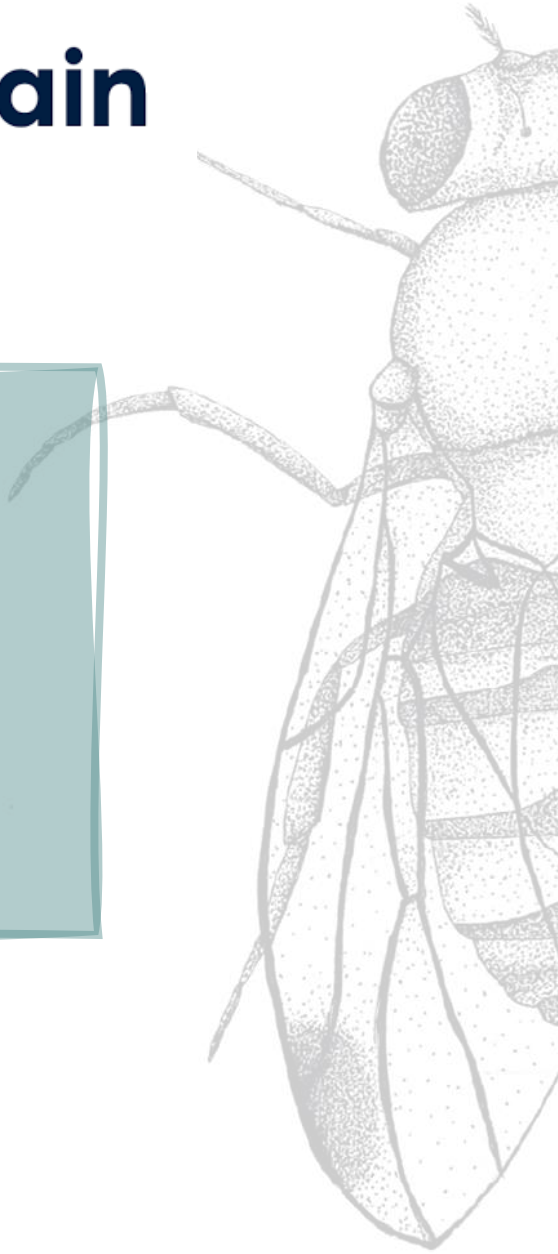
Avec le soutien de la Wallonie

LIÈGE université Gembloux Agro-Bio Tech

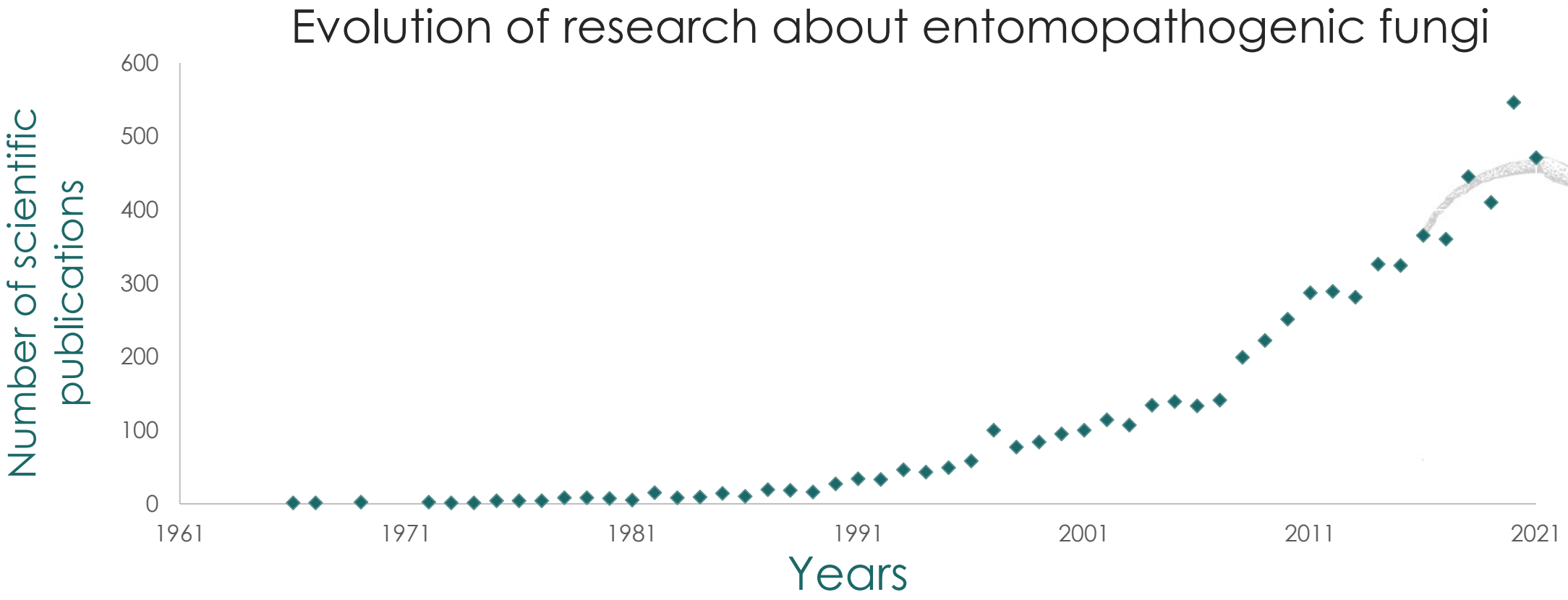
UCLouvain

Development of biological alternatives to insecticides to control *Drosophila suzukii* with **semiochemicals** and **entomopathogenic fungi**

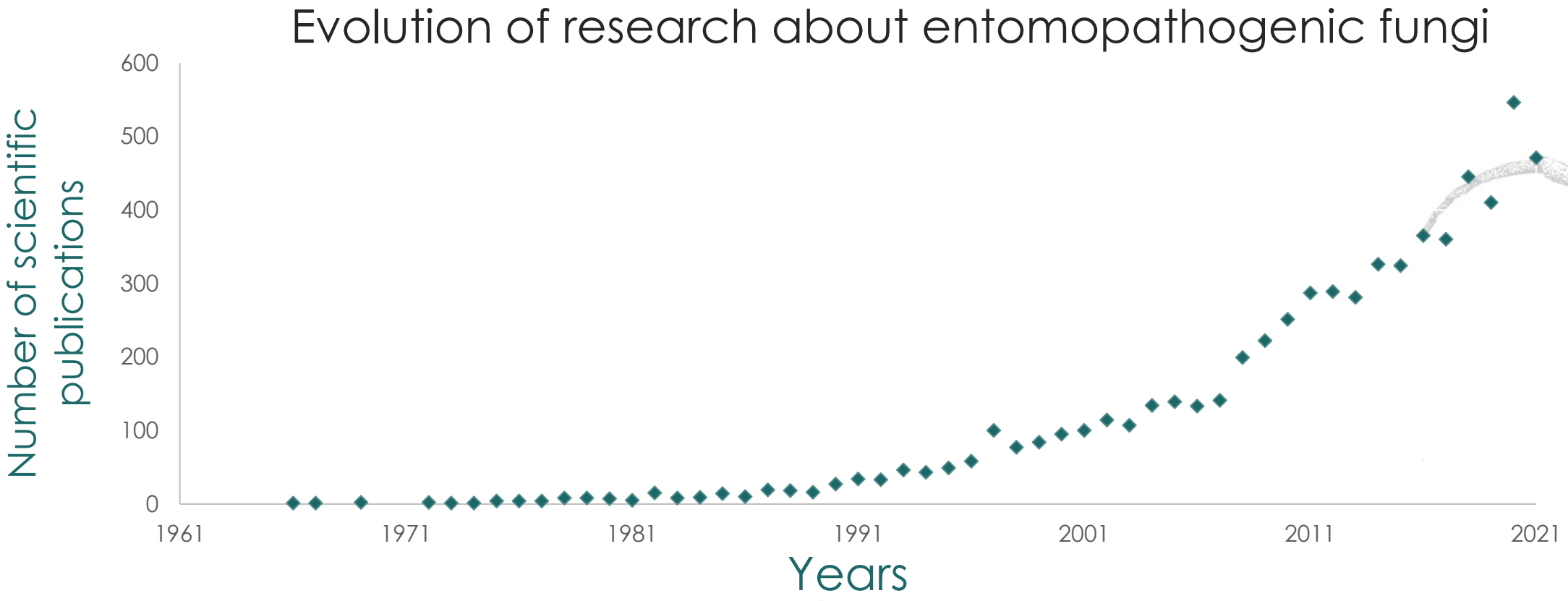


Galland C., Capelle J., Lalaymia I., Declerck S. et Verheggen F.

Context

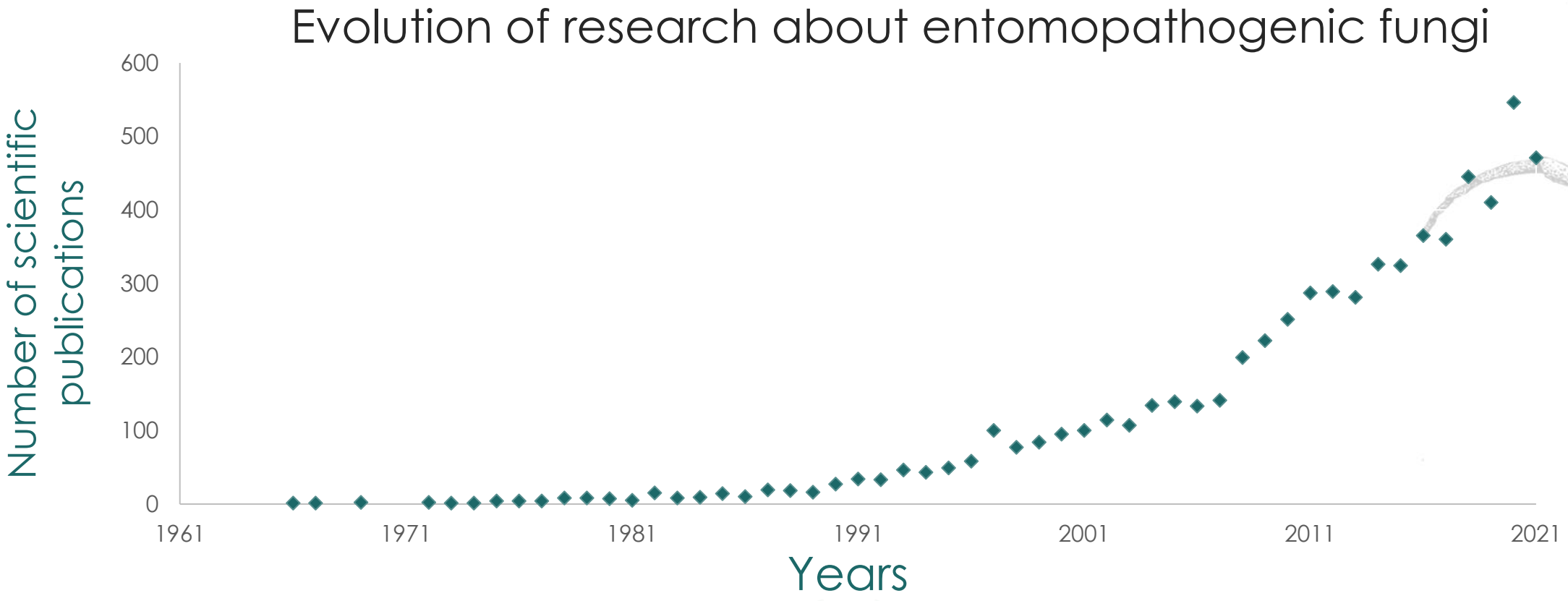

Evolution of research about entomopathogenic fungi
Number of scientific publications
600
500
400
300
200
100
0
1961
1971
1981
1991
2001
2011
2021
Years

Context



Why are entomopathogenic fungi (EPF) interesting ?

Context



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Why is the number of commercial products low ?

Why are EPF interesting ?

Deka et al, 2021 ; Poprawski et al, 2000

Why are EPF interesting ?

Insecticide limitations

- No human-safety 
- Environmental cost 
- Legislation 

Deka et al, 2021 ; Poprawski et al, 2000

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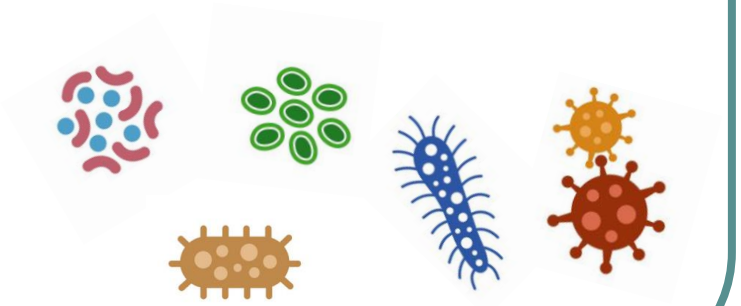
Microbial organisms

- Coevolution
- Human safety
- No toxic residue



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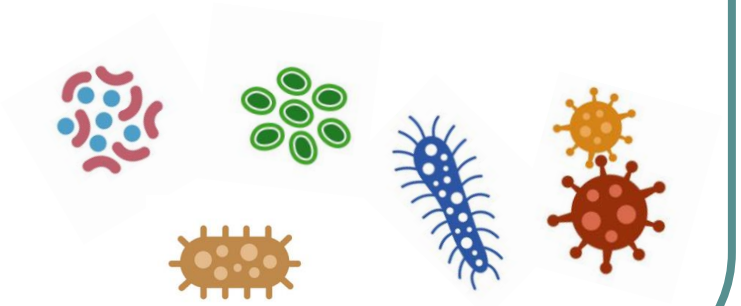
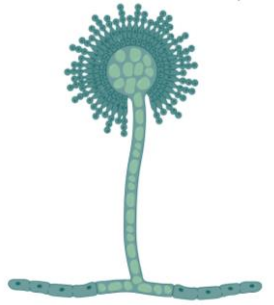


EPF

- Selectivity
- High reproduction
- Diptera



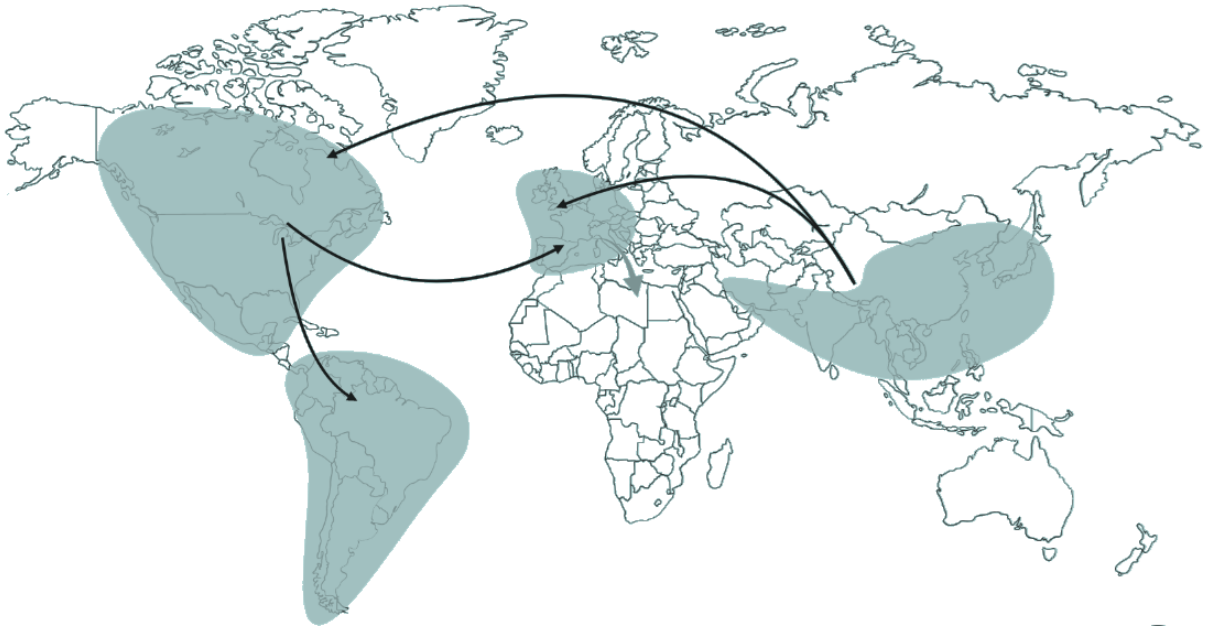
Deka et al, 2021 ; Poprawski et al, 2000

Drosophila suzukii

Asplen et al, 2015 ; Calabria et al, 2012

Drosophila suzukii

- Invasive specie



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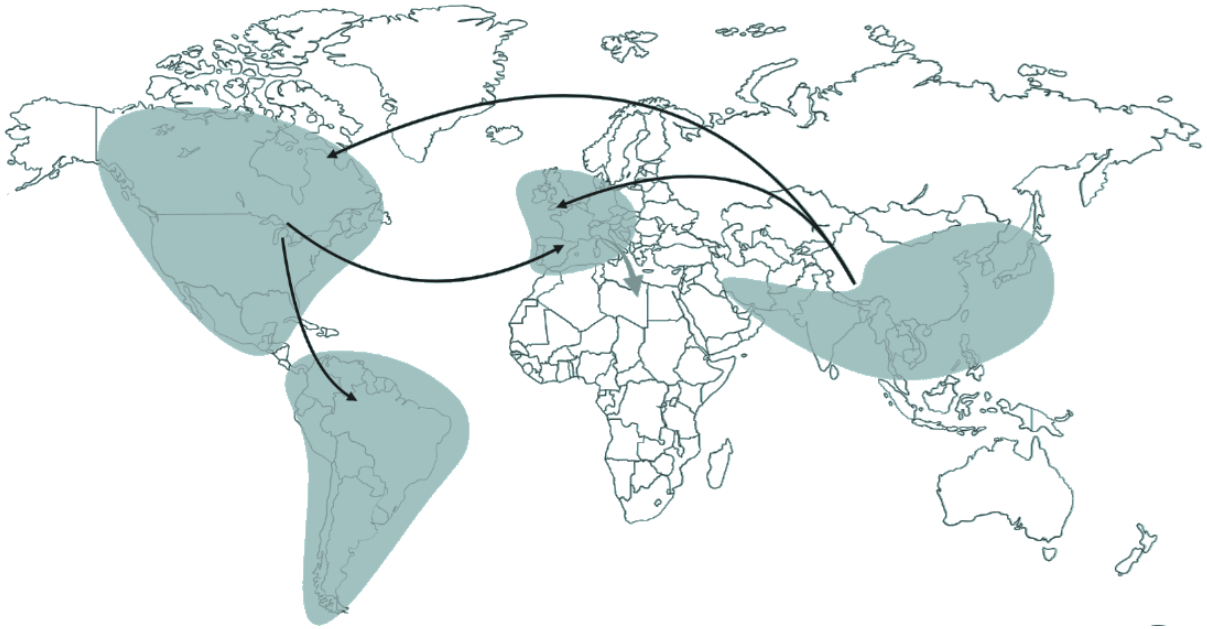

