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EURopeanAssociationofACarologists

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IN THIS ISSUE:
- Spotlight on recent exciting findings on mites
- Young acarologists present their research
- Upcoming events: ICA Recife 2010

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Editors: Peter Schausberger + Stefan Peneder

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DEAR ACAROLOGISTS

This is the 1st issue of the EURAAC Newsletter. It could also be called an Oldsletter - it was supposed to appear in May 2009 - but the delay in appearance was caused by an unexpected necessary change in co-editorship. Anyway, the co-editorship issue has now been settled and the next issues should appear on time (two times per year in May and November).

The Newsletter comprises six sections: Spotlight, Forum, Theses, Media, Job openings and Events. In the Spotlight section, EURAAC committee members (in this issue a purely subjective selection by Peter Schausberger) highlight three recent (past 6 months) exciting findings on mites or ticks, two of which by European researchers. The Forum section is open to miscellaneous mite- or tick-related announcements or comments. The Theses section introduces recently finished MSc and PhD theses on mites or ticks. The Media section is dedicated to announcements of new books, journals, CDs, videos, and webpages. The Events section announces scientific events of potential acarological interest.

Thanks to all contributors who kindly shared their news and informations with us. Please keep on informing us, the Newsletter lives from the contributions of its readers. As a matter of course, contributions are not restricted to Europe but are welcome from all over the world. Please send your contributions to euraacnews@boku.ac.at. Deadline for news to be included in the 3rd issue (May 2010) is end of April.

The Editors
Peter Schausberger + Stefan Peneder

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April 2009. **Ros V.I.D.* & Breuwer J.A.J.** disentangle the effects of two endosymbiotic bacteria infecting one and the same spider mite host. Heredity 102, 413-422
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THE EFFECTS OF, AND INTERACTIONS BETWEEN, *CARDINIUM* AND *WOLBACHIA* IN THE DOUBLY INFECTED SPIDER MITE *BRYOBIA SAROTHAMNI*

Many arthropods are infected with vertically transmitted, intracellular bacteria manipulating their host's reproduction. Cytoplasmic incompatibility (CI) is commonly observed and is expressed as a reduction in the number of offspring in crosses between infected males and uninfected females (or females infected with a different bacterial strain). CI is often related to the presence of *Wolbachia*, but recent findings indicate that a second reproductive parasite, *Cardinium*, is also capable of inducing CI. Although both *Wolbachia* and *Cardinium* occur in arthropods and may infect the same host species, little is known about their interactions. We observed *Wolbachia* and *Cardinium* in the sexual spider mite *Bryobia sarothamni* (Acari: Tetranychidae) and investigated the effects of both bacteria on reproduction. We performed all possible crossing combinations using naturally infected strains, and show that *Cardinium* induces strong CI, expressed as an almost complete female mortality. *B. sarothamni* is the third host species in which *Cardinium*-induced CI is observed, and this study reveals the strongest CI effect found so far. *Wolbachia*, however, did not induce CI. Even so, CI was not induced by doubly infected males, and neither singly *Wolbachia*-infected nor doubly infected females could rescue CI induced by *Cardinium*-infected males. Possibly, this is related to the differences between *Cardinium* strains infecting singly and doubly infected individuals. We found a cost of infection in single infected individuals, but not in doubly infected individuals. We show that infection frequencies in field populations ranged from completely uninfected to a polymorphic state. In none of the populations infections were fixed.

January 2009. **Hoffmann D.*, Vierheilig H., Riegler P. & Schausberger P.** link below- and above-ground processes and document that arbuscular mycorrhiza enhances population growth of spider mites. Oecologia 158, 663-671
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ARBUSCULAR MYCORRHIZAL SYMBIOSIS INCREASES HOST PLANT ACCEPTANCE AND POPULATION GROWTH RATES OF THE TWO-SPOTTED SPIDER MITE *TETRANYCHUS URTICAE*

Most terrestrial plants live in symbiosis with arbuscular mycorrhizal (AM) fungi. Studies on the direct interaction between plants and mycorrhizal fungi are numerous whereas studies on the indirect interaction between such fungi and herbivores feeding on aboveground plant parts are scarce. We studied the impact of AM symbiosis on host plant choice and life history of an acarine surface piercing-sucking herbivore, the polyphagous two-spotted spider mite *Tetranychus urticae*. Experiments were performed on detached leaflets taken from common bean plants (*Phaseolus vulgaris*) colonized or not colonized by the AM fungus *Glomus mosseae*. *T. urticae* females were subjected to choice tests between leaves

from mycorrhizal and non-mycorrhizal plants. Juvenile survival and development, adult female survival, oviposition rate and offspring sex ratio were measured in order to estimate the population growth parameters of *T. urticae* on either substrate. Moreover, we analyzed the macro- and micronutrient concentration of the aboveground plant parts. Adult *T. urticae* females preferentially resided and oviposited on mycorrhizal versus non-mycorrhizal leaflets. AM symbiosis significantly decreased embryonic development time and increased the overall oviposition rate as well as the proportion of female offspring produced during peak oviposition. Altogether, the improved life history parameters resulted in significant changes in net reproductive rate, intrinsic rate of increase, doubling time and finite rate of increase. Aboveground parts of colonized plants showed higher concentrations of P and K whereas Mn and Zn were both found at lower levels. This is the first study documenting the effect of AM symbiosis on the population growth rates of a herbivore, tracking the changes in life history characteristics throughout the life cycle. We discuss the AM-plant-herbivore interaction in relation to plant quality, herbivore feeding type and site and the evolutionary implications in a multi-trophic context.

October 2008. **Okabe, K.* & Makino, S.** suggest that wasps evolved pockets to house parasitic mites acting as their bodyguards. Proceedings of the Royal Society Biological Sciences 275, 2293-2297
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PARASITIC MITES AS PART-TIME BODYGUARDS OF A HOST WASP

Some bees and wasps that host mites have peculiar pocket-like structures called acarinaria. These have long been considered as morphological adaptations to securely transfer beneficial mites into nests, and thus are thought to be the product of a mutualistic relationship. However, there has been little compelling evidence to support this hypothesis. We demonstrated that the parasitic mite *Ensliniella parasitica*, which uses acarinaria, increases the reproductive success of its host wasp *Allodynerus delphinalis* by protecting it from parasitoid wasps. Every time the parasitoid *Melittobia acasta* accessed a prepupal or pupal wasp host cell, adult mites attacked it, continuously clinging to it and possibly piercing the intersegmental membrane of the parasitoid with their chelicerae. Subsequent mortality of the parasitoid depended on the number of attacking mites: an average of six mites led to a 70% chance of mortality, and 10 mites led to a 100% chance of mortality. In this way, parent mites protect the food source (juvenile wasps) for themselves and ultimately for their offspring. We propose that wasps evolved acarinaria to maintain this protective guarding behaviour.

