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THE PREVALENCE OF ANTI-LEPTOSPIRAL AGGLUTININS IN SERA OF WILDLIFE IN SOUTHEASTERN AUSTRALIA

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Abstract: Anti-leptospiral agglutinins were found in the serum from 18 (7 species) of 419 (25 species) animals sampled from various areas of southeastern Australia. Positive serologic reactions were observed in 5 of 25 (20%) brush-tailed possum *(Trichosurus vulpecula),* 1 of 26 (3.8%) tammar wallaby *(Macropus eugenii),* 2 of 12 (16.7%) swamp wallaby *(Wallabia bicolor),* 1 of 3 (33.3%) koala *(Phascolarctos cinereus),* 3 of 41 (7.3%) common wombat *(Vombatus ursinus),* 2 of 100 (2%) bush rat *(Rattus fuscipes)* and 4 of 12 (25%) rusa deer *(Cervus timorensis).* The majority (55.5%) of serologic reactions were to serovar *hardjo.*

No serologic reactions were observed in samples from echidna *(Tachyglossus aculeatus),* brown antechinus *(Antechinus stuartii),* swainson's antechinus *(Antechinus swaisonsii),* long-nosed bandicoot *(Perameles nasuta),* brown bandicoot *(Isoodon obesulus),* common ringtail *(Pseudocheirus peregrinus),* greater glider *(Schoinobates volans),* eastern grey kangaroo *(Macropus giganteus),* red-necked wallaby *(Macropus rufogriseus),* rabbit *(Oryctolagus cuniculus),* water rat *(Hydromys chrysogaster),* black rat *(Rattus rattus),* eastern swamp rat *(Rattus lutreolus),* broad-toothed rat *(Mastacomys fuscus),* fox *(Vulpes vulpes),* sambar deer *(Cervus unicolor),* hog deer *(Axis porcinus)* and fallow deer *(Dama dama).*

INTRODUCTION

The most extensive surveys of the prevalence of infection with *Leptospira interrogans* in Australian wildlife have been conducted in the northern, tropical areas of Australia. In northern Queensland it was concluded from serologic and bacteriologic evidence that numerous wildlife species including *Rattus sordidus conatus, Rattus rattus, Rattus norvegicus, Rattus assimilis, Perameles nasuta, Isoodon macrourus* and *Mus musculus* were maintenance hosts for various leptospiral serovars.[1,5] In a more recent survey in this area, 6.1% of the rodents sampled had evidence of infection and, although the overall prevalence of rodent leptospirosis was low, highly infected foci were observed in wet environments.[7]

In a more temperate area of Australia, Munday[10] surveyed 26 species of Tasmanian fauna for antibodies to a number of serovars but obtained few positive reactions. He considered that wombats *(Vombatus ursinus)* may be susceptible to infection with *pomona* and that *Rattus norvegicus* may be a maintenance host for *icterohaemorrhagiae.* Durfee and Presidente[4] in a serologic survey of Vic-

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torian wildlife for antibodies to leptospires of the Hebdomadis serogroup, found a high prevalence of reactors in brush-tailed possums *(Trichosurus vulpecula),* wombats and rusa deer *(Cervus timorensis).*

A number of reports indicate that Australian wildlife may be of importance in the transmission of leptospirosis to both humans and domestic animals. Sullivan[13] noted that Weil's disease in humans is acquired from rats, as are most cases of "canefields leptospirosis" caused by serovars *australis* and *zanoni* in Queensland. Battey *et al.*[1] noted that *Rattus sordidus conatus* was responsible for many human infections with *australis* and *grippotyphosa* in northern Queensland. Both the wombat and the feral pig may be involved in the transmission of *pomona* to domestic animals.[8,10,11]

Because of the potential importance of wildlife in the transmission of leptospirosis to man and domestic animals a survey was performed using 12 leptospiral serovars to determine the prevalence of antibodies in wildlife sera collected in New South Wales and Victoria.

MATERIALS AND METHODS

Sampling Areas. Samples were taken from a number of areas throughout southeastern Australia (Fig. 1). Most locations were forested with only limited possibilities for contact with domestic animals.

