

# Biodiversity of natural enemies in cranberry crops in Quebec



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and Valérie Fournier<sup>1</sup>**

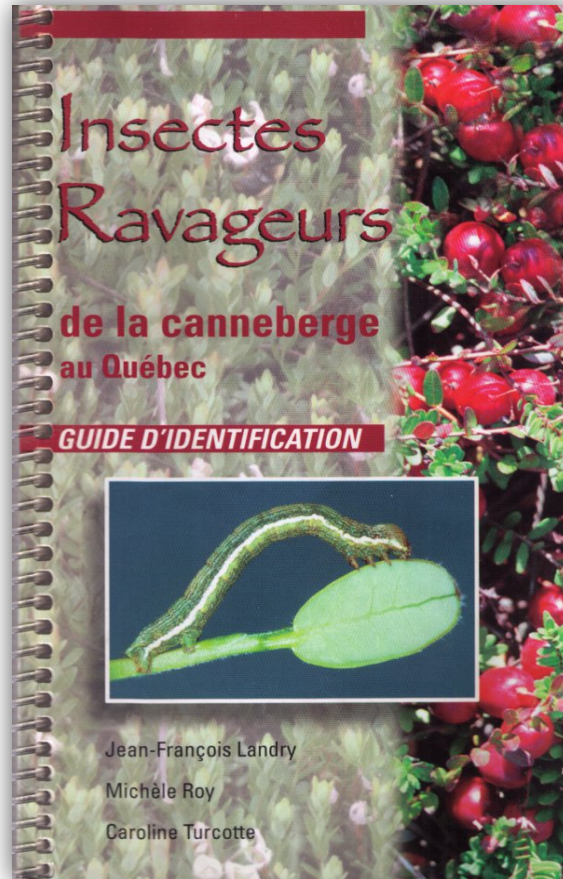
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# Insect pests

✓ 38 species



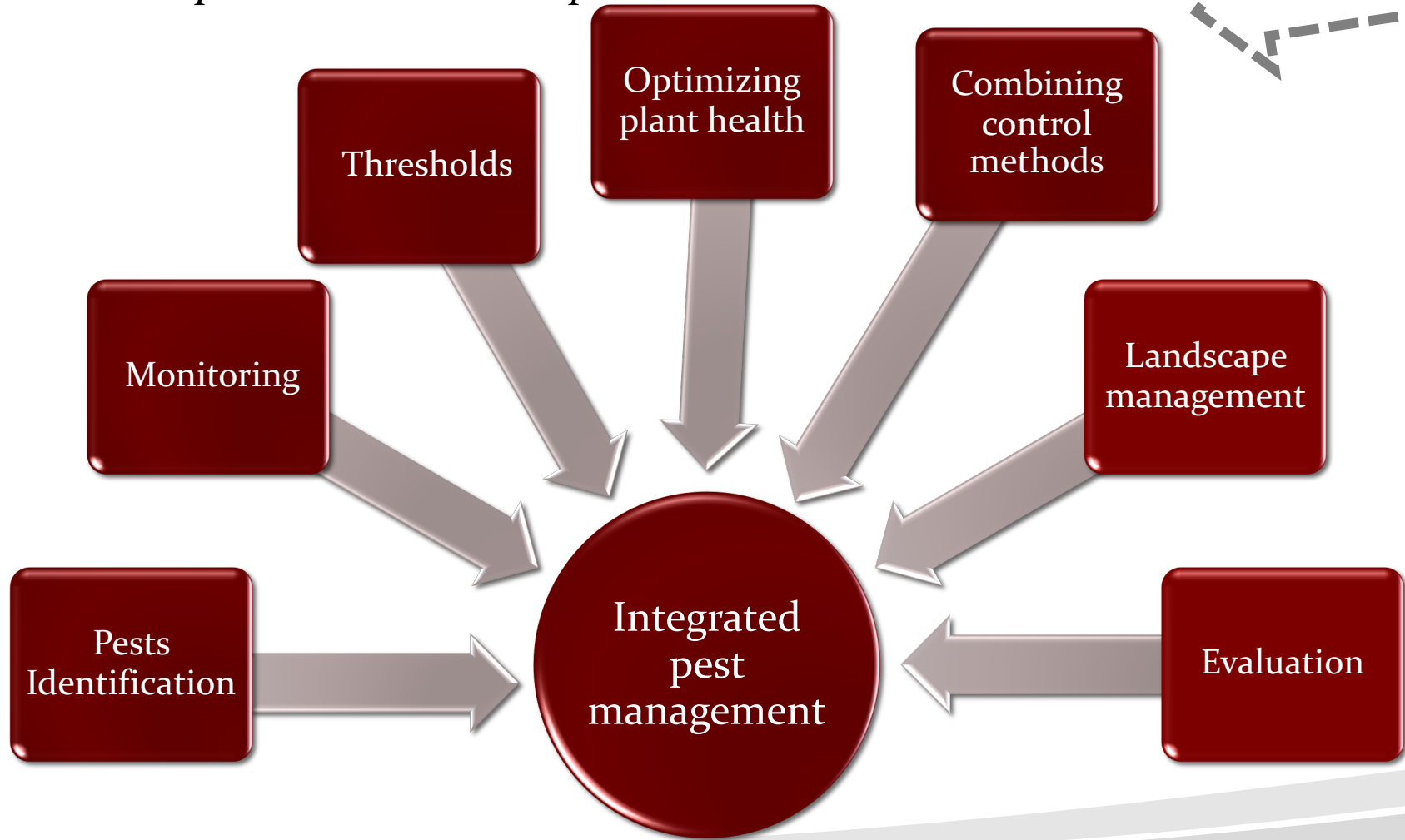
- ✓ Centre-du-Québec region: 67 farms
- ✓ 87% CETAQ members



859, Ancienne route de l'Église  
Notre-Dame-de-Lourdes (Québec) G0S 1T0

# Integrated pest management:

*Relies on a combination of several actions to address problems related to pests*



# #1: Use of pesticides



## Concerns

- ✓ Environment
- ✓ Health
- ✓ Non-target organisms
  - ✓ Pollinators
  - ✓ Natural enemies

# #2: Cultural methods

## Spring flood



Plants completely submerged:  
spring larvae, craberry weevil

## Fall flood



1 to 3 inches above soil level:  
cranberry fruitworm

Several studies in **Wisconsin** (Steffan, Singleton and Zalapa), in **Massachusetts** (DeMoranville, Averill, Sylvia, Caruso and Sandler) and in **Quebec**: Drolet, Deland and Firlej

# #3: Biological control

- ❑ Environmentally sound and effective means of **mitigating pests**
- ❑ **Ecological services**
  - ❑ Prevent major pest infestation
  - ❑ Maintain low density of pest populations
  - ❑ Reduce pesticide dependancy
  - ❑ Develop ecologically stable and sustainable agricultural systems

# Literature review



[originenordouest.com/#](http://originenordouest.com/#)



[avis-vin.lefigaro.fr/magazine-vin](http://avis-vin.lefigaro.fr/magazine-vin)



[pepiniere-fleurs-terre.com/lesbleuets](http://pepiniere-fleurs-terre.com/lesbleuets)

