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PROEFCENTRUM FRUITTEELT VZW

Integrated pest management in pip fruit orchards and the challenge to control stink bugs (Pentatomidae)

Integrated Pest Management in horticulture: research for practice

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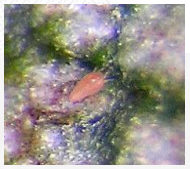
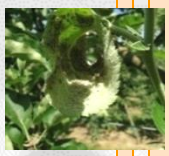
Pip fruit growing: A lot of potential pest outbreaks


Apple sawfly


Rusty leaf mite

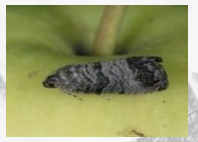

Aphid eggs


Rosy apple aphid


Green capsid bug


Winter moth


Rosy apple aphid


Codling moth


Leaf miners


Apple grass aphid


Apple leaf midge


Woolly apple aphid


Apple mussel scale


Winter eggs red spider mite

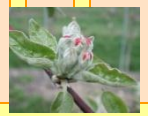

Apple blossom weevil


Leafrollers, fruit tortrix moth

Control sprayings

APPLE







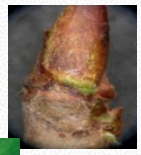
PEAR

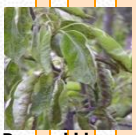







Winter eggs red spider mite

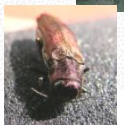

Pear leaf blister mite


Pear aphid


Leafrollers, fruit tortrix moth


Pear leaf midge


Codling moth


sinuate pear borer


Eggs pear sucker


Pear sucker


Pear midge

Rusty leaf mite

Winter moth

Leafrollers, fruit tortrix moth

Stink bugs

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Integrated Pest Management (IPM)

- "The rational application of a combination of biological, biotechnical, chemical, cultural or plant-breeding measures, whereby the use of plant protection products is limited to the strict minimum necessary to maintain the pest population at levels below those causing economically unacceptable damage or loss".

- From "calendar (preventive) sprayings" with broad-spectrum products to "economic threshold sprayings" with selective products

- Beneficial arthropod populations increase and redress the balance between pests and their natural control agents, resulting in fewer catastrophic occurrences of crop damage

- EC Directive 2009/128: 2014, all pest control activity in agriculture in EU Member States should be conducted within an IPM framework

- In Belgian pip fruit growing: **IPM adoption already in 90-ties**

Integrated Pest Management (IPM)

Key principles of IPM in pip fruit growing

- Apple: key beneficial: predatory mite *Thyphlodromus pyri* for control of spider mites (*Panonychus ulmi, Tetranychus urticae*) and rust mites (*Aculus schlechtendali*)



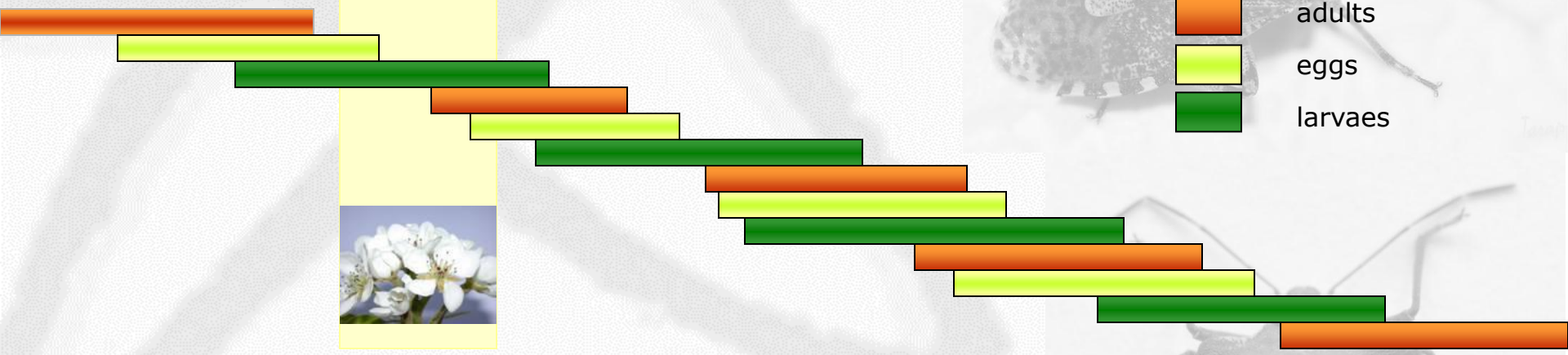
- Pear: key beneficial: predatory bugs (*Anthocoris, Orius* sp.) for control of pear suckers (Psyllids, *Cacopsylla pyri*)



