FOODS OF SCALED QUAIL (*CALLIPEPLA SQUAMATA*) IN SOUTHEASTERN NEW MEXICO

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ABSTRACT

One hundred-twenty scaled quail (*Callipepla squamata*) were collected in southeastern New Mexico to determine the amounts and kinds of food items ingested and to evaluate sexual and temporal variation in feeding habits. Seeds of *Helianthus petiolaris, Amaranthus, Prosopis glandulosa, Chenopodium,* and *Croton* were the dominant food items. Occurrence of several uncommon food items differed between the sexes, suggesting some niche separation between males and females. For both sexes, feeding habits differed from morning to afternoon. *Key words*: *Callipepla squamata*, scaled quail, food habits, feeding ecology, New Mexico.

INTRODUCTION

Considering the importance of scaled quail *(Callipepla squamata)* as a game bird in the Southwest, there are relatively few quantitative data about the feeding ecology of this species. The early accounts of Judd (1905) and Kelso (1937) lumped specimens from several southwestern states; later, detailed studies were conducted in Texas (Lehmann and Ward 1941; Wallmo 1956; Ault and Stormer 1983), Oklahoma (Schemnitz 1961), Colorado (Hoffman 1965), and Arizona (Gallizioli 1965). Three previous studies of scaled quail feeding ecology have been conducted in New Mexico—one near Tucumcari (Russell 1932), one in Lea County (Campbell 1964; Campbell et al. 1973), and one in western Lea and eastern Eddy counties (Davis and Banks 1973; Davis et al. 1975). We identified and quantified the food items ingested by scaled quail in southeastern New Mexico and were the first to investigate sexual differences and temporal variation in foods selected by this species.

MATERIALS AND METHODS

The study area was centered at drill hole ERDA 9 (SE corner, sec. 20, T22S, R31E), and extended outward to a radius of eight kilometers. Most of the area was in eastern Eddy County, but it also extended into extreme western Lea County. Extensive vegetation analyses have been conducted on this noncultivated site by W. C. Martin of the University of New Mexico (see Best and Jackson 1982). Our specimen collections were restricted to the shinnery oak-mesquite (*Quercus havardii-Prosopis glandulosa*) association to minimize the effects of differing habitat types. Davis' study area was a few kilometers southeast of ours, is similar, and has been described repeatedly (for example, Davis and Banks 1973; Davis et al. 1974; Davis et al. 1975).

In 1979, 120 scaled quail were collected from 13 to 18 November by shooting during the day (from 0630 until 1700 MST). For each quail, the time and sex were recorded. Crop contents were removed, placed into plastic vials, frozen, and later air dried. Food items were identified by comparison with plant and arthropod samples collected on the study site. Food items that were not identifiable to family were listed as unknowns.

Average weights and measurements of seeds were taken for each food item found in the crops (Best et al. 1982). The volume of each food item was determined by multiplying the seed dimensions by the number of seeds in the crops. Percent volume was calculated for each food item, using a formula similar to that of Martin et al. (1946)—volume of each item/total volume $\times$ 100. Food items with less than 0.01 percent volume were included as trace occurrences (tr.). Mean and standard deviation (frequency) also were calculated for each food item. Discriminant analyses (Nie et al. 1975) were used to evaluate sexual and temporal variation in food habits; the numbers of seeds of each food item served as characters. Statistical analyses were conducted using the IBM computer systems at Eastern New Mexico University and The University of New Mexico.

RESULTS AND DISCUSSION

Crop Contents

The crop contents for individual scaled quail are listed in Best et al. (1982). The frequency, mean and standard deviation of frequency, and percent volume for each food item are presented in Table 1. *Helianthus petiolaris* accounted for 28 percent of the total volume and was present in 75 percent of the crops. The volume of *Amaranthus* also was important (26 percent) and was present in 24 percent of the crops. Seven other food items were present in 28-47 percent of the crops: *Prosopis glandulosa, Chenopodium* B, *Croton*, U128, *Paspalum*

TABLE 1.—Food items in crops of scaled quail (*Callipepla squamata*) collected in southeastern New Mexico. Frequency, mean, standard deviation, and percent volume are listed by sex for each item.

