



The evolution of dispersal during the invasion process

Opportunity for research and implication for management

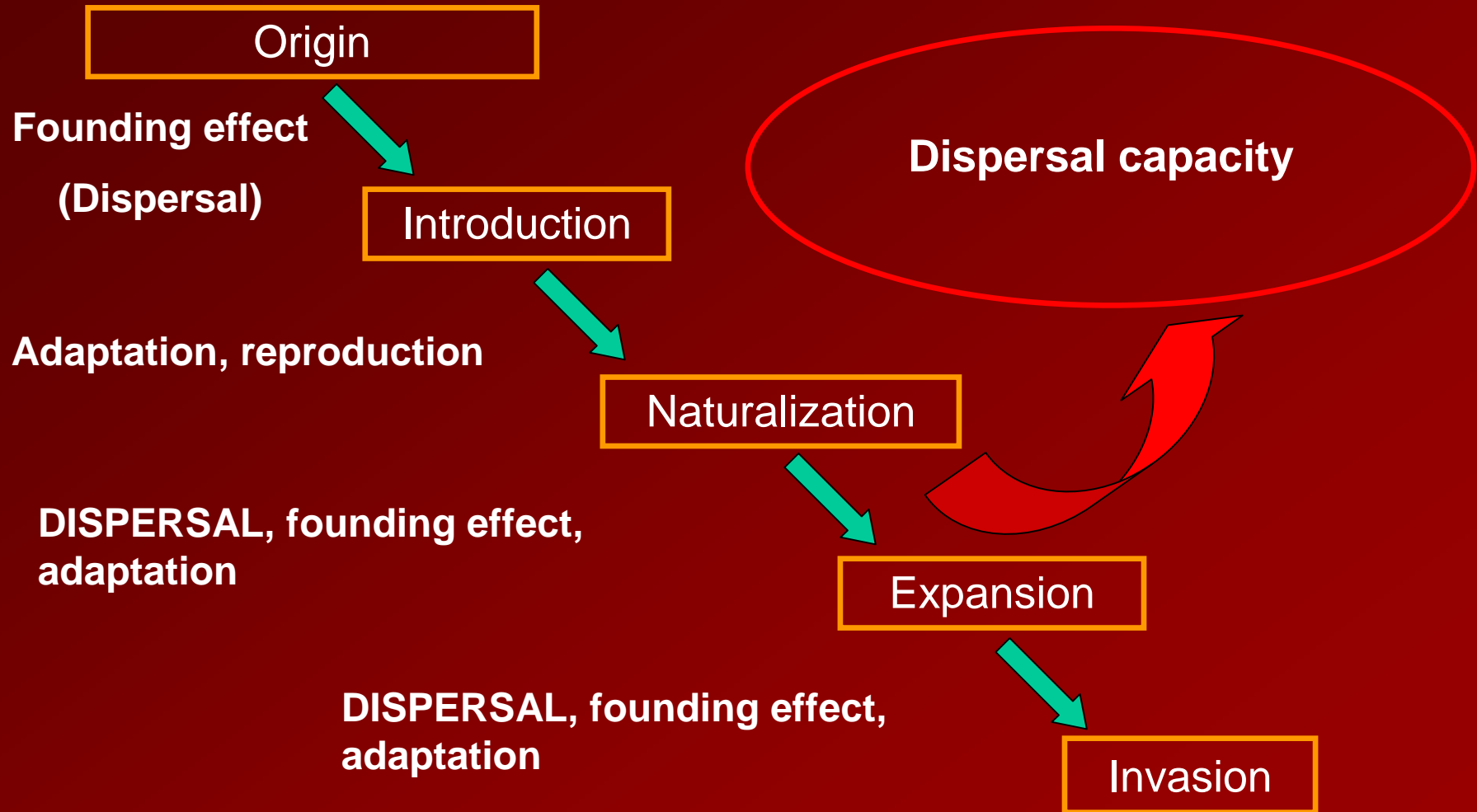
MAHY G.

