

Hybridization Between Native And Introduced *Rubus* In California And The Pacific Northwest

Lindsay V. Clark and Marie Jasieniuk, Department of Plant Sciences, University of California – Davis. Contact: lvclark@ucdavis.edu

Introduction and Objectives

Many species of *Rubus* worldwide are invasive, including the apomictic *R. armeniacus* in Western North America. Given that hybridization frequently contributes to invasiveness in plants, our objectives are to

- Identify spontaneous hybridization events between native and introduced *Rubus* or among introduced *Rubus* species that could potentially lead to new invasive forms, and
- Determine whether invasive populations are all one clone of *R. armeniacus* or are derived from other species in the European *R. fruticosus* complex.



Map of field collection sites

Materials and Methods

- Leaf material for DNA extraction was collected from 592 individuals across California, Oregon, and Washington.
- All individuals were genotyped with eight nuclear microsatellite markers and two chloroplast markers (trnK and ndhF).
- Genetic distances between individuals were calculated based on distances between alleles, using the method of Bruvo *et al.* (Mol Ecol 13: 2101) for mixed polyploid systems, implemented in R.
- For 471 individuals with complete data, Principal Coordinate Analysis was used to identify distinct genetic groups and hybrids.

Rubus native and naturalized to the West Coast, obtained in field collections

Subgenus *Rubus* (blackberries)

Sect. *Ursini*

R. ursinus (Pacific blackberry, native)

Sect. *Rubus* (*R. fruticosus* agg.)

R. armeniacus (Himalayan blackberry, Europe)

R. laciniatus (Cutleaf evergreen blackberry, Europe)

R. ulmifolius (Elm-leaf blackberry, Europe)

Sect. *Arguti*

R. pensilvanicus (Pennsylvania blackberry, Eastern North America)

Subgenus *Ideaobatus* (raspberries)

R. leucodermis (blackcap raspberry, native)

R. spectabilis (salmonberry, native)

Subgenus *Anaplobatus*

R. parviflorus (thimbleberry, native)

Other *Rubus* included in study

- *R. allegheniensis* – Subgen. *Rubus* Sect. *Allegheniensis*, Eastern North America
- *R. oederatus* – Subgen. *Anaplobatus*, Eastern North America
- *R. idaeus* (red raspberry) – cultivated raspberry originating in Europe – cultivars ‘Cuthbert’, ‘Chilliwick’, ‘Cascade Delight’, ‘Autumn Britten’
- Loganberry – *R. ursinus* x *idaeus*
- Boysenberry – Loganberry x blackberry x raspberry
- Ollaliberry – Loganberry x raspberry x dewberry
- Marionberry – *R. armeniacus* x *R. ursinus* x Loganberry x Ollaliberry
- Thornless Marionberry
- Tayberry – blackberry x raspberry
- ‘Navajo’ thornless blackberry
- ‘Siskiyou’ blackberry – Ollaliberry x Boysenberry
- ‘Chester’ thornless blackberry
- ‘Silven’ blackberry

Conclusions

- Spontaneous hybridization between the invasive *R. armeniacus* and common native *R. ursinus* occurs rarely.
- *R. armeniacus* in Central and Southern California appears to be of a single clonal lineage, but multiple clones are present in invasive populations in Northern California and the Pacific Northwest, potentially derived from hybridization with *R. laciniatus*, *R. ulmifolius*, and/or other species.
- Hybrid populations that are maternally derived from *R. ursinus* are present in Bidwell Park (BWP) and Coal Oil Point Reserve (COP). These may be hybrids with *R. pensilvanicus* or a species not included in this study.
- *R. ursinus*, which is thought to be an ancient hybrid between a blackberry and raspberry, hybridizes freely with native and cultivated raspberry species.
- Popularly cultivated hybrid *Rubus* has not contributed to invasive populations.