# Literature review



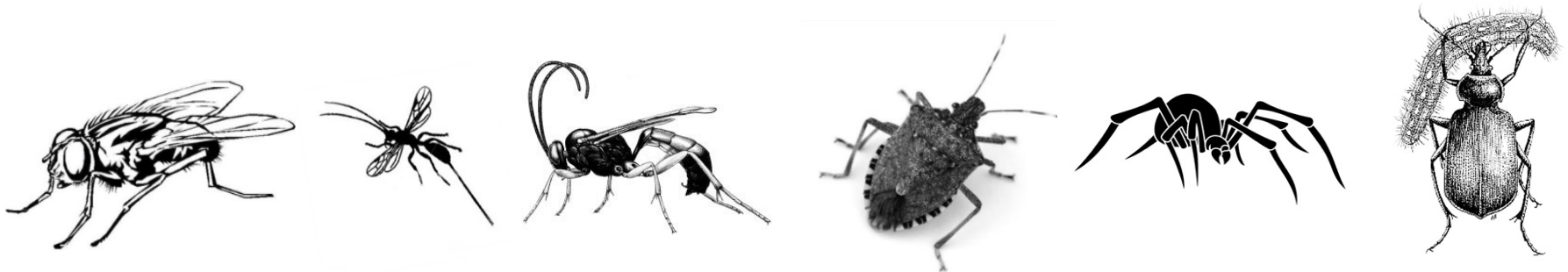
**FIRST INITIATIVE  
in this research field  
in Quebec**



# 1 - Taxonomic study of natural enemies in commercial cranberry plantations in Centre-du-Québec region

- Parasitoids of larvae of 5 main Lepidopteran pests
- *Generalist predators living on the canopy and at ground level*

# 2 - Comparison of richness and abundance of natural enemies between organic and conventional managements



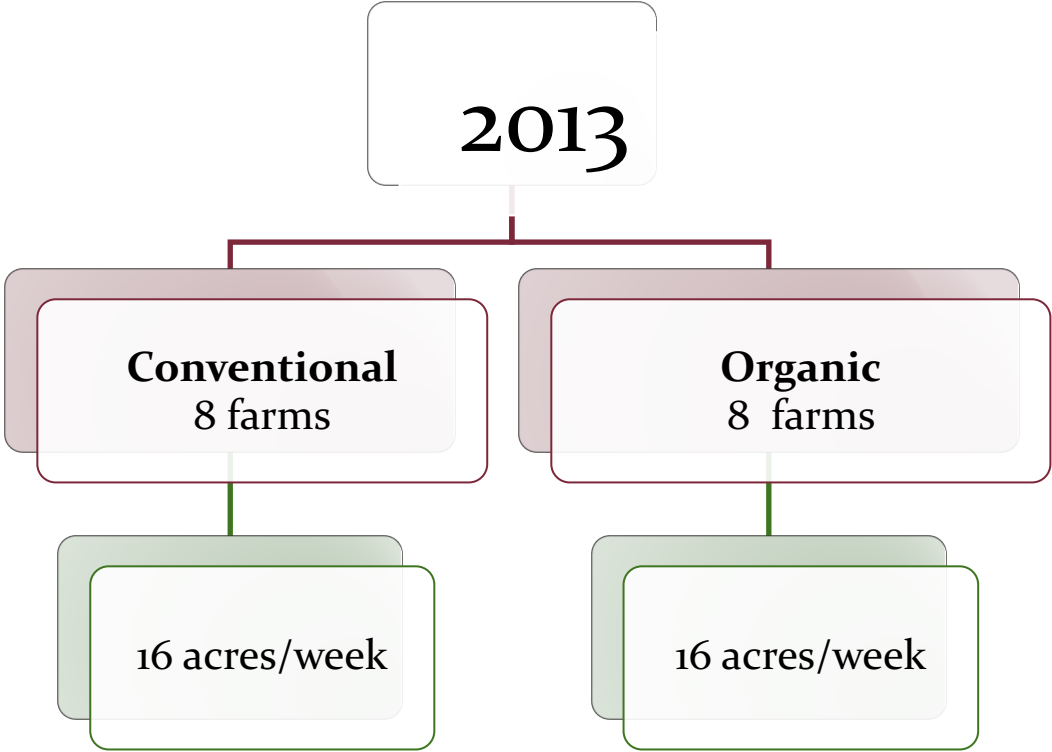
No difference between  
organic and conventional management  
✓ **Richness + Abundance**  
✓ **Parasitism rate**

IPM concepts (monitoring, thresholds)

Control methods: Pesticides

Impacts on natural enemy communities

# 2 years Experimental plan



**Variations between years**

1. # Farms
2. # Weeks
3. # Weeks/Sampling tools
4. Sampling unit selection



May

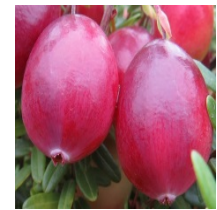
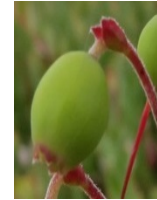
June

July

August

Sept-Oct

Species



**Green spanworm**  
(*Macaria sulfurea*)



= ms

**Rannock looper**  
(*Macaria brunneata*)



= mb

**False armyworm**  
(*Xylena nupera*)



= xn

**Black-headed fireworm**  
(*Rhopobota naevana*)



= rn

**Sparganothis fruitworm**  
(*Sparganothis sulfureana*)



= SS

# Sampling

## Sweep net



## Visual observation



Rodriguez-Saona et al., 2012; Singleton & Mahr., 2011; Gardiner et al., 2010; Leduc & Turcotte., 2004; Germain C. 2004; Buffington & Redak., 1998; Bradwell & Avrill., 1997