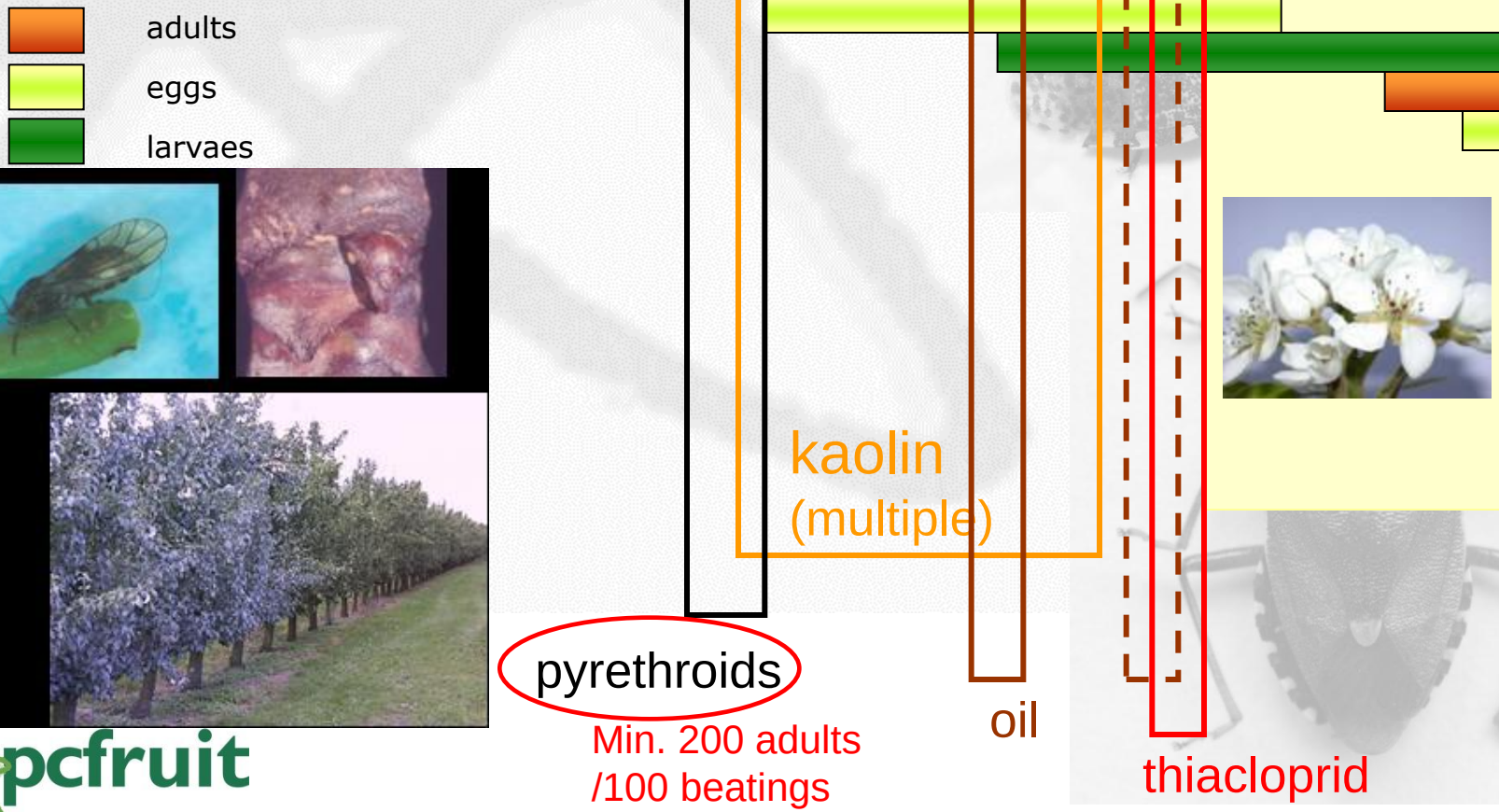
Life cycle pear sucker

Overwintering adults	First generation	Second generation	3rd - 4th generation	Last generation	

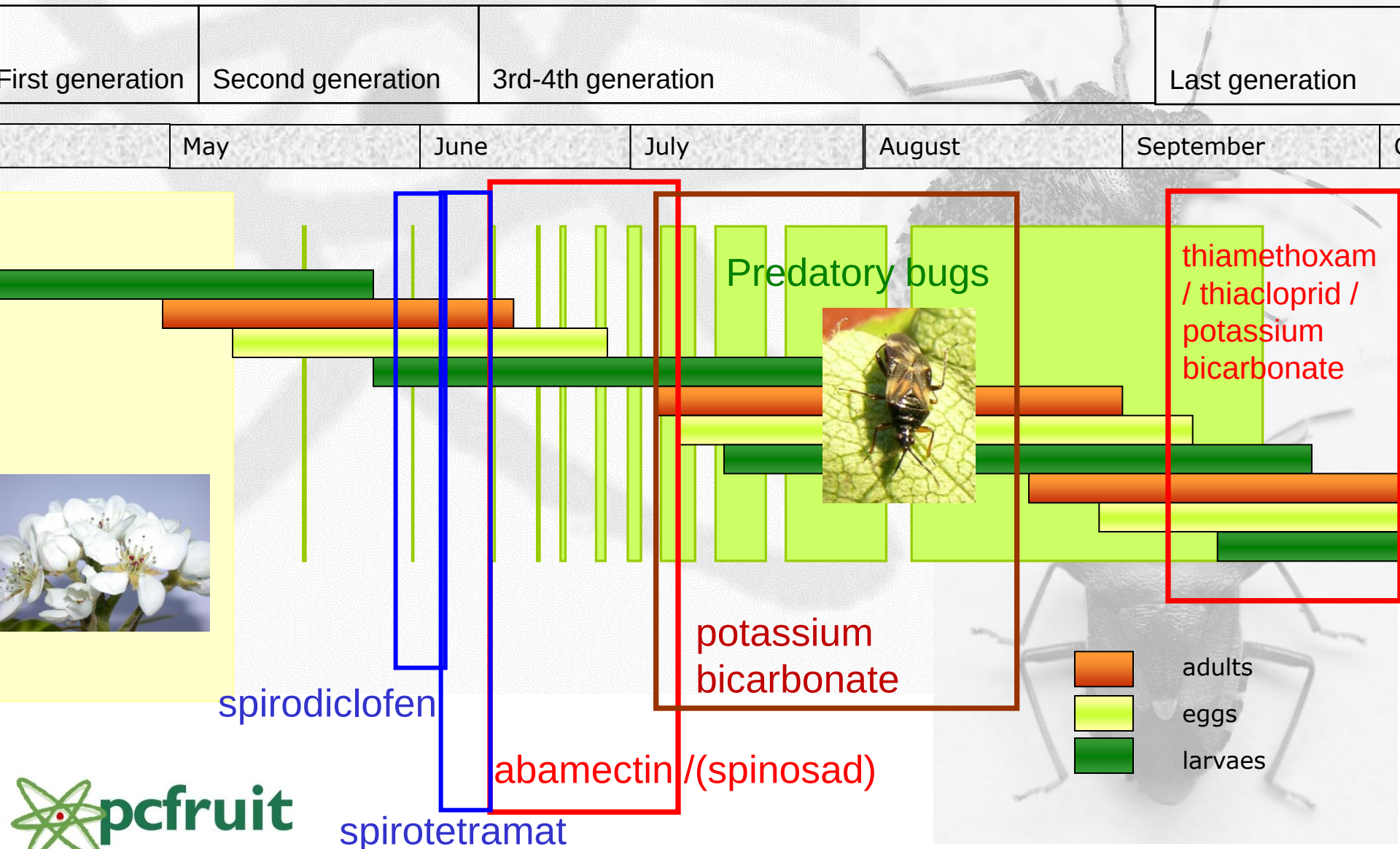
Februar	March	April	May	June	July	August	Septem	October	Novem	Decem	Jar



