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SOME NATURAL HISTORY OF THE TERRESTRIAL ISOPODS.

Submitted by;
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June, 1938.

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SOME NATURAL HISTORY OF TERRESTRIAL ISOPODS

Introduction

Isopods are classified as Crustacea in the subclass Malacostraca. They were formerly placed in the Order Arthrostraca, with the Amphipoda.(Richardson, 1904). More recent publications, however, have made both the Isopoda and the Amphipoda separate orders.(Hegner,1936 and others). There are seven superfamilies or tribes generally recognized in the Isopoda. According to G. O. Sars, all of the land Isopods are grouped together in the superfamily Oniscoidea, since all of them have terminal uropods, pleopods fitted for air breathing, and are not parasitic.(Sars,1899).

Many papers in many languages have been written concerning the Isopoda. Few, however, make any mention of their natural history, since practically all of them are primarily interested in the taxonomy of the group. In the three outstanding works dealing with the Isopods there will be found scattered natural history data. These works are those of Budde-Lund, 1885; Sars, 1899; and Richardson, 1905. This imformation seems to have been added as an afterthought, as it is in fine print or at the end of the discussion of the species. Harriet Richardson has, however, a publication entitled, "Contributions to the Natural History of the Isopoda". In this paper she very briefly describes the external anatomy, internal anatomy, development, size, habitat, food and habits for all seven of the superfamilies of Isopods. A large part of these discussions is taken up with the aquatic

forms and very little is said of the Oniscoidea. Allee in one of his studies of animal aggregations studied "Causes and Effects of Bunching in Land Isopods". This was of course a laboratory study, but as he stated applicable to these conditions in nature and in several instances in my study this was borne out. Other studies of Allee have also delt with Isopods. As already stated there are many papers on Isopods, however, those mentioned above are by far the more important of those that were found.

General Statement of Problem

This study was begun in early March and continued through May of 1938. During this time weekly visits - weather permittimg - were made to the area where the study was carried out. This area was the Arboretum in Ann Arbor, Michigan. Collections were also made in several nearby areas in Washtenaw County as a check on the distribution of the species that were found in the Arboretum.

Numbers and Species

Although it was expected that several genera and species would be found, only three genera and one species of each genera were located. They were Cylisticus convexus, Porcellio rathkei and Armadillidium vulgare. Cylisticus convexus was rather plentiful in the area studied, but the other two were far from numerous. Only one individual Porcellio rathkei was collected and only 13 Armadillidium vulgare were found in the area studied. Armadillidium was, however, found to be plentiful in the city. On the University of Michigan campus it was the predominant species and in greenhouses it was very

abundant. See the chart for numbers of each species, when seen and conditions on that date.

It will be noticed on the chart that Cylisticus convexus was found earlier than the others. Armadillidium vulgare was found later and Porcellio rathkei still later. Could it be that Cylisticus convexus comes out of hibernation earlier than the others? The evidence is meager, however, and not conclusive, but it may point in that direction.

Cylisticus convexus was found in situations where other Isopods were not found. They were present, however, in the situations where the others were collected. It would seem that a habitat suitable for one species is suitable for the others.

Young Cylisticus convexus were usually found with the adults, but as far as could be determined there were no relations between the two, such as care of young or protection of them by the adult.

Only in a few instances were Isopods found alone - that is they were the only animals in that particular situation. Generally other land invertebrate animals were found in the same habitats. Usually ground beetles, ants, crickets, cave crickets or other insects, slugs, land snails, earthworms, milipedes or centipedes were present. On March 9 a young garter snake was found under a rock where a good number of Isopods were bunched. None of these invertebrates would be harmful to one another, but instead their presence could be explained in that they all preferred a similar habitat - dark, damp, cool and near their food.

CHART I.

