Development of Non-invasive Plant Alternatives for Use in the Landscape

Benjamin M. Clasen*, Alan G. Smith

Horticultural Science

University of Minnesota

Outline

- Cost of Invasive Ornamentals
- Introductions Gone Wild
- Methods to Produce Sterile Plants
- Research Objectives
- Preliminary Results

Cost of Invasive Ornamentals

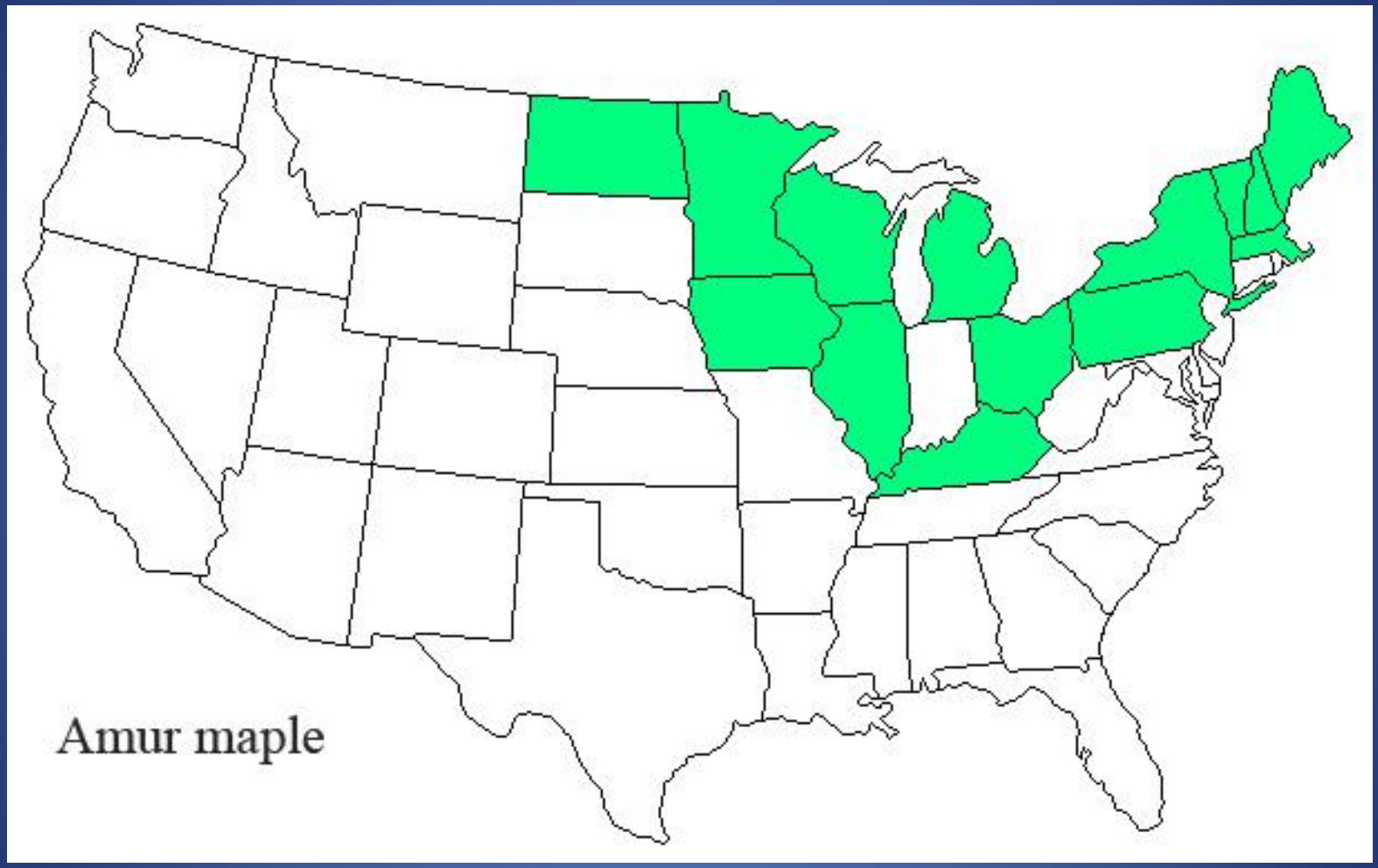
- Invasive plants reduce biodiversity-plants, animals, insects
- Collateral damage associated with the removal of invasive species
- Aesthetically negative
- Burden on consumers, producers, government
- Many woody invasive species were introduced as ornamentals

