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Soybean Insects and Related Arthropods in Missouri

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Soybean Insects and Related Arthropods in Missouri

C. C. BICKENSTAFF AND J. L. HUGGANS¹

INTRODUCTION

Although soybeans is a major cash crop of Missouri, involving 2,235,960 acres worth \$93 million (USDC 1961) and accounting for 8.5% of farm income in 1959, very little information is available with respect to the insects affecting this plant. The lack of information may be due to good yields obtained in spite of insect attack or to nonrecognition of insect damage. Surveys of insect species and their abundance in soybean fields were conducted in 1958, 1959, and 1960 to determine which species might be of potential economic importance. Increasing concern was expressed during the late 1950's by shippers in southeastern Missouri over seed damage attributed to stink bugs. Preliminary cage studies were therefore made to determine the type and extent of damage caused by stink bugs and another sucking insect, the tarnished plant bug (*Lygus lineolaris* (P.de B.)). Results of four insecticide control tests are also reported.

REVIEW OF LITERATURE

Only two detailed studies of the insects in soybean fields have previously been reported. One was made in Ohio (Balduf 1923) during 1919-21 in one field each year, with 156 species reported as actually in soybean fields, plus 53 species in nearby vegetation. Balduf stated that "the green cloverworm (*Plathypena scabra* (F.)) is the only insect that deserves to be ranked as a general pest of soybeans in this country," and listed as possible pests grasshoppers, leafhoppers, plant bugs, grape colaspis [*Maecolaspis* (= *Colaspis*) *flavida* (Say)?], flea beetles, and the bean leaf beetle (*Cerotoma trifurcata* (Forster)). The second study was made in Minnesota in 1946 (Kretzschmar 1948) in which three sampling techniques were compared. Kretzschmar identified 84 species plus 28 other family groups collected but actually listed only 64 species by name. Thirty-nine species occurred more than 10 times in 298 collections with the potato leafhopper (*Empoasca fabae* (Har.)) predominating. With reference to Balduf's work Kretzschmar stated: "Generally speaking, the insect population of soybean plants in Minnesota is comparable to that found in Ohio so far as families are concerned."

Probst and Everly (1957b) also gave a summary list of all insects collected in early August 1950 and 1951 from soybeans adjacent to insecticide plots in Indiana. For the most part, insects were grouped in various ways under orders.

¹Entomology Research Division, Agric. Res. Serv., USDA, in cooperation with University of Missouri. A.E.S. Project 369.

Nine of the more common pest species were listed individually, the most numerous being the meadow spittle bug *Philaenus spumarius* (L.), the potato leafhopper, and the tarnished plant bug.

Several summaries of economic pests of soybeans have been published. Some of the more inclusive are: Piper and Morse (1923), Morse et al. (1949), Morse (1950), Packard (1951), Anonymous (1953), and Anonymous (1957) for the United States; Starks (1954) for Iowa; Milliron (1958) for Delaware; and Ratcliffe et al. (1960) for Maryland. The most extensive of these was by Packard who discussed 19 species and 7 groups.

In the USDA Cooperative Economic Insect Reports from 1951 through 1960 a total of 75 species, 12 genera, and 13 larger groups were reported from the United States. These reports list damaging pests almost exclusively, or those capable of causing damage. Of all reports during the 5-year period 1956-1960, 50 percent concerned the following 5 species: Bean leaf beetle, green cloverworm, corn earworm (*Heliothis zea* (Boddie)), velvetbean caterpillar (*Anticarsia gemmatilis* Hubner), and Mexican bean beetle (*Epilachna varivestis* Muls.).

Although control recommendations for most soybean pests are available to the public, only a few published results of experimental work appear in the literature. The following were found: Ellisor et al. (1938), Poos (1940), Kulash (1947), Everly & Probst (1952), Bigger (1953), Probst and Everly (1957 a,b), Reynolds et al. (1957), Miner (1959), and Ratcliffe et al. (1960). Although it is obvious that control of severe damage would result in yield increase, in only one of these reports is yield increase following treatment actually given (Ratcliffe et al. 1960).

The ability of the plant to make up for wide plant spacing, and to withstand and recover from simulated hail damage indicates that early loss of stand from soil insects (Probst 1945) and moderate defoliation by leaf feeders (Gibson et al. (1943), Kalton et al. (1949), Camery and Weber (1953), Weber (1955)) is probably of little economic importance. The effect of sucking insects has not yet been determined, with the exception of Miner's report on the three-cornered alfalfa hopper (*Spissistilus festinus* (Say)), which girdles the stem.

SURVEY

Methods and Procedures

Systematic collections in farmers' fields were made by using a standard 15-inch sweep net and taking 25 sweeps per field. In 1958 six collections were made in Boone County; in 1959, 84 collections were made in 19 counties representing the major soybean-producing areas in the State; and in 1960, 72 collections were made in Boone County. In 1959 all collections were made near the middle of each month, and in 1960 they were made every 2 weeks. At the beginning of the season, fields were selected to represent a nearly equal number of early, medium,

and late plantings. Two fields were used for sampling in 1958, 21 in 1959, and 11 in 1960. Collections were made throughout the growing season from June through September, except in 1958, when they were begun near the middle of the growing season in August.

Insects collected were killed in the net with ethyl acetate and stored in cardboard ice-cream cartons for later sorting, counting, and recording. Data from a few additional miscellaneous collections were obtained in the same manner. Representative specimens of most species were pinned, preserved in alcohol, or mounted on slides, and sent to taxonomists of the Entomology Research Division, Agric. Res. Serv., U.S.D.A., for identification. Spiders, collected in 1958 and 1959, were identified by students taking a course in araneology at the University of Missouri. Lepidopterous larvae were, for the most part, identified by the junior author. The complete collection is stored in the Entomology Department Museum, University of Missouri.

Although it is felt that, for the most part, comparisons with identified specimens and recording of numbers were correct, it is impossible for nontaxonomists to accurately separate closely related forms. Because numerous collections and a large number of species were handled errors were bound to occur. Therefore, the data presented below can be considered correct in that these species were collected from soybean fields, but there may be some inaccuracies in the data accompanying each species, except for the more easily distinguished forms. Errors especially may have occurred in identifications of Hymenoptera and Diptera, and of the spiders, made by the students.

Results

The number of insect species collected was nearly 540. Of these, 367 were specifically identified, 118 placed to genus, and 45 to family or order. Seven mites and approximately 38 spiders, most of which were identified only to genus or family, were also collected. Sixty-one insects, or approximately 11 percent of the species, occurred in 10 percent or more of the systematic collections. Kretzschmar (1948) found only 39 species in 3 percent or more of his collections. In this study, the families Cicadellidae, Fulgoridae, Miridae, and Chrysomelidae comprised 16 percent of all species collected. In previous surveys they represented 39 percent (Balduf 1923), and 29 percent (Kretzschmar 1948) of all species collected.

Those 61 species which occurred in 10 percent or more of the systematic 1959 and 1960 collections, regardless of number of individuals taken, are listed in table 1. Included in the table are data indicating relative abundance by 2-week periods and for each season, the number and percent of collections in which they occurred, and the length of season during which they were present in the fields. These comprised 11.3 percent of the total species, and 86 percent of all (28,692) individuals counted.

Numbers of individuals do not necessarily reflect importance, but they may be used to indicate relative abundance. In Balduf's and Kretzschmar's studies,

TABLE 1—SEASONAL AND RELATIVE ABUNDANCE OF THE MORE COMMON INSECTS
COLLECTED IN SOYBEAN FIELDS; MISSOURI, 1959-60.

Species	Number Indivi- duals Taken	Number Collec- tions Taken	Average Number Individuals/100 Sweeps by Half-Month Periods										Occurrence during Span			
			May		June		July		August		September		Percent of Collections		Individuals/100 Sweeps	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1959	1960	1959	1960
<u>Sericothrips</u> <u>variabilis</u>	11,417	100	0	-	3/ 1,039	2/ (622	833	228	366	86	28	1)	40	99	78	572
<u>Empoasca</u> <u>fabae</u>	1,637	110	(25	- /	24	13	95	94	80	30	9/	3)	64	83	34	54
<u>Halticus</u> <u>bracteatus</u>	1,590	80	0	- (	6	3	10	40	34	75	80/	23)	60	46	67	14
<u>Cerotoma</u> <u>trifurcata</u>	1,217	121	(106	- /	5	10	17	16	13	57	40	28)	82	74	47	12
<u>Orisu insidiosus</u>	1,197	104	(11	- /	22	26	71	47	42	15	40/	1)	62	75	28	36
<u>Frankliniella tritici</u>	943	70	0	- /	44	(57	82	19	38	4)	2/	0	34	75	7	49
<u>Chaetocnema pulicaria</u>	821	77	(30	- /	3	1	8	16	16	50	24/	5)	58	42	35	5
<u>Frankliniella</u> <u>fusca</u>	685	58	0	- /	70	(80	34	3)	5	1	4/ P /	0	44	67	11	35
<u>Plathypena</u> <u>scabra</u>	497	97	(2	- /	3	4	6	8	32	15	19	17)	57	68	12	13
<u>Agallia</u> <u>constricta</u>	464	77	(5	- 9/		2	14	45	14	6	1/	3)	49	57	16	9
<u>Maecolaspis</u> sp.	438	53	(3	- 0/		17	37	28	5/	3)	0	0	41	67	20	13
<u>Diabrotica</u> <u>duodecimpunctata</u>	297	101	(6	- /	13	3	9	11	5	6	7	12)	61	68	10	5
<u>Lygus lineolaris</u>	295	77	(5	- /	11	7	17	14	4	4	5	2)	37	64	6	10
<u>Aceratagallia</u> <u>sanguinolenta</u>	272	65	(8	- /	17	10	8	19	2	3	2/	1)	38	48	8	5

TABLE 1-(continued)

Species	Number Indivi- duals Taken	Number Collec- tions Taken	Average Number Individuals/100 Sweeps by Half-Month Periods												Occurrence during Span			
			May		June		July		August		September		Percent of Individuals/ Collections		100 Sweeps			
			1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1959	1960	1959	1960		
<u>Scophytopus</u>																		
<u>frontalis</u>	253	43	(4	- /	1	1	2	P	1	3	4	40)	40	14	12	1		
<u>Aeolothrips</u>																		
<u>bicolor</u>	238	51	0	- /	5(	3	22	13	13	P)	2/	0	17	61	1	13		
<u>Nabis kalmii</u>	231	83	(2	- /	2	2	8	9	13	4	9	1)	45	62	4	8		
<u>Trialeurodes</u>																		
<u>abutilonea</u>	196	22	0	- /	1	0	3	0	46	3	5	P/	-	29	0	11		
<u>Oscinella</u>																		
<u>carbonaria</u>	144	49	0	- /	9	1	2	3	1	8/	2	2)	48	18	6	1		
<u>Graminella</u>																		
<u>nigrifrons</u>	144	43	(2	- /	3	2	7	3	3	6	3/	P)	19	39	4	3		
<u>Telenomus</u>																		
<u>podisi</u>	137	58	0	- /	1(	1	7	2	13	5	1	1)	35	42	2	5		
<u>Lasius</u>																		
<u>alienus</u>	121	37	0	- /	13(	6	10	2	1	1/	P)	0	25	35	2	6		
<u>Oscinella</u>																		
<u>soror</u>	117	41	(1	- /	2	1	2	5	6	5/	1	1)	30	27	4	3		
<u>Epitrix</u>			2/		3/													
<u>fuscula</u>	116	38	(1	- /	10	4	6	4	2	1	3)	0	17	38	2	4		
<u>Anthicus sp.</u>	109	15	0	-	0(	P	P	16	0	1)	0	0	28	-	8	0		
<u>Plagiognathus</u>																		
<u>politus</u>	101	33	0	-	0/	6	8	2	4	1	1	P/	-	50	0	6		
<u>Stomatothrips</u>																		
<u>flavus</u>	94	35	0	-	0	0/	2	3	13	3	2/	0	-	66	0	7		
<u>Geocoris sp.</u>	86	32	0	-	(3	P/	3	1	1	5	1	1)	25	21	3	1		

TABLE 1-(continued)