NUMBERS OF SPECIES

Date	Species	Nos.	Conditions when seen
March 9, 1938	Cylisticus convexus	18	Snow, but melting /
March 30	" "	29	Wet. cloudy, cold.
April 4	" "	50	Damp, cloudy, warm.
	Armadillidium vulgare	1	
April 20	Cylisticus convexus	25	Moist,clear, warm.
April 27	" "	14	Dry, clear, hot.
May 4	" "	6	Dry, clear, hot.
May 11	" "	44	Dry, cloudy, windy, cool
	Armadillidium vulgare	5	
	Porcellio rathkei	1	
May 18	Cylisticus convexus	36	Wet, clear, cool
	Armadillidium vulgare	1	
May 25	Cylisticus convexus	56	Damp, clear, cool
	Armadillidium vulgare	6	

TOTALS -

Cylisticus convexus -	278
Armadillidium vulgare -	13
Porcellio rathkei -	1
	292

Habitats

There were several general types of locations where Isopods were found and there were other situations where none were located. By far the greater number were collected from open fields. It did not make any difference whether or not the grass on the field was tall or cut close to the ground. Another good collecting ground were the open deciduous woods. In such a situation the forest floor would be covered with green vegetation and some decaying matter - such as rotting logs, stumps and piles of leaves. When, however, as in a heavy wooded area, there was little if any green vegetation on the floor, few Isopods would be found. Those that were found were always located in decaying logs between the wood and the bark. The coniferous woods in the area were devoid of Isopods, as far as could be determined. Here there was very little green vegetation on the floor, as a thick mat of needles covered most of the ground. Not only were Isopods not found here, but few of the invertebrates usually associated with them as to habitat, were found.

Although Sars states that Cylisticus is generally to be found where the ground consists of loose pebbles, none were found in this situation. Instead the majority of them were collected in sandy or clay soil regions.

Very wet situations, with one exception, were devoid of Isopods. The one exception was a board in the overflow of a spring. The board was, however, seldom very wet, but usually only moist, even though the area was rather swampy.

Every time this board was examined there were usually Isopods on its under surface.

Slopes seem to be preferred to level ground, but not too careful records were made concerning these factors.

In these general locations there were certain specific situations where Isopods were to be found. Although Sars says that Cylisticus convexus prefers somewhat dry situations, they were usually found in moist, but not damp locations. According to Richardson (1905) Cylisticus is to be found under bricks and boards; in woods, under logs; along roads, under stones. Cylisticus convexus was found in all of these habitats. They, however, were found in other locations ; such as in woods, between bark and wood of decaying logs, in compost (Decaying leaves and other vegetation piled under trees); in open fields, under trash (paper, cloth and the like), under stones; and in ant nests. Cylisticus convexus was found several times under rocks where ant nests were located. Once on digging out a nest several of these Isopods were found in the tunnels about three inches below the surface.

Porcellio rathkei is, according to Richardson (1905) , to be found on rotten logs, under bricks and boards, under logs, at river bottoms. The only one that was collected in this study, however, was found under a stone in an open field.

Armadillidium vulgare was found under boards and paper in moist situations in open fields and slightly wooded areas.

It appears that the requirements of a desirable habitat for Isopods are darkness, some moisture, something to hide under and to cling to, and nearness to food.

Effects of Moisture

During the time the study was made there was about a two and a half week period during which there was practically no rain. This afforded the opportunity of studying the effect of lack of moisture on Isopods. It was found that those habitats that were exposed to drying conditions were the first to be abandoned. Level open fields were the first to show decreases in Isopods. Next to show a decrease in numbers were the open slopes. Dried up creek beds and decaying logs also showed slight decreases in numbers. Isopods were more numerous in wooded areas during this dry period than formerly.

During the drought there was also a change in habits. Allee (1926) had found in the laboratory that on dry filter paper Cylisticus convexus tend to become bunched. Several bunches of Isopods were found during this dry period. The situation in all cases was similar: dirt was becoming powdery, other animals were not present or were dead, and all of the Isopods were bunched in the deepest and dampest part of the hollow formed by the rock, under which they were living.

None of the Isopods found during this dry period were active, but instead were rather sluggish, never hiding when habitat was disturbed or moving when picked up.

Following this drought there was a period of excessive rain. It was found under this condition that larger numbers of Isopods were together, but never bunched. All were very active.

Young

Young or immature Cylisticus were found throughout the period in which the study was made. They were first found on March 9, when snow was still on the ground. Young were also born in the laboratory. Those born on May 15,1938 were about 1.5mm. long, a pale cream color and covered with white longish hairs. These hairs persisted through at least the third molt. Young Cylisticus convexus found in the natural habitat were about 3mm. long and about 1mm. wide. Their color was a pale brown. They too were covered with hair or fuzz, but it was not so thick as in the earlier stages.

