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*** START OF THE PROJECT GUTENBERG EBOOK FOOD OF THE CROW, *CORVUS BRACHYRHYNCHOS* BREHM, IN SOUTH-CENTRAL KANSAS ***

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BY

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FOOD OF THE CROW, *CORVUS BRACHYRHYNCHOS* BREHM, IN SOUTH-CENTRAL KANSAS

By Dwight Platt

Introduction

The yearly diet of the crow was studied from December, 1952, to February, 1954, in Harvey County and the northeastern townships of Reno County, in south-central Kansas. In the United States much attention has been devoted previously to the food taken by the crow because it is of economic importance. The work of Barrows and Schwarz (1895) was the first of a series of studies made by the United States Department of Agriculture. Kalmbach (1918, 1920, 1939) continued these studies by analyzing stomach contents from various parts of the United States. Also he diet of the crow has been studied by local areas (Imler—Oklahoma, 1939; Hering—New York, 1934; Black—Illinois, 1941; Lemaire—Louisiana, 1950).

I am grateful to Dr. Henry S. Fitch, for many valuable suggestions and helpful encouragement given in the course of my study. Professor E. Raymond Hall, who read the manuscript, likewise offered valuable suggestions. Dr. R. L. McGregor and Mr. Wilford Hanson provided invaluable assistance in identification of plants and insects found in the crow pellets.

Methods

Previous studies were based mostly on analyses of stomach contents. My study is based on the analysis of 617 regurgitated pellets collected from roosts and lookout posts. Fifty-three collections of pellets were made throughout the year at regular intervals, except that none was made in January, March, or May. The pellets were wrapped individually in paper or leaves as collected, and each was analyzed separately. The percentages by bulk of different food residues (excluding sand and other extraneous material) were estimated in each pellet and recorded.

Description of the Study Area

The study area is on the eastern edge of the Great Bend Prairie physiographic province of Moore (1930). The climate is characterized by moderate precipitation (ann. 30"), a wide range of temperature variations, moderately high wind velocities, and comparatively rapid evaporation. The summers are generally hot, and the winters are moderately cold but are free from excessive snowfall. The weather during the study period was unusually dry, and the summer temperatures were above normal. A drought had begun in 1952, following the cool and wet summer of 1951.

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The study area includes the zone of transition from bluestem or tall-grass prairie to the buffalo grass or short-grass prairie. The principal farm crop in the study area is wheat. Sorghum grain, oats, hay crops (especially alfalfa), and corn are also grown. The study area supported a small population of breeding crows; an estimate based on field observations mainly in eastern Harvey County, was not more than one pair per square mile. In winter a large population of crows migrates into the area from the northern Great Plains. Censuses showed that on parts of the area the feeding population might be as great as 180 birds per square mile. These wintering crows concentrate in the western part of the study area where the flat, fertile wheat fields of central Harvey County are replaced by sand dunes and the sandy Arkansas River Valley. Here much land is devoted to raising livestock, and sorghum grain is an important field crop. There is also more waste land there than elsewhere in the area.

Data From Analysis of Pellets

Data obtained from the analysis of pellets were grouped in biweekly collections, and percentages of various food residues in the pellets collected within each biweekly period were averaged. Also frequency of occurrence was computed, and maximum and minimum percentages were included to permit a broader interpretation. In determining the minimum percentage, only those pellets were considered in which the food residue was present.

Pellets from roosts of resident crows were collected on a year round basis in eastern Harvey County near Newton (see tables 1 and 2). The data from these pellets were interpreted separately from data on collections made in the western part of the study area from under roosts of wintering crows (see tables 3 and 4).

In studies of the food of owls analysis of materials in regurgitated pellets has been widely used, but with crows this method has been little used because the nature of their food makes identification of material more difficult. Analysis of pellets has certain merits, however, and, if closely correlated with field studies, can give valuable information concerning food habits. The availability of pellets and the ease of collecting them are obvious advantages. Under large roosts in winter the number that can be collected is almost unlimited. At other seasons, pellets are scarcer, but even so they usually are more available than stomachs.

