TRAVEL GRANT REPORT

Title: IOBC Working Group on Integrated Control of Plant-feeding Mites, Chania, Greece.

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Dr Chantelle Jay, NIAB EMR

Headline bullet points:

- Researchers in Vienna are 'teaching' predatory mites how to find their prey
- Researchers in Greece have found that tomato plants infested with an endophytic fungus *Fusarium solani* strain K have less spider mite
- Work at the University of Amsterdam is showing that predatory mites could be bred to have different dispersal tendencies
- New slow release sachets with additional protection from the elements, and humidity control are being developed in Japan, although they gave no indication of cost
- The predatory mites *Amblyseius andersoni*, *Neoseiulus californicus* and *N. fallacis* showed the strongest pest reduction for control of a tomato russet mite in experiments in Belgium.
- Researchers in Greece found that plant strengtheners and entomopathogenic fungi may be useful for spider mite control on tomato

Background: This event was organised by the IOBC as a working group meeting of the 'Integrated control of plant-feeding mites' group. It was organised by George Broufas of the Democritus University of Thrace, Greece, with Eric Palesvsky (Israel) as the working group convenor. There were at least 46 participants from 12 countries (n.b.not all particpants from the commercial sponsors were registered). Sponsors included BioBest, Bioplanet, Bioline AgroSciences and Koppert Biological Systems.

Expanded Findings: Peter Schausberger from the University of Vienna described how generalist predatory mites such as *Neoseiulus californicus* and *Amblyseius swirskii* are well able to learn prey in early life, profoundly and persistently enhancing the predators' foraging performance on this prey later in life. Enhanced foraging performance is evident in quicker prey recognition, shorter attack time, and higher predation rates, accompanied by higher oviposition rates. They described work to show how they can enhance the learning ability using water based extracts. Their ultimate goal is the control of Western flower thrips, *Frankliniella occidentalis*.

Serge Kreiter from Montpellier SupAgro looked at the effects of the plot landscape and pollen concentration on phytoseiid mites (Acari: Phytoseiidae) in three French viticultural regions, however although the pollen abundance had a positive effect on densities of the various stages of the mite *Kampimodromus aberrans* it was variable depending on the period of the year and between years of study.

Spider mites perform worse on tomato plants infested by the endophytic fungus *Fusarium solani* strain K, according to Maria L. Pappas Democritus University of Thrace, Greece, They assessed the efficiency of Fusarium solani strain K (FsK), an endophytic fungus previously shown to confer resistance against plant pathogens, on the performance of the two-spotted spider mite *Tetranychus urticae*. They found that spider mites performed worse on plants infested with the fungus, with no effect on plant growth parameters. Furthermore, inoculated plants were more attractive to *Macrolophus pygmaeus*, a natural enemy of spider mites. Our results highlight the role of FsK in promoting plant growth but also protecting plants from spider mites in addition to pathogens.

Alexandra M. Revynthi of the University of Amsterdam described artificial selection for aerial dispersal tendency in *Phytoseiulus persimilis* (Acari: Phytoseiidae). With the ultimate aim of controlling two-spotted spider mite (*Tetranychus urticae*) they discussed creating predator strains with desirable traits, such as high dispersal tendency, that could remain on the crop longer can lead to a more effective biological control. Their theory predicts the existence of two types of predator dispersal strategies: a strategy with high dispersal tendency, which is called Milker, and a strategy with low dispersal tendency, which is called Killer. They showed that 6 rounds of strong selection for early or late dispersal resulted in a line of *Phytoseiulus persimilis* displaying earlier or later dispersal, respectively. Their study can provide a basis for breeding programs to create strains with desirable traits and improve biological control of two-spotted spider mites.

Takeshi Shimoda of the Central Region Agricultural Research Center in Japan described a novel method for protecting slow-release sachets of predatory mites *Neoseiulus californicus* (McGregor) against environmental stresses and for increasing release of predators in greenhouses. As predator release from slow-release sachets can be inhibited by environmental stresses such as pesticide sprays and severe wet conditions they developed plant-attached shelters made of waterproof paper that hold the sachets (“sheltered sachets”). They also found that more predators were released from sheltered sachets moisturized with a humidifier than from unsheltered sachets under dry conditions. These results indicated that sheltered sachets were potentially useful in protecting the predatory mites against environmental stresses and enhancing their release to crops.

Biological control of the tomato russet mite *Aculops lycopersici* (Acari: Eriophyidae) in greenhouse grown tomatoes was discussed by Juliette Pijnakker of Biobest Belgium. The efficiency of nine species of Phytoseiidae in controlling the tomato russet mite *Aculops lycopersici* Massee (Eriophyidae) was evaluated on tomato plants in an experimental greenhouse. Five hundred mites of the species *Neoseiulus andersoni, Neoseiulus califonicus, Neoseiulus fallacis, Galendromus occidentalis, Amblyseius swirskii* and *Amblydromalus limonicus* were released four times on lightly infested plants. *Amblyseius andersoni, N. californicus* and *N. fallacis* showed the strongest pest reduction. Even though these species did not display good

survival and the curative strategy did not totally eliminate the pest, the plants remained healthy. Only two species (*A. swirskii* and *A. limonicus*) succeeded to develop and reproduce on the plants, but only once the plants were damaged to the extent that the trichomes had collapsed and no longer interfered with the development of the predators. *Amblyseius andersoni, N. californicus* and *N. fallacis* could be used in waterproof breeding sachets or with dribble introductions in a preventative biological control strategy.

