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UNITED ARAB EMIRATES
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT

الإمارات العربية المتحدة
وزارة التغير المناخي
والبيئة

2016 AWARD WINNER at

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Best New Product for the Middle East Market – Agriculture

Winner of the MENTION OF HONOUR at

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

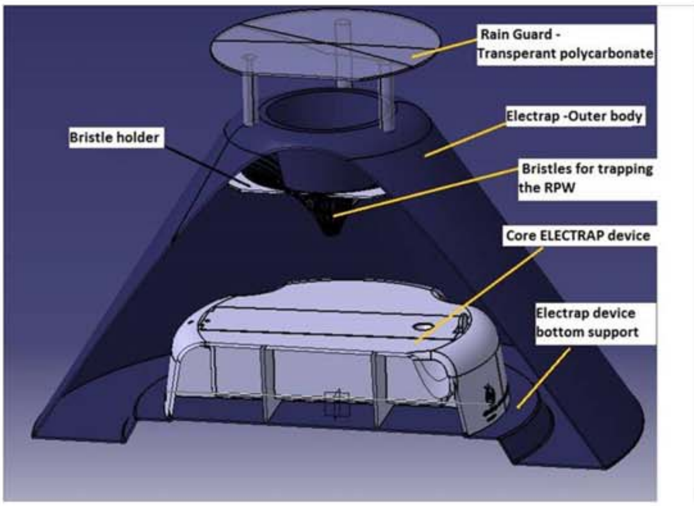
Innovative Ideas and Technologies in Agribusiness

2017 INTERNATIONAL AWARD

electrap

RED PALM WEEVILS
FINAL SOLUTION

GLOBAL INFORMATION SUMMARY



Future Innovation Right Solutions Technologies
AFZ Licence n. 10047 | UAE
P.O. Box 27709 | Abu Dhabi
Tel. +971 56 633 6308 | Skype: uaefirst_support
electrap@uaefirst.com | www.uaefirst.com

INDEX

"Date palms not only provide food and income, but are part of the history, culture and tradition of the region"

José Graziano da Silva, FAO Director-General 16 March 2014, Abu Dhabi

ELECTRAP at a glance

In ELECTRAP insects are captured and disabled using pulsed emission from MASER (Microwave Amplification by Stimulated Emission of Radiation). Inside the core Electrap device is placed the specially designed Phero-Kairo 925+, a pheromone lure (Ferrolure) and the formulation of the kairomone (ethyl acetate).

The invention has been granted a patent by the UAE and in the GCC.

Electrap functions on the principle of MASER, where a fully inside mirrored 'Resonance Chamber'(core Electrap device), loaded by natural light, incessantly reflecting the light, starts a resonance process till the saturation of the light reflection inside the chamber, thereby emitting the infrared electromagnetic radio waves loaded by the lures molecules and attracting the insects.

In Electrap the said Resonance Chamber is mounted horizontally in the trap and the semiochemicals (Pheromone and Kairomone), specially manufactured by ChemTica in Costa Rica, when placed inside, can last for 4 to 6 months without renewal.

Once RPW adults enter into the Electrap, escape of the trapped weevils is prevented due to the presence of the one-way bristles crown at the entrance. Subsequently the trapped weevils die due to quick dehydration.

The dismountable bottom support allows an easy periodical removal of the dead weevils. It is pertinent to mention that the Electrap, besides being bait and water free, is also without any insecticide as often used in traditional traps to kill the trapped weevils. So is fully fitting for the "ORGANIC" farming.

All of it means that ELECTRAP, approved by United Nations, Abu Dhabi Baladyia, KSA Ministry of Agriculture and many others, is the most effective and less expensive solution against RPW!

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION
INVESTMENT AND TECHNOLOGY PROMOTION OFFICE ITALY

ITPO
INVESTMENT AND TECHNOLOGY PROMOTION OFFICES
ROME, ITALY

National Research Council of Italy

International Award 2017 – II Edition

Innovative Ideas and Technologies in Agribusiness

Electrap – Luigi Porcella

Mention of Honor

Milano – May 10, 2017

SEEDS & CHIPS
MAY 8-11, 2017 | MILANO

Italian Development Cooperation
Ministry of Foreign Affairs and International Cooperation

Ministero degli Affari Esteri e della Cooperazione Internazionale

UNITED ARAB EMIRATES
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT

الإمارات العربية المتحدة
وزارة التغيير المناخي
والبيئة

Award Winner

ELECTRAP

by

First – Future Innovation Right Solutions Technologies

was presented the

Best New Product for the Middle East Market – Agriculture

at

AgraME | AquaME
AWARDS
2016

EUROVETS
VETERINARY SUPPLIERS

informa
exhibitions

THE BACKGROUND

FIRST (Future Innovative Right Solutions Technologies, UAE) has developed a revolutionary trap for the Palm Red Weevils (Rhynchophorus Ferrugineus-RF), severely affecting palm tree and dates industry.

The red palm weevil (RF) invaded the Gulf States in the mid-1980s, and has caused havoc with date plantations ever since. The beetle-like weevil is widely found in southern Asia and Melanesia where it is a well known threat to coconut plantations as well as date palms. The weevil expanded its territory westwards very rapidly.

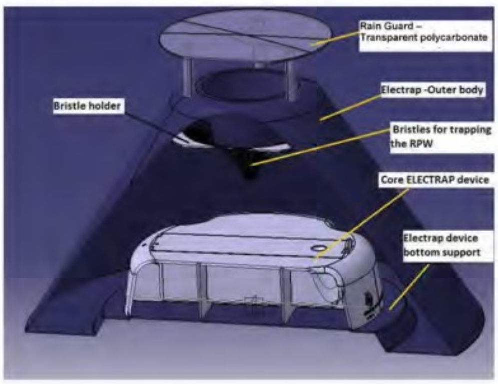
The pest was recorded for the first time in the United Arab Emirates in 1986, Saudi Arabia in 1987 and in Iran in 1992. It crossed the Red Sea into North Africa and by 1995 it had infested over 10,000 farms across Arabia. In infested plantations, yields have been estimated to have dropped from 10 tonnes to 0.7 tonnes per hectare, according to the Food and Agricultural Organisation (FAO). And the situation is going worst and worst, despite the already started campaigns.

After decades of disappointing results, pheromone and kairomone traps haven't performed up to their original expectations. They're not overly effective and may only capture 10 to 25% of the insects in a given area, based on anecdotal information. As a result, pheromone and kairomone traps have been downgraded from insect management devices to insect monitoring devices.

If traps were made to be more effective, their market value would increase and alternative control measures (such as repellent spraying) could be reduced or eliminated. In order for this to happen, insect trap efficacy would have to increase dramatically.

Specifically aiming to your worst enemy: the Red Palm Weevil!

ELECTRAP® GENERAL OVERVIEW



THE MAIN CONCEPT

A literature review turned up no evidence whatsoever that physical contact ever occurred between the scent (i.e. an insect pheromone and kairomone) and the purported receptors (odorant receptor proteins found on the dendritic membranes). Instead, detection might be occurring at a distance which suggests electromagnetic effects may be mediating this whole process. Therefore, vibrational frequencies became the prime candidate for an alternate theory.

If these vibrational frequencies are involved, then theoretically, smell can be both amplified and squelched. Both of these phenomena have been successfully demonstrated in the laboratory, and ELECTRAP® capitalizes on the former.

Specifically, the breakthrough discovery revealed that placing a scent in a highly reflective cavity resulted in heightened activity among Palm Red Weevils.

Over 4,000 experiments have been completed to date, and the surprising results are telling us that the **efficiency is increased more than 300% whilst the management cost is reduced by more than 50%.**

In fact, as a matter of an example, the pheromone and kairomone lures last for lengthily periods of time. There's no need to replace the pheromone and kairomone lures according to manufacturer's recommendations.

Moreover, also if ELECTRAP® should be cleaned periodically as the level of infestation warrants, the trap is still highly effective without meticulous cleaning.

The ELECTRAP® is considerably more sensitive than the standard traps on the market. We can make an immediate impact upon a particular infestation, and over a few short seasons can exercise complete control. In addition to being highly effective, our trap differs from all other RPW traps currently on the market.

ELECTRAP® key issues

- **Efficiency**
  - The **market traps attract approximately 13% of the Red Weevils** under laboratory conditions.
  - Under the same conditions, **our traps capture over 80%**.
- **Inexpensiveness**
  - Based on five years timeframe, **the global cost of a traditional system is more expensive than an ELECTRAP system in reason of almost 370%**. And the lifespan of a well maintained device is more than 10/15 years…
  - Due, inter alias, to the overcoming of the necessity of water provision, the needed manpower for maintenance is dramatically reduced by, at least, 60%,
  - Pheromone and kairomone lures will last up to a year in ELECTRAP®, with virtually no loss in efficacy.
- **Safety**
  - ELECTRAP® doesn't use ANY insecticides and. doesn't need handling with protective gloves.
  - Chemical control with pesticides is expensive, it can be dangerous, it pollutes the environment and it's quickly losing favour with a public that is demanding chemical-free food because public sentiment is driving the organic industry.

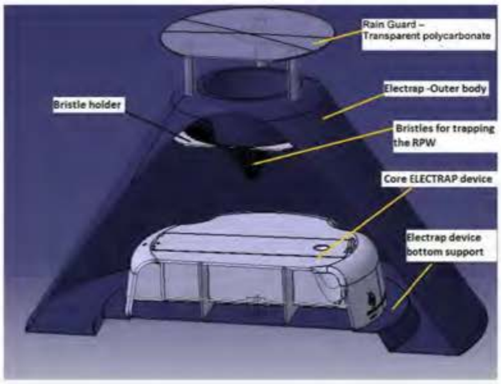
ELECTRAP® is the answer to your problems. Let us work together to severely reduce or eliminate Red Palm Weevils.

Contact us and let us know how we can help your business.

ELECTRAP® will give you many years of worry-free use. Happy trapping!

electrap
RED PALM WEEVILS
FINAL SOLUTION

ELECTRAP® GENERAL OVERVIEW



Red Palm Weevils
Behavioral Control Systems

assessed by

Professor Walid Kaakeh PhD

- Ph.D. in Entomology, Virginia Polytechnic Institute & State University (Virginia Tech)
- M.S. in Entomology West Virginia University, USA
- B.Sc. in Agriculture Aleppo University, Syria
  - ◊ Global Experts, General Director & Senior Consultant
  - ◊ Entec Europe, UAE Environmental Consultant (Pest Control)
  - ◊ UAE University, UAE Professor of Entomology & Pesticide Toxicology
  - ◊ UAE University, UAE Associate Professor of Entomology. & Pesticide Toxicology
  - ◊ UAE University, UAE Assistant Professor of Entomology. & Pesticide Toxicology
  - ◊ Purdue University, USA Manager of Sponsored Product Research
  - ◊ University of Georgia, USA Post-Doctoral Research Associate
  - ◊ Virginia Tech, USA Post-Doctoral Research Associate

1st Future Innovation Right Solutions Technologies United Arab Emirates

Future Innovation Right Solutions Technologies
electrap@uaefirst.com | www.uaefirst.com

No. GE/WK/2015/7-8
Date: 9th July 2015

Dr. Luigi Porcella PhD
Founding Partner – Chairman UAE FIRST
Suite 508 - The Fairmont - Sheikh Zayed Road
Dubai, UAE

Subject: Field Evaluation of Semiochemical (Pheromone + Kairomone) Traps against the Red Palm Weevil (RPW) in UAE - UPDATE

Dear Dr. Luigi,

This is referring to my letter GE/WK/2015/7-6, dated 5th July 2015, and to your kind communications about it.

