

Reintroduction of the Alligatorweed Flea Beetle (*Agasicles hygrophila* Selman and Vogt) Into the United States from Argentina

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INTRODUCTION

The attempt to control floating alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.) in the southeastern United States with an imported Argentine flea beetle (*Agasicles hygrophila* Selman and Vogt) is often cited as a successful example of the biological control of an aquatic weed in the United States (1, 4). This is true in most waterways in Florida and other warm areas in the Southeast where the beetles survive the winter, but in the colder areas, including northern Alabama, North Carolina, South Carolina, and portions of other states, alligatorweed has not been controlled.

In February 1979, while surveying in South America for natural enemies of noctuid moths, the senior author collected alligatorweed flea beetles from near Mar del Plata, Argentina, which is the southernmost, or coldest, limit of the beetle's known distribution (3). The results of the releases of these beetles in the southeastern United States are reported in this paper. All previous U.S. releases had been made with beetles collected at Ezeiza Lagoon near Buenos Aires, except for a small number from Uruguay that had been apparently collected at about the same latitude as Buenos Aires.

MATERIALS AND METHODS

On February 27-28, 1979, all small streams (arroyos) intersecting the highway from Mar del Plata to Necochea and Tres Arroyos, 38-38.5 S latitude, were checked for alligatorweed and flea beetles. High wind and rain hampered collection much of the time and only two adult beetles were found during 30 minutes of sweeping and visual observations at Arroyo Nutria Mansia, Highway 88, about 30 km NE of Necochea. Alligatorweed was present but not abundant in most of the arroyos. A large but undamaged stand of terrestrial and floating alligatorweed was present at Tres Arroyos. A small colony of flea beetles was found at a small stream, Arroyo Pantanoso, 20 km NE of Balcarce just north of 38 S. latitude. Twenty adults, 30-40 larvae, and 4 egg masses were collected on floating plants of alligatorweed in 3 man-hours. All individuals observed were collected.

These field collected insects were reared and maintained in the Biological Control of Weeds Laboratory, USDA, ARS, at Hurlingham, Argentina, until March 21, 1979,

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when 20 females, 11 males, and several egg clusters were successfully shipped by air freight to Gainesville. Food and humidity were provided in the shipping container by bouquets of alligatorweed and a damp organandy-covered sponge. Wood excelsior provided the insects with footholds.

In the Florida Department of Agriculture and Consumer Services, Division of Plant Industry's quarantine laboratory, the adults were separated into pairs which were reared in glass jars in a room at 24 C under fluorescent lighting. The eggs originally shipped with the adults plus the eggs deposited in transit initiated a reserve colony. F₁ progeny (25 individuals/mating pair) were checked for entomopathogens to ensure that the individuals used in this release program were disease-free. Smears of larval, pupal, and adult tissues were examined at 40 and 100X with a phase contrast microscope. No definite entomopathogens were detected. The only microorganisms observed were associated with the alimentary tract and were presumed to represent normal gut microflora. One female's progeny which had an abundance of this gut microflora and the reserve colony were destroyed as a precaution, but the progeny of all others were used for rearing. The beetles were reared on alligatorweed in a large cage in a greenhouse. Small populations of the original lines were maintained separately in the jars and added occasionally to the cage.

Beetles were aspirated from the cage before the field release in June 1979 and were held for 1 to 2 days in cool temperature cabinets at about 12 C until all had been collected. The chilled beetles were placed into paper sacks containing alligatorweed bouquets and were carried in cold boxes containing chemical ice packs to the field release sites in North and South Carolina. The total journey lasted 11½ days. The release areas were searched for beetles or feeding damage immediately before the releases. The bouquets and the open sacks were then placed on the alligatorweed mats. The beetles released in Charleston Co., SC, were refrigerated overnight by a cooperator and released the next day. Three additional releases were made in July 1979 by cooperators with beetles sent by air freight from Gainesville.

Subsequent releases in Alabama during October 1979 were made with beetles from a greenhouse colony at the Waterways Experiment Station (WES). This colony had been initiated in July 1979 when the Gainesville colony was discontinued and the remainder of the original parental lines, which had been maintained separately, were sent by air freight to WES. Waxed paper cups containing adults and eggs from the WES colony, along with a small amount of moistened paper toweling and bouquets of alligator-

weed were carried by auto to the release sites. The alligatorweed bouquets and the cups were placed upon the alligatorweed mats.