ON THE WAY TO THE MOLECULAR DIAGNOSTIC OF SPECIES OF PHYTOSEIIDAE

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Difficulties and crisis in taxonomy

The family Phytoseiidae (Acari: Mesostigmata) is well known and studied because of the ability of several species within this family to limit mite pests in crops, all over the world. Like most of mites, Phytoseiidae are microscopic organisms (200 to 500 µm in length). Their specific identification is very difficult as the number of visible characters available for identification is limited. Some species are sometimes considered as different because only some seta lengths on the idisoma are different or because the number of teeth on the chelicera are different. However, it is sometimes difficult to accurately name a specimen because its measurements are in between those of taxa considered as two different species. Furthermore, the lack of valuable knowledge of the diagnostic value (importance) of some morphological characters make the identification difficult and quite subjective. This often leads to the existence of very morphologically close species whose validity would require to be tested.

To deal with taxonomy is thus not an easy task, often requiring highly specialized knowledge and a long time and experience to acquire it. May be, taxonomy has never been a central science as nowadays, as the 1.5 million species described to date represents only a fraction of the actual diversity on Earth. Furthermore, owing to the constant threat of biodiversity loss, there is an increasingly urgent need to accelerate the pace of species discovery and taxonomic databasing. These elements would normally lead to an increase of the number of taxonomists in the world. However, as everybody knows, we are in the opposite situation. The number of taxonomists decreases all over the world, involving two major risks (1) The anarchical increase of false new species; (2) the loss of expertise and we do not know anymore what we work on and what we talk about.

How to do? Could we imagine to simplify and at the same time make the identification process more reliable?

One tool developed to reach these aims, was the Barcoding approach, that consists in assigning a short DNA sequence (usually partial sequence of the gene CO1) to a known species, according to intra- and interspecific molecular divergences. This approach would furthermore allow the identification of the specimens whatever their development stage (whereas for Phytoseiidae mites, acccurate identification is only valuable at female stage).

The Acarology team of Montpellier SupAgro (UMR CBGP) developed for several years researches combining classic taxonomy and molecular diagnosis. These new approaches for Phytoseiidae have already allowed to solve some taxonomic problems. This is the particular topic of the PhD of Mireille Okassa who studied the suitability of several molecular markers for taxonomy reliability. She works on several species presenting an economic interest like *Phytoseiulus*

persimilis Athias-Henriot *Typhlodromus pyri* Scheuten, *Kampimodromus aberrans* (Oudemans), *Amblyseius andersoni* (Chant) and *Neoseiulus californicus* (McGregor) and their relative morphological close species. The first results show that two molecular markers could be suitable for species identification, 12S mtDNA and CytB mtDNA. The intraspecific distances are lower than the interspecific distances and no overlap is observed, encouraging the development of such approaches in combination with traditional taxonomy. This study opens furthermore several scientific research points for the future.

And for the future?

More than 500 DNA sequences of Phytoseiidae have already been obtained. They are compiled in a molecular library (database). However, this number is relatively small considering that several specimens of several populations of a same species have to be tested in order to accurately establish the molecular diagnostic thresholds (based on molecular distances). Only some species have been taken into account until now. Can we imagine to build a greater database compiling sequences of all the species of Phytoseiidae as possible? Can we imagine to structure this activity and to finance it? Can we imagine that such database could be free for all the taxonomists who contributed to its building? Can we imagine that this database would allow a direct assignment to the species name? We think that this constitutes one of the dream / challenge for future taxonomy of Phytoseiidae mites. And we would like to increase all the taxonomists interested in such an activity awareness. So what to do? Only send us specimens of identified species in pure (100%) alcohol. At last, why not imagining also as for morphological types deposited in institutes and/or museum (and remained available), to deposit also a "type DNA sequence" in this library when new species are described? We can imagine that if this database is complete, the problems of "false new species" would be limited.

Of course, this is not for tomorrow, of course more researches have to be carried out especially on the assignment algorithms, but of course this would be possible only if many species could be sequenced and tests realised to ensure these approaches.

ADDRESS TO SCIENTISTS OF ALL COUNTRIES (physicians, biologists, parasitologists, acarologists, zoologists, veterinarians, infectionists, epidemiologists)

by **Rakhima D. Zhaxylykova***
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Dear colleagues!

36 years ago the statement of consultants-dermatologists about safety for surrounding people of the patients releasing demodexes from the skin served as a reason to conduct more careful clinical monitoring of the skin condition of gastroenterologic patients. By the end of our basic clinical scientific work we had

own conclusion: demodexes are the cause of people demodectic acariasis, which is rather contagious.

When we re-examined the received results we found out the following facts: besides demodexes on the people skin there are frequently discovered dermatophagoideses, which cause the homonymous acariasis. Some patients have sarcoptids, which not just simply present on them (as considered by scabiologists), but cause a subclinical variant of sarcoptic acariasis. Very seldom other mites of the household dust cause a homonymous acariasis.

Results of our researches are provided in our numerous publications. In clinical medicine acariasis is not diagnosed. There is not proper struggle with acariasis. Therefore acariasis grows progressively and results in various complications, which doctors of all clinical specialties encounter now. Displays of acariasis are clearly visible clinically, with simple unaided eye. We developed methods of full treatment of some the illnesses, which are actually clinical masks of acariases. For example, our knowledge of acariasis allows us to show full treatment of some patients suffering an allergy and allergodermatoses, for which the official medicine ascertains as an allergy on food or sunlight.

For the patient and the doctor of XXI century the purposeful acarologic inspections are important. To draw attention of acarologists to the problem we spoke at the Congress of European Association of Acarologists in Montpellier in 2008. Acarologic aspects of the problem of acariasis are summed up in the article sent to the specialized International Magazine.