Molting

As most of the Isopods brought back to the laboratory molted, their method of molting was studied. Instead of making a lengthwise break down the back as do insects, a circular break is made, dividing the exuviae into an anterior part and a posterior portion. This break seems to occur between the segments of the thorax; generally between the fourth and fifth or the third and fourth segments. Soon after the break occurs, the posterior part becomes loose and then the animal seems to crawl out of it. There is a slight movement of the legs and pleopods, before the animals crawls away. This motion may be due to the Isopod freeing itself of the cast off skin from its ventral appendages. The

anterior portion of the old skin remains for some time. The longest period was found to be 24 hours and the shortest to be two hours. The Isopods in the laboratory bury themselves in the dirt and seem to be rubbing themselves against the close walls of their burrows. No anterior portions of the exuviae were found in their entirety, as were the posterior parts of these cast off skins. Instead they were always found broken into several pieces and along no definite lines.

Exuviae were left in the containers with living Isopods and all food was removed. There was no attempt as far as could be ascertained to eat these cast off skins, even though all food was removed for a period of two weeks.

Adults as well as immature specimens were found to molt. The periods were, however, longer as the animal tended towards maturity. Young born on May 15 molted on the 17th. then again on the 25th. and thirdly on the 6th. of June. There would be, therefore, intervals of 2, 8 and 12 days between these first three molts. Young found that were about the size of the former ones at their third molt, molted around 15 days after being brought into the laboratory and again in 22 days. The interval between molts in mature adults was found to vary from two to five weeks.

Habits

As already stated earthworms were usually found with Isopods. When this was the situation a rather interesting habit was observed. Soon after the rock or other object under which Isopods were living was disturbed, the Isopods

all seem to make for these earthworm burrows. At different times Cylisticus convexus were taken from under one rock and turned lose under another. As soon as they would find a burrow they would go down it.

When Cylisticus convexus waspicked up, it would draw in its legs and lie motionless for about 15 seconds, as if "Playing dead". If touched on the back they would also "Play dead", lying very flat against the ground with legs drawn in and head turned down. If turned on their back this "Playing dead" would last for about 25 seconds, and then all legs would come into action at once. Then those on one side (usually the right) would give a greater stroke than those on the other side and over the animal would roll back to its normal position.

An effort was made to see if Isopods migrate and if so, how far do they go. This experiment was unsuccessful as the method of identification consisted of marks of various colors in certain places, and when the individual molted there was no way of telling how it had been marked. Then too it was very dry during the time the experiment was run. None of those marked were ever found again.

As already mentioned bunching was found to occur under dry conditions. It was also found that on cold days Isopods would be grouped together. When exposed to light suddenly, as by overturning a stone, they would tend to come together when there was no other way of escape. These conditions had been reported by Allee (1926), but his were laboratory controlled experiments.

The chief methods employed by Cylisticus convexus for protection have already been described. Besides "Playing dead" and flattening out against the ground, they will occasionally roll up into a crude ball. This, however, is the chief means of defense used by Armadillidium vulgare. This Isopod makes a very compact ball on rolling up - the antennae are drawn in and the head is enclosed inside the ball.

Many of the Isopods picked up were regenerating legs, antennae and in a few cases pleopods. When caught Isopods readily give up any appendage that is hindering their escape. Appendages are very readily broken off by them. Even those that are being killed in preservative break off antennae and legs.

Summary

1. Three species of Oniscoidea were found. They were Cylisticus convexus, Porcellio rathkei and Armadillidium vulgare. Of the three, Cylisticus was by far the more numerous.

2. There does not seem to be any specific habitat for any of these species. Protection from light, some moisture, nearby food and something to be against are the main qualifications for an Isopod habitat.

3. Isopods were found in open fields and deciduous woods. None were located in coniferous woods. Sandy and clay soils are preferred to rocky or pebbly soil.

4. Cylisticus convexus was found living in ant nests.

5. Allee's laboratory findings as to effects of temperature, light and moisture on the bunching of Isopods were found to also be true for those living in the field.

6. Young Cylisticus convexus were found throughout the period of study.

7. Cylisticus convexus was found earlier than the others. It was postulated as to whether or not it comes out of hibernation earlier than the rest.

