Automeris louisiana (Lepidoptera: Saturniidae) populations in the chenier plain habitat of coastal Texas, with new distributional and larval host plant records


Abstract
Evidence for a viable Texas population of Automeris louisiana, using historical collection records, and biogeographical analysis are presented. Results include new distributional records for the species and the first analysis to show it possibly endemic to Texas coast chenier plain marshes. A new larval hostplant Bolboschoenus robustus is identified in this study.

Keywords: chenier plain, hostplant, endemic, Automeris louisiana, Bolboschoenus robustus

Introduction
Moths in the genus Automeris, Hübner (1819), are members of the family Saturniidae. Automeris is a large genus believed to contain about 100 species; all but a few of which belong to the subgenus Automeris (Michener 1952). Most of the species are Neotropical. Four species are known from the United States [4]. A wide variety of host plants for the genus are recorded; among them Quercus, Salix, Liquidambar, Acer and Betula (Stone, 1991) [10]. Automeris caterpillars typically progress through six (6) instars. Like other members of Subfamily Hemileucinae, Automeris caterpillars bear urticating spines that deliver a painful sting. The eggs are laid in clusters. Larvae are gregarious through the first 3 instars. Pupation occurs in a flimsy cocoon or naked in the soil [13].

Automeris louisiana Ferguson & Brou, 1981 was described from specimens collected in Golden Meadow, Lafourche Parish, Louisiana by Ferguson and Brou, in 1981. It differs from other Nearctic Automeris by the lack of dimorphism (sexual and seasonal), salt-marsh habitat, and brownish coloring, which may be a cryptic adaptation to the grassland environment. The typical habitat for this species is described as open, treeless, salt marsh or cordgrass prairie of the outer Mississippi river delta [3]. In the wild, multiple marshland plants were speculated as possible larval host plants. The dominant plant is smooth cordgrass, Spartina alterniflora Loisel. Other main components of the vegetation are Carex spp., Distichlis spicata (L.) Greene, Juncus effusus L., Juncus roemerianus Scheele, Maricurus sp., Panicum spp., Phragmites communis Trin., Sagittaria spp., Scirpus spp., other Spartina spp., Typha domingensis Pers., and Zizaniopsis miliacea (Michx.) Doell & Aschers (Kuchler, 1964) [3]. Documented larval host plants include Quercus virginiana Mill, sugarberry Celtis laevigata Wild., and smooth cordgrass S. alterniflora [13].
The senior author was contacted in 2005 by Matthew Whitbeck, a USFWS wildlife biologist at Anahuac National Wildlife Refuge in Chambers County Texas. Whitbeck had on several occasions observed larvae of a large Saturniid species while on the Anahuac National Wildlife Refuge. In June 2005 Whitbeck encountered a large caterpillar (Fig. 1) feeding on sturdy bulrush *Bolboschoenus robustus* (Pursh) Soják. This caterpillar was photographed and returned to the hostplant on which it was feeding. Whitbeck’s initial inquiry focused on establishing the identity of the insect.

Matt Whitbeck first encountered this species on the Anahuac NWR in 2000. On May 7, 2000 he found a large larva feeding on *B. robustus* near Coon Creek, a small tidal creek off East Bay (Table 1). He confined the larva and continued to feed it on *B. robustus* for several days until it pupated on May 10, 2000. The adult moth eclosed in late May 2000 and was subsequently photographed (Fig. 2). Positive identification by the senior author lead to opportunities to study and better document the existence of a breeding population at Anahuac NWR. On July 22, 2005 multiple black-light collecting devices were placed near the salt marsh. Early in the morning of July 23, 2005 two adult female moths were collected (Fig. 3). These specimens were placed into brown Kraft paper bags and allowed to oviposit (Fig. 4). To ensure against catastrophic loss, the resulting 312 ova were distributed among three lepidopterists. Rearing attempts on sweetgum, *Liquidambar styraciflua* with 82 of 97 ova hatching, resulted in none reaching the pupal stage. Rearing attempts on smooth cordgrass, *S. alterniflora* with 121 of 128 ova hatching, resulted in none reaching the pupal stage.

