

**THE ANISOPTEROUS ODONATA OF
MONTGOMERY COUNTY, TENNESSEE, WITH A
CHECK LIST OF THE ANISOPTERA OF TENNESSEE**

BY

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THE ANISOPTEROUS ODONATA
OF MONTGOMERY COUNTY, TENNESSEE, WITH A CHECK LIST
OF THE ANISOPTERA OF TENNESSEE

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

by
Glenda Carolyn Locke
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To the Graduate Council:

I am submitting herewith a Research Paper written by Glenda Carolyn Locke entitled "The Anisopterous Odonata of Montgomery County, Tennessee, with a Check List of the Anisoptera of Tennessee". I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Biology.

Floyd M. Ford
Major Professor

Accepted for the Council:

Wayne E. Kemp
Dean of the Graduate School

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CHAPTER I

INTRODUCTION

From April 16, 1971 through October 30, 1971, a study of the anisopterous Odonata was made in Montgomery County, Tennessee to determine which species are found in the county, the relative abundance of the species based on the number sighted and caught, and some ecological factors affecting Anisoptera. Another purpose of the study was to add to the list of known species in the county and possibly to the state.

History. Montgomery (1971) states that the Science of Odonatology may be said to have originated in the 1839-1842 with the publications of H. C. Burmeister, H. A. Hagen, M. E. De Selys-Longchamps, and M. P. Rambur, with the first of these, written by Burmeister, describing only 159 species for the entire world. Watson (1968) gives the world fauna as more than 4,000 species, constituting less than 0.5 per cent of the known species of insects. Included in these figures are the Anisozygoptera, with only one species (Needham and Westfall, 1955), Zygoptera, and Anisoptera, the three suborders of the order Odonata. The exact numbers of species in Zygoptera and Anisoptera are unknown.

The term "dragonflies" is sometimes used to refer to both common suborders of Odonata. However, it is generally used to refer to the Anisoptera, dating back about four centuries to the time it was applied only to this group of insects (Watson, 1968). The Zygoptera (damselflies) were not studied in the present survey. Any further reference to dragonflies throughout this paper shall be to the Anisoptera.

Other names applied to the Anisoptera sometimes reflect how little is known about their habits. Three such names are "horse stingers", "snake doctor", and "devil's darning needle". Except for relatively

harmless spines on the legs, which aid in catching and holding prey, the dragonflies have no defense structures which would justify these names.

Another name sometimes used is "mosquito hawks". This name has justification, for the adult Anisoptera are great predators of mosquitoes (Needham and Westfall, 1955), as well as flies, wasps, moths, and even smaller dragonflies, and as larva, of earthworms, terrestrial beetles, and other small animals of the bogs (Watson, 1968).

Review of the literature. Dragonflies are beneficial to man. The local occurrence and/or disappearance of species of dragonflies, have very relevant connections with changes in the environment and possible pollution of bodies of water in which they are found. Odonata, occupants of a position at the apex of the predator-prey pyramid of invertebrate life, reflect any disturbance in faunae and act as final accumulators of persistent toxins in ponds, lakes, and streams (Montgomery, 1971). If for no other reason, more study is needed of the Odonata. This paper deals with only a minute fraction of the vast amount of unexplored facets of odonatology.

Johnson (1968), while studying phenomena affecting population regulation of Oplonaeschna armata Hagen, concluded that adult emergence and flying season are related to the annual air and water temperature cycles. Though annual temperatures were not studied in this survey, the highest and lowest temperatures of the air for the collection dates of each species sighted and caught are given. These dates and temperatures are given with the species in Table I. These temperatures are based on the temperatures recorded at Ozark Airlines in Clarksville, Tennessee. Ozark checks the temperature daily approximately every two hours from

6:00 A. M. through 6:00 P. M.

Another important aspect in odonatology is the effects of temperature on the movements of dragonflies. A study by Miller (1963) on temperature control had results which suggested that temperature may affect the motor neurones of the spiracle muscles either directly or via a controller neurone in the head.

Most species of Odonata are diurnal; they hunt by day (Moore, 1957). Others are crepuscular, flying at dusk or dawn while it is cooler, and perching by day. Miller (1964), quoting Corbet (1962, p. 125), states that "the behavior and time of flight (of dragonflies) are largely determined by the need to maintain a body temperature within the range at which spontaneous activity is possible".

Some dragonflies hunt by flying continuously, catching and consuming prey on the wing. Others perch in a prominent position and make short rapid flights at passing insects, seizing them on the wing, then returning to the perch to devour them. Miller has found that the perching habit seems to be more suited to small species of dragonflies, and the flying habit more suited to larger species.

Moore (1954) has found that population density is partly dependent on time of day and weather. Temperature varies throughout the day, affecting feeding habits and flight. The greatest population density of males in flight over water is determined by behavior of the species within that environment (Moore, 1962). The greatest population density for each species will vary with the temperature. A species which can withstand higher temperatures may be seen more often during the hotter periods of the day than a species which is more abundant, but must

remain in shaded areas until the cooler parts of the day.