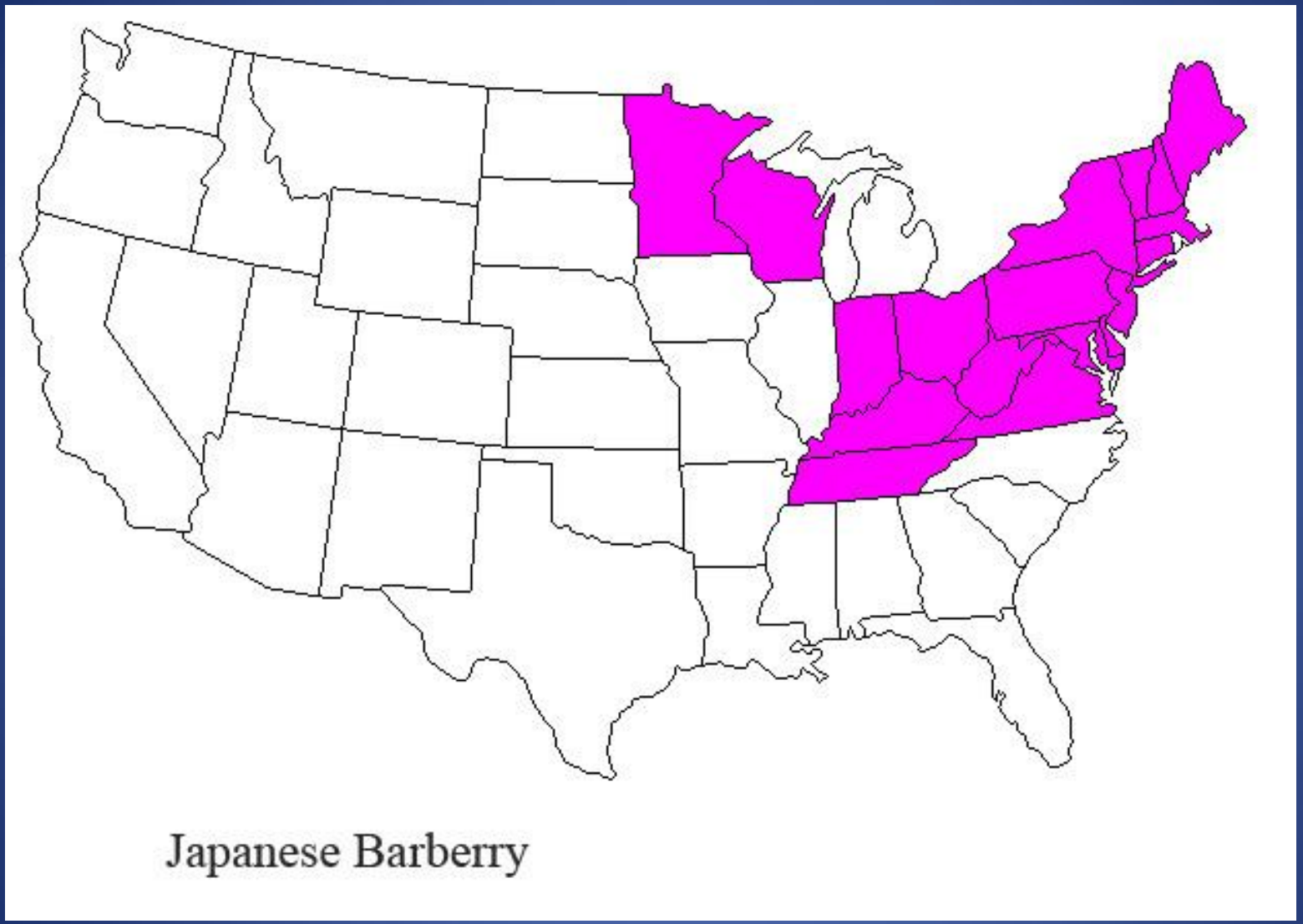
Introductions Gone Wild

- Burning Bush *(Euonymus alatus)*
- Amur Maple *(Acer ginnala)**
- Norway Maple *(Acer platanoides)**
- Japanese Barberry *(Berberis thunbergii)**

<u>*Considered potentially invasive in one or more states including MN and WI</u>

Norway Maple


Amur maple



Japanese Barberry

Valuable Ornamentals

Species	Connecticut Annual Wholesale*	Connecticut Annual Retail*
Acer ginnala	$280,000	$560,000
Acer platanoides	$450,000	$900,000
Berberis thunbergii	$2,450,000	$4,900,000

