

## CITRUS TREE BORERS: 11) EFFECT OF PRUNING AND WORMING TREATMENTS ON THE REDUCTION OF *PAROPTA PARADOXA* (LEPIDOPTERA:COSSIDAE) INFESTING MANDARIN ORCHARDS IN EGYPT

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**ABSTRACT:** Two non-conventional and environmentally safe means (worming as mechanical and pruning as horticultural treatments) were evaluated in an infested citrus orchard for controlling *Paropta paradoxa*. Trials were conducted at Nasser district, Beni Suif governorate during one single year as well as cumulative effects for two and three successive years (January 2009 to December 2011). *P. paradoxa* infestation resulted in adequate control due to applying winter and summer pruning all together with worming treatments, as the direct effect for one single year resulted in 62.3% reduction, increased to 73.31% reduction when repeated two successive years, and magnified to 82.54% reduction when repeated three successive years. Combined winter and summer pruning treatments showed satisfactory control, as the respective reduction of infestation for 1, 2 and 3 years were 48.4%, 54.17% and 67.72%. Whole year worming treatment for 1, 2 and 3 years showed the respective 37.17%, 49.77 and 61.02% reduction of infestation. Winter pruning treatment was also good that averaged the respective 39.57%, 45.38% and 57.5 reduction of infestation. On the contrary, summer pruning treatment showed slightly reduction of infestation averaged only the respective 9.09%, 11.04% and 18.52%.

**Key words:** environment, mandarin orchards, *Paropta paradoxa*, pruning, worming

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### INTRODUCTION

Citrus plantations (*Citrus* spp., Rutaceae) occupied the first rank in fruit production in Egypt either for local consumption or exportation. The area under cultivation extended through the old Delta and valley lands, as well as new reclaimed lands and approximated 400 000 feddans produces more than 3 million tons. Mandarin (*Citrus reticulata* Blanco) rank the second level in citrus production after orange varieties.

*Paropta paradoxa* (Lepidoptera: Cossidae) is a dangerous pest in Egypt attacking fig orchards (Willcocks, 1937), apple orchards (Kinawy *et al.*, 1991), and grape vineyards (Tadros, 1982), and grape vineyards in Israel (Plaut, 1964). However, it became recently a serious pest in mandarin orchards in Egypt, and threatening other citrus species and varieties. El-Assal, *et al.* (2008) found that the population fluctuation of carpenter worm started at late March / early April until late October / early November, with 3 peaks in mandarin orchards.

Studies on the control of *P. paradoxa* in mandarin orchards is lacking in Egypt and all over the world. Young larvae bore directly into sapwood of twigs, branches, and main trunks, while old larvae bored heartwood. Larval tunnels might reach 8 mm in diameter and always kept open and enlarged gradually. Mature larvae lined their tunnels with loose dim silky webbing. Pupation occurred at the end of the tunnels, and the pupal skins partially protruded from the opening after moth emergence. Larvae consume large amounts of tree wood, causing weakness, breakage, reducing the production, and finally death of trees (Kinawy, 1981 and Shehata *et al.*, 2003).

Successful integrated pest control depends largely on monitoring and behavior studies especially the seasonal fluctuation to determine the proper timing of the pest control treatments. The use of insecticides for the protection of fruit trees from *P. paradoxa* infestation still the main tool of control

(Tadros, 1982, Kinawy, 1981 and Hashim, 2004), and has been recently increased.

In an attempt to contribute to such a gap in knowledge, the main scope of this study is to prevent the yield losses due to the damage of this boring pest, eliminate the pesticide residues, prevent the outbreaks of secondary species, decrease the environmental pollution, magnify the role of the biological control agents (parasites, predators and pathogens) and obtain better production of decontamination of fruits through using non-traditional and environmentally safe approaches for "Integrated Control Programs" for the management of *P. paradoxa* in mandarin orchards.

## **MATERIALS AND METHODS**

Experiments on *P. paradoxa* were carried out during the three successive activity seasons of 2009, 2010 and 2011. Field trials were carried out in heavily infested mandarin orchards (10 feddans, more than 15 years old) at Nasser district, Beni Suif governorate as follows:

### **1.Effect of one-year treatments: Treatments to control *P. paradoxa* were applied during 2009, 2010, and 2011.**

- 1.1.Winter pruning treatment: During the horticultural winter pruning in January of each year, mandarin branches infested with *P. paradoxa* were pruned by sharp scissors and saws, then immediately got rid of them.
- 1.2.Summer pruning treatment: During the activity season of larvae (summer and autumn), pruning of newly appeared severely infested branches were applied by the sharp scissors and saws, then immediately got rid of them.
- 1.3. Whole year worming treatment: Manual killing *P. paradoxa* larvae inside their tunnels using a flexible wire was applied four times each season (during winter in January, spring in April, summer in July, and autumn in October).

