FOOD HABITS OF BIG BROWN BATS *(EPTESICUS FUSCUS)* IN SIOUX FALLS, SOUTH DAKOTA

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ABSTRACT

Food habits of *Eptesicus fuscus* in Sioux Falls, South Dakota were described. Six hundred and twenty bats were collected from the South Dakota Department of Health in 2000 and 2001. Of these 620, only 56 bats had identifiable contents in the stomach. The stomach contents were examined with a dissecting microscope and insect parts were identified by comparing the contents to a reference collection of insects collected in South Dakota (Borror and White, 1970). Four orders of insects were identified: Coleoptera (beetles), Hemiptera (true bugs), Diptera (flies) and Lepidoptera (moths). Carabidae (ground beetles) occurred at an occurrence frequency of 29.1%, followed by unidentifiable insects (18.2%), Lepidoptera (12.2 %), unidentified Coleoptera (7.3%), Pentatomidae (stinkbugs) (7.3%), Diptera (1.8%), and hairballs (5.3%).

Keywords

Big brown bats, food habits, South Dakota, Department of Health, Coleoptera, Lepidoptera, Pentatomidae, Diptera, stomach contents

INTRODUCTION

All bats that reside in eastern South Dakota are insectivorous (Nowak, 1994). Knowing what insects these bats prey upon is an important step towards bat conservation. Dietary studies of bats are important because these animals devour agricultural pests such as corn root worm beetles *(Diabrotica* spp.) (Whitaker, 1995), which are one of the most serious crop pests in the United States (Krysan and Miller, 1986). If studies can show that bats consume enough of these agricultural pests to make a significant impact, then bats can possibly be considered as a biological control agent, deserving further conservation efforts.

In particular, ground beetle (Carabidae) parts were found in greater frequency than other families of insects (Whitaker, 1972). *Eptesicus fuscus* have large powerful jaws that allow them to feed more effectively on the hard bodies of beetles (Freeman, 1981). In northeastern Kansas, Scarabaeidae (scarab beetles), Carabidae (ground beetles), and Pentatomidae (stink bugs) were found in the stomachs of E. fuscus (Phillips, 1966). In Indiana, Scarabaeidae, Carabidae, and Pentatomidae were found in the stomachs of E. fuscus, along with Formicidae (ants), Ichneumonidae (ichneumon wasps) and Lepidoptera (moths) (Whitaker, 1972).

In 2000 and 2001, over 600 bats were collected throughout the state for rabies testing (South Dakota Animal Disease Research and Diagnostic Laboratory Report, 2000). A majority (98%) of the submitted bats were E. fuscus collected from Sioux Falls, Minnehaha County. After testing, the carcasses are usually destroyed. However, during 2000 and 2001, all bats that tested negative for rabies were saved and stomach contents of these E. fuscus were documented to formulate a baseline for the diet of E. fuscus in South Dakota.

MATERIALS AND METHODS

In 2000 and 2001, 620 bat carcasses were received by the Animal Disease Research and Diagnostic Laboratory at South Dakota State University for rabies testing. After testing, the rabies negative carcasses were transferred to our lab. Measurements such as forearm length, total length, ear length, tail length, total body length, mass, and sex and reproductive condition were taken on each carcass. Then, if any insect remains appeared in any of the stomachs, the stomachs were removed and the contents were identified.

Of the 620 bats, only 56 proved to have any stomach contents. These stomachs were preserved in plastic vials with 75% ethanol until analysis could be performed. Analysis consisted of identifying the stomach contents with a dissecting microscope. Each stomach was removed from its storage container and weighed on an assay scale (± 0.01 g). Then, the stomach was carefully cut open and placed inside a petri dish. The contents were bathed with 75% ethanol until all were removed from the lining of the stomach.

Once all the contents were contained with the petri dish, it was placed underneath a dissecting microscope and any identifiable insect parts were removed. Each petri dish of stomach contents was examined twice, a first sweep to remove any identifiable parts and a second sweep to verify that all applicable parts were removed. These sweeps were performed at different times so as to decrease the amount of human error from eyestrain. All insect parts were compared to a reference collection I made of insects collected in South Dakota. Individual insects from the collection were dissected into smaller parts in order to identify the stomach contents to order, and if possible to family.

RESULTS

Of the 56 stomachs, the contents of 20 stomachs were so mechanically broken down that nothing could be identified. Ten of these were taken from bats in April-September (Table 3.1) and were completely empty. These bats may have been captured after they had already completed the digestive processes, leading to an empty stomach or during the hibernation period when bats are not eating. Stomachs with identifiable contents were taken from bats captured in January through October (Table 3.1).