Another important factor besides temperature that affects which species is found in an area is territoriality. Young (1965) states that many Odonata species show territoriality. This can be easily detected, for the male will fly about in approximately the same small area, chasing away other males which invade his territory. Occasionally a more aggressive dragonfly will chase away the owner of the territory, and take it for his own.

All these factors - temperature, weather, and species behavior such as hunting patterns and territoriality, as well as visibility around the area under surveillance - affect a survey of an area which involves the abundance of the dragonflies based primarily on sight. Constant fliers are more readily seen than the perchers, but are more difficult to catch.

Previous records of Montgomery County, Tennessee Anisoptera. Very little work has been done on the Anisoptera in Montgomery County, Tennessee. Wilson (1912) lists five species from the county that were collected in 1911. Included were Anax junius Drury, Gomphus plagiatus Selys, Pachydiplax longipennis Burmeister, Perithemis tenera Say, and Plathemis lydia Drury. Fletcher (1969) surveyed an area in the county, Marks' Slough, from April 16, 1969 through July 3, 1969. Fletcher records the presence of Pachydiplax longipennis and Plathemis lydia, which were on Wilson's list, and adds Epiaeschna heros Fabricius, Erythemis simplicicollis Say, Gomphus townesi Gloyd, Helocordulia selysii Hagen, Libellula cyanea Fabricius, Libellula luctosa Burmeister, Libellula pulchella Drury, Perithemis domitia Drury, Sympetrum rubi-

cundulum Say, and Sympetrum sp.

Perithemis tenera was found many times during the present study. Perithemis domitia was never found. Needham and Westfall (1955) records the distribution of Perithemis domitia as south of the United States, and no other records were found of the presence of this species in Tennessee, nor in any other state. Fletcher records collecting three specimens of the species. There is a possibility that Fletcher mistakenly identified Perithemis tenera as Perithemis domitia because of similiarity in appearance. The check list of the species of dragonflies in Montgomery County, Tennessee in Table III, and the list for Tennessee in Table IV, do not include Perithemis domitia.

An additional list of species found in the county was made from the identification cards for the private entomological collection of Dr. Floyd M. Ford, an entomologist at Austin Peay State University. This list is given in Table II.

The check list of the Tennessee dragonflies in Table IV includes Gomphus submedianus Williamson, Gomphus villosipes Selys, Gomphus consanguis Selys, Gomphus ventricosus Walsh, Gomphus exilis Selys, Anax longipes Hagen, Macromia alleghaniensis Williamson, Celithemis fasciata Kirby, Erythrodiplax minuscule Rambur, and Ladona deplanata Rambur reported by Trogdon (1962). Goodwin (1968) adds Gomphiaeschna antilope Hagen, Gomphus viridifrons Hine, Ophiogomphus mainensis Packard, Epicordulia regina Hagen, Tetragoneuria williamsoni Muttkowski, Celithemis monomelaena Williamson, and Ladona exusta Say. Hylogomphus brevis was reported by Cuyler (1968). The rest are from Fletcher.

