

BIBLIOGRAPHY

1. Bateman, Bryant A., Dr. 1958. Personal Communication.
2. Clark, Harry. 1958. Personal Communication.
3. Dahlberg, Burton L. and Ralph C. Guettinger. 1956. The White-Tailed Deer in Wisconsin. Wisconsin Conservation Department. Pp. 88-89.
4. Greer, William E., D.V.M., Emmett B. Shotts and Frank A. Hayes, D.V.M. 1957. A Preliminary Report from the Southeastern Cooperative Deer Disease Study. Proceedings of the Eleventh Annual Conference, Southeastern Association of Game and Fish Commissioners. Pp. 45-49.
5. James, C. D. 1958. County Agent, Tensas Parish. Personal Communication.
6. Leopold, Aldo. 1947. Game Management. Charles Scribner's Sons, New York, N. Y. P. 106.
7. McDonald, Mac. 1958. County Agent. Madison Parish. Personal Communication.
8. McDonald, E. R. 1957. Chairman Louisiana Wildlife and Fisheries Commission. Report on Calling off Antlerless Deer Season in Tensas Parish.
9. Perkins, Carroll J. 1958. Outsider.

LIVER FLUKES IN THE SOUTHEASTERN WHITE-TAILED DEER

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Within the past decade, the importance of wild animals as reservoirs and vectors of disease has received considerable emphasis. Although many infectious conditions of man and domestic animals maintain reservoirs in wild animals, a thorough understanding of the various factors responsible for many of these relationships has not been attained. Additional knowledge of the epidemiology of such diseases will offer newer concepts in the development of public health principles, livestock disease control procedures and game management programs. Since so many wildlife conservation efforts are now dependent on the cooperation of livestock producers, it is becoming increasingly essential that game management specialists take every precaution to prevent the spread of disease from wild animals to domestic livestock.

This discussion involves a group of parasites which are of considerable economic importance to the livestock industry. The subject matter has been derived primarily from a review of the literature and has been compiled to possibly assist southeastern game management officials in the development of a program to control the spread of liver flukes.

The liver flukes which reportedly infect deer in the United States are the lancet fluke (*Dicrocoelium dentriticum*), the common liver fluke (*Fasciola hepatica*) and the large American liver fluke (*Fascioloides magna*).⁸ Although *D. dentriticum* is relatively common in European deer, the present incidence of infection in this country is confined to the northeastern section and is of little significance in deer.⁸ *F. hepatica* is a serious problem among domestic livestock in the Southeast, however, it is apparently rare in deer.⁸ *F. magna*, the most important trematode of deer in the southeastern United States, is the helminth considered in this discussion.

F. magna was first described in 1875 by Bassi from deer in Italy. Presence of the parasite in Italy was attributed to the importation of infected American

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elk. Except for limited distribution in Italy and Germany, this fluke apparently is indigenous only to North America.

REPORTED DISTRIBUTION OF THE LARGE AMERICAN FLUKE IN THE SOUTHEAST

Fascioloides magna is known to be present in at least seven of the southeastern states. From personal communication with game management officials of several states, it has been determined that deer are infected in restricted areas of Alabama, Florida, Louisiana, Mississippi, South Carolina and Tennessee.⁵ Although the parasite infects cattle in Arkansas, game management personnel contacted have no records of its being in deer.⁵ Infections in domestic livestock from a given area indicate either that fluke infected deer are present or that infected livestock have been shipped into the area. Since the definitive and intermediate hosts for *F. magna* are present throughout the Southeast, a true picture of the actual geographical distribution of the parasite probably has not been determined.