- Dollar amounts for Connecticut

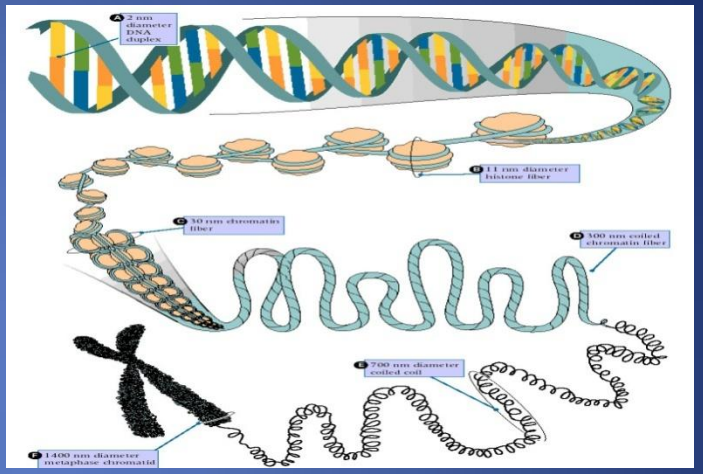
*Connecticut Invasive Species Council

Invasive Spread

- Seed and fruit production can be primary determinants of invasive spread
- Target species of this research spread primarily by seed

Methods to Produce Sterile Plants

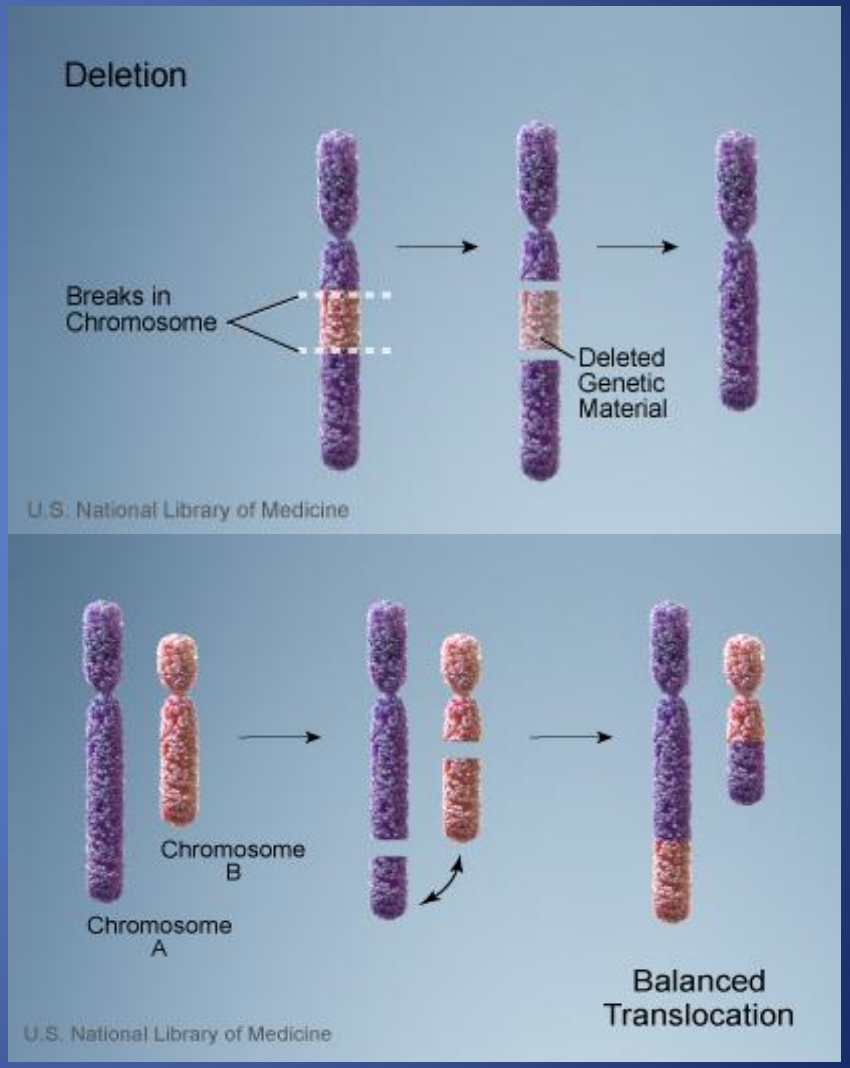
- Biotechnology
  - Sterility gene introduction



