2023 Abstract Award Winners

1st Place: **Paola Villamarin**

Title**: Evaluation of four release methods for *Amblyseius swirskii* on bell pepper commercial production**

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Commercially available predatory mites are a sustainable alternative for agricultural pest management. The predatory mite *Amblyseius swirskii* is often used to control insects and mites on pepper crops. The release method of predators impacts predation rate and foraging behavior. The traditional method is manual sprinkling, releasing the mites directly from the container on the canopy, which is time consuming and labor intensive. There are other release methods such as mechanical distribution using blower machines, and the slow-release methods using sachets. Sachets are small bags containing a blend of factitious prey, a carrier, and the predators to allow a continuous release through slight openings. A variation of sachets uses small boxes instead of bags. The boxes are filled with predators before installation (Fig. 1d). We hypothesized that there might be an *A. swirskii* release technique other than the manual approach that could be more efficient and affordable in pepper crops. The specific objectives were (a) to determine the most effective method to release *A. swirskii* on pepper crop, (b) examine the population dynamics of *A. swirskii*, and (c) conduct an economic analysis to choose the most advantageous release technique. The experiment was conducted on a hectare of commercial pepper in Comayagua, Honduras. *Amblyseius swirskii* was released 15 days after planting in rates of 87.5 mites/m_2. There were four replicates in the experimental plot and four treatments (Fig. 1, 2a) —manual release as industry control, blower, sachet, and zamobox (box-variation of sachet)— _in a randomized complete block design (Fig. 2a). The predatory mites were released in the entire plot as required by the company. The slow-release techniques were placed every nine plants in all the beds (Fig. 2b), the manual and blower techniques were used in accordance with the sowing lines. Samples were taken weekly for three months, counting the number of eggs and motile stages of *A. swirskii* on six plants considerer as sampling point (Fig. 2b). From each plant six leaves were evaluated. The same site of each treatment was sampled during the experiment. The number of predator eggs did not significantly vary among treatments (ANOVA: F=2.02, df=3, P=0.1101), although the sachet had the larger number of eggs during the first week (Fig. 3). *Amblyseius swirskii* motile population was the lowest under the blower method (Fig. 3). These data are still under revision to determine which method is the most efficient in delivering large numbers of predatory mites. Regarding the release cost, blower has the biggest investment cost of 1277 USD/hectare (Table 1), but this equipment is only bought once. The sachet has the lowest cost at 273 USD/hectare (Table 1). According to the preliminary data analysis, the blower release method could be a financially viable alternative to manual release in large crop extensions and it is also a way to reduce application times and labor costs.

2nd Place: **Marcello De Giosa**

Title: **Extraction of Saliva from Eriophyid Mites by Immersion in Different Oils**

Authors: Marcello De Giosa[1], Livia M. S. Ataide[1], Zi Teng [2], Yaguang Luo[3], Ronald Ochoa[4], Enrico de Lillo[5], & Alexandra M. Revynthi[1]
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The superfamily Eriophyoidea includes herbivore mites of economic importance. *Aceria litchii* (Keifer) and *Acalitus simplex* (Flechtmann & Etienne) are gall-making species feeding on *Litchi chinesis* (Sonnerat) and *Ruellia simplex* (Wright), respectively. The feeding activities of both mites cause hypertrophic reactions, which lead to an abnormal growth of the leaf trichomes, called erinea. Erinea are open galls and depending on the eriophyid species inducing their formation, they can have different colors, such as white, amber, or purple. Erinea can develop on different plant tissues including leaves, stems, buds, flowers, and fruits. *Aceria litchii* and *A. simplex* spend their entire lifecycle inside the erinea where they feed, reproduce, and seek refuge from biotic (e.g., predators) and abiotic factors (e.g., unfavorable environmental conditions). Although eriophyids are important herbivore pests of agricultural crops, no information is available on how eriophyids can induce symptoms (e.g., erinea) and how these can develop on the host plants. We hypothesize that the saliva injected during feeding in the plant tissue is responsible for inducing changes in plant physiology, resulting in the development of symptoms. Hence, the goal of this research is to understand the role of saliva in the development of erinea. To reach this goal, we developed three objectives for our research. The first objective is to obtain the saliva by stimulating the mites to produce it when they are immersed in different types of media. The second objective is to develop an appropriate protocol for collecting mite saliva and the third objective is the characterization of the saliva by conducting a proteomics analysis. Here, only results regarding the first objective are presented. To stimulate saliva production, we tested 25 vegetable and 10 immersion oils and vaseline on *A. litchii* and *A. simplex*. We found that sunflower, rice, tea seed vegetable and Zeiss N immersion oils are good candidates for stimulating saliva production in *A. litchii*. Immersion of *A. litchii* in chia, walnut, vaseline, and virgin coconut oils did not result in the production of saliva (**Figure 1**). *Aceria litchii* died within 30 minutes when immersed in hemp, vanilla, cumin, pumpkin seed, and cedar vegetable oils. We also explored combination of sunflower and rice oils at 25%, 50%, 66.7%, and 75% concentration since these oils induced the highest saliva production and caused less mortality than tea seed and Zeiss N. The combination of sunflower and rice oil did not result in larger proportion of mites producing saliva. Pure concentration (100%) of sunflower was the most effective among the four combinations, causing less mortality and stimulating more saliva production (**Figure 2**). We also evaluated the saliva production in sunflower oil of *A. simplex*. Preliminary results show that sunflower oil might be the most effective oil in stimulating saliva production in *A. simplex* as well (**Figure 3**). Media, such as the sunflower oil that allow us to obtain large saliva quantities will be used to reach our goal of obtaining saliva for the proteomics analysis.

