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Distribution and Habitat Preference of Minnesota Dragonfly Species (Odonata, Anisoptera) I.[1]

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ABSTRACT — The Anisoptera species found in Minnesota collections are listed. Eighteen of the 63 species are reported for the first time as occurring in Minnesota. The geographical distribution of the 63 species is presented. Factors affecting geographical distribution are discussed. The seasonal distribution of common species and genera with restricted flying times is discussed.

During the course of our six-year study of Minnesota Anisoptera, sixty-three species have been collected. Other references to the composition of the Minnesota dragonfly population suggest that the species treated here do not comprise the entire anisopteran fauna of the state. We believe this to be true as eighteen of these species have not previously appeared in published accounts concerning Minnesota dragonflies. These are identified in the tabulated data. Recent unpublished studies of the dragonflies in and around the Itasca Biological Station of the University of Minnesota have been supplied to us by Dr. K. C. Kim. Kim (1960) and Johnson (1965) list five of these eighteen unreported Minnesota species; therefore, thirteen of the sixty-three species included in this study may be considered as previously unreported.

In one of the earlier treatments of Minnesota dragonflies, Whedon (1914) reported thirty-five species from southern Minnesota. Needham and Westfall (1955) list forty-six species as occurring within the state. Walker (1958) ascribes eighteen species of Aeschnidae and Gomphidae to Minnesota. All of these studies included some species not held in our collection. The studies of the Libellulidae genera *Sympetrum* by Miller et. al (1964) and *Leucorrhinia* by Hamrum et. al. (1965) added another five species to the known Minnesota dragonfly population. In all likelihood, at least eighty species will be found to be living in the state.

Collections of both adult and immature dragonflies form the basis for this study. A few specimens were obtained from individual collectors. As previously mentioned, faunal lists were received from the University of Minnesota. The University made all their specimens available for the studies of Miller et. al. (1964) and Hamrum et. al. (1965).

The aims of this paper are threefold: (1) to list the species of dragonflies that reside in Minnesota; (2) to describe the geographical distribution of these species based upon our collections, and discuss the environmental factors that influence this distribution; (3) to discuss the seasonal distribution of some forms.

Minnesota dragonfly species are not uniformly distribtued about the state. This fact is not particularly remarkable in the light of the varied habitats to be found within the state. Furthermore, a great many environmental factors could account for individual distributional differences among these species. It must also be recognized that additional collections will certainly alter the recorded ranges of some species. It should also be emphasized that varying seasonal distribution among these dragonfly species very likely influences our geographic distribution data.

The sites collected are shown in Fig. 1. The most intensive collecting has been in the northern part of the state during the summers of 1964-65. These collection sites essentially represent our distributional data for such

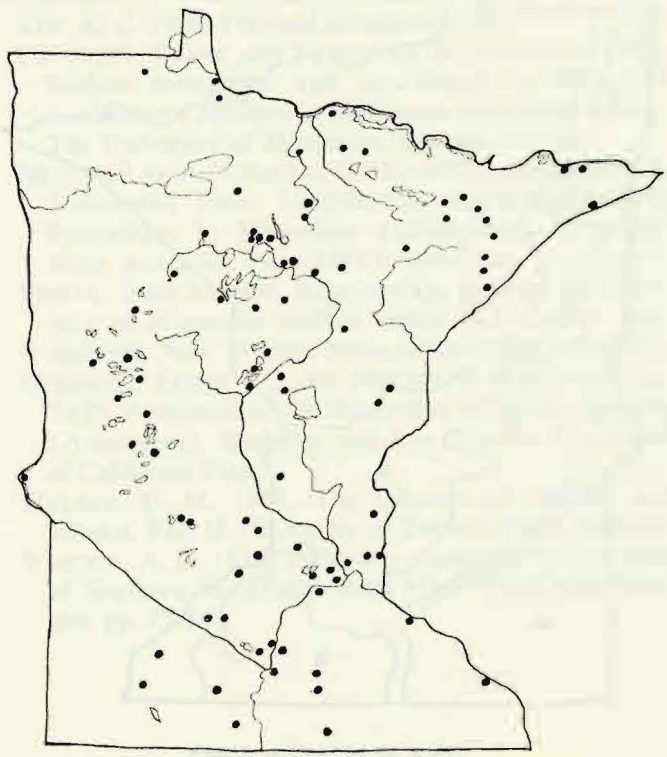

FIG. 1. COLLECTION SITES

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wide-spread species as *Anax junius* and *Libellula pulchella*. However, not all of our species are this adaptable.

