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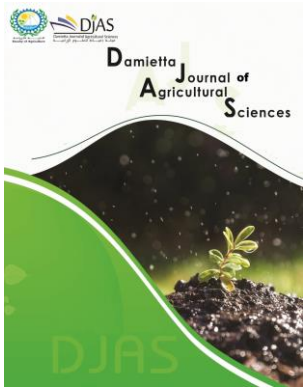
Population dynamics of the black scale, *Parlatoria ziziphi* (Lucas) on different citrus species in Damietta Governorate, Egypt

El-Kady, H.A.*; S.S. Awadalla** and Mai M. A. Eisa*
* Plant Protection Dept. Fac. of Agric. Damietta Univ., Egypt.
** Economic Entomology Dept. Fac. of Agric. Mans. Univ., Egypt.



Abstract:

Field experiments were conducted in acitrus orchard located at kafr Elbattikh, Damietta Governorate, Egypt to evaluate the population density of the black scale, *Parlatoria ziziphi* on varying citrus plant species, Mandarin, Lemon and Navel orange trees. Furthermore, the seasonal activity of *P. ziziphi* and the ectoparasitoids *Aphytis* spp. was examined during the two successive years (2021/22 and 2022/23). The living black scales reached the highest peak of abundance on the navel orange and balady lemon trees in 3rd of November 2021 with 414 and 321 scales during the first year, respectively. During the second year (2022/23), *P. ziziphi* reached the highest peak of abundance on navel orange trees in 21st of October, 2022 with 342 scales. During both years of investigation, navel trees hosted the highest numbers of the black scale with an average of 162.0 ± 21.06 and 150.6 ± 15.00 scales, followed by mandarin with 150.7 ± 16.22 and 140.3 ± 14.48 scales and then Balady lemon with 135.6 ± 12.62 and 115.70 ± 10.66 scales during the first and second year, respectively with non-significant differences between citrus species . The highest population peak of *Aphytis* spp. recorded 143 and 136 parasitoids on navel orange, 129 and 129 on mandarin and 117 and 103. on balady lemon during the first and second years, respectively. The ectoparasitism by *Aphytis* spp. contributed with the highest mortality in populations of *P. ziziphi* on the three citrus species, whereas predation came in the second category with significant differences during the two years of the study.

Key words: *Parlatoria ziziphi* , Citrus, scale insects, ectoparasite *Aphytis* spp.

INTRODUCTION

Citrus fruits are one of the most extensively cultivated fruit crops worldwide, with a sizable global market, particularly in Egypt. The largest exportable agricultural product in Egypt is citrus fruit. In the Delta and old Valley, citrus orchards ranged in size from 1 to 5 ha, but in newly reclaimed land, orchards are typically 50 ha or larger. 31572 ha produce 706826 tons, or 53% of the national total production **(Abobatta, 2018)**. However, one of the major harmful elements thought to be in charge of the decline of citrus trees in Egypt is insect pests, that infest the leaves, flowers, bark, fruits, and branches of citrus. The sucking piercing pests such as aphids, mealybugs and scale insects are known to attack citrus trees hardly **(Kamel, 2010)**. Among the most important pests affecting citrus trees worldwide, especially in Egypt, the black scale, *Parlatoria ziziphi* (Lucas) **(Abd-Rabou, 2009; Jendoubi, 2012 and Nabil *et. al.*, 2019**). Citrus scale control can be accomplished with the use of biological control via the introduction of parasitic wasps. Hymenopterous parasitoids belonging to the family Aphelinidae have achieved high effectiveness in biological control of armored scale insects. The ectoparasitoid, *Aphytis* spp. highly synchronized with *P. ziziphi* populations and thus considered to be the most effective parasitoid of this insect species in citrus trees **(Moustafa, 2012; Abdel-Rahman, 2021; Awadalla *et. al.*, 2021 and Eldefrawy *et. al.*, 2021).** Therefore, this work carried out to examine the effect of varying citrus species on populations of the black scale, *P. ziziphi* and its ectoparasitoid wasp, *Aphytis* spp. Further, to determine the most important mortality agent acting populations of *P. ziziphi*.

