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FOOD HABITS OF RAFINESQUE'S BIG-EARED BAT FROM FLORIDA

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ABSTRACT: *As in Kentucky and North Carolina, Rafinesque's big-eared bat,* Corynorhinus rafinesquii*, at the southernmost known colony which is in Osceola County in central Florida fed primarily on moths throughout much of the year, although they ate a few other insects, mainly flies and beetles. Nearly all of the moths were noctuids. Several calliphorids were eaten, and it is possible that the bats caught them in the roost.*

Key Words: bats, *Corynorhinus*, food, insectivorous bats, moths

BATS of the North American genus *Corynorhinus* appear to be moth specialists (Ross, 1967; Whitaker et al., 1977, 1981; Dalton et al., 1986; Clark, 1991; Sample and Whitmore, 1993; Hurst and Lacki, 1997; Burford and Lacki, 1995). The only previous studies of foods eaten by Rafinesque's big-eared bat, *Corynorhinus rafinesquii*, include those of Clark (1991), Hurst and Lacki (1997), and Lacki and Ladeur (2001) from Kentucky and North Carolina. Data from these papers indicate that Rafinesque's big-eared bat primarily feeds on moths during spring, summer and fall. The purpose of this study was to determine the food habits of *C. rafinesquii* some 800 km to the south from Florida in the southernmost known colony of this species.

MATERIALS AND METHODS—Fecal pellets were collected from under a colony of *Corynorhinus rafinesquii* in a large abandoned mobile home and associated shed located near Reedy Creek on the Osceola/Polk county line in central Florida. This site is one of only four maternity colonies of this species known in Florida, and is the southern-most known population of the species throughout its range (Finn, 2000). Bats roosted at multiple sites in rooms of the trailer and in a small shed built as a bat roosting area. Only fresh pellets were collected and they were collected only from under where bats were roosting at the time. Pellets were collected in multiple plastic bags on the various dates, depending on how many places the bats were roosting. Fifty pellets per bag were examined except when less than 50 were present in a bag. Samples (number of pellets in parentheses) were collected on 3 November 2002 (n = 150); 8 December 2002 (50); 12 January 2003, 15 January 1996, and 20 January 1999 (50 each); 3 February 2003 (118); 2 March 2002 (28); 3 March 1995, 16 March 1996, and 29 March 1995 (50 each); 22 April 1996 (100); 9 May 1995 (50); 3 (100), 10 (50), and 28 September 1995 (50); and 10 October 1996 (100). In addition to fecal pellets, 251 culled wings of lepidopterans, plus a few other wings – Neuroptera (2), Coleoptera (1), Odonata (2), Diptera (2),

and Hymenoptera (1) – were collected on 4 dates, January through April, from beneath the roosts in the mobile home and identified by CLS.

Each prey item in a pellet was identified by JOW to the lowest taxonomic level possible and its percent volume visually estimated. Data were summarized by percent volume (sum of volumes in individual pellets for each item/sum of total volume × 100; see Whitaker, 1988), which indicates the relative amount of each type of prey in a sample. Percent frequency is the percentage of pellets in which a given food occurs.

RESULTS—The major food of the bats in this sample was lepidopterans. Of the 1096 fecal pellets examined during this study, 1089 or 99.4% of them contained lepidopterans, and 901 or 82% of them contained 100% lepidopterans. Only 7 pellets (0.64%) had no lepidopteran remains. The estimated volume of lepidopteran in the 1096 pellets was 93.7%. The monthly % volume of Lepidoptera varied from 80.1 (April) to 99.7 (February and March).

The second most abundant food by volume was the muscoid fly, apparently Calliphoridae (calliphorids were present, but not all fragments could be clearly identified as belonging to this family), which appeared sparingly through the samples, and totalled 2.2% of the volume. Eighteen other items were present but all formed less than 1% of the volume of food in the samples.

In November, when the percent volume of moths was only 84.2% (Table 1), calliphorid flies formed 15.1% of the total. In April (80.1% lepidopterans), beetles (unidentified and scarabaeid) formed 7.0% and unidentified insects formed 8.4% of the volume.