Controlling pear sucker spring

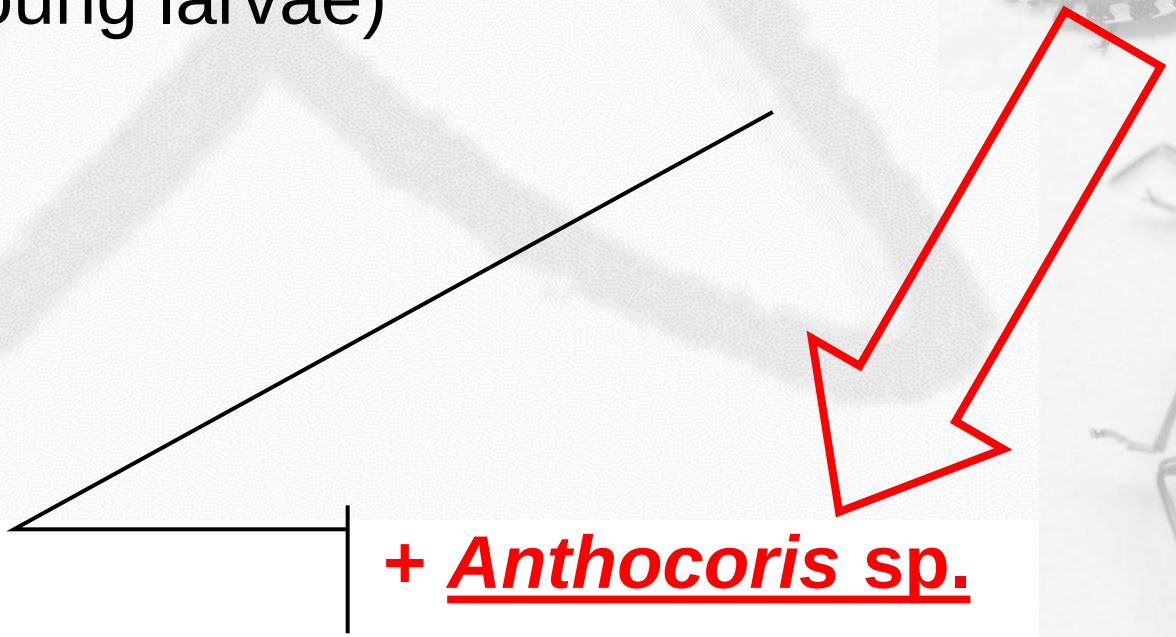


Summer control pear sucker



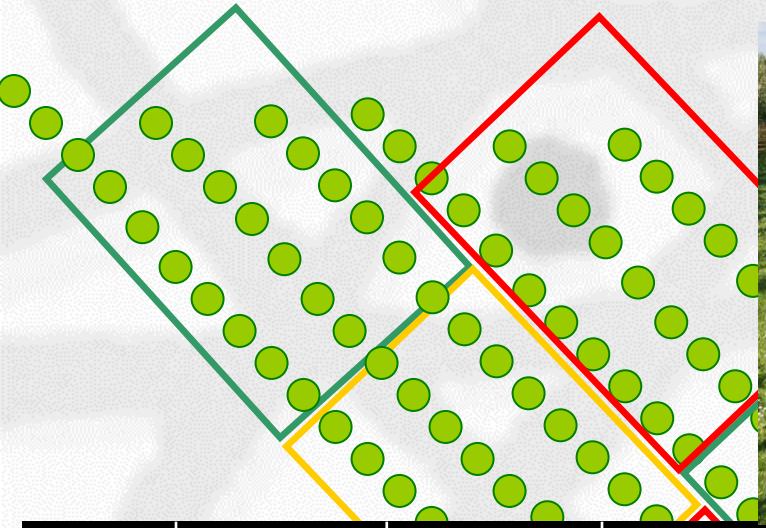
Preflowering treatments Consequences for IPM system?

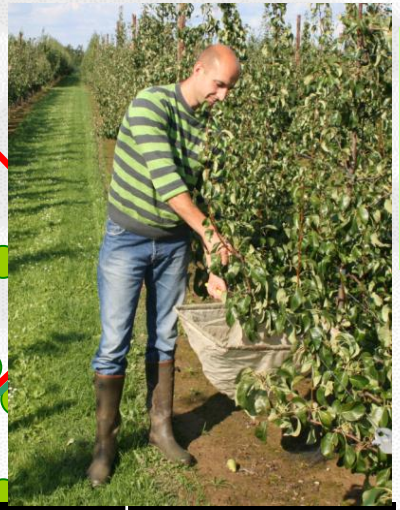
– 1st generation, before flowering (pyrethroid against adults, oil or repellent, thiacloprid on young larvae)



+ *Anthocoris* sp.

Field trials: Determining of side effects





OBJECT	1st gen eggs (Ref Appl. A)	1st gen larvae (Ref. Appl. B)	2nd gen hatching eggs (Ref. Appl. C)	2nd gen larvae (Ref. Appl. D)
1.	-	-	spirodiclofen (+ adjuvant)	spirodiclofen (+ adjuvant)[b]
2.	-	pyrethroid	spirodiclofen (+ adjuvant)	spirodiclofen (+ adjuvant)[b]
3.	-	thiacloprid	spirodiclofen (+ adjuvant)	spirodiclofen (+ adjuvant)[b]
4.	kaolin[a] or mineral oil	-	spirodiclofen (+ adjuvant)	spirodiclofen (+ adjuvant)[b]
5.	kaolin[a] or mineral oil	-	spirodiclofen (+ adjuvant)	abamectin[b]

[a] 1or 3 applications, [b] 1 or no application

Materials & Methods

- **Random block design, macroplots (min.40 trees) (mobile insects), 4 replicates**
- **Treatments with knapsack sprayer, Leaf Wall Area (LWA) dose expression**
- **Sampling of Anthocorids larvae and adults by fixed number of beatings per plot (10-20): One beating = 3 short solid beatings per branch, on 3 randomly chosen branches in centre of plot. Predatory bugs caught in beating tray (min. 40 cm x 50 cm) + counted for each plot. Number of larvae/adults registered separately.**
- **Assessment of mortality (side effect):**

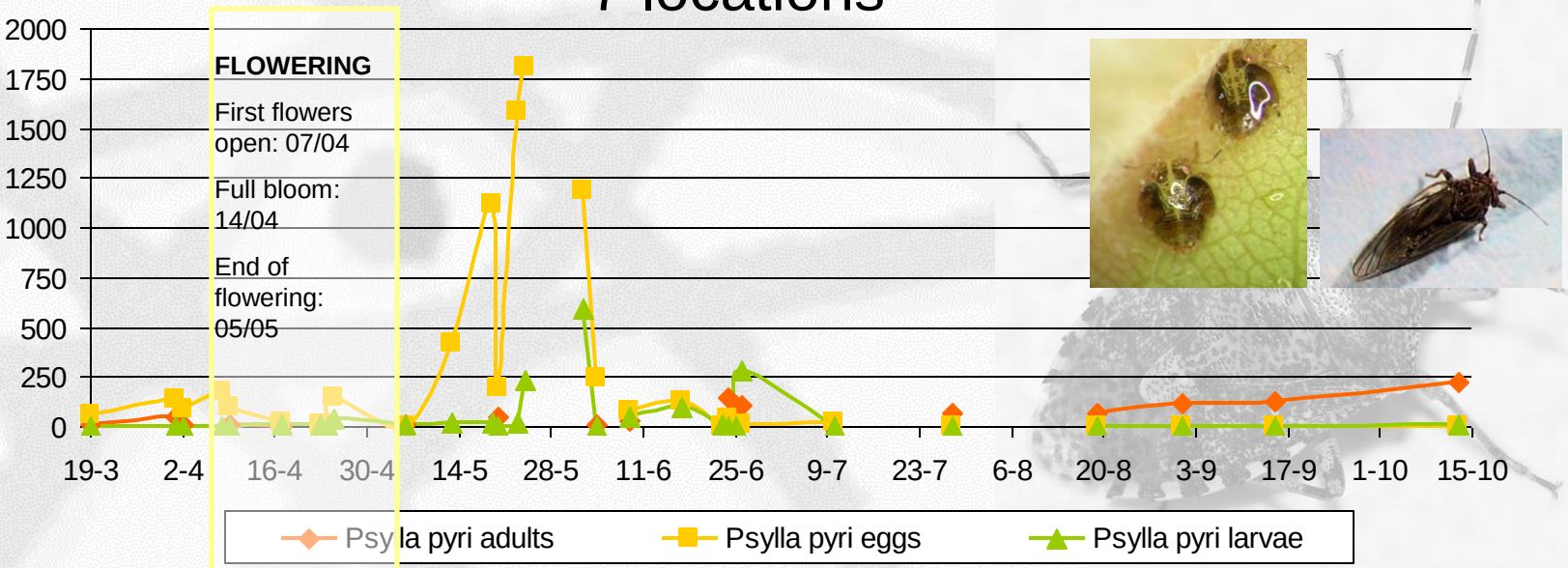
Formula Abbott (%): Side effect = ((C – T)/C) * 100