- Laying their eggs in ripe fruits

Asplen et al, 2015 ; Calabria et al, 2012

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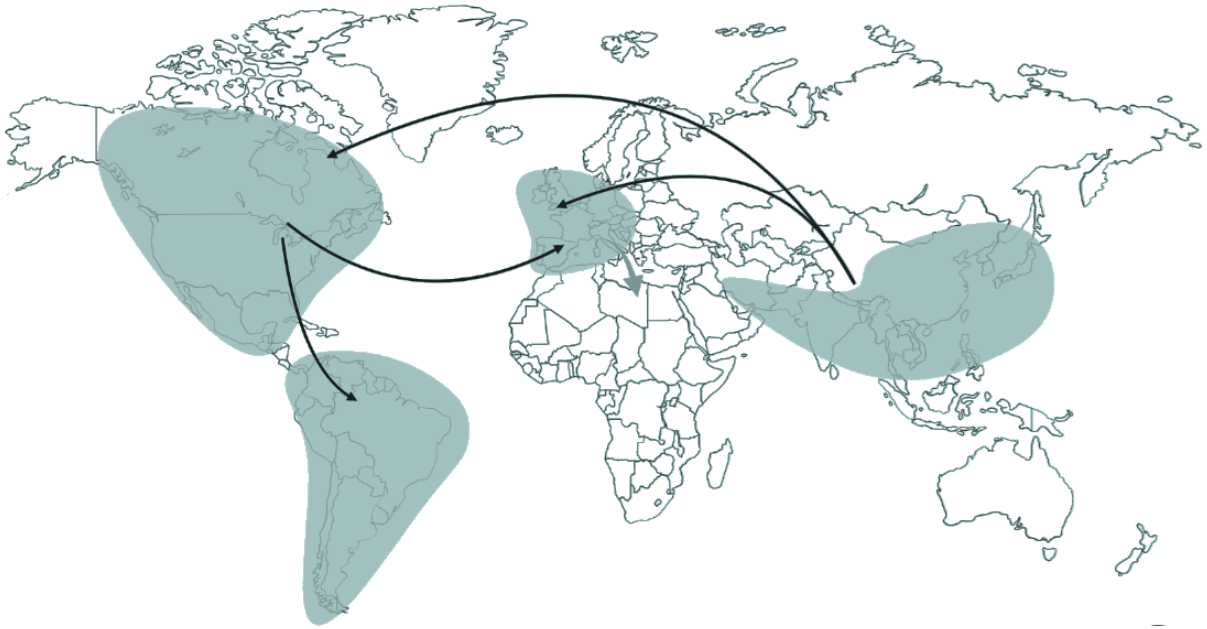
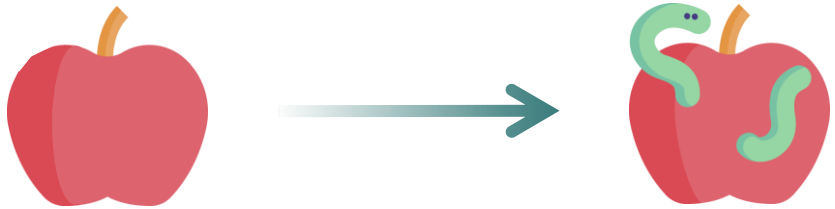


- Short generation time

- Laying their eggs in ripe fruits



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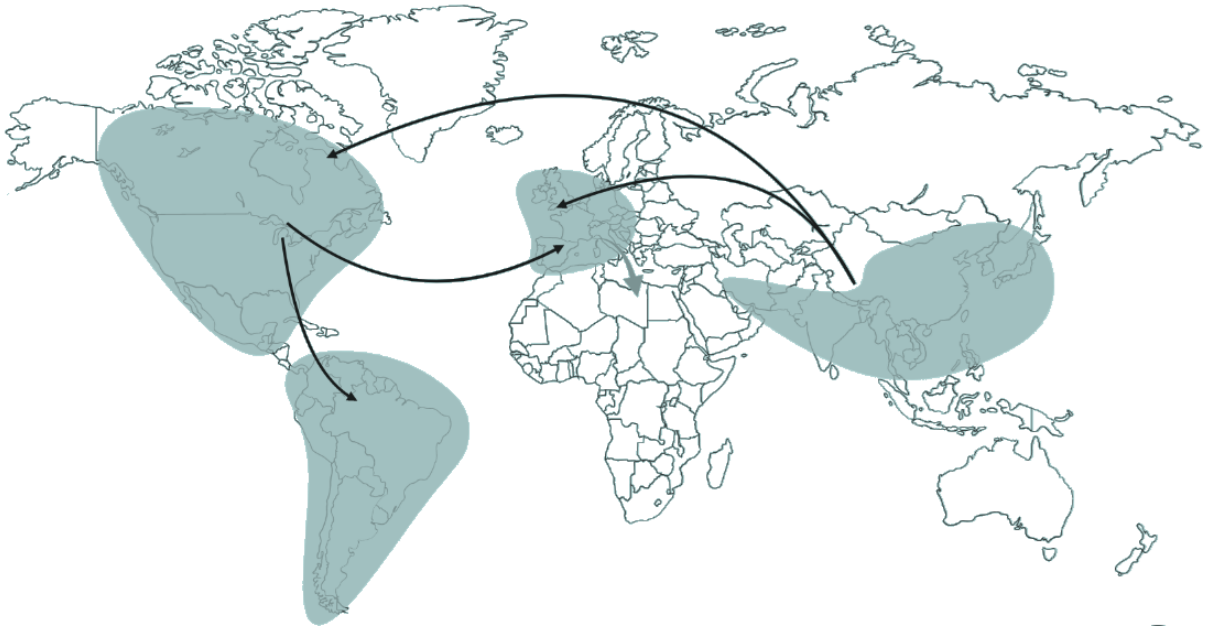

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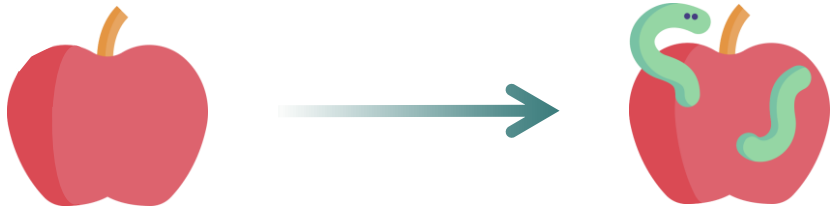
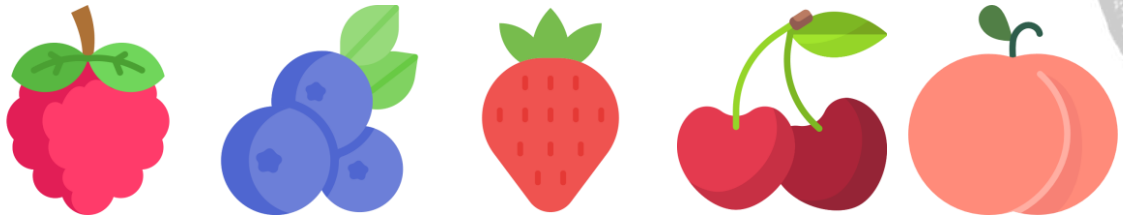


- Large number of potential hosts



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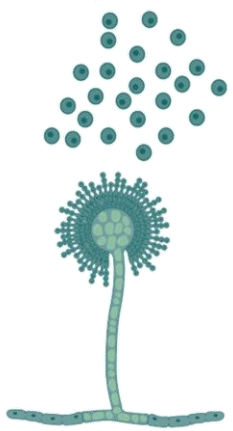
Why is the number of commercial products low ?



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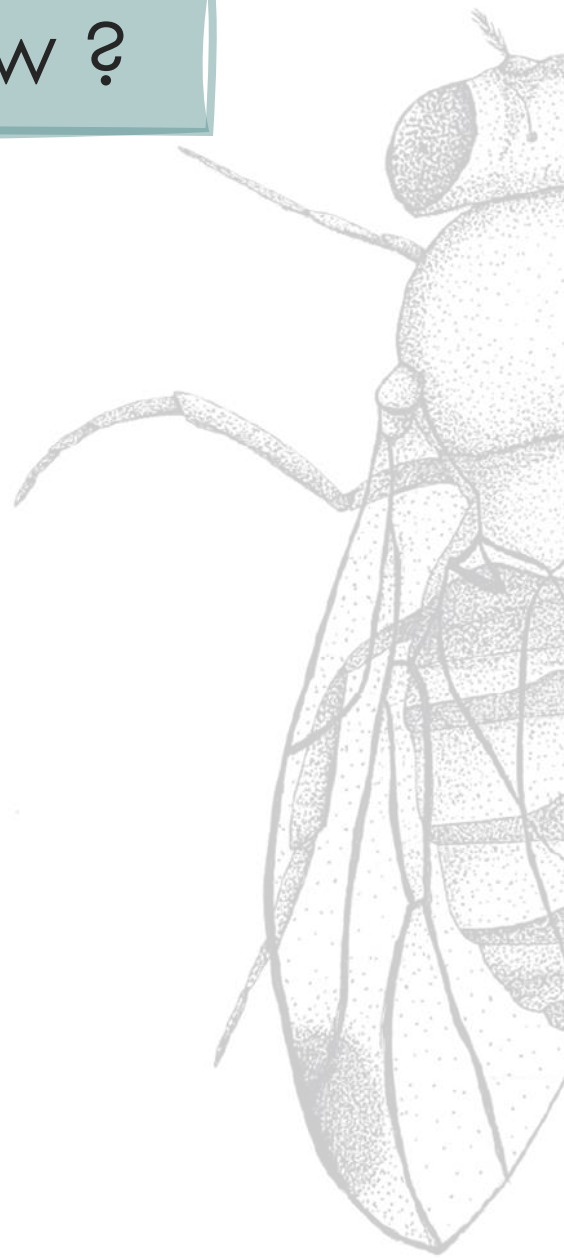
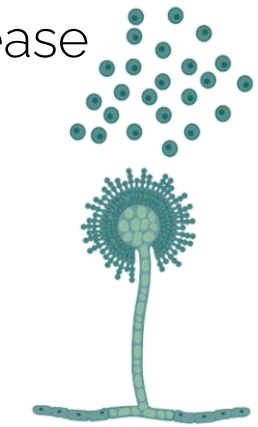


1 Conidia release



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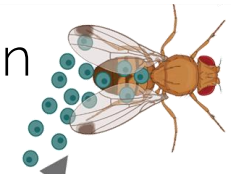
Why is the number of commercial products low ?

2 Conidia adhere on insect cuticule



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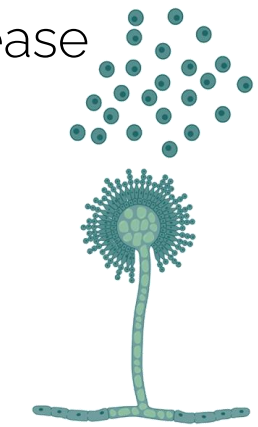

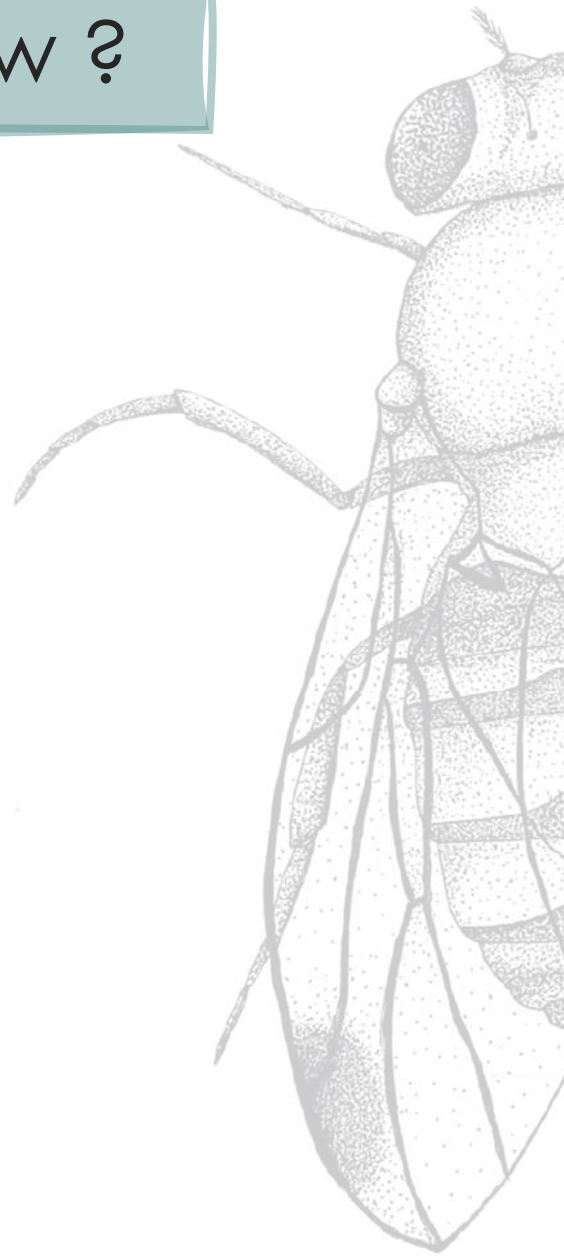

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3 Conidia penetrate in hemolymph
Insect dies

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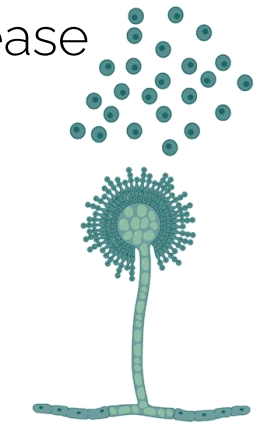

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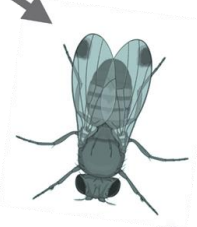

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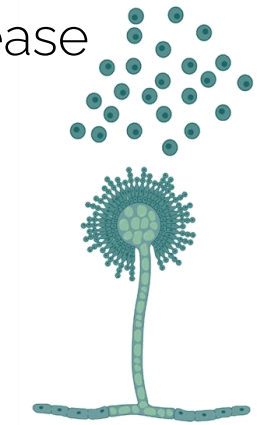
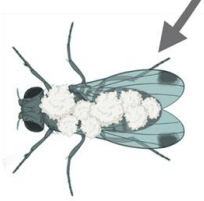
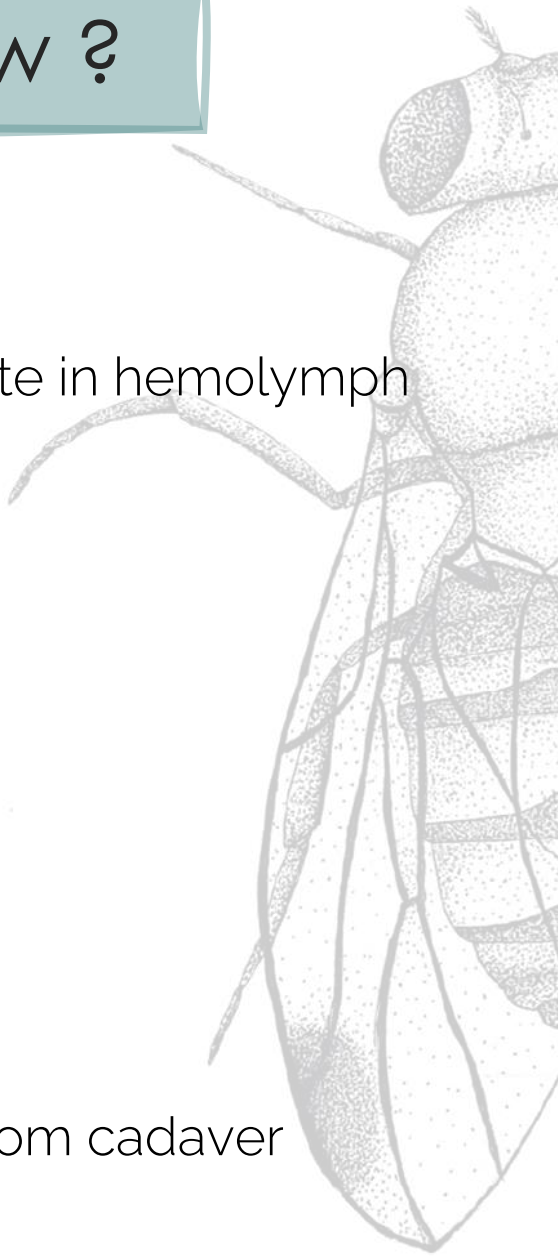




4 Fungus emerge from cadaver



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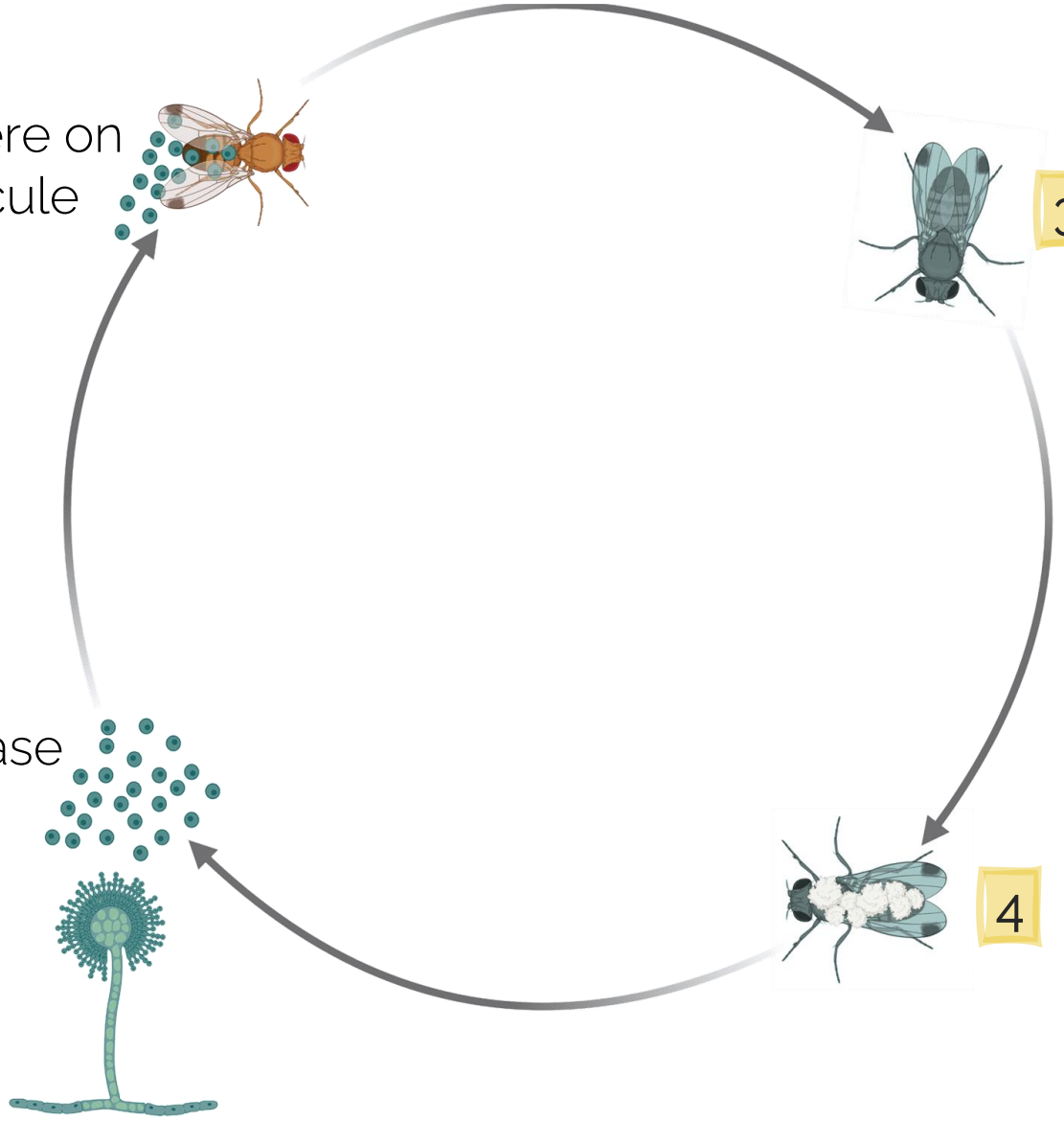

