Growing Location Effects on Composition of Rubus Cultivars

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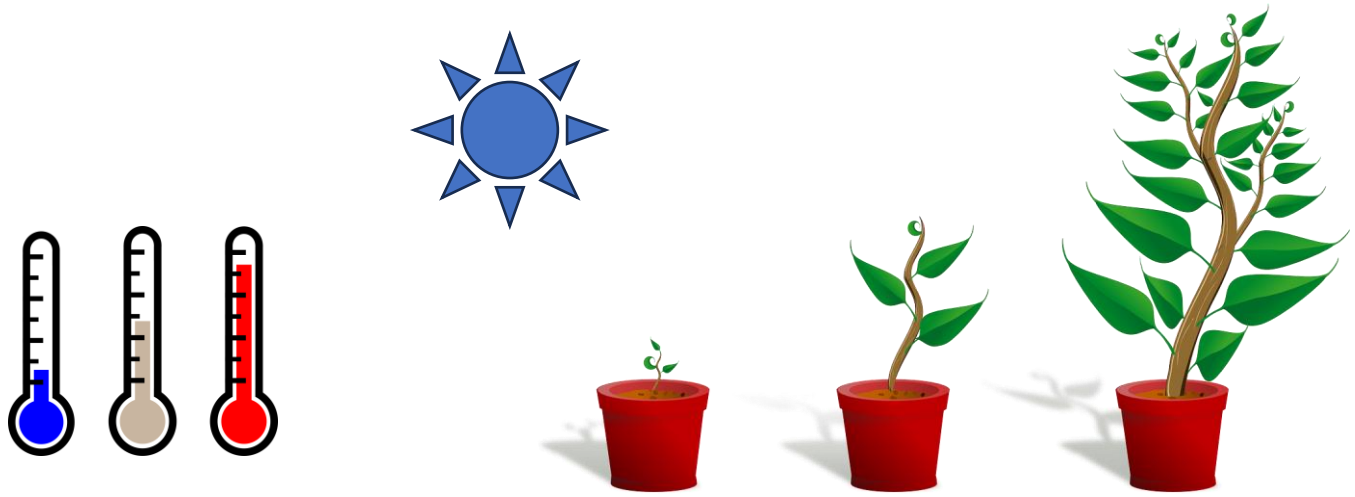
- *Rubus* includes raspberry, blackberry, black raspberry and a number of wild species
- A wide variation in color, from almost white to darkest black-purple
- Most of the color (99%) is anthocyanin
- Pairwise interested in diving into the genomics of Rubus to better understand chromosomes that control traits of interest

Genetics plays a big role

What about environmental effects?

-Geographic location (light, temperature, water)

-Time of bloom development (floricane in fall, primocane on spring/summer wood)



Purpose:

Compare specific and classic Rubus cultivars to determine

1. How composition differs among these genotypes/cultivars
2. How primocane vs floricane fruit differ in composition
3. How fruit vary in composition across geographic locations

Methods

Rubus genotypes selected based on historical and P/F:

Blackberry: Chester Thornless (floricane only, semi erect)
PrimeArk 45 (floricane and primocane, thorny, erect)

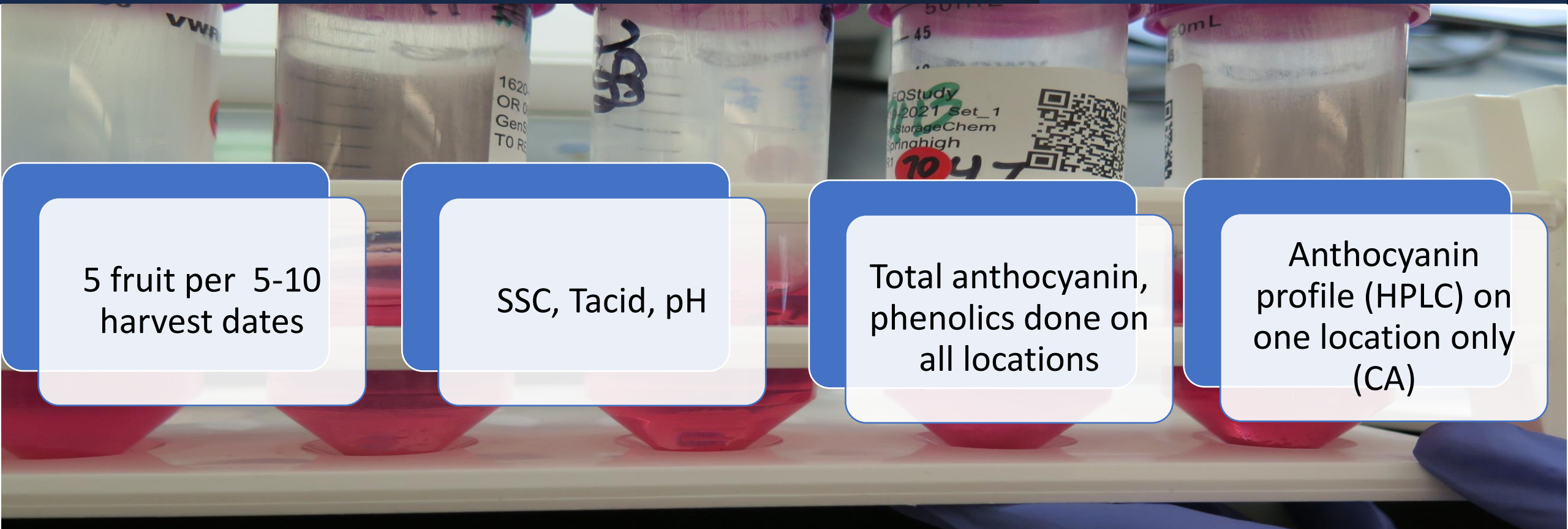
Raspberry: Latham (floricane only, 1860's red)
Heritage (floricane and primocane, 1960's, red)

