Veterinary Parasite Problems

By W. S. BAILEY, D.V.M., Sc.D.

PARASITISM has exerted a tremendous influence on the livestock industry of the southeastern United States. The story of cattle tick fever and its eradication is a familiar one. Other parasitic infections of a less spectacular nature have continued to plague our livestock, usually in the form of inapparent or undiagnosed chronic infections. Such infections tend to attract little attention until an acute clinical outbreak occurs. Certainly parasitism in the domestic animals is not a problem peculiar to the southeastern States, but a number of factors (*1*) contribute to make many of our problems of greater magnitude than in other areas of the United States.

The very large number of parasites of domestic animals in the southeastern States vary greatly in their distribution, incidence, and pathogenicity. It is difficult to present an accurate, brief account of the veterinary parasite problems. This is particularly true since our knowledge of these parasites is, in many instances, incomplete or entirely lacking. The task is seen to be more difficult when one realizes that the line of demarcation between clinical and subclinical, or latent, parasitism is variable, influenced by a number of factors in the host-parasite relationships. Consequently, many parasites not generally considered to be primarily pathogenic may be of importance in a particular disease of an individual or group of animals.

Dr. Bailey is head professor, department of pathology and parasitology, School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn, Ala.

Specific parasite problems will be discussed by the host relationship. No attempt will be made to rank the infections according to importance or to catalog all of the parasites that may be present as major factors. Rather, a brief summary of internal parasitism in the different animals will be presented, and one or more entities will be discussed in greater detail because of differences in incidence, greater economic importance, or biological interest.

Cattle

During the past 10 years there has undoubtedly been a greater change in parasitism of cattle in the southeast than in any other host and probably than in any other area. The most striking aspect of this change has been the common occurrence of clinical parasitism in mature animals. The figures below illustrate the marked increase in clinical parasitism in southern Georgia as determined at autopsy by Andrews, Sippel, and Jones at the Tifton, Ga., experiment station (*2*).

Year	*Percent of cattle with clinical parasitism*
1945–50	Negligible
1950–51	6
1951–52	11
1952–53	17

From March 21, 1952, to June 2, 1953, 14 animals, aged from 6 months to 10 years, were found to have been suffering from clinical parasitism at autopsy. The animals were from 10 farms on which there was a death loss of 5 percent of 1,900 animals.

Although the criteria are not exactly the

same, and, no doubt, evaluators differ somewhat, these figures appear to be rather close to those given in the following table taken from the autopsy records of the department of pathology and parasitology, School of Veterinary Medicine, Alabama Polytechnic Institute. The diagnosis for 11.1 percent of 422 cattle autopsied was primary parasitism, and the diagnosis for an additional 5.6 percent of these cattle was secondary parasitism.

The results of Cooperrider's study (*3*) on the economic losses in cattle due to internal parasitism further emphasize the common occurrence and great importance of clinical parasitism of cattle in this area. We would be amazed if we could but know the magnitude of the loss resulting from combined clinical and subclinical parasitism of cattle in the southeast.

These losses are due primarily to infections with the stomach worms, *Haemonchus*, *Ostertagia*, and *Trichostrongylus*. These natural infections are almost always in the form of a parasitic gastroenteritis, with certain intestinal parasites contributing to the disease. In some instances the intestinal parasites are the primary cause of the syndrome.

There is relatively little information on the number of these parasites required to produce clinical parasitism and death. This is mainly because parasitic infections may be parts of more complex diseases in which malnutrition and concurrent or previous infections with other pathogens play major roles. Rarely will one find infections with more than 10,000 *Haemonchus*, but as many as 300,000 immature *Haemonchus* have been reported. The presence of 50,000 to 75,000 *Ostertagia* or *Trichostrongylus*, or both, is apparently sufficient to cause severe symptoms and death in some animals. Recent reports include a number of cases with from 200,000 to 500,000 of these worms, and as many as 1,100,000 have been found. In these massive infections a large percentage of the worms often are immature.

Primary and secondary parasitism as found at autopsy at the Alabama Polytechnic Institute, May 1, 1953, to Mar. 18, 1955.

Host	Number animals autopsied (all ages)	Primary parasitism [1]		Secondary parasitism [2]	
		Number	Percent	Number	Percent
Dog	532	38	7.2	23	4.3
Cat	51	3	6.8	2	3.9
Sheep and goat	52	8	15.3	1	1.9
Cattle	422	47	11.1	24	5.6
Equine	46	3	6.5	2	4.3
Hog	186	5	2.6	7	3.7

[1] Considered the primary cause of death. [2] Considered to be a contributing factor to the illness and death of the animal.

