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# ADDENDUM to ABSTRACT BOOK

The ADDENDUM contains materials arriving after the Abstract Book was sent to the printers

# Abstracts of oral and poster presentations

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Andreadis S.S.[1]*, Mazin M.[2], Jenkins N.E.[2], Cloonan K.R.[2], Baker T.C.[2], Rajotte E.G.[2]

**Daily activity and distribution of the mushroom phorid fly, *Megaselia halterata*, in areas surrounding commercial mushroom farms**

[1]Institute of Plant Breeding and Genetic Resources, Hellenic Agricultural Organization – Demeter, Thermi, Greece
[2]Department of Entomology, Penn State University, University Park, PA, USA

Corresponding author's e-mail address: *stefandr@ipgrb.gr*

The mushroom phorid fly, *Megaselia halterata* (Wood) (Diptera: Phoridae), is acknowledged asa key pest in mushroom farming in most parts of the world. So far studies on the mushroom phorid fly have focused on its life history within mushroom growing houses, but little is known about its activity outside mushroom farms. In this study daily activity and distribution of adult *M. halterata* in the areas surrounding mushroom growing houses was studied using yellow sticky traps. According to our results significantly more adults of *M. halterata* focuses its flight activity over grassy areas rather than windbreaks or spent compost piles, possibly for courtship and mating purposes. Furthermore, flight activity is highest in the afternoon until midnight at high temperatures yet at lower temperatures activity ceases after sunset. Establishing temperature and daylight thresholds for *M. halterata* flight activity may be useful in developing IPM tactics for this species. The most successful IPM tool that mushroom growers use at present is fly exclusion. In order to enhance fly exclusion measures farm operations should be limited to nighttime hours possibly after sunset and should be avoided after 4 pm until sunset. Further studies are needed to determine with far more precision the activity of *M. halterata* in relation to daylight and temperature.

Session/symposium: *Practical applications/independent presentation*
POSTER
number: 172

Durovic G.[1]*, Anfora G.[1,2], Alawamleh A.[3], De Cristofaro A.[3]

**Development of a liquid food trap with addition of bioactive microorganisms to improve attractiveness and specificity for *Drosophila suzukii***

[1]Research and Innovation Centre, Fondazione Edmund Mach, 38010 San Michele all'Adige, Italy;
[2]Centre Agriculture Food Environment (C3A), University of Trento, San Michele all'Adige

Corresponding author's e-mail address: *valerianaof@gmail.com*

The spotted-wing drosophila (SWD), *Drosophila suzukii* Matsumura (Diptera: Drosophilidae), native to Eastern Asia, is one of the main emerging pests of valuable horticultural crops, attacking soft fruits and wine grapes in Europe and the Americas. Differing from other Drosophilae, SWD is capable of penetrating the skin of ripening fruit and laying eggs inside, where larval instars feed, develop and cause damage. Current control strategies rely on the heavy use of insecticides, which inflict negative ecological impacts, and, in the long run, they are neither effective nor sustainable. The tools that chemical ecology provides fit perfectly into the Integrated Pest Management programs of *D. suzukii*, and could offer more sustainable approaches to limit its spread and damage.

Our focus and aim is to improve existing commercial liquid baits for SWD "Droskidrink" and to attempt to develop innovative traps both for monitoring and mass trapping. Laboratory and field studies confirm that Droskidrink shows a higher attractiveness than other commercial baits; moreover, with the addition of different microorganisms, its attractiveness improves. Our results show that traps with D.D and different strains of *Oenococcus oeni* bacterium among other different lactic acid bacteria catch a higher number of flies and show good results in laboratory behavioral experiments.

Our goal is to exploit volatiles of the lactic acid bacterium *O. oeni* in the production of organic volatile molecules attractive to SWD, and as a consequence, to assess the potential to improve the performance of liquid baits and traps by addition of its viable cultures, design an innovative trap system and eventually transfer technology towards the use of innovation in the development of strategic methods for decreasing the numbers of this notorious pest.