I'm pleased to confirm that the data, related to the field study, conducted as detailed in the above-mentioned letter, already statistically depurated as per your request, show an average catching ratio of RPW with an index of 1:2.55 in favor of the ELECTRAP® versus the Conventional traps.

Please do not hesitate to call me if you require additional information.

Regards,

جلوبال اكسبرتس
Al Ain - U.A.E
GLOBAL EXPERTS
ENVIRON AND AGRI CONSULT. AND TRAINING L.L.C.

Walid Kaakeh, Prof.
General Director & Senior Consultant

Global Experts جلوبال اكسبرتس
P. O. Box 19585, Al-Ain, UAE ص. ب. 19585، العين، الإمارات العربية المتحدة
Tel: +971-3-7219929 * Mobile: +971-50-4484839
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http://www.global-experts.net

Global Experts جلوبال اكسبرتس

Environmental and Agricultural Consultancy & Training للتدريب والاستشارات الزراعية والبيئية

No. GE/WK/2015/7-6
Date: 5th July 2015

Dr. Luigi Porcella PhD
Founding Partner – Chairman UAE FIRST
Suite 508 | The Fairmont - Sheikh Zayed Road
Dubai, UAE

Subject: Field Evaluation of Semiochemical (Pheromone + Kairomone) Traps against the Red Palm Weevil (RPW) in UAE.

Dear Dr Luigi,

A field study was conducted for two months (28th April - 1st July 2015) in two date palm trees farms located in Al Ain City, with the assistance of the staff deployed by the Farmers Services Center. The objective of the study was to compare ELECTRAP® with the conventional food baited, suspended pheromone traps for their efficacy in mass trapping of the RPW. Weekly maintenance and data collection of all traps were personally made during the study.

Based on the field evaluation, ELECTRAP® provided a better practical, effective and sustainable solution for controlling RPW in date palm farms at the best of the current state of the art. Our results were based on the weekly catch of adult RPW in all traps. Conventional traps required a weekly maintenance (as adding water and dates) while ELECTRAP® did not require any.

Please note that I have evaluated many semiochemical traps during the past 20 years, during my tenure at UAE University and my managing various consultancies and research studies conducted at Global Experts Ltd.

ELECTRAP® device, therefore, is nowadays to be considered the best device to manage the population of RPW, the most dangerous pest on date palm in the UAE as well as in the Gulf Countries. ELECTRAP®, for that reasons, should be the essential component of any Innovative/Integrated Pest Management program.

Please do not hesitate to call me if you require additional information.

Regards,
Walid Kaakeh, Prof.
General Director & Senior Consultant

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Università degli Studi di Sassari
Dipartimento di AGRARIA
Viale Italia n. 39 - 07100 SASSARI SS

Sez. Patologia vegetale ed Entomologia
Prof. Pietro Luciano
Tel.: 079-229328 - Fax: 079-229329
e-mail: pluciano@uniss.it

TO WHOM IT MAY CONCERN

Sassari, 19 December 2014

This is to attest that from the month of November the Department of Agriculture, University of Sassari, is conducting a survey on the effectiveness of semiochemical (pheromone and kairomone) traps for monitoring and mass trapping of the red palm weevil, *Rhynchophorus ferrugineus*, comparing two traditional traps with ELECTRAP, patented by Dr. Luigi Porcella of First Innovation Right Solutions Technologies, Ajman Free Zone, UAE.

Even though the total quantity of data collected so far needs more time to allow a final and complete statistical comparison among traps, we observed constant and relevant higher weekly captures on ELECTRAP devices than on the other traps tested.

Scientific Coordinator

Pietro Luciano

(Prof. Pietro Luciano)

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture
Kingdom of Saudi Arabia المملكة العربية السعودية

الرقم
التاريخ
المشفوعات

[٣٧٤]

سعادة مدير عام شركة فيوتشر اينوفيشن رايت سوليتر تيكنولوجيز المحترم

السلام عليكم ورحمة الله وبركاته

بناء على طلب سعادتكم كتابة تقرير مبسط عن المصيدة الألكترونية (الكتراب) والتي تم تجربتها في مركز النخيل والتمور بالأحساء

افيدكم انه عندما تم اختبار مصيدة بيكوسان الهرمية بدون استخدام الايثيل اسيتيت كانت النتائج تشير الى تماثل جميع المعاملات إحصائيا مما يمكن في هذه الحالة أن نعطي الأفضلية لمصيدة الكترا على اعتبار أنها لا تحتاج إلى خدمة ، وتصطاد بنفس كفاءة المصيدتين السعودية والهرمية والتي تحتاج إلى الخدمة على الأقل مرة واحدة كل اسبوعين لتغير الغذاء والماء.

آمل ان يفي تقريرنا المختصر بالمطلوب

وتقبلوا خالص التحية والتقدير

مدير عام مركز النخيل والتمور بالنيابة

د. يوسف بن احمد الفهيد

Respected Excellency the General Manager of Future Innovation Right Solutions Technologies Company

May the peace, mercy, and blessings of Allah be with you

Assalamu'alaikum warahmatullahi wabarakatuh السَّلَامُ عَلَيْكُمْ وَرَحْمَةُ اللهِ وَبَرَكَاتُهُ

Your Excellency,

as per your request to provide a simple written report about the Electrap which was tested in Al-Hasa palms and dates Centre, we would like to inform you that when the Picusan pyramidal trap was tested without using the ethyl-acetates, the results were similar in all statistic processes so, in this case, we can give the preference to Electrap because it needs no maintenance at all and it catches with the same efficiency equal to the Saudi and pyramidal traps that need at least maintenance once every two weeks to change food and water.

I hope that our summary report will fill the requirement.

Please, accept our best regards and appreciation.

Deputy General Manager of Palms and Dates Centre

Dr. Yousif Ben Ahmed Al Fuhaid

AGRICULTURAL MATERIAL CO. LTD.

Al Ain	Tel. : 7641064 - 7644911	
Al Ain	Fax : 7662259	P.O. Box : 1290
Sanaiya	Tel. : 7212559	
Abu Dhabi	Tel. : 6273080	P.O. Box : 2954
Dubai	Tel. : 2679209	P.O. Box : 3490
Lewa	Tel. : 8822100	P.O. Box : 50374
Ras Al Khaima	Tel. : 2461774	P.O. Box : 7702

٧٠ عاماً في خدمة المزارع
70 Years in Farms Service

شركة المواد الزراعية المحدودة

العين	هاتف : ٧٦٤٤٩١١ / ٧٦٤١٠٦٤	
العين	فاكس : ٧٦٦٢٢٥٩	ص.ب : ١٢٩٠
الصناعية	هاتف : ٧٢١٢٥٥٩	
أبوظبي	هاتف : ٦٢٧٣٠٨٠	ص.ب : ٢٩٥٤
دبي	هاتف : ٢٦٧٩٢٠٩	ص.ب : ٣٤٩٠
ليوا	هاتف : ٨٨٢٢١٠٠	ص.ب : ٥٠٣٧٤
رأس الخيمة	هاتف : ٢٤٦١٧٧٤	ص.ب : ٧٧٠٢

التاريخ :15 يونيو 2017.

السادة / لشركة فيوشراينوفيشن رايت سوليوشنز تكنولوجيز المحترمين

<u>الموضوع / تقرير عن استخدام مصيدة الجافة "ألكتراب"</u>

تحية طيبة وبعد،،،،

تم استخدام عدد 6 اجهزة "الكتراب" المصيدة في احد مزارع التابعة لامارة أبوظبي في منطقة الباهية خلال الفترة من شهر نيسان وايار حتى حزيران لعام 2017 م وتم اخد النتائج التالية :

1- كفائة عالية في صيد سوسة النخيل الحمراء حيث انها صادت 50 سوسة خلال شهرين في احد المصائد.

2- سهولة الاستخدام والصيانة كونه لا داعي لوضع الماء والتمر وبقاء الفرمون صالح لفترة طويلة.

3 – تغطيتها لمساحة جغرافية واسعة.

شاكرين لكم جهودكم

وتفضلوا بقبول فائق الاحترام والتقدير ،،،،

محمد ابو علي

فرع ابوظبي

شركة المواد الزراعية المحدودة ذ.م.م.
فرع ابوظبي
AGRICULTURAL MATERIALS CO. LTD.
ABU DHABI BRANCH
TEL ; 02 - 6260640 - Abu Dhabi - UAE

15th June 2017

Gentlemen/Respected FIRST Company

Subject: Report of using dry trap (Electrap)

6 Electrap were used in one of farms in Al Baheya area in the Emirate of Abu Dhabi, April to June 2017, and following results were taken:

1. High efficiency of catching RPW. One of them did catch 50 RPW in two months period.
2. Easy to use and maintenance, since there is no need for dates and water and pheromone is valid for a long period.
3. It covers a wide geographical area.

Thanks for your efforts.

Please accept our great repect and appreciation.

Mohammed Abu Ali.

Abu Dhabi branch

Western Beach Gen. Con.
الشاطئ الغربي للمقاولات العامة

دائرة الشؤون البلدية والنقل
DEPARTMENT OF MUNICIPAL AFFAIRS AND TRANSPORT

PARSONS

Date :
Ref:

Operation & Maintenance of landscape and Irrigation Assets at AL-Saadiyat Island Freeway - Contract No. 175/1R

Subject: Red Date Palm Weevils "ELECTRAP" New Device Technical Report.

With a reference to the above mentioned subject, we have examined and tested "Electrap", an innovative device for the mass trapping of RDPW.
Here below our observation .

The Operational Concept:
"Electrap" along with The traditional (bucket Trap) have been installed in (Operation & Maintenance of landscape and Irrigation Assets at AL-Saadiyat Island Freeway Project-Contract No. 175/1R),
We found that:

- The catches ratio of "Electrap" is Much Higher.
- "Electrap" is much easier to use and does not required Maintenance.
- ELECTRAP is not requiring servicing and water changing.
- The pheromone+kairomone active for 6 months with high efficiency.

Final Conclusion:
We highly recommend to use the "Electrap" As Red Date Palm Weevil control.

This is for your information.

Eng: SALAH
P.P ARE

Consultant

12
06
2017

We are recommended to use this trap instead of the current traps ..

