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PHYTOPHAGOUS INSECTS ASSOCIATED WITH *BACCHARIS CONFERTA* KUNTH AND *B. DIOICA* VAHL (ASTERACEAE: ASTEREAE) IN MEXICO

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Abstract.—Surveys of the phytophagous insect faunas on *Baccharis conferta* and *B. dioica* were undertaken in Mexico as part of a program to find biological control agents for *B. halimifolia*, a serious weed in Australia. Fifty-three species were found on *B. conferta* but only eleven species on *B. dioica*. No species, from either plant, was considered a potentially valuable biological control agent for *B. halimifolia*.

Key Words: surveys, biological control, *Baccharis*

The woody shrub *Baccharis halimifolia* L. (Asteraceae: Astereae: Baccharidinae) is a declared noxious weed in Queensland, Australia, where it invades cattle pastures, reforested areas, and disturbed sites (Kleinschmidt and Johnson 1977, Stanley and Ross 1986). Native to the eastern seaboard of the United States (Stanley and Ross 1986), it is thought to have been introduced into Australia in the latter part of the 19th century (Bailey 1900). A biological control program has been supported by the Queensland Department of Lands since 1960 as part of efforts to control this weed.

The New World (and predominantly South American) genus *Baccharis* is extremely large, with 450–500 species divided into a number of sections (Cuatrecasas 1967). More recently, Nesom (1990a) placed the 43 species native to North or Central America in six sections and placed *B. halimifolia* in the section *Baccharis* with 13 other species.

Host specificity work at the North American Field Station over the past decade has indicated that most of the narrowly stenophagous insects found on *B. halimifolia* accept other species from the section *Baccharis* as hosts in the laboratory (Palmer and Diatloff 1987, Palmer 1989, 1993a, Palmer and Tomley 1993). Similarly, insects from these other species can attack *B. halimifolia* (Palmer and Tilden 1988, Palmer et al. 1993). Therefore any species placed in the section *Baccharis* is a potential source of biological control agents for *B. halimifolia*.

This paper describes the insect fauna found in Mexico on two such species, *B. conferta* Kunth and *B. dioica* Vahl which were surveyed in an attempt to find more biological control agents for *B. halimifolia*.

THE HOST PLANTS AND THEIR DISTRIBUTION

Baccharis conferta is an erect shrub, up to 2 m in height, that resembles *B. pilularis* DC subspecies *consanguinia* in gross morphology. It occurs throughout central Mexico (Nesom 1990b) at altitudes greater than 2000 m.

Baccharis dioica, also an erect shrub, grows to about 3 m in height. It very closely resembles *B. halimifolia* except that the leaves are not dentate. It occurs on the Yu-

