

AN ECOLOGICAL STUDY OF THE SPIDERS IN SELECTED HABITATS
IN THE DOUGLAS LAKE, MICHIGAN REGION

Submitted by
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INTRODUCTION

The purpose of this study was to discover the differences in the spider fauna of varied habitats and to try to determine the reasons for these differences. The observations were made in the Douglas Lake region during the period of June 27, 1949 to August 4, 1949.

Since three habitats which were very different in their soil, flora, and fauna were desired, it was decided to choose one area from each of the following types of ecological associations: bog, aspen forest, and gravel pit. In each of these an area of ten square meters was selected. The study included all of the Aranea observed in these selected habitats up to a height of two meters.

Observations and collections were made twice a week, usually on Monday and Thursday mornings, regardless of weather conditions. Between one half hour and one hour was spent at each location every time the field trips were made. This amount of time seemed sufficient for the size of the area chosen.

Weather conditions were observed on each collecting trip. Temperature, velocity of wind, relative humidity, sky conditions and amount of sunlight were recorded. Also recorded were notes regarding the microhabitat and other interesting facts such as web, food, habits, and life history of each

spider collected. All of this data was recorded in the field on habitat census and field record sheets prepared especially for this study. A sample of one of these sheets is shown as Table 5.

The method of collection was manual. Apparatus taken on each field trip included one pair of BB forceps, a dry bulb thermometer, a wet bulb thermometer (used in determining the relative humidity), a Weston MasterII Exposure Meter and collecting bottles filled with 70% alcohol.

DESCRIPTION OF HABITATS

Bog

The bog habitat observed was located in Reese's Bog near the Hogsback Road iron bridge across Carp Creek. The locus key for the area is T36N/R3W/S4. The exact location is marked on the map - Figure 1.

The soil has been built up over a period of years from the decaying material of the bog. The top mat of decaying material was between one and two inches thick. The ground was very damp, and mucky and in one part of the area chosen, there was standing water. The region chosen was fairly level.

Plants were very abundant in the area, seventeen species being recorded. These were:

Aralia nudicaulis

Athyrium filix femina

Phegopteris dryopteris

Arisaema triphyllum

Clintonia borealis

Acer spicatum

Taxus canadensis

Hepatica sp.

Fissidens cristatus

Cephalozia sp.

Mnium cuspidatum

Brachythecium rivulare

Thuidium delicatulum

Thuja occidentalis

Mnium stellare

Mnium punctatum

Caltha palustris

There were several ~~standing~~ stumps between two and three feet in height and one foot in diameter and one fallen log about two inches in diameter and four feet long. The *Acer spicatum* was about four feet in height and the *Thuja occidentalis* about ten feet tall. A photograph of the area is shown on Plate I.

Other fauna observed in the area included phalangids and mosquitoes, both of which were very abundant, deer flies, phantom craneflies, millipeds and centipedes, chickadees, ruffed grouse and one garter snake.

The amount of sunlight received varied from one hundred to six hundred candles per square foot, the average being about two hundred thirty three. The light readings were always taken at the same location and at approximately the

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same time. (Figure 3)

The temperature varied from 62 to 76 degrees Fahrenheit, the average being about 69 degrees. (Figure 2)

The relative humidity varied from 69% to 90%, the average being about 79%. (Figure 4)

Aspen

An area along the east side of the Topinabee Road was chosen as typical of an aspen forest. The locus key for the area is T37N/R3W/S34. The exact location is marked on the map. (Figure 1).

The soil was covered with a thin layer of decaying leaves from the aspens and braken. The ground was usually moist although not damp as in the bog habitat. The area was very level.

Plants were abundant here although fewer species were recorded than in the bog. There were five Aspens of varying sizes in the area and one Pin Cherry tree. The Braken was very thick. The species recorded are as follows:

Populus tremuloides
Prunus pennsylvanica
Pteris aquilina
Rubus allegheniensis
Gaultheria procumbens
Diervilla lonicera
Maianthemum canadense

There were three dead trees standing, two about eight feet in height and one about five feet tall. There were three fallen trees all about two or three inches in diameter. One of these was blown down during a storm in the first part of the session. A photograph of the area is shown on Plate II.

Other fauna observed in the area included mosquitoes, (fewer than in the bog), many ants, several species of Diptera and one *Plethodon cinereus*.

The amount of sunlight received varied from 75 to 300 candles per square foot, the average being 127. These readings were always taken at the same place - as in the bog - near the center of the area and about five feet from the ground. However, in the aspen forest considerable less light reached the forest floor than in the bog because of the thick braken growth. (Figure 10)

The maximum temperature recorded was 86 and the minimum was 69. The average of the temperatures recorded for the aspen forest habitat was about 76. (Figure 9)

The relative humidity varied from 49% to 90%, the average being about 64%. (Figure 11).

Gravel Pit

The gravel pit behind the Vertebrate laboratory on the Biological Station Campus was chosen for the third habitat studied. The locus key for the area was T37N/R3W/S33. The exact location is marked on the map. (Figure 1)

The soil was sandy with much gravel and many rocks

present. There was a slope of about thirty degrees. There was some decaying vegetation present.

Some plants were present although there were not as many as in either of the other two locations chosen. None of the vegetation exceeded a height of about four feet with the majority of it being about two feet tall. The plants recorded are as follows:

Rhus glabra
Prunus pennsylvanica
Diervilla lonicera
Hieracium aurantiacum
Rubus idaeus
Poa compressa
Asclepias syriaca
Fragaria virginiana
Solidago sp.

A photograph of the area is shown on Plate III.

Very little fauna was observed in this habitat with the ants being the most abundant.

