

OCCASIONAL PAPERS OF THE MUSEUM OF  
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

PUBLISHED BY THE UNIVERSITY

NOTES ON CELITHEMIS WITH DESCRIPTIONS  
OF TWO NEW SPECIES (ODONATA)

BY E. B. WILLIAMSON

Mr. Jesse H. Williamson collected dragonflies in Florida from March 1 to April 26, 1921. Localities visited and dates are as follows: Sebring, March 1; Fort Myers, March 3-7 and 10-19; Taxambas, Marco Island, March 8; Labelle, March 21-27; Moore Haven, March 29 and 30 and April 2; Palm-dale, March 31 and April 3-8; enroute Moore Haven to West Palm Beach, across Lake Okeechobee, April 9; Miami, April 12; Enterprise, April 15-26. From April 29 to May 9 he collected at Kathwood, Aiken County, South Carolina, but at this time most of the species observed were just emerging. Among the 4,547 dragonflies collected on the trip are several new and many interesting things.

At Enterprise he found four species of *Celithemis*, one of which was closely related to another species, taken earlier on the trip as well as at Enterprise, but which he recognized in the field as specifically distinct. In order to place this species

properly I found it necessary to study carefully the smaller species of the genus, heretofore known as *ornata* and *amanda*. The larger species, *eponina*, *elisa*, *fasciata* and *monomelaena*, seem well enough known, but they are included briefly in the following key for the sake of completeness. The smaller species are treated in more detail, for this study has shown that no less than three species have been included under the name *ornata*.

In addition to specimens collected by Jesse H. Williamson, I have seen specimens from the following collections: the Academy of Natural Sciences, abbreviated A. N. S. in the text, through the kindness of Dr. Calvert; the Museum of Comparative Zoology, abbreviated M. C. Z. in the text, through the kindness of Mr. Banks; the United States National Museum, abbreviated U. S. N. M. in the text, through the kindness of Miss Currie; Ohio State University, abbreviated O. S. U. in the text, through the kindness of Dr. Kennedy; and the private collections of Mr. Davis, abbreviated W. T. D. in the text, and Dr. Ris, abbreviated Ris in the text. Specimens in my collection are indicated by the abbreviation E. B. W. Mr. Davis kindly gave me the male and female of *Celithemis martha*, which I have designated as type and allotype. To Drs. Calvert and Ris I am indebted for suggestions and advice received during the course of this study. The wing photographs for the two plates were made by Miss Mina L. Winslow.

#### *Key to the Species of Celithemis*

1. Wings with postnodal markings. Rs and Rspl separated by two cell rows or at least a few double cells..... 2.
- 1'. Wings without postnodal markings. Rs and Rspl separated by a single cell row with very rarely a single double cell. 5.
- 2(1). Wing membrane yellow to orange, a band of darker color across the wing just before the stigma; other wing mark-

- ings all antenodal or extending beyond the nodus only posterior to the costa.....*eponina*.
- 2'. Wing membrane hyaline; a colored area distal to the stigma and another midway between stigma and nodus, the two areas varying greatly in size..... 3.
- 3 (2'). Spot between nodus and stigma rounded and not reaching the costa; a smaller spot, sometimes wanting, on the anterior end of the triangle in the front wing extending forward at a maximum to  $M_{1-3}$ , no other antenodal markings in the front wing; antenodals and postnodals more or less darker edged, especially the basal antenodals of the second series ..... *elisa*.
- 3'. Spot between nodus and stigma not rounded, reaching the costa broadly and often divided or constricted into an anterior and a posterior portion; a larger or smaller colored area or areas proximal to the nodus in the front wing, especially between Sc and R, where the colored area may extend from the wing base to the nodus; antenodals and postnodals not darker edged excepting sometimes the former in areas in which, in other specimens, the entire membrane is dark..... 4.
- 4 (3'). Wing markings relatively reduced in area, brown or black in color with paler areas hyaline, antenodal dark area in front wing extending posteriorly no farther than Mspl.....  
..... *monomelaena*.
- 4'. Wing markings relatively more extensive in area, brown or black in color with the enclosed pale basal area in the hind wing and sometimes other antenodal pale areas more or less yellowish or orange tinged; antenodal dark area in front wing extending posteriorly across  $Cu_1$ .....*fasciata*.
- 5 (1'). Two rows of cells between  $M_4$  and  $Cu_1$ , in the front wing at about the level of the nodus (Mspl not well developed, separated from  $M_4$  and from  $Cu_1$  by one row of cells)..... 6.
- 5'. Three rows of cells between  $M_4$  and  $Cu_1$ , in the front wing at about the level of the nodus (Mspl well developed, separated from  $M_4$  by one row and from  $Cu_1$  by two rows of cells) ..... 7.
- 6 (5). A double cell between  $Cu_1$  and  $Cu_2$  in the hind wing at their origin. Thirteen or more cells between  $Cu$  spl ( $A_2$ ) and  $A_2$  ( $A_3$ ) in the hind wing (any double cell counted as one). Three cells in the first row distal to the triangle in the hind wing. *Face and frons* above pale yellowish or greenish, frons darkening to a reddish yellow in old males; frons dark at base in a triangular area which surrounds the median ocellus with a border about as wide as

