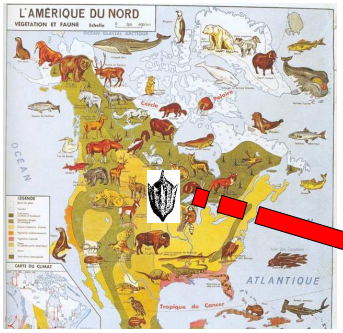
Second International Ragweed Conference, March 28-29 - 2012, Lyon, France

HOW TO EXPLAIN THE INTRODUCTION OF COMMON RAGWEED INTO EUROPE DURING THE XIXth CENTURY

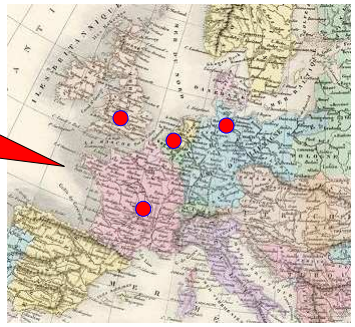
Bruno Chauvel & Quentin Martinez

Ambrosia artemisiifolia in Europe

- **1860-1870** – first introductions into Europe from North America:



Germany ~ 1863
France ~ 1863
Great Britain ~ 1865
Netherlands ~ 1870

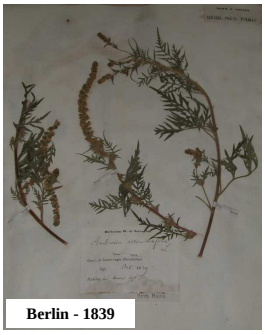


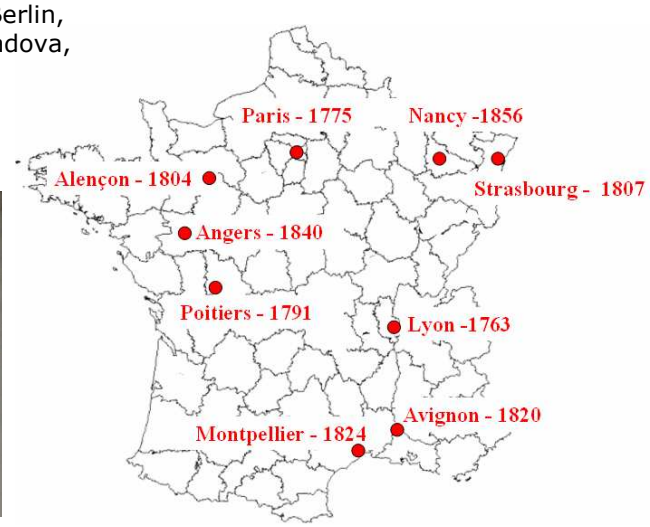
Map from Jacobs after Fremin, 1860

- Very close dates: a same vector in the different countries?

Original presence in botanical gardens

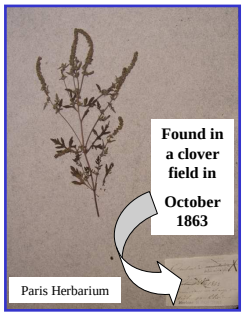
and presence in Berlin, Geneva, Berne, Padova, Kew, etc.





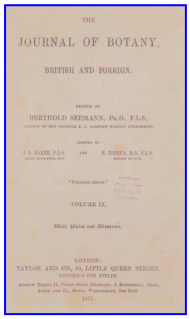
Not considered as an escape from botanical gardens

How to identify the first introduction vector(s)?



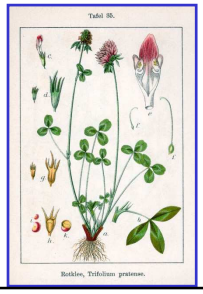
Sources of references:

* XIXth- and early XXth-century literature
* Data on herbarium specimen



• **Red clover** is for sure the first vector of common ragweed introduction in Germany (Ascherson, 1874), in Great Britain (Hon, 1871), in the Netherlands (Anonymous, 1902) and in France (Olivier, 1876).

• Introduction to different points in each country with the same vector during many years.



Trifolium pratense
Sturm, 1796

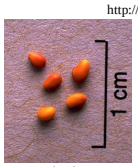
A unique vector and a single geographical origin for the first introduction?

Geographical origin?

- North America …
- Canada …

http://forages.oregonstate.edu/media_library/red_clover/screen/28.jpg

Ragweed

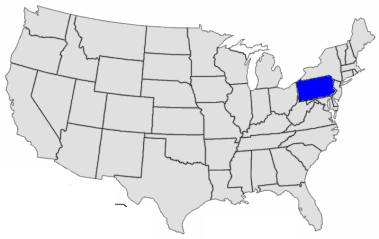


Red clover

1860-1870: - period highly disturbed in Europe with numerous conflicts
- beginning of the imports of products from the North American continent due to free trade agreements (cereals, clover seeds, etc.)

