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ENDOWMENT

For Control of Red Palm Weevils in Palm Trees

Saudi Arabia

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Edit



Studies on curative treatment of red palm weevil, Rhynchophorus - ferruginous Olivier infested date palms based on an innovative fumigation technique

- Hypothesis
- Goal
- Trials
- Results
- Conclusion

The hypotheses







The hypotheses

- * RPW need oxygen.
 - * Air reaches RPW stages through tunnels.
 - * Tunnels are connected to outside Air.
- ∴ Air can be used to deliver insecticides by means of fumigation .



The hypotheses

- limited effectiveness of old fumigation method ? :
 - Short exposure time .
 - Low Therapeutic Levels.



The hypotheses

PHOSPHINE GAS LEVELS OUTSIDE PLASTIC WRAP

OLD METHOD

No. of Trees	No. of Tablet	6 Hours	12 Hours	24 Hours	36 Hours	48Hours	72Hours	96Hours
10	3	1.4 - > 5	0.6 - 5	0.3 - 5	0.0 - 3.1	0	0	0
10	5	0.9 - > 5	0.5 - 5	0.9 - 5	0.0 - 1.9	0	0	0

The goal

- * Maintaining a high concentration of Phosphine gas in the palm tree for sufficient time to eliminate RPW in all infested sites.



















The goal

PHOSPHINE GAS LEVEL OUTSIDE PLASTIC WRAP

NEW METHOD

No. of Palm Trees	No. of Tablet	6 Hours	12 Hours	24 Hours	48 Hours	72 Hours	96 Hours
10	10	0	0	0	0	0	0
10	15	0	0	0	0	0	0

Measurement done by using Gas Alert Extreme – Phosphine Portable Gas detector. PPM

The goal

PHOSPHINE GAS LEVEL INSIDE PLASTIC WRAP

NEW METHOD

No. of Palm Trees	No. of Tablet	6 Hrs.	12 Hrs.	24 Hrs.	2 Day	3 Day	4 Day	5 Day	6 Day	7 Day
24	15	> 5	> 5	> 5	> 5	4.5 - 5	2.3 - 4.8	1.4 - 3.2	1.4 - 2.3	1.1 - 2.2

Measurement done by using Gas Alert Extreme – Phosphine Portable Gas detector. PPM

The Trials

Trials

* Aimed to determine the dose of Aluminium phosphide (3gm tablet 57%) and duration of treatment required to eliminate ALL phases of red palm weevils.

Resistance to commonly used insecticides and phosphine fumigant in red palm weevil, *Rhynchophorus ferrugineus* (Olivier) in Pakistan

Waqas Wakil, Muhammad Yasin, Mirza Abdul Qayyum, Muhammad Usman Ghazanfar, Abdullah M. Al-Sadi, Geoffrey O. Bedford, Yong Jung Kwon

Published: July 19, 2018 <https://doi.org/10.1371/journal.pone.0192628>

Abstract

The red palm weevil *Rhynchophorus ferrugineus* (Olivier) is an important pest of date palms in many regions of the world. This paper reports the first survey of insecticide resistance in field populations of *R. ferrugineus* in Pakistan which were collected from seven date palm growing areas across Punjab and Khyber Pakhtunkhwa (KPK) provinces, Pakistan. The resistance was assessed by the diet incorporation method against the formulated commonly used chemical insecticides profenophos, imidacloprid, chlorpyrifos, cypermethrin, deltamethrin, spinosad, lambda-cyhalothrin and a fumigant phosphine. Elevated levels of resistance were recorded for cypermethrin, deltamethrin and phosphine after a long history of insecticide use in Pakistan. **Resistance Ratios (RRs) were 63- to 79-fold for phosphine** 16- to 74-fold for cypermethrin, 13- to 58-fold for deltamethrin, 2.6- to 44-fold for profenophos, 3- to 24-fold for chlorpyrifos, 2- to 12-fold for lambda-cyhalothrin and 1- to 10-fold for spinosad compared to a susceptible control line. Resistant *R. ferrugineus* populations were mainly found in southern Punjab and to some extent in KPK. The populations from Bahawalpur, Vehari, Layyah and Dera Ghazi Khan were most resistant to chemical insecticides, while all populations exhibited high levels of resistance to phosphine. Of the eight agents tested, lower LC and LC values were recorded for spinosad and lambda-cyhalothrin. These results suggest that spinosad and lambda-cyhalothrin exhibit unique modes of action and given their better environmental profile, these two insecticides could be used in insecticide rotation or assist in phasing out the use of older insecticides. A changed pattern of both insecticides can be used sensibly be recommended without evidence of dose rates and frequencies used.

Trials

T1 : 20 Tablets for 10 days.

applied as 10,5 and 5 Tablet at 1,3 & 6 Days.

T2 :15 Tablets for 10 days.

T3 :15 Tablets for 5 days.

T4 :10 Tablets for 10 days.