- 1.4. Combined winter and summer pruning treatments: Treatments number 1.1 and 1.2.
- 1.5.Combined winter and summer pruning treatments together with the whole year worming treatments: Treatments number 1-1, 1-2 and 1-3.
- 1.6.Untreated check: Trees of this treatment did not receive any horticultural or mechanical treatments.

### **2.Effect of two and three successive years treatments:**

The same six previously mentioned one - year treatments that applied during 2009 were repeated in other mandarin orchards during 2010 and 2011 seasons to confirm the results for the 2<sup>nd</sup> and 3<sup>rd</sup> years. In addition, the same previously one-year treatments of 2009 were repeated in the same mandarin orchard during 2010 and 2011 seasons to studying the effect of the cumulative effect of treatments for two and three successive years.

### **3.Statistical analysis:**

The experimental design was completely randomized at significance level 5% split design with 10 trees, each replicated 3 times (30 trees each treatment). Evaluation of the different treatments was carried out at the end of the year (during December) by counting the alive larvae in the treated and untreated mandarin trees. Active holes with mass of sawdust indicate alive larvae (in case of uncertainty, branches were dissection). The efficiency of treatments was based on the percentage reduction of infestation according to the following formula:  
% Reduction of infestation =  $[(C - T) / C] \times 100$   
Where: C: Mean number of alive larvae in the untreated trees.  
T: Mean number of alive larvae in the treated trees.

Analysis of variance (F test) and Least Significant Difference (LSD) (Snedecor and Cochran, 1990) were used for differentiation between treatments.

## **RESULTS AND DISCUSSION**

The effect of horticultural and mechanical

***Citrus tree borers: 11) effect of pruning and worming treatments on .....***

treatments on the reduction of *P. paradoxa* infestation was studied in mandarin orchards at Nasser district, Beni Suif governorate during 1, 2 and 3 successive seasons (2009, 2010 and 2011). Data concluded the following results:

**1.Effect of one single year treatments (direct effect):**

Statistical analysis of variance and LSD 5% in the Table (1) resulted in the following descending reduction of *P. paradoxa* infestation:

- 1.1.Combined winter and summer pruning treatments together with the whole year worming treatments: These treatments showed superior results, as the reduction in infestation reached 62.3% (range, 59.16 – 64.39%).
- 1.2.Combined winter and summer pruning treatments: Treatments resulted in adequate reductions of infestation showing 48.4% (range, 47.28 – 49.57%).
- 1.3.Winter pruning treatment: The treatment achieved a good percentage reduction of infestation averaged 39.57% (range, 37.87 – 42.74%).
- 1.4.Whole year worming treatment: The treatment achieved a good percentage reduction of infestation averaged 37.17% (range, 32.92 – 40.44%).
- 1.5.Summer pruning treatment: The treatment was of some reduction of

infestation averaged 9.09% (range, 8.66 – 9.56%).

**2.Effect of two successive years treatments (cumulative effect):**

Statistical analysis of variance and LSD 5 % in Table (2) resulted in the following descending reduction of *P. paradoxa* infestation:

- 2.1.Combined winter and summer pruning treatments together with the whole year worming treatments: These treatments showed superior results, as the reduction in infestation reached 73.31% (range, 72.41 – 74.07%).
- 2.2.Combined winter and summer pruning treatments: Treatments resulted in adequate reductions of infestation showing 54.17% (range, 52.71 – 55.39%).
- 2.3.Whole year worming treatment: The treatment achieved a good percentage reduction of infestation averaged 49.77% (range, 48.77 – 50.66%).
- 2.4.Winter pruning treatment: The treatment achieved a good percentage reduction of infestation averaged 45.38% (range, 44.31 – 46.06%).
- 2.5.Summer pruning treatment: The treatment was of some reduction of infestation averaged 11.04% (range, 10.15 – 11.41%).

