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A Report
on
THE BIOLOGY OF HELISOMA TRIVOLVIS

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1. Material and Equipment

Living snails collected from their localities were brought in Eureka wide-mouth jars and put in the aquarium. The aquarium is in the form of three sinks the opening of each is plugged with a cork stopper through which passes a 30 or 35 cm. glass tube. The other side of the cork stopper fits into the opening of a cylindrical wire tube. Running water is supplied from a continuously opened tap for lake water. Water in the sink will be always at the same level as the water in the glass tube. The wire tube keeps the snails far from the opening of the glass tube.

Snails were fed on lettuce leaves which were changed daily or every two days.

Shells collected from different localities were brought to the lab carefully cleaned and dried.

Ecological features were recorded in the field. Associate snails were identified also in the field or brought to the lab if necessary. Associate vegetation was brought to the lab, carefully cleaned and pressed and then checked against text books of Aquatic flowering plants and the collections of the Aquatic Flowering Plants class.

For the life history, the egg masses were separated in finger-bowl dishes with lake water which was changed daily or twice a day.

General Survey of Cheboygan and Emmet Counties

a. FONTINALIS RUN

6 - 28 - 1948.

T 37 N R 27 S 11.

The snails are found on both sides, mainly in the part behind the bridge; few of them were found in the part between the bridge and the mouth of the run into the lake. The water is more or less stagnant; shore line is indefinite specially in the part behind the bridge. In the latter part the banks are low, while in the part between the bridge and the mouth they are of medium height. They are intermixtures of sand and clay and they are open (not shaded). Water is colorless, slightly turbid in most parts, highly turbid in the others. Bottom formed mainly of sand mixed with a small amount of silt.

Many logs are found on both sides of the Run and some are submerged. The logs are usually found crossing each other; the snails are found in the mesh water placed in the meshes.

The snails usually crawl on these logs at a distance of 30-90 cm. from the shore. Depth of place varies from 20 cm. to 1 meter. In all instances they crawl on the logs immediately under the surface of the water, in such a way that they can be easily seen. Therefore all the measurements have to be taken at a depth immediately under the surface. When the snails are put in the aquarium, they behave the same i.e. crawl immediately under the surface of the water although few sink to the bottom at some intervals.

Crawling on the logs is in most cases at right angle with the surface of adhesion, however, in few instances they are found adhering obliquely.

The snails are of the large size; the shell is dark brown in color, although covered by a dirty gelatinous layer more or less similar in color to a similar layer covering most of the logs and found at the banks. It is most probable to be periphyton.

Associate Snails:

1. *Lymnaea megasoma*
2. *Planorbula armigera*.
3. *Gyraulus parvus*.

Vegetation:

1. *Anacharis canadensis* (Elodea)
2. *Hypericum tubulosum*.
3. *Eupatorium perfoliatum*.
4. *Nymphaea odorata*.
5. *Eleocharis tenuis*.
6. *Utricularia vulgaris*.
7. *Lyrica Gale*.

b. MOUTH OF BISSEY CREEK

On north west corner of Douglas Lake

6 - 26 - 1948.

T 38 N - R 3 W - S 18.

The snails were found on both sides crawling on *Iris virginica* just below the surface of water, and at a right angle with it and with the plant. Depth of place varies from 25 cm. to 70 cm., at a distance of about 20 to 50 cm. from the shore and this is the region in which *Iris* is found.

Shore line not quite distinct due to the presence of dense vegetation.

Some logs are found on the sides specially near the bridge which is not so far from the mouth of the creek. Banks are of medium height formed of sand mixed with top soil. Bottom is formed of a sandy layer together with a mucky substance formed of decaying vegetation; sand is also mixed with silt. Turbidity in most parts is low becoming high at the least disturbance. Color of water is coffee or dilute tea.

A large number of shells was found on the beach of the lake near mouth of the creek; similar shells are also found at the bottom of the creek. On the whole the snails are not now so abundant in this locality; this is most probably due to the fact that they were collected during the last few years by biologists from the station.

