PROCEEDINGS
26th
ANNUAL MEETING

THE
AMERICAN ASSOCIATION
OF
VETERINARY PARASITOLOGISTS

JULY 19-20, 1981
ST. LOUIS, MISSOURI

PROGRAM
AMERICAN ASSOCIATION OF
VETERINARY PARASITOLOGISTS
ANNUAL MEETING

July 19-20, 1981
CERVANTES CENTER, ROOM 260

Sunday, July 19

SESSION 1: ANTHELMINTIC THERAPY
Presiding Officer: H. Ciordia

9:00 AM 1* The Anthelmintic Efficiency of MK-401 against Fasciola hepatica in Cattle under Puerto Rican Conditions
D. de Leon and R. Quinones, Rio Piedras, PR

9:15 2 Xanthene Dyes - A New Approach to Control of Bovine Gastrointestinal Nematodes
JA Hawkins, MC Healy, JR Heitz and MH Johnson, Mississippi, MS

9:30 3 Anthelmintic Efficacy of Oxibendazole on Equids: A Comparison of Methodologies
VJ Theodorides, T Nawalinski, N Chimes, C Weideman and SM Free
W. Chester, PA

9:45 Ivermectin: Introduction and Development
WHD Leaning, Rahway, NJ

9:50 4 Ivermectin: Efficacy Evaluation in Horses
WHD Leaning and ES Brokken, Rahway, NJ

10:00 5 Ivermectin: Efficacy Evaluation in Cattle
RA Roncalli, WHD Leaning and ES Brokken, Rahway, NJ

10:10 6 Efficacy of Ivermectin Against 'Summer Sores' due to Draschia and Habronema Infection of Horses
RP Herd and JC Donham, Columbus, OH

10:20 Discussion

10:30 Break

11:00 7 Fenbendazole - Introduction and Development
R. Muser, Somerville, NJ

11:10 8 Efficacy of Fenbendazole Against the Fringed Tapeworm, Thysanosoma actinioides in Range Sheep
RC Bergstrom and BA Werner, Laramie, WY

11:20 9 Treatment of Drug Resistant Small Strongyles of Equines with Combinations of Fenbendazole and Piperazine
RB Wescott, LW Jen and LE Hellier, Pullman, WA

11:30 10 Clinical Trials with Fenbendazole and Fenbendazole-Piperazine Mixtures in Horses
JA DiPietro, TF Lock and KS Todd, Urbana, IL

11:40 11 Production Parameters of Wisconsin Dairy Heifers Following Systematic Deworming with Fenbendazole
GH Myers and AC Todd, Somerville, NJ

11:50 12 Controlled-Release Prophylactic Albendazole Treatment for Helminths of Sheep
RS Rew and R. Fetterer, Beltsville, MD

12:00 Invited Comments and Discussion
H. Ciordia, Experiment, GA

12:30 Lunch

* Abstract Number

SESSION 2: CLINICAL AND PATHOLOGICAL STUDIES
Presiding Officer: N. Baker

1:30 PM 13 Sudden Deaths in Pigs Associated with Swine Kidney Worms
EG Batte, Raleigh, NC

1:45 14 Mechanisms of Development of Ascariasis Induced Esophago-gastric Ulcers in Swine
V Lopez and SM Gaafar, W. Lafayette, IN

2:00 15 Demodicosis in Goats
JF Williams and CSF Williams, E. Lansing, MI

2:15 16 Observations on the Nature and Treatment of Giardiasis in Parakeets
R Scholtens and J New, Knoxville, TN

2:30 17 Clinical, Pathologic and Epidemiologic Observations on Equine Protozoal Myeloencephalitis
IG Mayhew, R Fayer and CF Simpson, Gainesville, FL

2:45 18 Ollulanus tricuspis, a Gastric Nematode in Cats
JL Blanchard, AM Hargis and DJ Prieur, Pullman, WA

3:00 19 Occurrence of Paramphistomum microbothrioides Price and McIntosh, 1944, in American Bison (Bison bison) and Domestic Beef Cattle.
RP Herd and BL Hull, Columbus, OH

3:15 20 Vacuum Cleaner Method in the Detection of Skin Parasites
TW Schillhorn van Veen and E Klayman, E. Lansing, MI

3:30 Break

SESSION 3: RESEARCH NEEDS AND PRIORITIES IN VETERINARY PARASITOLOGY: A REPORT BY THE AAVP RESEARCH COMMITTEE

3:45 Introduction
JB Malone, Baton Rouge, LA

3:55 Ruminants
JC Williams, Baton Rouge, LA

4:15 Equids
TR Klei, Baton Rouge, LA

4:25 Swine
TB Stewart, Baton Rouge, GA

4:35 Avian
M Ruff, Beltsville, MD

5:00 Business Meeting

Monday, July 20

SESSION 4: PARASITISMS OF DOGS AND CATS
Presiding Officer: E. Roberson

9:00 AM 21 Praziquantel, a New Cestocide for Dogs
ML Sharp and HD McCurdy, Shawnee, KS

9:10 22 Efficacy of DRONCIT (praziquantel), a New Injectable Cestocide for Dogs and Cats
DD Cox and RG Arther, Shawnee, KS

9:20 23 Efficacy of a Tablet Formulation of DRONCIT (praziquantel), a New Cestocide for Dogs and Cats
RG Arther and DD Cox, Shawnee, KS

9:30 24 Efficacy of Praziquantel Against Echinococcus spp.
FL Andersen, AA Marchiondo, and GA Conder, Provo, UT

9:45 Discussion

10:00 25 Longevity and Productivity of *Taenia taeniaeformis* in Cats
JF Williams and A Shearer, E. Lansing, MI

10:15 Break

SESSION 5: EXPERIMENTAL STUDIES
Presiding Officer: B. Hammerberg

10:45 26 *Dipetalonema reconditum* in Beagles: Studies using Experimental Infections
BA Lindemann and JW McCall, Athens, GA

11:00 27 *In vitro* Cultivation of Equine Strongyle Larvae to the Fourth Stage
RG Farrar and TR Klei, Baton Rouge, LA

11:15 28 Modulation of Abomasal Gland Respiration by *In vitro* Products of *Ostertagia*
C Wakley and B Hammerberg, Blacksburg, VA

11:30 29 *In vitro* and *in vivo* Models for Maintenance of *Dirofilaria immitis* microfilariae
R Grieve and M Mika, Philadelphia, PA

11:45 Lunch

SESSION 6: PARASITISMS WITH ZOONOTIC POTENTIAL
Presiding Officer: PM Schantz

1:00 PM 30 Surveillance Systems and Current Status of Parasitic Zoonoses in the United States
PM Schantz, Atlanta, GA

1:30 31 Animal and Public Health Implications of the Nematode Genus *Baylisascaris*
KR Kazacos, W. Lafayette, IN

1:45 32 Epizootic Toxoplasmosis in Montana Associated with Aborton in Dairy Goats
JP Dubey, Bozeman, MT

2:00 33 Resistance of *Trichinella nativa* to Low Temperatures
HJ Smith, New Brunswick, CANADA

2:15 34 Currrent Status of Technology for Surveillance of Trichinosis in Swine
RS Isenstein, Beltsville, MD

SESSION 7: EPIDEMIOLOGY
Presiding Officer: R. Corwin

2:45 35 Bionomics of Ruminant Gastrointestinal Parasites During a Season of Record Drought
MA Brauer and RM Corwin, Columbia, MI

3:00 36 Inhibited Larval Development of *Ostertagia ostertagi* in Spring and Maturation of Worms in Autumn
JC Williams, JW Knox, BA Baumann, TG Snider, MG Kimball and TJ Hoerner, Baton Rouge, LA

3:15 37 Clinical Outbreak of *Fasciola hepatica* in Domestic Goats in Montana
WJ Foreyt, CW Leathers and A Fetcher, Pullman, WA

3:30 38 A Two-Year Study on Seasonal Transmission of *Fasciola hepatica* to Louisiana Cattle
JB Malone, A Loyacano and M Hugh-Jones, Baton Rouge, LA

3:45 Break

SESSION 8: IMMUNITY
Presiding Officer: R. Herd

4:15 39 Immunochemical Studies on the Epicuticle of *Strongyloides ransomi*
KD Murrell, Beltsville, MD

4:30 40 Vaccination of Foals Against *Strongylus vulgaris*
TR Klei, BJ Torbert, MR Chapman and R Ochoa, Baton Rouge, LA

4:45 41 Importance of Cell-Mediated Immunity in the Development of or Resistance to Clinical Coccidiosis in the Chicken
JJ Giambrone, PH Klesius, MK Eckman and SA Edgar, Auburn, AL

5:00 42 *Fasciola hepatica*: Influences on the Immune System of Sheep
GL Zimmerman and JE Cerro, Corvallis, OR

5:15 43 Plasma Enzyme Levels as a Possible Means of Diagnosis of *Fasciola hepatica* Infections in Beef Calves
JH Wyckoff III and RE Bradley, Sr., Gainesville, FL

1 THE ANTHELMINTIC EFFICACY OF MK-401 AGAINST FASCIOLA HEPATICA IN CATTLE UNDER PUERTO RICAN CONDITIONS.

D. DE LEON and R. QUIÑONES, Department of Animal Industry, Agricultural Experiment Station, University of Puerto Rico, Río Piedras, Puerto Rico.