INPLANBEL

Laboratoire d'Ecologie

FUSAGx

Dispersal and invasion



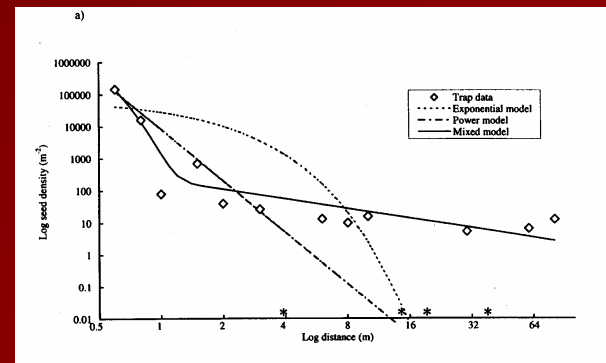
Dispersal : an interaction species traits - landscape

POPULATIONS / SPECIES

Propagules production



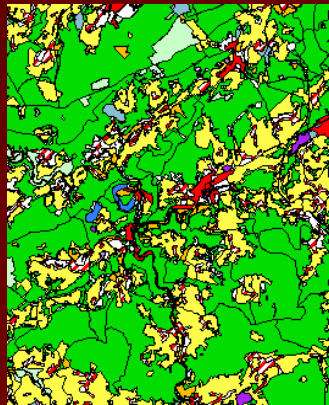
Dispersal capacity



Static
or
evolving
traits ?

LANDSCAPE

Habitat spatial structure

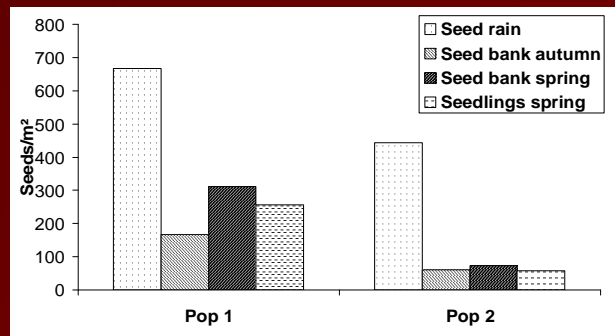


Metapopulation dynamics
Realized dispersal

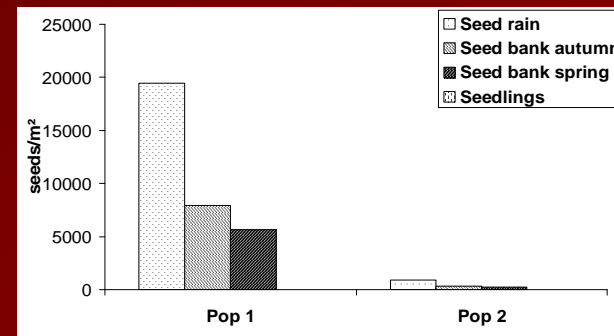
Propagule production : the basic information

Seed demography
Seed rain
Seedbank
Seedlings

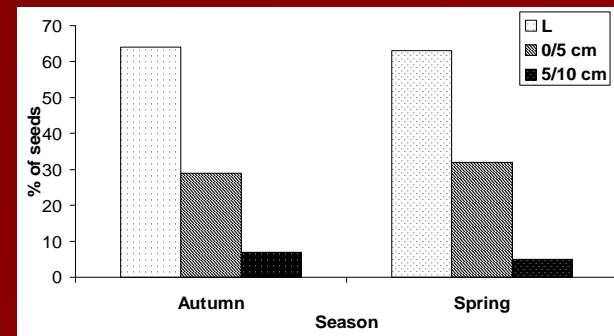
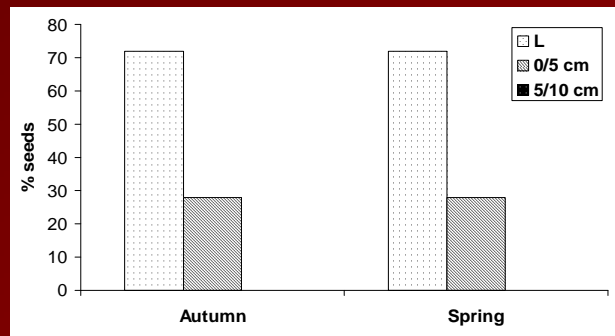
H. mantegazianum



S. inaequidens



Distribution of seeds in relation to depth in the seed bank



Germination

62 % 15 w. cold humid conditions

76 % for fresh seeds

Need stratification
Lost of seed viability after seed drying
Transient seed bank

No dormnacy
High germination rates
Short-term persistent seed bank

Propagule production : a fixed trait for invasion risk assesment ?

Restoration of seed production in *F. japonica* trough hybridization

A new dimension for dispersal ?

