

National Plant System
Hemp Germplasm Repository:

*Developing resources to serve the global hemp
community*

Zachary Stansell

Hemp germplasm collection at PGRU

- Understand & contextualize hemp germplasm research, breeding, and conservation.
- Acquisition, documentation, preservation, distribution, & evaluation of diverse genetic resources to breeders+researchers
- Capture and distribute novel phenomic data, genomic resources, and scientific tools

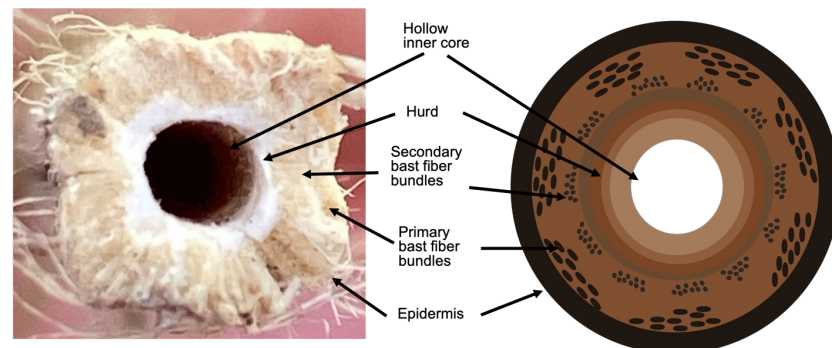
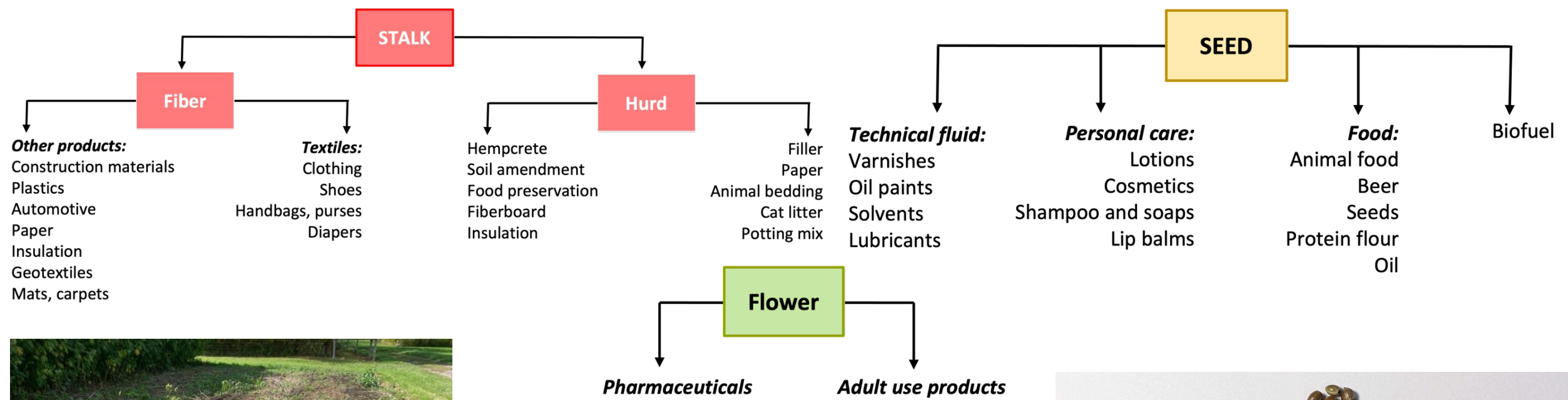


What is hemp?

Cannabis sativa

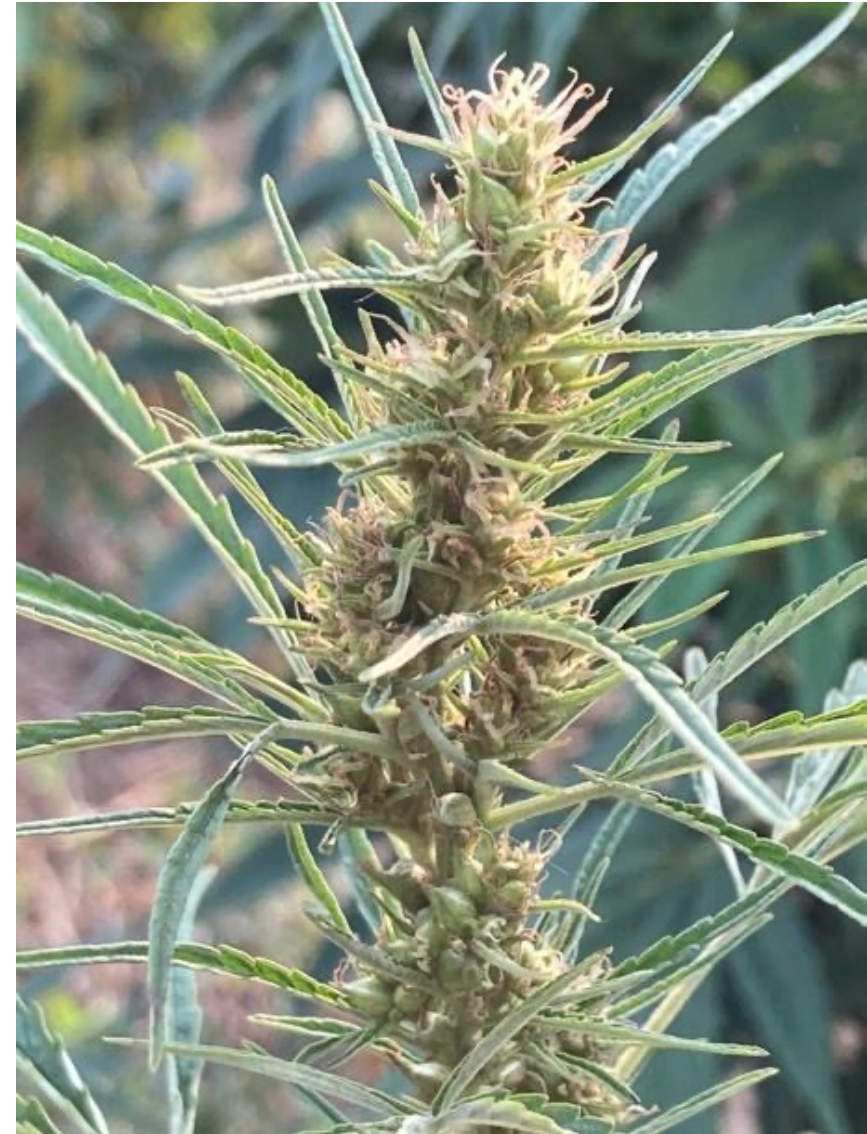
- < 0.3% THC
- Dioecious
- Diploid ($2n=20x$)
- Short-day
- Multipurpose