Our achievements took place due to the moral and material support of academicians B.A. Atchabarov and M.E. Zeltzer, with assistance of some scientists, heads and doctors of practical public health services of the cities of Almaty, Kentau, Astana (Kazakhstan). Publications of scientists of biological profile from many countries of the world rendered the invaluable help in interpretation of the results received by us. Many thanks to all of them.

Dear colleagues - allergists, dermatologists, rheumatologists, oncologists and specialists in other clinical disciplines! The rate of growth of illnesses in your branches of medicine makes you ascertain the epidemic distribution of diseases among people. We do not cease to trumpet for 28 years about presence on the planet of pandemic of acariases, which clinical masks now make up 70-90% of so-called "noninfectious diseases" registered in clinical medicine. As a matter of fact we approach to a single problem from opposite positions. It is time to unite our efforts in eradication of avalanchely extending illnesses. Only we thoroughly know the clinic of acariases.

Yours faithfully,

Rakhima D. Zhaxylykova

PS: Documentary proofs of the stages of our researches is in the www.allergy.kz .

BIOEFFICACY OF CLOFENTEZINE 50 SC AND FLUFENZIN 20 SC AGAINST BROAD MITE, *POLYPHAGOTARSONEMUS LATUS* (BANKS) ON CHILLIES, TAMIL NADU, INDIA

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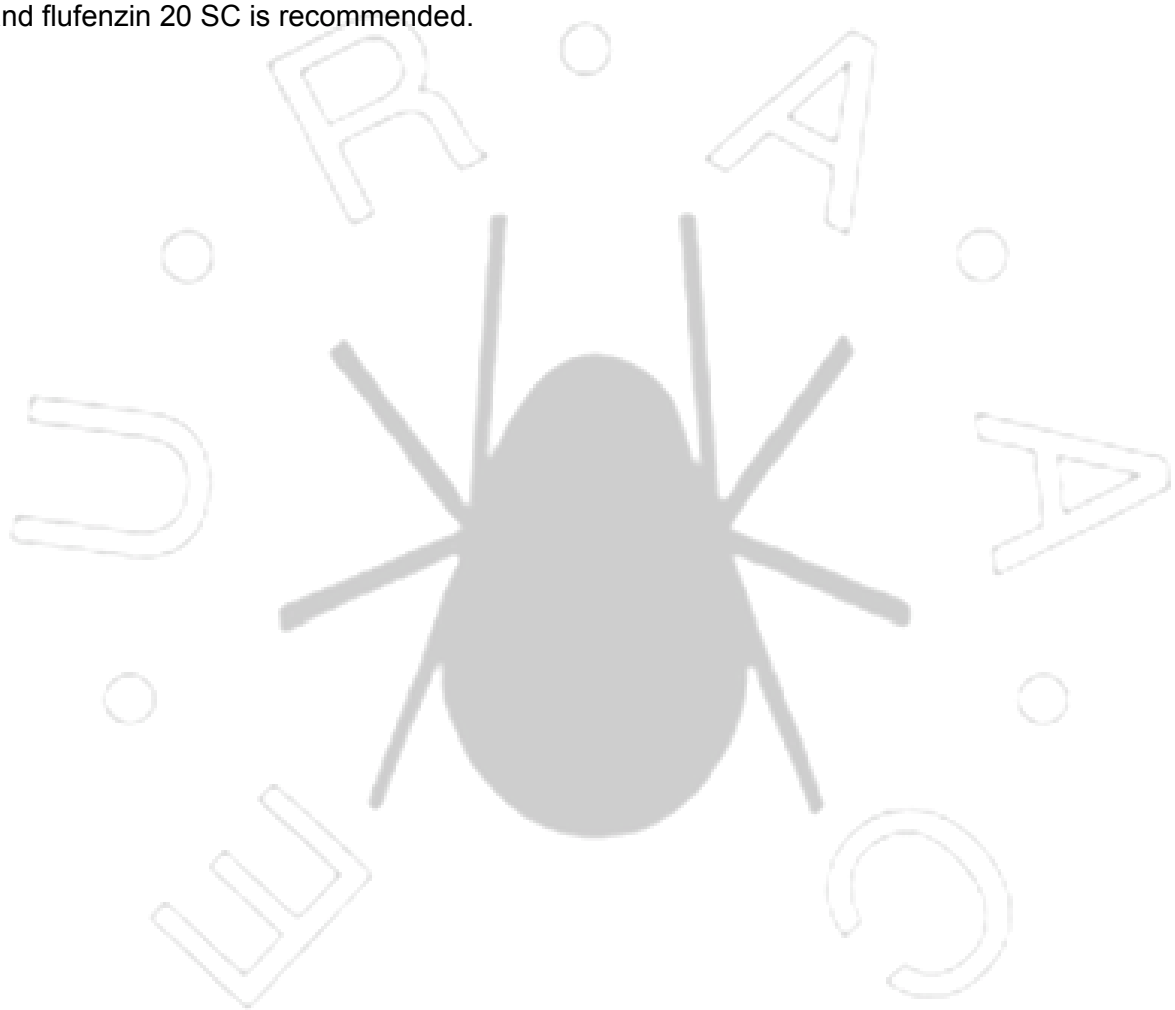
Chilli (*Capsicum annuum* L.) is world's second most important solanaceous vegetable crop. India is the largest producer of chillies in the world contributing 25 per cent of the world production. It is cultivated in an area of 9.15 lakh ha. in India with a production of 10.18 lakh tonnes of dry chillies. It is one of the major commercial crops grown under both irrigated and rainfed conditions in different states. It suffers attack by more than 300 different insect and mite pests, among them chilli mite, *Polyphagotarsonemus latus* (Banks) and thrips, *Scirtothrips dorsalis* Hood, both in nursery and main field. If the plants are attacked in flowering stage, the flowers may wither and dropped down, the fruits of attacked plants are much smaller than the normal and the crop fails to yield more than one or two pickings which results in 60 - 75 per cent yield reduction in affected areas. Two field experiments were conducted to evaluate the efficacy of new acaricides *viz*., clofentezine 50 SC and flufenzin 20 SC against broad mite, *P. latus* on chillies near Coimbatore. The variety used was Namadhari and K-10 hybrids. The experiments were laid out in a Randomised Block Design with eight treatments. The treatments include clofentezine 50 SC 200 g a.i. ha^{-1}, 250 g a.i ha^{-1}, 300 g a.i ha^{-1}, flufenzin 20 SC 60 g a.i ha^{-1}, 80 g a.i ha^{-1}, 100g a.i ha^{-1}, dicofol 18.5 EC 462 g a.i. ha^{-1}(standard check) and untreated control. Two rounds of spraying were given at 14 days interval. Six plants were selected at random from each plot for observation. From each plant two growing tips were selected and populations of nymphs and adults of yellow and predatory mites were recorded on 0, 3, 7, 10 and 14 days after each spraying and expressed as numbers / leaf let. The extent of phytotoxicity, if any, was recorded. The yield data on green chilli was recorded.