Insect wings found under the roost were the following: LEPIDOPTERA (total 251): Noctuidae: *Phoberia atomaris* (Hübner), n = 141; *Panopoda repanda* (Walker), n = 28; *Panorpa* sp., probably *rufimargo* (Hübner), n = 27; *Mocis latipes* (Guenee), n = 14; *Catocala* sp., probably *ilia* (Cramer), n = 6; *Metaxaglaea* sp., n = 5; *Metria amella* (Guenee), n = 24; *Catocala* sp. (n = 1); Geometridae: *Oxydia vesulia transponeus* (Walker), n = 1; Notodontidae: *Nadata gibbosa* (Smith), n = 1; *Heterocampa astarte* Doubleday (n = 1); Sphingidae: *Darapsa myron* Cramer (n = 1); and 1 wing, probably Pyralidae. NEUROPTERA (2): Myrmeleontidae: *Glenurus gratus* (Say), 2 forewings; COLEOPTERA (1): Silphidae: *Nicrophorus* sp. probably *N. orbicollis* (Say), n = 1; ODONATA (2): Aeschnidae: *Gynacantha nervosa* (Rambur), n = 2; DIPTERA (2): Tabanidae: *Tabanus* sp. (n = 1); Tipulidae: tipulid sp., n = 1; and HYMENOPTERA (1): *Polistes* sp. (1); Hymenopteran sp., n = 1.

DISCUSSION—In the first study of the food of this species, Clark (1991) collected 19 orders of insects in 22 samples with Malaise traps in her study area in North Carolina. Lepidopterans formed only 6% of the insects in the Malaise samples, but examination of fecal samples from under the maternity roost indicated that lepidopterans formed the majority of the prey.

The first detailed study of food of this species was by Hurst and Lacki (1997) who studied 94 fecal pellets and 86 culled moth wings found in *C. rafinesquii* roosts and feeding shelters in southeastern Kentucky. Seven orders of insects were identified from fecal pellets. Lepidopterans occurred in all

TABLE 1. Percent volume and percent frequency (in parentheses) of prey items of *Corynorhinus rafinesquii* from fecal pellets, from a roost in central Florida.

Taxon	Nov. n = 150	Dec. n = 50	Jan. n = 150	Feb. n = 118	March n = 178	April n = 100	May n = 50	Sept. n = 200	Oct. n = 100	Total % volume
Lepidoptera	84.2 (98.7)	92.4 (100)	98.3 (99.3)	99.7 (100)	97.7 (100)	80.1 (98)	92.2 (98)	97.3 (99.5)	94.6 (100)	93.7 (99.4)
Muscoid fly, apparently a calliphorid	15.1 (39.3)	–	–	–	0.08 (0.8)	0.2 (2.0)	2.6 (8.0)	0.1 (0.5)	–	2.2 (5.5)
Scarabaeidae	0.6 (0.6)	–	–	–	0.1 (1.7)	1.9 (4.0)	–	0.6 (1.0)	–	0.4 (0.8)
Unidentified Diptera	0.2 (1.3)	5.5 (12.0)	1.4 (4.0)	0.3 (1.3)	0.8 (2.2)	–	0.3 (2)	0.3 (2.0)	0.6 (3.0)	0.7 (2.0)
Acarina	trace (0.6)	–	–	–	0.02 (0.08)	–	–	–	–	trace (0.2)
Carabidae	–	1.8 (2.0)	–	–	–	–	–	–	–	0.08 (0.1)
Hemiptera	–	0.2 (2.0)	–	–	0.1 (0.8)	–	0.6 (2)	0.1 (1.0)	0.2 (1.0)	0.09 (0.5)
Unidentified Coleoptera	–	0.1 (2.0)	0.05 (1.3)	–	0.7 (2.2)	7.0 (16)	–	0.3 (1.5)	0.6 (2.0)	0.8 (2.3)
Araneae	–	–	0.1 (2.0)	–	0.2 (0.8)	1.1 (2.0)	0.5 (2)	0.2 (1.5)	2.0 (4.0)	0.4 (0.2)
Unidentified insect	–	–	0.03	–	0.3 (2.5)	8.4 (20.0)	–	–	–	0.8 (2.1)
Vegetation	–	–	–	–	0.1 (0.8)	–	–	–	–	0.02 (0.1)
Gryllidae	–	–	0.10 (1.3)	–	–	–	–	0.2 (0.5)	–	0.04 (0.3)
Formicidae	–	–	–	–	–	–	–	–	0.3 (1.0)	0.03 (0.1)
Ichneumonidae	–	–	–	–	–	–	0.9 (2)	0.2 (0.5)		0.07 (0.3)
Trichoptera	–	–	–	–	–	1.1 (3.0)	3.2 (6.0)	–	–	0.2 (0.5)
Curculionidae	–	–	–	–	–	0.15 (1.0)	–	0.03 (0.5)		0.02 (0.2)
Cicadellidae	–	–	–	–	–	–	–	0.5 (0.02)	–	0.08 (0.5)
Tipulidae	–	–	–	–	–	–	–	0.2 (0.05)	–	0.03 (0.1)
Chironomidae	–	–	–	–	–	–	–	0.2 (0.5)	–	0.03 (0.1)
Cicadidae	–	–	–	–	–	–	–	–	1.8 (2.0)	0.2 (0.1)
Total	100.1	100	100	100	100.1	100	100.3	100.1	100.1	

