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Insects Associated with Apple in the Mid-Atlantic States¹

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ABSTRACT

The insect fauna of managed, abandoned, and "organic" apple orchards in Virginia, West Virginia, Pennsylvania, and New York were sampled during 1983 and 1984. A total of 191 species of phytophagous insects were identified from 164 genera, 58 families, and 9 orders. Species of Lepidoptera (43%) and Homoptera (32%) were most numerous. Managed orchards, compared with abandoned orchards, had fewer phytophagous species but a greater proportion were pests. Non-phytophagous insects from thirteen orders also were identified.

INTRODUCTION

Apple (*Malus x domestica* Borkh.), although native to southern Eurasia, is grown commercially in temperate regions throughout the world. In North America, apple has become naturalized, acquiring a large and diverse insect fauna. Most of these insects are native to North America and have adapted to apple with varying degrees of usage, from a primary dependence on it for food and shelter to occasional feeding. However, many species, including some of the most serious pests, have been introduced from other regions of the world.

The evolving nature of orchard management requires a broad knowledge of regional arthropod populations on apple. Changes in management practices can create conditions favoring population growth of previously innocuous species (Brown 1984). Reservoirs for such potential pests exist outside managed orchards, as naturalized, ornamental, and abandoned apple trees or as other related native and introduced plants. An

awareness of real and potential pest species on apple throughout a region is needed to form the basis for a comprehensive pest management system.

Extensive research has been conducted on economic pests and their natural enemies in North American apple orchards. Fewer studies have investigated the total arthropod fauna of apple over a broad region. Surveys of pests and beneficial arthropods have been conducted in Canada (Macnay and Creelman 1958, LeRoux 1960, Lord 1972, Hagley 1974, MacLellan 1977, Madsen and Madsen 1982) and in the United States (Slingerland and Crosby 1914, Frost 1951, Cleveland and Hamilton 1958, Oatman et al. 1964, Horsburgh and Asquith 1968). Surveys limited to specific taxa have also been conducted (Clancy and McAlister 1958, Specht and Dondale 1960, Legner and Oatman 1962, Chapman and Lienk 1971, McCaffrey and Horsburgh 1980, Strickler and Whalon 1985).

The purpose of this report is to provide a record of insects associated with apple in four mid-Atlantic states, as of 1983-1984.

MATERIALS AND METHODS

Our survey was conducted from April to September, 1983 - 1984, in Virginia, West Virginia, Pennsylvania, and New York. Two managed orchards and one abandoned orchard were sampled in each of three states each year. Orchards under minimal management, called "organic" by the growers, also were sampled in West Virginia (1983-1984), eastern New York (1983), and Pennsylvania (1984). In every orchard we sampled five to seven trees selected randomly at each visit except in the Pennsylvania "organic", which because of the small size of the trees, ten were sampled. Orchard

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locations, ages, cultivars, and sampling dates are listed in Table 1. Sampling consisted of close examination of nine branch sections distributed throughout the tree (Table 2); in the Pennsylvania "organic" only two branches per tree were sampled. Branch sections were subjectively defined, based on a generalized tree structure (Fig. 1). Ladders were used to sample the middle and uppermost portions of the trees.

For each branch section we recorded the presence of all species of phytophagous insects, and some non-phytophagous species, feeding on, resting on, or in some other way utilizing apple as a resource. Branches were approached cautiously to observe highly mobile individuals before a more intensive examination was made. Specimens that could not be identified in the field were collected and preserved or reared to the adult in the laboratory for later determination. Species determinations or confirmations were done by personnel at the USDA-ARS Systematic Entomology Laboratory, Beltsville, Maryland, and their cooperators. Specimens are kept in a collection at the Appalachian Fruit Research Station, Kearneysville, WV.

RESULTS AND DISCUSSION

Phytophagous insect species encountered on apple in this study are listed by year, region, and type of orchard management in Tables 3-8. Insects from 191 species, 164 genera, 58 families and 9 orders were identified from apple in the mid-Atlantic states (Table 9). Lepidoptera (83 species) and Homoptera (61 species) comprised 75% of these phytophagous species. Cicadellidae (28 species) and Tortricidae (27 species) were the most represented families.

A summary of phytophagous insect taxa by region and orchard type is given in Table 10. Differences in number of species among regions is a result of variable sampling frequency (see Table 1). Within a region, more species (and higher taxa) were found in abandoned than managed orchards. "Organic" orchards were intermediate in most cases. Managed orchards had a greater ratio of pest to non-pest species than the abandoned orchard within a region (Figure 2); a species was considered a pest if it was listed in either Davidson and Lyon (1979) or Brunner and Howitt (1981) as being a pest of apple. Orchard management, therefore, reduced the number of species present and also resulted in an insect community dominated by pest species.

Comparisons among faunistic studies are tenuous at best. Differences in sampling methods, sampling intensity and frequency, and size of the region studied all affect the number and type of species found. In general, the number and taxonomic distribution of phytophagous species are

similar to other faunistic studies of apple in North America (Cleveland and Hamilton 1958, Macnay and Creelman 1958, Oatman et al. 1964, Lord 1972).

Thirteen orders of parasitic, predatory, scavenger, and transient insects were recorded (Table 11). Parasitic Hymenoptera (the most abundant order found by Cleveland and Hamilton (1958) and Oatman et al. (1964)) are especially under-represented. Our list is based on incidental observations and represents only a fraction of the non-phytophagous insects present.

This publication provides a record of the insect community on apple in the mid-Atlantic states during 1983-1984. In conjunction with the other faunistic studies cited, our list provides a reference to compare with future studies in examining the effects of changes in orchard management and the environment on the insect community. Particular attention should be given to non-pest species found in managed orchards; these species could become pests in the future.

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Table 1. Orchard descriptions, locations, and sample dates, 1983-1984.

Orchard Type	Location ¹	Approximate Age (yrs)	Cultivars	Date
1983				
WEST VIRGINIA				
Abandoned	*Shenandoah Jct., Jefferson Co.	30-40	Bisbee Red Delicious	18 April, 12 May, 15 June, 6 & 27 July, 24 Aug., 27 Sept.
"Organic"	*near Unger, Morgan Co.	15-20	York, Gold. Delicious	20 April, 14 May, 14 June, 1 & 28 July, 25 Aug.
Commercial	Shenandoah Jct., Jefferson Co.	20-25	York, Red Delicious	21 April, 10 May, 10 & Golden Delicious June, 7 & 29 July, 22 Aug.
	*Bardane, Jefferson Co.	10-15	Golden Delicious	12 April, 10 May, 10 & 30 June, 2 & 22 Aug.
VIRGINIA				
Abandoned	Greenville, Augusta Co.	30-40	Unk.	6 April, 17 May, 13 July, 7 Sept.
Commercial	Massie Mill, Nelson Co.	10-15	Rome	5 April, 18 May, 12 July, 6 Sept.
	Massie Mill, Nelson Co.	10-15	Red Delicious	18 May, 12 July, 6 Sept.
NEW YORK				
Abandoned	near Walkill, Ulster Co.	30-40	Unk.	27 April, 1 June, 9 Aug.
"Organic"	Ulster Park, Ulster Co.	20-25	Unk.	27 April, 2 June, 10 Aug.
Commercial	Milton, Ulster Co.	10-15	McIntosh, Golden & Red Delicious	26 April, 1 June, 9 Aug.
	Milton, Ulster Co.	15-20	McIntosh, Golden & Red Delicious	26 April, 1 June, 9 Aug.
1984				
WEST VIRGINIA				
Abandoned	*Shenandoah Jct., Jefferson Co.	30-40	Bisbee Red Delicious	26 April, 17 May, 20 June, 19 July, 8 Aug., 12 Sept.
"Organic"	*near Unger, Morgan Co.	15-20	York, Golden Delicious	2 & 22 May, 21 June, 20 July, 13 Aug., 11 Sept.
Commercial	*Bardane, Jefferson Co.	10-15	Golden Delicious	25 April, 16 May, 22 June, 18 July, 9 Aug., 5 Sept.
	Kearneysville, Jefferson Co.	13, 25-30	Stayman, Rome, York Delicious	27 April, 16 May, 15 June, Golden & Red 20 July, 9 Aug., 6 Sept.
PENNSYLVANIA				
Abandoned	Orfield, Letch Co.	30-40	Unk.	31 May, 10 July, 17 Aug.
"Organic"	Maxatawny, Berks Co.	4	Rome, McIntosh, Liberty, Gold. Delicious	1 June, 9 July, 15 Aug.
Commercial	Orfield, Letch Co.	10-15	Rome	31 May, 9 July, 16 Aug.
	Orfield, Letch Co.	15-20	Rome	1 June, 9 July, 16 Aug.
NEW YORK				
Abandoned	Sodus, Wayne Co.	30-40	Baldwin, Cortland	13 June, 24 July, 28 Aug.
Commercial	Sodus, Wayne Co.	20-25	Rome, R.I. Greening	12 June, 24 July, 28 Aug.
	Sodus, Wayne Co.	10-15	Ida Red, Mutzu, Monroe, Gold. Delicious	12 June, 24 July, 29 Aug.

¹ Indicates same orchard sampled in both years.² Unk. = cultivars not known.

Table 2. Subjective determination of branch samples for surveying insects on each apple tree (see Figure 1).

Branch section	No. examined	Delimitation
center	1	scaffold limb from trunk to first major fork
mid-section	2	scaffold limb from first fork to where limb branches out and foliage becomes dense
terminal	4	from the end of the mid-section to the outside, including side branches
sprouts	2 ¹	root suckers or water sprouts arising from trunks, centers, or mid-sections not previously sampled
9		

¹Some trees in abandoned orchards had few sprouts, in which case only 7 - 8 branch sections were sampled.

