

THE PHYTOPHAGOUS INSECT FAUNA ASSOCIATED WITH  
*BACCHARIS HALIMIFOLIA* L. IN THE  
EASTERN UNITED STATES

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*Abstract.*—A survey of the phytophagous insects found on *Baccharis halimifolia* along the eastern seaboard of the United States was undertaken as part of an extensive program to find biological control agents for this plant in Australia. One hundred and seventy four phytophagous insect species were collected or were recorded in the host records of the Division of Plant Industry, Bureau of Entomology insect collection at Gainesville. Fourteen species were considered to be monophagous and potential biological control agents. Lepidoptera and endophages constituted a high proportion of this group. Fifty five general predators and 51 agricultural pests were also found on *B. halimifolia*.

*Key Words:* Biological control, survey, weed

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*Baccharis halimifolia* L. (Family Asteraceae: Tribe Astereae: Sub-Tribe Baccharinae) is a North American shrub that has become a noxious weed in Queensland, Australia (Stanley and Ross 1986). As part of its effort to control this weed, the Queensland Department of Lands initiated a program in 1960 to find suitable biological control agents from the New World where the Baccharinae are native.

*B. halimifolia* is found along the eastern seaboard of the United States from Florida to Massachusetts. It was probably introduced into Australia from Florida which has a subtropical climate most closely approximating that of southeast Queensland where *B. halimifolia* is most troublesome. The eastern seaboard was therefore selected as a very appropriate area in which to survey the insect fauna associated with this plant. From the survey it was hoped that monophagous species suitable for importation and

release into Australia could be selected for further study.

Various surveys of insect faunas on *Baccharis* have already been reported. Tilden (1951) listed 221 insects, including 55 primary herbivores, associated with the vegetative parts of *B. pilularis* DC. F. D. Bennett (unpublished) surveyed the fauna on various species of *Baccharis* in Brazil. Kraft and Denno (1982) listed the major foliage-feeding herbivores attacking *B. halimifolia* in Maryland. Palmer (1987) surveyed the insect fauna on *B. halimifolia* and the closely related *B. neglecta* Britton in Louisiana, Texas, and northern Mexico and reported 133 phytophagous species, of which 11 were considered monophagous. Boldt and Robbins (1987) surveyed *B. neglecta* in Texas and reported 91 phytophagous species.

*B. halimifolia* is a perennial, dioecious woody shrub that grows to a height of 15 feet. It produces new growth in spring, and

the quality of the foliage in terms of nitrogen content, moisture content, secondary chemicals, and toughness declines as the year progresses (Kraft and Denno 1982). It flowers in autumn, producing a prodigious quantity of seed (Panetta 1979). The phenology of this plant is described in more detail by Palmer (1987).

#### THE AREA AND METHODS OF SURVEY

The area between southern Florida and Washington, D.C. was first surveyed on two car trips of 3–4 weeks in 1962. The first trip was made in spring when the *B. halimifolia* was producing new foliage, and the second was undertaken in October when the plants were in full flower. Two to three sites, approximately 50 miles apart, were examined each day on these trips. From 1982–1987 further surveying was undertaken on visits of a few days to Miami and Gainesville, Florida; to Charleston, South Carolina; to Williamsburg, Virginia; and to Toms River, New Jersey. In 1983 a site near Gainesville was also inspected each month.

Collecting procedures were much as described by Palmer (1987). Insects were found by visual inspection and sweeping the foliage. Inflorescences were examined under the microscope. Immatures were reared through to adulthood to enable them to be accurately identified. All insects were sent to expert taxonomists (cf. acknowledgments) for their identification.

A second source of data was the collection and files of the Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services (DPI), in Gainesville. This collection maintains a catalogue of host records for all insects submitted for identification. Because the authors had no control over the collection or treatment of these data, information from this collection is clearly marked in the tables to distinguish it from our own collections.

Identified insects were classified as monophagous if restricted to *Baccharis*, oli-

gophagous if the host range was restricted to the tribe Astereae and polyphagous if having a wider host range. Evidence of host range was obtained from observations during the course of the survey, consultations with acknowledged experts, examination of host data attached to specimens in major insect collections, information in texts such as Arnett (1985), Slater and Baranowski (1978), Arnett et al. (1980), Smith and Smith (1978), Baranowski and Slater (1986), and Borror et al. (1981), and, in some instances, formal host testing.

Insects were classified as endophagous if they were found feeding on internal tissues of *Baccharis* and ectophagous if they fed externally on *Baccharis*. They were classified as pest species if mentioned as such in Arnett (1985).

Monophagous species were considered potential agents for biological control of *B. halimifolia* and their potential was rated subjectively by the authors and objectively by applying the formula of Goeden (1983). An insect can score a maximum of 79 points by this formula and is classified as effective, partially effective or ineffective if it scores >50, 20–50, or <20, respectively.

#### RESULTS

The phytophagous fauna (excluding pollen and nectar gatherers) found on *B. halimifolia* are shown in Table 1. One hundred and eight species were collected and a further 66 species were obtained from the DPI files. The Acari, Hemiptera, Homoptera, Lepidoptera, Coleoptera and Diptera were represented by 5 (3% of total species), 20 (11%), 71 (41%), 22 (13%), 43 (25%) and 13 (7%) species, respectively.

Fourteen species (8% of the total species) were considered to be monophagous. Three species were considered oligophagous, and the remainder were either polyphagous or host range unknown. Of the monophagous species, 7 (50% of the monophagous species) were Lepidoptera and 8 (57%) were endophagous for at least part of their life cycle.

Table 1. Phytophagous species collected on *B. halimifolia* along the eastern seaboard of the United States.