# Laboratory rearing to detect parasitism



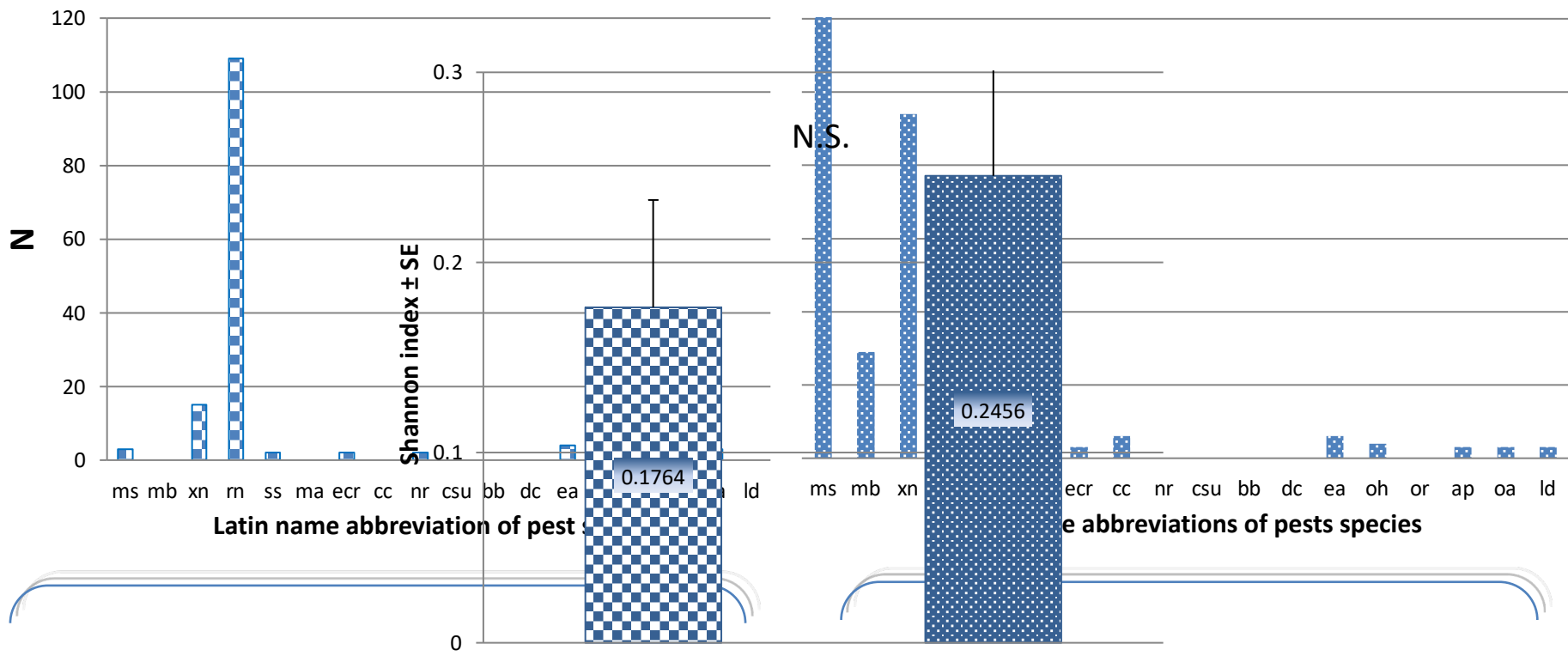
1497 larvae



# Pest species diversity: 2012

## Organic

## Conventional



### Diversity index:

- 1) **Richness:** 9 species
- 2) **Evenness:** 1 dominant, 1 moderate, others low abundance

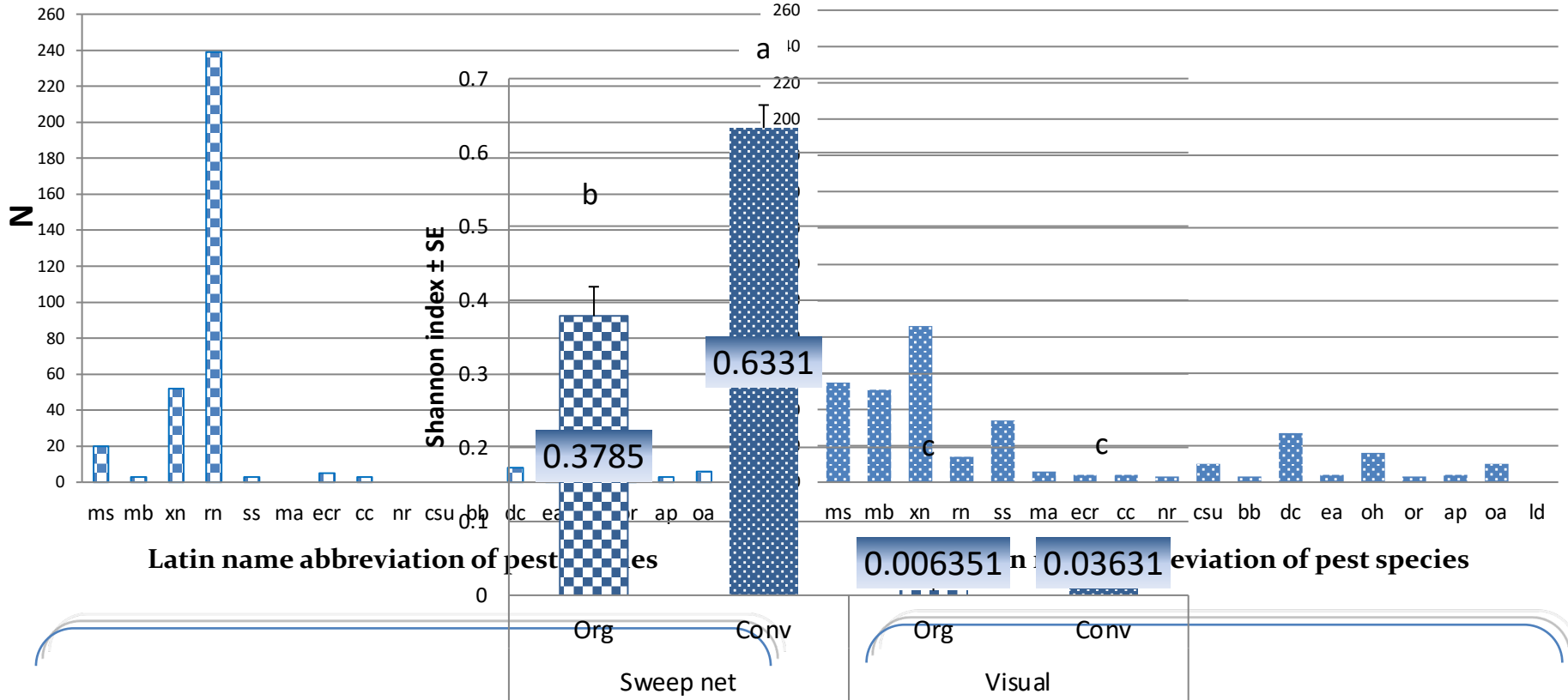
### Diversity index

- 1) **Richness:** 12 species
- 2) **Evenness:** 2 dominants, 1 moderate, others low abundance

# Pest species diversity: 2013

## Organic

## Conventional



### Diversity index:

- 1) **Richness:** 14 species
- 2) **Evenness:** 1 dominant, 2 moderate, others low abundance

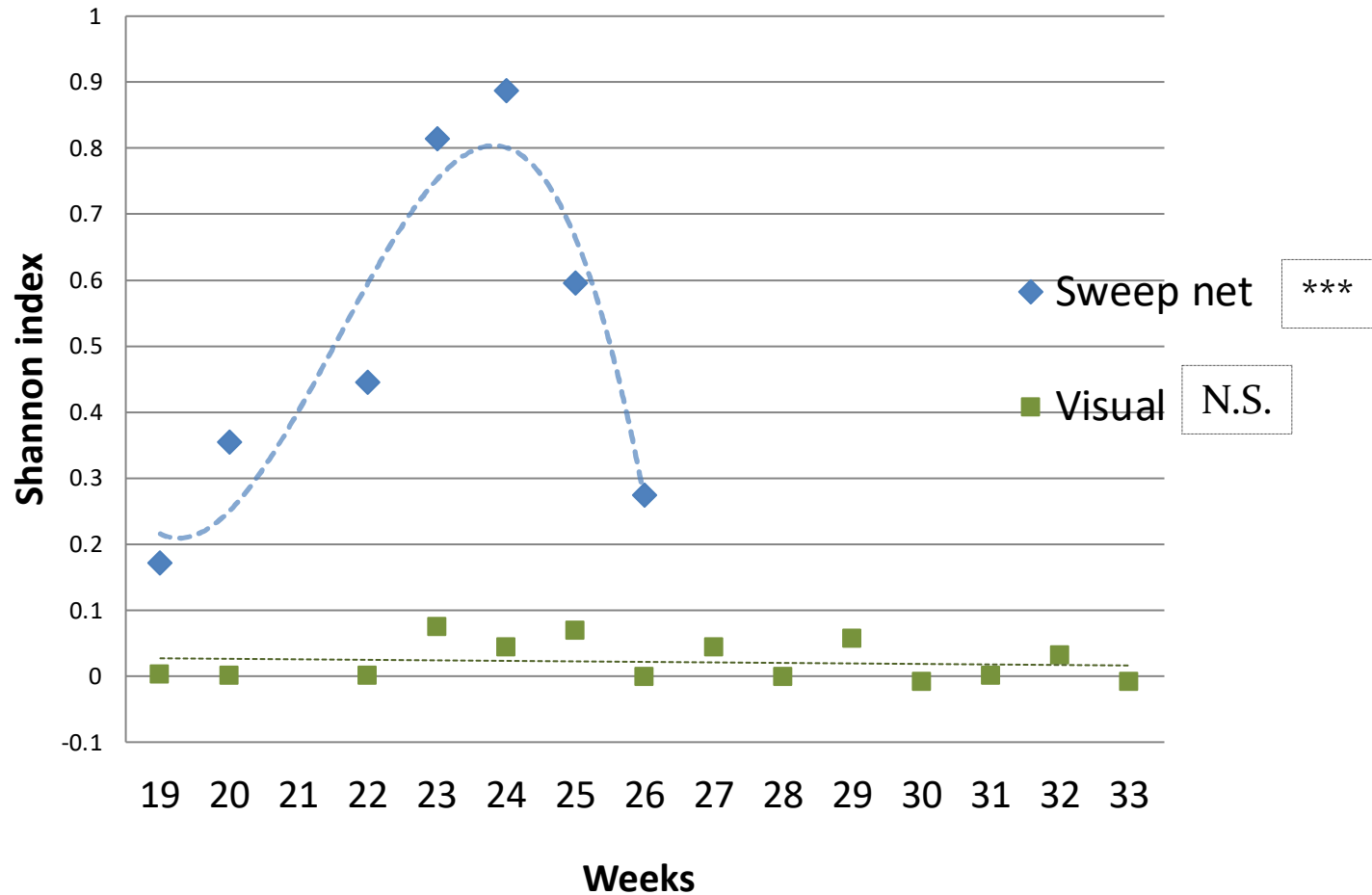
### Diversity index:

