Host Specificity of *Sameodes albiguttalis*[1] in Argentina, a Biological Control Agent for Waterhyacinth[2]

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ABSTRACT

Sameodes albiguttalis (Warren) is highly specific to the plant family Pontederiaceae. In laboratory tests, it laid 60.3% of 13,645 eggs on waterhyacinth, (*Eichhornia crassipes* (Mart.) Solms), and 33.3% on 3 other species of Pontederiaceae; a few eggs were laid on 12 other plants of the 46 species tested. Larvae completed their development and produced adults or pupae only on waterhyacinth or occasionally on *Eichhornia azurea* (Swartz) Kunth and *Pontederia cordata* L. in the laboratory. However, in the field, larvae and pupae of *S. albiguttalis* were collected only from waterhyacinth and occasionally from *E. azurea*. *Sameodes albiguttalis* has never been reported in Argentina on *P. cordata* or as a pest of any beneficial plant, and it did not damage any beneficial plants tested (except *P. cordata* in the laboratory). It appears safe for introduction into the U.S. to control waterhyacinth.

The pyralid moth, *Sameodes* (= *Epipagis*) *albiguttalis* (Warren), is native to South America where the larvae feed on waterhyacinth, *Eichhornia crassipes* (Mart.) Solms. Silveira-Guido[5] collected it from waterhyacinth in Uruguay and at Iguazú (on the border between Argentina and Brazil). Bennett and Zwölfer (1968) collected it regularly from waterhyacinth in Trinidad, Guyana, Surinam, and the Amazon basin of Brazil.

Bennett (1968), in limited starvation tests in Trinidad, found that larvae fed on other plants under starvation conditions but could complete their development only on the Pontederiaceae. In India, Rao,[6] using a laboratory culture imported from Trinidad, tested the feeding of 1st instars of *S. albiguttalis* on 7 test plants, *Allium cepa* L. (onion), *Canna orientalis* Bouché, *Colocasia esculenta* (L.) Schott (taro), *Cucurbita maxima* Duch. (winter squash), *Eleusine coracana* (L.) Gaertn. (African millet), *Musa paradisiaca* L. (plantain), and *Saccharum officinarum* L. (sugar cane); larvae did not feed on any test plant except onion (slight feeding), and these larvae all died within 48 h. Rao[6] also tested oviposition on these same test plant species plus *Commelina benghalensis* (L.) (day flower), *Brassica caulorapa* (DC.) Pasq. (kohlrabi), and *B. oleracea* L. (cabbage); eggs were laid only on onion (but the larvae died within 2 days) and on African millet (the eggs did not hatch).

In Australia, Harley[7] tested the ovipositional and larval feeding specificity of *S. albiguttalis* in quarantine using a culture obtained from the Biological Control Laboratory, USDA, Agri. Res. Serv., Gainesville, FL. In addition to several plants we tested, he included *Atriplex nummularia* Lindl. (saltbush), *Nasturtium officinale* R. Br. (watercress), *Triticum aestivum* L. (wheat), *Trifolium subterraneum* L. (subterranean clover), *Eucalyptus saligna* Sm. and *E. tereticornis* Sm., *Rumex brownii* Campd. (dock), *Monochoria cyanea* F. Muell. (monochoria), *Malus sylvestris* Mill. (apple), *Fragaria* × *ananassa* (strawberry), and *Citrus* spp. (orange, lemon, and mandarin). Moths oviposited and larvae fed extensively on waterhyacinth, less on *Pontederia cordata*, but not on any of the other 30 plants species tested.

DeLoach (1975) rated *S. albiguttalis* 2nd only to *Acigona infusella* Walker as a potential biological control agent of waterhyacinth. However, since *A. infusella* appeared to have too wide a host range for introduction,[8] *S. albiguttalis* was rated the most promising control agent. DeLoach and Cordo (1978) made detailed studies of its biology in Argentina. The investigation reported here was made at Hurlingham, Argentina, on the outskirts of Buenos Aires, from 1973–1977 to measure the host range of *S. albiguttalis*, to determine whether it attacked beneficial plants, and to determine whether it was safe to introduce into the United States to control waterhyacinth.

