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A STUDY OF THE HOME LIFE OF THE BROWN THRASHER, *TOXOSTOMA RUFUM*. (Linn.)

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Introduction.

The observations on which this paper is based were made during the summer session, 1911, of the Iowa Lakeside Laboratory, on Lake Okoboji, Iowa. The plan followed was that first successfuly employed by Prof. F. H. Herrick, namely, of erecting a blind at the nest and studying the birds at close range. The aim of the work was to record the feeding activity for several consecutive days, particularly from the economic standpoint.

The problem was suggested by Prof. T. C. Stephens, of Morningside College, to whom I wish to express my gratitude for much help and many valuable suggestions in carrying on the work and in preparing this report. I also wish to thank Prof. T. H. MacBride for the opportunity of attending this session of the Laboratory. The plan could not have been carried out without the help given by the workers in the Laboratory, and to the following persons particularly my thanks are due for assistance in carrying out the study: Miss Hochstetler, Miss Mae Gittens, Miss Gladys Price, Miss Mildred Sykes, Miss Idylene Tovey, Miss Harriet Wilson, Miss Alice Yocum, and Mr. A. H. Schatz. My thanks are due Miss Pearl A. Woodford, of Morningside College, for help in preparing this paper.

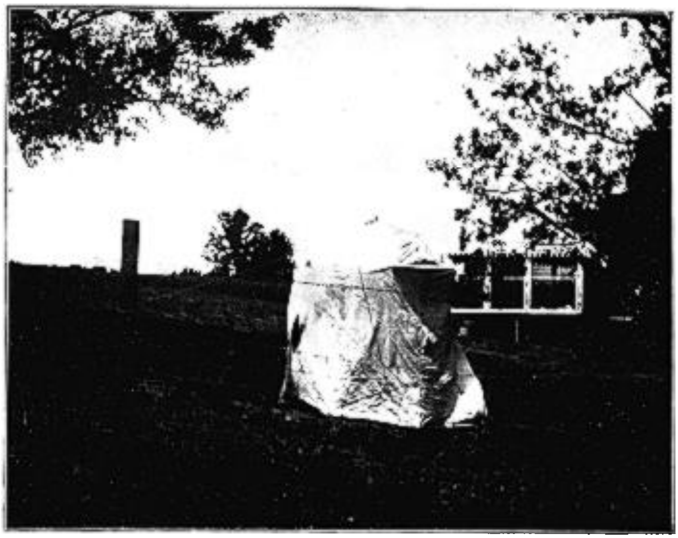

Figure 1. The blind in position at the thrasher nest. The nest is midway between the blind and the box to the left. The slit in the blind is the opening through which the birds were watched.

The blind used was very simple and one easily made. It was constructed of a sign umbrella held in position by three guy ropes. The wall of muslin dyed grey was in one piece and was fastened over the ends of the umbrella ribs by a draw string. The bottom was staked down and the blind was ready for use. Figure 1 is a photograph of the blind as it appeared at the thrasher nest.

The nest chosen for study was that of a Brown Thrasher (*Toxostoma rufum*). It was built on the ground, which is rather an unusual nesting site for this species. The grass had been quite long, but had been cut, leaving the nest in a very exposed position. When first discovered on June 17, it contained four young, not more than twenty-four hours old, and one addled egg. The blind was placed in position on the morning of the 23d. Within an hour the parent birds had become completely reconciled to its presence and were using the guy ropes for a perch. Soon after the study was commenced it was noticed that one of the birds had a conspicuous white spot on the back of the head and, after watching an hour or two, it was decided that this bird was the female. This white mark furnished a sure means of determining the sex of the parent feeding. It is visible in figure 2 and 3.

TABLE I.

The data in Table I is simply a condensed form of the records of feeding as they were taken in the blind. The first column contains the number of the feeding (all the feedings from the first to the last day of observation are numbered consecutively). The second column contains the sex of the parent feeding; the third the time of day; the fourth the character and amount of food; the fifth the nestling receiving the food; and the last one the data on sanitation.

Data for June 23, 1911. From 12:45 to 5:45 p. m.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
1.	m	12:45	4 white moths, 2 small insects.		
2.	f	12:48	Did not feed.		
3.	m	12:50	1 grasshopper.		
4.	f	12:54	2 grasshoppers.		
5.	f	12:55	1 grasshopper.		
6.	m	12:59	1 grasshopper, several crickets.	(2)	devoured.
7	f	1:06	1 mayfly, 5 white moths.		

Figure 2. The female feeding the young. The white spot on the head is visible in this figure.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
8.	f	1:25	1 maybeetle.		
9.	f	1:48	1 grasshopper.		
10.	m	1:49	2 unknown bugs.		
11.	f	1:53	1 grasshopper.		devoured.
12.	f	1:55	1 white moth.		
13.	m	1:56	3 white moths.		
14.	f	2:00	1 maybeetle.		
15.	f	2:10	2 white moths, 1 grey moth.		
16.	f	2:23	1 green worm.		
17.	f	2:26	2 grasshoppers.		
18.	m	2:30	2 grasshoppers.		devoured.
19.	m	2:34	1 unknown.		
20.	f	2:34	1 cutworm.		devoured.
21.	m	2:45	3 green worms.		
22.	m	2:55	1 cutworm, 1 grasshopper.		
23.	f	3:10	1 white moth, 1 larva.		
24.	f	3:16	1 cutworm.		
25.	m	3:21	1 grasshopper.		devoured.
26.	m	3:25	1 dragonfly.		
27.	m	3:35	1 cutworm, 1 white moth.		devoured.
28.	f	3:36	1 butterfly.		
29.	m	3:40	3 white moths, 1 grasshopper.		
30.	m	3:48	1 brown larva.		
31.	f	3:50	1 centipede.		
32.	f	3:53	1 cutworm.		
33.	f	4:04	1 grasshopper.		
34.	f	4:10	1 cutworm.		
35.	f	4:15	3 green worms, 1 cutworm, 1 fly.		
36.	m	4:19	1 centipede, 1 cutworm.		
37.	f	4:25	1 large green worm.		devoured.
38.	f	4:30	1 mayfly.		devoured.
39.	m	4:31	1 large brown moth.		
40.	f	4:32	1 large white moth, 1 cutworm.		
41.	f	4:38	2 grasshoppers, 1 moth.		
42.	m	4:45	1 large brown moth.		
43.	m	4:47	4 grasshoppers.		devoured.
44.	f	4:48	1 mayfly.		
45.	f	4:55	2 mayflies.		
46.	m	4:58	1 cutworm, 1 spider.		
47.	m	5:05	2 grasshoppers.		
48.	m	5:10	1 grasshopper.		
49.	f	5:11	1 beetle.		
50.	f	5:13	2 grasshoppers.		
51.	m	5:15	1 mayfly, 1 moth.		
52.	f	5:19	2 grasshoppers.		
53.	m	5:19	1 spider.		devoured.
54.	f	5:22	1 grasshopper.		
55.	m	5:23	2 moths.		devoured.
56.	f	5:35	1 grasshopper, 1 cutworm, 1 unknown.		
57.	m	5:40	1 grasshopper.		devoured.
58.	f	5:42	1 cutworm.		

Data for June 24, 1911. From 12:45 to 6:00 p. m.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
59.	f	12:50	3 grasshoppers.		
60.	f	12:58	2 white moths.		
61.	m	1:01	1 grasshopper.		
62.	m	1:09	2 mayflies.		
63.	f	1:10	2 cutworms.		devoured.
64.	m	1:13	1 grasshopper.		
65.	f	1:28	2 mayflies.		
66.	m	1:49	1 grasshopper.		
67.	f	1:52	1 grasshopper, 1 mayfly.		
68.	f	1:55	1 grasshopper.		
69.	m	1:56	2 green worms.		
70.	f	1:57	1 grasshopper.		
71.	f	2:04	1 cutworm.		
72.	f	2:05	1 mayfly.		
73.	f	2:07	2 beetles.		
74.	m	2:43	1 mayfly, 1 grasshopper, 1 green worm.		
75.	f	2:16	1 grasshopper.		
76.	m	2:19	1 beetle.		devoured.
77.	m	2:24	1 grasshopper.		
78.	f	2:29	1 grasshopper.		
79.	f	2:30	1 mayfly.		
80.	f	2:32	1 beetle.		
81.	f	2:34	1 grasshopper.		
82.	m	2:35	2 mayflies.		
83.	m	2:38	1 grasshopper.		devoured.
84.	f	2:41	1 grasshopper.		
85.	f	2:43	1 mayfly.		
86.	f	2:45	2 grasshoppers.		
87.	f	2:55	2 white moths.		
88.	m	2:55	1 grasshopper.		
89.	f	2:56	1 grasshopper.		
90.	f	3:04	2 grasshoppers.		carried away.
91.	f	3:12	1 unknown worm.		
92.	f	3:13	2 white moths.		
93.	f	3:15	2 mayflies, 1 cutworm.		
94.	f	3:28	2 grasshoppers.		
95.	m	3:32	1 mayfly, 1 grasshopper.		devoured.
96.	m	4:03	2 white moths.		
97.	f	4:03	1 grasshopper, 1 green worm.		
98.	f	4:07	1 grasshopper.		devoured.
99.	f	4:17	2 grasshoppers.		
100.	f	4:18	1 white moth.		
101.	f	4:22	2 mayflies.		
102.	f	4:25	1 mayfly, 1 beetle.		devoured.
103.	m	4:26	1 grasshopper.		carried away.
104.	f	4:30	1 mayfly.		
105.	m	4:36	1 mayfly, 1 grasshopper.		
106.	m	4:47	1 mayfly.		
107.	m	4:54	2 mayflies.		
108.	m	5:00	1 grasshopper.		
109.	f	5:00	2 grasshoppers.		