Species	Number Indivi- duals Taken	Number Collec- tions Taken	Average Number Individuals/100 Sweeps by Half-Month										Occurrence during Span			
			May		June		July		August		September		Percent of Collections		Individuals/ 100 Sweeps	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1959	1960	1959	1960
<u>Monomorium</u> sp.	82	27	0	- /	7(	7	4	1	1	1)	P	P/	13	28	2	3
<u>Thaumatomyia</u> <u>glabra</u>	79	24	0	- (	17	1/	P	2	P	2	1	2)	22	11	4	0.4
<u>Adelphocoris</u> <u>rapidus</u>	71	44	(3	- /	2	1	4	5	3	P	3/	P)	23	36	2	2
<u>Hippodamia</u> <u>convergens</u>	71	36	(3	- /	7	2	2	2	0	2	P/	5)	26	20	2	1
<u>Deltocephalus</u> <u>flavocosta</u>	68	20	0	- (	13	P	P	1	0	3/	2	1)	20	7	3	0.3
<u>Paraphlepsius</u> <u>irroratus</u>	65	17	0	- /	2	2	0(	1	2	1)	0	0	20	15	2	3
<u>Oecanthus</u> <u>argentinus</u>	64	26	0	-	0(	P/	P	1	1	2	3/	4)	14	28	2	2
<u>Bradysia</u> sp.	62	20	0	- /	1(	6	5	2	0	P)	0	0	21	15	2	3
<u>Carabidae</u> gen. sp. undet.	58	28	0	-	0(	8/	2	2	P/	2	1	2)	30	12	2	1
<u>Melanophthalma</u> sp.	57	24	(2	-	0	0	0/	1	5	3	1	P)	2	49	0.1	5
<u>Dolocopodidae</u> gen. sp. undet.	49	34	0	- (	1/	1	1	2	2	1/	P	1)	19	30	1	2
<u>Melanophthalma</u> sp.	48	23	(1	-	0	1/	1	1/	0	1	3	1)	21	23	2	1
<u>Melanoplus</u> <u>differentialis</u>	48	18	0	-	0	0	0	0/	1(	3	2/	2)	20	6	3	0.4
<u>Sitona</u> <u>hispidula</u>	46	15	0	- /	8	P(	1	3/	0	1	P	P)	14	13	2	2
<u>Reuteroscopus</u> <u>ornatus</u>	45	25	0)	- /	1	1	1	1	7	P	1	1/	-	35	0	2

TABLE 1--(continued)

Species	Number Indivi- duals Taken	Number Collec- tions Taken	Average Number Individuals/100 Sweeps by Half-Month Periods										Occurrence during Span					
			May		June		July		August		September		Percent of Individuals/ Collections		Percent of Individuals/ 100 Sweeps			
			1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1959	1960	1959	1960		
<u>Melanoplus</u>																		
<u>femurrubrum</u>	45	18	0	-	0	0	0	0	0	1	1	7	16	17	2	1		
<u>Conocephalus</u>																		
<u>fasciatus</u>	39	17	0	-	0	P	P	1	0	2	0	2	22	-	2	0		
<u>Jalysus</u>																		
<u>spinus</u>	37	27	0	-	0	5	2	2	1	P	P	0	20	22	1	1		
<u>Liburniella</u>																		
<u>ornata</u>	37	26	0	-	1	P	1	1	0	2	2	P	16	24	1	1		
<u>Exitianus</u>																		
<u>exitiosus</u>	37	19	0	-	/	1	P	1	3	2	1	P	0	8	23	1	1	
<u>Acrosternum</u>																		
<u>hilare</u>	35	15	0	-	0	0	0	0	0	1	2	3	13	36	2	3		
<u>Piesma sp.</u>	34	21	0	-	/	1	1	1	4	P	P	1	13	16	1	1		
<u>Euschistus</u>																		
<u>variolaris</u>	34	19	0	-	0	0	1	P	1	1	4	0	6	30	0.2	2		
<u>Melanoplus</u>																		
<u>bilituratus</u>	34	19	0	-	0	1	P	P	0	1	2	0	28	9	2	0.		
<u>Diabrotica</u>																		
<u>longicornis</u>	34	16	0	-	0	0	P	1	7	2	P	P	13	20	0.5	2		
<u>Orchelimum</u>																		
<u>vulgare</u>	32	15	0	-	0	0	0	P	1	2	0	4	13	24	2	1		
<u>Phyllobaenus sp.</u>	29	15	(	1	-	1	3	0	P	1	P	1	P	14	16	1	1
<u>Coleomegilla</u>																		
<u>maculata</u>	28	19	(	2	-	0	P	1	P	P	2	P	P	14	16	1	1
<u>Colias philodice</u>																		
<u>eurytheme</u>	27	24	(2	-	1	/	1	1	P	1	P	1	P	14	21	1	1

TABLE 1-(continued)

Species	Number Indivi- duals Taken	Number Collec- tions Taken	Average Number Individuals/100 Sweeps by Half-Month Periods ^{1/}										Occurrence during Span Percent of Individuals/ Collections 100 Sweeps				
			May		June		July		August		September		1959	1960	1959	1960	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd					
<u>Draeculacephala</u>																	
<u>mollipes</u>	27	19	0	-	(1/	P	P	1	1	P/	1	1)	15	13	1	0.5	
<u>Balclutha</u>																	
<u>neglecta</u>	24	17	0	-	0/	1	P	2	2	P	P/	0	-	27	0	2	
<u>Chrysopa</u>																	
<u>occulata</u>	22	17	0	-	0	0/	1(	P	1	P	1/	P)	9	21	0.5	1
<u>Delphacodes</u>																	
<u>puella</u>	22	15	(1	-	0	P/	P	P	0	1	1/	1)	13	8	1	0.3	
Totals	25,346	-	226	-	1,381	924	1,353	688	817	439	324	180	-	-	-	-	

^{1/} Number of collections by period:

	May		June		July		August		September		Total
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	
1959	4	0	1	9	5	13	0	26	11	15	84
1960	0	0	6	10	11	11	11	11	9	3	72

^{2/} (1959 span)

^{3/} /1960 span/

^{4/} P = 0.5 or less

Empoasca fabae was the most numerous species, but in Probst and Everly's paper and in this study it was the next most numerous.

Leafhoppers, as a group, were abundant in all four studies. Occurring in large numbers in three of the four studies were the insidious plant bug (*Orius insidiosus* (Say)), *Lygus lineolaris*, and *Maecolaspis* sp. In this study, three species of Thysanoptera were among the 10 most numerous and the order accounted for 50 percent of all specimens recorded, whereas in the other three studies, the order was either not mentioned or only a few specimens recorded.

In this study, *Sericothrips variabilis* (Beach) was by far the most numerous species present; it accounted for 40 percent of all insect specimens collected, and occurred in 64 percent of all collections. The only insects present in as many or more collections were *Empoasca fabae*, *Cerotoma trifurcata*, *Orius insidiosus*, and the spotted cucumber beetle (*Diabrotica undecimpunctata howardi* Barber).

Other species found very commonly in this study were *Agallia constricta* VanD. (also by Balduf), *Plathypena scabra* (Fab.) (also by Kretzschmar), *Halticus bracteatus* (Say), and *Chaetocnema pulicaria* Melsh.

Sixteen predaceous, or possibly predaceous, and one parasitic species were among the 61 common species: The hemipterans *Orius insidiosus*, *Nabis kalmii* Reuter, *Plagiognathus politus* Uhler (probably), and *Geocoris punctipes* (Say); the coleopterans *Hippodamia convergens* Guer., *Coleomegilla maculata* Timb., *Anthicus* sp. (possibly), *Phyllobaenus* sp., and an undetermined carabid; the neuropteran *Chrysopa oculata* Say; the thysanopterans *Aeolothrips bicolor* Hinds (possibly) and *Stomatothrips flavus* Hood (possibly); the dipterans *Thaumatomyia glabra* (Mg.) and a Dolichopodid; and the hymenopterans *Monomorium* sp., *Lasius alienus* (Foerster), and *Telenomus podisi* Ashm. (parasitic).

Some of the 61 species are probably of little or no economic importance, but 41 could be considered as potential pests. Those considered as having no damage potential are *Ocinella carbonaria* (Lw.), and *O. soror* (Macq.) In spite of the common occurrence of many known and potential pests, very little damage was observed in the fields surveyed. Thrips caused some silvering of leaves on seedling plants, and the bean leaf beetle caused considerable defoliation and some loss of plant stand in a few fields. The grape colaspis was common and widespread but was observed causing serious damage in only one nonsurvey field. Damage from this species and that of the spotted cucumber beetle and the clover root curculio (*Sitona hispidula* (F.)) could very easily have been overlooked, however, as could damage caused by sucking insects.

All the species of insects collected and identified are listed systematically below by order and family following a modified arrangement of Borror and De-Long (1954). Genera and species are listed alphabetically within families. County distribution, the first and last dates of collection, and the number of collections in which taken are given for each species.

Mites were scarce at all times possibly due to the large number of insect predators present. None of the economically important species was collected.

Spiders were common throughout the survey, but were counted and identified only in 1958 and 1959. *Oxyopes salticus* Hentz was by far the most common spider and accounted for 38 percent of the 385 specimens taken in 84 collections in 1959. It was present throughout the season in 50 percent of the collections but was collected in larger numbers during June. Other common species and the proportion of 1959 collections in which they occurred were: *Misumenops asperatus* (Hentz), 14 percent; *Acantheperira stellata* (Marx), 10 percent; and *Tetragnatha elongata* (Walck.), 11 percent. Unidentified species of Salticidae were also common and widespread. Orders and families of the Arachnida are placed at the end of the list following the arrangement of Kaston and Kaston (1953) for the spiders, and Baker and Wharton (1952) for the mites. Genera and species are arranged alphabetically under families.

List of Insects and Related Arthropods Collected in Soybean Fields in Missouri, 1958, 59, 60

CLASS—INSECTA

Order—COLLEMBOLA

Family—Poduridae

Pseudachorutes subcrassoides Mills. July 2nd; 1; Boone.

Family—Sminthuridae

Bourletiella hortensis (Fitch). June 2nd; 1; Boone.

Sminthurus fitchi Folsom. June 2nd—Sept. 1st; 11; Boone.

Order—EPHEMEROPTERA

Family—Baetidae

Callibaetis sp. June 1st; 1; Boone.

Order—ORTHOPTERA

Family—Tetrigidae

Tettigidea lateralis (Say). Aug. 1st—Aug. 2nd; 1; Knox, Boone.

Family—Acrididae

Chortophaga viridifasciata (DeG.). Sept. 2 (1958); Boone.

Dissosteira carolina (L.). Aug. 2nd; 1; Mississippi.

Melanoplus bilituratus (Walk.). See table 1; Bates, Boone, Butler, Cape Girardeau, Clinton, Grundy, Mississippi, New Madrid, St. Louis, Shelby, Sullivan.

Melanoplus bivittatus (Say). July 1st—Sept. 1st; 3; Mississippi, Daviess, Clinton.

Melanoplus differentialis (Thos.). See table 1; Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis.

Melanoplus femurrubrum (DeG.). See table 1; Boone, Butler, Cape Girardeau, Cass, Clinton, Knox, Mississippi, New Madrid.

Schistocerca americana (Drury). Sept. 1st; 1; Mississippi.

Family—Tettigoniidae

Conocephalus fasciatus (DeG.). See table 1; Barton, Bates, Butler, Cape Girardeau, Cass, Clinton, Knox, Mississippi, New Madrid, St. Louis.

Conocephalus strictus (Scudd.). (1958); Boone.

Orchelimum nigripes Scudd. Aug. 1st—Aug. 2nd; 2; Boone, Sullivan.

Orchelimum vulgare Harris. See table 1; Boone, Butler, Cape Girardeau, Daviess, St. Louis, Shelby, Sullivan.

Scudderia sp. Aug. 1st—Sept. 1st; 4; Cape Girardeau, Boone.

Family—Gryllidae

Oecanthus argentinus Sauss. See table 1; Barton, Boone, Butler, Clinton, Grundy, Mississippi, New Madrid, Perry, St. Louis.

Oecanthus nigricornis Walk. June 2nd—Sept. 1st; 10; Boone, Grundy.

Order—THYSANOPTERA

Family—Aeolothripidae

Aeolothrips bicolor Hinds. See table 1; Bates, Boone, Cass, Clinton, Knox, New Madrid, St. Louis.

Stomatothrips sp. almost certainly *flavus* Hood. See table 1; Boone.

Anaphothrips sp. June 2nd; 1; Grundy.

Family—Thripidae

Chirothrips crassus Hinds. July 2nd—Aug. 2nd; 5; Boone.

Chirothrips manicatus (Hal.). July 1st—Sept. 1st; 8; Bates, Boone.

Echinothrips americanus Morgan. Aug. 2nd; 1; Bates.

Frankliniella exigua Hood. June 2nd; 1; Boone.

