TEAM NEWSLETTER

TEPHRITID WORKERS OF EUROPE AFRICA AND THE MIDDLE EAST

No. 2 **July 2006**

TO OUR READERS

In this newsletter we present for the first time the logo of our group at the top right of this page. The idea for this logo was first conceived by David Nestel and then developed with the help of other members of the Steering Committee.

The last few months we also made decisions regarding the first Scientific Meeting, which will be held at the end of September or beginning of October 2007 in Majorca, Spain. The Organizing Committee of the Meeting will consist of Miguel Miranda (Chairman), Ana Alemany, Pedro Ros, Lola Ochando, Vincente Navarro, Rafael Argilles, Pedro Castanera, Andreu Muntaner, Nikos Papadopoulos, Abdel Bakri, Yoav Gazit and Rui Perreira. The Steering Committee of TEAM will serve as the Scientific Committee of the Meeting with the inclusion of Nikos Kouloussis, the editor of our newsletter. The Scientific Committee will be led by David Nestel and Abdel Bakri serving as co-chairmen. The first announcement for the Meeting will be sent out by September 2006.

This first Scientific Meeting of TEAM in Majorca will deal with the current advances in the ecology of fruit flies in Europe, Africa and the Middle East. The meeting will emphasize novel and emerging research areas that open new horizons to the study of Tephritidae and provide fresh concepts of how to approach them as agricultural threats. An important side aim of the meeting is to create for the participants the conditions to interact freely and informally. To this end we plan different forums for trading questions and answers regarding Tephritids, sharing ideas about management problems, discussing findings, planning coordinated research, etc. We expect this meeting to be innovative in promoting integration of the three regions of TEAM and strengthening cooperation between its members.

In September the fruit fly world meets in Salvador, Bahia, Brazil to attend the 7th International Symposium of Fruit Flies of Economic Importance, the 6th Meeting of the Working Group on Fruit Flies of the Western Hemisphere, and also Satellite Meetings that take place during the first two weeks of September. We are all excited about meeting fruit fly experts from all over the globe and discussing with them recent research findings, developments in the fruit fly business and ideas for the future of fruit fly research and management. The Steering Committee of TEAM will convene as well to address current issues and discuss the development of the group.

Despite difficulties the web page of TEAM is almost ready thanks to the efforts of the group of Abdel Bakri. You can find some more information about the web page below in this newsletter. We consider the web page of TEAM as a very important development facilitating and stimulating direct interaction among our members.

We would like once again to ask all members to contribute to this newsletter. Material to be included but also ideas for new thematic areas are very welcome. As you can see most of the information in the current newsletter comes from the members of the Steering Committee. The rest are invited contributions. We would like to get news from all of you and use the newsletter as a platform of communication and interaction. Therefore, I urge you to send your news to be included in our newsletter.

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- Piquetiniooo. EHEEE!!. How do you like the Warm Latin Blood? – Chupetinooo!!! I never experienced something better in my life!!!
(By David Nestel)