All three of the stomach worms are bloodsuckers and anemia of variable degree is a characteristic symptom of *Haemonchus* and *Ostertagia* infections. Digestive disturbances, usually in the form of a persistent diarrhea, are almost constantly present. There is a great need for additional information on the host-parasite relationships of these worms, especially with regard to pathogenesis and immunity.

The intestinal helminths contributing most to general parasitic gastroenteritis and which may be primarily responsible for the disease under certain conditions are: *Cooperia* spp.; *Bunostomum phlebotomum*, the cattle hookworm; *Nematodirus* spp.; and *Oesophagostomum radiatum*, the nodular worm.

There are a number of other helminths in the intestines of cattle, but they generally are of little pathogenic importance in the southeast. One or two of these should be mentioned, however. *Neoascaris*, the cattle ascarid, may be a problem in individual herds. It apparently is found more in scattered herds in Louisiana and Florida than in any other of the southeastern States. The anoplocephaline tapeworms, *Moniezia* spp., are quite common but appear to be relatively nonpathogenic. There is, however, the tendency to attribute damage produced by the minute parasites to these large ones.

Coccidiosis continues to be an important problem in many herds. Of the 10 species occurring in cattle in this area, *Eimeria zurnii* and *Eimeria bovis* are the most pathogenic, but some of the others may contribute to, or be primarily responsible for, the infection. As is true with the worm infections, older animals may also have clinical coccidiosis.

Fasciola hepatica infections have been diagnosed in a number of the southeastern States.

At the present time the only State east of the Mississippi River in which *Fasciola* infection is considered to be of any appreciable importance is Florida. *Fascioloides* infection is probably much more widespread than reports indicate. Although many deer in certain areas of Alabama are infected, the first bovine case came to our attention last year. It is not known if the case was an autochthonous infection.

Lungworm infection is quite widespread in the southeast, and is especially important in the low, wet areas which provide an ideal environment for the larvae. Heavy infections often result in severe bronchitis and death. We do not appear to have in the area the "atypical" lungworm infection of mature cattle described recently by the English workers (*4*), but the possibility of this should not be overlooked, especially in the wet areas.

Bovine genital trichomoniasis, caused by *Trichomonas foetus*, has been diagnosed in practically all the States. This disease does not appear to have caused as much trouble in most southeastern States as it has in the more heavily concentrated dairy areas of the midwest. In individual herds in any of the States, however, it may be of great economic importance. Until 1954 we knew of no definite diagnosis of this infection in Alabama. Our first diagnosis was made in a herd into which bred heifers were brought from a midwestern State. Since that time the infection has been diagnosed in three additional herds and probably exists in a number of others.

Although the exact classification of the etiologic agent of anaplasmosis is unsettled, it is included with the parasitic diseases in this discussion. In some of the southeastern States anaplasmosis is currently of only spotty distribution and little importance. However, South Carolina, Florida, Mississippi, and Louisiana may truly be referred to as enzootic areas. The incidence and distribution of this disease is intimately related to, but not limited by, the density of the several arthropod vectors which may transmit it.

Sheep and Goats

The prevalence of internal parasites was a major factor in the decline of the sheep industry in a number of southeastern States in years past, and the promise of better control measures has contributed to an increase in the sheep population in recent years. Since many of the problems are much the same as for cattle and are produced by the same or closely related species of parasites, no separate discussion for these hosts will be given in this general and brief review.

Swine

A number of the gastrointestinal parasites of hogs are not appreciably different in the southeastern States from most of the rest of the country, although the intensity of infection may be somewhat heavier. The stomach worms are widely distributed, but are not often primarily responsible for trouble. The hog ascarid is also widely distributed and of major importance. Undoubtedly many of the factors relating to the distribution and epidemiology of the human ascarid are also operative in this infection.

The thorny head worm of hogs is not as widely distributed as the ascarid but may be an important problem in given herds, in which control is difficult. Occasionally, death occurs from light infections due to peritonitis resulting from perforation of the intestinal wall by the proboscis. Of the several species of nodular worms infecting the hog, only one, *Oesophagostomum dentatum*, appears to be widely distributed in this country. The others are somewhat restricted to the southeastern States. Lungworm infection is quite common and is often the cause of respiratory symptoms and even death.

