

WINTER FAUNA OF CLADOCERA AND COPEPODA
IN PONDS AND DITCHES,
LYON COUNTY, KANSAS

A Thesis Submitted to
the Division of Biological Sciences
Emporia Kansas State College, Emporia, Kansas

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
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May, 1975

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ACKNOWLEDGEMENTS

The author wishes to express sincere appreciation to Dr. Carl W. Prophet for his advice and constructive criticism throughout the development of this study and for verification of entomostraca; Dr. Robert J. Boles and Dr. John Ransom for their suggestions for the improvement of this manuscript; Steve Waite for verification of entomostraca; and Connie Bennet for technical assistance. Special thanks is extended to my wife, Nancy Korber, for her patience and encouragement, and for typing this manuscript.

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INTRODUCTION

Pennak (1953) defines entomostraca as a convenient general descriptive term which might be used to designate collectively all fresh-water Crustacea. In my study the term entomostraca will be confined to those microcrustaceans classified as either Cladocera or Copepoda.

Many studies concerned with species composition and relative abundance of entomostraca in aquatic habitats in Lyon County have been conducted. However, most of these studies dealt with only one kind of habitat. My study was concerned with winter species composition and relative abundance of entomostraca in selected ponds and ditches within the vicinity of Emporia, Kansas.

One of the first studies of species composition and seasonal variation of entomostraca in temporary and permanent lentic communities in Kansas was conducted by Leonard and Ponder (1949). Their investigation took place within a 4 km radius of Lawrence in Douglas County, Kansas. The results of their study provided an annotated list of 29 species of microcrustacea, 12 of which were Cladocera and seven were Copepoda. A comprehensive study on the ecology of the cladocerans of Kansas was conducted by Brooks (1956) from April, 1949, to April, 1952. During his study qualitative net samples were collected from at least three bodies of water in each county of the state, except for a few far western counties. The collecting sites included 113 roadside ditches, 95 ponds, 42 creeks, 26 sloughs, 16 lakes, 5 backwaters,

2 salt marshes and 2 strip-pits. Thus, the majority of the 301 tow-net samples collected were from lentic communities. He reported a total of 41 species of cladocerans, 23 of which were new records for the state. Ratzlaff (1952) was the first investigator to study the limnological features, including the entomostraca, of six different ditch habitats between Emporia and Strong City along U. S. highway 50 in Lyon and Chase Counties for one year beginning March, 1950. He identified 16 species of Cladocera and only five species of Copepoda and noted that definite fluctuations in plankton abundance occurred at different times during the investigation.

Numerous studies of entomostraca have been conducted on Lake Wooster, a small artificial pond located on the campus of Emporia Kansas State College (Carter, 1954; Wilhm, 1955; Spencer, 1955; McKinley, 1960; and Gehrs, 1967). Gehrs (1967) was the first to examine the distribution of Cladocera and Copepoda in relation to various types of microhabitats within Lake Wooster. The accumulation of data concerning species composition, relative abundance, and physiochemical conditions from all of the studies conducted on Lake Wooster provide an exiguous but valuable insight as to what might be expected to occur in other pond habitats in Lyon County.

Davies (1958) conducted an eight month study of winter plankton in a Kansas slough. Compared to the previously mentioned studies, his study was unique because it concerned the plankton of a recently reflooded aquatic habitat. Although

the slough had a history of intermediate dry periods, its nature was not characteristic of other ephemeral habitats which completely dry up and refill several times during a year. The results of his study indicated a more diverse composition of species than those studies conducted on Lake Wooster.

My study may be considered a follow-up of the work of Prophet, Andrews, and Goulden (1959). They obtained plankton samples from numerous lentic and lotic habitats throughout Lyon County, Kansas, during the period September, 1958 to April, 1959, and compiled a species check list of the Cladocera and Copepoda of Lyon County, with annotations of their relative abundance and seasonal occurrence. It is hoped that my study will provide a more complete and up-to-date check list of the winter entomostracans of pond and ditch habitats in the Emporia area, and that this information will be useful in the continuing efforts to develop a state-wide list of those organisms.

The primary objectives of my study were: (1) to determine the variations in the winter species composition and relative abundance of microcrustaceans in lentic communities in the vicinity of Emporia, Kansas, and (2) to compile a species list of Cladocera and Copepoda for Lyon County, Kansas.

