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Allelopathic potential of aqueous extracts from the most frequent Brazilian weeds in chick-peas germination

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Workshop Information

I Workshop of Plant Biology (I Workshop de Biologia Vegetal) was held in the Bioscience Institute – UNESP, campus of Rio Claro, Brazil, during August 20 and 21, 2012. Workshop was a scientific event organized by Post-graduate students from that Institute aiming to integrate Post-graduate and Graduate students from different areas related to Plant Biology (Anatomy, Ecology, Evolution, Morphology, Physiology, and transitional areas) from different Universities. Workshop Organization offered a large number of speaking activities, scientific discussions, and extra short-courses to improve the knowledge and formation of students in Plant Biology.

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INTRODUCTION

The chick-peas (*Cicerarietinum* L.) is a legume of the winter that has shown favorable characteristics of high roughness, such as low incidence of pests and diseases and drought tolerance. Its seeds are a source of protein, carbohydrates, minerals, vitamins and fiber, are considered of high nutritional value of legumes (Kaur et al. 2007).

Although the chick-peas lie between the five most important legumes worldwide, being produced in 40 countries. In Brazil its production is concentrated in the southern region (Oliveira 2007), and its attainment is not sufficient to meet the internal market, making it necessary to import this product.

The incidence of weeds in this crop appears as one of the factors that can interfere on productivity, decreasing the production and quality of the product, as well as increasing production costs (Baker 1989).

Considering the potential for production of chick-peas in São Paulo State, this study aimed to analyze the interference caused by aqueous extracts of eight weed species commonly found in this region at the germination of *C*. *arietinum*seeds.

MATERIAL AND METHODS

The experiment was conducted at the Departamento de Biologia Aplicada à Agropecuária, FCAV - UNESP, Jaboticabal, in controlled conditions, using a completely randomized design.

We used three relative controls (distiled water with pH adjusted to 7.0 (T1), 6.5 (T2) and 6.0 (T3)) and three concentrations (2.5% (T4), 5.0% (T5), 10.0% (T6) (weight / volume)) from the shoot aqueous extracts from *Alternathera tenella* (At), *Amaranthus viridis* (Av), *Coniza bonariensis* (Cbo), *Raphanus raphanistrum* (Rr), *Cynodon dactylon* (Cd), *Digitaria nuda* (Dn), *Cyperus rotundus* (Cr), *Commelina benghalensis* (Cbe).

Plants used to prepare the extracts were in vegetative stage and were collected at the FCAV UNESP in a field close a threshold weed competition experiment with chick-peas. We used the proportion of 1:3 (100 g per 300 mL) fresh material:distiled water to produce the extracts.

The experiments were conducted in a germination chamber with 25 ° C ± 2 º C and under 12/12 h photoperiod. Twenty-five seeds were used in each

transparent plastic boxes (11x11x3 cm) per repetition (4 repetitions). The seed were distributed in five columns in each box. Two-filter paper sheets moistened with 12 mL of extract or distilled water were used per treatment.

Daily, during 15 days, we evaluated the germinated seeds. The seed were considered germinated when the radicle appearance of length greater than 50% of the size to avoid false seed germination by expansion of the embryo imbibition (Labouriau 1983).

The calculations of percentage of germination (G), mean time of germination (MTG), speed of germination (S) and germination rate (GR) were performed according to models cited for Labouriau and Valladares (1976).

The data were subjected to One-Way ANOVA and means were compared by Tukey test at 5%.

RESULTS AND DISCUSSION

We observed almost all extracts did not interfered at the chick-peas germination. The final germination in all treatments were around 95%, and the seeds started to germinate one day after sowing (DAS) (Figure 1A). The final germination in time was around 2 (T1 and T2) and 3 (T3) DAS, and overall, for the treatments T4, T5 and T6 were 7, 10 and 11 DAS respectively. Among of these treatments,seeds from T4 showed smaller germination time and T6, the largest. At the T4,C. benghalensis (Cbe) expressed similar effects than controls (5 DAS) and for T6, R. raphanistrum (Rr) extracts showed the longer time (13 DAS) (Figure 1B). The seeds from controls spent around 1.6 (T1 and T2) and 1.8 (T3) days to germinate.

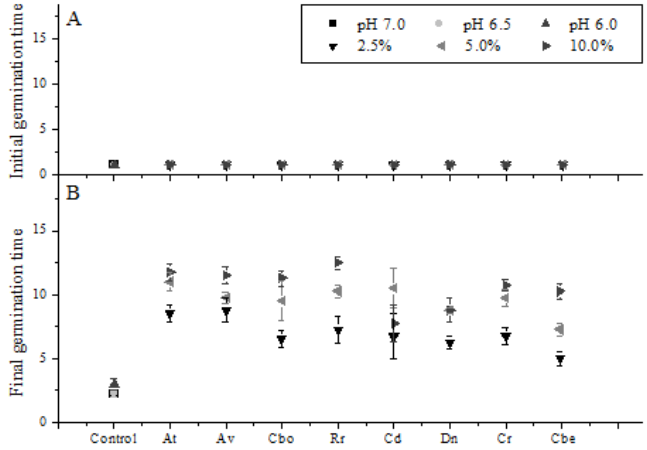

Figure 1. Initial germination time (A) and final germination on time (B) of chick-peas seeds subjected to the action of aqueous extracts from (At) *A. tenella*, (Av) *A. viridis*, (Cbo) *C. bonariensis*, (Rr) *R. raphanistrum*, (Cd) *C. dactylon*, (Dn) *D. nuda*, (Cr) C. *rotundus* and (Cbe): *C. benghalensis*), and controls with distilled water and pH adjusted.