Species <sup>1</sup>	Location (State)	Insect-Host Relationship to <i>Baccharis</i>	Specificity <sup>2</sup>	Pest Status <sup>3</sup>
<b>Acari</b>				
<b>Eriophyidae</b>				
* <i>Aceria</i> nr. <i>baccharices</i> Kiefer	Fl	ectophagous	*?	
* <i>Tegonotus acidotus</i> (Keifer)	Fl	ectophagous	*?	
* <i>Tegonotus</i> nr. <i>baccharis</i> (Keifer)	Fl	ectophagous	*?	
<i>Tegonotus</i> undescribed sp.	Fl	ectophagous	*?	
<b>Tetranychidae</b>				
* <i>Paratetranychus</i> sp.				
<b>Hemiptera</b>				
<b>Coreiidae</b>				
<i>Acanthocephala confraterna</i> (Uhler)	Ga-Fl	ectophagous	*	
<i>Acanthocephala femorata</i> (F.)	SC-Fl	ectophagous	*	
<i>Acanthocephala terminalis</i> (Dallas)	Fl	ectophagous	*	
<i>Catorhintha guttula</i> (F.)	Fl	ectophagous	U	
* <i>Euthochtha galeator</i> (F.)	Fl	ectophagous	*	
<i>Leptoglossus phyllopus</i> L.	NC-Fl	ectophagous	*	*
<i>Merocoris typhaeus</i> Fab.	Fl	ectophagous	*	
<b>Lygaeidae</b>				
* <i>Ochrimnus lineoloides</i> Slater	Fl	ectophagous	*	
<i>Ochrimnus mumulus</i> (Stål)	Fl	ectophagous	**	
* <i>Palagonatus divergens</i> Distant	Fl			
<b>Miridae</b>				
<i>Adelphocoris rapidus</i> (Say)	NC	ectophagous	*	*
<i>Lopidea hesperus</i> (Kirkaldy)	Fl	ectophagous	*	
<i>Slaterocoris pallipes</i> (Knight)	NY-Fl	ectophagous	***	
<i>Taylorlygus pallidulus</i> (Blanchard)	Ga-Fl	ectophagous	*	
<b>Pentatomidae</b>				
* <i>Euschistus crassus</i> Dallas	Fl	ectophagous	*?	
<i>Euschistus servus</i> Say	SC-Fl	ectophagous	*	*
* <i>Loxa</i> sp.	Fl	ectophagous		
<i>Mormidea</i> sp.	Fl	ectophagous		
<b>Tingidae</b>				
<i>Corythucha baccharidis</i> Drake	Fl	ectophagous	**	
* <i>Corythucha marmorata</i> (Uhler)	Fl	ectophagous	*	*
<b>Homoptera</b>				
<b>Acanaloniidae</b>				
* <i>Acanalonia latifrons</i> Walker	Fl	ectophagous	U	
<b>Aleyrodidae</b>				
* <i>Bemesia herbicola</i> Cockerell	Fl	ectophagous	*	
* <i>Paraleyrodes naranjæ</i> Dozier	Fl	ectophagous	*	
<b>Aphididae</b>				
<i>Aphis coreopsidis</i> (Thomas)	SC-Fl	ectophagous	*	*
<i>Aphis gossypii</i> Glover	Fl	ectophagous	*	*
<i>Macrosiphum</i> sp.	Fl	ectophagous		
<i>Myzus persicae</i> (Sulzer)	Fl	ectophagous	*	*
<i>Toxoptera aurantii</i> (Fonscolombe)	Fl	ectophagous	*	*
<i>Uroleucon eupatoricolens</i> (Patch)	Fl	ectophagous	*	
<i>Uroleucon gravicornis</i> (Patch)	Fl	ectophagous	**	
<b>Cercopidae</b>				
* <i>Aphrophora</i> sp.	Fl	ectophagous		
<i>Clastoptera obtusa</i> Say	Fl	ectophagous	*	
<i>Clastoptera xanthocephala</i> Germar	NJ	ectophagous	*	

Table 1. Continued.