MATERIALS AND METHODS:

Field experiments were conducted in a citrus orchard located at kafr El-battikh region, Damietta Governorate, Egypt to examine the population density of the black scale, *P. ziziphi* on

varying citrus species: mandarin (*Citrus reticulata*), balady lemon (*Citrus limon*) and navel orange (*Citrus sinensis* Washington). Furthermore, the seasonal activity of the ectoparasitoids, *Aphytis* spp. was monitored on populations of *P. ziziphi* during the two successive years (2021/22 and 2022/23). In addition, the seasonal mortality factors of *P. ziziphi* were estimated on varying citrus trees. One feddan from this orchard, which kept free of any insecticides application throughout the period of the study, was chosen.

Five trees of the same age and size from each citrus host plant were selected as replicates. Samples were collected biweekly during the two successive years from September 2021 till September 2022 in the first year and from September 2022 till September 2023 in the second year. Each sample consisted of 100 leaves and 25 branches were randomly collected from each host plant (20 leaves and 5 branches from each tree from the four directions and the middle of each tree). The collected leaves and branches from each host plant were taken to the laboratory in polyethylene bags for further investigation of the number of the black scale, *P. ziziphi* which counted by using a stereo microscope. The black scale, *P. ziziphi* was recorded as living, parasitized by the immature ectoparasitoids, consumed by predators, and dead by unknown mortality factors.

Statistical analysis:

One-way ANOVA was used to analyze the data followed by Duncan's Multiple Range Test to compare means ($\alpha = 0.05$) if there was significant effect. The simple correlation coefficient between the population abundance of the main insect pests and the main associated predators was determined using Spearman test. All analysed were performed using Costat program **(Costat software, 2004)**.

RESULT AND DISCUSSION

1- The population density of the black scale, Parlatoria ziziphi (Lucas) on different citrus trees:

Data illustrated in **Fig. (1)** show the population density of the living stages of the black scale, *P. ziziphi* on different citrus species during the first year 2021/22. The black scale reached the highest peak of abundance according to the alive individuals on Navel orange and Balady lemon trees in 3rd of November 2021with 414 and 321 indiv., respectively then the population fluctuated increasing or decreasing until the end of the year. While, the alive stages of the scale insect *P. ziziphi* reached the highest peak of abundance on Mandarin trees in 20th of October 2021 with alive number of 375 indiv. and the population increased or decreased until the end of the year.

Data represented in **Fig. (2)** showed the population density of the living stages of the black scale, *P. ziziphi* on varying citrus trees during the second year 2022/23. The black scale reached the highest peak of abundance according to the alive individuals on Navel orange trees in 21st of October 2022with 342 indiv. then the population fluctuated increasing or decreasing until the end of the year. While, the alive stages of the scale insect *P. ziziphi* reached the highest peak of abundance in 4th of Novamber 2022 on Mandarin and Balady lemon trees with alive number of 348 and 256 indiv., respectively and the population increased or decreased until the end of the year.

