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## Ecological Observations on Iowa Shore Flies (Diptera, Ephydriidae)

D. L. Deonier  
*Iowa State University*

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## Ecological Observations on Iowa Shore Flies (Diptera, Ephydriidae)

D. L. DEONIER<sup>1</sup>

*Abstract:* An intensive survey of the ephyridid fauna of Iowa was conducted in 1959-1961. The ecological and preliminary distribution and phenological data are presented in tabular form.

Ecologically, the Ephydriidae are a very interesting group. Considerable ecological homogeneity is apparent in immature and mature instars. This homogeneity tends to be obscured by the diversity of the aquatic or semiaquatic habitats of various species. Many species occur only in maritime habitats or only in freshwater habitats; others are found in both types of habitats.

The maritime species (especially the halophilic ones) have been thoroughly studied ecologically. In the Nearctic Region, Aldrich (1912) conducted one of the first of such studies on species of *Ephydra* at the large saline and alkaline lakes of the Great Basin. Ping (1921) performed a much more thorough biological investigation of a halophilic ephyridid species. He studied the entire life cycle of *Ephydra riparia* Fallen (as *E. subopaca*) which he found living in and on small, isolated salt pools near Ithaca, New York.

One exceptional habitat of certain ephyrids is that of the hot springs, the ephyridid faunas of which were studied by Brues (1932) in the Nearctic Region and by Tuxen (1944) in the Palaearctic Region. The former author found larvae of one species of *Ephydra* occurring in both the acidic and alkaline types of hot springs. Perhaps the most exceptional ephyridid habitat known is that of the crude oil pools in California, inhabited by the larvae of the petroleum fly, *Helaeomyia petrolei* (Coquillett).

The study of dissemination in the ephyridid habitats has been neglected largely. According to Dahl (1959), wind and water combined are the most efficient method of dissemination (especially of the puparia). The results of aerial plankton surveys by Hardy and Milne (1938) and by Glick (1960) show that adults of some species of Ephydriidae may be disseminated over considerable distances when they are caught in high air currents.

<sup>1</sup>Department of Zoology and Entomology, Iowa State University, Ames, Iowa

## HABITAT DESCRIPTIONS

Habitat as used in this study (Table 1) is a seral community or a physiognomic subdivision thereof. It should not be construed as synonymous with biotype as used by Dahl (1959). I delimited the habitats of Ephydriidae in Iowa only after extensive collecting and observation.

*Floating-vegetation Habitat*

This habitat is considered synonymous with the floating stage of the hydrosere as described by Weaver and Clements (1938). Limnologically, this habitat is littoral and lenitic. The microflora available as food for shore flies is apparently relatively sparse.

Habitat sites: Springbrook State Park, Guthrie Co.; Goose Lake, Hamilton Co.; Pilot Knob State Park, Hancock Co.

*Marsh-reeds Habitat*

This lenitic habitat is considered synonymous with the reed-swamp stage of the hydrosere of Weaver and Clements.

Habitat sites: Lakin Slough, Guthrie Co.; Goose Lake and Little Wall Lake, Hamilton Co.; Dead Man's Lake in Pilot Knob State Park, Hancock Co.; Harmon Lake, Winnebago Co.

*Floating Algal-mat Habitat*

This is often only a physiognomic subdivision of the marsh-reeds community or of the sedge-meadow community. The algal mats studied were those occurring in small, open pools among cattails or sedges. The occasional large mats extending over large areas in the limnetic zone were not studied.

Habitat sites: Lakin Slough, Guthrie Co.; Little Wall Lake, Hamilton Co.; Lake Odessa, Louisa Co.

*Limnic-wrack-Habitat*

This habitat is at least superficially similar to the limnic-wrack beds of Scandinavian shores as described by Dahl (1959). In Iowa, it is only a physiognomic subdivision of the marsh-reeds community or occasionally of the floating-vegetation community where the latter extends to the shoreline. In general, the limnic-wrack habitat may be considered as an accumulation of decaying plant debris. At some localities it is of long duration, being repeatedly increased in amount for several seasons.

