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ECOLOGICAL STUDIES OF THE ENTOMOSTRACA OF THE ST. LOUIS DISTRICT. PART I. DIAPTOMUS PSEUDOSANGUINEUS SP. NOV. AND A PRELIMINARY LIST OF THE COPEPODA AND CLADOCERA OF THE ST. LOUIS DISTRICT

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ECOLOGICAL STUDIES OF THE ENTOMOSTRACA OF THE ST. LOUIS DISTRICT. PART I. DIAPTOMUS PSEUDOSANGUINEUS SP. NOV. AND A PRELIMINARY LIST OF THE COPEPODA AND CLADOCERA OF THE ST. LOUIS DISTRICT

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Diaptomus Pseudosanguineus Sp. Nov.

The form is closely related to *Diaptomus sanguineus* Forbes and *Diaptomus conipedatus* Marsh, both of which it resembles in having a very rudimentary endopodite on the fifth foot of the male. If we ignore color, it is almost impossible to differentiate the females of this species from those of *Diaptomus sanguineus* Forbes. The males, however, are quite distinct. The fifth foot is quite different, as is also the armature of the male antenna. The fifth foot of the male of this species is similar to that of *Diaptomus conipedatus* Marsh but the antipenultimate joint of the right male antenna, in addition to a hook, similar to but somewhat longer than that of *Diaptomus conipedatus* Marsh, also bears a hyaline flange similar to that of *Diaptomus sanguineus* Forbes.

Description of the female. (*pl.* 1, *fig.* 1; *pl.* 2, *fig.* 1).—The female is about 2.00 mm. long and the widest portion of the thorax is about 0.54 mm. wide. The reflexed antennae extend to the distal extremity of the furcal setae. Viewed from the dorsal aspect, the cephalothorax widens gradually from the tip of the head to about the third thoracic somite, from which point it gradually tapers to the tip of the abdomen. Viewed from the lateral aspect the body slopes continuously upwards and backwards from the tip of the head to the third thoracic somite. Thence it extends almost horizontally to about the middle of the last thoracic somite, from there sloping abruptly to the abdomen. The cervical suture is distinct. Each latero-caudal margin of the thorax is produced outward and armed with two nipple-like tubercles (pl. 1, fig. 1c; pl. 3, fig. 4b). About the middle of the ventral surface of the first abdominal somite, and located nearer the sides than the middle line, there is a pair of long curved spines, somewhat larger than the tubercles (pl. 2, fig. 2f). The outed ramus of the fifth foot is two-jointed (pl. 3, fig. 5). The subrectangular first joint is twice as long as wide; for two-thirds its length the second joint is almost straight on its outer edge, the inner margin tapering gradually from its base to that point; there the foot abruptly turns inward at an angle of more than 45°, terminating in a blunt point. On its lower third it bears three spines. The inner one, which extends to the angle in the segment, is the longest; the next about half this long; and the outer one somewhat shorter than the intermediate one. The inner ramus of the fifth foot is straight and about five times as long as wide; at its tip are two setae which are about half as long as the ramus. The outer margin, on its distal third, is distinctly hairy. The specimens so far found are of a dirty white color.

Description of the male. (pl. 1, fig. 2).—The male is about four-fifths the size of the female; the tubercles on the laterocaudal margin of the thorax are absent or inconspicuous; there is no armature on the first abdominal somite. The first basal joint of the right fifth foot is short, about as long as broad (pl. 3, fig. 1); the second basal joint is about twice as long as wide and fully twice as long as the preceding joint. The inner ramus (endopodite) is missing; the outer (expodite) is composed of two joints of about equal length. The first of these joints is about the same length as the second basal segment but much more slender and bears at its outer distal margin a broad tooth-like expanse. The second joint is slightly curved inwards, its distal extremity somewhat wider than its proximal. Near the tip of its outer margin it bears a straight spine which is about two-thirds as long as the somite. At its tip is a stout curved claw which is about the same length as the segment. The first segment of the left fifth foot is about as long as the second and the whole appendage extends to a little beyond the tip of the first segment of the expodite of the right foot. The two segments of the outer ramus (exopodite) are of about the same length; the second bears at its tip one long and one short claw-like spine. The inner ramus (endopodite) is slender and about as long as the outer ramus; is unsegmented; its distal third pronouncedly hairy; and the inner margin of its intermediate third coarsely crenate. The antipenultimate segment of the right male antenna (pl. 1, fig. 2; pl. 2, fig. 3) bears a stout almost opaque curved process composed of the same material as the body of the antenna. This process is a little shorter than the next segment of the antenna. Intimately connected with this process and extending along the whole margin of the antipenultimate segment, is a hyaline flange similar to that of *Diaptomus sanguineus* Forbes.

Like the female, the male is of a dirty white or gray color. In the prime of life *Diaptomus sanguineus* Forbes, so far as my experience goes, is red in color, or marked with red or blue. However, it is not claimed that this color difference is of taxonomic value. In other localities the color scheme may be different for it is well known that color in Entomostraca sometimes varies with environment. Nevertheless, the color described is that of individuals in the prime of life, for numerous specimens were found in copulo (pl. 3, fig. 3) and many more with spermataphores attached (pl. 1, fig. 3j; pl. 2, fig. 2g).

Habitat.—The specimens were found in a spring-fed marsh where about two inches of water rested upon more than two feet of water-soaked silt. Originally this marsh was a reservoir which had been constructed on a shelf-like depression between two hills. In addition to receiving the wash from the surrounding hills, this pond was fed by a spring which furnished sufficient water to cause a continuous overflow through the spillway of the dam. The fine materials washed from the surrounding hills have gradually transformed this reservoir into a marsh but the water continues to flow out through the spillway. It was near this spillway that the specimens were found. A group of cattails, which has been gradually increasing in size since the day when it was surrounded by water many inches deep, still flourishes, and patches of duckweed are scattered over the surface of the marsh. At the time the specimens were found the temperature of the water was 25°C., the temperature of the surrounding atmosphere being over 32°C. The PH of the water was 7.6.

Associates.—The following Entomostracans were found associated with it: *Bosmina longirostris* (O. F. Mueller), *Ceriodaphnia rigaudi* Richards, *Cyclops leuckarti* Claus. In May *Cyclops albidus* Jurine var. *tenuicornis* was found in the same place; also *Cyclops viridis* Jurine. A species of Vorticellidae was found as a commensal, attached to the abdomen, among the eggs (pl. 2, fig. 1 e).

Preliminary List of Copepoda and Cladocera of St. Louis District

In this communication no attempt is made to give a complete list of synonyms; such lists will be found in the references mentioned. For easy reference, the genera and species are arranged in alphabetical order under each family.

Copepoda

FAMILY CENTROPAGIDAE

GENUS DIAPTOMUS WESTWOOD

1. DIAPTOMUS ASHLANDI Marsh 1893.

Diaptomus ashlandi, Marsh, '93. p. 198. pl. 3, fig. 11-13.

Diaptomus ashlandi, Herrick & Turner, '95. p. 60. pl. 6, fig. 4-6.

Diaptomus ashlandi, Schacht, '97. pp. 167-169. pl. 32, fig. 1-4.

Common. Found in lakes, no-outlet ponds and marshes, through a temperature range of 15-35°C. Usually abundant.

2. DIAPTOMUS OREGONENSIS, Lilljeborg 1889.

Diaptomus oregonensis, Herrick & Turner, '95. pp. 72, 73. pl. 4, fig. 7-12; pl. 9, fig. 3.

Diaptomus oregonensis, Schacht, '97. pp. 151-154, pl. 29, fig. 1, 2.

Found three times in this district in no-outlet ponds; in one case collected from the midst of vegetation; in the other two cases the ponds contained no higher plants. The temperature of the water ranged from 15-20°C. The PH value ranged from 7.6 to 8.2. Abundant in each case.

3. DIAPTOMUS PALLIDUS Herrick 1879.

Diaptomus pallidus, Herrick & Turner, '95. pp. 73, 74. pl. 4, fig. 1-6; pl. 5, fig. 10; pl. 13, fig. 17.

Diaptomus pallidus, Schacht, '97. pp. 144-146. pl. 27, fig. 3.

