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No evolutionary shift in the mating system of the invasive weed *Ambrosia artemisiifolia* populations in France

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Objectives

- **Study of the mating system of *Ambrosia artemisiifolia* within an agricultural landscape.** What we know: in the native area (North America) and in colonized range in China, *A. artemisiifolia* populations have a strong self-incompatibility system and high outcrossing rates (Li, *et al*., 2012).

➡ **Q1. Evolutionary shift towards selfing or partial selfing in isolated *A. artemisiifolia* populations within an agricultural landscape ?**

- Outcrossing facilitates gene flow by pollen and admixture among invasive (Genton, *et al*., 2005).

➡ **Q2. Are *A. artemisiifolia* populations genetically differentiated at a local scale ?**

Methods

✓ *Distribution and sampling of the* A. artemisiifolia *populations:*

Location: South-East of Dijon (Burgundy, France)

Surface area: 28 km²

Sampling: Mid-September to mid-October 2013.

Nb of populations: 17

Total number of individuals: 434

Fig1. Map showing patches of *Ambrosia artemisiifolia*

- **Exhaustive sampling:** all observed populations (17) of *A. artemisiifolia* were sampled (Fig1).
- The species was mostly present in **cultivated fields**, rarely in non-cultivated areas.
- *A. artemisiifolia* grew preferentially in **spring crops** such as sunflower, maize and soybean.

✓ *Q1: Mating system parameters*

1. Populations & markers

- **5 populations:**
  - 7 to 8 mother-plants per population
  - 8 to 16 progeny-plants per mother-plant (614 plants in total)
- **6 microsatellites markers**

↓ Null alleles detection

2. Genotype analysis between progeny-plants and mother-plants

➡ correction of null alleles

↓ MLTR 3.2

3. Estimated parameters for the mating system:

- Multi-locus outcrossing rate ***tm***
- Maternal inbreeding coefficient ***F***
- Outcrossing rates between related individuals ***tm-ts:***
- Correlations of paternity ***rp:***

(Ritland, 2002)

✓ *Q2: Genetic differentiation of* Ambrosia artemisiifolia *populations*

- **17 *A. artemisiifolia* populations** (434 ind., leaf samples)
- **10 microsatellites markers**

➡ **Estimated parameters:**
1. Genetic differentiation (F_{ST})
2. Bayesian clustering (STRUCTURE 2.2)

(Goudet, *et al.* 2005 ; Pritchard, *et al*. 2000)

Results

✓ *Q1: Mating system parameters*

Tab 1. Estimation of the mating system parameters for 5 *A. artemisiifolia* populations using six microsatellites markers

Populations	Mating system parameters		
	tm	*tm-ts*	*rp*
02	0.999 (0.073)	0.137 (0.075)	0.274* (0.065)
05	0.983 (0.097)	0.137* (0.067)	0.172* (0.047)
07	0.966 (0.035)	0.119* (0.045)	0.228* (0.059)
10a	0.885 (0.051)	0.28* (0.038)	0.481* (0.111)
11	0.992 (0.075)	0.215* (0.071)	0.303* (0.052)

* Values significantly different from 0.000 ; values in brackets are the standard errors

- **Maternal inbreeding coefficient F = 0.087 (0.056)**
  Non significantly different from 0
- **High multi-locus outcrossing rates** (*tm*).
- **Low but significant rates of mating between related individuals** (tm-ts) for 4 populations.
- **Low but significant correlations of paternity** (*rp*) for all populations.

The results show:
- **Obligate outcrossing (F, tm)**
- **Some degree of biparental inbreeding (tm-ts)**
- **Large number of pollen donor parents except for the population 10a**

➡ **large gene flow by pollen among populations ?**

✓ *Q2: Genetic differentiation of* Ambrosia artemisiifolia *populations*

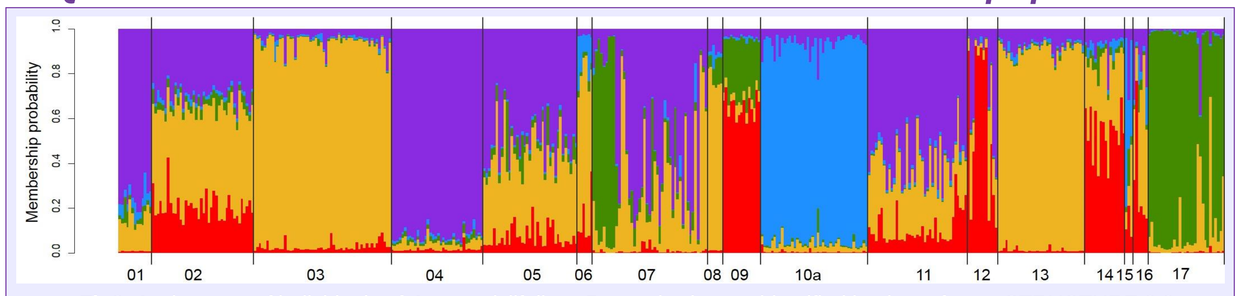

Fig2. Assignment of individuals of *A. artemisiifolia* to 5 genetic clusters identified by the software STRUCTURE 2.2

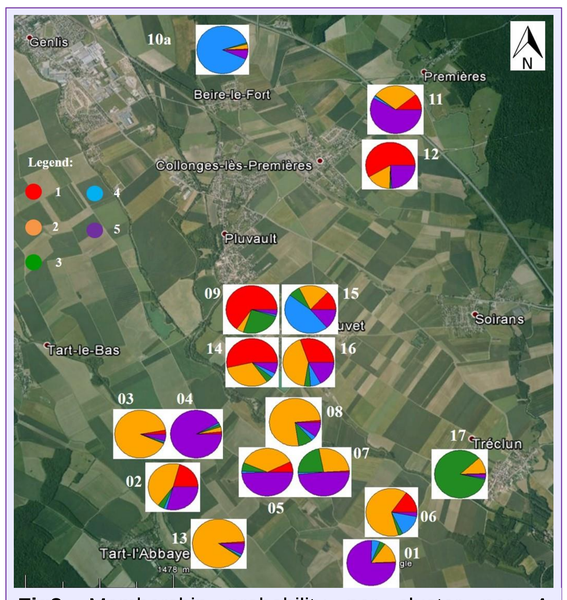

Fig3. Membership probability per cluster per *A. artemisiifolia* population as shown on Fig2 within the agricultural landscape

- **F_{ST} = 0.058**
  (Monte Carlo test: p-value = 0.001)
- **High level of admixture** is observed.
- Some **spatial structure** is apparent (Fig3): Clusters 2 & 5 are mainly localised in the south of the area whereas cluster 1 is mainly localised in the centre.
- **2 populations** (10a & 17) are **genetically distinct** from the other populations.
  ➡ 2 more recent colonization events ?

Low but **significant genetic differentiation:**
- *A. artemisiifolia* populations are **genetically structured** within this agricultural landscape.
- **Distinct colonization events** may also have occurred at this scale

Conclusions

- **Q1: No detectable evolutionnary shift towards autogamy** in the **surveyed agricultural landscape.**
  ➡ The **mating system of isolated plants** should be **investigated**.
- **Q2:** At a **local scale**, *Ambrosia artemisiifolia* **populations** are **both genetically differentiated and structured.**
  ➡ The **successful spread** of this species may be facilitated by **multiple introductions followed by genetic admixture**.
  ➡ The **spatial organisation of genetic diversity** will be investigated.