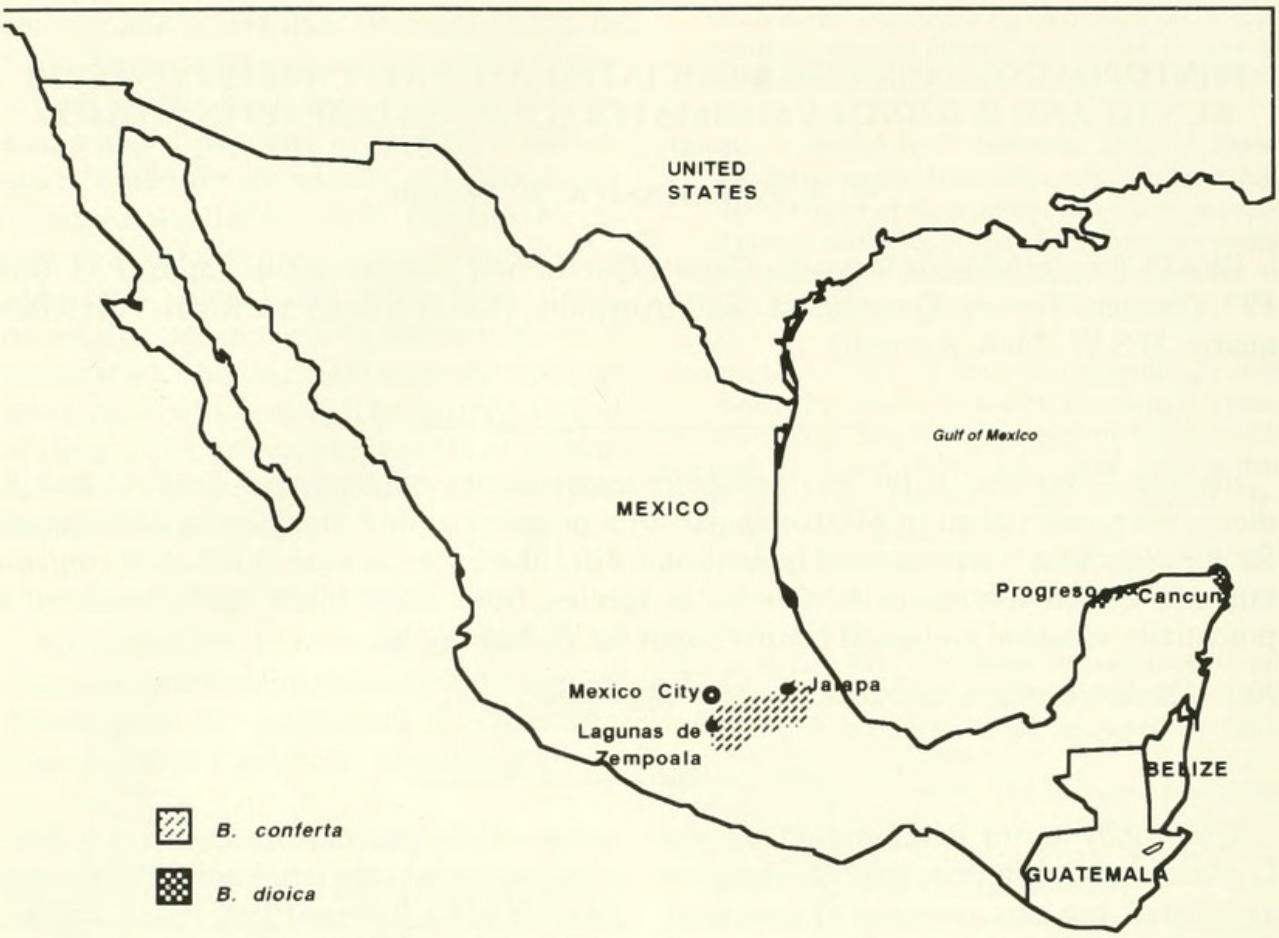

Fig. 1. The areas of search for insects associated with *B. conferta* and *B. dioica* in Mexico.

catán peninsula of Mexico (Nesom 1990b) and in southern Florida (Long and Lakela 1971). This distribution suggests that this species may have originated elsewhere, possibly in the Carribean islands such as Cuba and Hispaniola where it is common (Britton and Millspaugh 1920).

Materials and Methods

The geographic areas searched in relation to both plants are shown in Fig. 1. *Baccharis conferta* was regularly examined throughout 1989 in the area surrounding the Lagunas de Zempoala in the state of Morelos. Less frequently, it was examined in the states of Veracruz and Puebla.

The Yucatán Peninsula was visited three times: May 1986, October 1990, and November 1992. Surveying was limited to areas adjacent to major roads. On the second survey we drove around the Yucatán passing through Cancún, Mérida, Campeche, and Chetumal. *Baccharis dioica* was only found on, or very near, the island of Cancún and along the northwestern coast to the east and west of Progreso (30 km north of Merida). This distribution confirmed that given by Nesom (1990b).

Insects were collected by visually inspecting the plants and by sweeping the foliage. When evidence of internal insect infestation was present, plants were either removed from the ground and dissected or the appropriate limb sawn off and split. Any evidence of feeding by the insect was noted. Immatures (particularly caterpillars, leafminers, and gall formers) found without associated adults were reared to enable identification.

All insect specimens were first submitted to the Systematic Entomology Laboratory, Agricultural Research Service, USDA, Beltsville, Maryland for identification by specialist taxonomists. When species could

not be fully identified by this laboratory, the specimens were sent to other taxonomists. After the insects had been properly identified, the literature and entomologists knowledgeable about the particular species or group were consulted to determine the degree of stenophagy exhibited by the species.

All identified species were recorded in a computer database along with details gathered at the time of collection and relevant literature (Palmer 1993c). In this way a profile about each species was developed, and these are available from the senior author.

