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Parasites and Condition of Coexisting Populations of White-tailed and Exotic Deer in South-central Texas

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ABSTRACT: We examined the parasites and physical condition of coexisting white-tailed deer (*Odocoileus virginianus*), axis deer (*Axis axis*), fallow deer (*Dama dama*), and sika deer (*Cervus nippon*) on the YO Ranch (Kerr County, Texas, USA) during December 1982 to January 1984. White-tailed deer harbored 12 species of parasites. Exotic deer were infected with nine species of parasites. All parasites recovered from exotic deer and white-tailed deer have been reported from white-tailed deer. Exotic deer had higher condition ratings than white-tailed deer.

Key words: exotics, deer, condition, parasites, survey, Texas.

Axis, fallow, and sika deer were introduced in south-central Texas in the 1930's. Exotic game populations have increased from 13 species totaling 13,000 animals in 1963 (Harmel, 1980) to 67 species exceeding 164,000 animals by 1988 (Traweek, 1989). Axis, fallow, and sika deer are the most widespread and numerous exotic deer in Texas. Native and exotic game and domestic livestock often occur at densities which are conducive to intraspecific and interspecific transmission of disease (Davis et al., 1984). Little is known regarding parasitic disease interactions among white-tailed, axis, fallow, and sika deer in Texas. Our objective was to survey the parasite fauna and condition of coexisting white-tailed, axis, fallow, and sika deer in south-central Texas.

Data were collected from December 1982 to January 1984 on the YO Ranch (Kerr County, Texas, USA). The 22,000-ha ranch is located in the semiarid Edwards Plateau Region about 125 km northwest of San Antonio, Texas (30°11'N, 99°24'W). The ranch is surrounded by 2.3-m net wire fence and is managed for domestic sheep, goats, cattle, and horses as well as native and exotic wildlife. Habitat was described by Waid (1983) and Bryant et al. (1983).

The ranch was stocked with 26 species of exotic ungulates. Axis deer, fallow deer, sika deer, feral swine, blackbuck antelope (*Antelope cervicarpa*), aoudad sheep (*Ammotragus lervia*), mouflon sheep (*Ovis musimon*) were free ranging and the most numerous. The ranch had an estimated population of 1 wild ungulate per 5 ha in 1983 (Richardson, 1986). White-tailed deer were the most numerous, accounting for 65% of the wild ungulate population. Axis, fallow, and sika deer collectively made up 17%, and the remaining species combined totaled 18%. About 5% of the male white-tailed and male exotic deer were harvested annually. Female white-tailed and female exotic deer were essentially unharvested. The ranch also was stocked with about 3,000 domestic sheep, 1,000 domestic goats, 800 cattle, and 50 horses. Livestock were shifted among pastures according to forage availability, but no formal grazing system was used.

Twenty-eight white-tailed deer, 30 axis deer, 19 fallow deer, and 16 sika deer were examined from December 1982 to January 1984 (Table 1). Ages of deer were determined by tooth replacement and wear (Severinghaus, 1949; Graf and Nichols, 1966; Chaplin and White, 1969; Duff, 1969). Physical condition was rated 1 (poor), 2 (fair), 3 (good), or 4 (excellent) based on endogenous fat deposits (Stockle et al., 1978). External lesions were noted during removal of representative ectoparasite and viscera within 3 hr of death. Vis-

TABLE 1. Date of collection and sex of deer examined on the YO Ranch, Kerr County, Texas, 1982 to 1984.

	Species							
	White-tailed deer		Axis deer		Fallow deer		Sika deer	
Date	M[a]	F[a]	M	F	M	F	M	F
12-82	4	—	—	1	1	5	—	4
10-83	—	—	6	—	5	—	—	—
11-83	13	—	3	7	4	—	—	—
12-83	4	—	5	2	2	—	3	—
01-84	—	7	—	6	2	—	3	6
Totals	21	7	14	16	14	5	6	10

[a] M, male; F, female.

cera were refrigerated and examined within 24 hr or were frozen for later examination. The lungs/trachea, heart, liver, kidneys, esophagus/reticulum/rumen, abomasum/omasum, and small intestines/large intestines/cecum were examined using the methods of Nettles (1981) and included (1) examination of feces by the Baermann technique (Georgi, 1974), (2) abomasal parasite counts (Eve and Kellogg, 1977), and (3) intestinal parasite counts (Demarais, 1979). Voucher specimens have been deposited in the U.S. National Parasite Collection (Beltsville, Maryland 20705, USA; under Accession numbers 79348 to 79352). Categorical data analysis using the MGLH module of SYSTAT (Wilkinson, 1988) was used to analyze the condition ratings of deer. The Bonferoni test was used for multiple contrasts.

White-tailed and fallow deer were all adults (>2 yr). Two axis deer were subadults (1 to 2 yr) and 27 were adults. Sika deer included three fawns (<1 yr) and 13 adults.

