Babesia development within mammalian and tick vectors

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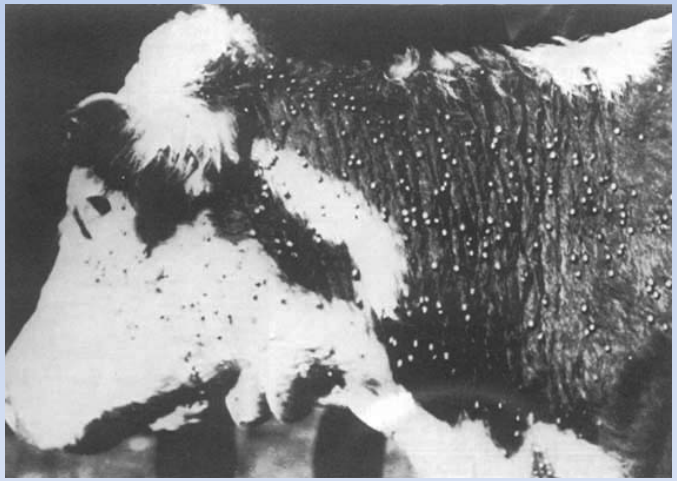
USDA-SAGARPA Cattle Fever Tick Summit
November 2016

- Solve basic and applied problems concerning persistent infectious diseases of domestic animals

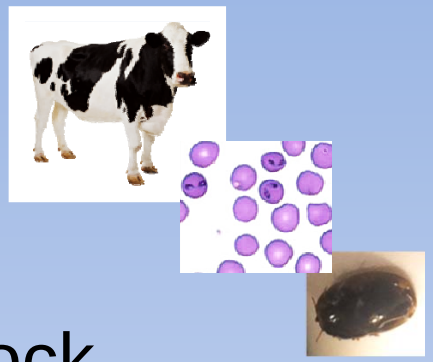
- Tick-borne pathogens of livestock

  - Strategies to control tick-borne pathogens of cattle and horses

Pathogens transmitted by tick vectors remain the major concern and challenge to improve animal health.



