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Concentrations of propolis in the physiological potential of *Pterogyne nitens Tul* seeds

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A B S T R A C T

Pterogyne nitens Tul is popularly known as wild peanut, consists of a forest species native to the Atlantic Forest of great ornamental, ecological and economic potential. The objective of this study was to evaluate the effect of the concentrations of alcoholic extract of green propolis on the physiological potential of P. nitens seeds. The experiment was carried out at the Plant Science Laboratory of the Agricultural Sciences Engineering Campus of the Federal University of Alagoas (Campus de Engenharias de Ciências Agrárias, da Universidade Federal de Alagoas), Rio Largo, AL. The experimental design was completely randomized (DIC), with four replications of 25 seeds per treatment. Five treatments were tested at doses of green propolis alcohol extract (11% dry extract) of 0 mL (control), 2, 4, 8, 16 mL per liter of distilled water, the material was stored in a germination chamber type Biochemical Oxigen Demand (B.O.D.) regulated at a constant temperature of 30°C. The variables germination, first germination count, length and dry mass of seedlings were negatively influenced by the increase in propolis extract concentrations. Concentrations of propolis alcohol extract negatively interfere with the physiological potential of P. nitens seeds, and are not recommended for the treatment of seeds of this species.

RESUME

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Introduction

Pterogyne nitens Tul is popularly known as wild peanut, belonging to the Fabaceae family, consists of a forest species native to the Atlantic Forest, mostly in the semideciduous broadleaf forest (Nascimento et al., 2006). The species has ornamental and ecological potential due to its importance in reforestation, especially of the Atlantic Forest, due to its rapid growth and adaptation to environmental conditions; in addition to having great economic potential (Medeiros et al., 2014; Santos et al., 2018; Figueiredo et al., 2018).

According to Goulart (2018), seed quality is determined by the sum of physical, genetic, physiological, and sanitary attributes. Among the attributes that determine the quality of native seeds, the sanitary factor is one of the most targeted, as the involvement by bacteria, viruses and fungi makes production unfeasible. Especially fungi, which are relevant causal agents of plant diseases, both in agricultural and forest species (Camargo, 2007; Medeiros et al., 2014). However, according to Nascimento et al. (2006) there are few references in the literature on the presence of fungi in native seeds.

Seed treatment is an extremely important practice for the success of plant development both in the nursery and in the field, contributing to the reduction of the incidence of fungi. However, “conventional” control with synthetic stimulants and fungicides has long-term consequences, such as damage to the environment and human beings, as they are more persistent in the environment and cause changes in local biodiversity, which is why the search for more sustainable alternatives is sought (Camargo, 2007). Propolis has an extensive area of application, being used in agriculture due to its performance in the control of pathogenic fungi (Pereira; Matte; & Venâncio, 2016). The objective of this study is to evaluate the alcoholic extract of green propolis on the physiological potential of P. nitens seeds.

Methodology

The experiment was carried out at the Plant Science Laboratory of the Agricultural Sciences Engineering Campus of the Federal University of Alagoas (Universidade Federal de Alagoas), Rio Largo, AL, Brazil. The seeds of Pterogyne nitens Tul were harvested with the aid of aerial scissors with an extension cable from eight mother trees belonging to forest fragments, located in the municipality of Garanhuns, PE, located at 08°53'25"S and 36°29'34"W, at an average altitude of 896 m. According to the Köppen climate classification, the climate is type As, a tropical climate with a rainy season. Data collection took place between March and May 2022.

Five treatments were tested at doses of propolis alcohol extract (11% dry extract) of 0 mL (control), 2, 4, 8, 16 mL per liter of distilled water (Fraga et al., 2016). Germinated seeds were considered to be seeds that originated normal seedlings, with all their essential structures,

thus showing the potential to continue their development and produce normal plants, when developed under favorable conditions (Brasil, 2009). The daily germinated seed counts were carried out at the same time, for fifteen days, and the material was stored in a Biochemical Oxigen Demand (B.O.D.) germination chamber, set at a constant temperature of 30ºC.

Variables analyzed

Germination: Total number of seeds placed to germinate (Carvalho et al., 2005); first germination count: Performed in conjunction with the germination test, computing the percentage of normal seedlings obtained from the fourth day after the installation of the tests; Germination Speed Index: G1/N1 + G2/N2 + ... + Gn/Nn, sendo IVG = G1, G2 and Gn = number of germinated seeds computed in the first, second and last count and N1, N2 and Nn = number of days from sowing to the first, second and last count (Maguire, 1962); seedling length: At the end of the germination test, the normal seedlings of each subsample were measured with the aid of a graduated ruler and the results were expressed in centimeters per seedling; seedling dry mass: After the end of the germination test, the normal seedlings of each replicate were packed in paper bags, then placed in a forced ventilation oven at 80ºC for a period of 24 hours. After this time, the samples were desiccated with activated silica gel and weighed on an analytical balance with a precision of 0.001 g, and the result was expressed in g/seedlings (Nakawaga, 1999).