The results indicated that flufenzin 20 SC at 100 g a.i. ha^{-1} was found to be the most effective treatment against mites at Pachapalayam location (Trial I) with a mean population reduction of 67.83 and 85.17 per cent over control up to 14 days after the first and second round of spraying, respectively. Similar trend was also observed in the second trial (Location: Coltonpet) with a mean population reduction of 82.01 and 85.57 per cent over control up to 14 days after the first and second round of spraying, respectively. The higher dose of flufenzin100 g a.i. ha^{-1} recorded a cumulative mean reduction of 78.20 and 83.50 per cent in the first and second trial, respectively. This is followed by clofentezine 300 g a.i. ha^{-1} and flufenzine 80 g a.i. ha^{-1}. The standard check dicofol 462 g a.i. ha^{-1} was moderately effective.

Among the chemicals tested, dicofol (462 g a.i. ha^{-1}) was found to be the most toxic to predatory mites by recording a highest mean per cent reduction of 96.67 and 100.00 after the first and second round of spraying, respectively. All the three doses of flufenzin *viz.,* 60, 80 and 100 g a.i. ha^{-1} and clofentezine *viz*., 200, 250 and 300 g

a.i.ha^{-1}, were moderately toxic to predatory mites. Application of clofentezine and flufenzin did not cause any phytotoxic symptoms on chillies, irrespective of doses in both the trials. Clofentezine 300 g a.i. ha^{-1} recorded a maximum yield of 14.10 and 15.30 tonnes of green chilli fruits ha^{-1} at Pachapalayam and Coltonpet, respectively. Based on the results, need based application of clofentezine 50 SC and flufenzin 20 SC is recommended.



BIOLOGY, ECOLOGY AND MANAGEMENT OF SPIDER MITES (ACARI: TETRANYCHIDAE) IN CALIFORNIA VINEYARDS

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Spider mites cause significant damage in California vineyards leading grape growers to treat more than 100,000ha annually with pesticides. *Tetranychus pacificus* McGregor and *Eotetranychus willamettei* (McGregor) (Acari: Tetranychidae) are the two most common spider mites in vineyards. The western predatory mite, *Galendromus occidentalis* (Nesbitt) (Acari: Phytoseiidae), is an important natural enemy of both spider mites.

Temperature is a critical factor influencing pest outbreaks. I evaluated the effects of temperature on life histories of the three mites and found that higher temperatures are more favorable for *T. pacificus* than for *E. willamettei* and *G. occidentalis.* The upper development threshold was estimated to be 31, 37 and 40°C for *E. willamettei, G. occidentalis* and *T. pacificus*, respectively. *T. pacificus* developed significantly more rapidly than *E. willamettei* above 23°C, whereas *G. occidentalis* developed significantly faster than either spider mite from 11 to 36°C.
Water stress is another factor influencing spider mite outbreaks. A field study showed that plant water stress increased grape leaf surface temperature. Densities of *T. pacificus* increased significantly with increasing frequency of leaf temperatures above 31°C while those of *E. willamettei* showed no relationship and those of predatory mites (Acari: Phytoseiidae) showed a negative relationship. These results help to explain why outbreaks of *T. pacificus* occur in hot or water stressed vineyards, while *E. willamettei* develops higher populations in cool or well irrigated vineyards.

Applications of pesticides against other vineyard pests may affect biological control by *G. occidentalis.* The insecticides imidacloprid and buprofezin negatively affected the population growth of *G. occidentalis* but had no effect on *T. pacificus.* The fungicide wettable sulfur significantly decreased *T. pacificus* population growth but it did not affect *G. occidentalis*. In addition, the insecticides buprofezin and methoxyfenozide and the fungicide trifloxystrobin altered the stage structure of *G. occidentalis*.

Populations of *T. pacificus* from vineyards that reported acaricide failures in recent years developed statistically significant 11-fold resistance to pyridaben, seven-fold resistance to bifenazate and four-fold resistance to propargite compared to a susceptible laboratory population. These results underline the importance of alternation of products from different mode of action groups to delay resistance development.

BIOLOGICAL CONTROL BASES FOR *TETRANYCHUS URTICAE* KOCH IN CLEMENTINE ORCHARDS

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The two spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), is one of the most damaging tetranychid mites affecting clementine orchards in Spain. *Tetranychus urticae* has a high reproductive potential and shows a strong aggregative pattern. It inhabits the lower side of leaves, where it sucks on the leaf surface and covers it with a dense web. This web protects the individuals of the colony from predators, acaricides and adverse climatic conditions which hinders their control and makes them particularly well-adapted to high temperature and low relative humidity environments. Their feeding behavior lowers the nutrient contents of leaves and alters the normal transpiration and photosynthesis of the plant. Moreover, heavy *T. urticae* infestations combined with water stress can led to serious defoliations. The symptoms derived are yellowish chlorotic spots that can be visible on the upper side of leaves and characteristic fruit scarring that becomes highly visible during the ripening phase and downgrades fruit. To date, the control of this pest has been mainly based on the use of acaricides. However, this control method is not always as effective as desired and, furthermore, it can induce other environmental, social and economic problems. Development of alternative control methods is imperative. Within the citrus Integrated Pest Management program, much emphasis has been placed on implementing environmentally friendly and sustainable control measures for *T. urticae*. The general goal of this thesis was the improvement of the biological control of *T. urticae* in clementine orchards as one of these rational control measures. Knowledge of the natural enemies that co-occur with a given pest is essential when trying to improve its biological control. Isolated observations had reported a few predatory arthropods in association with colonies of *T. urticae* in citrus but studies in depth lacked. Therefore, from 2004 to 2007, we carried out a detailed survey of arthropod predators of *T. urticae* in Spanish clementine orchards. Eight predator species belonging to five different insect orders (Coleoptera, Diptera, Hemiptera, Thysanoptera and Neuroptera) and six phytoseiid mite species were found in association with *T. urticae* colonies. Among these natural enemies, three phytoseiid mite species: *Euseius stipulatus* Athias-Henriot, *Neoseiulus californicus* (McGregor) and *Phytoseiulus persimilis* (Athias-Henriot) were selected as possible candidates for future conservation and/or inoculative release strategies to enhance *T. urticae* control. In the laboratory, *E. stipulatus*, the dominant phytoseiid in our citrus agro-system, proved to be poorly adapted to prey on *T. urticae.* Conversely, under the same conditions, *N. californicus* and *P. persimilis* achieved a higher intrinsic rate of increase (rm) than *T. urticae* fed on clementine leaves. Moreover, when promoting these species by inoculative releases in semi-field conditions, they successfully controlled *T. urticae* populations throughout the year. In the field, these species reach low relative abundances even in presence of high *T. urticae* populations, leading to a poor natural control of the phytophagous mite. Laboratory and semi-field trials suggested that superiority in intraguild (IG) interactions by *E. stipulatus* on smooth surfaces (the most common patches found in citrus) over *N. californicus* and *P. persimilis* could contribute to the dominance of the first species and limit population build-up of the last two. Further knowledge of IG predation and non-lethal

