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GERMINATION CHARACTERISTICS OF TEDERA (BITUMINARIA BITUMINOSA VAR. BITUMINOSA)

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ABSTRACT

This study was conducted to evaluate the germination response of tedera seeds (*Bituminaria bituminosa* var. *bituminosa* C. H Stirt) to water submersion t. Tedera is a perennial legume considered as a potential new pasture for Mediterranean, African and arid areas and traditionally used as forage for ruminants. It is characterized by deep-rootedness, drought tolerance, high protein content and nutritive value, offering elevate interest in animal nutrition. The experiment was undertaken from October 2015 with freshly harvested seeds collected by hand on natural populations from Gran Canaria, Canary Islands. Seed weight of tedera was compared using four replicates of 50 seeds. The seeds were divided into two groups (two replicates each group) and submerged on ambient temperature water during 16 or 24 hours each group. The mean seed weight was 23mg and it germinates in temperatures ranging from 12°C to 20°C. Tedera have no germination requirement for light. Tedera showed radicle protrusionfrom 4-8 cm with no significant difference between groups. However, the highest percentage of seed germination was achieved in the 24 hours group (65%) compared to the 16 hours group (27%), which showed a significant decrease ($p<0, 05$) in the percentage of seed germination. This study demonstrated that submersion during affected the *Bituminaria bituminosa* var. *bituminosa* seed germination and suggesting that tedera is a promising species for direct seeding. The results suggest that additional experiments are required for direct seeding.

Key words: *Bituminaria bituminosa*, seed germination, water submersion, direct seeding.

INTRODUCTION

Tedera (*Bituminaria bituminosa* L. C. H. Stirton) is a legume widely distributed in African and Mediterranean areas (Real et al., 2009) that can endure drastic conditions, contaminated and degraded soils. Tedera, traditionally used for feeding ruminants in the Canary Islands, is yet a promising legume as a feed for livestock (Sternberg et al., 2006). *Bituminaria bituminosa* L. presents 3 botanical varieties (*bituminosa*, *albomarginata* and *crassiuscula*). *Bituminaria bituminosa var.*

*bituminosa*has a wide adaptation across the Canary Islands and is the only one present in the Mediterranean basin. Characterized by deep-rootedness, drought tolerance, high protein and nutritive value, tedera offering elevates interest for low-rainfall or arid areas (Foster et al., 2015; Ventura et al., 2004; 2009; Pecetti et al., 2016). The domestication of *B. bituminosa* will require producing seed at the lowest cost. To achieve this objective, it is necessary to study on germination capacity of the seeds (Correal et al., 2008). Temperature and light are key factors that influence seed dormancy and germination. Temperature is the most important factor affecting the breaking of dormancy and seed germination (Baskin and Baskin, 1998; Cochrane and Probert, 2006; Mott, 1974), whereas light tends to stimulate germination (Vleeshouwers et al., 1995). Species such as lucerne must be sown at 5-10 mm for best establishment (Moore et al., 2006). The aim of this project was to study germination requirements of tedera seed and identify any potential constraints to its establishment. Such information is crucial to enable this new species to be sown commercially.

MATERIALS AND METHODS

Tedera seeds were collected by hand from natural populations of Gran Canaria, Canary Islands, on 12 October 2015. To investigate water submersion effect on tedera seed germination a completely randomized design with 2 replications was used. Studied factor included duration of water submersion: 16 and 24 hours. Tedera seeds were submerged on ambient temperature water during 16 and 24 hours. Then submerged seeds were germinated on filter paper moistened with distilled water in sterilized petri dishes. After 6 days, under the same conditions, temperature and UV protection, final germination percentage and germination rate were calculated. Seeds were classified as germinated if there was a protrusion of the radicle through the seed coat.

Statistical analysis

The germination was calculated according to the following formula;

Germination (%) = Number of germinating seeds/number of viable seeds initiated x 100

The data were tested at 5% level of significance to interpret the significant findings. Thedata were compoundedfor analysis of variance(ANOVA) by software StatPlus (AnalystSoft Inc.,2015). The percentage data fromthe different germination tests were arcsinetransformed.

