

# Experimental crosses provide insight into the potential risk of genetic extinction of *Populus nigra* L.

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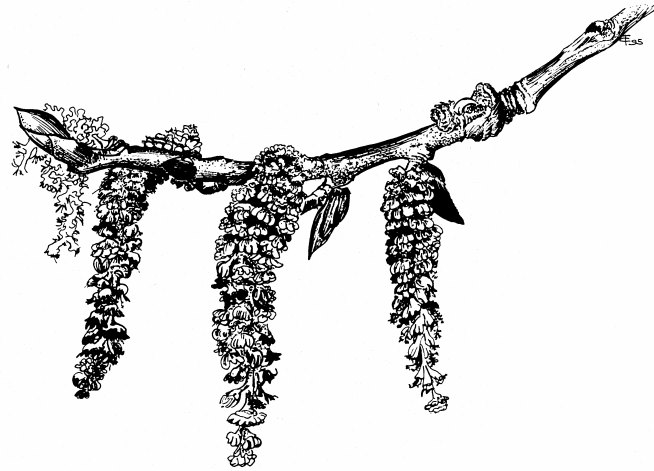
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# Rare species



*“interspecific gene flow is perhaps the greatest gene flow hazard in plant conservation genetics”*

*Ellstrand (1992, Oikos 63, 77-83)*

# Risk of Genetic Extinction

- Sympatry with congeneric species
- Degree of reproductive compatibility
- Congener populations: numerically larger or reproductively more effective

# The rare species: *Populus nigra* L.

- syn. European black poplar
- native in Europe, northern Africa and Central and West-Asia
- dioecious
- obligatory outcrosser
- wind-pollinated
- threatened tree species



# The congener:

*P. x euramericana* (Dode) Guinier.



- syn. *P. x canadensis* Moench.
- cross between *P. deltoides* x *P. nigra*
- woodproduction
- narrow genetic base

# Aim

- fitness of *P. x euramericana*
- processes that affect hybridization
- effects of hybridization on natural *Populus nigra* resources

# Method

- Experimental study: controlled, hand-pollinated crosses with pollen mixes
- Observational field study: seed set and hybrid formation

## 2. Hand pollinations

♀ \ ♂	DN	N	DN + N	DN + N24
N	15	14	14	11
DN	7	7	8	

N: *Populus nigra*

DN: *Populus x euramericana*

## 2. Hand pollinations (2)

### Reproductive capacity

- *in vitro* pollen germination
- seed set & seed viability
- hybrid formation
  - paternity analysis of progeny with SSR-markers











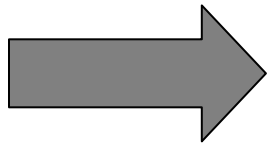
# 3. Field observations

- Collection of half-sib open pollinated (OP) progenies
  - 9 *P. nigra* females
- Collection of poplar seedlings on river banks
  - 29 seedlings



# Results of field study

- Alleles of *P. deltoides* in OP offspring
- cpDNA: seedlings originating from hybridization N x DN



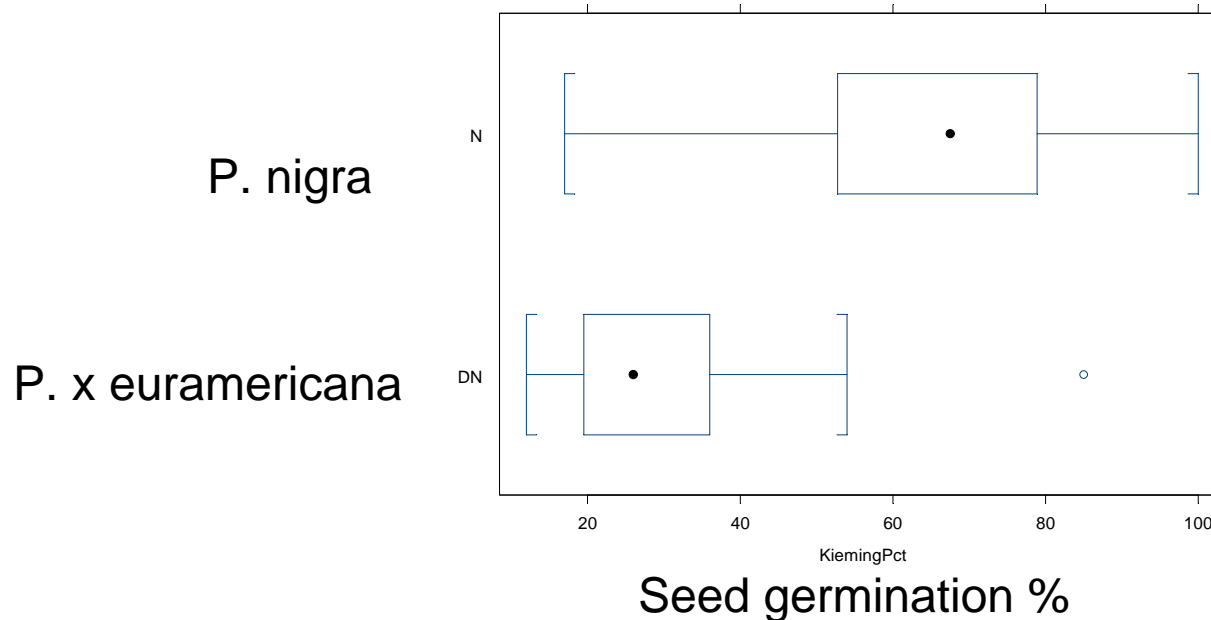
Natural hybridization between  
♀ *P. nigra* and ♂ *P. x euramericana*

