

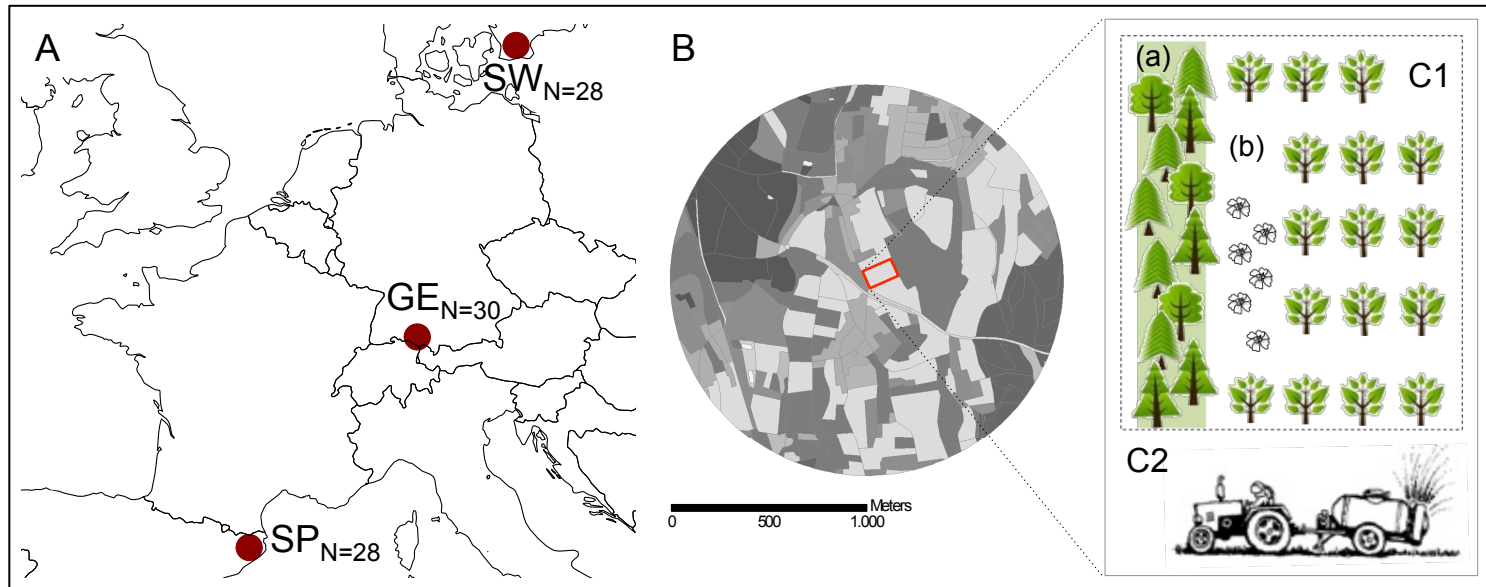
Developing Apple Pest control strategies through an Integrated agro-ecosystem approach

Marco Tasin

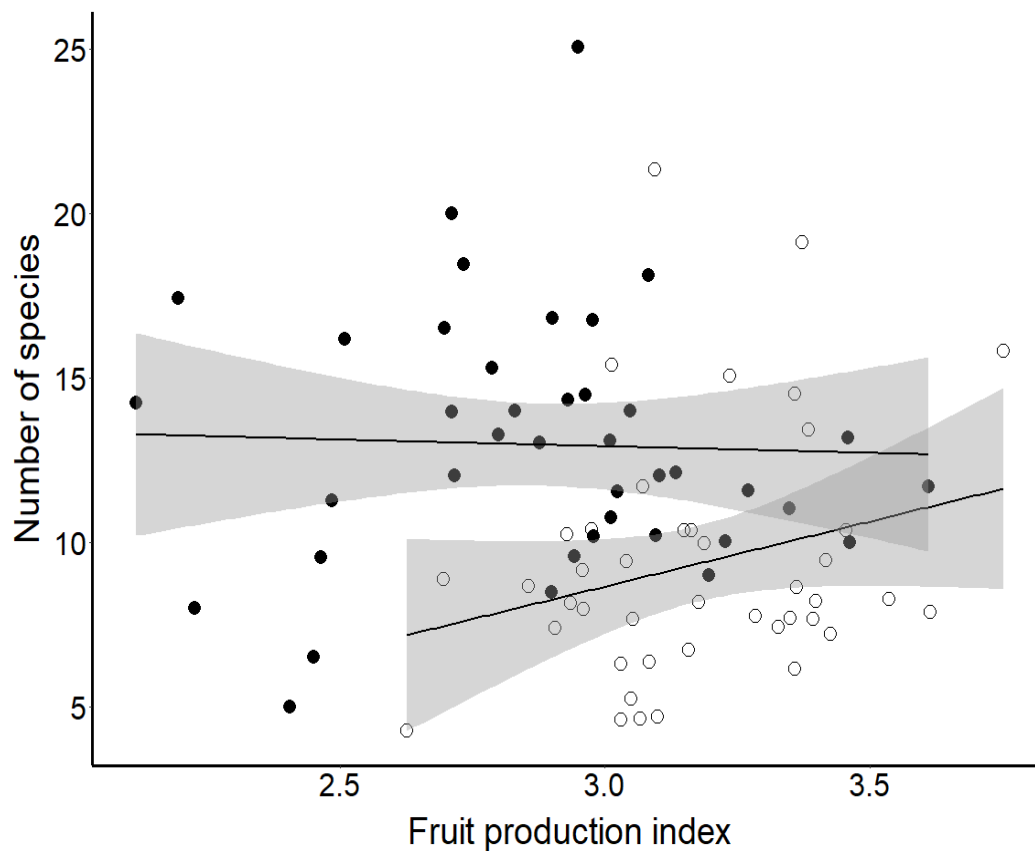
SLU, Alnarp, Sweden

Effect of orchard management on ecosystem services across Europe (Ecofruit, BioDiversa project)

