

Evaluation of pedigree relationships in apfel:gut apple breeding

Presenter: Nicholas P. Howard

Post-doctoral scientist

Institut für Biologie und Umweltwissenschaften, Carl von Ossietzky Universität, Oldenburg, Germany

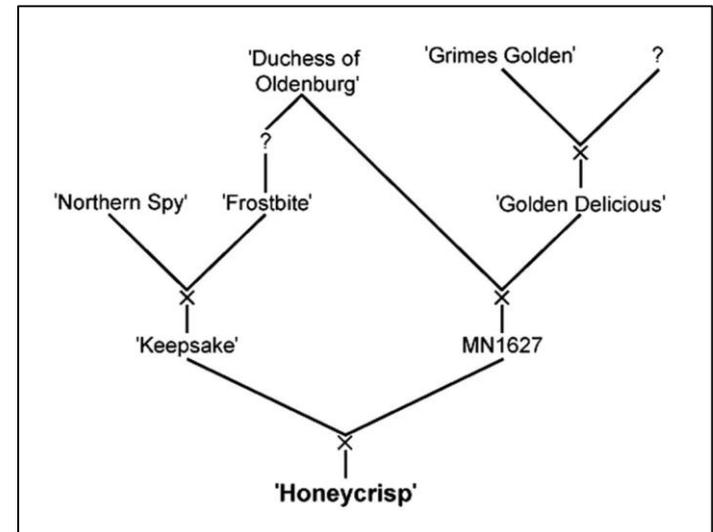
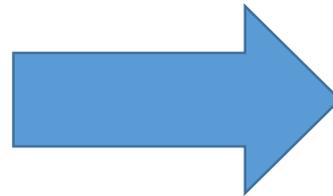
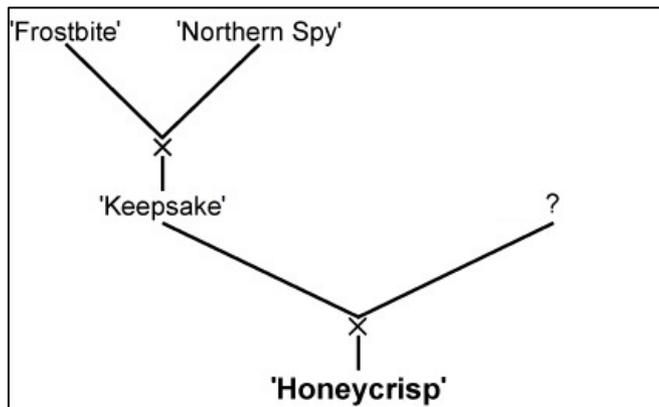
Department of Horticultural Science, University of Minnesota, St Paul, USA

Presentation outline

1. Research description
2. (Brief) Project methods
3. Results of apfel:gut material

Background

- Pedigree information of fundamental importance in breeding programs
- Apple cultivars are interrelated by recent and distant common ancestors
- Many old cultivars still exist in germplasm collections
- SNP arrays have been used to identify pedigree relationships with precision:



- Howard et al. 2017. Elucidation of the 'Honeycrisp' pedigree through haplotype analysis with a multi-family integrated SNP linkage map and a large apple (*Malus × domestica*) pedigree-connected SNP data set. *Horticulture research*, 4, 17003.

- These new pedigree findings have been successfully implemented in breeding programs and QTL studies

Collaborative project to identify direct and distant pedigree relationships in apple

- Research goal:
 - Connect pedigrees of a very large diverse set of historically and economically important cultivars
- Purposes:
 - To be useful in development of new apple cultivars
 - To help us better understand genetics of important traits
 - To benefit germplasm collections
 - Connecting material between germplasm collections
 - Assessing true-to-typeness
 - To provide historical information about apple cultivars to appeal to people's cultural connection to apples

Germplasm

- >30 different germplasm collections
- Currently >5400 cultivars
 - Soon to be >6000
- apfel:gut breeding selections and likely ancestors from collections were included

Group	Country	Accessions
INRA	France	596
National Fruit Collection	UK	548
Plant and Food Research	New Zealand	528
USDA	USA	502
Fondazione Edmund Mach	Italy	483
University of Copenhagen	Denmark	384
Ökowerk	Germany	380
Sveriges lantbruksuniversitet	Sweden	378
CRA-W	Belgium	215
UNIBO	Italy	180
Seed Savers Exchange	USA	161
Julius Kühn Institute	Germany	146
RBIPH	Czech Republic	146
Universidad Publica de Navarra	Spain	141
NIAB EMR	UK	81
University of Minnesota	USA	63
Wageningen University and Research	The Netherlands	58
VNIISPK	Russia	57
NARO	Japan	56
Hans-Joachim Bannier (private orchard)	Germany	50
Temperate Orchard Conservancy	USA	49
Agroscope	Switzerland	30
Warsaw University of Life Sciences	Poland	27
Canadian Clonal Genebank	Canada	25
Das Apfel Schiff	Germany	17
Laimbourg	Italy	15
IFG	Belarus	13
Research Institute of Horticulture	Poland	12
Other	Various	62
	Total	5403

Research methods brief overview

- Collect leaf samples of culturally, historically, and economically important cultivars
- Analyze leaf samples on SNP arrays
 - I.e. obtain genetic information from samples
- Highly curate SNP data
 - I.e. clean the data
- Identify pedigree relationships using various old and new methods
 - Three papers on this topic are being written



