

**THE RELATIVE SUSCEPTIBILITY AND MONITORING OF
CITRUS / VARIETIES TO THE FLATHEADED BORER *PTOSIMA
UNDECIMMACU LATA* HERBST
(COLEOPTERA: BUPRESTIDAE) IN CITRUS ORCHARDS**

HASHIM, S. M., R. M. ABD EL-MOATY and A. W. TADROS

Plant Protection Research Institute, Agric. Res. Center, MOA, Giza, Egypt.

(Manuscript received 22 February 2018)

Abstract

The relative susceptibility and monitoring of nine widely spread citrus / varieties: Navel orange, Balady orange, Valencia orange, grape-fruit, Balady Mandarin, lime, Lemon, Sour orange and Volkamer lemon to *Ptosima undecimmaculata* (Coleoptera: Buprestidae) borer infestation as well as the population fluctuation were studied at Sharkia governorate, during the three successive years 2015, 2016 and 2017. The mean rate of susceptibility of citrus species and varieties to *P. undecimmaculata* infestation reached 16.3% (range, 2 – 46 %). The grand mean degree of susceptibility of citrus species / varieties to *P. undecimmaculata* infestation approximated 0.377 beetles / tree / year. Infestation increased from 0.341 beetles / tree at the end of 2015 (one year), to 0.720 beetles / tree at the end of 2016 (two years) to 1.331 beetles / tree at the end of 2017 (three years). Summer months recorded the maximum beetle flight (0.242 beetles), followed by spring (0.077 beetle) or autumn months (0.058 beetles) /tree, and stopped during winter. The grand mean degree of susceptibility of citrus species / varieties to *P. undecimmaculata* infestation approximated 0.094 beetles / tree / season. Generally, Navel orange (19.1%) and Valencia orange (17.2%) were the most susceptible species followed descending by Balady orang (14.3%), Grape fruit, (13.8%) Mandarin (13.8%), Volkamer Lemon (10.3%), while the least were Sour orange (6.4%), Lime (4.5%) and Lemon (2.4%).

INTRODUCTION

Citrus are the most favorite and popular fruits; as well as are the most economic exporting crop. Therefore in Egypt, citrus rank first in fruit area and production and several citrus species and varieties are spread all-over Egyptian zones to increase the harvesting period and accommodate local consumption and exportation. The most widely spread citrus / varieties are 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*).

P. undecimmaculata stem borer is widely distributed all-over the Mediterranean basin area. All-over the governorates of Egypt, *P. undecimmaculata* attack citrus orchards (Hashim *et al.* 2017) well as different fruit tree hosts such as mango

(Hashim and Ahmed, 2011), apricot (Kinawy *et al.*, 1992 and Tadros *et al.*, 2006-a), peach, plum, almond, etc. (Batt, 1999 and Hashim, 2009). Larvae live and feed in a shallow tunnels under the bark of tree stem and main branches and cause girdling the wood, weakness, reducing the production, and finally their death. The total life cycle was completed in an almost one year

Citrus trees also are attacked by several Coleopteran stem borers such as the cerambycids *Chlorophorus varius* (Tadros, 1993), *Macrotoma palmata* (Tadros *et al.*, 1993), *Scolytus amygdale* (Tadros, 1994), the Bostrichid *Enneadesmus obtusidentatus* (Tadros *et al.*, 1997), as well as the Lepidopterous cossid *Paropta paradoxa* (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 borer's infestation is lacking all over the world and in Egypt.

The present study is an attempt to contribute such a gap in the knowledge on the population fluctuation and the relative susceptibility of citrus tree borers to different citrus species and varieties. The broad objective of investigation is to add a 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 (Tadros *et al.*, 2006-b).

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 *P. undecimmaculata* borer infestation were subjected to the present study.

Infestation studies (rate and degree) of the target borer *P. undecimmaculata* were carried out during the three successive seasons 2015, 2016 and 2017 in citrus orchards spread all-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 *P. undecimmaculata* 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 four times 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 January 1st 2015 until January 1st 2017 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 year after another.