Germany, Spain, Sweden (N=120 orchards)



Effect of management on ecosystem services: Germany, Spain, Sweden (N=120 orchards)



Diversity can be increased with limited yield loss.
Organic 38% more insect and spiders species than IPM

(o = IPM)

Effect of flower cover between trees on predator abundance in orchards (Skåne, 2014)

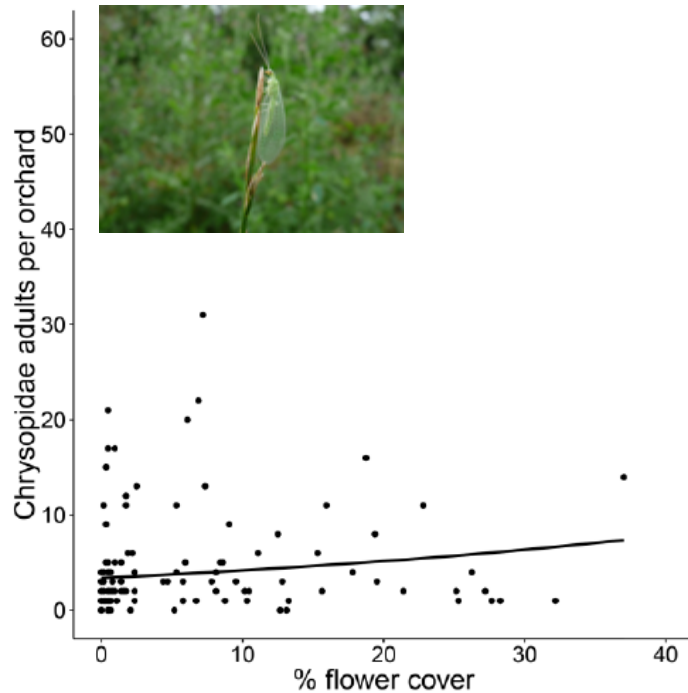


Fig. 9. Relationship between % flower cover between tree lines and Chrysopidae adult abundance in conventional and organic apple orchards in weeks 22-29 (2014).

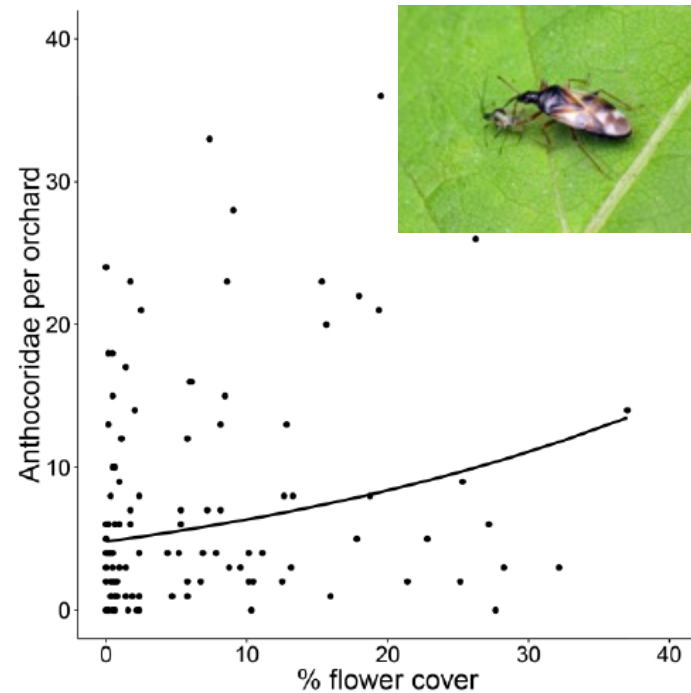


Fig. 10. Relationship between % flower cover between tree lines and Anthocoridae adult and nymph abundance in conventional and organic apple orchards in weeks 22-29 (2014).