the long axis of the ocellus; frontal vesicle largely or entirely pale colored, darkening to yellowish or greenish brown with age. *Dorsal thoracic* dark area brown, not sharply defined, roughly quadrangular in shape; a narrow, short, dull stripe above on the humeral and second lateral sutures and a trace of color about the metastigma. *Abdominal segment* 3 yellow with an apical black ring; 4 with this apical ring produced anteriorly, in lateral view triangular in shape with the apical transverse carina and the lateral carina the two short sides of the triangle, not reaching the median transverse carina; 5-7 each with the black area of the preceding segment produced to and encircling the base, enclosing a dorsal yellow spot on each segment; 8-10 black; superior appendages of male same color as dorsal pale spots on 5-7. *Front wing* hyaline, usually with the area between Sc and R as far as the first antenodal, and the cubital space as far as the cubito-anal crossvein, and sometimes the cells posterior to A to about the same level, yellowish tinged. Base of hind wing yellow tinged to the level of the third antenodal along the costa and to or near the point of forking of  $M_{1-2}$  and  $M_3$  and the distal angle of the anal loop, except the median space, the area between R and  $M_{1-3}$  and the extreme posterior border which are scarcely or not at all tinged; in this yellowish area are the following darker markings; an oblique spot or stripe (*a*) posterior to the cubito-anal crossvein and extending backward and inward to the wing margin; a spot (*b*) covering the triangle, the supertriangle, the area between  $M_{1-3}$  and  $M_4$  adjoining the supertriangle, and a small area of the cubital space adjoining the triangle; a large rounded area (*c*) occupying the basal posterior wing area, its anterior point, along the side of Cu spl, separated from A by four or five cells; from this anterior point with its inner anterior margin parallel to the posterior border of spot *a*, its outer anterior border formed by Cu spl; posteriorly it reaches to within one or two cells of the wing margin; a diffuse area or stripe (*d*) across the wing joining the distal anterior end of spot *b* with spot *c* along Cu spl posterior to the distal fork in Cu spl; costa yellow or yellowish at base to at least the first antenodal; veins in colored area of hind wing yellow or reddish.... *amanda*.

- 6'. A single row of cells between  $Cu_1$  and  $Cu_2$  in the hind wing at their origin. Eleven or fewer cells between Cu spl ( $A_2$ ) and  $A_2(A_3)$  in the hind wing. Two cells in the first row distal to the triangle in the hind wing. *Face*

pale colored, the labrum and frons yellower, the frons in younger males and in females with black at base as in *amanda*; at an early age the entire frons of the male becomes dark or black and in the oldest specimens the entire face is black with the frons shining black; frontal vesicle pale colored over a limited area at the apex only, if at all, usually light brown, darkening with age, shining black in the adult male. *Dorsal thoracic* dark area wider than in *amanda*, always distinctly widened above; on either side the mesepisternum with a large, rounded brown spot which attains the upper and lower extremities of the sclerite only along the humeral suture; a small brown area above and including the metastigma, and a less distinct narrow stripe above on the second lateral suture; this thoracic pattern is soon lost by maturing males which, in the oldest individuals, have the thorax and abdomen black, the thorax shining and bluish. *Abdominal segment* 3 yellow with an apical black ring produced anteriorly on the side nearly or quite to the median transverse carina; 4 with this anteriorly directed black expanded into a quadrangular lateral stripe which parallels and includes the lateral carina and reaches the median transverse carina; 5-10 similar to *amanda* with the yellow spots on 5-7 slightly smaller; superior appendages of male darker apically, the base yellowish brown till in the mature specimen, when the appendages, like the entire abdomen, become black. *Wing* markings very variable; the front wing of the males hyaline, sometimes with a trace of yellowish at the base, and the first antenodal of the second series clouded; in the females at the minimum in the front wing the first antenodal of the second series and the cubito-anal crossvein are slightly edged or clouded and there are basal tinges of yellowish; at the maximum the base of the front wing, excepting the areas on either side of the arculus, is yellowish tinged as far as the third antenodal and the proximal side of the triangle with the three basal antenodals of the second series and the cubito-anal crossvein edged to form rounded spots. Base of hind wing yellow tinged and brown marked at a minimum to scarcely the level of the second antenodal, in which case spot *b* is reduced, and at a maximum to slightly beyond the third antenodal; in some cases the entire colored area is brown with little or no yellowish, though the area enclosed or bordered by spots *a*, *b*, *c* and *d* is always yellow in the female and usually so in the male; in other cases in the male this area is brown or black and the

identity of the several spots is lost in the uniformly colored area; area anterior to spots *a* and *b* yellow tinged in the female, hyaline in the male, with an added spot or stripe (*e*) in both sexes which extends from the wing base between Sc and R and to a lesser extent between C and Sc along Sc at a minimum to the first antenodal and at a maximum to slightly beyond the third; at the distal end this spot *e* may be joined with *b*, spots *a* and *b* joined by a colored area in the median space, thus differing from *amanda*, which has *a* and *b* not joined and which lacks the spot *e*; spots *a* and *c* not joined in the female, joined or not along the wing margin in the male; spot *d* present or lacking in both sexes, usually at least a trace of it present and often it joins spots *b* and *c*; wing veins black or dark except sometimes some of the antenodals which may be paler; costa at base always brown to black; veins in the colored area of the hind wing of females and younger males yellow, in adult males dark brown or black. A close relative of *ornata*, which it most resembles in wing coloration and from which it is separated at once by the color of the thorax and by having only two rows of cells between  $M_4$  and  $Cu_1$  in the front wing at about the level of the nodus.....*martha*, n. sp.