Associate habitat:

Snails:

1. *Succinea retusa* (land snail) found crawling also on the same vegetation but above the surface of the water.
2. *Lymnaea stagnalis apressa*; large number usually nearer to the bank than *Hel-*
3. *Stagnicola palustris*

Vegetation:

The creek is characterised by the heavy vegetation on both sides.

1. *Typha latifolia*
2. *Heliacrus smallii*
3. *Chalamagrostis canadensis*
4. *Vallisneria americana*
5. *Potamogeton Richardsonii*
6. " *angustifolius*
7. " *natans*
8. *Anacharis canadensis*

9. *Anacharis occidentalis*
 10. *Polygonum coccineum*
 11. *Spyrogyra* sp.
 12. *Equisetum fluviatile*
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GOOSE POND

In Wilderness Park, at a distance of about 60 meters from the beach of Michigan Lake. 7 - 1 - 1948. and 7 - 3 - 1948.

T 39 N - R 5W - S 28.

Emmet County

Helisoma trivolvis was found also crawling near the surface at a distance of about 40 cm. from the bottom, however, some were found adhering to *Utricularia vulgaris* at a distance of about 25 cm. from the surface.

The distance from the shore varies between 10 and 50 cm. Shore line is clear smooth with only few curvings. As it is mentioned above the snails are found not far from the shore, a region where the water have no considerable movements. The surface water is moving due to seiches. In one part of the pond there is a bridge above a "fall" so to speak, leading to an extension from the pond. At some distance near this fall no *Helisoma tr.* was found. At this side of the pond the bank is very low formed mainly of sand. At the other side, however, the bank is high abrupt in some parts and of medium height in others and is formed mainly of clay and small amount of sand. In general the banks are open.

The bottom is formed of sand and a small amount of silt. Water is clear, slightly turbid.

The measurements have to be taken at more than one depth

The snails are of two types; those which are big in size and those which a

are intermediate in size. It is noticed that the big ones are abundant on one side of the pond, while the small ones are abundant on the other side (that in which the bridge is found); movements of water are more or less pronounced than the other side.

The smaller snails have a pronounced height as compared with the diameter, and also the whorls are carinate above. If the splitting of Baker is accepted here, the smaller ones should be called *Helisoma trivolvis pilsbri* and the others are the typical *Helisoma trivolvis*. It can be concluded therefore that *Helisoma trivolvis pilsbri* lives in water containing more movements than that in which the typical type lives.

Associate habitat:

Snails:

1. *Helisoma antrosum*; in large numbers
2. *Amnicola limosa*
3. *Gyraulua parvus*
4. *Physa gyrina*.

The last three snails are found nearer to the shore than *Helisoma trivolvis* in shallower region and also differ in inhabiting the bottom.

Vegetation:

1. *Polygonum amphibium*
2. *Potamogeton Friesii*
3. " *Berchtoldii*
4. *Zannichellia palustris*
5. *Hyphenicum Kalmanicum*
6. *Cicuta bulbifera*.
7. *Utricularia vulgaris*.

3. *Chara fragilis*.
 4. *Potamogeton Richardsonii*
 5. *Myriophyllum* sp.
 6. *Megalodonta Beckii*
 7. *Vallisneria americana*
 8. *Potamogeton Friesii*.
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DOUGLAS LAKE

6 - 18 - 1948. to 8 - 10 - 1948.

1. Dead shells on the beach near the mouth of Bessey Creek.
2. One shell near the mouth of Maple river.
3. In South Fishtail Bay after two windy days, one living snail was found drifted on the beach in the region of the camp, together with a shell. It is quite probable that they are brought to the lake from one of the inflowing streams.

Conclusion: Douglas lake is not a suitable place for *Helisoma trivolvis*.

NIGER CREEK

7 - 17 - 1948.

T 37 N - R 2 W - S 8.

Bottom of the creek is deep in some parts but floating logs, leaves together with black muck makes it seem to be shallow in these parts.

