POTENTIAL OF BOLL WEEVIL REPRODUCTION ON *CIENFUEGOSIA DRUMMONDII* IN SOUTH TEXAS

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Abstract

The North American distribution of *Cienfuegosia drummondii*, a member of the Malvaceae, is apparently restricted to the Lower Rio Grande Valley and Coastal Bend of Texas. It is a known reproductive host of the boll weevil, *Anthonomus grandis* Boheman. As a potential source of boll weevil, particularly in present or future eradication zones, more knowledge is needed of *C. drummondi*'s importance to population dynamics of the pest. Our study showed the presence of *C. drummondi* populations in previously unreported soil types, indicating widespread and common occurrence of the plant in non-cultivated habitats of the Coastal Bend. We found that *C. drummondii* can provide early season oviposition sites for boll weevil about 45 days prior to hostable cotton square availability, and that flower buds and fruit capsules of *C. drummondii* can be available for about four months after cotton stalk destruction deadlines. Boll weevil infestation of *C. drummondii* varied considerably between field sites and years, with the highest percent recorded after the regulated cotton production season. Several native and exotic ectoparasitoids parasitized boll weevils infesting reproductive structures of *C. drummondii*, indicating the potential of biological control for management of boll weevil in non-cotton habitat.

Introduction

Cotton pests such as bollworm, tobacco budworm, armyworms, plant bugs, and whiteflies may utilize many hosts for population buildup and maintenance. IPM programs for these pests include management not only in cotton, but in other crops, and in some cases, in wild hosts. Since the late 1970s, eradication has been a long-term goal for dealing with the boll weevil, *Anthonomus grandis* Boheman, in the U.S. One factor deemed important in facilitating elimination of the boll weevil was that in the temperate region of the cotton production belt, cotton is the only reproductive host.

Lukefahr and Martin (1962) first reported *Cienfuegosia drummondii* as a host for the boll weevil in subtropical South Texas. Burke and Clark (1976) stated that this plant grows naturally only in clayey, poorly-drained soils and is confined mostly to the coastal counties of the Lower Rio Grande Valley and Coastal Bend of Texas. These soils (Victoria, Orelia, Raymondville series) are especially suitable for production of cotton and grain sorghum, and a large percentage has been converted to such use. However, thousands of acres remain as rangeland for livestock production or are contained in private and public refuges providing habitat for wildlife.

Burke and Clark (1976) conducted a three-year survey in the Texas Coastal Bend and observed boll weevils infesting *C. drummondii* in Kleberg, Nueces, San Patricio, and Refugio counties. These counties are included in the South Texas/Winter Garden Boll Weevil Eradication Zone. Due to the potential for *C. drummondii* to serve as a resource for reproducing boll weevils, it is important to better understand this host plant/pest relationship and determine its significance to boll weevil population dynamics. The objectives of our study were to identify areas of *C. drummondii* habitat, monitor plant reproductive growth, determine the seasonal incidence and degree of weevil infestation in selected *C. drummondii* sites, and evaluate the ability of native and exotic ectoparasitoids to utilize boll weevil infesting this wild host.

Materials and Methods

County soil maps were used to identify locations with soil types that could harbor *C. drummondii* in the Lower Rio Grande Valley and the Coastal Bend. Periodic surveys consisted of vehicular travel to potential areas and ground inspections to verify the presence of *C. drummondii*. Latitude and longitude were recorded with a hand held GPS device for locations containing *C. drummondii* populations.

Six plots containing *C. drummondii* plants on the Welder Wildlife Foundation Refuge (WWFR) in San Patricio Co. were established beginning 11 March 1997 and 10-25 plants per plot were randomly selected each sampling date and monitored bi-weekly until 9 December 1998. All floral buds and seed capsules were removed from sampled plants and taken to the laboratory for determining weevil infestation. Weekly monitoring of adult boll weevil was made with 10 pheromone traps located along the WWFR main entrance during the same period of plant monitoring.

Approximately 50 *C. drummondii* plants were dug and transplanted to establish a small field plot in Weslaco, Hidalgo, Co. Infestation monitoring at weekly intervals of

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plants in this plot began 11 September 1997. Floral buds and seed capsules attached to the plants were removed and abscised reproductive forms were collected and taken to the laboratory for inspection under a dissection microscope.

A field site near Taft in San Patricio Co. was established 3 November 1998 and sampled weekly until 19 December 1998. Floral buds and seed capsules were collected at random from plants and taken to the laboratory to determine boll weevil infestation status.

In the laboratory, immature *C. drummondii* fruit capsules were artificially infested with 3rd instar boll weevil and the fruit peduncle was inserted in a water pick apparatus. Groups of 20 infested fruit were then separately exposed for 7 days to 10-15 mated females of three parasitoid species of boll weevil: *Catolaccus grandis*, *Bracon compressitarsis*, and *B. thurberiphagae*. The experiment consisted of three replicates and was conducted twice. After the 7 day exposure period, the capsules were dissected and parasitization status of boll weevil was recorded.