Encountered in this region but once, in June, 1920, when it was abundant in a no-outlet pasture pond.

4. **DIAPTOMUS PSEUDOSANGUINEUS,** sp. nov. (pl. 1-3).

For description consult the first section of this paper.

5. DIAPTOMUS SANGUINEUS Forbes 1876.

Diaptomus sanguineus, Forbes, '76. pp. 15, 16, 23. fig. 24, 28-30.

Diaptomus sanguineus, Herrick & Turner, '95. p. 71. pl. 13, fig. 12.

Diaptomus sanguineus, Schacht, '97. pp. 133-137. pl. 23-25.

Collected but once in this district, in a no-outlet pond in 1909.

6. DIAPTOMUS SICILIS Forbes 1882.

Diaptomus sicilis, Herrick & Turner, '95. pp. 60, 61. pl. 5, fig. 1-7; pl. 13, fig. 18.

Diaptomus sicilis, Schacht, '97. pp. 122-124. pl. 21, fig. 1-3.

Found in April, 1909, in large numbers in the open waters of a large lake, the temperature of which was 11°C. The water was free from vegetation and there were practically no algae. The altitude of the lake is 440 feet. Not found since although frequent collections have been made in the same part of the lake.

7. DIAPTOMUS STAGNALIS Forbes 1882.

Diaptomus stagnalis, Forbes, '82. pp. 15, 16, 23. fig. 24, 28-30.

Diaptomus stagnalis, Herrick & Turner, '95. pp. 71, 72. pl. 13, fig. 8-10.

Diaptomus stagnalis, Schacht, '97. pp. 138-141. pl. 28, fig. 2.

Found in this district only once, in June, 1920, in a shallow, no-outlet pond free from vegetation.

FAMILY CYCLOPIDAE

GENUS CYCLOPS O. F. MUELLER

8. CYCLOPS ALBIDUS Jurine 1820, var. tenuicornis Sars 1863.

Cyclops signatus, var. *tenuicornis,* Herrick & Turner, '95. pp. 106, 107. pl. 15, fig. 5-7; pl. 20, fig. 1-7; pl. 33, fig. 1, 2.

Cyclops albidus, E. B. Forbes, '97. pp. 47-49. pl. 13.

A species widely distributed in this district, in marshes, small temporary ponds, small no-outlet ponds, and lakes. It is found where vegetation does and does not exist, occurring in water ranging from 10°-25°C. and having PH values ranging from 7.2 to 8.0. In some specimens the hyaline plate on the antenna is smooth, in others finely serrated. Found in both fetid water and in water having no perceptible odor. April, May and July.

9. CYCLOPS ALBIDUS Jurine 1820, var. CORONATUS.

Cyclops signatus, var. *coronatus*, Herrick & Turner, '95. p. 106. pl. 15, fig. 1-4.

Found only once in this district, among cattails in a shallow pond, the temperature of which was 21°C.

10. CYCLOPS BICUSPIDATUS Claus 1857.

Cyclops forbesi, Herrick & Turner, '95. p. 104.

Cyclops bicuspidatus, E. B. Forbes, '97. pp. 44-47. pl. 12, fig. 1-4.

Found in this district in four different no-outlet ponds free from vegetation, but once only in each place. In one pond the temperature was 17°C.; in another 19°; temperature of the others not recorded. The hydrogen ion content of one pond only was measured, the PH value being 7.2. April and October.

11. CYCLOPS FIMBRIATUS Fischer 1853.

Cyclops fimbriatus, Herrick & Turner, '95. pp. 121, 122. pl. 17, fig. 8, 9; pl. 21, fig. 11; pl. 25, fig. 9-14.

This form is rare here, it having been collected but once, June 1, 1921, when I obtained a few from a shallow temporary pond with a PH value of 8.2.

12. CYCLOPS FUSCA Jurine 1820.

Cyclops signatus, var. *coronatus*, Herrick & Turner, '95. p. 106. pl. 15.

I have always considered this a variety of *C. albidus* and have discussed it under that head.

13. CYCLOPS PHALERATUS Koch 1853.

Cyclops phaleratus, Herrick & Turner, '95. pp. 120, 121. pl. 17, fig. 1-7; pl. 18, fig. 2, 2d; pl. 19, fig. 1; pl. 21, fig. 6-10.

Cyclops phaleratus, E. B. Forbes, '97. pp. 59-63. pl. 20, fig. 3.

A few found on one occasion in a no-outlet pond, the temperature of which was 32°C. Also found in a weedy marsh with PH value of 8.2.

14. CYCLOPS LEUCKARTI, Claus 1857.

Cyclops leuckarti, Herrick & Turner, '95. pp. 96-98. pl. 16; pl. 18, fig. 1 a-j; pl. 24, fig. 2-6.

Cyclops edax, Forbes, '97. pp. 33-36. pl. 9, fig. 1-3.

Collected from three different localities in this district. Two were vegetationless no-outlet ponds, the other a weedy marsh. The temperature of the water and the hydrogen ion content were determined for only one locality, the temperature being 25°C. and the PH value 7.8. May, June and August.

15. CYCLOPS, SERRULATUS Fischer 1860

Cyclops serrulatus, Herrick & Turner, '95. pp. 111, 112. pl. 15, fig. 8-11.

Cyclops serrulatus, E. B. Forbes, '97. pp. 54-57.pl. 17; pl. 18. fig. 1-3.

One of the most widely distributed copepods in this district. Found throughout the season in all types of habitat, at all temperatures and in waters with hydrogen ion content varying from PH 7.00 to PH 8.2.

16. CYCLOPS VIRIDIS Jurine 1820, var. INSECTUS Forbes 1882.

Cyclops insectus, Forbes, '82. p. 649. pl. 9, fig. 6.

Cyclops viridis, var. *americanus*, Herrick & Turner, '95. pp. 91, 92. pl. 14, fig. 1-9.

Cyclops viridis var. *insectus*, E. B. Forbes, '97. pp. 41-44. pl. 11, fig. 3-6.

Perhaps the most common copepod in this district, occurring in all types of habitat, at all seasons and temperatures, and in waters with the hydrogen ion content ranging from PH 7.0 to PH 8.2. This and certain species of Vorticellidae and of one-celled green algae are often commensals.

Cladocera

FAMILY BOSMINIDAE

GENUS BOSMINA BAIRD 1845

1. BOSMINA LONGIROSTRIS (O. F. Mueller) 1785.

Bosmina longirostris, Birge, '18. p. 706. fig. 1096.

Common in this district, being abundant in many of the no-outlet ponds during the warm season. It has been found where vegetation does and does not exist. The hydrogen ion content of the water was determined for only three ponds, varying from PH 7.8 to 8.2.

FAMILY CHYDORIDAE

GENUS ALONA BAIRD 1850

2. ALONA COSTATA Sars 1862.

Alona costata, Herrick & Turner, '95. pp. 245, 246. pl. 60, fig. 3.

Collected in November, 1909, among pond lilies in a small no-outlet pond having a temperature of 18°C., the only time encountered in this district.

3. ALONA RECTANGULAR Sars 1861.

Alona pulchra, Herrick & Turner, '95. p. 245.

In May, 1921, this species was found in a marsh and in a large no-outlet pond. The hydrogen ion content in each case was PH 8.2. The temperature of the water was 27°C.

GENUS CHYDORUS LEACH 1843

4. CHYDORUS SPHAERICUS (O. F. Mueller) 1783.

Chydorus sphaericus, Birge, '78. pp. 23, 24.

Chydorus sphaericus, Herrick & Turner, '95. p. 261. pl. 64, fig. 4, 7, 8, 10.

This species is common in marshes and among the vegetation in certain no-outlet ponds of this district. The temperature of the water in which it was found varied from 18-31°C. The hydrogen ion content of the water was determined in only one instance, being 8.2. May to October.

GENUS KURZIA DYBOWSKI AND GROCHOWSKI 1894

5. KURZIA LATISSIMA (Kurz) 1874.

Kurzia latissima Birge, '18. p. 718. fig. 1120.

