2nd Mediterranean Plant Conservation Week
"Conservation of Mediterranean Plant Diversity: Complementary Approaches and New Perspectives"

'Assisted reproduction' as a tool for enhancing fitness and persistence likelihood of threatened plant populations

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Supported by:

Reproductive constraints and Conservation concern

- Pollen limitation
- Inbreeding depression
- Compatible mating

More severe reproductive limitations in small and isolated populations

Journal of Ecology 2006
94, 942–952

ESSAY REVIEW

How general are positive relationships between plant population size, fitness and genetic variation?

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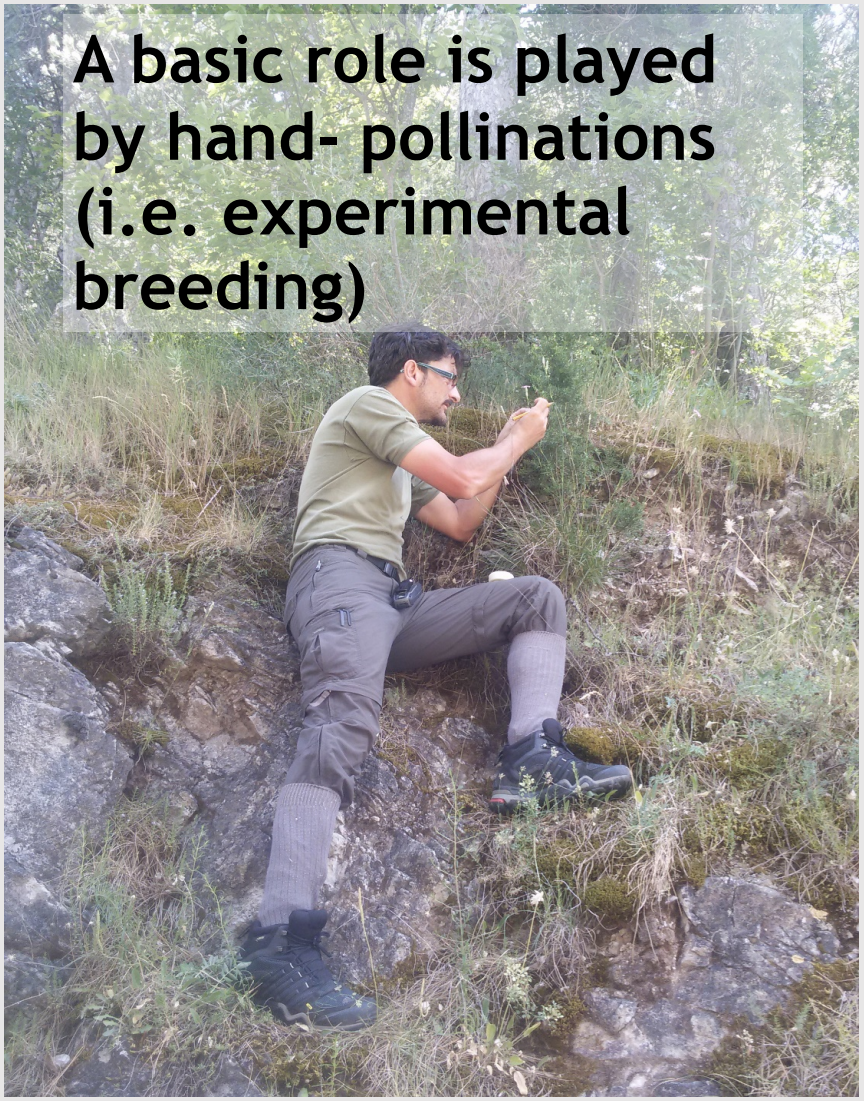
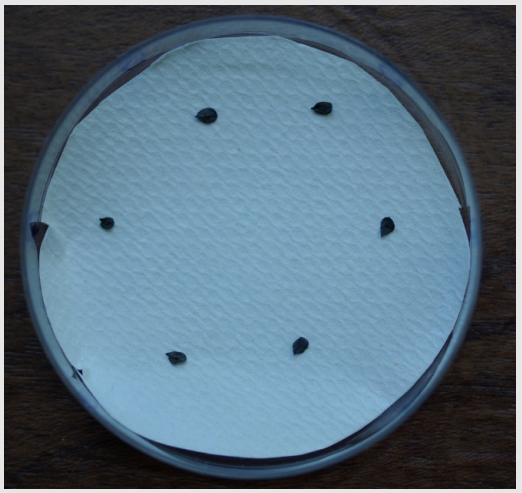
Reproductive restrictions are more likely in target populations for conservation actions