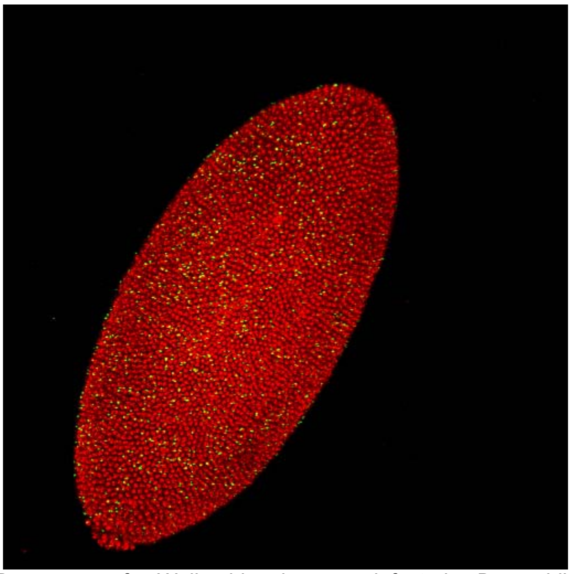
THE SYMBIOTIC BACTERIUM WOLBACHIA AS A TOOL FOR INSECT PEST CONTROL

Wolbachia pipientis (*Wolbachia* for the purpose of this paper) is a widespread group of obligatory intracellular maternally transmitted bacteria belonging to the α-Proteobacteria. *Wolbachia* has been reported in several hundreds of arthropod species including all major insect groups, mites, isopods and filarial nematodes (Werren et al. 1995; Werren and O'Neill, 1997; Jeyaprakash and Hoy, 2000; Werren, 1997; Stouthamer et al. 1999; Bourtzis and Braig 1999). Although *Wolbachia* infections have been detected in somatic tissues, they mainly reside in the reproductive tissues and organs of arthropods (Figure 1). Several studies have conclusively shown that the presence of Wolbachia in the reproductive system of its hosts is associated with the induction of a number of reproductive alterations including cytoplasmic incompatibility (CI), thelytokous parthenogenesis, feminization of genetic males, and male-killing (Werren, 1997; Stouthamer et al. 1999; Bourtzis and Miller 2003). Each of these reproductive alterations favors the transmission of the bacterium at the expense of the uninfected arthropod population. Treatment of the infected hosts with antibiotics results in the restoration of normal reproductive phenotypes (Werren, 1997; Stouthamer et al. 1999; Bourtzis and Miller 2003).

The most common and widespread reproductive abnormality *Wolbachia* infections induce in their arthropod hosts is CI (Hoffmann and Turelli, 1997; Bourtzis et al. 2003). CI results in embryonic mortality in crosses between infected males and females with different infection status. It can be either unidirectional or bi-directional. Unidirectional CI is typically expressed as embryonic mortality when an infected male is crossed with an uninfected female. The reciprocal cross (infected female and uninfected male) is fully compatible, as are crosses between infected individuals. Bidirectional CI usually occurs in crosses between infected individuals harbouring different strains of *Wolbachia*. In most insects, the expression of CI is lethal to the developing embryo. As a consequence of CI, *Wolbachia* infections can spread and persist in nature by replacing uninfected populations (Turelli and Hoffmann, 1991). *Wolbachia*-induced CI has been reported in almost all major insect orders and is the most frequent of the *Wolbachia* induced phenotypes. The mechanism of *Wolbachia*-induced CI has not yet been resolved at the molecular level. However, a number of genetic, cytogenetic and cellular studies indicate that *Wolbachia* somehow modifies the paternal chromosomes during spermatogenesis (mature sperm do not contain the bacteria) thus influencing their behaviour during the first mitotic divisions and resulting in loss of mitotic synchrony (Breeuwer and Werren, 1990; O'Neill and Karr, 1990; Reed and Werren, 1995; Callaini et al., 1997; Tram and Sullivan, 2002).

There is an interest in the use of Wolbachia infections in an applied context. They might be used: (a) as a tool to suppress natural population of pests through cytoplasmic incompatibility; (b) as a tool to improve beneficial insect species; (c) as a para-transformation tool for insects; (d) as a driving mechanism to replace natural insect populations and (e) as an organism that can change the senescence of disease vectors (Beard et al. 1993; Sinkins et al., 1997; Bourtzis and Braig, 1999; Sinkins and O'Neill, 2000; Aksoy et al., 2001; Bourtzis and Robinson, 2006).

Wolbachia are widespread and abundant among insect species, however, several species of agricultural and medical importance are not infected. The Mediterranean fruit fly, *Ceratitis capitata*, is a very important agricultural pest. All field populations so far assayed have been negative for Wolbachia (Bourtzis et al., 1994) with the exception of a recent report that describes the presence of Wolbachia in natural populations of Mediterranean fruit fly in Brazil (Rocha et al., 2005). The aim of one of our recent studies was to establish Wolbachia-infected lines of the Mediterranean fruit fly in an attempt to use the mechanism of Wolbachia-induced CI as a novel and environmentally friendly tool for the control of medfly populations.

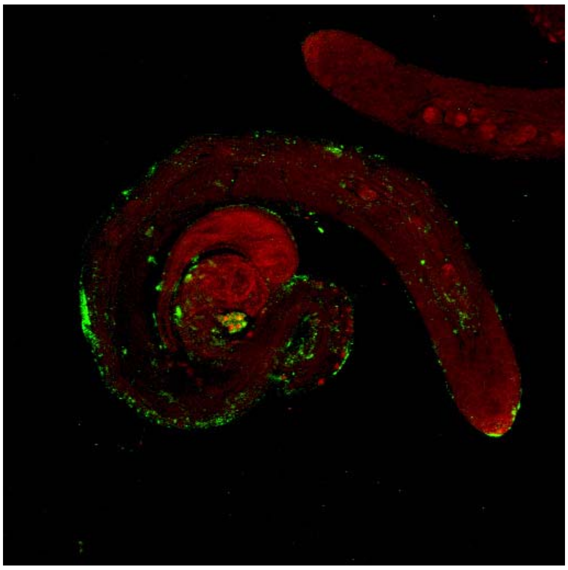


Presence of *Wolbachia* in an infected *Drosophila melanogaster* embryo. The posterior part of the embryo shows the pole cells (the precursors of gonads). Bacteria are visualized green-yellow and Drosophila nuclei red (Photo by Zoe Veneti and Kostas Bourtzis).