Black Raspberry: Bristol (floricane only)

Locations:

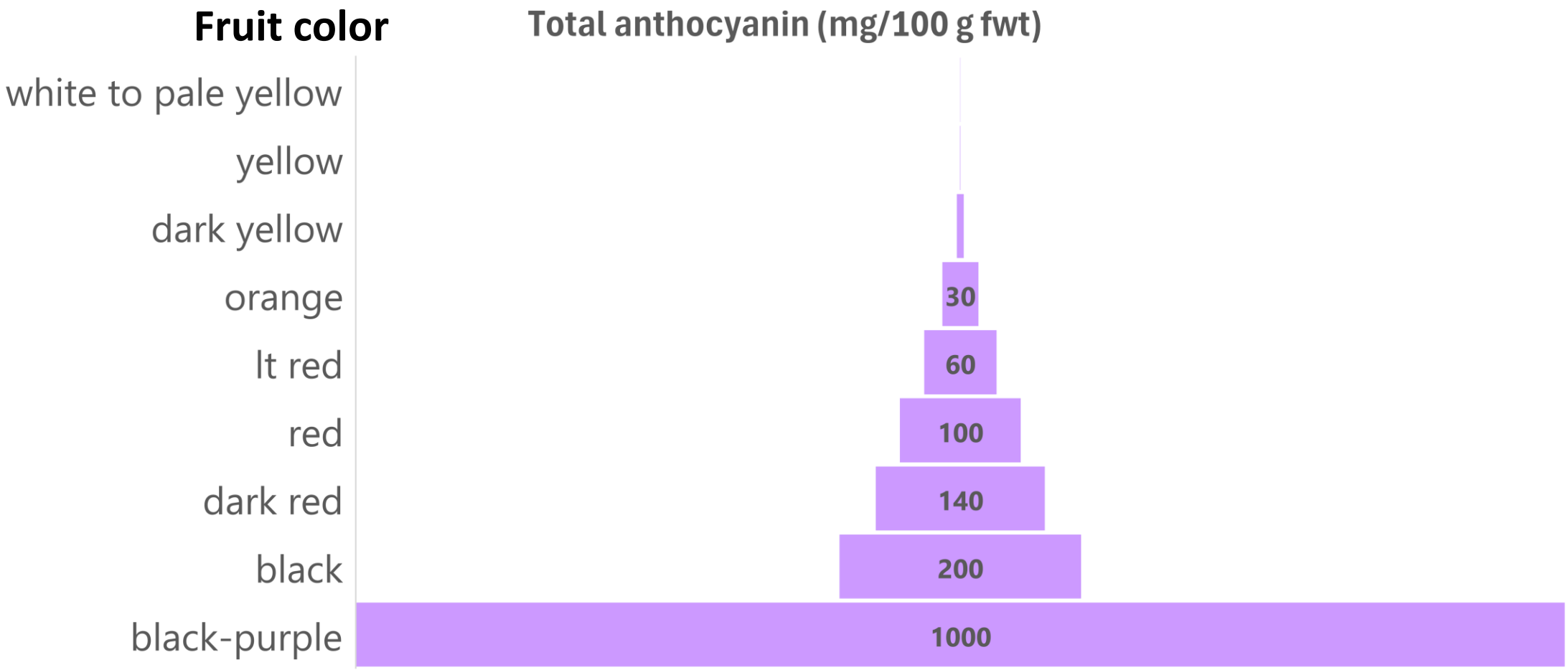
NY, NC, AR, OR, CA

Methods



- 5 fruit per 5-10 harvest dates
- SSC, Tacid, pH
- Total anthocyanin, phenolics done on all locations
- Anthocyanin profile (HPLC) on one location only (CA)

What gives Rubus color?