IG effects between these species in field conditions may help to choose proper biological control strategies against *T. urticae*.

MOLECULAR CHARACTERIZATION OF ISRAEL'S SPIDER MITES (ACARI: TETRANYCHIDAE)

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Within my thesis I produced rDNA-ITS2 sequence barcodes for 16 of the spider mite (Tetranychidae) species of Israel and showed that these barcodes may serve as an applicable and effective diagnostic tool for quarantine and other pest management goals. I collected spider mites from 25 locations (different combinations of host/site) throughout the Mediterranean, semi-arid and arid climatic regions of Israel. The Israeli check list of Tetranychidae was updated to include 20 species, to which seven were added. I contributed sequences of 12 species to the international ITS2 database, most of which are agricultural pests, and recorded the genetic variation within these sequences. This could provide a future platform for the uniform, accurate, practical and easy-to-use routine of spider mite identification worldwide.

The ITS2 marker was found suitable for phylogenetic studies in spider mites. The barcoded species formed distinct, non-overlapping monophyletic groups in the Maximum-Parsimony phylogenetic tree, in congruence with the morphological classification, with one exception. Genus *Oligonychus* was not monophyletic in phylogenetic trees based on the two molecular markers, ITS2 and COI (mtDNA). The genetic distance between *O. afrasiaticus* and *Tetranychus* spp. was smaller than that to the other *Oligonychus* species, which were close to each other, according to both markers. This appears to reflect the heterogeneity within *Oligonychus* spp. as documented in previous morphological studies.

The most polymorphic species was the indigenous polyphagous *Eutetranychus orientalis*. Nevertheless one common sequence was present in all seven populations analyzed, indicating gene flow between these subpopulations and ruling out the suggested population structure or the existence of cryptic sister-species in Israel.
The lowest genetic divergence was found between *Tetranychus turkestani* and *T. urticae* RF (red form). The two species were mostly found in separate agricultural ecosystems: the former in deciduous orchards and the latter on vegetable crops. Mixed populations were found in a few fields of watermelon, which was the preferred host in laboratory assays. Such an overlapping habitat suggested a reproductive interaction between them which could affect their fitness.
In interspecific crosses the two species produced viable but sterile F_1 females, indicating a post-zygotic reproductive barrier. Males of both species courted virgin conspecific and heterospecific females at the same rate and readily tried to copulate with them. Female mate recognition seemed to be more reliable in *T. turkestani* than in *T. urticae* RF, as the number of copulations was significantly higher and their duration significantly shorter in the *T. turkestani* interspecific as compared to the intraspecific crosses, a phenomenon not observed in *T. urticae* RF crosses. In mixed cultures of one couple of each of the two species, *T. urticae*

RF suffered a nearly significant reduction in female progeny ratio, which was not observed for *T. turkestani*, suggesting an asymmetric reproductive interference in favor of the latter. A significant 40% reduction in female production took place in a whole-plant experiment, consisting of 20 couples of the two species, during one generation. The long-term outcome of this effect is yet to be determined, because additional reproductive factors such as a higher oviposition rate and better progeny survival to adulthood in *T. urticae* RF may reduce the probability of its displacement by *T. turkestani*, when sharing the same host-plant.

IDENTIFICATION AND ECOLOGICAL CHARACTERIZATION OF NATURAL ENEMIES OF THE COCONUT MITE *ACERIA GUERRERONIS*: THE BRAZILIAN EXPERIENCE

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The thesis comprises four studies on the occurrence and ecology of the coconut mite *Aceria guerreronis* (Eriophyidae) and its natural enemies, with the common objective of developing a biological control strategy against the pest mite. (1) Coconut growing areas of Brazil were surveyed aiming to determine the occurrence and distribution of phytophagous mites, particularly *A. guerreronis*, and associated natural enemies. *A. guerreronis* was the most abundant phytophagous mite followed by *Steneotarsonemus furcatus* (Tarsonemidae). *Neoseiulus paspalivorus* and *N. baraki* (both Phytoseiidae) followed by *Proctolaelaps bickleyi* (Ascidae) were the most abundant predatory mites. Climate factors and surrounding vegetation influenced mite occurrence. (2) The fine scale spatial distribution of *A. guerreronis* and associated competitors and predators in the chambers under the coconut perianth was investigated. *A. guerreronis* preferentially resided in the tightest chambers to the fruit surface. *S. furcatus* and *N. baraki* showed a different but more similar repartition among the chambers than *P. bickleyi*. (3) The life history characteristics of *N. paspalivorus* and *P. bickleyi* when feeding on *A. guerreronis* were determined and other potential food sources tested for their suitability. Both predators thrived on *A. guerreronis* resulting in shorter developmental time, higher oviposition rate and higher intrinsic rate of increase than achieved with any other diet. (4) The compatibility of *N. paspalivorus* and *P. bickleyi* in spatial niche use and intraguild predation were studied. Both predators preferentially resided and oviposited inside the tight chambers. The oviposition rate of *P. bickleyi* and residence time of *N. paspalivorus* inside the chamber were reduced in the presence of a conspecific female. Residence behaviour of *N. paspalivorus* was also influenced by the presence of *P. bickleyi*. Intraguild predation was relatively moderate.

