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HOST SPECIFICITY OF *URESIPHITA REVERSALIS* (GUENÉE) (CRAMBIDAE)

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ABSTRACT. Host specificity tests were conducted on *Uresiphita reversalis* and to a lesser degree on *U. polygonalis*. First instars of *U. reversalis* were limited to feeding on quinolizidine-bearing tribes of fabaceous legumes. However, *U. polygonalis* from the Canary Islands and *U. reversalis* both failed to complete development on *Cytisus scoparius* (Genisteae) beyond the second instar. *Cytisus scoparius* and Cytisus *striatus* were never observed as hosts of *U. reversalis* in California during the years of this study (1984–1989). Host range of *U. reversalis* encompassed six quinolizidine-bearing tribes of the Fabaceae: Genisteae, Sophoreae, Thermopsidae, Bossiaeeae, Podalyreae, and Euchresteae, although the latter two tribes have not been reported as hosts in the field. Both native and introduced species in quinolizidine-bearing tribes will undoubtedly be used by *U. reversalis* when the opportunity arises.

Additional key words: Pyralidae, Pyraustinae, aposematism, host plant range, French broom, quinolizidine alkaloids.

Uresiphita reversalis (Guenée) expanded its host range from native legumes to include several introduced ornamental broom species. Feeding by *U. reversalis* on *Genista monspessulana* (L.) L. Johnson (commonly known as French broom or Genista) was first reported to the USDA Agricultural Research Service, Albany, California, in 1983 when larvae caused substantial defoliation of some populations in the San Francisco Bay area. These studies were undertaken to determine if *U. reversalis* might be used to control the introduced weedy brooms in California (Leen 1992). Unfortunately, plants defoliated in the summer or fall were completely refoliated the following spring. Early spring growth of the brooms prior to the increase of insect populations also indicated *U. reversalis* was unlikely to be a significant control agent. Studies on the potential host range of *U. reversalis* were completed even though the insect was no longer considered a potential, augmentative control agent.

MATERIALS AND METHODS

Host acceptance tests of first instars of *U. reversalis* were conducted on insects originating from Alameda County, California, USA and *U. polygonalis* (Denis & Schiffermüller) originating from Masca, Tenerife, Canary Islands, Spain. *Uresiphita reversalis* was collected from *G. monspessulana,* and *U. polygonalis* was collected from *Retama monosperma* (L.) Boiss. First instars were obtained by collecting and rearing larvae to adults and later removing newly laid eggs from foliage before hatching. Upon hatching, one or two, and occasionally more, larvae were placed on each test plant. An equal number of larvae was used as controls and

TABLE 1. Plants in the Fabaceae accepted by first instars of *Uresiphita reversalis*. P = potted plant tested, C = cutting (excised leaf) tested.

Hostplant	No. insects	No. plants	P/C
Genisteae			
Cytisus scoparius (L.) Link	20	20	P
Cytisus scoparius (Dallimore hybrid) (lilac broom)	10	10	P
Cytisus striatus (Hill) Rothm.	20	20	C
Genista lydia Boiss.	12	6	P
Genista linifolia L.	30	30	P
Genista monspessulana (L.) L. Johnson	30	30	P
Genista tinctoria L.	24	24	P
Genista stenopetala Webb & Berth.	32	32	P
Laburnum anagyroides Medik.	26	26	P
Laburnum alpinum (Mill.) Ber. & J.Presl.	30	30	P
Lupinus albifrons Benth.	30	30	C
Lupinus arboreus Sims	30	30	P
Lupinus chamissonis Eschsch.	30	30	P
Lupinus luteus L.	20	20	P
Lupinus succulentus Koch	20	20	P
Lupinus variicolor Steudel	20	10	C
Spartium junceum L.	25	25	P
Ulex europaeus L.	20	20	P
Thermopsidae			
Baptisia australis (L.) R.Br.	30	30	P
Baptisia lactea (Raf.) Thieret.	30	30	P
Baptisia tinctoria (L.) Vent.	30	30	P
Thermopsis rhombifolia Nutt. ex Richards.	30	15	P
Thermopsis macrophylla Hook. & Arn.	30	15	C
Sophoreae			
Sophora davidii (Franch.) Skeels.	6	3	P
Sophora secundiflora (Ort.) Lag. ex DC	30	30	P
Podalyreae			
Podalyria sericea (Andrews) R.Br.	8	4	P
Euchresteae			
Euchresta Benn.	4	2	P
Vicieae			
Vicia sativa L. (flowers only)	16	40	C

