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The Phytophagous Arthropods Associated with *Senna obtusifolia* (Caesalpiniaceae) in Mexico and Honduras and Their Prospects for Utilization for Biological Control

W. A. Palmer* and K. R. Pullen†

*Alan Fletcher Research Station, Queensland Department of Natural Resources, P.O. Box 36, Sherwood, Queensland, 4075, Australia; and
†Division of Entomology, CSIRO, G.P.O. Box 1700, Canberra, ACT 2601, Australia

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A survey of the phytophagous arthropod fauna associated with sicklepod, *Senna obtusifolia*, was undertaken between 1991 and 1993 to find biological control agents for this increasingly serious weed in Australia and its closely related congener, *Senna tora*. The survey concentrated in Mexico on the Gulf coast, the Pacific coast, and the Yucatan peninsula. Additional searching was undertaken in the state of Morelos, Mexico and Honduras. Some 108 phytophagous insect species were found. Literature searches and preliminary observation indicated that 10 species were sufficiently stenophagous to warrant further consideration as potential biocontrol agents. Two species, *Mitrapsylla albalineata* (Homoptera: Psyllidae) and *Conotrachelus* sp. 'Morelos' (Coleoptera: Curculionidae), have been brought to Australia for further study. © 2001 Academic Press

Key Words: **sicklepod; *Senna tora; Cassia obtusifolia; Mitrapsylla albalineata; Conotrachelus* sp.; biological control.**

INTRODUCTION

Senna (= *Cassia*) *obtusifolia* (L.) Irwin and Barneby, known as sicklepod, is a serious weed of field and pasture in many tropical and subtropical regions such as Australia, the United States of America, and the Pacific Islands. In Australia, sicklepod is found along the tropical east coast of Queensland, often in association with foetid senna, *Senna tora* (L.) Roxb. (Mackey *et al.*, 1997). In pastures it is an aggressive invader and can completely dominate grass species, leading to unproductive monocultures.

Preliminary assessments of the phytophagous fauna associated with *S. obtusifolia* and the prospects for biological control have been provided, chiefly from the literature, by Cock and Evans (1984) and Waterhouse and Norris (1987). More recently, the insect fauna of *S. obtusifolia* in Brazil has been described (Fontes *et al.*, 1995; Sujii *et al.*, 1996).

The genus *Senna* (Bauhin) Miller has over 300 species. It is well represented in South and Central America, southern Africa, and Australia but has fewer representatives in North America, northern Africa, and Asia (Irwin and Barneby, 1982; Randell and Barlow, 1998). *S. obtusifolia* is thought to be neotropical in origin (Irwin and Barneby, 1982) but is now almost circumtropical as well as inhabiting various warm temperate regions. It is found in abundance in Mexico, Central America, Colombia, the Brazilian Planalto, and northwest Argentina. Within the genus *Senna*, *S. obtusifolia* and *S. tora* have been placed within the section *Chamaefistula* (Colladon) Irwin & Barneby, a section represented in the Americas by 143 described species assigned to 21 series (Irwin and Barneby, 1982). Section *Chamaefistula* is not well represented in Australia, where there are 9 exotic and 3 endemic species (Randell, 1988). *S. tora* is morphologically very similar to *S. obtusifolia*, from which it is thought to have evolved in Asia (Randell, 1995).

The Queensland Department of Natural Resources commenced a research project in 1990 to effect biological control of *S. obtusifolia*. The first phase of this project was to conduct a survey of the insects associated with the weed in Mexico and Central America and select prospective biocontrol agents from this fauna. This area was selected because it represented the northern portion of the natural range of *S. obtusifolia*, which had not been surveyed, and because the work could be undertaken through the North American Field Station in Temple, Texas. Further, a comparison of the climates of the Mexican cities of Acapulco, Veracruz, and Mérida, using CLIMEX (Skarratt *et al.*, 1995) indicated that there were favorable climate matches with the areas in Australia infested with the weed.