MULTIPOLAR INTERACTIONS BETWEEN BEETLES, MITES AND FLIES: DISPERSAL STRATEGIES FOR THE USE OF EPHEMERAL TROPHIC RESOURCES

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Phoresy is a dispersal mode for inadequately mobile organisms that use carriers. The aim of our work is to study the mechanisms that govern phoresy among three partners: Scarabaeidae beetles – Sphaeroceridae flies - Macrochelidae mites.

The diversity of host-phoretic interactions has been analysed, with descriptions of new mite species and the study of two main dispersal strategies: generalist and specialist. Phoresy determination needs precise recognition of the host by the phoretics, with a choice of potential available carriers, and a tendency to specialization which probably favours speciation. Laboratory experiments (behavioural and olfactometric tests) and chromatographic analyses have been driven to separate visual and chemical stimuli (cuticular products) in carrier discrimination.

The host choice is based on chemical criteria for mites, on visual criteria for flies. Dung beetles carry their phoretics to their pedotrophic nest where the mites regulate the number of phoretic flies by predation on eggs and larvae, with, in reaction, a shortening of the fly development length compared to other coprophilous flies. An analysis of different Macrochelid mite species affinity, using morphological, molecular and behavioural data, shows that the specialized choice of a carrier could appear independently in the different mites lineages.

BIODIVERSITY OF MITES ASSOCIATED WITH INSECTS IN TAMIL NADU, INDIA

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Investigations on the mites associated with insects in Tamil Nadu, India, revealed, the association of phoretic or parasitic mites with the insect orders *viz*., Coleoptera, Orthoptera, Hymenoptera, Odonata, Diptera, Dermaptera and Hemiptera. The mesostigmatid mites were predominantly phoretic and all astigmatid mites were either specialized phoriants on their hosts or detrivores. Only a few prostigmatids had parasitic relationship with their hosts. Thirty-one insect associated mites under 14 families of class Acari have been discovered and identified. Of them, 13 belong to Mesostigmata, 12 to Prostigmata and 6 to Astigmata. A few mites were described new to science. Five mites have been reported for the first time in Tamil Nadu.

Two *Macrocheles* sp. of 'limue' complex of glaber group S. Str. in Tamil Nadu, India as phoretic associates of scarabaeid beetles were identified for the first time. A few economically important parasitic mites species *viz*., *Leptus* spp. on grasshoppers and *Allothrombium maduraiensis* sp. nov. and *Allothrombium elaterinae* sp. nov on click beetle and *Cheletomorpha acanthaspisae* sp. nov. on reduviid bug have been reported.

Two mite species were identified and described for the first time in Tamil Nadu

from dammer bee colonies *viz*., *Blattisocius trigonae* sp. nov. and *Fuscuropoda irridipennae* sp. nov. as new to science. The other mite species studied include: *Digamasellus rhynchophorae* sp. nov., *Digamasellus coleophorae sp. nov., Eviphis spatulaesetae* Ram. and Moh., *Uroobovella trilophinae* sp. nov., *Sejus cerambicenae* sp. nov., *Dinogamasus dipterae* sp. nov., *Gamasellus onitae* sp. nov., *Hypoaspis pseudoachetae* sp. nov. and *Rhyzolaelaps batocerae* sp. nov. under Parasitiformes as phoretic ones; *Imparipes bengalensis* sp. nov., *Grandiella batocerae* Vis. and Moh., *Sennertia carpenteri* Ram. and Moh., *Acarus coleophorae* sp. nov., *Caloglyphus ferruginae* sp. nov. and *Calvolia falcatae* sp. nov. under Acariformes presumed to be parasitic.

Biodiversity indices revealed that mite species richness was maximum in Aliyar Nagar location and minimum in Othagamandalam. Mite species diversity was rich in Mettupalayam and low in Othagamandalam and Evenness of mites was observed maximum in Mettupalayam and minimum in Othagamandalam. Insect associated mite species collected from Ramanatham and Aliyar Nagar locations showed 96 per cent similarity. Species richness and species diversity was maximum insect family for Curculionidae and minimum for Reduviidae. Species richness, species diversity and evenness were high in the suborder Prostigmata and low in Astigmata.

STUDIES ON THE DETERMINATION AND HOST PLANTS OF TENUIPALPIDAE (ACARINA: PROSTIGMATA) SPECIES IN ANKARA

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During 2005-2006, 1130 samples were obtained from ornamental shrubs and plants of the parks in Ankara. In this study, 124 plants species were examined and out of them 23 plants species were infected by mites. In totally 11 species were identified in the family of Tenuipalpidae. The species of *Aegyptobia cupressus* (Baker and Tuttle 1972), *A. aletes* (Pritchard & Baker 1958), *A. salisicola* (Al-Gboory 1987), *Cenopalpus lanseolasetae* (Attiah 1956) and *Pentamerismus erythreus (*Ewing 1917) were considered as new record for the Turkish Acari fauna.

Beside the phytophagous mites 5 beneficial mite species such as *Antoseius bagdasarjani* (Wainstein et Arutunjan) 1967, *Antoseius tranquillus* (Livshits & Kuznetzov 1972), *Cheyletogenes ornatus* Canestrini et Fanzago, 1876, *Zetzellia mali* (Ewing) and *Tydeus* sp. were identified during the surveys in Ankara.

Cenopalpus pulcher Canestrini and Fanzago 1876 is the most common phytophagous species followed by *Pentamerismus oregonensis* McGregor, 1949 and *P. taxi* (Haller,1877) in Ankara from shrubs and plants of the parks. Cupressaceae is the most important host plants for the Tenuipalpidae.