To determine whether the medfly can support the *Wolbachia* infection, the transinfection of medfly was attempted by using embryonic cytoplasmic injections. The laboratory strain of Benakeion was used as a recipient, while two populations of *Rhagoletis cerasi* were used as donor strains (Riegler and Stauffer 2002): a double infected one from Austria (wCer1 + wCer2) and a triple infected one from Sicily (wCer1 + wCer3 + wCer4) (Zabalou et al. 2004). Two stably transinfected lines were produced: one singly infected with wCer2 (namely 88.6) and the second, singly infected with wCer4 (namely S10.3). Both transinfected lines exhibit so far 100 % infection rates being stable for almost 4 years now (over 50 generations).

The stably transinfected medfly lines were then tested for the expression of CI. CI levels were measured in single pair matings. All crosses were performed at 24°C. For single pair matings, two-days-old virgin females were individually mated with one-day-old virgin males. The egg laying plates were removed daily and all eggs were scored for a period of 6-8 days. Hatching rates were scored 72 hours after egg collection. The embryonic mortality was determined as the percentage of unhatched eggs.

The genetic test crosses were performed in different generations post injection between transinfected lines and the parental uninfected medfly strains. All crossing experiments showed the same results: (a) crosses between uninfected females and Wolbachia-infected males resulted in 100% egg mortality; (b) the reciprocal crosses resulted in between 16 to 32% egg mortality; (c) crosses between females and males carrying the same *Wolbachia* strain resulted in about 65% egg mortality; these observed high mortalities could be due to additional fertility effects of wCer2 and wCer4 on Mediterranean fruit fly females, effects other than CI, or to incomplete rescue of the modification by infected Mediterranean fruit fly females, (d) crosses between females and males from the uninfected Benakeion strain resulted in about 12% egg mortality, and (e) crosses between the two transinfected Mediterranean fruit fly lines WolMed 88.6 (wCer2) and WolMed S10.3 (wCer4), each infected with a different *Wolbachia* strain, were 100% bidirectionally incompatible (100% egg mortality) (Zabalou et al., 2004). Similar results have been obtained in test crosses performed three years post injection (Bourtzis and Zabalou, unpublished observations). It has to be noted that complete CI has only been observed in very few *Wolbachia*-infected species such as C. pipiens (Laven, 1967). This was the first report that a newly transinfected host species shows high stability of the infection and, at the same time, expresses 100% CI (both uni-directional and bi-directional).



Presence of *Wolbachia* in an infected *Drosophila melanogaster* testes. Bacteria are visualized green-yellow and Drosophila nuclei red (Photo by Zoe Veneti and Kostas Bourtzis).

The next step was to determine whether cytoplasmic incompatibility expressed by the *Wolbachia*-infected medfly lines can be used for applied purposes, that is, in population suppression strategies. The population suppression experiments were performed in six population cages at 24°C. Each cage contained equal numbers of two days old virgin uninfected females and one day old virgin uninfected males (1:1), plus one day old virgin transinfected males at different ratios 1:1:0, 1:1:1, 1:1:10, 1:1:20, 1:1:30, 1:1:50. The first five cages were containing about 300 flies and the last one (ratio 1:1:50) 520 flies. Egg laying plates were removed every day for a period of 6-8 days. In the first two cages a random sample of 500 eggs was kept daily, while in the rest of them all layed eggs were collected. Hatching rates were scored 72 hours after egg collection. Survival was determined as percentage of hatched eggs. The results of these experiments were very exciting. The caged medfly populations were suppressed by these single “releases” of incompatible males in a ratio-dependent manner. Population suppression was extremely efficient reaching levels of >99% at release ratios of 50:1. Although these laboratory experiments are very encouraging they need to be extended to field cage systems where wild flies are used as the control population and a more natural environment is provided (FAO/USDA/IAEA 2003).

Recently, Dobson and colleagues reported the transfer of wAlbB *Wolbachia* strain, naturally occurring in *Aedes albopictus*, and its establishment into the naive mosquito host *A. aegypti* (Xi et al., 2005). Crossing experiments indicated strong CI (100%): no egg hatch observed from >3800 eggs examined from crosses of uninfected females and *Wolbachia*-infected males. This is the second report that a newly transinfected host species shows high stability of the infection and, at the same time, expresses 100% CI.