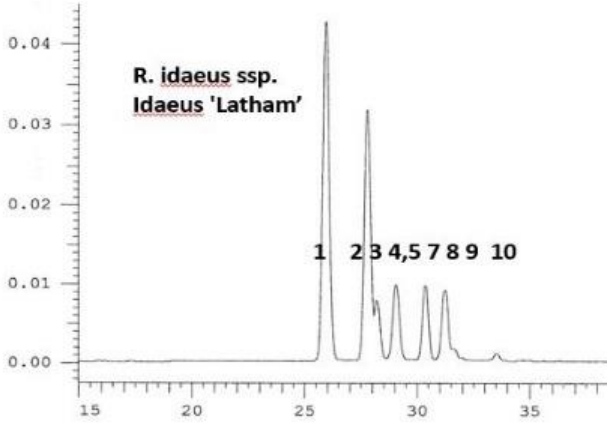


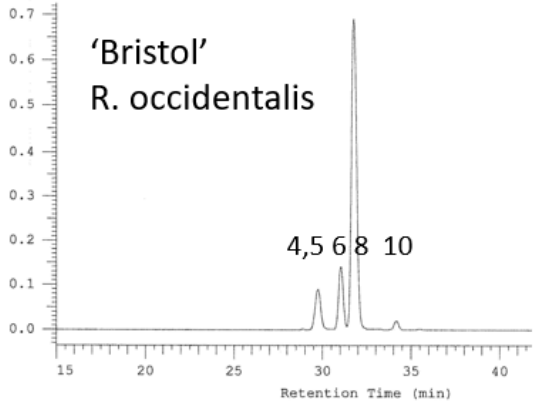
Rubus anthocyanins across species

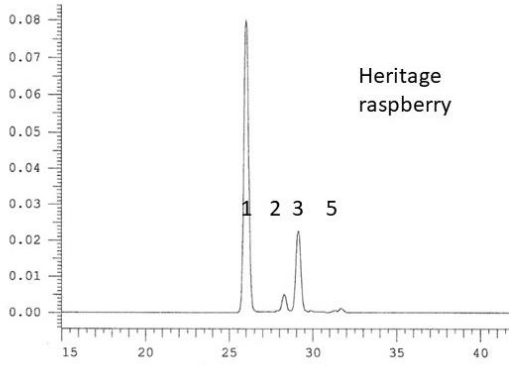
1. Mostly cyanidin, pelargonidin
2. Complexed with different sugars

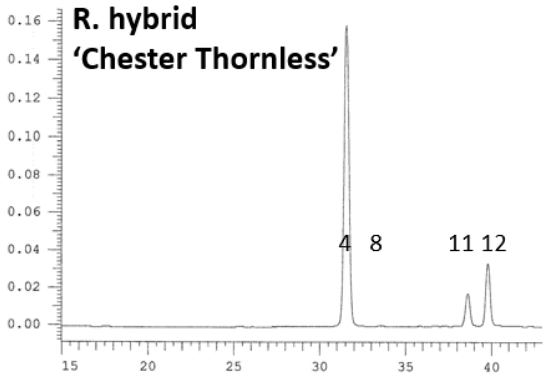
3. Glucoside, rutinoside in common across most species

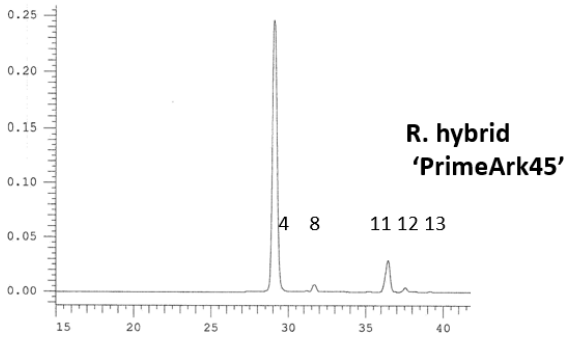
4. Differences are in di- and tri-sugar complexes











1. Cyandin-3-sophoroside (C3So)
2. Cyanidin-3-glucosylrutinoside (C3GR)
3. Pelargonidin-3,5-glucoside? (Pg3,5DG)
4. Cyandin-3-glucoside (C3G)
5. Cyandin-3-sambubioside (C3Sam)
6. Cyandin-3-xylorutinoside (C3XR)
7. Pelargonidin-3-sophoroside (Pg3So)
8. Cyanidin-3-rutinoside (C3R)
9. Pelargonidin-3-glucoside (Pg3G)
10. Pelargonidin3rutinoside/glucosylrutinoside
11. Cyanidin-3-xyloside (C3X)
12. Cyanidin-3-(6"malonylglucoside) (C3MG)
13. Cyanidin-3-dioxalylglucoside/ Cyanidin-3-*O*-*β*-(6"-(3-hydroxy-3-methylglutaroyl)-glucoside (C3XG)

