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Cactus Moth Update



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Distribution of *Opuntia* in the Region

By Victor Maddox
Geosystems Research Institute

New populations of *Opuntia* have been recorded in Mississippi recently. Cactus moth has been found in southern Louisiana, intensifying work there.

On the Cactus Moth Detection and Monitoring Network database, 236 instances are reported in Louisiana, with new reports added constantly. A number of new populations of host cacti are also marked. Most are *Opuntia engelmannii* Salm-Dyck ex Engelm. on canal levees (Fig. 1), on and around Fort Livingston, or in residential landscapes.

Plants on levees may have escaped from Fort Livingston located on Grand Terre Island to the south of the canal levees. *Opuntia engelmannii* was apparently planted at Fort Morgan in Alabama for soil stabilization.

Similar planting may have taken place many years ago at Fort Livingston, possibly making it

Fig. 1. *Opuntia engelmannii* Salm-Dyck ex Engelm. on a canal levee in southern Louisiana. This plant was not infested with cactus moth, but many others in the area are. (Photo by Victor Maddox).



Figure 2. Larger vegetation associated with *Opuntia engelmannii* Salm-Dyck ex Engelm. grows on canal levees in southern LA. Identifying taller vegetation saves time, since could indicate potential hosts. (Photo by Victor Maddox).

non-native. Still, *Opuntia engelmannii* is well established on Grand Chenier in southwest Louisiana. *Nopalea cochenillifera* (L.) Mill. and *Opuntia ficus-indica* (L.) Mill. have been identified in residential landscapes, but are uncommon.

Surveys continue in southern Louisiana for host s from populations. Many are accessible only by boat and scattered over a

vast area. Associate species have been recorded for a number of the *Opuntia engelmannii* populations on canal levees. They are generally associated with *Baccharis halimifolia* L., *Celtis laevigata* Willd., *Distichlis spicata* (L.) Greene, *Ilex vomitoria* Ait., *Iva frutescens* L., *Lantana camara* L., *Melia azedarach* L., *Quercus virginiana* Mill., *Rubus trivialis* Michx., *Sesbania drummondii* (Rydb.) Cory, *Solidago semper-virens* L., *Spartina patens* (Ait.) Muhl., *Teucrium canadense* L., *Triadica sebifera* (L.) Small., and *Zanthoxylum clava-herculis* L.

Other less common species were also associated with *Opuntia*, but the larger woody species appear to be better indicators since they are visible from greater distances (Fig. 2). Data for each population will be collected and entered into the Cactus Moth Detection and Monitoring Network database.

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“MSU-GRI assisted with two sets of host/pest surveys in Southern Louisiana.”

Helping APHIS Find Cactus Moth

By Victor Maddox
Geosystems Research Institute

Since before the detection of cactus moth in Louisiana, MSU-GRI has coordinated and collaborated with USDA-APHIS in their efforts to eradicate cactus moth in the Midsouth.

In early June MSU-GRI assisted USDA-APHIS with cactus moth surveys on the Mississippi barrier islands. Teams inspected thousands of plants for cactus moth on Horn and Petit Bois Islands during a strategic time.

Following the detection of cactus moth in Louisiana MSU-GRI assisted with two sets of host/pest surveys in Southern Louisiana. The first set of surveys was conducted during the 3rd week of June and focused on all roads south of Highway 90. The second set of host/pest surveys was conducted the last week of June.

Boat surveys in the marsh south of Lafitte, LA (Figure. 1) took the first day. Representatives from Texas trained in recognizing the various stages of pest activity and host damage (Figure 2). The remaining

surveys were road surveys on and adjacent to Highways 45 and 23 south of New Orleans.

Data on new host populations were gathered during these surveys, entered into the Cactus Moth Detection and Monitoring Network (CMDMN) database. Both Louisiana data and Texas sentinel site contacts from the database have been shared with USDA-APHIS. Currently, MSU-GRI is working on sharing CMDMN host data for Texas with George Nash, USDA-APHIS, in Texas.

During cactus moth and host



Fig. 1. Boat survey for cactus moth and hosts in southern Louisiana with USDA-APHIS representatives. MSU-GRI collected data for the Cactus Moth Detection and Monitoring Network (Photo by Victor Maddox).

Helping APHIS Find Cactus Moth (cont.)

survey trips, invasive plant species data was also collected for the Invasive Plant Atlas of the MidSouth (IPAMS) for sharing. Numerous data forms were collected during these trips including data on species new to IPAMS and federal noxious species.