No.	Sex.	Time.	Food.	Young fed.	Excreta.
110.	m	5:01	2 mayflies.		
111.	m	5:02	1 mayfly,.		
112.	f	5:07	1 mayfly, 1 cutworm, 1 grasshopper.		
113.	m	5:09	1 grasshopper.		
114.	f	5:10	1 white moth.		
115.	m	5:11	1 mayfly.		
116.	m	5:13	1 green worm.		
117.	f	5:19	1 white moth.		
118.	m	5:26	1 grasshopper, 1 beetle, 1 white moth, 1 worm.		
119.	f	5:26	2 grasshoppers.		
120.	m	5:32	1 grasshopper.		
121.	f	5:35	1 fly.		
122.	m	5:36	1 worm.		
123.	f	5:41	1 white moth, 1 spider.		
124.	m	5:42	1 earthworm.		devoured.
125.	f	5:46	1 grassshopper.		
126.	f	5:55	1 spider.		

Data for June 26, 1911. From 12:45 to 8:40 p. m.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
127.	m	12:55	3 mayflies.		
128.	f	12:58	1 grasshopper.		
129.	m	1:03	1 grasshopper.		carried away.
130.	f	1:03	1 grasshopper.		
131.	m	1:05	1 grasshopper.		carried away.
132.	f	1:07	1 grasshopper.		
133.	m	1:07	1 grasshopper.		
134.	m	1:16	1 grasshopper.		carried away.
135.	f	1:16	1 grasshopper.		carried away.
136.	m	1:24	1 grasshopper.		
137.	f	1:28	1 grasshopper.		
138.	m	1:33	1 mayfly.		
139.	m	1:41	1 grasshopper.		
140.	m	1:44	1 cutworm.		
141.	m	1:49	1 black butterfly.		
142.	f	1:56	1 grasshopper.		
143.	m	2:06	1 grasshopper.		carried away.
144.	m	2:07	1 grasshopper.		carried away.
145.	m	2:12	1 grasshopper.		
146.	f	2:13	1 grasshopper.		
147.	f	2:17	1 grasshopper.		
148.	f	2:19	1 fly.		
149.	m	2:21	1 grasshopper.		
150.	m	2:31	1 grasshopper.		carried away.
151.	f	2:34	1 moth.		
152.	m	2:35	1 grasshopper.		
153.	f	2:37	1 grasshopper.		
154.	f	2:42	1 grasshopper.		
155.	m	2:43	1 grasshopper.		
156.	f	2:49	1 grasshopper.		
157.	f	2:55	1 fly larva.		
158.	m	3:02	1 grasshopper.	Orange.	carried away.
159.	m	3:22	1 grasshopper.	Blue.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
160.	f	3:25	1 grasshopper.		carried away.
161.	f	3:37	1 grasshopper.	Blue.	carried away.
162.	m	3:39	1 grasshopper.	Orange.	carried away.
163.	m	3:51	1 larva.	White.	
164.	f	4:09	1 moth.	White.	
165.	m	4:11	1 earthworm.	Green.	
166.	f	4:13	2 mayflies.	Green.	carried away.
167.	m	4:35	1 cutworm.	Green.	carried away.
168.	m	4:45	1 cutworm.	Green.	carried away.
169.	f	4:45	1 dragonfly.	Blue.	
170.	m	4:50	1 spider.	White.	
171.	f	4:54	3 mayflies.	White.	carried away.
172.	m	4:56	1 cutworm.	White.	
173.	f	4:56	1 cutworm.	Orange.	carried away.
174.	f	5:00	3 mayflies.	O. 2, G. 1.	
175.	m	5:02	1 cutworm.	Green.	
176.	f	5:10	3 mayflies.	O. 2, G. 1.	
177.	m	5:15	1 cutworm.	Orange.	
178.	m	5:20	1 cutworm.	Orange.	carried away.
179.	f	5:20	1 unknown.	Green.	
180.	f	5:21	1 white worm.	Green.	from Green.
181.	f	5:23	1 cutworm.	White.	
182.	f	5:35	1 large caterpiller, 1 maybeetle, 2 mayflies.	Green.	
183.	f	5:39	3 mayflies.	W. 2, B. 1.	
184.	m	5:41	1 grasshopper.	Blue.	from Orange.
185.	f	5:44	5 mayflies.	Orange.	
186.	m	5:48	1 cutworm.	Blue.	from Green.
187.	f	5:49	1 mayfly.	Blue.	
188.	f	5:52	1 larva.	Orange.	
189.	m	5:52	2 mayflies.	Blue.	
190.	f	5:55	1 larva.	Green.	
191.	m	6:00	1 cutworm.	Orange.	taken from Orange.
192.	f	6:04	1 cutworm.	Green.	
193.	m	6:11	1 cutworm.	Blue.	
194.	f	6:15	2 mayflies.	Blue.	
195.	f	6:18	3 mayflies, 1 earthworm.	White.	from White.
196.	f	6:28	2 mayflies.	White.	
197.	f	6:35	1 cutworm.	Blue.	
198.	f	6:38	2 mayflies.	Blue.	
199.	m	6:48	1 beetle.	Blue.	
200.	m	6:52	1 mayfly.	White.	from White.
201.	m	6:57	1 mayfly.	White.	
202.	f	6:57	1 beetle, 1 grasshopper.	Orange.	
203.	m	6:59	2 mayflies.	Blue.	from Green.
204.	f	7:02	1 mayfly.	Blue.	
205.	f	7:05	4 mayflies.	White.	
206.	f	7:08	2 mayflies.	W. 1, B. 1.	
207.	f	7:11	1 cutworm.	White.	
208.	f	7:12	1 cutworm.	White.	
209.	f	7:14	2 grasshoppers.	G. 1, B. 1.	
210.	m	7:15	1 cutworm.	White.	from White.
211.	f	7:15	1 earthworm.	Green.	from Green.
212.	m	7:20	1 cutworm.	Orange.	from Orange.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
213.	f	7:23	1 maybeetle.	Green.	from Green.
214.	m	7:26	1 grasshopper.	Green.	
215.	f	7:30	1 dragonfly, 1 mayfly.	Green.	
216.	f	7:36	1 maybeetle.	Blue.	
217.	f	7:38	1 maybeetle.	Blue.	
218.	f	7:42	1 larva.	Blue.	from Green, eaten.
219.	f	7:44	1 spider.	Green.	
220.	f	7:45	1 dragonfly.	Orange.	from Orange
221.	f	7:46	1 moth.	White.	from White.
222.	m	7:50	1 cutworm.	Orange.	
223.	f	7:52	3 mayflies.	White.	
224.	m	7:52	2 worms.	W. 1, B. 1.	
225.	m	7:54	1 cutworm.	White.	
226.	f	7:56	1 mayfly.	White.	
			1 moth.	Blue.	
227.	f	7:56	1 mayfly.	Blue.	
228.	f	8:10	1 mayfly.	Blue.	from Green.
229.	f	8:14	unknown insect.	Green.	
230.	m	8:26	1 maybeetle.	Orange.	from Orange.
231.	m	8:28	1 unknown insect.	Green.	from Green.
232.	m	8:35	1 grasshopper.	Green.	
		Data for June 27, 1911.	From 3:30 a. m. to 9:00 p. m.		
233.	—	4:12	1 grasshopper.	——	——
234.	f	4:16	1 cutworm.	——	
235.	f	4:22	3 mayflies.	——	——
236.	f	4:28	3 x * mayflies.	Blue.	from Blue.
237.	m	4:30	1 mayfly.	White.	from White.
238.	f	4:33	3 mayflies.	O. 2, G. 1.	from Orange.
239.	m	4:33	2 mayflies.	Orange.	
240.	f	4:34	2 mayflies, 1 fly.	White.	
241.	m	4:34	1 beetle.	Green.	
242.	f	4:36	1 mayfly, 1 larva.	White.	
243.	m	4:37	2 grasshoppers.	Green.	
244.	f	4:39	1 unknown.	Blue.	
245.	f	4:43	1 worm.	Orange.	
			1 raisin.	Green.	
246.	m	4:44	2 grasshoppers.	Orange.	
247.	f	4:46	3 mayflies.	Orange.	
248.	f	4:54	2 raisins.	Blue.	
249.	f	5:00	3 mayflies.	Orange.	
250.	f	5:21	2 mayflies.	White.	
251.	f	5:30	1 cutworm.	White.	
252.	m	5:35	1 cutworm, 1 mayfly.	Blue.	from Blue.
253.	f	5:38	1 mayfly.	Green.	
			1 moth.	White.	
254.	m	5:40	1 cutworm.	Blue.	
255.	f	5:50	2 moths.	Green.	
256.	f	5:52	1 earthworm.	Green.	——
257.	--	5:55	1 dragonfly, 1 spider.	White.	
258.	f	6:00	1 dragonfly.	Green.	from Green.
259.	f	6:06	2 mayflies.	Green.	