# Results: Pollen viability

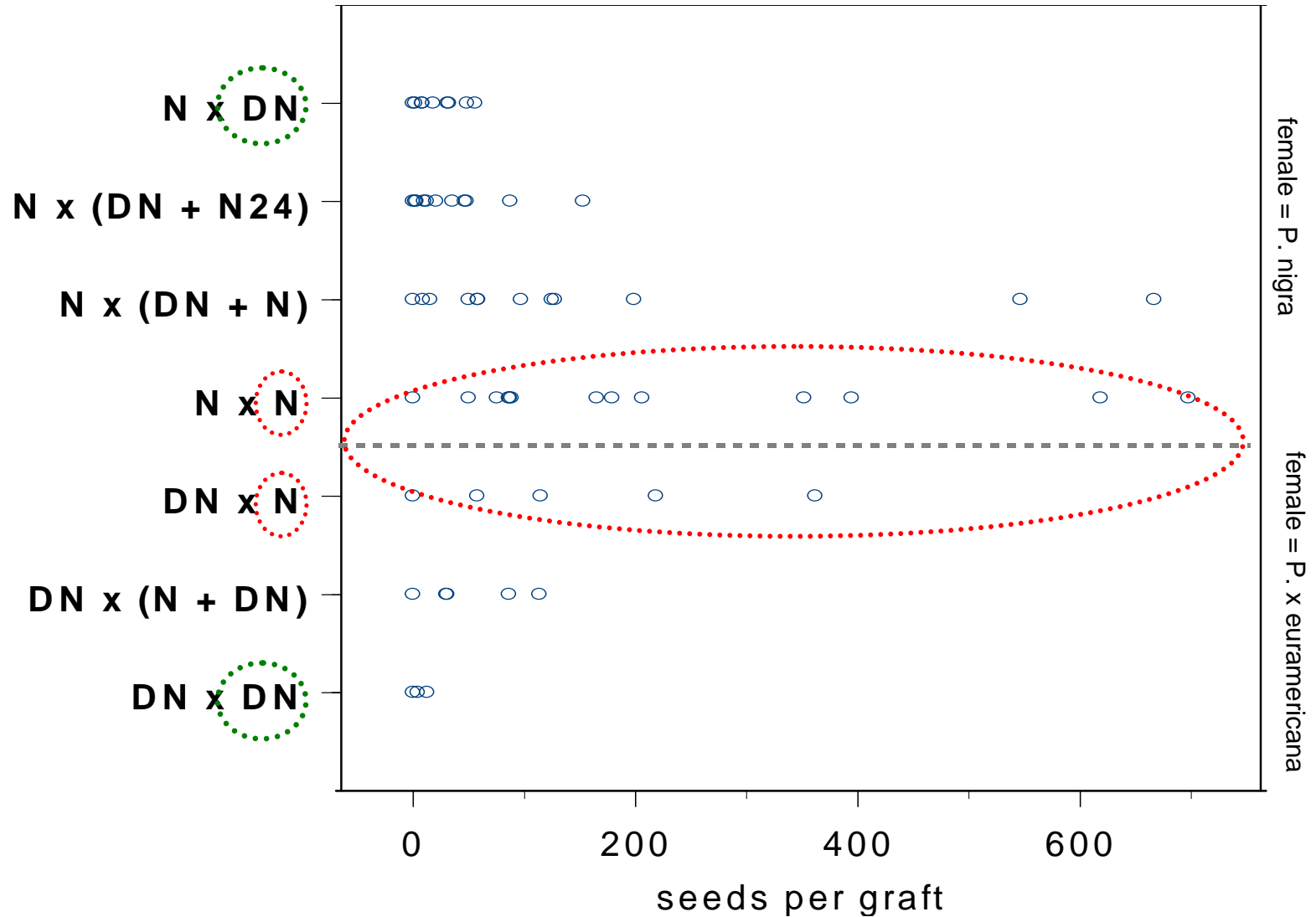
## Pollen viability

Hybrid pollen lower germination %

