### AN ANNOTATED LIST OF PHYTOPHAGOUS INSECTS COLLECTED ON IMMATURE BLACK WALNUT TREES IN SOUTHERN ILLINOIS<sup>1</sup>

P. L. Nixon and J. E. McPherson<sup>2</sup>

#### 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

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<sup>&</sup>lt;sup>2</sup>Graduate student and Associate Professor, respectively, Department of Zoology, Southern Illinois University at Carbondale, Carbondale, Illinois 62901.



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,

1977

| Plant.<br>no | County     | Location       | Year<br>planted | Acres | Other tree<br>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 517    | 1973            | 8     | mixed deciduous                   |
| 9            | Randolph   | T7S R5W S21    | 1972-1973       | 2     | none                              |
| 10           | Jackson    | T85 R4W S12    | 1972            | 4     | none                              |
| 11           | Jackson    | T8S R4W S22    | 1973            | 3     | none                              |
| 12           | Jackson    | T95 R2W S25    | 1965            | . 1   | none                              |
| 13           | Jackson    | T9S R1W S31    | 1970            | 2     | none                              |
| 14           | Jackson    | T10S R1W S25   | 1965            | 2     | none                              |
| 15           | Union      | T115 R2W 58    | 1969            | 12    | none                              |
| 16           | Union      | T125 R2W S8    | 1970            | 2     | none                              |
| 17           | Alexander  | T14S R2W S28   | 1967-1970       | 6     | none                              |
| 18           | Alexander  | T15S R2W S5    | 1969            | 7     | autumn olive,alder                |
| 19           | Massac     | T14S R4E S34   | 1967            | 1     | & black locust<br>mixed deciduous |
| 20           | Johnson    | T12S R4E S3610 | 1965            | 5     | mixed deciduous                   |
| 21           | Роре       | T12S R7E S6    | 1972            | 4     | none                              |
| 22           | Роре       | 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                |
| 25           | Hardin     | T12S R8E S4    | 1965            | 1     | & black locust<br>none            |
| 26           | Hardin     | T12S R8E S3    | 1963,1966       | 2.5   | none                              |
| 27           | Gallatin   | T10S R8E S32   | 1973            | ų     | none                              |

Table 1. Descriptions of black walnut plantations surveyed.

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  $23.9\pm1.1^{\circ}$ 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 ( $29 \times 18 \times 13$  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,  $26.7\pm1.1^{\circ}$ 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  $7.2\pm0.6^{\circ}$ 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 integerima 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.

| Тахол  | Plantation<br>numbers | Rel.<br>freq.a | Stages<br>collected <sup>b</sup> | Feeding<br>record <sup>c</sup> | Assoc.<br>plant<br>partsd,e |
|--|-----------------------|----------------|----------------------------------|--------------------------------|-----------------------------|
| COLLEMBOLA   |                       |                |                                  |                                |                             |
| Poduridae<br><i>Hypogastrura packardi</i> (Folsom)<br>Isotomidae | 14                    | U              | Aξ∕or J(HP)                      |                                | Ва                          |
| Isotomurus palustris balteatus (Reuter)<br>Entomobryidae         | 17                    | R              | A&/or J(S)                       |                                |                             |
| Entomobrya atrocineta Schott                                     | 14                    | R              | A&/or J(S)                       |                                |                             |

| TaxonORTHOPTERA<br>Acrididae  | Plantation<br>numbers       | Rel.<br>freq. <sup>a</sup> | Stages<br>collected <sup>b</sup> | Feeding<br>record <sup>C</sup> | Assoc.<br>plant<br>partsd,e |
|---|-----------------------------|----------------------------|----------------------------------|--------------------------------|-----------------------------|
| TaxonORTHOPTERA<br>Acrididae  |                             | Rel.<br>freq. <sup>a</sup> | Stages<br>collected <sup>b</sup> |                                | plant<br>parts_d,e          |
| ORTHOPTERA<br>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   |                             | P                          | 1 (UD)                           | F*                             |                             |
| Conocephalus brevipennis (Scudder)  | 13<br>16                    | R<br>R                     | A(HP)<br>A(HP)                   | F*                             | Le<br>Le                    |
| C. fasciatus (DeGeer)<br>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)                             |                                |                             |
|   | 2,13,16,27                  | ΰ                          | N(S)                             |                                |                             |
| Pterophylla camellifolia (Fabricius)  | 14                          | Ř                          | 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                       | С                          | A,N(HP,S)                        | F*                             | Le                          |
| 0. latipennis Riley 4,13  | 3,14,16,20,27               | U                          | A,N(HP,S)                        | F*                             | Le                          |
| 0. nigricornis F.Walker   | 13                          | R                          | A,N(HP,S)                        | F*                             | Le                          |
| 0. niveus (DeGeer) 3,9,13   | 3,14,16,20,27               | 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                    | ΰ                          | A(HP)                            |                                | Le                          |
| -   |                             | -                          |                                  |                                |                             |
| HEMIPTERA   |                             |                            |                                  |                                |                             |
| Miridae   |                             |                            |                                  |                                |                             |
| Ceratocapsus sp. near   | 7 14 14 05 04               |                            |                                  |                                |                             |
|   | 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*<br>F**                      | Le                          |
| Lopidea confluenta (Say)  | 13,14,17                    | VC                         | A(HP)                            | F                              | Ra                          |
| Lygus lineolaris (Palisot<br>de Beauvois) 9,12                                    | 17 14 16 17                 | VC                         | A (LID)                          | F*                             | Le                          |
|   | 2,13,14,16,17<br>3,14,16,17 | C                          | A(HP)<br>A(S)                    | F*                             | Le                          |
|   | 2,13,14,17                  | ບັ                         | A(HP,S)                          | F**                            | Le                          |
| P. politus Uhler  | 13                          | R                          | A(S)                             |                                |                             |
| P. repletus Knight  | 12,14,17                    | ΰ                          | A,N(HP)                          | F**                            | Le                          |
| Stenotus binotatus (Fabricius)  | 17                          | R                          | A(S)                             |                                |                             |
| Tingidae  |                             |                            | (-)                              |                                |                             |
|   | 4,16,17,24,26               | VC                         | A,N(HP)                          | F**                            | Le                          |
| Lygaeidae   |                             |                            | ,                                |                                |                             |
| Lygaeus kalmii (Stal)   | 12,13                       | υ                          | A(HP,S)                          |                                | Le                          |
|   | 12,13                       | С                          | A,N(HP)                          | F*                             | Le                          |
| Oncopeltus fasciatus (Dallas)   |                             |                            |                                  |                                |                             |
| Coreidae  |                             |                            |                                  |                                |                             |
| Coreidae<br>Acanthocephala terminalis (Dallas)                                    | 5,14,22                     | υ                          | A,N(HP,S)                        | F*                             | Le                          |
| Coreidae<br>Acanthocephala terminalis (Dallas)<br>Euthochtha galeator (Fabricius) | 5,14,22<br>27<br>U campus   | U<br>R<br>R                | A,N(HP,S)<br>A,N(HP)<br>A(S)     | F*<br>F*                       | Le<br>Ra                    |

