Regional Symposium

on the

Management of Fruit Flies in Near East Countries

Hammamet, Tunisia 6-8 November 2012

BOOK OF ABSTRACTS

رسالة ترحيب

سيداتي سادتي، ضيوفنا الكرام

مرحبا بكم في هذا المؤتمر الخاص بالمكافحة المتكاملة لذباب الفاكهه في منطقة الشرق الأدنى الذي ينتظم بالبلاد التونسية من 6 إلى 8 نوفمبر 2012.

يعتبر ذباب الفاكهة الذي ينتمي إلى عائلة ذوات الجناحين، فصيلة Tephritidae، من أهم الآفات المضرة بالمحاصيل الزراعية على غرار القوارص/الحمضيات والزياتين والأشجار المثمرة ذات النوى وبعض الخضروات. وتتسبب هذه الآفات في خسائر فادحة على المحاصيل حيث تشتمل على أضرار مباشرة على الإنتاج زيادة على ارتفاع كلفة التدخل. كما تحد هذه الآفة من إمكانيات التصدير في الأسواق الخارجية باعتبار الإجراءات الصارمة للحجر الزراعي التي تطبقها عديد البلدان.

وأمام تطور عمليات التبادل التجاري في العالم، أصبحت بلدان الشرق الأدنى أكثر عرضة لتواجد بعض الأنواع الدخيلة من الذباب التي لا يستبعد أن تجد المجال المناسب للانتشار في غياب مستلزمات الرصد والمعطيات الفنية الضرورية للتشخيصها والتوقي منها.

هذا، وفي مجال المكافحة، لا بد من التذكير بأهم الأولويات في التنمية الفلاحية المستدامة التي تتجسد في ضرورة العمل على اعتماد طرق تدخل ضد الآفات الزراعية، ومن بينها ذباب الفاكهة، تمكن من المحافظة على التوازن البيئي وصحة الإنسان.

وفي هذا السياق، تتنزل أهمية هذا المؤتمر في توفير منتدى مشترك لمختلف المتدخلين في القطاع من باحثين وخبراء وعاملين في مجال حماية النباتات ومجال الإرشاد، يمكّن من تبادل المعلومات والخبرات في الجوانب البيولوجية والإيكولوجية لذباب الفاكهة، وكذلك الطرق المعتمدة لرصد ومكافحة هذه الآفة. كما يتيح الفرصة لوضع الإجراءات والتدابير الصحة النباتية الكفيلة بإحكام إدارة عملية المكافحة المتكاملة لهذه الآفة.

د. بوزيد نصراوي **د. خالد الرويشدي**

Welcome message

Ladies and gentlemen, our guests.

Welcome to this special Symposium on Integrated Pest Management of fruit flies in the Near East region, which is organized in Tunisia from 6 to 8 November 2012.

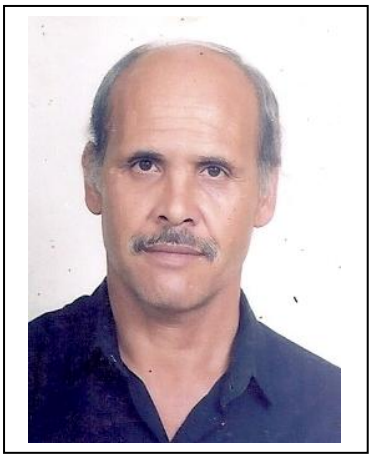
The fruit flies, which belong to Diptera: Tephritidae, one of the most important pests causing damages to fruits and other plant crops such as citrus, olive, stone fruits and some vegetables. These pests cause significant losses to crops which include direct damage to production and rising cost of protection. These pests are also limiting the access to potential foreign markets since strict quarantine measures are applied by many countries.
And due to the development of trade exchange in the world, the Near East countries became more vulnerable to some exotic species of flies that may find the appropriate conditions to their dispersion in the absence of monitoring, survey and technical data necessary for the diagnosis and prevention.
Thus, to control pests it is necessary to remember that the most important priorities in sustainable agricultural development is to adopt control methods against agricultural pests, including fruit flies, while managing to maintain ecological balance and human health.

In this context, this symposium will provide a common forum for the various stakeholders: researchers, experts, technicians and plant protection stffs, that can exchange information and experience in the biological and ecological aspects of fruit flies, as well as the methods adopted to monitor and control these pests. It also provides the opportunity to develop procedures and phytosanitary measures to tightly manage the process of integrated control of these pests.

Dr Bouzid Nasraoui **Dr Khaled Alrouechdi**

Tribute to Mr. Hassine Ben Salah

The choice of a great person to honor in an international symposium, is difficult, no doubt, but never arbitrary in the context, objective and program of the present congress. In this event, we are pleased to honor Mr. Hassine Ben Salah.



Born in Sousse in 1944, he served as a Researcher Officer in the Entomology Laboratory of the National Institute of Agricultural Research of Tunisia from 1970 to 2004.

Agronomist engineer, he has one of the major contributions in the field of Integrated Pest Management (IPM) in Tunisia. He had a decisive contribution both at the institutional level and the human relationship.

He participated to medfly SIT in Tunisia, desert locust control campaigns, citrus scale control. After retirement, he participated in the PASP as a national adviser for 7 years and in an IPM program to control the potato tuber moth which is presently largely used by Tunisian farmers.

Mr. Hassine Ben Salah obtained the First Price of the Technology Innovation CAT/CIT in 1995 and the National Order of Merit (Chevalier) in the Agriculture Field in 1995.

To honor the researcher and the man, we want to testify today our esteem for his countless contributions to the advancement of science.

This symposium aims to develop further control of fruit flies in the regional level that Mr. Hassine Ben Salah helped to initiate.

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Acknowledgement to Official Organizing and Supporting Institutions

The organizing committee would like to give thanks to the following Tunisian and international institutions which had provided funds to develop this event

- Arabic Atomic Energy Agency, AAEA
- Association Tunisienne de la Protection des Plantes, ATPP
- Agence de Vulgarisation et de Formation Agricole, AVFA
- Direction Générale de la Protection et du Contrôle de la Qualité des Produits Agricoles, DGPCQPA
- European and Mediterranean Plant Protection Organisation, EPPO
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- International Organisation for Biological and Integrated Control for Noxious Animals and Plants (IOBC)
- Institution de la Recherche et de l'Enseignement Supérieur Agricoles, Tunisie, IRESA

Hammamet City glance

Hammamet (Arabic:الحمامات*El-Ḥammāmāt*) is a town in Tunisia. Due to its beaches it is a popular destination for swimming and water sports. It was the first tourist destination in Tunisia. It is located in the south east of the northern peninsula of Cap Bon in the Governorate of Nabeul, on the northern edge of the Gulf of Hammamet.The reported number of inhabitants varies from 20,000 to 70,000 and the population quadruples due to tourists in the summer.

History

In the 1st century, there was a settlement here known as Pupput. It was a town (now in the suburbs of Hammamet) that became a Roman colony in 2nd century. In 13th century, walls around town were built and medina of Hammamet was built in 15th century. Then it came under Spanish and Turkish rule.

In 1601 it was the object of a successful Spanish attack. At that time the Spanish name for the place was "La Mahometa". Alonso de Contreras participated and tells the story in his autobiography. Three hundred men took seven hundred prisoners, mostly women and children because most of the men in the town had fled.

On 14 August 1605 there was another Spanish attack in which Contreras also participated but this time the result was disastrous for the attackers. It was carried out by six galleys, four from Malta, six from Sicily carrying Spanish and

other Christian troops. The initial taking of the town was successful as the Spanish managed to climb the walls and open the gates but then there was an unexpected call to retreat which could not be later determined where or how it originated. In the confusion the retreat was done in disorder and the Spanish were massacred at the beach by a much smaller number of Moors. There were 1200 men gathered at the beach trying to get back to their ships but the wind had changed and conditions were difficult. The leader of the expedition, Adelantado de Castilla, lost his life as he tried to swim out to the Spanish ships and as the captain in charge of his skiff fled and ignored his calls for help. That captain was later court-martialed and, when it became clear he would be sentenced to die, his own brother poisoned him. In World War II, it became one of the headquarters of general Erwin Rommel.

Source *(Wikipedia: http://en.wikipedia.org/wiki/Hammamet,_Tunisia)*

Sessions

Session 1 : Biology, Ecology and Population Dynamics(I)

Session 2 : Biology, Ecology and Population Dynamics (II)

Session 3 : Biology, Ecology and Population Dynamics (III)

Session 4 : Control methods- Cultural and biocontrol

Session 5 : Control methods- Chemical control

Session 6 : Control methods- Mass trapping and bait stations

Session 7 : Control methods- MAT and SIT

Session 8: Genetics, Quarantine and Post-harvest Treatments

Keynote presentations

Biology and management of fruit flies in Africa and their potential impact in Near East countries by Samira Mohamed Faris.Tuesday 06 th.

IPM activities of IOBC-WPRS for the control of fruit flies (Tephritidae) in Europeby Sylvia Blümel. Wednesday 07 th.

Area-wide integrated pest management of tephritid fruit flies using the sterile insect technique by Rui Pereira. Thursday 8th.

ORAL PRESENTATIONS

Session 1

Biology, Ecology and Population Dynamics (I)

(O-1)

A look at fruit flies species in the Near East countries

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A table of the known species of fruit flies in the Near East countries was established, in collaboration with colleagues from the region, as an introduction to our work on the subject. (According to FAO, Near East countries are: from Iran until Mauritania " Middle East, GCC and North Africa"). Do we know which species of fruit flies are surly identified, not sure or not yet identified, or need to be properly identified, in Near East countries? The answer in all the countries is: not at all. We talk usually about *Ceratitis capitata* and some species of *Bactrocera*, especially *B. oleae* and recently *B.*zonata. But what about *B.cucubitae* , *B. dorsalis* and *B. invadens*? What about *C. cosyra*? *C. quinaria*? Fig fruit flies? What about *Carpomylia* spp.? The picture is not clear. A regional and updated survey is highly needed, in collaboration with our colleagues in Asia, Europe and Africa. A first draft, could be established during this symposium with the identification of suitable donors.

Key words: Fruit flies, Near East, Survey, regional project, donors.

(O-2)

Biology and management of fruit flies in Africa and their potential impact in Near East countries.

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Despite the economic importance and high potential of horticultural production in Africa and the Middle East, the subsector is severely hampered by several constraints. Notably are the biotic factors, which include among others, heavy attacks by several insect pests for which fruit flies of the family Tephritidae rank very high. Tephritids of the genus *Bactrocera* are globally recognized to be frequent invaders and aggressive colonizers of new environments. Due to globalization of trade and ever-growing tourism coupled with the fragile nature of the quarantine facilities and lack of phytosanitary expertise in Africa and Middle East countries, these regions continue to be under continuous threat of invasion by species belonging to this genus. Species that have invaded Africa and some of Middle East countries, and already causing havoc to the horticultural industry are *Bactrocera cucurbitae*, *B. latifrons,B. zonata*, and *B. invadens*, the latter two being of major threat to this industry in North Africa/Middle East and sub-Saharan Africa, respectively. *Bactrocera invadens* putatively believed to be of Sri Lankan origin was detected in 2003 at the Kenyan Coast. Currently the pest is established in over 30 African countries including Sudan, thus it represent an eminent threat to North Africa and the Middle East. On the other hand, the peach fruit fly *B. zonata*, a highly polyphagous pest has invaded some of the Middle East (e.g. Saudi Arabia, Oman, Yemen, Iran,..) and Northern African countries (e.g. Egypt, Libya). The pest has recently invaded Sudan, a clear indication of its south wards movement. Owing to their high reproductive capacity coupled with the lack of competitors and efficient natural enemies of these pests, and further compounded with the poor quarantine infrastructure in the regions, the pests have continued to spread at an alarming rate across the regions, with far reaching socioeconomic consequences. The Trans-regional invasions by these alien invasive pests require a consolidated and systematic regional-wide approach for their early detection and management. This presentation highlights the current distributional range and projects the African and global potential areas at risk of invasion and establishment by these pests. The paper also highlights proven technology for fruit fly monitoring and management using eco-friendly IPM approach.