Methods

Adults, eggs, and larvae of *Sameodes albiguttalis* used in the tests were obtained from larvae or pupae collected from waterhyacinth growing in the field at

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[5] Silveira-Guido, A. 1965. Natural enemies of weed plants. Final report. (Unpubl. report, Dept. Sanidad Vegetal, Univ. de la República, Montevideo, Uruguay.) 123 pp.

[6] Rao, V. P. 1972. Studies on four species of natural enemies for biological control of *Eichhornia crassipes*. Unpubl. Report, Indian Station, CIBC, Bangalore, India. 15 pp.

[7] Harley, K. L. S. 1976. Unpublished Report, Division of Entomology, CSIRO, Long Pocket Laboratories, Indooroopilly, Brisbane, Australia.

[8] Unpublished reports of this laboratory.

Campana, 70 km NW of Buenos Aires; at the town of Dique Luján, 40 km NW of Buenos Aires; or from the Dique Los Sauces at La Rioja, 1000 km NW of Buenos Aires. Adults reared from these were used in the oviposition tests, and eggs and larvae from these adults were used in the larval feeding tests. Adult *S. albiguttalis* were identified by Pastrana[9]. A total of 47 test plants were used in the host specificity tests.

Ovipositional Specificity

Ovipositional specificity was measured in 8 tests using adults from pupae collected at Dique Luján or La Rioja. Both male and female moths were allowed to emerge from pupae in the cage with the test plants and remained with the plants until all moths had died (except that adults were placed directly in the cages in tests 2 and 3). Pupae were placed on plastic foam in the bottom of a clay pot in a pan of water and covered with a 2nd pot; a strip of screen wire in the pot provided a place for the newly emerged adults to hang for wing expansion, and they exited through the hole in the top of the pot. The adults were provided with a 1:3 honey-water solution in sponges hung from the top of the cage.

The test plants were obtained from the field or from laboratory cultures and were all exposed simultaneously to the moths. The aquatic plants were held in 2-liter containers of hydroponic solution and the terrestrial plants were held in pots of soil (except in tests 2 and 3 described below). In most tests, artificial cuts, a notch in the petiole or stem and longitudinal slashes in the leaves, were made on each plant to encourage oviposition.

Conditions of the 8 tests were as follows:

Test 1. Whole plants with artificial cuts, one each of 22 species, plus 2 additional plants of *E. crassipes*, were changed daily and sometimes hourly to measure time of day of oviposition. The test was made in a screen cage 0.7×0.7×0.7 m in the greenhouse. Pupae were from Dique Luján, collected Nov. 20–21. We tested 22 ♀, 28 ♂ and 8 moths of unknown sex for 15 days, Nov. 26–Dec. 10, 1973 (spring). Eggs and emerged larvae were counted only once, at the end of the test.

Test 2. Cut leaves with artificial cuts, 2 leaves of each of 21 species were used. The test was made in a glass cage 36×28×35 cm with sealed glass top and wet paper toweling in bottom, held in the laboratory at room temperature. Pupae were from Dique Luján. We tested 2 ♀ and 2 ♂ for 1 day, Jan. 27–28, 1974 (summer). Eggs were counted once at the end of the test. One of the 2 ♀ had deformed wings and could not fly.

Test 3. This was the same as Test 2, with the same 2 ♀ but 2 new ♂. The test lasted 3 days, Jan. 28–31, 1974 (summer).

Test 4. Whole plants, 2 each of 33 species, one plant of each species with artificial cuts, plus one undamaged plant, were used. The test was made in a screen cage 1.3×1.3×1.3 m out-of-doors under the shade of a tree. Pupae were from Dique Luján, collected Jan. 15. We tested 11 ♀, 15 ♂ and 13 moths of unknown sex for 24 days, Jan. 17–Feb. 10, 1976 (summer). Third instars were counted once, at the end of the test. Some adults possibly were infected with a microsporidian pathogen.

