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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 SCIENCE AT MASSEY UNIVERSITY

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Abstract

The occurrence of anthelmintic resistance to benzimidazoles and avermectin 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 avermectin the analogues, ivermectin and ivermectin aglycone were used in the LDA. The normal range of LD_{50} values was estimated by assaying eggs from Kaimanawa feral horses (n = 22) for each analogue used. From these the mean LD_{50} values + 2xstandard 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 LD_{50} 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 LD_{50} 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 sulfoxide
Dy, Drury
E, Exported horse
ED₅₀, 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
L₀ First stage larvae
L₁ Second stage larvae
L₂ Third stage larvae
L₃ Fourth stage larvae
LD₅₀ The dose that prevents 50% of the eggs develop into L₃ larvae
LDA Larval development assay
LE less effective
mg milligram
MgSO₄ 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
r² 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