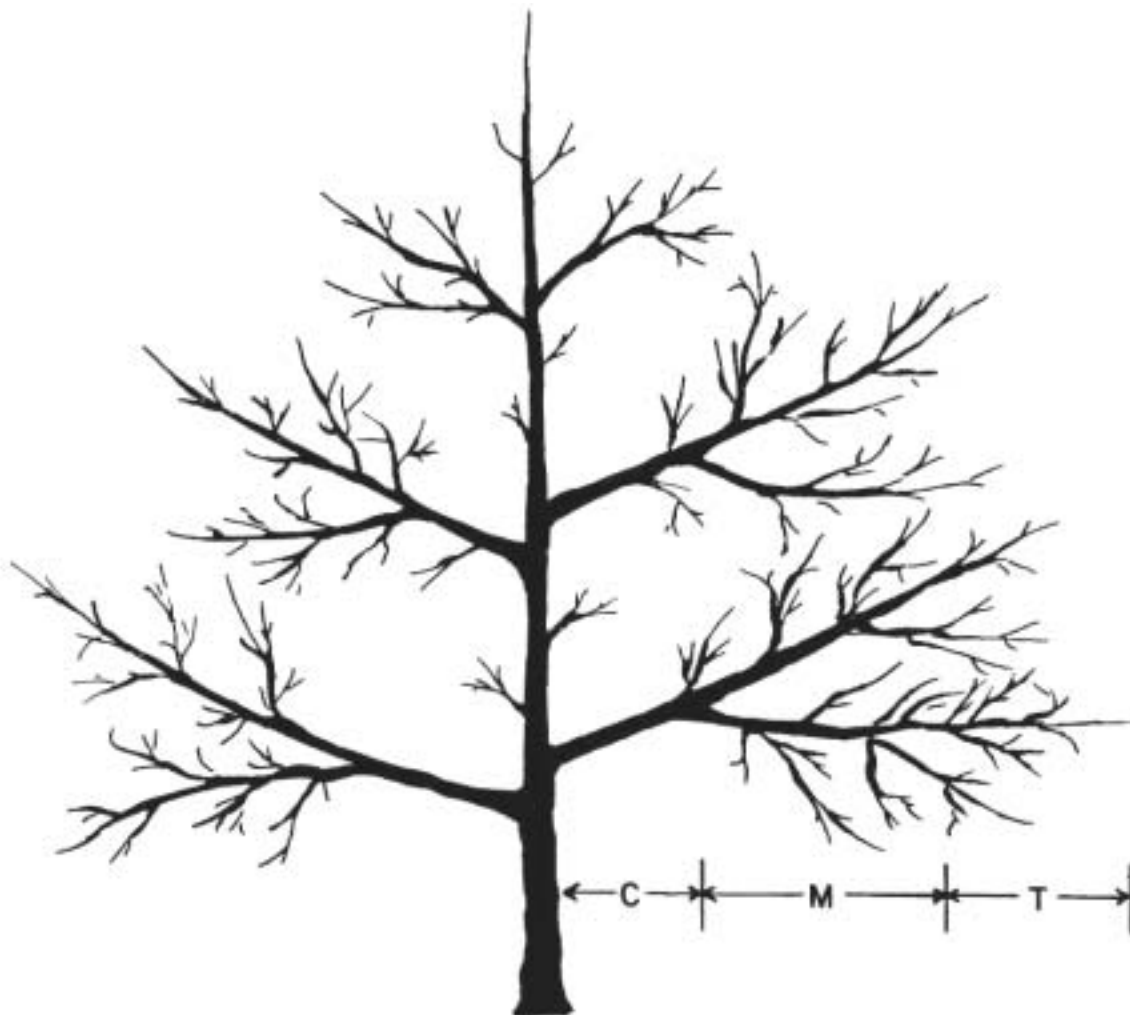


Figure 1. Schematic diagram of an apple tree showing branch sections used in sampling the insect community; C - center section, M - mid-section, T - terminal section. (Drawing by L. Claire Stuart)

Table 3. Phytophagous insects found on apple in West Virginia apple orchards, 1983.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Orthoptera			
Tettigoniidae			
Undetermined A	0	R	
Gryllidae			
<i>Neoxabea bipunctata</i> (DeGeer)*	C		
<i>Oecanthus nigricornis</i> Walker*	R		
<i>Oecanthus fultoni</i> Walker*	O	R	
Undetermined A		R	
Thysanoptera			
Undetermined A	0		R
Hemiptera			
Miridae			
<i>Lopidea media</i> (Say)		O	
<i>Prepops insitivus</i> (Say)		R	
<i>Banzovius agelenopsis</i> Henry	O	R	
Tingidae			
<i>Corythucha arcuata</i> (Say)*	O		O
Berytidae			
<i>Jalysus wickhami</i> Van Duzee			R
<i>Noides muticus</i> (Say)		R	
Pentatomidae			
<i>Euschistus servus</i> (Say)	R	O	
Undetermined A	R		
Undetermined B			O
Undetermined A	R		
Undetermined B		R	
Homoptera			
Cicadidae			
<i>Macrocicada septendecim</i> (Linnaeus)*		O	
Membracidae			
<i>Entylia baccata</i> Germar	R		
Undetermined A	R		
Cicadellidae			
<i>Agallioipsis ancistra</i> Oman	R		
<i>Agallioipsis novella</i> (Say)	O		
<i>Empoasca fabae</i> (Harris)	O		R
<i>Erythroneura obliqua</i> (Say)	R		
<i>Graphocephala coccinea</i> (Forster)	O		
<i>Idiocerus fitchi</i> Van Duzee	R		
<i>Idiocerus provancheri</i> Van Duzee	C		
<i>Jlikradia olitoria</i> (Say)	R		
<i>Oncometopia orbona</i> (Fabricius)	O		
<i>Orientus ishidae</i> (Matsumura)	O		
<i>Scaphytopius acutus</i> (Say)	O	C	
<i>Scaphytopius frontalis</i> (Van Duzee)*		R	
<i>Typhlocyba pomaria</i> McAtee	C	C	A
Undetermined A		R	
Undetermined B		R	
Undetermined C		R	
Undetermined D		O	

Table 3., Cont

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Undetermined E	R		
Undetermined F	O		
Undetermined G	R		
Undetermined H	R		
Undetermined I	O		
Undetermined J	O		
Undetermined K	R		
Cercopidae			
<i>Clastoptera testacea</i> Fitch		R	
<i>Philaenus spumarius</i> (Linnaeus)	C	O	O
Derbidae			
<i>Cedusa kedusa</i> McAtee	O	C	
Flatidae			
<i>Anormenis chloris</i> (Melichar)	O		
<i>Metcalfa pruinosa</i> (Sey)	C		
<i>Ormanoides varusta</i> (Melichar)		O	
Acanaloniidae			
<i>Acanalonia bivittata</i> (Sey)	O		
Aleyrodidae			
Undetermined A	C	O	C
Aphididae			
<i>Aphis</i> sp. ³	C	C	A
<i>Dysaphis plantaginea</i> (Passerini)		C	C
<i>Eriosoma lanigerum</i> (Hausmann)	C	C	C
<i>Rhopalosiphum fitchii</i> (Sanderson)		O	
Undetermined A	O		
Diaspididae			
<i>Chionaspis fufura</i> (Fitch)*			R
<i>Lepidosaphes ulmi</i> (Linnaeus)	O		
<i>Quadraspidiotus perniciosus</i> (Comstock)	C		
Pseudococcidae			
<i>Pseudococcus comstocki</i> (Kuwana)*	R		R
Coleoptera			
Elateridae			
Undetermined A	R		
Buprestidae			
Undetermined A	R		
Undetermined B		R	
Scarabaeidae			
<i>Popillia japonica</i> Newman	O		
Cerambycidae			
<i>Psenocerus supernotatus</i> (Sey)	R		
Chrysomelidae			
<i>Diabrotica undecimpunctata howardi</i> Barber	R		
<i>Odonota dorsalis</i> (Thunberg)			R
Undetermined A (Alticinae)	O		R
Curculionidae			
<i>Rhinocyllus conicus</i> (Froelich)	R		
Undetermined A	R		
Lepidoptera			
Arctiidae			
<i>Hyphantria cunea</i> (Drury)	O		R

