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**BOVINE TUBERCULOSIS IN
THE BRUSHTAIL POSSUM
(*TRICHOSURUS VULPECULA*)**

***BEHAVIOUR AND DEVELOPMENT OF AN AEROSOL
VACCINATOR***

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ABSTRACT

The Australian brushtail possum (*Trichosurus vulpecula*) is a wildlife reservoir of tuberculosis (*Mycobacterium bovis*) in New Zealand. The disease is endemic over one third of the country. Possum control operations have reduced the prevalence of disease in livestock but have not fully controlled infection in wildlife or geographic spread of the disease. The disease is transmitted to livestock when they investigate the unusual behaviour of terminally ill possums. Reduction of disease incidence in possums through vaccination with bacille Calmette-Guerin (BCG) has shown promise both in pen trials and field studies. Integration of vaccination into existing control programmes may reduce transmission of tuberculosis among possums, and from possums to livestock.

There are two parts to this thesis. Part one is a longitudinal, behavioural study of tuberculous and non-tuberculous wild possums. Part two is a description of an aerosol delivery device (aerosol vaccinator) designed to administer aerosolised BCG vaccine to possums in the wild, and a record of its progressive development.

The aim of part one was to identify aspects of behaviour of tuberculous possums that may influence disease transmission to livestock. Twenty two tuberculous and eight healthy possums were observed. Possums were radio tracked weekly and live trapped at bimonthly intervals on a 56 hectare site in the Wairarapa, New Zealand.

Generally possums remained within their activity range apart from infrequent long distance forays. Possums were weak, lethargic and uncoordinated during the terminal stages of disease which lasted for one to three weeks. Only three possums made long forays when terminally ill with tuberculosis.

The carcasses of 17 tuberculous possums were recovered of which 15 were in dense scrub or on long grass under scrub and two were on pasture. Of these 17 carcasses, 14 were within or near (<200m) to their activity range.

Most tuberculous possums died in their activity range and in scrub. These possums represent little risk of infection to livestock, but a risk to other wildlife. However, the small number of tuberculous possums that died on pasture present an important risk to livestock. Interactions between diseased and healthy possums during long distance forays may cause considerable geographical spread of tuberculosis.

Part two, the development of an aerosol vaccinator, consisted of pen and field trials. The aim of pen trials was to evaluate the willingness of possums to investigate novel objects and the influence of social hierarchy on this investigative behaviour. It also allowed refinements to aerosol vaccinator design.

Four captive colonies were used. In each colony most possums (80%) showed minimal neophobia and would actively investigate novel objects. A small proportion (20%) would not approach a novel object. A loose social hierarchy existed with one dominant animal and a changeable middle order. In two of the four colonies, there was one possum clearly at the bottom of the social order. Social hierarchy did not affect the proportion of a colony which could investigate a novel object or vaccinator. However it did effect the order in which individual possums would investigate.

The aim of the field trials was to evaluate the efficacy of an aerosol vaccinator with possums in the wild. During five field trials, the proportion of the possum population marked with dye from the device steadily increased and ranged from 0%–34%. Trials were conducted over eight months and during this period a total of 56% of the study population was marked with dye. Some possums would repeatedly use a vaccinator.

These results justify further research into aerosol vaccination of wild possums with BCG. Three key avenues for future research include determining the proportion of a possum population which will use the device, developing an aerosol container suitable for dispensing BCG vaccine and determining whether the combination of vaccinator and aerosol vaccine elicits a protective immune response.

The aerosol vaccinator may be use to deliver aerosolised materials other than BCG to possums. It may also be altered to suit use by other species.

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