T5 :10 Tablets for 5 days.

T6 : 5 Tablets for 10 days.

T7 : Control [No Treatment]

* **T5** : black wrap used ,others transparent.



BEFORE TREATMENT
05-FEB-2018



AFTER TREATMENT
06-FEB-2018

NAME OF THE FARM : AL-KHALIFA FARM, SACKH [AREA NO. 1]
KIND OF PALM TREE : EKHLASS [FEMALE]





211 - Dead Larvae
139 - Dead Adult
32 - Dead Pupa
0 - Live stages

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The Results

Results of trials

Summary of Basic Trial 1

(20 tablets in three batches) for 10 days

Number of Trees	Duration (Days)	d 1	d 3	d6	Age	severity of infestation	Distance from Ground (cm)	Evaluation	Larvae		Pupa		Adult insect	
		No.of tablets							Dead	Live	Dead	Live	Dead	Live
100	10	10	5	5	12 years	Mild - Severe	40-90	scraping	5-211	0	46-0	0	0-139	0

Total Count: 5215, 0

No living phases found

Results of trials

Summary of Basic Trial 2

(15 tablets on the first day) 10 days

Number of Tree	Duration (Days)	No.of tablets	Age	severity of infestation	Distance from Ground (cm)	Evaluatio	Larvae		Pupa		Adult insect	
							Dead	Live	Dead	Live	Dead	Live
50	10	15	12 years	Mild - Severe	40-80	scraping	0-107	0	0-34	0	1-180	0

Total Count : 2007, 0

No living phases found

Results of trials

Summary of Basic Trial 3

(15 tablets on the first day) 5 days

Number of Tree	Duration (Days)	No.of tablets	Age	severity of infestation	Distance from Ground (cm)	Evaluation	Larvae		Pupa		Adult insect	
							Dead	Live	Dead	Live	Dead	Live
50	5	15	12 years	Mild - Severe	40-80	scraping	86-0	0	16-0	0	64-0	0

Total Count : 2115, 0

No living phases found

Results of Trials

Summary of Basic Trial 4

(10 tablets on the first day) 10 days

Number of Tree	Duration (Days)	No.of tablets	Age	severity of infestation	Distance from Ground (cm)	Evaluation	Larvae		Pupa		Adult insect	
							Dead	Live	Dead	Live	Dead	Live
25	10	10	12 years	Mild - Severe	40-80	scraping	0-65	0-2	0-19	0	0-63	0-4

Total Count : 787, 8

3 Palm Trees with live phases - 25 (12%)

Results of Trials

Summary of Basic Trial 5

(10 tablets on the first day) 5 days For a palm trees
using a black plastic cover

Number of Tree	Duration (Days)	No.of tablets	Age	severity of infestation	Distance from Ground (cm)	Evaluation	Larvae		Pupa		Adult insect	
							Dead	Live	Dead	Live	Dead	Live
50	5	10	6 years	Mild - Severe	trunk	scraping	0-68	0	0-12	0	4-60	0

Total Count : 2185, 0

No living phases found

Results of Trials

Summary of Basic Trial 6

(5 tablets on the first day) 10 days

Number of Tree	Duration (Days)	No.of tablets	Age	severity of infestation	Distance from Ground (cm)	Evaluation	Larvae		Pupa		Adult insect	
							Dead	Live	Dead	Live	Dead	live
10	10	5	12 years	Mild - Severe	40-80	scraping	0-33	0-9	0-13	0	114-6	0-8

Total Count : 543, 108

8 Palm Trees with live phases - (80%)

Results of Trials

Summary of Basic Trial 7

No Aluminium phosphide used – treatment duration 10 days

Number of Tree	Duration (Days)	No.of tablets	Age	severity of infestation	Distance from Ground (cm)	Evaluation	Larvae		Pupa		Adult insect	
							Dead	Live	Dead	Live	Dead	Live
10	10	0	12 years	Mild - Severe	40-80	scraping	0	0-9	0	0-3	0	3-17

