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DOMESTICATION POTENTIALS OF PANCRATIUM MARITIMUM L. AND IRIS CEDRETII DINSMORE.

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ABSTRACT

Biodiversity is being lost at an alarming rate never seen before. This threat is prevalent in Lebanon especially in sea and mountain tourist resorts. Becoming an urgent need, biodiversity conservation would be easier if linked to sustainable use.

Two plant species native to Lebanon were selected for domestication studies, the coastal Pancratium maritimum and the mountainous Iris cedretii.

An investigation of Pancratium maritimum bulb propagation did not lead to commercially feasible results. However, chipping revealed to be the most appropriate technique among those tested.

Re-introduction trials of P. maritimum on sandy beaches resulted in determining preliminary suitable techniques for re-introduction: planting bulbs at 40 cm depth and encased seeds at 30 cm depth.

Embryo culture of Iris cedretii in vitro was optimized by determining the sucrose concentration (10%) that led to the highest amount of transplantable plantlets. Collar thickness, root system branching and number of leaves were

found to be the best indicators for predicting transplanting success of in vitro grown seedlings.

Keywords: *biodiversity, conservation, domestication, re-introduction, Pancratium maritimum, Iris cedretii, Lebanon.*

RÉSUMÉ

La biodiversité régresse à un taux alarmant jamais rencontré. Au Liban, ce danger concerne les centres touristiques côtiers et montagniers. Devenue un besoin urgent, la conservation de la biodiversité serait plus facile si elle etait associée à une utilisation durable.

Deux espèces indigènes du Liban ont été choisies pour des études de domestication: le Pancratium maritimum côtier et l'Iris cedretii montagnard.

La recherche d'une technique de propagation des bulbes de Pancratium maritimum n'a pas abouti à des résultats satisfaisants au niveau commercial. Cependant, la technique de "chipping" s'est révélée être la plus appropriée parmi celles testées.

Des essais de réintroduction de P.maritimum sur des plages de sable ont abouti à la détermination d'une technique adéquate préliminaire: plantation des bulbes à 40 cm de profondeur et des graines empaquetées à 30 cm de profondeur.

La culture d'embryons d'Iris cedretii in vitro a été optimisée par la détermination de la concentration en saccharose (10%) qui a abouti au plus grand nombre de transplants. L'épaisseur au collet, la ramification du système racinaire et le nombre de feuilles ont été les meilleurs indicateurs pour prévoir le succès de transplantation des vitroplants.

Mots-clés*: biodiversité, conservation, domestication, réintroduction, Pancratium maritimum, Iris cedretii, Liban.*

INTRODUCTION

The IUCN has listed, in 1997, 10% of the world plant species as threatened by extinction. As a result, many strategies for *in situ* and *ex situ* conservation have been developed. In developing countries, those predicated on complementary approaches linking conservation to use are seen as the only affordable

way in which natural resources can be conserved (Synge, 1995). In this respect, the development and commercialization of new wild plant species were defined among the Global Plan of Action's priority activities (FAO, 1996). Introduction of potential new species requires knowledge of its domestication. In Lebanon, none of the native species with economic potentials has been domesticated although many of them are recognized as medicinal or ornamental plants (Khouzami, 1999).

In this study, two native plant species with economic potentials (ornamental, medicinal, aromatic), were selected. These are *Pancratium maritimum* (endemic to the Mediterranean) and *Iris cedretii* (endemic to Lebanon) (Rix, 1997).

The study had the following objectives: develop appropriate propagation techniques that can be applied to safeguard the species and/or to promote them commercially.

MATERIALS AND METHODS

1. Selection of collection sites

P. maritimum bulbs and seeds were collected from Al-Kharayeb beach which harbored the largest population among all those visited. *I. cedretii* seeds were collected in a previous season from a population near the village of Becharreh (1450 m) (Saad, 2001).

2. Vegetative propagation of *P. maritimum*

Three bulb propagation methods were compared: twin scaling, chipping, and scoring. The first method involved cutting the bulb into 48 pieces of two leaf-scales each called twin scales. In the second method, bulbs were cut into 16 segments. While in the third method, cuts were made in the basal plate (Hartmann and Kester, 1983; Rix, 1983; Rees, 1992; Mathew, 1997). Fifteen bulbs were used for each treatment. Treated bulbs were placed in trays in a warm, shady well-aerated location where temperature ranged between 21 and 22°C.

3. Transplanting of propagated *P. maritimum* plantlets

Emerging shoots were transplanted after rooting. Transplanting was attempted in two different media (perlite and 1:1 peat: sand) and two different atmospheres (under mist and in plant tray). Survival rate, average number of leaves and shoot length (cm) were recorded four weeks after transplanting.

