XI. PARASITES OF DOGS AND CATS OF OKLAHOMA

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Dogs and cats are used extensively in our laboratories as subjects for dissection and for various kinds of experimentation. The dog especially serves as an admirable experimental animal because it responds so readily to various kinds of stimuli and treatment. Its responses, in many cases, are so similar to those of human beings that the results of such experimentation can often be utilized in closely allied conditions in man.

As pets, cats and dogs possess admirable qualities that make them very desirable. Much has been said and written concerning the canine as a friend, as a companion, as a hunter, as a guide, and as playmate for children. Nearly as much can be said of the feline in the capacity of a playmate for children and as an object for bestowing and receiving caresses. On the other hand, a great deal can be said against these animals in that they are capable of carrying parasites and spreading diseases to man and his domesticated animals. Ordinarily, and in due respect, these objections are not warranted against the restricted and well cared for dog or cat, but against the vagrant, ownerless, or unrestricted animal that goes about whenever and wherever he chooses. Such should be regarded with suspicion, in fact he should be regarded as a public nuisance, as it is very adequately shown in discussions by Hall (1915, 1917).

Both canines and felines are highly subject to parasitic infestation of various kinds. Whether we have these animals as household pets or for domestic use, or whether we use them for laboratory purposes, cases of parasitic infestation frequently come under our observation and we are desirous of knowing the kind and nature of the parasitism. The object of this paper is to give some idea of the prevalence of parasitism in these animals in Oklahoma. Heretofore, no records have been available in regard to the extent of parasitism or the kinds of parasites infesting our cats and dogs. The writer has autopsied and made parasitic examinations of fifty doygs and thirty cats in Oklahoma. While this is not a large number of parasitological studies it serves to point out, to a degree, the extent and the nature of parasitism prevalent here.

The results of the studies showed 90% of the dogs and 85% of the cats to be infested with worms of one or more species. The vagrant, or ownerless, dog or cat usually harbours more parasites than do the pet house animals. However, this is not always the case, as frequently the reasonably well cared-for animal is as heavily

infested as the street cur. Some of the examinations referred to here were made on subjects used in the laboratory for dissection. The most of these animals, however, were taken at random from the streets. Many of the autopsies were performed on animals sent to the laboratory from various parts of the state as rabies suspects. This class of dogs is fairly cosmopolian as far as caste is concerned.

The symptoms of worm infection, as a rule, are not marked unless the worms are numerous. Then they may be noted from emaciation, anemic and toxic conditions and frequently a diarrhoea, especially when hookworms are present. Segments of tapeworms and eggs can be found upon examination of the feces. Young dogs often have "fits" and may sometimes show slight indications of chorea, especially from hookworm infestation.

External Parasites

The external parasites of our dogs and cats are numerous. It is an unusual occurrence to find a dog, which has been allowed ordinary liberties, to be free from fleas and lice. Cats, as a rule, are not as heavily infested. *Ctenocephalus canis,* the dog flea, and *Ctenocephalus felis,* the cat flea, are closely related, in fact are considered as identical by some writers. These fleas are commonly found on the dogs and cats of this country. It is not uncommon to find these parasitic insects upon man as they are so cosmopolitan in their habitat that they are not limited entirely to one particular host. *Pulex irritans,* the human flea, is commonly found on dogs and cats of Oklahoma. Aside from the irritation and annoyance caused by these parasites, they are also capable of transmitting the dog tapeworm, *Dipylidium caninum* and also in the parts of the world where bubonic plague is prevalent, they may be carriers. We very often find the chicken "sticktight" flea, *Echidnophaga gallinacea,* on the dogs and sometimes on cats of this locality. They are usually found on the underparts of the abdomen not heavily covered with hair.

Oklahoma dogs are commonly infested with the biting louse, *Trichodestes latus,* and occasionlly with the sucking louse, *Linognathus* (*Haematopinus*) *piliferus.* Cats aparently harbour only one species, *Trichodectes subrostratus,* a biting louse.

