

THE RELATIVE SUSCEPTIBILITY AND MONITORING OF CITRUS SPECIES /VARIETIES TO *CHLOROPHORUS VARIUS* Mull. IN CITRUS ORCHARDS IN EGYPT

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Abstract

The relative susceptibility and monitoring of nine widely spread citrus species / varieties: Navel orange, Balady orange, Valencia orange, grape-fruit, Balady Mandarin, lime, Lemon, Sour orange and Volkamer lemon to the wasp beetle, *Chlorophorus varius* (Coleoptera: Cerambycidae) borer infestation as well as the population fluctuations were studied at Sharkia governorate, during the three successive years 2010, 2011 and 2012. The mean rate of susceptibility of citrus species and varieties to *C. varius* infestation reached 32.5% (range, 5.0 – 55.3%). The grand mean degree of susceptibility of citrus species / varieties to *C. varius* infestation approximated 0.6177 beetles / tree / year. Infestation increased from 0.52 beetles / tree at the end of 2010 (one year), to 1.123 beetles / tree at the end of 2011 (two years) to 1.853 beetles / tree at the end of 2012 (three years). Summer months recorded the maximum beetle flight (0.3677 beetles), followed by spring (0.1241 beetle) and autumn months (0.1148 beetles) /tree, but stopped during winter. The grand mean degree of susceptibility of citrus species / varieties to *C. varius* infestation approximated 0.1533 beetles / tree / season. Generally, Navel orange proved to be the most susceptible species followed by Balady orange, Valencia orange, Grape fruit, Mandarin, Lime, Lemon, Sour orange and at last Volkamer Lemon. Infestation increased from 0.13 beetles / tree at the end of 2010 (one year), to 0.28 beetles / tree at the end of 2011 (two years) to 0.46 beetles / tree at the end of 2012 (three years), that impose the need to control this pest in citrus orchards.

INTRODUCTION

In Egypt, citrus ranks first in fruit area and production, as well as is the most economic exporting crop and most favorite popular fruit. Several citrus species and varieties are spread all-over Egyptian Agricultural zones to prolong the harvesting period and accommodate local consumption and exportation. The most widely spread citrus species / varieties could be arranged descendingly as follows: Navel orange (*Citrus sinensis*), Balady orange (*C. sinensis*), Valencia orange (*C. sinensis*), grape-fruit (*C. paradisi*), Mandarin (*C. reticulata*), lime (*C. aurantifolia*), Lemon (*C. limon*), Sour orange (*C. aurantium*) and Volkamer lemon (*C. volkameriana*). *Chlorophorus varius* (Coleoptera: Cerambycidae) is widely distributed all-over the Mediterranean basin area, Europe and Russia (Winkler., 1932; Porta, 1934; Bodenheimer, 1934 and Schmidt, 1962) as well as in Egypt (El-Zoheiry, 1950). Larvae of *C. varius* feed inside the stem and main branches of trees and cause their death, and the total life cycle

was completed in almost one year (Tadros, 1993). Frequent field observations indicated that the most important boring pests in citrus orchards are the Coleopterous Cerambycids *C. varius* that attack 21 fruit tree species (Tadros, 1994) and 14 wood and ornamental tree species (Nour, 1963 and Haggag, 1982), *Macrotoma palmata* also attack citrus trees (Tadros *et al.*, 1993), the Scolytids *Hypothenemus eruditus* seriously infest sweet lemon, mandarin, lemon and kumquat (Batt *et al.*, 1993), *Scolytus amygdale* (Tadros, 1994) and the Bostrichid *Enneadesmus obtusedentatus* (Tadros *et al.*, 1997), as well as the Lepidopterous Cossid *Paropta paradoxa* was recorded attacking mandarin trees (El-Assal *et al.*, 2008).

Studies on the rate and degree of infestation, seasonal fluctuation of the target pest population, the progress of infestation, the seasonal cycle, and the effect of the main weather factors is essential in successful integrated pest control. However, the literature on the relative susceptibility of citrus species and varieties to borers infestation is lacking all over the world.

