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Source: Journal of Wildlife Diseases, 10(4) : 436-441

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-10.4.436

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PARASITES OF FERAL PIG X EUROPEAN WILD BOAR HYBRIDS IN SOUTHERN TEXAS*

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Abstract: Ten feral pig (*Sus scrofa domesticus*) X European wild boar (*Sus scrofa cristatus*) hybrids collected from Aransas National Wildlife Refuge harbored the following internal parasites; *Gongylonema pulchrum, Ascaris suum, Globocephalus urosubulatus, Stephanurus dentatus, Sarcocystis* sp. and three species of *Metastrongylus*. External parasites consisted of the following three Ixodid tick species; *Amblyomma cajennense, Amblyomma maculatum,* and *Ixodes scapularis.* Extensive inflammation, fibrosis and accumulations of necrotic debris characterized the lesions in the liver and perirenal tissues containing somatic larvae and adult *Stephanurus dentatus.* Two young piglets recently captured at the Aransas Refuge harbored *Strongyloides ransomi.*

INTRODUCTION

A population of feral hogs (*Sus scrofa domesticus*) occupied the area now known as the Aransas National Wildlife Refuge beginning in the late 1800's. In 1930, 11 European wild boar (*Sus scrofa cristatus*) were introduced to this area and crossbred well with the feral hogs. Today, these feral hog X European wild boar hybrids, referred to in this report as wild pigs or wild hogs, are a well established member of the fauna of the Aransas Refuge and adjacent properties. Refuge personnel and other biologists performing an ecological study of the wild hogs estimate their annual population to fluctuate between 300 and 500 animals depending on the intensity of trapping and hunting by refuge personnel. This gives an average density of approximately one animal per 56 hectares. Other wildlife on the refuge which compete with these wild hogs for either space or food include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), javelina (*Tayassu tajacu*), and wild turkey (*Meleagris gallapavo*).[8,9]

The Aransas National Wildlife Refuge is situated on the central Texas coast and is well known by the public as the winter home of the whooping crane (*Crus americana*). This 21,600 hectare refuge consists of a low sandy peninsula covered mainly with live oak (*Quercus virginiana*), black-jack oak (*Quercus marilandica*), red bay (*Persea borbonia*) and numerous coastal grasses. A recent food habits study on the refuge revealed that acorns, grapes, spike-rush, bull-rush, cat-tails and mushrooms constitute the major vegetative portion of the wild hog's diet.[13] Common fauna ingested by the hogs include earthworms (*Lumbricoides* spp.), bugs (Hemiptera), larvae of beetles (Coleoptera), dragonflies (Odonata) and flies (Diptera), plus leeches (Hirudinea), rodents and carrion. Due to habits of feeding in moist areas and repeated rooting, these wild hogs frequently expose themselves to the developmental stages of helminth parasites having indirect life cycles.

* Contribution #162 Welder Wildlife Research Foundation, and the Department of Veterinary Parasitology, Texas Agricultural Experiment Station, Texas A&M University.

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MATERIALS AND METHODS

Ten wild pigs were collected from the Aransas National Wildlife Refuge between the months of October 1973 and February 1974. Pertinent data on physical characteristics is recorded in Table 1. Necropsies were performed within 3 hours of collection. External parasites present and skin samples were preserved in 70% ethanol. Internal organs except nervous tissue were examined grossly and then were incised for closer examination. Samples of diaphragm and masseter muscles were pressed between glass slides and examined microscopically for *Trichinella spiralis* larvae. Fifty gram muscle samples collected from five of the hogs were examined for *Trichinella* by digesting the tissues overnight in a pepsin-hydrochloric acid solution followed by the Baermann technique for recovery of larvae. Small samples of cardiac and skeletal muscle from five pigs were preserved in 10% formalin for histopathological examination. These samples were embedded in paraffin, cut at 10 μ thickness and stained with hematoxylin and eosin.

The stomach and its contents were examined for parasites and then preserved for a separate dietary study. The entire incised intestinal tract was examined for parasitic lesions and helminths. Fecal flotations using a saturated sodium chloride solution were performed to screen for coccidia oocysts and helminth ova. Nematodes preserved in 10% formalin were later cleared in lactophenol for identification.

RESULTS AND DISCUSSION

The following species of ticks were recovered from the ten pigs; *Amblyomma cajennense, Amblyomma maculatum* and *Ixodes scapularis.* Tick infestations at this time of the year were light (0-26) in the ten wild pigs. Four wild pigs examined from the Aransas Refuge during

TABLE 1. Physical Characteristics of Wild Pigs From the Aransas National Wildlife Refuge, Texas.

