# Field trials for Gummy Stem Blight Resistance

**Principal Investigators:**

**Cecilia McGregor**
Dept. of Horticulture
1111 Miller Plant Sciences
University of Georgia
Athens, GA 30602
Phone: (706) 542-0782
Fax: (706) 542-0624
E-mail: cmcgre1@uga.edu

**David Langston**
Dept. of Plant Pathology
Horticulture Bldg
4604 Research Way
Tifton, GA 31793
Phone (229) 386-7495
Fax:
E-mail: dlangsto@uga.edu

**Rational:**

Gummy stem blight (GSB), caused by a seed born fungus is one of the most serious and devastating diseases of watermelon in the U.S. Because of the importance of this disease to watermelon growers, we included mapping of GSB resistance in a multi-crop Agriculture and Food Research Initiative - Plant Breeding and Education Program Grant proposal submitted in 2009 (proposal # 2009-04819). This successful proposal includes genomic mapping and greenhouse screening of a $F_{2:3}$ population for GSB resistance. However, because GSB resistance in the field and greenhouse is weakly correlated and development of cultivars with field resistance have proved so elusive, we need to also do replicated field trials for this population. In order to do this we need to develop recombinant inbred lines (RILS) from the current $F_{2:3}$ population and screen these RILs in replicated field trails. To add this aspect to our already funded project we are requesting funds to support half of an assistantship for a graduate student and some limited greenhouse supplies and travel funds (for travel to field plots).

**Objectives:**

(i) Make recombinant inbred lines (RILs) from existing $F_{2:3}$ mapping population
(ii) Screen RILs for GSB resistance in replicated field trails.

**Background:**

Because heritability for GSB resistance is typically low, effective breeding and selection have necessitated phenotypic screening in replicated trials across locations and years using different pathogen strains (St. Amand and Wehner, 1995; Wehner and Shetty, 2000). High-throughput phenotypic screening for GSB resistance has been difficult, partly because greenhouse and field resistance phenotypes are weakly correlated ($r$ = 0.3) (Gusmini et al., 2005; Wehner, 2008). Genomics tools should enable the identification, efficient transfer, and incorporation of genes conferring resistance to GSB into improved cultivars.

The practical use of genomic tools in watermelon breeding has been rather limited to date, mainly due to the lack of genomic information for this crop. With our collaborators we recently developed a large number of watermelon molecular markers (simple sequence repeats (SSRs) and single nucleotide polymorphisms (SNPs)) that will make dense mapping and marker assisted

selection in watermelon possible at a level similar to other crops. Due to its importance, GSB was included in a funded multi-crop proposal that aims to (i) find markers linked to GSB resistance and (ii) develop high-throughput markers that can be used to select for GSB resistance. Our current funding only allows for disease screening in the greenhouse, however, the large effect of environmental conditions on GSB disease necessitates replicated field trails. In order to carry out these replicated field trails, recombinant inbred lines must be developed from the current mapping population in order to have enough uniform plants originating from each $F_2$ plant. These additional field trials will greatly increase the probability that the markers developed will be useful for selection of GSB resistance under field conditions.

**Experimental plan:**

We will develop RILs from the current mapping population by selfing the approximately 200 $F_{2:3}$ lines for 4 generations to yield $F_{2:7}$ lines (Figure 1). RILs will be developed by repeated selfing of the mapped $F_2$ generation using single plant selection through every generation to produce $F_7$ lines that can be traced back to a specific $F_2$ plant.