### Table 1: Texas records for *Automeris louisiana*

<table>
<thead>
<tr>
<th>Date</th>
<th>Reporter</th>
<th>Place Name</th>
<th>County</th>
<th>Stage</th>
<th>Details</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/11/1994</td>
<td>Charles Bordelon, Jr.</td>
<td>McFadden NWR</td>
<td>Jefferson</td>
<td>Adult</td>
<td>Adult; Texas State Record</td>
<td>29.700673 *</td>
<td>-94.082983</td>
<td>Catalog#: LEPSOC_A_00059351</td>
</tr>
<tr>
<td>7/30/1994</td>
<td>Charles Bordelon, Jr.</td>
<td>McFadden NWR</td>
<td>Jefferson</td>
<td>Adult</td>
<td>Adults black light near bay</td>
<td>29.700673 *</td>
<td>-94.082983</td>
<td>Catalog#: LEPSOC_A_00059351</td>
</tr>
<tr>
<td>6/17/1996</td>
<td>Ron H. Leuschner</td>
<td>McFadden NWR</td>
<td>Jefferson</td>
<td>Adult</td>
<td>Adult</td>
<td>29.700673 *</td>
<td>-94.082983</td>
<td>Catalog#: LEPSOC_A_00055500</td>
</tr>
<tr>
<td>5/7/2000</td>
<td>Matthew Whitbeck</td>
<td>Anahuac NWR</td>
<td>Chambers</td>
<td>Larva</td>
<td>Larva on <em>B. robustus</em></td>
<td>29.573882 *</td>
<td>-94.547115</td>
<td>Pers Comm</td>
</tr>
<tr>
<td>6/14/2005</td>
<td>Matthew Whitbeck</td>
<td>Anahuac NWR</td>
<td>Chambers</td>
<td>Larva</td>
<td>Larva near E. Bout ramp</td>
<td>29.606339 *</td>
<td>-94.399672</td>
<td>Pers Comm</td>
</tr>
</tbody>
</table>

Records in boldface are previously unreported

The third lepidopterist, Michael Van Buskirk, hatched 70 of 87 ova, rearing caterpillars on sugarberry, *C. laevigata*. A total of 32 larvae pupated and developed to imago by October 2005. The hatch-pupation period for Van Buskirk’s cohort ranged from 38 to 47 days [12].

The adult specimens from Van Buskirk’s cohort (Fig. 5) exhibited the distinct morphological features of *A. louisiana* and were clearly not *A. io*. The morphology of *A. louisiana* consists of a greenish tint to the fore and hind wings with extensive white coloration in the hind wing eyespot, while *A. io* ranges from yellow to dark reddish-brown wing coloration. (Fig. 12)
2. Materials and Methods
This paper uses historical records extracted from published online database sources, author field captures and associated larval rearing records.

Adult captures
Adult moths were attracted to black light fluorescent lights shining on a vertical sheet. These were placed at dusk near marsh lands bordering the East Bay at Anahuac NWR. Two adult females were found on the sheets before dawn on July 23, 2005.

Larval captures
Larval capture and observations by authors. Whitbeck found a single larva feeding on *B. robustus*, in May 2000. He captured and reared to pupa, which successfully eclosed. Whitbeck found a second late instar larva, in a different area of the Anahuac NWR, feeding on sturdy bulrush *B. robustus* in June 2005 (Fig. 2). This larva was photographed and returned.