RESULTS AND DISCUSSION

The widely populations produced a mean of 126, 9 flowers per plant with a mean of 19, 30 seeds per flower in autumn (Table 1). Thus, estimation seed production founded was 2442 seeds per plant (58, 78 g). The mean seed weight was 23, 83 mg, these results are similar to *var. albomarginata* (24, 7 mg) reported by Correal *et al.,*(2008). However, production founded are higher than the reported by Correal *et al.,*(2008), who showed that *var. bituminosa* produced 43g, *var. albomarginata* 50g and *var. crassiusscula* 38g per plant. According to Beard *et al.,*(2014), the results confirmed that tedera seed was large (Figure 1) and it could be easier to establish.

Figure 1. Flower, fruit, seed and germinate seeds of Tedera.

The effects of submersion during (16 or 24 hours) are summarized in Table 2. According with Bewley and Black (1994), germination was defined when the protrusion of the radical through the seed coat. Overall, the results presented showed that tedera was found to have no significant physical dormancy characteristics that restrict germination. Thus, seeds germinate without the presence of light or scarification.

The highest percentage of germination was achieved in the 24 hours water submersion (65%) compared to the 16 hours (27%), which showed a significant increase in the percentage of seed germination under water submersion.

Table 1. Description of sample populations;seeds per flower, number of flo-wers, number of produced seeds, weigh of seeds, seed size and seed produced (g per plant).

	Sample populations											
Parameters	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean**	**SEM**
Seeds per flower	22,00	18,00	22,00	20,00	18,00	18,00	19,00	20,00	18,00	18,00	19,30	1, 64
Number of flowers	120, 00	98, 00	108, 00	134, 00	129, 00	156, 00	142, 00	128, 00	140, 00	114, 00	126, 90	17, 35
Seed produced	2640	1764	2376	2680	2322	2808	2698	2560	2520	2052	2442	324
Weight (mg)	22,30	25,00	22,70	24,60	23,98	24,14	24,44	23,90	24,00	23,20	23,83	0, 85
Size (mm)	13,50	18,00	10,00	15,30	17,00	16,60	17,20	15,70	17,80	14,00	15,51	2, 46
Seed produced (g)	58,87	44,10	32,23	65,93	55,68	67,79	65,93	61,18	60,05	76,06	58,78	12,56

Table 2. Mean values of seed weight, seed size, germination percentage and radicle protruding.

Parameters	submersionduring (16hrs)	(24hrs)	SEM	p-value
Weigh (mg)	23, 00	22, 80	0, 29	0, 75
Seed size (mm)	13, 50	13, 25	0, 18	0, 25
Germination (%)	27, 00	65	21, 97	<0, 01
Radicle protruding (cm)	6, 04	6, 44	0, 28	0, 29

This study demonstrated that submersion during affected the *Bituminaria bituminosa* var. *bituminosa* seed germination and suggesting that tedera is a promising species for direct seeding. According to Beard *et al.* (2014), the results indicated that tedera requires a high water content to germinate. The results supported the findings of Correal *et al*. (2008),who reported a germination rate without scarification of 55 and 70% for var. bituminosa from Mijas and Calnegre populations, respectively. Castello et al.,(2015) founded that var. albomarginata and crassiuscula with soaking in gibberellic acid and mechanical scarification resulted in high germination (79.7% and 84.3%, respectively) than the results showed in this study for var. bituminousa (65%) without scarification or soaking in gibberellic acid. However, the results showed that var. Bituminosa under 24 hours submersion (65%) has a higher germination rate than variety albomarginata unthreshed with beak intact (25%) reported by Beard et al. (2014).

CONCLUSION

Overall, this study demonstrated that submersion during affected the *Bituminaria bituminosa* var. *bituminosa* seed germination. The results presented that tedera was found to have no significant physical dormancy characteristics that restrict germination. Thus, seeds germinate without the presence of light or scarification. The highest percentage of germination was achieved under 24 hours water submersion (65%). Also, this research founded that var. *bituminosa* was a plant with highly prolific seed production with a mean of 2442 seeds per plant (58, 78 g). The results suggesting tedera as a promising specie for direct seeding and easier for establishment. The domestication of *B. bituminosa*var. *bituminosa* will require additional researchs for producing seed and direct seeding.

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