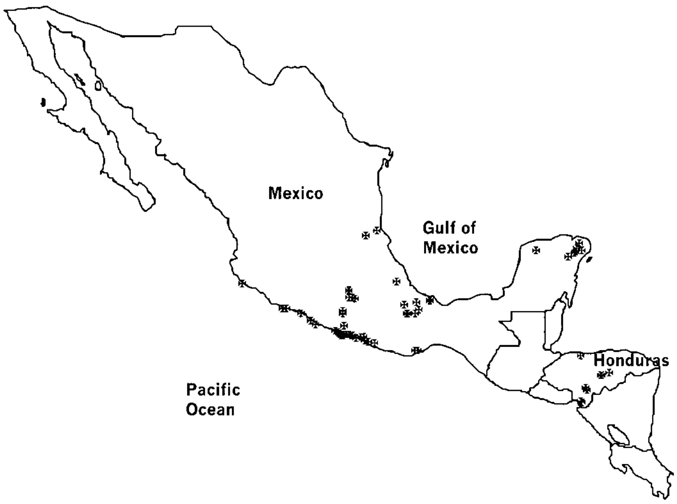

FIG. 1. Survey sites (✠) in Mexico and Honduras from which insects were collected.

MATERIALS AND METHODS

The investigation was conducted from Temple and Cuernavaca (Morelos, Mexico), where the first and second authors, respectively, were based. It was undertaken from September 1991 to December 1993. The area of search (Fig. 1) in Mexico consisted of the Gulf coast states of Veracruz and Tamaulipas, the Pacific coast states of Guererro, Oaxaca, Michoacán, and Jalisco, the central state of Morelos, and the Yucatan peninsula states of Yucatan and Quintana Roo. One collecting trip was also made to Honduras in December 1993.

Throughout these areas, plants were usually examined along roadsides after being spotted from a car. Selected areas such as Lake Tequesquitengo (Morelos), Chapultepec and Cruz Grande (Guerrero), Playa Vicente (Veracruz), and Temascal (Oaxaca) were reexamined on a number of occasions. In all, stands of *S. obtusifolia* were examined on some 93 separate occasions during the project.

S. obtusifolia is mostly an annual. In the area of survey, germination commences after the onset of the rainy season in July, flowering commences by September, and the plants usually begin senescing by December with mature pods remaining on the plants. Searching was therefore undertaken mainly in the second half of the year to coincide with this phenology.

Insects were collected both by visually inspecting the plant and, when appropriate, by sweeping the foliage. When evidence of internal insect infestation was present, either the plant part was removed and placed in an emergence enclosure or it was opened and the insect removed. Any evidence of feeding by the insect was noted. Immatures were reared to maturity to obtain adults for identification.

All insect specimens were first submitted to the Systematic Entomology Laboratory, Agricultural Research Service USDA, Beltsville, Maryland for identification. When not identified by this laboratory, they were forwarded to other taxonomists as appropriate. Specimens of some species were retained by the taxonomists responsible for identification. These were mostly deposited in the US National Museum of Natural History. Most specimens were returned and are retained in the collection at the Alan Fletcher Research Station. Duplicate material was deposited in the collections of Texas A&M University and the Universidad Nacional Autónoma de México.

After identification, the insects were first classified as phytophagous or nonphytophagous. Species thought to feed on plant parts other than nectar, pollen, or dead tissue were considered phytophagous (Strong *et al.*, 1984). Nonphytophagous insects were known predators, parasites, fungivores, pollen or nectar feeders, and others whose habits indicated only casual association with the plant. Insects captured only in a nonphytophagous life stage (e.g., adult Lepidoptera and almost all adult Diptera) were treated as nonphytophagous and are not reported.