8. Instead of a longitudional split down the middle of the back of the exuviae, Isopods have a circular split, which separate the old skin into two parts - an anterior and a posterior part. This split usually occurs between segments in about the middle of the thorax.

9. Earthworm burrows are used by Isopods as a means of eascape when disturbed.

10. Cylisticus convexus has a habit of playing dead when touched.

11. Both Cylisticus convexus and Armadillidium will roll up into a ball as a means of protection. This method is the only device used by Armadillidium vulgare for protection, but Cylisticus convexus will often "Play dead" instead of rolling. A Very compact ball is formed by Armadillidium, but a loose one is formed by Cylisticus.

REFERENCES USED.

Allee, W. C. , 1926, Studies in Animal Aggregations: Causes and Effects of Bunching in Land Isopods. Journal of Experimental Zoology, 45 (1). 255- 277.

Budde-Lund, G. , 1885, Crustacea - Isopods Terrestria.

Hegner, R. W. , 1936, Invertebrate Zoology, Macmillan Co., New York.

Sars, G. O. , 1899, An Account of the Crustacea of Norway, Volume II, Isopoda, Bergen Museum, Christiania.

Richardson, H. , 1904, Contributions to the Natural History of the Isopoda, Volume I. Proc. U. S. Nat. Mus. , Volume 27, pp 1 - 89.

Richardson, H. , 1905, A Monograph of the Isopods of North America. Bulletin 54, United States National Museum.

5-36-1M TAXONOMIC - DISTRIBUTION - ABUNDANCE RECORDS

Year Spring, 1938 Collection of Stephen R. Hatchett

Scientific Name Isylisticus convexus

Common Name

Serial No. NA138 NA238 NA338 Det.by S.P. Hatchett
Serial No. NA438 NA538 Det.by
Serial No. NA638 NA738 Det.by
Serial No. NA838 NA938 Det.by
Serial No. NA138 Det.by
Serial No. NA1138 NA1638 Det.by S.P. Hatchett
Serial No. NA1738 NA1838 Det.by
Serial No. NA1938 NA2138 Det.by
Serial No. NA2238 NA2338 Det.by
Serial No. NA2438 Det.by
NA2538, NA2638, NA2738, NA2838, PL138, NA2938, NA3038, NA3138, NA3238, NA3338, NA3438, NA3538 (over)

Phylum Arthropoda Class Crustacea
Subclass Malacostraca Order Isopoda
Suborder Superfamily - Oniscoidea Family Oniscidae
Subfamily Genus Isylisticus
Species convexus Variety

Genus erected by Schnitzler, H. J Date 1783
Reference De Oniscinis agri Bonnensis

Species described by De Geer, C. Date 1778
Reference Memoires pour servir à l'histoire des Insectes

Synonomy Oniscus convexus, Porcellio planiformis, Porcellio laevis, Porcellio armadilloides, Isylisticus laevis, Porcellio convexus

DISTRIBUTION AND ABUNDANCE

I LOCAL :- Washtenaw County ~~Cheboygan and Emmet~~ Counties.

County	Locality	Locus key	Relative Abundance	F. R. Sheet Nos.	H. C. Sheet Nos.
Washtenaw	Arboretum, Ann Arbor	T2S/R6E/S3E	Very	1-4,6-10	1-4,6-10
	Saginaw Forest	T2S/R5E/S2E	"	5	5
	Pleasant Lake Area	T3S/R4E/S22	"	11	11

U.M.B.S. Nat. Hist. Invert. T.D. & A. Sheet No. 1.

(Continued on other side)

Serial nos.
NA3638
NA3936
NA3937
NA3939

(Continued from other side)

II MICHIGAN :-

Counties	Abundance	Records By	Citation -- Remarks
~~Saginaw~~		Richardson, H.	Richardson, 1905

III NORTH AMERICAN :-

States or Provinces	Abundance	Records By	Citation -- Remarks
Ohio,		Richardson, H.	Richardson, 1905
New York-			
Dist of Col.			
Massachusetts			
New Jersey			
Michigan			

IV WORLD :-

Countries	Abundance	Records By	Citation -- Remarks
Sweden			Richardson, 1905, Sars, 1899
Denmark			
Norway			
British Isles			
Germany			

Holland, France, Turkey, Belgium -

BIBLIOGRAPHY OF LITERATURE USED

Budde-Lund, G., 1885- Crustacea - Isopoda Terrestria

(S)Sars, G. O., 1899, An account of the Crustacea of Norway, Vol. II, Isopoda

Richardson, H, 1905, A monograph on the Isopods of North America, Bull 54, U. S. Nat. Mus.

