USDA-APHIS-PPQ-CPHST

CPHST News

Volume V, Issue 2 Spring 2008

CPHST Support of the CAPS Program

The Center for Plant Health Science and Technology (CPHST) develops numerous tools in support of the Cooperative Agricultural Pest Survey (CAPS). The CAPS program is a collaboration between the U.S. Department of Agriculture (USDA)-Animal and Plant Health Inspection Services (APHIS)-Plant Protection and Quarantine (PPQ), state departments of agriculture, tribal governments, and cooperators who work together to develop and conduct surveys to provide early detection of exotic plant pests deemed to be of regulatory significance in the United States . CPHST supports CAPS through the NAPPFAST system, the Global Pest and Disease Database, methods development work at the CPHST Otis Lab, Exotic Pest Information Collection and Analysis notifications, and the North American Plant Protection Organization Phytosanitary Alert System.

Commodity-based Survey

Recently, CAPS surveys shifted from single pest–based surveys to national commodity-based surveys, where surveyors search for a complex of pests on a given commodity at the same time. CPHST is involved in developing two different types of documents to support these surveys: the commodity-based survey references and commodity-based survey guidelines. The survey references include images of the pests and information on pest biology, hosts, and distribution. The survey guidelines include detailed survey and diagnostic information, as well as a step-by-step survey protocol. The CPHST NAPPFAST group currently is developing pest risk maps, based on climate and pest biology, to be included in each survey manual. Recent deliverables from this project include the pine reference and guidelines, the small grains reference and guidelines, and the grape reference. The grape survey guidelines are expected to be available this summer and the corn survey reference is slated to be available in early fall.

Pest Prioritization

CPHST and the CAPS program, in collaboration with various subject matter experts, prioritize plant pests for national early detection surveys based on risk. The CAPS program considers high-risk pests, prioritized by the analytic hierarchy process (AHP) decision analysis model, for addition to the CAPS commodity-based Pests of National Concern list and

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CAPS SUPPORT (CONTINUED FROM PAGE 1)

the Additional Pests of Regulatory Concern list. To target pests that could be new threats to the United States, a set of constraints recently was developed and applied to the set of pests in the current AHP Prioritized Pest List. Currently, CPHST is revising of the AHP model to focus more closely on the potential impact of invasive pests becoming established in the United States.

CAPS Survey and Diagnostic Methods Matrix

In 2007, CPHST developed the first version of the CAPS Survey and Diagnostic Methods Matrix, a spreadsheet that provides quick and easy access to information for the top 50 pests on the AHP Prioritized Pest List. The matrix includes information on survey methods (e.g., pheromones for the detection of an insect pest, soil sampling for nematodes, etc.) and diagnostics (e.g., molecular diagnostic tools, culturing methods, etc.). Currently, CPHST is updating information on pests from the FY08 matrix and adding new pests from the FY09 AHP Prioritized Pest List. This matrix is used by the CAPS national survey coordinator and program managers to identify gaps in survey and diagnostic tools and by CAPS surveyors when planning and conducting surveys.

Smooth-walled oogonium of *Phytophthora alni* (Swedish variant) with oospore and amphigynous antheridium. Thomas Jung, Bugwood.org