| Taxon  | Plantation<br>numbers     | Rel.<br>freq. <sup>a</sup> | Stages<br>collected <sup>b</sup> | Feeding<br>record <sup>c</sup> | Assoc.<br>plant<br>parts <sup>d</sup> , |
|--|---------------------------|----------------------------|----------------------------------|--------------------------------|---|
|  |                           |                            |                                  |                                |   |
| Rhopalidae                                       |                           |                            |                                  |                                |   |
| Liorhyssus hyalinus (Fabricius)                  | 13                        | R                          | A(HP)                            | F**                            | Le                                      |
| Alydidae   |                           |                            |                                  |                                |   |
| Alydus eurinus (Say)                             | 13,27                     | υ                          | 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,T                                 |
| B. quadripustulata (Fabricius) 12,1              | 3,14,17,18,22,23,27       | 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   |                           |                            |                                  |                                |   |
| <i>Sehirus c. cinctus</i> (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<br>Magicicada tredecassini             |                           |                            |                                  |                                |   |
|  |                           | n                          | . (110)                          | F*                             | D -                                     |
| Alexander & Moore                                | 14                        | R                          | A(HP)                            |                                | Ra                                      |
| Tibicen lyricen (DeGeer)                         | 14                        | R                          | A(S)                             |                                |   |
| Membracidae                                      | 1 4 10 17 14 05           |                            |                                  |                                | n -                                     |
| 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                  | С                          | 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, | VC                         | A, N(HP)                         | F**                            | Le,Ra                                   |
|  | 16,20,22,25,27            |                            |                                  |                                |   |
| Colladonus clitellarius (Say)                    | 13                        | R                          | A(S)                             | F*                             | Le                                      |
| Draeculacephala antica (Walker)                  | 16,27                     | R                          | A, N(S)                          |                                |   |
| Empoasca fabae (Harris)                          | 17,18                     | С                          | A(S)                             |                                |   |
| Endria inimica (Say)                             | 18                        | R                          | A(S)                             |                                |   |
|  | 13,14,17,18,24,27         | VC                         | A(S)                             | F*                             | Le                                      |
|  | 2,12,13,14,16,20          | C                          | A(HF)                            | F**                            | Le,Ra                                   |
|  | 14, 16, 20, 23, 24, 25    | Ċ                          | A(HP)                            | F**                            | Le                                      |
| Gyponana sp.                                     | 2                         | R                          | N(HF,S)                          | F*                             | Le                                      |
| Latalus sayi (Fitch)                             | 13                        | R                          | A(S)                             |                                |   |
| Macrosteles fascifrons (St21)                    | 17,18                     | R                          | A(S)                             |                                |   |
| Menosoma cincta (Osborn & Ball)                  | 12,13                     | Ŭ                          | A(HP)                            | F**                            | Le                                      |
|  | ,3,4,5,8,12,13,14,        | vс                         | A,N(HP)                          | F**                            | Le,Ra                                   |
|  | 16,17,20,22,25,26         | ۴ü                         | 5,3(117)                         |                                | ,na                                     |
| 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                          |                                  | г<br>F**                       | Ra                                      |
| Paraulacizes irrorata (Fabricius)                | 13                        | к<br>U                     | A(HP)<br>A(HP)                   | r<br>                          | Le                                      |
| Penthimia americana Fitch                        | 22                        | R                          | A(HP)                            | F*                             | Le                                      |
| Planicephalus flavocostatus                      | 22                        | к                          | A(HP)                            | t.                             | Le                                      |
|  | 12                        | n                          | 1(0)                             |                                |   |
| (Van Duzee)<br>Samhaidaya titamya Pall           | 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)                             |                                |   |
| lercopidae                                       | 17.05                     |                            |                                  |                                |   |
|  |                           |                            |                                  |                                |   |
| Clastoptera achatina Germar<br>C. laenata Fowler | 13,25<br>19               | R<br>R                     | A(S)<br>A(HP)                    |                                | Ra                                      |