LIFE CYCLE

An intelligent approach to any parasite problem requires a practical understanding of the life cycle. The life history of *Fascioloides magna* involves not only definitive and intermediate hosts, but also proper environmental relationships between these hosts making possible the transfer of the parasite. Wild or domestic ruminants serve as definitive hosts for the large American liver fluke. In North America, six species of aquatic snails have been incriminated as suitable intermediate hosts.⁹ The adult parasite resides in the liver tissue of its definitive host where it produces ova which are emptied into the intestinal tract via the bile ducts and eliminated in the feces. Shallow, aerated water favors development and hatching of the eggs. Hatching occurs 30 to 35 days after the ova are passed in the feces and free-living, motile miracidia are released. These are actively motile for a period of 12 to 24 hours, during which time they must locate and penetrate a suitable intermediate host. The phase of development within the snail requires 7 to 8 weeks. After intramolluscan development is complete, intermediate forms of the parasite called cercariae are liberated. These cercariae encyst on firm vegetation in and around water to form metacercariae. Only through the ingestion of metacercariae can a definitive host become infected. In the host the metacercariae excyst and penetrate the intestinal wall. The immature fluke migrates through the abdominal cavity, pierces the capsule of the liver and continues its migration in the hepatic tissue. Completion of the life cycle depends upon the response of the liver to the parasite.

DIFFERENCES IN THE HEPATIC TISSUE RESPONSE IN VARIOUS HOSTS

Among the various ruminants which serve as definitive hosts for *F. magna*, three distinct types of host-parasite relationships have been observed and studied.¹¹

In cattle, the liver migration is quickly arrested by the proliferation of fibrous tissue and the formation of a thick-walled capsule around the immature parasite. Liver damage is thereby minimized. In most cases the thick cyst wall completely encloses the parasite and ova are not allowed to escape from the cyst. The potentials of the fluke to perpetuate itself are obviously disrupted.

In sheep, migration of the young parasite through the liver tissue is usually continuous and unrestricted. Occasionally a migrating fluke may become encysted within a very thin layer of fibrous tissue. The cyst may not occlude intersected bile ducts thus allowing ova to escape into the intestinal tract. Due to the extensive liver migration in sheep, several flukes may rapidly encroach upon the hepatic reserve. Most sheep apparently succumb to liver destruction before the fluke reaches sexual maturity.

In deer and other Cervidae, a different situation exists. The young flukes migrate freely through the hepatic tissue but become encysted in the paren-

chyma before excessive liver damage occurs. The cysts are thin-walled, fibrous cavities within which the parasites reach sexual maturity. Such intersected bile ducts are not occluded as a result of the encapsulation process, ova are allowed to escape into the intestinal tract. Apparently deer suffer an adverse effect only when very heavily parasitized.

ROLE OF DEER IN THE TRANSMISSION OF THE FLUKE

When fluke infected deer are introduced into noninfested areas where they can share pastures and snail infested water with cattle and sheep, the domestic ruminants will most probably become infected. Undoubtedly some of the inter-state and intra-state deer restocking programs have been responsible for the introduction of *F. magna* into some of the regions where it now exists. The best example on record of the role played by Cervidae in the transmission of *F. magna* is the presence of that fluke in parts of Italy and Germany as a result of the importation of infected American wapiti.

CONTROL

Several methods have been suggested to control the spread of *Fascioloides magna*. These methods involve the exclusion of all deer from areas where domestic ruminants are pastured, the use of cooper sulfate to destroy intermediate hosts or repeated fecal examinations during a prolonged period of quarantine preceding the movement of deer to new ranges. Although they are effective, most of these procedures are not suitable for practical application. Control programs should be based on an understanding of the ecological factors which influence the life cycle of *F. magna* and should vary with local conditions.

Total eradication of the large American liver fluke is not feasible; however, the spread of fascioloidiasis can be controlled. This can be accomplished by locating areas of infestation and restricting the movement of live deer from such regions. Prior to the removal of animals from an area for restocking purposes, the status of the large American fluke can be determined by the examination of livers taken during a hunting season from a representative number of deer.

Sheep production in the Southeast is a relatively new and growing industry, and the beef cattle industry is well established. Due to the potential pathogenicity of *F. magna* for sheep and the fact that livers of infected cattle are condemned at slaughter, every precaution should be taken to prevent transfer of the parasite from deer to domestic ruminants.

SUMMARY

This discussion has been presented to explain some of the environmental conditions which influence the transmission of *Fascioloides magna* and to possibly assist in the establishment of a program to control the spread of liver flukes by deer.