Test 5. Whole plants, all with artificial cuts, one each of 34 species, were used. The test was made in a screen cage 0.85×1.20×1.25 m out-of-doors under the shade of a tree. Pupae were from La Rioja, collected Jan. 13–15. We tested 17 ♀ and 5 ♂ for 17 days, Jan. 18–Feb. 4, 1977 (summer). Eggs were counted Jan. 21, 25, 28, and Feb. 4. The examination made at end of the test showed that moths were not diseased. The weather was rainy and cool during test.

Test 6. This test was the same as Test 5 except that the pupae were from Dique Luján, collected Jan. 28. We tested 15 ♀ and 25 ♂ for 22 days, Feb. 3–25, 1977 (summer). Eggs were counted Feb. 11, 14, 17, 22, and 25.

Test 7. This test was the same as Test 5, except that the pupae were from La Rioja, collected Feb. 13–16. We tested 59 ♀ and 58 ♂ for 16 days, Feb. 19–Mar. 7, 1977 (late summer). Eggs were counted twice, on Feb. 24–25 and Mar. 2–7.

Test 8. This test was the same as Test 5, except that we used a smaller screen cage 1.00×0.75×0.70 m and the pupae were from La Rioja, collected Feb. 13–16. We tested 43 ♀ and 44 ♂ for 14 days, Feb. 18–Mar. 4, 1977 (late summer). Eggs were counted Feb. 22, 23, 24, 26, 28, and Mar. 4.

Larval Feeding and Development

Larval feeding and development was measured in 5 tests using 23 plant species in 15 plant families. Whole plants were held in containers of hydroponic solution (aquatic plants) or in pots of soil (terrestrial plants). Eggs were obtained from females held in 2-liter glass jars containing leaves of *E. crassipes;* the jars were covered with perforated polyethylene film and held in growth chambers at 25°C or in the laboratory at room temperature. First instars 1–2 days old were used in tests 1–3, and eggs just before hatching (cephalic skelton visible) were used in tests 4 and 5. The eggs or larvae were placed in punctures made in the stems, petioles, or leaves. Fifteen larvae or eggs were tested on each plant species (3 larvae in each of 5 plants) in tests 1, 2, 4, and 5, and 30 larvae on each species in test 3 (3 larvae in each of 10 plants). The larvae or eggs were obtained from moths reared from pupae collected at Dique Luján in test 1 and from La Rioja in tests 2–5. After 1–4 wk the plants were dissected and the number and stage of development of *S. albiguttalis* were recorded. Any living larvae were transferred to a fresh plant for further rearing, and pupae were held for emergence of adults.

Conditions of the 5 tests were as follows:

Test 1 began Dec. 11–13, 1973, in the green-

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house, with 1st instars. Plants were examined after 4–6 days except that *Limnobium, Alternanthera,* and *Brassica* were examined after 2–3 days, *P. rotundifolia* after 8 days, *P. cordata* and *E. crassipes* after 23 days, and *E. azurea* after 8 and 23 days.

Test 2 began Mar. 24, 1976, in the laboratory at room temperature (17.9°±4°C), with 1st instars. All larvae were from eggs laid by one ♀. Plants were examined after 5 days except that *Pistia* was examined after 12 days, *Typha* and *P. rotundifolia* after 15 days, and *E. crassipes, E. azurea,* and *P. cordata* after 26 days.

Test 3 measured development only on the 4 species of Pontederiaceae plus *Pistia* and *Limnobium* on which moths had laid eggs in previous oviposition tests. The test began Apr. 1, 1976, in the greenhouse at a temperature of 25°±8.6°C, with 1st instars. *Limnobium* was examined after 11 days, *P. rotundifolia* after 18 days, *Pistia* and *P. cordata* after 21 days, *E. azurea* after 18, 27, and 33 days, and *E. crassipes* after 21 and 33 days.