Serology. Serologic testing was performed by the microscopic agglutination test (MAT) as reported by Galton *et al.*[6] and modified by Cole *et al.*[2] Each serum was tested against members of the following serogroups: Australis (serovar *australis),* Autumnalis *(autumnalis),* Ballum *(ballum),* Bataviae *(bataviae),* Canicola *(canicola),* Grippotyphosa *(grippotyphosa),* Hebdomadis *(hardjo),* Icterohaemorrhagiae *(icterohaemorrhagiae* and *copenhageni),* Pomona *(pomona),* Pyrogenes *(zanoni)* and Tarassovi *(tarassovi).*

Each serum was screened at a final dilution of 1:40 against each antigen. All positive reactors were then titrated to an end point. Titers less than 1:32 were regarded as negative.

Animals. Serum samples were obtained from 419 animals (25 species, 12 families) (Table 1). No attempt was made to isolate leptospires from these samples. All samples from *Macropus eugenii, Cervus timorensis* and *Dama dama* were from captive animals. All other animals sampled were free ranging.

RESULTS

Anti-leptospiral agglutinins were detected in the serum of 18 animals from 7 species (Table 1). The prevalence of antibodies was highest in rusa deer, brush-tailed possums and swamp wallabies, although 1 of the 3 koala samples was positive.

The serum-antibody titers were low with the exception of the titers of 1:1024 to *hardjo* in one brush-tailed possum and one rusa deer.

The majority (55.5%) of serologic reactions obtained were to *hardjo.*

DISCUSSION

The results of the present survey indicate that 18 of 419 (1.9%) animals examined had evidence of past or present infection with leptospires. It must be emphasised, however, that although representatives of 11 pathogenic serogroups were used as antigens in the present study, no indication of the prevalence of infection with other, untested, leptospires can be gauged because of the serogroup specific nature of the MAT.

The lack of evidence of widespread infection in the rodents examined in this study was surprising. Although it has

been demonstrated that some individual rodents may excrete leptospires without having detectable circulating antibodies[7,12] it would appear that in southeastern Australia these animals do not constitute a reservoir for any of the serogroups tested. This is contrary to the situation described in north Queensland by Battey *et al.*[1] and Emanuel *et al.*[5] who considered that a number of rodent species were responsible for both maintaining and spreading infection.

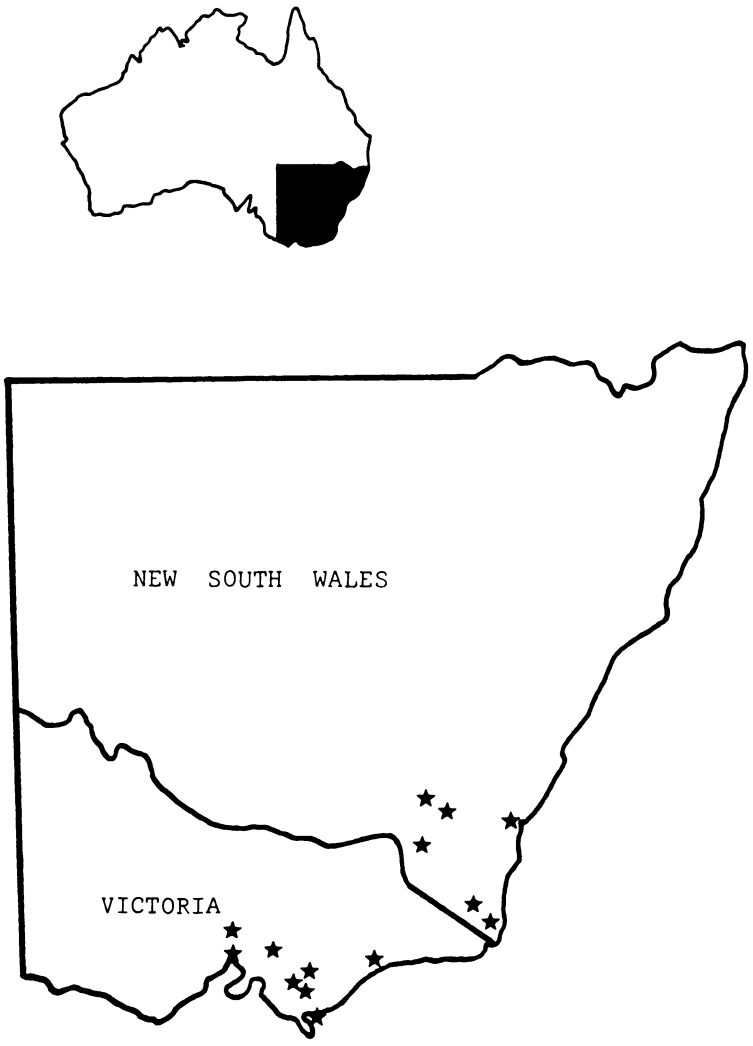

FIGURE 1. Principle areas of collection (★) of animals in New South Wales and Victoria.

