

Prevalence and risk factors for *Anaplasma marginale* seropositivity in cattle in California

S. Chen,¹ DVM, MPVM; A. Hill,² DVM, MPVM, PhD; W. Jackson,² DVM, MPVM, PhD; B. Munk,³ MS, DVM; M. Saunders,⁴ PhD, MSPH; S. Gassama,¹ BS; G. Maier,¹ DVM, MPVM, PhD, DACVPM

¹Department of Population Health & Reproduction, School of Veterinary Medicine, University of California Davis, Davis, CA 95616

²California Animal Health and Food Safety Lab, University of California Davis, Davis, CA 95616

³California Department of Fish and Wildlife, Rancho Cordova, CA 95670

⁴California Department of Public Health, Richmond, CA 94804

Introduction

Bovine anaplasmosis, a tick-borne disease caused by *Anaplasma marginale*, imposes considerable economic burden on cattle industries throughout the world. Clinical signs of bovine anaplasmosis include fever, weight loss, lethargy, jaundice, abortion and death. The severity of the disease increases with age, and calves under 1 year of age generally do not progress to clinical disease or develop mild disease. Once infected, cattle remain persistently infected carriers for life. Climate change and drought conditions may affect the distribution and prevalence of tick populations and tick-borne diseases and re-evaluating the seroprevalence of *Anaplasma* would provide a better understanding of the disease dynamics in California. To our knowledge, there has been no updated study regarding the distribution of *Anaplasma* infection status in California since 2008, and the information on weather factors related to the disease is also limited. There is an urgent need to evaluate the prevalence of *Anaplasma* infection in different regions of California. The goal of this study is to estimate the seroprevalence of *Anaplasma* infection in California cattle over time, and the specific goal is to identify potential risk factors for infection including animal demographics, region, *Anaplasma* seroprevalence of wild ruminants, *Dermacentor* tick species presence, and weather effects.

Materials and methods

A total of 3703 *Anaplasma* cELISA test results from cattle submitted to the California Animal Health and Food Safety Lab between 2010 and 2023 were used in this study. True prevalence was calculated based on the sensitivity and specificity of the ELISA test. Generalized estimating equations with a logit link were used to analyze risk factors, including sex, age, production type, region and weather factors. Considering effects of tick ecology on the disease, weather data from the same year to 3 years before data collection were analyzed in the regression models.

Results

The overall prevalence of *Anaplasma* infection was 24.1% (95% CI: 22.8 - 25.5). In GEE models with weather data from the same year (model 0) and one year (model 1) before the test, cattle at two years of age or older (model 0: $P = 0.005$; model 1: $P = 0.011$), beef cattle (model 0 & 1: $P < 0.001$), higher temperature in wet season (model 0 and 1: $P = 0.009$), and lower average temperature in dry season (model 0 and 1: $P = 0.001$) were positively associated with *Anaplasma* seropositivity. As for the models with weather data from two and three years prior to sample collection, none of weather factors were significantly associated with positivity of *A. marginale*.

Significance

The results suggested that *Anaplasma* infection in cattle in California is associated with animal and environmental characteristics. Weather effects, such as temperature, on infection may be related to tick population dynamics.