METHODS AND MATERIALS

A total of 180 qualitative plankton samples were collected from 16 ponds and 14 ditches during the winter season of 1973-74 in the vicinity of Emporia, Kansas. Sampling occurred during November, 1973, and February and May, 1974. All samples were collected within ten consecutive days from the beginning of each sampling period.

Two qualitative tow-net samples, taken from near the surface, were collected from each site during each collecting period. Each sample consisted of two or three longitudinal hauls of approximately 2 meters using a tow-net constructed of no. 20 bolting silk, with a mouth diameter of 21 cm and a sleeve length of 35 cm. Each plankton sample was transferred to a 50 ml screw-cap bottle and relaxed by addition of nicotine before being preserved in 10 % formalin.

A water-tight plastic counting chamber was constructed within a petri dish (Figure 1). The counting chamber was approximately 5 cm x 5 cm x 2.5 cm in dimension. The bottom of the counting chamber was divided into 16 quadrates, each enclosing an area of 12.7 cm².

Because of the qualitative nature of the samples, it was necessary to devise a method to obtain comparable representations of species abundance from each habitat. One sample from each of the entire sample sets from each habitat was chosen at random and subjected to the following procedure. The sample was emptied

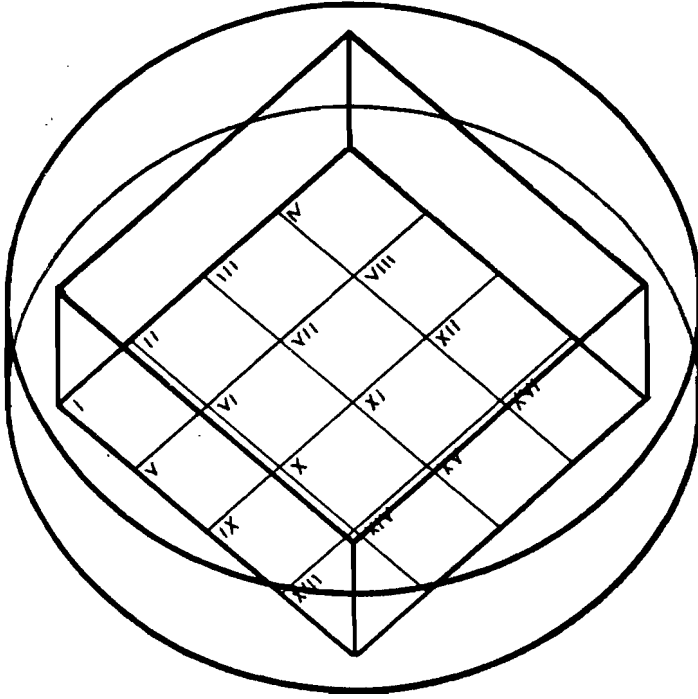


Figure 1. Plastic counting chamber.

into the counting chamber and the total number of all Cladocera and Copepoda in each of the 16 quadrates was recorded. The accumulative average number of Cladocera and Copepoda per quadrate for the sample was determined and plotted as in Figures 2 and 3. From these results it was determined that six squares would give a good representation of the density of species in each sample bottle.

A random sampling procedure was used to determine which six squares within the counting chamber would be examined in each sample bottle. The entomostraca found within the six randomly chosen squares of the counting chamber were used to determine the relative abundance and species composition of each habitat. The remaining organisms in each sample bottle were later scanned under a binocular scope to see if there were any species present that did not occur in the randomly chosen squares. A new random number of squares was selected for each site during the three sampling periods.

All Cladocera and Copepoda were identified to species. The taxonomic keys used for identification of entomostraca were Brooks, 1959; Wilson and Yeatman, 1959; Pennak, 1953; Brooks, 1957; and Goulden, 1968.

