

Epidemiology of mycoplasma mastitis in dairy cows

Lawrence K. Fox
Washington State University
Pullman, WA 99264



Mycoplasma mastitis

- A difficult disease to get a handle on:
- Is it contagious, with udder to udder spread?
- Or, are there mycoplasma Mary cows- asymptomatic carriage which account for blooms?



Mycoplasma Mastitis: Emerging trends with an emerging disease

- Introduction- emerging problem?
- History of mycoplasma mastitis
- Detection
- Dissemination of the disease: Risk Factors
 - Experimental findings
 - Field conditions
- Conclusion
 - Contagious- udder to udder or other organ to udder?
 - Outbreak bloom that is short lived?

The old Air Force One

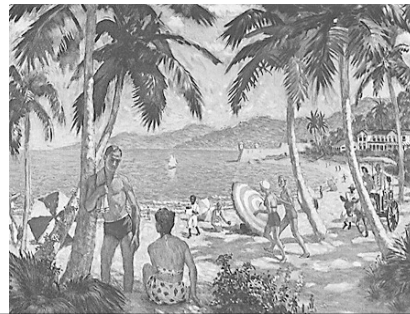


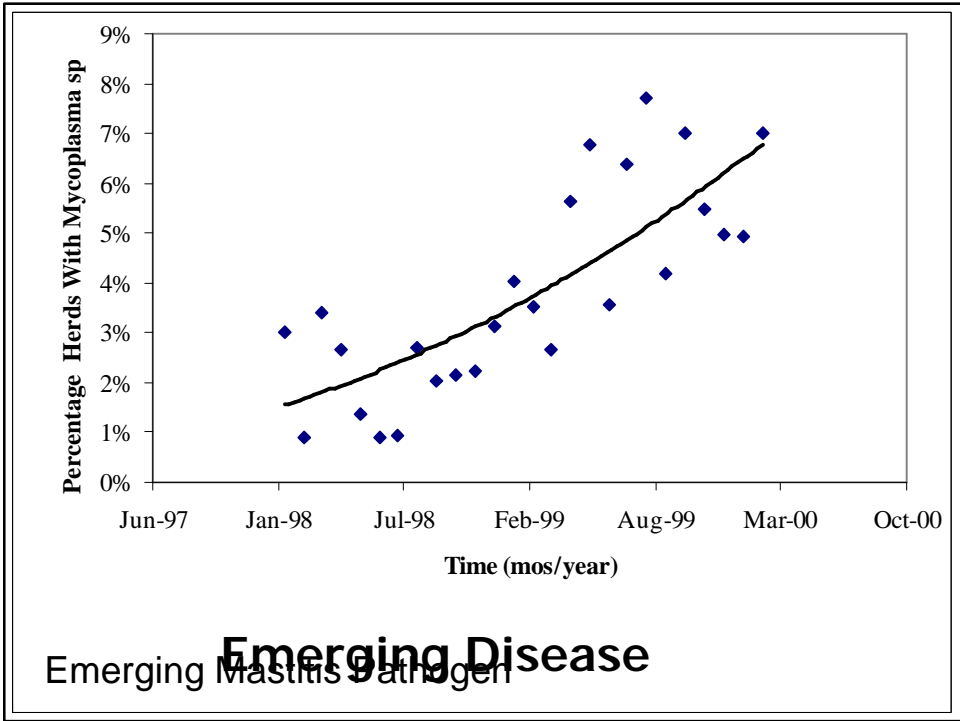
Exotic Problem?

- A. J. Bramley and F. H. Dodd (Journal of Dairy Research, 51:481)
- “Problems of mycoplasma mastitis seem to have been greatest in the USA, particularly in California, although this partly reflects the degree of enthusiasm of the search for the causative agent”

Old Paradigm

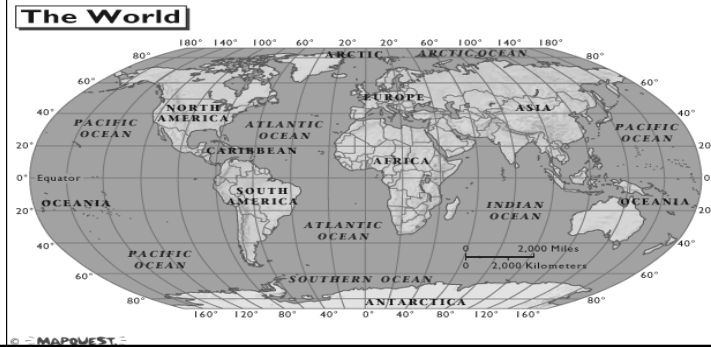
Highly contagious
“Hidden” disease
From California (exotic)



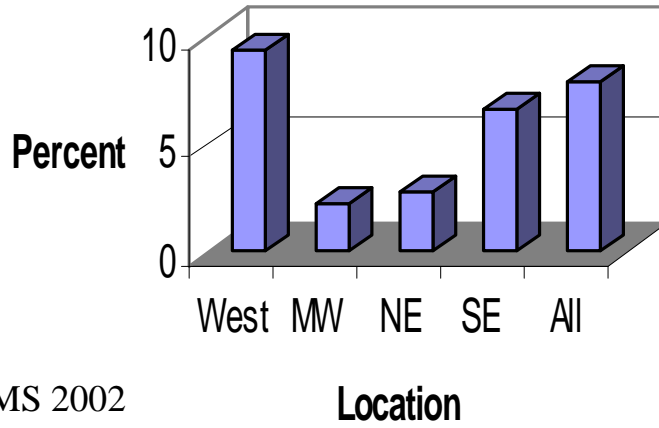


New Reports: Previously Unreported

Prince Edward Island, Canada (Olde Riekerink et al., 2006),
 Northern Greece (Filioussis et al., 2005),
 Saudi Arabia (Al-Abdullah and Fadl, 2006)