Species <sup>1</sup>	Location (State)	Insect-Host Relationship to <i>Baccharis</i>	Specificity <sup>2</sup>	Pest Status <sup>3</sup>
<b>Cicadellidae</b>				
* <i>Empoasca kraemeri</i> Ross & Moore	Fl	ectophagous	*	*
* <i>Empoasca</i> sp.	Fl	ectophagous		
* <i>Graminella nigrifrons</i> (Forbes)	Fl	ectophagous	*	*
* <i>Graphocephala coccinea</i> (Forster)	Fl	ectophagous	*	
* <i>Graphocephala versuta</i> (Say)	Fl	ectophagous	*	
<i>Gyponana</i> sp.	Fl	ectophagous		
* <i>Paraphlepsius</i> sp.	Fl	ectophagous		
* <i>Penthimia</i> nr. <i>americana</i> Fitch	Fl	ectophagous	*	
* <i>Ponana</i> sp.	Fl	ectophagous		
<i>Oncometopia nigrifrons</i> (Walker)	Fl	ectophagous	*	
* <i>Scaphytopius</i> sp.	Fl	ectophagous		
<b>Cixiidae</b>				
* <i>Bothriocera</i> sp.	Fl	ectophagous		
* <i>Myndus crudus</i> Van Duzee	Fl	ectophagous	*	*
<i>Myndus pallidus</i> Caldwell	Fl	ectophagous	*	
<i>Oharus</i> sp.	NJ	ectophagous		
<b>Coccidae</b>				
<i>Ceroplastes ceriferus</i> (F.)	Fl	ectophagous	*	*
* <i>Ceroplastes cirripediformis</i> Comstock	Fl	ectophagous	*	*
* <i>Ceroplastes floridensis</i> Comstock	Fl	ectophagous	*	*
<i>Coccus hesperidum</i> L.	Fl	ectophagous	*	*
* <i>Coccus longulus</i> (Douglas)	Fl	ectophagous	*	
<i>Coccus viridis</i> (Green)	Fl	ectophagous	*	*
* <i>Eucalymnatus tessellatus</i> (Signoret)	Fl	ectophagous	*	*
<i>Kilifia acuminata</i> (Signoret)	Fl	ectophagous	*	*
<i>Kilifia elongatus</i> (Signoret)	Fl	ectophagous	*?	
* <i>Parasaissetia nigra</i> (Nietner)	Fl	ectophagous	*	*
<i>Protospulvinaria pyriformis</i> (Cockerell)	Fl	ectophagous	*	*
* <i>Pulvinaria innumerabilis</i> (Rathvon)	Fl	ectophagous	*	*
<i>Pulvinaria psidii</i> Maskell	Fl	ectophagous	*	*
<i>Pulvinaria urbicola</i> Cockerell	Fl	ectophagous	*	*
<i>Saissetia coffeae</i> (Walker)	Fl	ectophagous	*	*
* <i>Saissetia miranda</i> (Cockerell & Parrott)	Fl	ectophagous	*	*
<i>Saissetia neglecta</i> DeLotto	Fl	ectophagous	*	*
<i>Saissetia oleae</i> (Olivier)	Fl	ectophagous	*	*
<b>Delphacidae</b>				
<i>Stobaera pallida</i> Osborn	NJ-Fl	ectophagous	***	
<b>Diaspididae</b>				
<i>Abgrallaspis cyanophylli</i> (Signoret)	Fl	ectophagous	*	*
<i>Aonidomytilus solidaginis</i> (Hoke)	Fl	ectophagous	*	
<i>Hemiberlesia lataniae</i> (Signoret)	Fl	ectophagous	*	*
<i>Melanaspis simulacris</i> (Comstock)	Fl	ectophagous	*	
* <i>Pinnaspis strachani</i> (Cooley)	Fl	ectophagous	*	*
* <i>Pseudaonidia trilobitiformis</i> (Green)	Fl	ectophagous	*	*
<i>Rhizaspidotus dearnessi</i> (Cockerell)	Ga	ectophagous	*	*
* <i>Velataspis dentata</i> (Hoke)	Fl	ectophagous	*	*
<b>Flatidae</b>				
<i>Anormenis septentrionalis</i> (Spinola)	Fl	ectophagous	*	*
<i>Cyarta melichari</i> Van Duzee	Fl	ectophagous	*	*
<b>Fulgoridae</b>				
<i>Cyrpoptus reineckei</i> Van Duzee	SC	ectophagous	*	
<i>Poblicia fuliginosa</i> Olivier	Ga	ectophagous	*	

Table 1. Continued.

Species <sup>1</sup>	Location (State)	Insect-Host Relationship to <i>Baccharis</i>	Specificity <sup>2</sup>	Pest Status <sup>3</sup>
<b>Membracidae</b>				
* <i>Acutalis tartaren nigrinervis</i> Fowler	Fl	ectophagous	*	
<i>Acutalis tartaren semicrema</i> (Say)	Fl	ectophagous	*	
* <i>Campylenchia latipes</i> (Say)	Fl	ectophagous	*	
* <i>Micrutalis</i> sp.	Fl	ectophagous		
* <i>Spissistilus festinus</i> (Say)	Fl	ectophagous	*	
<i>Umbonia crassicornis</i> (A. and S.)	Fl	ectophagous	*	
<i>Vanduzeeea arquata</i> Say	Fl	ectophagous	*	
<b>Ortheziidae</b>				
<i>Orthezia insignis</i> Brown	Fl	ectophagous	*	*
<b>Pseudococcidae</b>				
<i>Dysmicoccus</i> sp.	Fl	ectophagous		
* <i>Dysmicoccus hispinosis</i> Beardsley	Fl	ectophagous	U	
* <i>Planococcus citri</i> (Risso)	Fl	ectophagous	*	*
<i>Pseudococcus sorghiellus</i> Forbes	Ga-Fl	ectophagous	*	
<b>Lepidoptera</b>				
<b>Arctiidae</b>				
* <i>Estigmene acrea</i> (Drury)	Fl	ectophagous	*	
<b>Cochyliidae</b>				
<i>Loria baccharivora</i> Pogue	SC-Fl	ectophagous	***	
<b>Coleophoridae</b>				
<i>Coleophora</i> sp.	Va-Fl	ectophagous		
<b>Cossidae</b>				
<i>Prionoxystus piger</i> (Grote)	Fl	endophagous	***	
<i>Prionoxystus robiniae</i> (Peck)	Fl	endophagous	*	*
<b>Gelechiidae</b>				
<i>Aristotelia ivae</i> Busck	SC-Fl	ectophagous	***	
<i>Dichomeris serrativittella</i> Zeller	Fl	ectophagous	U	
<i>Gnorimoschema</i> sp.	Fl	endophagous		
<b>Geometridae</b>				
<i>Anacamptodes defectaria</i> (Guenée)	NC	ectophagous	*	
* <i>Anavitrinella pampinaria</i> (Guenée)	Fl	ectophagous	*	*
* <i>Eusarca fundaria</i> (Guenée)	Fl	ectophagous	U	
<i>Itame varadaria</i> (Walker)	SC-Fl	ectophagous	***	
<b>Lyonetiidae</b>				
<i>Bucculatrix ivella</i> Busck	NJ-Fl	endo and ecto	***	
<b>Noctuidae</b>				
<i>Spodoptera ornithogalli</i> (Guenée)	Fl	ectophagous	*	*
<i>Spragueia onagrus</i> (Guenée)	Fl		U	
<b>Psychidae</b>				
* <i>Cryptothelia</i> sp.	Fl			
<b>Pyralidae</b>				
<i>Glyphodes floridalis</i> (Fernald)	Fl	ectophagous	U	
<b>Pterophoridae</b>				
<i>Oidaematophorus balanotes</i> (Meyrick)	NJ-Fl	endophagous	***	
<b>Tortricidae</b>				
<i>Choristoneura parallela</i> (Robinson)	NC	ectophagous	*	*
<i>Epiblema discretivana</i> (Heinrich)	SC-Fl	endophagous	***	
<i>Epiblema</i> nr. <i>scudderiana</i> (Clemens)	NC-Fl	endophagous	*	
<i>Sparganothis sulfureana</i> (Clemens)	Fl	ectophagous	*	
<b>Anthribidae</b>				
* <i>Toxotropis floridanus</i> Leng	Fl	ectophagous	*	