Bovine babesiosis

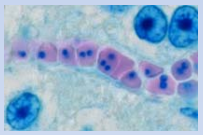


- Most prevalent tick-borne disease of livestock

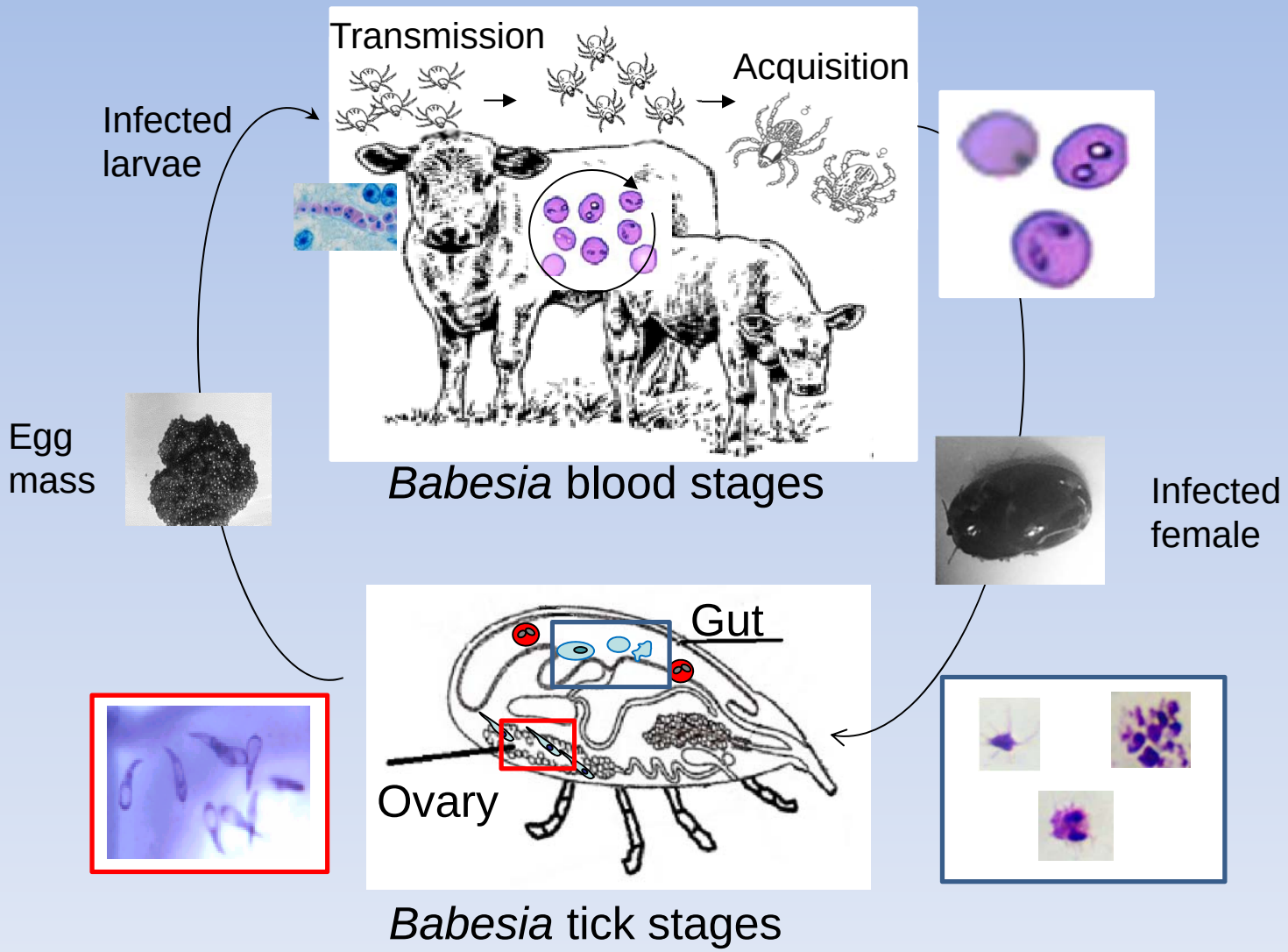
- Tropical and subtropical distribution
  - *Babesia bovis* and *B. bigemina*
    - Asia, Africa, Central and South America, Europe, and Australia
  - *Babesia divergens*
    - Europe

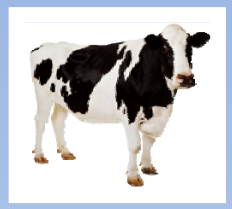
Tick-borne diseases of livestock

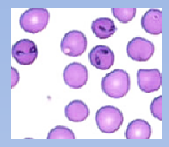
- Bovine babesiosis
  - Significant losses
    - > $800 million per year in Latin America
      - High morbidity
      - High mortality (cerebral babesiosis)
      - Abortion
      - Reduction in milk and meat production



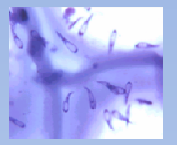
Babesia development within vertebrate and invertebrate hosts







Genomic sequence of *B. bovis*



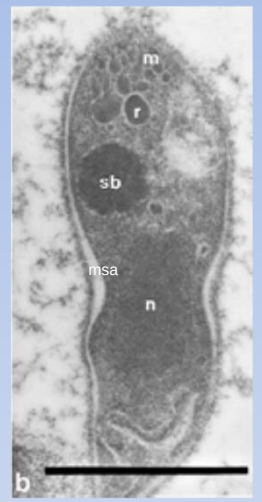
Features	Species		
	P. falciparum	*T. parva*	*B. bovis*
Size (Mbp)	22.8	8.3	8.2
Number of chromosomes	14	4	4
Total G+C composition (%)	19.4	34.1	41.8
Size of apicoplast genome (kbp)	35	39.5	33
Size of mitochondrial genome (kbp)	~6 linear	~6 linear	~6 linear
Number of nuclear protein coding genes	5,268	4,035	3,671
Average protein coding gene length (bp)[a]	2,283	1,407	1,514
Percent genes with introns	53.9	73.6	61.5
Mean length of intergenic region (bp)	1,694	405	589
G+C composition of intergenic region	13.8	26.2	37
G+C composition of exons (%)	23.7	37.6	44
G+C composition of introns (%)	13.6	25.4	35.9
Percent coding	52.6	68.4	70.2
Gene density[b]	4,338	2,057	2,228

