DEVELOPMENT OF STRATEGIES TO CONTROL SEA BUCKTHORN FRUIT FLY IN ORGANIC FARMING

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OUTLINE

- Sea buckthorn fruit fly (SBF) in Germany
- Biology of SBF
- Project modules
  - Traps
  - Soil covering
  - Soil tillage
  - Macroorganisms
  - Varieties
- Summary

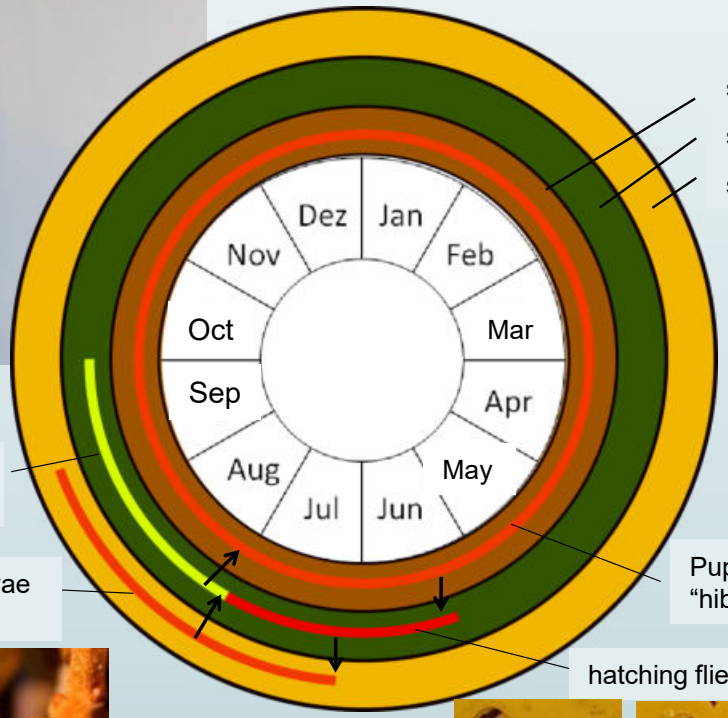
SEA BUCKTHORN FRUIT FLY IN GERMANY

- first occurrence in 2012
- rapid spread especially in orchards around Berlin
- very differentiated infestation situation
- major damage in sea buckthorn orchards since 2015 (>20% infestation)

- MoPlaSa-Project 2019-2022

Goal:
Development of a modular plant protection strategy based on different sustainable, non-chemical methods to control the sea buckthorn fly

KNOWLEDGE ABOUT THE BIOLOGY OF SEA BUCKTHORN FRUIT FLY



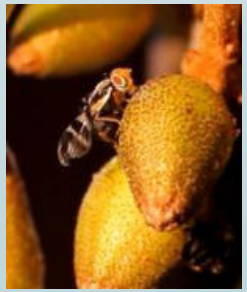
soil

soil surface

sea buckthorn bushes

migrating larvae, pupation

flies, oviposition and larvae development (fruits)



Pupae with “hibernators”

hatching flies

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PROJECT MODULES

Practical tasks and trials

- screening sands for pupae
- monitoring flight season (orchards, also in big cages)
- hatching trials (i. a. temperature threshold, phenology) – laboratory, climatic chamber, greenhouse
- traps (many variations and baits, also different colors); chicken
- microorganisms (entomopathogenic fungi, *Bacillus thuringiensis*) – laboratory, semi field
- soil cultivation – semi field, field
- barriers (permanent, temporary) – semi field, field
- nematodes - laboratory, semi field, field
- varieties (infestation level and trigger) – laboratory, field
- parasitism level by antagonists – laboratory
- combination micro- macroorganisms and adhesives - laboratory, field