The kidney worm of hogs, *Stephanurus dentatus*, is of little importance outside the southeast. In fact it is only in the lower tier of States and up the Atlantic seaboard to Virginia that the infection is of any great significance. In these areas, however, it is still a major problem, and losses occur in a number of ways. The loss most easily determined is that due to condemnation or trimming of parts of carcasses at the killing abattoir.

According to a personal communication from J. A. Langford a heavy infection with the larval stage of *Diphyllobothrium* (*Spirometra*)

mansonoides was diagnosed in a range hog in Florida recently.

Poultry

Little will be said about poultry parasites. The common gastrointestinal helminths and protozoa are widely distributed and of variable importance throughout the southeast.

Leucocytozoon smithi infection of turkeys appears to be quite common in many parts of the southeast, as evidenced by the observations of a number of workers (*5–8*). Bierer (*8*) indicates that this is primarily a disease of the tidewater area along the eastern seaboard. Recent outbreaks in South Carolina have been particularly striking. Wild turkeys apparently served as a reservoir of infection. The disease may be very acute and highly fatal as described by Stoddard and associates (*7*), who reported 75 percent mortality of 1,600 birds in 7 days, or it may be more insidious and with low mortality. The latter outbreaks may be associated with the breeding season in which case there seems to be a greater mortality in toms than in hens.

Equines

With the decrease in the horse and mule population, a number of the parasite problems in these animals have become less marked but have by no means disappeared. Bot infections are still very common, and marked gastritis due to infections with *Trichostrongylus axei* is quite common. The latter is not surprising in view of the increasing importance of this parasite in ruminants, inasmuch as there is good evidence that cross transmission occurs. Cutaneous habronemiasis is seen much less than in earlier years. However, this disease may constitute a problem on even the best of farms if the animals are infected with the adult worms and there is a high transmission potential because of an abundant fly population.

The most important intestinal parasites are the ascarid, *Parascaris equorum*, and the strongyles, particularly the large strongyles, *Strongylus vulgaris*, *Strongylus edentatus*, and *Strongylus equinus*. Ascarid infections are usually of clinical significance only in young animals. In addition to the bloodsucking activity of the large strongyles, the parasitic aneurysm produced by *S. vulgaris* is of great importance. This aneurysm, with the resulting thrombus formation, of the anterior mesenteric artery may cause a variety of intestinal disturbances, and frequently results in death. Pinworm infection may constitute a problem in individual or groups of animals, but it generally is of little pathogenic importance.

Dogs and Cats

Spirocerca lupi, the dog esophageal worm, appears to be very rare in this country except in the south. Over a period of approximately 4 years we have found slightly over 4 percent of 943 dogs of all ages infected (*9*). Since this includes a large number of puppies, the incidence in dogs old enough for the life cycle to have been completed would be appreciably higher. Only a small percentage of the dogs infected with *Spirocerca* show clinical symptoms. However, this infection takes on added interest and importance in view of the recent report by Seibold and associates (*10*) that it may be an inciting cause of the development of malignant esophageal tumors of the dog.

A number of intestinal helminths are very widely distributed, not only in the southeast but in much of the Nation, and some are highly pathogenic. We have no comprehensive figures on the incidence of *Strongyloides* in the dog in the southeast, but it is certainly more common than the reports indicate. It is often the cause of respiratory symptoms and intestinal disturbance, and the mortality rate in heavily infected puppies is quite high. Although the worm is apparently indistinguishable from *Strongyloides* of man, it is likely that man does not easily become infected with the dog form.

The hookworms, *Ancylostoma caninum* and *Ancylostoma braziliense*, continue to take a heavy toll of our young dogs. Prenatal infections are very common and highly pathogenic. Some of the heaviest infections have been in mature dogs concurrently suffering with some other disease.

Roundworm infections are very common, especially in young dogs, with prenatal infection

again being of great importance. *Toxocara canis* is the one most often encountered.

Light tapeworm infections are found in a high percentage of dogs, and heavy infections are common. *Dipylidium caninum* is the one found most often in this area, but *Taenia taeniaformis* and *Taenia pisiformis* are not uncommon and seem to occur most often in the cat. There is a recent report of natural infection of dogs with *Echinococcus granulosus* in Mississippi (*11*). The public health importance of this needs no elaboration.