The vegetation zone map of Leverett and Sardeson (1917) has been selected to indicate the gross habitat preference for the dragonflies abiding in Minnesota. These zones are very broad and do not indicate the many habitats within the zones that support specific populations, i.e. rivers and impounded waters. Certain geological, climatological, and water chemistry data also follow these zones. As the distribution of dragonflies is largely dependent upon the environment in which the immatures reside, an analysis of the chemistry of surface waters may shed light on understanding this distribution. Certain chemical constituents of Minnesota waters, analyzed by Moyle (1956), indicate a general pattern of increasing concentration extending from northeast to southwest. Total alkalinity, measured as the carbonate content of water, sulphate ions, chloride ions, phosphorus, and nitrogen had the lowest readings in northeastern Minnesota increasing towards the west and south. Thus, there seems to be a correlation of water chemistry with the vegetation zones in Fig. 2, and it also may be a relevant parameter in limiting dragonfly distribution.

Other factors affecting distribution patterns are oxygen content and water temperature. This would vary greatly within the general zones, and these conditions will be studied later in a more detailed treatment of individual species. The many ecological niches provided by the varied topography and water conditions, in addition to the long list of dragonfly species, make Minne-

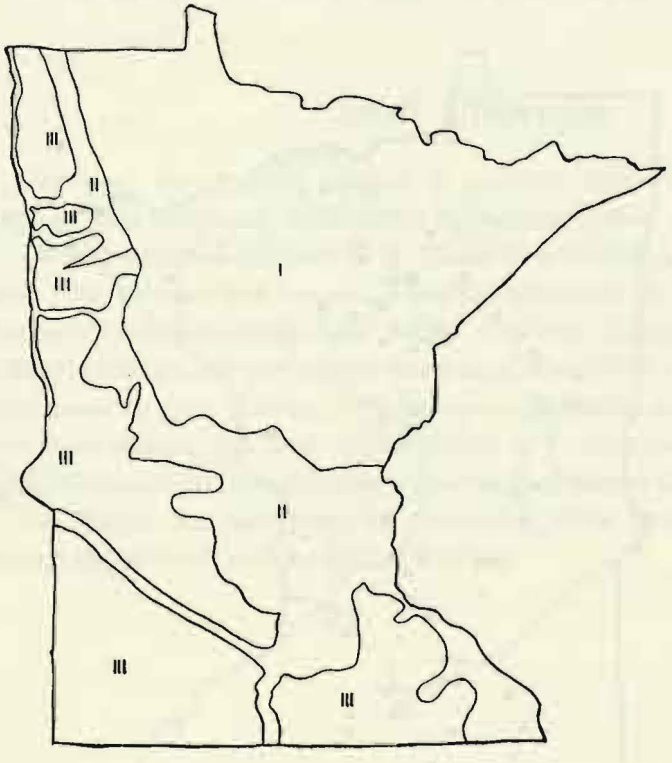


FIG. 2. VEGETATION ZONES

I. CONIFEROUS AND DECIDUOUS II. DECIDUOUS III. PRAIRIE

TABLE 1. Minnesota Anisoptera. Distribution According to Vegetation Zones of Leverett and Sardeson 1917 [1]

	Zones Coll. I	II	III	No. Coll. Sites	No. of Specimens
AESCHNIDAE					
Anax junius	x	x	x	12	100+
Aeschna canadensis	x	x	x	9	27
A. constricta	x	x	x	12	54
A. eremita*	x			1	1
A. interrupta	x	x	x	7	16
A. umbrosa	x	x	x	8	100+
A. tuberculifera*	x			1	4
Basiaeschna janata*	x	x		2	3
Boyeria vinosa*	x			1	1
CORDULEGASTERIDE					
Cordulegaster maculatus*	x			2	3
LIBELLULIDAE (CORDULINAE)					
Cordulia shurtleffiv*	x			2	4
Dorocordulia libera	x			2	7
Epicordulia princeps	x			3	3
Somatochlora ensigera*	x			1	2
S. franklini	x			1	3
S. minor*	x			2	3
S. walshii	x			1	1
Tetragoneuria canis*	x			5	7
T. cynosura	x	x		13	37
T. spinigera	x	x		15	59
LIBELLULINAE					
Celithemis elisa	x	x		4	12
C. eponia	x	x		13	37
Erythemis simplicicollis	x	x		9	32
Ladona julia	x	x		13	46
Libellula luctuosa		x	x	5	33
L. pulchella	x	x	x	14	100+
L. quadrimaculata	x	x	x	18	40
Plathemis lydia	x	x		5	70
Tramea lacerata		x		1	4
T. onusta*		x	x	2	10
Pantala flavescens*		x	x	2	6
Pantala hymenea*		x		1	6
Perithemis tenera*		x		3	4
Pachydiplax longipennis	x	x		6	17
Leucorrhinia frigida	x	x		5	8
L. intacta	x	x	x	52	377
L. hudsonica	x			4	4
L. proxima	x			16	53
L. glacialis	x			2	3
Sympetrum costiferum	x	x	x	51	275
S. internum	x	x	x	34	80
S. obtrusum	x	x	x	162	590
S. rubicundulum	x	x	x	39	75
S. semicinctum	x	x	x	11	41
S. occidentale		x	x	6	15
S. vicinum	x	x	x	52	287
S. danae	x	x		10	16
Tarnetrum corruptum	x	x	x	12	90
MACROMINAE					
Didymops transversa	x	x		3	3
Macromia illinoiensis*	x			3	4
GOMPHIDAE					
Gomphus brevis*	x			1	4
G. cornutus	x	x		2	2
G. exilis*	x			2	2
G. externus		x		1	2
G. graslinellus	x			2	4
G. lividus	x			1	2
G. fraternus	x			1	1
G. spicatus	x	x		12	30

