AMERICAN ASSOCIATION OF VETERINARY PARASITOLOGISTS

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Affiliated with the American Veterinary Medical Association

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**PROGRAM**

**AMERICAN ASSOCIATION OF VETERINARY PARASITOLOGY**

**31ST Annual Meeting**

Georgia World Congress Center
Room 165

Sunday, July 20

7:00 AM - Registration

**Session 1: CHEMOTHERAPY**

Moderators: Dennis French and Gerald Coles

1. 8:00 Efficacy of BAY 5757 (febantel) against lung worms and gastro-intestinal nematodes of calves.
   T. J. Kennedy, R. G. Arther, and D. D. Cox

2. 8:15 Efficacy of febantel against natural gastrointestinal nematodes in cattle.
   G. L. Zimmerman, E. P. Hoberg, L. G. Rickard, D. J. Schons and R. G. Arther

3. 8:30 Field and control trial evaluations of fenbendazole and ivermectin in cattle.
   T. A. Yazwinski, B. L. Presson and H. Holtzen

4. 8:45 Efficacy of fenbendazole against immature stages of *Parascaris equorum*.

5. 9:00 Efficacy of ivermectin against naturally acquired *Strongyulus* sp. larvae and *Parascaris equorum*

6. 9:15 Efficacy and safety of clorsuon alone and in combination with ivermectin given subcutaneously to cattle.
   G. W. Benz
7. 9:30 Strategic use of ivermectin in dairy heifers.  
   R.P. Herd, C. R. Reinemeyer and L. E. Helder

8. 9:45 Effects of ivermectin on productivity and control of G-I nematodes in weaner-yearling beef cattle.  
   J. C. Williams, J. W. Knox, K. S. Marbury, M.D., Kimball,  
   E. R. Willis, T. G. Snider and J. E. Miller.

9. 10:00 The response of Trichostrongylus colubriformis in lambs to ivermectin.  
   D. J. Giordano, J. P. Tritschler II and G. C. Coles

10. 10:15 The use of ivermectin Injectable against Psoroptes ovis  
    (Acarina: Psoroptidae) in sheep.  
    R. A. Ronacalli and L. H. Sutherland

11. 10:30 Controlled test evaluation of dienbendazole against mature Parascaris equorum from experimental infection. T. R. Bello

10:45 - 12:00 POSTER SESSION (Coffee) RM 164

12. Effect of Bacillus thurigensis Israelenis toxin on eggs of  
    Trichostrongylus colubriformis.  
    K. B. Bottjer, L. W. Bone and S. S. Gill

13. Factors influencing the ovicidal toxicity of Bacillus thurigensis  
    Israelenis for Trichostrongylus colubriformis.  
    L. W. Bone, K. B. Bottjer and S. S. Gill

14. Logenic amines and their catabolites from the sexes of Trichostrongylus  
    colubriformis.  
    J. C. Frandsen and L. W. Bone

15. Epidermitis in a dog caused by Anatrichosoma sp. (Nematoda:  
    Trichosomoididae).  
    B. L. Blagburn, C. M. Hendrix, T. R. Boosinger, D. S. Lindsay and  
    R. T. Logan

16. Effects of cryoprotectants on Cryptosporidium sporozoites of avian  
    J. A. Ernst, B. L. Blagburn and D. S. Lindsay

17. Bovine onchocerciasis: Transplantation studies and use of bovine species  
    of Onchocerca for experimental chemotherapy.  
    K. El Sinnary, E. Blanco and J. F. Williams

18. Cell-parasite interactions in cultures of developing larvae of Ascaris  
    suum.  
    K. J. Hamann and B. E. Stromberg

19. Efficacy of the morantel sustained release bolus for controlling  
    gastrointestinal Nematodirus in beef cows.  
    T. A. Yazwinski, T. J. Newby, B. L. Presson and H. M. Holtzen

    J. P. Tritschler II, D. J. Giordano, and G. C. Coles
21. Efficacy of Vercom™ (febantel + praziquantel) paste against experimental immature and mature infection of Uncinaria stenocephala and Toxascaris leonina in dogs.
   T. J. Kennedy, R. G. Arther and D. D. Cox

22. Efficacy of oxibendazole against benzimidazole-resistant strongyles in horses in Ontario.
   O. Slocombe

   L. Pote and J. Ainsworth

24. Major genetic types of Trichinella identified by DNA structure and correlated with infectivity for pigs.
   J. B. Dame and K. D. Murrell

12:00 - 1:00 LUNCH

1:00 Presentation of Distinguished AAVP AWARD - Bob Corwin

1:10 Acceptance - Norman D. Levine

Session 2: IMMUNOLOGY
Moderators: Ray Gamble and Lou Gasbarre

25. 1:30 KEYNOTE ADDRESS - Immunologic regulation of gut epithelium as a component in host resistance to parasitism.
   G. A. Castro - Professor, Department of Physiology & Cell Biology, The University of Texas Health Science Center at Houston

26. 2:00 Intestinal expulsion of Trichinella spiralis for pigs exposed naturally to Ascaris suum and Trichuris suis.
   J. F. Urban, R. D. Romanowski and H. R. Gamble

27. 2:15 Immunization of swine with Trichinella spiralis newborn larval antigens.
   H. P. Marti, K. D. Murrell and H. R. Gamble

28. 2:30 Dermal cellular responses in calves infected with Ostertagia ostertagi.
   D. A. Cross, P. H. Klesius, L. A. Hanrahan and T. B. Haynes

29. 2:45 Ostertagia ostertagi: Characterization of eosinophil chemotactin with monoclonal antibodies.
   P. H. Klesius, L. W. Horton, D. A. Cross and T. Snider

3:00 - 3:15 REFRESHMENTS (Coffee Break)

30. 3:15 Regulation of the local immune response in Ostertagia ostertagi infected calves.
    L. Gasbarre
31. 3:30 Evaluation of an antigenic fraction isolated from *Taenia hydatigena* metacestode cyst fluid for immunodiagnosis of bovine and porcine cysticercosis.
   E. Kamanga-Sollo, M. Rhoads and K. D. Murell

32. 3:45 Protection of pasture reared pony foals against acute and chronic challenge infections of *Strongylus vulgaris* by an irradiated L3 vaccine.

33. 4:00 Characterization of eosinophils and neutrophils from ponies with *Strongylus vulgaris* induced eosinophilia.

**Session 3:** VETERINARY ENTOMOLOGY SYMPOSIUM

Moderator: Jim Hawkins

34. 4:15 Cellular events associated with tick feeding on naive and immunologically sensitized hosts.
   S. J. Brown, University of Illinois, Urbana, Illinois

35. 4:35 Whole-systems management of lone star ticks in beef cattle forage areas.
   D. R. Barnard, USDA Lone Star Tick Research Lab, B. Poteau, Oklahoma.

36. 4:55 Cattle grub control: Current strategies and future outlook.
   D. D. Colwell, Agriculture Canada Research Station, Lethbridge, Alberta, Canada

5:15 Business meeting

6:30 Society Social

**Monday, July 21**

**Session 4:** Clinical - Experimental

Moderators: George Conder and Christine Uhlinger

37. 8:00 KEYNOTE ADDRESS - Animal Health: Has nature provided the answer?
   M. Murray - Professor, Department of Veterinary Medicine, University of Glasgow Veterinary School

38. 8:30 Genetic resistance to *Haemonchus contortus* infection in young Merino sheep.
   G. D. Gray, G. A. A. Albers and J. S. F. Barker

39. 8:45 Comparative performance of modern parasite control programs in feed lot cattle.
   G. H. Myers and R. J. Grant

40. 9:00 Studies on detection methods of anthelmintic responses.
   T. W. Schillhorn-VanVeen and E. Braselton
41. 9:15 Detecting \textit{in vitro} anthelmintic effects using a micromotility meter.

42. 9:30 Effects of anthelmintic schedules on the incidence of colic on two large horse farms.
   C. Uhlinger

43. 9:45 The continuous strategic use of anthelmintics in working donkeys on a small Greek island over a 5-year period.
   D. H. Bliss, I. E. Georgoulakis, W. J. Jordan and E. D. Svendsen

10:00 \textbf{COFFEE BREAK}

44. 10:15 Mass chemotherapy of dogs for control of \textit{Echinococcus multilocularis} infection.
   P. M. Schantz, J. F. Wilson and R. A. Rausch

45. 10:30 Excretory - secretory antigens from adult \textit{Dirofilaria immitis} as candidates for antigen detection assays.
   R. B. Grieve, T. John, D. D. Bowman and M. Mika-Grieve

46. 10:45 The electronic bolus: A novel intermittent release anthelmintic drug delivery system for cattle.
   R. J. Gyurik and B. G. Bagnall

47. 11:00 Clinical observations following oral ivermectin administration to fourteen collies.

48. 11:15 Clinical trials with ivermectin liquid in horses.

49. 11:30 Response to physostigmine administration in collie dogs exhibiting ivermectin toxicosis.

50. 11:45 Avermectin structure - activity correlations: Impact on population dynamics of free-living nematodes, flunitrazepam binding, and acute toxicities to water fleas.

12:00 - 1:00 \textbf{LUNCH}
Session 5:  **EPIDEMIOLOGY**

Moderators: Charlie Courtney and Julie Ann Jarvinen

51. 1:00 Climate forecasts for fascioliasis based on water budget analysis.
    J. B. Malone, T. Williams, R. A. Muller and A. Loyacano

52. 1:15 *Cryptosporidium* sp. in Louisiana equines.

53. 1:30 Biologic characterization of *Trypanosoma cruzi* isolated from Louisiana dogs, opposums and armadillos.
    S. C. Barr, V. A. Dennis and T. R. Klei

54. 1:45 *Nematodirus* sp. in New England lambs.

55. 2:00 Late fall transmission of *Nematodirus battus* in Oregon.
    L. G. Rickard, E. P. Hoberg, G. L. Zimmerman and J. K. Erno

56. 2:15 Epizootiologic studies on zebra parasitism.
    R. C. Krecek

57. 2:30 Depletion of numbers of strongylid and trichostrongylid eggs/larvae by *Aphodius* spp. and *Orthellia* sp.
    R. C. Bergstrom, L. K. Mancini and C. K. Mathiason

58. 3:00 A 3-year study on the epidemiology of parasitism in stocker cattle using a rotational grazing system in Wisconsin.
    L. L. Smith and D. H. Bliss

3:15 **REFRESHMENTS**

Session 6:  **EXPERIMENTAL**

MODERATORS: Byron Blagburn and Mike Fleming

59. 3:30 The characterization of cuticular proteins from developmental stages of *Ascaris suum*.
    R. H. Fetterer and J. F. Urban

60. 3:45 Populations of cells observed in lung lavage samples from uninfected and *Ascaris suum*-infected beagles.
    G. A. Conder, J. A. Oostveen, I. M. Richards, R. L. Griffin and D. S. Nowakowski

61. 4:00 Relationship of reproductive status and periparturient egg rise in ewes infected with *Haemonchus contortus*.
    M. W. Fleming and R. C. Rhodes III

62. 4:15 Characterization of exsheathment fluid of *Haemonchus contortus*.
    H. R. Gamble and R. H. Fetterer
63. 4:30 Experimental cryptosporidiosis in turkeys induced by inoculation with oocysts of chicken origin (AU-BI isolate).
   D. S. Lindsay and B. L. Blagburn

64. 4:45 Effects of Cryptosporidium infections on weight gains, feed conversion and carcass quality in broiler chickens.
   B. L. Blagburn, D. S. Lindsay, J. J. Giambrone, C. A. Sunderman and F. J. Hoerr

Tuesday, July 22

Session 7: VACCINES AGAINST PARASITES?
Moderator: R. M. Corwin

65. 8:30 Current status of vaccines against the haemoproteozoa.
   Charles R. Sterling

66. 8:55 Vaccines against avian coccidia.
   Keith Murray.