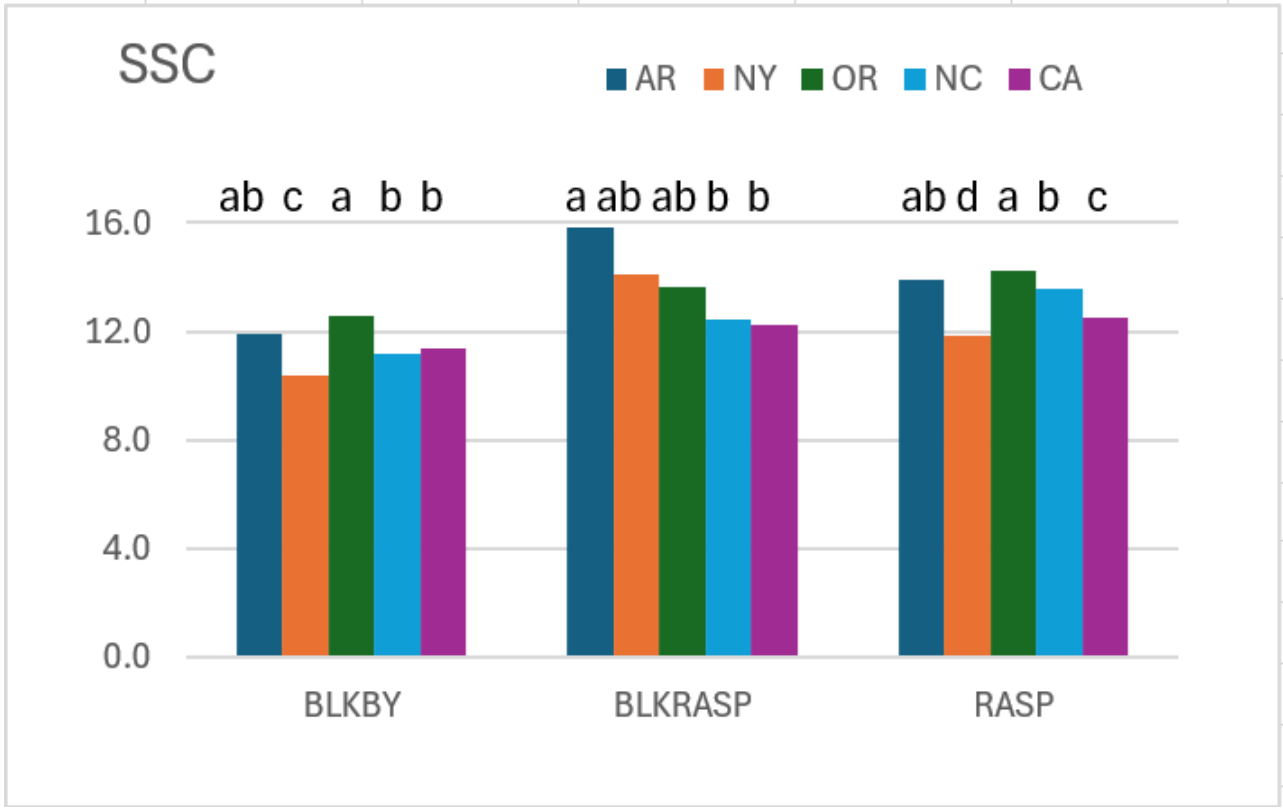
Total solids content (sugars or SSC)

Genotypes:

Black Raspberry ≥ Raspberry >Blackberry

Location:

Blackberry: OR, AR> NY, CA, NC
Blk Raspberry: CA,NC lowest
Raspberry: NY, CA lowest