Submitted by Lisa Jackson, Kim Schwartzburg, & Melinda Sullivan

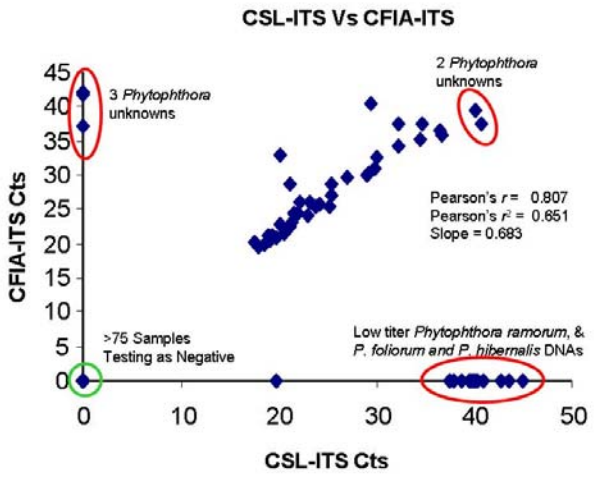
A NEW REAL-TIME PCR SYSTEM FOR SOD MOLECULAR DIAGNOSTICS

The USDA-Animal and Plant Health Inspection Service (APHIS) uses one of the most sophisticated diagnostic systems ever deployed on a national level to regulate *Phytophthora ramorum*. To ensure positive determinations are accurate and negative determinations provide confidence that hosts are disease-free, a complex combination of morphological, biochemical, and molecular methods are used. Of these, the methods that use the polymerase chain reaction (PCR) provide the most sensitive indication that the pathogen is present and the best assurance that negative determinations are free of disease.

The PCR diagnostics used in the current *P. ramorum* program are a combination of two conventional PCR assays that target the internal transcribed sequence (ITS) regions of the pathogen genome and one real-time PCR assay that also targets the ITS region. Both diagnostic methods have internal quality control reactions to assure extracted DNA is of sufficient quantity and quality for analysis.

Stakeholders of the USDA *P. ramorum* regulatory program recommended improving the reliability and throughput of the current diagnostics. The improvements included moving to real-time PCR formats; requiring confirmation using, at least, two separate genomic targets in the causal agent; and using target and control reactions, which have enhanced specificity to reduce the risk of false positive reactions from related species.

In response to these recommendations, the CPHST Beltsville Lab in Beltsville, Maryland, evaluated five real-time PCR assays that have become available using various gene targets: Elicitin with a 5.8S *Phytophthora* internal control multiplex assay (developed by the Canadian Food Inspection Agency [CFIA]); COX with a plant DNA internal control multiplex assay (developed by the USDA Agricultural Research Service); ß-Tubulin and ITS multiplex assays both without an internal control (developed by CFIA); and the *Ypt1* assay without an internal control (developed by the Scottish Crop Research Institute, Dundee, Scotland). A comparative analysis was performed on the sensitivity, specificity, and



Graph by Zeller, Levy, and Shiel, Nov. 16, 2007

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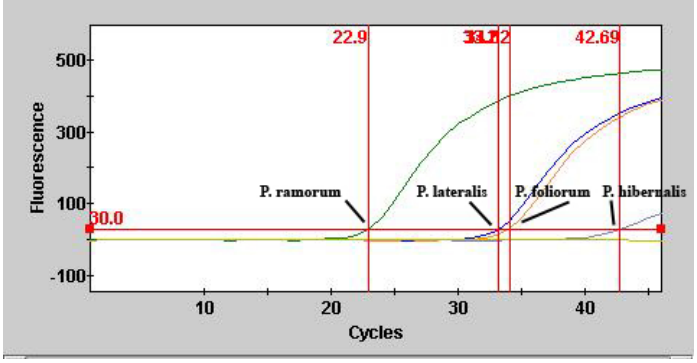
REAL-TIME PCR (CONTINUED FROM PAGE 2)

reliability of these assays and the current assays used in the USDA *P. ramorum* program.

The analysis results indicated that using the current ITS real-time PCR assay combined with the CFIA Elicitin/5.8S internal control real-time assay produces the needed sensitivity and selectivity to improve the current program. Simultaneous use of these two real-time PCR methods combines the sensitivity of the current ITS based real-time PCR (which is greater than other current real-time PCR assays tested) and the demonstrated specificity of the Elicitin/5.8S real-time PCR assay. In addition, the separateness of the genomic targets used by both assays, and the two reciprocal control reactions provided by these two real-time PCR assays specifically address stakeholder recommendations and program needs.



If requested, the current conventional and real-time PCR assays is still available since the nested conventional PCR assay continues to be the most sensitive evaluated PCR assay to date. This option will also remain available for laboratories that do not possess real-time PCR capabilities, however, wish to continue as a laboratory approved for *P. ramorum* molecular diagnostics.

