UNITED STATES DEPARTMENT OF AGRICULTURE
Cooperative State Research, Education, and Extension Service
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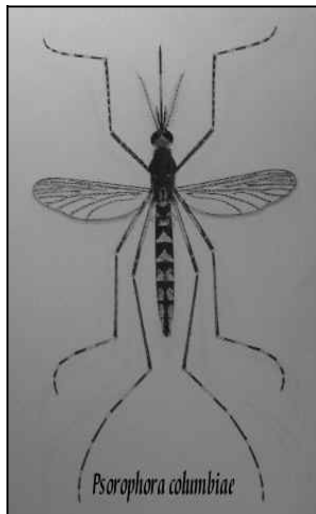
Multistate Regional Research Project
S-300: Mosquito and Agricultural Pest Management in Riceland Ecosystems



Annual Report in 2004 and 2005

Project Duration: October 1, 2000 - September 30, 2006

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COOPERATING AGENCIES AND PRINCIPAL LEADERS: John Bernhardt, University of Arkansas, Stuttgart, AR; Max Meisch, University of Arkansas, Fayetteville, AR; Larry D. Godfrey, University of California, Davis, CA; Sharon P. Lawler, University of California, Davis, CA; William E. Walton, University of California, Riverside, CA; Arhsad Ali, University of Florida, Apopka, FL; Robert Novak, University of Illinois, Champaign, IL; Boris Castro, LSU Ag Center, Baton Rouge, LA; Mike Stout, LSU Ag Center, Baton Rouge, LA; Jim Robbins, Mississippi State University, Stoneville, MS; Mike Boyd, University of Missouri, Portageville, MO; Jim Olson, Texas A&M University, College Station, TX; M. O. Way, Texas A&M University Agricultural Research and Extension Center, Beaumont, TX; Richard Jones, Administrative Advisor, University of Florida; and Hendrik 'Rick' Meyer, CSREES Representative, USDA, Washington, DC.

PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:

Objective 1: To determine the best chemicals to use in riceland systems in terms of their providing maximum control of rice pests (esp. the rice water weevil) and riceland mosquitoes while causing the least amount of harm to non-target organisms.

In AR, **Meisch** found that ULV aerial applications of Scourge 18-54 and Aqua-Scourge 10-30 gave about 80% mortality of *Anopheles quadrimaculatus* adults 24 hours after treatment. An aerial ULV application of liquid BTI in a dense rice canopy gave excellent control of *A. quadrimaculatus* larvae but resurgence occurred after 5 days. A non-optimized aerial ULV application of Aqua Kontrol gave inconsistent results and averaged only 37% control of *A. quadrimaculatus* adults. *A. quadrimaculatus* adults from three sites in AR showed no resistance to resmethrin, permethrin and malathion, but the latter was the least toxic. In AR and MS, fields treated with Karate Z had the same populations of mosquito larvae as did untreated fields. In AR, **Bernhardt** found that Prolex gave control of rice water weevil (RWW) equivalent to that of Karate Z and Mustang Max. In a seed treatment test, A14006 gave control of RWW equivalent to Karate Z and Mustang Max, but significantly less than fipronil. Aquatic barrier traps were used to monitor RWW adults in 10 counties in AR. When compared to actual densities of larvae per core sample, the predicted levels from trap catches underestimated actual densities. The formation of algal mats in 3 counties interfered with proper function of traps. Persistent rainy weather during the spring may have interfered with post-flood movement of adults, thereby influencing post-flood within field movement of adults and trap catches.

In CA, **Lawler** completed a test that had Warrior applied in late season. Warrior was detrimental to both mosquitoes and beneficial insects but could promote pyrethroid resistance in *Culex tarsalis*, a vector of West Nile virus. Sprays of ULV pyrethrin over wetlands produced dramatic but a temporary drop in mosquitoes. The impact of the pesticide sprays on non-target organisms is also being evaluated. In CA, **Godfrey's** experiments measured the performance of experimentals versus standards and modification of use patterns of existing products to facilitate RWW management. Etofenprox and Steward were very effective for RWW control. Platinum as soil applied, Proaxis and Mustang applied post-flood provided very good control of RWW. Warrior applied at 10, 6 and 3 days pre-flood provided control of RWW similar to an application at the 3-leaf stage. Proaxis and Mustang applied 1 day before flood also provided excellent control of RWW. In the greenhouse, azadirachtin (neem extract) gave excellent RWW control when applied at the time of seeding or 19 days after seeding. From 2003 data, populations of non-target invertebrates (except segmented worms) were suppressed by pre-flood treatments of insecticides until early June. Post-flood treatments were generally detrimental to mid-August. Warrior applications in July were especially detrimental to invertebrate populations.

In LA, **Stout** continued to evaluate insecticides for RWW control with special interest in products that would minimize drift into crawfish ponds. Prolex was found to be as effective as other registered pyrethroids. A14006 and Cruiser as seed treatments at several rates and over two years of tests gave control of RWW comparable to fipronil. Karate Z and Mustang Max impregnated on urea fertilizer granules when applied 1 day after flood gave control of RWW similar to post-flood foliar sprays of the two insecticides. Etofenprox in water and drill-seeded tests gave inconsistent RWW control due to an application timing problem in the water-seeded rice and close proximity of treatments and plots in the drill-seeded test. Water and drill-seeded plots were used to test late post-flood applications of dinotefuran. Nearly acceptable control of RWW was achieved only at a high rate and dinotefuran may need to applied earlier to compensate for the slow action of the insecticide. The effect of Karate Z and repeated applications of WS-BTI on mosquitoes was investigated. Only the highest rate of WS-BTI on the last of three treatment dates gave adequate mosquito control. Karate Z applications gave good mosquito control for less than a week.

In LA, **Castro** tested seven insecticides for rice stink bug (RSB) control. One application of Karate Z, Prolex, Mustang Max, and Orthene reduced RSB populations below threshold for 14 days after treatment, while Malathion and Sevin kept RSB below threshold for about 7 days. The IGR Diamond was slow acting and required 7 days to reduce RSB below threshold. Six insecticides were tested for stem borer control. One or two applications of Icon, Intrepid, Confirm, Prolex, Karate Z and Mustang Max significantly reduced the total number of whiteheads and partial whiteheads over the untreated. The pyrethroids performed slightly better than Icon, Intrepid and Confirm. Two applications did not improve control. In three large-scale single field tests, pyrethroid insecticides Karate Z, Prolex and Mustang Max performed better than methyl parathion and Sevin in reducing RSB populations for at least 6 days after treatment.

In TX, **Olson** found no elevations of insecticide tolerance of *Culex quinquefasciatus* adults in Galveston, Jefferson and Orange counties. In central Houston (Harris Co.) *Cx. quinquefasciatus* adults had an increased tolerance to resmethrin. A greater than expected susceptibility of these populations to malathion was detected.

In TX, **Way** found that seed treatments with Cruiser, Karate Z and A14006 performed as well as Icon to control RWW. The time of application of Mustang Max was tested in small plots. The best control occurred when application was shortly before flood to about 5 days after flood. Early post-flood applications resulted in higher yield responses that pre-flood applications. A combination of sugarcane borer and Mexican rice borer was effectively controlled with two applications (1-2 inch panicle and late boot/early heading) of either Karate Z or Mustang Max. Karate Z, Mustang Max and Prolex gave about 80-90% contact control of RSB. Residual activity of Karate Z and Mustang alone or in combination with selected oils gave inadequate control. Regardless of planting date or which pyrethroid insecticide was used, controlling RWW resulted in about a 600 lb/acre increase of rough rice compared to the untreated rice. After factoring in cost of control, the benefits of properly managed RWW were about $30/acre net return.

Objective 2: To determine the best nonchemical tactics to use in riceland systems to manage problems with rice pests, weeds, and mosquitoes.

In AR, **Bernhardt** found hybrid lines XP710 and XP712 had significant yield losses if 3 to 4 RWW larvae per plant were present. Hybrids XP716, XP723 and CLXL8 had very small yield losses at the same RWW densities. Planting date studies did not have RWW populations sufficient in three planting dates to properly assess for field tolerance in the rice varieties Bengal, Medark, Wells, Banks, Cybonnet and Cypress. Wells was least susceptible variety to rice stalk borer. Banks was the least susceptible variety to rice stink bug.

In CA, **Lawler** completed a publication titled 'Management of Mosquitoes on the Farm' which addresses mosquito problems and prevention in a wide variety of agricultural situations, including irrigated fields and pastures, rice fields, dairy operations, and a number of mosquito breeding habitats.

In CA, **Godfrey** compared ten rice varieties for susceptibility to RWW infestation and yield loss. M-202, Calmati-201 and M401 had the most leaf scarring and larval densities were greatest in M-202, Calhikari-201 and M-401. There was a 5 times range in larval populations across varieties. Yield losses, at the RWW densities recorded, were minimal. Refined rice seedling establishment techniques (different soil tillage and rice production methods) are being investigated primarily to improve weed management, but these may have influences on insects. Armyworm and RWW populations were monitored, but infestations were insufficient to make conclusions.

In LA, **Stout** a three year planting date study found that early planting was associated with benefits in that RWW and RSB populations were lower than later dates. Later planting dates had greater yield losses due to insects than early planting dates. Rice lines were evaluated in the field for RWW resistance. In 2004 the performance of lines was generally consistent with results from field and greenhouse tests in previous years.

In TX, **Way** found that in a host plant resistance study of eight rice lines (Priscilla, Cheniere, Cocodrie, Cypress, Jefferson, XP723, CL161 and CLXL8), Priscilla was the most susceptible and XP723 and CLXL8 were the least susceptible to sugarcane borer and Mexican rice borer.

Objective 3: To develop a database on the bionomics of rice pests, riceland mosquitoes and beneficial aquatic fauna coming to associate with harvested rice fields flooded during the winter.

In AR, **Bernhardt** conducted a limited survey for rice borers in two counties in southeastern AR near the LA border. Only specimens of the rice stalk borer were located in the 15 sampled.

In CA, **Godfrey** continued a 40 year program of monitoring adult RWW flights with UV light traps. Monitoring RWW flights is important in determining the levels and interval of peak flight activity and to compare RWW trends over years. In 2004, RWW flight activity was very low, very early and was completed by 3 May. Armyworms (true armyworm and western yellow-striped armyworm) have developed into significant pest of rice during the last 5 years and in some areas a mid-season insecticide application has become common. Weeds in rice may influence occurrence of armyworm and in a test fewer armyworms were found in weed controlled plots vs plots with high densities of weeds. Populations were intermediate where either broadleaf or grass weeds were controlled. Pheromone traps were used to gain insights on the timing of armyworm flights, but it did not appear that traps could provide a forewarning of the time sampling needs to be intensified in rice fields.

In LA, **Stout** developed a degree day model to describe the emergence of RWW from overwintering sites in early spring and to describe the development of larvae in flooded rice fields. Field tests showed that direct monitoring of adults in rice fields was the best sampling method. Greenhouse experiments indicated that RWW females lay approximately 30 to 45 eggs over a 7-day infestation period. Field experiments were initiated to determine the relationship between adult densities and subsequent larval density 3 weeks later which can be used to develop action/economic thresholds for insecticide applications.

In TX, **Way** used pheromone traps to monitor the eastward movement of the Mexican rice borer. Moths were detected in traps for the first time east of Houston (Harris Co.) in Chambers Co. The three moths in Chambers Co. triggered a quarantine of SE Texas sugarcane by the LA Dept. of Ag. and Forestry to prevent transport in LA for processing. Moths were found in Liberty Co. just east of Beaumont and larvae were found in rice near the traps.

Objective 4: To update and refine existing databases on the local distribution, genetic relationships and disease vector potential of mosquito species occurring in rice-producing areas of the U.S.

In TX, **Olson** continued a study on the distribution patterns of *Anopheles quadrimaculatus* species complex. Results continue to indicate *An. quadrimaculatus* to be the most wide-spread species and the only other species detected thus far *An. smaragdinus* found in five counties in north and southeast TX. Temperature-dependent development studies for *Aedes albopictus* and *Ae. aegypti* strains form Galveston Co. and sites in the Lower Rio Grande Valley were completed but not yet analyzed. A West Nile virus (WNv) risk map for Brazos Co. was created using GIS and ENVI (remote sensing platform) to decipher elements that have a high correlation with dead bird locations and to depict the elements as risk factors. Risk factors determined to be most important were sewer system manhole covers, vegetative cover and floodplains. A public survey was initiated in selected neighborhoods in Bryan and Houston to assess what citizens are doing to protect themselves from mosquitoes and WNv infections and to assess the effectiveness of public information programs designed to inform people as to how to protect themselves. To date, 1100 survey questionnaires have been mailed with a 24.6 and 20.8 percent return rate being recorded for Bryan and Houston, respectively. Data are accumulated. Surveillance of the Brazos Co. area for WNv activity was continued, with only one site in Bryan found to have mosquitoes positive for the virus during 2004. Control recommendations were made on the basis of this survey and monitoring effort.

USEFULNESS OF FINDINGS:

Research conducted in 2004 by all participating members of S-300 resulted in significant progress in understanding the biology and ecology of mosquitoes and insects associated with the rice agroecosystem and other wetlands. The population dynamics of these pestiferous insects is largely a function of the management practices employed by operators (e.g., rice farmers) of these natural and artificial wetlands. As production practices evolve, due to advances in technology and changes in regulatory policies, pest management practices must also evolve.

Last year rice production entomologists fine-tuned IPM practices for the key insect pests of rice including rice water weevil, rice stink bug and rice borers. Results were disseminated to producers via extension meetings and publications. This will help farmers achieve better control of these pests with fewer insecticide applications and fewer costs. Mosquito entomologists continued to provide updated research results and management guidelines to clientele including mosquito control districts, farmers and government health officials. Proper mosquito prevention has many economic benefits such as reduced costs to local mosquito abatement districts, improved yields for livestock, improved property values, and fewer lost wok days due to mosquito-borne diseases or nuisance problems. Mosquito entomologists are also carefully monitoring the spread of recently introduced mosquito borne diseases such as West Nile virus. This proactive approach serves to dampen the unknowns associated with a new disease. Together S-300 participants are accumulating information on the impact of insecticide applications for rice insect pests or applications for mosquitoes in wildlife areas and abatement programs on non-target organisms. Additional work with public information surveys will provide data that can be used to assess the effectiveness of public information programs regarding what people can do to protect themselves against infection and to modify the programs to be more effective if indicated.

In summary, in 2002, S-300 participants continued to add new knowledge relative to pestiferous insects and non-target organisms associated with artificial and natural wetlands. This knowledge is being used to develop more effective, safe and affordable management of these insect pests.

WORK PLANNED:

Participants in S-300 will cooperate in research studies across state and disciplinary lines to better understand how management of a single insect affects the population dynamics of other insects associated with wetlands. For instance, insecticides registered for rice water weevil, rice stink bug, and rice borers will be evaluated for effects on mosquitoes and their aquatic predators. Wetland nitrogen management in California will be investigated to determine the effects on rice production pests and mosquitoes. Participants are heavily involved in mosquito control and pesticide resistance monitoring because of the potential dire effects of the West Nile virus transmitted by mosquitoes.

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2004 AND 2005 ANNUAL REPORT FOR COOPERATIVE REGIONAL PROJECTS

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APPROVAL:

Roger Crickenberger
______________________________ April 20, 2006
Administrative Advisor Date

M.O. Way
______________________________ April 20, 2006
Chair, Technical Committee Date

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PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:

Objective 1: To determine the best chemicals to use in riceland systems in terms of their providing maximum control of rice pests (esp. the rice water weevil) and riceland mosquitoes while causing the least amount of harm to non-target organisms.