Overall, the mean germination on time for the treatments T4, T5 and T6 was higher than controls, showing around 3 (T4) and 4 (T5 and T6) days. Among these treatments, the seeds from T4 had shorter mean germination on time and from T6, the longest. The extracts at 2.5% (T4) from D. nuda (Dn) and A. tenella (Ac) showed similar effects than controls (2.41 and 2.45 days respectively), and at 10% (T6) the longest germination time was observed for C. rotundus (Cr) and R raphanistrum (Rr) (5.70 and 5.48 days respectively) (Figure 2).

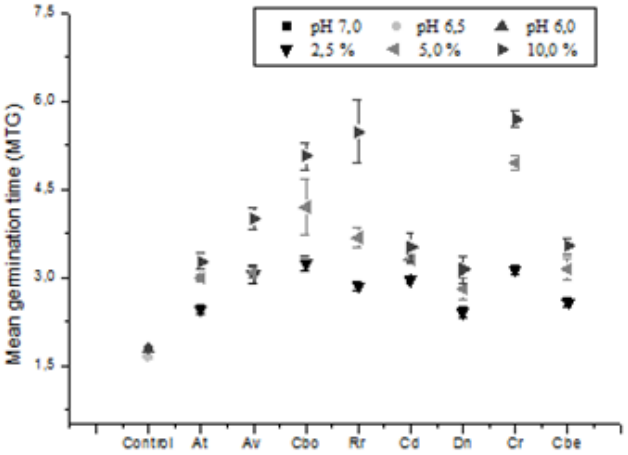

Figure 2. Mean germination time (MTG) of chick-peas seeds subjected to the action of (At) *A. tenella*, (Av) *A. viridis*, (Cbo) *C.bonariensis*, (Rr) *R. raphanistrum*, (Cd) *C. dactylon*, (Dn) *D. nuda*, (Cr) *C. rotundus*and (Cbe) *C. benghalensis* aqueous extracts and controls with distilled water and pH adjusted.

The speed of germination (S) from controls was around 0.60 (T1 and T2) and 0.55 (T3) seeds per day (SD), The S for the treatments T4, T5 and T6 were lower than controls (0.36, 0.30 and 0.25 respectively). Among these treatments the seeds from T4 showed higher GR and the T6, the smallest. The S from T4 with extracts from *D. nuda* (Dn) and *A. tenella* (Ac) done similar effects than controls (0.42 SD) and from T6, *C. rotundus* (Cr) and *R. raphanistrum* (Rr) lowest speeds (0.18 and 0.19 SD respectively) (Figure 3).

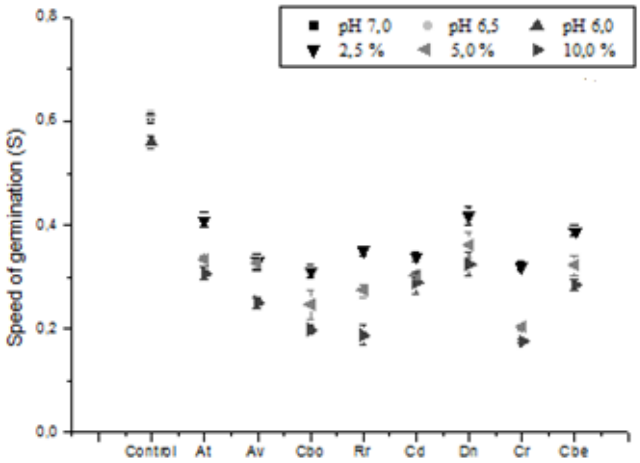

Figure 3. Speed of germination of seeds of chick-peas subjected to the action of aqueous extract from (At) *A. tenella*, (Av) *A. viridis*, (Cbo) *C. bonariensis*, (Rr) *R. raphanistrum*, (Cd) *C. dactylon*, (Dn) *D. nuda*, (Cr) *C. rotundus*and (Cbe) *C. benghalensis*), and controls with distilled water and pH adjusted.

This gradually germination, reflects the influence of weed extract obtained in increasing the mean germination on time and decreased speed of germination in accordance with the increase of extract concentration diluted. This means that depending on the concentration of weeds in the soil, there may be affect the speed at which seeds germinate and thus, the won in weight of the grains, causing damage to production.

CONCLUSIONS

The chick-peas seeds exposed to treatment with the highest concentrations of the aqueous extract showed higher mean germination time due to lower germination rate, reflecting the activity of the extract of the weed in these variables. The extracts obtained from *C*. *rotundus* and *R*. *raphanistrum* were that most influenced the germination of chick-peas.

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Review process and quality of English writing is responsibility of Workshop Scientific Committee.