The work instructions and other documents needed to successfully perform the new diagnostics are being prepared and this new diagnostic tool is scheduled for transfer to the *P. ramorum* regulatory program this spring. In addition, these documents will be made available to state, university, and National Plant Diagnostic Network laboratories so they can obtain reagents and test control reactions for incorporation into their diagnostic programs. The protocol for this new PCR procedure will be posted to the APHIS *P. ramorum* website: http://www.aphis.usda.gov/plant_health/plant_pest_info/pram

Submitted by Laurene Levy & Pat Shiel

COMMODITY-BASED IDENTIFICATION RESOURCE DEVELOPMENT WORKSHOP

The Cooperative Agricultural Pest Survey (CAPS) program is a combined effort by Federal and State agricultural organizations to survey, detect, and monitor agricultural plant pests and select agents. During the past few years, CAPS shifted from single pest-based surveys to a commodity-oriented strategy. CPHST is involved in this effort—CPHST Fort Collins recently delivered commodity-based survey references and commodity-based survey guidelines for citrus, soybean, grape, and small grains to CAPS.

The National CAPS committee is interested in evaluating Lucid identification tools as a third component of its commodity-based strategy, along with its references and guidelines. The CAPS program asked CPHST to develop a prototype for such a tool. To that end, CPHST Fort Collins has initiated development of a Lucid resource for pests and diseases of cultivated palms. Florida A&M University (FAMU) proposed the need for a palm-based resource, particularly in Florida and California.

As the concept of a palm commodity resource took shape, it became apparent that several different areas of expertise would need to be covered. CPHST scientist **Terrence Walters** assembled a group of entomologist and plant pathologist experts on palm pests, diseases, and disorders to be tool authors. Further, Walters and **Julia Scher** realized that this palm resource, planned as a prototype for CAPS, can also serve as a model for collaborative resource development for CPHST.

A workshop was planned, envisioned to be one of several to be held at different stages of development. This first

Terrence Walters introduces a topic for discussion to the Palm Resource Development Workshop participants.

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WELCOME CPHST LEADERSHIP

With the challenges and transitions the Agency encounters, it is fundamental to bring aboard talented individuals to provide enriched perspectives and harmonized visions to lead PPQ's Center for Plant Health Science and Technology (CPHST). In May 2008, PPQ deputy administrator Rebecca Bech announced the selection of **Dr. Philip Berger** as the new and permanent CPHST director. In March 2008, **Mr. Willard A. (Bill) Dickerson** was selected to serve as the new associate director for CPHST. Both these individuals bring a wealth of knowledge and expertise to the CPHST leadership team and demonstrate a long-term dedication to protecting American agriculture.

Phil Berger's federal career began in 2003 when he was selected as PPQ's national science program leader for the Molecular Diagnostics and Biotechnology Program at the Center. More recently, he served as the acting associate director for the Center and the acting CPHST director before his nomination.

Phil graduated from the University of Minnesota with a bachelor's in psychology and physiology in 1977 and a master's degree in plant pathology in 1980. He earned his Ph.D. in plant pathology in 1983 from Texas A&M University. After postdoctoral research at the University of Kentucky, Phil joined the faculty of the University of Idaho in 1988. He served as a professor of plant pathology and as the associate director of the Idaho Agricultural Experiment Station. Phil has authored over 70 refereed research papers, books, and book chapters. He is an active member of American Association for the Advancement of Science, American Phytopathological Society, and numerous other professional organizations. In addition, Phil is a recipient of the Phi Kappa Phi Distinguished Faculty Award University of Idaho (1999) and Distinguished Alumnus Award, Department of Plant Pathology, University of Minnesota (2006) for his pioneering research in virus transmission, virus detection, viral evolution and the development of virus-resistant plants.