Frequently cases of mange come under our observation from our canine and feline population. Sarcoptic mange, caused by varieties of *Sarcoptes scabiei,* is the common type in our cats and dogs. Occasionally, among our dogs, we find a subject showing the follicular type which is caused by *Demodex folliculorum canis,*

and auricular mange, produced by *Otedectes cynotis*, is not unknown to both cats and dogs.

Several species of ticks are known to dwell upon the bodies of cats and dogs. The common dog tick, *Dermacentor variabilis* (*electus*), is the species most frequently found upon our canines and, occasionally, on our felines. This species may also attack man. *Ixodes ricinis*, the castor bean tick, and *Ixodes hexagonus*, the European dog tick, are occasionally met with in our domesticated carnivores. *Margaropus annulatus*, the Texas-fever tick, *Ornithodorus megnini*, the ear tick of cattle, and *Amblyomma americanum*, the lone star tick, have been taken from dogs and as these ticks are found upon some of our domesticated animals we might expect to find them at times upon our dogs. We have no record of *Dermacentor venustus*, the spotted-fever tick, from Oklahoma but this parasite has been known to live upon dogs. This tick is perhaps the most dangerous of any that have been mentioned. They often produce a form of paralysis in man and animals and many cases of its occurrence are found in literature. This tick may be found in western Oklahoma as it occurs in Colorado and New Mexico.

Protozoa

The Protozoa of dogs and cats are only slightly known from the United States. *Neuroryctes hydrophobiae*, the name applied to the supposed protozoan organism which is the cause of, or at any rate, associated with rabies, is very common in some localities and we find it much too often in dogs, and occasionally in cats, of Oklahoma. This disease should be and can be prevented by simply muzzling dogs for a sufficient period for it to die out. England has eradicated rabies by muzzling its dogs. Rabies has been practically stamped out of Norway, Sweden, and Denmark by legislative muzzling of dogs.

Hall (1918) reported the occurence of the coccidian, *Diplospora bigemina* in 7.5% of 200 dogs from Michigan. This indicates that the disease may be more common than we anticipate. It is important that medical zoologists consider this problem because this parasite is one of the species that occurs in man. Coccidiosis in man, caused by this species, is relatively common in some parts of the world. This disease has been recorded from both man and dogs in California. No cases have been reported from Oklahoma but it would not be surprising to find it here.

Trypanosoma equiperdum was reported in an imported dog and *T. evansi* has been recorded in a case of experimental infection. These, with the exception of one of two less clearly defined cases,

comprise the list of protozoa from the cats and dogs of this country.

Trematodes

Trematodes are rare in dogs and cats for we have but very few records of their occurrence in the United States. No records of these parasites have been made from Oklahoma dogs. Hall and Wigdor (1918), and Wigdor (1918), reported three species of trematodes from Michigan dogs. One species reported by Ward and Hirsch (1915), a report by Ransom (1920), and one from the cat by Riley (1922), comprise the only other records for this group of parasites from dogs and cats in the United States.

Tapeworms

Of the dogs examined for parasites 84% have been infested with at least one species of tapeworm. The species most commonly found are *Taenia pisiformis* (*serrata*), *Dipylidium caninum* and *Multiceps serialis*, with their frequency in the order named. *Taenia pisiformis* was found in 53% of the dogs harbouring cestodes. 40% harboured *Dipylidium caninum* while *Multiceps serialis* infested 13%. Some of the dogs were parasitized by more than one species of tapeworm. Descriptions of the tapeworms from dogs and cats, with keys for identification, may be found in Hall, 1919.

