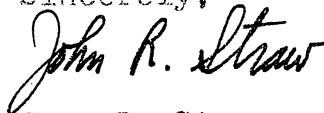


Dear Dr. Edgar and Dr. Sparrow,

I originally planned to do my N.S.F. study on the invertebrates of Little Carp Creek, in the second half of the session after I was better able to identify invertebrates as a result of four weeks in invertebrate class; but by the last two weeks of the session I found too little time to complete the study to my satisfaction. Although I had both plankton and benthos data from both sand and silt areas at four stations along Little Carp Creek, I did not feel that I had taken enough quantitative samples to be accurate and I did not feel that a mere qualitative list of organisms in Little Carp Creek would be sufficient. As a result, I am submitting the following report, "Observations and Library Research on Lycosa gulosa". I hope this work will satisfy the requirements of my N.S.F. grant as this report is more extensive than what was required by the class assignment.

Sincerely,

A handwritten signature in cursive script that reads "John R. Straw". The signature is written in dark ink and is positioned above the typed name.

John R. Straw

Observations and Library Research on Lycosa gulosa

Presented to: Dr. Arlan L. Edgar and
Dr. Frederick K. Sparrow
in fulfillment of N.S.F.
grant.

By: John R. Straw
August 14, 1970

Table of Contents

	pages
I. Characteristics and Taxonomy of <u>Lycosa gulosa</u> .	1
II. Natural History.	7
III. Distribution and Abundance.	11
Taxonomic - Distribution - Abundance Records.	12
IV. Summary and Conclusions from Field and Terrarium Observations	13
References	
V. Field Notes.	19

I. Characteristics and Taxonomy of Lycosa gulosa.

Phylum: Arthropoda

Class: Arachnida

Order: Araneida

Superfamily: Argiopoidea Series: VI

Family: LYCOSIDAE (Wolf Spider) Sundevall

Subfamily: Lycosinae

Kaston (1948) reports the following characteristics of

- Lycosidae:
1. Eight, homogeneous, dark eyes of unequal size with the posterior row so strongly recurved as to form two rows of two eyes each. The anterior eyes are the smallest, the posterior median eyes the largest.
 2. The chelicerae are strong, with boss, scopula, and toothed margins.
 3. Labium is free, indites more or less parallel with scopulae.
 4. Claw on female palp.
 5. Superior claws similar, pectinate with few teeth in a single row. The third claw is either smooth or has a single tooth.
 6. Trichobothria numerous and irregularly arranged on tibiae, metatarsi, and tarsi.
 7. Trochanters have semicircular notch on distal margin (Kaston, 1948, pg. 677, fig. 1058).
 8. Legs usually scopulate and spinose (Kaston, 1948, pg. 677, fig. 1062).
 9. Male palp never has apophysis on femur, tibia, or patella.
 10. Pedicel lorum with anterior sclerite rounded behind and fitting into a notch of the posterior sclerite (Kaston, 1948, pg. 676, fig. 1059).
 11. Three pairs of cardiac ostia.
 12. The thracheal system is limited to the abdomen and the spiracle is close to the spinnerets.
 13. There are relatively simple silk glands and long poison glands.
 14. There are two pairs of dorsoventral muscles in the abdomen.

Lycosidae is subdivided into two subfamilies, Pardosinae and Lycosinae. The Pardosinae have faces with sides that are usually vertical, metatarsus IV is longer than tibia plus patella IV, and the labium is not longer than wide. The Lycosinae have faces which are usually not vertical, the metatarsus IV is not longer than tibia plus patella IV and the labium is longer than wide. (Kaston, 1948, pg. 303)

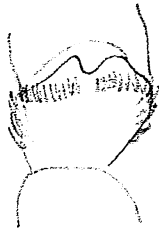
Genus Lycosa

- Kaston (1940) lists the following key characters of the genus Lycosa:
1. The anterior eye row is not very procurved.
 2. The AME separation is not greater than the distance from the ALE. (Comstock, 1940, pg. 636, fig. 713).
 3. The head has sloping sides which make it narrower at the top than below.
 4. The distal pair of ventral spines on tibia I are always apical.
 5. The labium is longer than wide with the basal articular notches usually about one-third its length.
 6. The metatarsus IV is shorter than the tibia plus patella IV.
 7. The cephalothorax as seen from the side shows more or less of a declivity beginning in the thoracic region. (Kaston, 1948, pg. 676, fig. 1064)
 8. Tibia IV has a dorsal spine and a bristle, which is drawn out thin and fine at the end, and is much longer than the hairs and trichobothria. (Kaston, 1948, pg. 676, fig. 1062)
 9. The carapace is hirsute.
 10. Tibia III and IV have a true robust spine above at base and distally.
 11. The embolus is evenly curved and the apophysis is not elongated, but is normal in length.