دائرة الشؤون البلدية والنقل
DEPARTMENT OF MUNICIPAL AFFAIRS AND TRANSPORT
بلدية مدينة أبوظبي
ABU DHABI CITY MUNICIPALITY

نموذج اعتماد مواد
Material Approval Form

Application Number 116-047404 **Date** 18-06-2017

Project Name	operation and maintenance of landscape and irregation assets on sadiyat island freeway	اسم المشروع
Contract No	C175/1R	رقم العقد
Contractor	western beach	اسم المقاول
Consultant	Parsons International LTD	اسم الاستشاري
Client	ADM	المالك

Material Type	*Irrigation & Landscape Materials*	نوع المادة

الرقم المرجعي للمواصفات **Spec. Ref.**	الرقم المرجعي لقائمة جدول الكميات **BOQ Ref**	وصف المادة (نوع المادة ، مصنعة من ، الموديل) **(Material Description One/ make, model etc)**
volume2 c-section-02900	n/a	pheromone trap (Electrap)

PARSONS INTERNATIONAL LIMITED
بارسونز انترناشيونال ليمتد
ص.ب ٥٤٩٨
ابوظبي - ا.ع.م.
P.O. Box: 5498
Abu Dhabi
U. A. E.

Intended Usage	palms protection	الغرض من الاستخدام
Manufacturer/ Source	teknic toolings	المصدر / المصنع
Supplier/Applicator	future innovation	المورد / المطبق

Submitted Attachments Checklist قائمة مرجعية للمرفقات في التقديم

- [x] Material Source Declaration Form (MSDF)
- [x] Copies of Relevant Parts of Specs. BoQ & Drawings
- [x] Technical Comparison Table
- [x] Manufacturer's Technical Data / Original Catalogues
- [ ] Recent Test Reports/Certificates
- [ ] Drawings
- [x] Department of Economic Development (Registration)
- [x] Manufacturer / Supplier's Guarantee (as per Contract)
- [ ] Previous Approvals
- [x] Applicator's Method Statement
- [x] Others (Supplier's Profile & Photos)
- [x] Consultant technical Evaluation Report

Submittal Status ***Approved As Noted***

AHMED RASHID ESSAEI
Material Quality Section
Infrastructure Support Teams
Infrastructure & Municipal Assets Sector
Email : MQ.IS@adm.abudhabi.ae
Direct: +971 2 695 7543

قسم جودة المواد
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البريد الإلكتروني: .IS@adm.abudhabi.ae
مباشر: +971 2 695

دائرة الشؤون البلدية والنقل
DEPARTMENT OF MUNICIPAL AFFAIRS AND TRANSPORT

Ongoing Report for ELECTRAP evaluation trial
From 11 September to 08 October 2017
Jordan Valley

The aim is to evaluate the efficacy of the ELECTRAP to catch the Rynchophorus Ferrugineus (RPW) adult in the field comparing with the traditional trap. Four infested farms were selected in Jordan Valley to conduct this trial.

The sites were chosen depending on infestation density of RPW in four sites; high, medium and low with specific condition.

- Site A infestation reaches more than 50% of the trees; it got an injection treatment for 20 trees
- Site B infestation reaches more than 50% of the trees; it got an injection and fumigation treatment for all infested trees
- Site C infestation reaches more than 20% of the trees; next week will be treated
- Site D infestation reaches more than 20% of the trees; it got both cutting and spraying treatment.

The traditional traps consist of 10 letter white plastic pot (with six vents two at the lead and four at the side) containing one letter plastic pot inside, the content being as follows: (1) a RPW pheromone capsule; (2) a processed kairomone; (3) fruits with water and two tea spoons of bakery yeast

Meanwhile, the ELECTRAP consist of: (1) ELECTRAP black body; (2) a pheromone capsule; (3) kairomone capsule.

These field trials were started on 11 September 2017. (1) Both ELECTRAP and traditional traps were placed in the selected farms at the med space between the trees to let sun light go through the traps; (2) all traps were far from each other more than 50 meters in a full randomization in the farms; (3) data were taken bi-weekly.

The results were as follows:

Reading Date	Trap #	Farm A		Farm B		Farm C		Farm D	
		Electrap	traditional	Electrap	traditional	Electrap	traditional	Electrap	Traditional
24/09/17	01	22	2	2	--	4	--	2	0
	02	18	2	3	--	19	--	0	0
	03	10	1	5	--	--	--	0	0
	04	9	0	8	--	--	--	0	0
	05	6	0	10	--	--	--	0	0
	06	0	0	--	--	--	--	0	0
8/10/17	01	20	2	5	4	15	2	1	0
	02	12	3	6	0	8	0	0	0
	03	8	0	6	0	--	--	0	0
	04	9	0	9	0	--	[illegible]	0	0
	05	0	0	12	0	--	--	0	0
	06	4	0	--	--	--	--	--	--

(--) means no trap

المركز الوطني للبحث والإرشاد الزراعي

Some comments on results

1. The numbers gathered of caught RPW fluctuating in the same reading and between traps depend on infestation fluctuation in the field, the population dynamics and treated trees in the farms
2. There is a big difference (gap) between the traditional and ELECTRAP caught reading
3. In low or non infested farms, putting the traps did not harm to the farm as many farmers think
4. The traditional traps were placed in B and C farms on 24/09/2017
5. The ELECTRAP is a very effective trap in catching RPW

Amman, 10 October 2017

Trial and readings programmed and conducted by:

Dr. Muna Mashal

(director plant protection consultant)

expert in establishing and management date palm farms, NCARE

Eng. Basil Obeidat

(main researcher, plant protection)

expert in establishing and management date palm farms, NCARE

MAINTENANCE

COMPARATIVE COST ANALYSIS

Traditional vs. ELECTRAP

TRADITIONAL TRAPS

FIRST YEAR COST

Item ;	Item Descripti	Unit Cost	Qty.	Unit	Total Cost	Notes	
01	Device	**AED 15.00**	1	piece	AED 15.00	supposed to last 5 years	
02	Pheromone	**AED 5.00**	12	piece	AED 60.00	1 piece per trap every month	1.5 AE
03	Kairomone	**AED 0.00**	12	piece	AED 0.00	1 piece per trap every month	
04	Maintenance	**AED 14.49**	26	visit/year	AED 376.74	one visit every two weeks	
				SubTot 01	**AED 451.74**		

SUBSEQUENT YEARS COST

Item ;	Item Descripti	Unit Cost	Qty.	Unit	Total Cost	Notes
01	Device	**AED 15.00**	10	piece		
02	Pheromone	**AED 5.00**	12	piece	AED 60.00	1 piece per trap every month
03	Kairomone	**AED 0.00**	12	piece	AED 0.00	1 piece per trap every month
04	Maintenance	**AED 14.49**	26	visit/year	AED 376.74	one visit every two weeks
				SubTot 02	**AED 436.74**	

NOTE
the item 04 (maintenance) is here calculated as possibly sufficient for the cold/middle season weather.
During the hot season (i.e. 4 months), due to the water evaporation ratio, the frequency need to be at least tripled

FIVE YEARS COST

Year	Amount	Progressive
01	AED 451.74	AED 451.74
02	AED 436.74	AED 888.48
03	AED 436.74	AED 1,325.22
04	AED 436.74	AED 1,761.96
05	AED 436.74	**AED 2,198.70**

`

ELECTRAP

FIRST YEAR COST

Item	Item Description	Unit Cost	Qty.	Unit	Total Cost	Notes
01	Device*	**AED 280.00**	1	piece	AED 280.00	
02	Phero/Kairomone	**AED 12.50**	2	piece	AED 25.00	1 piece per trap every 6 months ???
04	Maintainance	**AED 14.49**	3	visit/year	AED 43.47	one day visit every 120 days ????
				SubTot 01	**AED 348.47**	

SUBSEQUENT YEARS COST

Item	Item Description	Unit Cost	Qty.	Unit	Total Cost	Notes
01	Device	**AED 0.00**	1	piece	AED 0.00	
02	Phero/Kairomone	**AED 15.00**	2	piece	AED 30.00	1 piece per trap every 6 months
04	Maintainance	**AED 14.49**	3	visit/year	AED 43.47	one day visit every 120 days
				SubTot 02	**AED 73.47**	

FIVE YEARS COST

Year	Amount	Progressive
01	AED 348.47	AED 348.47
02	AED 73.47	AED 421.94
03	AED 73.47	AED 495.41
04	AED 73.47	AED 568.88
05	AED 73.47	**AED 642.35**

Comments

(*) The exposed cost of 280 AED is just nominal for statistic calculation and intended for an end-user being the effective cost sensibly lower.

FIVE YEARS COMPARATIVE TABLE

TRADITIONAL TRAPS

Year	Amount	Progressive Cost
01	AED 451.74	AED 451.74
02	AED 436.74	AED 888.48
03	AED 436.74	AED 1,325.22
04	AED 436.74	AED 1,761.96
05	AED 436.74	**AED 2,198.70**

ELECTRAP

Year	Amount	Progressive Cost
01	AED 348.47	AED 348.47
02	AED 73.47	AED 421.94
03	AED 73.47	AED 495.41
04	AED 73.47	AED 568.88
05	AED 73.47	**AED 642.35**

GAP

Year	Annual Difference	Progressive Benefit
01	-AED 103.27	AED 103.27
02	-AED 363.27	AED 466.54
03	-AED 363.27	AED 829.81
04	-AED 363.27	AED 1,193.08
05	-AED 363.27	**AED 1,556.35**

percentage ratio 1 **342.29 %** ***percentage ratio 2*** **29.21 %**

Comments

A A minimum team as detailed in the MAINTENANCE COST spreadsheet is needed to maintain an average of not more than 40 traps per day in the best case

B The life span of ELECTRAP, if properly managed, can easily reach more than 10 years

CONCLUSIONS

Assuming the need to consider 150,000 Traps deployed, the related savings (a part of the potentially increased number of captures) will be of not less than AED 233,452,500

MAINTENANCE DETAILED COST ANALYSIS

Team Composition	Months Qty	Subtotal	Individual Daily Cost	Subtotal Daily Cost
Team Manager	1	1	AED 160	AED 160
Field Units	3			
Driver	1	3	AED 120	AED 360
Trained Manpower	2	6	AED 96	AED 576
Car	1	4	AED 140	AED 560
			Gen. Subtotal	AED 1,656
			Average per Field Unit	AED 552

Cost per solar year	Months Qty	Subtotal	Total	Effective Working Days	Cost per Day
Team Manager	12	AED 4,000	AED 48,000	300	AED 160
Driver	12	AED 3,000	AED 36,000	300	AED 120
Trained Manpower	12	AED 2,400	AED 28,800	300	AED 96

These data tentatively include other costs as visa, insurance, annual leave, accommodation, food, personal transportation, etc.

Car	12	AED 3,500	AED 42,000	300	AED 140

These data tentatively include other costs as ordinary maintenance, fuel and oil, insurance, tires, etc.

