Figure 1. Particpants in the XIII International

Patch quality, life expectancy and patch residence time in female egg parasitoids

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Drezen

Synchronized development of *Encarsia scapeata* and its univoltine whitefly host, *Trialeurodes lauri*

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Previous life history studies of *Encarsia* species were conducted on multivoltine host species. The present work deals with the developmental adaptations of *Encarsia scapeata*, which develops on a univoltine whitefly host, *Trialeurodes lauri* on *Arbutus andrachne* trees inhabiting the Mediterranean hills of central and northern Israel. The tree has one flush of leaves each year during April and May and the whiteflies respond by emerging during that time, laying eggs and within ca. 3 weeks, developing to the 4th instar. The whiteflies pass the next 10-11 months of the year as 4th instar nymphs (in diapause), rather than as pharate adults. Parasitoid emergence occurs at two separate times. Some female emergence occurs in the fall (group 1) whereas most females and all males emerge in the spring (group 2). The mated females of group 2 lay female-producing eggs in the new whitefly generation during May.

A few of these will emerge in the fall and give rise to group 1 females which are virgins and will lay male-producing eggs in parasitized hosts. Most female parasitoids develop to adults only from January through April, probably after inducing premature development of their hosts. These parasitoid females will constitute group 2 and will emerge in the spring together with the males that develop from the eggs laid by group1 females. Thus, there is considerable developmental synchrony between the parasitoid and its host requiring a complex series of interactions between the two insects.

Hagen KS et al. 1970. *Bolletino Laboratorio di Entomologia Agraria Filippo Silvestri* **28**:113-34; Hagen KS, RL Tassan. 1972. *In* J.G. Rodriguez (ed.) *Insect and Mite Nutrition*. North Holland, Amsterdam, The Netherlands

Inter-clone conflicts in the parasitoid wasp *C. floridanum*: Do precocious larvae mediate competition between broods in a single host?

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The braconid *Coeloides bostrichorum* and the pteromalid *Rhopalicus tutela* are two ectoparasitoid wasps attacking the late instar of the spruce bark beetle *Ips typographus*. *R. tutela* is a polyphagous species attacking numerous bark beetles on pine and spruce while *C. bostrichorum* has been reported as the most efficient parasitoid of *Ips typographus*. Both species search for hosts from the bark surface, preferentially in the upper section on tree. Therefore interspecific encounters between foraging females might be frequent. The host searching efficiency of each species, alone or in the presence of the other, was investigated in the laboratory using the "phloem sandwich" technique. When the females searched alone for hosts, *C. bostrichorum* had better host searching abilities than *R. tutela*. In the presence of *C. bostrichorum*, *R. tutela* increased its host finding abilities through direct displacement and stealing of hosts discovered by *C. bostrichorum*. This cleptoparasitic behavior did not seem to affect the success in host location and parasitism of *C. bostrichorum*. However, cleptoparasitism had a disturbing influence on *C. bostrichorum* as the females only probed at bark locations without a host in the presence of *R. tutela* and as they were observed to fly away from the bark after several acts of aggression from *R. tutela*. This study suggests that cleptoparasitism

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from one of its hosts

Hymenoptera

to

a

2b) unwashed versus washed leaves after the brown soft scale had
been removed

to

or their residue,

equally 26 to 29 d-old brown soft scale or their

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Tritrophic effects of host plant chemistry on the polyembryonic parasitoid *Copidosoma sosares*.

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Insect parasitoids and insect herbivores with parasite-like life histories have proved to be excellent model systems for developing theory in behavioral and evolutionary ecology and for testing theoretical predictions in the laboratory. Tests of predictions in nature have proven to be much more difficult, however, in large part because reproduction by adult females is distributed widely over space and time. Tests in nature are now critical to advancing our knowledge of parasitoid biology. Here we report a new approach to measuring realized lifetime oviposition success of individual female herbivores and parasitoids in nature. Our approach is based upon (1) studies of strictly proovigenic species (i.e., species that mature all their eggs before emerging as adults) that also do not resorb eggs and (2) a simple technique for capturing adult females at the end of their lives and quantifying their residual egg load. We use this technique to assess the roles of egg limitation, time limitation, predation risk, and body size in shaping female reproductive success in nature. Early empirical results from two systems will be presented, including a parasite-like herbivore (the

gall midge *Rhopalomyia californica*) and a parasitoid (*Anagrus* sp.).