The snails either crawl on the vegetation near the surface or at a depth of about 20 cm. below the surface. Distance from shore varies from 25 to 40 cm. Slight movement of the water is noticed.

Banks are low in some parts high and sloping in others, slightly swampy,

formed of sand, silt and clay. A very small part is slightly shaded, the rest is open.

Turbidity higher in the part behind the bridge than in front of it.

Associate Habitat:

Snails:

1. *Physa gyrina*
2. *Gyraulus deflectus*

Vegetation:

1. *Potamogeton crispus*
2. *Nymphaea odorata*
3. *Equisetum fluviatile*
4. *Chara fragilis*
5. *Neobeckia aquatica*
6. *Typha latifolia*.

OTHER LOCALITIES

Informations will be mentioned here indicating other localities in which the snail is found and others with negative results.

1. Snails are found in Carp River, mainly in the source of the river from carp lake. T 39 N - R 4 W - S 15.
2. Shells are collected on the beach of Carp Lake near the source of Carp River.
3. Snails were collected from Sedge Pool. T 37 N - R 3 W - S 21.
4. Munro Lake T 38 N - R 3 W - S 4,9,16.
5. Picherel Lake T 35 N - R 4 W, 3 W * S 26, 27, 34, 35.
6. Crooked Lake T 35 N - R 4 W - S 15, 22.
7. Lullet Lake T 37 N - R 1 W - S 8.

In all these lakes the snails are found in protected localities where water movements are very much reduced.

No *Helisoma trivolvis* was found in Maple River (Emmet County); running water.

T 37 N - R 3 W - S 25.

No *Helisoma trivolvis* or any associate snail were found in the following Bog Lakes:

1. Bryant's Bog

2. Mud Lake

T 38 N - R 3 W - S 21, 28.

4. SHELL MORPHOLOGY

Discoidal, flat and showing all the whorls above and some of them below. Whorls are 4 in the mature shell, they are rounded on the periphery, more or less angled (carinate) above, but not so on the base. The spire is sunk below the level of the last whorl. Whorls are covered with fine regularly arranged growth lines. The disc is low as compared with the diameter of the shell in the adult. In case of young shells this is the reverse i.e. the disc is high as compared with the diameter.

Umbilicus very narrow showing some of the volutions. Aperture large, slightly extended below. Outer lip slightly reflected and lined inside with a brownish or sometimes greyish band. Parietal wall is covered with a thin callus of bluish-white or greyish color.

Color of the epidermis varying from light yellow to dark brown. In case of shells found in the drifts, the epidermis is sometimes removed and the shells seem to be chalky white.

A subspecies of *Helisoma trivolvis* called *Helisoma trivolvis pilsbri* by F. C. Baker have some variations concerning the shell. Height of the shell is pronounced when compared with the diameter. Body whorl more carinate above than

the typical *Helisoma trivolvis*. The whorls are also more compact and tight than *Helisoma trivolvis*.

5. LIFE HISTORY

a. Ovoposition

Ovoposition takes place on the walls of the aquarium to which each mass adheres more or less firmly. Each mass is at a distance of few centimeters from the surface of water, however, some are layed at furthermore depths.

Specific gravity of the whole mass is more than that of water; it sinks when getting loose. Ovoposition does not take place on lettus leaves.

The snails from Fontinalis Run were the only ones which layed eggs, those from other localities did not do so.

b. Developmental Stages

Developmental stages were also studied but they still need some details.

1. Newly layed egg mass:

Layed July 21, 1948; investigated on the same day. The mass contains 14 eggs. Each egg is circular, polygonal or more or less triangular, yellow in color with a shining spot either in the center or at one of the poles. The eggs are found very close to one another or with minute spaces in between. They do not adhere to the surface of the mass but a certain distance is left in between.

Another mass July 19, 1948, contains 20 eggs; 7 of which are in a good condition, the others are colorless, probably with no developing embryos inside. Dr. Eggleton suggests that they are unfertilised.