CHAPTER II

METHODS AND MATERIALS

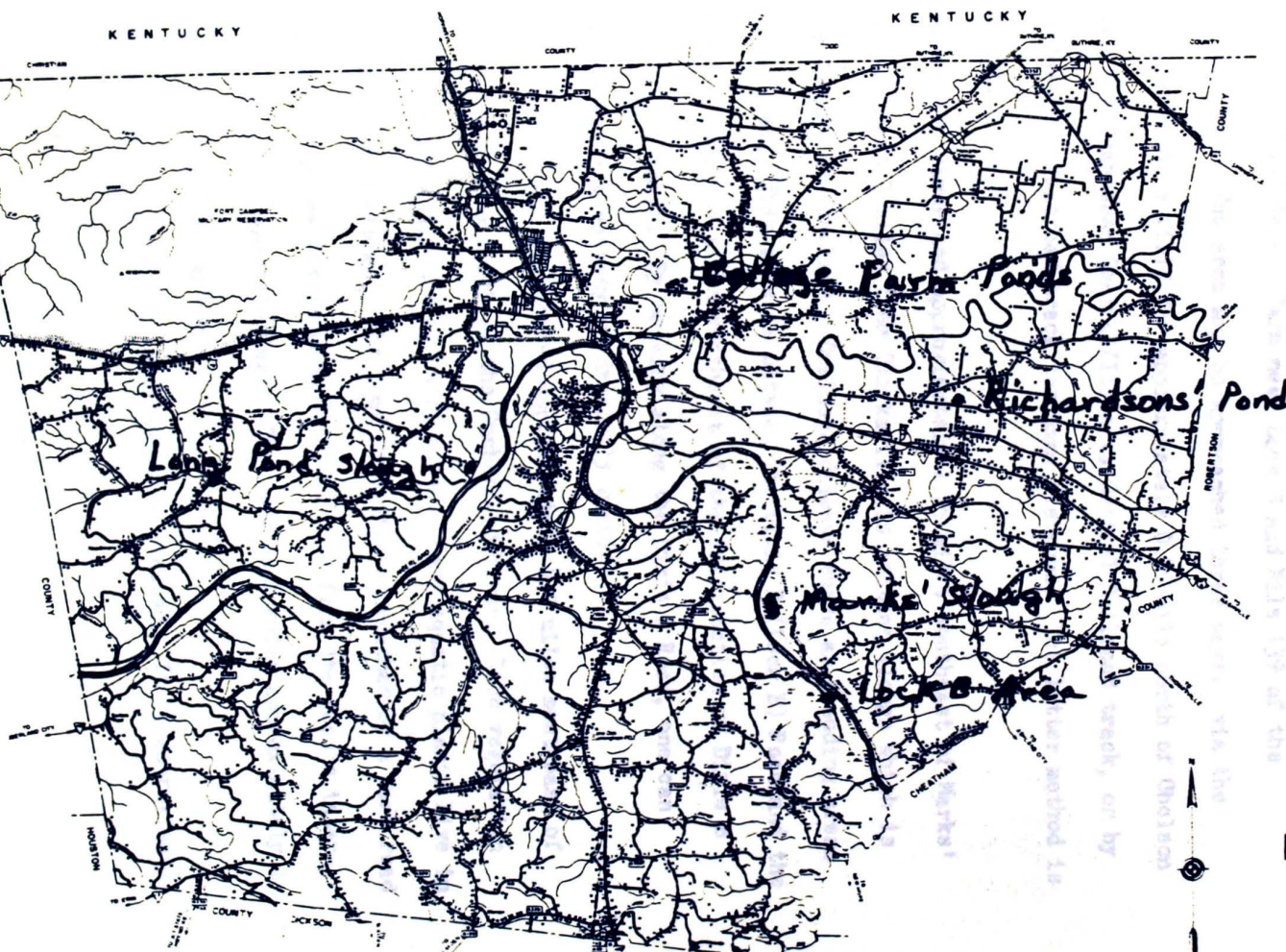
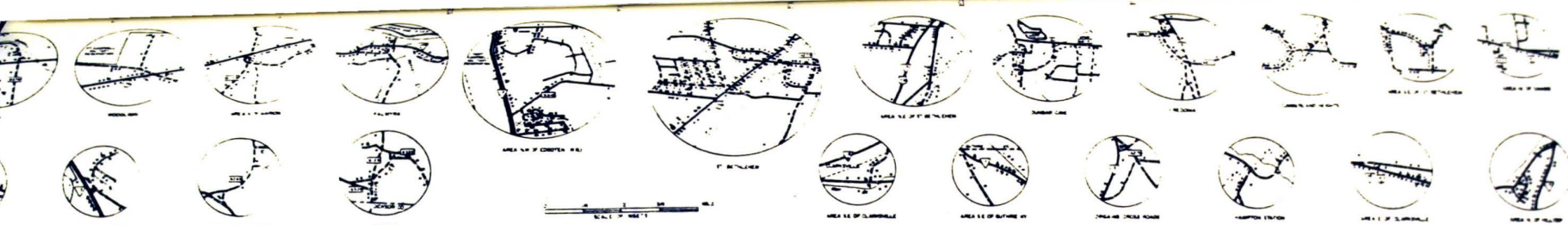
Though the survey began April 16, 1971, the first dragonfly was not seen until May 1, 1971. The last dragonfly was sighted October 16, 1971. The dates given in Table I do not include the times the sites were checked before each species was first seen, nor the times checked after it was last observed. Collection dates for each site observed during the study followed no pattern.

Due to the extensive area covered, it was impossible to spend much time at each site if all sites were checked in one day. Frequently observations were made from dawn until dusk, while on other days, only short periods were spent. Variations in the time of day for checking each site was practiced throughout the survey. This insured each site being observed a fairly equal amount of time during the more active times of day for each species.

Description of the study areas. Four sites scattered throughout the county were picked as good habitats for Anisoptera. Another area was frequently visited, and a surveillance for dragonflies was kept at all times when driving around in the county.

The four sites are Marks's Slough, Long Pond Slough, Richardsons' Pond, and the Austin Peay State University farm ponds. The area frequently visited is across the Cumberland River from Clarksville, Tennessee, approximately one mile southeast of Lock B along the Dixie B Road. These locations are marked in Figure I.

Marks' Slough, the area studied by Fletcher (1969), which is a reclaimed swamp, is an excellent area for dragonfly studies, for it provides the water necessary in the dragonfly's nymph stage and flora



GENERAL HIGHWAY MAP
MONTGOMERY COUNTY
 TENNESSEE

PREPARED BY
 TENNESSEE DEPARTMENT OF HIGHWAYS
 RESEARCH AND PLANNING DIVISION

which attracts the insects necessary for its food. The area, about one-half mile in length and approximately 60 yards wide, contains a freshwater spring which fluctuates in width and depth throughout the year. During rains, water from the surrounding land drains into this slough.

