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AN ANNOTATED LIST OF PHYTOPHAGOUS INSECTS COLLECTED ON IMMATURE BLACK WALNUT TREES IN SOUTHERN ILLINOIS[1]

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ABSTRACT

An annotated list of phytophagous insects on immature black walnut in southern Illinois was compiled between 26 April, 1974, and 9 October, 1975. Approximately 300 species, in 10 orders, were collected by hand-picking and sweeping. Notes taken on the various species included types of feeding damage, instars present, predators and parasites, and distribution in southern Illinois. Lepidoptera (about 80 species collected) were responsible for the majority of damage observed.

This study was conducted to compile an annotated list of the phytophagous insects found on immature black walnut trees (*Juglans nigra* L.) in southern Illinois. To our knowledge, the only other general list of black walnut insects is that by Barrett (1932) which was compiled from the literature. Notes were gathered on types of feeding damage, instars present, predators and parasites, and distribution in southern Illinois.

Black walnut grows for about 10 years before it is ready for earliest commercial seed production. Insect damage during this time is particularly important because the tree produces the first 9 to 17 feet of trunk height. This trunk must grow at a constant rate and be straight for veneer log production, the highest quality wood (Carmean, 1970).

In 1968, the north central region of the United States (i.e., Indiana, Illinois, Iowa, Missouri, Kansas, Nebraska, Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota) produced most of the black walnut veneer logs used in the United States (Blyth, 1973). From 1963 to 1968, Illinois production of these logs increased from 2.3 to 3.0 million board feet (Blyth, 1973). In 1973, U.S. consumption and exports totaled 28.3 million board feet at a value of $1414/1000 board feet (Anonymous, 1974).

Insects have been shown to decrease black walnut production. A weevil [*Conotrachelus retentus* (Say)] and the husk fly [*Rhagoletis suavis* (Lowe)] cause considerable damage to developing nuts (Miller, 1973). Several insects, including a shoot moth (*Gwendolina concitatricana* Heinrich), case moths [*Acrobasis caryivorella* Ragonot and *A. juglandis* (LeBaron)], weevils (*C. retentus* and *C. juglandis* LeConte), and periodical cicadas (*Magicicada* spp.) cause stem deformation through terminal bud or elongating shoot injury (Miller, 1973). Several species, including walnut caterpillar (*Datana integerrima* Grote & Robinson) and walnut aphids (e.g., *Monellia* spp.), cause defoliation or sap removal, thus reducing biomass additions to stem and nut crops (Miller, 1973). Others, including the flatheaded apple tree borer [*Chrysobothris femorata* (Olivier)] and white oak borer [*Goes tigrinus* (DeGeer)], bore into the wood creating holes that may result in large wounds (Miller, 1973).

METHODS AND MATERIALS

Southern Illinois was arbitrarily defined as that part of the state south of an east-west line passing through St. Louis, Missouri, and Vincennes, Indiana. All plantations surveyed

[1]Part of a research report submitted to Southern Illinois University at Carbondale by the senior author in partial fulfillment of the requirements of the M.S. degree in zoology.

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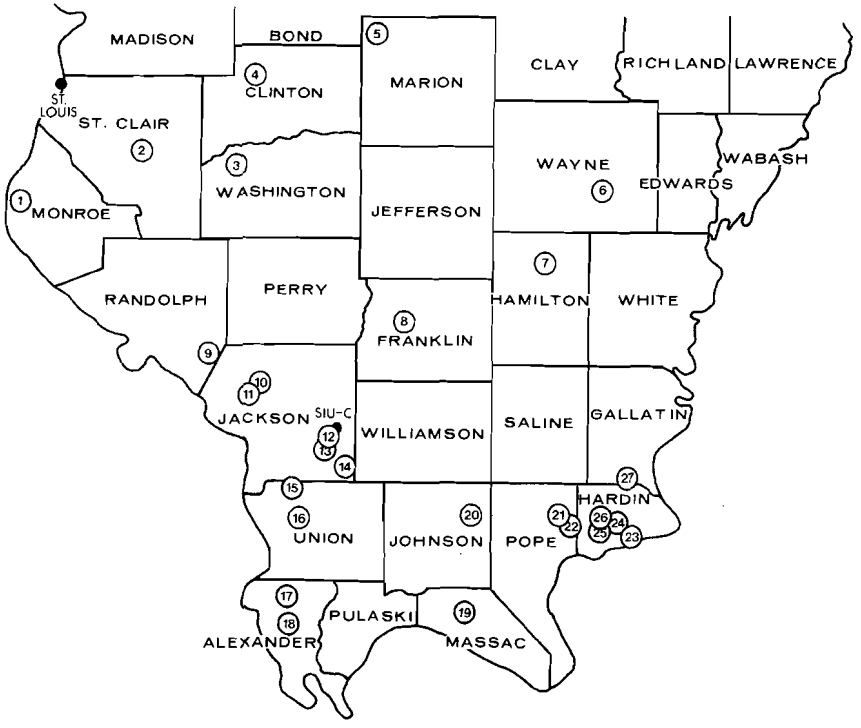

Fig. 1. Location of black walnut plantations surveyed.