- 7 (5'). Triangle of front wing followed by three cells, followed by three (81.54% of 65 wings examined). *Side of abdominal segment 4* with a large quadrangular black area which reaches the median transverse carina in front and is produced dorsally behind to encircle the segment (in some females there is a pale colored streak in the black area); 5-10 similar to those of *martha*, male appendages black. *Black at base of frons* in both sexes regardless of age more extensive than in the females and the youngest males of *martha*, being about half again as wide; in *ornata* this pattern is retained even by the oldest males and in no case is there the subsequent loss of pattern and entire blackening of frons and face which occurs in ageing males of *martha*; the face darkens with age in *ornata*, but it remains yellow or yellowish brown; frontal vesicle largely pale colored, darkening to yellowish or greenish brown with age. *Thoracic markings* similar in the two sexes; dorsal black stripe large, quadrangular in shape, the lateral margins concave; humeral black stripe wide, widened near its upper end so the pale area on either side enclosed by the dorsal and humeral black areas is elliptical below, constricted above and, following this constriction, again

expanded at its upper extremity in a flattened triangular area, giving the entire pale area in general the shape of a fish; metastigma covered by a large quadrangular black area which extends upward about half the height of the thorax, joined at its lower anterior corner by a curved stripe with the humeral stripe below, and at its upper posterior corner by a dorso-posteriorly directed stripe with a black stripe on the second humeral suture; the pale area on the mesepimeron and the pale area above on the metepisternum are thus joined into one area which is separated from the pale area below on the metepisternum; in old males the pale thoracic color becomes dark reddish brown instead of yellow as in females and younger males, but in the oldest specimens seen the thoracic pattern is still discernible; the same is true of the abdomen, and in no case is there the complete blackening of both thorax and abdomen, especially of the thorax, attained by males of *martha*. *Wing markings* very similar to *martha*, but in extreme cases the colored areas are more reduced than in *martha* and, at the other extreme, the areas are never as extensive as in the most highly colored specimens of *martha*; in the darkest males of the two species the only difference is the more extensive posterior development of spot *c* and the complete joining of spots *b* and *c* by *d* in *martha*, while in *ornata* *c* is more widely separated from the posterior wing margin and *d* is never represented by more than a spot between *b* and *c*, and *a* and *c* are never connected along the wing margin, thus leaving the yellow-tinged areas enclosed by these spots much more extensive in *ornata* than in *martha*. In male *ornata* at the minimum the front wing is entirely hyaline; in the hind wing *e* is wanting, but the first antenodal of the second series is brown-edged; *a* occupies the cubital space from the base to beyond the cubito-anal crossvein and extends posteriorly along the edge of the wing; *c* is represented by an area of about the same size as *a* and is bounded distally by Cu spl; basally it does not attain the wing border; *b* and *d* are wanting. In the darkest males there is a trace of basal yellow in the front wing in addition to the dark edging of the first antenodal of the second series and a lesser edging of the cubito-anal crossvein; in the hind wing *e* is present to slightly beyond the third antenodal; *a* and *b* are present and are joined; *c* is well developed but separated from the posterior margin by two or three cells; and *d* is present as a spot midway between the distal extremities of *b* and *c*.

In the most reduced females the frong wing is entirely hyaline and in the hind wing only spots *a* and *c* remain as small, narrow streaks with the area between them yellow tinged; the cubito-anal crossvein is dark edged, but otherwise the cubital space is unmarked, being yellow tinged basally to the cubito-anal crossvein, and hyaline distally. In the darkest females in the front wing the first two antenodals of the second series and the cubito-anal crossvein are dark edged and the cubital space is yellow tinged as far as the level of the arculus; in the hind wing *e* extends to the first antenodal of the second series and the second and third antenodals of the second series are broadly dark edged; *a* and *b* are present and joined; *c* is present and is a little larger than *a*; there is no trace of *d*. Costa in adult males brown or yellowish brown at base, yellow and brown in females and younger males; venation dark or black except usually some of the antenodals, which are yellow or yellowish, and the veins in the colored area of the hind wing, which are yellow in females and younger males and red in adult males.....*ornata*.