PROJECT MODULES

1. Traps

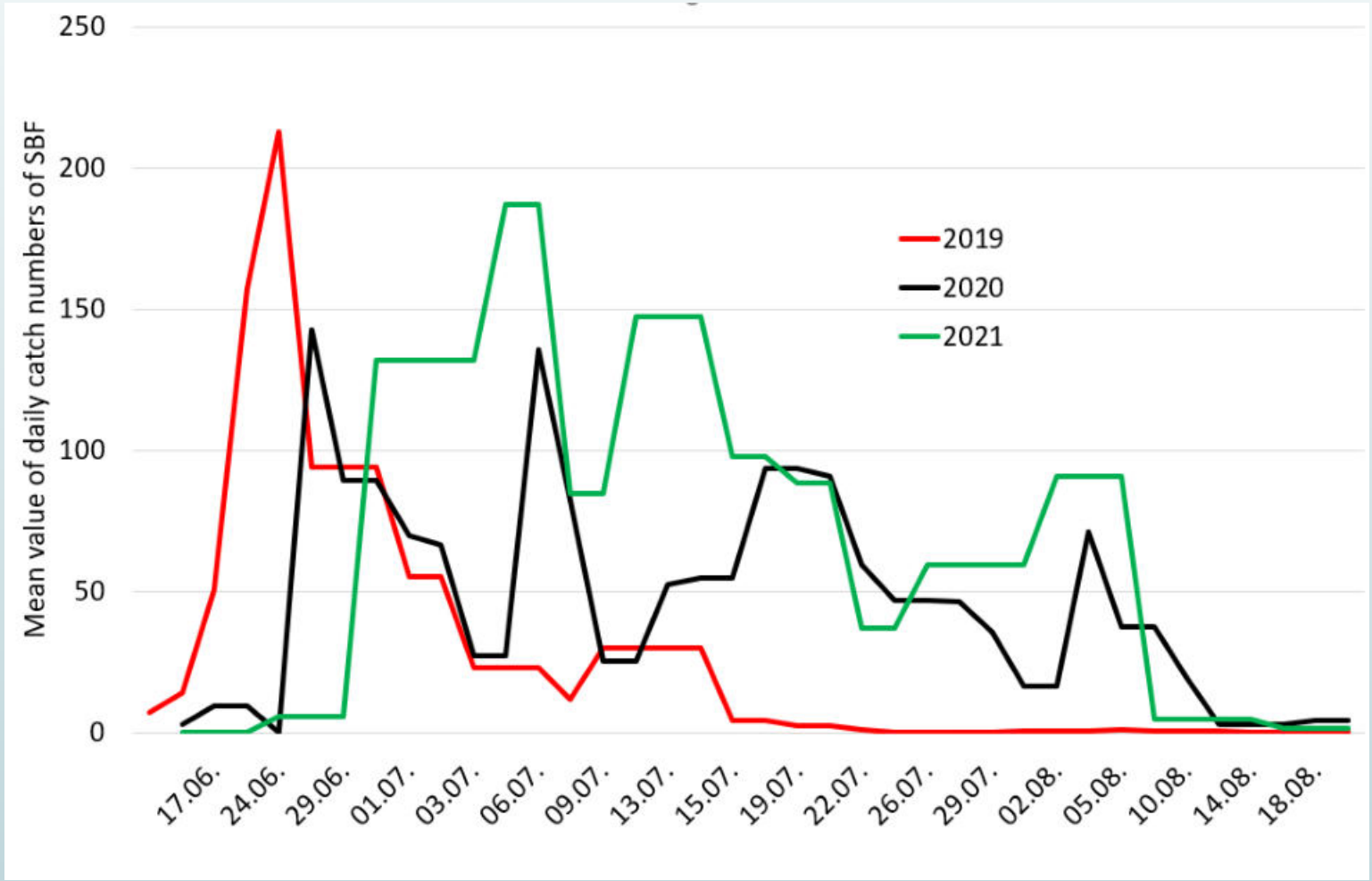
Investigations

- testing of different traps and attractants
- use for flight monitoring or also mass trapping ?

PROJECT MODULES

1. Traps

Results



Daily catch number of seabuckthorn fly (mean value from three yellow cross glue traps, research station Berlin-Dahlem) 2019-2021

PROJECT MODULES

1. Traps

Results

- best catch results with yellow cross glue traps
- wasp traps + ammonium carbonate bait (4 weeks durability)
- evaporation of wasp traps: decrease by addition of propylene glycol
- by-catch: glue traps higher than wasp traps
- decrease in catch numbers 2019-2022

Conclusion

- effective means to monitor flight characteristics (start, climax, number), not for mass trapping

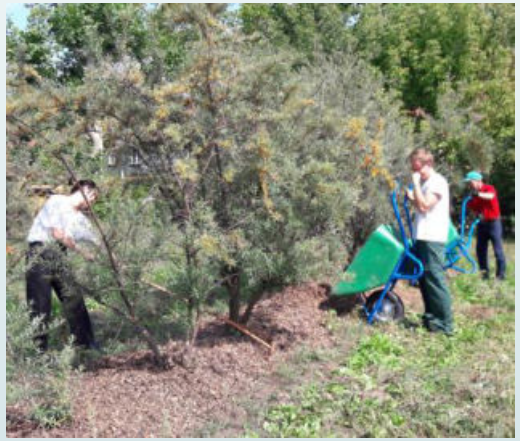
PROJECT MODULES

2. Barriers

Investigations

A) permanent: woven tapes, wood chips, biodegradable foils

B) temporary: biodegradable liquid adhesives with aggregates (cellulose, wood fibers)



spreading of wood chips to cover the ground

'search window' for soil sampling to determine the number of pupae in the soil under woven tapes