Keywords: *Bactrocera zonata*, *B. invadens*, trans-regional invasion, Middle East, Sub-Saharan Africa, Management

(O-3)

Fruit flies and role of regional plant protection in minimizing their impact

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Agriculture dominates the economies of most Near East countries, and for many people it is their main source of income. This sector continues to play a crucial role due to its contribution to employment and represents about 12% of the regional gross domestic product. Main agricultural exported products are fresh fruit and vegetables, contribute significantly to total commodities exports in some countries. However, these exports are threatened by fruit flies.

Fruit flies (*Tephritidae*) are of major economic importance. They cause direct losses in the yield and result in losses of marketability, they represent significant threats to international trade by affecting adversely export of fruit and vegetables to lucrative markets abroad.*Ceratitiscapitata* (Wiedemann), one of the world's most destructive fruit pests, is originating from the Mediterranean region of Europe and North Africa. *Bactrocera zonata* (Saunders) occurs in Egypt, Iran, Libya, Oman, Saudi Arabia and Sudan and poses a real threat to their neighboring countries.

Regional cooperation is crucial in surveying, controlling and reducing the impact of such transboundary pest, and this is one of the mandate of the Near East Plant Protection Organization (NEPPO). NEPPO is an intergovernmental organization which entered into force on January 8, 2009, and is currently constituted by 10 member countries namely, Algeria, Egypt, Jordan, Libya, Malta, Morocco, Pakistan, Sudan, Syria and Tunisia.

One of the objectives of NEPPO is to promote international cooperation, to support the work of the plant protection organizations and strengthen the capacity to control pests properly; to prevent the introduction and spread of pests; and to promote safe trade; through:

- Better coordination in surveying and preventing the introduction and spread of pests,
- Cooperation within the region to strengthen implementation of phytosanitary measures and build capacity of NPPOs staff;
- collection and sharing of information,
- Cooperation with International Plant Protection Convention Secretariat in developing and implementing international standards for phytosanitary measures.

Keywords: NPPO, economy, information, standards, phytosanitary.

Session 2

Biology, Ecology and Population Dynamics(II)

(O-4)

Status of the peach fruit fly, *Bactrocera zonata* (Saunders) and its control measures in Egypt

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The tephritid peach fruit fly (PFF), *Bactrocera zonata* (Saunders) is a recently introduced exotic fruit fly species that has established and become a widespread pest in Egypt. It was ranked as an A1 serious quarantine pest. *B. zonata* threatens countries in the Near East and North Africa and to a lesser extent in Southern Europe. PFF has not established yet in any other region of the Mediterranean or Africa so quarantine concerns are likely to be much more significant for Egypt. PFF poses a threat to many of Egypt's export markets and a more immediate threat to the welfare of the industry than the Medfly and for this reason is likely to prevent further spread. PFF populations are building up slowly from early April reaching high levels in July which persist well in to the fall. Its major host plants in Egypt are; mango, guava, peach, apricot and citrus. PFF has beenalso recorded as a secondary pest species threatens some vegetable crops in Egypt. PFF detection in Egypt depends on scattered traps using non-toxic methyl eugenol plugs. Control methodology, using killing bags, bait spraying of tree trunks beside chemical control has relatively limited effect on the pest control. Through a wide survey, natural enemies, particularly native parasitoid species, seem to be absent. For nonnative pests, conservation is likely to be inadequate because sufficiently effective natural enemies will be absent. In such cases, introducing new effective natural enemy species as additional mortality factors against the pest is absolutely essential, and is an approach that historically has been extremely successful.

Keywords: *Bactrocera zonata*, Status, Control measures, Egypt.

(O-5)

Seasonal occurrence and infestation patterns of fruit flies invading guava orchards in upper Egypt

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Seasonal occurrence of the peach fruit fly (PFF) and infestation patterns of the peach and med flies were determined in guava orchards in three areas belonging to Manfalut province, Assiut Governorate, Upper Egypt, during 2010 and 2011 seasons. The (PFF) *Bactrocera zonata* (Saunders) exhibited gradually increase in numbers and showed annually peak, with an average of 58.63 and 110.86 individuals/lure trap in October of both 2010 and 2011 seasons, respectively. Peaks of the pest were coincided with the ripening period of guava fruits in both seasons. The pest incidence showed highly significant difference between the examined areas. Infestation patterns of the fruit flies in guava orchards showed that: 1- Most of the ripening and/or fallen guava fruits were infested by the pest (23.21 pupae/18.54 fruits). 2- Mean numbers of the emerged adults is equal 75.79% of the collected pupae. 3- The emerged *B. zontata* flies is equal 6.71 fold of *C. capitata*.

Keywords:*Ceratitis capitata* (Wiedemann), *Bactrocera zonata* (Saunders), Guava (*Psidium guajava* L.), Seasonal Occurrence and Infestation Patterns.

(O-6)

Population fluctuation of the peach fruit fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) in relation to prevailing weather factors in Assuit Governorate.

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Monitoring of the pest population round the year is one of the most important basic information in formulating IPM concept for sustainable agriculture. The study aimed to investigate the seasonal fluctuation of the adult fly round the year for two successive seasons 2008/2009 and 2009/2010 through the use of cue-lure, as well as the main affecting weather factors such as temperature (minimum, maximum) and mean relative humidity at Assiut Governorate.Significant variation in occurrence of the pest was recorded during the period of investigation. During warm months the flies were more active as compared to the cold weather period (December, January, and February) . Significant positive correlation (r) of fly incidence was noted with maximum and minimum temperature (r = +0.395 and +0.413 respectively) with the fruit fly catch per trap for the first year 2008/09 and (r = +0.243 and +0.280 respectively) for the second year 2009/10. However, for relative humidity negative correlation was obtained for the two Years (r= -0.218 and -0.182 respectively) with the fly catch. The efficiency ofthese factors was: minimum temperature first, relative humidity, and maximum temperature came second or third in its efficiency. Results of the present investigation may be utilized in sustainable pest management strategy in the agro-ecological system under consideration.

Keywords: Peach fly-sticky traps- weather factors- IPM.

(O-7)The occurrence of the peach fruit fly, *Bactrocera zonata* (Saunders) (Tephritidae) in fruit orchards in Sudan

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The peach fruit fly, *Bactrocera zonata* (Saunders) (Tephritidae), was captured in fruit fly detection traps during July 2011 in three locations in the Gezira area, Sudan. The first samples were identified through Marcde Meyer (Royal Museum for Central Africa, Belgium) and Ian White (The Natural History Museum, London) in fruit fly traps. The traps were meant to survey *Bactrocera invadens* in Sudan, mounted in Wad Medani, Gezira, mid 2011. A survey during late 2011 and early 2012 revealed the presence of *B. zonata* in all traps at various periods in Wad Medani area. The percentage *B. zonata* of the total catch ranged between 4 and 82% during the surveyed period in Wad Medani area. In Singa and Elkamlin area, *B. invadens* was present in all traps at various periods. However, *B. zonata* was present with a very small proportion only on two occasions in Singa and one occasion in Elkamlin.

Keywords: *Bactrocera zonata*, identification, survey, Sudan.

(O-8)
Abundance of *Bactrocera invadens* in central Sudan

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The newly described species ofTephritidae*, Bacrocera invadens* appears to have invaded Africa from Sri Lanka. In Africa it has been detected in Kenya and Tanzania in 2003 and it had spread to more than 10 countries in CentralAfrica where is reported as pest of economic importance. This fruit fly is highly invasive and polyphagous with high reproductive potential. A survey was initiated in 6 orchards of mixed fruits in central Sudan (Gezira and Khartoum areas) between December 2011 and August 2012. In this study CHEMPAC bucket traps® were used to capture fruit fly species. Methyl Eugenol was used to attract the fruit flies and Dichlorvos tablets were used to kill any attracted flies. The results showed a differential abundance of the three sites surveyed in Gezira area. The weekly number of *B. invadens* adult flies attracted in the three sites ranged between 50-900, 36-1207 and 104-2027 for Hantop 1, Hantop 2 and Geziert Alfil. In Khartoum area in the three sites surveyed the weekly number of fruit flies caught ranged between 12-47, 12-29 and 22-25 for Alfaki Hashim, Shambat and Albagir sites.

Keywords: *Bacrocera invadens,* survey, trapping, Khartoum.

(O-9) Seasonal abundance of *Bactrocera invadens*, *Ceratitis cosyra* and *Ceratitis capitata* (Tephritidae: Diptera) in river nile state (Shendi area), Sudan

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Fruit flies of the family Tephritidae are among the major pests that attack horticultural crops reducing economically their. This study was conducted in Shendi area, River Nile State, during the period from May-2007 to May-2008 to monitor the fluctuation of the population of three fruit flies species, *Bactrocera invadens*, *Ceratitis cosyra* and *Ceratitis capitata* and to correlate their relation to climatic factors in order to determine specific time for control operation. The study showed that the fruit fly, *Bactrocera invadens* has two peaks, in August and November while the other two species have one peak, August for *Ceratitis cosyra* and November for *Ceratits capitata*. The seasonal activity of fruit flies varies according to climatic factors and host range availability. Climatic factors, especially relative humidity have contribute significantly to the fluctuation of fruit flies populations and fruit infestation. Monitoring based on Pheromone traps is necessary to detect the presence of the different species and to evaluate their populations, because both the species and their populations are continuously changing.

Keywords*: Ceratitis capitata, Ceratitis cosyra, Bactrocera invadens*, fluctuation, monitoring.

Session 3

Biology, Ecology and Population Dynamics (III)

(O-10)

Effect of Guava Fruit Colour and Size on Fruit Fly Incidence in Khartoum State

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The guava (*Psidium guajava* L.) fruit marketable sizes were measured attempting to standardize them. That is, the means for the big (B), medium (M) and small (S) guavas are 6 cm X 5 cm, 5cm X 4 cm, and 4 cm X 3 cm, respectively. However, the mean infestation of fruit flies in guava fruits decreases with the fruit size. That is, the Green (G) B, M and S guavas showed an infestation of 13.04, 8.28, and 6.56 worm/ fruit (w/ f), respectively. Whereas, the corresponding figures for the yellow green (YG) guava are 20.24, 18.42 and 10.54, respectively and for Y guavas are 25.66, 17.22, and 18.44, respectively. These results reflect a decreasing pattern in infestation proportional to the fruit size and the rind yellowness and vice versa. It is worth noting that the total means for B, M and S guavas were 19.65, 14.64 and 11.85 (w/ f), respectively which are closer to the M colour/ size readings. However, the LSD is highly significant for G and Y, G and YG guavas and insignificant for that of Y and YG. It is also highly significant for the B & M guavas, and for the B & S guavas. Nevertheless, it is insignificant for the M & S guavas at 0.05 level.

Keywords: Guava fruit size, guava fruit color and fruit flies.

(O-11)

Study the geographical distribution and host range for Medfly *Ceratitis capitata* in fruit planting regions in Babylon-Iraq during 2009-2010

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This study was conducted in the fruit planting regions in Babylon,100 km south of Baghdad during 2009-2010. The results revealed that the Medfly *C. capitata* was found in all fruit planting regions and the highest number of Medfly was found in the Hindia duck region, was reached to 16.5 insect/ trap and the least was in the Tihmazia region, was reached 2.33 insect/ trap. the results also revealed that the apple fruits *Malus pumila* gave high infection,was reached 10.84 scar and 19.79 larvae/fruit respectively, but the *Citus limone*,*Ficus carica*,*Ziziphusmauitania,Prunus domestica* and *Pyrus communis* was none preference by the Medfly, the infection rate was 0.0 scar and 0.0 larvae fruit.

Keywords: *Ceratitis capitata,* Babylone, trapping.

(O-12)

Ecological studies on the peach/mango fruit fly *Bactrocera zonata* (saunders) Tephritidae: Diptera) in Lahij Governorate, Republic of Yemen.

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The Peach/Mango fruit fly *Bactrocera zonata* (Saunders) Tephritidae: Diptera) is a quarantine pest that has been spread during the past few years and causing economic damages to mango, peach, guava and other crops. Pheromone traps using Methyl eugenol, were used to monitor the movement of the pest in mango and guava fields in 2010/2011. The results have shown that the pest is available almost all the year around, but it reached its peak in September, where the mean pheromone trap catch was 2278 male adults. The number declined when the temperature decreased reaching its minimum (196 male adult) in January and March. It has been noticed that the number of male adults caught in pheromone traps was higher in morning that in evening. The preferred color of the pheromone trap that attracts more male adults was the white color, followed by the yellow one; the least attracted was the black color. There is a positive correlation between the increase in temperature and the number of adults available in the pheromone traps (r=0.85). Rainfall has little correlation, while the effect of winds was not that clear. Field food preference trials, as well as fruit juices, showed that the insect prefers mango compared to other fruit trees available in the area. This information is vital for developing an Integrated Pest Management (IPM) program for the pest in the area.