The controlled test method was used to evaluate the anthelmintic efficacy of MK-401 against Fasciola hepatica in cattle in Puerto Rico. A total of 20 Holstein-Friesian and Brown Swiss calves, of both sexes, approximately 3 to 5 months old, parasite-free and artificially infected per os with 500 to 600 F. hepatica metacercariae in sealed gelatin capsules were used in this study. Eight weeks after exposure to F. hepatica metacercariae the experimental calves were treated with MK-401 and the control calves were given a placebo. Dose levels of drug tested were 3 mg/kg, 6 mg/kg, and 12 mg/kg bwt.

Three weeks after administration of the drug, all the calves were sacrificed and necropsied. MK-401 at 3 mg/kg bwt. was less effective against 8-week old F. hepatica, as indicated by the presence of 1 to 16 flukes in the liver of the treated calves. At 6 mg/kg and 12 mg/kg bwt. the drug had a 100% efficacy against F. hepatica.

The calves given placebo had 19 to 120 immature and mature liver-flukes.

2 XANTHENE DYES - A NEW APPROACH FOR CONTROL OF BOVINE GASTROINTESTINAL NEMATODES

J. A. HAWKINS, M. C. HEALEY, J. R. HEITZ, and M. H. JOHNSON, College of Veterinary Medicine, Mississippi State University, Mississippi State, Mississippi

Certain Xanthene dyes have recently been shown to be extremely toxic to a number of different insects. The primary mechanism of action is a light dependent photooxidation. This study is apparently the first attempt to apply this principle of photodynamic action to the control of bovine gastrointestinal nematodes.

Eight heavily parasitized mixed breed calves with naturally acquired mixed infections were treated per os with erythrosin B at 20, 30, 40, 60 mg/Kg (2 calves per dosage level). Two calves served as untreated controls. Fecal samples were collected daily from these calves. EPG counts were monitored daily and fecal samples were periodically set up for culture. After 10-14 days, third stage larvae were collected by baermannization and exposed to a controlled light source of approximately 1/10 the intensity of direct sunlight. Larval mortality was observed every 30 minutes for six hours. This experiment was replicated many times. Feces was also collected from untreated parasitized calves and erythrosin B was added at a rate of 125 to 3000 mg/Kg of feces. Larvae were cultured from this treated feces and exposed to light as before. Larval mortality reached 90% at a dosage of 30-40 mg/Kg body weight after 3-3½ hours of light exposure if calves were treated per os. If the feces was treated directly with dye, larval mortality approached 90% at 750 mg/Kg of feces after 5-5½ hours of light exposure. Larval mortality in controls generally remained below 10%.

These studies indicate that erythrosin B is extremely toxic to third stage larvae of gastrointestinal nematodes of cattle. Even if the toxic effects are limited to infective larvae, this approach can be utilized to effectively "clean up" a pasture so that reinfection may be minimized to insignificant levels.

3 ANTHELMINTIC EFFICACY OF OXIBENDAZOLE ON EQUIDS: A COMPARISON OF METHODOLOGIES

V. J. THEODORIDES, TED NAWALINSKI, NICHOLAS CHIMES, C. WEIDEMAN, and S. M. FREE, Applebrook Research Center, SmithKline Corp., West Chester, Pennsylvania.

Oxibendazole paste at a dose level of 10 mg/kg removed 94 to 100% of Craterostomum acuticaudatum, Cyathostomum spp., Cylicostephanus spp., Cylicocyclus spp., Cylicodontophorus spp., Gyalocephalus capitatus, Habronema spp., larval and adult Oxyuris equi, Poteriostomum spp., Strongylus edentatus, Strongylus equinus, Strongylus vulgaris, and Triodontophorus spp.; it also removed 92% of immature small strongylids, as determined by the Critical Test. A detailed comparison of the one-group "Critical Test" with the two-group "Control Test" showed the Two-Group Test to be 2.4 times as cost-effective as the Critical Test, largely a result of greatly reduced labor cost because no post-treatment feces need to be sieved for expelled worms. The Two-Group Test is also more statistically sound since, unlike the Critical Test, it develops data that permit an unbiased comparison.

4 IVERMECTIN: EFFICACY EVALUATION IN HORSES.

W. H. D. LEANING and E. S. BROKKEN, Merck Sharp & Dohme Research Laboratories, P. O. Box 2000, Rahway, New Jersey.

Ivermectin for the control of a wide range of gastrointestinal nematodes and stomach bots in horses has been evaluated in 13 controlled efficacy trials and 30 field trials; a total of 1,316 horses was involved. Four dose titration studies suggested that the optimal dose rate, when given parenterally, was between 200 and 300 mcg/kg, with particular emphasis on the control of small strongyles. A series of 6 dose-confirmation studies was conducted in the U.S.A. comparing the two intramuscular dose rates. There was no significant difference between 200 and 300 mcg/kg. A total of 11 controlled efficacy dose-confirmation studies carried out in the U.S.A. resulted in the following efficacy profile. For adult parasites the average reduction in worm burden was greater than 96% for Strongylus vulgaris, S. edentatus, Triodontophorus spp, small strongyles: (Cyathostomum spp, Cylicocyclus spp, Cylicostephanus spp), Parascaris equorum, Trichostrongylus axei, and Habronema muscae. Adult Oxyuris equi were reduced by 90%. Taken as a group, small strongyles were reduced by more than 99%. Not all the small strongyles occurred in all trials where the species were identified; efficacy was sufficiently high, however, to give confidence that a single intramuscular injection of ivermectin would effectively control all species of small strongyles listed. Immature small strongyles were reduced by 96 to greater than 99%; Immature Oxyuris equi by 93 to 97%. Those stages of the horse bots, Gastrophilus spp, that reside in the stomach (L_2 and L_3) were also controlled. Reductions of more than 99% to 100% were observed for G. intestinalis, G. nasalis and G. haemorrhoidalis.

5 IVERMECTIN: EFFICACY EVALUATION IN CATTLE.

R. A. RONCALLI, W. H. D. LEANING and E. S. BROKKEN, Merck Sharp & Dohme Research Laboratories, P. O. Box 2000, Rahway, New Jersey.

Ivermectin for the subcutaneous treatment and control of gastrointestinal and pulmonary nematodes, sucking lice, mange mites and cattle grubs was evaluated in 56 controlled efficacy studies and 181 field trials. A total of 8,205 cattle was involved, of which 5,094 received ivermectin at the proposed dose of 200 mcg/kg or more; the remainder serving as controls. A series of 13 dose titration studies suggested 200 mcg/kg as the optimal dose. A total of 31 controlled trials provided data useful for evaluating the efficacy of the selected dose against a wide range of endoparasites. Efficacy was 95% or better against adult and immature Haemonchus placei, Ostertagia ostertagi (including inhibited L_4 stages), Ostertagia lyrata, Trichostrongylus axei, Cooperia spp, Oesophagostomum radiatum, Nematodirus spathiger (adult) and Dictyocaulus viviparus.

The dose rate confirmed as optimal for endoparasites also proved very effective against sucking lice and mange mites. In nine of ten trials with Linognathus vituli, no living lice were found on the treated animals 7 days after injection. In five trials Haematopinus eurysternus was eliminated from the cattle by seven days. In ten trials activity against the biting louse, Damalinia bovis was variable and ivermectin could be considered as an aid in the control of this infestation. In four trials no living Psoroptes ovis mites were found 14 days after a single subcutaneous injection of 200 mcg/kg. In all three trials, Sarcoptes bovis mites were eliminated by 7 days after treatment. Ivermectin has shown practically complete control of all 3 instars of cattle grubs, Hypoderma bovis and H. lineatum. In 82 field trials involving 2,088 cattle, no anaphylaxis associated with killing migrating larvae occurred.