4. Re-introduction of *P. maritimum* in natural habitats

Three sandy beaches were chosen to conduct the re-introduction trials (Al-Kharayeb beach, Jbeil Paradise Beach and Tyre Coast Nature Reserve). At each site, three replicate plots were prepared 150 cm apart. Each plot consisted of a 120cm*120cm square. Treatments were randomly assigned. Re-introduction treatments consisted of "direct seeding" which involved planting seeds at 30 cm depth, bulb planting at 40 cm depth and "encased seeds planting".

5. In vitro cultivation of *Iris cedretii* embryos

5.1. Plant material

Iris cedretii seeds were surface sterilized in a 50% commercial bleach solution (5.5% sodium hypochlorite) for two hours, and soaked for five days in sterile distilled water and water was changed daily under aseptic conditions. Embryos were extracted after cutting the seeds transversally at the end opposite to the micropyle.

Embryos were placed on solid half MS media in Magenta® culture pots (220 ml). Cultures were placed in an incubator (Precision Scientific®) at 25°C in the dark for two weeks. They were then transferred to light (fluorescent, 3000 lux, 16 h photoperiod) until further transplanting.

5.2. Embryo culture

Three levels of sucrose were tested in order to optimize embryo germination and subsequent plant growth. These treatments were 5%, 7.5% and 10% sucrose supplemented to a half strength MS medium (Murashige and Skoog, 1962) with 5% agar at a 5.7-5.8 pH. Four hundred and sixty-eight embryos were cultured, 156 per treatment. Every three embryos were placed in a Magenta® culture pot (220 ml), thus leading to fifty-two replicates per treatment. Measured parameters were percentage of germination, root and shoot length, percentage of seedlings with branching roots, average number of leaves, percentage of viable plantlets, and plant vigor.

5.3. Transplanting of *I. cedretii* seedlings

Plantlets with high vigor rating were planted individually in clay pots containing a mixture of peatmoss: perlite: sandy loam (1:1:1) (Wang et *al.*, 1999) and placed in the greenhouse under mist.

The period needed to reach transplanting stage and percentage survival after transplanting were recorded.

RESULTS AND DISCUSSION

1. Vegetative propagation of *P. maritimum*

DMRT results showed significant differences among propagation techniques (twin scaling; chipping and scoring) and among variants of these techniques (with and without layering in perlite. Regular chipping (without layering) produced the highest yield: 2.4 bulbils per bulb.

2. Transplanting of *P. maritimum* plantlets

Analysis of variance showed that plantlets put under mist developed significantly longer shoots than those put in plant trays regardless of the media they were assigned to. Shoots planted in a peat : sand 1:1 mixture and put under mist gave the highest average number of leaves: three per bulbil. Those planted in perlite and put in plant trays gave the highest shoot length: 15.1 cm. Survival rate was 100%.

3. Re-introduction results of *P. maritimum*

Analysis of variance (ANOVA) revealed that seed germination treatments were significantly different. This difference however was location dependant as evidenced by the significant interaction between location and re-introduction technique. In Jbeil, 75% of encased seeds germinated while none of those that were directly planted in the sand did. Of these, 66.7% developed bulbils and 11 % of them produced shoots. In contrast, in Al-Kharayeb an equivalent percent germination was noted in both treatments. The improved germination of encasing seeds could be explained as follows: soil mixture provided seeds with additional moisture. However, this was not the case at Al-Kharayeb site and this difference could not be explained since the plant mixture was the same. The environmental conditions did not seem to justify the positive germination results noted in Jbeil's location since these were unfavorable to germination (saline water reached the plots and a new sand layer was added on the surface of the experimental plot).

In Tyre Coast Nature Reserve, all of the three plots were destroyed: the whole site was turned into a public beach. In fact, a high proportion of the Lebanese coastal beaches have been converted to private or public tourist resorts.

4. In vitro cultivation of *I. cedretii* embryos

Germination, plant viability and root length were not affected by different sucrose treatments. On the other hand, the 10% sucrose concentration treatment produced the shortest shoots, the highest percentage of plantlets with high vigor rating, the highest number of leaves and the highest rate of seedlings with branching roots.

5. Transplanting of *I. cedretii* seedlings

The 10% sucrose treatment generated the highest amount of transplantable plantlets followed by the 7.5% sucrose treatment. The 7.5% and the 10% sucrose treatments gave the highest survival rates after transplanting. In fact, high sucrose concentration is suspected to lead to vigorous plantlets at the transplanting stage (Kim and De Hertog, 1994). In this experiment, plantlets that survived the best were those that had a thick collar, well-branched root system, and the highest average number of leaves.

CONCLUSION

Re-introduction, propagation, and transplanting techniques were tested for *Pancratium maritimum*. Results from these trials were not conclusive. Embryo culture of *Iris cedretii* was optimized by determining the sucrose concentration (10%) that led to the highest amount of transplantable plantlets. In addition, visual criteria for transplanting have been identified: thick collar and branched root system with a minimum of two leaves.

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