67. 9:20 Development of vaccines against bovine trypanosomes.
   Max Murray

9:45 Break

68. 10:15 Can we induce resistance to ticks?
   Steven Brown

69. 10:40 Are vaccines against nematodes possible?
   Darwin Murrell

70. 11:05 Resistance to cestodes and trematodes.
   Jefferey Williams

*Co-sponsored by the American Association of Veterinary Parasitologists and the American Veterinary Medical Association
1. EFFICACY OF BEFANTEL AGAINST LUNGWORMS AND GASTROINTESTINAL NEMATODES OF CALVES. T. J. KENNEDY*, AEF RESEARCH INC., WAUNAKEE, WI, R. G. ARTHEN AND D. D. COX, MOBAY CORPORATION, ANIMAL HEALTH DIVISION, SHAWNEE, KS.

Febantel, in a paste formulation containing 45.5% febantel, is proposed for the removal of adult and immature stages of gastrointestinal and pulmonary nematodes of cattle. A controlled anthelmintic trial was conducted to evaluate the efficacy of febantel paste at 5 mg/kg against mature and immature stages of Dictyocaulus viviparus in naturally infected calves. After acclimation and confirmation of D. viviparus infection, calves were treated with febantel paste or a placebo. Seven days after treatment, all animals were euthanatized and examined for gastrointestinal and pulmonary nematodes. Efficacy against Dictyocaulus viviparus was 98.34%. Efficacy against mature forms was 98.79% while immature worms were reduced 93.75%. Reductions in gastrointestinal nematodes were 100% for Haemonchus and Trichostrongylus axei. Efficacy against adult Ostertagia was 97.8% and adult Cooperia 91.3%. Control animals harbored an average of 36.2 Dictyocaulus per animal.

2. EFFICACY OF FEBANTEL AGAINST NATURAL GASTROINTESTINAL NEMATODES IN CATTLE. G.L. ZIMMERMAN*, E.P. HOBERG, L.G. RICKARD, D.J. SCHONS, COLLEGE OF VETERINARY MEDICINE, OREGON STATE UNIVERSITY, CORVALLIS, OR 97331 AND R.G. ARTHEN, MOBAY CORPORATION, SHAWNEE MISSION, KS 66201.

The anthelmintic efficacy of febantel against naturally acquired gastrointestinal nematodes was evaluated in January, 1985, using beef calves. Ten control calves were given drug vehicle and ten experimental calves were given oral febantel at 5 mg/kg. Seven days post-treatment the calves were slaughtered and gastrointestinal nematodes were recovered by standard techniques. The percent efficacies against the various nematodes were: adult Ostertagia spp, 83; L-4 Ostertagia spp, 35.7; adult Cooperia spp, 94; L-4 Cooperia spp, 97.6; Trichostrongylus spp, 99; Bunostomum phlebotomum, 100; Nematodirus helvetianus, 84; and Oesophagostomum spp, 100. No adverse reactions to the drug were observed.
3. FIELD AND CONTROL TRIAL EVALUATIONS OF FENBENDAZOLE AND IVERMECTIN IN CATTLE. T.A. YAZWINSKI, B.L. PRESSON, J.S. MILLER, AND Z. JOHNSON. DEPARTMENT OF ANIMAL SCIENCE, UNIVERSITY OF ARKANSAS, FAYETTEVILLE, AR 72701

During the spring and summer of 1985, control and field trials were performed to evaluate the anthelmintic efficacies of fenbendazole (SAFEGUARD® HOECHST) and ivermectin (IVOMEC® Merck) in cattle. In both trials, ivermectin was given as a subcutaneous injection at the rate of .2 mg/kg BW. For the control and field trials, fenbendazole was given in the suspension and paste formulations respectively, both at the rate of 5 mg/kg BW. In the control trial, the anthelmintics were given at postinfection days 14 and 28 of experimentally-induced Nematodirus helvetianus infections. All calves were killed 14 to 15 days after the final treatments. In comparison to the mean control calf burden, percent reductions of 14 and 28 day old infections were 96.04 and 97.84 for fenbendazole and 84.3 and 35.34 for ivermectin. In the field trial, each anthelmintic was given at 40 day intervals over a 160 day grazing period. Approximately 45 Holstein replacements were used. Posttreatment "Strongyle" EPG counts rose faster and to higher levels (P<0.05) for fenbendazole-treated animals than for ivermectin-treated calves. Nematodirus spp EPG counts were not depressed due to administration of ivermectin. Weight gains by treatment group were ivermectin > fenbendazole > controls, although no significant differences were found.


Fifteen parasite free pony foals were inoculated with a minimum of 1500 infective Parascaris equorum eggs. The foals were randomly assigned to 1 of 3 treatment groups (n=5). Treatments included 10 mg of fenbendazole (FBZ)/kg on day 11 postinoculation (PI), 10 mg of FBZ/kg given daily on days 11-15 PI and no treatment (controls). The foals were euthanatized 25 days PI and examined for the presence of P. equorum larvae in the small intestine, lung and liver.

Significantly (p<.05) lower mean numbers of P. equorum larvae were found in foals treated on days 11-15 PI, 1.4 (0-6), than in those treated on day 11 PI, 429.2 (0-777), and in the controls, 500 (284-802). Adverse reactions due to treatment were not observed.

20 Shetland pony foals were naturally infected with Parascaris equorum and Strongylus vulgaris comingling on contaminated pastures with Quarter Horse mares and their foals. At 18-27 weeks of age foals were divided into 2 similar groups and placed on cement dry lots. One group was treated with ivermectin paste (200 mcg/kg) (IVM) 7 days after separation. 5 foals from each group were necropsied at 2 weeks post treatment (WPT) and the remaining foals were necropsied at 5 WPT.

P. equorum adults were not recovered from IVM treated foals at 2 or 5WPT. IVM was 92% effective against P. equorum larvae in the small intestine (SI) at 2 WPT. At 5 WPT SI P. equorum larval numbers were not significantly different between groups. P. equorum larvae were not recovered from the lungs of IVM foals at 2WPT, however only few larvae (2 to 3/foal) were recovered from untreated foals. There was no difference in lung larval recoveries at 5WPT. Small numbers of S. vulgaris larvae were present in 4/5 IVM foals at 2 WPT and 2/5 IVM foals at 5 WPT. (This study was supported in part by a grant from MSD AgVet.)


Clorsulon (2 mg/kg SC) alone and in combination with ivermectin (200 mcg/kg SC) was shown in a series of dose-confirmation trials to be highly effective against adult Fasciola hepatica and not to interfere with the efficacy of ivermectin. Field trials with clorsulon alone and with the combination given at the proposed use levels and at twice the use levels demonstrated the clinical safety of the formulations under practical conditions. No adverse reactions were observed in the trials except for minor, transient pain following injection and the presence in a few animals of injection-site swellings which reached maximum size within 3-7 days after treatment, regressing thereafter. Cattle also tolerated the products at up to three times the use levels for three consecutive days with no clinical effects, other than the occasional injection-site swellings. Cattle slaughtered three weeks after being given either product at the use level had no important gross lesions in the subcutaneous tissues of the injection site.

The effect of 2 prophylactic treatments with ivermectin (0.2 mg/kg) was evaluated in Holstein dairy replacement heifers treated 3 and 8 weeks after turnout to spring pasture in Ohio on May 7, 1984. The standard timing of 3 and 6 weeks was extended to 3 and 8 weeks because of the more persistent anthelmintic activity of ivermectin. This approach was designed to prevent the normal summer/autumn escalation of pasture larvae in northern latitudes and to increase animal weight gains. A total of 22 heifers were randomly assigned to 2 treatment and 2 control groups and grazed 4 similar pastures contaminated with Cooperia, Haemonchus, Ostertagia and Trichostrongylus spp. Cumulative weight gains recorded 20 weeks after the first treatment were compared by analysis of variance, after adjusting for initial weight by covariance.

The mean adjusted weight gain of the treated heifers (62.3 kg) was 61.8% (p<0.02) greater than that of the control heifers (38.5 kg). Initial weight was not a significant source of variation in cumulative weight gains. There was a sixfold difference in mean pasture larval counts between treated (56 L3/kg) and control (358 L3/kg) pastures by the time that heifers were housed for the winter on 18th October. The economic advantage of prophylactic treatments early in the grazing season is that heifers reach optimum breeding size at an earlier age and maintenance costs are reduced.


This grazing expt. extended from Oct. 31, 1984 (weaning) through Oct. 9, 1985. Group treatments were as follows: Gp1, n=16, Ivermectin x 1 on Oct. 31, safe pasture; Gp2, n=16, Ivermectin x 3 on Oct. 31, Jan 28, and Apr. 22, contaminated pasture; Gp3, n=16, Ivermectin x 2 on Oct. 31 and Apr. 22, contaminated pasture; Gp4, n=16, Fenbendazole x 1 on Oct. 31 and individual salvage treatment thereafter, contaminated pasture, O-P treatment for grubs also at weaning. Fecal samples, herbage larvae, and blood samples (plas. pep.) collected and weights taken monthly. Tracer calves were grazed on all pastures in Nov. and Apr. and representative yearlings were killed in April and Oct. 1985. Fecal egg counts and herbage larvae varied considerably between groups, but basically were highest from weaning to March and then reduced. Tracer calf worm counts in November were lowest for Gp1 and highest for Gp4. In contrast counts in April tracers were highest (including O. ost.) in Gp1 and Gp4. Total worm counts for yearlings in April were highest in Gp1 and Gp4. While nos. of adult O. ost. were lowest in Gp1, nos. of El4 were high and similar to totals of El4 from Gp3 and Gp4. Nematode control and productivity were best provided by the 3x Ivermectin treatment (Gp2 - 336 kg) although differences in final weight gains between Gp2 and the other groups treated with Ivermectin (Gp1 - 322 kg and Gp3 - 312 kg) were not significant (P < 0.05).
9. THE RESPONSE OF TRICHOSTRONGYLUS COLUBRIFORMIS IN LAMBS TO IVERMECTIN. D.J. GIORDANO*, J.P. TRITSCHLER, AND G.C. COLES, UNIVERSITY OF MASSACHUSETTS, AMHERST, MA 01003

Eight lambs were infected with a mixed nematode population and wormed subcutaneously (SQ) six days (D6) following infection with 100 ug ivermectin (Ivomec) per kg body weight. This process was repeated with SQ D6 wormings of 200, 250 and 225 ug/kg, respectively. It was then necessary to passage the population of nematodes (~100% T. colubriformis) through lambs with no anthelmintic exposure to increase our stock of the strain. A definitive controlled test was run with 45 lambs to compare this selected strain of T. colubriformis to the original strain with respect to dose level and method of administration. The treatments were 150 ug/kg subcutaneous (SQ) D6, 200 ug/kg SQ D6, 200 ug/kg intraruminal (IR) D6 and 200 ug/kg SQ D21. All treatments were compared to untreated controls. The IR D6 and SQ D6 150 ug/kg treatments were >99% effective in both strains while the SQ D6 200 ug/kg treatment was 85% and 48% effective in the original or selected strain respectively. The SQ D21 200 ug/kg treatment was only 58% effective. The data was statistically analyzed using Harvey's LSML76 Program. There was a highly significant difference in both fecal egg output and worm counts between the original and selected strains of nematodes. Neither the SQ D21 nor D6 200 ug/kg treatment of the selected strain was significantly different from the unwormed control indicating that these treatments no longer produced the efficacy results shown with a non-selected population of ovine nematodes.