- 1) **Richness:** 17 species
- 2) **Evenness:** 0 dominant, 5-6 moderate, others low abundance



# Pest species diversity:

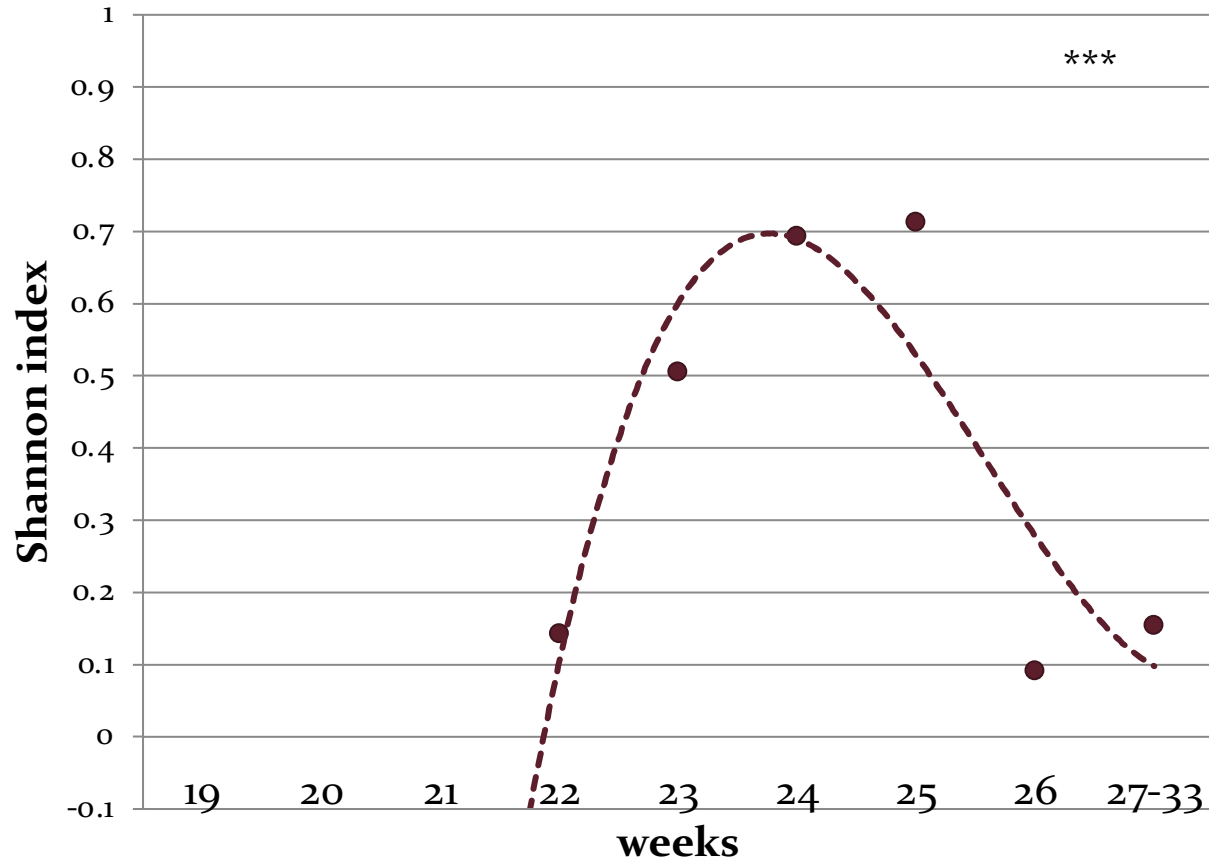
Evolution through out the sampling period – year 2013



**Figure:** Variation of Shannon index of pest diversity over time (weeks 19 to 33) for both sampling methods (sweep net and visual observations)

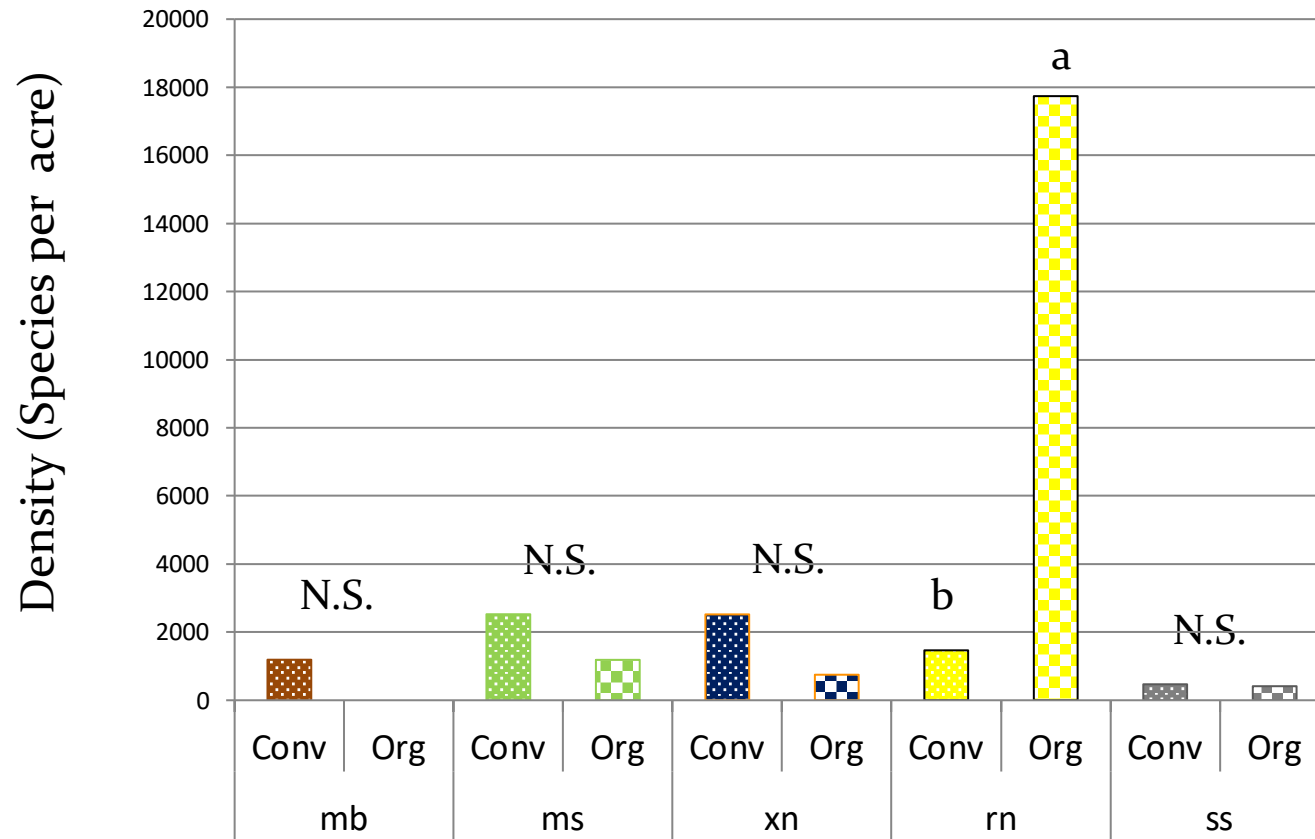
# Parasitoid species diversity:

Evolution through out the sampling period – Year 2013



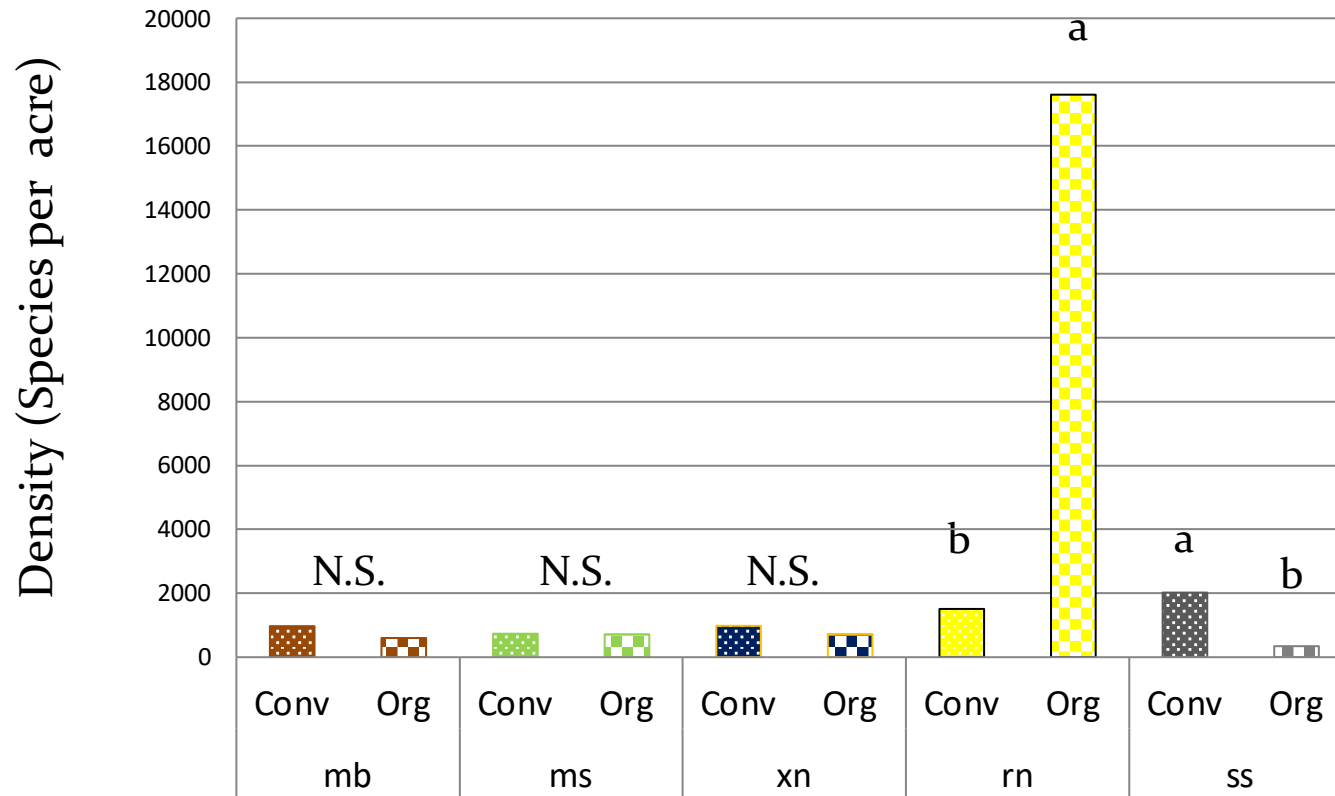
**Figure:** Variation of Shannon index for the parasitoid community over time (weeks 22 à 27, 27-33)

# Seasonal density of the 5 main pests: 2012



**Figure:** Pest density per acre for organic versus conventional management. LSD  $\alpha = 0,05$

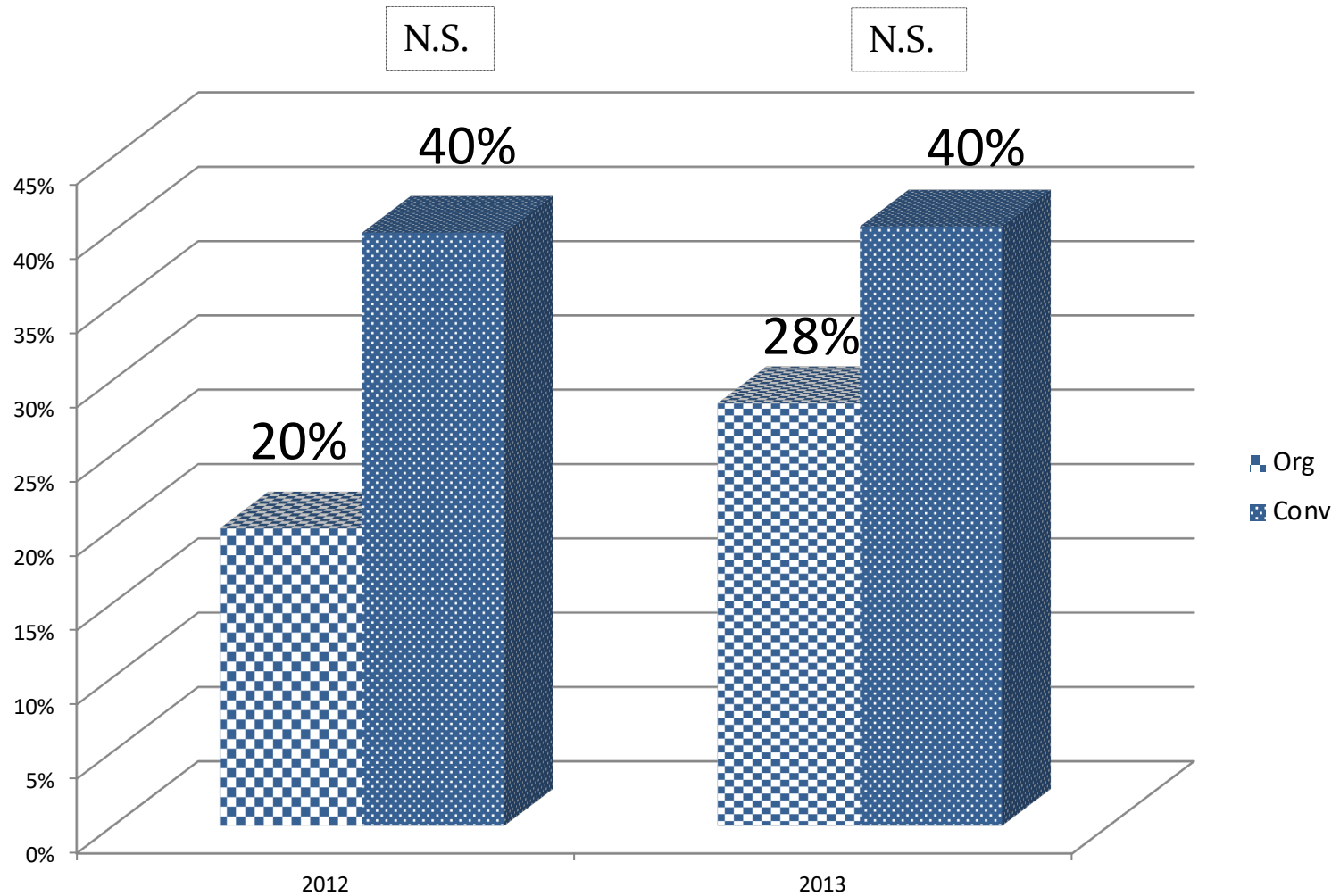
# Seasonal density of the 5 main pests: 2013