The present comparative ecological study is an attempt to contribute to such a gap in the knowledge on the population fluctuation and the relative susceptibility of different citrus species to citrus tree borers. The broad objective of investigation is to gain new information that may help in planning citrus structure system, choice of economic species and varieties and effective "Integrated Control Programs" for the management of tree borers in citrus orchards.

MATERIALS AND METHODS

The relative susceptibility of the following nine citrus species and varieties, Navel orange, Balady orange, Valencia orange, grape-fruit, Mandarin (Balady), lime, Lemon, Sour orange (Naring) and Volkamer lemon to *C. varius* borer infestation was studied. Infestation studies (rate and degree) were carried out during the three successive seasons 2010, 2011 and 2012 in citrus orchards spread over about 100 feddans area (more than 25 years old) located at Wadi El-Mollak district, Sharkia governorate.

1. Rate of Infestation:

The rate of infestation was assessed by the percentage of numbers of infested trees with *C. varius* in each citrus species / variety randomly distributed in the considered citrus orchards each year.

2. Degree of Infestation:

The degree of infestation was estimated by the mean number of adult beetles per tree (indicated by the exit holes) that completed their life cycle and emerged from each citrus species / variety in the considered random citrus orchards each year at four time intervals at the end of each season (winter, spring, summer and autumn). At the end of each season, the old counted exit holes were canceled by spray paint.

3. Progress of infestation:

Data of the degree of infestation were accumulated from December 31st 2010 until December 31st 2012 for each year. The total number of adults represented the accumulated number for the three years together.

Progress of infestation indicated the rate of increase in the borer infestation through advanced years.

The relative susceptibility of the following citrus species and varieties, Navel orange, Balady orange, Valencia orange, grape-fruit, Mandarin (Balady), lime, Lemon, Sour orange (Naring) and Volkamer lemon to *C. varius* were recorded.

RESULTS AND DISCUSSION

The relative susceptibility to *C. varius* and the population density (rate and degree of population) on the following nine citrus species and varieties, Navel orange, Balady orange, Valencia orange, grape – fruit, Mandarin (Balady), lime, Lemon, Sour orange (Naring) and Volkamer lemon to the borer were studied.

1. Rate of *C. varius* Infestation:

The rate of *C. varius* infestation varied from one citrus species / varieties to another. Navel orange was the most susceptible species to the borer infestation showing 37 – 78%, with a mean of 55.3%, followed by Balady orange ranging 33 – 75%, with a mean of 51.3%, Valencia orange showing 29 – 69%, with a mean of 49% infestation, Grape fruit ranging 31 – 58%, with a mean of 43.7%, Mandarin ranging 25 – 50%, with a mean of 38%. The moderately and least susceptible were Lime (17 – 28%, with a mean of 22.3%), Lemon (12 – 22%, with a mean of 16%), Sour orange (9 – 15%, with a mean of 11.7%), and last Volkamer lemon (4 – 7%, with a mean of 5%). The general mean percent of *C. varius* infestation in citrus (species / varieties) orchards ranged from 27.4 – 36%, with a grand mean of 32.5%.

Table 1. Rate of *C. varius* infestation in citrus species / varieties at Sharkia governorate during 2010, 2011 and 2012 seasons.

No.	Variety	Rate of infestation (%)			
		2010	2011	2012	Mean
1	Navel orange	78	51	37	55.3
2	Balady orange	46	33	75	51.3
3	Valencia orange	69	29	49	49
4	Grape fruit	42	31	58	43.7
5	Mandarin	25	50	39	38
6	Lime	17	22	28	22.3
7	Lemon	14	12	22	16
8	Sour orange	11	15	9	11.7
9	Volkamer lemon	4	4	7	5
Total		306	247	324	292.3
Mean / species or variety		34	27.4	36	32.5

2. The degree of *C. varius* infestation:

The degree of *C. varius* infestation showed obvious variations among different citrus species / varieties (Tables 2, 3 and 4).

2.1. Navel orange was the most susceptible as the mean number of holes / tree approximated 0.85, 1.02 and 1.15 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / tree / month were 0.07, 0.09 and 0.10 holes / tree.