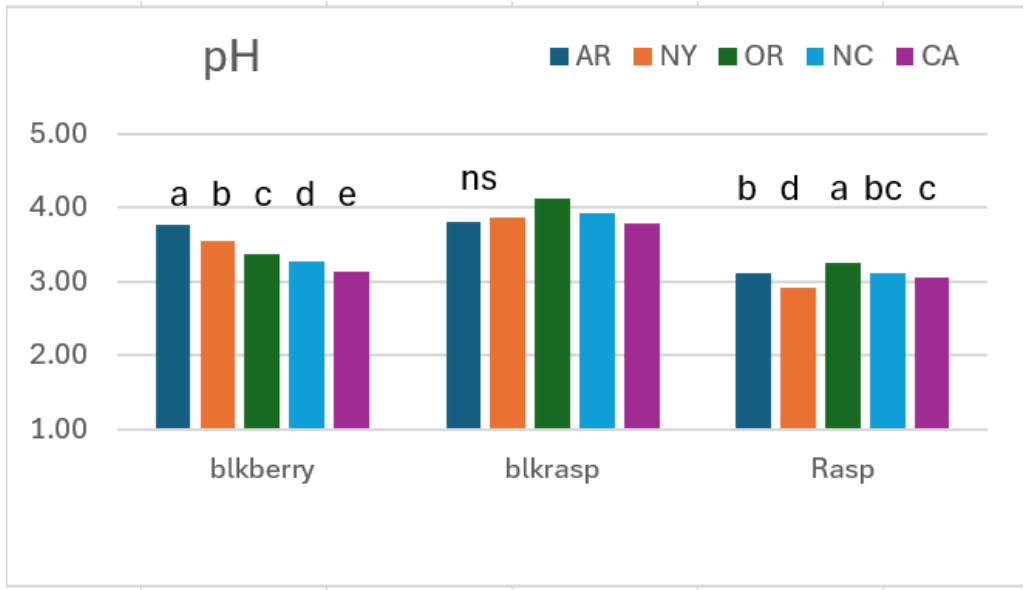
Fruit composition

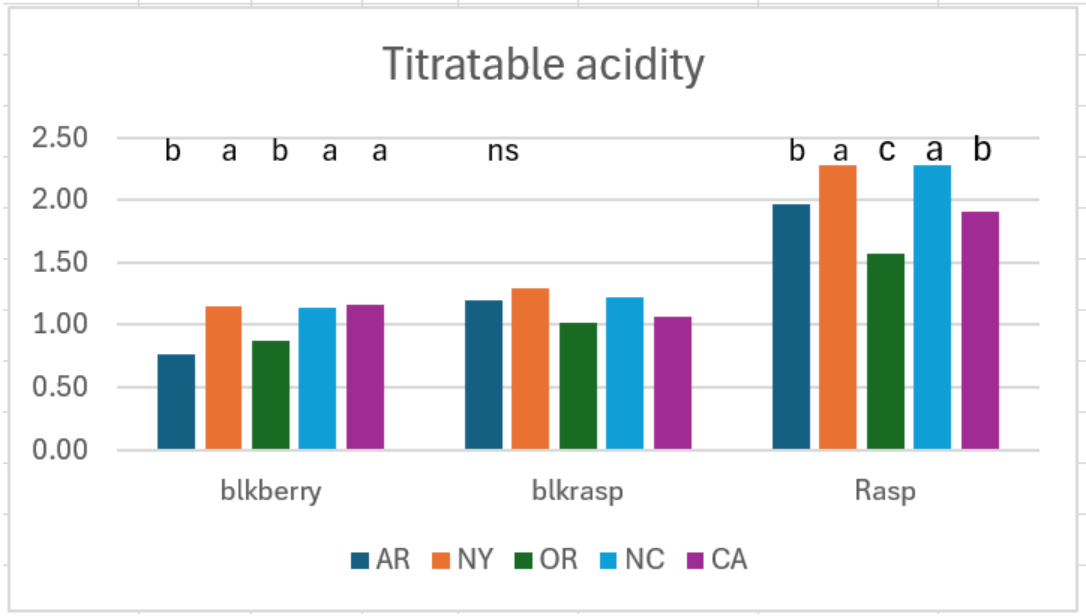
Among genotypes

- pH highest in blk raspberry
- Tacid highest in raspberry

Among locations

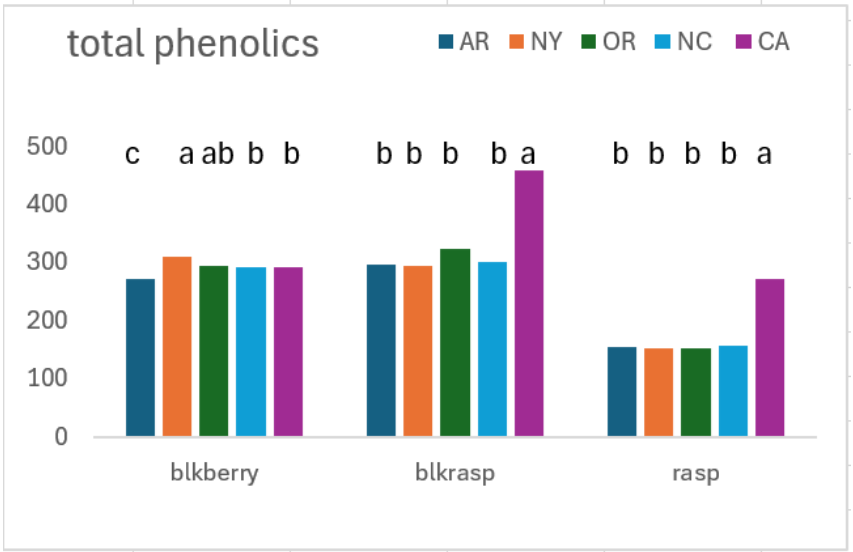
- Black raspberry least differences
- AR, OR low in Tacid in blackberry
- NY, NC high in Tacid for raspberry