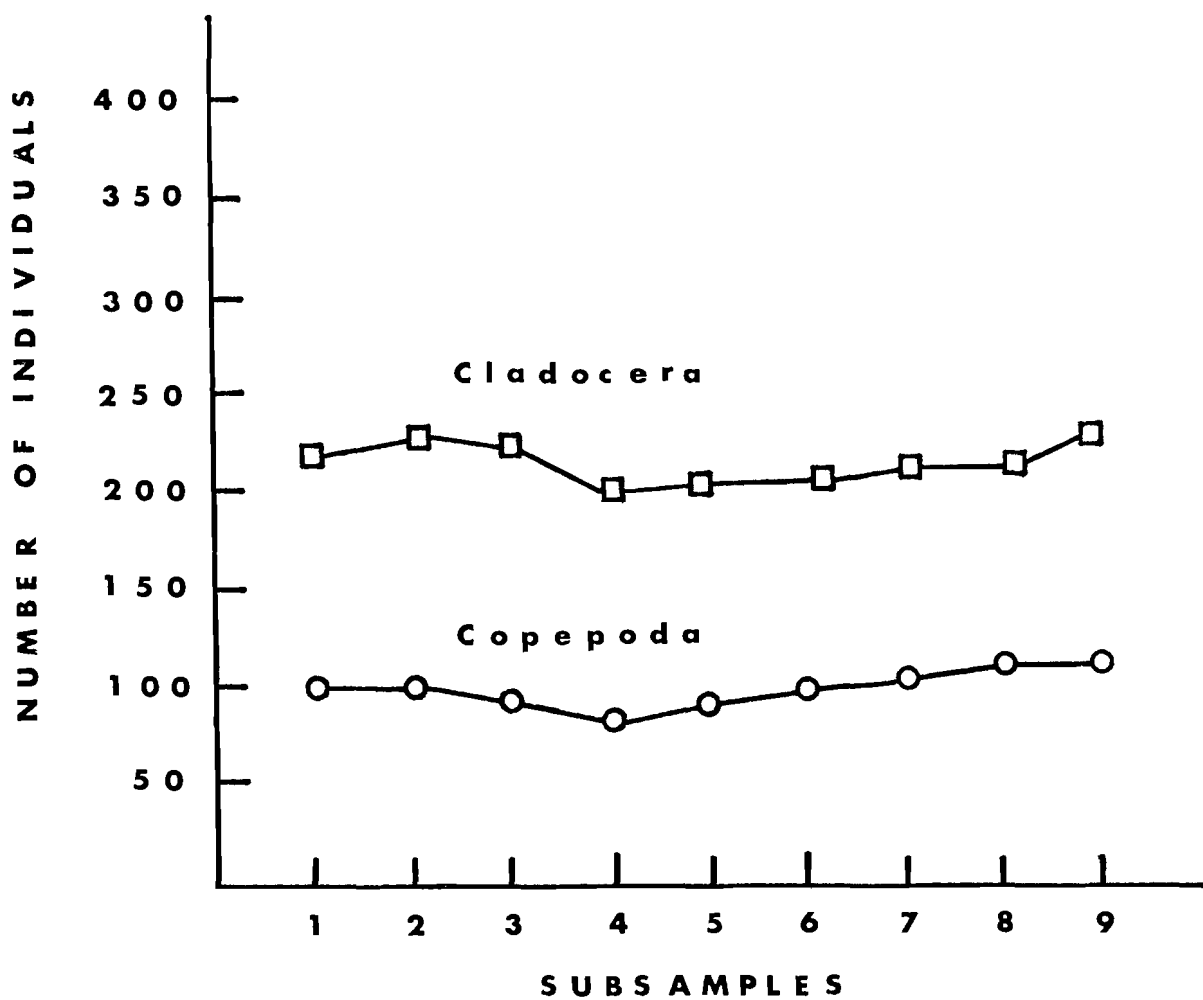


Figure 2. Variation in average numbers of Cladocera and Copepoda in pooled subsamples.