Species gulosa (Walckenaer)

Kaston (1948) lists the following key characters of the

- species gulosa:
1. The carapace has a median band which is as wide or nearly as wide as the third eye row. This stripe is light gray, while the rest of the carapace is dark brown. This stripe is strongly constricted in front of the median furrow and less markedly so behind this furrow. (Comstock, 1940).
 2. The abdomen is grayish brown with a black spot on each side near the base of the abdomen above and often one or two others extending posteriad. In the males the black forms two bands extending back beyond the middle of the abdomen. (Kaston, 1948, pg. 682, figs. 1106 and 1107)
 3. The lateral depressed areas of the epigynum are narrow and elongate and the septum of the guide of the epigynum is about the same width throughout. (Kaston, 1948, pg. 682, fig. 1109)
 4. Palp with a small median apophysis. (Kaston, 1948, pg. 682, fig. 1108)
 5. The female is 11 to 14 mm. in length, while the male is only 10 to 11 mm.



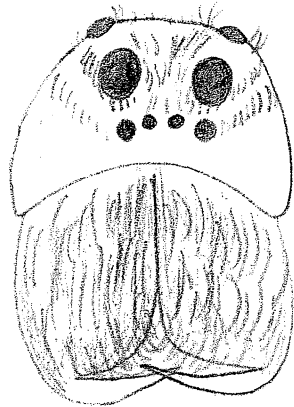
LYCOSIDAE
NOTCHED
TROCHANTER
Fig. 711
COMSTOCK
1058 KASTON



FIGURE 1062
TARSUS of LEG I
LYCOSA AFTER
KASTON



FIGURE 712 LORUM of
PEDICEL of LYCOSA
AFTER COMSTOCK
1059 KASTON



LYCOSA FACE
SHOWING
EYE
ARRANGEMENT

Fig. 713
COMSTOCK



FIGURE 1064

LYCOSA CEPHALOTHORAX
FROM SIDE
AFTER KASTON



FIGURE 1106
BODY OF FEMALE
FROM ABOVE

LYCOSA gULOSA
AFTER KASTON



FIGURE 1107
BODY OF MALE
FROM ABOVE

LYCOSA gULOSA
AFTER KASTON



FIGURE 1109 EPIGYNUM
OF LYCOSA gULOSA
AFTER KASTON



FIGURE 1108
VENTRAL ASPECT OF PALP
LYCOSA gULOSA
AFTER KASTON

II. NATURAL HISTORY

According to Emerton (1902), Lycosidae is the family of spiders which are most often seen. They are very active and are not as well concealed as other spiders. This family contains some of the largest spiders. Gertsch (1949) adds that the Lycosidae are hunters and are the dominant predators in their habitat. They eat insects among plant roots and in grass, where sunlight penetrates all but the thick grass. To capture prey, the Lycosidae pounces on it, holds it with its front legs, and bites and crushes it with stout chelicerae. It can go several days without food. Lycosidae have very good eyesight for a spider (spiders have poorer sight than order Insecta).

The genus Lycosa are often found running over the ground in damp pastures or lurking under stones or rubbish in fields or at edges of woods. Some live near water, run freely on water and can dive under water when alarmed. (Comstock, 1940)

Some species of Lycosa are wandering spiders, most build retreats. The retreat may be a shallow excavation under a log or stone, lined with silk and surrounded by a wall of earth or sticks and stones. More often, the retreat is a vertical or diagonal tube in the ground, sometimes a foot or more in depth. This tube, often lined with a thin film of silk, especially when made in loose soil, lining is thicker toward opening. Some species surround the mouth of the tube with a circular wall of dirt and pebbles from the burrows, or with bits of grass and dirt or twigs and dirt fastened together with silk. Both the male and

and the female construct retreats. The female may also use her retreat as a nest. (Comstock, 1940) Kaston (1948) also adds that the Lycosa leave their retreat most commonly at night to hunt insects. Other species are wanderers all of the time.

