

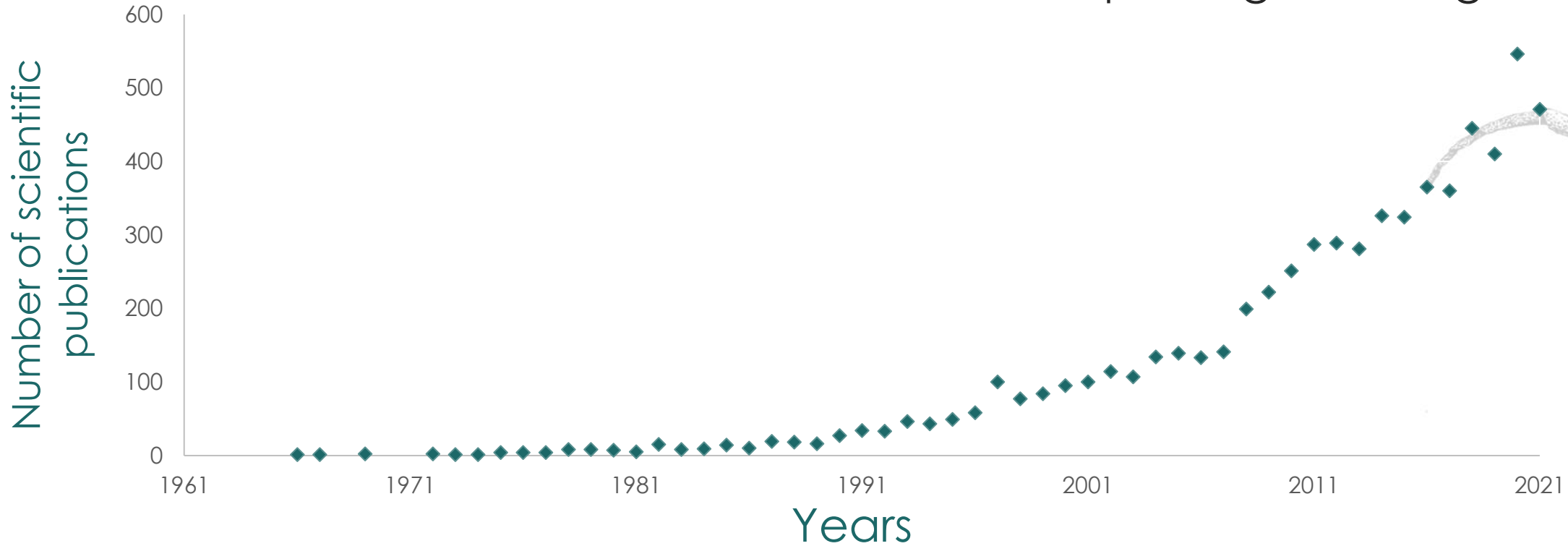
Efficacy of entomopathogenic fungi
on *Drosophila suzukii* and their
impact on beneficial organisms

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



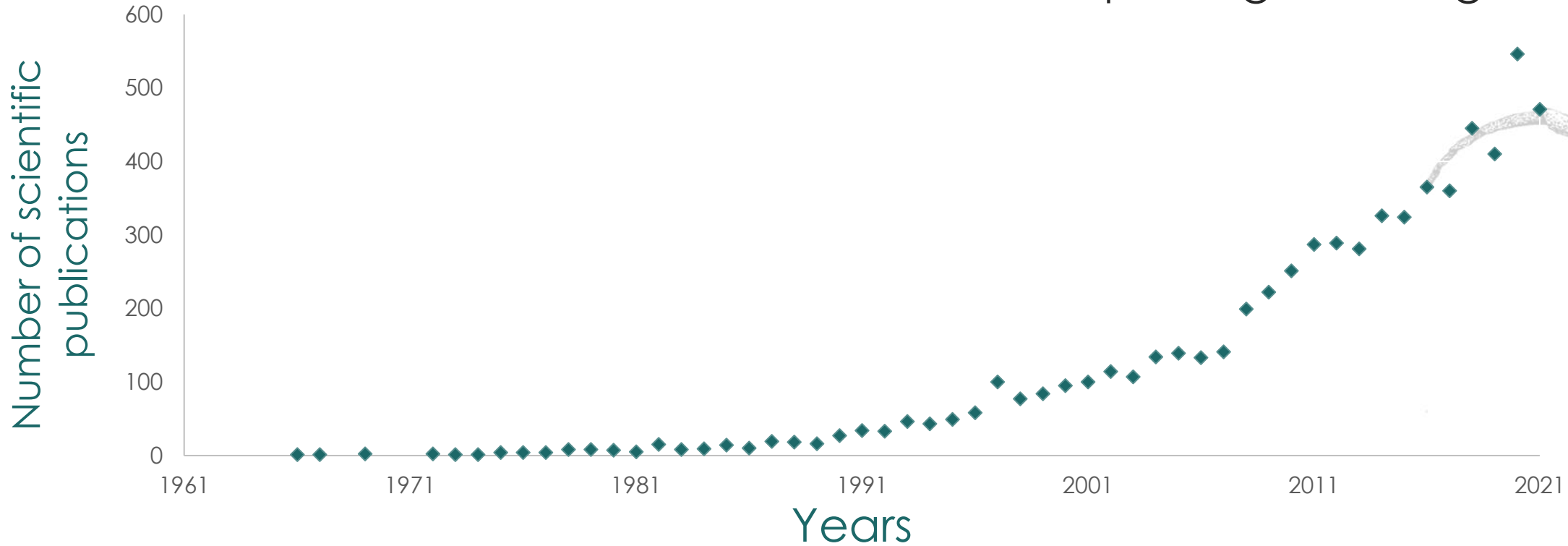
Context

Evolution of research about entomopathogenic fungi



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Evolution of research about entomopathogenic fungi

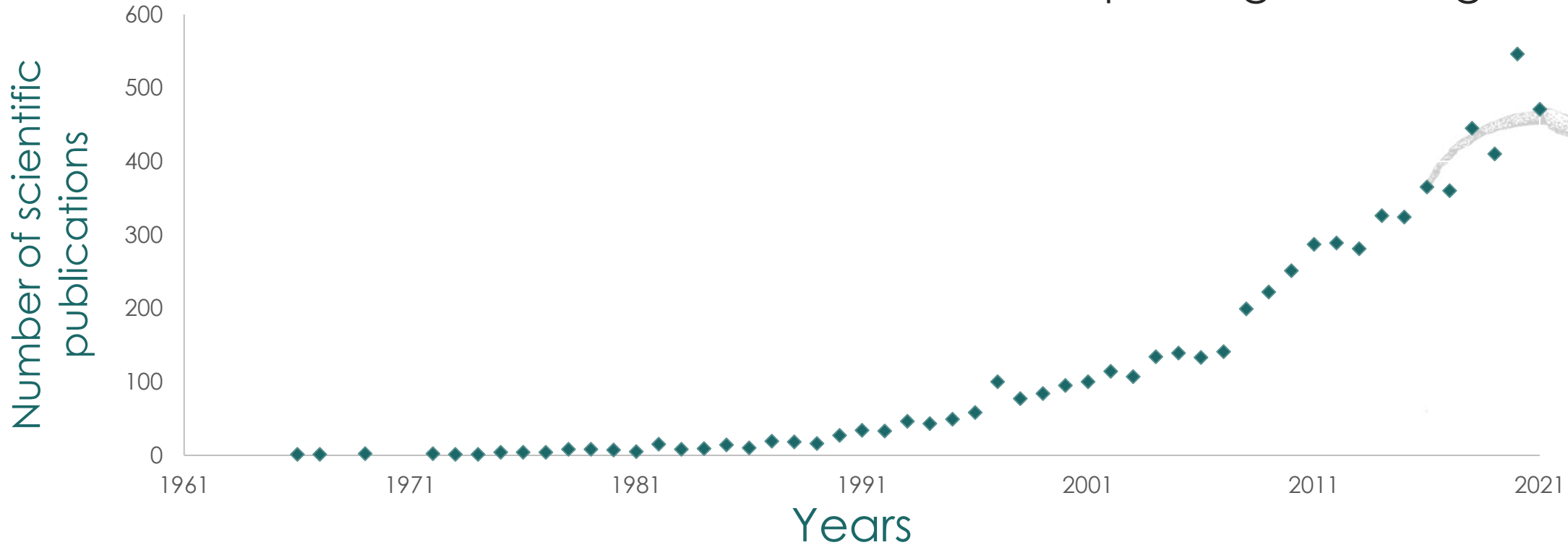


Why are entomopathogenic fungi (EPF) interesting ?



Context

Evolution of research about entomopathogenic fungi

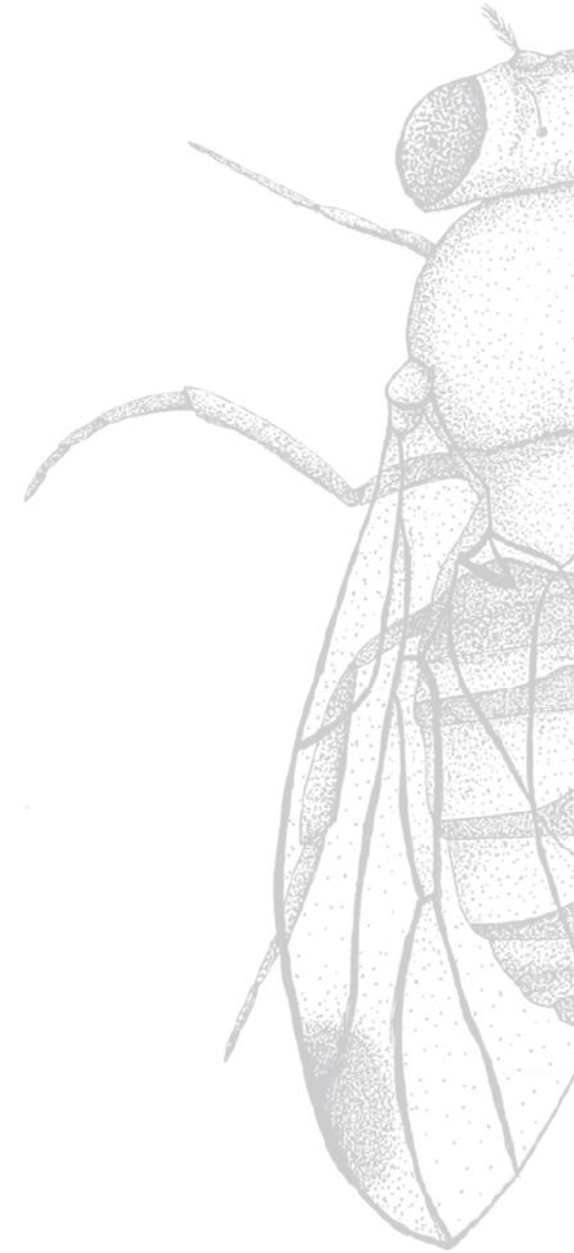


Why are entomopathogenic fungi (EPF) interesting ?

Why is the number of commercial products low ?






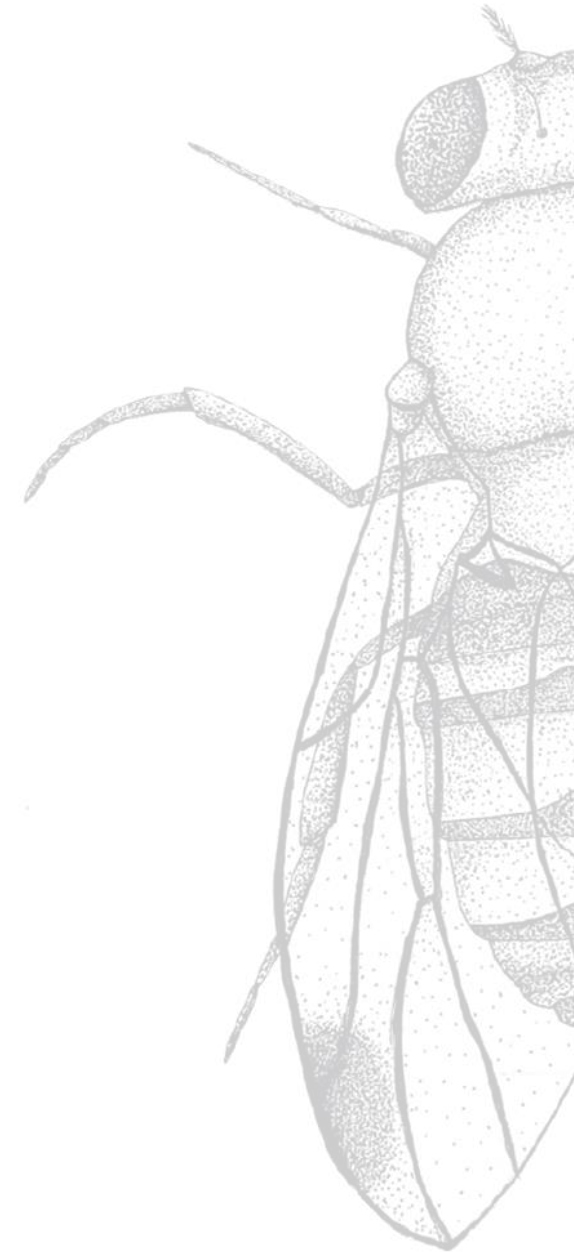
Why are EPF interesting ?



Why are EPF interesting ?




Insecticide limited

- Knowledge 
- Cost 
- Legislation 




Why are EPF interesting ?

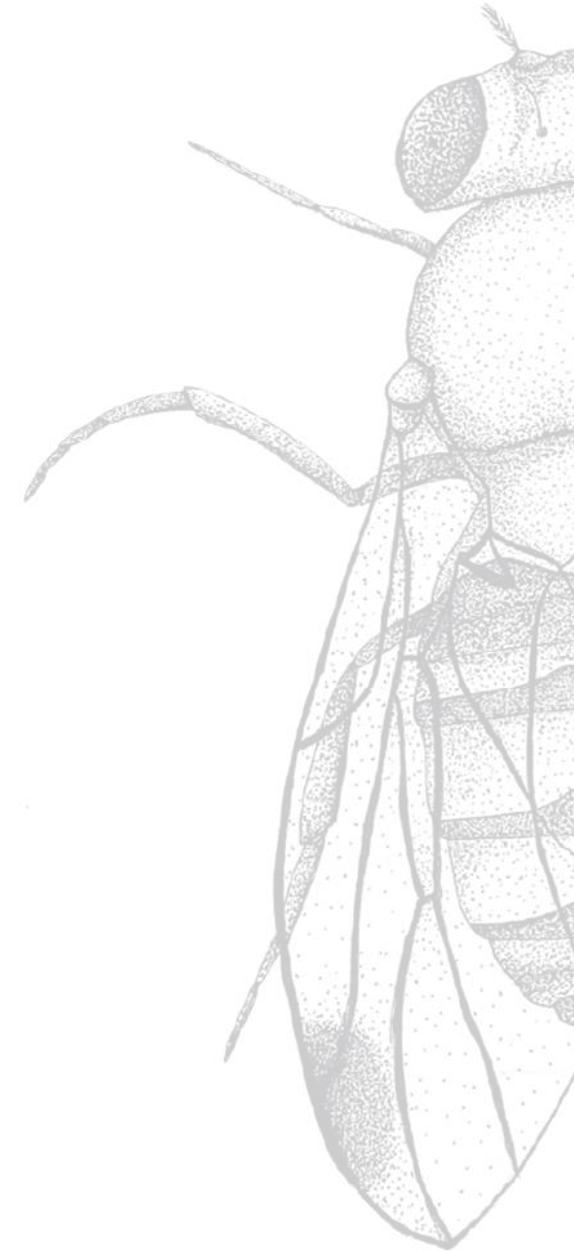
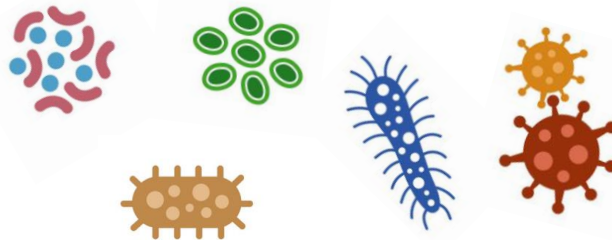
Insecticide limited

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Microbial organisms

- Coevolution 
- Human safety 
- No toxic residue 



Why are EPF interesting ?

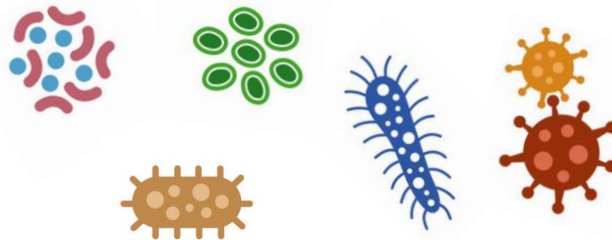
Insecticide limited

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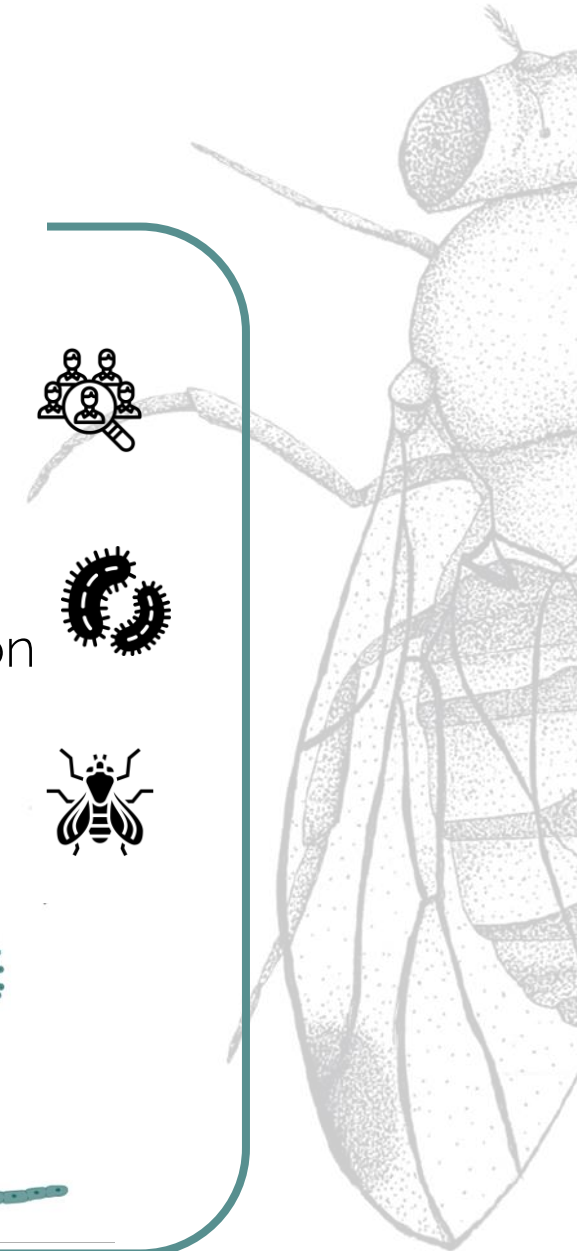
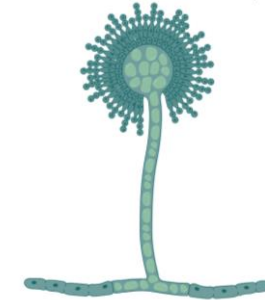
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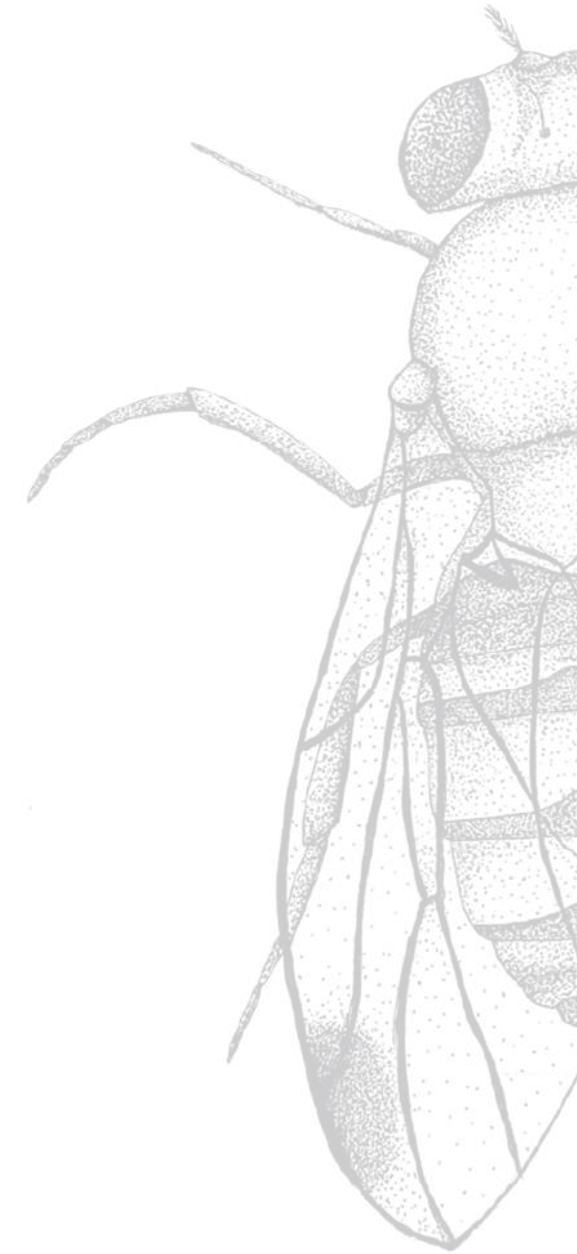


