

A NESTING STUDY

of the

BLACK-THROATED GREEN WARBLER

Dendroica virens virens (Gmelin)

by

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also
see Wilson Bull.
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INTRODUCTION

This nesting study of the Black-throated Green Warbler (Dendroica virens virens) was undertaken as an individual research problem in an advanced ornithology course presented by Dr. O. S. Pettingill with the assistance of Miss Theodora Nelson at the University of Michigan Biological Station, Douglas Lake, Cheboygan County, Michigan, during the summer session of 1938.

The study itself covered a period of five weeks--from June 26th to July 30th; on the former date the pair of warblers was discovered building the nest, and the last observation was made on the latter date when the young were six days out of the nest. With the exception of June 27, July 10, 27, 28, and 29, the nest was visited daily and of approximately 55 hours spent at the nest, 15 hrs-40 min. constituted the longest single period of observation (July 21st, 4:20 A.M. - 8:00 P.M.)--the purpose of the latter being a study of feeding activity and frequency during the day.

The nest, 2½ feet above the ground, was observed with the aid of a canvas blind built on the platform of a 16-foot tower (see plate I). Weights of young were taken by means of a portable Cenco scale carried to the blind during the nestling stage. Measurements of the nestlings were also taken.

In presenting the data accumulated in this study, the author has used the table of contents in Hahn's "Life History of the Ovenbird" (6) for a model.

ACKNOWLEDGEMENTS

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DISTRIBUTION

I. General

Chapman states (2:460) that the Black-throated Green Warbler breeds in the lower Canadian and transition zones from central Alberta, southern Manitoba, central Ontario, central Quebec, and Newfoundland south to southern Minnesota, southern Wisconsin, northern Ohio, northern New Jersey, Connecticut and Long Island and in the Alleghenies south to northern South Carolina, northern Georgia, and northern Alabama. A race (D. v. Waynei) is resident in the coastal district of South Carolina. In migration this species moves west to eastern Texas, and winters from Mexico to Panama. Recently (Wilson Bulletin, ? (1936)), L. Irby Davis has reported the wintering of the Black-throated Green Warbler in the lower Rio Grande valley of Texas.

With regard to its Michigan distribution, VanTyne classifies the Black-throated Green Warbler as a common transient throughout the state and a summer resident south to Huron County (6:33).

II. Local

Writing of the birds of the Douglas-Lake region, Blanchard (1) states: "The Black-throated Green Warbler is probably the commonest warbler of the bog forests. It may be seen and heard at all times of the summer in such situations and is not infrequently found in the aspens at long distances from the conifer woods. One nest found July 11, 1934, was about 18 feet up in a maple tree in the Brutus Hardwoods; the nest contained one Cowbird about 10 days old and an unhatched Black-throated Green Warbler egg."

The author found this species one of the most abundant war-

blers in the region--common in bog areas and frequent in pine woods about Douglas Lake and along the shores of Lake Michigan at Wilderness Park and Lake Huron on Duncan Bay. At no time was it observed in aspen areas, but it no doubt occurs there--especially after the young are out of the nest.

III. Territory

Due to the fact that only one pair of Black-throated Green Warblers occurred in the area in which the study was made, there was no opportunity for observation of territorial relations of different pairs of this species. With reference to the location of the nest, the male was to be found or heard at varying distances always to the south of ten as much as $\frac{1}{4}$ mile; however, this had no territorial significance since it was obviously a case of preferred habitat and the bird was never observed in the upland aspens to the east or the semi-open woods to the north. The nearest other pair of Black-throated Green Warblers was located at Pine Point on Douglas Lake, about $\frac{3}{4}$ miles up the shore towards North Fishtail Bay. Another pair nested to the other side of the Biological Camp on Grapevine Point, and it was probably this pair that was observed ^{July 19th} by several ornithologists in camp feeding a young cowbird.

THE NEST

General Habitat

This study was made in a slightly rolling, sandy area bordering the eastern shore of Douglas Lake (see fig. 1, plate I) where the chief trees were Norway pine (Pinus resinosa), white birch (Betula papyrifera), Oak (Quercus borealis), white pine (Pinus strobus), large-toothed aspen (Populus grandidentata), and trembling aspen (Populus tremuloides). A common high shrub was the service-berry (Amelanchier canadensis); among the low shrubs and ground plants, the blueberry (Vaccinium pennsylvanicum), huckle-berry (Gaylussacia baccata), bear-berry (Arctostaphylos uva-ursi), and bracken-fern (Pteris aquilina) were the most noticeable.

The pines, not doubt, constituted the chief habitat attraction for the Black-throated Green Warblers, and though this species is characteristic of bogs, the only approach to the latter type of habitat in the present situation was the shallow and circular depression in the sand, perhaps 100 feet in diameter, the bottom of which was always damp and as a result overgrown with a more luxuriant vegetation. The nest studied was located in one of the Norway pines growing along the western rim of this depression.

Other species of birds more or less common in the area were the Red-eyed Vireo (Vireo olivaceus), Hermit Thrush (Hylocichla guttata faxoni), Crow (Corvus brachyrhynchos brachyrhynchos), Cedar Waxwing (Bombocilla cedrorum), Chipping Sparrow (Spizella passerina passerina), Nashville Warbler (Vermivora r. ruficapilla), and Pine Warbler (Dendroica p. pinus).

Nesting Site

The nest studied was located in a Norway pine about 23 ft. above the ground and was placed on a horizontal portion of a branch approximately $5\frac{1}{2}$ ft. out from the trunk. The nest was built directly on the branch, supported by a small side branchlet and protected from above by clusters of pine needles.

Another nest, found in Wilderness Park on July 4th, also located in a Norway pine, was placed about 12 ft. above the ground and also on a horizontal branch about 5 ft. from the trunk. (At this time the nest contained three young about 8 days old; the nest was collected on August 1st.)

