STUDIES ON THE EPIZOOTIOLOGY OF BOVINE BABESIOSIS IN COMMON BORDER AREAS OF NEW SOUTH WALES AND QUEENSLAND

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Introduction

In a previous study, Curnow (1973) concluded that the incidence of subclinical babesiosis was low in New South Wales. The origin of the sporadic infections could not be determined, but in the Kyogle area between 1964 and 1966 the incidence of infected herds declined with increasing distance from the Queensland border. It was thought that some of the infections in this area could have been caused by infected *Boophilus microplus* larvae carried from Queensland. More precise information on the distribution of babesial infection in the New South Wales-Queensland border areas might allow further conclusions concerning the origin of outbreaks in New South Wales. This paper reports the results of surveys in the border areas of the Tweed valley of New South Wales.

Methods

Determination of Parasite Rates

The term "parasite rate" refers to the incidence of parasitaemia in defined age groups (Mahoney 1969). The incidence of parasitaemia was determined by the thick blood film technique of Mahoney and Saal (1961).

Complement Fixation (CF) Tests

The method described by Mahoney (1962*a*) and modified by Curnow (1973) was used throughout.

Transmission Tests for Detecting Subclinical Infection

The method of carrying out transmission tests has been described (Curnow 1973).

Areas Surveyed

The Tweed quarantine area adjoins Queensland, and the interstate border is mostly on a natural boundary of high cliffs (the Macpherson Range) so that contact between the cattle in the two States is precluded by topography. At two places, Numinbah in the west and Piggabeen-Cobaki in the east, cattle are separated only by a fenced buffer zone one chain wide. At Numinbah the buffer zone is less than a quarter of a mile long but at Piggabeen it extends for more than five miles. Because of the variation in the nature of the border division and the fact that outbreaks of babesiosis occurred close to the border in 1965 and 1966 the northern part of the Tweed area was selected for a survey in 1966 and 1967. The aim was to determine if the incidence of subclinical infection was related to the border variation.

Although Mahoney (1962*b*) investigated the epizootiology of babesiosis in selected herds in south eastern Queensland, little information was available on the incidence of infection in southern border areas of that State. To obtain such information for comparison with the situation in New South Wales, epizootiological surveys of herds in the Currumbin and Tallebudgera valleys, which adjoin the Piggabeen-Cobaki areas of New South Wales, were conducted.

A map of the areas surveyed is shown in Figure 1.

The New South Wales Survey

The New South Wales survey was carried out between October 1966 and April 1967 on herds selected at random from the area north of the northern branch of the Tweed River. Approximately 70% of herds in this area were tested. Serums were taken from all animals in each herd and tested by the CF method. To confirm the presence of infection, transmission tests were carried out on all animals showing a positive CF reaction.

The Queensland Survey

The Queensland survey was carried out on six herds selected at random in the Currumbin and Tallebudgera valleys during March 1969. Thick blood films were examined and serums for CF testing were taken from all animals in the herds. Four holdings (numbered 1-4) had a poor standard of tick control and acaricidal treatment of cattle was only carried out when ticks appeared numerous. Ticks were efficiently controlled on the fifth holding as a result of routine acaricidal treatments during the six months preceding the date of examination, and on the sixth holding they were under excellent control as a result of weekly sprayings during the previous year.

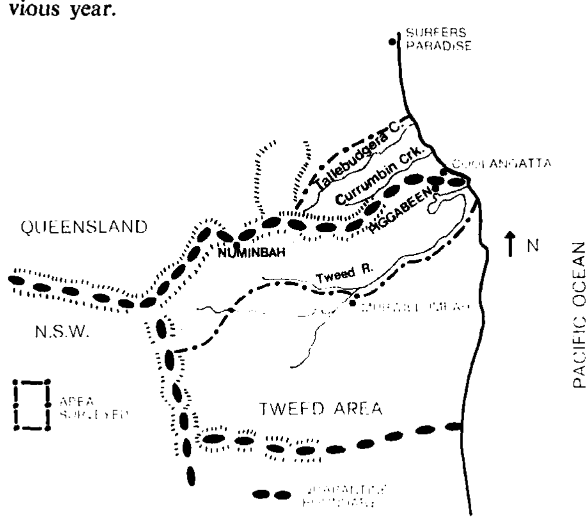

Figure 1. Map showing the border areas of New South Wales and Queensland included in the survey for babesiosis.

TABLE 1

Results of a Complement Fixation Test Survey for Babesiosis in the Northern Part of the Tweed Quarantine Area of New South Wales 1966-67

Area	No Herds Tested	No Cattle Tested	Animals Positive (%) to CF Test *B. argentina*	Animals Positive (%) to CF Test *B. bigemina*	Animals Infected* (%) with *B. argentina*	Animals Infected* (%) with *B. bigemina*	Herds Infected* (%) with *B. argentina*	Herds Infected* (%) with *B. bigemina*
Piggabeen herds adjoining Queensland border	11	914	1.53	0.66	1.31	0.11	45.4	9.1
Remainder of Piggabeen & Cobaki valleys	16	1,260	0.91	0.64	0.08	—	6.3	—
Remainder of Tweed area north of the northern branch of the Tweed River	191	13,827	1.13	0.46	0.03	0.01	2.6	0.5
Total area tested	218	16,001	1.14	0.49	0.11	0.01	5.0	0.9

*Determined by carrying out transmission tests on animals positive to the CF test.