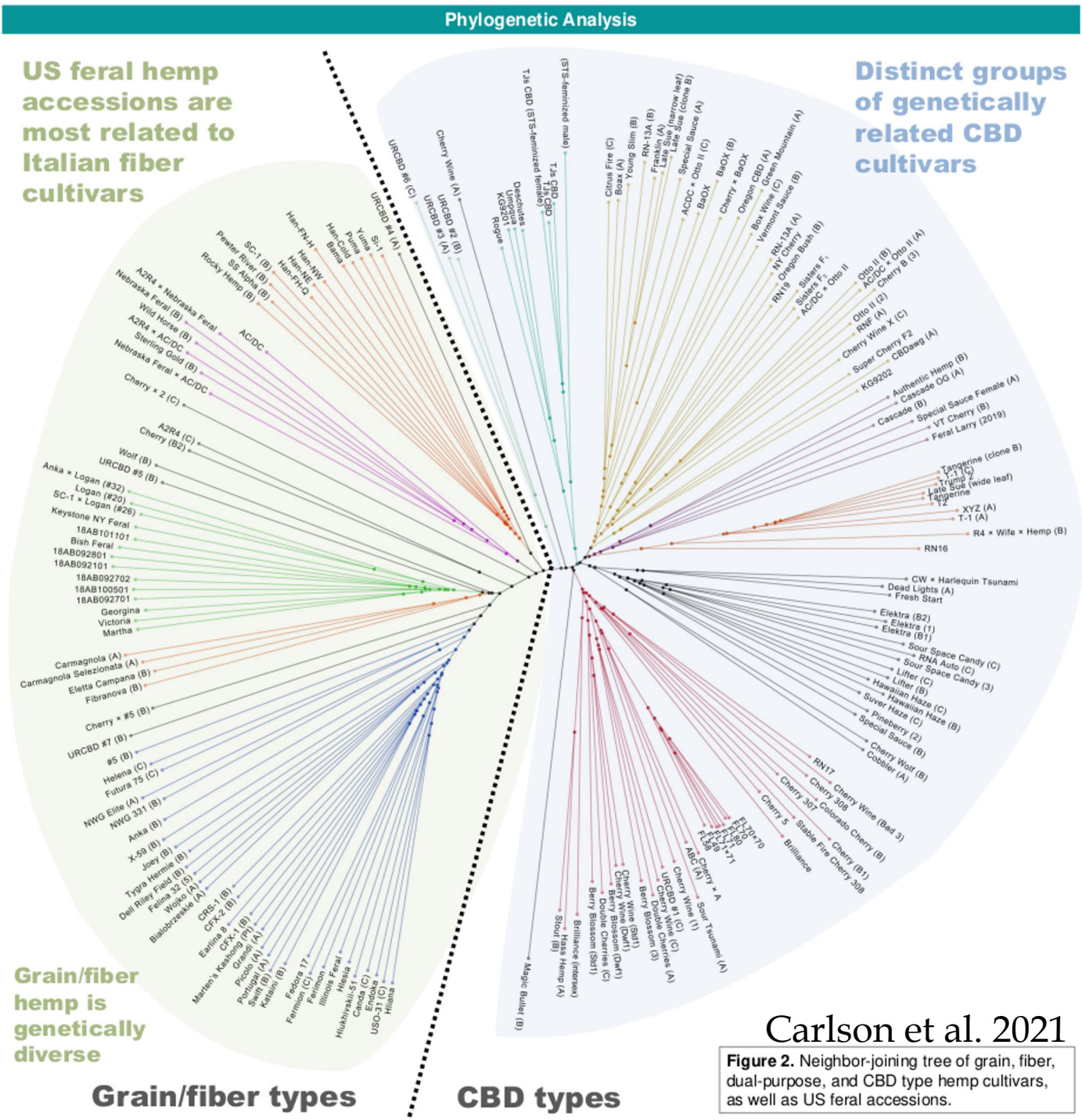
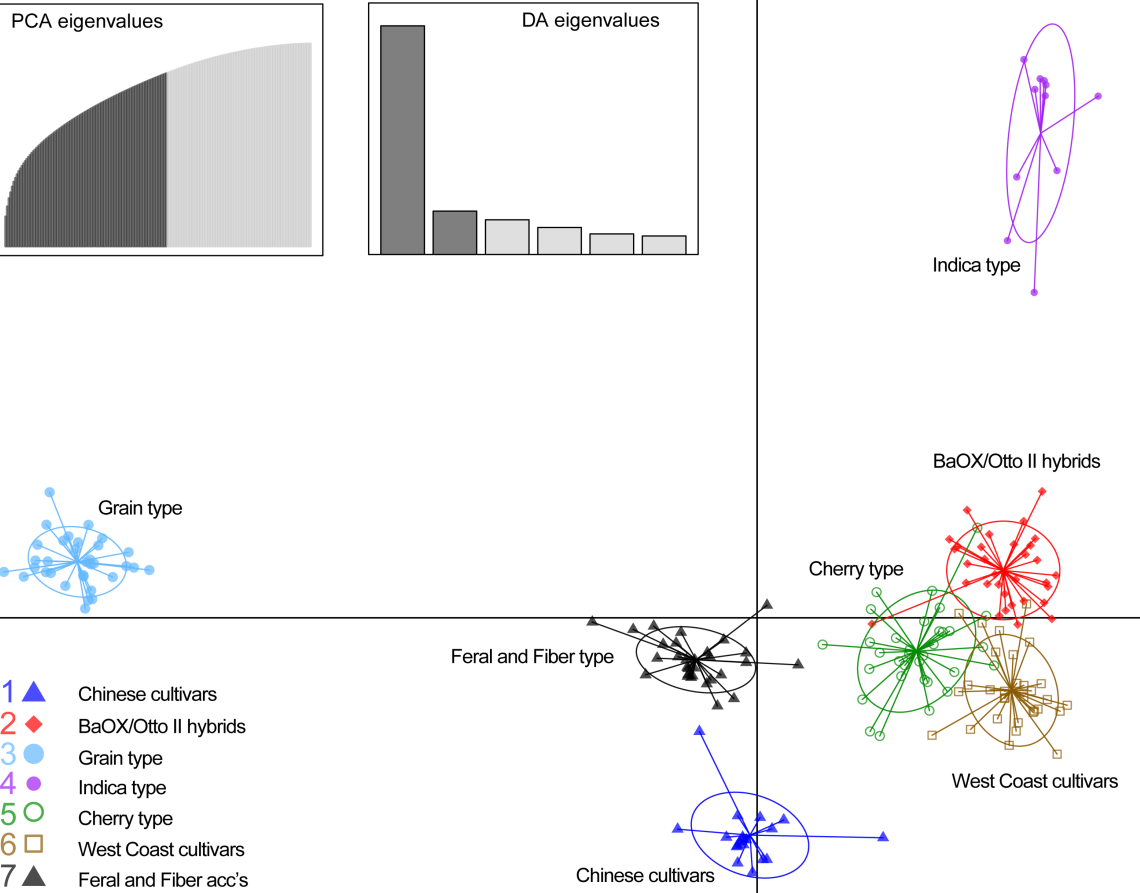
Plant Sex:

Female (left), male (center) and monoecious (right)