Structure of the Nest

Nest A (at Douglas Lake):

Lining - mostly hairs; some grasses, one small black feather, also wool-like plant fibers.
Bulk - grasses, rootlets, small, thin and short pine twigs.
Trimming - mostly birch bark; some more of the wool-like plant fibers, some cottony material very likely from seeds, and also a piece of partially decayed leaf blade.

birch bark

Nest B (at Wilderness Park):

Lining - mainly thin grasses, some hairs.
Bulk - rootlets, blades of grass, short pine twigs.
Trimming - bits of birch bark and a considerable quantity of hypnaceous mosses.

Weights and measurements:

	Nest A	Nest B
Inside diameter	4.5 cm.	5.0 cm.
Outside diameter	7.8 cm.	7.5 cm.
Inside depth	3.0 cm.	3.0 cm.
Outside depth		
Minimum	3.0 cm.	3.0 cm.
Maximum	5.5 cm.	6.5 cm.
Weight	4.92 gr.	7.85 gr.

Of the two nests, Nest B is probably the more average in weight and measurements. Nest A was a decidedly flimsy structure, which might have been due (considering the late date at which the nest was begun) to an unsuccessful first nest during early June or it might have been the female's first attempt at nest-building.

Building of the Nest

When first discovered on June 26th (about 3 p.m.), the pair of Black-throated Green Warblers were accumulating bits of nesting material on a pine branch; both male and female were observed building the nest at the same time, and each member of the pair tried to work the material in the nest alone. On June 28th (1:30 p.m.) the bulk of the nest was built; both on this date and on June 30th, the female was observed working on the lining of the nest.

EGGS

Egg-Laying

The first egg was found on July 1st with an egg of the Cowbird. The second egg was laid the morning of July 3rd when the female was observed on the nest but did not appear during visits to the nest in the early and late afternoon. The last egg was laid on July 5th. However, at the time the third egg of the warbler was found, the Cowbird egg was gone. A search of the ground below the nest was made and the remnants of the egg shell were found at the base of the pine tree which held the nest. Two pieces of the shell had marks of the incisors of some small rodent, probably a chipmunk or thirteen-lined ground squirrel. Whether this egg was kicked out of the nest by the warbler or whether it was removed by some predator remains a puzzle.

Eggs

The eggs, numbering three (four is the usual number), were creamy white spotted and speckled with olive brown and purplish, these markings being numerous about the larger end. One of the eggs was decidedly less marked so about the larger end than the other two. No measurements were taken because of the fragility of the eggs and the precarious position of the nest with relation to the blind, the placement of which was delayed to within a few days of hatching to insure against the warblers' deserting. Weights were also not taken since a single set of such weights would be of negligible scientific value even apart from the fact that the eggs lose weight as hatching time approaches. According to Forbush (4:265), egg measurements for this species are .58 to .73 x .49 to .53.

Incubation

Incubation apparently began on July 4th, three days after the first egg was laid (last egg laid on July 5th). At no time was the male observed on the nest although this has been reported (Forbush, 4:265). During the period of incubation, the female exhibited increasing fearlessness, most remarkably in her stay on the nest during the placement of the tower and accompanying hammering, movement and disturbance in general. No extended observations were made of the on-and-off periods of the female with regard to incubation except for a portion of one afternoon, during which time the female remained off the nest for periods of 12-13 minutes and remained on it for periods of about 35 minutes. During incubation, more or less frequent shifts of position were made, and in the observer's presence, the female would change her position apparently to be better able to watch his movements. Once (late afternoon, July 14th), the female

was discovered asleep on the nest.

During the incubation period, the male was found near the nest but once--on the fourth day of incubation (July 8th), on which date the female left the nest at the observers approach, giving her alarm note and remaining about six feet away from the nest in spite of the fact that the observer had moved back. At this time, the male appeared, flying directly to the nest branch, moving to the rim of the nest, and apparently making some adjustments of the eggs which had slid to one side of the nest-cup due to the observers disturbance in pulling the branch. The male then moved about the branches surrounding the nest as if for further inspection and then left. Thereupon, the female returned to the nest and settled on it immediately. During the raising of the tower (at which time the female remained on the nest, see above), the male chipped occasionally in the vicinity.

Hatching

Three nestlings were found on July 16th, 11 days after the last egg was laid, 15 days after the first, and 12 days after the apparent beginning of incubation. The young were naked with the exception of down on the feather tracts, this being the longest on the crown (5 mm.).

THE NESTLING STAGE

Young Birds in the Nest

Weights and measurements of the nestlings were taken during the period in the nest and also on one day after leaving the nest. Weights (see table I, p. 22) are graphed on page 23 and show a steady increase in weight to the sixth day, a three-day period of more or less consistent weight, followed by a drop after the young leave the nest. Measurements are presented in table II, page 24, and the growth rate of L-W, one of the young Black-throated Green Warblers, as shown by measurements of length, extent, wing, tarsus, bill, tail, and nostril to tip of bill, is graphed on page 25.

Pin-feathers appeared in the major tracts on the fourth day after hatching, on which date the eye slits also began to open. The sheaths of the feathers began to break on the sixth day. The young were able to grasp objects on the 7th day after hatching.

Because of the flimsiness of the nest structure combined with the exposure to strong winds sweeping across Douglass Lake, the female's habit of tipping the nest slightly while brooding, and the observer's contribution towards the unbalancing of the nest in pulling it out, it soon became evident that before the nest study was completed, one or two or possibly the entire nest would fall out of the tree. To prevent the last, the nest was tied down, but on July 20th, one of the young birds (R-W) fell out during a strong wind from the lake and was found dead on July 21st. On July 23rd, another (B) was found out of the nest and from his weakened condition appeared to have been out perhaps several hours; the bird was placed back into the nest and apparently overcame any effects of exposure.