Supplementary material
We also evaluated the oils' viscosity that may influence the induction of saliva (**Table 1**). We found that sunflower, rice, and tea seed, which were more effective in inducing saliva production in *A. litchii*, are characterized by medium-high viscosity ranging from 80 to 87 cps. Immersion of *A. litchii* in oils characterized by extremely high or extremely low viscosity, such as mustard (93.33 cps) and almond (9.67 cps), did not result in large saliva production. It remains unknown how oil viscosity can affect the saliva production. We will test the vegetable oils, and vaseline, and immersion oils on *A. simplex, Aculops lycoperisici,* and *Tegolophus perseaflorae* with the same methodology used for inducing saliva production in *A. litchii* (**De Giosa et al. 2022**). We want to collect the saliva from these species since they have a different lifestyle. *Callistus simplex* is a gall-making mite, while *A. lycopersici* is a free-living eriophyid mite feeding on plant tissues where it causes bronzing, rusting, and discoloration. *Tegolophus perseaflorae* is a bud-inhabiting eriophyid mite feeding on the buds, causing necrotic spots on the young apical leaf and fruit deformation and discoloration. Once we obtain enough saliva from the mentioned eriophyid species and found an appropriate protocol to extract the saliva, we will conduct a proteomics analysis. Using this molecular technique and the known *A. lycopersici* genome as a guide, we aim to identify the proteins present within the saliva of each eriophyid species, and provide hypotheses on their role, thus the role of the saliva. We will investigate whether these proteins are the same or differ between each gall-making (*A. litchii*), free-living (*A. lycopersici*), and bud-inhabiting (*T. perseaflorae*), and within the same lifestyle, considering *A. litchii* and *A. simplex*, which are two gall-making species.

3rd Place: **Maria A. Canon**

Title: **Evaluation of Biorational Pesticides Against Acarine Pests of Hemp (*Cannabis sativa*), a Greenhouse Approach and Production of Mite-Free Cuttings**
Authors: Maria A. Canon, Livia M. S. Ataide, Paola Villamarin, Lance Osborne, Paul E. Kendra and Alexandra M. Revynthi

Industrial hemp (*Cannabis sativa* L.) is a crop with a delta-9 tetrahydrocannabinol (THC) concentration of less than 0.3 % on a dry weight basis, which distinguish it from Marijuana plants. Hemp plants are attractive to insect and mite pests. Common insects include stink bugs, beetles, aphids, whiteflies, mealybugs, and thrips. Common acarine pests include spider mites (*Tetranychus urticae, T. gloveri*), broad mites (*Polyphagotarsonemus latus*) and russet mites (*Aculops cannabicola)*. Despite the high number of common pests that affect hemp, in Florida chemical control is restricted and only approved by the Florida Department of Agriculture and Consumer Services – Division of Plant Industry (FDACS-DPI) products can be applied. Our research aims to evaluate FDACS-DPI approved biorational pesticides to control the most common acarine pests on hemp. Single active ingredient products were selected and included citric acid, rosemary, thyme, sesame, and garlic oil. A mineral oil was also included as a positive control and water as a negative control. The products were prepared at the maximum label rate **(Table 1)** and sprayed either on leaf discs (1 cm diameter) as indirect contact or directly on the mites as a direct contact. Mite mortality was evaluated after 4, 24, 48, 72 and 96 hours, where live and dead mites were scored. The experimental arenas were maintained in controlled conditions, at 25.0 °C RH 60% 12:12 h (L:D) for all the species. Garlic oil caused the 100% mortality to *A. cannabicola* and *P. latus*, and 97% to *T. urticae* and *T. gloveri*. Thyme oil was the second most efficacious active ingredient, causing 100% mortality to *P. latus*, 99% to *A. cannabicola* and 94% to *T. gloveri*.to. In *T. urticae*, 80% mortality was observed when citric acid was used. Garlic oil, citric acid and thyme oil will be further tested against *T. urticae* and *T. gloveri,* under greenhouse conditions. Spider mites are the most common acarine pests in Florida. Hemp plants will be infested individually with one mite species. Groups of 10 plants each will be sprayed with either one of the biorational pesticides or water (control). The efficacy of each treatment will be evaluated weekly by sampling five leaves per plant and counting the number of live and dead individuals.

Finally, garlic oil and citric acid will be evaluated for their potential to produce mite free propagative material. Hemp is propagated through cuttings. For these experiments *T. urticae* will be used. Hemp mother plants used for propagation will be infested with *T. urticae* and sprayed with a treatment or water a control. Following the treatment, five cuttings will be taken from each plant and dipped in a container with the same treatment or water. The number of mites prior, and 1-, 7- and 14-days post treatment will be scored. We expect both biorational pesticides to significantly decrease the mite populations compared to control. Our results can be implemented in an integrated pest management program for hemp.