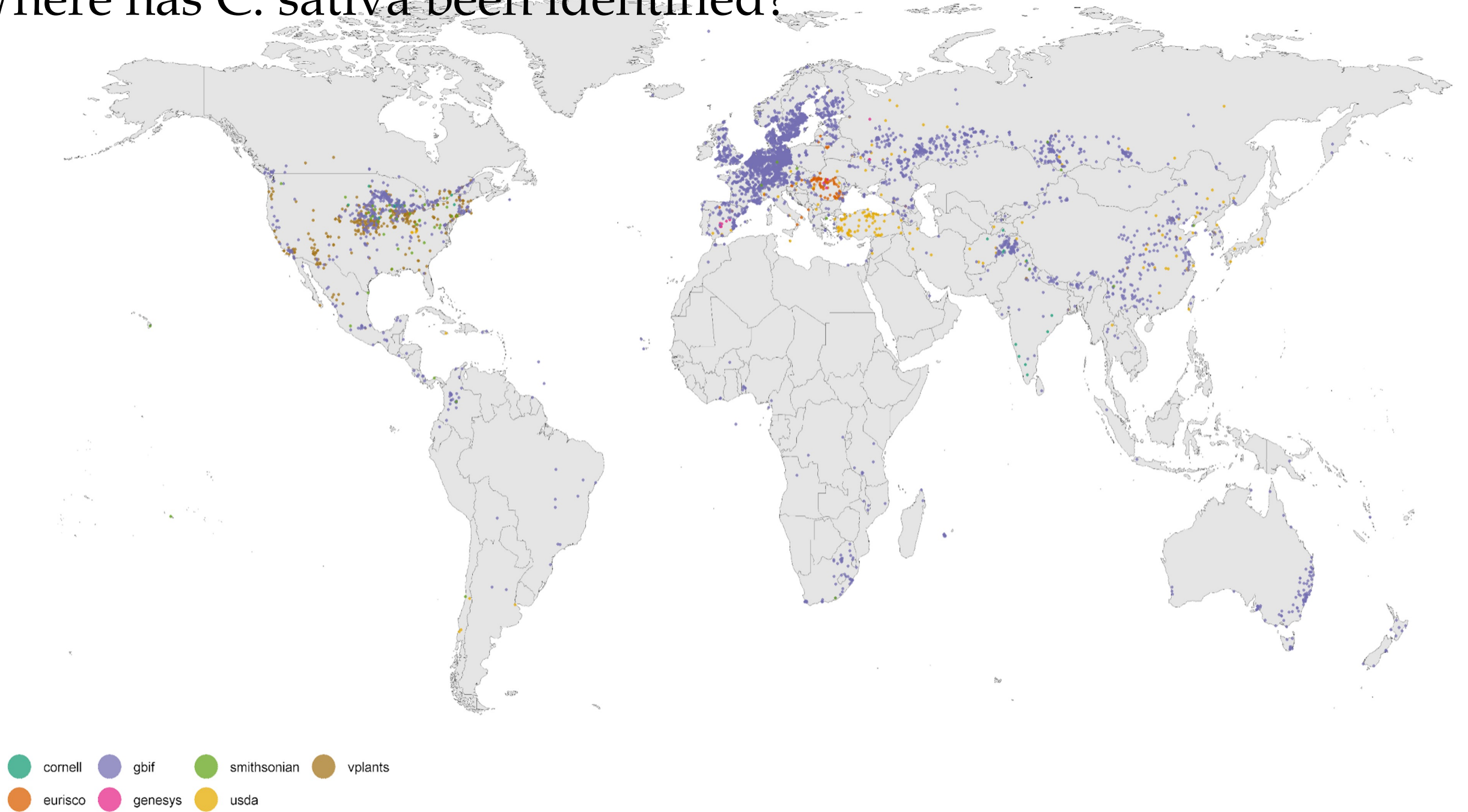


(Photo credit: Daniela Vergara)

Hemp Genetic Diversity



Where has *C. sativa* been identified?



Hemp is no stranger to the Genebanks!

947. BETULA DAVURICA (?)

Birch.

From Nertchinsk, Siberia. Received through Prof. N. E. Hansen, May 24, 1898.
Collected by Mr. Roborovsky. (4 packages.)

948. CANNABIS SATIVA.

Hemp.

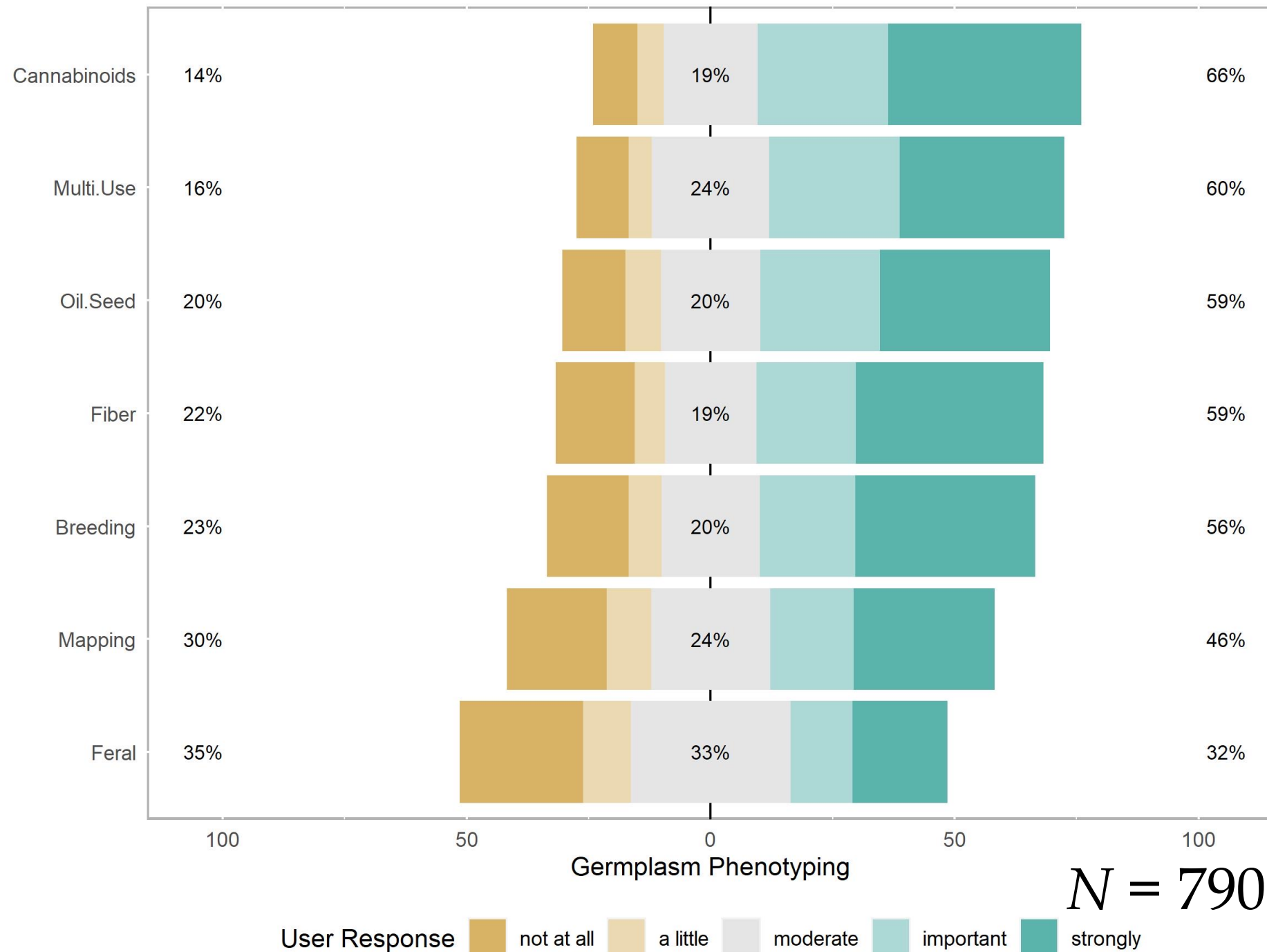
From Nertchinsk, Siberia. Received through Prof. N. E. Hansen, May 24, 1898.
Collected by Mr. Roborovsky. (3 packages.)

949. TAGETES.

Marigold.

From Nertchinsk, Siberia. Received through Prof. N. E. Hansen, May 24, 1898.
Collected by Mr. Roborovsky. (3 packages.)

Germplasm Stakeholder Survey



Status

Hemp Germplasm Repository Status

- Hired hemp breeder, Tyler Gordon (2022)
- Collected ~180 accessions + germplasm increase
- Developed phenotyping handbook
- Phenotyping efforts underway (Field, GH, GC)
- Established 6 phenotyping collaborations
- Working closely with many stakeholders to develop a **common** genotyping platform.



