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A hypothesis on the interactions between microbiomes in a parasitic relationship: The case of *Apis mellifera* and its parasite *Varroa destructor*

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Varroa destructor is a parasite mite that accomplishes its reproductive cycle exclusively in honey bee colonies. It was originally a symbiont of the Asian bee *Apis cerana*. After the first contact with colonies of *Apis mellifera* at the beginning of the sixties, it spread all over the word except for Australia and Madagascar. *Varroa* fed on old bee larvae, pupae in sealed cells and adult bees. It is well known that this mite can act as a vector of several pathogenic agents, both bacterial and viral, which altogether cause a syndrome called varroasis. To date, the microbiome of adult *A. mellifera* is well-known, but that of larval stages is far to be characterized, as like as the microbiome of the parasitic mite. Consequently, it is still unclear how bacterial communities characterizing the two organisms affect each other, if we exclude some works on the transmission of a specific pathogen. Our hypothesis is that varroa mites play a fundamental role in the alteration of bacterial community composition of honey bee larvae, not only being a vector, but also acting as a "stargate", an open "door" through which exogenous bacteria alter the mechanisms of primary succession in honey bee microbiome. We studied varroa and honeybee bacterial communities through barcoded amplicon pyrosequencing methods, taking advantage of the of hight-throughput sequencing technologies and the opportunity to detect uncultured and uncultivable bacteria allowed by such techniques. In summary, we characterized the honey bee-associated microbiota in the larval stage and the parasite-associated microbiota, and explored the possible patterns of interaction between the two microbiomes.

Host-adaptation of parasitoids to the newly introduced invasive species, *Drosophila suzukii*

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The reciprocal evolutionary interaction between a pest and its natural enemies leads to a dynamic runaway escalation or 'arm-race'. The final result of this co-evolutionary process between species guarantees the population control, leading to an ecological balance. This balance is no longer maintained when a pest colonizes a new environment, in which specific biological control agents are lacking. The present study focused to determine the field occurrence of indigenous parasitoids of *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae). Since its introduction in USA and Europe in 2008, this invasive pest caused hundred thousand dollars worth of damage to small and stone fruits business. The uncontrolled outbreaks of *D. suzukii* in the invaded regions were mainly due to the absence of specialized natural enemies. On the contrary, in the areas of *D. suzukii* origin, a number of hymenopteran parasitoids, having a co-evolutionary history with this pe st, have been reported. Here we state the results of a survey aimed at determining the presence of indigenous *D. suzukii* parasitoid populations carried out from May to October 2012 in two areas negatively affected by this fruit pest: Trento Province, Northern Italy., and Oregon in the Pacific Northwest of the USA. We conducted field and laboratory studies in order to determine the status of biological control agents utilizing *D. suzukii* as a host. Our study sites included a range of commercial soft fruit and natural non-commercial habitats. In each site, sentinel traps were baited with either *D. suzukii* or *Drosophila melanogaster* Meigen (Diptera: Drosophilidae) larvae in different food substrates. The generalist parasitoid, *Pachycrepoideus vindemiae* (Rondani) (Hymenoptera: Pteromalidae), was collected from both *D. suzukii* and *D. melanogaster* pupae in traps deployed in a selection of these sites. This report of *P. vindemiae* in 2012 represents the first identification of *D. suzukii* parasitoids in Europe. A successive parasitism efficacy test was set up under controlled conditions confirming the ability of *P. vindemiae* to attack *D. suzukii* pupae. We discuss the possible practical implications of this finding for the biological control of *D. suzukii.*