Table 3., Cont

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Noctuidae			
<i>Elaphria grata</i> Hübner		R	
<i>Lacanobia subjuncta</i> (Grote and Robinson)*		R	
<i>Pseudoplusia includens</i> (Walker)	R		
Undetermined A	R		
Notodontidae			
<i>Datana angustii</i> Grote and Robinson	R		
<i>Schizura unicornis</i> (J. E. Smith)	O	O	
Lymantriidae			
<i>Lymantria dispar</i> (Linnaeus)	C	R	
<i>Orgyia leucostigma</i> (J. E. Smith)	O	R	
Lasiocampidae			
<i>Malacosoma americanum</i> (Fabricius)	R		
Geometridae			
<i>Eutrapela clemataria</i> (J. E. Smith)*			O
<i>Lemnographa vestaliata</i> (Guenee)	C		
Undetermined A	R		
Undetermined B	R		
Pyrilidae			
<i>Acrobasis indigenella</i> (Zeller)	O		
<i>Microcrambus elegans</i> (Clemens)		R	
Tortricidae			
<i>Acleris</i> sp.1	O		
<i>Acleris</i> sp.2	O		
<i>Argyrotaenia velutinana</i> (Walker)	C	O	O
<i>Choristoneura rosaceana</i> (Harris)	C	R	R
<i>Coelostathma discopunctana</i> Clemens		R	
<i>Cydia pomonella</i> (Linnaeus)		R	
<i>Grapholita molesta</i> (Busck)	R		
<i>Hedya chionosema</i> (Zeller)	O		
<i>Pandemis lamprosa</i> (Robinson)	O		
<i>Pandemis limitata</i> (Robinson)	R	R	R
<i>Platynota flavedana</i> Clemens		O	
<i>Platynota idaeusalis</i> (Walker)	O		C
<i>Pseudoxentera mali</i> Freeman	O	O	
<i>Spilonota ocellana</i> (Denis and Schiffermüller)	O		
Undetermined A	O		
Undetermined B	R		
Gelechiidae			
<i>Evippe prunifoliella</i> Chambers	R		
<i>Dichomeris fagulella</i> Hübner		O	
Blastobasidae			
<i>Hypatopa</i> sp.	R		
Oecophoridae			
<i>Antaeotricha leucillana</i> (Zeller)	R		
Choreutidae			
<i>Choreutis pariana</i> (Clerck)	O		
Heliozelidae			
<i>Coptodisca selendoriferella</i> (Clemens)	C		
Coleophoridae			
<i>Coleophora malivorella</i> Riley	R		
<i>Coleophora serratella</i> (Linnaeus)	O		

Table 3., Cont

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Gracillariidae			
<i>Phyllonorycter blancardella</i> (Fabricius)C	C	C	
Lyonetiidae			
<i>Bucculatrix pomifoliella</i> Clemens	C	C	R
<i>Lyoneta speculifera</i> Clemens	O	C	O
Psychidae			
Undetermined A	R		
Undetermined A		R	
Undetermined B		R	
Undetermined C		R	
Undetermined D	O		
Undetermined E	R		
Undetermined F	R		
Undetermined G	O		
Undetermined H	R	R	O
Undetermined I		R	
Diptera			
Tephritidae			
<i>Rhagoletis pomonella</i> (Walsh)	O		O
Undetermined A	O	O	
Insecta - General			
Undetermined A	R		
Undetermined B	C	O	

1 * Indicates an unconfirmed identification.

2 Letters indicate abundance class: R-rare, found only once; O-occasional, 2-3 found at one time, or one found on more than one sample day; C-common, found more than 2-3 times but on less than 30% of the branch samples; A-abundant, found on more than 30% of the branch samples on more than one sample day, or on more than 50% of the samples once.

3 A complex of *Aphis pomi* DeGeer and *Aphis citricola* van der Goot, determinations of individual specimens were not made.

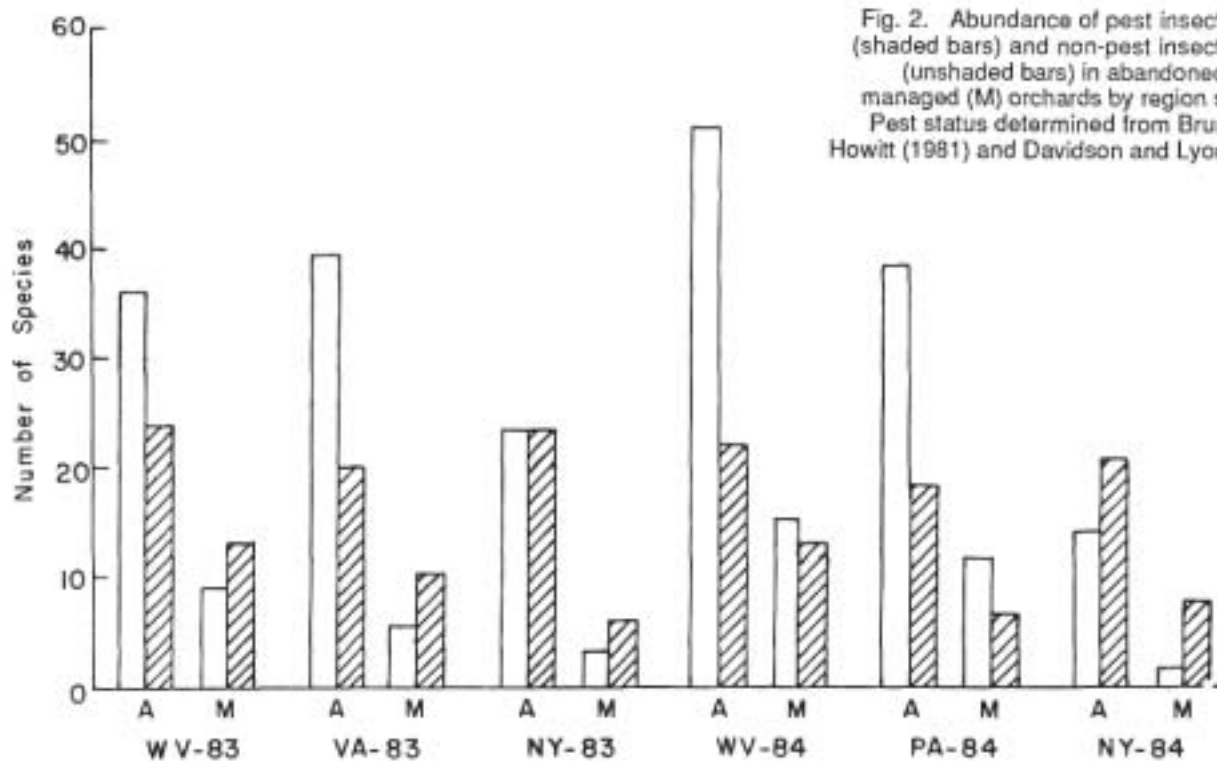


Fig. 2. Abundance of pest insect species (shaded bars) and non-pest insect species (unshaded bars) in abandoned (A) and managed (M) orchards by region sampled. Pest status determined from Brunner and Howitt (1981) and Davidson and Lyon (1979).

Table 4. Phytophagous insects found on apple in Virginia apple orchards, 1983.

Species ¹	Orchard Type ²	
	Abandoned	Managed
Orthoptera		
Gryllidae		
<i>Neoxabea bipunctata</i> (DeGeer)*	O	
<i>Phyllopalpus pulchellus</i> (Uhler)	O	
Thysanoptera		
Undetermined B	R	R
Hemiptera		
Miridae		
<i>Lopidea media</i> (Say)	O	
<i>Ranzovius agelenopsis</i> Henry*	R	
Undetermined A	R	
Pentatomidae		
<i>Euschistus servus</i> (Say)*	R	
Undetermined C	R	
Undetermined C	O	
Homoptera		
Cicadidae		
<i>Tibicen</i> sp.*	O	
Cicadellidae		
<i>Amphigonalia gothica</i> (Signoret)	R	
<i>Empoasca fabae</i> (Harris)	O	R
<i>Erythroneura obliqua</i> (Say)	O	
<i>Graphocephala coccinea</i> (Forster)	O	
<i>Gyponana</i> nr. <i>mali</i> DeLong*	O	
<i>Idiocerus provancheri</i> Van Duzee	R	
<i>Orientalis ishidaei</i> (Matsumura)	O	R
<i>Scaphytopius acutus</i> (Say)*	O	
<i>Typhlocyba pomaria</i> McAtee	O	C
Undetermined L	R	
Undetermined M	O	
Undetermined N	R	
Undetermined O	O	
Cercopidae		
<i>Philaenus spumarius</i> (Linnaeus)	O	
Undetermined A	R	
Derbidae		
<i>Cedusa kedusa</i> McAtee	R	
Flatidae		
<i>Anomenis chloris</i> (Melichar)	O	
<i>Metcalfa pruinosa</i> (Say)	C	
Undetermined A	R	
Acanaloniidae		
<i>Acanalonia bivittata</i> (Say)	O	
Aleyrodidae		
Undetermined A	O	R
Aphididae		
<i>Aphis</i> sp. ³	O	A
<i>Dysaphis plantaginea</i> (Passerini)	C	
<i>Eriosoma lanigerum</i> (Hausmann)	O	C
<i>Rhopalosiphum fitchii</i> (Sanderson)		O

Table 4. Cont.

Species ¹	Orchard Type ²	
	Abandoned	Managed
Diaspididae		
<i>Chionaspis furtura</i> (Fitch)	C	
Pseudococcidae		
<i>Pseudococcus comstocki</i> (Kuwana)*	R	R
Coleoptera		
Buprestidae		
Undetermined C	R	
Scarabaeidae		
<i>Popillia japonica</i> Newman	O	
Chrysomelidae		
<i>Cryptocephalus notatus notatus</i> Fabricius	O	
Undetermined A (Alticinae)	R	O
Curculionidae		
<i>Anthonomus juniperinus</i> (Sanborn)	R	
<i>Rhynchaenus pallicornis</i> (Say)*	R	O
Undetermined B	R	
Lepidoptera		
Lycaenidae		
Undetermined A	R	
Arctiidae		
Undetermined A	R	
Undetermined B	R	
Noctuidae		
<i>Lacanobia subjuncta</i> (Grote and Robinson)*	O	R
Notodontidae		
<i>Schizura unicornis</i> (J. E. Smith)	O	
Undetermined A	R	
Lasiocampidae		
<i>Malacosoma americanum</i> (Fabricius)	O	
Geometridae		
<i>Anavitrinella pampinaria</i> (Guenee)	R	
Undetermined C	R	
Undetermined D	O	
Undetermined E	R	
Undetermined F	R	
Limacodidae		
<i>Tortricia</i> sp.*	R	
Undetermined A	R	
Pyralidae		
<i>Acrobasis indigenella</i> (Zeller)	C	
<i>Epipaschia superatalis</i> Clemens	R	
Tortricidae		
<i>Acleris nivisellana</i> (Walsingham)	R	
<i>Acleris</i> sp. 1	R	
<i>Amorbia humerosana</i> Clemens	O	
<i>Ancylis apicana</i> (Walker)	O	
<i>Argyrotaenia mariana</i> (Fernald)	O	O
<i>Argyrotaenia velutinana</i> (Walker)	C	
<i>Choristoneura rosaceana</i> (Harris)	O	
<i>Hedya chionosema</i> (Zeller)	R	
<i>Clethroutus malana</i> (Fernald)	R	
<i>Platynota flavodana</i> Clemens	C	C
<i>Platynota idaeusalis</i> (Walker)	O	R

Table 4. Cont.