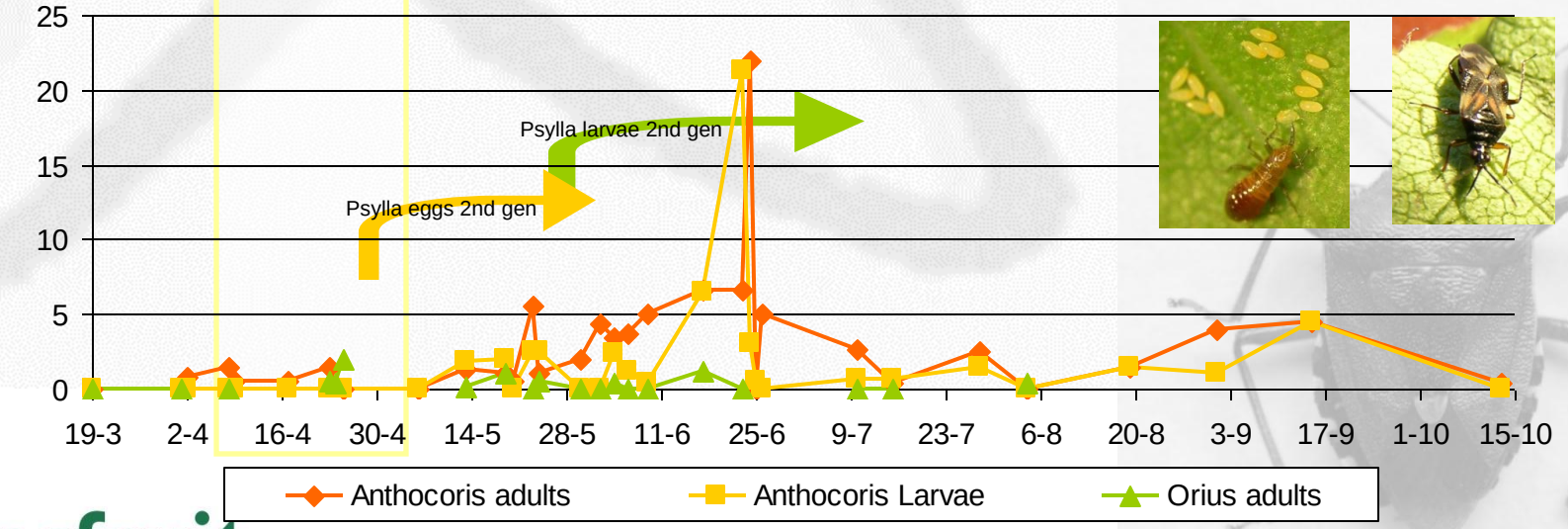
C = average degree of beneficial population in untreated object

T = average degree of beneficial population in treated object

- **Statistical analysis:** homogeneity of variances test(transformations), ANOVA: multiple comparisons (Duncan, Newman–Keuls) or Friedman (two-way ANOVA)

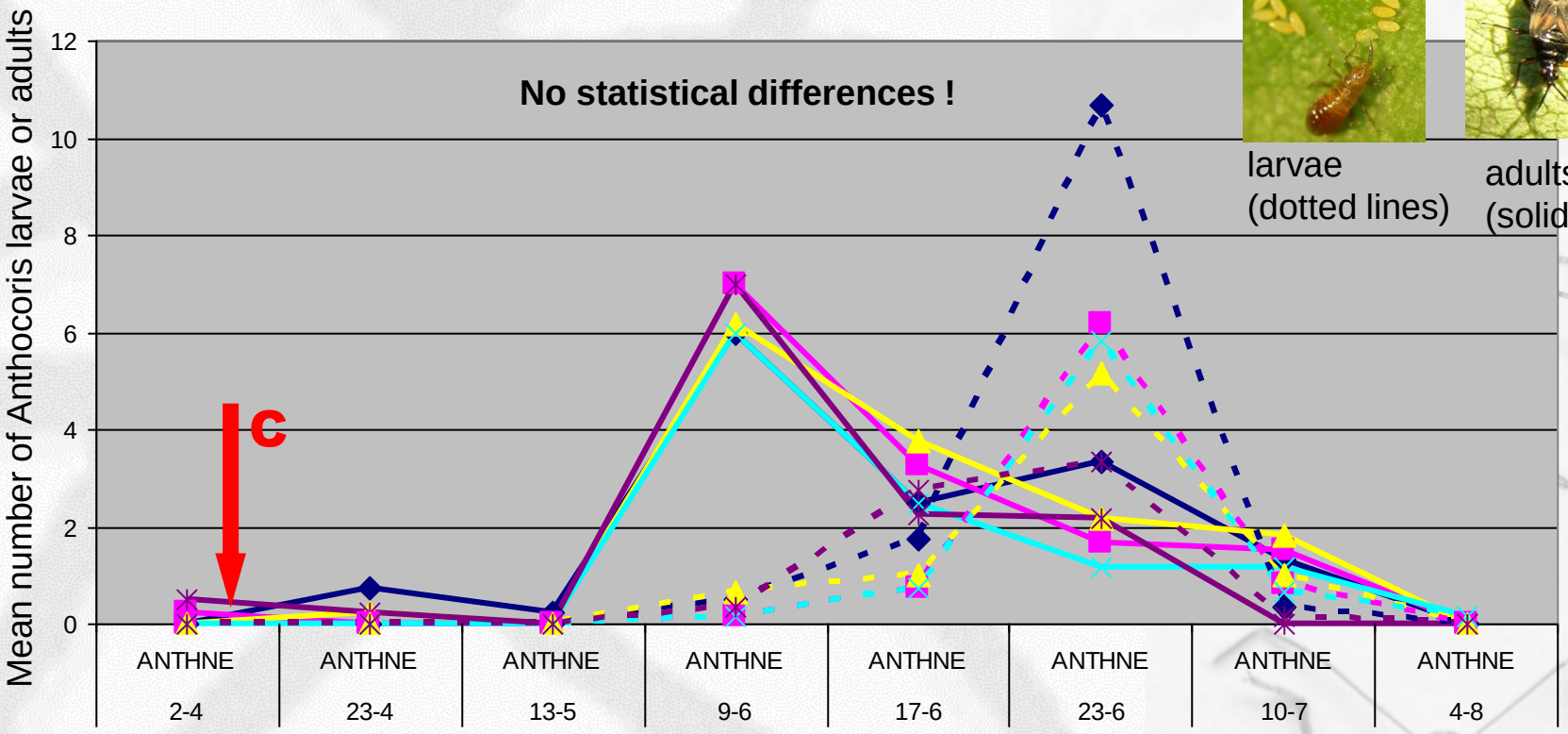
Anthocoris nemoralis & *Cacopsylla pyri* population dynamics 7 locations