The above studies clearly indicated that *Wolbachia* can be transferred by embryonic cytoplasmic injections into novel host species, establishing symbiotic associations which express complete CI thus encouraging the introduction of *Wolbachia* into pest and vector species of economic and health relevance in order to suppress or modify natural populations (Zabalou et al., 2004; Xi et al. 2005).

Acknowledgements

The Medfly-*Wolbachia* experiments described above were performed in the Institute of Molecular Biology and Biotechnology and are described in detail in the following publication: Zabalou, S., Riegler, M., Theodorakopoulou, M., Stauffer, C., Savakis, C. & Bourtzis, K. (2004). *Wolbachia*-induced cytoplasmic incompatibility as a means for insect pest population control. Proc. Natl. Acad. Sci. U.S.A. 101: 15042-15045. This research was supported by the European Union grant QLK3-CT-2000-01079 (Kostas Bourtzis and Charalambos Savakis), Austrian Science Foundation grant (Christian Stauffer) and EU COST 850 travel grant (Markus Riegler).

References cited:

Aksoy, S., Maudlin, I., Dale, C., Robinson, A.S. & O’Neill, S.L. 2001: Prospects for control of African trypanosomiasis by tsetse vector manipulation. Trends Parasitol. 17: 29-35.

Beard, C.B., O'Neill, S.L., Tesh, R.B., Richards, F.F. & Aksoy, S. 1993: Modification of arthropod vector competence via symbiotic bacteria. Parasitol Today 9: 179-183.
Bourtzis, K. & Braig, H. R. (1999). The many faces of *Wolbachia*. In: Rickettsiae and Rickettsial Diseases at the Turn of the Third Millennium*,* eds Raoult and Brouqui: 199-219.
Bourtzis, K, Braig HR, Karr TL (2003). Cytoplasmic Incompatibility. In: Bourtzis K, Miller T, eds. Insect Symbiosis. Florida: CRC Press, pp 217-246.
Bourtzis, K. & Miller, T. eds (2003). Insect Symbiosis. CRC Press, Florida, USA.
Bourtzis K, Robinson AS. Insect pest control using *Wolbachia* and/or radiation. In: Bourtzis K, Miller T, eds. Insect Symbiosis 2. Florida: Taylor and Francis Group, LLC, 2006:in press.
Bourtzis, K., Nirgianaki, A., Onyango, P. & Savakis, C. 1994: A prokaryotic *dnaA* sequence in *Drosophila melanogaster*: *Wolbachia* infection and cytoplasmic incompatibility among laboratory strains. Insect Mol. Biol. 3: 131–142.
Breeuwer JA, Werren JH. (1990). Microorganisms associated with chromosome destruction and reproductive isolation between two insect species. Nature 346: 558–560.
FAO/IAEA/USDA. 2003. Manual for Product Quality Control and Shipping Procedures for Sterile Mass-Reared Tephritid Fruit Flies, Version 5.0. *International Atomic Energy Agency*, Vienna, Austria. 85pp.
Hoffman AA, Turelli M. (1997). Cytoplasmic incompatibility in insects. In: O'Neill SL, Hoffmann AA, Werren JH, eds. Influential passengers: Inherited microorganisms and arthropod reproduction. Oxford: Oxford University Press, pp 42-80.
Jeyaprakash, A. & Hoy, M.A. 2000: Long PCR improves *Wolbachia* DNA amplification: *wsp* sequences found in 76% of 63 arthropod species. Insect Mol Biol 9: 393-405.
Laven, H. 1967: Eradication of *Culex pipiens fatigans* through cytoplasmic incompatibility. Nature 216: 383–384.
O'Neill SL, Karr TL. (1990). Bidirectional incompatibility between conspecific populations of *Drosophila simulans*. Nature 348: 178-180.
Reed KM, Werren JH. (1995). Induction of paternal genome loss by the paternal-sex-ratio chromosome and cytoplasmic incompatibility bacteria (*Wolbachia*): a comparative study of early embryonic events. Mol. Reprod. Dev. 40: 408–418.
Callaini G, Dallai R, Riparbelli MG. (1997). *Wolbachia*-induced delay chromatin condensation does not prevent maternal chromosomes from entering anaphase in incompatible crosses of *Drosophila simulans*. J Cell Sci 110: 271-280.
Tram U, Sullivan W. (2002). Role of delayed nuclear envelope breakdown and mitosis in *Wolbachia*-induced cytoplasmic incompatibility. Science 296: 1124-1126.
Riegler, M. & Stauffer, C. 2002: *Wolbachia* infections and superinfections in cytoplasmically incompatible populations of the European cherry fruit fly *Rhagoletis cerasi* (Diptera, Tephritidae). Mol. Ecol. 11: 2425-2434.
Rocha LS, Mascarenias RO, Perondini ALP . and Selivon, D. (2005) Occurrence of *Wolbachia* in Brazilian samples of *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae). Neotropical Entomol 34: 1013-1015.
Sinkins, S.P., Curtis, C.F. & O'Neill, S.L. (1997). The potential application of inherited symbiont systems to pest control. In: Influential passengers: Inherited microorganisms and arthropod reproduction, eds O'Neill, Hoffmann and Werren: 155-175.
Sinkins, S.P. & O'Neill, S.L. 2000: *Wolbachia* as a vehicle to modify insect populations. In: Insect Transgenesis, eds Handler and James: 271-287.
Stouthamer, R., Breeuwer, J.A.J. & Hurst, G.D.D. 1999: *Wolbachia pipientis*: microbial manipulator of arthropod reproduction. Annu. Rev. Microbiol., 53: 71-102.
Turelli M, Hoffmann AA. (1991). Rapid spread of an inherited incompatibility factor in California *Drosophila*. Nature 353:440-442.
Werren, J.H. 1997: Biology of Wolbachia. Annual Review of Entomology 42: 587-609.
Werren, J.H. & O'Neill, S.L. 1997: The evolution of heritable symbionts. In: Influential Passengers: Inherited Microorganisms and Arthropod Reproduction, eds O'Neill, Hoffman and Werren: 1–41.
Werren, J.H., Zhang, W. & Guo, L.R. 1995: Evolution and phylogeny of *Wolbachia*: reproductive parasites of arthropods. Proc. R. Soc. London (B), 261: 55-63.
Xi, Z., Khoo, C.C.H. & Dobson, S.L. 2005: *Wolbachia* establishment and invasion in an *Aedes aegypti* laboratory population. Science, 310: 326-328.
Zabalou, S., Riegler, M., Theodorakopoulou, M., Stauffer, C., Savakis, C. & Bourtzis, K. (2004). *Wolbachia*-induced cytoplasmic incompatibility as a means for insect pest population control. Proc. Natl. Acad. Sci. U.S.A. 101: 15042-15045.