Keywords: *Bactrocera zonata*, traps, fruit juices, IPM

(O-13)

Comparative study between nine trapping techniques for monitoring the med fly in citrus orchard in Jordan

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Field trial was conducted in the central Jordan valley, to compare captures of med fly, *Ceratitis capitata* (Wied.) in nine types of traps, baited with female and male targeted lures. Traps consisted of food synthetic attractants: three component lures (ammonium acetate, putreseine and trimethylamine) tested in McPhail type traps with Dichlorovinyl Phosphate (DDVP) and water, additionally dome traps baited with diammonium phosphate (DAP) + yeast and protein hydrolysate + borax, vertical yellow sticky traps alone or with solid diammonium phosphate ovoid yellow sticky traps alone or with soluble trimedlure and finally Jackson trap with TML. Jackson and ovoid yellow sticky traps, baited with male specific trimedlure, captured more males than in the traps baited with female attractants. However, the total capture of med fly was highest in Jackson traps than in McPhail traps, baited with the three component synthetic lures. More females were captured in traps baited with the three component lures than in traps baited with other female targeted lures. Moderate number was obtained from dome trap with protein hydrolysate and borax. The lowest efficient traps were both vertical yellow sticky traps and dome traps, with DAP. Two main flight activities were appeared for med fly in central Jordan valley. The first one extended from January to June and the second one from October to December. Results showed five generations of the med fly in central Jordan valley with three miner peaks.

Key words: *Ceratitis capitata* (Wied.), Trapping techniques, Monitoring, Citrus orchard, Jordan.

(O-14)

Current Status of The Mediterranean Fruit Flyin Montenegro

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The Mediterranean fruit fly, *Ceratitis capitata* Wied. (Diptera: Tephritidae) is an established pest on Montenegro coast for more than 10 years. Distribution, host plants and population dynamic of *C. capitata* were recorded since 2002. Different lures were used. From 2008 only 3 component female-targeted attractants (ammonium acetate, trimethylamine and putrescine) in Tephri traps were practiced. Initially, presence of *C. capitata* was restricted to the coast. It was detected inland in surrounding area of the city Podgorica in 2008 and Skadar Lake in 2010. Mandarins, oranges, lemon (cultivar Lunario), grapefruit, figs, persimmon, jujube and apples were confirmed as host plants so far. All these fruit species were found infested on the coast, while in the area of Podgorica and Skadar Lake were only persimmons and apples. Apples were detected as new host in 2010. In an economic sense, the most important host is mandarin (cultivar Unshiu) which mainly grows along the coast. Figs and persimmons (although without economic importance) are very important for breeding of the fly in early summer and early autunm. Figs are the first infested fruits in the season (July and August), while mandarins is from mid-September. Results of four years monitoring with Biolure-Unipak (2008-2011) showed some earlier captures of *C. capitata*. Along the coast, first flies were detected in July, with an exception in 2011 when it was detected on 17th June. Number of captured flies / trap/ day (FTD) also indicated that after low capture rates in July and August, level of population reached a peak from mid-

September to end of October and started decreasing in November. Flies capture ending in December. No flies were detected between January and June/July. In inland first captures were in August and September with low number until mid-November. Results of monitoring also showed fluctuation of FTD depending on monitoring date and locality, with statistical significant differences in adult population density. A maximum FTD reached 153.3, 162.07, 197.19 and 53.5 (in 2008, 2009, 2010 and 2011, respectively). It was recorded in the last week of September 2009 and 2010 and in the second half of October in 2008 and 2011. Our findings suggest that *C. capitata* has spread from Montenegro coast towards the inland and gradually increased number of host plants. Surrounding of Podgorica is the most important area for peach production in Montenegro and *C. capitata* could become a serious threaten for it, although peaches haven`t found infested so far.

Keywords:*Ceratitis capitata*, distribution, host plants, population dynamic, Pheromone traps, Montenegro.

(O-15)

Geographic distribution, population dynamics and management of the Mediterranean fruit fly , *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) in northern Mediterranean countries

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The Mediterranean fruit fly (medfly), *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) is one of the most important insect pests of fruit commodities world wide, and a highly “virulent” invasive species that threatens the sustainable fruit and vegetables production worldwide. From the ancestral habitats of the sub-Saharan Africa, *C. capitata* has dispersed, in less than 200 years, to multitude tropical and subtropical areas including some temperate ones. In Europe, established populations occur in many (mostly) coastal areas of almost all the Mediterranean countries and Portugal. The northern limits of the geographic distribution of *C. capitata* in Europe lay south of the 43° northern latitude, and within this marginal zone established populations occur in northern Greece, the coastal area of Slovenia, Croatia, Montenegro, and southern France. Sporadic detections of *C. capitata* in several central European countries are attributed to non-established populations introduced via fruit trading from Mediterranean and possible other countries. Analyzing the population dynamics of medfly across a range of latitudes, from Crete (Southern Greece) to Split (Coastal Croatia) distinct seasonal patterns emerge. Year round adult detections (sporadic and few during winter though), and peak population densities during summer and mid autumn are reported in the southern warmer areas. On the other hand, adult detection is restricted to 3-4 months (late summer – autumn) for the northern most established populations.

Apparently, the northern (cooler) the area, the higher the habitat resilience for medfly development and thriving. An extremely long overwinter generation and small population increase rates, under low population densities, in spring and early summer explains the long absence of adult detection in northern areas. It seems that life history adjustments, such as long – lasting duration of the immature stages (especially larvae), certain degree of cold tolerance, and thermal plasticity account for successful establishment in cooler more temperate areas. Winter temperatures that inhibit overwintering, host fruit availability and the duration of the fruiting season consists the main barriers prohibiting *C. capitata* of being established in the fruit growing areas of central Europe. However, recent climatic changes seem to relax some of the previous constrains rendering currently unsuitable areas appropriate for medfly establishment. The results of the current analysis points towards developing area specific strategies for the managements of the Mediterranean fruit fly based on local population trends and climatic conditions.

Key words: The Mediterranean fruit fly, population dynamics, northern Mediterranean countries

Session 4

Control Methods: Cultural and Biological Control

(O-16)

IPM activities of IOBC-WPRS for the control of fruit flies (Tephritidae) in Europe.

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The contributions of the International Organization for Biological Control (IOBC) to research and development of tools and strategies for Integrated Pest Management of three economically important Tephritid species in Europe are presented. The potential utilization of thereby generated knowledge for the control of other fruit fly species, which pose an actual or emerging plant health risk is discussed with regard to future challenges for sustainable plant protection. Integrated Pest Management activities for fruit flies (Tephritidae) are covered in the IOBC Working Groups (WG) of "Fruit Flies of Economic Importance" (1956-2004) and more specifically in the crop related IOBC-WPRS WGs for IPM in citrus crops, olives and stone fruits and are supported by input from the WG "Pesticides and beneficial organisms" http://www.iobc-wprs.org/). Whereas the WGs on "Fruit Flies of Economic Importance" mainly focused on research about natural enemies or autocidal techniques, the crop related WGs address other important aspects of IPM such as the use of biotechnical tools, biopesticides or combinations of several plant protection measures and their implementation into integrated control strategies. The fruit fly species of major interest are *Bactrocera* (syn. *Dacus*) *oleae* (Gmelin), *Ceratitis capitata* (Wiedemann) and *Rhagoletis cerasi* L., which are not categorized as quarantine pests in Europe, except *C. capitata* which is recommended for regulation by EPPO (http://www.eppo.int/QUARANTINE/listA2.htm). Research topics include studies on developmental cycles, host plant range, flight activity, spatio-temporal infestation patterns, population genetics, population dynamics and geographical distribution, on forecasting and monitoring, on autocidal control

(SIT and IIT), on natural enemies (parasitoids and ground beetles), on chemical ecology (attractants, repellents, pheromones) and mass trapping systems, on combined control techniques such as different combination bait sprays (attract and kill) or push and pull, on microorganisms as fruit fly biocontrol agents and recently also on host plant resistance (olive trees).
For the knowledge exchange and dissemination at least 18 IOBC meetings (3 of them in cooperation with the EC) with emphasis on IPM and biocontrol of fruits flies, were held and as many IOBC-WPRS bulletins produced. Additionally crop specific Integrated Production Guidelines reflecting a holistic plant production concept were developed under the coordination of the IP-Commission for the crops olive, citrus and stone fruits. With regard to the future challenges due to increasing threats to plant health from the introduction and natural invasion of non-endemic fruit fly species and a decline in the availability of conventional synthetic pesticides, as well as growing consumer and market demands, integrated plant protection strategies will gain more importance.

Keywords: fruit flies, IPM , biocontrol, Europe**.**

(O-17)

Cultural Practices: The Hidden Role on Management of Tephritid Fruit Flies (Diptera)

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Fruit flies of the family Tephritidae are the major pests that attack horticultural crops reducing economically their production. In Sudan, in the year 2007, the fruit fly problem exaggerated to the extent that thepest statusof Tephritidae was upgraded and they were added to the list of the notorious national pests of Sudan. The role of cultural practices as part of integrated pest management to control fruit flies was investigated for two consecutive growing seasons of mango. Three orchards within the study area were chosen and subjected to a package of cultural practices included hoeing, flooding, orchard cleaning and early harvesting of fruits before ripening. Results showed a highly significant difference in the level, percentage and degree of infestation for the different mango varieties grown on the study areas. The reduction percentage ranged from 49-73% and 57.3-99 %, from 44.9-72% and 64.6-83.4% and from 29-55%and 49.6-75.4 % for the three parameters respectively for the two seasons.This result was in accordance withthe number of trapped fruit flies per month. High performance of cultural practices on lessening infestation levels of fruit flies give it the priority to be applied as an effective method in management of fruit flies to avoid overlapping of generations and to reduce the growth rate of insects' population.

Keywords: cultural practices, fruit flies, infestation.

(O-18)

La fourmi *Monomorium subopacum* (Formicidae) agent de control biologique de la mouche méditerranéenne des fruits *Ceratitis capitata* (Tephritidae) dans la forêt d'arganier au sud-ouest du Maroc.

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L'arganier représente le plus grand réservoir au monde de la prolifération et la dissémination de la mouche méditerranéenne des fruits *Ceratitis capitata*. Ce ravageur occasionne des pertes énormes dans la production des fruits et des légumes maraichères dans les régions de pullulation. L'utilisation des agents biologiques contre la Cératite représente une alternative viable contre les méthodes chimiques de lutte de plus en plus contestées. Dans cette étude, notre objectif vise l'étude des attributs de la myrmécofaune de l'arganeraie et leur importance dans le control des populations de la Cératite.

Notre étude est conduite au laboratoire et sous les arganiers dans les conditions de terrain. Dans un premier lieu, nous nous somme intéressée à dresser l'inventaire des espèces de fourmis qui fourragent sous les arganiers et la caractérisation de la structure spatio-saisonnière de leurs peuplements. Ensuite, cette recherche a visé la détermination des espèces prédatrices et l'évaluation du taux de prédation qu'elles occasionnent. Enfin, l'étude s'est focalisée sur l'importance des rythmes circadiens d'activité de l'espèce prédatrice *Monomorium subopacum* et celui de l'émergence des larves de la Cératite des fruits d'arganiers dans la synchronisation du comportement de la prédation entre les deux antagonistes.

Les résultats ont montré que deux espèces de fourmis *Monomorium subopacum* (54%) et *Tapinoma simrothi* (31%) sont écologiquement dominantes dans l'arganeraie. Quatre espèces de fourmis sont impliquées dans la prédation des larves de la Cératite. La fourmi *M. subopacum* est le prédateur majeur des larves de *C. capitata* (66%). L'étude des rythmes d'activité de l'espèce *M. subopacum* et de la dynamique d'émergence des larves montre une nette synchronisation de l'activité entre les deux espèces antagonistes.Ces résultats mettent en évidence les attributs de *M. subopacum* comme majeur prédateur de la Cératite et soulignent son efficacité comme agent de lutte biologique éventuel dans les programmes de gestion biologiques de la mouche méditerranéenne des fruits dans l'arganeraie et dans les systèmes agro-forestiers de la région.