* The letter x is here used in place of the plus mark.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
260.	f	6:08	1 moth.	White.	from White.
			1 earthworm.	Green.	
261.	f	6:11	1 cutworm.	White.	
262.	f	6:13	1 dragonfly.	Orange.	
			1 cutworm.	Green.	
263.	f	6:15	1 moth, 1 grasshopper.	Blue.	
264.	f	6:18	1 unknown bug.	Orange.	from Orange.
265.	f	6:20	1 moth.	Green.	
266.	f	6:28	4 mayflies, 2 moths.	White.	
267.	m	6:29	1 cutworm.	Orange.	
268.	f	6:30	2 raisins.	O. 1, G. 1.	
269.	m	6:31	1 cutworm, 1 moth.	White.	
270.	f	6:31	1 moth.	White.	
271.	f	6:36	1 grasshopper.	White.	
272.	f	6:40	1 mayfly.	Blue.	from Blue.
273.	m	6:41	1 beetle.	White.	
274.	m	6:43	1 beetle.	White.	
275.	f	6:43	2 mayflies.	Green.	
276.	m	6:45	1 butterfly.	Orange.	
277.	f	6:48	2 dragonflies.	White.	
278.	f	6:49	1 maybeetle.	White.	
279.	f	6:53	1 grasshopper.	Green.	from Green.
			1 flying ant.	Blue.	
280.	f	6:55	1 cutworm.	White.	
281.	f	6:58	1 grasshopper, 1 spider.	Blue.	
282.	m	7:07	1 moth.	White.	
283.	f	7:16	1 unknown.	White.	
284.	m	7:16	1 cutworm.	White.	
285.	f	7:20	1 moth.	Blue.	
286.	m	7:35	1 cutworm.	White.	
287.	f	7:35	1 mayfly.	Blue.	
288.	f	7:38	2 moths.	G. 1, O. 1.	
289.	m	7:40	1 moth.	Orange.	from Orange eaten.
290.	f	7:41	2 unknown insects.	Green.	
291.	m	7:42	1 cutworm.	Green.	
292.	f	7:44	unknown.	Blue.	from Blue.
293.	m	7:48	1 grasshopper.	Green.	from Green.
294.	f	7:50	1 moth.	White.	
			2 mayflies.	Blue.	
295.	m	7:56	1 cutworm.	White.	from White.
296.	f	8:03	1 dragonfly.	Blue.	
297.	f	8:06	1 grasshopper.	Orange.	
			1 dragonfly.	Green.	
298.	m	8:08	1 moth, 1 grasshopper.	White.	
299.	f	8:12	2 moths.	Blue.	
300.	f	8:14	1 grasshopper.	Blue.	
301.	f	8:15	1 grasshopper, 1 moth.	Blue.	
302.	m	8:16	1 ant, 1 worm.	Orange.	
303.	f	8:21	2 moths.	Green.	
304.	f	8:24	1 moth.	Blue.	
305.	f	8:26	3 moths.	O, 2. G. 1.	
306.	f	8:27	2 moths.	B. 1, G. 1.	
307.	m	8:34	1 cutworm.	Green.	from Blue
308.	f	8:35	1 mayfly, 1 moth.	Blue.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
309.	m	8:35	2 mayflies.	W. 1, G. 1.	
310.	f	8:40	1 mayfly, 1 moth.	Blue.	
			1 unknown insect.	Orange.	
311.	m	8:44	2 moths.	G. 1, W. 1.	from White.
312.	f	8:46	1 mayfly.	Orange.	
			1 dragonfly.	Green.	
313.	f	8:48	2 moths.	O. 1, G. 1.	
134.	m	8:51	1 cutworm.	Blue.	
			1 moth.	White.	
315.	f	8:54	1 grasshopper.	Orange.	
316.	f	8:58	2 moths.	White.	
317.	f	9:09	1 mayfly,1 damsel fly.	White.	from White.
318.	m	9:10	unknown.	Orange.	
319.	f	9:12	1 moth.	Blue.	
320.	f	9:15	1 mayfly, 2 moths.	Blue.	
321.	m	9:16	2 cutworms.	Orange.	
322.	f	9:16	1 wire worm, 1 moth.	White.	
323.	f	9:17	1 caterpiller.	Orange.	
324.	m	9:23	1 grasshopper, 1 mayfly.	Blue.	
325.	f	9:27	1 unknown insect.	Green.	
326.	m	9:29	1 moth, 1 worm.	Green.	
327.	f	9:30	1 raisin.	Blue.	
328.	m	9:32	2 cutworms.	Orange.	
329.	f	9:32	3 x * moths.	Green.	
330.	f	9:34	1 wire worm, 2 moths.	White.	
331.	m	9:35	1 grasshopper.	Blue.	
			1 moth.	White.	
332.	m	9:37	1 cutworm.	White.	from White eaten.
333.	f	9:38	2 mayflies.	Green.	
334.	f	9:39	4 x * mayflies.	Green.	
335.	f	9:40	1 cut worm.	White.	
336.	f	9:45	1 beetle.	Orange.	
337.	m	9:49	1 dragonfly, 1 moth.	Orange.	
338.	f	9:50	3 x * moths.	Green.	
339.	f	9:54	1 moth.	Blue.	
340.	f	9:57	1 moth.	Green.	
341.	f	10:01	1 moth, 1 beetle.	Green.	from Green eaten.
342.	f	10:03	1 moth, 3 mayflies.	White.	
343.	m	10:15	1 wire worm, 1 moth, 1 cut-worm.	Green.	
344.	f	10:16	5 x * mayflies.	B. 3, G. 2.	
345.	m	10:16	1 wire worm.	White.	
346.	m	10:18	1 cutworm.	Orange.	from Orange.
347.	f	10:21	2 moths.	Green.	
348.	f	10:24	unknown.	White.	from White eaten.
349.	m	10:26	1 moth.	White.	
350.	f	10:30	2 moths.	Green.	
351.	m	10:30	1 moth.	Orange.	
352.	f	10:31	1 raisin.	Orange.	from Orange.
353.	m	10:33	1 moth, 1 beetle.	Green.	
354.	f	10:35	1 beetle.	White.	
355.	f	10:39	1 moth.	Green.	