The technique of pellet analysis is more easily applied to a study of the yearly diet than is the technique of stomach analysis. The crow is euryphagous and, as shown by this study, the diets of crows a few miles apart may differ. Therefore a study made on a limited area within one biotic community, on a year round basis, and correlated with changes in the habitat should be of greatest value. For such a study, collection of stomachs is not practical unless individuals are abundant so that many can be sacrificed, but collection of pellets is practical and profitable.

One limitation of data based on material from pellets is the impossibility of closely correlating the

volume of indigestible residues with the proportion of food items actually eaten. Such correlation is prevented not only by the different percentages of indigestible residues in different food items but also by irregularities in regurgitation and in the efficiency of the crow's digestive system. Barrows and Schwarz (1895:24-25) cite several instances of such irregularities in captive crows. In certain pellets that I studied, part of the wheat or other grain was undigested or partly digested, whereas in other pellets the only residue was finely divided chaff. Certain foods that lack hard parts may leave no recognizable residues in pellets. A captive crow that I raised did not form pellets when fed soft food. Nevertheless, data from analysis of pellets when supplemented by field observations, should serve as a sound basis for valid conclusions concerning the relative proportions of various foods eaten. The following field observations of habitat factors aid in interpreting the information obtained from pellet analysis.

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Field Observations and Correlations

RESIDENT CROWS IN EASTERN HARVEY COUNTY.—Although no field observations were made on feeding behavior in April, the large percentage of oat hulls found in the pellets suggests that newly sown fields of oats must have been one of the major feeding grounds in that month. Oats were planted between February 15 and March 20.

The pellets collected in June were all from the roost of one family group of crows. This group spent much time in a cherry orchard and in the shelterbelt near it. Residues of cherry and wheat constituted the only plant foods found in the pellets. In both frequency and percentage, scarabaeid beetles constituted the other important food source. The wheat harvest started on June 17.

The cherry harvest was over by June 29. Grain harvest was over and the fields were being plowed by July 2. Alfalfa was being cut for hay in early July and crows were then feeding on plowed fields and the newly mown alfalfa fields. Much time in the middle of the day was spent along the creeks where crayfish could be obtained. During most of the summer, pellets were difficult to find because the roosts were small, shifting, and scattered and because few pellets were produced. For weeks at a time there were no usable pellets under roosts occupied by hundreds of birds, although droppings and feathers were present. At other times large collections of pellets could be gathered from small roosts. Plowing was a major farm operation at the season when pellets were most scarce. Larvae of insects (especially beetles), and earthworms might have provided a major source of food which lacked sufficient indigestible material to form pellets. A few feces were collected and analyzed in an attempt to find the residue of such soft-bodied foods. Indigestible materials were found in the feces, but these were of the same types as those found in the pellets. Only a few fragments were found which might have been the mouthparts of grubs.

After mid-July pellets were common under one small roost. In late July they were scarce, even at a roost with several hundred crows. The principal feeding grounds of crows were stubble fields and plowed fields. All grain picked up at this time was waste. Plowing was interrupted by rain from July 11-18 but was the major farm operation again after July 19.

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From late July into early September crows fed in plowed fields, stubble fields, pastures, and newly mown hay fields. Pellets were scarce, considering that hundreds of crows used the roost where pellets were collected. Plowing was almost over by July 31. Brome grass was in full head during the early part of this period. Corn was in the milk stage during the early part of August but did not show up in any pellets. Although Sudan grass was in head during the early part of this period, other sorghum did not head out until September.

From early September to early October sorghum was in full head. The crows spent most of their feeding time in plowed fields, stubble fields, or pastures. Much time was spent along creeks where pools, which contained many small fish, were drying. Pellets were common under a small roost. Grasshoppers and beetles were the two staple foods in the diet at this time, as shown by their high frequencies and high percentages in pellets. The high percentage and frequency of wheat corroborates the observation that most of the feeding was being done in wheat fields. The relatively large percentages of fish bones, crayfish, and snail shells can be correlated with the observation that much time was spent by the crows at the pools in creek beds. Many ants were in the pellets. The total percentage of animal materials in the pellets was much higher in this period than in other periods. Plant material had been the highest, percentagewise, during most of the summer, except in the latter part of July. Most studies of food of the crow have shown a higher content of animal material during the summer than does my study. It would seem that much of the food material which did not show up in pellets during the summer was animal material.

