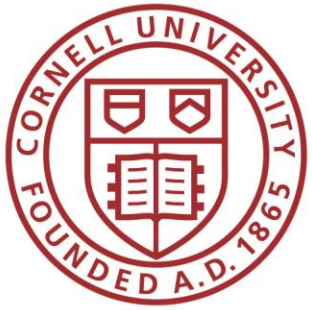


Cornell CALS

College of Agriculture and Life Sciences

Current status of fungicide resistance in Stemphylium leaf blight of onion in New York

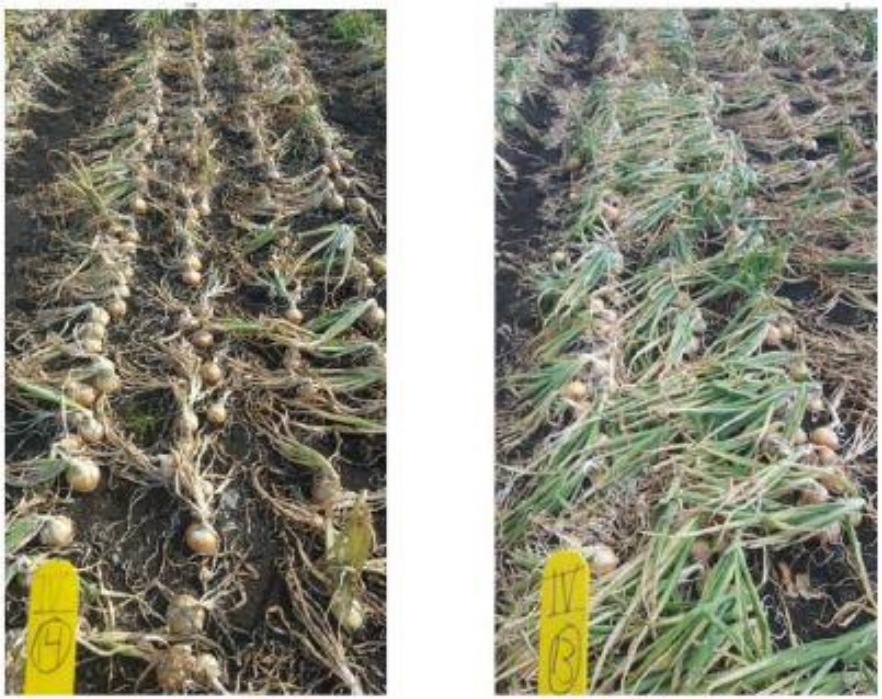
Frank Hay (Senior Extension Associate)
School of Integrative Plant Science,
Cornell University – NY State Agricultural Experiment Station
Geneva.

Acknowledgements

- **Collaborators:**
  - Christy Hoepting Cornell Cooperative Extension
  - A/Prof. Sarah Pethybridge Cornell University, NYSAES
- **Technical Staff:**
  - Elizabeth Maloney, David Strickland, Karen Luong
  - Carol Bowden, Sean Murphy, CCE staff.
- **Growers** for allowing field trials, surveys especially CY Farms, Triple G Farms and Torrey Farms, Elba.
- **Funding:**
  - Onion Research Development Program in 2015 and 2016.
  - NIFA CPPM,
  - Federal Capacity Fund
  - NYFVI SCBG

Fungicide resistance?

2015 field trial conducted by Christy Hoepting (CCE) showed poorer efficacy of Quadris® (azoxystrobin) vs Quadris Top® (azoxystrobin + difenoconazole)



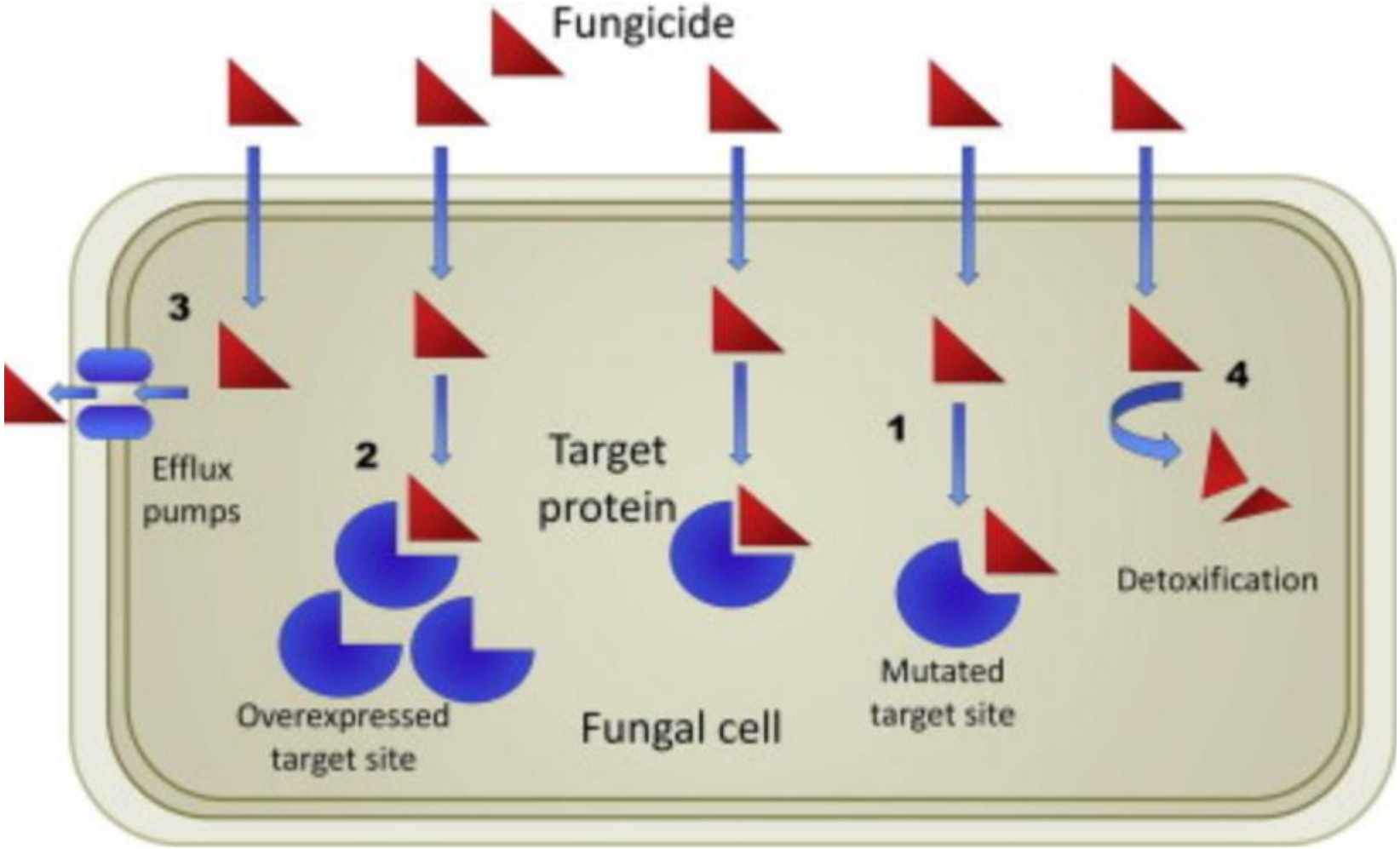
Side-by-side comparison of the efficacy of Quadris (left) and Quadris Top (right) for control of Stemphylium leaf blight in onion in fungicide evaluation field trial, Elba, NY, 2015. Fungicides belonging to fungicide resistance group 11 (e.g. Quadris) failed to control SLB, while fungicides belonging to groups 3 (component of Quadris Top) and 7 (example not shown) provided best control of SLB with the healthiest foliage and proper lodging at harvest.
Photos: Christy Hoepting, Cornell Vegetable Program

Number of reasons for fungicide failures in the field

- Incorrect rate.
- Incorrect timing (too soon or too late!).
- Poor conditions at application e.g. wind during application, rain during or soon after application.