Required measures to restore population fitness

Plant Reproduction Investigation Tools (*PRIT*s)

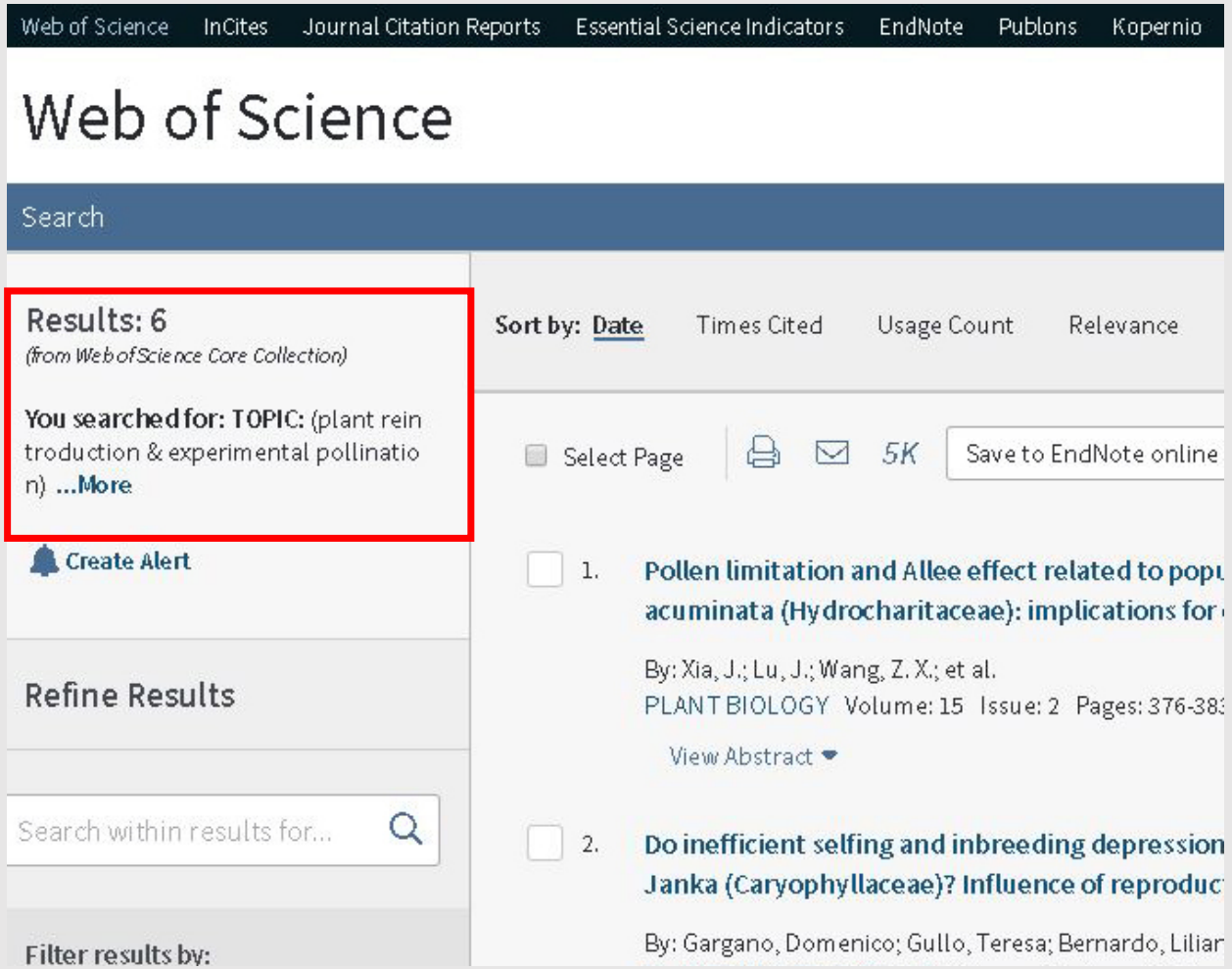
Fitness comparisons among plant lineages