Species ¹	Orchard Type ²	
	Abandoned	Managed
<i>Pseudoxentera mali</i> Freeman	A	
<i>Spilonota ocellana</i> (Denis and Schiffermüller)	O	
Gelechiidae		
<i>Chionodes mediotuscella</i> (Clemens)	O	
<i>Coleotechnites</i> sp.	R	
<i>Elatima eoulatrix</i> Hodges*	C	
Glyphipterygidae		
Undetermined A	R	
Choreutidae		
<i>Choreutis pariana</i> (Clerck)	O	
Heliozelidae		
<i>Coptodisca splendoriferella</i> (Clemens)	O	
Coleophoridae		
<i>Coleophora malivorella</i> Riley	C	
<i>Coleophora serratella</i> (Linnaeus)	O	
Gracillariidae		
<i>Phyllonorycter biancardella</i> (Fabricius)	O	R
Lyonetidae		
<i>Bucculatrix pomifoliella</i> Clemens	O	
<i>Lyoneta speculifera</i> Clemens	O	C
Psychidae		
Undetermined B	O	
Nepticulidae		
<i>Stigmella pomivorella</i> (Packard)*	R	
Undetermined J		R
Undetermined K		O
Undetermined L		R
Undetermined M	O	
Undetermined N	R	
Undetermined O	R	
Undetermined P	R	
Undetermined Q	R	
Diptera		
Tephritidae		
Undetermined B	O	
Cecidomyiidae		
<i>Dasineura mali</i> (Kieffer)*	R	
Hymenoptera		
Tenthredinidae		
Undetermined A	R	

¹ * Indicates an unconfirmed identification.

² Letters indicate abundance class: R-rare, found only once; O-occasional, 2-3 found at one time or one found on more than one sample day; C-common, found more than 2-3 times but on less than 30% of the branch samples; A-abundant, found on more than 30% of the branch samples on more than one sample day, or on more than 50% of the samples once.

³ A complex of *Aphis pomi* DeGeer and *Aphis citricola* van der Goot, determinations of individual specimens were not made.

Table 5. Phytophagous insects found on apple in New York apple orchards, 1983.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Orthoptera			
Gryllidae			
<i>Oecanthus fultoni</i> Walker*	O		
Hemiptera			
Miridae			
<i>Lygus lineolaris</i> (Palisot de Beauvois)			O
<i>Ranzovius agalenopsis</i> Henry	O	O	
Berytidae			
Undetermined A		R	
Pentatomidae			
<i>Euschistus</i> sp.*	R		
Undetermined D	R		
Undetermined D	R		
Homoptera			
Cicadidae			
<i>Tibicen</i> sp.*			R
Cicadellidae			
<i>Colladonus clitellarius</i> (Say)	R		
<i>Empoasca maligna</i> (Walsh)*	R		
<i>Graphocephala coccinea</i> (Forster)	O	O	
<i>Gyponana</i> nr. <i>maii</i> DeLong*	R		
<i>Gyponana protenta</i> DeLong	R		
<i>Idiocerus provancheti</i> Van Duzee	R		
<i>Jlikradia olitoria</i> (Say)	O		
<i>Orienteus ishidae</i> (Matsumura)	R	O	
<i>Paraulacizus irrorata</i> (Fabricius)*	R		R
<i>Penthimia americana</i> Fitch	R		
<i>Scaphoideus incisus</i> Osborn		R	
<i>Scaphytopius frontalis</i> (Van Duzee)*	R		
<i>Typhlocyba pomaria</i> McAtee	C	C	A
Undetermined P	R		
Undetermined Q	R		
Undetermined R		R	
Undetermined S		R	
Cercopidae			
<i>Philaenus spumarius</i> (Linnaeus)		R	
Undetermined B	O		
Flatidae			
<i>Metcalfa pruinosa</i> (Say)	C	O	
Psyllidae			
<i>Psylla pyricola</i> Foerster*		O	
Aleyrodidae			
Undetermined A	O	O	O
Aphididae			
<i>Dysaphis plantaginea</i> (Passerini)	O	O	
<i>Eriosoma lanigerum</i> (Hausmann)	O	O	O
<i>Rhopalosiphum fitchii</i> (Sanderson)	O	O	
Undetermined B	R		
Margarodidae			
<i>Icerya purchasi</i> Maskell*	R		
Diaspididae			

Table 5. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
<i>Lepidosaphes ulmi</i> (Linnaeus)	C		
<i>Quadraspidiotus perniciosus</i> (Comstock)	O	R	O
Coccidae			
<i>Parthenolecanium corni</i> Bouche*	O		
<i>Mesolecanium nigrofasciatum</i> Pergande*	R		
Pseudococcidae			
<i>Pseudococcus comstocki</i> (Kuwana)*	R		
Undetermined A	O		
Coleoptera			
Chrysomelidae			
Undetermined A (Alticinae)		R	
Curculionidae			
<i>Conotrachelus nenuphar</i> (Herbst)	R	R	
Lepidoptera			
Noctuidae			
<i>Hyppa xylinoides</i> (Guenee)		O	
<i>Orthosia hibisci</i> (Guenee)		O	
<i>Phalaenochana pyramusalis</i> (Walker)	R		
Undetermined B		O	
Lymantriidae			
<i>Lymantria dispar</i> (Linnaeus)	O	R	
<i>Orgyia leucostigma</i> (J. E. Smith)	O		
Lasiocampidae			
<i>Malacosoma americanum</i> (Fabricius)		O	
Geometridae			
<i>Hypagyrtis unipunctata</i> (Haworth)		R	
<i>Prochoerodes transversata</i> (Drury)		R	
Undetermined G	R		
Tortricidae			
<i>Acleris nivisellana</i> (Walsingham)	R		
<i>Archips argyrospilus</i> (Walker)	O		
<i>Argyrotaenia velutinana</i> (Walker)	R	R	
<i>Choristoneura rosaceana</i> (Harris)	C		
<i>Cydia pomonella</i> (Linnaeus)	O		
<i>Olethreutes malana</i> (Fernald)	C	O	
<i>Platynota idaeusalis</i> (Walker)	O	O	
<i>Pseudoxentera mali</i> Freeman	C		
<i>Scarganothis divticostana</i> (Walsingham)	C	O	
<i>Scolionota ocellana</i> (Denis and Schiffmüller)	O		
Undetermined C	R		
Undetermined D		R	
Gelechiidae			
<i>Exippe prunifoliella</i> (Chambers)		R	
Choreutidae			
<i>Choreutis pariana</i> (Clerck)	O		
Heliozelidae			
<i>Costodesca splendoriferella</i> (Clemens)	C	O	R
Coleophoridae			
<i>Coleophora malivorella</i> Riley	O		
<i>Coleophora serratella</i> (Linnaeus)	O		
Gracillariidae			
<i>Phyllonorycter</i> sp. ⁴	O	C	A

Table 5. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Lyonetidae			
<i>Bucculatrix pomifoliella</i> Clemens	C	A	R
<i>Lyoneta speculella</i> Clemens		R	
Psychidae			
<i>Psyche casta</i> (Pallas)	O		
Undetermined R		R	
Undetermined S		O	
Undetermined T	R		
Undetermined U	R		
Undetermined V	R		
Diptera			
Tephritidae			
<i>Rhagoletis pomonella</i> (Walsh)		O	
Insecta-general			
Undetermined C R	R		
Undetermined D R			
Undetermined E	C	C	R
Undetermined F		R	
Undetermined G		R	
Undetermined H		R	

1 *Indicates an unconfirmed identification.

2 Letters indicate abundance class: R-rare, found only once; O-occasional, 2-3 found at one time or one found on more than one sample day; C-common, found more than 2-3 times but on less than 30% of the branch samples; A-abundant, found on more than 30% of the branch samples on more than one sample day, or on more than 50% of the samples once.

3 A complex of *Aphis pomi* DeGeer and *Aphis citricola* van der Goot, determinations of individual specimens were not made.

4 *Phyllonorycter blancardella* (Fabricius) and *Phyllonorycter crataegella* (Clemens) were both present, specific determinations were not made.