(27) had been planted since 1962 by private individuals under the direction of the Illinois State Department of Conservation, or by the U.S. Forest Service, and were located in 17 of the 28 counties. Each plantation was assigned a number for easy reference when referring to the various insect species collected (Table 1). Location of each plantation is shown in Figure 1, and plantation location, planting dates, acreage, and other tree species present are given in Table 1.

Insects were collected from 26 April to 1 October, 1974, and from 8 April to 9 October, 1975. The April and October dates were before leafing out and after leaf drop, respectively, of black walnut in southern Illinois during these two years. Although collecting trips were made to plantations prior to the April and after the October dates, no specimens were found.

This study consisted of two parts. During 1974 and most of 1975, sampling was confined to three plantations (Nos. 12, 13, 14) within 10 miles of the Southern Illinois University-Carbondale campus; trips were made to these plantations 1-2 times/week. Of the remaining 24 plantations, two were visited in 1974 (21 August, plantation 15; 27 August, plantation 11), the other 22 in 1975. Each of the 24 was visited only once.

Specimens were collected by hand-picking or sweeping the foliage and branches of various black walnut trees in each plantation. Notes taken on the various species included types of feeding damage (e.g., leaflet consumption, sap removal, bud boring), instars present, predators and parasites, and distribution in southern Illinois. A field feeding record by a chewing insect was defined as the observation of mandibles removing pieces of leaflet,

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Table 1. Descriptions of black walnut plantations surveyed.

Plant. no.	County	Location	Year planted	Acres	Other tree species present
1	Monroe	T3S R11W S4	1970	1	none
2	St. Clair	T1N R7W S31	volunteer	3	mixed deciduous
3	Washington	T1S R5W S13	1969	2	none
4	Clinton	T3N R4W S30	1969	1	mixed deciduous
5	Marion	T4N R1E S16	1968-1969	2	none
6	Wayne	T2S R7E S12	1962	2	none
7	Hamilton	T4S R6E S15	1972	2	none
8	Franklin	T6S R2E S17	1973	8	mixed deciduous
9	Randolph	T7S R5W S21	1972-1973	2	none
10	Jackson	T8S R4W S12	1972	4	none
11	Jackson	T8S R4W S22	1973	3	none
12	Jackson	T9S R2W S25	1965	1	none
13	Jackson	T9S R1W S31	1970	2	none
14	Jackson	T10S R1W S25	1965	2	none
15	Union	T11S R2W S8	1969	12	none
16	Union	T12S R2W S8	1970	2	none
17	Alexander	T14S R2W S28	1967-1970	6	none
18	Alexander	T15S R2W S5	1969	7	autumn olive, alder & black locust
19	Massac	T14S R4E S34	1967	1	mixed deciduous
20	Johnson	T12S R4E S3&10	1965	5	mixed deciduous
21	Pope	T12S R7E S6	1972	4	none
22	Pope	T12S R7E S8	1970	11	mixed deciduous
23	Hardin	T12S R9E S17	1966-1967	7	none
24	Hardin	T12S R8E S2&3	1969	7	autumn olive, alder & black locust
25	Hardin	T12S R8E S4	1965	1	none
26	Hardin	T12S R8E S3	1963,1966	2.5	none
27	Gallatin	T10S R8E S32	1973	1	none

and by a sucking insect, mouthparts inserted in the plant tissue for at least 30 consecutive seconds. Field feeding records were not possible with the sweeping technique.

Most specimens not observed feeding in the field were returned to the laboratory for further observation. A laboratory feeding record by a chewing insect was defined as either the observation of feeding, or the disappearance of pieces of leaflets from the insect's container. For a sucking insect, it was defined the same as a field observation.

Many insects collected as immatures were laboratory reared to adult to facilitate identification. Specimens returned to the laboratory for observation and rearing were placed in petri dishes (about 9 cm diam, 2 cm depth) with moistened filter paper on the bottom. Black walnut leaflets for chewing insects, and leaflets with a section of rachis for sucking

insects, were added for food. The dishes were kept in an incubator maintained at 23.9±1.1°C and constant light of about 130 ft-c, and checked at least once/day to record possible feeding. Food was changed and water added about 1 and 2 times/week, respectively, for active specimens, water added less often for pupae. Filter paper was changed as needed, usually once every two weeks.

Pupae of several large Lepidoptera (i.e., Danaidae, Notodontidae, and Saturniidae) were placed in large, clear, plastic containers (29 X 18 X 13 cm) covered with cheesecloth to provide adequate room for wing expansion when the adults emerged. The containers were kept in the laboratory outside (room temperature, 26.7±1.1°C) or inside the incubator.

Several Lepidoptera reared from eggs or larvae apparently entered diapause upon pupation. Since diapause can be broken by a cold period (Beck, 1968), these pupae were placed in a refrigerator at 7.2±0.6°C. Those collected in 1974 were kept in the refrigerator from 27 November, 1974, to 27 February, 1975, those collected in 1975, from 6 November, 1975, to 6 March, 1976. A longer cold period was used in 1975-1976 in an attempt to increase the percentage of those breaking diapause and thus reaching adult.