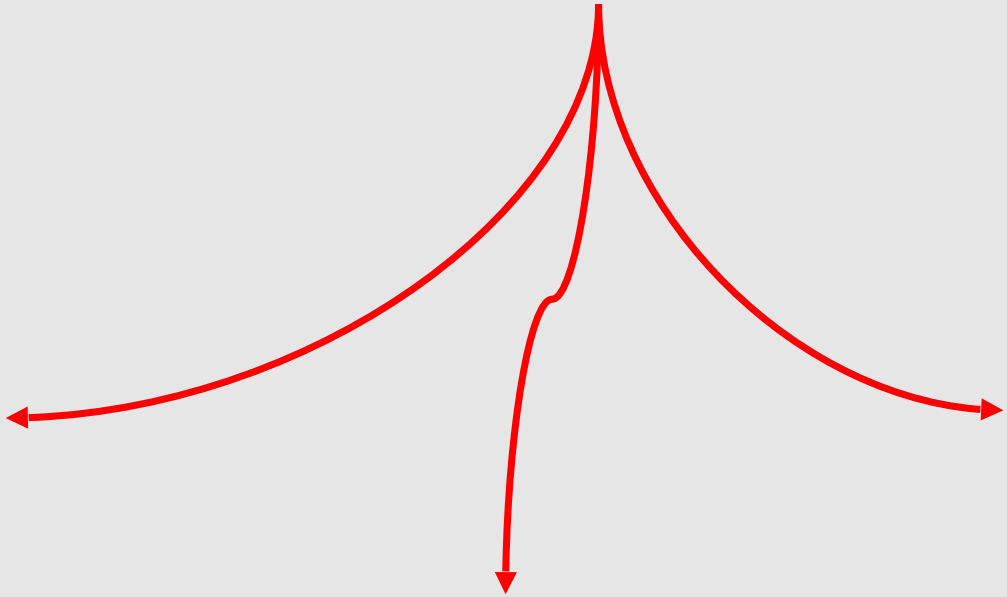
Commonly used in population biology studies

Not routinely integrated in conservation practices…..



….but their usefulness is widely encouraged [*Maschinski et al. 2013*; *Orsenigo et al. 2017*]

Integrating *PRIT*s in population restoration programs as a form of 'assisted reproduction'



1) Investigating and restoring pollination efficiency within target populations

2) Evaluating the potential for fitness improvement of intra-population assisted mating

3) Evaluating the potential for fitness improvement of inter-population assisted mating

Applying ‘assisted reproduction’ to rare *Dianthus* species

D. balbisii Ser.

- Rare in C-Mediterranean
- Conservation Status: NE
- Major threats: Locally threatened by habitat dynamics and urbanization, increasing fragmentation.

D. guliae Janka

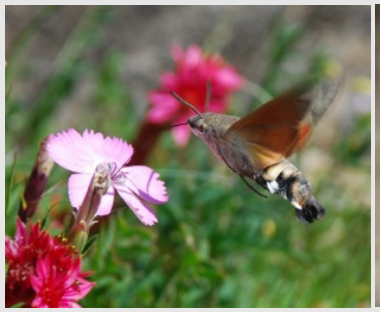
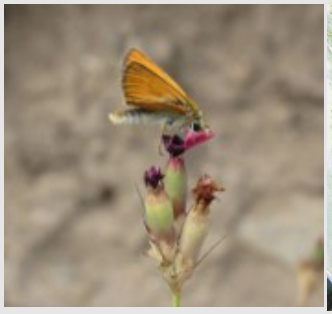
- Endemic to Italian peninsula
- Conservation Status: EN
- Major threats: Occurrence in small and fragmented populations, Habitat changes, Declining EOO, AOO