Session/symposium: *Practical applications/independent presentation*
POSTER
number: 168

Fu N.[1], Baur S.[1], Kunert M.[1], Becker T.[1], Schmidt L.[1], Yang Z.[2], Pauchet Y.[2], Rossner A.[3], Heinemann S.H.[3], Burse A.[1], Boland W.[1]

**Two chemical defensive lines in leaf beetles: P450s are involved in the biosynthetic pathways**

[1]Department of Bioorganic Chemistry, Max Planck Institute for Chemical Ecology, Jena, Germany
[2]Department of Entomology, Max Planck Institute for Chemical Ecology, Jena, Germany
[3]Institute of Biochemistry and Biophysics, Friedrich-Schiller-Universität Jena, Jena, Germany

Corresponding author's e-mail address: *nfu@ice.mpg.de*

Leaf beetles (chrysomelidae) have been reported to colonize on a series of host plants, ranging from herbs and shrubs to some Salicaceae trees. Their successful colonization is attributed, to certain extent, to their chemical defensive weapons, which favor them to conquer potential threatening factors like predators, parasites and microbiomes. Previous studies showed that there exist at least two independent chemical defensive lines. One is based on the remarkable dorsal glandular reservoirs in which volatile chrysomelidial is stored, while the other line depends on isoxazoline-5-one glucoside (ISO 1) and its 3-nitropropanoic acid (3-NPA) derivatives (ISO 2) that are stored in the hemolymph. Although their biosynthetic pathway have been proposed via labelled precursor feeding assays, enzymes that are involved in the specific biosynthetic pathways remained partially documented. Here, with combination of proteomic, transcriptome and RNAi, we identified two *P. cochleariae* cytochrome P450s, C7758 and C480, which have been proved to participate in the production of the glandular deterrent chrysomelidial and hemolymph pre-toxin ISO 2 respectively. Knocking down C7758 led to a significant reduction of both 8-hydroxygeraniol-glucoside and chrysomelidial, indicating C7758 is involved in the production of 8-hydroxygeraniol in the chrysomelidial biosynthetic pathway. In vitro enzymatic assay further confirmed C7758 was able to catalyzed geraniol to 8-hydroxygeraniol. Similarly, when the expression of C480 was inhibited, the production of ISO2 in hemolymph was dramatically decreased, accompanied by a slightly increase of ISO1, suggesting C480 is likely to participate in the biosynthesis of 3-NPA. Altogether, our results showed different P450s were recruited for the production of two different chemical defensive weapons in leaf beetles.

Session/symposium: *Intraspecific relationships/independent presentation*
POSTER
number: 171

Lona I.D.[1], Miller D.G.[1], Hatfield C.[1], Rosecrance R.C.[1], Chen Y.[2], Seybold S.J.[3]*

**Landing rate of the walnut twig beetle, *Pityophthorus juglandis*, on two western North American walnut species, *Juglans californica* and *J. major***

[1]California State University Chico, Biological Sciences Department/College of Agriculture, Holt 205, 400 West First Street, Chico CA 95929 USA
[2]Ernest & Julio Gallo Winery, 600 Yosemite Blvd, Modesto, CA 95354 USA
[3]USDA Forest Service, Pacific Southwest Research Station, 1731 Research Park Drive, Davis, California, 95618 USA