2. Stage II, 2 to 3 days after laying:

Egg mass (July 18, 1948) investigated July 20, 1948 is found to contain 17 eggs. The shining spot in the center or at one pole of the egg is now becoming

darker and more pronounced. Two of the eggs are unfertilized.

3. Stage III 4 to 5 days after laying

The egg mass (July 16, 1948) contains 14 eggs; investigated on July 20, 1948; young embryos with shells were seen inside the eggs. Color of shell, light brown, slightly orange in some parts. Color of the remaining part of the egg becoming very faint yellow. Two of the eggs were unfertilized.

Another mass of the same stage is not flat but more or less cylindrical and contains also 14 eggs.

c. Hatching

4. Stage IV.

The egg mass layed on July 16, 1948, investigated for stage III on July 20 is reinvestigated on July 24, 1948. At about the middle of the day the young snails began to leave the egg mass and move freely in water. At the end of the day 7 have already left it and the other 7 are still inside it.

Description of the snail at this stage:

Shell: Light brown transparent, very fragile. Aperture wide (1 mm.); one whorl, round on the periphery, more or less angled above. The shell is high (.75 mm.) as compared with its diameter, Diameter of the umbilical side, .6 mm. ; diameter of the upper side, .75 mm.

Animal : Protrudes mostly from one side only of the ~~shell~~ wide aperture. Tentacles are very clear, eyes and the foot are quite distinct. Tentacles and body are slightly pigmented. Eyes are clearly black.

5. 14-day snail

1. Movement of the animal is increased.
2. Whorl slightly extended.
3. The following measurements were taken.

Aperture 1.6 mm.

Diameter of upper side 1 mm.

Diameter of umbilical side .9 mm.

Height 1.1 mm.

All the above measurements are considered to be average.

Other egg masses:

July 24, 1948 3 masses (25 and an unfertilized egg, 21 eggs and 13 eggs).

July 26, 1948 2 masses each 24 eggs.

July 28, 1948. 1 egg mass containing 13 eggs.

It was found that variation takes place in the elapse of time between laying and hatching of the eggs as shown from the following table:

No.	Date of laying	Date of hatching	Period between laying and hatching
1	July 16	July 24	7 days
2	July 19	July 27	8 "
3	July 21	July 30	9 "
4	July 24	Aug. 3	10 "
5	July 26	Aug. 4	9 "
6	July 28	Aug. 7	10 "
7	July 29	Aug. 8	10 "
8	July 31	Aug. 10	10 "
9	Aug. 3	Aug. 14	11 "

This variation may be quite normal. Some factors may also have taken part e.g. variation in temperature or in dissolved O₂ or some other factors. It may also be due to the combined effect of all of them.

d. Some observations and conclusions

1. The gelatinous mass surrounding the eggs is most probably for protection. It is not for nutrition because it remains as it is after the embryos leave it. Protection may be against some bacteria, other fungi or against some predators.

2. The fact that the egg masses differ in the number of eggs they contain (some 25, others 14 and few 2) may suggest that a snail has to lay a more or less limited number of eggs in successive times. This means that it lays 24 eggs in the first time, 14 in the second and so on.

3. The comparatively wide aperture may be closed partly i.e. reduced in size as the animal grows by a secretion from the mantle.

4. Further study has to be made of the spot which appears in the center or at one pole of the egg. It is not the nucleus, it may be the embryonic mass.

5. In connection with no. 2 it is suggested that the snails have to be isolated and watched carefully for the number of egg masses and the number of the contained eggs layed by the snail per season or per year as the case may be.

e. Nutrition

Young snails were left for about 6 days after leaving the egg mass with nothing except changing the lake water once or twice every day. Then on putting small portions of lettuce leaves they started feeding on them. Excreta was quite noticed. But as it was expected the embryos hatching from the egg mass of July 26 were fed directly on lettuce leaves; increase in rate of growth was quite noticed.

Further investigation has to be made to find out the substances necessary for feeding the snails; whether plankton (and this is doubtful), whether dissolved organic matter or whether vegetation is necessary for this purpose.

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