placed on *G. monspessulana* cuttings. Development was observed until the first instar was completed. Later, tests of *U. reversalis* and *U. polygonalis* on *Cytisus scoparius* (L.) Link were continued beyond the first instar to determine if development could be completed on this species. All experiments were conducted on naive larvae under a 16L:8D photoperiod at 20° C. Developmental tests were conducted on *C. scoparius* because *U. reversalis* was observed under field conditions to oviposit and complete development through the fifth instar on almost all other

TABLE 2. Leguminous plants rejected by *Uresiphita reversalis* larvae. P = potted plant tested, C = cutting (excised leaf) tested.

Hostplant	No. insects	No. plants	P/C	Instar
Fabaceae				
Genisteae				
Cytisus scoparius (L.) Link	20	20	C	2
Thermopsidae				
Pickeringia montana Nutt.	41	11	C	1
Hedysareae				
Hedysarum coronarium L.	30	30	P	1
Lespedeza bicolor Turcz.	8	4	P	1
Trifolieae				
Ononis L.	30	30	P	1
Medicago sativa L.	26	26	P	1
Trifolium L.	26	26	P	1
Loteae				
Anthyllis vulneraria L.	30	30	P	1
Lotus scoparius (Nutt.) Ottley	25	25	P	1
Vicieae				
Lathyrus latifolius L.	24	12	P	1
Vicia villosa Roth	9	25	C	1
Desmodieae				
Indigofera tinctoria L.	16	8	P	1
Phaseoleae				
Pueraria lobata (Willd.) Ohwi.	6	3	P	1
Crotalarieae				
Crotalaria capensis Jacq.	8	4	P	1
Caesalpiniaceae				
Cercidae				
Cercis canadensis L.	20	10	P	1
Cercidium floridum A. Gray	16	8	P	1
Cassieae				
Ceratonia siliqua L.	6	3	P	1
Mimosaceae				
Ingeae				
Albizia julibrissin Durazz.	8	4	P	1
Mimoseae				
Mimosa pudica L.	16	8	P	1
Leucaena leucocephala (Lam.) DeWit	20	10	P	1
Acacieae				
Acacia Mill.	10	10	P	1
Acacia longifolia (Andrews) Willd.	2	6	C	1

reported hosts in the Genisteae except *C. scoparius* and *Cytisus striatus* (Hill) Rothm. Again, an equal number of larvae were used as controls and placed on *G. monspessulana*. The plant species used in tests of *U. reversalis* are listed in Tables 1 and 2. First instars of *U. polygonalis* were tested on potted plants of *Phaseolus vulgaris* L., and an equal number of larvae were tested on *G. monspessulana*.

Fourth instars of *U. reversalis* from Alameda County, California, were

tested on *Lonicera sempervirens* L., *Convolvulus arvensis* L., and *Eugenia* L. sp. Fourth instars of *U. reversalis* originating from a population near Lake Placid, Florida, and collected from *Lupinus diffusus* Nutt., were also tested on cuttings of *L. sempervirens*. In each test, one larva was tested on each plant and an equal number of larvae were tested on *G. monspessulana*. Both populations were fed *G. monspessulana* prior to testing and observed under the same environmental conditions as above.

Nearly all potted plant specimens were originally collected as seed from locations within California or obtained from a variety of commercial seed sources and botanical gardens within the USA and abroad. The Botanical Garden at the University of California, Berkeley, graciously provided many of the seeds from sources outside California. Plants grown from seed were fertilized biweekly for the first three months on Hoagland's solution (Hoagland & Arnon 1938). Older plants were then fertilized every six to nine months with a timed-release, 17-6-10, fertilizer (Osmocote). Attempts were made to infect test plants with *Rhizobia* by inoculating soil with roots infected with *Rhizobia* from closely related plants. A few of the potted plants were obtained by purchasing mature plants from nurseries. These potted plants were fertilized with Osmocote as above. Tests with cuttings were conducted on plant specimens obtained from localities within California and initiated within 48 hours from the time of collection.