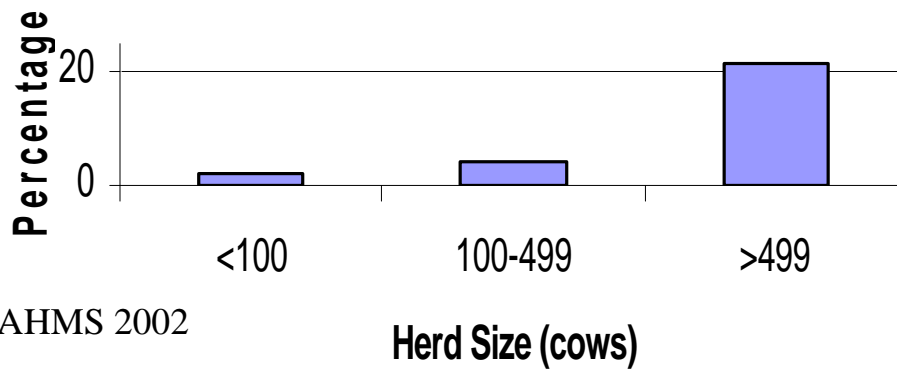


Percent Myco. Positive Bulk Tanks



NAHMS 2002

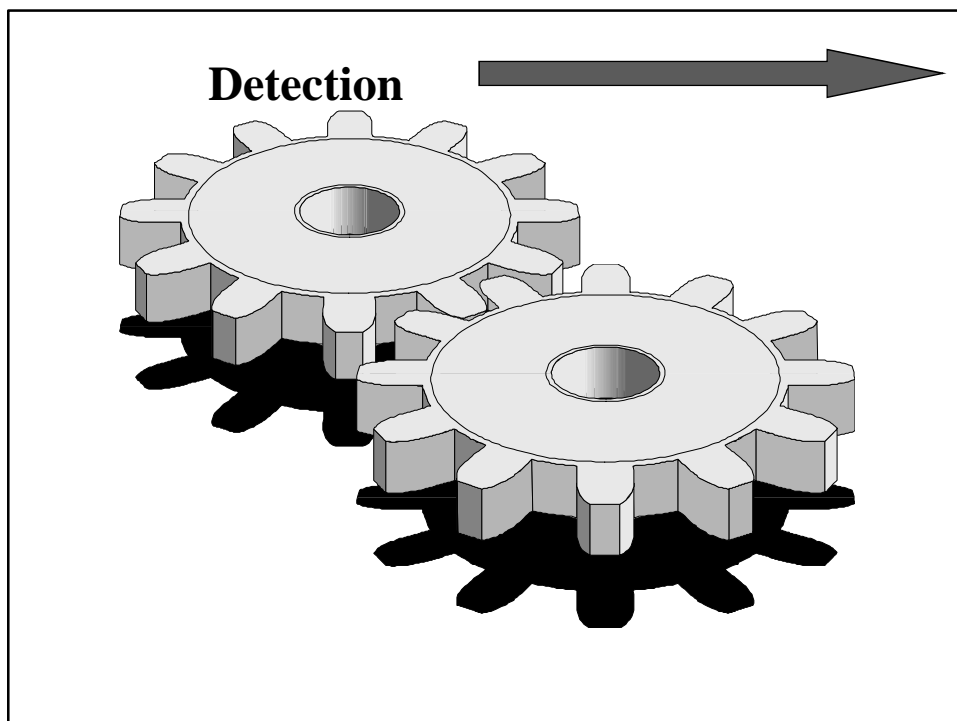
Percentage Farms with Myco in Bulk Tanks



NAHMS 2002

Herd size and Risk

- Expanding herds world wide
- Greater prevalence, by herd and by cow
- Is there a relationship between between herd size (expansion) and mycoplasma mastitis?.....
-perhaps the strongest risk factor for the disease