10. THE USE OF IVERMECTIN INJECTABLE AGAINST PSOROPTES OVIS (ACARINA: PSOROPTIDAE) IN SHEEP. R.A. RONCALLI* AND I.H. SUTHERLAND. MERCK SHARP & DOHME RESEARCH LABORATORIES. RAHWAY, N.J. 07065

Psoroptes ovis, an obligatory skin parasite, causes mange, a highly contagious disease that is a serious problem of the sheep industry in many countries including Argentina, Brazil, Italy, and South Africa. The disease causes decreased productivity and, sometimes, death. The clinical disease is most prevalent in late autumn, winter and early spring. Control measures include dipping of animals; however, this method is labor intensive and increases the risk of pneumonia. A simpler method of control would be welcomed by the sheep industry.

The efficacy of ivermectin injectable was evaluated in 4 trials conducted in Brazil, West Germany, Romania, and South Africa in which 27 sheep were treated with ivermectin subcutaneously with 200 mcg/kg of body-weight once; 27 were dosed twice at a 7-day interval, and 27 were kept as untreated controls. The P. ovis infestation was either naturally acquired or experimentally induced. The results show that a single injection of ivermectin markedly reduced the number of P. ovis and frequently led to resolution of clinical signs; two injections with a 7-day interval eliminated mange mites.

The results of 7 field trials, performed in Argentina, Italy, the Netherlands, South Africa and West Germany using naturally-infected sheep, confirmed the earlier findings.
11. CONTROLLED TEST EVALUATION OF DIENBENDAZOLE AGAINST MATURE PARASCARIS EQUORUM RESULTING FROM EXPERIMENTAL INFECTION.
THOMAS R. BELLO. SANDHILL EQUINE CENTER, SOUTHERN PINES, NC 28387.

The antiascarid effect of dienbendazole (VET 220, VETEM S.p.A., Milan, Italy) was determined in a controlled test of 24 pony weanlings maintained in open paddocks. Each foal was given 10,000 infective Parascaris equorum eggs, and was treated when the infection became patent. Single treatments of dienbendazole were given at 2.5, 5.0 or 10.0 mg/kg of bodyweight dosage or nontreated. All feces passed daily for 7 days was collected and examined for parasites. Any ascarids present in weanlings at necropsy were compared with those passed in feces and those in the controls. Clinical reductions of strongyle eggs from naturally-acquired infections (84, 94, 95%) and of P. equorum eggs (97, 99, 99%) by the dosage range were seen. Critical efficacy was 94, 100 and 100% against mature P. equorum.

There were no adverse effects related to treatment. By 3 days after treatment there was improvement in attitude, appetite, and apparent intestinal motility, most likely related to the removal of the source of worm toxin.


A toxin(s) from crystals of Bacillus thuringiensis israelensis is lethal to eggs of the ruminant nematode Trichostrongylus colubriformis. Treatment of eggs with toxin increased the incorporation of radiolabelled phenylalanine within 2 hours. Iodine staining of the eggs was altered within 5 minutes of exposure to toxin, which caused a dose-dependent effect. The toxin's activity was increased when the osmolarity of the egg's medium was elevated. Exopeptidase activity in toxin-treated eggs declined.

The ovicidal activity of Bacillus thuringiensis israelensis crystal toxin for eggs of the ruminant nematode Trichostrongylus colubriformis was not altered by heat-activation up to 42°C for 24 hours or by storage at 4°C for up to 6 days. Treatment of the microbial crystals with trypsin for 0 to 72 hours caused a time-dependent increase in toxicity. Cupric and ferric chloride reduced, but did not eliminate, the ovicidal toxicity. Eight additional metal chlorides had no effect on toxicity. Membrane filtration reduced the toxicity of B. t. israelensis for nematode egg due to apparent retention on the filter, based on HPLC and bioassay analyses.

BIOGENIC AMINES AND THEIR CATABOLITES FROM THE SEXES OF TRICHOSTRONGYLUS COLUBRIFORMIS. J.C. FRANDSEN* AND L.W. BONE. USDA, ARS, REGIONAL PARASITE RESEARCH LABORATORY. AUBURN, AL 36831-0952.

Biogenic amines (BA) and their catabolites have been identified via high performance liquid chromatography (HPLC) in extracts prepared from adult males and females of the threadworm, Trichostrongylus colubriformis, recovered from goats infected 3 weeks previously with 3rd-stage larvae. L-dopa, epinephrine, norepinephrine, octopamine, metanephrine, normetanephrine and dopamine have been identified in extracts from both sexes. L-dopa was by far the most abundant BA in all extracts (67.9-160.0 μg/mg protein), with epinephrine (6.4-55.8 μg/mg protein) usually next in abundance. The relative abundances of the other BA varied from batch to batch, but normetanephrine (0.5-4.0 μg/mg protein) or metanephrine (0.3-4.2 μg/mg protein) were least abundant. Sexually-associated differences in amounts of BA have not been identified. The large batch-to-batch differences in the amounts and relative abundances of the BA suggest that a number of unidentified factors, perhaps involving both host and parasite physiology, are playing influential roles.
15. EPIDERMESIS IN A DOG CAUSED BY ANATRICHOSOMA SP. (NEMATODA: TRICHO­SOMOIDIDAE. BYRON L. BLAGBURN*, CHARLES M. HENDRIX, TIMOTHY R. BOOSINGER, RICHARD T. LOGAN AND DAVID S. LINDSAY, AUBURN UNIVERSITY, AL 36849-3501 AND ANDREWS AVENUE ANIMAL HOSPITAL, OZARK, AL 36360.

A 5-month-old, female Boxer was presented with a raised, flaking, erythematous nodule on the dorsal midline of the lumbar region. Skin scraping of the nodule revealed thick-shelled, double-operculated, embryonated ova. Ova were also observed in a fecal flotation performed 3 weeks prior to the skin scraping. Seven embryonated ova measured 62.5 X 50.0 um (mean). Biopsy revealed a multifocal epidermitis consisting of intraepidermal microabscesses containing primarily neutrophils. The epithelium was mildly acanthotic and hyperkeratotic. The superficial dermis was infiltrated with neutrophils, eosinophils, and fewer macrophages. Numerous small nematodes were present in the epidermis. Examination of sections of female parasites led to a tentative diagnosis of Anatrichosoma sp. based on the following features: a stichosome consisting of numerous large glandular stichocytes, paired bacillary bands, coelomyarian - polymyarian musculature, and embryonated ova in the uteri. Male worms were not observed. Anatrichosoma species and their hosts are: A. cutaneum, A. cynamolgi (Asian monkeys); A. rhina, A. nacepobi (Indian monkeys); A. gerbilis (North African gerbil); A. ocularis (Thai tree shrew); and A. buccalitis (common opossum). The present report represents, as far as we are aware, the first in a dog, and also the first report Anatrichosoma sp. in a domestic animal in the western hemisphere.

16. EFFECTS OF 3 CRYOPROTECTANTS ON SPOROZOITES OF CRYPTOSPORIDIUM SP. OF AVIAN ORIGIN. JAMES A. ERNEST*, BYRON L. BLAGBURN AND DAVID S. LINDSAY. AUBURN UNIVERSITY, AL 36849-3501.

Cryptosporidium sp. oocysts of avian origin (AU-B1 isolate) were separated from chicken feces by Sheather's sugar flotation, resuspended in Hanks' Balanced Salt Solutin (HBSS), sterilized with a mixture of penicillin-streptomycin with amphotericin B, and excysted in 20% sterile goat bile in HBSS at 37°C. Sporozoites were then resuspended in HBSS to which an equal volume of sterile cryoprotectant was slowly added. Sporozoites were allowed to equilibrate for 45 minutes at room temperature, after which they were cooled and frozen at a rate of 1.15°C per minute. Final concentrations of 7.5, 10, and 12.5% glycerin (v/v), dimethylsulfoxide (DMSO)(v/v), and polyvinylpyrrolidone (PVP)(v/v) were used as cryoprotectants. Freezing was performed using a Cryo-Med liquid nitrogen freezing apparatus. Frozen sporozoites were stored in liquid nitrogen for 24 hours. They were thawed quickly in a 37°C water bath. Microscopic examination of sporozoites revealed that based on sporozoite morphology and motility, PVP was the most effective cryoprotectant, followed by glycerin with moderate efficacy, and DMSO and HBSS which showed little ability to protect sporozoites. Studies are in progress to confirm the viability of sporozoites using an in ovo assay.
17. **BOVINE ONCHOCERCIASIS: TRANSPLANTATION STUDIES AND USE OF BOVINE SPECIES OF**
**ONCHOCERCA FOR EXPERIMENTAL CHEMOTHERAPY. K. EL SINNARY*, E. BIANCO AND**
**J.F. WILLIAMS. MICHIGAN STATE UNIVERSITY, EAST LANSING, MI 48824, AND THE**
**LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, UNITED KINGDOM.**

In a survey of bovine onchocerciasis in Michigan approximately 30% of 250
slaughtered cull cows were found to be infected with *Onchocerca lienalis,*
*Onchocerca gutturosa,* or both. Microfilariae were present in skin samples
from the umbilical region, and adults were found in the gastro-splenic and
nuchal ligaments respectively. Microfilariae were stained for acid phos­
phatase and the distribution used as an aid in differentiation of species.
In experimental studies adults of *O. gutturosa* were transferred surgically
to the peritoneal cavities of rodents, and patent (microfilaremic) infections
were successfully established with survival of adults for up to 135 days.
Microfilariae of *O. gutturosa* and *O. lienalis* were used in a series of
experiments on the in vitro microfilaricidal activity of avermectins and
aminoquinolines. The results suggest that the readily available bovine
*Onchocerca* species offer utility for laboratory studies aimed at the
development of chemotherapeutic agents for treatment of human onchocerciasis.

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18. **CELL-PARASITE INTERACTIONS IN CULTURES OF DEVELOPING LARVAE OF ASCARIS**
**SUUM. K.J. HAMANN AND B.E. STROMBERG*. DEPARTMENT OF IMMUNOLOGY, MAYO**
**CLINIC AND FOUNDATION, ROCHESTER, MN, 55905, AND DEPARTMENT OF VETERINARY**
**PATHOBIOLOGY, UNIVERSITY OF MINNESOTA, ST. PAUL, MN 55108.**

Cultures in which third-stage larvae of *Ascaris suum* normally develop to
the fourth stage were examined for the effects of peritoneal exudate cell
adherence upon their growth, molt, and survival. Guinea pig eosinophil-
enriched peritoneal cell populations (45% eosinophils, 41% macrophages,
7% neutrophils) adhered through complement (C3) mediation and/or through
mediation by antibody produced to excretory-secretory antigen(s).

When cells were added in the presence of immune serum, growth (mean
length) and molt (%) of larvae binding cells were significantly depress­
ed (p <0.025) by day 5 and mortality was significantly elevated (7.0% vs.
28.2%; p <0.05) by day 4 of the culture period. Similar results were ob­
tained when cells were added in the presence of fresh normal serum, but
effects were less pronounced. Electron microscopic (EM) examinations
showed early and intimate association of eosinophils with the cuticles of
the larvae. Degranulation and release of eosinophil granule contents onto
the surface of the worms was seen but gross damage to the cuticle was not
observed. Macrophage adherence also took place; however, these cells were
seen primarily engaged in phagocytosis of cell and other debris and were
not observed by EM to exocytose onto the parasites.

The effect of the morantel sustained release bolus (MSRB) was evaluated using cow-calf pairs during a 113 day summer grazing period. An established pasture was subdivided into 3 equal areas which were in turn used for the separate grazing of 3 treatment groups. At trial initiation, 45 cows with spring-born calves were randomly allotted into 3 equal treatment groups; nonmedicated cows and calves (group I), MSRB-treated calves and unmedicated cows (group II), and MSRB-treated calves with morantel tartrate-treated cows (group III). The trial was started on 6/21/83 and terminated on 10/12/83.