Pseudophyllidean tapeworms appear to be rare in dogs in this area. *Diphyllobothrium latum* has been reported from Florida. *D.* (*Spirometra*) *mansonoides* has been reported from Louisiana and, during the past year, from the Alabama-Georgia area (*12*). Langford, who recently sent us the larvae of this parasite from a hog, in his letter reported finding a number of cases of *Diphyllobothrium* infection in dogs and cats.

Light to moderate infections with the whipworm, *Trichuris vulpis*, are common in the dog, and occasionally very heavy infections are encountered in which the parasite is apparently the cause of death. In such cases not only is the cecum filled with worms, but the entire surface of the colon is covered.

A number of intestinal protozoa are commonly found in the dog. Eyles and associates (*13*) have recently reported finding 8.4 percent of 143 dogs in Memphis, Tenn., infected with *Entamoeba histolytica*, using cultural methods. We certainly agree with their observation that cysts of *E. histolytica* are almost never passed and that the trophozoites are passed in small numbers in the feces of dogs.

Shown below are the protozoan infections found by direct smear examinations at the small animal clinic, Alabama Polytechnic Institute, from September 1953 to May 1954. Of 871 dogs examined, 193, or 22 percent, were found to have protozoan infections, although there may have been more than one infection per dog.

	Number	*Percent*
Giardia	75	8.6
Trichomonas	57	6.5
Isospora	44	5.0
Entamoeba histolytica	7	.8
Entamoeba coli	1	.1
Balantidium	9	1.0

Each of the seven dogs infected with *E. histolytica* showed a characteristic profuse diarrhea, continuous or intermittent and often of long duration. In the *E. coli* infection, cysts were being passed, and this dog was concurrently infected with *E. histolytica*. Only a small percentage of the dogs infected with *Giardia* showed symptoms attributable to the organism. It is possible even in these cases that the symptoms are not due solely to the protozoan. There is evidence (*14*) suggesting that a combined *Giardia* (protozoa) and *Pseudomonas* (bacteria) infection may be quite pathogenic in the chinchilla. The intestinal trichomonads are common in the dog, and the incidence figure rises rather markedly when cultural methods are used in diagnosis. Here again the organism appears to be associated occasionally, apparently in some causal relationship, with a severe diarrhea, which may also be of long duration.

Even though occurring in a low percentage of dogs, *Balantidium* infection is much more common than we had earlier suspected. It appears to be pathogenic in the dog in practically every infection. Light infections with the dog coccidia are common, and when animals, especially puppies, acquire heavy infections, marked symptoms and death may result. In Georgia, 2 of 3 recently reported cases of human infection with *Isospora* appeared to be related to an infection in the family dog (*15*).

Although we probably have more information on the distribution of *Dirofilaria immitis*, the dog heartworm, than on almost any other of the parasites of veterinary importance in the southeast, its distribution still has not been well defined. The infection is obviously quite common in many areas where it is not present at disease-producing levels. The presence of adult worms in sufficient numbers to result in clinical infection is evidence of a high transmission potential. On the basis of current information this appears to be common in the southeast only along the seacoast. There are inland areas where the transmission potential is sufficiently high to result in the presence of moderate numbers of adults and even in some instances in clinical infection, as emphasized by Eyles and associates (*16*) in their recent study in the area of Memphis, Tenn. Auburn, Ala., is a good

example of an area with low transmission potential. In a recent limited survey it was found that microfilariae could be demonstrated, using concentration procedures, in approximately 37 percent of the dogs. Our autopsy records of the past 5 years have not been summarized to give the incidence of adult worms, but it certainly is appreciably lower than the 4 percent found in Memphis. The only clinical cases which have come to autopsy in recent years were sent to us from coastal areas where the infection is certainly a major problem.

There are a few reported cases of the giant kidney worm, *Dioctophyma renale*, in the southeastern States (*17*). There appears to be a small enzootic area in southeast Georgia.

We do not know how common canine toxoplasmosis is in the southeast. Serologic tests made elsewhere indicate that inapparent or otherwise undiagnosed cases are quite common, as in other animals. From July 1954 through March 1955 we autopsied 148 dogs, of which 6, 4 percent, were diagnosed as toxoplasmosis, or toxoplasmosis together with distemper. In addition to these cases from autopsy, all of which were from Alabama, we have made a diagnosis during this period of toxoplasmosis from at least one place in Florida, Georgia, South Carolina, Virginia, and Tennessee by the histological examination of tissues sent to us by practicing veterinarians.