AR: Bernhardt
Trebon (etofenprox) did not give adequate control of rice water weevil, (RWW), *Lissorhoptrus orzyphilus*, when applied 3 days after flood but gave better control when applied 7 days after flood. Icon 6.2FS as a seed treatment gave better control of RWW than A14006 and Cruiser 5FS as seed treatments. Poncho (clothianidin) showed promise as a seed treatment for RWW. Poncho (clothianidin) also gave good control of grape colaspis, *Colaspis brunnea,* in a field test. Orthene 97 (acephate) and methyl parathion exhibited excellent initial control of rice stink bug, (RSB), *Oebalus pugnax*, in a cage study. Orthene 97 provided excellent residual activity up to 5 days after treatment. Karate Z applied in a large scale field test eliminated adult RWW and reduced densities of adult and larval predaceous diving beetles, water scavenger beetles and water boatman.

AR: Meisch
Spinosad was applied to bird seed and fed to Japanese quail. *Culex quinquefasciatus* fed on the birds but no significant mosquito mortality was observed. Neat formulations of Anvil (sumethrin) performed better against *Anopheles quadrimaculatis* than oil formulations when applied with a cold aerosol generator. Droplet size of PyGanic (natural pyrethrin) is critical to successful ULV applications. At 1 hour post treatment, ULV PyGanic gave good knockdown of *A. quadrimaculatus* but performed poorly 24 hours post treatment. Preliminary research was conducted to test the efficacy of perimeter rather than whole target area treatments of selected insecticides to control vector mosquitoes in a deployed military setting.

CA: Godfrey

Dimilin 2L, Warrior, Proaxis and Mustang are registered in CA for control of RWW and armyworms. Due to cancellation of Icon 6.2FS, more insecticides (old and novel) are being evaluated. Etofenprox and indoxacarb applied at the three leaf stage provided very good control of RWW but were not effective applied preflood. Dinotefuron also was effective but not as effective as etofenprox or indoxacarb. V10170 provided nearly 100% RWW control. Neemazal (active ingredient is azadirachtin derived from the neem tree) did not provide adequate control of RWW. However, a liquid formulation (Aza-Direct) of azadirachtin gave moderate control. RWW were sterilized by feeding on treated foliage. Warrior, Proaxis and Mustang applied 4 days before flooding gave good RWW larval control. Preflood applications of Warrior had minimal effects on aquatic invertebrates. However, postflood applications of pyrethroids produced 2-3 weeks of detrimental effects on aquatic insects. After this initial reduction, populations recovered. Warrior is becoming increasingly popular as an armyworm insecticide applied late season. This timing can have a major detrimental effect on aquatic non-target invertebrates.

CA: Lawler

The pesticide, lambda-cyhalothrin, was found to kill mosquitofish. The second of a 3 year study was completed. This study is quantifying the effects of ULV pesticide fogs on mosquitoes and invertebrates inhabiting seasonal wetlands.

LA: Stout

Several seed treatments under secrecy agreements gave good control of RWW. A14006 also gave good control. Split applications (1 day preflood and 6, 14 or 20 days postflood) of dinotefuron provided excellent control of RWW. A single application of dinotefuron at 21 days after flood controlled RWW larvae showing direct control of larvae. Preflood and 1, 2 and 6 day postflood applications of pyrethroids impregnated on fertilizer gave adequate control of RWW in an early season test. In a late season test, none of the treatments were effective. Etofenprox in a small plot study reduced larval populations 30-40% but this low level of control may have been due to miscalculation of the rate of etofenprox relative to basin size. A Section 18 request for etofenprox use in LA was submitted in December 2005. Karate Z and Aquabac (BTI product) were evaluated in a replicated plot study for effects on mosquitoes. Mosquito larvae placed in cages suffered greater mortality in Karate Z than BTI-treated plots.

MS: Robbins

Preliminary lab tests show excellent control of RSB with etofenprox. Prolex and Karate Z gave similar control of RSB. Also, aerial dispersion of etofenprox granules was similar to that of fertilizer. Etofenprox and seed treatments from Syngenta gave good control of RWW. Yields in RWW-treated plots were about 1000 lb/acre greater than in untreated plots.

MO: Boyd

No report submitted. Boyd no longer is employed by University of Missouri.

TX: Olson

Populations of *C. quinquefasciatus* at two locations in Jefferson Co. demonstrated high tolerance to malathion. Several populations in Harris Co. exhibited elevated tolerances to resmethrin and sumethrin. Resistance management programs have been initiated in those areas where pyrethroid tolerances were detected. In Orange Co., populations tested were all in the acceptable range of insecticide susceptibilities. A resistant management program has been in place in this county.

TX: Way

Rice seed treatments were evaluated for RWW control. A14006, Cruiser 5FS and STP15299 performed well under heavy RWW pressure. Cruiser 5FS provided the best control (95%) of the seed treatments tested and gave a 1133 lb/acre yield advantage over the untreated. Another seed treatment under a confidentiality agreement gave excellent control of RWW. Foliar treatments were evaluated for RWW control. Aza-Direct and Neemazal were applied immediately before flood. Aza-Direct and Neemazal gave 35 and 32% control, respectively. In a drill-planted, delayed flood system, etofenprox (MTI-500) at 200 g (AI)/ha applied 2 days after flood gave excellent control (90%) of RWW and produced a 602 lb/acre yield advantage over the untreated. Also, in a separate experiment, etofenprox applied immediately before flood gave excellent control (97%) of RWW and produced a 1081 lb/acre yield advantage over the untreated. Gamma-cyhalothrin and acephate were evaluated for stem borer control at Ganado, TX. Mexican rice borer (MRB), *Eoreuma loftini,* was the predominant stem borer. Best control (94% reduction in whiteheads) was two applications of gamma-cyhalothrin at 1-2 inch panicle and late boot. The associated yield advantage was 1819 lb/acre over the untreated. Acephate applied at panicle differentiation or 1-2 inch panicle reduced whitehead numbers about 38%.

Objective 2: To determine the best nonchemical tactics to use in riceland systems to manage problems with rice pests, weeds, and mosquitoes.

CA: Godfrey

Two species of armyworms attack CA rice. These species are the western yellow-striped armyworm (WYSAW), *Spodoptera praefica,* and the true armyworm (TAW), *Pseudaletia unipuncta,* which are becoming more problematic. Armyworms damage rice by defoliation and feeding on developing panicles and kernels. In general WYSAW develop on weeds and rangeland plants before moving to rice. Female adults prefer to lay eggs on broadleaves. In a small plot study, armyworms were most abundant in plots with no weed control. Pheromone trap catches of TAW showed peaks in mid-July and late August. However, WYSAW exhibited no dramatic peaks. Armyworm larvae were collected in July and August and reared on artificial diet. Up to 57% of these larvae were parasitized. Two species of parasites were the most common. *Hyposoter exiguae* and *Apanteles militaris* attacked WYSAW and TAW larvae, respectively.

CA: Walton

Mosquito production from the open water zones did not differ statistically from zero during June-July. The combination of ongoing integrated mosquito management (IMM) activities and water management that reduced the harborage for immature mosquitoes probably lowered mosquito production during late autumn. Our results to date indicate that the utilization of thin bands of emergent vegetation enhances mosquito control efforts in IMM programs for wetlands stocked with larvivorous fishes.

LA: Stout

The relationship between densities of adult and immature RWW was determined to calculate an estimate of fecundity. In turn, an action threshold was determined to be used in conjunction with adulticides applied to recently flooded rice fields. A 3 year study showed that early planted (mid-March) rice can avoid severe RWW damage. Several rice breeding lines and commercial cultivars exhibited more or less resistance than the susceptible standard Bengal. A few lines exhibited tolerance.

TX: Way

Three hybrid rice varieties (CLXP730, XP721 and XP723) and two conventional varieties (Priscilla and Presidio) were evaluated for resistance to stem borers, sugarcane borer (SCB), *Diatraea saccharalis,* and MRB. Data showed that whiteheads were much more abundant in Priscilla and Presidio than the hybrids. The average main crop yield of the hybrids in treated plots was 10395 lb/acre. The average main crop yields of Presidio and Priscilla treated plots was 7400 and 7386 lb/acre, respectively. The hybrids have a considerable yield advantage over conventional varieties; thus, hybrid rice acreage is rapidly expanding. A date of planting study at Eagle Lake, TX involving Cocodrie (most commonly grown rice variety in TX) and XL8 (hybrid) revealed the latest planting date (May 19) produced the highest number of whiteheads (an average of 34 per plot) compared to the earliest (Mar 24 – 16 per plot) and middle (Apr 15 – 5 per plot) planting dates. These data confirm observations that late planted rice is most susceptible to stem borer attack. The primary stem borer in this study was MRB. After 2 years of field studies, a new sampling method for RSB was developed. The new method is based on a "sweep stick" (made of PVC pipe) which is passed through the rice panicles (heading, milk or dough) in a 180° arc. Research shows that two sweeps of the "sweep stick" correlate well with 10 sweeps of the sweep net.

Objective 3: To develop a database on the bionomics of rice pests, riceland mosquitoes and beneficial aquatic fauna coming to associate with harvested rice fields flooded during the winter.

CA: Lawler

A 3 year study on how rice straw and winter flooding affect mosquito populations showed mosquito populations increased in response to on-site decomposition of rice straw, even though beneficial arthropod densities increased. Also, winter flooding interacts with residual straw to increase mosquito numbers, and draining fields prior to herbicide applications can result in unusually dense mosquito populations upon reflooding.

Objective 4: To update and refine existing databases on the local distribution, genetic relationships and disease vector potential of mosquito species occurring in rice-producing areas of the U.S.

TX: Olson
A. quadrimaculatus and *A. smaragdinus* are the only species of this genus confirmed in TX. *A. quadrimaculatus* is the most widely distributed while *A. smaragdinus* was found mainly in wooded, wetland areas of east and SE TX. Data from a survey of residents in Bryan and Houston, TX to identify and quantify the measures residents take to protect themselves from mosquito are being processed at this time. Surveillance of Brazos County, TX for West Nile Virus (WNV) revealed 14 samples of *C. quinquefasciatus* were positive.

Miscellaneous
LA: Castro
A survey was conducted to establish the presence or absence of panicle rice mite (PRM), *Steneotarsonemus spinki*, in LA. This mite occurs in Asia, Latin America and the Caribbean and has caused yield losses as high as 100%. Injury is caused by direct feeding and interaction with the fungus, *Sarocladium oryzae*, which is an important agent of sheath rot and contributes to "pecky" rice. Fifteen LA parishes were surveyed in 2005 representing over 200 acres. The PRM was not found. Also, the rice delphacid, *Togosodes orizicolus*, was surveyed in 2005 in LA. A sweep net was used to sample commercial rice fields in LA. Over 2000 acres in 15 parishes were surveyed. Samples from the survey have not been processed at this time. In addition, a survey was conducted in LA in 2005 from April through October with efforts concentrated on inspecting recently emerged rice for South American rice miner (SARM), *Hydrellia wirthi*. Again, 15 parishes were surveyed representing more than 3000 acres. SARM was identified from 14 rice fields. Results indicated that SARM infestations were higher and more damaging in coastal parishes.

TX: Way
A survey was conducted for SARM. SARM was found and evidence of damage observed throughout the Texas Rice Belt (TRB) but no fields were judged to exhibit economic losses. In 2005, pheromone trapping of the MRB in the TRB proved the occurrence of adults in Jefferson County where Beaumont is located. Thus, another county in the TRB has been added to the list of counties with confirmed MRB. In addition, this new find shows that all counties in the TRB have MRB except Orange County which is the farthest east county in the TRB. Orange County borders LA, so MRB is gradually moving east (about 15 miles per year) towards LA. We expect MRB to invade LA in the near future. In fact, incipient, low populations may already exist in LA where sugarcane farmers are concerned since MRB is a serious pest of sugarcane in the Lower Rio Grande Valley of TX.

USEFULNESS OF FINDINGS:

AR: Bernhardt
Results from 2005 could be used by rice farmers to significantly improve rice stink bug management if Orthene becomes registered. The brief but significant impact of an insecticide on non-target insects could impact mosquito control by reducing the effectiveness of several groups of predaceous insects.

AR: Meisch
Mosquito management programs are largely defensive and pesticide oriented. New chemicals for mosquito control are lacking, existing compounds, formulations, and application techniques must be improved. There is a need to evaluate new improved formulations of existing compounds as well as new products. These studies should lead to more effective measures employed in control of mosquitoes. Also, less waste and environmental contamination due to better or more accurate application are other benefits as well.

CA: Lawler
The online paper 'Management of Mosquitoes on the Farm' is a useful reference document for mosquito prevention and control in row crops, dairies and orchards. California's Mosquito and Vector Control Districts and U.C. extension personnel can refer growers to this publication for information. Our work on rice straw management informs growers and mosquito abatement districts about potential mosquito issues associated with on-site decomposition of rice straw and winter flooding.

CA: Walton
The results of this study will help to provide criteria for the management of pest and pathogen-transmitting mosquitoes that utilize rice fields and constructed treatment wetlands as developmental sites. Mosquito abatement and resistance management of mosquitoes to control agents must be included as part of any comprehensive plan for the design and operation of multipurpose constructed treatment wetlands, particularly where human residences are situated near wetlands. The work summarized here will assist a multiagency effort to develop criteria for the construction of large-scale wetlands systems that will be designed to conserve precious water resources, promote the biodiversity of endemic wetlands organisms, and protect the public from mosquitoes and the diseases that they cause.

TX: Olson
Insecticide susceptibility tests are assisting in the development of a database on the occurrence and distribution of insecticide resistance in mosquito populations breeding in the rice-producing area of southeast Texas; and the database is subsequently being used to give direction to insecticide resistance management in mosquito populations of concern. Knowledge of the occurrence and distribution patterns of the members of the *A. quadrimaculatus* species complex in Texas is providing insight as to the vector potential for malaria in the Texas rice-producing area as well as elsewhere in the state. Research on the effects of temperature and humidity on the eggs and development of *Aedes aegypti* and *Ae. albopictus* is helping explain and better predict

the patterns of occurrence and spread of these two mosquito species in the rice-producing areas and elsewhere in the state of Texas. The public information survey will provide data that can be used to assess the effectiveness of public information programs regarding what people can do to protect themselves against infection by such mosquito-borne diseases as WNv and to modify the programs to be more effective when such is indicated. WNv surveys performed by TAES served to assist in the statewide effort to prevent and control outbreaks of this virus in Texas during 2005.

TX: Way

Adoption of the "sweep stick" for sampling RSB will encourage farmers and consultants to sample for this pest. Adoption of the "sweep stick" will result in more farmers sampling more frequently for RSB which will improve management and decrease RSB damage. Our results show that hybrid rice varieties are much less susceptible to stem borers than conventional varieties. Hybrids are producing significantly higher yields than conventional varieties. Farmers are eagerly adopting this new technology which possesses a significant degree of stem borer resistance. Our results show late plantings can suffer from severe stem borer damage. We encourage farmers to plant early to minimize this problem. Thus, we have developed a stem borer management package which includes host plant resistance, cultural control and insecticidal control. Registration of an effective seed treatment for RWW and other secondary pests would help rice farmers immensely. Our data show several seed treatments are very effective against RWW. These seed treatments are becoming more important because farmers are adopting lower seeding rates (especially for hybrids which are planted at about 35 lb/acre; the normal seeding rate for conventional varieties in TX is about 80 lb/acre).

WORK PLANNED:

AR: Bernhardt:

Work planned for 2006 will be continuation of several important projects. The evaluation of new chemicals for pest control, screening cultivars for field tolerance/resistance to insect pests, and the impact of cultural practices such as tillage practices and delayed flood on pest infestation and damage will all need additional field tests. More effort will be made to assess the impact on aquatic non-targets when an insecticide is applied for rice water weevil. With the use of fipronil absent, research will be continued to test insecticides for grape colaspis control.

CA: Lawler

Over the next 5 years we will quantify effects of commonly-used mosquito adulticides on wetland food webs. We are cooperating with the U.S. Fish and Wildlife Service (USFWS); our USFW collaborator Cathy Johnson will quantify pesticide residue in wetland water and sediments. The Colusa and Sutter-Yuba Mosquito Vector Control Districts (MVCDs) are assisting us with this research as needed. We will measure pesticide residues in water and sediment (USFWS), quantify effects of adulticides on nocturnal flying insects, test whether adulticides change the abundance or family composition of zooplankton and test whether adulticides change the abundance or family composition of aquatic insects.

