G57 How Cadaver Decomposition in Soil is Affected by Moisture: Part II: A Controlled Laboratory Experiment

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After attending this presentation, attendees will understand the interaction between soil moisture and soil texture can have a significant effect on processes associated with cadaver decomposition in soils.

This presentation will impact the forensic community and/or humanity by demonstrating the influence of moisture on processes associated with cadaver decomposition in soils of contrasting texture.

Decomposition processes associated with an organic resource, such as a cadaver buried in soil, can be affected by the nature of the soil physicochemical environment (e.g., soil texture, moisture status) and the activity of soil organisms. In a laboratory setting, matric potential (as defined in Part I) can be manipulated in order to test the effect of soil moisture status on decomposition processes associated with a cadaver buried in soil. Other measurements of soil moisture status, such as a simple gravimetric moisture content (g H_2O g^{-1} dry soil) and the estimation of moisture content in relation to saturation or field capacity (% water holding capacity), do not provide an assessment of the availability of moisture to soil microorganisms. Hence, the calibration and maintenance of matric potential can be used to exclude the activity of larger organisms such as protozoa and nematodes. Peak soil microbial activity is typically associated with a matric potential of approximately –0.01 megapascals (MPa).

Soil from the sites described in Part I were sampled (0-10 cm depth) and sieved (2 mm) field fresh. The soil from Site 1 was a sandy loam soil. The soil from Site 2 was a loamy sand soil. Sieved soils (500 g) were weighed into sealable 2 L polyethylene incubation chambers and calibrated to a matric potential of –0.3 MPa (to simulate dry conditions) or –0.01 MPa (to simulate wet conditions). Following an equilibration period of seven days, juvenile cadavers (*Rattus rattus*: ~18 g) were buried at a depth of 2.5 cm and incubated at 22°C. Cadaver mass loss and soil microbial activity were measured over a period of 28 days in order to determine if an increase in soil moisture would result in an increased rate of cadaver decomposition. The present experiment also tested the hypothesis that burial in loamy sand soil will result in an increased rate of decomposition. This experiment was replicated 4 times and controls (soil without cadaver) were used.

In the sandy loam soil a matric potential of –0.3 MPa resulted in an increase in the rate of all decomposition processes. Conversely, increased decomposition was observed in the loamy sand soil calibrated to a matric potential of –0.01 MPa. Significant differences in the rate of decomposition processes were observed between soils of similar matric potential. These contrasting results demonstrate that the rate of cadaver decomposition can be affected by an interaction between soil texture and moisture content. Reduced activity in the loamy sand calibrated to –0.3 MPa may be due to the inability of the soil microbiota to utilize the little water that is tightly bound between soil particles under dry conditions. Reduced activity in the sandy loam is likely due to a decreased diffusion coefficient of gases (e.g., O_2, CO_2) associated with an abundance of moisture and a high microbial demand for O_2 during the aerobic catabolism of an organic resource. These conditions may lead to anaerobiosis. Greater cadaver mass loss took place in the field experiment described in Part I. This phenomenon may be due to the presence of arthropods in a field setting. Unlike the findings from the field experiment in Part I, cadaver decomposition in soil from Site 1 decreased with an increase in moisture. This might indicate that the aerobic threshold for the sandy loam soil following cadaver burial is between –0.005 MPa and –0.001 MPa.

Cadaver Decomposition, Soil, Moisture

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