The slough is located about six miles south of Clarksville, Tennessee on Author Marks' farm near Lock B and Mile 139 of the Cumberland River. The area may be approached three ways: via the river, by crossing a field for approximately 0.25 mile north of Gholson Road near the Tennessee Central/Illinois Central Railroad track, or by walking down the railroad track the same distance. The latter method is the easiest.

Across the river and approximately 1.25 miles southeast of Marks' Slough, and about 7 miles from Clarksville, is another slough which is being reclaimed as farmland. Drainage ditches serve as breeding areas for dragonflies. This area is between the Dixie B (Lock B) Road and the Cumberland River, 3.7 miles southeast of the intersection of Dixie B and Chapel Hill roads. By walking along the Dixie B Road, one can observe and catch a variety of dragonfly species.

Long Pond Slough is located approximately 4.7 miles southeast of Clarksville on a farm north of the Cumberland River. Rich vegetation surrounds approximately ten acres of water. Many aquatic plants live in and on this narrow slough. The pond is easily approached by a farm road leading left from the Gip Manning Road 0.8 mile from the road's intersection with the Dodsonville Road. The pond is located approximately 1 mile from the Gip Manning Road.

Richardson's Pond is the smallest area studied. It is approximate-

ly 35 yards long and 25 yards wide at its longest and widest parts. Rains often have great effects on the water depths in the pond, sometimes causing the depth to increase as much as a foot. These changes can easily be seen by noticing the water level on the willow (Salix sp.) bushes and tree growing in the pond. On two sides, the pond is bordered by a fence covered with japanese honey suckles (Lonicera japonica). Grasses and scattered blackberry briars (Rubus argutus) border the other two sides.

Richardson's Pond is located about 2.7 miles east of Clarksville across the road from the end of the Sango Road at its intersection with Through Spring Road. The pond is in one corner of a pasture on a farm belonging to Mr. Tandy W. Richardson.

The Austin Peay State University farm is located 1.5 miles from Clarksville. Three of the ponds near the farm house were used in this study. Each pond was about the size of Richardson's Pond, and all were located in pastures. Grasses and a few trees surround the ponds. All ponds were easy to approach.

Materials used during the study. The materials used consisted of a net made from cheese cloth with a wire loop with a diameter of 10 inches and a handle 73 inches in length; a kill jar made from a fruit jar with alcohol and a klenex; boots for wading in water and as a protection against snakes; insect pins and styrafoam boards for spreading the collected dragonflies; and a dissecting microscope and hand lens to aid in identification. A lamp was used for quick drying the insects to retain color.

Methods used to survey the dragonflies. To find the species pres-

ent and their relative abundance, the dragonflies were observed and occasionally collected. Some of the collected ones were kept; others were released after identification. Many individuals were seen and recorded several times. By using this method rather than by counting only the collected dragonflies, an exact number of each species was not possible. This method was to get a relative abundance in comparison with other species in the county rather than to deplete the population. Examples of each have been placed in the collection of Dr. Floyd M. Ford, Entomologist at Austin Peay State University.

Generally, the dragonflies were caught while perching. A few were caught in flight.

A kill jar, along with the net, was taken to all collecting sites for the purpose of killing the captured dragonflies that were not to be released. After an insect died, it was taken from the jar, its wings spread straight out from its body, and dried by the heat of a lamp or by leaving it until the next day. Identification was then made using Needham and Westfall's, Dragonflies of North America (1955). Common names were taken from Berror's "Common Names for Odonata" (1963).

All collecting and observing was within the hours between dawn and dusk. Occasionally observations began before the dragonflies became active. At other times it continued until after activities ceased.

CHAPTER III

RESULTS

The results of this survey is summarized in Tables I, II, and III. Table I gives the species observed during the study, with the range of dates each was sighted and the highest and lowest temperatures for these observation days. Table II is taken from the collection records of Dr. Floyd M. Ford. Table III is a compilation of all known species for the county, and Table IV a compilation for the state of Tennessee. Table III contains the species from this survey, from Fletcher's (1969) survey, and from the collection records of Ford. Table IV's Check List of the Anisoptera of Tennessee is taken from Cuyler (1968), Trogdon (1962), Goodwin (1968), and Fletcher (1969).

During the study, 18 species were collected, identified, and observed. Five unidentified species were observed, but never collected. Four of these were seen at Marks' Slough. The other species was at the Lock B Area. These five are not included in Table I.

Seven of one of the unidentified species was observed. These were dark blue, almost black, and were about 3 inches in length. Their abdomens were narrow. Five were seen July 22, 1971, and two August 8, 1971. These were at Marks' Slough. The highest and lowest temperatures during the two days they were observed were 86 degrees Fahrenheit and 59 degrees Fahrenheit. These dragonflies are swift fliers, constantly moving.

