



**Resistance to two SDHI fungicides in  
*Stemphylium vesicarium*, 2023.**

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# Stemphylium leaf blight (SLB)

- Pathogen: *Stemphylium vesicarium*
- First reported in Ontario in 2008
- Host: **onions**, asparagus, leek, pears and others – weeds
- Leaf dieback reduces bulb size and limits the uptake of sprout inhibitor, maleic hydrazide



# SLB on onion

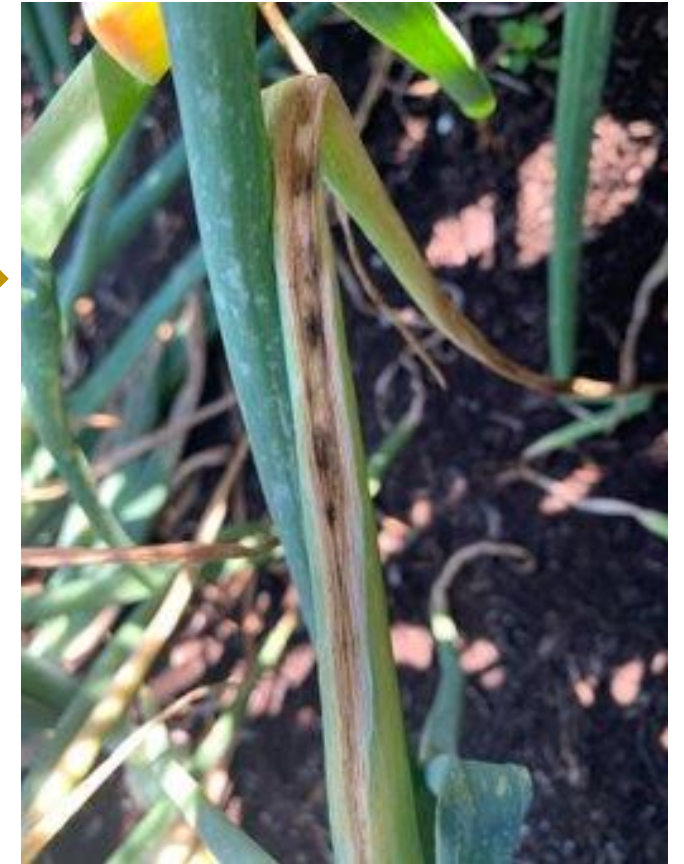


## Starts as...

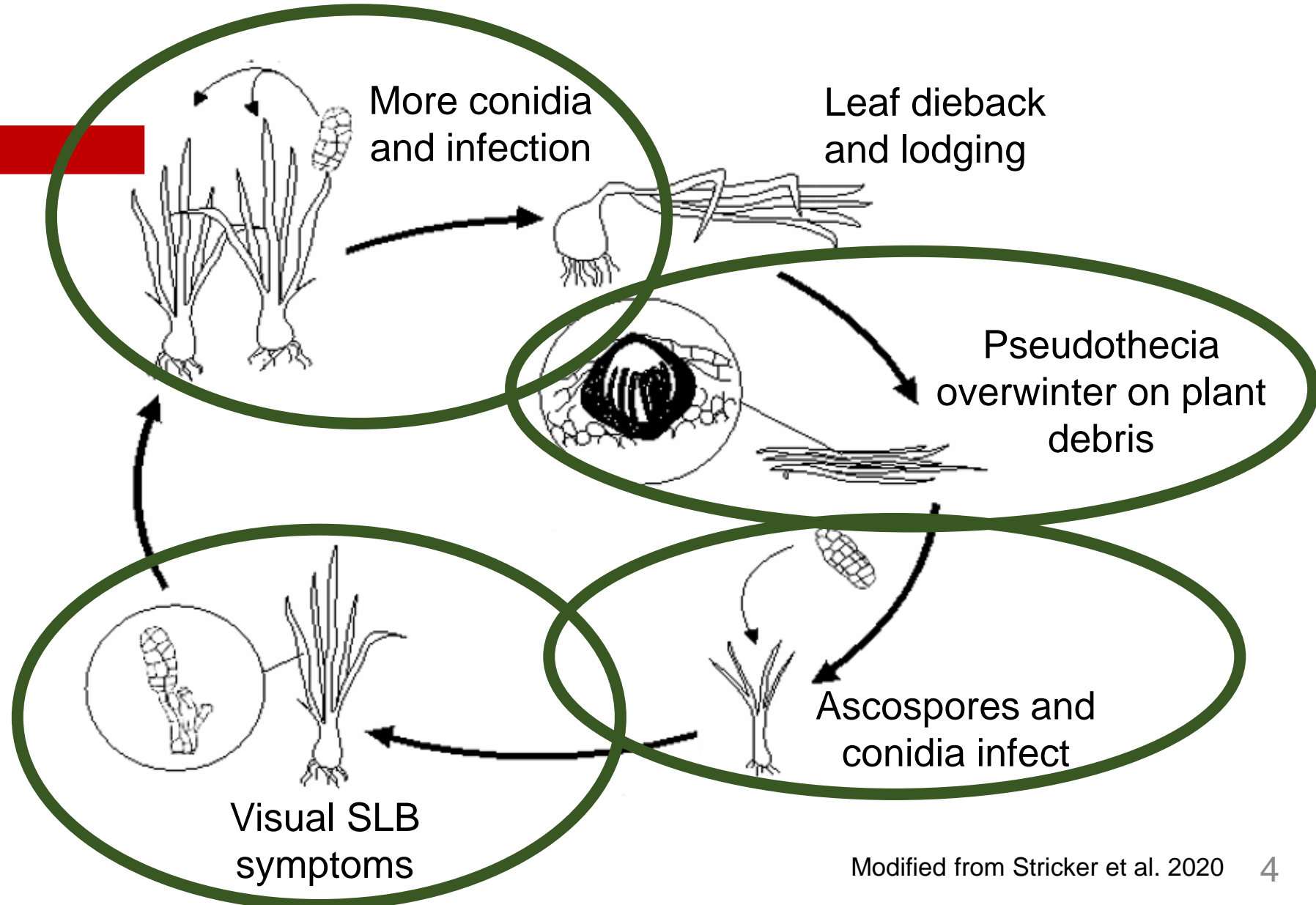
- Yellow to tan water-soaked oval lesions
- Leaf dieback