Results and Discussion

Cienfuegosia drummondii populations were found in 2 sites in Cameron, 4 in Aransas, 6 in Refugio, and 16 in San Patricio counties. Populations varied considerably from very sparse to high density. All sites with mallow plants were encountered within ca. 20 yards of vehicular access roads, usually along perimeters of large ranches or refuges. No surveys were conducted further into the interiors of these areas, but with the frequent encounters observed, it is likely that distribution is quite widespread and common in appropriate soil types, especially in the Coastal Bend. In addition to the soil types reported for *C. drummondii* by Burke and Clark (1976), we found plant populations in Aransas and Victine clays and in Narta and Willamar fine sandy loams. Thus, lighter textured soils, if characterized by slow drainage, are suitable for *C. drummondii* growth. No plants were found in cultivated or fallow crop land, and only rarely in areas which have undergone severe disturbance (particularly root plowing) of the top soil.

At the WWFR in 1997, flower buds and seed capsules were available for weevil development from early April through November (Fig. 1). Reproductive growth of *C. drummondii* was greatly influenced by soil moisture and was highest during early spring and early fall precipitation periods. Drought conditions from mid-June to mid-September caused near cessation in reproductive growth. The number of combined buds and capsules per plant was highest (=3.02) on 11 April and gradually declined to =0.21 by 18 July (Fig. 1). During this same period, weevil trap captures averaged 1.1 per trap per week. On 18 July, captures increased to 251.7 per trap and averaged 58.8 weevils per trap for the following six weeks. Thereafter, captures averaged 1.6 weevils per trap for the following five weeks. No weevils were captured after 9 October. After heavy fall rains, bud and capsule production increased and averaged 0.95 per plant from 9 October to 20 November. In 1997, no buds or capsules from the WWFR plots were found to be infested by boll weevil, nor were adults encountered on sampled plants.

A similar pattern of reproductive growth by *C. drummondii* and for weevil captures was observed at the WWFR plots in 1998 (Fig. 2). However, weevil trap capture levels were about 1/10 that recorded in 1997. Reproductive structures were available to boll weevil from early March through mid December, but no buds or capsules from the WWFR plots were found to be infested by boll weevil, and only one adult was observed in a plant sample. As in 1997, trap captures at WWFR were highest in July when reproductive structures were fewest in number.

At the location near Taft in 1998, infestation of reproductive structures of *C. drummondii* were found during four of six sample dates (Table 1). Inspection at this site was not begun until ca. six weeks after the cotton stalk destruction deadline. The highest infestation of flower buds was 6.5 percent on 3 November, but weevil infestation persisted until the last sample date of 17 December. A light frost in late December terminated reproductive growth of mallow plants. Out of a total of 21 boll weevil adults (3 collected on plants and 18 emerging from collected buds or capsules) from this location, 8 remained alive as of 30 December 1998.

At the Weslaco location in 1997 (Fig. 3), percent weevil infestation of *C. drummondii* reproductive structures ranged from 0 to 31.8 (=8.1) and adult emergence from infested forms ranged from 0 to 62.5 percent (=26.6). The sampling period at this location in 1997 was after the 1 September stalk destruction deadline. At the same location in 1998, percent infestation of flower buds and seed capsules of mallow plants (Table 2) was much lower than that observed in 1997. The highest infestation of flower buds was 9.1 percent and occurred on 26 June. Infestation of *C. drummondii* reproductive structures was only observed during the seasonal production cycle of cotton in 1998.

At the Weslaco field location in 1997, natural parasitism of boll weevil larvae in *C. drummondii* ranged from 0 to 33.3 percent with 95 percent of the total attributable to *Catolaccus hunteri*. *Bracon mellitor* was the other parasitoid recovered. Both species are native and have broad host ranges. In the laboratory study where boll weevils in *C. drummondii* fruit capsules were exposed to three species of exotic ectoparasitoids, all species successfully parasitized boll weevils (Fig. 4). Tactics do not currently exist for management of boll weevil in *C. drummondii* habitat (where insecticidal applications are prohibited), thus parasitoid augmentation may have potential as a suppression approach for weevils utilizing this host plant.

In summary, we found that *C. drummondii* can provide oviposition sites for boll weevil from early March through December. Cotton, in compliance with planting and stalk destruction deadlines, typically provides reproductive sites only from ca. mid-April to mid-September. The degree of boll weevil infestation varied considerably between field sites and years. *Cienfuegosia drummondii* obviously represents a potential resource for reproducing weevils, but the value of this species in population recruitment and survival of boll weevil requires more study. Preliminary laboratory results indicate that boll weevil can become reproductive on *C. drummondii* without feeding on cotton pollen. Further survey is planned to better delineate this host plant's habitat and activities will continue to further assess the significance of *C. drummondii* on boll weevil population dynamics and the feasibility of parasitoid augmentation for management of the pest in non-cotton habitat.

References

Burke, H.R., and W.E. Clarke. 1976. *Cienfuegosia drummondii* as a host of the boll weevil, *Anthonomus grandis*, in South Texas, pp. 12-21 *In* Boll Weevil Suppression, Management, and Elimination Technology. Proceedings of a Conference, Feb. 13-15, 1974, Memphis, TN. ARS-S-71.