*Typha latifolia* and *Scirpus validus* are often uprooted by freezing and thawing and the rafts thus formed become the chief components of limnic wrack when they are washed ashore. Tangled masses of *Nuphar advena*, species of *Potamogeton*, *Utricularia vulgaris*, and planktonic filamentous algae constitute the

Table 1. The ecological distribution of Iowa Ephydriidae

Species	Per cent presence (P) <sup>a</sup> and estimated abundance (A) <sup>b</sup> within the habitats investigated																					
	Floating Vegetation		Marsh Reeds		Floating Algal Mat		Sedge Meadow		Limnic Wrack		Mud Shore		Sand Shore		Eragrostis Mat		Stream Rocks		Freshet Seep		Spoil Bank	
	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
<i>Athyroglossa glaphyropus</i>									r	14				r	11							
<i>A. granulosa</i>									r	14				r	22							
<i>Gymnopa tibialis</i> <sup>c</sup>																						
<i>Parathyroglossa ordinata</i>														r	22		r	25				
<i>Coenia curvicauda</i>			o	83					o	29												
<i>Ephydra riparia</i>											r	10	r	22				a	100			
<i>Limnelli stenhammari</i> <sup>c</sup>																						
<i>Parcoenia bisetosa</i>				r	33				r	14												
<i>Philotelma alaskensis</i>									r	29												
<i>Scatella dictaeta</i> <sup>c</sup>																						
<i>S. favillacea</i>			r	33			r	25	o	43	c	50	a	78		r	25					
<i>S. obsoleta</i>									o	29				c	89					o	50	
<i>S. paludum</i>													r	11								
<i>S. quadrimotata</i>													r	11								
<i>S. stagnalis</i>	o	33	o	83			o	100	c	71	c	60	c	67		a	100	o	50			
<i>Scatella trisetata</i>																c	75	c	100			
<i>Scatophila adamsi</i>												r	10					r	50	r	50	
<i>S. arenaria</i>													r	11								
<i>S. carinata</i>											r	10										
<i>S. despecta</i>							r	13	r	14	r	20	r	11							o	50
<i>S. iowana</i>																		r	50	a	100	

<sup>a</sup>For the number of localities for each habitat, see descriptions of habitats.  
<sup>b</sup>Symbols used: va-very abundant; a-abundant; c-common; o-occasional; r-rare.  
<sup>c</sup>Not collected by the author.

Table 1 Continued

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Per cent presence (P)<sup>a</sup> and estimated abundance (A)<sup>b</sup>  
within the habitats investigated

Species	Floating Vegetation		Marsh Reeds		Floating Algal Mat		Sedge Meadow		Limnic Wrack		Mud Shore		Sand Shore		Eragrostis Mat		Stream Rocks		Freshet Seep		Spoil Bank	
	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
<i>Setacera atrovirens</i>					c	100					r	10										
<i>Brachydeutera argentata</i>											r	10	r	11					r	50		
<i>Hyadina albovenosa</i>			o	33																		
<i>H. binotata</i>			o	13			o	63					r	11	o	50						
<i>H. cesta</i>			r	13					r	29												
<i>H. corona</i> <sup>c</sup>							r	25														
<i>H. furva</i>							r	25														
<i>H. gravida excavata</i>			o	33			o	13	o	14			r	11								
<i>H. species A</i>									r	14												
<i>H. subnitida</i>							r	13														
<i>Ochthera lauta</i>													r	11								
<i>O. mantis mantis</i>	o	33	r	13			o	38	r	29	c	100	c	56	o	50			o	50		
<i>Parydra aldrichi</i> <sup>c</sup>																						
<i>P. appendiculata</i>			o	33			o	38	c	86	c	40	r	11			c	50	o	50		
<i>P. bituberculata</i>									r	14	o	20	c	89								
<i>P. breviceps</i>							o	50	o	57	a	100	r	11			r	75				
<i>P. paullula</i>			o	50			o	38	o	11	o	30										
<i>P. pinguis</i>							r	13	r	14	r	20										
<i>P. quadrītuberculata</i>							o	50	c	57	va	100	o	56	r	50	o	50	o	50		
<i>P. tibialis</i>													o	11					c	50		
<i>Pelina canadensis</i>			r	13																		
<i>P. truncatula</i>			o	50			o	50	o	14												
<i>Dichaeta caudata</i>			c	66			r	13	c	29	r	10										