EPF

- Selectivity 
- High reproduction 
- Diptera 

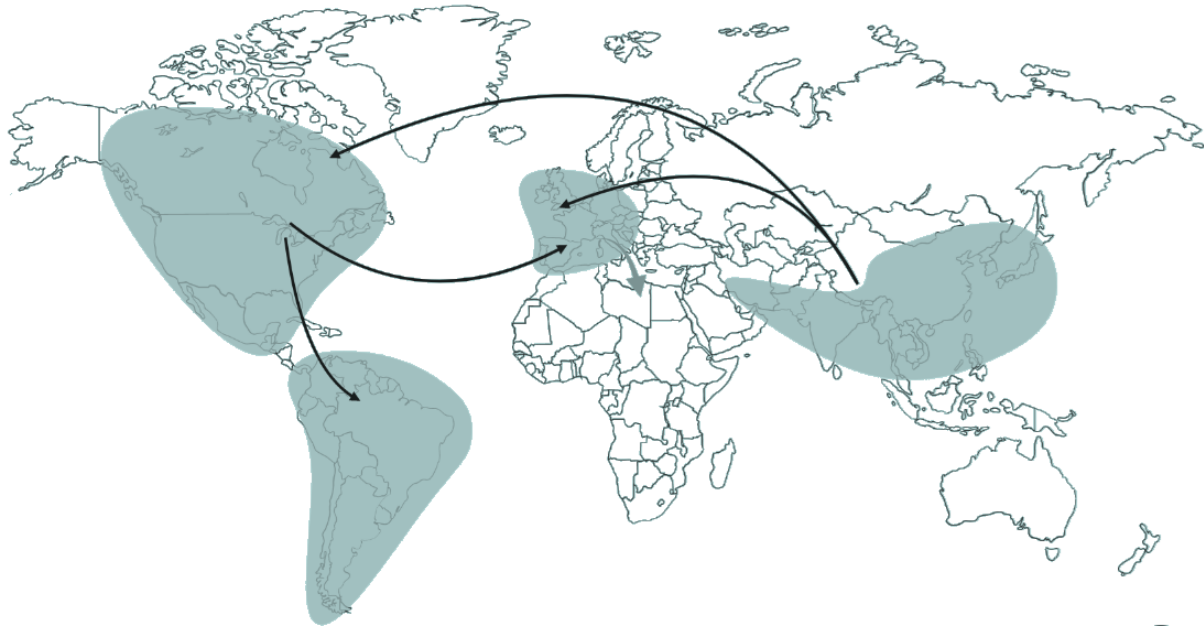


Drosophila suzukii



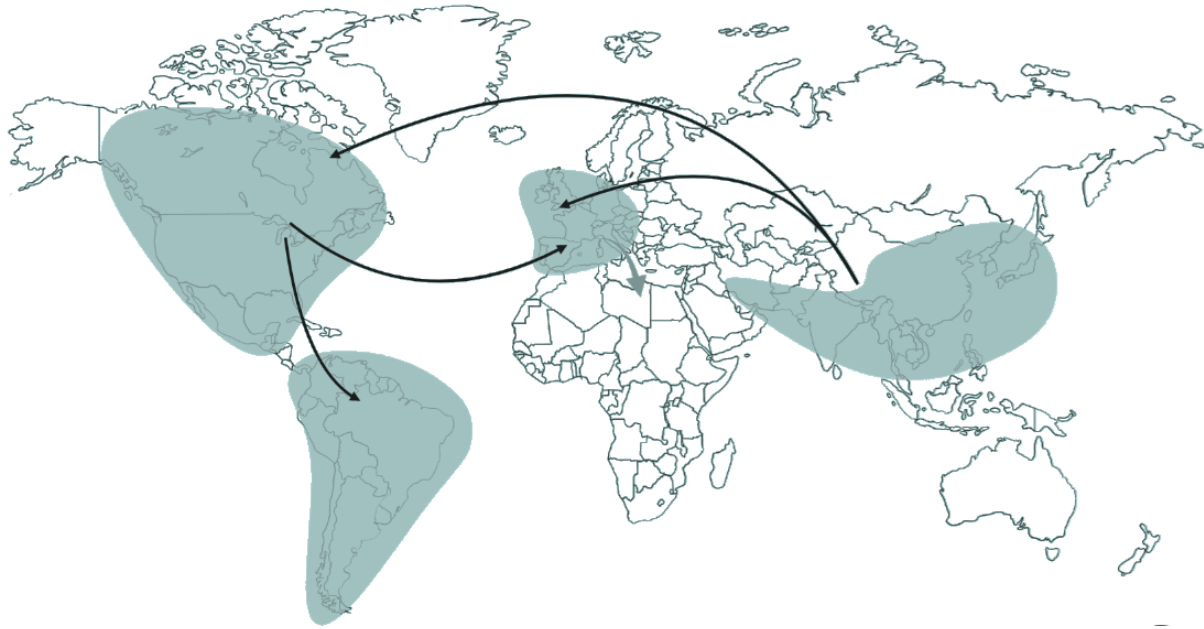
Drosophila suzukii

➤ Invasive specie



Drosophila suzukii

➤ Invasive specie

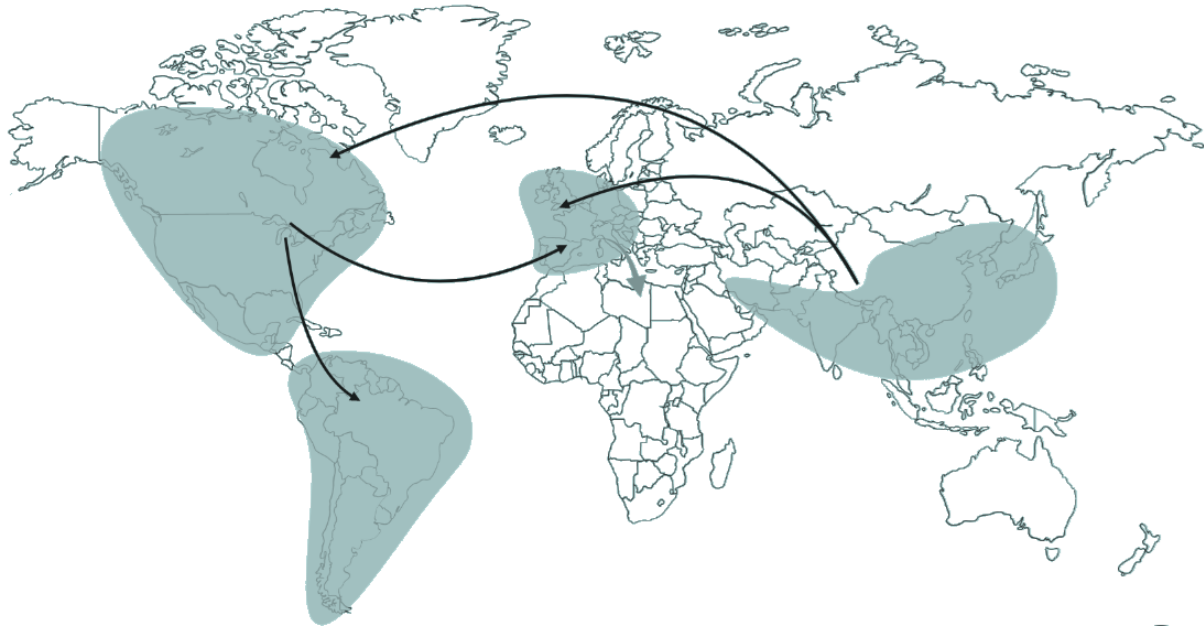


➤ Laying theirs eggs in ripe fruits

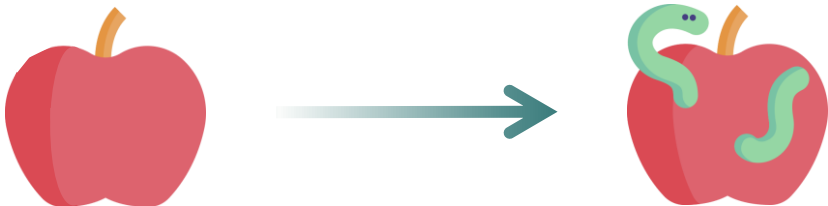


Drosophila suzukii

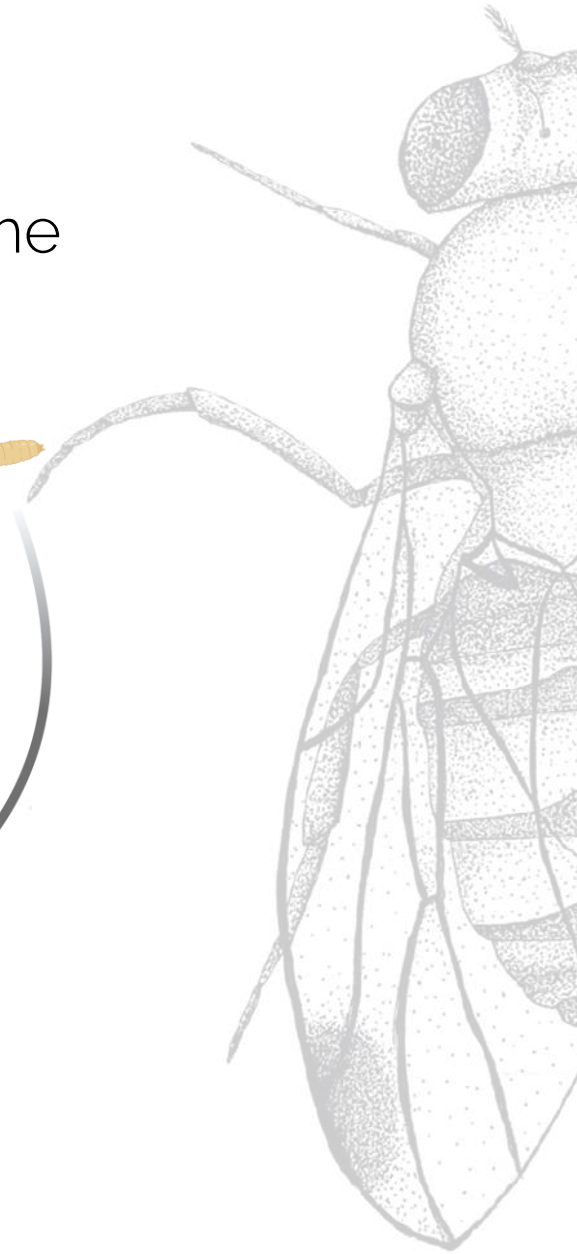
➤ Invasive specie



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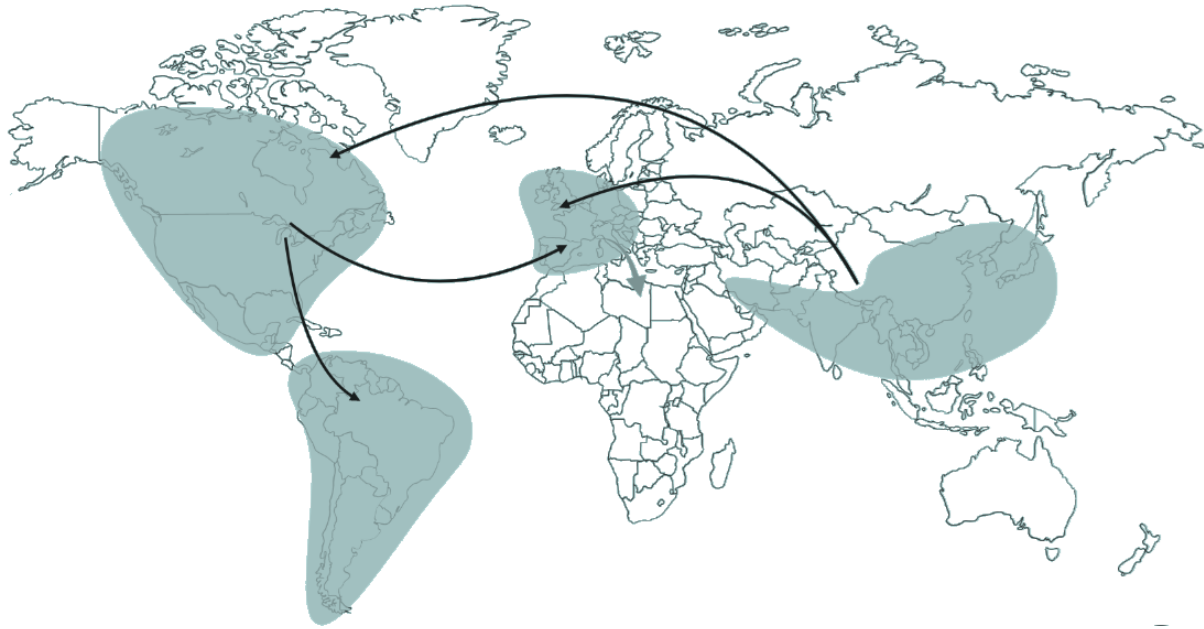


➤ Short generation time



Drosophila suzukii

➤ Invasive specie



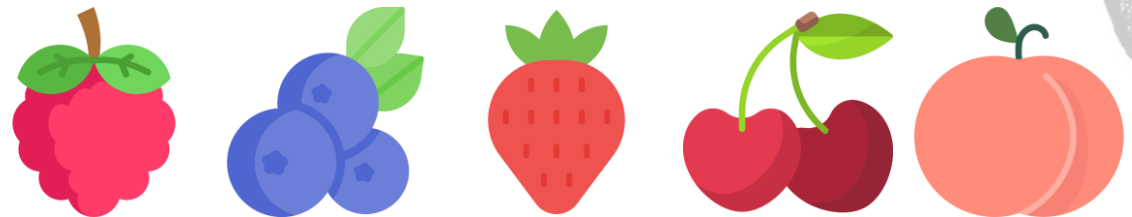
➤ Short generation time



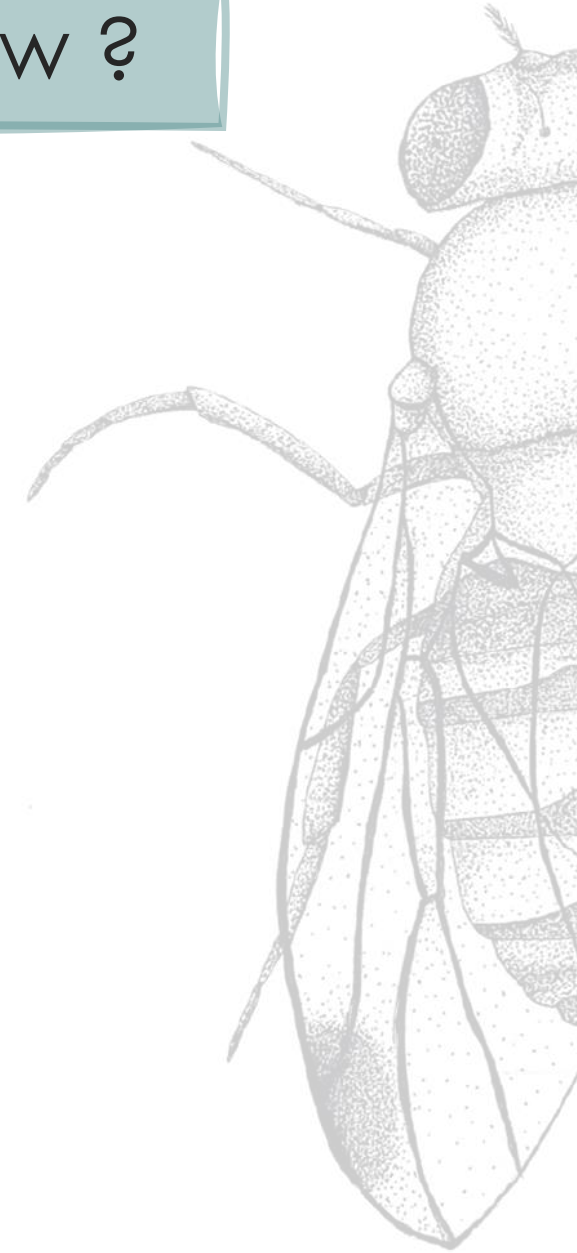
➤ Laying theirs eggs in ripe fruits



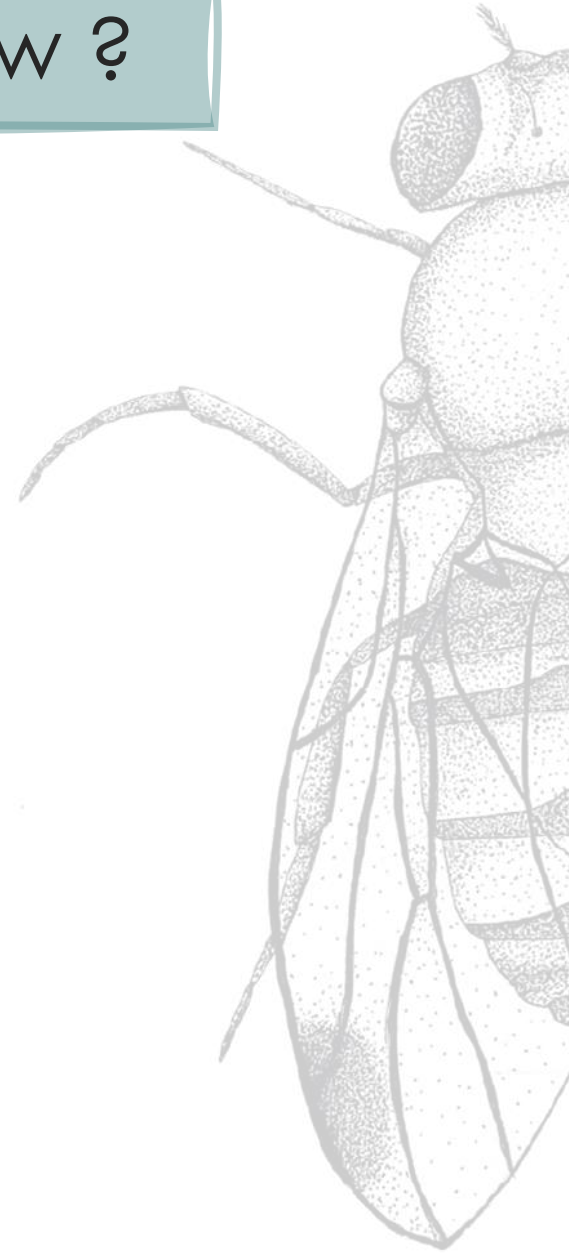
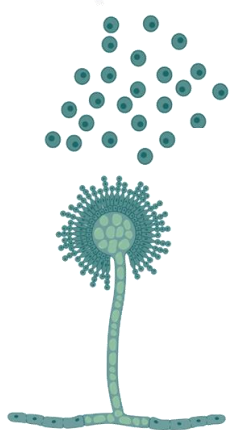
➤ Large number of potential hosts



Why is the number of commercial products low ?



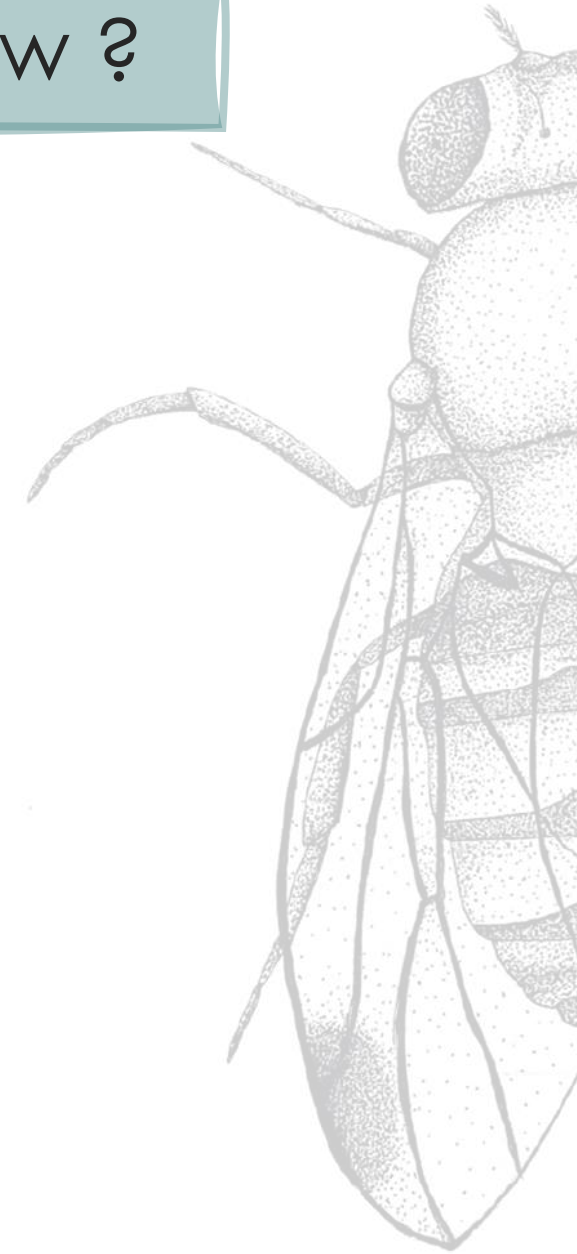
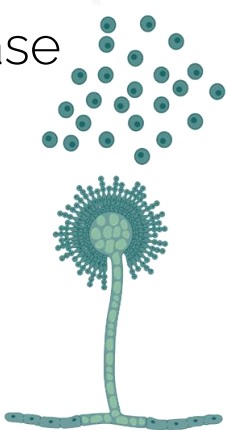
Why is the number of commercial products low ?



Bugti et al, 2020
Sharma et al, 2020

Why is the number of commercial products low ?

1 Conidia release



Bugti et al, 2020
Sharma et al, 2020

Why is the number of commercial products low ?

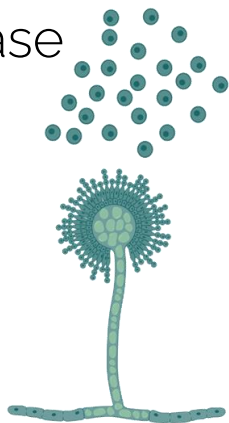
2

Conidia adhere on insect cuticule



1

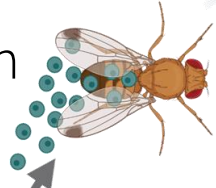
Conidia release



Why is the number of commercial products low ?