Frankliniella fusca (Hinds). See table 1; Barton, Bates, Boone, Butler, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid.

Frankliniella tenuicornis (Uzel). Aug. 2nd; 1; Boone.

Frankliniella tritici (Fitch). See table 1; Barton, Bates, Boone, Butler, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, St. Louis.

Frankliniella sp. July 1st—Sept. 1st; 4; Boone.

Limothrips cerealium (Hal.). ? June 2nd—Aug. 1st; 4; Boone.

Microcephalothrips abdominalis (Crawf.). Sept. 1st; 1; Boone.

Sericothrips variabilis (Beach). See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, St. Louis, Sullivan.

Family—Phlaeothripidae

Eurythrips sp. June 2nd—Aug. 2nd; 4; Barton, Boone.

Leptothrips sp. pr. *mali* (Fitch). June 2nd—July 2nd; 3; Bates, Boone, Butler.

Order—HEMIPTERA

Family—Anthocoridae

Orius insidiosus (Say). See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby, Sullivan.

Family—Miridae

Adelphocoris rapidus (Say). See table 1; Boone, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby, Sullivan.

Ceratocapsus sp. ? Not in USNM. July 1st; 1; Butler.

Collaria oculata (Reuter). Aug. 2nd (1958); 1; Boone.

Garganus fusiformis (Say). Aug. 2nd—Sept. 1st; 2; Shelby, Sullivan.

Halticus bracteatus (Say). See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Daviess, Grundy, Knox, Mississippi, St. Louis, Shelby, Sullivan.

Ilnacora stalii Reuter. June 2nd—Sept. 1st; 5; Boone, Grundy, St. Louis, New Madrid.

Lopidea media (Say). June 2nd; 1; Boone.

Lygus lineolaris (P. de B.). See table 1; Bates, Boone, Cape Girardeau, Cass, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby, Sullivan.

Neurocolpus nubilus (Say). Sept. 2nd; 2; Cape Girardeau, Mississippi.

Phytocoris tibialis Reuter. June 2nd; 1; Boone.

Plagiognathus politus Uhler. See table 1; Boone.

Psallus seriatus (Reuter). June 1st; 1; Boone.

Reuteroscopus ornatulus (Reuter). See table 1; Boone.

Reuteroscopus sulphureus (Reuter). June 2nd—July 1st; 7; Boone.

Trigonotylus coelestialium (Kirkaldy). June 1st—Sept. 2nd; 12; Boone, Butler, Cass, Clinton, Knox, Mississippi, New Madrid, St. Louis.

Family—Reduviidae

Sinea diadema (F.). June 1st—Sept. 2nd; 11; Barton, Bates, Boone, Butler, Cass, Clinton, Grundy, Perry, St. Louis.

Family—Nabidae

Nabis kalmii Reuter. See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby, Sullivan.

Nabis roseipennis Reuter. June 2nd—Sept. 1st; 9; Boone, Butler, Cass, Clinton, Grundy, Knox, New Madrid.

Family—Tingidae

Atheas mimeticus Heid. July 1st; 1; Boone.

Corythucha marmorata (Uhler). June 2nd—Aug. 2nd; 8; Boone.

Gargaphia angulata Heid. May 1st—Aug. 2nd; 2; Boone, St. Louis.

Gargaphia solani Heid. July 1st—Aug. 2nd; 7; Boone, Grundy.

Family—Piesmidæ (Piesmatidae)

Piesma cinerium (Say). See table 1; Bates, Boone, Butler, Cass, Clinton, Daviess, Knox, Mississippi.

Family—Neididae (Berytidae)

Jalysus spinosus (Say). See table 1; Bates, Boone, Butler, Cass, Clinton, Knox, Mississippi, Shelby, Sullivan.

Family—Lygaeidae

Blissus leucopterus (Say). July 2nd; 2; Clinton, Knox.

Cymus angustatus Stal. Sept. 1st; 1; Clinton.

Geocoris punctipes (Say). See table 1; Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Shelby, Sullivan.

Nysius raphanus Howard. July 1st—Aug. 1st; 4; Bates, Boone.

Ortholomus scolopax (Say). Sept. 2nd; 1; Clinton.

Family—Coreidae

Alydus eurinus (Say). Sept. 1st—Sept. 2nd; 4; Clinton, Grundy, St. Louis.

Alydus pilosulus H.-S. Aug. 2nd—Sept. 2nd; 6; Boone, Clinton, Knox, St. Louis.

Anasa tristis (DeG.). June 2nd; 1; Boone.

Arbyssus indentatus (Hambleton). July 2nd—Aug. 2nd; 3; Clinton, Sullivan.

Arbyssus lateralis (Say). June 2nd—Aug. 2nd; 4; Boone, Clinton

Harmostes reflexulus (Say). June 2nd; 1; Boone.

Leptoglossus phyllopus (L.). Aug. 2nd (1958); 1; Boone.

Liorbyssus hyalinus (F.). Sept. 1st; 1; Boone.

Family—Saldidae

Micracanthia humilis (Say). May 1st—Aug. 2nd; 2; Boone, St. Louis.

Family—Cydnidae

Sebirus cinctus (P. de B.). July 1st—Aug. 1st; 2; Boone.

Family—Pentatomidae

Acrosternum hilare (Say). See table 1; Boone, Cape Girardeau, Knox, Mississippi, New Madrid, St. Louis.

Chlorochroa sayi Stal. July 2nd (1958); 1; Boone.

Corimelaena pulicaria (Germar). July 1st—July 2nd; 4; Boone, Shelby.

Euschistus servus (Say). Sept. 1st—Sept. 2nd; 3; Boone, New Madrid, St. Louis.

Euschistus variolarius (P. de B.). See table 1; Boone, Cass, Clinton.

Holcostethus limbolarius (Stal.). Sept. 1st; 1; Boone.

Oebalus pugnax (F.). July 2nd—Aug. 2nd; 3; Boone, Butler.

Podisus maculiventris (Say). June 2nd—Sept. 2nd; 6; Boone, Butler, New Madrid.

Thyanta pallidovirens accerra (McAtee). Aug. 1st—Sept. 2nd; 7; Barton, Boone, Mississippi.

Order—HOMOPTERA

Family—Membracidae

Acutalis tartarea semicrema (Say). Sept. 2nd; 1; Mississippi.

Campylenchia latipes (Say). June 2nd—July 2nd; 5; Barton, Boone, Butler, Knox.

Entylia sinuata (F.). July 2nd; 3; Bates, Boone.

- Micrutalis calva* (Say). June 1st—Aug. 2nd; 4; Boone, Clinton.
Spissistilus festinus (Say). Aug. 2nd; 2; Barton, Perry.
Stictocephala bupalus (F.). July 1st—Aug. 2nd; 8; Boone, Cass, Grundy, Mississippi, Sullivan.

Family—Cercopidae

- Clastoptera xanthocephala* Germ. Sept. 2nd; 1; Butler.
Lepyronia quadrangularis (Say). Aug. 1st—Sept. 2nd; 4; Boone, Gundy, St. Louis.

Family—Delphacidae

- Delphacodes campestris* (VanD.). June 1st; 1; Boone.
Delphacodes puella (VanD.). See table 1; Bates, Boone, Butler, Clinton, Grundy, Mississippi, New Madrid, Perry, Sullivan.
Stobaera tricarinata (Say). Aug. 1st; 1; Boone.

Family—Cicadellidae

- Aceratagallia sanguinolenta* (Prov.). See table 1; Barton, Bates, Boone, Butler, Cass, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, St. Louis, Scott, Shelby, Sullivan.
Agallia constricta VanD. See table 1; Barton, Bates, Boone, Butler, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby.
Agalliopsis novella (Say). July 2nd—Sept. 1st; 2; Boone.
Balclutha neglecta (DeLong & Davidson). See table 1; Boone.
Chlorotettix tunicatus Ball. June 2nd—Aug. 2nd; 5; Bates, Clinton, Grundy, Mississippi.
Cuerna costalis (F.). May 1st—Sept. 30th; 13; Bates, Barton, Boone, New Madrid, St. Louis.
Deltocephalus flavocostatus VanD. See table 1; Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, St. Louis.
Draeculacephala mollipes (Say). See table 1; Boone, Butler, Clinton, Grundy, Mississippi, St. Louis, Sullivan.
Driotura gammaroides (VanD.). July 1st; 1; Boone.
Empoasca fabae (Harris). See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Shelby, Sullivan.

Endria inimica (Say). July 2nd—Sept. 1st; 10; Boone, Sullivan.

Exitianus exitiosus (Uhler). See table 1; Bates, Boone, Butler, Mississippi.

Flexamia pyrops (Crumb). June 2nd; 1; Boone.

Graminella nigrifrons (Forbes). See table 1; Boone, Butler, Cape Girardeau, Clinton, Knox, Mississippi, New Madrid, St. Louis.

Graphocephala coccinea (Forster). Sept. 2nd; 1; Mississippi.

Graphocephala versuta (Say). Aug. 2nd; 1; Shelby.

Gyponana octolineata (Say). Sept. 2nd; 4; Butler, Cass, Mississippi, New Madrid.

Keonolla dolobrata (Ball). July 2nd; 1; Bates.

Mascrosteles fascifrons (Stal). June 1st—Sept. 1st; 6; Boone.

Neokolla hieroglyphica (Say). June 1st—Sept. 2nd; 10; Bates, Boone, Clinton, Grundy, Knox, Mississippi, St. Louis.

Norvellina seminuda (Say). June 2nd—July 1st; 2; Boone.

Oncometopia undata (F.). Aug. 2nd—Sept. 2nd; 4; Butler, Mississippi, New Madrid, Shelby.

Paraphlepsius irroratus (Say). See table 1; Boone, Clinton, Grundy, Knox, Mississippi, New Madrid, Shelby.

Family—Delphacidae

Liburniella ornata (Stal). See table 1; Bates, Boone, Butler, Cape Girardeau, Grundy, Knox, Mississippi, St. Louis, Shelby, Sullivan.

Family—Dictopharidae

Phylloscelis atra Germar. Aug. 1st—Sept. 1st; 4; Boone.

Scolops pungens (Germ.). Aug. 1st—Aug. 2nd; 3; Boone, Shelby.

Family—Flatidae

Metcalfa pruinosa (Say). July 2nd; 1; Bates.

Ormenoides venusta (Melichar). Aug. 1st; 1; Boone.

Family—Issidae

Bruchomorpha oculata Newman. June 2nd; 1; Boone.

Family—Psyllidae

Aphalara curta Cald. May 1st or June 2nd; 2; Boone. (Specimens kept in USNM.)

Aphalara furcata Cald. May 1st or June 2nd; 1; Boone. (Specimens kept in USNM.)

Arytaina sp. June 2nd; 1; Boone. (Specimens kept in USNM.)

Polyamia apicata (Osborn). Aug. 1st; 1; Boone.

Polyamia caperata (Ball). July 1st; 1; Boone.

Scaphytopius acutus (Say). June 2nd—Sept. 2nd; 10; Boone.

Scaphytopius cinereus (Osborn & Ball). Aug. 1st; 1; Boone.

Scaphytopius frontalis (VanD.). See table 1; Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Shelby, Sullivan.

Xerophloea majesta Lawson. Aug. 1st—Sept. 1st; 6; Boone.

Xestocephalus pulicarius VanD. Aug. 2nd; 1; Shelby.

Family—Acanaloniidae

Acanalonia bivittata (Say). Aug. 2nd—Sept. 1st; 3; Boone, Clinton.

Acanalonia conica (Say). Aug. 1st—Aug. 2nd; 4; Boone.

Family—Cixiidae

Cixius stigmatus (Say). Sept. 2nd; 1; Cape Girardeau.

Oliarius aridus Ball. Aug. 1st—Sept. 2nd; 10; Boone.

Family—Aleyrodidae

Trialeurodes abutilonea (Hald.). See table 1; Boone.

Family—Aphidae

Anuraphis bakeri (Cowen). June 2nd; 1; Boone.

Aphis craccivora Koch. June 1st—July 1st; 6; Boone.

Hyalopterus atriplicis (L.). June 2nd—Aug. 1st; 5; Boone.

Hysteroneura setariae (Thos.). July 1st; 1; Boone.

Macrosiphum sp., *ambrosiae* complex. June 1st—Aug. 2nd; 3; Boone.

Macrosiphum sp.—apterous nymph. May 1st—Aug. 1st; 4; Boone, Mississippi.

Macrosiphum sp., *euphorbiae* complex. June 1st—June 2nd; 2; Boone.

Macrosiphum granarium (Kby.). July 1st; 1; Boone.