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Table 1 Continued

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Species	Per cent presence (P) <sup>a</sup> and estimated abundance (A) <sup>b</sup> within the habitats investigated																					
	Floating Vegetation		Marsh Reeds		Floating Algal Mat		Sedge Meadow		Limnic Wrack		Mud Shore		Sand Shore		Eragrostis Mat		Stream Rocks		Freshet Seep		Spoil Bank	
	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
<i>Hydrellia cruralis</i>							r	13														
<i>H. definita</i>	r	33					r	25														
<i>H. formosa</i>									r	13							r	100				
<i>H. griseola</i>	c	67	o	50			c	100	c	71	o	60	c	56	c	100	o	75				
<i>H. harti</i> complex <sup>a</sup>	r	67					r	13	r	29												
<i>Hydrellia ischiaca</i>	r	67					r	13	r	29												
<i>H. luctuosa</i>									r	14												
<i>H. morrisoni</i>			r	13			r	13														
<i>H. penicilli</i>			r	13																		
<i>H. procteri</i>			r	50			r	13									r	25				
<i>H. suspecta</i>			r	33																		
<i>H. tibialis</i>	o	33	o	33			va	75	o	29			r	11	va	100						
<i>Ilythea flavipes</i>							o	52			o	10										
<i>I. spilota</i>							r	13	o	29	o	10	r	11			c	50				
<i>Nostima quinquenotata</i> <sup>a</sup>																						
<i>N. scutellaris</i>							r	13														
<i>Notiphila atripes</i>			r	16								r	10									
<i>N. avia</i>			r	16							r	14										
<i>N. carinata</i>			o	33			o	38														
<i>N. macrochaeta</i>			a	63	c	14	o	38	c	14				o	100							
<i>N. olivacea</i>			c	33	o	38	c	14	c	14												
<i>N. pallidipalpis</i>			r	33			r	14														

<sup>a</sup>Complex of *Hydrellia harti*, *ascita*, *trichaeta*, and *bilobifera*.

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Table 1 Continued

Species	Per cent presence (P) <sup>a</sup> and estimated abundance (A) <sup>b</sup> within the habitats investigated																					
	Floating Vegetation		Marsh Reeds		Floating Algal Mat		Sedge Meadow		Limnic Wrack		Mud Shore		Sand Shore		<i>Eragrostis</i> Mat		Stream Rocks		Freshet Seep		Spoil Bank	
	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
<i>N. riparia</i>			c	33			o	13	c	14												
<i>N. scalaris</i>			c	33					c	14												
<i>Notiphila sicca</i>			c	50			o	25	c	14												
<i>N. species A</i>			r	13																		
<i>N. vittata</i>			c	67			o	38	c	29												
<i>Oedenops nuda</i>													o	45								
<i>Paralimna punctipennis</i>			r	13			r	13	o	29	o	20	c	33	r	50			r	50		
<i>P. texana</i>													r	11								
<i>Philygria debilis</i>			r	13			o	25	r	14												
<i>Typopsilopa atra</i>			c	66			c	63	o	42					o	50						
<i>Pseudohecamele abdominalis</i>							r	25	r	14												
<i>Allotrichoma atrilabris</i>							r	14			r	20	r	22								
<i>A. simplex</i>							r	50			o	20	o	67	r	100						
<i>Atissa litoralis</i> <sup>o</sup>																						
<i>A. pygmaea</i>													o	33								
<i>Discocerina brunneonitens</i>													r	11								
<i>D. buccata</i>											r	10	r	11								
<i>D. exigua</i> <sup>o</sup>																						
<i>D. glauccella</i>											o	30	c	56								
<i>D. lacteipennis</i>							o	13	o	29	c	40	a	89	r	50					o	50
<i>Discocerina lenis</i>									o	43	o	10	r	11								
<i>D. leucoprocta</i>							r	38	o	29	o	10	c	89					o	59	o	50
<i>D. obscurella</i>	c	100	o	33			o	75	c	71	c	100	a	89	o	100					o	100

