Developing the Ability to Capture Traits From Diploid *Gossypium* species

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The Objective

The cotton family of germplasm (*Gossypium*) is comprised of cultivated tetraploid species and wild/uncultivated diploid species. The multitude of valuable natural traits in the diploid species is not readily available to cotton breeders because they will not readily cross pollinate with the cultivated types. Furthermore, when this type of cross can be made, it requires a long time with standard breeding techniques to develop a new variety. This collaborative project was initiated to take advantage of specialized crossing techniques developed by the Gembloux University in Belgium plus the advanced cotton molecular marker capability within TG&T and the breeding skills within PhytoGen to transfer the Reniform nematode resistance trait from the diploid species, *G. longicalyx* into a proprietary PhytoGen variety.

The Process

The process and progression for this project can be described functionally by evaluating the goals for each of the three collaborating groups.

Gembloux – The development of fertile hybrid plants that are compatible with the cultivated *G. hirsutum* cottons and that carry the Reniform resistance trait.

TG&T – Develop molecular markers that are linked to the resistance trait and that can be used to track the trait and aid in the breeding process.

PhytoGen – Transfer the resistance trait from the initial fertile plants from Gembloux to a commercial variety for the US cotton industry.

The Nematode

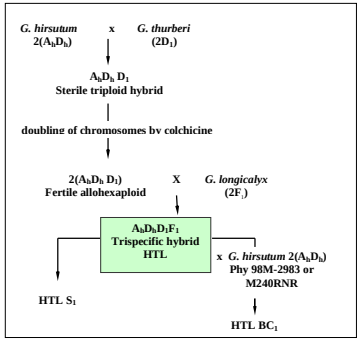
Reniform nematode: *Rotylenchulus reniformis* **Linford and Oliveira**

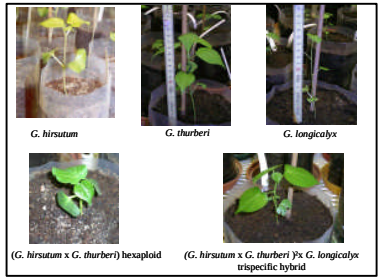


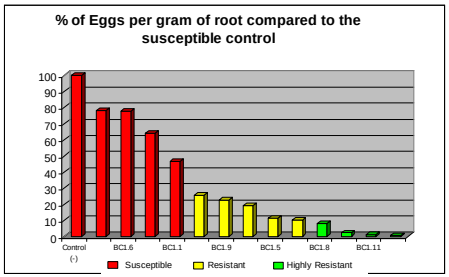

The Results

Development of fertile hybrid plants with resistance to the Reniform nematode

Gembloux made the trispecific hybrid (HTL) between the cultivated *G. hirsutum* and the Reniform resistant diploid, *G. longicalyx*, by using the diploid *G. thurberi* as a bridge species along with chromosome doubling using colchicine (diagram)







The trispecific hybrids were crossed to two PhytoGen lines and the resulting progeny showed resistance to the nematode (graph).

These results illustrate two important milestones: fertility of the hybrids and heritability of the resistance trait.

The Results

Development of molecular markers to track the resistance trait from *G. longicalyx*

1,008 SSR markers were screened on *G. longicalyx*, C2, *G. thurberi* and C2 x *G. thurberi* and identified 192 informative markers. The 192 selected markers were then screened on 9 HTL hybrids. 92 markers were found that tracked the *G. longicalyx* and the resistance trait in the introgression program. Further backcrossing and analysis with larger populations is needed to identify specific markers for the trait.

The Results

Introgression of the resistance trait toward the development of new cotton varieties

Gembloux made crosses between the HTL hybrids and two PhytoGen lines. 14 seeds were obtained resulting in 10 plants. Reniform nematode (RN) screening capability was established in the Indy greenhouses. Four of the 10 surviving plants showed RN resistance of which 3 have set seed. One of the PhytoGen lines is resistant to the Root Knot nematode (RKN). The introgression goal is to develop stacked RN and RKN resistance that provides virtually a complete nematode resistance package.

The Summary

The potential value of this project is to mine and ultimately market the untapped wealth of traits present in the wild species of cotton. This possibility has arisen from the innovation and expertise of three groups. The Gembloux University has developed procedures to consistently make crosses between wild and cultivated cotton species. TG&T has developed molecular markers in cotton that will serve as the tools to utilize these new crosses. The PhytoGen breeding team has the germplasm and techniques to develop new varieties that contain the traits from these crosses. This is a good example of independent innovation brought together by collaboration to add value for DAS.