| C. obtual (Say)       14       R       A(HP) $$ Lepprovia quadragularia (Say)       27       R       A(HP) $F^*$ Le, Ra         Delphacidae       Lilarmiella contata (StR1)       8,13       R       A(HP) $F^*$ Le, Ra         Derbidae       Derbidae       R       A(HP) $F^*$ Le       Derbidae         Anotis bonnetit Kirby       3       R       A(HP) $F^*$ Le         Catina point and point of the second scalars       R       A(HP) $F^*$ Le         Catina point of the second scalars       N(HP) $F^*$ Le       Catina point of the second scalars       N(HP) $F^*$ Le         Catina point of the second scalars       N(HP) $F^*$ Le, Ra       A(S) $$ $$ R       A(S) $$  | Taxon                                | Plantation<br>numbers | Rel.<br>freq.ª | Stages<br>collected <sup>b</sup> | Feeding<br>record <sup>c</sup> | Assoc.<br>plant<br>partsd.e |
|---|--------------------------------------|-----------------------|----------------|----------------------------------|--------------------------------|-----------------------------|
| Lepprovia         quadrungularie         (5a)         27         R         A(HP)         F**         Res           Delphacidae         Liburyiella ornata (StB1)         8,15         R         A(HP)         F**         Le,Ra           Derbidae         Anotia cornata (StB1)         8,15         R         A(HP)         F**         Le           Anotia cornata (StB1)         8,15         R         A(HP)         F**         Le           Anotia cornata (StB1)         3         R         A(HP)         F**         Le           Guanta devices         14         U         A(HP)         F**         Le,Ra           Cistuas p.         14         R         A(S)             Idipticuis pictifrons (StB1)         17         R         A(S)             Idipticuis pictifrons (StB1)         1,3,12,15,14,16,27         VC         A,N(HP)         F**         Le,Ra           Accorda consta (Say)         1,3,14,26         R         A(HP)         F**         Re         Ra           Accorda (Say)         1,3,14,61,77         VC         A,N(HP)         F**         Re         Re           Isidae         previncia suridae (Sistitata (Sa)  | C. obtusa (Say)                      | 14                    | R              | A(S)                             |                                |                             |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  |                                      |                       |                |                                  | F*                             | Ra                          |
| Delphacidae<br>Litlarricella cornata (StB1) 8,15 R A(HP) F** Le<br>Derbidae<br>Anotia bornetit Kirby 14 R A(S)<br>Apacha degearit (Kirby) 3 R A(HP) F** Le<br>Gyntames unler Ball 4,5,13,14,22,27 U A(HP) F** Le, Ra<br>Citikas sp. 14 R A(HP) Tr<br>Dight as points provided (Spinola) 5,5,12,13,14,17 V A(HP) F** Le, Ra<br>Citikas sp. 14 R A(S)<br>Ditanae sp. 14 R A(S)<br>Ditanae sp. 14 R A(S)<br>Ditanae sp. 14 R A(HP) F** Le, Ra<br>Amount septentrionalis (Spinola) 5,5,12,13,14,17 VC A,N(HP,S) F** Le, Ra<br>Amount septentrionalis (Spinola) 5,5,12,13,14,16,27 VC A,N(HP,S) F** Le, Ra<br>Amount septentrionalis (Spinola) 5,5,12,13,14,16,27 VC A,N(HP) F** Ra<br>Amount septentrionalis (Spinola) 5,5,12,13,14,16,27 VC A,N(HP) F** Ra<br>Amount septentrionalis (Spinola) 5,3,27 R A(HP) F** Ra<br>Amount septentrionalis (Spinola) 5,3,27 R A(HP) F** Ra<br>Amount septentrionalis (Spinola) 13,4,26 R A(HP) F** Ra<br>Amount septentrionalis (Spinola) 13,4,26 R A(HP) F** Ra<br>Amount septent (Germar) 4 R A(HP) F** Ra<br>Amount septent (Germar) 4 R A(HP) F** Ra<br>Syllidae<br>Thiotia builtata (Say) 16 R A(S)<br>Mathyne trans (Germar) 4 R A(HP) F** Ra<br>Syllidae Ciferon 13 R A(S)<br>Mathyne trans (Gerfrey) 14 R A(HP) Le<br>Monallia migrepundite Granovsky 9,15,20,23 C A(HP) Le<br>Monallia migrepundite Granovsky 9,15,20,23 C A(HP) Le<br>Monallia migrepundite (Gerfrey) 14 R A(HP) Le<br>Mathyne taker (Cowan) 13 R A(S)<br>Mathyne taker (Cowan) 13 R A(S)<br>Mathyne matid (Fitch) 19 R A(HP) Le<br>Monallia migrepundite (Rathvon) 14 R A or N(S)<br>Econderus Lividus (DeGeer) 14,17 R A(HP) Le<br>Mathyne matid (Gitch) 19 R A(HP) Le<br>Mathyne mathyne sp. 13 R A(S)<br>A, transformeratile (Rathvon) 14 R A or N(S)<br>Mathyne for A(HP) P* Le<br>Diagressus (Melseimer) 14,17 R A(HP) P* Le<br>Leodardia cornative (Say) 13 R A(S)<br>A, transformeratile (Rathvon) 14 R A(S)<br>Mathyne for A(HP) P* Le<br>Diagressus (Pallat Say 13 R A(S)<br>Mathyne for A(HP) P* Le<br>Diagressus (Pallat   |                                      | 2,3,5,8,12,13         | С              |                                  | F**                            | Le,Ra                       |
| Derbida   |                                      |                       |                |                                  |                                |                             |
| Derbidae         Anotia bornetti Kirby         14         R         A(S)             Apacha bornetti Kirby         3         R         A(HP)         F**         Le           Syntames uhlari Ball         4,5,13,14,22,27         U         A(HP)         F**         Le,Ra           Cixius sp.         14         R         A(HP)         F**         Le,Ra           Cixius sp.         14         R         A(HP)         F**         Le,Ra           Cixius sp.         14         R         A(S)             Cixius sp.         14         R         A(S)             Cixius sp.         14,16,27         VC         A,N(HP)         F**         Le,Ra           Acanalonidae         Acanalonidae         A(HP)         F**         Le,Ra         A(HP)         F**         Ra           Ascanalonidae         Sidae         Thioria bulltata (Say)         3,27         R         A(HP)         F**         Ra           Isidae         Thioria publicat (Germar)         4         R         A(HP)             Thioria parmalis (Fitch)         13         R         A(S)   | Liburniella ornata (St21)            | 8,13                  | R              | A(HP)                            | F**                            | Le                          |
| Approximation         Approximation         Stress         R         A(HP)         F*         Le           Contains         Contains         Le         U         A(HP)         F*         Le           Springene         Lift         U         A(HP)         F**         Le         Ra           Christias         Contains         A(HP)         F**         Le         Ra           Christias         Presentations         Stress         A(HP)         F**         Le         Ra           Christias         Presentations         Stress         A(HP)         F**         Le         Ra           Anormenics         esptentrionalis         J, J, L, J, J, L, J, L, J, L, J, L         VC         A, N(HP)         F**         Le, Ra           Anormicalis         repretivosa         (Say)         J, Z, J, L, J, L, J, L         VC         A, N(HP)         F***         Re           Acontaid         builtatia         (Say)         J, Z, Z         R         A(HP)         F***         Re         Re           A contaids         fild         Le         Ra         A(HP)         F***         Re         Re         A(HP)         F***         Re         Re         A(HP)         Re  |                                      |                       |                |                                  |                                |                             |
| Ceduca Keduca McAree         14         U         A(HP)         F**         Le, Ra           Cixiidae         Castus sp.         14         R         A(HP)         F**         Le, Ra           Cixiidae         14         R         A(HP)         F**         Le, Ra           Cixiidae         14         R         A(HP)          Tr           Normeroids sptematics (Stil)         17         R         A(S)             Flatidae         Anormeroids exprematics (Stil)         1,3,1,2,13,14,16,27         VC         A,N(HP),S)         F**         Le, Ra           Acanalonidae         Commonidae (Melichar)         3,14,26         R         A(HP)         F**         Re, Ra           Acanalonidae         Say)         1,3,4,4,14,19         U         A,N(HP)         F**         Ra           Acanalonidae         Generar)         4         R         A(HP)         F**         Ra           Acanalonidae         Generar)         3,27         R         A(HP)         F**         Ra           Acanalonidae         Generar)         4         R         A(HP)         F**         Ra           Acanalonidae         Generar)         13   | Anotia bonnetti Kirby                | 14                    | R              | A(S)                             |                                |                             |
|   | Apache degeerii (Kirby)              | 3                     | R              | A(HP)                            | F*                             | Le                          |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$   | Cedusa kedusa McAtee                 | 14                    | U              | A (HP)                           | F**                            | Le                          |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | Syntames uhleri Ball                 | 4,5,13,14,22,27       | U              | A(HP)                            | F**                            | Le,Ra                       |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | Cixiidae                             |                       |                |                                  |                                |                             |
| Oliarus sp.       14       R       A(S)           Flatidae       Anommenie septentrionalis (Spinola) 3,5,12,13,14,16,27       VC       A,N(HP,S)       F**       Le,Ra         Amenonidae venueta (Melichar)       3,12,15,14,16,27       VC       A,N(HP)       F**       Le,Ra         Anomalonia bivittata (Say)       3,12,71       R       A(HP)       F**       Ra         A. contac (Say)       1,3,4,8,14,19       U       A,N(HP)       F**       Ra         Issidae       Trionia bullata (Say)       16       R       A(S)          T. simplet (Germar)       4       R       A(HP)       F**       Ra         Agerthosiphon pisum (Harris)       14       R       A or N(S)           Datymotas sp.       27       R       A(HP)       F**       Ee         Macorthis sp.       27       R       A(HP)        Le         Momelia sp.       2       R       A(HP)        Le         Macortabis sp.       13,20,25       C       A(HP)        Le         Macortabis sp.       13       R       A or N(S)           Macortabi  | Cixius sp.                           | 14                    | R              | A(HP)                            |                                | Tr                          |
| Oliarus sp.       14       R       A(S)           Flatidae       Anommenie septentrionalis (Spinola) 3,5,12,13,14,16,27       VC       A,N(HP,S)       F**       Le,Ra         Amenonidae venueta (Melichar)       3,12,15,14,16,27       VC       A,N(HP)       F**       Le,Ra         Anomalonia bivittata (Say)       3,12,71       R       A(HP)       F**       Ra         A. contac (Say)       1,3,4,8,14,19       U       A,N(HP)       F**       Ra         Issidae       Trionia bullata (Say)       16       R       A(S)          T. simplet (Germar)       4       R       A(HP)       F**       Ra         Agerthosiphon pisum (Harris)       14       R       A or N(S)           Datymotas sp.       27       R       A(HP)       F**       Ee         Macorthis sp.       27       R       A(HP)        Le         Momelia sp.       2       R       A(HP)        Le         Macortabis sp.       13,20,25       C       A(HP)        Le         Macortabis sp.       13       R       A or N(S)           Macortabi  | Haplixius pictifrons (Stal)          | 17                    | R              | A(S)                             |                                |                             |
| Anomenie septentrionalis (Spinola) 3,5,12,13,14,17         VC         AN, E(HP, S)         F**         Le, Ra           Metoaifa venusta (Melichar)         3,14,26         R         A(HP)         F**         Br.Le, Ra           Acanalonidae         3,14,26         R         A(HP)         F**         Br.Le, Ra           Acanalonidae         1,3,4,8,14,19         U         A, N(HP)         F**         Ra           Acanalonidae         1,3,4,8,14,19         U         A, N(HP)         F**         Ra           Sidae         Thionia bullata (Say)         16         R         A(S)            T. simplex (Germar)         4         R         A(HP)         F**         Ra           Agerthosiphon pisum         Harris)         14         R         A or N(S)            Datymotas sp.         27         R         A(HP)         F**         Le           Macolitos sp.         27         R         A(HP)         F*         Le           Macolitos sp.         2         R         A(HP)          Le           Macolita sp.         13,20,23         C         A or N(HP)         F*         Le           Macotabis sp.         13         R   |                                      | 14                    | R              | A(S)                             |                                |                             |
| Metcalfa pruinaza (Say)         1,3,12,13,14,16,27         VC         A,N(HP,S)         F**         Br, Le, Ra           Acamalonida biotitata (Say)         3,27         R         A(HP)         F**         Br, Le, Ra           Acamalonida biotitata (Say)         1,3,4,8,14,19         U         A,N(HP)         F**         Ra           A. contac (Say)         16         R         A(S)          F**         Ra           Thionia bullata (Say)         16         R         A(S)          F**         Ra           Syllida         Livia vernalia (Fitch)         13         R         A(S)             Agythosiphon pisum (Harris)         14         R         A or N(S)             Datynotus sp.         27         R         A(HP)          Le         Monellia nigropunctata Granovsky         9,13,20,23         C         A(HP)  | Flatidae                             |                       |                |                                  |                                |                             |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | Anormenis septentrionalis (Spinola)  | 3,5,12,13,14,17       | VC             | A,N,E(HP,S)                      |                                | Le,Ra                       |
| Acamalonia bivitata (Say)       3,27       R       A(HP)       F**       Ra         Acamalonia bivitata (Say)       1,3,4,8,14,19       U       A,N(HP)       F**       Ra         Isidae       '''       '''       A (HP)       F**       Ra         Thionia bullata (Say)       16       R       A(S)           Phioliae       A       R       A(HP)       F**       Ra         Agurbhoshphon pisum (Harris)       14       R       A or N(S)           Dactynotus sp.       27       R       A(HP)        Le         Monellis nigropunctata Granovsky       9,15,20,23       C       A(HP)        Le         Monellis nigropunctata Granovsky       9,15,20,23       C       A(HP)        Le         Mearotaphis bakeri (Cowan)       13       R       A or N(S)           Mearotaphis   | Metcalfa pruinosa (Say)              | 1,3,12,13,14,16,27    | VC             | A,N(HP,S)                        | F**                            | Br,Le,Ra                    |
| Acamalonia bivitiata (Say) $3,27$ R $A(HP)$ $F^{**}$ RaA. conica (Say)1,3,4,8,14,19U $A,N(HP)$ $F^{**}$ RaIssidae"Thionia bullata (Say)16R $A(S)$ T. simplata (Germar)4R $A(HP)$ $F^{**}$ Rasyllidae13R $A(S)$ Livia vernalis (Fitch)13R $A(S)$ Acyrthosiphon pisum (Harris)14RA or $N(S)$ Acyrthosiphon pisum (Harris)14RA (HP)LeMonellia rigropunctata Granovsky9,13,20,23CA(HP)F*LeMonellia sp.27RA(HP)LeMonellia sp.27RA(HP)LeMacardis sp.13,14,15CA or $N(HP)$ F*LeMonellia sp.2RA(HP)LeMearetaphigue sp.13RA, or $N(HP)$ LeSchizaphicg graminum (Rondani)14RA or $N(S)$ Pulvinaria innumerabilie (Rathvon)14RA or $N(HP)$ F**BrColLEOPTERA13RA(S)Melanotus depressus (Melsheimer)14,17RA(S)Interidae13RA(S)Conderus lividus (DeGeer)14,25UA(HP)F**BrDropete   | Ormenoides venusta (Melichar)        | 3,14,26               | R              | A(HP)                            | F**                            | Le,Ra                       |
| A. aonica (Say)       1,3,4,8,14,19       U       A.N(HP)       F**       Ra         Issidae       Thionic bullata (Say)       16       R       A(S)           T. eimplex (Gemar)       4       R       A(HP)       F**       Ra         syllidae       13       R       A(S)           Lvia vernalis (Fitch)       13       R       A(S)           Datynobus sp.       27       R       A(HP)        Le         Monellion igromunctata Granovsky       9,13,20,23       C       A(HP)       F*       Le         Monelliopsis caryae (Monell)       12,13,14,15       C       A or N(S)        Le         Meacoalita sp.       2       R       A(HP)        Le       Meacoalita sp.        Le         Meacoalita sp.       13       R       A or N(S)   | Acanaloniidae                        |                       |                |                                  |                                |                             |
| Issidae for the form of the f | Acanalonia bivittata (Say)           | 3,27                  | R              | A(HP)                            | F**                            | Ra                          |
| Issidae   | A. conica (Say)                      | 1,3,4,8,14,19         | U              | A,N(HP)                          | F**                            | Ra                          |
| T. simplex (Germar)4R $A(HP)$ $F^{**}$ RasyllidaeLivia vernalis (Fitch)13R $A(S)$ phididaeAcyrthosiphon pisum (Harris)14R $A$ or $N(S)$ Datymotus sp.27R $A(HP)$ LeHyalopterus pruni (Geoffroy)14R $A$ (HP)LeMomellia rigropunctata Granovsky9,13,20,23C $A(HP)$ F*LeMomellia sp.2R $A(HP)$ F*LeMyacoaliks sp.13R $A$ or $N(HP,S)$ LeMacotaphum maidis (Fitch)19R $A(HP)$ LeSchizaphis graminum (Rondani)14RA or $N(S)$ Lecantum corni Bouche14,19UA or $N(HP)$ F**BrCOLEOPTERA13RA or $N(HP)$ F**BrDravetas geminatus (DeGeer)14,25U $A(HP)$ LeMolanus depressus (Melsheimer)14,17R $A(S)$ LateridaeColeoptere13R $A(S)$ Drapetas geminatus (Say)13R $A(S)$ Agrilus arcuatus (Say)13R $A(S)$ Lietaridae13,14,17U $A(HP)$ F*LeDrapetas geminatus (Say)13R $A(S)$ A fallax Say   | Issidae                              |                       |                |                                  |                                |                             |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $  | Thionia bullata (Say)                | 16                    | R              | A(S)                             |                                |                             |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | T. simplex (Germar)                  | 4                     | R              | A(HP)                            | F**                            | Ra                          |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | cyllidae                             |                       |                |                                  |                                |                             |
| phididae       Agyrthosiphon pisum (Harris)       14       R       A or N(S)           Adyrthosiphon pisum (Harris)       14       R       A (HP)        Le         Bactynotus sp.       27       R       A(HP)        Le         Hyalopterus pruni (Geoffroy)       14       R       A(HP)        Le         Monellia rigropunctata Granovsky       9,15,20,23       C       A(HP)       F*       Le         Monellia sp.       2       R       A(HP)       F*       Le         Mazoallis sp.       13       R       A or N(HP)       F*       Le         Mazoallis sp.       13       R       A or N(S)        Le         Pemphigus sp.       13       R       A or N(S)        Le         Schizaphis graminum (Rondani)       14       R       A or N(S)           Schizaphis graminum (Rondani)       14       R       A or N(HP)       F**       Br       Tr.Tr.Tw         Pulvinaria innumerabilis (Rathvon)       14       R       A or N(HP)       F**       E        Le       A(HP)        Le         Malartidae   |                                      | 17                    | ъ              | 4(5)                             |                                |                             |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$  |                                      | 15                    | ĸ              | A(S)                             |                                |                             |
| Datymotics sp.       27       R       A(HP)        Le         Hyalopterus prani (Geoffroy)       14       R       A(HP)        Le         Momellia nigropunatata Granovsky       9,13,20,23       C       A(HP)       F*       Le         Momellias sp.       2       R       A(HP)       F*       Le         Mazacallis sp.       13       R       A,A or N(HP)       F*       Le         Nearctaphis bakeri (Cowan)       13       R       A,A or N(S)        Le         Pemphigus sp.       13       R       A or N(S)        Le         Schuaphis graminum (Rondani)       14       R       A or N(S)           Lecantium 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       13       R       A(S)        Le         Malareidae       13       R       A(S)           Dropetes geminatus Say       13       R       A(S)           Agrilua arcuatus (Say)  |                                      | 14                    | n              | A                                |                                |                             |