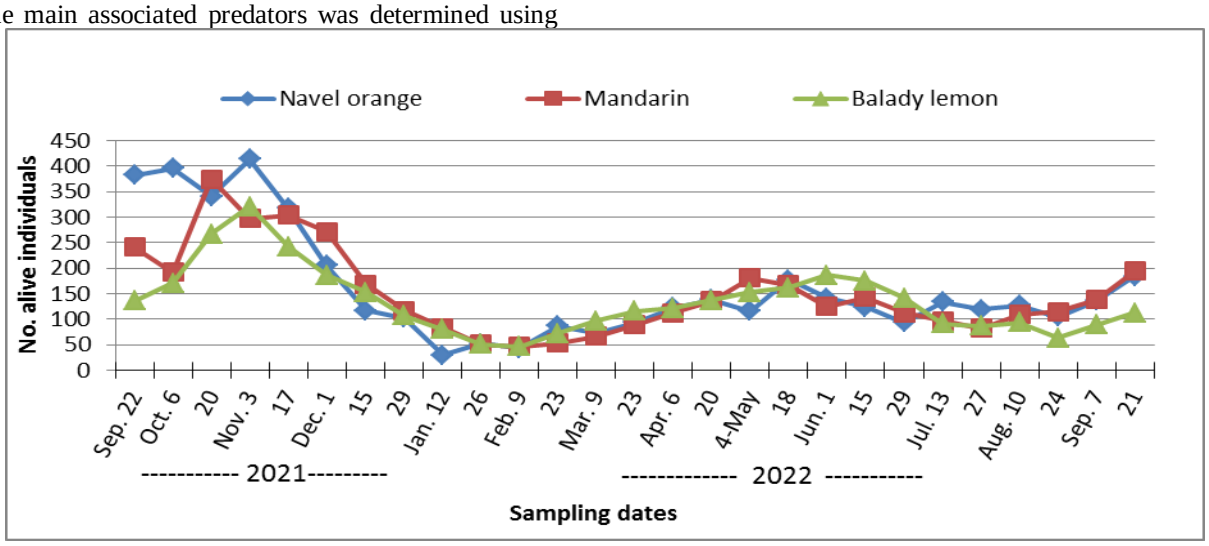


Fig.(1):Population density of the black scale, *Parlatoria ziziphi* on varying citrus species during 2021/2022 season at Kafr-El battikh region, Damietta Governorate .

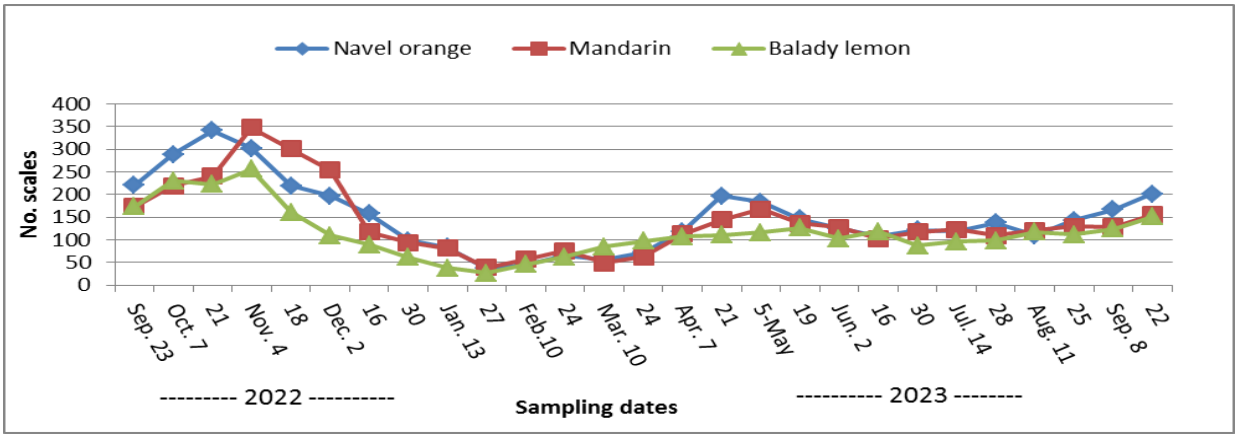


Fig.(2):Population density of the black scale, *Parlatoria ziziphi* on varying citrus species during 2022/2023 season at Kafr-El battikh region, Damietta Governorate .