Parental Care of Young Birds in the Nest

Both male and female warblers fed the young while the latter were in the nest. The female fed the young decidedly more often than the male and in apparent independence of him. On the fifth day after hatching, when continued observation was made from 4:20 A.M. to 8:00 P.M., the female brought food 30 times while the male brought food only 17 times. The female's activity during this day is shown in graph III, which presents the lengths of time away from the nest alternated with the periods at the nest. This graph, together with data collected during the morning and afternoon on the third day after hatching, would indicate that both the periods on the nest and the intervals during which the female is away from the nest tend to increase in length into the late afternoon, after which feeding becomes more frequent. The length of the intervals between the visits of the male are shown in graph IV, which indicates the greatest intervals in the morning and afternoon. Both of these activity graphs can be correlated with graph V, which shows most feeding and therefore more frequent visits of the parents during the early morning, at noon, and in the early evening.

In spite of the fact that the female's feeding of the young appeared to be independent of that of the male, the appearance of the latter with food at the nest more often in the absence of the female than in her presence is probably to be accounted for by the use of the song during the male's approach (considered belong^{ed} under "Singing") in response to which the female would leave the nest before he appeared. If the male arrived while the female was on the nest, the female would simply leave the nest, perch on one of the branches nearby, and, after the male fed the young, return to the nest.

It is a singular fact that the male brought more food at every one of his visits than the female. Almost without exception, the male brought two or three green lepidopterous larvae of the same species and about 1 inch in length. The female brought small Diptera, small larvae and worms, and the bulk always amounted to a fraction of the amount brought by the male. In the observer's presence, the female was seen to consume the food she had intended for the young, and on other occasions both the male and female were observed carrying it away after trying to approach the nest.

As the young grew older, the periods of brooding by the female were shortened. During the fifth day after hatching, when extended observations were made, the female brooded throughout the periods at the nest except for short periods before and after leaving the nest during the late morning and afternoon. It became increasingly difficult for the female to settle on the young and once she was observed to make two attempts, getting on and off the nest, before finding a comfortable position the third time. During the periods when the female was not brooding, but standing at the rim of the nest, she was often observed to work the material in the bottom of the nest. At one time, when L-W was returned to the nest (after weighing and measuring) in the female's presence, she came to the rim of the nest and appeared to be pulling down off of the nestling (5th day after hatching).

With regard to sanitation of the nest, both male and female warblers removed and swallowed faecal sacs, and on occasions when these were particularly large, they were carried away and probably dropped.

Leaving the Nest

On July 25th, L-W was found out of the nest--nine days after hatching. On that date, B was observed perched on the rim of the nest. This observation was made in the evening of the 25th, and B apparently remained in the nest till the following date (10th day after hatching) when he, too, left. The "white-washed" pine needles close to the rim of the nest indicated that B spent some time there before descending. On the afternoon of the 26th, while the young were being located and photographed, the female showed her attachment to the nest by continuing to bring food to it in spite of the fact that it was empty.

YOUNG BIRDS AFTER THEY HAVE LEFT THE NEST

After the young left the nest, the male was not observed to take any part in the feeding. With the exception of his appearance on the scene and feigning injury on the evening of the 25th when L-W was located in the undergrowth and his occasional appearance in the vicinity of the nest during observations on the afternoon of the 26th, the male took no active part in the care of the young.

The ground cover of bracken fern, blueberry, and bearberry provided excellent protection for the young, which remained perfectly still during the observer's searches for them until one was actually knocked down or disturbed from its perch, and the best way to locate them was to remain off in the background and wait for the call of the young which could then be assigned to some definite little territory and a search made thereof. On the second day after leaving the nest, L-W was able to make short flights and even ascend into a pine tree. B, his first day out of the nest, could only make descending flights and scramble along the ground. On July 30th, one juvenile, fed by the female, were observed still in the vicinity of the nest (5th day after leaving.).

THE COWBIRD

In the Douglas Lake area and in the region as a whole, the Cowbird is abundant and cowbird parasitism is common in a number of species, the Black-throated Green Warbler no doubt being one of these. Details regarding the cowbird egg layed in the nest considered in this study and its subsequent disposal have been presented above (page 8). The observation by several ornithologists in camp on July 19th of a pair of Black-throated Green Warblers feeding a cowbird has also been mentioned previously (page 5), in which case the nestlings of the warbler probably suffered the usual fate.

PROTECTION OF YOUNG

The second day after hatching of the young, the female was noted to feign injury during the observer's approach to the nest; the female remained a few feet from the nest, fluttering her wings and bending forward slightly. This same exhibition was given on the day L-W left the nest (July 25th) and later the same day, she performed on the ground at which time the tail was dragged along in addition to the wing fluttering and body bending. Also on this date, the male appeared on the scene of the excitement and feigned injury in the same manner--but just once.

On the eighth day after hatching, ^{of the young} a red squirrel was observed to approach the blind, coming to within 7 feet of the nest. At this time, the female simply left the vicinity of the nest at once and gave no alarm notes. Later the same day, when a young Black and White Warbler approached the blind on the nest branch to a distance of 5 feet from the nest, the female pounced upon it and struck with considerable force. The Black and White Warbler

flew off and after recovering from the shock began calling again. In its youthful ignorance and curiosity, it approached again, whereupon the female approached and upon reaching a distance of 1 foot, gave the young Black and White Warbler a chase on wing. The Black and White Warbler did not appear again.

SINGING

The Song

The Black-throated Green Warbler has two songs, both of which may be given with certain modifications. The first and most common one may be shown as follows:

Song A

— — — — —
zee-zee-zee-zee-zu-zwee

The zee's preceding the zu-zwee may be reduced to two or increased to six in number. Thayer (3:160) interprets this song as wi-wi-wi-wi-wi-wi-wer-weee, the last note highest pitched as well as most emphatic.