* The letter x is here used in place of the plus mark.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
356.	m	10:42	1 grasshopper.	Orange.	
357.	f	10:43	1 grasshopper.	Green.	
			1 mayfly.	White.	
358.	m	10:45	1 moth.	White.	
359.	f	10:50	3 moths.	Green.	
360.	f	10:53	3 moths.	G. 1, W. 1, O. 1.	
361.	f	10:56	1 grasshopper.	Blue.	
362.	f	11:00	2 grasshoppers.	White.	from White.
363.	m	11:03	1 cutworm.	Orange.	
364.	f	11:05	3 moths.	Green.	from Green.
365.	f	11:13	1 mayfly.	White.	
366.	f	11:17	1 cutworm.	Green.	
367.	m	11:17	1 cutworm.	Orange.	
368.	f	11:20	1 grasshopper.	Green.	
369.	m	11:22	1 grasshopper.	Green.	
370.	f	11:23	1 moth.	Orange.	
371.	m	11:25	2 grasshoppers.	Green.	
372.	m	11:35	1 grasshopper.	Green.	
373.	f	11:36	3 moths.	G. 2, B. 1.	
374.	m	11:37	1 moth.	White.	
375.	f	11:38	1 cutworm.	White.	
376.	f	11:48	1 mayfly.	Orange.	
377.	m	11:49	1 mayfly.	Orange.	from Orange.
378.	f	11:50	1 moth.	Green.	
379.	m	11:55	1 grasshopper.	Green.	from Green.
380.	f	11:56	2 grasshoppers, 1 moth.	Blue.	
381.	f	12:06	1 cutworm, 1 moth.	White.	from White.
382.	m	12:07	1 cutworm, 1 moth.	White.	
383.	f	12:12	1 mayfly.	Green.	
384.	m	12:17	2 moths.	Orange.	
385.	f	12:20	1 mayfly, 1 moth.	Green.	
386.	f	12:25	2 grasshoppers.	Green.	
387.	m	12:26	1 larva.	Green.	
388.	f	12:27	1 cutworm.	Orange.	
389.	m	12:28	2 green worms.	Blue.	
390.	f	12:32	1 grasshopper.	White.	
391.	f	12:33	1 grasshopper.	White.	
392.	m	12:36	2 moths.	Blue.	
393.	f	12:43	1 mayfly.	Orange.	
394.	m	12:46	1 cricket.	Blue.	
395.	f	12:51	1 grasshopper.	Orange.	
396.	f	1:06	2 moths.	Orange.	
397.	m	1:06	1 cutworm.	Orange.	
398.	f	1:07	1 raisin.	White.	
399.	m	1:08	1 grasshopper.	Green.	
400.	f	1:09	1 moth.	White.	
401.	m	1:17	1 maybeetle.	Orange.	
402.	f	1:20	1 grasshopper.	Blue.	
403.	f	1:22	3 moths.	O. 2, 1 escaped.	
404.	m	1:22	2 moths.	Orange.	
405.	f	1:26	1 beetle, 3 x black ants.	Orange.	
406.	m	1:34	1 grasshopper.	Green.	from Green.
407.	f	1:34	2 mayflies.	Orange.	
408.	f	1:50	1 cutworm.	Orange.	from Orange.

