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Phytotoxic activity of *Sapindus saponaria* L. leaf and stem bark on initial growth of *Triticum aestivum* L.

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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.

Scientific Committee

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INTRODUCTION

Among the factors that determine community structure and dynamics are the positive and negative plant-plant interactions (Michalet et al. 2006, Souza et al. 2010). One of the several ways by which plants can interact is through the release of secondary metabolites in the environment, which may cause direct or indirect interference of one plant on another, by a process called allelopathy (Rice 1984).

Sapindus saponaria L. (Sapindaceae), popularly known as soapberry, is a native arboreous species, pioneer, evergreen or semi-deciduous, heliophytic and medium size (Albiero 2001). In Brazil, it occurs from Pará to the Rio Grande do Sul, with regular distribution in the states of North, Northeast and Midwest. This tree flowers in July and August and is extensively used in urban landscaping and recovery of degraded areas. Its wood is used in construction and the fruit by local population as soap for washing clothes, and for curing ulcers, external wounds and inflammations (Pelegrini et al. 2008). It is a species that presents great diversity of chemical compounds. Abdel-Wahab and Selim (1985) detected the presence of carbohydrates, steroids, flavonoids and saponins in the leaves and stems of *S. saponaria*.

Thus, the objective of this study was to evaluate the phytotoxic potential of aqueous extracts of leaves and stem barks of *S. saponaria* on initial growth of *Triticum* aestivum L. (wheat).

MATERIAL AND METHODS

Leaves and stem barks of *S. saponaria* were collected in São Carlos, SP (22° 02' S and 47° 52' W) in May of 2011. The region is characterized by Aw climate (Köppen 1948), with dry winters (April to September) and wet summers (October to March). Leaves were collected from 10 trees, while the stem bark were collected from three of them. After collection, leaves and barks were dried at 40°C for 72 hours and ground in an electric mill. Aqueous extract was prepared in a proportion of 100 g of dry plant material in 1000 mL of distilled water, producing a concentration of 10%. Dilutions of this concentrate were made with distilled water to 7.5, 5.0 and 2.5%.

For analysis of wheat (*T.* aestivum) initial growth, were used seedlings germinated in water with 3 mm-

long roots, which were selected and transferred to transparent plastic boxes (13 x 8 x 3 cm) containing filter paper as substrate that was moistened with 8 mL of water or leaves and barks extracts. The experiment was conducted in a germination chamber at 25°C, with a photoperiod of 12 hours (Bortolini and Fortes 2005). The experiment design was completely randomized, utilizing four replicates of 10 seedlings. After seven days, the seedlings were classified as normal or abnormal (Brasil 2009) and the shoot and primary root lengths were measured using a digital caliper.

Data were statistically analyzed using normality (Shapiro-Wilk) and homogeneity (Levene) tests. When these two assumptions were met, the analysis of variance (ANOVA) was applied, followed by Tukey's test at 0.05 significance. Linear or quadratic regression models were adjusted when the ANOVA *F* was significant. The goodness of the models was tested at 0.05 significance and evaluated by its coefficient of determination (R^2).

RESULTS AND DISCUSSION

Extracts of *S. saponaria* leaves and stem barks induced the occurrence of abnormalities in the seedlings for all concentrations. Percentage of normal seedlings of wheat grown in the leaves and barks extracts ranged from 100% (control) to 40% (10% concentration) and from 100% (control) to 65% (10% concentration), respectively (Figure 1). The most common abnormalities were roots necrosis, negative geotropism and stunted seedlings.

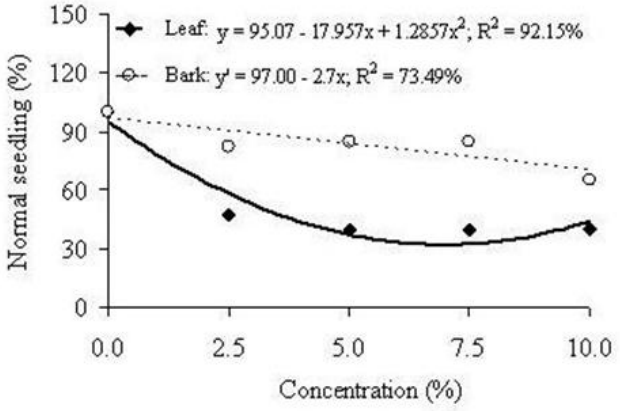

Figure 1. Effect of *Sapindus saponaria* L. leaf and stem bark extracts on the percentage of normal seedlings of *Triticum* aestivum L.