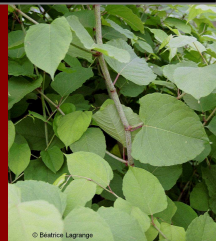


Male sterile
No pollen - No seed
Vegetative propagation



Hermaphrodite
Viable pollen
Rare

F. X bohémica



Hermaphrodite
Viable pollen
In expansion

	Mean pollen/flower	Mean pollen viability (%)
<i>F. japonica</i>	0.1 (0.4)	0.0 (0.0)
<i>F. sachalinensis</i>	9.2 (13.7)	0.0 (0.0)
<i>F. sachalinensis</i>	7689.0 ^{a b}	79.9 ^a
<i>F. xbohémica</i>	3643.4 (2284.4) ^a	21.3 (10.8) ^b
<i>F. baldschuanica</i>	17208.3 (3611.6) ^b	7.9 (1.4) ^c

Tiébré MS., Mahy G., unpublished

Propagule production : a fixed trait for invasion risk assesment ?

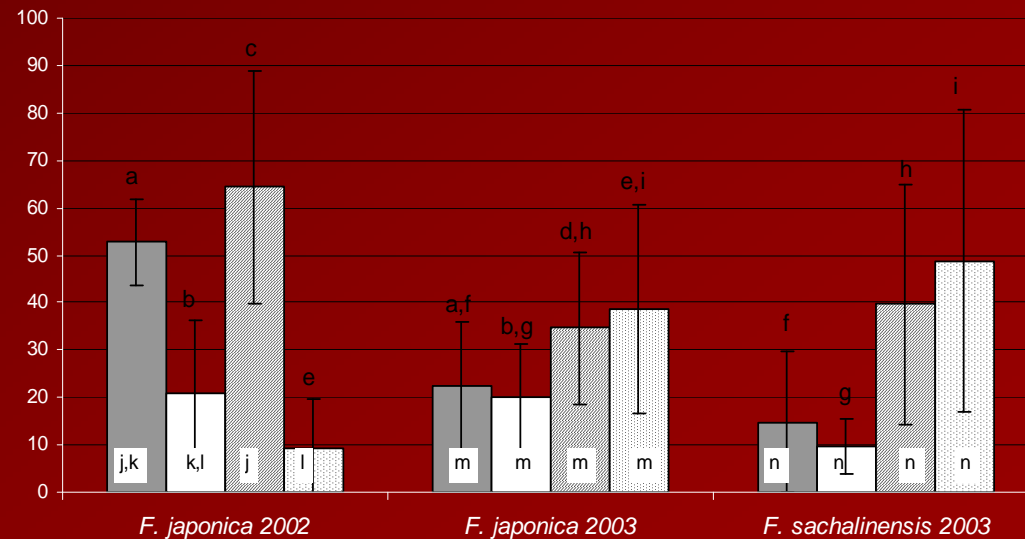
Restoration of seed production in *F. japonica* trough hybridization

A new dimension for dispersal !

Seeds / clone
482.712
(46000 – 1768000)

Seeds / m² (production)
1944
(287 – 3774)

Compost-greenhouse Laboratory
Compost-wintering Laboratory + cold period



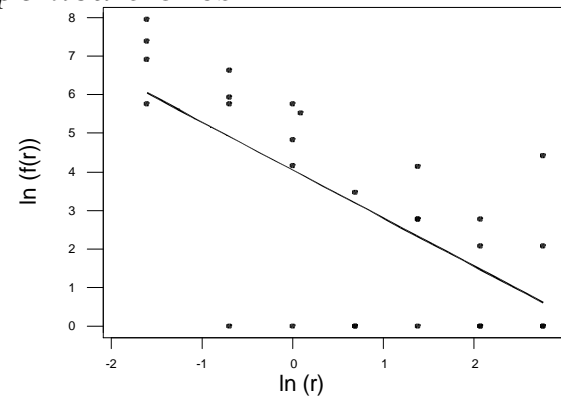
Germination rates of *F. japonica* seeds in various treatments

Tiébré MS., Vanderhoeven S., Mahy G., unpublished

Propagule dispersal : How far ?