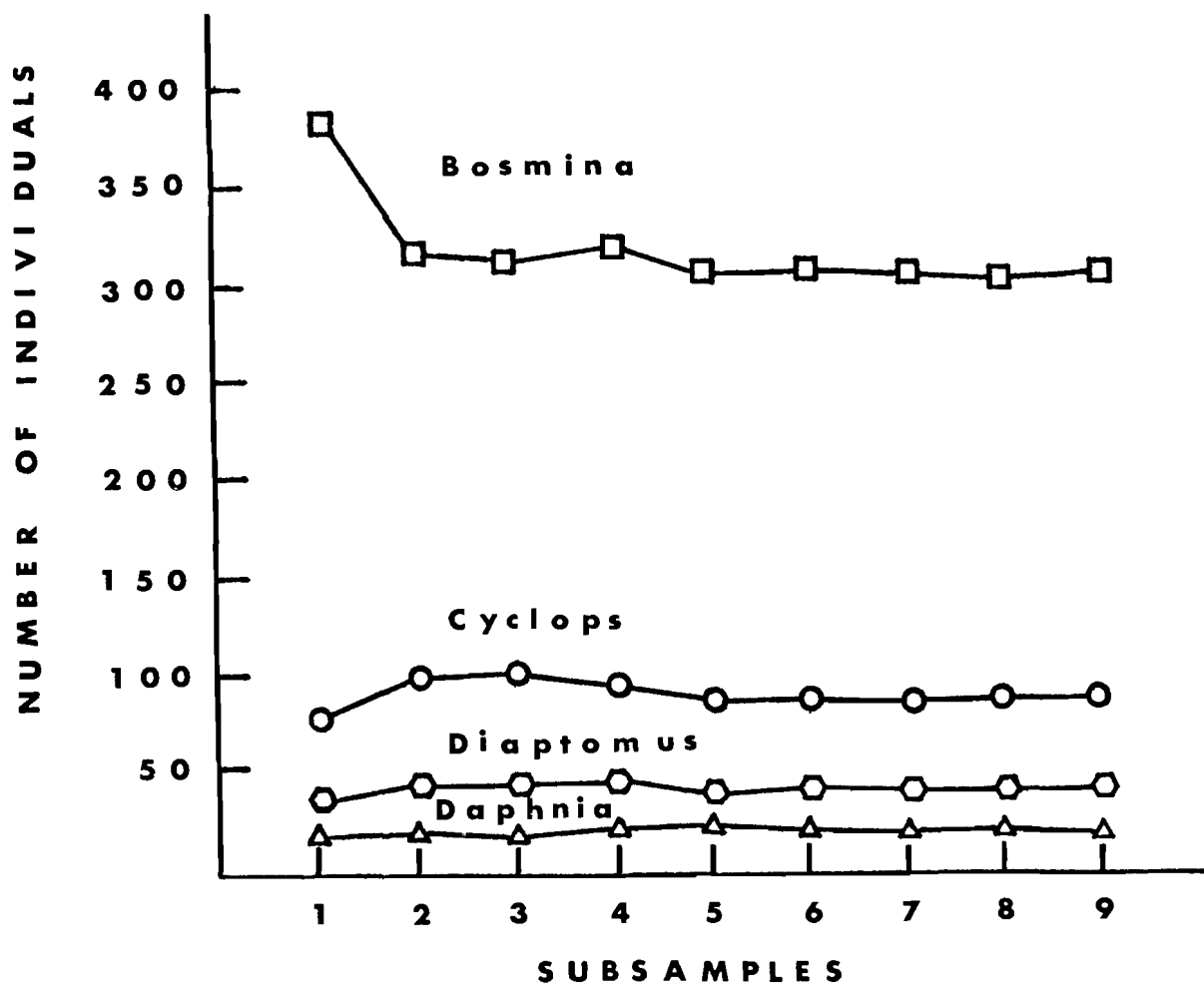


Figure 3. Variation in average numbers of two genera of Cladocera and Copepoda in pooled subsamples.

RESULTS AND DISCUSSION

The Cladocera and Copepoda Faunas of Lyon County, Kansas

A total of 25 species of Cladocera and 11 species of Copepoda were identified in townet samples collected from 14 roadside ditch habitats and 16 small farm ponds within a radius of 35 km of Emporia, Kansas (Table I).

Comparisons of present-day species lists with lists published by previous researchers are often confusing due to nomenclatural changes and misidentification of organisms. The most frequent cases of misidentification and use of invalid names in publications pertaining to the Cladocera and Copepoda of Kansas were discussed by Prophet and Waite (1974) and will not be repeated here. However, their interpretations influenced my conclusions concerning similarities between my observations and those of earlier investigators.

One of the first published investigations reporting species composition and relative abundance of Cladocera and Copepoda in ditch habitats in Kansas was that of Ratzlaff (1952). He reported 16 species of Cladocera and five species of Copepoda from six roadside ditch habitats in Chase and Lyon Counties. All of the species identified by Ratzlaff (1952) were found in my study with the exception of Kurzia latissima, Macrocylops alter, and Diaptomus clavipies.