EPG counts for group II and III calves were significantly reduced when compared to group I calves until trial termination, at which time there were no significant differences. Body weight gains for the 3 calf groups proved the inverse, with similar gains until trial termination, at which time group II and III calves had significantly outgained the control calves. Levels of cow EPG's never varied significantly between groups during the trial. Bodyweight gains were also similar for the cows until the final 30 days of the trial, at which time only the cows of group III were seen to maintain their weight. For principal calves killed at trial termination (3/group), mean total nematode counts were only 4194, 1985 and 1658 for groups I, II and III, respectively. Burdens of Ostertagia did not vary significantly for these animals, whereas Cooperia burdens were significantly reduced in MSRB-treated calves.

20. EPIDEMIOLOGIC STUDIES ON THE CONTROL OF SHEEP NEMATODES IN NEW ENGLAND. J.P. TRITSCHLER II*, D.J. GIORDANO AND G.C. COLES. UNIVERSITY OF MASSACHUSETTS, AMHERST, 01003

Prophylactic (A), clean pasture (C), and worm-move (D) strategies were compared to drench as needed (B), during 3 consecutive summers. In 1983, 58 weaned lambs were drenched and randomized into two groups (B & C). No difference in daily weight gains (ADG) (B=0.103, C=0.112 kg/lamb) was noted. While overall fecal egg counts (EPG) were higher from group B, both groups had to be drenched in early September. In 1984, 52 weaned lambs were drenched and randomized into four groups (A,B,C, & D). Again, no differences in ADG (A=0.138, B=0.124, C=0.109 & D=0.122 kg/lamb) were noted. Group A had significantly lower EPG throughout the summer. Late summer EPG were also significantly reduced for D, but C again failed to improve EPG compared to B. In 1985, 62 weaned lambs were drenched and randomized into three groups (A,B, & D). Again, no differences in ADG (A=0.113, B=0.125 & D=0.124 kg/lamb) were noted. By late summer D (but not A) showed significantly lower EPG. Lambs nursing ewes had died from benzimidazole resistant Haemonchus in 1982. However, Nematodirus spathiger was now the most prevalent nematode. These observations are consistent with overwintering of the major nematode pathogens as hypobiotic larvae. It is possible that these strategies did not show improvement over traditional (B) drenching, since hypobiosis is no longer a vector in weaned lambs and the anthelmintic used (7.5 mg levamisole/kg) was highly efficacious against abomasal nematodes.
21. **EFFICACY OF VERCOM™ (FEBANTEL + PRAZIQUANTEL) PASTE AGAINST EXPERIMENTAL IMMATURE AND MATURE INFECTIONS OF UNCINARIA STENOCEPHALA AND TOXASCARIS LEONINA IN DOGS.** T. J. KENNEDY, AEF RESEARCH, INC., WAUNAKEE, WS, R. G. ARTher* AND D. D. COx, MOBAY CORPORATION, ANIMAL HEALTH DIVISION, SHAWNEE, KS

Vercom™, an anthelmintic paste containing 3.4% febantel plus 0.34% praziquantel, is approved for the removal of the adult stages of most common intestinal cestodes and nematodes of dogs and cats. A controlled anthelmintic trial using 30 adult mixed-breed dogs was conducted to evaluate efficacy of Vercom™ paste against immature and mature stages of *Uncinaria stenocephala* and *Toxascaris leonina* of dogs. On Day 0 each dog was given orally 1600 third stage *U. stenocephala* larvae and 1068 infective *T. leonina* eggs. On Days 7, 8, 9, ten dogs received Vercom™ paste at the rate of 1.0 g./7.5 lb. b.w./day (equivalent to 10.0 mg. febantel + 1.0 mg. praziquantel/kg. b.w.). On Days 42, 43, and 44, ten additional dogs were treated with the same dosage of Vercom™ paste. The remaining 10 dogs served as controls and received an equivalent volume of blank paste vehicle on days 7, 8, 9 and 42, 43, 44. On Day 42 two of the 10 control dogs were euthanatized and examined to confirm the presence of adult *U. stenocephala* and *T. leonina*. The remaining 28 dogs were euthanatized on Day 52 and examined for gastrointestinal helminths. Efficacy against 7-day old *U. stenocephala* and *T. leonina* (i.e. 4th stage *U. stenocephala* and 2nd stage *T. leonina*) was 99.1 and 87.7%, respectively. Efficacy against 42-day old *U. stenocephala* and *T. leonina* (i.e. adult stages of both parasites) was 99.5 and 91.8%, respectively. The control dogs harbored 596.6 *U. stenocephala* and 12.2 *T. leonina* per dog.

23. **EIMERIA MAXIMA: AN IMMUNOLOGICAL CHARACTERIZATION.** L. POTE* AND J. AINSWORTH. COLLEGE OF VETERINARY MEDICINE. MISSISSIPPI STATE UNIVERSITY, MISSISSIPPI STATE, MS 39762.

*Eimeria maxima* is highly antigenic; therefore making it an excellent model for parasitology-immunology studies. To identify the immunogenic protein or proteins present in *E. maxima*, we attempted to extract and separate the proteins present in the sporulated oocyst.

Several extraction methods were attempted. Sonication or the French pressure cell press was used to disrupt the organism. Protein was then solubilized via one of the following treatments: dodecyl sodium sulfate, Tween 80, Triton x-100, Deoxycholate or no treatment. Protein isolation was optimized by using the French press at 10,000 PSI pressure followed by no detergent treatment. The solubilized protein was placed on a Sephacryl 200 column and two main fractions were isolated; designated Fraction I and Fraction II. BALB/C mice were carried through an inoculation regimen with Fraction I. Splenocytes were fused to FOX-NY myeloma cells and hybridomas assayed (by enzyme-linked immunosorbent assay) for antibody production. Four hybridomas were cloned and designated EM1, EM2, EM3 and EM4. Each clone was injected into pristane primed mice for antibody production into ascites fluid. Presently only EM1 and EM2 ascites fluids have been tested. Both were positive in the ELISA for antibody to French press whole protein and Fraction I column chromatographed protein. Work is presently underway to isolate ascites fluid antibody and better characterize the *E. maxima* protein from French press extracts using high pressure liquid chromatography and electrophoresis.
24. SUBSPECIES OF TRICHINELLA CHARACTERIZED BY DNA STRUCTURE ANALYSIS AND CORRELATED WITH INFECTIVITY FOR PIGS.
JOHN B. DAME* AND K. D. MURRELL. USDA/ARS, ANIMAL PARASITOLOGY INSTITUTE, BELTSVILLE, MD 20705

Isolates of Trichinella from sylvatic hosts differ in their potential to reproduce in pigs. The structure of the genomic DNA from 21 isolates, including T. spiralis, T. s. nativa, T. s. nelsoni, T. s. pseudospiralis, and previously uncharacterized Trichinella isolates, has been examined and correlated with the potential of the isolate to infect pigs. Restriction fragment length differences have been identified which serve as convenient molecular markers to identify each subspecies. Using these markers all isolates were classified as to subspecies. Sylvatic isolates classified by molecular markers as T. s. spiralis had a high reproductive capacity in pigs. Sylvatic isolates classified as one of the other three subspecies had a substantially lower reproductive capacity in pigs than the T. s. spiralis isolates. Two clones of repetitive DNA from T. s. spiralis were selected from a library of genomic DNA fragments cloned in the plasmid pUC8. When used as probes these clones hybridized only to the DNA of isolates of T. s. spiralis. Therefore, they are potentially useful as diagnostic reagents to predict whether new isolates are infectious for pigs.

25. IMMUNOLOGICAL REGULATION OF GUT EPITHELium AS A COMPONENT IN HOST RESISTANCE TO PARASITISM. G.A. CASTRO. UNIVERSITY OF TEXAS MEDICAL SCHOOL. HOUSTON, TX 77225.

A role for gut epithelium as an effector tissue in acquired resistance to enteric parasites is postulated from results of experiments on immunity to Trichinella spiralis. Refractoriness to reinfection with this nematode in some species is expressed by rapid rejection of L1 larvae upon entry into the small intestine. Mechanisms proposed to explain this phenomenon must account for (a) the rapid onset of the response, (b) rejection of the parasite in a noninjured state, and (c) accessibility of immune elements to a parasite that resides within mucosal epithelium. Immunophysiological evidence will be presented in support of the hypothesis that local anaphylaxis rapidly transduces antigenic signals from an initial few invading parasites into physiological changes in epithelial cells. Furthermore, these changes in the worms microhabitat prevent most of the larvae in the infective inoculum from establishing. Partial support for this hypothesis is derived from experimental results indicating that mucosal anaphylaxis accompanies rapid worm rejection and, also, induces changes in epithelial physiology within a comparable time frame.

Natural exposure of pigs to infection with A. suum results in strong intestinal immunity to a homologous challenge. To test the specificity of this response, pigs were either exposed naturally to eggs of A. suum and T. suis on a contaminated dirt lot or maintained helminth-free in confinement and their responses to inoculation with either A. suum eggs, or T. spiralis larvae, or a combined inoculum were compared. Lot-exposed pigs had >99% fewer A. suum larvae in their lungs 7 days after a challenge with A. suum than controls. A second group of lot-exposed pigs had 57% fewer adult T. spiralis in their intestines at 7 days after a challenge with T. spiralis than controls, but this reduction was not statistically significant. A third group of lot-exposed pigs had a significant reduction (81%) in the number of T. spiralis adults recovered at 7 days after a combined inoculation with T. spiralis and A. suum compared to controls. Lot-exposed pigs had antibodies to ES products from A. suum larvae but not to ES from T. spiralis adults, however, antibodies to extracts from T. spiralis larvae and adults of A. suum, T. suis, and Haemonchus contortus were present. Specific induction of intestinal immunity to a homologous challenge with A. suum appears to enhance resistance to a concomitant heterologous infection with T. spiralis.

27. IMMUNIZATION OF SWINE WITH TRICHINELLA SPIRALIS NEWBORN LARVAL ANTIGENS. H.P. MARTI*, K.D. MURRELL AND H.R. GAMBLE. ANIMAL PARASITOLOGY INSTITUTE, AGRICULTURAL RESEARCH SERVICE, USDA, BELTSVILLE, MD 20705

In swine the high degree of immunity to reinfection cannot be attributed to rapid expulsion of the intestinal stages and only partially to a decreased fecundity of the adult female worms. The detection of antibody binding to the surface of the migrating newborn larvae (NBL) and the high degree of resistance in naive animals after passive transfer of immune serum led to attempts to vaccinate pigs using NBL. Three groups of 11 pigs each received either saline, a muscle larval (ML) excretory-secretory antigen (300mg total/pig) or a freeze-thaw NBL preparation (1 million total NBL/pig); subdivided into 3 doses and given in Freund's complete adjuvant intra peritoneally at weekly intervals. One week after the last injections the pigs were inoculated with 2000 infective ML. Six weeks later the pigs were killed and the number of ML in tongue and diaphragm was determined. Pigs immunized with NBL had a 80% reduction in ML burden compared to the control group; pigs immunized with larval ES antigens had a 40% reduction. Further experiments are being carried out to enhance the high protection obtained with this NBL preparation and to identify the relevant antigens using monoclonal antibodies.
28. DERMAL CELLULAR RESPONSES IN CALVES INFECTED WITH OSTERTAGIA OSTERTAGI. 
D.A. CROSS,* P.H. KLESIUS, L.A. HANRAHAN, AND T.B. HAYNES. USDA, ARS, 
REGIONAL PARASITE RESEARCH LABORATORY, AUBURN, AL 36831-0952.

