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Short Communication

Pre-sowing temperature treatment effect on emergence of *Cucumis myriocarpus* seedlings

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Efficacy of *Cucumis myriocarpus* fruit crude extracts on suppression of *Meloidogyne incognita* is well documented in Indigenous *Cucumis* technologies. Currently, test fruits are collected from the wild, and this unreliable source cannot meet the quantities required for producing a commercial bio-pesticides. Thus, objective of this work was to evaluate effect of temperature-exposure of *C. myriocarpus* seeds on seedling emergence. Treatments comprising 5, 25, 35, 45 and 55°C, arranged in a randomized complete block design (RCBD), with 10 replications. Seedling emergence responded linearly to temperature ranges, which suggested additional work to determine maximum temperature for denaturing inhibitory germination chemicals on seeds of wild cucumber.

Key words: Bio-pesticides, indigenous *cucumis* technologies**,** seed dormancy, seedling emergence, temperature pre-treatment.

INTRODUCTION

Initial attempts to propagate seeds of wild cucumber (*Cucumis myriocarpus "Naudin"*), at the University of Limpopo were unsuccessful (unpublished data). The observation suggested that there were internal factors that inhibited seed germination, which possibly included after-ripening or seed dormancy. After-ripening refers to physiological changes that occur within the seed post-ripening that enable germination to occur and is usually treated by long storage of seeds and exposure to high temperature (Cui and Yin, 1995; Hartmann et al., 2002).

Ground crude extracts of *C. myriocarpus* fruit have been used in Indigenous *Cucumis* Technologies (ICTs) for over 10 years with consistent results in nematode suppression and improved crop yield (Mashela et al., 2011). In this technology, the material was researched and developed to address the plant-parasitic nematode problems in low-input agricultural systems, particularly for marginalised farming communities in South Africa. In particular, ICTs comprises of four technology types, *viz*. (1) ground leaching, (2) fermented crude extracts, (3) nematode resistance and (4) inter-generic grafting. Despite the successful use of this indigenous wild plant, obtaining of raw material either by collecting from wild field or propagating by seeds remains a challenge.

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C. myriocarpus seeds have relatively soft testa, which rules-out the presence of physical dormancy. Seeds of some *Cucumis* species have high concentration of abscissic acid (ABA), which is a known chemical inhibitor (Tucker and Gray, 1986). Soaking seeds in running water or exposure to high temperatures increase seedling emergence of *C. melo* (Bussell and Gray, 1976). However, an effect of these stimuli is not documented for *C. myriocarpus*. Therefore, the objective of this study was to evaluate the effect of temperature-exposure of *C. myriocarpus* seeds on seedling emergence.

MATERIALS AND METHODS

The study was established under field conditions at the Horticultural Unit of the University of Limpopo, South Africa (23°53'10'S; 29°44'15'E). Ripe fruits of *C. myriocarpus* were locally collected from wild and prepared. Treatments, comprising 5, 25, 35, 45 and 55°C, were arranged in a randomized complete block design (RCBD) with 10 replications. Seeds were exposed to 5°C in a refrigerator, 25°C in laboratory shelves, with the remaining temperature-exposures achieved in air-forced ovens for 24 h. Seeds were planted in plots at 1.5 cm depth at inter-row and intra-row spacing of 25 and 10 cm, respectively. After direct seeding, plots were irrigated to field capacity. A week after the first irrigation, one tensiometer per plot was inserted at 20 cm depth for scheduling irrigation and plots were irrigated with 5 L tapwater when readings averaged 10-15 kPa. Minimum and maximum ambient temperatures averaged 18 and 30°C, respectively, with no rainfall. Seedling emergence, defined as the first appearance of a germinant at the soil surface, was recorded daily. Emerged seedlings were marked to ensure that they were not recounted. Recording continued for 21 consecutive days. The study was repeated on same season of the subsequent year with minimum and maximum ambient temperatures averaging 14 and 25°C, respectively. Seedling emergence data were transformed using LN (1 + x) prior to analysis in order to homogenize the variances. Analysis of variance (ANOVA) was performed on treatment using software Statistix 8. Least significant difference (LSD) at 0.05 probability level was used to determine differences among means. When means were different, lines of the best fit between variables and temperature were determined using scatter diagrams with polynomial equation and co-efficient of determination (R^2).

RESULTS AND DISCUSSION

Exposure to temperature increased the emergence of *C. myriocarpus* seedlings. Significant relationships occurred between seedling emergence and temperature. In both experiments, seedling emergence had a positive linear relationship with temperature (Figure 1). Temperature accounted for 95% and 96% for the total treatment variation (TTV) in seedling emergence in Experiment 1 and 2, respectively.