- 7'. Triangle of front wing followed by three cells, followed by two cells for one-three rows, then three (94.74% of 76 wings examined). *Side of abdominal segment 4* black as in *ornata*, but with a pale spot, usually triangular in shape in the black area, the pale spot, with its apex directed posteriorly, often reaching from the median transverse carina posteriorly along the lateral carina almost to the apex of the segment, so the black in such cases is reduced to a triangular area, lying dorsal to the pale spot, with its apex directed anteriorly, and extending from the base of the segment to the median transverse carina; 5-10 similar to those of *ornata*; superior appendages of male with the apical half above yellowish brown or brown, becoming black in the oldest specimens; inferior appendage and base of the superiors black; (in *martha* the base of the superior appendages in younger males is pale; in *bertha* the base is dark and it is the apex which is pale). *Black at base of frons* slightly more reduced than in *martha*; in the males the frons never blackens with age, but the entire face and frons, except the basal black, changes from yellowish or greenish to bright red; frontal vesicle largely pale colored, becoming dark red in adult males. *Thoracic markings* dissimilar in the two sexes; in the female similar to that of *ornata* with the dorsal black area usually somewhat more reduced so the pale antehumeral stripe is wider and less



constricted above; in the male the dorsal area is reduced to a narrow triangle with the lateral sides concave so the dorsum of the thorax is largely yellow in young and red in older males; side of thorax similar in the two sexes and similar to that of *ornata* except that the dorso-posteriorly directed stripe from the quadrangular black area covering the metastigma is wanting, so that the pale area on the mesepimeron, the pale area above on the metepisternum and the pale area below on the metepisternum are all joined above; color pattern of thorax and abdomen retained in the oldest males as in *ornata*, the darkening pale color redder in *bertha* than in *ornata*. *Wing markings* more reduced than in *ornata* and *martha*, those most reduced being less colored than in the most reduced specimens of the other two species, and in the most highly colored males of *bertha* the colored area is less than the most reduced males of *martha* and but little more extensive than the most reduced males of *ornata*. In the most reduced males the front wing is entirely hyaline; in the hind wing the cubital space is yellow as far as the cubito-anal crossvein; spot *a* is a small, rounded spot reaching A and the wing margin; *c* is represented by the merest edging of two or three veins on the posterior margin of the yellow area which surrounds spot *a*; all other spots wanting. In the darkest males in the front wing the area between Sc and R to the first antenodal and the cubital area halfway to the cubito-anal crossvein are yellow tinged; in the hind wing the base is yellow tinged between Sc and R and to a lesser extent between C and Sc to the second antenodal; the median space is largely yellow tinged and the cubital space entirely so except where limited darker color occurs; spot *a* is present, slightly larger than in those specimens with reduced coloration; *b* is present as a small spot or area on the proximal side of the triangle and *a* and *b* are narrowly joined; *c* is about as large as *a* and *b* together; it extends distally only as far as the level of the proximal side of the triangle; there is no trace of *d* or *e*. The description of the most reduced male wings will apply to all the females seen, except that the hind wing, in addition to the markings described for the male, is tinged with yellow at the base between C and R as far as the first antenodal. C and R in the male pale and reddish (or yellowish in tenerals) to the stigma; in the female the costa at base, some antenodals, and the veins in the colored wing area in the hind wing, yellow, other veins in the

female wing dark or black; in the male the wing veins basal to a line drawn from about the first or second post-nodal to the wing margin posterior to the triangle in the front wing, and to near the posterior end of the anal loop in the hind wing, bright red (yellow or pinkish yellow in teneral).....*bertha*, n. sp.

#### VENATIONAL CHARACTERS OF FOUR SPECIES OF *CELITHEMIS*

Tabulation based on ten wings of each species. Figures in tabulation are percentages. The number of cells enclosed by *R*spl and *M*spl is sometimes uncertain because of indefiniteness proximally or distally of these sectors, or their lack of definiteness throughout. In such cases the number of cells is indicated in the tabulation as doubtful.

<i>Characters</i>		<i>amanda</i>	<i>martha</i>	<i>ornata</i>	<i>bertha</i>
Antenodals, front wing .....	{ 7			100	50
	8	90	60		50
	9	10	40		
Antenodals, hind wing .....	5	100	100	100	100
Postnodals, front wing .....	{ 5	10			
	6	90	10	80	100
	7		80	20	
	8		10		
Postnodals, hind wing .....	{ 6	70	10	20	10
	7	20	60	50	60
	8	10	30	30	30
Last antenodal front wing:					
Continuous .....				70	30
Discontinuous .....		100	100	30	70
Unopposed basal postnodals, front wing .....	{ 2	30	30	40	70
	3	70	70	60	30
Unopposed basal postnodals, hind wing .....	{ 2	60	40	40	40
	3	40	60	60	60
Triangle front wing, once crossed		100	100	100	100

<i>Characters</i>	<i>amanda</i>	<i>martha</i>	<i>ornata</i>	<i>bertha</i>
Triangle hind wing, free.....	100	100	100	100
Triangle front wing followed by:				
2 cells, then 2.....	10	30		
3 cells, then 2.....	90	70		
3 cells, then 2 for 1-3 rows, then 3 .....			20	80
3 cells, then 3.....			80	20
Triangle hind wing followed by:				
2 cells for 2-4 rows, then in- creasing.....		100	100 <sup>a</sup>	100 <sup>b</sup>
3 cells, then 2 for 2-4 rows, then increasing .....	100			
Postanal area front wing:				
One-celled .....	20	10	20	60
Two-celled .....	80	90	80	40
Subtriangle front wing:				
One-celled .....		10		
Two-celled .....		10		
Three-celled .....	100	70	100	100
Four-celled .....		10		
A single row of cells between $Cu_1$ and $Cu_2$ in hind wing.....		100	100	100
A double cell between $Cu_1$ and $Cu_2$ at their origin in hind wing .....	100			
Number of cells between $Cu$ spl ( $A_2$ ) and $A_2$ ( $A_3$ ) in hind wing (any double cell count- ed as one).....	6			20
	7		10	50
	8	30	20	30
	9	40	30	
	10	30	30	
	11		10	
	14	10		
	15	10		
	16	40		
	17	40		