Average Cost per Single Trap Maintenance

Daily Mantained Traps per Field Unit		40
Daily Average Cost per Field Unit	AED	552
Cost per One Trap Maintenance	AED	13.80
Overhead 5%	AED	0.69
TOTAL AVERAGE COST per TRAP	**AED**	**14.49**

GENERAL CONSIDERATIONS AND NOTES

1. **TRADITIONAL spreadsheet**
    a. The cost per one visit is calculated as per the analysis on MAINTENANCE COSTS spreadsheet, i.e. AED 14.49
    b. The yearly maintenance cost is calculated multiplying by 26 (i.e. 52/2) assuming a visit costs, as mentioned in the above related table, AED 14.49
    c. Please also note, as mentioned, that:
        i. The item 04 (maintenance) is here calculated as sufficient for the cold/middle season weather.
        ii. During the hot season (i.e. 4 months), mainly due to the water evaporation ratio, the frequency need to be at least tripled
2. **ELECTRAP spreadsheet**
    a. According to our guarantee and to the evidences of many field tests, the most important being the one conducted by Dr. Romeno Faleiro (FAO) for the KSA Ministry of Agriculture (see attached reference letter at pages 8 and 9):
        i. ELECTRAP needs no more than one pheromone and kairomone set with, at maximum, a semiannual frequency
        ii. ELECTRAP needs no more than one maintenance visit with, at maximum, a semiannual frequency. Anyway, we put a quarterly frequency for a fairest calculation.

We stress again the fact that the exposed end user cost of 280 AED is just nominal for statistic calculation, being the effective cost lower than it.

Environmental Aspects

The materials composing ELECTRAP are: (1) Polypropylene + glass fibre, (2) Nylon 66, (3) Polymethyl methacrylate, (4) ABS. with an expected life span of, at least, ten years if not crushed by traumatic events.

All the parts are UV treated, with a very high melting point (within 200 and 400 Celsius), stable to decomposition with no any dispersion in the air under any weather conditions, 100% recyclable.

The device doesn't need any power supply, nor cable or battery operated, not implying, therefore, any related emission and/or any possible battery leakage.

The structure of ELECTRAP (Rainguard, Conic Dome, draining bottom closure, etc,) make out of it a device totally indifferent to rainy events also if of some intensity.

Regarding the Agriculture, currently, several are the aspects strongly linked to the environmental matters.

The first one, obviously, is the Public point of view, related to the public health.

The use and, often, the abuse of some fertilizers and, mainly and more dramatically, of many pesticides, constitute a severe risk for the land fertility and water conditions for the future but, chiefly, for the personal health and safety of the current and future generations. Especially if the risk is vehiculated by the food!

On the other hand, we shall also consider the constantly increasing orientation of the market towards the natural approach, favouring more and more the certified natural and organic products.

In summary, ELECTRAP is the only totally eco-friendly solution to the RPW problem because, **"simply"** it doesn't need and/or imply, at any level and step of implementation and management, any use of any pesticide and/or of any contaminating pollutant.

Social Aspects

We have to consider several aspects regarding the social impact of ELECTRAP:

Amongst them, the more obvious is the increasing of the font revenue for both family and corporate managed farms with the consequent benefits, while the deeper one is the protection, preservation and spreading of a symbol of the heritage and traditions of the Country, being the roots of the past a fundamental asset for the future and for the future generations too.

Moreover, there are two other critical aspects.

It is well known that there is a critical difference between the academic approach and the daily real life. In fact, when a theoretically valid solution is advised or even delivered to a farmer, if this implies, as consequence, an almost daily burden to a farmer, the human nature is pushing him to gradually disregard boring and heavy duties like water refilling, cleaning, providing bites and so on, as – in our case – the traditional traps forcibly require to get some results. And day after day, the results will be more and more as we can see nowadays.

ELECTRAP, that is easy to be managed also by non skilled personnel and thus increasing and easing their fruitful employment, doesn’t represent any risk or danger both for manpower and visitors due to its smooth and safe design, With its “trendy” fashionable aesthetics, the use of ELECTRAP will give the farmers the opportunity to increase both their awareness and their self and social responsibility without bearing an exacting burden without being able to see an immediate benefit as it happen with the obsolete traditional systems.

PATENT PROCESSES

UNITED ARAB EMIRATES
Ministry Of Economy
Industrial Property Department

الإمارات العربية المتحدة
وزارة الاقتصاد
إدارة الملكية الصناعية

براءة اختراع
رقم : 874

... الاقتصاد

... الاطلاع علي المادة 13 من القانون رقم 31 لسنة 2006 الخاص ببراءات الاختراع والرسوم والنماذج الصناعية ،
...ي طلب البراءة رقم : 2014/P-242 بتاريخ : 2014/03/13 والمستندات الملحقة به.

مادة (1) تمنح براءة اختراع أصلية برقم : **874**

إلى	1- فيوتشر اينوفيشن رايت سوليوشنز تكنولوجيز – ش .م .ح . 2- الدكتور / لويجي بورسيلا.
المركز العام	سلطة منطقة عجمان الحرة – دولة الامارات العربية المتحدة. رخصة تجارية رقم 10047 - هاتف رقم: **056 633 6308**
عن إختراع	جهاز انبعاث مع نظام لجذب ومحاصرة سوسة النخيل الحمراء (رينكوفوروس فيروجينيوس)
...سم المخترع	الدكتور / لويجي بورسيلا. / ايطالي.
...دة البراءة	عشرون عاما تبدأ من : 2014/03/13م. وتنتهي في : 2034/03/13م.

- ويتمتع الطلب بحق أسبقية استنادا للطلب رقم : (لا يوجد).

ما... 2) صدرت بناءا على القرار الوزاري رقم 714 بتاريخ 2016/12/29م.

خلفان أحمد السويدي
مدير إدارة الملكية الصناعية

لايعن... هذه البراءة إعطاء الحق بتسويق المنتج داخل الإمارات العربية المتحدة ، ولتسويق المنتج موضوع هذه البراءة يلزم إتباع الإجراءات والقو... انونية المعمول بها للحصول على حق التسويق والتداول داخل الإمارات العربية المتحدة من الجهات المعنية.

UNITED ARAB EMIRATES
MINISTRY OF ECONOMY

الإمارات العربية المتحدة
وزارة الإقتصاد

مستند أولوية

Priority Document

تشهد إدارة الملكية الصناعية بأن :-

السادة شركة / فيوتشر اينوفيشن رايت سوليوشنز تكنولوجيز – ش .م .ح.

الجنسية / دولة الامارات العربية المتحدة.

قد تقدمت إلينا بطلب براءة اختراع وفقاً للبيانات الآتية :-

Application No.	**2014 / P- 242**		الطلب
Filing Date	**2014 / 03 / 13**		تقديم الطلب
Applicants Name	1-First Innovation Right Solutions Technologies. 2- Dr. Luigi Porcella PhD.	1- فيوتشر اينوفيشن رايت سوليوشنز تكنولوجيز – ش .م .ح. 2- الدكتور لويجي بورسيلا.	الطالبين
Inventor Name	Dr. Luigi Porcella PhD.	الدكتور لويجي بورسيلا.	المخترع
Title of Invention	RED PALM WEEVIL (Rhynchophorus Ferrugineus) TRAPPING SYSTEM WITH A LURE EMITTING DEVICE.	جهاز انبعاث مع نظام لجذب ومحاصرة سوسة النخيل الحمراء (رينكوفوروس فيروجينيوس).	الاختراع
Attorney Agent	❖❖❖❖	❖❖❖❖	

ر هذه الشهادة كمستند أولوية بناء على طلب الطالب ,,, ومرفق المستندات المقدمة مع الطلب وهي :-

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☑ وصف كامل - عربي / انجليزي

خلفان أحمد السويدي
مدير إدارة الملكية الصناعية

تحريراً في : 2017/02/05م.

• أي شطب يلغي المستند .

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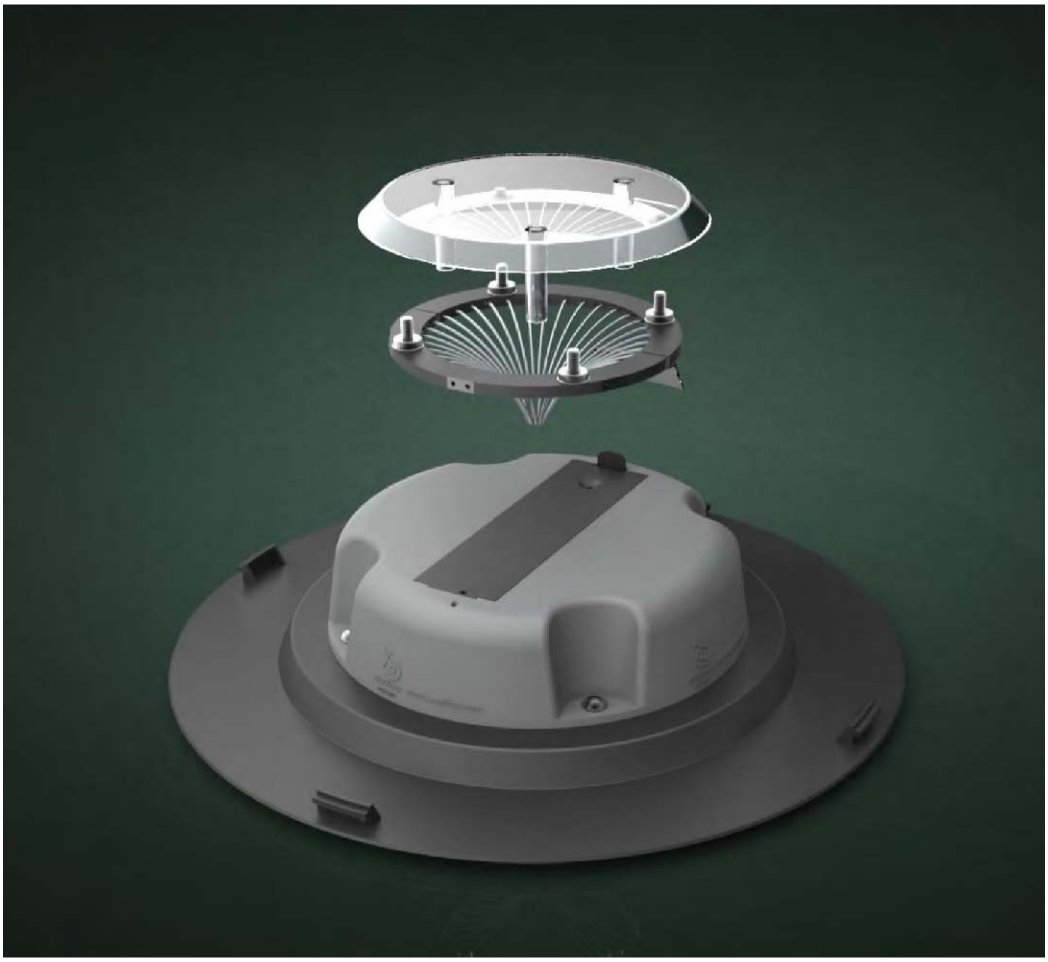
Electromagnetic Communication and Olfaction in Insects

Progresses in Studies and Applications on RPW Plague



date:

27 November 2013

authored by:

Dr. Luigi Porcella PhD

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The importance of infrared radiation as a vehicle for the conveyance of information by "invisible rays" was recognized by the military early in World War II. The versatile Bell Laboratories physicist, Herbert E. Ives, developed the Sniperscope, which uses infrared light, and also developed infrared signalling between ships. Every object above a temperature of absolute zero (-273[degrees] C) radiates infrared wavelengths. Everything at the temperature of life radiates infrared. That is why we call it "the radiation of life".