Alonopsis latissima, Herrick and Turner, '95. pp. 232, 233. pl. 61. fig. 8; pl. 68. fig. 1, 9.

Collected on two occasions in July, 1920, in large numbers among water plantain in a shallow lake.

GENUS LEYDIGIA KURZ 1874

6. LEYDIGIA QUADRANGULARIS (Leydig) 1860

Leydigia quadrangularis, Herrick & Turner, '95. p. 234. pl. 59, fig. 8; pl. 60, fig. 4.

Collected twice in this neighborhood, in April, 1910, among water lilies, in a shallow no-outlet pond, the temperature of which was 20°C.; and in August, 1921, in a shallow no-outlet pond, the temperature of which was 32°C. and the hydrogen ion content PH 7.4.

7. LEYDIGIA ACANTHROCERCOIDES (Fischer) 1854.

Leydigia acanthocercoides, Herrick & Turner, '95. p. 234.

A few specimens of this collected on June 25, 1910, in a no-outlet pond, the only time it has been encountered.

GENUS OXYURELLA DYBOWSKI AND GROCHOWSKI 1894.

8. OXYURELLA TENUICAUDIS (Sars) 1862.

Alona tenuicaudis, Herrick & Turner, '95. pp. 242, 243, pl. 62, fig. 11.

A few collected in June, 1921, in a shallow transitional pond having a temperature of 24°C.

GENUS PLEUROXUS BAIRD 1843.

9. PLEUROXUS DENTICULATUS, Birge, 1877.

Pleuroxus denticulatus, Birge, '76. pp. 20, 21. pl. 1, fig. 21.

Pleuroxus denticulatus, Herrick & Turner, '95. p. 256. pl. 45, fig. 8; pl. 63, fig. 10a, 12, 13.

Common in marshes and among vegetation, in no-outlet ponds and lakes of this district. Collected from water with temperature ranging from 18-31°C. The hydrogen ion content of the water was calculated only once, when it was found to be PH 8.2.

10. PLEUROXUS HAMULATUS Birge 1910.

Pleuroxus hamatus, Birge, '76. pp. 22, 23. pl. 2, fig. 13, 14.

Pleuroxus hamatus, Herrick & Turner, '95. p. 257. pl. 60, fig. 1.

This species which heretofore has not been found outside of New England and the Southern States, has been collected from three different no-outlet ponds of this district. In one case the pond was weedy and this species seemed to be dominant; in the other cases the water was free from any vegetation higher than algae. In two cases the water was comparatively fresh; in the third it had a disagreeable stench. The temperature and hydrogen ion content of the water were determined in only one case, the temperature being 32°C, the PH 7.4.

FAMILY DAPHNIDAE

GENUS CERIODAPHNIA DANA 1853

11. CERIODAPHNIA LACUSTRIS Birge 1893.

Ceriodaphnia lacustris, Birge, '18. p. 701. fig. 1083.

Found in this district in a large reservoir furnishing water for the Wabash railroad. The temperature of the water was 27°C., the hydrogen ion content PH 8.2.

12. CERIODAPHNIA LATICAUDATA P. E. Mueller 1867.

Ceriodaphnia laticaudata, Herrick & Turner, '95. p. 171. pl. 41, fig. 22.

Ceriodaphnia consors, Herrick & Turner, '95. pp 171, 172. pl. 42, fig. 4; pl. 44, fig. 5, 6.

Collected twice in this district, each time from a temporary pond, once in June, 1910, when it was abundant, and again in June, 1920, when it was rare.

13. CERIODAPHNIA PULCHELLA Sars 1862.

Ceriodaphnia pulchella, Herrick & Turner, '95. p. 169. pl. 41, fig. 14, 19.

Collected in this district among water plantain in a lake.

14. CERIODAPHNIA RECTICULATA (Jurine) 1820.

Ceriodaphnia reticulata, Herrick & Turner, '95. p. 170. pl. 41, fig. 15, 21; pl. 42, fig. 3; pl. 43, fig. 3; pl. 44, fig. 3. 4.

This species was found in a no-outlet pond in March and in November, 1909.

15. CERIODAPHNIA RIGAUDI Richard 1894.

Ceriodaphnia riguadi, Birge, '18. p. 700, fig. 1078.

Collected July 21, 1921, from a no-outlet pond the temperature of which was 29°C. and the PH value 7.8. August 1, 1921, it was collected from a marsh having a temperature of 25°C. and a PH value of 7.8. On each occasion some of the females were carrying winter eggs. To the best of my knowledge this is the first time this species has been reported from this part of the country.

GENUS DAPHNIA O. F. MUELLER 1785

16. DAPHNIA LONGISPINA (O. F. Mueller) 1785.

Daphnia longispina, Herrick & Turner, '95. p. 199.

A form which seems to be the typical form of this species, found in a large reservoir having a temperature of 27°C. and a PH value of 8.2. Although it was May, some of the females were carrying winter eggs.

17. DAPHNIA LONGISPINA var. HYALINA Leydig, 1860.

Daphnia hyalina, Herrick & Turner, '95. pp. 195, 196. pl. 22, fig. 7, 8; pl. 27, fig. 6; pl. 35, fig. 16; pl. 49, fig. 3-5; pl. 53, fig. 1-4.

Found in spring and early summer in certain of the no-outlet ponds in this vicinity. Of the form *mendolatae.* In the latter part of May some of the females were carrying winter eggs.

18. DAPHNIA LONGISPINA var. LONGIREMIS Sars 1861.

Daphnia longiremis, Herrick & Turner, '95. p. 202.

Found in April, 1909, in great numbers in an ox-bow lake with a temperature of 15°C. Collected in May, 1920, from a small temporary pond the temperature of which was 18°C.

19. DAPHNIA PULEX (de Geer) 1778.

Daphnia pulex, Herrick & Turner, '95. pp. 193, 194.

The most common daphnid of this district. Frequently encountered in summer, even in water so fetid as to have a disagreeable stench. Occurs at temperature ranging from 19-35°C. and in water having a hydrogen ion content varying from PH 7.2 to 7.6. Winter eggs found in June and July.

20. DAPHNIA RETROCURVA Forbes 1882.

Daphnia kalbergenesis, Herrick & Turner, '95. pp. 203, 204. pl. 27, fig. 1-3; pl. 53, fig. 5-8.

Collected in spring and early summer from one of our lakes. The helmet on the head is small and rounded, probably enough so to warrant calling it var. *breviceps* Birge. The temperature of the water varied from 24-31°C. and the hydrogen ion content of the water was PH 8.0.

GENUS MOINA BAIRD 1850

21. MOINA BRACHIATA (Jurine) 1820.

Moina brachiata, Herrick & Turner, '95. pp. 162, 163. pl. 39, fig. 5-8; pl. 43, fig. 1, 2.

At times during the summer this species is abundant in some of the muddy ponds and marshes of this district. Found in water having a hydrogen ion content of PH 7.6-8.0. It frequently bears commensal Vorticellidae.

22. MOINA RECTIROSTRIS (Leydig) 1860.

Moina rectirostris, Herrick & Turner, '95. pp. 163, 164. pl. 39, fig 1-4; pl. 41, fig. 2, 5, 8, 10, 11.

Found in certain muddy temporary ponds of this district in May and June. The temperature of the water varied from 20-35°C., the hydrogen ion content from PH 7.0 to PH 7.6.

GENUS SCAPHOLEBERIS SCHOEDLER 1858

23. SCAPHOLEBERIS MUCRONATA (O. F. Mueller) 1785.

Scalpholeberis mucronata, Birge '78. pp. 6-9. pl. 2, fig. 8, 9.

Scapholeberis mucronata, Herrick & Turner, '95. pp. 174, 175. pl. 43, fig. 4-7; pl. 45, fig. 5.

Abundant in weedy marshes and certain ponds in this neighborhood. Collected in water ranging in temperature from 27-32°C. and having a hydrogen ion content between 7.6 and 8.2. The marshes dry up in summer and the ponds are temporary. April, May, June, and October.

GENUS SIMOCEPHALUS (O. F. MUELLER) 1776

24. SIMOCEPHALUS SERRULATUS (Koch) 1841.

Simocephalus americanus, Birge, '78. pp. 6-8. pl. 1, fig. 6.