RESULTS AND DISCUSSION

1. Rate of *P. undecimmaculata* Infestation:

Data presented in table (1) showed that The rate of *P. undecimmaculata* infestation which varied from one citrus / varieties to another. Navel orange was the highest susceptible species to the borer infestation showing 23 – 46%, with a mean of 33%, and Valencia orange showing 15 – 39%, with a mean of 24.7%, Ballady orange ranging 13 – 35%, with a mean of 22.3% infestation, and Grape fruit ranging 12 – 32%, with a mean of 23%, Mandarin ranging 11 – 21%, with a mean of 16.7%. The moderately and least susceptible were Volkamer lemon (8 – 14%, with a mean of 10.7%), Sour orange (6 – 9%, with a mean of 7.7%), and last Lime (1 – 10%, with a mean of 5.3%), and lemon (2 – 5%, with a mean of 3.3%).

The general mean percent of *P. undecimmaculata* infestation in citrus (species / varieties) orchards ranged from 13.9 – 17.8%, with a grand mean of 16.3%.

Table 1. Rate of *P. undecimmaculata* infestation in citrus species / varieties, Navel orange, Balady orange, Valencia orange, grape fruit, Mandarin, lime, Lemon, Sour orange and Volkamer lemon at Sharkia governorate during 2015, 2016 and 1017 activity seasons.

No.	Variety	Rate of infestation (%)			
		2015	2016	2017	Mean
1	Navel orange	23	30	46	33
2	Ballady orange	35	13	19	22.3
3	Valencia orange	39	15	20	24.7
4	Grape fruit	12	32	25	23
5	Mandarin	21	11	18	16.7
6	Lime	1	5	10	5.3
7	Lemon	5	3	2	3.3
8	Sour orange	9	8	6	7.7
9	Volkamer lemon	10	8	14	10.7
Total		155	125	160	146.7
Mean / species or variety		17.2	13.9	17.8	16.3

2. The degree of *P. undecimmaculata* infestation and seasonal activity:

The degree of *P. undecimmaculata* infestation and seasonal activity showed obvious variation between different citrus species / varieties (Tables 2, 3 and 4).

2.1. Navel orange:

It was the highly susceptible citrus species as the mean number of holes / tree approximated 0.55, 0.61 and 0.72 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.046, 0.05 and 0.06 holes / tree. Summer months showed the mean number of beetles, 33, 35 and 40 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Spring months showed less mean number of emerged beetles, 12, 15 and 18 holes (emerged beetles) / tree during the respective three years. Autumn months were the least mean numbers of emerged beetles (holes) / tree were 10, 11 and 14 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.14, 0.15 and 0.18 holes during the respective three years.

2.2. Valencia orange:

Was also highly susceptible citrus species as the mean number of holes / tree approximated 0.5, 0.56 and 0.65 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.04, 0.05 and 0.05 holes / tree.

Summer months showed the mean number of emerged beetles, 31, 34 and 38 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Spring months showed less mean number of emerged beetles, 10, 12 and 15 holes (emerged beetles) / tree during the respective three years. Autumn months showed same mean numbers of emerged beetles (holes) / tree were 9, 10 and 12 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.14, 0.14 and 0.16 holes during the respective three years.

2.3. Ballady orange:

Data proved that, ballady orange was highly susceptible citrus species as the mean number of holes / tree approximated 0.45, 0.48 and 0.54 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.0375, 0.04 and 0.045 holes / tree. Summer months showed the mean number of emerged beetles, 29, 30 and 33 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Spring months showed less mean number of emerged beetles, 9,

10 and 12 holes (emerged beetles) / tree during the respective three years. Autumn months were also the same mean numbers of emerged beetles (holes) / tree were 7, 8 and 9 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.11, 0.12 and 0.135 holes during the respective three years.