Summer months showed the mean number of emerged beetles, 57, 66 and 71 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Spring months showed less mean number of emerged beetles, 20, 23 and 26 holes (emerged beetles) / tree during the respective three years. Autumn months were the least mean numbers of emerged beetles (holes) / tree were 8, 13 and 18 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.21, 0.26 and 0.29 holes during the respective three years.

2.2. Balady orange was also highly susceptible citrus species as the mean number of holes / tree approximated 0.78, 0.88 and 1.14 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / month were 0.065, 0.07 and 0.095 holes / tree.

Summer months showed the mean number of emerged beetles, 49, 53 and 68 holes (emerged beetles) / tree during the three studied years 2010, 2011 and 2012, respectively. Spring months showed less mean number of emerged beetles, 18, 20 and 22 holes (emerged beetles) / tree during the respective three years. The mean numbers of emerged beetles (holes) / tree in autumn months were 11, 15 and 24 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.20, 0.22 and 0.28 holes during the respective three years.

2.3. Valencia orange was also highly susceptible citrus species as the mean number of holes / tree approximated 0.69, 0.80 and 0.98 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / month were 0.06, 0.07 and 0.08 holes / tree.

Summer months showed that the mean numbers of emerged beetles were, 42, 47 and 55 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Spring months showed less mean number of emerged beetles, 17, 18 and 21 holes (emerged beetles) / tree during the respective three years. Autumn months showed also low mean numbers of emerged beetles (holes) / tree reaching 10, 15 and 22 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.17, 0.20 and 0.25 holes during the respective three years.

2.4. Grape fruit was the relatively highly susceptible citrus species as the mean number of holes / tree approximated 0.64, 0.65 and 0.84 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / month were 0.05, 0.05 and 0.07 holes / tree.

Summer months showed that the mean number of emerged beetles were, 39, 39 and 48 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Spring months showed less mean number of emerged beetles, 13, 13 and 18 holes (emerged beetles) / tree during the respective three years. Autumn months showed also low mean numbers of emerged beetles (holes) / tree giving 12, 13 and 18 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.16, 0.16 and 0.21 holes during the respective three years.

2.5. Mandarin (Balady) was the highly susceptible citrus species as the mean number of holes / tree approximated 0.52, 0.73 and 0.74 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / month were 0.04, 0.06 and 0.06 holes / tree.

Summer months showed the mean number of emerged beetles, 31, 44 and 40 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Spring months showed less mean number of emerged beetles, 10, 15 and 19 holes (emerged beetles) / tree during the respective three years. Autumn months showed the least mean numbers of emerged beetles (holes) / tree showing 11, 14 and 15 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.13, 0.18 and 0.185 holes during the respective three years.

2.6. Lime was the highly susceptible citrus species as the mean number of holes / tree approximated 0.47, 0.56 and 0.75 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / month were 0.04, 0.04 and 0.06 holes / tree.

Summer months showed that the mean number of emerged beetles were, 29, 35 and 43 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Autumn months gave the least mean numbers of emerged beetles (holes) / tree were 10, 12 and 18 holes / tree during the respective three years. Spring months showed less mean number of emerged beetles, 8, 9 and 14 holes (emerged beetles) / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.12, 0.14 and 0.19 holes during the respective three years.

2.7. Lemon was moderately susceptible citrus species as the mean number of holes / tree approximated 0.35, 0.31 and 0.49 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective

degrees of infestation / month were 0.03, 0.03 and 0.04 holes / tree.

Summer months showed that the mean number of emerged beetles were, 23, 27 and 30 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Autumn months showed lower mean numbers of emerged beetles (holes) / tree were 7, 8 and 11 holes / tree during the respective three years. Spring months showed less mean number of emerged beetles, 5, 6 and 8 holes (emerged beetles) / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.09, 0.08 and 0.12 holes during the respective three years.