No.	Sex.	Time.	Food.	Young fed.	Excreta.
409.	f	1:52	2 moths.	Blue.	from Blue.
410.	f	1:54	1 moth, 1 dragonfly.	White.	from White.
411.	m	1:55	1 grasshopper.	Blue.	
412.	m	1:58	1 cutworm.	Orange.	
413.	f	1:59	1 moth.	Green.	
414.	f	2:00	1 grasshopper.	Green.	
415.	m	2:07	1 grasshopper.	White.	
416.	f	2:14	1 mayfly.	Orange.	
417.	f	2:16	3 grasshoppers.	B. 1, G. 2.	from Green.
418.	f	2:17	1 grasshopper.	Blue.	
419.	f	2:21	1 moth.	White.	
420.	f	2:22	2 unknown bugs.	White.	
421.	f	2:24	1 grasshopper.	Green.	
422.	f	2:26	1 grasshopper.	White.	
423.	f	2:28	1 grasshopper.	Orange.	from Orange.
424.	f	2:30	1 moth.	White.	
425.	m	2:31	1 grasshopper.	Orange.	
426.	f	2:32	unknown.	White.	
427.	f	2:35	1 moth, 1 earthworm.	Green.	
			1 ant.	Blue.	
428.	m	2:36	1 grasshopper.	Green.	
429.	m	2:44	1 cutworm.	Blue.	
430.	f	2:46	2 unknown insects.	White.	
431.	m	2:46	1 grasshopper.	Blue.	
432.	m	2:50	1 grasshopper.	Orange.	
433.	f	2:52	2 grasshoppers.	White.	
434.	f	3:00	1 grasshopper.	White.	
435.	f	3:03	1 moth.	Blue.	
436.	m	3:08	2 grasshoppers.	Orange.	from Orange eaten.
437.	f	3:09	2 x black ants.	Green.	
438.	f	3:10	1 grasshopper.	Orange.	
439.	f	3:11	1 moth.	Blue.	from Blue.
440.	f	3:16	1 moth.	Green.	
441.	m	3:20	1 moth.	White.	
442.	f	3:22	1 moth.	White.	from White.
443.	m	3:31	1 moth.	White.	
444.	f	3:32	1 grasshopper.	Blue.	
445.	m	3:36	1 grasshopper.	White.	
446.	f	3:39	1 grasshopper.	White.	
447.	f	3:41	1 grasshopper.	White.	
448.	m	3:41	1 ant.	Orange.	
449.	f	3:44	1 beetle.	Blue.	
450.	f	3:46	1 grasshopper.	Orange.	
451.	m	3:48	1 grasshopper.	Orange.	from Orange.
452.	m	3:51	1 moth.	Orange.	
			1 unknown.	Green.	
453.	m	3:52	1 grasshopper.	Orange.	
454.	f	3:57	1 grasshopper.	White.	
455.	f	3:59	1 grasshopper.	Orange.	
456.	f	4:04	1 moth.	Blue.	
457.	m	4:06	1 grasshopper.	Orange.	
458.	f	4:06	1 moth.	Green.	
459.	f	4:14	1 grasshopper.	White.	removed.
460.	m	4:17	1 moth.	Blue.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
461.	m	4:20	1 ant x.	Green.	removed.
462.	m	4:24	1 unknown.	Green.	
463.	f	4:24	1 moth.	Orange.	removed.
464.	m	4:30	1 moth.	Blue.	
465.	f	4:35	1 raisin.	Orange.	
466.	f	4:40	1 grasshopper.	White.	removed.
467.	m	4:44	1 moth.	Blue.	
468.	f	4:49	1 grasshopper.	Green.	
469.	m	4:52	1 cutworm.	Blue.	removed
470.	m	4:55	1 cutworm.	White.	
471.	m	5:06	1 unknown insect.	Green.	
472.	f	5:19	1 worm.	Green.	
473.	f	5:26	1 moth.	Blue.	
			1 cutworm.	White.	
474.	m	5:27	1 unknown.	Green.	
475.	m	5:30	1 unknown.	Orange.	
476.	m	5:32	1 cutworm.	White.	
477.	f	5:33	1 cutworm.	Orange.	
478.	f	5:35	1 cutworm.	Orange.	removed.
479.	f	5:40	1 dragonfly.	White.	removed.
480.	f	5:43	2 moths.	B. 1, G. 1.	removed.
481.	m	5:45	1 grasshopper.	Blue.	
482.	f	5:46	1 grasshopper.	White.	from White.
483.	f	5:49	1 grasshopper.	Blue.	
484.	m	5:54	1 worm.	Green.	
485.	f	6:05	1 mayfly, 1 cricket.	Green.	from Green.
486.	f	6:11	1 maybeetle.	Blue.	from Blue.
487.	f	6:15	1 mayfly, 2 moths.	Green.	
488.	m	6:17	1 cutworm.	Blue.	
489.	f	6:21	1 grasshopper, 2 dragonflies.	Green.	
490.	f	6:26	1 wireworm.	White.	
491.	m	6:28	2 cutworms, 1 unknown.	White.	from White.
492.	f	6:30	3 mayflies.	White.	
493.	m	6:43	1 moth, 1 grasshopper.	White.	
494.	f	6:44	1 cutworm.	White.	from Blue.
495.	f	6:45	1 grasshopper.	White.	
496.	m	6:47	1 cutworm.	Blue.	
497.	f	6:47	2 mayflies.	Green.	
498.	f	6:52	1 larva.	Blue.	from Blue.
499.	f	6:57	1 larva.	White.	from White.
500.	m	6:58	1 grasshopper.	Blue.	from Blue.
501.	f	7:05	1 larva.	White.	
502.	m	7:10	1 larva.	Orange.	
503.	f	7:24	1 cutworm.	White.	
504.	f	7:26	1 grasshopper.	White.	
505.	f	7:28	2 cutworms.	W. 1, B. 1.	from White.
506.	f	7:31	1 grasshopper.	White.	
507.	f	7:48	2 moths.	Orange.	
508.	f	7:49	1 raisin.	Orange.	
509.	f	7:52	unknown.	Orange.	
510.	m	7:56	1 worm.	White.	from White.
511.	f	7:56	3 x moths.	Blue.	from Blue.
512.	f	7:58	1 moth.	Green.	
513.	m	7:59	1 moth.	Orange.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
514.	f	8:00	1 mayfly.	Green.	
515.	f	8:03	2 moths.	Blue.	
516.	f	8:06	3 moths.	B. 2, G. 1.	
517.	f	8:09	2 moths.	Green.	
518.	f	8:10	2 moths.	Green. from Green & White.	
		Data for June 28, 1911. From 3:30 a. m. to 9:00 p. m.			
519.	m	4:02	unknown.	——	removed.
520.	m	4:07	1 moth.	——	removed.
521.	f	4:14	1 moth.	Orange.	
522.	f	4:15	1 moth.	White.	
523.	m	4:15	3 moths.	Orange.	
524.	m	4:16	2 unknowns.	G. 1, O. 1.	
525.	f	4:16	1 grasshopper.	White.	
526.	f	4:17	1 moth.	Blue.	
527.	m	4:17	1 unknown.	White.	
528.	f	4:18	2 x moths.	Orange.	
529.	f	4:19	1 grasshopper.	Green.	
530.	m	4:20	1 unknown.	Orange.	removed.
531.	f	4:21	2 unknowns.	G. 1, B. 1.	
532.	f	4:22	1 mayfly.	Blue.	
533.	m	4:24	1 moth, 1 larva.	Orange.	
534.	m	4:28	3 x unknowns.	O. B. W.	
535.	f	4:29	2 x unknowns.	White.	removed.
536.	f	4:31	2 grasshoppers.	Orange.	
537.	m	4:38	1 larva.	Orange.	
538.	f	4:10	1 grasshopper.	White.	
			2 mayflies.	Blue.	
539.	f	4:50	2 unknowns.	Orange. Blue.	
540.	m	4:55	1 beetle.	Orange.	
541.	f	4:58	1 moth.	White.	
542.	f	5:05	1 mayfly.	Green.	
543.	f	5:10	1 grasshopper.	Blue.	
544	f	5:11	1 mayfly, 1 cricket.	Green.	removed.
545.	f	5:12	1 grasshopper.	White.	removed.
546.	f	5:15	4 mayflies.	O. 3, W. 1.	
547.	f	5:25	1 mayfly.	Orange.	
548.	f	5:28	1 grasshopper.	White.	
549.	f	5:30	1 unknown.	Orange.	
550.	f	5:32	1 grasshopper.	Orange.	
551.	f	5:35	1 grasshopper.	White.	
552.	f	5:36	1 mayfly.	Green.	
553.	m	5:40	1 cutworm.	White.	
554.	f	5:42	1 grasshopper.	Green.	
555.	f	5:45	5 mayflies.	O. 2, W. 3.	removed.
556.	f	5:48	2 mayflies.	Green.	removed.
557.	f	5:50	1 mayfly.	Blue.	
558.	f	5:53	1 grasshopper.	Green.	
559.	m	5:58	3 mayflies.	White.	
560.	m	6:00	2 beetles.	Green.	
561.	f	6:02	1 mayfly.	Blue.	
562.	m	6:02	2 beetles.	Blue.	
563.	f	6:03	1 moth.	Blue.	
564.	f	6:04	1 unknown.	Green.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
565.	m	6:07	1 cutworm.	White.	
566.	f	6:07	1 cutworm.	Green.	
567.	f	6:12	1 grasshopper.	Orange.	removed.
568.	m	6:12	1 grasshopper.	Orange.	
569.	m	6:14	1 mayfly, 1 worm.	Blue.	
570.	f	6:15	2 mayflies.	Blue.	
571.	m	6:16	4 mayflies.	Blue.	removed.
572.	f	6:20	5 mayflies.	Orange.	
573.	m	6:25	4 mayflies.	White.	
574.	f	6:25	2 mayflies, 1 cutworm.	Blue.	
575.	f	6:27	1 mayfly, 2 moths.	Orange.	
576.	f	6:35	7 mayflies.	Blue.	
			1 beetle.	Green.	
577.	f	6:44	6 x mayflies.	White.	
578.	m	6:44	6 x mayflies.	Orange.	
579.	m	6:53	5 mayflies.	Orange.	from Orange.
580.	m	6:54	1 larva.	White.	from White.
581.	f	6:57	2 mayflies.	Blue.	
582.	m	7:06	1 unknown.	Blue.	
583.	m	7:12	4 x mayflies.	Green.	from Green.
584.	f	7:12	4 x mayflies.	Green.	
585.	m	7:13	1 unknown.	Orange.	
586.	f	7:14	1 mayfly.	Green.	
587.	m	7:15	3 x mayflies.	White.	
588.	f	7:17	4 x mayflies.	O. G.	
589.	m	7:18	2 x mayflies.	Green.	
590.	f	7:20	1 mayfly, 1 raisin.	Orange.	
591.	f	7:21	3 x mayflies.	Green.	
592.	m	7:22	3 mayflies.	Green.	
593.	f	7:26	1 mayfly, 1 unknown.	——	
594.	f	7:28	3 x mayflies.	White.	
595.	m	7:31	3 mayflies.	Blue.	
596.	f	7:31	1 unknown.	——	
597.	f	7:33	3 x mayflies.	O. G.	
598.	f	7:35	2 mayflies.	Green.	
			1 unknown.	White.	from White.
599.	m	7:37	3 mayflies.	Green.	
600.	f	7:38	3 mayflies.	Green.	
601.	f	7:41	6 x mayflies.	White.	
602.	m	7:44	1 damselfly, 1 mayfly.	White.	
603.	f	7:53	4 x mayflies.	O. 2, B. Rest.	from Blue.
604.	f	7:56	1 mayfly.	Orange.	
605.	m	7:55	2 mayflies.	Blue.	from Blue.
606.	m	7:59	2 mayflies.	Green.	
607.	f	8:01	1 cutworm, 1 mayfly.	White.	
608.	f	8:08	2 mayflies.	Orange.	
609.	f	8:11	1 cutworm.	Orange.	
610.	f	8:15	5 mayflies.	B. 2, W. 3.	
611.	f	8:17	4 mayflies.	White.	
612.	m	8:20	4 mayflies.	Blue.	
613.	f	8:20	2 mayflies.	White.	
614.	m	8:23	4 mayflies.	W. 2 mayflies.	
			1 cutworm.	B. rest.	
615.	m	8:26	1 moth, 1 mayfly, 1 cutworm.	Orange.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
616.	f	8:28	1 maybeetle.	White.	from White.
617.	f	8:30	4 mayflies.	White.	
618.	f	8:31	1 cutworm.	Orange.	
619.	f	8:33	6 x mayflies.	White.	
620.	m	8:35	1 cutworm, 1 mayfly.	Blue.	
621.	f	8:35	1 cutworm.	Blue.	
622.	m	8:40	1 cutworm.	Green.	
623.	m	8:43	1 cutworm, 1 wireworm.	Green.	
624.	f	8:47	1 worm.	Green.	
			1 mayfly.	Orange.	
625.	f	8:49	2 mayflies.	B. 1, G. 1.	
626.	f	8:53	1 mayfly.	White.	from Green.
627.	f	8:58	2 mayflies.	White.	
628.	m	8:59	1 wireworm.	Green.	from Green.
629.	f	9:04	1 mayfly.	Blue.	
630.	m	9:05	1 mayfly.	White.	
			1 wireworm.	Green.	
631.	f	9:09	2 mayflies.	Green.	
632.	f	9:13	1 mayfly, 1 wireworm.	Green.	
633.	f	9:15	1 mayfly.	Blue.	
634.	f	9:17	2 grasshoppers.	Green.	
635.	m	9:17	unknown.	Orange.	
636.	m	9:19	3 mayflies.	B. 1, W. 2.	
637.	f	9:23	1 mayfly, 1 wireworm, 1 fly.	Blue.	
638.	m	9:32	1 wireworm.	Orange.	
639.	f	9:33	unknown.	Orange.	
640.	f	9:35	1 raisin.	Blue.	
641.	m	9:36	unknown.	W. O. fed.	from White.
642.	f	9:39	3 mayflies.	Orange.	
643.	f	9:40	1 mayfly, 1 damselfly.	Orange.	
644.	m	9:48	3 mayflies.	Green.	from Green.
645.	f	9:52	1 mayfly, 1 raisin.	Green.	
646.	m	9:56	1 grasshopper.	Orange.	
647.	f	10:01	1 mayfly.	White.	
648.	m	10:03	1 spider.	Orange.	
649.	m	10:06	2 mayflies.	Orange.	
650.	f	10:09	2 moths.	White.	from White.
651.	f	10:11	1 grasshopper.	Blue.	from Blue.
652.	m	10:12	4 mayflies.	Green.	
653.	f	10:14	1 grasshopper.		
654.	m	10:22	2 moths.	O. 1, G. 1.	
655.	f	10:24	2 larvae.	O. 1, G. 1.	
656.	f	10:27	1 raisin.		removed.
657.	m	10:29	1 larva.	White.	
658.	m	10:30	1 larva.	Orange.	
659.	f	10:30	1 unknown.	Blue.	
660.	f	10:33	2 ants.	W. B.	
661.	f	10:36	1 grasshopper.	Blue.	
662.	m	10:37	1 moth.	Blue.	
			1 mayfly.	Orange.	
663.	f	10:38	1 mayfly.	White.	
664.	m	10:40	1 larva.	Green.	
665.	m	10:47	2 mayflies.	Orange.	
666.	f	10:50	1 mayfly.	White.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
667.	f	10:50	1 moth.		
668.	m	10:54	2 mayflies.	Blue.	
669.	f	10:54	1 grasshopper.	Green.	
			1 moth.	Blue.	
670.	f	10:58	1 butterfly, 1 mayfly.	White.	from White.
671.	f	11:06	1 moth, 1 cutworm.	Blue.	
672.	m	11:07	1 cutworm.	White.	
673.	f	11:09	1 moth.	Blue.	
674.	f	11:14	2 moths.	Orange.	
675.	f	11:15	3 mayflies.	Green.	
676.	m	11:15	1 grasshopper.	White.	
677.	f	11:16	1 grasshopper.	Orange.	
678.	f	11:20	4 mayflies.	Green.	
679.	f	11:26	2 mayflies.	Blue.	
680.	m	11:26	1 mayfly.	Green.	
681.	f	11:30	2 mayflies.	Blue.	
682.	f	11:36	2 mayflies.	Blue.	
683.	m	11:40	1 cutworm.		
684.	m	11:45	1 grasshopper.	White.	
685.	f	11:45	3 moths.	White.	from White.
686.	f	11:50	1 grasshopper.	White.	
687.	f	11:51	1 grasshopper.	Green.	from Green.
688.	f	11:56	2 moths.	Blue.	
689.	f	12:05	1 moth.	Blue.	
690.	m	12:06	1 grasshopper.	Orange.	from Orange.
691.	f	12:08	1 mayfly.	Orange.	
692.	m	12:09	1 moth.	Blue.	
693.	f	12:10	2 mayflies.	White.	
694.	f	12:13	2 mayflies.	White.	
695.	f	12:14	1 mayfly.	White.	
696.	m	12:14	1 grasshopper, 1 mayfly.	White.	
697.	f	12:16	1 mayfly.	Orange.	
698.	f	12:19	4 grasshoppers.	G. 3, W. 1.	
699.	m	12:26	2 mayflies.	Orange.	
700.	m	12:37	1 caterpiller.	White.	
701.	m	1:08	2 mayflies.	Orange.	
			1 moth.	White.	
702.	m	1:10	1 piece of cherry.	Orange.	
703.	m	1:14	1 moth.	Orange.	
704.	m	1:15	1 moth.	Blue.	
705.	m	1:16	1 moth.	Blue.	
706.	m	1:25	3 mayflies.	O. 2, B. 1.	
707.	m	1:32	1 grasshopper.	Blue.	
708.	m	1:41	1 grasshopper, 1 larva.	Orange.	
709.	m	1:47	1 grasshopper, 1 mayfly.	Blue.	from Blue.
710.	m	1:49	1 grasshopper.	White.	
711.	m	1:52	1 grasshopper.	White.	
712.	m	1:53	1 grasshopper.	Orange.	
713.	m	1:57	1 grasshopper.	Blue.	
714.	m	2:06	1 grasshopper.	Orange.	
715.	m	2:08	1 grasshopper.	Orange.	from Orange.
			1 mayfly.	White.	
716.	m	2:15	2 grasshoppers.	Orange.	
717.	m	2:19	1 grasshopper.	Orange.	