Another species was observed several times, but was very cautious whenever a net approached. This dragonfly would occasionally perch, but was quickly on its way before it could be caught. The species is orange and brown, similar to Celithemis eponina Drury in color and shape, but

larger. These were observed from June 4, 1971 through July 3, 1971 at Marks' Slough. The highest temperature was 90 degrees Fahrenheit, and the lowest 62 degrees Fahrenheit during this time.

The third unidentified species was seen only at the Lock B Area along the Dixie B Road. This species has a blue and black striped abdomen. These swift dragonflies are fliers. None were ever seen perched. Males were guarding territories. Four of this species were spotted during the study. Three were seen June 29, 1971, and one seen July 3, 1971. The highest and lowest temperatures were 87 degrees Fahrenheit and 63 degrees Fahrenheit.

The fourth species was a yellow and black striped, long, narrow dragonfly. One was seen July 14, 1971 at Marks' Slough. The highest and lowest temperatures for that day were 90 degrees Fahrenheit and 71 degrees Fahrenheit. The dragonfly was a swift flier.

The fifth unidentified species had a light green background with black or dark blue stripes over the thorax and abdomen. The size and shape were similar to that of Anax junius. The only one sighted was at Marks' Slough. The highest and lowest temperatures for the day it was sighted, October 16, 1971, were 71 degrees Fahrenheit and 62 degrees Fahrenheit. This was a swift flier.

Small species found in the survey are perchers, with most large species fliers. Territoriality was noticed most among smaller species.

The 18 species which were identified range in number observed in the county from 1 to approximately 666. The species are arranged in Table I and below according to the number sighted. Some results not given in Table I are given below.

Pachydiplax longipennis was found in all collecting sites. The best location is Long Pond Slough. This small species is a percher and easily caught. Females may generally be found perching on vegetation around the pond. Males fly over the water more than the females, guarding their territories. The species may be found during most of the season, but especially from June 15th through July 3rd at Long Pond Slough. During this time, it is impossible to get an exact count of the vast number present. The figure "666" is an estimate for the total count.

Plathemis lydia was seen throughout the county, as well as in all the collecting sites. The best location is Marks' Slough. This medium size species was found more days than Pachydiplax longipennis, but the total number observed was less. The male is easily distinguished from the female by the color patterns on the wings. The female has three brown spots over a clear background on each wing; the male has one broad brown strip from front to back across the middle of each wing. Teneral (newly emerged dragonflies) were seen June 4th through June 22nd. Mature males have pruinose abdomens.

Erythemis simplicicollis females were seen for about two weeks before any males were sighted. The female's dominant color is green. The male is easily distinguished by its blue-green thorax and pruinose abdomen. Some territoriality was evident. The best site for collecting these medium size perchers is Long Pond Slough. This species was never seen at the Lock B Area.

Perithemis tenera is a colorful, small species which was found most at Richardsons' Pond. The ponds at the University Farm are also good

sites. This species was never sighted at the Lock B Area. Males are brown with bright yellow wings. Females have clear wings with brown and yellow spots. Males exhibit territoriality, staying over water most of the time. Females are found more often over land, perching on the vegetation.

Epiaeschna heros is a huge flier which was sighted most at the Lock B Area. These insects feed in the early morning and late afternoon hours. Generally flight is well above reach of a net, but occasionally one does swoop down low enough to be caught. When one perches, it is usually high in trees. This species was sighted at all sites except Richardsons' Pond. Territoriality was not noticed.

Libellula vibrans were found most often at Marks' Slough, but were seen several times at the Lock B Area. None were sighted at the other locations, though one was seen near the intersection of Preachers Mill Road with the State Line Road. These insects are the largest libellids found during the survey. Mature males have pruinose abdomens. Wings have smoke colored tips with a smoke colored nodus (small spot at the center of the anterior part of the wings). These fliers perch more often than any other flier observed. Males establish territories.

Pantala hymenea is a swift, medium size flier which is very difficult to catch. As with other dragonflies, teneral are the easiest to catch. Teneral make poor specimens, for the wings are faded in color and wings and abdomens are wrinkled. The species was found most often at Richardsons' Pond, with the University Farm Ponds the next best location. None were sighted at Marks' Slough.

Libellula luctuosa is a medium size percher. The pruinose abdomen

of the male distinguishes it from the female. These dragonflies were found at all sites, but the best site was Marks' Slough. Territoriality was evident.

Ajax junius were found most at the college farm. Some were sighted at all areas except the Lock B Area. These hugh fliers rarely stop to rest. Much time is spent in the early morning and late afternoon hours searching for food over vegetated land. Territoriality was not noticed.

Tramea lacerata is a very difficult species to catch. These strong fliers rarely rest, and are quick to fly when approached while perching. These skimmers were found at all sites, but most at Richardsons' Pond. They are easily distinguished from other species by the large red and yellow spot at the base of each wing.