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SOUTH AFRICA GIVES TRAINING IN FRUIT FLY REARING AND SIT

The South African Medfly S.I.T. programme, based in Stellenbosch in the Western Cape, has been running since 1996, and has been well-supported by the International Atomic Energy Agency in Vienna and the local fruit industry. The first releases of sterile Medfly males of the Vienna 7/97 tsl strain started in 1999 in the Hex River Valley pilot project, which later developed into a fully-fledged commercial programme when SIT was privatised in 2003 under SIT Africa (Pty) Ltd. Technical support for this programme is provided by the Agricultural Research Council's Infruitec-Nietvoorbij Institute for Fruit, Vine and Wine in Stellenbosch. Many of the SIT Africa Medfly Facility rearing technicians have received in-depth training under the eagle-eye and expert task-master, Carlos Caceres, at the FAO/IAEA Biotechnology Laboratory in Seibersdorf, Austria. Carlos has also visited South Africa a number of times to do on-site training.

After these 6 or 7 years of experience with the Vienna 7 strain, with various other tsl strains of Medfly, and now with Vienna 8, the Stellenbosch team has become very experienced in producing good quality sterile males which are now released in three fruit production areas. Because aerial releases proved too expensive for the South African programme, a ground-release system was developed with the help of an expert in this procedure, Dr Gerardo Ortiz from Mexico, and is now the only release method in use in the Western Cape. Because of the relative uniqueness of the


Carlos Caceres discussing some of the finer details of rearing Vienna 7/97 with Infruitec and SIT Africa staff

South African programme the IAEA has been sending fruit fly workers from elsewhere in Africa and surrounding islands to the SIT Africa Medfly Facility for fellowship training in rearing and releasing sterile Medflies. In addition, some other visitors have been sent by their governments to see the South African SIT programme.

Ethiopia

The first visitor was Dr Emiru Seyoum from the Addis Ababa University in Addis Ababa, Ethiopia, in February 2003. His interest was the integration of parasitoids into a fruit fly SIT programme. After some hands-on training in fruit fly mass rearing principles he visited the false codling moth (FCM) rearing facility of Cederberg Biocontrol in Citrusdal. FCM is a major pest on citrus, and FCM parasitoids are mass-reared by Cederberg Biocontrol and released into citrus orchards for biological control of FCM.