Biological & Ecological Remarks

MATING SYSTEM
- PROTERANDRY
- MALE-STERILITY
- SELFCOMPATIBLE BUT LIMITED SELF-FERTILIZAT



POLLINATION SYSTEM
- GENERALIST, INVOLVES MOTHS, BUTTERFLIES, AND FLIES


HABITAT
- EDGE-SPECIALISTS TYPICAL OF BORDERS BETWEEN WOODY AND OPEN PATCHES AT LOW/MIDDLE ELEVATION



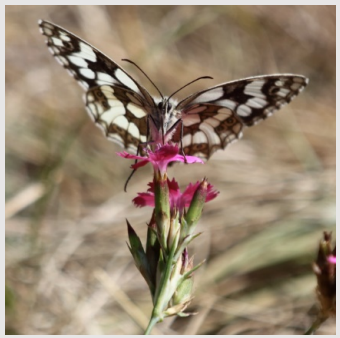
1) Using *in situ* 'assisted reproduction' to evaluate and buffer habitat-driven fitness loss in *Dianthus balbisii*

Increasing canopy closure

Little efficient pollinators

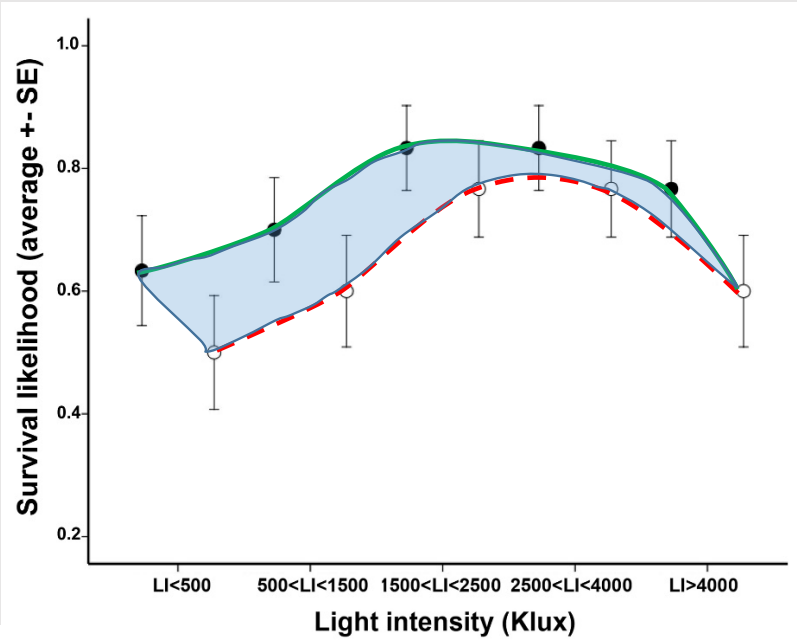
Highly efficient pollinators

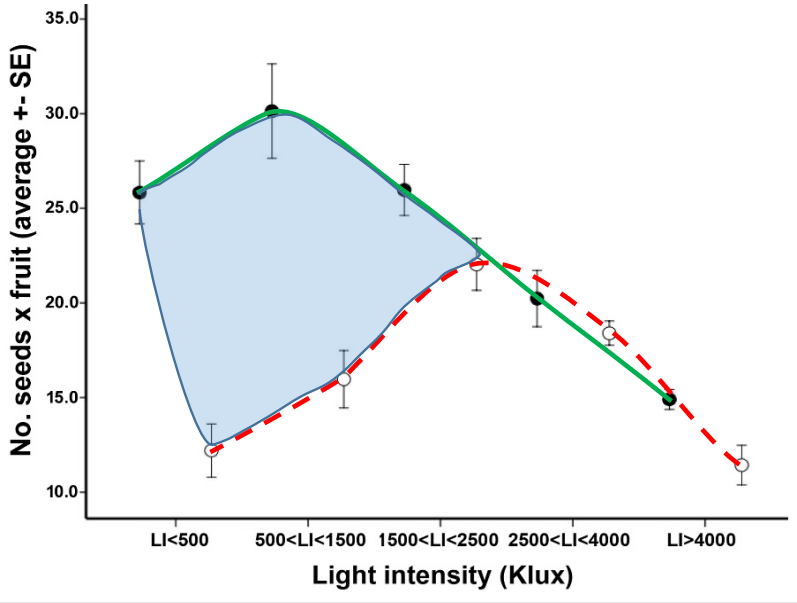
Middle efficient pollinators



-Qualitative and quantitative fitness loss with increasing canopy cover
-Hand-cross pollinations help in filling fitness gaps over the habitat gradient

