

# *Prevalence, Level, & Survival of Salmonella in Spices offered for Import into the United States*

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## **Salmonella in Spices/Seasonings – Concern for Public Health**

- *Salmonella* hazard in 95% of U.S. food recalls associated with spices, FY1970-FY2003
- Three large-scale illness outbreaks in U.S. attributed to *Salmonella*-contaminated spices/seasonings: 2007-2010
- *Spices & Seasonings* category among the top 3 for Reportable Food Registry primary entries & *Salmonella* primary entries: Year 1 & 2

# FDA Research

1. How common is *Salmonella* contamination?
2. How extensive is the contamination?
3. How long will *Salmonella* survive in spice?

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*Pathogens & Filth in Spices Risk Profile Team* (FDA & CDC)

# ***1. How common is Salmonella contamination?***

## **Determine PREVALENCE**

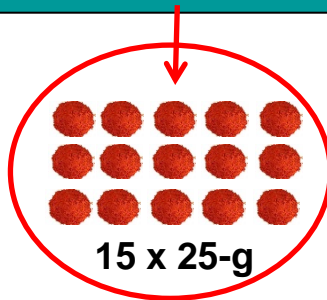
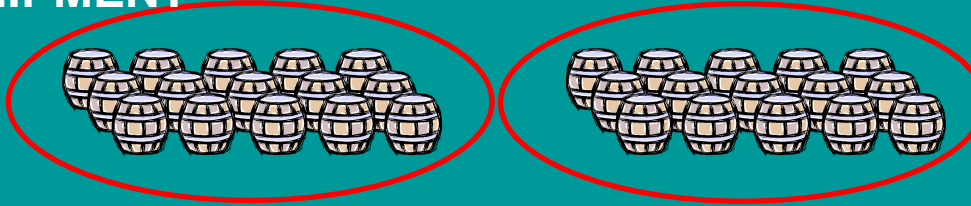
***Analyze annual imported foods  
Surveillance Sampling Test Results  
FY2007—FY2009***

**2844 Shipments of Imported Spice**

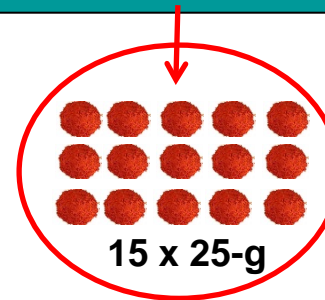
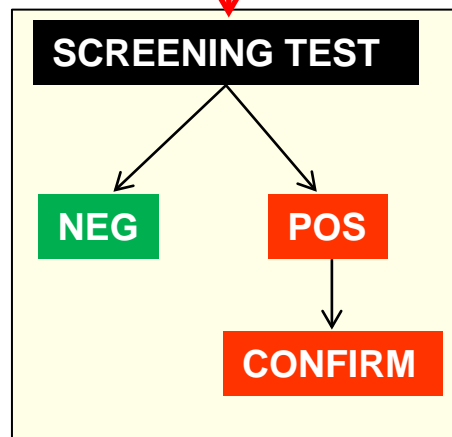
**17508 Shipments of Other Imported Foods**