Summary

The ongoing debate over the mechanism of primary olfaction has two opposed theories: according to some researchers, the olfactory epithelium reads the shape of odorant molecules; others assert that the electronic or vibratory aspect of the scent molecule is crucial.

Several recent studies, contrarily, demonstrate that insects "smell" pheromones a kairomones by tuning into their infrared emissions. Molecules do not need to interact physically: the interaction can be via electromagnetic field.

This study is the analytical approach to the field implementation of the most scientifically accredited theory and of its corollary consequences.

Introduction

Why is a moth attracted to a candle flame? The question has baffled many entomologists. A clue comes from the fact that a moth is attracted to a candle flame or to certain lights, but not to the light of a campfire (unless green wood is being burned). The English poet, Thomas Carlyle, attributed the moth's self-destructive behaviour to passionate love. In a way, Carlyle was correct.

After many years of fascination with the moth and the flame, scientific community decided that there must be something besides visible light coming from the candle. A candle is made of wax, and the insect is coated with wax. Perhaps heated waxes emit some unknown frequency that the moth can sense. Perhaps this frequency is in the infrared region.

We shall see that careful research confirmed these ideas. Once sensitive spectroscopic technology became available, it was possible to confirm that the candle produces a wide range of infrared emissions corresponding to the emissions of pheromone/kairomone molecules.

Insect Communication

Insects have a fantastic ability to find specific mates, hosts and crops among the myriads of nature's species and the diverse attractant molecules they emit. These insect sex and food attractants are called, respectively, pheromones and kairomones, words from the Greek: pherein (to carry), kairos (the right or opportune moment) and hormain (to excite).

A problem with the pheromone/kairomone attraction hypothesis is that a male moth can find a female who is downwind. The breezes are carrying the so-called attractant molecules away from the male moth, and not toward him. This dilemma with chemical attraction in insects has similarities to the problem in homeopathy. There is a point in the dilution of a molecule, beyond Avogadro's number, where there are essentially no molecules remaining in a given volume, yet a biological effect is still present. Entomologists and naturalists dating back to the early 18th Century had suggested the possibility that insects communicate by radiations emitted from oscillating molecules.

In 1894, a famous American entomologist, C. V. Riley, attributed the insect's remarkable sense of direction to some unknown communication system, which goes beyond scent and hearing. Riley referred to certain subtle vibrations that could be detected by a sense organ that does not respond to light of the same frequencies that our eyes can see, but that responds to other frequencies to which we are blind.

An equally famous French entomologist, J. H. Fabre, speculated in 1913 that the (then) recent invention of wireless telegraphy might have been anticipated by the Peacock moth, which can attract males from miles away, possibly by "electric or magnetic waves."

Other entomologists concluded that neither sight nor smell is sufficient to explain the attraction of the male moth from long distances. Many of these scientists concluded that insects must emit some sort of "special waves or rays" for long-distance communication.

In the more recent literature, a British electrical engineer, E. R. Laithwaite, had noticed that the moth antenna has a remarkable resemblance to a radar antenna. In 1960, Laithwaite wrote "A radiation theory of the assembling of moths." He also noted that a male moth can fly with the wind to find a female. Laithwaite concluded that there must be an electromagnetic attractant signal that travels independent of the wind.

I agree: the chances of a chemical molecule landing on the male antenna are far less than the chances of the antenna passing through the electromagnetic field emitted by the pheromone/kairomone and the shape of the moth antenna resembles that of a direction finder. Perhaps the insects are homing in on signals they detect by moving from side to side off the main beam, like pilots follow a directional beacon to an airport. Perhaps the zigzag flights of moths and butterflies are simply a scanning process, using direction-finding antenna arrays. Also Callahan found a variety of correspondences between the structures of various insect antennas and radio and microwave antennas.

The MASER

Charles H. Townes, who received the Nobel Prize with Arthur L. Schawlow for the invention of the laser, observed that Microwave Amplification by Stimulated Emission of Radiation (MASER) is common in nature.

Oscillations from molecules can be coherent. Townes had noted that some gases oscillate very readily in the infrared region. It is easier to obtain fluorescence in the infrared region (particularly the far-infrared) because the energies (in terms of electron volts) are lower than for the shorter and more energetic wavelengths in the visible and ultraviolet region.

Visible light from the sun can "pump" or energize the vibrations of scent molecules so that they fluoresce. The night sky is illuminated by light from the moon and from the 3,500 or so bright stars that emit in the infrared region only. This light is invisible to us. The infrared light at night is energetic enough to "pump" scent molecules to fluoresce in the far-infrared region of the spectrum.

These molecules need not be contained in sealed tube and be pumped by high voltages, as in a laser. Instead, they can fluoresce naturally as they float through the air, pumped by the natural light sources mentioned above. These emissions are then collected by sense organs such as insect antennas, which are tuned directional resonating systems.

After reviewing all of the literature and suggestions, I agreed that:

- the insect sensory mechanism is both infrared and olfactory;
- insects "smell" odours electronically by tuning into the narrowband infrared radiation emitted by sex, preys, and host-plant scent molecules;
- molecules do not need to interact physically with receptors;
- the interaction can be via the electromagnetic field.

This phenomenon is now recognized by a number of entomologists as being involved in the ability of insects to locate mates, host plants, host mammals (e.g., ticks and mosquitoes), birds, and prey (e.g., spiders).

The Experiments

The most telling evidence that insects use infrared communication systems comes from studies done in Tifton, Georgia. A six-watt blacklight bulb was enclosed inside an infrared filter that completely removed visible and ultraviolet, while passing infrared light with wavelengths from 1 to 30 [micro] m.

This "trap" was placed in a 15' x 15' walk-in cold room set at 65 [degrees] F. Each night, for five successive nights, he released 100 male armyworms into the totally dark room with the trap. At the end of a week, only 7% of the moths had entered the trap. The infrared radiation by itself was not the attractant.

In another week of experiments, two virgin female moths were placed in the trap each night and the armyworm moths were released into the room as before. During this second week, 98% of the male moths were in the trap.

During a final week of experimentation, the females were placed in the trap, but the light was not turned on. No male moths entered the trap. Clearly neither the pheromone/kairomone nor the infrared light alone is the attractant. It is the combination of infrared radiation and pheromone/kairomone molecules released by the female moths that powerfully attracts the male moths.

Another aspect of insect behaviour that has fascinated entomologists is the constant rubbing and cleaning of the antenna by all species of insects and by spiders. Callahan suspected that such rubbing by a female moth might amplify the outgoing infrared pheromone/kairomone signals and thereby facilitate the detection of the message by the male moth.

The mechanism he proposed was that the rubbing spread the scent molecules uniformly over the sensilla surface and the more uniform spacing then enabled the female to emit the signals coherently, analogous to the mirrors at either end of a gas laser. When he placed a thin layer of pheromone/kairomone on a beeswax plate, spread it out by rubbing with a silk cloth, and modulated it at 55 cycles per second, he detected the narrowband MASER-like line.

Research has shown that almost all scents operate by stimulation of the C=H double bond. Both light and low frequency sounds (such as the buzzing of a mosquito) can vibrate or "stretch" these C=H bonds in such a manner that the scent molecules emit in the infrared region. For example, ants emit sound around 5 Hz (this is caused by the rapid tapping of their antennas on the ground or on the antennas of other ants). This tapping stimulates emissions by scent molecules the ants lay down to create trails so they can follow each other. When they greet each other, ants can distinguish animals from the same colony by the stimulated emissions from the Dufours gland, which contains a recognition substance.

Bees, mosquitoes, flies, crickets, and locusts each emit specific frequencies by the beating of their wings. The stories of the ways these insects use these sounds to stimulate scent molecules in their environment is one of the most fascinating tales of natural history. Callahan research is an example of how much can be learned by combining the keen eye of a naturalist with sensitive biophysical measurement techniques.

Orienting Behaviour

How the male moth orients as he approaches the female? An insect warms its body by beating its wings. The metabolism of the thoracic muscles warms the body surface and the thermal energy is radiated in the infrared region. A moth beating its wings has a surface temperature as much as 8[degrees] F above its resting temperature.

A female moth receptive to mating sits in one spot and vibrates her wings. Night-flying male moths seek their mates at night when the ambient temperature is around 65[degrees] F. The surface of the vibrating moth is not at 65[degrees], but is at about 73[degrees].

Using Wien's formula, we can determine that the background infrared radiation of the earth and leaf surfaces at 65[degrees] F peaks around 10.34 [micro] m, whereas the moth stands out against this background because it is radiating at 9.88 [micro] m. To another organism able to "see" in the infrared region, the female moth stands out like a beacon against the background.

Moreover, the beating of the wings up and down across the warm thoracic region of the female moth's body modulates or "chops" the infrared signal, so the male, sensitive to the infrared, sees a flashing or flickering beacon. The extent of the flickering depends on the male's orientation with respect to the female. Head and abdomen put out little radiation, whereas the thorax emits strongly.

Again, the flickering effect using a pyroelectric infrared detector made of a crystal of triglycinesulfate has been confirmed. The signal emitted by a moth beating its wings varied in intensity, depending on the angle between the insect and the detector. The different oscilloscope traces obtained with the pyroelectric detector at different angles from the female moth showed two peaks in the tracings in the upper right and lower left and notches.

These double and notched peaks arise because the female moth has two wings on each side, and these wings can twist or change their pitch independently of each other. The relation between the peaks gives the approaching male moth information on his azimuth in relation to the female, and on his angle of approach. Callahan compared this insect navigational system with the instrument landing systems (ILS) developed by the United States Air Force to enable planes to land under conditions of poor visibility.

Waiting for Technology

In some cases, obvious experiments had to be postponed until the appropriate instrumentation became available. The evolution of laser technologies, and thinking deeply about how laser and MASER-like systems might function in nature were patiently watched One of the first fast Fourier transform (FFT) spectrophotometers from Digilab, when they first became available in 1970, was used as instrument to demonstrate that the infrared output from pheromone/kairomone samples is greatly increased when the samples are vibrated with sounds similar to those made by insects. In the early years of his research, it was difficult to generate pure infrared signals. But the researchers were ready to test the effects of pure IR on insect behaviour when good sources became available.

Candle Flames, Green Wood, and an Irish Singer

In his experiments, using the FFT spectrophotometer, Callahan was able to demonstrate that paraffin and beeswax candles emit many narrowband infrared frequencies between 2 and 30 [micro] m. He observed the male protrude his claspers toward the flame-something the moth normally does only in the presence of a pheromone/kairomone from a female of his own species.

