Cornell Hemp

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Sex Determination in Hemp

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Take home message:

- **Sex determination is complex**
- **Sex phenotype can be affected by genetics and environment**
- **Sex expression does not always match sex chromosome genotype**

Top findings:

1. Cases of XY female or monoecious and XX male plants exist in hemp
2. These sex phenotypes may be heritable
3. We are currently deciphering the genetic basis for these unusual sex phenotypes and the prevalence of them in broader germplasm
4. Understanding sex determination and sex expression could help us breed sex biased populations for specific applications (e.g. female biased populations for grain production, or all-male populations for bast fiber production)

Figure 1. Population GVA-H-21-1133 expresses all-female phenotype in the greenhouse.

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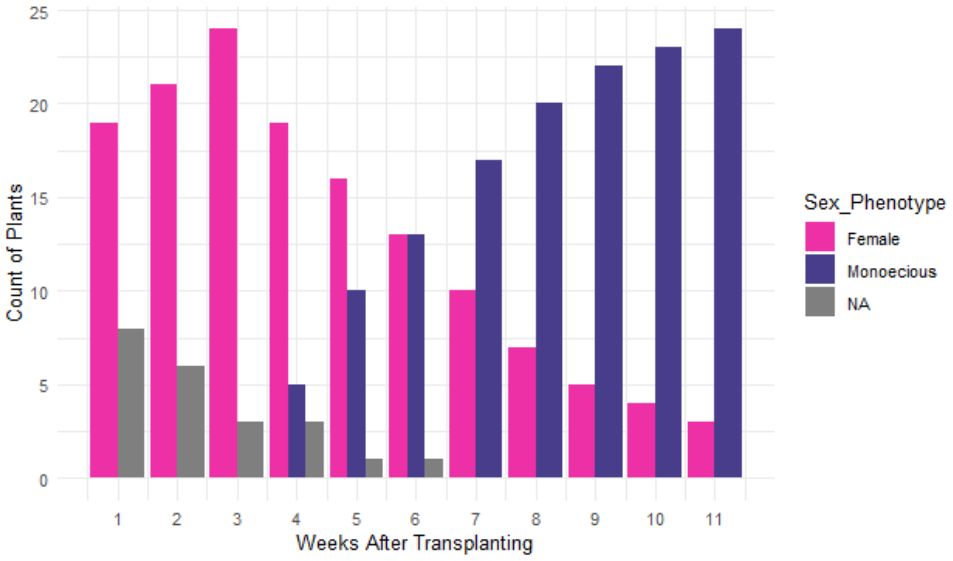

Figure 2. Temporal changes in sex phenotype of XY plants from population GVA-H-21-1133 when grown in the field in 2023.

Pistillate flowers on XY plants

- GVA-H-21-1133 population presented female when grown in the greenhouse in small pots (Fig. 1)
- Unbiased sex genotype 1:1 XX:XY
- In the field, the XY phenotype changed temporarily, wherein it started all-female then most XY plants developed some level of monoecy (Fig 2.)
- Crosses were made to investigate the genetic basis for this trait and are being evaluated in the field

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Common Pollen Parent	Seed Parents	
P3025-2 (XX ♂)	P3025-2	→ Self
	Late Sue	Outcrosses
	FL58	
	Z25	
	Picolo	
	Abacus	
	TJ's CBD	
	Tangerine	
	Si-1 #1091	

Figure 3. Crosses in the field in 2024 to investigate XX male phenotype.

An XX male identified

- Male plant with XX genotype found in a feminized population which had been selfed
- Clones of this plant, P3025-2, have consistent male phenotype in different environments
- Crosses were performed to investigate the heritability and genetic basis of this trait (Fig. 3)
- Progeny are being evaluated in the field