6 EFFICACY OF IVERMECTIN AGAINST "SUMMER SORES" DUE TO DRASCHIA AND HABRONEMA INFECTION IN HORSES.

R. P. HERD and J. C. DONHAM, College of Veterinary Medicine, The Ohio State University, Columbus, Ohio.

Thirty-one naturally occurring cases of "summer sores" were treated with a single intramuscular injection of 0.2 mg/kg of Ivermectin (22,23-dihydroavermectin B1) during the summer of 1980. Larvae of Draschia and/or Habronema spp. were recovered from biopsy samples taken from 21 out of 25 of the horses (84%) on the day of treatment.

There was a marked clinical improvement 7 days post-treatment in 26 horses (84%). The typical "summer sores" was replaced by healthy pink granulation tissue at 7 days and this healed after a further 1-5 weeks. Biopsy samples were taken from 21 of these horses 1-6 weeks post-treatment. In 18 horses (86%), the samples were negative for larvae. Five of the 31 infected horses did not respond to a single treatment and appeared to have become re-infected. Biopsy samples taken from 3 of these horses were positive for larvae 2-4 weeks after the first treatment, but became negative and healed 1-2 weeks after a second treatment with Ivermectin.

Histopathological examination of sections from lesions before treatment showed granulation tissue with marked eosinophilic infiltration, multiple eosinophilic abscesses and transverse sections of nematodes. In post-treatment sections there was a striking reduction in the number of eosinophils, an absence of eosinophilic abscesses or nematodes, and the granulation tissue was more mature as indicated by the appearance of dense fibrous connective tissue.

7 FENBENDAZOLE - INTRODUCTION & DEVELOPMENT

R. K. MUSER, Hoechst-Roussel Pharmaceuticals Inc., Somerville, NJ.

Fenbendazole is an anthelmintic with a wide spectrum of activity against nematode parasites. A favorable safety margin should allow use in many host animals regardless of their use type, sex and reproductive status. The drug has been commercially available in Europe for use in cattle since 1974. In the United States it is currently only approved for use in horses.

Basic safety and efficacy features concerning the major target species (cattle, horses & pigs) will be discussed.

8 EFFICACY OF FENBENDAZOLE AGAINST THE FRINGED TAPEWORM, THYSANOSOMA ACTINIOIDES, IN RANGE SHEEP.

R. C. BERGSTROM and B. A. WERNER, Division of Microbiology and Veterinary Medicine, University of Wyoming, Laramie 82071

The fringed tapeworm, T. actinioides, usually does not cause clinical disease in sheep. However, in concert with trichostrongylid nematodes, bacterial or viral infections, the effect of the tapeworm infection assumes more importance. Liver condemnations at slaughter have been high due to the presence of the tapeworm in hepatic, bile or pancreatic ducts. Most anthelmintic drugs now available for use in sheep are not effective against T. actinioides. Fenbendazole (Hoechst-Roussel) has shown good efficacy in recent trials against the cestode in Wyoming sheep. At dosage levels of 5 mg/kg the drug removed only 0-15% of the T. actinioides adults. At 10 mg /kg the efficacy was increased to 68-84%. The drug was effective against adults of Moniezia expansa but not against Cysticercus tenuicollis. Trichostrongylid nematode species present were, in order of prevalence and numbers per host: Ostertagia sp., Nematodirus sp., Cooperia sp., Trichostrongylus colubriformis and Marshallagia marshalli. Based on necropsies and fecal examinations, these species were reduced in number by 95-98% at 5 mg/kg and from 99-100% at 10 mg/kg. Trichuris sp., were present in low numbers before and after treatment. Necropsy and laboratory assistance by Dr. R. Muser, as well as anthelmintic and financial aid from Hoechst-Roussel is hereby acknowledged.

9 TREATMENT OF DRUG RESISTANT SMALL STRONGYLES OF EQUINES WITH COMBINATIONS OF FENBENDAZOLE AND PIPERAZINE

R. B. WESCOTT, L. W. JEN, AND L. E. HELLIER, College of Veterinary Medicine, Washington State University, Pullman, Washington

Efficacy of fenbendazole and combinations of fenbendazole and piperazine [dihydrochloride (D) and piperazine phosphate monohydrate (M)] was evaluated in three clinical tests and one critical test in horses harboring benzimidazole resistant small strongyles. In two clinical tests, groups of 8 to 11 horses were treated with 3, 4, or 5 mg/kg fenbendazole alone and in combination with 25, 40, or 55 mg/kg piperazine M. The critical test was performed on six horses. Two received 5 mg/kg fenbendazole alone and the remainder 5 mg/kg of fenbendazole with 40 mg/kg piperazine M. Efficacy in the clinical tests, measured by reductions in fecal egg counts before and after treatment, was 84 to 87% in horses given fenbendazole alone and 92 to <99% in horses given combinations of fenbendazole and piperazine. Efficacy in the critical test, measured by numbers of parasites present in feces after treatment and remaining at necropsy, in horses given fenbendazole alone was 14, 45, 60, 67, 83, and 67% for Cyathostomum coronatum, Cylicocyclus leptostomus, C. nassatus, C. brevicapsulatus, C. insigne, and Cylicostephanus goldi respectively and excellent (96 to 100%) for seven other species of small strongyles. Similar populations of small strongyles in horses given fenbendazole with piperazine were removed more effectively (92 to 100%). The results of both the clinical and critical tests suggest that combinations of piperazine (25 to 55 mg/kg D or M) and fenbendazole (3 to 5 mg/kg) were more effective than fenbendazole alone for removal of benzimidazole resistant small strongyles.

10 CLINICAL TRIALS WITH FENBENDAZOLE AND FENBENDAZOLE-PIPERAZINE MIXTURES IN HORSES

J. A. DiPietro, T. F. Lock, and K. S. Todd, College of Veterinary Medicine, University of Illinois, Urbana, Illinois 61801

Clinical trials were done on 40 horses of various sex, breed, and age with naturally acquired parasitic infections from a herd with a history of routine deworming with benzimindazoles. Prior clinical trials on this herd demonstrated incomplete activity of Fenbendazole (FBZ) against strongyles. The horses were randomly assigned 1 of 4 treatments (Tx): Tx 1 - 4 mg/kg FBZ, Tx 2 - 4 mg/kg FBZ and 55 mg/kg piperazine base (PZ), Tx 3 - 4 mg/kg FBZ and 40 mg/kg PZ, and Tx 4 - 4 mg/kg FBZ and 25 mg/kg PZ. The dihydrochloride salt of piperazine was used. The treatments were administered once via stomach tube. Fecal samples were obtained from the rectum immediately prior to treatment and 7 days post treatment. A strongyle egg per gram count (EPG) was done on the samples using a modified McMaster's technique. Observation of the horses for signs of adverse reactions were carried out for seven days post treatment.

The horses treated with FBZ alone had the smallest mean percent reduction in strongyle EPG, 14.2%. A 100% reduction in mean strongyle EPG occurred in the horses in Tx 2 (4 mg/kg FBZ and 55 mg/kg PZ) and in Tx 3 (4 mg/kg FBZ and 40 mg/kg PZ). A 78.6% reduction in mean strongyle EPG occurred in the horses in Tx 4 (4 mg/kg FBZ and 25 mg/kg PZ). Forty mg/kg was the minimum dose of PZ to combine with FBZ to maximize the reduction in strongyle EPG. The mixtures appeared to be significantly more effective in the control of strongyles than FBZ alone. Adverse reactions were not observed in any of the horses.

11 PRODUCTION PARAMETERS OF WISCONSIN DAIRY HEIFERS FOLLOWING SYSTEMATIC DEWORMING WITH FENBENDAZOLE

G. H. MYERS, Hoechst-Roussel Pharmaceuticals Inc., Somerville, NJ. and A. C. Todd, University of Wisconsin, Madison, WI.

From August 1977 through October 1979 average daily gains, (ADG) a measure of growth, were compared among 212 replacement heifers on 12 Wisconsin dairy farms. Half the heifers were dewormed at 30 or 60 day intervals with fenbendazole 10% suspension (FBZ) at 5 mg/kg. The objective was to raise dairy heifers relatively free of gastrointestinal helminths demonstrating the effects of chronic subclinical infections on growth and future productivity in comparison with untreated controls. Treatment every 30 days achieved effective control of subclinical infections and improved ADG by 0.09 kg ($P < 0.01$).