Libellula pulchella resembles the Plathemis lydia female in coloration except for the pruinose spots on the wings of the male. The male is also larger. This species was sighted four times at Marks' Slough, once at the Lock B Area, and none at the other sites. Only males were noticed. They are swift fliers.

Gomphus sp. was sighted three times at Marks' Slough, and twice at Richardsons' Pond. Territoriality was noticed. This species closely resembles Erythemis simplicicollis in size and color. The red segments at the posterior end of the abdomen distinguish it without making a close examination.

Sympetrum rubicundulum was found at the Lock B Area three times, and once at Marks' Slough. This tiny red species is a percher.

Epicordulia princeps is another species which resembles the Plathemis lydia female. It is easily distinguished by its narrow abdo-

men and large size. This species exhibits territoriality. Only one female was seen. The only place the species was sighted was around Richardsons' Pond.

Tramea carolina resembles Tramea hymenea, but has a dark red spot which is almost black at the base of the wings. This species was sighted twice at Richardsons' Pond. These are swift fliers and hard to catch.

Gomphus vastus was found only once. This was at the Lock B Area early in the morning before any dragonflies were sighted in flight. The species was perched on a plant and easily caught. This Gomphus differs from the other clubtails caught by its unusually large "club" at the posterior end of the abdomen.

Gomphus sp. was sighted and caught at Long Pond Slough. It was perching when sighted. Only one was seen during the survey.

TABLE I
ANISOPTERA COLLECTED IN MONTGOMERY COUNTY, TENNESSEE

Species	Total Number Sighted	Range of Collection Dates in 1971	High/Low Temperatures- F°
<u>Pachydiplax longipennis</u>	*666	May 8-September 11	93 - 54
<u>Plathemis lydia</u>	555	May 1-September 25	93 - 54
<u>Erythemis simplicicollis</u>	336	May 15-September 25	93 - 48
<u>Perithemis tenera</u>	254	May 15-September 25	90 - 48
<u>Epiaeschna heros</u>	34	May 15-July 9	88 - 48
<u>Libellula vibrans</u>	32	May 22-August 7	90 - 53
<u>Pantala hymenea</u>	28	June 22-September 11	87 - 61
<u>Libellula luctuosa</u>	23	June 10-August 28	90 - 55
<u>Ajax junius</u>	22	June 21-August 28	80 - 55
<u>Libellula cyanea</u>	13	June 1-July 22	90 - 59
<u>Tramea lacerata</u>	12	June 22-August 12	86 - 62
<u>Libellula pulchella</u>	8	June 10-August 28	86 - 55
<u>Gomphus</u> sp.	7	June 10-June 16	85 - 62
<u>Sympetrum rubicundulum</u>	6	June 16-October 16	90 - 62
<u>Epicordulia princeps</u>	6	May 31-June 3	90 - 62
<u>Tramea carolina</u>	2	June 8-June 10	83 - 62
<u>Gomphus vastus</u>	1	June 22	82 - 67
<u>Gomphus</u> sp.	1	June 15	83 - 70

*Estimate.

TABLE II

A CHECK LIST OF THE MONTGOMERY COUNTY, TENNESSEE ANISOPTERA
IN THE COLLECTION OF DR. FLOYD M. FORD (AUGUST 30, 1971)

Family Aeschnidae

Basiaeschna janata Say

Boyeria vinosa Say

Epiaeschna heros Fabricius

Family Libellulidae

Tetragoneuria cynosura Say

Perithemis tenera Say

Celithemis elisa Hagen

Celithemis fasciata Kirby

Libellula cyanea Fabricius

Libellula luctuosa Burmeister

Plathemis lydia Drury

Sympetrum semicinctum Say

Erythemis simplicicollis Say

Pachydiplax longipennis Burmeister

Tramea carolina Linnaeus

Tramea lacerata Hagen

Pantala hymenea Fabricius

TABLE III

A CHECK LIST
OF THE MONTGOMERY COUNTY, TENNESSEE ANISOPTEROUS ODONATA
WITH COMMON NAMES SUGGESTED BY BORROR (1963)

Family Gomphidae - Clubtails

Gomphus plagiatus Selys - Slanted Clubtail

Gomphus townesi Gloyd - Townes' Clubtail

Gomphus vastus Walsh - Desolate Clubtail

Gomphus sp.

Gomphus sp.