Table 6. Phytophagous insects found on apple in West Virginia apple orchards 1984.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Orthoptera			
Gryllidae			
<i>Neoxabea bipunctata</i> (DeGeer)	O		
<i>Oecanthus nigricornis</i> walker*		R	
Undetermined A		R	
Dermoptera			
Forficulidae			
<i>Forficula auricularia</i> Linnaeus	R		
Thysanoptera			
Undetermined B			R
Hemiptera			
Miridae			
<i>Lygus lineolaris</i> (Palisot de Beauvois)	R		

Table 6. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
<i>Paracroba capitata</i> (Uhler)	R		
<i>Banzovius agelenopsis</i> Henry*	O		
Undetermined B	R		
Undetermined C		R	
Tingidae			
<i>Corythucha arcuata</i> (Say)	O		
Lygaeidae			
<i>Lygaeus kalmii</i> Stal			O
Berytidae			
Undetermined B		R	
Pentatomidae			
<i>Brochymena quadripustulata</i> (Fabricius)		R	R
Homoptera			
Cicadidae			
<i>Tibicen</i> sp.*		O	O
Membracidae			
<i>Helina scalaris</i> (Fairmaire)	R		
<i>Spissistilus borealis</i> (Fairmaire)	O		
Cicadellidae			
<i>Agallia constricta</i> Van Duzee	R		
<i>Agallioptis novella</i> (Say)	R		
<i>Empoasca fabae</i> (Harris)	O	O	O
<i>Graphocephala coccinea</i> (Forster)	C		
<i>Gyponana</i> nr. <i>mali</i> DeLong	O		
<i>Idiocerus provancheri</i> Van Duzee	C		
<i>Norvellina seminuda</i> (Say)		R	R
<i>Oncometopia orbona</i> (Fabricius)	R		
<i>Orienteus ishidae</i> (Matsumura)	O		
<i>Paraphlepsius</i> sp.		R	
<i>Paraulacizes irrorata</i> (Fabricius)	R		
<i>Scaphoideus intricatus</i> Uhler	O		
<i>Scaphoideus minus</i> DeLong and Beery	R		
<i>Scaphytopius acutus</i> (Say)	R	R	
<i>Scaphytopius frontalis</i> (Van Duzee)			R
<i>Typhlocyba pomaria</i> McAtee	C	C	C
Undetermined T	O		
Undetermined U	O		
Undetermined V	R		
Cercopidae			
<i>Philaenus spumarius</i> (Linnaeus)	C	O	C
Flatidae			
<i>Anomenis chloris</i> (Melichar)	O		
<i>Metcalfa pruinosa</i> (Say)	C	O	
<i>Omenoides venusta</i> (Melichar)	C		
Acanaloniidae			
<i>Acanalonia bivittata</i> (Say)	R		
<i>Acanalonia conica</i> (Say)	O		
Psyllidae			
<i>Trioza obtusa</i> Patch		O	
Undetermined A			O
Aleyrodidae			
Undetermined A	C	O	R

Table 6. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Aphididae			
<i>Aphis</i> sp. ³	C	C	A
<i>Dysaphis plantaginea</i> (Passerini)	C	C	C
<i>Eriosoma lanigerum</i> (Hausmann)	C	C	C
<i>Schizaphis graminum</i> (Rondani)			R
<i>Rhopalosiphum fitchii</i> (Sanderson)	C	C	R
<i>Rhopalosiphum maidis</i> (Fitch)			R
<i>Rhopalosiphum padi</i> (Linnaeus)			R
Diaspididae			
<i>Lepidosaphes ulmi</i> (Linnaeus)	O		
<i>Quadraspidiotus perniciosus</i> (Comstock)	C	R	
Pseudococcidae			
<i>Pseudococcus comstocki</i> (Kuwana)*	O		R
Coleoptera			
Elateridae			
<i>Conoderus lividus</i> (DeGeer)	O		
Scarabaeidae			
<i>Popillia japonica</i> Newman	O	C	
Chrysomelidae			
<i>Chaetocnema pulicaria</i> Melsheimer	R		
<i>Diabrotica undecimpunctata howardi</i> Barber		R	
<i>Odontota dorsalis</i> (Thunberg)	O		
<i>Sumitrosis rosea</i> (Weber)	R		
Curculionidae			
<i>Ceutorhynchus assimilis</i> Paykull			R
<i>Mylocerus hilleri</i> Faust	O		R
Rhynchitidae			
<i>Psalaphorhynchites elusus</i> (Blatchley)		O	
Scolytidae			
<i>Scolytus mali</i> (Bechstein)	R		
Lepidoptera			
Arctiidae			
<i>Halysidota tessellaris</i> (J. E. Smith)	O		
<i>Hyphantria cunea</i> (Drury)	R		
<i>Spilosoma virginica</i> (Fabricius)	R		
Undetermined C		R	
Undetermined D	R		
Noctuidae			
<i>Acronicta pruni</i> Harris	O		
<i>Balsa malana</i> (Fitch)		R	
<i>Palthis angulalis</i> (Hübner)	O		
<i>Pseudoplusia includens</i> (Walker)			O
Undetermined C	R		
Undetermined D			O
Undetermined E			R
Notodontidae			
<i>Schizura unicornis</i> (J. E. Smith)	R		
Lymantriidae			
<i>Lymantria dispar</i> (Linnaeus)	C	O	O
<i>Orgyia leucostigma</i> (J. E. Smith)	R		

Table 6. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Geometridae			
<i>Anavitrinella pampinaria</i> (Guenee)	O	R	R
<i>Erannia stilaria</i> (Harris)	O	C	
<i>Euchlaena ampocnaria</i> (Guenee)	R		
<i>Eutrapela clemataria</i> (J. E. Smith)	R		C
<i>Lomographa vestaliata</i> (Guenee)	O		
<i>Prochoerodes transversata</i> (Drury)	O	R	
Undetermined H	R		
Undetermined I	O		
Undetermined J	R		
Undetermined K	R		
Undetermined L	C		
Undetermined M		R	
Undetermined N			O
Undetermined O			R
Undetermined P			R
Undetermined Q			O
Pyralidae			
<i>Acrobasis indigenella</i> (Zeller)	C	R	
Tortricidae			
<i>Acleris</i> sp. 1	O		
<i>Acleris</i> sp. 2	R		
<i>Argyrotaenia quadrifasciana</i> (Fernald)	O		
<i>Argyrotaenia velutinana</i> (Walker)	O	R	R
<i>Choristoneura rosaceana</i> (Harris)	C	R	R
<i>Grapholitha molesta</i> (Busck)	O		
<i>Hedya chionosema</i> (Zeller)	C		
<i>Pandemis limitata</i> (Robinson)	O	O	R
<i>Platynota flavedana</i> Clemens		C	
<i>Platynota idaeusalis</i> (Walker)	C	R	C
<i>Pseudoxentera mali</i> Freeman	C		
<i>Ptychloma virescens</i> (Clemens)			O
<i>Sparganothis dauticostana</i> (Walsingham)		R	
<i>Sparganothis sulfureana</i> (Clemens)		R	
<i>Solionota ocellana</i> (Denis and Schiffmüller)	R		
Undetermined E	O		
Undetermined F		R	
Gelechiidae			
<i>Dichomeris ligulella</i> Hübner	O		
Oecophoridae			
<i>Antaeotricha leucilana</i> (Zeller)	O		
Heliozelidae			
<i>Coptodisca splendoriferella</i> (Clemens)	C		
Coleophoridae			
<i>Coleophora malivorella</i> Piley	R		
<i>Coleophora serratella</i> (Linnaeus)	O		
Gracillariidae			
<i>Phyllonorycter blancardella</i> (Fabricius)	C	A	C
Lyonetidae			
<i>Bucculatrix pomifoliella</i> Clemens	C	C	R
<i>Lyonetia speculella</i> Clemens	O	C	C
Undetermined W			O
Undetermined X	O		
Undetermined Y			R

Table 6. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Undetermined Z R			
Undetermined AA	O		
Undetermined BB	R		
Undetermined CC	R		
Undetermined DD	R		
Undetermined EE	R		
Undetermined FF	R		
Undetermined GG	R		
Undetermined HH	R		
Undetermined II	R		
Diptera			
Tephritidae			
Undetermined C			R
Insecta-General			
Undetermined I	R		
Undetermined J		R	
Undetermined K			R

1 * Indicates an unconfirmed identification.

2 Letters indicate abundance class: R-rare, found only once; O-occasional, 2-3 found at one time or one found on more than one sample day; C-common, found more than 2-3 times but on less than 30% of the branch samples; A-abundant, found on more than 30% of the branch samples on more than one sample day, or on more than 50% of the samples once.

3 A complex of *Aphis pomi* DeGeer and *Aphis citricola* van der Goot, determinations of individual specimens were not made.

