

## THE CRUSHING OF *CARYA* NUTS IN THE GIZZARD OF THE TURKEY

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It is well known that the Wild Turkey (*Meleagris gallopavo*) feeds avidly on wild pecans, swallowing the nuts entire. In 1890 Geombeck, writing from Arkansas, doubted that it was generally known that turkeys feed on hickory nuts on which they become very fat. Webb (1941) in his study of the winter food of the Wild Turkey in Alabama (based on 38 crops and gizzards) reported that 2.95 per cent consisted of the fruit of hickories (*Carya* spp.). The spring foods (based on 116 crops and gizzards) consisted of 2.61 per cent of the fruits and flowers of hickory and pecan (Good and Webb, 1940). Martin (1951) lists the hickory as furnishing a winter food for turkeys in the southeast. A. L. Nelson kindly examined the original food cards at the Patuxent Research Refuge. Occasionally the pecan was mentioned, but in the great majority of cases the identification was generic. During the severe winter of 1946-1947 in West Virginia, Glover (1948) reported that on two areas Wild Turkeys had eaten hickory nuts that were over a year old. Having personally never found in the wild a sound hickory nut of this age, I wrote to R. Wayne Bailey for further information. He replied that Glover's statement was probably based on observations of turkeys scratching under hickory trees, and that he had never found a viable nut over a year old. He added: "There is no question about turkeys eating good hickory nuts. We have seen them in crops and in droppings. Generally, they eat those that squirrels have opened."

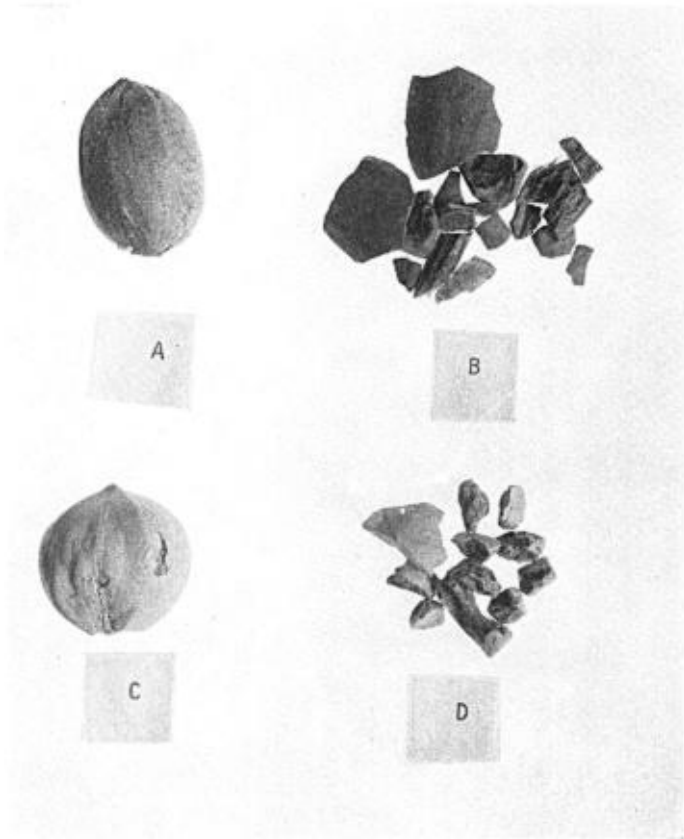
Over two centuries ago, Réamur (1756), in his experiments on avian digestion, forced English walnuts (*Juglans regia* L.) down the throat of a domestic turkey. Beginning with one nut, the number was gradually increased until the dosage numbered 24. Even this large number left the crop within 24 hours, as determined by palpitation. He stated that the nuts were of the ordinary size, some being very large. If their size was comparable to that of the nuts found in the market today, it is quite remarkable that the gizzard could handle 24 of them in as many hours. Until visiting a country home in France, Trebeden (1902) did not know that it was customary to fatten turkeys by force-feeding the entire walnut.

The main objective of my experiments was to determine the length of time that pecans and hickory nuts remained in the gizzard before

being crushed. The experiments were conducted with 16-month-old female domestic Broad-breasted Bronze turkeys. The temperament of the wild bird is such as to make it a poor subject for experiments of this nature. The preliminary work was done with a 14-month-old gobbler to determine the approximate length of time that the nuts required for comminution. Holes 2 mm. in diameter were bored through the shell of the nuts, part of the kernel removed and the cavity filled with a dye. Both methylene blue and crystal violet were employed. The opening was plugged in some cases with nitrocellulose lacquer, in others with a hydrocarbon of high melting point, care being taken that the plugs extended well below the inner surface of the shell. The methylene blue was destroyed in the process of digestion, but the crystal violet appeared in the feces unchanged. The fragments of shell in the latter were so small as to be scarcely detectable. A gelatin capsule containing crystal violet was given to the turkey at 9:20 A.M., and the dye appeared copiously in the feces at 1:00 P.M. Using pecans (*Carya pecan*) containing crystal violet, a nut administered at 8:35 A.M. showed some dye in feces at 12:20, but the color was not intensive until 3:00 P.M. In the case of similar experiments with the nuts of the shellbark hickory (*Carya ovata*), the earliest appearance of dye in the feces was 10 hours. It became apparent that the data were unreliable and that the plugs were being forced into the nuts by the gravel or other inert materials in the gizzard, thereby permitting escape of the dye long before the nuts were crushed.