Aims

= soil covers against burrowing of larvae or hatching of flies

➔ permeability/durability of material, mobility of larvae

PROJECT MODULES

2. Barriers

Results

A) permanent:
- less pupae below woven tapes
- no impeding effect of wood chips

B) temporary:
- liquid adhesives: hints to less emerging flies

Issues:

A) high expenditure (mobility of larvae: range at least 80 cm), obstructive, use of plastics

B) no organic certification of aggregates feasible, unnoticed parasitism: no conclusive results

Conclusion

- A) not practicable ; B) unreliable; A)/B) environmental impact


Mobility trial in Berlin, Dahlem 2021


Squirting trial in Berlin, Dahlem 2020

PROJECT MODULES

3. Mechanical soil cultivation

Investigations

- soil cultivation in the bushes row
- aim: effective impairment of pest (no further development from pupa to imago) through different tillage tools (disc or rotary harrow)

PROJECT MODULES

3. Mechanical soil cultivation

Trial

- experimental area beside a sea buckthorn orchard
- subdivision into 3 plots, placing 100 pupae in each

PROJECT MODULES

3. Mechanical soil cultivation

Results

- very few fruit flies found (also in the control)
- interfering external influences (sun exposure, loose soil, late monitoring): no conclusive results
- hypothesis: existence of a connection between soil cultivation and spreading of sea buckthorn disease inducing pathogen

Conclusion

- no further investigations

PROJECT MODULES

4. Macroorganisms – A)

Aims

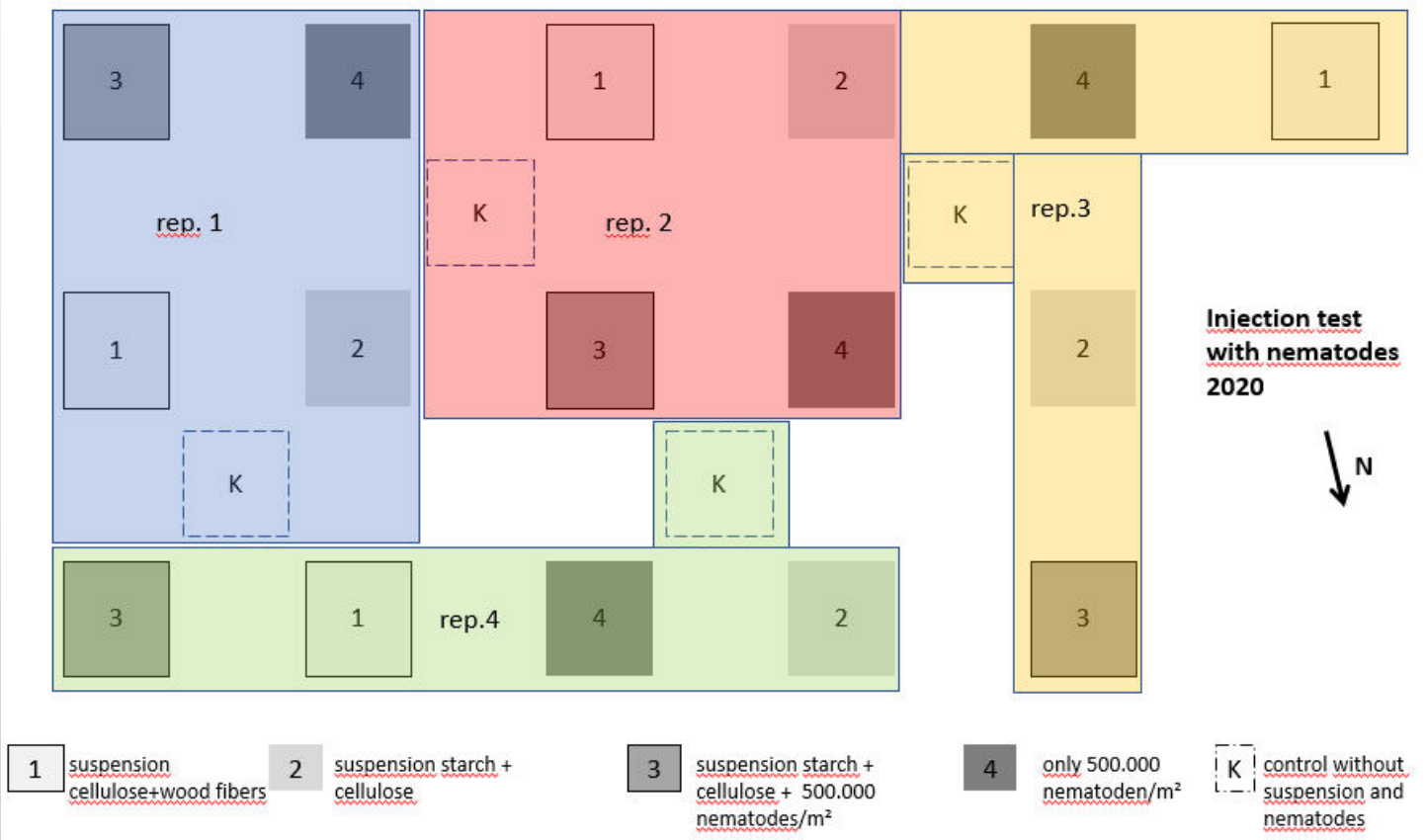
- Reduction of hatching flies by nematodes (small plot experiments)