Bill Dickerson, CPHST Associate Director

Bill Dickerson began his government career in 1963 working with the USDA Agricultural Research Service as a research entomologist. He served as the plant pest administrator from 1987 to 1997 and as director of the Plant Industry Division, North Carolina Department of Agriculture from 1997 to 2006. He was the president of the National Plant Board from 2003- 2005. Bill also served in the officer chain of the Plant Board System for the previous 10 years, including two years as the president of the Southern Plant Board. During that same period, he was the president of both the Gypsy Moth Management Board and the North Carolina Entomological Society. From 2002 to 2006, Bill also served on the National Invasive Species Advisory Committee.

In March of 2006, Bill returned to work with USDA as the coordinator of invasive species for both Plant Protection and Quarantine and for the Animal Plant Health Inspection Service. From November 2007 to March 2008, Bill served as a domestic regional program manager for the PPQ Eastern Region. PPQ selected Bill as the the associate director of CPHST in March 2008.

Phil Berger, CPHST Director

He has authored or coauthored approximately 100 scientific publications, served as the senior editor for three books, and is the holder of one U.S. patent. Among numerous other recognitions, Bill is a past recipient of the United States Department of Agriculture's National Association of State Departments of Agriculture National Honor Award, presented to him by Secretary Ann Veneman, and of the Entomological Society of America's Distinguished Achievement Award in Regulatory Entomology.

In the summer issue of the CPHST News, Phil and Bill will share their insight on their vision and goals for CPHST and the challenges they anticipate as they strive to lead CPHST to its highest level of performance.

A BRIGHTER FUTURE FOR MEDFLY CONTROL

At the beginning of the 20th century, the frugivorous Mediterranean fruit fly, commonly know as Medfly and a pest that originates from Sub-Saharan Africa, invaded North America. Since then, the pest has conquered a number of fruit producing territories in this continent. World Food Prize Winners Drs. E. Knipling and R. Bushland proposed the sterile insect technique (SIT) as a control strategy for invasive pest populations, including Medfly. The SIT concept is based on the mass production, sterilization, and release of insects of the pest species. Control is achieved because the large numbers of sterile released males interfere with female reproduction, thereby reducing population growth over time.

Medfly strains currently in mass production are based on the rearrangement of pre-existing genes, in what is known as second generation classical genetic manipulations. This approach generated flies that can be separated by sex, based on pupae color (males are brown; females are white). Females also carry a temperature-sensitive lethal (TSL) gene, which is attached to the gene for white pupal color and that kills female eggs when they are subjected to high temperature

Figure 1: Sterile Medflies destined for release are coated with a fluorescent powder in the pupal stage. The powder is transferred to the adult stage as they eclose.

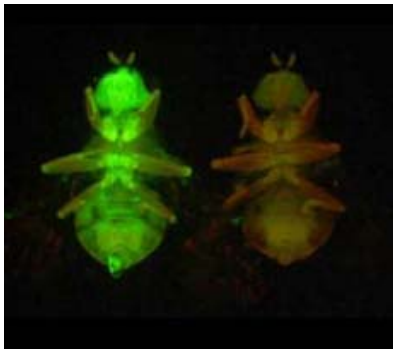


Figure 2: Normal Medfly adult (right) and an adult from a genetically modified strain with an inserted gene of a green fluorescent protein (left).

(118°F) for 12 hours inside water baths. This allows for the production of males only for field release. Single sex releases increase SIT efficiency by three-fold.

Once sterile flies are released in the field, they are likely to be collected in field monitoring traps used to determine pest population levels. A dilemma arises when laboratory-sterilized flies are caught in field monitoring traps along with "wild" counterparts. Currently, this problem is solved by marking sterile Medfly prior to irradiation/release with a fluorescent powder (Figure 1). Unfortunately, this technology is not fail-proof and generates uncertainties of whether the trapped flies are sterile or wild, which may result in needless control actions or quarantine restrictions to trade, and usually with expanded expensive survey programs.