It should be emphasized that those insects that fed on black walnut in the laboratory had no other food source available to them. Thus, these feeding records demonstrated only that these insects have the potential to feed on black walnut in the field, not that they actually do so.

Parasites that emerged from black walnut insects returned to the laboratory were preserved for later identification.

Certain species proved to be very common during this study, others very rare. The relative abundance of each (inclusive of all stages) is indicated as follows: rare, less than 5; uncommon, 5-15; common, 16-30; very common, more than 30.

All specimens, except the few retained by the U.S. National Museum, are housed in the Entomology Collection, Southern Illinois University at Carbondale Zoological Research Museum.

RESULTS AND DISCUSSION

Insects primarily caused chewing and sucking damage to leaves of immature black walnut trees in southern Illinois, although some ovipositional [e.g., *Anormenis septentrionalis* (Spinola)] and trunk boring damage were observed. Chewing species bored in buds and stems, and removed leaflets. Sucking species removed photosynthates from branches, twigs, rachises, and leaflets; the latter often resulting in spotting. Ovipositional damage presumably resulted in death of twigs. Boring beneath bark occurred in a dying tree.

Approximately 300 species, in 10 orders, were collected during the two years (1974-75) of this study (Table 2). The order Lepidoptera was best represented, with about 80 species collected, and was responsible for the majority of damage observed. Larvae of *Acrobasis* spp. (Pyralidae) killed buds and stems by their boring activity. Larvae of *Hyphantria cunea* (Drury) (Arctiidae), *Morrisonia confusa* (Hübner) (Noctuidae), *Datana integerrima* Grote & Robinson (Notodontidae), *Gretchena bolliana* (Slingerland) (Olethreutidae), and *Gracillaria blandella* Clemens (Gracillariidae) were most important in leaflet removal (partial defoliation).

Table 2. Phytophagous insects from immature black walnut in southern Illinois.

Taxon	Plantation numbers	Rel. freq.[a]	Stages collected[b]	Feeding record[c]	Assoc. plant parts[d,e]
COLLEMBOLA					
Poduridae					
Hypogastrura packardi (Folsom)	14	U	A&/or J(HP)	---	Ba
Isotomidae					
Isotomurus palustris balteatus (Reuter)	17	R	A&/or J(S)	---	---
Entomobryidae					
Entomobrya atrocincta Schott	14	R	A&/or J(S)	---	---

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Table 2. continued.

Taxon	Plantation numbers	Rel. freq.[a]	Stages collected[b]	Feeding record[c]	Assoc. plant parts[d,e]
ORTHOPTERA					
Acrididae					
Melanoplus differentialis (Thomas)	11,15	R	A(HP)	---	Le
M. femurrubrum (DeGeer)	13	R	A(HP)	F*	Le
M. punctulatus griseus (Thomas)	22	R	A(HP)	F*	Le
M. rusticus obovatipennis (Blatchley)	13,22	R	A(HP)	F*	Le
M. sanguinipes (Fabricius)	13	R	A(HP)	F*	Le
M. s. scudderi (Uhler)	13,27	R	A(HP)	F*	Le
Tettigoniidae					
Conocephalus brevipennis (Scudder)	13	R	A(HP)	F*	Le
C. fasciatus (DeGeer)	16	R	A(HP)	F*	Le
C. strictus (Scudder)	21	R	N(HP)	F*	Le
Microcentrum retinerve (Burmeister)	2,13	R	N(HP,S)	F*	Le
M. rhombifolium (Saussure)	13	R	A(S)	---	---
Orchelimum sp.	12,13,16,27	U	N(S)	---	---
Pterophylla camellifolia (Fabricius)	14	R	A(S)	---	---
Scudderia curvicauda (DeGeer)	16	R	A(HP)	F*	Le
S. furcata Brunner	8,13,15	U	A,N(HP)	F**	Le
Gryllidae					
Hapithus agitator Uhler	8,13,26	R	A,N(HP)	F*	Le
Oecanthus argentinus Saussure	12,13	C	A,N(HP,S)	F*	Le
O. latipennis Riley	4,13,14,16,20,27	U	A,N(HP,S)	F*	Le
O. nigricornis F.Walker	13	R	A,N(HP,S)	F*	Le
O. niveus (DeGeer)	3,9,13,14,16,20,27	U	A,N(HP)	F*	Le
Orocharis saltator Uhler	13,19,25	R	N(HP,S)	F*	Le
Phyllopalpus pulchellus Uhler	13,16	R	A,N(S)	---	---
Phasmatidae					
Diapheromera femorata (Say)	15	R	N(HP)	---	Br
PSOCOPTERA					
Psocidae					
Metylophorus purus (Walsh)	14	R	A(HP)	---	Br
Psocus leidyi Aaron	14	R	A(S)	---	---
THYSANOPTERA					
Thripidae					
Anaphothrips obscurus (Mueller)	17	R	A(S)	---	---
Frankliniella fusca (Hinds)	17	R	A(S)	---	---
F. tritici (Fitch)	12,17,22	U	A(HP)	---	Le
HEMIPTERA					
Miridae					
Ceratocapsus sp. near *digitulus* Knight	2,12,13,14,16,25,26	VC	A,N(HP)	F*	Le
Diaphnidea pellucida Uhler	14	U	A(S)	---	---
Hyaliodes vitripennis (Say)	12,13,14	R	A(S)	F*	Le
Lopidea confluenta (Say)	13,14,17	VC	A(HP)	F**	Ra
Lygus lineolaris (Palisot de Beauvois)	9,12,13,14,16,17	VC	A(HP)	F*	Le
Orthotylus sp.	13,14,16,17	C	A(S)	F*	Le
Plagiognathus flavicornis Knight	12,13,14,17	U	A(HP,S)	F**	Le
P. politus Uhler	13	R	A(S)	---	---
P. repletus Knight	12,14,17	U	A,N(HP)	F**	Le
Stenotus binotatus (Fabricius)	17	R	A(S)	---	---
Tingidae					
Corythucha juglandis (Fitch)	12,13,14,16,17,24,26	VC	A,N(HP)	F**	Le
Lygaeidae					
Lygaeus kalmii (Stål)	12,13	U	A(HP,S)	---	Le
Oncopeltus fasciatus (Dallas)	12,13	C	A,N(HP)	F*	Le
Coreidae					
Acanthocephala terminalis (Dallas)	5,14,22	U	A,N(HP,S)	F*	Le
Euthochtha galeator (Fabricius)	27	R	A,N(HP)	F*	Ra
Leptoglossus oppositus (Say)	SIU campus	R	A(S)	---	---