TX: Olson

Monitoring of the insecticide resistance/susceptibility in target mosquito populations in the Texas rice belt will be continued. The research on the effects of temperature and humidity on the eggs and general development of *Ae. aegypti* and *Ae. albopictus* populations in Texas will be completed. The public information survey regarding actions taken by individual citizens to protect themselves against mosquitoes and mosquito-borne diseases will be completed. Participation in the WNv survey and monitoring program in Texas will be continued. Otherwise, candidate pesticides will be assessed as to their efficacy for use in the riceland mosquito control program as these chemicals become available.

TX: Way

We will cooperate with Dr. Jim Olson to evaluate preflood applications of etofenprox, lambda-cyhalothrin, zeta-cypermethrin and gamma-cyhalothrin on mosquito populations. The stem borer planting date experiment will be repeated, in addition to counting whiteheads and taking yield, we will count and weigh filled and unfilled grains from a given number of randomly selected panicles. Studies will be conducted to determine economic injury levels/thresholds for stem borers using small plots in commercial fields. Economic injury levels for RSB will be revised using small cage studies conducted in the field and greenhouse. Evaluations will be continued on seed treatments for control of RWW and secondary pests. Acephate for RSB and stem borer control will be evaluated. The spread of MRB will continue to be monitored. Ongoing evaluations will be conducted with novel insecticides for RWW, RSB and/or stem borer control. Released cultivars for resistance to stem borers will be repeated and a review of rice mill records will be conducted to determine the relationship between insecticide applications (kinds and number) and pecky rice.

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REGIONAL PROJECT ANNUAL REPORTS

S-300

RESEARCH REPORTED HEREIN

FOR OCTOBER 1, 2004 – SEPTEMBER 30, 2005

ARKANSAS

CALIFORNIA

LOUISIANA

MISSISSIPPI

TEXAS

ARKANSAS

S300 Project: Mosquito and Agricultural Arthropod Pest Management in Rice and Natural Wetlands

John Bernhardt, University of Arkansas
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Stuttgart, AR 72160

January 1 to December 31, 2005

Accomplishments:

Objective 1. Chemicals for Rice Water Weevil Control.

The chemical Trebon (etofenprox, Mitsui) was tested for control of rice water weevils. Trebon did not give adequate control at any rate when applied 3 days after permanent flood compared to Karate Z and Furadan. Trebon applied 7 days after flood had better control, but still not adequate. No significant differences were found between grain yields for any treatment.

Chemical & Rate in lb ai / acre	# Larvae/Core 3 wk	# Larvae/Core 4 wk	% Control 3 wk	% Control 4 wk	Yield (bu/A)[a]	Important Dates
Karate Z 0.03 (7)	1.4 d	1.4 e	95	93	207	Planted 4/19
Furadan 0.6 (10)	0.9 d	3.7 de	97	83	204	Emerged 5/7
Trebon 0.13 (3)	16.9 b	13.4 b	42	39	212	Flooded 6/1
Trebon 0.18 (3)	15.3 bc	8.7 c	47	60	200	Cores 6/22-23
Trebon 0.22 (3)	11.9 bc	5.7 cde	49	74	199	Cores 6/30-7/1
Trebon 0.18 (7)	10.2 c	7.2 cd	65	67	212	
Untreated	29.2 a	21.9 a	-	-	207	Harvest 9/8
	LSD= 6.6	LSD= 4.7			NS	

[a](1 bu = 45lbs) Cocodrie.

The chemicals Crusier (thiamethoxam, seed treatment) and A14006 (Syngenta, abamectin, seed treatment) were tested for control of rice water weevil and compared to Icon as a seed treatment. Icon gave superior control, but as a seed treatment none of the other chemicals tested gave acceptable control. Karate Z was applied at the 1 leaf stage in case grape colaspis were present. Colaspis were not present.

Chemical & Rate in lb ai / acre	# Larvae/Core 3 wk APF	% Control 3 wk APF	Yield (bu/A)[a]	Important Dates
Karate Z 0.03 post	26.4 a	0	123 b	
A14006 0.05 ST	6.4 bc	71	128 b	Planted 5/24
A14006 0.1 ST	5.4 bc	75	126 b	Emerged 6/9
Cruiser 0.08 ST	9.6 b	56	122 b	Flooded 7/10
Icon 0.04 ST	0.9 c	96	153 a	Cores 8/4-5
Untreated	21.8 a	-	128 b	Harvest 10/7
	LSD = 6.4		LSD = 20.8	

[a](1 bu = 45lbs) Cocodrie.

The test, without Karate Z, was repeated at a location in northeast Arkansas. Individual plots were not surrounded by levees. The chemical Poncho (clothianidin, seed treatment) was added. Infestation by weevils were very low. Icon and Poncho greater than 1 oz of formulated product per 100 lb of seed gave control superior to that of Cruiser and A14006.

Chemical & Rate in lb ai / acre	# Larvae/Core 3 wk APF	% Control 3 wk APF	Yield (bu/A)[a]	Important Dates
A14006 0.05 ST	10.9 a	17	158 c	
A14006 0.1 ST	8.7 ab	22	165 abc	Planted 5/11
Cruiser 0.08 ST	7.9 ab	30	156 c	Emerged 5/18
Icon 0.04 ST	0.9 c	92	173 a	Flooded 6/16
Poncho 1 oz	4.9 bc	57	161 c	Cores 7/7
Poncho 2 oz	2.1 c	81	166 abc	Harvest 10/4
Poncho 4 oz	1.2 c	89	166 abc	
Untreated	11.2 a	-	163 bc	
	LSD = 4.3		LSD = 10.4	

[a](1 bu = 45lbs) Cocodrie.

Objective 1. Chemicals for Grape Colaspis Control.

The chemical Poncho was tested for grape colaspis control at an experiment station in Lonoke, AR. Plots were 150 feet long and colaspis infestation was in a gradient from high to low in the east to west direction. Evaluations presented in the table were at the 2 leaf stage. Poncho at the lowest rate tested, 1oz of formulated product per 110 lb of seed, protected the seed and seedlings from severe grape colaspis damage The untreated plots had severe damage in the east, moderate damage in the middle and the least damage in the west.

Chemical & Rate	Average plants per row foot			Yield (bu/A)[a]	Important Dates
	emerged	healthy	dead/dying		
Poncho 1 oz	17.5 a	17.3 a	0.2 a	146 a	Planted 5/13
Poncho 2 oz	17.0 a	16.8 a	0.2 a	149 a	Emerged 5/20
Poncho 4 oz	16.8 a	16.7 a	0.1 a	147 a	Flooded 6/22
Untreated	9.0 b	7.0 b	2.0 b	120 b	Harvested 9/14
	LSD = 2.6	LSD = 2.5	LSD = 0.5	LSD = 15.4	

[a](1 bu = 45lbs) Cocodrie.

Objective 1. Chemicals for Rice Stink Bug Control.

The chemical Orthene 97 (acephate) was tested for rice stink bug adult control. Nylon tull cages were used to confine adults over panicles of rice. Cages and bugs were placed in the rice before application of insecticides. On various days after treatment, cages and bugs were placed over panicles to test residual activity of the chemicals. **Test Methods 2005**: 3 RSB (2 female and 1 male) were caged over 3 panicles with a nylon large-mesh sleeve cage. Cages were placed on 8/18 and sprayed with Orthene (0.5 lb AI/acre) or methyl parathion (0.5 lb AI/acre). Unsprayed cages over rice were checks. Each treatment on 8/18 had 8 cages (8 reps) and on 5 dates after the spray - 8/19, 20, 21, 23, and 8/25- 4 cages (4 reps) were placed over panicles.

Each set of cages remained on the plots for 72 hours. Rain (0.4") occurred on 8/23 after cages were placed. Rain (1.2") on 8/27 and more rain (1.1") fell on 8/28. Orthene and methyl parathion had excellent initial contact mortality. Methyl parathion had very little residual activity after the day of treatment. Orthene had excellent residual activity up to 5 days after treatment.

Days after treatment (date when cages placed and	Percent Mortality		
	Check	acephate	methyl parathion
0 (8/18-21)	0	100	100
1 (8/19-22)	0	100	33
2 (8/20-23)	0	75	0
3 (8/21-24)	0	92	0
5 (8/23-26)	0	92	0
7 (8/25-28)	8	58	-

Objective 1. Karate Z Impact on Non-Target Organisms.

Due to my inability to be in two places at the same time, a test for the impact of insecticide on non-target organisms was conducted in only one field. The field was 80 acres in size, but only the northern 20 acres were used for the test. The field was flooded by May 31. On June 4 eight aquatic barrier traps were placed along the west side of the 20 acres in bar ditches within 50 of the outside levee. The test area was halved and one half was treated with Karate Z at 0.03 lb ai/acre on June 7. Traps were monitored through June 16. The attached figures give the results. Not included in the figures are damselfly naiads and tadpoles. Both were in low densities and affected by the insecticide similar to the other species.

The Karate Z treatment eliminated rice water weevils and reduced the densities of adult and larval diving and scavenger beetles and water boatmen. At 3 to 4 days after treatment low densities of beetles and boatmen were found in the traps.

Impact of Accomplishments:

Results from 2005 could be used by rice farmers to significantly improve rice stink bug management if Orthene becomes registered. Even though Poncho was effective at controlling grape colaspis, the company has chosen not to pursue registration. The brief but significant impact of an insecticide on non-target insects could impact mosquito control by reducing the effectiveness of several groups of predaceous insects.

Plans for 2006:

Work planned for 2006 will be continuation of several important projects. The evaluation of new chemicals for pest control, screening cultivars for field tolerance/resistance to insect pests, and the impact of cultural practices such as tillage practices and delayed flood on pest infestation and damage will all need additional field tests. More effort will be made to assess the impact on aquatic non-targets when an insecticide is applied for rice water weevil. With the use of fipronil absent, research will be continued to test insecticides for grape colaspis control.

Max V. Meisch
Accession: 0187263
Agency: CSREES ARK
Project number: ARK01884
Mosquito and Agricultural Pest Management in Riceland Ecosystems.

Progress Report
A probe was conducted using Spinosad treated seed fed to Japanese quail. The quail were exposed to *Culex quinquefasciatus* mosquitoes which fed readily on the quail. No significant mosquito mortality was observed. An experiment was conducted aimed at applying neat vs. dilute formulation of sumethrin. The chemical was delivered by ground ULV cold aerosol generator against adult *Anopheles quadrimaculatus* females. The neat formulation proved more effective than the oil diluted formulation. Ground ULV application of Pyganic (registered) (natural pyrethrin) were evaluated against adult *Anopheles quadrimaculatus* females. Three formulations were tested. The primary goal of the test was to increase product efficiency by increasing droplet rate without increasing application rate. The experiment revealed very good initial "knockdown" at 1 hr posttreatment; however, recovery 24 hr posttreatment revealed the overall effect was below accepted levels. A perimeter application of residual insecticide to reduce mosquito vector infiltration by passive exposure to treated vegetation and harborage while at rest was made. The research was performed by a cooperative funded project (ARS#56-6615-5-248). The objectives were to assess perimeter barrier treatments in adult mosquito resting habitats and an outdoor small plot protocol for screening potential barrier pesticide. Authorization to begin this project was delayed and only a few preliminary trials were accomplished. Equipment purchase, mosquito trap installation, plot layout, and one preliminary Talstar (registered) application were done.

Impact
Mosquito management programs are largely defensive and pesticide oriented. New chemicals for mosquito control are lacking, existing compounds, formulations, and application techniques must be improved. There is a need to evaluate new improved formulations of existing compounds as well as new products. These studies should lead to more effective measures employed in control of mosquitoes. Also, less waste and environmental contamination due to better or more accurate application are other benefits as well.

CALIFORNIA

Cooperative Research Project: Mosquito and Agricultural Arthropod Pest Management in Rice and Natural Wetlands

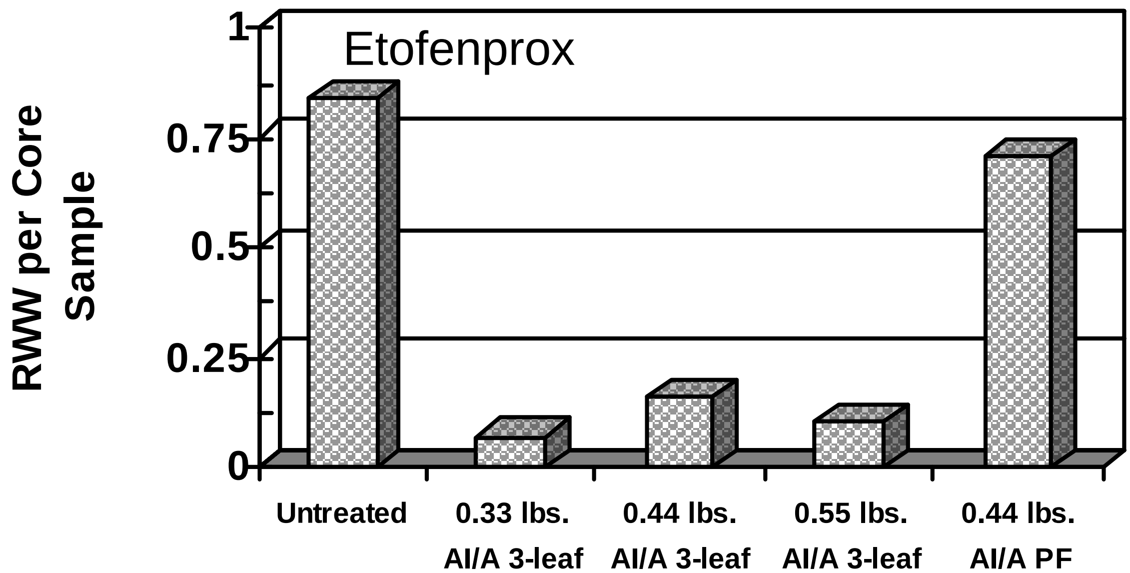
Larry D. Godfrey, Univ. of California-Davis