Taenia pisiformis occurred in numbers of from one to ten in the autopsies performed by the writer. The intermediate stage of this cestode is in the rabbit, usually the cottontail (*Sylvilagus floridanus similies*). *Cysticerus pisiformis*, or larval stage of this tapeworm lives as a rule free in the body cavity or may be attached to the mesentery or liver. This tapeworm has also been reported from the cat. Ackert and Grant (1917:94) infested kittens by feeding *Cysticercus pisiformis*. *Dipylidium caninum* was found in numbers ranging from 2 to 50 in the dogs examined. This cestode is transmitted through fleas and lice. The cat may also be infested with this cestode, although the writer has not met with it in cats in Oklahoma. This species has frequently been reported from man, especially from children. Dr. Ellison, in discussing a paper of the present writer (Guberlet, 1922:193), reported a case from Oklahoma City where seven *Dipylidium caninum* were taken from one child.

Multiceps serialis usually occurs in rather large numbers when an infestation is found. The smallest number found was 30 specimens from one dog while the largest number taken was 355 from a young bull dog. This dog was killed, a suspect of rabies, which was negative. An examination of the alimentary tract revealed

the stomach filled with straw and small stones and the large number of cestodes in the small intestine. The intermediate stage of this tapeworm is also in the rabbit, usually the jack rabbit (*Lepus texianus*). The larval stage, *Coenurus serialis,* is usually found in the connective tissues, muscles and subcutaneous tissues, of the rabbit, often forming prominent tumors beneath the skin.

Other tapeworms undoubtedly occur in Oklahoma dogs but as yet the writer has not met with any in the autopsies that he has performed. However, some intermediate stages of other species have been found. *Cysticercus tenuicollis,* the larval stage of *Taenia hydatigena* (*marginata*), has been found a number of times in the livers and mesenteries of sheep. This larval form may also occur in hogs and cattle. *Taenia hydatigena* is one of the largest of the dog tapeworms and may reach a length of 15 or more feet.

Multiceps multiceps no doubt occurs in our dogs from time to time but up to the present it has not been found here. *Coenurus cerebralis,* the larval stage of this worm and the cause of gid in sheep, is found occasionally in our sheep.

Taenia ovis may occur in our dogs although we have no records of it at the present time. Sheep are often imported from regions of the west where this worm is prevalent. The larval stage, *Cysticercus ovis,* occurs in the muscles of sheep in Colorado, Wyoming, Montana and Idaho. *Echinococcus granulosus* (*Taenia echinococcus*) occurs in our dogs occasionally. The larval stage, or hydatid, occurs in man, cattle, sheep, horses or hogs, in such tissues as the liver, kidney, muscles, brain, or lungs. A large number of cases of hydatid disease in man have been recorded from the United States. In recent years there has been a large increase of hydatid disease among the domestic animals that have been slaughtered at the abattoirs. There has been an alarming increase in this state and the prevalence of this disease in our domestic animals gives us an idea to what extent man is exposed. The fact that it is present in sufficient proof for the suppression of the dog nuisance.

The cats examined for parasites showed a very high percentage (85%) of infestation with tapeworms. The common and only species found in cats that were studied was *Taenia taeniaeformis* (*crassicollis*). The larval stage, *Cysticercus fasciolaris;* is commonly found in rats, mice, and other rodents. Cats may also harbour *Dipylidium caninum* and *Taenia pisiformis* as mentioned above.

Roundworms

Roundworms infesting dogs and cats are primarily of two species, hookworms and ascarids. Sixty-eight per cent of the dogs

examined harboured roundworms. Of these 88% were infested with hookworms, *Ancylostoma caninum*. In other words about 60% of all dogs examined were parasitized with hookworms. The ascarid, *Belascaris marginata*, (*Ascaris marginata*), showed an infestation of 35% with an average of 4 worm per dog. *Toxascaris limbata*, another ascarid from the dog has not been found in Oklahoma. We have records of both of these ascarids being reported from man. The percentage of ascarid infestation in our dogs is rather low compared with the percentage of Hall and Wigdor (1918:739) for Michigan dogs. They found 53% of 300 dogs infested with *Belascaris marginata*, with an average of 25 worms per dog.