# FDA Surveillance Sampling Protocol

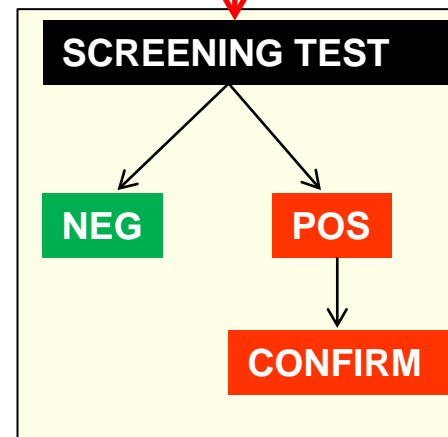
## SPICE SHIPMENT



Composite 1

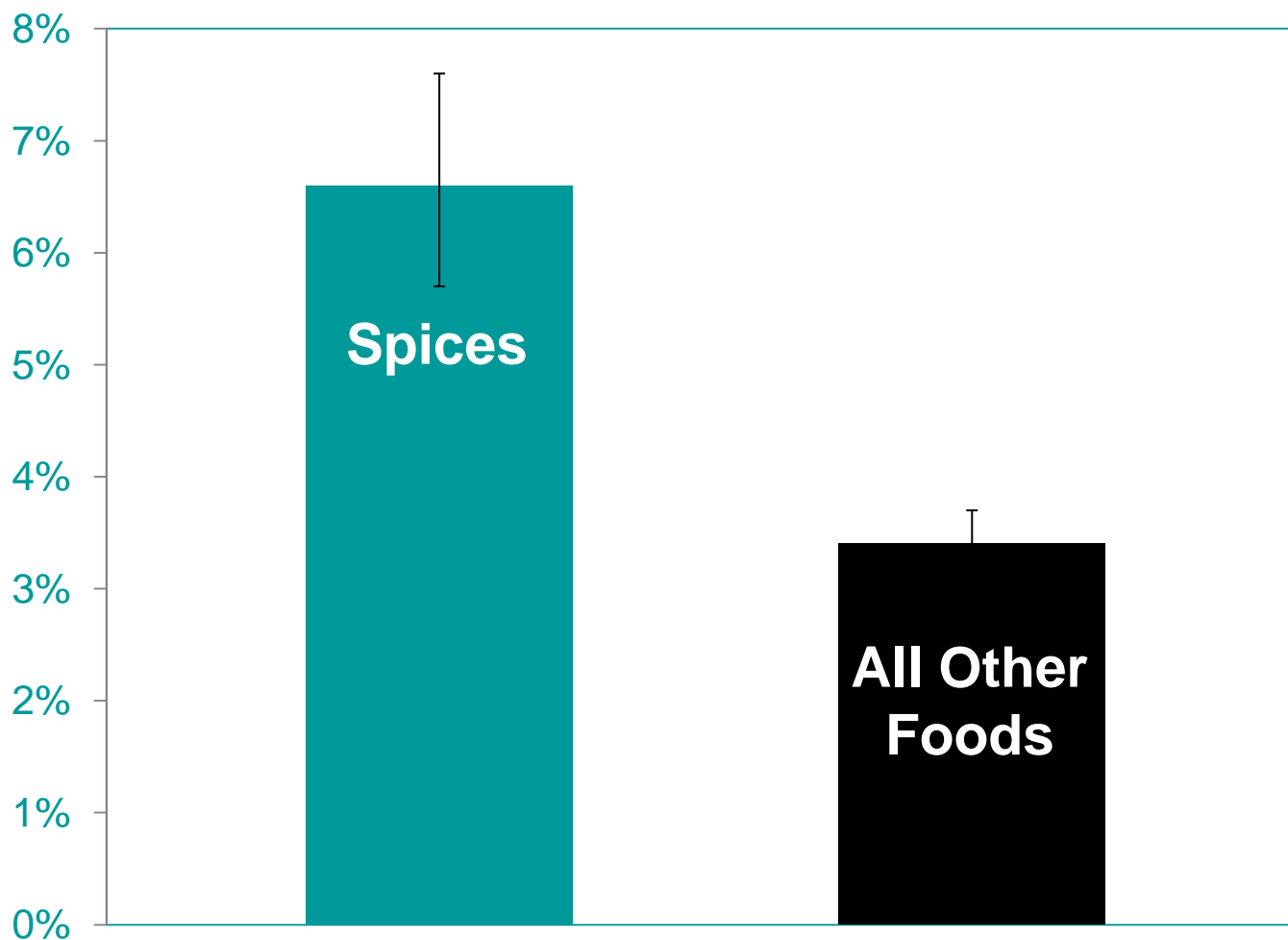


Composite 2

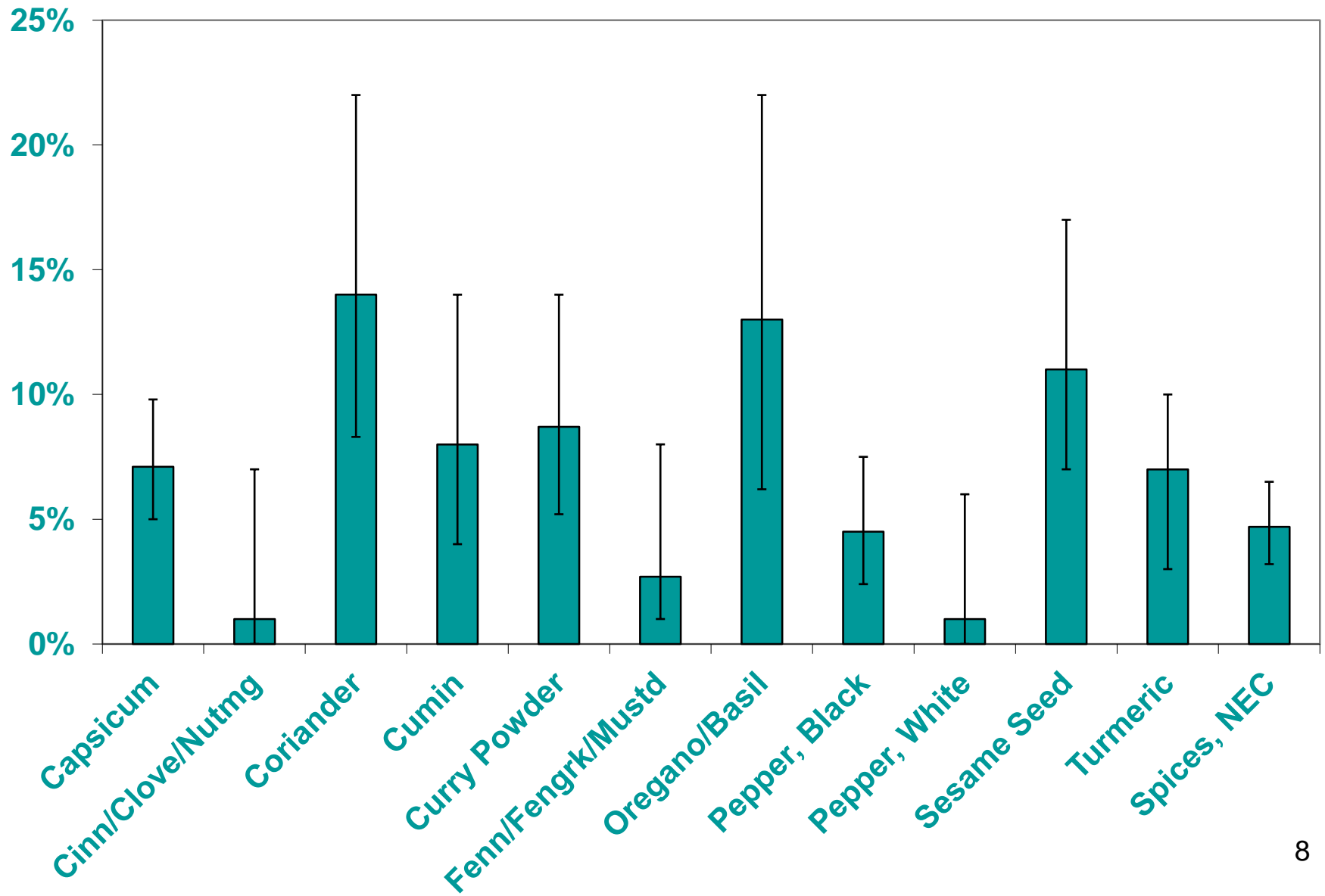