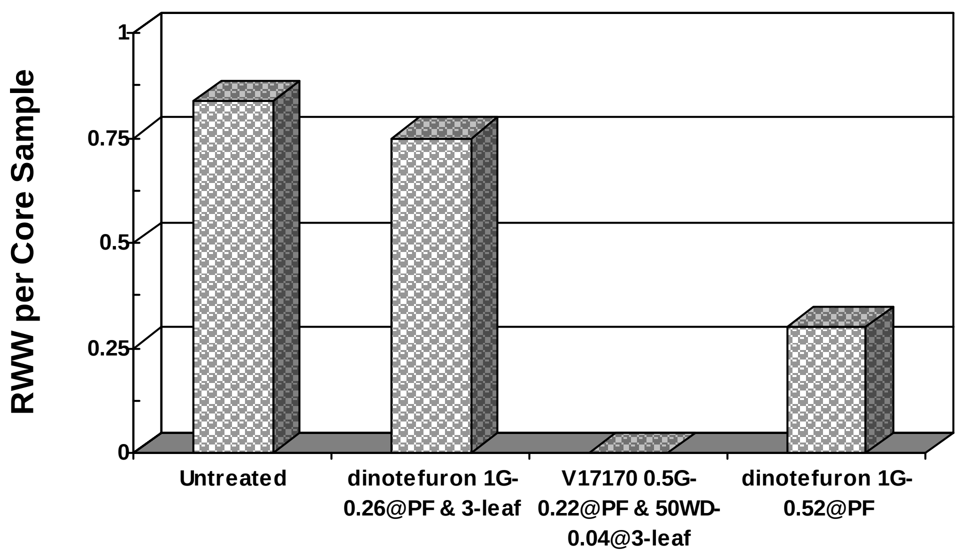
January 1 to December 31, 2005

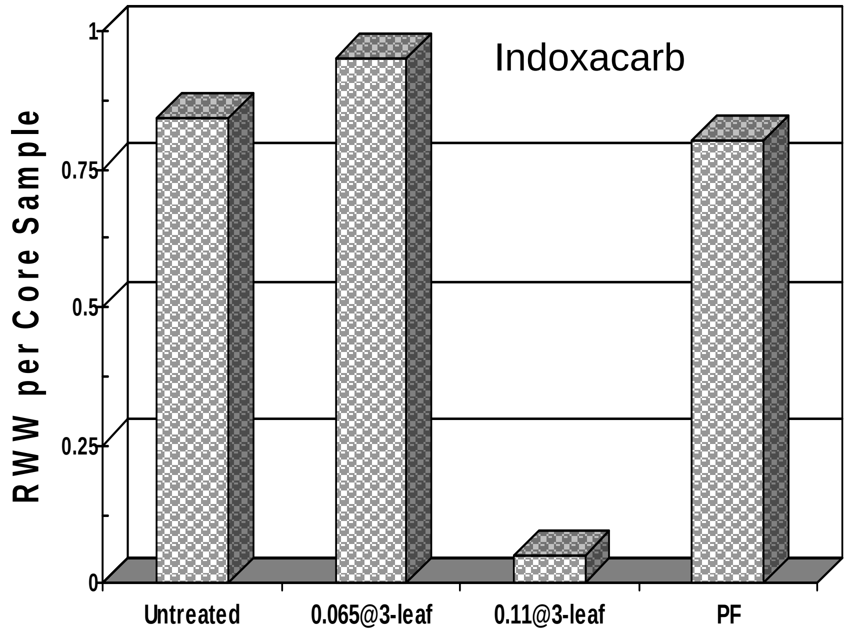
Research was conducted in 2005 on various aspects of rice water weevil (RWW) and armyworm (AW); studies were generally divided into investigations of the biology and the management of these two major rice arthropod pests. Results will aid in refining the IPM schemes for these pests as well as to continue to build upon the existing cost-effective and environmentally compatible management programs in rice. Best Management Practices have been developed and put forth for the industry to aid in mitigation of mosquito populations. This area has taken on added importance with the emphasis on West Nile Virus in California. A study was continued to evaluate the effects of registered and experimental rice insecticides on non-target invertebrates in rice fields. These organisms could play an important role in mosquito management. Inconsistent RWW and AW populations hindered data collection on a couple of studies but overall success was achieved. The rice water weevil is the most important invertebrate pest of California rice, although armyworms are becoming more important. Dimilin® 2L, Warrior®, Proaxis®, and Mustang® are the insecticides registered to control both of these pests. The efficacy of new insecticides and management approaches was stressed.

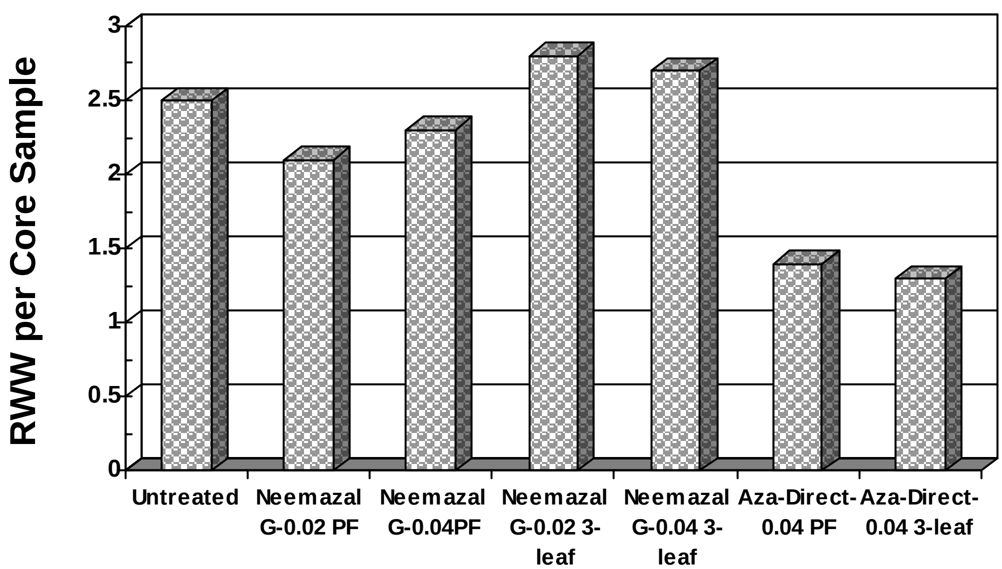
Rice Water Weevil - Management: Studies were continued in 2005 in ring plots and in large field plots to evaluate experimental materials versus registered standards for RWW control and to modify the use patterns of the existing products to facilitate management. Twenty-two treatments (a total of ten different active ingredients) were established in ring plots to accomplish this research. Research continued on three experimental insecticide active ingredients, etofenprox, dinotefuron, and indoxacarb, and began with another, V10170. Efforts in this research area have increased recently due to the cancellation of Icon registration in the southern rice, the additional scrutiny placed on rice insecticides due to West Nile Virus, and some emerging environmental issues with pyrethroid insecticides. Etofenprox applied at the 3-leaf stage provided very good RWW control; etofenprox applied preflood was ineffective. Indoxacrb, applied at the 3-leaf stage, was very effective for RWW control although the higher (0.11 oz.) rate was needed. The lower rate as well as a preflood application was ineffective. Dinotefuron was also effective although somewhat less than the other two products. Finally V10170 provided nearly 100% RWW control at the rates and application methods tested.

A biological material was also evaluated in this ring test and in another field test in 2005. A granular formulation of Azadirachtin (Neemazal®) at the two tested rates did not provide RWW control. In the second field test, Neemazal also was ineffective with six tested rates/application methods; however, a liquid formulation of this material (Aza-Direct®) showed moderate activity. Greenhouse studies were used to investigate this biological material further and there was a definite rate response, especially with the AZA-Direct product. Rates higher than 0.015 lbs. AI/A were effective with the post-flood timing being slightly better than the preflood treatment. The Neemazal product was also less effective in greenhouse studies. The mode of action of Azadirachtin on RWW was investigated; the product affects different species of insects in different ways. RWW were sterilized by feeding on treated foliage; however, studies on repellency were inconclusive. Additional studies in small field plots were hindered due to low RWW populations. In ring tests, the efficacy of preflood applications of pyrethroid insecticides against RWW was studied. Warrior, Proaxis and Mustang (applied 4 days before flooding) provided good RWW larval control.



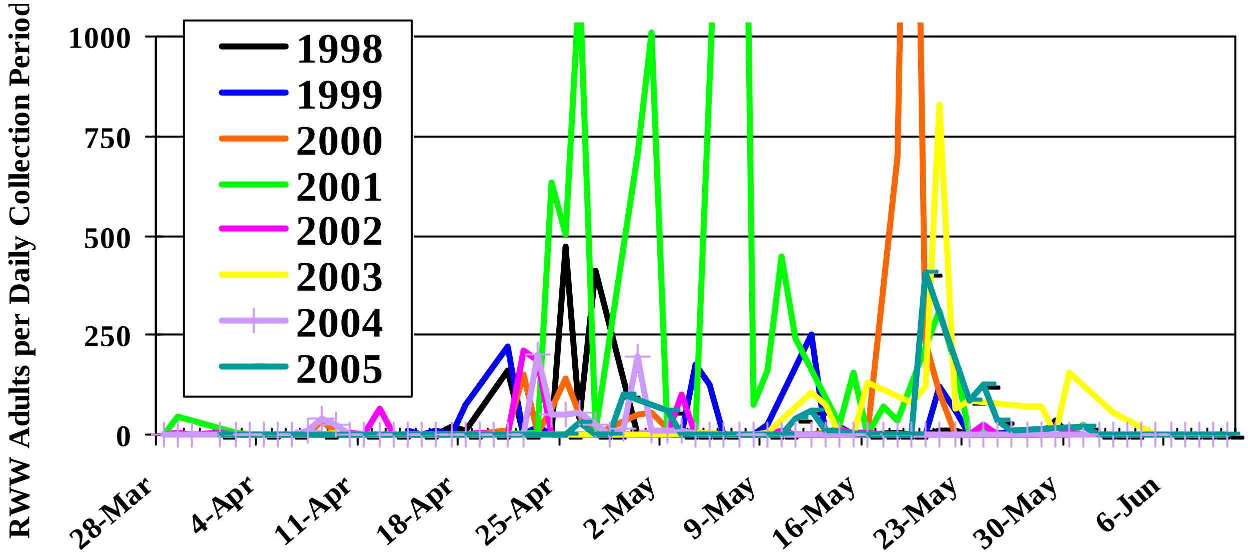






Finally, studies evaluated the effects of insecticide treatments in rice on populations of invertebrate non-targets. Results from 2004 field collections were finalized and the 2005 samples are still being sorted, counted, and summarized. Preflood applications of Warrior had minimal effects on the number of aquatic insects and the number of invertebrates in 2004. For the post-flood applications (five different products were tested), it appears that some products (etofenprox, Mustang) have some short-term detrimental effects on populations of aquatic insects and that most, if not all, the insecticides reduced levels of other invertebrates for 2-3 weeks after application. Some of these reductions were in the 50% range, i.e., Warrior on invertebrates on 17 June. However, after this initial reduction, the populations recovered and were not affected the rest of the season. Warrior was evaluated as a representative material that could be applied against armyworms in mid-July. The Warrior application was quite damaging to these populations.

Rice Water Weevil - Biology: RWW biology was studied in terms of adult flight, relative susceptibility of commonly grown rice varieties to RWW infestation and to yield losses, and the influence of rice seedling establishment methods of RWW population severity. The timing of RWW adult flight was delayed in 2005, as was the rice seeding, because of the cool, wet spring. In 2005, there were minor flights from 26 April to 2 May and from 11 May to 13 May with the majority of the flight (over 75% of the total capture) occurring from 20 May to 26 May. A total of 978 RWW adults were captured, slightly more than in 2004 but about ½ the total in 2003 and 1/8 that in 2001.



Twelve rice varieties were compared for susceptibility to and yield loss from RWW. There were significantly more larvae in M-206 and M-205 than in Calhikiri-201; populations were similar in the other varieties from within the randomized plot area. An eleven-fold difference in larval populations was noted between the most and least susceptible variety. The RWW population was too low to substantially impact grain yields. In six of the varieties, there was a yield advantage for the plots where RWW was controlled and this averaged 8.0%.

RWW populations (adult scarring and larval numbers) as well as armyworm populations were evaluated in the rice systems/seedling establishment study. RWW infestation in this plot was low. Adult scarring did not differ significantly among the treatments but did range up to 18.8% scarred plants in the stale seedbed no till water-seeded treatment. This was about 3x more damage than in the drill-seeded plots. Larval populations were significantly higher (a 5X difference) in the delayed spring till water-seeded treatment than in the stale seedbed no till drill-seeded treatment.

Armyworm Biology and Infestations in Rice: Armyworms have developed into significant pests of rice during the last ~5 years and in some areas a mid-season insecticide treatment for this pest is common. Two species of armyworms are present in Sacramento Valley rice fields; the western yellow-striped armyworm (*Spodoptera praefica*) and the "true" armyworm (*Pseudaletia unipuncta*) and seem to be adapting to the rice agroecosystem and becoming a more significant pest. Armyworms can damage rice 1.) by defoliation and 2.) by feeding on developing panicles and kernels. The latter damage is much more important than is simple leaf removal. The two species of armyworms have similarities and differences. Numerous weed species hosts are known to be suitable hosts and in many cases, western yellow-striped armyworm develops first on weed or rangeland plants, before moving on to crops. It is reported to only lay eggs on broad-leaf weeds and prefers to feed on these plants over rice. Therefore, weed populations may influence populations of armyworms.

Armyworm Biology: We continued investigations of this relationship in 2005 by setting up plots with 1.) very few weeds, 2.) predominantly grassy weeds, 3.) predominantly broadleaf weeds, and 4.) both grassy and broadleaf weeds. Armyworm populations were fairly low in this test but peaked on 5 Aug. and were highest in the plots with no weed control. These plots also had the most weeds and were primarily infested with ricefield bulrush, bearded sprangletop and some arrowhead (in broadleaf plots).

Pheromone traps (these two species utilize different pheromones) were used to study the timing of armyworm adult flight. Separate traps for western yellow-striped armyworm and "true" armyworm were placed near rice fields in 4 locations in Colusa Co. and 3 locations in Butte Co; with moths collected from traps weekly. In addition, larval populations were monitored in 6 and 7 rice fields in Colusa and Butte Co., respectively, every week. Armyworm moth captures in 2003 and 2004 exhibited distinct peaks, i.e., periods of very few moths captured followed by periods of high activity. These peaks are representative of the various life cycle generations for this pest. In 2005, from July to September the true armyworm exhibited a high flight peak in mid-July and again in late Aug. (the late Aug. peak was only seen in Butte Co.). Western yellow-striped armyworm moth captures showed no peaks in 2005; more of a constant but low flight during July and August. The mid-July flight peak corresponded to a mid-July larval population peak in the rice field searches. Populations peaked at 6 worms found per 15-minute search at this time. Armyworm larvae were collected in July and August and held in the laboratory on artificial diet to evaluate parasitism. Parasitized larvae die within a few days. Percentages of parasitism ranged up to 57% on 9 Aug. Two species of parasites are common; these are both small wasps. On western yellow-striped armyworm larvae the common parasite is *Hyposoter exiguae* whereas *Apanteles militaris* is most common on true armyworm larvae. Have these parasitic wasps become less common or delayed or impeded in terms of their period of activity? This is an area that warrants additional research but could play a role in armyworm larval population build-up to treatable levels in rice field. In summary, it does appear that the use of pheromone traps could provide a forewarning of armyworm infestations. An insecticide efficacy test against armyworm was conducted in 2005 with five treatments but populations were not high enough for meaningful data.

Cooperative Research Project: S-300: Mosquito and Agricultural Arthropod Pest Management in Rice and Natural Wetlands

Sharon P. Lawler, Univ. of California-Davis

In 2005 I made significant progress on several projects designed to generate and disseminate knowledge about mosquito production and control in riceland agroecosystems. I completed data analysis and write-up for a three-year project on how rice straw and winter flooding affect mosquito populations in the rice agroecosystem. This study showed that mosquito populations increased in response to on-site decomposition of rice straw, even though beneficial predators also became more abundant. The first paper from this work was the December cover article for *Ecological Applications* (Lawler and Dritz 2005). A second manuscript has been submitted to the Journal of Medical Entomology; this ms shows that winter flooding interacts with residual straw to increase mosquito numbers, and that draining fields for herbicide applications may lead to unusually dense mosquito populations upon re-flooding.

Greg Lanzaro and I completed the U.C. D.A.N.R. extension publication 'Managing mosquitoes on the farm'. The work is now available online (U.C. DANR, IPM and Mosquito Research Program websites). This publication addresses how to manage mosquitoes in a wide range of agricultural settings, including dairy farms, orchards, rice fields and other row crops, and natural lands adjacent to fields.

I revised a second manuscript on how the agricultural pesticide lambda-cyhalothrin affects mosquitoes and beneficial predators, and submitted it to Pest Management Science. Our previous results showing that this pesticide can kill mosquitofish have been incorporated into a California Rice Research Board brochure for growers (see http://www.carrb.com/Facts/Mosquito.HTM).

We completed the second year of field work for a three-year study on how ultra-low volume pesticide fogs for mosquito control affect the invertebrates of seasonal wetlands. Seasonal wetlands in rice-growing areas both produce mosquitoes and harbor mosquitoes from adjacent rice fields. The Colusa Mosquito Abatement District applied a pyrethrin insecticide over wetlands on Colusa Wildlife Refuge twice per week in September and October of 2005, and left Sacramento Wildlife Refuge untreated. We established study areas in three large wetland basins per refuge. We completed two series of light-trapping samples on nights before, during, and after a spray to estimate mortality of flying insects. We collected zooplankton samples and sweep-net samples of aquatic insects from all sites. In addition, we used *Daphnia magna* as 'sentinel' zooplankton to test whether adulticides affect zooplankton. A parallel study by Cathy Johnson is assessing whether the pesticide precipitated into the wetlands. This work will not be published until after all years of the study are complete.