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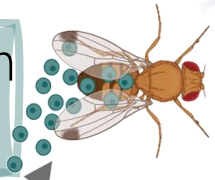

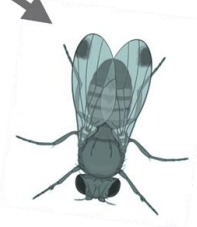

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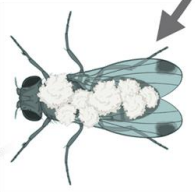

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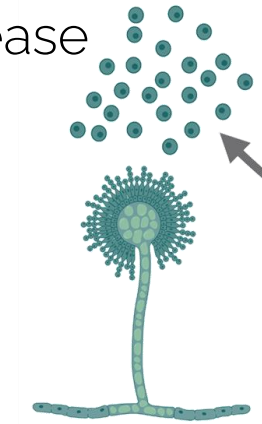

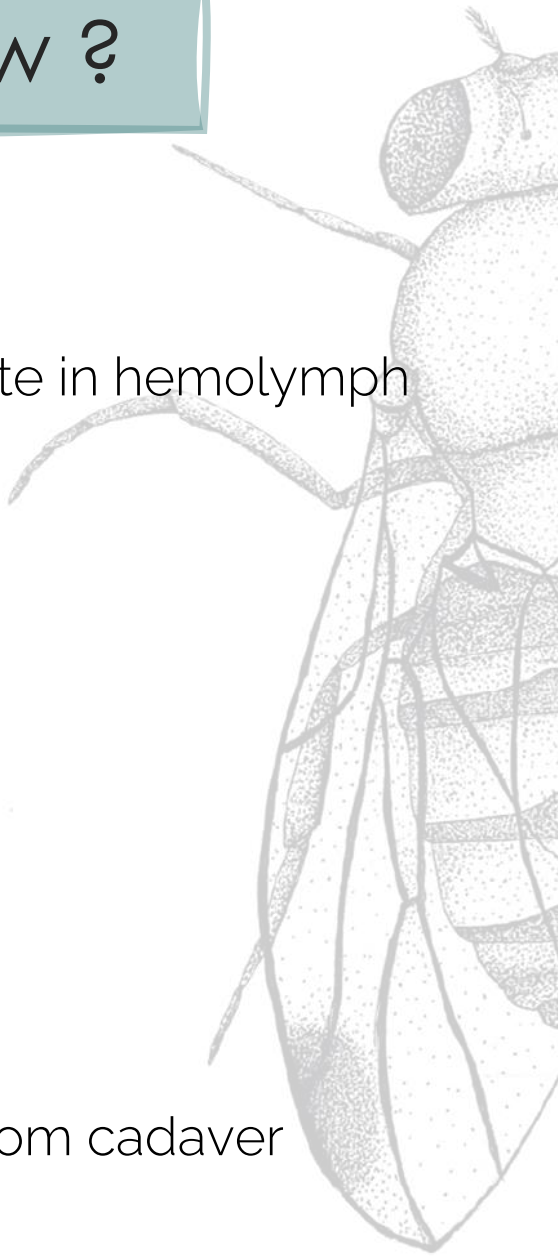

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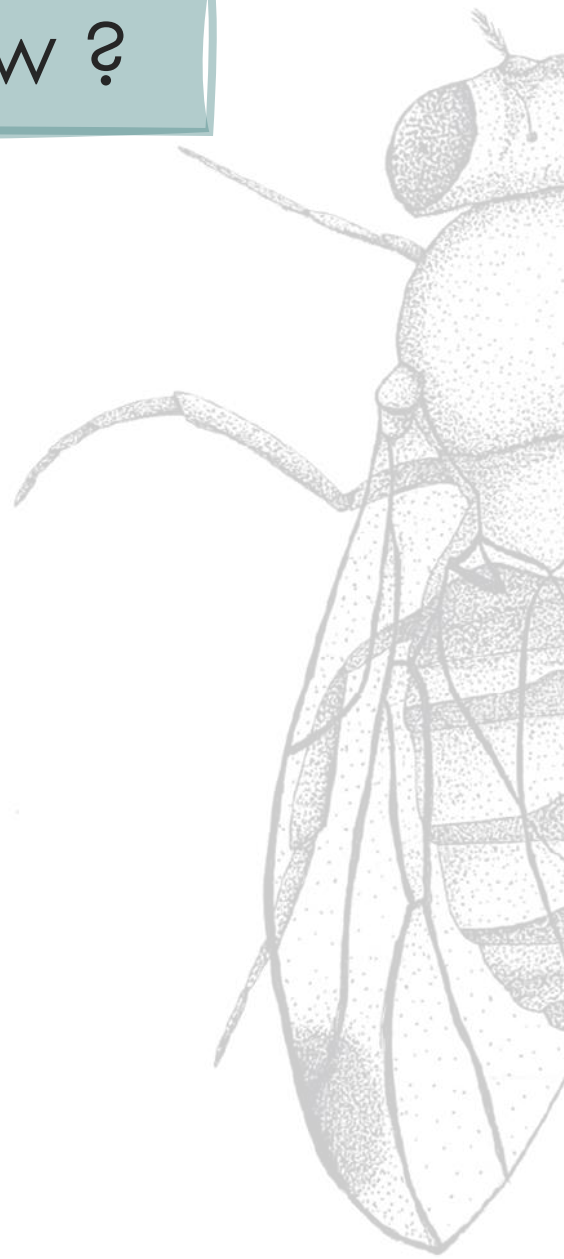

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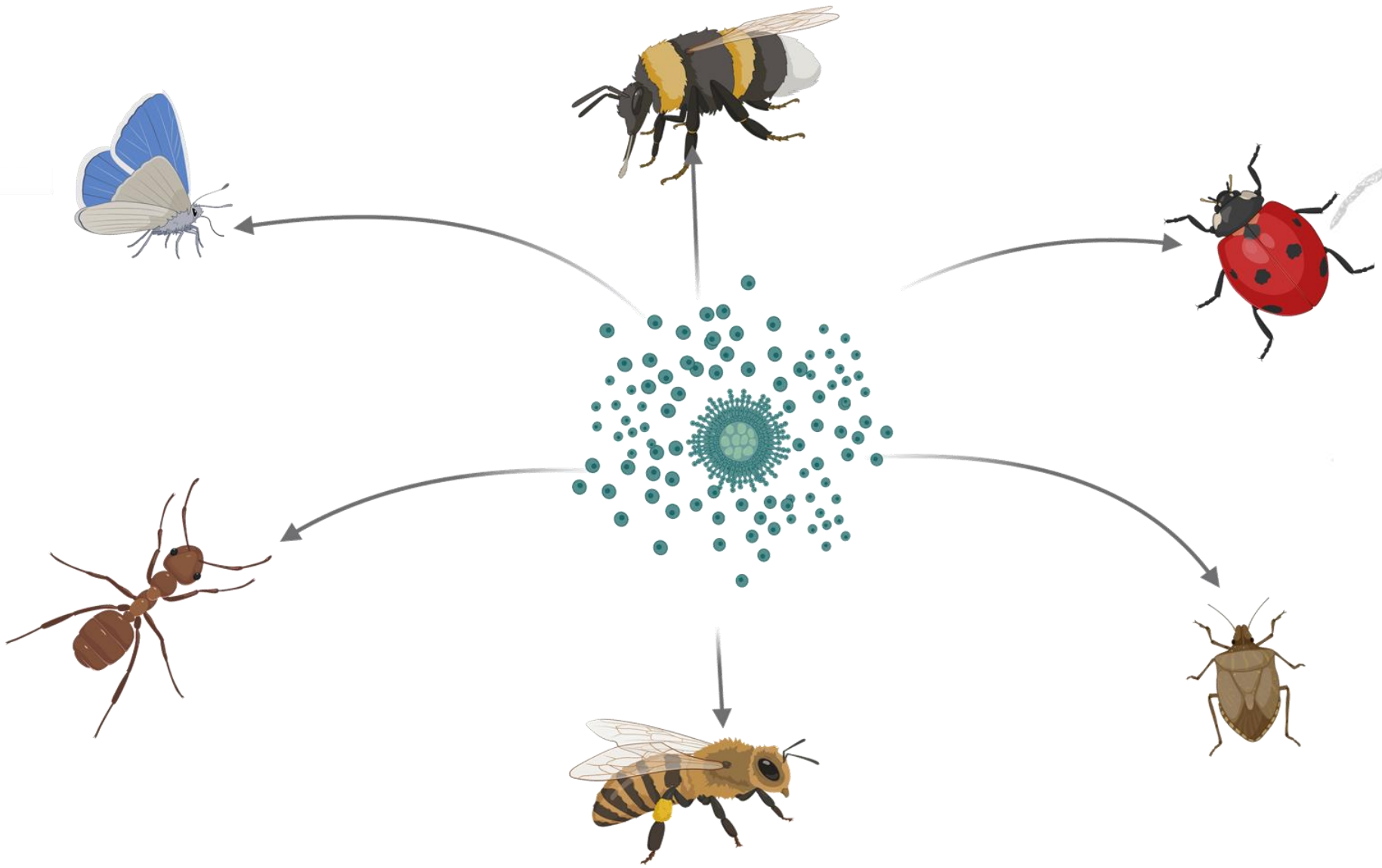

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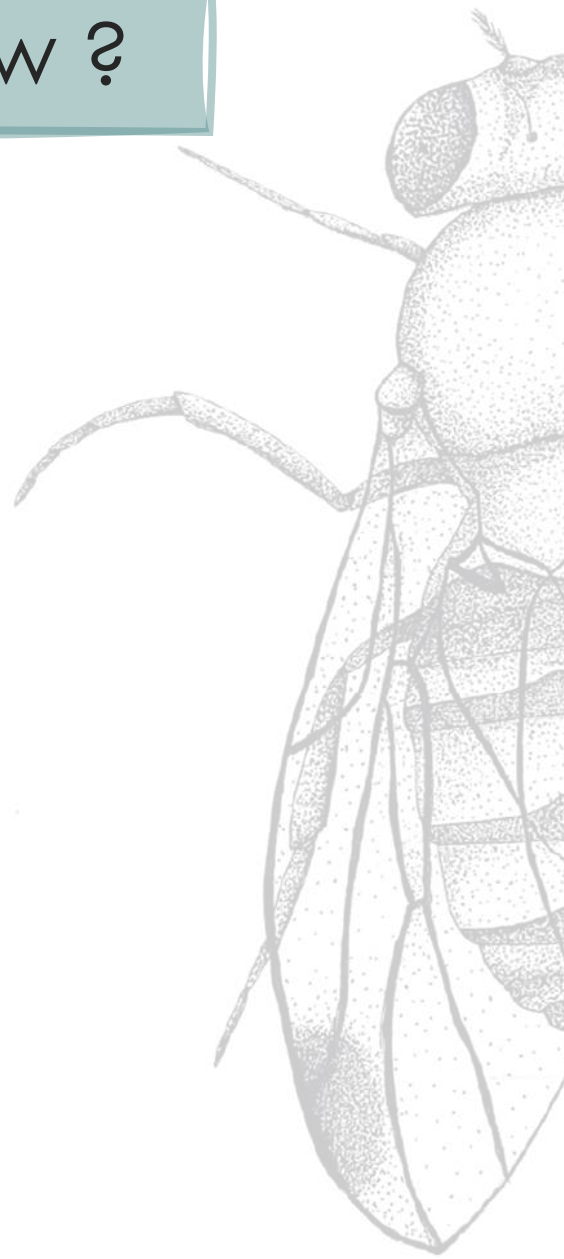

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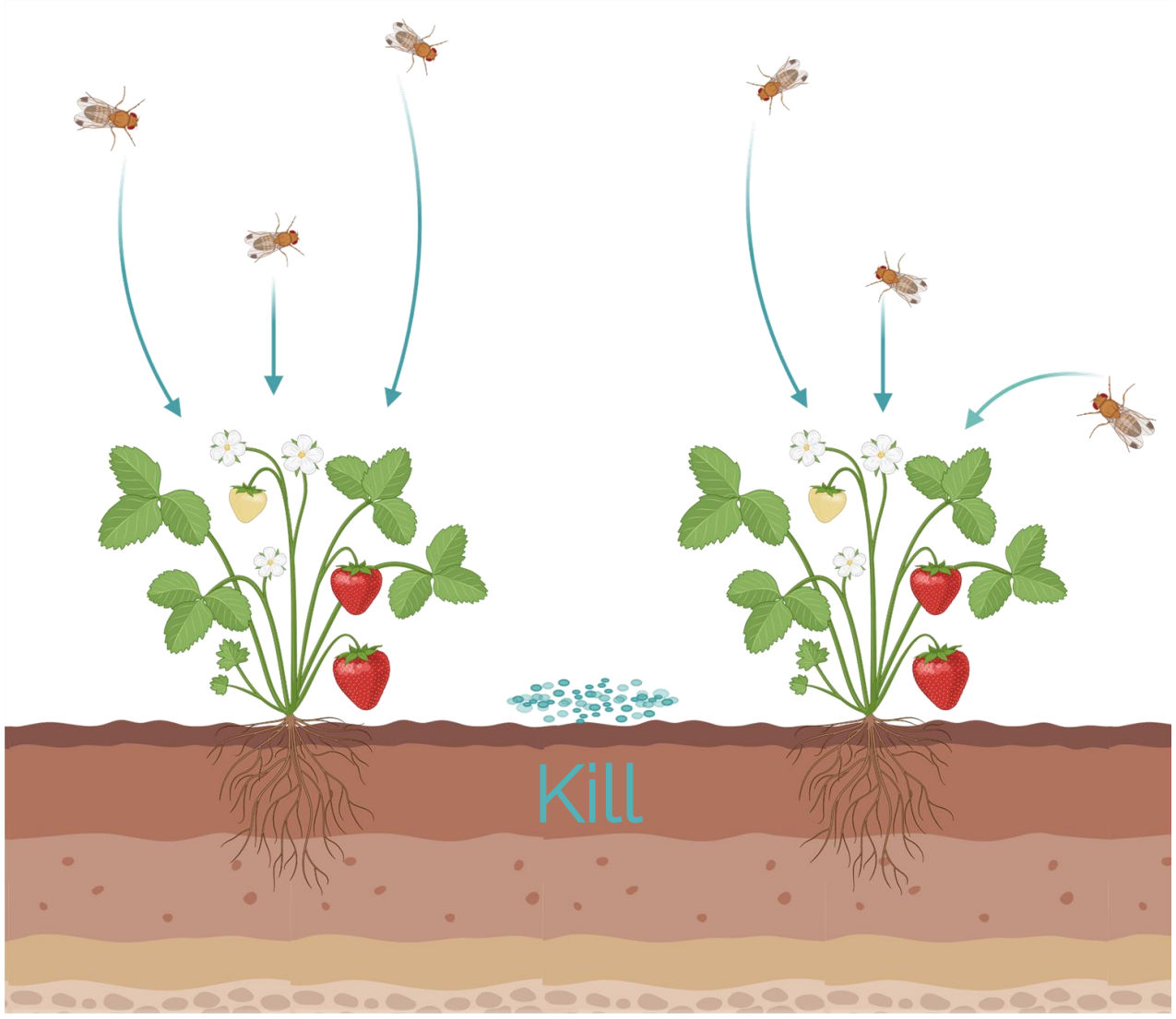
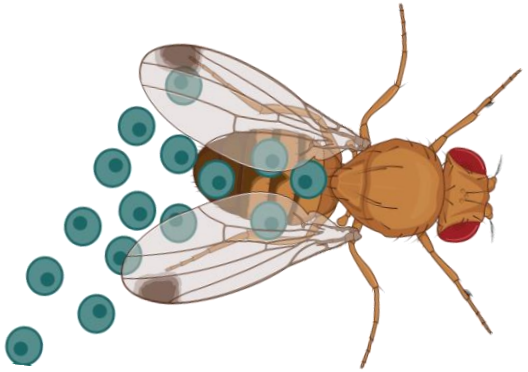


Aims

Aims

1

Select an effective EPF by integrating its ability of adhesion



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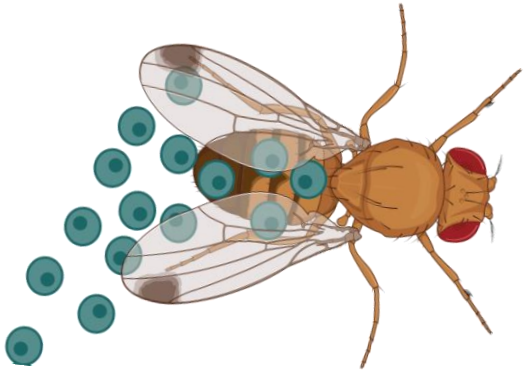