Total Count : 0, 100

All insect stages are alive

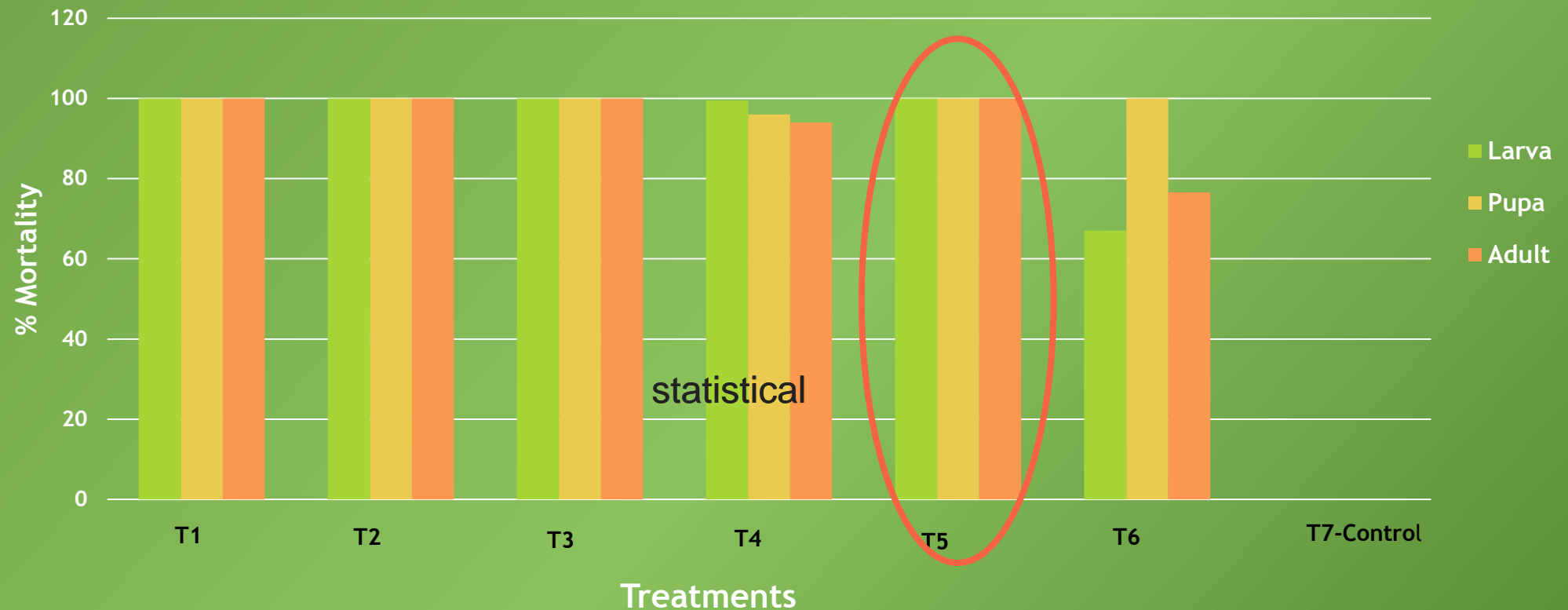
Analysis Performed at IASRI Server

Treatment Name	% Mortality		
	Adults	Larvae	Pupae
T 1: 20 Tablets for 10 days applied in 3 Splits of 10,5 & 5 at 1,3 & 6 Days, respectively [white Plastic wrap]	100.00 ^A	100.00 ^A	100.00 ^A
T2:15 Tablets for 10 days [Transparent plastic wrap]	100.00 ^A	100.00 ^A	100.00 ^A
T3:15 Tablets for 5 days [Transparent plastic wrap]	100.00 ^A	100.00 ^A	100.00 ^A
T4:10 Tablets for 10 days [Transparent plastic wrap]	94.00 ^B	99.50 ^A	96.00 ^B
T5:10 Tablets for 5 days [Black plastic wrap]	100.00 ^A	100.00 ^A	100.00 ^A
T6: 5 Tablets for 10 days [Transparent plastic wrap]	76.55 ^C	67.02 ^B	100.00 ^A
T7: Control [No Treatment]	0.00 ^D	0.00 ^C	0.00 ^C
General Mean	95.31	95.45	96.27
p-Value	<0.0001	<0.0001	<0.0001
CV (%)	7.59	5.53	6

Means with at least one letter common are not statistically significant using

DUNCAN's Multiple Range Test

Mortality of RPW in Date Palm Treated with Alumium Phosphide



T1:20 Tablets for 10 days applied in 3 Splits of 10,5 & 5 at 1,3 & 6 Days, respectively [Transparent Plastic wrap]

T2:15 Tablets for 10 days [Transparent plastic wrap]

T3:15 Tablets for 5 days [Transparent plastic wrap]

T4:10 Tablets for 10 days [Transparent plastic wrap]

T5:10 Tablets for 5 days [Black plastic wrap]

T6: 5 Tablets for 10 days [Transparent plastic wrap]

T7: Control [No Treatment]

Advantages of innovative fumigation method

- * 100% effective for all insect stages.
- * Easy to apply.
- * Low cost.
- * Safe if proper method is used.
- * Reduce possibility of development of Resistance to Phosphine gas.

Advantages of innovative fumigation method

- * Possible use in other palm species and other insects.
- * Facilitate disposal of severely infested palm trees.
- * Could be used in quarantine treatment.

Conclusion

- *The method is 100% effective, easy to apply, low cost, safe, environmentally friendly with no harmful effect on palm trees.
- * The method may provide a major leap in the efforts to combat red palm weevil world wide.

PROTOCOL

Studies on curative treatment of red palm weevil,
Rhynchophorus -ferrugineus Olivier infested date
palms based on an innovative
fumigation technique

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