Large Lycosa live two or more years according to Comstock (1940) while Kaston (1948) says it is possible that some live two years. In the winter the Lycosa close the entrance to their burrows with debris fastened with silk. Kaston (1948) has reported seeing mature females from winter to June and again from September to winter. He has seen males from winter to June.

Kaston (1948) reports that egg cases are carried from early April to late May. Many females are seen carrying spiderlings in May and June. The egg sac of Lycosa is spherical and usually white, but it becomes a dirty brown with age as it is carried. The seam between the two valves of the egg sac is sometimes very conspicuous. (Comstock, 1940, p. 642, fig. 719) The female sews up the seam without seeing it. (Gertsch, 1949) The egg sac is attached to the spinneretes according to Emerton (1902). The egg sacs are 6 to 10 mm in diameter. They contain non-agglutinated yellow eggs, each about 1 mm in diameter. In different egg sacs, Kaston (1948) has counted the following numbers of eggs: 118, 150, 160, 164, 174, 207, 235, 274. The mother will protect the egg sac, but she can be fooled and will pick up and carry cork, paper or cotton.

Comstock (1940) says that when the spiderlings are ready to emerge, the female rips open the egg sac with her chelicera. She pulls out threads along the equator of the sac. The young climb

onto the mother's back and remain for about one week. As the spiderlings continue to emerge, they cover the mother's entire body except the head. While on the mother, the spiderlings wait for another molting and then they go off into the grass to hunt for their own food. While on the mother's back, the spiderlings do drink water; they drink dew or drink when the mother stops.

The species Lycosa gulosa is found running over dead leaves on the forest floor where their colors blend with the background. They mature late in fall, mating in early spring as early as March. Their sexual behavior was described by Kaston in 1936. (Kaston, 1948) and by Edgar in 1966.

The palpal organ of the male is used for copulation. There is no tubular connection between the palpal organ and the testes. The palp must be charged with sperm in a process called sperm induction. The male spider spins a small triangular or trapezoidal web no longer than his body. The hunting spiders, such as Lycosa gulosa use the indirect method of Gerhardt to obtain their sperm. They deposit a seminal droplet on the upper surface of the web sheet and then reaching down around the edge, apply palpi to the droplet and absorb the fluid through the fibers of the web. The stimulus for sperm induction is presumably the sensation of fullness in the testes and of emptiness in the palpal organs (Kaston, 1948).

The male actively searches for the female. When he has found her and she becomes willing to mate, the male mounts upon the back of the female and faces the opposite direction. He rests his sternum on the dorsum of the female cephalothorax. The male

holds onto the female with his first three pairs of legs and uses the fourth pair to balance.

The mating of Lycosa gulosa takes approximately five hours. During the mating process, the male is able to move the female abdomen from side to side. He alternates palpi into their respective sides of the epigynum. The female moves very little throughout the mating procedure except to move her palps as if to obtain a better grip. It is a repetitive cycle with the male extending the palp to the epigynum, starts distal and strokes proximal returns distal and then relaxes, pauses, moves into and then away and returns to a kneeding position where the palp is kneeded by the chelicera. This is thought to perhaps renew the seminal fluid in the palp. This process takes about five seconds. (Edgar, 1966) The ejaculation of the sperm is brought about by an increase in the blood pressure in the haematodocha which becomes distended during copulation. (Kaston, 1948). When mating is completed the spiders disengage and the male goes away from the female. She moves very little from the area of copulation. She spends much time in thoroughly preening herself. If the male wanders onto the female, he again retreats very quickly, while the female moves only a short distance (not more than two inches). (Edgar, 1966)

III. DISTRIBUTION AND ABUNDANCE

According to Comstock (1940), there are 30 known species of Lycosa in the United States and Canada. Many are very widely distributed. And Kaston (1948) reports 11 species in the northeastern United States. Lycosa gulosa is widely distributed with its range covering the greater part of the United States. It is common in forests where its brown and gray colors, like those of dead leaves, are protective. At times, it is also known as Lycosa Kochii. Kaston (1948) reports that Lycosa gulosa is extremely common in Connecticut.