Lukefahr, M.J., and D.F. Martin. 1962. A native host plant of the boll weevil and other cotton insects. J. Econ. Entomol. 55: 150-155.

Table 1. Percent infestation of flower buds and seed capsules of *Cienfuegosia drummondii* by boll weevil in 1998 near Taft, San Patricio, Co.

Date	Flower buds	Seed capsules	Combined forms	No. forms inspected
11/03	6.5	4.3	5.5	163
11/10	1.7	1.3	1.6	1078
11/17	0.7	1.2	0.9	569
11/25	0.0	0.0	0.0	395
12/09	0.0	0.0	0.0	300
12/17	0.3	0.0	0.2	582

Table 2. Percent infestation of flower buds and seed capsules of *Cienfuegosia drummondii* by boll weevil in 1998 at Weslaco, Hidalgo Co.

Date	Flower buds	Seed capsules	Combined forms	No. forms inspected
5/19	0.0	0.0	0.0	240
5/27	0.0	0.0	0.0	290
6/04	0.0	0.8	0.6	156
6/09	0.0	0.0	0.0	94
6/18	2.5	0.0	0.9	114
6/26	9.1	0.0	2.1	47

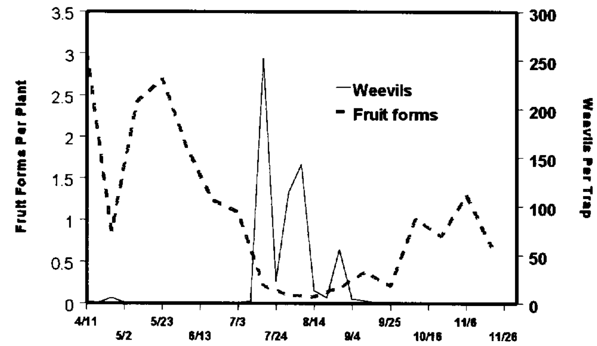

Figure 1. Seasonal phenology of *Cienfuegosia drummondii* reproductive growth and boll weevil captures at Welder Wildlife Foundation Refuge in 1997.

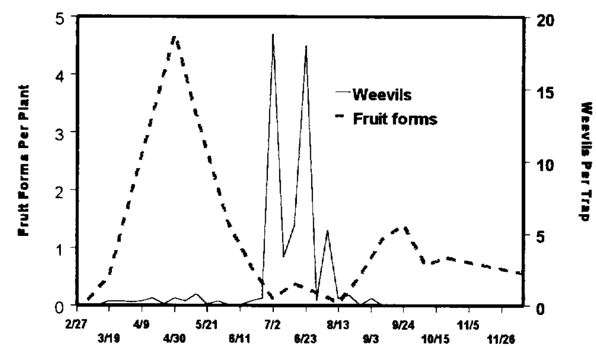

Figure 2. Seasonal phenology of *Cienfuegosia drummondii* reproductive growth and boll weevil captures at Welder Wildlife Foundation Refuge in 1997.

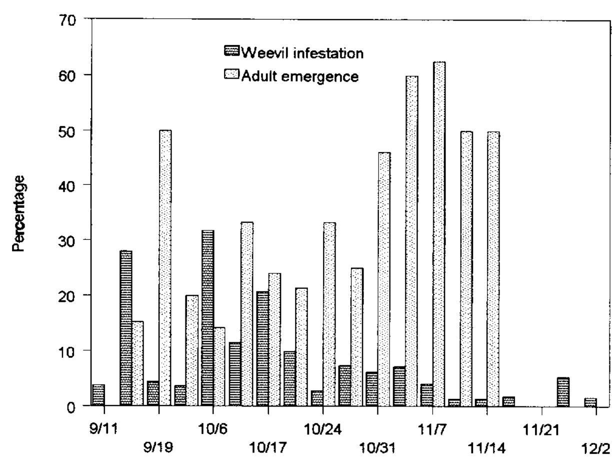

Figure 3. Percentage infestation of *Cienfuegosia drummondii* reproductive structures and adult emergence of boll weevil at Weslaco, Hidalgo Co. in 1998.

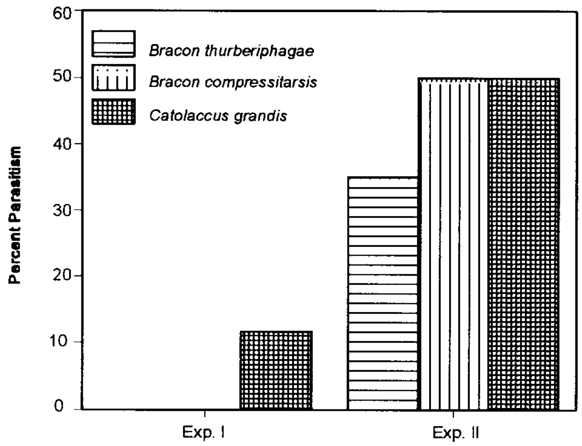

Figure 4. Percent parasitism in the laboratory of boll weevils in fruit capsules of *Cienfuegosia drummondii*.