The host range of each identified, phytophagous species was assessed by consulting entomologists knowledgeable about the particular species or group, insect collections in various institutions, and the literature. All available knowledge about each species was used to assign it to host range categories (Table 1), from "*" for a species thought to have hosts outside the Order Fabales to "******" for one having only *S. obtusifolia* as its host. However, it must be emphasized that these ratings in many cases are no more than our "best estimate" at the conclusion of the project.

Each species was recorded in a computer database (Palmer, 1995) along with details gathered at the time of collection and relevant literature. In this way a profile of each species was developed and these are available on request from the first author.

RESULTS

General Analyses

The phytophagous fauna associated with *S. obtusifolia* in Mexico and Honduras is listed in Table 1. Some 108 species representing seven orders and 40 families were found. The orders represented were Orthoptera (3 species, 2.8% of species), Thysanoptera (3, 2.8%), Hemiptera (16, 14.8%), Homoptera (33, 30.6%), Coleoptera (45, 41.7%), Diptera (1, 0.9%), and Lepidoptera (7, 6.5%).

Many of the insects were found only once or twice, indicating that *S. obtusifolia* is utilized intermittently by a large number of species. Only 20% of the fauna was found either "occasionally" or "commonly" (our criteria). Six species were endophagous.

TABLE 1

The Phytophagous Insects Associated with *Senna obtusifolia* in Mexico and Honduras

Species	Frequency[a] of collection	Distribution[b]	Stages[c] found	Plant[d] part	Specificity[e] index	Pest[f] status
Orthoptera						
Gryllidae						
Oecanthus fultoni Walker	R	2	A	Leaf	*	*
Pyrgomorphidae						
Sphenarium sp.	R	2	A	Leaf	—	
Tettigoniidae						
Anaulocomera sp.	R	3	A	Leaf	—	
Thysanoptera						
Thripidae						
Caliothrips phaseoli (Hood)	C	2	L, P, A	Leaf	*	*
Frankliniella nr. *curiosa* Priesner	R	2	A			
Franklinothrips vespidiformis (Crawford)	R	4	A	Leaf		
Hemiptera						
Alydidae						
Megalotomus sp.	R	1	A	Leaf	—	
Coreidae						
Anasa scorbutica (F.)	R	1	A	Leaf	*	*
Sagotylus confluens (Say)	R	3	N, A	Leaf	*	
Zicca taeniola (Dallas)	R	1	A	Leaf	*	
Largidae						
Largus cinctus (Herrich-Schaeffer)	R	2, 3	A	Stem	*	
Lygaeidae						
Craspeduchus pulchellus (F.)	R	3	A		*	
Xyonysius californicus (Stål)	R	4	A	Leaf	*	
Miridae						
Garganus albidivittis Stål	R	1	A			
Neurocolpus mexicanus Distant	R	1	A	Flower	*	*
Prepops latipennis (Stål)	C	2, 3	N, A	Leaf	**	
Rhinacloa sp.	R	4	A	Terminal	—	
Taedia sp.	O	2, 4	A	Flower	—	
Pentatomidae						
Euschistus sp.	O	2, 5	A	Pod	—	
Rhopalidae						
Harmostes sp.	R	2	A	Leaf	—	
Niesthrea sidae (F.)	R	5	A	Leaf	*	
Scutelleridae						
Chelysomidea variabilis (Herrich-Schaeffer)	R	1	A	Stem	*	
Homoptera						
Acanaloniidae						
Acanalonia sp.	R	2	A	Flower	—	
Aphididae						
Aphis craccivora Koch	O	1, 2	N, A	Stem	*	*
Myzus ornatus Laing	R	4	N, A	Stem	*	*
Cicadellidae						
Agallia producta Osborn & Ball	R	1	A	Leaf		
Agallia sp.	R	1, 4	A	Leaf	—	
Agrosoma pulchella (Guérin)	R	1	N, A		*	
A. terebra Medler	R	2	A	Leaf	*	
Draeculacephala soluta Gibson	R	1	A		*	*
Graphocephala rufimargo (Walker)	R	1	A		*	
Graphogonalia vulgaris Young	R	2	A			
Gyponana sp.	O	2, 3, 4	N, A		—	
Homalodisca icthyocephala (Signoret)	O	2	N, A		*	
Hortensia similis (Walker)	R	1	A		*	*
Ollarianus sp.	R	2	A		—	
Oncometopia clarior (Walker)	R	1, 3	A	Stem	*	
Sibovia occaminis Young	R	1	A			
Coccidae						
Philephedra parvula (Cockerell)	R	2	A	Stem	*	
Toumeyella sp.	R	1	A	Stem	—	
Derbidae						
Anotia sp.	R	2	A	Stem	—	