Grasshoppers predominated in the diet in early October; some pellets consisted of little other than grasshopper mandibles and leg joints. Wheat is sown in this area from September 10 to October 15, most of it being sown after October 5, the recommended Hessian fly-free date. Most of the grain sorghum is harvested by mid-October. However, the utilization of both of these items was low in October. By October 10 only one pool was left in the creek bed under observation. The amount of fish bones, crayfish, and snail shells in the pellets decreased during this period.

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Killing frosts occurred in mid-October. The percentage of grasshoppers in the diet then declined rapidly and later in the autumn declined more slowly. Nevertheless, grasshoppers and beetles remained the predominant animal-food residues into December and frequencies of occurrence remained relatively high.

As autumn progressed and insects became scarcer, plant material made up an ever-larger percentage of the diet. Wheat and sorghum constituted more than one-half of the food residues in this period. However, in December utilization of sorghum by resident crows in eastern Harvey County decreased. Sorghum is not an important crop in this area.

ROOSTS OF WINTERING CROWS.—The collections of pellets from roosts of wintering crows in western Harvey County and northeastern Reno County differed in having a higher percentage of plant material. Sorghum, corn, and wheat predominated in early autumn, while sorghum, sunflower seed, and corn predominated in the winter. Ants were utilized to a much greater extent in early autumn. For grasshoppers and beetles, frequency of occurrence was high but percentages were low. Most of the standing water in the sand dune country had dried approximately one year before, and the aquatic component of the diet was almost entirely lacking.

The two principal food items taken by crows in the winter of 1953 were grain sorghum and sunflower seed. Censuses in late November and late December, 1953, showed that feeding was mostly in harvested sorghum fields and corn fields, but alfalfa fields, wheat fields, plowed fields, and native pasture were also utilized.

Sorghum and sunflower seeds were also the staple foods during December, 1952. Oats and wheat showed higher percentages than in 1953, perhaps because different foods were available in these two winters or because of differences in locality. The pellets collected in 1952 were from western Harvey County, whereas most of those collected in 1953 were from northeastern Reno County.

The collection taken in February, 1954, showed a large percentage of oats in the diet. Newly sown oat fields were probably a major source of food at that time.

Economic and Ecologic Significance

The chief factors that determine the economic bearing of crows locally are: the yearly diet, the time of year in which each food item is taken, and fluctuation in the population density at different times of year. In the study here reported upon, the yearly diet was computed by averaging the percentages of each item determined for each biweekly period. Of the twenty-one collecting periods shown in the tables, six are overlapping pairs; that is to say, each includes one collection from eastern Harvey County and one from the western part of the study area. The average of these pairs was used in computing the yearly average. The yearly average is therefore based upon eighteen separate samples. [Pg 484]

The percentages are weighted toward the food items taken in summer and autumn, since many biweekly periods in late winter and early spring are not represented. Of the collecting periods represented, two were in spring, six were in summer, seven were in autumn, and three were in winter. Pellets collected at a number of different localities are averaged together as a percentage; consequently the figures obtainable do not necessarily represent the diet of any one group of crows. Nevertheless the percentages obtained by this method are perhaps valid as a general indication of the diet of the crows in this area.

In my samples, plant material amounted to 69 per cent of the indigestible residues. Similar percentages have been found in other studies, ranging from 57 per cent (Barrows and Schwarz, 1895:72) to 71.86 per cent (Kalmbach, 1918:43). The percentage of plant material was highest in the winter. In one collection from a wintering crow roost it amounted to 99.5 per cent. In December in eastern Harvey County it averaged only 85.3 per cent. The lowest percentage (20) was found in the first half of October in eastern Harvey County when grasshoppers amounted to more than half the diet. At this same time pellets collected from the wintering roosts contained 72.4 per cent plant material.