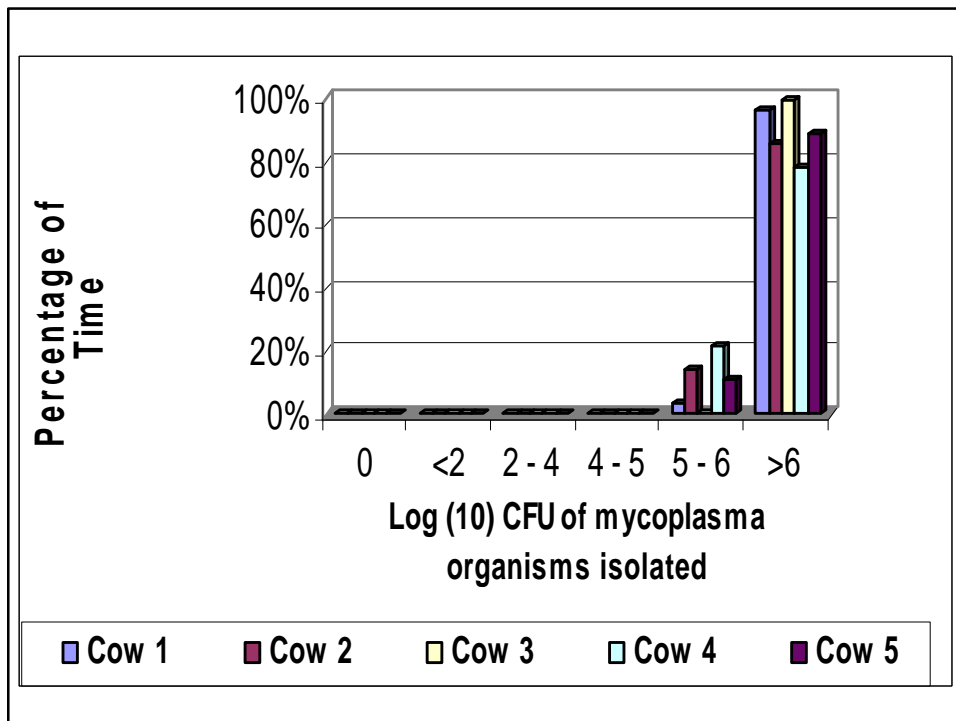
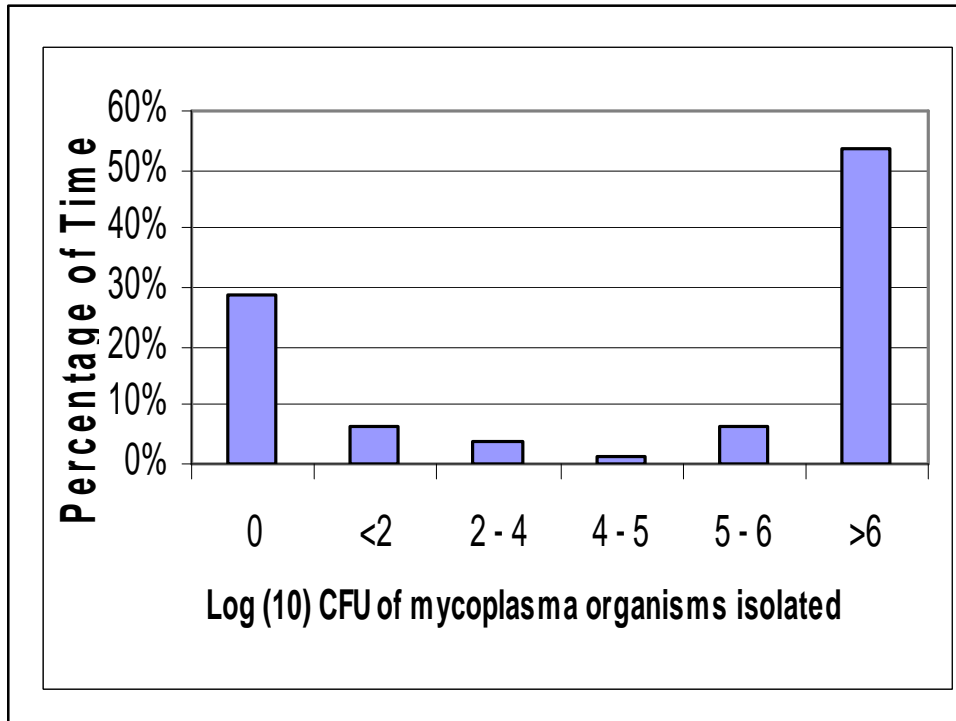


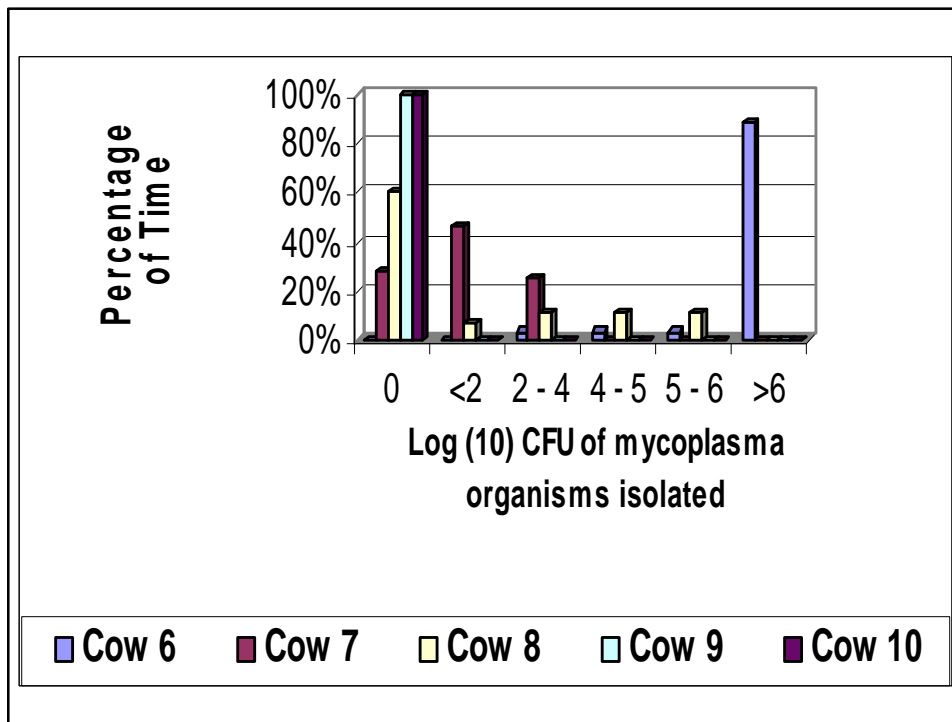
Detection

- Variation in shedding of mycoplasma in milk and effect on culture-
- Improvement in recovery via centrifugation
- Storage of samples
 - Freezing
 - Refrigeration