pellets and comprised over 90% of the food by volume. Coleopterans ranged from 2.5 to 7.8 % of the volume of food and Homoptera 0–0.8%. Other orders represented included dipterans, hemipterans, hymenopterans, and trichopterans but comprised no more than 0.3% in any one sample. Wingspread of moths, based on the culled wing samples, ranged from 20 to 95mm and included 7 species from 5 families. Two taxa, *Deidamia inscripta* (Sphingidae, n = 45 individuals) and *Catocala* sp. (Noctuidae, n = 27 individuals) comprised the majority of the moths in the sample, but 10 other noctuids, 2 arctiids, 1 geometrid and 1 notodontid also occurred.

Lacki and Ladeur (2001) examined seasonal patterns in lepidopteran prey from Powell County, Kentucky, by collecting culled wings at a known roost. Twenty-two species representing six families were identified from 135 culled wings as follows: Noctuidae (58 individuals, including 15 unidentified; 13 individuals *of Panopoda rufimargo*, 6 of *Polia latex*, 6 of *Pseudaletia unipuncta*, and fewer than 6 individuals of 8 other genera and species); Geometridae (33 individuals, including 11 of *Epimecis hortaria*, 8 of *Eutrapela clemataria*, 7 unknown and 5 other species with lower numbers); Notodontidae (15 moths, including 11 specimens of *Nadata gibbosa*); Sphingidae (15, including 14 specimens of *Darapsa* sp.); Arctiidae (13, including 10 specimens of *Halysidota tessellaris*); and Megalopygidae (1).

As in other food habits studies of big-eared bats, the bats in the Florida colony fed primarily on adult moths (Lepidoptera). Moths formed 93.7% of the volume of prey items overall, with 80.1% being the minimum in any one sample. All but 7 of the 1096 pellets examined contained Lepidoptera. It is not possible at this time to identify moths beyond order from pellets, but this bat often culls wings which can be identified. Analysis of the sample of wings from below the roost indicates that most of the lepidopterans being eaten by the bats were noctuids (246 of 251). There was much more variation in lepidopteran families in the studies by the earlier authors. Hurst and Lacki (1997) found mainly 2 families (Sphingidae 45 and Noctuidae) of two species. Lacki and Ladeur (2001) found 5 main families of lepidopterans represented: Noctuidae 58 individuals, Geometridae 33, Notodontidae 15, Sphingidae 15, and Arctiidae 13. Arctiids are eaten in low numbers as many species apparently taste bad. The relatively high volume of dipterans in some of the samples was somewhat surprising. Bats usually forage outside, not in roosts, but flies were common in these roosts and it is possible that the bats obtained these flies inside the roost.

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