II MICHIGAN :-

COUNTIES	ABUNDANCE	RECORDS BY	CITATION -- REMARKS
Cheboygan		John R. Straw	

III NORTH AMERICAN :-

STATES OR PROVINCES	ABUNDANCE	RECORDS BY	CITATION -- REMARKS
Connecticut	Extremely common	Kaston	

IV WORLD :-

COUNTRIES	ABUNDANCE	RECORDS BY	CITATION -- REMARKS

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IV. Summary and Conclusions from Field and Terrarium Observations.

Grapevine Point cove beach was the habitat used for the collection and study of Lycosa gulosa. Grapevine Point cove is an area with a sand beach about one to two feet wide, which is followed by a litter zone approximately one foot wide. The litter zone contains many pieces of driftwood, under which most of the adult Lycosa gulosa were found, especially females with egg sacs. Behind the litter zone is the taller grasses which extends to the forest of Grapevine Point (refer to diagram on page 20).

Gertsch reported that the Lycosa were hunters and usually the dominant predators in their habitat. After examining the assemblage of invertebrates on the beach at Grapevine Point cove, it was determined that Lycosa gulosa was the dominant predator there. With their large, strong chelicera, mouth parts, quick movements, and camouflaging tan-brown color, they are well adapted for preying on other invertebrates. "They mash the animal to a pulp between the chelicera and endites as the digestive fluid is poured out over it. Only a small mass of indigestible material, such as the chitinous elements, is discarded." (Kaston, 1948)

A female with an egg sac was first collected on June 22 and placed in a pint jar for observation. She was found under a piece of driftwood. A terrarium was set up to study the Lycosa gulosa in its natural habitat. An ecotone area of the beach, litter and grass zones, about six inches deep, was dug up and placed in the terrarium. A piece of driftwood as well as some old clam shells were placed in it as these were the objects in nature under which the Lycosa gulosa were found. Four Lycosa gulosa, two males and two females, were collected. Each of the females was carrying an egg sac and one of the females had some babies on its back. These were collected on the edge of the grass layer of the cove, usually under driftwood. Other animals from the habitat were also put into the terrarium: beetles, a milliped, isopods, and insects.

The spiders collected did not appear very active until we tried to catch them. Most were under driftwood or within the litter of the beach. As we tried to catch them, they would all try to run deeper into the vegetation and grass. Comstock (1940) reported that they would dive under water to escape, but these all ran away from the water into the thick grassy vegetation. This was probably because it was farther to the water over a barren, sandy beach which offered no cover.

Comstock (1940) reports that most species of Lycosa are burrowers, but that some are wanderers. I suspect that Lycosa gulosa is a wanderer except possibly in July and August. When the Lycosa gulosa were collected and put into the jar and terrarium, they tried to escape. The jar top was punched with holes, so the

female could not escape, but after the spiderlings were old enough to travel, an occasional one would be seen crawling across the desk top away from the jar. Since their number gradually decreased, many probably crawled through the holes in the jar top. The spiders which were placed in the terrarium also tried to escape. One male crawled out while transporting the terrarium. Even if there was sufficient food and water, the animals still crawled out. The young spiders would also continually crawl out of the terrarium. Almost everytime it was observed, one or two small Lycosa gulosa would be on the outside of the net covering the terrarium.

When the spiders were being collected for the terrarium, one female with an egg case was observed under a piece of driftwood, but she could not be caught. She was chased approximately one and one-half feet from where she was found. The driftwood was returned to its original position. The next day the same piece of driftwood was overturned, but she had not returned to it. This suggests that Lycosa gulosa are wanderers and do not have a specific home territory, but are content anywhere within their habitat where there is sufficient food, water and covering.

When the terrarium was cleaned out, no adults were found, but eight live young (from 3 to 7 mm) long were recovered. No spiders had been seen for about two weeks, except occasionally one or two about three mm long were seen on the clam shell within the terrarium. As the driftwood and plants were removed, no spider activity could be seen. The entire surface was scanned very carefully in case some were hidden by blending in with their surroundings. Some holes, which could be burrows, were noted in

the sand, however, it was impossible to dig down them as the sand was interlaced with roots from the plants. When small clumps of the sand were shaken out, occasionally a small spider would fall out. All of the eight young spiders were collected this way.

I returned to Grapevine Point cove in July and again in August to try to obtain more specimens to replace those which were lost from the terrarium. I could find none. Kaston (1948) has reported seeing them in almost all months, but not in July or August. Since these are the two hottest months of the year, the spiders probably find a cooler home for the summer. This could either be farther into the forest or in burrows. The forest floor was searched, but no Lycosa gulosa were found, so they probably live in burrows during the summer.