Test 4 began Feb. 21, 1977, in a growth chamber at 25°±1.5°C and 16-h photophase, with eggs laid on *E. crassipes* in a colony of 22 adult moths (oviposition test 8). Plants were examined after 9 days except that *Typha* and *Oryza* were examined after 7 days, *P. cordata* and *P. rotundifolia* after 14 days, and *E. azurea* and *E. crassipes* after 21 days.

Test 5 began Feb. 21, 1977, in the greenhouse with eggs as in Test 4. Plants were examined after 10 days except that *Typha* and *Oryza* were examined after 7 days, *Sagittaria, Saccharum, Panicum, Paspalum, Alternanthera, Beta,* and *Lycopersicon* after 13 days, and *E. crassipes, E. azurea, P. cordata,* and *P. rotundifolia* after 21 days.

Larval feeding on corn was measured in 2 tests. Eggs and larvae were obtained from adult *S. albiguttalis* collected at La Rioja. The treatments were held in clean glass jars with moist paper toweling in the bottom and the top covered with perforated polyethylene film in a temperature cabinet at 25°±2°C and 16-h photophase. Feeding was measured after 5, 9, and 26 days. In the 1st test, ten 1st instars (1–2 days old) were placed individually in punctures in the pith of cross-sectional slices of corn ears ca. 4 cm thick. The test began Mar. 15, 1976; 5 replications were made. In the 2nd test, 10 eggs with the cephalic skelton of the embryo visible were placed on exposed, partially dry silks of a corn ear; 5 replications were made. The test began Mar. 28, 1976.

Results and Discussion

Oviposition

Sameodes albiguttalis was highly specific to the plant family Pontederiaceae in ovipositional preference and strongly preferred *E. crassipes* among the 46 plant species in 24 plant families tested (Table 1). Of the 13,654 eggs laid by 181 ♀ moths in the 8 tests, 93.6% were laid on the 4 species of Pontederiaceae and 75.1% on the 2 species of *Eichhornia.* A few eggs were laid on 12 other test plants, and no eggs were laid on any of the 30 other species of plants included in the tests.

Moths from populations in the 2 widely separated areas of Dique Luján (tests 1, 2, 3, 4 and 6) and La Rioja (tests 5, 7 and 8) showed few differences in host preference and these can probably be explained by differences in the testing conditions. Extreme crowding in tests 7 and 8 (117 and 87 moths/cage, respectively) apparently caused more eggs to be laid on the less preferred host plants. For example, in the 1st 6 tests, 99.3% of the eggs were laid on the 4 species of Pontederiaceae, but in tests 7 and 8, only 92.7% were laid on these plants.

The low rate of oviposition in tests 4 and 6 might have been caused by infection of the moths from Dique Luján by a microsporidian pathogen; the low oviposition rate is characteristic of this disease, but its presence was not confirmed by microscopic examination. None of the moths collected at La Rioja appeared to be diseased. The low rate of oviposition in test 5 probably was caused by cool, rainy weather during the test, which was conducted out-of-doors; examination of these moths after the test showed that they were not infected by microsporidia. The preferred species of Pontederiaceae varied considerably between tests conducted in the large screen cages and in the small air-tight glass cages (tests 2 and 3), possibly because of differences in air circulation or RH or because of chance variation due to the small number of females used in the tests in the small cages.

Larval Feeding and Development

Larvae of *S. albiguttalis* developed to the pupal and adult stage only on the Pontederiaceae. The 90 larvae tested on each plant species produced 39 adults or pupae on *E. crassipes,* 8 adults or pupae on *E. azurea,* and 2 adults on *P. cordata* (Table 2); on *E. azurea,* 1 third, 4 fourth, and 1 fifth instar lived 8 days and then died. On the other 19 plant species, only 2 larvae developed beyond the 1st instar, one reached the 4th instar on *Typha* and one the 2nd instar on *Limnobium;* both these larvae died. All other larvae on the other test plants were dead when first examined, and no indication of feeding was found.