TABLE 1—*Continued*

Species	Frequency[a] of collection	Distribution[b]	Stages[c] found	Plant[d] part	Specificity[e] index	Pest[f] status
Flatidae						
Flatormenis sp.	O	2	A	Leaf	—	
Issidae						
Dictyssa sp.	R	2	A		—	
Hysteropterum sp.	R	2	A	Stem	—	
Thionia obtusa Melichar	R	2	A	Pod		
Kinnaridae						
Oeclidius sp.	R	2	A	Terminal	—	
Margarodidae						
Icerya sp.	R	1	N, A	Stem	—	
Membracidae						
Micrutalis malleifera Fowler	O	1, 2	A	Leaf	*	*
Spissistilus rotundatus (Stål)	R	3	A	Stem	*	
Stictopelta sp.	R	2	A		—	
Tylopelta gibbera (Stål)	R	2, 3	A	Terminal	*	
Nogodinidae						
Bladina sp.	R	1	A	Stem	—	
Pseudococcidae						
Ferrisia virgata (Cockerell)	R	2	N, A	Pod	*	*
Ferrisia sp.	R	1	A		—	
Psyllidae						
Mitrapsylla albalineata Crawford	C	1, 2, 4	E, N, A	Terminal	****	
Coleoptera						
Anthribidae						
Ormiscus sp.	R	2	A	Pod	—	
Bostrichidae						
Amphicerus cornutus (Pallas)	R	1	A	Stem	*	
Bruchidae						
Acanthoscelides megacornis Kingsolver	R	2, 4	A	Pod	**	
Sennius fallax (Boheman)	O	2, 4	E, L, P, A	Pod*	***	
S. lebasi (Fahraeus)	O	2	E, L, P, A	Pod*	****	
S. morosus Sharp)	C	1, 2, 4	E, L, P, A	Pod*	****	
S. rufomaculatus (Motschulsky)	C	1, 2, 3, 4	E, L, P, A	Pod*	****	
Zabrotes chavesi Kingsolver	R	2	A	Pod	****	
Buprestidae						
Paragrilus sp.1	R	2	A	Leaf	—	
Paragrilus sp.2	R		A	Leaf	—	
Cerambycidae						
Tylosis puncticollis Bates	R	4	A	Leaf		
Chrysomelidae						
Acalymma blomorum Munroe & Smith	R	3	A	Leaf	*	
Calligrapha nr. *pantherina* Stål	R	2	A	Leaf		
Cerotoma atrofasciata Jacoby	R	2	A	Leaf	*	*
Chalepus nr. *bellulus* (Chapuis)	R	2	A	Leaf	*	
Charidotella trisignata (Boheman)	R	2	A	Leaf	*	
Colaspis nr. *chloropsis* Blake	R	4	A	Leaf		
C. nr. *lebasi* Lefevre	R	1	A	Leaf	*	
C. nr. *viridiceps* Schaeffer	R	1	A	Leaf	*	
Crepidodera sp.	R	1	A	Leaf	—	
Cryptocephalus nr. *irroratus* Suffrian	R	1	A			
Deuteronoda suturalis (Lefevre)	C	1, 2, 3, 4, 5	A	Leaf	****	
Disonycha pr. *glabrata* (F.)	R	2	A	Leaf	*	*
Lexiphanes pr. *guerini* (Perbosc)	R	4	A	Leaf		
Lexiphanes sp.	R	1	A	Terminal	—	
Pachybrachis sp.	R	2	A		—	
Systena sp.	R	2	A		—	
Trirhabda nr. *variabilis* Jacoby	R	4	A	Leaf		
Urodera sp.	R	5	A	Leaf	—	