Animal Number	Date Collected	Sex	Age*	Carcass Weight (lbs)	Body Condition**
1	11-3-73	M	4 yrs.	205	Excellent
2	12-1-73	M	15 mos.	130	Excellent
3	12-1-73	F***	2 yrs.	120	Good
4	12-1-73	M	6 mos.	50	Excellent
5	12-1-73	M	9 mos.	60	Good
6	2-1-74	M	16 mos.	110	Excellent
7	2-1-74	M	10 mos.	40	Good
8	2-2-74	F	1 yr.	90	Excellent
9	2-2-74	M	2 yrs.	175	Excellent
10	2-2-74	M	4 yrs.	155	Poor****

* Ages of pigs under two years based on tooth eruption. Pigs over two years were aged via staining cementum layers of incisor III. [2,6]

** Based on external appearance and deposition of body fat.

*** Pregnant. The uterus contained four fetuses with crown-rump length of 5 cm.

**** Old, unhealed bullet wound through snout.

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the previous summer were heavily infested with an average of 425 adult ticks per animal including, in addition to the above three species, *Dermacentor variabilis*.[13] Mites and lice were not found during necropsy nor by stereoscopic examination of preserved skin specimens.

The internal parasites recovered from the ten pigs are recorded in Table 2. *Gongylonema pulchrum* was recovered with greater frequency from the taste buds and crypts of the tongue than from the esophagus. Three species of lungworms, *Metastrongylus apri, M. salmi,* and *M. pudendotectus* were recovered from seven of the ten pigs examined. Ages of infected wild pigs ranged from 6 months to 4 years of age. All three *Metastrongylus* species have not been described together in previous surveys of feral hogs and wild boar in various regions of the United States. Mel'Nikova[5] found the same three species of lungworms however, in pure strain wild boar from Tadzhikistan, USSR.

The lung lesions of *Stephanurus dentatus* larvae and adults consisted of encapsulated areas containing caseous material. Aberrant larval migrations to the lungs with subsequent maturation and pulmonary migration of skin penetrating larvae are a fairly common occurrence with *Stephanurus* infections in domestic swine.[4,11]

The livers in all ten pigs examined had areas of necrosis, suppurative inflammation, abscessation and fibrosis with subsequent localized bacterial proliferation characteristic of hepatic migration of *S. dentatus* larvae. The most extensive lesions involved *S. dentatus* adults and larvae in the perirenal tissues, kidney pelvises and ureters of nine of the ten pigs. A 9 month old boar, whose kidneys were unaffected did have a prepatent infection with *S. dentatus* in the liver. Extensive areas of greyish discoloration which were histologically composed of inflammatory cells, necrotic debris and fibrous tracts containing adult kidney worms typified

TABLE 2. Internal Parasites of Wild Pigs From the Aransas National Wildlife Refuge, Texas.

Parasite	Locations Found	Animals/Animals Positive/Examined
Gongylonema pulchrum	Tongue	6/9
	Esophagus	1/10
Physocephalus sexalatus	Stomach	1/10
Ascaris suum	Sm. Intestine	5/10
Globocephalus urosubulatus	Sm. Intestine	9/10
Stephanurus dentatus	Liver (L)*	10/10
	Lungs (L+A)	5/10
	Kidney Pelvises and Perirenal Tissues (A)	9/10
*Metastrongylus spp***	Lungs	7/10
Sarcocytis sp.	Cardiac and Skeletal Muscle	3/5

*(L) = larvae
(A) = adults

** *Metastrongylus apri, M. salmi* and *M. pudendotectus* were recovered.

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with lesions in the kidney pelvises, ureters and perirenal tissues. *Stephanurus* larvae and adults were found in many aberrant locations including the lungs, parietal peritoneum, psoas muscles and on the surfaces of the bladder and prostate. Although patency of these fibrous tracts with the ureters could be demonstrated grossly, flotations were performed on urine samples taken from the bladders of four of the animals to confirm the presence of *Stephanurus* eggs. Several workers have previously noted the high prevalence of *S. dentatus* in feral swine and wild boar from various southern states and have described similar lesions.[1,4,5]

The swine hookworm *Globocephalus urosubulatus* was present in nine of the ten wild hogs examined. Only a few adults were attached to the small intestine and were causing no apparent injury. A low prevalence of this hookworm (4%) was found in 49 feral swine from Georgia[1] but no hookworms were found during a survey of 205 wild hogs in Tennessee.[5] A transcolostral transmission of *Globocephalus* is suspected which would perpetuate the existence of this hookworm in heavily infected wild hog populations.[7]