New Medfly strains developed by private companies are now being tested to determine their mass rearing, quality control, and field performance profiles. These strains are based on transgenic technologies that produce females carrying a lethal gene under a control system that allows survival of both males and females in the presence of tetracycline. In absence of tetracycline, females die and the strain produces only males for sterilization and release. An additional transgene can also be inserted that allows either green or red fluorescent proteins (GFP or DsRed) to be expressed during the adult stage (Figure 2). Strains with an internal genetic marker are expected to be more efficient in their categorical response to the question of fly origin (wild vs. sterile released). In addition, genetically modified sexing strains based on insertions (e.g., sensitivity to tetracycline) rather than translocations (e.g., TSL) are expected to be more productive, thereby introducing additional savings to mass rearing operations (Figure 3). If this new technology complies with quality and performance requirements, as well as regulatory issues, then it is expected to be available in two to three years for Medfly action programs.

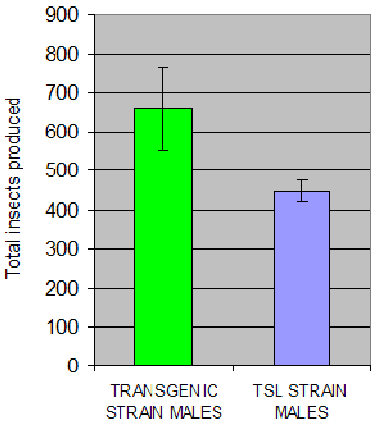


Figure 3: Relative number of adults produced starting with the same number of eggs in the larval diet using two different Medfly strains. Preliminary results suggest that transgenic strains are, in fact, more productive.

Submitted by Pedro Rendon

ART FOR WOOD'S SAKE

Stop to admire the practical beauty of a pallet or spend some quality time with dunnage, barrels, or crates, you might notice the artful evolution of markings on these ubiquitous soldiers of commerce. The establishment of international phytosanitary standards for wood packaging and the subsequent implementation of corresponding regulations by APHIS and its counterparts around the world have changed the face of wood packaging forever with a simple, but important, logo. The unassuming mark is a stylized nod to the well-known logo of the United Nations Food and Agriculture Organization (FAO), which is the host organization for the International Plant Protection Convention (IPPC) Secretariat. The IPPC Secretariat developed the logo to identify wood packaging that met internationally agreed phytosanitary treatment requirements. However, it wasn't as simple as scratching a design on the back of a napkin. In fact, the logo followed quite a tortured political and legal path to adoption; a path that includes links to CPHST and the Research Triangle Park in North Carolina.

Figure 1. Marked pallets, the FAO logo, and the IPPC mark for wood packaging

In the late 1990s, the IPPC undertook to develop an international standard to encourage the harmonization of phytosanitary regulations applied to wood packaging. A key aspect of this effort was finding a practical way to identify materials that conformed to agreed standards.

At about the same time, the IBM Corporation office in Research Triangle Park developed a "no-bug" logo to mark the packaging associated with their products moving internationally. IBM offered their mark to the IPPC, which incorporated the mark into the draft international standard. In the meantime, another U.S. company noticed that IBM had not copyrighted the mark so they legally adopted the same mark for their own purposes. FAO soon realized that the mark was usurped and that anyone using the mark in the future could be required to pay royalties to the legal owner. A legal challenge was briefly considered, but FAO ultimately opted to find a different mark. This time the mark was developed secretly in the IPPC Secretariat by **Christina Devorshak** and **Bob Griffin** (hence, the link to CPHST).

A number of interesting, practical, and even comical suggestions were made to the Secretariat as they labored to identify an appropriate logo (Figure 1). Ultimately, the choice was a simple bit of art produced internally by the Secretariat and copyrighted by FAO before it was shared.