**Table 1: Effect of one single year treatments on the reduction of *P. paradoxa* infestation in mandarin orchards at Nasser district, Beni Suif governorate during 2009, 2010 and 2011.**

No	Treatments	Mean no. of alive larvae per tree (L/T) and percent reduction of infestation (%RI)								
		2009		2010		2011		Mean		Grouping
		L/T	%RI	L/T	%RI	L/T	%RI	L/T	%RI	
1	Winter pruning	2.01	42.74	2.26	38.25	2.51	37.87	2.26	39.57	b
2	Summer pruning	3.19	9.12	3.31	9.56	3.69	8.66	3.40	9.09	c
3	winter and summer pruning	1.77	49.57	1.90	48.09	2.13	47.28	1.93	48.4	ab
4	Whole year worming	2.16	38.46	2.18	40.44	2.71	32.92	2.35	37.17	b
5	winter and summer pruning together with whole year worming	1.25	64.39	1.33	63.66	1.65	59.16	1.41	62.3	a
6	Untreated (check)	3.51	--	3.66	--	4.04	--	3.74	--	c

Values within a column followed by different letter are significantly different (P> 0.05), L.S.D. = 0.51

**Table 2: Effect of two and three successive year's treatments on the reduction of *P. paradoxa* infestation in mandarin orchards at Nasser district, Beni Suif governorate during two and three successive years (2009, 2010 and 2011).**

No	Treatments	Mean no. of alive larvae per tree (L/T) and percent reduction of infestation (%RI)							
		2- successive years						3- years	
		2009/10		2010/11		Mean		Mean (2009/11)	
		L/T	%RI	L/T	%RI	L/T	%RI	L/T	%RI
1	Winter pruning	2.25	44.31	2.60	46.06	2.425 b	45.38	2.41 b	57.5
2	Summer pruning	3.63	10.15	4.27	11.41	3.95 c	11.04	4.62 c	18.52
3	winter and summer pruning	1.92	52.71	2.15	55.39	2.035b	54.17	1.83ab	67.72
4	Whole year worming	2.08	48.77	2.38	50.66	2.23b	49.77	2.21b	61.02
5	winter and summer pruning together with whole year worming	1.12	72.41	1.25	74.07	1.185 a	73.31	0.99 a	82.54
6	Untreated (check)	4.06	--	4.82	--	4.44 d	--	5.67 d	--

Values within a column followed by different letter are significantly different ( $P > 0.05$ ), L.S.D. for 2 years = 0.83, and for 3 years = 0.95

**3.Effect of three successive years treatments (cumulative effect):**

Statistical analysis of variance and LSD 5% in Table (2) resulted in the following descending reduction of *P. paradoxa* infestation:

- 3.1. Combined winter and summer pruning treatments together with the whole year worming treatments: These treatments showed superior results, as the reduction in infestation reached 82.54%.
- 3.2. Combined winter and summer pruning treatments: Treatments resulted in adequate reductions of infestation showing 67.72%.
- 3.3. Whole year worming treatment: The treatment achieved a good percentage reduction of infestation averaged 61.02%.
- 3.4. Winter pruning treatment: The treatment achieved a good percentage reduction of infestation averaged 57.5%.

3.5. Summer pruning treatment: The treatment was of some reduction of infestation averaged 18.52%

**Conclusion**

As shown in Tables (1 and 2), the non-conventional environmentally safe means of *P. paradoxa* control resulted in rather good reduction of infestation. However, repeating these treatments year after another on the same trees magnified the reduction of infestation. Satisfactory cumulative reduction of infestation ascending from 62.3% when the combined winter and summer pruning treatments together with the whole year worming treatments were applied for one single year, increased to 73.31% when applied for two successive years, and magnified to 82.54% reduction of infestation when applied for three successive years.

Combined winter and summer pruning treatments were also satisfactory, showed the respective 48.4%, 54.17% and 67.72% reduction of infestation.

## **Citrus tree borers: 11) effect of pruning and worming treatments on .....**

Whole year worming treatment was impractical as it is difficult, needs too much cost in labor, time and cost, however it achieved the respective 37.17%, 49.77 and 61.02% reduction of infestation.

Winter pruning treatment was promisingly good that averaged the respective 39.57%, 45.38% and 57.5 reduction of infestation.

On the contrary, summer pruning treatment was of some – but not good – results as the branches even infested, farmers do not want to prune fruitful infested branches. The reduction of infestation averaged only the respective 9.09%, 11.04% and 18.52%.

The present results were somewhat in agreement with Tadros *et al.* (1993) who evaluated the efficiency of pruning, worming, and complete coverage spraying treatments in the reduction of *P. paradoxa* infestation, and obtained good results, but they stated that worming showed low reduction of infestation due to the difficulty of applying this treatment.