Hemp Phenotyping Handbook

ABOUT

PASSPORT

ARCHITECTURE

LEAF

SEX & INFLORESCENCE

SEED

FIBER

SECONDARY METABOLITES

DISEASE

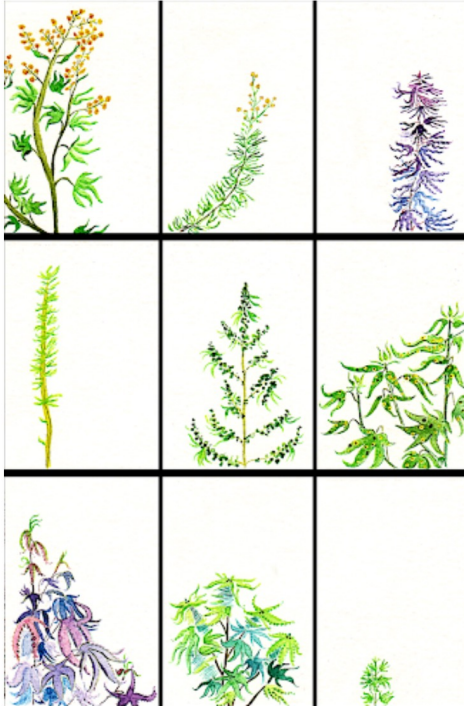
INVERTEBRATE

REFERENCES

USDA Hemp Descriptor and Phenotyping Handbook

Zachary Stansell, Anya Osatuke

14-Jul-2021



ABOUT

This text compiles methods and protocols used by the hemp community to characterize, evaluate, and describe hemp and these characters have been identified as important or useful to conserve, describe, identify, or improve germplasm and reliable data describing hemp germplasm will empower conservation of hemp genetic diversity and selection of unique phenotypes for breeding programs.

Specifically, this handbook was undertaken with the following objectives:

Hemp Phenotyping Handbook

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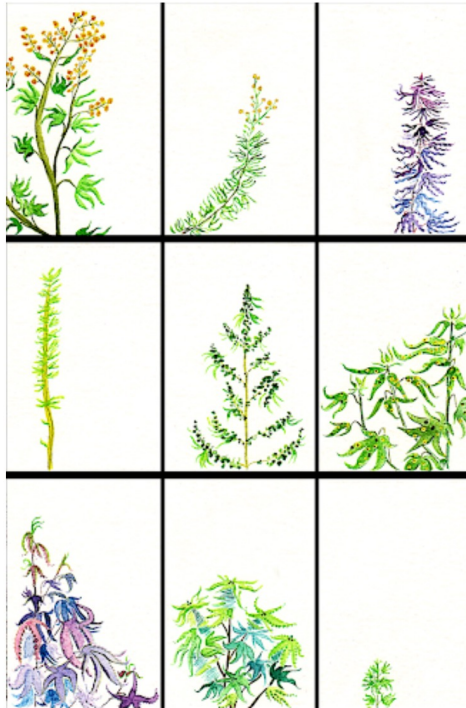
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REFERENCES

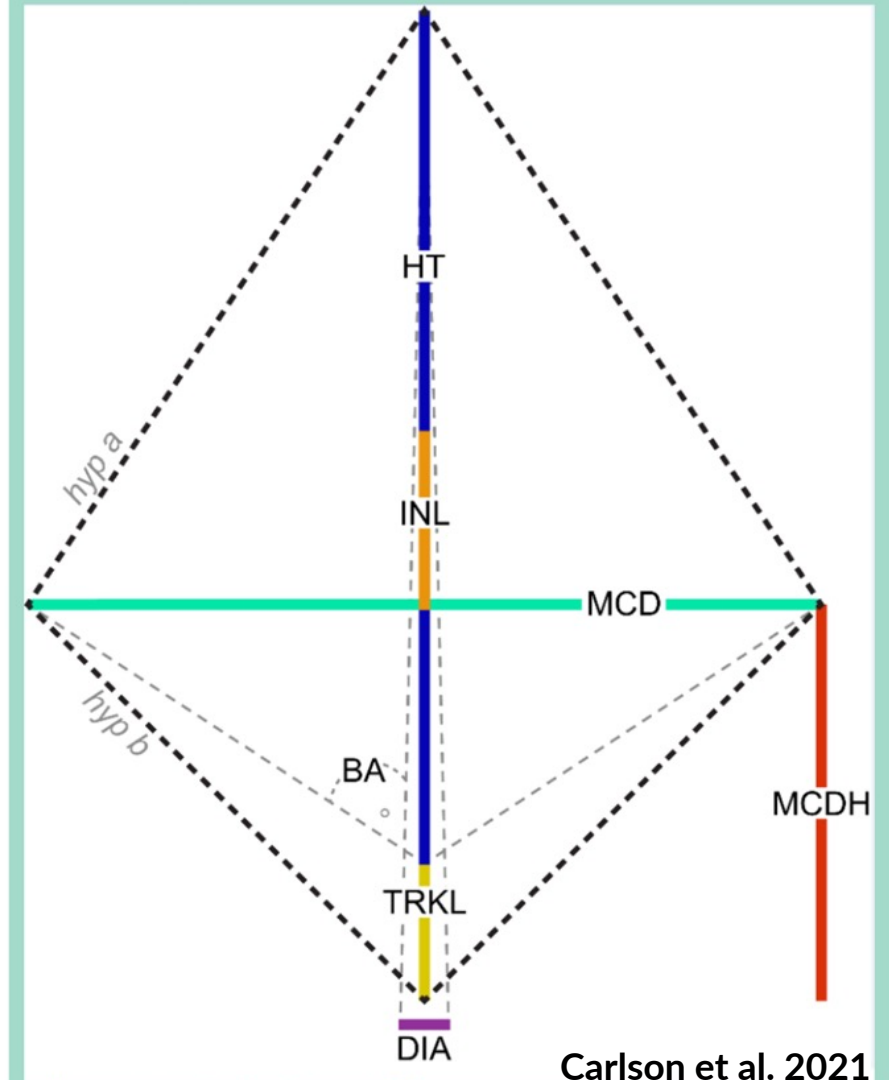
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Morphology



Architectural traits modified from Carlson et al. (2021).

MCD [decimal; cm]

Maximum canopy diameter as width of plant at widest set of branches, see Carlson et al. (2021)). Measured from widest tip to tip without stretching branches. Include flowering tissue in measurement.

MCDH [decimal; cm]

Height at maximum canopy diameter from ground to tip of primary stem, see Carlson et al. (2021).

TRKL [decimal; cm]

Trunk length is evaluated as distance from ground to first branch. See Carlson et al. (2021).

INL [decimal; cm]