Seed density as a function to distance from *F. japonica* clones

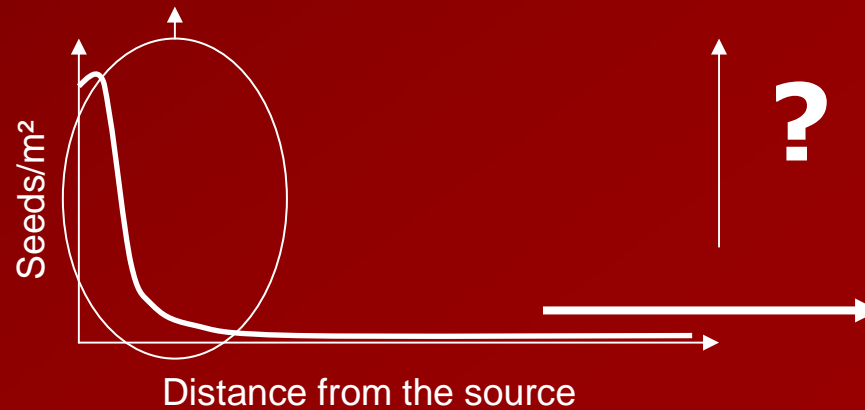


Tiébré MS., Mahy G., unpublished

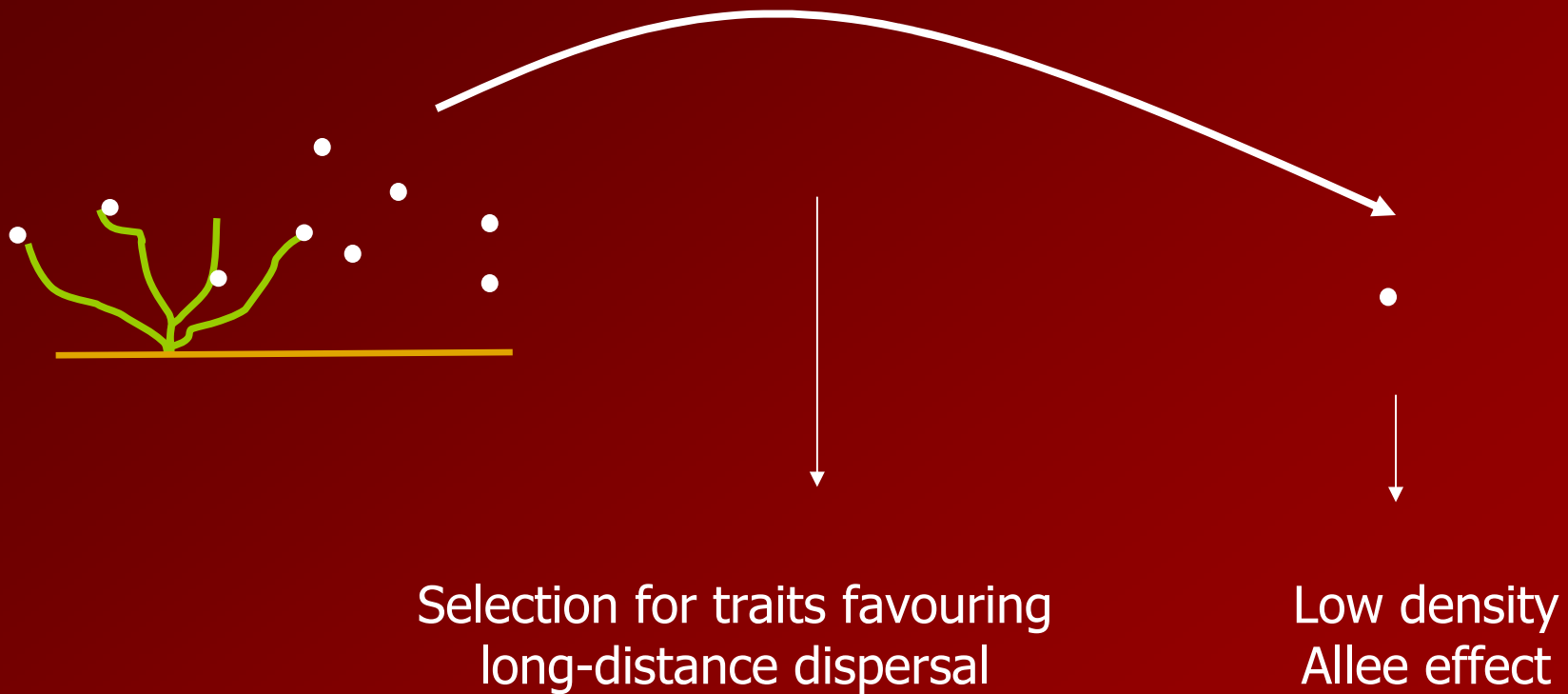


Near dispersal
(structured group of populations)

Long distance dispersal
(new foci of invasion)



Propagule dispersal : a fixed trait for invasion risk assesment ?