[*Gargano et al., 2017, AoBPlants*]





2-3) Using intra- and inter-population assisted mating for restoring a threatened population of *Dianthus guliae*

‘Assisted reproduction’ to optimize fitness by local mating

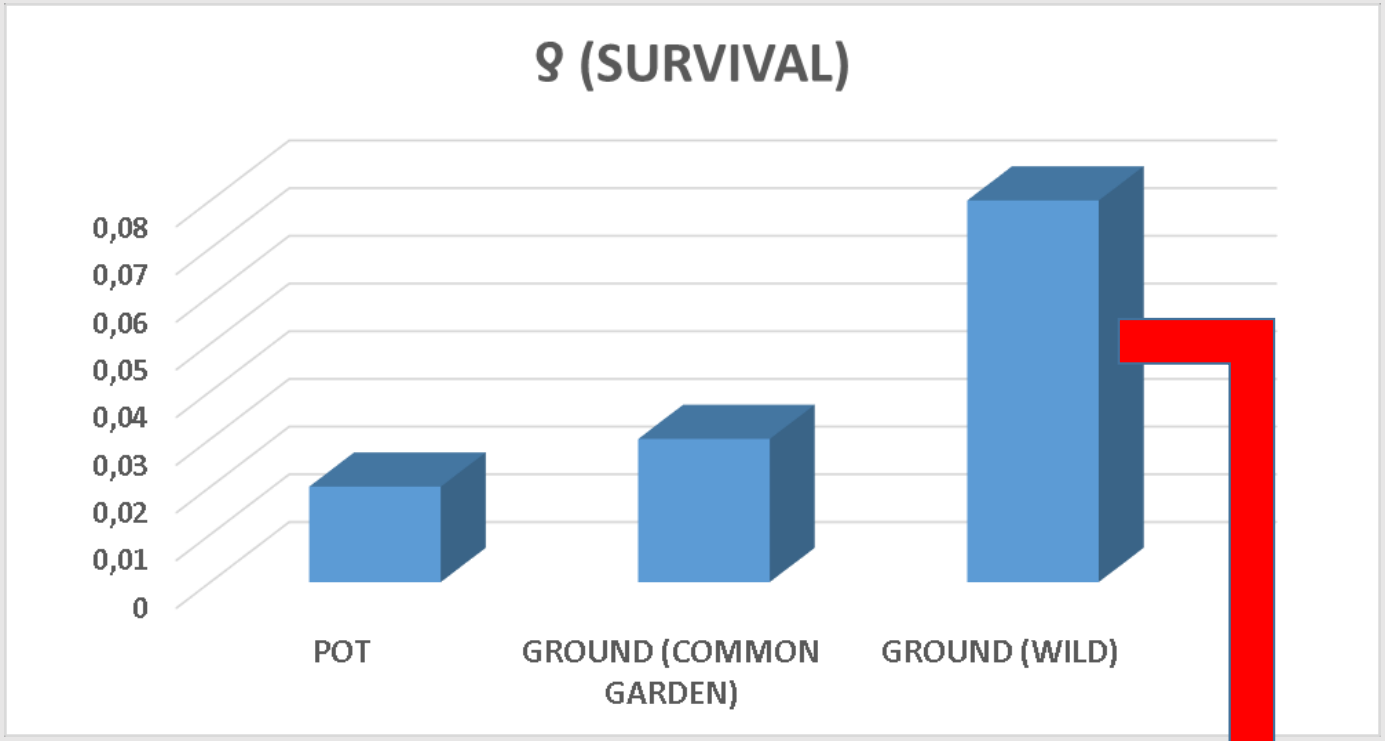
Very high initial mortality with further peaks in later life stages

High initial mortality, then it becomes constantly low

The fraction of plants reaching flowering is much higher in the outbred lineage

Mortality patterns in lineages of *Dianthus guliae* obtained by inbreeding (upper side) and cross-fertilization (lower side) from a very small population.

