Distribution of the Indiana Aeshnids (Odonata; Aeshnidae)

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Dragonflies of the family Aeshnidae are among the largest of the order, and except for a few moths are the largest insects found in this country.

Forty-two species distributed among 12 genera occur north of Mexico. Five genera, all of which are monotypical and three of which occur in Indiana, are Nearctic in distribution. Three are Neotropical but two of these extend into the Nearctic in the southwestern states or Florida. Two genera may be considered Cosmopolitan, another is circumtropical and one is Holarctic. Some species are very limited in distribution, others are widespread and one, the very common *Anax junius* (Drury), is found throughout North America from Alaska into Mexico and the Antilles, also in Hawaii and the eastern coast of Asia.

This study attempts to summarize the available date on the distribution of the Indiana species of this group of large and interesting insects. The six genera found in Indiana belong to four subfamilies — Aeshninae (Aeshna), Gomphaeschninae (Basiaeschna and Boyeria), Brachytrinae (Epiaeschna and Nasiaeschna) and Anactinae (Anax).

Any study of the distribution of insects reveals the inadequacy of our knowledge. Comparisons of faunae of different ares are usually based upon state lists. An examination of any such list shows that the data are very uneven; some forms are quite widespread and well-known and their exact range within a state quite well defined, others are included from a single record of a single specimen. As the limits of the ranges of species fluctate, the inclusion of species known from a small number of records at long intervals as a part of the fauna is questionable. The Odonata of Indiana were collected and recorded, both intensively and extensively for over 50 years (4). The seasonal distribution of the flight periods for all species were compiled by tabulation of the records of over 40 years, by thirds of months (indicated as I, II, III, respectively) (1).

The records which have been accumulated over such a long period of intense collecting have been used in this study to compare the aeshnid fauna of Indiana with those of other states. The records for other areas have been compiled over the years from state lists and other reports.

Many formulae for a quantitative expression of the relationship between faunae have been proposed. That by Preston (5) has been used previously for the Odonata of the North Central (2) and the Western (3) states. This formula is $\left(\frac{a}{a+b}\right)^z + \left(\frac{b}{a+b}\right)^z = 1$, where "a" is the fauna (in numbers) of one area, "b" that of the other, "a + b" the total number for the two areas, and "z" is an index of dissimilarity in percentage; similarity is obtained by subtracting the dissimilarity value from 100. The solution of the equation for the value of "z" is very difficult but Preston furnished a table from which this value can be read directly when the values of the two quantities have been calculated. A more simple measure of similarity may be computed by dividing the number of species common to both areas by the total number of taxa for both areas. This appears to be valid if the numbers in the two areas are approximately equal but not for cases in which the number in one area is much greater or less than that of the other. Both measures

comparing the fauna of Indiana with those of all other states and the provinces of Canada for which there are adequate records of the aeshnids have been computed and are given in Tables 1 and 2.

The known distribution within Indiana, the entire range and the extent of the flight period in the state (by thirds — I. II. III. — of months), respectively, are indicated for each species in the following list of genera and species.

TABLE 1. *Measures of similarity of the aeshnid fauna of Indiana with those of other states*

States	number of species		indices of similarity	
	recorded from state	common with Indiana	Preston's	direct percentage
Montana	2	0	0	0
New Mexico	3	0	0	0
Wyoming	4	0	0	0
Arizona	7	1	6	5
Colorado	8	1	7	5
Delaware	1	1	37	8
Oregon	6	1	9	6
South Dakota	1	1	33	8
California	12	2	12	9
Kansas	3	2	28	14
Utah	11	2	28	14
Arkansas	4	3	38	21
Nevada	9	3	23	16
Washington	8	3	23	17
West Virginia	3	3	23	23
Missouri	5	4	48	29
Nebraska	5	4	47	29
Georgia	11	5	31	26
Minnesota	6	5	53	36
Mississippi	8	5	43	31
Texas	8	5	42	31
D.C.	7	6	38	30
Florida	13	6	38	30
Kentucky	8	6	56	40
Rhode Island	6	6	75	46
Tennessee	7	6	59	43
Virginia	8	6	53	40
Alabama	9	7	58	47
Iowa	7	7	78	54
Louisiana	10	7	54	44
Oklahoma	9	7	58	47
South Carolina	9	7	58	47
Vermont	11	7	78	47
Illinois	8	8	82	62
North Carolina	13	8	67	44
Pennsylvania	13	8	67	44
Maine	14	10	66	59
Maryland	12	10	73	67
New Jersey	12	10	73	67
Wisconsin	11	10	78	71
Connecticut	12	11	84	79
Michigan	16	11	69	61
New Hampshire	17	11	69	61
Ohio	14	11	69	69
New York	16	12	72	71
Massachusetts	17	13	90	76