Table 7. Phytophagous insects found on apple in Pennsylvania apple orchards, 1984.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Orthoptera			
Tettigoniidae			
Undetermined B (Pseudophyllinae)	R		
Gryllidae			
<i>Neoxabea bipunctata</i> (DeGeer)	C		
<i>Oecanthus exclamationis</i> Davis	O		
<i>Oecanthus fultoni</i> Walker	C		
<i>Oecanthus nigricornis</i> Walker	O	C	
Dermaptera			
Forficulidae			
<i>Forficula auricularia</i> Linnaeus		O	
Thysanoptera			
Undetermined B	R		
Hemiptera			
Miridae			
<i>Campylomma verbasci</i> (Wolff)		O	
<i>Neurocolpus nubilus</i> (Say)			R
<i>Banzovius agelenopsis</i> Henry*			O
Undetermined D		O	
Tingidae			
Undetermined A		R	

Table 7. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Berytidae			
Undetermined C	R		
Coreidae			
<i>Anasa tristis</i> DeGeer		R	
Homoptera			
Cicadidae			
<i>Tibicen</i> sp.*			R
Membracidae			
<i>Enchenopa binotata</i> (Say)			R
<i>Micrutalis calva</i> (Say)		R	
<i>Spissistilus borealis</i> (Fairmaire)*	R	O	
<i>Vanduzeeea arcuata</i> (Say)		R	
Cicadellidae			
<i>Agallioopsis ancistra</i> Oman	R		
<i>Agallioopsis novella</i> (Say)	O		
<i>Colladonus citellarius</i> (Say)	O	O	R
<i>Empoasca fabae</i> (Harris)	O	A	
<i>Empoasca maligna</i> (Walsh)	R		
<i>Erythroneura lawsoniana</i> Baker	R		
<i>Graphocephala coccinea</i> (Forster)	R	O	
<i>Gyponana</i> nr. <i>mali</i> DeLong		R	
<i>Idiocerus provancheri</i> Van Duzee	C	R	R
<i>Jkradia olitoria</i> (Say)	R	O	
<i>Orientalis ishidae</i> (Matsumura)	C	A	
<i>Scaphytopius acutus</i> (Say)	O		
<i>Tychlocyba pomaria</i> McAtee	C	A	A
Undetermined W	R		
Undetermined X		R	
Cercopidae			
<i>Philaenus spumarius</i> (Linnaeus)	O		C
Derbidae			
<i>Cedusa kedusa</i> McAtee	R		
Flatidae			
<i>Anormenis chloris</i> (Melichar)	C		
<i>Metcalfa pruinosa</i> (Say)	C	O	
Acanaloniidae			
<i>Acanalonia bivittata</i> (Say)	O		
<i>Acanalonia conica</i> (Say)	C	O	
Psyllidae			
<i>Pachypsylla celtidis-vesicula</i> Riley		O	
Aleyrodidae			
Undetermined A			R
Aphididae			
<i>Aphis</i> sp. ³	R	C	A
<i>Dysaphis plantaginea</i> (Passerini)	C	R	
<i>Eriosoma lanigerum</i> (Hausmann)	O		
<i>Rhopalosiphum fitchii</i> Sanderson		R	
Diaspididae			
<i>Quadraspidiotus perniciosus</i> (Comstock)	C		
Pseudococcidae			
<i>Pseudococcus comstocki</i> (Kuwana)*			R

Table 7. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Coleoptera			
Elateridae			
<i>Conoderus lividus</i> (DeGeer)		R	
Anobiidae			
<i>Calymmaderus nitidus</i> (LeConte)		O	
Scarabaeidae			
<i>Popillia japonica</i> Newman		C	
Chrysomelidae			
<i>Crepidodera nana</i> (Say)		O	
<i>Crioceris asparagi</i> (Linnaeus)		R	
<i>Dibrotica longicornis</i> (Say)			R
<i>Matriona bicolor</i> (Fabricius)		R	
<i>Odonotus dorsalis</i> (Thunberg)		O	R
Undetermined B		R	
Undetermined C		O	
Lepidoptera			
Nymphalidae			
<i>Limenitis arthemis astyanax</i> (Fabricius)*	R		
Arctiidae			
<i>Halysidota tessellaris</i> (J. E. Smith)*	R		
<i>Hyphantria cunea</i> (Drury)		R	
Noctuidae			
<i>Amphipyra pyramoides</i> Guenee	R		
<i>Balsa malana</i> (Fitch)	R	C	R
<i>Lacanobia subjuncta</i> (Grote and Robinson)		R	
<i>Lithophane laticinerea</i> Grote*	O		
<i>Orthosia hibisci</i> (Guenee)	R		
<i>Pseudoplusia includens</i> (Walker)		R	
Undetermined F			O
Undetermined G	C		
Undetermined H			O
Notodontidae			
<i>Heterocampa guttivitta</i> (Walker)		R	
Undetermined B	R		
Lymantriidae			
<i>Lymantria dispar</i> (Linnaeus)	C	C	
<i>Orgyia leucostigma</i> (J. E. Smith)	C	O	
Lasiocampidae			
<i>Malacosoma americanum</i> (Fabricius)		R	
Geometridae			
<i>Anavitrinella pampinaria</i> (Guenee)	O	O	
<i>Calothyrsanis amaturaria</i> (Walker)	R		
<i>Erannis tiliaria</i> (Harris)		R	
<i>Hypagyrtis unipunctata</i> (Haworth)	O		
<i>Lomographa vestaliata</i> (Guenee)		O	
<i>Nematocampa limbata</i> (Haworth)	O		
<i>Tetracis cachexiata</i> Guenee	O		
Undetermined R	R		
Undetermined S	O		
Undetermined T	R		
Undetermined U			R
Undetermined V		R	
Undetermined W		R	

Table 7. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Limaconidae			
<i>Photostrom pitheciatum</i> (J. E. Smith)	R		
<i>Tortricidia</i> sp.*	O		
Undetermined B		R	
Pyralidae			
<i>Acrobasis indigenella</i> (Zeller)	R	O	
Tortricidae			
<i>Argyrotaenia quadrifasciana</i> (Fernald)		R	
<i>Argyrotaenia velutinana</i> (Walker)	O	O	
<i>Choristoneura rosaceana</i> (Harris)	O	O	
<i>Clepsis melaleucana</i> (Walker)	R		
<i>Celostathma discopunctana</i> Clemens			R
<i>Pandemis limitata</i> (Robinson)	O		
<i>Platynota flavedana</i> Clemens		O	
<i>Platynota idaeusalis</i> (Walker)	R	O	R
<i>Pseudoxentera mali</i> Freeman	C	O	O
<i>Sarganopsis diluticostana</i> (Walsingham)	C	R	
Undetermined G	R		
Gelechiidae			
<i>Dichomeris ligulella</i> Hübner	C	C	
Oecophoridae			
<i>Antaeotricha leucillana</i> (Zeller)		C	
Choreutidae			
<i>Choreutis pariana</i> (Clerck)	R		
Heliozelidae			
<i>Crotophaga splendorella</i> (Clemens)	C	O	
Coleophoridae			
<i>Coleophora malivorella</i> Riley		R	
<i>Coleophora serratella</i> (Linnaeus)	O		
Gracillariidae			
<i>Phyllonorycter</i> sp. ⁴	C	C	R
Lyonetidae			
<i>Bucculatrix pomifoliella</i> Clemens	C		R
<i>Lyonetia speculella</i> Clemens	O	C	O
Tischeriidae			
<i>Tischeria malifoliella</i> Clemens	R		
Psychidae			
Undetermined C	R		
Undetermined JJ			R
Undetermined KK	R		
Undetermined LL	O		
Undetermined MM	R		
Undetermined NN	O		
Undetermined OO	R		
Undetermined PP		R	
Undetermined QQ		R	
Diptera			
Tephritidae			
<i>Euaresia bellula</i> Snow		R	

Table 7. Cont.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Insecta-general			
Undetermined L			C
1	* Indicates an unconfirmed identification.		
2	Letters indicate abundance class: R-rare, found only once; O-occasional, 2-3 found at one time, or one found on more than one sample day; C-common, found more than 2-3 times but on less than 30% of the branch samples; A-abundant, found on more than 30% of the branch samples on more than one sample day, or on more than 50% of the samples once.		
3	A complex of <i>Aphis pomi</i> DeGeer and <i>Aphis citricola</i> van der Goot, determinations of individual specimens were not made.		
4	<i>Phyllonorycter blancardella</i> (Fabricius) and <i>Phyllonorycter crataegella</i> Clemens were both present, specific determinations were not made.		

Table 8. Phytophagous insects found on apple in New York apple orchards, 1984.

Species ¹	Orchard Type ²		
	Abandoned	"Organic"	Managed
Hemiptera			
Miridae			
<i>Ranzovius agelenopsis</i> Henry*	O		
Undetermined E	O		R
Berytidae			
Undetermined D	R		
Homoptera			
Membracidae			
<i>Spissisilius borealis</i> (Fairmaire)	O		
Cicadellidae			
<i>Empoasca fabae</i> (Harris)	R		
<i>Erythroneura tricincta</i> Fitch	R		
<i>Gyponana</i> nr. <i>mal</i> DeLong*	O		
<i>Isiocerus provancheri</i> Van Duzee	O		
<i>Typhlocyba pomaria</i> McAtee	C		A
Flatidae			
<i>Ormenoides venusta</i> (Melichar)	O		
Aleyrodidae			
Undetermined A	O		
Aphididae			
<i>Aphis</i> sp. ³	C		C
<i>Dysaphis plantaginea</i> (Passerini)	O		R
<i>Eriosoma lanigerum</i> (Hausmann)	C		C
Diaspididae			
<i>Chionaspis furtiva</i> (Fitch)*	R		
<i>Lepidosaphes ulmi</i> (Linnaeus)	C		
<i>Quadraspidiotus perniciosus</i> (Comstock)	R		
Coccidae			
<i>Parthenolecanium corni</i> Bouche*	O		
Pseudococcidae			
<i>Pseudococcus comstocki</i> (Kuwana)*	O		C
Coleoptera			
Curculionidae			
<i>Polydrusus sericeus</i> (Schaller)	R		

Table 8. Cont.