Results

- hints to hatching rate reduction of SBF but masked by external interfering impacts (drought, predators)

Conclusion

- not unreservedly recommendable



PROJECT MODULES

4. Macroorganisms - B

Aims

- reduction of SBF through parasitism by natural antagonists (investigation of entomologists of Leibniz Centre for Agricultural Landscape Research

Bracnoid wasp hatched from SBF pupa

Results

- increasing number of infested pupae by parasites
- mainly Bracnoid wasp (*Braconidae*)
- occasionally Ichneumon fly (*Ichneumonoidea*)

Ichneumon fly hatched from SBF pupa

Conclusion

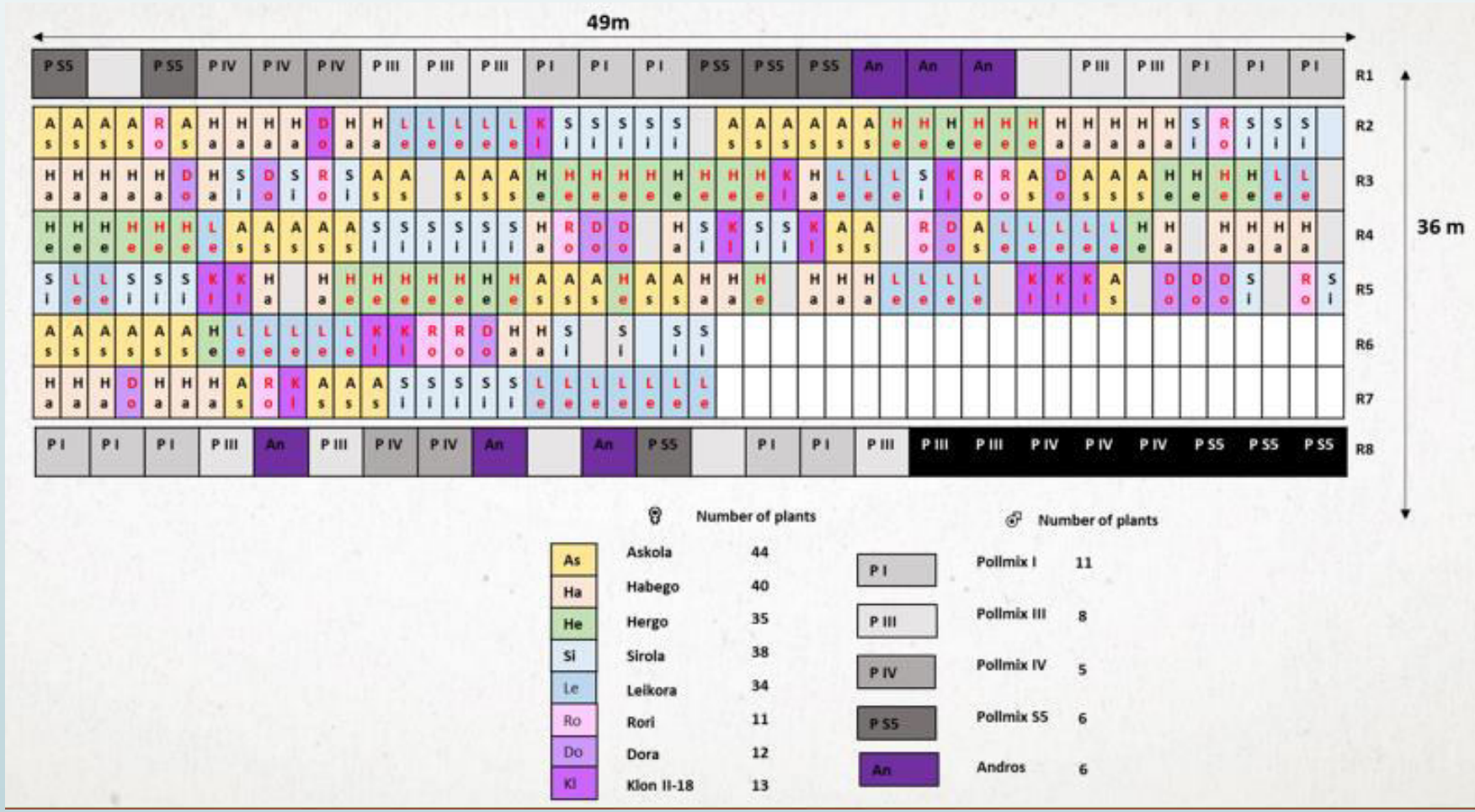
- support of parasites of SBF very advantageous