Macrosiphum pisi (Harris). June 1st—June 2nd; 2; Boone.

Rhopalosiphum maidis (Fitch). July 1st—Aug. 1st; 13; Boone.

- Rhopalosiphum pseudobrassicae* (Davis). June 2nd; 1; Boone.
Rhopalosiphum rubiabdormalis (Sasaki). July 2nd—Aug. 1st; 2; Boone.
Toxoptera graminum (Rond.). June 1st—July 1st; 4; Boone.
Therioaphis riehmi (Bnr.). June 1st; 1; Boone.
Therioaphis trifolii (Mon.). July 2nd; 1; Boone.

Order—NEUROPTERA

Family—Hemerobiidae

Micromus subanticus (Walker). May 1st—June 2nd; 2; Boone, St. Louis.

Family—Chrysopidae

Chrysopa oculata Say. See table 1; Bates, Boone, Clinton, Knox, St. Louis.

Chrysopa sp. *carnea* group July 1st—Sept. 1st; 6; Boone, Clinton, Knox.

Order—COLEOPTERA

Family—Carabidae

(No specialist available)

- Gen. sp. undet. 1 specimen. June 1st; 1; Boone.
 Gen. sp. undet. 1 specimen. June 1st; 1; Boone.
 Gen. sp. undet. 1 specimen. July 2nd; 1; Bates.
 Gen. sp. undet. 1 specimen (Metalic blue-green). July 2nd; 1; Clinton.
 Gen. sp. undet. 1 specimen (Long neck). May 2nd; 1; Barton.
 Gen. sp. undet. 1 specimen. Sept. 1st; 1; Boone.
 Gen. sp. undet. 1 species. See table 1; Bates, Boone, Butler, Cape Girardeau, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, Sullivan.

Family—Histeridae

(No specialist available)

- Gen. sp. undet. 1 species. June 2nd—July 1st; 4; Boone.

Family—Staphylinidae

Oxytelus incolumis Er. Aug. 1st; 1; Boone. (Specimen kept in USNM.)

- Tachinus* sp. July 1st; 1; Boone. (Specimen kept in USNM.)
 Gen. sp. undet. 1 specimen. July 2nd; 1; Boone.
 Gen. sp. undet. 2 specimens. Aug. 2nd—Sept. 2nd; 2; Boone.
 Gen. sp. undet. 1 species. June 1st—Sept. 1st; 7; Barton, Boone, Knox.
 Gen. sp. undet. 1 specimen. Aug. 2nd; 1; Boone.

Family—Orthoperidae

- Molamba* sp. Sept. 2nd; 1; Boone.
Orthoperus glaber LeC. Aug. 2nd—Sept. 2nd; 2; Boone.
Orthoperus sp. July 1st—Aug. 2nd; 5; Boone, Daviess, Knox.

Family—Cantharidae

- Chauliognathus marginatus* (F.). June 1st—Aug. 1st; 5; Boone, Butler, St. Louis.
Chauliognathus pennsylvanicus (DeG.). July 2nd—Sept. 2nd; 6; Boone, Grundy, Perry, St. Louis.
Podabrus rugulosus LeC. June 1st; 1; Boone.
Silis sp. Aug. 2nd; 1; Grundy.

Family—Melyridae

- Anthocomus erichsoni* (LeC.). June 1st; 1; Boone.
Collops sp. prob. *punctatus* LeC. Aug. 2nd; 1; Clinton.
Collops quadrimaculatus (F.). May 1st—Sept. 2nd; 10; Barton, Boone, Cape Girardeau, Clinton, Mississippi, Shelby, St. Louis, Sullivan.

Family—Cleridae

- Phyllobaenus* sp. See table 1; Barton, Bates, Boone, Cass, Clinton, New Madrid, St. Louis.

Family—Elateridae

- Aeolus scutellatus* (Schaeff.). May 1st—Aug. 1st; 4; Boone, Butler, Mississippi.
Conoderus auritus (Hbst.). May 1st—July 1st; 2; Butler, Mississippi. (This species and *Aeolus scutellatus* were combined in the records. Additional collections for which no distinction was made were obtained in Bates, Cass, Clinton, Knox and New Madrid.)
Conoderus bellus (Say). June 1st; 1; Boone.
Conoderus near *lividus* (DeG.). One larva Aug. 1st; 1; Boone.

Conoderus vespertinus (F.). July 1st; 1; Butler.

Melanotus prob. *ignobilis* Melsh. Two larvae Aug. 1st; 1; Boone.

Melanotus opacicollis LeC. May 2nd; 1; Barton.

Negastrius sp. May 1st; 1; New Madrid.

Family—Cucujidae

Telephanus velox Haldeman. June 1st—Aug. 1st; 2; Boone.

Family—Phalacridae

Phalacrus sp. Sept. 1st—Sept. 2nd; 2; Clinton, Perry.

Stilbus apicalis (Melsh.). July 2nd—Sept. 2nd; 5; Bates, Butler, Clinton, Mississippi.

Family—Lathridiidae

Cartodere constricta (Gyll.). Aug. 1st; 1; Boone.

Melanophthalma distinguenda ? (Com.). See table 1; Boone, Mississippi, New Madrid.

Melanophthalma sp. See table 1; Bates, Boone, Butler, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Sullivan.

Family—Coccinellidae

Coccinella 9-notata Hbst. May 2nd—June 2nd; 2; Boone, Butler.

Coleomegilla maculata lengi Timb. See table 1; Bates, Boone, Butler, Cape Girardeau, Clinton, Grundy, Mississippi, New Madrid, Scott, Shelby, Sullivan.

Cycloneda munda (Say). May 1st—Sept. 2nd; 10; Boone, Mississippi, Sullivan.

Epilachna varivestis Muls. July 2nd—Sept. 1st (1958); 2; Boone.

Hippodamia convergens Guér. See table 1; Barton, Bates, Boone, Butler, Cass, Clinton, Grundy, Knox, Mississippi, St. Louis, Shelby, Sullivan.

Hyperaspis binotata (Say). June 1st; 1; Boone.

Hyperaspis undulata (Say). Aug. 2nd; 1; Daviess.

Scymnus (Pullus) sp. Aug. 2nd; 2; Clinton, St. Louis.

Family—Anthicidae

Anthicus cervinus Laporte. July 1st; 2; Boone.

Anthicus sp. See table 1; Barton, Bates, Butler, Cass, Clinton, Grundy, Knox, Mississippi, Shelby, Sullivan.

Notoxus bicolor Say. Aug. 1st; 1; Boone.

Notoxus sp. Aug. 2nd; 1; Boone.

Family—Meloidae

Epicauta fabricii (LeC.). July 2nd—Aug. 1st; 2; Bates, Boone.

Epicauta immaculata (Say). May 1st—Aug. 2nd; 3; Bates, Knox, New Madrid.

Epicauta lemniscata (F.). June 2nd—Aug. 2nd; 4; Barton, Clinton, Knox, Shelby.

Epicauta pennsylvanica (DeG.). Aug. 2nd; 2; Daviess, Knox.

Epicauta pestifera Werner. July 1st—Aug. 2nd; 3; Boone, Daviess.

Family—Mordellidae

Mordellistena sp. June 1st—Sept. 1st; 8; Bates, Boone, Butler, Shelby.

Family—Anobiidae

Catorama sp. June 1st—Aug. 1st; 2; Boone.

Family—Lyctidae

Trogoxylon parallelipedum (Melsh.). June 1st; 1; Boone.

Family—Cerambycidae

Dectes spinosus (Say). July 2nd; 1; Boone.

Family—Chrysomelidae

Anomaea laticlavata (Forster). June 2nd—July 1st; 4; Boone, Butler.

Anoplitis rosea (Weber). Sept. 2nd; 1; Cape Girardeau.

Cerotoma trifurcata (Forster). See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Scott, Shelby, Sullivan.

Chaetocnema sp., probably *denticulata* (Ill.). May 1st—Sept. 2nd; 13; Barton, Bates, Boone, Mississippi, New Madrid, Shelby, St. Louis.

Chaetocnema sp., probably *pulicaria* Melsh. See table 1; Barton, Bates, Boone, Butler, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Scott, Shelby, Sullivan.

Chrysochus auratus (F.). July 2nd; 1; Knox.

Maecolaspis (= *Colaspis*) sp. See table 1; Barton, Bates, Boone, Butler, Cass, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby.

Deloyala guttata (Oliv.). July 2nd—Sept. 1st; 2; Clinton.

- Diabrotica longicornis* (Say). See table 1; Boone, Clinton, Knox, Sullivan.
- Diabrotica undecimpunctata howardi* Barber. See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Shelby, Sullivan.
- Disonycha glabrata* (F.). July 1st—Aug. 2nd; 5; Boone, Butler, Cape Girardeau.
- Disonycha xanthomelas* (Dalm.). May 2nd—Aug. 2nd; 5; Bates, Boone, Clinton.
- Epitrix fuscula* Cr. See table 1; Bates, Boone, Butler, Cape Girardeau, Clinton, Grundy, Knox, Mississippi, Scott.
- Epitrix hirtipennis* (Melsh.). June 1st—Sept. 1st; 3; Boone, Clinton.
- Gallerucella notulata* (F.). June 2nd; 1; Boone.
- Glyptina cyanipennis* Crotch. Aug. 2nd; 1; Perry.
- Glyptina* sp. June 1st; 2; Boone.
- Longitarsis* sp. June 1st; 1; Boone.
- Metriona bicolor* (F.). June 2nd—Sept. 2nd; 7; Boone, Clinton, Grundy, Perry.
- Myochrous denticollis* (Say). May 2nd; 1; New Madrid.
- Nodonota clypealis* Horn. July 1st; 1; Boone.
- Pachybrachis* sp. June 1st; 1; Boone.
- Palaeothona picta* (Say). June 2nd; 1; Boone.
- Phyllotreta bipustulata* (F.). June 2nd; 1; Boone.
- Phyllotreta zimmermanni* (Cr.). May 1st—June 1st; 2; Boone, New Madrid.
- Psylliodes punctulata* Melsh. June 1st; 1; Boone.
- Rhabdopterus* sp. prob. *deceptor* Schffr. May 2nd; 1; Barton.
- Systema blanda* (Melsh.). May 1st—Sept. 1st; 13; Boone, Butler, Cape Girardeau, Mississippi, New Madrid, St. Louis.
- Systema elongata* (F.). July 1st; 1; Butler.
- Systema frontalis* (F.). June 2nd—Sept. 1st; 6; Grundy, New Madrid, Sullivan.
- Systema hudsonias* (Forster). May 1st; 1; St. Louis.
- Typophorus viridicyaneus* Crotch. June 1st—June 2nd; 2; Boone.
- Xenochalepus horni* (Smith). Sept. 2nd; 1; Cape Girardeau.

Zygogramma sp. June 2nd—July 2nd; 3; Boone.

Family—Anthribidae

Trigonorhinus sp. Aug. 2nd; 2; Clinton, Shelby.

Family—Bruchidae

Acanthoscelides distinguendus (Horn). May 2nd; 1; Barton.

Acanthoscelides sp. Aug. 2; 1; Knox.

Bruchus brachialis Fahrens. July 1st; 1; Butler.

Meilbomeus musculus (Say). July 1st; 1; Butler.

Sennius cruentatus (Horn). May 1st—Sept. 2nd; 14; Barton, Boone, Knox, Mississippi, Shelby, St. Louis.

Family—Curculionidae

Apion sp. Aug. 2nd; 2; Knox, St. Louis.

Anthonomus nigrinus Boh. Aug. 1st—Aug. 2nd; 2; Boone, Grundy.

Anthonomus sp. Sept. 2nd (1958); 1; Boone.

Auleules prob. *ater* Dtz. June 2nd; 1; Boone.

Baris sp. July 2nd; 1; Boone.

Centrinaspis penicellus (Hbst.). July 2nd; 1; Clinton.

Centrinaspis picumnus (Hbst.). July 1st—Sept. 1st; 3; Boone, St. Louis.

Ceutorhynchus spp. (3). May 1st; 1; New Madrid. Sept. 1st; 1; Sullivan. June 1st; 1; Boone.

Conotrachelus erinaceus LeC. May 2nd; 1; New Madrid.

Conotrachelus recessus (Csy.) July 1st; 1; Boone.

Conotrachelus seniculus L. July 2nd; 1; Clinton.

Conotrachelus sp. Aug. 1st (1958); 1; Boone.

Cylindrocopturus sp. June 1st—July 2nd; 3; Boone, Clinton.

