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Poxvirus in Scaled Quail and Prevalences of Poxvirus-like Lesions in Northern Bobwhites and Scaled Quail from Texas

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ABSTRACT: Prevalences of poxvirus-like lesions were determined for 177 northern bobwhites (*Colinus virginianus*) and 24 scaled quail (*Callipepla squamata*) trapped in southern Texas from 1976 to 1979 and for 190 northern bobwhites and 105 scaled quail shot at five locations in southern Texas from 1980 to 1981. None of the northern bobwhites trapped in 1976-1977 was infected, but 54% of the trapped scaled quail were infected; 17% of the northern bobwhites and 34% of the scaled quail shot in 1980-1981 had pox lesions, primarily on the wings. Prevalence was unrelated to sex or age of birds. For both species, prevalence was greatest during late spring and early summer. Histologic and electron microscopic examination confirmed poxvirus in two scaled quail, which constituted the first report of poxvirus in this species.

Key words: Poxvirus, northern bobwhite, scaled quail, *Colinus virginianus*, *Callipepla squamata*, field study, prevalence.

Poxvirus has been reported in three species of New World quails (Odontophorinae). Eleven of 146 Gambel's quail (*Callipepla gambelii*) from Arizona (Blankenship et al., 1966) and 97 of 428 California quail (*Callipepla californica*) from Oregon (Crawford et al., 1979; Crawford, 1986) were infected with poxvirus. Stoddard (1931) noted the occurrence of poxvirus (<2% prevalence) in northern bobwhites in Florida, Georgia and South Carolina. Davidson et al. (1980) described an epornitic (312 infected birds of 2,586 examined) of poxvirus in northern bobwhites in Florida, Georgia, North Carolina and Tennessee. Gallagher (1916) reported an outbreak of poxvirus in a group of 400 quail shipped from Mexico to Missouri. Poxvirus also was noted in captive quail (Morley, 1933; Shillinger and Morley, 1937). The purposes of this research were to determine if poxvirus occurred in scaled

quail and to compare prevalences of poxvirus-like lesions in northern bobwhites and scaled quail in southern Texas, USA.

Quail were captured with baited walk-in traps from April 1976 through November 1977 at the Rob and Bessie Welder Wildlife Refuge (Welder Refuge; 80 km northeast of Corpus Christi, San Patricio County, Texas; 28°06'N, 97°25'W) and with nets during December 1979 at the Babb Ranch (8 km southwest of Langtry, Val Verde County, Texas; 29°46'N, 101°37'W). Quail were collected by shooting from January 1980 through April 1981 at (1) Welder Refuge; (2) Chaparrosa Ranch (11 km west of LaPryor, Zavala County, Texas; 28°53'N, 99°59'W); (3) Apache Ranch (8 km northwest of Laredo, Webb County, Texas; 27°57'N, 99°53'W); (4) Killam Ranch (18 km north of Laredo, Webb County, Texas; 27°33'N, 99°25'W); and (5) Rio Grande Plain Experiment Ranch (Rio Grande Ranch; 45 km southwest of Uvalde, Maverick and Kinney counties, Texas; 29°05'N, 100°10'W).

Sex and age (adult or immature), based on the appearance of primary coverts (Ohmart, 1967; Rosene, 1969), and presence and location of poxvirus-like lesions were noted for all birds. Immatures ranged from 1 mo of age, based on the molt sequences of primary feathers (Ohmart, 1967; Rosene, 1969), to approximately 12 mo; adults were >12 mo old. Prevalences were based on the frequency of occurrence of poxvirus-like lesions on birds examined in the field. Poxvirus-like lesions were distinct, proliferative processes on the skin of a bird and were accompanied by inflammation of the site and superficial necrotic

TABLE 1. Prevalence of poxvirus-like lesions in northern bobwhites and scaled quail at six study areas in southern Texas, 1976–1981.