Larval rearing
Larval rearing methodology. Observations reported here resulted from the successful rearing of a cohort of larvae by Van Buskirk. A total of 128 ova were placed in rearing cages with temperatures ranging from 21 to 37 degrees C. Humidity ranged between 50% to 100%. Elapsed time from hatch to pupation was 38-47 days and the larvae were primarily fed sugarberry, *C. laevigata*. The larvae consumed all cut hostplant in one day during the 5th and 6th instars. Rearing cages were cleaned twice a day. Larval frass did not remain in the cages for longer than 10 hours or so, at any time.

Georeferencing and GIS
The records in Jefferson and Chambers counties are tightly linked to the presence of chenier plain ecosystems. The Texas Parks and Wildlife TEAM application [11] was used to explore this association. All sighting records were created as reference points and exported as individual KML files from Google Earth. These geotagged data points were then uploaded to TEAM to identify the habitat where the organisms were found. The TEAM application, by default, samples an area of 2,007.85 acres surrounding the center of each data point and in most of our sites this includes open water. Open water is not used by this species, so we have removed the open water area from the summary data in Table 2 to give an accurate accounting of the ecosystem types in our sampled areas. This adjustment gives us a better understanding of the importance of the various chenier plain and marsh ecosystems for this organism.

3 Results
Observations
The nine recorded observations of *A. louisiana*, (from five individual collectors) as compiled here represent the most complete knowledge of the species distribution in Texas to date (Table 1). Bordelon’s records from June 1994 (Fig. 10D) were reported on the Season Summary website of the Lepidopterist’s Society [9]. They are the first reported occurrence of the species in Texas. They were reported as “Sabine Pass, Texas”. However, label data on of these specimens was more specific, stating McFaddin NWR as the locality. This more accurate locality data allowed georeferencing of these specimens and of the later observations reported by Bordelon and Leuschner in 1996. The McFaddin NWR is homogeneous chenier plain fresh and oligohaline tidal marsh. Whitbeck’s observations at Anahuac NWR, (first reported here), were the second locality reported in Texas. His new distributional records for Chambers County had accurate GPS coordinates. Kent’s collection of the species in Jefferson County, Texas, (first reported here), has been georeferenced by communication [5]. Nuelle’s collection records from 2005, were georeferenced from collection data. Georeferencing of all known Texas records has allowed biogeographical analysis using the TPWD Texas Ecosystem Analytical Mapper application [11].

4. Discussion
Analysis of locality data using the TPWD ecosystem mapper [11] indicates that the larvae are thriving in mesohaline or polyhaline tidal marshes. The new larval hostplant, *B. robustus*, is a key indicator species for mesohaline and polyhaline conditions. The localities in Jefferson County are described in the TPWD ecosystem mapper [11] as chenier plain salt and brackish low marsh. Those in Chambers County are chenier plain fresh and oligohaline tidal marsh. *Automeris louisiana* is incapable of unassisted, widespread dispersal in either larval or adult forms due to the limited life span of the adults and the limited vagility of the larva. The adult moths lack functional mouthparts and only live a few days after eclosion. The females use pheromones to attract a mate and after fertilization females typically take flight in the dark, early morning hours, to locate suitable hostplant and ovipositor. This life cycle makes it unlikely that these records represent incidental strays from source populations in Louisiana. Persistent larval populations in Chambers County, across a five-year span, supports the hypothesis of a viable Texas resident breeding population.