Submitted by Bob Griffin

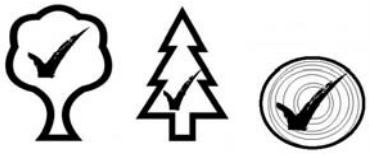
Original IBM no-bug logo

FAO Graphic Design Dept. proposals

Canada proposals

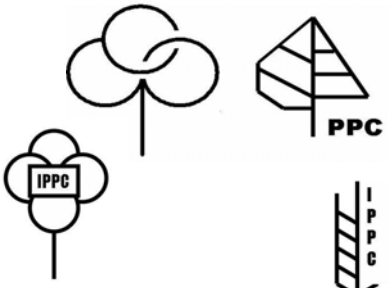
New Zealand proposal

Sweden proposal



APHIS/US Industry proposals

UK proposals



IPPC Secretariat proposals including the final choice

DEVELOPING & DEPLOYING LUCID ID TOOLS

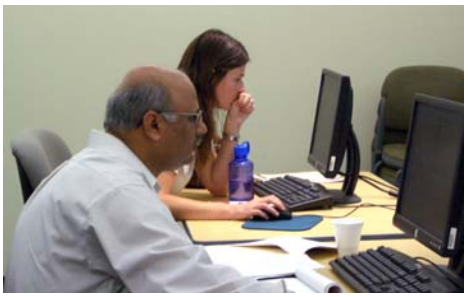
In April, CPHST's Identification Technology Program (ITP) held a workshop entitled "Developing and Deploying Lucid Identification Tools" for PPQ personnel and collaborators interested in learning how to build Lucid identification tools to support Plant Protection and Quarantine.

The ITP coordinated two workshop sessions: one at PPQ's Western Region office in Fort Collins, CO, and one at North Carolina State University in Raleigh, NC. CPHST was very fortunate to have **Kevin Thiele**, the original creator of Lucid and director of the Western Australian Herbarium, and **Matt Taylor**, Lucid programmer and director of the Centre for Biological Information Technology, University of Queensland, Australia, as workshop instructors. CPHST ITP staff Julia **Scher** and **Terrence Walters** provided instructional and logistical support.

The 29 workshop participants came from 14 institutions and agencies within the United States and Canada. Those represented were California Department of Food & Agriculture, Florida's Department of Plant Industries, Canadian Food Inspection Agency, Southern Plant Diagnostic Network, and USDA-APHIS.

During the two-day workshop, each participant developed a basic Lucid key to their favorite organisms using their own data. In addition to learning how to create and score a matrix-based key, they successfully enhanced their keys by attaching images and HTML pages. Several participants demonstrated the keys they had created. This generated valuable discussion and critique of their work.

Lucid Workshop instructors and participants from the Fort Collins April 2008 session.



Workshop participants Kristin Kaser and Muhammed Haseeb developing their Lucid keys.

In written workshop evaluations, one participant felt the workshop was "the best way to learn about Lucid." In comparison to other workshops, someone wrote, "this is one of the better trainings I have participated in – the material is highly relative to my work." Several participants commented about how much they appreciated the opportunity to be instructed by Lucid software developers. The participants agreed that the workshop instructors were extremely knowledgeable and presented the content in an organized, flexible way that allowed time for discussions and questions.

Submitted by Terrence Walters & Julia Scher

CPHST AWARDS

On April 24, the **CPHST Otis Lab** received the APHIS Facility Environmental Excellence Award for Fiscal Year 2007. The Otis Lab successfully passed a surprise, third-party environmental compliance audit conducted in April 2007.

Two distinguished PPQ teams were honored with the 2007 Deputy Administrator's Safeguarding Award. The awards are selected upon the contributions demonstrated for high performance and an exceptional level of fulfilling PPQ's mission to safeguard U.S. agriculture. Several CPHST scientists were members of these honored teams.

CPHST scientist **Amy Roda** participated in the Red Palm Mite Response Team that was led by **Paul Hornby**, PPQ State Plant Health Director for in Gainesville, FL. The multi-agency team addressed one of the suspect pathways for red palm mite on palm handicrafts carried by passengers on cruise ship lines.

CPHST scientists **Ken Bloem**, **Stephanie Bloem**, **Ron Weeks**, and **Craig Hinton** contributed to the *Cactoblastis cactorum* Cooperative Program led by **Joel Floyd** of PPQ. This program has been successful in halting the westward movement of *Cactoblastis* (cactus moth), a pest to native cactus species, populations along the U.S. Gulf Coast by using the sterile insect technique.