Lactation data including age at parturition continue to be assembled. To date, data have been obtained from 51 control and 54 treated heifers on 7 farms. Due to sample size and the as yet incomplete nature of the study only limited conclusions can be drawn concerning the future productivity of dairy heifers raised on the control program.

12 CONTROLLED-RELEASE PROPHYLACTIC ALBENDAZOLE TREATMENT FOR HELMINTHS OF SHEEP

R. S. REW and R. FETTERER, USDA, SEA, Animal Parasitology Institute, Beltsville, Maryland

30 Polled Dorest sheep were divided into 6 groups. 3 groups were given 3-4 controlled-release albendazole (ABZ) boluses/sheep. Each bolus group weighed 18-25 g and contained 20% ABZ. Beginning 3 days after bolus introduction, the sheep were inoculated with either Haemonchus contortus infective larvae (5,000) or Fasciola hepatica metacercariae (150) or both. Egg counts and PCV were done weekly for H. contortus infected sheep. Egg counts, PCV and gamma-GT were done for F. hepatica infected sheep. 10 sheep infected with H. contortus only were necropsied 4 weeks following inoculation. Egg counts for these 10 sheep indicated a 97-99% decrease in EPG as compared to controls. Necropsies demonstrated an 88% decrease in worm burdens. Boluses removed from the rumen and weighed indicated a release rate of 0.53-1.0 mg ABZ/kg body weight/day in 5 sheep. Bile duct pathology at 7 or 9 weeks postinoculation of 20 F. hepatica infected sheep as measured by serum gamma-GT indicated no decrease in fluke burdens by controlled release ABZ boluses. Necropsy of those 20 F. hepatica infected sheep 13 weeks postinoculation demonstrated no difference between fluke burdens of treated and untreated sheep.

13 SUDDEN DEATHS IN PIGS ASSOCIATED WITH STEPHANURUS DENTATUS

EDWARD G. BATTE, School of Veterinary Medicine, North Carolina State University, Raleigh, North Carolina 27650

The swine kidneyworm (Stephanurus dentatus) has a wide geographical distribution is tropical and subtropical regions of the world. Kidneyworm larvae migration and resultant damage is responsible for a large percentage of liver and carcass condemnation in abattoirs.

Experimental infection of parasite-free piglets with infective S. dentatus larvae consistently resulted in deaths of some infected animals. The deaths occurred 20-30 days post infection. This correlates with the migration of larvae from the mesenteric lymph nodes to the liver. The piglets were apparently normal in the afternoon but some died overnight.

At necropsy severe peritonitis, intussusception, adhesions and necrosis were observed. Histological examinations of amorphous reactionary tissue masses showed S. dentatus larvae surrounded by lymphoid and reticuloendothelial cells and a few eosinophils. There was extensive fibrosis surrounding the inflammatory foci.

Veterinarians practicing in S. dentatus endemic areas have reported finding pigs that died overnight with lesions similar to those experimentally produced by infecting pigs with S. dentatus larvae.

Treatment of naturally infected sows with an effective anthelmintic will remove S. dentatus which serve as a source of infection of piglets.

14 MECHANISMS OF DEVELOPMENT OF ASCARIASIS INDUCED ESOPHAGO-GASTRIC ULCERS IN SWINE.

V.LOPEZ and S. M. GAAFAR, Department of Veterinary Microbiology and Pathology, School of Veterinary Medicine, Purdue University, West Lafayette, Indiana.

Two experimental oral inoculations with larvated *Ascaris suum* eggs at a two week interval induced esophago-gastric ulcers in young pigs. No larvae were demonstrated in or around the ulcer. Esophago-gastric ulceration is of common occurrence in pigs and ascariasis seems not to be the only cause of the lesion. The clinical signs of the condition are observed less frequently than the deep ulcers in the *pars esophagea* of the stomach after death of the pigs. The economic importance of swine esophago-gastric ulcers has been discussed by several authors.

The mechanism of development of the ulcers is not known. In the pigs having *A. suum* induced ulcers an intense hepatic fibrosis appears to be a prerequisite for the development of the ulcers. A several fold increase in Portal Venous Pressure (PVP) has been demonstrated in these pigs compared to uninfected or single inoculation controls. The hypertension seems to cause sludging and localized circulatory embarrassment in the venous drainage from the esophago-gastric area which is then followed by ulceration.

An experimental model has been developed to induce presinusoidal portal hypertension by surgically inoculating inert polystyrene microspheres directly into the portal circulation. Though no fibrosis occurs a raised PVP was induced and esophago-gastric ulcers were produced. These were histologically identical to those produced by *A. suum* inoculations or other causes.

The implications of these findings will be briefly discussed.

15 DEMODICOSIS IN DAIRY GOATS.

J. F. WILLIAMS and C. S. F. WILLIAMS, Department of Microbiology and Public Health, and Laboratory Animal Care Service, Michigan State University, East Lansing, Michigan.

Multiple nodular skin lesions on an adult Saanen doe were found to be caused by demodectic mites. An identical condition developed in the daughter of the affected goat despite separation from the mother at 24 hours after birth. Of seven other goats in contact with the doe, two had a few demodectic nodules. Of 84 goats examined at a local show, seven (from four herds) were similarly affected. The observations suggested that the nodular form of demodicosis is widespread in Michigan dairy goats, and that perinatal transmission may occur.

16 OBSERVATIONS OF THE NATURE AND TREATMENT OF GIARDIASIS IN PARAKEETS.

ROBERT G. SCHOLTENS and JOHN C. NEW, College of Veterinary Medicine, University of Tennessee, Knoxville, Tennessee.

Giardia is a common intestinal flagellate of many mammals, but has been found in only a few birds, all at necropsy. The prevalence of giardiasis in 77 parakeets from 4 widely varied sources was found to be 66%. The infection appeared most common in young birds. Both cysts and trophozoites were found in fecal samples, and persisted in birds caged alone for up to four months. New infections appeared when infected and noninfected birds were caged together. Treatment with 200 ppm dimetridazole in the drinking water was less effective than three oral doses at 1.5 mg/30gm bird at 12 hour intervals by stomach tube. Metronidazole therapy was not effective.

17 CLINICAL, PATHOLOGIC AND EPIDEMOLOGIC OBSERVATIONS ON EQUINE PROTOZOAL MYELOENCEPHALITIS.

I.G. MAYHEW[1], R. FAYER[2] and C.F. SIMPSON[1], [1]College of Veterinary Medicine, University of Florida, Gainesville, Florida and [2]USDA, Beltsville, Md.

Since 1978, Equine Protozoal Myeloencephalitis (EPM) has been diagnosed histologically in 31 horses, and clinically in approximately 20 further horses, at the University of Florida. An essentially identical disease is seen in Brazil. Previous serologic data from North American cases suggested an association with Sarcocystis cruzi (bovicanis) whereas serologic data from Brazil related that disease to Toxoplasma gondii. In a trial in Florida, 2 corticosteroid immunosuppressed and 2 intact horses were given 1 X 10^6 viable S. bovicanis sporocysts p.o. and 2 suppressed and 2 intact horses used as controls. Clinicopathologic, clinical, or gross and microscopic pathologic examinations as well as indirect hemagglutinating (IHA) antibody testing all failed to confirm successful infection with S. bovicanis. Toxoplasma IHA antibody testing of sera from New York (n=5) and Florida (n=5) horses with EPM and horses without EPM (n=10), as well as indirect fluorescent antibody testing of some of the New York (n=3) and Florida (n=2) horses with EPM and a control, failed to related EPM with toxoplasmosis. Kidney sections from 10 horses from New York with EPM and 10 horses without EPM were scrutinized for the presence of Klossiella equi organisms, which were seen in only one horse with EPM and in none of the controls. Three horses, clinically suspected of having EPM, were given corticosteroids and neurologic signs progressed rapidly. Large numbers of protozoa were present in their CNS tissues. Electronmicroscopic examination of these multiplying organisms indicated a form of endopolyogeny similar to that described for Sarcocystis spp. Merozoites were detected in leukocytes within intact capillaries in the CNS. Light microscopic examination of buffy coat smears from two of these horses failed to reveal a parasitemia.