2.8. Sour orange (Naring) was the less susceptible citrus species as the mean number of holes / tree approximated 0.25, 0.27 and 0.33 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / month were 0.02, 0.02 and 0.03 holes / tree.

Summer months showed that the mean number of emerged beetles were, 18, 19 and 22 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Autumn months showed lower mean numbers of emerged beetles (holes) / tree were 4, 6 and 8 holes / tree during the respective three years. Spring months showed the least mean number of emerged beetles, 3, 2 and 3 holes (emerged beetles) / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.06, 0.07 and 0.08 holes during the respective three years.

2.9. Volkamer lemon was the least susceptible citrus species as the mean number of holes / tree approximated 0.10, 0.11 and 0.15 holes (emerged beetles) / tree / year during the three years of study 2010, 2011 and 2012, respectively. The respective degrees of infestation / month were 0.008, 0.01 and 0.01 holes / tree.

Summer months showed that the mean number of emerged beetles were, 7, 8 and 10 holes (emerged beetles) / tree during the three years 2010, 2011 and 2012, respectively. Autumn months showed lower mean numbers of emerged beetles (holes) / tree were 2, 2 and 3 holes / tree during the respective three years. Spring months showed the least mean number of emerged beetles, 1, 1 and 2 holes (emerged beetles) / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.025, 0.03 and 0.04 holes during the respective three years.

Table 2. Mean number of *C. varius* beetles in Navel orange (Nav), Balady orange (Bal), Valencia orange (Val), Grape-fruit (G-f), Mandarin (Man), Lime (Lim), Lemon (Lem), Sour orange (S-o) and Volkamer Lemon (V-m) citrus orchards, at Sharkia governorate during 2010 seasons.

Date of inspection	Mean no. of beetles \ 100 trees									
	Nav	Bal	Val	G-f	Mnd	Lim	Lem	S-o	V-m	Mean
Winter (Jan. – Mar.)	0	0	0	0	0	0	0	0	0	0
Spring (Apr. – Jun.)	20	18	17	13	10	8	5	3	1	10.55
Summer (Jul. – Sept.)	57	49	42	39	31	29	23	18	7	32.77
Autumn (Oct. – Dec.)	8	11	10	12	11	10	7	4	2	8.33
Grand Total (GM)	85	78	69	64	52	47	35	25	10	51.65
GM / tree/year	0.85	0.78	0.69	0.64	0.52	0.47	0.35	0.25	0.10	0.52
GM / tree/ season	0.21	0.20	0.17	0.16	0.13	0.12	0.09	0.06	0.025	0.13
GM / tree/ month	0.07	0.065	0.06	0.05	0.04	0.04	0.03	0.02	0.008	0.043

Table 3. Mean number of *C. varius* beetles in Navel orange (Nav), Balady orange (Bal), Valencia orange (Val), Grape-fruit (G-f), Mandarin (Man), Lime (Lim), Lemon (Lem), Sour orange (S-o) and Volkamer Lemon (V-m) citrus orchards, at Sharkia governorate during 2011 seasons.

Date of inspection	Mean no. of beetles \ 100 trees									
	Nav	Bal	Val	G-f	Mnd	Lim	Lem	S-o	V-m	Mean
Winter (Jan. – Mar.)	0	0	0	0	0	0	0	0	0	0
Spring (Apr. – Jun.)	23	20	18	13	15	9	6	2	1	11.89
Summer (Jul. – Sept.)	66	53	47	39	44	35	27	19	8	37.55
Autumn (Oct. – Dec.)	13	15	15	13	14	12	8	6	2	10.89
Grand Total (GM)	102	88	80	65	73	56	41	27	11	60.33
GM / tree/year	1.02	0.88	0.80	0.65	0.73	0.56	0.31	0.27	0.11	0.603
GM / tree/ season	0.26	0.22	0.20	0.16	0.18	0.14	0.08	0.07	0.03	0.15
GM / tree/ month	0.09	0.07	0.07	0.05	0.06	0.04	0.03	0.02	0.01	0.05

Table 4. Mean number of *C. varius* beetles in Navel orange (Nav), Balady orange (Bal), Valencia orange (Val), Grape-fruit (G-f), Mandarin (Man), Lime (Lim), Lemon (Lem), Sour orange (S-o) and Volkamer Lemon (V-m) citrus orchards, at Sharkia governorate during 2012 seasons.