Detection

- Daily milking of 10 cows with IMI for 28 d
- Collection of quarter and composite milk samples
- **Goal:**
 - To determine the shedding patterns of cows with mycoplasma mastitis
 - And thus to determine sensitivity of detection of cows with IMI by milk culture (Cow/BT)



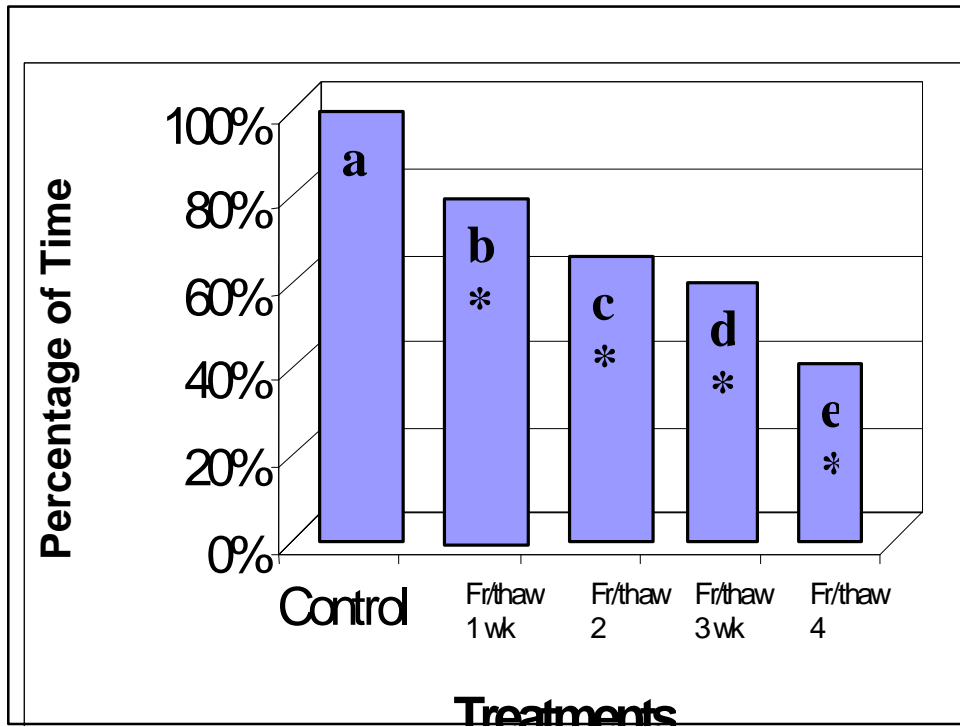
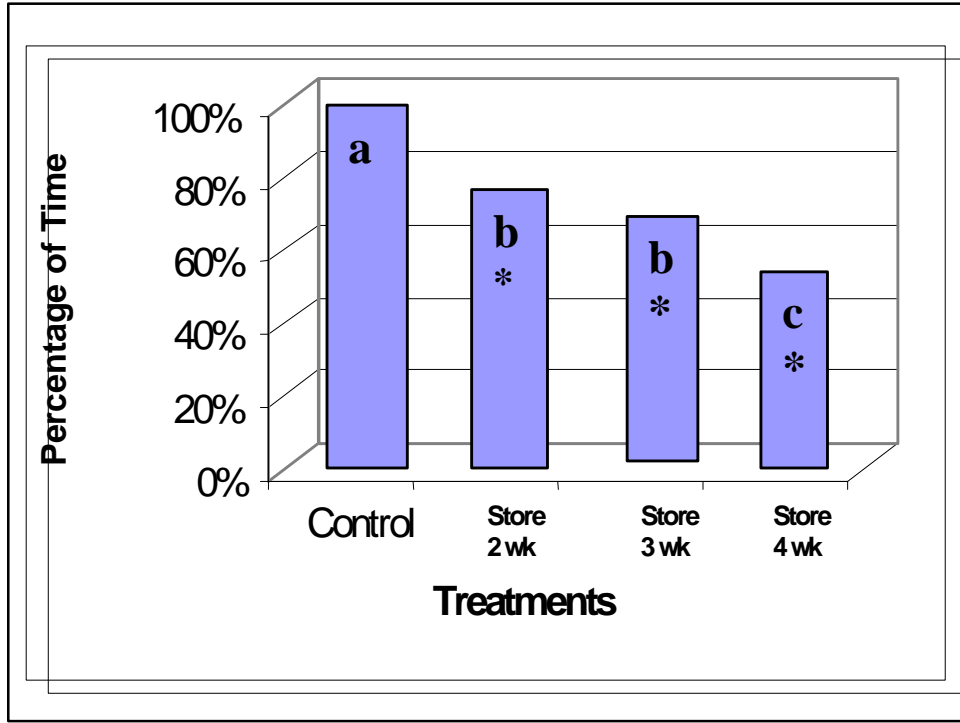


Significance of Shedding Pattern Study

- We estimate that approximately 30% of the “time” that a single cow would not shed sufficient numbers of mycoplasma to be detected in bulk tank milk of herd size between 330-2000 cows.
- That is, 30% of the time a single cow with mycoplasma mastitis would not shed enough pathogen to lift numbers > 10 CFU/ml

Storage Test	Treatment Number	Method of Storage Sample
	Control	Sample Plated on week 1
	1	Sample Frozen for 1 week, thawed, refrozen
	2	Sample Frozen for 2 weeks, thawed, refrozen
	3	Sample Frozen for 3 weeks, thawed, refrozen
	4	Sample Frozen for 4 weeks, thawed, refrozen
	5	Sample Frozen for 2 weeks, thawed
	6	Sample Frozen for 3 weeks, thawed
	7	Sample Frozen for 4 weeks, thawed