Table 2. continued.

Taxon	Plantation numbers	Rel. freq.[a]	Stages collected[b]	Feeding record[c]	Assoc. plant parts[d,e]
Rhopalidae					
Liorhyssus hyalinus (Fabricius)	13	R	A(HP)	F**	Le
Alydidae					
Alydus eurinus (Say)	13,27	U	A(HP)	---	Le
A. pilosulus (Herrich-Schaeffer)	13	R	A(HP)	---	Le
Pentatomidae					
Acrosternum hilare (Say)	12,13,14	R	A,N,E(HP,S)	---	Le
Brochymena arborea (Say)	14	R	A,N,E(HP)	---	Br,Ra,Tw
B. quadripustulata (Fabricius)	12,13,14,17,18,22,23,27	VC	A,N(HP)	F**	Ra
Euschistus servus (Say)	12,13,14,24,27	VC	A,N,E(HP,S)	F**	Le,Ra
E. t. tristigmus (Say)	14	R	A(HP)	---	Le
Mormidea lugens (Fabricius)	14	R	A(S)	---	---
Cydnidae					
Sehirus c. cinctus (Palisot de Beauvois)	4	R	A(HP)	F*	Le
Corimelaenidae					
Corimelaena agrella McAtee	14	R	A(S)	---	---
C. l. lateralis (Fabricius)	13	R	A(S)	---	---
C. pulicaria (Germar)	12,13	VC	A(HP)	F**	Le
Galgupha atra Amyot & Serville	11	R	A(HP)	---	Le
HOMOPTERA					
Cicadidae					
Magicicada tredecassini Alexander & Moore	14	R	A(HP)	F*	Ra
Tibicen lyricen (DeGeer)	14	R	A(S)	---	---
Membracidae					
Enchenopa binotata (Say)	1,4,12,13,14,25	VC	A,N(HP)	F**	Ra
Entylia bactriana Germar	8,22	R	A(HP)	F*	Le,Ra
Micrutalis calva (Say)	17,18,27	U	A(HP)	F*	Ra
Spissistilus borealis (Fairmaire)	13,14	R	A(HP)	F**	Ra
Stictocephala bubalus (Fabricius)	9,12,13,20	U	A(HP)	F**	Ra
S. taurina (Fitch)	13,26	R	A(HP,S)	F**	Ra
Cicadellidae					
Agallia constricta Van Duzee	12,14,16	C	A(HP)	F**	Le,Ra
A. quadripunctata (Provancher)	20	R	A(HP)	F*	Le
Agalliopsis novella (Say)	14,22	R	A(HP)	F**	Le
Coelidia olitoria (Say)	2,3,4,5,9,12,13,14, 16,20,22,25,27	VC	A,N(HP)	F**	Le,Ra
Colladonus clitellarius (Say)	13	R	A(S)	F*	Le
Draeculacephala antica (Walker)	16,27	R	A,N(S)	---	---
Empoasca fabae (Harris)	17,18	C	A(S)	---	---
Endria inimica (Say)	18	R	A(S)	---	---
Erythroneura spp.	12,13,14,17,18,24,27	VC	A(S)	F*	Le
Graphocephala coccinea (Forster)	2,12,13,14,16,20	C	A(HP)	F**	Le,Ra
G. versuta (Say)	13,14,16,20,23,24,25	C	A(HP)	F**	Le
Gyponana sp.	2	R	N(HP,S)	F*	Le
Latalus sayi (Fitch)	13	R	A(S)	---	---
Macrosteles fascifrons (Stål)	17,18	R	A(S)	---	---
Menosoma cincta (Osborn & Ball)	12,13	U	A(HP)	F**	Le
Nanopsis verticis (Say)	1,2,3,4,5,8,12,13,14, 16,17,20,22,25,26	VC	A,N(HP)	F**	Le,Ra
Oncometopia orbona (Fabricius)	18,24	R	A(HP)	F*	Ra
Paraphlepsius irroratus (Say)	1,12	R	A(HP,S)	F**	Le
P. tennessa (DeLong)	14,16	R	A(HP)	F**	Ra
Paraulacizes irrorata (Fabricius)	13	U	A(HP)	---	Le
Penthimia americana Fitch	22	R	A(HP)	F*	Le
Planicephalus flavocostatus (Van Duzee)	12	R	A(S)	---	---
Scaphoideus titanus Ball	12	R	A(HP)	F**	Le
Scaphytopius acutus (Say)	12,13	R	A(S)	---	---
S. frontalis (Van Duzee)	12,13,18	R	A(HP)	F**	Le
Stragania sp.	14	R	N(S)	---	---
Cercopidae					
Clastoptera achatina Germar	13,25	R	A(S)	---	---
C. laenata Fowler	19	R	A(HP)	---	Ra