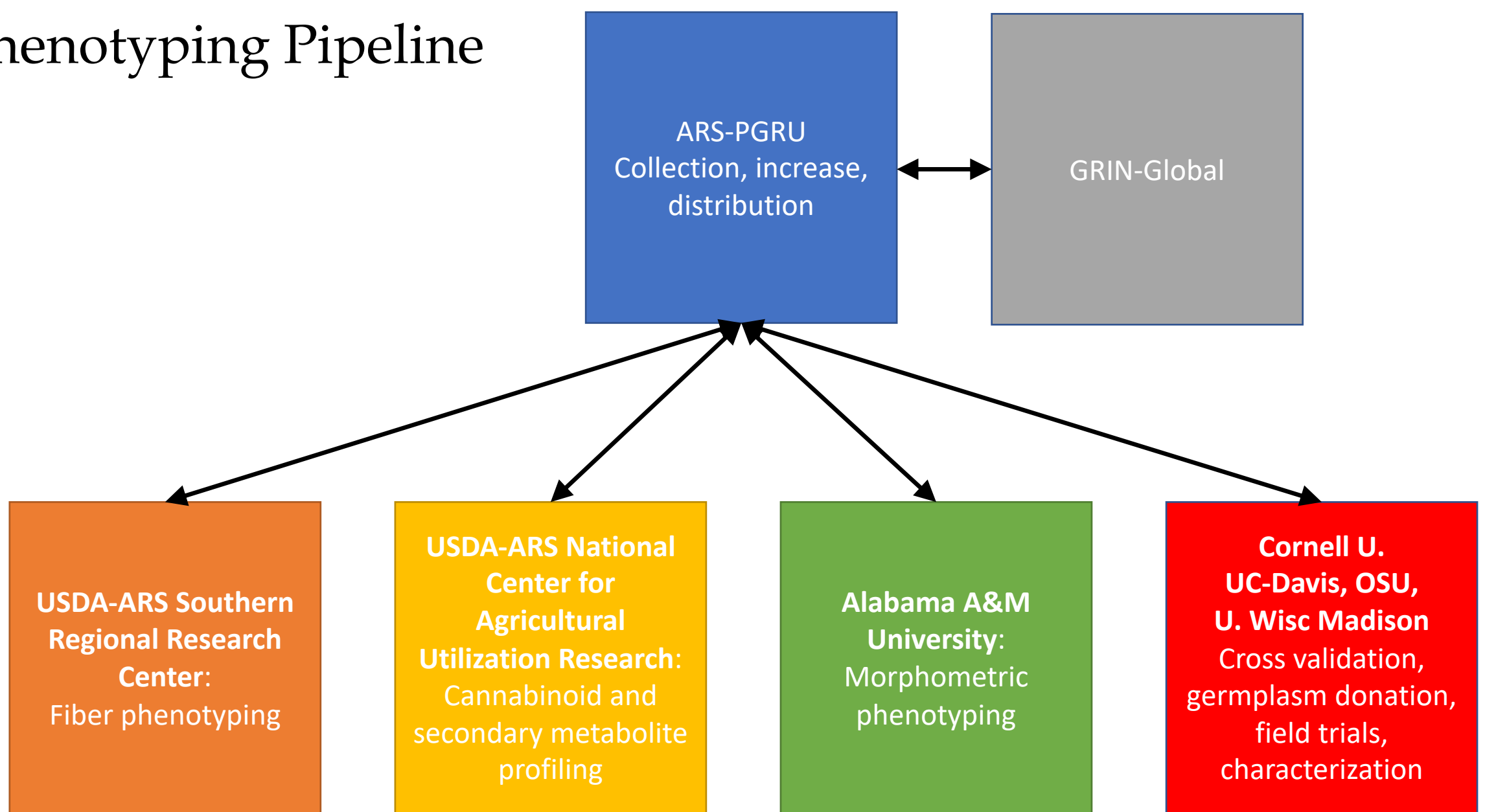
Internode length is calculated by counting the number of branching pairs along 50 cm of the primary stem in the middle of

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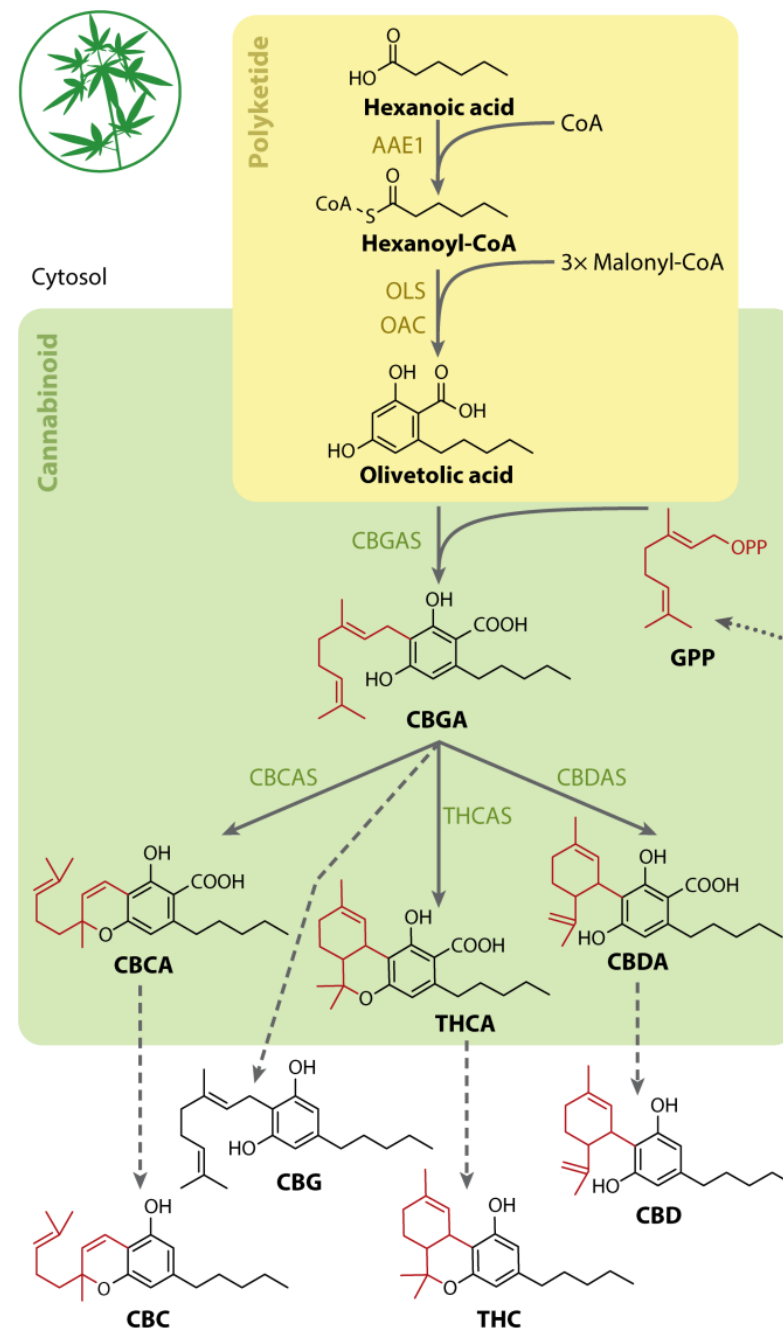
Phenotyping Pipeline