2.4. Grape fruit:

It was the relatively highly susceptible citrus species as the mean number of holes / tree approximated 0.48, 0.49 and 0.52 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.04, 0.041 and 0.043 holes / tree. Summer months showed the mean number of emerged beetles, 34, 35 and 35 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Spring months showed less mean number of emerged beetles, 8, 9 and 11 holes (emerged beetles) / tree during the respective three years. Autumn months were the same mean numbers of emerged beetles (holes) / tree were 6, 5 and 6 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.12, 0.1225 and 0.13 holes during the respective three years.

2.5. Mandarin (Balady):

Mandarin (balady) species showed the highly susceptible one as the mean number of holes / tree approximated 0.41, 0.46 and 0.52 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees / of infestation month were 0.033, 0.038 and 0.043 holes / tree. Summer months showed the mean number of emerged beetles, 28, 30 and 32 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Spring months showed less mean number of emerged beetles, 8, 10 and 10 holes (emerged beetles) / tree during the respective three years. Autumn months were the least mean numbers of emerged beetles (holes) / tree were 5, 6 and 8 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / month were 0.10, 0.115 and 0.13 holes during the respective three years.

2.6. Volkamer lemon:

It was less susceptible citrus species as the mean number of holes / tree approximated 0.29, 0.33 and 0.39 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.024, 0.027 and 0.032 holes / tree. Summer months showed the mean number of emerged beetles, 20, 21 and 24 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Spring months showed less

mean number of emerged beetles, 6, 7 and 8 holes (emerged beetles) / tree during the respective three years. Autumn months were the least mean numbers of emerged beetles (holes) / tree were 3, 5 and 7 holes / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.07, 0.08 and 0.097 holes during the respective three years.

2.7. Sour orange (Naring):

This species was the lower susceptible when compared with aforementioned citrus species as the mean number of holes / tree approximated 0.19, 0.21 and 0.24 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.016, 0.017 and 0.02 holes / tree. Summer months showed the mean number of emerged beetles, 14, 15 and 17 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Autumn months were the least mean numbers of emerged beetles (holes) / tree were 2, 3 and 2 holes / tree during the respective three years. Spring months showed less mean number of emerged beetles, 3, 3 and 5 holes (emerged beetles) / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.05, 0.05 and 0.06 holes during the respective three years.

2.8. Lime :

It was much low susceptible citrus species as the mean number of holes / tree approximated 0.13, 0.15 and 0.17 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.01, 0.012 and 0.014 holes / tree. Summer months showed the mean number of emerged beetles, 10, 11 and 12 holes (emerged beetles) / tree during the three years 2015, 2016 and 2017, respectively. Autumn months were the least mean numbers of emerged beetles (holes) / tree were 1, 2 and 3 holes / tree during the respective three years. Spring months showed less mean number of emerged beetles, 2, 2 and 2 holes (emerged beetles) / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.03, 0.037 and 0.037 holes during the respective three years.

2.9. Lemon:

This citrus species was the least susceptible as the mean number of holes / tree approximated 0.06, 0.08 and 0.49 holes (emerged beetles) / tree / year during the three years of study 2015, 2016 and 2017, respectively. The respective degrees of infestation / month were 0.005, 0.007 and 0.008 holes / tree. Summer months showed the mean number of emerged beetles, 5, 6 and 7 holes (emerged beetles) /

tree during the three years 2010, 2011 and 2012, respectively. Autumn months were the least mean numbers of emerged beetles (holes) / tree were 0, 8 and 1 holes / tree during the respective three years. Spring months showed less mean number of emerged beetles, 1, 1 and 1 holes (emerged beetles) / tree during the respective three years. Beetles stopped emergence during winter months. The grand means of emerged beetles / tree / season were 0.015, 0.02 and 0.022 holes during the respective three years.