Results

The phytophagous insects found on *B. conferta* (Table 1) consisted of 53 species in the orders Coleoptera, Diptera, Homoptera, Hemiptera and Lepidoptera. Immatures of 15 species were taken or noted, which indicates that these species complete their life cycle on this plant. Very few internal feeders and no stem borers were found. Only three species, (i.e. the delphacid *Stobaera pallida* Osborn, the geometrid *Itame imitata* Druce, and the lyonetid *Bucculatrix* sp.) were thought likely to be narrowly stenophagous.

Only 11 insect species were taken on *B. dioica* (Table 2). Of these, seven were found with, or as, immatures. Two species were internal feeders. The only species thought likely to be narrowly stenophagous were two species of the gelechiid genus *Aristotelia*.

Discussion

The phytophagous insect fauna on *B. conferta* was less diverse than has been observed on other *Baccharis* spp. in the United States where 73 species were reported on *B. pilularis* (Tilden 1951), 174 species on *B. halimifolia* (Palmer and Bennett 1988), 91 species on *B. neglecta* Britton (Boldt and Robbins 1987) and 64 species on *B. sarathroides* Gray (Boldt et al. 1988). Much greater efforts were put into these studies which were all conducted over a number of years.

Follow-up host specificity studies were not conducted on any of the possibly stenophagous species as none looked sufficiently promising to warrant such investigations. The delphacid *S. pallida* has been previously investigated (Palmer 1993b). The geometrid *I. imata* might possibly be conspecific with *Itame varadaria* Walker (D. Ferguson, pers. comm.), a species which has been studied (Palmer 1989). While the *Bucculatrix* sp. may also have proved stenophagous, *B. ivella* Busck has already been introduced into Australia (Palmer and Diatloff 1987) and other *Bucculatrix* spp. are available from the United States. All other species were probably polyphagous, with little potential for biological control.

The paucity of insect species associated with *B. dioica* and the relative scarcity of the plant itself support the hypothesis that *B. dioica* may be an adventive species on the Yucatán peninsula. Even allowing for the limited collecting, the 11 insect species found were fewer than anticipated.

No host specificity studies were conducted on the insects of *B. dioica*. The pterophorid *Oidaematophorus kellicotti* (Fish) is known to attack *Solidago* spp. in the United States (Cashatt 1972) and *B. neglecta* Britt. in northern Mexico (Palmer 1987, Palmer and Haseler 1992). The two *Aristotelia* spp., both possibly narrowly stenophagous, did not look sufficiently promising to justify experimentation given the considerable distance from the laboratory to this area and that *A. ivae* Busck has already been introduced (Diatloff and Palmer 1988). The other species on this plant were probably polyphagous.

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Table 1. Phytophagous insects collected on *B. conferta* in central Mexico.

Species	Frequency[1]	Stages Found	Plant Part[2]	Specificity[3]
HEMIPTERA				
Lygaeidae				
Nysius sp.	C	adult	flower, stem	
Miridae				
Poecilocapsus sp.	O	adult	leaf	
Proba sallei (Stål)	O	adult	leaf	**
Proba sp.	R	adult	leaf	
Rhinacloa sp.	R	adult	leaf	
Pentatomidae				
Edessa sp.	R	adult		
Euschistus sp.	O	adult		*
Tingidae				
Atheas nigricornis Champion	R	adult		*
Corythucha setosa Champion	R	adult		
HOMOPTERA				
Aphididae				
Aphis sp.	R	all stages	stem	
Dactynotus sp.	R	all stages	stem	
Cercopidae				
Philaronia sp.	R	adult		
Cicadellidae				
Empoasca ingena Davidson & DeLong	R	adult	leaf	
Empoasca nr. *crocostigmata* Davidson & DeLong	R	adult	leaf	
Empoasca sp.	R	adult	leaf	
Graphocephala guerreroensis (Fowler)	R	adult	leaf	
Graphocephala nr. *subrufa* (Delong & Curie)	R	adult	leaf	
Graphocephala spinosa (Delong & Curie)	R	adult	leaf	
Graphocephala sp.	O	adult		
Momoria misella (Ball)	R	adult	leaf	**
Oncometopia sp.	R	adult		
Penestragania sp.	R	adult		
Cixiidae				
Cixius conjector Kramer	R	adult		
Cixius nr. *cinctus* Ball	R	adult	leaf	
Coccidae				
Ceroplastes cistodiformis Cockerell	R	all stages	stem	*
Pulvinaria psidii Maskell	R	all stages	stem	*
Dephacidae				
Stobaera pallida Osborn	C	all stages	stem	***
Flatidae				
Hyphancyclus falcatus Fowler	R	adult		
Membracidae				
Aconophora laminata Fairmaire	R	all stages	stem	*
Polyglypta sp.	R	adult	leaf	

Table 1. Continued.