Therefore, pre-sowing temperature exposure removed chemical dormancy in seeds of *C. myriocarpus*. The observation agreed with that of seed of PI 264217, an accession of *C. myriocarpus* (Heit et al., 1978) and seed

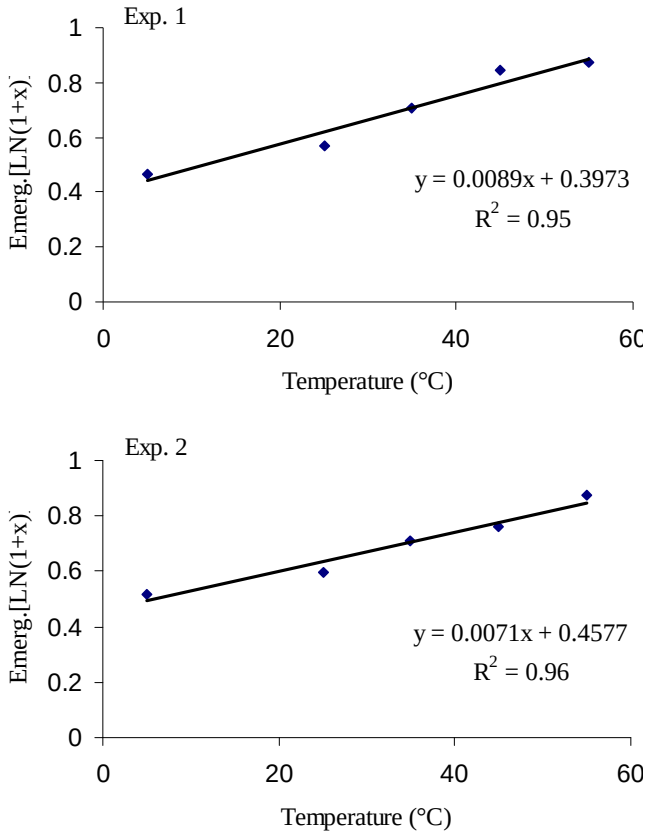

Figure 1. Responses of *C. myriocarpus* seedling emergence over pre-sowing temperature [Exp.1 (First) and Exp. 2 (Repeated)].

of *C. sativus* (Cui and Yin, 1995), where high temperature removed IGCs. Similarly, pre-heating seeds of *Panicum maximum* at 55°C for 15 h broke seed dormancy, increased germination and subsequent seedling establishment (Silva, 1998). Higher temperature shift is essential in breaking seed dormancy, enhance seed germination and emergence of many plant species including cucumber (Bewley and Black, 1982; Amritphale et al., 2000).

Xie (1985) showed that seed-peeling treatment on *C. sativus* had no significant effect in breaking seed dormancy. Due to the soft nature of *C. myriocarpus* seed testa, it appeared that any form of seed dormancy in this plant would be due to chemical inhibitors instead of testa dormancy. Tucker and Gray (1986) suggested that the physiological role of high temperature may be breakdown of germination inhibitors through the alterations in the properties of cellular membranes. Also, it may possibly be due to the neutralizing effects or concentration decrease of phenolic substances and abscissic acid in the endosperm (Puppala and Fowler, 2003). High temperature enhances production or activation of

cytokinin and gibberellins, and inhibits abscissic acid production during a promoter-inhibitor balance and quantative-relations of the hormones determine removal of seed dormancy (Eira and Caldas, 2000). The alteration of chemical inhibitors in the seeds to facilitate germination and subsequent emergence depend on the duration of exposure to thermal temperature (Susko et al., 2001).

Emergence is determined by environmental factors such as soil, light, temperature, water and air (Forcella et al., 2000). When the other factors are at optimal, temperature had a dominant effect on seedling emergence. *Cucumis* species are warm season crops that grow best in soil temperature range 18 to 30°C (Salunkhe and Kadam, 1998). Temperature below the range delays germination and subsequent emergence, but seeds may remain in cold soil for long time and then germinate when temperature becomes favourable (Susko et al., 2001).

In conclusion, the results of this study demonstrated the advantage of presowing treatments of *C. myriocarpus* seeds. However, the relationship found in this study was linear, thus suggesting that the additional work necessary to determine the maximum temperature for denaturing the inhibitory chemicals in seeds of *C. myriocarpus* warrant further research attention.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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