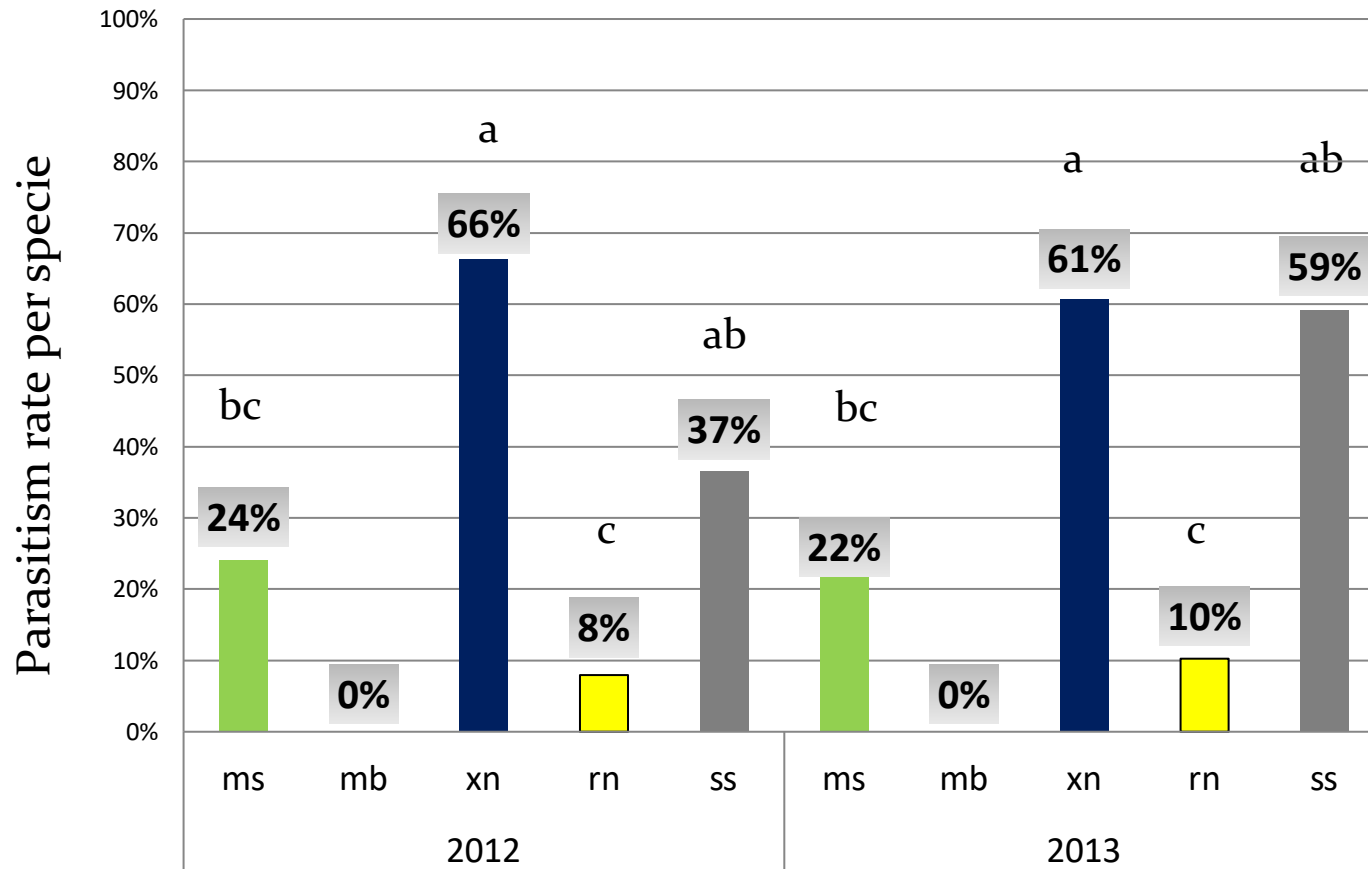
**Figure:** Pest density per acre for organic versus conventional management. LSD  $\alpha = 0,05$

# Parasitism rates (Management)

Pool all 5 main pest species



# Parasitism rates



**Figure:** % parasitism of each 5 main pest species for both years (2012-2013)

# Parasitoid richness

- Total 2012+2013 (all pest species)
  - 24 wasp species
  - 6 fly species
- 5 main pests
  - 77% of parasitoid species
  - 18 wasp species
  - 5 fly species



ars.usda.gov



Wiman & Jones., 2013

## Green spanworm

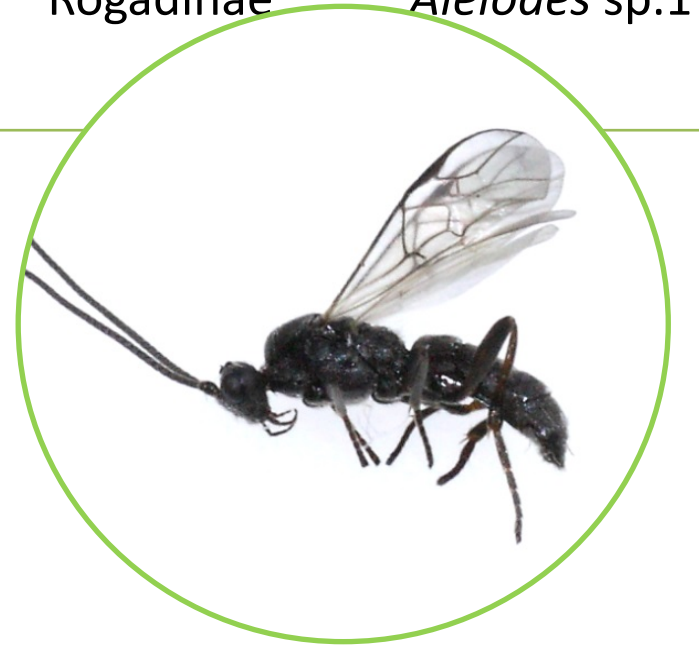
*Macaria sulphurea* (PACKARD)