- Fungicide resistance – “an acquired, heritable reduction in fungicide sensitivity of a fungus to a specific anti-fungal agent (or fungicide)” www.frac.info

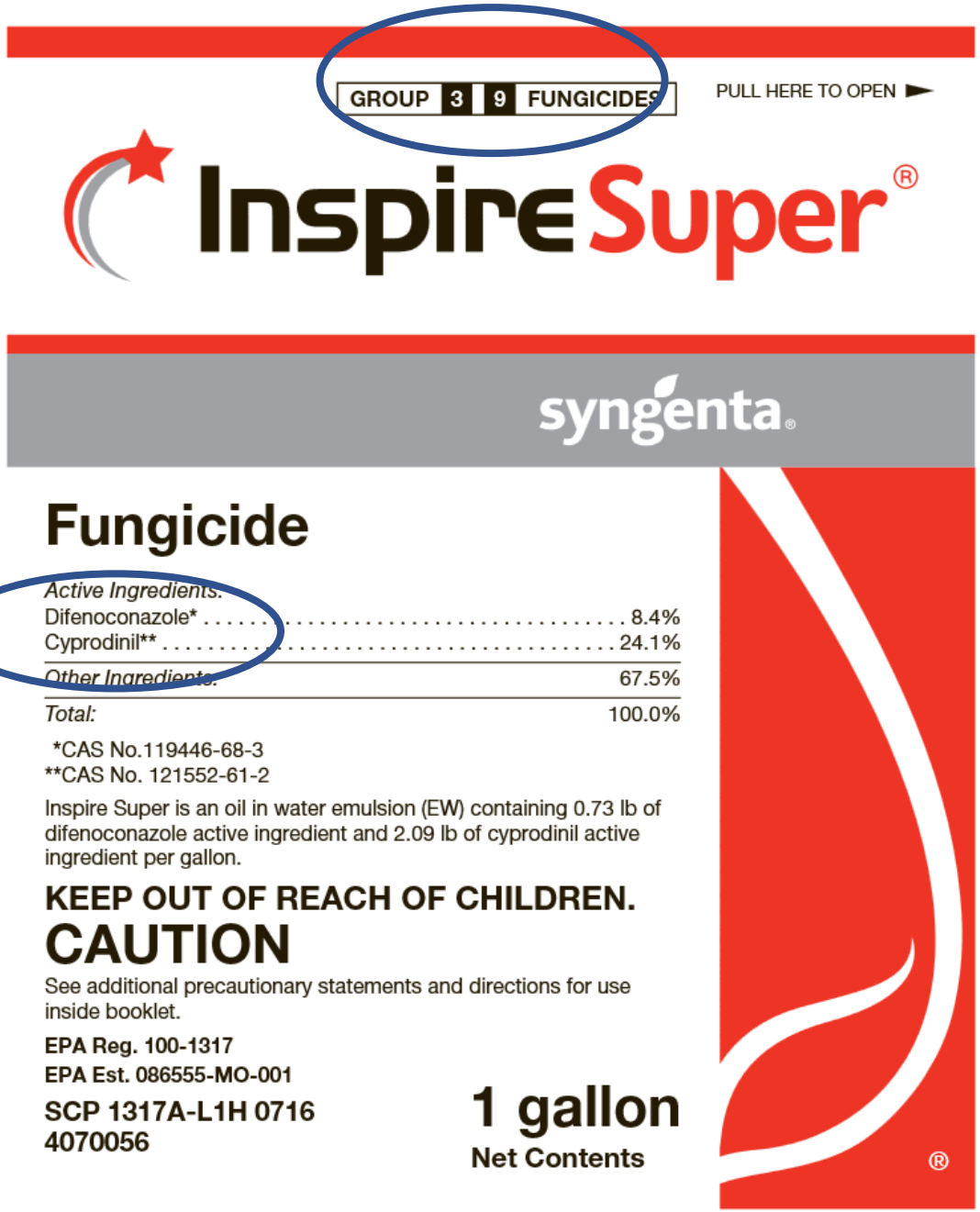
Mechanisms of fungicide resistance



From: Lucas JA, Hawkins NJ, Fraaije BA (2015) https://doi.org/10.1016/bs.aambs.2014.09.001

- **Fungicide Resistance Action Committee**

- Group active ingredients of fungicides into FRAC codes according to their mode of action against fungi.



FRAC
FUNGICIDE RESISTANCE ACTION COMMITTEE

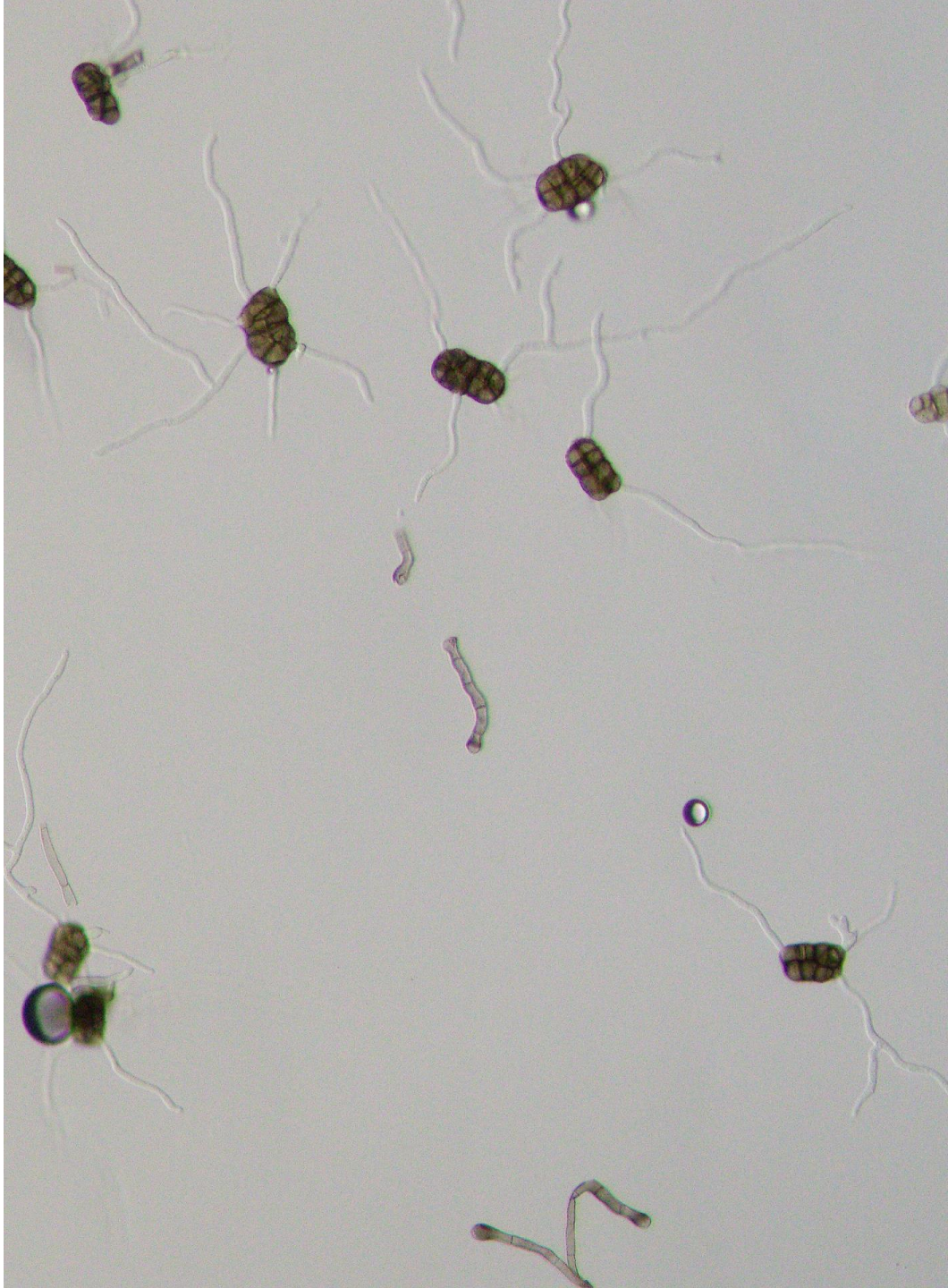
www.frac.info/

Fungicides and their active ingredients used in NY onion production for foliar disease management

	FRAC 2	FRAC 3	FRAC 7	FRAC 9	FRAC 11
Quadris®					azoxystrobin
Quadris Top®		difenoconazole			azoxystrobin
Inspire Super®		difenoconazole		cyprodinil	
Rovral®	iprodione				
Luna Tranquility®			fluopyram	pyrimethanil	
Merivon®			fluxapyroxad		pyraclostrobin
Pristine®			boscalid		pyraclostrobin
Endura®			boscalid		
Scala®				pyrimethanil	