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Table 2. continued.

Taxon	Plantation numbers	Rel. freq.[a]	Stages collected[b]	Feeding record[c]	Assoc. plant parts[d,e]
C. obtusa (Say)	14	R	A(S)	---	---
Lepyronia quadrangularis (Say)	27	R	A(HP)	F*	Ra
Philaenus spumarius (Linnaeus)	2,3,5,8,12,13	C	A(HP)	F**	Le,Ra
Delphacidae					
Liburniella ornata (Stål)	8,13	R	A(HP)	F**	Le
Derbidae					
Anotia bonnetti Kirby	14	R	A(S)	---	---
Apache degeerii (Kirby)	3	R	A(HP)	F*	Le
Cedusa kedusa McAtee	14	U	A(HP)	F**	Le
Syntames uhleri Ball	4,5,13,14,22,27	U	A(HP)	F**	Le,Ra
Cixiidae					
Cixius sp.	14	R	A(HP)	---	Tr
Haplixius pictifrons (Stål)	17	R	A(S)	---	---
Oliarus sp.	14	R	A(S)	---	---
Flatidae					
Anormenis septentrionalis (Spinola)	3,5,12,13,14,17	VC	A,N,E(HP,S)	F**	Le,Ra
Metcalfa pruinosa (Say)	1,3,12,13,14,16,27	VC	A,N(HP,S)	F**	Br,Le,Ra
Ormenoides venusta (Melichar)	3,14,26	R	A(HP)	F**	Le,Ra
Acanaloniidae					
Acanalonia bivittata (Say)	3,27	R	A(HP)	F**	Ra
A. conica (Say)	1,3,4,8,14,19	U	A,N(HP)	F**	Ra
Issidae					
Thionia bullata (Say)	16	R	A(S)	---	---
T. simplex (Germar)	4	R	A(HP)	F**	Ra
Psyllidae					
Livia vernalis (Fitch)	13	R	A(S)	---	---
Aphididae					
Acyrthosiphon pisum (Harris)	14	R	A or N(S)	---	---
Dactynotus sp.	27	R	A(HP)	---	Le
Hyalopterus pruni (Geoffroy)	14	R	A(HP)	---	Le
Monellia nigropunctata Granovsky	9,13,20,23	C	A(HP)	F*	Le
Monelliopsis caryae (Monell)	12,13,14,15	C	A or N(HP)	F*	Le
Myzocallis sp.	2	R	A(HP)	---	Le
Nearctaphis bakeri (Cowan)	13	R	A,A or N(HP,S)	---	Le
Pemphigus sp.	13	R	A or N(S)	---	---
Rhopalosiphum maidis (Fitch)	19	R	A(HP)	---	Le
Schizaphis graminum (Rondani)	14	R	A or N(S)	---	---
Coccidae					
Lecanium corni Bouche	14,19	U	A or N(HP)	F**	Br,Tr,Tw
Pulvinaria innumerabilis (Rathvon)	14	R	A or N(HP)	F**	Br
COLEOPTERA					
Elateridae					
Conoderus lividus (DeGeer)	14,25	U	A(HP)	---	Le
Melanotus depressus (Melsheimer)	14,17	R	A(HP)	F*	Le
Throscidae					
Drapetes geminatus Say	13	R	A(S)	---	---
Buprestidae					
Agrilus arcuatus (Say)	13	R	A(S)	---	---
A. fallax Say	13	R	A(S)	---	---
A. transimpressus Fall	13,14,17	U	A(HP)	F*	Le
Dicerca lepida LeConte	13	R	A(HP)	F*	Le
Ptilodactylidae					
Ptilodactyla angustata Horn	2	R	A(HP)	---	Le
P. serricollis (Say)	14	R	A(HP)	---	Le
Helodidae					
Cyphon sp.	12	R	A(S)	---	---
Scirtes orbiculatus (Fabricius)	1	R	A(HP)	---	Le
Languriidae					
Languria mozardi Latreille	14	R	A(S)	---	---
Phalacridae					
Phalacrus sp.	13	R	A(HP,S)	---	Le
Stilbus sp.	13	R	A(S)	---	---
Pedilidae					
Macratria sp.	14	R	A(HP,S)	---	Le

Table 2. continued.