Table 2. Mean number of *P. undecimmaculata* 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) in citrus orchards, at Sharkia governorate during 2015 activity 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.)	12	9	10	8	8	2	1	3	6	6.555
Summer (Jul. – Sept.)	33	29	31	34	28	10	5	14	20	22.666
Autumn (Oct. – Dec.)	10	7	9	6	5	1	0	2	3	4.777
Grand Total (GM)	55	45	50	48	41	13	6	19	29	33.998
GM/tree/year	0.55	0.45	0.5	0.48	0.41	0.13	0.06	0.19	0.29	0.34
GM / tree/ season	0.14	0.11	0.125	0.12	0.10	0.03	0.015	0.05	0.047	0.085
GM / tree/ month	0.05	0.037	0.04	0.04	0.033	0.01	0.005	0.016	0.024	0.0283

Table 3. Mean number of *P. undecimmaculata* 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) in citrus orchards, at Sharkia governorate during 2016 activity 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.)	15	10	12	9	10	2	1	3	8	7.777
Summer (Jul. – Sept.)	35	30	34	35	30	11	6	15	24	24.44
Autumn (Oct. – Dec.)	11	8	10	5	6	2	1	3	5	5.666
Grand Total (GM)	61	48	56	49	46	15	8	21	33	37.88
GM / tree/year	0.61	0.48	0.56	0.49	0.46	0.15	0.08	0.21	0.33	0.379
GM / tree/ season	0.15	0.12	0.14	0.12	0.115	0.037	0.02	0.05	0.08	0.095
GM / tree/ month	0.05	0.04	0.05	0.04	0.038	0.012	0.007	0.017	0.027	0.032

Table 4. Mean number of *P. undecimmaculata* 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) in citrus orchards, at Sharkia governorate during 2017 activity 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.)	18	12	15	11	12	2	1	5	3	8.77
Summer (Jul. – Sept.)	40	33	38	35	32	12	7	17	15	25.44
Autumn (Oct. – Dec.)	14	9	12	6	8	3	1	2	7	6.88
Grand Total (GM)	72	54	65	52	52	17	9	24	39	41.09
GM / tree/year	0.72	0.54	0.65	0.52	0.52	0.17	0.09	0.24	0.39	0.411
GM / tree/ season	0.18	0.135	0.16	0.13	0.13	0.04	0.022	0.06	0.097	0.103
GM / tree/ month	0.06	0.045	0.05	0.043	0.043	0.014	0.008	0.02	0.032	0.034

Table 5. Progressive mean number of *P. undecimmaculata* beetles in citrus (in Navel orange, Balady orange, Valencia orange, Grape-fruit, Mandarin, Lime, Lemon, Sour orange and Volkamer Lemon) orchards, at Sharkia governorate during 2015, 2016 and 2017 activity seasons.

Date of inspection	Mean no. of beetles \ trees				
	2015	2016	Sum of two successive years	2017	Sum of three successive years
Winter (Jan. – Mar.)	0	0	0	0	0
Spring (Apr. – Jun.)	0.066	0.078	0.144	0.088	0.232
Summer (Jul. – Sept.)	0.227	0.244	0.471	0.254	0.725
Autumn (Oct. – Dec.)	0.048	0.057	0.105	0.069	0.174
GM / tree/year	0.341	0.379	0.720	0.411	1.131
GM / tree/ season	0.085	0.095	0.180	0.103	0.283
GM / tree/ month	0.028	0.032	0.060	0.034	0.094

3. Progress of infestation:

Infestation with *P. undecimmaculata* 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 increased from 0.341 beetles in 2015 to 0.379 beetles in 2016 to 0.411 beetles (expressed by exit holes) / tree at the end of 2017. Thus infestation almost doubled after one year (0.720) and increased three times at the end of the third year showing 1.131 beetles / tree / year. This rapid increase impose the urgent need of control.