[*Gargano et al., 2011, Plant Biology*]



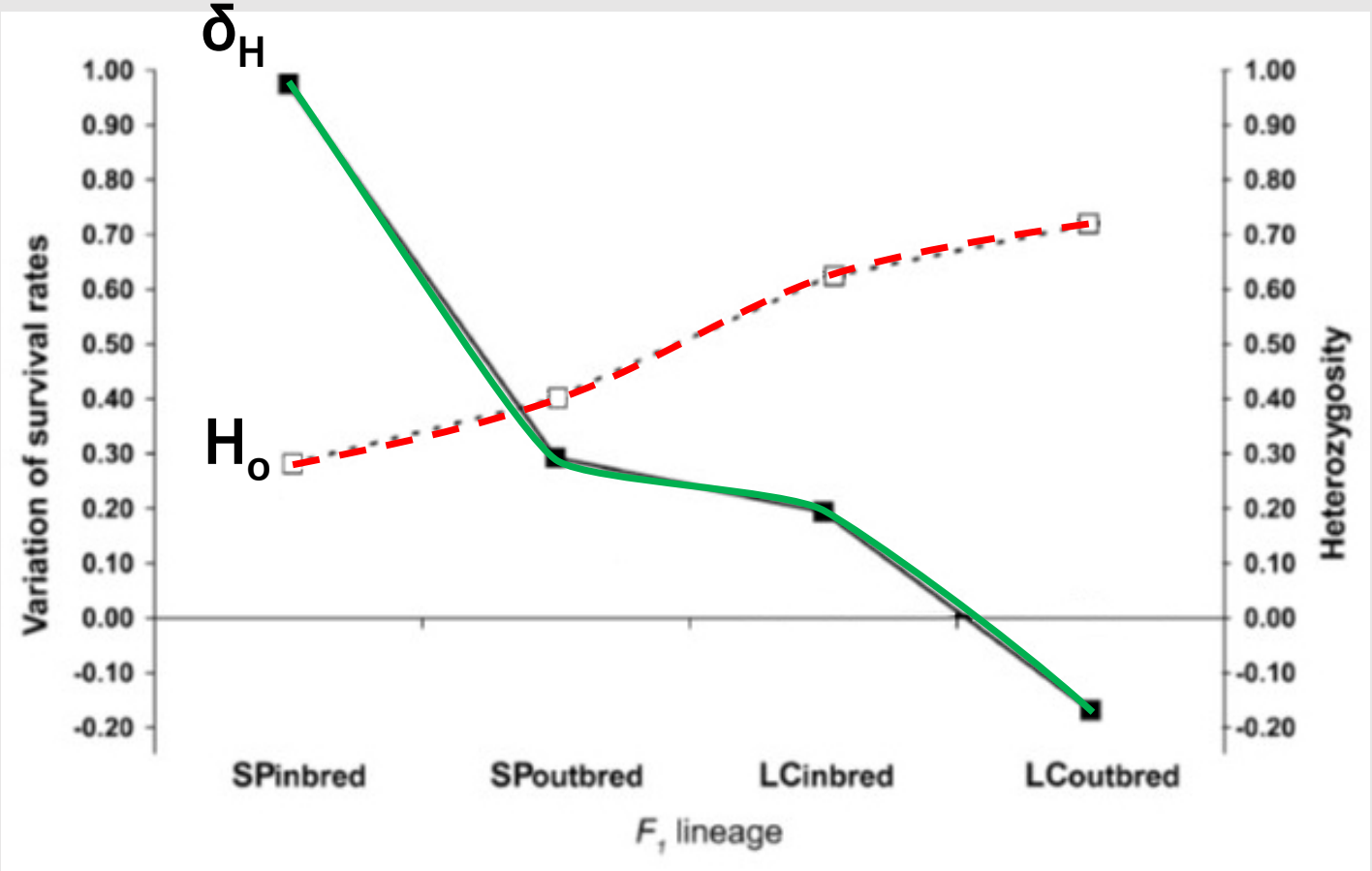
The fitness gap between inbreed and outbred progenies augments across cultivation protocols simulating increasing ecological harshness.

[*Gargano et al., 2011, Plant Biology*]

Using experimentally crossed offspring would augment chances of success of a reinforcement program.

