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STUDIES ON STEPHANOFILARIASIS IN QUEENSLAND

**Thesis submitted by
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**for the degree of Doctor of Philosophy in the Department of Tropical
Veterinary Science, Faculty of Science at James Cook University.**

Sept 1989

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ABSTRACT

Stephanofilariasis is an infection of the skin of cattle and less commonly other ruminants, with small filarial nematodes of the genus *Stephanofilaria*. This disease was discovered in Queensland and Australia for the first time in 1980 and this thesis outlines the results of the subsequent investigation of determinants of the disease, its pathogenesis and control, and the life cycle and morphology of the parasite which induces disease in Queensland.

The disease was found in cattle and was manifest as circumscribed hairless lesions in the skin. The surface of the lesions was usually slightly raised, dry and hyperkeratotic with small areas of dried blood. Less commonly, the lesions were cracked and scab encrusted.

Lesions were restricted to four sites: the medial canthus of the eye, where all infected animals had lesions; the neck, where older animals had lesions (41% of steers, 35% of cows and 4% of bulls); the sternum, (18% of bulls, 0.6% of steers and 1% of cows); and head, where 0.6 to 1% of animals were infected independently of sex, breed or age. Whether the location of lesions reflected preferred vector biting sites or a greater physiological receptivity of infected skin to infection than skin in other locations was not determined. In either case, the location of the lesion on the host animal is unlikely to be a useful character for determining the species of *Stephanofilaria* found in the present study.

Adult parasites were found either in small groups in cysts formed from the remnants of hair follicles or singly in the epidermis and superficial dermis. Microfilariae were found in the superficial areas of the dermal papillae adjacent to

the epidermis. The presence of adult parasites elicited a severe local inflammatory reaction comprising lymphocytes, histiocytes and eosinophils and resulted in the destruction of hair follicles and associated sebaceous glands.

Alopecia is a constant feature of stephanofilarial lesions yet its pathogenesis has not been determined. In histological sections, most adults were entwined in cysts formed in the base of hair follicles but adults of both sexes were found in the epidermis and superficial dermis.

Microfilariae recovered from the skin of cattle in this study were confined within semi rigid vitelline membranes. Small spherical bodies, probably yolk remnants, were also confined within the membranes. Live microfilariae were actively motile within the membrane but they were unable to effect any progressive movement of the entire structure when suspended in saline. Furthermore, no microfilariae were recovered in the saline recovery technique. These findings strongly suggest that the microfilariae of this *Stephanofilaria* sp. are incapable of independent migration. Therefore, adult females would have to migrate through the superficial dermis and epidermis to discharge microfilariae in areas accessible to potential vectors. The males found in this situation may have been migrating in search of females. If these adults and maturing larvae re-entered other hair follicles then the repeated invasion of hair follicles and destruction of the germinal matrix cells would cause the local alopecia which is characteristic of stephanofilarial lesions.

The histopathology of the lesions examined in this study showed differences from those of lesions produced by fly feeding alone and also to those described for lesions induced by

hypersensitivity to other biting flies. This, and the successful transmission of the parasite to produce a characteristic lesion strengthens the conclusion that lesions previously called "buffalo fly lesions" are stephanofilariasis dermatitis. The following determinants of stephanofilariasis were observed in abattoir and field studies.

- (a) Sex: Prevalence of lesions was highest in bulls, intermediate in steers and lowest in cows for all breeds and in all areas.
- (b) Age: Prevalence of lesions increased with increasing age, independently of sex or breed. Animals as young as 37 days of age were found infected.
- (c) Breed: Prevalence of lesions was lower in *Bos indicus* animals than in *B. taurus* animals. Within *B. indicus* genotypes, animals with 75% Brahman content or >7/8 Sahiwal content were significantly more resistant to development of lesions than animals with lower Brahman or Sahiwal content.
- (d) Season: In some areas, the prevalence of lesions was higher in winter (June-August) than at other times.
- (e) Coat colour: In some years prevalence of lesions was lower in animals with lighter coat colour.
- (f) Distance from the coast: Prevalence of the disease tended to decrease with increasing distance from the coast. Prevalence ranged from 95% on Cape York Peninsula to less than 5% in southern Queensland where the occurrence was sporadic.
- (g) Range of *Haematobia irritans exigua*: The occurrence of stephanofilariasis corresponded with the geographical range of *H. i. exigua*.

It was concluded that *H. i. exigua* is the vector of stephanofilariasis in Queensland for the following reasons;

- (a) It was shown to be capable of ingesting microfilariae, supporting development of the larvae and transmitting infective third stage larvae to cattle.
- (b) Females taken from infected cattle were found to contain developing larvae of the parasite
- (c) It is the only haematophagous fly with a distribution matching that of the parasite.

Stephanofilarial larval development occurred in the abdominal haemocoel of the fly but a few larvae were found enclosed within membranes attached to the fat body of the vector. Most infected flies (91%) contained only a single developing larva of *Stephanofilaria* sp. and the maximum number of larvae found in a single fly was four.

Adults and microfilariae of the parasite were found in a previously uninfected animal 35 days after wild-caught flies were first allowed to feed on that animal and 19 days after the last fly died. This indicates a prepatent period of less than 35 days for this parasite. Developing larvae were found within lesions suggesting that the larvae of this *Stephanofilaria* sp. may not undergo an extensive or prolonged somatic migration.

The adults of the Australian species of *Stephanofilaria* are small. The males are 2.3-3.2(2.8)mm long and 50-80(68) microns wide and the females are 3.8-6.4(5.2)mm long and 62-93(81) microns wide.

The mouth is surrounded by 15-16 peribuccal spines, the cuticular striations lack a posterior frill, and the males have a spicule ratio of 6.8:1.

The Australian species thus differs from all other species in the genus in lacking cephalic spines and therefore probably represents a hitherto undescribed species.

Prolonged treatment with avermectin caused a significant regression in lesion size and lower prevalence of lesions in treated animals than in control animals. Similar treatment with closantel was ineffective.

A single dose of either avermectin, levamisole or morantel was ineffective against adult *Stephanofilaria* sp. whereas a single dose of oxfendazole appeared to have limited efficacy.

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