THE BREEDING HABITS OF THE MYRIOPOD, FONTARIA INDIANAE.

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There are in Ohio, three species of the genus Fontaria and further work will probably discover one or two others. The species under consideration is limited in its range in the State to the northern third, or perhaps it descends no farther southward than the latitude of Bucyrus. The species *indianae* Bollman, is about two inches in length. The ground color is yellowish brown above while the ventral parts are uniform light yellow. Dorsally, the posterior edges of the segments are bounded by lighter yellow, similar to that of the ventral parts. The head is uniform brown. These considerations will distinguish the genus from any other in the State. The present species is distinguishable from the other species by the fact that in the male the genital hooks are curved inward, i. e., toward one another. The form is the narrowest of those of the species found in the State, the pleura of the segments not being bent outward as in the other species, but rather bent downward to quite a degree.

The observations on which the present paper is based were all made near Sandusky, Ohio, and mainly on Cedar Point, during the summers of 1900, 1901, 1902 and 1903. The animals began to leave their winter quarters about the first of May or, in some years, earlier when the temperature had been higher for several weeks. Often after leaving the fallen leaves, etc., under which they pass the winter, they were forced to again bury themselves owing to cold periods. As soon as summer sets in in earnest, the myriopods are quite common. They are to be seen running here and there over the sand in the daylight hours, but from the tracks left in the sand it is evident that they are active during the night. This is rendered certain by finding adults running about during the night when, by means of a lantern, the sand is illuminated, and also by finding a labyrinth of tracks on the sand which, during the late afternoon and evening, has been swept smooth by a storm, thus obliterating the tracks made during the day. It is very probable that their activities during the night are directed towards foraging for food.

Up until the middle of July, while the species is common everywhere, yet only isolated individuals are seen. After that date, however, they apparently congregate and are found associated together. An examination showed that these collections were not of either one sex, but were made up of individuals of both sexes. Soon, however, the sexes pair off and are found in the tall grass that borders the south beach of Cedar Point which is washed

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by Sandusky Bay. Here they lay their eggs immediately, except when the weather becomes cold, as during the summer of 1903. For weeks during that summer, there were strong winds from the west and northwest that drove a heavy surf against the beach mentioned. Moreover, the major portion of the season during which oviposition generally takes place, remained cold and cloudy. The result was that the myriopods did not lay their eggs until late. During the latter part of July and the first of August, adults were not to be seen, as during hot summers like that of 1902, running about in groups on the sand, but were found huddled together in numbers under the dead marsh grass and debris that covered the bay beach above the wash of the waves.

For a short while in the second week in August, some were found pairing in the grass farther towards the middle of the Point, and a little later, several nests were discovered. The nests are built in loose sand, preferably that when mixed with a little loam and always soil that is somewhat damp. The nests are dug by the female while the male is mounted. She uses her anterior appendages to dig the hole, passing the dirt upward to the opening of the hole by means of the remaining appendages. She removes the dirt until she has made a cavity a little greater than the width of her body and about two inches in depth. When the greatest depth has been reached that she is to make the hole, she widens out a cave-like terminus which reaches a diameter of about half an inch. She is now ready to deposit the eggs. To understand this process, it is necessary to keep in mind that the external generative opening of the female is on the second body segment. Hence the female is enabled to deposit the eggs without withdrawing from the hole. The eggs are fastened to the walls of the enlargement at the base of the tubular nest, and after she has lined the cavity, she keeps on depositing eggs until she has made four or five layers of eggs. Sometimes the whole of the enlargement is filled, but generally there is a lumen in the center of the mass of eggs.

There is no evidence furnished by the present observations for the statement made by some authors[1] that the female guards the nest after she has deposited her eggs. Of the many cases watched, none of the females nor males remained in the vicinity of the nest after the egg-laying had been completed. The mouth of the nest was in each case left uncovered, but usually, by chance, the opening became stopped up either by rain or wind or some other factor.

Young specimens were found during the whole of the summer amongst the adults. These immature individuals ranged in length from three-quarters of an inch to full size. In color they differed

1. Korschelt and Heider, Embryology of Invert. Vol. III, p. 218.

decidedly from the adults, being clay colored, the bands on the posterior borders of the terga in the adults being represented by paler markings in these immature specimens. By successive moultings, they increased in size and after several weeks became colored like the adults when kept in the open air or in sunlight. Experiments on the young at different stages failed to bring out the adult colors until the normal length had been attained. The eggs lie over winter and the larvae emerge in the following spring as minute white bodies which grow quickly into the young described above.