Simocephalus serrulatus, Herrick & Turner, '95. pp. 179.

Simocephalus americanus, Herrick & Turner, '95. p. 179. pl. 45, fig. 9.

In this district frequently found in marshes and among vegetation in ponds and lakes from March to November, in water varying in temperature from 14-32°C. Sometimes so numerous in a certain pond as to be the dominant form and the following year failing to appear in that pond.

FAMILY MACROTHRICIDAE

GENUS ACANTHOLEBERIS LILLJEBORG 1853

25. ACANTHOLEBERIS CURVIROSTRIS (O. F. Mueller) 1776

Acantholeberis curvirostris, Herrick & Turner, '95. p. 218. pl. 49, fig. 1-4.

Rare or accidental in this district, a few having been found in a weedy pond on one occasion.

GENUS MACROTHRIX BAIRD 1843

26. MACROTHRIX LATICORNIS (Jurine) 1820

Macrothrix laticornis, Herrick & Turner, '95. p. 212. pl. 54, fig. 9-12; pl. 56, fig. 8, 9.

Found in four different localities in this district; in a marsh, among the water plants in a lake, in a no-outlet permanent pond, and in a transitional pond, the bottom of each being mud. The temperature range of the water was 14-31°C. The hydrogen ion content was determined for only three of the localities; for two it was PH 8.2 and for the third PH 7.2. In the marsh and lake only a few specimens were found; in the transitional pond it was abundant. April, May, June, and August.

FAMILY SIDIDAE

GENUS DIAPHANOSOMA FISCHER 1850

27. DIAPHANOSOMA BRACHYURUS (Lievin) 1848

Daphnella brachyura, Herrick & Turner, '95. pp. 148, 149. pl. 26, fig. 11-16.

In July, 1920, this was common in a transitional pond with muddy bottom, in a St. Louis park. The temperature of the water was 30°C.

28. DIAPHANOSOMA LEUCHTENBERGIANUM FISCHER 1850

Daphnella brandtiana, Herrick & Turner, '95. p. 149. pl. 37, fig. 3-6.

In June, 1920, this species was abundant in a temporary pond near Koch, Mo. The water was muddy and free from vegetation, with a temperature of 30°C.

GENUS LATONOPSIS SARS 1888

29. LATONOPSIS OCCIDENTALIS Birge 1891.

Latonopsis occidentalis, Birge, '91. pp. 383-388.

Latonopsis occidentalis, Herrick & Turner, '95. pp. 150-151. pl. 38

Collected in June, 1920, from a small permanent pond near Jefferson Barracks, Mo. The bottom was muddy and the pond held no vegetation. the water itself being clear.

GENUS PSEUDOSIDA HERRICK 1884

30. PSEUDOSIDA BIDENTATA Herrick 1884.

Pseudosida tridentata, Herrick & Turner, '95. pp. 147, 148. pl. 36, fig. 2-6; pl. 50, fig. 9.

In June, 1910, a few specimens were collected from a swamp near Union Avenue and Natural Bridge Road, St. Louis.

Succession of Life in a Transitional Pond

A transitional pond is one which is dry during part of the year, but which, during periods of high water, is connected to a permanent pond or lake.

It is not the purpose of this section to give an exhaustive treatment of the succession of entomostracan life in ponds and lakes but, by discussing the succession of cladoceran and copepodan life in one transitional pond for two successive years, it is hoped to demonstrate the futility of drawing conclusions as to the nature of and the reasons for the succession of life in inland waters without spending years in accumulating accurate data.

In one of the parks of St. Louis there is a lagoon-like pond that is several hundred yards long. About three-fourths of its length from one end is a strait-like constriction, the portion of the pond beyond this constriction being at times of high water much shallower than the remainder. During dry weather this portion gradually dries up. This shallow arm is the transitional pond that is to be discussed. During the high waters of early spring large areas of grass are submerged which die after a certain length of time. From that time until the pond dries up there is no vegetation higher than algae in the water. The depth of the water varies from a few inches to two feet, with mud bottom. The pond is exposed to the sun during most of the day, the temperature of the water ranging as high as 35°C and the hydrogen ion content varying from PH 7.2 to PH 8.2. The record presented is for the spring and summer of 1920 and the spring and summer of 1921.

Spring and summer 1920.—April 4. Water high; much grass submerged; temperature 15°C.; *Simocephalus serrulatus* Koch and *Cyclops viridis* (Jurine) *var. insectus* Forbes present in moderate numbers.

May 5. Water high; grass growing in water; temperature 16°C.; *Simocephalus serrulatus* Koch the dominant form; *Cyclops viridis* (Jurine) var. *insectus* Forbes present in large numbers.

May 20. Water high; grass abundant; temperature 22°C.; *Simocephalus serrulatus* Koch the dominant form; *Cyclops viridis* (Jurine) var. *insectus* Forbes and *Bosmina longirostris* (O. F. Mueller) present in large numbers.

May 22. Water high; grass dying; temperature 29°C.; *Simocephalus serrulatus* Kock the dominant form, *Bosmina longirostris* (O. F. Mueller) abundant, *Cyclops viridis* (Jurine) var. *insectus* Forbes and *Daphnia pulex* (de Geer) present in small numbers.

June 20. Water becoming shallow; no grass in pond; pond teeming with animal life; *Daphnia pulex* (de Geer) now the dominant form, *Cyclops viridis* (Jurine) var. *insectus* Forbes, *Bosmina longirostris* (O. F. Mueller) and *Ceriodaphnia laticaudata* P. E. Mueller abundant, *Simocephalus serrulatus* Koch and *Oxyurella tenuicaudis* (Sars) present in small numbers.

July 20. Pond drying up rapidly; no vegetation in the water; temperature 35°C.; animal life very scare, a few specimens of *Cyclops viridis* (Jurine) var. *insectus* Forbes and of *Diaphanosoma brachyurum* (Lievin) found.

August 17. Pond nearly dry and entomostracan life has almost disappeared, a few specimens of *Cyclops serrulatus* Fischer found.

Spring and summer 1921.—April 2. Pond moderately high; no vegetation in water; temperature 19°C.; hydrogen ion content PH 7.9; *Cyclops albidus* Jurine the dominant form; *Cyclops viridis* Jurine var. *insectus* Forbes abundant.

April 16. Pond moderately high; temperature 19°C.; hydrogen ion content PH 7.0 (a heavy rain having fallen the previous night); *Cyclops viridis* (Jurine) var. *insectus* Forbes and *Cyclops serrulatus* Fischer abundant, neither dominant, *Cyclops albidus* Jurine has almost entirely disappeared.

April 23. Water high owing to heavy rains; temperature 17°C.; hydorgen ion content Ph 7.4; *Cyclops viridis* (Jurine) var. *insectus* Forbes dominant, *Cyclops serrulatus* Fischer abundant.

April 30. Conditions about the same as on April 23; *Cyclops viridis* (Jurine) var. *insectus* Forbes the dominant form, *Cyclops serrulatus* Fischer abundant, *Bosmina longirostris* (O. F. Mueller) present in small numbers.

May 11. Water at greatest height; grass growing in water; temperature 22°C.; hydrogen ion content PH 7.4; distribution of life about the same as on April 30, although *Bosmina longirostris* (O. F. Mueller) Sars may be more abundant.

May 20. Physical features about as on May 11; *Cyclops viridis* (Jurine) var. *insectus* Forbes dominant, *Bosmina longirostris* (O. F. Mueller) abundant, *Cyclops serrulatus* Fischer has disappeared.

June 1. Water falling; hydrogen ion content PH 8.2; *Cyclops viridis* (Jurine) var. *insectus* Forbes dominant, *Bosmina longirostris* (O. F. Mueller abundant, *Cyclops fimbriatus* Fischer, *Macrothrix laticornis* (Jurine) and *Scapholeberis mucronata* O. F. Mueller present in small numbers.

July 5. Water lower, otherwise physical conditions same as on June 1; *Cyclops viridis* (Jurine) var. *insectus* Forbes dominant and present in enormous numbers, *Moina brachiata* (Jurine) abundant; no other cladocerans nor copepodans.