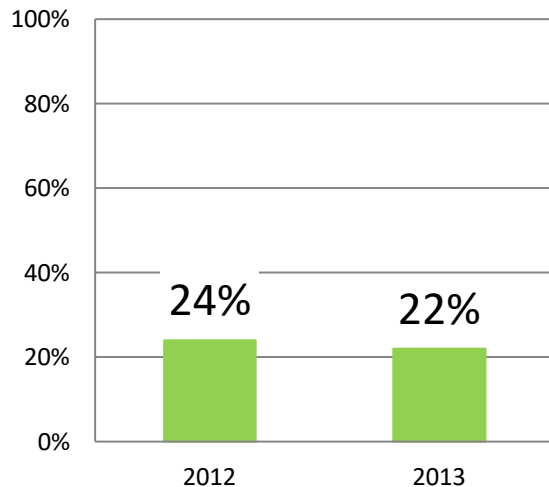
## Taxonomy of parasitoids

Family	Sub-family	Species
Braconidae	Rogadinae	<i>Aleiodes sp.1</i>

100% of the parasitism  
*Aleiodes sp.1*



% Parasitism per year





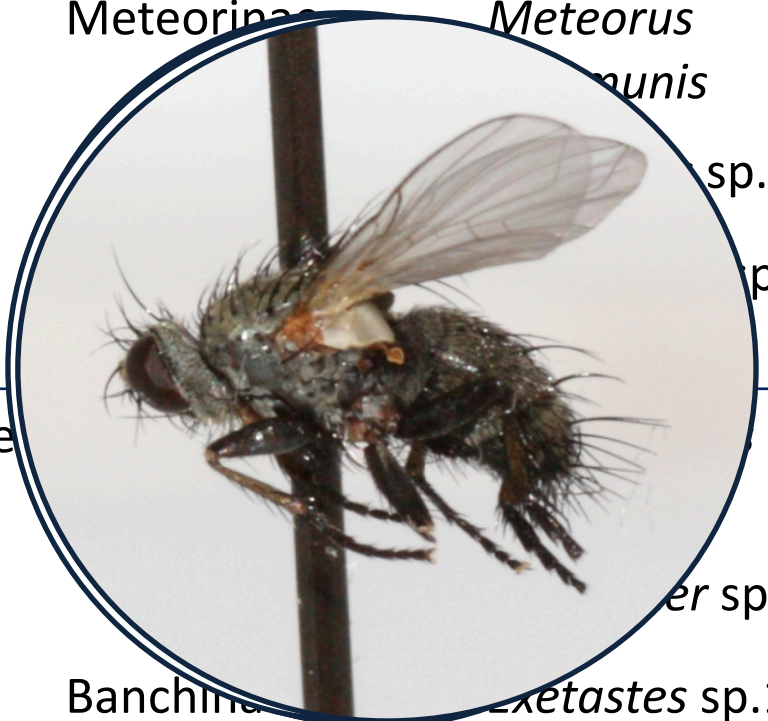
# False armyworm

*Xylena nupera* (Lintner)

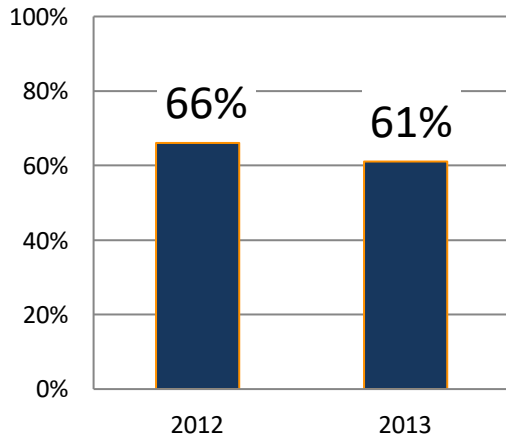


# Taxonomy of parasitoids

Family	Sub-family	Species
Braconidae	<p>38% of the parasitism</p> <p>27% of the parasitism</p> <p><i>Rogadinae</i> sp.1</p> <p><i>Campylocheilus</i> sp.1</p> <p>Image: bugguide.net</p> <p><i>Meteorinae</i></p>	<p><i>Aleiodes</i> sp.2</p> <p><i>Meteorus</i></p> <p><i>munis</i></p> <p>sp.3</p> <p>sp.1,</p>
Ichneumonidae		sp.2
Banchinae		<i>er</i> sp.1
		<i>zetastes</i> sp.1
Tachinidae		<i>Phryxe pecosensis</i>
		<i>Campylocheta semiothisae</i>

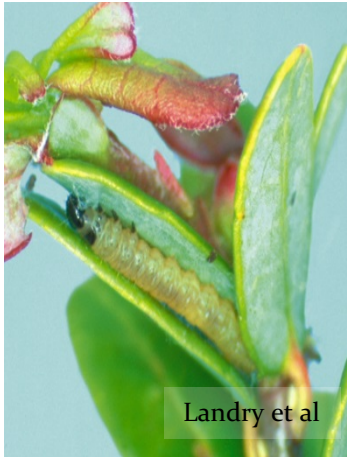


% Parasitism per year



# Black-headed fireworm

Rhopobota naevana (Hübner)



