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CYRTOBAGOUS SALVINIAE (COLEOPTERA: CURCULIONIDAE) SUCCESSFULLY OVERWINTERS IN TEXAS AND LOUISIANA

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Salvinia molesta D. S. Mitchell, an invasive floating fern, has invaded 12 states in the U.S. and is now well established in Texas and Louisiana (Jacono 1999). This plant quickly colonizes the surface of slow moving, fresh water bodies causing severe ecological and economic problems (Harley & Mitchell 1981). Successful biological control programs targeting this weed have been conducted in at least 13 countries worldwide using a small weevil, *Cyrtobagous salviniae* Calder and Sands (Coleoptera: Curculionidae) (Julien & Griffiths 1998). This species was first collected in southeastern Brazil in 1979 (Forno & Bourne 1984) and, after extensive host range testing, was released in Australia in 1980 where it reduced a large infestation of *S. molesta* by more than 95% after 13 months (Room et al. 1981). Since then *C. salviniae* has been introduced into different countries with infestations of *S. molesta* where it successfully reduced the weed to acceptable levels in most cases (Julien & Griffiths 1998).

Although *C. salviniae* has been present in Florida since at least 1960 (Kissinger 1966) where it reproduces on common salvinia, *S. minima* Baker, attempts to transfer it to Texas and Louisiana sites infested with *S. molesta* in 1999 met with mixed results (Tipping, unpublished data). A comparison of gene sequence data between the Florida and Brazilian populations (ex Australia) revealed some differences, the biological significance of which remain under study (Goolsby et al. 2000). Consequently, further releases of the Florida population were discontinued in favor of the Brazilian population that had been imported from Australia. After additional host range testing confirmed its specificity to *S. molesta*, a general release permit was obtained for a designated area in eastern Texas and western Louisiana.

The first releases were conducted during October 10-11, 2001 when a total of 880 *C. salviniae* adults was released at four sites (220 per site). No more releases were done until March 2002 in order to determine if the insects could survive the winter. Subsequent visits to these sites plus four control sites were conducted in December 2001 and March 2002. During December 4-6, 2001, one hundred plants from the mat of *S. molesta* confined within a floating 1 m^2 square of PVC pipe frame, were selected without bias and hand-searched and the number of adults found was recorded and left in place. Adults were recovered from three of the four sites with up to nine adults detected at one site from the 100 plant sample. Hand-searching was used because it is non-destructive. However, destructive methodologies like Berlese funnels usually extract 5-10 times more adults than hand searching (Tipping, unpublished data) so the weevil density may have been up to 90 adults in the sampled area at one site.

Further sampling was halted during the winter and resumed on March 25-27, 2002. Two of the four release sites yielded adult *C. salviniae* during hand searches with three and four adults found at those sites. It is unknown if these weevils were the original adults or progeny from the October, 2001 release. Sands et al. (1986) found that adults held under constant temperatures of 23, 27, and 31°C lived an average of 163.1, 116.9, and 101.5 days, respectively. These adults were found inside the original release square but sampling within paired 0.1 m^2 quadrats, one along either side of a transect line, 1, 5, and 10 meters away from the release square, yielded no *C. salviniae*. It is noteworthy, therefore, that adults of *C. salviniae* were able to persist or propagate over a period of 166 days despite air temperatures that reached as low as -9.1 °C and - 7.1°C at Toledo Bend reservoir and Lake Texana, respectively. The former site is the most northern and the latter the most southern.

Temperature data were not available in the immediate vicinity of these research sites so the nearest recording stations were used (Table 1). In addition, unlike air temperatures, water temperatures were only available on selected dates which varied between the Toledo Bend and Lake Texana sites. In the area around Toledo Bend reservoir, there were 26 days during October 2001 through March 2002 when the minimum air temperatures were below 0°C. In contrast, only 7 days had minimal air temperatures below 0°C in the Lake Texana area. These temperatures probably were not maintained for long; in every case the daily maximum temperature was above 0°C. Whiteman & Room (1991) found that *Salvinia molesta* was killed when its buds were exposed to temperatures less than -3°C for 2-3 h. In many locations at these two sites, the plants were in coves and backwater areas sheltered from direct winds and protected by overhanging vegetation from the shoreline or adjacent floating plants like water hyacinth, *Eichhornia crassipes* (Mart.) Solms. These conditions likely buffered any negative temperature effects on the plants and insects. As expected, water temperatures lagged behind the colder air temperatures (Table 1).

This finding indicates that the Brazilian population of *C. salviniae* can survive the winter climate where *S. molesta* is extant in Texas and Louisiana.

TABLE 1. AIR AND WATER TEMPERATURES (°C) ON SELECTED DATES FOR SAMPLE SITES NEAR AND IN TOLEDO BEND RESERVOIR AND LAKE TEXANA.

Toledo Bend Reservoir				Lake Texana			
	Air Temperature[1]		Water Temperature[2]		Air Temperature[3]		Water Temperature[4]
Date	Max	Min	Surface	Date	Max	Min	Surface
10/09/01	25.9	17.2	22.7	10/13/01	26.7	15.6	25.3
11/13/01	24.3	12.3	20.7	11/08/01	28.8	15.5	23.2
12/11/01	10.9	0.4	15.2	12/06/01	26.5	19.5	20.5
01/08/02	17.8	-2.3	9.5	01/15/02	18.8	3.4	12.9
02/12/02	15.2	-1.3	9.5	02/14/02	20.0	3.7	13.6
03/12/02	14.4	6.6	12.5	03/28/02	28.7	11.7	17.1

[1]Texas A&M University Agricultural Research and Extension Center at Overton, TX.
[2]Texas Sabine River Authority, station #15659.
[3]Texas A&M University Crop Weather Program - Victoria County weather station.
[4]Lavaca-Navidad River Authority, site #13985.

SUMMARY

Cyrtobagous salviniae survived the winter of 2001-2002 in eastern Texas and western Louisiana after its release in October 2001 on giant salvinia, *Salvinia molesta*. Adults were recovered from Toledo Bend reservoir and Lake Texana in March 2002, up to 166 days after they were released. Although minimum air temperatures were recorded at or below 0°C on at least 26 days at Toledo Bend reservoir, water temperatures likely buffered these extreme conditions. Weather conditions at Lake Texana, a more southern site, were more benign.

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