RESULTS

First instars of *U. reversalis* from California accepted 27 plant species from five tribes (Genisteae, Thermopsidae, Sophoreae, Podalyreae, and Euchresteae) in the Fabaceae (Table 1). All accepted tribes are well represented by species bearing quinolizidine alkaloids (Wink 1992) with a few exceptions. *Pickeringia montana* Nutt., in the Thermopsidae, is not known to contain quinolizidine alkaloids and was rejected by *U. reversalis* (Table 2). Flowers, but not leaves, of *Vicia sativa* L. in the Vicieae were accepted by *U. reversalis*. Neither this species nor the tribe are reported to contain quinolizidine alkaloids. The foliage of *V. sativa* and the foliage and flowers of *Vicia villosa* were both unacceptable to *U. reversalis* (Table 2).

Fourteen species from eight tribes (Thermopsidae, Hedysareae, Trifolieae, Loteae, Vicieae, Desmodieae, Phaseoleae and Crotalarieae) in the Fabaceae were rejected by first instars of *U. reversalis* (Table 2). Eight species from five tribes of nonfabaceous legumes were also rejected by first instars (Table 3). Thirty two species in 12 nonleguminous families were rejected by first instars, and three species in three families were rejected by fourth instars (Table 2.) Some of these rejected families (e.g., Ranunculaceae, Scrophulariaceae) were chosen for testing be-

TABLE 3. Non-leguminous plants rejected by *Uresiphita reversalis* larvae. P = potted plant tested, C = cutting (excised leaf) tested.

Hostplant	No. insects	No. plants	P/C	Instar
Caprifoliaceae				
Lonicera japonica Thumb.	19	4	P	1
Lonicera hispidula Dougl.	45	5	P	1
Lonicera sempervirens L.	40	20	P	1
Lonicera sempervirens L.	15	15	P	4
Sambucus mexicana C. Presl.	8	4	P	1
Symphoricarpus albus (L.) S.F.Blake	5	5	P	1
Asteraceae				
Arctium minus (Hill) Bernh.	24	24	P	1
Calendula officinalis L.	20	20	P	1
Centaurea cyanus L.	24	24	P	1
Centaurea diffusa Lam.	48	48	P	1
Centaurea maculosa Lam.	24	24	P	1
Chrysanthemum leucanthemum L.	30	30	P	1
Chrysanthemum parthenium (L.) Bernh.	30	30	P	1
Helianthus tuberosus L.	40	20	P	1
Isatis tinctorius L.	32	16	P	1
Santolina chamaecyparissus L.	19	5	P	1
Serratula radiata (Waldst. & Kit.) Bieb.	24	24	P	1
Silene italica (L.) Pers.	20	20	P	1
Tagetes erecta L.	8	4	P	1
Euphorbiaceae				
Euphorbia esula L.	20	20	P	1
Convolvulaceae				
Convolvulus arvensis L.	25	25	P	1
Convolvulus arvensis L.	20	20	P	4
Papaveraceae				
Eschscholzia californica Cham.	30	30	P	1
Papaver orientale L.	30	30	P	1
Papaver somniferum L.	46	46	P	1
Ranunculaceae				
Cimicifuga racemosa (L.) Nutt.	20	1	P	1
Aconitum napellus L.	20	1	P	1
Malvaceae				
Malva alcea L.	24	24	P	1
Scrophulariaceae				
Antirrhinum majus L.	20	20	P	1
Plantaginaceae				
Plantago lanceolata L.	24	24	P	1
Brassicaceae				
Brassica oleracea L.	20	20	P	1
Lamiaceae				
Mentha aquatica L.	24	24	P	1
Myrtaceae				
Eugenia L.	15	1	C	4
Boraginaceae				
Ehretia anacua (Teran & Berl.) I.M. Johnson	45	30	P	1

cause they are reported to contain species bearing quinolizidine alkaloids. Several of the rejected plant species (*L. sempervirens*, *Ehretia anacua* (Teran & Berl.) I. M. Johnston and *Eugenia*) were reported as hosts of *U. reversalis*.