4. Discussion and conclusion:

P. undecimmaculata attacks several fruit species mainly apricot, peach, plum, almond, apple and pear (Kinawy *et al.*, 1992). Citrus orchards are also subjected to *P.*

undecimmaculata infestation (Hashim *et al.*, under publication) as well as other fruit tree borers such as *Chlorophorus varius*, *Macrotoma palmata*, *Hypothenemus eruditus*, and *Paropta paradoxa* (El-Assal *et al.*, 2008). The current study is unique in determining the relative difference in the susceptibility of local and established foreign citrus 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. Citrus / varieties showed variable rates of *P. undecimmaculata* infestation. Navel orange was the highest rate (33% infested trees), followed by Valencia orange, Grape fruit, Balady orange, Mandarin, and Volkamer lemon (24.7, 23, 22.3, 16.7, and 10.7% infested trees, respectively). The least rate were Sour orange, Lime and Lemon (7.7, 5.3, and 3.3% infested trees, respectively). The grand mean rate of infestation was (16.3% infested trees).

The progress of infestation data confirmed that *P. undecimmaculata* infestation almost doubled after each one single year, infestation will seriously multiple in few years especially in navel orange (0.72 beetles / tree / year) and Valencia orange (0.65 beetles / tree / year). Balady orange, Mandarin, and Grape fruit, were also threatened (54, 52 and 52 beetles / tree / year, respectively). Volkamer Lemon was moderately attacked (0.39 beetles / tree / year), while the least susceptible species were Sour orange (0.24 beetles / tree / year) and Lime and Lemon species (17 and 9 beetles / tree / year, respectively), similar rank of citrus species susceptibility was recorded by Hashim *et al.* 2014 for the peach tree borer *Chlorophorus varius*. According to 2017 season, summer months recorded the maximum beetle flight (0.07 – 0.40, with a mean of 0.2544 beetles/ tree / year), followed by spring (0.01 – 0.18, with a mean of 0.0877 beetles/ tree / year), or autumn months (0.01 – 0.14, with a mean of 0.0688 beetles/ tree / year), /tree, but flight stopped during winter, similar flight beetles activity was recorded by Hashim and Ahmed 2011 for *P. undecimmaculata* in mango orchards. These rates and degrees of *P. undecimmaculata* infestation impose the need to control this pest in citrus orchards, especially in Navel orange, Balady orange, Valencia orange, Grape fruit, Mandarin, and Lemon orchards.

REFERENCES

1. Batt, A. M. 1999. Survey of borers attacking deciduous fruit trees in Egypt with reference to certain biological and ecological studies. Egyptian J. of Agric. Res., 77 (3): 1081-1102.

2. 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.
3. Hashim, S. M. 2009. Ecological and Control Studies on Mango Tree Borers and Their Natural Enemies in Egypt. Ph D Thesis, Faculty of Science, Cairo University.
4. Hashim, S. M., Abd El-Moaty, R. M., and Tadros, A.W. (under publication): Monitoring *Ptosima undecimmaculata* Herbst (Coleoptera: Buprestidae) in orange orchards in Egypt. Egypt. J. Agric. Res., Cairo, Egypt, in PRESS
5. Hashim, S. M. and Ahmed, H.M. 2011. Population fluctuation of the metallic Beetle *Ptosima undecimmaculata* (HERBEST) (Coleoptera: Buprestidae) in Mango Orchards. Bull.Ent.Soc. Egypt, 88, 2011(169 – 177).
6. Hashim, S. M., A. W. Tadros and Eman A. Abdel Hamid. 2014. The relative susceptibility and monitoring of citrus species varieties to *Chlorophorus varius* in citrus orchards in Egypt. J. Agric. Res., 92 (1): 9- 19.
7. Kinawy, M. M.; F. F. Abd-Allah and A. W. Tadros. 1992. Seasonal abundance of the plum woodborer, *Ptosima undecimmaculata* Herbst (Coleoptera: Buprestidae) on apricot in Egypt. Communications in Science and Development Research, Alexandria, Egypt, 40 (496): 231-242.
8. 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.
9. Tadros, A.W. 1994. Monitoring the population of the shot-hole bark-beetle, *Scolytus amygdali* Guer. (Coleoptera: Scolytidae) on peach and its hosts in Egypt. Egypt. J. Agric. Res., 72 (1): 91-102.
10. Tadros, A.W., A. M. Abdel-Rahman and I. A. Abdel-Hamid (2006-a): Stone Fruit Pests: (5) Monitoring the major apricot tree borers (*Ptosima undecimmaculata*, *Chlorophorus varius*, *Macrotoma palmata* and *Scolytus amygdali* (Col.: Scolytidae) in Egypt. Egypt. J. Agric. Res., Egypt, 84 (6): 1789-1809.
11. Tadros, A.W., A. M. Abdel-Rahman and I. A. Abdel-Hamid. (2006-b): Stone Fruit Pests: (6) Alternative means of control of *Ptosima undecimmaculata* by horticultural, mechanical, microbiological and local chemical treatments in apricot orchards in Egypt. Egypt. J. Agric. Res., Egypt, Feb 19th, 2006.
12. 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.
13. 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.

