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Hematology, Intestinal Parasites, and Selected Disease Antibodies from a Population of Bobcats (*Felis rufus*) in Central Arkansas

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ABSTRACT: Eight bobcats with adjoining or overlapping home ranges were examined. Hematological values were within previously reported ranges. Six bobcats demonstrated antibody titers to *Toxoplasma gondii*, *Isospora* spp., *Taenia taeniaeformis*, *Spirometra mansoides*, *Physoloptera rara*, *Toxocara cati*, *Strongyloides* spp., *Trichurus* spp., *Capillaria* spp., and *Ancylostoma* spp. were found also in the animals examined. The mean number of parasite species per host was 4.1. All bobcats tested negative for serum antibodies to Rocky Mountain spotted fever (*Rickettsia rickettsii*). Two bobcats had titers $\leq 1:20$ for tularemia (*Francisella tularensis*), and two were positive for leptospirosis (*Leptospira* spp.).

Key words: Bobcat, hematology, parasites, serology, *Felis rufus*.

Literature dealing with parasites and diseases of bobcats (*Felis rufus*) is extensive (for a review see: McCord and Car-doza, 1982; Tumilson et al., 1985). However, the majority of these studies, either have been limited in scope, involved broad geographic areas, or examined animals whose interrelationships were unknown. Hematological data, on the other hand, is limited (Fuller et al., 1985; Kocan et al., 1985). Therefore, there is a need for data on bobcats with documented home range relationships.

During 1982-1984, eight bobcats (five male, three female) were captured, radio-collared, and subsequently tracked on a 71-km² area of the Muddy Creek Wildlife Management Area (approximately 80 km west of Hot Springs, Montgomery Co., Arkansas; 34°35' to 34°42'N and 93°45' to 93°52'W). It was determined that the eight bobcats had either adjoining or overlapping home ranges and formed a closely associated part of the general population in the area (Rucker et al., 1985). This study

reports on the intestinal parasites, selected serum antibodies, and hematology of the eight bobcats.

Animals were captured using North-woods Number 1.75 coil-spring leg-hold traps equipped with off-set jaws (North-woods Wildlife Management Equipment, P.O. Box 375, Greensburg, Pennsylvania 15601, USA). Bobcats were immobilized with 10 mg/kg ketamine hydrochloride (Ketaset, Bristol Laboratories, Thompson Road, P.O. Box 4755, Syracuse, New York 13221, USA) and 1.5 mg/kg acetylpromazine (Ayerst Laboratories, 685 3rd Street, New York, New York 10017, USA) using a 1-cc concussion-fired dart shot from a 1-m blowgun (Pneu-Dart, Inc., Williams- port, Pennsylvania 17703, USA). After being anesthetized, bobcats were placed in a holding cage and transported to a veter-inary clinic (fourth author, MEB) for ex-amination and marking. Blood samples were taken (using a syringe) from either the cephalic or jugular vein and placed into vacutainer tubes containing EDTA and vacutainer tubes without anticoagu-lant. Fecal samples were examined for ova and cysts of intestinal parasites. Following examination and full recovery from an-esthesia, animals were released at the site of capture. More detailed information con-cerning the capture and handling of ani-mals is given in Rucker et al. (1985).

Hematology was conducted on a model 5550 Coulter Counter (Coulter Electron-ics, Inc., P.O. Box 2145, Hialeah, Florida 33012, USA). Fecal flotations were con-ducted using fecasol and a fecalyzer (Eu-sco Pharmaceutical Corporation, Ocean-side, New York 11572, USA); identifications followed Sloss and Kemp (1978). Tulare-

TABLE 1. Mean hematological values for bobcats examined from Arkansas compared to those reported for bobcats from Oklahoma and Minnesota.

Parameter	Present study (n = 8)	Oklahoma ^a (n = 11)	Minnesota ^b (n = 27)
Hemoglobin (g/dl)	12.28 (0.59) ^c	13.1 (1.6)	13.30 (1.57)
Hematocrit (%)	36.47 (2.24)	36.3 (4.5)	38.72 (4.37)
Mean corpuscular volume (fl)	53.68 (2.83)	59.5 (4.1)	49.35 (10.49)
Erythrocyte count (10 ⁶ /cc)	7.11 (0.48)	6.1 (4.5)	7.98 (1.46)
White blood cell count (10 ³ /cc)	11.59 (3.06)	10.6 (6.5)	15.81 (5.04)
Neutrophils (10 ² /cc)	69.60 (9.48)	82.7 (4.2)	14.04 (1.02)
Lymphocytes (10 ² /cc)	24.10 (8.22)	21.7 (8.1)	1.77 (1.02)
Monocytes (10 ² /cc)	2.02 (1.12)	0.7 (1.1)	0.00 (0.00)
Eosinophils (10 ² /cc)	2.78 (3.92)	3.1 (6.9)	0.00 (0.00)
Basophils (10 ² /cc)	0.10 (0.33)	0.3 (2.9)	0.00 (0.00)

^a Kocan et al. (1985); these data only include bobcats without observable erythroparasites (*Cytauxzoon felis*).