MSU-GRI continues to coordinate activities with USDA-APHIS to assist their efforts, which is especially important when there are USDA budget shortfalls. USDA is establishing trap lines in LA and TX and seeking more host information and volunteers in TX.



Fig. 2. Joe Bravata with USDA-APHIS in Louisiana inspecting *Opuntia engelmannii* Salm-Dyck ex Engelm. for cactus moth. USDA-APHIS representatives from Texas participated in the survey as training for activities in Texas. (Photo by Victor Maddox).

“Dissection of Male Genitalia of the Cactus Moth” - A Training Video

By Richard L. Brown
Department of Entomology

The identification of the cactus moth can be dependent upon making dissections of the male genitalia for distinguishing this species from related cactus moths. Proper methods for

making dissections are known to many Lepidoptera specialists, but these have not been made widely known to others who are involved in making diagnostic identifications. A new video has been produced that covers the tools and reagents needed for making dis-

sections and the detailed methods for cleaning, staining, and slide mounting the abdomen and genitalia. This video will be available on CD as well as on web pages, and as such will be the first video on dissection methodology that is available on line.

A new web site on cactus moths will cover 21 genera and include taxonomic and identification information, morphology, life history, larval hosts and images.

New Web Page on the Cactus Moth and Related Native Species

By Richard L. Brown
Department of Entomology

A new web site on cactus moths in North and South America is in development by Thomas Simonsen and Richard L. Brown, with various author authors contributed selected pages. The site will cover 21 genera and include taxonomic and identification information,

morphology, life history, larval hosts, and images. At present the site includes this information for all *Cactoblastis* and *Melitara* species.

New information that is available on-line for the first time includes images of comparative morphology of *Cactoblastis* and *Melitara*, a synthesis of new information on life history and

known hosts of *Cactoblastis*, a complete bibliography for *Cactoblastis* (with pdfs for some publications), and a compiled and categorized list of links to other sites. The site can be accessed at: <http://mississippientomologicalmuseum.org.msstate.edu/Researchtaxapages/CactusMoths/ListGenera.html>.

Opuntia and *Cactoblastis* Habitat Models and Population Genetics



By Gary N. Ervin
Department of Biological Sciences

(T)he moth's distribution is strongly influenced by the presence of its preferred host species (or that the two are mutually influenced by one or more other factors).

Our proposed work for 2009-2010 encompasses three major areas of research—continued habitat modeling efforts based on our large data set from the *C. cactorum* native range, continued genetic studies in *Opuntia* and cactophagous moths, and experimental studies of growth performance of *C. cactorum* and native US cactus moths on native southeastern US *Opuntia* species.

The following is an update on progress towards our proposed deliverables for 2010.

A. Analyses of comparative growth chamber studies.

We initiated a controlled laboratory experiment aimed at investigating unique defense responses from prickly pear hosts to feeding by *C. cactorum* (invasive moth) and *M. prodenialis* (native).

This experiment also will provide a direct comparison of life history difference between these two cactophagous moth species including information about phenology, reproductive characteristics, and survivorship on their most commonly

utilized Floridian host plant species (*O. humifusa* and *O. stricta*).

B. Analyses of genetic data resulting from Argentina sampling trips.

We completed genetic analyses for *C. cactorum* in its native range in Argentina, its invasive range in Florida, and for *Melitara prodenialis* across its native Floridian range. These analyses have shown that *C. cactorum* has considerable geographically structured genetic diversity in its native range, similar to *M. prodenialis* in its native range.

Cactoblastis cactorum in Florida has far reduced genetic diversity relative to its native range (5 vs. 55 COI haplotypes), but this diversity also is geographically structured, with a Gulf Coast clade, an Atlantic Coast clade, and a more widespread clade overlapping these other two.

These data support published inferences of multiple introductions to Florida, but only from the nearby Caribbean range. A manuscript discussing these findings is nearing completion and should be submitted during the next quarter.

C. Calibration of environmental tolerance models for *Cactoblastis*, based on data collected in the two Argentina research trips.

We have begun comparative habitat modeling approaches aimed at testing hypotheses regarding factors influencing the distribution of *C. cactorum* across Florida.

This work, and a field study completed during summer 2008, suggest the moth's distribution is strongly influenced by the presence of its preferred host species (or that the two are mutually influenced by one or more other factors). We presently are expanding this work to evaluate potential habitat for the moth in areas of the Gulf Coast beyond the Florida-Alabama distribution.