Treatments	Log ₁₀ CFU LSMEAN ¹	Standard Error	P value ²
Control Sample	6.29	0.10	
Freeze Thaw/1 Week	4.64	0.10	<0.0001
Freeze Thaw/2 Weeks	3.69	0.10	<0.0001
Freeze Thaw/3 Weeks	3.01	0.10	<0.0001
Freeze Thaw/4 Weeks	1.86	0.10	<0.0001
Frozen 2 Weeks/Thawed	4.41	0.10	<0.0001
Frozen 3 Weeks/Thawed	4.13	0.10	<0.0001
Frozen 4 Weeks/Thawed	3.18	0.10	<0.0001



Storage by Refrigeration



Concentrate Mycoplasma by Centrifugation

Dissemination

- Experimental infection
- California studies (Jain et al., 1969)



Spread of mycoplasma from inoculated to non-inoculated quarters

■ Cow no.	Day post-inoc	RF	RR	LF	LR
■ 44	0	-	-	-*	-
	1	-	-	+	-
	2, 3	-	-	+	-
	4 to 74	-	+	+	+
■ 1039	0	-	-*	-*	-
	1, 2	-	+	-	-
	3	-	+	+	-
	4 to 34	-	+	+	+
■ 3†	0	-	-	*	-
	1, 2	-	-	+	-
	3 to 32	-	-	+	+

Number of samples yielding *Mycoplasma*/number negative for *Mycoplasma* following intramammary inoculation

■ Cow no.	Blood	Nose	Eye	Vagina
■ 44	0/18	5/9	2/9	3/6
■ Calf	0/8	1/10	1/10	2/10
■ 39	0/10	8/9	5/12	7/10
■ 3	1/21	4/14	3/16	2/17
■ 1221	1/2	2/2	2/1	2/3
■ Total				
■ samples	2/59	20/44	13/48	16/46

Spread of Myco within the Body

- **Does Myco spread from one body site to the mammary gland to cause mastitis?**
- **Update on WSU work- preliminary data:**

Body site study

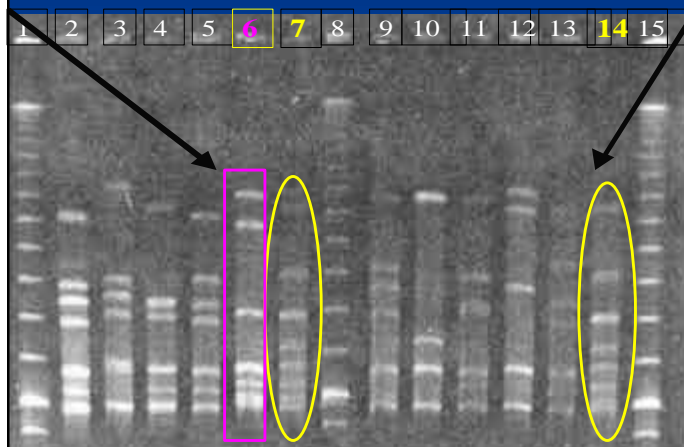
- **7 Cows with myco mastitis were used**
- **Body sites sampled for mycoplasma:**
 - **Mucosal surface samples of the eyes, nares, ear, vagina, and rectum**
 - **Internal organ samples collected at slaughter**

Body Site Samples

- **Pre-slaughter**
 - Mucosal surfaces (eyes, nasal, rectal, vaginal and ocular)
- **Slaughter**
 - Bronchus, lung, lymph nodes (bronchial, mediastinal, and supramammary), spleen, mammary parenchyma, cranial, pericardial, bladder and leg bone joints.

Fingerprint

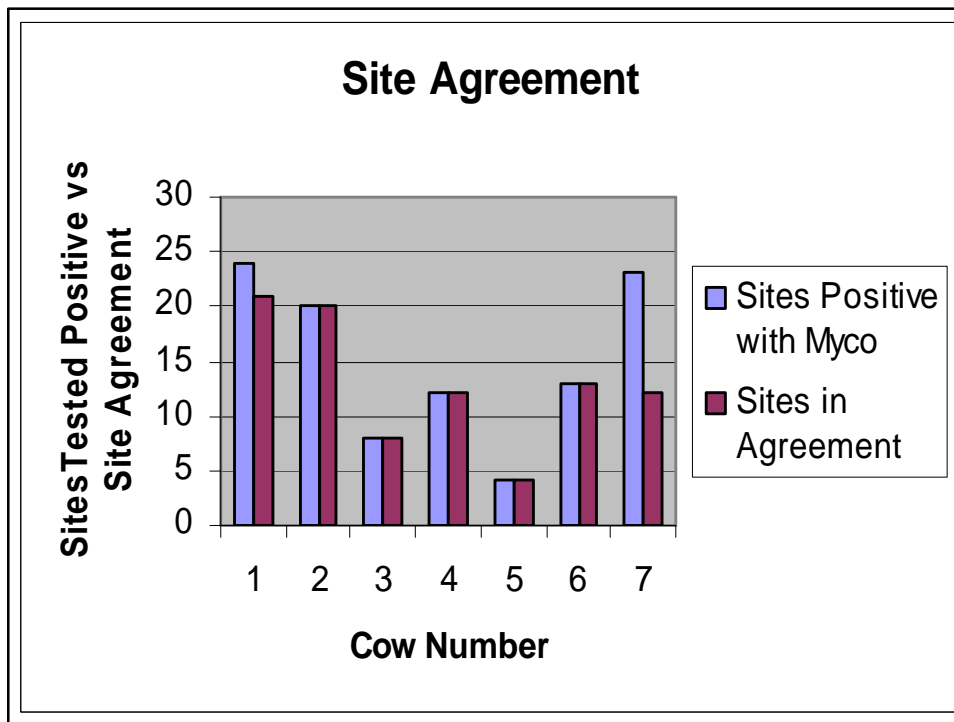
Mycoplasma **The Disease Process**



- ✓ Analysis of PFGE fragments
- ✓ *Sma* I digestion
- ✓ Show distinct pulsed field profiles

(Kusiluka et al., 2000)

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Body Site- Mammary Match

- Do not know direction
 - Mammary gland to body site?
 - Body site to mammary gland?
- Important to know.....