718.	m	2:23	1 grasshopper.	Orange.	
719.	m	2:25	1 grasshopper.	Orange.	
720.	m	2:26	1 mayfly.	White.	from White.
721.	m	2:40	2 grasshoppers.	O. 1, B. 1.	from Blue.
722.	f	2:53	2 x ants.	White.	
723.	f	2:54	1 ant.	White.	
724.	f	3:00	3 x ants.	Blue.	
725.	f	3:33	1 grasshopper, 1 mayfly.	Blue.	
726.	f	3:45	1 cutworm.	Blue.	
727.	f	3:50	1 grasshopper.	Blue.	
728.	f	3:52	1 mayfly.	White.	from White.
729.	f	3:58	3 moths.	White.	
730.	f	4:00	2 mayflies.	White.	
731.	f	4:01	1 grasshopper.	White.	
732.	f	4:04	1 grasshopper, 1 larva.	Blue.	from Blue.
733.	f	4:06	unknown.	White.	
734.	f	4:55	1 dragonfly.	Blue.	
735.	m	5:43	1 mayfly.	Blue.	
			2 moths.	White.	from White.
736.	f	5:45	unknown.	Blue.	
737.	f	5:53	1 grasshopper, 1 moth.	Blue.	
738.	f	5:55	1 mayfly.	Blue.	
739.	f	5:58	1 grasshopper.	Blue.	
740.	f	6:00	1 mayfly.	Blue.	
741.	f	6:01	1 mayfly.	Blue.	
742.	f	6:04	1 mayfly.	White.	
			1 moth.	Blue.	
743.	f	6:06	3 mayflies.	B. 2, W. 1.	
744.	f	6:07	1 beetle, 1 mayfly.	White.	
745.	f	6:42	1 moth.	Blue.	
746.	f	7:02	1 cutworm.	Blue.	
747.	f	7:04	1 moth.	Blue.	
748.	f	7:08	1 mayfly, 1 moth.	White.	
749.	f	7:18	1 moth.	Blue.	from Blue.
750.	m	8:25	1 grasshopper.	Blue	

Data for June 29, 1911. From 4:00 a. m. to 8:10 a. m.

751.	m	4:18	1 grasshopper.	Blue	
752.	f	4:20	unknown.	Blue.	
753.	f	4:25	1 mayfly.	White.	from White.
754.	f	4:30	1 earthworm.	Blue.	from White.
755.	f	4:31	unknown.	White.	from Blue.
756.	f	4:33	3 mayflies.	Blue.	
757.	f	4:36	1 raisin.	White.	
758.	m	4:40	1 moth.	White.	
759.	f	4:56	unknown.	White.	
760.	f	5:00	2 moths.	White.	
761.	f	5:10	3 mayflies.	White.	
762.	f	5:42	1 mayfly.	White.	
763.	f	6:13	3 mayflies.	White.	
764.	f	6:15	1 mayfly.	White.	
765.	f	6:16	1 beetle.	White.	
766.	f	6:21	1 beetle.	White.	
767.	f	6:30	1 mayfly.	White.	
768.	f	6:33	1 moth.	White.	

No.	Sex.	Time.	Food.	Young fed.	Excreta.
769.	f	6:45	unknown.	White.	
770.	f	6:53	1 grasshopper.	White.	
771.	f	7:02	1 grasshopper.	Blue.	Blue on nest.
772.	f	7:07	1 beetle.	White.	
773.	m	7:14	1 grasshopper.	White.	
774.	f	7:22	unknown.	White.	
775.	m	7:35	1 moth.	Blue.	

Brooding.

The first observations were taken on the afternoon of June 23, when the young birds were about six days old. The afternoon was hot and sultry and the nest was in such a position as to be exposed to the hot rays of the sun. One or the other of the old birds brooded almost all of the time. During the afternoon, the male brooded once for a period of twenty-six minutes and the female for twenty minutes, but the periods as a rule were short, being from two to five minutes in length. At about two o'clock the shadow of an oak tree was thrown on the nest and the old birds ceased brooding. On the next day the brooding was carried on until about the same time, but the old birds were not so particular about staying on the nest all of the time, and by the following Monday, June 26, the brooding to protect the young had practically ceased.

There was a marked difference in the position assumed by the male and female in brooding. The male sat on the edge of the nest with his feathers ruffled up, or stood in the nest in much the same posture, affording very poor protection for the young as compared with that given by the female. She spread her wings, ruffled her feathers, and stood in such a position as to completely shade the nest. Figures 3 and 4 show this contrast in behavior much better than it can be described. The position in protecting the young from the rain during the storm of the 25th, was entirely different. The female was on the nest every time it was visited during the morning. She sat down close to the nest and so well did she cover it that, after one of the worst rain storms of the season, the nest was perfectly dry. On the last two nights that we watched the nest until the close of the feeding activity, we

Figure 3. The female brooding. Notice the position of the wings and the open mouth. The white spot is visible also in this figure.

found, to our surprise, that it was the male who commenced brooding for the night; but whether the female took his place part of the time was not determined. Neither were we able to determine which bird left the nest as we approached in the morning.