TABLE 1. Prevalence of anti-leptospiral agglutinins in the sera of wildlife in southeastern Australia.

Family	Species	(common name)	Number Examined		Prevalence
			Total	Sero-positive*	(%)
TACHYGLOSSIDAE	*Tachyglossus aculeatus*	(echidna)	1	—	—
DASYURIDAE	*Antechinus stuartii*	(brown antechinus)	19	—	—
	Antechinus swainsonii	(swainson's antechinus)	17	—	—
PERAMELIDAE	*Perameles nasuta*	(long-nosed bandicoot)	8	—	—
	Isoodon obesulus	(brown bandicoot)	3	—	—
PHALANGERIDAE	*Trichosurus vulpecula*	(brush-tailed possum)	25	5	20
PETAURIDAE	*Pseudocheirus peregrinus*	(common ringtail)	4	—	—
	Schoinobates volans	(greater glider)	8	—	—
MACROPODIDAE	*Macropus eugenii*	(tammar wallaby)	26	1	3.8
	Macropus giganteus	(eastern grey kangaroo)	20	—	—
	Macropus rufogriseus	(red-necked wallaby)	23	—	—
	Wallabia bicolor	(swamp wallaby)	12	2	16.7
PHASCOLARCTIDAE	*Phascolarctos cinereus*	(koala)	3	1	33.3
VOMBATIDAE	*Vombatus ursinus*	(common wombat)	41	3	7.3
LEPORIDAE	*Oryctolagus cuniculus*	(rabbit)	25	—	—
MURIDAE	*Hydromys chrysogaster*	(water rat)	9	—	—
	Rattus rattus	(black rat)	10	—	—
	Rattus fuscipes	(bush rat)	100	2	2
	Rattus lutreolus	(eastern swamp rat)	10	—	—
	Mastacomys fuscus	(broad-toothed rat)	4	—	—
CANIDAE	*Vulpes vulpes*	(fox)	20	—	—
CERVIDAE	*Cervus timorensis*	(rusa deer)	12	4	25
	Cervus unicolor	(sambar deer)	6	—	—
	Axis porcinus	(hog deer)	11	—	—
	Dama dama	(fallow deer)	2	—	—

*Antibody titers: *Trichosurus vulpecula:* 1:64, 1:64, 1:64, 1:256 and 1:1024 to *hardjo. Macropus eugenii:* 1:64 to *pomona. Wallabia bicolor:* 1:64 and 1:256 to *ballum. Phascolarctos cinereus:* 1:32 to *hardjo. Vombatus ursinus:* 1:64 to *australis,* 1:256 to *pomona* and 1:256 to *grippotyphosa. Rattus fuscipes:* 1:32 to *australis* and 1:32 to *ballum. Cervus timorensis:* 1:128, 1:128, 1:256 and 1:1024 to *hardjo.*

Climatic differences between these two areas may provide an explanation for this.

Of the 41 wombats investigated in the present study, only 3 (7.3%) had a positive reaction in the MAT. Unlike other reports, there was no indication of widespread infection in this species with either *pomona* or *hardjo*.[3,10,11] The high prevalence of reactions to *hardjo* in brush-tailed possums and rusa deer has been reported previously.[3] It has been shown that serologic reactions in brush-tailed possums to members of the Hebdomadis serogroup were due to infection with *balcanica*, another member of the Hebdomadis serogroup. Persistant infection in brush-tailed possums was demonstrated, but transmission appeared to be only from possum to possum.[3,4] The significance of titers to *hardjo* in rusa deer is unclear but, as these animals were farmed, there are increased opportunities for contact with cattle which, in Victoria, have a high prevalence of serologic reactions and are the source of frequent isolations of this serovar.[9]

It would seem that leptospirosis is only common in brush-tailed possums and possibly wombats and rusa deer in southeastern Australia. The infecting serovars are members of the Hebdomadis serogroup. There is no evidence suggesting that these animals constitute either a human or veterinary health hazard in this area, although Munday[10] postulated that the wombat may be involved in the transmission of *pomona* to domestic animals. Unfortunately, no samples were obtained from either *Rattus norvegicus*, postulated to be a maintenance host of leptospirosis[1,5] or feral pigs, shown to have a high prevalence of *pomona* infection in New South Wales.[8] The results of the present study support the earlier suggestion[11] that human leptospirosis in Victoria is attributable to occupational contact with domestic animals.

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