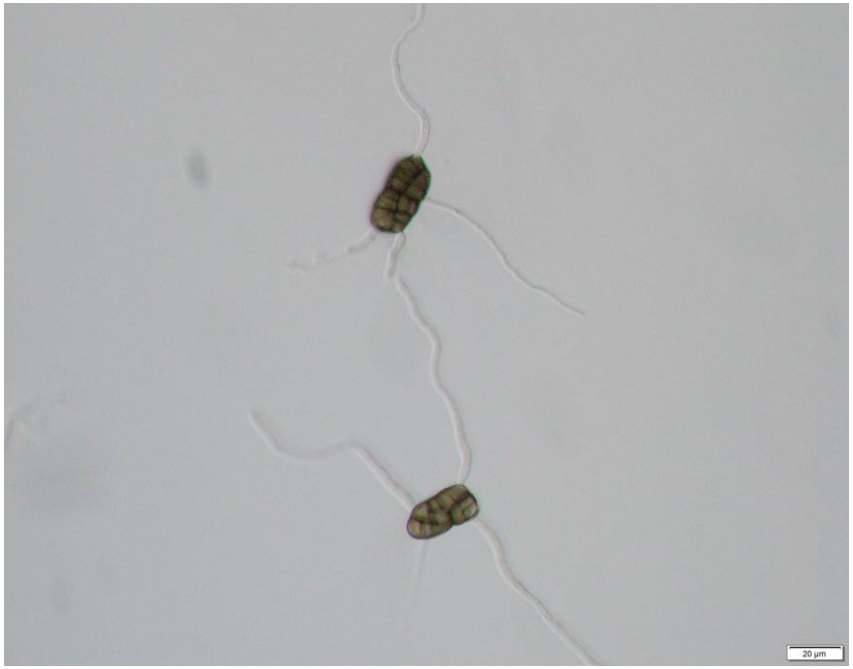
Fungicide sensitivity testing

EC_{50}:
***E**ffective **c**oncentration of fungicide need to reduce spore germination by 50% in comparison to germination in the absence of fungicide.*