From this somewhat meager data on brooding, it would seem that at the age of six days, at least, the old birds brooded only during the heat of the day. Brooding as a protection from the heat practically ceased on the seventh and eighth day. Brooding at night and as a protection from the rain continued until the young left the nest.

Feeding the Young.

The principal object of these observations was to obtain data in regard to the character and amount of food the young received from the parents, and in this we were fairly successful. Besides this, much other data was secured relative to the manner of feeding. Table II will show the number of times each day that the parent birds brought food to the young during the time they were under observation.

TABLE II.

Showing the number of visits by each parent bird.

Date.	Time.	By Male.	By Female.	Total.
June 23	12:45 P. M.–6:00 P. M.	26	32	58
June 24	12:50 P. M.–5:55 P. M.	27	41	68
June 26	12:55 P. M.–8:40 P. M.	47	59	106
June 27	3:30 A. M.–9:00 P. M.	98	186	286 *
June 28	3:30 A. M.–8:42 P. M.	90	142	232
June 29	4:15 A. M.–8:10 A. M.	4	21	25
Total times fed		292	481	775

From this table it will be seen that the female was much more active than the male in procuring food. The data given

* Twice on the 27th the young were fed without the sex of the parent feeding being determined.

for June 29, and a small part of that for June 28, does not correctly represent the total feeding activity of both parents, for, after the first fledgling left the nest, one of the parents would remain with it for a period of two hours or more until relieved by its mate — that is, the labor of feeding was divided between the nest and the departed brood. They could be seen in a ravine near by attending to the fledglings, but the distance was too great to secure any trustworthy data. From June 26 at 12:55 p. m. until the last young bird left the nest, practically every feeding is recorded. The two mornings when the observations commenced at 3:30 a. m. it was found that the old birds did not begin feeding till about 4:15, and on the morning of the 29th the parent bird was still on the nest when the observer entered the blind at 4:15. So from noon on the 26th until they left the nest three days after, the nestlings were under constant observation during the time of daily feeding activity.

Table III will show something of the character of the food received by the young birds during this part of the nestling period and also something of the quantity. It will be noticed that in the tabulated data given that the number of insects was not always determined exactly but was entered in this manner, " 6+mayflies," etc. In all such cases the minimum number was used in computing the tables. As all of the persons who assisted were cautioned especially to note the number of insects exactly, it is safe to assume that if there be any error in the data, it is in having recorded too few insects rather than too many.

TABLE III.

Date—June	23	24	26	27	28	29	Totls.
Unknown Insects	6	.	3	21	21	5	56.
Larvæ	2	.	4	6	10	.	22.
Spiders	2	2	2	2	1	.	9.
Raisins, Cherry	.	.	.	10	5	1	16.
Unknown Worms	.	3	3	6	2	.	14.
Earthworms	.	1	3	3	.	1	8.

TABLE III—(Continued).

Date—June	23	24	26	27	28	29	Totls.
Wireworms	.	.	.	5	6	.	11.
Ants	.	.	.	10	7	.	17.
Caterpillars	.	.	1	1	1	.	3.
Flies	1	1	2	1	1	.	6.
Damselflies	.	.	.	1	2	.	3.
Dragonflies	1	.	3	13	1	.	18.
Butterflies	1	.	1	1	1	.	4.
Crickets	3	.	.	2	1	.	6.
Green Worms	8	5	.	2	.	.	15.
Cutworms	12	5	20	48	18	.	103.
Centipedes	2	.	.	.	.	.	2.
Moths	28	13	4	139	48	5	237.
Mayflies	6	27	56	79	244	13	425.
Beetles	3	6	6	12	8	3	38.
Grasshoppers	31	41	35	81	55	4	247.
Daily Totals	106	104	143	443	432	32	1260.

This table, which covers only a period of fifty-six and a fraction hours, shows a total of twelve hundred and forty-four insects (excepting a few worms) consumed by this one family of young birds in that time. This does not, of course, include anything eaten by the parents. As it was found that the working day for the parents began at 4:15 a. m. and closed about 8:30 p. m., a period of about sixteen hours, it will be seen that the period of fifty-six hours, during which the nest was under observation, was only a fraction of the total number of feeding hours. The young birds were in the nest from June 17 to June 29, a period of twelve days; but as they left on the morning of the 29th, we will omit that day from the total, leaving a period of eleven days for the nestling period. These eleven days represent one hundred and seventy-six feeding hours — over three times the period during which the birds were under observation. Computing the total number of insects eaten by the nestlings on the basis of the food consumed during the fifty-six hours, we have a total of 3800. While this number seems large, it must be borne in mind that the possible lower food requirement of the first half of the nestling period is compensated in the calculation by those insects missed in the data for the last half. The fledglings were observed around the ravine as late as July 25 to be positively identified. As it is certain that the daily consumption of insects did not diminish to any marked extent, the value of these birds as insect destroyers may readily be inferred. The four insects consumed in the largest quantities were found to be as follows: grasshoppers 247, Mayflies 425, moths 237, and cutworms 103. Two of these, at least, are positively destructive insects; and in the summer of 1911 the grasshoppers were almost a plague in parts of northern Iowa. Many fields of grain were destroyed and many more were cut green to prevent destruction, making the oats light weight and of poor quality. The grasshoppers stripped the oats from the straw by cutting the stem of each grain. This was done while the grain was in the milk, so it was a total loss. Many fields which promised from thirty to forty bushels yielded from five to ten bushels to the acre after the grasshopper invasion. As twenty per cent of the food of this family of thrasher consisted of grasshoppers, it can readily be seen this species is of considerable economic importance. A glance at the rest of the list will show that almost without exception, the insects fed to the young were of an injurious character. The feeding of the raisins was for a time a puzzle to all, and at first they were not recognized as raisins; but after being brought several times they were identified. The next question was as to the source of supply. It was observed that only the female brought them. A careful watch was kept around the buildings and she was seen to pick something out of the grass by the kitchen door. On investigation a quantity of raisins was found there and it was learned that a box of them had been accidentally spilled a few days before. The male was not observed to bring any, and as an experiment, a few were placed near the nest. He paid no attention to them for a number of visits, but finally he picked at one several times; then picked it up, carried it to the fence and swallowed it. He made no attempt to feed them to the young, although sev-

Figure 4. Male brooding. Contrast the position of the male with that of the female while brooding as shown in figure 3.

eral times after this he ate one himself. The female on the contrary was never observed to eat one of them, but fed a number to the young from the ones by the nest. The piece of cherry was also placed by the nest to see what the birds would do with it. The male happened to be the first to visit the nest and, after picking at it several times, gave it to one of the nestlings. Most of the beetles were May beetles, and the larvæ were practically all of this form. The unknown insects and worms were of various kinds and were either so badly crushed as to be unrecognizable or else were of a species unfamiliar to those in the blind at that time.

On June 26, about 4 o'clock in the afternoon, it was decided to make an effort to determine the quantity of food received by each nestling, and to that end a colored thread was tied on the leg of each. By frequently observing the position of the young birds in the nest, the color of the leg band, and paying close attention to the changes in position, it was possible to get a record of the food each nestling received. The colors were green, orange, blue, and white, and each nestling will hereafter be designated by the color of the leg band. Green was by far the most enterprising of the four and left the nest several hours before any of the others, and almost a day before Blue, who was the weakest and most sluggish of all.

From June 26 at 4:11 p. m., until Green left the nest on the 28th, at 12:19 p. m., he was fed 152 times; Orange 142 times; White 169 times; and Blue 133 times. Orange was a small and active bird; White was large and inactive, but seemingly possessed of plenty of strength; Blue was weak and timid. White stayed in the nest until almost the time Blue left, but this was due more perhaps to his inactive disposition than to inability to go. During the period of observation, White was fed a total of 205 times before leaving the nest, and Blue only 163 times in the same period.