The second and less frequent song may be shown as follows:

Song B

~~~~~ ~~~~~ — — —  
zrrr-zrrr-zu - zu-zwee

The second or last or both notes may be omitted resulting in the following modifications: zrrr-zrrr-zu-zu or zrrr-zu-zu-zwee or zrrr-zu-zu. Thayer (3:160) interprets this song as sweer-swerrr-swi-ni-swee, the first and last accented notes highest pitched.

One of the most interesting observations of the song made in this study was its use by the male as an apparent warning to the female brooding the young of his approach to the nest with food. These observations were made during the fifth day after hatching (July 21st).

Records of the number of times the song was given were begun in the early part of the day to arrive at some kind of a frequency; but it was soon noted that for about three to five minutes before arriving at the nest with food and for the same period after leaving the male sang, but with a few exceptional times, not in between these periods. During the approach to the nest song A was given and after leaving either song A or B was given. The singular thing about the approach song was that the closer to the nest the male came, the more ventriloquistic the song became in quality until, when the singer was but a few feet from the blind, the song became a whisper and unless one was aware of the male's presence, it sounded as if coming from the distance. Usually the female left the nest before the male reached the nest tree. Once the female left the nest in response to a single performance of the song, remaining perched near the nest while waiting for the male, who came with food a minute or so later. On a few occasions the female remained on the nest until the male was within a few feet of the nest and until he had given a few soft "chip's in addition to the whisper-song. During the singing periods, song A was given on an average of 5-6 times a minute while song B was given only about 3 times a minute.

The assumed ventriloquistic quality of the song may be used to ward off any supposed enemies in the vicinity while the actual giving of the song, as stated before, may be a warning to the female of the male's approach with food. Food held in the bill apparently has no effect on the performance of the song. (This has also been the writer's experience with Mourning Warblers.) In almost all of the cases where the female remained on the nest in spite of the male's approach, the former had fed the young a short time before and apparently did not deem it necessary to go off in search of food