## Develops into...

- Sunken, chlorotic lesions
- 'Dirty' or speckled with sporulation
- Leaf necrosis



# Lifecycle of *S. vesicarium*



# Fungicides registered for SLB on onion

- Penflufen (Evergol Prime, FRAC 7) seed treatment
- Fungicide application beginning at 3 – 4 leaf stage (late June)
- Continuation of fungicide application until early August

Product	Active Ingredient	FRAC (group)
Quadris Top	azoxystrobin + difenoconazole	11 + 3
Luna Tranquility	fluopyram + pyrimethanil	7 + 9
Sercadis	fluxapyroxad	7
Aprovia	benzovindiflipyr	7
Miravis Duo	pydiflumetofen + difenoconazole	7 + 3
Merivon	fluxapyroxad + pyraclostrobin	7 + 11

# Issues with fungicide resistance

- Registered fungicides are not very effective

## Difenoconazole (FRAC 3)

- 1% of isolates were resistant in a mycelial growth assay (n=106), but is ineffective against conidia in 2018 – 2019

## Pyrimethanil (FRAC 9)

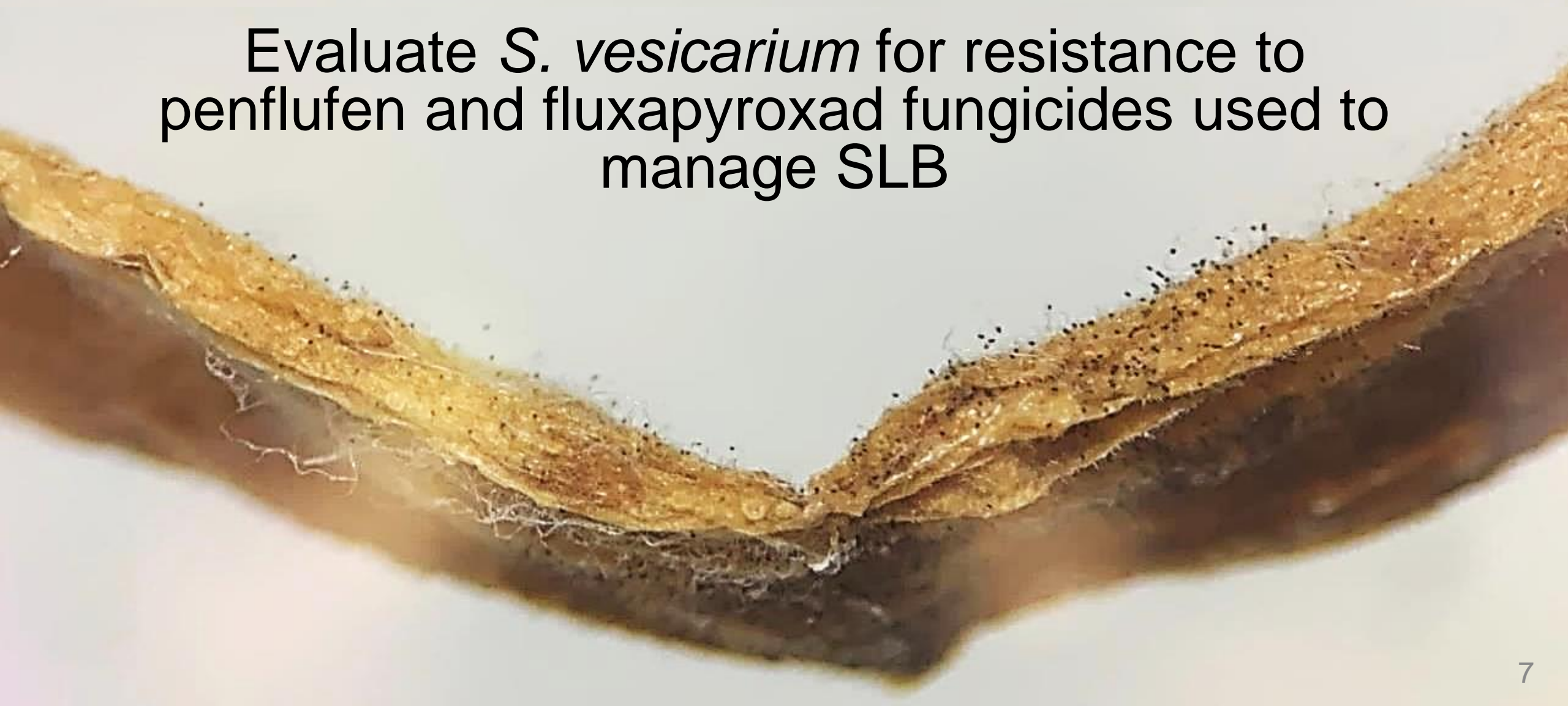
- In 2018 – 2019, 49% (n= 49, conidia) and 12% (n= 49, mycelia) of isolates were resistant