July 19. Water quite low, otherwise physical conditions same as on July 5; no perceptable change in life conditions.

July 27. Pond quite shallow; hydrogen ion content PH 7.2; literally thick with entomostracan life confined to the two species *Cyclops viridis* (Jurine) var. *insectus* Forbes and *Moina brachiata* (Jurine), the former dominant, all other cladocerans and copepodans absent or so scarce as to escape detection among the myriads of the two species mentioned; the Moinas bearing summer eggs but the

Cyclops not active sexually; of the countless millions of females practically none bearing eggs. When one remembers how prolific these creatures usually are this pronounced sexual impotence furnishes food for thought.

August 12. Pond almost dry, communicating with the permanent pond by a very shallow neck of water; the hydrogen ion content PH 8.0; water almost void of cladoceran and copepodan life; repeated hauls of the dredge discover a few specimens of each of *Cyclops serrulatus* Fischer, *Cyclops viridis* (Jurine) var. *insectus* Forbes, *Moina brachiata* (Jurine), all bearing eggs or young.

Two weeks ago this pond was literally teeming with life, today it is almost void of life. The explanation is as follows: A succession of life appears in the pond. *Cyclops viridis* (Jurine) var. *insectus* Forbes gradually becomes the dominant form. One by one the species associated with it die out until only *Moina brachiata* (Jurine) survives. *Cyclops viridus* (Jurine) continues to multiply until it is present in numbers unbelievably large, but they are sexually impotent. In a few more days that immense population disappears almost entirely. What is the cause? The deaths during the early and intermediate stages of the season may have been due to the elimination of the vegetation, or to the rise in temperature, or to the fluctuations in the hydrogen ion content of the water, but none of these factors accounts for the catastrophic destruction of this *Cyclops* in the early part of August. True the pond contained living grass at the beginning of the history and no vegetation at the close, but *Cyclops viridis* (Jurine) is as much at home in water free from vegetation as it is in the midst of water plants. The pond was quite shallow at the time of the climax but this copepod flourishes in the shallowest ponds as well as in the deeper lakes. The temperature of the water varied from 19°C to 17° and up to 35° but this species of *Cyclops* thrives throughout that entire range. The hydrogen ion content of the water descends from PH 7.9 to PH 7.0 and then ascends to PH 8.2 but this entomostracan has been found breeding throughout that entire range. When the pond contained multitudes of these minute crustaceans it must have been highly charged with the products of organic decay but this water did not have a disagreeable odor and this creature has been found flourishing in fetid water. Has not the marvelous prolificacy of this species, co-operating with the rapid evaporation of the water, caused the population to outgrow its food supply and thus to induce a famine which caused universal sexual impotency followed by death? The few individuals of *Cyclops serrulatus* Fischer which were found in the pond soon after the catastrophe were dwarfs of their kind. This is in harmony with the above conclusion, for excessive reduction of the food supply means underfed naupli, and underfed naupli develop into undersize adults.

As stated above, these seasonal life histories are recorded for the purpose of showing that a study of the succession of life in ponds and marshes, for only one or two seasons, does not furnish sufficient data to warrant the formation of scientific conclusions concerning the succession of life in inland waters. These two records have certain things in common. When winter gives place to spring there is very little life in the pond. Species after species appears, each to remain for a longer or shorter period of time. Some cladoceran or copepod becomes the dominant form. The living individuals contiuously become more and more numerous until the history culminates in a catastrophic elimination of almost the entire population. This is about all the two years have in common. In April, 1920, the first forms to become conspicuous are *Simocephalus serrulatus* (Koch) and *Cyclops viridis* (Jurine), neither of which is dominant; in April, 1921, the first to appear are *Cyclops albidus* (Jurine) and *Cyclops viridis* (Jurine), the former of which is dominant. In 1920 *Simocephalus serrulatus* (Koch) becomes dominant in the early part of May and retains the dominancy until the latter part of June, when it is succeeded by *Daphnia pulex* (de Greer); in 1921 *Cyclops viridis* (Jurine) achieves the dominancy about the middle of April and retains it until the elimination, and neither *Simocephalus serrulatus* (Koch) nor *Daphnia pulex* (de Geer) appears in that pond during the season, altho they do exist in other ponds of the district. *Simocephalus serrulatus* (Koch), *Daphnia pulex* (de Geer), *Ceriodaphnia lacticaudata* P. E. Mueller, *Oxyurella tenuicaudis* (Sars) and *Diaphanosoma brachyurum* (Lievin) are present during a part of 1920 but none of these appear in 1921. *Cyclops albidus* (Jurine), *Cyclops fimbriatus* Fischer, *Scapholeberis mucronata* Birge and *Moina brachiata* (Jurine) are in evidence during a part of 1921 but were not encountered at all during 1920.* Surely such contradictory data do not warrant reliable generalizations.

Commensalism and Symbiosis.—In the small ponds and marshes, *Cyclops viridis* (Jurine) almost invariably forms a symbiotic union with certain one-celled green algae.

This same species often bears certain Vorticellidae (*Pyxedium* sp.? and *Vorticella* sp.?) as commensals.

On several occasions *Daphnia pulex* (de Geer) has been noticed bearing a certain species of *Brachionidae* as a commensal. The union was not permanent. The rotifer attached itself by its toes and was free to leave when it became necessary. Whenever I have attempted to secure photographs, the attached commensal has always escaped.

Moina brachiata (Jurine) occasionally bears certain Vorticellidae as commensals (Pl. 4, Fif. 3).

A certain species of Vorticellidae has been seen as a commensal on *Diaptimus pseudosanguineus*, sp. n. (Pl. 2, Fig. 1e.)

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*These forms may not have been entirely absent from the pond but, if they were present, they were so rare as to escape detection.

Commensal Vorticellidae (*Pyxedium* sp., etc.) have been discovered on *Scapholeberis mucronata* Birge.

Explanations of Tables.

The following tables epitomize the results of field observations. In the tables on seasonal distribution certain months are omitted, those being months in which no field work was done.

The tables on seasonal distribution, those on distribution according to temperature, and those on distribution according to habitat epitomize the work of four collecting seasons; the table giving the distribution according to the hydrogen ion content of the water is the result of only one year's work.

The centigrade scale is used for temperature; the hydrogen ion content is expressed in PH values.

The tables record the results of field observations, and contain neither inductions nor deductions.

Distribution of St. Louis Copepoda From April 1909 To June 1910

	1909							1910		
	Apr.	May	June	Aug.	Sept.	Oct.	Nov.	Apr.	May	June
1. Cyclops albidus	p	p	..	..	..	..	..	..	..	..
2. Cyclops bicuspidatus	..	p	..	..	..	p	..	..	..	..
3. Cyclops fusca	..	p	..	..	..	..	..	..	..	..
4. Cyclops phaleratus	..	..	p	..	..	..	..	..	..	..
5. Cyclops serrulatus	p	..	p	..	..	..	..	..	p	..
6. Cyclops viridis insecta	p	p	p	p	..	p	..	p	..	..
7. Diaptomus pallidus	..	..	p	..	..	..	..	..	p	..
8. Diaptomus sanguineus	..	..	..	..	p	..	..	..	..	..
9. Diaptomus sicilis	p	..	..	..	..	..	..	..	..	..

