THE BIOLOGY OF THE ISOPODA OF THE REGION OF DOUGLAS LAKE, MICHIGAN

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General Statement of the Problem

This study was made during the summer of 1938 - June 27 to August 14. During this time many places in the vicinity of Douglas Lake were visited, both for terrestrial and aquatic Isopoda. An attempt was made to visit as many different types of habitats as possible. The first three and a half weeks were devoted to the exclusive collecting of terrestrial species. The latter part of this summer period was spent in collecting the aquatic species, but terrestrial Isopods were also observed.

TERRESTRIAL ISOPODA

Local Species

Previous to this study, a similar one had been carried out in the Arboretum at Ann Arbor, Michigan from March through May of 1938. Here it was found that Cylisticus convexus was by far the predominant species. Porcellio rathkei and Armadillidium vulgare were also collected. It was expected, therefore, that Cylisticus convexus and prehaps the other two species - Porcellio rathkei and Armadillidium vulgare - would be found in the vicinity of Douglas Lake. Both Cylisticus and Porcellio were found here, but Armadillidium was not collected. This latter fact is not too suprising, since the conditions under which Armadillidium vulgare was collected at Ann Arbor - in

greenhouses and in flower beds in the city - do not exist in any of the areas studied here around Douglas Lake.

Besides Cylisticus convexus and Porcellio rathkei, two other species were found. They were Porcellio scaber and Oniscus asellus.

In other words three genera and four species of land Isopods are found in the region of Douglas Lake. These species are Cylisticus convexus, Porcellio rathkei, Porcellio scaber and Oniscus asellus.

Numbers

Since the terrestrial Isopods were found in such large numbers, no attempt was made to count the number of individuals. Instead a rough estimate of the comparative number of species was made for each habitat. It was found that in most situations Cylisticus convexus predominated. Porcellio rathkei, however, was the most abundant species in very damp places, such as under fallen timber in bogs. Only two Porcellio scaber and only one at a time were collected. Oniscus asellus was found in only one place.

Habitat

Terrestrial Isopods were found in many types of habitats. In fact there were only two situations where none were collected. It was previously reported that Isopods were not to be found in the pine woods in the Arboretum in Ann Arbor, Michigan. This was also true in the areas around Douglas Lake that were studied - the woods on Fairy Island, pine grooves in Carp Creek Gorge, the area of the old Bio-

logical Station, and around Pine Point were all studied and no Isopods were found in these coniferous woods. The second sort of situation where Isopods were not collected was in Aspen woods. Here it was very dry and this may be one of the principle reasons for their absence. The aspen woods studied were those on the hill behind the present Biological Station, woods along the top of the gorge of Carp Creek, woods east and north of Burt Lake but not directly on the shore, woods on Pine and East Points, and woods around Ocqueoc Falls. As previously reported none of the animals usually found with Isopods were present in the aspen and pine woods that were studied.

In the paper on the Isopods of the Arboretum at Ann Arbor it was reported that they were present in open fields in large numbers, and that they were also to be found in deciduous woods. In the present study no collections were made in open fields. Deciduous woods, however, were studied. In both open woods and heavily wooded areas Isopods were found. Usually they were in rotting logs, under the bark, where the wood was riddled by decay, rot and insects. Isopods were also to be found among the leaves on the floor, under fallen timber and boards, and in hollows formed by the surface roots.

Sandy and gravelly lake shores were also studied and were found to be excellent collecting grounds. Here Isopods were found under rocks and debris, but especially

under wood that had been washed ashore. More Isopods were to be found at the edge of the beach where trees and other vegetation overhung. Few were found on the beach near the waters' edge. Cylisticus convexus predominated in this sort of habitat.

Another habitat where many terrestrial Isopods were found was in the boggy areas around streams, lakes, beach pools and in bogs themselves. The Isopods were usually to be found on the undersurface of a log or board that was partly out of the water; Near that part of the board that just entered the water and where the water rose on the board due probably to capillary action. As already stated Porcellio rathkei was the abundant species here, although all the other species were also to be found in this type of situation.

Ant nests in moist situations were in three instances found to house Cylisticus convexus. This Isopod was not only found under boards and rocks with ants, but was actually down in the tunnels. The lowest one that was located was down about one and a half inches in the main tunnel and might have gone further, but the tunnel branched here and became too small for an Isopod.

Oniscus asellus was found under a fallen log on the shore of the Cheboygan River, near the city of Cheboygan,Michigan. Not only are they to be found in such a situation, but according to Richardson (1905) they are also to be found under leaves and stones, and are common in hothouses.

Cylisticus convexus was found in woods, bogs, along stream beds, and on beaches. It was collected from under logs, boards, stones, gravel, peebles, and debris, and in rotting wood.