The candle flame emits almost the exact same narrow 17- [micro] m frequencies as the pheromone. The flickering of the flame also modulates the candle radiation to produce a chopped ILS-type signal as described above. The male moth is convinced he is approaching the love of his life, as Carlyle suggested.

The moth is attracted to the campfire when green wood is being burned. Callahan learned that this attraction is due to the thousands of infrared frequencies emitted from the heated hydrocarbon gases extracted from the green wood by the intense heat. Emissions of chlorophyll are particularly attractive. Seasoned wood lacks chlorophyll and is of much less interest to the moth.

While Callahan has retired from his successful research program, he continues to observe nature and report his findings in his books. For example, in Nature's Silent Music he describes a moth in an Irish pub spiralling in front of a singing Irishman. The moth is attracted to the singer's breath.

The alcohol in his breath is "doped" with ammonia, and the combination, when "pumped" with low frequency sound, emits strong infrared emissions that resemble those of certain plant scent molecules.

Different Species, Different Codes

The narrowband frequencies that would fit into the atmospheric windows between 2 and 30 [micro] m would provide more than 930 different infrared "radio" channels available to code information on different species of insects, prey animals, and food crops.

When one considers the millions of insect species in nature, this infrared coded scent system provides a logical mechanism for recognition and communication. The infrared frequency band is the largest part of the electromagnetic spectrum, occupying some 17 octaves, in contrast to the single octave in the visible spectrum.

A familiar example of infrared technology is the remote control we use every day to operate our televisions. Each channel and each function has a code that is communicated as a low power pulsing infrared beam. Nature invented this trick long ago.

Theoretical Conclusions

A consequence of ancient thinking, dating to Democritus, Epicurus, and Lucretius, is that all matter is composed of "imperishable" atoms, tiny indivisible particles that can neither be created nor destroyed.

“Billiard-ball” units, atoms or molecules, move in straight lines in all directions, in accordance with the iron laws of "necessity" that were eventually replaced with Newton's Laws of Motion. Interactions cannot take place between atoms or molecules unless they touch one another.

These ideas were pivotal for the development of Western science. A legacy of this natural philosophy is the modern molecular view of regulatory interactions in which signal molecules such as hormones or neurotransmitters or pheromones diffuse, wiggle, and bump about randomly until they chance to approach an appropriate receptor site, at which point electrostatic and other short-range forces draw the signal molecule into the receptor, much like a key fits into a lock. The "key" obviously has to have a structure or shape that matches the "lock." For this model, shape is crucial.

We now know that atoms are not solid and indivisible, and we also know that the "lock and key" model is an incomplete picture of regulations. The random meeting between hormone and receptor, or enzyme and substrate, taking place in a sea of other randomly moving molecules, has a statistical probability approaching zero. Under these conditions, the simplest biological event or regulatory process should require some thousands of years to take place.

Albert Szent-Gyorgyi recognized years ago that life is simply too fast and too subtle to wait for molecules to wander around aimlessly until they happen to bump into the right targets. Electromagnetic signalling is not only physically possible; it is the ideal mechanism for communication in living systems. For this model, electromagnetic resonance, not shape, is crucial.

The lock and key model is so easy to visualize and so deeply ingrained in our scientific culture that many have had difficulty comprehending energetic interactions in which molecules interact by co resonance, like radio transmitters and receivers. In living systems, as in radio and television, long-range electromagnetic fields exchange messages across distances because of matching emission and absorption spectra. Non- resonating, unwanted random signals are excluded simply because they do not resonate.

All of this is fully consonant with the laws of physics. Resonance is a truly remarkable phenomenon, but it is not magic.

Infrared signalling has many applications beyond insect communication. The concept of bio-electromagnetic communications is receiving increasing attention in the scientific community.

For example, see Bioelectrodynamics and Biocommunication by Ho, Popp and Warnke and a series of studies on cellular infrared cellular "vision" by Albrecht-Buehler. Over the years scientists who have published in Frontier Perspectives have written a number of key papers on this topic. As examples, see the work of Benveniste, Smith, and Popp.

The research with insects has obvious and fundamental implications for regulatory biology, energetic therapies, and environmental electromagnetic effects. Its findings also have deep significance for the current debate over the mechanism of primary olfaction, which has split into two camps-those who assume that the olfactory epithelium reads the shape of odorant molecules, and those who suggest that the electronic or vibratory aspect of the scent molecule is crucial.

An engrossing popular book on this topic, The Emperor of Scent, documents the pervasive influence of the lock and key or "shapist" model in primary olfaction, in spite of many inconsistencies in structure-odour relationships.

Practical Conclusions

Using the aforesaid concepts, it is nowadays available a revolutionary device, ELECTRAP®, and here is a short description about it works.

As exposed, there is no evidence whatsoever that physical contact ever occurred between the scent (i.e. an insect Pheromone and Kairomone) and the purported receptors (odorant receptor proteins found on the dendritic membranes). Instead, detection might be occurring at a distance which suggests electromagnetic effects may be mediating this whole process.

Therefore, vibrational frequencies became the prime candidate for an alternate theory.

If these vibrational frequencies are involved, then theoretically, smell can be both amplified and squelched. Both of these phenomena have been successfully demonstrated in the laboratory, and ELECTRAP® capitalizes on the former.

Specifically, the breakthrough discovery revealed that placing a scent in a highly reflective cavity resulted in heightened activity among Palm Red Weevils.

Over 4,000 experiments have been completed to date, and the surprising results are telling us that the efficiency is increased more than 300% whilst the management cost is reduced by more than 50%.

In fact, as a matter of an example, the Pheromone and Kairomone lures last for lengthily periods of time. There's no need to replace the Pheromone and Kairomone lures according to manufacturer's recommendations.

The ELECTRAP® is considerably more sensitive than the standard traps on the market. After an immediate impact, over a few short seasons it can exercise complete control.

Efficiency

The "bucket" traps attract approximately 13% of the RPW under laboratory conditions.

- Under the same conditions, ELECTRAP® capture over 80%.

Inexpensiveness

- Based on five years timeframe, the global cost of a traditional system is 170% more expensive than an ELECTRAP® system, the lifespan of a well maintained device being more than 10-15 years…
- Due, inter alias, to the overcoming of the critical necessity of water provision, the needed manpower for basic maintenance is radically reduced by, at least, 60%.
- Pheromone and Kairomone lures will last up to a year in our trap with virtually no loss in efficacy.

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Efficacy of bait free pheromone trap (Electrap™) for management of red palm weevil, *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae)

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ABSTRACT: The Red Palm Weevil (RPW) *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae) is a key pest of palms that has significantly expanded its geographical range in diverse agro-ecosystems during the last three decades. Food baited pheromone (ferrugineol) traps have been widely used in both RPW surveillance and also in mass trapping programmes for over two decades. Currently RPW pheromone traps have to be serviced (change of food bait and water) at bi-weekly intervals to sustain the trapping efficiency. In area-wide RPW- Integrated Pest Management (IPM) pragrammes, trap servicing is unsustainable and also not possible due to the enhanced cost associated with this practice. In this study the comparative efficiency of the service-less dry pheromone trap (Electrap™) against the traditional food baited traps, revealed that weevil captures in both the Electrap™ and the food baited traps (PicusanTrap™ and the bucket trap) were statistically similar. The Electrap™ offers a sustainable service-less trapping option for RPW management, especially in areas where the trap density has to be increased due to high weevil activity.

Keywords: Dry trap, Electrap™, pheromone traps, *Rhynchophorus ferrugineus*

INTRODUCTION

The Red Palm Weevil (RPW) *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae) also known as the Asian Palm Weevil is one of the world's most invasive pest species currently reported to infest 40 palm species (http: //www.savealgarvepalms.com/en/weevil-facts/host-palm-trees). The RPW has its home in South and South East Asia where it is a major pest of coconut (Lefroy, 1906). After it was reported on date palm in the Middle East during the mid 1980s (Zaid *et al.*, 2002), the pest rapidly expanded its geographical range (Giblin-Davis *et al.,* 2013) and is currently reported from nearly 50 countries in diverse agro-ecosystems worldwide including the Mediterranean basin countries where it is a key pest of the Canary Island palm. Weak quarantine measures at the local, regional and international level have resulted in the rapid spread of RPW both internally and also across international borders making it a trans-boundary pest. Difficulties in detecting infested palms in the early stage of attack makes it extremely difficult in controlling the pest. Infested palms exhibit tissue damage internally and extrusion of chewed up palm tissue with a typical fermented ordour. Severely infested palms may harbor overlapping generations of the pest and often topple due to extensive tissue damage (Abraham *et al.*, 1998; Dembilio and Jacas, 2012). The annual loss due to removal of severely infested palms in the GCC countries, at 1 and 5% infestation has been estimated to range from $5.18 to $25.92 million, respectively (El-Sabea *et al.*, 2009).

The RPW is currently managed employing an Integrated Pest Management (IPM) strategy where the use of food baited pheromone (ferrugineol) traps (FBPTs) forms an important component of the strategy (Abraham *et al.*, 1998). With the synthesis of the male produced aggregation pheromone by Hallett *et al.*, (1993), FBPTs have been widely used in both RPW surveillance and also in mass trapping programs for over two decades where captures are female dominant usually in a ratio of 1:2 (male : female). Additionally, the trapped weevils are known to be young, gravid and fertile indicating significant impact of trapping on the population reduction of the weevil in a given locality (Faleiro *et al.*, 2003). However, recent olfactometer based assays reveal that only a part of the adult RPW population is attracted to the pheromone (El-Shafie and Faleiro, 2017). In order to attain high weevil captures in RPW pheromone traps it is essential to adopt the best trapping protocols (Hallett *et al.*, 1999; Faleiro, 2006; Vacas *et al.*, 2016; Oehlschlager, 2016) with respect to the trap design, trap components (lure, bait and water), trap servicing, trap density etc. Black coloured RPW traps have been found to capture more weevils (Al-Saoud, 2013), while dome shaped traps are known to be superior as compared to the bucket traps (Vacas *et al.*, 2013). The aggregation pheromone is more attractive to RPW when combined with Kairomones or volatiles emitted from the host (Hallett *et al.*, 1999). RPW pheromone traps with dates mixed in water exhibit the best bait-lure synergy, consequently attracting a higher number of weevils as compared to other food baits (Faleiro and Satarkar, 2005). The food bait laced with insecticide is known to prevent escape of weevils for the traps that occurs in FBPTs without insecticide. Vacas *et al.*, (2013) reported that the addition of water to traps baited with palm tissues is essential, as this increased captures more than three fold compared with dry traps without water. Co-attractants based on fermenting compounds, ethyl acetate and ethanol, could improve the attractant level of ferrugineol and potentially replace non-standardised natural kairomones in RPW trapping systems (Oehlschlager, 2016; Vacas *et al.*, 2016).

