SEED CHEMICAL AND PHYSICAL DEFENSE IN RELATION TO SEEDBANK PERSISTENCE.
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Persistent soil seedbanks drive the long-term population dynamics of annual weeds of arable fields, yet most weed management tactics are targeted at the seedling stage. Development of effective strategies for weed seedbank management will depend upon better mechanistic understanding of the ecological determinants of seed persistence in the soil seedbank. Chemical and physical defense of seeds of common lambsquarters, field pennycress, giant foxtail, kochia, velvetleaf and yellow foxtail were quantified in relation to short- and long-term persistence of these seeds in the soil seedbank. Seed *ortho*-dihydroxyphenol content varied more than threefold between the least protected species (common lambsquarters, 9.2 μg g seed^{-1}) and the most protected species (kochia, 34.1 μg g seed^{-1}). The level of seed chemical protection was inversely related ($r = -0.77$, $P < 0.001$) to seed half-life in the soil estimated from long-term burial studies. Mechanical damage to the seed coat increased mortality for all six species during a two-month burial in field soil, regardless of the severity of damage. Mortality during burial for seeds subjected to the lowest intensity of damage was negatively associated ($r = -0.35$, $P < 0.01$) with seed phenol concentration and positively associated ($r = 0.42$, $P < 0.01$) with seed half-life in the soil. The results reveal an important weakness in the way seed defenses are constructed. Weed species with transient seedbanks appear to invest more in chemical defense than those species with highly persistent seedbanks. As a result, seeds in the latter category are relatively more dependent upon physical seed protection for persistence in the soil seedbank, and more vulnerable to management tactics that reduce the physical integrity of the weed seed coat.

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