again. The last (emphatic) note of song A was usually dropped in the whisper song.

#### Call-Notes

The usual alarm note of the female was a soft tzip distinctly less metallic than the chip of the male. During the excitement of the first two days after the young left the nest, the female gave a decidedly sharper, louder chip upon the observer's approach. Once the female gave a series of soft chips--directed at B who failed to open his bill following his replacement in the nest after the observer discovered the nestling on the ground (see page 11). The female also gave a soft chip once when the male was singing close to the nest as if calling to him in addition to giving her usual alarm note--tzip. The female's call to the youngsters while approaching them was a soft and rapidly repeated sh-sh-sh-sh. On the seventh day after hatching, the nestlings <sup>began</sup> to utter a rapidly repeated chi-chi chi-chi upon a parent's arrival at the nest or during the observer's handling of them.

Thayer (3:160) states that two at least of this warbler's call notes are fairly characteristic--a plainly Dendroicine but rather loud and full-toned tsip and a reduplicated, smaller chip often running into 'chipping' like that of many young but few other adult warblers.

## SUMMARY

1. This paper constitutes the report of a research problem directed by Dr. O. S. Pettingill in presentation of a course in advanced ornithology at the University of Michigan Biological Station.
2. A nesting study of the Black-throated Green Warbler (Dendroica v. virens) was made in a five-week period during late June and July in a pine-dominated area bordering the east shore of Douglas Lake.
3. The Black-throated Green Warbler is one of the most abundant warblers in the Douglas Lake region, preferring pineland and especially bog habitats.
4. No observations of territorial relations could be made.
5. The nest, located in a Norway pine 23 feet above the ground, was built chiefly of grasses and rootlets, lined mostly with hair, and trimmed with birch bark; both members of the pair took part in nest-building, but chiefly the female. Four days were required for the building of the nest.
6. Three eggs were laid with a two day interval between each; incubation apparently began on the third day after the first egg was laid. The incubation period is 12 days.