الحساسية النسبية لإصابة أهم أصناف / الموالح بحفار ساق البرقوق مبطة الرأس

Ptosima undecimmaculata (Coleoptera: Buprestidae)

في حدائق الموالح في مصر

صلاح محروس هاشم ، راضي محمدي عبد المعطي و انطون ولسن تادرس

معهد بحوث وقاية النباتات- مركز البحوث الزراعية - 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 البرقوق مبطة الرأس *P. undecimmaculata* لدراسة الحساسية النسبية لتسعة أنواع / أصناف محلية أو أجنبية مستوطنة ومنتشرة في مصر حاليا في حدائق الموالح (الحمضيات) وهي البرتقال بسرة Navel orange، والبرتقال البلدي Balady orange، والبرتقال الصيفي Valencia orange، والجريب فروت Grape fruit، واليوسفي البلدي Mandarin، والليمون البلدي البنزهر Lime، والليمون الأضاليا Lemon، وأصل النارج Sour orange، والأصل فولكا ماريانا Volkamer Lemon في محافظة الشرقية علي مدار ثلاثة أعوام متتالية (٢٠١٥ & ٢٠١٦ & ٢٠١٧). بلغ معدل الحساسية النسبية / الأصناف للإصابة بالحفار ١٦,٣% (المدى: ٢ - ٤٦%). بلغت درجة الحساسية النسبية / الأصناف للإصابة بالحفار ٠,٣٧٧ خنفساء / شجرة / في السنة. إزدادت الإصابة من ٠,٣٤١ خنفساء / شجرة في نهاية ٢٠١٥ (سنة واحدة)، إلي ٠,٧٢٠ خنفساء / شجرة في نهاية ٢٠١٦ (سنتان)، إلي ١,٣٣١ خنفساء / شجرة في نهاية ٢٠١٧ (ثلاث سنوات). سجلت شهور الصيف أعلى نشاط للحشرات (٠,٢٤٢ حشرة)، يليها الربيع (٠,٠٧٧ حشرة). والخريف (٠,٠٥٨ حشرة) / شجرة. وتوقف النشاط خلال الشتاء. بلغ المتوسط الإجمالي لدرجة الإصابة حوالي ٠,٠٩٤ خنفساء / شجرة / فصل من السنة. تضاعف معدل الإصابة بالحفار يستوجب مكافحة هذه الآفة في حدائق الموالح. وفي جميع الأحوال كان البرتقال بسرة أكثر حساسية للإصابة (١٩,١%)، يليه البرتقال الصيفي (١٧,٢%)، ثم البرتقال البلدي (١٤,٣%)، ثم الجريب فروت واليوسفي البلدي (١٣,٨%)، ثم الأصل فولكا ماريانا (١٠,٣%)، وأخيرا البرتقال المالح (٦,٤%)، والليمون الأضاليا (٤,٥%) والليمون البلدي البنزهر (٢,٤%).