Mots clés:lutte biologique – *Ceratitis capitata* – *Monomorium subopacum* – *Argania spinosa*-– Morocco.

(O-19)

Status of the management of the invasive fruit fly, *Bactrocera invadens* in Senegal

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Bactrocera invadens is an invasive tephritid fruit fly introduced to Senegal since July 2004. It has become the most economically important tephritid on mango.A mango IPM associate award began in July 2008 for the management of *B. invadens* in Senegal but fruit flies remain a severe constraint on mango growers in Senegal. Three techniques were tested for managing these fruit flies in orchards and two variations of a technique were tested to reduce fruit fly emersion from culled fruit in an area where retail fruit is sold by women alongside the road. A fruit fly population monitoring network was established. Extension agents were trained to collect data on fruit fly populations in the field and DPV took the role of validating the field data. Fruit bagging was tested as a technique appropriate for protecting fruit because it requires no cooperation between growers. It was found to be effective, and two types of bags tested also seemed to protect mangoes from the fungal disease anthracnose. At the end of the bagging period, the incidence infestation by *B. invadens* was 70% on unbagged control fruits compared with 0.45% for fruit bagged with any of the three bag types. Therefore, substantial protection can be provided by any of the three bag types. The incidence of the fungal disease anthracnose (*Colletotrichum gloesporiodes)* on unbagged mangoes was 64%. Over 50 field agents, grower group representatives, and other stakeholders were trained in fruit fly management and fruit fly identification. 352 mango growers were trained in area-wide fruit fly management. The field trial covered a total of 180ha. It demonstrated the effectiveness of combining the male annihilation technique with protein bait sprays that attract and kill female flies at a period when fruit fly pressure is high. The result was highly significantly different ($p<0.0005$), indicating that growers who received one treatment had significantly higher opinion of the quality of their harvest compared to nearby growers outside of the treatment block. Biological control method was recently introduced in Senegal as part of an integrated fruit fly management approach. The abundance of alternative hosts for fruit flies in Basse Casamance and the frequent proximity of orchards to forests there makes fruit fly management with sprays or traps inherently more difficult there than north of the Gambia where mangoes themselves are the dominant vegetation. The parasitoid, *Fopius arisanus* waspis a small insect that seeks out eggs of their preferred host and lays eggs in them.

Key words:*Bactrocera invadens,* Status*,* IPM measures*,* Fruit bagging, Senegal

(O-20)

Spinosad bait an organic green bio-insecticide for the control of the cucurbit fly *Dacusciliatus* (Loew) and the peach fly *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) in Egypt

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The efficacy of spinosad (GF-120) as a bait application was evaluated in Egypt for the control of *Dacus ciliatus* (Loew) on three cucurbit crops;squash, snake cucumber and cucumber, the bait was also tested on mango for the control of *Bactrocera zonata* (Saunders), compared to Malathion 57% EC as a cover spray. The products were evaluated under a high population pressure especially pronounced in the cucurbit crops.GF-120 applied at 3 weekly intervals at 1.2 L product diluted in three water concentrations of 9.6, 14.4, 19.2 L to treat one hectare of crop out performed Malathion at 1.2 L/ha in 480 L water for the 3 vegetables. GF-120 was sprayed 3 times with a 7 days interval at 0.98, 1.2 and 1.2 L in 9.8 , 9.8 and 24 L of water, respectively and was also better than malathion at 2.4 L in 2400 L water / ha to control *B. zonata* onmango. The GF-120 in lower volumes of water showed better results than high volumes on the 3 vegetable crops as well as on Mango versus Malathion.Delete space There was no emergence of any pupae of *D. ciliatus* in the three vegetable crops when GF-120 was used diluted at the lowest water volume, as well in the two cucumber crops at the middle dilution.Delete spaceThe spinosad bait proved to be a very effective and viable alternative to Malathion, and could be a valuable tool within IPM programs for the control of both fruit fly in Egypt.

Key words: GF-120, Malathion, fruit fly, *Cucurbitaceae,* mango

Session 5

Control Methods: Chemical Control

(O-21)

Geographical distribution of the Mediterranean fruit fly, *Ceratitis capitata* (Wiedeman) (Diptera: Tephritidae) and its management in Iraq

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Ceratitis capitata (Wied.) is considered an invasive pest which introduced to Iraq recently. This pest was recorded on Citrus in Diyala 2006. Several surveillances have been conducted to monitor its population density in 2009-10. These surveillances have been done in citrus, stone fruits and poly crops orchards. Pheromone traps; Tephri and Jackson traps have been used to monitor the population density and geographical distribution in seven provinces at middle of Iraq. Pheromone traps optimization was studied mainly on citrus. The results showed that highest infestation was found in Wasit, Diyala and Salahddin. Also, it approved that the poly crop orchards have recorded the highest populations in comparison with the mono crop orchards like *e.g.* citrus orchards.The major component of the pest management have been discussed.

Key words: *Ceratitis capitata,* Population density, poly crops, Pheromone traps, optimization, control, Iraq

(O-22)

The olive fruit fly, *Bactrocera oleae* Gmelin (Dip: Tephritidae) management in Iran

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During the past 15 years its plantation has widely extended up to 100000 ha in 3 north provinces of country and other provinces with suitable conditions.Till, 2004 Olive fly was a Quarantine pest for the country but during this year its damage was recorded in olive orchards confirming its entrance from neighboring countries. In summer of 2004, it was first reported from Roodbar, Iran, and then dispersed in 10 other provinces. Considering it as an exotic pest and the importance of olive as a strategic crop, it was necessary to start a comprehensive study on the IPM of the olive fruit fly. Therefore, an investigation was carried out during 2005-2009 to find best solutions of the pest control in accordance with sustainable agriculture rules. The objectives of the project included pest bio-ecology, plant resistance, Bait trap, attract and kill technique and comparison of available chemical sprayers on olive fruit fly.

Its biology and establishment was studied from 2005-2007 in olive orchards of Roudbar, Tarom, loshan & Dezphol located in Gilan, Zanjan, Ghqzvin & khozestan Provinces, respectively. Results showed that the fly overwinters as adult mainly, but rarely as pupa beneath the plant debris and surface soil layer of the olive orchards. Pooled analysis of the data showed that the olive fruit fly had at least 3 complete overlapping generations in the studied localities commencing from July and ending late in Sept in the olive orchards.

A study was carried out to design an IPM program based on 4 types of traps (vertical yellow sticky trap, bucket trap, dome trap and bottle trap) and 5 attractants (sex pheromone, ammonium bicarbonate, protein hydrolysat, sex pheromone + ammonium bicarbonate and sex pheromone + protein hydrolysat). The results showed, vertical yellow sticky trap was the best trap (with mean capture 138.1 in first year and 23.9 in second year) and sex pheromone, sex pheromone with protein hydrolysat and sex pheromone with ammonium bicarbonate had most capturing (with mean capture of 46.313 -83.625 per trap in first year and 10.063 - 15.313 in second year respectively.

Different cultivars show different reaction to pest damage which could be used in integrated pest management. Using the olive collections of the Roudbar, Tarom and Loshan research stations located in Gilan, Zanjan and Qazvin provinces respectively, this research was carried out during 2005 – 2007. Overall results showed that konservalia cultivar due to its susceptibility from early season until harvest could be assumed as a trap crop in the integrated management of the pest.

A study was conducted to evaluate some bait spray of new compounds under Iran climate. Considering obtained results, environment safety, economic benefits and small difference in fruit infestation percentage, we advise deltamethrin EC 2.5% in every other tree way for controlling olive fruit fly.

Keywords: Olive, olive fruit fly, *Bactrocera oleae*, biology, traps, sex pheromone cultivars, baits, Deltamethrin, Dimethoate, Spinosad .

(O-23)

Development of a management strategy against the fruit fly *Bactrocera dorsalis* in mandarin (*citrus reticulata*)

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The experiment was conducted at Hill Tract Agriculture Research Station, Ramgorh, Khagrachari, Bangladesh during July to December 2010 to find effective control measures against citrus fruit fly, *Bactrocera dorsalis*. Citrus is an important fruit crop cultivated almost everywhere in Bangladesh. But it is grown commercially in greater Sylhet, Chittagong and Norsingdi districts. The most important species of citrus grown in Bangladesh are lemon, lime and pummelo but there are some other citrus species viz. jaralebu (*C. medica*), ada lebu (*C. asamensis*), mandarin (*C. reticulata*), satkara (*C. macroptera*), sweet lime *(C. limettioides*) and kata jamir (*C. jambheri*) etc. cultivated in limited areas of greater Sylhet. Mandarin, *Citrus reticulata* is commonly known as orange. It is a very much popular fruit . Amongst the insect pests threatening the production of this fruit, the fruit fly, *Bactrocera dorsalis* is of major importance . The control of this pest appeared difficult because of internal feeding habits. Considering the above facts, the present study has been designed. There were six treatments used in the experiment bagging of fruits with perforated polybags, bagging of fruit with butter bag, hand picking of infested fruits, use of methyl eugenol sex pheromone trap, spraying of Metasystox @ 1.5ml/L of water and control. The results indicated that bagging of fruits with perforated polybags showed best performance in reducing fruit fly infestation of mandarin. (how the treatments were rated ?)

Key words: Fruit fly, mandarin, bagging, hand picking and methyl eugenol pheromone trap

Session 6

Control Methods: Mass Trapping and Bait Stations

(O-24)

Area-wide integrated pest management of tephritid fruit flies using the sterile insect technique

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Tephritid fruit flies are among the most important agricultural pests. Additionally, as illustrated by the recent exotic tephritid fruit fly pest invasions into Africa (e.g. *Bactrocera invadens* and *B. zonata*) and other parts of the world, they disrupt control strategies and interfere with international trade in fresh fruits and vegetables from those regions. Strengthening of quarantine, surveillance, and early response measures in the potential areas of tephritid fruit fly invasions is crucial to prevent these economically disruptive situations. The Sterile Insect Technique (SIT) and the male annihilation technique (MAT) are being successfully applied to prevent, contain, or eliminate outbreaks of tephritid fruit fly pests as a component of an area-wide integrated pest management (AW-IPM). The SIT has also a successful track record for eradication or routine suppression of fruit fly populations to establish pest-free areas and areas of low pest prevalence, providing better options to address International Plant Protection Convention (IPPC) Standards and to overcome barriers to international agricultural trade. The SIT is environment-friendly in view that it is non-polluting, species specific and does not introduce exotic insects, but its operational application is complex. It requires a long-term commitment, the organization of growers and the participation of other stakeholders. Furthermore, sterile insects need to be systematically released as part of an AW-IPM approach. There are active programmes targeting major fruit fly species in the Americas, Europe, Middle East, Asia, Africa and Australia.

Key words: Sterile Insect Technique, Tephritid fruit flies, male annihilation technique.

(O-25)

Attract & kill (AA L&K) Cerat: New solution based on Attract and Kill technology to control the Mediterranean fruit fly

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The Mediterranean fruit fly *"Ceratitis capitata"* is considered a major pest of citrus, and can cause losses of up to 80-100 % in this crop. In the past different methods to control this pest have been used. Control is usually based on the use of pheromone for monitoring,mass trapping and insecticide treatments. Atlas Agro has developed a new method called AA L&K which combines two technologies in one: first the attraction of male insects by a pheromone, and then the elimination of the insect with a very low doses of an insecticide. The pheromone is released gradually to attract adult males that will approach the lure for mating. Their elimination by the insecticide removes them from the reproductive cycle, and the insect population decreases. This method can be a good alternative of the use of high doses of insecticide and high number of pheromone trap.
The mode of action, advantage and results of trails will be shown and discussed.

