Ortenburger (1927) reported that all (number unspecified) *G. agassizii* in a cage completely exposed to the sunlight died within a day, and a tethered animal that got tangled and was unable to reach shade died before noon.

Kicking sand appears never to have been reported before in fighting male *Gopherus*. Our observations of this act show it is not merely a consequence of rapid locomotion away from the opponent but is also done by stationary gopher tortoises. One of us (JNL) has observed sand kicking as a regular feature of burrow maintenance by the entering gopher tortoise. This behavior was associated with tortoises being chased into their burrows when he (JNL) attempted to capture them for marking. He has the impression that the forefeet are always used for this purpose. Thus, one action pattern (sand kicking) is used in three contexts: burrow maintenance, predator repulsion, and intraspecific aggression.

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NOTES ON EARLY SPRING PARASITES AND PATHOLOGIES OF OKLAHOMA *Crotalus atrox*

A study of western diamondback rattlesnakes, *Crotalus atrox*, collected in the spring of 1987 and 1988 during Oklahoma's rattlesnake round-ups presented an opportunity to examine parasites and pathologies of this species from three localities: Waurika (Jefferson Co.), Waynoka (Major Co.), and Okeene (Blaine Co.).

METHODS

Snakes sampled were collected within a 30-mile radius of each locality by area residents two weeks prior to the public event (at which time snakes may be brought from various localities). In 1988, viscera from 296 snakes (128 male:168 female) were collected immediately as snakes were killed by decapitation, and were preserved at once by submerging in 10% formalin. After formalin-fixation for several days, viscera were soaked for 24 h in water, then transferred to 70% ethanol for storage. Viscera were referenced to previously weighed and measured (several parameters) snakes by recovery of a numbered plastic tag inserted deeply into the esophagus of each live snake examined. In 1987, viscera from 60 (22:38) representative Waynoka snakes were similarly collected, but were not tag-referenced to individual living snakes.

Viscera were examined during the summers of 1987 and 1988. G-I tracts were slit lengthwise from the esophagus to the rectum, and macroscopically examined for parasites, pathologies, food, and fangs. Samples of tissue and gut contents for microscopic examination were removed and transferred to vials of ethanol. Gut contents samples were examined and photographed at 160x or 1000x magnification using Kodacolor-200 film and a Zeiss "Standard-17" microscope with Contax RTS camera. Photos were printed to 86 X 125 mm size. Representative tissue samples were sectioned, stained, and examined at the Research Animal Diagnostic and Investigative Laboratory, College of Veterinary Medicine, Univ. of Missouri (Columbia) (Accession number 003155-88). Parasite indications were observed in 41 snakes (11.5%), though as will be elaborated below not all of these can be unequivocally designated as parasites of *C. atrox*. All material is presently maintained in the University of Kansas Biology Teaching Collection.

RESULTS

Waurika. Results are summarized in Table 1. Pulmonary aspergillosis was evident as severe, diffuse interstitial and alveolar granuloma with numerous hyphae and terminal conidia. The multiple intraserosal trematode cysts recorded from a single male were clustered around the small intestine. A male (1220 mm SVL, 1520 g) contained numerous pentastomid eggs, and 14 adults *(Porocephalus crotali)* were observed in the lung (see Self and Kuntz 1967).

Okeene. Results are summarized in Table 2. The intraserosal trematode cysts recorded were clustered primarily around the animals' small intestines and kidneys, but occasionally were found in the adjacent mesentery and the serosal surface of a fat body (one animal). The two males containing pentastomids [*Porocephalus*

crotali (see Self and Kuntz 1967)] were not equivalently infected. One (1168 mm SVL) contained 36 adult and subadult pentastomids in the lung; additional subadults (ca. 20 mm) were also seen in the coelom and under the mesentery adjacent to the large intestine. Total weight of all pentastomids in this animal was 8.3 g. The other male (SVL not recorded) contained one adult pentastomid (wt. 0.2 g) in its lung.

Waynoka. Results are summarized in Table 3. Pentastomids [*Porocephalus crotali* (see Self and Kuntz 1967)] were recorded from two females. One of these (921 mm SVL) contained 26 pentastomids (adults and subadults—21 within the lung, 4 attached to its serosal surface, and 1 attached to a kidney). Weight of the 21 from within the lung was 4.6 g. The other female (930 mm SVL) contained 25 pentastomids (wt. 5.0 g) in the lung.

Again, the multiple intraserosal trematode cysts were found clustered mainly around the small intestine and adjacent coelom wall. Additionally (in one male) cysts were adherent to the gall bladder. The female containing trematode cysts was non-reproductive. An unidentified tapeworm was found in one snake. No pentastomid eggs were noted.

Table 1. Waurika Summary.