	Males (N = 59)				Females (N = 56)			
Food item[a]	Freq.[b]	Mean[c]	SD	% Vol.	Freq.	Mean	SD	% Vol.
Amaranthaceae								
Amaranthus albus	3	60	47	0.05	0			0
Amaranthus A	15	1442	1422	26.60	13	1300	1522	25.73
Boraginaceae								
Lithospermum multiflorum	3	2	1	0.04	4	2	2	0.08
Cactaceae								
Opuntia phaeacantha	1	11		0.23	2	16	8	0.80
Chenopodiaceae								
Chenopodium incanum	7	377	351	0.98	14	1424	1815	9.11
Chenopodium A	8	219	241	1.94	6	81	97	0.67
Chenopodium B	23	313	426	7.20	25	582	739	18.01
Commelinaceae								
Commelina sp.	4	3	2	0.10	3	8	9	0.24
Compositae								
Ambrosia A	5	34	28	2.81	9	37	34	2.30
Ambrosia B	2	6	0	0.08	2	8	4	0.13
Helianthus petiolaris	45	243	278	31.97	38	172	209	23.76
Heterotheca sp.	0			0	1	8		0.01
Verbesina eucleioides	4	6	4	0.14	0			0
Cruciferae								
Dithyrea wislizenii	3	2	2	0.01	3	2	1	0.01
Cucurbitaceae								
Cucurbita foetidissima	0			0	1	1		0.04
Euphorbiaceae								
Croton sp.	19	10	15	3.07	21	11	11	4.64
Euphorbia A	33	129	359	5.03	24	155	209	5.44
Euphorbia B	16	16	21	0.93	12	9	8	0.50
Euphorbia C	5	4	4	0.01	3	11	10	0.03
Euphorbia D	1	13		tr.	0			0
Graminae								
Bouteloua gracilis	4	8	6	0.01	1	1		tr.
Panicum obtusum	13	26	68	0.72	11	5	4	0.13
Paspalum setaceum	28	47	75	2.15	26	53	91	2.79
Setaria leucopila	6	13	17	0.14	15	9	12	0.29
Sporobolus cryptandrus	3	6	2	tr.	3	1	0	tr.
Triplasis purpurea	3	11	8	0.03	4	4	3	0.02
Labiatae								
Monarda punctata	19	76	228	0.52	14	17	13	0.10
Leguminosae								
Astragulus sp.	20	11	17	0.36	15	7	10	0.22
Hoffmanseggia jamesii	4	2	1	0.15	3	2	2	0.19
Phaseolus sp.	1	6		0.03	0			0
Prosopis glandulosa	23	8	13	8.94	21	2	2	2.99

TABLE 1.—Continued.

Linaceae								
Linum aristatum	1	14		0.01	0			0
Loasaceae								
Mentzelia sp.	6	11	13	0.06	8	15	23	0.15
Nyctaginaceae								
Abornia fragrans	4	14	18	0.20	2	19	21	0.17
Onagraceae								
Gaura villosa	3	1	1	0.05	1	1		0.02
Plantaginaceae								
Plantago sp.	0			0	1	15		0.02
Polygonaceae								
Eriogonum sp.	0			0	1	3		tr.
Rumex sp.	1	1		0.02	0			0
Portulacaeae								
Portulaca oleracea	6	24	43	0.02	3	11	11	0.01
Portulaca A	6	12	13	tr.	6	14	18	0.01
Solanaceae								
Solanum rostratum	2	53	27	0.12	1	174		0.25
Verbenaceae								
Verbena bracteata	3	350	419	0.20	7	227	251	0.36
U6	0			0	2	4	3	0.03
U101	5	4	2	0.02	5	4	2	0.03
U128	19	432	840	5.01	13	70	123	0.69
U135	3	2	2	0.05	1	3		0.03
U136	0			0	1	3		0.02
U138	2	122	99		1	3		
U143	1	5		tr.	0			0
U145	0				1	31		
U157	1	2			0			
U186	0			0	1	1		tr.
U193	4	6	4	tr.	1	6		tr.
U195	0			0	1	1		tr.
U196	0			0	1	23		0.02
U197	1	20		tr.	0			0
Grasshoppers	1	1			0			
Insect galls	5	3	2		2	2	1	
Mouse feces	1	2			0			

[a]Number of crops examined = 120; number of crops with contents = 115.
[b]Number of crops containing each item.
[c]Average number of seeds in the crops of those containing the item.

setaceum, Astragalus, Monarda punctata. These seven foods accounted for 28 percent of the volume. Of the 59 food items found, over one-half were present in amounts less than 1 percent of the total volume.

Campbell et al. (1973) reported that *Acacia, Gutierrezia, Croton, Euphorbia,* and green leaves and stems were most important (58.3 percent of the total volume) in the 227 crops of scaled quail they examined during 1960-1962; the most frequently encountered items were green leaves and stems, insects, grit, *Croton, Prosopis,* and *Acacia*

(all at frequencies of more than 40 percent). *Acacia* was not present in our study area, but the other major food items reported by Campbell et al. (1973) were common. Volumes of most food items in their study were different from those we observed. However, their frequencies of *Amaranthus, Prosopis,* and *Croton* were similar to ours.

Our results also may be compared with cool-season data from Davis and Banks (1973) and Davis et al. (1975). *Prosopis, Euphorbia, Croton,* and *Gutierrezia* had the greatest mean percent weights in the crops of scaled quail examined by Davis and Banks (1973). *Prosopis, Euphorbia,* and *Croton* also were among the eight most important items we found. The food items with the greatest mean volume reported by Davis et al. (1975) were *Gutierrezia, Prosopis,* green vegetation, and insects. Of these, only *Prosopis* was important in our study.