Keywords: *Ceratitis capitata*, mass-trapping, pheromone, insecticide

(O-26)

Evaluation of Ceranock attract and kill and Femilure nass trapping strategies tocombat Mediterranean fruit fly, *Ceratitis capitata* (Wied.) in Tunisia

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Effectiveness of two techniques, Ceranock attract and kill and mass-trapping, using the female food-attractant Femilure, were evaluated against the Mediterranean fruit fly (Med-fly), *Ceratitis capitata (*Wiedemann*).* Treatments were carried out in two peach orchards of 3 hectares; one highly infested located in Borj-Touil, the second moderately infested in Mornag, Northern Tunisia. Ceranock is a specialized systems based on hydrolyzed proteins and alpha-cypermethrin. Femilure contains dry food volatiles: ammonium acetate, and tri-methylamine chloride. During this study, 400 Ceranock bait stations were placed in every hectare, four weeks before fruits color changes. In mass trapping strategy, Femilure baited McPhail traps were placed at a density of 60 traps/ha. Femilure and Ceranock systems were found to be effective in reducing the number of *C. capitata* population to 50 and 70%, respectively. Femilure also found very selective for Med-fly, capturing an average of 80% females. Fruit damages assessment showed significant differences between treatments in the decrease of fruits infestation. Therefore, Femilure and Ceranock baited treatments were able to reduce dropped and soften fruits, respectively to 4 and 7 times relative to control plots. While, damages were restricted to 9 and 5%, compared to 33% recorded in control field. Nevertheless, Ceranock system showed better performance than Femilure mass-trapping to combat Med-fly.

Keywords: Med-fly, *Ceratitis capitata,* Femilure attractant, Mass trapping, Ceranock, Attract and Kill, fruit damages, Tunisia

(O-27)

The IPM based on mass-trapping: is it an efficient method to control the medfly *Ceratitis capitata* (Diptera, Tephritidae)?

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In Tunisia, the Medfly is the most damaging pest in Citrus orchards, and its control remains based on the chemical way. Aware of theside effects ofpesticideson humansand nature, these recent years,the'Research community' supported bythe Ministry ofAgriculture,has been invested infinding alternativesagainstthis pest.Among them, mass-trappingwasfirst testedsingle then andas a component of IPM programsonorangesvar.Thomson.The variousprograms implementedhave associatedmass-trapping with othersmeasures such as field sanitation, chemosterilization, applications of non-conventionalsubstances(GA_3) and rationalized chemical control. The effectiveness of programstested wasevaluated by consideringtwoparameters: the levelof Medfly populationsand the rate offruitbitten (%), who were monitored fromripening to harvest. The results werequite satisfactorywithdamage at theharvest that doesn't exceed15%.This performancewas confirmedafter the extensionof IPMonTakelsaarea(300 ha of Citrus orchards) with only 4% offruitspunctured at the harvest.Tested during thecampaign2011-2012, in an organic orchard, theIPMbased on mass-trapping, protectedtheorangesThomsonsuccessfullyreducingdamage toabout 2%. Thus, the integrated management ofthe Mediterranean fruit flybased onsanitation andmass-trapping, canactually reducethe use of pesticidesand replace thechemical control, especially as, it was supported by theCitrus growers.

Keywords: *Ceratitis capitata*, mass-trapping, chemosterilization, spinosad, GA_3, field sanitation, integrated management, organic orchard, *Citrus*.

(O-28)

Chemo Sterilization Effectof Some Iorganic Saltsonthe Cucurbit Fly, *Dacus Ciliatus* (LEOW) (Diptera: Tephritidae)

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Five inorganic salts were evaluated to detect their effect on the cucurbit fly, *Dacus ciliatus* (Leow) (Diptera: Tephritidae) by applying the pupal dipping method in a serial of descending concentrations. The result showed that all tested inorganic salts adversely affected the adult emergence and reduced the egg laying capacity and egg hatchability. These salts could be arranged according to their toxicological effect to *D. ciliatus* as following: KBr_2> NaoH > $ZnSo_4$> $NaHpo_4$ > $Cucl_2$; and according to their sterility effect as following: $Cucl_2$= KBr_2=NaoH =$ZnSo_4$> $NaHpo_4$. This approach helps in mass production techniques of this pest and utilization the spreading sterilized pupae as a tool minimizing the population size.

Key words:*Dacus ciliatus*, Inorganic salts, Chemosterilization, Effect.

Session 7

Control Methods: MAT and SIT

(O-29)

Comparison of susceptibility and nychtemerals rhythms of reared and wild populations of the Mediterranean fruit fly (*Ceratitis capitata* Wiedemann) in Algeria treated with a fenthion insecticide

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Fenthion toxicity was studied with topical application and the lethal doses LD50 and DL80 were assessed on various *C. capitata* populations. Toxicity was lower in wild individuals than in reared insects, among which individuals irradiated with 90 Gy gamma ray were significantly more susceptible. A nychthemeral variation in the susceptibility to this insecticide was characterized with some peculiarities related to the origin of the insects and the lethal dose considered.

Keywords:*Ceratitis capitata* - Tephritidae - Wild population - Insecticide - Fenthion - Rayons gamma.

(O-30)

Application of sterile insect technique for controlling *Ceratitis capitata* (Diptera: Tephritidae)

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The losses of *Ceratitis capitata* according to amount of the hosts on different horticultural products especially on citrus are too much, and tangerine is very sensitive and will be attacked completely. Due to biology of the pest, application of the usual methods of control cannot control the pest. Because of high success of using low doses of gamma irradiation in controlling Diptera insects compared to other orders, research has been done on application of sterile insect technique for controlling *Ceratitis capitata.* First after transferring contaminated tangerine, collection pupa and with emergence adults in the cage, eggs collecting have been done. The eggs will be transfer red to artificial diet, and mass rearing continue in 26±2, 65±5% RH, 12 hours light and 12 hours darkness condition. The six days old pupa irradiated with different gamma irradiation dose ranged from 0 to 80 Gy. The adults after eclusion crossed according to the following situations: Irradiated male × Irradiated female and wild male × wild female in four replications and in every replication 5 pairs of adults crossed, and the eggs during of living period were transferred to artificial diet. Sampling has been doneaccording to eggs hatchpercentage. The result shows that irradiation of pupa six days old with 70 Gy respectively control *Ceratitis capitata*.

Key words: *Ceratitis capitata*, Sterile insect technique, Dose, Pupa.

(O-31)

Fitness improvement of mass-reared sterile males of *Ceratitis capitata* (Vienna 8 strain) after gut enrichment with probiotics

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Successful mass rearing is crucial for SIT programs. One of the essential requirements is a continuous supply of a large number of insects of appropriate quality. In most industrial operations, it is the mass-rearing conditions and the irradiation process that contribute most to the inferiority in the field performance of sterile males compared to wild males. It is likely that the sterilizing irradiation procedure affects the gut bacterial community structure of the medfly and is responsible for this low competitiveness. A bacteria-enhanced diet could improve growth and the fly's performance.

We investigated ways of increasing the competitiveness of mass-reared sterile males. We tested the hypothesis that the addition of beneficial bacteria to the larvae's diet would lead to a significant increase in their levels in the gut of the sterile adults and consequently improve their size and fitness. As expected, enriching the diet of mass-rearing Vienna-8 strain larvae with beneficial bacteria (*Klebsiella pneumonia*, *Citrobacter freundii* and*Enterobacter* spp,) increased the original microbial community in the medfly's gut and consequently significantly improved the quality control parameters and sexual performance of *Ceratitis capitata* males at emergence.

Keywords: Probiotics, Medfly, fitness , reproduction.

(O-32)

Suppression of medfly by Sterile Insect Technique (SIT) in Neretva river valley of Croatia

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Mediterranean fruit fly (medfly), *Ceratitis capitata* (Wied.) is a pest of high economic importance in Neretva valley (Croatia), affecting production of several fruit species, especially mandarins, *Citrus reticulata* Blanco grown mainly for export to former Yoguslavia countries, EU and Russia. The export reached up to 75% of total yield valued to over 20 million of Euros per year. Medfly infestation in mandarin's fruits is estimated to be 10-30% without any control measures and also causes major problems to exports due to quarantine restrictions and pesticide residues in fruits. After preliminary economic and technical feasibility studies conducted and two years of successfull suppression through an SIT pilot projectconducted with cooperation of the FAO/IAEA, the Croatian Ministry of Agriculture expanded the project to the whole lower part of the Neretva valley, covering over 4000 hectares of fruit orchards ofmainly mandarins. For this reason, a fruit fly emergence and release facility was build and equipped in the city of Opuzen, with packing capacity of 20 million sterile flies per week. Releases are performed mainly with two ground release machines using chilled flies mounted on vehicles. Trapping system is set and geo-referenced over the whole SIT treated and non-treated area of the valley (additional 4000 ha) with 3C lures Tephri Traps. Captured flies are checked by fluorescent lamps to separate sterile from the wild flies. At the same time provide information on the insect population level. Routine fruit sampling is undertaken to evaluate fruit infestation and suppression efficacy. Results of the two years of pilot project showed that medfly population, measured as number of larvae per kg of fruit, was reduced annually from 75,9 – 93,2% in figs and 75,9 – 99,2% in mandarins in SIT treated area compared with non-treated area.

Keywords: Neretva valley, mandarins, medfly, SIT

Session 8

Control Methods: Quarantine and Post-harvest Treatments

(O-33)
EPPO's recommendations, standards, and information on fruit flies

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The European and Mediterranean Plant Protection Organization (EPPO) is a regional standard-setting organization created in 1951.The organization has two main areas of activities: plant quarantine and plant protection products.

Plant quarantine: helping EPPO members prevent entry and spread of pests?

One of EPPO's main priorities is to prevent the introduction of dangerous pests from other parts of the world, and to limit their spread within the region should they be introduced. In order to achieve this aim several activities are conducted within EPPO.

- Identification of potential risks:

The EPPO Secretariat has established an early warning system to identify emerging risks which includes the Alert List and the EPPO Lists of Invasive Alien Plants.

- Evaluation of potential risks: Pest Risk Analysis

Measures adopted by countries to protect their territories from the introduction of new pests should be technically justified. A system has been established to perform Pest Risk Analysis (PRA) at the EPPO level and Expert Working Groups are convened to conduct PRAs on specific pests. In the framework of this programme a PRA was conducted on *Bactrocera invadens*

- Recommendations on the pests which should be regulated as quarantine pests

Pests which have been evaluated through the EPPO system and have been recommended for regulation as quarantine pests for the EPPO region are included in the EPPO A1 and A2 Lists. EPPO maintains appropriate documentation on the pests included on these lists. Several fruit flies are listed on the A1 and A2 lists of pests recommended for regulation.

- Recommendations on how to detect and identify pests

When a pest is recommended for regulation, EPPO Standards can also be developed in order to provide guidance on how to detect them during inspection and how to identify them in the laboratory. More than 100 diagnostic protocols have been adopted as well as standards on quality assurance. A database on diagnostic expertise in the EPPO region has also been created. Three diagnostic protocols on fruit flies have been adopted so far and more are in preparation.

- Recommendations on how to eradicate or control pests

EPPO provides guidance on eradication and containment and one standard has been developed for *Bactrocera invadens.*

- Dissemination of information

The information generated within EPPO is disseminated though different channels (EPPO Website, EPPO Bulletin, EPPO Reporting Service). Freely available databases are also maintained.

Plant protection productspromoting the use of modern, safe, and effective pest control methods

There has always been a need to keep crops free from pests and EPPO consequently plays a role in particular in providing guidance for the evaluation of plant protection products. Over recent decades,

crop protection practices have changed as many active substances have disappeared from the market in many European countries. This is causing considerable difficulties in agriculture because it became increasingly difficult to control specific pests (including diseases and weeds) in a satisfactory way. One of EPPO's main priorities is to develop principles of good plant protection practice on major crops in the EPPO region by employing the most efficient application practices and incorporating non-chemical methods into pest control programmes.

Key words: plant quarantine, plant protection products, regional standards

(O-34)

DNA finger prints of major Tephritid fruit flies of Sudan

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The insect mitochondrial cytochrome oxidase 1 was used to determine the sequences of 15 fruit fly species belonging to three genera of the family Tephritidae. The complete sequence has been determined for species belonging to the genera *Bactrocera*, *Ceratitis* and *Dacus* at both the DNA and amino acid levels. Phylogenetic relatedness was established for some African and Asian Tephritid fruit flies.

Keywords: Mitochondrial DNA, Bactrocera, Ceratitis, Dacus.