Epicareus imbricatus (Say). June 1st; 1; Boone.

Hypera nigrirostris (F.). Aug. 1st (1958); 1; Boone.

Hypera punctata (F.). May 2nd—Sept. 1st; 4; Bates, Boone, Mississippi, Sullivan.

Lissorhopturus oryophilus Kuschl. July 1st; 1; Butler.

Rhinoncus pericarpus (L.). July 2nd; 1; Grundy.

Rhodobaenus tredecimpunctata (Ill.). July 2nd (1958); 1; Boone.

Rhyssomatus palmicollis (Say). Sept. 2nd; 1; Butler.

Sitona hispidula (F.). See table 1; Boone, Butler, Cape Girardeau, Knox, Shelby.

Smicronyx ovipennis LeC. June 1st—July 1st; 2; Boone.

Smicronyx spp. (2). May 2nd—June 1st; 2; Boone, Mississippi. Sept. 2nd; 1; Boone.

Stictobaris sp. May 2nd; 1; Cass.

Tanymecus sp. Sept. 2nd; 1; St. Louis.

Trichobaris trinotata (Say). May 1st—June 1st; 2; Boone, St. Louis.

Order—LEPIDOPTERA

Family—Pieridae

Colias eurytheme Bdv. LARVAE: See table 1; Boone, Butler, Knox, Mississippi, New Madrid. ADULTS: Aug. 2nd; 1; Cass.

Family—Nymphalidae

Gen. sp. undet. LARVAE: Aug. 2nd; 1; Mississippi.

Family—Lycaenidae

Everes comyntas (Godt.). ADULT: (1958); Boone.

Gen. sp. undet. LARVAE: Aug. 1st; 1; Boone.

Family—Hesperiidae

Polites themistocles (Latr.). ADULT: (1958); Boone.

Gen. sp. undet. LARVAE: Sept. 2nd; 1; Cape Girardeau.

Family—Arctiidae

Diacrisia virginica (F.). LARVAE: Sept. 1st (1958); Boone.

Gen. sp. undet. LARVAE: July 2nd—Sept. 2nd; 12; Boone, Butler, Knox, Mississippi, Sullivan.

Family—Noctuidae

Heliothis zea (Boddie). LARVAE: July 1st—Sept. 1st; 5; Boone, Knox, Sullivan. ADULT: Sept. 1st; 1; Boone.

Plathypena scabra (F.). LARVAE: See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, Shelby, St. Louis, Sullivan. ADULTS: July 2nd—Sept. 2nd; 4; Boone, Clinton, Grundy, Perry.

Gen. spp. undet. (10-15 spp.). LARVAE: May 1st—Sept. 2nd; 30; Bates, Boone, Clinton, Mississippi, St. Louis.

Family—Notodontidae

Gen. sp. undet. LARVAE: June 2nd; 1; Boone.

Family—Geometridae

Eupithecia sp. LARVAE: Sept. 2nd (1958); Boone.

Gen. spp. undet. (5-6 spp.). LARVAE: June 1st—Sept. 1st; 38; Boone, Butler, Clinton, Grundy, Knox, Mississippi, Perry, Shelby, St. Louis.

Family—Crambidae

Crambus vulgivagellus Clem. ADULTS: (1958); Boone.

Gen. sp. undet. LARVAE: May 1st—Sept. 1st; 4; Boone, New Madrid, Sullivan.

Family—Pterophoridae

Gen. sp. undet. LARVAE: Aug. 1st—Aug. 2nd; 2; Boone.

Family—Tortricidae?

Gen. sp. undet. LARVAE: July 1st—Sept. 2nd; 2; Boone, Clinton.

Family—Gracilariidae

Gen. sp. undet. LARVAE: June 2nd; 1; Bates.

Family undet.

Gen. spp. undet. LARVAE: June 1st—Sept. 1st; 11; Boone, Perry, St. Louis. ADULTS: May 1st—Sept. 2nd; 17; Bates, Boone, Butler, Cape Girardeau, Clinton, Grundy, Mississippi, New Madrid, St. Louis.

Order—DIPTERA

Family—Tipulidae

Pales ferrugineus (F.). July 2nd; 2; Clinton, Grundy.

Family—Chironomidae

Chironomus sp. Sept. 1st; 1; Boone.

Gen. sp. undet. June 1st—Aug. 2nd; 2; Boone.

Procladius bellus (Coq.). July 1st—Aug. 2nd; 2; Boone.

Family—Ceratopogonidae

Atrichopogon levis (Coq.). June 1st—Aug. 2nd; 2; Boone.

Atrichopogon spp. Aug. 2nd (1958); 1; Boone.

Dasyhelea sp. Aug. 2nd—Sept. 1st; 2; Boone.

Family—Culicidae

Psorophora ciliata (F.). Sept. 2nd; 1; Cass.

Psorophora cyanoescens (Coq.). May 2nd—Aug. 1st; 2; Boone, Butler.

Family—Mycetophilidae

Euphrosyne sp. Aug. 2nd; 1; Knox.

Leia bivittata Say. July 2nd; 1; Boone.

Family—Sciaridae

Bradysia sp. (2.5 to 3 mm. long). June 1st—Aug. 2nd; 5; Barton, Butler, Boone.

Bradysia sp. (1.5 to 2.0 mm. long). See table 1; Bates, Boone, Butler, Clinton, Grundy, Knox, New Madrid, Sullivan.

Eugnoriste occidentalis Coq. July 2nd—Sept. 1st; 2; Boone, Butler.

Family—Cecidomyiidae

Anarete sp. June 2nd—Aug. 2nd; 9; Boone.

Lestremiini, gen., sp. July 2nd (1958); 1; Boone.

Family—Asilidae

Diogmites misellus Lw. Aug. 1st—Aug. 2nd; 2; Boone.

Family—Empididae

Gen. sp. undet. (4.0 mm. long). June 2nd—Aug. 1st; 10; Boone.

Gen. sp. undet. (1.0 mm. long). Aug. 2nd—Sept. 2nd; 9; Cass, Clinton, Daviess, Grundy, Knox, Mississippi, Shelby.

Family—Dolichopodidae

Chrysotus sp. Aug. 1st—Aug. 2nd (1958); 2; Boone.

Condylostylus siphon (Say). Aug. 2nd—Sept. 2nd (1958); 2; Boone, New Madrid.

Condylostylus sp. Aug. 2nd—Sept. 2nd (1958); 2; Boone, New Madrid.

Paraphrosylus sp. May 1st—Aug. 2nd; 5; Boone, Clinton, Knox, Scott, Sullivan.

Gen. sp. undet. No specialist available. (A mixture of species but similar to *Condylostylus siphon*.) See table 1; Barton, Boone, Clinton, Grundy, Mississippi, New Madrid, St. Louis.

Family—Phoridae

Megaselia sp. Aug. 2nd; 1; Cass.

Family—Pipunculidae

Gen. sp. undet. Sept. 1st (1958); 1; Boone.

Family—Syrphidae

Mesograpta marginata (Say). June 1st—Aug. 2nd; 3; Boone, Clinton.

Mesograpta polita (Say). Aug. 2nd—Sept. 2nd (1958); 1; Boone.

Family—Otitidae

Euxesta notata (Wied.). July 1st; 1; Boone.

Rivellia boscii R.-D. Sept. 2nd (1958); 1; New Madrid.

Rivellia quadrifasciata (Macq.). May 1st—Sept. 2nd; 7; Butler, New Madrid.

Tetanops luridipennis Lw. June 1st—Aug. 2nd; 5; Boone.

Family—Tephritidae

Euaresta aequalis (Lw.). Aug. 2nd; 4; Clinton, Grundy, Knox.

Euaresta bellula Snow. Aug. 1st; 1; Boone.

Paroxyna sp. July 1st; 1; Boone.

Family—Lauxaniidae

Camptoprosopella sp. July 2nd—Sept. 2nd; 8; Boone, Butler, Grundy, Mississippi, Shelby.

Family—Sepsidae

Sepsis sp. July 1st—July 2nd; 2; Boone.

Family—Anthomyzidae

Mumetopia occipitalis Mel. Aug. 2nd—July 2nd; 5; Boone.

Family—Agromyzidae

Agromyza parvicornis (Lw.). Aug. 2nd; 3; Boone, Knox, Perry.

Cerodontha dorsalis (Lw.). Aug. 2nd; 1; Boone.

Liriomyza sp. June 2nd—Aug. 2nd; 10; Boone.

Melanagromyza sp. Sept. 1st; 1; Grundy.

Phytomyza sp. Aug. 1st; 1; Boone.

Family—Drosophilidae

- Chymomyza amoena* (Lw.). July 1st; 1; Boone.
Scaptomyza adusta (Lw.). May 2nd; 1; Clinton.
Scaptomyza pallida (Zett.). July 2nd—Aug. 2nd; 3; Boone, Mississippi.

Family—Ephydriidae

- Hyadina albovenosa* Coq. June 2nd—July 2nd; 3; Boone.
Notiphila sp. July 1st; 1; Boone.
Philygria debilis Lw. June 1st—Aug. 2nd; 6; Boone, Butler, Cass, Grundy, Knox, St. Louis.

Family—Chloropidae

- Ceratobarys eulophus* (Lw.). July 1st; 1; Boone.
Chlorops sp. July 2nd; 1; Boone.
Conioscinella trigramma (Lw.). July 1st—July 2nd; 6; Boone.
Ectecephala sulcata Sabr. July 2nd—Sept. 1st; 3; Boone, Clinton, Mississippi.
Elachiptera costata (Lw.). June 2nd—Sept. 1st; 12; Butler, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Shelby.
Elachiptera erythropleura Sabr. June 2nd—Sept. 2nd; 4; Boone.
Hippelates bishoppi Sabr. July 1st—Sept. 2nd; 3; Boone.
Hippelates pallipes (Lw.). Aug. 2nd; 2; Boone, New Madrid.
Hippelates particeps (Beck.). June 2nd—Aug. 2nd; 10; Boone.
Meromyza americana Fitch. July 2nd—Sept. 1st; 4; Boone, Clinton, Sullivan.
Oscinella carbonaria (Lw.). See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby, Sullivan.
Oscinella coxendix (Fitch). June 2nd—Aug. 1st; 4; Boone.
Oscinella melancholica Beck. July 1st; 1; Boone.
Oscinella minor (Ad.). Aug. 2nd; 1; Boone.
Oscinella neocoxendix Sabr. July 1st—Sept. 1st; 4; Boone.
Oscinella soror (Macq.). See table 1; Bates, Boone, Butler, Clinton, Grundy, Knox, Mississippi, Perry, St. Louis, Shelby, Sullivan.
Oscinella sp. July 1st—July 2nd; 2; Boone.

Siphonella setulosa Mall. July 2nd; 1; Boone.

Siphonella sp. Aug. 1st; 1; Boone.

Siphonella parva Adams. June 2nd—July 2nd; 3; Boone.

Thaumatomyia glabra (Mg.). See table 1; Boone, Butler, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, St. Louis, Shelby, Sullivan.

Family—Sphaeroceridae

Leptocera fontinalis (Fall.). June 1st—Aug. 1st; 5; Boone.

Family—Tachinidae

Leucostoma aterrimum (Villers). Aug. 2nd; 1; Clinton.

Nemorilla sp. Aug. 1st; 1; Boone.

Winthemia sinuata Rein. Two specimens reared from Lepidoptera larvae, Oct. 1958; Boone.

Winthemia sp. Aug. 2nd—Sept. 2nd; 4; Butler, Cape Girardeau, Mississippi.

Gen. sp. undet. Sept. 1st; 1; Clinton.

Family—Sarcophagidae

Sarcophaga derelicta Walk. June 1st—Aug. 2nd; 4; Boone, Daviess, Grundy.

Sarcophaga lherminieri (R.-D.). July 2nd; 1; Boone.

Sarcophaga reversa Ald. Aug. 2nd; 1; Cape Girardeau.

Sarcophaga ventricosa Wulp. Aug. 2nd—Sept. 2nd; 7; Clinton, Cape Girardeau, Mississippi, Shelby, St. Louis.

Family—Muscidae

Coenosia (Limosia) atrata Walk. Aug. 1st—Aug. 2nd; 2; Boone.

Coenosiinae, gen. sp. undet. Aug. 2nd; 1; Butler.

Family—Anthomyiidae

Gen. sp. undet. May 1st—July 2nd; 3; Grundy, St. Louis, Sullivan.

Order—HYMENOPTERA

Family—Ichneumonidae

Casinaria sp. May 2nd—Sept. 2nd; 3; Barton, Boone, Clinton.