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Table 1 Continued

Per cent presence (P)<sup>a</sup> and estimated abundance (A)<sup>b</sup>  
within the habitats investigated

Species	Floating Vegetation		Marsh Reeds		Floating Algal Mat		Sedge Meadow		Limnic Wrack		Mud Shore		Sand Shore		Eragrostis Mat		Stream Rocks		Freshet Seep		Spoil Bank	
	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
<i>D. orbitalis</i>							r	13	o	42	c	30	c	56	r	50					o	50
<i>D. pulchella</i>											o	30	o	22								
<i>D. trochanterata</i>													o	33					r	50		
<i>D. species A</i>													r	45	r	50						
<i>D. species B</i>													r	11							r	50
<i>Leptopsilopa atrimana</i>			r	13			o	25							r	100						
<i>Psilopa compta</i>							r	25							r	50						
<i>P. dupla</i>	r	13					o	38	r	14					o	100						
<i>P. olga</i>							c	38	o	57												
<i>Ptilomyia enigma</i>							r	13			r	10	r	22				r	50			
<i>Trimerina madizans</i> <sup>o</sup>																						



wrack present around shores without a zone of emergent vegetation. *Polygonum amphibium* and other terrestrial shoreline plants grow on limnic wrack and thus augment its ecotonal characteristics.

Habitat sites: south pond in Ledges State Park, Boone Co.; Trumbull Lake, Clay Co.; Lakin Slough, Guthrie Co.; Goose Lake, Hamilton Co.; Dead Man's Lake in Pilot Knob State Park, Hancock Co.; Blue Lake in Lewis and Clark State Park, Monona Co.; pond on reserve of Izaak Walton League near Ames, Story Co.

#### *Sedge-meadow Habitat*

This habitat is considered synonymous with the sedge-meadow stage of Clements and Weaver. In the lotic subdivision of this habitat, *Ranunculus aquatilis* and other species of *Ranunculus* as well as certain grasses, are important.

Habitat sites: Little Paint Creek, 3 miles east-southeast of Waterville, Allamakee Co.; south bank of Des Moines River at Fraser, Boone Co.; Little Wall Lake, Hamilton Co.; Lake Odessa and Mark Twain National Wildlife Refuge, Louisa, Co.; Missouri River near Whiting, Monona Co.; pond on reserve of Izaak Walton League near Ames, Story Co.; Banner Mine Area, Warren Co.

#### *Sand-shore Habitat*

This is a relatively barren habitat in respect to macro-flora in early summer. The substratum ranges from fine sand to coarse gravel. The sand shore is somewhat unstable during the latter part of the summer. In late July and in August, *Eragrostis hypnoides* often ecizes in dense mats on sand shores, and in late August and in September various Compositae often appear where the substratum is coarse.

Habitat sites: north bank of Des Moines River at Fraser, east bank of Des Moines River and Peese Creek in Ledges State Park, Boone Co.; Pike's Point State Park, Dickinson Co.; Mississippi River 4 miles north of Oakville, Louisa Co.; Missouri River near Whiting, Monona Co.; Clear Creek and Skunk River at Ames; and 4 miles east of Gilbert, Story Co.

#### *Mud-shore Habitat*

Although there are many similarities between the mud- and sand-shore habitats, their ephydrid faunas are different. Generally, the mud-shore habitat is even more temporary and unstable than the sand-shore habitat. Since the mud shore is the result of repeated inundation, the macroflora is usually very sparse in the spring. However, in August this habitat is often invaded by great numbers of pioneering plants such as *Leersia oryzoides*.

