Soil Biology and Biochemistry 150 (2020) 107883

Contents lists available at ScienceDirect

Soil Biology and Biochemistry

journal homepage: http://www.elsevier.com/locate/soilbio

# Corrigendum to "Soil suppressiveness to Pythium ultimum in ten European long-term field experiments and its relation with soil parameters" [Soil Biology and Biochemistry 133 (1029) 174–187]

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The authors regret < To the editor of Soil Biology and Biochemistry, While reviewing the data for another manuscript I found an error in the calculation of the decomposition measured by the tea bag method that was included in the article: "Soil suppressiveness to *Pythium ultimum* in ten European long-term field experiments and its relation with soil parameters" by Bongiorno G., Postma J., Bünemann E., Brussaard L., de Goede R., Mäder P., Tamm L., and Thürig B. published in 2019 in Soil Biology and Biochemistry 133: 174–187.

The error made was this: to calculate the tea bag decomposition, the final weight of the tea bag instead of the % mass loss (i.e. 1-final weight/initial weight) was taken. Hence, the negative partial correlation originally found should be positive, which actually makes more sense.

I am very sorry for this unfortunate error and herewith provide you with the corrected results, see the correct rows in the tables at the end of this message. Below, the consequences for the conclusions of the current manuscript are described.

In summary: the error found in the final calculation of tea bag decomposition does not undermine the messages and results of the article.

In detail:

Text: In the text below, which can be found in the beginning of the result section 3.3, I changed the incorrect text:

"Bivariate correlation analysis showed that soil suppressiveness (SSni) (calculated from the management treatment samples) was positively associated with higher values of various chemical (pH, total N, cation exchange capacity (CEC), Ca and K), physical (water holding capacity (WHC), silt, clay, penetration resistance), microbial parameters (microbial biomass C and N (MBC and MBN)), soil respiration (SR), microbial quotient (qMic), earthworm number and biomass, and labile carbon fractions (hydrophilic dissolved organic carbon (Hy-DOC), permanganate oxidizable carbon (POXC) and hot water extractable carbon (HWEC)) (Table S4). In contrast, we found negative correlations with C to N ratio (C/N), bulk density (BD), sand, tea bag decomposition, dissolved organic carbon and hydrophilic organic carbon specific ultraviolet absorbance (DOC SUVA and Hy SUVA). The partial correlation showed that after normalization for structural differences between the LTEs (i.e. for the pedoclimatic characteristics) higher values of total N, MBC, soil respiration, qMic, earthworm number, tea bag decomposition, Hy SUVA, POXC, HWEC and carbon in the particulate organic matter (POMC) were associated with higher values of SSni, while higher values of C to N ratio, and DOC SUVA were associated with lower values of SSni (Table 4)."

Table 1 (see below): The unit of tea bag decomposition is % mass loss and not g mass loss.

Tables 4 and 5 (see below): The now positive partial correlation of tea bag decomposition with soil suppressiveness is similar to that of MBC, soil respiration and qMic, which makes more sense. However, decomposition based on the tea bag method is not one of the most important variables in later analyses (simple mixed linear models in Table 5), so it would not have been used in the structural equation model and it is not at variance with later results.

Table S4 (see below): The now negative bivariate correlation of the bag decomposition with soil suppressiveness is due to the fact that the long-term field experiments CH1 and CH2 have high values of soil suppressiveness but low decomposition values.

I, therefore, would like to request a correction of the manuscript in the indicated section, and I submit this request together with the corrections in the contact form available on the Elsevier Journal Article Publishing Support Center.

Sincerely,

Giulia Bongiorno

DOI of original article: http://dx.doi.org/10.1016/j.soilbio.2019.03.012.

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https://doi.org/10.1016/j.soilbio.2020.107883

Available online 28 September 2020

**Table 1**
Overview on methods used to determine chemical, physical, and biological parameters linked with soil functions as measured in the framework of the iSQAPER project, and the methods used to measure labile carbon fractions (Bongiorno et al., 2019).