The amount of sunlight was at least 1600 candles per square foot with only one exception - that day a reading of 800 was taken. Since the light meter does not record readings over 1600 these figures are not very accurate and it is probable that the average would be higher than 1600. (Figure 17)

The temperature also was constantly higher than in the other two habitats, the maximum recorded being 90 and the

minimum, 75. The average temperature was 82 degrees Fahrenheit (Figure 16).

The relative humidity varied from 35% to 79%, the average being about 60%. (Figure 18).

OBSERVATIONS OF LIFE OF SPIDERS

Bog

Webs of Tetragnatha sp. were observed on two different occasions. Each web was built slightly inclined about five feet above the ground. In both cases also, the webs were about a foot and a half in diameter. In the first one observed, the spider was resting near the center of the web with the first and second pairs of legs projecting forward, the third pair extended laterally and the fourth pair stretched backward. The second web had no spider on it but observation of one of the branches that had been used as a basis for the web revealed the spider. It was stretched out on the twig in a position similar to that of the spider on the web - the third pair of legs being used to hold on to the branch.

On two occasions, eggs cases which fit the description (Comstock - The Spider Book - p. 418) of Theridiosoma radiosa were observed. The lightly colored egg sac was suspended from a thread and was about three sixteenths of an inch in diameter. One of these was brought into the laboratory for observation but the spiderlings did not hatch.

The representative of the family Agelenidae^{collected} on July 30 was discovered in its web in the base of a stump. The main

part of the web was of the sheet type but there was a distinct funnel shaped retreat. The spider was at the time of collection near the edge of the sheet part of the web. The specimen taken on July 7 was noticed as it was warily leaving the retreat. It retreated several times finally remaining in the retreat for more than ten minutes before venturing forth again.

The one specimen of the family Amaurobiidae collected was found in its web which was constructed in the top of one of the old stumps in the area. The web seemed to have no shape or arrangement being very loose and irregular.

On the first few field trips made, more adults than spiderlings were collected. After the July 11th trip the number of spiderlings was continually greater than the number of adults. It seemed probable that the intensive collecting in the area was responsible for part of this difference. To check this theory a control area was set up. The area chosen was as similar as possible to the first in location, soil, type of flora and weather conditions. Plate 1 shows a photograph of this second area selected in the bog. On the last three field trips collections were made from both areas. Comparing the number of adults from each location did not coincide with the theory. (Figure 8). However in each case, the number of spiderlings collected was much greater from the new area than from the one from which the collecting had been done. (Figure 6). Therefore it can be said that the intensive collecting did have a definite effect on the Aranea fauna of the area in which the study was being made.

Aspen

Since ~~the~~ majority of spiders collected from the aspen habitat were ~~the~~ members of the family Linyphiidae, many webs were ~~observed~~ observed. Most of the webs were located ~~beneath~~ beneath the braken but a few were on the branches of the aspens. ~~Almost~~ Almost always when the spider was at rest it was found near ~~the~~ center of the irregular web resting underneath what ~~appears~~ appears to be a dome. When disturbed it retreats to the edge of ~~the~~ web. On one occasion, the spider dropped to the ground, a ~~distance~~ distance of four feet, but within five minutes it was back on ~~its~~ web. A photograph of a Linyphiidae web is shown on Plate 3.

The ~~spiders~~ spiders of this family Attidae which were collected were found on ~~the~~ forest floor. Their jumping habit for which they are known ~~is~~ is a very good means of protection against enemies.

As in ~~the~~ bog habitat, spiderlings became more abundant as this study progresses. Here also another area as similar as possible to the first was selected. (Plate 2). However in this case the number of adults collected from the newly set up area exceeded the number found in the one which the intensive collecting had been done in all three field trips. (Figure 15). The number of spiderlings collected in this new location was also greater each time. It was obvious therefore that the collecting did have a great effect here too. (Figure 13).

Gravel Pit

All three of the spiders collected from this habitat were found on the ground and no significant observations were made. Since only one spider was collected up to the very last collecting tip, no second area was set up in the gravel pit as in the other two habitats.

FAMILIES COLLECTED WITH NOTES AS TO ABUNDANCE

Bog Altogether ten families of spiders were collected from the three selected habitats. As a whole, the Linyphiidae seemed the most common family, more than half of the adults collected being members of this family. The Argiopidae adults represented about one fourth of the adults collected from all of ~~the~~ the habitats. The other fourth of the adults represent the Agelenidae - four adults, Attidae and Thomisidae, three adults each, Clubionidae and Lycosidae, two adults each and Amaurobiidae, Pisauridae and Hahniidae, one each. All of these figures can be seen clearly in Table 1.

A total of 263 specimens were taken during this study. Of this total more than two thirds were spiderlings. Since it is very difficult to identify spiderlings they have not been added in the totals of the families in the tables and figures but added separately, being listed only as spiderlings.

Bog

From the bog habitat, representatives of six families were collected. These were Amaurobiidae, Clubionidae,

11.

Lycosidae, Agelenidae, Linyphiidae and Argiopidae. As can be seen in Table 2, only one specimen of each of the first three families mentioned was collected. The Agelenidae were represented by four specimens, the Linyphiidae by eight and the Argiopidae by sixteen. Therefore it seems that the Argiopidae are the most common family found in the bog habitat, twice as many of these being collected as Linyphiidae and four times as many as the Agelenidae. Another fact pointing to the dominance of the Argiopidae in the bog habitat is that of the thirty-one adults collected half of them - sixteen - were members of the family Argiopidae.

More than three-fourths of the total number of specimens collected from this habitat were spiderlings.