Impact:

The online paper 'Management of Mosquitoes on the Farm' is a useful reference document for mosquito prevention and control in row crops, dairies and orchards. California's Mosquito and Vector Control Districts and U.C. extension personnel can refer growers to this publication for information. Our work on rice straw management informs growers and mosquito abatement districts about potential mosquito issues associated with on-site decomposition of rice straw and winter flooding.

S-300: Mosquito and Agricultural Pest Management in Riceland Ecosystems

William E. Walton, University of California-Riverside

An integrated mosquito management (IMM) strategy including both source reduction (isolating emergent vegetation to narrow raised planting beds) and the addition of larvivorous fish was studied in a 10 hectare wetland used to process secondary-treated municipal effluent. The distribution and abundance of mosquitofish (*Gambusia affinis*) and the efficacy of mosquitofish for reducing mosquito production from 20-meter (wide) versus 3-meter (narrow) bands of emergent vegetation (*Schoenoplectus californicus*) was studied on 4 dates. Transects perpendicular to the path of water flow through the vegetation bands were established at 3 positions (1.5 meters, 5 meters and 10 meters from the open water-emergent vegetation interface) in replicate wide bands of vegetation, in the center of replicate narrow bands of vegetation and in the open water. Thirty sites in each of two marshes were sampled per date. Samples were taken in June (2 dates), July, and September 2005. Mosquito production was measured using emergence traps. Mosquitofish and large mobile aquatic insects were sampled using minnow traps lined with fiberglass window screen. Mosquitofish were not distributed uniformly across the transects in the two marshes. In inlet marsh 1, significantly fewer fish were collected at the 5-meter and 10-meter positions in the wide band of vegetation than were collected in the narrow band of vegetation and in the open water during June-July. In inlet marsh 5, significantly fewer fish were collected at the 10-meter position than were collected at the other positions during June-July. In contrast to the summer collections, the trends for the number of mosquitofish collected at the 5 positions were consistent in the two inlet marshes in September. Significantly more mosquitofish were collected in the narrow bands of vegetation than were collected at positions towards the interior of the wide bands of vegetation in both inlet marshes. Nearly 10-fold more mosquitofish (N = 3189) were collected in September than were collected in June-July. Mosquito production in the center of the wide vegetation bands was comparatively greater than at positions closer to the open water-vegetation interface in inlet marsh 1 and at all positions in the wide vegetation band relative to the narrow band in inlet marsh 5 in June-July. In inlet marsh 1, nearly 200 CULEX were emerging daily from each square meter of vegetation in the center of the 20-meter bands despite an ongoing IMM program using larvicides and adulticides. The benefit of using narrow vegetation bands in wetlands containing larvivorous fishes is evidenced by the comparatively lower mosquito production from the narrow bands of vegetation within each inlet marsh. Mosquito production from the open water zones did not differ statistically from zero during June-July. The combination of ongoing IMM activities and water management that reduced the harborage for immature mosquitoes probably lowered mosquito production during late autumn. Our results to date indicate that the utilization of thin bands of emergent vegetation enhances mosquito control efforts in IMM programs for wetlands stocked with larvivorous fishes.

Culex quinquefasciatus populations were selected to recombinant strains of *Bacillus thuringiensis* that produced Cyt1Aa, Cry11Aa or a 1:3 mixture of these strains. After 20 generations, the resistance ratio was 1237 in the Cry11Aa-selected population, 242 in the Cyt1Aa-selected population and only 8 in population selected with the combination of the toxins. When the resistant strain selected with the combination of toxins was assayed against Cry11Aa after 48 generations, resistance was 9.3-fold. These results indicate even though resistance to Cry11Aa evolved in the presence of Cyt1Aa, the level of resistance was much lower than when Cyt1Aa was absent. Cyt1Aa is the principal factor responsible for delaying the evolution and expression of resistance to mosquitocidal Cry proteins.

Impact:

The results of this study will help to provide criteria for the management of pest and pathogen-transmitting mosquitoes that utilize rice fields and constructed treatment wetlands as developmental sites. Mosquito abatement and resistance management of mosquitoes to control agents must be included as part of any comprehensive plan for the design and operation of multipurpose constructed treatment wetlands, particularly where human residences are situated near wetlands. The work summarized here will assist a multiagency effort to develop criteria for the construction of large-scale wetlands systems that will be designed to conserve precious water resources, promote the biodiversity of endemic wetlands organisms, and protect the public from mosquitoes and the diseases that they cause.

LOUISIANA

S300 Project: Mosquito and Agricultural Pest Management in the Riceland Ecosystems
February 2006

Boris A. Castro, LSU Agricultural Center
Department of Entomology
404 Life Sciences Bldg.
Baton Rouge, LA 70803

Report from January 1 to December 31, 2005

Objective 1: To determine the best chemicals to use in riceland systems for efficacy to control rice pests while minimizing harm to non-target organisms.

a. Rice water weevil (RWW), *Lissorhoptrus oryzophilus*

Four demonstration trials were conducted in commercial riceland systems using a pyrethroid insecticide impregnated on granular fertilizer (urea). This new insecticide delivery method was studied for its potential to reduce drift problems normally associated with aerial applications of liquid formulations to non-target areas. The potential also exists for reduced application costs since the insecticide and the fertilizer are delivered simultaneously during the same aerial application. The objective of the trials was to evaluate the efficacy of this new insecticide delivery system against the RWW compared to traditional foliar spray applications to manage RWW infestations. Three commercial fields were treated with Karate Z and one field was treated with Mustang insecticide. Materials, methods, treatments, and results are presented in Appendix 1. Prior to the trials, producers believed the insecticide impregnation method would allow control of larval infestations of the RWW. Our trials showed that once larvae were established in the root system, there was no evidence to suggest any larval reduction in the fertilizer impregnation treatment compared to the foliar insecticide application (see Field 3, Appendix 1). However, the fertilizer impregnated technique performed as good as the foliar spray to manage adult RWW. Therefore, it still is recommended to apply the fertilizer impregnated shortly after the establishment of the permanent flood (i.e. within one week of the permanent flood).

b. Rice stink bug (RSB), *Oebalus pugnax*

Two insecticide tests were conducted in small plots at the LSU AgCenter's Northeast Research Station near St. Joseph, LA. Experiments were planted on May 5, 2005 and July 17, 2005 to increase opportunities to study RSB populations at two different times in the growing season. However, none of the experiments experienced significant infestations by the RSB.

c. Sugarcane borer (SCB), *Diatraea saccharalis*

One insecticide test was conducted in repeated small plots at the LSU AgCenter's Northeast Research Station near St. Joseph, LA. The experiment was planted on July 17, 2005. SCB infestations in 2005 were lower compared to those observed in the previous two years. In 2005, no significant differences ($P = 0.07$) were detected in the numbers of whitehead per plot among the different treatments and the UTC (se Appendix 2). Among seed treatments tested, there was a trend for lower number of whiteheads per plot in Syngenta's A14006 seed treatment compared to Icon (fipronil) or Cruiser (thiamethoxam). Results from 2003 and 2004 (data not shown) indicated that the best timeframe to apply a foliar spray against SCB infestations in LA rice were between panicle differentiation and early boot stages. During those years, no significant differences in number of whiteheads were detected when a pyrethroid insecticide was applied once at PD or twice (PD + 7 days).

Objective 2: To determine the best nonchemical tactics to use in riceland systems to manage problems with rice pests.

a. Rice water weevil (RWW), *Lissorhoptrus oryzophilus* – Influence of planting date on RWW populations in commercial rice fields.

This project was part of a three-year study conducted in collaboration with Dr. Michael Stout. Core samples taken from commercial rice fields in Vermilion parish indicated that early planted fields (i.e. early March) escaped heavy RWW infestations (see Appendix 3).

b. South American rice miner (SARM), *Hydrellia wirthi*

A survey was conducted to determine the distribution and severity of this new invasive rice insect pest in riceland areas of Louisiana. Survey results indicated the SARM is distributed in eight rice parishes of LA including Acadia, Allen, Vermilion, Jefferson Davis, Cameron, St. Martin, Concordia, and Tensas parishes (see Appendix 4). SARM infestations caused rice seedling death and associated economic losses in rice in coastal parishes of Louisiana (Cameron, Jefferson Davis, Vermilion, and Acadia). The SARM affected late-planted rice (i.e. rice planted after mid-May in Southwest LA) and severity of infestations were higher from two to six weeks after emergence. No preference was detected for a particular rice variety or seeding method.

c. Panicle rice mite, *Steneotarsonemus spinki*

A survey was conducted in 2005 in all commercial rice producing areas of LA to determine the presence of the panicle rice mite. The panicle rice mite is of quarantine importance and is spreading through rice areas of the American tropics. Yield losses in association with the mite are reported in the range from 30 to 100 percent in Caribbean and Central American countries. Despite the mite was reported and described in 1967 from Louisiana, the mite was not found in our survey in 2005.

d. Rice delphacid, *Tagosodes oryzicolus*

Commercial rice fields were surveyed to detect the presence and/or distribution of the rice delphacid. The rice delphacid was reported in southeastern United States in the 1950s and is the main vector of the Hoja Blanca virus in the tropics. Several specimens of the insect family Delphacidae were collected and sent to the USDA/PPQ identifier. Identification results are pending.

APPENDIX 1
Fertilizer and Pyrethroid Impregnation Trials in Commercial Rice Fields in 2005

FIELD 1

Producer: Dane Hebert

Field Location:	1 mile south of hwy 699 off hwy. 700, near Leroy
Coordinates:	30°02.79 N and 092°14.44 W
Total area:	Approx. 58 acres
Planting date:	March 29, 2005
Variety:	Bengal
Plant emergence:	April 11, 2005
Permanent flood:	Initiated on April 22, 2005
Monitoring for RWW:	Twice a week
RWW infestation date:	April 27, 2005
Pre-treatment core samples:	0 larvae in 5 core samples throughout field
Treatment date:	April 28, 2005 (both: fertilizer impregnation and foliar spray)

Treatments:

1. Urea @ 100 lb/acre impregnated with Karate Z at 60 acres/gallon (= 2.13 oz/acre), area treated = approx 15 acres.
2. Karate Z foliar spray at rate of 60 acres per gallon (= 2.13 oz/acre). Area treated = approx. 43 acres.

Larva sampling: Core samples taken from each treated area on May 12, 2005 (14 days post treatment).

Results:

	Urea + Karate Z impregnated		Karate Z foliar spray	
Soil core #	larvae	pupae	larvae	pupae
1	**2**	**0**	**0**	**0**
2	**1**	**0**	**0**	**0**
3	**0**	**0**	**1**	**0**
4	**1**	**0**	**0**	**0**
5	**0**	**0**	**0**	**0**
Total (5 cores)	4	0	1	0
Average per core*	0.8	0	0.2	0

*Larval action threshold level = 5 larvae per core.

Note: Water in this field was released on May 7 to boost plant growth. Water was put back on by May 11. Core samples taken on May 14 were taken from lower areas of both fields that remained flooded throughout.

FIELD 2

Producer: Boyd Landry

Field Location:	At Cabrol and Weston Rd., near Meaux
Coordinates:	30°00.71 N and 092°11.79 W
Total area:	Approx. 55 acres
Planting date:	April 23, 2005
Variety:	Clearfield 161
Flash flood:	May 12, 2005
Permanent flood:	Initiated May 19, 2005. Established May 23, 2005
Monitoring for RWW:	Twice per week
RWW infestation date:	Lots of adults and feeding scars at initiation of permanent flood
Treatment date:	May 24, 2004, **one day after completion of permanent flood** (both: fertilizer impregnation and foliar spray)

Treatments:

1. **Urea @ 100 lb/acre impregnated with Karate Z** at 60 acres/gallon (= 2.13 oz/acre), area treated = 25 acres.
2. **Karate Z foliar spray** at rate of 60 acres per gallon (= 2.13 oz/acre). Area treated = 30 acres.

Larva sampling: Core samples taken from each treated area on June 3, 2005 (10 days post treatment)

Results:

	Urea + Karate Z impregnated larvae				Karate Z foliar spray larvae			
Soil core #	small	medium	large	pupae	small	medium	large	pupae
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**
4	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total (5 cores)	1				1			
Average per core*	0.2				0.2			

*Larval action threshold level = 5 larvae per core.

FIELD 3

Producer: Christian Richard

Field Location:	Off Hwy. 699 and Dulva Rd. about 6 miles north of Kaplan.
Coordinates:	30°04.90 N and 092°18.63 W
Total area:	Approx. 57 acres
Planting date:	March 21, 2005
Variety:	Clearfield 161
Planting Method:	Dry seed on flooded field. Water released two days after seeding
Permanent flood:	Initiated May 7, 2005
Monitoring for RWW:	Twice per week
RWW infestation date:	Lots of adults and feeding scars observed on May 19, 2005
Pre-treatment larva sampling:	Took 5 core samples on May 19, 2005 and found 0 larvae and 0 pupae in 5 core samples throughout the entire field.

Treatment date: May 23, 2004, **16 days after initiation of permanent flood** (both: fertilizer impregnation and foliar spray)

Treatments:

1. **Urea @ 100 lb/acre impregnated with Karate Z** at 60 acres/gallon (= 2.13 oz/acre), area treated = 24 acres.
2. **Karate Z foliar spray** at rate of 60 acres per gallon (= 2.13 oz/acre). Area treated = 33 acres.

Larva sampling: Core samples taken from each treated area on June 3, 2005 (11 days post treatment)

Results:

	Urea + Karate Z impregnated larvae				Karate Z foliar spray larvae			
Soil core #	small	medium	large	pupae	small	medium	large	pupae
1	**0**	**0**	**4**	**0**	**1**	**0**	**2**	**3**
2	**0**	**4**	**0**	**0**	**1**	**1**	**0**	**1**
3	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
4	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**3**
5	**2**	**2**	**0**	**2**	**2**	**2**	**2**	**4**
Total (5 cores)	17				24			
Average per core*	3.4				4.8			

*Larval action threshold level = 5 larvae per core

FIELD 4

Fertilizer and Mustang EW fertilizer Impregnation vs. Mustang Max Spray Trial in a Commercial Rice Field in 2005

Vermilion Parish, Louisiana

Producer: Hubert Faulk

Field Location:	Off Hwy 699, near Leroy, Vermilion Parish
Coordinates:	30°15.46 N and 092°51.56 W
Total area:	Approx. 114 acres total
Planting date:	May 2, 2005
Variety:	CL 161
Planting Method:	Drill seeded
Flush:	May 5, 2005
Newpath applic.:	May 18, 2005
Flushed again:	May 20, 2005

Newpath + Mustang Max @ 4 oz/acre: May 29, 2005

Permanent flood: Started on May 31, 2005

Field observations: June 3, 2005 – lots of weevil adults and feeding scars in the field, therefore, it was decided we will use this field to test the fertilizer impregnation with Mustang EW and compare it to the normal Mustang Max spray application.

Pre-treatment core samples:
Date taken: June 06, 2005 – two days before treatment (see table next page)

Treatments: Both treatments: spray vs. the fertilizer impregnation applied on June 8, 2005, <u>8 days after the initiation of permanent flood</u>

1.- Fertilizer impregnation: 150 lb of 33% fertilizer plus 4.3 oz Mustang EW, applied to the east side of field on 59 rice acres.

2. - Spray: Mustang Max at 4 oz/acre applied to the west side of field on 55 acres.