Entanyacra sp. Sept. 1st; 1; Sullivan.

Itopectis sp. June 1st—Sept. 1st; 2; Boone.

Neotypus nobilitator (Grav.). July 2nd; 1; Boone.

Phygadeuon sp. Sept. 2nd; 1; St. Louis. (Parasitic in Muscoid Diptera)

Family—Braconidae

Apanteles bedelliae Vier. Sept. 1st (1958); 1; Boone.

Apanteles marginiventris (Cress.). Aug. 2nd (1958); 1; Boone.

Apanteles spp. (Mixture of at least 3 spp.). June 1st—Sept. 1st; 13; Boone, Butler, Clinton, Grundy, Mississippi, New Madrid.

Bracon gelechia Ashm. July 2nd—Aug. 2nd; 2; Boone.

Bracon mellitor Say. June 2nd—Sept. 2nd; 9; Bates, Boone, Clinton, Grundy, Knox, Mississippi, St. Louis.

Bracon sp. June 2nd; 1; Boone.

Crassomicrodus apicipennis Mues. Aug. 1st (1958); 1; Boone.

Lysiphlebus testaceipes (Cress.). June 1st—Aug. 1st; 4; Boone.

Meteorus leviventris (Wesm.). June 2nd; 1; Boone.

Microgaster facetosa Weed. July 2nd—Aug. 2nd; 5; Boone.

Microgaster garmani (Ashm.). June 2nd; 1; Boone.

Opius dimidiatus (Ashm.). June 1st—Aug. 2nd; 11; Bates, Boone, Butler, Knox, St. Louis, Shelby.

Opius foersteri Gahan. July 2nd—Aug. 2nd; 5; Boone, Grundy, Knox, Sullivan.

Polystenidea parksi Vier. Sept. 2nd (1958); 1; Boone.

Praon sp. July 1st; 1; Boone.

Rogas sp. July 2nd—Sept. 1st; 6; Boone, Clinton, Knox, Mississippi, Sullivan.

Urosigalphus femoratus Cwfd. Aug. 2nd; 3; Boone, Mississippi, St. Louis.

Urosigalphus neomexicanus Cwfd. Aug. 2nd; 2; Boone.

Wesmaelia pendula Forster. Aug. 1st; 1; Boone.

Family—Mymaridae

Anagrus armatus (Ashm.). Aug. 2nd—Sept. 2nd (1958); 2; Boone.

Lymaenon sp. July 1st—Aug. 2nd; 3; Boone, New Madrid.

Mymar sp. Aug. 2nd (1958); 1; Boone.

Ooctonus sp. June 1st; 1; Boone.

Polynema sp. July 1st—Sept. 1st; 4; Boone.

Family—Trichogrammatidae

Abbella acuminata (Ashm.). July 1st—Aug. 2nd; 5; Boone.

Aphelinoidea plutella Grlt. June 2nd—Sept. 1st; 2; Boone.

Oligosita sanguinea (Grlt.). July 1st—Aug. 1st; 2; Boone.

Trichogramma minutum Riley. Aug. 2nd (1958); 2; Boone.

Family—Eulophidae

Aphelinus sp. July 1st; 1; Boone.

Cirrospiloideus seminigriventris Grlt. July 2nd; 1; Boone.

Closterocerus cinctipennis Ashm. Aug. 1st; 1; Boone.

Derostenus variipes Cwfd. July 1st—Aug. 1st; 2; Boone.

Diaulinopsis callichroma Cwfd. June 1st—Aug. 2nd; 8; Boone.

Diglyphus begini (Ashm.). June 2nd—July 1st; 2; Boone.

Encarsia sp. Sept. 1st (1958); 1; Boone.

Euderus sp. Aug. 1st; 1; Boone.

Euplectrus comstockii How. July 1st; 2; Boone.

Euplectrus plathypenae How. Aug. 1st; 1; Boone.

Galeopsomyia columbiana (Ashm.). Aug. 2nd; 1; Boone.

Pediobius lithocolletidis (Ashm.). Aug. 2nd; 1; Boone. (Specimen kept in USNM.)

Pediobius sp. July 1st; 1; Boone.

Pnigalio guttiventris (Grlt.). Sept. 1st (1958); 1; Boone.

Pnigalio sp. July 2nd; 1; Boone.

Sympiesis sp. July 1st; 1; Boone.

Tetrastichus coerulescens Ashm. May 2nd—Aug. 2nd; 7; Bates, Boone, Mississippi.

Tetrastichus semilongifasciatus (Grlt.). July 1st; 1; Boone.

Tetrastichus whitmani (Grlt.). July 2nd; 1; Boone.

Tetrastichus sp. July 1st—Sept. 2nd; 8; Boone.

Zagrammosoma interlineatum Grlt. July 1st—Sept. 2nd; 3; Boone.

Family—Elasmidae

Elasmus sp. Aug. 1st; 1; Boone.

Family—Eutrichosomatidae

Eutrichosoma albipes Cwfd. Sept. 1st; 1; Boone.

Family—Encyrtidae

Anagyrus pulcher (Ashm.). Sept. 1st; 1; Boone.

Aphycus sp. June 1st; 1; Boone.

Copidosoma truncatellum (Dalm.). June 2nd—Aug. 2nd; 6; Boone.

Copidosoma sp. June 2nd—Aug. 2nd; 7; Boone.

Homalotylus cockerelli Timb. July 2nd; 1; Boone. (One specimen kept in USNM.)

Ooencyrtus sp. Aug. 1st—Sept. 2nd; 3; Boone.

Xanthoencyrtus sp. June 2nd; 2; Boone.

Family—Eupelmidae

Eupelmus sp. July 2nd; 1; Boone.

Family—Perilampidae

Perilampus hyalinus Say. Aug. 2nd; 1; Clinton.

Family—Torymidae

Ditropinotus aureoviridis Cwfd. Sept. 2nd (1958); 1; Boone.

Eridontomerus isosomatis (Riley). June 2nd; 1; Boone.

Liodontomerus longfellowi (Grlt.). June 1st—Aug. 2nd; 3; Boone, Clinton, Daviess.

Monodontomerini. Aug. 2nd; 1; St. Louis. (One ♀ kept in USNM.)

Family—Pteromalidae

Eupteromalus sp. July 1st; 1; Boone.

Halticoptera sp. [part det. as *H. aenea* (Walk.)]. May 2nd—Aug. 2nd; 12; Boone, Mississippi, Shelby.

Heterolaccus hunteri (Cwfd.). June 1st—July 2nd; 2; Boone.

Merisus destructor (Say). May 2nd; 2; Barton, Bates.

Pteromalus coeruleiventris (Ashm.). Sept. 1st; 1; Boone.

Sphegigaster sp. June 2nd; 1; Mississippi.

Family—Eurytomidae

Bruchophagus gibbus (Boh.). July 2nd—Aug. 2nd; 4; Boone.

Bruchophagus spp. (2). Aug. 1st—Sept. 1st; 7; Boone, Clinton, Knox, Mississippi.

Eurytoma sp. Aug. 1st; 1; Boone.

Family—Chalcididae

Brachymeria ovata (Say). July 2nd—Aug. 2nd; 3; Boone, New Madrid.

Spilochalcis delumbis (Cress.). Aug. 2nd; 1; Boone.

Spilochalcis side (Walk.). May 2nd—Sept. 1st; 4; Boone, Mississippi.

Family—Cynipidae

Pseudeucoila (Hexamerocera) sp. Aug. 2nd; 2; Daviess, Grundy.

Rhoptromeris sp. June 2nd—Sept. 1st; 4; Boone, Clinton, New Madrid.

Family—Ceraphronidae

Aphanogmus sp. Aug. 1st—Sept. 1st; 7; Boone.

Ceraphron spp. June 2nd—Aug. 2nd; 11; Boone.

Family—Diapriidae

Loxotropa sp. Aug. 2nd; 1; Sullivan.

Phaenopria sp. May 2nd; 2; Butler, Mississippi.

Trichopria sp. July 1st—Aug. 1st; 2; Boone.

Family—Scelionidae

Acoloides sp. Sept. 2nd (1958); 1; Boone.

Baeus sp. Aug. 1st; 1; Boone.

Ceratoteleia marlattii (Ashm.). May 1st—Sept. 2nd; 4; Barton, Boone, New Madrid.

Stictotelia virginiensis (Ashm.). June 2nd—Sept. 1st; 3; Cass, Grundy, Knox.

Telenomus podisi Ashm. See table 1; Barton, Bates, Boone, Butler, Cape Girardeau, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Shelby, Sullivan.

Telenomus spp. Sept. 2nd (1958); 1; Boone.

Trichasius sp. July 1st—July 2nd; 2; Boone.

Trimorus sp. July 1st; 1; Boone.

Trisacantha sp. July 2nd; 1; Boone.

Trissolcus brochymenae Ashm. Aug. 1st; 1; Boone.

Family—Platygasteridae

Amblyaspis sp. Sept. 2nd (1958); 1; Boone.

Leptacis pallipes Fons. June 1st—Aug. 2nd; 2; Boone, St. Louis.

Leptacis sp. July 1st—Sept. 2nd; 3; Boone.

Platygaster sp. June 2nd—Aug. 2nd; 7; Boone.

Family—Bethylidae

Perisierola cellularis (Say). May 2nd; 1; New Madrid.

Pristocera armifera (Say). July 2nd; 1; Bates.

Family—Tiphidae

Tiphia intermedia Mall. July 2nd—Aug. 1st; 2; Bates, Boone.

Family—Formicidae

Crematogaster sp. June 2nd—Sept. 2nd; 3; Boone, Butler, Knox.

Dorymyrmex sp. June 2nd; 1; Boone.

Formica fusca L. July 2nd—Aug. 2nd; 2; Shelby, St. Louis.

Formica (*Neoformica*) sp. June 1st—Sept. 2nd; 14; Bates, Boone, Grundy, Mississippi, New Madrid.

Lasius alienus (Forster). See table 1; Barton, Bates, Boone, Butler, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Shelby.

Lasius spp. July 2nd—Aug. 2nd; 6; Boone, Clinton, Daviess, Knox, Shelby.

Leptothorax curvispinosus Mayr. July 2nd (1958); 1; Boone.

Monomorium sp. See table 1; Barton, Boone, Butler, Cass, Mississippi.

Myrmecina americana Emery. Sept. 2nd (1958); 1; Boone.

Myrmica americana Weber. June 1st—Aug. 2nd; 10; Boone, Butler, Clinton, Knox, Mississippi.

Myrmica sp. July 2nd—Sept. 2nd; 4; Boone, Cass, Clinton, Mississippi

Paratrechina (*Nylanderia*) sp. June 2nd; 1; Boone.

Pheidole sp. July 2nd; 2; Boone.

Ponera coarctata pennsylvanica Buckl. Aug. 2nd; 2; Daviess, Grundy.

Solenopsis molesta (Say). June 2nd—Aug. 2nd; 2; Boone.

Solenopsis (*Diplorhoptrum*) sp. Sept. 2nd (1958); 1; Boone.

Stigmatomma pallipes (Hald.). June 1st—Aug. 1st; 2; Boone.

Tapinoma sessile (Say). June 1st—June 2nd; 3; Boone, Cass.

Family—Pompilidae

Auplopus nigrellus (Bks.). Sept. 2nd; 1; New Madrid.

Family—Sphecidae

Alysson melleus Say. Sept. 2nd (1958); 1; Boone.

Cerceris clypeata Dahlb. Aug. 1st (1958); 1; Boone.

Cerceris sp. Aug. 2nd (1958); 1; Boone.

Family—Halictidae

Agapostemon texanus Cr. July 1st—Aug. 2nd; 4; Boone, Butler, Perry.

Augochlorella striata (Prov.). Aug. 1st (1958); 1; Boone.

Halictus rubicundus (Chr.). July 2nd; 1; Boone.

Lasioglossum (Chloralictus) spp. July 2nd—Sept. 1st; 3; Boone, Grundy.

Family—Megachilidae

Megachile mendica Cr. Aug. 1st; 3; Boone.

Family—Apidae

Apis mellifera L. July 1st; 1; Boone.

Bombus griseocollis (DeG.). Aug. 2nd; 1; Grundy.

CLASS—ARACHNIDA

Order—ACARINA

Family—Phytoseiidae

Typhlodromus sp. July 1st, 1960; 1; Boone.

Family—Erythraeidae

Balaustium sp. June 1st—Sept. 1st, 1960; 16; Boone.

Leptus sp. June 1st—Sept. 1st, 1960; 8; Boone.