***If either composite tests positive = Contaminated Lot***

## Prevalence of *Salmonella* in Imported Spices/Other Foods FY2007-2009

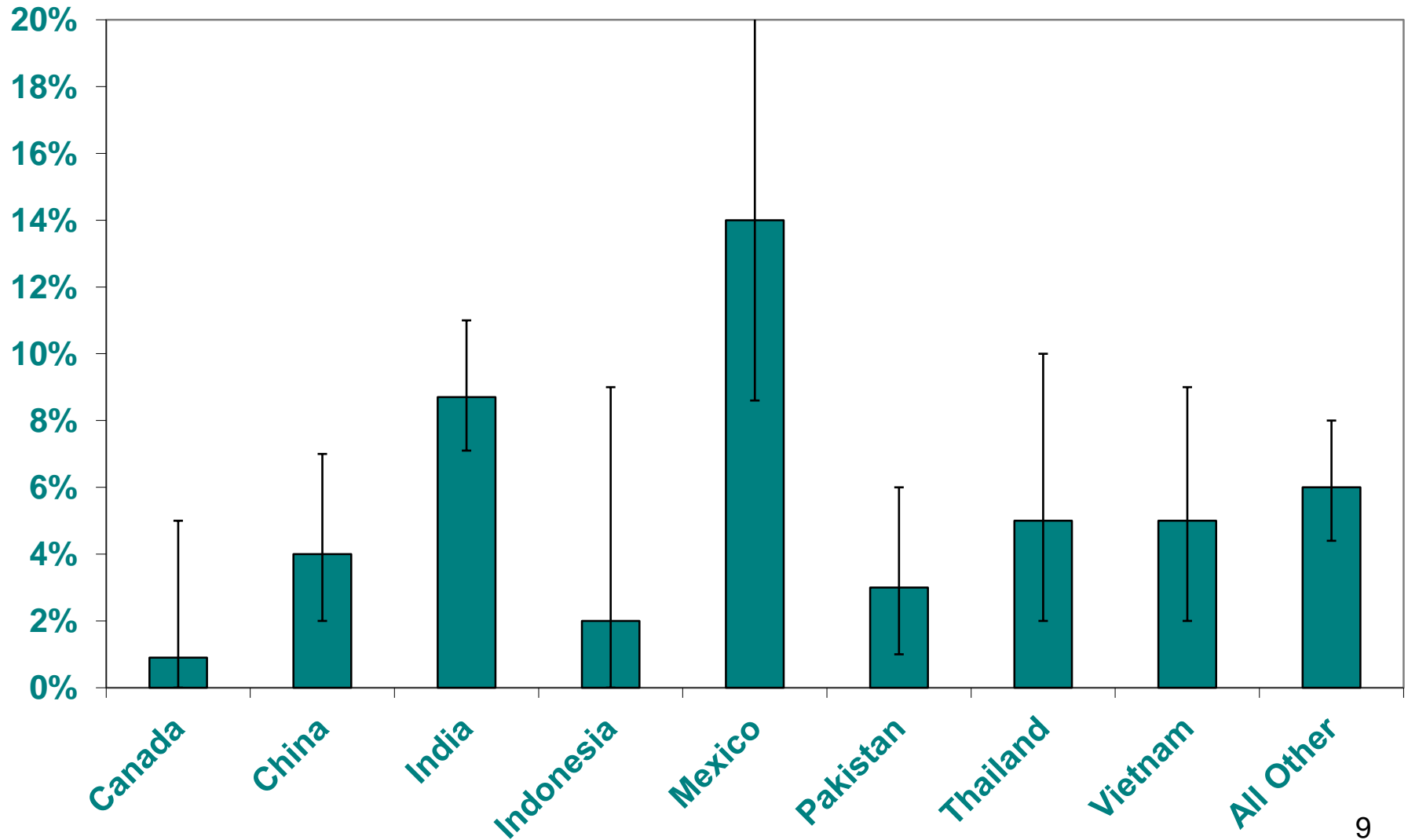


# Prevalence of *Salmonella* by Spice Type





## Prevalence of *Salmonella* by Export Country



## 