^b Fuller et al. (1985).

^c Numbers in parentheses are standard deviations.

mia and leptospirosis serum antibody titers were determined by standard slide agglutination techniques (Damon and Johnson, 1944; Galton et al., 1965). Sera were tested for antibodies to *Toxoplasma gondii* by the hemagglutination technique (Jacobs and Lunde, 1957) and Rocky Mountain spotted fever by complement fixation (Centers for Disease Control, 1981). During the study, three bobcats died and were necropsied by the Southeastern Cooperative Wildlife Disease Study (Athens, Georgia 30602, USA); intestinal parasite data are included.

Means and standard deviations of hematological values for bobcats are presented in Table 1. Included, for comparison, are hematological data from Kocan et al. (1985) and Fuller et al. (1985). In general, data from these studies are in agreement, and all fall within the reported ranges for other felids (Wallach and Boever, 1983). As with the other studies, leukocytes demonstrated the greatest variation. Kocan et al. (1985) pointed out that stress during trapping and anesthesia may influence blood parameters, particularly leukocytes.

Ten species of intestinal parasites were recorded from the eight hosts (all bobcats were infected). The number of species in an individual host ranged from one to eight, with a mean of 4.1. The most commonly

observed species were *Toxoplasma gondii* and *Ancylostoma* spp. (each found in six hosts). Other species and the number of hosts included *Isospora* spp. (four hosts), *Taenia taeniaeformis* (one), *Spirometra mansoides* (one), *Physaloptera rara* (one), *Toxocara cati* (three), *Strongyloides* spp. (two), *Trichuris* spp. (one), and *Capillaria* spp. (five). In addition, unidentified ascarid ova were recovered from three hosts.

Stone and Pence (1978) and Watson et al. (1981) conducted two comprehensive studies on the helminth parasites of bobcats. Their studies concluded that there was a great deal of variation in the parasitic fauna; probably related to locally available prey. Further, Watson et al. (1981) felt that 13 species of helminths should be considered typical faunal components of bobcats. Of these, five were found in this study (*Spirometra mansoides*, *Ancylostoma* spp., *Physaloptera rara*, *Capillaria* spp., *Toxocara cati*). Our intestinal parasite count may, however, be underestimated since we could only conduct fecal floats one time and were able to have just three of the eight hosts necropsied.

Toxoplasma gondii is of special interest since six (75%) bobcats exhibited serum antibodies to the parasite (three had titers $\geq 1:256$, two had titers $\geq 1:128$, and one had a titer $\geq 1:64$). The presence of serum

antibodies, while not indicating an active infection, does indicate exposure.

Toxoplasmosis has been extensively documented in bobcats and seropositive results have been quite variable. For example, Oertley and Walls (1980) found 27 of 150 (18.6%) bobcats positive in West Virginia and Georgia, Marchiondo et al. (1976) reported 12 of 27 (44%) in New Mexico, Franti et al. (1976) found 59 of 86 (69%) in northern California, and Walton and Walls (1964) recorded 11 of 15 (77.3%) from Fort Stewart, Georgia. More recently, Dubey et al. (1987) found a congenitally acquired infection. Since fields are known to play a major role in transmission of the parasite (Miller et al., 1972; Wallach and Boever, 1983), bobcats may be an important factor in the infection in wildlife as well as humans regularly in contact with wild felids (Oertley and Walls, 1980; Heidt et al., 1985).

Sera were tested for antibodies to tularemia (*Francisella tularensis*), leptospirosis (*Leptospira* spp.), and Rocky Mountain spotted fever (*Rickettsia rickettsii*). None of the bobcats tested positive to Rocky Mountain spotted fever. Two bobcats demonstrated serum antibody titers of $\leq 1:20$ against tularemia and two different bobcats demonstrated antibody titers against leptospirosis (serovars *pomona* and *grippotyphosa*). These diseases did not appear to be of major importance for this particular population during the study. However, since both tularemia and Rocky Mountain spotted fever are of considerable importance in Arkansas (McChesney et al., 1982; McChesney and Narain, 1983), further research in this area is warranted. Tularemia serum antibody titers have been reported previously in bobcats from Florida, Georgia, and Utah (McKeever et al., 1958; Thorpe et al., 1965). Bobcats infected with leptospirosis serovars *pomona*, *ballum*, and *grippotyphosa* have been reported in Georgia (McKeever et al., 1958; Shotts et al., 1975) and *pomona* in Louisiana (Roth, 1964).

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