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Plasticity in cyanogenesis of *Trifolium repens* L.: inducibility, fitness costs and variable expression

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ABSTRACT

The polymorphism for cyanogenesis – the production of cyanide by damaged tissue – in white clover (*Trifolium repens* L.) has long been a model system for studying the maintenance of genetic variability. The prevailing model holds that opposing selective forces maintain the polymorphism; cyanogenesis protects the clover from herbivory, but incurs a cost of defence at lower temperatures and under drought. To date, most studies of cyanogenesis have focused on the presence or absence of the trait, although there is evidence of variability in expression within individuals. It is known that inducibility in some plant defence systems alleviates costs by initiating or increasing the expression of a costly defence only when it is most needed. It follows, then, that defences might also be downregulated when they are likely to be most costly. We used a modified Feigl-Anger assay to quantify the extent of cyanogenesis (both cyanoglucoside and β-glucosidase enzyme) in clones of *T. repens* under different environmental conditions, historically associated with the costs and benefits of the polymorphism. Neither simulated herbivory nor herbivory by the snail *Helix aspersa* resulted in a significant increase in expression of cyanogenesis (cyanoglucoside or enzyme). Therefore, we conclude that cyanogenesis is not an inducible defence. However, drought stress led to an apparent decrease in activity of β-glucosidase in samples with amplified linamarin concentrations. Furthermore, genotypes showed significantly weaker expression when grown in cold than when grown in warm temperatures. Our results suggest that some conditions that favour acyanogenic plants may also result in a decreased expression in cyanogenic morphs – a plasticity that changes our understanding of the selective forces at work in this system.

Keywords: chemistry, cost of defence, cyanogenesis, plant defence, plasticity.

INTRODUCTION

Genetic polymorphisms have long served as model systems for the study of forces that maintain genetic diversity as a whole. Any trait providing a fitness advantage should come to dominate a population; a polymorphism, then, requires some intervening dynamic of

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