2. How extensive is the contamination?

**Determine LEVEL & DISTRIBUTION**

**SAMPLE , SCREEN, & ENUMERATE**

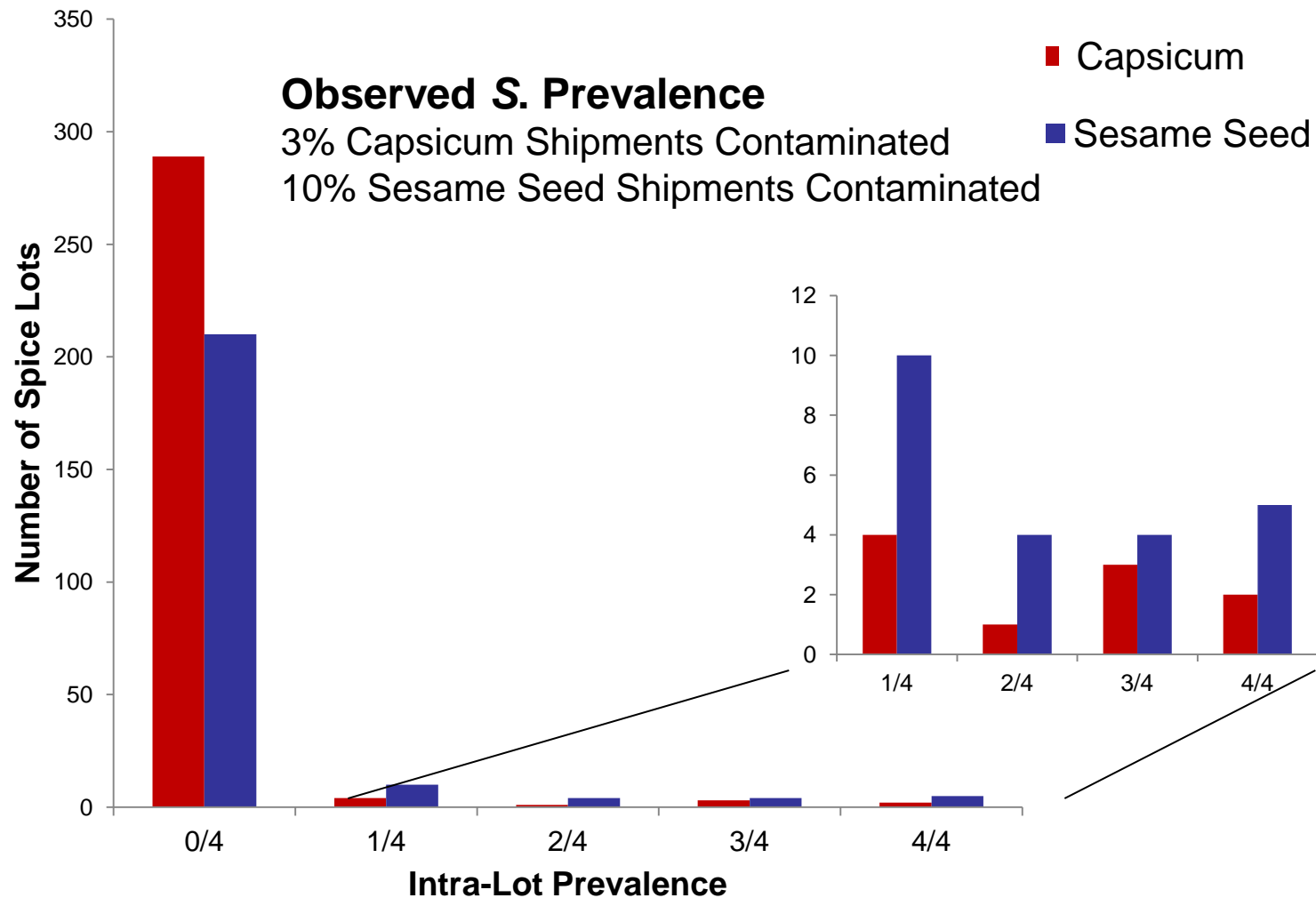


**299 Imported Capsicum Shipments**

**233 Imported Sesame Seed Shipments**



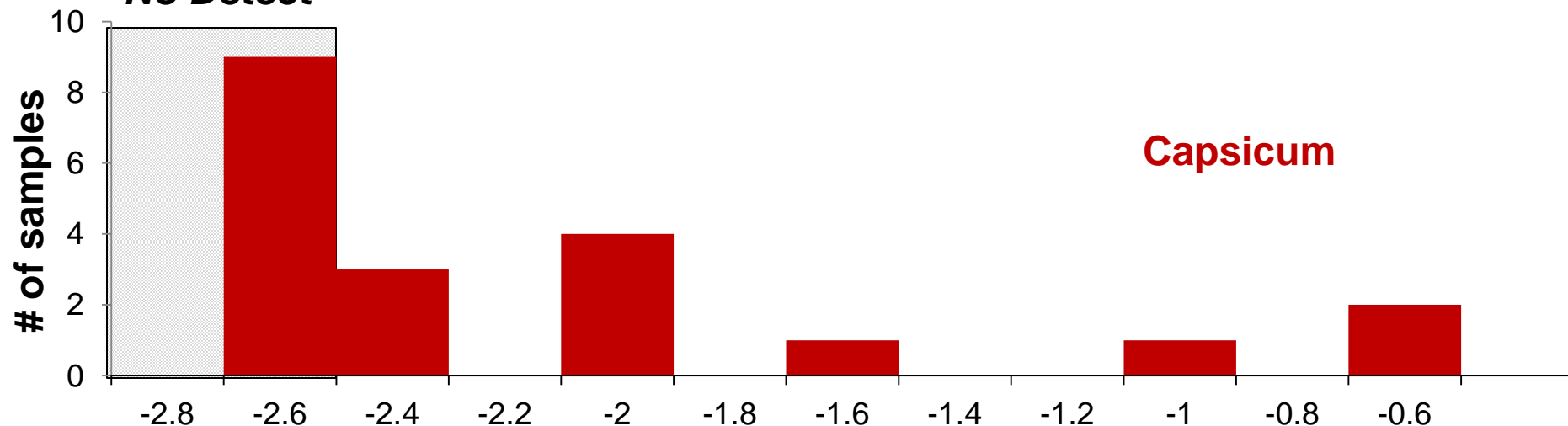