Species	Frequency[1]	Stages Found	Plant Part[2]	Specificity[3]
COLEOPTERA				
Apionidae				
Ceratapion disparipes (Fall)	R	adult		
Chrysapion auctum (Sharp)	O	adult		
Coelocephalapion aduncirostre (Gerstaeker)	R	adult		
Kissingeria trichium (Kissinger)	R	adult		
Bruchidae				
Meibomeus desmoportheus Kingsolver & Whitehead	R	adult		
Stator dissimilis Johnson & Kingsolver	R	adult		
Chrysomelidae				
Zygogramma signatipennis Stål	R	adult		*
Curculionidae				
Epimechus sp.	R	adult		
Tenebrionidae				
Lobometopon metallicum (Champion)	R	adult		
DIPTERA				
Agromyzidae				
Liriomyza sp.	O	larva	leaf*	
Phytobia sp.	R			
Tephritidae				
Neotephritis finalis (Loew)	R	adult		**
Neotephritis staminea (Wulp)	R	adult		
Paracantha cultaris (Coquillett)	R	adult		*
Paroxyna sp.	R	adult		
LEPIDOPTERA				
Geometridae				
Eupithecia sp.	O	larva	leaf	
Itame imitata Druce	O	larva	leaf	
Sabulodes aegrotata (Guenée)	R	larva	leaf	*
Gracillariidae				
Acrocercops sp.	R	pupa		
Lyonetiidae				
Bucculatrix sp.	O	larva	leaf	
Noctuidae				
Cucullia oribac Barnes	R	larva	leaf	
Lophoceramica pyrrha Druce	O	larva	leaf	*
Tortricidae				
Argyrotaenia montezumae (Walsingham)	R	larva	leaf	*

[1] R = rare, O = occasional, C = common.
[2] An * following the plant part indicates the insect was found inside the plant part.
[3] * = host range exceeds family Asteraceae, ** = host range restricted to Asteraceae, *** = host range restricted to *Baccharis*.

Table 2. Phytophagous insects collected on *B. dioica* on the Yucatán Peninsula, Mexico.

Species	Frequency[1]	Stages Found	Plant Part[2]	Specificity[3]
HOMOPTERA				
Coccidae				
Philephedra lutea (Cockerell)	O	all stages	leaf, stem	
Flatidae				
Flatormenis sp.	R	adult	stem	
Ortheziidae				
Orthezia insigna Browne	O	all stages	stem	*
Pseudococcidae				
Phenacoccus solenopsis Tinsley	R	all stages	terminal	*
HEMIPTERA				
Lygaeidae				
Nysius sp.	R	adult		
COLEOPTERA				
Cerambycidae				
Anelaphus sp.	R	adult	stem*	
Chrysomelidae				
Cryptocephalus sp.	R	adult	leaf	
LEPIDOPTERA				
Gelechiidae				
Aristotelia sp. 1	O	larva	leaf	
Aristotelia sp. 2	O	larva	leaf	
Pterophoridae				
Oidaematophorus kellicottii (Fish)	O	larva	stem*	**
Tortricidae				
Platynota sp.	R	larva	leaf	

[1] R = rare, O = occasional, C = common.
[2] An * following the plant part indicates the insect was found inside the plant part.
[3] * = host range exceeds family Asteraceae, ** = host range restricted to Asteraceae, *** = host range restricted to *Baccharis*.

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Literature Cited

Bailey, F. 1900. The Queensland flora, Part 3. A. J. Diddhams and Co., Brisbane.

Boldt, P. E. and T. O. Robbins. 1987. Phytophagous and pollinating insect fauna of *Baccharis neglecta* (Compositae) in Texas. Environmental Entomology 16: 887–895.

Boldt, P. E., W. Woods, and T. O. Robbins. 1988. Phytophagous insect fauna of *Baccharis sarathroides* Gray (Asteraceae) in Arizona and New Mexico. Proceedings of the Entomological Society of Washington 90: 207–215.