Tests with Corn

The ability of larvae of *S. albiguttalis* to feed on corn was tested because we had previously found that *Acigona infusella,* a moth whose biology is similar to *S. albiguttalis,* could complete its development on corn if larvae were force-fed under very artificial conditions.

When larvae of *S. albiguttalis* were fed on cross sections of the ear in the 1st test, one living 1st instar was found after 5 days; the other 49 larvae were dead, and there was no evidence of feeding. After 9 days, this larva had reached the 2nd instar but had died; some excrement was found, indicating that it had fed slightly. In the 2nd test, 50 eggs were placed on corn silks. No living larvae were

Table 1.—Ovipositional specificity of *Sameodes albiguttalis* in multiple-choice tests in the laboratory.

Test plant	No. eggs laid in indicated test[a]								Total laid	% of total
	1	2	3	4	5	6	7	8		
PTERIDOPHYTA										
Salviniaceae										
Salvinia auriculata Aubl. (salvinia)	0	—	—	0	0	0	107	5	112	0.82
MONOCOTYLEDONAE										
Typhaceae										
Typha latifolia L. (cattail)	—	—	—	—	0	0	136	296	432	3.16
Alismaceae										
Sagittaria montevidensis Cham. and Schlecht. (arrowhead)	—	0	0	0	0	0	45	0	45	0.33
Hydrocharitaceae										
Limnobium stoloniferum (G.F.W. Meyer) Grisb. (frogbit)	—	0	0	5	0	0	10	—	15	0.11
Gramineae										
Saccharum officinarum L. (sugarcane)	0	0	0	0	0	0	0	32	32	0.23
Panicum elephantipes Nees	—	—	—	—	0	0	0	17	17	0.12
Araceae										
Pistia stratiotes L. (waterlettuce)	7	0	0	0	0	0	0	0	7	0.05
Commelinaceae										
Tradescantia crassifolia Cav. (spiderwort)	0	1	0	0	0	0	0	0	1	0.01
Pontederiaceae										
Pontederia cordata L. var. *lancifolia* (Muhl.) Torr.[b] (pickerelweed)	42	0	0	3	0	0	175	741	961	7.04
P. (= *Reussia*) *rotundifolia* (L.f.) Castell.[b]	30	0	0	0	0	0	667	879	1576	11.54
Eichhornia azurea (Swartz) Kunth (anchored waterhyacinth)	127	233	50	12	0	0	970	620	2012	14.74
E. crassipes (Mart.) Solms (waterhyacinth)	852	0	149	63	132	231	3978	2833	8238	60.33
Liliaceae										
Agapanthus africanus (L.) Hoffmgg. (African lily)	0	1	0	0	—	—	—	—	1	0.01
DICOTYLEDONAE										
Amaranthaceae										
Alternanthera philoxeroides (Mart.) Griseb. (alligatorweed)	—	0	0	0	0	0	0	6	6	0.04
Cruciferae										
Brassica oleracea var. *capitata* L. (cabbage)	0	0	0	0	0	0	0	86	86	0.63
Umbelliferae										
Eryngium eburneum Decne	—	—	—	0	0	0	0	113	113	0.83
Total eggs laid	1058	235	199	83	132	231	6088	5628	13,654	100.00
Mean no. eggs per female	40.7	117.5	99.5	4.9	7.8	15.4	103.2	130.9	79.8	
No. ♀ moths tested	26	2	2	17	17	15	59	43	181	

