

## Allelopathy of Aqueous Canola Extract on Sunflower Seeds

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**Received date:** 15 August 2019, **Accepted date:** 30 September 2019, **Online date:** 22 November 2019

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### Abstract

Allelopathy can be considered as any effect, beneficial or harmful, of a plant towards another, in the presence of chemical compounds in the environment. In this context, the present paper, has its aim to assess the influence of allelopathy in the aqueous extract of the aerial part of the canola plant (*Brassica napus*), about the germination of sunflower seeds (*Helianthus annuus*). The experimental outline used has been entirely randomized with four repetitions in total. The treatments were as follows: concentrations of 1, 2.5, 5 and 10% of the canola aqueous extract and the witness plant with distilled water, conducted in germitest paper with 50 seeds per roll, under a temperature of 27°C. Daily account of germinated seeds has been carried out and at the end of eight days, germination percentage, vigor, average speed of germination and average time for germination have also been analyzed. Lilliefors, not existing a need of transformation, submitted the obtained data to the normality test the averages were compared by the Tukey Test ( $P \leq 0.05$ ), through the computerized application WinSTAT®. The aqueous canola extract affected the variables of germination of the sunflower seeds in a negative way. It is recommended to be cautious about the use of sunflower coming about the canola culture, thus field experiments should be conducted in order to attest such effect.

**Keywords:** *Brassica napus*, *Helianthus annuus*, efeito antagonista. Allelopathy

### INTRODUCTION

Allelopathy can be considered as a chemical interaction recurrent between plants, playing an essential role in various ecosystems (MARIESSE, 2005). According to Rice (1979), the effect of allelopathy can be direct or indirect, beneficial or harmful, in the presence of chemical compounds that are released in the environment.

The main form through which the allelochemicals may affect plants in inhibiting germination of the seeds (ESPINDOLA *et al.*, 2000).

Canola (*Brassica napus* L.), culture belonging to the Brassicaceae family, presents potential in the production of vegetable oil and biofuel (RIZZARDI *et al.*, 2008). Studies have shown that species of this family yield secondary metabolites entitled glucosinolates. When decomposed, they are converted into isothiocyanate and thiocyanate (EBERLEIN *et al.*, 1998). Glucosinolates are mentioned as a substance of natural defence against herbivores (JÖNSSON, 2005), in low concentrations they can cause plugging in the germination of seeds, and in case of high concentrations it can stop the germinations of a few species (PETERSEN *et al.*, 2001).

This way, canola when succeeded by another culture may cause allelopathy effects either harmful or beneficial, as states Castro *et al.* (1983), considering that this plant extracts inhibited the root growth and germination of the tomato and lettuce plants and Silva *et al.* (2011), that describes the allelopathy effect of the canola plant on the soybeans culture.

The sunflower (*Helianthus annuus*) is an annual plant of the Asteraceae family, considered a good alternative in the rotation or succession of cultures, such as canola. However, there are no studies that could indicate if there is an effect of the remains of

the canola culture on the sunflower culture sown right after. Thus, the present study aimed to evaluate the effect of aqueous extract of the aerial part of the canola plant on the germination of sunflower seeds.

## MATERIAL AND METHODS

The experiment has been conducted in the Laboratório de Sementes da Universidade Tecnológica Federal do Paraná, Câmpus Dois Vizinhos (UTFPR-DV), in Dois Vizinhos, PR. The canola plants were cultivated in the field and before its flourishing and then collected and dried out in a greenhouse under 40°C for 24 hours after which they have been triturated and weighed.

In the composing of the extract concentration, 10% weight/volume, that is, 100g of dry plant / 1l of water. The plant was submerged into glass beakers of distilled water that had been properly isolated with transparent plastic wrap and to avoid light incidence, a black plastic wrap has been used for 24 hours in room temperature.

Taking the standard solution into account (10%), distilled water dilutions have been conducted obtaining the remaining concentrations 1%, 2.5% and 5%. The standard solution was kept static during 24 hours, at the end of this period, the extract was strained with the auxiliary of a filter paper. The treatment of the witness received distilled water.

Fifty seeds per germitest<sup>®</sup> paper roll were humidified 2,5 (60 ml) was its aqueous extract weight according to treatments RAS (BRASIL, 2009).

The evaluations were conducted daily for a period of eight days, considering the germinated seeds the ones which presented root protrusion above 2mm. The analyzed variables were the percentage of germination (G %), according to the rules proposed by the RAS (BRASIL, 2009). Average speed of germination (VMG), by the formula  $VMG = 1/t$  where: t= average time of germination; (TMG), according to Silva e Nakagawa (1995), calculated by the formula  $TMG = (\sum ni) / \sum ni$ , being ni = number of seeds germinated per day and ti = day on which the seed germinated.

The adopted experimental outline was entirely randomized (DIC) with four repetitions. As followed, the seeds were stowed in a germination chamber with average temperature of 27°C.