Post treatment core samples:
June 10, 2005 (2 d.a.t.): Several bucket samples and field observation: No adults and no larvae.
June 13, 2005 (5 d.a.t.): Core samples taken (see table next page)
June 20, 2005 (12 d.a.t.): Core samples taken (see table next page)

Results:

1. Pre-treatment core sample on June 6, 2005 (2 days before treatment):

Soil core #	Fert. + Mustang EW impregnated larvae	pupae	Mustang Max foliar spray larvae	pupae
1	**0**	**1**	**0**	**1**
2	**0**	**0**	**0**	**0**
3	**1**	**0**	**0**	**0**
4	**3**	**0**	**0**	**0**
5	**0**	**0**	**1**	**0**
Total (5 cores)	4	1	1	1
Average per core*	0.8	0.2	0.2	0.2

*Larval action threshold level = 5 larvae per core

2. Core sample from June 13, 2005 (5 days after treatment):

Soil core #	Fert. + Mustang EW impregnated larvae	pupae	Mustang Max foliar spray larvae	pupae
1	**1**	**0**	**0**	**0**
2	**1**	**0**	**0**	**0**
3	**1**	**0**	**2**	**0**
4	**3**	**0**	**1**	**0**
5	**0**	**0**	**0**	**0**
Total (5 cores)	6	0	3	0
Average per core*	1.2	0	0.6	0

*Larval action threshold level = 5 larvae per core

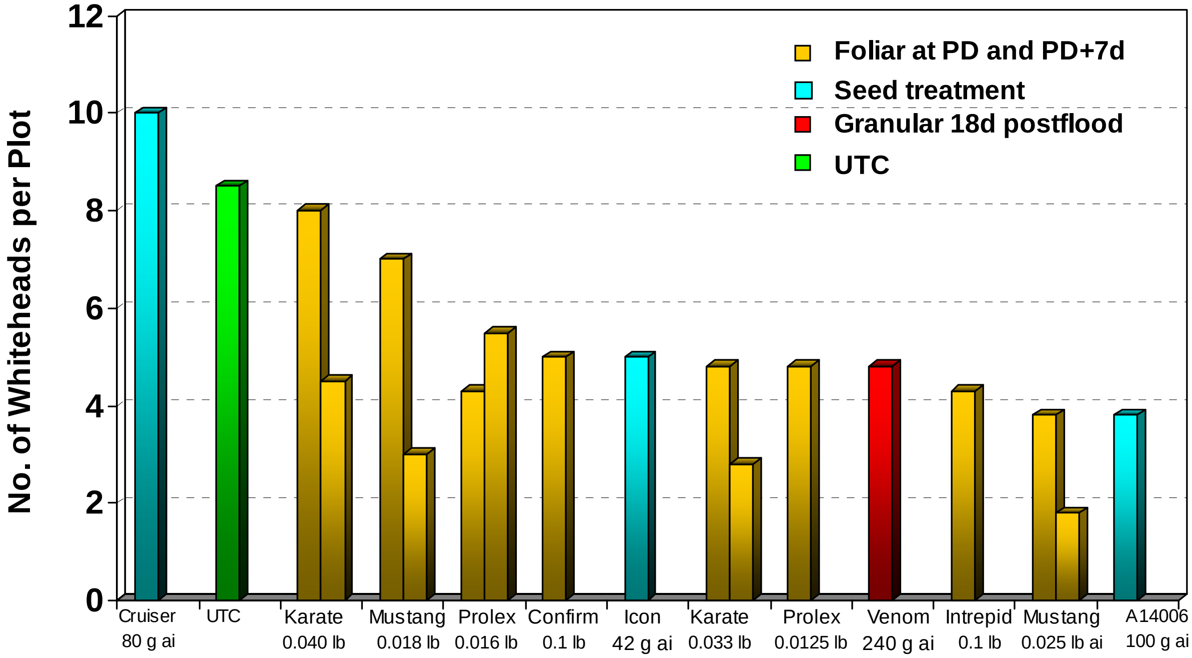
3. Core sample from June 20, 2005 (12 days after treatment):

Soil core #	Fert. + Mustang EW impregnated larvae	pupae	Mustang Max foliar spray larvae	pupae
1	**1**	**0**	**3**	**0**
2	**0**	**0**	**0**	**0**
3	**4**	**0**	**3**	**0**
4	**2**	**0**	**5**	**0**
5	**1**	**0**	**0**	**0**
Total (5 cores)	8	0	11	0
Average per core*	1.6	0	2.2	0

*Larval action threshold level = 5 larvae per core

APPENDIX 2

Management of Sugarcane Borer Infestations in Rice Using Selected Rates of Insecticides, Louisiana 2005



Treatment name	Rate	Application time	Whiteheads / plot (5' x 15' plots)
Cruiser	**80 g ai/100 kg seed**	**SEEDT**	**10**
UTC	**---**	**---**	**8.5**
Karate Z	**0.04 lb ai/acre**	**PD**	**8**
Karate Z	**0.04 lb ai/acre**	**PD+7d**	**4.5**
Mustang Max	**0.018 lb ai/acre**	**PD**	**7**
Mustang Max	**0.018 lb ai/acre**	**PD+7d**	**3**
Prolex	**0.016 lb ai/acre**	**PD**	**4.3**
Prolex	**0.016 lb ai/acre**	**PD+7d**	**5.5**
Confirm	**0.1 lb ai/acre**	**PD**	**5**
Icon	**42 g ai/100 kg seed**	**SEEDT**	**5**
Karate Z	**0.033 lb ai/acre**	**PD**	**4.8**
Karate Z	**0.033 lb ai/acre**	**PD+7d**	**2.8**
Prolex	**0.0125 lb ai/acre**	**PD**	**4.8**
Venom	**240 g ai/acre**	**PD**	**4.8**
Intrepid	**0.1 lb ai/acre**	**PD**	**4.3**
Mustang Max	**0.025 lb ai/acre**	**PD**	**3.8**
Mustang Max	**0.025 lb ai/acre**	**PD+7d**	**1.8**
A14006	**80 g ai/100 kg seed**	**SEEDT**	**3.8**

LSD, *P* = 0.07

APPENDIX 3
Rice Water Weevil and Planting Date Study in Louisiana 2005

Boris Castro and Mike Stout, Department of Entomology, LSU Agricultural Center

Planting date	Core date	Rice variety	Flooding	Parish	Acres	Producer	Feeding scars	RWW larvae/pupae per core 1	2	3	4	5	Average Larvae/Pupae
March 10, 2005	**Apr. 11, 2005**	**Bengal**	**Continuous**	**Vermilion**	**20**	**Christian Richard**	**No**	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	0/0
March 10, 2005*	**Apr. 27, 2005**	**Bengal**	**Continuous**	**Vermilion**	**20**	**Christian Richard**	**No**	**4/0**	**1/0**	**0/0**	**0/0**	**3/0**	1.6/0
March 12, 2005	**Apr. 15, 2005**	**Cypress**	**Pin-point**	**Vermilion**	**60**	**Christian Richard**	**No**	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	0/0
March 12, 2005*	**Apr. 27, 2005**	**Cypress**	**Pin-point**	**Vermilion**	**60**	**Christian Richard**	**No**	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	0/0
March 18, 2005**	**May 19, 2005**	**Cocodrie**	**Continuous**	**Allen**	**30**	**Hine Unkle**	**Yes**	**14/1**	**8/3**	**16/1**	**9/0**	**9/3**	11.2/1.6
March 20, 2005**	**May 19, 2005**	**Cocodrie**	**Continuous**	**Jeff Davis**	**40**	**Eric Unkle**	**Yes**	**15/1**	**0/0**	**6/0**	**4/0**	**4/1**	5.8/0.4
March 21, 2005**	**May 19, 2005**	**CL 161**	**Delayed**	**Vermilion**	**57**	**Christian Richard**	**No**	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	0/0
March 22, 2005	**Apr. 15, 2005**	**Cocodrie**	**Pin-point**	**Vermilion**	**50**	**Boyd Landry**	**No**	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	0/0
March 29, 2005	**Apr. 27, 2005**	**Bengal**	**Continuous**	**Vermilion**	**40**	**Dane Hebert**	**No**	**0/0**	**0/0**	**1/0**	**0/0**	**0/0**	0.2/0
March 29, 2005	**Apr. 27, 2005**	**Bengal**	**Continuous**	**Vermilion**	**20**	**Dane Hebert**	**few**	**2/0**	**1/0**	**0/0**	**1/0**	**0/0**	0.8/0
March 30, 2005*	**May 19, 2005**	**Cocodrie**	**Continuous**	**Allen**	**60**	**Hine Unkle**	**Yes**	**7/3**	**8/2**	**10/0**	**10/0**	**2/0**	7.4/1

Fields were not sprayed with insecticides prior to core sampling.
*This fields were at green ring at time of sampling.
**These fields were past green ring when sample

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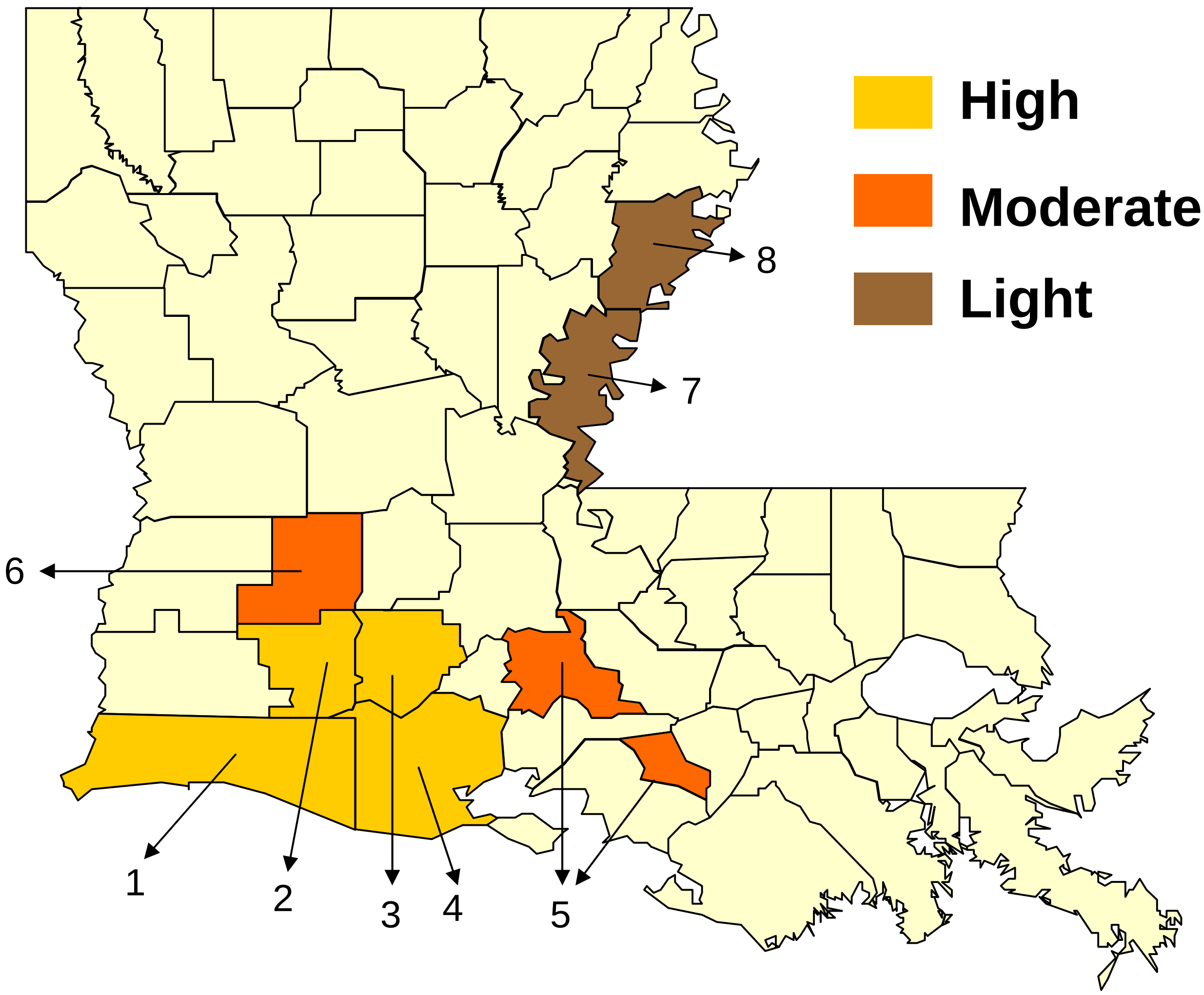
APPENDIX 4 - Distribution of the SARM in Louisiana in 2005

Dr. Boris A. Castro, Dept. Entomology, LSU Agricultural Center



High infestation resulting in plant death = Cameron (1), Jefferson Davis (2), Acadia (3), and Vermilion (4) parishes. Moderate infestations resulting in reduced tillering, some plant death and uneven maturity = St. Martin (5) and Allen (6) parishes. Light infestations resulting in leaf scarring = Concordia (7) and Tensas (8) parishes.

S300 Project: Mosquito and Agricultural Pest Management in Riceland Ecosystems
Mike Stout, LSU Agricultural Center
26 February 2006

Objective 1: Chemical control of rice pests and riceland mosquitoes; non-target effects

Developing strategies for the effective use of insecticides against the rice water weevil (Oral presentation: Tuesday 2/28 @ 3:40 p.m.; Poster presentation #10)

Tests of alternative insecticides

Evaluating insecticides for efficacy against the rice water weevil continues to be a priority in Louisiana for three reasons: 1) the loss of Icon from the rice market; 2) increasing problems with drift of pyrethroids into crawfish ponds; and 3) concerns about development of resistance to pyrethroids. Several alternative insecticides, and alternative formulations of currently registered insecticides, were tested in eight tests in 2005:

- Several seed treatments (including A14006, a Syngenta product, and two seed treatments evaluated under secrecy agreements) gave good to excellent control of weevil larvae in drill-seeded tests. A14006 also controlled larvae in water-seeded culture. Control given by A14006and the other insecticides was better than that given by Icon.
- Split applications of dinotefuran (1 d pre-flood and 6, 14, or 20 d post-flood) provided excellent control of weevil larvae (better than control given by Furadan) in two experiments. In addition, a single application of a high rate of dinotefuran made 21 d after flooding also controlled weevil larvae, indicating that dinotefuran was directly controlling larvae.

Results of late-season test of dinotefuran, 2005, Crowley

	Larvae per core sample ± s.e. on:		
Treatment	**7/12/05 (20d post)**	**7/19/05 (27d post)**	**7/25/05 (33d post)**
Untreated control	**35.6 ± 5.3**	**40.3 ± 8.1**	**26.6 ± 4.0**
V10170 pre+5d post	**1.3 ± 0.4**	**3.8 ± 0.8**	**2.5 ± 0.2**
Dinotefuran pre+14d	**3.7 ± 0.5**	**5.9 ± 1.5**	**9.8 ± 2.8**
Dinotefuran pre +21d post	**6.7 ± 2.5**	**7.1 ± 2.5**	**2.6 ± 0.9**
Dinotefuran 21d post	**34.6 ± 2.1**	**19.9 ± 2.1**	**4.6 ± 1.1**

- The efficacies of two pyrethroids (zeta-cypermethrin and lambda-cyhalothrin) coated or impregnated on fertilizer were investigated in two small-plot experiments. Rates used for the fertilizer impregnation were similar to rates used for foliar sprays. In the early-season test, a pre-flood application and 1, 2, and 6 day post-flood applications gave adequate control of weevils. A 20 d post-flood application also gave some control. Overall, the data indicated little post-flood larvacidal activity. In the late-season test, applications of pyrethroids coated on fertilizer failed to control weevils.
- Etofenprox was evaluated in two demonstration trials and a replicated small-plot experiment. In the small plot experiment, etofenprox at three rates and two timings reduced larval populations by only 30-40%. The poor results in this experiment were

likely attributable to heavy weevil populations and to improper calculation of etofenprox rates (on the basis of plot size versus area flooded). A standard post-flood foliar application of Karate Z gave virtually no control of weevil larvae in the same experiment. Control given by etofenprox was somewhat better in the demonstration trials. A Section 18 request for this product in rice for 2006 was submitted in December. This insecticide is pyrethroid-like, has been used extensively for weevil control in Japan for over 15 years, and worked well in 2005 in California and Texas. The usage pattern of etofenprox will be similar to that of the pyrethroids, but, because it is a granular, drift problems should be minimal.