Aspen

Representatives of eight families were collected from the aspen habitat, the family Linyphiidae being the best represented (Table 3). More than two thirds of the adults - thirty-seven - collected from this location were members of the family Linyphiidae. The other third contains representatives of the families Argiopidae - five, Attidae and Thomisidae - three each, and Clubionidae, Lycosidae, Pisauridae, and Hahniidae, one each, making a total of fifty-two adults collected in the aspen woods. The proportion between adults and spiderlings seemed more equal here than it was in the bog habitat. Of the total of one hundred and twenty six specimens taken, seventy-four were spiderlings and the other fifty-two adults as accounted

for above. At the present there seems to be no reason for this difference in proportion.

Gravel Pit

Only three specimens were taken from the gravel pit habitat. One of these was an adult Argiopidae, the other two were spiderlings. (Table 4).

CONCLUSIONS

Effect of soil and plant life

As noted above a total of two hundred and sixty three specimens belonging to ten families were taken from the three habitats. Eight families were represented in the collection from the aspen woods while spiders of only six different families were collected from the bog. However the total number of specimens from each area was almost the same. As mentioned before only three spiders were found in the gravel pit with only one family being represented. Since there was more of a variety of plants in the bog than in either of the other two habitats it seems probable that this fact explains the wider variety of Aranea families. ^{in the bog} (Table 1).

Effect of weather

One of the field trips was taken during a light drizzle. This day - July 4th - fewer spiders than average were ~~were~~ collected in the bog and aspen habitats but in the case of the bog there were four other days that the

13.

same number were taken and in the case of the aspen woods there were four days that the same number or fewer were collected. By the time the collecting was done in the gravel pit that day the drizzle had stopped and the sky was clearing. This was the day that the one adult was found in the gravel pit area. It therefore seems that some spiders tend to hide during a rain.

No other definite conclusions can be made at this time as to the effect of temperature, humidity or amount of sunlight on the spider population of an area. Comparing the graphs made of the weather data recorded with the graph of the total number of specimens collected and with the graph comparing the number of adults and spiderlings seems to uncover no significant facts. Probably however, if the study had been made over a longer period of time insignificant day by day fluctuations of these factors could be eliminated and the more important weather variations might show some effect on either the number of families or the total number of spiders collected.

SUMMARY

1. Intensive collection in a small area has a definite effect on the spider fauna of that area. This seems to indicate that spiders do not migrate much.
2. The aspen woods and the bog were about equally favorable as habitats for spiders.
3. The gravel pit was a very poor habitat for spiders.
4. Spiders have a tendency to hide during rainy weather.
5. Day by day changes in temperature, humidity, and amount of sunlight seem to have little or no effect on spiders.
6. Great numbers of spiderlings appeared during the middle of July.
7. The family Argiopidae was the most common in the bog.
8. The family Linyphiidae was the most common in the aspen woods.
9. The ratio between the number of adults collected and the number of spiderlings collected was one to two.
10. To be more accurate, a much longer period of time for observation and collection is needed.