18 OLLULANUS TRICUSPIS, A GASTRIC NEMATODE IN CATS.

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Ollulanus tricuspis, a minute gastric nematode with worldwide distribution but not previously identified in the United States, was found in four of six feline breeding colonies in the Pacific Northwest. The life cycle of Ollulanus is direct and it is believed that Ollulanus is transmitted when nonparasitized cats ingest vomitus containing the third or fourth stage larvae or adult parasites. Information on the life cycle of Ollulanus is incomplete, and it is not known which larval stage is infective or if endogenous development occurs. Adult and larval Ollulanus are not visible grossly (1 mm length) and usually are not present in the feces. Therefore, it seems likely that Ollulanus has been overlooked during antemortem and postmortem examinations. Diagnosis of Ollulanus can be made by examination of vomitus or stomach contents with a dissecting microscope. In the present study, stomachs from infected cats contained a mild increase in mucosal lymphoid follicles and fibrosis. Ollulanus may cause unthriftiness in kittens by causing catarrhal gastritis with resultant vomiting. One cat reportedly died due to chronic sclerosing gastritis caused by Ollulanus. Because of the potential problems associated with this parasite, such as interfering with research results or growth and propagation of neonates, an effective means of antemortem diagnosis and treatment would be beneficial.

19 OCCURRENCE OF PARAMPHISTOMUM MICROBOTHRIOIDES PRICE & MCINTOSH, 1944, IN AMERICAN BISON (BISON BISON) AND DOMESTIC BEEF CATTLE.

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Intestinal paramphistomiosis was diagnosed in a Hereford bull and cow admitted to The Ohio State University Veterinary Hospital in 1980. The animals exhibited severe diarrhea and weight loss over a prolonged period, but had negative mucosal stains and fecal cultures for Mycobacterium paratuberculosis, as well as negative fecal flotation and plasma pepsinogen determinations.

The history of the farm of origin suggested that infection with Paramphistomum microbothrioides had been transmitted from American bison (Bison bison) to the beef cattle. The rumen fluke, P. microbothrioides was recovered from the rumen of 3 bison at slaughter. Single operculate eggs of P. microbothrioides measuring 130 x 69 microns were recovered from feces of the Hereford bull, from 9 of 10 bison and from 3 of 9 other beef cattle. Snails of the genera Physa and Helisoma were collected at the farm of origin. This appears to be the first report of an amphistome parasite in American bison.

20 THE VACUUM CLEANER METHOD IN THE DIAGNOSIS OF ECTOPARASITIC INFECTIONS IN ANIMALS.

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A vacuum cleaner fitted with an in-line filter was used to collect samples from suspected cases of ectoparasitic infection in animals. Filter samples, including hair, were hydrolyzed in hot potassium hydroxide and the residue was concentrated by flotation in concentrated sugar and then examined under a microscope.

Two hundred and six animals were examined. Fleas, flea feces, forage mites, Cheyletiella, Sarcoptes, Chorioptes, Psoroptes, Otodectes, Demodex, and Damalinia spp were found. The sensitivity of this technique in the diagnosis of ectoparasite infestations was better than that of conventional skin scraping techniques or direct observation.

21 PRAZIQUANTEL - A NEW CESTOCIDE FOR DOGS.

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Praziquantel is a new chemical entity unlike any of the current anthelmintics with activity primarily against cestodes and schistosomes. It has been studied in dogs by various investigators using injectable (56.8 mg praziquantel/ml) and tablet (34 mg praziquantel/tablet) formulations. The injectable solution is approved for use against Taenia pisiformis, Dipylidium caninum and Echinococcus granulosus in dogs.

The drug is rapidly absorbed and eliminated by the dog. Praziquantel acts on cestodes by causing a rapid contraction of the musculature, interrupting the integument and producing a disruption in the metabolic processes.

Preliminary studies indicated that the same mg/kg dose rate was less effective in animals under 25 lb. body weight than it was in heavier animals. A logarithmic dosage schedule was developed that would provide a relatively higher dose for the smaller dog. This was the dosage schedule that was studied and reported here.

Seventy dogs with confirmed natural infections of either T. pisiformis, D. caninum or both were used. Forty-six were treated with praziquantel and 24 others were untreated controls. Treated animals received either the injectable formulation or the 34 mg tablet. Efficacy was measured by comparing the elimination of cestodes following dosing with those found at necropsy. Praziquantel produced 100% elimination of all T. pisiformis and D. caninum in all animals treated according to the recommended dosage schedule. The drug was ineffective against nematodes.

22 EFFICACY OF DRONCIT[R] (PRAZIQUANTEL), A NEW INJECTABLE CESTOCIDE FOR DOGS AND CATS

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The development of praziquantel included evaluation of various dose levels and routes of administration for tapeworm control in dogs and cats. The Food and Drug Administration approved DRONCIT[R] (praziquantel) Injectable Cestocide for Dogs on February 3, 1981 for use by subcutaneous or intramuscular injection. Approval of the product for cats is pending.

Forty-four dogs infected with Taenia pisiformis were treated with praziquantel in 8 critical or controlled-critical trials. A single praziquantel injection of 2.2 - 4.9 mg/kg gave 100% efficacy against T. pisiformis in all 18 treated dogs. A dose of 1.1 mg/kg resulted in 100% efficacy against T. pisiformis in 13 of 13 dogs but gave poor (0-72%) control in 7 puppies. The lowest doses tested (0.5 - 0.6 mg/kg) frequently gave unsatisfactory efficacy (0-100%) in 6 dogs. Efficacy of praziquantel against Dipylidium caninum was evaluated in 4 of the trials (6 dogs). Treatment with 2.2 - 2.5 mg/kg gave 100% efficacy in 3 dogs, while doses of 0.6 - 1.1 mg/kg resulted in 0-73% efficacy in 3 dogs.

The efficacy of injectable praziquantel against experimental and natural infections of T. taeniaeformis was evaluated by treating 55 cats in 5 controlled-critical trials. Twenty of the 55 (2 trials) were treated 7 days after experimental infection with T. taeniaeformis. A single treatment with 2.3 - 10.2 mg/kg resulted in 100% efficacy against T. taeniaeformis in all 55 cats. The effect of injectable praziquantel on D. caninum was determined by treating 13 infected cats in 3 trials. Efficacy was 100% in all 13 animals treated with doses of 2.3 to 7.1 mg/kg.

23 EFFICACY OF A TABLET FORMULATION OF DRONCIT[R] (PRAZIQUANTEL), A NEW CESTOCIDE FOR DOGS AND CATS

R. G. ARTHER and D. D. COX, Pharmaceutical Research and Development, Bayvet Division of Cutter Laboratories, Inc., Shawnee, Kansas.

DRONCIT[R] (praziquantel) Injectable Cestocide was recently introduced in the United States for control of canine tapeworms. Oral formulations of praziquantel are also highly effective against canine and feline tapeworms. Efficacy of praziquantel administered in tablets or capsules against canine tapeworms was evaluated in 10 studies involving 65 treated and control dogs. Single oral dosages of 0.5 to 1.0 mg/kg provided 100% efficacy against Taenia pisiformis in 7 of 8 dogs, and 100% efficacy in 29 of 29 dogs receiving dosages of 1.1 to 5.7 mg/kg. Efficacy against T. pisiformis was 100% in 4 of 4 dogs receiving 0.5 mg/kg daily for 3 days. Efficacy of praziquantel against Dipylidium caninum was 100% in 12 of 13 dogs treated with single oral dosages between 0.5 and 4.9 mg/kg. Efficacy of praziquantel in tablet formulation against feline tapeworms was evaluated in 5 studies involving 53 treated and control cats. Single oral dosages between 2.5 and 10.3 mg/kg provided 100% efficacy in 27 of 27 cats infected with Taenia taeniaeformis. Efficacy against D. caninum was 100% in 6 of 7 cats receiving 2.5 to 7.4 mg/kg.

24 EFFICACY OF PRAZIQUANTEL AGAINST ECHINOCOCCUS SPP.

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Praziquantel, which is known to be effective against a variety of cestodes and trematodes, was tested in our laboratory for efficacy against mature and immature Echinococcus granulosus tapeworms in experimentally infected dogs, and also against immature E. multilocularis tapeworms in experimentally infected dogs and cats. The compound was found to give complete removal of the tapeworms when given at dosage levels of either 5 or 8 mg/kg of body weight, and when administered via tablet or injectable formulation. Signs of toxicosis were not observed in any of the experimental hosts given either dosage or formulation of praziquantel. We feel this compound is extremely effective against Echinococcus spp. found in the United States, and can now be highly recommended as the drug of choice in all preventive and control programs which might be implemented in regions where these parasites are found to be endemic.