‘Assisted reproduction’ to evaluate benefit of inter-population mating

Fitness differences among 4 lineages of *Dianthus guliae*, from 2 source population, subjected to crossing within-population and crossing between population

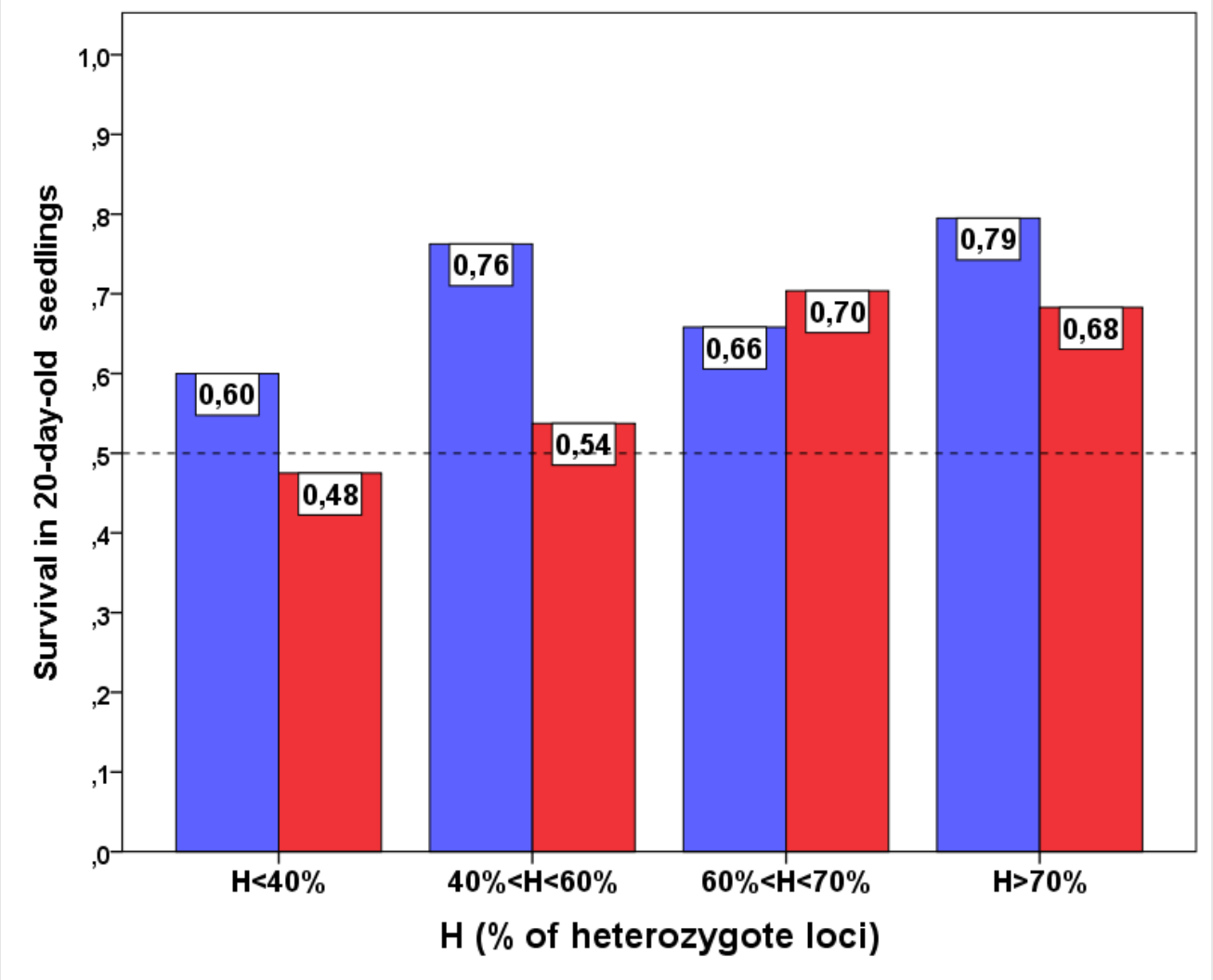


[*Gargano et al., 2015, Conserv Genet*]

Inter-population ‘Assisted mating’ to reduce ‘future maladaptation’