G. vastus	x	x	2	2
Hagenius brevistylus	x		4	4
Ophiogomphus carolus*.	x		1	3
O. colubrinus*	x		1	1
O. rupinsulensis	x		4	7

[1] Leucorrhinia and Sympetrum data includes borrowed specimens.

I. Coniferous and Deciduous
II. Deciduous
III. Prairie
* Designates first published report in Minnesota

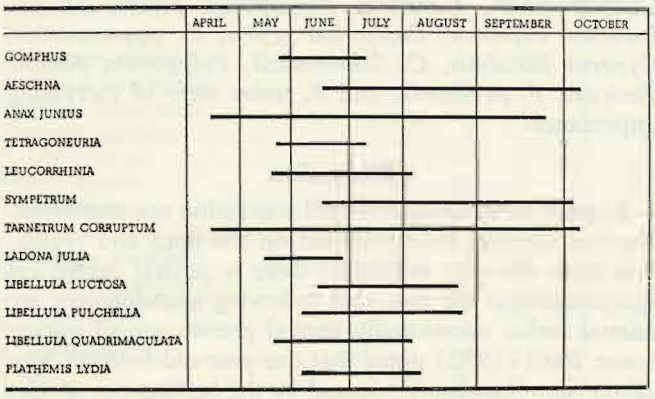
sota an ideal area in which to study environmental requirements of individual species.

The distribution of each species is shown in Table 1. Contrasts in habitat preference among the families, as well as among species, are apparent. Members of the family Aeschnidae appear to be adapted to all of the potential breeding waters of the state whereas the Cordulinae species except some *Tetragoneuria* and many Gomphidae are restricted to Zone 1. *Tetragoneuria cynosura* and *T. spinigera* and some gomphids have been collected from Zone II, but the prairie environment of Zone III is devoid of these groups. The greatest variation within a group is seen in the large subfamily Libellulinae. *Pantala* sp., *Libellula luctuosa*, and *Tramea* sp. appear to be restricted to the southern and western regions of the state, while *Ladona julia, Leucorrhinia proxima, L. hudsonica* and *Celethemis elisa* represent the northern ranging species. On the other hand, *Libellula pulchella, L. quadrimaculata, Tarnetrum corruptum*, most *Symptrum*, and *Leucorrhinia intacta* are found in all zones.

These introductory studies point out a need for further investigations attempting to determine the critical environmental factors that control the geographical distribution of dragonflies and also the physiological requirements of individual species that must be met by the environment. Some of these studies are being initiated at this time. These investigations also include extensive collections in areas of the state now poorly represented.

That the seasonal distribution has an effect upon the geographic distribution reflected by the presented data is apparent in Table 2. It is possible to arrive in a collection area after some species have ceased to fly and others have not yet emerged. This problem has been alleviated somewhat through immature collections. Several visits to an area at different periods of the season are needed to insure complete collection opportunity. This is another rearson why more time will be given to this study.

TABLE 2. SEASONAL DISTRIBUTION OF SOME MINNESOTA DRAGONFLY GENERA AND SPECIES



In some instances a very restricted emergence period is apparent for some genera such as *Gomphus* and *Tetragoneuria*. It seems from this that intrageneric competition has not been avoided by the evolution of different emergence times. That variation among the species does occur within a single genus is evidenced in *Libellula* where there is about a one-month range in adult emergence. According to some odonatists, the genus *Tarnetrum* should be included in the genus *Sympetrum*. Although they are very closely related, *Tarnetrum* is set apart by its early emergence followed by continued flying time throughout the summer.

The initiation of the period of adult emergence has not been related to any environmental factors other than light. Naturally, of course, the immatures cannot emerge through the ice. Minnesota dragonflies seem to fall into a group emerging during the longest photo-period, a group emerging when the photoperiod starts to decrease, and a group which emerges throughout the entire growing season regardless of the photoperiod.

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