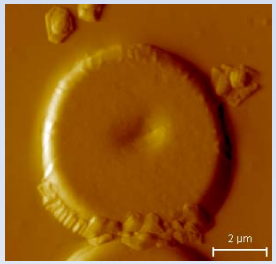
[a]Not including introns.
[b]Genome size/number of protein coding genes.

Brayton K.A., et al. PLoS Pathog. 2007

Proteins expressed by *Babesia* blood stages

- RAP-1
  - Goff, WL et al. Infect. Immun. 1988; Suarez, CE, et al. Int. J. Parasitol. 2004
- BboRhop68
  - Baravalle, ME, et al. Parasitol. Int. 2010
- Smorf
  - Ferreri, LM et al. Int. J. Parasitol. 2011
- MSA-1 and MSA-2
  - Goff, WL et al. Infect. Immun. 1988; Hines, SA, et al. Mol. Biochem. Parasitol. 1989; Jasmer, DP, et al, Mol. Biochem.Parasitol. 1992
- VESA
  - Allred, DR, Microbes Infect. 2001; Allred, DR, Vet. Parasitol. 2006; Brayton, KA, et al. PLoS Pathog. 2007

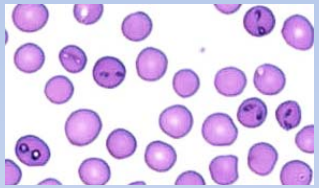




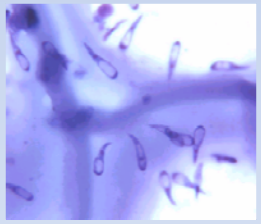
Transcription regulation during *B. bovis* development within vertebrate and invertebrate hosts

Animal infected with *B. bovis* stabilate

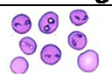
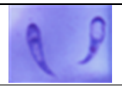
B. bovis blood stage