Britton, N. L. and C. F. Millspaugh. 1920. The Bahama Flora. Britton and Millspaugh. 1920 pp.

Cashatt, E. D. 1972. Notes on the *balanotes* (Meyrick) group of *Oidaematophorus* Wallengren with description of a new species (Pterophoridae). Journal of the Lepidopterists' Society 26: 1–13.

Cuatrecasas, J. 1967. Revisión de las especies colombianas del género *Baccharis*. Revista de la Academia columbiana de Ciencas exactas, fiscas y naturales 13: 5–102.

Diatloff, G. and W. A. Palmer. 1988. The host specificity and biology of *Aristotelia ivae* Busck (Gelechiidae) and *Lorita baccharivora* (Tortricidae), two microlepidoptera selected as biological control agents for *Baccharis halimifolia* (Asteraceae) in Australia. Proceedings of the Entomological Society of Washington 90: 458–461.

Kleinschmidt, H. E. and R. W. Johnson. 1977. Weeds of Queensland. Queensland Department of Primary Industries, Brisbane. 469 pp.

Long, R. L. and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press, Coral Gables, Florida. 962 pp.

Nesom, G. L. 1990a. Infrageneric taxonomy of North and Central American *Baccharis* (Asteraceae: Astereae). Phytologia 68: 40–46.

Nesom, G. L. 1990b. Two new species of Mexican *Baccharis* (Asteraceae: Astereae). Phytologia 68: 32–39.

Palmer, W. A. 1987. The phytophagous insect fauna associated with *Baccharis halimifolia* L. and *B. neglecta* Britton in Texas, Louisiana and northern Mexico. Proceedings of the Entomological Society of Washington 89: 185–199.

Palmer, W. A. 1989. Food plant specificity and biology of *Itame varadaria* (Walker) (Geometridae), a North American moth introduced into Australia to control the weed *Baccharis halimifolia*. Journal of the Lepidopterists' Society 43: 305–312.

Palmer, W. A. 1993a. A note on the host specificity of the mirid *Slaterocoris pallipes* (Knight). Proceedings of the Entomological Society of Washington 95: 640–641.

Palmer, W. A. 1993b. On the host range of the delphacid planthopper *Stobaera pallida* Osborn (Homoptera). Proceedings of the Entomological Society of Washington 95: 241–244.

Palmer, W. A. 1993c. The use of computer databases during the foreign exploration phase of a biological control programme. Proceedings of the eighth international symposium on biological control of weeds, Lincoln University, Canterbury, New Zealand. (ed.), DSIR/CSIRO, Melbourne (in press).

Palmer, W. A. and F. D. Bennett. 1988. The phytophagous insect fauna associated with *Baccharis halimifolia* L. in the eastern United States. Proceedings of the Entomological Society of Washington 90: 216–228.

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. Journal of the Lepidopterists' Society 41: 23–28.

Palmer, W. A., G. Diatloff, and J. Melksham. 1993. The host specificity of *Rhopalomyia californica* Felt (Diptera: Cecidomyiidae) and its importation into Australia as a biological control agent for *Baccharis halimifolia* L. Proceedings of the Entomological Society of Washington 95: 1–6.

Palmer, W. A. and W. H. Haseler. 1992. The host specificity and biology of *Oidaematophorus balanotes* (Meyrick) (Lepidoptera: Pterophoridae); A species introduced into Australia for the biological control of *Baccharis halimifolia* L. Journal of the Lepidopterists' Society 46: 195–202.

Palmer, W. A. and J. W. Tilden. 1988. Host specificity and biology of *Prochoerodes truxaliata* (Guenée) (Geometridae), a potential biocontrol agent for the rangeland weed *Baccharis halimifolia* L. in Australia. Journal of the Lepidopterists' Society 41: 199–208.

Palmer, W. A. and A. J. Tomley. 1993. The host range and biology of *Amniscus perplexus* Haldeman (Coleoptera: Cerambycidae), a candidate evaluated for the control of *Baccharis halimifolia* in Australia. Coleopterists Bulletin 47: 27–34.

Stanley, T. D. and E. M. Ross. 1986. Flora of southeastern Queensland. Vol. 2. Queensland Department of Primary Industries, Brisbane. 623 pp.

Tilden, J. W. 1951. The insects associates of *Baccharis pilularis* De Candolle. Microentomology 16: 149–188.