The present data tabulated in **Table (1)** show the seasonality average number of the alive individuals of the black scale *P. ziziphi* on different citrus trees during 2021/22 and 2022/23. Autumn season during the two years 2021/22 and 2022/23 recorded the highest average number of the alive individuals *P. ziziphi* on different citrus trees as a host plants and presented by 310.4 ± 41.54, 264.3 ± 26.64 and 211.1 ± 25.55 indiv. for the first year and 246.9 ± 24.73, 236.1 ± 29.09 and 177.4 ± 23.86 indiv. for the second year on Navel orange, Mandarin and Balady lemon, respectively. Spring season come in the second category during the first year with an avarege 130.7 ± 9.86, 136.3 ± 11.85 and 150.1 ± 10.13 indiv. While during the second year summer came in the second category with an average of 142.9 ± 12.15, 126.4 ± 5.62 and 112.1 ± 8.12 indiv. on Navel orange, Mandarin and Balady lemon, respectively. On the other hand, Winter season came in the last category with (64.5 ± 11.24 and 64.5 ± 9.41indiv.) on Navel orange (69.7 ± 11.01 and 66.0 ± 8.58 indiv.) on Mandarin and(75.5 ± 9.93 and 53.2 ± 8.40) on Balady lemon during the two years (2021/22 and 2022/23), respectively.

Table(1): Influence of different host plants on the average number of the alive individuals of black scale, *Parlatoria ziziphi* during the two years 2021/22 and 2022/23 according to the different seasons.

Seasons	Navel orange	Mandarin	Balady lemon
First year 2021/22			
Autumn	310.4 ± 41.54 a	264.3 ± 26.64 ab	211.1 ± 25.55 b
Winter	64.5 ± 11.24 a	69.7 ± 11.01 a	75.5 ± 9.93 a
Spring	130.7 ± 9.86 a	136.3 ± 11.85 a	150.1 ± 10.13 a
Summer	128.3 ± 10.99 a	121.1 ± 13.77 a	97 ± 9.32 a
Average ± SE	162.0 ± 21.06 a	150.7 ± 16.22 a	135.6 ± 12.62 a
Second year 2022/23			
Autumn	246.9 ± 24.73a	236.1 ± 29.09 ab	177.4 ± 23.86 b
Winter	64.5 ± 9.41 a	66.0 ± 8.58 a	53.2 ± 8.40 a
Spring	135.7 ± 16.37 a	121.9 ± 12.78 a	111.1 ± 3.70 a
Summer	142.9 ± 12.15 a	126.4 ± 5.62 ab	112.1 ± 8.12 b
Average ± SE	150.6 ± 15.00 a	140.3 ± 14.48 a	115.70 ± 10.66 a

Means followed by the different letters in a row for each year are significantly differences at 5% level of the probability.

Statistical analysis revealed that a significant difference in Autumn season during the two years between the different citrus host plants. While, insignificantly differences were recorded in the other seasons during the two years of the study. Moreover, Navel orange came in the first category with an average of 162.0 ± 21.06 and 150.6 ± 15.00 followed by Mandarin with 150.7 ± 16.22 and 140.3 ± 14.48 indiv. and Balady lemon with 135.6 ± 12.62 and 115.70 ± 10.66 indiv. during the two years with insignificantly differences at 5% level of the probability, respectively.

2- The seasonal activity of the ectoparasitoid *Aphytis* spp.:

Data illustrated in **Fig. (3)** show the seasonal activity of the ectoparasitoid *Aphytis* spp. on populations of the black scale, *P. ziziphi* on different citrus species as a host plant during the first year 2021/22. The ectoparasitoid *Aphytis* spp. reached the highest peak of activity on Navel orange in 13th of Jule 2022 with 143 indiv. Meanwhile, *Aphytis spp*. Reached to the highest peak of activity on Mandarin in 3th of November 2021 with 129 indiv.. Moreover, *Aphytis spp* reached the highest peak of activity on Balady lemon in 20th of October 2021 and presented by 117 indiv.