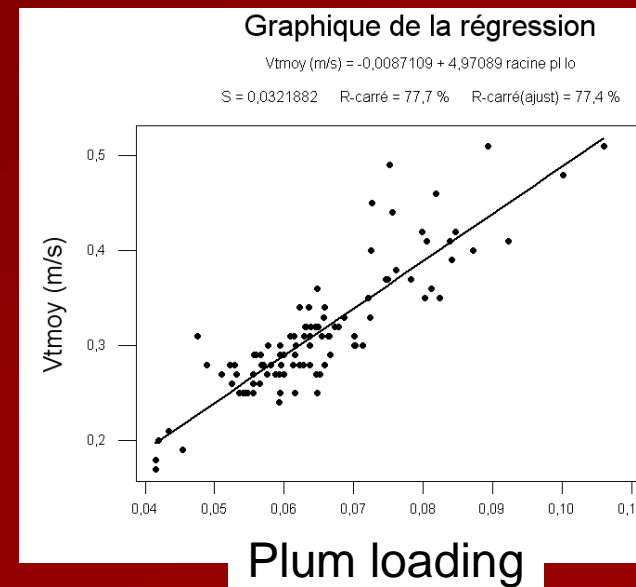
Propagule dispersal : A pragmatic approach

Proxi - traits

Terminal velocity
(VT)

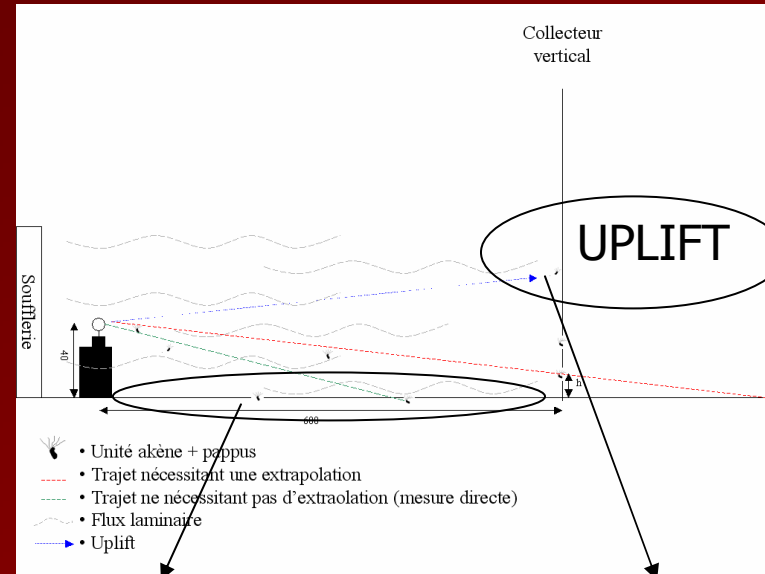


Trait proxi	% VT explained
Total weight	12,8
Seed diameter	NS
Seed length	NS
Seed mass	38,9
Pappus diameter	42,1
Diam. Pappus/Diam. Seed	17,5
Plum loading	77,4



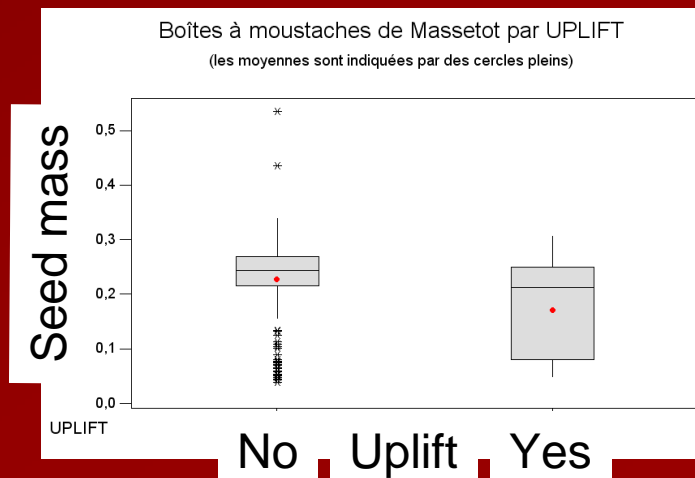
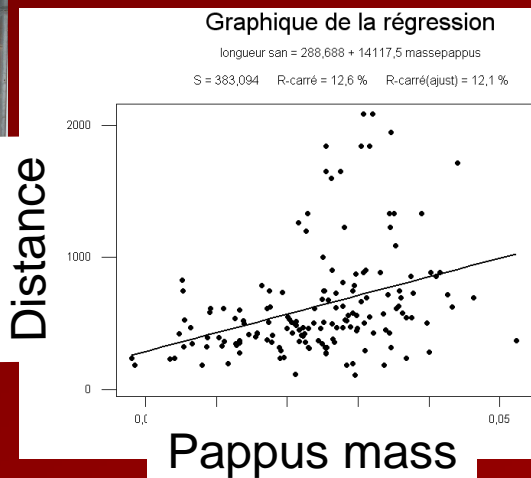
Propagule dispersal : A pragmatic approach