PROJECT MODULES

5. Varieties - Infestation

Investigations

- differences in the susceptibility to SBF
- reasons for the preference for a particular variety
- sea buckthorn orchard, HU-Berlin, Dahlem:
  - German varieties: `Habego`, `Hergo`, `Sirola`, `Leikora`, `Askola`
  - Romanian varieties `Klon`, `Rori`, `Dora`
  - 9 up to 42 shrubs/variety



PROJECT MODULES

5. Varieties - Infestation

Trials:

submersion of fruits – catching of larvae
catching of pupae from cut branches
optical evaluation of infestation of shrubs
investigations on phenology and morphology,
determination of ascorbic acid and sugar content

PROJECT MODULES

5. Varieties - Infestation

Results: distinctions:

extremely susceptible (Infestation up to max. 100 %) = Sirola
very susceptible (Infestation up to max. 90 %) = Leikora, Habego
medium susceptible (Infestation up to max. 70 %) = Askola, Klon
little susceptible (Infestation up to max. 10 %) = Rori, Dora, Hergo

Hergo

Askola

Habego

PROJECT MODULES

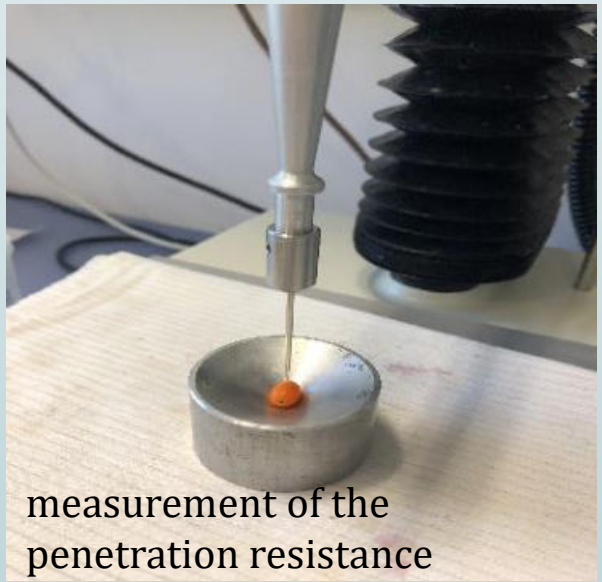
5. Varieties - Infestation

Conclusion

- less susceptible varieties are identified
- no clear influence on the preference of the SBF derivable according to :
  - development stages
  - amount of ascorbic acid or sugar
- tendency of SBF to varieties with big fruit with soft skin

HI 3850 Ascorbic acid test kit

sample centrifugation
before sugar determination



measurement of the
penetration resistance

TAKE HOME

Traps:
- wasp traps + ac-bait (+propylene glycol) suitable for monitoring (start of treatment) + better protection of beneficial organisms

Barriers:
- control effect not entirely reliable, environmental compatibility questionable

Nematodes/microorganisms:
- control effect not (fully) proven

Antagonists:
- high potential – promotion/protection is crucial

Varieties:
- less susceptible varieties are identified
- promising strategy: "Opferpflanzenkonzept"

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