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FLYING INSECT POPULATIONS AS SAMPLED BY MALAISE TRAP ON CROWLEY'S RIDGE IN NORTHEAST ARKANSAS

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ABSTRACT

Malaise trap collections from woodlot and open field sampling sites on Crowley's Ridge yielded 10,830 individuals during the months of May, July and September, 1980. Greatest numbers of insects were collected in May, with fewest in September. Four orders comprised 97% of the total catch: Diptera (57%), Lepidoptera (17%), Hymenoptera (15%) and Homoptera (8%). Coleoptera, Hemiptera, Neuroptera, Odonata and Orthoptera comprised the remaining 3%. Ordinal composition and seasonal occurrence patterns are discussed and compared for the two sampling sites.

INTRODUCTION

The Malaise trap as described by Townes (1962) is a relatively unbiased collecting apparatus for flying insects and renders itself as a useful tool for surveying flying insect populations. The trap utilizes no attracting devices and takes advantage of an insect's natural tendency to fly or crawl upward when trying to escape, thus directing it into a collecting container at the top of the trap (Breeland and Pickard, 1965).

Previous studies by Matthews and Matthews (1970, 1971) found the Malaise trap an efficient means of sampling flying insect populations for faunal composition and seasonal occurrence patterns. The Malaise trap has proven also to be useful for sampling specific dipteran populations such as Tabanidae (Roberts, 1971) and Culicidae (Breeland and Pickard, 1965). Covell (1979) and Walker (1978) found the trap to be effective for sampling lepidopteran populations as did Townes (1962) for hymenopterans.

Crowley's Ridge provides an appropriate study site as a natural division of Arkansas, geographically isolated as it rises out of the Mississippi embayment surrounded by delta lowlands. The flying insect populations of this area have not previously been surveyed.

Two adjacent but separate ecological communities (a woodlot and an open field) were utilized as collecting sites for this study. The ordinal and seasonal occurrence patterns for the Malaise trap catches at these locations are compared and discussed.

METHODS AND MATERIALS

This investigation was conducted during the months of May, July and September, 1980, on the Arkansas State University dairy farm in Craighead County, Arkansas.

The woodlot community was composed primarily of *Carya*, *Quercus* and *Ulmus* species. *Cornus* and other less abundant species were present as understory. The woodlot was bordered on the south by a stock pond. An area with sparse understory was chosen for Malaise trap placement to provide relatively unobstructed insect flyways.

The open field community was located adjacent to the woodlot on the east. It consisted of a grassland area primarily composed of *Panicum*, *Setaria* and *Sorghum* species along with less abundant flowering plant species.

The Malaise trap used for this study was a commercially purchased, square trap with a 2.44 m center support. Four central vanes directed the flying insects into the collecting head at the top of the trap which contained a 2,2-dichlorovinyl dimethyl phosphate Shell No-Pest® Strip as the killing agent.

Collecting periods of 24 hr duration were conducted once each week at each study site. The trap was emptied at 6 hr intervals from 12 p.m. to 12 p.m. the following day. Six-hour samples were sorted and identified to the family level.

Weather data, recorded by the Jonesboro Flight Station located approximately 2.14 km from the collecting sites, was obtained for each 24 hr. period and is summarized in Table 1.

RESULTS AND DISCUSSION

A total of 10,830 insect specimens representing 79 families in nine orders was collected during the 12 weeks of this study. Four orders (Diptera, Lepidoptera, Hymenoptera and Homoptera) comprised 97% of the total catch. Diptera were the most commonly collected representing 57% of the total number, followed by Lepidoptera (17%), Hymenoptera (15%) and Homoptera (8%). The combined Coleoptera, Hemiptera, Neuroptera, Odonata and Orthoptera collections formed the remaining 3% of the catch.

Diptera were represented by 24 families with 15 of these comprising at least 1% of the total ordinal composition during one of the three collecting periods. The percentage of major families of dipterans collected is shown in Table 2.

The dipterans collected were primarily nematocerous. Chironomidae and Psychodidae were collected in large numbers in the woodlot during May and September. Although less abundant, Chironomidae were predominantly collected in the open field community during July. Tipulidae were abundant in May and were taken in nearly equal numbers at both collecting sites.