- Mutation breeding
  - Gamma Radiation

Mutagenesis Breeding

- Changes Chromosome Structure
- Changes in Chromosome Number



Mechanism of Sterility

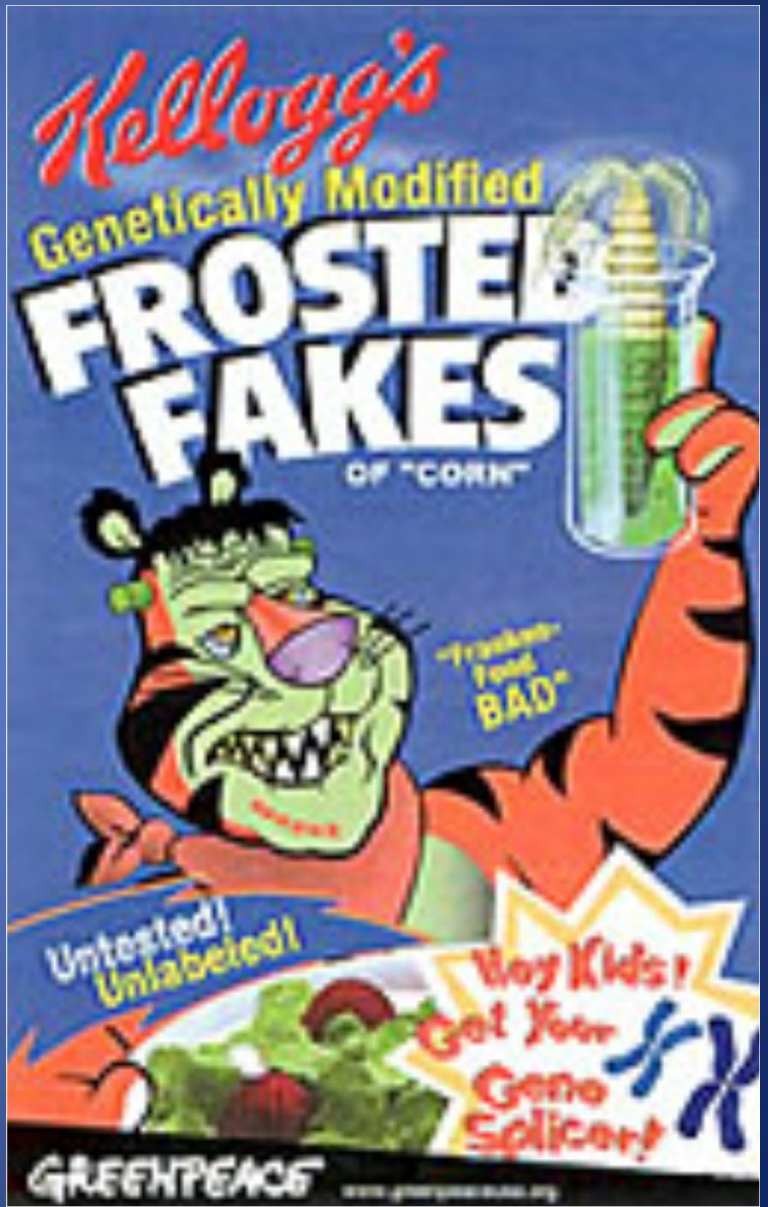
- Chromosome number aberrations alter pairing/separation during meiosis
- Inhibits functional pollen/ovule formation
- Mutations may knock out genes necessary for gamete formation

Sterility through Mutagenesis

- Verbena (4/128 male- and female-sterile)
  (Kanaya et al. 2008)
- Chrysanthemum (89/1200 male-sterile)
  (Broertjes and Dejong, 1984)
- African Nightshade (19/139 male-sterile)
  (Ojiewo et al. 2005)

Why Mutagenesis?

- Not regulated
- Many alterations
- A tried and true method of generating new varieties
- Thousands of horticultural varieties have been created



Research Objectives

Year 1

- Determine Radiation Sensitivity in terms of median lethal dose (LD_{50})
  - Important parameter for applying radiation dose
  - High frequency of mutations without high frequency deleterious mutations

Research Objectives

Year 1

- Measure:
  - Seedling/Sapling Survival
  - Amount of Growth
  - Winter Mortality

Research Objectives

Year 2

- Determine a set of predicted doses likely to induce male/female sterility based on LD_{50}
- Select sterile plants