One of the more extensive studies on the occurrence of

Table I. Species list of Cladocera and Copepoda found in 16 pond habitats and 14 ditch habitats in Lyon County, Kansas.

Species	Ponds	Ditches
CLADOCERA		
<u>Diaphanosoma brachyurum</u>	X	X
<u>Daphnia ambigua</u>	X	X
<u>Daphnia parvula</u>	X	X
<u>Daphnia pulex</u>	X	X
* <u>Simocephalus exspinosus</u>		X
<u>Simocephalus vetulus</u>	X	X
<u>Scapholeberis kingi</u>	X	X
<u>Ceriodaphnia reticulata</u>		X
<u>Ceriodaphnia lacustris</u>	X	X
* <u>Ceriodaphnia quadrangula</u>	X	X
* <u>Ceriodaphnia laticaudata</u>		X
* <u>Moina affinis</u>		X
<u>Bosmina longirostris</u>	X	X
<u>Bosmina coregoni</u>	X	X
<u>Macrothrix laticornis</u>		X
* <u>Camptocercus oklahomensis</u>		X
<u>Leydigia quadrangularis</u>		X
<u>Alona guttata</u>	X	
<u>Alona quadrangularis</u>		X
<u>Alona costata</u>		X
<u>Alona rectangula</u>	X	X
<u>Pleuroxus denticulatus</u>	X	X
* <u>Pleuroxus hamulatus</u>	X	
<u>Chydorus sphaericus</u>	X	X
* <u>Alonella excisa</u>	X	

Table I. (continued)

Species	Ponds	Ditches
COPEPODA		
<u>Diaptomus siciloides</u>	X	X
<u>Diaptomus pallidus</u>	X	X
<u>Ectocyclops phaleratus</u>	X	X
* <u>Macrocyclops albidus</u>	X	X
** <u>Eucyclops speratus</u>	X	
<u>Eucyclops agilis</u>	X	X
<u>Tropocyclops prasinus</u>	X	X
<u>Cyclops vernalis</u>	X	X
<u>Cyclops bicuspidatus thomasi</u>	X	X
<u>Mesocyclops leukarti</u>	X	
<u>Canthocamptus robertcokeri</u>	X	X

* Not listed as common to east central Kansas (Prophet and Waite, 1974)

**Indicates new species record for the state

Cladocera and Copepoda in Lyon County, Kansas was that of Prophet et al. (1959). They identified 35 species of Cladocera and 18 species of Copepoda in samples taken from 33 cattle ponds, 21 streams, 6 sloughs, and 9 roadside ditches from September, 1958 to April, 1959. Twenty-nine of the species observed in that study were also found during my study. The larger number of species they reported could be attributed to the greater variety of habitats sampled; and since their study began in September, two months earlier than mine, there is a chance that they collected some summer species. Species collected in my study but which were not reported by Prophet et al. (1959) were Daphnia parvula, Daphnia ambigua, Moina affinis, Alonella excisa, Ectocyclops phaleratus, and Eucyclops speratus. Daphnia pulex was collected by Prophet et al. (1959) but Prophet and Waite (1974) pointed out that some cladocerans identified as Daphnia pulex in earlier studies were probably either Daphnia parvula or Daphnia schödleri. Thus, species of Daphnia common in east central Kansas are D. parvula, D. pulex, and D. ambigua (Prophet and Waite, 1974).

To date, a total of 59 species of Cladocera and 23 species of Copepoda have been verified as occurring in Kansas (Prophet and Waite, 1974). They listed 24 species of Cladocera and 13 species of Copepoda as being common in Lyon, Chase, Coffey, Marion and Morris Counties, of which 18 of the cladocerans and 13 species of the Copepoda were found during my study (Table I).

Only one species observed during my study, Eucyclops

speratus, had not been previously reported for the state and constitutes a new species record. This species was found during November in a farm pond which was approximately 40 ares in area. There was no obvious aquatic vegetation in the pond, and only one specimen was found in the two tow-net samples collected from that habitat. Eucyclops speratus was not observed at any other time during my study.

A combined species list of the Cladocera and Copepoda in Lyon County was compiled from the results of my study and from other available records (Brock, 1965; Brooks, 1947; Griffith, 1961; Prophet, 1959; Prophet, 1965; Prophet, 1970). To date, 43 species of Cladocera and 21 species of Copepoda have been reported for Lyon County (Table II). Species found in my study representing a new record for the county were Camptocercus oklahomensis and Eucyclops speratus. Eucyclops speratus was mentioned in an unpublished thesis but there was no indication that this species had been verified.