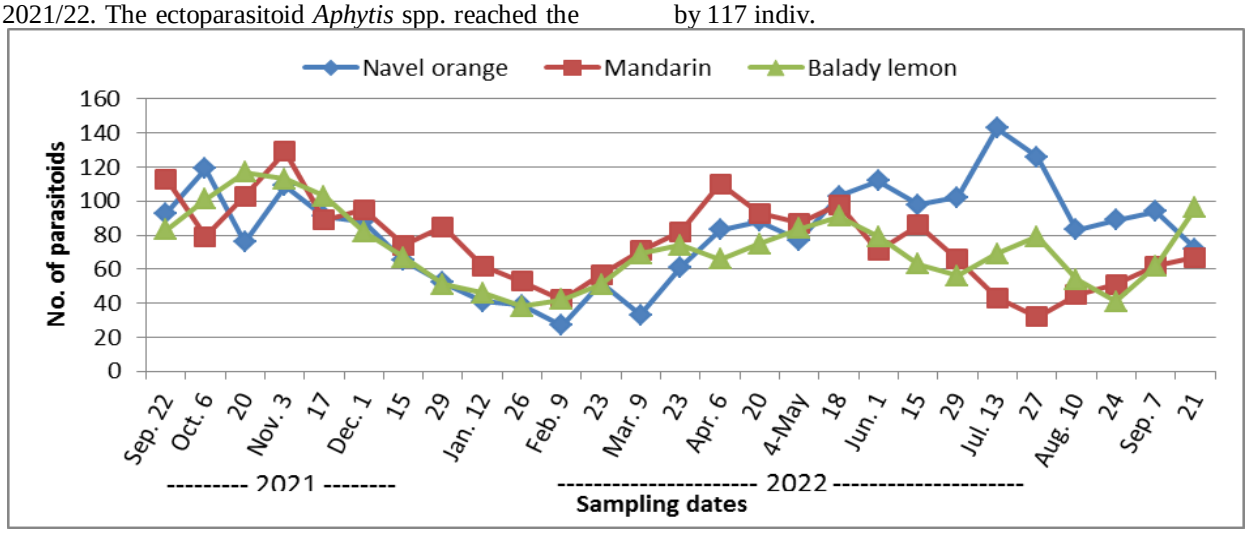


Fig.(3):Seasonal activity of the ectoparasitoid *Aphytis spp* on the black scale, *Parlatoria ziziphi* during 2021/22 season at Kafr-El battikh region, Damietta Governorate .

Data illustrated in **Fig. (4)** show the seasonal activity of the ectoparasitoid *Aphytis spp* parasitized the black scale, *P. ziziphi* on different citrus trees as a host plant during the second year, 2022/23. The ectoparasitoid *Aphytis spp* reached the highest peak of activity on Navel orange in 23rd of September 2022 with 136 indiv. Meanwhile, *Aphytis spp.* Reached to the highest peak of activity on Mandarin in 16th of June 2023 with 129 indiv.