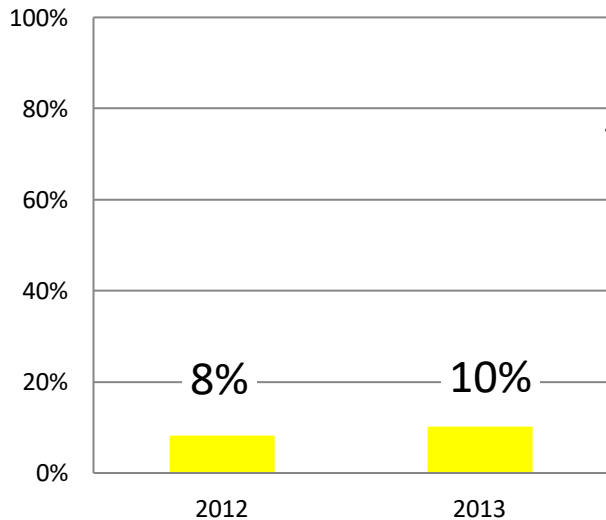
## Taxonomy of parasitoids

Family	Sub-family	Species
Eulophidae	Eulophinae	<i>Sympiesis</i> sp.1

88% of the parasitism  
 Super FAM *Mesochorid pyste*  
 Image: Bugguide.net



% Parasitism per year



Tachinidae

*la pyste*

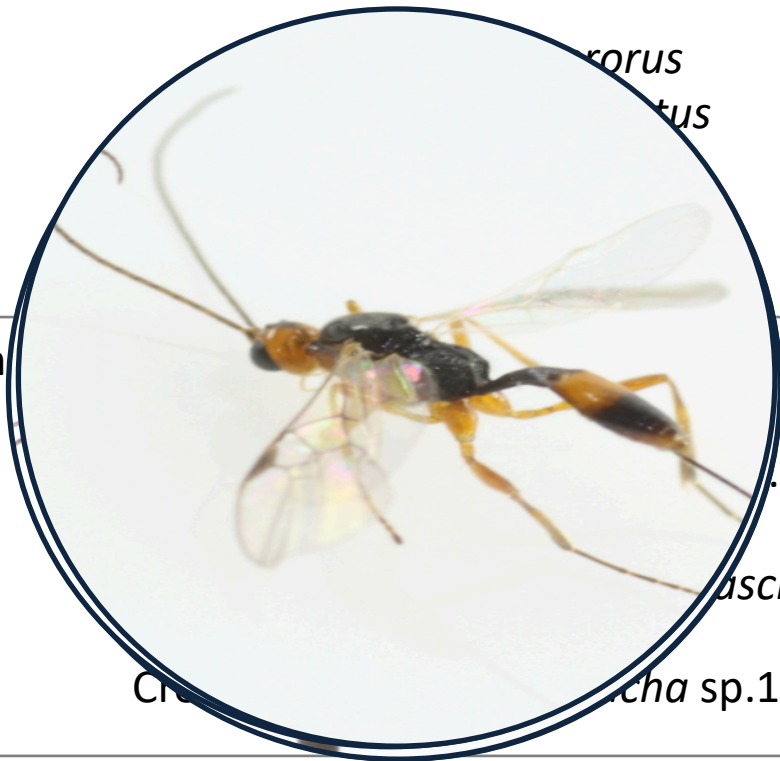
# Sparganothis fruitworm

*Sparganothis sulfureana* (Clemens)



## Taxonomy of parasitoids

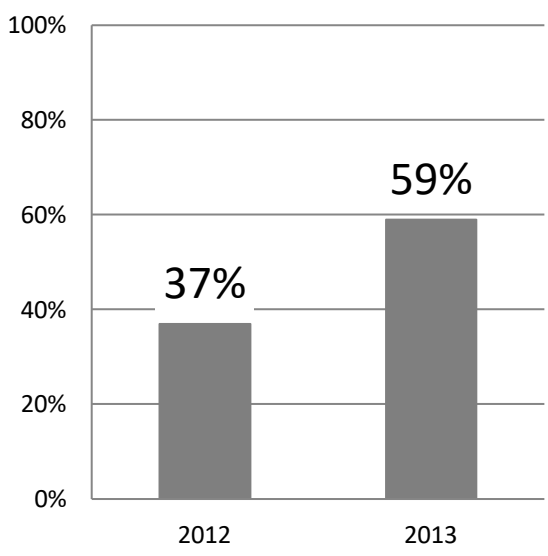
Family	Sub-family	Species
Braconidae	Meteorinae	<i>Meteorus</i> sp.3



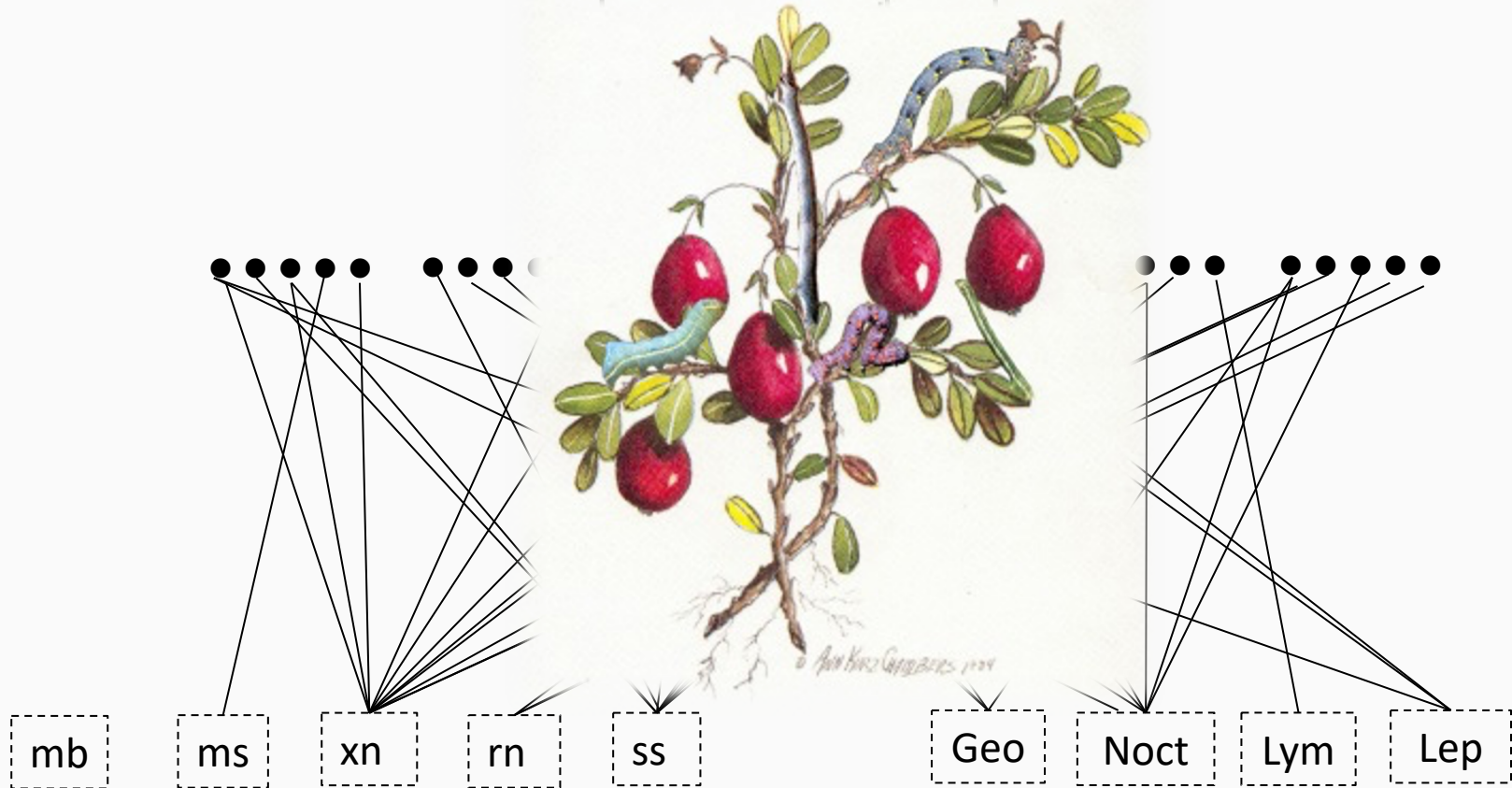
Ichneumon		<i>Ichneumon</i> sp.1
		<i>Ichneumon</i> sp.2
		<i>Ichneumon</i> sp.3
		<i>Ichneumon</i> sp.4
		<i>Ichneumon</i> sp.5
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		<i>Ichneumon</i> sp.98
		<i>Ichneumon</i> sp.99
		<i>Ichneumon</i> sp.100

Tachinidae		<i>Nemorilla pyste</i>
		<i>Erynnia tortricis</i>

% Parasitism per year



## 30 Parasitoids species of Lepidopteran PESTS



Lepidopteran PESTS  
**2nd trophic level**

- 38 pest species
- Beneficials: 30 parasitoid species
- IPM refinement
- Cornerstone of future advances in biological control



# Thanks

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# Questions

Thanks for your attention