Porcellio rathkei was usually to be found in bogs, under logs or boards. It was also collected from rotting wood in deciduous woods, under debris on beaches and along stream beds. It appears that this species likes more moisture than the others.

Porcellio scaber was only collected at two places. One was along the shore of Munro Lake under a board in a rather moist situation. The other speciman was found under a log in a boggy area along the shore of Nigger Creek, at the Iron Bridge. Richardson (1905) reports it as being found under dead leaves and stumps, under bricks and boards; along the shores; in greenhouses.

Associations

Many invertebrates seem to prefer the same type of habitat as do the terrestrial Isopods. Centipedes, milipedes, spiders, snails, slugs, earthworms, cave crickets, crickets, beetles, ants and other adult as well as larval stages of insects were found with the terrestrial Isopods. Both a red-backed salamander and a common newt were found in habitats with Isopods. A nest of mice was also found under a log where

a few Isopods were collected. These vertebrates that were found, may use the terrestrial Isopods for food, but as yet there is no definite evidence of this surmise.

Young

Females collected during the first week of the study - June 27 to July 3 - were found to be carrying eggs with them. These eggs were in abrood pouch or a marsupium between the second and fifth pair of legs. This pouch or marsupium is composed, according to Richardson (1904), of four pairs of plates that are attached to the origin of the legs and overlap on the ventral side in the median line. As development continues in the marsupium, these plates begin to separate. In fact just before the young leave the pouch there is a definite gap between the two rows of plates. Not only do the plates on the right tend to be pushed from those on the left, but plates on the same side are pushed downward and apart as development continues in the embryoes.

Fifty female Cylisticus convexus were killed and the number of embryoes in their pouches counted. The number in a marsupium varied from 21 to 56. The average number of them being 41. It was noted that the larger the female, the more eggs she carried. The size of the embryoes varied from .5mm to 1mm. The latter were perfectly formed young that were nearly ready to leave the marsupium.

The females of some Cylisticus were segregated - ten in all-

and were observed from time to time. On July 15, two were noticed to be "giving birth" to their young. The female was arched up in the middle and ever now and then would straighten out, only to arch again. This movement was not related, as far as could be determined, to the young leaving the marsupium, except that the young left only when the female was arched with her head down.

A part of this process was observed under a 10X binocular, with the female slanted to one side. Under such a condition it was found the the young back out of the pouch, between the two rows of plates, that have now a wide slit between them. These nearest the slit were the first to leave. One emerged about every 25 seconds for about two hours and gradually the interval became longer. In this particular case twenty one young or about half of the brood were out of the pouch at 11 P.M.; the first leaving shortly after 1 P.M. A total of 45 young left the marsupium of this particular female over her delivery period, which was around three weeks.

The ten segregated females were placed in plaster of paris cups, about two inches deep on the inside. The plaster sides were about three fourths of an inch wide and the inner diameter of the cup was about two and a half inches. These cups were covered witha circle of thick glass and placed in a pan of water. The water in the pan was around a half of an inch deep. With each female potato and decaying leaves were placed. These cups were examined every other day.

Of the ten females that were placed in the cups on July 13, six "gave birth" to young beginning on July 15. The other four had young on July 21. On the first day of delivery the average number of young to leave their marsupium was 15; the largest number to one pouch was 23 and the smallest was 5. Young were separated from the female as soon as they were found. The period of delivery lasted between two and half weeks to three weeks. The larger the females the more young and the longer the delivery period. The average number of young born during the entire delivery period was 37; the smallest number was 15 and the largest was 52.

The young Isopods at birth measured about 1.5mm in length and less than .5mm in width. The last or seventh thoracic segment was missing and so was the last pair of legs. Besides these factors and those of color and size the young Isopod resembles its Mother. The young specimens were cream color, but in about an hour after birth a dark dorsal median line appears on some. On close observation it will be found that these young Isopoda are slightly translucent and that this dark line is nothing more than their digestive tract showing through the outer layers. It would appear from this that young Isopods eat soon after leaving the marsupium.

At the end of the delivery period the female molts. The exuviae of the last three thoracic segments and those of the abdomen is shed first and in one piece. About a day later the head and the first four thoracic segments shed their old skin and it is also shed in one piece. It was noted that

the exuviae were eaten or at least torn apart by the young. The adults were not found feeding or around the cast off skins.

During the first day of its free existence it was found that a young Cylisticus convexus grew around .5mm in length and also became somwhat broader. Most of the young soon after the first day showed the dark median stripe on their backs that appears to be the digestive tract. After about a week young Cylisticus are 3mm. long and at the end of two weeks are over 3.5mm long. The first molt comes at around the second week. After this molt they are 4mm. long, with a constriction at the end of the sixth thoracic segment and the seventh pair of legs appear, but they are drawn up. This may be due to the constriction. After about two days this constriction is gone and the seventh and new pair of legs are in use. Growth is slower after this molt, for at the end of the third week they are only about 4.5mm long. They are now a definite tan and under low magnification lighter areas are visible in the same locations as those in the adults.

