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Indigenous soil cyanobacteria influence seed germination and seedling growth of native arid species used in restoration

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Direct seeding of native species is critical to reinstate biodiversity in landscape-scale restoration of drylands. The early phases of seed germination and seedling emergence are crucial stages that initiate the return of functional plant communities and thus, the persistence of terrestrial ecosystems and maintenance of ecosystem biodiversity worldwide. Cyanobacteria from soil biocrusts can enhance soil fertility and promote plant growth. However, the role of these organisms in seedling establishment of arid plants used in land restoration has not yet been investigated. Here, we assessed germination and seedling growth of bioprimed seeds with indigenous cyanobacteria, for five native species used in dryland restoration (Acacia hilliana, Senna notabilis, Grevillea wickhamii, Triodia epactia and Triodia wiseana). These species are native to the Pilbara region (north-west Western Australia), a semi-arid biodiverse hotspot subject to intensive land use activities and with large demands for ecosystem restoration. Cyanobacteria from the genera Microcoleus and Nostoc were isolated from soil biocrust samples collected in the Pilbara, and cultured under controlled conditions. A two-factor experiment was conducted under laboratory conditions including cyanobacteria culture and the culture growth medium (BG11) as the two factors. We measured total germination, germination rate (i.e. the time taken to reach 50% of the total germination), and seedling growth of each species. We found significant positive effects of bio-primed seeds with cyanobacteria on seed germination and seedling growth of S. notabilis and A. hilliana, respectively, and no significant effects on the other species. Cyanobacteria did not have an inhibitory effect on any of the species studied. Overall, our study provides evidence for the potential beneficial role of bio-priming seeds with indigenous cyanobacteria from biocrust for seedling recruitment and development of key targeted plant species used in dryland restoration.