5-36-1M TAXONOMIC - DISTRIBUTION - ABUNDANCE RECORDS

Year Spring 1938 Collection of Stephen R. Hatchett

Scientific Name Porcellio Rathkei

Common Name

Serial No. NA1438 Det.by S.R. Hatchett Serial No. Det.by

Serial No. Det.by Serial No. Det.by

Serial No. Det.by Serial No. Det.by

Serial No. Det.by Serial No. Det.by

Serial No. Det.by Serial No. Det.by

Phylum Arthropoda Class Crustacea
Subclass Malacostraca Order Isopoda
Superfamily
~~Suborder~~ Oniscoidea Family Oniscidae
Subfamily Genus Porcellio
Species Rathkei Variety

Genus erected by Latreille Date, 1804
Reference Hist. Nat. Crust. et insectes

Species described by Brandt, J. F. Date 1833
Reference Conjectura monographiae Crustaceorum Oniscodorum.

Synonomy Porcellio fenestratus, Porcellio trilineatus, Porcellio trivittatus, Porcellio tetramerus, Porcellio striatus

DISTRIBUTION AND ABUNDANCE

I LOCAL :- Washtenaw County
~~Cheboygan and Emmet Counties~~.

County	Locality	Locus key	Relative Abundance	F. R. Sheet Nos.	H. C. Sheet Nos.
Washtenaw	Arboretum, Ann Arbor	72, 76, 104	Rare	6	6

U.M.B.S. Nat. Hist. Invert. T.D. & A. Sheet No. 3

(Continued on other side)

II MICHIGAN :-

Counties	Abundance	Records By	Citation — Remarks
Saginaw			Richardson, H, 1905

III NORTH AMERICAN :-

States or Provinces	Abundance	Records By	Citation — Remarks
Ohio			Richardson, H, 1905
New York			
Georgia			
Massachusetts			
Dist of Col.			
Michigan			
Maine -			
Texas -			
Rhode Island			

IV WORLD :-

Countries	Abundance	Records By	Citation — Remarks
Europe -			Sars, G. O, 1899 & Richardson, 1905.
"Everywhere"			

BIBLIOGRAPHY OF LITERATURE USED

Buddde-Lund, G, 1885, Crustacea - Isopoda Terestri

Sars, G. O, 1899. An account of the Crustacea of Norway: Vol II - Asopoda

Richardson, H, 1905, A monograph of the Isopods of North America - Bull 54, U.S. Nat. Mus.

5-36-1M TAXONOMIC - DISTRIBUTION - ABUNDANCE RECORDS

Year Spring, 1938 Collection of Stephen P. Hatchett

Scientific Name Armadillidium vulgare

Common Name

Serial No. NA1038 Det.by ______ Serial No. C238 Det.by ______

Serial No. NA1238 Det.by ______ Serial No. AF138 Det.by ______

Serial No. NA1338 Det.by ______ Serial No. ______ Det.by ______

Serial No. NA2038 Det.by ______ Serial No. ______ Det.by ______

Serial No. C138 Det.by ______ Serial No. ______ Det.by ______

Phylum Arthropoda Class Crustacea
Subclass Malacostraca Order Isopoda
~~Suborder~~ Superfamily Oniscoidea Family Armadillidae
Subfamily ______ Genus Armadillidium
Species vulgare Variety ______

Genus erected by Brandt, J. F Date 1883
Reference Conspectus monographie Crustaceorum Oniscodorum

Species described by Latreille, P. A. Date 1805
Reference Hist. Nat. Crust. et Insectes

Synonymy Armadillo vulgare, Armadillo silesiaie, Armadillo ater
Armadillidium commutatum, Armadillo trivalis

DISTRIBUTION AND ABUNDANCE

I LOCAL :- Washtenaw County ~~Cheboygan and Emmet~~ ~~Counties~~.