7. The female showed increasing fearlessness during the incubation period; normally she remained on the nest about 35 minutes and away 12-13 minutes. The male was observed at the nest but once during the incubation period.
8. Weights and measurements of young are presented in tabulated form; weights of young show a steady increase to the sixth day, a three-day period of more or less consistent weight, followed by a drop after the young leave the nest.
9. Both male and female feed the young in the nest, the latter decidedly more often, though the former brought more food at one visit. Lulls in feeding occurred in the late morning and afternoon; the main feeding periods were early morning, noon, and early evening. Both male and female removed and swallowed or carried away faecal sacs.
10. Periods of brooding by the female were shortened as the nestlings grew older and larger.
11. The young left the nest nine (L-W) or ten (B) days after hatching.
12. The male took no active part in the care of the young after the latter had left the nest.
13. Both parents attempted to protect their young by feigning injury. The female attacked <sup>small</sup>avian intruders coming too close to the nest.

14. Cowbird parasitism is common in the Douglas Lake region and the Black-throated Green Warbler is a frequent victim.
15. Two songs with word interpretations are recorded.
16. Details of an approach song of the male uttered in bring food to the nest are given. The increasing ventriloquism of the song as the male approaches is apparently intended to detract enemies while the song itself warns the female of the male's approach to which the female responds usually by leaving the nest and returning with food after the male leaves.
17. A number of call-notes of both male and female are given.

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TABLE I  
WEIGHTS OF NESTLINGS

| Date              | Weights in grams                   |      |         |
|-------------------|------------------------------------|------|---------|
|                   | B*                                 | L-W* | R-W*    |
| July 16           | (Eggs hatched; weights not taken.) |      |         |
| 17                | 1.67                               | 1.96 | 1.72    |
| 18                | 2.77                               | 2.98 | 2.90    |
| 19                | 3.83                               | 4.29 | 4.02    |
| 20 (7:15<br>p.m.) | 4.92                               | 5.90 | 5.48    |