(O-35)

The use of molecular markers for the determination of pattern distribution and genetic variability of the fruit flies

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Fruit fliesare the world's worst pests of fruit and fruiting vegetables, causing millions of dollars' worth of *damage*a year. Modern control strategies request the use of techniques like SIT (Sterile Insect technique) and semiochemicals that are specific to the species. But these techniques require a deep understanding ofthetaxonomy andstructureof the target population. The analysis of the fruit flypopulationsisimportant because ithelps to understandthe history of thedevelopment potentialof this species andto drawconclusionsforthefutureand forrisk assessment. Determining theorigins ofcolonization eventscan only help tounderstand the biologyof invasion andtherefore to designcontrol strategies. The present work reports the first data from molecular markers employed to assess the genetic variability of Mediterranean populations of five Tunisian populations of *Ceratitis capitata* and two Tunisian populations of *Bactrocera oleae*. Different mitochondrial DNA regions of the cytochrome oxidase Iand the NADH dehydrogenase 4 and 5 genes have been analyzed. The results show different levels of genetic polymorphism at all genes region in the analyzed populations. The findings are discussed in relation to the population structure and dynamics of both flies.

Keywords:*Ceratitis capitata, Bactrocera olea*, contol, identification, genetics

(O-36)

Vapour heat treatment against tephritid fruit flies: approval of Egyptian facility by Jordanian phytosanitary authority

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Vapor Heat Treatment (VHT) is a safe method for treatment of infested fruits so that it passes the quarantine inspection and enabling the fruits to be exported. The process complies with phytosanitary international standards. In VHT, the pulp temperature of the commodity is raised by the saturated water vapor to 46-48 °C during a ramp up time of 4 hours and then the fruits will be held at the required temperature for a period of 30 minutes. During the process, the temperature and humidity are meticulously controlled so that the fruit is not damaged and freshness is naturally preserved. Phytosanitary authority in the Ministry of Agriculture in Jordan approved two facilities for vapor heat treatment of mango and guava fruits in Egypt and Yemen to facilitate access of these fruits to Jordanian market, to open new resources of fruits and to ensure getting free fruit flies fruits. The phytosanitary department had put a group of conditions for importing vapor treated fruits which guarantee cleanliness and high fruit quality. This document provides a detailed description of the Egyptian facility, the testing procedure and Jordanian conditions of importing these fruits.

Keywords: Vapour heat treatment, Phytosanitary treatment, Fruit flies, Mango, Guava.

(O-37)

Phytosanitary treatments for *Ceratitis capitata* (Wiedemann)(Diptera: Tephritidae) and other fruit flies important to Near East Region

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Fruit flies are important pests for the Near East Region because they cause damage and restrict market access for fruits and vegetables. Effective *management* of fruit flies is important in elevating production, *ensuring food security and promoting exports. Phytosanitary treatments are a key component in exports promotion. Many phytosanitary treatments were developed by countries mostly against the med fly*(*Ceratitis capitata*). *The globally*harmonized phytosanitary treatments are developed by the Phytosanitary Treatments Technical Panel (TPPT) and the Standards Committee (SC) of the International Plant Protection Convention (IPPC) and adopted by the Commission Phytosanitary Measures CPM. Phytosanitary treatments against Fruit flies are either cold, heat or irradiation treatments. The heat treatments are hot water, vapor heat and hot air. Hot water dips for fruit require 90 min exposure to 46°C. An extended hot water treatment was developed to control fruit fly infestation in mangoes. Small fruits and medium-size fruits are dipped in the heated water for 38 and 44 minutes, respectively. Large fruits require 53-minute dipping time. The fruits should be dipped 10 cm below surface of the heated water with a temperature of 48°C. A pulp temperature of 46°C should be held for 15 minutes; fruits are then air cooled for ten minutes prior to hydro-cooling. Hot air remains the second most common pest treatment method for mangos to vapor heat treatment.In 2012 the TPPT evaluated a high temperature forced air treatment for use as a generic treatment against fruit flies in fruits. A vapor heat treatment for *C. capitata* on *Mangifera indica* is in a draft stage. The vapor heat treatment for *Bactroceracucurbitae* on *Cucumismelo* var. *reticulatus* was finalized and the panel recommended the treatment to the SC. A generic irradiation treatment for fruit flies was developed and approved (ISPM 28 Phytosanitary Treatments No. 7: Irradiation treatment for fruit flies of the family Tephritidae). This treatment applies to the irradiation of fruits and vegetables at 150 Gy minimum absorbed dose to prevent the emergence of adults of fruit flies at the stated efficacy. An irradiation treatment for *Ceratitiscapitata* was also developed and approved as the phytosanitary treatment No. 14 (ISPM 28: Phytosanitary Treatments: Irradiation treatment for *C. capitata*). The cold treatments for fruit flies established by Animal and Plant Health Inspection Service (APHIS) in 2006 include T107-a for *C. capitata (*1.11^{o}C, 1.67^{o}C and 2.22^{o}C for the period of 14, 16 and 18 days respectively) and T107-a-1 for *C. capitata* and *Anastrepha spp*. Formal objections on cold treatments schedules presented for CPM-7 for adoption had been made by major citrus exporting contracting parties and may have reflected a fear that the adopted treatments could hinder trade.

Keywords: Phytosanitary treatments, *Ceratitis capitata,* irradiation treatment, heat treatment, cold treatment.

POSTER SESSION

(P-1)

Introduction ofFruit flies(Diptera-Tephritidae)Ceratitis, *Bactrocera*, *Dacus* and *Rhagoletis* from I. R.of IRAN.

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In Iran, about 2400000 hectare horticulture crops such as apple,Pear,Quince, Apricot, Nectarine, peach, black cherry,cherry, vitis, citrus,mango,plum, and about 700000 hectare vegetable crops are such as watermelon & melonCantaloupe, Cucumber, Squash &Tamato. This product some times damage by fruit flies (Diptera-Tephritidae species of *Ceratitis,Bactrocera*, *Dacus* and *Rhagoletis*).Therefore we always need to have useful program for monitoring and control of them. Most of this fruit flyies is common pest and some of them are regulated and internal Quarantine pests.

A. Common pests:

2. *Bactrocerazonata* (Saund)
On mango, guava, In Sistan&Baluchestan province
3.*Dacus ciliatus* Loew
OnCantaloupe,Cucumber,Squash,watermelon& melon, In Fars, Khorasan razavi, Tehran, Khuzestan & Hormozgan provinces.
4.*Dacus* (=*Leptoxyda*)*persicus* (Hend.)
On mango, (guava) , In Sistan&Baluchestan province
5. *Rhagoletis* (=*Spilographa*) *cerasi* (L.)
On cherry, sour cherry & barberry, In Azarbaijan gharbe, Fars, Hamedan, Isfahan, Tehran, Khorasan razavi, some provinces that growing the hosts
6.*Rhagoletisflavvigenualis* Her.,
On cherry in Golestan province,

B.Regulated & Internal Quarantine pests:

1. *Bactrocera oleae* (Gm.)
On olive , In Qazvine, Zanjan& Gilan provinces
2. *Ceratitis capitata* (Wiedemann)
On Citrus , In Mazandaran, Golestan, Fars, Kermanshah provinces.

Monitoring and management:

The methods for monitoring and detection are visual inspection & pheromone trapsTrimedlure, Biolure with some kind of trap and Yellow panel.
The methods of management and controlling of fruit fly in Iran is using inspection, surveillance or treatment , in order of control we use the lure ,attractant such as protein hydrolizate with Malathion,Ammonium acetate ,attract and kill, with Tephri trap, CeraTrap, Mac Phile typ trap, Yellow panel , Jackson Trap, and bait spry in some caudation.

Key words: Fruit fly, pest, Quarantine, monitoring, management

(P-2)

Carpomya vesuviana Costa(Diptera, Tephritidae) a new pest in Montenegro

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Jujube - *Ziziphus jujube* Mill. is grown in the coastal zone of Montenegro and its hinterland, as individual tree at the yards. There is no great economic importance of this fruit due to the small production and it is used only for fresh consumption. Until now, the pests of jujube in Montenegro were not studied, but the presence of Mediterranean fruit flies (*Ceratitis capitata* Wied.) was noted. In 2011 many gardeners registered a significant presence of larvae in the jujube fruit which is attributed to the *C. capitata*.

Bearing in mind the presence of *Carpomya vesuviana* and *Carpomya incompleta* on jujube in the neighboring countries, Croatia and Italy, in order to determine the possible presence of species of the genus *Carpomya*, the yellow sticky traps were set up at several locations in the region of Ulcinj, Bar and Budva in the mid-June. The trapswere monitoredin the intervalsof 7 to 15 days.

First captured flies were registered in late June in the region of Bar, and in July in the region of Ulcinj and Budva. Laboratory analysis determined the *Carpomya vesuviana* Costa (Diptera, Tephritidae), making this paper the first report of its presence in Montenegro.

Key words:*Carpomya vesuviana*, jujube, fruit flies

(P-3)

Fruit Flies of Economic Importance in Turkey, With Special Reference to Mediterranean Fruit Fly, *Ceratitis capitata* (Wied.)

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Three fruit fly species occur in Turkey that can be considered as important pests of agricultural crops; The Mediterranean fruit fly (Medfly), *Ceratitis capitata* Wied.,the olive fruit fly *Bactrocera oleae* Gmel. and the cherry fruit fly, *Rhagoletis cerasi* L. (Diptera: Tephritidae).

Mediterranean fruit fly is by far the most important fruit fly species, due to its considerable number of hosts. Citrus species are of main importance among the hosts because of the export limitations. The pest is widely spread all over the country where citrus is planted. Due to the mild winter and the widespread of host crops, population of the pest is very high, having 4-8 generations throughout the year. Yield losses can reach up to 80%, if proper control measurements are not applied. The control of the pest is based mainly on insecticide treatments.Growers determine when to spray based mainly on the time of year and state of the fruit.The only application recommended is baitspraying.There is very little mass trapping, but some growers do rely on monitoring traps.

Olive fruit fly is the most significant olive fruit pest and found at almost all olive growing areas. The damage is caused by tunneling of larvae in the fruit. If it is not controlled, it causes a damage of 15-30%. The impact of the damage can vary considerably depending on whether the fruit is for oil extraction or for table consumption. Mass trapping, bait and cover sprayings are the most preferred control methods.

Cherry fruit fly is the most economically important pest of sweet and sour cherry. The mid and late ripening cultivars are highly affected. The pest gives 1 generation a year. The control of the pest is based mainly on 1-2 insecticide treatments either by bait or cover spraying. Mass trapping with the combination of chemical treathments also gives good results.

Sysytematic surveys are regularly carried out by plant protection services in order to establish the necessity, appropriate time and methods for the control of these three fruit flies. Throughout the years, studies are undertaken to examine the best methods to manage.

Key Words: Mediterranean fruit fly, *Ceratitis capitata, Bactrocera oleae, Rhagoletis cerasi,* management

(P-4)

Sugar compositioninfluencing the development of the Mediterranean fruit fly on the Argan fruit

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The Argan tree, *Argania spinosa L (*Skeels, 1911) of the Sapotacae Familly is an endemic and emblematic tree in south-western Morocco. Therefore, it'is known as a largest reservoir of proliferation and dissemination of the harmful polyphagous and cosmopolitan fruit fly *Ceratitis capitata* wied who migrate actively from Argan tree and invade neighboring other host plants in the region.To understand mechanisms of infection of the Argan fruit, we have studied the phenotypic and biochemical factors, maturity stage and continentality that may influence the multiplication of the Medfly. Thus, we analyzed the concentration of sugars content in Argan fruit pulp according to the phenotypic variability of fruits, its maturity stage, the continentality and the degree of attack.

The results show that, the totals sugars were influenced significantly by the degree of attack at 20%, and the stage of maturity and phenotypic variability of fruit at 5%.

Since the attack by Ceratitis generally causes an increase in sugars content, as well as the pulp accumulate more sugars in the coastal region (R'zwa) than semi continental zone (Mijji). The results also highlighted a clear effect of stage of maturity and form of fruit on the accumulation of reserve sugars in the pulp. Sugars content and phenotypic variability showed a significant effect on the degree and distribution of the fruit fly attacks.

Key words*: Ceratitis capitata*, *Argania spinosa*,continentality, totals sugars.