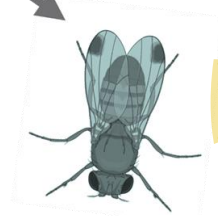
2

Conidia adhere on insect cuticule



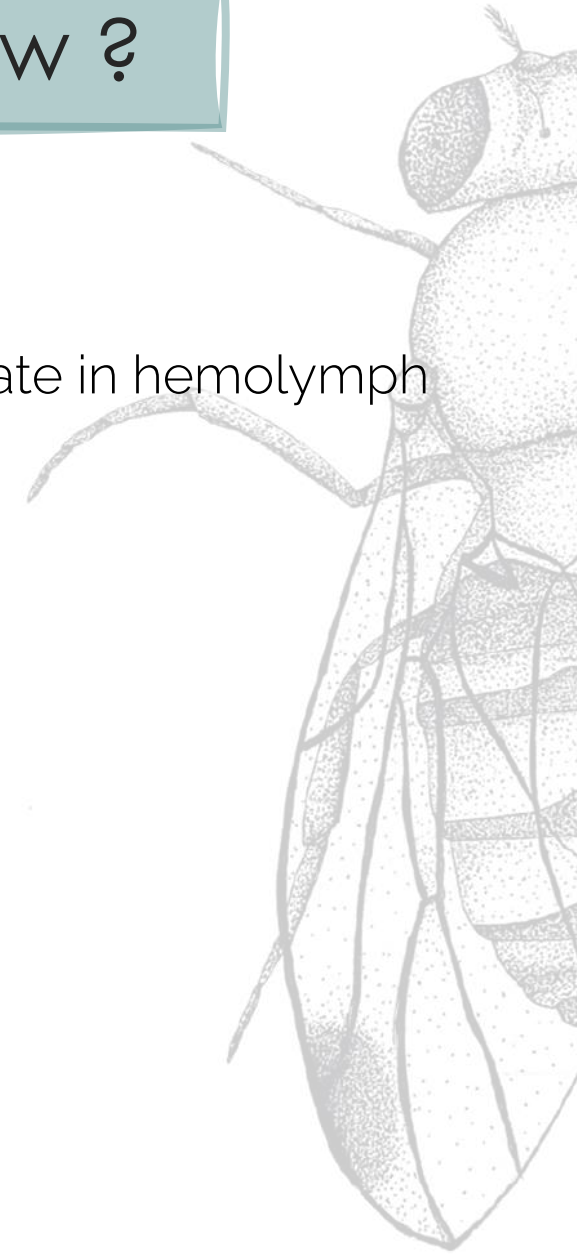
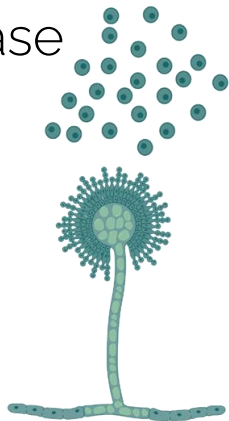
3

Conidia penetrate in hemolymph
Insect dies

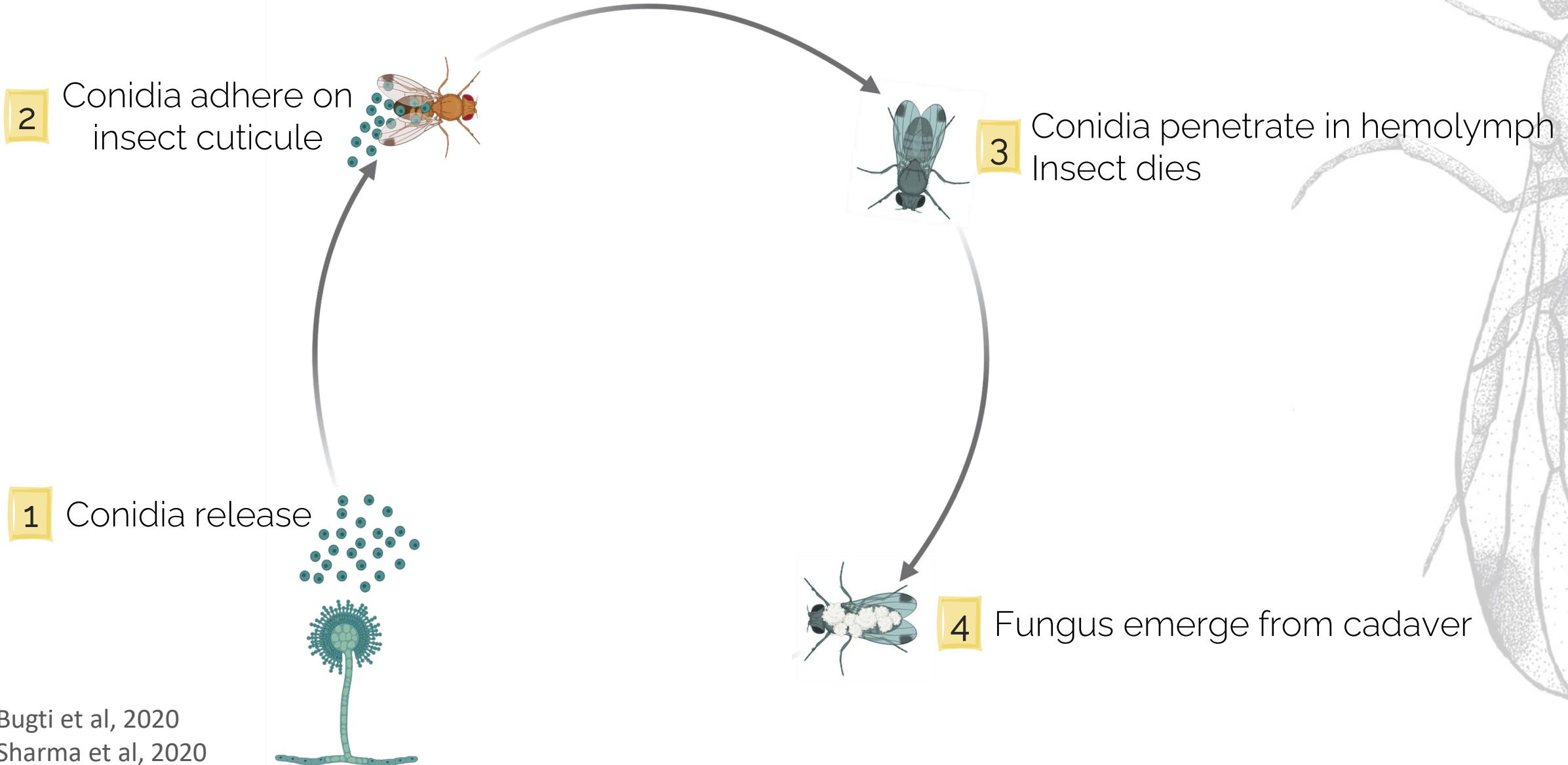


1

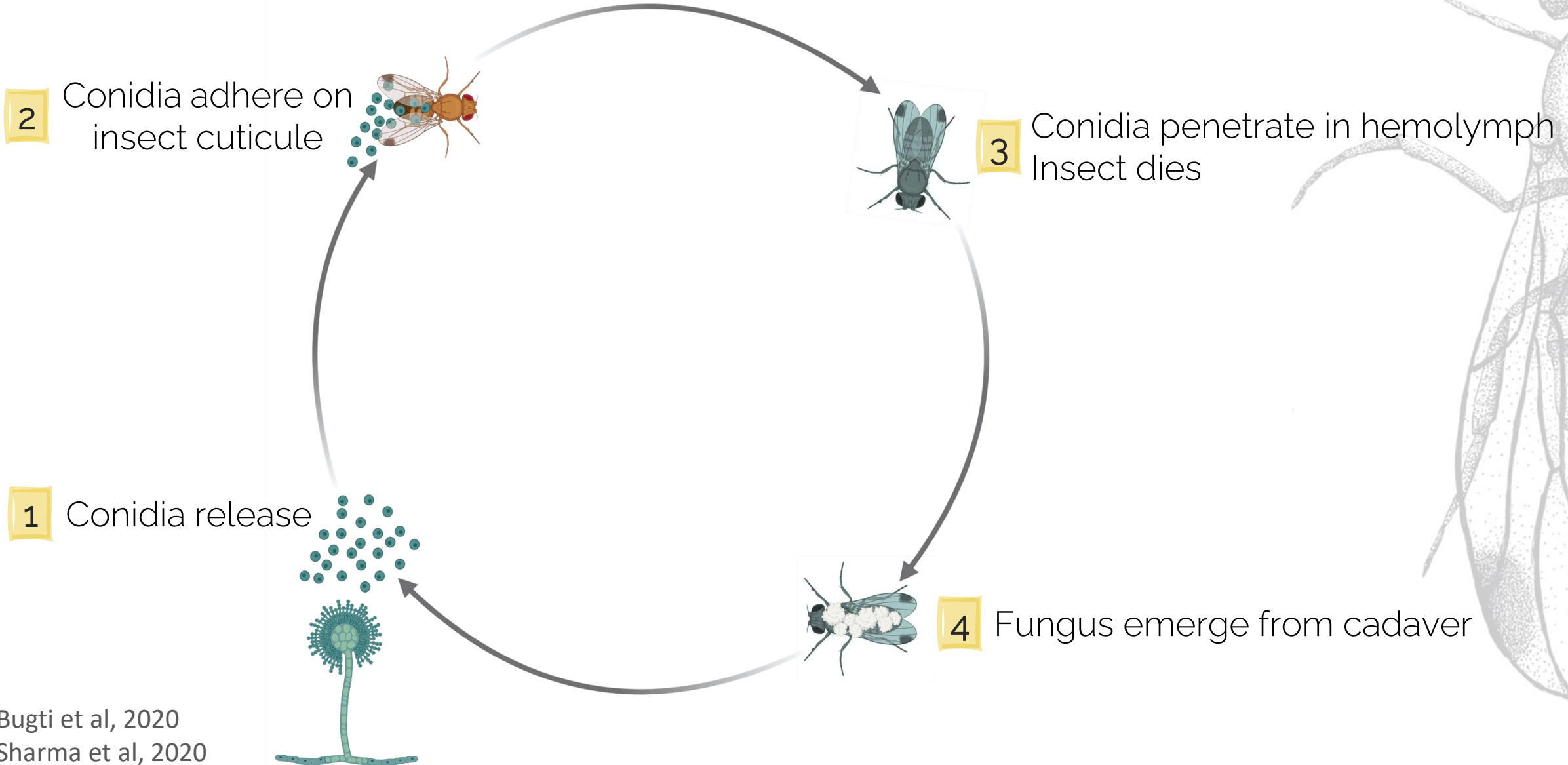
Conidia release



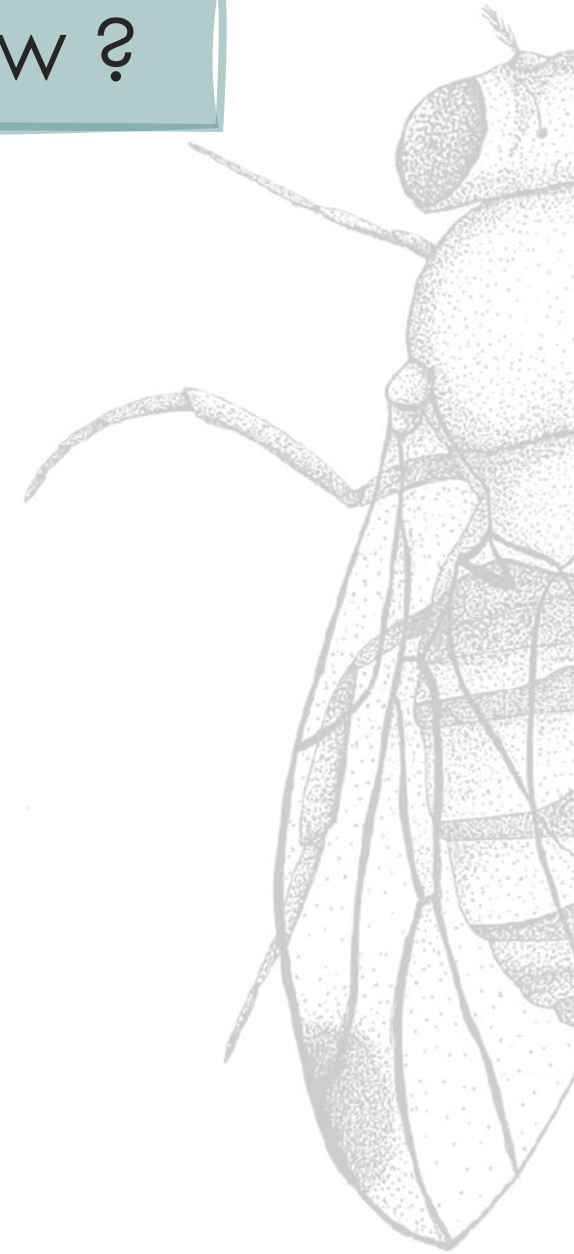
Why is the number of commercial products low ?



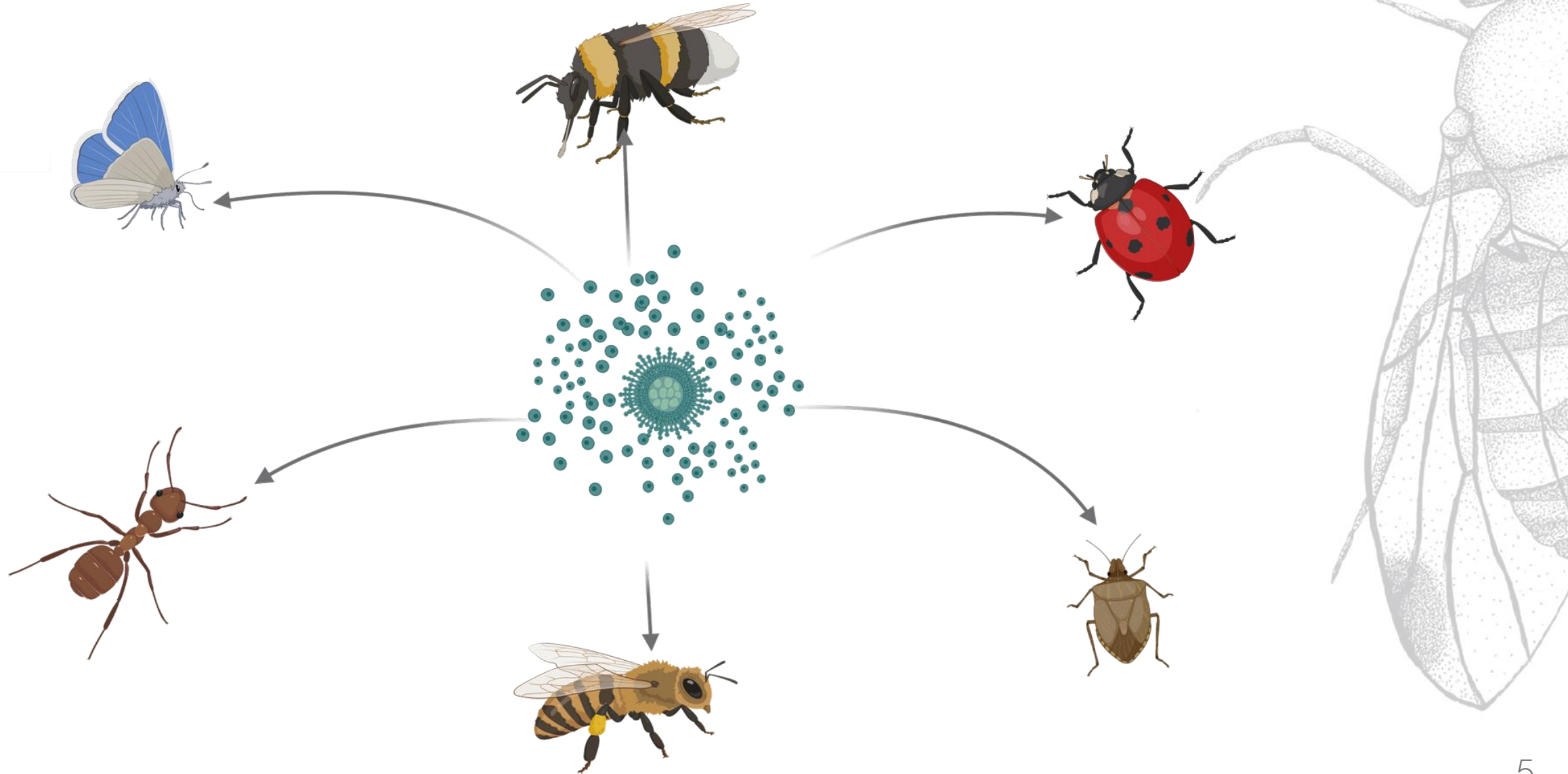
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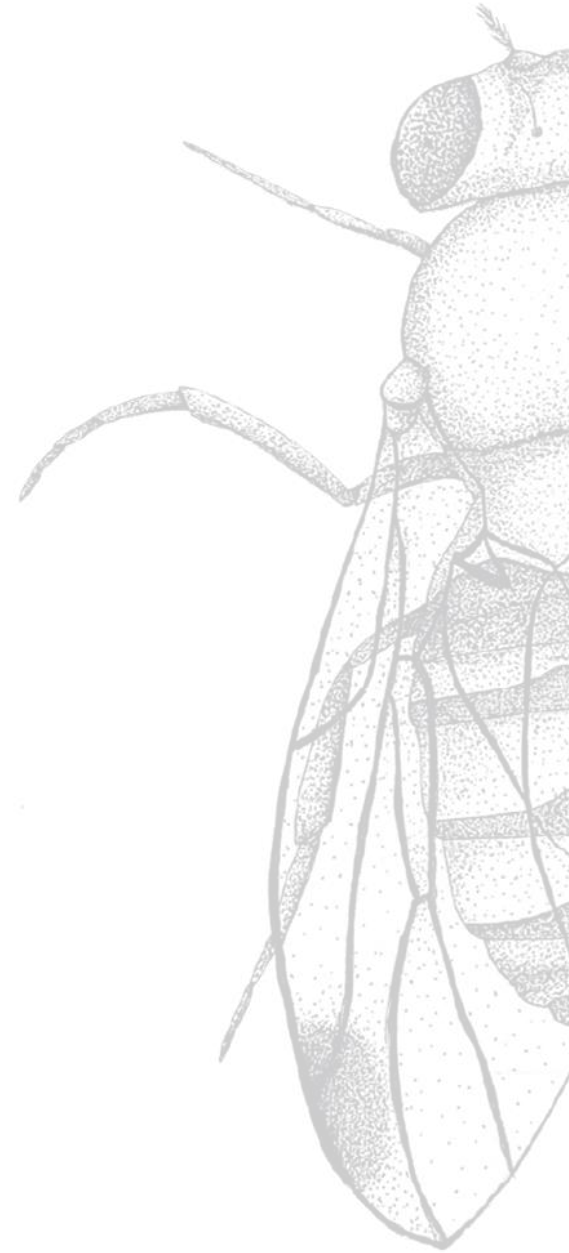
Why is the number of commercial products low ?



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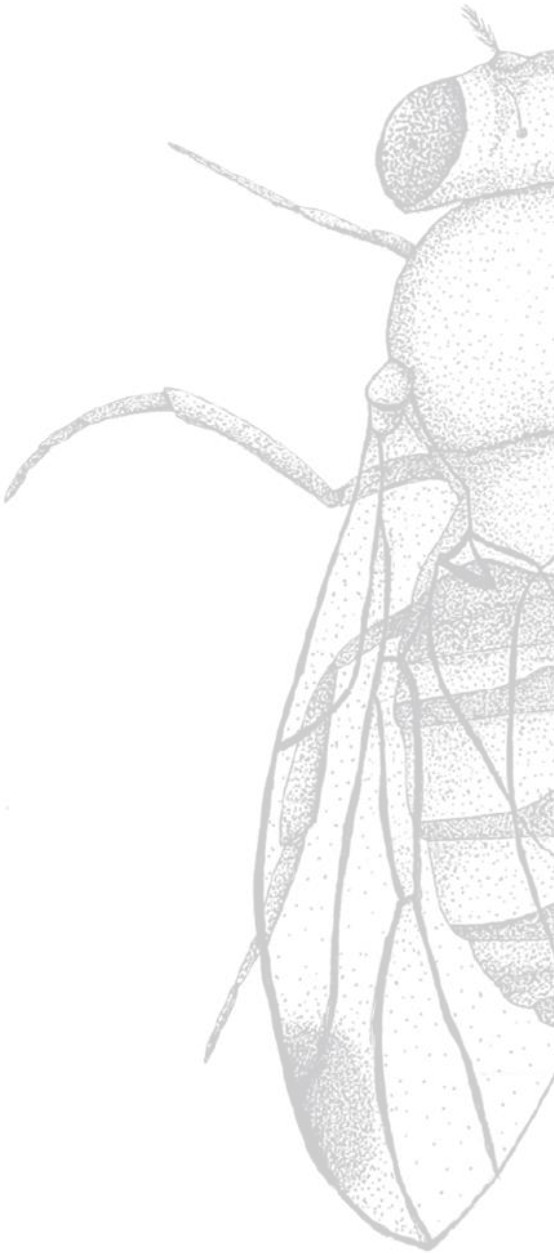
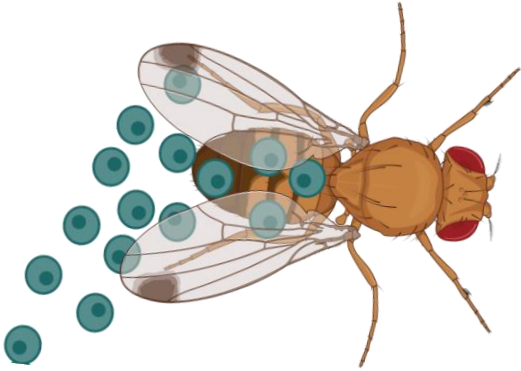
Aims



Aims

1

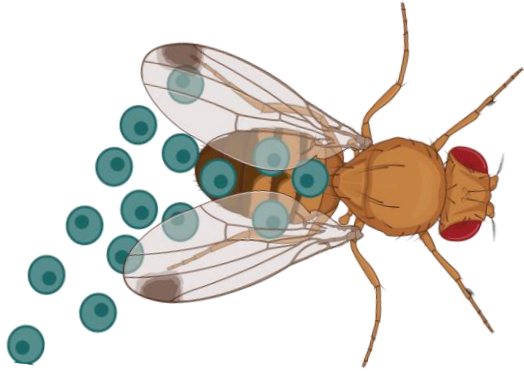
Select an effective EPF by integrating its ability of adhesion