Proxi - traits



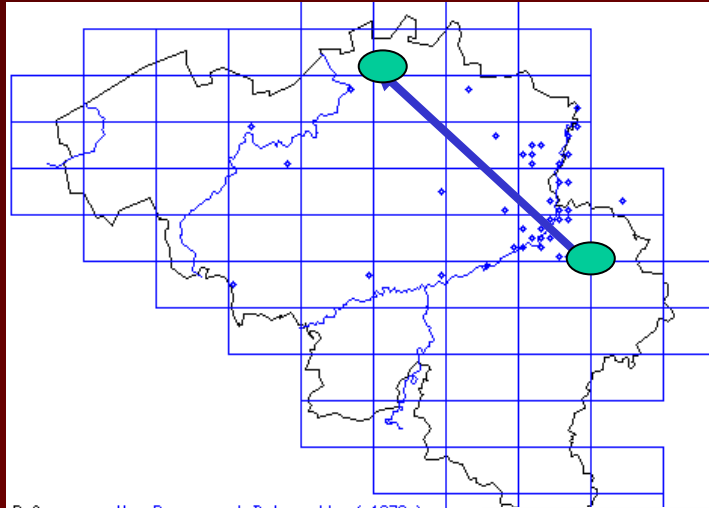
Near dispersal
(structured group of populations)

Long distance dispersal
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Propagule dispersal : a fixed trait for invasion risk assesment ?

Dispersal traits evolution in an invading species ?

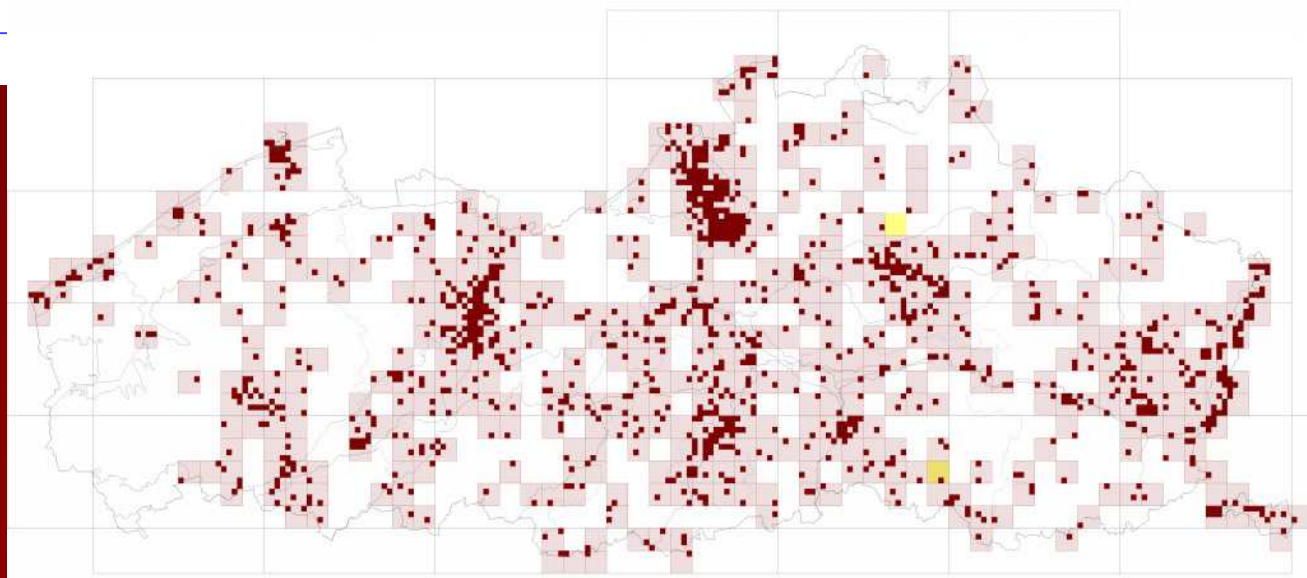


1040 - *Senecio inaequidens* DC.