25 LONGEVITY AND PRODUCTIVITY OF TAENIA TAENIAEFORMIS IN CATS.

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The longevity and productivity of Taenia taeniaeformis was studied in experimentally infected cats. Nineteen of 20 cats became infected after being given 8-12 strobilocerci. In 8 cats the mean prepatent period was 47.1 days ± 5.9 S.E. with a range of 34-80 days. Patent periods in the infected animals ranged from 7 to 34 months. In 11 cats in which the infections were allowed to terminate naturally the mean patent period was 17.4 months ± 2.3 S.E. Two of these cats were then given a second dose of strobilocerci and both became reinfected. The mean daily proglottid output in 6 cats followed over the entire patent period was 4.3 ± 0.5 S.E. Destrobilization occurred spontaneously and sporadically throughout the infection, but did not always increase at the time of natural termination. In most cases proglottid productivity began to decline after the first year of infection. Shed proglottids contained 0-12,180 eggs, with a mean of 1606 ± 402 S.E., but over 60% contained 500 or less. Taenia taeniaeformis appears to be as persistent as other taeniids, such as T. ovis and T. hydatigena in the dog, but it is less prolific as an egg producer.

26 DIPETALONEMA RECONDITUM IN BEAGLES: STUDIES USING EXPERIMENTAL INFECTIONS.

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Dipetalonema reconditum is a subcutaneous filarial nematode of dogs. Although it is generally considered non-pathogenic, little is known about the parasite. This dearth of knowledge is primarily due to difficulties in establishing experimental infections. This study was initiated 1) to establish experimental infections in dogs by subcutaneous inoculation, 2) to determine whether anesthetized dogs could be infected by oral inoculation or skin penetration and 3) to determine whether cats or jirds are susceptible to this filaria following subcutaneous inoculation. A total of 11 mongrel and Beagle dogs (both sexes) ranging in age from 17 days to 25 months, 2 adult male cats and 6 adult male Mongolian jirds were used. All animals were housed in mosquito-proof quarters and were negative for microfilariae prior to inoculation. Infective larvae were collected from Ctenocephalides felis adults which had been placed on a microfilaremic dog (100-200 mf/ml) 10-14 days earlier. Inoculum size varied from 19 to 123 larvae. One of the 4 dogs inoculated orally died of distemper 26 days PI. All six dogs which were inoculated subcutaneously developed microfilaremias ($\bar{X}$ prepatent period=79 days) and remained microfilaremic for at least 365 days or until necropsied. The mean maximum microfilaremia was 238 mf/ml. One of the dogs inoculated orally developed a microfilaremia at 66 days PI and remained microfilaremic (max. mf/ml=21) for at least 391 days. The 2 remaining dogs were amicrofilaremic. The dog which was infected by "skin penetration" became infected probably by larval entrance via an abrasion in the skin. This dog was microfilaremic by day 83 PI and amicrofilaremic by day 148 PI with a maximum microfilaremia of 10 mf/ml. The 2 cats and 6 jirds never developed patent infections and did not have worms at necropsy.

27 IN VITRO CULTIVATION OF EQUINE LARGE STRONGYLE LARVAE TO THE FOURTH STAGE

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Strongylus edentatus was successfully cultured in vitro to the L_4 stage. Growth and differentiation were maintained for periods of 40-50 days at which time marked reductions in viability were observed in some of the culture media systems. Various combinations of media, sera, buffers and organ explant cultures were tested. All cultures were incubated at 37°C in an atomosphere of 95% air and 5% CO_2. Larvae underwent growth and differentiation to the L_4 stage in all media-serum combinations and in media-serum combinations containing all types of organ explant cultures. Development and growth did occur but viability was reduced to non-significant levels in media without serum or cells. Optimal growth, differentiation and longevity were observed in bicarbonate buffered RPMI-1640 with 10% fetal calf serum and gerbil cecum explant cultures.

Observations indicate that S. vulgaris and S. equinus can also be cultured to the L_4 stage using similar techniques. Distinct differences in morphological events were observed between differentiation of S. edentatus and S. vulgaris.

28 MODULATION OF ABOMASAL GLAND RESPIRATION BY IN VITRO PRODUCTS OF OSTERTAGIA.

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Infection of the ruminant abomasum by Ostertagia sp. results in marked functional and structural changes in the glandular and mucosal cells of the abmosal mucosa. The possibility that molecules produced by Ostertagia may be in part responsible for the pathology of ostertagiasis is being investigated by adding in vitro products of larval and adult Ostertagia to isolated gland preparations while monitoring gland respiration.

Two hundred thousand infective stage larvae were cultured up to young adults over a period of 42 days in 100 ml of complex medium described by Douvres and Molakatis (1977). Every 6 days media were changed and processed as follows: lyophilized media were fractionated according to molecular weight by column chromatography on Sephadex G-25 and Sephacryl 200 then desalted by gel filtration or dialysis prior to lyophilization. Isolated gastric glands were obtained from lambs, goats, and rabbits by hyperperfusion (to separate mucosa from the submucosa and serosa) followed by collagenase digestion.

Approximately 8,000 glands in 3 ml of buffer were monitored for the rate of oxygen consumption and these rates were compared between glands incubated with control media and media from worm cultures. Substances between 2,000 and 4,000 daltons in molecular weight in media from worm cultures inhibited sheep abomasal gland respiration up to 80% compared to the same molecular weight fraction from media incubated without worms. This effect was time dependent in that 80% inhibition was achieved after glands and inhibitor had been incubated together for 90 min., while shorter incubation times produced less inhibition. Worm culture medium fractions with molecular weights greater than 4,000 but less than 11,000 increased gland respiration four-fold over medium controls. Between 1 and 3 mg/ml of worm medium products were used in these experiments and similar responses were observed with rabbit and goat gastric glands. The possibility that these small molecular weight materials mimic host endogenous hormones and that the in vitro effects are reproducible in vivo are currently being investigated.

29 IN VITRO AND IN VIVO MODELS FOR THE MAINTENANCE OF DIROFILARIA IMMITIS MICROFILARIAE.

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Experimental studies on live microfilariae of Dirofilaria immitis have been limited due to the lack of a suitable, inexpensive model. Although microfilariae can easily be transfused to and will circulate in dogs, the expense of purchasing and maintaining dogs and the irreproducibility of data between dogs makes extensive studies in dogs infeasible. Maintenance of microfilariae in vitro and in inbred mice provides potential for studies on many aspects of D. immitis microfilariae and the microfilaremia.

Microfilariae, recovered cell-free and maintained in vitro have consistently survived for greater than 6 weeks at 37°C under optimum culture conditions. Similarly, when microfilariae were maintained at 27°C with optimum conditions many organisms underwent morphologic development and survived approximately 4 weeks. Microfilariae recovered from blood by different purification methods prior to in vitro inoculation have shown differences in both the duration of survival at 37°C and the pattern of morphologic development at 27°C. Mature Balb/c female mice were sublethally irradiated with 550r of gamma radiation, then, 48 hours later, inoculated with $1x10^5$ cell-free D. immitis microfilariae. In several experiments, a microfilaremia was demonstrable for greater than 5 weeks. The extent and duration of the microfilaremia were lessened if microfilariae were adversely affected prior to inoculation. (Supported in part by NIH Research Grant AI-18249).

30 SURVEILLANCE SYSTEMS AND CURRENT STATUS OF PARASITIC ZOONOSES IN THE UNITED STATES

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Of the many zoonotic parasitic infections that occur in the United States, trichinosis is the only one for which epidemiologic data are collected systematically. The annual numbers of reported trichinosis cases has been recorded since 1947 and since 1967, more detailed epidemiologic on individual cases has been collected and analyzed. Three out of 4 currently reported cases are caused by commercially purchased pork often consumed as homemade sausage by persons of European ancestry. Other cases are associated with ingestion of hamburger meat adulterated with pork and meat of wild animals. Although trichinosis has declined markedly in the past 40 years, it has now reached a plateau. Further progress may require development and implementation of a specific eradication program. Other parasitic zoonoses are not reportable but, surveillance information is obtained from a variety of sources including requests to the Centers for Disease Control for serologic testing, parasitic disease drugs, and special investigations. Available surveillance data concerning echinococcosis, toxocariasis, taeniasis/cysticercosis, and dirofilariasis will be discussed.