TABLE IV. AMOUNT OF FOOD EACH YOUNG BIRD RECEIVED

	GREEN				ORANGE				WHITE					BLUE				
DATE: June	26	27	28	*Total*	26	27	28	*Total*	26	27	28	29	*Total*	26	27	28	29	*Total*
Insects, unidentified	3	6	3	12		5	9	14		7	6	4	17			5	1	6
Larvae	1	1	2	4	1	1	5	7	1	3	2		6	1	1	1		3
Spiders	1			1			1	1	1	1			2					
Raisins		2	1	3		3		3		1		1	2		4	1		5
Worms, unidentified	1	3	1	5		2		2	1	1			2	1		1		2
Earthworms	2	3		5					1				1				1	1
Wireworms		1	3	4			1	1		4			4					
Ants		3		3		5		5			3		3		2	4		6
Caterpillars	1			1		1		1			1		1					
Flies										1			1					
Damselflies							1	1		1	1		2					
Dragonflies	1	5		6	1	2		3		2			2	1	1	1		3
Butterflies						1		1			1		1					
Crickets		1	1	2											1			1
Green Worms															2			2
Cutworms	5	5	4	14	6	13	3	22	6	18	4		28	3	7	7		17
Moths		50	11	61		22	13	35	2	31	11	4	48	1	33	17	1	52
Mayflies	7	16	57	80	9	17	54	80	21	23	75	10	129	15	14	58	3	90
Beetles	2	3	2	7	2	3	1	6		4	2	3	9	2	2	3		7
Grasshoppers	2	23	10	35	3	16	17	36		22	14	2	38	4	17	12	2	35
Daily Totals	26	122	95	243	22	91	106	219	33	119	120	24	296	28	84	110	8	230

Total of Orange to time Green left the nest, 200. Total of White to time Green left the nest, 246. Total of Blue to time Green left the nest, 189.

In Table IV it will be seen that, up to the time Green left the nest, the nestlings had received insects as follows: Green 243, Orange 200, White 246, and Blue 189. When one considers that this distribution extended over parts of three days, it will be seen that the parents did well in dividing it up so evenly. The total amount distriubted was 978 insects, or an average of 219 to each young bird. Green and White received slightly over the average, and Orange slightly less. Blue was 30 below the average, but as already stated, he was neither as active nor as large as the others, and possibly this may have had something to do with the result.

Nothing definite was determined, nor could it be expected in so short a series of observations, as to the method of apportioning the food. A number of throats were sometimes tried before the food was finally given to one of the young, but usually this could be attributed to the insect, or insects, being so large they could not be swallowed. When this happened the parent bird would take the insect to some convenient perch and pound it up till it was small enough for the young to swallow. Sometimes it seemed as if chance determined which individual would receive the morsel, and at other times it looked as if there were other factors. There seemed to be a tendency to feed the one nearest the parent bird, and, as the old birds almost invariably approached the nest from the south, it would follow that the nestling on that side would get the most food. However that may be, the young were constantly trying to get to that side of the nest. One would no sooner get into place on that side than another would crowd him out. This was not always the case, for at times the parents would reach over and feed those on the farther side. Again it seemed as if the nestling that made the greatest disturbance received the food. The old birds, the first day or two, of observation, on approaching the nest and finding that the young made no response, would utter a quick "kek" and every head would instantly come up. After a day or two this was not necessary, as the mouths would all be open before the parents reached the nest.

Tables were also prepared to show the difference, if any, in the character of the food procured by the two parents. It was found that practically the same variety was brought by each one. The male brought centipedes on two different occasions; and raisins, flies, and dragon flies were brought by the female and never by the male.

Sanitation.

In the sanitation of the nest the birds were scrupulously clean. The excreta was seized by one of the parents before it touched the nest, except on two occasions, and these at the latter end of the nesting period. Three interesting facts were noted in connection with the passage of the excreta: viz., the young birds made no attempt to void the excreta except when one of the parent birds was present; second, only one of the nestlings voided the excreta at any one visit of the parent birds; and third, almost always the bird fed, or if two were fed, one of the two voided the excreta. The following table will show this latter fact. The data for this table covers only the last two days and a half of observation, as no means of distinguishing the birds was used until that time:

TABLE V.

Showing the relation of feeding and the passage of excreta.

Date.	Excreta from same bird as fed.	From some other bird.	Total.
June 26	12	5	17
June 27	54	2	56
June 28	35	1	36
June 29	3	0	3
Totals	104	8	112

The results of these observations seem to indicate that the feeding may possibly be the direct stimulus to the voiding of the excreta, as out of a possible 112 times 104 sacs of excreta were removed from the nestling receiving the food at that visit, while only eight were removed from different birds. The parents always stopped a few seconds after feeding, pos-

Figure 5. Male removing the excreta from one of the nestlings.

sibly waiting for the appearance of an excreta sac. In the case of the nestling voiding the excreta, there were usually some premonitory signs: viz., general uneasiness, ruffling the feathers, and flirting the tail. Then followed the elevating of the posterior end of the body, and as the sac came away the parent bird seized it and either devoured it or carried it away. See Figure 5.

In regard to disposing of the excreta there did not seem to be any constant behavior. During the first four days of observation, the most of it was devoured by the parents at the nest or carried a short distance and swallowed. The following table will show the total number of times the nest was cleaned. It will be seen from this table that the work of sanitation was about equally divided between the male and female. Compare Table VI with Table VII, which shows the number of times the excreta was devoured by each of the parents:

TABLE VI.

Total number of times the nest was cleaned.

Date.	By male.	By female.	Total.
June 23	9	3	12
June 24	5	4	9
June 26	20	14	34
June 27	18	38	56
June 28	18	18	36
June 29	0	3	3
Total	70	80	150

TABLE VII.

Number of times the excreta was devoured.

Date.	By male.	By female.	Total.
June 23	9	3	12
June 24	4	3	7
June 26	1	3	4
June 27	3	5	8
June 28	1	0	1
June 29	0	0	0
Total	18	14	32

A study of this table will show that on the first day, out of a total of twelve times the nest was cleaned, the excreta was devoured every time; on the second day, June 24, seven out of nine sacs were devoured; on the 26th only four out of thirty-four were devoured; on the 27th, eight out of fifty-six; and on the 28th, one out of thirty-six. On the 29th, only two birds were in the nest, and that only for a short time. This would seem to indicate that the period of devouring the excreta came to an end on the 25th and 26th, for while on the 27th the total number of sacs devoured was as large as on the 24th, yet in proportion to the total it was much smaller. It would seem then that about the eighth or ninth day the old birds ceased devouring the excreta and commenced to carry it away. There were several occasions when the sac broke in the bird's beak; when this happened, the old bird devoured the piece retained in the mouth, then picked up the other and flew away with it. These were not counted in the table relating to the devouring of the excreta, as there was no way of determining whether or not it would have been devoured if it had not broken. When the excreta was carried from the nest there were several distinct modes of procedure. Several times the parent bird flew to a branch in an oak about twenty feet from the nest and then dropped the sac after alighting; occasionally it was dropped just before the perch was reached; at other times it was carried to the perch and then devoured, the beak being wiped on the limb afterwards. While not universally true, the excreta was generally carried to one of three oak trees in the vicinity of the nest and either devoured or dropped. An attempt was made to determine whether there was any periodicity in the voiding of the excreta, but the results were not conclusive. The intervals in each young bird varied from two minutes to over five hours in length, with a majority of intervals from one to one and a quarter hours in duration. The four nestlings seemed to get equal attention in this particular: Green was attended 27 times; White 38 times; Blue 25 times; and Orange 22 times. White and Blue were in the nest about twenty-four hours after Green left, and about fifteen hours after Orange left. Blue, during the time the others were in the nest, received the least attention; the excreta being removed from him only twenty times up to the time of Green's departure. White received the most attention, thirty-four times in the same period, while Orange was attended twenty-one times.

Departure of the Young.

At about noon, June 28, the young birds became very restless, especially Green and Orange. They were continually crawling out of the nest and back again. At 12:20 p. m. Green crawled out of the nest and sat chirping for a short time. He then spread his wings and made an attempt to fly, but only succeeded in going a few inches. Immediately on falling he commenced to hop rapidly away; stopping a short interval at a fence about ten feet distant. One of the old birds returned at this time and coaxed him along until he reached the top of a little hill some sixty yards away. Here he stayed for some time, being fed at intervals by the old birds. One of the parents was with him most of the time from now on. From the time he left until 2:40 the female never visited the nest, and when she returned, the male went away and came back only once the rest of the afternoon.

At 2:10, Orange left the nest in much the same way. The male went with him and by coaxing him a short way at a time soon had the second nestling on the little knoll occupied by Green. The male busied himself the rest of the day caring for these two while the female fed White and Blue in the nest.

The next morning White started away at 7:07 and was coaxed along by the female for about thirty yards. Blue remained alone in the nest until 7:45, being fed only once in the interval, though White was fed three times. 7:45 Blue left the nest, but no parent bird returned to aid in the journey as long as the observations were continued. At 8:15, when the observations ceased, Blue was still alone in the grass.

Later all four of the fledglings were found in the ravine near by. They were noticed here several times, July 25 being the latest date on which they were positively identified. At this time the strings were still on their legs, but were so faded that no particular color could be recognized.

Sioux City, Iowa.