Methods years	Location	Northern bobwhites		Scaled quail	
		Number examined	Prevalence of lesions (%)	Number examined	Prevalence of lesions (%)
Trapped					
1976–1977	Welder Refuge	177	0	0	—
1979	Babb Ranch	0	—	24	54
Shot					
1980–1981	Welder Refuge	66	8	0	—
1980–1981	Chaparrosa Ranch	48	21	28	25
1980–1981	Apache Ranch	35	17	8	38
1980–1981	Killam Ranch	14	36	46	37
1980–1981	Rio Grande Ranch	27	26	23	39

tissue. Lesions from two scaled quail were submitted for electron microscopic examination by A. K. Eugster (Texas Veterinary Medicine Diagnostic Laboratory, College Station, Texas 77843, USA) and for histological examination by R. M. Robinson (Texas Veterinary Medicine Diagnostic Laboratory) in 1979 (Accession Number C 197534). Chi-square analysis (Snedecor and Cochran, 1967) was used to test for differences in prevalences among sex and age categories within each species and prevalences between species. Previous work with California quail (Crawford, 1986) indicated differences in prevalences of poxvirus between trapped and shot birds; consequently, quail obtained by different methods in this study were treated separately.

Both species of quail were present at four study sites (Table 1). Scaled quail were not found at the Welder Refuge and northern bobwhites were not located at Babb Ranch.

None of 177 northern bobwhites trapped at Welder Refuge from April 1976 to November 1977 was infected with poxvirus-like lesions (Table 1). However, 13 of 24 scaled quail (54%) trapped at Babb Ranch in December 1979 had poxvirus-like lesions. Electron microscopic examination of lesions from two of these scaled quail revealed the presence of vaccinia virus particles and the infection was diagnosed as

poxvirus (A. K. Eugster, pers. comm.). Histological examination revealed epithelial hyperplasia and the presence of Bollinger bodies, characteristic of poxvirus (R. M. Robinson, pers. comm.).

Sixty-nine quail (33 northern bobwhites and 36 scaled quail) shot from January 1980 through April 1981 were infected with poxvirus-like lesions (Table 1). An additional 10% of the northern bobwhites and 13% of the scaled quail had exposed fleshy areas on the wings or small swollen areas on the legs. These lesions may have been caused by poxvirus. However, because there was no laboratory confirmation of poxvirus in these birds, they were not included in numbers of birds with poxvirus-like lesions. Quail with poxvirus-like lesions were found at all locations (Table 1). The lowest prevalence was 8% for northern bobwhites at Welder Refuge and the highest prevalence was 39% for scaled quail at the Rio Grande Ranch. Overall prevalence of poxvirus-like lesions was 34% for scaled quail and 17% for northern bobwhites. Prevalences were not significantly different ($\chi^2 = 3.32$, $P > 0.05$, 1 df) for the four areas (data combined) where the two species coexisted (23% for northern bobwhites and 34% for scaled quail); this indicated that prevalence was not species specific. Prevalences of poxvirus-like lesions in northern bobwhites (8–36%) were within the range (0–39%) reported by Da-

TABLE 2. Monthly prevalences of poxvirus-like lesions in northern bobwhites and scaled quail shot in southern Texas, 1980-1981.

Month	Northern bobwhites		Scaled quail	
	Number examined	Prevalence of lesions (%)	Number examined	Prevalence of lesions (%)
January	70	11	12	25
February	9	0	4	0
March	9	11	6	0
April	11	9	21	52
May	15	33	7	86
June	11	55	13	46
July	25	24	17	35
August	6	17	0	—
September	18	17	7	14
October	9	11	11	9
November	6	17	7	14
December	1	0	0	—
Total	190	17	105	34

vidson et al. (1980) during an epornitic, but far exceeded values (1-2%) reported by Stoddard (1931) from 1925 to 1929 and Davidson et al. (1980) from 1969 to 1977. Prevalences for scaled quail (25-39%) were among the highest reported for any quail species in the New World.

