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Poster #53

Extracts of Native and Non-Native Plant Species for the Control of Cogongrass (*Imperata cylindrica* L)

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One of the most invasive species in Florida and other Gulf Coast States is Cogongrass. Cogongrass poses a major problem in natural habitats, on forested lands, rights-of-way and interstate highways. The present study was undertaken to evaluate the performance of cogongrass when grown in extracts of muhly grass (*Muhlenbergia capillaries* Lam) and chenopodium (*Chenopodium ambriosiodes* L). Genets and ramets of cogongrass were transplanted into magenta vessels containing 50% solution of root and shoot extracts of muhly grass and chenopodium, and placing magenta vessels in a growth chamber maintained at 28^{o}C, 16/8 hour photoperiod and a relative humidity of 55 %. The genets and ramets of cogongrass were evaluated once per week for shoot and root growth, as well as rhizome extension after transplanting. Preliminary results show that the extracts of muhly grass and chenopodium reduced shoot growth and rhizome extension of cogongrass. Shoot extracts of muhly grass and chenopodium were more effective in reducing the performance of cogongrass compared to muhly grass and chenopodium root extracts. Root: shoot ratios of cogongrass also decreased by 50-70%. Thus, muhly grass and chenopodium extracts may contain some allelochemicals that could impact the invasiveness of cogongrass.

KEYWORDS: culms, *in vivo*, *in vitro*, Chenopodium, Muhly grass, genets, ramets, extracts, magenta vessels, allelochemical.

INTRODUCTION

Cogongrass (*Imperata cylindrica* L.) sometimes called japgrass, blady grass, spear grass and alang-alang, is a C_4 rhizomatous perennial weed with culms that grow erect typically reaching a height of 1.2 m but may sometimes grow as tall as 3m. The fibrous roots are extensive and extend from a scaly rhizome (Brown, 1944). Cogongrass is one of the most difficult weed to control. It can grow almost any where in the world and under any temperature. Cogongrass is not found in the Antarctica (Willard et al, 1990). Cogongrass was introduced to the United States in the late nineteenth century and early twentieth centuries. Today, cogongrass is an invasive weed in the Gulf Coast States of southeastern United States. Cogongrass is considered a serious invasive species in parts of Florida, southern Alabama, southern Mississippi, and Georgia where it invades pastures, nurseries, pecan plantation, highway right-of-way, lawns, phosphate mined areas, pine plantation, parks and recreational areas (Onokpise, 2000; Patterson et al., 1980). It constitutes an impediment to efforts aimed at reclamation and restoration of these sites to their natural conditions or productive lands. Cogongrass is mainly spread by rhizomes and seed. Once cogongrass is established it competes with neighboring crops and plants and reduces their yields (Bolfrey-Arku et al.; 2002, 2004). The persistent and aggressive rhizome of cogongrass remains the main mechanisms for survival and spread, while its resilience makes it difficult to control. Besides the rhizomes, wind blown seeds have aided in the establishment of vast areas of cogongrass.

Based on studies conducted on the species (Shilling et al., 1997) a combination of herbicides (glyphosphate and imazapyr), and mechanical treatments provide excellent control. However a single herbicide application is costly. Reinvasion by cogongrass rapidly occurs if ecological niche is not replaced by another plant species. Imazapyr is the recommended herbicide because it is effective and has a long lasting residual effect on soil and prevent revegetation of the controlled areas while glyphosphate and others are relatively biodegradable. The impact on non target species from the use of herbicide often has severe implications causing reinvasion of cogongrass or invasion by other weed species (Gaffney and Shilling, 1996). For economic and environmental reasons the current control strategies are often not acceptable and necessary considerations need to be given other control methods. Studies conducted in other parts of the world with leguminous plant species, have revealed that these species provide effective control of cogongrass in their natural habitat (Bolfrey-Arku et al., 2002; Chikoye et al., 1999)

Biological control is the action of one organism (plant or animal) in the control or maintenance of another organism. The aim is to maintain the organism at economic level. There are many advantages of using biological control for the management of weeds. There are no environmental residues, self reputation with human assistance, non toxic to animals and human, and more sustainable to the environment (Zimdahl, 1993). The use of native plant species, as biological control agents (Onokpise et al.; 2007), maybe an expensive and efficient way of controlling cogongrass which will prove beneficial to the forestry, agricultural, and other communities in the southern region of United States. Species with potential for use in the biological control of cogongrass are Chenopodium (*Chenopodium ambrosioides*) and Muhly grass (*Muhlenburgia capillaries* Lam.). These species may possess natural chemicals that may inhibit the growth and extension of cogongrass rhizomes. The objective of this study was to evaluate extracts from two plant species for effectively controlling cogongrass *in vitro*.

