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Environmental factors and non-chemical methods to suppress growth of the invasive plant *Gutenbergia cordifolia*

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Abstract

Little is known about preferred environmental conditions and non-chemical control of invasive *Gutenbergia cordifolia*. We assessed the effects of different *A. annua* crude extract concentrations, synthetic herbicide (glyphosate), fire regime and shade to *G. cordifolia* germination, shoot and root dry biomass, seedling height and leaf chlorophyll. High concentrations (75%) of *A. annua* crude extracts significantly reduced germination percentage of *G. cordifolia* by 25% ($F_{2,4}=77.2, p < 0.001$), and suppressed shoot and root dry biomass ($F_{2,4} = 80.3, p < 0.001$; $F_{2,4}=46.104, p < 0.001$, respectively) as well as seedling height and leaf chlorophyll ($F_{2,4} = 12.02, p < 0.002$; $F_{2,4} = 15.9, p < 0.001$), respectively. Medium temperature (60 °C) and long exposure time (5 min) significantly increased *G. cordifolia* germination percentage ($F_{2,7} = 32.6, p < 0.001$) while extreme temperatures (≥ 150 °C) at both (1 min) short and (5 min) long exposure time completely suppressed germination of *G. cordifolia*. Under high shade, while germination percentage was a third that of other treatments ($F_{2,4} = 20.9, p = 0.008$), mean germination took twice as long ($F_{2,4} = 17.9, p = 0.010$) and shoot fresh biomass was reduced by half ($F_{2,4} = 16.92, p = 0.004$). Shoot and root dry biomass were reduced to more than a third under high shade, seedling height reduced to half but leaf chlorophyll content was not affected ($F_{2,4} = 6.3, p = 0.030$; $F_{2,4} = 9.1, p = 0.020$; $F_{2,4} = 18.3, p = 0.003$; $F_{2,4} = 3.02, p = 0.120$, respectively). We suggest using *A. annua* as a potential bio-herbicide and highlight considering fire and shade as suppressor tools to control *G. cordifolia*, but first include in-situ trials to assess their impacts to both native plants and animals

Keywords, *Artemisia annua*, Glyphosate, Fire, Shade, Invasive