Although *U. reversalis* completed development on *C. scoparius* and *C. striatus* through the first instar (Table 1), larvae did not complete development beyond the second instar on *C. scoparius* (Table 2). *Uresiphita polygonalis* did not complete development beyond the second instar on *C. scoparius* (n = 20 potted plants tested) or beyond the first instar on *P. vulgaris* (n = 22 potted plants tested). Fourth instars of *U. reversalis* from California did not feed upon nonleguminous plants (Table 3). All larvae died before molting or pupating. The Floridean population of *U. reversalis* also refused to accept *L. sempervirens* (n = 15 cuttings tested). Most of the rejected plants are not known to bear quinolizidine alkaloids. Control larvae rarely died or failed to complete development on *G. monspessulana*. Observed deaths were attributed to handling problems rather than to the control plants and are therefore not tabulated.

DISCUSSION

There are inconsistencies among reported hosts and host acceptance tests of *Uresiphita*. Although *C. scoparius* is a reported host for several species of *Uresiphita*, the accuracy of such reports is questionable for several reasons. First, rejection of *C. scoparius* by both *U. reversalis* and *U. polygonalis* indicates this species could not support these larvae through complete development. Second, *C. scoparius* is frequently confused with *G. monspessulana* by collectors in California. Insect specimens are thus labelled incorrectly with records of Scotch broom, *Cytisus* or *C. scoparius*, as the host plant. Third, *G. monspessulana* was classified as *Cytisus monspessulanus* L. in several floras. Inaccurate records for other species of *Uresiphita* in regard to *Cytisus* may also exist. The rejection of *C. scoparius* by *U. reversalis* and *U. polygonalis* does not exclude the possibility that other species of *Uresiphita* use *Cytisus* and are able to complete development. An explanation as to why *C. scoparius* is apparently the only rejected species in the tribe Genisteae cannot presently be offered. Tests on *C. striatus* were not conducted beyond the first instar for *U. reversalis* (Table 4). Larvae may be unable to complete development beyond the second instar on other species of *Cytisus*.

Bernays and Montllor (1989), citing my preliminary host plant data for first instars, reported that feeding does not occur upon *Pickeringia*, *Trifolium*, *Vicia*, and *Medicago* and that extensive feeding occurs on *C. scoparius*, *C. striatus*, *L. arboreus*, and *G. monspessulana*. They also stated that development cannot be completed upon *Laburnum* or *Ulex*.

Only the information on *L. arboreus*, *G. monspessulana*, *Pickeringia montana* (a monotypic genus), *Trifolium*, and *Medicago* is accurate.

Although some nonleguminous plant families are known to contain genera that bear quinolizidine alkaloids (Schwarting 1973, Wink 1992), none of the tested genera in these particular families and others were acceptable. Most of these collection records are probably not indicative of species used by *Uresiphita*.

Two genera (*Adenostoma*, *Rosa*) in the Rosaceae have been reported as hosts of *U. reversalis*. The collection and rearing of larvae from *Adenostoma fasciculatum* Hook. & Arn. was from a location where other probable hosts are not present (the old lighthouse at Point Loma, California) and thus is assumed accurate. First instars of *U. reversalis* did not complete development on *A. fasciculatum* in the lab. Two explanations are offered for the conflicting collection record and laboratory results. One, *A. fasciculatum* may be an acceptable host for later instars if *U. reversalis* was transferred (e.g., by humans) onto *Adenostoma*. Two, the source of tests plants of *A. fasciculatum* was central California rather than southern California where the insect was collected. Host plant variation may explain the laboratory rejection of *A. fasciculatum*.

Larval hosts of *Uresiphita* spp. are primarily limited to quinolizidine-bearing tribes of the Fabaceae (Leen 1992 1997) and larval hosts of *U. reversalis* are similarly limited in range. Native hosts come from three tribes: Genisteae, Sophoreae, and Thermopsidae. However, host specificity tests, collections, and publications indicate additional species bearing these alkaloids will be utilized when the opportunity arises.

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