2

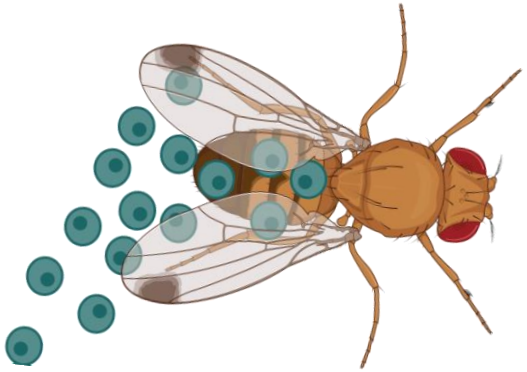
Test impact of EPF on non-target insects

Aims

1. Select an effective EPF by integrating its ability of adhesion

2. Test impact of EPF on non-target insects

3. Select semiochemicals



Selecting an effective EPF against *D. suzukii*

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EPF tested

Species	Strains
Beauvaria bassiana	MUCL 1555
Metarhizium anisopliae	MUCL 6859
Metarhizium brunneum	MUCL 9645
Lecaniccillium lecanii	MUCL 8115
Paecilomyces fumosoroseus	MUCL 15122

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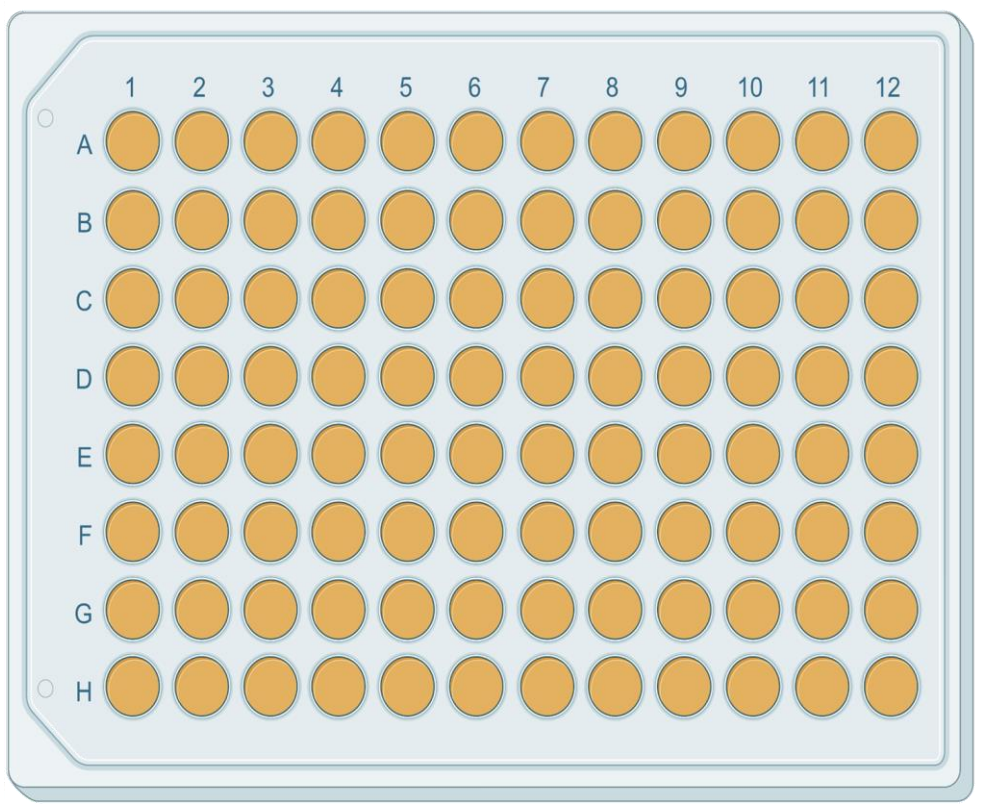
+ Positive control (insecticide)