The death rate appears to be very high among young Cylisticus in these cups. Take for instance Female A. She had 20 young on July 25, but on the 29th there were but ten young. On August 3 there were 8 that were alive and on the 8th only 6 alive and on the eleventh there were but 5. Here the deaths appeared early - over half dying the first few days. Female E had 20 young also. Of these 20 seventeen of them lived up to the first molt. But during the molting period 7 died and three more the next week.

It is of interest to note that young Cylisticus the day they leave the marsupium are able to contract and to roll into a compact ball as do the adults.

AQUATIC ISOPODS

Local Species

Three species of aquatic Isopods were found in the region of Douglas Lake, Michigan. They were Mancasellus tenax, Mancasellus macrourus and Asellus communis.

Habitats

Aquatic Isopods were found only in a few localities in this region. The negative locations were many and varied. It would appear that Isopods do not inhabit the lakes of this region. Douglas, Munro, Lancaster, Carp, Burt, Mullet and Ocqueoc Lakes were all devoid of Isopods as far as could be determined. Beach pools around Douglas Lake are also without aquatic Isopods. Fast flowing water in a stream with little vegetation and a shifting bottom were also without Isopods. Two such streams that were visited were Maple River and Carp River. Aquatic Isopods may or may not live in bogs. Reese's, Nichol's and Bryant's Bogs were devoid of them, but menbers of the biological station report having found Aquatic Isopods in other bogs.

Aquatic Isopods were found in large numbers in Indian River and Nigger Creek. In both instances the bottom is composed chiefly of mud and there is a great deal of vegetation and little current. Fontinalis Run, however, meets all of these

requirements and on the one visit there, no aquatic Isopods were found. Isopods were also collected from springs along the shore of the Straits of Mackinaw. Here the water was covered with moss and by pulling this up, Isopods and Amphipods were to be collected in large numbers, from the roots. The water was very cold in these springs. Nearby on the same shore of the straits in Mill Creek, Isopods were found up as far as the first falls. This creek was rather rocky, but had a stable bottom. Above the series of falls near U.S. Highway no. 23. there were no aquatic Isopods. Could it be possible that the Isopods in the lower part of Mill Creek came originally from the nearby springs?

In those locations where aquatic Isopods were found, they were collected from under the rocks, submerged debris - logs and the like, on the under surface of lily pads and in the debris on the bottom. Also as previously mentioned among the roots of moss growing in the spring.

Habits

Aquatic Isopods are lovers of the semidarkness, as are the terrestrials. They are seldom found swimming free, but are usually under some object.

Terrestrial Isopods usually have their backs against some object. The aquatics, however, are usually to be found upside down clinging to the undersurface of some object and may have their backs against the bottom.

Aquatic Isopods also carry their eggs in a marsupium, and like the terrestrials the young are also carried there.

After leaving the marsupium, the young tend to remain for awhile on the female, crawling all over her body. But by the second day, all have either dropped off or have swam away.

SUMMARY

1. Terrestrial Isopods in the area around Douglas Lake are Oniscus asellus, Cylisticus convexus, Porcellio rathkei, and Porcellio scaber.

2. Terrestrial Isopods are to be found in deciduous woods, both open and heavily wooded areas; in bogs; along streams; and on beaches, of sand or gravel.

3. Terrestrial Isopods are to be found under stones, logs, drift woods, boards and gravel; in rotting wood and decaying vegetation such as leaves; in hollows under roots; and in ants' nests.

4. Terrestrial Isopods were not found in coniferous and aspen woods.

5. The average number of eggs per female Cylisticus convexus was found to be 41. The number varying from 21 to 56 in the 50 specimens examined.

6. Young Cylisticus convexus are born over an interval of time. The longest period was three weeks from the time the first was born to the last of the brood.

7. Young Cylisticus convexus are about 1.5mm long, with the seventh thoracic segment and pair of legs missing.

8. The average number of young Cylisticus convexus per female was 37. The smallest number was 15 and the largest number was52. The larger the female the larger the brood and the longer the delivery period.

9. After the delivery period the female molts. The young Cylisticus convexus molt during their second week after they have left the marsupium. After this molt they have all seven thoracic segments and seven pairs of legs.

10. Aquatic Isopods of the Douglas Lake region are Mancasellus tenax, Mancasellus macrourus and Asellus communis.

11. Aquatic Isopods are to be found under rocks, on the undersurfaces of lily pads, on moss roots and in the debris on the bottom of the stream.

12. Aquatic Isopods usually are to be found in running water where there is plenty of vegetation and a permanent bottom.

13. In habits, Aquatic Isopods are very similar to the terrestrial Isopods.

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