| Parameters | Methodology | Unit | Laboratory of analysis |
|---|---|---|---|
| **Chemical parameters** | | | |
| Total organic carbon (TOC) | SIST ISO 10694: Soil quality - Determination of organic and total carbon after dry combustion ("elementary analysis") | % | University of Ljubljana (SL) |
| Total nitrogen (TN) | SIST ISO 13878:1999: Soil quality - Determination of total nitrogen content by dry combustion ("elementary analysis") | % | University of Ljubljana (SL) |
| pH | $CaCl_2$ determination- SIST ISO 10390:2006: Soil quality - Determination of pH | – | University of Ljubljana (SL) |
| Cation exchange capacity (CEC) | ISO 13536:1995 - Soil quality - Determination of the potential cation exchange capacity and exchangeable cations using barium chloride solution buffered at pH = 8,1 | mmol 100 $g^{-1}$ soil | University of Ljubljana (SL) |
| Plant available phosphorus ($P_2O_5$) | ÖNORM L 1087 - modification: ammonium lactate extraction | mg $kg^{-1}$ soil | University of Ljubljana (SL) |
| Available phosphorus (P-Olsen) | SIST ISO 11263-1996 | mg $kg^{-1}$ soil | University of Ljubljana (SL) |
| Plant available potassium ($K_2O$) | ÖNORM L 1087 - modification: ammonium lactate extraction | mg $kg^{-1}$ soil | University of Ljubljana (SL) |
| Exchangeable magnesium, calcium, sodium, and potassium ($Mg^{2+}$, $Ca^{2+}$, $Na^{+}$, $K^{+}$) | ammonium acetate extraction; Soil survey laboratory methods manual, 1992 | mg $kg^{-1}$ soil | University of Ljubljana (SL) |
| **Physical parameters** | | | |
| Water stable aggregates (WSA) | Wet sieving method modified as in Kandeler (1996) | mg $kg^{-1}$ soil | FiBL (CH) |
| Bulk density (BD) | Volumetric assessment with ring | g $cm^{-3}$ | Field assessment by LTE owners |
| Silt, Clay and Sand | SIST ISO 11277:2011: Soil quality - Determination of particle size distribution in mineral soil material - Method by sieving and sedimentation | % | University of Ljubljana (SL) |
| Penetration resistance | Pressure needed to insert penetrometer in the soil | Mpa | Field assessment by LTE owners |
| Water holding capacity (WHC) | Calculated with a pedotransfer function using the % clay, silt and total organic carbon (Tóth et al., 2015) | % | Wageningen University & Research (NL) |
| **Biological parameters** | | | |
| Microbial biomass carbon (MBC) | Fumigation extraction method (Vance et al., 1987) | mg $kg^{-1}$ soil | Trier University (DE) |
| Microbial biomass nitrogen (MBN) | Fumigation extraction method (Vance et al., 1987) | mg $kg^{-1}$ soil | Trier University (DE) |
| Soil respiration | Incubation of soil at 25 °C for 72 h in thermostat bath | μg $h^{-1}$ $g^{-1}$ soil | University Miguel Hernandez (ES) |
| Earthworm abundance and biomass | Hand sorting from 30*30*30 $cm^3$ monolith | Number and fresh weight (g $m^{-2}$) | Field assessment by LTE owners |
| Tea bag decomposition | Tea bag incubation (tea bag index) (Keuskamp et al., 2013) | % mass loss | Field assessment by LTE owners |
| **Labile carbon fractions** | | | |
| Dissolved organic carbon (DOC) | Extraction with ultrapure water and filtration at 0.45 μm filters. | mg $kg^{-1}$ soil | Wageningen University (NL) |
| Hydrophilic dissolved organic carbon (Hy-DOC) | Fractionation of DOC with DAX-8 resin (Van Zomeren and Comans, 2007). | mg $kg^{-1}$ soil | Wageningen University (NL) |
| Dissolved organic carbon and hydrophilic dissolved organic carbon specific ultraviolet absorbance (DOC SUVA and Hy SUVA) | Analysis of DOC and Hy solution with spectrophotometer at 254 nm ( Weishaar et al., 2003; Amery et al., 2008). | L g $C^{-1}$ $cm^{-1}$ | Wageningen University (NL) |
| Permanganate oxidizable carbon (POXC) | Oxidation with $K_2MnO_4$ (Weil et al., 2003). | mg $kg^{-1}$ soil | Wageningen University (NL) |
| Hot water extractable carbon (HWEC) | Extraction with hot water (80 °C) for 16 hours and filtration at 0.45 μm filters (Ghani et al., 2003). | mg $kg^{-1}$ soil | Wageningen University (NL) |
| Particulate organic matter carbon (POMC) | Suspension in NaCl for 15 hours, wet-sieving through a 53 μm sieve and calculation of POM by loss on ignition (Salas et al., 2003). | mg $kg^{-1}$ soil | FiBL (CH) |