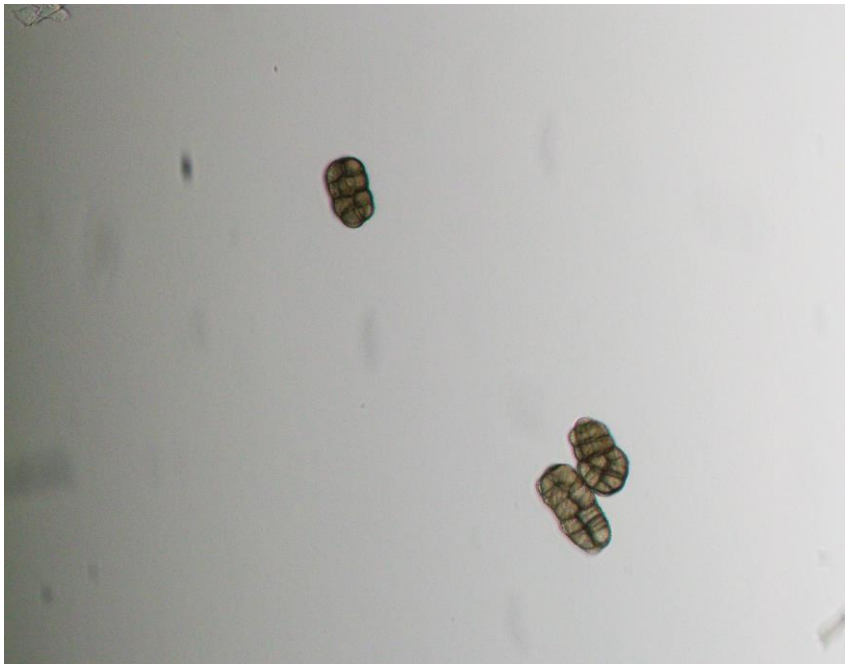


Isolate of Stemphylium sensitive to azoxystrobin

No fungicide



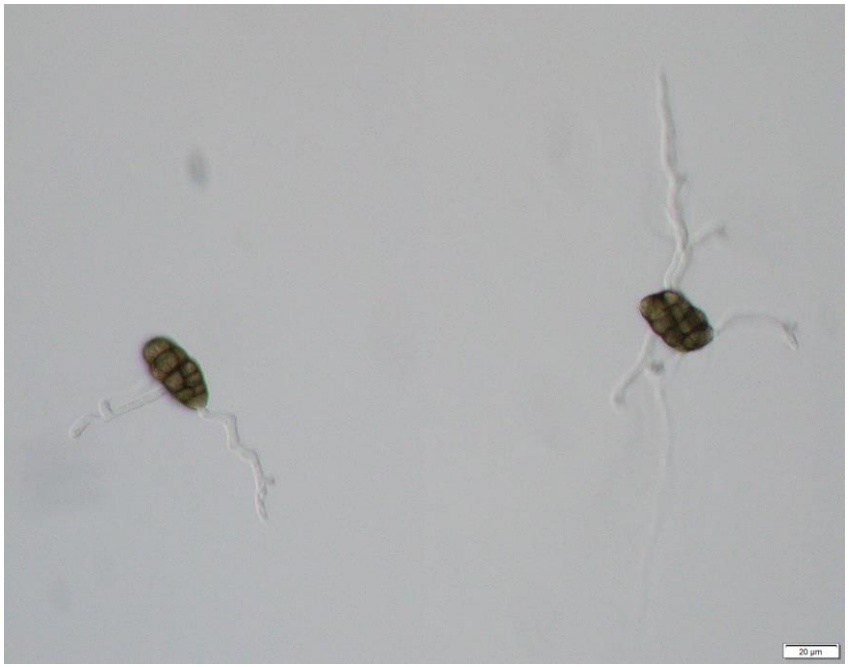
Azoxystrobin 0.5 µg/ml



Isolate of Stemphylium insensitive to azoxystrobin

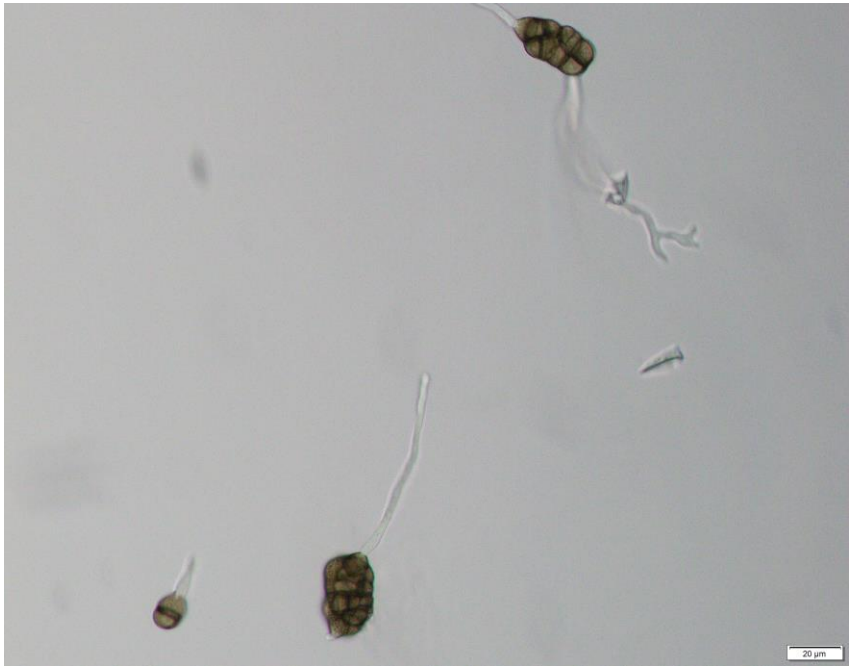
No fungicide

Azoxystrobin 0.5 µg/ml

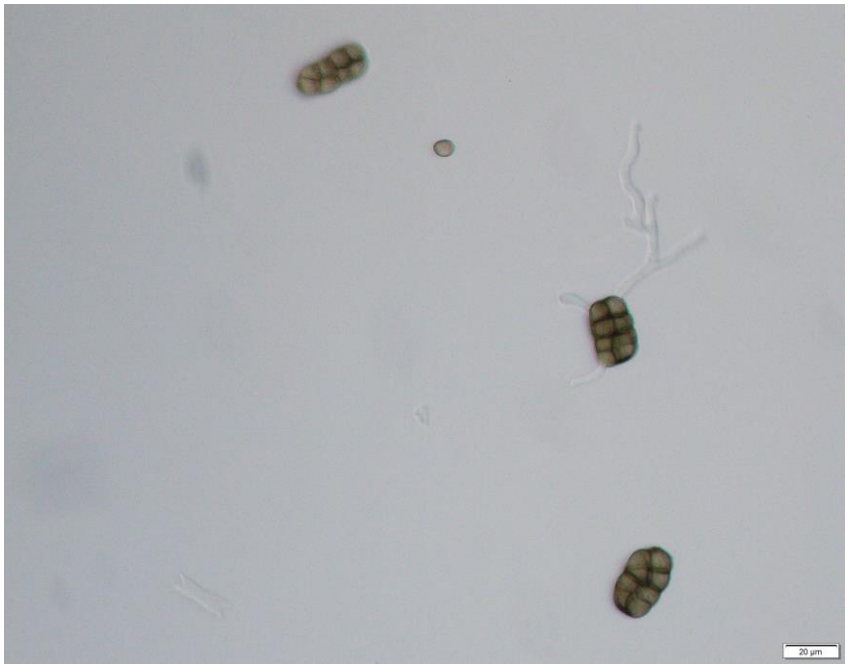


Isolate of Stemphylium insensitive to azoxystrobin

Azoxystrobin 10.0 µg/ml

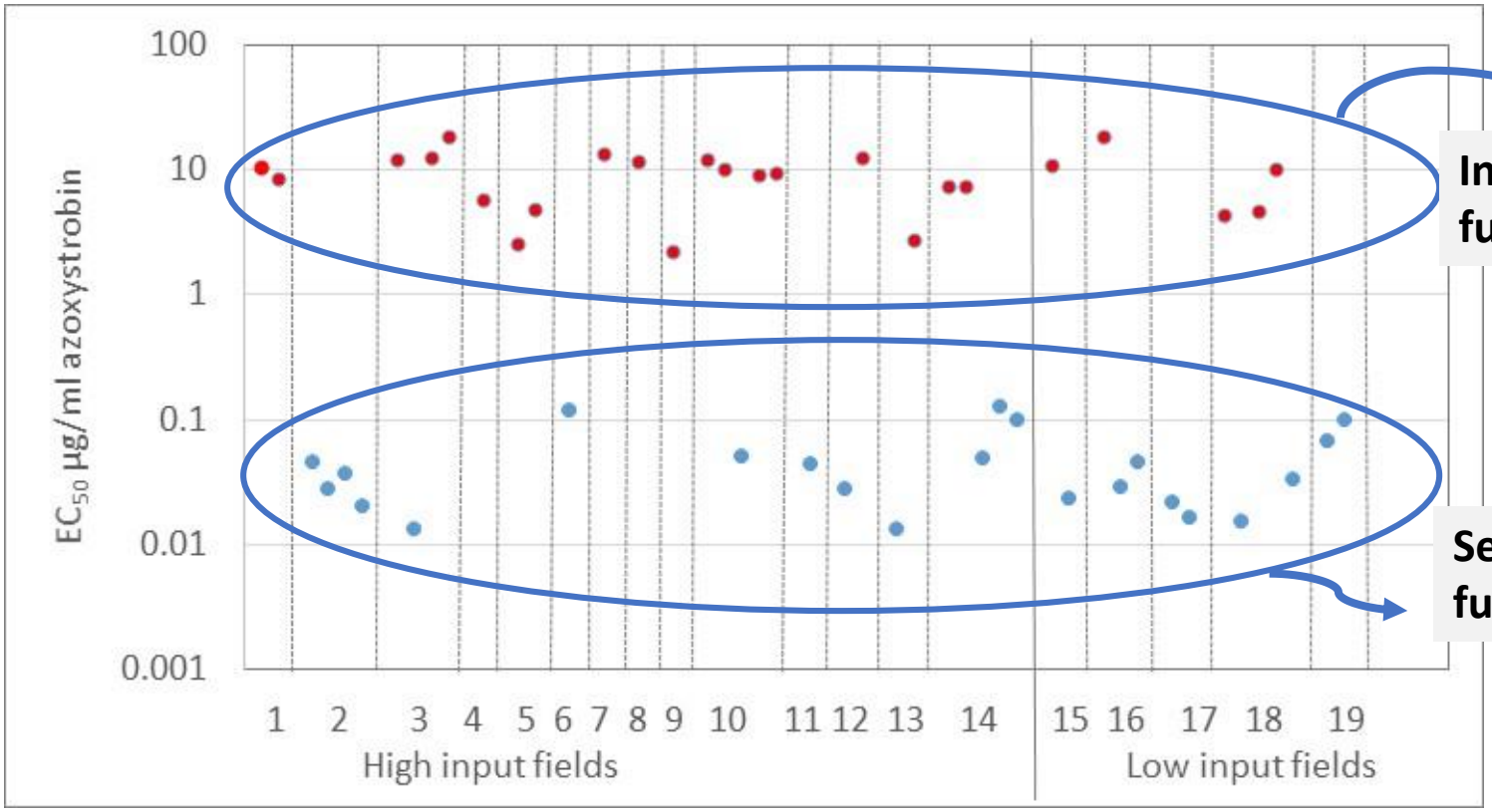


Azoxystrobin 25.0 µg/ml



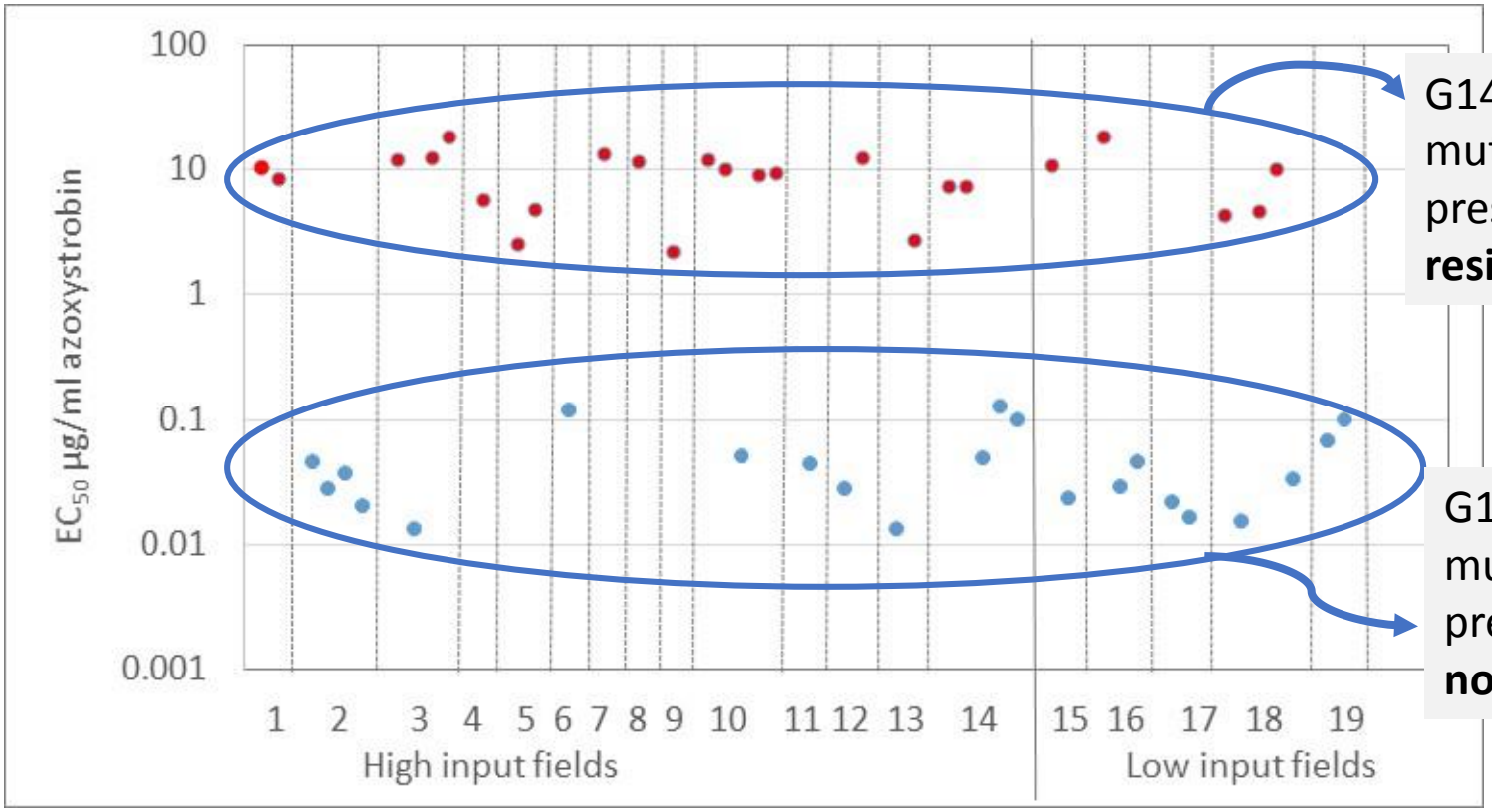
FRAC 11: Azoxystrobin

Effective concentration of azoxystrobin required to inhibit spore germination by 50% (EC_{50}) for 46 isolates of *Stemphylium vesicarium* collected from 19 NY onion fields in 2015.