What is the Reservoir?

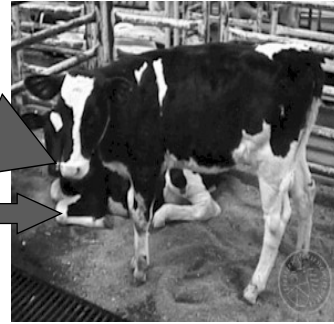


Transmission

- Calves with head tilts, otitis media, calve with myco mastitis?
- Cows with joint problems, develop myco mastitis?
- Is mycoplasma mastitis strictly a udder to fomite to udder transmission problem, that can be controlled by MTH?????.....



↑
Mycoplasma



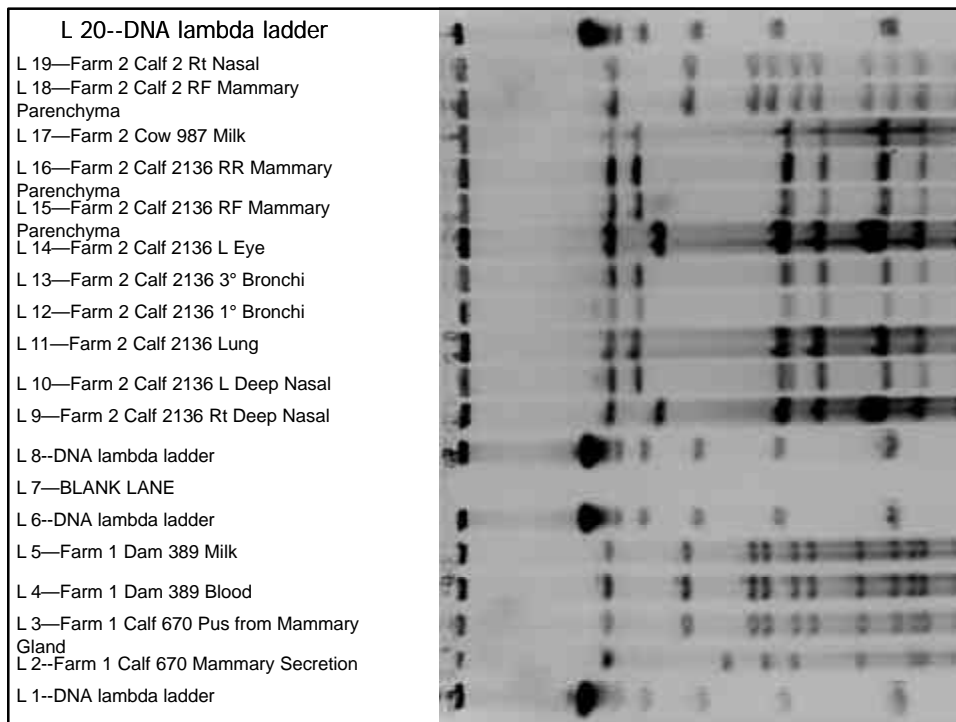
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Non lactating animal involvement

Disease in other organ sites other than
mastitis (arthritis, otitis, **pneumonias...**)

Case Report

- Two adjacent farms, same veterinary svc.
- Six month old heifers with intramammary nodules noted at vaccination time
- *Mycoplasma sp.* isolated from lacteal secretions of these heifers
- Heifers necropsied, tissue samples collected, *Mycoplasma sp.* isolated



Roy and coworkers (2007)

- Prepubertal calf with *M. bovigentialium*
 - Mammary IMI
 - Arthritis (a first with *M. bovig.?*)
- No other animals affected
- No myco mastitis in the lactating herd by BT testing
- Authors suggest that the spread to the mammary gland was from the tarsus

Wilson et al. 2007

- 9 lactating cows in a closed herd
- Arthritis and mastitis were diagnosed
- Suspect *M. bovis*