Distribution of St. Louis Cladocera From March 1909 To June 1910

	1909							1910		
	March	April	May	June	August	October	November	April	May	June
1. Alonaceostata							p			
2. Bosmina longirostris							p			
3. Ceriodaphnia laticaudata										p
4. Ceriodaphnia reticulata	p						p			
5. Chydorus sphaericus						p	p			
6. Daphnia longiremus		p				p				
7. Daphnia pulex		p								
8. Leydigia acanthocercoides										p
9. Leydigia quadrangularis								p		
10. Moina brachiata					p					
11. Moina rectirostris					p					
12. Pleuroxus denticulatus			p	p			p			
13. Pleuroxus hamulatus			p	p						
14. Pseudosida bidentata										p
15. Scapholeberis mucronata		p		p		p			p	
16. Simocephalus serrulatus	p		p	p	p	p	p	p	p	p

Distribution of St. Louis Cladocera From April 1920 To August 1921

	1920					1921				
	April	May	June	July	August	April	May	June	July	August
1. Alona rectangularis							p			
2. Bosmina longirostris		p	p			p	p	p	p	p
3. Ceriodaphnia lacustris							p			
4. Ceriodaphnia laticaudata			p	p						
5. Ceriodaphnia rigaudi									p	p
6. Chydorus sphaericus				p	p		p			
7. Daphnia longiremis hyalina		p								
8. Daphnia longiremis longispina							p	p		
9. Daphnia pulex		p	p			p	p	p	p	
10. Daphnia retrocurva		p	p				p			
11. Diaphanosoma brachyurum				p						
12. Diaphanosoma leuchtenbergianum			p							
13. Kurzia latissima				p						
14. Leydigia quadrangularis										p
15. Latonopsis occidentalis			p							
16. Macrothrix laticornis					p	p	p			
17. Moina brachiata				p					p	p
18. Moina rectirostris			p				p			
19. Oxyurella tenuicaudis			p							
20. Pleuroxus denticulatus			p	p			p			
21. Pleuroxus hamulatus			p							p
22. Scapholeberis mucronata		p	p				p	p		
23. Simocephalus serrulatus	p	p	p	p						

Distribution of St. Louis Copepoda From April 1920 To August 1921

	1920					1921				
	April	May	June	July	August	April	May	June	July	August
1. Cyclops albidus	p	p	p	..	..	p	..	..	p	..
2. Cyclops bicuspidatus	..	..	..	..	..	p	..	..	..	..
3. Cyclops fimbriatus	..	..	..	..	..	..	..	p	..	..
6. Cyclops fusca	..	..	..	..	..	..	p	..	..	..
7. Cyclops leuckarti	..	..	..	..	..	..	..	p	..	p
8. Cyclops phaleratus	..	..	..	..	..	..	p	..	..	..
9. Cyclops serrulatus	p	p	p	p	p	p	p	p	..	p
10. Cyclops viridis insectus	p	p	p	p	p	p	p	p	p	p
11. Diaptomus ashlandi	..	p	p	..	..	..	p	p	..	..
12. Diaptomus oregonensis	..	..	p	..	..	..	p	..	p	..
13. Diaptomus pallidus	..	..	p	..	..	..	..	..	..	..
14. Diaptomus pseudosanguineus	..	..	..	..	..	..	..	..	..	p
15. Diaptomus stagnalis	..	..	p	..	..	..	..	..	..	..

TEMPERATURE DISTRIBUTION OF ST. LOUIS CLADOCERA

	5°-9°	10°-14°	15°-19°	20°-24°	25°-29°	30°-35°
1. Alona costata	....	....	p	....	....	....
2. Alona rectangularis	....	....	....	....	p	....
3. Bosmina longirostris	....	....	....	p	p	....
4. Ceriodaphnia lacuustris	....	....	....	p	....	....
5. Ceriodaphnia laticaudata	....	....	....	p	....	....
6. Ceriodaphnia reticulata	....	....	p	....	....	....
7. Ceriodaphnia rigaudi	....	....	....	....	p	....
8. Chydorus sphaericus	....	....	p	....	....	p
9. Daphnia longiremis hyalina	....	....	p	....	....	....
10. Daphnia longiremis longispina	....	....	....	....	p	....
11. Daphnia pulex	....	p	p	p	p	p
12. Daphnia retrocurva	....	....	....	p	....	p
13. Diaphanosoma brachyurum	....	....	....	....	....	p
14. Diaphanosoma leuchtenbergianum	....	....	....	....	....	p
15. Kurzia latissima	....	....	....	....	....	p
16. Leydigia acanthoceroides	....	....	....	....	....	p
17. Leydigia quadrangularis	....	....	....	....	....	p
18. Macrothrix laticornis	....	....	p	....	....	p
19. Moina brachiata	....	....	....	p	p	p
20. Moina rectirostris	....	....	....	p	....	p
21. Oxyurella tenuicaudis	....	....	....	p	....	....
22. Pleuroxus denticulatus	....	p	p	....	....	p
23. Pleuroxus hamulatus	....	p	....	....	....	p
24. Pseudosida bidentata	....	....	....	p	....	....
25. Scapholeberis mucronata	....	p	....	....	....	p
26. Simocephalus serrulatus	....	p	p	p	p	p

Temperature Distribution of St. Louis Copepoda

	5°-9°	10°-14°	15°-19°	20°-24°	25°-29°	30°-35°
1. Cyclops albidus	....	p	p	p	....	....
2. Cyclops bicuspidatus	....	....	p	....	....	....
3. Cyclops fusca	....	....	....	p	....	....
4. Cyclops leuckarti	....	....	....	p	p	p
5. Cyclops phaleratus	....	....	....	....	p	p
6. Cyclops serrulatus	....	p	p	p	p	p
7. Cyclops viridis insectus	p	p	p	p	p	p
8. Diaptomus ashlandi	....	....	p	p	....	p
9. Diaptomus oregonensis	....	....	p	p	....	p
10. Diaptomus pallidus	....	....	....	p	....	....
11. Diaptomus pseudosanguineus	....	....	....	....	p	....
12. Diaptomus sanguineus	....	....	p	p	....	....
13. Diaptomus sicilis	....	p	....	....	....	....
14. Diaptomus stagnalis	....	....	....	p	p	....

Distribution of St. Louis Copepoda and Cladoera According to the Hydrogen ion Content of the Water

CLADOCERA	7.0	7.2	7.4	7.6	7.8	8.0	8.2
1. Alona rectangularis	...	...	...	...	...	...	p
2. Bosmina longirostris	...	...	...	...	p	...	p
3. Ceriodaphnia lacustris	...	...	...	...	...	...	p
4. Ceriodaphnia rigaudi	...	...	...	...	p	...	...
5. Chydorus sphaericus	...	...	...	...	...	...	p
6. Daphnia longiremis hyalina	...	...	...	...	...	...	p
7. Daphnia longiremis longispina	...	...	...	...	...	...	p
8. Daphnia pulex	...	p	...	p	...	...	...
9. Daphnia retrocurva	...	...	...	...	...	p	...
10. Leydigia quadrangularis	...	...	p	...	...	...	...
11. Macrothrix laticornis	...	p	...	...	...	...	p
12. Moina brachiata	...	...	...	...	p	p	...
13. Moina rectirostris	p	...	...	...	...	...	...
14. Pleuroxus denticulatus	...	...	...	...	...	...	p
15. Pleuroxus hamulatus	...	...	p	...	...	...	p
16. Scapholeberis mucronata	...	...	...	...	...	p	p
COPEPODA							
1. Cyclops albidus	...	p	...	...	...	p	...
2. Cyclops bicuspidatus	...	p	...	...	...	...	...
3. Cyclops fimbriatus	...	...	...	...	...	...	p
4. Cyclops leuckarti	...	...	...	...	p	...	...
5. Cyclops serrulatus	p	p	p	...	...	p	p
6. Cyclops viridis insectus	p	p	p	p	p	p	p
7. Diaptomus ashlandi	...	...	...	...	...	p	...
8. Diaptomus oregonensis	...	...	...	p	...	...	...
9. Diaptomus pseudosanguineus	...	...	...	...	p	...	...