Table 1. Continued.

Species <sup>1</sup>	Location (State)	Insect-Host Relationship to <i>Baccharis</i>	Specificity <sup>2</sup>	Pest Status <sup>3</sup>
Buprestidae				
* <i>Chrysobothris chrysoela</i> (Illiger)	Fl	endophagous	*	
<i>Chrysobothris femorata</i> (Olivier)	Fl	endophagous	*	*
Cerambycidae				
<i>Amniscus perplexus</i> (Haldeman)	Ga-Fl	endophagous	***	*
* <i>Ancylocera bicolor</i> (Olivier)	Fl		*	
* <i>Anelaphus inermis</i> (Newman)	Fl		*	
* <i>Leptura</i> sp.	Fl			
<i>Sternidius rusticus</i> (LeConte)	NJ		U	
<i>Typocerus zebra</i> Olivier	SC		U	
Chrysomelidae				
* <i>Altica ludoviciana</i> Fall	Fl	ectophagous	*	
<i>Anomoea latclavia</i> (Forster)	SC	ectophagous	*?	
* <i>Bassareus brumpeus</i> Olivier	Fl		U	
* <i>Chlamisus</i> sp.	Fl			
* <i>Chrysomela scripta</i> F.	Fl		U	
<i>Colaspis recurva</i> Blake	Va		U	
<i>Cryptocephalus pumilus</i> Haldeman	SC-Fl	ectophagous	*	
<i>Diabrotica balteata</i> LeConte	Fl	ectophagous	*	*
<i>Diabrotica undecimpunctata howardii</i> Barber	Ga-Fl	ectophagous	*	*
<i>Diachus auratus</i> (F.)	SC	ectophagous	*	
* <i>Disonychia conjugata</i> F.	Fl	ectophagous	*	
* <i>Exema gibba</i> F.	Fl	ectophagous	U	
<i>Exema neglecta</i> Blatchley	SC-Fl	ectophagous	*	
* <i>Pachybrachys</i> sp.	Fl	ectophagous		
<i>Paria aterrima</i> Olivier	SC-Fl	ectophagous	U	
* <i>Triachus cernuus</i> LeConte	Fl	ectophagous	U	
<i>Trirhabda bacharidis</i> (Weber)	NJ-Fl	ectophagous	***	
Curculionidae				
<i>Apion metallicum</i> Germar	Fl	ectophagous	*	*
<i>Apion</i> sp.	Fl	ectophagous		
<i>Artipus floridanus</i> Horn	Fl	ectophagous	*	*
* <i>Baris</i> sp.	Fl			
* <i>Centrinaspis albotectus</i> Casey	Fl		*	
* <i>Chalcodermus aeneus</i> Bohemann	Fl		*	*
<i>Curculio</i> sp.	Fl			
* <i>Diaprepes abbreviatus</i> (L.)	Fl		*	*
<i>Epicaerus formidolosus</i> Boheman	Fl	ectophagous	*	
* <i>Nicentrus grossulus</i> Casey	Fl		*	
<i>Notolomus basalis</i> LeConte	Fl	ectophagous	*	
<i>Pachnaeus opalus</i> (Olivier)	Fl	ectophagous	*	
<i>Rhodoaenus tredecimpunctatus</i> (Illiger)	Fl	ectophagous	*	
<i>Sitophilus oryzae</i> L.	Fl	ectophagous	*	*
<i>Tanymecus lacaena</i> (Herbst)	Fl	ectophagous	*	
Scarabaeidae				
* <i>Pachystethus marginatus</i> F.	Fl		*	
<i>Popillia japonica</i> Newman	Va	ectophagous	*	*
Diptera				
Agromyzidae				
* <i>Amauromyza maculosa</i> (Malloch)	Fl	endophagous	*	
* <i>Liriomyza trifolii</i> (Burgess)	Fl	endophagous	*	
<i>Melanagromyza</i> sp.	Fl	endophagous		

Table 1. Continued.

