MEETING

ABSTRACTS OF PAPERS PRESENTED AT

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RESEARCH ON ACARI IN ISRAEL

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Opening Lecture

Acarina Research in Israel

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The Acarina are an important order of the Arachnida since they include pests (*e.g.* Tetranychidae, Eriophyidae), saprophytes feeding on organic matter of plant and animal origin (Acaridae, Oribatidae), vectors of animal and human diseases (soft and hard ticks) as well beneficials playing an important role as predators (Phytoseiidae, Cheyletidae, Hemisarcoptidae) in biological control of agricultural pests (mites and insects). As agricultural pests they are prevalent in both open fields and glasshouses of cultivated plants, vegetables, orchards, and ornamentals, as well as of stored products, livestock and beehives. Due to their short life cycle and genetic variability they are developing quickly resistance to pesticides and are therefore difficult to control.

In Israel (then Palestine) F.S. Bodenheimer in 1922 and H.Z. Klein (Avidov) in 1926 started the local research on phytophagous tetranychid mites attacking citrus: the oriental red mite, *Eutetranychus (Anychus) orientalis* (Klein), the common red spider mite, *Tetranychus telarius* (Linnaeus), and later on the common red mite *Epitetranychus althaeae* v. Hanst and *Bryobia praetiosa* Koch. In 1935 the biology, phenology, geographic contribution and natural enemies of those tetranychids and of the sooty-mold feeding mite, *Oribatula plantivaga* Berlese (Oribatidae) were studied. In 1944 H.Z. Klein found on citrus the citrus rust mite, *Phylocoptruta oleivora* Ashmead (Eriophyidae) and later, in 1953, E. Swirski studied its biology, ecology and reproduction.

Several studies were performed on the red spider mite, *Panonychus ulmi* Koch, by H.N. Plaut in 1963 and by H. Bytinski-Saltz in 1966. The pesticide effects of acarides were studied by H.N. Plaut, F. Mansour, K.R.S. Ascher and Rachel Cwilich. Biology, reproduction, taxonomy and distribution of predatory phytoseiid mites were studied by E. Swirski, A. Porath and S. Amitai. A local strain of *Phytoseiulus persimilis* Athias-Henriot is commercially bred by the Biological Control Laboratories at Sede Eliyyahu and distributed all over the world. M. Sternlicht described the reproduction strategy of the eriophyid *Aceria* (Eriophyes) *sheldoni* Ewing. M. Costa was a taxonomist of soil *Mesostigmata* mites. Bruria Feldman-Musham, A. Hadani and Rachel Galun investigated the biology, reproduction and epidemiology of ticks. M. Samish studied the natural enemies of ticks. Several research works on cytogenetics, hibernation and parthenogenesis of Phytoseiidae and Eriophyidae were conducted by M. Wysoki and E. Swirski. U. Gerson is a well known Israeli acarologist who studied soil mites, parasitic mites (*Hemisarcoptes coccophagus* Meyer (Hemisarcoptidae), mites of the Cheyletidae and Tydeidae families, and published several papers on the Acarina fauna of Australia. Recent studies of Acarina were presented at this meeting by U. Gerson, E. Palevsky and Y. Slabezki.

My Travels with Mites

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In a personal talk the speaker traced his development as an acarologist. Early work on the biological control of scale insects drew his attention to parasitic and predacious mites, especially *Hemisarcoptes coccophagus.* This interest arose from taxonomic treatments of several groups (Cheyletidae; Tydeidae; Raphignathoidea), which at that time were little known in Israel. Another important strand was a post-doctoral study of *Eustigmaeus* spp., mites that feed on mosses. Several major projects were then undertaken, with local and overseas colleagues.

Spider mite webbing: The first-ever exploration of factors (temperature, humidity, plant host, pesticide) affecting acarine webbing, their amino acid constituents and the significance of the web for mite survival.

Rhizoglyphus: This mite became a major pest of onions and garlic in the late 1970s. We evaluated control measures, and determined the source of the pest, which turned out to be a soilborne mite, the outbreaks of which were brought about by agricultural practices. *Rhizoglyphus* was subsequently used as a model in laboratory studies of pesticide detoxification by mites.

Hemisarcoptes: The life history of this parasite of scale insects, its pattern of host tracking and utilization, and factors determining the sex ratio were studied in the field and laboratory. It proved to be a rare case where the females of a biparental arthropod can influence the sex of its progeny.

Hirsutella: We studied and evaluated three acaropathogenic species of this fungus for their ability to control phytophagous mites.

Other major projects, such as the European red mite, and bee mites, were discussed by other speakers.

More recently the speaker's interest has shifted to revising a book on the use of mites in the control of arthropod, weed and pathogen pests, and to the taxonomy of several Israeli and Australian mites, phytophagous as well as predacious.