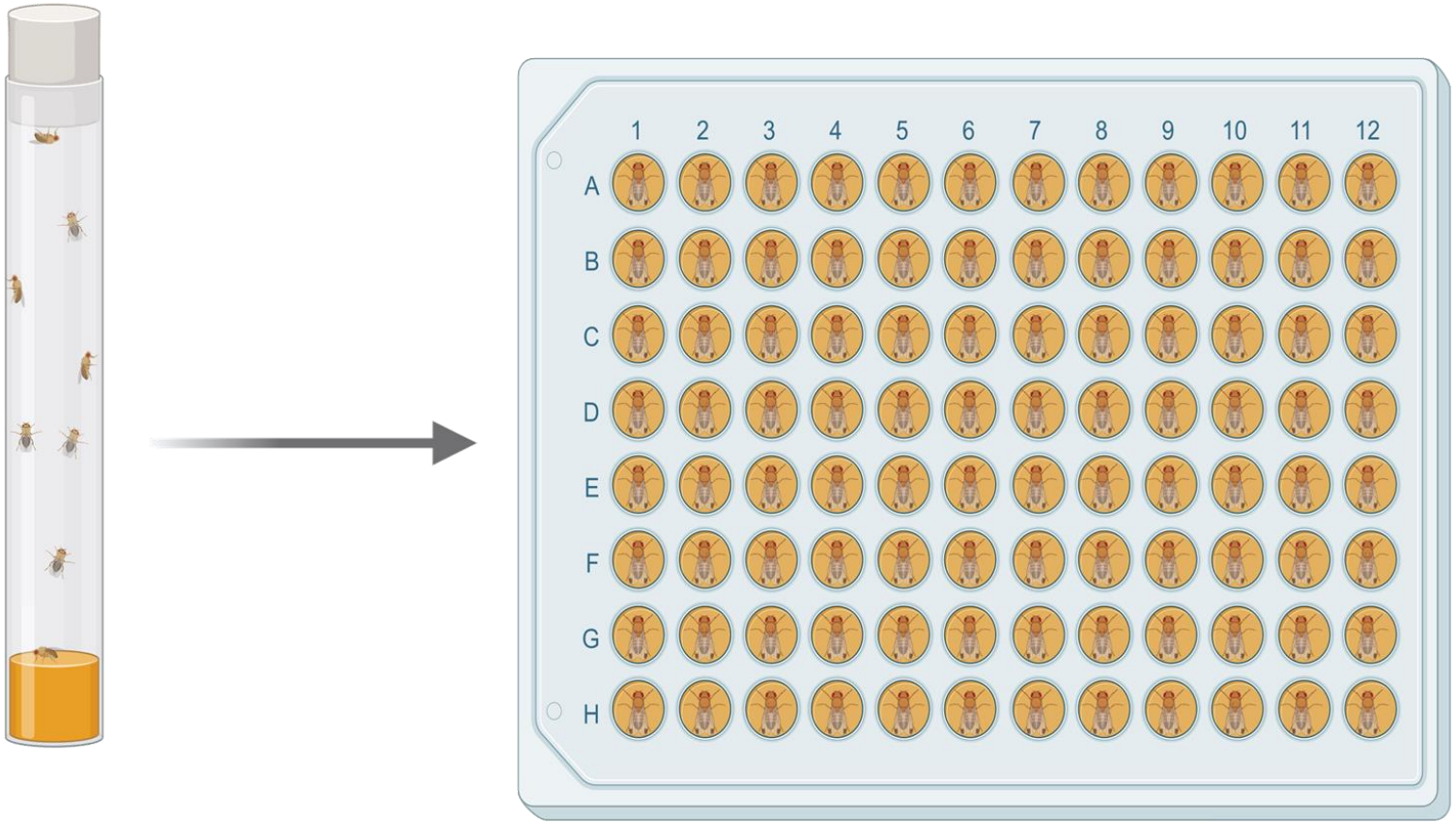
+ Negative control

Selecting an effective EPF against *D. suzukii*



Selecting an effective EPF against *D. suzukii*

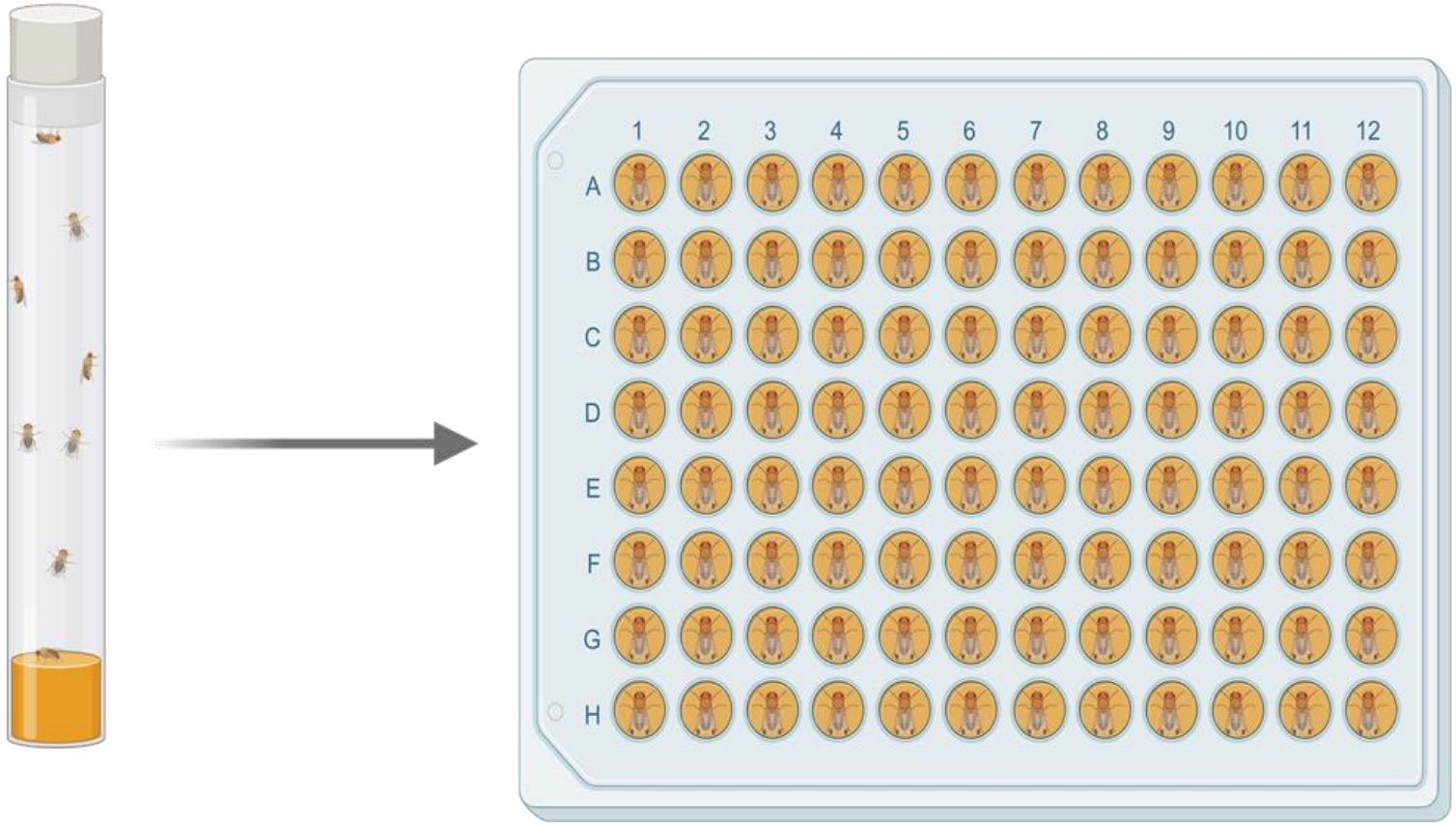
3 hours



Selecting an effective EPF against *D. suzukii*

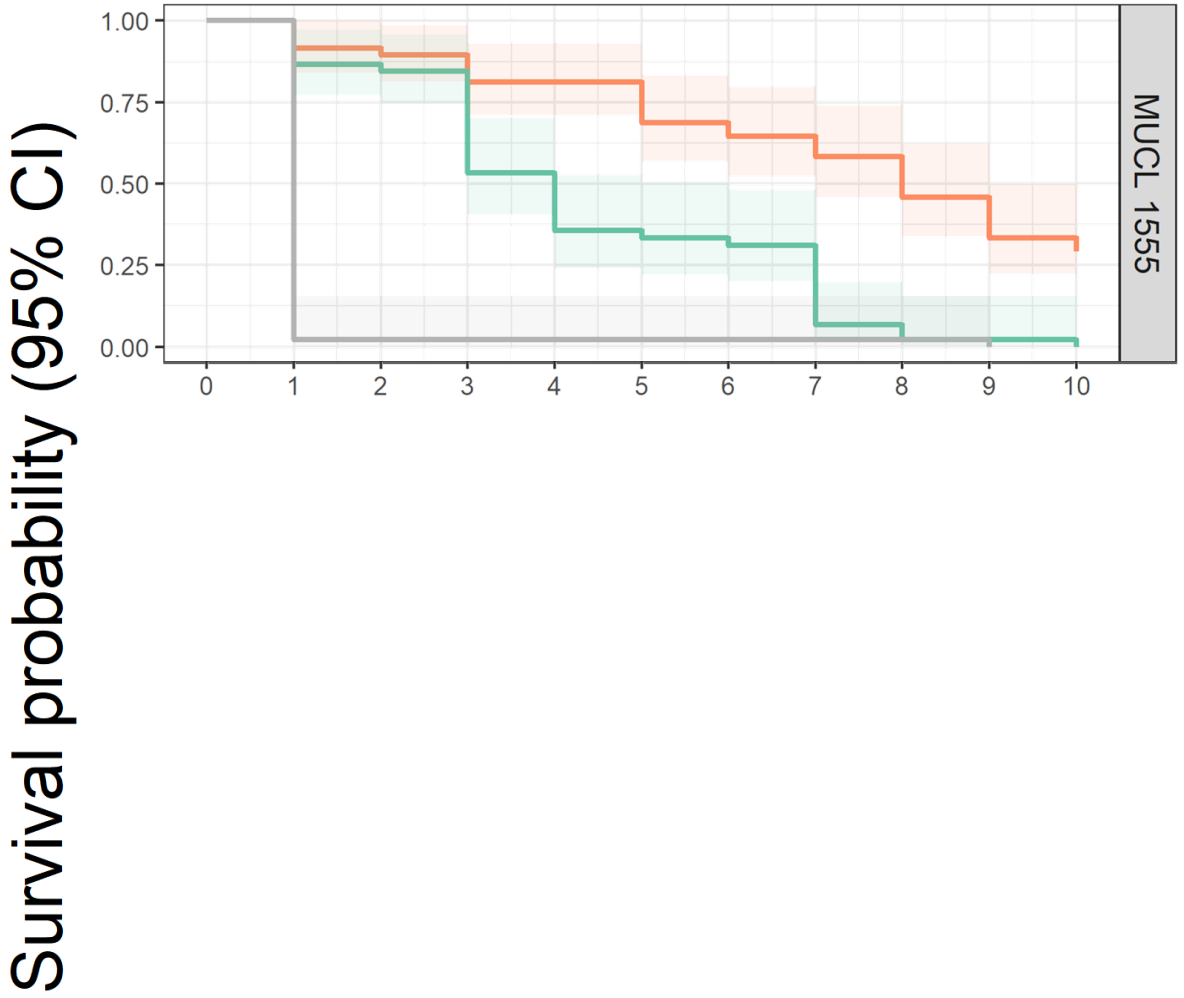
3 hours

N = 48 / fungus

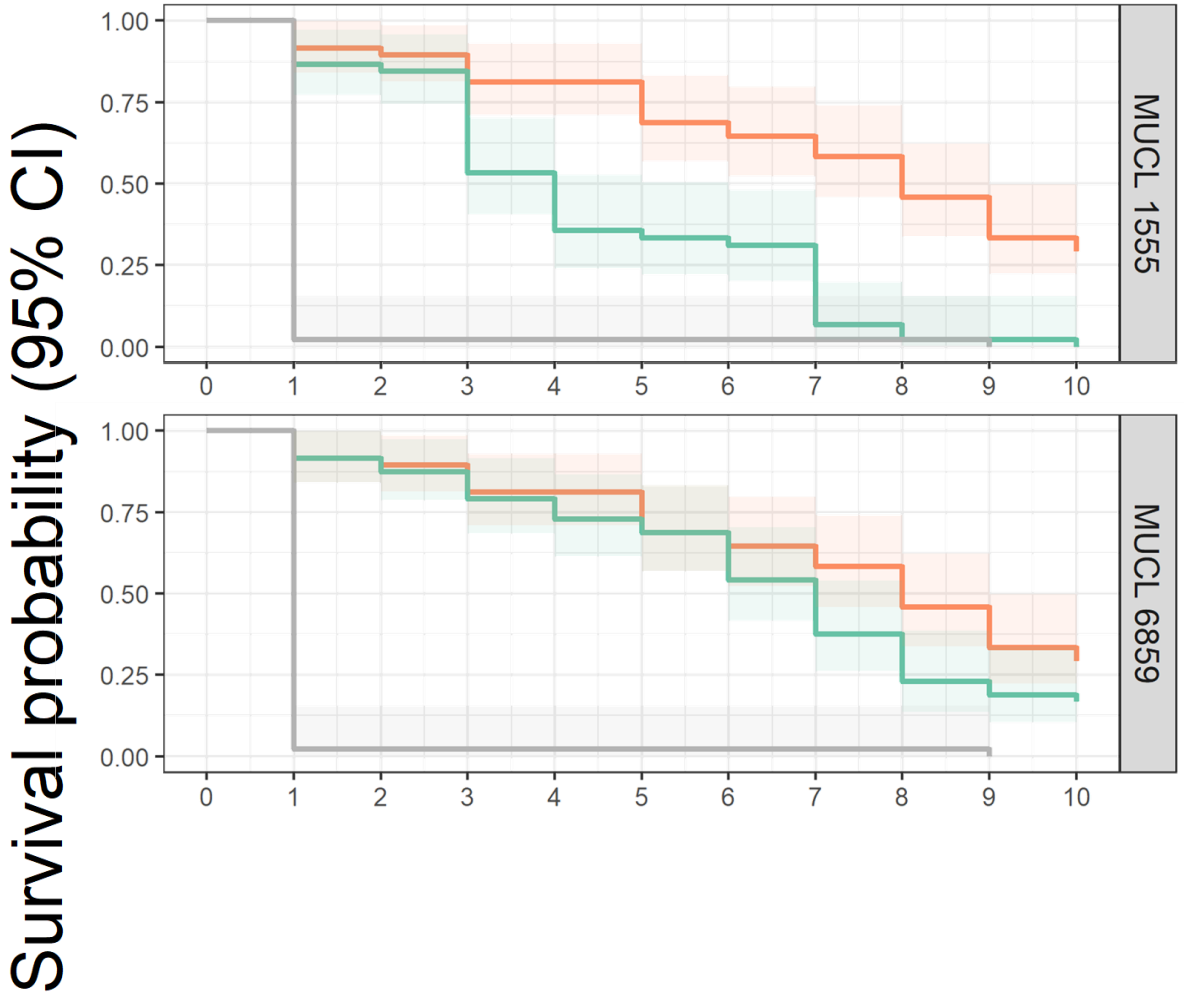


Evaluating mortality for 10 days

Selecting an effective EPF against *D. suzukii*



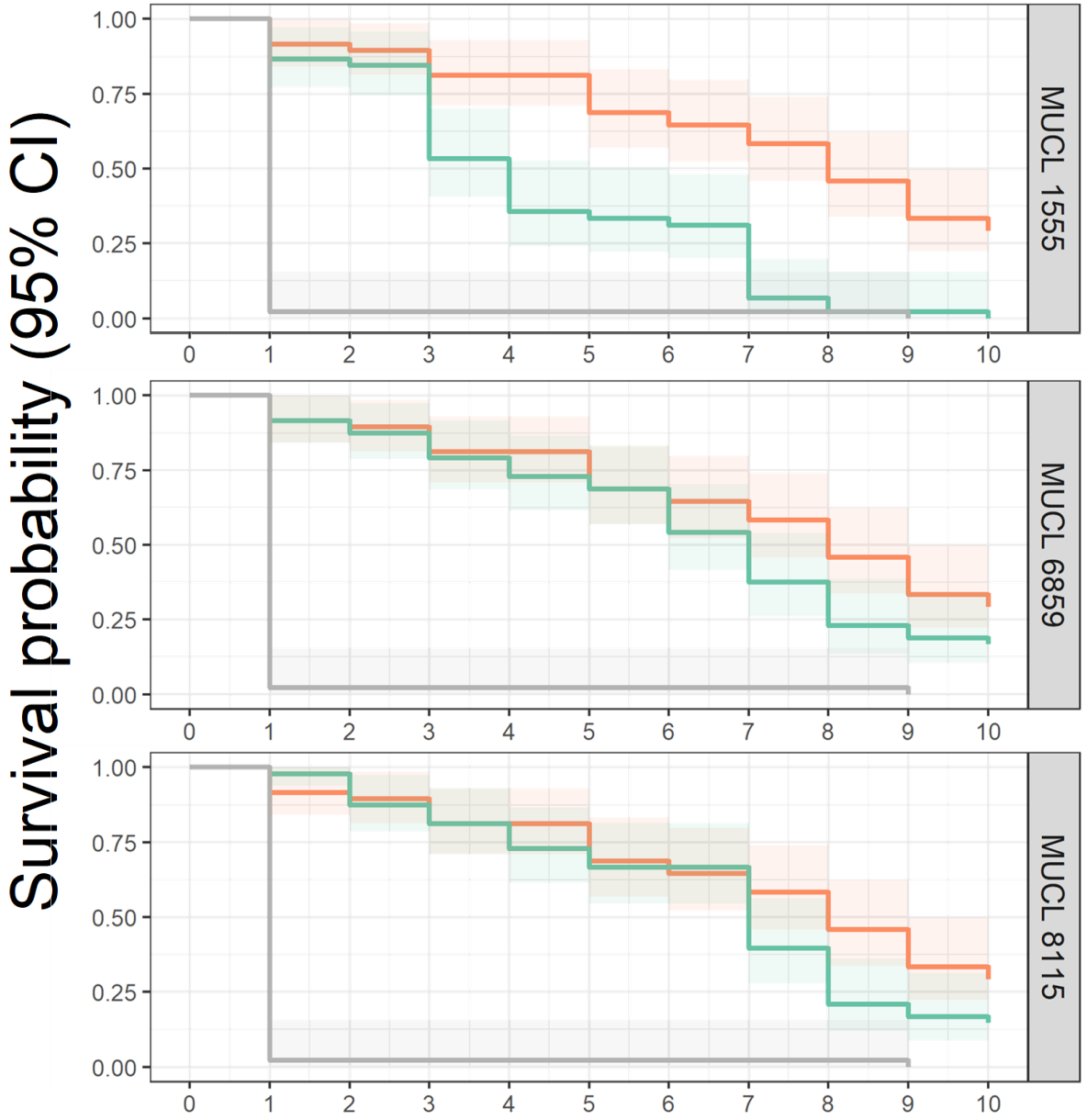
Selecting an effective EPF against *D. suzukii*

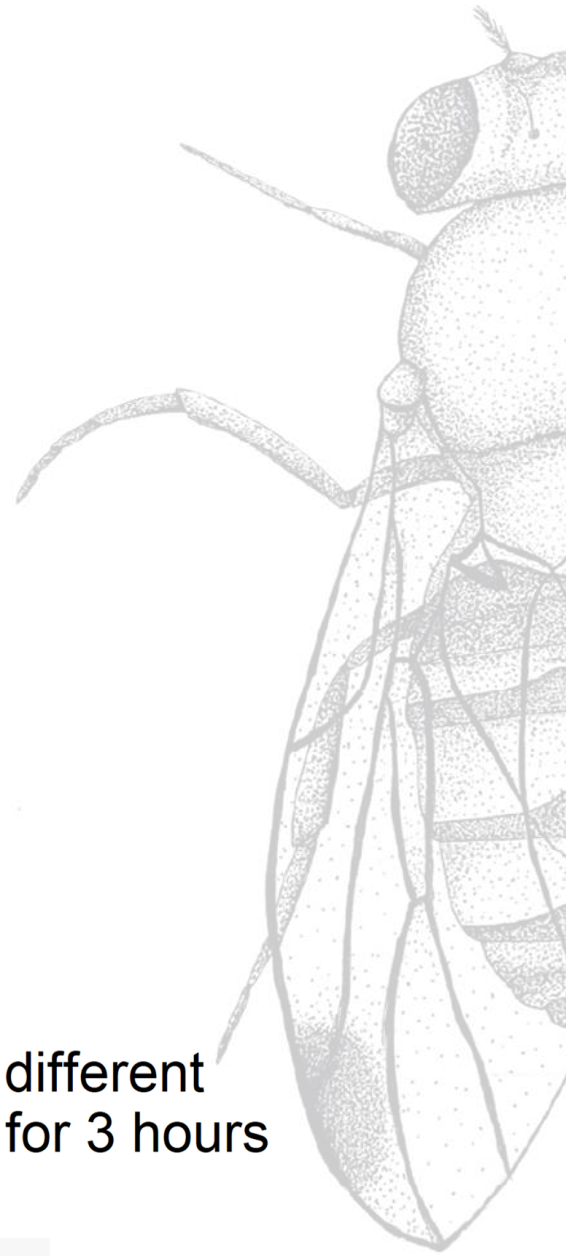


Days after exposure to different entomopathogenic fungi for 3 hours

Control Fungus Insecticide

Selecting an effective EPF against *D. suzukii*





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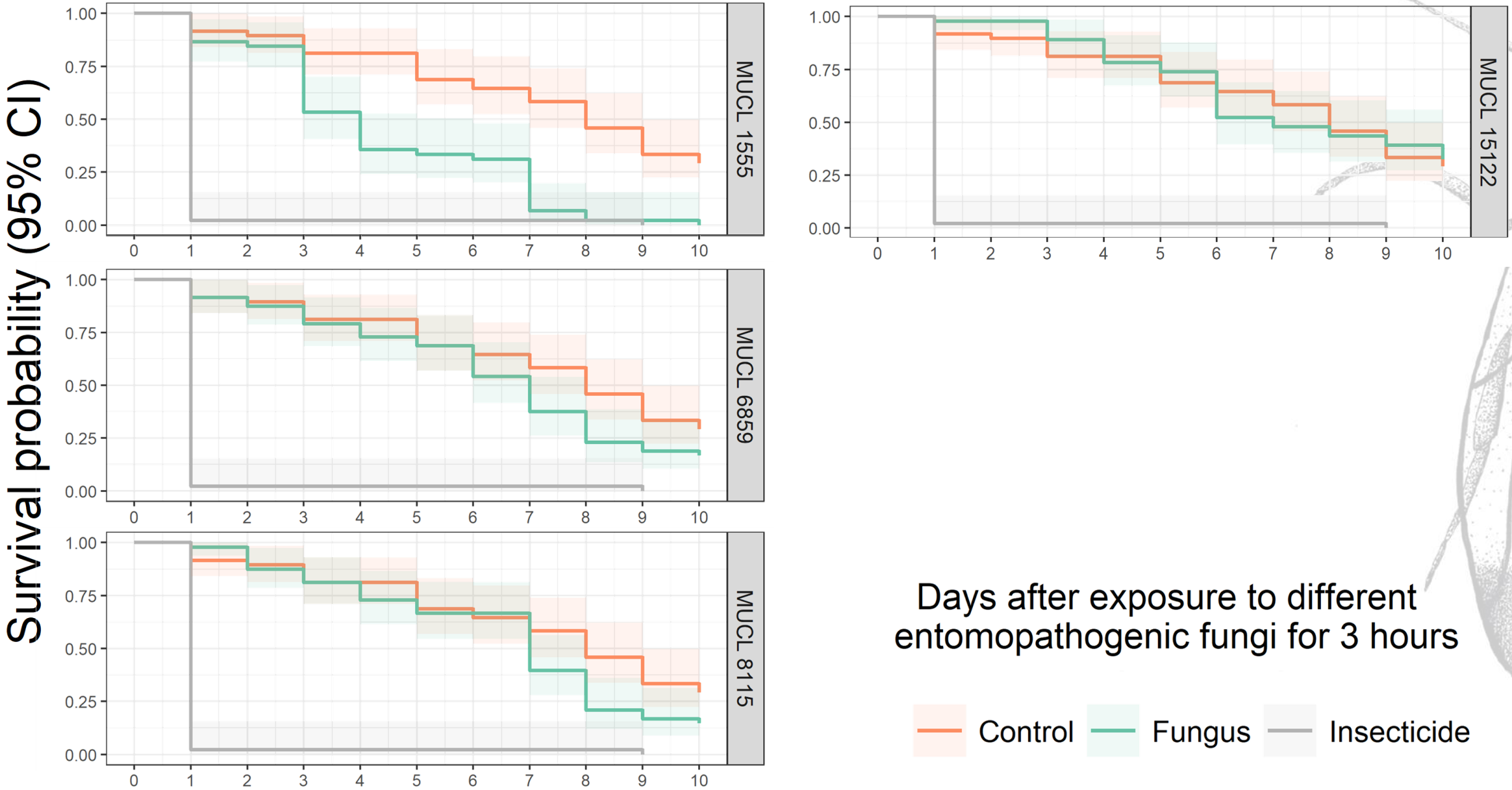

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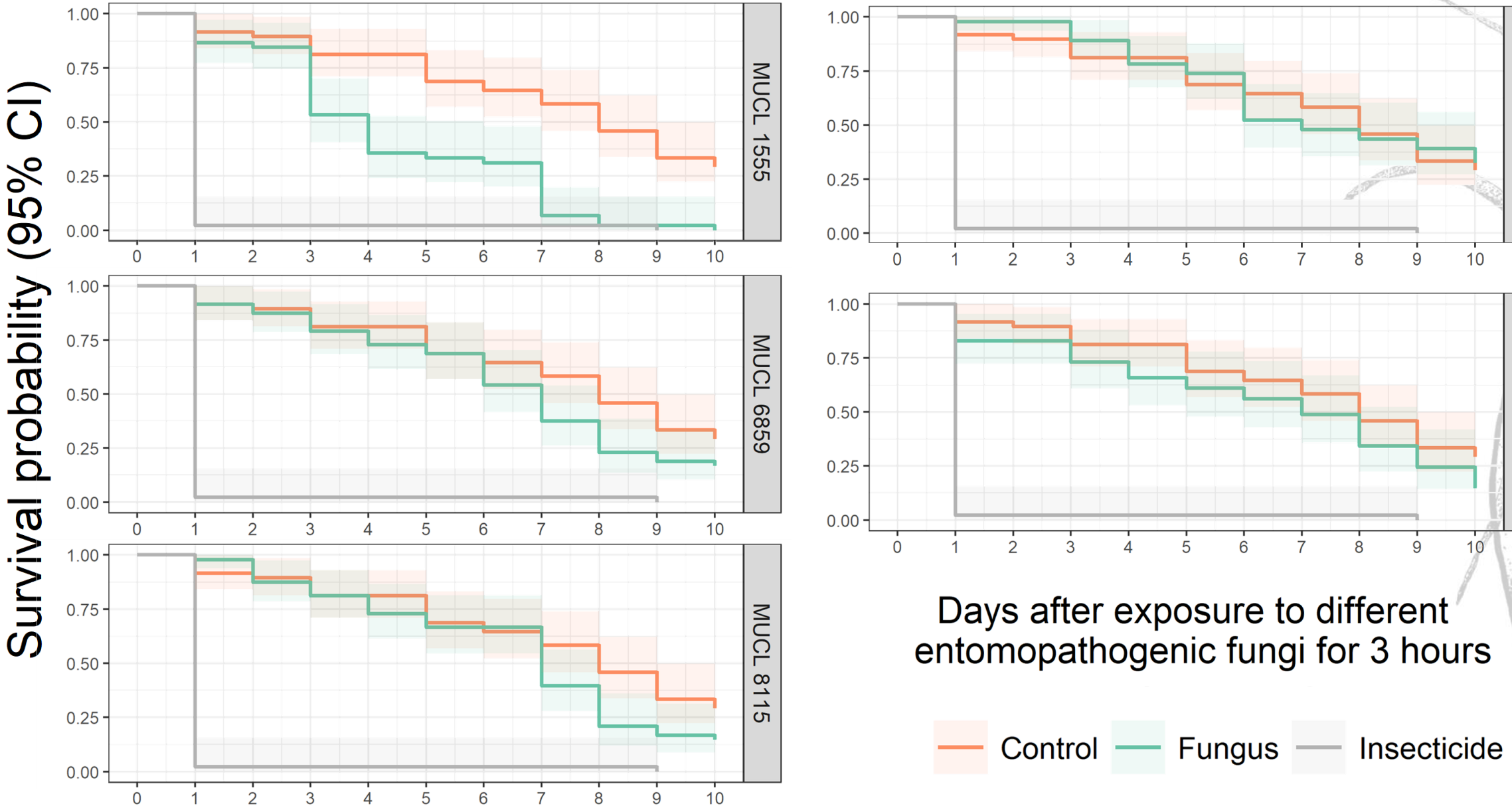


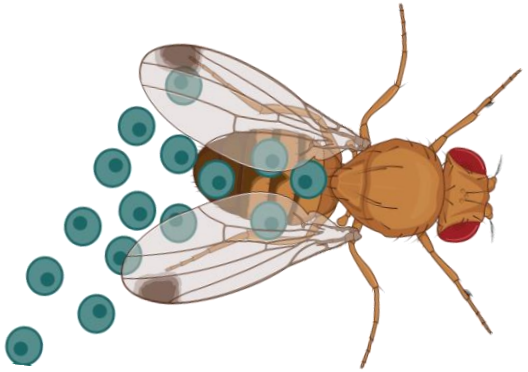
TAKE-HOME MESSAGES

1 | MUCL 1555 is lethal for *D. suzukii* after a 3hr-contact

Aims

1

Select an effective EPF by integrating its ability of adhesion

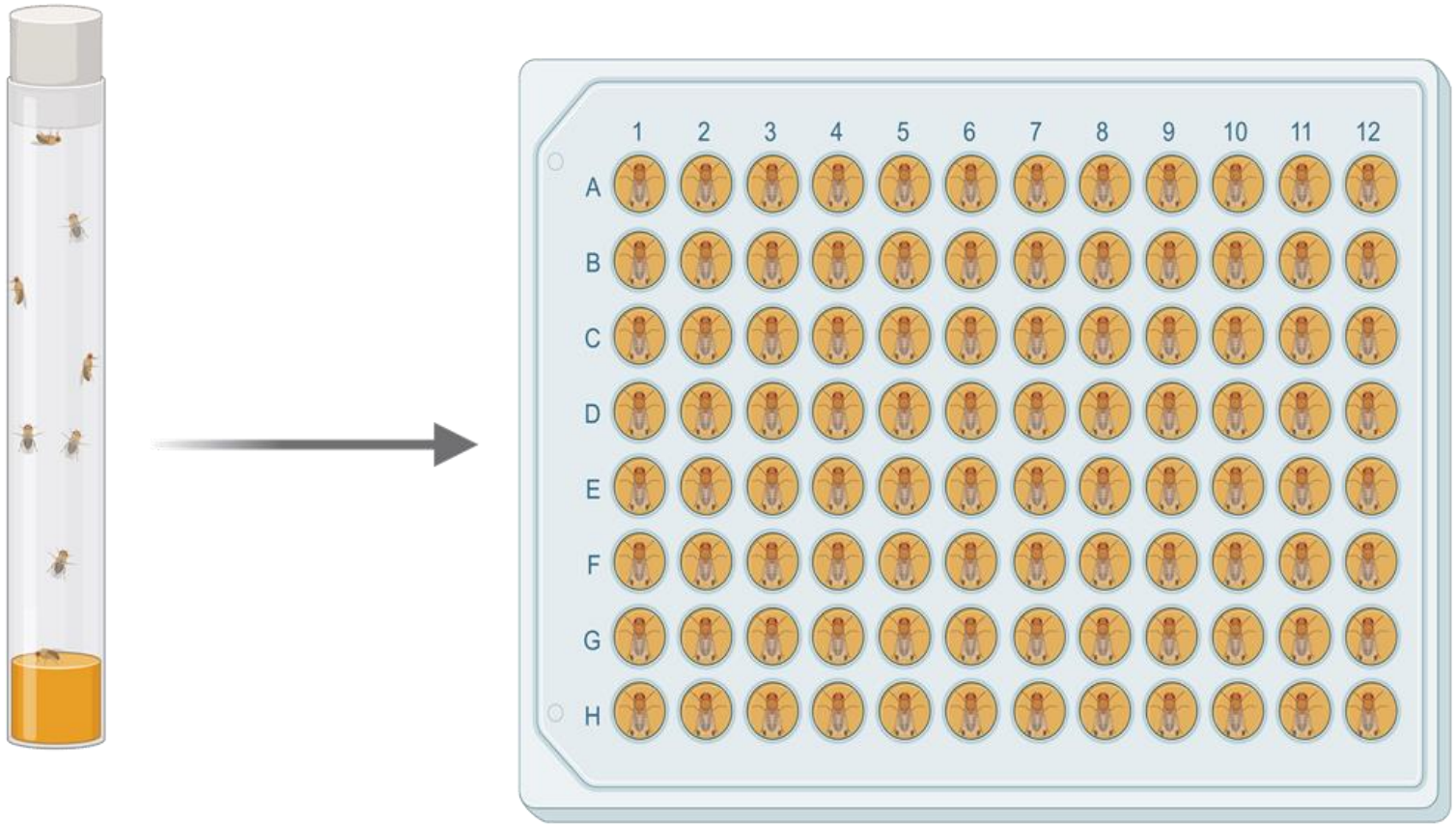


About shorter contact times?

About shorter contact time ?