Corresponding author's e-mail address: *sjseybold@gmail.com*

The walnut twig beetle (WTB), *Pityophthorus juglandis*, vectors a phytopathogenic fungus, *Geosmithia morbida*, which causes Thousand Cankers Disease (TCD) in walnut trees, *Juglans*. We are investigating the susceptibility of two walnut species native to the western USA (*Juglans californica* and *J. major*) by comparing WTB flight and landing responses to small diameter branch sections. Twenty unbaited branch sections (10 each of *J. californica* and *J. major*) were presented in a completely randomized design to populations of WTB at the USDA ARS National Clonal Germplasm Repository Juglans collection located at Wolfskill Experimental Orchards (Winters, California) and at the Agricultural Teaching and Research Center (ATRC) in Chico, California. Stickem-coated acetate sheets were placed around the branch sections and exchanged weekly. Three assays were completed at Wolfskill (Assays 1-3), and one assay was completed at ATRC (Assay 4). Landing rates on these traps were compared between *J. californica* and *J. major*. An additional assay (Assay 5) was completed at Wolfskill to compare responses to J. californica and to a similarly sized cardboard tube (negative control). A statistical analysis that pooled results from Assays 1-3 showed a preference by WTB for *J. californica*. However, in Assays 4 and 5 WTB showed no preferences between treatments, perhaps due to the low population densities of WTB flying during the assays. The fruit-tree pinhole borer (an ambrosia beetle), *Xyleborinus saxeseni*, showed relatively higher flight responses during all assays, which suggests a higher population density or a greater sensitivity to host volatiles. The flight responses of WTB recorded in some of the assays during this study indicate that host preference by this pest may be determined by long-range olfactory cues.

Session/symposium: *Interspecific relationships/independent presentation*
POSTER
number: 173

Malka O.[1], Santos-Garcia D.[1], Feldmesser E.[2], Sharon E.[1], van Brunschot S.[3], Seal S.[3], Colvin J.[3], Morin S.[1]*

**Species-complex evolution and host-plant associations in *Bemisia tabaci*: a plant-defense, detoxification perspective revealed by RNAseq analyses**

[1]Department of Entomology, the Hebrew University of Jerusalem, Rehovot, Israel
[2]Department of Biological Services, Weizmann Institute of Science, Rehovot, Israel.
[3]Natural Resources Institute, University of Greenwich, Kent, UK

Corresponding author's e-mail address: *shai.morin@mail.huji.ac.il*

*Bemisia tabaci* is a complex of more than 35 cryptic species. The putative mechanisms driving this impressive diversification focused so far on allopatric forces that assume a common, broad, host-plant range. To ask if host-adaptation processes have played a role in *B. tabaci* diversification, we aimed, in this study, to identify macroevolution patterns in the relationship between *B. tabaci* species and their host plants that have the potential to promote diversification. At first, we conducted a literature survey, which indicated that many species in the complex have been documented to harbor a limited host-range, with only few showing a truly broad one. Next, we tested if differences in performance and in expression profiles of genes involved in host utilization (detoxification genes), are shaped more by the phylogenetic relationships amongst the species in the complex, or by the species ability to successfully utilize many plants as hosts. Six species, representing different geographical regions and documented host ranges were analyzed. Performance assays divided them into two groups, one showing higher performance on various host plants than the other. The same grouping pattern appeared when the species were clustered according to their expression profiles, despite the species in the higher-performance group being only distantly related phylogenetically. Finding that the ability to perform well on multiple hosts exists in various clades of the *B. tabaci* species complex and that these species share a "common" detoxification machinery, can support a species expansion model (known as the "oscillation hypothesis") in which an ancestral ability to perform well on multiple hosts sets the stage for subsequent local adaptation and specializations, leading to fragmentation and eventually speciation.

Session/symposium: *Intraspecific relationships/independent presentation*
ORAL PRESENTATION

Ray A.M.[1]*, Francese J.A.[2], Zou Y.[3], Bower R.[1], Watson K.[4], Crook D.C.[2], Millar J.G.[3]
**Detection of velvet longhorned beetle populations using attractant baited traps**

[1]Xavier University, Cincinnati OH;
[2]U.S. Department of Agriculture, Animal and Plant Health Inspection Service - Plant Protection and Quarantine - Center for Plant Health Science and Technology;
[3]University of California, Riverside CA;
[4]Utah Department of Agriculture and Food