It was found that if a nut was given to the bird when the crop was completely empty it passed almost immediately into the gizzard, as shown by palpation; however, if there was food in the crop the time of passing to the gizzard varied. Accordingly, the birds were not fed during the 24 hours preceding the experiments. It was apparent that no reliable data could be obtained except by killing the turkeys at intervals after the force-feeding of the nuts. I will here express my great thanks to Professor Frank L. Chermis, Department of Poultry Husbandry, University of Wisconsin, who not only provided 15 turkeys but killed and dressed them so that the gizzards could be examined. This cooperation removed the difficulty to be encountered in working with commercial poulterers.

The wild pecans used came from Throckmorton County, Texas, and averaged 2.5 cm. in length by 1.5 cm. in width. On account of their thicker shell, they were used in place of the larger and thinner-shelled wild pecans supplied from Kerr County, Texas, by Colonel L. R. Wolfe. The hickory nuts, collected in Dane County, Wisconsin, aver-



**Figure 1. A. Natural pecan. B. Pecan after remaining in the gizzard one hour. C. Hickory nut showing incipient fracture. D. Hickory nut after remaining in the gizzard for 31 hours.**

aged 2 cm. in length and 2 cm. in greatest width. Their crushing strength was determined at the Forest Products Laboratory, using 14 nuts of each species of *Carya* selected for uniformity in size and shape. The pressure, in pounds, is merely the load required to fracture the nut. The results are given in the following table:

		<i>Pressure in Pounds</i>	
		<i>Parallel to suture</i>	<i>Perpendicular to suture</i>
Hickory Nut	Range	124-202	198-336
	Average	167	257
Pecan	Range	42.5-96	60-110
	Average	66	79

The above data show great variability in crushing strength of apparently identical nuts and explain in part the lack of uniformity in crushing obtained in the gizzard.

Check experiments showed that pecans were crushed after remaining in the gizzard for one hour (Figure 1). Pecans recovered after periods of one-half and three-fourths of an hour in the gizzard were unchanged. In two experiments hickory nuts were crushed in 30 and 32 hours, respectively; however, in two other experiments lasting 30.5 and 31 hours the hickory nuts showed wear on the surfaces but no fractures. The pecans are crushed without apparent wear, but this is not the case with hickory nuts. The muscular action of the gizzard combined with the gravel grinds the surface of the nut, smoothing of the ridges of the latter being conspicuous, until a small cavity is formed by forcing the shell inward. One nut recovered after six hours had a cavity 1 x 3 mm., and another, after eight hours, a cavity 3 x 6 mm. (see Figure 1). There is no reason to believe that the disintegration of the nuts is other than mechanical. While it might be expected that the nuts would separate at the suture, this is not the case. Hickory nuts kept in water at room temperature for 30 days showed no weakening at the suture.

The times required to crush the nuts, one hour for pecans and 30 to 32 hours for hickory nuts, must be accepted as only approximate. The experiments were conducted with domestic female turkeys accustomed to soft foods and having a less powerful gizzard than the males. The wild birds, accustomed to harder foods, might crush the nuts in a shorter time. Two factors are important in preventing duplication of results: (1) the great variation in resistance to fracture of nuts, over which there can be no control; (2) the "psychological" condition of the turkey. A pecan, recovered after seven hours in the gizzard of one hen,

though showing considerable smoothing, was still intact. Ligon (1946) mentions seeing some old Merriam's Wild Turkeys, trapped with full crops, so badly frightened that digestion ceased entirely, the birds eventually dying.

It is yet to be proved that the Wild Turkey will eat the ordinary hickory nut in any quantity. If it does, it may select the bitternut (*Carya cordiformis*), the thin shell of which is not much more resistant to crushing than that of the pecan. An attempt over a period of two weeks to condition a male turkey to eating pecans and hickory nuts failed. When the cracked nuts were offered, the loose meats were eaten, but rarely if a piece of the shell remained attached.

In addition to the assistance rendered by Professor Chermis, Charles B. Norris made arrangements for the mechanical tests.

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