We also have begun work to integrate habitat modeling studies with results we have obtained to date from our genetic analyses (i.e., modeling habitat for specific genotypes). We have manuscripts in development based on this habitat modeling work.



Cactus Moth Detection and Monitoring Network Homepage

By Clifton Abbott
Geosystems Research Institute

The Cactus Moth Detection and Monitoring Network continues to provide critical information in the fight against the invasive and destructive cactus moth.

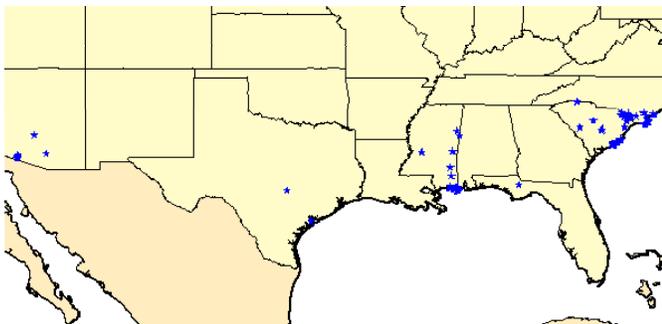
The network currently holds 7,788 positive and negative pricklypear cactus surveys across the nation and Mexico with many more waiting to be entered.

These surveys identified 2,560 populations of pricklypear cactus spanning 23 states and Mexico. Of those cactus populations, 103 are identified as positive locations for the cactus moth.

The network is also continuing to provide information about the leading edge of the moth's advancements along the East and Gulf coasts. Recently, the cactus moth was detected in three Southeast Louisiana parishes.

The network provided information about cactus locations in that area to assist in an extensive search led by USDA-APHIS. GRI's Victor Maddox assisted USDA-APHIS in

Figure 2. Cactus Moth Detection and Monitoring Network sentinel sites are monitored on regular intervals for the presence of the cactus moth.



searching for cactus locations and potential infestations in Southeast Louisiana.

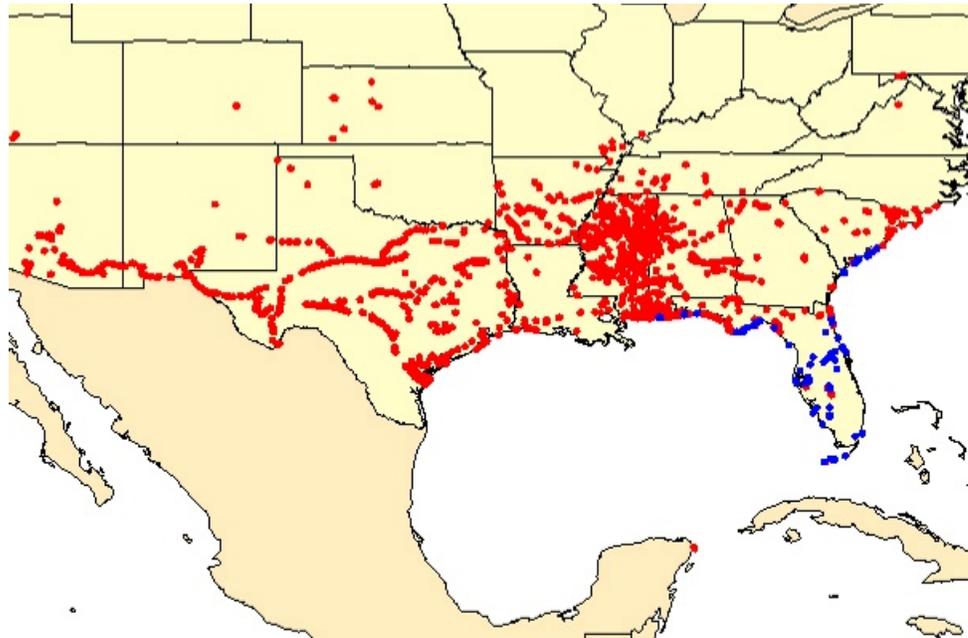


Figure 1. Cactus Moth Detection and Monitoring Network Map shows positive *Opuntia* populations (red) with positive moth infestations (blue).

The result of this survey effort produced 69 cactus locations with 45 locations being positive for cactus moth infestations. Additional surveys were collected 30 June and 1 July 2009. The data is currently being prepared for entry into the network.

GRI has been planning software and hardware upgrades to the servers that house the Cactus Moth Detection and Monitoring Network. These upgrades

have been plagued with problems with both the software and the hardware.