## Azoxystrobin (FRAC 11) and Fluopyram (FRAC 7)

- 97% (n=30) of isolates were resistant to azoxystrobin in 2020
- All isolates (n=30) were resistant to fluopyram in 2020
- Multiple resistance was observed with 17% (mycelia) and 70% (conidia) of isolates resistant to fluopyram and azoxystrobin in 2020

# Objective

Evaluate *S. vesicarium* for resistance to penflufen and fluxapyroxad fungicides used to manage SLB

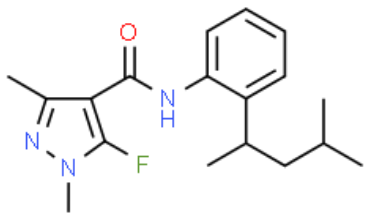


# Screening Methods

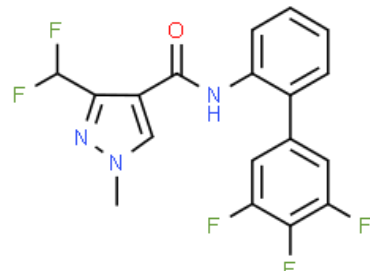
## PDA amended media

- penflufen (FRAC 7, SDHI)
  - 50  $\mu\text{g}$  a.i./mL (ppm)
- fluxapyroxad (FRAC 7, SDHI)
  - 40, 100  $\mu\text{g}$  a.i./mL

