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USDA'S SYSTEMATIC ENTOMOLOGY LABORATORY DIGITAL KEYS

The Systematic Entomology Laboratory (SEL), is part of the USDA's in-house Agricultural Research Service. It develops and transfers solutions to agricultural problems of high national priority and provides information access and dissemination. Located in Beltsville, Maryland (left picture) and Washington, DC (right picture), SEL is involved in a range of entomological projects, including the development of a number of Lucid keys (www.lucidcentral.org) for insect and mite pests.



A number of these projects have involved USDA's Identification Technology Program as well as other collaborators. Brief details of these keys are provided below.

Scale insect keys:

- Since scale insects are among the most commonly encountered insects at ports of entry, a key to Scale Families (<http://idtools.org/id/scales/key.php?families>) was built to help identify all known families of scale insects. Despite some disagreement about the status of a few of these families, this list is consistent with the hypotheses of most coccidologists.
- A key to Mealybug and Mealybug-like Families (<http://idtools.org/id/scales/key.php?key=mealybugs>) was built specifically to help identify species in three closely related scale insect families previously included in the Pseudococcidae, or mealybugs (Pseudococcidae, Putoidae, and Rhizoecidae).
- The Soft Scales key (<http://idtools.org/id/scales/key.php?key=soft>) was built to help identify pest species (Coccidae). Many soft scales are serious pests, particularly as invasive species. In the United States there are 42 introduced species of soft scales and 41 of them are pests.

- A fourth key deals with Other Scales (<http://idtools.org/id/scales/key.php?key=other>), pest scales in various families not treated elsewhere but which have been or thought likely to be intercepted at U.S. ports-of-entry.

A tool for identifying aphids:

- “AphID” (<http://aphid.aphidnet.org/index.php>) allows users to key the 66 most polyphagous and cosmopolitan aphid species intercepted at U.S. ports of entry. In addition to a Lucid key, AphID offers users detailed descriptions of morphological features critical to identifying aphids along with annotated photographs to help illustrate each feature. This site benefits workers in aphid taxonomy and systematics worldwide, biological control workers, extension agents, and federal and state regulatory agencies.

Mite identification:

- “Flat Mites of the World” (<http://idtools.org/id/mites/flatmites/>), the result of collaborative research with the University of Maryland and USDA-APHIS, provides detailed, interactive web based identification tools and a catalog for use internationally by identifiers, regulatory officials and other plant protection professionals. The citrus-tea-coffee flat mite complex of species is the most complicated and diverse group in the flat mite family as well as being the most commonly intercepted group of mites at U.S. ports-of-entry.

Since three of the most economically important species in the family are consistently confused and misidentified, the tool helps to identify 36 genera of flat mites present throughout the world, including specific diagnostics for 13 species in the red palm mite group, 14 species in the common red flat mite complex, and mite species associated with orchid plants. Since its launch in March 2012 there have been over 123,800 visits to the website with inquiries from 180 countries.

- **Key to Bee mites** (<http://idtools.org/id/mites/beemites/>)
The purpose of this interactive web based identification tool, developed in collaboration with the University of Michigan and USDA-APHIS, is to help identify 117 mite species that may be found on various types of temperate and tropical bees and in their nests. The Lucid key and a searchable image gallery of over 850 mite images helps users to distinguish harmless mites from those that might harm bee colonies. This identification tool is useful to bee keepers, scientists, extension agents, and quarantine officers worldwide: since its launch in November 2016, there have been 8115 visits to the site from 133 countries.

Fruit fly keys:

SEL has been involved in the development of a number of fruit fly identification tools, including:

- Keys to over 300 species of the genera *Anastrepha* and *Toxotrypana*, the most economically important fruit flies in the American tropics and subtropics, including descriptions, illustrations, and interactive keys – see DELTA (<http://delta-intkey.com/anatox/intro.htm>) and Lucid (http://idtools.org:8080/key_server/player.jsp?keyId=51) keys:
- Pest Fruit Flies of the World (<http://delta-intkey.com/ffl/www/wintro.htm>) is an identification tool for economically important fruit flies of the world; adult key (190 spp) and larval key (80 spp).
- The Fruit Flies (Tephritidae) of Ontario (http://cjai.biologicalsurvey.ca/jmhn_15/jmhn_15.html):

Leaf beetle tools:

Diabrotica ID (<http://idtools.org/id/beetles/diabrotica/>) is an identification tool for all 125

Diabrotica species known to occur in North and Central America. Diabrotica species feed on



flowers, leaves and roots

of a wide variety of

herbaceous plants,

including agricultural

crops, vegetables, fruits

and ornamentals, and are

vectors of viral and other

lethal plant diseases. A

single species, *D. virgifera*,

is estimated to cause one

billion dollars damage

annually. The tool provides species descriptions, detailed illustrations and keys to help identify pest and potentially invasive species from innocuous, native US species.

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8TH INTERNATIONAL AGRICULTURE CONGRESS AND 6TH INTERNATIONAL SYMPOSIUM FOR FOOD & AGRICULTURE (IAC-ISFA 2018)

We would like to invite you to the 8th International Agriculture Congress and 6th International Symposium for Food & Agriculture (IAC-ISFA 2018) to be held 13th-15th November 2018, Auditorium Rashdan Baba, TNCPI Building, Universiti Putra Malaysia UPM), Serdang, Selangor, Malaysia.

This joint symposium under the theme "Shaping the Future through Agriculture Innovation" will be co-organized by the Faculty of Agriculture, UPM and Faculty of Agriculture, Niigata University, Japan.

By 2050, a projected global population of 9.7 billion will demand 70% more food than is consumed today. Feeding this expanded population nutritiously and sustainably will require substantial improvements in the global food chain systems that are expected to upgrade the livelihood of farmers as well as providing safe and nutritious food for consumers. Having the theme "Shaping the Future through Agriculture Innovation", the International Agriculture Congress 2018 will explore the application of cutting-edge technologies such as internet of things (IoT), simulation technology, big data analytics (BDA), digital economy, genome editing and biome sciences in shaping the future of agriculture. These include building inclusive, sustainable, efficient and nutritious food chain systems through leadership-driven, market-based action and

collaboration, informed by insights and innovation for changes in food chain systems; mobilizing leadership and expertise at the global level.

The objectives of this symposium will be:

1. To create a forum for intellectual dialogue to discuss, deliberate and disseminate innovative ideas and findings to enhance agriculture productivity.
2. To expose delegates to advanced and proven technologies in agriculture.
3. To showcase discoveries, innovations, strategies and policies to enhance agricultural sustainability.

Please visit the conference website at <http://conference.upm.edu.my/IAC18> for online registration and more information.

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IAPPS Mission: to provide a global forum for the purpose of identifying, evaluating, integrating, and promoting plant protection concepts, technologies, and policies that are economically, environmentally, and socially acceptable.

It seeks to provide a global umbrella for the plant protection sciences to facilitate and promote the application of the Integrated Pest Management (IPM) approach to the world's crop and forest ecosystems.

Membership Information: IAPPS has four classes of membership (individual, affiliate, associate, and corporate) which are described in the IAPPS Web Site www.plantprotection.org.

The *IAPPS Newsletter* welcomes news, letters, and other items of interest from individuals and organizations. Address correspondence and information to:

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