HABITAT DISTRIBUTION OF ST. LOUIS CLADOCERA

	Ditch	Marsh	Tem. Pond	Tran. Pond	N. O. Pond		O. Pond		Lake	
					Veg.	Open	Veg.	Open	Veg.	Open
1. Alona costata	..	..	..	..	p	..	..	..	..	..
2. Alona rectangularis	..	p	..	..	..	p	..	..	..	..
3. Bosmina longirostris	..	p	..	p	p	p	..	..	..	..
4. Ceriodaphnia lacustris	..	..	..	..	..	p	..	..	..	..
5. Ceriodaphnia laticaudata	..	..	..	..	..	p	..	..	..	..
6. Ceriodaphnia pulchella	..	..	..	..	..	..	..	..	p	..
7. Ceriodaphnia reticulata	..	..	..	..	p	..	..	..	p	..
8. Ceriodaphnia rigaudi	..	p	..	..	p	..	..	..	..	..
9. Chydorus sphaericus	..	p	..	..	p	p	..	..	p	..
10. Daphnia longiremis hyalina	..	..	..	..	..	p	..	..	..	..
11. Daphnia longiremis longispina	..	..	p	..	..	p	..	p	..	p
12. Daphnia pulex	..	p	p	p	..	p	..	p	..	..
13. Daphnia retrocurva	..	..	..	..	..	..	..	..	..	p
14. Diaphanosoma brachuyrum	..	..	p	p	..	p	..	..	..	..
15. Diaphanosoma leuchtenbergianum	..	..	p	..	..	p	..	..	..	..
16. Kurzia latissima	..	..	..	..	..	..	..	..	p	..
17. Latonopsis occidentalis	..	..	..	..	..	p	..	..	..	..
18. Leydigia acanthoceroides	..	..	..	..	p	p	..	..	..	..
19. Leydigia quadrangularis	..	..	..	..	p	p	..	..	..	..
20. Macrothrix laticornis	..	p	..	p	p	p	..	..	p	..
21. Moina brachiata	p	p	p	p	..	p	..	..	..	..
22. Moina rectirostris	p	..	p	..	..	p	..	..	..	..
23. Oxyurella tenuicaudis	..	..	..	p	..	p	..	..	..	..
24. Pleuroxus denticulatus	..	p	..	..	p	p	..	..	p	..
25. Pleuroxus hamulatus	..	..	..	..	p	p	..	..	..	..
26. Pseudosida bidentata	..	p	..	..	..	..	..	..	..	..
27. Scapholeberis mucronata	..	p	..	p	p	p	p	..	p	..
28. Simocephalus serrulatus	..	p	p	p	p	p	..	..	p	..

Habitat Distribution of St. Louis Copepoda

	Ditch	Marsh	Tem. Pond	Tran. Pond	N. O Pond Veg.	N. O Pond Open	O. Pond Veg.	O. Pond Open	Lake Veg.	Lake Open
1. Cyclops albidus	..	p	p	..	p	p	..	..	..	p
2. Cyclops bicuspidatus	..	..	..	..	..	p	..	..	..	..
3. Cyclops fimbriatus	..	..	..	p	..	p	..	..	..	..
4. Cyclops fusca	..	..	..	..	p	..	..	..	..	..
5. Cyclops fimbriatus	..	..	..	p	..	p	..	..	..	..
6. Cyclops phaleratus	..	p	..	..	..	p	..	..	..	..
7. Cyclops leuckarti	..	p	..	..	..	p	..	..	..	..
8. Cyclops serrulatus	p	p	p	p	..	p	p	..	p	p
9. Cyclops viridis insectus	..	p	p	p	p	p	..	p	..	p
10. Diaptomus ashlandi	..	p	..	p	..	p	..	..	..	p
11. Diaptomus oregonensis	..	..	p	..	p	..	..	..	..	..
12. Diaptomus pallidus	..	p	..	..	..	p	p	..	..	..
13. Diaptomus pseudosanguineus	..	p	..	..	..	..	..	..	..	..
14. Diaptomus sanguineus	..	..	p	..	..	p	..	..	..	..
15. Diaptomus sicilis	..	..	..	..	..	..	..	..	..	p
16. Diaptomus stagnalis	..	..	p	..	..	p	..	..	..	..

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Explanation of Plates

PLATE I.

Fig. 1. *Diaptomus pseudosanguineous*, sp. nov., ventral view of female; c, tubercles on the distal margin of the thorax; d, strong curved spine on the lateroventral portion of the first segment of the abdomen.

Fig. 2. *Diaptomus pseudosanguineous*, sp. nov., lateral view of male.

Fig. 3 Lateral view of the female; j, spermatophore.

Fig. 4. Antenna of the female.

PLATE II.

Fig. 1. Lateral view of female illustrating a case of commensalism between this form and certain Vorticellidae; e, one of the commensal Vorticellidae. By examining that portion of the illustration labeled e with a magnifying glass the protozoan will be distinct. The use of the glass will also reveal retracted Vorticellidae among the eggs.

Fig. 2. Caudal extremity of the thorax and the first abdominal somite of a female (lateral view); f, stout curved spine; g, spermatophore.

Fig. 3. Antipenultimate segment of the male right antenna; h, terminal claw; i, hyaline flange.

PLATE III.

Fig. 1. Fifth foot of the male; a, endopodite of the left fifth foot.

Fig. 2. Antennae of the male.

Fig. 3. Pair in copulo.

Fig. 4. Enlarged view showing the tubercles on the caudal margin of the thorax; b, the tubercles.

Fig. 5. Fifth foot of the female. The terminal setae moved reflexly, while the photo was being taken, thus causing the appendage to appear to have several terminal setae. There are only two long setae at that place.

PLATE IV.

Fig. 1. *Ceriodaphnia rigaudi*, shell markings.

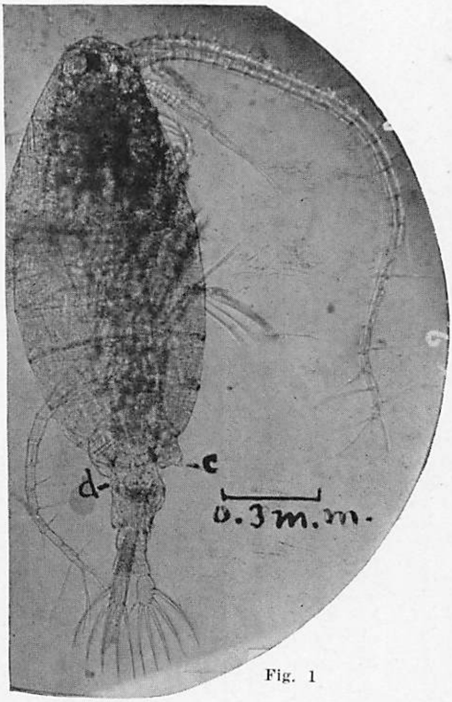
Fig. 2. *Ceriodaphnia rigaudi*, Female. b, antennae c, beak-like projection from head.

Fig. 3. *Moina brachiata*, female, showing commensalism; a, Vorticellidae.

Fig. 4. *Pleuroxus hamulatus*.

Fig. 5. *Ceriodaphnia laticaudata*.

Fig. 6. *Ceriodaphnia rigaudi*, female, showing the escape of a young specimen from the brood sac. By turning the page sidewise the details of this photo become more distinct.



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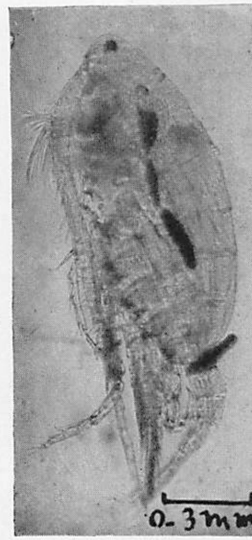

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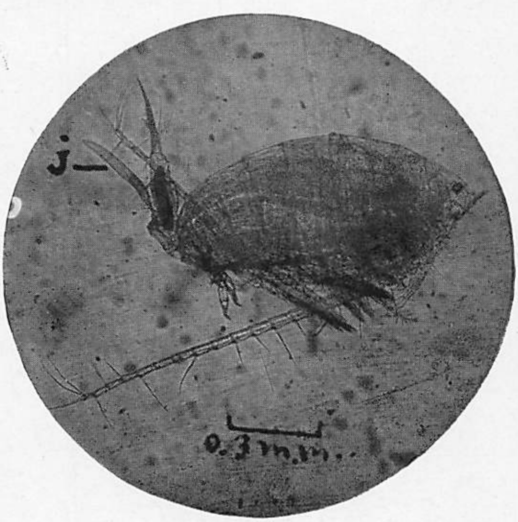