Egypt

The first IAEA-sponsored fellows were from the Plant Protection Research Institute in Giza, Egypt – Nehad Soliman, Mokhtar El-Wakkad and Yousry Afia. Egypt has done some research on mass rearing Medfly for a future SIT programme for this species. The three Egyptians spent between 3 and 4 months with SIT Africa in early 2004 on an IAEA fellowship course. Besides being trained in rearing, radiation sterilization, quality control, and release and other field operations, they also worked on a mini-project, evaluating a newly-formulated liquid larval diet for Medfly.


Mokhtar and Yousry doing some QC tests on the larval diet


Mokhtar and Nehad; Keisie Valley in background

Mauritius

In June 2004 we had a visit by Pradeep Nundloll from the Entomology Division of the Ministry of Agriculture in Mauritius. Mauritius has a number of species of fruit flies and has already eradicated oriental fruit fly with an aggressive baiting programme. Pradeep came to South Africa for 1 week to get first hand experience of SIT in a resource-limited programme.


Pradeep (standing) and another visitor inspecting fallen fruit collected from an SIT orchard for disposal

Egypt again

Dr Eman El-Akhdar of the Atomic Energy Authority in Cairo visited Stellenbosch in 2005 on an IAEA fellowship to gain first-hand experience of fruit fly mass production techniques and quality control as done in the South African programme. She spent 3 months at the SIT facility and ARC Infruitec-Nietvoorbij, and successfully completed a mini-project to evaluate different yeasts in the adult diet for optimum female fecundity and fertility.

Madagascar

In May 2006 we received two visitors from Madagascar, Ms Michèle Rasamoel and Mr Gabriel Rasamoelina from the Ministry of Agriculture in Nanisana on Madagascar. Michèle was on a 1-month IAEA fellowship training course, and Gabriel on an 2-week IAEA Scientific Visit. Training included mass-rearing and sterilisation, trapping and fruit sampling, sterile fly releases, other population suppression methods, quality control, data management, and overall programme management.

It is often said South Africans do things differently. We have had to implement an SIT programme "on the smell of an oil rag" – i.e. with very little funding. It is possibly this, and the fact that we have achieved a certain success despite the constraints, that has resulted in these people from diverse surroundings and circumstances visiting our programme to see things done the South African way. We have been

Gabriel (left) and Michèle on their first day of training, getting their hands dirty in some larval diet.

honoured to receive all these people for training, and trust that the visitors have returned to their countries with first-hand knowledge on SIT that they may be able to put into practice. In this way we hope in some small way to repay the wonderful support we have received from all our supporters and especially the IAEA.

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AREA WIDE MANAGEMENT OF THE OLIVE FRUIT FLY IN GREECE

Olive is cultivated in most prefectures of Greece and constitutes a major crop for the Greek economy with an annual yield of 350,000 tons of olive oil and 100,000 tons of edible (table) olives. The olive fruit fly *Bactrocera oleae* (Rossi) (Diptera: Tephritidae) comprises the main threat for the olive production reducing the yield by 60% in some years. Because of the importance of the olive fruit fly, the Greek government has established a nation-wide project for the control of this notorious pest since 1953. The project is coordinated by the Plant Protection Section of the Ministry of Agriculture, while the implementation relies on the extension services, which are located in each prefecture.

In each area *B. oleae* population is monitored with an extensive grid of McPhail traps (one trap per 1000 trees) baited with aqueous solutions of ammonium sulphate from May to September, and with aqueous solutions of proteins plus borax from September to the end of the monitoring period (November). It is believed that protein solutions increase trap efficacy towards olive harvest. Every 5 days traps are serviced, captured adults are counted and baits renewed. If a significant increase in population size is reported, the extension service, in collaboration with the Plant Protection Service (Ministry of Agriculture), makes a decision to apply bait sprays. Baits sprays are applied every second or third tree depending on the density of the plantation. Approximately 350 ml of bait solution are applied on each of the treated trees, avoiding application on fruits. Bait solution is composed by hydrolyzed proteins, sugars and an insecticide as follows:

1. From May to the end of July 10% alpha cypermethrin
2. During August 50% fenthion, and
3. Since the beginning of September dimethoate 40%.

A pilot use of (a) lamda cyalothrin 10.05% in 33,300 ha and (b) spinosad 0.24% in 53,300 ha has been planned for 2006.

The decision of whether or not to include an area in the nation-wide olive fruit fly management program is based on olive production that has to be over 20 or 25% of the highest expected production for edible and oil producing cultivars respectively. The infestation level in years with low olive production is very high and very difficult to manage with the current project. If infestation levels are bellow 10% the project is considered successful.

