A CROSS-SECTIONAL STUDY OF BLUETONGUE VIRUS AND MYCOPLASMA BOVIS INFECTIONS IN DAIRY CATTLE:  
I. THE ASSOCIATION BETWEEN A POSITIVE ANTIBODY RESPONSE AND PRODUCTION EFFICIENCY

I.J. UHAAR, H.P. RIEMANN, M.C. THURMOND AND C.E. FRANTI

Department of Epidemiology and Preventive Medicine, University of California,  
Davis, CA 95616, USA

The Veterinary Teaching and Research Center, Tulare, CA 93274, USA

Dr Uhaa's present address is Viral and Rickettsial Zoonoses Branch, Division of  
Virus and Related Diseases, Center for Infectious Diseases, G13, Centers for Disease  
Control, Atlanta, GA 30333, USA

Correspondence

ABSTRACT


In a cross-sectional study of bluetongue virus (BTV) and Mycoplasma bovis (M. bovis) infections, a sample of 572 California dairy cows was tested for the presence of antibodies to answer the question: Is it possible to identify and to assess quantitatively the associations between positive antibody test and production? Serum samples collected from these cows during December 1986 were tested for the presence of antibodies to BTV and M. bovis using the enzyme-linked immunosorbent assay (ELISA). Data on milk production were extracted from individual cow sheets of the California Dairy Herd Improvement Association (DHIA) record-keeping system and interfaced with percentage ELISA results for analysis.

Univariate and multivariate statistical analyses, using the $\chi^2$ test for categorical variables or Student's t-test for continuous variables and multiple logistic regression respectively, were carried out to evaluate for possible associations between positive antibody tests to each agent and each production variable of interest.

Complete data on all variables studied were obtained for 289 (50.5%) cows for M. bovis and 423 (74%) cows for BTV. For cows with complete data on all variables, estimates of the point prevalence of antibodies to BTV and M. bovis were 70.5% and 66.1%, respectively. Results of this study indicated that Guernsey cows were more likely to have a positive BTV test than Holstein cows and that cows in higher lactations were more likely to test positive to BTV ELISA than those in lower lactations ($p < 0.05$). Because all cows except those on one farm were Holstein, our confidence in the effect of breed is limited. The association between lactation number and BTV seropositive test may be an age factor identified earlier in the study. For M. bovis, the results of the analysis indicated that seropositive cows were more likely to produce less milk, on a mature equivalent basis (ORadj = 0.96, $p = 0.034$), and that they had less extended 305 day milk production potential (ORadj = 0.90, $p < 0.0001$) than seronegative cows.

Keywords: bluetongue, cattle, ELISA, Mycoplasma, productivity

INTRODUCTION

In the context of commercial animal production, a herd health programme can be defined as a planned and co-ordinated approach to achieving and maintaining optimal health and productive efficiency of livestock, with the optimum being defined in
relation to the goals of the herd owner (Blood et al., 1978; Dohoo et al., 1983). In general, the prime requirement in dairy production is economic efficiency, whether it be in the individual cow, the herd, or in regional or national dairy industries. The efficiency of milk production, calf production and cow replacement are all of major economic importance to the dairy farmer (Noordhuizen et al., 1983). Farm income may be increased and fluctuations in income may be minimized if the level of disease in the animals on the farm is reduced. Blood and colleagues (1978) argued that approaches to herd health based on diseases producing easily recognizable clinical signs may be effective in improving health in terms of those specific diseases, but that such approaches may be ineffective against those diseases which manifest themselves principally through impairment of productive efficiency, without producing clinical signs. A fuller understanding of the rôle of disease, clinical and subclinical, in production systems is needed in order to improve the approach to control and to provide a more realistic orientation to livestock development programmes (Ozawa, 1986). The economic losses caused by subclinical diseases may not be fully realized until such time as they cause serious problems, namely production losses in dairy cattle or inability to attain market weight rapidly in beef cattle.

There are compelling reasons to expect that cows which experience episodes of subclinical infection might suffer some longer term residual effects on reproductive function and production. These residual effects may be a result of direct or indirect tissue damage, with subsequent scarring and continued dysfunction. It is important that several factors be taken into consideration when evaluating the effects of disease on production, since no single factor may be necessary and sufficient to precipitate observable losses. Some of the factors which should be taken into account include the rôle of various production parameters; the relationships between diseases and the quantification of the impact of diseases on production, after appropriate control for possible confounders (Dohoo et al., 1983).

Residual effects of subclinical infections in dairy cattle have not been evaluated under field conditions. Studies of the effects of clinical disease on production have, however, been reported. For example, Boothby and colleagues (1986) found that experimental cows vaccinated with a live *Mycoplasma bovis* vaccine had decreased milk production. The association between exposure to clinical bluetongue (BT) and congenital deformities and losses in newborn calves has also been established (Richards et al., 1971; Luedke et al., 1977). Osburn and colleagues (1981) reported that inoculation of BT-8, a vaccine strain, into ovine fetuses produced hydrocephaly and retinal dysplasia, thus suggesting possible growth retardation in the newborn. In a recent study (Mousing, personal communication, 1989) associations were demonstrated between subclinical lesions in the respiratory system of slaughter pigs and the presence of antibodies to various infectious agents. In summary, while research information is available in the veterinary literature on the effects of some types of subclinical infection, there remains a lack of knowledge of the impact of subclinical exposure to BTV and *M. bovis* on production efficiency in dairy cattle. This study was designed to evaluate, statistically identify and quantify associations between positive reactions to bluetongue virus (BTV) or *M. bovis* antigens and milk production in dairy cows from three herds in the Central Valley of California.