The shoot length of wheat seedlings grown in the stem bark extracts was minimal (44.03 mm) at a concentration of 7.10% and for the seedlings grown in the leaf extracts there was a linear decrease of 4.85 mm for each addition of 0.01 mg mL^{-1}extract. The lowest root length for seedlings grown in the leaf (17.42 mm) and stem bark (33.33 mm) extracts was recorded in the estimated concentrations of 7.36 and 7.20%, respectively. Roots of the wheat seedlings were more damaged than the aerial part (Figure 2). Others authors have also reported that roots are more sensitive to allelochemicals than aerial parts (Ribeiro et al. 2009, Grisi et al. 2012, and Souza et al. 2010).

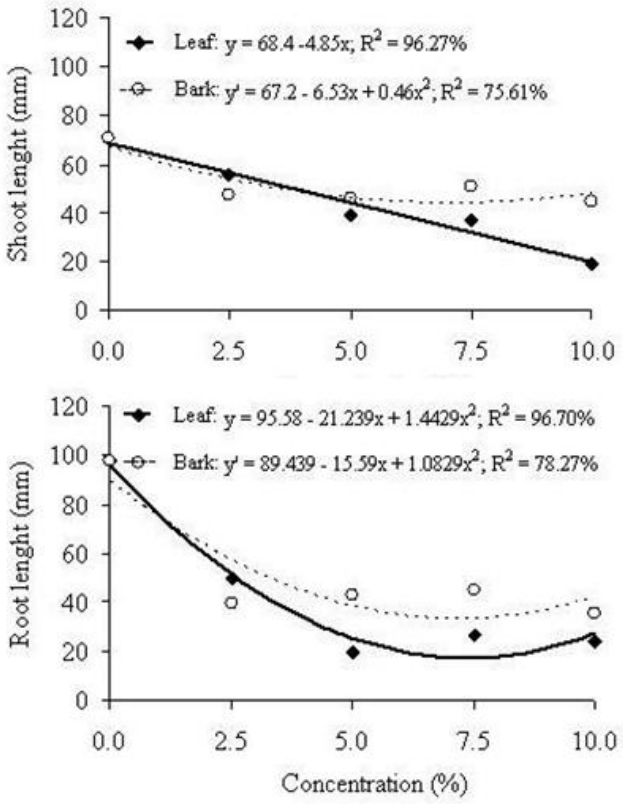

Figure 2. Effect of *Sapindus saponaria* L. leaf and stem bark extracts on the aerial part and root length of *Triticum* aestivum L.

In general, *S. saponaria* leaf extracts inhibited the seedling development more strongly than stem bark extracts and the negative effects increased with the concentration of the extracts. Souza et al. (2010) also observed that the negative effects of *Esenbeckia leiocarpa* Engl. leaf extracts on seedling growth were more pronounced than those of bark extracts.

Each organ of the plant may contribute to the phytotoxic effects. However, the leaf is the plant organ more metabolically active, with higher concentration (Sodaeizadeh et al. 2009) and diversity of allelochemicals (Ribeiro et al. 2009, Tanveer et al. 2010). The difference in phytotoxic effects of *S. saponaria* leaf and stem bark extracts may be related to the different concentrations of allelochemicals or chemical composition among extracts, as discussed by Grisi et al. (2012). Although our data do not provide conclusive information about the phytotoxic effects of *S. saponaria* stem barks and leaves, they showed the potential of this species to strongly inhibit the growth of wheat seedlings.

CONCLUSIONS

The extracts of *S. saponaria* leaf and stem bark were phytotoxics and potentially induced abnormalities and reduced the growth of wheat seedlings, with concentration-dependent inhibitory effects. However, leaf extracts affected the seedling development more strongly than stem bark extracts.

Acknowledgements

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