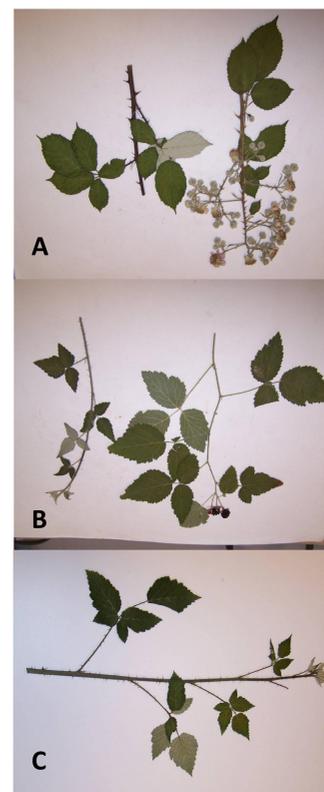
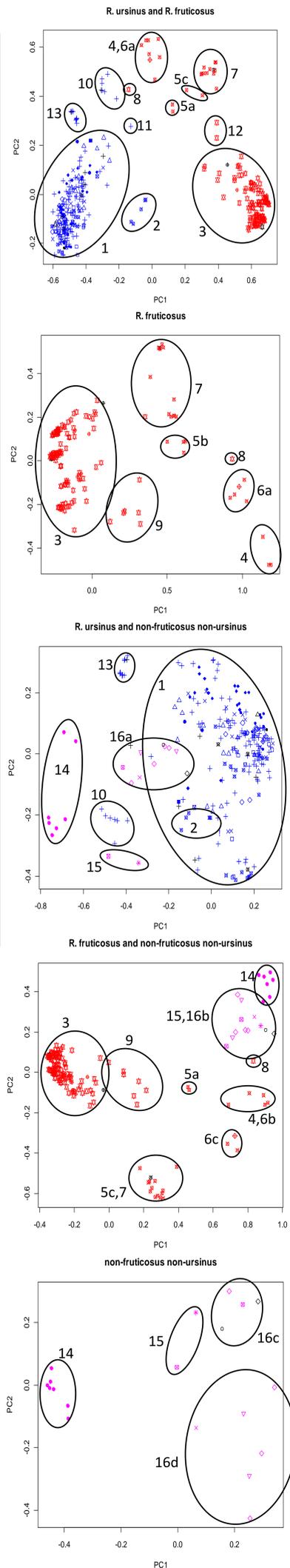
Principal Coordinate Analyses of genetic distances between individuals.

Distances are based on nuclear microsatellite genotypes. Chloroplast haplotypes are indicated by colors and symbols.

- Blue: “uncut” trnK allele, indicative of *R. ursinus* as well as hybrids and cultivars maternally derived from *R. ursinus*.
- Red: individuals with the “cut” trnK allele that morphologically appear to be in the *R. fruticosus* complex.
- Magenta: individuals with the “cut” trnK allele that morphologically do not appear to be in the *R. fruticosus* complex.
- Black: missing data at trnK locus.
- Each symbol indicates a different ndhF allele.

Key to circled clusters:

- 1) *R. ursinus*
- 2) *R. ursinus* x *armeniacus* hybrids at CSP
- 3) *R. armeniacus*
- 4) *R. ulmifolius* in ARP
- 5a) *R. laciniatus* in FCR and PLV
- 5b) *R. laciniatus* in FCR and PLV, *R. armeniacus*-like in CMW and KRC
- 5c) *R. armeniacus*-like in CMW and KRC
- 6a) *R. ulmifolius* in MCD, *R. armeniacus*-like in FCR
- 6b) *R. ulmifolius* in MCD
- 6c) *R. armeniacus*-like in FCR
- 7) *R. armeniacus*-like in FCR, CSR, CMW
- 8) ‘Navajo’ thornless blackberry
- 9) *R. armeniacus*-like in ARP, CFX, DVS
- 10) Boysenberry
- 11) ‘Siskiyou’ blackberry
- 12) *R. armeniacus*-like in DVS, CSR
- 13) *R. ursinus*-like in BWP, COP
- 14) *R. pensilvanicus* in BWP
- 15) *R. parviflorus* in KRC and SRP
- 16a) *R. leucodermis*, cultivated raspberries, Tayberry, unidentified species in TCM, *R. ursinus* in KRC, *R. allegheniensis*, *R. oederatus*, Marionberry
- 16b) *R. leucodermis*, cultivated raspberries, unidentified species in TCM, *R. allegheniensis*, *R. oederatus*, Marionberry
- 16c) cultivated raspberries, Marionberry
- 16d) *R. leucodermis*, unidentified species in TCM, *R. allegheniensis*, *R. oederatus*



Example of morphological intermediacy of hybrids
A) *R. armeniacus*. B) *R. ursinus*. C) *R. ursinus* x *armeniacus*.

Acknowledgements

Stella Hartono, Anna Sherwood, Annabelle Kleist, Jeffrey Firestone, and Noor-ul-ain Noor for lab and field assistance; Cosumnes River Preserve, Caswell Memorial State Park, American River Cherry Company, and Pacific Star Gardens for allowing us to collect samples; Coal Oil Point Reserve, Paradise Reserve, and Sedgwick Reserve for mailing samples to us; Kristina Schierenbeck, Susan Lambrecht, and Ramona Robison for leads on interesting blackberries; and Jastro-Shields Research Award and Plant Sciences Departmental Research Assistantship for funding.