Approach 1: Flower strips

- Adding non-crop vegetation to increase shelter, alternative prey, nectar and pollen for natural enemies of pest



Achillea millefolium
(Rolika)



Geranium pyrenaicum
(Skuggnäva)



Hypochaeris radicata
(Rotfibbla)



Daucus carota
(Morott)



Cichorium intybus
(Vägvårda)



Medicago lupulina
(Humle lusern)

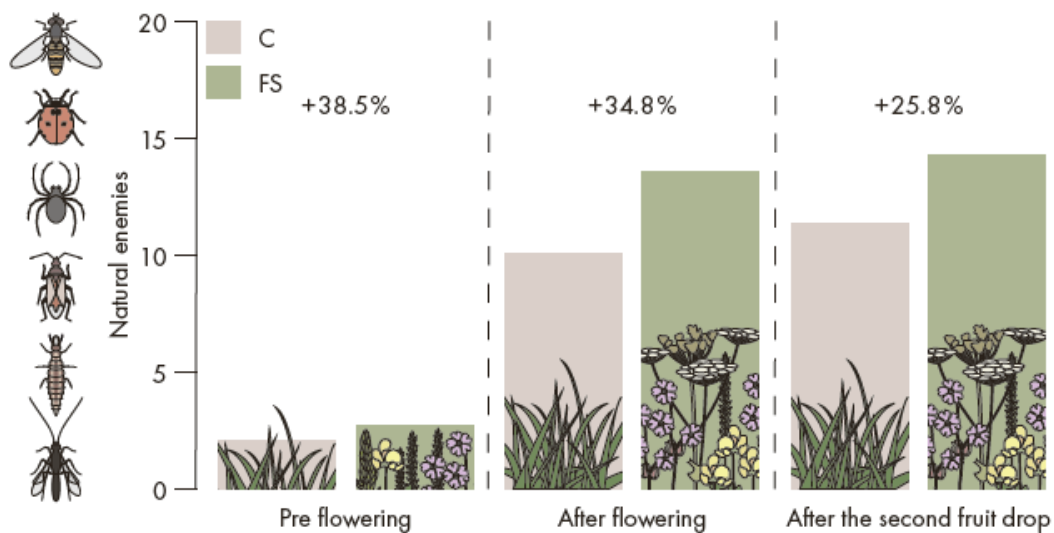


Trifolium pratense
(Röd klover)

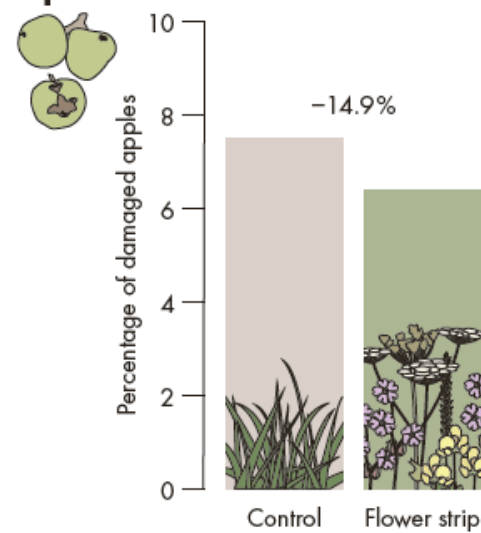
Flower species sown in flower strips
with high survival in Skåne orchards
(2015-2017)



Promotion of aphid natural enemies during the season



Reduction of fruit damages caused by aphids





Innovativ design & förvaltning för att gynna funktionell lantbruksbiologisk mångfald.

Inbjudan till workshop

Att gynna och följa upp naturliga fiender i äppelodling.

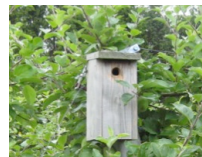
Välkommen till workshop på SLU Alnarp torsdag den 25e februari. Syftet är att skapa ett nätverk av intresserade praktiker och forskare samt utbyta praktisk, lokal-specifik och vetenskaplig kunskap kring hur naturliga fiender påverkas av odlingsteknik och hur de kan gynnas. Workshoppen är en del av det Europeiska nätverket och projektet EcoOrchard.

Fokus kommer att ligga på att gemensamt utveckla enkla men korrekta metoder för att mäta deras förekomst i odlingen. Intresserade odlare kan välja en eller flera metoder de vill testa och utvärdera på sin gård under odlingsäsongen. Metoderna presenteras av oss forskare, rådgivare och odlare tillsammans.

En gemensam utvärderande workshop kommer att organiseras under kommande höst eller vår.

Vi bjuder på resa med tåg, buss eller bil (samåk gärna!), lunch, fika och en eventuell övernattning vid behov.

Plats: Alnarp, seminarierummet i Horticum
Datum, tid: torsdag 25e februari 9.30-16.30
Språk: vi kommer att blanda svenska och engelska och summerade översättningar vid behov.
Anmälan: senast 1 februari på länken i mailet (<http://goo.gl/forms/tqxaHwJdq5>).
Kontakt: veronika.swiergiel@slu.se, 040-415312



Foton Weronika Swiergiel

Mer information om projektet
<http://coreorganicplus.org/research-projects/ecoorchard/>

EcoOrchard finansieras av CORE Organic Plus



Technical guide

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Functional agrobiodiversity

Perennial flower strips – a tool for improving pest control in apple organic orchards



FIBL

Wallonia
recherche
CRA-W

økologisk

shel

SLU

UNIVERSITY OF
COPIENHAGEN

Soil preparation and sowing of flower strips

Sowing periods

Two sowing periods are possible:

In regions with short winters:

- (i) from April to May and
- (ii) from early September to mid-October.

In regions with long winters:

- (i) in May and
- (ii) in August to early September (after harvest).