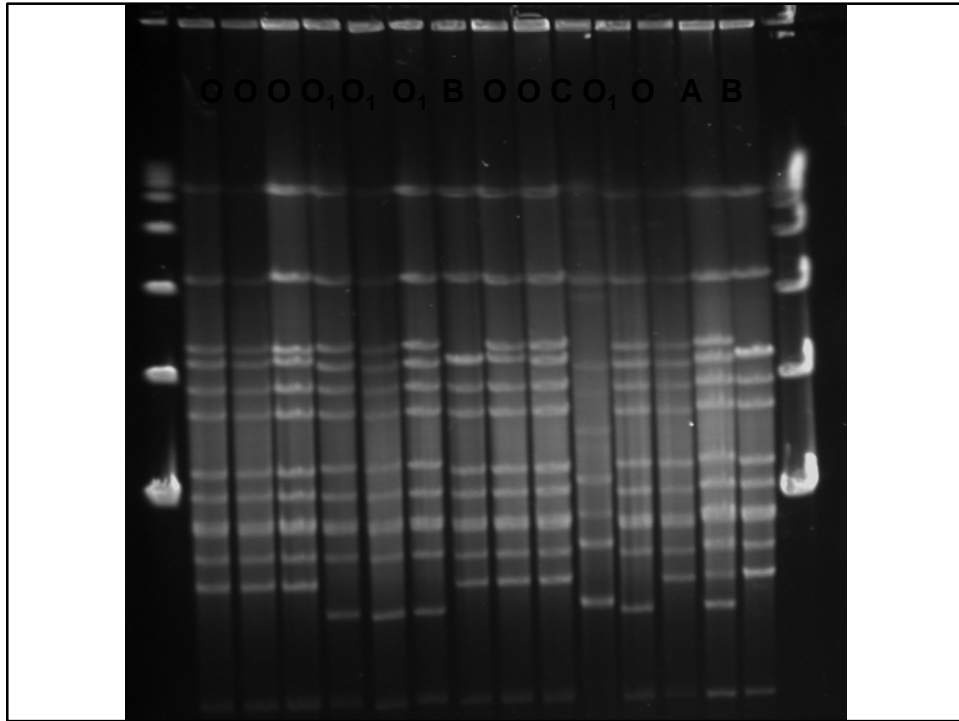
Outbreak at the Univ. of ID Longitudinal Study

- History
 - herd traditionally free of mycoplasma mastitis
 - bull calf with untreatable pneumonia was culled
 - Mycoplasma sp.* in the BT milk, clinical case identified, and culled
 - Second case of mycoplasma mastitis was found and investigation initiated

Mycoplasma mastitis at UI- Cows
Longitudinal Study

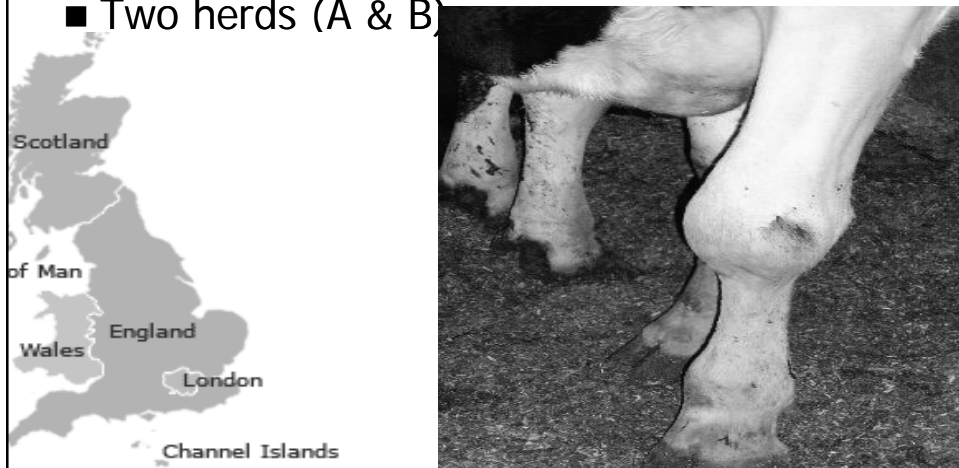
No cow developed IMI after colonization

Mycoplasma mastitis at UI- Calves
Longitudinal Study



Houlihan et al., 2007

- Arthritis, mastitis, and abortions
- Two herds (A & B)



Houlihan et al., 2007

- Herd A (120 cows):
- “Flying Herd” Purchases cattle frequently
- Abortions, only possible abortifacien isolated was *M. bovis*
- Arthritis, some adult cattle with nasal discharge
- 7 known cases of mycoplasma mastitis, more suspected.

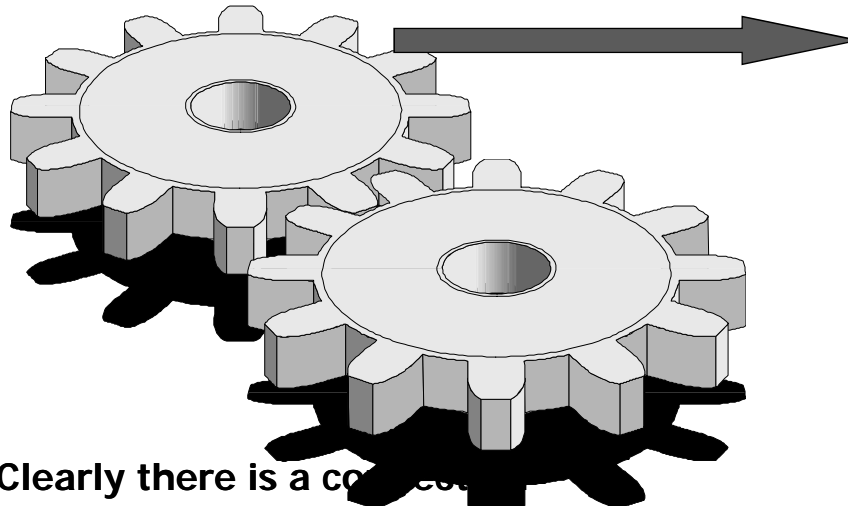
Houlihan et al., 2007

- 17 cows culled due to mastitis (17/120)
- ~50 animals culled due to arthritis (50/120?)
- No arthritic cows became mastitic
- Treatment largely unrewarding, although fluoroquinolones had success as early TX.
- Purchased animals came into the herd with arthritis

Houlihan et al., 2007

- Herd B: Organic herd (84 cows)
- Two confirmed cases of mycoplasma mastitis (*M. bovis*), others suspected.
- Only 1 arthritis
- Problem appeared to resolve in short order.

What does this all mean?



Clearly there is a connection
between body site colonization
and IMI, suspect such
colonization is a risk for IMI.....