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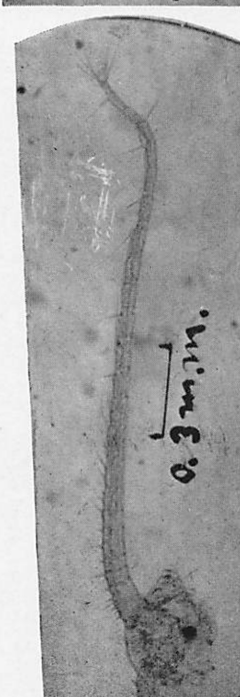

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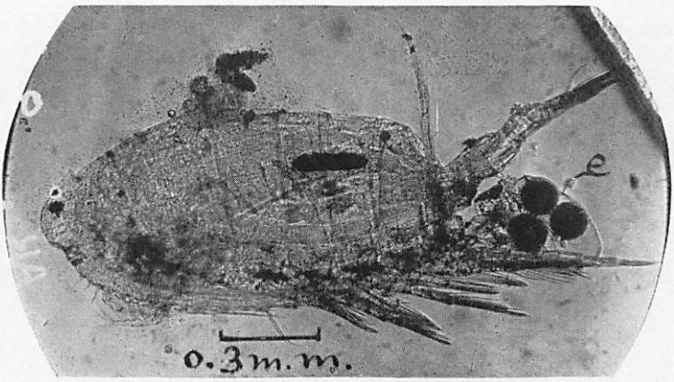

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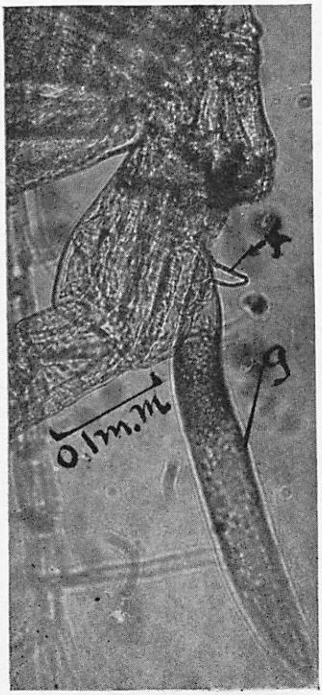

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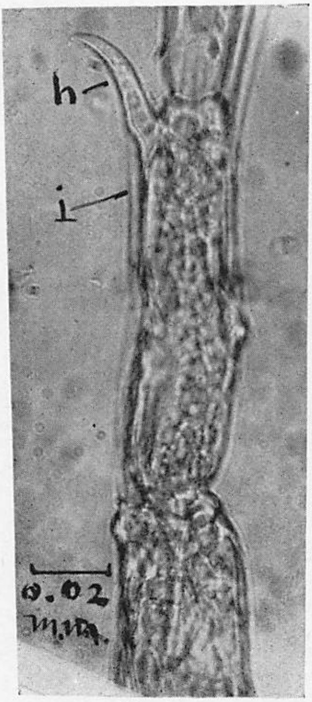

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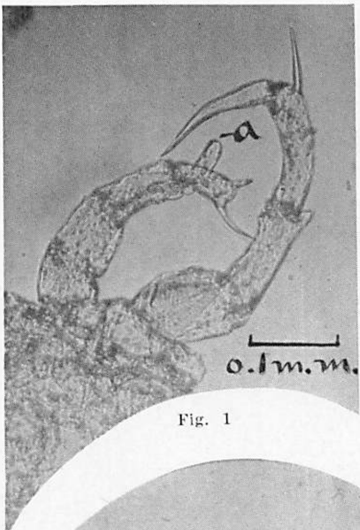

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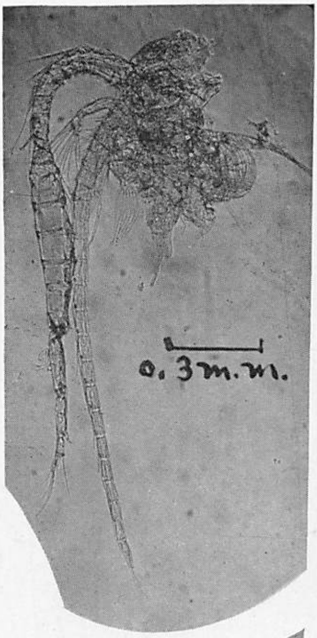

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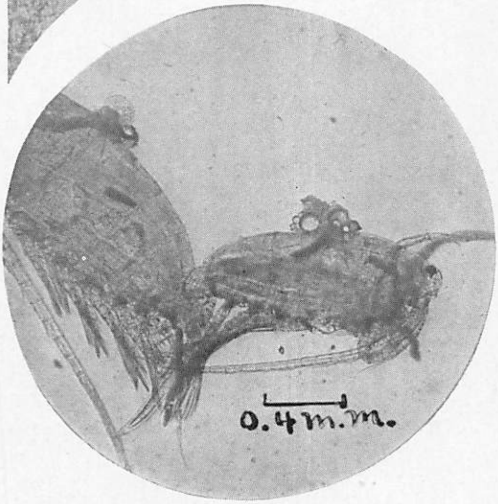

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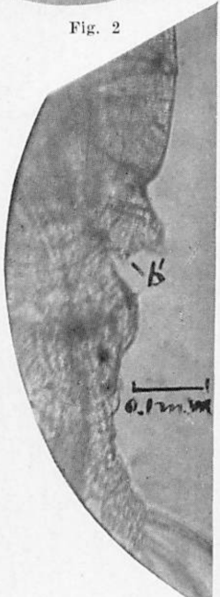
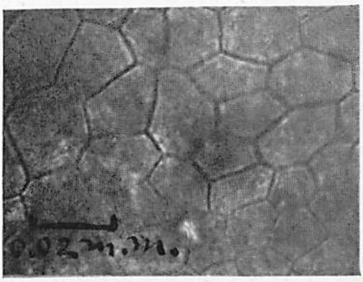


Fig. 4

Fig. 5



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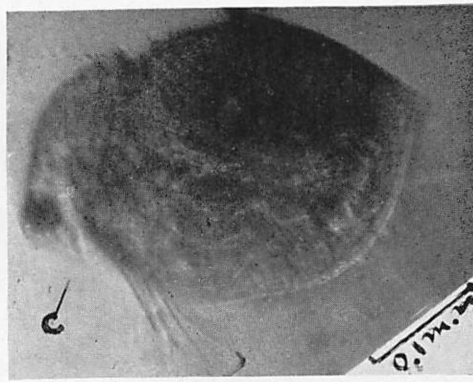

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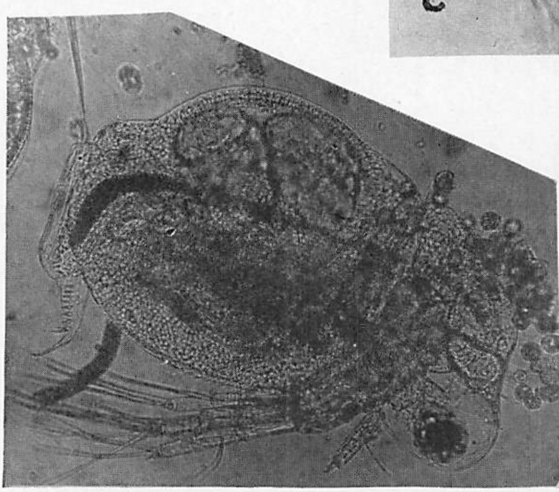

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Fig. 3

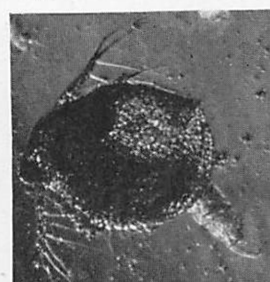

Fig. 5

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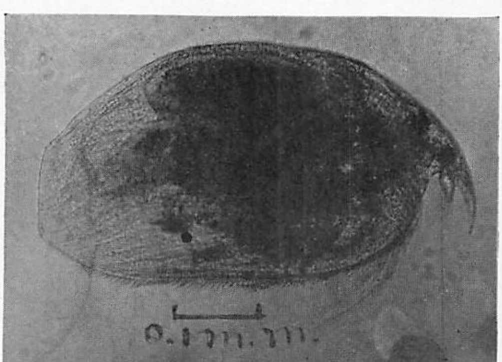

Fig. 4

Fig. 6