Aims

1

Select an effective EPF by integrating its ability of adhesion

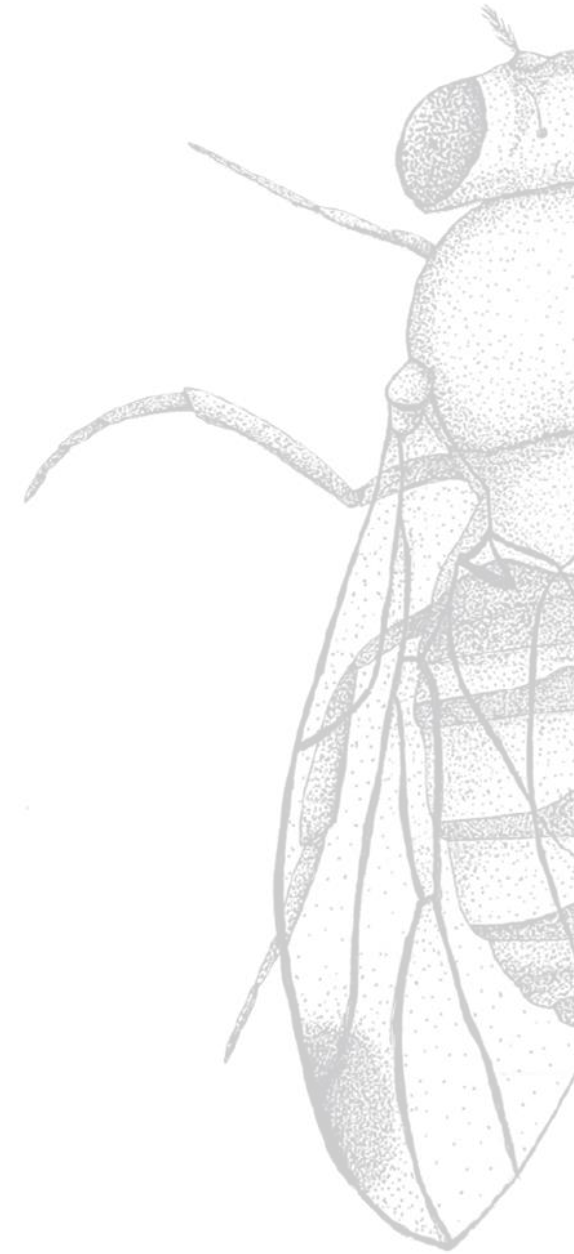


2

Test impact of EPF on non-target insects



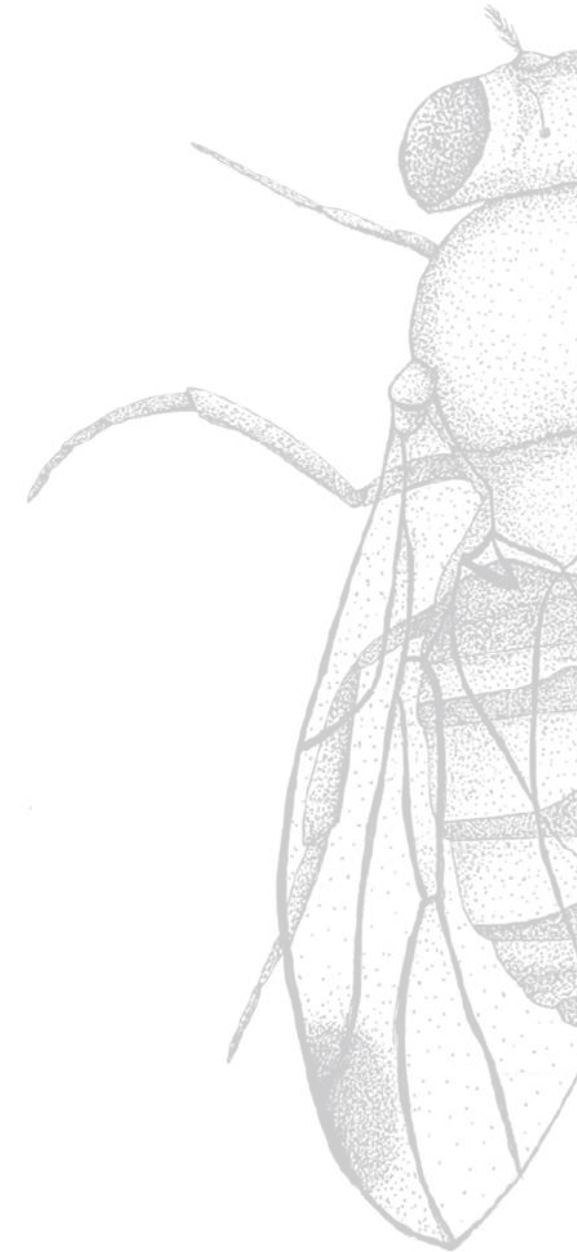
Select an effective EPF against *D. suzukii*



Select an effective EPF against *D. suzukii*

EPF tested

Specie	Strain
<i>Beauveria bassiana</i>	MUCL 1555
<i>Metarhizium anisopliae</i>	MUCL 6859
<i>Metarhizium brunneum</i>	MUCL 9645
<i>Lecaniccillium lecanii</i>	MUCL 8115
<i>Paecilomyces fumosoroseus</i>	MUCL 15122



Select an effective EPF against *D. suzukii*

EPF tested

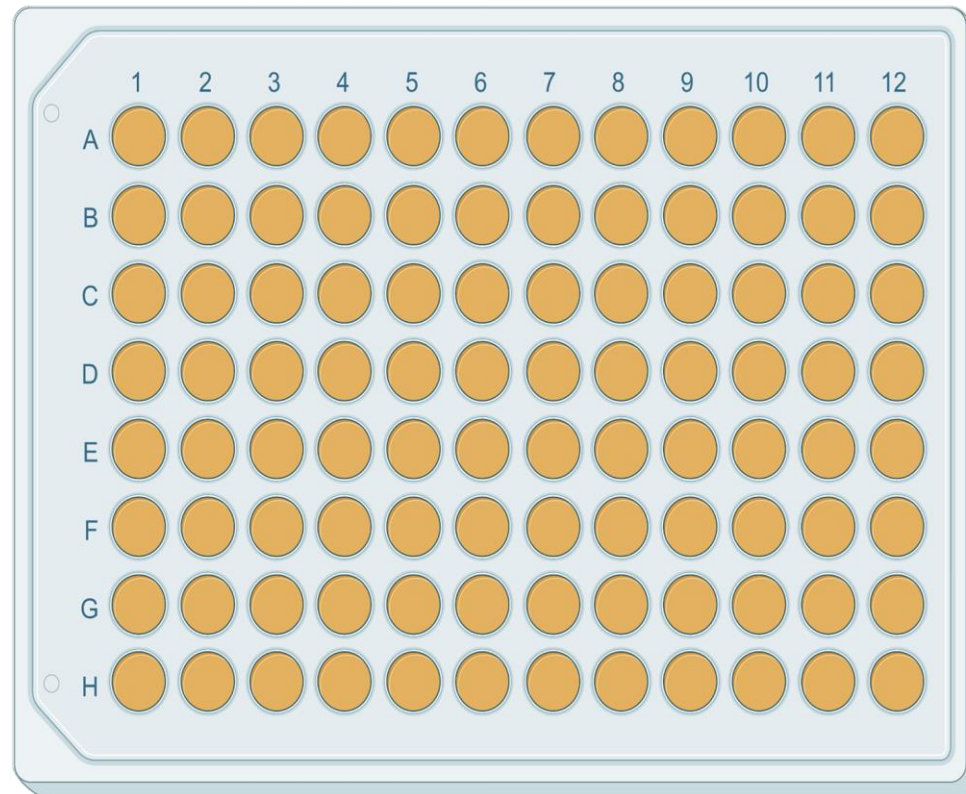
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Insecticide

Control



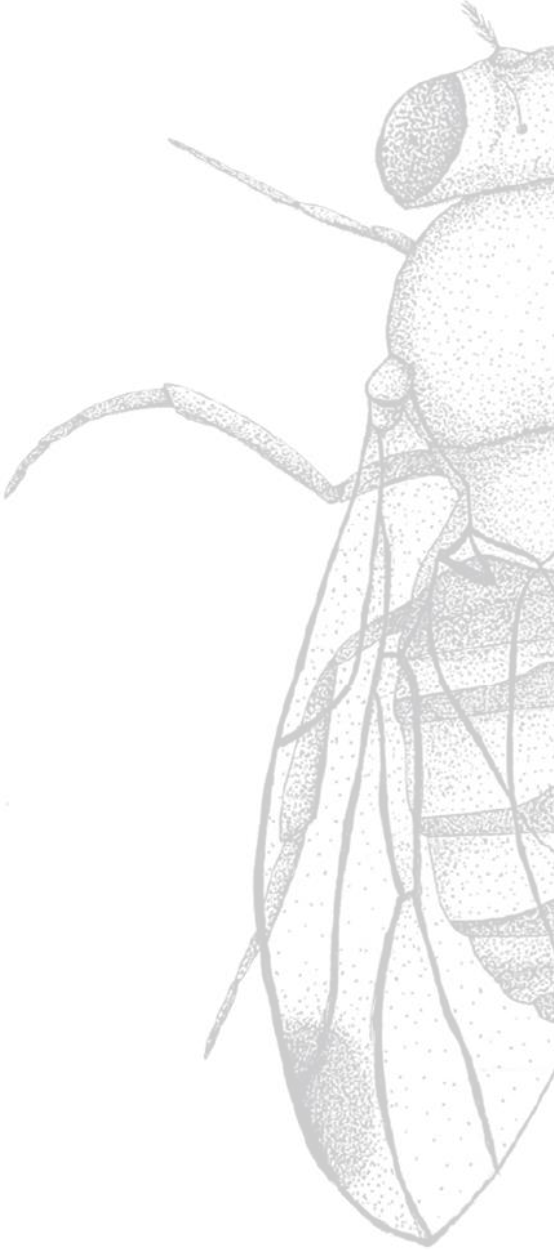
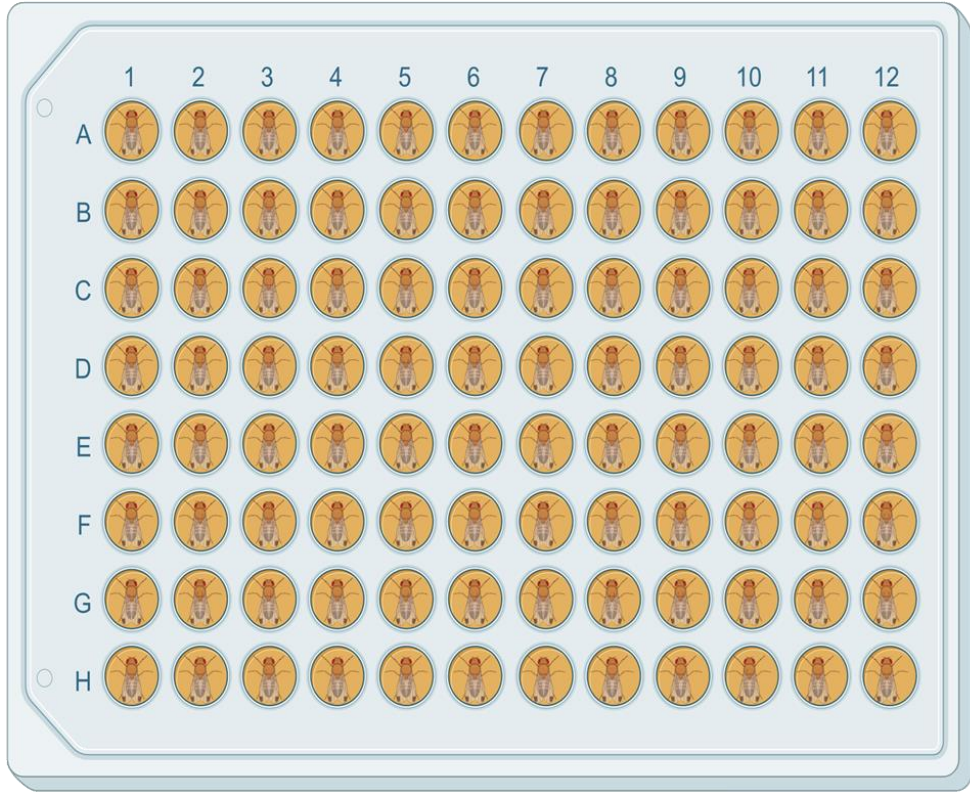
Select an effective EPF against *D. suzukii*



Select an effective EPF against *D. suzukii*



3 hours

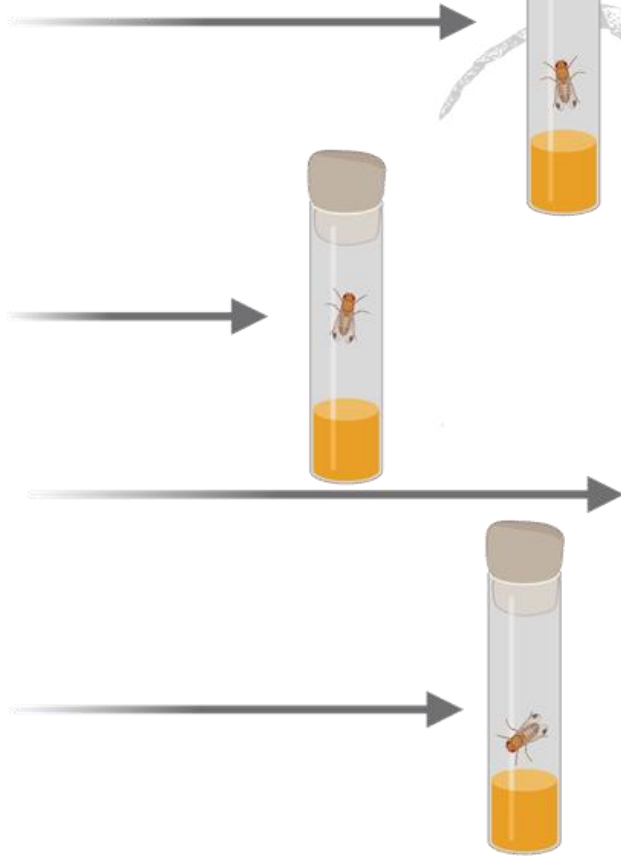
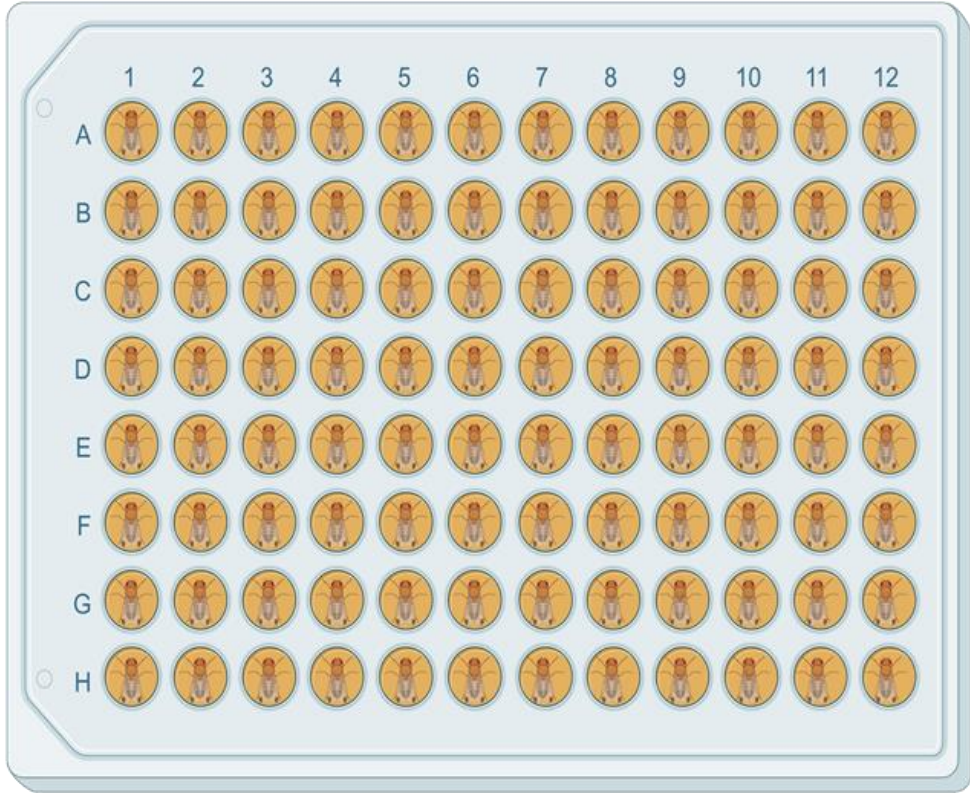


Select an effective EPF against *D. suzukii*



3 hours

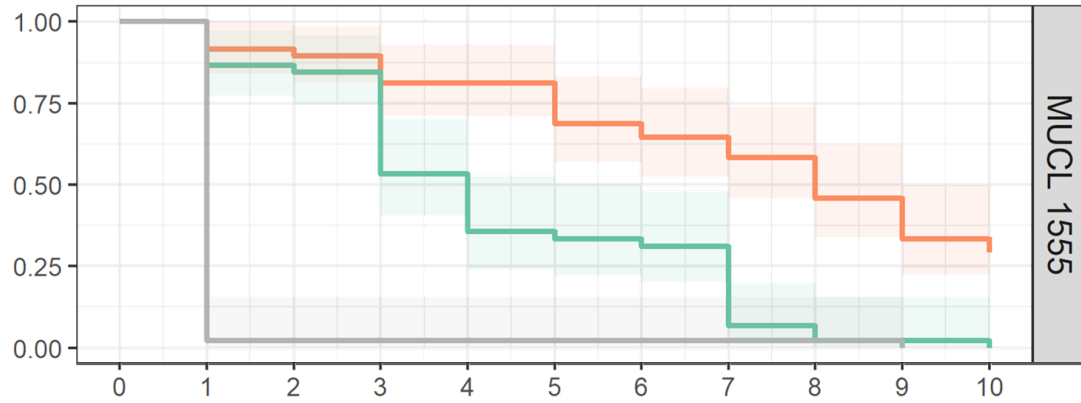
N = 48 / fungi



Evaluate mortality for 10 days

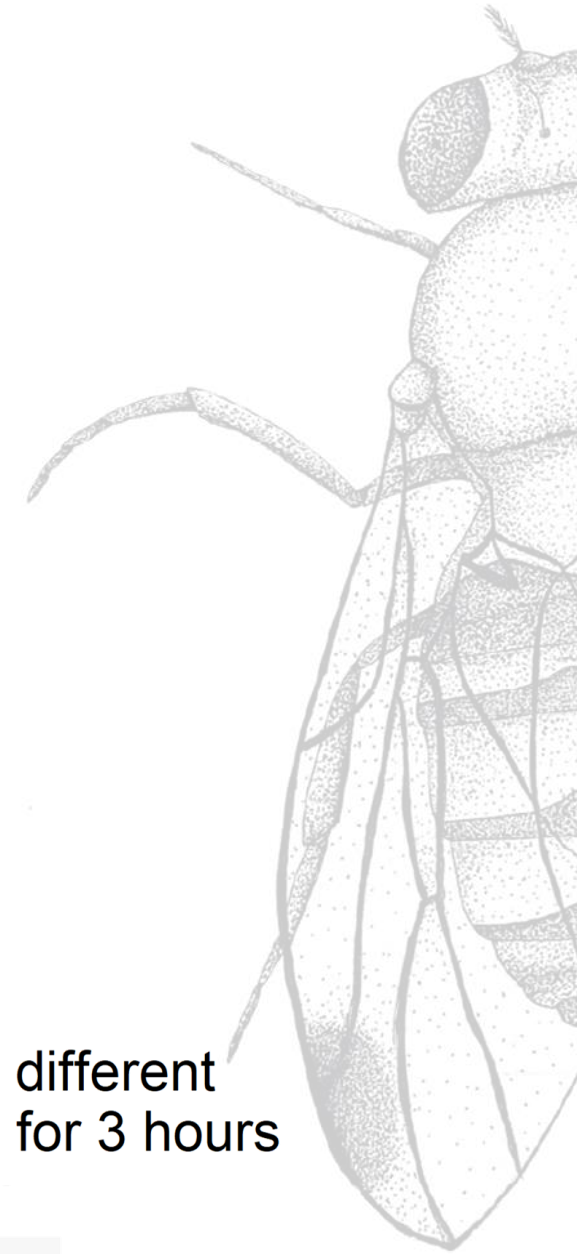
Select an effective EPF against *D. suzukii*

Survival probability (95% CI)



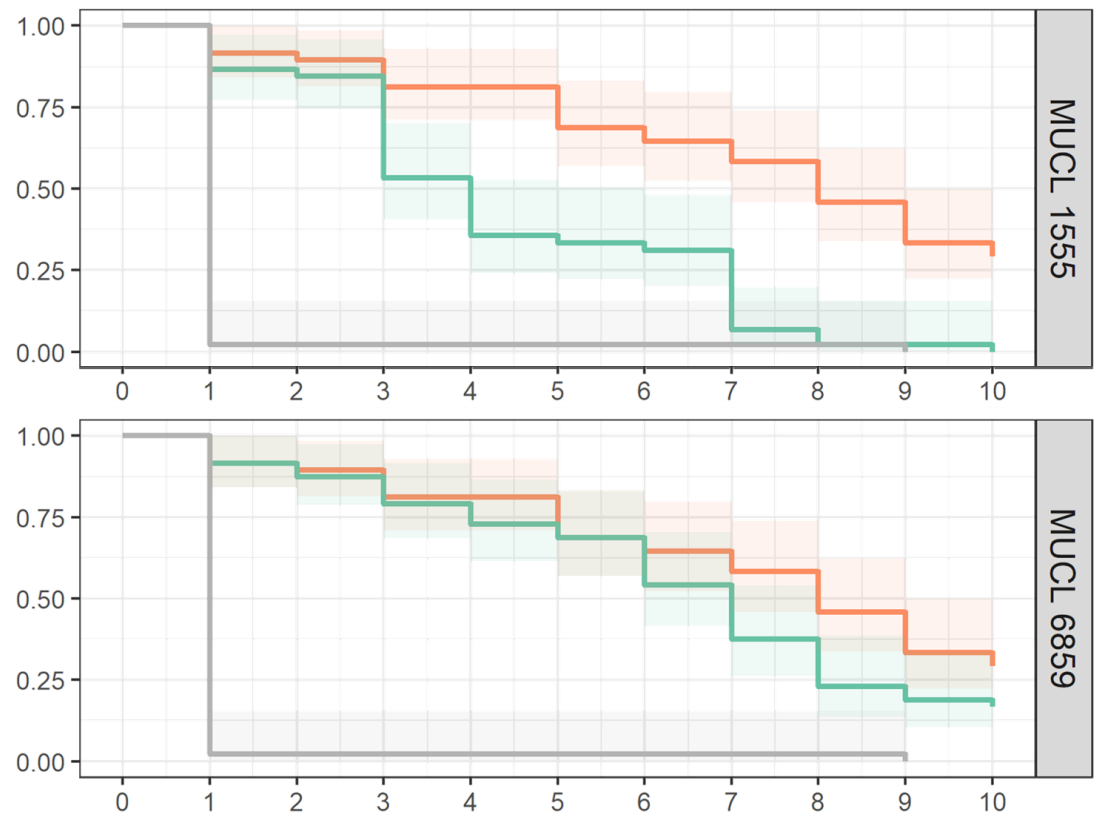
Days after exposure to different entomopathogenic fungi for 3 hours