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When maize plants are damaged by caterpillars they initiate the release of a blend of specific volatiles. This odorous blend is used as an effective host location cue by parasitoids of the caterpillars.

We study ways to exploit and improve this indirect plant defense for biological pest control. Field assays with plants that were treated to release induced volatiles showed higher attraction of parasitoids to these plants. We obtained less conclusive results with field experiments using maize inbred lines that show clear differences in the induced odors they emit, but found promising differences in parasitism rates and indications that particular plant compounds may be responsible for these differences. I will discuss our current research approach in which we make use of a six-arm olfactometer that allows the testing of multiple maize varieties for attractiveness while simultaneously collecting part of the odor of these plants for subsequent chemical analyses. The purpose of these experiments is to determine the compounds that are most important for attraction and are likely candidates for successful manipulation of parasitoid attraction.

Pentalonia nigronervosa

Plants respond to herbivory by producing volatiles that attract natural enemies of the herbivores responsible for the damage. Early studies of this phenomenon have focused on lepidopterous larvae and mites, but more recent work has included other arthropods as well. For several years we have studied plant response to exogenous elicitors and to herbivory by *Lygus* spp., a crop pest with piercing-sucking mouthparts. The blend of herbivore-induced plant volatiles (HIPVs) emitted after *Lygus* feeding is a complex mixture of compounds that vary in concentration. Little is known about the perception of these compounds by *Lygus* or its natural enemies, or the subsequent influence of these chemicals on their behavior. This poster describes our work on the perception of HIPVs by two economically important *Lygus* species, and by *Anaphes iole* Girault, an egg parasitoid of *Lygus*. Our ultimate goal is to apply knowledge of HIPV-insect interactions toward biological control of *Lygus*.

Z)-3-hexenyl acetate *Z*)-2-hexenyl acetate

Male *A. iole* were most responsive to c-3-hex-1-ol, α-farnesene, and (*Z*)-3-hexenyl acetate. For *L. lineolaris* and *L. hesperus*, both genders were most responsive to green leaf volatile alcohols. The terpenoid α-farnesene also elicited a strong response by *L. lineolaris*. Results from behavioral trials in a four-armed olfactometer indicated that female *A. iole* were significantly ($P<0.0001$) attracted to (*Z*)-3-hexenyl acetate. Ongoing behavioral trials will test the response of *A. iole* to other HIPVs. Our results suggest that *A. iole* and *Lygus* spp. exhibit differential perception of plant volatiles. *Anaphes iole* appeared to be responsive to most of the compounds tested; *Lygus* spp., however, exhibited little response to several compounds. For *A. iole*, differential selectivity and sensitivity between the genders suggests the importance of different chemicals for male and female wasps. Males may be more responsive to chemicals involved in sexual communication than to plant-produced compounds. Heightened sensitivity by female antennae to several of the HIPVs suggests roles in host habitat location. For *Lygus*, our results suggest that green leaf volatiles and α-farnesene might play roles in plant host finding and acceptance. Green leaf volatiles, relatively common plant volatiles, may be important for general host plant orientation, while α-farnesene, induced by *Lygus* feeding, may play a role in host acceptance. The effect of these volatiles on *Lygus* behavior remains to be studied.

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Species of *Aphelinus* in the *varipes* complex have been imported into the US and released for biological control of *Schizaphis graminum* and *Diuraphis noxia*. Several different names have been applied to these species including *Aphelinus varipes*, *albipodus*, *nigritus* and *hordei*. Here we concentrate on sympatric pairs of populations reared from *Rhopalosiphum padi* and *D. noxia* from France and Georgia (former USSR). A companion paper by Hopper et al. presents evidence that all four of these forms are reproductively isolated and have different patterns of host utilization. A complex of cryptic species is clearly involved. Portions of COI and COII (mitochrondrial genes) and ITS1 and 28sD2 region (nuclear ribosomal genes) show little differentiation among these four species but the majority of nucleotide substitutions and insertion-deletion events that are present occur as autapomorphies in single species. Morphometric study of size and shape differences in the antennae, wings and mesosoma of these four species reveals that they are differentiated from one another by subtle, but consistent differences in the shape of antennal segments, the shape of the delta region in the forewing, and the shape of the lateral lobes of the mesoscutum. In general, both males and females of all four species are significantly different from one another with respect to each body region. Species that have more autapomorphic genetic differentiation are more strongly reproductively isolated, show more morphological differentiation in antennae, wings and mesoma, and have narrower host ranges than species with less autapomorphic genetic differentiation.