31 ANIMAL AND PUBLIC HEALTH IMPLICATIONS OF THE NEMATODE GENUS BAYLISASCARIS.

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The genus Baylisascaris contains eight recognized and two provisional species, all but one being parasites of placental and marsupial carnivores in the families Procyonidae, Mustelidae, Ursidae and Dasyuridae. Baylisascaris procyonis and B. columnaris, ascarids of raccoons and skunks, respectively, are important producers of visceral larva migrans (VLM) and cerebrospinal nematodiasis (CN) in animals in North America. Naturally occurring fatal central nervous system (CNS) disease due to these species has been reported in mice, squirrels, woodchucks, rabbits, nutria, partridges, chickens and quail, with probable cases in chinchillas, beavers, pigeons and emu. We have found the following range of hosts susceptible to VLM and CN due to B. procyonis, upon experimental inoculation at varying dosages (number fatal CN/number inoculated): 1.) Rodents - mice (25/25), hamsters (32/32), rats (13/20), grey squirrels (13/13); 2.) Avians - chickens (17/50), ducks (8/20); 3.) Carnivores - ferrets (3/4); Primates - squirrel monkeys (4/4). Larval migration was typically extensive and CNS lesions severe. Encapsulation sites varied among these species and did not occur in avians. In addition, experimental swine (0/6) had lung and liver lesions early, but no larvae entered the CNS and encapsulations were restricted to the intestinal tract. Sequential studies in mice, hamsters, rats, ferrets and swine revealed pulmonary damage by 12 hours, maximal at about 48 hours. Several cases of infected pet raccoons were identified, one being linked to a large outbreak of fatal CN in domestic quail (85/85 birds). In urban W. Lafayette, IN, 21 of 89 (24%) raccoons were positive for B. procyonis, compared to 22 of 86 (26%) rural raccoons. Twenty-six of 97 (27%) urban raccoon scats collected from human residences were positive for B. procyonis eggs, compared to 36 of 121 (30%) rural scats. B. procyonis is a proven threat to animal health, and based on these results should be considered a significant potential zoonosis.

32 EPIZOOTIC TOXOPLASMOSIS IN MONTANA ASSOCIATED WITH ABORTION IN DAIRY GOATS.

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Perinatal toxoplasmosis was diagnosed in goats from 2 farms in Montana. Of 7 pregnant does from one farm, 1 aborted a dead fetus and 2 each had a kid infected in utero. Toxoplasma gondii was demonstrated histologically in the placenta of 2 of the infected does and by mouse inoculation in all 3 of them. The organism also was isolated from internal organs of 6 of 7 does, 4 of 4 cats, and 3 of 11 chickens from the farm. A pregnant doe from the other farm delivered 3 kids infected with T gondii. One kid was born dead, 1 was moribund when born, and 1 was healthy when born. Toxoplasma gondii was isolated from the placenta and several tissues of all 3 kids.

33 RESISTANCE OF TRICHINELLA NATIVA TO LOW TEMPERATURES

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Comparative refrigeration trials were carried out with Trichinella nativa and T. spiralis in feline, vulpine and ursine musculature by refrigerating at different temperatures 20 to 50 gram samples of infected musculature sealed in polyethelene bags. At predetermined intervals, samples were thawed at room temperature and digested in a pepsin digestion mixture for 48 hours prior to examination for the presence of viable larvae. At a mean temperature of -15.4°C, T. nativa survived for long periods of time (in one instance over 300 days to date) while T. spiralis survived only for a few days (maximum of 7 days in these trials). At a temperature of -31.9°C, T. nativa survived several days while T. spiralis survived only a few hours. In one trial at lower temperatures, T. nativa larvae were shown to survive less than 24 hours at -45°C and -70°C. Alternate freezing at -15.4°C and thawing of vulpine musculature on six occasions over a period of 12 days did not have deleterious effects on the survival of T. nativa larvae.

These findings reveal that T. nativa infected musculature is not sterilized by the temperatures routinely used in the refrigeration of meat products suggesting that the meat of arctic mammals should be cooked well before human consumption.

34 CURRENT STATUS OF TECHNOLOGY FOR SURVEILLANCE OF TRICHINELLOSIS IN SWINE.

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Trichinellosis in swine in the United States is a parasitic disease of low incidence and high emotional visibility. A program to inspect swine for the presence of trichinae would be instrumental in bringing the disease under control and at the same time relieving the swine industry of perceived enormous economic losses. During the past decade, the marriage and development of various immunological techniques and instrument packages has proceeded to a point where it is believed feasible to test animals on a mass basis. These techniques are applicable to other infectious diseases and toxic agents and the simultaneous testing for more than one disease condition will enhance their economic attractiveness. Mass testing of domestic animals together with the utilization of effective animal identification methods also will contribute greatly to the epidemiologic and epizootiologic understanding of trichinellosis and other animal diseases.

35 BIONOMICS OF RUMINANT GASTROINTESTINAL PARASITES DURING A SEASON OF RECORD DROUGHT

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Missouri experienced record high temperatures and a prolonged period of drought during the 1980 summer grazing season and during the 1980-81 winter grazing season. The transmission of ruminant gastrointestinal parasites was monitored in 3 central Missouri cow-calf herds during the summer season with bi-weekly forage parasite larvae counts and fecal parasite egg counts, and in a fourth herd during the winter season with monthly worm counts in tracer calves.

Parasite larvae migration was severely limited during the summer season but significant rises in fecal egg output were nevertheless observed in 2 of the 3 herds. Of particular interest was an unexpected rise in the level of infection with Nematodirus spp. in one of the herds following the season's highest temperatures. Worm counts were similarly low during the winter in spite of unseasonably mild temperatures. Preliminary evidence was observed for arrested parasitic development during March and April, a period which coincided with the severest shortage of moisture but not necessarily with the coldest temperatures.

36 INHIBITED LARVAL DEVELOPMENT OF OSTERTAGIA OSTERTAGI IN SPRING AND MATURATION OF WORMS IN AUTUMN

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An epidemiological investigation of Ostertagia ostertagi in yearling beef cattle was conducted from winter to autumn in 1980. A major objective of this study was to determine when large burdens of inhibited O. ostertagi, acquired during spring, would mature and would there be any incidence of clinical disease (type II) at this time. The study was begun in January 1980 with 81 Angus cross-bred yearling cattle. Between January and March, 2-3 cattle per month were removed from pasture and killed. Total worm counts remained relatively low, but numbers of inhibited O. ostertagi were greatly increased by March. In April, 6 calves were killed and a mean number of 334,965 inhibited larvae were present. In early May, 62 cattle were randomly alloted into 3 groups of 20 or 21 animals per group; all groups grazed on separate pastures at a standard stocking rate of 20 animals per ha. The cattle were worked at 3-week intervals for weighing, collection of blood and facal samples and clinical observation. Pasture grass samples for larval recovery were also collected at these intervals. Examination of tracer calves after May grazing indicated the acquisition of considerable numbers of inhibited larvae; significant decrease in numbers of larvae was observed in tracers grazed through mid-June.

Representative numbers of cattle (3-4 per group) were killed in mid-June in early August, and in mid-October. Numbers of inhibited O. ostertagi remained at high levels (means of near 600,000) in June and August throughout the summer. By August, numbers of inhibited larvae were slightly increased over levels seen in June and adults remained relatively low. However, in August an increase in numbers of developing larvae was observed. While egg counts, plasma pepsinogen values, and pasture larval counts remained low during most of the excessively dry and hot summer, some cases of moderate to severe parasitism were observed during September and early October in all groups. In animals killed in mid-October, numbers of adult worms were vastly increased and a significant reduction in numbers of inhibited larvae was observed. Egg counts and plasma pepsinogen levels were significantly increased for all groups in October.

37 CLINICAL OUTBREAK OF FASCIOLA HEPATICA IN DOMESTIC GOATS IN MONTANA.

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A naturally occurring outbreak of fascioliasis (Fasciola hepatica) is described in a herd of approximately 90 domestic goats in Montana. Twenty-eight goats had died after a month long clinical course of anorexia, weight loss, depression, lethargy, and decreased milk production. Significant clinical laboratory findings were anemia, low hemoglobin, hypoproteinemia, hypoalbuminemia, eosinophilia, and elevated liver enzymes. Livers of infected goats had extensive parenchymal damage, necrosis, fibrosis, and biliary hyperplasia.