Date of inspection	Mean no. of beetles \ 100 trees									
	Nav	Bal	Val	G-f	Mnd	Lim	Lem	S-o	V-m	Mean
Winter (Jan. – Mar.)	0	0	0	0	0	0	0	0	0	0
Spring (Apr. – Jun.)	26	22	21	18	19	14	8	3	2	14.78
Summer (Jul. – Sept.)	71	68	55	48	40	43	30	22	10	40.00
Autumn (Oct. – Dec.)	18	24	22	18	15	18	11	8	3	15.22
Grand Total (GM)	115	114	98	84	74	75	49	33	15	73.0
GM / tree/year	1.15	1.14	0.98	0.84	0.74	0.75	0.49	0.33	0.15	0.73
GM / tree/ season	0.29	0.28	0.25	0.21	0.185	0.19	0.12	0.08	0.04	0.18
GM / tree/ month	0.10	0.095	0.08	0.07	0.06	0.06	0.04	0.03	0.01	0.06

Table 5. Progressive mean number of *C. varius* beetles in citrus (in Navel orange, Balady orange, Valencia orange, Grape-fruit (G-f), Mandarin, Lime, Lemon, Sour orange and Volkamer Lemon) orchards, at Sharkia governorate during 2010, 2011 and 2012 seasons.

Date of inspection	Mean no. of beetles \ trees				
	2010	2011	Sum of two successive years	2012	Sum of three successive years
Winter (Jan. – Mar.)	0	0	0	0	0
Spring (Apr. – Jun.)	0.1055	0.1189	0.2244	0.1478	0.3722
Summer (Jul. – Sept.)	0.3277	0.3755	0.7032	0.4000	1.1032
Autumn (Oct. – Dec.)	0.0833	0.1089	0.1922	0.1522	0.3444
GM / tree/year	0.52	0.603	1.123	0.73	1.853
GM / tree/ season	0.13	0.15	0.28	0.18	0.46
GM / tree/ month	0.043	0.05	0.093	0.06	0.153

3. Progress of infestation:

Infestation in citrus species / varieties (Navel orange, Balady orange, Valencia orange, Grape fruit, Mandarin, Lime, Lemon, Sour orange and Volkamer Lemon) increased from one year to another (Table, 5).

Generally, infestation slightly increased from 0.52 to 0.603 after one year (2010 or 2011), to 1.123 beetles (exit holes) / tree after two successive years (at the end of 2011), and increased three times at the end of the third successive year showing 1.853 beetles / tree.

Seasonally, infestation slightly increased from 0.13 in 2010 or 0.15 in 2011 to 0.28 beetles / tree at the end of 2012 and increased three times at the end of the third year showing 0.46 beetles / tree.

These rapid increases impose the urgent need of control.

4. Discussion and conclusion:

The present study affirmed the previous survey and monitoring studies carried out by Tadros *et al.*, 1997 who indicated that *C. varius* is the dominant and most economically important boring insect pest in several fruit orchards. The current study is unique in determining the relative difference in the susceptibility of local and established foreign species / varieties to the target borer infestation. Monitoring studies (especially the seasonal fluctuation of insect pest population, progress of infestation, seasonal cycle, and effect of the main weather factors on the target pests) are essential in planning successful and effective "Integrated Control Programs" for the management of boring insect pest (Tadros, 1982).

Approximately one-third (32.5%) of citrus trees were infested with *C. varius* and obvious differences in susceptibility was noticed between one species / varieties to another (5 - 55.5%). Navel orange, Balady orange, Valencia orange, and Grape fruit, were highly susceptible species (43.7 – 55.3 beetles / tree), while Mandarin showed moderate degree of infestation (38% beetles / tree). Lime and Lemon were less susceptible species (16 – 22.3 beetles / tree). Sour orange and Volkamer Lemon were the least susceptible species (5 – 11.7 beetles / tree).