Numbers per 10 shoot/clusters or beatings

Example of results for one location



larvae
(dotted lines)

adults
(solid lines)

Check / spirodiclofen + adjuvant (D)

pyrethroid (C) / spirodiclofen + adjuvant (D)

thiacloprid + adjuvant (C) / spirodiclofen + adjuvant (D)

kaolin (AB) / spirodiclofen + adjuvant (D)

kaolin (AB) / spirodiclofen + adjuvant (D), abamectin (E)

Conclusion for IPM system pear

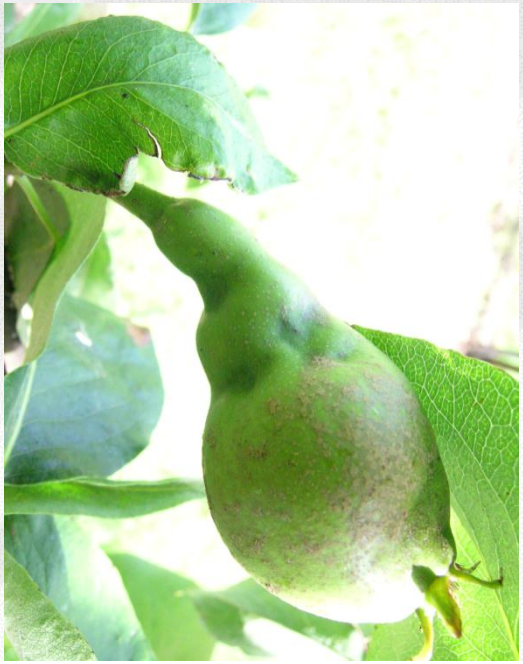
- No stastistical differences between check and thiacloprid objects in larvae of *Anthocoris* sp. in 5 large scale trials
- When statistical differences are found in the number of adults, no differences are found between thiacloprid and the selective IPM references
- thiacloprid can be used on a selective way when applied before flowering, before appearance of *Anthocoris* sp. in the orchard

= ***Selectivity based on timing of application***

IPM in pear orchards

Only selective plant protection products

New challenges: increasing populations of secondary pests
→ economic threshold



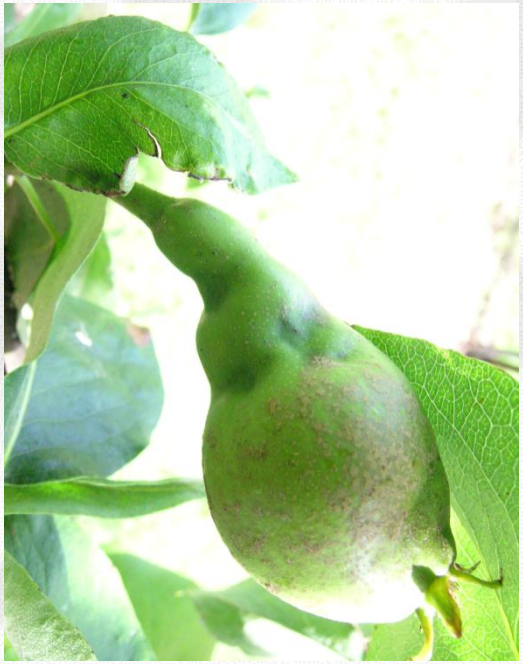
IPM in pear orchards

Only selective plant protection products

New challenges: increasing populations of secondary pests

→ economic threshold

Stink bug damage !



Rhaphigaster nebulosa

Peribalus strictus

Pentatoma rufipes

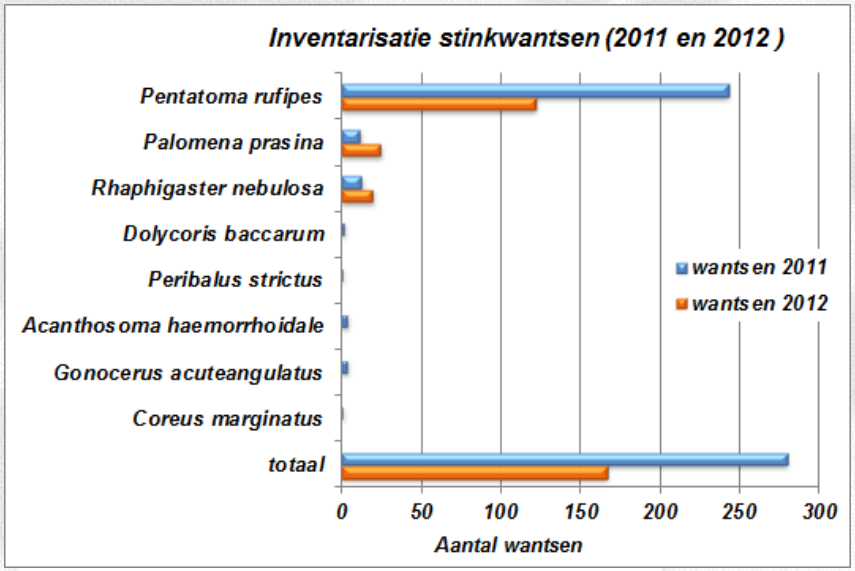
Palomena prasina

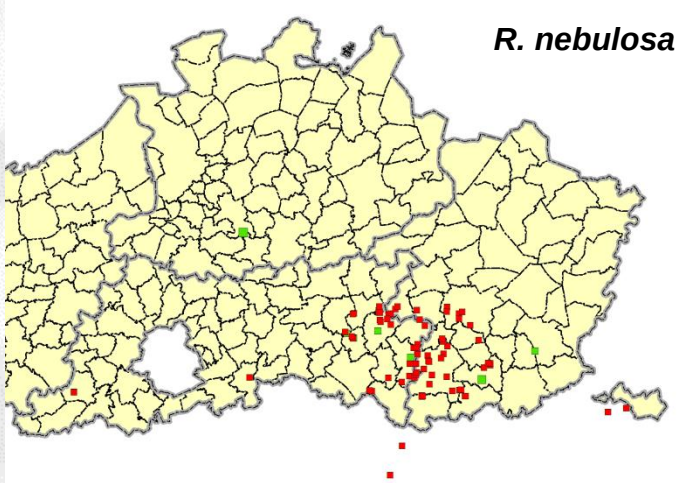
Asopinae: beneficial !