— Control — Fungus — Insecticide

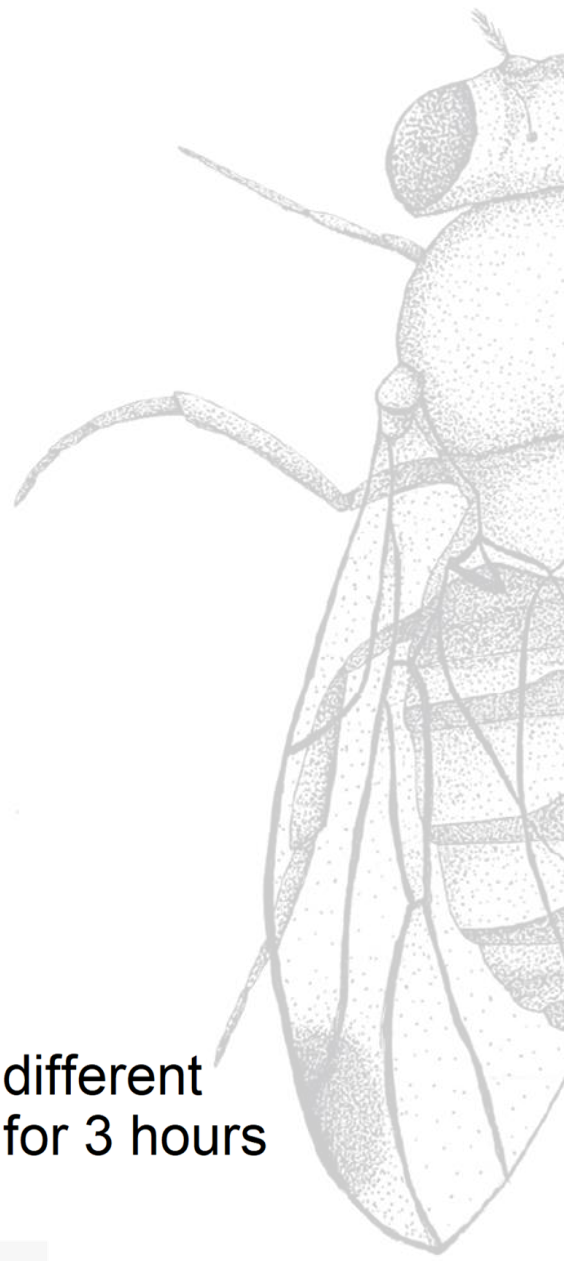
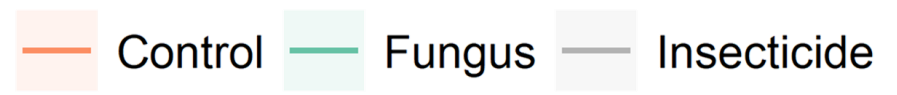


Select an effective EPF against *D. suzukii*

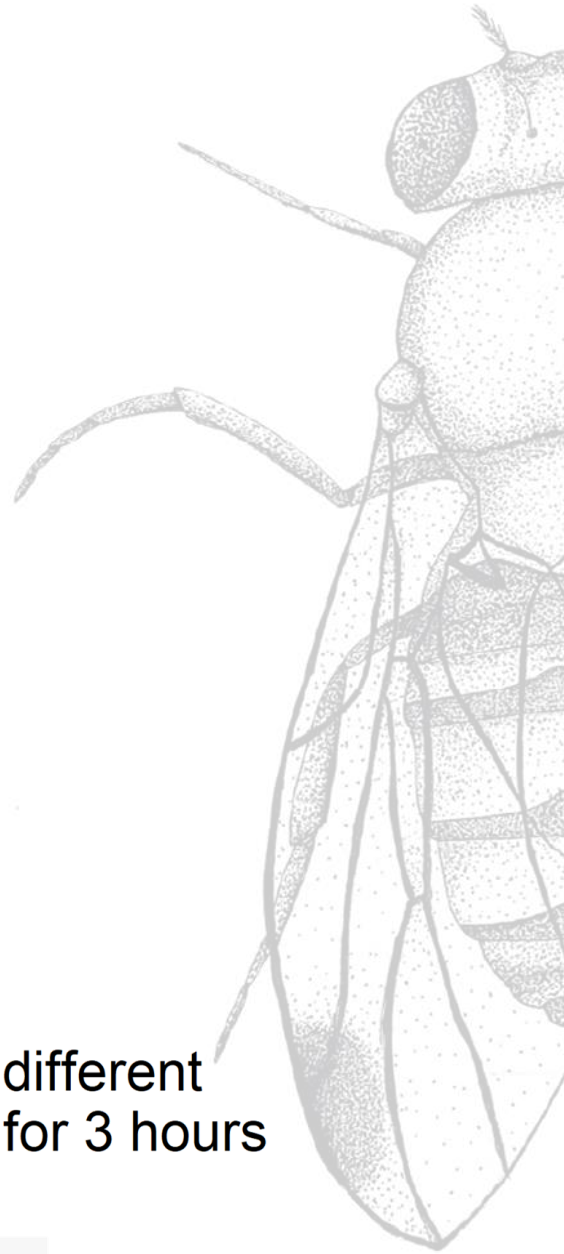
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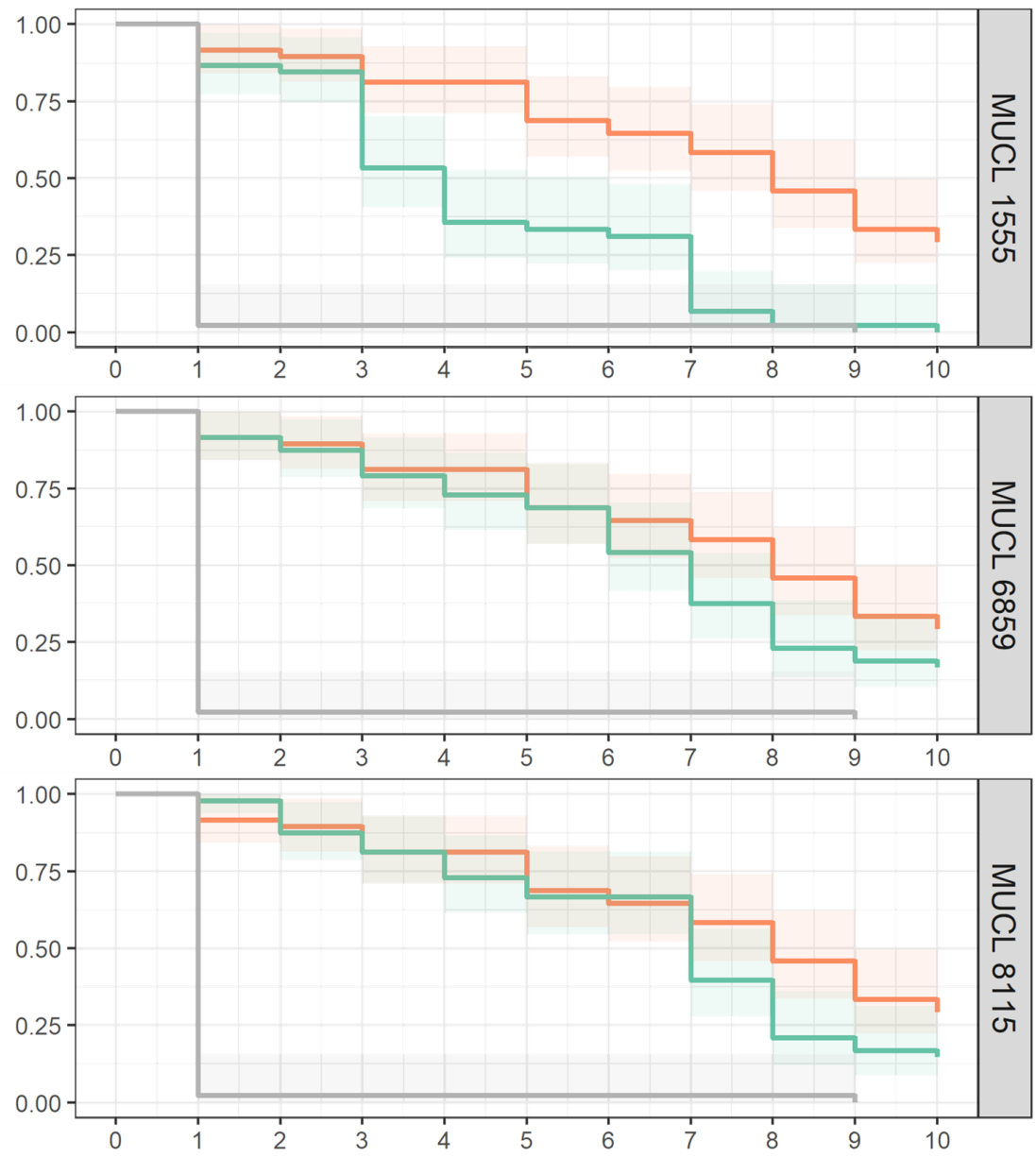
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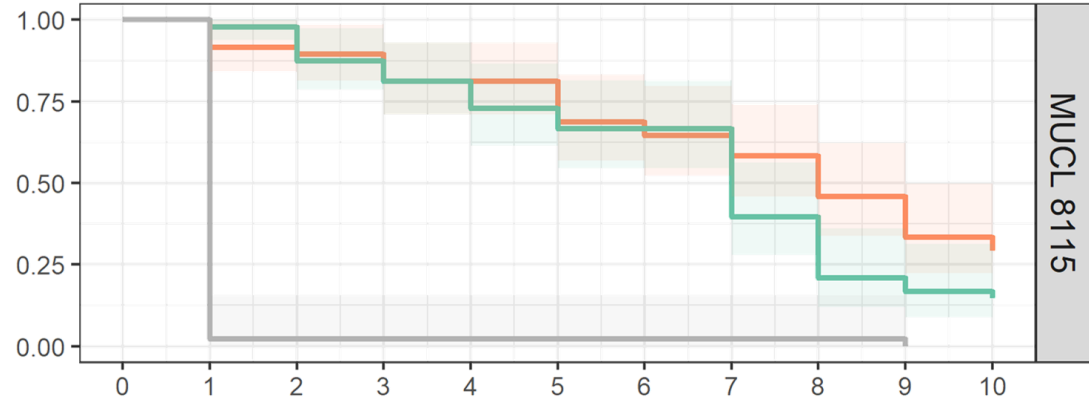
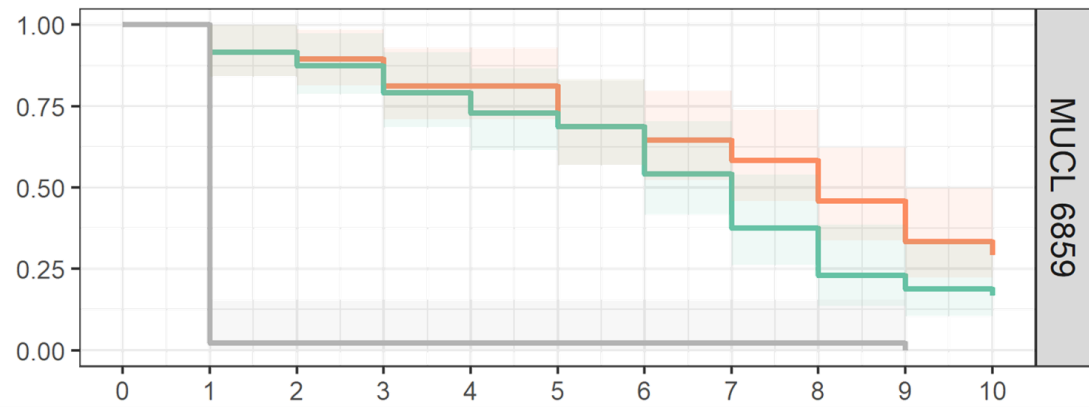
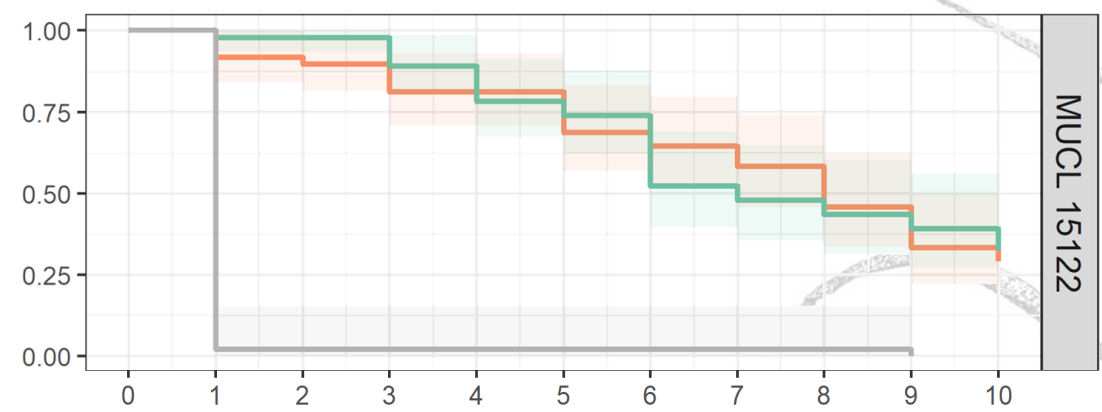
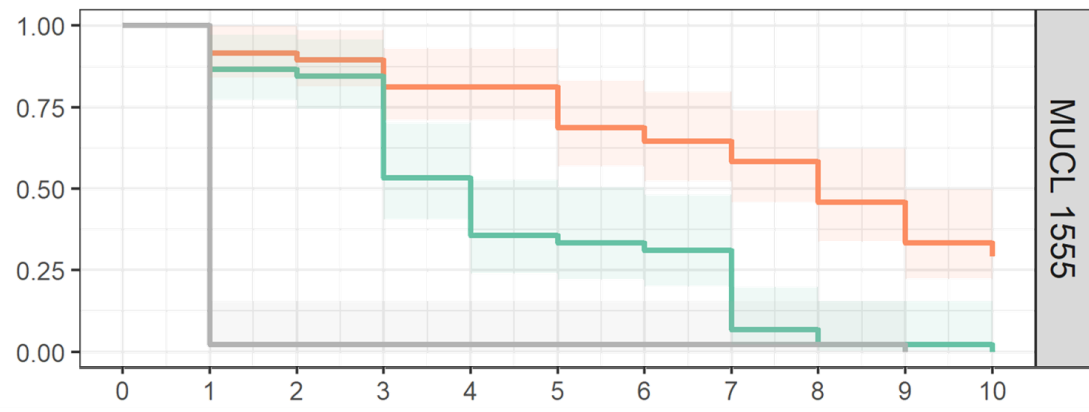


Days after exposure to different entomopathogenic fungi for 3 hours

Control Fungus Insecticide

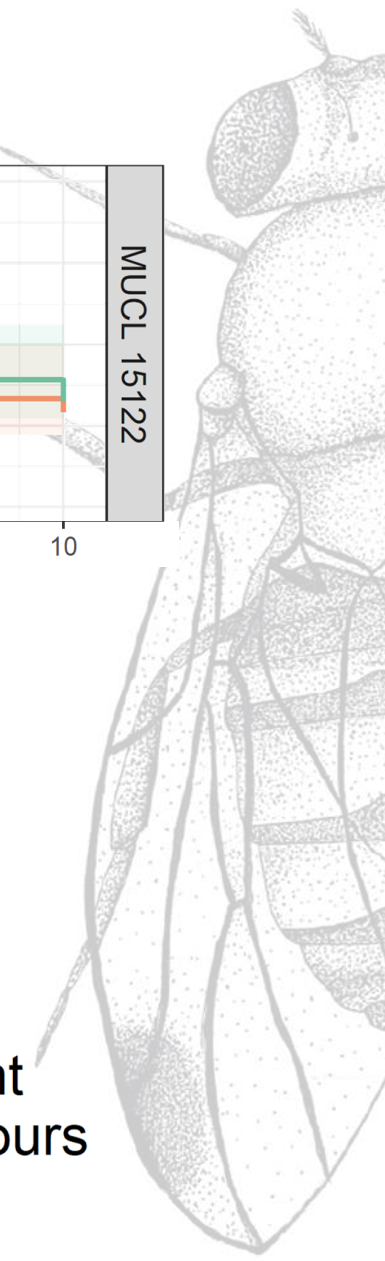
Select an effective EPF against *D. suzukii*

Survival probability (95% CI)



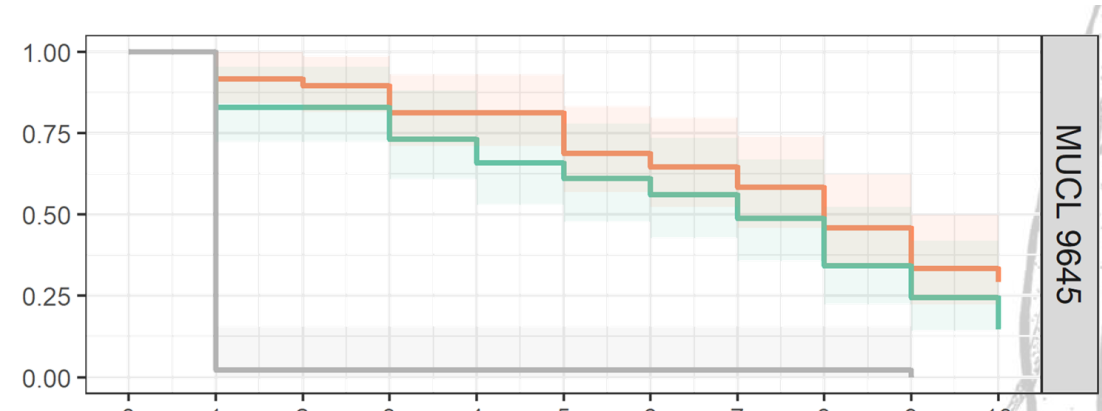
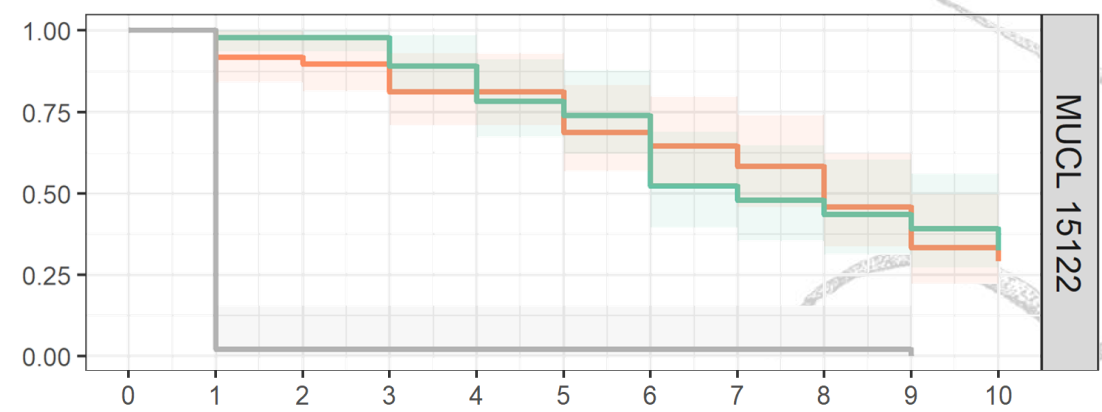
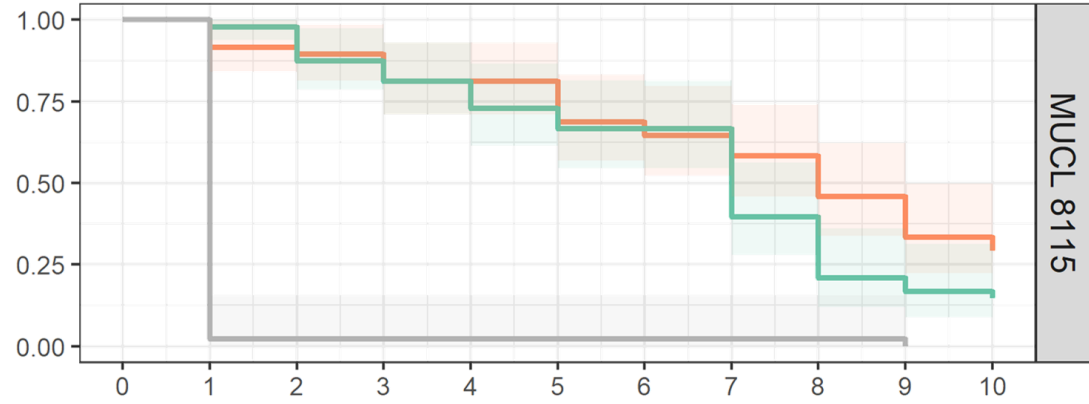
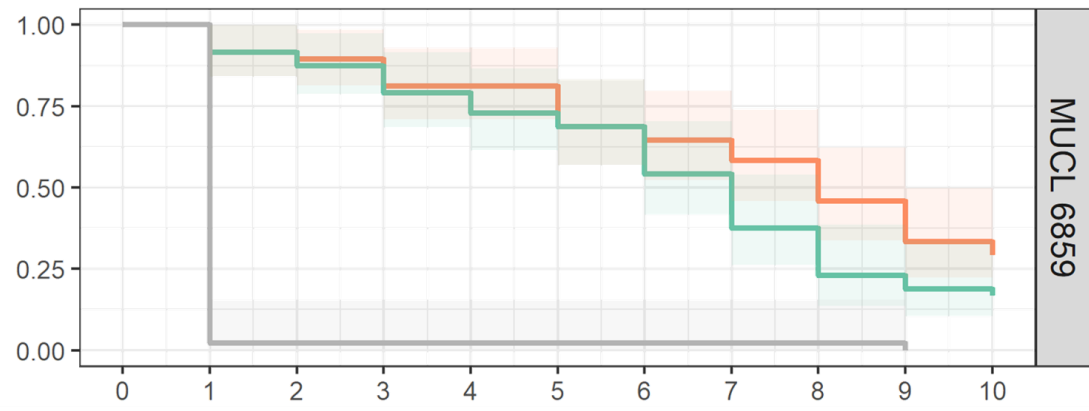
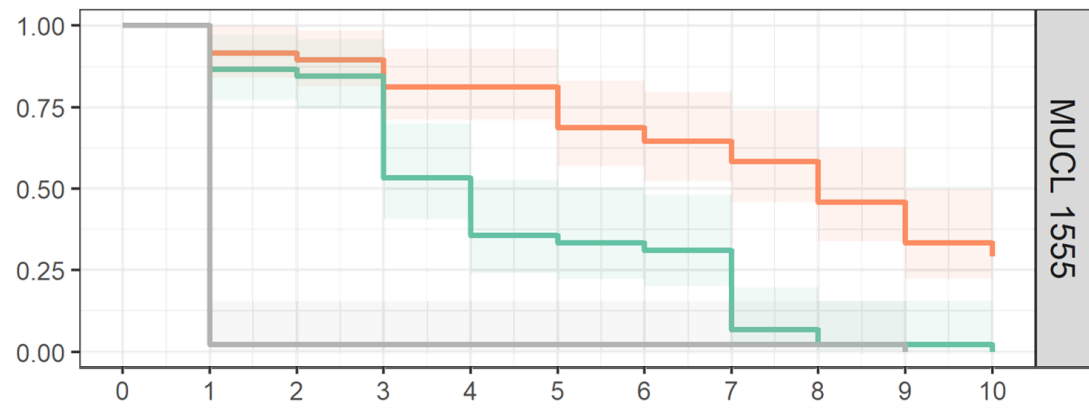
Days after exposure to different entomopathogenic fungi for 3 hours