Species <sup>1</sup>	Location (State)	Insect-Host Relationship to <i>Baccharis</i>	Specificity <sup>2</sup>	Pest Status <sup>3</sup>
<i>Nemorimyza posticata</i> (Meigen)	SC-FI	endophagous	*	
<i>Phytobia</i> sp.	SC-FI	endophagous		
Cecidomyiidae				
<i>Contarinia</i> nr. <i>perfoliata</i>	Md	ectophagous	U	
<i>Dasineuria</i> undescribed sp.	Md	ectophagous		
<i>Neolasioptera baccharicola</i> Gagné	Va	endophagous	***	
<i>Neolasioptera lathamii</i> Gagné	NJ-FI	endophagous	***	
<i>Neolasioptera</i> undescribed sp.	Md	ectophagous		
<i>Prodiplosis</i> undescribed sp.	Md	ectophagous		
Tephritidae				
<i>Paroxyma</i> sp.	Ga	ectophagous		
<i>Tephritis subpura</i> (Johnson)	NC-FI	endophagous	***	

<sup>1</sup> \* = Record from DPI collection card file.

<sup>2</sup> \*\*\* = Monophagous (host-plants apparently restricted to the genus *Baccharis*); \*\* = oligophagous (host-plants apparently restricted to the tribe Astereae); \* = polyphagous (having a wider host range than above two categories); \*? = specificity unknown but very likely polyphagous; U = specificity unknown.

<sup>3</sup> \* = Pest species.

Conversely, 8 of 18 (44%) endophagous species were monophagous.

Only 2 of the monophagous species, *P. piger* and *N. baccharicola*, had a limited geographic distribution. The other 12 species were found in at least 2 states and 6 species were found throughout the survey area. Ten of the 14 species (72%) were found west of the Mississippi River by Palmer (1987). By contrast only 27 of the total number of species (16%) were common to this survey and that of Palmer (1987).

Nearly one third of the phytophagous species (51 species) were pests of agricultural or ornamental plants. These included well known pests such as the brown stinkbug, *Euchistus servus* (Say); the green peach aphid, *Myzus persicae* (Sulzer); the black citrus aphid, *Toxoptera aurantii* (Fonsecolombe); the green scale, *Coccus viridis* (Green); the green shield scale, *Pulvinaria psidii* Maskell; the carpenterworm, *Prionoxystus robiniae* (Peck), the yellow-striped armyworm, *Spodoptera ornithogalli* (Gueneé); and the southern corn rootworm, *Diatraea undecimpunctata howardi* Barber.

Non-phytophagous insects such as pollinators, predators, parasitoids, nectar gatherers, and casual associates that were collected or reared during the survey are listed

in Table 2. This list includes 55 predatory species.

#### NOTES ON THE MORE IMPORTANT SPECIES

The phenologies of *Trirhabda bacharidis* Weber, *Ammiscus perplexus* (Haldeman), *Oidaematophorus balanotes* (Meyrick), *Bucculatrix ivella* Busek, *Aristotelia ivae* Busek, *Epiblema discretivana* (Heinrich), *Neolasioptera lathamii* Gagné, *Tephritis subpura* (Johnson), *Ochrimmus minutus* (Stål), and *Stobaera pallida* Osborn were described by Palmer (1987). These species were all commonly encountered along the eastern seaboard. In Florida, however, the phenologies of *T. bacharidis* and *O. balanotes* were different from the previous description (Palmer 1987). Here larvae of *T. bacharidis* were commonly found in the autumn and early spring, suggesting a partial second generation or some populations being asynchronous. Similarly, *O. balanotes* was not discretely univoltine in Florida. A survey in February revealed a range of immature stages from early instars to pupae.

The black mirid, *Slaterocoris pallipes* (Knight), was abundant. It occurs further south, however, than Wheeler (1981) described with the southern limit of its range at Gainesville, Florida.

Table 2. Parasitoids, predators, and incidental visitors recorded, reared or collected on *B. halimifolia* during the course of the survey.

Species <sup>1</sup>	Habit
<b>Acari</b>	
Bdellidae	
* <i>Bdellodes longirostris</i> (Hermann)	general predator
Phytoseiidae	
* <i>Typhlodromalus peregrinus</i> (Muma)	general predator
Passalozetidae	
* <i>Passalozetes</i> sp.	incidental
Tydeidae	
* <i>Lorryia formosa</i> Cooreman	general predator
* <i>Tydeus</i> nr. <i>munsteri</i> Meyer and Ryke	general predator
<b>Araneae</b>	
Anyphaenidae	
* <i>Ayscha</i> sp.	general predator
Araneidae	
* <i>Araneus mimiatus</i> (Walckenaer)	general predator
* <i>Argiope</i> sp.	general predator
* <i>Conepeira mineatus</i> (Walckenaer)	general predator
* <i>Neoscona</i> sp.	general predator
Clubionidae	
* <i>Clubiona maritima</i> L. Koch	general predator
* <i>Trachelas volutus</i> Gertsch	general predator
Salticidae	
* <i>Hentzia ambigua</i> (Walckenaer)	general predator
* <i>Hentzia nutrata</i> Hentz	general predator
Theridiidae	
* <i>Anelosimus studiosus</i> (Hentz)	general predator
* <i>Anelosimus textrix</i> (Walckenaer)	general predator
* <i>Theridion flavonotatum</i> (Becker)	general predator
Thomisidae	
* <i>Misumenops oblongus</i> (Keyserling)	general predator
<b>Thysanoptera</b>	
* <i>Diceratothrips</i> sp.	general predator
* <i>Leptotherips mali</i> (Fitch)	general predator
<b>Hemiptera</b>	
Anthocoridae	
* <i>Orius insidiosus</i> (Say)	general predator
Nabidae	
* <i>Nabis capsiformis</i> Germar	general predator
Pentatomidae	
* <i>Euthyrhynchus floridanus</i> (L.)	general predator
* <i>Podisus maculiventris</i> (Say)	general predator
* <i>Stiretrus anchorago</i> (F.)	general predator
Phymatidae	
* <i>Phymata fasciata fasciata</i> (Gray)	general predator
* <i>Phymata fasciata mystica</i> Evans	general predator
Reduviidae	
* <i>Apiomerus spissipes</i> (Say)	general predator
* <i>Pselliopus cinctus</i> F.	general predator
* <i>Zelus longipes</i> (L.)	general predator
* <i>Zelus cervicalis</i> Stål	general predator
* <i>Zelus longipes</i> (L.)	general predator



Table 2. Continued.