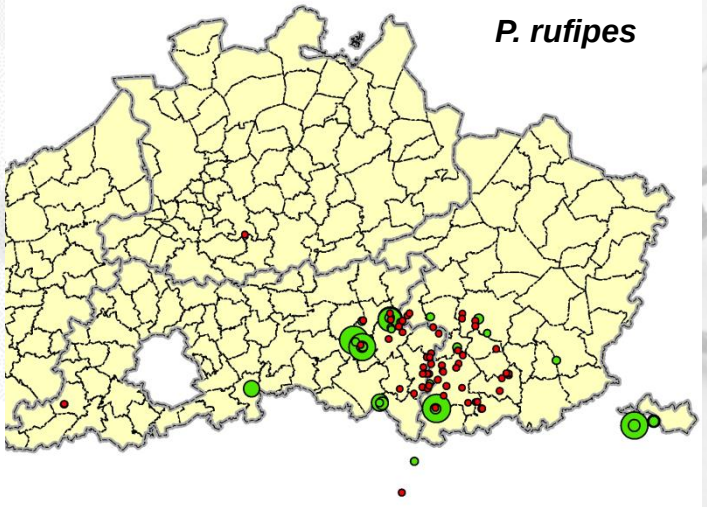
Timing treatments /selectivity: which is causing main damage? How is life cycle?

Stink bugs in pear orchards

Which species is mainly responsible for increasing damage?







→ *P. rufipes* correlation - damage pears

IPM control method: beat and kill

Location	Method	Total	*P. Rufipes* stink bugs	Other stink bugs	% damage	Mean % damage
Huldenberg	Beat and kill	17	15	2	9.12	11.9
				2	8.86	
				1	10.18	
				6	19.50	
				11		
				7	7.44	7.8
				5	5.92	
				7	4.83	
				2	12.85	
				21		

Abbott control

29.9 %

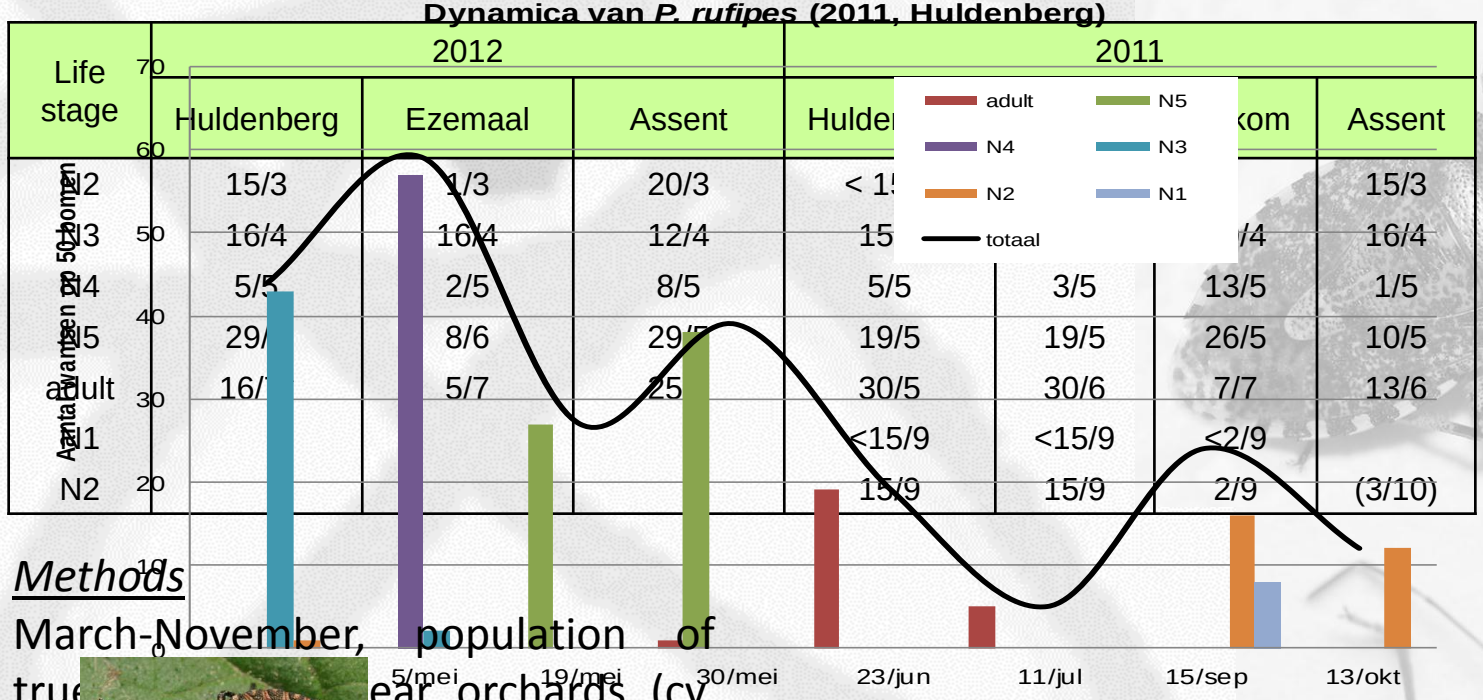
5.4 %

→ Very labor intensive: variable efficacy results

Stink bugs in pear orchards

Population dynamics of *Pentatoma rufipes* ?

Life stage	2012 Huldenberg	2012 Ezemaal	2012 Assent	2011 Hulde	2011	2011 kom	2011 Assent
N2	15/3	1/3	20/3	< 15			15/3
N3	16/4	16/4	12/4	15		/4	16/4
N4	5/5	2/5	8/5	5/5	3/5	13/5	1/5
N5	29/	8/6	29/5	19/5	19/5	26/5	10/5
adult	16/	5/7	25	30/5	30/6	7/7	13/6
N1				<15/9	<15/9	<2/9	
N2				15/9	15/9	2/9	(3/10)



Methods

March-November, population of true ear orchards (cv. Con monitored by bea n 3 shoots of 50 tree d bugs were identifi stage sex) and cour

Overwintering as nymph !