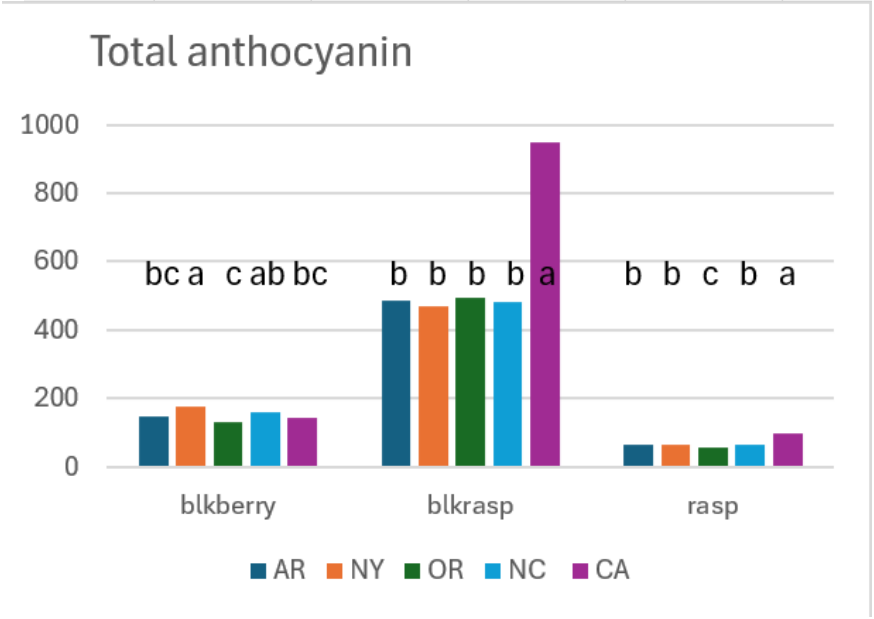
Among genotypes

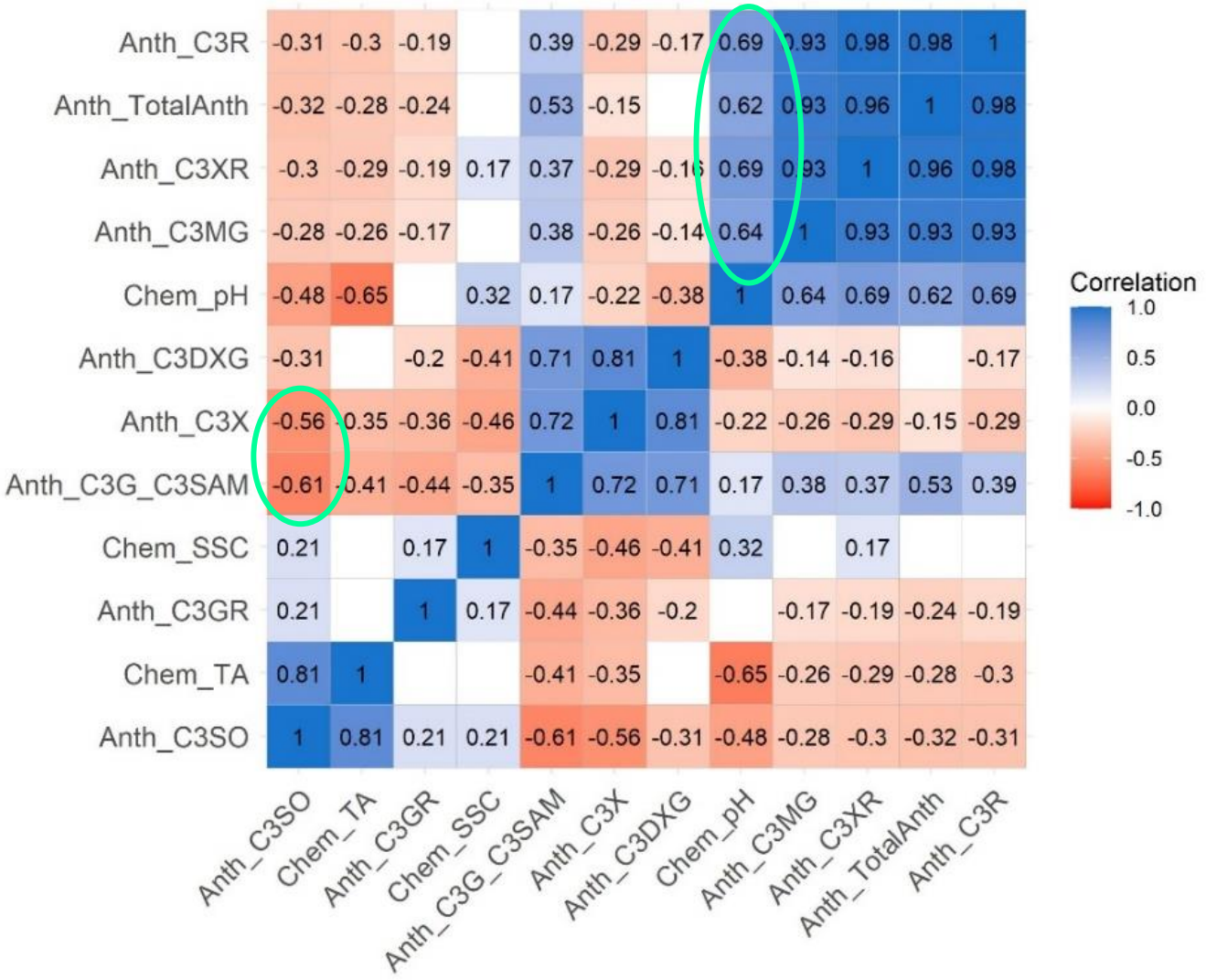
- Raspberry lowest in total phenolic content
- Black raspberry highest in anthocyanin content