Engorged infected *R. microplus*

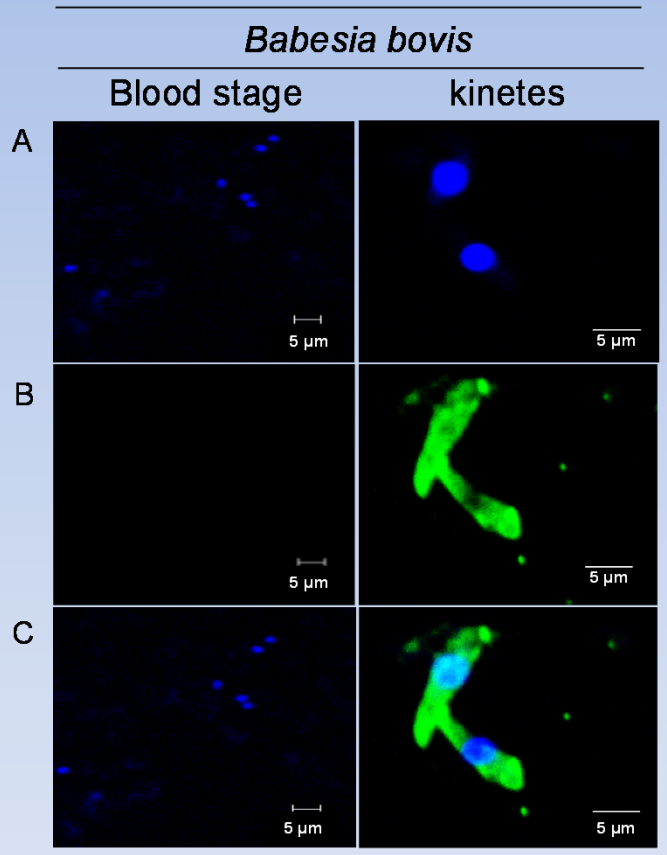


B. bovis tick stage

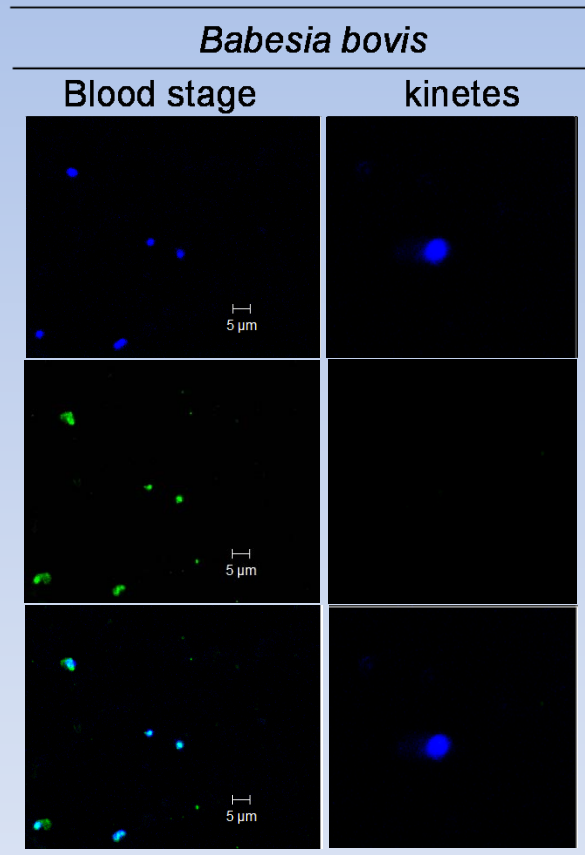
	B. bovis	
	Blood stages	Kinetes
B. bovis gene name		
BBOV_IV010280	4,240	3
BBOV_IV009870	4,141	2
BBOV_IV009860	2,068	1
BBOV_IV011230	26,438	74
BBOV_I003060	271,778	251
BBOV_I003010	23,228	14
BBOV_I003020	9,038	7
BBOV_I002990	11,229	6
BBOV_I003000	8,050	1
BBOV_I002220	265	1,188,531
BBOV_IV000290	1,159	1,096,089
BBOV_II006620	153	752,203
BBOV_II006100	97	176,535
BBOV_II006600	29	83,939