Results

The New South Wales Survey

The Tweed survey area was divided into three zones relative to the Piggabeen portion of the New South Wales-Queensland border. The incidence of infected herds and infected animals in each zone is shown in Table 1.

Initially 1.14% of all samples were positive to the CF test for *Babesia argentina* and 0.49% for *B. bigemina*. However, when transmission tests were completed only 0.11% were found to be infected with *B. argentina* and 0.01% with *B. bigemina*.

The incidence of subclinical infections and infected herds was highest in the group of herds adjoining the New South Wales-Queensland border at Piggabeen (1.42% and 54.5%, respectively). A considerably lower incidence of subclinical infections (0.04%) and infected herds (3.1%) was found in the area outside the Piggabeen-Cobaki valleys. There was also a marked difference between the incidence of *B. argentina* infections in the holdings along the border and the rest of the Piggabeen-Cobaki area.

The one holding adjoining the border at Numinbah was also infected but holdings adjoining it were not.

The Queensland Survey

The incidence of CF positive animals was much higher in the Queensland herds (Table 2).

Although the incidence of positive CF reactions was similar in the adult animals (over 2 years of age) in herds 1 to 5 where tick control was classed as poor or good, a much lower incidence

TABLE 2

Results of a Complement Fixation Test Survey for Babesiosis in the Currumbin and Tallebudgera Valleys of Southern Queensland in 1969

Standard of Tick Control*	Number of Herds		No of Animals Positive to CF test for *B. argentina* 0-3 mths	3-6 mths	6-12 mths	1-2 yrs	Over 2 yrs	All ages	No of Animals Positive to CF test for *B. bigemina* 0-3 mths	3-6 mths	6-12 mths	1-2 yrs	Over 2 yrs	All ages
Poor	4		3/5	22/28	18/19	63/69	91/136	197/257	3/5	26/28	19/19	64/69	95/136	207/257
		%	60	78	95	91	67	77	60	93	100	93	79	81
Good	1						49/56	49/56					35/56	35/56
		%					87	87					62	62
Excellent	1			0/1	0/7	0/8	13/23	13/39		0/1	0/7	0/8	7/23	7/39
		%					56	33					30	18
Overall totals	6		3/5	22/29	18/26	63/77	153/215	259/352	3/5	26/29	19/26	64/77	137/215	249/352
		%	60	76	69	82	71	74	60	90	71	84	64	71

*Poor = Cattle treated only when ticks appeared numerous.
Good = Cattle treated regularly during the preceding six months.
Excellent = Cattle treated weekly during preceding year.

TABLE 3

Babesiosis Survey in Southern Queensland, 1969 — Parasite Rates in Currumbin and Tallebudgera Herds Determined by Examination of Thick Blood Films

Standard of Tick Control*	Number of Herds		Parasite Rates for *B. argentina* 0-3 mths	3-6 mths	6-12 mths	1-2 yrs	Over 2 yrs	All ages	Parasite Rates for *B. bigemina* 0-3 mths	3-6 mths	6-12 mths	1-2 yrs	Over 2 yrs	All ages
Poor	4		2/5	9/28	12/19	25/69	17/136	65/257	2/5	14/28	8/19	3/69	3/126	30/257
		%	40	32	63	36	13	25	40	50	42	4	2	12
Good	1						0/56	0/56					0/56	0/56
		%					0	0					0	0
Excellent	1			0/1	0/7	0/8	0/23	0/39		0/1	0/7	0/8	0/23	0/39
		%		0	0	0	0	0		0	0	0	0	0
Overall Totals	6		2/5	9/29	12/26	25/77	17/215	65/352	2/5	14/29	8/26	3/77	3/215	30/352

*Poor = Cattle treated only when ticks appeared numerous.
Good = Cattle treated regularly during the preceding six months.
Excellent = Cattle treated weekly during the preceding year.

was recorded in herd 6 where excellent control had been used. The incidence of positive *B. bigemina* reactors was lower than the incidence of positive *B. argentina* reactors in herds 5 and 6. In the herds with minimal tick control (herds 1 to 4) positive reactions were recorded early in life in a high percentage of animals but the incidence declined in the animals over 12 months of age.

Transmission tests were undertaken on three CF negative adults from one of the herds with poor tick control and on three CF negative adults in herd 5. All of these tests were positive for both organisms.

Parasite rates in the Queensland herds are shown in Table 3. Rates in the herds with poor tick control were highest in the groups under 12 months of age. With *B. argentina* the highest rate was in the 6-12 months group while with *B. bigemina* it occurred in the 3-6 months group. The *B. bigemina* parasite rate declined rapidly after 12 months of age, with only 2% of animals over two years having parasitaemias. With *B. argentina* the rate declined more slowly and the rate in the adults was 13%. Parasitaemias were not seen in the animals in the two herds where tick control was good.