Varroa and Tracheal Mites Attacking Honeybees in Israel

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The tracheal mite (*Acarapis woodi*) and the varroa mite (*Varroa jacobsoni*) are two major pests of the beekeeping industry in Israel and worldwide. They have a large economic impact on honey production and pollination of cultivated crop plants in Israel. The research on both mites is focused on their population dynamics throughout the year, damage to the colony, and the integrated pest management of the mites.

The varroa mite attacks honeybees, both adults and brood, and without appropriate treatment and management the colony will collapse. The mite originated in Southeast Asia, and from there spread throughout the whole world. In the beginning of the 1980s a large scale advance monitoring survey was carried out in order to discover the first signs of varroa mites in Israel. The mites were discovered in late 1984 simultaneously in many areas in Israel. Despite the advance discovery, the beekeeping industry in Israel suffered heavy losses of bee colonies and honey production from the mite during 1985 and 1986. The varroa mite completes its reproductive cycle in the sealed brood cells within the colony. The outside temperature and the environment in Israel enable continuous egg laying by the queen and development of brood throughout the year, thereby increasing the reproduction of the mites within the colonies. Therefore, the treatment against varroa is more complicated in comparison

with temperate zones. (The female mite with her offspring is protected from chemical treatments inside the sealed cells.)

Nowadays, it is impossible to keep bees in Israel without treatment against varroa mites. Until 1987 the treatments were based on a series of 10 to 15 fumigations with amitraz at intervals of 3–4 days. Since 1987 varroa control in Israel has been accomplished by using fluvalinate – a pyrethroid which acts as an acaracide against the mite, with very high efficacy. During 1997 the first cases of resistance to fluvalinate were discovered. Since then, the active ingredient against varroa is again amitraz. The invasion of varroa into Israel, the direct damage to the colonies and the need to treat with chemicals have changed the very delicate balance in the colonies and exposed them to secondary infections. This situation demands intensive consideration of all health aspects of the apiary.

The tracheal mite was discovered in Israel in 1994. It is a microscopic parasite that lives in the upper respiratory system of the adult honeybee. The reproductive cycle takes place within the trachea. A large population of the mite causes closing and destruction of the trachea. When the number of infected bees is high, especially during the low season, the population of the colony diminishes dramatically and later the colony will collapse. Fumigation with amitraz is very effective against the tracheal mites.

Intra- and Interspecific Competition between the Phytoseiids (Acari: Phytoseiidae) *Typhlodromus athiasae* and *Neoseiulus californicus*

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The phytoseiid mite *Typhlodromus athiasae* (Phytoseiidae) is a common biocontrol agent of the European red mite (ERM), *Panonychus ulmi* (Tetranychidae), an important secondary pest of apples in Israel. As the predator provides only partial biocontrol of ERM, we introduced another phytoseiid, *Neoseiulus californicus*, an efficient predator of ERM in apple orchards in temperate and subtropical regions. The establishment of *N. californicus* was monitored for three consecutive seasons. A month following its release, *N. californicus* was easily found on release trees. One and two years (1997 and 1998) following the release, *N. californicus* was recovered but population levels were negligible compared with those of *T. athiasae*. The behavioral patterns of these two species were compared in the laboratory in order to interpret field results. The studied traits included: (*a*) Larval frequencies of feeding, walking, intraspecific interaction and tendency to aggregate (when resting); *(b)* predation and cannibalism levels on phytoseiid eggs by young females; and *(c)*) the effects of a 10-day starvation period on young females in regard to ambulation speed, longevity, fecundity, progeny survival and sex ratio. Larvae of *T. athiasae* were almost inert, did not feed and hardly walked or interacted, whereas those of *N. californicus* fed, walked and interacted. Egg predation by adults of both species was substantially higher than cannibalism, implying that adults of both phytoseiids are capable of recognizing their eggs. Adult predation on eggs by *N. californicus* was significantly higher than that by *T. athiasae.* Cannibalism was similar for both species. During a 10-day starvation period, the ambulation speed of *N. californicus* ranged from 1.8 to 10.1 times that of *T. athiasae.* Mortality of *T. athiasae* was observed from the 2nd day of the starvation period, whereas the first *N. californicus* succumbed only on the 7th day. None of the *T. athiasae* (of mites surviving the 10-day period) recovered following the reintroduction of prey, whereas 75% of *N. californicus* recovered and resumed oviposition after 2 days. These adult traits should enable *N. californicus* to persist when prey is scarce; however, the selective predation of *N. californicus* eggs by *T. athiasae* could prevent the establishment of *N. californicus* in the orchard. The degree of specialization of these two predators was discussed.