Stink bugs in pear orchards

Field trial: control efficacy sprayings

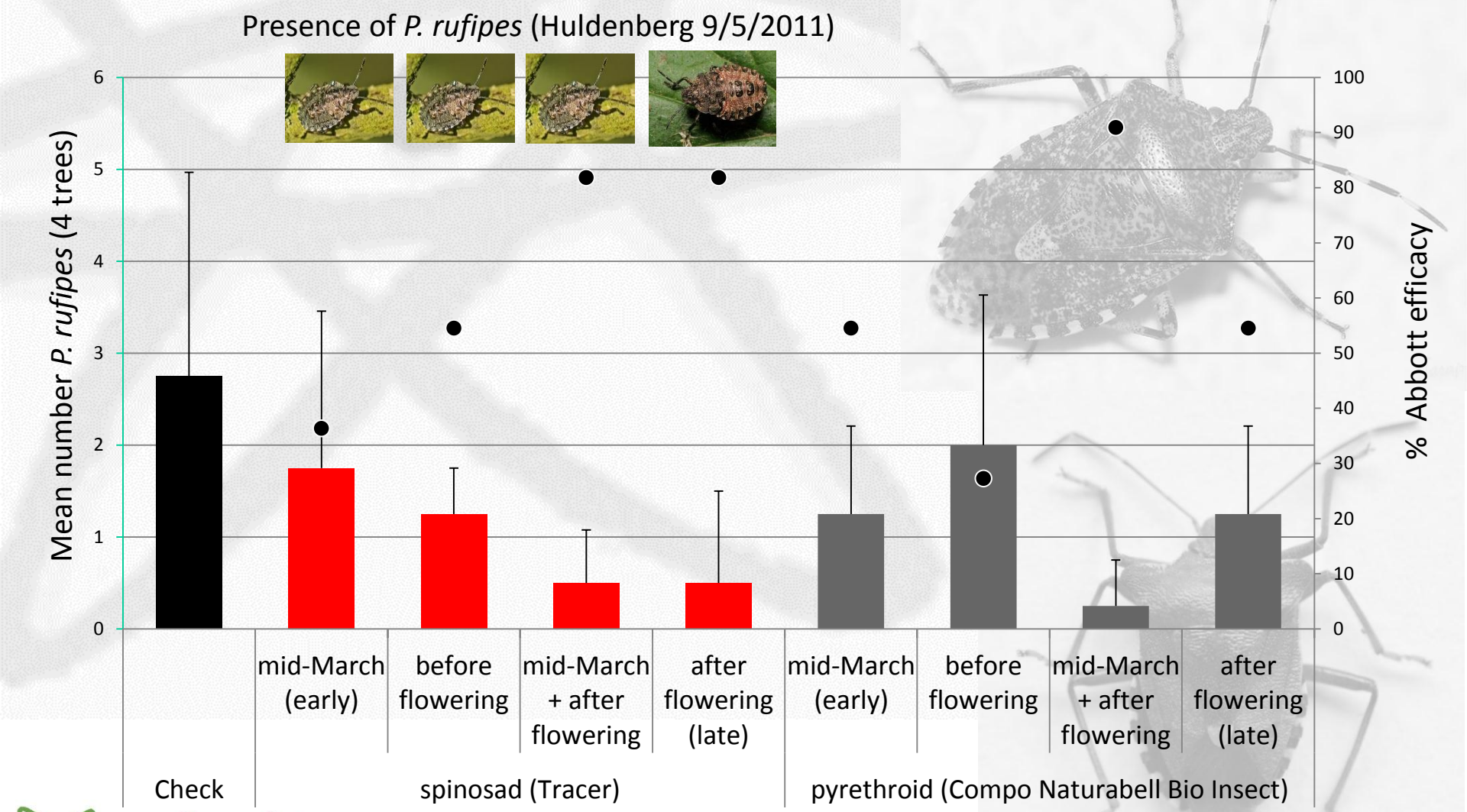
Methods

- Randomized microplot block design (6 trees/plot, 4 plots/treatment) in two pear orchards (cv. Conférence) using a motorized knapsack sprayer
- Assessments of *P. rufipes* in May and in June,
- Assessments of damaged fruit (%) in July
- Efficacy calculated as corrected mortality (%) according to Abbott (1925).

Obj	Product	Active ingredient	Dose rate	App	Application time
	Check (untreated)				
1	Tracer 480 EC	Spinosad	0.3 l/LWA	1	March 15 (early season)
2	Tracer 480 EC	Spinosad	0.3 l/LWA	1	April 1 (before bloom)
3	Tracer 480 EC	Spinosad	0.3 l/LWA	1	April 19 (after bloom)
4	Tracer 480 EC	Spinosad	0.3 l/LWA	2	March 15 + April 19
5	naturabell Bio insect 180 EC	Pyrethrum + Piperonylbut	3 l/LWA	1	March 15 (early season)
6	naturabell Bio insect 180 EC	Pyrethrum + Piperonylbut	3 l/LWA	1	April 1 (before bloom)
7	naturabell Bio insect 180 EC	Pyrethrum + Piperonylbut	3 l/LWA	1	April 19 (after bloom)
8	naturabell Bio insect 180 EC	Pyrethrum + Piperonylbut	3 l/LWA	2	March 15 + April 19