Climatic conditions immediately after sowing have a major influence on the result. Sowing between the end of April and early June enables germination of a part of the seeds before summer drought. Further seeds will germinate in the following years.

In regions with frequent dry periods in spring, sowing can be postponed or done in autumn, in order to increase the chance to quickly benefit from a wet period inducing a good germination rate. Late sowing also allows soil cultivation during summer, which reduces perennial weeds and regrowth of grasses. Moreover, lower weed developments can occur during autumn.

Soil preparation

A carefully prepared seedbed promotes good germination and early development of the sown species and reduces later maintenance measures. The goal is to prepare a seedbed reducing the grass competition, so that it will stay vegetation-free at least for four weeks.

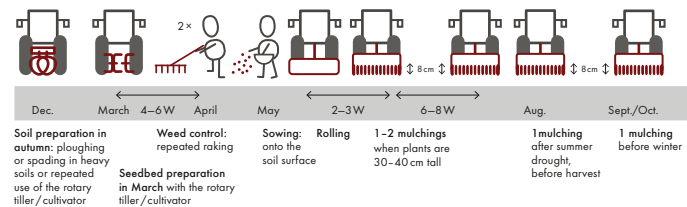


The recommended width for flower strips is equal to the inner distance between the tractor wheels plus 10 cm, resulting in a 5–10 cm overlap into the tractor track at each wheel. It depends on the available machinery for soil preparation and mulching.

How to proceed:

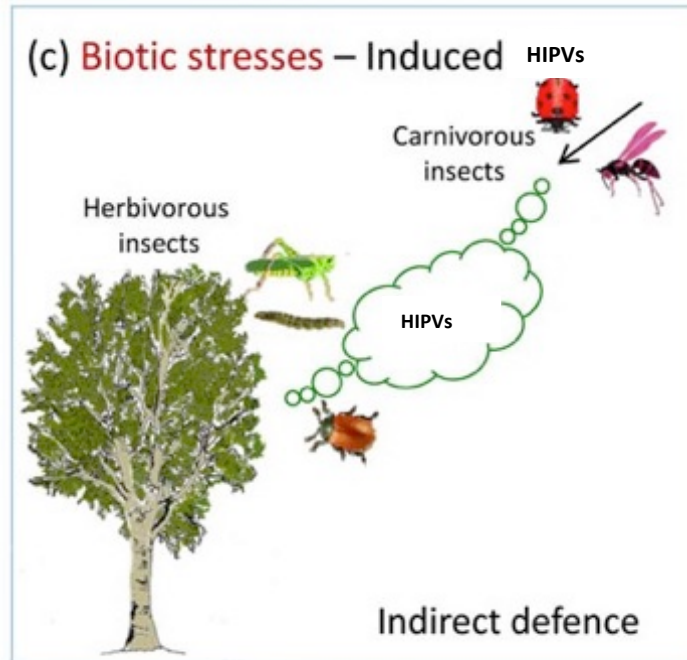
- Only work the soil after it has dried well.
- Prepare a relatively fine seed-bed using a rotary tiller / cultivator. Avoid too fine seedbed, as it will silt when it rains and thus hinder emergence of the sown plants.
- Ensure good settling of the soil for four to six weeks to allow a good contact between seeds and soil.
- Before sowing, encourage germination of weed seeds through repeated (two times) superficial (max. 3 cm deep) mechanical harrowing or manual raking. This will reduce weed pressure after germination of the seed mixture.

Procedure for sowing a flower strip and management in the first year



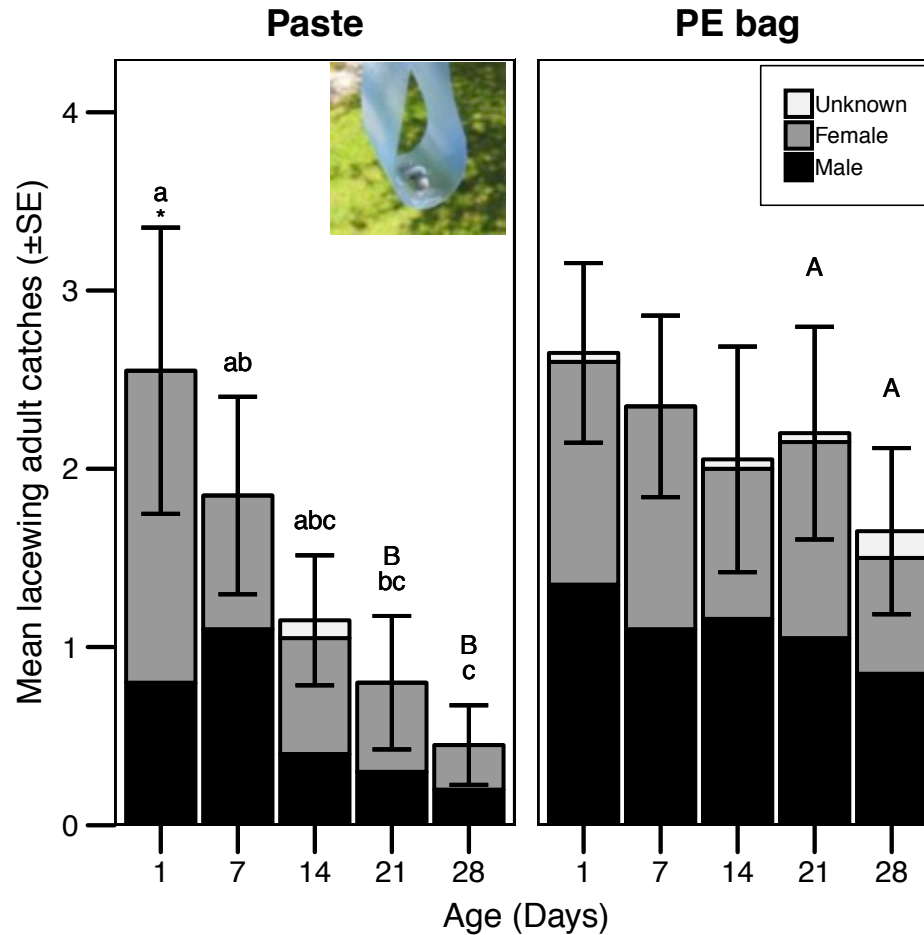
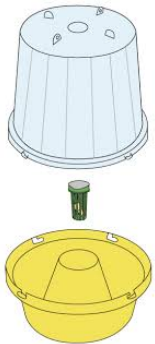
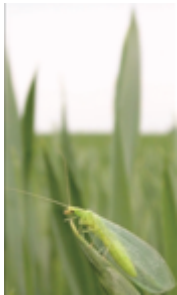
Approach 2: Attracting NE to apple trees