MATERIALS AND METHODS

1. Preparation of planting materials

The cogongrass plant materials were collected from an infested area on Tram Road Tallahassee, Florida. They were harvested by digging the cogongrass from the soil with a Hisco garden spade blade hollow back size 67/8 inches x 105/8 inches. Ramets were separated from genets, cleaned, washed and then cut into three inches pieces and placed in 36 cell plastic flat trays measuring 30 cm x 14 cm. The trays were then filled with commercial ready made potting medium ("Pro-Mix" Premier Horticulture, Quebec, Canada). Approximately one, two-node ramet was planted in each cell. Ramets were grown in the George Connoly Greenhouse on Florida A&M campus until they were at two-leaves stage and ready to be transplanted.

2. Extract Preparation

The Chenopodium plants were obtained from the FAMU Research and Extension Farm, Quincy, Florida and Muhly grass plant materials were obtained from the St. Marks

National Wildlife Refuge, Florida. The study was conducted in the growth chambers, in the Forestry and Agronomy Laboratory located in Room 303 South Perry-Paige Building at Florida Agricultural and Mechanical University, Tallahassee, Florida.

The chenopodium and muhly grass plants were collected by using heavy duty garden fork with four angular back tines so the soil could plunge through. The hands were used to remove unwanted leaves and soil. The chenopodium and muhly grass were then washed under a steady stream of water from the top. Then the plants were separated into different plant parts (root, stem and leaf). They were then cut into ¼ inche pieces washed and weighed into 140 gram and placed 140 gram into storage bags. Materials from each 140 gram bags were retrieved and blended with 400 ml of distilled water using Hamilton Beach blender at high speed until the parts became liquefied. The liquid was then poured from the blender into a four gallon mixing bowl the extract was thoroughly mixed for about five minutes. Cheese cloth (grade #10 with 20 v x12 h threads per inch) was cut and was used to filter the extract to remove remaining pieces of plant parts. The extract was then strained a second time with the cheese cloth folded into four layers so as to remove the very small particles. The resulting solution (plant extract) was then measured into aliquots of 100 ml and poured into magenta vessels. Cogongrass at the two leaves-stages were then retrieved and removed from trays. They were washed in a laboratory tray to remove soil particles from roots of plants and one plant each was inserted into each magenta vessel containing plant extracts. The magenta vessels were then placed into a growth chamber set at 28^{o}C and 16/8 hour photoperiod. The plants were observed for new roots and new leaf at seven days intervals. The data collected was the number of new cogongrass root and new shoot produce after planting. Data was analyzed using SAS 9.0 (SAS 2003).

RESULTS AND DISCUSSION

A pair wise comparison was done following analysis of data. When muhly grass leaf extract and control when compared there was no significant difference in the survival rate (figure 1). Also muhly grass root extract when compared with control showed no significant difference between the two treatments. However, when the muhly grass root with muhly grass shoot extract were compared cogongrass survival rate was a significantly difference between these two treatments (Figure 1). The muhly grass root however, was more effective in controlling cogongrass growth (Figure 1). However, there was no significant difference for survival percentages for cogongrass treated with chenopodium root and stem extracts (Figure 2). The root and stem extracts of chenopodium were equally effective in controlling cogongrass growth (Figure 2). However the chenopodium leaf was the least effective in controlling the growth of cogongrass. When the control was compared against chenopodium treatments, chenopodium stem and root did better in controlling the growth of cogongrass (Figure 3). There is very limited information in literature in the use of plant extracts form muhly grass and chenopodium for controlling cogongrass. While some information exist for the possible allelochemical of cogongrass it is possible that muhly grass and chenopodium may possess such allelochemicals that will significantly impact cogongrass development and growth. The results from our study may allow for utilization

FIGURES (Following 3 pages)