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Table 2. Preliminary distribution and phenological data for Ephydriidae in Iowa

Species	Counties													Months and Number of Specimens Examined																					
	Allamakee	Boone	Clay	Dickinson	Guthrie	Hamilton	Hancock	Linn	Louisa	Lyon	Monona	Story	Warren	Winnebago	Woodbury	Other	January	February	March	April	May	June	July	August	September	October	November	December	Specimens						
<i>Athyroglossa glaphyropus</i>																Van Buren																		3	
<i>A. granulosa</i>		x														Van Buren																			11
<i>Gymnopa tibialis</i>																Van Buren																			3
<i>Parathyroglossa ordinata</i>																Palo Alto																			7
<i>Coenia curvicauda</i>																Palo Alto																			15
<i>Ephydra riparia</i>																Palo Alto																			56
<i>Linnellia stenhammari</i>																Palo Alto																			2
<i>Paracoenia bisetosa</i>																Palo Alto																			3
<i>Philotelma alaskensis</i>																Palo Alto																			3
<i>Scatella dichaela</i>																Polk																			2
<i>S. favillacea</i>																Polk																			173
<i>S. obsoleta</i>																Polk																			255
<i>S. paludum</i>																Dubuque																			1
<i>S. quadrinotata</i>																Dubuque																			1
<i>Scatella stagnalis</i>																Cerro Gordo																			407
																Dallas, Dubuque																			
<i>S. trisetata</i>																Henry																			29
<i>Scatophila adamsi</i>																Henry																			5
<i>S. arenaria</i>																Henry																			2
<i>S. carinata</i>																Henry																			3
<i>S. despectata</i>																Henry																			19
<i>S. iowana</i>																Henry																			1271
<i>Setacera atrovirens</i>																Henry																			40
<i>Brachydeutera argentata</i>																Henry																			14
<i>Hyadina albovenosa</i>																Henry																			7

Table 2 Continued

Species	Counties													Months and Number of Specimens Examined														
	Allamakee	Boone	Clay	Dickinson	Guthrie	Hamilton	Hancock	Linn	Louisa	Lyon	Monona	Story	Warren	Winnebago	Woodbury	Other	January	February	March	April	May	June	July	August	September	October	November	December
<i>H. binotata</i>	x	x			x			x			x									x	x	x	x	x	x	x	x	25
<i>H. cesta</i>					x	x					x										x	x	x					7
<i>H. corona</i>		x																		x								1
<i>Hyadina furva</i>											x												x					23
<i>H. gravida excavata</i>		x			x		x	x				x								x	x	x	x	x				41
<i>H. species A</i>						x																	x					2
<i>H. subnitida</i>	x																						x					2
<i>Ochthera lauta</i>	x	x																					x	x	x			9
<i>O. mantis mantis</i>	x	x		x	x	x		x		x	x	x								x	x	x	x	x				162
<i>Parydra aldrichi</i>		x																			x							1
<i>P. appendiculata</i>	x	x	x	x	x	x		x		x	x										x	x	x	x		x		171
<i>P. bituberculata</i>	x	x					x				x									x	x	x	x	x				149
<i>P. breviceps</i>	x	x	x	x	x	x		x	x	x	x	x												x				822
<i>P. paullula</i>	x	x		x	x	x				x			x							x	x	x	x	x		x		46
<i>P. pinguis</i>	x										x	x									x	x	x					12
<i>P. quadrituberculata</i>	x	x	x	x	x	x		x	x	x	x	x								x	x	x	x	x				2332
<i>Parydra tibialis</i>		x																				x	x		x	x		30
<i>Pelina canadensis</i>						x																	x					1
<i>P. truncatula</i>		x			x	x	x		x			x									x	x	x	x		x		20
<i>Dichaeta caudata</i>		x	x	x		x	x		x		x	x		x	x						x	x	x	x		x		46
<i>Hydrellia cruralis</i>	x																							x				1
<i>H. definita</i>						x					x	x											x	x				12