THE QUALITY CORNER

With the retirement of **John Gallagher**, former CPHST director of Quality Management, it seemed appropriate to re-evaluate the CPHST quality management system and to refocus our resources on the immediate goals and objectives which must be achieved to support the CPHST and PPQ missions.

CPHST Quality Management: *Where are we now?*

CPHST management affirmed their commitment to implementing a fully functional quality management system at all CPHST locations. Currently, three CPHST laboratories (PERAL, Gulfport, and Mission) are operating within the bounds of a quality management system. Two additional laboratories are actively working to develop and implement their quality management systems (Beltsville and TQAU).

Where are we going?

CPHST's quality management goals and objectives:

Improve our current function. This will be accomplished through automating quality management forms for easy accessibility and use at all CPHST locations and applying the collective auditor expertise found throughout CPHST to conduct internal audits.

Increase the scope of processes included in the quality management system. This will be accomplished through implementing a quality management system for CPHST headquarters and laboratories, expanding the scopes of all existing laboratory quality management systems, and designating a quality manager at each CPHST laboratory.

Increase the understanding of quality management within CPHST. This will be accomplished through disseminating of information to all CPHST personnel through a recurrent article in the CPHST newsletter, developing a minimum required training plan for quality managers in CPHST, and conducting an annual quality manager's conference held at a different CPHST laboratory each year. The conference will include training, document review and an internal audit at the host laboratory.

Increase the understanding of quality management within PPQ and APHIS. This will be accomplished through implementation of a CPHST customer satisfaction survey to be conducted at the completion of every project, assisting other APHIS and PPQ organizations as they move forward with their implementation of quality management systems and ISO registration processes, and participation in auditor exchange practices between CPHST and other PPQ and APHIS organizations.

In summary, when you think of what the CPHST Quality Management System (QMS) represents, remember the following: **CPHST QM**

Commitment by Management

Processes Documented

Honor Commitment- adhere to documented system

Systematic Review

Take Steps Necessary for Improvement

Quality Internal Audits Conducted

Meet Customer's Expectations

Success!!

Submitted by Kathy Burch

COMMODITY-BASED ID RESOURCE DEVELOPMENT (CONTINUED FROM PAGE 3)

workshop, entitled "Developing a Lucid Identification Resource to Ornamental Palm Pests and Diseases" was held in Tallahassee, FL, in January 2008. Florida's Southern Plant Diagnostic Network coordinator, the director of FAMU's Center for Biological Control, an entomologist from Florida's Division of Plant Industries, two participants representing PPQ, and CPHST's **Melinda Sullivan** representing CAPS participated in the workshop as taxonomic experts on commodity pests and diseases. The workshop began with presentations by Walters and Scher to demonstrate options for structuring Lucid tools and a "tour" of existing commodity-based tools. The remainder of the full-day workshop was a round-table discussion, led by Walters, on a prepared list of topics. The discussion led to consensus on important resource development issues. A copy of the workshop final report is available from Walters. A second workshop was conducted on June 3, 2008 to focus on coordination of development tasks among the identification resource's 10 authors.

CPHST hopes that by utilizing the palm resource as a prototype, the CAPS community will be able to determine the value and usefulness of such tools in meeting their survey and detection goals.

Submitted by Terrence Walters & Julia Scher

GET TO KNOW THE NEW CPHST TEAM MEMBERS!