Percentages of the chief items in the total food residues, and (in parentheses) number of sampling periods in which each item was represented, are shown in the following list: wheat 23.2 per cent (20), sorghum 15.2 (16), oat 7.8 (8), sunflower 7.2 (8), corn 5.4 (12), brome 4.2 (5), other grass 2.4 (7), cherry 1.2 (2), beetle 13.3 (21), grasshopper 9.3 (19), ant .7 (3), miscellaneous insect .2 (2), mammal 2.6 (19), bird .8 (1), eggshell .5 (3), snake .1 (2), fish .9 (9), crayfish 2.4 (12), snail .2 (9).

Wheat is the "staff-of-life" of the crows in south-central Kansas and the percentage recorded in the diet in my study is much higher than the percentages found by other investigators. Wheat, being the principal crop in this area, was a readily available food. The fluctuations in the use of wheat were due to fluctuations in the availability of other foods that were preferred. In eastern Harvey County wheat consumption was 35.7 per cent of the diet in the latter part of July, and 49.1 per cent in December. [Pg 485]

Consumption of wheat was high (34.4 per cent) during the harvest in June. However, this does not indicate serious damage since the crow population at this time was low, and much of the wheat eaten probably was shattered waste grain. When plowing began, wheat consumption was much reduced. At the time wheat was sown, September 10 to October 15, consumption was average to low.

In western Harvey County wheat was less important in the diet of wintering crows. After reaching a peak (22.7 per cent) in October, just after sowing, it steadily decreased, varying from 6.9 per cent to none in December.

The wheat consumption of crows has little significance economically. No instances of damage were reported to me either at the time of harvest or at the time of sowing. Although crows undoubtedly do eat wheat from newly sown fields, this utilization seldom damages the stand. No evidence of pulling young wheat was found. Most wheat eaten was waste grain.

Grain sorghum was the staple food of the wintering crows. In eastern Harvey County, where sorghum is not an important crop, its consumption began in August, reached a peak in the last part of November, and fell off sharply in December. The grain sorghum crop is vulnerable to damage by crows and it is ripening in the autumn as the crow population is building up. In certain areas and certain years the loss may be important. An exceptional instance was reported to me of crows taking 40 per cent of the crop from a small field of early ripening sorghum near a roost. Most farmers and county agents interviewed thought that the over-all damage was not great. The crop is usually combined and little remains in the fields after October, when the majority of wintering crows arrive. Nevertheless, even waste grain picked up after harvest should be counted as a loss on some farms where stock are turned in to clean up such grain.

Oats were taken sparingly as waste grain in summer, autumn, and winter, and most were eaten in late winter and early spring from newly sown fields (37.2 per cent of the February diet and 72.6 per cent of the April diet). These percentages were probably high, since there is a high proportion of indigestible residues in oats. This is more than compensated for in the yearly average by the paucity of collections made in the period when consumption of oats was highest. [Pg 486]

Fields newly sown to oats provided a major supply of food in the early spring when other food supplies had been depleted. However, no instance of damage to a stand of oats was reported to me. Aldous (1944:294) mentioned that crows fed on spring-sown oat fields in Oklahoma but suggested that they picked up only grain which was not covered.

Sunflower seeds, although not important as a food of the crows in eastern Harvey County, were a staple food of these wintering in the western part of the study area. Consumption of sunflower seeds began in September. In the latter part of December the percentage increased and many pellets were composed entirely of sunflower seed hulls. Sunflower seeds have a high percentage of indigestible residue.

In both popular accounts and scientific studies, the economic significance of the consumption of weed seeds such as those of sunflowers by birds often has been interpreted in an oversimplified manner. It has been assumed that if crows eat several million sunflower seeds in the winter, the sunflowers growing in the farmers' fields the next year will have been reduced by the same number. However, like most annual plants, sunflowers produce a great surplus of seeds each year. Most of the seeds consumed by crows would never have a chance to grow to maturity, even if they were not eaten. Therefore this component of the crow's diet is only slightly beneficial or neutral for the farmer. The effect of crows (or of the entire bird population for that matter) upon the sunflower crop in the farmers' fields is probably slight.