“Historical” Reports

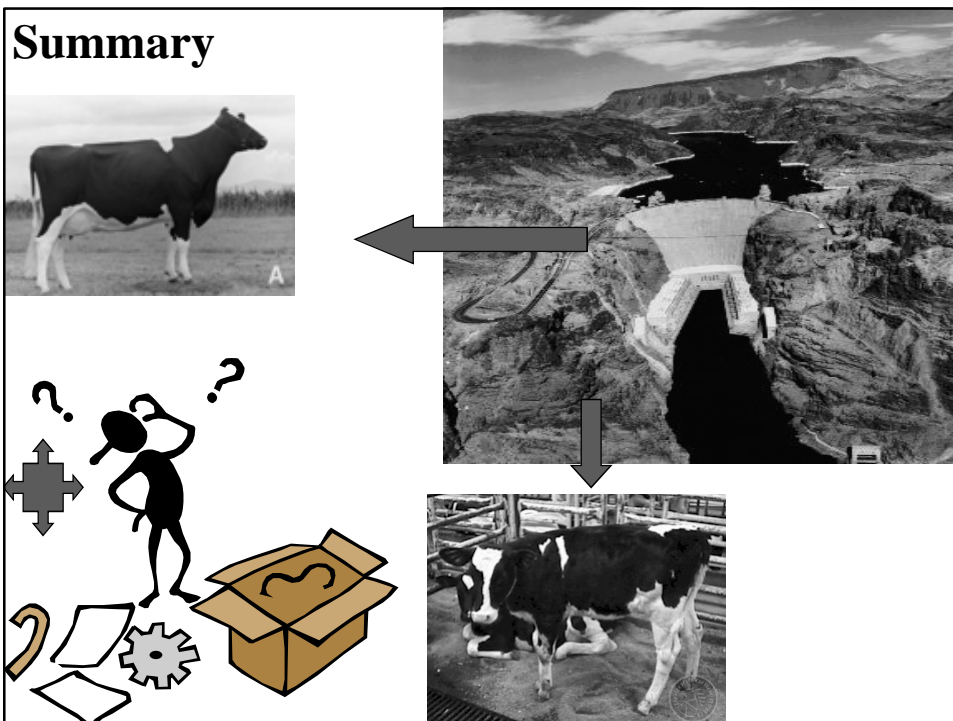
- Evidence for contagious- udder to udder
 - Jasper et al., 1966: several herds, other contagious pathogens, poor MTH, peak in IMI
 - Brown et al, 1990, peak, 6% cows with IMI, segregation, search and destroy appeared to solve the problem
 - Bayoumi et al., 1988, other contagious mastitis, continued for several years
 - Bicknell et al, 1983- ~14% herd with IMI, peak at 5 mos, segregation, search and destroy appeared to solve the problem
 - Jackson et al., 1981, ~10% of the herd with IMI, SCC>800k, strict hygiene reported to solve the problem

“Historical” Reports

- Evidence for the “bloom”- nature of outbreak is not udder to udder
 - Bicknell et al., 1978: IMI appeared in dry cows of 2 dairies, not a lactating cow prob.
 - Mackie 1986: 85/140 dry cows with IMI, 16/101 lactating cows, vaginal swabs +
 - Mackie et al., 2000: Dry cows and recently fresh heifers affected.
 - Gunning and Shepherd, 1996: 4 heifers and 5 cows with IMI over 7-10 period, then ended, only 4 culled

Take Home Points

- Traditionally myco was seen as a contagious mastitis pathogen
 - Transmission at milking
 - Expanding herds were at risk
- Yet current and historical observations suggest outbreaks not a result of failure of MTH-
Perhaps, (a)symptomatic carriage from an extramammary site.....



Summary

- Previous data, and longitudinal studies (UI) indicate that mycoplasma mastitis is linked to disease and colonization at other body sites.
- This linkage has been known for some time (Boughton, 1979; Jasper, 1981)

Summary

- "*Mycoplasma bovis* may be present in other organ systems in dairies without mycoplasma mastitis. Presumably this represents a threat of future mammary infection. We do not know how often this occurs or how great the threat. We do know that mycoplasma mastitis is usually very costly.....and much work remains...to control and/ prevent these losses."

Jasper, 1981.

Summary

- From 3 WSU studies we know that different strains of *Mycoplasma sp.* can reside on a farm.
- The mastitis causing strains in these studies colonized different sites of diseased animals, along with other strains, and in the longitudinal study, for long periods of time. Yet the outbreak may be short lived.

Summary

- **The longitudinal study indicated that colonization did not appear to precede intramammary infection.**
- **Nor was colonization apparent during and after the intramammary infection.**
- **The risk factors for the development and maintenance of an outbreak (the "bloom") appear to be rather short lived- immunity may develop.**
- **Suspect changes to the outbreak strain genome**

Conclusion

- 1) *Mycoplasma mastitis* may be a different threat to dairy herds than dogma of yester-year would suggest
 - Often dairy herds have adopted MTH strategies that have led to reduced contagious mastitis
 - Perhaps the majority of new reports of *mycoplasma mastitis* suggest the disease has ties to other organ sites, short duration.

Conclusion

- 2) The tie between the carriage of *Mycoplasma sp.* at non-mammary body sites with mastitis has been known for many years
- 3) But, the true risk this non-mammary carriage presents to udder health is not clear
- 4) Slow growth and fastidious requirements of the pathogen in vivo has hampered epidemiological studies

Final Thought

- Importance of fingerprinting isolates in studying the epidemiology of mycoplasma mastitis.