Characters	<i>amanda martha ornata berthia</i>					
Number of cells enclosed by Rspl in front wing.....	{	4	20			
		5	60	10		
		6	20	10	60	10
		7		20	30 <sup>c</sup>	30
		8		60	10	50
		9			10 <sup>c</sup>	
Number of cells enclosed by Rspl in hind wing.....	{	5	50		20	
		6	50	20	30	
		7		40	40 <sup>c</sup>	40
		8		40	10 <sup>c</sup>	60 <sup>c</sup>
Number of cells enclosed by Mspl in front wing.....	{	doubtful	100	90		
		4			20	
		5			50	10
		6		10	20	80
		7			10	10
Number of cells enclosed by Mspl in hind wing.....	{	doubtful	80	90	30	
		4	20		50	20
		5		10	10	70
		6			10	10
Number of rows of cells be- tween M <sub>4</sub> and Cu <sub>1</sub> in front wing at level of nolus.....	{	2	100	100		
		3			100	100

## DISCUSSION OF SPECIES

*Celithemis eponina* Drury. Taxambas, Marco Island, Fort Myers, Labelle, Moore Haven, Palmdale, Miami, and Enterprise, all in Florida, J. H. Williamson, 44 males, 51 females. There are also in my collection the following Florida specimens: West Palm Beach, February 22, 1904, male; Miami, January 19, 1899, male; Lake Helen, April 27, 1906, male, all collected by Mrs. C. C. Deam; St. Petersburg, March 24, 1913, L. A. Williamson, 3 males.

a. In one wing 2 cells, then 1 for 2 rows, then 2 for 1 row, then increasing.

b. In two wings 2 cells, then 1 for 1 row, followed by 2, increasing.

c. One cell double in one wing; i. e., Rs and Rspl separated by 2 rows of cells for 1 cell's length.

*Celithemis elisa* Hagen. Kathwood, Aiken County, South Carolina, J. H. Williamson, teneral female.

*Celithemis amanda* Hagen. Abdomen, male 19-19.5, female 17-19; hind wing, male 23.5-24, female 23-25; stigma, front wing 1.6-2, hind wing 1.9-2.2.

The cells between  $Cu\ spl$  and  $A_2$  in the hind wing are narrow, are frequently divided, and the venation generally between these veins is more wavy and irregular than it is in the same area in related species.

Material examined: *North Carolina*, Southern Pines (July 25, 1910, A. H. Manee, male, female, Ris; August 4, 1915, A. H. Manee, male, W. T. D.); *Georgia* (Morrison, 2 males, 2 females, M. C. Z.); *Florida* (3 males, 1 female, A. N. S.; July 21, 1897, male, O. S. U.), Cedar Keys (June 4, male, U. S. N. M.), Gotha (June 27, 1898, through James Tough, male, E. B. W.), Gulfport (September, 1914, June 19, 1915, A. G. Reynolds, 9 males, 5 females, Ris), Enterprise (May 10, 1887, male, M. C. Z.; April 18, 1921, J. H. Williamson, male, E. B. W.). In the M. C. Z. is a male labelled Brazil, Heyer; this is undoubtedly a mistake.

*Celithemis martha* Williamson. Abdomen, male 20.5-22, female 18-20; hind wing, male 25.5-27, female 23-26; stigma, front wing 2.1-2.4, hind wing 2.4-2.7.

Described in the preceding key. Named for Miss Mattie Wadsworth, for nearly thirty years a careful and unselfish collector and student of Maine dragonflies, who collected many specimens of the species here named in her honor.

Of 58 front wings examined, the last antenodal was not continuous in 56 wings, and the two wings where it was continuous were on two specimens. On the other hand, of 70 wings of the nearly related *ornata*, 55 wings had the last antenodal continuous.

This is *Celithemis ornata a* of Ris, Coll. Zool. Selys, Libellulinen, page 1193. Working independently of this later note by Dr. Ris, I arrived at the conclusion that northern specimens, heretofore referred to *ornata*, were a distinct species, and in the preceding key I have indicated characters for its recognition in addition to the equally valuable characters well described by Dr. Ris. Dr. Ris's description of *ornata*, on pages 723, 724 and 727 of the work above cited, was largely based on specimens of *martha* which explains his statement under B, p. 723, "Im Discoidalfeld der Vorderflügel 3 Zellen an t, dann 2 Reihen," which is true of *martha*, but not of *ornata*.