TABLE 1—*Continued*

Species	Frequency[a] of collection	Distribution[b]	Stages[c] found	Plant[d] part	Specificity[e] index	Pest[f] status
Curculionidae						
Anthonomus sp.1	R	1	A	Leaf	—	
Anthonomus sp.2	O	1, 3	A	Leaf, Flower	—	
Aphrastus submarginatus Champion	R	2	A	Leaf		
Cleistolophus pr. *viridimargo* Champion	R	5	A	Leaf		
Conotrachelus cruciferae Champion	R	2	A	Leaf		
Conotrachelus sp. 'Morelos'	O	4	L	Stem*	—	
Cryptorhynchus sp.	R	1	A	Stem	—	
Mitostylus nr. *tenuis* Horn	R	2	A			
Pantomorus nr. *viridis* Champion	R	2	A	Leaf		
P. sp.	R	2	A		—	
pr. *Pantomorus* sp.	R	2	A	Leaf	—	
Polydrusus nr. *pallidisetus* (Champion)	R	2	A	Leaf		
Sibinia pr. *ochreosa* Casey	R	2	A	Terminal		
Meloidae						
Epicauta cupraeola (Duges)	O	2	A	Leaf	**	
Phalacridae						
Acylomus submaculatus (Sharp)	R	2	A	Pod		
Acylomus sp.	R	1, 2	A	Pod		—
Diptera						
Agromyzidae						
Melanagromyza sp.	R	1	A	Leaf	—	
Lepidoptera						
Gelechiidae						
Aristotelia sp.	O	1, 3	L, P	Terminal	—	
Gracillariidae						
Marmara sp.	R	4	L	Stem	—	
Hesperiidae						
Typhedanus undulatus (Hewitson)	O	1, 2	L	Leaf	**	
Pieridae						
Eurema albula Cramer	R	1	L	Leaf	***	
Eurema salome Felder	R	4	L	Leaf		
Phoebis sennae L.	O	1, 2	L	Leaf	**	
Pyralidae						
Anabasis ochrodesma (Zeller)	C	1, 2, 3	L	Pod*, Leaf, Terminal*	***	

[a] R, rare, being found 1–2 times; O, occasional, being found 3–9 times; C, common, being found 10 or more times.
[b] Insect found in following regions. 1, Mexico, Gulf Coast (Veracruz, Tamaulipas); 2, Mexico, Pacific Coast (Guerrero, Oaxaca, Colima, Michoacán, Jalisco); 3, Mexico, Yucatán Peninsula (Yucatán, Quintana Roo); 4, Mexico, Central (Morelos); 5, Honduras.
[c] E, egg; L, larva; P, pupa; A, adult; N, nymph.
[d] An * following the plant part indicates that the insect was found inside that plant part.
[e] *, Host range exceeds order Fabales; **, hosts restricted to order Fabales; ***, hosts restricted to Caesalpiniaceae; ****, hosts restricted to genus *Senna;* *****, hosts restricted to section *Chamaefistula;* ******, monophagous; —, insect not identified to species.
[f] An * indicates that the species is a known economic pest.

Only three species found in this survey were reported on *S. obtusifolia* in Brazil (Sujii *et al.*, 1996). These were *Colaspis lebasi*, *Typhedanus undulatus*, and *Phoebis sennae*. Although many of the species found in Brazil were not identified to species level, it was apparent that different insect faunas occurred on *S. obtusifolia* in North and South America.

