

### Co-evolution and biological control: multitrophic interactions between the tree of heaven, brown marmorated stink bug and their natural enemies.

**Authors:** Ioriatti Claudio<sup>5</sup>, Mazzoni Valerio<sup>6</sup>, Anfora Gianfranco<sup>4</sup>, Cristofaro Massimo<sup>1</sup>, Profeta Erica<sup>3</sup>, Roselli Gerardo<sup>2</sup> and FH Sforza René<sup>7</sup>, <sup>1</sup>BBCA-onlus, via A. Signorelli 105, 00123 Rome, Italy ENEA SSPT\_BIOAG, via Anguillarese 301, 00123 Rome, Italy, <sup>2</sup>BBCA-onlus, via A. Signorelli 105, 00123, Rome, Italy Fondazione Edmund Mach, 38010, San Michele all'Adige (TN), Italy Center of Agriculture, Food and Environm, <sup>3</sup>BBCA-onlus, Via A. Signorelli 105, 00123, Rome, Italy, <sup>4</sup>Center Agriculture Food Environment, University of Trento, San Michele all'Adige, TN, Italy; Research and Innovation Centre, Fondazione Edmund Mach, Via E. Mach, Italy, <sup>5</sup>Center for Technology Transfer, FEM-IASMA, Italy, <sup>6</sup>Fondazione Edmund Mach Center for Research & Innovation, Italy, <sup>7</sup>USDA-ARS-EBCL, France

**Abstract:** *Ailanthus altissima*, commonly known as tree of heaven, is an invasive plant species of eastern Asian origin and it has been introduced in Europe, Africa, South America and North America at the end of 18th century. It is able to germinate and grow in a wide variety of soil and site conditions proving that it has been and still is troublesome from urban landscapes to woodlands. Moreover, in addition to its non-native invasive status, the tree of heaven may also play an important role in the biology of two invasive alien insect pests, both of the same geographic origin: brown marmorated stink bug (BMSB, *Halyomorpha halys*) and spotted lanternfly (*Lycorma delicatula*). The tri-trophic interaction between the target weed, the associated insect pests and one of its potential biocontrol candidate agents, the eriophyid mite *Aculus mosoniensis*, is presented and evaluated in the framework of invasion ecology assessment. We evaluated if the impact of the eriophyid mite on the fitness of the invasive plant species, in particular the induced changes in its physiological patterns, can influence the evolutionary responses and population dynamics of the associated insect pest species.

### Unravelling the reproductive biology traits of *Drosophila suzukii* as a basis for specific and long-term control of this species

**Authors:** Ioriatti Claudio<sup>1</sup>, Gasperi Giuliano<sup>4</sup>, Carraretto Davide<sup>5</sup>, Malacrida Anna R.<sup>10</sup>, Puppato Simone<sup>7</sup>, Grassi Alberto<sup>6</sup>, De Cristofaro Antonio<sup>9</sup>, Caceres-Barrios Carlos<sup>8</sup>, Gomulski Ludvik<sup>3</sup> and Giardina Sara<sup>2</sup>, <sup>10</sup>University of Pavia, Italy, <sup>1</sup>Center for Technology Transfer, FEM-IASMA, Italy, <sup>2</sup>Department of Biology and Biotechnology, University of Pavia, Italy, <sup>3</sup>Dept. of Biology and Biotechnology, University of Pavia, Pavia, Italy, <sup>4</sup>Dept. of Biology and Biotechnology, University of Pavia, Pavia, Italy, <sup>5</sup>Dept. of Biology and Biotechnology, University of Pavia, Pavia, Italy, <sup>6</sup>Edmund Mach Foundation, Italy, <sup>7</sup>Edmund Mach Foundation, Italy, <sup>8</sup>Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Austria, <sup>9</sup>University of Molise, Department of Agricultural, Environmental and Food Sciences, Via De Sanctis 1, Campobasso 86100, Italy

**Abstract:** The rapid and extensive establishment of *D. suzukii* outside of its indigenous regions has been facilitated by tolerance to a broad range of climatic conditions, and by its high reproductive potential. Overwintering of adult males and females and early season reproductive behaviour play important roles in the seasonal buildup of the populations. The females are reproductively active from early spring until late autumn, and the most stringent bottleneck for *D. suzukii* populations is from January to March in temperate climates. Overwintered *D. suzukii* females are thought to store sperm from autumn matings to counteract the winter bottleneck that may result in a scarcity of mature males in early spring. This strategy would allow them to resume oviposition when they exit reproductive diapause in the early spring, without needing to mate again. Given this background, an important unexplored aspect of *D. suzukii* reproductive behaviour is the assessment of the number of times that a female mates in the wild across the seasons. This influences the effective population size and may constitute a critical factor in determining the success of control methods. Using molecular markers, we investigated the presence and the extent of polyandry in different seasons. Moreover, we evaluated sperm utilization by females. These aspects of *D. suzukii* mating behaviour may locally be a constraint to the application of the environmental friendly control methods such as the Sterile Insect Technique (SIT).

### Predatory Potential of Various Predators on Citrus Leafminer, *Phyllocnistis citrella* (Gracillariidae; Lepidoptera) under laboratory conditions

**Authors:** Irfan Ullah Muhammad Irfan, Abdullah Asad, Afzal Muhammad, Arshad Muhammad, Altaf Nimra, Ali Shaukat and Muhammad Ali Zahid Syed

**Abstract:** Citrus leafminer (CLM), *Phyllocnistis citrella* Stainton (Gracillariidae: Lepidoptera) is a pest native to Southeast Asia which has threatened the citrus industry worldwide. To control this menace, different insects were screened to determine their predatory potential in the laboratory at  $26 \pm 2^\circ$  temperature and  $65 \pm 5\%$  R.H. Six different potential predators used against citrus leafminer included ants (*Solenopsis invicta* and *Lasius niger*), green lacewing (*Chrysoperla carnea*), ladybird beetle (*Coccinella septempunctata*) and spiders (*Zygiella x-notata* and *Myrmarachne* sp.). Results revealed that *S. invicta* (red fire ant) showed the highest predation (5.8 CLM larvae) followed by *C. carnea* (green lacewings) (2.6 CLM larvae) against citrus leafminer. Ladybird beetles and both spider species did not feed on CLM but caused slight mortality by scratching or damaging the mines and larvae. *L. niger* showed no harm to CLM larvae during the study. Observations for the time of feeding activity confirmed that *S. invicta* and *C. carnea* are both active diurnally because both showed maximum activity into the photophase. During CLM predation, the searching period was found highest in *S. invicta* followed by *C. carnea* (132 and 111.5 minutes respectively) while handling period was maximum in *C. carnea* (37.5 minutes) followed by *S. invicta* (26.5 minutes). The retreat period (no locomotion, no body movement) was found maximum in the case of both spider species as the spiders mostly remained inside their webs. Least retreat period was observed in *S. invicta* and *C. carnea* (21.5 and 31 minutes respectively).