Results of large-plot demonstration of etofenprox, 2 replications, Crowley, 2004

	Larvae per core sample ± s.e. (% control relative to control) on:		
Treatment	**7/6/05**	**7/13/05**	**7/20/05**
Untreated plots	**18.8 ± 3.1**	**24.9 ± 2.6**	**26.3 ± 0.6**
Treated plots	**10.7 ± 1.0 (43%)**	**16.3 ± 2.8 (35%)**	**18.1 ± 0.1 (31%)**

Development of preliminary action threshold

The relationship between densities of adult rice water weevils and densities of immature rice water weevils was evaluated in greenhouse experiments in 2004 and 2005 (Poster #10). Results of these experiments were used to calculate an estimate of weevil fecundity, which was in turn used to calculate a preliminary action threshold for use of adulticidal insecticides in recently-flooded rice fields. We will attempt to verify this action threshold in 2006.

Evaluation of insecticides against the rice stink bug

Efficacies of insecticides against stink bugs were evaluated in two experiments, but stink bug populations were too low for a satisfactory evaluation. A test conducted in collaboration with Dr. Don Groth compared the effectiveness of various timings of insecticide and fungicide (simulated tank mixes) for stink bug and sheath blight control.

Effects of agricultural pest management on mosquitoes in rice

A small-plot experiment was conducted to investigate the effects of control measures for rice stink bug (two applications of Karate) on mosquitoes, and to test the efficacy of WS-BTI against mosquito larvae. [WS-BTI is a powdered mixture composed of 4.3% *Bacillus thuringiensis* subsp. *israelensis* (BTI, EPA Reg. No. 62637-7) and proprietary inert ingredients that creates a monomolecular film spreading system to distribute the BTI active ingredient across the surface of standing water.] Twelve individually-leveed plots (simulated rice paddies) were established at the LSU Rice Research Station, each measuring approximately 20’ x 100’. Each plot contained four 4’ x 20’ stands of rice. Treatments (control, Karate, WS-BTI, or Aquabac, a widely-used BTI product) were assigned to the twelve plots according to a randomized complete block design. Three methods were used to assess the effects of insecticide applications on populations of mosquito larvae: 1) standard dip samples before and after insecticide applications; 2) placement of floating cages containing 30 3rd-instar *Culex quinquefasciatus* into each plot and assessing mortality 24 h after insecticide application; and 3) removing water samples from plots and assessing mortality of larvae exposed to water from the various treatments.

Although the results have not yet been fully analyzed, dip sampling from treated and control plots showed no differences in natural populations of mosquito larvae in plots of the various treatments. However, larvae placed in cages in Karate-treated plots suffered greater mortality than larvae in control or BTI-treated plots. A high rate of mortality was also observed in one case in mosquitoes exposed in the lab to water samples from Karate-treated plots. Adult mosquitoes placed on leaves from rice in Karate-treated plots showed higher mortality than adults placed on leaves from control plots.

In a large-plot demonstration, aerial application of Karate at 0.03 lbs AI/A caused high mortality of mosquito larvae seeded in cages in plots. Mortality in the Karate-treated field was higher than mortality in the untreated field.

Laboratory evaluations of WS-BTI showed the product to have efficacy similar to that of commercial BT products.

Objective 2: Non-chemical tactics for rice pest management

Influence of planting date on pest populations and yield losses

A three-year date-of-planting study (completed in 2004) showed that planting rice before April in southwest Louisiana was associated with benefits with respect to insect management. In 2004, for example, densities of weevil larvae approximately four weeks after flooding were very low in plots planted on 15 March (the earliest planting date in this experiment). In collaboration with Boris Castro, weevils were sampled in several early-planted fields in Vermilion Parish, LA in 2005 (see accompanying data). Some of these early-planted fields escaped heavy weevil infestations.

Plant resistance research

A set of rice breeding lines and commercial varieties was evaluated for resistance to the rice water weevil for the third year. Several lines showed greater resistance to weevils than a commercial standard (Bengal) in the 2005 test, and several lines showed greater susceptibility. The performance of lines was generally consistent with their performance in previous greenhouse and field studies. A few lines showed indications of tolerance (high yields despite high levels of weevil infestation). Another set of varieties with varying levels of resistance to rice blast (verified by Dr. Groth) were evaluated for resistance to weevils, but no varieties showed resistance.

Greenhouse experiments were conducted to characterize phenotypic correlates of tolerance to weevil injury in rice.

MISSISSIPPI

S300 Project: Mosquito and Agricultural Pest Management in Riceland Ecosystems
James T. Robbins, Mississippi State University

The big news this year were the two hurricanes that hit the delta rice crop in August and September, Katrina and Rita. I think Rita may have had the greater impact on tests due to the higher rainfall which was in excess of 6 inches over a twenty four hour period compared to Katrina which was much less here at Stoneville. The rice plants were laid over and yields were lowered in the tests by as much as 30 per cent compared to last years' yields.

This year a new granular insecticide and a seed treatment were tested. The granular treatment is applied by air and is etofenprox made by Mitsui Corporation and the seed treatment is a combination fungicide and insecticide produced by Syngenta. These two new treatments target rice water weevils, chinch bugs, colaspis beetles, and other early season insects of rice. Preliminary laboratory tests with etofenprox show excellent control of rice stinkbugs. According to company representatives an 'EC' formulation may become available after test results are evaluated for the granular material. Calibration for different rates of etofenprox applied by air proved to be no different than fertilizer calibrations. The dispersion of the granules was very uniform due to the shape and size of the granules. Test results show that both compounds are very effective in controlling the target pests. Additional tests next year will determine how efficacious they are against rice insects here in the delta. According to company representatives projected costs will be 'competitive' with other products. Additional tests were conducted with different rates and application timings of Prolex, Mustang Max, Karate Z, Methyl Parathion, and others for control of rice stink bugs. Prolex applied at one gallon to 85 acres proved to be very effective and comparable to Karate Z applied at one to 66 acres. Prolex is a 'gamma' cyhalothrin as opposed to Karate Z which is a 'lambda' cyhalothrin.

This year test fields with the new seed treatments of a fungicide plus insecticide had higher yields compared to those fields with only a foliar treatment applied for rice water weevil and rice stink bugs. Highest average yields were from tests where both a seed treatment and foliar applications were applied. Yields averaged 5275 lb per acre where only fungicides were used compared to average yields of 6160 to 6360 lb per acre where both fungicide and insecticide seed treatments were used. Yields from test fields were low compared to previous years due to the hurricane damage.

Table 1. Rice Yields from Tests Conducted at Stoneville, MS, 2005

Treatment	Yield lb/A
Fungicide Seed Treatment Only	5275
Insecticide + Fungicide Seed Treated w/ insecticide #1	6160
Insecticide + Fungicide Seed Treated w/ insecticide #2	6206
Insecticide + Fungicide Seed Treated w/ insecticide #3	6360
Seed Treatment + Foliar	6788

Note: Drill planted on 8 May, 2005 and harvested 7 October, 2005.

TEXAS

ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECT
Supported by Allotments of the Regional Research Fund,
Hatch Act, as Amended August 11, 1955

January 1 to December 31, 2005

PROJECT:
S-300, Mosquito and Agricultural Pest Management in Riceland Ecosystems
COOPERATING AGENCY AND PRINCIPAL LEADER:
Texas Agricultural Experiment Station (TAES) ____________ J.K. Olson*
*Voting member on Technical Committee

PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:

Objective 1: To determine the best chemicals to use in Riceland systems: TAES continued to conduct insecticide susceptibility tests on select populations of *Cx. quinquefasciatus* Say female adults in the rice-producing region of southeastern Texas. Jefferson Co. populations demonstrated high tolerance to malathion at two locations, with insecticide resistance management strategies being recommended for implementation at these sites. Several populations in Harris Co. demonstrated elevated tolerances to the pyrethroids, resmethrin and sumethrin. Insecticide resistance management programs have been initiated in each area where pyrethroid tolerances were detected in Harris Co. Orange Co. populations tested were all in the acceptable range of insecticide susceptibilities, with resistance management strategies being continued in this county. .

Objectives 2 & 3: No work was performed by TAES on either of these objectives.

Objective 4: To update and refine existing databases on mosquito species occurring in rice-producing areas of the U.S.: The TAES study of the distribution patterns of the *Anopheles quadrimaculatus* species complex in Texas was completed, with *An*. *quadrimaculatus* and *An*. s*maragdinus* being the only two species confirmed as being present in the state. *An*. *quadrimaculatus* was the most widely-distributed species, while *An*. *smaragdinus* was confined primarily to wooded wetland areas of east and southeast Texas. Data from the temperature-dependent development studies of Texas populations of *Aedes albopictus* and *Ae*. a*egypti* eggs continued to be analyzed for inferences as to why *Ae*. *albopictus* is able to replace *Ae*. a*egypti* in certain regions of the state. A public survey in select neighborhoods of Bryan and Houston , TX, to assess what citizens are doing to protect themselves from mosquitoes and West Nile virus infections and to assess the effectiveness of public information programs designed to inform people as to how to protect themselves was completed, with resulting data now being analyzed. Surveillance of the Brazos County, TX, area for West Nile virus activity was continued by TAES. A total of 14 samples of *Cx*. *quinquefasciatus* adults were found positive for WNv during 2005, as were numerous bird blood samples, one horse and three humans. Control recommendations were made on the basis of the survey and monitoring effort.

IMPACT OF ACCOMPLISHMENTS:

- Insecticide susceptibility tests are assisting in the development of a database on the occurrence and distribution of insecticide resistance in mosquito populations breeding in the rice-producing area of southeast Texas; and the database is subsequently being used to give direction to insecticide resistance management in mosquito populations of concern.

- Knowledge of the occurrence and distribution patterns of the members of the *An. quadrimaculatus* species complex in Texas is providing insight as to the vector potential for Malaria in the Texas rice-producing area as well as elsewhere in the state.

- Research on the effects of temperature and humidity on the eggs and development of *Ae. aegypti* and *Ae. albopictus* is helping explain and better predict the patterns of occurrence and spread of these two mosquito species in the rice-producing areas and elsewhere in the state of Texas.

- The public information survey will provide data that can be used to assess the effectiveness of public information programs regarding what people can do to protect themselves against infection by such mosquito-borne diseases as WNv and to modify the programs to be more effective when such is indicated.

- WNv surveys performed by TAES served to assist in the statewide effort to prevent and control outbreaks of this virus in Texas during 2005.

WORK PLANNED FOR NEXT YEAR:

Monitoring of the insecticide resistance/susceptibility in target mosquito populations in the Texas rice belt will be continued. The research on the effects of temperature and humidity on the eggs and general development of *Ae. aegypti* and *Ae. albopictus* populations in Texas will be completed. The public information survey regarding actions taken by individual citizens to protect themselves against mosquitoes and mosquito-borne diseases will be completed. Participation in the WNv survey and monitoring program in Texas will be continued. Otherwise, candidate pesticides will be assessed as to their efficacy for use in the riceland mosquito control program as these chemicals become available.

TEXAS' ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECT
S-300 Mosquito and Agricultural Pest Management in Riceland Ecosystems

January 1 to December 31, 2005

COOPERATING AGENCY AND PRINCIPAL LEADER:
P.I.: M. O. Way
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Collaborator: T.E. Reagan
Louisiana State University (LSU)
402 Life Sciences Bldg.
Baton Rouge, LA 70803
225.578.1823 (phone)
treagan@agctr.lsu.edu (e-mail)

PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:

Objective 1: To determine the best chemicals to use in riceland systems in terms of their providing maximum control of rice pests (esp. the rice water weevil) and riceland mosquitoes while causing the least amount of harm to non-target organisms.

1) **Rice water weevil (RWW), *Lissorhoptrus orzyophilus***

Rice seed treatments were evaluated for RWW control. A14006, Cruiser 5FS and STP15299 performed well under heavy RWW pressure. Cruiser 5FS provided the best control (95%) of the seed treatments tested and gave a 1133 lb/acre yield advantage over the untreated. We also evaluated another seed treatment under a confidentiality agreement. This seed treatment gave excellent control of RWW.

Foliar treatments were evaluated for RWW control. Aza-Direct and Neemazal (both contain the active ingredient azadirachtin) were applied immediately before flood. Aza-Direct at 26 oz/acre and Neemazal at 20 lb/acre gave 35 and 32% control, respectively. Both levels of control were significant compared to the untreated. In a drill-planted, delayed flood system, etofenprox (MTI-500) at 200 g (AI)/ha applied 2 days after flood gave excellent control (90%) of RWW and produced a 602 lb/acre yield advantage over the untreated. Also, in a separate experiment, MTI-500 at 200 g (AI)/ha applied immediately before flood gave excellent control (97%) of RWW and produced a 1081 lb/acre yield advantage over the untreated.

2) **Stem borers**

Gamma-cyhalothrin and acephate were evaluated for stem borer control at Ganado, TX. Mexican rice borer (MRB), *Eoreuma loftini*, was the predominant stem borer. Best control (94% reduction in whiteheads) was two applications of gamma-cyhalothrin at 0.015 lb (AI)/acre at 1-2 inch panicle and late boot. The associated yield advantage was 1819 lb/acre over the untreated. Acephate applied at 0.5 lb (AI)/acre at panicle differentiation or 1-2 inch panicle reduced whitehead numbers about 38%.

Objective 2: To determine the best nonchemical tactics to use in riceland systems to manage problems with rice pests, weeds, and mosquitoes.

1) **Stem borers:**

Three hybrid rice varieties (CLXP730, XP721 and XP723) and two conventional varieties (Priscilla and Presidio) were evaluated for resistance to stem borers, sugarcane borer (SCB), *Diatraea saccharalis* and MRB. Paired plots of a given variety at Ganado, TX were left untreated or treated multiple times with lambda-cyhalothrin. Data showed that whiteheads, a sign of stem borer damage, were much more abundant in Priscilla and Presidio than the hybrids. Average number of whiteheads in Priscilla untreated plots was 102 while in hybrid plots whiteheads averaged 10. Presidio averaged 21. These data confirm previous years' data which show hybrids consistently produce fewer whiteheads than conventional varieties. The average main crop yield of the hybrids in treated plots was 10395 lb/acre. The average main crop yields of Presidio and Priscilla treated plots was 7400 and 7386 lb/acre, respectively. The hybrids have a considerable yield advantage over conventional varieties; thus, hybrid rice acreage is rapidly expanding.

A date of planting study at Eagle Lake, TX involving Cocodrie (most commonly grown rice variety in TX) and XL8 (hybrid) revealed the latest planting date (May 19) produced the highest number of whiteheads (an average of 34 per plot) compared to the earliest (Mar 24 – 16 per plot) and middle (Apr 15 – 5 per plot) planting dates. These values were significantly different from one another. Stem borer protected plots averaged 579 lb/acre more than unprotected plots–this difference was significant. These data confirm observations that late planted rice is most susceptible to stem borer attack. The primary stem borer in this study was MRB.

In 2005, pheromone trapping of the MRB in the Texas Rice Belt (TRB) proved the occurrence of adults in Jefferson County where Beaumont is located. Thus, another county in the TRB has been added to the list of counties with confirmed MRB. In addition, this new find shows that all counties in the TRB have MRB except Orange County which is the farthest east county in the TRB. Orange County borders LA, so MRB is gradually moving east (about 15 miles per year) towards LA. We expect MRB to invade LA in the near future. In fact, incipient, low populations may already exist in LA where sugarcane farmers are concerned since MRB is a serious pest of sugarcane in the Lower Rio Grande Valley of TX.