- Can we enhance the effect of flower strips by attracting natural enemies from the flowers to the apple trees?



HIPVs = Herbivory Induced Plant Volatiles

Lacewing catches in the orchard



Approach 3: Mating disruption for tortricids (vecklare)



Adoxophyes orana
Fruktskalvecklare

Archips podana
Frukträdsommarvecklare

Archips rosana
Häcksommarvecklare

Pandemis heparana
Tandbredvecklare



Spilonota ocellana
Lövträdknoppvecklare

Cydia pomonella
Äpplevecklare

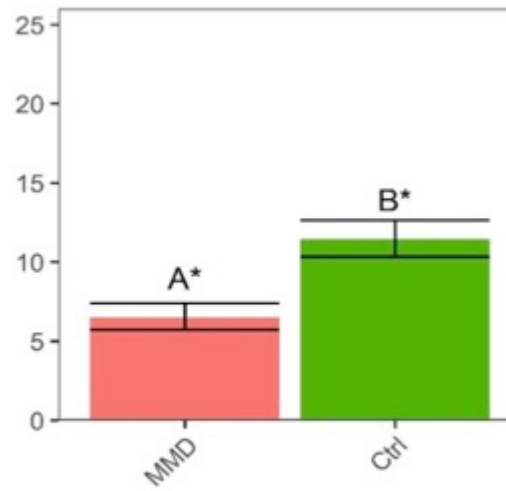
Approach 3: Multipurpose mating disruption

(2012-2016, Registration in 2020)

- *Cydia pomonella* (E8, E10-12:OH; 12:OH; 14:OH)
- *Pandemis heparana* (Z9-14:Ac; Z11-14:Ac)
- *Adoxophyes orana*
- *Archips podana*
- *Archips rosana*
- *Spilonota ocellana* (Z8-14:Ac; Z8-14:OH)



Approach 3: result (2012-2015)



Mating disruption gives same or better efficacy than standard insecticides

Novel Approach 4: 1+2+3

MMD = multispecies mating disruption (6 tortricids)



Reward = flower strips to support natural enemies



Attract = plant volatiles to attract natural enemies to the trees



2015-2018 (Sweden, 5 organic orchards)

MMD

MMD + R

MMD + A

MMD + A + R



From 2015 to
2018
(N=5, Skåne)