As a group, brachycerous dipterans were collected in relatively low numbers. Tabanidae occurred in greatest numbers during July and September in the open field.

Cyclorrhaphous dipterans were best represented by Tachinidae, Phoridae and Muscidae. Tachinidae were present in sizeable numbers in the open field during May and September but reached their greatest population levels in both communities in July, comprising the bulk of the dipteran population for the month. The Phoridae and Muscidae were collected in considerably lower numbers but also reached their peak in mid-summer.

Table 1. Weather data for the three collecting periods.

Month (1980)	Mean Temperature Max. C.	Min. C.	Total Rainfall (mm)	Mean Relative Humidity
May	27.2	14.3	87.9	52%
July	36.6	23.5	1.0	40%
September	23.5	16.0	107.9	80%

Although Culicidae and Tabanidae were numerous in the vicinity of the trap sites, they were not collected in large numbers (Table 2). This finding is in agreement with the results of studies conducted by Matthews and Matthews (1970). Breeland and Pickard (1965) and Roberts (1971, 1972) found the Malaise trap to be highly effective for trapping these two families. However, the traps they used were modified to help influence the collection of Tabanidae and Culicidae. Roberts (1970a, 1970b, 1972, 1975, 1978) found that trap size and shape, baffel arrangement, color and other factors could significantly influence numbers of Tabanidae collected.

The percentage of major families of lepidopterans collected at both sites is shown in Table 3. The lepidopteran population was primarily composed of the family Pyralidae, which was taken in large numbers from both communities throughout the study. The Pyralidae were most abundant in the woodlot, especially in July, and were at their lowest numbers in late season. Adults of the family Noctuidae were collected in considerably smaller numbers, but with similar success, in both communities. Skippers (Hesperiidae) increased in numbers during September in both the woodlot and the open field communities. This may be attributable to seasonal migration. Studies by Covell (1979) show that several species of skippers may be collected in relatively large numbers from August to October. Lycaenidae were collected primarily in May and September with preference being shown for the open field community.

Ichneumonidae was the predominant family collected of the ten major ones of Hymenoptera, represented by percent composition in Table 4. The ichneumonids were collected in greatest numbers in the woodlot during May. Numbers of collected individuals began to decrease and level off to approximately equal ratios by mid-summer in both communities. Halictidae and Formicidae also were collected in considerable numbers. Halictidae reached their peak level in the open field throughout September. Formicidae were present in large numbers in the open field during May and July but reached their largest percentage of the hymenopteran population in September in the woodlot. The other major families were collected in smaller, but relatively constant, numbers and tended not to show a distinct preference for a particular community.

Homopterans were represented by four families with the two major families being Aphididae and Cicadellidae (Table 5). Aphids showed a preference for the woodlot during May and July but were not collected in recordable percentages from either community during September. Cicadellidae comprised the bulk of the homopteran population and maintained an almost constant level in both communities for each collecting period. Flatidae and Membracidae appeared only in very small numbers throughout the study.

The remaining orders, with the exception of Coleoptera, were collected in extremely low numbers. Collections of coleopterans increased slightly in the woodlot during July and September with the appearance of numerous Curculionidae. In view of the fact that Coleoptera constitutes the largest insect order, its poor representation may be explained, in part, by their tendency to drop to the ground when they encounter an obstacle in flight (Matthews and Matthews, 1970, 1971).

Relative abundance of the insect orders in the woodlot and open field communities is represented on a weekly basis in Figs. 1 and 2. Most orders in the woodlot began to decrease numerically by September with the exception of Lepidoptera. All orders showed a population increase following rains which occurred during the third and fourth weeks of September.

In the open field community, several population trends were observed. Hymenoptera showed an increase in numbers during the second week of July, followed by a sharp decline. This order steadily decreased in population in the woodlot community. Lepidoptera also

Table 2. Percentage of major families of Diptera.