| HyaCopterus prani (Geoffroy)       14       R       A(HP)        Le         Monellia nigropunctata Granovsky       9,13,20,23       C       A(HP)       F*       Le         Monellia sigropunctata Granovsky       9,13,20,23       C       A(HP)       F*       Le         Musclissis cargage (Monell)       12,15,14,15       C       A or N(HP)       F*       Le         Mearctaphis bakeri (Cowan)       13       R       A,A or N(HP,S)        Le         Pemphigus sp.       13       R       A or N(S)        Le         Schizaphis graminum (Rondani)       14       R       A or N(S)           occidae       14,19       U       A or N(HP)       F**       Br, Tr, Tw         Pulvinaria innumerabilis (Rathvon)       14       R       A or N(HP)       F**       Br         COLEOPTERA       Iateridae       Coleoptrus       Coleoptrus       A or N(HP)       F**       Br         Iateridae       Coleoptrus       14,17       R       A(HP)        Le         Melanctus depressus (Melsheimer)       14,17       R       A(S)           Intrasidae       13       R   |                                      |                       |                |                                  |                                |                             |
| $\begin{array}{llllllllllllllllllllllllllllllllllll$  |                                      |                       |                |                                  |                                |                             |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $  | Monellia nigrorumatata (represelu    |                       |                |                                  |                                |                             |
| 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(HP, S)        Le         Schizaphis graminum (Rondani)       14       R       A or N(S)        Le         Schizaphis graminum (Rondani)       14       R       A or N(S)        Le         Schizaphis graminum (Rondani)       14       R       A or N(HP)       F**       Br, Tr, Tw         Pulvinaria innumerabilis (Rathvon)       14       R       A or N(HP)       F**       Br         COLEOPTERA       Iateridae       Concoderus lividus (DeGeer)       14,17       R       A(HP)        Le         Melanotus depressus (Melsheimer)       14,17       R       A(HP)       F*       Le       Iateridae         Drapetes geminatus Say       13       R       A(S)         Le         Agrilus arcuatus (Say)       13       R       A(S)            A. transimpressus Fall       13,14,17       U       A(HP)        Le       Iateridae       Iat   |                                      | 9,15,20,25            |                |                                  | -                              |                             |
| Mearctaphis bakeri (Cowan)13RA,A or N(HP,S)LePemphigus sp.13RA or N(S)Mhopalosiphum maidis (Fitch)19RA(HP)LeSchizaphis graminum (Rondani)14RA or N(S)lecanium corni Bouche14,19UA or N(HP)F**Br,Tr,TwPulvinaria innumerabilis (Rathvon)14RA or N(HP)F**Br,Tr,TwPulvinaria innumerabilis (Rathvon)14,17RA(HP)LeMelanotus depressus (Melsheimer)14,17RA(HP)F*LeDrapetes geminatus Say13RA(S)A. fallar Say14RA(HP)F*Letilodactylidae14RA(HP)LePtiodactyla angustata Horn2RA(HP)LeP. serricolis (Say)14RA(S)Saftree orbiculatus (Fabricius)1RA(HP)LeIdodidae12RA(S) </td <td>Muneritopsis cargae (Monerr)</td> <td>12,15,14,15</td> <td></td> <td></td> <td>-</td> <td></td>  | Muneritopsis cargae (Monerr)         | 12,15,14,15           |                |                                  | -                              |                             |
| Pemphigus sp.13RA or N(S)Rhopalosiphum maidis (Fitch)19RA (HP)LeSchlaghis graminum (Rondani)14RA or N(S)LeloccidaeLecanium corni Bouche14,19UA or N(HP)F**Br,Tr,TwPulvinaria innumerabilis (Rathvon)14RA or N(HP)F**Br,Tr,TwCOLEOPTERAIteridaeConderus lividus (DeGeer)14,25UA (HP)F**LeMalanotus depressus (Melsheimer)14,17RA (HP)F*LeIeMalanotus depressus (Melsheimer)14,17RA (S)Drapets geminatus Say13RA(S)A. failas Say13RA(S)A. failas Say13RA(S)A. failas Say13RA(S)A. failas Say13RA(S)A. failas Say13RA(S)A. failas Say13RA(HP)F*LeDicerca Lepida LeConte13RA(HP)LeP. serricollis (Say)14RA(HP)LeelodidaeLeColdaeLeSutribus objecture1RA(HP)LeP. se  |                                      |                       |                |                                  |                                |                             |
| Mhopalosiphum maidis (Fitch)       19       R       A (HP)        Le         Sohizaphis graminum (Rondani)       14       R       A or N(S)           Sociale       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, Tr, Tw         COLEOPTERA       Iateridae       Condenus lividus (DeGeer)       14,17       R       A (HP)        Le         Melanotus depressus (Melsheimer)       14,17       R       A (HP)       F*       Le         Intoscidae       Drapetes geminatus Say       13       R       A(S)           Agrilus arcuatus (Say)       13       R       A(S)            A. fallax Say       13       R       A(S) <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<>   |                                      |                       |                |                                  |                                |                             |
| Schizaphis graminum (Rondani)       14       R       A or N(S)           loccidae       Lecanium cormi Bouche       14,19       U       A or N(HP)       F**       Br,Tr,Tw         Pulvinaria innumerabilis (Rathvon)       14       R       A or N(HP)       F**       Br,Tr,Tw         COLEOPTERA       Iateridae       Conderus lividus (DeGeer)       14,25       U       A (HP)        Le         Melanotus depressus (Melsheimer)       14,17       R       A (HP)       F*       Le         Drapetes geminatus Say       13       R       A(S)           Agrilus arcuatus (Say)       13       R       A(S)           A. fallar Say       13       R       A(S)           A. fallar Say       13       R       A(S)           A. transimpressus Fall       13,14,17       U       A(HP)       F*       Le         tilodactylidae       13       R       A(S)           P. serficollis (Say)       14       R       A(HP)        Le         elodidae       12       R       A(HP) <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>  |                                      |                       |                |                                  |                                |                             |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $  |                                      |                       |                |                                  |                                |                             |
| Lecanium corni Bouche14,19UA or N(HP)F**Br, Tr, TwPulvinaria immumerabilis (Rathvon)14RA or N(HP)F**BrCOLEOPTERAlateridaeConderus lividus (DeGeer)14,25UA(HP)LeMelanotus depressus (Melsheimer)14,17RA(HP)F**DeDrapetes geminatus Say13RA(S)Agrilus arcuatus (Say)13RA(S)A. fallax Say13RA(S)A. fallax Say13RA(S)A. fallax Say13RA(HP)F*LeDicerca Lepida LeConte13RA(HP)F*LeLiodactylidae14RA(HP)LePtilodatyla angustata Horn2RA(HP)LeCyphon sp.12RA(S)Sairtes orbiculatus (Fabricius)1RA(HP)LeLanguri mozardi Latreille14RA(S)Stilbus sp.13RA(HP,S)LeLanguria pustani Latreille14RA(S)Stilbus sp.13RA(HP,S)LeIanguria e13RA(HP,S)Languria sp.13RA(HP,S)LeLa  |                                      | 14                    | к              | A or N(S)                        |                                |                             |
| Pulvinaria innumerabilis (Rathvon)       14       R       A or N(HP)       F**       Br         COLEOPTERA         Blateridae         COLEOPTERA         Blateridae         COLEOPTERA         Blateridae         COLEOPTERA         Blataridae         Coleoptication (DeGeer)       14,25       U       A(HP)        Le         Melanotus depressus (Melsheimer)       14,17       R       A(HP)       F*       Le         Drapetes geminatus Say       13       R       A(S)           A fallar sequentus (Say)       13       R       A(S)           A. fallar Say       13       R       A(S)            A. fallar Say       13       R       A(S)            A. fallar Say       13       R       A(HP)       F*       Le       Le       te       te <td></td> <td>14 10</td> <td></td> <td>A N((10))</td> <td><b>F++</b></td> <td>D (T (T)</td>   |                                      | 14 10                 |                | A N((10))                        | <b>F++</b>                     | D (T (T)                    |
| COLEOPTERAlateridaeConderus lividus (DeGeer)14,25U $A(HP)$ LeMelanchus depressus (Melsheimer)14,17R $A(HP)$ F*LehroscidaeDrapetes geminatus Say13R $A(S)$ Agrilus arcuatus (Say)13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. transimpressus Fall13,14,17U $A(HP)$ F*LeDiaerca Lepida LeConte13R $A(HP)$ F*LeDiaerca Lepida LeConte14R $A(HP)$ LePtilodactylidae14R $A(HP)$ LePdildae14R $A(S)$ Cyphon sp.12R $A(S)$ Satrtes orbiculatus (Fabricius)1R $A(HP)$ Leanguriidae14R $A(S)$ Languria mozardi Latreille14R $A(S)$ halacridae13R $A(HP,S)$ Leedilidae13R $A(S)$ filourus sp.13R $A(S)$ reduitidae13R $A(S)$   |                                      |                       |                |                                  |                                |                             |
| lateridaeConoderus lividus (DeGeer)14,25U $A(HP)$ LeMelanotus depressus (Melsheimer)14,17R $A(HP)$ $F^*$ LehroscidaeDrapetes geminatus Say13R $A(S)$ uprestidae13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. transimpressus Fall13,14,17U $A(HP)$ $F^*$ LeDicerca Lepida LeConte13R $A(HP)$ $F^*$ Letilodactylidae14R $A(HP)$ Leelodidae14R $A(S)$ Scirtes orbiculatus (Fabricius)1R $A(HP)$ Leanguriidae14R $A(S)$ Phalacrus sp.13R $A(HP,S)$ LeStilbus sp.13R $A(S)$ edilidae13R $A(S)$   | Full thirth that erabilits (Rathvon) | 14                    | к              | A OF N(HP)                       | r · ·                          | BL                          |
| lateridaeConoderus lividus (DeGeer)14,25U $A(HP)$ LeMelanotus depressus (Melsheimer)14,17R $A(HP)$ $F^*$ LehroscidaeDrapetes geminatus Say13R $A(S)$ uprestidae13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. transimpressus Fall13,14,17U $A(HP)$ $F^*$ LeDicerca Lepida LeConte13R $A(HP)$ $F^*$ Letilodactylidae14R $A(HP)$ LePtilodastyla angustata Horn2R $A(HP)$ Leelodidae14R $A(S)$ Cyphon sp.12R $A(S)$ Sairtes orbiculatus (Fabricius)1R $A(HP)$ Leanguriidae14R $A(S)$ Halacridae13R $A(HP,S)$ LeStilbus sp.13R $A(S)$ Leedilidae13R $A(S)$ edilidae13R $A(S)$ elodidae1R $A(S)$ el   | COLEOPTERA                           |                       |                |                                  |                                |                             |
| $\begin{array}{cccc} Conoderus lividus (DeGeer) & 14,25 & U & A(HP) & & Le \\ Melanotus depressus (Melsheimer) & 14,17 & R & A(HP) & F* & Le \\ hroscidae & & & & & \\ Drapetes geminatus Say & 13 & R & A(S) & & \\ Agrilus arcuatus (Say) & 13 & R & A(S) & & \\ A. fallax Say & 13 & R & A(S) & & \\ A. fallax Say & 13 & R & A(S) & & \\ A. fallax Say & 13 & R & A(S) & & \\ Le Dicerca Lepida LeConte & 13 & R & A(HP) & F* & Le \\ tilodactylidae & & & & \\ Ptilodactyla angustata Horn & 2 & R & A(HP) & & Le \\ Ptilodatyla (Say) & 14 & R & A(HP) & & Le \\ elodidae & & & & \\ Cyphon sp. & 12 & R & A(S) & & \\ Sairtes orbiculatus (Fabricius) & 1 & R & A(HP) & & Le \\ Languria mozardi Latreille & 14 & R & A(S) & & \\ Phalacrus sp. & 13 & R & A(HP,S) & & Le \\ Stilbus sp. & 13 & R & A(S) & & \\ Le \\ elilidae & & & & \\ \end{array}$   | COLOT TENT                           |                       |                |                                  |                                |                             |
| $\begin{array}{cccc} Conoderus lividus (DeGeer) & 14,25 & U & A(HP) & & Le \\ Melanotus depressus (Melsheimer) & 14,17 & R & A(HP) & F* & Le \\ hroscidae \\ Drapetes geminatus Say & 13 & R & A(S) & & \\ uprestidae & & & & & & & & & & & & & & & & & & &$  | lateridae                            |                       |                |                                  |                                |                             |
| Melanotus depressus (Melsheimer)14,17R $A(HP)$ $F^*$ Lehroscidaehroscidaenorscidae $A(HP)$ $F^*$ LeDrapetes geminatus Say13R $A(S)$ agrilus arcuatus (Say)13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. fallax Say13R $A(S)$ A. transimpressus Fall13,14,17U $A(HP)$ $F^*$ LeDiserca Lepida LeConte13R $A(HP)$ $F^*$ Letilodactylidae14R $A(HP)$ LePrisocollis (Say)14R $A(HP)$ Leelodidae12R $A(S)$ Cyphon sp.12R $A(HP)$ Leanguriidae1R $A(HP)$ Leanguriidae14R $A(S)$ Phalacrus sp.13R $A(HP,S)$ LeStilbus sp.13R $A(S)$ edilidae13R $A(S)$  |                                      | 14.25                 | 11             | A (HP)                           |                                | Le                          |
|   |                                      |                       |                |                                  | F*                             | Le                          |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |                                      | ,                     |                |                                  |                                |                             |
| uprestidae         Agrilus arcuatus (Say)       13       R       A(S)          A. fallax Say       13       R       A(S)           A. fallax Say       13       R       A(S)           A. fallax Say       13       R       A(S)           A. fallax Say       13       R       A(S)           A. fallax Say       13       R       A(HP)       F*       Le         Dicerca Lepida LeConte       13       R       A(HP)       F*       Le         tilodactylidae       Ptilodastyla argustata Horn       2       R       A(HP)        Le         P. serticollis (Say)       14       R       A(HP)        Le         elodidae         Le        Le         Solvites orbiculatus (Fabricius)       1       R       A(HP)        Le         anguriidae       1       R       A(S)           Halacridae        13       R       A(HP,S)        Le         Stilbus sp.       13       R   |                                      | 13                    | R              | A(S)                             |                                |                             |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |                                      | 10                    |                | 11(0)                            |                                |                             |
| A. fallax Say13R $A(S)$ A. transimpressus Fall13,14,17U $A(HP)$ $F^*$ LeDicerca lepida LeConte13R $A(HP)$ $F^*$ Letilodactylidae13R $A(HP)$ $F^*$ LePtilodactyla angustata Horn2R $A(HP)$ $$ LeP. serricallis (Say)14R $A(HP)$ $$ Leelodidae2R $A(HP)$ $$ Le $Cyphon sp.$ 12R $A(S)$ $$ $$ Satztes orbiculatus (Fabricius)1R $A(HP)$ $$ Leanguria mozardi Latreille14R $A(S)$ $$ $$ halacridae13R $A(HP,S)$ $$ Lestilbus sp.13R $A(S)$ $$ $$ collidae13R $A(S)$ $$ $$   |                                      | 13                    | R              | A(S)                             |                                |                             |
| A. transimpressus Fall13,14,17U $A(HP)$ $F^*$ LeDicerca Lepida LeConte13R $A(HP)$ $F^*$ Letilodactylidae13R $A(HP)$ $F^*$ LePtilodactyla angustata Horn2R $A(HP)$ LeP. serricollis (Say)14R $A(HP)$ LeelodidaeCyphon sp.12R $A(S)$ Leanguridae1R $A(HP)$ LeLanguria mozardi Latreille14R $A(S)$ halacridae13R $A(HP,S)$ LeStilbus sp.13R $A(S)$ edilidaeLe  |                                      |                       |                |                                  |                                |                             |
| DiagramLetterLetterDiagramLeConte13RA(HP)F*Le13RA(HP)FilodactylidaePtilodactyla angustata Horn2RA(HP)P. serricollis (Say)14RA(HP)LeLodidae2RA(HP)LeScirtes orbiculatus (Fabricius)1RA(HP)Leanguridae1RA(HP)LeLanguria mozardi Latreille14RA(S)halacridaeFhalacrus sp.13RA(HP,S)LeStilbus sp.13RA(S)Le   |                                      |                       |                |                                  | F*                             | Le                          |
| tilodactylidae<br>Ptilodactylidae<br>Ptilodactyla angustata Horn 2 R A(HP) Le<br>P. serricollis (Say) 14 R A(HP) Le<br>elodidae<br>Cyphon sp. 12 R A(S)<br>Seirtes orbiaulatus (Fabricius) 1 R A(HP) Le<br>angurildae<br>Languria mozardi Latreille 14 R A(S)<br>halacridae<br>Phalacrus sp. 13 R A(HP,S) Le<br>Stilbus sp. 13 R A(S)   |                                      |                       |                |                                  | -<br>F*                        | Le                          |
| Ptilodavtyla angustata Horn2RA(HP)LeP. serricallis (Say)14RA(HP)Leelodidae12RA(HP)LeCyphon sp.12RA(S)Scirtes orbiculatus (Fabricius)1RA(HP)Leanguriidae1RA(HP)LeLanguria mozardi Latreille14RA(S)halacridae13RA(HP,S)LeStilbus sp.13RA(S)   |                                      | 10                    | ~              | n(in )                           | •                              | 10                          |
| P. serricollis (Say)       14       R       A(HP)        Le         elodidae       Cyphon sp.       12       R       A(S)        Le         Scirtes orbiculatus (Fabricius)       1       R       A(HP)        Le         anguridae       Larguria mozardi Latreille       14       R       A(S)        Le         halacridae       Phalacrus sp.       13       R       A(HP,S)        Le         stilbus sp.       13       R       A(S)  |                                      | 2                     | R              | A (HP)                           |                                | Le                          |
| elodidae<br>Cyphon sp. 12 R A(S)<br>Seirtes orbiculatus (Fabricius) 1 R A(HP) Le<br>angurila<br>Languria mozardi Latreille 14 R A(S)<br>halacridae<br>Phalacrus sp. 13 R A(HP,S) Le<br>Stilbus sp. 13 R A(S)  |                                      |                       |                |                                  |                                |                             |
| Cyphon sp.12RA(S)Scirtes orbiculatus (Fabricius)1RA(HP)Leanguriidae14RA(S)Languria mozardi Latreille14RA(S)halacridae13RA(HP,S)LeStilbus sp.13RA(S)edilidae   |                                      | * *                   |                |                                  |                                | 20                          |
| Scirtes orbiculatus (Fabricius)       1       R       A(HP)        Le         angurida       Larguria       mozardi       Latreille       14       R       A(S)           Larguria       mozardi       Latreille       14       R       A(S)        Le         halacridae       Phalacrus sp.       13       R       A(HP,S)        Le         Stilbus sp.       13       R       A(S)           edilidae   |                                      | 12                    | R              | A(S)                             |                                |                             |
| angurildae<br>Languria mozardi Latreille 14 R A(S)<br>halacridae<br>Phalacrus sp. 13 R A(HP,S) Le<br>Stilbus sp. 13 R A(S)<br>edilidae  |                                      |                       |                |                                  |                                | Le                          |
| Languria mozardi Latreille     14     R     A(S)         halacridae     Phalacrus sp.     13     R     A(HP,S)      Le       Stilbus sp.     13     R     A(S)       Le       edilidae     13     R     A(S)  |                                      | 1                     | N.             |                                  | -                              | 10                          |
| halacridae<br>Phalacrus sp. 13 R A(HP,S) Le<br>Stilbus sp. 13 R A(S)<br>edilidae  |                                      | 14                    | p              | A(S)                             |                                |                             |
| Phalacrus         sp.         13         R         A(HP,S)          Le           Stilbus         sp.         13         R         A(S)           edilidae   |                                      | ±.+                   | N              | A(0)                             | -                              |                             |
| Stilbus sp. 13 R A(S)<br>edilidae   |                                      | 17                    | D              | A(HP C)                          |                                | 10                          |
| edilidae  |                                      |                       |                |                                  |                                |                             |
|   |                                      | 13                    | r              | N(D)                             |                                |                             |
|   | dilidao                              |                       |                |                                  |                                |                             |