| 21                | 5.90                               | 7.54 | (5.24)' |
| 22                | 7.69                               | 8.61 |         |
| 23                | (Weights not taken.)               |      |         |
| 24                | 8.02                               | 8.59 |         |
| 25                | 8.46                               | 8.66 |         |
| 26 (4:30<br>p.m.) | 7.31                               | 7.87 |         |

\*B-black, L-W-left white, R-W-right white, denoting thread markers on legs of nestlings.

'Weight of dead bird.

Note: Unless otherwise indicated, weights were taken about 5:00 p.m. Scales were not available for weight-taking on July 16th and 23rd.

Graph I

WEIGHT INCREASE IN  
NESTLINGS OF THE BLACK-THROATED GREEN WARBLER  
(based on Table I)

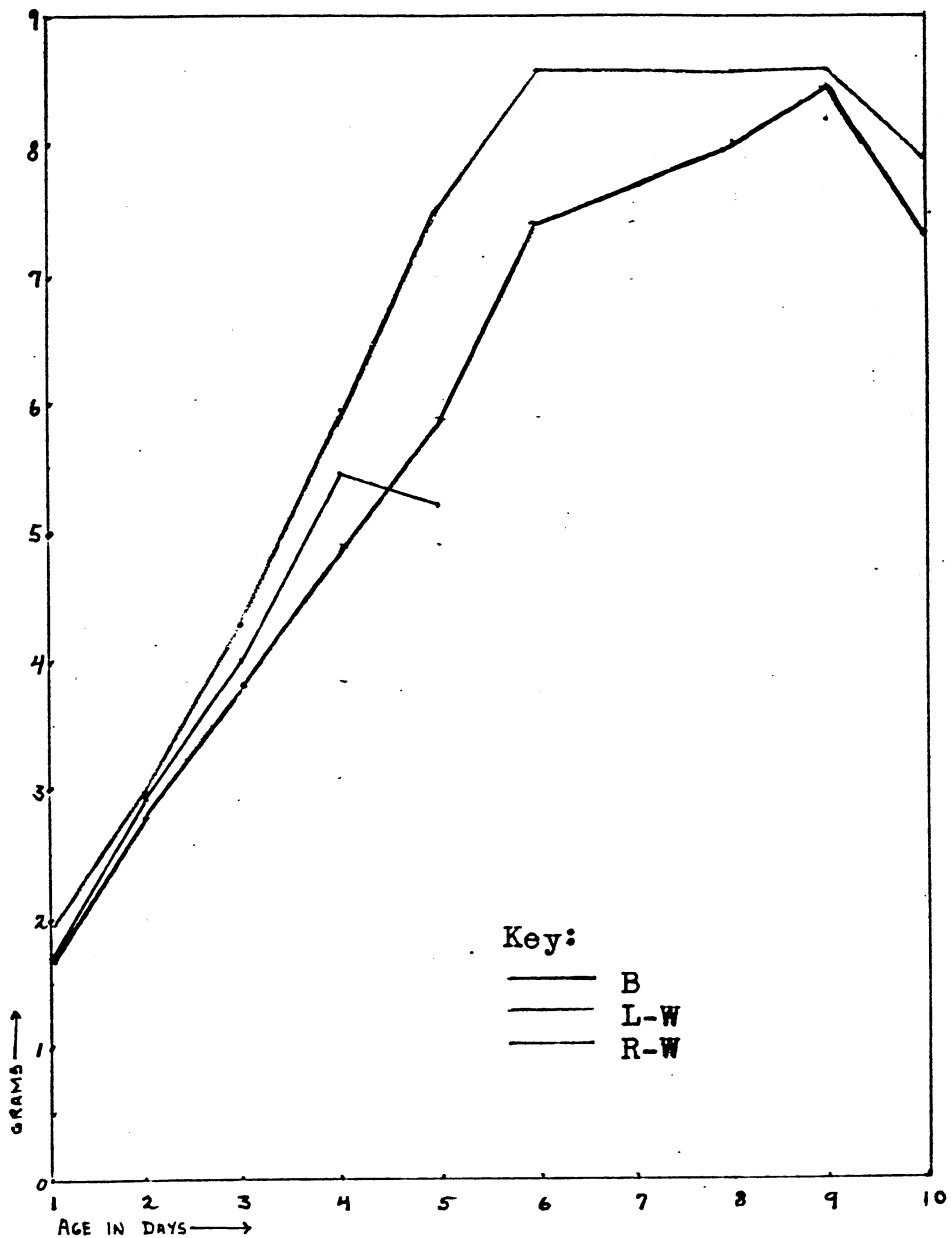




TABLE II

## MEASUREMENTS OF NESTLINGS

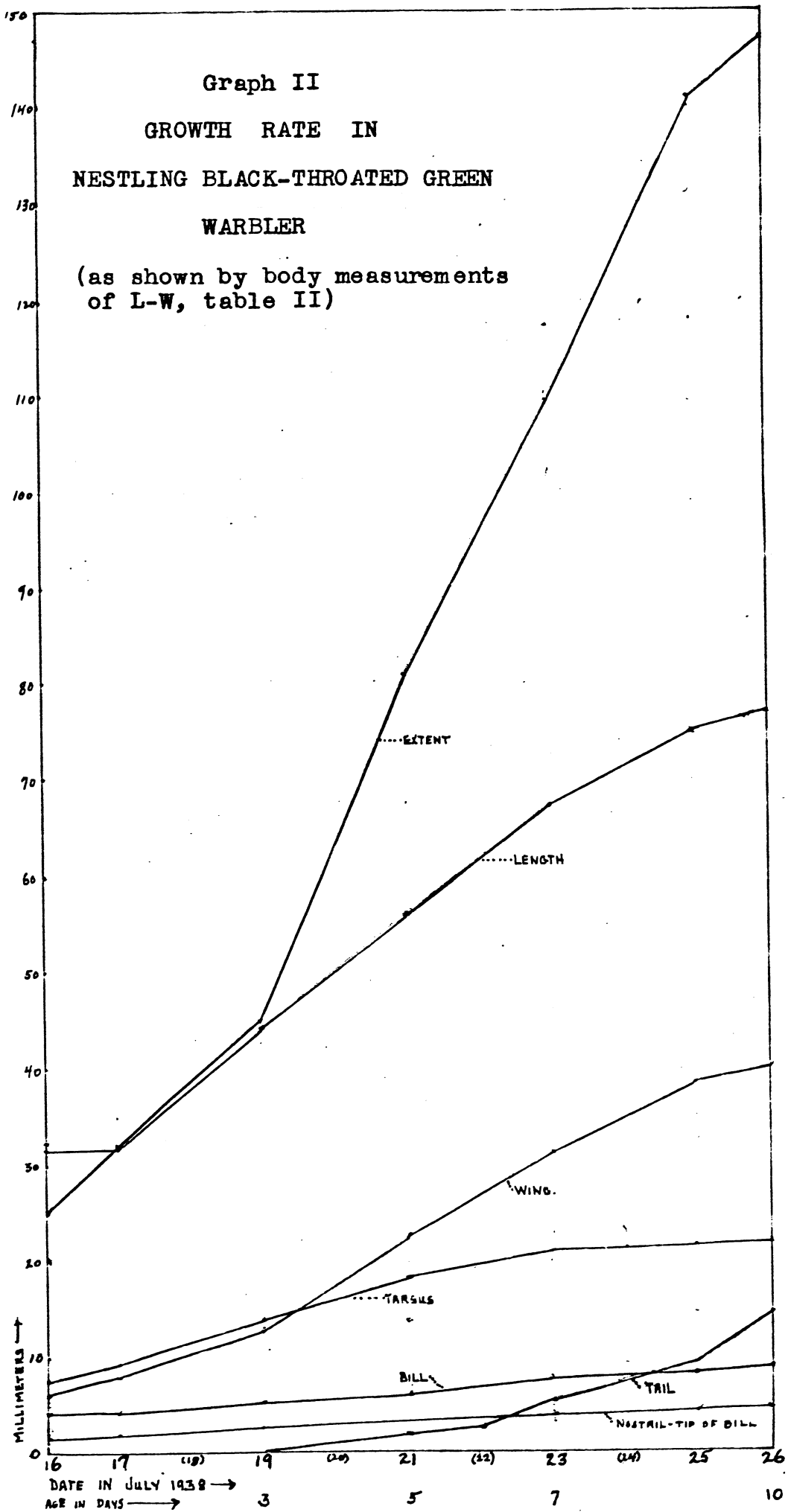
(in millimeters)

| Date    | Bill  |     |       | Nostril-Tip<br>of Bill |     |     | Tarsus |      |      | Length |      |        |
|---------|-------|-----|-------|------------------------|-----|-----|--------|------|------|--------|------|--------|
|         | L-W   | R-W | B     | L-W                    | R-W | B   | L-W    | R-W  | B    | L-W    | R-W  | B      |
| July 16 | 4.0   | 3.7 | 3.7   | 1.8                    | 1.6 | 1.6 | 7.5    | 6.9  | 7.0  | 32.0   | 32.0 | 31.0   |
| 17      | 4.0   | 4.0 | 3.7   | 1.9                    | 1.7 | 1.7 | 9.0    | 8.2  | 8.8  | 31.5   | 35.0 | 33.0   |
| 19      | 5.3   | 5.0 | 5.0   | 2.5                    | 2.4 | 2.2 | 13.7   | 13.0 | 12.6 | 44.0   | 43.0 | 43.0   |
| 20      |       | 5.7 |       |                        | 2.8 |     |        | 15.3 |      |        | 53.0 |        |
| 21      | 6.2   |     | 5.8   |                        |     | 3.0 | 18.0   |      | 17.2 | 56.0   |      | 52.5   |
| 22*     | (6.2) |     | (6.0) |                        |     |     |        |      |      | (68.0) |      | (64.0) |
| 23      | 7.6   |     | 6.7   | 3.6                    |     | 3.2 | 21.0   |      | 20.0 | 67.0   |      | 59.0   |
| 25      | 7.8   |     | 7.0   | 4.2                    |     | 3.8 | 21.2   |      | 21.0 | 75.0   |      | 70.0   |
| 26      | 8.2   |     | 7.4   | 4.6                    |     | 3.8 | 22.0   |      | 21.1 | 77.0   |      | 73.0   |

|         | Extent  |      |         | Wing   |      |        | Tail  |     |       |