Corn is one of the preferred foods of crows, but little corn was grown in the study area. Other investigators have found higher percentages elsewhere. In eastern Harvey County corn reached its highest point in December but was insignificant in the diet. In the western part of the study area it made up a larger percentage of the diet of wintering crows. The corn eaten early in the season was undoubtedly from the standing crop. However, most of that picked up in late autumn and in winter was waste grain. Since little corn was shocked and left in the fields, there was less opportunity for damage. The amount of corn pulling at planting time was not determined, since no pellets were collected then. However, the population of crows at that time was low. I received no complaints of such damage to corn nor of significant damage to the corn crop at other seasons. [Pg 487]

There were pastures of brome grass in the area under study in eastern Harvey County, and the seeds seemed to be a preferred food, constituting a major food supply for the crows in the latter part of July and the first part of August. Having a high content of indigestible residues they probably showed up in the pellets in percentages out of proportion to their importance in the diet. They were unimportant in the diet of wintering crows in the western part of the study area. This component of brome grass in the diet was economically of little significance in the study area, although it could be of significance where brome grass seed was being harvested.

Cherries were recorded only in June and only from one family of crows in eastern Harvey County; cherry orchards are few in this area. The damage done by the crows in the cherry orchard was slight, since only a few crows fed there.

Weed seeds such as those of spurge (*Euphorbia*), ragweed, and pigweed were found in trace amounts in the diet of the crows. However, they were not preferred foods, since they were available in large quantities.

Wild fruits such as grape and pokeberry also showed up in trace amounts. Elsewhere, investigators have found wild fruit forming a major source of food in winter. However, it was not readily available in this area.

Plant fibers and seeds unidentifiable with the resources at hand formed 2.2 per cent of the residues.

It was reported to me that crows caused damage to watermelons which are extensively grown in the sandhills region but no residues of this crop were found in any pellets collected.

Insects were most important in the animal portion of the food. The economic and ecologic significance of insects in the diet of birds is often oversimplified. The effects of predation upon animal populations are complex, and predation is often a by-product of population rather than a controlling factor.

A female insect eaten before oviposition has a greater ecologic significance than one eaten after she has laid her eggs and is ready to die.

Beetles made up more than half of the insect component of the diet. Scarabaeids were readily recognizable. Other beetles were classified as predaceous or non-predaceous according to the type of mandibles found. When mandibles were lacking the occurrences were listed merely as unclassified beetles, and those made up 5.6 per cent of the yearly food residues. Predaceous beetles made up 3.3 per cent, whereas non-predaceous beetles made up only 1.3 per cent. Both were found in one-half of the collecting periods. Predaceous and non-predaceous beetles formed 1.2 per cent of the yearly food residues. This preponderance of predaceous beetle material is what might be expected from the manner in which crows feed. Many predaceous ground beetles of the family Carabidae would be found under rocks and clods and on the ground.

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Beetles were a constant component of the diet in summer. They reached a peak of 48.7 per cent in the last part of July. In November the percentage declined and by December they formed only 2.5 per cent of the diet.

Scarabaeid beetles were utilized in large quantities when they were most abundant; they made up 28.7 per cent of the diet in the latter part of June. The larvae of scarabaeid beetles are destructive to wheat and alfalfa and live in the ground from one to three years before metamorphosing into adult beetles. Adults emerge from the ground from April to mid-August, the maximum flight occurring in May and June. Most of the eggs are laid from the last of May to the middle of July (Hayes, 1920:306). Afterward the adults soon die. Many of the beetles are nocturnal, but some of the more important destructive forms are diurnal (Hayes, 1918:142). Crows pick up the diurnal forms when they are active and perhaps find the nocturnal forms under clods or in burrows and eat them in ecologically significant numbers.