The techniques used for the original air freight shipment from Argentina were used for all air freight shipments in the U.S.

RESULTS AND DISCUSSION

Immature stages of the flea beetle were released during May and June, 1979, in Gainesville at Hogtown Creek and at outdoor pools at the quarantine laboratory. A small population remained in the pools throughout the summer, providing migrants to the surrounding areas. The releases at Hogtown Creek were not monitored because the beetles were already well established in Gainesville and the two populations have no distinguishing characters.

Approximately 4800 adults and 40 egg masses were released in South and North Carolina in June 1979 and an additional 1300 adults were sent to cooperators in those states in July 1979. In October 1979, approximately 180 adults and 1500 eggs were released in northern Alabama. The release sites,² dates, and approximate numbers released were: Sumter Co., SC—Shaw Air Force Base, June 7, 960 adults, 20 egg masses; Charleston Co., SC—Snee Farms, June 8, 960 adults; Marlboro Co., SC—Bennettsville, July 13, 350 adults; Richland Co., SC—Blythwood, July 13, 300 adults; Georgetown Co., SC—Peedee River, July 13, 650 adults; Columbia Co., NC—Lake Waccamaw, June 8, 960 adults; New Hanover Co., NC—Wilmington, 1920 adults, 20 egg masses; Colbert Co., AL—Wilson Reservoir, Pickwick Reservoir, and Colbert steamplant canal, October 17, 60 adults, 500 eggs at each site.

Cooperators reported that the beetles colonized all sites during 1979 and that secondary releases that year were made by them with beetles collected at the initial release sites. We were unable to visit the release sites in 1980, but the only successfully overwintering population reported by the cooperators was at Snee Farms, SC.³ Beetles from that population were redistributed by cooperators during

²More detailed information on release sites is included in Buckingham, G. R. and D. Boucias. 1982. Release of potentially cold-tolerant alligatorweed flea beetles (*Agasicles hygrophila* Selman and Vogt) into the U.S. from Argentina. Misc. Paper A-82-2, U.S. Army Engineer Waterways Exp. Station, Vicksburg, MS. 10pp.

³William Melven, personal communication.

1980. We found no beetles or damage in July 1981 at Shaw Air Force Base, Bennettsville, Lake Waccamaw, Castle Hayne near Wilmington, and at 7 additional South Carolina locations. A large beetle population was present at Snee Farms and had destroyed much of the alligatorweed ringed two small ponds. Beetles were also found in Beaufort Co., SC, at Garden's Corner, near sites where beetles from Snee Farms were released by cooperators in 1980.³

Apparently these newly introduced beetles have been unable to overwinter in the colder areas of the alligatorweed range. The fact that they have survived in Charleston Co. and Beaufort Co., SC, suggests that they may be slightly more cold hardy than the beetles introduced earlier. The earlier beetles colonized the Charleston area for several years (2) but apparently were unable to survive the cold winters although intensive surveys were not conducted to confirm their absence. The Snee Farm population survived the third winter and was present in May 1982.³ If the beetles are able to establish themselves permanently in that area, they will be accessible to water managers for redistribution. However, they will still need to be released each spring or summer in cold areas, if they are to be of benefit for biological control in those areas.

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LITERATURE CITED

1. Bennet, F. D. 1977. Insects as agents for biological control of aquatic weeds. *Aquat. Bot.* 3:165-173.
2. Coulson, J. R. 1977. Biological control of alligatorweed, 1959-1972. A review and evaluation. USDA, ARS, and COE, U.S. Army Tech. Bull. 1547. 98 pp.
3. Vogt, G. B., J. U. McGuire, Jr., and A. D. Cushman. 1979. Probable evolution and morphological variation in South American disonychine flea beetles (Coleoptera: Chrysomelidae) and their amaranthaceous hosts. USDA Tech. Bull. 1593. 148 pp.
4. Wapshere, A. J. 1979. Recent progress in the biological control of weeds. *EPPO Bull.* 9:95-105.