The experimental design was completely randomized (DIC), with four replications of 25 seeds per treatment. The data were submitted to analysis of variance (ANAVA) and polynomial regression. The analyses were performed with the aid of the SISVAR 5.6 software (Ferreira, 2011). The means were compared using Tukey's test with a 5% probability, since there was significance according to the F test.

Results and discussion

The performance of Pterogyne nitens Tul seeds under different concentrations of propolis alcohol extract can be seen in Table 1. It describes the values of first germination count (PCG), germination (GER) and germination speed index (IVG). There was a statistical difference for the variables analyzed ($p < 0,05$).

Table 1.

First germination count (PCG), germination (GER) and germination speed index (IVG) pf Pterogyne nitens Tul seeds, subjected to doses of extract propolis alcoholic

Propolis extract (mL)	PCG (%)	GER (%)	IVG
0	90 a	97 a	5.111 a
2	82 ab	90 ab	4.345 b
4	72 bc	84 b	4.047 bc
8	66 cd	74 c	3.924 c
16	58 d	60 d	3.367 d
Number of "F"	15.8*	72.9*	44.0*
CV (%)	8.65	4.18	4.64

FV	GL	Medium square		
		PCG	GER	IVG
Treatment	5	381.14**	682.76**	0.494**
Residue	18	7.25	13.30	0.025
CV (%)		6.78	5.82	22.07

Means followed by the same lowercase letter in the column do not differ at 5% probability by Tukey's test.

Notes: Survey Results, 2023.

It was observed that the control treatment induced the maximum percentage of germination of P. nitens seeds (97%) (Table 1). It is noteworthy that no other studies were found in the literature using propolis extract for this species. However, the studies by Souza et al. (2017 a) and Souza et al. (2017 b) for the cucumber and cauliflower species, respectively, had different results, in which the concentrations of propolis extract did not interfere with the physiological quality of the seeds, with no statistically differing the means of the germination variables and the first germination count regardless of increased propolis concentrations.

The speed of germination is associated with the entry of water into the seed, resulting in the activation of metabolic processes. In this case, higher concentrations of propolis caused negative effects on the analyzed variables (Table 2), causing the imbibition and germination processes to be slower. This result corroborates the study by King-Días et al. (2015), in which they present the flavonoids present in propolis extract as a cause of interference in the flow of electrons in the Hill reaction (water photolysis), causing damage to the embryo and, consequently, in the emergence and development of plants.

Table 2.

Mean time (TM), uncertainty (I), mean speed (VMG) and synvhrony (Z) of germination of Pterogyne nitens Tul seeds subjected to doses of propolis alcohol extract

Propolis extract (mL)	TM (days)	I (bit)	VMG	Z
0	4.9 a	0.950 a	0.190 a	0.928 a
2	5.6 b	1.513 b	0.170 b	0.426 b
4	5.7 bc	1.828 c	0.155 c	0.381 bc
8	6.2 c	1.950 c	0.145 c	0.361 bc
16	6.7 d	2.521 d	0.130 d	0.288 c
Value of "F"	37.29*	157.16*	79.87*	107.81*
CV (%)	3.90	5.26	3.27	10.38

Means followed by the same lowercase letter in the column do not differ at 5% probability by Tukey's test.

Notes: Survey Results, 2023.

Unlike the present study, which obtained greater interference with the maximum concentration of the extract, Pezzi (2016), working with carrot and parsley seeds with different doses of propolis, obtained as a result that the increase in concentrations with the maximum of 16 mL of propolis extract did not cause interference in the physiological quality of the seeds. This may have occurred due to the difference in species, as they have morphologically different seeds, as well as different rates of absorption of the extract by both. Seedling growth is associated with dry mass and length variables (Vanzolini et al., 2007).

The dry mass of seedlings for the concentrations: 4, 8 and 16 mL (Table 3) did not show statistical difference at 5% probability, since the highest mean values were of the control (0.435 g) (without application of propolis) and in the concentration of 2 mL of propolis alcohol extract (0.287 g). For the length variable, the control treatment had the longest length of 8 cm (Table 3), which is contrary to the study conducted by Souza et al. (2017a), which obtained the aerial part of the plant not influenced by propolis dosages; however, it was observed that cucumber seeds treated with propolis obtained greater root length at the dosage of 15%, and the dosage of 25% did not affect the physiological quality.

Table 3.

Length (COMP) and dry mass (DMP) of seedlings from Pterogyne seeds nitens Tul. Subjected to doses of alchoholic extract of propolis

Propolis extract (mL)	COMP (cm)	MSP (g)
0	8.00 a	0.435 a
2	6.20 b	0.287 b
4	5.50 bc	0.137 c
8	5.00 c	0.100 c
16	4.70 c	0.062 c
Value of "F"	46.18*	50.62*
CV (%)	6.55	21.25

Means followed by the same lowercase letter in the column do not differ at 5% probability by Tukey's test.

Notes: Survey Results, 2023.

Conclusion

Concentrations f propolis alcohol extract interfere negatively in the physiological potential of Pterogyne nitens Tul seeds, and are not recommended for the treatment of seeds of this species.

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