Theory of microbial coexistence in promoting soil–plant ecosystem health

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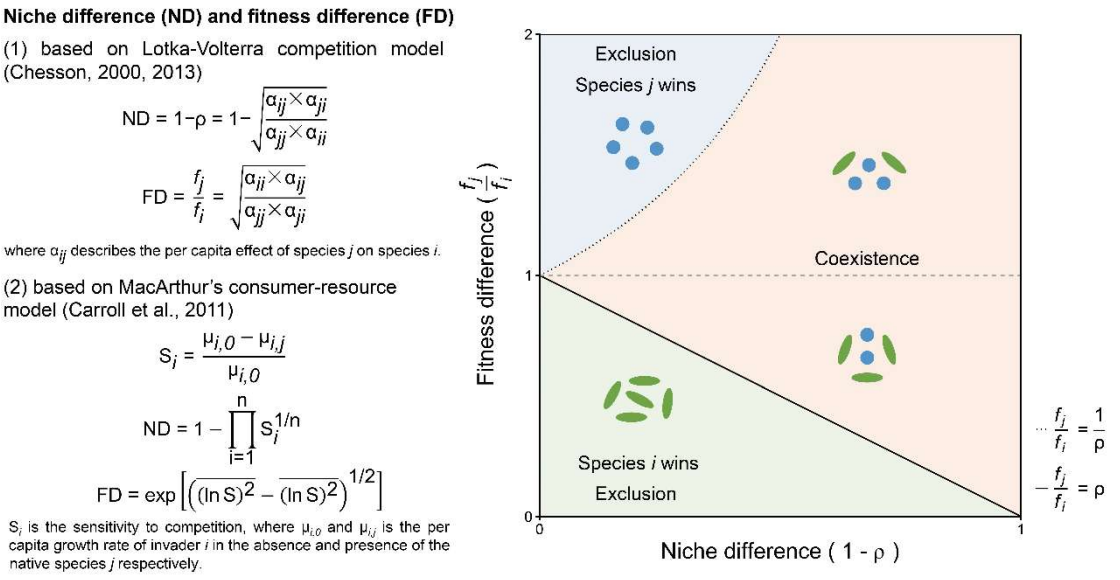

Figure 1 The conceptual diagram of modern coexistence theory. The competitive outcome is determined by the balance between niche difference (ND) and fitness difference (FD), which can be calculated based on the Lotka-Volterra competition model (Chesson, 2000, 2013) or MacArthur's consumer-resource model (Carroll et al., 2011). The dotted and solid lines represent the boundaries where f_j / f_i equals $1/\rho$ or ρ, respectively. The right area indicates the region where coexistence occurs; the top and bottom areas indicate where species *j* or *i* is dominant, respectively. Figure modified from Ke and Letten (Ke and Letten, 2018).