Small numbers of the roundworm *Ascaris suum* ranging from one to three adults per pig were found in five of the ten pigs examined. Infection rates of *A. suum* previously described in hogs or wild boar by Hanson and Karstad[4] in Georgia and South Carolina, by Babero et al.[1] in Georgia and by Henry and Conley[5] in Tennessee were 5 of 32 (15.5%), 12 of 49 (24.5%) and one of four (25%), respectively. Babero et al.[1] were the only workers to comment on numbers of ascarids per infected animal. They described one to six roundworms per animal which agrees with the low level of infection of the Aransas wild pigs. Hanson and Karstad[4] stated that, "The most important factor determining the degree of ascarid infestation in swine appears to be contamination of pastures with viable ascarid ova. Where swine have free range and populations are not high, the opportunities for accidental ingestion of infective ascarid ova is greatly reduced." Mel'Nikova[8] found this same trend when comparing the incidence of *A. suum* in feral hogs with that of domesticated swine in the Tadzhikistan region of Russia. He also concluded that differences in living conditions and nutrition between these two groups of swine accounted for this and other parasite disparities.

Parasites were absent from the large intestines and caeca. Numerous nodules 3-6 mm in diameter were suggestive of *Oesophagostomum* larval nodules but on histopathological examination they proved to be normal aggregations of lymphoid tissue.

Fresh muscle samples examined microscopically for encysted *Trichinella spiralis* larvae were negative in all ten cases. Artificial digestion studies of muscle samples for *Trichinella* larvae were also negative. During a dietary study of wild pigs from Aransas National Wildlife Refuge, Springer[13] examined muscle tissue microscopically from 19 additional hogs for trichinellosis and found all to be negative. A low prevalence of *Trichinella* in American wild hog populations seems to be the rule.[1,4] Mel-Nikova[8] described small natural "nidus areas" of trichinellosis that cycled in the wild boar and carnivore populations of the Vakhsh Mountains of the USSR but comparable situations seem to be uncommon in the United States.

Three of five samples of cardiac and skeletal muscle examined histologically were positive for *Sarcocystis*. Hanson and Karstad[4] found this protozoan in the muscles of every feral pig that they examined. Due to the limited size and number of muscle specimens examined from the Aransas wild hogs, the true prevalence of *Sarcocystis* may actually be higher than reported here.

During a food habits study of the Aransas wild hog population in the spring and summer of 1973, Springer[13] also recorded the incidence of lungworms and kidney worms. He observed a 100% infection rate with adult *Stephanurus* in 21 additional wild hogs which ranged in age from 6 months to 7 years. Of 15 additional animals examined for lungworms, 11 (73%) were infected.

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In July 1973, two wild pigs shot from the same herd had coccidiosis, with typical plaques in the intestine and oocysts in the feces. These have been the only confirmed cases of coccidiosis in over 30 wild pigs examined for this parasite.

In March 1974, a pair of 2 week old wild hog piglets were captured at the Aransas Refuge and are now being raised in a concrete pen.[10] Fecal samples from these piglets were noted to contain larvated eggs and were incubated for 48 hours after which rhabditiform larvae of *Strongyloides ransomi* were recovered in great numbers. Since these represent the only piglets studied from the Aransas Wildlife Refuge, the prevalence of *Strongyloides* in wild hog piglets is not known. The transplacental route of infection is the most common in domestic piglets although skin penetration and ingestion of soil contaminated with infective larvae are also proven routes.[7,12] Considering the extremely young age at the time of infection and the absence of skin lesions a transplacental infection of these two piglets seems most probable. Babero et al.[1] described *Strongyloides* in 10% of 49 feral swine and commented on the difficulty of demonstrating adults due to their habit of burrowing deeply into the intestinal mucosa. The ease with which *Strongyloides* larvae can be recovered after incubation and Baermannization of fresh feces suggests that this technique can be used in conjunction with direct examination for adults to improve accuracy of future swine parasite surveys.

Most of the prevalent helminth parasites in the wild hogs from Aransas National Wildlife Refuge, including *Stephanurus, Metastrongylus* and *Gonglyonema,* may have earthworms, beetles, bugs and numerous larvae as intermediate or paratenic hosts.[7,12,14] These invertebrates are common dietary items of wild hogs and provide protection for the developmental stages of these helminth parasites while also serving as a convenient mode of transmission from hog to hog via their ingestion. Since *Ascaris suum* rarely utilizes paratenic hosts, geographical dilution and environmental damage of ova serve as important limiting factors to the prevalence of this and other swine parasites with predominantly direct life cycles.

Acknowledgements

The authors acknowledge the personnel of the Aransas National Wildlife Refuge for their cooperation in this study and Dr. M. J. Reardon for his examination and comments of the tissue sections submitted to him .The authors also thank Drs. B. W. Cain, R. M. Robinson, R. R. Bell and J. P. Smith for their review and comments on the manuscript.

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Received for publication 27 May 1974

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