2) **Rice stink bug (RSB), *Oebalus pugnax***

After 2 years of field studies, a new sampling method for RSB was developed. The current method is based on a sample unit of 10 sweeps of a standard sweep net. The new method is based on a "sweep stick" (made of PVC pipe) which is passed through the rice panicles (heading, milk or dough) in a 180° arc. The end (last 15 inches−which is the diameter of a standard sweep net) of the "sweep stick" is painted orange. As the operator disturbs the panicles during sampling, he/she counts the RSBs observed on the impacted panicles or moving off the panicles. Only those RSBs impacted by the orange portion of the "sweep stick" are considered. Our research shows that two sweeps of the "sweep stick" correlate well with 10 sweeps of the sweep net. This new method works equally well for different varieties, different daily sampling times and different operators. The major advantages of the "sweep stick" over the sweep net are labor savings since swinging the sweep net in maturing rice is much more laborious than passing the "sweep stick" through rice panicles.

3) **South American rice miner (SARM), *Hydrellia wirthi***

A survey was conducted for SARM. We found the SARM and evidence of damage throughout the TRB but no fields were judged to exhibit economic losses. In general, we found damage associated with sparse stands of postflood rice.

Objective 3: To develop a database on the bionomics of rice pests, riceland mosquitoes and beneficial aquatic fauna coming to associate with harvested rice fields flooded during the winter.

No work done by TAES on this objective.

Objective 4: To update and refine existing databases on the local distribution, genetic relationships and disease vector potential of mosquito species occurring in rice-producing areas of the U.S.

No work done by TAES on this objective.

USEFULNESS OF FINDINGS:

Adoption of the "sweep stick" for sampling RSB will encourage farmers and consultants to sample for this pest. Many of our farmers apply methyl parathion to control RSB. Methyl parathion has very little residual activity, so damaging populations of RSB can move into rice fields soon after application. Adoption of the "sweep stick" will result in more farmers sampling more frequently for RSB which will improve management and decrease RSB damage.

Our results show that hybrid rice varieties are much less susceptible to stem borers than conventional varieties. Hybrids are producing significantly higher yields than conventional varieties. Farmers are eagerly adopting this new technology which possesses a significant degree of stem borer resistance. Our results show late plantings can suffer from severe stem borer damage. We encourage farmers to plant early to minimize this problem. Thus, we have developed a stem borer management package which includes host plant resistance, cultural control and insecticidal control.

Our etofenprox results helped LA rice farmers apply for a Section 18 emergency exemption because many LA rice fields are in close proximity to crayfish ponds. Currently registered pyrethroids are very toxic to crayfish while etofenprox as a granular formulation is much less of a hazard. TX also may apply for a Section 18 emergency exemption for etofenprox for use close to crayfish and bass ponds. TX has very little crayfish acreage relative to LA.

Registration of an effective seed treatment for RWW and other secondary pests would help rice farmers immensely. Fipronil was registered as a seed treatment but is being phased out due to possible adverse effects on crayfish in LA. Our data show several seed treatments are very effective against RWW. These seed treatments are becoming more important because farmers are adopting lower seeding rates (especially for hybrids which are planted at about 35 lb/acre−normal seeding rate for conventional varieties in TX is about 80 lb/acre). Consequently, establishment of a good rice stand and subsequent good management is crucial to the production of a profitable crop.

WORK PLANNED:

We will cooperate with Dr. Jim Olson to evaluate preflood applications of etofenprox, lambda-cyhalothrin, zeta-cypermethrin and gamma-cyhalothrin on mosquito populations. The stem borer planting date experiment will be repeated, in addition to counting whiteheads and taking yield, we will count and weigh filled and unfilled grains from a given number of randomly selected panicles. Studies will be conducted to determine economic injury levels/thresholds for stem borers using small plots in commercial fields. Economic injury levels for RSB will be revised using small cage studies conducted in the field and greenhouse. Evaluations will be continued on seed treatments for control of RWW and secondary pests. Acephate for RSB and stem borer control will be evaluated. The spread of MRB will continue to be monitored. Ongoing evaluations will be conducted with novel insecticides for RWW, RSB and/or stem borer control. Released cultivars for resistance to stem borers will be repeated and a review of rice mill records will be conducted to determine the relationship between insecticide applications (kinds and number) and pecky rice.

Minutes of the S-300 Cooperative Multi-State Project
Marriott Hotel, The Woodlands, TX
26 February, 2006

Meeting Participants:

In attendance were Max Meisch and John Bernhardt (AR), Sharon Lawler and Larry Godfrey (CA), Boris Castro and Mike Stout (LA), Jim Robbins (MS), Jimmy K. Olson, M.O. Way, Luis Espino, and Francis Reay-Jones (TX), and Roger Crickenberger (Experiment Station Administrative Advisor).

The meeting was called to order at 9:00 a.m. by Chair M.O. Way. The participants introduced themselves. As our new administrative advisor, Dr. Crickenberger introduced himself and gave the group a brief background summary. Chairman Way apologized profusely to Dr. Crickenberger for some lapses of protocol. As he explained on bended knees, previous chairman Michael Boyd unexpected left his position at the University of Missouri without preparing a report for activities in 2004. A report for activities in 2004 will be prepared by John Bernhardt and a report for activities in 2005 will be prepared by M.O. Way.

Selection of Officers: The second item of business was the selection of chairman for the next meeting. John Bernhardt will assume the chair.

2007 Meeting Site: The group discussed a site for the 2007 meeting. The site chosen was the Holiday Inn Express in Arlington, TX. A tentative date of Sunday February 11, 2007 was also chosen.

Roger Crickenberger had a few comments about proposed funding changes. In the new federal budget the USDA portion has again become a target for changes. A large portion of formula funds may be moved to competitive funds. Experiment station directors are opposed to reallocation of funds in this manner. Following our advisor’s comments, participants presented state reports.

Arkansas, Max Meisch:

(a) no mortality of *Culex quinquefasciatus* mosquitoes was noted after adults fed on Japanese quail that had been fed seed treated with spinosad; (b) undiluted sumethrin in a cold aerosol generator was significantly more effective in controlling adult *Anopheles quadrimaculatus* than were oil-dilute formulations thereby reducing costs and mixing errors for mosquito abatement programs; (c) by increasing droplet size without increasing the application rate, a natural pyrethrin (PyGanic) gave very good initial knockdown at 1 hour post-treatment, but at 24 hours recovery reduced the overall effect below acceptable levels.

Arkansas, John Bernhardt:

(a) a procedural problem may have been the cause of poor performance of etofenprox against rice water weevils (RWW) in a small plot test; (b) application of etofenprox 7 days after flood gave better control than did an application at 3 days after flood and the former would allow monitoring of RWW adults to assess population levels; (c) in a seed treatment test, fipronil gave better control of RWW than did A14006 and thiamethoxam (Cruiser); (d) clothianidin (Poncho) gave excellent control of grape colaspis; (e) acephate (Orthene) and methyl parathion had excellent initial knockdown of rice stink bugs (RSB), but methyl parathion had very little residual activity whereas acephate had activity up to 7 days after treatment; (f) a 7 day after flood application of lambda-cyhalothrin (Karate Z) effectively controlled RWW and reduced non-target beneficial predators for 3 to 4 days before some recovery was noted.

California, Sharon Lawler:

(a) a three-year project on how rice straw and winter flooding showed that mosquito populations increased in response to one-site decomposition of rice straw, even though beneficial predators also became more abundant; (b) from the same study, draining fields for herbicide applications may lead to unusually dense mosquito populations upon re-flooding; (c) completed an on-line extension publication ‘Managing mosquitoes on the farm’ that addresses how to manage mosquitoes in many agricultural settings; (d) lambda-cyhalothrin (Warrior) was found to impact mosquitoes and beneficial predators; (e) a second year of research was completed on how ultra-low volume pesticide fogs for mosquito control affect the invertebrates of seasonal wetlands.

California, Larry Godfrey:

(a) etofenprox and indoxacarb only at the higher rate when applied at the 3-leaf stage provided very effective control of RWW, but both were ineffective when applied preflood; (b) dinotefuron was less effective than the previously mentioned insecticides; (c) an experimental V10170 provided nearly 100% control of RWW at the rates and application timings tested; (d) a granular formulation of azadirachtin (Neemazal) gave ineffective RWW control; (e) a liquid formulation of azadirachtin (Aza-Direct) gave moderate control; (f) greenhouse tests confirmed results of field tests with Neemazal and Aza-Direct; (g) the mode of action of azadirachtin on RWW is sterilization of females by feeding on treated foliage; (h) pyrethroids Warrior, Proaxis and Mustang applied 4 days before flood provided good control of RWW; (i) preflood applications of Warrior had minimal effects on aquatic invertebrates, while postflood applications of five insecticides had detrimental effects on aquatic insects for 2 to 3 weeks after application then the populations recovered; (j) a mid-July application of Warrior as a representative insecticide that would be applied against armyworms was quite damaging to aquatic insect populations; (k) when compared to other years RWW flights in 2005 were found to be delayed because of the cool wet spring; (l) there were significantly more RWW larvae in M-206 and M-205 than in Calhikiri-201; (m) the impact of tillage practices and rice production methods on RWW were compared and larval populations were significantly higher in the delayed spring till water-seeded treatment than in the stale seedbed no-till drill-seeded treatment; (n) armyworms had higher populations in plots with no weed control when compared to plots with few weeds, grasses or broadleaf weeds alone; (o) pheromone traps monitored population changes in armyworms but did not appear to forewarn of armyworm infestations.

Louisiana, Boris Castro:

(a) a survey of 15 parishes did not yield any specimens of the panicle rice mite, *Steneotarsonemus spinki*; (b) a survey of 15 parishes yielded several specimens of dephacids which were sent to the Plant Pest Quarantine to identify for *Tagosodes orizicolus*; (c) a survey of 15 parishes yielded 45 vials containing fly specimens which were sent to the USDA, ARS, Systematic Entomology Laboratory to identify for South American rice miner, *Hydrellia wirthi*; (d) *H. wirthi* was collected in 8 parishes and caused localized economic losses in 5 parishes in SW Louisiana; (e) no preference for a rice variety was noted; (f) 2 parishes in NE Louisiana did not have economic damage; (g) in a demonstration trial with three locations, lambda-cyhalothrin (Karate Z) impregnated on urea fertilizer had larval densities of RWW comparable to densities in rice treated with a foliar application of Karate Z.

Louisiana, Mike Stout:

Louisiana submitted a section to the EPA for use of granular formulations of carbofuran and etofenprox for control of RWW. With the loss of fipronil seed treatment for RWW and the reliance on foliar pyrethroids for RWW control, rice growers have experienced more drift problems from rice into ponds for crawfish production. Granular formulations have a tendency to drift less. Other research: (a) several seed treatments gave good to excellent control of RWW in drill-seeded rice tests; (b) a numbered compound as a seed treatment also controlled RWW in a water-seeded test; (c) split applications of dinotefuran provided excellent control of RWW; (d) a single application of dinotefuran at 21 days post-flood controlled larvae indicating activity on larvae; (e) lambda-cyhalothrin and zeta-cypermethrin impregnated on fertilizer applied preflood and 1, 2 and 6 days postflood gave only adequate control of RWW in an early season test; (f) a late season of the same insecticides and rates failed to control weevils; (g) a procedural problem may have been the cause of poor performance of etofenprox in a small plot test; (h) 3 large plot sites gave control of 31 to 43% of RWW with etofenprox; (i) the relationship between densities of adult RWW and densities of larvae was evaluated in the greenhouse; (j) control of *Culex quinquefasciatus* larvae assessed by using floating cages with larvae was better with lambda-cyhalothrin than with WS-BTI or BTI (Aquabac); (k) adult *C. quinquefasciatus* placed on leaves from lambda-cyhalothrin treated plots had higher mortality than adults on leaves from untreated plants; (l) laboratory evaluations of WS-BTI gave efficacy similar to that of commercial BT products; (m) planting rice before April in SW Louisiana escaped heavy infestations by RWW; (n) several lines from a group of breeding lines when assessed for RWW resistance were found to have greater tolerance than others in laboratory and field tests.

Mississippi, Jim Robbins:

(a) several tests were impacted by the heavy wind and rain of the two hurricanes; (b) pyrethroids and methyl parathion were tested for control of RSB and gamma-cyhalothrin (Prolex) at one gallon to 85 acres gave control comparable to lambda-cyhalothrin (Karate Z) at one gallon to 66 acres; (c) test fields with a new seed treatment with a fungicide and an insecticide had higher yields than fields with foliar treatments for RWW and RSB and the highest yield was where both a seed treatment and foliar applications were used. A grant pre-proposal for monitoring mosquito species, population levels, presence of West Nile virus, and biocontrol options in the Stoneville, MS area was being developed by researchers. Any advice and participation in identifying species of mosquitoes was solicited. The grant may be expanded to other states in the future.

Texas, J. Olson:

(a) in 2005, increased levels of tolerance to insecticides were detected in adult *Culex quinquefasciatus* populations; (b) insecticide resistance management strategies were recommended in two locations of Jefferson Co. for high tolerance to malathion, in several locations in Harris Co. for high tolerance to resmethrin and sumithrin, and for a continuation in Orange Co. where no tolerances were detected; (c) only two species of *the Anopheles quadrimaculatus* complex, *A. quadrimaculatus* and *A. smaragdinus*, were confirmed to be in TX; (d) *A. smaragdinus* was confined to woody wetland areas of east and southeast TX and *A. quadrimaculatus* was the most widely distributed; (e) *Aedes albopictus* dominates and out-competes *Aedes aegypti* in moist areas (east TX), but *Ae. aegypti* competes better in dry areas (west TX); (f) a survey was conducted in neighborhoods of Bryan and Houston to assess what citizens are doing to protect themselves from mosquitoes and West Nile virus and to assess the effectiveness of public information programs designed to inform people how to protect themselves; (g) mosquito control recommendations were made on the basis of a continuing survey in Brazos Co. where 14 samples of *Culex quinquefasciatus* adults, many bird blood samples, one horse and three humans were found positive for West Nile virus.

Texas, M. Way:

(a) a regional section 18 for acephate in rice for RSB control was submitted to the EPA; (b) in a seed treatment test for RWW, Cruiser gave the best control (95%) compared to A14006 and Icon and Cruiser had a 1133 lb/acre yield increase over the untreated; (c) Aza-Direct and Neemazal applied before flood gave 35 and 32% control, respectively, of RWW; (d) etofenprox applied 2 days after flood gave excellent control of RWW and a yield increase of 602 lb/acre over the untreated; (e) etofenprox applied immediately before flood gave excellent control (97%) of RWW and 1081 lb/acre yield increase over the untreated; (f) two applications gamma-cyhalothrin gave 94% control of whiteheads caused mainly by the Mexican rice borer and gave a 1819 lb/acre yield increase over the untreated; (g) one application of acephate at PD reduced whiteheads by 38%; (h) RiceTec hybrids had 5 to10 times fewer whiteheads caused by the sugarcane borer and the Mexican rice borer than two conventional check lines; (i) in a planting date study, the latest planted rice had more damaged from rice borers than did the earliest or middle dates; (j) Mexican rice borers were found in pheromone traps in Jefferson Co. near the eastern edge of the TX rice area and near the western border of LA; (k) a new method of RSB sampling using a sweep stick was developed and tested; (l) a survey in all rice areas in TX produced evidence of the South American rice miner, but no fields were judged to have economic losses.

Following state reports, the group had a lively discussion on the future direction of the S-300 project. The group was somewhat split on the direction for the new project. Most of the discussion was centered on a general procedure for evaluation of the impact of chemicals used for rice water weevil control, stem borers and rice stink bugs on non-target organisms, especially beneficial predators of mosquitoes. A brief comment introduced the idea of retaining all four objectives from the existing project. Most participants agreed.

Finally, the participants thanked S. Lawler for coordinating the project proposal development committee. The meeting was adjourned near 5:30 pm on February 26, 2006.

Respectfully submitted by S-300 2006 Secretary, John Bernhardt.

Members (+) of S-300:
Mosquito and Agricultural Pest Management in Riceland Ecosystems
(Attendance at February 26, 2006 meeting in The Woodlands, TX is indicated by*)

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