Calves, uninfected and experimentally infected with 100,000 Q. ostertagi, received intradermal injections of sterile saline and soluble larval extract (SLE) from Q. ostertagi L3 larvae. A dose response study using SLE at protein concentrations from 1 to 200 µg/ml was performed with biopsies at 48 hours. A kinetic study was also performed using a 100 µg/ml SLE and biopsies at 1, 4, 8, 12, 24, 48, and 72 hours post injection. All SLE injected sites had an immediate wheal and increase in skin thickness. Eosinophils infiltrated the SLE sites and infected calves had significant eosinophil numbers in response to a wider range of SLE concentrations in the dose response study. Basophil infiltration of SLE sites was also significant in infected calves. Neutrophils appeared early in the kinetic study to SLE and was similar in both uninfected and infected calves. Some perivascular accumulation of mononuclear cells was observed in the deep dermis of infected animals, as well as a decrease in the numbers of detectable mast cells at the SLE sites. The results of this study demonstrate substances from L3 larvae which affect cellular activation and locomotion.

29. OSTERTAGIA OSTERTAGI: CHARACTERIZATION OF EOSINOPHIL CHEMOTAXIN WITH 
MONOCLONAL ANTIBODY. P.H. KLESIUS,* L.W. HORTON, D.A. CROSS, AND 
T.G. SNIDER. USDA, ARS, REGIONAL PARASITE RESEARCH LABORATORY, AUBURN, 
AL 36831-0952 AND VETERINARY PATHOLOGY, LOUISIANA STATE UNIVERSITY, 
BATON ROUGE, LA 70816.

The chemotactic properties of excretory/secretory (ES) substance from the third larval (L3) stage of Ostertagia ostertagi were investigated in vitro. The ES is a chemotaxin for bovine eosinophils. Pronase and trypsin treatment of ES abolished its chemotactic activity while chymotrypsin treatment did not. The ES is resistant to heat treatment up to 80° C. Electroblot analysis showed that ES has a molecular weight of about 14,000 daltons. Immunoperoxidase reaction demonstrated the presence of the ES in the gut and nerve cord cells of L4 larvae in situ. The present study results suggest that ES is a peptide product of Q. ostertagi and plays an important role on the accumulation of eosinophils in the tissues surrounding parasitized gastric glands of the abomasum of cattle with ostertagiasis.
30. REGULATION OF THE LOCAL IMMUNE RESPONSE IN OSTERTAGIA OSTERTAGI INFECTED CALVES. L.C. GASBARRE, USDA, ARS, API, HDL. BELTSVILLE, MD 20705.

Primary infection of calves with Ostertagia ostertagi results in a marked increase in the size of the lymph nodes draining the site of infection, but few of the lymphoid cells in the nodes are specific for parasite antigens. The apparent lack of an Ostertagia-specific response is not due to the presence of non-specific suppressor cells because cells taken from abomasal lymph nodes (ABLN) from infected calves had no suppressive effect when mixed with autologous keyhole limpet hemocyanin (KLH) primed lymphoid cells. In fact, ABLN cells were readily recruited into a KLH-specific response. Immunization of calves with excretory-secretory products (ESP) of O. ostertagi undergoing the molt from 4th stage larvae to young adults results in a high frequency of Ostertagia-specific T cells as assessed by limiting dilution analysis (LDA). Although these Ostertagia-specific T cells were readily demonstrated in the LDA the cells did not grow in conventional blastogenic assays. A similar phenomenon is seen in experimentally infected calves very late in a primary infection. These results indicate that O. ostertagi releases potent immunogens, but that the anti-Ostertagia response in infected calves may be regulated by interference in lymphokine mediated growth of the activated cells or by a polyclonal lymphocyte activation induced by the infection.


An antigenic fraction (ThFAS) isolated from Taenia hydatigena metacestode cyst fluid was used in an enzyme-linked immunosorbent assay (ELISA) to detect antibodies to the heterologous cestodes Taenia saginata and Taenia solium in experimentally-infected animals. Ten calves were dosed with 1,000 to 100,000 T. saginata eggs (20 to 60% viability) and at necropsy 13 to 26 weeks later contained from 83 to 1840 total cysts (14 to 1630 viable cysts). Antibodies were detected in all animals by the third week after infection and up to the time of slaughter. Four pigs were dosed with 10,000 or 20,000 T. solium eggs (20% viability) and at necropsy 13 to 15 weeks later contained from 12 to 74 total cysts (2 to 24 viable cysts). Antibodies were detected in these animals as early as the second week after infection and antibody titres rose up to the time of slaughter. No shared antigens were demonstrated between ThFAS and Fasciola hepatica, Haemonchus contortus, Ascaris suum or Trichinella spiralis. This antigenic fraction appears therefore, to have both sensitivity and specificity for the immunodiagnosis of bovine and porcine cysticercosis.
32. PROTECTION OF PASTURE REARED PONY FOALS AGAINST ACUTE AND CHRONIC CHALLENGE INFECTIONS OF STRONGYLUS VULGARIS BY AN IRRADIATED L3 VACCINE. T.R. KLEI*, M.A.M. TURK, J.R. MCCLURE, M.R. CHAPMAN. LOUISIANA STATE UNIVERSITY, BATON ROUGE, LA 70803

Eighteen pony foals were reared on pasture with their dams. Nine foals were vaccinated with 2 per Os inoculations of 500 gamma irradiated third stage S. vulgaris larvae (L3) at 8 to 10 weeks of age. Mares and foals were treated at 8 week intervals with ivermectin (0.2 mg/kg, paste) during the course of the experiment. Three vaccinated and 3 nonvaccinated foals were removed from pasture and challenged with 4000 L3 at 8, 25 and 36 wks following vaccination. Foals reared under helminth free conditions were also challenged with 4000 L3 at these intervals. Foals were monitored daily and necropsies performed at 21 days following challenge infection. Acute (challenge) and chronic (pasture exposure) infections were differentiated at necropsy by arterial lesion characteristics and arterial larval stage and size. Results indicate that vaccination protects pasture reared foals against acute and chronic challenge infections, and that minimal pasture exposure to S. vulgaris produces protective resistance to acute challenge but not to chronic S. vulgaris exposure. (Supported in part by USDA Grant 82-CRSR-2-2033).

33. CHARACTERIZATION OF EOSINOPHILS AND NEUTROPHILS FROM PONIES WITH STRONGYLUS VULGARIS INDUCED EOSINOPHILIA. V.A. DENNIS*, T.R. KLEI, M.R. CHAPMAN AND G.W. JEFFERS. LOUISIANA STATE UNIVERSITY, BATON ROUGE, LOUISIANA 70803

Eosinophilia and neutrophilia are characteristics of initial and challenge infections of S. vulgaris. Previously we had demonstrated antibody dependent adherence, immobilization and killing of S. vulgaris larvae by eosinophils from eosinophilic ponies. In the present study, the chemotactic and chemokinetic responses to zymosan activated serum (ZAS); FC and complement (C) receptors; phagocytic and bactericidal activities of eosinophils (EOS) and neutrophils (PMN) from S. vulgaris infected eosinophilic ponies were compared to that of cells from normal ponies. EOS from eosinophilic and normal ponies demonstrated similar chemotactic responses to ZAS while PMN from both eosinophilic and normal ponies demonstrated similar chemokinetic responses. Increased percentages of FC and C receptors were detected on EOS and PMN from eosinophilic ponies as compared to normal cells. Generally, there were higher percentages of C as compared to FC receptors. However, eosinophilic PMN consistently had higher percentages of both receptors as compared to eosinophilic EOS. Only PMN demonstrated phagocytosis and bactericidal activities. PMN phagocytosis was greatest in cells from eosinophilic ponies. This data suggests an activation of EOS and PMN by chronic S. vulgaris infections. (Supported in part by USDA Grant 82-CRSR-2-2033).
34. CELLULAR EVENTS ASSOCIATED WITH TICK FEEDING ON NAIVE AND IMMUNOLOGICALLY SENSITIZED HOSTS. STEPHEN J. BROWN. UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS 61801.

Tick feeding on vertebrates induces immunological sensitization that results in the expression of resistance seen as decreased tick yield and engorgement weight. Both antibody and cell-mediated immune mechanisms are involved in this response as demonstrated by passive transfer and ablation studies. Histologically, the site of tick feeding in animals expressing resistance is dominated by eosinophils (bovine) or basophils (rodents); naive hosts express dominant neutrophil responses. Pharmacokinetic studies suggest 1) basophil derived histamine is a primary mediator in host immunity to ticks, and 2) tick susceptibility to host immune responses occurs early during the attachment process and later at the time of rapid engorgement. Tick salivary gland-derived antigens are responsible for the induction and elicitation of host resistance. Furthermore, it appears as if early immunological events are dependent on these salivary antigens, whereas later developing immune responses may be augmented by regurgitated midgut derived antigens.

35. WHOLE-SYSTEMS MANAGEMENT OF LONE STAR TICKS IN BEEF CATTLE FORAGE AREAS. D.R. BARNARD. USDA LONE STAR TICK RESEARCH LABORATORY. POTEAU, OK 74953.

Whole-systems management of ticks in beef cattle forage areas comprises consideration of biologic, control, economic, and production factors in devising control strategies. Biologic factors pertain to intrinsic rates of increase and decrease in populations of ticks. Survivorship in parasitic and free-living ticks, natality, fecundity, and host-finding, and the influence of seasonal factors in each case are considered in this category. Control factors include the efficacy of a treatment methodology for inducing mortality in ticks. A broad spectrum of methodologies comprises, among others, chemical control and vegetation and animal management methods. Principal economic factors are product (commodity) value and treatment cost. Production factors include methods of herd and pasture management, producer attitudes, and cultural factors...where the pernicious effect of an arthropod pest to livestock is nuisance/annoyance, the fulcrum for whole-systems management is the economic threshold. Economic thresholds are derived from knowledge of the pest density-production loss function. In this presentation the cow-calf system of beef production is presented as a model for the development of whole-systems management strategies for lone star ticks.
36. CATTLE GRUB CONTROL: CURRENT STRATEGIES AND FUTURE OUTLOOK. DOUGLAS D. COLWELL, AGRICULTURE CANADA RESEARCH STATION, LETHBRIDGE, ALBERTA, CANADA.

Systemic insecticides applied to cattle for control of hypodermosis are generally effective, but have not yet achieved eradication. Environmental concerns about these pesticides and a need to develop control strategies for cattle grubs which will integrate with other programs for the management of parasites and diseases provided a rationale for investigating alternative control strategies. Currently the largest program is the Joint Canada-United States Cattle Grub Control Project. This program is evaluating the effectiveness and economics of a pest management approach which integrates sterile heel fly releases with standard chemical control. Recently, because of their high potential and broader applicability to livestock management, research and development of vaccines has received a high priority. Single season protection of livestock from infestation with cattle grubs has been achieved with crude and refined antigens although improvements are required before this approach can become commercial. As well, study of the basic elements of host responses to the migrating fly larvae are underway with the aim of finding other techniques for enhancing the host induced mortality. The role of eosinophils as effectors and/or as modulators of host responses is one area of interest. Also, attempts are being made to enhance host responses via the use of various immunomodulators. Identification of cattle which are resistant to grubs has made it possible, through the use of superovulation and embryo transplant technology, to begin an examination of the nature of this resistance and the search for lymphocyte and other markers of the trait.

37. ANIMAL HEALTH: HAS NATURE PROVIDED THE ANSWER? MAX MURRAY, UNIVERSITY OF GLASGOW VETERINARY SCHOOL, GLASGOW, SCOTLAND.

