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DISSEMINATION OF SEEDS OF *ERYNGIUM PANICULATUM* CAV. ET DOM EX DELAROCHE FROM ISOLATED PLANTS III. RELATIONSHIP BETWEEN SEED-FRUIT WEIGHT AND DISTANCE OF SEEDLINGS

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Abstract

A experiment was carried out to determine the relationship between the seed weight and the distance they fall from the mother plant when they disseminate. There was an inverse relationship between the number and weight of seed and the distance from the mother plant. Greatest weight were registered between 0.25-0.40 m and there were no seeds further from the mother plant inspite of them being small and easy to disseminate.

Introduction

The greatest amount of seed is disseminated relatively close to the mother plant (Cook, 1980). Some of them present morphologic characteristics that allow them to disseminate to further distances (Cavers & Benoit, 1989; Eriksson, 1989). The main ways of dissemination are the wind, water, animals, soil preparation, usage of fields with contaminated seeds and agricultural machinery (Carmona, 1992).

The experiences about dissemination with isolated plants allow us to know the spread potential, the capacity to establish new plants according to the amount of seeds per unit area, to determine the structure of functioning of the future population, the natality index according to the viability and germination of the collected seeds per area. These form the initial part for the studies for prediction and simulated models for the establishment of colonizing species.

The collection of resources by the mother plant is important for the future generation because it determines the size and number of weeds (Wolf *et al.*,). Generally the size of the seeds within the plant populations has greater variation than the isolated plants (Harper *et al.*, 1970; Thompson, 1981), because the size of the seeds represent an important capital for the seedlings after germination, the components that they have are convenient and necessary for the plant development.

Different aspects of seed dissemination have been studied by Werner (1979), Comins *et al.*, (1980), Venable & Levin (1983), Levin *et al.*, (1984), Venable & Brown (1988), Johnson (1990) and Eriksson (1992). Most of these studies referred to the seed effects in relation to the achieved distance, size, habitat, the adverse effects of pathogenic agents against dissemination, time of dissemination, the beginning of populations multiplied in a vegetative way and also different hypotheses about the initial establishment of populations of cloned division.

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The present report describes the relationship between the number and weight of *Eryngium paniculatum* seeds with the future production of seedlings at different distances.

Materials and Methods

A plant of *E. paniculatum* growing from seed and transplanted at six month age in an isolated terrain of the Department of Agronomy and Zootechnics, University of Tucuman, Argentina (Experimental Field El Manantial) was used. During 1992 and 1993 the seedlings and populations expansion were studied. In December 1993, the seedling that germinated at 60 meters from the mother plant was isolated and cleaned through plastic seed collectors with protected net and small wing against wind and birds placed at 18x23x 4.5 cm to 5 cm height. The treatments were placed at 0.25, 0.40, 0.60, 0.80, 1.00 and 1.30 m with 50 cm distance between traps. There were 5 traps per treatment with 3 replicates. The seeds were collected weekly from 15/01/94 and at the end of the fruit maturation the total weight per tray was obtained.

The non-parametric test of Kruskal-Wallis and the Wilcoxon Sum Rank Test were used to study the quantity of seeds, while the traditional One Way Analysis of Variance and the least significance difference for means were used to study the weight of seeds.

Results and Discussion

The non-parametric test of Kruskal-Wallis was applied and the null hypothesis of equal treatment effect was rejected ($p < 0.01$) (Table 1). When the Wilcoxon Sum Rank Test was applied to every pair of treatments with an a-value of 0.10, there were no differences among the treatments when the seeds were collected between 0.25 and 0.40 m and for 0.60, 0.80, 1.00 and 1.30 m. Up to a distance of 0.40 m the greatest quantity of seeds was collected with the lowest values between 1.00 to 1.30 m. In some species the size of the seed influences the relative growth value of the plant during the initial establishment especially in competitive conditions as observed in *Trifolium plantense* (Anderson, 1971), Sesbania (Marshall, 1986), *Desmodium paniculatum* (Wulff, 1986) and *Rumex acetosella* (Houssard & Escarré, 1991).

Table 1. Quantity of collected seeds according to the distance from the mother plant.

Treatment (distance m)	Sum	Average of collected seeds
0.25	134	44.66 a
0.40	108	36.00 a
0.60	58	19.33 b
0.80	41	13.66 bc
1.00	32	10.66 cd
1.30	18	6.00 d

*Treatments followed by the same letter at p=0.05.

As mentioned earlier, it can be assured that the size is the factor that influence the initial establishment of *E. paniculatum* affecting the demographic advance. Its low capacity for establishment does not allow it to compete in the first growing area. There are antecedents about this subject but they differ in methodology and results (Lallana *et al.*, 1991). These authors did not isolate plants, neither they placed traps at different distances nor they protected them with wind and birds but they were the first ones in doing experiments with this species.

The size of the seed is a determining factor in the establishment process of the species and produces variations in the population when compared to other filed components (Harper, 1977). In *E. paniculatum* the relationship is not simple. When the weight is correlated to the distance the new offsprings would be far from the mother plant, but this is not true, because the relationship of distance-weight is tighter at shorter distances of 0.25 and 0.40 m.

In the present study the size of the seed (0.4-0.9 mm) is a limiting factor together to the plagues and diseases that influence the number of the seeds when considering the distance. They are not moved far from the original plant by the wind and its establishment has various limited factors.

Table 2 analyzes the seed weight that has an inverse relationship to the distance, the same happens with the number. The analysis of variance was applied and the null hypothesis of equal treatment was rejected ($p< 0.05$), so there are statistically significant differences among the treatments. When the least significant difference test was applied, there was no difference between the treatments followed by the same letter.

Table 2. Seed weight collected according to the distance from the mother plant.

Treatment (distance m)	Sum	Average of collected seeds
0.25	589.6 x 10-4	196.53 x 10-4 a
0.40	475.2 x 10-4	158.40 x 10-4a
0.60	255.2 x 10-4	85.06 x 10-4b
0.80	180.4 x 10-4	60.13 x 10-4b
1.00	140.8 x 10-4	46.93 x 10-4b
1.30	79.2 x 10-4	26.40 x 10-4c

*Treatments followed by the same letter.

The heaviest seeds fall to a distance of 25 cm from the mother plant and the lightest ones at 1.30 m. The presence of seedlings at greater distance (100 m) in the enclosure and in total isolation are not due to definite causes but they can be the results of movements through the animals and man. The analysis of these trials to distances lower than 2 m are due to observations done before in exploratory studies of dissemination of the species that determined a greater spread in the neighbourhood of the original plant and almost nothing to a distance of 2 m.

According to literature survey (Lallana *et al.*, 1991) and the experience of the authors of the present study, it can be assumed that the characteristics of the traps, placement distance and their distribution systems throughout the isolated plant have to be established according to the species under study.

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