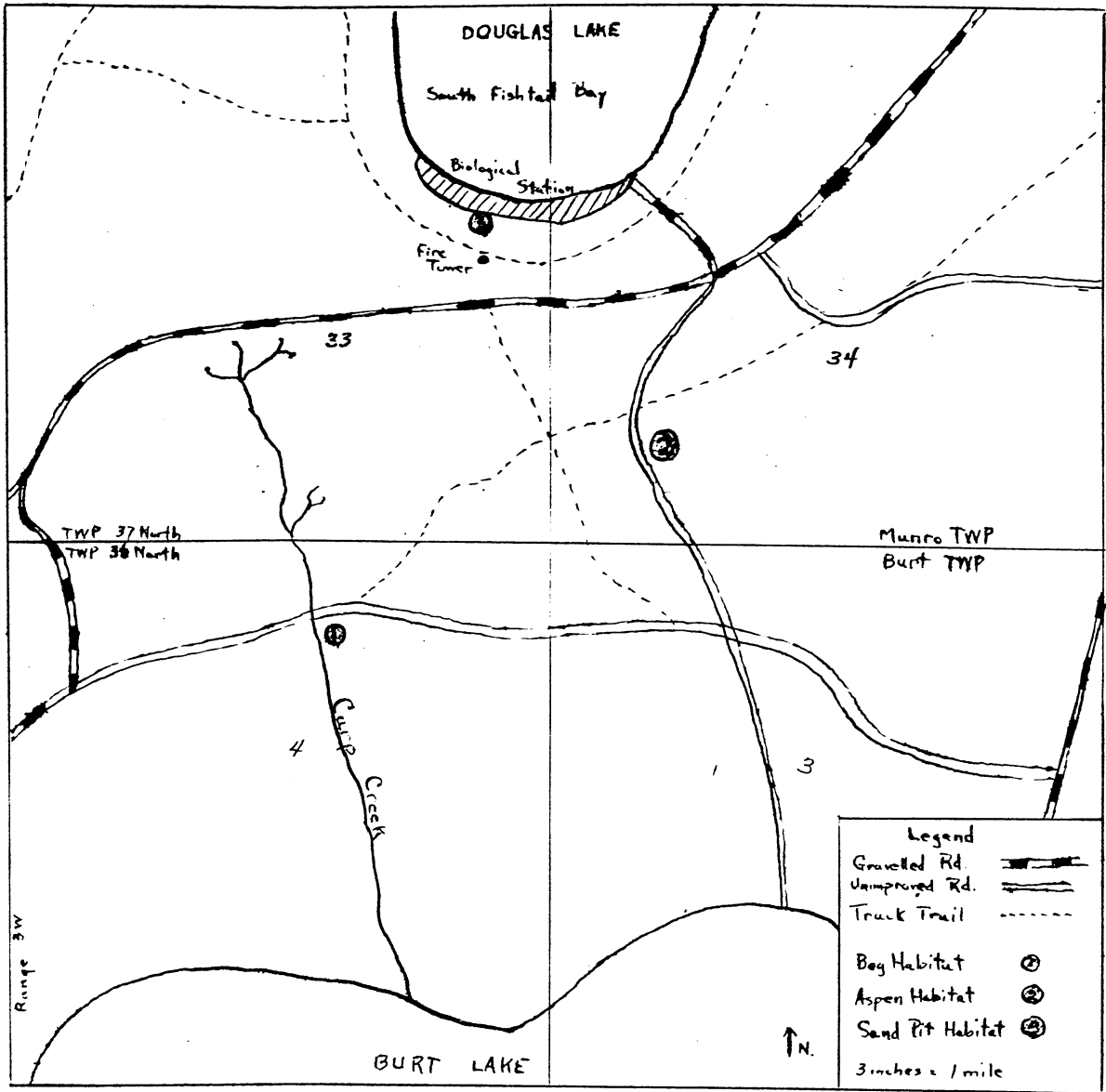


Figure 1

Vicinity of University of Michigan Biological Station to show location of the three selected habitats.

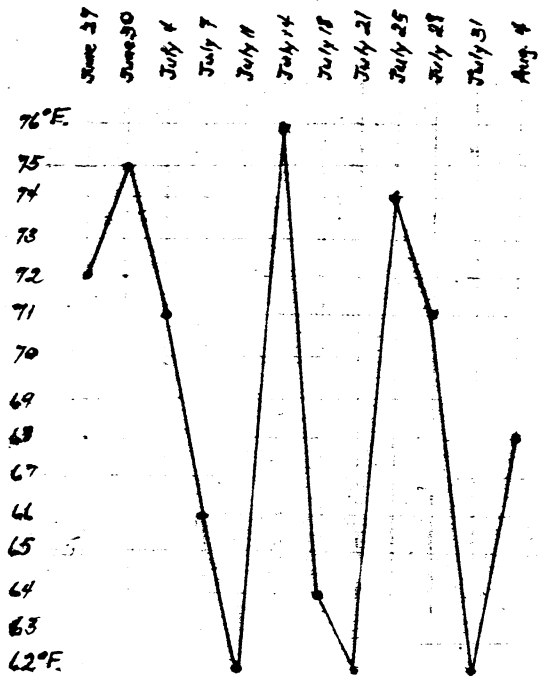


Figure 2- Temperatures recorded in the bog habitat.

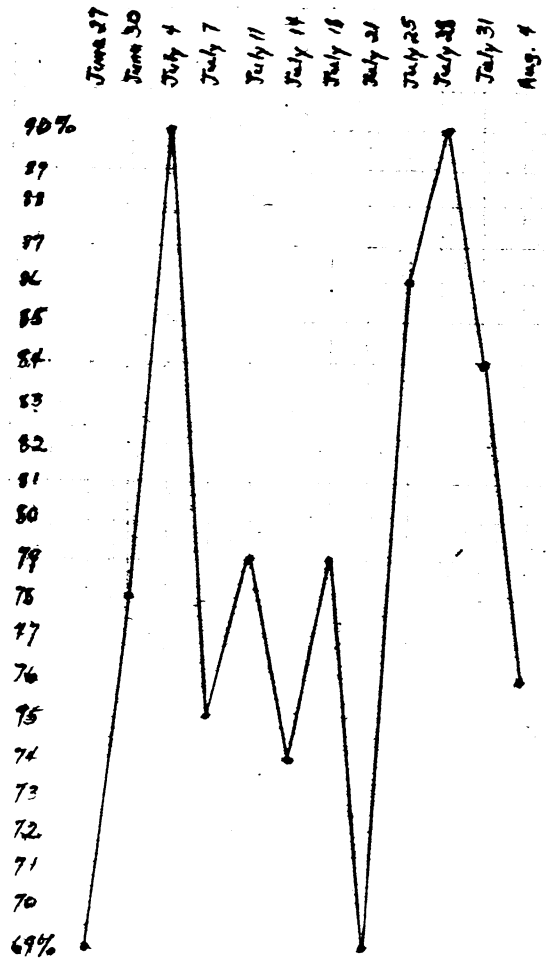


Figure 4- Relative humidity in the bog habitat.

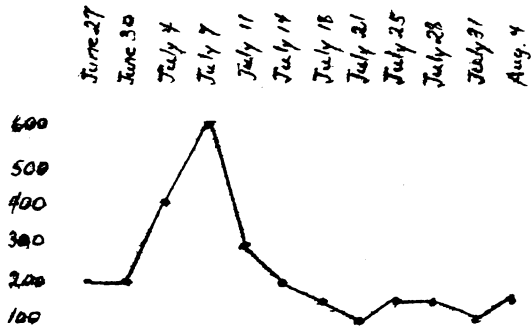


Figure 3- Light readings (candles per square foot) in the bog habitat

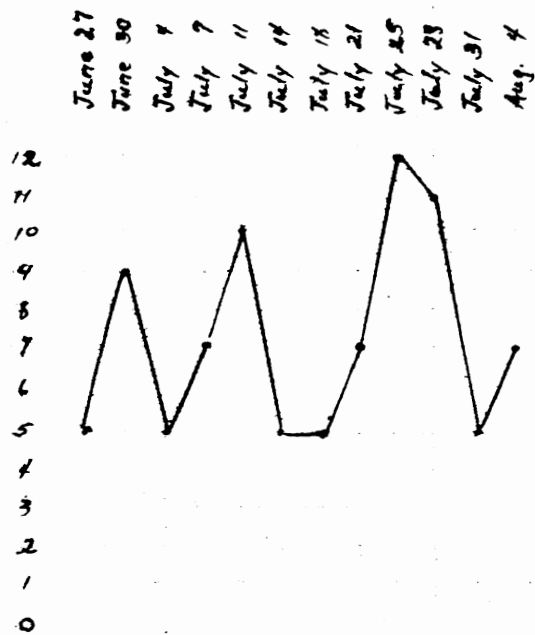


Figure 5- Total number of spiders collected in the bog habitat.