White-tailed deer and exotic deer had low parasite intensities. White-tailed deer harbored 12 species of parasites, axis deer 6 species, and fallow and sika deer five species each (Table 2). Lung worm larvae were not found in feces. All parasites recovered from exotic and white-tailed deer have been reported from white-tailed deer (Kingston, 1981; Prestwood and Pursglove, 1981; Strickland et al., 1981). The parasites recovered from axis and fallow deer have been reported commonly from white-tailed deer in the southeastern United States (Prestwood and Pursglove, 1981; Strickland et al., 1981). Sika deer also had parasite fauna typical of white-tailed deer except for the louse *Haematopinus suis*. This parasite is found infrequently on white-tailed deer and is associated more commonly with wild swine (Strickland et al., 1981).

Skin lesions attributable to parasitism were observed in white-tailed and exotic deer. All four species had mild focal cutaneous inflammation associated with tick bites. Two sika deer had lesions often associated with elaeophorosis (Adcock, 1967; Hibler and Prestwood, 1981). Necropsy procedures did not allow recovery of this parasite. Lesions observed included facial dermatitis, necrosis of the ears and forehead, antler deformities, and opaque corneas. *Elaeophora schneideri* has been reported in sika deer from this region of Texas (Wiley, 1983; Robinson et al., 1978) and in white-tailed deer from the YO ranch (Waid et al., 1984).

The mean condition ratings of axis, sika and fallow deer were higher than white-tailed deer ($P < 0.05$) (Table 3). The physical condition of white-tailed deer suggested the population was experiencing nutritional deprivation (Eve, 1981; Harmel and Litton, 1981). While exotic deer appeared to be in better condition than white-tailed deer, inferences concerning

TABLE 2. Parasites collected from white-tailed, axis, fallow, and sika deer from the YO Ranch, Kerr County, Texas, 1982 to 1984.[a]

Parasite	White-tailed deer	Axis deer	Fallow deer	Sika deer
Nematodes	$n = 28$	$n = 30$	$n = 19$	$n = 16$
Haemonchus contortus	54, 144, 540	3, 20, 20	16, 33, 60	0, –, –
Ostertagia dikmansi	11, 231, 360	0, –, –	0, –, –	0, –, –
Ostertagia spp.	4, 60, 60	0, –, –	0, –, –	0, –, –
Oesophagostomum venulosum	18, 57, 110	10, 41, 128	11, 16, 16	6, 16, 16
Trichuris spp.	4, 60, 60	0, –, –	0, –, –	0, –, –
Arthropods	$n = 24$	$n = 30$	$n = 13$	$n = 12$
Amblyomma americanum	29, L, L[b]	33, L, L	38, L, M	50, L, M
Dermacentor albipictus	4, L, L	7, L, L	38, L, M	0, –, –
Ixodes scapularis	4, L, L	3, L, L	8, L, L	0, –, –
Lipoptena mazamae	67, L, L	37, L, L	0, –, –	33, L, L
Solenoptes binipilous	13, L, M	0, –, –	0, –, –	0, –, –
Tricholiperus parallelus	8, L, L	0, –, –	0, –, –	0, –, –
Haematopinus suis	0, –, –	0, –, –	0, –, –	6, L, L

[a] Numbers in columns are prevalence, intensity, and maximum intensity.
[b] Actual counts not made; intensities rated as low (L), and moderate (M).

the nutritional status of exotic deer and interspecific comparison of health status are difficult because of a lack of baseline data for exotic deer. Axis and sika deer have maintained their health status in situations that were nutritionally deficient to white-tailed deer (Harmel, 1979; Armstrong and Harmel, 1981). Under high stocking rates, livestock and exotics compete heavily with white-tailed deer for foods, and preferred white-tailed deer foods may be eliminated (Cook, 1984). Exotic deer are less specialized in their food requirements, giving them a competitive advantage over white-tailed deer (Harmel, 1979; Armstrong and Harmel, 1981).

Studies by Davidson and Crow (1983) and Davidson et al. (1985) suggested that in addition to foraging advantages that exotic deer possess, that differing susceptibilities to parasitic disease might enhance the competitive advantage that exotic deer have over white-tailed deer. Because of the relatively low parasite intensities for all deer species in this study, parasitic disease did not appear to be a major factor in their interspecific relationships.

TABLE 3. Condition ratings of white-tailed, axis, fallow, and sika deer from the YO Ranch, Kerr County, Texas.

Species	n	Condition rating $\bar{x}$	Condition rating SE
White-tailed deer	28	2.1 A[a]	0.2
Axis deer	30	2.6 B	0.1
Fallow deer	19	2.7 B	0.2
Sika deer	16	3.4 C	0.2

[a] Means followed by different letters are different from each other ($P < 0.05$).

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