|---------|---------|------|---------|--------|------|--------|-------|-----|-------|
|         | L-W     | R-W  | B       | L-W    | R-W  | B      | L-W   | R-W | B     |
| July 16 | 25.0    | 25.0 | 23.5    | 6.3    | 6.0  | 6.0    | 0.    | 0.  | 0.    |
| 17      | 32.0    | 28.0 | 28.0    | 7.7    | 7.1  | 7.2    | 0.    | 0.  | 0.    |
| 19      | 45.0    | 47.0 | 44.0    | 12.6   | 11.7 | 11.0   | 0.    | 0.  | 0.    |
| 20      |         | 72.0 |         |        | 17.2 |        |       | 0.  |       |
| 21      | 81.0    |      | 77.0    | 22.6   |      | 19.4   | 1.9   |     | 1.3   |
| 22*     | (125.0) |      | (114.0) | (31.0) |      | (28.0) | (2.5) |     | (2.5) |
| 23      | 107.0   |      | 96.0    | 31.3   |      | 28.5   | 5.3   |     | 5.7   |
| 25      | 141.0   |      | 132.0   | 38.2   |      | 36.0   | 9.0   |     | 6.0   |
| 26      | 147.0   |      | 140.0   | 40.0   |      | 37.5   | 12.3  |     | 11.6  |

\*Measurements taken by Dr. Pettingill.

Note: Fractional digits are open to question and should be taken only as approximations.



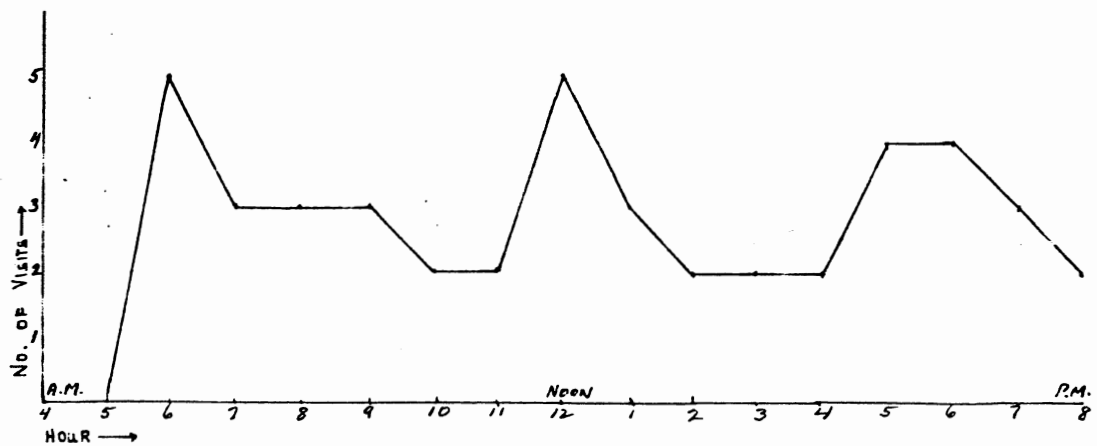
GRAPH V

RATE OF FEEDING OF YOUNG

Black - throated Green Warblers

FIFTH DAY AFTER HATCHING

(Based on number of feedings per hour)



Note: The point above each hour indicates the number of feedings during the preceding hour.

Description of

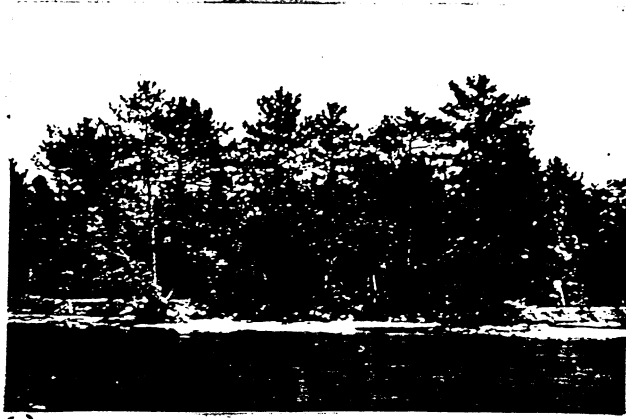
PLATE I

Fig. 1--Scene on east shore of Douglas Lake showing general habitat in vicinity of the nest of the Black-throated Green Warbler.

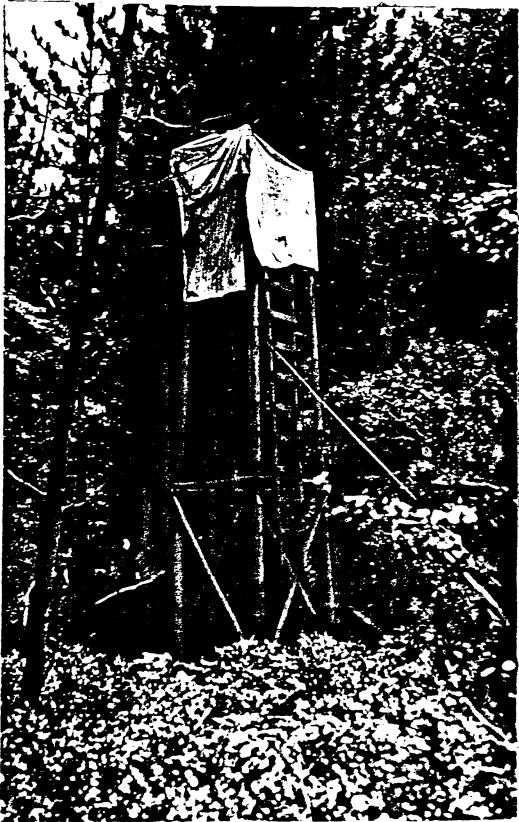
Fig. 2--View of tower and blind, the platform of which was 16 feet above ground.

Fig. 3--Another view; nest located on one of the horizontal branches of the pine back of the canvas 24 feet above the ground.

PLATE I



(1)



(2)



(3)

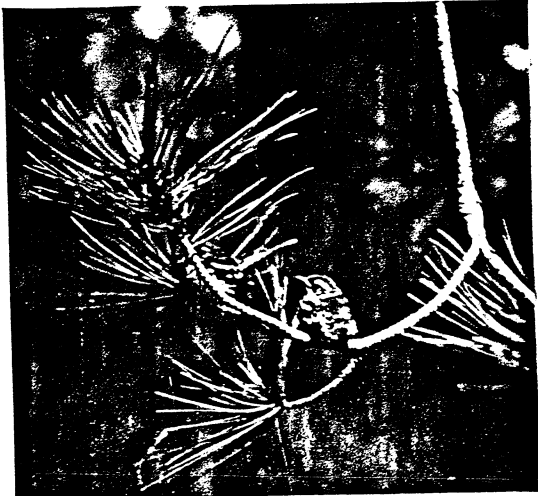
PLATE II



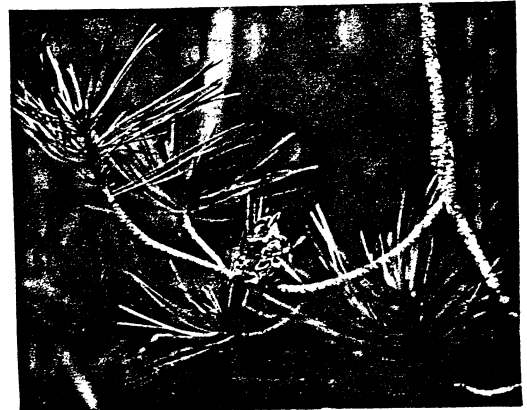
(4)



(5)



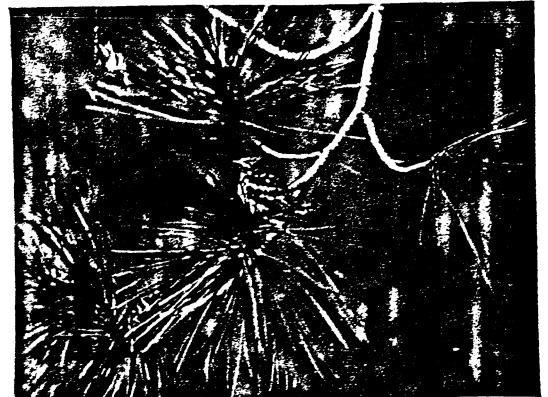
(6)



(7)



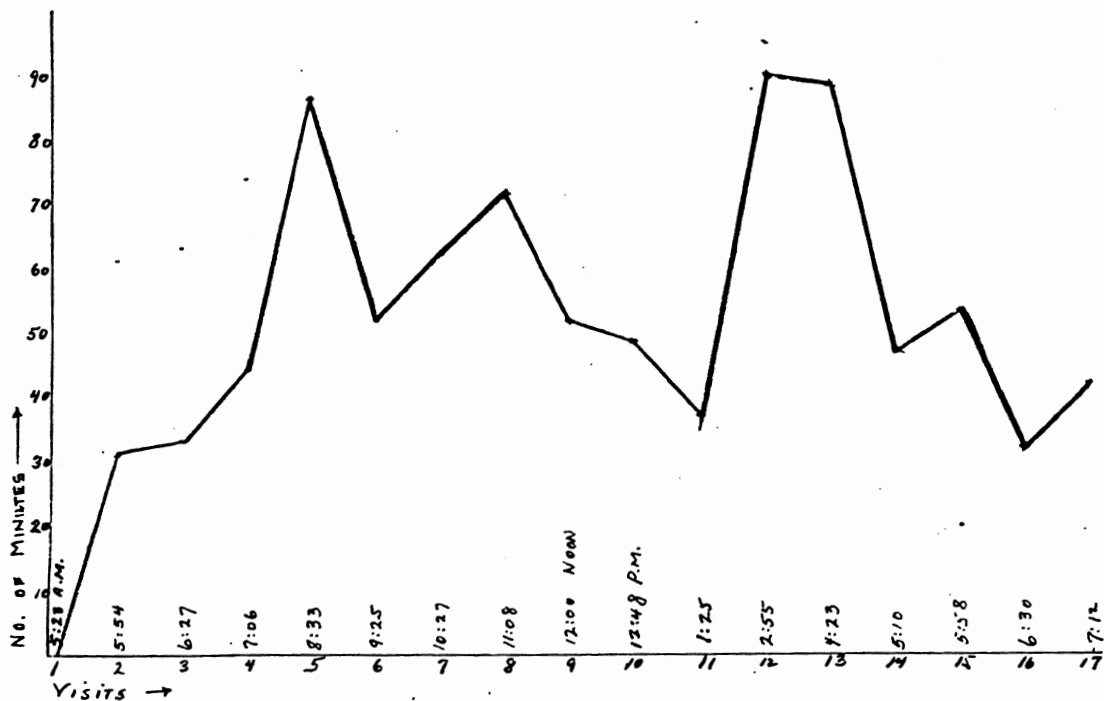
(8)



(9)

GRAPH IV

FEEDING ACTIVITY OF THE MALE  
BLACK-THROATED GREEN WARBLER  
FIFTH DAY AFTER HATCHING OF YOUNG.



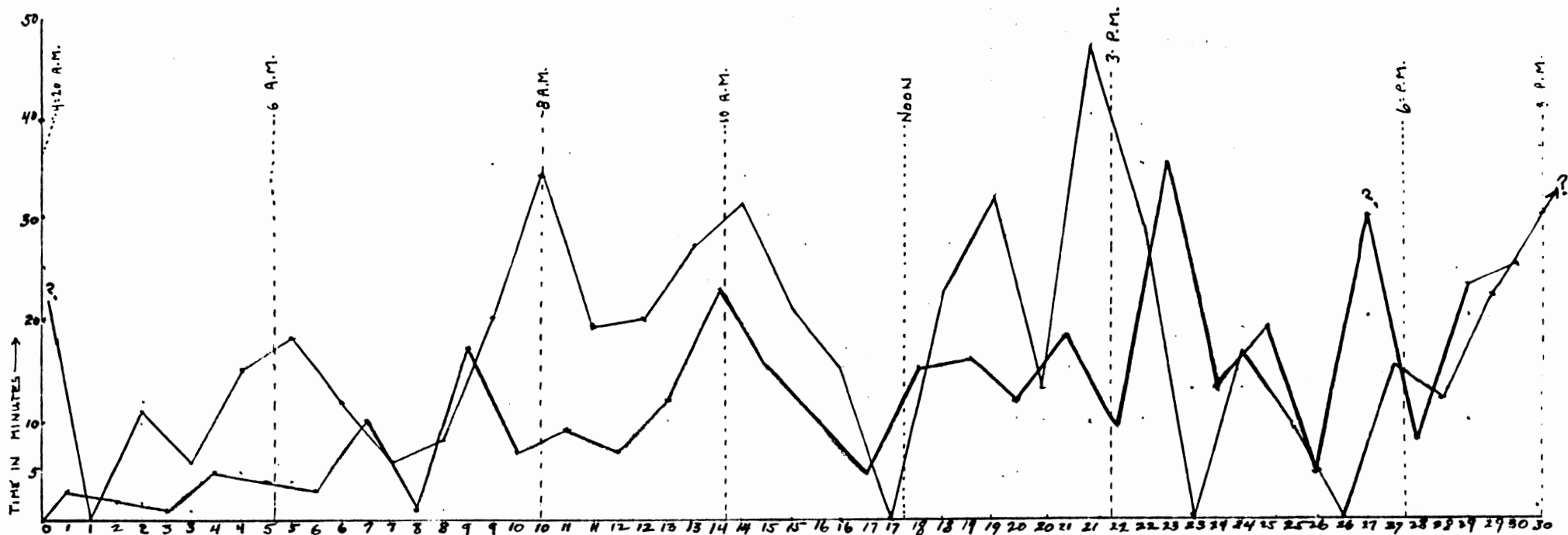
Red line indicates length of interval between each visit; time of visit is given above the number of the visit.

GRAPH III

FEEDING ACTIVITY OF THE FEMALE

BLACK-THROATED GREEN WARBLER

FIFTH DAY AFTER HATCHING  
OF YOUNG



Key:

— Periods on (or at) nest. Alternated with

— Intervals away from the nest.