The grand mean degree of susceptibility of citrus species / varieties to *C. varius* infestation approximated 0.6177 beetles / tree / year. Infestation increased from 0.52 beetles / tree at the end of 2010 (one year), to 1.123 beetles / tree at the end of 2011 (two years) to 1.853 beetles / tree at the end of 2012 (three years). Summer months recorded the maximum beetle flight (0.3677 beetles), followed by spring (0.1241 beetle) or autumn months (0.1148 beetles) /tree, and stopped during winter. The grand mean degree of susceptibility of citrus species / varieties to *C. varius* infestation approximated 0.1533 beetles / tree / season. Generally, Navel orange was the most susceptible species followed descendingly by Balady orange, Valencia orange, Grape fruit, Mandarin, Lime, Lemon, Sour orange and at last Volkamer Lemon. Infestation increased from 0.13 beetles / tree at the end of 2010 (one year), to 0.28 beetles / tree at the end of 2011 (two years) to 0.46 beetles / tree at the end of 2012 (three years), that impose the need to control this pest in citrus orchards.

REFERENCES

1. Batt, A. M., A. M. Okil, S. M. Haggag and G. N. Girgis. 1993. Studies on borers attacking citrus trees in Egypt. Zagazig J. Agric. Res., 20 (11): 395 – 404.
2. Bodenheimer, F. S. 1934. Studies on the ecology of Palestinean Coleoptera: II. Seasonal and diurnal appearance and activity. Bull. Soc. Roy. ent. Egypt, 18: 211-241.
3. El-Assal, M.M.A., M.M. Abdel-Azim and A.W. Tadros. 2008. Monitoring the solitary carpenter worm, *Paropta paradoxa* (Lepidoptera: Cossidae), recently serious pest in mandarin orchards in Egypt. Egypt. J. Agric. Res., Cairo, Egypt, 17 Feb., 2008.
4. El-Zoheiry, M. S. 1950. The wasp beetle, *Chlorophorus varius* Mull. (Col.: Cerambycidae) a new pest of grapevine in Egypt. Proc. 8th Int. Cong. ent., Stockholm, pp. 727-731.
5. Fisher, R. A. 1950. Statistical methods for research workers. Oliver and Boyed Ltd., London.
6. Haggag, S. M. 1982. Studies on *Chlorophorus varius* Mull. (Coleoptera: Cerambycidae). Ph. D. Thesis, Fac. Agric., Al-Azhar Univ.
7. Nour, H. 1963. Classification of wood- boring beetles as known to exist in Egypt, UAR, (Coleoptera). Tech. Bull. 35 pp.
8. Porta, A. 1934. Fauna Coleopterorum Italica. IV. Heteromera-Phytophaga. Piacenza, Stabilimento Piacentiono, Italiana: 209-210.
9. Schmidt, G. 1962. A contribution to the occurrence and life-history of *Chlorophorus annularis* F. (Col.: Cerambycidae). Z. angew. Zool. 49: 87-94.
10. Tadros, A.W. 1982. Biological, Ecological and Control Studies on *Paropta paradoxa* H. Schaeff. (Lepidoptera: Cossidae) and *Chlorophorus varius* Mull. (Coleoptera: Cerambycidae) on grapevine trees in Egypt. Ph. D. Thesis, Fac. Agric., Cairo Univ.
11. Tadros, A.W. 1993. The life cycle of the wasp beetle, *Chlorophorus varius* Mull. (Coleoptera: Cerambycidae) on peach in Egypt. Egypt. J. Agric. Res., 71 (2): 429-435.
12. Tadros, A.W. 1994. Monitoring the population of the wasp beetle, *Chlorophorus varius* Mull. (Coleoptera: Cerambycidae) on peach and its hosts in Egypt. Egypt. J. Agric. Res., 72 (1): 103-115.
13. Tadros, A.W., M.M. Kinawy and F.F. Abd-Allah. 1993. Population dynamics and host range of *Macrotoma palmata* F. (Coleoptera: Cerambycidae). Insect Science and its Application, Nairobi, Kenya, 14 (5 - 6): 246-354.
14. Tadros, A.W., A.M. Semeada, S.I. El-Sherif and A.A. Fattouh. 1997. Survey of the insect pests in vineyards in Egypt. 7th Nat. Conf. of Pest & Dis. of Vegetables & fruits in Egypt, 1997: 242-249.
15. Winkler, A. 1932. Catalogus Coleopterorum regions palaearticae Dittesgasse II, Wie, 18: 1178.