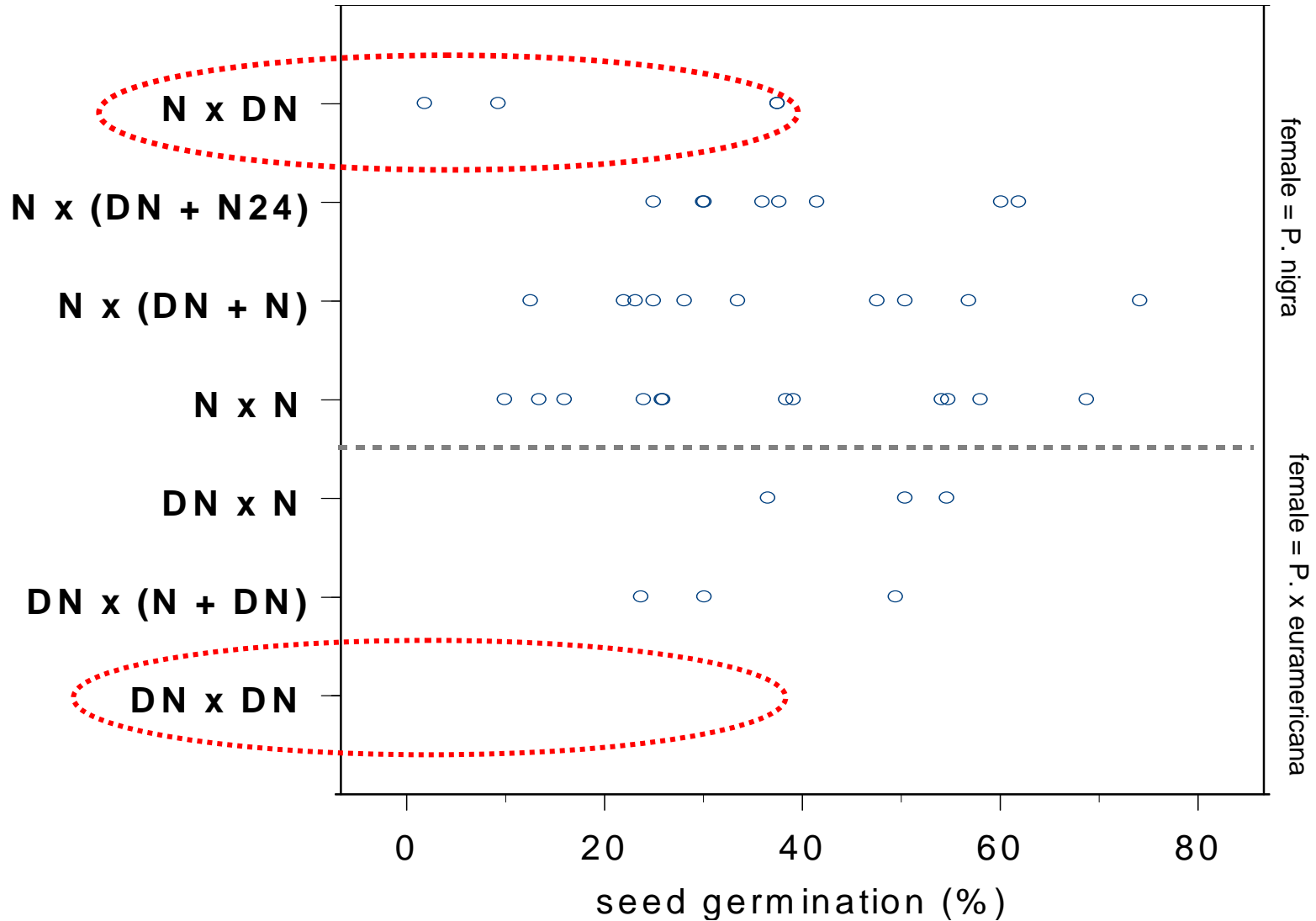
(wilcoxon rank sum test  $Z = -2.6416$ ,  $p\text{-value} = 0.0083$ )