# Screening Test Results



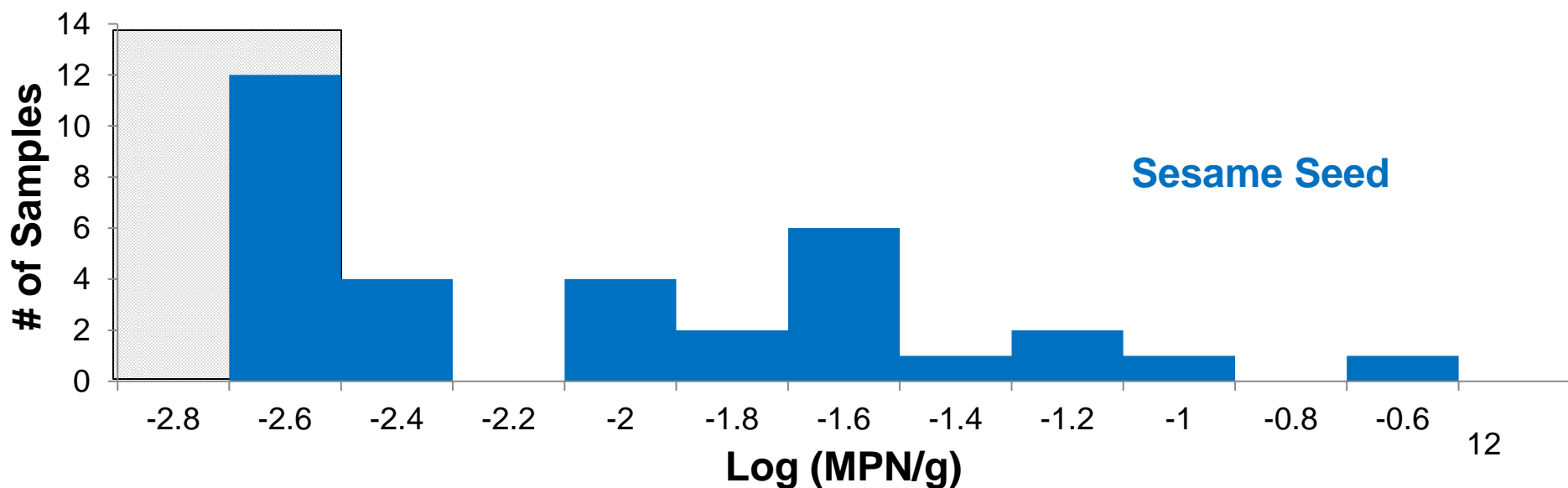


## MPN Values - Contaminated Lots

*No Detect*

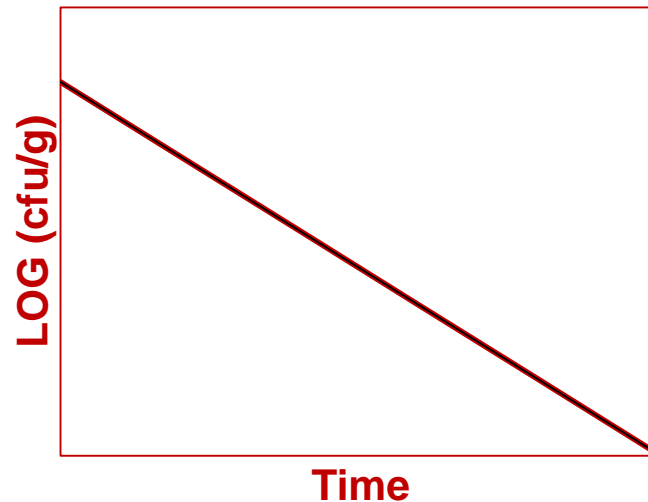


**Sesame Seed**



3. How long will *Salmonella* survive in spice?

