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OTRF Funded Research Project

■ Final Report

Title	Biological Control of Crabgrass
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Executive Summary

Crabgrass is a major problem in turf in Canada and infestations can be as high as 30% of a residential lawn. Due to the bans and restrictions on the use of chemical herbicides in several provinces, cities and municipalities across Canada, there are currently no effective solutions for controlling crabgrass. Two species of crabgrass, large (*Digitaria sanguinalis*) and smooth (*Digitaria ischaemum*), are commonly found in cropland and turf. Several species of phytopathogenic fungi have been studied in China and USA as possible biocontrol agents of *Digitaria* spp. The most promising for the use in Canada, from among those tested, are species in the genus *Curvularia* (*C. intermediate, C. lunata, C. eragrostidis*). In the present study, 23 fungal cultures associated with *Digitaria* spp. were isolated from leaves with visual symptoms of diseases. They were identified to a genera or species level. Growth and spore production were evaluated for each isolate and slowly growing and poorly sporulating isolates were eliminated from further experiments. Twenty remaining isolates were tested for pathogenicity on large and smooth crabgrass. Isolates belonging to *C. eragrostidis* species were the most effective. These isolates did not appreciably harm the majority of turf grasses and cereal crops, but caused major damage on tested forage grasses. Due to the absence of difference in the host range and superiority in spore production, isolate Dip0307 (*C. eragrostidis*) was chosen for further evaluation. Optimal temperature and dew duration conditions and minimal requirements for successful weed control with isolate Dip0307 were determined and compared with those for QZ-2000, the Chinese strain of *C. eragrostidis.* **It was concluded that *C. eragrostidis* isolate Dip0307 is a strong candidate for development as a bioherbicide against large and smooth crabgrass in Canada.**

Background	

There are currently no effective alternative solutions for controlling crabgrass. Two species of crabgrass, the large *(Digitaria sanquinalis)* and the smooth *(Digitaria ischaemum)*, are commonly found in turf and cropland. Once established,crabgrass plants tolerate high temperatures, compact soils, and dry soils better than most turf grasses. "Crabgrass, the weed everyone loves to hate, tops America's list of lawn complaints" (www.Almanac.com Nov. 27, 2009). Crabgrass is
more problematic in turf than in other cropping systems (Kim et al. 2002). That survey acknowledged the relative significance of large and smooth crabgrass in turf and the need for improved control measures in turf. Herbicides have been the mainstay for crabgrass control until now, but with the herbicide restrictions and bans, sport turf managers, golf course managers, professional lawn care companies and homeowners do not have viable alternatives for treating crabgrass. Corn gluten is the current organic choice, but the efficacy of corn gluten has not been proven. There is aneed to develop an effective, nonchemical method for treating crabgrass.
Biological Control of Digitaria (Crabgrass)
The goal of this project is to develop a fungus called *Curvularia* into an effective and selective bioherbicide for crabgrass. Several species of *Curvularia* have been studied as possible biocontrol agents of *Digitaria* and other grassy weeds (Biological Control 22: 246-255, 2001; Biocontrol Sci. & Techn. 12:165-172, 2002; Biological Control 25:12-21, 2002; Biocontrol Sci. & Techn. 14:769-782, 2004). In China, *Curvulariaeragrostidis,* a pathogen from blighted leaves of crabgrass, likewise was pathogenic on crabgrass and many species, while numerous crops and other desirable specieswere unharmed, including *Festuca arundinacea* and other temperate turf grass species. Isolate QZ-2000 of C.*eragrostidis* has been formulated as a commercial bioherbicide under the name of DISANG in China.

Objectives	

Isolate fungal pathogens of crabgrass in Eastern Canada, evaluate methods to mass produce, assess their virulence on *Digitaria sanguinalis* and select the most potent ones for further experiments.
<u>Hypothesis</u>: There are naturally occurring fungal pathogens of *Digitaria* spp. in Eastern Canada, which could be potential biological control agents of crabgrass

Methods & Results	

Contact OTRF office for complete report.

Conclusions [Final Report]	

1) 23 fungal cultures were isolated from leaves of large and smooth crabgrass and 5 isolates of *C. eragrostidis* had the highest virulence against large crabgrass.
2) Virulence of *C. eragrostidis* isolates against smooth crabgrass was as high as against large crabgrass, however majority of the cereal crops and turf grasses were not harmed. Two forage grasses timothy and brome grass were highly susceptible to tested *C. eragrostidis* isolates,

which could be a limiting factor for the future use of the bioherbicide on foraging fields.
3) It was shown that both factors, dew duration and dew temperature, are equally important for successful spore germination and invasion of the host tissue. At higher temperatures fungus needed less time to cause >50% leaf blight of large crabgrass plants: at 25°C the minimum of 6h of dew was required, at 15°C – 24.
4) It was shown that Canadian isolate Dip0307 is as effective as Chinese strain QZ-2000. There was no advantage found of isolate Dip0307 at suboptimal conditions. However, Canadian isolate of *C. eragrostidis* remains the potent candidate for the bioherbicide development against smooth and large crabgrass in Canada. And it has an advantage to Chinese strain as indigenous fungus, which does not require the proof to be safe for Canadian nature and could be tested in Level 1 laboratory and in the field.
5) Among the tested natural substrates, spore production on corn kernels inoculated with a plug of *C. eragrostidis* mycelium was the highest. All tested solid media and their modification did not show better results of mycelia growth and spore production when compared with PDA.

Future Objectives & Goals	
The overall objective of obtaining a biological control for crabgrass registration will be achieved over three phases. This report completes Phase 1. In 2012, it is anticipated that Phase 2 will commence which will attempt to discover effective means to mass produce sufficient quantities of the isolate of *C. eragrostidis which* remains the potent candidate for the bioherbicide development against smooth and large crabgrass in Canada.	

Project Communication	List all industry and academic presentations and submitted publications
N/A	