**Table 4**
Partial correlation coefficients (ρ) between the soil suppressiveness index (SSni) and chemical, physical and biological parameters used as dependent variables, corrected for the long-term field experiments (LTEs). The number of samples used in the analyses was 101.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Chemical parameters** | | | | | | | |
| TOC | pH | TN | C/N | CEC | Ca | Mg | K |
| 0.06 | −0.10 | **0.21*** | **−0.32*** | 0.01 | −0.08 | −0.03 | 0.02 |
| **Physical parameters** | | | | | | | |
| WSA | WHC | Bulk density | Silt | Clay | Sand | Penetration resistance | |
| 0.10 | −0.15 | 0.005 | 0.06 | −0.07 | 0.14 | | – |
| **Biological parameters** | | | | | | | |
| MBC | MBN | Soil respiration | $qCO_2$ | qMic | Earthworm number | Earthworm biomass | Tea bag decomposition |
| **0.26*** | 0.18 | **0.25*** | −0.04 | **0.27*** | **0.35**** | **0.16** | **0.27*** |
| **Labile carbon fractions** | | | | | | | |
| Hy | Hy SUVA | DOC | DOC SUVA | POXC | HWEC | POM-C | |
| 0.09 | **0.23*** | 0.04 | **−0.32*** | **0.27*** | **0.26*** | **0.21*** | |

*TOC* total organic carbon, *TN* total nitrogen, *C/N* carbon to nitrogen ratio, *CEC* cation exchange capacity, *WSA* water stable aggregates, *WHC* water holding capacity, *BD* bulk density, *MBC* microbial biomass carbon, *MBN* microbial biomass nitrogen, $qCO_2$ metabolic quotient (soil respiration/MBC), *qMic* microbial quotient (soil respiration/TOC), *Hy* hydrophilic carbon, *Hy SUVA* specific ultraviolet absorbance of hydrophilic carbon, *DOC* dissolved organic carbon, *DOC SUVA* specific ultraviolet absorbance of dissolved organic carbon, *POXC* permanganate oxidizable carbon, *HWEC* hot water extractable carbon, *POM-C* particulate organic matter carbon.
$*p \leq 0.05$, $**p \leq 0.001$, $***p \leq 0.0001$.

**Table 5**
Simple mixed linear model with random slope and intercept for each LTE determined from soil parameters measured in the 101 soil samples. The dependent variable was the soil suppressiveness index (SSni). The explanatory variables were chemical, physical and biological indicators. In the table estimates, standard error, t-value, p-value and marginal and conditional $R^2$ ($R^2_m$ and $R^2_c$ respectively) are reported. Differences are considered significant at $p \leq 0.05$ (significant parameters are given in bold).