Winter moth

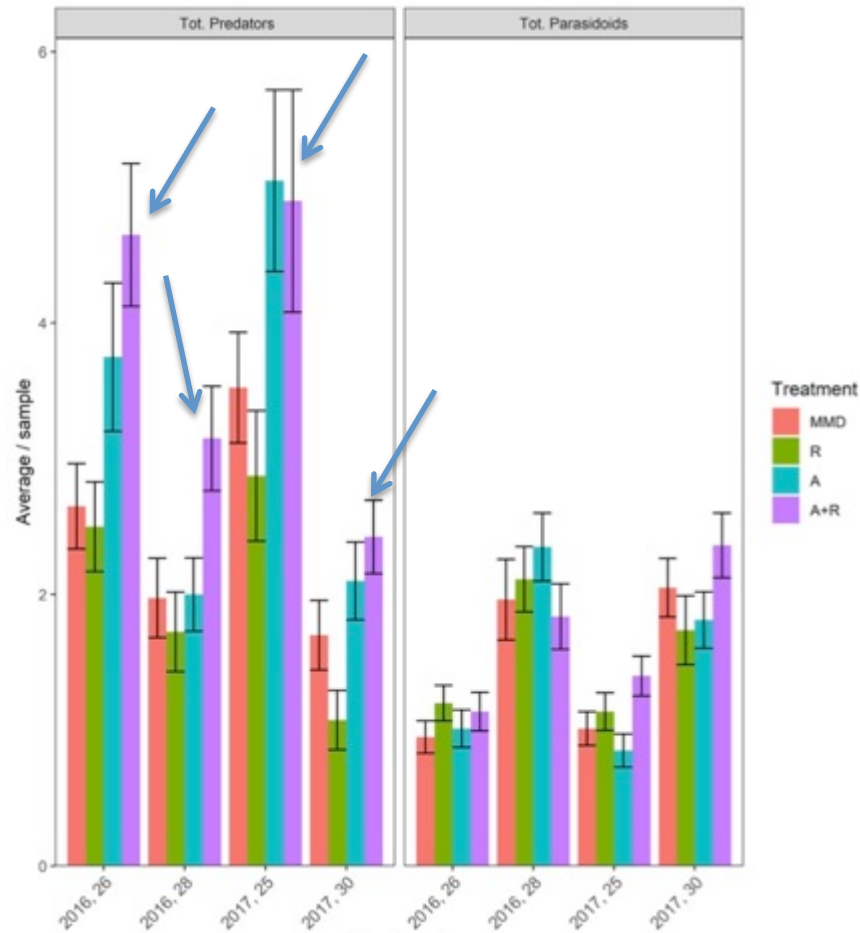


6 tortricids

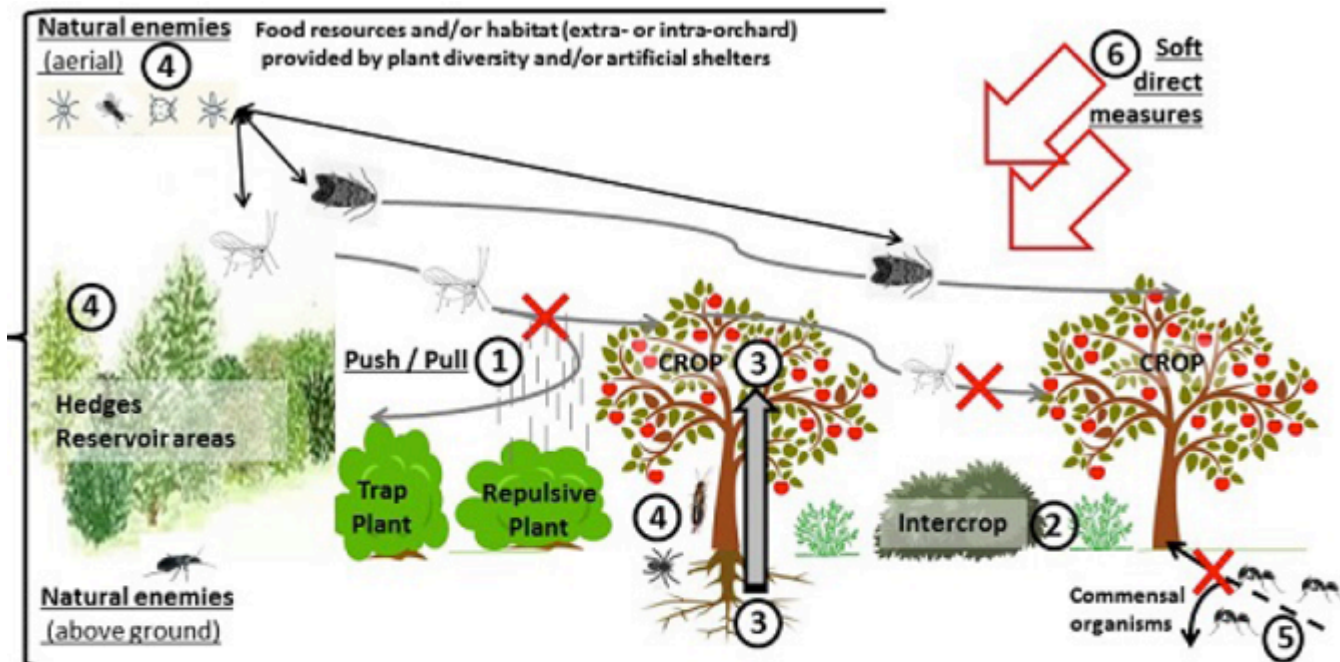


Natural enemies

Effect of Attract, Reward and MMD (2015-2018, Skåne)