Hall and Wigdor (1918:737) report infestation with the whipworm, *Trichuris depressiuscula*, from 39% of 300 Michigan dogs. This worm undoubtedly occurs occasionally in the dogs of Oklahoma but as yet we have not found a single record of its occurrence. *Dirofilaria immitis*, a nematode found in the blood vessels or the heart of dogs, is fairly common in some parts of the couth but at present we have no record of its occurrence in this state. *Spirocera* (*Spiroptera*) *sanguinolenta*, a nematode occurring in nodules or tumors in the oesophagus of dogs, has been reported a number of times from the southern states. We have one record of its occurrence from Stillwater, Oklahoma. *Dioctophyme renale* has not been reported from Oklahoma although it is found occasionally in the kidney and abdominal cavity of dogs of the United States.

Cats in this part of the country seem to have a slightly higher percentage of infestation with roundworms tha ndo our dogs. Of the cats examined 60% also harboured the ascarid, *Belascaris mystax*. Cats are rarely afected with other species of nematodes.

Conclusions

The above does not record by any means the entire list of parasites that have been found in dogs. It merely gives those that have been found, or that might reasonably be expected to be found, in the canines and felines of Oklahoma. It is rather difficult to draw conclusions from such a small number of autopsies, but nevertheless, it does give us some idea of the nature and prevalence of parasitism in these animals.

The foregoing gives us some conception of the necessity for controlling the dog nuisance. The stray, ownerless cur should be destroyed. Owners of dogs should control their activities by not allowing them too much freedom and by supervising their diet so

see that they eat none of the larval stages of the various tapeworms. In this respect it must be stated that the livestock owners should not allow the offal from slaughtered or dead animals to be eaten by dogs, unless cooked. These things must be carried out in the interests of public health as well as for the health of our domestic animals.

In this connection it is advisable to bear in mind that the freedom allowed certain of the dogs and cats should be restricted and at the same time their unwarranted associations and familiarities with their master's family, especially children, should by all means be curtailed. The fact must not be overlooked that dogs and cats are not persons. Consequently, restrictions upon their liberties not only safeguards their welfare in regard to parasitic infestations and infectious diseases, but also protects their master's families and indirectly safeguards the health of the public as well as that of the domestic animals.

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XII. EXPERIMENTS ON EGG PRODUCTION IN BRUCHUS

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The following observations of *Bruchus quadramaculatus* were made at the University of Oklahoma betwene June 1 and August 1, 1922. The work was preliminary to a study of the embryology of the weevil and was primarily concerned in determining the optimum temperature at which the weevils deposit their eggs. The humidity in each experiment was kept at as near a point of saturation as it was possible to do so. The weevils used were from the stock of Dr. J. K. Breitenbecher.

In the first test twelve females were mated and placed into test tubes with cowpeas. They were kept at a temperature of 37° C. saturated humidity. This test lasted over a period of five days. The number of eggs layed by the weevils ranged from 0 to 87. Thirty-eight was the average. Twenty-nine was the largest number of eggs produced by a female in a twenty-four hour period. This occurred twice by the female which laid the 87 eggs. On the fourth day of the test five of the females had died. On the following day all of the remainder were dead.

The day after this experiment was started, eight other pair were mated in the same way. Here the average number of eggs laid was 39, although three pair failed to produce any eggs. Ninety-seven was the largest number laid by a female.

An observation was made at this time on the distribution of the eggs over the peas in the bottle. In most cases there was but one egg on a pea. This also is true of the first lot. Only in two or three cases were there more than two eggs on a pea, while most frequently where less than twenty eggs were laid in one day they were distributed so that there was seldom more than on egg on a pea.

On June 19 twenty-five matings were made and run at the same temperature. This was stock that had been in-bred for several generations. Here the largest number produced by any female for the entire time was 22. Seven had laid only one egg during the entire period. These were active vigorous weevils. Part of them