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# SEED PHYSIOLOGY AND GERMINATION STUDIES OF *TRIODIA* AND *PLECTRACHNE* HUMMOCK GRASSES IN ARID AND SEMI-ARID AREAS OF AUSTRALIA

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## ABSTRACT

*In 1995 a project funded by the Australian Mining Industry Research Association was commenced to research the germination and establishment requirements of Triodia and Plectrachne hummock grass species. The University of Queensland sub-program provides facilities for work on seed germination, viability, dormancy and storage characteristics of a number of species endemic to the sponsoring mining operations (i.e. the Pilbara, Mt Isa and Tanami Desert regions). This paper outlines the project.*

## INTRODUCTION

Little work has been conducted on the germination characteristics of the 64 *Triodia* and *Plectrachne* hummock grass species endemic to arid and semi-arid Australia. This is despite the dominance of these species across 23% of the Australian continent (Griffin 1984). Jacobs (1973) provides the only detailed study on a few *Triodia* species while the Kings Park Plant Research Group in WA is currently working on the germination characteristics of *Plectrachne* species common to the Kimberley region.

Hummock grasslands are utilised by pastoralists, Aboriginal people, conservation departments, tourists, horticulturalists and the mining industries. It is this last group, who are concerned with land restoration after mineral extraction, that have provided funds for this present study. The sponsors are keen to rehabilitate disturbed lands damaged through mineral exploration or extractive activities as a means to minimise environmental impact and maintain biological integrity and to comply with decommissioning criteria set down by government legislative bodies. Hummock grasslands dominate the ecosystems of the active mining areas, however no reliable rehabilitation system has been devised to restore these grasslands due to insufficient knowledge of germination and establishment requirements.

In mature populations, hummock grasses recruit biomass through vegetative means (Jacobs 1973), with recruitment by seed playing a minor role (Jacobs 1992). This is true in cases where disturbance to an existing population has occurred through fire, with regeneration from the root base providing the main recovery mechanism of the population (Jacobs 1992). An exception to this trend would be *T. basedowii*, which appears to regenerate largely by seed in central Australia (Westoby *et al.* 1988). However, if disturbance to the ecosystem includes the removal of the hummock root base or the whole topsoil, or in areas where no topsoil is to be utilised in the rehabilitation process, the only viable means of re-introducing the hummock grassland to the area is by seed or transplanted material.

## THIS STUDY

This current investigation will look at various seedlots of the following species: *P. melvillei*, *P. pungens*, *P. schinzii*, *T. angusta*, *T. basedowii*, *T. burkensis*, *T. longiceps*, *T. mitchellii*, *T. molesta*, *T. pungens*, *T. scariosa*, *T. secunda*, *T. wiseana*. The specific investigations of each species will depend on the size of the seed lots, while other species may be studied if material becomes available. The focus of the work will be to determine a rapid field test for seed viability to assist in seed collection, while laboratory studies will look at the mechanisms controlling seed imbibition, germination, dormancy and longevity in relation to broadcast seeding. The importance of soil mycorrhizas will also be analysed relative to nutrient and phosphorus uptake in developing seedlings.

Removal of the palea and lemma has been shown to increase germination in the laboratory, apparently by removing the physical barrier to the germination process. However, whether they contain a

germination inhibitory substance such as abscisic acid is not known. No one has investigated whether diaspore appendages assist seed lodgement and burial in the field as in *Themeda triandra* (Sindel *et al.* 1993), ultimately affecting germination. Optimum germination temperatures lie somewhere in the region of 30-40°C while temperatures lower than 20°C or above 45°C may be inhibitory (Jacobs 1973, G. Wells pers. comm.). Gibberellic acid has been shown to improve the germination response in *Triodia* (Jacobs 1973) and *Plectrachne* (G. Wells, pers. comm.), while fire has been implicated as a possible prerequisite for germination of *Triodia* (Jacobs 1973). Despite this, specific mechanisms dictating these responses have not been well defined and this study will attempt to clarify these phenomena.

Larvae of Chalcid wasps and Coleoptera (Jacobs 1973) have been found in unshed seeds in relatively low densities. This current study has shown, however, that in favourable conditions, insect numbers can be as high as several hundreds in 40 g of unshed fruits, with predatory *Systasis* wasps and other insects perhaps feeding directly on the developing caryopsis (Davidson and Burwell, unpublished).

A principal aim of the project is understanding the factors determining seed fill. To date, if any seeds are present at all, fewer than 3-4 seeds may be present in any *Triodia* spikelet (between 5-14 potential florets), with a tendency for only the first floret to be filled (Jacobs 1973). Wells (pers. comm.) has found that *Plectrachne* species fare somewhat better with up to five florets with filled grains being common in *P. pungens* and sometimes *P. bynoei* after good seasonal rains.

## CONCLUSIONS

The mechanisms of seed germination and dormancy in *Triodia* and *Plectrachne* species are poorly understood. So are those factors affecting seed production and viability in the field. Data to date would indicate that insects may play an important part in seed viability and production under favourable field conditions. Low germination and establishment of hummock grass in areas where no topsoil is present indicates a possible association with a soil symbiont such as mycorrhizal fungi. The re-introduction of hummock grasses into areas disturbed by mining is seen as a mandatory process if the ecological system of the area is to be maintained and sustained. This current project would hope to develop systems which can better realise this goal.

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