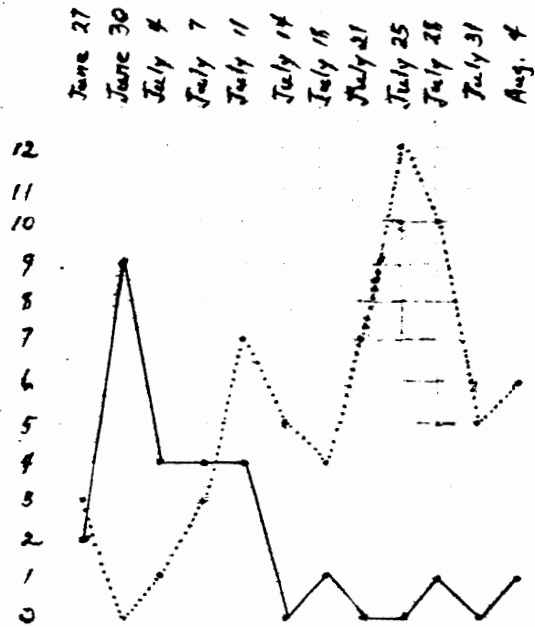


Figure 7- Comparison of the number of adults and the number of spiderlings collected in the bog habitat. Solid line shows the number of adults. Dotted line shows the number of spiderlings.

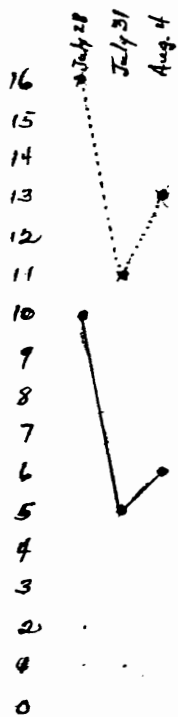


Figure 6 - Comparison of the number of spiderlings collected in the first bog habitat (solid line) and the new bog habitat (dotted line)

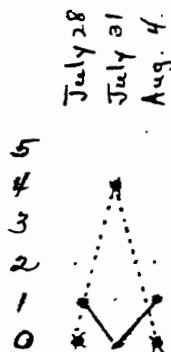


Figure 8- Comparison of the number of adults collected in the (bog) first habitat (solid line) and the new habitat (dotted line)

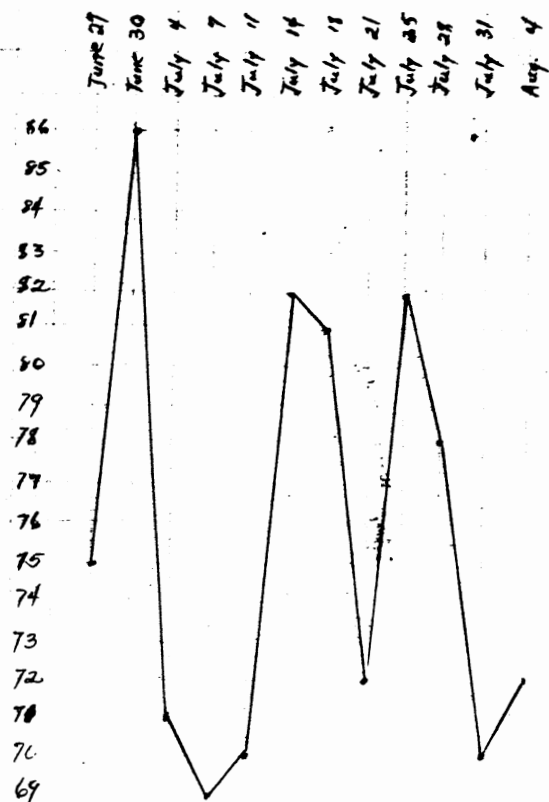


Figure 9- Temperatures recorded in the aspen habitat.

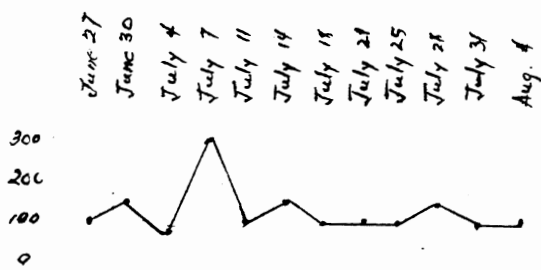


Figure 10- Light readings (candles per square foot) in the aspen habitat.

