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**DEVELOPMENT OF A NOVEL EQUINE COMBINATION
ANTHELMINTIC AND A STUDY OF ANTHELMINTIC
SUSCEPTIBILITY USING A LARVAL DEVELOPMENT
ASSAY**

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF PHILOSOPHY IN VETERINARY
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Abstract

The occurrence of anthelmintic resistance to benzimidazoles and ivermectin in cyathostome nematodes in New Zealand horses was investigated using a larval development assay (LDA) to conduct a small survey. For the benzimidazoles the analogue, thiabendazole was used and for ivermectin the analogues, ivermectin and ivermectin aglycone were used in the LDA. The normal range of LD₅₀ values was estimated by assaying eggs from Kaimanawa feral horses (n = 22) for each analogue used. From these the mean LD₅₀ values + 2×standard deviation was taken as the upper limit of normal. The survey involved domestic horses (n = 47) from several locations around New Zealand. For ivermectin and ivermectin aglycone 12% had LD₅₀ values higher than normal with resistance factors up to 5.3 and 6.8 respectively. This represents horses from three separate farms. For the benzimidazoles 43% of domestic horses had higher than normal LD₅₀ values with resistance factors up to 4.8. These results suggest that some nematodes in these domestic horses had an increased tolerance to avermectins and as well as to benzimidazoles.

Two studies were conducted to assess the efficacy of a combination of abamectin (0.2mg/kg), oxibendazole (10mg/kg) and bithionol (5mg/kg or 7mg/kg). In the first study bithionol was included at 5mg/kg and in the second study it was included at 7mg/kg. These studies showed the efficacy of the combination was >98% against adult luminal stages of *S. vulgaris*, *S. edentatus*, cyathostomes, migratory stages of *S. edentatus* and third instar stages of *Gasterophilus intestinalis*. Efficacy against mucosal stages of cyathostomes (about 64%) and arterial stages of *S. vulgaris* (71%) was poor. Inclusion of bithionol at 7mg/kg achieved an efficacy of 100% against *A. perfoliata* whereas at 5mg/kg the efficacy was only 84.6%.

In these studies the following species were identified: two species of *Strongylus* (*S. vulgaris* and *S. edentatus*); three species of *Triodontophorus* (*T. serratus*, *T. minor* and *T. tenuicollis*); and twelve species of cyathostomes (*Cyathostomum coronatum*, *Cyathostomum labiatum*, *Cyathostomum catinatum*, *Cylicocyclus nassatus*, *Cylicocyclus leptostomus*, *Cylicocyclus radiatus*, *Cylicocyclus insigne*, *Cylicostephanus poculatus*, *Cylicostephanus minutus*, *Cylicostephanus calicatus*, *Cylicostephanus longibursatus* and *Cylicostephanus goldi*).

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List of Abbreviations

μg	microgram
μl	microliter
μm	micrometer
μM	micromolar
AM	arithmetic mean
AOB	abamectin, oxibendazole, bithionol
AVM	Avermectin
BZ	Benzimidazole
C	Control
Ca	Canterbury
Ch	Christchurch
cm	Centimeter
CMA	Cranial mesenteric artery
D.	dorsal
DCS	Dose confirmation study
DMSO	Dimethyl sulphoxide
Dy	Drury
E	Exported horse
ED ₅₀	The dose that prevents 50% of the eggs to hatch
ELC	External leaf crown
epg	eggs per gram
F	Farm
FEC	faecal egg count
g	gram
GM	geometric mean
H	Hastings
HCl	hydrochloric acid
HE	highly effective
ILC	Internal leaf crown
IVM	Ivermectin
K	Kaimanawa
kg	kilogram
L	liter

L ₁	First stage larvae
L ₂	Second stage larvae
L ₃	Third stage larvae
L ₄	Fourth stage larvae
LD ₅₀	The dose that prevents 50% of the eggs develop into L ₃ larvae
LDA	Larval development assay
LE	less effective
mg	milligram
MgSo ₄	magnesium sulphate
ml	milliliter
mm	millimeter
NaCl	sodium chloride
ND	not done
NE	not effective
NM	not mentioned
No.	number
NTR	Not recorded
P	Palmerston North
p.p.m.	Parts per million
PES	Principal efficacy study
r ²	coefficient of determination
RF	Resistance factor
SD	Standard deviation
SF	susceptibility factor
SOP	Standard Operating Procedure
T	Treated
Ta	Takanini
TBZ	Thiabendazole
V.	ventral
wt	weight