In developing countries where the use of disease control methods has been limited, it would appear through a process of rigorous natural selection groups of ruminants have emerged that possess significant degrees of innate resistance to parasitic diseases, including those involving hemoparasites, helminths and ticks. These animals show the ability to control infection and or to resist the effects. Due to the lack of vaccines and to the problems associated with chemotherapeutic control such as drug residues, drug resistance, it is being recognised increasingly that animals which are genetically resistant to disease offer an alternative approach to the management of animal health. Currently, breeds of cattle that are recognised as being genetically resistant to disease are being improved by conventional management and breeding methods. At the same time, understanding of the mechanisms responsible might lead to the isolation of the appropriate genes and their transfection to create new breeds which are resistant to disease. That nature has already achieved such a goal can be seen in the vast savanna lands of Africa where large herds of wild Bovidae that emerged some 20 to 40 million years ago still roam virtually refractory to the massive disease problems which exist.
GENETIC VARIATION IN RESISTANCE AND RESILIENCE TO HAEMONCHUS CONTORTUS INFECTIONS IN YOUNG MERINO SHEEP. G.D. GRAY*1, C.A.A. ALBERS1, L.F. LE JAMBRE2, L.R. PIPER2, H.W. RAADSMA3 AND J.S.F. BARKER1. DEPARTMENT OF ANIMAL SCIENCE, UNIVERSITY OF NEW ENGLAND1, CSIRO2, ARMIDALE, AND NSW DEPARTMENT OF AGRICULTURE3, TRANGIE, NSW, AUSTRALIA.

The offspring of 60 Fine-Medium Merino rams, each of which was mated with 25 random unselected ewes, were infected with a standardised dose of infective H. contortus larvae. Each progeny group of around 20 lambs was infected in a crossover experimental design which enabled the growth rate of each lamb while infected to be compared with its growth rate while uninfected. Genetic analysis of resistance (worm egg output and decline in packed cell volume) and resilience (liveweight gain adjusted for worm egg output) indicated that both traits are heritable (30% and 20% respectively) and genetically correlated (60%). It was concluded that selection for resistance to H. contortus is feasible and would result in improved productivity.

A further striking example of resilience was obtained in an experiment to determine the effect of crossing among Merino strains and bloodlines on the response to H. contortus infection. Eight Merino bloodlines were used in a complete diallel design. Purebred lambs with parents of the same bloodline were as resistant as crossbred lambs. During infection, but at no other stage from birth to 9 months of age, crossbred lambs grew 46% more than purebreds, i.e. crossbreds were more resilient to infection. This work was supported by the Australian Meat and Livestock Research and Development Corp.

EFFECT OF DIFFERENT PARASITE CONTROL PROGRAMS ON THE PERFORMANCE OF FEEDLOT CATTLE

G.H. MYERS*, AND R.J. GRANT. HOECHST-ROUSSEL AGRI-VET COMPANY, SOMERVILLE, N.J. 08876

Seven feedlot performance trials were designed to evaluate the following parasite control programs: Control, fenbendazole, levamisole or ivermectin. In each trial a randomized complete block experimental design was used. Each study was located in a major feeding area of the United States. A total of approximately 2,000 crossbred yearling steers originating in the Southeast were used. Gastrointestinal nematode infections were diagnosed in a high percentage of the trial animals prior to treatment. Weight gains, feed consumption and fecal egg counts were obtained throughout the feeding period.

Following trial initiation, mean fecal egg counts decreased among all groups. Based on live animal performance for the entire feeding period, the fenbendazole and the levamisole programs significantly (P < .05) improved average daily gains and the fenbendazole program significantly (P < .05) improved feed efficiency resulting in the best improvement in steer performance of the programs tested. Steers treated with ivermectin had numerically improved average daily gains compared to the controls.
A study was carried out to determine optimal methods for the detection of anthelmintic residues in edible meat. Various bioassay methods were compared to a chemical determination (HPLC). The recovery rate of thiabendazole (TBZ), albendazole (ABZ), albendazole sulfoxide (ABZ-SO), albendazole sulfone (ABZ-SO2), and levamisole (LEV) from fortified liver was generally over 50%, but was only 23% for fenbendazole (FBZ). The bioassay methods using cuticle shedding of Nippostrongylus (Jenkin's method) or Ascaris (Rew method) larvae detected residues of benzimidazole and ivermectin at 0.01 to 0.1µg/ml, LEV and Morantel at 1µg/ml and did not detect minor residues of piperazine or certain organophosphates. Motility of the larvae was generally detectable at similar residue levels.

Limited pharmacokinetic studies in lambs, pigs and turkeys of TBZ, ABZ and LEV residues in liver and muscle demonstrated that tissue residues of these compounds and their metabolites are generally not detectable 1-2 days after dosing of the animal. The usefulness of anthelmintic residue testing at slaughter is discussed.

An in vitro target parasite anthelmintic assay utilizing a micromotility meter has been developed and validated. Haemonchus contortus, an economically important ruminant helminth with worldwide distribution, was the parasite used in the model. Four commercially available ruminant anthelmintics were evaluated at several drug levels (200, 150, 100, 50 µg/ml). All four (albendazole, ivermectin, levamisole hydrochloride and coumaphos) were significantly active at 200 and 150 µg, and three of four were active at 100 and 50 µg/ml. One Upjohn compound (p-toluoyl chloride phenylhydrazone) also was assayed and was significantly active at all four levels. The data indicate the in vitro H. contortus assay is sensitive, reliable, accurate, rapid, repeatable, and inexpensive. With additional effort, this model can be extended to incorporate other target helminth parasites and stages. This in vitro assay system should be a valuable addition to the battery of tests utilized to identify anthelmintic candidates.
EFFECTS OF ANTHelmINTIC SCHEDULES ON THE INCIDENCE OF COLIC ON TWO LARGE HORSE FARMS. CHRISTINE UHLINGER, NORTH CAROLINA STATE UNIVERSITY, SCHOOL OF VETERINARY MEDICINE, RALEIGH, NORTH CAROLINA 27606

The incidence of field cases of colic was monitored in five large herds of horses. The incidence of colic ranged from received non-benzimidazole anthelmintics every two months. Average herd pretreatment fecal strongyle egg counts ranged between 600-1700 epg. Larval cultures identified infection with cyathostomes. In two herds, the anthelmintic treatment frequency was increased such that herd fecal strongyle egg counts were kept below 50 epg. After a year on the modified schedule the incidence rate of colic on one farm dropped from .291 to .025 colic cases per horse year at risk and from .417 to .046 in the other herd. Depending on the control group selected, the relative risk of colic in herds on the bimonthly schedule compared to the herds on the modified schedules ranged between 6 and 13.

THE CONTINUOUS, STRATEGIC USE OF ANTHelmINTICS IN WORKING DONKEYS ON A SMALL GREEK ISLAND DURING A FIVE YEAR PERIOD. D. H. BLISS, I. E. GEORGOLAKIS, W. J. JORDAN & E. D. SVENDSEN.* MIDAMERICA AGRICULTURAL RESEARCH, INC. VERONA, WI 53593 AND THE INTERNATIONAL DONKEY PROTECTION TRUST, SIDMOUTH, DEVON, EX10 ONU, ENGLAND.

The long term efficacy of strategic anthelmintic treatment was tested over a five year period in working donkeys located on the Greek island of Kea. All donkeys kept on this small island received anthelmintic treatment three times each year given at four week intervals beginning in early March, 1981. Body condition scores were recorded to determine the clinical benefits of the program while fecal worm egg counts and fecal worm counts were conducted periodically to monitor parasite control. An overall mean reduction of 73% in fecal worm egg output and an overall improvement of 14% in body condition scores was observed by the end of the second year. Worms recovered from the faecal of selected donkeys given a therapeutic anthelmintic treatment at the end of the the second year demonstrated a 92% reduction in worm burdens. Further improvements in body condition scores and reductions in parasite population were recorded each subsequent year. These results demonstrated that significant benefits could be gained from a simple treatment regime practiced on a yearly basis in donkeys raised under Mediterranean peasant farming conditions.
The project was initiated on St. Lawrence Island, Alaska in 1982 with the purpose of determining if monthly mass treatments of dogs would be effective in reducing transmission of *E. multilocularis* in the village setting. Praziquantel (5 mg/kg/bw) has been administered monthly since June, 1982.

The effect has been to markedly lower environmental contamination with *E. multilocularis* eggs as measured by infection prevalence in voles (*Microtus oeconomus*) captured in selected localities surveyed in early June, 1982-1986. The infection rate in voles collected from within the village has declined from 25% in 1982 to 1.2% in 1985.

The hypothesis that the reduction in prevalence within the village is a result of the mass dog treatments is strengthened by comparison with linear trends in vole infection rates in other localities sampled which are tending toward increased prevalence. The rate of *Taenia polycantha* larvae in voles, another tapeworm of the vole/dog life cycle that would be affected by mass treatments, declined in Savoonga from 3% (7/226) in 1983 to 0 in 1984 and 1985.

Adult female and male *Dirofilaria immitis* were recovered aseptically from an infected dog at necropsy. Worms were incubated at 37° C./95% CO₂ in serum-free media both together and separated by sex. Excretory-secretory antigens, recovered from medium, were concentrated and dialyzed by ultrafiltration. Excretory-secretory antigens from female *D. immitis* were used to produce a rabbit polyclonal antiserum. This antibody reacted with serum from infected dogs in an immunodiffusion assay, but did not react with serum from noninfected dogs. Immunoblot analysis using the same antibody following SDS-polyacrylamide gel electrophoresis of one acid-soluble portion of adult *D. immitis* revealed that the rabbit antiserum recognized a complex of proteins of differing molecular weight. Monoclonal antibodies, suitable for incorporation into antigen-detecting assays, have been generated by immunization with adult *D. immitis* antigens and have been screened, in part, by immunoblot analysis with comparison to results obtained by using rabbit antiserum generated against excretory-secretory antigens.
46. THE ELECTRONIC BOLUS: A NOVEL INTERMITTENT-RELEASE ANTHelmINTIC DRUG DELIVERY SYSTEM FOR CATTLE. R. G. GYURIK*, AND B. G. BAGNALL. SMITHKLINE ANIMAL HEALTH PRODUCTS, 1600 PAOLI PIKE, WEST CHESTER, PA 19380.

An intraruminal intermittent release anthelmintic drug delivery system has long been sought to overcome the limitations of conventional sustained release methodologies which include the well-known problems of parasite resistance, sub-therapeutic efficacy and compromised immunocompetence. A device which delivers repeated precise doses automatically would provide a labor-saving convenience for animal management operations. Previously it has been technically difficult to achieve a reliable mechanism capable of withstanding the hostile conditions in the rumen. Recent breakthroughs in computer microelectronics now provide the opportunity to utilize this technology in the field of veterinary parasitology.

A novel electronic bolus has been developed which delivers three instantaneous full therapeutic doses of drug within the rumen at 31 day intervals with seconds-per-month quartz timing precision. The battery-powered device is controlled by a silicon chip microprocessor which measures the intervals and sends an electrical impulse to gas generating drug expulsion mechanisms. The weighted bolus is constructed of polypropylene which encases the drug and mechanisms in a safe waterproof environment. The device is administered by a standard balling gun and is activated by a built-in biosensor which switches on the timing oscillator after ten minutes recognition of the rumen environment.

This drug delivery system allows the convenience of long-term parasite control in cattle without repeated animal handling and stress; it is a flexible system which also allows the potential for future use of other veterinary drugs and different pulse intervals.

47. CLINICAL OBSERVATIONS FOLLOWING ORAL IVERMECTIN ADMINISTRATION TO FOURTEEN COLLIES. A.J. PAUL*, W.J. TRANQUILLI, R.L. SEWARD+ AND K.S. TODD. UNIVERSITY OF ILLINOIS. URBANA, ILL 61801 AND MSD AGVET+. RAHWAY, NJ 07065

Clinical evidence has accumulated indicating that a spectrum of sensitivity or individual idiosyncrasy to ivermectin-induced toxicity exists in Collies. This study was conducted to assess the response of 14 purebred Collies (12 rough-coated, 2 smooth-coated) to increasing dosages of orally administered ivermectin: 100, 200, 600, and 2500 mcg/kg.