Those issues have been worked through and the upgrades are now moving forward. The Cactus Moth Detection and Monitoring Network can be visited at http://www.gri.msstate.edu/cactus_moth.

The network currently holds 7,788 positive and negative pricklypear cactus surveys across the nation and Mexico with many more waiting to be entered.

(T)he moth's distribution is strongly influenced by the presence of its preferred host species (or that the two are mutually influenced by one or more other factors).

Coordination January—June 2009

Invasive Species Working Group teleconferences, last Thursday of each month, team member has participated each month.

NBII Content Workshop, February 3-5 2009, Baltimore, MD. John Madsen attended.

Gary Ervin and colleagues in the MSU Department of Biological Sciences continue collaborations with Dr. Guillermo Logarzo and Laura Varone at the South American Biological Control Laboratory in Buenos Aires, Argentina. They are collaborating in the design of studies to examine the degree of isolation among *Cactoblastis cactorum* genotypes identified

through ongoing genetic research.

Victor Maddox logged the following trips, working with USDA-APHIS

Mississippi barrier islands with USDA-APHIS. 9-11 Feb 2009. Inspected thousands of host plants during cactus moth first cycle surveys. No visuals for cactus moth.

Mississippi barrier islands with USDA-APHIS. 30-31 Mar 2009. Inspected thousands of host plants for cactus moth. No visuals for cactus moth.

Mississippi barrier islands with USDA-APHIS. 10-12 Jun 2009. Inspected thousands of host

plants for cactus moth. No visuals for cactus moth. Approximate first instar larvae found were native cactus moth (confirmed by Richard Brown).

Southern Louisiana with USDA-APHIS. 17-19 Jun 2009. Conducted cactus moth and host road surveys south of Hwy 90 across southern Louisiana.

Southern Louisiana with USDA-APHIS. 29-30 Jun to 1 Jul 2009. Assisted with cactus moth and host boat surveys south of Lafitte, LA and conducted cactus moth and host road surveys south of New Orleans. New cactus moth infestations identified and many new host populations documented.

Quarantine Facility for Rearing Cactus Moths Supporting Research and Identification

By Richard L. Brown
Department of Entomology

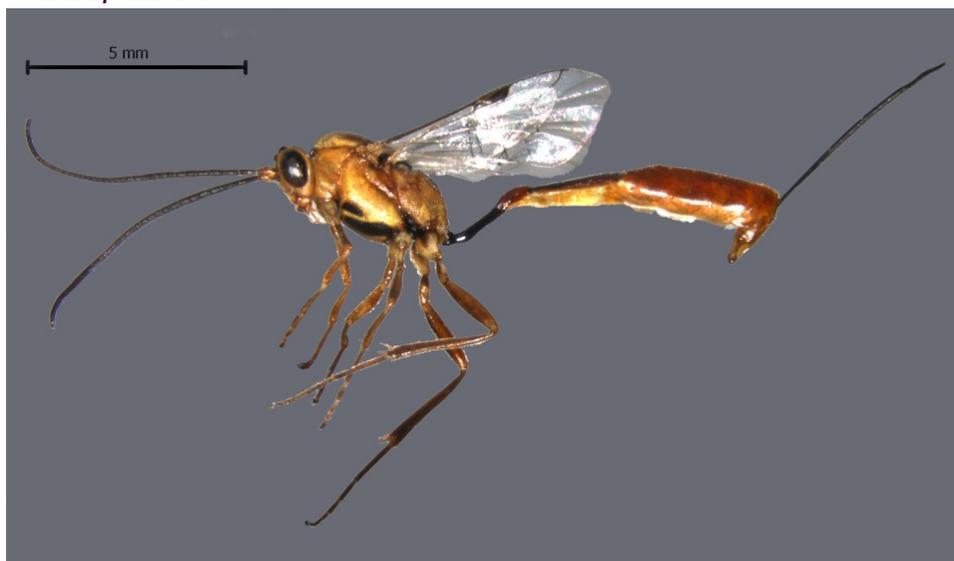
USDA-APHIS approved Standard Operating Procedures for

maintaining a quarantine facility in the Department of Entomology, allowing the rearing of egg sticks and young instar larvae

to verify their identification. Larvae from Jefferson Parish, LA provided voucher specimens of adults for documenting new distribution of the cactus moth. Larvae of native species were sent from western states to document their identity.