POSSIBILITIES OF USING FUNGAL PATHOGENS AGAINST TWO-SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* KOCH ON OKRA, TAMIL NADU, INDIA

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Studies were carried out both in laboratory and field to assess the bioefficacy, safety of fungal pathogens *viz., Hirsutella thompsonii* Fisher, *Beauveria bassiana* (Bals.-Criv.) Vuill and *Metarhizium anisopliae* (Metschn.) Sorokin against two-spotted spider mite, *Tetranychus urticae* Koch, predatory mite, *Amblyseius longispinosus* (Evans) and eggs of *T. urticae*. In laboratory (25 ± 1^{0}C and 90 ± 5% RH), the LC_{50} of *H. thompsonii* (Mycohit formulation) to *T. urticae* was determined to be 1.03 x 10^5 cfu ml^{-1}. The LT_{50} of *H. thompsonii* at the concentration of 2.5 x 10^4, 2.5 x 10^5 and 2.5 x 10^6 cfu ml^{-1} were 5.25, 4.90 and 4.76 days, respectively. The LC_{50} of *B. bassiana* to *T. urticae* was estimated to be 1.46 x 10^5 spores ml^{-1}. The LT_{50} values of *B. bassiana* at the concentration of 10^4, 10^5 and 10^6 spores ml^{-1} were 5.36, 4.95 and 4.85 days, respectively. The LC_{50} of *M. anisopliae* to *T. urticae* was estimated to be 2.7 x 10^6 spores ml^{-1}. The LT_{50} values of *M. anisopliae* at the concentration of 10^5, 10^6 and 10^7 spores ml^{-1} were 5.17, 4.71 and 4.57 days, respectively. The LC_{50} values of fungal pathogens, *H. thompsonii*, *B. bassiana* and *M. anisopliae* against eggs of *T. urticae* were 755.03, 681.20 and 775.83 conidia mm^{-2}, respectively.

Egg mortality studies were also conducted to assess the ovicidal effect of fungal pathogens. Among the fungal pathogens tested, *B. bassiana* caused significantly higher mortalities (37.50 per cent) at higher conidial concentration (1232 conidia mm^{-2}) followed by *M. anisopliae* (31.80 per cent) and Mycohit formulation containing *H. thompsonii* (24.27 per cent). At high conidial concentrations, all fungal pathogens caused significantly higher mortalities than the medium and low conidial concentrations. Mycohit formulation (*H. thompsonii*) caused lower mortalities of 24.27, 18.44 and 15.00 with higher (962), medium (360) and low (45) conidia mm^{-2}, respectively.

The results from pot culture experiments showed that *H. thompsonii* (Mycohit 50 g lit^{-1}) was found to be more effective by causing a cumulative reduction of 49.64 per cent and 57.78 per cent mite population over control. In both the pot culture experiments, *M. anisopliae* recorded the lowest cumulative per cent reduction.

It was also observed in pot culture experiments that the standard check dicofol brought down the predatory mite population to very low levels than other treatments. Among the fungal pathogens tested, *M. anisopliae* adversely affected the predatory mite population. Like wise, in field experiments the standard checks dicofol and wettable sulfur brought down the predatory mite population to very low levels than other treatments. Among the fungal pathogens tested, *M. anisopliae* had adverse effect on the predatory mite with cumulative per cent reduction of 30.90 and 29.29 at Singanallore and Vellalore locations, respectively. The results of the two field trials conducted on okra indicated that, among the fungal

pathogens, Mycohit 50 g lit^{-1} recorded the highest cumulative per cent reduction of mites 51.37 and 55.22 at Singanallore and Vellalore, respectively. *M. anisopliae* was found to be less effective against *T. urticae* causing cumulative per cent reduction of 25.12 and 26.29 at Singanallore and Vellalore, respectively. The standard checks, dicofol and wettable sulfur recorded highest cumulative per cent reduction in both the field trials. Mycohit 50 g lit^{-1} recorded the highest yield of 5115.75 Kg ha^{-1} and 5343 Kg ha^{-1}at Singanallore and Vellalore, respectively.

EVALUATION OF ABAMECTIN 1.8 EC AND PROFENOFOS 50 EC AGAINST TWO SPOTTED SPIDER MITE ON OKRA, TAMIL NADU, INDIA

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Investigations were carried out both in the laboratory and field to study the acute toxicity, bioefficacy, phytotoxicity, safety to natural enemies and residues of abamectin and profenofos used against two spotted spider mite, *Tetranychus urticae* Koch. The LC_{50} values of abamectin and profenofos against *T. urticae* were 0.067 and 31.490 ppm, respectively, by leaf residual bioassay method. The LT_{50} values of abamectin were 4.111, 2.416 and 1.157 h for 0.05, 0.10 and 0.20 ppm and LT_{50} of profenofos were 19.308, 11.188 and 6.839 h for 20.0, 40.0 and 80.0 ppm, respectively. The pot culture results showed that abamectin 0.0012 per cent was found to be more effective by reducing the two spotted spider mite population 92.53 per cent over control. Abamectin was ineffective as an ovicide, when compared to profenofos which registered higher action (76%). The results of the two field experiments conducted on okra indicated that the higher dose of abamectin (0.0012%) was more effective against *T. urticae* when compared to other treatments. However, the recommended dose of abamectin (0.0009%) was also equally effective and next best to higher dose in terms of reduction in mite population and increase in yield. The higher dose (0.0012) was the most effective treatment in reducing the mite population by 86.97 and 87.87 per cent at Thottadasanur and Thondamuthur locations, respectively after three sprays.

Dicofol 0.046 per cent was found to be toxic to predatory mites and recorded 69.90 and 65.31 per cent reduction in predatory mite population after three rounds of spraying at Thottadasanur and Thondamuthur, respectively. Abamectin 0.00045 per cent was comparatively safer to predatory mites.

No phytotoxic symptoms were recorded in any of the treatments. The residues of abamectin were detected in okra fruits up to 24 h after treatment at 0.00045, 0.0009 and 0.0012 per cent and reached below detectable level three days after application. Abamectin 0.0012 per cent recorded higher initial deposit of 0.401 and 0.362 $\mu g\ g^{-1}$ at Thottadasanur and Thondamuthur locations, respectively. The rate of dissipation was faster for abamectin. The residues of profenofos were detected on fruits up to seven days at Thottadasanur and five days at Thondamuthur. The half-life value arrived for profenofos 50 EC at 0.10 per cent was 1.9907 days and the suggested waiting

period for safe consumption of fruits after spraying was 3.2296 days. Abamectin 0.0012 per cent recorded the highest yield of 6840.25 and 7505.00 kg ha^{-1} at Thottadasanur and Thondamuthur locations, respectively.