Material examined: *Maine* (through Harvey, 3 males, 3 females, E. B. W.), Manchester (August 7 and 26, 1890, Mattie Wadsworth, male, female, A. N. S., July 16 and 26, 1897, July 13, 1898, July 11, 1899, Mattie Wadsworth, 1 male, 4 females, U. S. N. M., male and female taken July 26, 1897, figures 2 and 3, plate 42, Insect Book), Bradley (August 22, 1899, male, O. S. U.); *Massachusetts*, Wareham (July 8, 20, 30, and 31, 1912, O. Bangs, 4 males, 3 females, M. C. Z.); *New York*, Riverhead, Long Island (August 2, 1917, and July 19, 1918, W. T. Davis, male, 2 females, W. T. D.), Long Pond, Wading River, Long Island (July 27, 1914, July 31 and August 3, 1919, W. T. Davis, 2 males, 2 females, W. T. D.), Yaphank, Long Island (July, 1909, W. T. Davis, female, W. T. D.), Wyandanch, Long Island (August 21, 1917, W. T. Davis, type male and allotype female, E. B. W.); *New Jersey* (Uhler, female, M. C. Z.; male with printed label, N. J., M. C. Z.), Ocean View (August 25, 1892, P. P. Calvert, male, A. N. S.), Lakehurst (July 11, 25 and 30, W. T. Davis, male, 3 females, W. T. D.), Denisville (September 7, 1908, W. T. Davis, 2 males, W. T. D.), Jamesburg (July 2, W. T. Davis, male, W.

T. D.), Indian Creek, Egg Harbor Township (August 24, 1899, P. P. Calvert, female, A. N. S.); *Pennsylvania*, Philadelphia (Winthem, male, M. C. Z.); *Maryland*, Hyattsville (August 14, 1916, Busck, 2 males, U. S. N. M.); without locality (round card, printed 465, written label, *Diplax ornata*, female, M. C. Z.).

*Celithemis ornata* Rambur. Abdomen, male 22, female 21; hind wing, male 25-27, female 24-26; stigma, front wing 2.1-2.4, hind wing 2.2-2.6.

Of 70 front wings examined, 55 had the last antenodal continuous and 15 had it discontinuous. In the same wings one had the triangle followed by 3 cells, then 2 for three rows, followed by 3; one had the triangle followed by 3 cells, then 2 for two rows, followed by 3; ten had the triangle followed by 3 cells, then 2 for one row, followed by 3; and fifty-three wings had the triangle followed by 3 cells, then 3 cells.

This is *Celithemis ornata b* of Ris, Coll. Zool. Selys, Libellulinen, p. 1194. Rambur's description plainly indicates that this is the species he had before him.

Material examined: *North Carolina*, Ellis Lake (June 19-24, 1905, and May 23, 1907, C. S. Brimley, male, A. N. S., 2 males, 2 females, E. B. W.), Southern Pines (April 25, 1916, W. T. Davis, male, W. T. D.); *Georgia* (Morrison, male, 2 females, M. C. Z., male, A. N. S.); *Florida* (male, female, M. C. Z.; Uhler, 1860, male, female, M. C. Z.; Thaxter, 2 males, M. C. Z.); (2 males, 3 females, A. N. S.), Jacksonville (June 4, 1869, male, 2 females, M. C. Z.; S. A. Allen, 2 males, female, M. C. Z.), Capron (April 16, Hubbard and Schwarz, male, female, M. C. Z. and U. S. N. M.), St. Augustine (Palmer (?), male, M. C. Z.), Haulover (March 2, female, M. C. Z.; March 23 and 24, Hubbard and Schwarz, 4 females, U. S. N. M.), Daytona (March 23, 1906, Mrs. C. C. Deam, female, E. B. W.),

Daytona Beach (March 26, 1906, Mrs. C. C. Deam, 2 females, E. B. W.), West Palm Beach (February 22, 1904, Mrs. C. C. Deam, female, E. B. W.), St. Petersburg (Water-works pond, April 3, 1913, L. A. Williamson, female, E. B. W.), Stuart (February 29, 1904, Mrs. C. C. Deam, female, E. B. W.), Lake Poinsett (May 1, Hubbard and Schwartz, 2 males, 3 females, U. S. N. M.), Auburndale (March, 1905, N. R. Wood, 6 males, 2 females, U. S. N. M.), Gotha (June 27, 1898, through James Tough, male, E. B. W.), Enterprise (May 18, 1886, and May 10, 1887, 8 males, 11 females, M. C. Z.; May 17, Hubbard and Schwarz, 3 males, 1 female, U. S. N. M.; April 18, 19, 21, 22, 23, 25 and 26, 1921, J. H. Williamson, 104 males 47 females, E. B. W.), Labelle (March 22 and 23, 1921, J. H. Williamson, 3 males, 3 females, E. B. W.), Ft. Myers (March 12, 1921, J. H. Williamson, male, E. B. W.); without locality (Hagen Schu ?, 2 females, and Hagen, male, 2 females, M. C. Z.).