TABLE 2.   *Measures of similarity of the aeshnid fauna of Indiana with those of the Canadian Provinces*

Provinces	number of species		indices of similarity	
	recorded from prov.	common with Indiana	Preston's	direct percentage
Yokon	5	1	9	6
Northwest Territory	7	1	9	5
Alberta	10	3	21	15
Prince Edward Island	3	3	41	23
New Brunswick	7	4	27	21
Saskachewan	9	4	37	25
Manitoba	10	4	27	21
British Columbia	18	5	27	19
Nova Scotia	15	9	55	47
Quebec	17	10	61	50
Ontario	20	12	71	57

Aeshna is a large cosmopolitan genus with 25 species and subspecies in the Nearctic and 35 in the Neotropical, three of which are common to the two regions.

A. canadensis Walker — Steuben Co.; Washington and British Columbia to the Maritime Provinces, south to Missouri and Maryland, but apparently not yet recorded in the states from Michigan, Wisconsin and Iowa to Montana; August II-III.

A. clepsydra Say — Steuben and Whitley Co.; Iowa and Wisconsin to the Maritime Provinces and New Jersey; August II to September I.

A. constricta Say — Tippecanoe to Wells and Steuben Co., British Columbia and California to the Maritime Provinces and Maryland, although unrecorded from all states from Idaho and Montana to Iowa and Wisconsin; July II to October I, most abundant in September.

A. mutata Hagen — Lagrange, Steuben, Noble and Wells Co.; southern Ontario, Massachussetts and Michigan to Pennsylvania, Indiana and Kentucky; June I to July II.

A. tuberculifera Walker — Lagrange Co.; Ontario, Wisconsin and Indiana to the Maritime Provinces and Pennsylvania, also British Columbia, but not recorded from the intervening territory; one record each in July II and September III.

A. umbrosa Walker — Probably throughout the state, recorded from 17 counties, chiefly Tippecanoe northeast, but also in Henry, Wayne and Lawrence; Yukon and Northwest Territory to Laborador and Newfoundland to Oklahoma and Alabama; July I to October I, most abundant in mid-September.

A. verticalis Hagen — Seven scattered counties in the northeast third of the state; Manitoba and Iowa to Maritime Provinces and North Carolina; July III to September III, most abundant in mid-September.

A. junius (Drury) — Common throughout the state; Alaska to the Maritime Provinces to Mexico and the Antillies, also Hawaii and the east coast of Asia; March I to October I; this species probably has the longest flight period of an odonate in Indiana.

A. longipes Hagen — Tippecanoe, Warrick, Dubois and Clark Co.; southern New England through all Atlantic and Gulf coastal states, through Mexico and the Antilles to Brazil, apparently only occasionally inland to Indiana; June and (?) July.

Boyeria is a Holarctic genus with two species in the eastern states and one in Europe.

B. vinosa (Say) — Throughout the state, recorded from 25 counties from the extreme southwest to the extreme northeast; Texas and the first tier of states west of the Mississippi northward to Iowa, to Ontario and the Maritime Provinces and Florida, recorded from almost every state within these limits; one record in May II, June III to October I.

Basiaeschna, Epiaeschna and Nasiaeschna are monobasic genera with almost identical ranges from Texas or Mexico north and east to Quebec and the Maritime Provinces and Florida, similar to the range of *B. vinosa*. As Indiana is within this area all three species — *B. janata* (Say), *E. heros* (Fabricius) and *N. pentacantha* (Rambur) are found throughout the state. *B. janata* is an early season flier, May I to July I, most abundant in mid-May. *N. pentacantha* is a mid-season form, June I to August III, with some breaks in the record. *E. heros* has a long flight period, March III to October I, with a few breaks in the record, exceeded only by Anax junius.

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