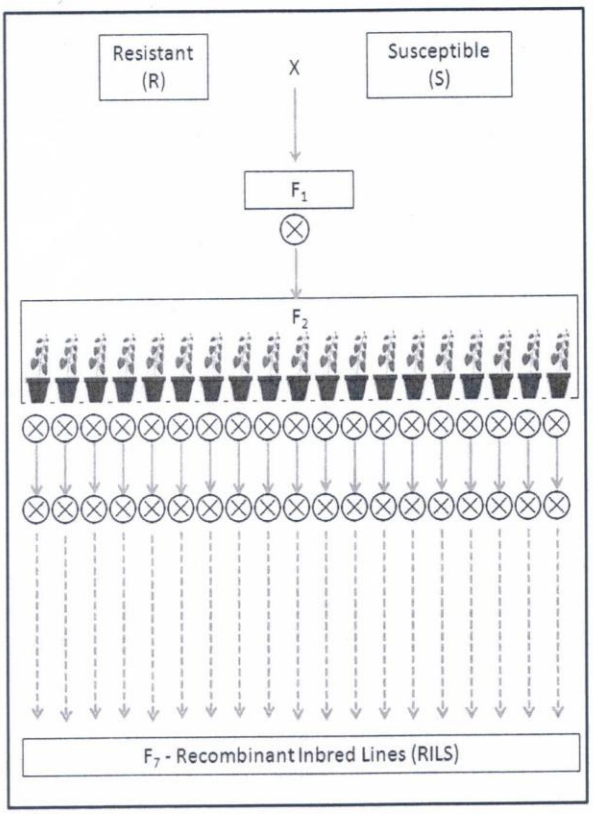


**Fig. 1** Development of Recombinant Inbred Lines (RILS) from $F_2$ mapping population.

At the $F_7$ generation the RILs will be individual, uniform lines that represent every mapped $F_2$ plant. These lines will be used in replicated field trails and scored for GSB resistance. The resistance scores generated from these field trials will be used to find markers linked to GSB resistance in watermelon.

**Facilities:**

*Greenhouses:*

RILs development will take place in the Horticulture Greenhouses at 2500 South Milledge Avenue, Athens GA. The facility is equipped with lights, benches and support that are optimally set up for growing watermelons.

**Budget:**

| Description | Expense | Amount Requested |
|---|---|---|
| **Year 1 (2010)** | | |
| | Graduate Student | 9,212 |
| | 5% Benefits (Student) | 461 |
| | Supplies | 1,500 |
| | Travel | |
| **Total (2010)** | | 11,173 |
| **Anticipated Year 2 (2011)** | | |
| | Graduate Student | 9,488 |
| | 5% Benefits (Student) | 474 |
| | Supplies | 1,500 |
| | Travel | |
| **Total (2011)** | | 11,462 |
| **Anticipated Year 3 (2012)** | | |
| | Graduate Student | 9,773 |
| | 5% Benefits (Student) | 489 |
| | Chemicals and Supplies | 1,000 |
| | Travel | 2,000 |
| **Total (2012)** | | 13,262 |
| **Total (overall for 3 years)** | | 35,897 |

**Budget Justification (Year 1):**

The majority (~83%) of the funding we are requesting is for half of an assistantship for a graduate student. This will make it possible for a graduate student to give their full attention to GSB resistance in watermelon (otherwise the student will have to spend half their time working on another crop).

Chemicals and Supplies requested are for greenhouse supplies (pots, soil, etc.).

In year 3, funds for travel will also requested to make travel to field trail locations possible.

The anticipated duration of this project is from 1 May 2010 to 30 April 2013.

**Literature Cited**

Gusmini, G., R. Song, and T. Wehner. 2005. New sources of resistance to gummy stem blight in watermelon. Crop Sci. 45:582-588.

St. Amand, P.C. and T. Wehner. 1995. Greenhouse, detached-leaf, and field testing methods to determine cucumber resistance to gummy stem blight. J. Am. Soc. Hort. Sci. 120:673-680.

Wehner, T. 2008. Watermelon, p. 381-418. In: Prohens, J. and Nuez, F. (eds.), Vegetables I: Asteraceae, Brassicaceae, Chenopodicaceae, and Cucurbitaceae. Springer, New York.

Wehner, T. and N.V. Shetty. 2000. Screening the cucumber germplasm collection for resistance to gummy stem blight in North Carolina filed tests. HortScience 35:1132-1140.

**Proposal Submitted to:** National Watermelon Association

**Title:** Field trials for Gummy Stem Blight Resistance

**Choose one of the following:**

(•) Research ( ) Instruction ( ) Public Service & Outreach ( ) Cooperative Extensi

Amount: $35897.00 Effective Date: 05/01/2010 End Date: 04/30/2013

## Project Director

| | |
|---|---|
| Name: | Cecilia McGregor |
| Rank / Title: | Assistant Professor |
| Department: | Horticulture |
| Phone: (000-000-0000) | 706-542-0782 Fax: 706-542-0624 |
| E-Mail Address: | cmcgre1@uga.edu |

## Endorsements

**Principal Investigator** C McGregor **DATE** 1/6/2010

Reset Form

Print Form

**Institutional Administrative Official** **DATE** 1/12/10