Species <sup>1</sup>	Habit
Neuroptera	
Chrysopidae	
<i>Chrysopa</i> spp.	aphid predators
Lepidoptera	
Phycitidae	
<i>Lactilea coccidivora</i> Comstock	coccid predator
Coleoptera	
Cantharidae	
<i>Cantharis</i> sp.	pollen feeder
<i>Chauliognathus marginatus</i> (F.)	pollen feeder
<i>Discodon</i> sp.	pollen feeder
Coccinellidae	
<i>Adalia bipunctata</i> (L.)	aphid predator
* <i>Azya orbigera</i> Mulsant	soft scale predator
<i>Coleomegilla maculata</i> (DeGeer)	aphid predator
* <i>Cryptolaemus montrouzeiri</i> Mulsant	mealybug predator
<i>Cycloneda sanguinea</i> (L.)	aphid predator
<i>Exochomus childreni</i> Mulsant	soft scale predator
<i>Hippodamia convergens</i> Guerin	aphid predator
<i>Hyperaspis signata</i> Olivier	soft scale predator
* <i>Microweisea</i> sp.	diaspine scale predator
<i>Olla v-nigrum</i> (Mulsant)	aphid predator
<i>Scymnus creperus</i> Mulsant	aphid predator
<i>Scymnus fraterius</i> LeConte	aphid predator
Elateridae	
<i>Ampedus luteolus</i> (LeConte)	incidental
* <i>Melanotus communis</i> (Gyllenhal)	incidental
Scarabaeidae	
<i>Trigonopeltastes delta</i> (Forster)	incidental
Diptera	
Asilidae	
<i>Asilus</i> sp.	general predator
* <i>Ommatius tibialis</i> Say	general predator
Bibionidae	
<i>Plecia nearctica</i> Hardy	incidental
Chamaemyiidae	
<i>Leucopis americana</i> Malloch	aphid predator
Micropezidae	
* <i>Taeniaptera trivatta</i> Macquart	incidental
Outidae	
* <i>Euxesta notata</i> (Wiedemann)	incidental
Platystomatidae	
<i>Rivellia steyskali</i> Namba	incidental
Sciomyzidae	
<i>Dictya</i> sp.	incidental
Syrphidae	
<i>Pseudodoros clavatus</i> (F.)	aphid predator
Tabanidae	
* <i>Chrysops flavidus</i> Wiedemann	incidental
<i>Tabanus imitans</i> Stone	incidental
Tachinidae	
<i>Lixophaga</i> sp.	incidental

Table 2. Continued.

Species	Habit
<b>Hymenoptera</b>	
<b>Aphelinidae</b>	
<i>Centrodora cereopiphagus</i> (Milliron)	egg parasite of <i>Clastoptera</i>
<i>Coccophagus</i> sp. 1	parasite of <i>Coccus hesperidum</i>
<i>Coccophagus</i> sp. 2	parasite of <i>Pulvinaria urbicola</i>
<b>Aphiidae</b>	
* <i>Diaeretiella</i> sp.	aphid parasite
<i>Lysiphlebus testaceipes</i> (Cresson)	aphid parasite
<b>Bethylidae</b>	
<i>Parisarola</i> sp.	parasite of <i>Epiblema discretivana</i>
<b>Braconidae</b>	
<i>Apanteles</i> undescribed sp.	parasite of <i>Bucculatrix ivella</i>
<i>Apanteles epinotiae</i> Viereck	parasite of Lepidoptera defoliator
<i>Apanteles forbesi</i> Viereck	parasite of Lepidoptera defoliator
<i>Agathis texana</i> Cresson	parasite of Lepidoptera
<i>Bucculatrixplex</i> sp.	parasite of <i>Bucculatrix ivella</i>
<i>Chelona</i> sp.	parasite of <i>Oidaematophorus balanotes</i>
<i>Chelonus (Microchelonus)</i> sp.	parasite of <i>Oidaematophorus balanotes</i>
<i>Macrocentrus cerasivoranae</i> Viereck	parasite of <i>Oidaematophorus balanotes</i>
<i>Macrocentrus delicatus</i> Cresson	parasite of Lepidoptera defoliator
<i>Macrocentrus pallister</i> Degant	
<i>Microgaster mediata</i> Cresson	
<i>Mirax texana</i> Muesebeck	parasite of <i>Bucculatrix ivella</i>
<i>Opus</i> undescribed sp.	parasite of agromyzid
<i>Opus</i> undescribed sp.	parasite of agromyzid
<b>Ceraphronidae</b>	
<i>Lygocerus</i> sp.	parasite of <i>Bucculatrix ivella</i>
<b>Chalcididae</b>	
<i>Spilochalcis sanguineiventris</i> (Cresson)	parasite of <i>Exema neglecta</i>
<b>Cynipidae</b>	
<i>Gonaspis potentillae</i> Bass	
<b>Eupelmidae</b>	
* <i>Anastatus</i> sp.	
<i>Eupelmus</i> sp.	parasite of <i>Exema neglecta</i>
<i>Eupelmus</i> sp.	parasite of agromyzid
<i>Eupelmus</i> sp.	parasite of <i>Epiblema discretivana</i>
<i>Eupelmus</i> sp.	parasite of <i>Tephritis subpura</i>
<i>Eupelmus</i> sp.	parasite of <i>Neolasiptera lathamii</i>
<b>Eulophidae</b>	
<i>Achrysocharella</i> sp.	parasite of agromyzid
<i>Chrysocharis parksi</i> Crawford	parasite of agromyzid
<i>Cirrospilus giraulti</i> Peck	parasite of <i>Bucculatrix ivella</i>
<i>Derostenus</i> sp.	parasite of agromyzid
<i>Tetrastichus minutus</i> (Howard)	parasite of <i>Coleomegilla maculata</i>
<b>Eurytomidae</b>	
<i>Eudecatoma quercilanae</i> (Fitch)	
<i>Eurytoma</i> sp.	
<b>Formicidae</b>	
* <i>Crematogaster ashmeadi</i> Mayr	
* <i>Crematogaster atkinsoni</i> Wheeler	
* <i>Dolichocerus pustulatus</i> Mayr	
* <i>Dorymyrmex pyramicus</i> (Rogor)	incidental
* <i>Hypoclinea mariae</i> Forel	general predator