Hydrachnellae larvae (Supercohort). Sept. 1st, 1960; 1; Boone.

Family—Scheloribatidae

Scheloribates sp. July 1st, 1960; 1; Boone.

Family—Oribatulidae

Zygoribatula sp. July 1st—Aug. 2nd, 1960; 2; Boone.

Family—Galumnidae

Galumna sp. Aug. 2nd, 1960; 1; Boone.

Order—ARANEIDA

Family—Micryphantidae

Gen. spp. undet. June 2nd—Sept. 2nd; 3; Barton, Boone, Butler, Clinton.

Family—Dictynidae

Dictyna sublata (Hentz). Sept. 1st, 1958; 1; Boone.

Family—Thomisidae

Misumenoides aleatorius (Hentz). June 1st—Sept. 2nd; 4; Boone, Cass, Clinton, St. Louis.

Misumenoides sp. July 2nd; 3; Boone, Clinton, Knox.

Misumenops asperatus (Hentz). June 2nd—Sept. 2nd; 12; Barton, Boone, Butler, Cape Girardeau, Clinton, Daviess, Grundy, Knox, Perry, St. Louis.

Misumenops ? sp. May 1st—Aug. 2nd; 4; Bates, Mississippi, Scott, St. Louis.

Xysticus triguttatus Keyserling. Aug. 1st; 2; Boone, Shelby.

Xysticus sp. July 2nd; 1; Bates.

Gen. spp. undet. July 2nd—Aug. 2nd; 4; Bates, Clinton, Knox, St. Louis.

Family—Salticidae

Evarcha hoyi (Peckham). Aug. 2nd—Sept. 2nd; 2; Boone, Perry.

Evarcha sp. Aug. 2nd; 2; Clinton, St. Louis.

Metaphidippus galathea (Walck.). June 1st; 1; St. Louis.

Metaphidippus ? sp. June 2nd—Sept. 1st; 2; Bates, Boone.

Paraphidippus sp. Aug. 2nd—Sept. 2nd; 3; Boone, Cape Girardeau, St. Louis.

Pellenes ? sp. Sept. 2nd; 1; St. Louis.

Phidippus audax (Hentz). July 2nd—Sept. 2nd; 3; Boone, St. Louis.

Phidippus purpuratus Keyserling. Sept. 1st; 1; Clinton.

Phidippus rimetor (Walck.) July 2nd; 1; Clinton.

Phidippus ? sp. June 2nd—Aug. 2nd; 6; Cass, Clinton, Knox, Mississippi, St. Louis.

Plexippus sp. Aug. 2nd; 1; Boone.

Thiodina sylvana (Hentz). Aug. 2nd; 1; Grundy.

Gen. spp. undet. June 2nd—Sept. 1st; 21; Barton, Bates, Boone, Butler, Clinton, Daviess, Grundy, Knox, Mississippi, New Madrid, Perry, Shelby.

Family—Pisauridae

Dolomedes triton (Walck.). Aug. 2nd; 1; Boone.

Family—Lycosidae

Pardosa distincta (Blackwall). Aug. 2nd; 1; Clinton.

Gen. spp. undet. June 2nd—Aug. 2nd; 4; Boone, Butler, Cass, Shelby.

Family—Oxyopidae

Oxyopes salticus Hentz. May 1st—Sept. 2nd; 39; Barton, Bates, Boone, Butler, Cass, Clinton, Grundy, Knox, Mississippi, New Madrid, Perry, St. Louis, Shelby, Sullivan.

Family—Theridiidae

Gen. spp. undet. July 2nd; 1; Bates.

Family—Araneidae

Araneus stellatus (Walck.). June 2nd—Sept. 2nd; 8; Barton, Boone, Knox, Perry, Mississippi, Shelby.

Drexelia directa (Hentz). Aug. 2nd; 2; Boone, Shelby.

Ebo latithorax Keyserling. June 1st; 1; St. Louis.

Neoscona arabesca (Walck.). Aug. 2nd—Sept. 2nd; 4; Boone, Knox, Shelby, Mississippi.

Neoscona sp. Aug. 2nd; 2; Mississippi.

Zygoballus sp. June 1st; 1; St. Louis.

Gen. sp. undet. July 1st—Aug. 2nd; 4; Clinton, Grundy, Mississippi.

Family—Tetragnathidae

Leucauge venusta (Walck.). Aug. 2nd; 1; Barton.

Tetragnatha elongata Walck. June 2nd—Aug. 2nd; 9; Boone, Butler, Clinton, Mississippi, Shelby.

Tetragnatha sp. July 2nd; 1; Boone.

Family—Linyphiidae

Leptyphantes ? sp. June 2nd; 1; Cass.

Linyphia coccinea Hentz. July 1st; 1; Butler.

Order—PHALANGIDA

Family—Phalangiidae

Gen. sp. undet. Aug. 2nd; 3; Clinton, Daviess.

CAGE TESTS

Methods and Procedures

A preliminary unreplicated field-cage test was started in 1958 to determine the effects of insect infestations on soybean seed production. In late July wire-screen cages 3 x 3 x 3 feet were placed over soybean plants 2.5 feet tall and in full bloom. Each cage contained 10 plants. On July 23 and 24 cages were stocked with two adult population levels per cage of the following species: *Acrosternum hilare* (Say), the green stink bug, 5 and 10; *Euschistus* spp., brown stink bugs, 5 and 10; *Lygus lineolaris* (P.deB.), the tarnished plant bug, 10 and 20; *Adelphocoris rapidus* (Say), the rapid plant bug, 10 and 20. One unstocked cage served as a check. Plants were harvested in late September and seed shelled by hand.

In October-December 1958 preliminary laboratory-cage tests were made in which field-collected adults were confined on potted soybean seedlings 8-10 inches tall. Adults of the tarnished plant bug, the green stink bug, the one-spot stink bug (*Euschistus variolarius* (P.deB.)), and the brown stink bug (*E. servus* (Say)) were used.

A replicated field-cage test was conducted in 1960 on Clark soybeans planted May 24 and June 21 at Columbia. Screen cages measuring 18 x 18 x 42 or 48 inches were placed over plants thinned to six per cage. Treatments consisted of infesting cages at the rate of 60 tarnished plant bugs or 6 stink bugs (a mixture of *E. servus* and *E. variolarius*) at 2-week intervals beginning at full bloom. Infestations were sprayed at the end of 2 weeks with TEPP. These treatments did not always terminate infestations of stink bugs and some infestations continued for 5 weeks. Each treatment was duplicated on each date of planting. At plant maturity the seeds were harvested and stored in paper envelopes until November 30 when they were examined for damage and weighed.

Results

1958 Cage Test.—Reproduction was evident only in the cage in which 10 *Acrosternum hilare* were introduced. As shown in table 2 this infestation decreased yield; decreased the number of seeds harvested; increased the percentage of small seeds; increased the percentage of discolored and moldy seeds after storage by 10 times; increased the number of pods with none or only 1 seed by approximately 3 times; and decreased stem length. The only other cages showing evidence of damage were those infested with *Euschistus*. In these the percentage of discolored and moldy seeds increased approximately two to seven times and the percentage of pods with none or only one seed was doubled. There was no evidence of damage by plant bugs.

1958 Laboratory Tests.—The green stink bug, when confined on soybean seedlings, fed readily on leaf stems and main stems and caused shriveled leaves and stem die-back. Adults of the brown and one-spot stink bugs, confined on plants for 2 months, caused no visible damage and were never observed feeding. The tarnished plant bug fed readily on cotyledons and growing tips, which caused the tips to die back.

1960 Cage Test.—The data are summarized in table 3. The tarnished plant bug which has been observed commonly in soybean fields and was thought to be capable of causing seed damage, had no demonstrable effect in terms of damaged seed at an infestation rate of 10 per plant for 2-week periods. Yield data were erratic in check cages of the early planting and the trend of decreasing yield with later infestations of tarnished plant bugs on the early planting is probably no meaningful. Stink bugs, however, at initial infestation rates of 1 adult per plant, produced characteristic seed damage and reduced yield. Although stink bugs were thought to cause most damage late in the season to nearly mature seed, these data show progressively less damage as the plants matured from full bloom or just past bloom to leaf drop. Comparatively little damage occurred when plants were infested for 2 weeks when all pods were full but not yet dry. No differences could be detected in amount of damage to lower, mid and upper plant portions. In the early planting, damage was reflected in number of seeds produced, seed weight, percent of damaged seed, and yield. In the late planting the only market difference was shown in percent of damaged seed. Mold did not develop under dry storage conditions but seed punctures were more readily seen and seeds more discolored and shriveled in midwinter than at time of harvest.

Stink bug damage to soybeans occurs as complete loss of seeds when punctured early in their development, small, wrinkled seeds if punctured when half developed, and normal-sized seeds with puncture marks if punctured when fully formed. The degree of wrinkling apparently depends largely on the number of punctures sustained. Reddish or purplish discoloration develops on punctured beans during storage but mold may or may not develop. The extent to which stink bug damage may affect oil quality and composition is not known.

TABLE 2—YIELD AND GROWTH OF SOYBEANS INFESTED WITH STINK BUGS AND PLANT BUGS. COLUMBIA, MO., 1958

Species	Number Per Cage	Yield Per Cage (Grams)	Total Number	Seeds			Pods With 0 or 1 Seed (Percent)	Average Stem Length (Inches)
				1/ Small (Percent)	Discolored and Moldy after Storage (Percent)	Per Plant (Average)		
<u>Euschistus spp.</u>	5	162	997	1.5	24.0	51	33.4	50.4
	10	169	1058	3.6	6.8	57	35.4	43.7
<u>Acrosternum</u>	5	169	1052	0.6	4.2	46	16.8	49.3
<u>hilare</u>	10	116	817	26.2	38.3	50	43.0	41.0
<u>Lygus</u>	10	181	1129	0.6	2.3	48	15.7	52.5
<u>lineolaris</u>	20	190	1130	1.1	3.5	48	13.1	51.4
<u>Adelphocoris</u>	10	178	1065	2.4	4.8	46	17.6	47.2
<u>rapidus</u>	20	165	966	1.6	3.3	43	20.7	49.7
Check	0	142	953	8.3	3.6	43	18.4	51.1

1/ Passing through a sieve with slots 10/64 x 3/4 inch.

TABLE 3-EFFECT OF STINK BUGS AND TARNISHED PLANT BUGS ON CAGED SOYBEANS.
AVERAGE OF TWO CAGES. COLUMBIA, MO., 1960

1/ Infestation Date	Tarnished Plant Bugs				Stink Bugs				Weeks of Infestation	
	No. Seed per		Damaged Seed	Yield Per Cage	No. Seed per		Damaged Seed	Yield Per Cage	Rep. I	Rep. II
	Cage	Gram	(Percent)	(Grams)	Cage	Gram	(Percent)	(Grams)		
Early Beans planted May 24										
July 16	363	7.4	0	49.1	22	9.6	70	2.4	5	5
30	242	10.8	0	23.2	194	8.8	49	23.6	3	2
Aug. 13	282	7.5	0	37.8	268	8.4	98	32.2	2	2
27	140	7.8	0	17.6	276	8.2	20	34.4	2	2
Sept. 10	-	-	-	-	285	7.8	4	36.9	2	2
Check	256	9.3	0	28.0	318	7.6	0	42.0	2	2
Late Beans planted June 21										
Aug. 8	441	6.9	0	64.2	406	6.6	41	61.2	4	4
22	428	6.5	0	66.4	406	6.6	28	61.6	2	2
Sept. 5	520	6.7	0	77.5	508	7.2	15	71.1	2	2
19	566	7.0	0	80.3	474	7.2	5	65.4	2	2
Oct. 3	528	7.0	0	76.2	508	7.3	1	69.3	2	2
Check	455	7.1	0	64.2	456	7.0	0	66.2	2	2

1/ Plant development at time of infestation:

Early Planting	
July 16	Full bloom
30	Late bloom
Aug. 13	Post bloom; pods filled bottom half
27	Post bloom; all but top pods full
Sept. 10	70-80% leaf drop; all pods full

Late Planting	
Aug. 8	2-1/2' tall; full bloom
22	3-1/2' tall; pods filling bottom half
Sept. 5	Post bloom; pods 1/2 full at top
19	Pods nearly all full; leaves yellowing
Oct. 3	100% leaf drop

INSECTICIDE TESTS

Methods and Procedures

In 1959 tests were made at Columbia to evaluate: 1) The relative effectiveness of several recommended foliage treatments along with a few promising new insecticides; 2) the effect of time of application with relation to blooming; and 3) the effect of soil treatment on yield. Since simulated hail-and mechanical-damage studies indicated that the period of bloom and seed set is the most critical with respect to yield loss, insecticides were applied during this period.