Species ¹	Orchard Type ²	
	Abandoned	Managed
Lepidoptera		
Noctuidae		
Undetermined I	R	C
Lymantriidae		
<i>Lymantria dispar</i> (Linnaeus)	R	
<i>Orgyia leucostigma</i> (J. E. Smith)	O	
Geometridae		
Undetermined X	R	
Undetermined Y	R	
Limacodidae		
Undetermined C	R	
Pyralfidae		
<i>Acrobasis indigenella</i> (Zeller)	R	
<i>Crambus praefectellus</i> (Zincken)		R
<i>Eudonia vivida</i> Munroe	R	
Undetermined A	C	
Tortricidae		
<i>Acteria</i> sp. 1	R	
<i>Argyrotornis velutinana</i> (Walker)	C	R
<i>Choristoneura rosaceana</i> (Harris)	C	C
<i>Pandemis limitata</i> (Robinson)	R	
<i>Platynota idaeusalis</i> (Walker)	R	
<i>Sparganothis diluticostana</i> (Walsingham)	R	
<i>Sparganothis directana</i> (Walker)	R	
<i>Spilonota ocellana</i> (Denis and Schiffermüller)	R	
Undetermined H	R	
Undetermined I		R
Heliozelidae		
<i>Cepodisca splendoriterella</i> (Clemens)	C	
Coleophoridae		
<i>Coleophora malivorella</i> Riley	R	
<i>Coleophora serratella</i> (Linnaeus)	R	
Gracillariidae		
<i>Phyltonorycter blancardella</i> (Fabricius)	C	A
Lyonetiidae		
<i>Bucculatrix pomifoliella</i> Clemens	O	
<i>Lyonetia speocutella</i> Clemens		O
Tischeriidae		
<i>Tischeria malifoliella</i> Clemens	C	
Nepticulidae		
<i>Stigmella pomivorella</i> (Packard)	C	
Undetermined RR	R	
Undetermined SS	R	
Diptera		
Cecidomyiidae		
<i>Dasineura mali</i> (Kieffer)	O	

Table 8. Cont.

Species ¹	Orchard Type ²	
	Abandoned	Managed
Insecta-general		
Undetermined M		R

1 * Indicates an unconfirmed identification.

2 Letters indicate abundance class: R-rare, found only once; O-occasional, 2-3 found at one time, or one found on more than one sample day; C-common, found more than 2-3 times but on less than 30% of the branch samples; A-abundant, found on more than 30% of the branch samples on more than one sample day, or on more than 50% of the samples once.

3 A complex of *Aphis pomi* DeGeer and *Aphis citricola* van der Goot, determinations of individual specimens were not made.

Table 9. Taxonomic diversity of phytophagous insects on apple in the mid-Atlantic states, 1983-1984.

Order	Family	Number of		
		Genera	Species	Undetermined
Orthoptera	Tettigoniidae	-	-	2
	Gryllidae	3	5	1
Subtotal		3	5	3
Dermoptera	Forficulidae	1	1	0
Thysanoptera	Undetermined			2
Hemiptera	Miridae	7	7	5
	Tingidae	1	1	1
	Lygaeidae	1	1	0
	Berytidae	2	2	4
	Coccidae	1	1	0
	Pentatomidae	2	3	4
	Undetermined			4
Subtotal		14	15	18
Homoptera	Cicadidae	2	2	0
	Membracidae	6	6	1
	Cicadellidae	19	28	24
	Cercopidae	2	2	2
	Derbidae	1	1	0
	Flatidae	3	3	1
	Acanaloniidae	1	2	0
	Psyllidae	3	3	1
	Aleyrodidae	-	-	1
	Aphididae	5	8	2
	Margarodidae	1	1	0
	Diaspididae	3	3	0
	Coccidae	2	2	0
	Pseudococcidae	1	1	0
Undetermined			1	
Subtotal		49	61	33

Table 9. Cont.

Order	Family	Number of		
		Genera	Species	Undetermined
Coleoptera	Elateridae	1	1	1
	Buprestidae	-	-	3
	Anobiidae	1	1	0
	Scarabaeidae	1	1	0
	Cerambycidae	1	1	0
	Chrysomelidae	8	9	3
	Curculionidae	7	7	0
	Rhynchitidae	1	1	0
	Scolytidae	1	1	0
	Undetermined			2
Subtotal		21	23	9
Lepidoptera	Nymphalidae	1	1	0
	Lycanidae	-	-	1
	Arctidae	3	3	4
	Noctuidae	11	11	9
	Notodontidae	3	3	2
	Lymantridae	2	2	0
	Lasiocampidae	1	1	0
	Geometridae	10	10	25
	Limacodidae	2	2	3
	Pyrilidae	5	5	1
	Tortricidae	19	27	9
	Gelechiidae	5	5	0
	Blastobasidae	1	1	0
	Oecophoridae	1	1	0
	Glyphypterigidae	-	-	1
	Choreutidae	1	1	0
	Heliozelidae	1	1	0
	Coleophoridae	1	2	0
	Gracilariidae	1	2	0
	Lyonetiidae	2	2	0
Tischeriidae	1	1	0	
Psychidae	1	1	3	
Nepticulidae	1	1	0	
Undetermined			45	
Subtotal		73	83	103
Diptera	Tephritidae	2	2	3
	Cecidomyiidae	1	1	0
Subtotal		3	3	3
Hymenoptera	Tenthredinidae	-	-	1
Undetermined				13
Total	58	164	191	185

Table 10. Summary of phytophagous insects on apple, by state and orchard type, 1983-1984.

Orchard	Orders	Families	Genera	Species	Undetermined
West Virginia, 1983	7	41	76	85	44
Abandoned	7	39	57	64	31
"Organic"	6	23	34	36	17
Managed	6	18	22	23	5
Virginia, 1983	8	38	58	63	35
Abandoned	8	38	57	62	32
Managed	4	10	13	15	6
New York, 1983	6	30	58	62	27
Abandoned	5	23	44	48	14
"Organic"	5	21	31	33	14
Managed	3	9	10	12	4
West Virginia, 1984	8	38	65	96	44
Abandoned	6	31	70	75	25
"Organic"	5	23	33	36	8
Managed	6	17	28	31	13
Pennsylvania, 1984	8	43	64	94	32
Abandoned	5	27	52	59	16
"Organic"	7	32	52	56	10
Managed	4	14	19	21	6
New York, 1984	5	24	37	40	13
Abandoned	5	24	35	38	11
Managed	3	9	10	11	4

20 Table 11. Non-phytophagous insects associated with apple, by region and orchard type, 1983-1984.

Species	Region	Orchard ¹ Type	Feeding ² Habit	Host
<i>Colembola</i>	NY-83, NY-84	A, O	S	
<i>Ephemeroptera</i>	WV-83, PA-84, NY-84	A, O, M	T	
<i>Orthoptera</i>				
<i>Gryllacrididae</i>				
<i>Campobrotus carolinensis</i> (Gerstaecker)	NY-83, WV-84	A	Pr	
<i>Psocoptera</i>				
<i>Psocidae</i>				
<i>Loensia modesta</i> (Hogen)	PA-84	O	S	
<i>Meloboris novaeboracae</i> (Walker)	VA-83	A	S	
<i>Amphipsocidae</i>				
<i>Telliosocus confertus</i> (Walsh)	VA-83	A	S	
Other	WV-83, VA-83, NY-83, WV-84	A, O, M	S	
<i>Thysanoptera</i>				
<i>Phlaeothripidae</i>				
<i>Lestobius mali</i> (Fitch)	WV-83, VA-83, NY-83, WV-84, PA-84	A, O, M	Pr	
Other	WV-83, VA-83, NY-83	A, O, M	Pr	
<i>Hemiptera</i>				
<i>Anthracocoridae</i>				
<i>Cixius insidiosus</i> (Say)	WV-83, WV-84, PA-84	O, M	Pr	
<i>Miridae</i>				
<i>Derocoris nebulosus</i> (Uhler)	WV-83, WV-84	A, M	Pr	
<i>Hyalobius vitripennis</i> (Say)	WV-83, VA-83, NY-83	A, O, M	Pr	
<i>Ethocoris canadensis</i> Van Duzee	WV-83, WV-84	A, O	Pr	
<i>Elytrocoris</i> sp.	WV-84	A	Pr	
<i>Plagiognathus politus</i> Uhler	PA-84, NY-84, WV-84, PA-84	A, M	Pr	
Other	WV-83, WV-84, NY-84	A, O, M	Pr	
<i>Nabidae</i>				
<i>Nabis ruscipennis</i> Reuter	WV-83, WV-84	A	Pr	
Other	PA-84	O		
<i>Reduviidae</i>				
<i>Acholla multispinosa</i> (DeGeer)	WV-83, NY-83	A	Pr	
Other	WV-83, VA-83, NY-83, WV-84	A, O	Pr	
<i>Phymetidae</i>				
<i>Ethmalia</i> sp.	VA-83	A	Pr	
Other	WV-83	A	Pr	
<i>Pentatomidae</i>				
Other	WV-83, VA-83, NY-83, WV-84	A	Pr	
PA-84	WV-83, VA-83, WV-84	A, M	Pr	
<i>Coleoptera</i>				
<i>Staphylinidae</i>	WV-83	O	S	
<i>Coryphidae</i>	WV-84	A, S		
<i>Orthocerus</i> sp.	WV-84	A, Pr		
<i>Cantharidae</i>	PA-84	O		
<i>Cantharis</i> sp.	WV-83, WA-83	A, M	Pr	
<i>Podabus</i> sp.	PA-84	O		
Other	WV-83, WA-83	A, M		
<i>Lampyridae</i>				
<i>Etholius</i> sp.	PA-84	O		

Table 11. Cont.