The female Lycosa gulosa were collected with egg sacs attached on the underside of the abdomen anterior to the spinnerets shortly before the spiderlings emerged. Kaston (1948) reports that the spiders mate in early March, carry an egg case in April and May and can be seen carrying spiderlings in May and June. The first spiderlings emerged on June 23. Since this area is farther north the Connecticut where Kaston's work was done, the spiderlings may emerge at a later date. Spiderlings appear gradually, they do not all hatch at the same time. Over about a three day period they continued to emerge. An egg case was cut open to observe the spiderlings shortly before they were ready to hatch. Within the sac, some of the spiderlings appeared more mature than others; some could easily walk around, while others had a hard time trying to maintain their balance, still others appeared to have part of a

yellow yolk sac still attached to their body, these could not walk at all, but would wiggle.

As the spiderlings crawled out of their egg sac, they climbed up on top of the mother's abdomen. When her back became too full, they continued on around until they completely encased her abdomen. None of the spiderlings were allowed onto her cephalothorax. One was observed trying to crawl up the mother's front leg onto her head and was quickly shaken off. Occasionally a spiderling would fall off and if possible would find a leg of the mother and crawl back on. While the babies were on her back, the mother would not eat, she was once observed standing over a dead mayfly and was possibly eating, but this occurred on only one occasion. She would regularly preen herself by pulling her legs up to her mouth area. Lozen (1967) also noted that the females would not eat while the young were being carried and reported one female that went without food for 38 days.

The spiderlings began to leave the mother about eight days after crawling onto her back. Comstock (1940) says that the spiderlings go through one molt before they are able to leave the mother. After leaving the mother, the babies are on their own. They are still very small, about 2 mm long. They are very active during the day and the night and wander continually.

About two weeks after babies were first seen on the mother's back, they had all left her back but were now crawling over her as they crawled over the other parts of their environment. Mother became more active and was usually in a different part of the jar each time she was observed. About four days after the babies had all crawled off, two mother Lycosa gulosa died. At first it was thought to be due to an insufficient amount of water, but one

regularly had a water supply. Lozen (1967) also reported this.

He thought it might be due to the fact that the mother could not stand to remain penned up in the same area with the babies or that the babies killed her.

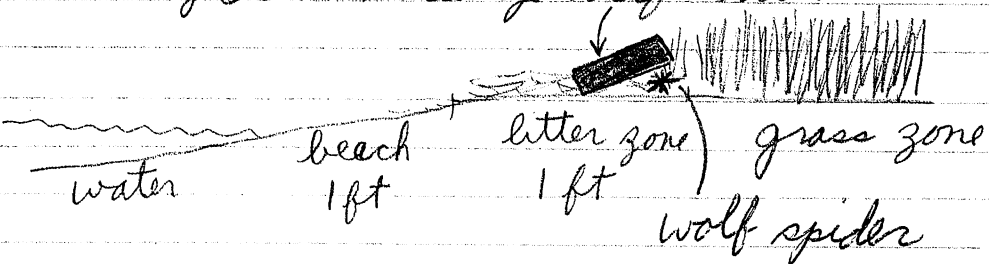
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- Kaston, Benjamin Julian, Spiders of Connecticut, State of Connecticut, State Geological and Natural History Survey, Bulletin No. 70, Hartsford Connecticut, 1948.
- Lozen, Timothy Jay, Certain Trophic Relationships between Mayflies, Phalangids and Wolf Spiders, unpublished, 1967.

June 26 noon put jar in display case
about 50+ babies

June 27 noon taken out of display case
she dropped egg case sometime in afternoon.
Still hasn't eaten mayfly or been very
active.

FR 8 4³⁰-6 pm Went back to Grape Vine
Point Cove to get other wolf spiders
and dig up their natural habitat
for a terrarium. Plants in habitat:
grass, poison ivy, grape vines,
small willows.
The wolf spiders all seem to be on
the edge of the grass area under
objects - mainly driftwood.



We found one ♀ wolf spider w/ no egg
sac but w/ babies on back under
a piece of driftwood (pictures 10, 11).
We scared her about 1½ foot back
into grass away from the board.
Decided to come back next morning
to see if she had returned.