The data were submitted to the Lilliefors normality test, not being needed to transformation the averages were compared by the Tukey Test ( $P \leq 0,05$ ), through the WinSTAT<sup>®</sup> computerized application (MACHADO E CONCEIÇÃO, 2002).

## RESULTS AND DISCUSSION

Significant differences were detected in all the tested variables, pointing out the allelopathy effect of the canola in the germination of sunflower seeds (Table 1 and Figure 1).

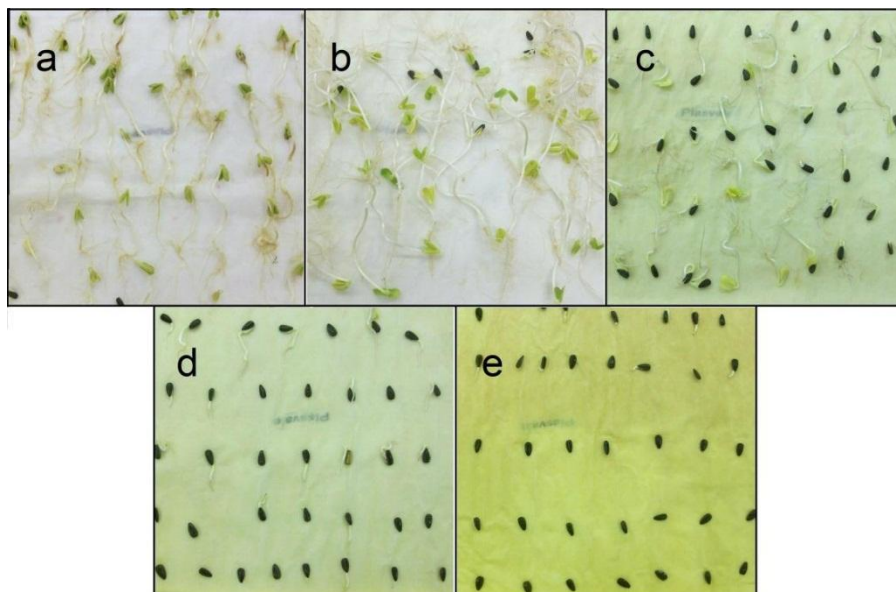
**Table 1:** Percentage of germination (G%), Vigor of the plants, the average time of germination (TMG) and average speed of germination (VMG) in sunflower seeds submitted to the allelopathy effect of the aqueous extract of canola, Dois Vizinhos – PR, UTFPR-DV, 2019.

Concentration (%)	G%	Vigor	TMG days <sup>-1</sup>	VMG
0	100a*	86,5a*	3,38a*	0,29a*
1	100 a	75,5 a	4,51 a	0,22 b
2.5	88 ab	17,5 b	7,87 ab	0,12 c
5	76 b	0,0 c	12,05b	0,08 d
10	26 c	0,0 c	24,21c	0,04 e

\* Averages on the same column, followed by the same letters do not differ by the Tukey Test ( $P \leq 0.05$ ).

For the variable percentage of germination, the concentrations of 5 and 10% of the extract affected it negatively, differing from the witness, presenting (G %) of 76 and 26%, respectively (Table 1).

Comparing the witness with the concentration of 10%, there occurs a reduction of 74% in the percentage of germination, such fact attests the allelopathy effect of the canola extract on the sunflower seeds, clearly visualized in Figure 1. The same did not occur with the beans seeds, where Rigon et al. (2010), tested the allelopathy effect of the canola extract, observing that the IVG went down as the concentration rose. However, there was no inhibitory effect in germination. In contrast, Rizzardi et al. (2008) verified that the rising in canola extract of 0 to 100%, reduces the germinations of achenes of *Bidens pilosa* in 80%.



**Figure 1:** Seeds of *Helianthus annuus* exposed to concentration of a) 5% of extract, b) 1% of extract, c); 2.5% of extract d); 5% of extract and e); 10% of extract of *Brassica napus*.

As for the vigour of the sunflower seeds, this has been altered based on the concentration of 2.5%, diminishing as the concentration of the canola extract rose, being utterly null in the concentrations of 5 and 10% when compared to the witness (Table 1 and Figure 1).

However, when considering TMG, it can be observed that there were significant differences, is that the concentrations of 5 and 10% differed from the witness. In the two major concentrations, they rose on average 9,12 and 20,83 days respectively the time of germination of the seeds when compared to the witness TMG that was of 3,38 days.

The average speed of germination diminishes as rising the concentrations of the substrates. This occurs since concentration of 1%.

The bigger the TMG the smaller the average speed of germination, it is more unfavourable to the culture because the weeds can establish first in the area and compete for lack of resources in the environment.

Studies indicate that the TMG and VMG of weeds and cultures can be affected by the different concentration of other vegetable extracts in lab conditions (BORTOLONI e FORTES, 2005; FORTES et al., 2009).

## CONCLUSIONS

The aqueous canola extract affected the variables of germination of sunflower seeds negatively. It is recommended to be cautious when using sunflower in the successiveness of the canola culture, although the field experiments must be conducted in order to attest such effect.

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