BIBLIOGRAPHY

1. Bailey, W. S.: Veterinary Parasite Problems in the Southeastern States. Publ. Health Repts., 70 (1955): 976-982.
2. Campbell, W. C.: *Fascioloides magna* (Trematoda) with Special Reference to the Adult in Relation to Disease. Dissertation Abst., 17, (1957): 2092.
3. Chandler, A. C.: Introduction to Parasitology with Special Reference to the Parasites of Man. 9th ed., John Wiley and Sons, Inc., New York, 1955.
4. Dinaburg, A. G.: Helminth Parasites Collected from Deer (*Odocoileus virginianus*) in Florida. Proc. Helminth Soc. of Wash., 6, (1939): 102-104.
5. Gerard, W. T.: Personal Communication, 1958.

6. Hall, M. C.: Our Present Knowledge of the Distribution and Importance of Some Parasitic Diseases of Sheep and Cattle in the United States. 27th Ann. Rep. BAI, USDA, (1910): 419-463.
7. Morgan, B. B. and Hawkins, P. A.: Veterinary Helminthology. Burgess Publishing Co., Minneapolis, 1949.
8. Price, E. W.: The Fluke Situation in American Ruminants. Jour. Parasit., 39, (1953): 119-134.
9. Price, E. W.: Liver Flukes of Cattle and Sheep. The Yearbk. of Agri., (1956): 148-153.
10. Stiles, C. W.: The Anatomy of the Large American Fluke (*Fascioloides magna*). Jour. Comp. and Vet. Arch., 15, (1894): 161-168; 225-243; 229-313; 407-417; 457-462. (As cited in reference No. 8, above.)
11. Swales, W. E.: The Life Cycle of *Fascioloides magna* (Bassi, 1875), the Large Liver Fluke of Ruminants, in Canada, with Observations on the Bionomics of the Larval Stages and the Intermediate Hosts, Pathology of *Fascioloides magna* and Control Measures. Canadian Jour. Res., 12 (1935): 177-215.
12. Swales, W. E.: Researches on the Liver Fluke in Deer. Trans. Amer. Game Conf., 21, (1935): 406-411.
13. Swales, W. E.: Further studies on *Fascioloides magna* (Bassi, 1875) Ward, 1917 as a Parasite of Ruminants. Canadian Jour. Res., Sect. D.—Zool. Sci., 14, (1936): 83-95.

FARM GAME SESSION

HISTORY OF THE IMPORTED FIRE ANT IN THE SOUTHEAST

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There are two species of native fire ants—(*Solonopsis geminata* Fabricius) and (*Solonopsis xyloni* Mac Cook)—in the Southeast which so closely resemble the Argentine fire ant (*Solonopsis saevissima richteri* Forel) that not until several years after the South American ant's introduction was it recognized as a newcomer. Even today most entomologists cannot identify the imported fire ant in the field.

There has been some confusion as to the date of first introduction of the Argentine fire ant in the Southeast, but the best information available indicates that it appeared in the Port of Mobile, Alabama, sometime around 1918. Dr. H. P. Loding, an amateur entomologist, was the first to recognize the species. Dr. Loding reported his findings to Dr. William S. Creighton of Harvard University, who was able to collect the ant in 1928. At that time it was confined to a relatively small area in the northwest section of the City of Mobile.

By 1930 this insect had spread inland several miles along the Mobile Bay area to the Gulf Coast in Mobile County and adjoining Baldwin County. By 1935 the infestation had expanded to cover the entire south half of Mobile County, reaching almost to the Mississippi line, and the southwest one-third of Baldwin County. A rapid movement followed and by 1940 all of Mobile and Baldwin Counties were affected along with the southern tips of Washington, Escambia, and Clarke Counties in Alabama, the western one-third of Escambia County, Florida, and the eastern one-third of George and Jackson Counties in Mississippi.

A report by E. O. Wilson and J. H. Eads to the Director of the Alabama Conservation Department in 1949 revealed that the imported fire ant was present in all or part of 10 Alabama, 3 Mississippi and 2 Florida Counties.

In 1958 the Plant Pest Control Division of the U. S. Department of Agriculture listed as infested with imported fire ants 52 counties in Alabama, 45