V. Field Notes - Wolf Spider Species Study

June 22 11 am F.R. Sheet # 3
♀ with egg case collected on beach
of Grape Vine Point Cove -
under drift wood at ecotone
between beach and litter and grass.
Put in 8 oz collecting jar
12³⁰ pm - Put in 3" dia,
4" high jar w/ moist sand, piece of bark,
2 small leaves - one dead - one green,
cap with water, mayfly, and holes
in top of jar

June 23 3³⁰ pm noticed 5 babies
on back. Took picture of her in white box
10³⁰ pm 11-12 babies on back

June 24 5 pm about 30 babies on back
egg sac still attached. She has
been very still and prefers to
sit on the bark. She has not eaten
or attempted to eat.

June 25 5 pm she is cleaning herself -
pulls back leg up to mouth.
One baby off - 10 min found mother
30-50 babies

some beach, some litter, and some grass. We also placed a piece of driftwood in it.

July 1, 7pm

Babies much more active than mother.
About 20 off crawling.

One baby started to crawl up one of mother's front legs toward her cephalothorax; she shook him off. Did however allow babies to crawl up back 3 pair of legs and onto back.

1:30 AM about 25-30 babies off mother's back and very active

July 2, 8am

mother standing over dead Mayfly which looks partially eaten

10am mother still by Mayfly.

Babies active only after jar disturbed

July 4, 8am

one baby seen 1ft from jar on table

July 7, 8am

no babies left on mother's back, but several crawling on legs and all over her. Mother seems more active than when babies on back.

June 28 8³⁰ - 10 am F.R. 9

We went back to Grape Vine Point Cove. The ♀ wolf spider had not returned to the spot under the driftwood. This would tend to suggest that the wolf spider does not set up a territory for itself but is content any place in its habitat where it has cover, food, moisture.

We did dig up a spot where a ♀ was caught and put it in a 12" x 12" x 24" aquarium. In it we put 4 wolf spiders - 2♂ and 2♀ one ♀ w egg case and babies one ♀ w to egg case but babies (it was the spot in which she was found) All 4 seemed to find their own cover. (However, one ♂ crawled out of the terrarium during the boat ride back to UMB'S - we put him back)

We also put in other representative animals from the habitat in the terrarium - beetles, a millipede, isopods, insects. The spot dug up for the terrarium also included representative plants and in addition to being the actual spot where one of the ♀s was captured, it was from the ecotone zone - meaning it contained

Didn't see any adults in terrarium,
 May have escaped thru net on
 top, or have burrowed into soil.
 Some babies here appear to be
 larger than those kept in the jar.

July 17 transferred babies in jar
 to 5 gal terrarium. Added only
 a few sticks and dry leaves,
 a water plate, and food plate.
 Saw new mother in terrarium
 (? Lycosa gulosa) w partially
 grown egg case, still white and
 about $\frac{2}{3}$ size of egg cases found
 on original spiders.

Theory as to genesis of this
 new spider - probably originally a
Lycosa gulosa which we had
 thought to be a male but in
 fact was a smaller, younger
 adult female which did not
 have an egg sac.

July 19 egg case fastened on underside
 of abdomen anterior to spinneretes

July 20
 young 2 mm babies head stripes
 are grayish white; those a little older
 3-5 mm are yellow; adult brownish gold

July 7 8am
 Mother #2 many babies on back

July 8 5¹⁵ pm another baby out of jar
 6 inches away on table
 possibly others had escaped
 from jar and off of table ???

July 9 Mom #2 only a few babies left.
 Now more active also

July 10 8am White fecal material?

July 11 Both mothers inactive.
 Babies still active some
 probably died and/or escaped
 can't count all but doesn't seem
 like original number

July 12 8am Both mothers
 determined to be dead

July 13 → 16 put in about 3 live
 mayflies per day. Babies would
 crawl over dead ones - eating ???

July 15 8am
 Transferred terrarium inside.
 Removed app. 2" H₂O from surface
 due to rain on July 14.

August 2

measured young - app 4 mm

August 5 10 am

emptied terrarium

8 spiders (Tycosa gulosa) found
by carefully picking thru
soil and shaking vegetation
and soil. no large
all medium sized. from 1st
batch of young? probably
none crawling on top, all must
have been in soil.

When put them in jar they
would momentarily flight when
they 1st came into contact
w each other.

All found were alive - in burrows

Sizes (mm) -

3, 4, 4.5, 5, 5, 5, 6, 7 - av. 5