Albendazole oral suspension (20 mg/kg) was used to treat 45 of the remaining 60 goats twice at a 30 day interval; 15 were untreated controls. Pre- and post-treatment means for the treated goats were PCV, 13.6 and 25 percent; hemoglobin, 5.1 and 8.7 d/gl; total protein, 5.8 and 7.3 g/dl; albumin, 1.9 and 3.2 g/dl; and SDH, 103.8 and 17.6 Iu/liter. Egg counts for the untreated group averaged 171 fluke eggs per gram of feces (epg) compared to less than 1 epg for the treated group. After treatment, 15.5% of the treated goats died, whereas 73% of the untreated goats died. Based on necropsy results, albendazole treatment was >99% effective against adult F. hepatica.

38 A TWO-YEAR STUDY ON SEASONAL TRANSMISSION OF F. HEPATICA TO LOUISIANA CATTLE

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Ten-meter plots in 3-5 permanent Fossaria bulimoides habitats were monitored bi-weekly from November, 1978 to December, 1980 to correlate snail population dynamics to transmission of F. hepatica to resident cattle. The seasonal availability of metacercariae was studied using fluke-free sentinel steers consecutively placed (groups of 6-8) on pastures at 45-day intervals and by the prevalence of F. hepatica eggs found by fecal sedimentation of samples collected from 25 or more cows at quarterly intervals. In year I, a ten-fold increase in snail numbers (150-1500) was observed in March-May following a reproductive effort beginning in February. Snail numbers declined after the first draught in May and returned to numbers approximately that observed prior to the Spring reproductive effort. In year II, a four-fold increase in snail numbers occurred after a reproductive effort beginning in December, 1979 during warm winter weather. Drought-related population decline occurred in May, 1979. Population changes correlated well with soil moisture (water budget) and soil temperature variations used as indicators of the microenviroment. Examination of livers of 122 sentinel calves at slaughter suggested that metacercariae of F. hepatica were available between May 24 and July 9, 1979, and February 21-July 7, 1980. A total of 9 flukes were found in 5 calves in 1979 and 456 in 20 calves in 1980. Herd prevalence of F. hepatica eggs in feces rose from 6% in July, 1979 to 40% in October. After declining to 23% by May 1980, herd prevalence rose to 96% by October, 1980. Results suggest that preventive semi-annual treatment with anthelmintics that affect primarily adult flukes is most effectively given in the Fall (Sept.-Nov.) and early Spring (Feb.-March) in Central Louisiana.

39 IMMUNOCHEMICAL STUDIES ON THE EPICUTICLE OF STRONGYLOIDES RANSOMI AND S. RATTI.

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Epicuticular antigens of the L_3 of Strongyloides ransomi and S. ratti were readily demonstrated using host antibodies. Immunocytochemical studies at the ultrastructural level showed the antigens to be uniformly and densely distributed over the epicuticular surface. Attempts to solubilize these antigens with detergents, hypertonic salt and organic solvents were unsuccessful. The antigens were also resistant to carbohydrases, lipases and most proteases. Cytochemial probes at the ultrastructural level suggested the presence of a mucopolysaccharide coat on the epicuticle. However, the epicuticle appears to be PAS negative and all of the lectins tested bound either weakly or not at all. The relevance of these epicuticular antigens to protective immunity could not be demonstrated by opsonisation or immunization tests.

Serological tests for the purpose of diagnosing porcine strongyloidiasis were also evaluated. Two indirect antibody binding (epicuticular) assays using intact L_3 were compared to an ELISA using a whole larval extract. The results indicated that antibody binding to the epicuticular antigens, detected by either FITC - or ^{125}I - labelled antipig IgG were less sensitive than the ELISA procedure.

40 VACCINATION OF FOALS AGAINST STRONGYLUS VULGARIS

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Nonimmune pony foals 9 to 12 months of age, vaccinated with 2 per os inoculations of third stage Strongylus vulgaris larvae (L_3) irradiated with 70 or 100 K rads of gamma irradiation were protected from clinical disease, and sever arterial lesions commonly associated with challenge infections of 5000 L_3 when compared to similarly challenged nonvaccinated controls or ponies vaccinated with L_3 irradiated with 130 K rads of gamma irradiation. Numbers of challenge population L_4 recovered from vaccinated ponies were 0 or greatly reduced. Protected ponies had higher ELISA antibody titers, and lymphocyte transformation responses to S. vulgaris antigen than did nonprotected animals. A high prechallenge eosinophilia also existed in these protected ponies prior to challenge and was followed by an anamnestic eosinophilia following challenge which was not present in the nonvaccinated challenged controls.

41 IMPORTANCE OF CELL-MEDIATED IMMUNITY IN THE DEVELOPMENT OF RESISTANCE TO CLINICAL COCCIDIOSIS IN THE CHICKEN

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The passive transfer of cell-mediated immunity (CMI), as measured by delayed type hypersensitivity (DH) and resistance to clinical coccidiosis in commercial broiler chickens, was examined. Broilers not immunized to coccidia were given 1 of 3 different dialyzable leukocyte extracts (DLE) prepared from spleen cells taken from chickens either previously immunized (2, DLE preparations) or not immunized to coccidia (1, DLE preparation). Chickens receiving 200 mg intraperitoneally of either of 2 different DLE's from coccidia immunized donor chickens displayed a positive DH reaction to an oocyst antigen extract and were highly refractory to challenge with Eimeria tenella oocysts as measured by % body weight gain, lesion scores and mortality. Chickens receiving the DLE from nonimmunized coccidia donors did not develop DH reactions to the oocyst antigen and showed little or no resistance to challenge when compared to the control chickens not given DLE. The results indicated that stimulation of CMI produces resistance. Concomitantly, these findings support the results of previous studies that show DLE acts to immunomodulate immunity to mammalian coccidiosis.

42 FASCIOLA HEPATICA: INFLUENCES ON THE IMMUNE SYSTEM OF SHEEP.

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The influences that two different levels of experimental Fasciola hepatica infection (250 metacercariae - group I and 500 metacercariae - group II) had on several parameters of ovine humoral and immune systems were evaluated. Electrophoretic separations revealed that the albumin levels of the high infection group (II) decreased more than those of the low infection group (I). Albumin levels of control lambs increased during the course of the 18 week study. No significant differences or changes were observed in the alpha or beta globulin fractions of either experimental group or controls. Beginning at 4 weeks (group II) and at 8 weeks (group I) post-infection (PI), the gamma globulin values of experimentals were significantly increased above those of controls. The specificity of at least some of these increased gamma globulins for F. hepatica antigens was established by the enzyme-linked immunosorbent assay (ELISA). Fluke-specific antibodies in serum from experimental lambs (group II) were detected by the ELISA as early as 2 weeks PI.

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43 PLASMA ENZYME LEVELS AS A POSSIBLE MEANS OF DIAGNOSIS OF FASCIOLA HEPATICA INFECTIONS IN BEEF CALVES.

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Experimental infections of Fasciola hepatica were induced in 3 groups of beef calves. Group I (5 calves) received 1000 metacercariae, group II (5 calves) received 100 metacercariae, and group III (4 calves) received 10 metaceriae respectively per os in single doses weekly for 3 weeks. Group 4 (4 calves) served as uninfected controls. Plasma enzyme levels of γ-glutamyl transpeptidase (GGTP), arginase (ARG) and aspartate transaminase (AST) were monitored weekly on all calves from 2 weeks prior to and until 16 weeks after the start of infection. On the 13th week after the start of infection, half of the calves were treated with albendazole paste (15 mg/kg) orally. Significant differences between the mean GGTP activity for Group I and the other groups occurred from week 9 through week 13. Significant differences in GGTP activity between group II and group IV occurred on weeks 10, 12 and 13. On week 16, group I GGTP activity was again significantly greater than that of group IV. No significant differences in GGTP activity occurred between groups II, III and IV. Significant differences in AST activity between group II and group IV were evident on week 4 and group II and III on week 5. On week 7, group I AST activity was significantly greater than that of group IV. On weeks 8 and 9, group I AST activity was significantly higher than that of the other groups. On week 16, group I AST activity was significantly greater than that of groups II and IV. Activity levels of ARG were not found to be useful in evaluating liver damage due to Fasciola hepatica infections in beef calves. Insignificant differences in GGTP and AST activity occurred between albendazole treated and untreated calves within the infected groups on weeks 14, 15 and 16. The treated infected calves generally had lower GGTP and AST activity levels than their untreated group counterparts.