[a] Thirty other test plant species included in these tests that always had zero oviposition (no. in parentheses are no. of times tested) were : Monocotyledonae: Alismaceae–*Echinodorus grandiflorus* Mich. (1); Graminae–*Oryza sativa* L. (rice) (7), *Zea mays* L. (corn) (5), *Paspalum repens* L. (water paspalum) (5); Cyperaceae–*Eleocharis haumaniana* Barros (1), *Scirpus californicus* (C. A. Mey.) Steud. (bulrush) (3); Araceae–*Zantedeschia aethiopica* (L.) Spreng. (calla) (1); Bromeliaceae–*Ananas comosus* (L.) Merr. (pineapple) (7); Commelinaceae–*Commelina tuberosa* L. (= *C. coelestis*) (day flower) (8), *C. virginica* L. (day flower) (7), *Zebrina pendula* Schnizl. (wandering jew) (3), *Tripogandra elongata* (G. F. W. Mey.) Woodson (4); Liliaceae–*Asparagus officinalis* L. (asparagus) (6), *Allium cepa* L. (onion) (4); Dicotyledonae: Polygonaceae–*Polygonum* sp. (1), *P. stelligerum* Cham. (1); Chenopodiaceae–*Beta vulgaris* L. var. *cicla* L. (chard) (4); Leguminosae–*Medicago sativa* L. (alfalfa) (3), *Glycine max* (L.) Merr. (soybean) (4); Malvaceae–*Gossypium hirsutum* L. (cotton) (4); Onagraceae–*Ludwigia peploides* (H. B. K.) Raven (water primrose) (1); Haloragaceae–*Myriophyllum brasiliense* Cambess (parrotfeather) (5); Umbelliferae–*Hydrocotyle ranunculoides* L. (water pennywort) (5), *Daucus carota* L. (carrot) (2); Convolvulaceae–*Ipomoea batatas* (L.) Lam. (sweetpotato) (4); Solonaceae–*Lycopersicon esculentum* Mill. (tomato) (8); Cucurbitaceae–*Cucurbita pepo* L. (pumpkin) (4), *Cucumis melo* L. (melon) (1); Compositae–*Helianthus annuus* L. (sunflower) (5), and *Lactuca sativa* L. (lettuce) (6).

[b] Lowden (1973) placed *Reussia rotundifolia* in the genus *Pontederia* and considered *P. lanceolata* to be *P. cordata* var. *lancifolia*. These species were referred to as *P. lanceolata* and *R. rotundifolia* in unpublished reports and previous publications of this laboratory.

Table 2.—Development of larvae of *Sameodes albiguttalis* on different test plants in no-choice tests in the laboratory.

Test plant	No. larvae reaching various stages in indicated test[a]					Total larvae tested	Total pupae or adults reared
	1	2	3	4	5		
MONOCOTYLEDONAE							
Typhaceae							
Typha latifolia (cattail)	–	1_A[b]	–	0	0	45	0
Alismaceae							
Sagittaria montevidensis (arrowhead)	–	0	–	0	0	45	0
Hydrocharitaceae							
Limnobium stoloniferum (frogbit)	1_2[c]	0	0	0	0	90	0
Gramineae							
Saccharum officinarum (sugarcane)	0	0	–	0	0	60	0
Oryza sativa (rice)	–	0	–	0	0	45	0
Zea mays (corn)	–	0	–	0	0	45	0
Paspalum repens (water paspalum)	–	–	–	0	0	30	0
Panicum elephantipes	–	0	–	0	0	45	0
Araceae							
Pistia stratiotes (waterlettuce)	0	0	0	0	0	90	0
Commelinaceae							
Zebrina pendula (wandering jew)	0	–	–	–	–	15	0
Pontederiaceae							
Pontederia rotundifolia	0[e]	0	0	0	0	90	0
P. cordata (pickerelweed)	1_A	1_A	0	0[d]	0[d]	90	2
Eichhornia azurea (anchored waterhyacinth)	2_P[c]	2_A	3_A	0[e]	1_A	90	8
E. crassipes (waterhyacinth)	9_A	6_A	16_A	3_A	4_A, 1_P	90	39
Amaranthaceae							
Alternanthera philoxeroides (alligatorweed)	0	0	–	0	0	60	0
Chenopodiaceae							
Beta vulgaris (chard)	–	0	–	0	0	45	0
Cruciferae							
Brassica oleracea (cabbage)	0	0	–	0	0	60	0
Onagraceae							
Ludwigia peploides (water primrose)	–	0	–	0	0	45	0
Umbelliferae							
Hydrocotyle ranunculoides (water pennywort)	–	0	–	0	0	45	0
Cucurbitaceae							
Cucurbita pepo (pumpkin)	–	–	–	0	0	30	0
Solanaceae							
Lycopersicon esculentum (tomato)	–	0	–	0	0	45	0
Capsicum annuum L. (red pepper)	–	0	–	0	0	45	0
Compositae							
Lactuca sativa (lettuce)	0	0	–	0	0	60	0