The soybean variety Clark was planted on May 5, June 6, and June 23. Foliage-application tests were made on each planting and the soil insecticide test made only on the late planting. Plot sizes were 1 row for the soil insecticide test, 3 rows for the miscellaneous insecticide test, and 4 rows for the timing test. All plots were 20 feet long. In the larger plots only the inside rows were used for insect counts and harvest data.

Foliage applications were made with a high-clearance sprayer delivering 24 gallons per acre at 40 pounds pressure, with 3 nozzles per row. Sprays coincided as nearly as possible with plant development: Prebloom, when first blooms appeared; midbloom, 10 or 11 days later when plants were in full bloom; and post-bloom, 10 days later when bloom had nearly ceased and pods were newly set to half-filled.

Soil insecticides were applied by hand in the furrow prior to planting, the furrow refilled, and then the seed planted.

Insect counts were made at 3 and 10-day intervals after applications. Each count consisted of five net sweeps in the one or two center rows of each plot in two replicates.

In 1960 an insecticide test was conducted at Sikeston² on a late planting (June 21) of the variety Hood. Five treatments were applied with a high-clearance sprayer delivering 18 gallons per acre at 60 pounds pressure and replicated 3 or 4 times. Plots were 3 rows wide and 30 feet long. One block of plots received seven applications at weekly intervals beginning at full bloom. A second block received two applications at last bloom and full pod set. A third block received one application only at full pod set. Insect counts were made by taking 10 sweeps in the center rows one day before and 23 days after the last application. Yield data was obtained by threshing the center row of each plot.

1959 Results

Insect damage was not observed in any of the plots, but flea hoppers, leaf hoppers, thrips, and flea beetles were common in all plantings.

²Applications and counts made by Armon J. Keaster, Research Assistant, Entomology Department, University of Missouri.

A. Miscellaneous insecticides. With the exception of flea beetles, percentage control decreased from prebloom applications to mid and postbloom applications. This was probably due to the increasing amount of foliage during this period and therefore progressively less thorough spray coverage. Since insect infestations and yield did not vary greatly among the three dates of planting, the data are summarized in table 4 by averaging all dates and times of application. Best overall control of the four pest groups was obtained with DDT and the toxaphene-DDT mixture, but the addition of toxaphene did not increase control over DDT alone. Sevin (1-naphthyl N-methylcarbamate), however, at the rate of two pounds per acre gave the best control of leaf hoppers. Hercules 5727 (m-isopropylphenyl methylcarbamate) caused phytotoxicity in the form of moderate leaf burning after each application. Yields were not affected significantly in any of the plantings.

B. Time of application. Toxaphene at the rate of 3 pounds per acre was applied 1) at prebloom only, 2) at midbloom only, 3) at latebloom only, and 4) at both mid and latebloom. On the basis of its performance in the miscellaneous insecticide test, it would be expected to control flea hoppers well, flea beetles to a fair degree, and leaf hoppers and thrips to a very small degree. Yields, as shown in table 5, showed no significant differences among treatments for any planting.

TABLE 5—AVERAGE YIELD OF SOYBEANS IN OUNCES PER PLOT FOR DIFFERENT TIMES OF APPLYING TOXAPHENE AT THE RATE OF THREE POUNDS PER ACRE. COLUMBIA, MO., 1959

Planting	Time of Application				Untreated check	F Value
	Pre-bloom	Mid-bloom	Late-bloom	Mid- & late-bloom		
Early	-	53.0	51.0	46.5	52.2	3.44 ns
Medium	46.2	51.5	49.0	43.8	49.5	1.42 ns
Late	40.0	37.8	43.8	32.5	39.8	2.56 ns
Average	43.1	47.4	48.1	40.9	47.2	

C. Soil Insecticides. Preplanting furrow applications of Zinophos (0, 0-diethyl 0-2-pyraginyl phosphonothioate) at 1, 2 and 4 pounds per acre, and heptachlor at 1 pound per acre to four replicates of late planted soybeans resulted in no significant differences in yield. Yields in ounces per plot in the above order were 99, 90, 91, 107, and for the untreated check, 90. No differences in plant height or growth were evident from general observations.

1960 Results

Insect counts on the late planting at Sikeston showed bean leaf beetles to be present in low numbers and other insects scarce. Yield data, summarized in table 6, show no significant effect among treatments.

TABLE 6-YIELD OF SOYBEANS FOLLOWING INSECTICIDE APPLICATIONS.
SIKESTON, MO., 1960

Insecticide	Lbs. actual per acre	Yield in Bushels per acre after --		
		One Application <u>1/</u>	Two Applications <u>2/</u>	Seven Applications <u>3/</u>
Sevin (85 S)	1.0	14.0	17.8	13.4
Toxaphene (6 lbs/gal. EC)	2.0	13.7	21.4	16.5
DDT (25% EC)	1.0	13.8	18.7	16.5
Toxaphene + DDT	2.0 + 1.0	12.7	18.0	14.8
Thiodan <u>4/</u> (24% EC)	0.5	12.5	19.0	16.3
Untreated	-	15.0	17.4	13.6

1/ September 29 at pod set; 3 replications.

2/ August 25 at last bloom, and September 29; 4 replications.

3/ Beginning at first bloom, and at weekly intervals to September 29; 4 replications.

4/ Chemical name is (6, 7, 8, 9, 10, 10-hexachloro-1, 5, 5a, 6, 9, 9a-hexahydro-6, 9-methano-2, 4, 3-benzo-dioxathiepin-3-oxide)

SUMMARY

A systematic survey of the insects in soybean fields as determined by sweeping with an insect net was conducted in Missouri during the growing seasons of 1958, 1959 and 1960. Approximately 540 species of insects and 49 species of Arachnida were collected of which 388 were specifically identified. Sixty-one, or approximately 11 percent of the insects occurred in 10 percent or more of the collections. The seasonal abundance and occurrence of these are recorded in tabular form, and all species are listed with collection data. The Archnids are also listed. The results, in terms of more common species, agree rather closely with three previous tabulations by other investigators except for the preponderance of Thysanoptera which accounted for half of the 28,692 insect specimens counted in this study. The most abundant potentially economic species present, in terms both of numbers of specimens and widespread occurrence were: *Sericopteryx variabilis*, *Frankliniella tritici*, and *F. fusca* (Thysanoptera); *Halticus bracteatus* and *Lygus lineolaris* (Hemiptera); *Empoasca fabae*, *Agallia constricta*, and *Aceratagallia sanguinolenta* (Homoptera); *Cerotoma trifurcata*, *Chaetocnema pulicaria*, *Maecolaspis* sp., and *Diabrotica undecimpunctata howardi* (Coleoptera); and *Plathypena scabra* (Lepidoptera). The more commonly occurring parasites and predators were: *Aeolothrips bicolor* (Thysanoptera); *Orius insidiosus*, and *Nabis kalmii* (Hemiptera); and *Telenomus podisi* (Diptera).

Although very little obvious insect damage to soybeans was observed during the survey, the more common potential pests are indicated. The effect of several of these on the soybean plant is unknown. The presence of a large number of parasitic and predaceous insects and spiders undoubtedly accounts in part for the lack of damage observed.

Cage tests demonstrated that several species of stink bugs are capable of causing severe seed damage and indicated that newly set seed is subject to more severe damage than mature seed. The tarnished plant bug under the same conditions had no demonstrable effect on seed production, damage or plant growth.

Insecticide tests conducted at Columbia in 1959 and Sikeston in 1960 did not result in increased yields indicating that pest populations were below the economic level in the test fields.

LITERATURE CITED

- Anonymous. 1953. You can control all known pests—by starting in time. Soybean Digest; 13(9):10-11.
- Anonymous. 1957. Insect pests of soybeans and their control. Soybean Digest 17(10): 16-18, 20.
- Baker, E. W., and G. W. Wharton. 1952. An introduction to acarology. The Macmillan Co., N. Y., 465 pp.
- Balduf, W. V. 1923. The insects of the soybean in Ohio. Ohio Agric. Expt. Sta. Bull. 366:145-181.
- Bigger, J. H. 1953. Biology and control of *Phyllophaga rugosa* on soybeans. Proc. Eighth Ann. Meet. N. Cent. Sts. Branch Amer. Ent. Soc.:29.
- Borror, D. J. and D. M. DeLong. 1954. An introduction to the study of insects. Rinehart and Company, New York, 1030 pp.
- Camery, M. P. and C. R. Weber. 1953. Effects of certain components of simulated hail injury on soybeans and corn. Iowa Agric. Expt. Sta. Res. Bull. 400:465-504.
- Ellisor, L. O., J. H. Gayden and E. H. Floyd. 1938. Experiments on the control of the velvet bean caterpillar, *Anticarsia gemmatilis* (Hbn.). J. Econ. Ent. 31 (6):739-742.
- Everly, R. T. and A. H. Probst. 1952. Treat soybean plots with soil insecticides. Ind. Rept. 65:8-11.
- Gibson, R. M., R. L. Lovvorn, and B. W. Smith. 1943. Response of soybeans to experimental defoliation. J. Amer. Soc. Agron. 35:768-778.
- Kalton, R. R., C. R. Weber, and J. C. Eldredge. 1949. The effect of injury simulating hail damage to soybeans. Iowa Agric. Expt. Sta. Res. Bull. 359: 736-796.
- Kaston, B. J. and E. Kaston. 1953. How to know the spiders. Wm. C. Brown Co., Dubuque, Iowa. 220 pp.
- Kretschmar, G. P. 1948. Soybean insects in Minnesota with special reference to sampling techniques. J. Econ. Ent. 41(4):586-591.
- Kulash, W. M. 1947. Benzene hexachloride, DDT and Ryanex to control soybean caterpillars. J. Econ. Ent. 40(6):927-928.
- Lincoln, Charles, F. J. Williams and Gordon Barnes. 1953. Importance of thrips in red spider control. J. Econ. Ent. 46(5):899-900.
- Milliron, H. E. 1958. Economic insect and allied pests of Delaware. Dela. Agric. Expt. Sta. Bull. 321:87 pp.
- Miner, Floyd D. 1959. The three-cornered alfalfa hopper. Ark. Farm Res. 8(4):8.
- Morse, W. J. 1950. History of soybean production, pp. 54-57. In K. S. Markley, Soybeans and soybean products, Vol. 2. Interscience Publishers, Inc. New York. 540 pp.
- Morse, W. J., J. L. Carter, and L. F. Williams. 1949. Soybeans; culture and varieties. U. S. Dept. of Agric. Farm Bull. 1520:34-37.
- Packard, C. M. 1951. Insect pests of soybeans and their control. Soybean Digest 11 (4):14-18.
- Piper, C. V., and W. J. Morse. 1923. The soybean. McGraw-Hill Book Co., Inc., New York: 329 pp.

- Poos, F. W. 1940. The locust leaf miner as a pest of soybean. *J. Econ. Ent.* 33(5): 742-745.
- Probst, A. H. 1945. Influence of spacing on yield and other characters in soybeans. *J. Amer. Soc. Agron.* 37:549-554.
- Probst, A. H. and R. T. Everly. 1957a. Effect of soil insecticides on emergence, growth, yield and chemical composition of soybeans. *Agron. J.* 49:385-387.
- Probst, A. H. and R. T. Everly. 1957b. Effect of insecticides on growth, yield and chemical composition of soybeans. *Agron. J.* 49:577-581.
- Ratcliffe, R. H., T. L. Bissell and W. E. Bickley. 1960. Observations on soybean insects in Maryland. *J. Econ. Ent.* 53(1):131-133.
- Reynolds, H. T., T. R. Fukuto, R. L. Metcalf, and R. B. March. 1957. Seed treatment of field crops with systemic insecticides. *J. Econ. Ent.* 50(5):527-539.
- Starks, K. J. 1954. Soybean insects. *Proc. Nineth Ann. Meet. N. Cent. Sts. Branch Ent. Soc. Amer.*:33-34.
- U. S. Department of Agriculture. 1951-1960. Cooperative Economic Insect Reports. Vols. 1-10. Plant Pest Control Division, Agr. Res. Serv.
- U. S. Department of Commerce, Bureau of the Census. 1961. U. S. Census of Agriculture: 1959, Final Report—Vol. 1—Part 17—Counties—Missouri.
- Weber, C. R. 1955. Effects of defoliation and topping simulating hail injury to soybeans. *Agron. J.* 47:262-266.