Control Fungus Insecticide



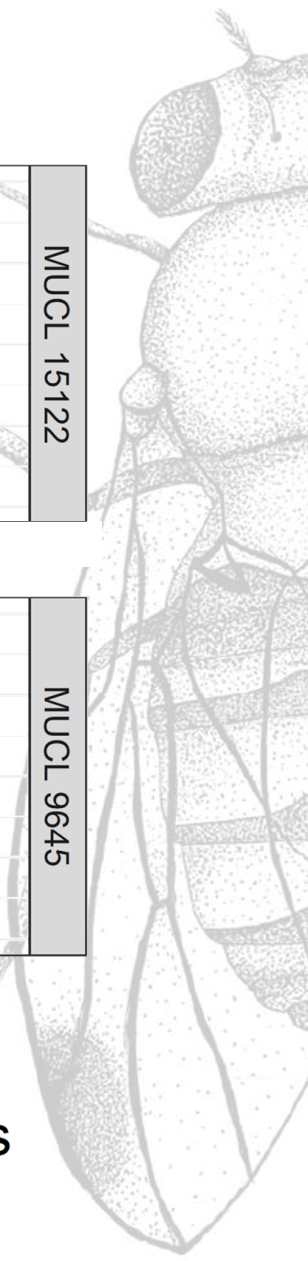
Select an effective EPF against *D. sukuzii*

Survival probability (95% CI)

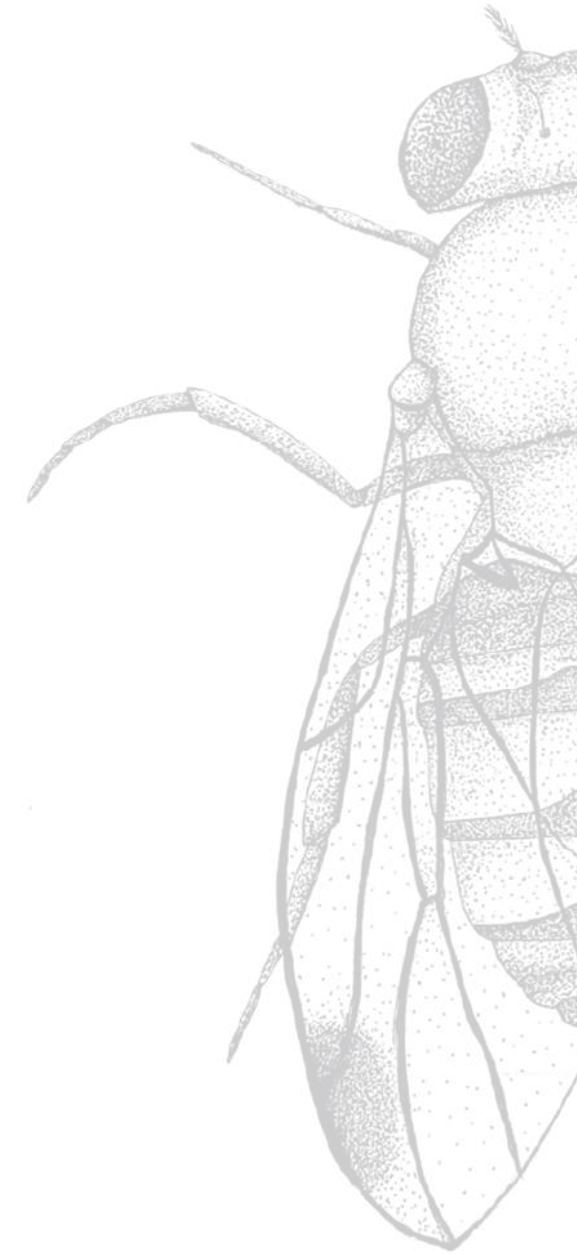


Days after exposure to different entomopathogenic fungi for 3 hours

Control Fungus Insecticide

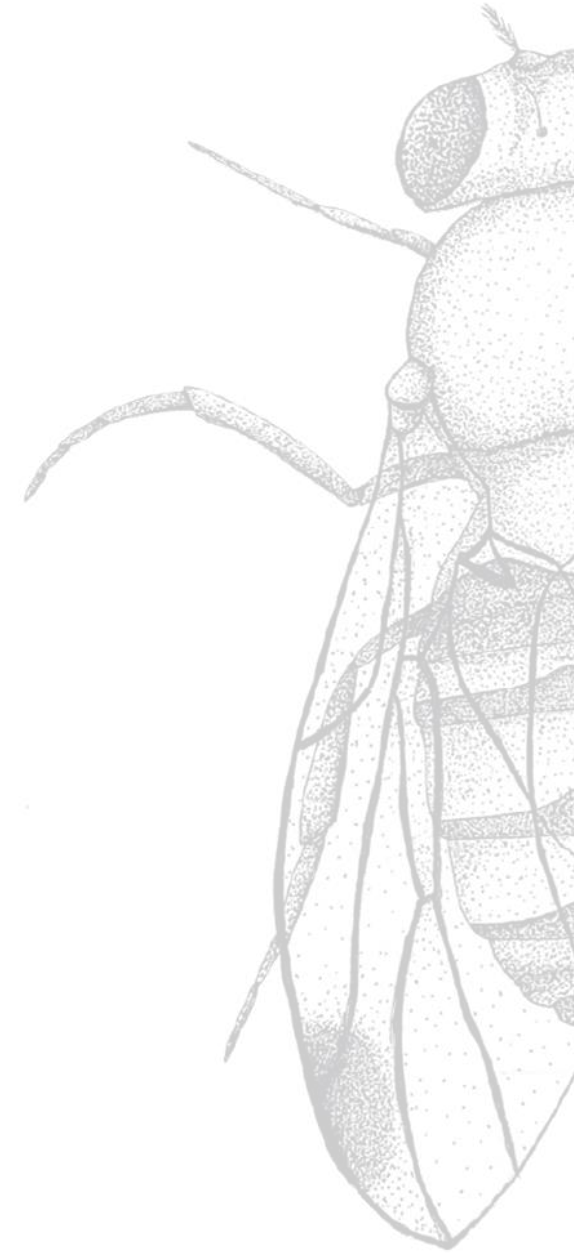


TAKE-HOME MESSAGE



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- 1 | MUCL 1555 is lethal for *D. suzukii* when it is in contact for 3 hours with insect



TAKE-HOME MESSAGE

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Is lethality similar with a shorter contact time?

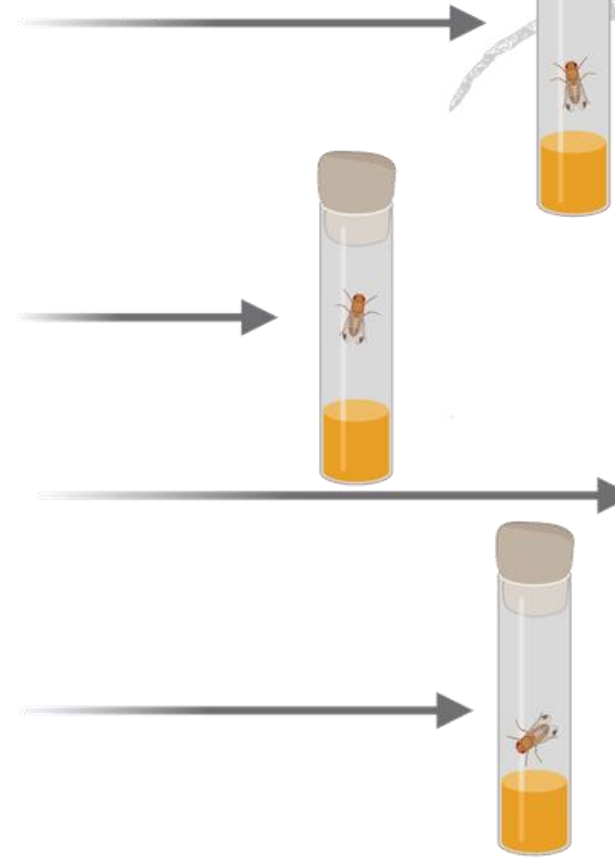
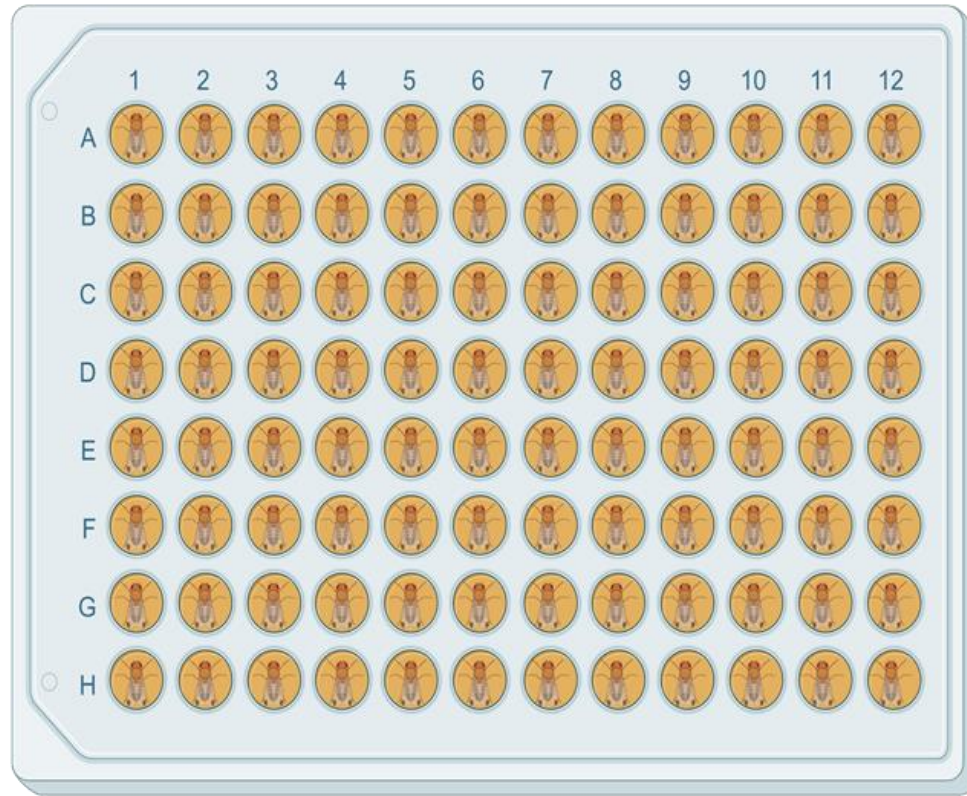


Is lethality similar with a shorter contact time?



10 sec, 1min, 10min, 1h

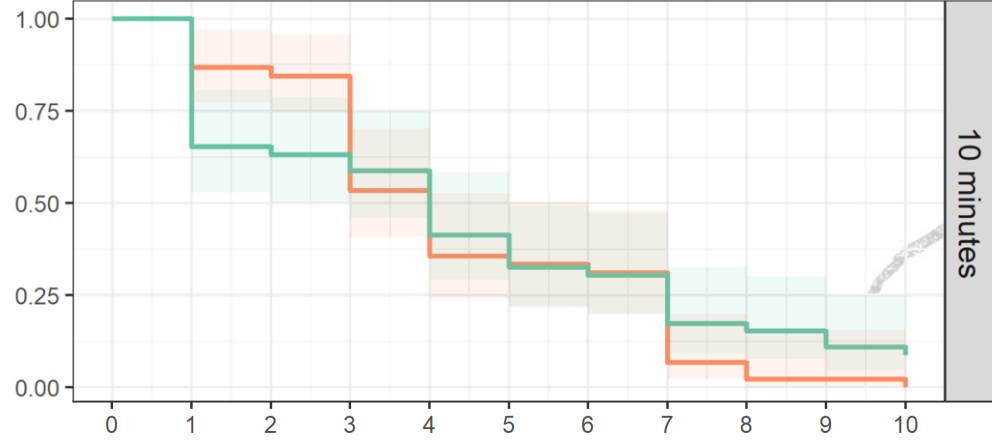
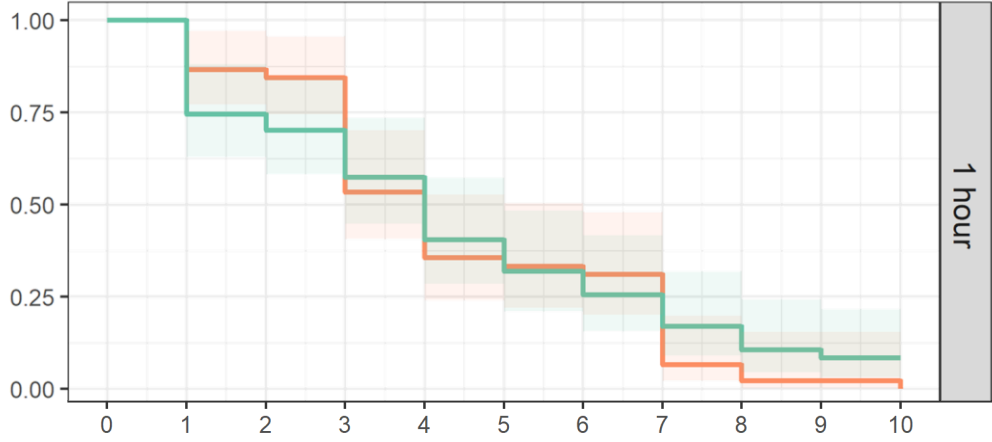
N = 48 / time



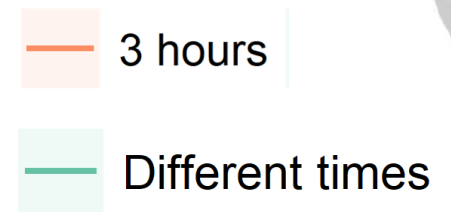
Evaluate mortality for 10 days

Is lethality similar with a shorter contact time?

Survival probability (95% CI)

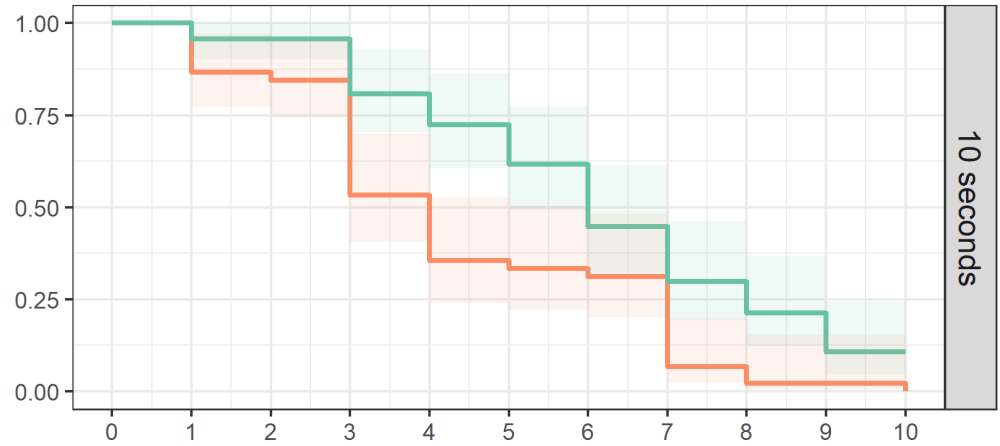
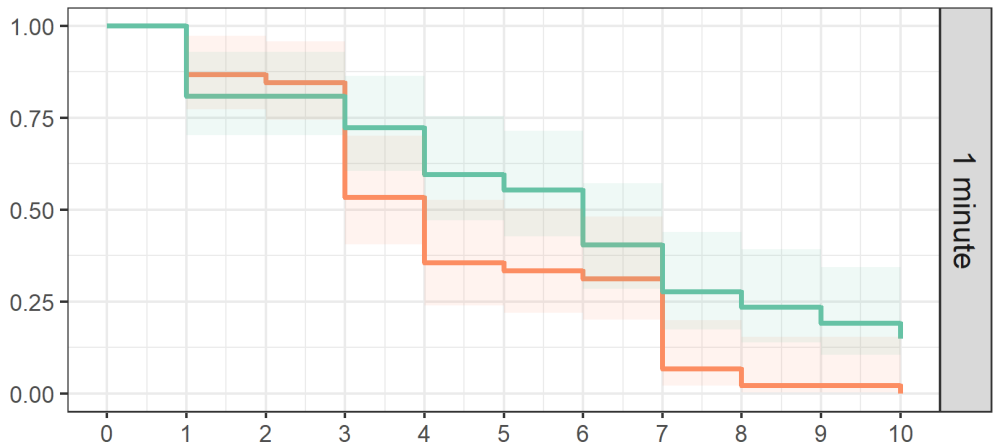
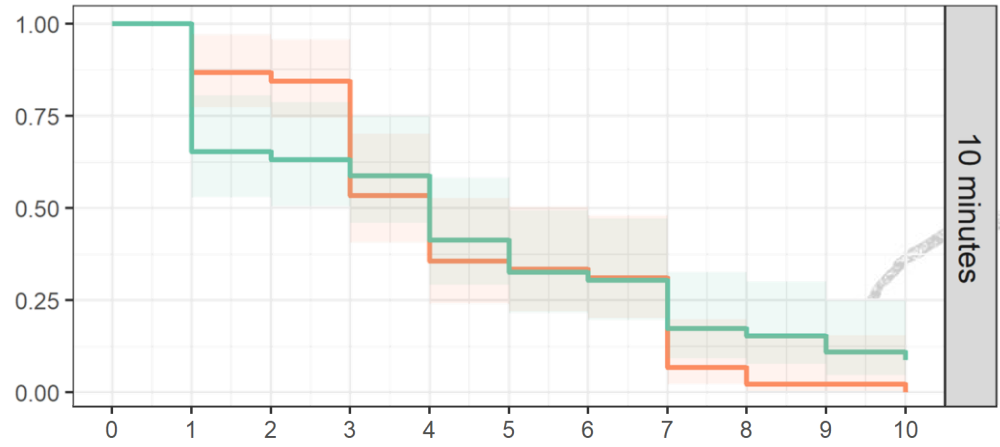
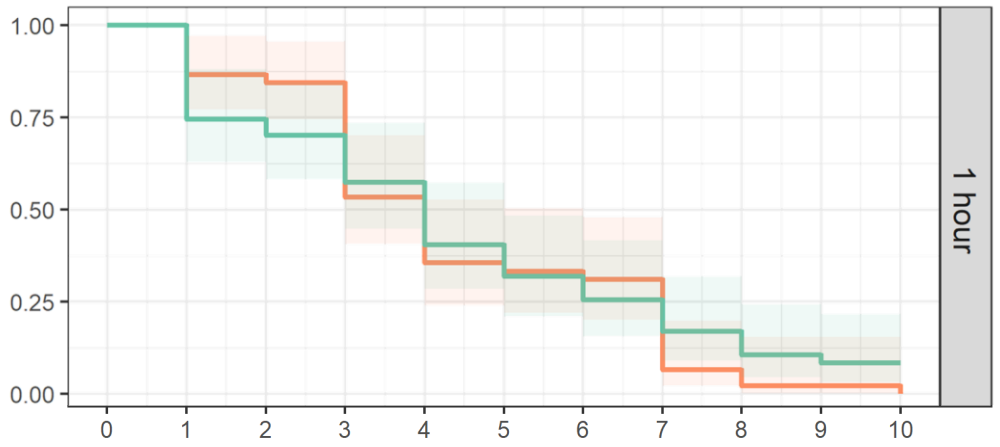


Days after exposure to *B. bassiana* (MUCL 1555) for different times



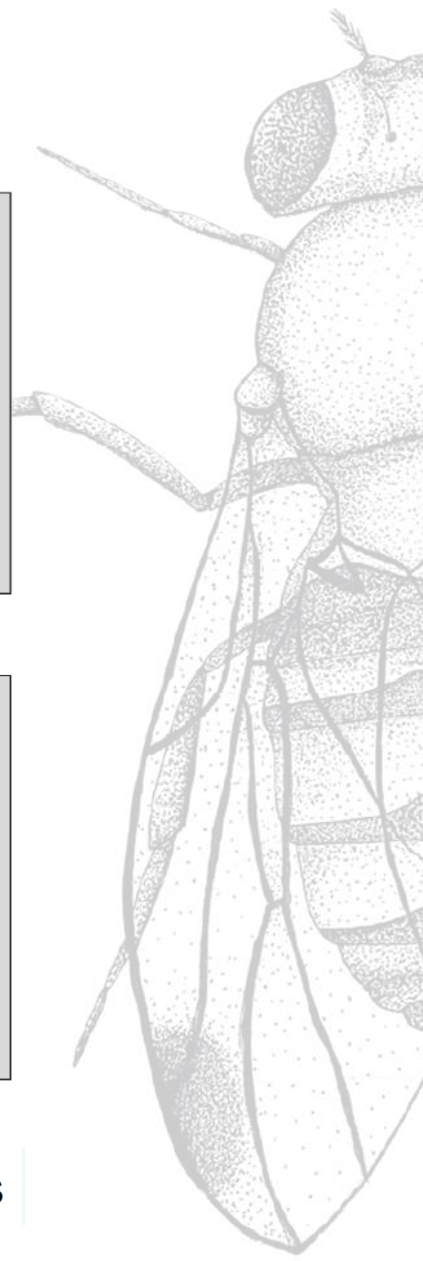
Is lethality similar with a shorter contact time?