Concentrations were replicated three times for both assays

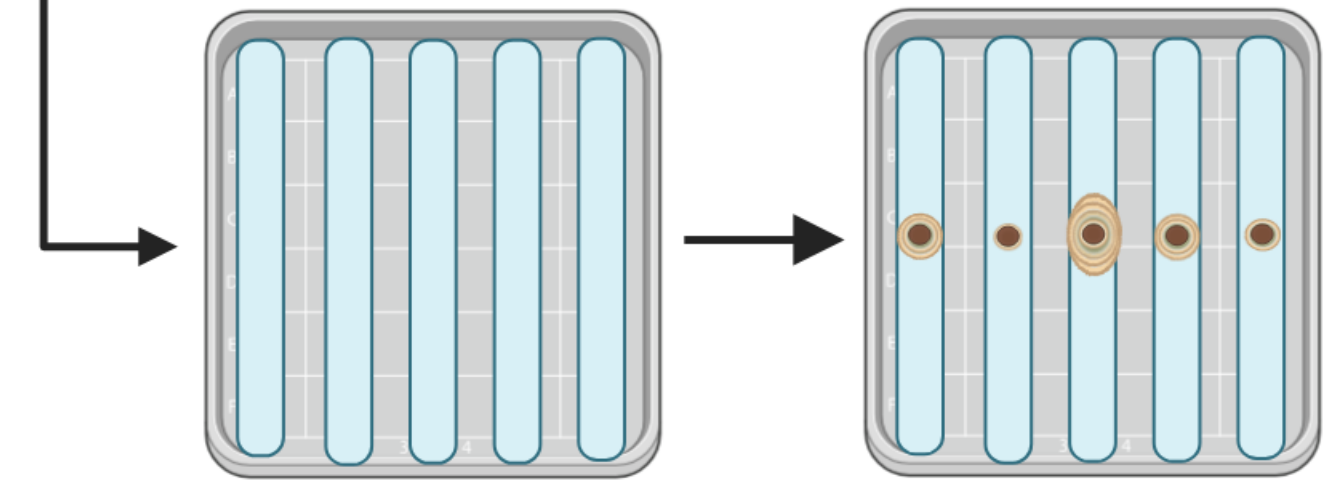
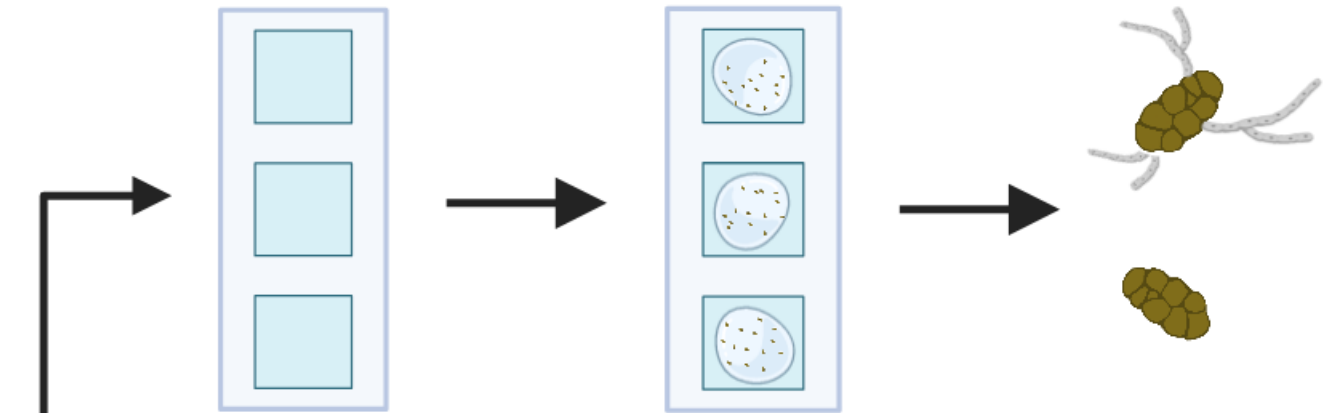