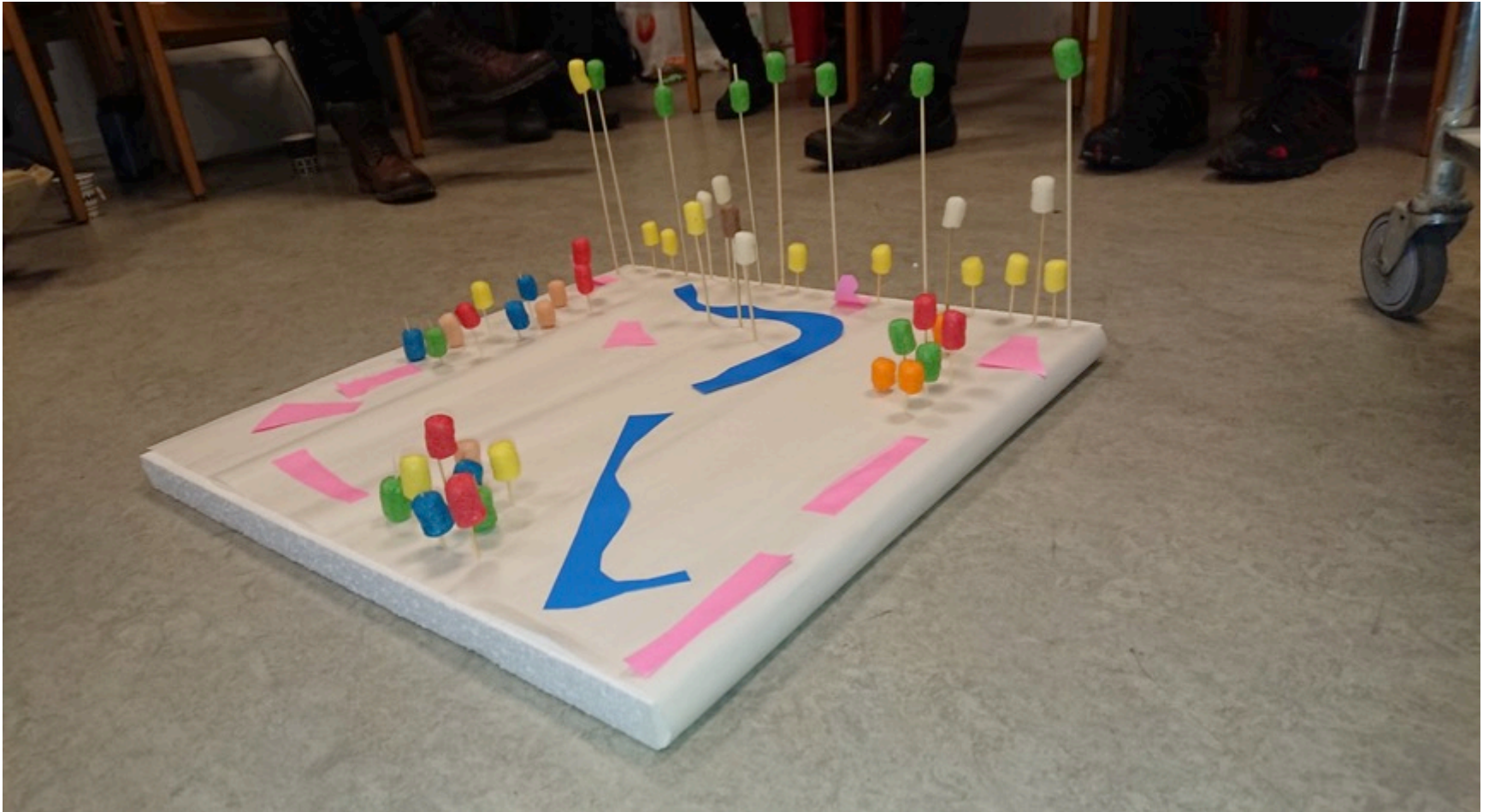


API-tree: Developing Apple Pest control strategies through an Integrated agro-ecosystem approach



- 1- **Push & Push/Pull** using trap and/or repulsive plants emitting plant volatiles
- 2- **Barrier and dilution effects** by increasing plant diversity within orchard
- 3- **Bottom up processes** through cultivar, tree nutrition, manipulation of tree architecture
- 4- **Top-down processes mediated by naturally occurring natural enemies of pests** (aerial and aboveground), through provision of food resources and/or habitat within the orchard and outside
- 5- **Diversion of commensal organisms (ants)**
- 6- **Direct measures with soft practices**, using predictive models to assess damage risk, including release of indigenous or exotic natural enemies.

WP2 “Design of systems with combinations of levers and orchard co-design” (Sweden and France)



WP2 “Design of systems with combinations of levers and orchard co-design”

Workshop on orchard co-design (Alnarp, February 2, 9-17)
3 advisors, 3 PhD students, 1 Researcher, 5 farmers

What are the existing biodiversity features in your orchard?

Challenge: Increase biodiversity in an old plantation

Began increasing species diversity using diverse species within the hedges.

Unfortunately, Länstyrelsen monitors hedge thickness rigidly, and if a hedge is beyond a certain thickness, they will reduce the land counted as ‘under agricultural cultivation’ which reduces land eligible for compensation in the EUs CAP.

Trying to integrate diversity in the water (stream / brook) on the property.

When clearing old trees, we can have an intermediate crop for a few years so that the soil can rest from apple trees, in order to have intermittent diversity.

We can create a bio diverse herb garden close to the gårdsbutik house, which would also be of interest to the visitors.

Create islands of other species inside the plantation.

API-tree WP3: diversion of ant attendance



Ants are pushing away natural enemies from aphid colonies

Can we use artificial “honeydew” to divert ants from aphid colonies?