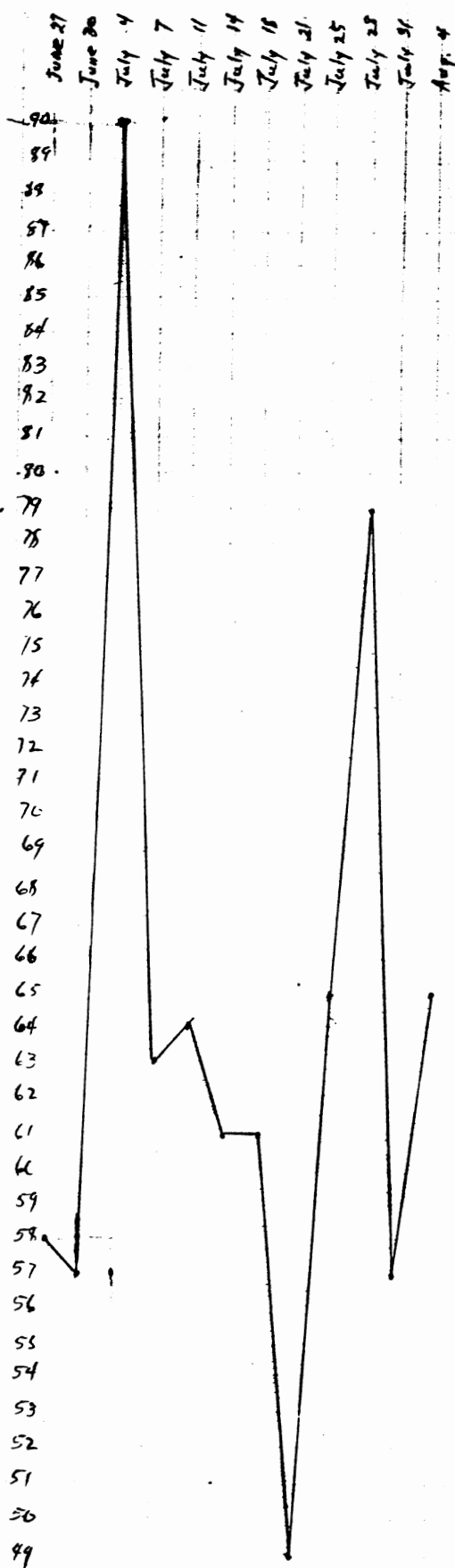


Figure 11- Relative humidity in the aspen habitat.

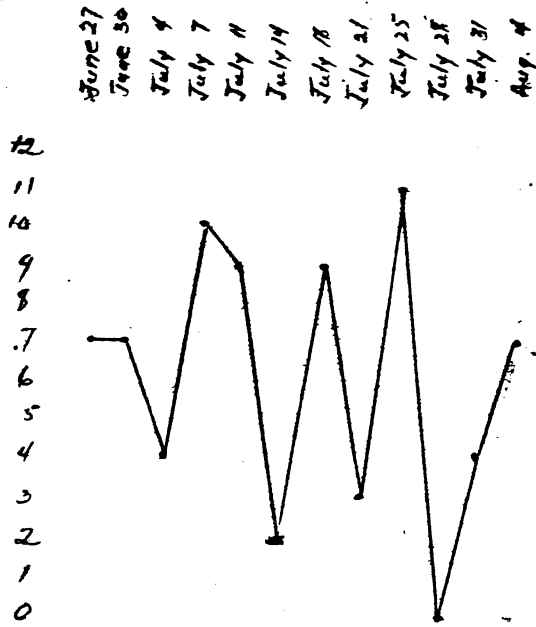


Figure 12 - Total number of spiders collected in the aspen habitat

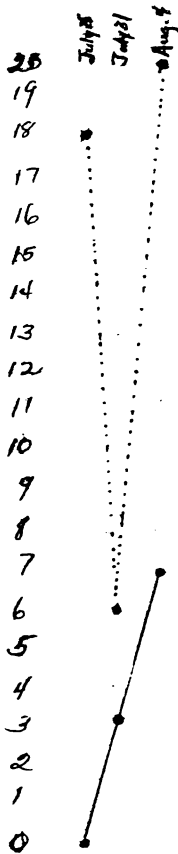


Figure 13 - Comparison of the number of spiderlings collected in the first aspen habitat (solid line) and the new aspen habitat (dotted line)

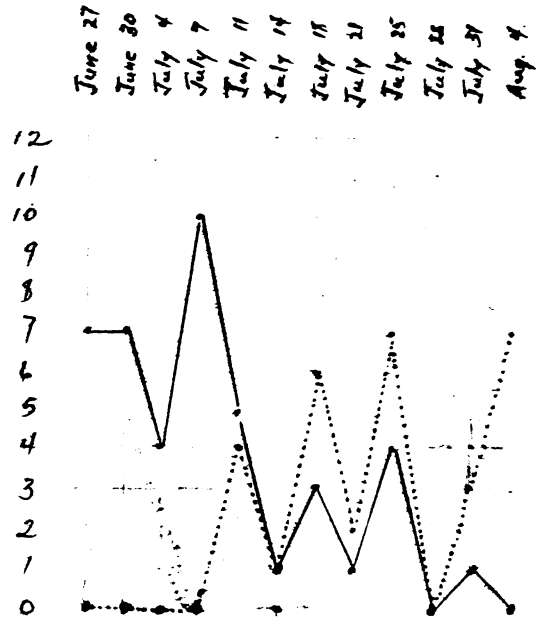


Figure 14 - Comparison of the number of adults and the number of spiderlings collected in the aspen habitat. Solid line shows the number of adults. Dotted line shows the number of spiderlings.

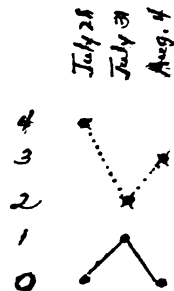


Figure 15 - Comparison of the number of adults collected in the first aspen habitat (solid line) and the new aspen habitat (dotted line)

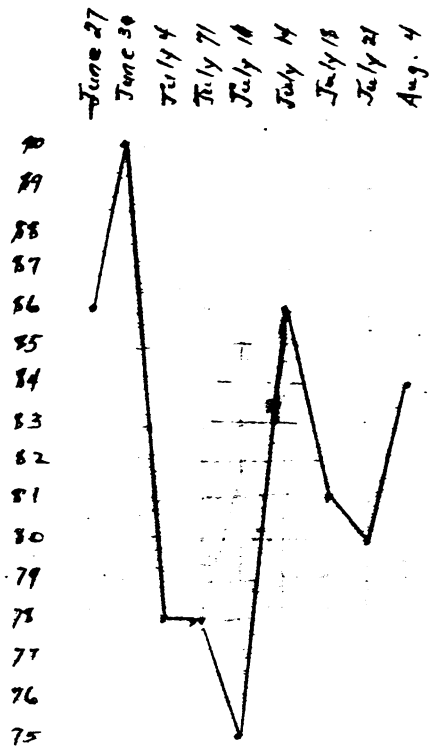


Figure 16- Temperatures recorded in the gravel pit habitat

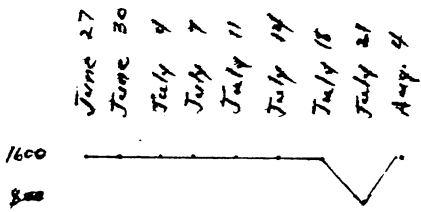


Figure 17- Light readings (candles per square foot) in the gravel pit habitat.