Biology

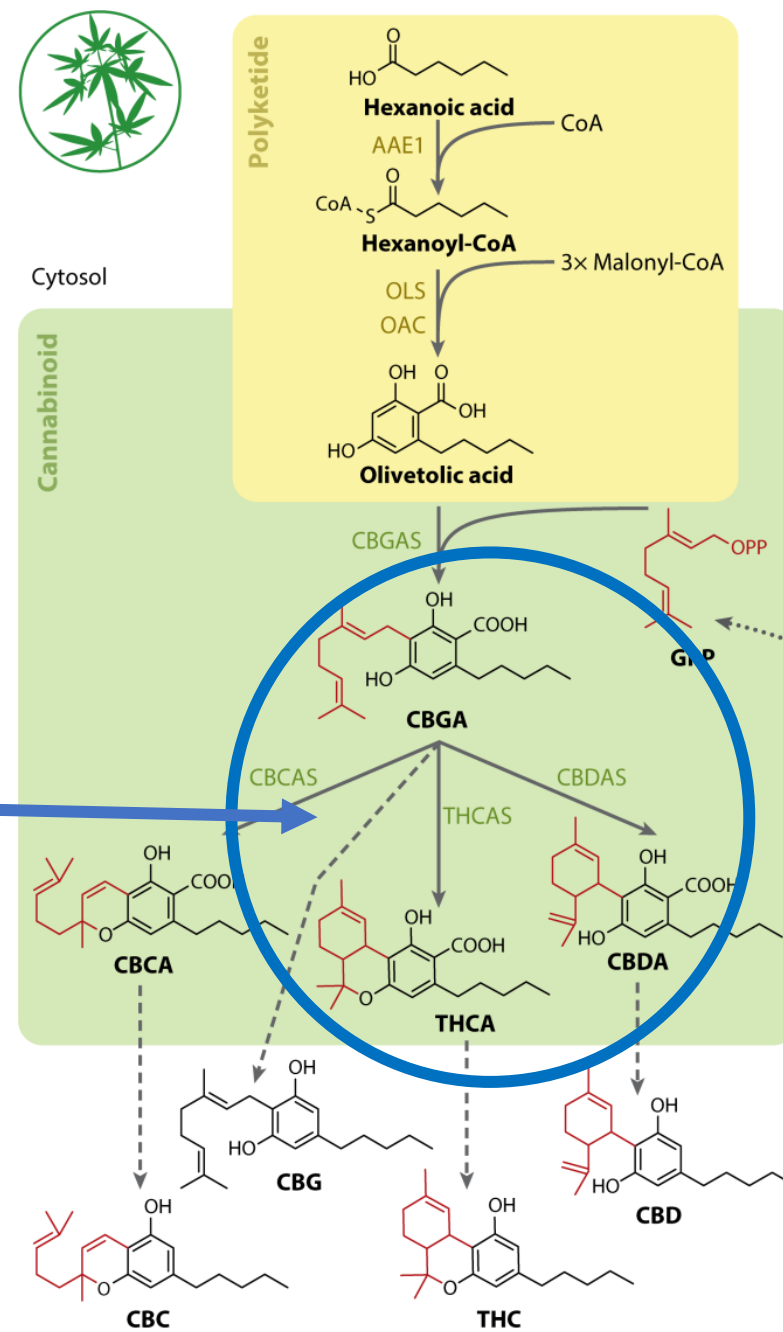
The Hot Hemp Question 🤔

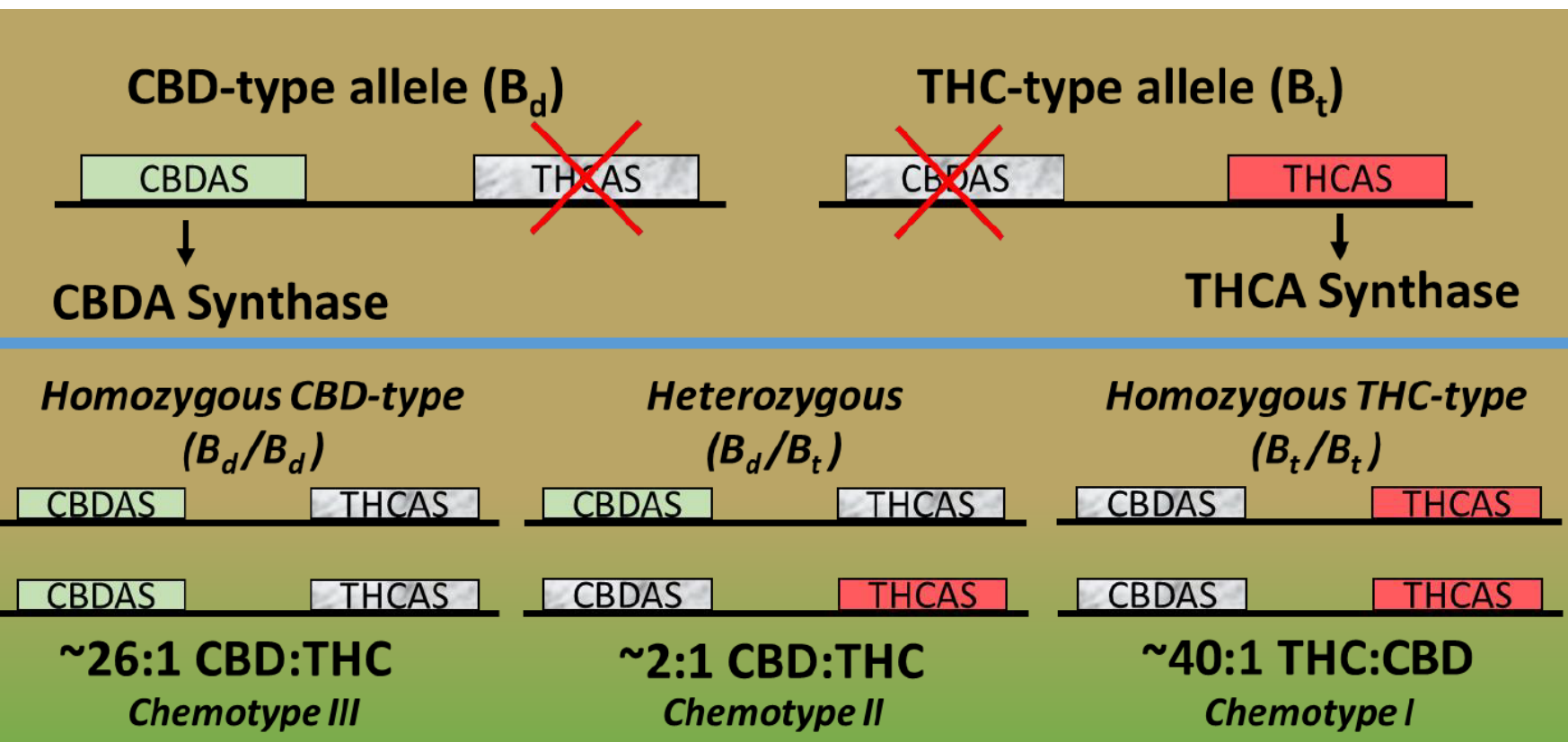
Cannabinoid biosynthesis

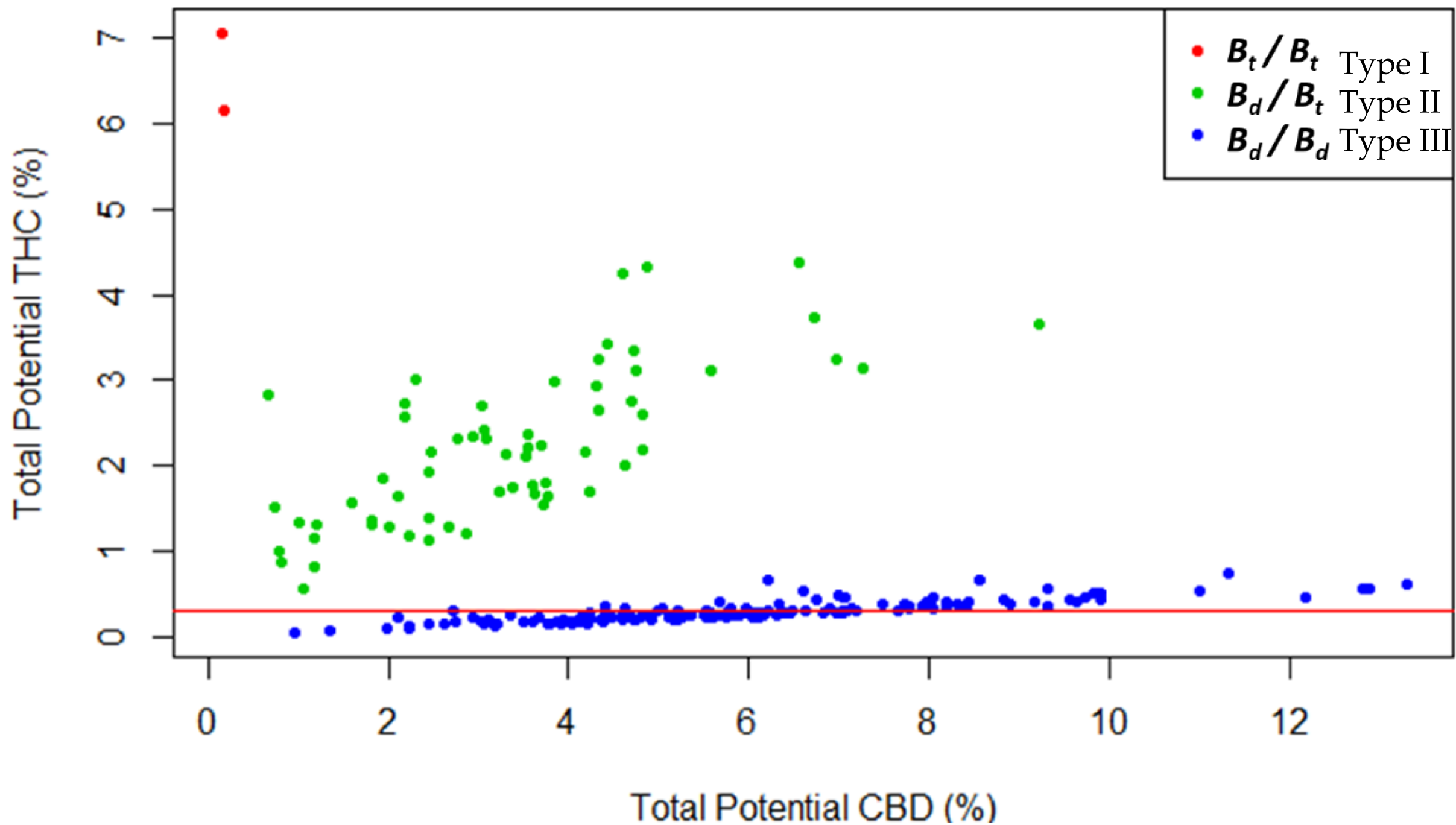


Cannabinoid biosynthesis

B locus
[$B_t + B_d$ alleles]







The Regeneration Question 🤔

Seed increase



Seed increase

Wind pollination ==
major hurdle for regeneration