	May		July		September	
	Woodlot	Open Field	Woodlot	Open Field	Woodlot	Open Field
Bibionidae	1.55	*	*	*	*	*
Calliphoridae	4.96	6.01	1.95	1.50	*	*
Chironomidae	24.73	7.50	9.88	13.02	59.22	29.35
Culicidae	1.19	2.00	9.96	20.31	4.47	14.13
Dolichopodidae	*	3.71	4.47	5.54	*	2.28
Muscidae	3.05	9.44	11.20	8.39	3.04	5.43
Otitidae	*	1.14	*	*	*	*
Phoridae	1.61	3.58	13.32	3.39	*	1.50
Pipunculidae	*	1.00	*	*	*	*
Psychodidae	36.86	11.87	*	1.05	15.02	3.04
Rhagionidae	*	1.72	*	*	*	*
Syrphidae	1.76	8.30	*	1.05	*	1.08
Tabanidae	*	*	2.12	6.14	1.62	2.32
Tachinidae	6.66	19.60	31.52	27.84	10.08	24.35
Tipulidae	10.49	16.74	1.90	1.35	*	1.08
N	1936	699	1368	668	1052	460

* Values less than 1.00.

Table 3. Percentage of major families of Lepidoptera.

	May		July		September	
	Woodlot	Open Field	Woodlot	Open Field	Woodlot	Open Field
Hesperiidae	3.41	4.32	1.60	9.64	30.76	37.67
Lycaenidae	*	11.73	*	3.55	*	9.95
Noctuidae	9.76	7.41	6.07	4.57	3.51	1.90
Pyralidae	47.80	32.10	67.09	36.55	22.34	28.51
N	205	162	313	197	508	422

* Values less than 1.00.

Table 4. Percentage of major families of Hymenoptera.

	May		July		September	
	Woodlot	Open Field	Woodlot	Open Field	Woodlot	Open Field
Braconidae	5.77	3.08	1.67	*	*	*
Cynipidae	*	5.64	2.86	3.25	8.33	2.09
Evaniidae	*	1.54	19.09	3.25	5.73	12.00
Formicidae	8.89	24.62	*	19.80	29.17	2.09
Halictidae	4.81	7.18	21.48	29.27	3.65	26.96
Ichneumonidae	72.36	47.18	17.42	21.95	29.17	25.71
Scoliidae	*	1.03	10.91	6.91	10.42	12.57
Sphecidae	1.68	1.54	7.16	6.91	3.13	1.14
Tiphiidae	*	*	2.86	1.22	1.04	6.86
Vespidae	3.61	6.13	3.34	4.47	5.73	8.29
N	416	195	419	246	192	175

* Values less than 1.00.

Table 5. Percentage of major families of Homoptera.

	May		July		September	
	Woodlot	Open Field	Woodlot	Open Field	Woodlot	Open Field
Aphididae	10.69	*	3.13	1.69	*	*
Cicadellidae	88.05	95.31	95.31	94.94	99.01	95.96
N	159	171	128	118	127	124

* Values less than 1.00.

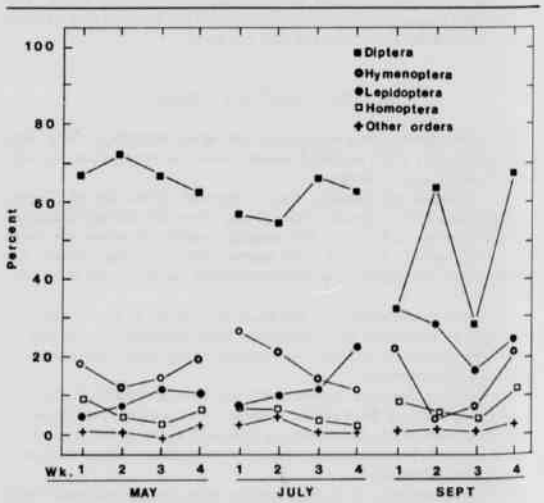

Fig. 1. Relative abundance of insect orders in woodlot.

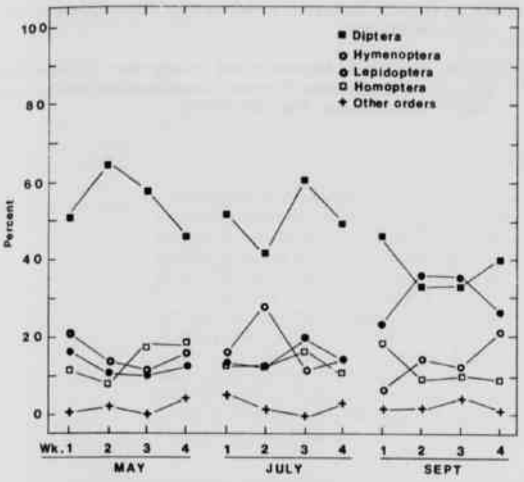

Fig. 2. Relative abundance of insect orders in open field.

increased in numbers during mid-summer in the open field but not in the woodlot. All orders except Diptera and Hymenoptera declined in population rather than increasing as in the woodlot after the rains in late September.