Alexander Pfaff of the Institute for Plant Protection in Horticulture and Forrest, Germany alerted us to the increase in occurrence of the acarid mite, *Aculops lycopersici* in tomato cultivation throughout Germany which can be devastating. They talked about an ongoing greenhouse trial, which may be interesting to follow up, using “Vertimec Pro” (Abamectin, Syngenta), “PREV-AM” (orange oil, OroAgri) and the entomopathogenic fungus Beauveria bassiana formulated as “Naturalis” (e-nema).

Madelaine Venzon Agriculture and Livestock Research Enterprise of MinasGerais, Brazil, presented work led by Ana Luiza Viana de Souza, Federal University of Lavras (UFLA), Brazil.They evaluated the compatibility of *Orius insidiosus* and *Neoseiulus californicus* for spider mite control in roses in laboratory behavioral studies. On rose leaflets, they observed that *O. insidiosus* was more active than the predatory mite. The presence of spider mite did not stop predation of by *O. insidiosus* on *N. californicus*. However, when both predators were combined, there was still an additive response in the consumption of nymphs and adults of spider mite, but not of eggs.

Konstantinos A. Samaras, of the Democritus University of Thrace, Greece studied the predation between introduced mite species and naturally occurring species in orchards. Although pollen provisioning reduced intraguild predation in some cases, the study highlighted the risk of releasing exotic biological control agents without previously assessing their interactions with native natural enemies of pests. Effects of commercial beneficial fungi and a plant strengthener on the two-spotted spider mite *Tetranychus urticae.*

Maria L. Pappas Democritus University of Thrace, Greece, looked at the effect of plant strengtheners and entomopathogenic fungi for control of spider mite on tomato. They found that all all products significantly affected spider mites. Our results highlight the potential of these products in herbivore suppression in addition to plant disease control.

Ada Leman, Wageningen University & Research, The Netherlands described how major mite pests could be controlled. In tulip bulbs a main pest is the eriophyid *Aceria tulipae*. This so-called dry bulb mite is particularly a problem after harvest when tulip bulbs are stored for several months. Another eriophyoid mite, *Acalitus essigi*, is a serious pest in the culture of blackberry. The mites hide in the buds, leaf

axils and bracts. Economic losses occur when they attack the fruit during drupelet ripening. The affected drupelets become hard, inedible and bright red. Tarsonemid mites give serious problems in various ornamental greenhouse crops. A major pest in amaryllis is the bulb scale mite *Steneotarsonemus laticeps*. Similar to the dry bulb mite, this mite hides deep into the bulbs and is thereby very hard to control with pesticides or biological control agents. Bromeliaceae are mainly attacked by the tarsonemid *Steneotarsonemus ananas* , whereas the most abundant tarsonemids in gerbera are *Tarsonemus violae* and the broad mite *Polyphagotarsonemus latus* . These mites live deep in flower microhabitats and cause flower deformation. Although these various small phytophagous mites all require a specific approach for biological control, there might also be similarities in ways to optimize control. They will be looking to enhance biological control of the above mentioned phytophagous mites with phytoseiid predatory mites.

Paraskevi Kolokytha of IPM Impact, Belgium, tested several products against the tomato russet mite, *Aculops lycopersici* on tomato plants. Several chemicals as well as physical and botanical insecticide and acaricide compounds were tested on a high population of the TRM. The majority of the chemical compounds were effective against this mite. On the other hand, only the appliance of thyme oil reduced the population of the mite, while some physical compounds, such as Kinetic, Agritrap and Eradicoat were estimated to be moderately to highly effective, according to EPPO guidelines.

Eveline Driesen, Faculty of Bioscience engineering, Belgium, assessed phytoseiid mite abundance and diversity in Belgian apple orchards. A total of four phytoseiid species were observed: *T. pyri, Amblyseius andersoni, Euseius finlandicus* and *Phytoseius horridus. T. pyri* was the most dominant

Marie-Stéphane Tixier described how metabarcoding can rapidly identifying Phytoseiidae predatory mite species. This methodological advances open new doors for rapid identification of predators and potentially give access to food webs, identifying prey species eaten by the predators.

Personal Statement: This conference offered excellent networking opportunities between mite specialists internationally and enabled NIAB EMR, as one of the few UK participants, to highlight their work in spray application and ecology. An oral presentation was given “Comparison of sprays from a fixed overhead spray boom with overall air-assisted knapsack spraying for control of Tetranychus urticae and the effects on phytoseiids in raspberry”. This will be available in the full published proceedings.

Contact details: Dr Chantelle Jay, Mobile: 07759 407552, chantelle.jay@emr.ac.uk

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