- 1972



- 2002



Propagule dispersal : a fixed trait for invasion risk assesment ?

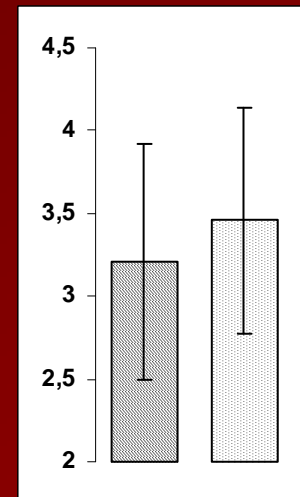
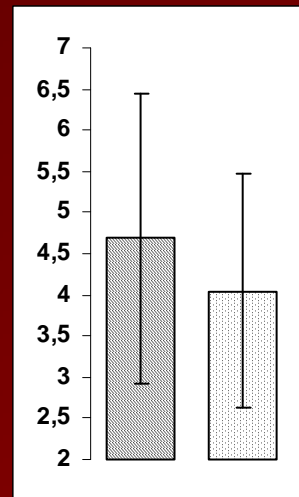
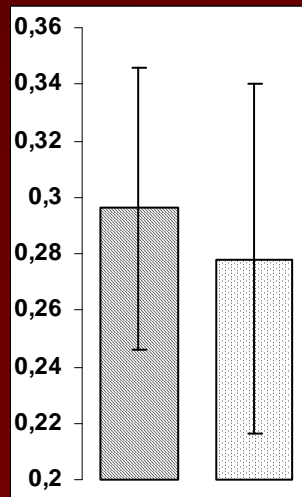
Uplift

Distance

Seed mass

Plum loading (x100)

Terminal velocity⁻¹



Population

Front

Origin

Population

NS

NS

NS

Individuals

*

*

Capitulum

NS

NS

Position

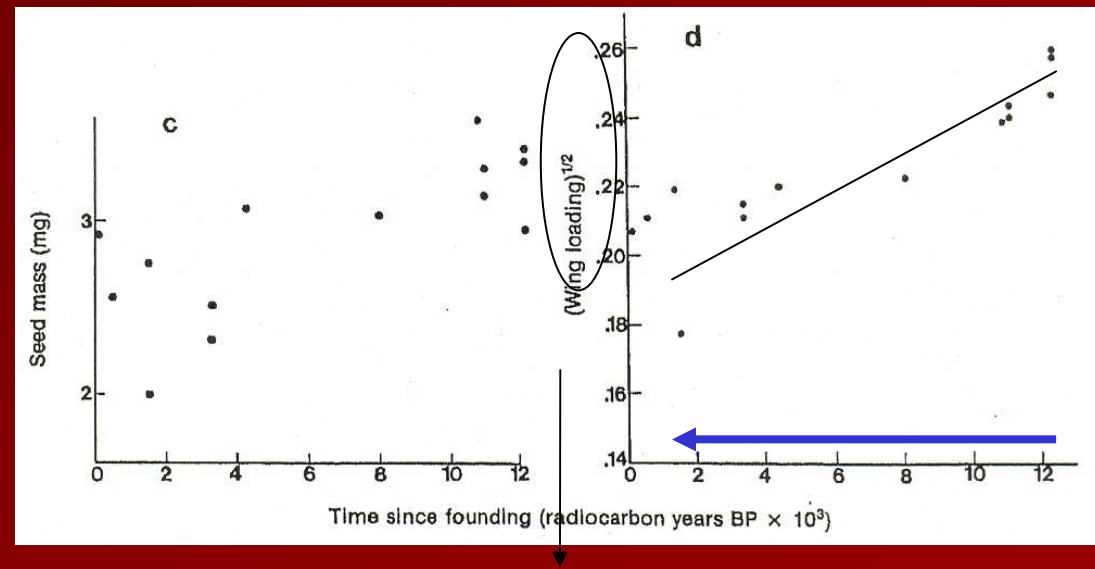
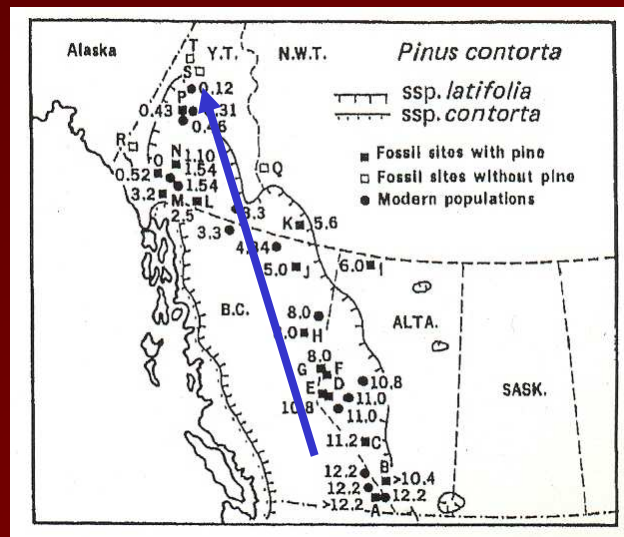
on