Three dogs exhibited mild clinical signs of toxicity (salivation, vomiting, confusion, ataxia and tremors) with the 100 mcg/kg dose. At the 200 mcg/kg dose, seven dogs (including 1 smooth-coated Collie) developed severe toxic signs (seizure-like activity, recumbancy, nonresponsiveness and coma) and two dogs exhibited minimal signs. Dogs that developed severe toxicity were not retreated. No severe signs of toxicity were observed at the 600 mcg/kg dose and only 1 dog became severely toxic at the 2500 mcg/kg dose.

Dogs exhibiting severe toxic signs were given supportive care during the comatose state. All dogs recovered completely. The results indicate that a wide range of sensitivity to ivermectin toxicosis exists in Collies (including smooth coated variety). Duration to the onset of clinical signs may be indicative of the eventual severity of toxicosis and an important prognostic factor for the clinician.
A field trial was done to determine the acceptability and efficacy of a new 1% liquid formulation of ivermectin (IVM), when administered at 200 mcg/kg, to horses as a drench or by stomach tube.

Horses (104) were assigned randomly to 1 of 4 treatments (n=26) and treated on day 0. Treatments included 1-untreated control, 2-IVM liquid via stomach tube, and 3 and 4-IVM liquid as a drench. Horses in treatment 1 were treated with IVM on day 14. Fecal samples were obtained on days 0, 14, and 28 for egg per gram counts and qualitative fecal examinations. The horses were observed for adverse reactions and irritation of the oral mucosa (those drenched).

Results of fecal examinations, performed 14 days after treatment with ivermectin, demonstrated marked reductions in parasite egg counts (99.6-100%) and the numbers of horses detecting passing parasite eggs (8%) as compared to the day of treatment (81-96%). Such reductions did not occur in the untreated controls. Adverse reactions due to treatment were not observed.

Physostigmine has been effective in the treatment of a variety of CNS toxic syndromes (e.g. Valium overdose). Valium is a benzodiazepine which induces CNS depression by increasing CNS GABA activity. It has been postulated that ivermectin toxicosis results from increased CNS GABA activity when access to the brain occurs. The purpose of this study was to assess physostigmines' effectiveness as a therapeutic agent in Collies exhibiting ivermectin toxicosis. Fourteen Collies were studied. Ivermectin was administered orally (200 mcg/kg). Dogs were observed continually for signs of toxicity. Six dogs developed severe depression, became comatose and were treated with 1 mg of physostigmine b.i.d. Fluids were given to prevent dehydration. Following physostigmine administration, all dogs became responsive and attempted to eat and drink. The duration of increased responsiveness ranged from 30 to 90 minutes. Physostigmine induced seizures in one dog that was not comatose. All affected dogs recovered within 12 days of ivermectin administration. In conclusion, physostigmine cannot be recommended as a sole therapeutic agent or complete antidote for inadvertent ivermectin toxicosis. Seemingly, its observable beneficial action is limited to the more severe depressant or comatose stages of ivermectin toxicity.

In an effort to examine relevant structure-activity features of avermectins, the activities of Ivermectin and 14 related compounds were evaluated in three assays: (1) impact on population growth of the free-living nematode, Caenorhabditis elegans, (2) stimulation of 3H-flunitrazepam binding using bovine brain synaptic membranes, and (3) acute toxicity to the water flea, Daphnia magna. Data suggested that selective hydrolysis of the disaccharide results in substantial losses in activity, especially in the invertebrate assays. Further, susceptibility of the invertebrates and stimulation of 3H-Flu binding were only moderately sensitive to changes in the nature of the C22-23 bonding (single vs double) and the C25 alkyl substituent (isopropyl vs secbutyl). However, incorporation of an OH at C23 significantly reduced binding and Daphnia, but not C. elegans, activity. Stereocahemical and substituent changes in the cyclohexene ring at positions 2, 3, 4 and 5 generally, but not always, had a negative impact on activity.


To develop a climate forecasting system for Louisiana, snail population dynamics, Fasciola hepatica transmission to sentinel calves and herd prevalence rates were evaluated over a 6-year period. Results indicate that most transmission occurs between February - July and that the Thornthwaite water budget can be effectively used as an indicator of climatic effects on annual F. hepatica transmission risk. Using step-wise multiple regression, the best fit to the data was provided by cumulative surplus water over the prior 4.5-month interval, followed by soil moisture storage in the top 2.5 cm zone, storage in the bottom 12.5 cm zone, and raw precipitation data over the prior 4.5 or 6-month period. Surplus water is proposed to be an appropriate indicator of standing water in habitats and flood dispersal of snails. A climate forecast system based on the Thornthwaite system was contrasted to local modifications of the 'wet-day' and 'Mt' models. The 'wet-dry' system was poorly correlated with total annual flukes transmitted per calf. The 'Mt' system and the LSU system correctly predicted annual flukes transmitted per calf (low <10; moderate, 10-40; high 40-100; very high >100) in 5 years. The Thornthwaite water budget is a convenient, available agricultural indicator of climate, it requires minimum local weather data input, and it has the advantage of broad potential application under divergent climate zones. The forecast model has been programmed to run on an IBM compatible microcomputer.
Over a 4 mo period, fecal samples were collected at 2 week intervals from foals in 3 herds of equids. These samples were examined for Cryptosporidium sp. oocysts using phase microscopy after flotation in Sheather's sugar solution. Foals in the herds, 11.5% (of 26 ponies), 13.6% (of 22 Thoroughbreds) and 20% (of 15 Quarter horses) shed oocysts at least once. Oocysts were not found in any mares on these farms.

Feces of 21 pony foals removed from their dams at 24 hrs post-partum and reared in a helminth-free environment were examined daily for Cryptosporidium sp. All shed oocysts. Beginning on day 9 to 28 post-partum and continuing for 2 to 18 days. The shedding of oocysts corresponded to periods of diarrhea. Viral particles (Corona and Rota) were found in 2 of the foals by electron microscopy both of which had diarrhea at the time of sampling. One of these animals was passing oocysts at the same time. This foal later died with an uncontrollable diarrhea. Salmonella was isolated from the feces of one animal following a period of oocyst shedding.

The atypical clinical features and isolation of a Trypanosoma cruzi-like organism from the peripheral blood of a Louisiana dog has been previously described from our laboratory. To date, blood samples from 56 armadillos, 18 opossums and 103 hunting dogs from southeastern Louisiana have been cultured in LIT medium for the isolation of a similar organism. A T. cruzi-like organism was isolated from 1 (1.8%) armadillo and 6 (33%) opossums and subsequently grown in vitro on Vero cell cultures. The prevalence of a T. cruzi-like organism in Louisiana mammals is similar to reports from other states. The growth and behavior of the 3 T. cruzi isolates in Vero cell cultures were studied. The 3 isolates showed some variation in the kinetics of their in vitro growth pattern. Trypomastigotes of each isolate grown in Vero cell cultures were subsequently inoculated intraperitoneally into 6 inbred strains of mice (10⁶ organisms per mouse) known to be susceptible to human pathogenic isolates of T. cruzi. None of the Louisiana isolates were pathogenic in mice. Although most mice developed parasitemias, some differences were observed in the level of parasitemia between isolates within the mouse strain, and between the mouse strains within the isolates. The differences in the in vitro and in vivo characteristics of the 3 isolates suggests that different strains exist in the wild.
NEMATODIRUS SP. IN NEW ENGLAND LAMBS. G.C. COLES*, J.P. TRITSCHLER II, D.J. GIORDANO. UNIVERSITY OF MASSACHUSETTS, AMHERST, MA. 01003

Lambs grazed on clean pasture or pasture used the previous year were divided into 3 groups of 5 each and dosed with levamisole (7.5 mg/kg) or thiabendazole (44 mg/kg) in early November 1983. In untreated animals 53% of worms were Nematodirus spathiger, 2% N. filicollis and 28% O. circumcincta. Levamisole controlled all abomasal and small intestinal nematodes except N. spathiger (95% efficacy). Thiabendazole was also highly effective (94% removal of total worm burden, 97% of N. spathiger removed), but left worms of 6 species in lambs. In June 1984, 54% of eggs in feces of 2 lambs were Nematodirus sp. but in late October only 3% in six lambs were Nematodirus sp. However, of the total worm burden 43% were N. spathiger and 27% N. filicollis. Undifferentiated egg counts can therefore be a misleading indicator of worm burden. Lower than usual rain fall in August and September of both years may have contributed to Nematodirus sp. being the dominant nematodes.

LATE FALL TRANSMISSION OF NEMATODIRUS BATTUS IN OREGON. L.G. RICKARD*, E.P. HOBERG, G.L. ZIMMERMAN AND J.K. ERNO. COLLEGE OF VETERINARY MEDICINE, OREGON STATE UNIVERSITY, CORVALLIS, OR. 97330

The seasonal transmission patterns of Nematodirus battus directly influence the potential for clinical disease in western Europe. The typical pattern of transmission of N. battus involves annual infections of lambs in the spring. Acquisition occurs following the mass hatch of eggs, containing infective third stage larvae, which were deposited during the previous grazing season.

As in Europe, the potential impact of N. battus in North America will depend on seasonal patterns of parasite abundance. In November 1985, a study was initiated to determine whether transmission follows the typical pattern seen in England or if the life cycle could be completed during other times of the year. On day 0, nine N. battus-naive sheep (7-9 months old) were placed on a controlled contaminated pasture and allowed to graze for 35 to 65 days. Fecal egg counts were conducted on a weekly basis beginning on day 16 and were positive by day 23. Animals were necropsied in 3 groups on days 36, 53-59, and 66; all animals harbored adult and immature stages of N. battus. This clearly indicates that the life cycle of N. battus can be completed under severe autumn conditions in Western Oregon. Thus, transmission may extend over a prolonged period of time and peaks of larval abundance may be dampened.
56. EPIZOOTIOLOGICAL STUDIES ON ZEBRA PARASITISM. R.C. KRECEK*, ANIMAL PARASITOLOGY INSTITUTE, AGRICULTURAL RESEARCH SERVICE, USDA, BELTSVILLE, MARYLAND 20705.

The nematode burdens of 52 Burchell’s and 21 Hartmann’s mountain zebras from five different environmental areas of southern Africa were determined. Seven nematode families were recovered [Atractidae, Strongylidae (Cyathostominae and Strongylinae), Habronematidae, Oxyuridae, Strongyloididae, Trichostrongylidae and Onchocercidae] and were represented by 17 genera and 27 species. Distribution of the nematodes recovered were evaluated according to climate, age of the host as well as interfamily and interspecific competition within the host. Zebras originating from the lowest rainfall areas (46-324 mm annually) had consistently higher burdens of the two atractids Probstmayria vivipara (1 257 810 – 42 004 300) and Crossocephalus viviparus (692 – 61 066 680) but fewer strongyle species (7). The reverse was true, however, for zebras in the highest rainfall areas (560-800 mm annually) which had lower burdens of atractids and a greater diversity of strongyles (17). Greater burdens of nematodes were recovered from the younger zebras. The influence of interfamily and interspecific competition on populations of zebra nematode parasites will be discussed.

57. Depletion of Strongylid and Trichostrongylid Eggs or Larvae in Feces by Aphodius spp. (Coleoptera; Scarabaeidae) and Orthellia sp. (Diptera; Muscidae) R. C. Bergstrom*, L. K. Mancini and C. K. Mathiason. University of Wyoming, Laramie, WY 82070.