Viscera examined (m:f)	137 (78:59)
Coccidians found in	12
Pulmonary aspergillosis in	7
Trematode	
ova (m:f)	2 (1:1)
cysts (m:f)	1 (1:0)
Pentastomid	
ova and/or	
adults/subadults (m:f)	1 (1:0)
Pinworm eggs	1

Table 2. Okeene Summary.

Viscera examined (m:f)	105 (63:42)
Coccidians found in	11
Trematode	
ova (m:f)	2 (2:0)
cysts (m:f)	10 (9:1)
Pentastomid	
ova and/or	
adults/subadults (m:f)	2 (2:0)

Table 3. Waynoka Summary.

Viscera examined (m:f)	60[1987] (38:22)
	92[1988] (52:40)
Coccidians found in	9 (1988)
Pulmonaryaspergillosis in (m:f)	
	2 (2:0) (1987)
Trematode	
ova (m:f)	2 (1:1)
cysts (m:f)	5 (4:1)
Pentastomid	
ova and/or	
adults/subadults (m:f)	2 (0:2)
Unidentified tapeworm segments	1

DISCUSSION

The Order Coccidia contains 25 genera (Hammond and Long 1973; Olsen 1986), two of which are *Isospora* (oöcysts with two sporocysts, each containing four sporozoites) and *Eimeria* (oöcysts with four sporocysts, each containing two sporozoites). *Isospora* is common in reptiles and *Eimeria* is quite common in mammals, and is not uncommon in snakes. Unfortunately, formalin fixation of the viscera made it impossible to distinguish between oöcysts of these coccidial genera. Therefore it is not possible to accurately determine the percent of snakes that were infected with *Isospora*. Several viperid–murid life cycles have been demonstrated for coccidians (see Wacha and Christiansen 1982; Haefner and Frank 1984; Upton and Barnard 1988), so this is not unexpected.

Pentastomid ova were found in Okeene and Waurika snakes, but none was found in Waynoka snakes. Waurika is located in south-central Oklahoma, whereas the other two localities are north-central. It is therefore unlikely that this difference is meaningful. Adult pentastomids were observed in one Waurika snake (male), two Okeene snakes (male), and two Waynoka snakes (female). Pentastomids are not uncommon parasites of snakes, and fairly large infestations seem not to cause host debilitation (Self and Kuntz 1967; Self 1969; Cooper 1984).

Intraserosal trematode cysts (Hoff et al. 1984) were identified almost exclusively from males (14 of 16 instances); of the two females, one was non-reproductive. The most common site for these cysts was the serosal surface of the small intestine. Trematode ova were found in seven animals (five of them male; one female was non-reproductive). Lyon (1986) documented helminths from six Idaho lizard species, two genera of which (*Crotaphytus* and *Cnemidophorus*) are potential prey of Oklahoma *C. atrox*. If lizards are part of the life cycle of these parasites in Oklahoma (a likely assumption), our data would indicate differential predation by the sexes of *C. atrox* in late summer and fall.

Keenlyne (1972) reported differences in the summer feeding behavior of gravid female (versus male and non-reproductive female) *Crotalus horridus* in Wisconsin. Gravid females did not feed during the later stages of embryogenesis. As reported separately (Fitch and Pisani, in press), most of the female *C. atrox* in the populations reported here seem to follow an annual reproductive cycle. If reproductive females of this species follow the observed pattern of its congener (a pattern also reported for gravid *Agkistrodon contortrix*; Fitch and Shirer 1971), this could explain the observed differential trematode parasitism.

We additionally offer another possible, though conjectural, hypothesis for this observation. It is probable that the two lizard genera mentioned above commence fall dormancy earlier than does *C. atrox*, and that some individuals may select hibernation sites around *C. atrox* den sites. If male rattlesnakes return to den sites earlier than females, they may consume these lizards as their final fall meals, rendering them more susceptible to trematode infection. These two hypotheses are not mutually exclusive.

Finally, it is also conceivable that our observed ratio is a statistical artifact of the small percent of snakes overall that were recorded with pathologies. While the total number of snakes with pathologies is small, the strong bias observed is nonetheless interesting in light of the foregoing.

Pulmonary aspergillosis was seen in nine snakes from Waurika and Waynoka, but in none from Okeene. As remarked above for pentastomids, we feel this locality difference is not meaningful.

These findings are presented with the intent of providing a spring reference point for further and more detailed work. The life history of *Crotalus atrox* is not well known, and it would be instructive to follow the parasite cycle of this species through several years (a project we are presently not in a position to pursue).

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THE FIRST REINTRODUCTION OF BLACK CAIMAN, *Melanosuchus niger*, INTO THE WILD

The black caiman (*Melanosuchus niger*) is a large crocodilian found throughout the Amazon River basin, the upper Essequibo and Berbice drainages in Guyana, and in coastal French Guiana. Owing to extensive commercial hide hunting which began in the 1940s, the black caiman has