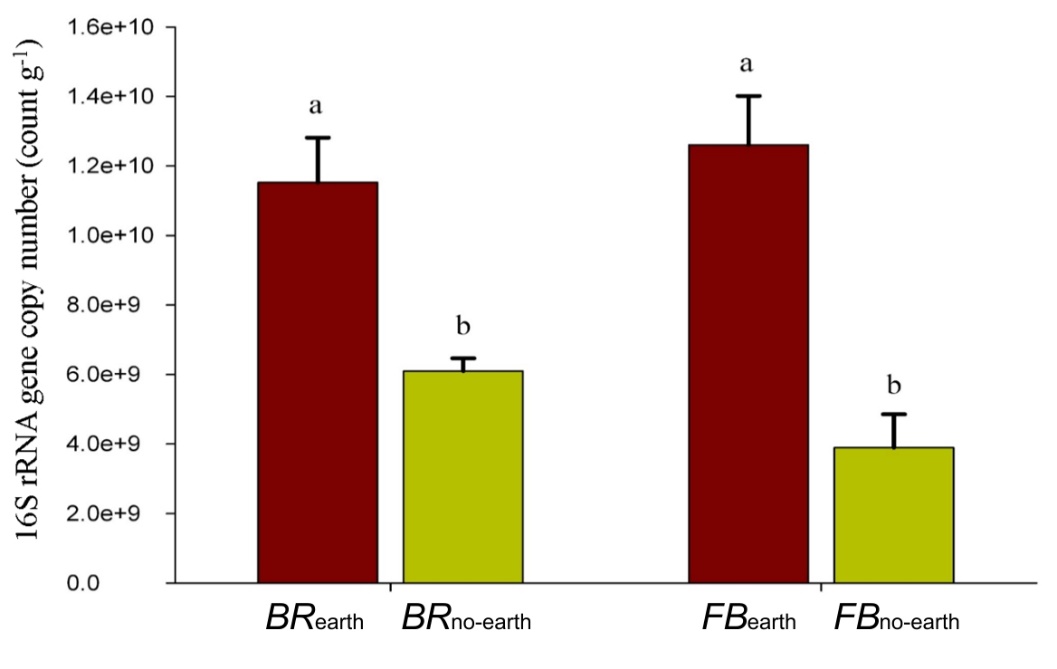
**Supplementary Figure S4.** Relative abundance (> 1%) of bacterial genera in soils under different treatments, consisting of broccoli with earthworms (*BR*earth), faba bean with earthworms (*FB*earth), broccoli without earthworms (*BR*no-earth), and faba bean without earthworms (*FB*no-earth). Ward's clustering method, using Euclidean distance, was used to estimate the distance among all bacterial genera in response to the treatments. The measures within each treatment are in triplicate.



**Supplementary Figure S5.** ANCOM differential abundance volcano plot: *BR*earth (broccoli with earthworms) vs *BR*no-earth (broccoli without earthworms) The x-axis value represents the centered log ratio (clr) transformed F statistic (between groups). The y-axis value represents the empirical distribution of W (the number of times of the null-hypothesis was rejected. Taxa with rejected null-hypothesis are shown (p: phyla; c: class; o: order; f: family; g: genus). The measures within each treatment are in triplicate.



**Supplementary Figure S6.** ANCOM differential abundance volcano plot: *FB*earth (faba bean with earthworms) vs *FB*no-earth (faba bean without earthworms). The x-axis value represents the centered log ratio (clr) transformed F statistic (between groups). The y-axis value represents the empirical distribution of W (the number of times of the null-hypothesis was rejected. Taxa with rejected null-hypothesis are shown (p: phyla; c: class; o: order; f: family; g: genus). The measures within each treatment are in triplicate.



**Supplementary Figure S7.** 16S rRNA gene copies number in soils under different treatments, consisting of broccoli with earthworms (*BR*earth), broccoli without earthworms (*BR*no-earth), faba bean with earthworms (*FB*earth), and faba bean without earthworms (*FB*no-earth). Means with similar letters are not significantly different at 5% probability level (Tukey's HSD test). The measures within each treatment are in triplicate.