Very little or unclear data on the geographical origin in the bibliography

Pennsylvania cited by *Knuth, 1888 Schulflora Schleswig Holstein*



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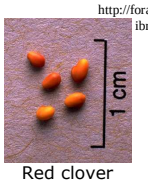


Red clover

- **Pennsylvania** cited by *Knuth 1888 Schulflora Schleswig Holstein*

* Presence of German settler-farmers in Pennsylvania.
- Area with high production of red clover
- Area with high densities of ragweed

➔ Acceptable hypothesis for Germany

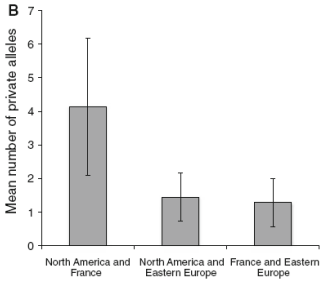

Oeffentliche Versteigerung.
Samstags, den 14ten nächsten März,
Milchkühe, ein junger Bull,
Junges Rindsvieh,
Kleesaamen bey der Buschel,
Johann Bamberger,
Christian Bamberger.
Gedruckt bey Johann Bär, Lancaster.

http://www.lancasterlyrics.com/

* For the other areas in Europe?
- American varieties of red clover described as more tolerant of cold temperatures.
- Free from dodder seeds (*Cuscuta* sp.).

Consequences on the invasion of ragweed

One species: *Trifolium pratense*
From a unique geographical origin?



Gladieux et al., 2011

Genetic studies indicate:

High genetic diversity in French invasive populations of common ragweed, as a result of multiple sources of introduction.

Subsequent admixture of historical populations, incorporating new alleles from multiple introductions.

Distinct invasion sources of common ragweed in Eastern and Western Europe.

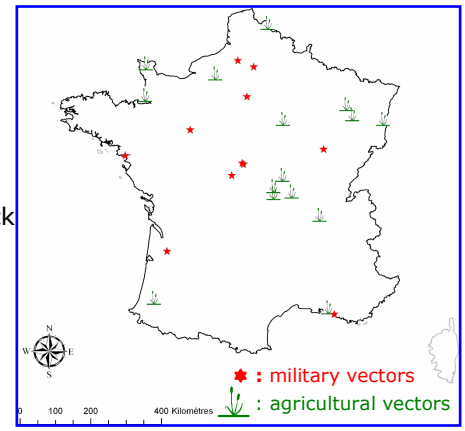
➔ It would be interesting to compare the native area (Pennsylvania?) with the first introduction areas in Europe.

possibility to use isolated populations in original introduction areas or DNA extracted from herbarium plants.

Introductions in France before 1920

***Agricultural vectors**
* Red clover
* Wheat (?)
* Potato

⇨Introduction of populations with large numbers of plants: bottleneck effect?
⇨Basis for the spread of ragweed in France.

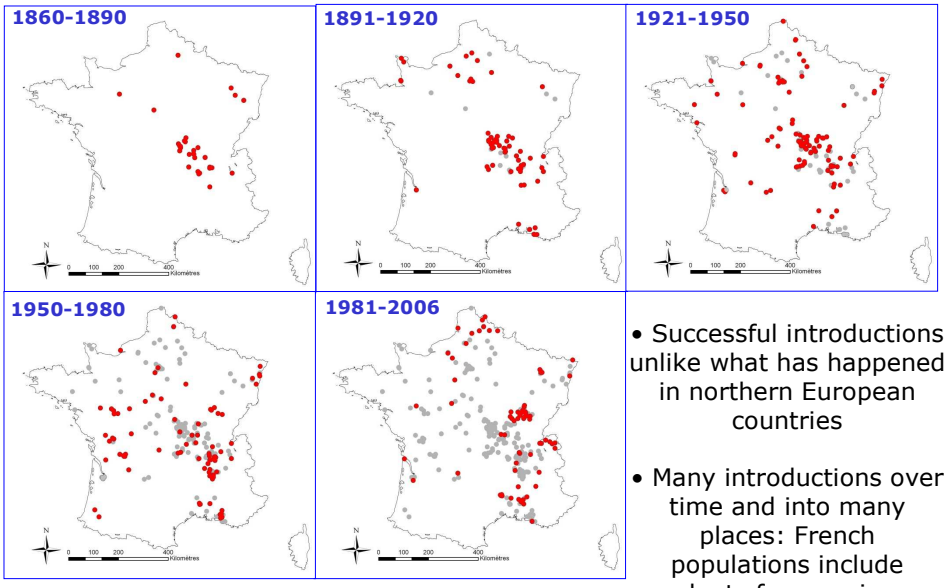


***Polemochorous origins (WW1)**
*fodder for horses, found in North American troop depots.

⇨ Introduction of populations in non-favorable ecological areas: most often disappearance of the populations.


http://www.greatwardifferent.com/Great_War/Americans_Arrive/Base_01.htm

Spread across French *communes*



●: new locations

- Successful introductions unlike what has happened in northern European countries
- Many introductions over time and into many places: French populations include plants from various sources