Sexual Differences

Campbell and Lee (1956) noted that the number of males in New Mexico scaled quail populations slightly outnumber females. The sex ratio they observed for New Mexico in general was 104.3 males per 100 females. This is similar to the sex ratio in the population we sampled: 105.4 males per 100 females.

Discriminant analysis of the crop contents in our sample indicated there were differences in the feeding habits of males and females (Table 2). Seventy-two percent of the individuals were correctly classified to sex based upon their crop contents. Females consumed more *Chenopodium incanum* and *Ambrosia* A than males. Conversely, males ate more *Bouteloua gracilis, Amaranthus albus,* insect galls, *Chenopodium* A, *P. glandulosa,* and grasshoppers. However, most of these food items were represented at low frequencies and volumes in the crops, and there was considerable overlap between sexes for most major food items. Thus, diets of the sexes were similar in most respects. Whether the differences reflect significant food-niche separation of the sexes should be addressed in future studies.

Temporal Differences

Schemnitz (1961) observed that scaled quail in Oklahoma fed from daybreak until about 10AM and from 4PM until dark. This appeared to be true on our study area as well. There were some differences in the feeding habits between morning and afternoon for both sexes (Table 2). Discriminant analyses were performed separately for the sexes since some differences were found in their feeding habits. For males, 95 percent of the birds were correctly classified as to time of collection (Table 2). Crops of males collected during the afternoon had more than eight times as much U128 as those collected in the morning; amounts of U197, *Triplasis purpurea,* and *P. glandulosa*

TABLE 2.—Discriminant analysis among sexes and times of day based upon crop contents of scaled quail (*Callipepla squamata*) from southeastern New Mexico.

Actual Group	*n*	Predicted group membership	
Between sexes[a,b]		Males	Females
Males	59	41(69.5%)	18(30.5%)
Females	56	14(25.0%)	42(75.0%)
Ungrouped	5	5(100%)	0
Between AM and PM for males[c]		Morning	Afternoon
Morning	37	34(91.9%)	3(8.1%)
Afternoon	22	0	22(100%)
Between AM and PM for females[d]		Morning	Afternoon
Morning	40	40(100%)	0
Afternoon	16	10(62.5%)	6(37.5%)

[a]The data below are given as: percent of specimens that were correctly classified; in decreasing order of importance, the variables accounting for differences.

[b]72.2%; *Bouteloua gracilis, Amaranthus albus,* insect galls, *Chenopodium* A, *Prosopis glandulosa, Ambrosia* A, grasshoppers.

[c]94.9%; *Chenopodium* A, *Croton, Gaura villosa,* U197, *Portulaca* A, *Mentzelia, Triplasis purpurea, Prosopis glandulosa, Amaranthus* A, *Chenopodium incanum, Euphorbia* A, *Chenopodium* B, *Ambrosia* A.

[d]82.1%; *Chenopodium incanum, Chenopodium* B, *Croton, Cucurbita foetidissima,* U186, *Euphorbia* B, *Bouteloua gracilis.*

were also greater in the afternoon. Males collected in the morning had more *Chenopodium* A, *Croton, Gaura villosa, Portulaca* A, *Mentzelia, Amaranthus* A, *C. incanum, Euphorbia* A, *Chenopodium* B, and *Ambrosia* A. The larger amount of U128 and lesser amounts of *Chenopodium* A, and *Croton* consumed by males collected in the afternoon accounted for most of the difference between morning and afternoon samples. For females, 82 percent of the birds were correctly classified to morning or afternoon collection (Table 2). Females collected in the afternoon had almost four times the *C. incanum* as those collected in the morning, but much lesser amounts of *Chenopodium* B, *Croton*, and *Euphorbia* B. Like males, the lesser amounts of *Chenopodium* A and *Croton* in specimens collected in the afternoon also contributed to the difference between morning and afternoon samples.

Many of the food items temporally separating morning and afternoon quail samples were among the most common items found in the crops. This supports a claim that there were considerable differences between morning and afternoon samples for males and females. We do not beilieve these differences existed simply because of an accumulation of seeds through the day. If this was true, all or most of the food items would be represented in the greatest numbers in specimens collected in the afternoon. This was not the case. Several food items in both sexes were found in greatest abundance in

specimens collected in the morning. However, there may have been some effect of habitat differences from one collection site to another within our study area. Because specimens were collected as they were encountered throughout the study area and many sites were revisited at various times during the day, differences between collecting sites were probably minimal. It is likely that food items appearing in greater quantities in either morning or afternoon samples did so because they were encountered or selected in greater amounts.

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