The project is quite extensive and demanding in resources and is supported by the growers who contribute 2% of their net income. There are 12,000 employees hired every year. The yearly cost of the project is about 32,000,000 Euros. Forty four percent of the budget goes to contractors, 38% to personnel, 11% for insecticides, 1% for proteins and other attractants, and 6% for miscellaneous expenses. The annual damage because of the olive fruit fly would amount to 650,000,000 Euros if the current nation-wide project were not implemented, while the net profit because of its implementation is estimated to be 550,000,000 Euros.

To improve the program the Ministry of Agricultural Development and Food supports research that is conducted in Institutes and Universities in the following areas:

1. Resistance of the olive fruit fly to insecticides
2. Effect of bait sprays in the beneficial fauna
3. Efficacy of the applied insecticides
4. Insecticides residues in olive oil and edible olives
5. Application of the Geographical Information Systems in olive fruit fly management

The future of the program depends on the cooperation of the growers and their unions with the Ministry of Agricultural Development and Food. The goal of the project is the protection of olive production and the protection of the growers' income together with the protection of the environment.

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TRAPPING (MEDFLY) - UNCERTAINTY

THE question: what is the actual number and distribution of a population?

Our method is monitoring. Medfly monitoring is mainly based on male traps which are based on the male synthetic para-pheromone trimedlure that mimics a biological activity (probably related to the sexual behavior of the fly) and lures the males from a certain distance.

The effectiveness of the trap is related to several parameters. We know some of them such as the concentration and direction of the plume of lure, which is influenced by wind, foliage, temperature and direct sunlight. We understand other cues of attraction that may associate or compete with the lure, like preferable habitats, presence of hosts, food and water and also there is the nature of the fly's population around. This is what stands behind the phenomena that some of us have experienced with, that a trap which was positioned on a non host trees like cypress, 20-30 m away from host tree (fig) with a high population of Medfly, failed to detect it. To make the point more "colorful" there is the role of the biology of the fly. Do Medfly males always consider trimedlure as first priority, or do they respond only when there is nothing else better (more interesting) to do around?

In order to increase the chance of catching flies, the trappers forecast on the basis of the above, where the Medfly is more likely to be trapped and place the traps accordingly. Although this approach is excellent for intercepting flies in orchards for control programs, it will not help much for areas without previous information on the fly.

Nevertheless, on the one hand we assume that no matter what, the effectiveness of all the traps is constant and that the trapping of a network of traps represents the actual population. Yet, on the other hand "to be on the safe side" we highly recommend to rotate the traps among the potential host trees - "increasing the probability" to catch flies. These decisions taken are directly influencing the catches and our precision and so at the end of the road, we always have doubts considering the actual population.

It is quite certain to say that we can ONLY determine the time and number of the flies that were lured (from their own reasons) to our traps that we located where we did (from our own reasons). It is quite clear then, that our means of detection (traps and decisions) are influencing the population we determined but are limited to show actual population. On a paraphrase I would almost say that the more precise we know the number and location of the trapped flies, the less we know about the real size and location of the actual population. The proof for that is present in more than 50 years of numerous trapping studies that have left us with more questions than answers.

With respect to physics, here is an example of how Heisenberg's principle of uncertainty is nicely concealed in entomology…

"The more precisely the POSITION is determined, the less precisely the MOMENTUM is known"
Werner Heisenberg (1901 - 1976):

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NEW BOOKS

Insect Symbiosis

Insects are one of the most speciose groups of living organisms and have one of the most successful lifestyles on earth. It has become increasingly apparent that these properties are, at least partially, due to symbionts' contributions. Kostas Bourtzis (University of Ioannina and Institute of Molecular Biology and Biotechnlogy, Greece) and Tom Miller (University of California Riverside, USA) have recently edited Insect Symbiosis (2003; CRC Press,Boca Raton, FL 347p. ISBN 0-8493-1286-8) and Insect Symbiosis Volume 2 (2006; CRC Press,Boca Raton, FL 347p. ISBN 0-8493-4194-9) which contain a wealth of information about symbionts of insects.

The first volume of Insect Symbiosis is a collection of chapters written by world authorities on the microbes that can be called symbionts that are associated with insects and mites. Whether bacteria, fungi or spiroplasmids, and whether endosymbionts or casual gut symbionts, these chapters describe some of the latest work in a field that grew rapidly following development of the newer molecular methods that allowed identification of even minute samples of microbes without the need for culturing. The book summarizes the current knowledge of the relationship between symbiotic organisms and their insect hosts. It also reveals possible new ways to control agricultural pests and disease-carrying insects worldwide. For example, *Wolbachia* is now considered as a potential symbiotic insecticide as well as a vehicle to deliver anti-malarial and anti-plant virus strategies.