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| Taxon  | Plantation<br>numbers  | Rel.<br>freq.ª | Stages<br>collected <sup>b</sup> | Feeding<br>record <sup>c</sup> | Assoc.<br>plant<br>partsd,e |
|--|------------------------|----------------|----------------------------------|--------------------------------|-----------------------------|
| Mycetophagidae   |                        |                |                                  |                                |                             |
| Litargus quadrispilotus LeConte                                      | 12                     | R              | A(S)                             |                                |                             |
| Meloidae   | 17                     | R              | A(C)                             |                                |                             |
| <i>Epicauta cinerea</i> (Forster)<br>Mordellidae                     | 13                     | к              | A(S)                             |                                |                             |
| 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)                                |                        | R              | A(S)                             | F*                             | Le                          |
| Valgus squamiger (Beauvois)  | 13                     | R              | A(HP)                            | F*                             | Le                          |
| Cerambycidae   | 14                     |                |                                  |                                |                             |
| Lepturges sp. near querci Fitch                                      | 14<br>14               | R<br>R         | L(HP)                            | F**<br>F**                     | UBa                         |
| L. sp. near symmetricus (Haldeman)<br>Megacyllene robiniae (Forster) | 14                     | R              | L(HP)                            | F*                             | UBa<br>Le                   |
| Tetraopes tetrophthalmus (Forster)                                   | 13                     | R              | A(S)<br>A(HP,S)                  | F*                             | Le                          |
| Chrysomelidae  | 15                     | ĸ              | A(Hr,3)                          | P.                             | re                          |
| 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<br>C. quadruplex Newman               | 13                     | R<br>U         | A(S)                             | <br>F*                         | 1 -                         |
| Diabrotica undecimpunctata   | 13,14,17<br>9,12,13,14 | C              | A(HP)<br>A(HP)                   | F**                            | Le<br>Le                    |
| howardi Barber   | 5,12,15,14             | C              | A(nr)                            | г                              | Ге                          |
| 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       | С              | 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  | 12                     | D              | 1(5)                             |                                |                             |
| Althaeus sp.   | 12                     | R              | A(S)                             |                                |                             |
| Curculionidae  | 12                     | R              | A (HD)                           |                                | Le                          |
| Anthonomus sp.<br>Apion sp.  | 12                     | R              | A(HP)<br>A(S)                    |                                | Le                          |
| Conotrachelus elegans (Say)  | 2                      | R              | A(HP)                            |                                | Le                          |
|  | ,9,12,13,14,16,        | ŶC             | A(HP,S)                          | F*                             | Le                          |
| (Roelofs)  | 24,25,26,27            |                |                                  | -                              | 2-                          |
| Eugnamptus sp. near  | 14,17                  | R              | A(S)                             |                                |                             |
| collaris (Fabricius)   | -                      |                | • •                              |                                |                             |
| 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   |                        | P              |                                  |                                | 1.                          |
| Danaus plexippus (Linnaeus)  | 13                     | R              | L(HP)                            |                                | Le                          |