Prevalence of poxvirus-like lesions in both species peaked during late spring and early summer (Table 2) when values reached 55% (June) for northern bobwhites and 86% (May) for scaled quail. Blankenship et al. (1966) found poxvirus in Gambel's quail only from May through July. Crawford (1986) reported the highest prevalences among California quail from late fall through early spring, the time of highest rainfall, in western Oregon. In southern Texas, late spring and early summer correspond to the period of greatest rainfall (Wilson and Crawford, 1987). This may affect mosquito abundance which could result in increased prevalence of poxvirus in quail.

Prevalence of poxvirus-like lesions was not significantly related to sex and age of northern bobwhites ($\chi^2 = 0.20$, $P > 0.90$, 3 df) or scaled quail ($\chi^2 = 2.05$, $P > 0.50$, 3 df). Sex and age composition of infected

and uninfected birds, respectively, was: northern bobwhite adult males (24%, 27%), adult females (16%, 18%), immature males (33%, 33%), and immature females (27%, 22%); scaled quail adult males (39%, 39%), adult females (11%, 21%), immature males (31%, 25%), and immature females (19%, 15%). Davidson et al. (1980) likewise noted no relationship of poxvirus to sex or age of northern bobwhites, but Crawford (1986) found a higher prevalence among immature California quail than among adults.

Previous studies (Table 3) of free-ranging northern bobwhites (Stoddard, 1931; Davidson et al., 1980) and California quail (Crawford et al., 1979; Crawford, 1986) revealed that >75% of infected birds had lesions on the legs and that <25% had lesions on their heads. All of the infected Gambel's quail examined by Blankenship et al. (1966) had lesions on their heads. In contrast, 79% of infected northern bobwhites and 86% of infected scaled quail in southern Texas had lesions on the wing near the alula (Table 3). Gallagher (1916) also noted lesions on the wings of quail, but all were caged birds. Northern bobwhites and scaled quail inhabit areas of dense brush in southern Texas (Wilson and Crawford, 1987) and it is possible that the leading edges of their wings became abraded by running and flying in this habitat. Abrasions on the wing may increase the likelihood of transmission of poxvirus by contact or the exposed skin may offer locations for feeding by mosquitoes.

This study provided the first documentation of poxvirus in scaled quail and revealed that, in contrast to previous work with free-ranging quail, northern bobwhites and scaled quail most frequently had lesions on their wings. Poxvirus-like lesions, in epornitic proportions, were found in both species at all locations where they occurred from 1979 to 1981. The timing of the epornitic in northern bobwhites at Welder Refuge in 1978 or 1979 coincided with high prevalences reported by Davidson et al. (1980) in four southeastern states. Apparently, the epornitic extended

TABLE 3. Numbers of free-ranging quail infected with poxvirus or poxvirus-like lesions and numbers of birds with lesions on legs, head, and wings for four species of New World quails as reported by various authorities.

Species	Number of infected birds	Locations of lesions			Authority
		Legs	Head	Wings	
Gambel's quail	11	0	11	0	Blankenship et al., 1966
California quail	97	96	2	0	Crawford et al., 1979; Crawford, 1986
Northern bobwhite	238	183 ^a	55	0	Davidson et al., 1980
Northern bobwhite	—	all	1	0	Stoddard, 1931
Northern bobwhite	33	12	0	26	This study
Scaled quail	49 ^b	6	2	42	This study

^a Number of birds with lesions on legs only; some of the 55 birds with lesions on head also had lesions on legs.

^b Includes 13 birds trapped in 1979 and 36 shot in 1980–1981.

at least to Texas. Although information from quail shot in 1980–1981 revealed high prevalences in late spring and early summer, the highest prevalence noted was for scaled quail trapped during January at the Babb Ranch. Perhaps this was the result of disproportionate susceptibility of poxvirus-infected quail to trapping (Crawford, 1986). Factors that affect epornitics of poxvirus on a large geographic scale and those that influence seasonal prevalences merit further investigation.

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