Taxon	Plantation numbers	Rel. freq.[a]	Stages collected[b]	Feeding record[c]	Assoc. plant parts[d,e]
Mycetophagidae					
Litargus quadrispilotus LeConte	12	R	A(S)	---	---
Meloidae					
Epicauta cinerea (Forster)	13	R	A(S)	---	---
Mordellidae					
Mordella sp.	12	R	A(S)	---	---
Mordellistena sp.	12,14,17	R	A(S)	---	---
Scarabaeidae					
Anomala flavipennis Burmeister	14	R	A(HP)	F**	Le
A. innuba (Fabricius)	14	R	A(S)	F*	Le
A. marginata (Fabricius)	14,17,18,25	U	A(HP)	F**	Le
Ataenius strigatus (Say)	12	R	A(HP)	---	Br
Cotinis nitida (Linnaeus)	24	R	A(HP)	F*	Le
Euphoria herbacea (Olivier)	14	R	A(S)	---	---
Macrodactylus subspinosus (Fabricius)	14	R	A(S)	F*	Le
Valgus squamiger (Beauvois)	13	R	A(HP)	F*	Le
Cerambycidae					
Lepturges sp. near *querci* Fitch	14	R	L(HP)	F**	UBa
L. sp. near *symmetricus* (Haldeman)	14	R	L(HP)	F**	UBa
Megacyllene robiniae (Forster)	13	R	A(S)	F*	Le
Tetraopes tetrophthalmus (Forster)	13	R	A(HP,S)	F*	Le
Chrysomelidae					
Anomoea flavokansiensis Moldenke	12,13	U	A(HP)	F**	Le
Babia quadriguttata (Olivier)	14	R	A(S)	F*	Le
Bassareus brunnipes (Olivier)	14,20	R	A(HP)	F*	Le
B. mammifer (Newman)	13	R	A(S)	F*	Le
Cerotoma trifurcata (Forster)	16	R	A(HP)	F*	Le
Chaetocnema confinis Crotch	24	R	A(S)	---	---
C. minuta Melsheimer	5	R	A(HP)	---	Le
Colaspis brunnea (Fabricius)	12,14	R	A(S)	---	---
Crepidodera nana (Say)	9,13	R	A(HP)	---	Le
Cryptocephalus guttulatus Olivier	9,14,22,27	U	A(HP)	---	Le,Ra
C. leucomelas Suffrian	13,14	R	A(HP,S)	F*	Le
C. mutabilis Melsheimer	8,14	R	A(HP,S)	F*	Le
C. nanus Fabricius	2,13,14,17	U	A(HP,S)	F*	Le
C. notatus quadrimaculatus Say	13	R	A(S)	---	---
C. quadruplex Newman	13,14,17	U	A(HP)	F*	Le
Diabrotica undecimpunctata howardi Barber	9,12,13,14	C	A(HP)	F**	Le
Labidomera clivicollis (Kirby)	12,13	U	A,L(S)	---	---
Longitarsus sp.	21	R	A(HP)	---	Le
Luperaltica nigripalpis (LeConte)	14	R	A(S)	---	---
Myochrous denticollis (Say)	13	R	A(HP)	F*	Le
Nodonota clypealis Horn	14,17	U	A(HP,S)	---	Le
N. tristis (Olivier)	9,12,13,14,17,18	C	A(HP)	F*	Le
Pachybrachys relictus Fall	1	R	A(HP)	F*	Le
P. subfasciatus LeConte	14	R	A(S)	F*	Le
Paria fragariae Wilcox	14,17,26,27	U	A(HP)	F*	Le
P. quadrinotata (Say)	14	R	A(S)	---	---
Phyllotreta zimmermanni (Crotch)	17	R	A(S)	---	---
Bruchidae					
Althaeus sp.	12	R	A(S)	---	---
Curculionidae					
Anthonomus sp.	12	R	A(HP)	---	Le
Apion sp.	13	R	A(S)	---	---
Conotrachelus elegans (Say)	2	R	A(HP)	---	Le
Cyrtepistomus castaneus (Roelofs)	8,9,12,13,14,16, 24,25,26,27	VC	A(HP,S)	F*	Le
Eugnamptus sp. near *collaris* (Fabricius)	14,17	R	A(S)	---	---
Hypera punctata (Fabricius)	20	R	A(HP)	---	Le
Madarellus undulatus (Say)	13	R	A(S)	F*	Le
Magdalis pandura Say	14,17	R	A(HP)	---	Le
Odontopus calceatus Say	13	R	A(HP)	---	Le
LEPIDOPTERA					
Danaidae					
Danaus plexippus (Linnaeus)	13	R	L(HP)	---	Le

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Table 2. continued.