Notes on Important Species

Mixed populations of four *Sennius* spp. (Bruchidae) were commonly found as the plants matured and produced pods. On occasions adults were very abundant and the pods were covered with many eggs. Similarly, quantities of adults emerged in the laboratory from collections of maturing pods. All four species are regarded as continuous breeders (Johnson and Slobodchikoff, 1979). None of these four *Sennius* spp. is host specific; all having 8–13 recorded host species. However, all recorded hosts belong to *Senna* (C. D. Johnson, Northern Arizona University, personal communication) except for a record of *S. fallax* from *Cassia hintoni* Sandwith. Although these species are clearly not monophagous, they do have host ranges basically confined to *Senna*. As they also have the potential to attack a high proportion of seed, they warrant further study. The life histories of *S. fallax* and *S. morosus* have been described (Center and Johnson, 1973).

Mitrapsylla albalineata was frequently found infesting the terminal leaves and appeared to be widespread in its distribution. The nymphs of this rather large psyllid (2–3 mm in length) extrude a white waxy filament, giving infested parts of the plant a "cottony" appearance. Other than this present study, its host range is not known (Crawford, 1914) but it is probably narrowly stenophagous. It was readily reared in the laboratory in Cuernavaca by placing captured adults on potted plants held in cages. *M. albalineata* is therefore considered a potential biocontrol agent and has been introduced into quarantine facilities in Australia for further study.

The pyralid *Anabasis ochrodesma* was found throughout the survey area and throughout the growing season. The larvae were commonly found feeding within webbed terminal leaves which they killed, within the terminal stem, or within pods where they fed on the immature seed. This species is known from other *Senna* spp. and from *Cassia javanica* L. (Heinrich, 1956). Because this species is narrowly stenophagous and damaging to the plant, it warrants further consideration as a biocontrol agent.

The populations of the curculionid *Conotrachelus* are reported here as two species, *C. cruciferae* from near the coast in Guererro and *Conotrachelus* sp. 'Morelos' from around Lake Tequesquitengo in Morelos. However, the two may be conspecific (M. L. Cox, International Institute of Entomology, personal communication). Both species produce a bulbous stem gall and are considered potential biocontrol agents. *Contotrachelus* sp. 'Morelos' has been introduced into quarantine facilities in Australia for further study.

The hesperiid *Typhedanus undulatus,* nominated by Sujii *et al.* (1996) as a potential agent for Brazil, was found in low numbers along both Mexican coasts. Its host range is unknown, although oviposition has been observed on *S. bicapsularis* (L.) Roxb. (R. Kendall, personal communication). It may warrant further study. Similarly, the host range of the pierid *Eurema salome,* which was also found in low numbers, may warrant study, as its host range is unknown.

The aphid *Aphis craccivora* and the thrips *Caliothrips phaseoli* were found at many sites, were clearly breeding, and were often causing appreciable damage to *S. obtusifolia*. However, both are well-documented cosmopolitan pests of many legumes (Singh, 1990).

The eumolpine chrysomelid *Deuteronoda suturalis* was found in all areas of the study. Typically only a few adults were collected on any occasion and they were never found in large, damaging numbers. Adults were found feeding on leaves and in flowers but were also collected on *S. alata* (L.) Roxb., *S. uniflora* (Miller) Irwin and Barneby, and an unidentified Caesalpiniaceae. Larvae were not found but those of the very closely related genus *Colaspis* (R. White, USDA-ARS, personal communication) are root feeders and the larvae often have a broader host range than the adult. For this reason this species is unlikely to be useful for biological control.

The mirid *Prepops latipennis* was found along the Pacific coast and the Yucatan peninsula, sometimes in appreciable numbers of both nymphs and adults. Infested plants showed characteristic speckling of the leaves. However, the wide host range of this bug, which includes potato, beans, and alfalfa, eliminates it from consideration for biological control.