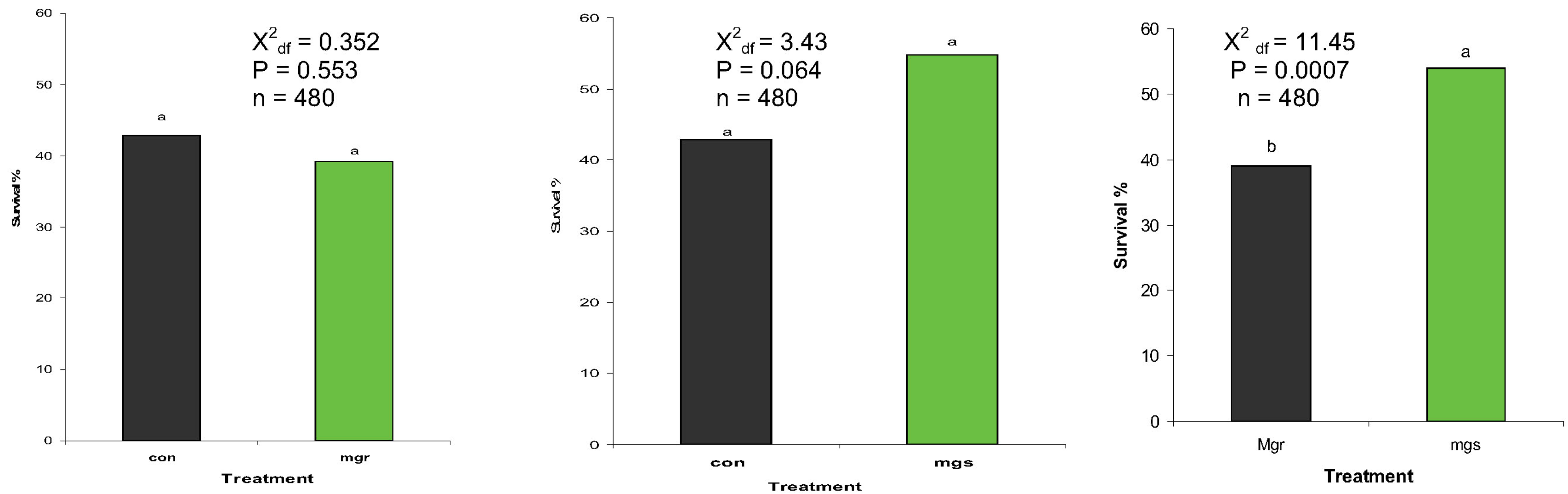

Figure 1. Proportion of Cogongrass Survival in Muhly grass root (mgr) extract, Muhly grass shoot (mgs) extracts and control (con) after six weeks