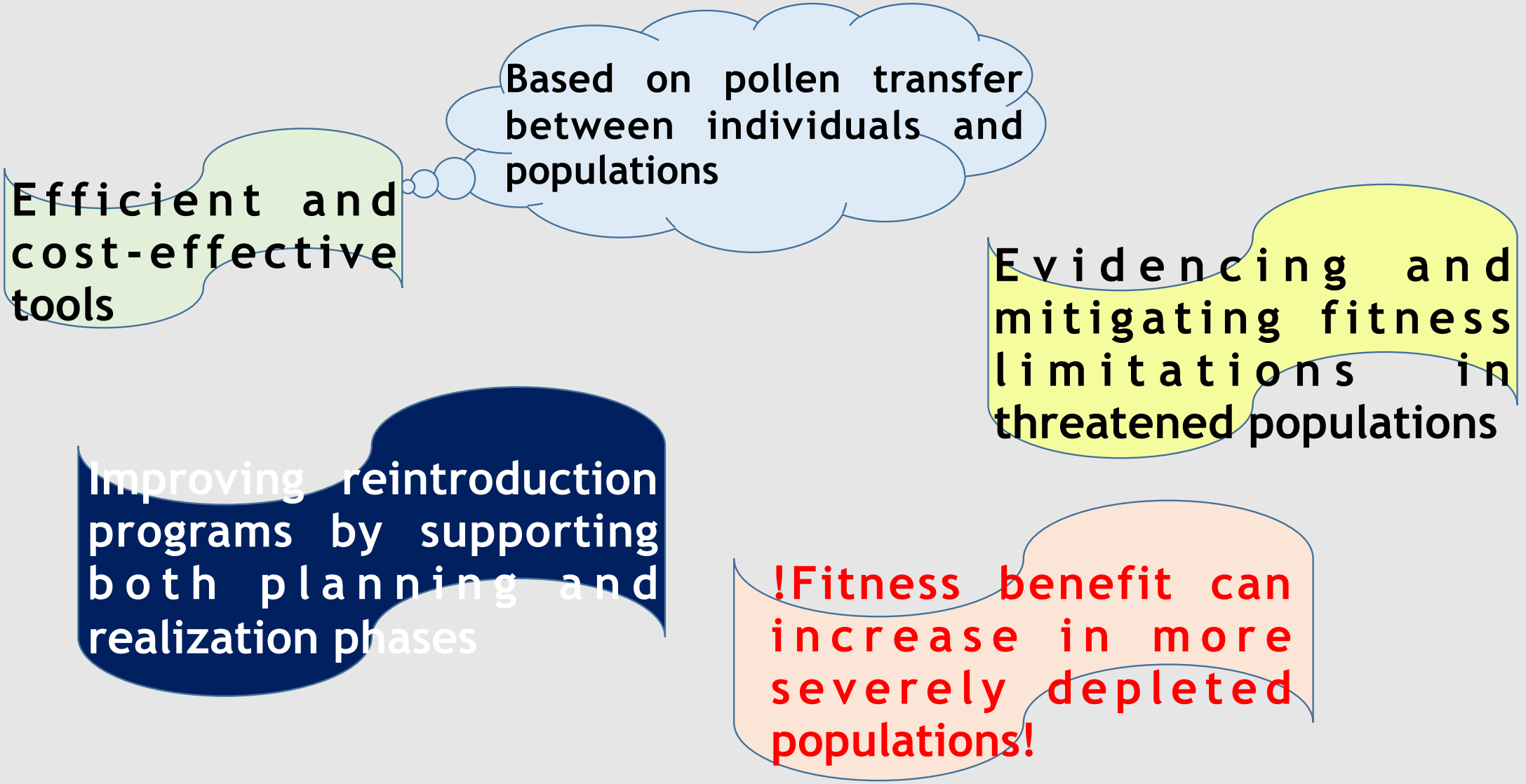
Early survival rates in lineages of *Dianthus guliae* obtained from different models of within- and between-population pollinations, showing different heterozygosity and experimentally subjected to a different aridity stress.

[*Gargano et al. in prep.*]



Blue bars: wet scenario; Red bars: dry scenario

Why use ‘assisted reproduction’ in conservation practices




THANK YOU