|   |                     |                |                                  | -                              |                             |
|---|---------------------|----------------|----------------------------------|--------------------------------|-----------------------------|
| Taxon   | Plantation<br>      | Rel.<br>freq.ª | Stages<br>collected <sup>b</sup> | Feeding<br>record <sup>c</sup> | Assoc.<br>plant<br>partsd,e |
| Lycaenidae<br>Satyrium calanus (Hübner)                                       | 12,13,14            | С              | A,L(HP,S)                        | F*                             | Le                          |
| Sphingidae<br>Cressonia juglandis (J.E.Smith)                                 | 13                  | R              | L(HP)                            |                                | Le                          |
| Saturniidae<br>Actias luna (Linnaeus)<br>Antheraea polyphemus (Cramer)        | 14,15<br>14         | R<br>R         | L,E(HP)<br>L(HP)                 | F*<br>F*                       | Le<br>Le                    |
| Citheronia regalis (Fabricius)  | 15                  | R              | L(HP)                            | F*                             | Le                          |
| Ctenuchidae<br>Cisseps fulvicollis (Hübner)                                   | 9,12,13             | U              | A(HP)                            |                                | Le                          |
| Arctiidae<br>Diacrisia virginica (Fabricius)<br>Ecpantheria scribonia (Stoll) | 25<br>14            | R<br>R         | L(HP)<br>L(HP)                   | F*<br>F*                       | Le<br>Le                    |
| Halisidota tessellaris (J.E.Smith   |                     | R              | L(HP,S)                          | F*                             | Le                          |
| Haploa colona fulvicosta (Clemens   |                     | R              | L(S)                             | F*                             | Le                          |
| Hyphantria cunea (Drury)<br>Noctuidae   | 1,10,12,13,14       | ŶC             | L(HP)                            | F**                            | Le                          |
| 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<br>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<br>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 | С              | L(HP)                            | F**                            | Le                          |
| Orthosia hibisci (Guenée)   | 14                  | U              | L(HP)                            |                                | Le                          |
| Peridroma saucia (Hübner)   | 14                  | U              | L(S)                             |                                |                             |
| <i>Spragueia leo</i> (Guenée)<br>Notodontidae                                 | 13                  | R              | A(S)                             |                                |                             |
| 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                          |
| <i>S. leptiniodes</i> (Grote)<br>Lymantriidae                                 | 5,12,13,14          | U              | L(HP)                            | F*                             | Le                          |
| Dasychira sp. near<br>basiflava (Packard)                                     | 14                  | R              | L(HP)                            | F*                             | Le                          |
| <i>Orgyia leucostigma</i> (J.E.Smith)<br>Lasiocampidae                        | 12,20               | R              | L(HP)                            | F*                             | Le                          |
| Malacosoma americanum (Fabricius)<br>Geometridae                              | 14                  | R              | L(S)                             |                                | ~                           |
| 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*<br>F*                       | Le                          |
| Hypagyrtis esther (Barnes)  | 13,14,20            | U              | L(HP)                            | Р*<br>F*                       | Le                          |
| H. unipunctata (Haworth)  | 12,22               | R              | L(HP)                            | F*                             | Le                          |
| Lambdina fervidaria (Hubner)  | 17                  | R              | L(S)                             | F*                             | Le                          |
| Melanolophia canadaria (Guenée)   | 14                  | R<br>R         | L(S)                             | F*                             | Le<br>Le                    |
| M. signataria (Walker)<br>Synchlora aerata (Fabricius)                        | 13,17<br>12,13      | R              | L(S)<br>A(S)                     | г                              | Le                          |
| Limacodidae   |                     |                |                                  |                                |                             |
| Prolimacodes scapha Harris<br>Sib.e stimulea (Clemens)                        | 12<br>16            | R<br>R         | L(HP)<br>L(HP)                   | F*<br>F**                      | Le<br>Le                    |
| Zygaenidae<br>Acoloithus falsarius Clemens                                    | 13,25               | R              | A(HP,S)                          |                                | Le                          |
| Pyralidae<br>Acrobasis demotella Grote  | 12 or 13,13         | U              | L(HP)                            | F**                            | IBu,ISt                     |
| A. juglandis (LeBaron)  | 12 or 13,13,14      | U              | L(HP)                            | г`**                           | IRa,Le                      |
| A. latifasciella Dyar   | 12 01 13,13,14      | U              | L(HP,S)                          | F**                            | IBu,ISt                     |
| Argyria nivalis (Drury)   | 14                  | R              | A(S)                             |                                |                             |
| Crambus elegans Clemens   | 12                  | U              | A(S)                             |                                |                             |
| C. sp. near teterellus Zincken  | 14                  | R              | A(S)                             |                                |                             |
| Tetralopha asperatella Clemens  | 14                  | R              | L(HP)                            | F*                             | Le                          |
|   |                     |                |                                  |                                |                             |