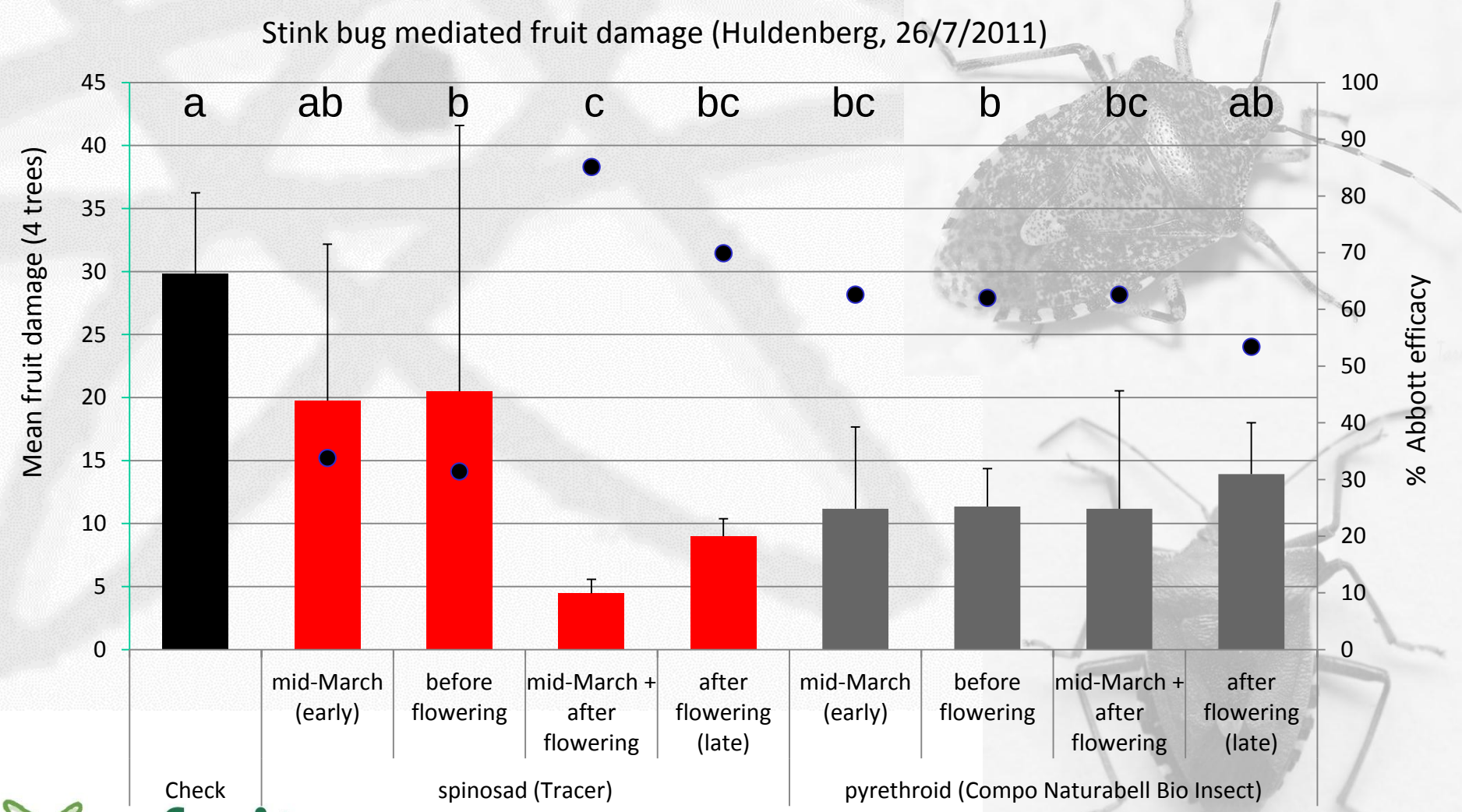
Stink bugs in pear orchards

Field trial: control efficacy sprayings



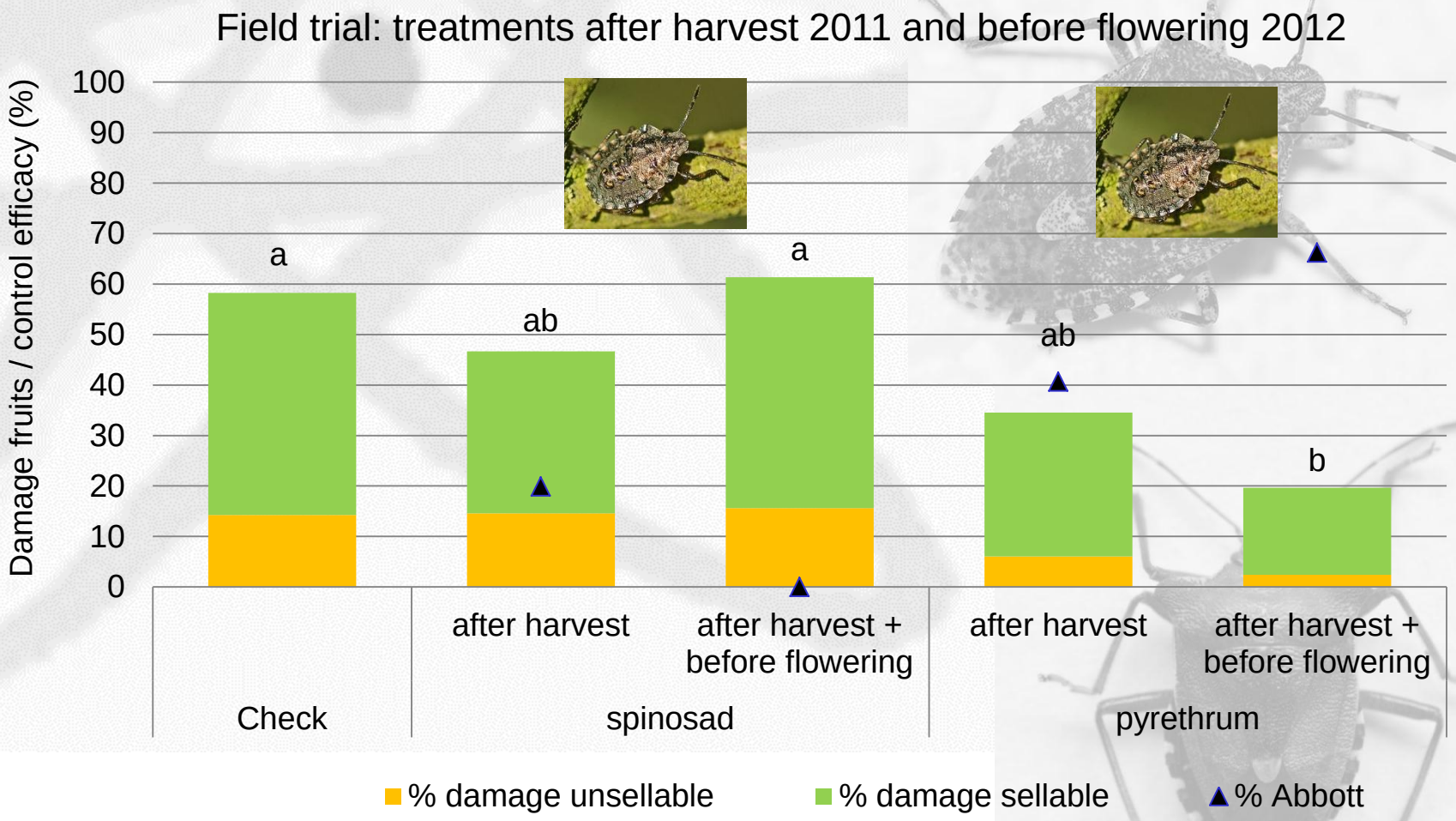
Stink bugs in pear orchards

Field trial: control efficacy sprayings



Stink bugs in pear orchards

Field trial: control efficacy sprayings



Conclusion stink bug control pear (IPM/organic)

- Forest bug *Pentatoma rufipes* is main stink bug pest species in pear
- In contrast to many other stink bugs, *P. rufipes* overwinters on the fruit trees as small nymphs

  → become active early in the spring and cause damage to the fruits before and after bloom.

- Timing treatments crucial: directed on (more sensitive) nymphs !
- Control efficacy is depending on timing and products used.

  spinosad: best efficacies around/after flowering

  pyrethroid: best efficacies after harvest and before flowering

- IPM system: differences in side effects (pyrethroid = broad spectrum) on beneficial arthropods (predatory bugs etc..) have to be considered in timing of the treatments.

  → **Timing of treatments = crucial aspect in IPM**

Thanks to

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PROEFCENTRUM FRUITTEELT VZW

- Colleagues pcfruit vzw
- CRA-W
- FOD Volksgezondheid RF 10/6231 PENTA-in-TOMIDAE
- IWT LA/110778
- CCBT

cra-w

federale overheidsdienst
VOLKSGEZONDHEID,
VEILIGHEID VAN DE VOEDSELKETEN
EN LEEFMILIEU

iwt

CCBT

- Phytopharmaceutical companies for support field trials / product development
- Fruit growers for trial orchards
- And you for your attention !