### **REFERENCES**

- El-Assal, M. M. A., M. M. Abdel Azim and A. W. Tadros (2008). Monitoring the carpenter worm *Paropta paradoxa* (Lepidoptera: Cossidae), recently serious pest in mandarin orchards in Egypt. *Egypt. J. Agric. Res.*, Cairo, Egypt, 86 (5): 1827-1841.
- Hashim, S. M. (2004). Integrated control of fig tree borers in the northern coast, Egypt. M. Sc. Thesis, Fac. Sci., Cairo Univ., Egypt.
- Kinawy, M. M. (1981). Studies on certain fig tree borers in ARE. Ph. D. Thesis, Fac. Agric., Cairo Univ., Egypt.
- Kinawy, M. M., A.W. Tadros and F. F. Abd Allah (1991). Effect of horticultural, mechanical and chemical treatments on the reduction of *Paropta paradoxa* (Lepidoptera: Cossidae) infestation in apple orchards. *Bull. Fac. Agric. Cairo Univ.*, 42 (1): 129 – 137.
- Snedecor, W and A. Cochran (1990). *Statistical Methods*. The Iowa State Univ. press, Ames, Iowa, USA.
- Plaut, H. N. (1964). Outbreak and new records. *FAO Plant Protec. Bull.*, 12 (6): 139 – 141.
- Shehata, W.A., A.W. Tadros and M.H. Saafan (2003). Certain Pests of Edible Fig Trees: (2) Monitoring and microbial control treatments (with bacteria and fungus) of *Paropta paradoxa* on fig tree bores in fig orchards at the north-western coast of Egypt. *Egypt. J. Agric. Res.*, 81 (1): 181-188.
- Tadros, A. W. (1982). Biological, ecological control studies on *Paropta paradoxa* (Lepidoptera: Cossidae) on grapevine trees in Egypt. Ph. D. Thesis, Fac. Agric., Cairo Univ., Egypt.
- Tadros, A.W., H. A. Mesbah and W. A. Shehata (1993). Horticultural, mechanical and chemical treatments for the reduction of *Zeuzera pyrina* L. infestation in pear orchards. *Egypt. J. Agric. Res.*, 71 (4): 935-942.
- Willcocks, F. C. (1937). A survey of the most important economic insects and mites in Egypt. *Bull. Sult. Agric., Soc.*, 1: 158 – 275.

## تأثير معالمتي التقليل وقتل اليرقات في أنفاقها بالسلك علي خفض الإصابة بحفار ساق العنب (Lepidoptera: Cossidae) *P. paradoxa* في بساتين اليوسفي في مصر

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### الملخص العربي

تعتبر الموالح من المحاصيل التصديرية الهامة في مصر سواء طازجة أو مصنعة. وتتعرض أشجار الموالح للعديد من الإصابات الحشرية، إلا أنه في السنوات الأخيرة تعرضت حدائق اليوسفي للإصابة بحفار ساق العنب *Paropta paradoxa* حيث يسبب أضرارا اقتصادية. وللد من التلوث البيئي بالمبيدات وتعظيم دور الأعداء الحيوية، تم تقييم فعالية بعض الطرق غير التقليدية الأمانة لتقليل الإصابة بالحفار مثل المعاملات البستانية (التقليم)، والميكانيكية (قتل اليرقات داخل أنفاقها بالسلك)، والمعاملات البستانية والميكانيكية معا في محافظة بني سويف خلال ثلاث سنوات متتالية (٢٠٠٩، ٢٠١٠، ٢٠١١). أظهرت النتائج فعالية المعاملات البستانية (بالتقليم الشتوي والصيفي) مع المعاملات الميكانيكية (بقتل اليرقات داخل أنفاقها بالسلك) في برنامج متكامل خلال الموسم، حيث أدت المعاملة لمدة عام واحد ثم عامين متتاليين ثم ثلاث أعوام متتالية بالتقليم الشتوي والصيفي معا بالإضافة قتل اليرقات بالسلك إلى تقليل الإصابة بنسبة 62.3%، إزدادت إلى 73.31%، وتعاضمت إلى 82.54%، علي الترتيب. وعند إجراء التقليم الشتوي والصيفي معا بلغت النسبة المئوية لتقليل الإصابة إلى 48.4% إزدادت إلى 54.17%، وتعاضمت إلى 67.72%، علي الترتيب. وعند إجراء معاملة قتل اليرقات بالسلك فقط بلغت النسبة المئوية لتقليل الإصابة إلى 37.17% إزدادت إلى 49.77%، وتعاضمت إلى 61.02%، علي الترتيب. وعند إجراء التقليم الشتوي فقط بلغت النسبة المئوية لتقليل الإصابة إلى 39.57% إزدادت إلى 45.38%، وتعاضمت إلى 45.38%، علي الترتيب. في حين أدي إجراء التقليم الصيفي فقط إلى تقليل الإصابة قليلا إلى 9.09% إزدادت إلى 11.04%، وتعاضمت إلى 18.52%، علي الترتيب.