Corresponding author's e-mail address: *raya6@xavier.edu*

The velvet longhorned beetle, *Trichoferus campestris* (Faldermann)(VLB; Cerambycidae: Cerambycinae: Hesperophanini), is native to east Asia where it feeds on a wide range of tree species, including orchard and timber trees. Larvae of VLB can be transported in wood packing material, and individuals are frequently intercepted in quarantine facilities. Populations of VLB have established outside of the native range of the species, including near Salt Lake City, UT USA. Adults are nondescript and nocturnal, and monitoring and control efforts have been hindered by a lack of attractant lures. We recently isolated and identified a novel variant of the conserved 2,3-alkanediol/ hydroxyketone chemical structure from headspace volatiles of males but not females. In field bioassays, this compound attracted significantly more adult beetles than did commercially available high-release ethanol lures or solvent control. We here describe results of subsequent bioassays evaluating the effects of trap design, trap color, and trap height on numbers of beetles captured. We also describe the results of a dose-response bioassay, the first results from field evaluation of commercial lures, and efforts to detect VLB populations in areas where the species was not known to occur. The results of our work will assist regulatory personnel and land managers in developing monitoring surveys for VLB throughout the world.

Session/symposium: *Practical applications/Semiochemical application for invasive species*
ORAL PRESENTATION

Selvamuthukumaran T.*, Arivudainambi S.

**Effect of Lactone Glycoside on Digestive Physiology and Midgut Histology of Tobacco caterpillar *Spodoptera litura* (Lepidoptera:Noctuidae)**

Phyto Insecticides lab, Department of Entomology, Annamalai University, Tamilnadu, India.

Corresponding author's e-mail address: *entoselva@gmail.com*

The plant active molecules with their known mode of action are important leads to development of newer insecticides. Lactone glycoside was identified earlier as the active principle in *Cleistanthus collinus* (Roxb.) Benth. (Fam: Euphorbiaceae). It possessed feeding deterrent, insecticidal and insect growth regulatory actions at varying concentrations. Deducing its mode of action opens a possibility of its further development. It reduced the digestive enzyme activities at sub lethal and lethal concentrations against third, fourth and fifth instars *Spodoptera litura* Fab. larvae. At LC95 70%, 67% and 76% reduction in protease, amylase and lipase activities were recorded against third instar *S. litura* larva as against untreated check. The effect was concentration and age dependent. This was mediated by midgut epithelial cytotoxicity. Necrosis, loss of microvilli, swollen nuclei in sub lethal concentrations and complete loss of cellular structure in lethal concentration noticed. Studies on molecular targets based on this preliminary site of action lead to new insecticide development.

Session/symposium: *Practical applications/independent presentation*
POSTER
number: 169

Zhang J., Fandino R., Obiero G., Yan S., Grosse-Wilde E., Bisch-Knaden S., Knaden M., Hansson B.S.*

**Hexanoic acid, natural repellent for female *Manduca sexta* oviposition**

Max Planck Institute for Chemical Ecology, Department of Evolutionary Neuroethology, Jena, Germany

Corresponding author's e-mail address: *jzhang@ice.mpg.de*

Finding a favorable site for oviposition is a challenging task for gravid females of herbivorous insects. At the same time, it is of paramount importance for the survival of a species considering most insect larvae have a very limited capability to locate alternative host plants. The hawkmoth, *Manduca sexta* (Sphingidae), oviposits on plants of the family Solanaceae. As already known that single caterpillar can sometimes defoliate a full plant, females should identify acceptable oviposition sites to guarantee low intraspecific and interspecific competition for their offspring. Here, we demonstrate that caterpillar frass is repellent for female oviposition. Hexanoic acid, the major volatile compound of frass from *M. sexta* larvae that were raised on *Datura wrightii* is sufficient to deter oviposition. We propose that females can appraise the competition of a candidate host plant by evaluating the olfactory signals from caterpillars and their frass.

Session/symposium: *Interspecific relationships/independent presentation*
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## LIST OF PARTICIPANTS

Barna, Balázs
balazs.barna@agra.mta.hu
Ockenfels, Peter
peterockenfels@mac.com
Papp, Gergely
papp.gergely@NAK.hu
Papazian, Stefano
stefano.papazian@umu.se