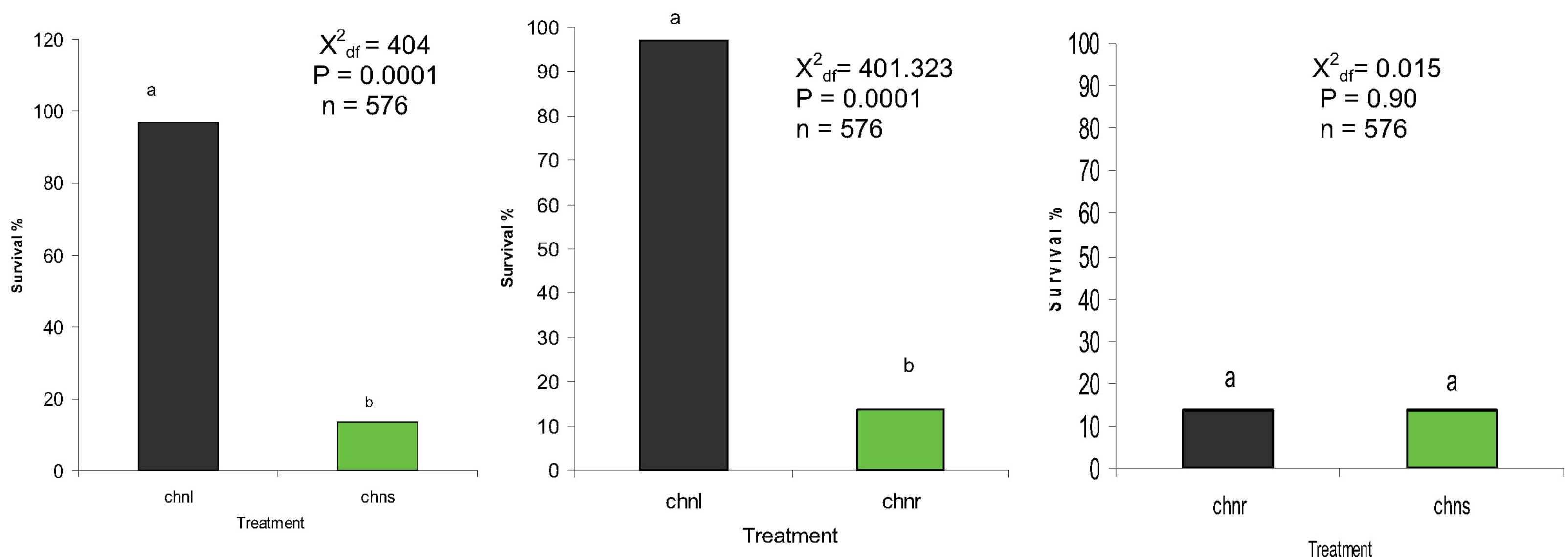

Figure 2. Proportion of cogongrass survival from Chenopodium root (chnr) Chenopodium leaf (chnl) and chenopodium stem (chns) extracts after six weeks

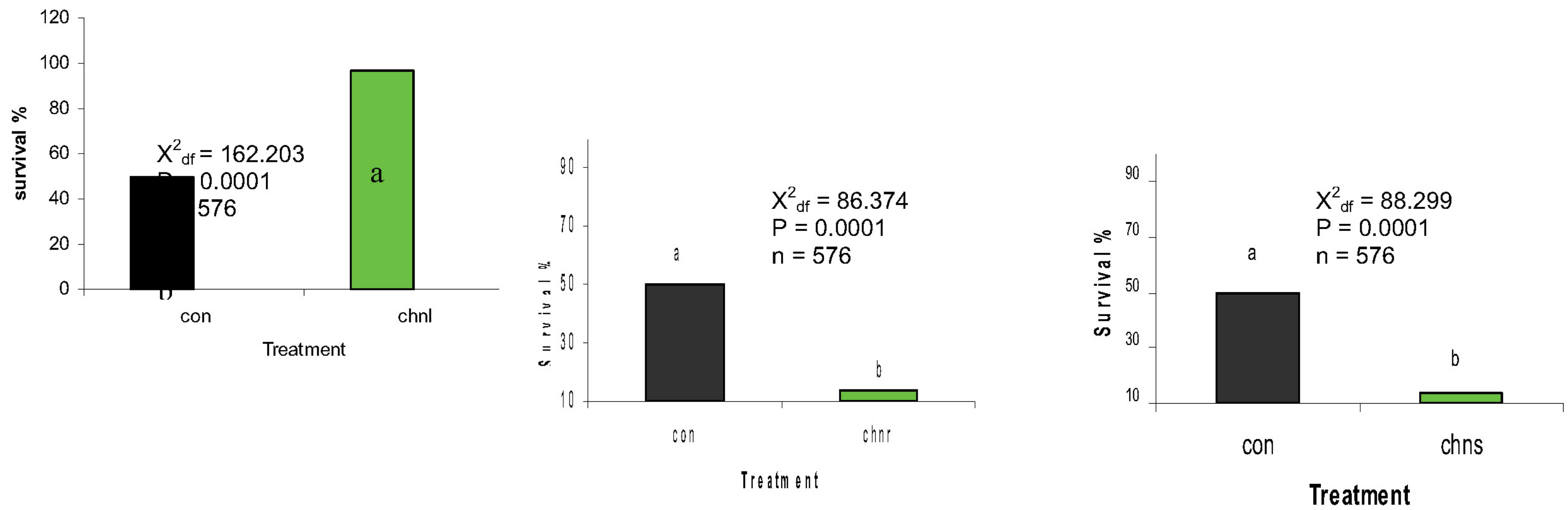

Figure 3. Proportion of cogongrass survival from Chenopodium root (chnr), Chenopodium leaf (chnl), chenopodium shoots (chns) extract and control (con) after six weeks

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