**Determine DECAY KINETICS**



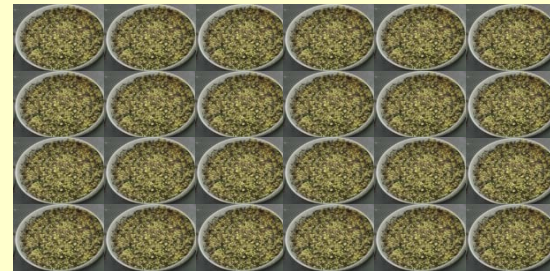
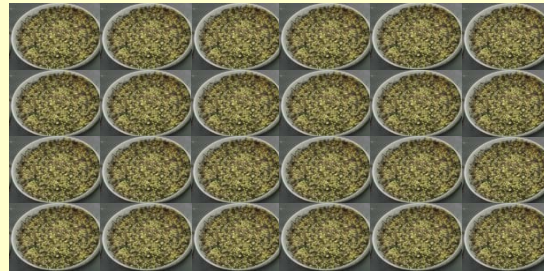
# Salmonella Survival Experiments



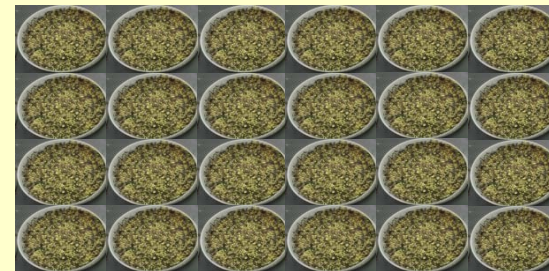
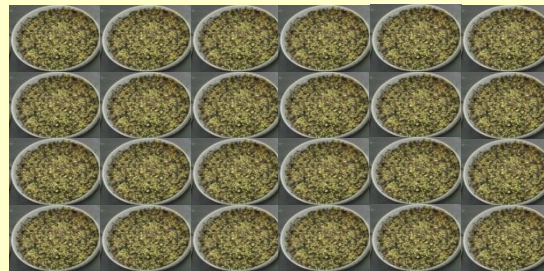
25 °C