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Table 2 Continued

Species	Counties											Months and Number of Specimens Examined																	
	Allamakee	Boone	Clay	Dickinson	Guthrie	Hamilton	Hancock	Linn	Louisa	Lyon	Monona	Story	Warren	Winnebago	Woodbury	Other	January	February	March	April	May	June	July	August	September	October	November	December	Specimens
<i>H. formosa</i>	x	x																											7
<i>H. griseola</i>	x	x		x	x	x	x		x		x	x	x	x		Dubuque, Van Buren			x	x	x	x		x	x				728
<i>H. harti</i> complex		x			x	x	x				x		x								x	x	x	x					11
<i>H. ischiaca</i>	x	x							x											x	x	x	x						53
<i>H. luctuosa</i>		x																					x						2
<i>H. morrisoni</i>	x						x														x		x						6
<i>H. penicilli</i>						x																x							1
<i>Hydrellia procteri</i>		x			x	x																	x	x					15
<i>H. suspecta</i>						x																x							2
<i>H. tibialis</i>	x	x			x	x	x		x				x						x				x	x	x				3024
<i>Ilythea flavipes</i>						x			x														x	x					12
<i>I. spilota</i>	x	x				x										Dubuque						x	x	x	x				32
<i>Nostima quinquenotata</i>																							x						1
<i>N. scutellaris</i>	x										x	x								x									3
<i>Notiphila atripes</i>					x		x					x									x	x							4
<i>N. avia</i>							x															x							4
<i>N. carinata</i>	x				x	x			x			x										x	x	x					16
<i>N. macrochaeta</i>		x			x		x		x		x	x	x									x	x	x	x	x	x		622
<i>N. olivacea</i>		x				x			x			x										x	x	x					62
<i>N. pallidipalpis</i>						x	x															x	x						12
<i>Notiphila riparia</i>						x		x	x			x										x	x	x					42
<i>N. scarlaris</i>		x				x																x	x						17
<i>N. sicca</i>						x	x		x			x										x	x	x					64
<i>N. species A</i>								x														x							4

Table 2 Continued

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Species	Counties											Months and Number of Specimens Examined																
	Allamakee	Boone	Clay	Dickinson	Guthrie	Hamilton	Hancock	Linn	Louisa	Lyon	Monona	Story	Warren	Winnebago	Woodbury	Other	January	February	March	April	May	June	July	August	September	October	November	December
<i>N. vittata</i>		x		x	x						x		x								x	x		x				47
<i>Oedenops nuda</i>		x							x														x	x				27
<i>Paralimna punctipennis</i>		x			x			x		x	x									x	x	x	x	x	x			125
<i>P. texana</i>		x																										1
<i>Philygria debilis</i>		x			x	x				x	x			x									x					110
<i>Typopsilopa atra</i>	x	x		x	x	x		x		x	x	x																7
<i>Pseudohecamele abdominalis</i>					x			x														x	x					10
<i>Altotrichoma atrilabris</i>		x		x	x							x									x	x	x	x				91
<i>A. simplex</i>	x	x		x	x	x		x		x	x	x								x	x	x	x	x		x		1
<i>Atissa litoralis</i>													x															5
<i>A. pygmaea</i>		x										x										x	x	x				4
<i>Discocerina brunneonitens</i>									x														x					4
<i>D. buccata</i>					x																x							4
<i>D. exigua</i>																					x	x						7
<i>D. glaucella</i>	x	x		x								x									x	x	x	x				40
<i>D. lacteipennis</i>		x	x						x	x	x	x	x								x	x	x	x	x			581
<i>D. lenis</i>					x	x						x										x	x					28
<i>D. leucaprocta</i>		x		x	x	x		x		x	x	x									x	x	x	x				213
<i>D. obscurella</i>	x	x	x	x	x	x	x	x	x	x	x	x		x							x	x	x	x	x			800
<i>D. orbitalis</i>		x		x	x	x		x	x	x	x	x									x	x	x	x	x			238
<i>D. pulchella</i>		x										x		x								x	x	x				79