الحساسية النسبية والتعداد لإصابة أهم أصناف / أنواع الموالح (الحمضيات)

بحفار ساق الخوخ ذو القرون الطويلة

Chlorophorus varius (Coleoptera: Cerambycidae)

في حدائق الموالح في مصر

صلاح محروس هاشم ، انطون ولسن تادرس ، إيمان أحمد عبد الحميد

معهد بحوث وقاية النباتات- مركز البحوث الزراعية - دقى - الجيزة- مصر.

تم دراسة معدل الإصابة (النسبة المئوية لعدد الأشجار المصابة) ودرجة الإصابة (عدد الخنافس التي أكملت دورة حياتها وخرجت من الأشجار المصابة خلال فصول السنة) بحفار ساق الخوخ ذو القرون الطويلة لدراسة الحساسية النسبية لتسعة أنواع / أصناف محلية أو أجنبية مستوطنة ومنتشرة في مصر حاليا في حدائق الموالح وهي البرتقال بسرة **Navel orange**، والبرتقال البلدي **Balady orange**، والبرتقال الصيفي **Valencia orange**، والجريب فروت **Grape fruit**، واليوسفي البلدي **Mandarin**، والليمون البلدي البنزهير **Lime**، والليمون الأضاليا **Lemon**، وأصل النارج **Sour orange**، والأصل فولكا ماريانا **Volkamer Lemon** في محافظة الشرقية علي مدار ثلاثة أعوام متتالية (٢٠١٠ & ٢٠١١ & ٢٠١٢). بلغ معدل الحساسية النسبية لأنواع / الأصناف للإصابة بالحفار ٣٢,٥% (المدى: ٥,٠ - ٥٥,٣%). بلغت درجة الحساسية النسبية لأنواع / الأصناف للإصابة بحفار ساق الخوخ ذو القرون الطويلة ٠,٦١٧٧ خنفساء / شجرة / في السنة. إزدادت الإصابة من ٠,٥٢ خنفساء / شجرة في نهاية ٢٠١٠ (سنة واحدة)، إلي ١,١٢٣ خنفساء / شجرة في نهاية ٢٠١١ (سنتان)، إلي ١,٨٥٣ خنفساء / شجرة في نهاية ٢٠١٢ (ثلاث سنوات). سجلت شهور الصيف أعلى نشاط للحشرات (٠,٣٦٧٧ حشرة)، يليها الربيع (٠,١٢٤١ حشرة). والخريف (٠,١١٤٨ حشرة) / شجرة. بينما توقف النشاط خلال الشتاء. بلغ المتوسط الإجمالي لدرجة الإصابة حوالي ١,٥٣٣ خنفساء / شجرة / فصل من السنة. تضاعف معدل الإصابة بالحفار في نهاية عام واحد (٢٠١٠) من ٠,١٣ خنفساء / شجرة، إلي ٠,٢٨ خنفساء / شجرة في نهاية عامين (نهاية ٢٠١١)، إلي ٠,٤٦ خنفساء / شجرة في نهاية ثلاث أعوام (نهاية ٢٠١٢)، مما يستوجب مكافحة هذه الآفة في حدائق الموالح. وفي جميع الأحوال كان البرتقال بسرة أكثر حساسية للإصابة، يليه البرتقال البلدي، ثم البرتقال الصيفي، ثم الجريب فروت، ثم اليوسفي البلدي، ثم الليمون البلدي البنزهير، ثم الليمون الأضاليا، ثم أصل النارج، وأخيرا الأصل فولكا ماريانا.