Crows are beneficial to the farmer insofar as they control the populations of scarabaeids and other non-predaceous beetles. However, destruction of predaceous beetles is harmful to the farmers' best interests.

Grasshoppers, second only to beetles in the insect component of the diet, are among the most destructive insects in Kansas. Eggs laid in autumn overwinter and hatch the next summer, from April to August, depending upon the species. The maximum numbers of grasshoppers are present in late summer and early autumn and they continue feeding on crops until the first killing frost. The greatest damage is caused by the destruction of the foliage of corn, wheat, and alfalfa (Smith, *et al.*, 1943:126). The consumption of grasshoppers closely followed the curve of their availability, since they are a preferred food of the crow. They were picked up in small quantities even in winter. In summer they made up 6 to 10 per cent of the diet of the crows in eastern Harvey County. Through the late summer and autumn this percentage rose, until during the first half of October they made up 59.6 per cent of the diet. However, in the western part of the study area, they constituted a smaller part of the diet.

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Predation upon grasshoppers, especially in summer and early autumn, benefits the farmer by helping to stabilize populations of grasshoppers. However, when grasshopper consumption was highest, in early October, many of those eaten probably already had completed their breeding cycle, and their consumption was hence of little significance economically or ecologically.

Ants were consumed only in September and October when they constituted as much as 14.9 per cent of the diet. Crows may make an entire meal from a large colony; at any rate, whenever ants were found in a pellet, they constituted a large percentage of it.

Miscellaneous insect remains constituted two-tenths of one per cent of the yearly diet. Hemipteran remains were present only in trace quantities (.5 per cent of the July 13-26 sample from eastern Harvey County).

Only a few questionable fragments from insect larvae were found in the pellets collected in the course of this study. However, as mentioned earlier, there is evidence that larvae constituted a major food supply during much of the summer.

Many investigators have found that crows feed on grubs and caterpillars (Aldous, 1944; Alexander, 1930; Lemaire, 1950; Kalmbach, 1918; Barrows and Schwarz, 1895). A number of county agents with whom I had correspondence mentioned that crows aided the farmer in this way. More investigation is required to determine the significance of crow predation upon insect larvae in this area. Most of the bone material recorded was fragmentary. Phalangeal or podial elements of rodents and various bones of rabbits were identified. The only teeth identified were those of the genus *Rattus*. Barrows and Schwarz (1895:24-25) found that small bones of mammals may be completely ground up and digested by the crow. Hence the amount of food furnished by mammals, either alive or as carrion, may be higher than my figures indicate.

Bones of birds were found in only one pellet, obtained in early July. However, few pellets were collected in the nesting season.

The eggshell occurring in the pellets probably was indicative of extensive feeding on dumping