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### Table 2. continued.

| Taxon   | Plantation<br>numbers | Rel.<br>freq.ª | Stages<br>collected <sup>b</sup> | Feeding<br>record <sup>c</sup> | Assoc.<br>plant<br>partsd,e |
|---|-----------------------|----------------|----------------------------------|--------------------------------|-----------------------------|
| T. nephelotella Hulst                               | 14                    | R              | L(HP)                            | F*                             | Le                          |
| T. subcanalis (Walker)                              | 14                    | R              | L(HP)                            | г<br>F*                        | Le                          |
| Udea rubigalis (Guenée)                             | 14                    | R              |                                  | -                              |                             |
| Olethreutidae                                       | 14                    | ĸ              | A(S)                             |                                |                             |
| Episimus argutanus (Clemens) (?)                    | 13                    | R              |                                  |                                | Le                          |
|   | 13                    | R              | A(HP)                            |                                | Le                          |
| Grapholitha eclipsana Zeller                        |                       |                | 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,         | VC             | A,L(HP,S)                        | F**                            | Le                          |
|   | 17,22,23,27           | _              |                                  |                                | _                           |
| Gwendolina concitatricana<br>Heinrich               | 3 or 23               | R              | L(HP)                            | F*                             | Le                          |
| Laspeyresia sp. near                                | 13                    | R              | A(HP)                            |                                | Le                          |
| <i>caryana</i> Fitch<br>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        | Ŭ              | L(HP)                            | É.                             | 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)<br>Stenomidae                  | 13,14,18              | U              | L(HP,S)                          | F*                             | Le                          |
| Antaeotricha leucillana (Zeller)<br>Coleophoridae   | 13                    | R              | A(5)                             |                                |                             |
| Coleophora caryaefoliella Clemens<br>Gracillariidae | 18                    | R              | L(HP)                            |                                | Le                          |
| Gracillaria blandella Clemens 1.                    | 5,9,12,13,14,24,26    | С              | A,L(HP)                          | F**                            | Le                          |
| Phyllonorycter juglandiella<br>(Chambers)           | 3,4,23                | U              | L(HP)                            | F**                            | Le                          |
| Psychidae   |                       |                |                                  |                                |                             |
| Thyridopteryx ephemeraeformis<br>(Haworth)          | 13,14                 | R              | L (HP)                           | F.                             | Le                          |
| DIPTERA   |                       |                |                                  |                                |                             |
| Cecidomyiidae                                       |                       |                |                                  |                                |                             |
| Clinodiplosis sp.                                   | 2,22                  | С              | L(HP)                            |                                | Le                          |
| HYMENOPTERA   |                       |                |                                  |                                |                             |
| Xyelidae  |                       | _              |                                  |                                | _                           |
| Megaxyela sp.                                       | 6 & 12 or 13          | R              | L(HP)                            |                                | Le                          |
| Tenthredinidae                                      | • •                   | -              |                                  |                                |                             |
| Caulocampus acericaulis<br>(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(5)                             |                                |                             |
|   |                       |                |                                  |                                |                             |

