Journal of the Cycad Society of South Africa

ENCEPHALARTOS

Tydskrif van die Broodboom Vereniging van Suid-Afrika

No. 104 June 2011 ISSN 1012-9987

Encephalartos middelburgensis on site propagation project: Progress and Prospects with Lessons learnt.

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Background

In issue 58 of ENCEPHALARTOS an article was published surrounding an artificial propagation project started on a private nature reserve on *Encephalartos middelburgensis* (Robbertse, Naude & Rousseau 1999). This project has been continued from such time and a follow-up article surrounding the efforts has seem to be in order. The Reserve covers 1200 ha. on which 3 clumps and 2 singular individuals of *E. middelburgensis* are found, constituting 3 males and 2 females. These are all of the "Wilge River form", quite appropriately as individuals are found on both sides of the river. Unfortunately in 2003 one of the single stemmed males, growing at the old farmhouse ruins, rotted and died. In addition, two isolated colonies of *E. lanatus* made up of 2 and 7 species respectively occur on the reserve. Also one specimen from the old farmhouse is presumed dead as we are unable to rediscover it after multiple attempts. The project was launched by Prof. Hannes Robbertse (species author), Prof. Theuns Naude and Robert Rousseau in 1997 with collection of pollen from *Male Plant A* and got underway in 1998 when *Female Plant A* coned. A second pollination event took place the year after in 1999 when *Female Plant B* coned in conjunction with *Male Plant B* and *Male Plant C*. The previous article then concluded at this stage with the prospect of transplanting seedlings from these two events back onto the Reserve once they have reached suitable size.

Progress

Since that time an official propagation project has been formed by the management committee with both authors as managers thereof. In terms of the project, the seeds from the 1st and 2nd event were germinated on site by the Reserve manager and at the University of Pretoria by Prof. Hannes Robbertse. Germination was less successful than the fertilisation (Robbertse *et al*. 1999) with only 580 of the ~2000 seeds successfully germinated on site and 100 out of 200 at the University of Pretoria. Germinated seeds were then transplanted into black plastic bags and placed in a plastic tunnel (Figure 1) thereafter control was transferred to the Reserve manager in terms of care. As for the mature individuals, pollen has been continuously collected from both remaining males plants and numerous suckers (Figure 2), and stored in a domestic deep-freeze at the authors' residence. Three pollination events have also taken place: 3rd event on five cones from *Female Plant A* in 2004 (Figure 3); 4th event on 2 cones of *Female Plant B* in 2005 (Figure 4), and simultaneously the 5th event was on two cones of *Sucker I* (*Female plant A*) (Figure 5). However from these pollination events less than 200 seedlings were generated. The first reason for this was an increase in what is probably baboon damage:

Figure 1.—: Seedlings from 1st and 2nd pollination events in plastic tunnel.

Figure 2.—: Two suckers from Male Plant A coning.

3rd event 2 cones found broken off around 18 September (Figure 6); 4th event one cone broken off before 26 February 2005; 5th event one cone found broken off before 12 March 2005. From the 3rd event all seeds recovered germinated, and we have continuously found germinated seed amongst rocks in the vicinity of the adult plant (Figure 7), probably carried there by small mammals. The last two events' damage was very early in the cones development and no seedlings could be generated from the recovered cones. Another possible reason for the lower yield might be the pollination schedule. The first pollination event was conducted by the three original authors usually during late

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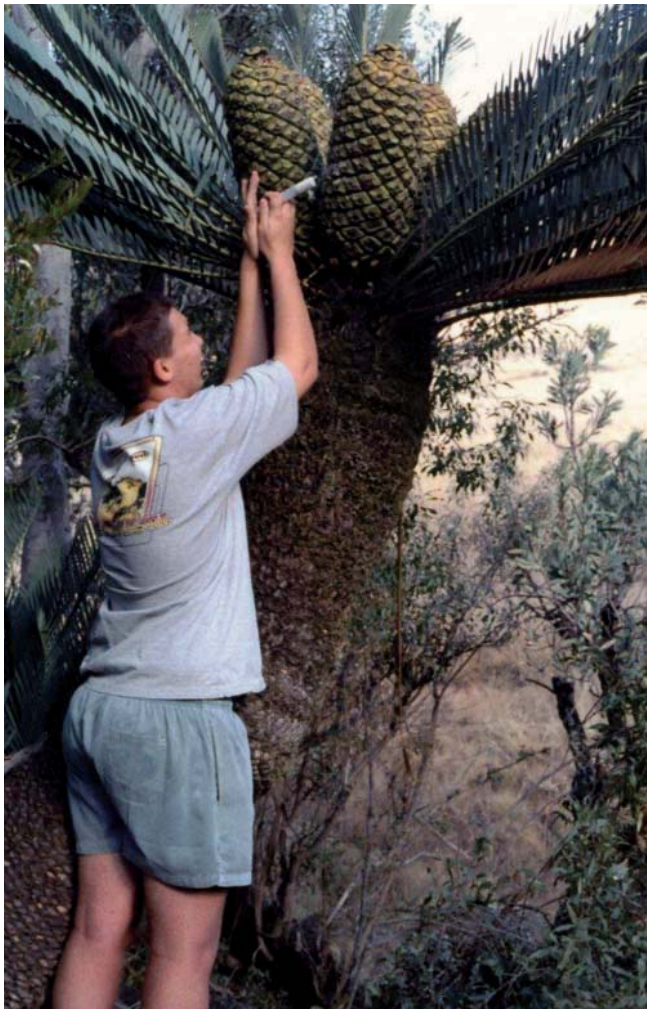

Figure 3.—: Female plan A being dry pollinated.

Figure 4.—: Female Plant B being wet pollinated.