At Ft. Myers the single male taken by Mr. Williamson was found at the edge of a plowed field along vegetation near a creek. At Labelle all the specimens, which were females or immature males, were taken along a road in a forest of scattered trees, with little underbrush, and with dry sandy soil. On April 22 he noted of six females captured, "on trail through woods." And on April 19, on which day 61 males and 21 females were taken, he noted, "numerous in open pine woods near Gleason's Pond, generally at edge of the woods and near but not over water (adult males); common in open sunny spots in pine woods, hovering a foot or so above the ground, about grass (females and teneral males)." On April 21 and 23 specimens were taken in woods near Enterprise. On April 22 he collected at Wiley's Pond, two miles north of Enterprise, a small lake similar in character to Buckeye Homestead Pond, where he collected April 26.



*Celithemis bertha* Williamson. Abdomen, male 22-22.5, female 20-21; hind wing, male 26-27, female 26-27; stigma, front wing 2.4-2.7, hind wing 2.6-3.

Described in the preceding key. Named for Miss Bertha P. Currie, of the Bureau of Entomology, U. S. Department of Agriculture, efficient and obliging custodian of dragonflies in the National Museum.

Of 76 wings examined, the last antenodal in the front wing was continuous in 36 wings and not continuous in 40 wings. In 30 front wings the postanal area was one-celled; in 46 it was two-celled. Specimens were sent to Drs. Calvert and Ris; neither of them was acquainted with the species.

Material examined: *Florida*, Gotha (June 10 and 15, 1897, A. Hemple, male, female, A. N. S.; June 27, 1898, through James Tough, male, female, E. B. W.), Enterprise (April 18, 21, 25 and 26, 1921, J. H. Williamson, 64 males, one of them teneral, 6 females, two of them teneral, type male and allotype female, taken in copulation, April 26, E. B. W.).

Mr. Williamson recognized this handsome species as distinct when he first found it on April 18 at a shallow marshy and mucky pond one and a half miles northeast of Enterprise and about a quarter of a mile east of Gleason's Pond. On April 21, when he took 42 males and 2 females, he collected at Buckeye Homestead Pond. This is a circular depression about three-eighths of a mile in diameter in pine woods. It is filled with clear, cool water, without an outlet, but there is a shallow seepage inlet. The bottom of the pond is firm sand. Waist-high rushes and weeds extended from the water's edge to ten to twenty feet from shore, where the water was about three feet deep. *Bertha* frequented rushes over deeper water, resting on the rush tips. *Ornata* was usually nearer shore over shallower water and was frequently found back from the

water's edge, where no *bertha* was seen. Woods surrounding the pond were of scattered turpentine trees with occasional clumps of smaller ones near the water's edge. On April 25 he collected at four ponds about four miles east of Enterprise and about a quarter of a mile north of the railroad at that point. April 26 was again spent at Buckeye Homestead Pond and is therefore the type locality for the species.

"The foregoing statements show that the Synopsis has been principally composed from species which I myself have examined, and which can be considered as undoubtedly fixed."—Hagen, Preface to the Synopsis of the Neuroptera of North America.

#### DISTRIBUTION OF SPECIES

Of the eight species of *Celithemis*, *eponina* has by far the widest range, occurring from about 23° N to about 45° N, and from Cuba, Florida, and Massachusetts on the east to Texas and Minnesota on the west. This covers the entire range of the genus except the extreme northeastern part in Maine, where *elisa* and *martha* are found, but where *eponina* has not yet been recorded. To offset this, *eponina* is the only species of the genus known from Texas and Cuba. The other species are definitely separated into two groups, a northern and a southern, the parallel 36°, so far as now known, being approximately the dividing line between them, though one northern species, *elisa*, occurs as far south as Georgia. The three northern species are *elisa*, *monomelaena* and *martha*; the four southern are *fasciata*, *ornata*, *bertha* and *amanda*. *Eponina* and all four of the southern species occur in Florida, and one, *bertha*, is found nowhere else. Florida may therefore be considered the place of origin of the genus. *Fasciata* and *monomelaena* are evidently closely related, and the latter has been derived from the former. *Fasciata* is confined to the extreme south-

eastern states, having been recorded from Louisiana, North Carolina, Georgia and Florida, while *monomelaena* has an equally restricted range in the north, having been recorded only from New York, New Jersey, Ontario, Ohio, Indiana and Wisconsin. In the same way that *monomelaena* has been derived from *fasciata*, *martha* has been derived from *ornata*. *Martha* is entirely eastern and is known from Maryland on the south through Pennsylvania, New Jersey, New York and Massachusetts to Maine. *Ornata* also is eastern and occurs only in North Carolina, Georgia and Florida.

This leaves one northern species, *elisa*, unaccounted for. In its range it almost rivals *eponina*, having been recorded for the following states: Georgia, South Carolina, North Carolina, Virginia, New Jersey, Pennsylvania, New York, Massachusetts, Maine, Ontario, Michigan, Ohio, Indiana, Illinois and Wisconsin. I can make only a guess as to its relationships. It seems to me it may have been derived from *eponina* at about the same time as *martha* was derived from *ornata*, and *monomelaena* from *fasciata*, and that the wide extension of *eponina* took place at a later date. The wide range of *elisa* shows that it shares with *eponina*, from which I think it has been derived, a high degree of adaptability.