Survival probability (95% CI)



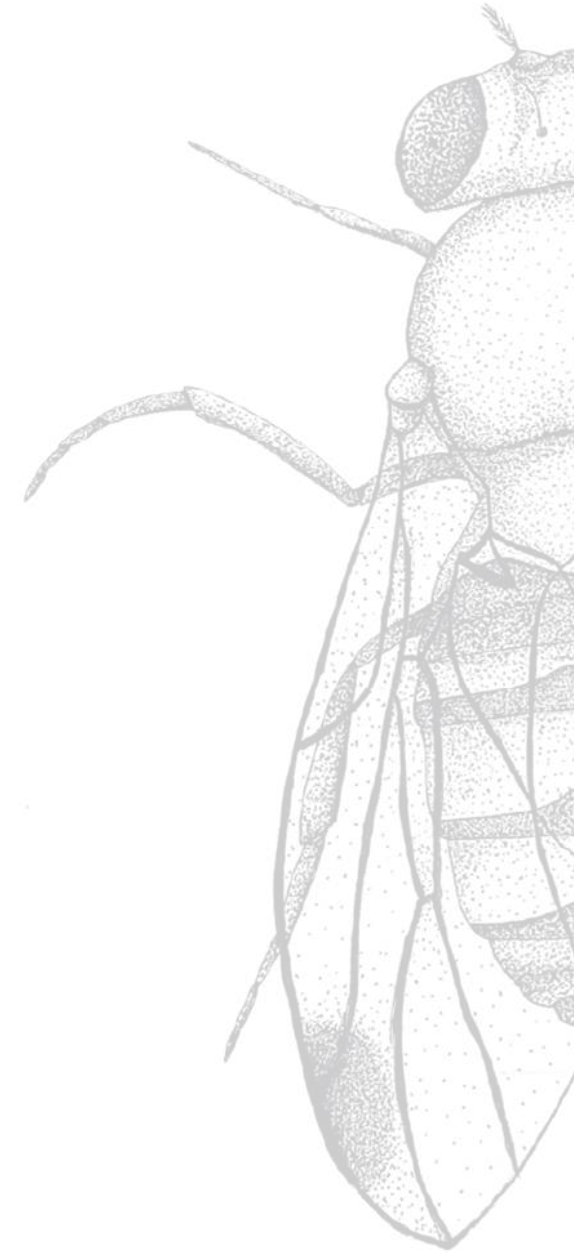
Days after exposure to *B. bassiana* (MUCL 1555) for different times

- 3 hours
- Different times



TAKE-HOME MESSAGE

- 1 | MUCL 1555 is lethal for *D. suzukii* when it is in contact for 3 hours with insect



TAKE-HOME MESSAGE

1 | MUCL 1555 is lethal for *D. sukuzii* when it is in contact for 3 hours with insect

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



TAKE-HOME MESSAGE

1 | MUCL 1555 is lethal for *D. suzukii* when it is in contact for 3 hours with insect

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Side effect on non-target insects ?



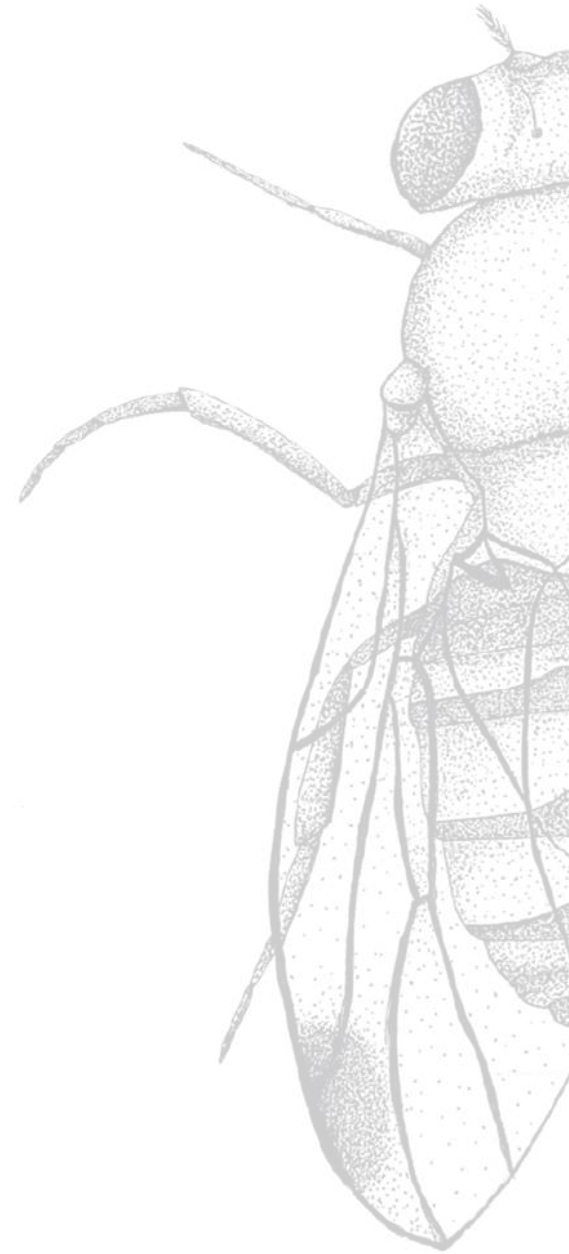
Side effect on non-target insects ?



Orius laevigatus



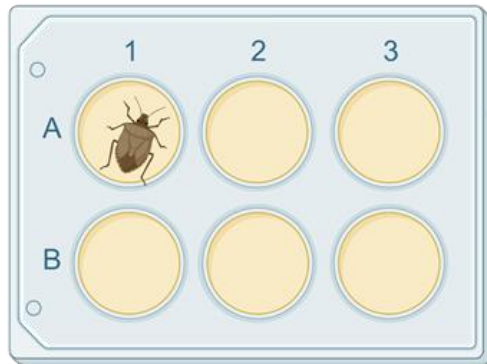
Bombus terrestris



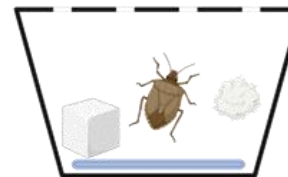
Side effect on non-target insects ?



Orius laevigatus



3 hours



Evaluate mortality for 10 days

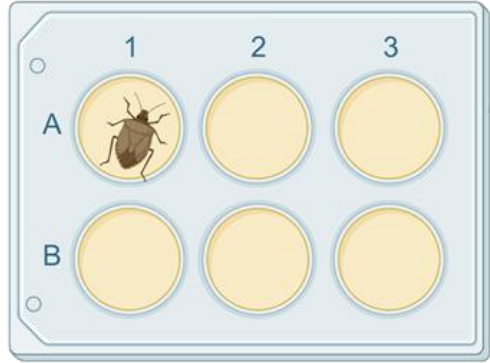
N = 44



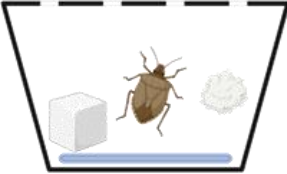
Bombus terrestris



Side effect on non-target insects ?

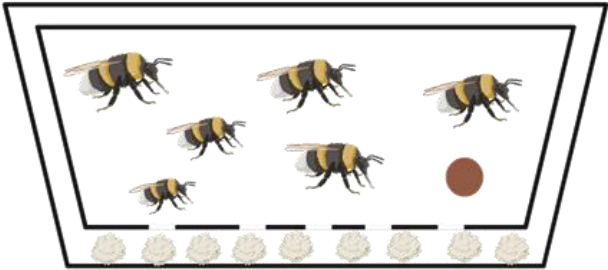
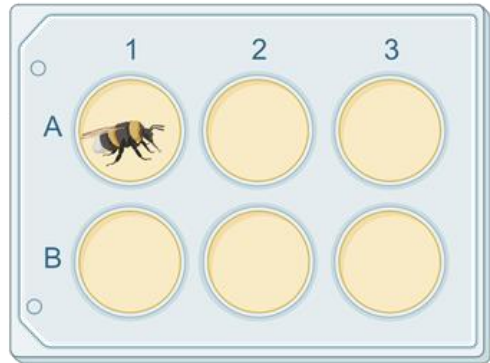


 3 hours



Evaluate mortality for 10 days

N = 44

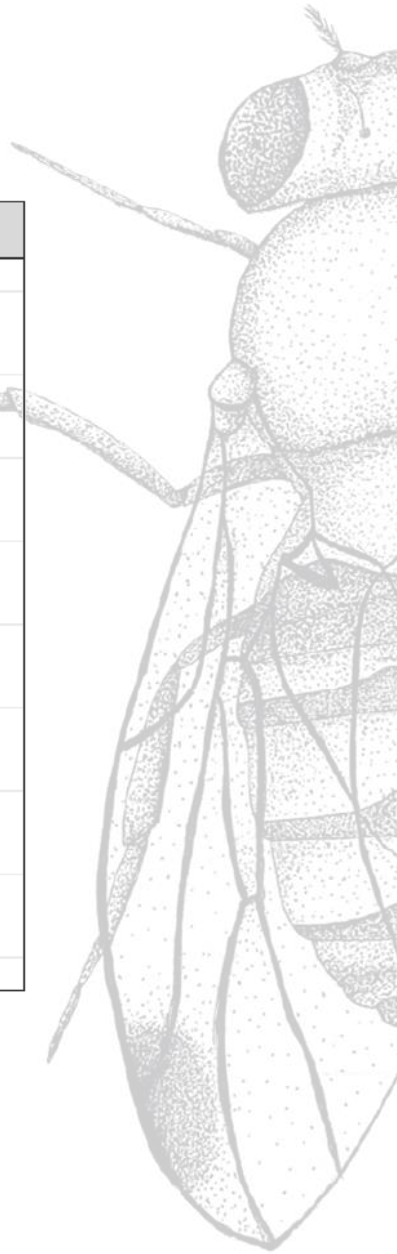


Evaluate mortality for 20 days

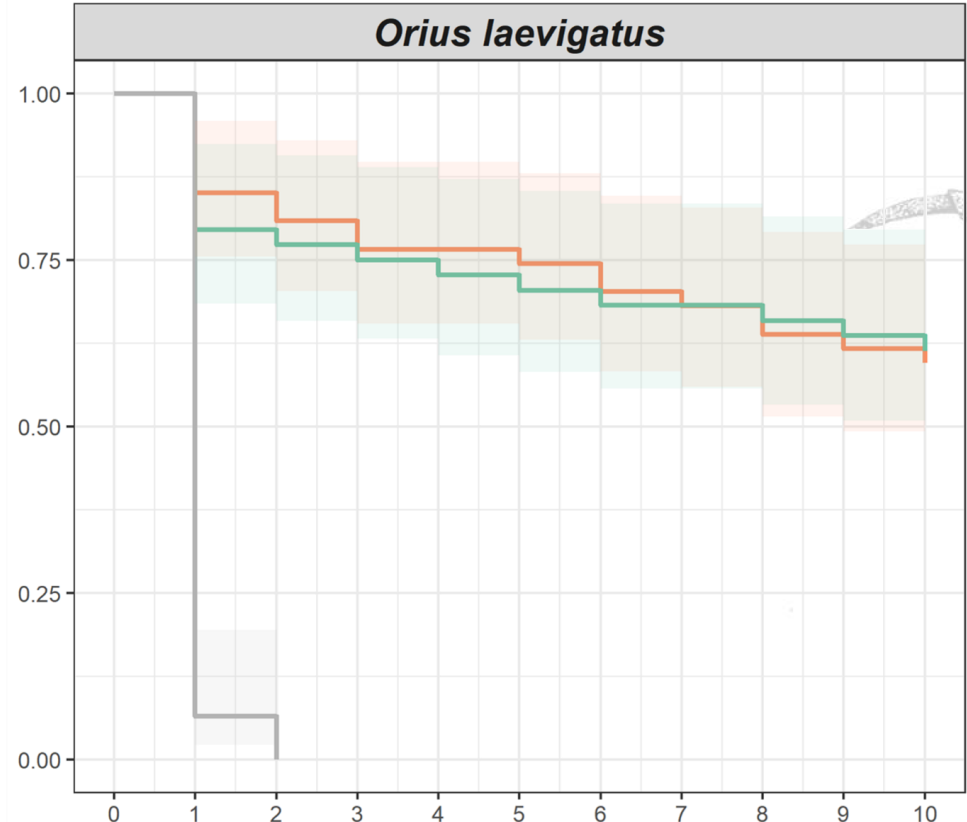
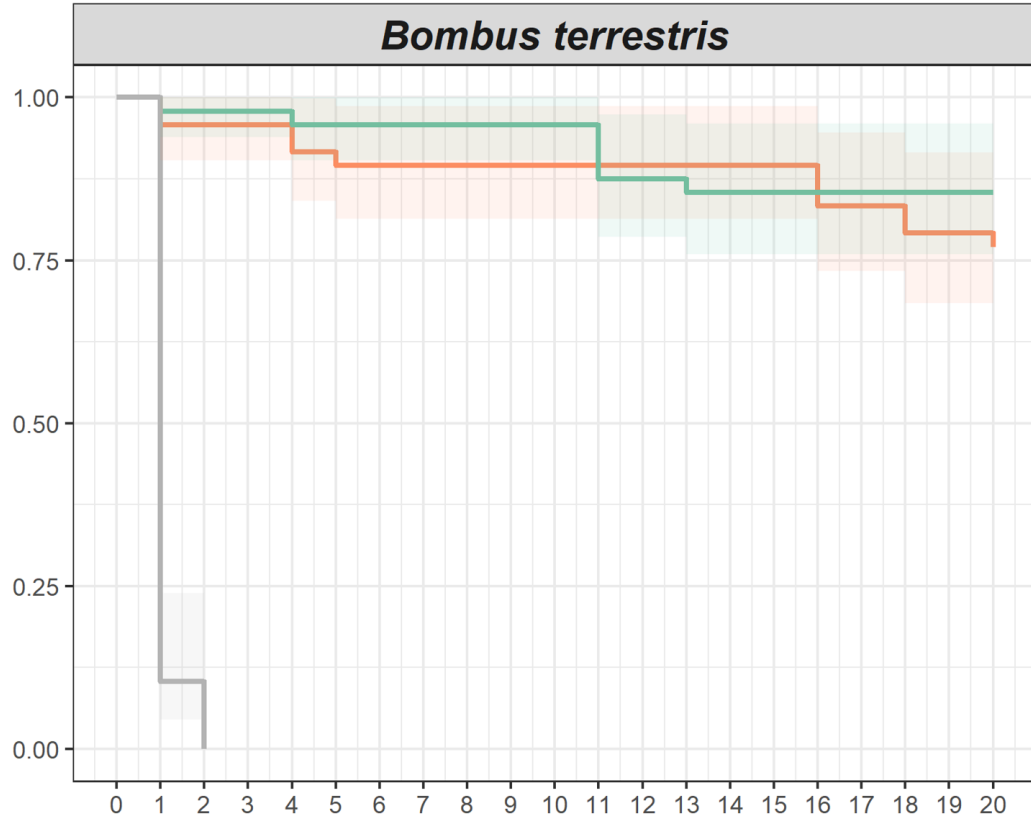
N = 48



Side effect on non-target insects ?



Survival probability (95% CI)



Days after exposure to *B. bassiana* for 3 hours

— Control — Fungus — Insecticide

TAKE-HOME MESSAGE

1 | MUCL 1555 is lethal for *D. suzukii* when it is in contact for 3 hours with insect

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



TAKE-HOME MESSAGE

1 | MUCL 1555 is lethal for *D. suzukii* when it is in contact for 3 hours with insect

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

3 | MUCL 1555 is specific

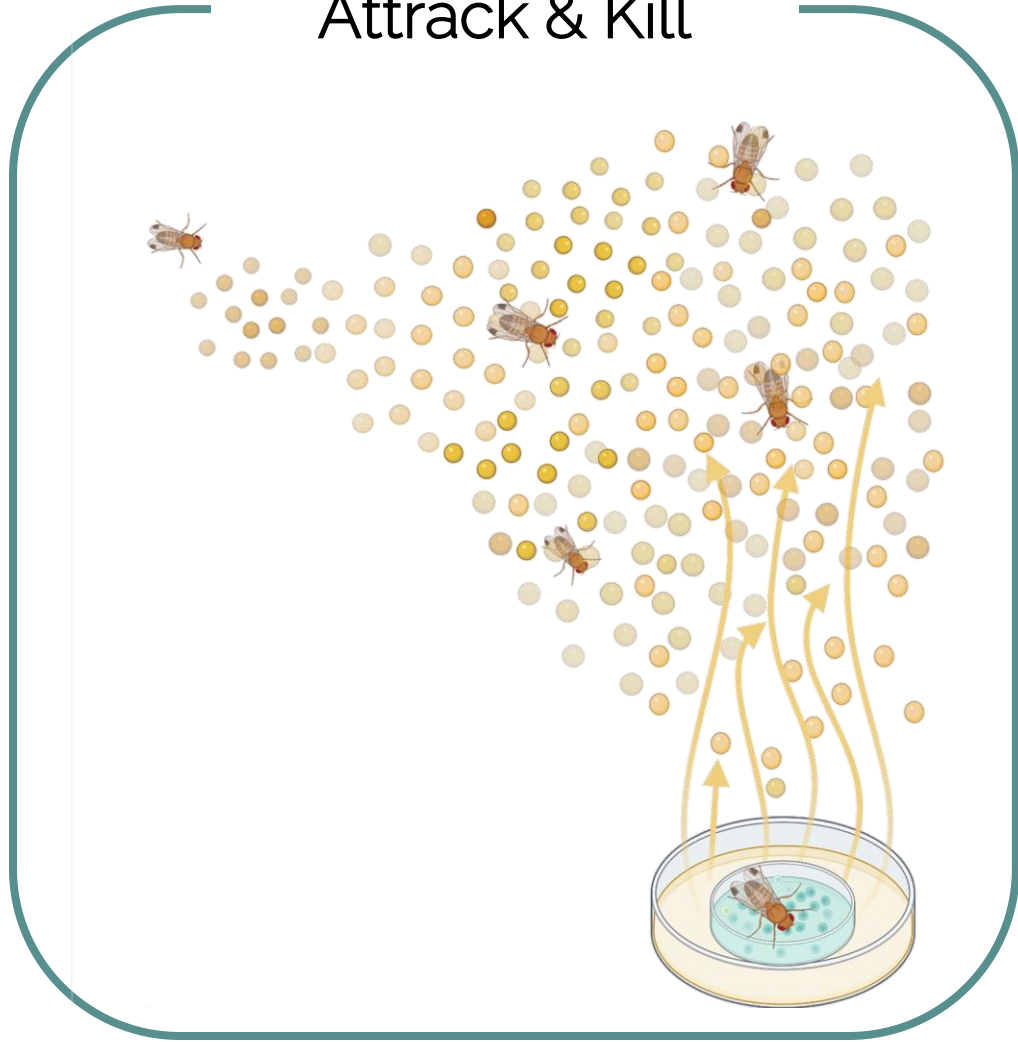


Perspectives



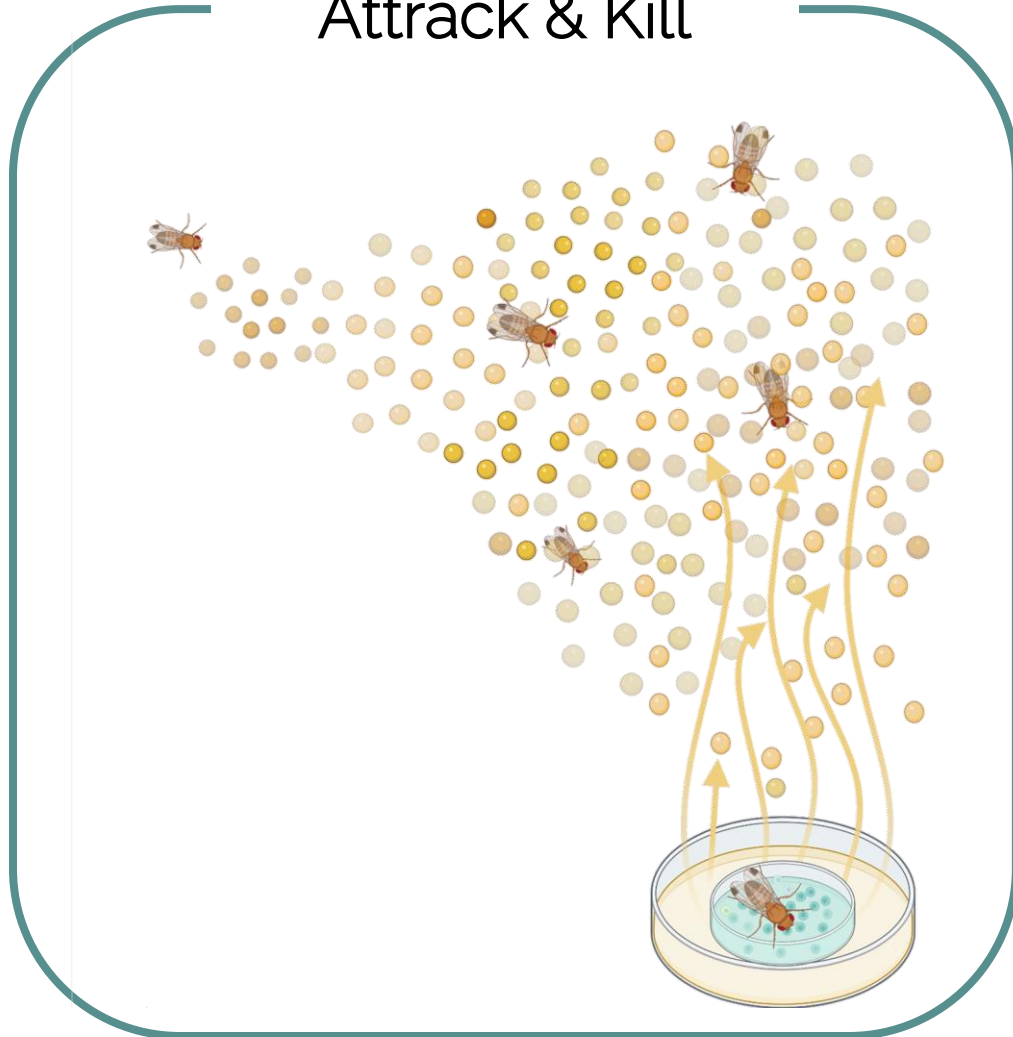
Perspectives

Attrack & Kill



Perspectives

Attract & Kill



Entomologia Generalis, Vol. 40 (2020), Issue 3, 263–272
Published online 29 September 2020