10 sec, 1min, 10min, 1h

N = 48 / time



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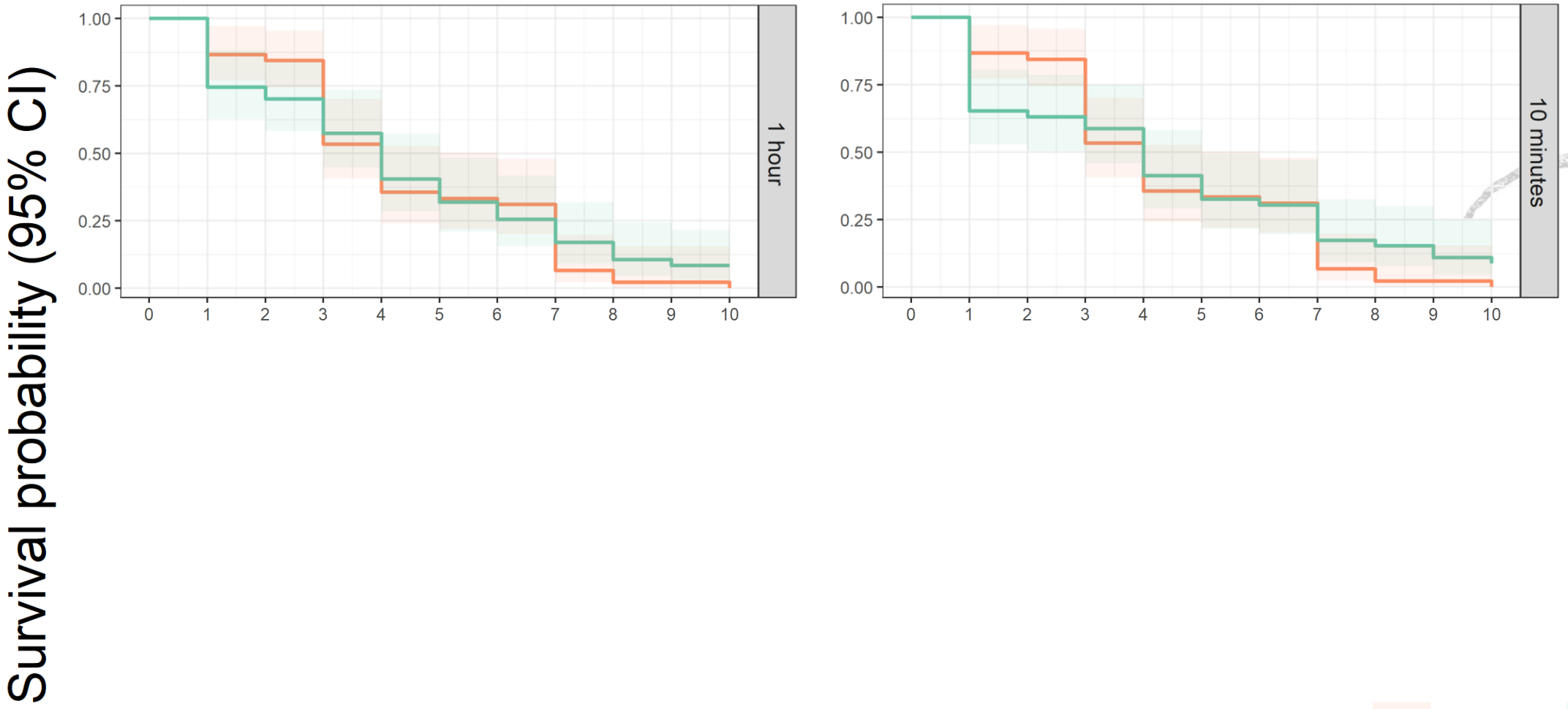
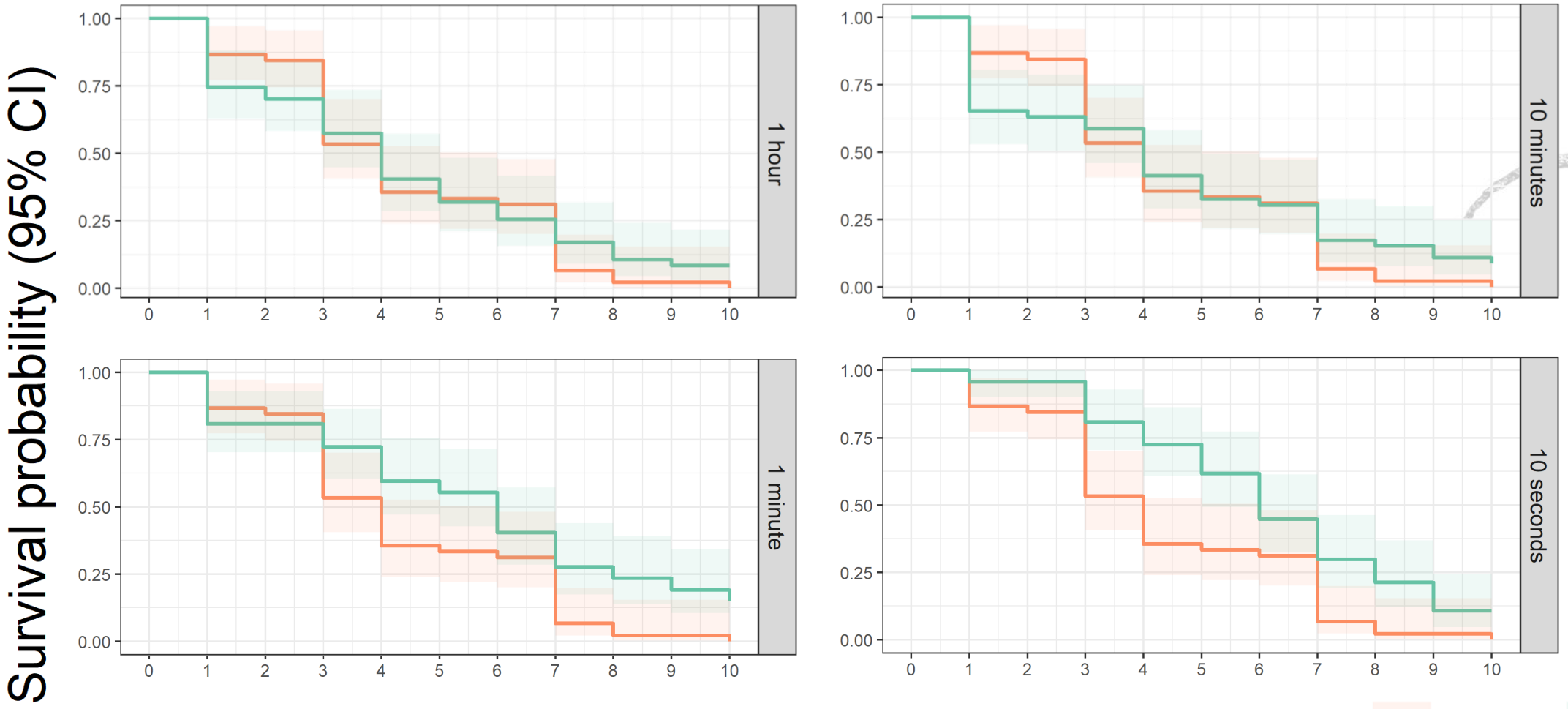


About shorter contact time ?



Days after exposure to *B. bassiania* (MUCL 1555) for different times

3 hours

Different times

TAKE-HOME MESSAGES

1 | MUCL 1555 is lethal for *D. suzukii* after a 3hr-contact

TAKE-HOME MESSAGES

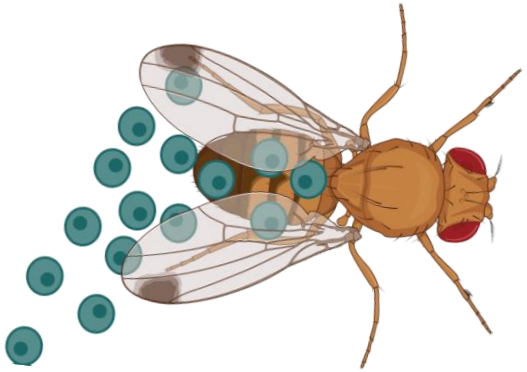
1 | MUCL 1555 is lethal for *D. suzukii* after a 3hr-contact

2 | MUCL 1555 has an ability to adhere to insect cuticule quickly and to kill this insect

Aims

1

Select an effective EPF by integrating its ability of adhesion



2

Test impact of EPF on non-target insects

Side effect on non-target insects ?

Side effect on non-target insects ?

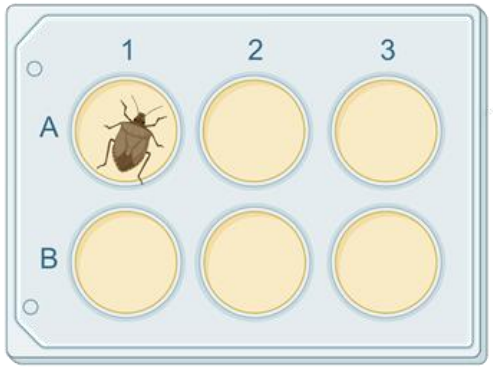
Orius laevigatus

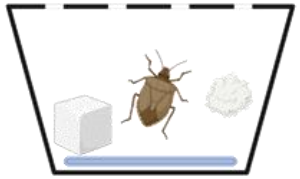
Bombus terrestris

Side effect on non-target insects ?

N = 44

Orius laevigatus





Evaluating mortality for 10 days

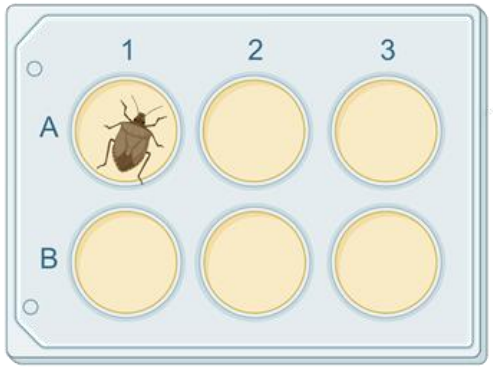
3 hours

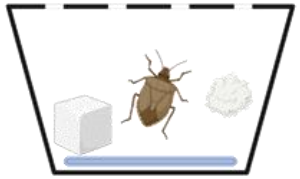
Bombus terrestris

Side effect on non-target insects ?

N = 44

Orius laevigatus



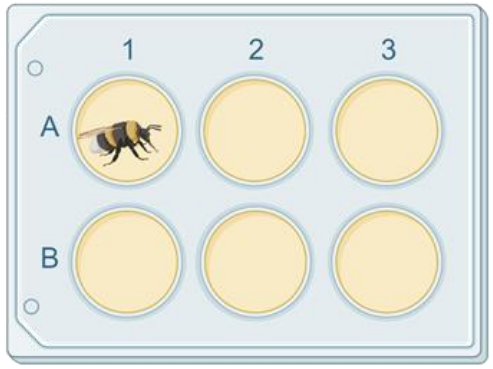


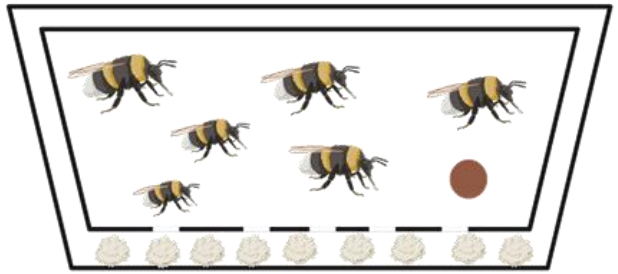
Evaluating mortality for 10 days

3 hours

N = 48

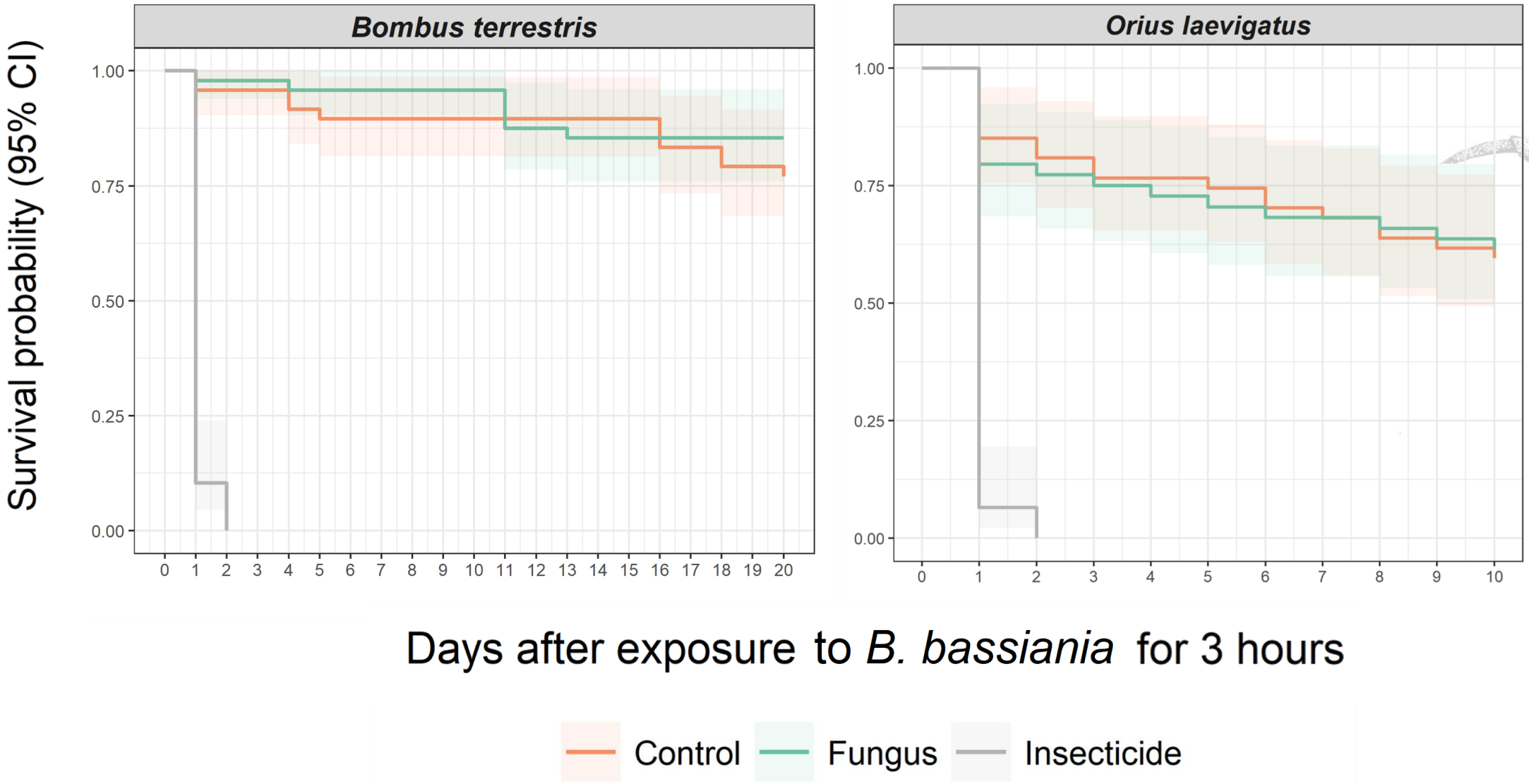
Bombus terrestris





Evaluating mortality for 20 days

Side effect on non-target insects ?



TAKE-HOME MESSAGES

1 | MUCL 1555 is lethal for *D. suzukii* after a 3hr-contact

2 | MUCL 1555 has an ability to adhere to insect cuticule quickly and to kill this insect

TAKE-HOME MESSAGES

1 | MUCL 1555 is lethal for *D. suzukii* after a 3hr-contact

2 | MUCL 1555 has an ability to adhere to insect cuticule quickly and to kill this insect

3 | MUCL 1555 is specific

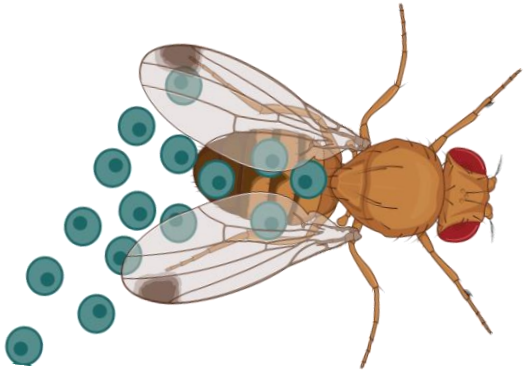
Aims

1. Select an effective EPF by integrating its ability of adhesion

2. Test impact of EPF on non-target insects

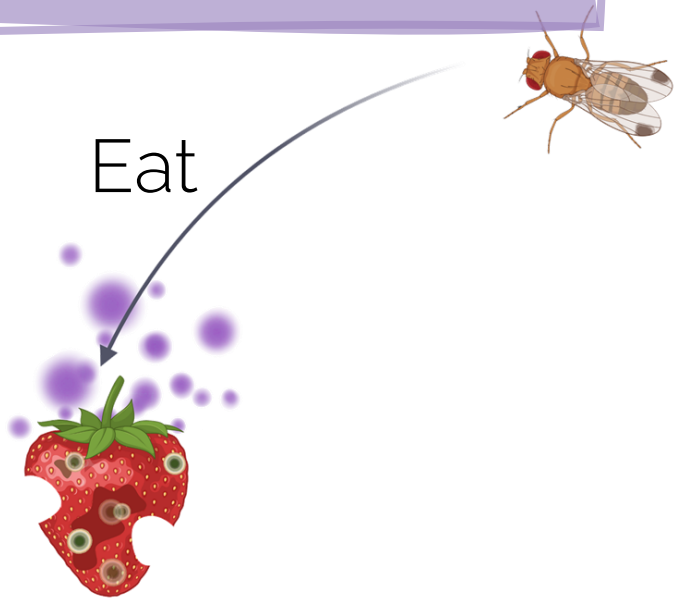
3. Select semiochemicals

→ How to attract *D. suzukii* ?



How to attract *D. suzukii* ?

How to attract *D. suzukii* ?



How to attract *D. suzukii* ?

Eat

Fermentation odors

How to attract *D. suzukii* ?

Eat

Fermentation odors

Wine and vinegar

How to attract *D. suzukii* ?