Taxon	Plantation numbers	Rel. freq.[a]	Stages collected[b]	Feeding record[c]	Assoc. plant parts[d,e]
Lycaenidae					
Satyrium calanus (Hübner)	12,13,14	C	A,L(HP,S)	F*	Le
Sphingidae					
Cressonia juglandis (J.E.Smith)	13	R	L(HP)	---	Le
Saturniidae					
Actias luna (Linnaeus)	14,15	R	L,E(HP)	F*	Le
Antheraea polyphemus (Cramer)	14	R	L(HP)	F*	Le
Citheroniidae					
Citheronia regalis (Fabricius)	15	R	L(HP)	F*	Le
Ctenuchidae					
Cisseps fulvicollis (Hübner)	9,12,13	U	A(HP)	---	Le
Arctiidae					
Diacrisia virginica (Fabricius)	25	R	L(HP)	F*	Le
Ecpantheria scribonia (Stoll)	14	R	L(HP)	F*	Le
Halisidota tessellaris (J.E.Smith)	14,26	R	L(HP,S)	F*	Le
Haploa colona fulvicosta (Clemens)	14	R	L(S)	F*	Le
Hyphantria cunea (Drury)	1,10,12,13,14	VC	L(HP)	F**	Le
Noctuidae					
Acronicta impleta (Walker)	12,13	R	L(HP)	F*	Le
Baileya australis (Grote)	12,13,14	R	L(HP,S)	F*	Le
Bomolocha sp. near *madefactalis* (Guenée)	1,13	R	A,L(HP,S)	F*	Le
B. sp. near *sordidula* Grote	14	R	L(S)	F*	Le
Catocala sp. near *neogama* J.E.Smith	20	R	L(HP)	F*	Le
Eupsilia sp. near *sidus* Guenée	13	R	L(HP)	F*	Le
Heliocontia apicella (Grote)	13	R	A(S)	---	---
Morrisonia confusa (Hübner)	9,12,13,14,16,17,18	C	L(HP)	F**	Le
Orthosia hibisci (Guenée)	14	U	L(HP)	---	Le
Peridroma saucia (Hübner)	14	U	L(S)	---	---
Spragueia leo (Guenée)	13	R	A(S)	---	---
Notodontidae					
Datana angusii Grote & Robinson	14,27	U	L(HP)	F**	Le
D. integerrima Grote & Robinson	1,5,12,13,14,15	VC	L,E(HP)	F**	Le
Heterocampa guttivitta (Walker)	14	R	L(S)	F*	Le
H. manteo (Doubleday)	17	R	L(HP,S)	F*	Le
Schizura ipomoeae (Doubleday)	1	R	L(HP)	---	Le
S. leptiniodes (Grote)	5,12,13,14	U	L(HP)	F*	Le
Lymantriidae					
Dasychira sp. near *basiflava* (Packard)	14	R	L(HP)	F*	Le
Orgyia leucostigma (J.E.Smith)	12,20	R	L(HP)	F*	Le
Lasiocampidae					
Malacosoma americanum (Fabricius)	14	R	L(S)	---	---
Geometridae					
Abbottana clemataria (J.E.Smith)	13,14	R	L(HP)	F*	Le
Anacamptodes defectaria (Guenée)	12	R	L(S)	F*	Le
A. ephyraria (Walker)	14	R	L(HP)	F*	Le
Anavitrinella pampinaria (Guenée)	13	R	L(S)	F*	Le
Hypagyrtis esther (Barnes)	13,14,20	U	L(HP)	F*	Le
H. unipunctata (Haworth)	12,22	R	L(HP)	F*	Le
Lambdina fervidaria (Hübner)	17	R	L(S)	F*	Le
Melanolophia canadaria (Guenée)	14	R	L(S)	F*	Le
M. signataria (Walker)	13,17	R	L(S)	F*	Le
Synchlora aerata (Fabricius)	12,13	R	A(S)	---	---
Limacodidae					
Prolimacodes scapha Harris	12	R	L(HP)	F*	Le
Sibine stimulea (Clemens)	16	R	L(HP)	F**	Le
Zygaenidae					
Acoloithus falsarius Clemens	13,25	R	A(HP,S)	---	Le
Pyralidae					
Acrobasis demotella Grote	12 or 13,13	U	L(HP)	F**	IBu,ISt
A. juglandis (LeBaron)	12 or 13,13,14	U	L(HP)	F**	IRa,Le
A. latifasciella Dyar	14	U	L(HP,S)	F**	IBu,ISt
Argyria nivalis (Drury)	12	R	A(S)	---	---
Crambus elegans Clemens	14	U	A(S)	---	---
C. sp. near *teterellus* Zincken	14	R	A(S)	---	---
Tetralopha asperatella Clemens	13	R	L(HP)	F*	Le

Table 2. continued.