(P-5)

Olive fly *Bactrocera oleae* – application of different models in forecasting infestation

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Olive fly *Bactrocera oleae*develops several generations per year that overlap. Protection measures are directed primarily to suppression of adults. Therefore, it is important to determine the time of fly appearance and the moment of application of insecticides and other products. Literature data indicate that the use of appropriate forecasting model of infestation can successfully determine the time of application of insecticides and provide satisfactory protection of olives. The olive as sortment and agro-ecological conditions of the region are important and indispensable factors in the selection of the forecasting model as well. The objective of this paper was to determine the applicability of two models in conditions of Montenegro seaside:

Model by Pucci (1993), which defines index of gravity of infestation Z based on the average number of females on chromotropic traps and mean daily temperature, and treatment is recommended when the Z > 0.1. Model by Lo Duca et al. (2003), which defines index Z based on the average number of males caught on pheromone traps and mean daily temperature, and treatment is recommended when Z> -1. Results show that the model based on monitoring of *B. oleae* flight dynamics using chromotropic traps in conditions of Montenegro seaside is not acceptable. According to this model protection period begins in the second half of September when the infestation is far above economic control threshold. The second forecasting model, based on flight dynamics monitoring by pheromone traps is useful in determination of optimal timing for control of this pest. According to this model the period in which olive should be protected from the olive fly is from the middle of August to the middle of October.

Key words:*Bactrocera oleae*, forecasting model, infestation

(P-6)

Population Density of Mediterranean Fruit Fly (*Ceratitis capitata)* in Fruit Orchards in South Baghdad and Using Tephri Traps and GF-120 as Control Methods

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Recently the Mediterranean Fruit fly, *Ceratitis capitata* distributed in the orchards of central part of Iraq and caused highly economic losses. This study was conducted in orchards in south Baghdad during 2009 and 2010 , field survey of the flies was carried out in four types of orchards (Citrus, Apricot, Alone Figs & Citrus and a mixture of fruit trees) used for this purpose Tephri Traps supplied with Q-Lure and dimethyl dichloroviny phosphate (DDVP).

The present preliminary study showed that the mediterranean fruit fly *C.capitata* had a year round presence in fruit orchards in central part of Iraq and reached its highest numerical density of the pest in citrus orchards during November and December were 345 and 363 Insect / Trap per month in citrus orchards and the least numerical density during January and February While the highest numerical density of the flies in orchards of the Apricot was in March 2010, Figs & Citrus was in August 2009 and a mixture of fruit trees in November 2009 and these were 45, 116, 311 flies /trap per month, respectively .

The highest population density of this pest was noted in 2010 in comparison with 2009 , Furthermore , the high temperature degree range (46 – 51 ^{0}C)was recorded in August 2010 which caused decreasing in the population density of this pest . *C. capitata* caused highly economic losses in citrus fruits which reached to 68% and 71% for Mandarin and Kaki fruits respectively . Currently in Iraq to fight this pest no control method available except using pesticides GF- 120 for reducing the economic losses in all types orange production caused by this pest except the use of pesticides GF–120.

Key words : Fruit fly(*Ceratitis capitata*) , Survey, Iraq, Population density, fruit orchards

(P-7)

Efficacy of Entomopathogenic fungi: *Beauveria bassiana* and bacteria: *Brevibacillus brevis* in the biological control of *Bactrocera oleae*

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The effectiveness of the entomopathogenic fungi *Beauveria bassiana* (Deuteromycotina: Hyphomycetes) (variant P1) and the bacterial strain *Brevibacillus brevis* I13 (GQ397858) (Biological control agents (BCA)) against the olive fruit fly *Bactrocera oleae* Gmel. (Diptera: Tephritidae) were evaluated in laboratory experiments.

Olives were placed in cages with fruit fly adults of varying sex (3 males and 8 females in each cage and 10 cages per trial. Fruit fly adults were exposed to viable spore concentrations (/gram) of the antagonistic fungi: 10^4, 10^5,10^6 and10^9 and fed on a mixture of yeast extract (0.75 g/L) and sugar during 12 days at 75% RH and 28°C. Five other trials with bacterial strain supernatants were tested using 30, 40, 60 and 80 mg / L. Distilled water is used as control (five repetitions) as well as a chemical reference treatment (the pyrethroid insecticide Deltamethrin) in 5 trials.

Calculated mortality of olive fruit fly adults in cage tests show high percentages: 82% with 10^9 spore concentrations of *B. bassiana* and 76% with 80 mg/ L with *B. brevis* I13 supernatant 12 days after the experiment.

Preliminary trials were conducted to confirm the effectiveness of the *B. bassiana* (variant P1) and *B. brevis* I13 for *B. oleae* control. Indeed, the bioinsecticides were as effective as the pyrethroid in reducing adult olive fruit fly and can therefore be considered a new and reliable tool for the management of *B. oleae* in organic olive groves.

Key words:*Bactrocera oleae,Beauveria bassiana* (variant P1)*, Brevibacillus brevis* I13, Bioinsecticides, control.

(P-8)

Performances des attractifs alimentaires synthétiques acétate d'ammonium, triméthylamine et putrescine formulés en Tripack® dans le piégeage de la mouche méditerranéenne des fruits (Diptera: Tephritidae).

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Les attractifs alimentaires synthétiques acétate d'ammonium, triméthylamine et putrescine sont largement utilisés dans le piégeage de *Ceratitis capitata* Wied., aussi bien pour le suivi de ses populations qu'à des fins de lutte par piégeage de masse. Ces derniers sont commercialisés sous plusieurs formes dont la formulation en un patch unique Tripack® (Biolure Unipack Suterra LLC U.S.A) ayant une durée d'action de 120 jours. Toutefois, cette durée n'a pas été vérifiée dans les conditions tunisiennes notamment en période estivale lorsque les températures sont très élevées. D'où l'objet de ce travail qui a porté sur l'évaluation de l'efficacité de ces attractifs sur une longue période. La nature des captures (sexe et sélectivité à l'égard des arthropodes non cibles) a été étudiée en comparaison avec le diammonium phosphate (DAP). L'évolution de l'état physiologique des femelles capturées au fur et à mesure de la dégradation des 3 attractifs a été suivie. Le travail a été conduit moyennant des pièges Moskisan® (Sansan prodesing SL) appâtés par les 3 attractifs ou le DAP, dans les jardins de l'Institut National Agronomique de Tunisie, comportant un mélange variétal d'agrumes. Les captures des pièges ont été relevées et analysées tous les 2 à 3 jours durant 6 mois et demi du 24/7/2009 au 19/2/2010. Les résultats obtenus montrent que les attractifs alimentaires formulés en Tripack® sont spécifiques aux femelles de cératite et attirent durant les 5 premières semaines de leur émission principalement les femelles vierges. Leur efficacité a été très peu affectée par les conditions climatiques avec des captures presque ininterrompues même en conditions très peu favorables au vol. La sélectivité de la formulation Tripack® à l'égard des arthropodes non cible est supérieure à celle du DAP. Vu leurs performances, les attractifs synthétiques en Tripack® peuvent être préconisés pour le piégeage de masse de la cératite.

Mots clés: Cératite, acétate d'ammonium, triméthylamine, putrescine, conditions climatiques, état physiologique des femelles, arthropodes non cible.

(P-9)

Trapping adults of the Mediterranean fruit fly, *Ceratitis capitata* and non target insects. Comparison of low-cost traps and lures

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Studies were conducted in an organic *Citrus* orchard from late September 2008 to January 2009 during the fruiting season to assess the efficacy of low cost and free of charge recyclable containers and attractants to capture *C. capitata* adults and non target insects in order to evaluate their potentialities for monitoring, bait station and/or mass trapping purposes. Thus, were tested (1) white or yellow empty 5-liters plastic containers used for household detergents, (2) one-liter plastic buckets of several colors; all baited with one of three solutions of attractants: Diammonium phosphate, DAP, the commercial protein hydrolysate, Lysatex and *Citrus clementina* Hort. Ex Tan. fresh juice and (3) plastic balls colored with red, yellow, green or orange mimicking *Citrus* fruits coated with adhesive. All experiments were done in a randomized block design with four replications.

In the container traps, there are no significant differences neither lure types nor trap colors for the capture of female and males *C. capitata*. However, yellow traps attract numerically more flies. All attractants capture more than 3-fold females than males.

Concerning beneficial insects (adults of Chrysopids and Syrphids), only the number of captured Syrphids varies significantly according to lure types. The Lysatex attracts 67-fold Syrphids than DAP and 3-fold than *C. clementina* fresh juice.

In bucket traps, the attractants DAP and *C. clementina* fresh juice captured respectively more than and nearly 2-fold females *C. capitata* than Lysatex. Indeed, males were more attracted by *C. clementina* juice and DAP than Lysatex. The number of captured Chrysopids did not significantly vary between lures. However, Syrphids did. Lysatex captured 34-fold Syrphids than DAP and 4-fold than *C. clementina* juice.

In balls mimicking fruits experiments, significant differences were detected between colors for Medflies male and female captures. More insects were trapped in red color traps followed by yellow and orange traps. The green color trap attracts the low numbers. Very low numbers of beneficial insects were captured. Moreover, in all trials there were significant numbers of captured non target insects (undetermined species of Diptera, Drosophila flies, Honeybees and Lepidoptera moths) in all traps with respectively 6.7-fold, 10-fold and 3.4-fold for container traps, bucket trap and ball traps.

Key words: *Ceratitis capitata*, *Citrus*, attractants, traps, colors, non target insects

(P-10)

Some Experience of Saudi Arabia in the Management of fruit flies.

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Fruit Flies are widespread in some areas of Saudi Arabia and cause heavy economic damage to some tropical and sub-tropical fruit trees. The Mediterranean fruit fly *Ceratitis capitata* is mainly reported in the North but also in Taif and Najrane in the South where it causes serious economic damage during some season. While the peach fruit fly *Bactrocera zonata* is mainly reported in Jazan region, on tropical fruits, especially guava and figs.Several trials have been conducted in Saudi Arabia, in collaboration between the Ministry of Agriculture and the Food and Agriculture Organization of the United Nations (FAO) on the use of IPM techniques for the management of fruit flies.

In these trials, we have used mixture of food attractants (Protein *hydrolyzate*) or sexual pheromones (*Eugenol Trimedlure*) and bio-pesticides or chemical pesticides. These mixtures were sprayed locally by applying the mixture to only one out of three rows of fruit trees. The mixture was also applied to wind breaks and to local part of the tree (about 1 square meter of the southern part of the three) as well as to wood pieces (10 x10 cm) hanged on each trees.

These trials have allowed a significant reduction of fruit flies and a successful management of fruit flies in the regions where we have tested this technology.

Keywords: Fruit flies, protein hydrolysate, pheromone.

(P-11)

Evaluation of the efficacy of Zonatrac system (lure and kill) to control peach fruit fly *Bactrocera zonata* (Saundera) by application of Male annihilation technique

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Male Annihilation Technique (MAT) involves the use of high density of bait stations consisting of a male lure combined with an insecticide is one of the essential component of eradication and crop protection programs for *Tephritid* fruit flies responding to various para pheromones to reduce the male population of fruit flies to such a low level that prevent mating between male and female flies. Zonatrac is an innovative system which is consist from blend of Methyl Eugenol (49%) and Spinosad (2%) in an emulsified wax formulation for attract and kill males of *Bactrocera* species such as *B. zonata* and *B. invadens* and *B. dorsalis* and other *Tephritid* flies attracted to Methyl Eugenol. In the present study performance of Zonatrac has been evaluated under field condition in Libya against *B. zonata* at dose of 2 grams /dollops which applied normally on the trunk or branch in shady part of the tree while in this study were applied in McPhail traps in order to count the number of captured flies. The result showed a steady release of attractant over a period of eight weeks in field condition. Average trap catches per flies per trap per day (FTD) in the first week were 132 Flies, and then dropped after the second week, until week eight with an average between 77 – 44 flies. Zonatrac showed results with efficacy more than 8 weeks. This system can be used successfully as MAT to combat various fruit fly species when applied for an area wide control.

Keywords: *Bactrocera zonata* , Zonatrac, Male Annihilation Technique

(P-12)

Testing bait spray and male annihilation traps for area wide management of the invasive fruit fly *Bactrocera invadens* in Senegal West Africa.