CPHST SPOTLIGHT: ASHLEY JACKSON

Ashley Jackson joined CPHST PERAL in October 2007 as editorial assistant. She graduated from Salem College, a liberal arts college for women, in May 2007 with a B.S. in Biology and a B.A. in English, as well as a minor in Chemistry. She spent her senior year doing projects on avian vocal learning, the evolutionary response of antipredator behavior under relaxed selection, and social selection pressures in a trio of science fiction novels. While pursuing her degrees, Ashley tutored biology and writing, worked as an assistant to the laboratory coordinator in the campus's biology department, and spent several semesters as a laboratory teaching assistant for ecology and introductory biology courses. To fulfill her undergraduate internship requirement, she spent a month interning full-time in the School and Public Programs Division of the NC Museum of Natural Sciences, where she observed museum programs, attended educator workshops on birdwatching and mammal collections, and had a slightly traumatic experience involving a Madagascar hissing cockroach. Ashley was born in Lexington, Kentucky, but grew up among the Sandhills of North Carolina. She enjoys cooking, working on her garden, reading science fiction, and playing with Heathcliff, her terrier puppy. She plans to volunteer backstage at a local community theater over the summer.

CPHST SPOTLIGHT: LESLIE FOSS

Leslie Foss is the new biological science technician in the APHIS-PPQ facility in Albany, CA. She earned her B.S. in Ecology and Systematic Biology from Cal Poly, San Luis Obispo, where she studied monarch ovipositional behavior. Afterwards, she worked for the USDA Forest Service conducting botany surveys and volunteering in wildlife surveys. In 2002, she completed an M.S. in Entomology at the University of Kentucky (UK). There she studied gypsy moth caterpillar preference for various oak species and the interactions between galled oaks and gypsy moth herbivory on their leaves. Upon graduation, she worked as a research analyst for UK, testing environmentally safe insecticides and other control methods on the eastern tent caterpillar, an insect whose infrequent outbreaks are linked to Mare Reproductive Loss Syndrome (MRLS) in the Kentucky bluegrass region. She then found her niche working with a new moth: rearing a colony of the light brown apple moth (LBAM). She is optimizing methods for more efficient rearing practices and providing support for USDA and institutional research. As the LBAM program expands, she will be involved in method development efforts of sterile insect technique for LBAM control. Leslie enjoys hiking, traveling, and learning languages.

CPHST SPOTLIGHT: DAN MACKINNON

Dan MacKinnon joined CPHST in April 2008 as a biological science technician in Fort Collins, CO. With a B.S. in Liberal Arts / Biology from Wake Forest University, Dan decided to forgo many offers in the pharmaceutical industry to teach environmental education in New England, preferring overalls to suits. Studying deciduous forest ecology piqued his interest in succession, which then led to a passion for agroecology. Faced with another important life choice, Dan chose bugs and plants over nozzles and pesticides, earning a M.S. in Ecology from Colorado State University in 2006 with Dr. Ruth Hufbauer. His work focused on the preference and performance of a flower feeding beetle (*Brachypterolus pulicarius*) on two invasive plants, yellow and Dalmatian toadflax. Armed with many field experiences mapping, tracking, and sampling invasives, Dan decided to learn more about IPM; he accepted a position to spray growth regulators and herbicides in agricultural settings. Finally, with these broad agricultural skills, he accepted a job as a biological science technician for PPQ.

USDA-APHIS-PPQ-CPHST

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We're on the Web!

www.aphis.usda.gov/plant_health/cphst

Plant Protection & Quarantine Mission

APHIS-PPQ safeguards agriculture and natural resources from the risks associated with the entry, establishment, or spread of animal and plant pests and noxious weeds. Fulfillment of its safeguarding role ensures an abundant, high quality, and varied food supply, strengthens the marketability of U.S. agriculture in domestic and international commerce, and contributes to the preservation of the global environment.

The Center for Plant Health Science and Technology Mission

The Center for Plant Health Science and Technology supports PPQ regulatory decisions and operations through methods development work, scientific investigation, analyses and technology.

CPHST Publications

Virgilio, M., **T. Backeljau**, **N. Barr** and **M. De Meyer**. Molecular evaluation of nominal species in the *Ceratitis fasciventris, C. anonae, C. rosa* complex (Diptera: Tephritidae). *Molecular Phylogenetics and Evolution* (May 22, 2008). http://www.ncbi.nlm.nih.gov/pubmed/18502154?ordinalpos=12&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum.

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