RNA seq data

B. bovis proteins

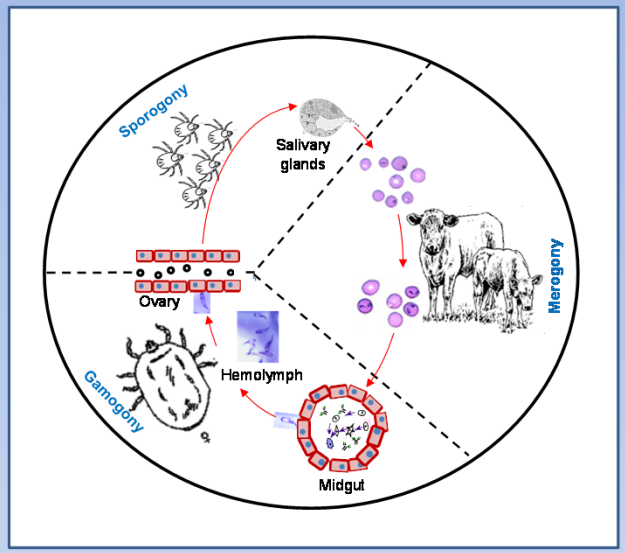


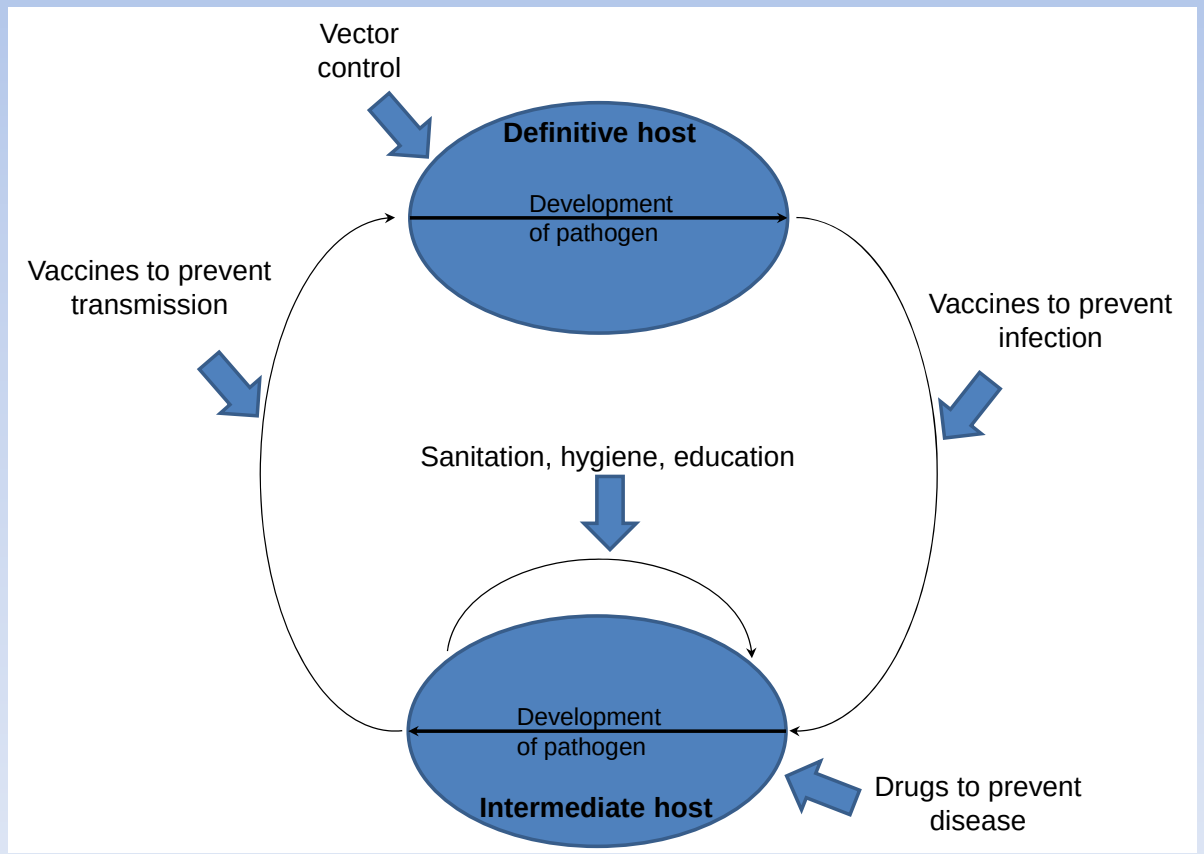
BBOV_I002220



BBOV_I001680

Control strategies for bovine babesiosis





- Understanding the life cycle will allow us to develop efficient strategies to prevent infection/disease in the mammalian host and/or block parasite transmission via tick vectors.

- These proteins are postulated to be critical for the *Babesia* parasite to complete its life cycle within mammalian and tick hosts.

Acknowledgement

Don Knowles
Carlos Suarez
Glen Scoles
Naomi Taus
Katie Reif
Hala E. Hussein
Carl Johnson
Paul Lacy
Ralph Horn
James Allison
Kathy Mason

This project was supported by:

Agriculture and Food Research Initiative Competitive Grant no. 2016-67015-24968 from the USDA National Institute of Food

Agriculture and USDA-ARS CRIS project number 2090-32000-039-00D

Questions