Table 2. Continued.

Species <sup>1</sup>	Habit
* <i>Monomorium floricola</i> (Jerdon)	
* <i>Pseudomyrma brunnea</i> F. Smith	general predator
* <i>Pseudomyrma pallida</i> F. Smith	general predator
* <i>Wasmannia auropunctata</i> (Rogor)	
Ichneumonidae	
<i>Brachycyrtus pretiosus</i> Cushman	parasite of <i>Chrysopa</i>
<i>Eiphosoma mexicana</i> Cresson	
<i>Labena grillator</i> Say	parasite of <i>Amniscus perplexus</i>
<i>Temelucha</i> sp.	parasite of <i>Oidaematophorus balanotes</i>
<i>Trogomorpha trogiformis</i> (Cresson)	
Mutillidae	
<i>Dasymutilla cypris</i> Bl.	general predator
Platygasteridae	
<i>Platygaster baccharicola</i> (Ashmead)	parasite of <i>Neolasioptera lathamii</i>
<i>Trichasis</i> sp.	parasite of <i>Neolasioptera lathamii</i>
Pteromalidae	
<i>Heteroschema</i> sp.	parasite of <i>Exema neglecta</i>
Sphecidae	
<i>Scelphron caementarium</i> Dru.	general predator
Vespidae	
<i>Polistes annularis</i> L.	general predator

<sup>1</sup>\* = Record from DPI collection card file.

The cossid, *Prionoxystus piger* (Grote), caused considerable damage to the shrubs by its stem-boring activity. This was a univoltine species, with moth activity in spring and larvae present in the stems throughout the year. It was found only in a very limited, frost-free area to the south of Miami, suggesting that it may be a tropical, immigrant species from the Caribbean Islands. It has been previously reported from Cuba (Grote 1865).

The cochylid, *Lorita baccharivora* Pogue, is a multivoltine species that was commonly encountered from South Carolina to Florida. Larvae tied terminal and surrounding leaves together with silken threads to form tubes in which they lived. This action caused growth to be arrested, and the growing points to die, as reported by Diatloff and Palmer (1988, in press).

The case-bearing chrysomelid *Exema neglecta* Blatchley, was also commonly encountered from South Carolina to Florida. Both larvae and adults fed on the plant.

#### PROSPECTS FOR BIOLOGICAL CONTROL

*Trirhabda bacharidis* (W. Haseler, unpublished), *Oidaematophorus balanotes* (W. Haseler, unpublished), *Aristotelia ivae* (Diatloff and Palmer 1988, in press), *Bucculatrix ivella* (Palmer and Diatloff 1987), *Lorita baccharivora* (Diatloff and Palmer 1988, in press), *Neolasioptera lathamii* (Diatloff and Palmer 1987), *Amniscus perplexus* (Palmer, unpublished), *Slaterocoris pallipes* (Palmer, unpublished), *Stobaera pallida* (Palmer, unpublished), and *Itame varadaria* (Palmer, unpublished) have been proven host specific and have been introduced into Australia. *Trirhabda bacharidis* and *A. ivae* have been established in the field in Queensland but they have not contributed to effective control except in localized areas. *Oidaematophorus balanotes* and *L. baccharivora* are at present being released and establishment is anticipated. *Bucculatrix ivella*, *A. perplexus*, and *I. varadaria* are undergoing final testing in Australia prior to their release. *Neolasioptera lathamii*, *S.*

*pallida*, and *S. pallipes* have not yet been successfully cultured in the Australian quarantine facilities. The remaining monophagous species will be further tested for host specificity in the future.

The monophagous species were rated by the formula of Goeden (1983) and also subjectively by the authors, based on their North American experience with the insects (Table 3). The two methods of assessment were not in close agreement, although both indicated a number of promising species. *Ammiscus perplexus*, *B. ivella*, *T. bacharidis*, and *O. balanotes* were given good scores by both methods. All 14 species received a score of >20 by the Goeden formula indicating that they might be at least partially effective agents and worthy of further study.

#### DISCUSSION

In order to find all the insects on the plant, we found it essential to use both sweeping and visual inspection. *Baccharis halimifolia* is a tall bush growing well above surrounding grasses and herbs and therefore can be swept with little risk that the sample will be contaminated with arthropods from other plants. Sweeping proved to be the best method for capturing small active species and caterpillars present in low numbers. On the other hand, it was essential to inspect the plants visually in order to collect endophages and tightly adhering insects such as coccids.