pellets	9	7	6	19	18	5	57	29	27	24	25	7	8
No. of collections	1	4	4	4	4	2	5	4	4	3	5	1	2
wheat	18.2 (90-5)	34.4 (99-50)	1.7 (10)	35.7 (80-10)	28.5 (80-5)	29.0 (55-20)	23.4 (100-5)	21.5 (100-5)	10.8 (60-15)	35.4 (85-10)	33.0 (80-35)	43.7 (98-30)	49.1 (98-20)
sorghum					2.0 (35)		10.7 (90-10)	14.0 (75-5)	7.6 (60-3)	24.4 (85-5)	24.7 (100-10)	28.6 (80-5)	6.9 (40-15)
oats	72.6 (99-50)			1.6 (30)									
sunflower seed												6.4 (40-5)	
corn										4.5 (50-10)	4.0 (80-10)	1.4 (10)	15.0 (70-50)
grass seed				.5 (5)	44.6 (90-60)	28.6 (85-5)	4.8 (70-5)						
grape							.1 (2)						
cherry		20.1 (70-20)	1.7 (10)										
spurge			.8 (5)	.1 (2)						.2 (5)			
misc. plant				1.6 (30-10)	5.2 (95)			4.4 (90-40)	1.6 (45)	2.1 (50)	5.5 (75-10)	2.9 (20)	14.3 (70-45)
TOTAL PLANT	90.8	54.5	4.2	39.5	80.3	57.6	39.0	39.9	20.0	66.6	67.2	83.0	85.3
scarabaeid beetle		28.7 (75-25)	5.0 (30)										
other beetle	2.7 (10-5)	.1 (3)	34.2 (100-20)	48.7 (90-10)	10.0 (90-10)	21.0 (45-10)	19.0 (80-5)	10.6 (95-5)	15.5 (98-1)	13.9 (70-5)	14.4 (65-5)	5.3 (15-2)	2.5 (20)
grasshopper		.1 (2)	6.6 (40)	10.9 (40-5)	4.2 (40-5)	15.0 (30-5)	23.4 (100-5)	36.3 (95-5)	59.6 (90-34)	11.8 (65-5)	14.3 (99-5)	10.3 (65-2)	4.4 (10-5)
ant							5.9 (90-75)						
misc. insect							1.9 (50-5)	2.8 (60)					
crayfish	.5 (5)	1.5 (10)	35.0 (100-10)		.6 (10)	1.0 (5)	1.2 (25-10)	.2 (5-2)	.4 (5-2)	1.4 (20-10)			
snail					.6 (10)		.6 (10-2)	1.3 (20-5)	trace (1)	1.1 (10-5)	.2 (5)		
fish				.1 (7)		.1 (5)	4.8 (20-5)	7.3 (20.5)	2.5 (20.1)	3.4 (20-5)	.6 (10-5)		
bird			15 (90)										
eggshell				.3 (5)	.6 (10)	3.0 (10-5)	2.0 (30-5)	1.1 (10-5)	.4 (1)	.2 (5)	.8 (20)	.7 (5)	
mammal	6 (45-10)	15.1 (100-5)			3.7 (50-5)	1.4 (5-2)	2.2 (60-2)	.5 (5)	1.6 (20-2)	1.6 (10-5)	2.5 (20-1)	.7 (5)	7.8 (25-2)
TOTAL ANIMAL	9.2	45.5	95.8	60.5	19.7	42.4	61.0	60.1	80.0	33.4	32.8	17.0	14.7

TABLE 2. FREQUENCIES OF OCCURRENCE OF FOOD RESIDUES IN PELLETS COLLECTED IN THE

EASTERN PART OF HARVEY COUNTY—1953.

	April 6-19	June 15- 28	June 29-July 12	July 13- 26	July 27- Aug. 9	Aug. 10- 23	Sept. 7-20	Sept. 21-Oct. 4	Oct. 5-18	Oct. 19- Nov. 1	Nov. 2-15	Nov. 16- 29	Nov. 30-Dec. 13
No. of pellets	9	7	6	19	18	5	57	29	27	24	25	7	8
wheat	6	3	1	18	16	4	27	12	10	15	13	4	6
sorghum					1		20	12	10	12	12	4	2
sunflower seed												2	
oats	8			1									
brome grass				2	10	4							
corn									3		3	1	2
cherry		3	1										
grass seed							11						
spurge			1	1					1				
grape							1						
misc. plant beetle (scarabaeid)		4	1										
beetle (other)	4	1	4	19	5	5	39	15	17	16	14	4	1
grasshopper		1	1	12	6	5	39	22	24	12	18	3	6
ant							4						
bug (hemipteran)				1									
misc. insect							3	1					
crayfish	1	1	3		1	1	3	2	2	2			
snail					1		7	4	1	4	1		
fish				2		1	28	14	7	7	2		
bird			1										
eggshell				1	1	2	10	5	8	1	1	1	
mammal	2	2			4	2	8	3	5	5	8	1	5

TABLE 3. AVERAGE, MAXIMUM, AND MINIMUM PERCENTAGES OF FOOD RESIDUES IN PELLETS COLLECTED AT WINTERING CROW ROOSTS IN THE WESTERN PART OF THE STUDY AREA—1952-53-54.