County	Locality	Locus key	Relative Abundance	F. R. Sheet Nos.	H. C. Sheet Nos.
Washtenaw	Arboretum, Ann Arbor	T2S-R6E-S30	Few	6,7,8,10	6,7,8
	U. of Michigan Campus " "	"	rather	9	9
	Greenhouse of Ann Arbor Floral Co.	"	very	10	10

U.M.B.S. Nat. Hist. Invert. T.D. & A. Sheet No. 2

(Continued on other side)

II MICHIGAN :-(No records found)

Counties	Abundance	Records By	Citation — Remarks

III NORTH AMERICAN :-

States or Provinces	Abundance	Records By	Citation — Remarks
Ohio			Richardson, 1905
Kentucky			
S. Carolina			
New York			
Dist of Col.			
Maryland			
Massachusetts			

IV WORLD :-

Countries	Abundance	Records By	Citation — Remarks
"Worldwide"			Sars, 1899, Richardson, 1905

BIBLIOGRAPHY OF LITERATURE USED

Budde-Lund, G. 1885, Crustacea Isopoda terrestria

Sars, G. O., 1899. An Account of the Crustacea of Norway, Vol II, Isopoda

Richardson, H, 1905 A monograph on the Isopods of North America, Bull. 54. U.S. Nat. Mus.

CC
9-27
250

YEAR 1938

Collection by
Stephen R. Hatchett

COLLECTION CATALOG

SERIAL NUMBER	DATE	LOCALITY (~~lake and station~~)	PROVISIONAL IDENTIFICATION	REVISED IDENTIFICATION	REMARKS
NA138	3/1/38	Arboretum	Clytisticus convexus		
NA238	3/9/38	"	" "		
NA338	3/9/38	"	" "		
NA ~~8~~ NA438	3/9/38	"	" "		immature
NA538	3/30/38	"	" "		
NA638	3/30/38	"	" "		
NA738	4/27/38	"	" "		
NA838	4/27/38	"	" "		
NA938	5/4/38	"	" "		
SF138	5/5/38	Saginaw Forest	" "		
NA1038	4/20/38	Arboretum	Armadillidium vulgare		
NA1138	4/20/38	"	Clytisticus convexus		
NA1238	5/11/38	"	Armadillidium vulgare		
NA1338	5/11/38	"	" "		
NA1438	5/11/38	"	Porcellio ~~ratzkei~~		
NA1538	5/11/38	"	Clytisticus convexus		
NA1638	5/11/38	"	" "		
NA1738	5/11/38	"	" "		
NA1838	5/11/38	"	" "		
NA1938	5/11/38	"	" "		
NA2038	5/18/38	"	Armadillidium vulgare		
NA2138	5/18/38	"	Clytisticus convexus		
NA2238	5/18/38	"	" "		
NA2338	5/18/38	"	" "		
NA2438	5/18/38	"	" "		
NA2538	5/18/38	"	" "		
NA ~~2438~~ NA2638	5/18/38	"	" "		
NA ~~2538~~ NA2738	5/18/38	"	" "		
C138	5/24/38	U. of Michigan Campus	Armadillidium vulgare		
C238	5/24/38	" "	" "		
NA2838	5/25/38	Arboretum	Clytisticus convexus		
PL138	5/24/38	Pleasant Lake Area	" "		immature
NA2938	5/25/38	Arboretum	" "		
NA3038	5/25/38	"	" "		
NA3138	5/25/38	"	" "		
NA3238	5/25/38	"	" "		
NA3338	5/25/38	"	" "		

YEAR 1938

COLLECTION CATALOG

SERIAL NUMBER	DATE	LOCALITY (lake and station)	PROVISIONAL IDENTIFICATION	REVISED IDENTIFICATION	REMARKS
NA3438	5/25/38	Arboretum	Cylisticus convexus		
NA3538	5/25/38	"	" "		
NA3638	5/25/38	"	" "		
NA3738	5/25/38	"	" "		
NA3838	5/25/38	"	" "		
NA 3939	5/25/38	"	" "		
NA 4039	5/15/38	"	" "		immature
AF138	5/25/38	Ann Arbor Florist	Armadillidium vulgare		