Among locations

- CA high in tphenol and tanth for black raspberry, raspberry
- OR lower in tanth for blackberry, raspberry
- AR lower in tphen for blackberry





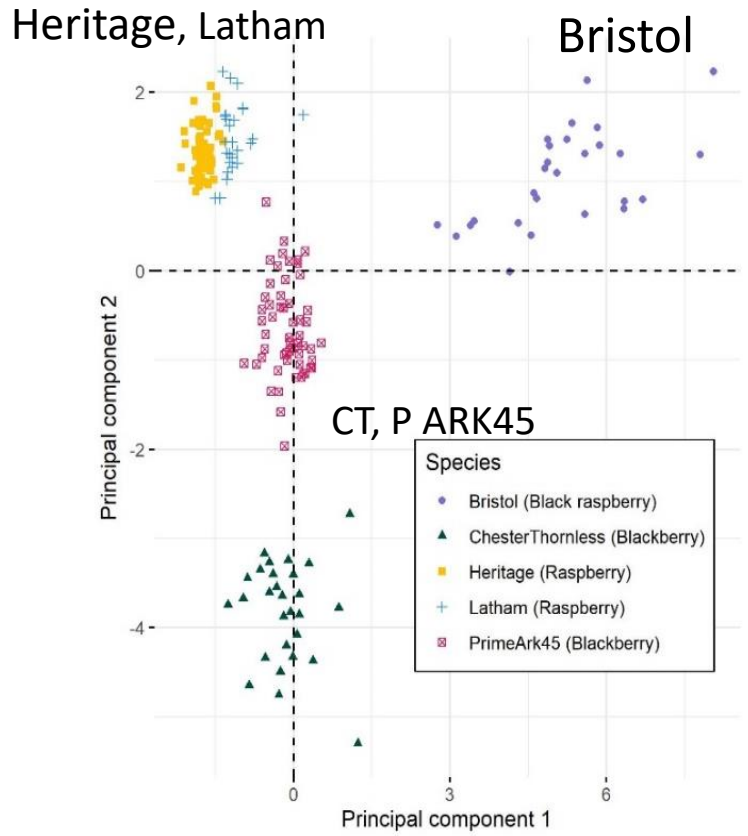
Correlations across compositional variables and all genotypes

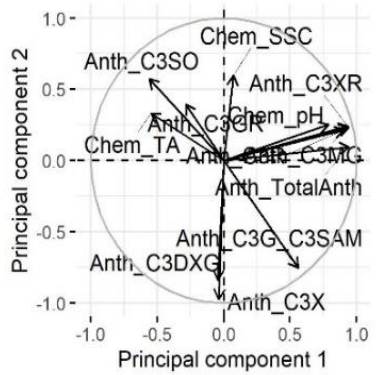
- pH and anthocyanin components most significant
- Tacid and pH significant
- Tacid and C3Sophoroside significant