The cat lungworm *Aeleurostrongylus abstrusus*, has been reported from Maryland, Virginia, North and South Carolina, Georgia, Tennessee, and Alabama (*18*). In these States although there are few reports of the infection, mostly only 1 or 2, many of these are fatal infections. Probably the infection is much more common than published reports indicate, as suggested by the recent finding of the infection in 6 of 50 cats in a Virginia county.

Information Needed

There are many different aspects of these and other infections that could profitably be discussed. This very incomplete account will be closed by pointing out the general needs with regard to veterinary parasitology in the southeast.

1. More information on the distribution and incidence of parasitic infections to determine more clearly the true nature and extent of the problem.

2. Better use of the information currently available in the control of these parasites.

3. More information on the biology and host-parasite relationships of the many parasites common in the southeast, for only on this foundation can we build truly effective control programs.

REFERENCES

(*1*) Schwartz, B.: Parasitism in relation to the livestock industry of the south. Scient. Monthly, 54: 448–454, May 1942.

(*2*) Andrews, J. S., Sippel, W. L., and Jones, D. G.: Clinical parasitism of cattle in the southeast. Proc. U. S. Livestock Sanit. A.: 228–238 (1954).

(*3*) Cooperrider, D. E.: Losses in cattle due to internal parasitism. North Am. Vet. 35: 350–353, May 1954.

(*4*) Taylor, E. L.: Parasitic bronchitis in cattle. Vet. Rec. 63: 859–867, Dec. 22, 1951.

(*5*) Travis, B. V., Goodwin, M. H., Jr., and Gambrell, E.: Preliminary note on the occurrence of *Leucocytozoon smithi* Laveran and Lucet (1905) in turkeys in the southeastern United States. J. Parasitol. 25: 278, June 1939.

(*6*) West, J. L., and Starr, L. E.: Further observations on a blood protozoan infection in turkeys. Vet. Med. 35: 649–653, November 1940.

(*7*) Stoddard, E. D., Tumlin, J. T., and Cooperrider, D. E.: Recent outbreaks of *Leucocytozoon* infection in adult turkeys in Georgia. J. Am. Vet. M. A. 121: 190–191, September 1952.

(*8*) Bierer, B. W.: Buffalo gnats and *Leucocytozoon* infection of poultry. Vet. Med. 49: 107–110, March 1954.

(*9*) Folse, D. S., and Newberne, J. W.: *Spirocerca lupi* infection in dogs. A four year survey. North Am. Vet. 35: 519–522, July 1954.

(*10*) Seibold, H. R., Bailey, W. S., Hoerlein, B. F., Jordan, E. M., and Schwabe, C. W.: Observations on the possible relation of malignant esophageal tumors and *Spirocerca lupi* lesions in the dog. Am. J. Vet. Res. 16: 5–14, January 1955.

(*11*) Franklin, M. A., and Ward, J. W.: *Echinococcus* infections in Mississippi. A new record of a natural infection in dogs. J. Parasitol. 39: 574, October 1953.

(*12*) Thorson, R. E., and Jordan, E. M.: A pseudophyllidean tapeworm from a dog in the southeastern United States. Proc. Helminthol. Soc. Washington 21: 123–124, July 1954.

(*13*) Eyles, D. E., Jones, F. E., Jumper, J. R., and Drinnon, V. P.: Amebic infections in dogs. J. Parasitol. 40: 163–166, April 1954.
(*14*) Shelton, G. W.: Giardiasis in the chinchilla. II. Incidence of the disease and results of experimental infections. Am. J. Vet. Res. 15: 75–78, January 1954.
(*15*) Routh, C. F., McCroan, J. E., and Hamer, C. G.: Three cases of human infection with *Isospora* in Georgia. Am. J. Trop. Med. & Hyg. 4: 1–8, January 1955.
(*16*) Eyles, D. E., Gibson, C. L., Jones, F. E., and Cunningham, M. E. G.: Prevalence of *Dirofilaria immitis* in Memphis, Tennessee. J. Parasitol. 40: 216–221, April 1954.
(*17*) Ehrenford, F. A., and Snodgrass, T. B.: Incidence of canine dictophymiasis (giant kidney worm infection) with a summary of cases in North America. J. Am. Vet. M. A. 126: 415–417, May 1955.
(*18*) Bailey, W. S., and Lowman, C. B.: Verminous pneumonia. Auburn Vet. 9: 36–38, Fall 1952.