Chauvel & Cadet, 2011

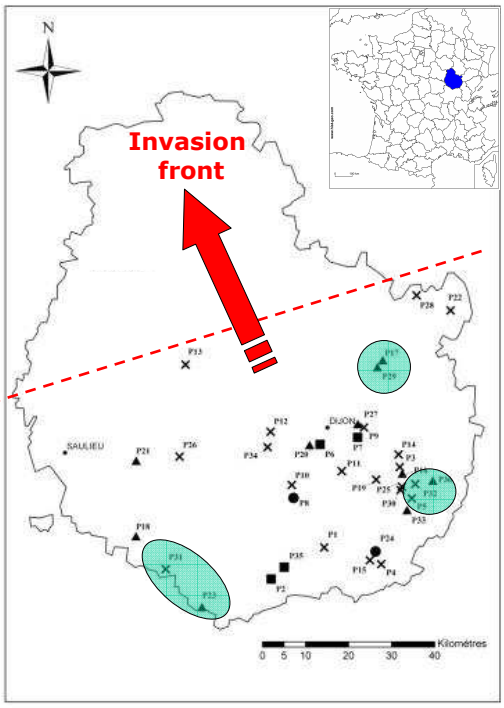
Consequences for a given place in France?

Possibilities to find in the same area:

- **Populations present for a variable duration**
- **« Recent » populations**

= in a same area, mix of populations with different levels of local adaptations; with different genetic structures …

: «former » populations



Chauvel, 2011

Change of habitats over time (France)

	Cultivated areas	Communi-cation ways	Habitats connected to human activities	Pertubated areas	Riparian habitats	Unknown
1860-1890	27	1	4	1	0	26
1891-1920	32	15	21	4	2	48
1921-1950	25	19	42	3	13	40
1951-1980	33	18	17	1	16	23
1981-2006	9	14	23	0	6	10


Cultivated areas

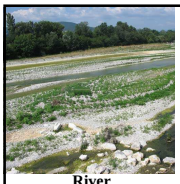

Communication ways

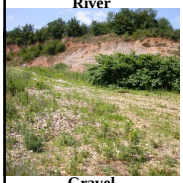

Human activities


Pertubated areas

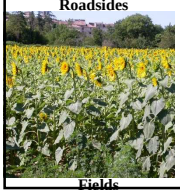

Riparian habitats

Chauvel & Cadet, 2011


River


Gravel

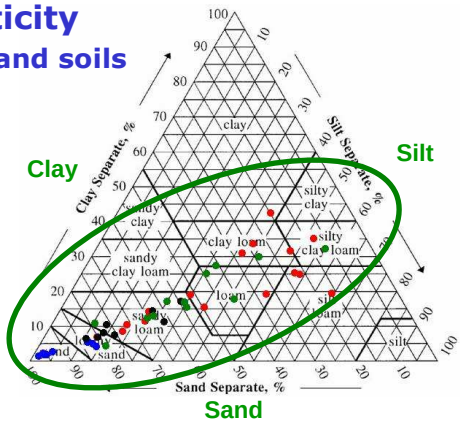

Roadsides


Fields

Ecological plasticity

Habitats and soils

Presence in open habitats with very different soil textures. Mostly in France on sandy or sandy-loam soils.



	Min	Max
pH KCl	4,09	8,64
C/N	0,68	38,7
N (g/Kg)	0,1	5,43
C (g/Kg)	0,33	121
Soil organic matter (g/Kg)	0,58	204
Calcium (CaCO3) total (g/Kg)	0,77	27,7

Fumanal et al., 2007

Ecological plasticity

Habitats and soil types

- Development in a large range of disturbed habitats differing in terms of
  - vegetation cover
  - species composition
  - type of soil
- Potential for invading spring crops and all semi-natural or disturbed open areas

- The success of this invasion can be explained by:
  - no significant predation effects
  - generalist character (ecological plasticity)
  - existence of vacant ecological niches poorly occupied by the French native flora.
  - indirect effects of environmental measures (reduction of herbicide use, floral set-aside, etc.)
  - global climate change, etc.

Harpalus cupreus

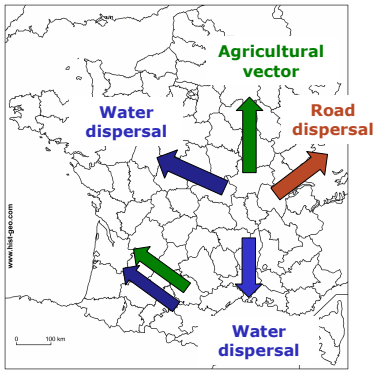
Conclusions

Various reasons can explain the success of *A. artemisiifolia* in France and in Europe

* introduction of plants from various sources (in space and time)
* strong variability (morphology, size, etc.)
* ecological plasticity

Different situations across areas and countries

The dominant habitats and the spread vector can differ
Potentially strong effects of the landscape (soil use)



➔ P. Blanc (1912): *"It is in this prosperous situation that, in 1908, I found this first population of Ambrosia. Since then, I have noted* ***with satisfaction*** *that it has not ceased to grow."*

Thanks for your attention

CHAUVEL B. & CADET É. 2011. Introduction et dispersion d'une espèce envahissante : le cas de l'ambroisie à feuilles d'armoise (*Ambrosia artemisiifolia* L.) en France. *Acta Botanica Gallica*, **158** (3), 309-328.