35 °C

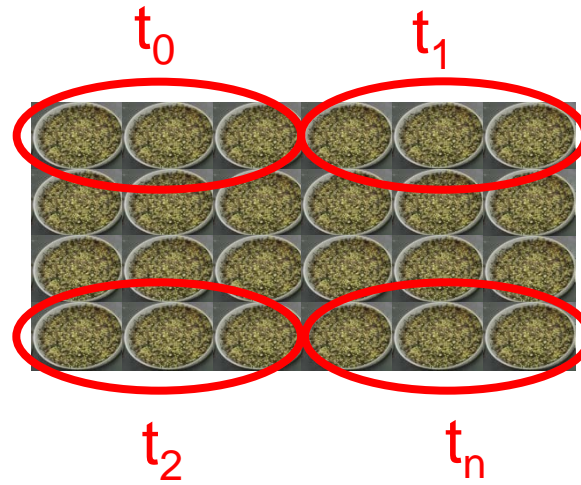
$\geq 97\%$  RH



$\leq 30\%$  RH



# Time Evolution



$t_0 :$



cfu/g



cfu/g



cfu/g

$t_n :$



cfu/g



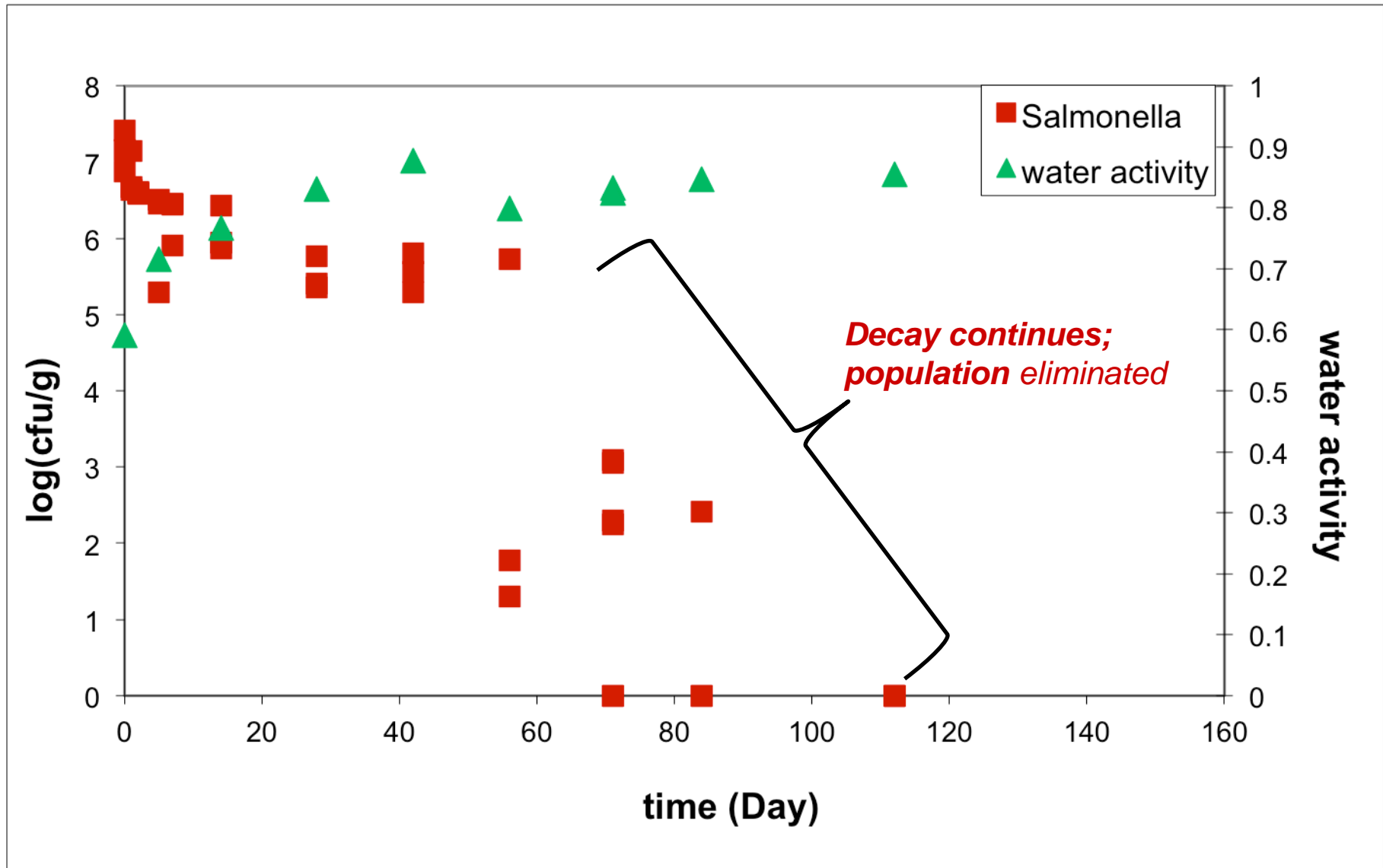
cfu/g



cfu/g

# Survival of *Salmonella* in black pepper

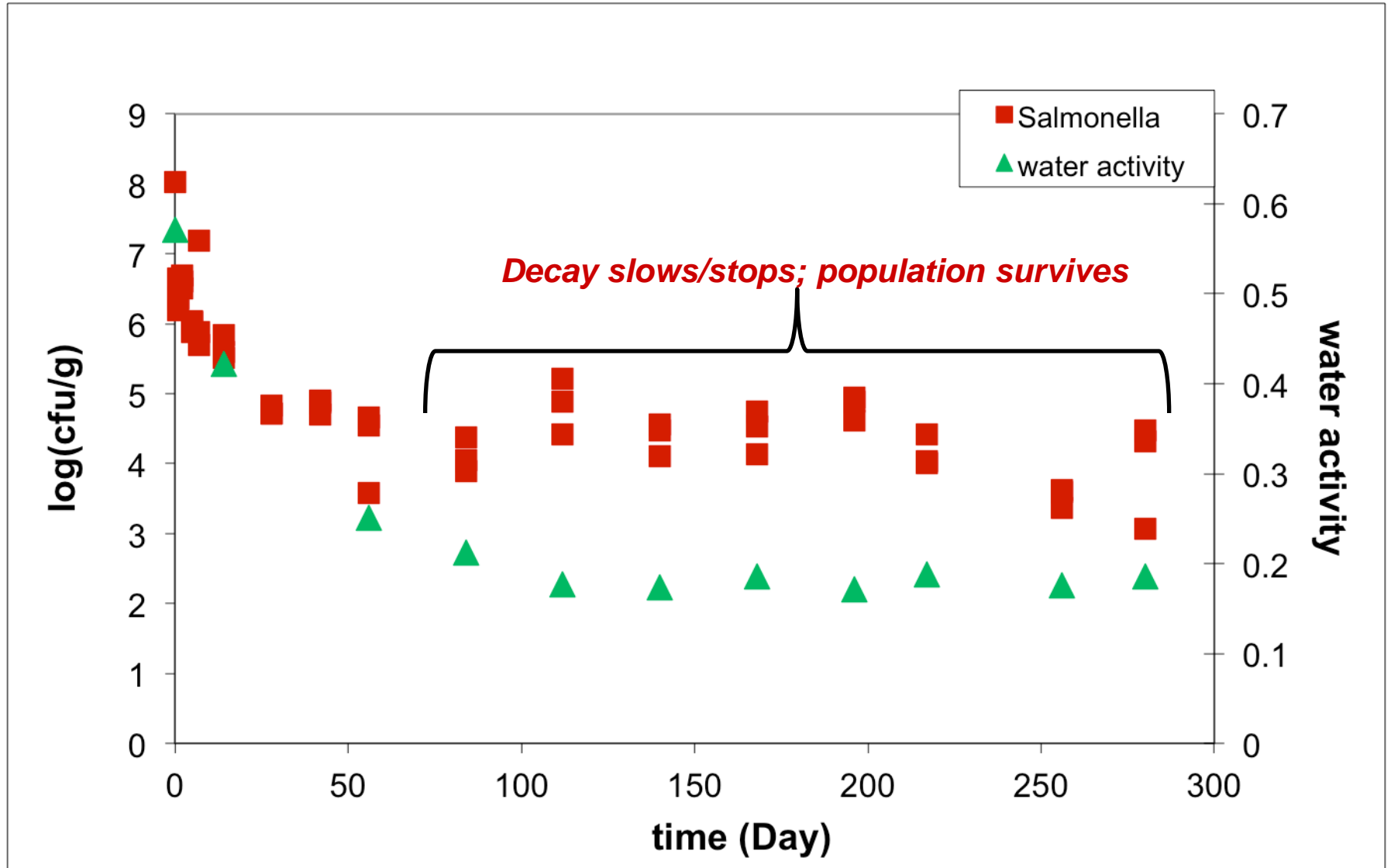
25 °C,  $\geq 97\%RH$





# Survival of *Salmonella* in black pepper

25 °C,  $\leq 30\%RH$



# Conclusions

- A wide diversity of imported spices exported from a wide range of countries are found to be contaminated with *Salmonella* when sampled at the point of entry into the U.S.
- Some differences in prevalence among groups of spices/export countries exist.
- The levels of *Salmonella* in examined imported capsicum and sesame seed lots were determined to average less than 1 MPN/g.
- *Salmonella* distribution in contaminated capsicum spice shipments (mostly ground/cracked) appear to be, on average, Poisson at U.S. entry.

# Conclusions

- *Salmonella* can survive for long periods of time when stored at room temperature at low water activity
- Water activity affects the length of survival; survival is shortened at high water activity
- Increasing temperature decreases survival time at high water activity

# QUESTIONS

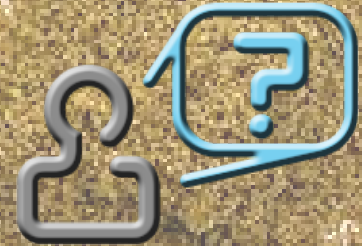


Image: <http://siamspices.com/images/categories/dry%20spices.jpg>