Comparison of Ditch and Pond Species Composition

Although the majority of the species observed during this study were found in both pond and ditch habitats, ditches appeared to support a greater diversity of species. Thirty-one species were found in ditches and 27 species were found in ponds. Of course, not all species reported in either habitat type were ever present in any single sample. Those species found in ditches but not ponds, and vice versa, are listed in Table I.

Table II. Species list of Cladocera and Copepoda for Lyon County, Kansas.

CLADOCERA

Family Sididae

Sida crystallina (O.F. Muller) 1785
Latona setifera (O.F. Muller) 1785
Diaphanosoma brachyurum (Lieven) 1848

Family Daphnidae

Daphnia ambigua Scourfield 1947
Daphnia parvula Fordyce 1901
Daphnia pulex Leydig, 1860 emend. Richard 1896
Daphnia catawba Coker 1926
Simocephalus exspinosus (Koch) 1841
Simocephalus vetulus Schödler 1858
Simocephalus serrulatus (Koch) 1841
Scapholeberis kingi Sars 1903
Scapholeberis aurita (Fischer) 1849
Ceriodaphnia rigaudi Richard 1894
Ceriodaphnia reticulata (Jurine) 1820
Ceriodaphnia lacustris Birge 1893
Ceriodaphnia quadrangula (O.F. Muller) 1785
Ceriodaphnia laticaudata P.E. Muller 1867
Moina micrura Kurz 1874
Moina macrocopa Straus 1820
Moina rectirostris (Leydig) 1860
Moina affinis Birge 1893

Family Bosminidae

Bosmina longirostris (O.F. Muller) 1785
Bosmina coregoni Baird 1857

Family Macrothricidae

Ilyocryptus spinifer Herrick 1884
Macrothrix laticornis (Jurine) 1820

Table II. (continued)

Family Chydoridae

Eurycercus lamellatus (O.F. Muller) 1785
Camptocercus oklahomensis Mackin 1930
Camptocercus rectirostris Schödler 1862
Kurzia latissima (Kurz) 1874
Leydigia quadrangularis (Leydig) 1860
Alona guttata Sars 1862
Alona affinis (Leydig) 1860
Alona quadrangularis (O.F. Muller) 1785
Alona costata Sars 1862
Alona rectangula Sars 1861
Pleuroxus striatus Schödler 1863
Pleuroxus denticulatus Birge 1878
Pleuroxus hamulatus Birge 1910
Chydorus globosus Baird 1850
Chydorus gibbus Lilljeborg 1880
Chydorus sphaericus (O.F. Muller) 1785
Alonella acutirostris (Birge) 1878
Alonella excisa (Fischer) 1854

COPEPODA

CALANOIDA

Family Diaptomidae

Diaptomus clavipes Schacht 1897
Diaptomus saltillinus Brewer 1898
Diaptomus siciloides Lilljeborg 1889
Diaptomus sanguineus S.A. Forbes 1876
Diaptomus pallidus Herrick 1879
Diaptomus oregonensis Lilljeborg 1889

CYCLOPOIDA

Family Cyclopidae

Ectocyclops phaleratus (Koch) 1838
Orthocyclops modestus (Herrick) 1883
Macrocyclus alter (Herrick) 1882

Table II. (continued)

Family Cyclopidae

Macrocyclops albidus (Jurine) 1820
Paracyclops fimbriatus poppei (Rehberg) 1880
Eucyclops speratus (Lilljeborg) 1901
Eucyclops agilis (Koch) 1838
Tropocyclops prasinus (Fischer) 1860
Cyclops vernalis Fischer 1853
Cyclops bicuspidatus thomasi S.A. Forbes 1882
Cyclops varicans rebellus Lilljeborg 1901
Cyclops bicolor Sars 1863
Mesocyclops edax (S.A. Forbes) 1891
Mesocyclops leukarti (Claus) 1875