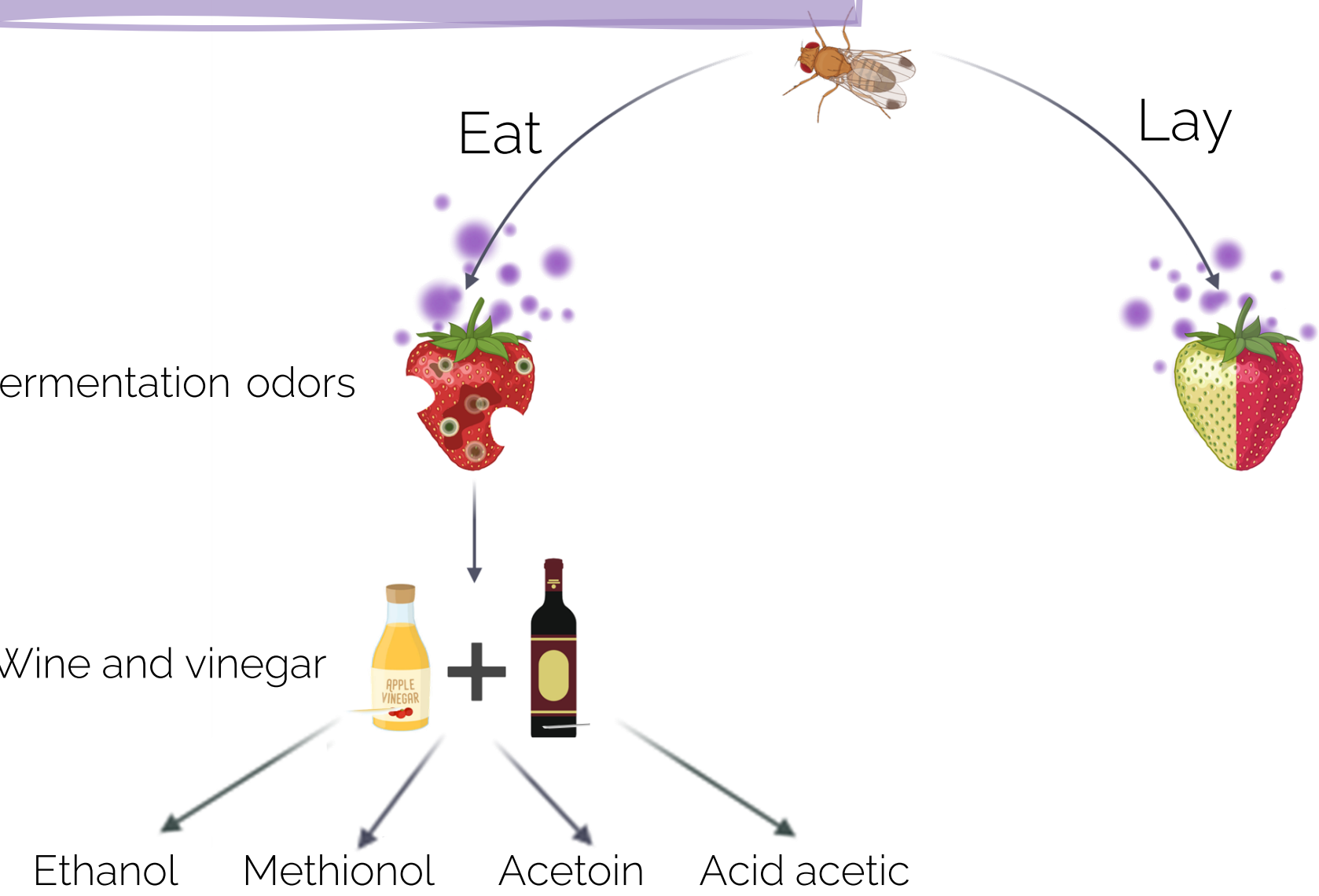
Eat

Fermentation odors

Wine and vinegar

Ethanol Methionol Acetoin Acid acetic

How to attract *D. suzukii* ?



How to attract *D. suzukii* ?

Eat

Lay

Fermentation odors

Fruit odors

Wine and vinegar

Ethanol

Methionol

Acetoin

Acid acetic

How to attract *D. suzukii* ?

Eat

Lay

Fermentation odors

Fruit odors

Wine and vinegar

Rasberry

Ethanol

Methionol

Acetoin

Acid acetic

How to attract *D. suzukii* ?

Eat

Lay

Fermentation odors

Fruit odors

Wine and vinegar

Rasberry

Ethanol

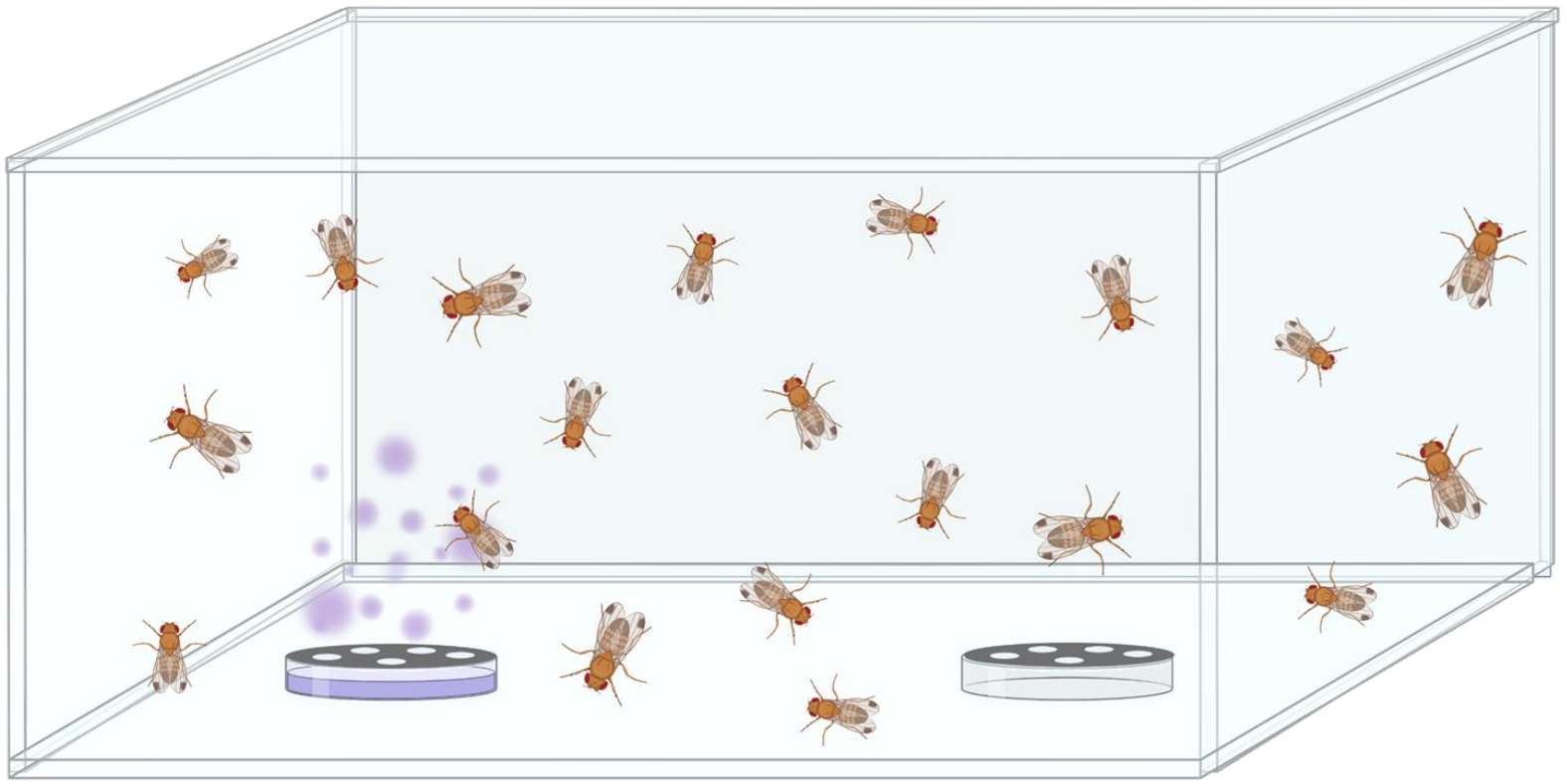
Methionol

Acetoin

Acid acetic

Rasberry ketone

How to attract *D. suzukii* ?



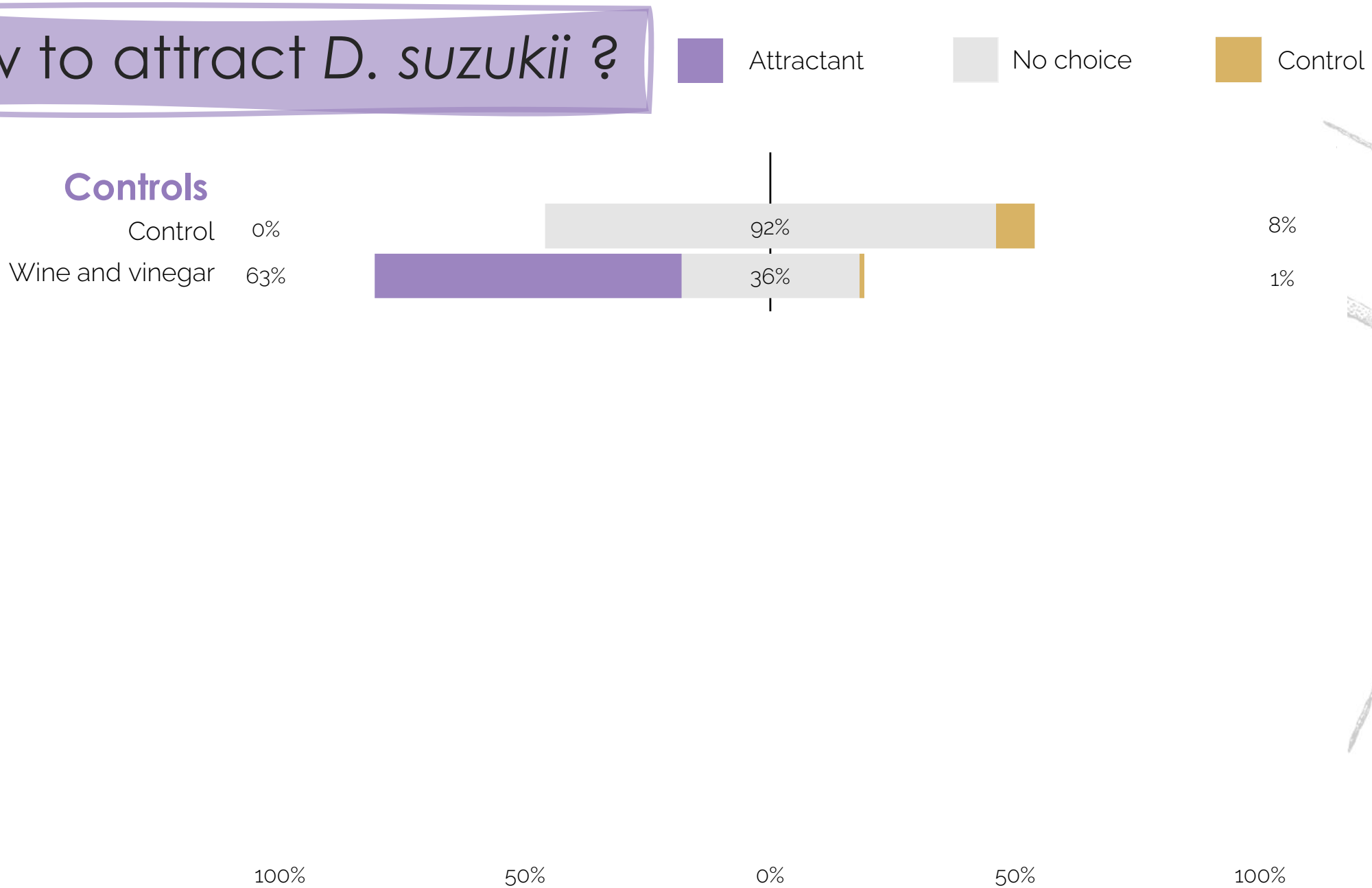
Attractant

Control (water)

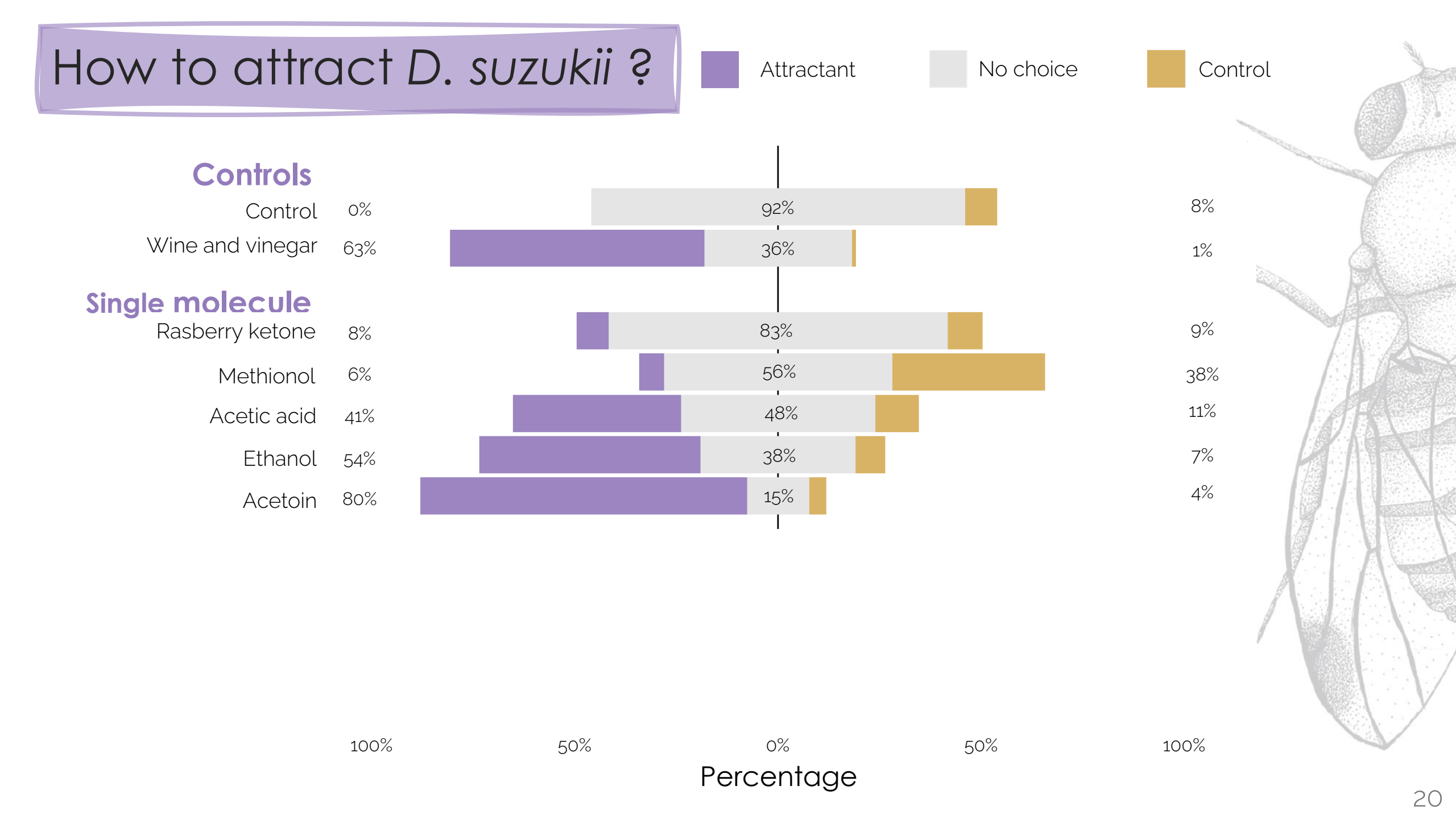
3 hours

How to attract *D. suzukii* ?

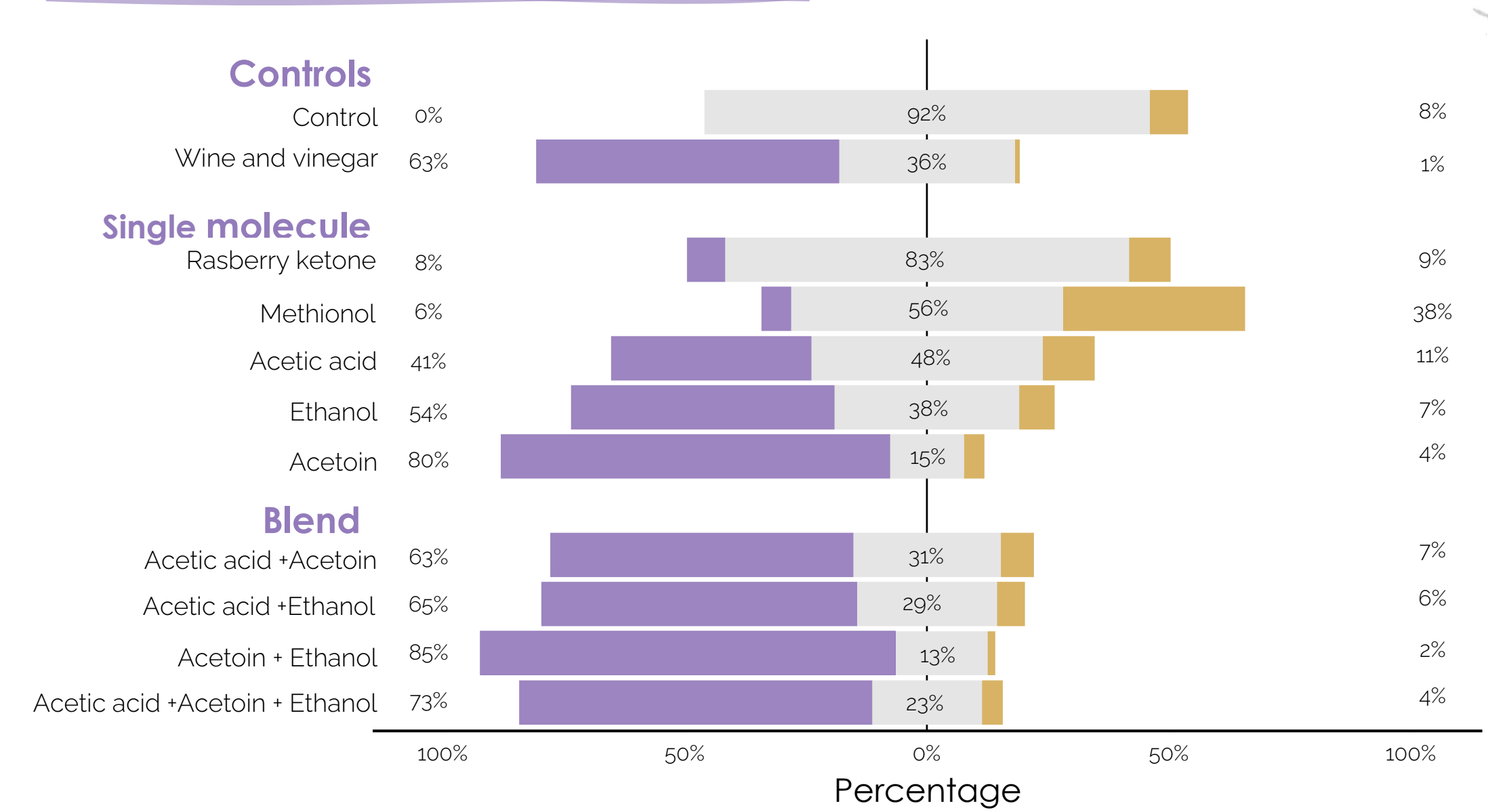
How to attract *D. suzukii* ?