Taxon	Plantation numbers	Rel. freq.[a]	Stages collected[b]	Feeding record[c]	Assoc. plant parts[d,e]
T. nephelotella Hulst	14	R	L(HP)	F*	Le
T. subcanalis (Walker)	14	R	L(HP)	F*	Le
Udea rubigalis (Guenée)	14	R	A(S)	---	---
Olethreutidae					
Episimus argutanus (Clemens) (?)	13	R	A(HP)	---	Le
Grapholitha eclipsana Zeller	13	R	A(S)	---	---
G. interstinctana (Clemens)	13	U	A(HP,S)	---	Le
Gretchena amatana Heinrich	13	R	L(S)	F*	Le
G. bolliana (Slingerland)	2,3,12,13,14, 17,22,23,27	VC	A,L(HP,S)	F**	Le
Gwendolina concitatricana Heinrich	3 or 23	R	L(HP)	F*	Le
Laspeyresia sp. near *caryana* Fitch	13	R	A(HP)	---	Le
Tortricidae					
Archips argyrospilus (Walker)	13,14	R	L(HP)	F*	Le
Argyrotaenia juglandana (Fernald)	12	R	P(HP)	---	Le
A. velutinana (Walker)	14	R	L(HP)	F*	Le
Choristoneura rosaceana (Harris)	12,14,23	U	P,L(HP)	F**	Le
Pandemis limitata (Robinson)	12,13,14,16,26	U	L(HP)	F*	Le
Sparganothis distincta (Walsingham)	11	R	A(HP)	---	Le
Gelechiidae					
Arogalea cristifasciella (Chambers)	12	R	A(HP)	---	Tr
Chionodes sp.	14	R	L(HP)	F*	Le
Dichomeris ligulella (Hübner)	14	R	L(HP)	F*	Le
D. ventrella (Fitch)	13,14,18	U	L(HP,S)	F*	Le
Stenomidae					
Antaeotricha leucillana (Zeller)	13	R	A(S)	---	---
Coleophoridae					
Coleophora caryaefoliella Clemens	18	R	L(HP)	---	Le
Gracillariidae					
Gracillaria blandella Clemens	1,5,9,12,13,14,24,26	C	A,L(HP)	F**	Le
Phyllonorycter juglandiella (Chambers)	3,4,23	U	L(HP)	F**	Le
Psychidae					
Thyridopteryx ephemeraeformis (Haworth)	13,14	R	L(HP)	F*	Le
DIPTERA					
Cecidomyiidae					
Clinodiplosis sp.	2,22	C	L(HP)	---	Le
HYMENOPTERA					
Xyelidae					
Megaxyela sp.	6 & 12 or 13	R	L(HP)	---	Le
Tenthredinidae					
Caulocampus acericaulis (MacGuillivray)	12	R	A(S)	---	---
Dolerus aprilis (Norton)	14	R	A(S)	---	---
Eriocampa juglandis (Fitch)	14,17	U	L(HP)	F*	Le
Macrophya flavicoxae (Norton)	13	R	A(S)	---	---

[a]C = common, R = rare, U = uncommon, VC = very common.
[b]A = adult, E = egg, J = juvenile, L = larva, N = nymph, P = pupa, HP = hand-picking, S = sweeping.
[c]F* = laboratory feeding record, F** = field feeding record.
[d]Refers to plant part upon which insect was collected or, if noted feeding in the field or laboratory, the part upon which it was feeding.
[e]Ba = bark, Br = branch, IBu = in bud, IRa = in rachis, ISt = in stem, Le = leaflet, Ra = rachis, Tr = trunk, Tw = twig, UBa = under bark.

Table 3. List of predators and parasites from black walnut insects.

Black Walnut Insects	Predator (Field) or Parasite (Laboratory) Family	Species	Comments
Lygaeidae			
Lygaeus kalmii Stål	Tachinidae	*Leucostoma gravipes* Wulp	Emerged from adult
Pentatomidae			
Euschistus servus (Say)	Scelionidae	*Trissolcus euschisti* (Ashmead)	Emerged from eggs
Cicadellidae			
Agallia constricta Van Duzee	Asilidae	*Cerotainia macrocera* (Say)	Feeding on adult in field
Chrysomelidae			
Anomoea flavokansiensis Moldenke	Pentatomidae	*Podisus maculiventris* (Say)	Feeding on adult in field
Arctiidae			
Halisidota tessellaris (J.E.Smith)	Ichneumonidae	*Parania g. geniculata* (Holmgren)	Emerged from pupa
Noctuidae			
Morrisonia confusa (Hübner)	Braconidae	*Apanteles hyphantriae* Riley	Emerged from larva
Notodontidae			
Datana integerrima Grote & Robinson	Scelionidae	*Telenomus ichthyurae* Ashmead	Emerged from pupa
	Ichneumonidae	*Barylypa* sp.	Emerged from pupa
	Ichneumonidae	*Tanypelma datanae* (Riley)	Emerged from pupa

Some of the more common sucking insects noted feeding in the field included *Lopidea confluenta* (Say) (Miridae), *Corythucha juglandis* (Fitch) (Tingidae), *Brochymena quadripustulata* (Fab.) (Pentatomidae), *Enchenopa binotata* (Say) (Membracidae), *Coelidia olitoria* (Say), *Nanopsis verticis* (Say) (Cicadellidae), *Anormenis septentrionalis* (Spinola), and *Metcalfa pruinosa* (Say) (Flatidae). However, the importance of sucking damage to the tree is difficult to determine.

The predators and parasites collected during this study, and their prey and hosts, respectively, are given in Table 3.

Additional biological information on southern Illinois black walnut phytophagous insects is provided by Nixon (1976).

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