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Table 2 Continued

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Species	Counties													Months and Number of Specimens Examined															
	Allamakee	Boone	Clay	Dickinson	Guthrie	Hamilton	Hancock	Linn	Louisa	Lyon	Monona	Story	Warren	Winnebago	Woodbury	Other	January	February	March	April	May	June	July	August	September	October	November	December	Specimens
<i>D. species A</i>		x							x		x										x	x	x	x					7
<i>Discocerina species B</i>		x																				x	x						8
<i>D. trochanterata</i>		x									x	x										x	x	x					20
<i>Leptopsilopa atrimana</i>		x				x					x	x	x	x		Henry, Polk				x	x	x	x	x	x	x			62
<i>Psilopa compta</i>		x																		x									10
<i>P. dupla</i>		x			x	x			x				x									x	x	x					50
<i>P. olga</i>		x	x						x		x	x									x	x	x						75
<i>Ptilomyia enigma</i>	x	x				x			x		x	x										x	x	x					17
<i>Trimerina madizans</i>								x			x										x								1

Also related to the inundation factor is the very abundant microflora of diatoms.

Habitat sites: 3 miles southeast of Waterville, Allamakee Co.; north and south banks of the Des Moines River at Fraser, north bank of the Des Moines River near Ledges State Park, Boone Co.; .5 mile south of Gull Point State Park, Dickinson Co.; Mark Twain National Wildlife Refuge, Louisa Co.; Missouri River near Whiting, Monona Co.; Skunk River at Ames, reserve of Izaak Walton League near Ames, and 4 miles east of Gilbert, Story Co.

#### Stream-rocks Habitat

This habitat of moss- and alga-covered shoal, or riffle rocks is only a small physiognomic subdivision of the stream-rapids community, and as such it is relatively poorly represented in Iowa. It consists of rocks and rock exposures projecting above the surface in shallow riffles and covered with bryophytes, species of *Nostoc*, and species of *Mougeotia*. Diatoms are very abundant and constitute the bulk of the microflora. This habitat, which is restricted to forested areas, is one of the most stable ephydrid habitats in Iowa.

Habitat sites: 3 miles southeast of Waterville, Allamakee Co.; 3.5 miles west of Boone, and Peese Creek in Ledges State Park, Boone Co.; White Pine Hollow State Park, Dubuque Co.

#### *Eragrostis*-mat Habitat

Although it is probably only a much-altered lotic subdivision of the sedge-meadow habitat, this habitat could not be readily included in the latter because of its distinct ephydrid fauna and because of the temporary nature of the mats. *Eragrostis hypnoides* seemed to ecize on the sand shores after the last midsummer inundation. After the sand shore is covered with mats of *Eragrostis*, its ephydrid fauna changes just as does that of the mud shore after invasions of *Leersia*.

Habitat sites: north bank of Des Moines River at Fraser and south bank of Des Moines River 0.75 mile southwest of Fraser, Boone Co.

#### *Freshet-seep* Habitat

This microhabitat usually consists of small seepage areas on embankments. The duration of this microhabitat is governed by the rainfall. Species of *Nostoc* and other species of Cyanophyta, together with mosses, usually grow on such areas and around the small pools at the bases of the embankments.

Habitat sites: Peese Creek in Ledges State Park and north bank of Des Moines River at Fraser, Boone Co.

*Spoil-bank Habitat*

This is probably the most exceptional ephydrid habitat in Iowa. It consists of small pools of water which runs from the bases of mine-refuse accumulations. Except for a sparse cover of grasses and a few trees, this habitat has no consistent macroflora. Physiographically the habitat is similar to some alkaline ephydrid habitats in western states.

Habitat sites: 3 miles west of Boone, Boone Co.; Banner Mine Area, Warren Co.

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