| | Estimate | Std. error | t value | *p*-value | $R^2_m$ | $R^2_c$ |
|---|---|---|---|---|---|---|
| **Chemical parameters** | | | | | | |
| TOC | 0.03 | 0.19 | 0.2 | 0.87 | 0.001 | 0.75 |
| TN | 0.38 | 0.22 | 1.7 | 0.14 | 0.12 | 0.75 |
| pH | 0.007 | 0.16 | 0.04 | 0.96 | <0.0001 | <0.0001 |
| CEC | 0.13 | 0.19 | 0.7 | 0.50 | 0.02 | 0.68 |
| C/N | **−1.58** | **0.52** | **−3.0** | **0.03** | **0.52** | **0.93** |
| Ca | 0.22 | 0.14 | 1.6 | 0.16 | 0.05 | 0.59 |
| Mg | 0.04 | 0.26 | 0.2 | 0.88 | 0.001 | 0.69 |
| K | 0.10 | 0.12 | 0.8 | 0.60 | 0.01 | 0.68 |
| **Physical parameters** | | | | | | |
| WSA | 0.22 | 0.19 | 1.11 | 0.37 | 0.04 | 0.71 |
| WHC | **0.72** | **0.11** | **6.3** | **0.002** | **0.49** | **0.64** |
| BD | −0.07 | 0.18 | −0.39 | 0.69 | 0.004 | 0.68 |
| Clay | 0.10 | 0.27 | 0.4 | 0.72 | 0.01 | 0.67 |
| Sand | **−0.78** | **0.11** | **−7.2** | **0.003** | **0.52** | **0.68** |
| Silt | **0.70** | **0.23** | **4.4** | **0.03** | **0.37** | **0.73** |
| **Biological parameters** | | | | | | |
| MBC | **0.52** | **0.13** | **3.9** | **0.005** | **0.25** | **0.71** |
| MBN | **0.37** | **0.11** | **2.1** | **0.04** | **0.14** | **0.66** |
| SR | 0.30 | 0.30 | 1.0 | 0.44 | 0.07 | 0.75 |
| $qCO_2$ | −0.22 | 0.18 | −1.2 | 0.50 | 0.04 | 0.69 |
| qMic | 0.46 | 0.22 | 2.0 | 0.12 | 0.19 | 0.73 |
| Earthworm number | 0.88 | 0.56 | 1.58 | 0.22 | 0.20 | 0.92 |
| Earthworm biomass | 0.21 | 0.13 | 1.63 | 0.21 | 0.05 | 0.65 |
| Tea bag decomposition | 0.11 | 0.11 | 0.99 | 0.33 | 0.01 | 0.76 |
| **Labile carbon parameters** | | | | | | |
| Hy | 0.06 | 0.11 | 0.5 | 0.60 | 0.004 | 0.69 |
| Hy SUVA | 0.16 | 0.09 | 1.7 | 0.09 | 0.02 | 0.78 |
| DOC | −0.05 | 0.18 | −0.3 | 0.77 | 0.002 | 0.81 |
| DOC SUVA | −0.30 | 0.11 | −2.6 | 0.12 | 0.08 | 0.71 |
| POXC | 0.24 | 0.13 | 1.8 | 0.09 | 0.05 | 0.71 |
| HWEC | **0.34** | **0.13** | **2.6** | **0.05** | **0.11** | **0.68** |
| POM-C | 0.41 | 0.31 | 1.3 | 0.23 | 0.08 | 0.86 |

**Table S4**
Spearman correlations between soil suppressiveness (%, SSni) and soil chemical, physical, biological parameters, and labile organic carbon fractions.

| **Chemical parameters** | | | | | | | |
|---|---|---|---|---|---|---|---|
| TOC (%) | pH | TN | C/N | CEC | Ca | Mg | K |
| 0.09 | 0.46*** | 0.47*** | −0.25* | 0.40*** | 0.48*** | 0.14 | 0.43*** |
| **Physical parameters** | | | | | | | |
| WSA | WHC | Bulk density | Silt | Clay | Sand | Penetration resistance | |
| −0.02 | 0.41*** | −0.26* | 0.53*** | 0.39*** | −0.59*** | 0.49*** | |
| **Biological parameters** | | | | | | | |
| MBC | MBN | Soil respiration | $qCO_2$ | qMic | Earthworms number | Earthworms biomass | Tea bag decomposition |
| 0.57** | 0.60*** | 0.49*** | −0.30* | 0.63*** | 0.28* | 0.34* | −0.45*** |
| **Labile carbon fractions** | | | | | | | |
| Hy-DOC | Hy SUVA | DOC | DOC SUVA | POXC | HWEC | POMC | |
| 0.37** | −0.20* | 0.09 | −0.21* | 0.29* | 0.54*** | −0.04 | |

*TOC* total organic carbon, *TN* total nitrogen, *C/N* carbon to nitrogen ratio, *CEC* cation exchange capacity, *WSA* water stable aggregates, *WHC* water holding capacity, *BD* bulk density, *MBC* microbial biomass carbon, *MBN* microbial biomass nitrogen, $qCO_2$ metabolic quotient, *qMic* microbial quotient, *Hy-DOC* hydrophilic dissolved organic carbon, *Hy SUVA* specific ultraviolet absorbance of hydrophylic carbon, *DOC* dissolved organic carbon, *DOC SUVA* specific ultraviolet absorbance of dissolved organic carbon, *POXC* permanganate oxidizable carbon, *HWEC* hot water extractable carbon, *POMC* particulate organic matter carbon.
*p ≤ 0.01, **p ≤ 0.001, ***p ≤ 0.0001.

The authors would like to apologise for any inconvenience caused.

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