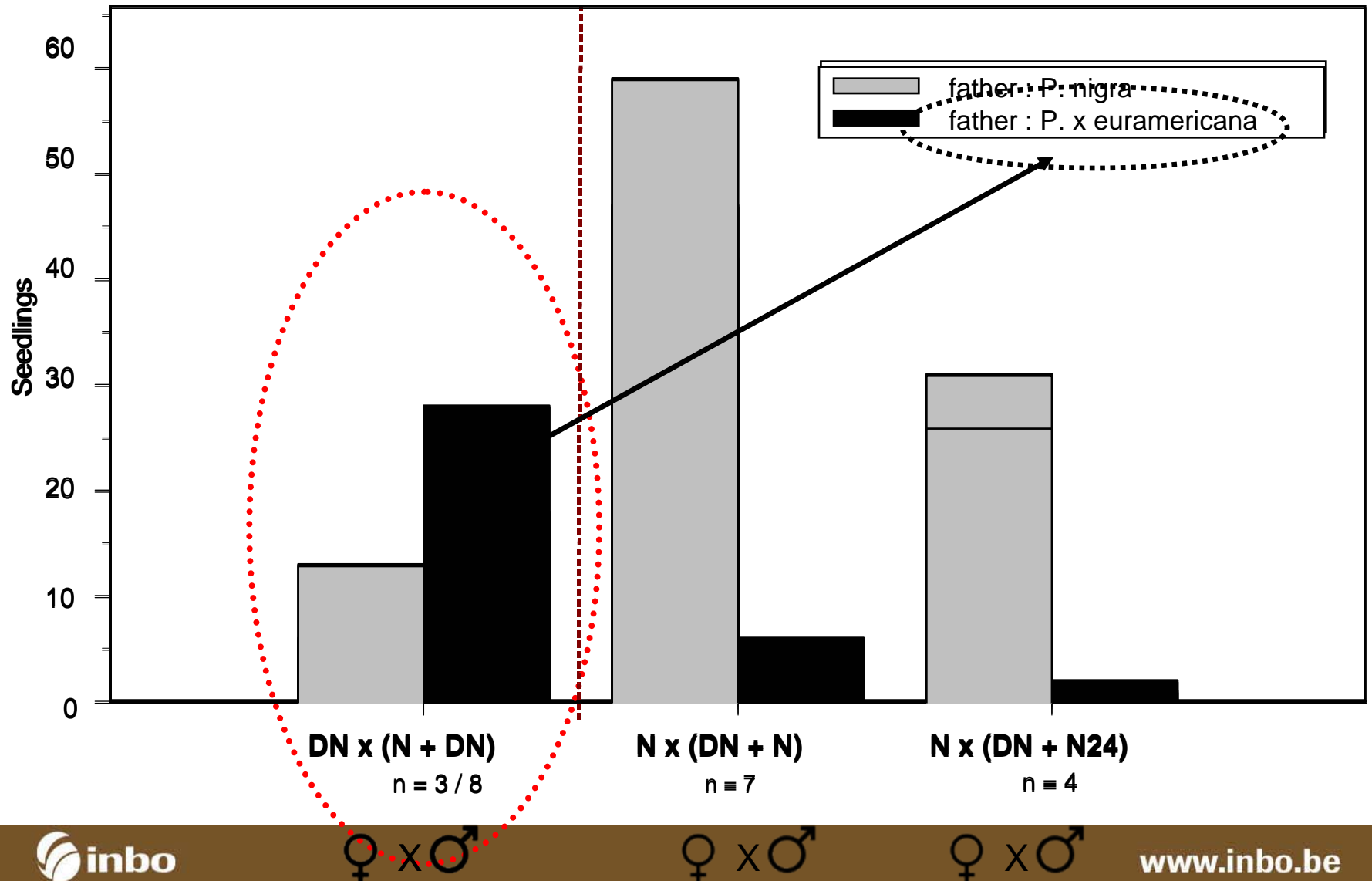
# Results: seed set



# Results: seed germination



# Results: paternity analysis



# *P. nigra as the female parent*

- DN pollen: few seeds / seedlings
- N-pollen: seeds & seedlings
- DN + N:
  - N pollen has advantage
  - Seed set reduction (although not significant)  
Seeds  $N \times DN < N \times (DN + N/24) < \text{seeds } N \times (DN + N)$


# *P x euramericana as the female parent*

- DN pollen: no viable seeds / seedlings
- N-pollen: seeds & seedlings
- DN + N: DN pollen perform significantly better on its own flowers

# Reproductive mechanisms

- Viability of pollen
- Interaction of pollen
  - P. nigra*: N pollen have an advantage
  - P. x euramericana*: N pollen help DN pollen
- Embryo abortion
  - when hybrid pollen are used in a mix

# Conclusions

- Gene flow mainly unidirectional  
*P. x euramericana* as the female parent
- use of pollen mix of different species  
can help to overcome reproductive  
barriers  
 application in breeding

# Consequences for conservation

risk for dispersal of hybrid genes  
particularly from

- seeds
- females of *P. x euramericana*
- mixed (males + females) hybrid plantations

When located closed to natural black poplar resources

# Consequences for conservation

Also without dispersal of genes, hybrid plantations may effect the viability of natural black poplar resources



- reduction of seed set
- waste of reproductive effort

# Transgenic poplars

## Implications for transgene flow

- Gene flow is complex
- GM-poplars with reduced fertility:  
interaction with natural poplar resources  
can result in transgene-flow

# Acknowledgements

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Thank you for your  
attention!