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Soil texture mediated microbial activity affects the transfer of litter-derived carbon to soil organic matter

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Knowledge about the nexus between litter decomposition and soil organic matter formation is still scarce, likely because litter decomposition studies are often conducted in the absence of mineral soil. Even if mineral soil is considered, variations in soil texture, which should substantially influence decomposition and soil C sequestration via, e.g., different capacities to store C or host microbial communities, have been neglected. Here, we examined the effect of soil texture on litter decomposition and soil organic matter formation by incubating sand- and clay-rich soils. These soils, taken under C3 vegetation, were amended with C4 litter to trace the fate of organic matter newly entering the soil. While we found only small amounts of litter-derived carbon (C) in the mineral soils after our six-month experiment, the microbial activity and amount of remaining litter between the sand- and clay-rich soils substantially differed. A high microbial activity combined with higher amounts of litter-derived C and a higher remaining litter mass in the clay-rich soil indicate a more effective transformation of litter to soil organic matter as compared to the sand-rich soil. In the sand-rich soil, microbial activity was lower, less soil C was litter-derived, and the litter lost more of its mass. We explain the apparently contradictory results of higher microbial activity and concurrently higher C contents with a more effective microbial pathway of SOM formation in the clay-rich soil. Our results indicate that soil texture does not only play a role in the provision of reactive surfaces for the stabilization of C but will also affect the decomposition of litter via effects on microbial activity, ultimately determining if litter C is transferred to the soil or respired to the atmosphere.