penflufen



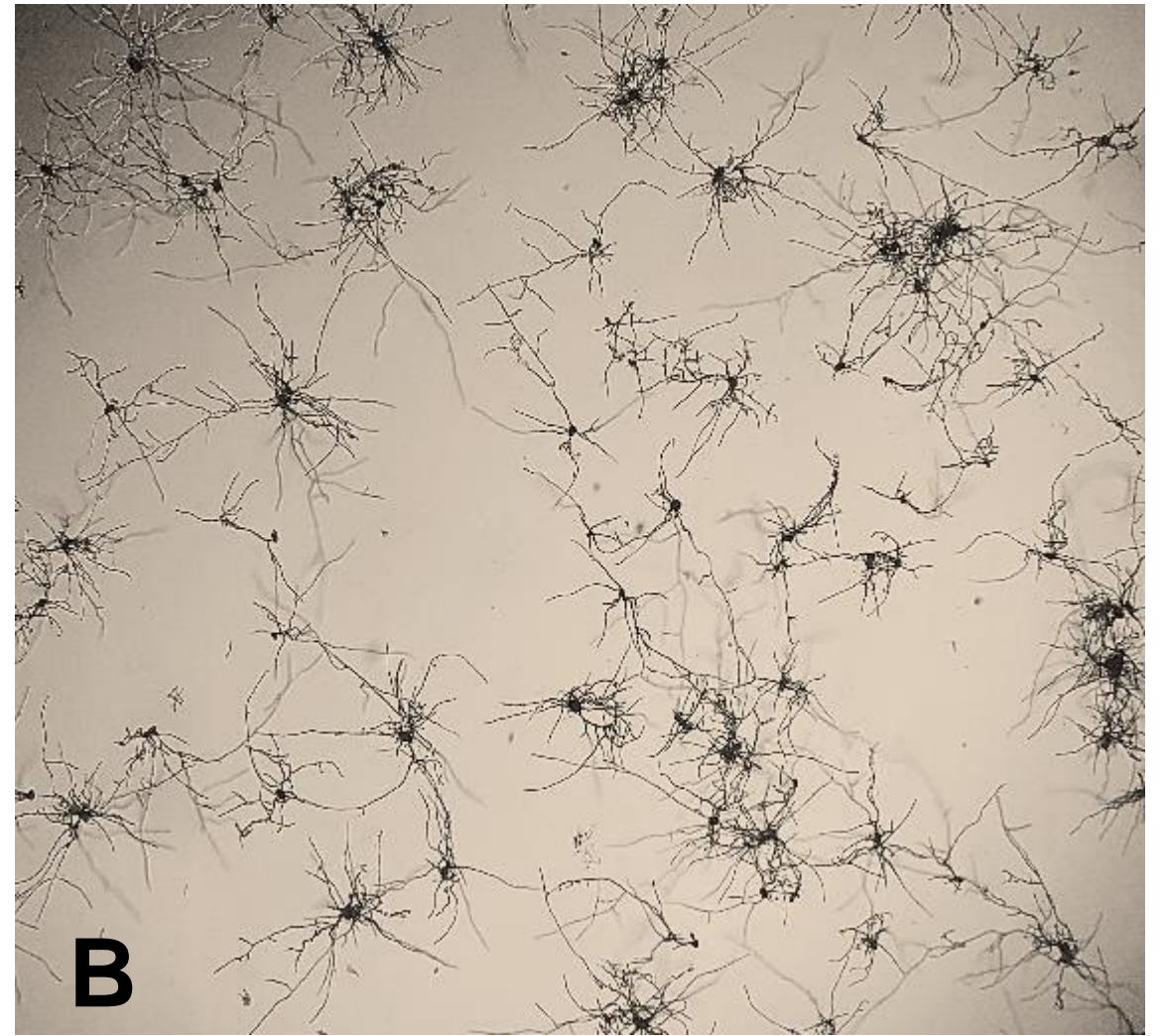