capitulum

Propagule dispersal : a fixed trait for invasion risk assesment ?

Indirect evidences Selection for dispersal traits during post-glacial recolonization

Pinus contorta ssp. *latifolia*



$$(\text{seed mass} / \text{wing area})^{1/2}$$

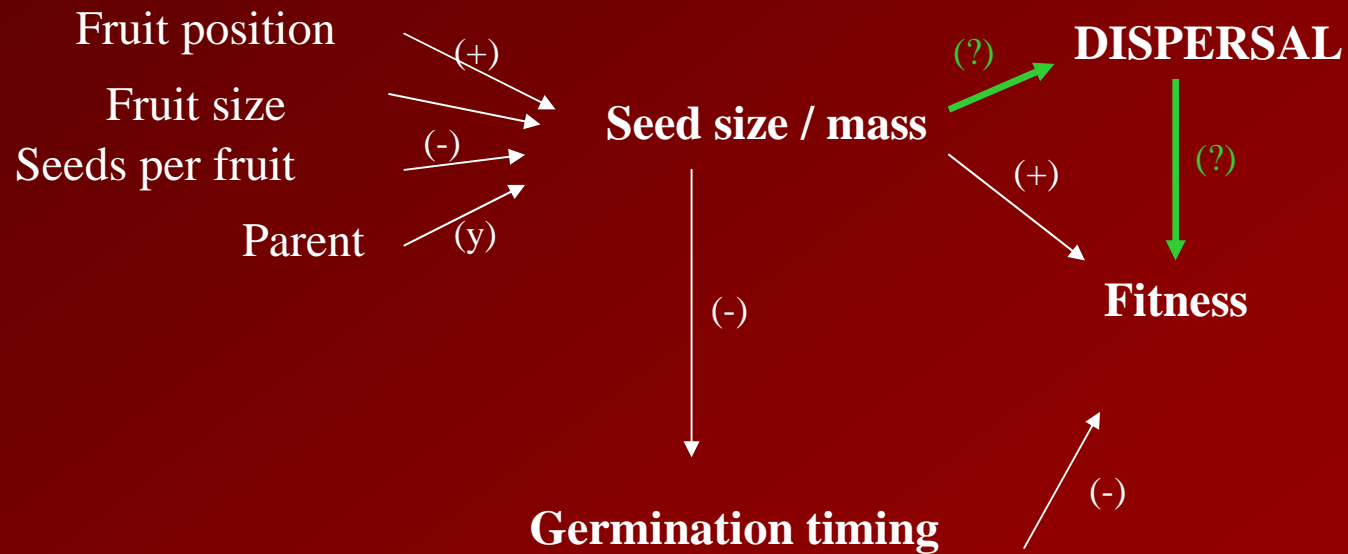
Populations at colonisation front exhibit better dispersal capacities

From

Cwynar & MacDonald. 1986. *Am. Nat.* 129 : 463-469..

La dispersion au cœur des histoires de vie

Issue depending also on traits trade off



D'après

Simons et al. 2000. Am. J. Bot., 87 : 124-132..

Conclusions

- **Good news for ... evolutionary ecologists**
 - **invasive species are a wonderful model for testing evolutionary theories**
 - **in this context, study of dispersal evolution should gain more attention**
- **Mitigate news for ... managers**
 - **because invasive species are evolving in their native range, prediction about the fate of invasion may be difficult**
- **Reconciliation**
 - **thorough scientific studies are needed to assess the importance of evolution in invasive species**