Laboratory and field evaluation of a combination of attractants and repellents to control *Drosophila suzukii*

Chloé D. Galland, Valérie Glesner, and François Verheggen*

Advances in the Chemical Ecology of the Spotted Wing Drosophila (*Drosophila suzukii*) and its Applications

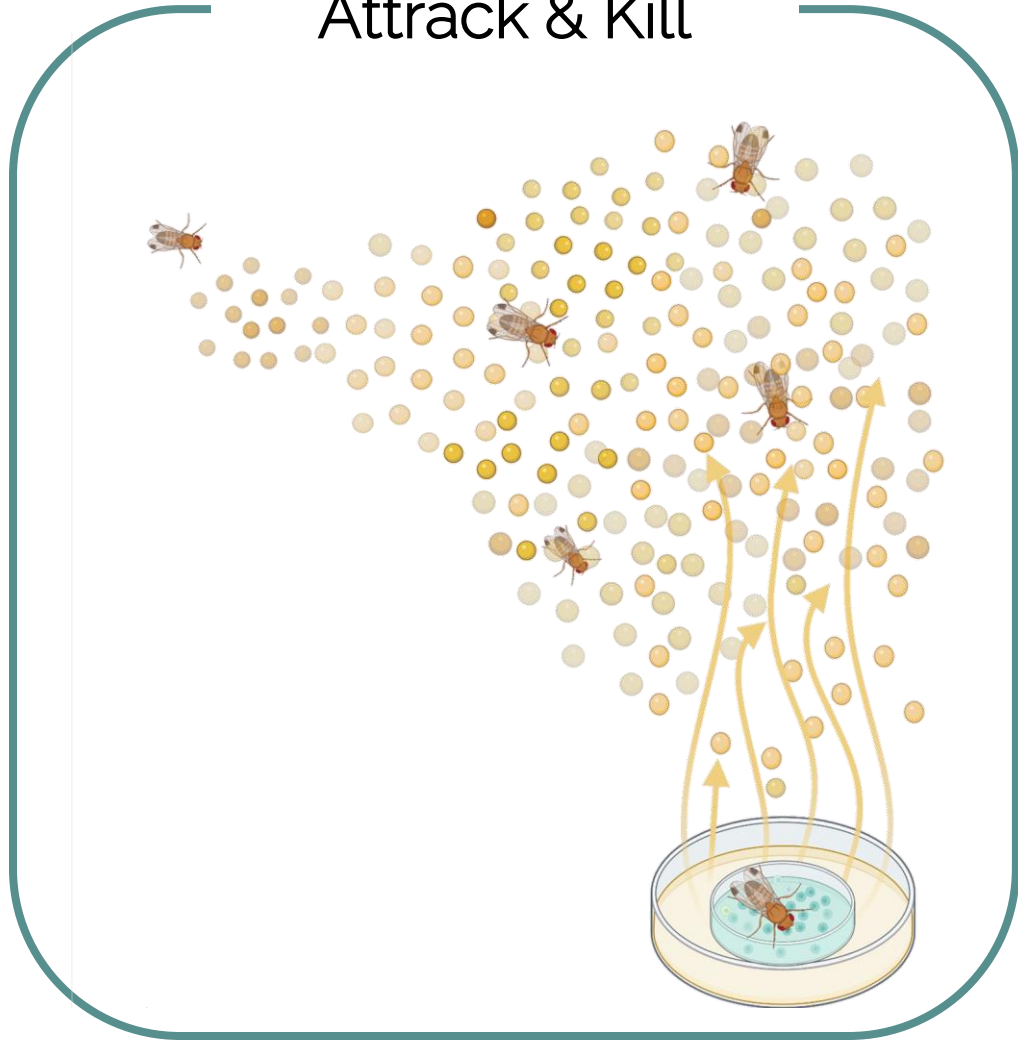
Kevin R. Cloonan¹  · John Abraham²  · Sergio Angeli³ · Zainulabeuddin Syed⁴ · Cesar Rodriguez-Saona¹



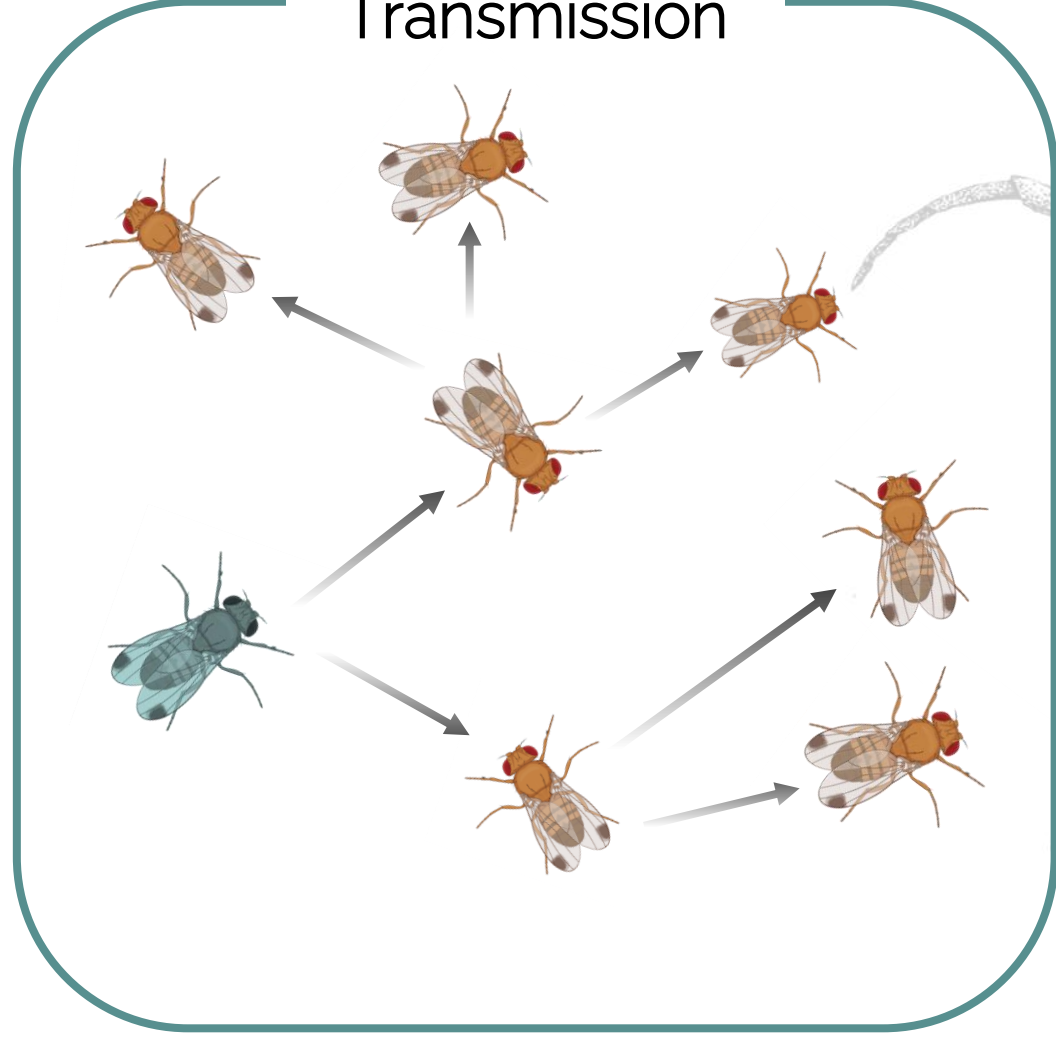
Article

Perspectives

Attrack & Kill

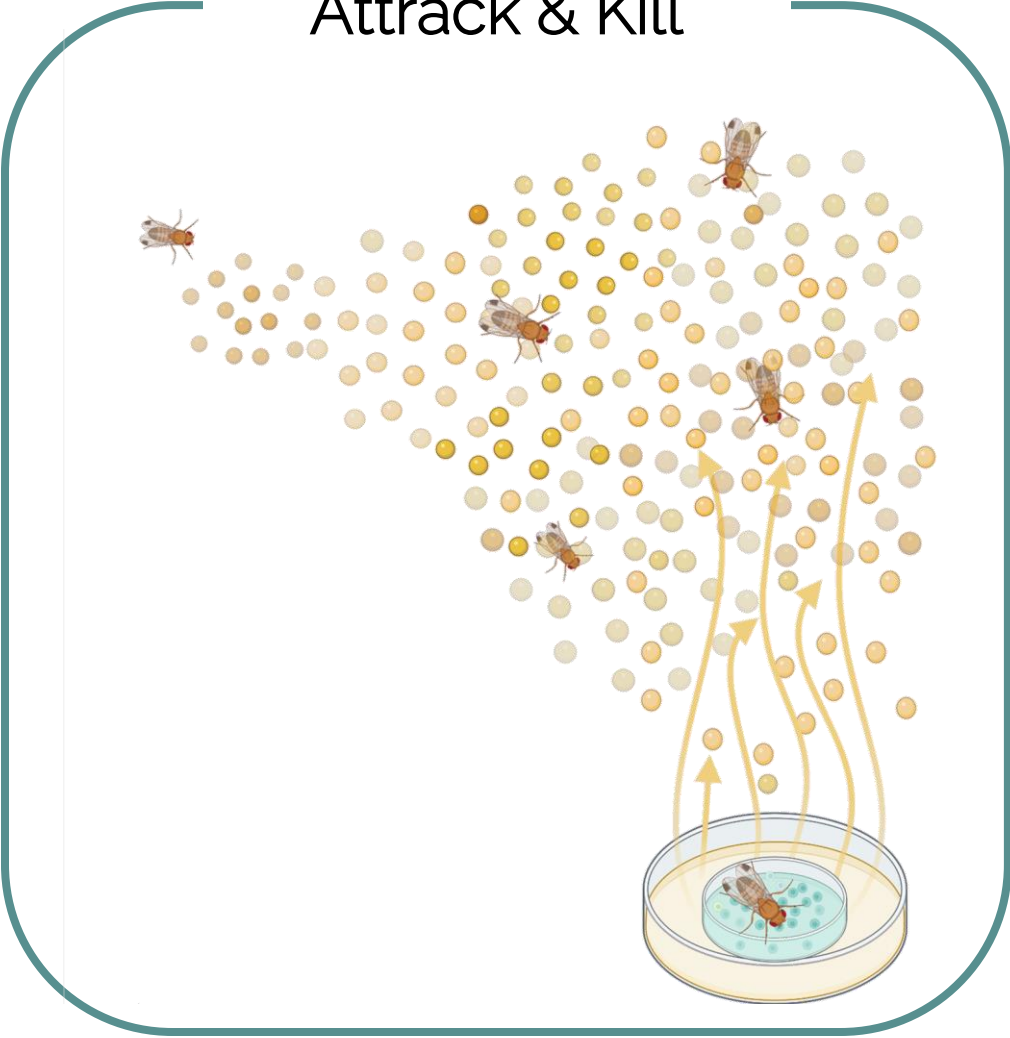


Transmission

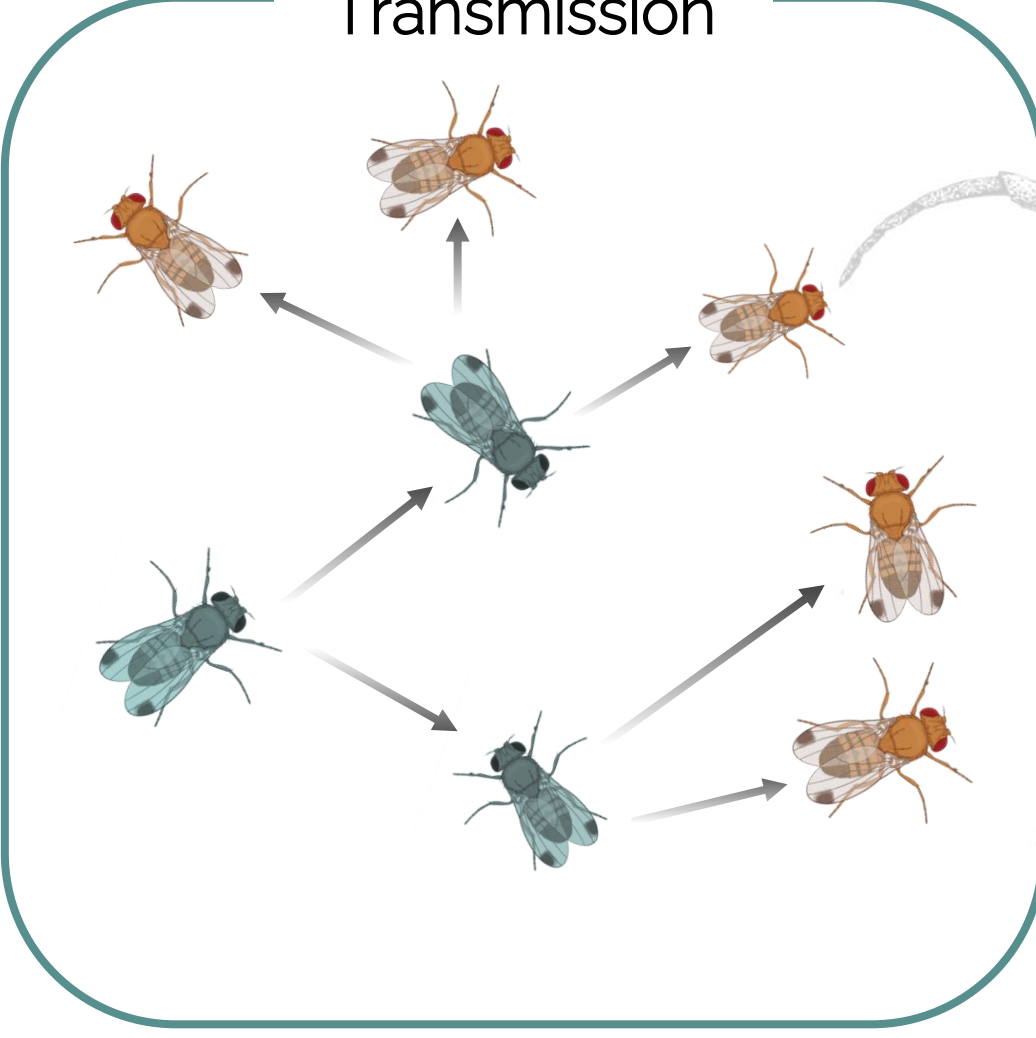


Perspectives

Attrack & Kill

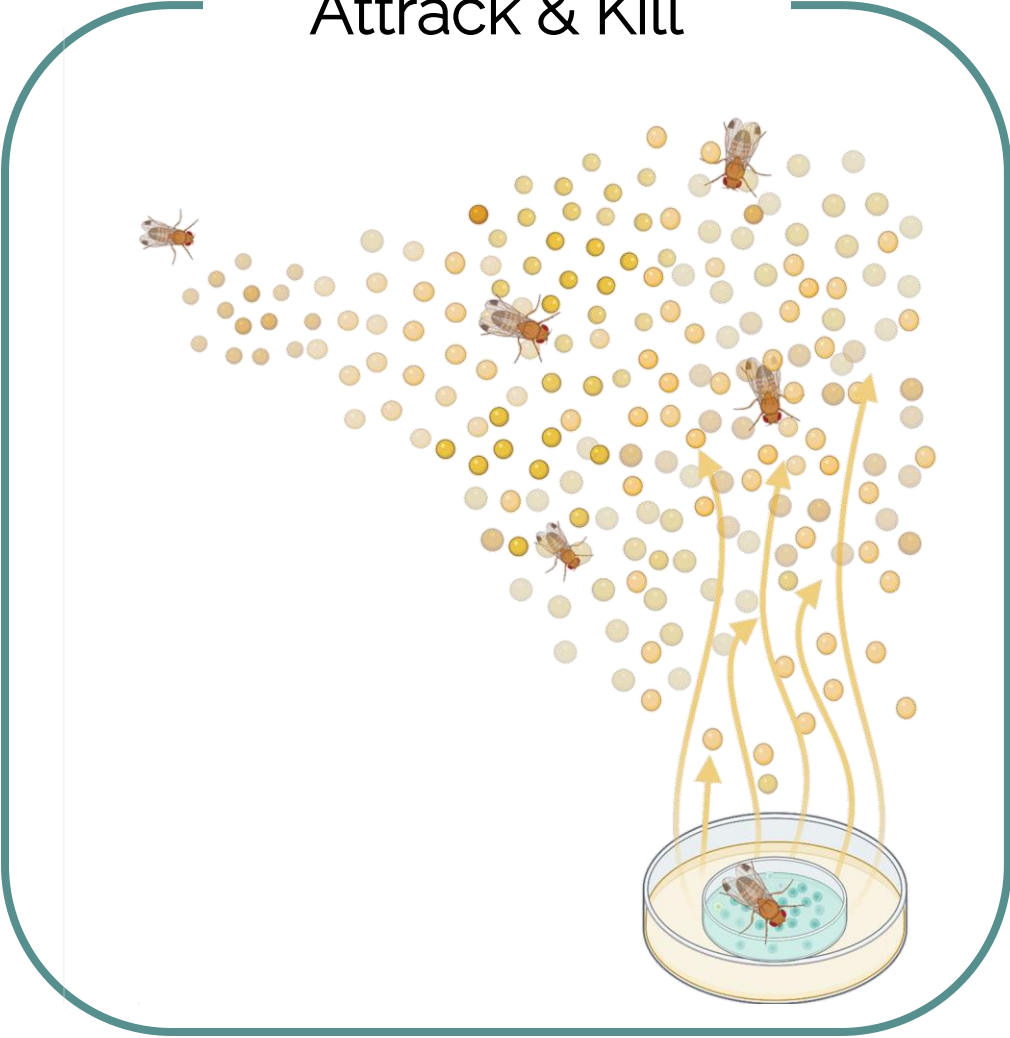


Transmission

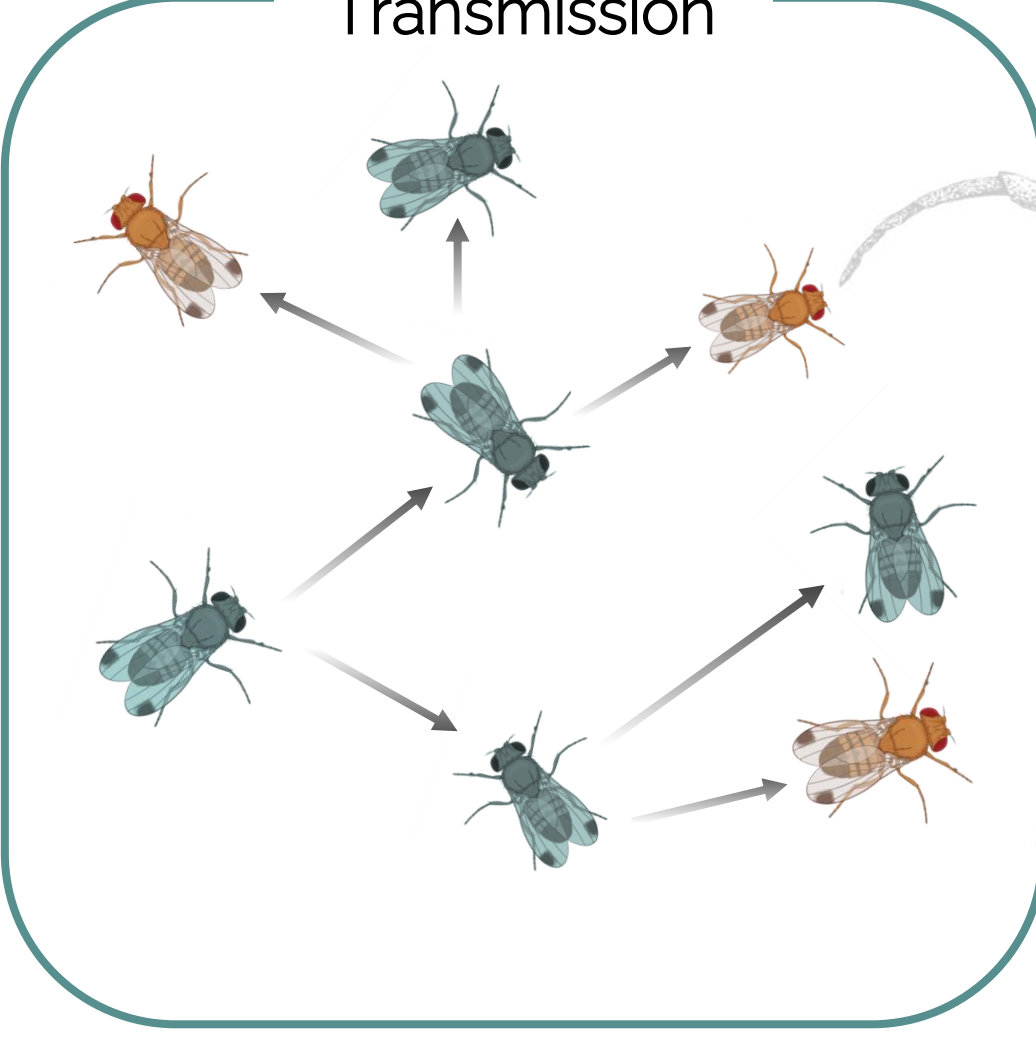


Perspectives

Attrack & Kill



Transmission



“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



Thank for your attention



Entomologie fonctionnelle et évolutive
Gembloux Agro-Bio Tech
Université de Liège

François Verheggen
Clément Martin
Nicolas Leroy
Solène Blanchard
Antoine Bouillis



Stéphane Declerck
Ismahen Lalaymia
Virginie Moreau