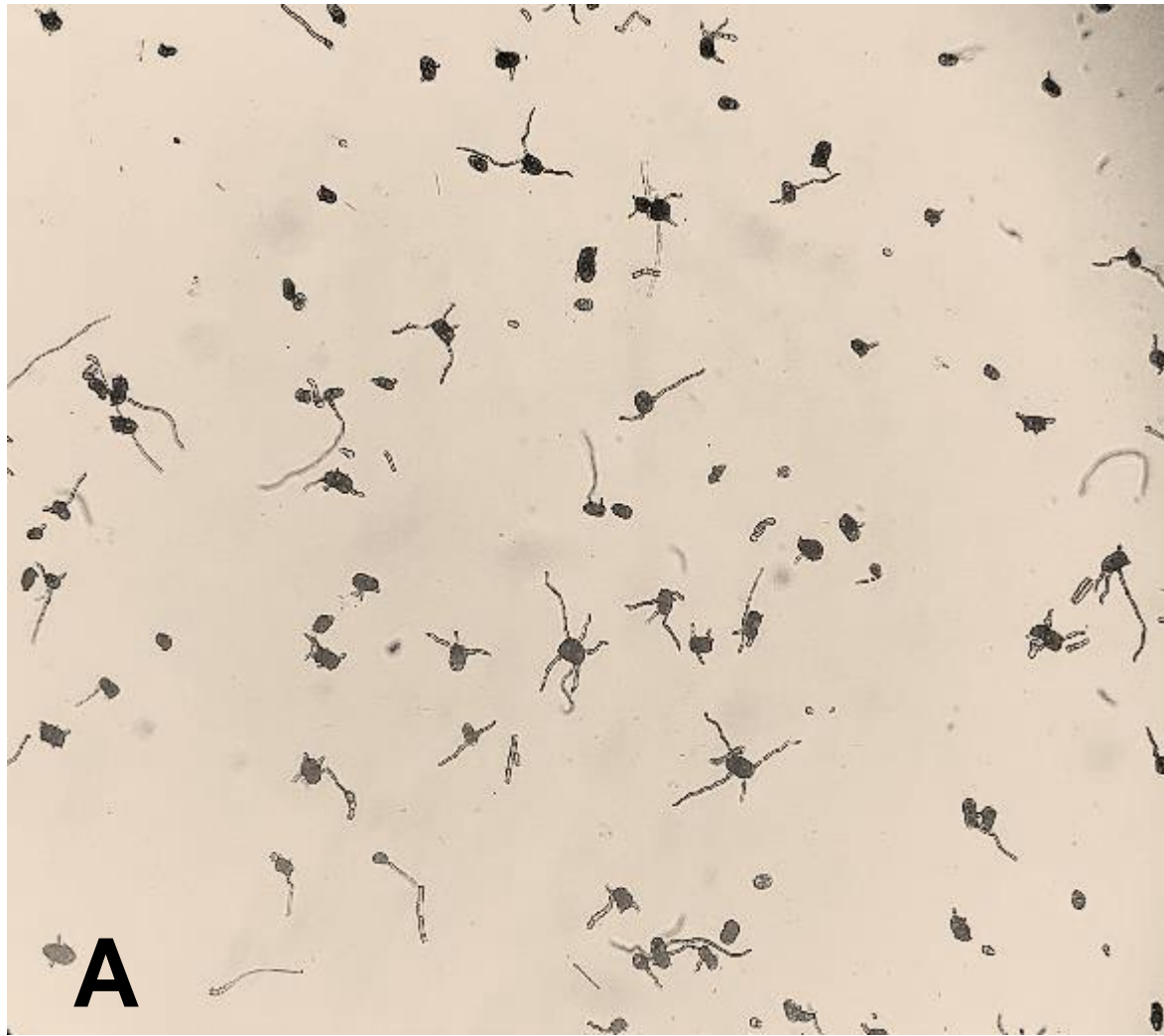
fluxapyroxad