The second volume of Insect Symbiosis describes the diversity of symbiotic bacteria associated with pests such as whiteflies, aphids, mealybugs, psyllids, and tsetse flies. The book illustrates how symbiosis research has important ramifications for evolutionary biology, physiology, parasitology, genetics, and animal behavior and is especially relevant to the control of agricultural and disease-carrying pests. The book includes updated information on *Wolbachia* biology and how it influences insect life, supplies two new examples of using symbionts in crop protection, and discusses the recent "bug in a bug" mealy bug case. It also reviews recent advances in understanding of the origin and evolutionary elaboration of mutualism in termites and provides an overview about what is known about the diverse relationships of spiroplasmas and phytoplasmas with their insect and plant hosts. This edited volume outlines the current state of the art in *Buchnera aphidicola* research, with a special focus on the main gene and genomic features of these bacteria that are a consequence of the symbiotic integration and describes the discovery of insecticidal proteins and speculates on their role in the biology of the bacteria-nematode-insect tritrophic interaction. In addition, the second volume of Insect Symbiosis investigates the use of the incompatible insect technique (IIT) and identifies the strengths and weaknesses of both the sterile insect technique and IIT.

Overall, both volumes of Insect Symbiosis provide analysis and synthesis of cutting-edge research in insect symbiosis that sheds light on the evolution of the host/symbiont relationship and on the potential use of symbiotic interactions for the control of agricultural pests and disease-carrying insects. They also offer findings of particular interest to professionals in entomology, genetics, evolution, physiology and veterinary medicine.

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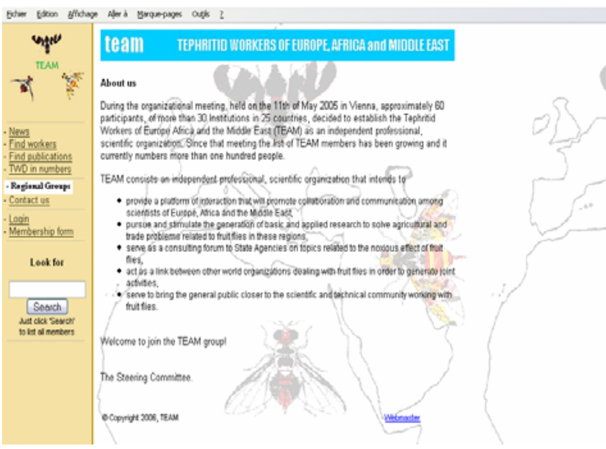
OUR WEB SITE

On May 2005, members of the **Tephritid Workers of Europe Africa and the Middle East** (**TEAM**) in Vienna recommended to develop the website of TEAM which will act as a platform to promote collaboration and communication between their members and to bring their ongoing activities to the general public and to other world organizations dealing with fruit flies. After one year of work, TEAM web site is ready to be launched on the internet in June 2006. TEAM is a free, non-commercial web based database. Under www.tephritid.org, click on **Regional Groups** on the left hand menu to access TEAM web site.

Call for registration membership

We welcome new members from the Europe Africa and the Middle East region. Registration can be done online. Just fill out the **Membership Form** on the left hand menu, choose your favourite username and password and submit. Then login to complete your registration. You can also use the Registration Form attached to this Newsletter.



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FORTHCOMING MEETINGS

Seventh International Symposium on Fruit Flies of Economic Importance and Sixth Meeting of the Working Group on Fruit Flies of the Western Hemisphere, 10-15 September 2006, Salvador, Bahia, Brazil.

First Meeting of Tephritid Workers of Europe Africa and the Middle East, Autumn 2007, Majorca, Spain.

THIS NEWSLETTER

This newsletter is intended for the publication of subjects of interest to the members of TEAM. All content is solicited from the membership and should be addressed to:

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TEAM

Tephritidae of Europe Africa and the Middle East

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(submit to nikopap@uth.gr)

First Name:

Family Name:

Title:

Institution:

Address:

Tel/Fax:

Email:

TYPE OF ACTIVITY

- ☐ Basic Research
- ☐ Applied Research
- ☐ Other

TEPHRITID GENERA

- ☐ Bactrocera
- ☐ Ceratitis
- ☐ Dacus
- ☐ Rhagoletis

SUBJECTS

- ☐ Biology
- ☐ Ecology
- ☐ Chemical ecology
- ☐ Behaviour
- ☐ Detection/monitoring methods
- ☐ Mass Rearing and Quality control
- ☐ IPM
- ☐ SIT
- ☐ Biological Control
- ☐ Others