How to attract *D. suzukii* ?



How to attract *D. suzukii* ?



TAKE-HOME MESSAGE

1 | MUCL 1555 is lethal for *D. suzukii* after a 3hr-contact

2 | MUCL 1555 has an ability to adhere to insect cuticule quickly and to kill this insect

3 | MUCL 1555 is specific

TAKE-HOME MESSAGE

1 | MUCL 1555 is lethal for *D. suzukii* after a 3hr-contact

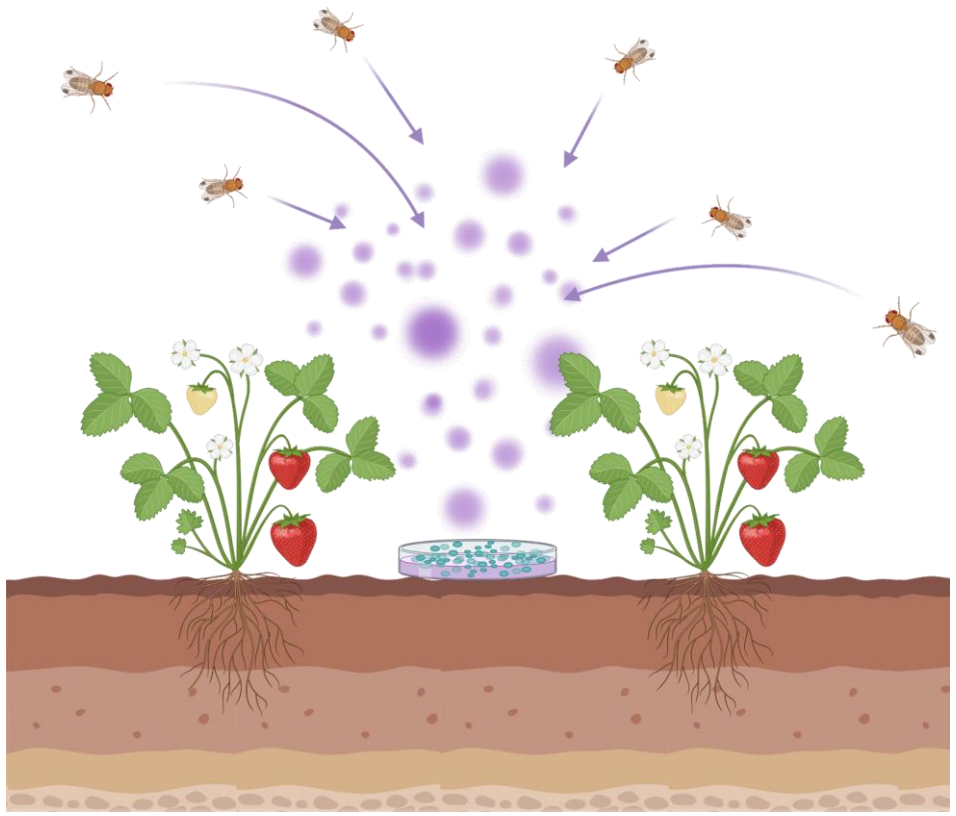
2 | MUCL 1555 has an ability to adhere to insect cuticule quickly and to kill this insect

3 | MUCL 1555 is specific

4 | *D. suzukii* is attracted by ethanol and acetoin

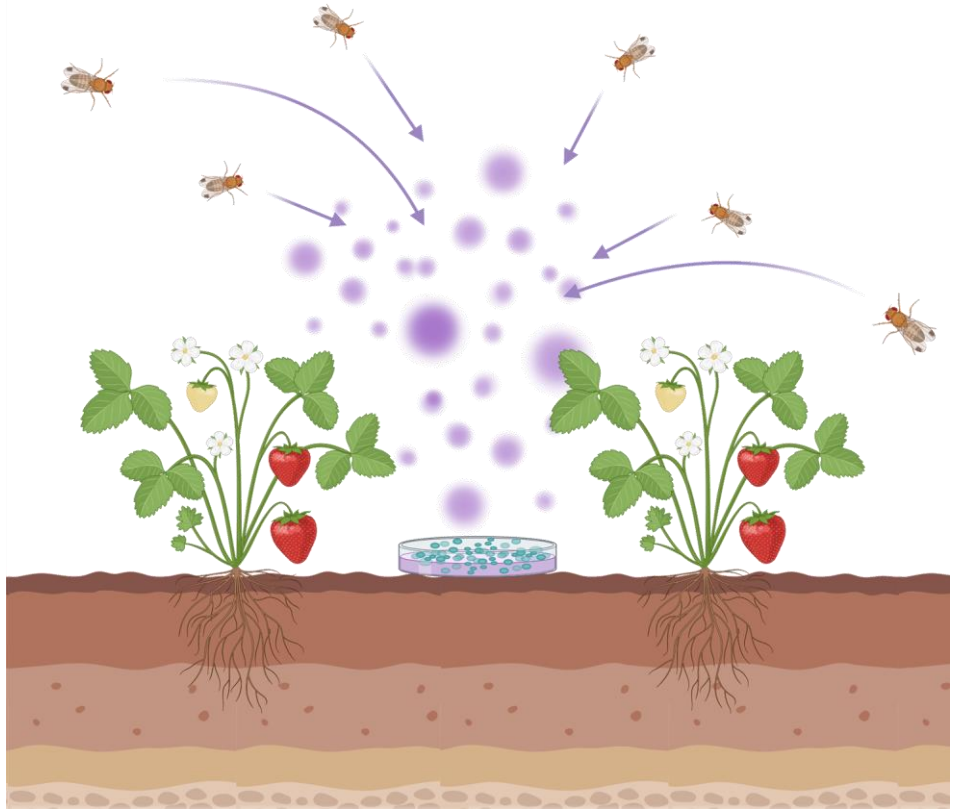
Perspectives

Attract & Kill

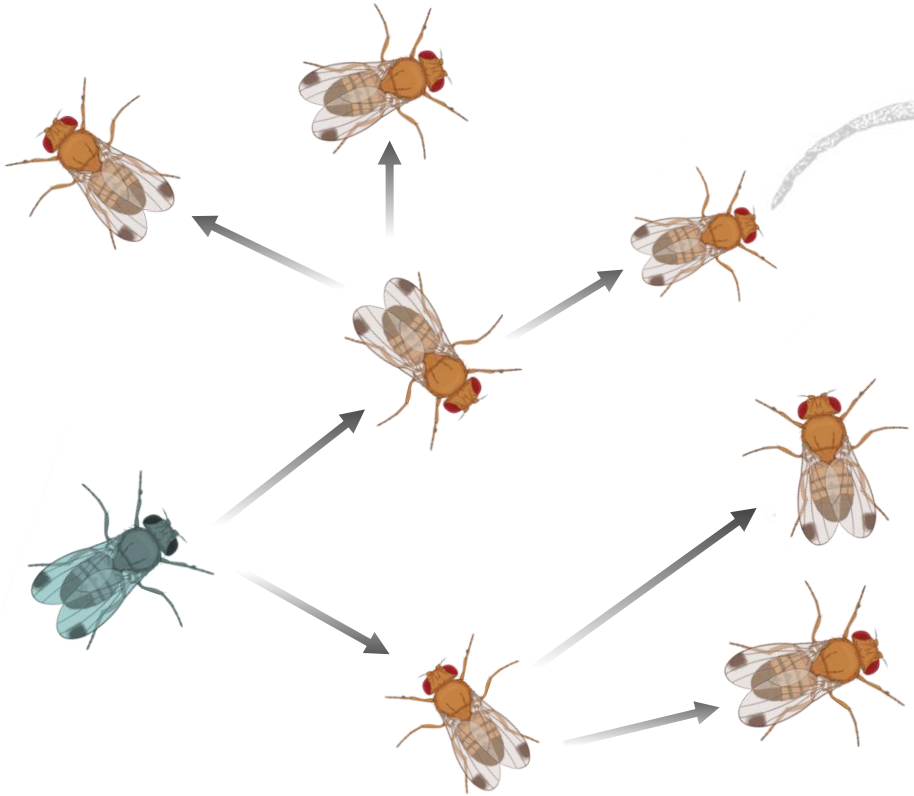


Perspectives

Attract & Kill

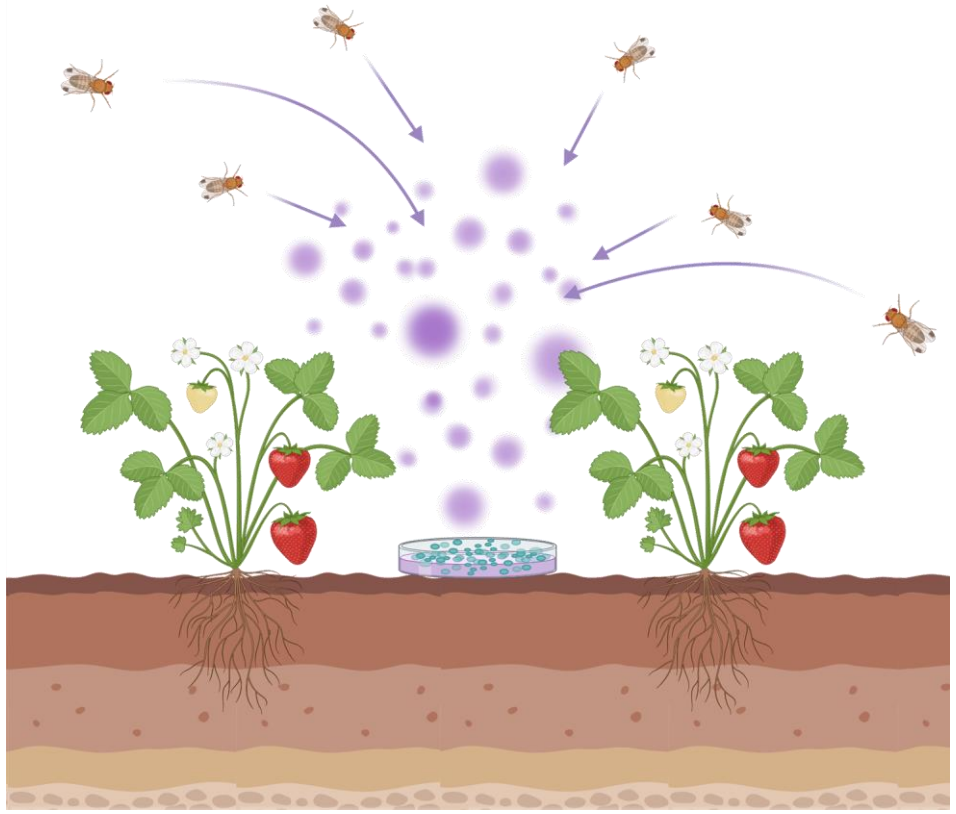


Transmission



Perspectives

Attract & Kill



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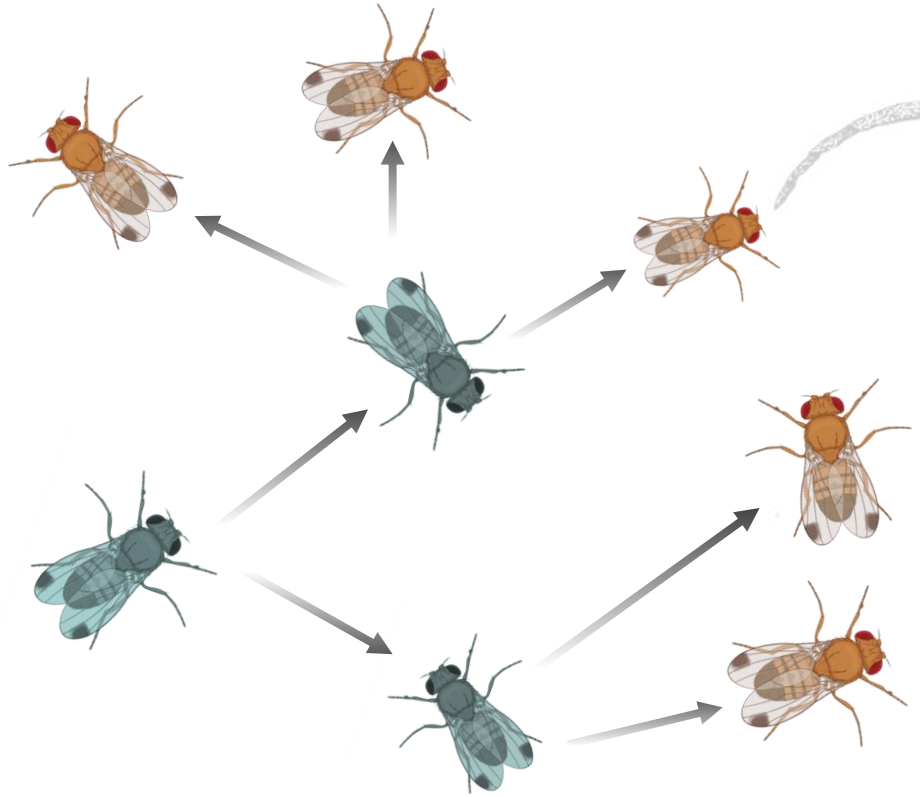
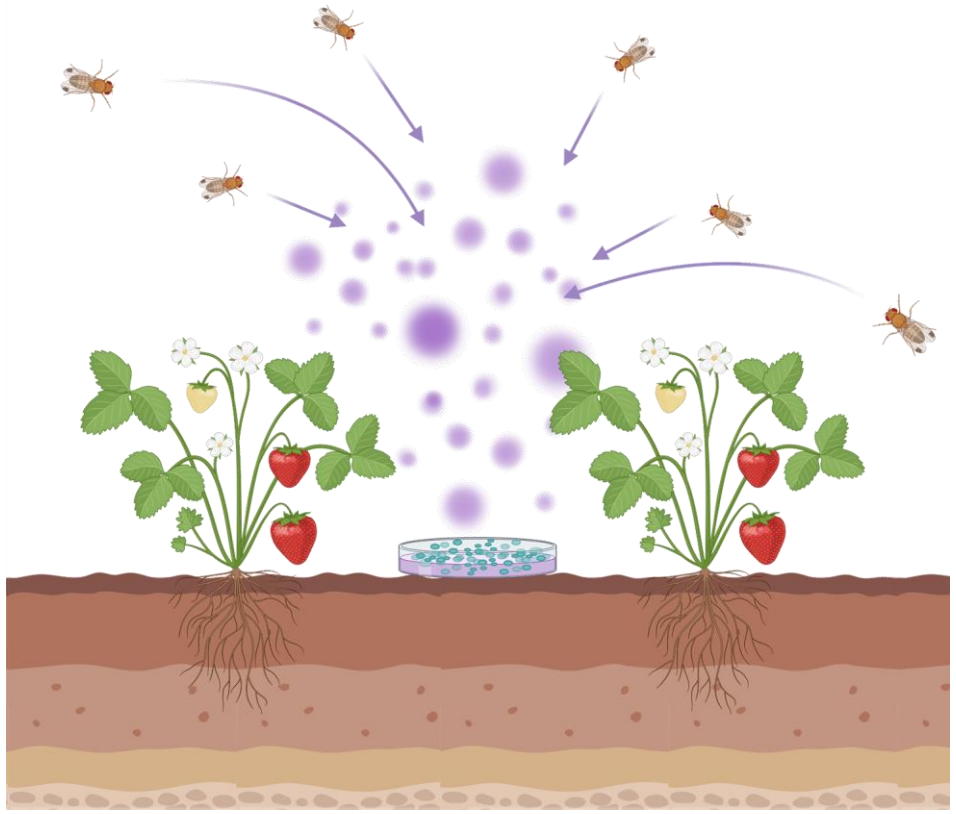
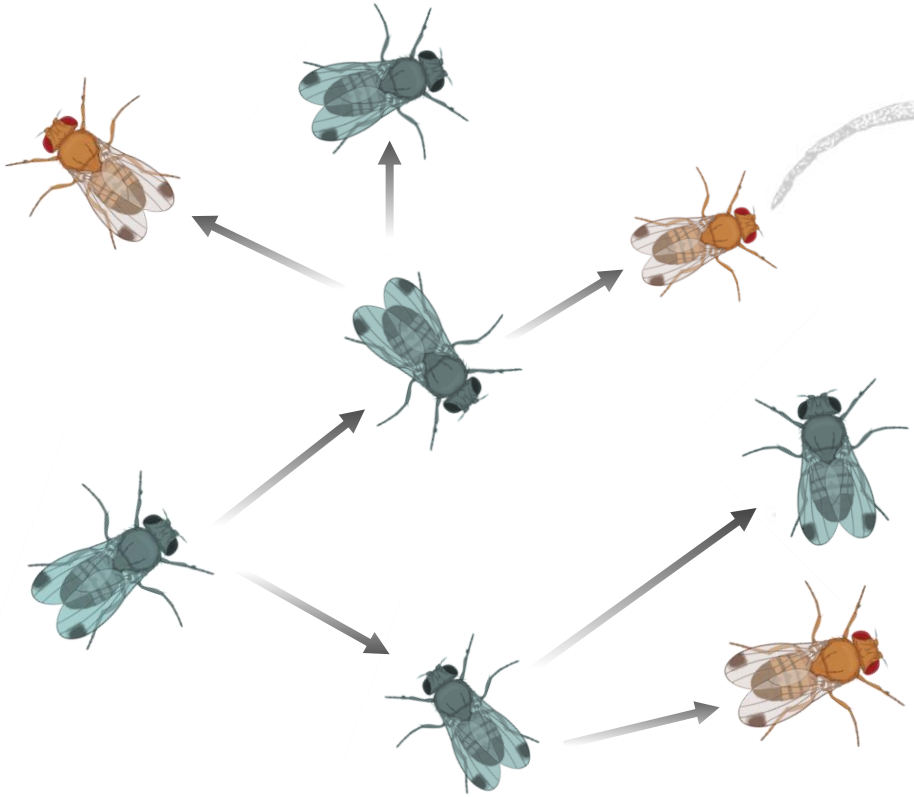


Perspectives

Attract & Kill



Transmission



Thank for your attention

LIÈGE université
Gembloux
Agro-Bio Tech

François Verheggen
Clément Martin
Nicolas Leroy
Julie Bonnet
Andréa Chacon
Fanny Ruhland
Solène Travaillard

UCLouvain

Stéphane Declerck

Ismahen Lalaymia

Virginie Moreau

"Insects become pests because of the monoculture structure of agricultural systems, and such structure responds to a capitalist economic model that destroys nature and displaces small farmers"

M. Altieri