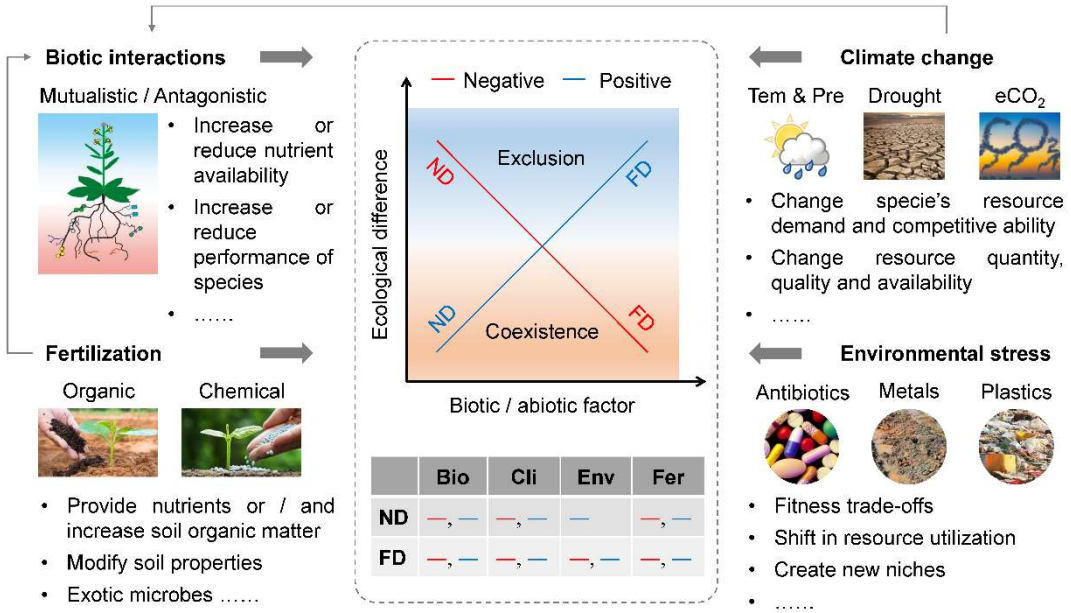

Figure 2 Graphical presentation of possible effects of biotic and abiotic factors on niche and fitness differences. ND: niche difference; FD: fitness difference. Bio: biotic interactions; Cli: climate change; Env: environmental stress; Fer: fertilization. Red and blue lines indicate negative and positive relationships, respectively. Gray thin arrows indicate indirect impact pathways.

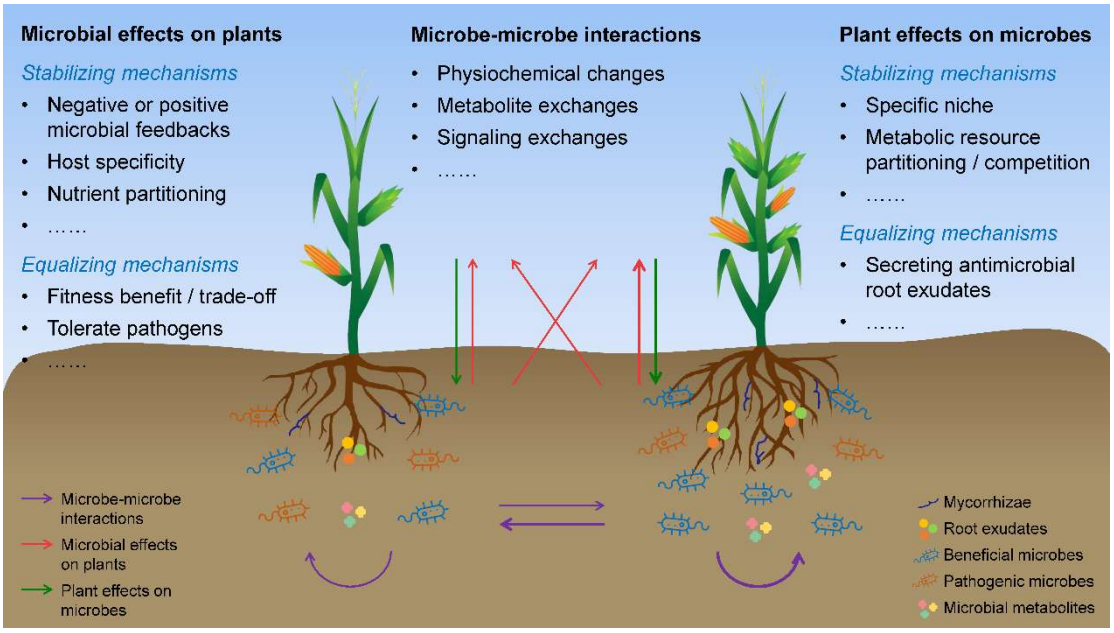

Figure 3 Schematic illustrating soil microbe-microbe interactions and plant-microbe interactions through modern coexistence theory. The conceptual model of microbe-microbe interactions and plant-microbe interactions is modified after Bever's model of pairwise plant-soil feedback and its derived framework (Bever et al., 1997; Bever, 2003; Kandlikar et al., 2019; Ke and Wan, 2019). The interactions among microbes can be mutualistic or antagonistic. Microbial effects on plants and plant effects on microbes can be positive or negative.