Family Aeschnidae - Darner

Basiaeschna janata Say - Janata Darner

Boyeria vinosa Say - Yellow-Spotted Streamer Darner

Anax junius Drury - Common Green Darner

Epiaeschna heros Fabricius - Hero Darner

Family Libellulidae - Common Skimmers

Epicordulia princeps Hagen - Royal Skimmer

Tetragoneuria cynosura Say - Dog-Tail Skimmer

Helocordulia selysii Hagen - Selys' Skimmer

Perithemis tenera Say - Common Amber-Wing

Celithemis elisa Hagen - Elisa Spotted Skimmer

Celithemis fasciata Kirby - Banded Skimmer

Libellula cyanea Fabricius - Blue Skimmer

Libellula luctosa Burmeister - Widow Skimmer

Libellula pulchella Drury - Ten-Spot Skimmer

Libellula vibrans Fabricius - Sparkling Skimmer

Plathemis lydia Drury - Common White-Tailed Skimmer

Sympetrum rubicundulum Say - Common Red Skimmer

Sympetrum semicinctum Say - Brown-Winged Red Skimmer

Sympetrum sp.

Erythemis simplicicollis Say - Green-Jacket Skimmer

Pachydiplax longipennis Burmeister - Blue Pirate

Tramea carolina Linnaeus - Carolina Raggedy Skimmer

Tramea lacerata Hagen - Common Raggedy Skimmer

Pantala hymenea Fabricius - Brown-Spotted Globe Skimmer

TABLE IV

A CHECK LIST OF THE TENNESSEE
ANISOPTEROUS ODONATA

Family Petaluridae

Tachoperteryx thereyi Hagen

Family Cordulegasteridae

Cordulegaster diastatops Selys

Cordulegaster erroneus Hagen

Cordulegaster maculatus Selys

Cordulegaster obliquus Say

Family Gomphidae

Progomphus obscura Rambur

Hagenius brevistylus Rambur

Ophiogomphus mainensis Packard

Ophiogomphus rupinsulensis Walsh

Ereptogomphus designatus Hagen

Gomphus brevis Hagen

Gomphus crassus Hagen

Gomphus dilatatus Rambur

Gomphus exilis Selys

Gomphus hybridus Williamson

Gomphus notatus Rambur

Gomphus pallidus Rambur

Gomphus plagiatus Selys

Gomphus quadricolor Walsh

Gomphus rogersi Gloyd

Gomphus scudderi Selys

Gomphus spiniceps Walsh

Gomphus submedianus Williamson

Gomphus townesi Gloyd (State record by Fletcher, 1969)

Gomphus vastus Walsh

Gomphus venticosus Walsh

Gomphus villosipes Selys

Dromogomphus spinosus Selys

Lanthus abistylus Hagen

Family Aeschnidae

Gomphiaeschna antilope Hagen

Boyeria vinosa Say

Boyeria grafiana Williamson (State record by Fletcher, 1969)

Anax junius Drury

Anax longipes Hagen

Basiaeschna janata Say

Nasiaeschea pentacantha Rambur

Epiaeschna heros Fabricius

Aeschna constricta Say

Family Macromiidae

Macromia alleghaniensis Williamson

Macromia georgia Selys

Macromia illinoisensis Walsh

Macromia taeniolata Rambur

Didymops transversa Say

Family Corduliidae

Neurocordulia obsoleta Say

Neurocordulia virginiensis Davis

Epicordulia regina Hagen

Epicordulia princeps Hagen

Tetragoneuria cynosura Say

Tetragoneuria Williamsoni Muttkowski

Somatochlora filosa Hagen

Somatochlora linearis Hagen

Somatochlora tenebrosa Say

Somatochlora williamsoni Walker

Platycordulia xanthosoma Williamson

Helocordulia uhleri Selys

Helocordulia selysii Hagen (State record by Fletcher, 1969)

Family Libellulidae

Ladona deplanata Rambur

Ladona exusta Say

Libellula auripennis Burmeister

Libellula cyanea Fabricius

Libellula flavida Rambur

Libellula incesta Hagen

Libellula luctuosa Burmeister

Libellula pulchella Drury

Libellula pulchella Drury

Libellula semifasciata Burmeister

Libellula vibrans Fabricius

Plathemis lydia Drury

- Perithemis tenera Say
- Celithemis elisa Hagen
- Celithemis fasciata Kirby
- Celithemis eponina Drury
- Celithemis monomolaena Williamson
- Erythrodiplax minuscule Rambur
- Sympetrum ambiguum Rambur
- Sympetrum corruptum Hagen
- Sympetrum rubicundulum Say
- Sympetrum semicinctum Say
- Sympetrum vicinum Hagen
- Leucorhinia intacta Hagen
- Pachydiplax longipennis Burmeister
- Erythemis simplicicollis Say
- Pantala hymeneae Say
- Pantala flavescens Fabricius
- Tramea lacerata Hagen
- Tramea onusta Hagen
- Tramea carolina Linneus
- Tramea abdominalis Rambur

CHAPTER IV

DISCUSSION AND CONCLUSIONS

Of the five areas surveyed in Montgomery County, Tennessee, the best area is Marks' Slough. Of the 23 species observed in Montgomery County during the study, sixteen were seen at Marks' Slough. Twelve species were sighted at Richardsons' Pond, the smallest area studied. Many of these species probably were from other ponds in the community, for they were often seen flying to or from the pond across the pasture. Some species were only seen on rare occasions, some only once, and were never observed defending a territory. Often males with territories around the pond were seen chasing visiting males from their territories.