HARPACTICOIDA

Family Canthocamptidae

Canthocamptus robertcokeri M.S. Wilson 1958

Throughout my study, in both types of habitats, the number of cladoceran species collected was approximately twice as great as the number of species of Copepoda. Similar trends have been observed in other studies (Ratzlaff, 1952; Wilhm, 1955; Prophet, et al. 1959). Ditches supported a greater number of species of Cladocera than ponds. Pennak (1957) stated that a limnetic population, according to ordinary sampling methods, usually consists of two to four species, each species being a different genus. Essentially, my results from both ponds and ditches exhibited these same trends. Generally, single samples from ditch habitats yielded three to five species of Cladocera and one to three species of Copepoda, while single samples from pond habitats yielded two to three species of Cladocera and one to three species of Copepoda. However, in some pond habitats single samples contained two species from the same genus. Bosmina longirostris and Bosmina coregoni were found to occur simultaneously in 13 of my 16 pond habitats. They did not coexist in any of the study ditches. In most instances, when these species coexisted in ponds, Bosmina longirostris was found in larger numbers. Two cyclopoids, Cyclops vernalis and Cyclops bicuspidatus thomasi, coexisted in some of the study ponds and ditches. Coexistence of these species has been reported in numerous other studies and therefore is not considered an uncommon occurrence.

Comparison of Habitat Occurrence

The frequency at which each species of Cladocera and Copepoda was observed in the study habitats was categorized as being either widespread or scattered. Widespread species were those that occurred in nine or more sites in either habitat type. Species that occurred in less than nine sites of either habitat type were considered scattered.

Nine species were found widespread in pond habitats and only six species were found widespread in ditches (Table III). Four species were widespread in both habitat types: Bosmina longirostris, Chydorus sphaericus, Diaptomus siciloides, and Cyclops vernalis.

On the basis of this study Daphnia parvula, Daphnia ambigua, Scapholeberis kingi, Bosmina longirostris, Bosmina coregoni, and Chydorus sphaericus are the species of Cladocera most likely to occur in pond and ditch habitats in Lyon County during the winter season. Those species of Copepoda most likely to occur in both habitat types in Lyon County during the winter months are Diaptomus pallidus, Diaptomus siciloides, Eucyclops agilis, Tropocyclops prasinus and Cyclops vernalis.

Relative Abundance

The relative abundance of species was determined from the total number of individuals of each species present in each of the 180 samples collected during my study. The relative abundance for a species was designated arbitrarily as either

Table III. Frequency of occurrence of entomostraca in pond and ditch habitats in Lyon County, Kansas.

Species	Ponds	Ditches
CLADOCERA		
<u>Diaphanosoma brachyurum</u>	S	S
<u>Daphnia ambigua</u>	W	S
<u>Daphnia parvula</u>	W	S
<u>Daphnia pulex</u>	S	S
<u>Simocephalus exspinosus</u>		S
<u>Simocephalus vetulus</u>	S	S
<u>Scapholeberis kingi</u>	S	W
<u>Ceriodaphnia reticulata</u>		S
<u>Ceriodaphnia lacustris</u>	S	S
<u>Ceriodaphnia quadrangula</u>	S	S
<u>Ceriodaphnia laticaudata</u>		S
<u>Moina affinis</u>		S
<u>Bosmina longirostris</u>	W	W
<u>Bosmina coregoni</u>	W	S
<u>Macrothrix laticornis</u>		S
<u>Camptocercus oklahomensis</u>		S
<u>Leydigia quadrangularis</u>		S
<u>Alona guttata</u>	S	
<u>Alona quadrangularis</u>		S
<u>Alona costata</u>		S
<u>Alona rectangula</u>	S	S
<u>Pleuroxus denticulatus</u>	S	S
<u>Pleuroxus hamulatus</u>	S	
<u>Chydorus sphaericus</u>	W	W
<u>Alonella excisa</u>	S	
COPEPODA		
<u>Diaptomus siciloides</u>	W	W
<u>Diaptomus pallidus</u>	W	S
<u>Ectocyclops phaleratus</u>	S	S
<u>Macrocyclus albidus</u>	S	S
<u>Eucyclops speratus</u>	S	
<u>Eucyclops agilis</u>	S	W
<u>Tropocyclops prasinus</u>	W	S
<u>Cyclops vernalis</u>	W	W
<u>Cyclops bicuspidatus thomasi</u>	S	S
<u>Mesocyclops leukarti</u>	S	
<u>Canthocamptus robertcokeri</u>	S	S

W - widespread

S - scattered

abundant, common or rare (Table IV). Abundant species were those found regularly in samples and were obviously present in large numbers. Species were designated as common when found sporadically in relatively modest numbers, and rare species were found infrequently and in limited numbers.