and genetic purity!



Seed increase

Regens must be conducted
in isolation; time
consuming & expensive



Seed increase

- collaborators!
- positive pressure?
- 10 μm mesh field cages?



Seed and Pollen Questions 🤔

Germination, dormancy, & pollen

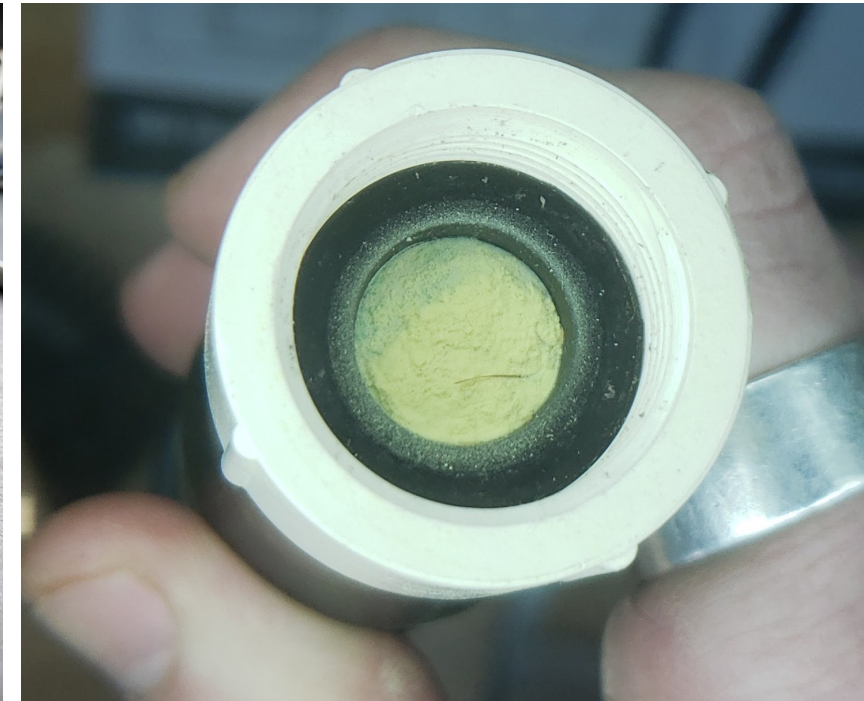
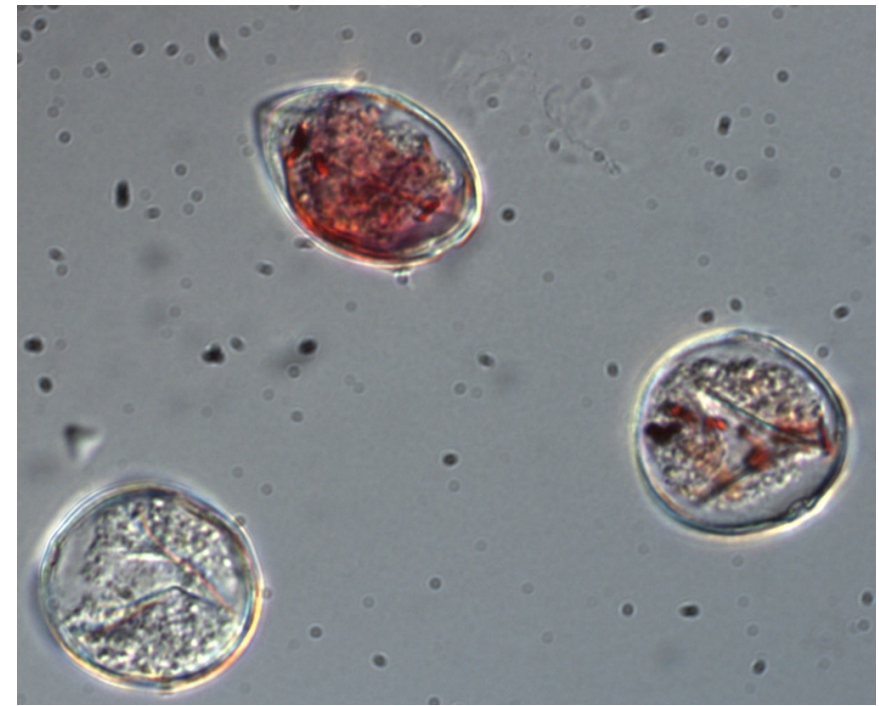
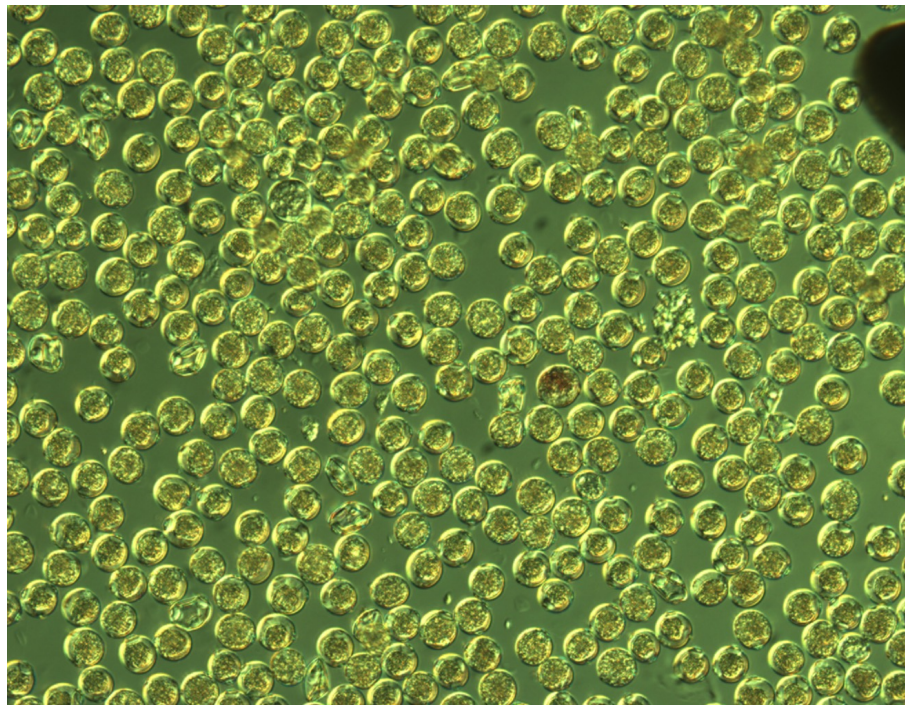