[Pg 495]

	Dec. 28-Jan. 11	Aug. 24- Sept. 6	Sept. 7- 20	Oct. 5- 18	Nov. 16- 29	Dec. 14- 27	Dec. 28-Jan. 10	Feb. 8- 21
Number of pellets	62	5	38	65	56	22	96	32
No. of Collections	1	1	1	1	3	1	1	1
wheat	6.9 (100-10)	62.8 (99-35)	14.6 (90-10)	22.7 (90-10)	2.2 (95-10)		3.3 (90-30)	2.8 (50-10)
sorghum	29 (100-5)	1 (5)	22.4 (95-5)	31.2 (100-10)	41.2 (100-5)	42.5 (100-5)	32.4 (100-10)	21.6 (100-10)
sunflower seed	26.3 (90-5)		3.3 (95-5)	5.0 (60-10)	26.9 (95-3)	22.0 (90-5)	32.4 (100-5)	21.6 (80-10)
corn	11.4 (100-10)	19.0 (40-15)	12.4 (95-5)	4.5 (85-30)	14.0 (100-5)	11.4 (100-10)	14.1 (100-5)	1.2 (20-10)
oats	14.1 (100-10)			4.9 (80-15)	5.7 (70-5)	5.5 (75-5)	4.6 (95-5)	37.2 (100-10)
brome grass	1.4 (85)						.1 (10)	
Other Grass	9.4 (95-5)			3.2 (80-20)	4.0 (90-10)	15.7 (95-10)	8.8 (100-10)	6.3 (50-20)
grape			trace (2)				.1 (10)	
pokeberry			.4 (15)	.5 (30-2)				
spurge				.4 (25)			.2 (10-1)	
					.1		.5	.2

ragweed				(5)		(10-5)	(5)
misc. plant	1	.8				.8	.2
	(50-1)	(30)				(80-2)	(3-2)
TOTAL PLANT	99.5	82.8	53.9	72.4	94.1	97.1	97.4
grasshopper	.1	6.0	8.9	10.5	1.4	.5	.3
	(5)	(30)	(30-5)	(70-5)	(15-5)	(15-5)	(5)
beetle	.1	9	17.8	12.1	1.7	.9	.4
	(5)	(15-10)	(95-2)	(80-3)	(15-2)	(10-5)	(10-5)
			14.9	3.4			
ant			(95-73)	(85-5)			
crayfish			.7	.8		.5	
			(10-5)	(50)		(50)	
snail	.1				.1	.1	
	(5)				(5)	(5)	
fish			.1			.1	
			(5)			(5)	
snake			1.8			.9	
			(60-5)			(20)	
eggshell					.3	.4	.6
					(10-5)	(10)	(10-5)
mammal	2	2.2	1.9	.8	2.4	.7	.4
	(10-5)	(5-1)	(20-5)	(10-5)	(60-5)	(10-5)	(10-5)
TOTAL ANIMAL	.5	17.2	46.1	27.6	5.9	2.9	2.6

TABLE 4. FREQUENCIES OF OCCURRENCE OF FOOD RESIDUES IN PELLETS COLLECTED AT WINTERING CROW ROOSTS IN THE WESTERN PART OF THE STUDY AREA—1952-53-54.

[Pg 496]

	Dec. 28-Jan. 11	Aug. 24-Sept. 6	Sept. 7-20	Oct. 5-18	Nov. 16-29	Dec. 14-27	Dec. 28-Jan. 10	Feb. 8-21
Number of pellets	62	5	38	65	56	22	96	32
wheat	11	5	10	27	3		5	4
sorghum	45	1	22	36	44	16	74	18
sunflower seed	43		5	12	32	9	68	19
corn	14	4	11	5	12	8	27	3
brome grass	1						1	
other grass	15			5	5	7	15	5
grape			1				1	
pokeberry			1	2				
spurge				1			5	
ragweed					1		8	1
misc. plant	4		1				2	2
grasshopper	1	1	23	38	10		5	2
beetle	1	4	38	48	15	3	6	4
ant			7	6				
crayfish			3	1			1	
snail	1				1		1	
fish			1				1	
snake			2			1		
eggshell					2	1	9	3
mammal	2	3	5	7	10	2	5	1

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