## Conidial germination assay



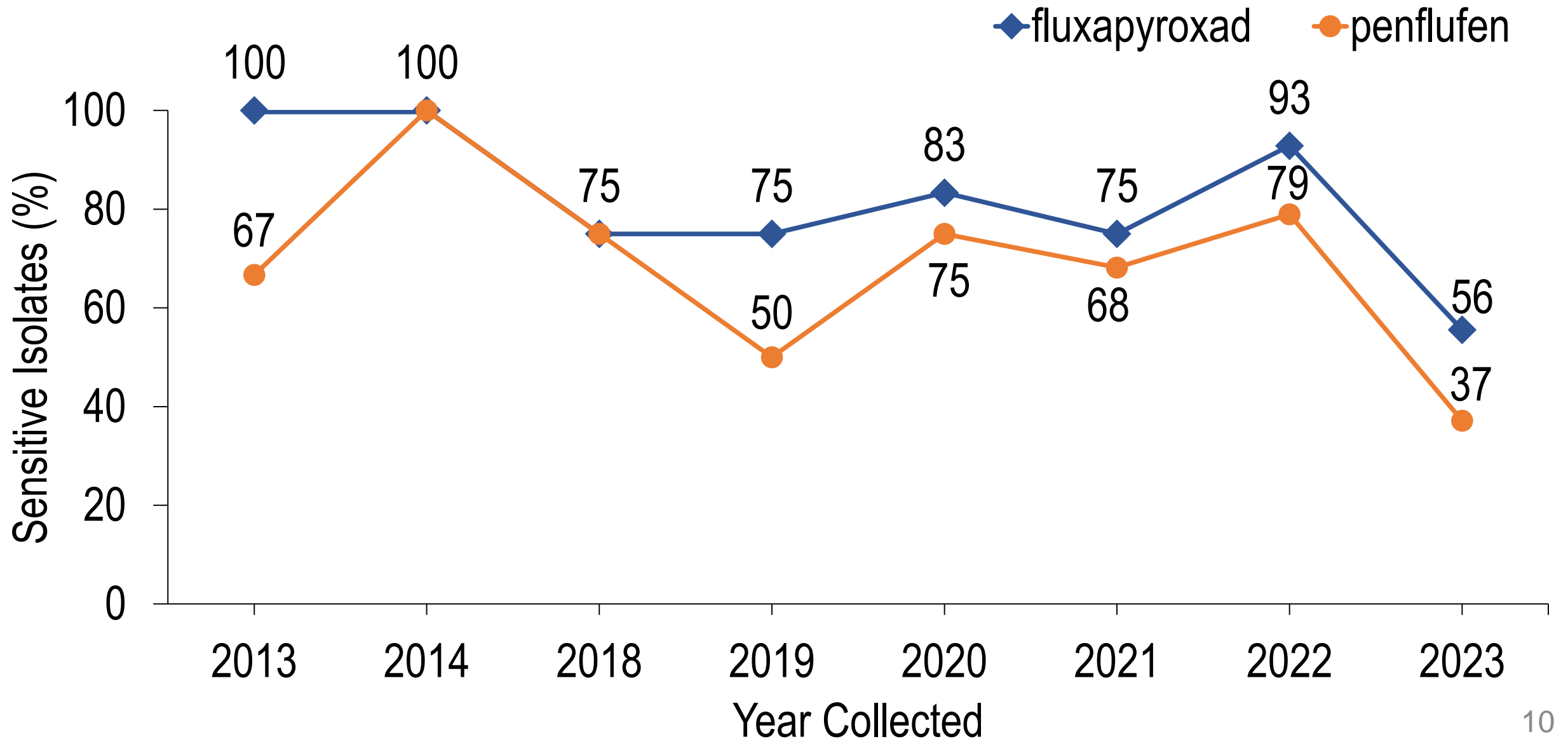
## Mycelial growth assay



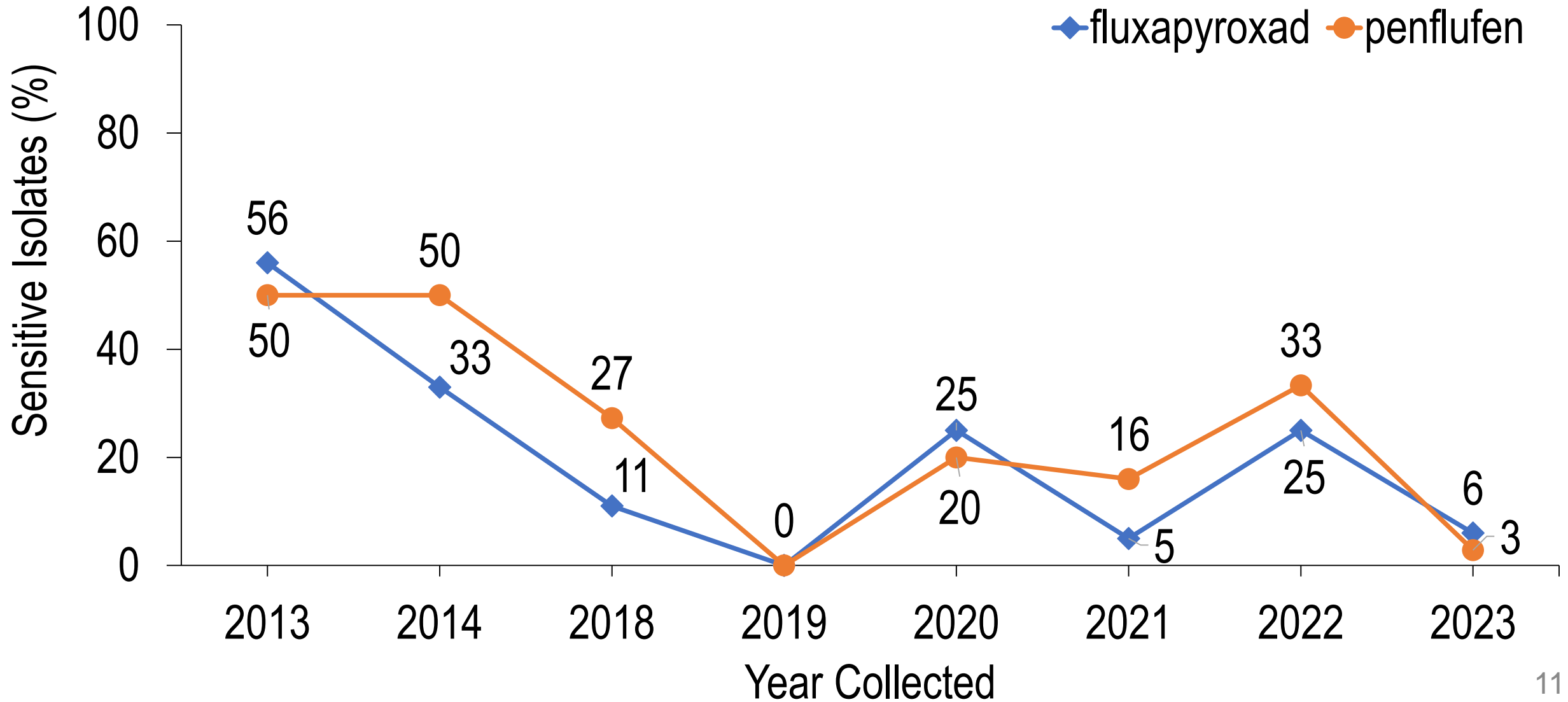


Conidial germination after 24 hours at 40  $\mu\text{g a.i./mL}$  fluxapyroxad for **A)** sensitive and **B)** resistant isolates of *S. vesicarium*.