Drs. Gary Ervin and Travis Marsico researched the comparative fitness of *Cactoblastis cactorum* and *Melittara prodenialis*, which has provided secondary benefits. With Richard Brown, they identified two species of parasitoids of *Melittara prodenialis*, a tachinid fly and an ichneumonid wasp, and the fungus *Beauveria bassiana* as causing mortality to *Melittara prodenialis*; the parasitoids have been submitted to the USDA Systematic Entomology Laboratory for identification.

Telemucha sp. (Ichneumonidae) – a parasitoid reared from *Melittara prodenialis*.



Submission of Digital Images of Pheromone Trap Samples for Identification

By **Richard L. Brown**
Department of Entomology

Pheromone traps to monitor for presence of cactus moths are currently being operated in AL, MS (Petit Bois and Horn Islands), LA, TX, AZ, and CA.

Development of the cactus moth identification guide

and adjacent counties in TX. Many of the non-target species captured in pheromone traps can be easily told from exotic and native cactus moths without microscopic examination. In the photograph of the trap sample shown here, submitted by Dr. Barron Rector, Texas A & M University Extension Service, the moths are easily iden-

tos without the need of mailing of samples. However, all digital images sent to Richard Brown moth@ra.msstate.edu should be labeled with the trap number and the accompanying email message must include all trap data, including dates of trap operation, trap location, including county, location, and coordinates, collector of trap



A pheromone trap sample from Texas with *Spodoptera exigua* moths.

(Brown and Lee, 2008) has reduced the number of trap samples submitted for identification. Discovery of the cactus moth in Jefferson Parish, LA has resulted in more monitoring and use of pheromone traps in other coastal Parishes of LA

tified as *Spodoptera exigua* by forewing pattern, especially the presence of yellow spots.

Moths photographed in traps oriented so their forewing patterns are fully exposed often can be identified by digital pho-

sample, and the contact email, phone number, and address of the submitter. All trap samples should be retained by the submitter until confirmation of the identification is made by email or phone.



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Publications January—June 2009

Peer-Reviewed Journals

Simpson, A., C. Jarnevich, J. Madsen, R. Westbrooks, C. Fournier, L. Mehrhoff, M. Browne, J. Graham, and E. Sellers. 2009. Invasive species information networks: collaboration at multiple scales for prevention, early detection, and rapid response to invasive alien species. Submitted to *BioDiversity*.

In-House

Madsen, J. D., Brown, R., Ervin, G., Shaw, D. R., Abbott, C. F., Maddox, V. L., Wersal, R. M., McBride, D. W., & Madsen, N. 2009. Research to Support Integrated Management Systems of Aquatic and Terrestrial Invasive Species: Annual Report 2008. GRI Report #5030. Mississippi State University: Geosystems Research Institute.

Awards

Gary Ervin received the 2009 College of Arts & Sciences Faculty Research Award at an awards banquet on April 30.

Gary Ervin also was selected as 2009 Doug Wilcox Outstanding Associate Editor for *Wetlands*, the journal of the Society of Wetland Scientists.

Professional Presentations

Cannon, Jeffery (undergrad) and Gary Ervin. Soil texture effects on *Opuntia pusilla* morphology. Mississippi State University Undergraduate Research Symposium at MSU, April 21, 2009.

Madsen, J. D., Brown, R. L., Ervin, G., Maddox, V. L., & Abbott, C. F. 2009. Update on the GRI Cactus Moth Detection Network. Invasive Species Working Group. Teleconference: National Biological Information Infrastructure, Invasive Species Information Node. June 2009.

Maddox, V. L. 2009. Invasive species information and plant identification. 2009 Hattiesburg Garden and Patio Show, 27-29 Mar 2009, Hattiesburg Convention Center, Hattiesburg, MS.

Maddox, V. L. 2009. Plant identification and invasive species information. 12th Annual Jackson Garden and Patio Show, 13-15 Mar 2009, Mississippi Trade Mart, Jackson, MS.

Leveraging Proposals Submitted

Madsen, J. D., V. L. Maddox, and R. L. Brown. 2009. Cactus moth response west of Mississippi: Survey, training, assessment and verification. USDA APHIS PPQ Cactus Moth National Program, July 1, 2009 – March 31, 2010. \$55,705.76. Pending.

Madsen, J. D., G. N. Ervin, C. Brooks, V. Maddox, L. Mehrhoff, R. Westbrooks, and T. Fera. 2009. Development Of A National Early Detection And Rapid Response Training Program For Invasive Plants In The United States. USDA CSREES AFRI Program, January 1, 2010 – December 31, 2012. \$499,290.45. Pending.

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