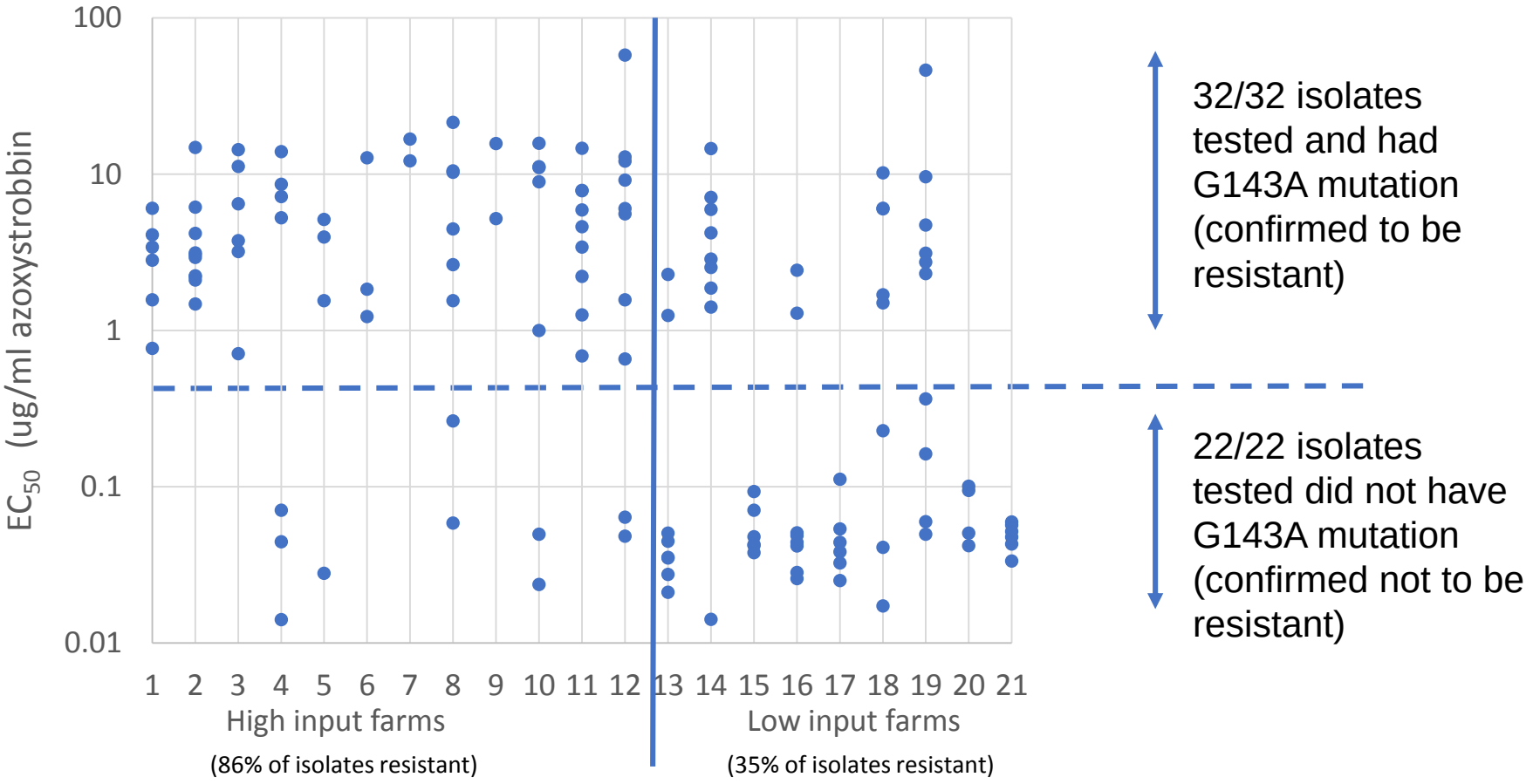
FRAC 11: Azoxystrobin

Effective concentration of azoxystrobin required to inhibit spore germination by 50% (EC_{50}) for 46 isolates of *Stemphylium vesicarium* from 19 NY onion fields.



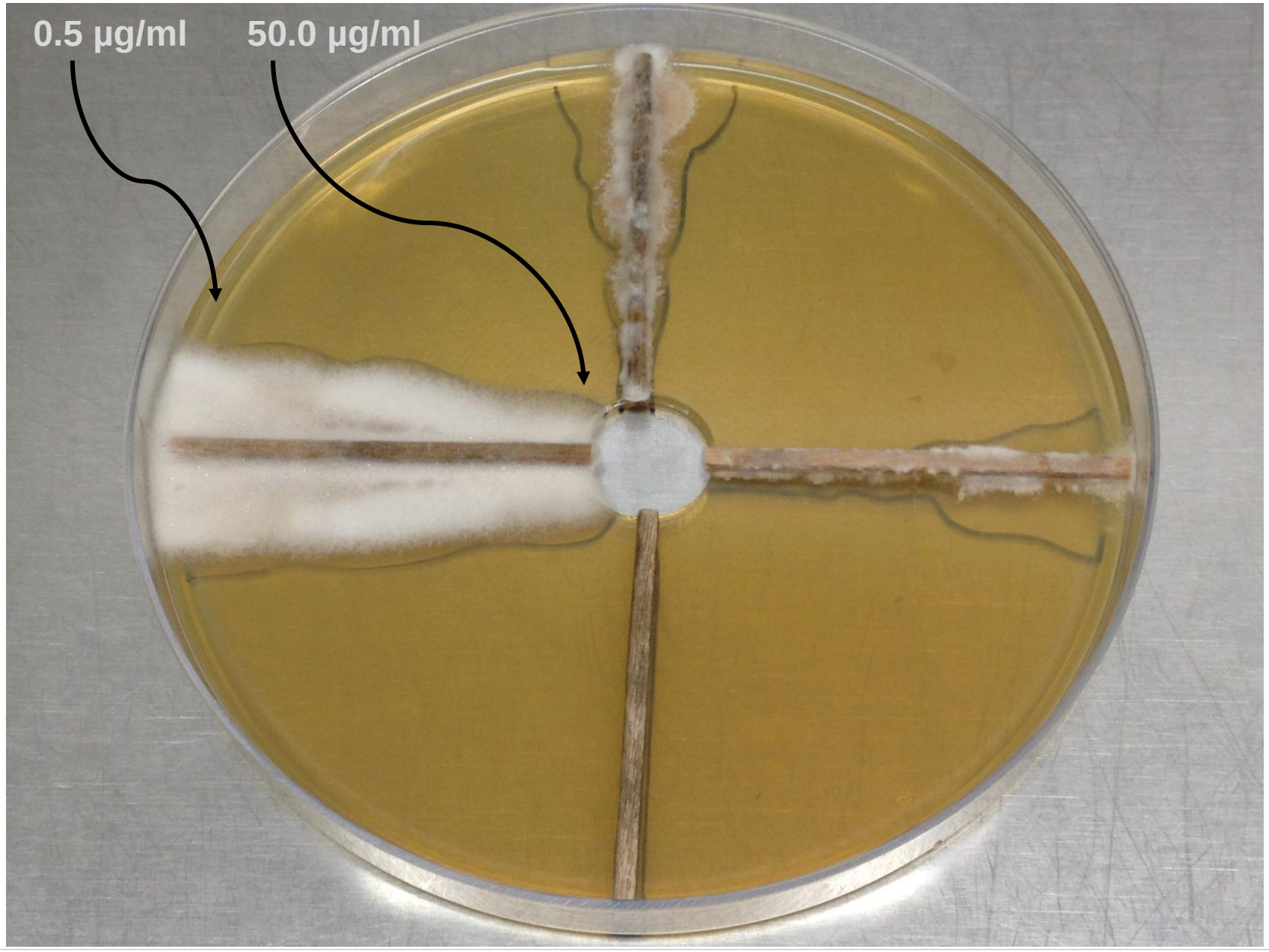
FRAC 11: Azoxystrobin

Effective concentration of azoxystrobin required to inhibit spore germination by 50% (EC_{50}) for 140 isolates of *Stemphylium vesicarium* from 21 NY onion fields in 2016.