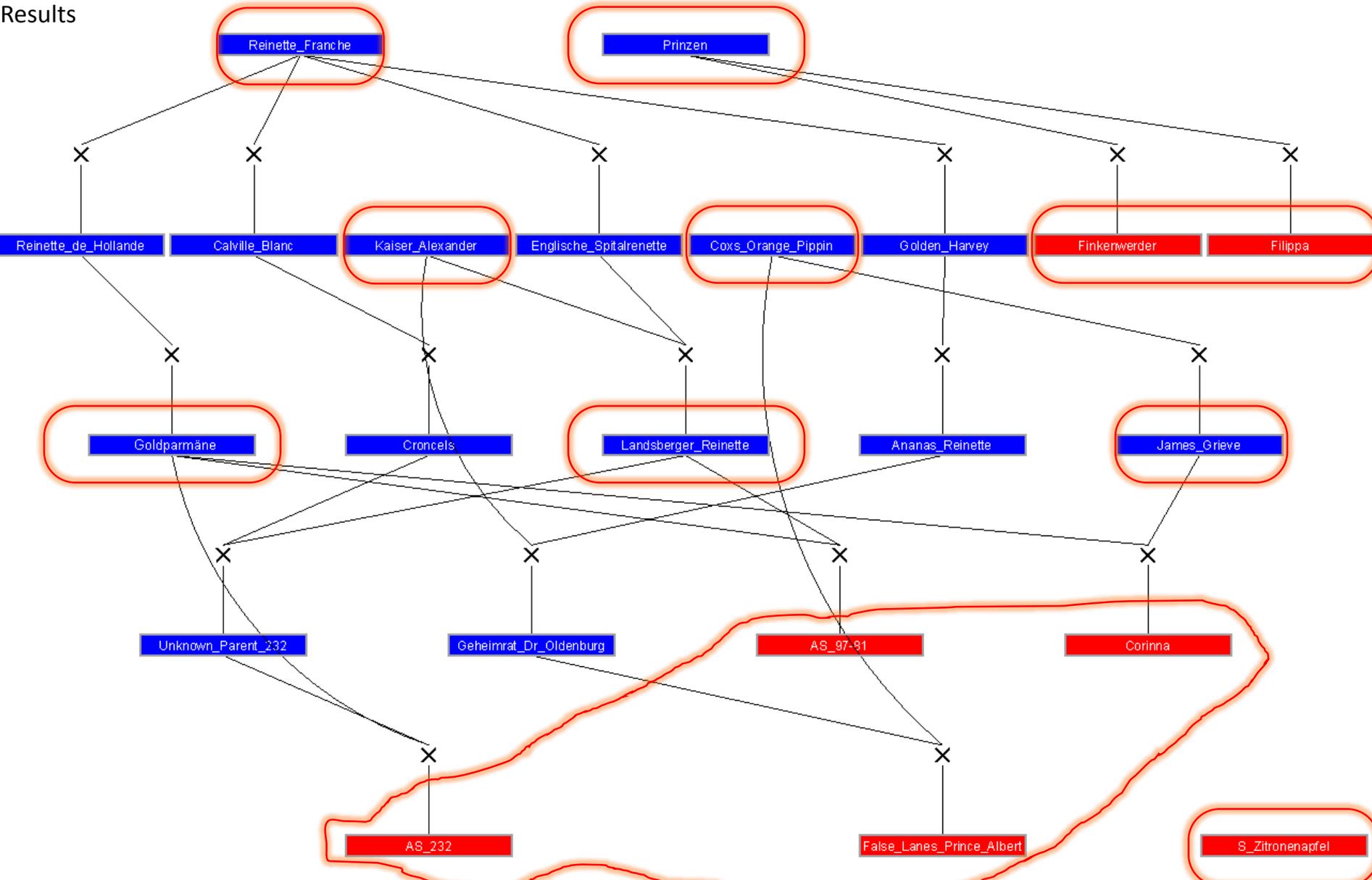
Results and applications
in apfel:gut breeding material

apfel:gut material genotyped

- Breeding selections
 - 97-81
 - 232
 - 06-09-06
- Breeding parents
 - Corinna
 - (False) Lanes Prinz Albert
 - Seestermüher Zitronenapfel
 - Filippa
 - Finkenwerder Herbstprinz
 - Karmina
 - (pedigree matches records, American/English derived)



Results



Key

-  Apfel:gut selection or breeding parent
-  Pedigree ancestor

Key extended project collaborator affiliations

 UNIVERSITY OF MINNESOTA
Driven to DiscoverSM



Nick Howard



James Luby

 FONDAZIONE
EDMUND
MACH



Michela
Troggio



Diego
Micheletti

 WAGENINGEN
UNIVERSITY & RESEARCH

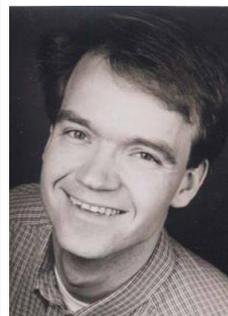


Eric van de Weg



Bjarne Larsen

 CARL
VON
OSSIEZKY
universität
OLDENBURG



Dirk Albach

 INRA
SCIENCE & IMPACT



Hélène
Muranty



Charles-Eric
Durel



Caroline
Denancé

 USDA



Gayle Volk



WASHINGTON STATE
UNIVERSITY



Stijn
Vanderzande



Cameron
Peace

Germplasm contributors



Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences



Förderverein zur Entwicklung und
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Plant & Food
RESEARCH

RANGAHAU AHUMARA KAI



upna

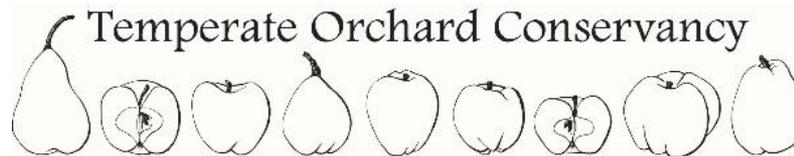
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