A plethora of insect orders, families and genera interact in some fashion with the ova and/or larvae of parasitic nematodes in fecal samples of domestic animals. In the trials recently completed, we wished to learn the percentage of Strongylid ova of horse feces and the Trichostrongylid ova in sheep feces that might be destroyed within a given time of interaction by the micropredation of Aphodius spp. beetles and Orthellia sp. fly larvae. Five Aphodius fimetarius adult beetles interacting with Strongyle ova in feces at 96-100% humidity and 23 C. decreased the eggs/ g. from 1630 to 190 within 72 hr. and to zero within 15 days. In five trials with Trichostrongylus colubriformis ova at from 700-2,200 eggs/ g., Orthellia sp. fly larvae in first and second instar destroyed from 18-100% of the nematode ova in sheep feces within 24 hr. The micropredation of Trichostrongylid ova by Orthellia sp. had not been previously noted in the literature. Conversely, the action of Aphodius spp. in feces had been noted by Bergstrom, et al. (Proc. Helminthol. Soc. Wash., Vol. 43: 171-174, 1976.
58. A THREE YEAR STUDY ON THE EPIDEMIOLOGY OF PARASITISM IN STOCKER CATTLE USING A
   ROTATIONAL GRAZING SYSTEM IN WISCONSIN. L.L. SMITH AND D.H. BLISS.* LODI VETERINARY
   HOSPITAL, LODI, WI 53555, AND MIDAMERICA AGRICULTURAL RESEARCH, INC. VERONA, WI
   53595.

The epidemiology of parasitic gastroenteritis was monitored in a commercial stocker cattle operation
during three consecutive summer grazing seasons in Wisconsin. Each year, twenty head of cattle
were purchased and maintained on the same 12.5 acres of improved trifoliate pasture divided equally
into two separate pastures. During the season, the cattle were rotated from one pasture to the other
depending upon grass growth and other normal pasture management considerations. The pasture area
was segregated from a 600 acre pasture operation and had been grazed by parasitized cattle for
several years prior to the initiation of the current three year study. The cattle were turned out to
graze each year in early May and brought in from pasture during the early part of October.

Results from the study demonstrated large seasonal variations in the levels of pasture larval
contamination during various times of the year and in the development of parasitic gastroenteritis
in the cattle grazing these pastures. As high as a 16 fold difference in parasite burdens was recorded
from the same category of cattle grazing the same pasture at the same time in different years
(300,798 worms recovered from tracer calves grazing the pastures in August, 1982 vs. 18,633
worms found in August, 1983). Both summer and winter weather patterns seemed to play a large
role in producing this seasonal variation.

59. THE CHARACTERIZATION OF CUTICULAR PROTEINS FROM DEVELOPMENTAL STAGES OF
   ASCARIS SUUM. R.H. FETTERER* AND J.F. URBAN, JR., HELMINTHIC DISEASES
   LABORATORY, ANIMAL PARASITOLOGY INSTITUTE, ARS, USDA, BELTSVILLE,
   MARYLAND 20705.

The cuticles of distinct developmental stages of A. suum were isolated
by detergent treatment of both in vivo and in vitro derived larvae or
by surgical removal of cuticle from adults. Proteins from isolated
cuticles were solubilized with reducing agents and analyzed by
SDS-polyacrylamide gel electrophoresis. Soluble proteins from adult
cuticle consisted of 5 bands with 80% of proteins in 2 bands with
molecular weights of 106 and 93 KD. Cuticular proteins from 3rd (L3)
and 4th (L4) larval stages were qualitatively similar to adult although
less protein was solubilized from larval cuticles than from adult.
Soluble cuticular proteins from both adults and larvae were sensitive
to collagenase digestion suggesting that these proteins are
collagen-like structural elements of cuticle. Pigs immunized with
isolated cuticle from in vitro derived L3 demonstrated pronounced liver
reaction and reduced number of lung larvae upon challenge and produced
antibody to soluble proteins from both adult and L3 cuticle. These
results show that pattern of cuticle proteins may be repeated during
development from L3 to adult and that structural cuticle proteins may
play a role in the immunobiology of A. suum.

Characterization of cell populations in uninfected and Ascaris suum-infected beagles was undertaken to aid in interpretation of data obtained in studies on Ascaris-induced bronchoconstriction in beagles, a model of human allergic asthma. Groups of 8 dogs (♂♂ 10 kg) were infected orally with 100 (low dose) or 10,000 (high dose) embryonated eggs of Ascaris suum. Two dogs each were used as noninfected Ascaris Ag-exposed or noninfected, nonexposed to Ascaris Ag controls. Lung lavage samples were collected from each dog at -2, 1, 2, 3, 4, 5, 7, 12 and 18 weeks postinoculation (PI). Each sample was pelleted by centrifugation, decanted and resuspended prior to cytocentrifugation, fixation with methanol, and staining with Wright-Giemsa. Prior to inoculation with A. suum (-2 weeks) mean cell populations by percent were neutrophils 19.5 ± 8.9%, eosinophils 4.0 ± 2.8%, basophils 0.5 ± 0.5%, mast cells 0.2 ± 0.3%, macrophages 7.4 ± 2.6%, small lymphocytes 2.1 ± 1.4%, large lymphocytes 0.4 ± 0.5%, monocytes 2.4 ± 1.4%, Type I pneumocytes 8.1 ± 5.0%, Type II pneumocytes 55.1 ± 10.3%, and others 0.3 ± 0.4%. Significant changes in numbers of various cell types were observed in A. suum-infected and Ascaris Ag-exposed beagles compared to noninfected, nonexposed to Ascaris Ag controls and between dogs infected with high and low doses of Ascaris.

61. RELATIONSHIP OF REPRODUCTIVE STATUS AND PERIPARTURIENT EGG RISE IN EWES INFECTED WITH HAEMONCHUS CONTORUS. MICHAEL W. FLEMING*1 AND RICHARD C. RHODES III2. 1HELMINTHIC DISEASES LABORATORY, API, ARS, USDA, BELTSVILLE, MD 20705 and 2DEPT. ANIM. & VET. SCIENCES, UNIVERSITY OF RHODE ISLAND, KINGSTON, RI 02881.

Arrestment of development during pregnancy and subsequent increased egg production near parturition by some ruminant gastrointestinal nematodes represents a significant strategy for surviving adverse environmental conditions as well as infecting naive host offspring. Experiments were conducted to produce experimental infections that demonstrated periparturient egg rise (PPR) and to examine the role of the host's reproductive hormones in larval arrestment and PPR.

Pregnant ewes inoculated with 20,000 larvae of Haemonchus contortus five times on alternate days of midpregnancy (Days 70-80) displayed a distinct PPR and increased number of adult worms compared to nonpregnant controls (486 ± 153 vs 71 ± 19, X ± SEM). Similarly, sham-operated pregnant ewes had higher egg counts and numbers of adult worms postpartum than sham-operated nonpregnant ewes (2704 ± 1156 vs 136 ± 84). Ovariectomized ewes had a bimodal distribution of adult worms; one-half of the ewes had high worm counts (3931 ± 506) and the remainder had low counts (195 ± 31). Thus, the regimen of larval inoculation successfully induced PPR, but ovariectomy produce conflicting results, perhaps due to genetic differences among the host animal.
CHARACTERIZATION OF EXSHEATHING FLUIDS FROM HAEMONCHUS CONTORTUS.
H. R. GAMBLE AND R. H. FETTERER, USDA, ARS, ANIMAL PARASITOLOGY INSTITUTE, HELMINTHIC DISEASES LABORATORY, BELTSVILLE, MARYLAND 20705

Exsheathing fluids were collected from infective third stage larvae of Haemonchus contortus by incubation in Earle's Balanced salt solution under CO₂ for 1 hr at 37°C; greater than 90% of the larvae ecdysed during this interval. Concentrated exsheathing fluids contained approximately 0.5 mg of protein/1 x 10⁶ larvae. SDS-polyacrylamide gel electrophoresis demonstrated that the majority of this protein was represented by a single band of approximately 89K molecular weight. This protein appeared to be a minor component of extracts of H. contortus L₃ and was absent in Coomassie blue stained extracts of L₄ and adult parasites. Monoclonal antibodies were generated with specificity for the exsheathment fluids. In immunoblots these antibodies recognized the 89K molecular weight protein and two additional proteins with approximate molecular weights of 37K and 43K. A bioassay, using intact second stage H. contortus cuticular sheaths, demonstrated that the exsheathment fluids contained a component which induced the formation of a refractile ring near the anterior end of the sheath.

EXPERIMENTAL INFECTIONS IN TURKEYS WITH CRYPTOSPORIDIUM SP. ISOLATED FROM CHICKENS. DAVID S. LINDSAY* AND BYRON L. BLACBURN. AUBURN UNIVERSITY, AL 36849-3501.

Oocysts of Cryptosporidium sp., originally isolated from the bursae of naturally infected broiler chickens (AU-B1 isolate), were inoculated into 3 groups of 6-day-old turkey poult's. Oral inoculation of 13 poult's, or intra-cloacal inoculation of 12 poult's with oocysts caused no clinical signs or deaths, but did result in patent infections. Intra-tracheal inoculation of 17 poult's with oocysts produced clinical signs of respiratory disease in 100% of the birds, mortality in 5 birds (29.4%), and gross lesions of airsacculitis in all birds examined 9 days postinoculation (DPI) through 25 DPI. Parasites developed in the microvillous border of the nasopharynges, larynges, tracheas, bronchi and air sacs of intra-tracheally inoculated poult's. Respiratory infections confined to the nasopharynges, larynges, and tracheas also occurred in 3 orally-inoculated poult's that were examined 11, 18 and 25 DPI. No respiratory infections occurred in intra-cloacally inoculated poult's. The mode of inoculation did not influence the distribution of Cryptosporidium sp. in the digestive tract. Cryptosporidia were not found in the duodenum, jejunum, ileum, terminal colon, liver or kidney of any birds examined. Cryptosporidia were observed in the cecum of only one bird examined, whereas the bursa of Fabricius was parasitized in 72.7% and the cloaca was parasitized in 100% of birds with patent infections. Cryptosporidium sp. was not observed in 12 control poult's during the study.
EFFECTS OF CRYPTOSPORIDIUM INFECTIONS ON WEIGHT GAIN, FEED CONVERSION AND CARCASS QUALITY IN BROILER CHICKENS. BYRON L. BLAUBURN*, DAVID S. LINDSAY, JOSEPH J. GIAMBRONE, CHRISTINE A. SUNDERMANN AND FREDERIC J. HOERR. AUBURN UNIVERSITY, AL 36849-3501.

Seven-day-old broiler chickens were inoculated orally or intra-tracheally (IT) with 2.5 x 10^5, 5 x 10^5, or 2 x 10^6 oocysts of Cryptosporidium sp. (6 groups, 32 birds each). Thirty two birds served as noninoculated controls. Mean weekly weight gain and feed conversion were determined on surviving birds during a 5-week-growth period. Carcass color was graded using a Roche color fan. Fecal oocyst outputs were calculated from random cage samples 6, 8, 11, 13, 15, 18, 20, 22, and 25 days postinoculation (PI). Clinical signs of respiratory disease, consisting of moist rales, snicking and sneezing were observed in all IT-inoculated birds 7-21 days PI. Seven deaths occurred in the IT-inoculated groups 14-21 days PI. At necropsy, lung parenchyma was discolored gray, firm and wet in the ventral region. Air sacs were covered by a foamy, white to gray, mucoid fluid. Mean weight gains for IT-inoculated birds were significantly lower (p<.05) than those of controls from 14 to 21 days PI, although mean weight gains for the 5-week-period were not significantly different. Color scores for IT-inoculated birds were significantly lower than control birds. Oocyst output was similar regardless of the route of inoculation. Our results reinforce field observations in that respiratory cryptosporidiosis can be a severe and sometimes fatal disease of broiler chickens. Cryptosporidiosis also affects weight gains during the period of maximum stress, and carcass quality.
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