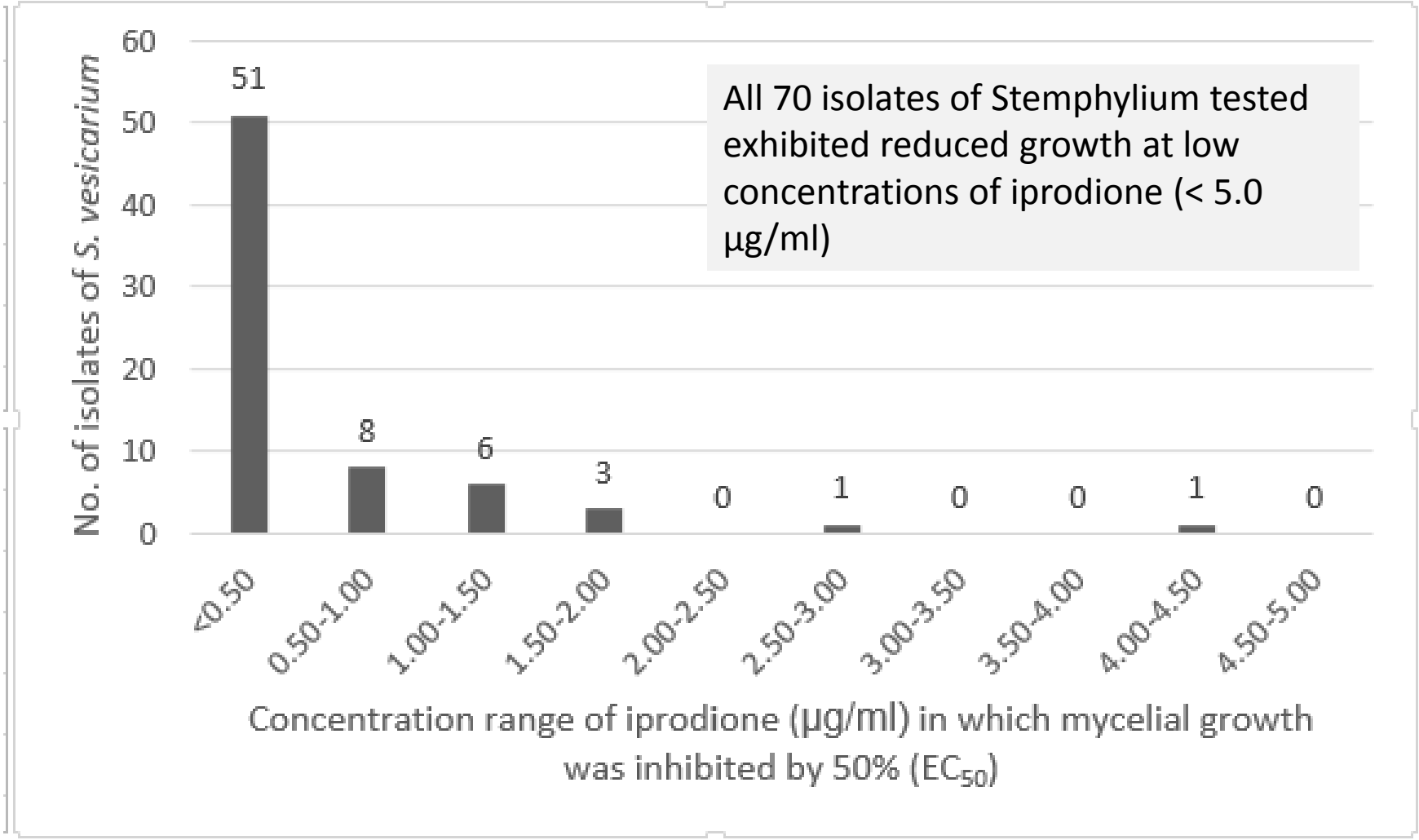


Fungicides used in onion production for foliar disease

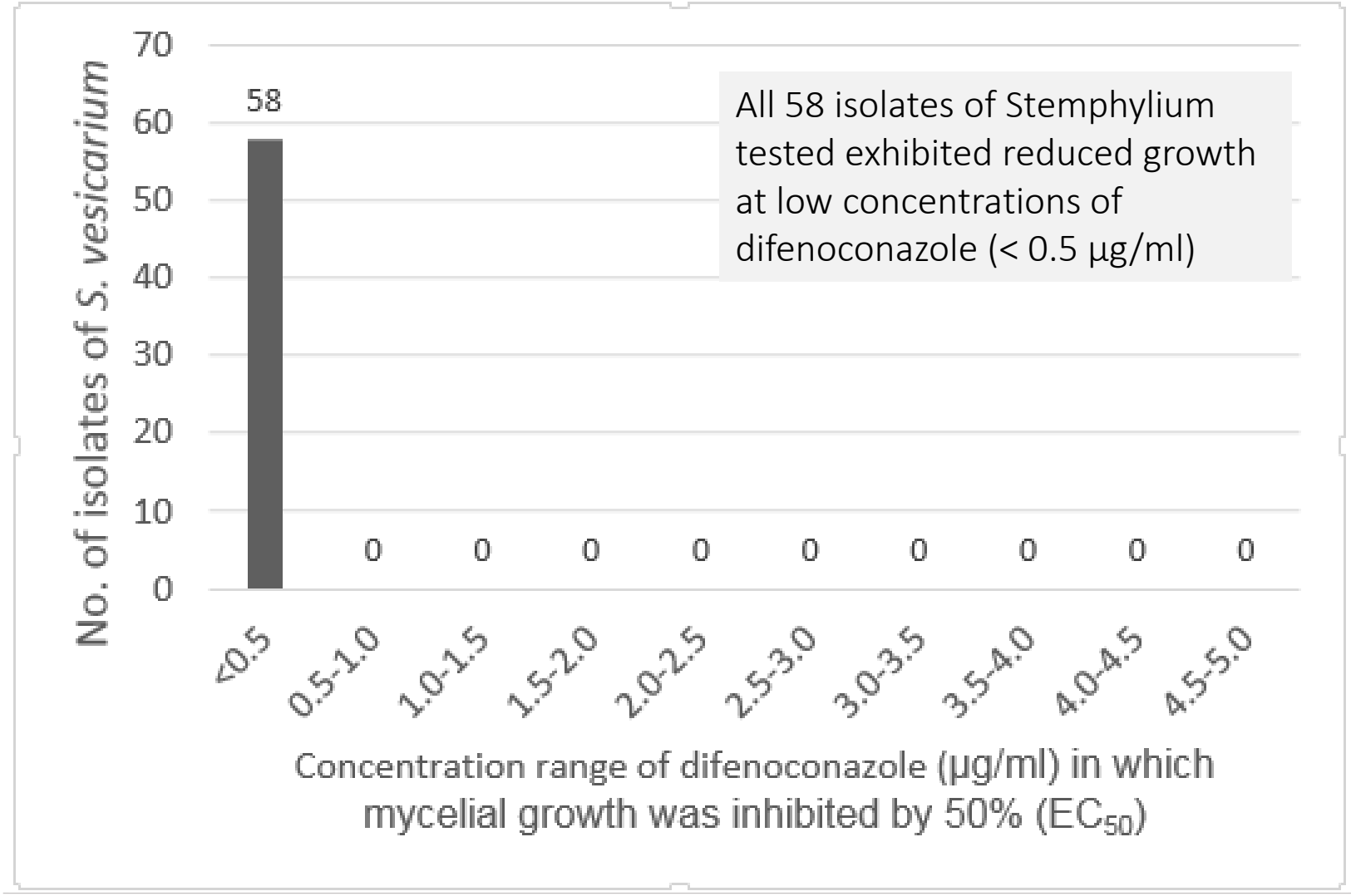
	FRAC 2	FRAC 3	FRAC 7	FRAC 9	FRAC 11
Quadris®					azoxystrobin
Quadris Top®		difenoconazole			azoxystrobin
Inspire Super®		difenoconazole		cyprodinil	
Rovral®	iprodione				
Luna Tranquility®			fluopyram	pyrimethanil	
Merivon®			fluxapyroxad		pyraclostrobin
Pristine®			boscalid		pyraclostrobin
Endura®			boscalid		
Scala®				pyrimethanil	