Bi-weekly replacement of the food bait is essential to sustain the trapping efficiency and is the main constraint in increasing the trap density in an area wide program where a higher trap density often needs to be adopted due to enhanced weevil activity (Faleiro, 2006; Vacas *et al.*, 2016). Mass trapping programs are usually initiated at 1trap/ha as recommended by Oehlschlager, 1994 but has often to be increased (4-10 traps/ha) depending on the weevil activity in the field (Faleiro *et al.*, 2011), which is unsustainable and also not possible due to the enhanced cost associated with trap servicing. In this context, it has become imperative to search for service-less trapping options. The use of attract and kill technology using trap and bait free systems have been found promising (El-Shafie *et al.*, 2011; Faleiro *et al.*, 2016). Another alternative is the use of a dry trap without the food bait, water and insecticide. Communication in insects has for long been attributed to factors other than scent and hearing (Riley, 1894) and the Electrap™ functions on the principle that insects communicate by radiations emitted from oscillating molecules and is the first of its kind developed and patented for attracting and trapping RPW. In this study we tested the comparative efficiency of the black coloured dome shaped dry pheromone trap (Electrap™) against the traditional food baited bucket trap in a RPW infested date plantations in the Al-Ahsa date palm oasis of Saudi Arabia.

The general overview of the Electrap™ is presented below (Figure 1). In this trap insects are captured and disabled using pulsed emission from MASER (Microwave Amplification by Stimulated Emission of Radiation). Inside the core Electrap™device is placed the pheromone lure (Ferrolure) and the solid formulation of the kairomone (ethyl acetate). The invention has been granted a patent by the United Arab Emirates as well as the Gulf Cooperation Council.

Since long the possibility that insects communicate by radiations emitted from oscillating molecules has been proposed (Riley, 1894; Callahan, 1965;Shimron et al., 1985). The Electrap™ functions on the principleof MASER, where a fully inside mirrored 'Resonance Chamber'(core electrap device), loaded by natural light, incessantly reflects the light, starts a resonance process till the saturation of the light reflection inside the chamber, thereby emitting the infrared electromagnetic radio waves loaded by the lures molecules and attracting the insects.This mechanism of electromagnetic communication and olfaction in insects has been previously reported by several workers (Laithwaite, 1960;Callahan, 1965; Turin, 1966; Wright, 1977; Porcella, 2013). In The Electrap™the said Resonance

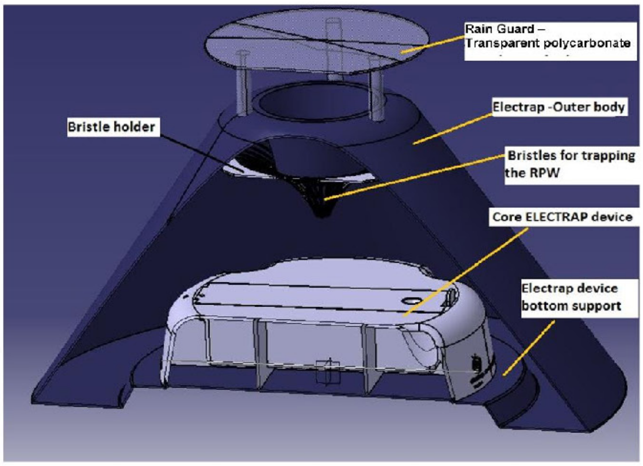

Fig. 1. General Cross section of the Electrap™ with the major components

Chamber is mounted horizontally in the trap and the semiochemicals (Pheromone and Kairomone) are placed inside which can last for 4 to 6 months without renewal.

MATERIALS AND METHODS

Two field trials were conducted between 31 January and 3 April, 2016. In trial-I (Three weeks: 31 January to 20 February, 2016), three treatments comprising T1: ELECTRAP™ (without the food bait); T2: Picusan Trap™ with pheromone (Ferrolure+) + Food bait (200g dates in 1L water) and T3: Traditional four window bucket (5L) trap with pheromone (Ferrolure+) + Food bait (200g dates in 1L water) were tested. Each treatment was replicated 10 times. Treatments were set 10 m apart within each replication while a distance 20m was maintained between two the replications. Trial-II was carried out in the same field (Six weeks: 22 February and 3 April, 2016). The same experimental protocols were followed as indicated above in trial-I. However the treatment involving the Picisan Trap™ in trial-I was eliminated and in trial-II, the Electrap™ (T_1) was tested against traditional four window bucket (5L) trap (T_2).

RPW population is known to be highly aggregated (Faleiro, 2006) that could result in experimental error with traps close to an infested palm capturing more weevils as compared to traps away from an emerging brood of weevils. To eliminate bias of treatments due to the aggregated / clumped distribution pattern of RPW, the treatments (traps) were moved sequentially from one spot to another every week in each block to eliminate spot bias if any. Observations on weevil captures were recorded at fortnightly intervals in all the traps, when also the food bait and water in the Picisan Trap™ and the traditional food baited bucket traps (T_2 and T_3 in trial-I and T_2 in trial-II) was renewed.

Data on weevil captures were compiled at the end of each experiment and subjected to statistical analysis (ANOVA p: 0.05) for trial-I, while for trial-II, weevil capture data were subjected to 't test'.

RESULTS AND DISCUSSION

Results presented in Figure 2 and 3 reveal that the mean weevil captures in the traps evaluated in both the trials were statistically similar. In trial-I, statistically similar weevil captures of 2.1, 1.9 and 1.1 weevils/trap were recorded in the PicusanTrap™, Electrap™ and the traditional bucket trap, respectively. Further, in trial-II trap captures of 2.0 and 1.9 were recorded in the bucket trap and Electrap™, respectively. Black-colored pyramidal (Picusan™) traps are known to significantly increase captures in food-baited pheromone traps (Vacas *et al.*, 2013). However, both the Picusan™ and the traditional food baited bucket trap have to be serviced to sustaing the trapping efficiency. It is relevant to point out that the Electrap™ does not need any servicing and its trapping efficiency is similar to the Picisan Trap™ and the traditional food baited bucket trap where the food bait and water has to be renewed at least once every two weeks. The Electrap™ invention emphasizes the role of electro-magnetic radiation in attracting RPW adults similar to the assembling of moths proposed by Laithwaite, 1960. Further, Callahan, 1965 showed evidence for a far infrared (FIR) electromagnetic theory of communication and sensing in moths.

Once RPW adults enter into the Electrap™, escape of the trapped weevils is prevented due to the presence of the one-way bristles crown at the entrance. Subsequently the trapped weevils die due to quick dehydration. The dismountable bottom support allows an easy periodical removal of the dead weevils. It is pertinent to mention that the Electrap™ besides being bait and water free is also without any insecticide as often used in the FBPTs to kill the trapped weevils.

El-Shafie and Faleiro, 2017 propose that RPW semiochemical mediated technologies which could be used in area-wide RPW-IPM programs need to focus on the development of pheromone traps that eliminate the need to periodic servicing (renewing water, food bait and insecticide). The Electrap™ is an advancement in this direction and offers a sustainable service-less trapping option for RPW especially in areas where the trap density has to be increased due to high weevil activity. This

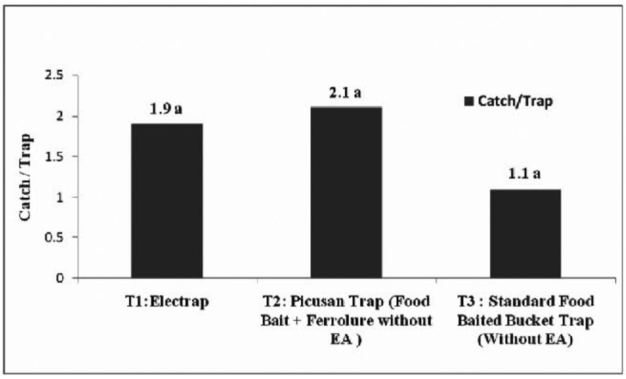

Fig. 2. Mean *R. ferrugineus* captures in different traps tested in Al-Ahsa, Saudi Arabia (31 January to 20 February, 2016)

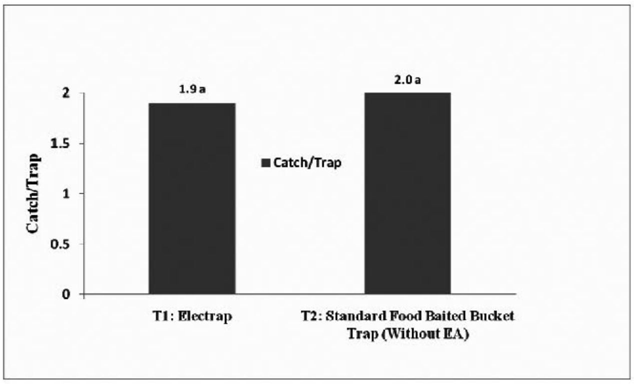

Fig. 3. Mean *R. ferrugineus* captures in different traps tested in Al-Ahsa, Saudi Arabia (22 February and 3 April, 2016)

invention based on patented electromagnetic diffusion system of semiochemical signalshas also been recently conferred with a United Nations Industrial Development Organization (UNIDO)http://www.unido.it/award2017/electrap/. The Electrap™ is the first efficient service-less dry pheromone trap that can be incorporated into the RPW-IPM programme to reduce the cost of the trapping programme especially in an area-wide operation. Further improvement to this service-less trapping option, would be the development of smart trapping device for automatic data collection and transmissionon the weevils captured for efficient decision making.

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REFERENCES

Abraham, V. A., Al-Shuaibi, M. A., Faleiro, J. R., Abozuhairah, R. A. and Vidyasagar, P.S.P.V. 1998. An integrated management approach for red palm weevil, *Rhynchophorus ferrugineus* Oliv., a key pest of date palm in the Middle East. *Sultan Qaboos University Journal of Science and Research (Agricultural Science)*, **3**: 77-83.

Al-Saoud, A. H. 2013. Effect of ethyl acetate and trap colour on weevil captures in red palm weevil (Coleoptera: Curculionidae) pheromone traps. *International Journal of Tropical Insect Science*, **33**(3): 202-206.

Dembilio, O. and Jacas, J. A. 2012. Bio-ecology and integrated management of the red palmweevil, *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae) in the region of Valencia (Spain). *Hellenic Plant Protection Journal*, **5**: 1-12.

El-Shafie, H. A. F. and Faleiro, J. R. 2017. Optimizing components of pheromone-baited trap for the management of red palm weevil, *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae) in date palm agroecosystem. *Journal of Plant Diseases and Protection*. DOI 10. 1007/s 41348-017-0097-5. Published on line, 26 April, 2017.

El-Sabea, A. M. R., Faleiro, J. R. and Abo El Saad. M. M. 2009. The threat of red palm weevil *Rhynchophorus ferrugineus* to date plantations of the Gulf region of the Middle East: an economic perspective. *Outlooks on Pest Management*, **20**: 131-134.

El-Shafie, H. A. F., Faleiro, J. R., Al-Abbad, A. H., Stoltman, L., and Mafra-Neto, A. 2011. Bait-free attract and kill technology (Hook™ RPW) to suppress red palm weevil, *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae) in date palm. *Florida Ent*omologist, **9**: 774-778.