Of all the identifiable insects parts, over 90% were legs and tarsi, the remaining 10% being pieces of the body cuticle or wings. The mechanical breakdown of the contents by the stomach reduced the ability to accurately identify all the insect parts. Most of what was left either consisted of small anatomical parts such as fragments of a femur, a few segments of antennae, or something totally unidentifiable that looked like insect mush.

Table 3.1: Number of stomachs collected by month, and percentages of identifiable, empty and unidentifiable contents (Department of Health bats from 2000 and 2001)

Month	Number of Bat Stomachs	% Identifiable	% Empty	% Unidentifiable
January	1			100
April	3	33	33	33
May	1		100	
June	7	71	29	
July	7	72	14	14
August	30	74	13	13
September	3	33	33	33
October	3	67		33
November	1			100

Eptesicus fuscus is thought to stop feeding for the year around late October and doesn't feed during the hibernation period (November-March). In Indiana, Whitaker (1972) examined the stomachs of 11 bats during the third week of October and only found one with a full stomach; only one of 178 bat stomachs collected during the hibernation period held any contents. Similarly in South Dakota, only two stomachs with identifiable material were collected in October and only two stomachs collected during the hibernation period held any contents. The stomach contents from the remaining hibernating bats were unidentifiable and looked like they had been in the digestive tract for a long time based on the discoloration and digestion of the material.

Four orders of insects were identified in the stomach contents of E. fuscus from South Dakota: Coleoptera (beetles), Hemiptera (true bugs), Diptera (flies) and Lepidoptera (moths). Of these, the family Carabidae (ground beetles) occurred at a frequency of 29.1%, followed by unidentifiable insects at 18.2%, Lepidoptera at 12.2 %, unidentified Coleoptera at 7.3%, Pentatomidae (stinkbugs) at 7.3%, hairballs at 5.3% and Diptera at 1.8% (Table 3.2). These insects were identified by the size, shape, or design pattern of different anatomical parts. The anatomical parts used to identify the insects to family or order were: tarsi and tarsal claws for Carabidae; tibia and tarsal claws for Lepidoptera; the veins in the wings for Diptera; tarsi and the spotting design on the legs for Pentatomidae; and by elytra or the presence of a hard outer cuticle for unidentified Coleoptera (Borror and White 1970).

Table 3.2: Frequency and percents of stomach contents from all months, South Dakota Department of Health bats, 2000-2001

Insect	Frequency	Percent
Carabidae (ground beetles)	16	29.1
Empty	10	18.2
Unidentifiable insects	10	18.2
Lepidoptera (moths)	7	12.2
Unidentifiable Coleoptera (beetles)	4	7.3
Pentatomidae (stinkbugs)	4	7.3
Hairball	3	5.5
Diptera (flies)	1	1.8

DISCUSSION

Based on the contents of the few stomachs taken from South Dakota Department of Health bats during 2000-2001, E. fuscus does not feed during the winter (November-March) and stops feeding sometime around late October. When feeding does resume in April, Carabidae beetles were consumed more often than other types of insects, similar to the results of a dietary analysis of E. fuscus from Indiana (Whitaker, 1972).

Only the percentages of coleopterans in the stomach contents of South Dakota bats were similar to other studies (Whitaker, 1972, 1995; Phillips, 1966; Hamilton, 1933). Otherwise, the frequencies of insects varied among the diets of E. fuscus in South Dakota to other studies. The percentages of lepidopterans were higher (12.2%) in the South Dakota bats than any other study.

Seasonal variation of insect abundance may account for some of the variability. In Indiana, coleopterans are not quite available in early spring, so bats seemed to rely on other orders. On April 2, lepidopterans made up 12.7% and dipterans 9.1% of the feces collected in the maternity colonies; while on May 3, coleopterans made up almost 100% (Whitaker, 1995). Analysis of the stomach contents of the bats from South Dakota did not reveal any preference of insects by season but most of the stomachs (80%) were collected from bats during the summer season (May-August), thereby limiting my analysis of seasonal trends in food choice.

Much more information is needed on the feeding habits of bats in South Dakota. Continued analysis of the stomach contents of bats collected from the Department of Health will add to the meager knowledge presented here. Also, collecting insects over the spring, summer, and fall seasons and correlating those collections with stomach content analysis may discover a seasonal variation to the diets of E. fuscus and show which insect orders are selected over others.

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