0.5 µg/ml
50.0 µg/ml

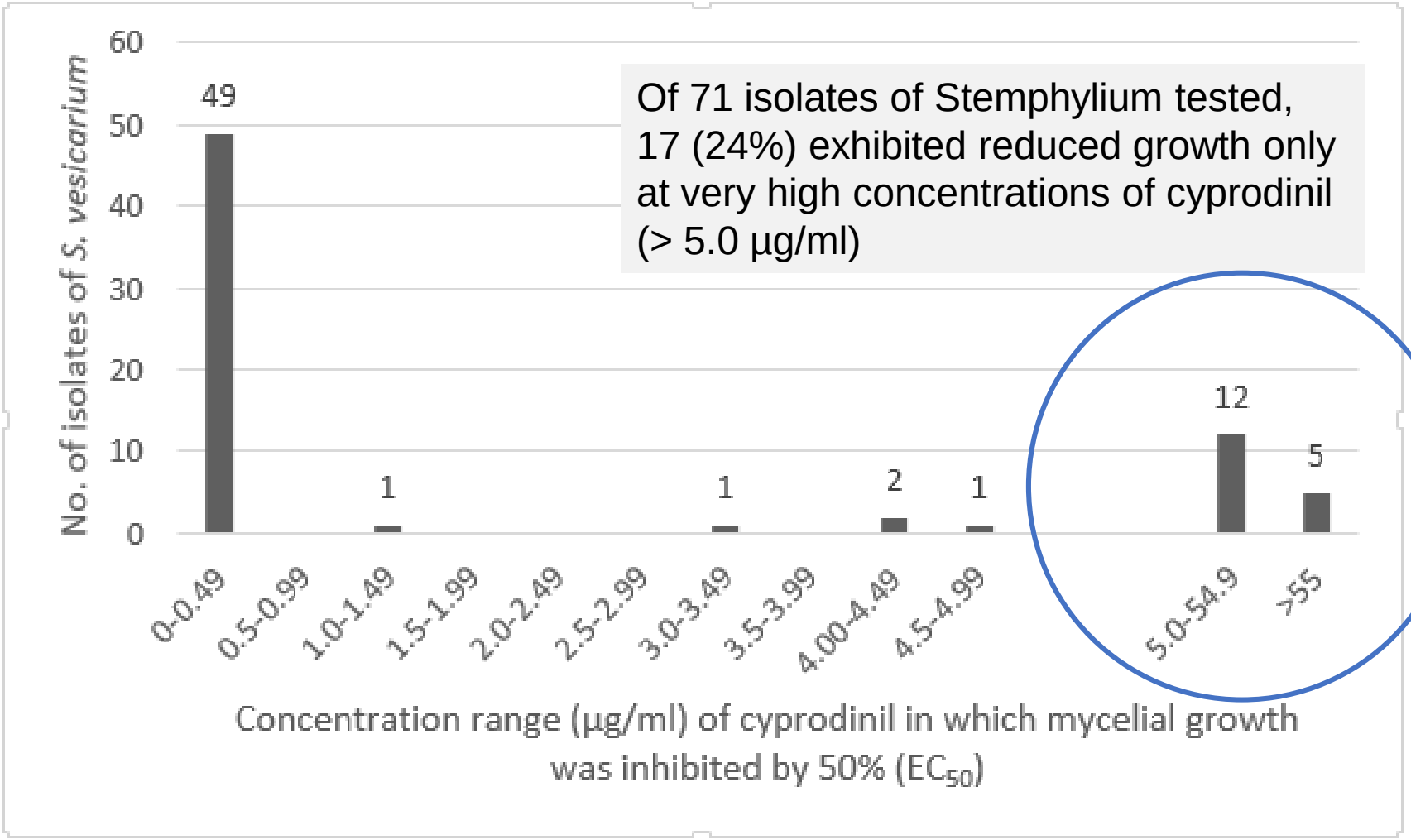
FRAC 2:
No evidence of resistance to iprodione (i.e. Rovral®)



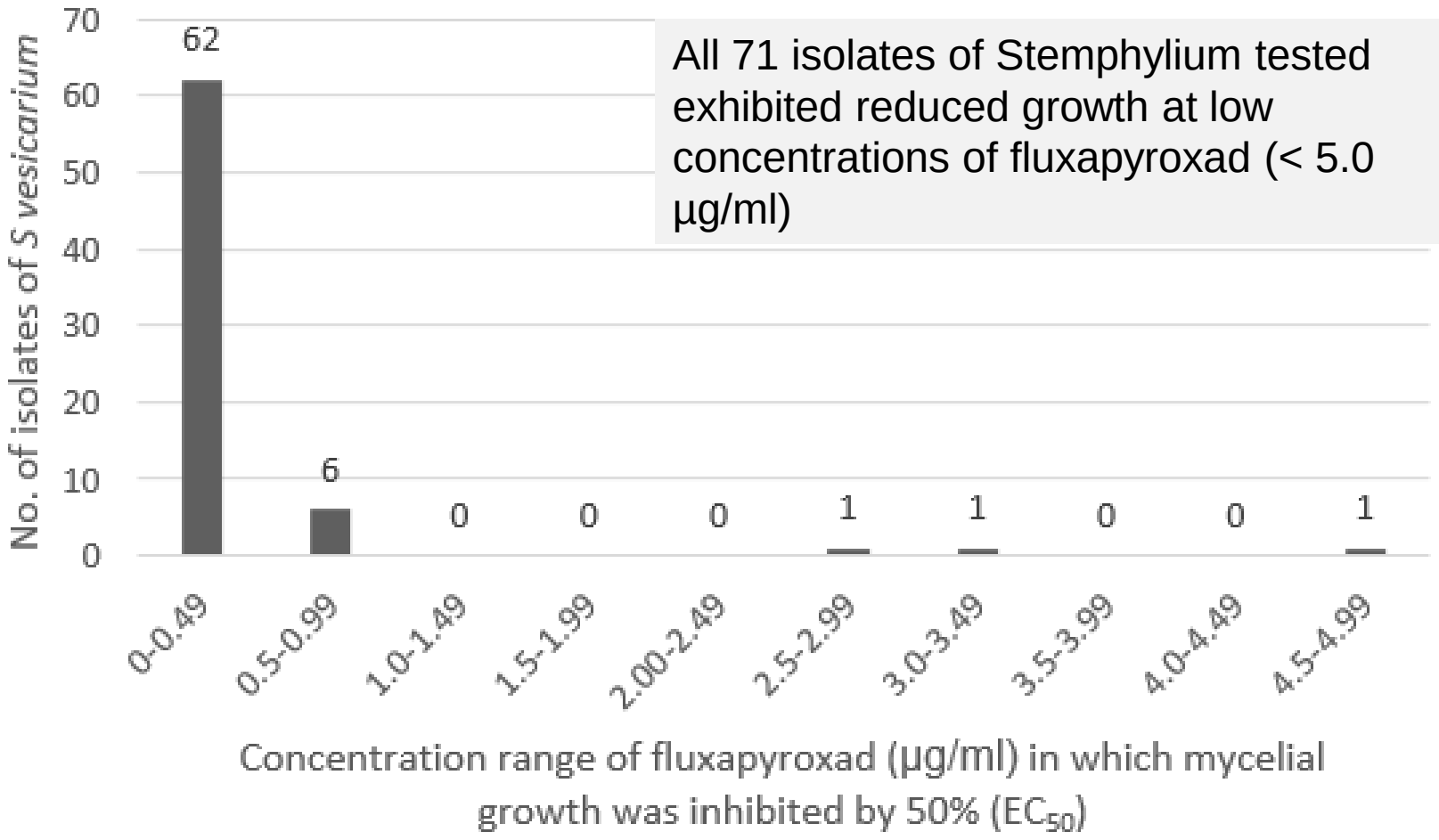
FRAC 3: No evidence of resistance to difenoconazole (an active of Quadris Top® and Inspire Super®)



FRAC 9: Evidence of some resistance to cyprodinil (an active ingredient of Inspire Super®)