Two southern species of limited range remain to be discussed. *Bertha* is known only from Florida. With little evidence to support the opinion, I believe it has been derived from *ornata*. The remaining species, *amanda*, is known from North Carolina, Georgia and Florida. I cannot detect any close relationship with any other species except that it is a very distinct member of the *ornata* group.

## PLATE I

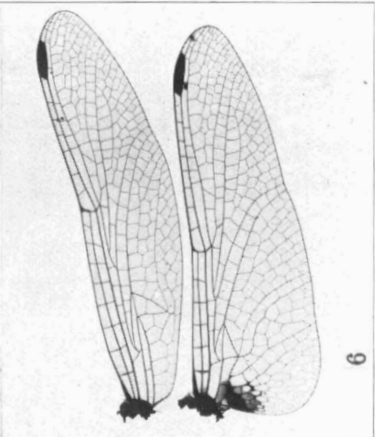
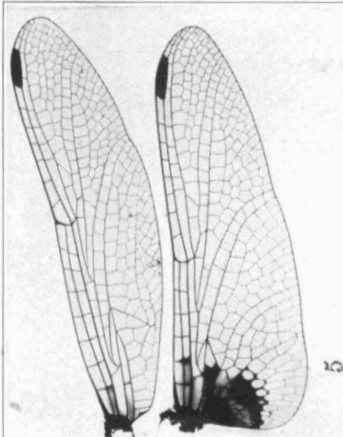
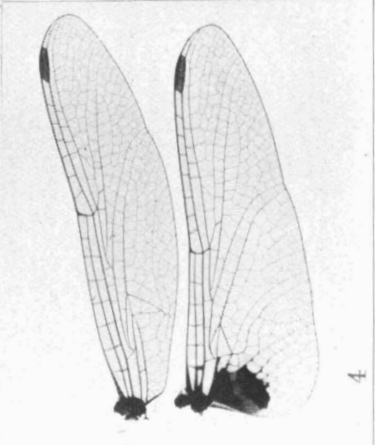
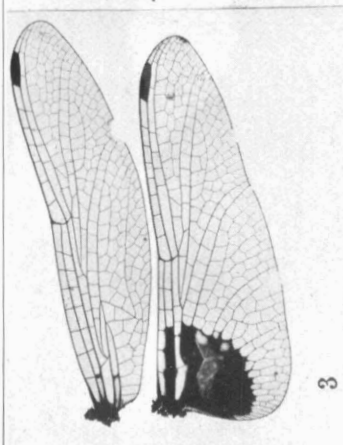
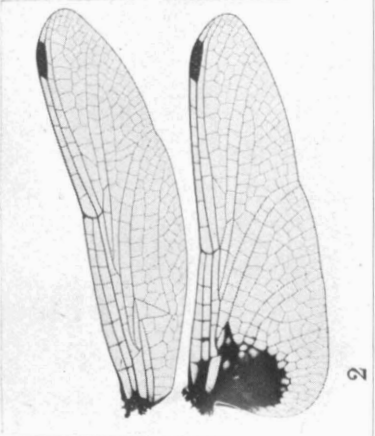
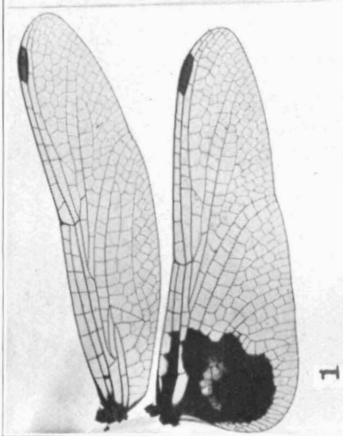
Wing photographs by Miss Mina L. Winslow. All figures of males, two figures of each species to show the extremes in wing coloration.

Fig. 1. *Celithemis martha*, male, Manchester, Maine, July 26, 1897, Miss Mattie Wadsworth, U. S. N. M.

Fig. 2. *Celithemis martha*, male, Long Pond, Wading River, Long Island, New York, July 31, 1919, W. T. Davis.

Figs. 3 and 4. *Celithemis ornata*, males, Enterprise, Florida, April 25 and 18, 1921, J. H. Williamson.

Figs. 5 and 6. *Celithemis berthia*, males, Enterprise, Florida, April 21, 1921, J. H. Williamson.







## PLATE II

Wing photographs by Miss Mina L. Winslow. Figures 7-11 females, 12 male; where two figures of a species are given they have been selected to show the extremes in wing coloration.

Fig. 7. *Celithemis martha*, female, Manchester, Maine, July 13, 1898, Miss Mattie Wadsworth, U. S. N. M.

Fig. 8. *Celithemis martha*, female, Yaphank, Long Island, New York, July, 1909, W. T. Davis.

Figs. 9 and 10. *Celithemis ornata*, females, Enterprise, Florida, April 18 and 25, 1921, J. H. Williamson.

Fig. 11. *Celithemis berthae*, female, Enterprise, Florida, April 18, 1921, J. H. Williamson.

Fig. 12. *Celithemis amanda*, male, Florida, July 21, 1897, O. S. U.



CELITHEMIS (ODONATA)