Table 6. Summary of all taxa collected.

Diptera	Hemiptera	Lepidoptera
Anthomyidae	Berytidae	Arctiidae
Asilidae	Lygaeidae	Ctenuchidae
Bibionidae	Miridae	Hesperiidae
Bombyliidae	Pentatomidae	Lycaenidae
Calliphoridae	Reduviidae	Noctuidae
Cecidomyiidae	Neuroptera	Notodontidae
Chironomidae	Chrysopidae	Nymphalidae
Culicidae	Hemerobiidae	Papilionidae
Dolichopodidae	Coleoptera	Pieridae
Muscidae	Buprestidae	Pyralidae
Mycetophilidae	Carabidae	Sphingidae
Otitidae	Cerambycidae	Microlepidoptera
Pipunculidae	Chrysomelidae	Hymenoptera
Phoridae	Coccinellidae	Andrenidae
Psychodidae	Curculionidae	Apidae
Rhagionidae	Elateridae	Braconidae
Sarcophagidae	Lampyridae	Chrysididae
Stratiomyidae	Melandryidae	Cynipidae
Syrphidae	Mordellidae	Evaniidae
Tabanidae	Scarabaeidae	Formicidae
Tachinidae	Odonata	Halictidae
Tephritidae	Coenagrionidae	Ichneumonidae
Therevidae	Orthoptera	Megachilidae
Tipulidae	Acrididae	Pompilidae
Homoptera	Blattidae	Scoliidae
Aphididae	Mantidae	Sphecidae
Cicadellidae	Tetrigidae	Tiphiidae
Flatidae	Tettigoniidae	Vespidae
Membracidae		

Table 7. Total seasonal composition by insect order.

	May			July			September		
	Woodlot	Open field	%Total	Woodlot	Open field	%Total	Woodlot	Open field	%Total
Diptera	1936	699	65.37	1366	668	55.99	1052	460	47.76
Lepidoptera	205	162	9.19	313	197	14.06	508	422	29.37
Hymenoptera	416	195	15.16	429	266	19.30	192	171	11.79
Homoptera	159	171	8.19	185	119	8.42	127	124	7.93
Coleoptera	30	35	1.66	77	22	2.73	66	16	2.59
Hemiptera	11	4	0.37	3	3	0.17	1	4	0.16
Orthoptera	2	1	0.07	3	7	0.28	0	5	0.19
Neuroptera	0	2	0.05	1	2	0.08	5	3	0.25
Odonata	1	0	0.02	1	0	0.03	2	4	0.19
Σ	2767	1269	4031	2311	1322	3633	1951	1215	3166

CONCLUSIONS

A summary of all taxa in the nine orders collected is represented in Table 6. The seasonal composition by insect order (Table 7) can be summarized by the following:

The woodlot turned out to be the prominent collecting site for this study, responsible for approximately 65% of the total catch each month. The open field community was most productive during the July collection period. Insect abundance was greatest during May, declining as the season progressed with the lowest numbers being collected in September.

The decrease of insect numbers collected from mid- to late-season may be related to extreme weather conditions (Table 1). This study was conducted during the longest hot-and-dry period ever recorded for this area.

The ordinal composition of this study compares favorably with similar Malaise trap studies of Matthews and Matthews (1970, 1971) and Martson (1965). They found that orders Diptera, Hymenoptera, Lepidoptera and Homoptera comprised at least 90% of the total collection (Matthews and Matthews, 1971). They also found that Hymenoptera generally occupied the second ordinal position. However, in this study, Lepidoptera represented the second largest order, exceeding Hymenoptera by 2%.

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Journal of the Arkansas Academy of Science, Vol. 35 [1981], Art. 9

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