DISCUSSION

One hundred and eight phytophagous species were found on *S. obtusifolia* in the present survey. This number is less than has been found in surveys of comparable plants. For example, McClay *et al.* (1995) list 262 species from the asteraceous *Parthenium hysterophorus* L. in Mexico and southern United States. The two hosts are comparable in terms of geographic range, architecture, and phenology, factors considered by Strong *et al.* (1984) to influence the size of the insect fauna of a plant.

Furthermore, we found a relatively depauperate fauna of Lepidoptera as larvae on *S. obtusifolia*. This group is easily compared between surveys because its association with the host is relatively unambiguous. They usually comprise about 10–15% of the total fauna (Palmer and Pullen, 1995). In the present survey this value was only 6%, and the important families Geometridae, Noctuidae, and Tortricidae, usually well represented, were completely absent.

Inherent attributes of the host plant such as biochemistry and morphology may be factors in the relatively low number of arthropod species found in the present survey. Sampling effort will, of course, also influence the total, and our field work was of shorter duration than the *P. hysterophorus* study (McClay *et al.,* 1995). Although Mexico was quite thoroughly searched for more than 2 years, the study was terminated earlier than intended and before Central America was thoroughly searched. *S. obtusifolia* was found to be abundant in Honduras and further work in Central America is desirable.

Relatively few biocontrol prospects were found in this survey. One reason is that a very high level of host specificity will be required by many countries because of the presence of native *Senna* spp. The attitude of individual countries to possible attack on endemic congeners of *S. obtusifolia*, or the use of *Senna* spp. as a pasture component (Quirk *et al.*, 1992), may determine whether biocontrol agents can be utilized, as it is quite likely that there are no completely monophagous species available.

Australia, for example, has some 24 endemic *Senna* spp. Three species are within the section *Chamaefistula* and another 5 are within the section *Senna* (two sections well represented in the Americas). The majority of species (16) are placed within the section *Psilorhegma*, essentially an endemic group of Gondwanan origin with sparse representation outside Australia and no representation in the Americas (Randell, 1989). There remains, therefore, the possibility that stenophagous insects found on *S. obtusifolia* in the Americas may not accept the Australian *Senna* spp. as hosts and thus could be used for biological control.

More likely, some attack on native *Senna* spp. by the prospective agents found in this study could reasonably be anticipated. However, many endemic Australian *Senna* spp. occur in desert areas where they would probably be protected by distance and climatic differences from exotic biocontrol agents released on *S. obtusifolia* infestations. Further, even if the agents were able to attack some of these *Senna* spp., the effect on the ecosystem may not be significant. An example of this is the case of *Euclasta whalleyi* Popescu-Gorj & Constantinescu which was released in Australia for the biological control of *Cryptostegia grandiflora* (Roxb.) R. Br. in 1988. Host-range tests indicated that this pyralid could develop on the Australian endemic *Gymnanthera oblonga* (Burm. F.) P. S. Green (McFadyen and Marohasy, 1990). This insect has since been found in the field on *G. oblonga* but it has not caused any ecological damage (Mo *et al.*, 2000). This outcome indicates that the effect on ecosystems of any attack on a native *Senna* spp. should also be properly evaluated and not be immediately assumed to be detrimental. Proposals to introduce and release biocontrol agents for *S. obtusifolia* or *S. tora* will therefore need to be accompanied by well-developed risk assessments.

One unanswered question of some practical relevance is whether insects associated with *S. obtusifolia* will also attack *S. tora* and the reverse. As these species are very similar morphologically and are phylogenetically close, it is likely that insects from one species will attack the other (Cock and Evans, 1984), although Waterhouse and Norris (1987) suggest otherwise. Some indication as to this will be gained during the host-range testing of *M. albalineata* and *Conotrachelus* sp. in Brisbane. There has been no systematic search for the phytophagous fauna of *S. tora* in its natural habitat of Africa and Asia, although a few species are listed (Cock and Evans, 1984; Waterhouse and Norris, 1987). The fauna of this plant might well yield further biocontrol agents for both weeds.

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