Faleiro J. R., Al-Shawaf, A. M., Al-Dandan, A. M., Al-Odhayb, A., Al-Rudayni, A., Abdallah, A. B., Peixoto, M.P., Vargas, R., Bottom, M., Chidi, S., Borges, R. and Mafra-Neto, A. 2016. Controlled Release Products for Managing Insect Pests. *Outlooks on Pest Management*, DOI: 10.1564/v27_jun_00.

Faleiro, J. R., Abo El-Saad, M. and Al-Abbad. A. H. 2011. Pheromone trap density to mass trap *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae/Rhynchophoridae/Dryophthoridae) in date palm plantations of Saudi Arabia. *International Journal of Tropical Insect Science*, **31**(1-2): 75-77.

Faleiro, J. R. 2006. A review of the issues and management of the red palm weevil *Rhynchophorus ferrugineus* (Coleoptera: Rhynchophoridae) in coconut and date palm during the last one hundred years. *International Journal of Tropical Insect Science*, **26**: 135-150.

Faleiro J. R., Rangnekar, P. A. and Satarkar, V. R. 2003. Age and fecundity of female red palm weevils, *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Rhynchophoridae) captured by pheromone traps in coconut plantations of India. *Crop Protection*, **22**: 999-1002.

Faleiro J. R. and Satarkar, V. R. 2005. Attraction of food baits for use in red palm weevil, *Rhynchophorus ferrugineus* Olivier pheromone traps. *Indian Journal of Plant Protection*, **33**(1): 23-25.

Giblin-Davis, R. M., Faleiro, J. R., Jacas, J. A., Peña, J. E. and Vidyasagar, P.S.P.V. 2013. Coleoptera: Biology and management of the red palm weevil, *Rhynchophorus ferrugineus*. pp. 1-34. *In* J. E. Peña [ed.], Potential Invasive Pests of Agricultural Crop Species. CABI Wallingford, UK.

Hallett, R., Oehlschlager, A. and Borden, J. 1999. Pheromone trapping protocols for the Asian palm weevil, *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae). *International Journal of Pest Management*, **45**(3): 231-237.

Hallett, R. H., Gries, G., Gries, R., Borden, J. H., Czyzewska, E., Oehlschlager, A. C., Pierce, H. D. JR., Angerilli, N. P.D. and Rauf, A. (1993). Aggregation pheromones of two Asian palm weevils, *Rhynchophorus ferrugineus* and *Rhynchophorus vulneratus*, *Naturwissens chaften*, **80**: 328-331.

Lefroy, H. M. 1906. The more important insects injurious to Indian Agriculture. Govt. Press, Calcutta, India.

Laithwaite, E. R. 1960. A radiation theory of the assembling of moths. *The Entomologist*, **93**: 113-117.

Oehlschlager, A. C. 2016. Palm weevil pheromones-discovery and use. *Journal of Chemical Ecology,* **42**(7): 617-630.

Oehlschlager, A. C, 1994. Use of pheromone baited traps in control of red palm weevil in the kingdom of Saudi Arabia. Consultancy Report - submitted to Ministry of Agriculture, Saudi Arabia, 17pp.

Porcella, L. 2013. Electromagnetic Communication and Olfaction in Insects - Progresses in Studies and Applications on RPW Plague, http: //www.uaefirst.com/ electr-com-and-olfaction-in-insects.pdf, 11 pp.

Riley, C. V. 1894. Social insects from psychical and evolutional points of view. Annual address of the President of the Society, Washington, D. C. cover title Proceedings of the Biological Society of Washington, 9, 74.

Shimron, O., Hefetz, A. and Tengo, K. 1985. Structural and communicative functions of Dufours gland secretion in *Eucerapales tinae* (Hymenoptera: Anthophoridae). *Insect Biochemistry*, **15**(5): 635-638.

Turin, L. 1996. A spectroscopic mechanism for primary ol factory reception. *Chemical Senses*, **21**(6): 773-791.

Vacas, S., Primo J. and Navarro-Llopis, V. 2013. Advances in the use of trapping systems for *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae): traps and attractants. *Journal of Economic Entomology*, **106**: 1739-1746.

Vacas, S., Melita, O., Michaelakis, A., Milonas, P., Roxana Minuz, R., Riolo, P., Abbass, M. K., Bue, P.L., Colazza, S., Peri, E., Soroker,V., Livne, Y., Primo, J., Navarro-Llopis, V. 2016. Lures for red palm weevil trapping systems: aggregation pheromone and synthetic kairomone. *Pest Management Science*, 10.1002/ps. 4289.

Wright, R. H. 1977. Odour and molecular vibration: neural coding of olfactory information. *Journal of Theoretical Biology,* **64**(3): 473-474.

Zaid, A., De Wet, P. F., Djerbi, M. and Oihabi, A. 2002. Diseases and pests of date palm. In: Date Palm Cultivation. Zaid, A. (Editor). FAO Plant Production and Protection Paper no. 156, Rev. 1. FAO, Rome.

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MS Accepted : 26 May 2017

INSTRUCTIONS

01 Firmly fix the three legs of the transparent Rainguard lens on the three holes on the top of the Top Conical Cover

02 Unscrew the Bottom Base and separate it from the Top Conical Cover

03 Open the lid of the internal Emission Resonance Chamber

04 Carefully open the aluminium sachet of Phero-Kairo 925+ v. 3.1

05 Place the coupled Phero-Kairo 925+ v. 3.1 diffusers flatly broaden on the bottom of the internal Emission Resonance Chamber with the small section slightly touching the vertical mirror wall on the opposite side of the clip of the lid (*pictures under B*). A simple, gentle finger pressure will be enough to fix it

06 Firmly close the lid of the Internal Emission Chamber

07 Put and screw again together Top Conical Cover and Bottom Base

08 Place your ELECTRAP® on the field, as much as possible, (1) under the full sun light (2) in the middle of the infested area and (3) at, at least, a couple of meters from any palm tree. See the attached distribution plan drawings, possibly favouring the Rectangular Scheme (*picture A 03*) or its multiples

09 The distance between each device and its nearest ones must be around 50 meters; in case of a very severe infestation, you can decrease this distance

10 Visit your ELECTRAP® every circa 60 days. just unscrewing the Bottom Base **without opening** the lid of the Internal Emission Resonance Chamber

11 Remove the trapped RPW and destroy them, possibly burning them in a safe way and place

12 Store your Phero/Kairo 925+ v. 3.1 in the original aluminium packing and under constant temperature, possibly in fridge, replacing them, according with their operating conditions, every 4/6 months

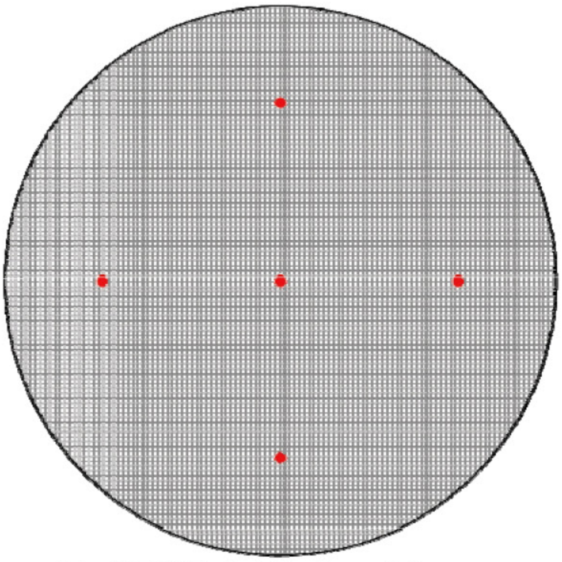
13 Keep the packaging cartons in a safe, dry place. We recommend you to use them in the case you will need new storage/displacement of your ELECTRAP®. Don't forget to carefully disassemble and gently wrap the Rainguard before re-packing

14 In case of any doubt, please contact us at assistance@uaefirst.com

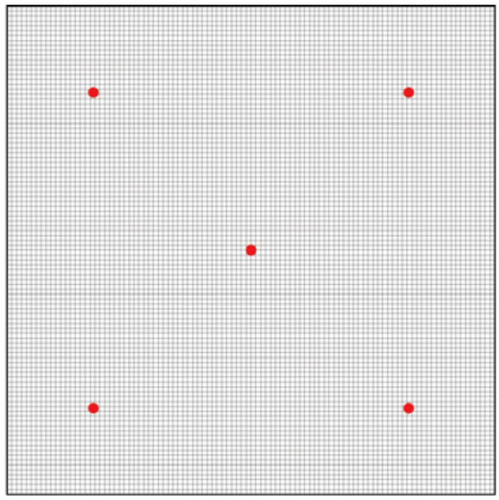
A. Distribution Schemes of ELECTRAP® on the Field

Note that:

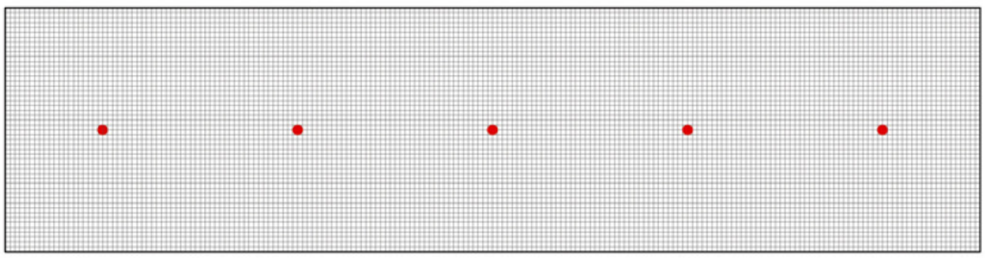
- *every small square is corresponding to a square metre **for a total of 10,000 square metres in one hectare***
- *the **optimal subdivisio**n, in any case but particularly in multiples for large areas, is the n. 03 - **RECTANGULAR***



01 - CIRCLE distribution of the area
(radius of 56metres, i.e. diametre of 112 metres)

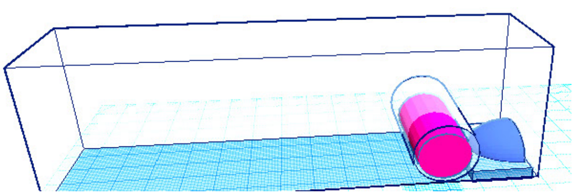


02 - SQUARE distribution of the area
(sides of 100x100 metres)

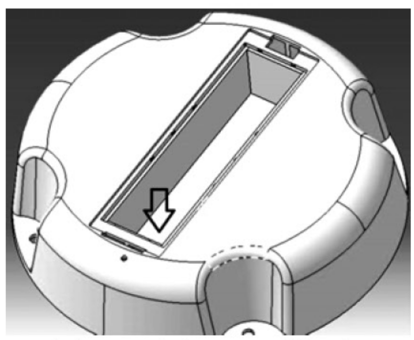


03 - RECTANGULAR distribution of the area
(sides of 50x200 metres)

B. Positioning of PHERO-KAIRO 925+ v. 3.1 inside the ELECTRAP® Emission Chamber



axonometry vision positioning



picture vision positioning