Biogeography
The mapping with “open water” areas omitted from the analysis indicates that 95.53% of the Chambers County habitat (Fig. 6, Fig. 7 and Table 2) and 99.84% of the Jefferson County habitat (Fig. 8, Fig. 9 and Table 2) surrounding the areas where the organisms were found, are classified as chenier plain habitat. Chenier plains are...a variety of tidal-influenced marsh types that may vary from year to year based primarily on storm events and precipitation, and across small areas due to small variations in elevation. Important species may include marshhay cordgrass, maidencane, southern cattail, three-square bulrush, saltgrass, and seashore paspalum [6]. Some chenier plains where the organisms were recorded, especially in Anahuac NWR, had sparse oak trees, thought to have been intentionally planted as wind-breaks. Table 2 shows the open water adjusted ecosystem analysis at capture points for both counties. There are a variety of ecosystems in the areas surrounding the capture data points; all consistent with the species larval hostplant preferences. These chenier plains represent ancient beach ridges that are a part of a strand plain. Chenier plain ecosystems are critical as stopover habitat for neotropical migrant birds and are ranked high on the conservation and land use planning priorities for wetlands in Texas.
In Chambers County (Fig. 8, Fig. 9 and Table 2) the four sampling locations have some overlap but there is one location significantly further northeast, in an isolated section, the Middleton Marsh tract, of the Anahuac NWR. In Jefferson county, 5 of the 6 data points are identical so we have omitted duplicated data. Table 2 shows that in Chambers County *A. louisiana* is tightly associated with these wet, marshy habitats with 99.30% of the habitat being identified as either chenier plain or salty prairie. In Jefferson County, a similar percentage of habitat, 99.84% is identified as a type of chenier plain. The *B. robustus* sedges found in these habitats have demonstrated that they can sustain populations of *A. lousiana*. 
The identification of *A. louisiana* was confirmed morphologically in both adults and larvae to be distinct from the only similar species in the region, *Automeris io* [8]. The consistently distinctive forewing coloration (Fig. 10) of adults captured or reared from Chambers County was the most distinctive character. The rearing logs indicate that larvae of *A. louisiana* were highly synchronous in their development through the 7th instar and were consistently larger than those of *A. io*. James Adams (2005) also reported to us that the development was remarkably synchronous, with pupation of many hundreds occurring all within 14 days [1]. Van Buskirk noted larval development occurred at a faster rate in *A. louisiana* than in a cohort of *A. io* from Huntsville State Park that he raised earlier in 2005. The larvae of *A. louisiana* are remarkably consistent in color with no evidence of a yellow morph as is common in *A. io*; larger than *A. io* in all instars; and noticeably more reddish brown in segments L1-L4 [12] (Fig. 10).

### Table 2: Detailed ecosystem composition within the areas surrounding *Automeris louisiana*

<table>
<thead>
<tr>
<th>Acres</th>
<th>Hectares</th>
<th>% Total</th>
<th># Polys</th>
<th>Tx Ecological System</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,111.94</td>
<td>1,259.36</td>
<td>99.84%</td>
<td>2</td>
<td>Chenier Plain: Salt and Brackish Low Tidal Marsh</td>
</tr>
<tr>
<td>5.04</td>
<td>2.04</td>
<td>0.16%</td>
<td>2</td>
<td>Urban High Intensity</td>
</tr>
<tr>
<td><strong>3,116.98</strong></td>
<td><strong>1,261.40</strong></td>
<td><strong>100.00%</strong></td>
<td><strong>4</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Acres</th>
<th>Hectares</th>
<th>% Total</th>
<th># Polys</th>
<th>Tx Ecological System</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,952.85</td>
<td>1,599.67</td>
<td>90.06%</td>
<td>12</td>
<td>Chenier Plain: Fresh and Intermediate Tidal Marsh</td>
</tr>
<tr>
<td>209.54</td>
<td>84.76</td>
<td>4.77%</td>
<td>14</td>
<td>Gulf Coast: Salty Prairie</td>
</tr>
<tr>
<td>116.54</td>
<td>46.51</td>
<td>2.66%</td>
<td>7</td>
<td>Chenier Plain: Salt and Brackish Low Tidal Marsh</td>
</tr>
<tr>
<td>79.84</td>
<td>31.47</td>
<td>1.82%</td>
<td>7</td>
<td>Chenier Plain: Salt and Brackish High Tidal Marsh</td>
</tr>
<tr>
<td>21.05</td>
<td>8.44</td>
<td>0.48%</td>
<td>13</td>
<td>Urban</td>
</tr>
<tr>
<td>9.50</td>
<td>3.84</td>
<td>0.22%</td>
<td>7</td>
<td>Other</td>
</tr>
<tr>
<td><strong>4,389.32</strong></td>
<td><strong>1,696.09</strong></td>
<td><strong>100.00%</strong></td>
<td><strong>60</strong></td>
<td></td>
</tr>
</tbody>
</table>