Species and Propagule Type

Species	Seeds	Unrooted Cuttings	n
Acer platanoides 'Emerald Lustre'	*		3,500
Acer platanoides 'Crimson King'	*		3,300
Acer ginnala 'Compacta'	*	*	12,580
Berberis thunbergii 'Rosy Glow'	*	*	2,170
Berberis thunbergii 'Golden Carousel'		*	1,540
Euonymus alatus		*	800
		Total	23,890

Seed Germination: Seed Trial 1

Acer platanoides ‘Emerald Lustre’, 0 kR

Acer platanoides ‘Emerald Lustre’, 10 kR

Seed Germination: Trial 2

Acer ginnala ‘Compacta’, 0 kR

Acer ginnala ‘Compacta’, 20 kR

Seed Germination

Acer ginnala ‘Compacta’, 10 kR

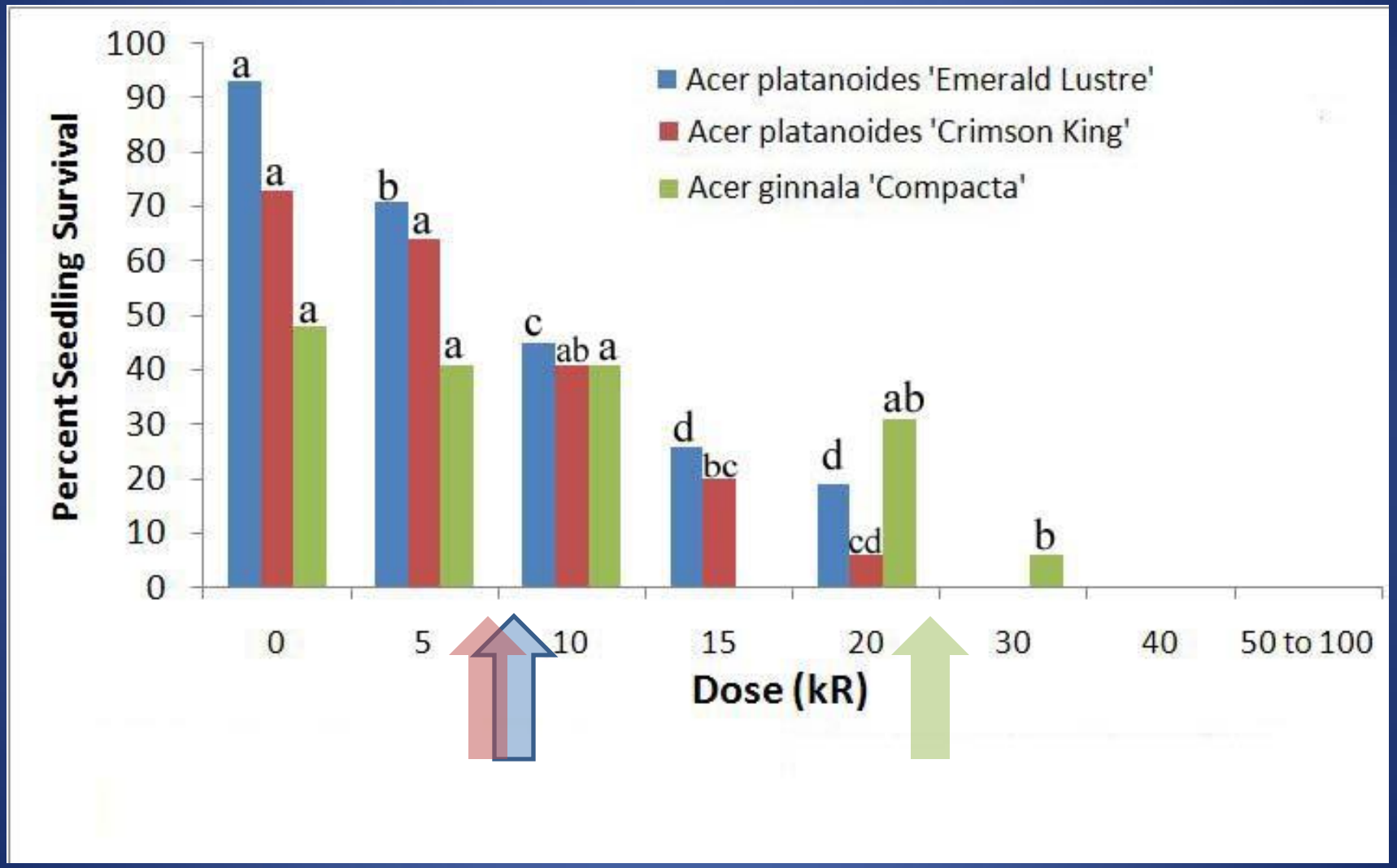
Color/Shape Mutations

Acer

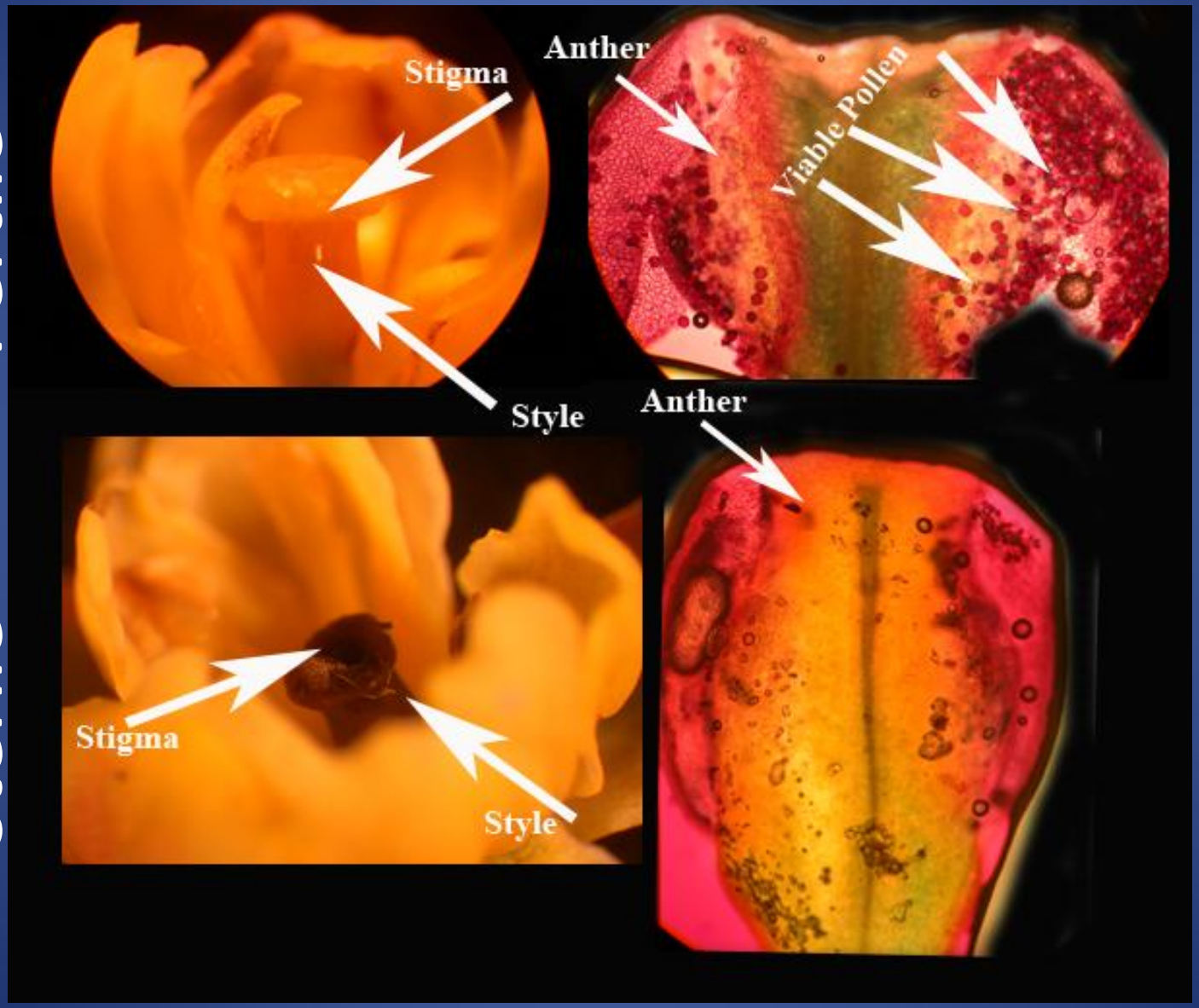
Reduced Size Mutations

Berberis

Seedling Survival: *Acer* species



Possible Sterility



Berberis thunbergii 'Rosy Glow' , 1.7 kR

Plants for Future Selection

Species	Number of Surviving Propagules at or above LD_{50}
Acer platanoides 'Emerald Lustre'	488
Acer platanoides 'Crimson King'	435
Acer ginnala 'Compacta'	1248
TOTAL	2,171

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