The Lock B Area was used as a site less than the other areas. Eleven species were seen here. Most of these were also observed at the nearby Marks' Slough. Vegetation in the two areas is similar.

Ten species were observed at Long Pond. The total number of dragonflies here was higher than any other area. Pachydiplax longipennis was sometimes seen in such an abundance it was impossible to count them accurately. The figure given in Table I is a rough estimate of the number observed. Probably many others were perching in grass or trees where they could not be easily seen. During the same month, more Erythemis simplicicollis than usual were sighted.

Only eight species were seen at the Austin Peay State University Farm Ponds. Cows in the pastures generally keep much of the grass around the ponds eaten. Many dragonflies prefer tall grass for perching.

Though observations were made from dawn until almost dark, no dragonfly was ever observed before 7:30 A. M., nor after 8:30 P. M. Central

Standard Time. An intensive study of the factors determining the activity periods of the dragonflies in the county was not made, though studies by other authors have determined that temperature is a primary factor [Johnson (1968), Miller (1963 and 1964), Moore (1954), and others]. Weather is another factor. No dragonflies were observed flying during rains except during the first few sprinkles. With completion of a rain, these dragonflies would suddenly appear and fly as usual for the species.

A comparison of the species found in Table II with those in Table III reveals nine species present in the county not found in this survey. These are Gomphus plagiatus, reported by Wilson (1912); Gomphus townesi and Helocordulia selysii, reported by Fletcher (1969); and Basiaeschna janata, Boyeria vinosa, Celithemis elisa, Celithemis fasciata, Sympetrum semicinctum, and Tetragoneuria cynosura, recorded in Ford's collection records (1971).

Several species found in this survey were recorded only by one other. These are Pantala hymenea, Tramea lacerata, and Tramea carolina in Ford's collection; Ajax junius, reported by Wilson; and Sympetrum rubicundulum reported by Fletcher.

The species found in the survey, by Fletcher, and by Ford are Erythemis simplicicollis, Libellula pulchella, Libellula luctuosa, Libellula cyanea, and Epiaeschna heros.

Only three species were found by all four collectors. These are Pachydiplax longipennis, Plathemis lydia, and Perithemis tenera (listed as Perithemis comitia by Fletcher).

Three new species have been added to the list of anisopterous

Odonata in Montgomery County, Tennessee as a result of the survey.

These are Gomphus vastus, Epicordulia princeps, and Libellula vibrans.

The unknown specific names of known genera were not figured in these comparisons. Some of these may be the same as known ones by another author. Due to variations in wing venation and keys that were written for identifications based on normal venation, positive identification is not always possible.

The first species sighted during the survey was seen at the Austin Peay State University Farm Ponds May 1, 1971. The last species seen here was seen September 25, 1971. Long Pond Slough and Marks' Slough were the next locations with adults. This was May 8, 1971. The last dragonflies were seen at Marks' Slough on October 16, 1971. The last for Long Pond Slough was September 25, 1971. No dragonflies were seen at Richardsons' Pond until May 31, 1971. The water level was a foot higher than it had been on previous visits. The temperature was 83 degrees Fahrenheit. The last species was seen at this pond September 11, 1971. Lock B Area had dragonflies from June 7, 1971 through August 7, 1971. As this area was not visited before June 7th, dragonflies possibly were here before this date.

Limited time for this survey prevented a complete list of all species occurring in the county. A survey covering a period of several years would be ideal for adding to the check list. This fact is stressed by the number of species found in Ford's collection, covering a number of years, not found in this survey.

CHAPTER V

SUMMARY

Five areas in Montgomery County, Tennessee were surveyed for dragonflies from April 16, 1971 through October 30, 1971. Twenty-three species were sighted; only 18 were collected and identified. Sixteen of the 23 species were seen at Marks' Slough, the best area of the five for studying the anisopterous Odonata.

The 18 identified species in order of relative abundance were Pachydiplax longipennis Burmeister, Plathemis lydia Drury, Erythemis simplicicollis Say, Perithemis tenera Say, Epiaeschna heros Fabricius, Libellula vibrans Fabricius, Pantala hymenea Fabricius, Libellula luctuosa Burmeister, Ajax junius Drury, Libellula cyanea Fabricius, Tramea lacerata Hagen, Libellula pulchella Drury, Gomphus sp., Sympetrum rubicundulum Say, Epicordulia princeps Hagen, Tramea carolina Linnaeus, Gomphus vastus Walsh, and Gomphus sp.

Some environmental factors affecting dragonflies were considered with the aid of literature.

All previous county records were compared with the survey, and a check list made of the Montgomery County, Tennessee anisopterous Odonata. A check list of the Tennessee dragonflies was also compiled. Three new records were added to the county list. None was added to the state list.

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