The cladocerans Bosmina longirostris, Bosmina coregoni, and Chydorus sphaericus, and three species of Copepoda, Eucyclops agilis, Tropocyclops prasinus, and Cyclops vernalis, were considered abundant during this study. Cyclops vernalis was the only species found abundant in both habitat types. These species are frequently mentioned as being abundant in plankton samples taken from a variety of habitat types in Lyon County (Gehrs, 1967; Endicott, 1965; Davies, 1958; Ratzlaff, 1952; Prophet et al., 1959).

Table IV. Relative abundance of Cladocera and Copepoda in 16 pond and 14 ditch habitats in Lyon County, Kansas during the winter season.

Species	Ponds	Ditches
CLADOCERA		
<u>Diaphanosoma brachyurum</u>	C	C
<u>Daphnia ambigua</u>	C	C
<u>Daphnia parvula</u>	C	C
<u>Daphnia pulex</u>	C	C
<u>Simocephalus exspinosus</u>		R
<u>Simocephalus vetulus</u>	C	C
<u>Scapholeberis kingi</u>	C	C
<u>Ceriodaphnia reticulata</u>		R
<u>Ceriodaphnia lacustris</u>	C	R
<u>Ceriodaphnia quadrangula</u>	R	R
<u>Ceriodaphnia laticaudata</u>		C
<u>Moina affinis</u>		C
<u>Bosmina longirostris</u>	A	C
<u>Bosmina coregoni</u>	A	C
<u>Macrothrix laticornis</u>		C
<u>Camptocercus oklahomensis</u>		R
<u>Leydigia quadrangularis</u>		C
<u>Alona guttata</u>	R	
<u>Alona quadrangularis</u>		R
<u>Alona costata</u>		R
<u>Alona rectangula</u>	R	C
<u>Pleuroxus denticulatus</u>	C	C
<u>Pleuroxus hamulatus</u>	C	
<u>Chydorus sphaericus</u>	A	C
<u>Alonella excisa</u>	R	
COPEPODA		
<u>Diaptomus siciloides</u>	C	C
<u>Diaptomus pallidus</u>	C	C
<u>Ectocyclops phaleratus</u>	R	R
<u>Macrocyclus albidus</u>	R	C
<u>Eucyclops speratus</u>	R	
<u>Eucyclops agilis</u>	C	A
<u>Tropocyclops prasinus</u>	A	C
<u>Cyclops vernalis</u>	A	A
<u>Cyclops bicuspidatus thomasi</u>	C	C
<u>Mesocyclops leukarti</u>	R	
<u>Canthocamptus robertcokeri</u>	C	R

A - abundant

C - common

R - rare

SUMMARY

Twenty-five species of Cladocera and 11 species of Copepoda were identified in 180 qualitative tow-net samples collected from 14 roadside ditches and 16 small farm ponds within a radius of 35 km of Emporia, Kansas, during the months of November, 1973 and February and May, 1974. Ditch habitats exhibited a greater diversity of species than pond habitats. In both habitat types the number of Cladoceran species collected was approximately twice as great as the number of species of Copepoda. Those entomostracans from pond and ditch habitats that were considered of widespread occurrence were Daphnia parvula, Daphnia ambigua, Scapholeberis kingi, Bosmina longirostris, Bosmina coregoni, Chydorus sphaericus, Diaptomus pallidus, Diaptomus siciloides, Eucyclops agilis, Tropocyclops prasinus, and Cyclops vernalis. Only four species were of widespread occurrence in both habitat types: Bosmina longirostris, Chydorus sphaericus, Diaptomus siciloides, and Cyclops vernalis. The six species considered abundant during this study were Bosmina longirostris, Bosmina coregoni, Chydorus sphaericus, Eucyclops agilis, Tropocyclops prasinus, and Cyclops vernalis. The only species found abundant in both habitat types was Cyclops vernalis. Camptocercus oklahomensis was reported for the first time in Lyon County. A cyclopoid, Eucyclops speratus constitutes a new species record for the state. A species list of Cladocera and Copepoda for Lyon County was compiled from the results of the present study and from other available records for the county.

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