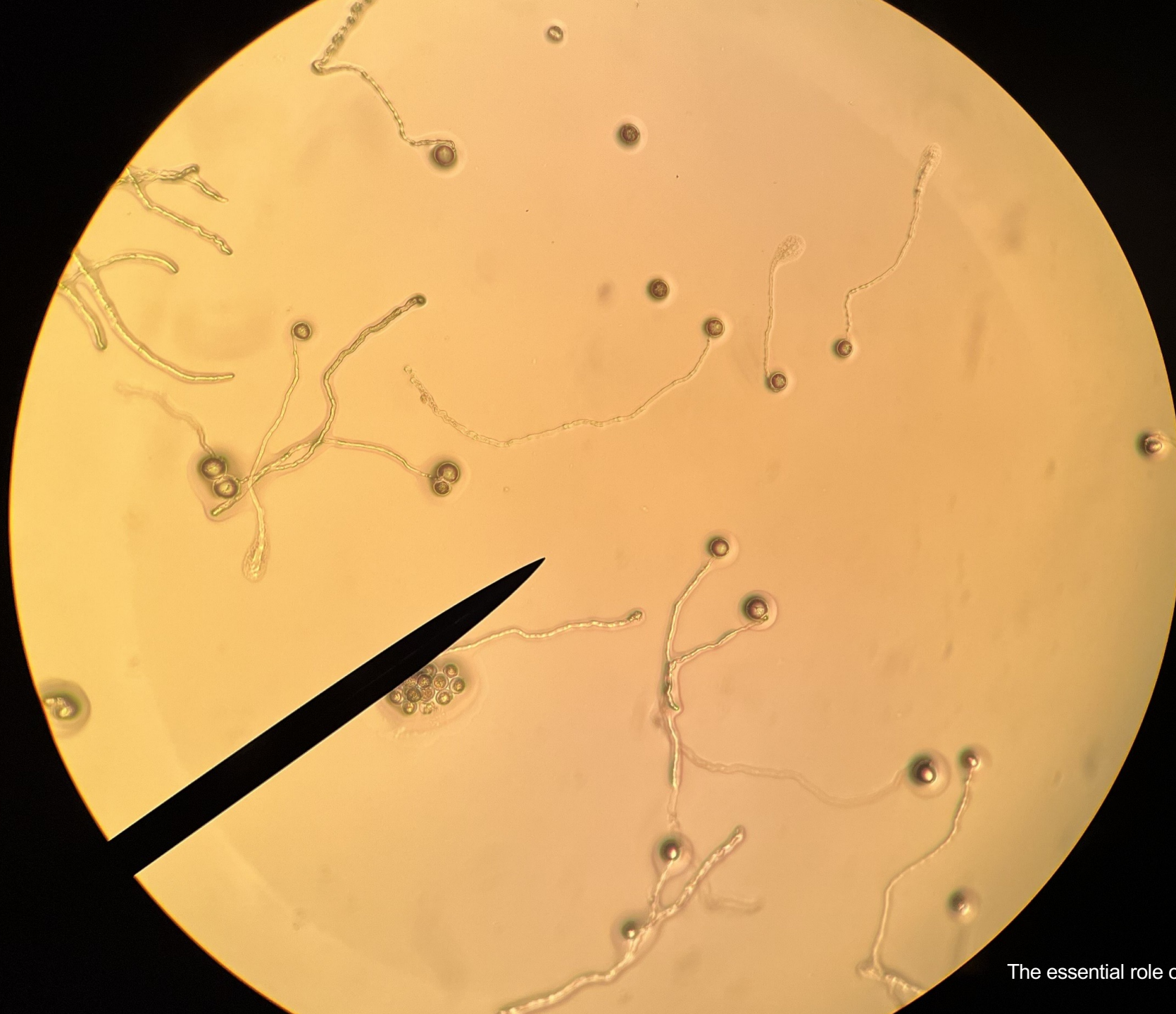
Nicholas Genna



Pollen:

Capture,
Evaluation,
Storage,
Distribution





Hemp pollen

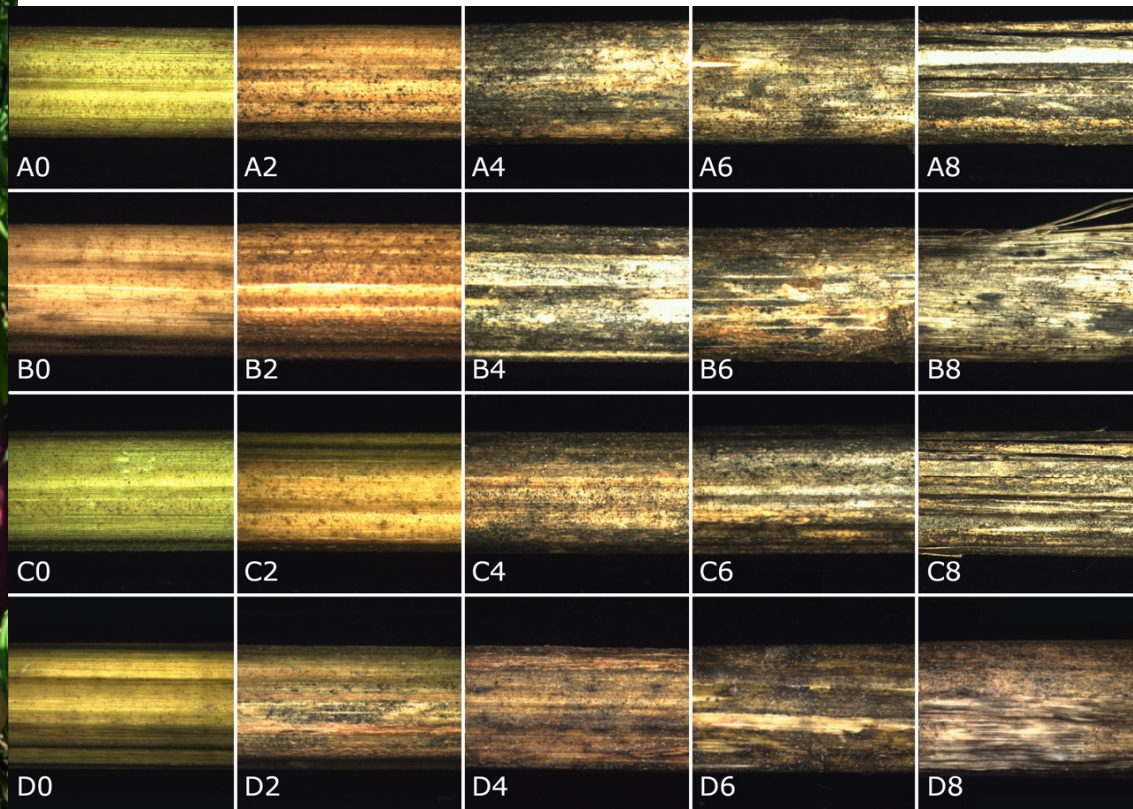
- ~25 μm
- Germinates on Brewbaker-Kwack media
- Sensitive to overdrying
- Storage longevity is unknown



Tony Barraco

Evaluating fiber quality

Collaboration with Chris Delhom at SRRC



Hemp Team:

Ashya Reid
Bob Martens
Colin Prior
David Osborn
Deb Johnston
Jackson Bartell
Maeve Reilly
Maria Mott
Nancy Consolie
Nick Genna
Paul Kisly
Reece Perrin
Scott Hoffman
Sherri Tennies
Tony Barraco
Tyler Gordon
Zachary Stansell
Zaria Smith