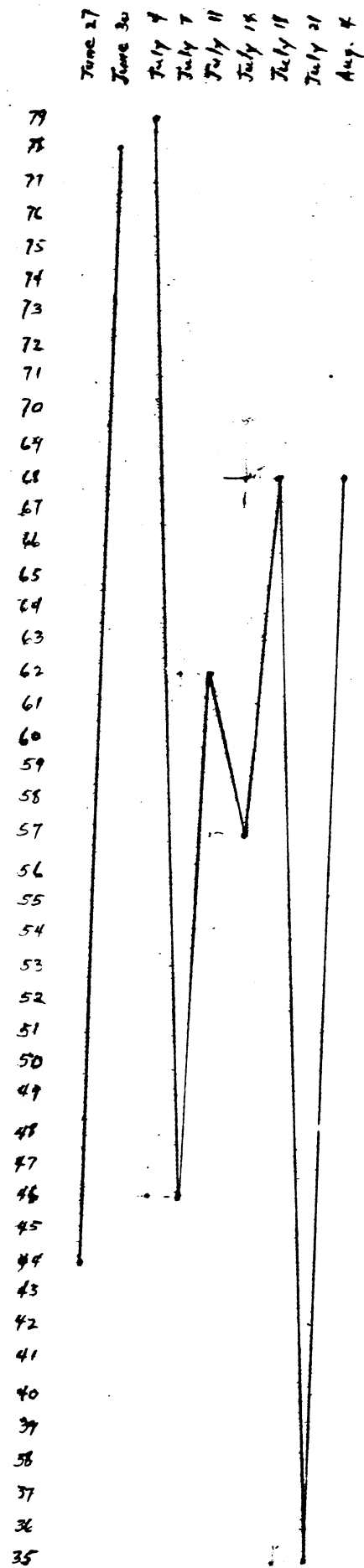


Figure 18- Relative humidity in the gravel pit habitat

Table 1

Comparison of the abundance of the spiders in each of the selected habitats.

	Bog	Aspen Forest	Gravel Pit	Total
Amaurobiidae	1	0	0	1
Attidae	0	3	0	3
Thomisidae	0	3	0	3
Clubionidae	1	1	0	2
Lycosidae	1	1	0	2
Pisauridae	0	1	0	1
Hahniidae	0	1	0	1
Agelenidae	4	0	0	4
Linyphiidae	8	37	0	45
Argropidae	16	5	1	22
Total number of adults collected	31	52	1	84
Spiderlings	103	74	2	179
Total - adults plus spiderlings	134	126	3	263

Table 2

Comparison of the abundance of the spiders collected on each field trip to the bog-habitat

	June 27	June 30	July 4	July 7	July 11	July 14	July 18	July 21	July 25	July 28	July 28 *	July 31	July 31 *	August 4	August 4 *	Total
Amaurobiidae					*	/										/
Attidae																
Thomisidae																
Clubionidae													/			/
Lycesidae			/													/
Pisauridae																
Hahniidae					.											
Agelenidae		2		1										1		4
Linyphiidae	/	2		1	1		1						2			8
Argiopidae	/	5	3	2	3					1			1			16
Spiderlings	3		1	3	7	5	4	7	12	10	16	5	11	6	13	103
Total	5	9	5	7	11	6	5	7	12	11	16	5	15	7	13	134

Table 3

Comparison of the abundance of the spiders collected on each field trip to the aspen habitat

	June 27	June 30	July 4	July 7	July 11	July 14	July 18	July 21	July 25	July 28	July 28*	July 31	July 31*	August 4	August 4*	Total
Amaurobiidae																
Attidae									1	1					1	3
Thomisidae	1								1	1						3
Clubionidae													1			1
Lycosidae													1			1
Pisauridae									1							1
Hahniidae													1			1
Agelenidae																
Linyphiidae	6	7	4	10	5	1	2				1				1	37
Argiopidae							1	1	1		1				1	5
Spiderlings					4	1	6	2	7		18	3	6	7	20	74
Total	7	7	4	10	9	2	9	3	11	0	22	4	8	7	23	126

Table 5

Habitat-Census and Field Record Sheet
E. Nauert-Araneae Habitat Census Study

Sheet No. _____ Bottle No. _____
 Locality _____ Co., Mich.
 Locus Key _____ Habitat Description _____
 Date _____ Time _____
 Sky _____ Wind _____
 Dry Bulb Temp. _____ Wet Bulb Temp. _____
 Humidity _____ Amt. Of Sun _____
 Method of Collections _____
 Apparatus _____

Identifications

Family	Species	Microhabitat	Notes

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I. Introduction

A. Purpose of study

To observe the Aranea fauna in three very different habitats and to try to discover the causes and effects of the differences.

B. Selection of habitats

1. Types of habitats chosen
2. Size of habitats chosen

C. Method of study

1. Time and frequency of observations
2. Types of observations made
3. Field record sheets
4. Collection methods

II. Description of Habitats

A. Bog

1. Exact location
2. Soil
3. Plants
4. Other fauna
5. Amount of sunlight
6. Temperature
7. Humidity

B. Aspen

- 1.-7. Same as under A.