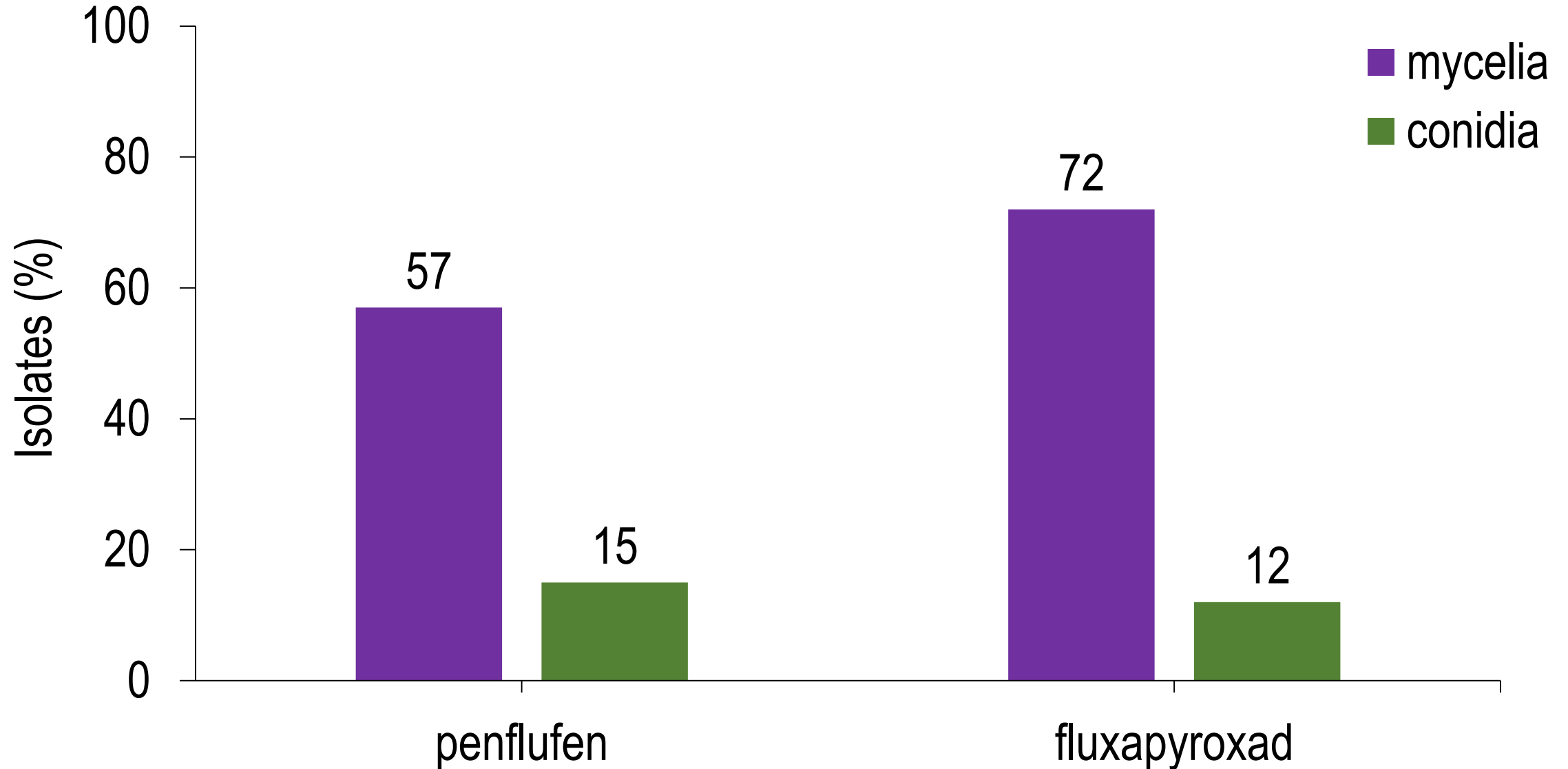
# *S. vesicarium* mycelial sensitivity from 2013–2023



# *S. vesicarium* conidial sensitivity from 2013–2023



# *S. vesicarium* conidia and mycelium sensitive 2021–2023.



# Results summary

## Fluxapyroxad

- Conidial sensitivity has declined from 56% in 2013 to 6% in 2023 (n = 32).
- However, 93% (n = 28) were sensitive in mycelial assays in 2022 and only 56% (n = 36) remained sensitive in 2023.

## Penflufen

- 50% (conidia) and 67% (mycelia) of isolates were sensitive in 2013.
- Few 2023 isolates (3%, n = 35) were sensitive to penflufen in conidial assay and but only 37% (n = 35) were sensitive in mycelial assay.
- 96% (n=122, conidia) and 82% (n=93, mycelia) of isolates from 2021 – 2023 were resistant to both penflufen and fluxapyroxad

# Implications

- Fungicides are only partially effective – likely related to resistance.
- Penflufen and fluxapyroxad are not effective against spore germination but mycelia is sensitive in some isolates.
- Penflufen does NOT provide early season protection against SLB but is effective against other pathogens, so use will continue.
- Need to limit use of fluxapyroxad fungicides.
- Delay resistance by:
  - Integrated pest management – spray when needed.
  - Alternate FRAC groups with low-risk fungicides.



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# Thank you

If you have more questions,  
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# References

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