EVALUATION OF PROFENOFOS 50 EC AND ABAMECTIN 1.8 EC AGAINST ERIOPHYID MITE, *ACERIA GUERRERONIS* KEIFER, ON COCONUT

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Investigations were carried out both in the laboratory and field to study the bioefficacy, toxicity to beneficial insects, predatory mite and phytotoxicity of profenofos and abamectin and the residues of profenofos used against coconut eriophyid mite, *Aceria guerreronis* Keifer. The LC_{50} values of profenofos and abamectin were 0.114 and 0.032 ppm, respectively, by meristematic tissue dip method. The LT_{50} values of profenofos were 2.39 and 2.07 h for 0.50 and 1.0 ppm and LT_{50} of abamectin were 6.62, 4.28 and 2.04 h for 0.05, 0.1 and 0.2 ppm, respectively. Abamectin 0.0144 per cent effected higher population reduction of 99.59 and 80.60 per cent in button dip and peduncle dip method, respectively. The efficacy of abamectin increased with increased concentration.

Spot application of abamectin 0.0144 per cent was found to be more effective in reducing the eriophyid mite population by 75.91 and 66.64 per cent over control at Perur and Sundapalayam locations, respectively, with low nut damage grade. Root feeding with abamectin 7.5 ml + 7.5 ml water and 5 ml + 5 ml water resulted in moderate reduction of 58.84 and 51.44 per cent mite population, respectively. The other treatments effected less than 50 per cent reduction of mite population. None of the chemicals either by root feeding or spot application brought complete control of mites even after two rounds.

Abamectin 0.0144 per cent was toxic to predatory mites and recorded 72.05 and 62.46 per cent reduction after two rounds of spraying at Perur and Sundapalayam, respectively. The lower dose of profenofos 0.05 per cent was the least toxic treatment. In the case of root feeding, profenofos 20 ml + 20 ml water and abamectin 7.5 ml + 7.5 ml water recorded the highest per cent reduction of predatory mite population of 51.81 and 69.93 at Perur and Sundapalayam trials, respectively.

Spot application of insecticides on bunches was more effective in reducing the mite population and nut damage than root feeding. Abamectin 0.0018 per cent recorded higher per cent adult emergence (87.26%) of *Bracon brevicornis (*larval parasitoid of coconut leaf caterpillar) which was comparable with the untreated check. Profenofos 0.2 and 0.1 per cent and abamectin 0.0072 and 0.0144 per cent were toxic to honeybees and the mortality ranged between 52.78 and 65.00 per cent. No phytotoxic symptoms were recorded in any of the treatments. No detectable amounts of residues were found in coconut water and kernel up to 60 days after two rounds of spray. Residues were detected from 3rd day up to 30th day in coconut kernel and nut water in profenofos 15 ml + 15 ml water and 20 ml + 20 ml

water after the second round of root feeding (RF). The kernel samples had 0.014 and 0.021 μg/g residues in 15 ml + 15 ml and 20 ml + 20 ml RF, respectively while the residues were below detectable level in water samples from 45th day after treatment. Hence, a waiting period of 45 days is recommended for harvesting of tender coconuts and matured nuts after root feeding.

BOOKS

Krantz, G.W. & Walter, D.E (eds) (2009) A Manual of Acarology, 3rd edition. Texas Tech University Press.

JOURNALS

Acarologia

- changed the editor-in-chief (now Serge Kreiter) and celebrates its 50th anniversary.

http://www1.montpellier.inra.fr/CBGP/acarologia/index.php

Acarines

The 2nd volume of the journal of the Egyptian Society of Acarology, has already been issued.

http://www.esaeg.org

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VIDEOS

Jeffrey Newton, a Ph.D. candidate in the lab of Heather Proctor at the University of Alberta (Canada) posted videos of soil arthropods (mainly mites) on youtube for outreach purposes. He also offered to provide original files to people who want to use them for educational purposes.

Search for "Jeffrey Newton Mites" on www.youtube.com or contact jeffreysnewton@gmail.com.

WEBPAGES

Belgian acarologists launched a new website to popularize mites and ticks

http://www.acari.be/

Mitox Consultants in Amsterdam, Netherlands is looking for an

ACAROLOGIST WITH AFFINITY FOR TAXONOMY OF ORIBATIDA

We are:

An independent contract laboratory specializing in entomological research in the agricultural sphere.
- Experimental: Laboratory and field trials in Western Europe according to Good Laboratory Practice (GLP)
- Taxonomic: Identification of terrestrial arthropods
- Consultancy: risk assessment for NTA (non-target arthropods)

As of the first of April we offer an interesting job in a stimulating environment that gives enough space to deepen your own interests in Acari. You will work with experienced colleagues with a clear specialization. Initially the contract is for the duration of 1 year, including a probationary period of 1 Month. Extension in the future is possible, depending on the amount of work and proven ability from your side. Salary in accordance with education or comparable experience. Location: Amsterdam Science Park.

Your profile
We expect you to have a general knowledge of Acarology to identify mite groups in the samples taken from the field to the family level. Examining samples, extracting data and mounting mites will be your routine work at Mitox. It would be advantageous if you have a good knowledge of Oribatida mites to identify them to the species level (or at least to the genera level).

Application

Are you interested in the above position and you meet the required profile, please send your application letter with CV before February 25, 2010 to the following email address: Gerard.pennards@mitox.org
Or send it to: Mitox Consultants, Attn: Gerard Pennards. Science Park 406, 1098 XH Amsterdam, the Netherlands. More info on this email address, or call 0031207512036. Selection of candidates will take approximately 2 weeks and selected candidates will be notified.

INTERNATIONAL SYMPOSIUM CUM WORKSHOP IN ACAROLOGY 2010

April 8 to 10, 2010
Kalyani, Kolkata, India

http://www.bckv.edu.in/news_details.php?nID=c9f0f895fb98ab9159f51fd0297e236d8

XIII INTERNATIONAL CONGRESS OF ACAROLOGY 2010

August 23 to 27, 2010
Recife, Pernambuco, Brazil

http://www.cenargen.embrapa.br/ica13/

13TH INTERNATIONAL BEHAVIOURAL ECOLOGY CONGRESS 2010

September 26 to October 1, 2010
Perth, Western Australia

http://isbeperth2010.com/

3RD MEETING OF THE IOBC/WPRS WG "INTEGRATED CONTROL OF PLANT-FEEDING MITES"

September 13 to 15, 2011
Český Krumlov, Czech Republic

Peter Schausberger + Stefan Peneder

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