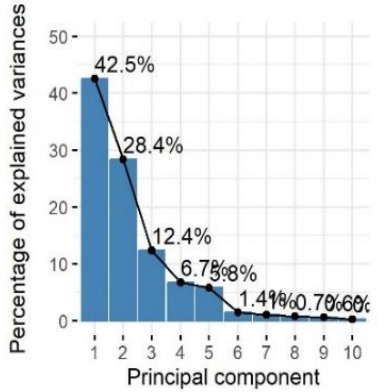
Fruit composition relationships

For CA fruit set Floricane only

- Each genotype clusters differently
- Blackberry cultivars differ considerably

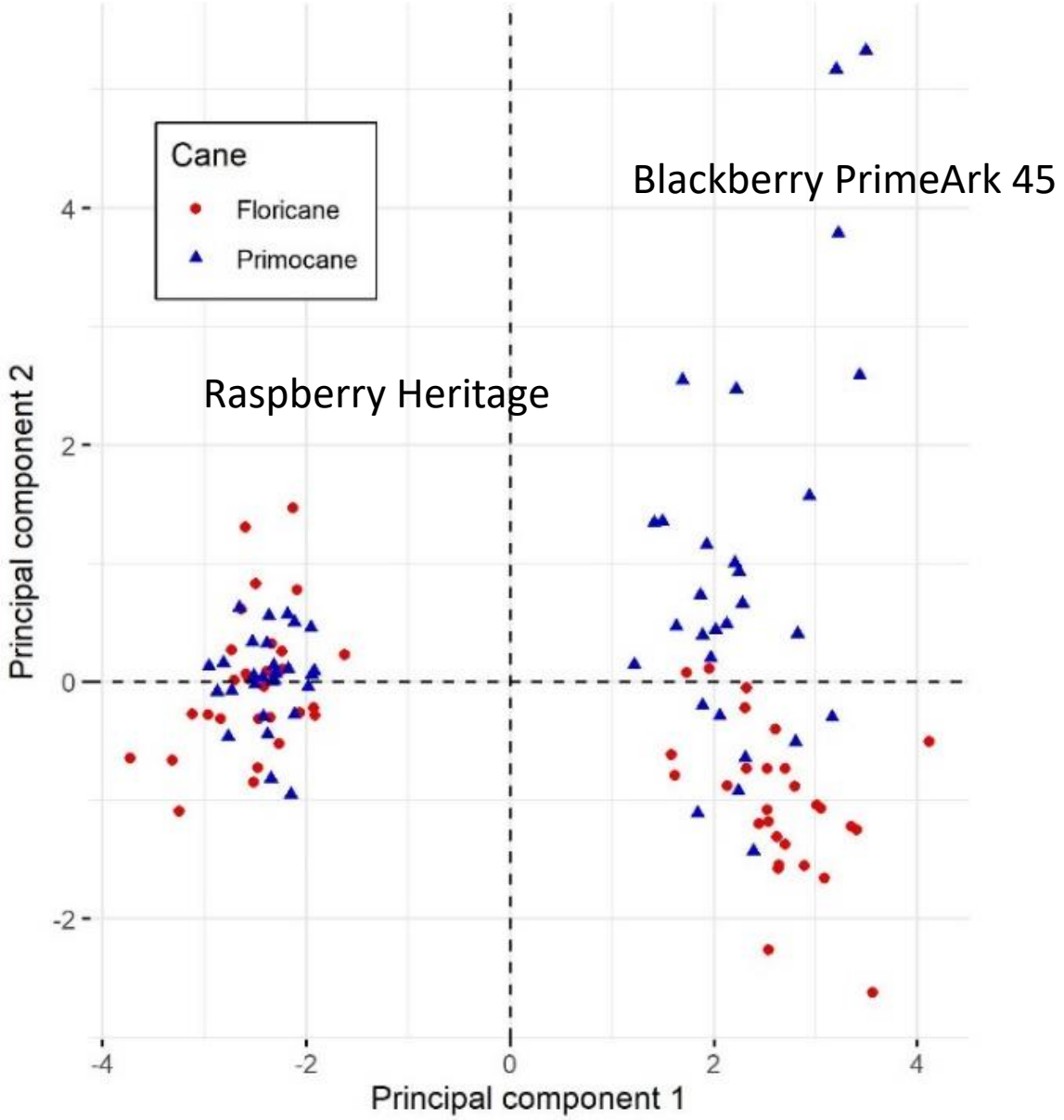






Primocane vs floricane

PF, F more similar overall for Heritage
compared to Prime Ark 45



Conclusion

- In this study, fruit of five seminal cultivars in three Rubus species were compared for their composition and anthocyanin profiles
- Blackberry, red raspberry, and black raspberry species were distinctly different in anthocyanin profiles and total phenolics, anthocyanin
- Within a species, cultivars yielded the most differences in fruit composition, followed by pc and fc effects, and fewest differences were found for location

What does this mean?

- Most of the differences in Rubus anthocyanins is in the attached sugars, not the anthocyanidin, similar to blueberry and strawberry
- PC and FC fruit vary in composition which may be related to the environment at fruit bud set and/or during fruit development
- At least for the simple compositional components (aromatic volatiles may yield a different story), location was far less important than cultivar, species, or pc/fc status


Storage of
Combustible Material
is NOT Permitted


Questions?