 $^{a}C$  = 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 = 

<sup>C</sup>F\* = laboratory feeding record, F\*\* = field feeding record. <sup>d</sup>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. <sup>e</sup>Ba = bark, Br = branch, IBu = in bud, IRa = in rachis, ISt = in stem, Le = leaflet, Ra = rachis, Tr = trunk, Tw = twig, UBa = under bark.

|                                       |                   | 1) or Parasite (Laboratory)                | <b>C</b>                     |
|---------------------------------------|-------------------|--|------------------------------|
| <u>Black Walnut Insects</u>           | Family            | Species                                    | Comments                     |
| Lygaeidae                             |                   |  |                              |
| Lygaeus kalmii Stal                   | Tachinidae        | Leucostoma gravipes Wulp                   | Emerged from adult           |
| Pentatomidae                          |                   |  |                              |
| Euschistus servus (Say)               | Scelionidae       | Trissol <i>c</i> us euschisti<br>(Ashmead) | Emerged from eggs            |
| Cicadellidae                          |                   |  |                              |
| Agallia constricta Van Duzee          | Asilid <b>a</b> e | Cerotainia macrocera<br>(Say)              | Feeding on adult<br>in field |
| Chrysomelidae                         |                   |  |                              |
| Anomoea flavokansiensis<br>Moldenke   | Pentatomidae      | Podisus maculiventris<br>(Say)             | Feeding on adult<br>in field |
| Arctiidae                             |                   |  |                              |
| Halisidota tessellaris<br>(J.E.Smith) | Ichneumonidae     | Parania g. geniculata<br>(Holmgren)        | Emerged from pupa            |
| Noctuidae                             |                   |  |                              |
| Morrisonia confusa (Hübner)           | Braconidae        | Apanteles hyphantriae<br>Riley             | Emerged from larva           |
| Notodontidae                          |                   |  |                              |
| Datana integerrima                    | Scelionidae       | Telenomus ichthyurae                       | Emerged from pupa            |
| Grote & Robinson                      |                   | Ashmead                                    |                              |
|                                       | Ichneumonidae     | Barylypa sp.                               | Emerged from pupa            |
|                                       | Ichneumonidae     | Tanypelma datanae<br>(Riley)               | Emerged from pupa            |

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

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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