Phenology

*Automeris louisiana* is documented feeding on a new larval host *B. robustus*. This new host plant and the previously documented *S. alterniflora* are common in chenier plain and coastal marsh from Louisiana to Texas. *Bolboschoenus robustus* grows 50–150 cm tall; leaf sheath fronts often papery at mouth, the veins reaching nearly to the summit (in some parts of the range of the species) or in the Gulf region (including TX) sometimes with a triangular, membranous, veinless area as in *B. maritimus* [2]. This is in stark contrast to the larval host plants of *A. io*, which are largely deciduous trees and other seasonal plants [10]. It may be speculated that a
shift in host plant may have allowed *A. louisiana* to become multivoltine in its Louisiana range (Fig. 1). Vernon Brou has documented the species in all but three months of the year in southern Louisiana \(^7\).

![Map of North America showing occurrence records for *Automeris louisiana*](image)

**Fig 11:** Map and occurrence records for *Automeris louisiana*

### 5. Conclusion
The life history documented from the rearing accounts and the analysis of the morphology of both adults and larval forms captured at Anahuac NWR confirm the presence of a breeding population of *A. louisiana* in Jefferson and Chambers County, Texas (Fig. 12). The records by Whitbeck and the authors are the first documented records of this species from Chambers County. The authors also confirm a new larval hostplant record *B. robustus* for this species. Data in Texas are limited and mostly inadvertent captures but indicate that the population may be univoltine (Fig. 11). The population may be endemic to chenier plain oligohaline marsh. More directed, areadjacent research in Texas using maps from the TPWD TEAM GIS application may further extend the known geographic distribution and further demonstrate the species’ affinity to chenier plain. Studies in a wider temporal range may document a multivoltine pattern.

![Butterflies](image)

The *Automeris io* male (A) on the left has very prominent yellow wings, heavily maculated with rusty red markings on a distinctly yellow background. The *Automeris louisiana* male (B) on the right is predominantly light olivaceous brown – yellow is not usually present on the male forewings. The males of these two species are highly dissimilar and readily differentiated visually.
The *Automeris io* female (C) on the left has very prominently yellow marked hindwings with huge eyespots. The *Automeris louisiana* female (D) on the right has strong white flashes central to the ocellate discal spot. The female *Automeris louisiana* has light, olivaceous brown forewings while the female *Automeris io* has deep, rusty red forewings. *Automeris louisiana* females typically have no yellow extending onto the margins of the hind wings. *Automeris louisiana* females are typically less maculated on the forewings than *Automeris io*, but they do have very similar areas of forewing shading. Males and females of *Automeris louisiana* are less sexually dimorphic than *Automeris io*.

**Fig 12:** *Automeris louisiana* differentiation guide

### 6. Acknowledgements

The July 2005 study at Anahuac National Wildlife Refuge was conducted under a permit from United States Fish and Wildlife Service. This expedition was funded by a grant from Mr. Wally Ward, a local, well known nature photographer and research supporter. The authors wish to acknowledge David Kent for sharing collection records. Dr. Jerry Cook and Dr. William Godwin, Sam Houston State Natural History Collections provided editorial advice and support. Dr. Richard S. Peigler, Department of Biology, University of the Incarnate Word spent hours in conversation regarding *Automeris* life history and guidance on understanding the validity of *Automeris* subspecies and forms. Dr. James Adams, Professor of Biology, Dalton State College, provided an initial review of much of the early material that was used to prepare this paper. His comments and insights on rearing *Automeris* caterpillars assisted in confirming our larval determinations.

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### 7. References