Despite differences in sampling procedures and time allocated for survey, the size of the insect fauna is similar to that found on *B. pilularis* (Tilden 1951) and on *B. halimifolia* and *B. neglecta* west of the Mississippi by Palmer (1987). However, in one respect, this survey differed from the others: a much larger number of species of scale insects was taken, all in Florida. This may be due in part to Florida's subtropical climate and proximity to the Caribbean Islands from which many tropical species have become established.

The survey emphasized the importance

Table 3. The potential effectiveness for biological control of the monophagous species as predicted by the formula of Goeden (1983) and by the authors' subjective assessment (with a poor candidate scoring 1 and a superior prospect scoring 5).

Species	Goeden's Formula	Authors' Assessment
<i>Ammiscus perplexus</i>	47	5
<i>Bucculatrix ivella</i>	45	5
<i>Prionoxystus piger</i>	37	5
<i>Trirhabda bacharidis</i>	45	5
<i>Oidaematophorus balanotes</i>	53	4
<i>Aristotelia ivae</i>	49	3
<i>Lorita baccharivora</i>	51	3
<i>Neolasioptera lathamii</i>	47	3
<i>Tephritis subpura</i>	40	3
<i>Itame varadaria</i>	44	2
<i>Slaterocoris pallipes</i>	30	2
<i>Stobaera pallida</i>	41	2
<i>Epiblema discretivana</i>	36	1
<i>Neolasioptera baccharicola</i>	37	1

of searching for endophages, as a very high proportion of these were monophagous as indicated also by Palmer (1987). Not only is there a high probability that an endophage will be monophagous, but their endophagous habit may protect them from many general predators and parasites in the country of release.

The survey also indicated that *B. halimifolia* harbours a rich insect fauna occupying a diverse range of niches. As *B. halimifolia* is a common plant along the eastern seaboard, it may be ecologically important to its habitat and to nearby human agricultural endeavours. This is suggested by the number of species of general predators associated with it and by the number of agricultural pests that either feed or seek shelter on it. It may therefore play an important role as an alternate host for these insects.

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#### LITERATURE CITED

- Arnett, R. H., Jr. 1985. American Insects: A Handbook of the Insects of America North of Mexico. Van Nostrand Reinhold Co., New York. 850 pp.
- Arnett, R. H., Jr., N. M. Downie, and H. E. Jacques. 1980. How to Know the Beetles. W. C. Brown Co., Dubuque, Ia. 417 pp.
- Baranowski, R. M. and J. A. Slater. 1986. Coreidae of Florida (Hemiptera: Heteroptera). Fla. Dept. Agr., Div. Plant Ind., Arthropods of Florida and neighboring land areas 12. 82 pp.
- Boldt, P. E. and T. O. Robbins. 1987. Phytophagous and pollinating insect fauna of *Baccharis neglecta* (Compositae) in Texas. *Envir. Entomol.* 16: 887-895.
- Borror, D. J., D. M. De Long, and C. A. Triplehorn. 1981. An Introduction to the Study of Insects. 5th edition. Saunders College Publishing, Philadelphia., Pa. 827 pp.
- Diatloff, G. and W. A. Palmer. 1987. The host specificity of *Neolasioptera lathamii* Gagné (Diptera: Cecidomyiidae) with notes on its biology and phenology. *Proc. Entomol. Soc. Wash.* 89: 122-125.
- . 1988. The host specificity and biology of *Arizotelia ivae* (Gelechiidae) and *Lorita baccharivora* Pogue: Two microlepidoptera selected as biological control agents for *Baccharis halimifolia* in Australia. *Proc. Entomol. Soc. Wash.* (In press.)
- Goeden, R. D. 1983. Critique and revision of Harris' scoring system for selection of insect agents in biocontrol of weeds. *Prot. Ecol.* 5: 287-301.
- Grote, A. R. 1865. Notes on the Bombycidae of Cuba. *Proc. Entomol. Soc. Philadelphia* 5: 227-255.
- Kraft, S. K. and R. F. Denno. 1982. Feeding responses of adapted and non-adapted insects to the defensive properties of *Baccharis halimifolia* L. (Compositae). *Oecol.* 52: 156-163.
- Palmer, W. A. 1987. The phytophagous insect fauna associated with *Baccharis halimifolia* L. and *B. neglecta* Britton in Texas, Louisiana and northern Mexico. *Proc. Entomol. Soc. Wash.* 89: 185-199.
- Palmer, W. A. and G. Diatloff. 1987. Host specificity and biology of *Bucculatrix ivella* Busck, a potential biological control agent for *Baccharis halimifolia* in Australia. *J. Lepid. Soc.* 41: 23-28.
- Panetta, F. D. 1979. The effects of vegetation development upon achene production in the woody weed, groundsel bush (*Baccharis halimifolia* L.). *Aust. J. Agric. Res.* 30: 1053-1065.
- Slater, J. A. and R. M. Baranowski. 1978. How to Know the True Bugs. W. C. Brown Co., Dubuque, Ia. 256 pp.
- Smith, C. F. and C. S. Smith. 1978. An annotated list of Aphididae (Homoptera) of North America. North Carolina Agr. Expt. Stn. Tech. Bull. 255. 28 pp.
- Stanley, T. D. and E. M. Ross. 1986. Flora of South-eastern Queensland. Vol. 2. Queensland Department of Primary Industries, Brisbane. Misc. Pub. QM84007. 623 pp.
- Tilden, J. W. 1951. The insect associates of *Baccharis pilularis* De Candolle. *Microentomology* 16: 149-188.
- Wheeler, A. G. 1981. The distribution and seasonal history of *Slaterocoris pallipes* (Knight) (Hemiptera: Miridae). *Proc. Entomol. Soc. Wash.* 83: 520-523.