L_EP+Su

L_EP+Su+M

L_B

S_CP+Su

EP+Su

S_B

L_CP+Su

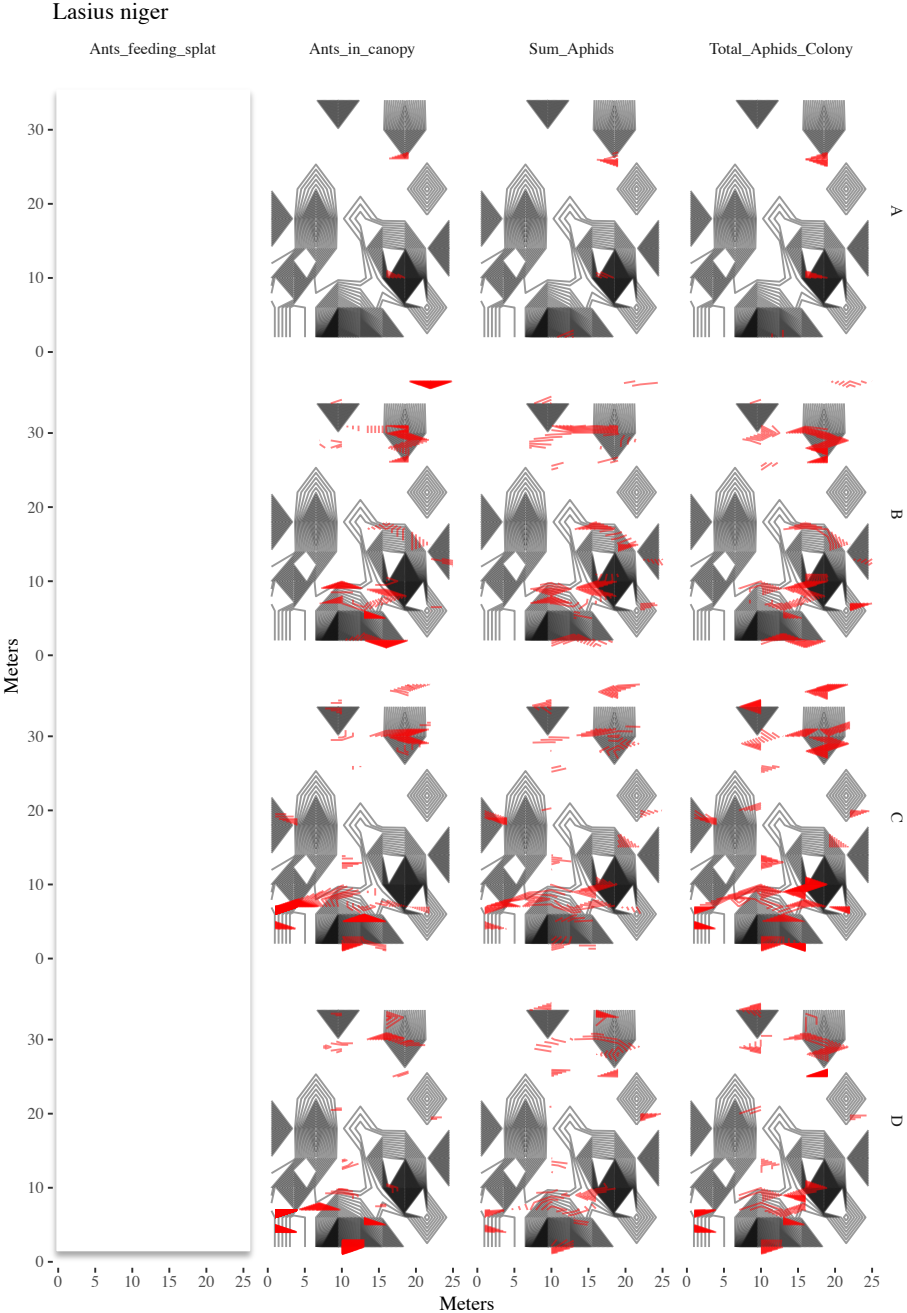
S_Su

L_Su

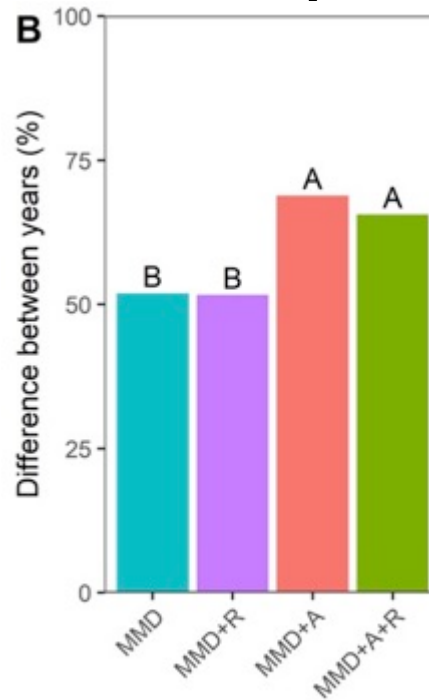
L_OSu

S_EP+Su+M

Mapping ants in the orchard: spatial correlation between ant and aphid density



Effect of Attract, Reward and MMD on pest damage (2015-2018, Skåne)



Attract, Reward and Disrupt (AR&D)

to

Attract, Reward, Disrupt and Divert
(AR in 2D)

(discussion on transition from 3 to 5 years project 😊 !)

Thank you !

- Apple growers and advisors (real innovators!)
- Formas
- Core Organic +
- BioDiversa
- C-IPM
- SLF Sweden
- Partnership Alnarp