[a] Subscripts indicate instar reached, P = pupa, A = adult.
[b] One 4th instar lived 15 days but died thereafter.
[c] On frogbit, a 2nd instar lived 3 days but died thereafter. On *P. rotundifolia* 3 first instars lived 8 days, and on *E. azurea* 1 third, 4 fourth, and 1 fifth instar lived 8 days; all these larvae later died except that 2 of the larvae on *E. azurea* produced the 2 pupae shown; we did not record whether or not these 2 pupae produced adults.
[d] Found 2 tunnels ca. 5 cm long in test 4 and 3 tunnels less than 10 cm long in test 5, caused by small larvae.
[e] Found 4 tunnels 10–15 cm long caused by small larvae.

found after 5 days, and none had entered the ear after hatching on the external silks. We therefore found no evidence that *S. albiguttalis* can develop on corn.

Field Observations

Periodic observations were made in the field during 3 yr to determine whether *S. albiguttalis* could develop on plants other than *E. crassipes*. A few larvae and pupae were found on *E. azurea* growing among stands of *E. crassipes* at Dique Luján on several occasions, but *E. crassipes* was strongly preferred. At Campana, 50–100 plants of *P. cordata* were examined on each of 14 dates during 2 grow-

ing seasons in a large stand in the curve near the Balneario Municipal. On the same dates, an estimated 50 plants were examined in front of the "Astillero," 175 m west of the curve. In Entre Rios Province, 50–150 plants were examined at each of 6 locations on Nov. 21, 1974, 50 and 165 plants at 2 locations on Dec. 19, 1974 and Mar. 6, 1975, and 300 plants on Feb. 26, 1976. No larvae or pupae of *S. albiguttalis* were found in or on any of these ca. 2591 plants of *P. cordata.*

Specificity of Related Species

Little is known of the host ranges of other species of *Sameodes* or *Epipagis* that are related to *S. albiguttalis,* but one species, *Epipagis cambogialis* (Guenée), appears to have a rather wide host range. Pastrana[9] (pers. comm.) stated that *E. cambogialis* was collected in Argentina feeding on cactus fruit and in Brazil (São Paulo, Rio de Janerio, and Pelotas) on *Calopogonium mucunoides* Desv. (Leguminosae), *Talinum patens* Willd. (Portulacaceae), and *Epiphyllum truncatum* Haw. (Cactaceae). *Mimorista* (= *Epipagis*) *pultherraris* was collected in Argentina (Entre Rios Prov.) on *Opuntia aurantiaca.* He made no reference to *Sameodes.*

Costa Lima (1968) listed the larvae of *E. cambogialis* in Brazil (states of Guanabara, Para, and Rio de Janerio) as feeding on the leaves of *Calopogonium mucunoides, Amaranthus* sp., *Pereskia grandifolia* (Cactaceae), *Bohemeria nivea* (Urticaceae), and *T. patens;* they also bore in the stems of *E. truncatum.* He listed *Mimorista* sp. larvae as feeding on leaves of *Rhipsalis* sp. (Cactaceae). He did not list *Sameodes* in his catalogue.

Recent taxonomic studies by Munroe[10] indicate that *S. albiguttalis* belongs in a separate genus and is not very closely related to species of any of the above genera (DeLoach and Cordo 1978). Recorded hosts of those related species probably indicates very little concerning the host range of *S. albiguttalis.*

Discussion

The host range of *Sameodes albiguttalis* appears to be limited to the family Pontederiaceae. In the field in Argentina, it was found only on waterhyacinth (its apparent natural host) and rarely on *E. azurea.* Other workers (Silveira-Guido,[5] and Bennett 1968) found it only on waterhyacinth in the field.