C. Sand Pit

- 1.-7. Same as under A.

III. Observations of life of spiders

A. Bog

1. Means by which they obtain prey
2. Food
3. Enemies and protection against enemies
4. Life history observations

B. Aspen

- 1.-4. Same as under A.

C. Gravel Pit

- 1.-4. Same as under A.

IV. Families collected with notes as to abundance

A. Bog

B. Aspen

C. Gravel Pit

V. Conclusions

A. Effect of soil and plant life on

1. Number of families observed
2. Number of individuals observed

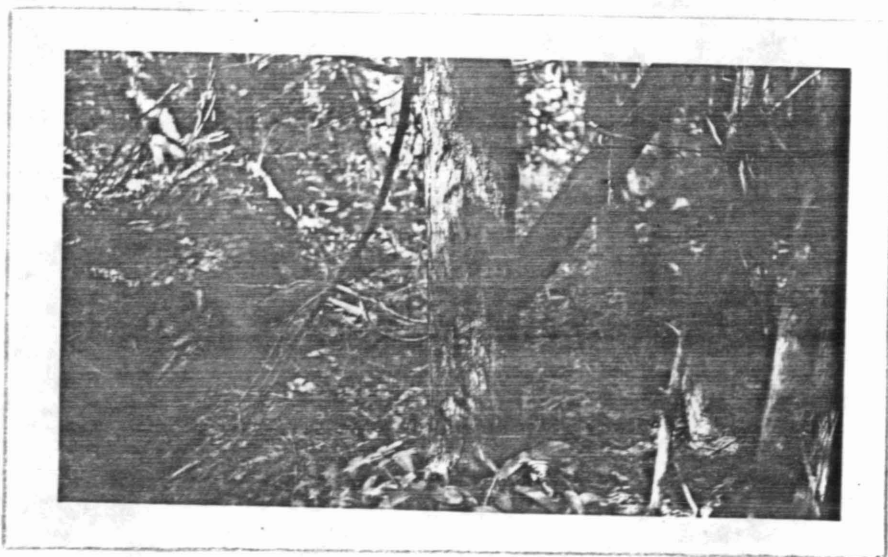
B. Effect of weather on

1. Number of families observed
2. Number of individuals observed

VI. Summary



First area chosen in the bog.



Second area chosen in the bog.

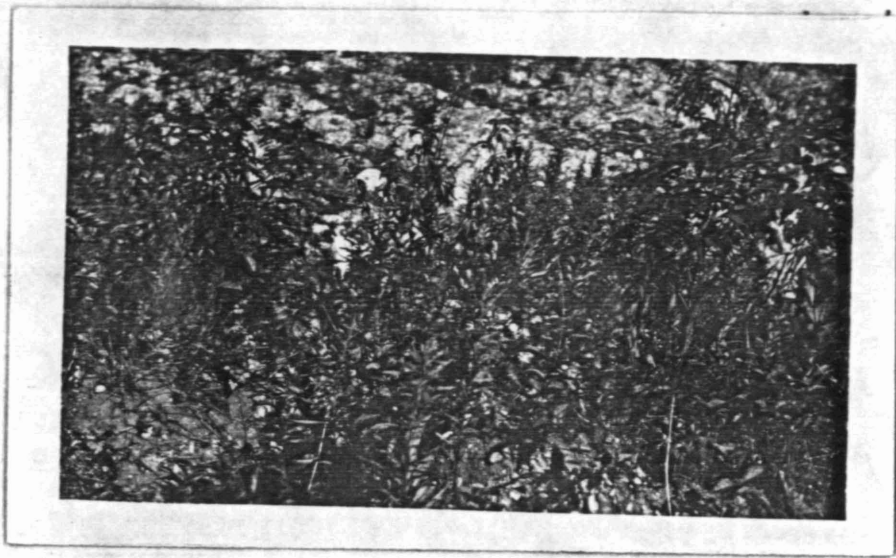


First area chosen in the aspen woods.

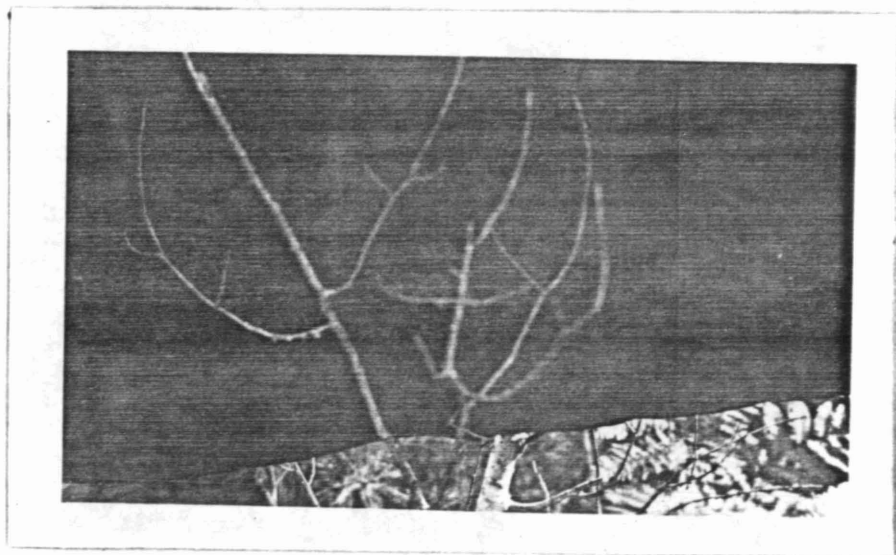


Second area chosen in the aspen woods.

Plate 3



Area selected in the gravel pit



Web of spider of the family Linyphiidae