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Bactrocera invadens is an invasive tephritid fruit fly recently introduced to Africa. It has become the most economically important tephritid on mango since its arrival. A large scale field trial was carried out in main commercial mango production region of Senegal at a time when fruit fly pressure was high. Male annihilation using parapheromone traps was compared to male annihilation plus weekly application of a protein bait that attract females. A 30ha parcel of each treatment was replicated 3 times. *B.invadens* dropped six-fold in the parcels receiving only male annihilation. The addition of the protein bait sprays resulted in a further six-fold decrease in the target population after the first two weeks progressing to an 11-fold difference from the effect of male annihilation alone. These results show that even relatively small management areas can overcome outside population influx.

Keywords:*Bactrocera invadens*, Senegal, MAT.

(P-13)

Effect of lowering irradiation doses on the reproductive potential of mass reared Mediterranean fruit fly males (*Ceratitis capitata*).

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The aims of the present work were to verify, under laboratory conditions, the assumptions made by (Parker and Mehta 2007) regarding the relationships between the level of residual fertility, competitiveness and sperm ratio of mass-reared Mediterranean fruit fly males, *Ceratitis capitata* (Diptera:Tephritidae), and radiation (doses). The males were irradiated in the late pupal stage at doses ranging from 50 to 145G y. Our results show for the first time that an acceptable sterility rate (95%) can be achieved at lower doses without modifying flight ability, survival and mating success. We also found that radiation dose has a linear relationship with both competitiveness and fertility. We used linear regression to calculate the impact of fertile eggs at various doses and at different over-flooding ratios. Sterile Insect Technique programs continue to use high irradiation doses to sterilize the Mediterranean fruit fly, without consideration of the relationship between sterility and competitiveness. Our results show a clear balance between competitiveness and sterility at lower doses. To conclude, irradiation is currently the most effective method for inducing sterility in insects.

Key words: Medfly, irradiation, sperm transfer, competitiveness.

(P-14)

The combined effect of gamma radiation and plant extracts on peach fruit fly, *Bactrocera zonata* (Saundera).

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Bactrocera zonata is one of the highly polyphagous fruit flies established in most Egyptian provinces and it causes severe damage to a wide range of fruits such as guava, peach, mango, and apricot. In our study the effect of gamma-irradiation on certain biological aspects of peach fruit fly, *Bactrocera zonata*resulted from irradiated 5-day-old pupae had been studied. Pupae were irradiated with doses of 10, 30, 50, 70 and 90 Gy Significant positive relationship between dose levels and the percentage of adult emergence were obtained. The results indicate that adult emergence and egg hatch decreased with increasing dose. The percentage of adult emergence decreased from 90% in the control to 86%, 82%, 77%, 73 and 68% when pupae irradiated with doses of 10, 30, 50, 70 and 90 Gy, respectively. The percentage of adult malformation were 2.8%, 4.3%, 6.0%, 8.3% and 11.6% when pupae irradiated with 10, 30, 50, 70 and 90 Gy, respectively, as compared with 3.3% in unirradiated pupae.

Females seemed to be more successful in eclosion than males at all treatments. The sex ratio of adults resulted from non irradiated pupae were in favor of females. It was 1: 1.04, 1: 1.08, 1: 1.08, 1: 1.12, 1: 1.20 and 1: 1.27 when pupae irradiated with doses of 10, 30, 50, 70 and 90 Gy, respectively.

The irradiated male treated as pupa paired with unirradiated Females to investigate the number of egg per female and percentage of egg hatchability. Data showed that mating irradiated males (males developed from irradiated pupae) with normal females did not affect the production of eggs, but it reduced their hatchability. The number of egg per female was 413, 455, 414, 407, 401 and 398 eggs when pupae irradiated with 0, 10, 30, 50, 70 and 90 Gy, respectively. The percentage of egg hatch were 52%, 39%, 20% and 5% when pupae irradiated with 10, 30, 50 and 70 Gy, respectively in comparing to 93% in control. No egg hatch found when pupae exposed to 90 Gy.

Laboratory experiment were carried out to investigate the contact toxicity effect of both two plant extract commercial products on the newly emerged adult of *Bactrocera zonata.* The first one was *Lilac*(0.3% Eugenol) and the second was *Shenyu* (0.5% Malrine sl).The results showed that the percentages mortality of adult were increased by increasing the applied concentration of Lilac. The percentages of mortality were 26.6, 38.3, 41,6, 48.3, 60.0, 66.6, 36.3, 75,0, 81.6 and 88.3when adult treated with 0, 10, 20,30, 40, 50, 60, 60, 70, 80, 90 and 100µ/ 5ml water respectively.

The results showed that the percentage mortality of adults was increased by increasing the applied concentration of *Shenyu*. The percentages of mortality were increased from 13.3% in the control to 43.3,

61.6, 66.0, 68.3, 70.0, 61.6, 60.0, and 68.3 when adult treated with 50, 100,150, 200, 250, 300, 400 and 500µ/ 5ml water respectively.

Keywords: Gamma radiation - *Bactrocera zonata*– Biology – Fecundity- Fertility- Malformation- sex ratio- plant extract commercial products.

(P-15)

Laboratory efficacy of neem extracts on survival, fecundity and emergence rate of adults of *Ceratitis capitata* Wied. (Diptera: Tephritidae).

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In Tunisia, the Mediterranean fruit fly *Ceratitis capitata*, is a serious pest causing quantitative and qualitative losses to several crops. Current management control approach is based on organophosphates applications. Malathion [diethyl (dimethoxy-thiophosphorylthio) succinate] is among the more used insecticides.Nevertheless, due to insect resistance, increasing environmental and human health concerns on the harmful effects of insecticides, the implementation of alternative are required. One approach toward this goal is toreplace such chemicals with botanically based insecticides, such as those extracted from the neem tree,*Azadirachta indica* (A. Juss). Thus, this study was undertaken to evaluate the neem efficacy under laboratory conditions against second instar larvae and adults of *C. capitata*.

For the assessment of neem efficacy, 3 doses of neem ethanolic extracts: 1, 2 and 4 µg/ml were tested. Bioassays were based on determination of survival, fecundity and emergence rate of adults together with pupation rate of larvae. Two application modes were used: (i): Topical application: extracts were deposited on larvae or adults using a Hamilton syringe and (ii) Ingestion method: extract were incorporated into the artificial diet for larvae or added to water solution for adults. Each trial was replicated ten times. Non treated insects were used as control; moreover, a positive control using only ethanolic extracts was performed.

Laboratory experiment showed that neem extracts were efficient against both larvae and adults of *C. capitata*. Using the ingestion method, the doses 1 and 4µg/ml of neem ethanolic extract achieved respectively 40 and 60% of mortality of adults against 0% for the control, whereas, when topical application test was used, 100% mortality for adults and larvae was obtained against 4% for the control.

Results showed that fecundity was strongly affected by neem extracts and that topical application method was more efficient than ingestion mode. In this regards, the mean number of eggs laid was 100 egg/female at the dose 4µg/ml against 2250 egg/female for the control for the topical application mode, whereas, fecundity was respectively 2250 egg/female for the control against 1750 egg/female for the treated females (dose 4µg/ml) with the ingestion mode. Moreover, neem extracts affected the egg laying period of treated females. Indeed, at the highest dose (4µg/ml), the laying period was shortened to 3 days against 10 days for the control (maximum obtained in 6 days).

Regarding, adult emergence rate, results showed important reductions with the increase of extracts doses. At the highest dose, only 5% of adults emerged against 98% for the control. Besides, the emerging adults were not able to reproduce and females do not lay eggs.

Concerning larvae trials, significant reductions in pupation rate was obtained with topical application mode. Results indicated that pupation rate decrease with the increase of neem extract doses. Pupation rates were 60%, 50% and 40% respectively at the doses 1, 2 and 4µg/ml against 100% of pupation for the control.

Neem ethanolic extracts reduced significantly *C. capitata* populations (larvae and adults), reduce female fecundity and decrease larvae pupation and adult emergence rates. Thus, neem extracts can be an efficient alternative to chemical control against *C. capitata* in Tunisia.

Keywords:*Ceratitis capitata,*Neem, Ethanolic extracts, fecundity, pupation rate

(P-16)

Addition du gingembre en poudre au milieu larvaire de la mouche méditerranéenne des fruits *Ceratitis capitata* (Wed.)

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La mouche méditerranéenne des fruits *Ceratitis capitata* (Wied.) est un ravageur très important, qui possède une capacité potentielle d'occasionner des dégâts aux fruits et de réduire ainsi le marché international pour ces produits (Hendrichs 2000, Hendrichs *et al.* 2002) et en conséquence contribuer à des déficits pour l'économie des pays. Elle s'attaque à plus de 250 espèces végétales dans le monde (Christenson et Stone 1956, Mourikis 1965, Liquido *et al.* 1990, Krafsur 1998). Par conséquent, l'expérimentation de divers moyens de lutte à l'égard de ce fléau ne cesse d'évoluer et de se diversifier en vue d'une meilleure maîtrise et d'un meilleur contrôle des populations naturelles au dessous du seuil de nuisibilité.

Vu les nombreux inconvénients des moyens de lutte chimiques sur l'environnement et sur l'équilibre biologique, une nouvelle technique de lutte a été utilisée contre certains ravageurs à intérêt économique. Cette technique qui est la Technique de l'Insecte Stérile (TIS), vise soit le contrôle ou l'éradication d'une espèce et se base sur l'élevage de masse d'une population au laboratoire, l'irradiation ou la stérilisation et la lâcher des mâles au champ (Knipling 1955).

La réussite de la TIS dépend principalement de l'aptitude des mâles stériles à entrer en compétition avec les mâles sauvages pour s'accoupler avec des femelles sauvages. Afin d'améliorer l'efficacité en plein champ des mâles stériles. La poudre des racines de gingembre est un stimulateur des mâles puisqu'elle contient de l'α-copaène qui est un attractif sexuel des mâles. Nous avons additionné la poudre des racines de gingembre (GP) à différentes doses [0, 1, 5 et 10 g/l] au milieu d'élevage larvaire pour étudier son effet sur les paramètres de qualité (poids, émergence, …) et le potentiel reproducteur des mâles stériles (compétitivité et composantes de la parade nuptiale).

Selon cette étude, le GP améliore significativement le taux et d'aptitude au vol des mâles traités au GP par rapport au témoin à partir de la dose D5 (de 89,6%±1.32 pour le témoin à 95,4%±0.67 pour D5). Le GP à la dose D10 améliore significativement de 30% la compétitivité des mâles par rapport à la dose D1. L'étude des composantes de la parade montre que le GP n'a pas d'effet significatif sur la durée

d'accouplement mais le temps de latence diminue significativement de 104,42±5.81 min avec D10 à 53.16±3.04 avec D5.

Key words:*Ceratitis capitata*, ginger root powder, larvae diet.

(P-17)

Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies of the International Plant Protection Convention

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The Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies (TPFF) was established in 2004 by the International Plant Protection Convention (IPPC) Commission on Phytosanitary Measures (CPM) to review scientific and technical data and to draft International Standards for Phytosanitary Measures (ISPM) in support of international agricultural trade through the establishment of fruit fly free areas, systems approaches for fruit flies and other related matters.

A list of topics relevant to fruit flies was proposed by National Plant Protection Organizations (NPPOs) and developed into specifications. Based on these specifications, the TPFF has developed ISPMs, including annexes and appendices that are currently adopted or at different stages of the adoption process.

Four ISPMs have already been adopted by the CPM:

- Establishment of pest free areas for fruit flies (ISPM 26, 2006).
- Establishment of areas of low pest prevalence for fruit flies (Tephritidae) (ISPM 30, 2008).
- Fruit fly trapping (Appendix 1 of ISPM 26, 2011).
- Systems approaches for pest risk management of fruit flies (ISPM 3**5**, 2012).

Other drafts have been submitted to the IPPC Secretariat for approval by the Standards Committee (SC) and are expected to be adopted in the next few years:

- Determination of host status of fruits to fruit fly (Tephritidae) infestation (approved for Country consultation in 2012).
- Phytosanitary procedures for fruit fly (Tephritidae) management.
- Establishment and maintenance of fruit fly quarantine areas within a pest free area in the event of outbreak detection (approved for Country consultation in 2012).

The ISPMs concerning fruit flies have provided additional phytosanitary options for exporting and importing countries to facilitate trade of fresh fruit and vegetables.

Key words: Fruit fly free areas, areas of low pest prevalence, systems approach, host status, tephritidae.