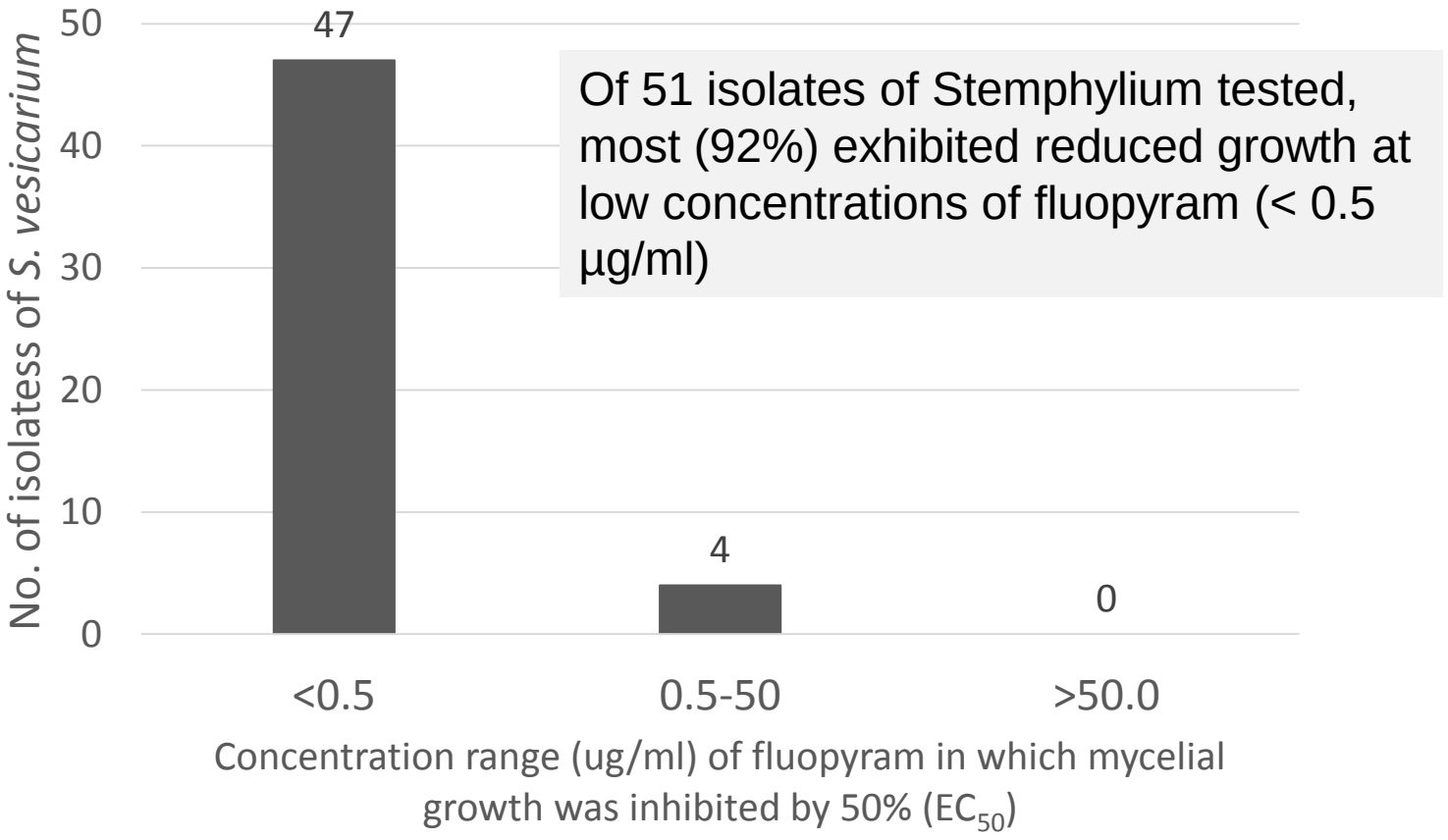


FRAC 7: No evidence of resistance to fluxapyroxad (an active ingredient of Merivon®)



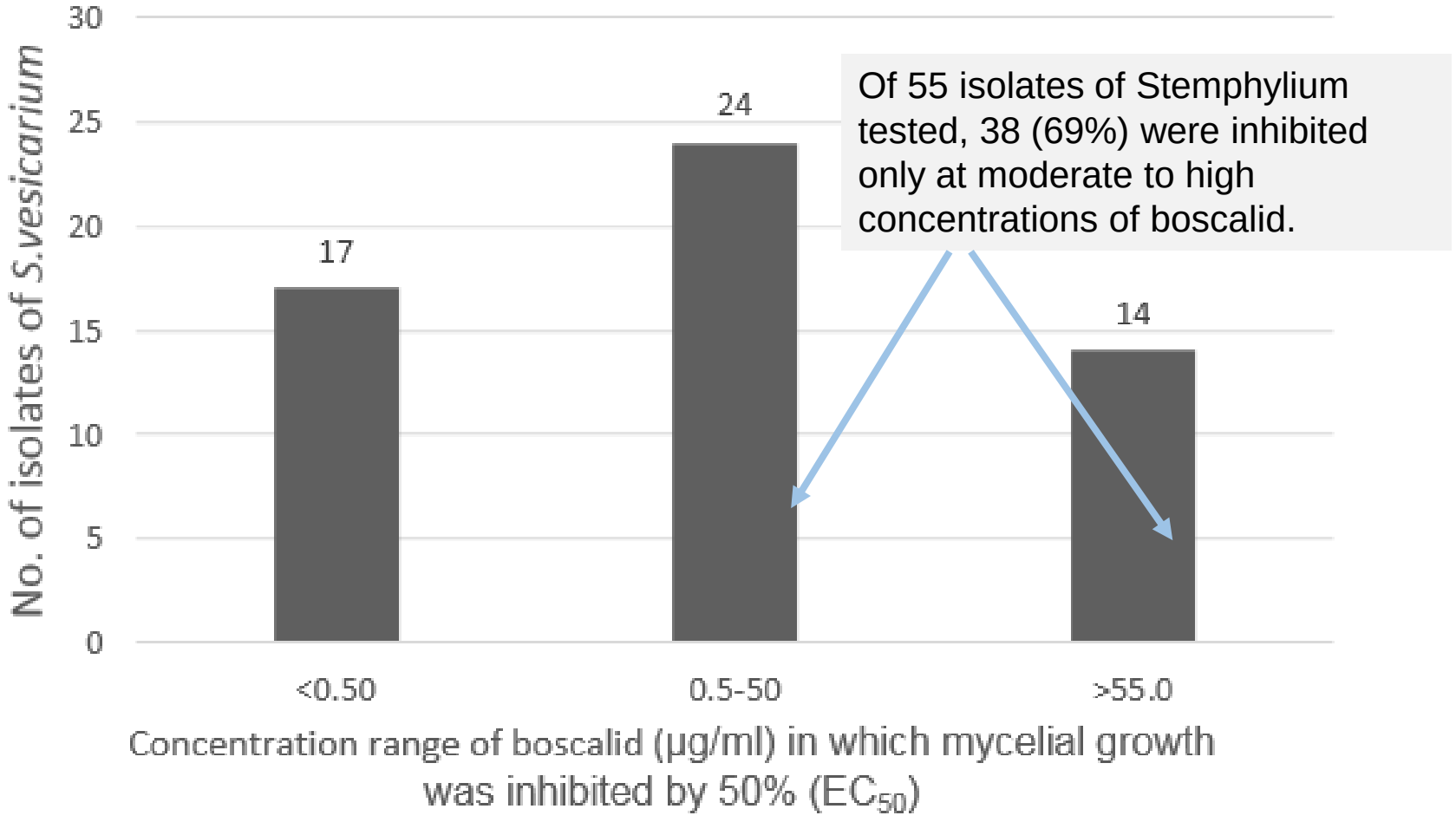
All 71 isolates of Stemphylium tested exhibited reduced growth at low concentrations of fluxapyroxad (< 5.0 µg/ml)

FRAC 7: No evidence of resistance to fluopyram (an active ingredient of Luna Tranquility®)



Of 51 isolates of Stemphylium tested, most (92%) exhibited reduced growth at low concentrations of fluopyram (< 0.5 µg/ml)

FRAC 7: Evidence of resistance to boscalid (an active ingredient of Endura® and Pristine®)



	FRAC 2	FRAC 3	FRAC 7	FRAC 9	FRAC 11
Quadris®					Azoxystrobin ☹
Quadris Top®		Difenoconazole ☺			Azoxystrobin ☹
Inspire Super®		Difenoconazole ☺		Cyprodinil 😐	
Rovral®	Iprodione ☺				
Luna Tranquility®			Fluopyram ☺	Pyrimethanil 😐	
Merivon®			Fluxapyroxad ☺		Pyraclostrobin ☹
Pristine®			Boscalid ☹		Pyraclostrobin ☹
Endura®			Boscalid ☹		
Scala®				Pyrimethanil 😐	

Challenges

- Design a fungicide regime which:
  - preserves the efficacy of the remaining FRAC groups.
  - is cost effective.
  - provides good control of Stemphylium leaf blight (and other pathogens).
- There are very few other FRAC groups of fungicides and those tested so far have proved ineffective.
- Develop an integrated management strategy incorporating other non-fungicidal strategies to take some selection pressure off fungicides.

Other work

- Federal Capacity Fund (2016-2019), NYFVI SCBG (2016-2018), NIFA-CPPM (2016-2018)
  - Varietal susceptibility (greenhouse)
  - Agronomic factors affecting disease severity e.g. plant stress, thrips, foliar feed etc. (greenhouse and field).
  - Identify sources of inoculum into crops e.g. seed, weeds, **onion debris**? (laboratory and field monitoring of crops)
  - Management of sources of inoculum e.g. burial of onion debris?