Figure 5.—: Sucker I (Female Plant A) being wet pollinated, note removed male cones.

Figure 6.—: Recovered female cone from Female Plant A, note sarcotesta damage and missing seeds.

afternoon. The second event was conducted only by the current authors but again was done during late afternoon, i.e. after 17: 00. Events 3-5 pollination was most often conducted late morning, midday and early afternoon by the current authors. There is building evidence in literature that the time of day and receptiveness is correlated and in some cases is towards late afternoons and evenings (Donaldson 1997; Terry 2001; Terry *et al*. 2004; Terry *et al*. 2008; Suinyuy 2010; Suinyuy *et al*. in press).

In late 2007 it was decided that 2008, 10 years after the first pollination event, was the year for transplanting seedling back onto the reserve. However due to the loss of the plastic tunnel and watering system and ensuing neglect, many seedlings had succumbed (Figure 8) and most were very under-developed (Figure 9), the final tally was only 120 seedlings. The decision was taken to transplant seedlings in May 2008 as Adolf Fanfoni's *Cycad World of Innovations* could graciously donate their work force at that time. Twenty seedlings were transplanted at each mature plant (Figure 10, 11, 12, 13) with a total of 40 seedlings transplanted at interested shareholders houses on the reserve.

Figure 7.—: Naturally dispersed seed growing near mother plant.

Figure 8.—: Significant mortality among neglected seedlings.

Lessons learnt

Since the project has now progressed to a stage where the human intervention has practically ended for the transplanted seedlings, it is prudent to review the process and make suggestions on how it can be improved. To this end a few areas have been identified:

1. **Pollination schedule.** Pollination will be mostly in the late afternoons, by the workers who will be trained, as the reserve is a 2 hour round-trip from Pretoria making everyday pollination tedious. This follows in the vain of various recent articles on *in situ* propagation programs making use of local people (Graham *et al*. 2011; Vovides *et al*. 2011; IUCN Cycad Specialist Group Undated). When the managers then pollinate this will be done at a different time, to maximize the potential for hitting the daily receptive period which is still unknown for *E. middelburgensis*.

2. **Protection of cones.** The loss of cones from all three of the last pollination events is a concern with the loss of seed estimated close to a thousand (see table in Robbertse *et al*. 1999). Possible remedies for this is the addition of chicken wire on females (Figure 14) or the more robust palisade fencing. Also we have played around with the idea of fake snakes and leopard scents around the females to deter baboons.

3. **Poor germination and growth.** Germination was very poor for 3rd-5th pollination event as they were simply sowed outside in a large seed tray on soil. No shading was provided and watering was sporadic and

Figure 9.—: Seedlings still at 2-5 leaf stage after 10 years of growth.

Figure 10.—: Adolf Fanfoni and crew planting seedlings at Male Plant A..

Figure 11.—: Seedling planted in ridge alongside Female Plant A.

Figure 12.—: Seedlings planted in a clearing below Female Plant A.

Figure 13.—: Robert Rousseau planting seedlings at Female Plant B.

Figure 14.—: Chicken wire placed on female plant to protect cones.

Figure 15.—: Herbivore damage to open area seedling.

usually with a hosepipe, doing more damage than good in some cases. Seedlings of the first two pollination events were exposed to very high temperatures in the plastic tunnel, with watering unsatisfactory. When the tunnel burnt down seedlings were moved under a large tree where watering followed the same regime as the 3rd-5th events seeds. To this end and with the retirement of the Reserve manager, the burnt down tunnel structure has been moved to the workers homes, a bore hole has been sunk, 40% shade cloth has been procured and once new seedlings arrive a watering system will be installed.

4. **Transplantation time**. The May transplanting was a clear mistake with many seedlings dying of drought and exposure through the winter that followed. In future transplantation will only be done after the first spring rains and after the winter fires.

5. **Location of transplanting.** There has been a clear distinction between success and failure in terms of area selected for planting. Almost all seedlings transplanted in open areas, where it was most convenient, have succumb to herbivores (Figure 15) or drought (Figure 16). Seedling transplanted in rocky areas have had much greater survival rate and protection from fire which ravaged seedlings in the open areas in 2011. To that effect remaining seedlings in open areas have been covered with stones (Figure 17) and damaged seedlings have been treated and will be replanted eventually (Figure 18).

Prospects

Firstly a propagation project on the *E. lanatus* plants will be officially presented to the council at the Reserves AGM in 2011. This is necessary as no seedling regeneration occurs and only a single female plant has coned in

Figure 16.—: Desiccated seedling planted in an open area.

Figure 17.—: Seedling artificially covered with large stones.

Figure 18.—: Damaged seedling treated with a sealant.

12 years doing so out of sync with male plants. In terms of the *E. middelburgensis*, since the last pollination event in 2005 no female plant has coned—a gap of six years. We are thus anticipating a large coning event possibly with at least two female plants in 2012. Also male plants have not produce cones in the last two years (2010-2011) and we anticipate having fresh pollen. We are also aware of other *E. middelburgensis* plants on surrounding farms and Nature Reserves and will aim to incorporate these isolated plants into the project. These surely are in the same situation as the plants on the Reserve were before the project with no seedling regeneration what so ever. Finally this project can serve as a model for all "on site *Encephalartos* conservation projects", incorporating workers and indigenous peoples for *in situ* conservation. To that end the project will also form part of the larger conservation program for *E. middelburgensis*, currently in development by Government, the South African Biodiversity Institute (SANBI) and the Lowveld Botanical Garden (Karin van der Walt pers. comm. 2011). As this project is ensured to continue with the support of the management committee and two generations of project mangers, along with the proposed and continues alterations, one can look forward too a holistically successful project culminating in a self-sufficient natural colony in many years time.

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