Discussion

The marked difference in the incidence of CF reactors in New South Wales and Queensland herds demonstrated the difference in epizootiological situations existing in the areas separated by the border. In addition, the positive transmission tests obtained with CF negative animals in Queensland show that the incidence of infection would be higher than the number of positive CF reactions indicated. On the other hand transmission tests performed on cattle positive to the CF test in New South Wales showed CF testing gave an over-estimate of the number actually infected.

The high incidence of infected herds adjoining the border at Piggabeen compared with the much lower incidence in the rest of the Tweed area suggests movement of infection across the border from Queensland.

Mahoney (1962*b*) found that at Samford near Brisbane 15 to 40% of animals (in all age groups) had parasitaemias with *B. argentina* and 5 to 12% with *B. bigemina.* The figures of 25% and 12%, respectively, for the two organisms in the Currumbin and Tallebudgera herds maintained under poor tick control were therefore similar to the Samford results. The highest parasite rate for *B. argentina* was in the 1 to 2 years age group (60%) at Samford while the peak in the present survey was in the 6-12 months group (63%). In both surveys there was a decline in rate with increasing age to rates of 10% and 13%. With *B. bigemina* the results of the two surveys were similar with a peak rate in the 1-6 months group of 45-50% declining to less than 10% after one year of age. It was therefore considered that in herds subjected to minimal tick control in the southern border areas of Queensland, the epizootiological situation was similar to that in other parts of the enzootic area for *Babesia* to the north and a considerable degree of environmental contamination with infected tick larvae would be expected along the Queensland side of the New South Wales border. Transport of these larvae by various undefined agencies could be the cause of the relatively high incidence of infections on holdings adjoining the border in New South Wales, and also for many of the sporadic outbreaks in areas more distant from the border.

The inability to detect parasitaemia in the Queensland herds in which efficient tick control was practised suggested that the rate of transmission of infection had been greatly reduced by such means. Animals under 2 years of age in one herd (number 6) showed no CF reactions and probably remained uninfected since birth. In this herd the incidence of *B. bigemina* reactions compared with *B. argentina* reactions was low. This finding perhaps indicated that recovery from *B. bigemina* infections occurred more rapidly than from *B. argentina* in the absence of reinfection.

Summary

Using thick blood films, complement fixation (CF) tests and transmission tests, epizootiological surveys for babesiosis were carried out in the northern part of the Tweed quarantine area of New South Wales in 1966-67 and the south eastern border area of Queensland in 1969.

In the New South Wales survey the incidence of positive CF reactions was 1.14% for *B. argentina* and 0.49% for *B. bigemina,* and after transmission tests were complete 0.11% of animals were found to be subclinically infected with *B. argentina* and 0.01% with *B. bigemina.* The incidence of subclinical infections and infected herds, 1.42% and 54.5%, respectively, was highest in the herds immediately adjoining the Queensland border at Piggabeen. The incidence was much lower (0.04% and 3.1%) further away from the border.

The incidence of positive CF reactions was much higher in the Queensland herds especially where tick control was poor (*B. argentina* 77% and *B. bigemina* 81%). Positive transmission tests were obtained with six animals in Queensland negative to the CF test, indicating that the actual number of subclinical infections was higher than the CF tests indicated. Parasite rates in these herds were similar to those found by Mahoney (1962*b*) in a herd near Brisbane. This suggests that the epizootiology of the southern border areas of Queensland was similar to that of the Brisbane area.

The high incidence of infection on the Queensland side of the border and the distribution of infected herds in New South Wales could be taken as evidence that infection was being carried across the border from Queensland.

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ANNOTATION

A VETERINARY ACADEMY OF THE FUTURE

Richard Howard, DVM, a small animal practitioner from La Mesa, California. says that the veterinary profession "lacks a philosophical perspective" and that "it needs a creative system that is energised for the future and implemented by a veterinary academy of futurists". His paper in *Vet. Econ.* (1972) **13:** 28 is provocative and stimulating and has enough ideas, suggestions, exhortations and fears to keep any veterinary graduate, and undergraduate, on his toes and thinking hard. He says that the progress of veterinary medicine (which as used in the United States of America includes the whole of veterinary science) "rests on five pillars": (1) our educational opportunities, (2) our moral and spiritual vitality, (3) the political and social matrix within which we operate, (4) the economic forces working to effect our motivation, and (5) our intellectualism and its influence in producing a creatively dynamic profession. He stresses the needs of the profession for a "larger frame of reference", and has some hard but timely words of warning about the "Big Syndrome", about overemphasis on refinement and detail ("Our myopia is so severe that many of our colleagues cannot see the herd for the cow"), about the need for veterinarians to become "experts with biological systems", and much more.

This is a thoughtful paper, a thought-provoking paper, and its ideas commend themselves to the future activities of the Australian College of Veterinary Scientists, which has in it the foundations and the planners for a Veterinary Academy of the Future. The builders and "staff" will be coming to it in an endless flow in the years ahead.

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