In laboratory tests, *S. albiguttalis* could complete its life cycle only on *E. crassipes* and occasionally on *E. azurea* and *Pontederia cordata.* This acceptance of *E. azurea* poses no danger since this plant occurs in the U.S. only in a small area of southern Texas (Correll and Johnston 1970) and is itself a noxious, introduced weed. The only risk to beneficial plants that our tests predicted would be to *P. cordata,* which is considered a beneficial food plant for waterfowl (Martin et al. 1951). However, this risk appears slight since *S. albiguttalis* was never found on *P. cordata* in the field in Argentina.

Of the 8 species of *Eichhornia* recognized by Castellanos (1958), 5 occur only in tropical or subtropical areas of Central and South America, within the natural range of *S. albiguttalis.* Introduction of *S. albiguttalis* outside its native range could thus possibly affect 3 species, *Eichhornia paniculata* Solms, *E. diversifolia* Wb., and *E. crassipes. Eichhornia paniculata* occurs in Cuba and Jamaica (where *Sameodes* apparently does not occur) and also in northern Brazil; *E. diversifolia* is known only from Africa. The status of these 3 species as weeds or beneficial plants should be established, and tests should be made to determine whether *S. albiguttalis* will attack them before the moth would be released in these areas. *Eichhornia crassipes* is the only species of the genus that has spread much out of its native range (tropical South America), and it is considered a major weed pest throughout most tropical and subtropical areas of the world; any control exerted by *Sameodes* in any of these areas would be desirable.

The genus *Pontederia* is known only in the New World (except that *P. cordata* is adventive in the British Isles (Sculthrope 1967) and Australia (Harley[7]), and its probable center of origin is Middle America. Lowden (1973) recognized only 5 species of the genus (he united the genera *Pontederia* and *Reussia*). Only *P. cordata* var. *cordata* and var. *lancifolia* (= *P. lanceolata*) are native in North America from southeastern Canada and the eastern and midwestern United States to the Gulf of Mexico. Both are utilized in localized areas as food by ducks. Both these varieties plus *P. cordata* var. *ovalis* (Mart.) Solms, *P. rotundifolia,* and *P. subovata* (Seub.) Lowden occur in South America south to Uruguay and northern or central Argentina; *P. sagittata* Presl and *P. parviflora* Alex. occur only in Central America. The introduction of *S. albiguttallis* into the U.S. therefore would affect only *P. cordata* var. *cordata* and var. *lancifolia;* the other species of the genus occur only within the native range of *S. albiguttalis.*

A few other genera of the Pontederiaceae occur in North America (*Eurystemon, Heteranthera, Monochoria,* and *Zosterella*), but none of these were available for testing in Argentina. However, these plants are of little or no beneficial value and some compete with more desirable plants.

Sameodes did not attack any beneficial plants in our tests other than *Pontederia cordata.* It has never been reported from *Pontederia* or as a pest of any beneficial plant in Argentina, and it is not listed by Hayward (1958) or Rizzo (1970) as a pest of cultivated plants in Argentina or by Costa Lima (1968) as a pest in Brazil. *Pontederia* probably will not be attacked by *S. albiguttalis* in the U.S., and any slight damage that might occur will probably be less than presently caused by the herbicides used to control waterhyacinth or by the competition to native vegetation presently caused by water-

[10] Eugene G. Munroe, Biosystematics Research Institute, Agriculture Canada, Ottawa.

hyacinth. On the basis of our tests, we conclude that *Sameodes albiguttalis* is safe to introduce into the United States for biological control of waterhyacinth.[11]

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[11] *Sameodes albiguttalis* was released at 3 locations in the field in Florida on Sept. 22, 1977, by the U.S. Army Corps of Engineers (G. R. Buckingham, Biological Pest Control Research Unit, Agric. Res. Serv., USDA, Gainesville, FL, pers. comm.).

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