Species	Region	Orchard ¹ Type	Feeding ² Habit	Host
Other	WV-83, VA-83	A, M	Pr	
Cloridae				
<i>Isotrochocera curtisemmsi</i> (Newman)	PA-84	A Pr		
Cryptophagidae				
<i>Anobionus ochraceus</i> Zimmermann	NY-83	M S		
Nitidulidae				
<i>Gilischrochilus fasciatus</i> (Olivier)	WV-84 VA-83	M A S	S	
Other				
Lathridiidae				
<i>Melanophthalma distinguenda</i> (Cornelli)	WV-83, NY-83, WV-84 A, O, M	S		
<i>Melanophthalma americana</i> Mannerheim	PA-84 NY-84	M S A, M	S	
Other				
Coccinellidae				
<i>Adalia bipunctata</i> (Linnaeus)	WV-83, VA-83, NY-83	A, O, M	Pr	
<i>Anatis labiculata</i> (Say)	WV-84, PA-84	A, M	Pr	
<i>Anatis mali</i> (Say)	PA-84	A Pr		
<i>Brachiscantha ursina</i> (Fabricius)	PA-84	O	Pr	
<i>Chilocorus stigma</i> (Say)	NY-83	A Pr		
<i>Coccinella septempunctata</i> Linnaeus	WV-84	A, O, M	Pr	
<i>Scymnus alternus</i> (Horn)	VA-83	A Pr		
<i>Scymnus circumscriptus</i> Horn	WV-84	A Pr		
<i>Scymnus tuberculatus</i> Casey	VA-83	A Pr		
<i>Scymnus</i> sp.	WV-84	M Pr		
<i>Stenobothrus punctum</i> (Le Conte)	WV-83, VA-83, NY-83, NY-84	A, O, M	Pr	
<i>Zilus horni</i> Gordon	WV-84	A Pr		
Other				
Anthribidae				
<i>Inoponotus tomentosus</i> (Say)	WV-84 VA-83	M S A Pr		
Other				
Other:	WV-83, VA-83, WV-84	A S		
Mecoptera				
Panorpidae				
<i>Panorpa lasiocornis</i> Hine	WV-84 NY-84	O Pr A Pr		
Other				
Neuroptera				
Coniopterygidae				
<i>Coniopteryx westwoodi</i> (Fitch)	VA-83, WV-84, NY-84	A, M	Pr	
Hemeroptidae				
<i>Hemembius humulus</i> Linnaeus	WV-83, PA-84	A, M	Pr	
<i>Hemembius</i> sp.	WV-83	A Pr		
<i>Micromus posticus</i> (Walker)	WV-84	M Pr		
Other	VA-83	A Pr		
Chrysopidae				
<i>Chrysopa oculata</i> Say	WV-83, PA-84	M	Pr	
<i>Chrysopa ruficornis</i> Ramb.	WV-83, VA-83, NY-83,	A, M	Pr	
Other	WV-84, NY-84, PA-84	A, O, M	Pr	
Other	WV-83	A Pr		

Species	Region	Orchard ¹		Feeding ² Habit	Host
		A	T		
Trichoptera					
Lepidoptera					
Epiphyropidae					
<i>Eulgora gisgus</i> (Edwards)	WV-83, WV-84	A	Pa	Mitcalla	grainosa
Diptera					
Tipulidae					
<i>Psychodidae</i>	WV-83	A	T		
<i>Chironomidae</i>	WV-83, WV-84	A	T		
<i>Simuliidae</i>	WV-83, VA-83, WV-84	A, M		T	
<i>Simulium vittatum</i> Zeitenstedt complex	WV-83, WV-84	A, M		T	
Anisopodidae					
<i>Subicola punctatus</i> (Fabricius)	WV-83	A	S		
Bibionidae					
<i>Bibio albicornis</i> Say	WV-84	A	S		
<i>Bibio femoratus</i> wiedmann	WV-84	A	S		
<i>Bibio fraternus</i> Loew	WV-84	O	S		
Cecidomyiidae					
<i>Achiloptes achilomyza</i> (Rondani)	WV-83, WV-84, NY-84	A, O, M		Pr	
Stratiomyidae					
<i>Allognosta fuscicornis</i> (Say)	WV-84	O	S		
Syrphidae					
<i>Sphaerophoria confinis</i> Macquart	PA-84	O		Pr	
<i>Syrphus pictus</i> Osten Sacken	WV-84	O	Pr		
<i>Toxomerus marginatus</i> (Say)	PA-84	C		Pr	
Other	WV-83, VA-83, NY-83, WV-84, PA-84, NY-84	A, O, M		Pr	
Oritidae					
<i>Callosistroria annulipes</i> (Macquart)	WV-84	A	S		
Lauxaniidae					
<i>Homoneura</i> sp.	WV-84	A	S		
Lonchaeidae					
<i>Lonchaea</i> sp.	WV-83	O	S		
Ephydriidae					
<i>Scatella tenuicosta</i> Collin	WV-84	C	T		
Drosophilidae					
<i>Drosophila arizonae</i> (Loew)	NY-84	A		S	
<i>Glaucotetrastoma inversa</i> Malloch	NY-84	A		S	
<i>Drosophila robusta</i> group	WV-84	A	S		
<i>Drosophila robusta</i> Sturtevant	WV-84	A	S		
Agromyzidae					
<i>Litomyza supabotzi</i> (Kaltenbach)	WV-84, NY-84	A, M		T	
Anthomyiidae					
<i>Tachinidae</i>	VA-83	A		T	
<i>Actia internuda</i> Curran	WV-83	A	Pa	Tetracidae	
Hymenoptera					
Braconidae					
<i>Agastis annulipes</i> (Cress.)	WV-84	A	Pa	Tetracidae	

Table 11. Cont.

Species	Region	Orchard ¹ Type	Feeding ² Habit	Host
<i>Agathis cincta</i> (Cress.)	PA-84 A	Pa	Tortricidae	<i>Platynota</i>
<i>Apanteles</i> sp.	WV-84, PA-84	A, M	Pa	<i>idauasalis</i>
<i>Apanteles</i> sp.	WV-83	A, Pa	Tortricidae	<i>idauasalis</i>
<i>Ascogaster mimetica</i> Vier.	NY-84 A	Pa	Tortricidae	<i>idauasalis</i>
<i>Ascogaster olivaceus</i> Vier.	WV-84	A, Pa	<i>Platynota</i>	<i>idauasalis</i>
<i>Cotesia</i> sp.	WV-83	M, Pa	?	<i>idauasalis</i>
<i>Macrocotinus delicatus</i> Cress.	WV-84	A, Pa	<i>Graebolthia</i>	<i>idauasalis</i>
<i>Meteorus</i> sp.	WV-83	A, Pa	Tortricidae	<i>idauasalis</i>
<i>Microplitis</i> sp.	PA-84 A	Pa	<i>Lithobara</i>	<i>idauasalis</i>
<i>Oncophanes americanus</i> (Wood)	NY-83	O, Pa	Tortricidae	<i>idauasalis</i>
<i>Phaenocarpa atrigata</i> (Wood)	WV-84	A, M	Pa	<i>idauasalis</i>
Other	WV-83	M, Pa	?	<i>idauasalis</i>
Ichneumonidae	WV-83	A, Pa	<i>Orgyia</i>	<i>idauasalis</i>
<i>Hyposoter</i> sp.	WV-83, VA-83, NY-83, PA-84	A, M	Pa	<i>idauasalis</i>
Other	WV-84, PA-84	O, Pa	Tortricidae	<i>idauasalis</i>
Eulophidae	WV-84, PA-84	A, Pa	<i>Nepticula</i>	<i>idauasalis</i>
<i>Elachertus protractata</i> (Howard)	NY-84	A, Pa		<i>idauasalis</i>
<i>Prigalis maculipes</i> (Crawford)				<i>idauasalis</i>
<i>Symonasis bimaculatiformis</i> (Girault)	WV-84, PA-84	A, M	Pa	<i>idauasalis</i>
Other	VA-83	A, Pa	?	<i>idauasalis</i>
Aphelinidae	NY-83	O, Pa	<i>Eriosoma</i>	<i>idauasalis</i>
<i>Aphelinus mali</i> (Haldeman)				<i>idauasalis</i>
Encyrtidae	NY-83	O, Pa	<i>Lymantria</i>	<i>idauasalis</i>
<i>Diencyrtus luvatae</i> (Howard)	WV-83, WV-84	A, Pa	?	<i>idauasalis</i>
Other	PA-84	O, Pa	<i>Choristoneura</i>	<i>idauasalis</i>
Torymidae	WV-83, WV-84	A, O	Pa	<i>idauasalis</i>
<i>Monodontomerus aeneus</i> Walker	PA-84	O, Pa		<i>idauasalis</i>
Chalcididae	WV-83, WV-84	A, O	Pa	<i>idauasalis</i>
<i>Brachymeria ornata</i> (Slay)	WV-83	O	Pa	<i>idauasalis</i>
<i>Ceratostigmella meliodi</i> Bunks	WV-84	A, Pa	?	<i>idauasalis</i>
Other	WV-84	A, Pa		<i>idauasalis</i>
Bethylidae	WV-84	A, Pa	<i>Graebolthia</i>	<i>idauasalis</i>
<i>Goniozus floridanus</i> (Ashmead)				<i>idauasalis</i>
Formicidae	WV-83, VA-83, WV-84, NY-84	A, O, M	Pr, S	<i>idauasalis</i>
Sphecidae	PA-84	A, Pr		<i>idauasalis</i>
Apidae	WV-83, WV-84	M	Pa	<i>idauasalis</i>
<i>Apis mellifera</i> Linnaeus				<i>idauasalis</i>

1 A-abandoned, O-organic, M-managed

2 S-scavenger, T-transient, Pa-parasite, Po-pollinator, Pr-predator