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THE USE OF AFLP TO DETERMINE IF A SLIMES–TOLERANT INDIGENOUS SPECIES SHOWS LOCAL ADAPTATION TO SLIMES DAM SOILS

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A dissertation submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the degree of Master of Science.

Johannesburg, 2005

DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

Signed: _____

On ___ day of _____ 2005

ABSTRACT

Plant populations show an ability to survive and adapt under varying environmental conditions. Adaptation to heavy metal contaminated soils usually results in a decrease in genetic variation. Slimes dams consist of the pulverized rock slurry left after the extraction of gold or uranium. High toxicity levels mean that these wastes often remain uncolonised and are therefore easily eroded through wind or water. Plant populations that will be viable for long-term vegetation of slimes dams will prevent erosion, and stabilise and improve the quality of the soil. Indigenous, locally adapted species are the most likely to be successful candidates for vegetation. Indigenous, slimes-tolerant species *Indigofera adenoides* and *Indigofera zeyheri* were therefore studied. The aim was to determine if plant populations show local adaptation to the adverse substrate conditions emanating from slimes dams, by investigating genetic and morphological variation between adjacent populations growing at different distances in relation to slimes dams. The AFLP technique was used to analyse genetic variation as it produces rapid results, is inexpensive, reproducible, and capable of screening the entire genome. Lower genetic diversity was observed in those areas of the dams with higher levels of slimes-associated contamination. This difference was observed in both species, and for all measures of genetic diversity (Shannon's information index, Nei's gene diversity, percentage of loci polymorphic). This may be due to a founder effect following colonisation, natural selection, flowering time differences, or a combination of these factors. Reduced morphological variation was observed in those areas of the dams with higher levels of slimes-associated contamination. Significant morphological differences were observed between groups of plants from different areas, some of which appear to have the capability to assist the plants in a slimes-contaminated environment. Some degree of adaptation to slimes-contaminated soil therefore seems to have occurred, with this being more pronounced in *Indigofera adenoides*, although it cannot be determined whether this is purely phenotypic, or a combination of phenotypic and genetic. These species therefore seem suitable as candidates for vegetation of slimes dams, although further work must be done to fully understand the effect of slimes-associated toxicity.

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