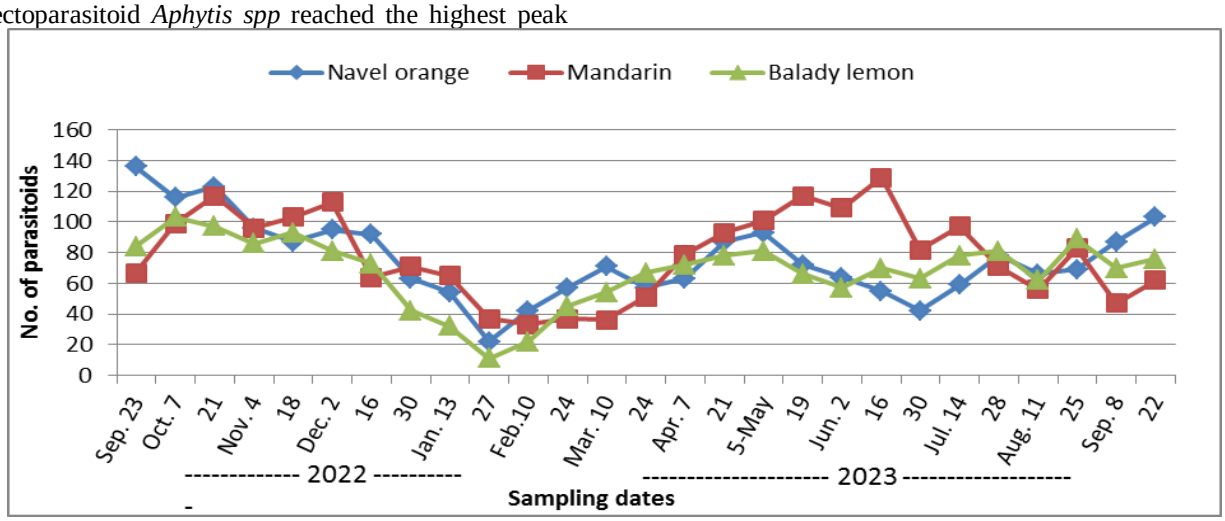


Fig.(4): Seasonal activity of the ectoparasitoid *Aphytis* spp. on the black scale, *Parlatoria ziziphi* during 2022/23 season at Kafr-El battikh region, Damietta Governorate.

Moreover, *Aphytis spp* reached the highest peak of activity on Balady lemon in 7th of October 2022 and presented by 103 indiv.

3- Mortality percentages in population of the black scale, *Parlatoria ziziphi*:-

The present data illustrated in **Table (2)** show the mortality factors acting populations of the black scale *P. ziziphi* on Navel orange trees during the two successive years. In respect to the ectoparasitoids *Aphytis* spp., they recorded the highest average number in summer season with 101.3± 9.45 indiv. (32.0%) followed by Autumn season with 91.6± 6.93 indiv. (28.9%) during the first year. While during the second year was in Autumn

season followed by Summer season and presented by 106.4±7.01 (36.4%) and 72.0±7.46 (24.6%) indiv., respectively. Statistical analysis revealed that a significant difference between both seasons of each year. Regarding to the predation factor, autumn season recorded the highest average number of the predation individuals with 50.1± 6.26 (32.5%) and 58.1±4.76 (32.8%) during 2021/22 and 2022/23, respectively. On the other hand, spring season came in the second category during the first year with 42.7± 3.71 indiv. (27.7%) and summer season during the second year with 55.7±5.26 indiv. (31.5%) with significant differences between seasons for each year.

According to the unknown mortality, Autumn season recorded the highest average number during the two years and presented by 42.3±2.30 indiv. (30.7%) and 48.4±3.87 indiv. (39.4 %) with significant differences seasons for each year. It can be noticed that, the ectoparasitism by *Aphytis spp.* caused the highest average individuales mortality for the black scale, *P. ziziphi* on Navel orange during the two years and presented by 82.1±5.58 and 75.9±5.01 indiv. with significant differences, respectively. While, predation factor came in the second category and presented by 40.0±2.71 and 45.9±3.34 indiv. during the two years, respectively.

Table(2): The seasonal mortality factors and their contribution in population mortality of the black scale, *Parlatoria ziziphi* on Navel orange trees during the two years, 2021/22 and 2022/23.

Seasons		Mortality factors					
		Ectoparasitism		Predation		unknown mortality	
		Average±SE	%	Average±SE	%	Average±SE	%
Year 2021/22	Autumn	91.6± 6.93a	28.9	50.1±6.26 a	32.5	42.3±2.30a	30.7
	Winter	40.7± 4.10b	11.0	26.8±2.77a	14.9	33.3±2.22b	20.7
	Spring	88.9± 6.49a	28.1	42.7±3.71a	27.7	35.6±2.08b	25.8
	Summer	101.3± 9.45a	32.0	38.3±4.54ab	24.8	31.4±2.28b	22.8
	Mean±SE	82.1±5.58 A	----	40.0±2.71 B	----	35.8±1.33 B	----
	Total	----	100	----	100	----	100
Year 2022/23	Autumn	106.4±7.01a	36.4	58.1±4.76a	32.8	48.4±3.87a	39.4
	Winter	51.5±7.09c	15.1	23.8±2.26c	11.5	19.2±2.09c	13.4
	Spring	70.1±5.57bc	24.0	42.9±4.47b	24.2	35.6±3.02b	28.9
	Summer	72.0±7.46c	24.6	55.7±5.26a	31.5	22.6±3.41c	18.4
	Mean±SE	75.9±5.01 A	----	45.9±3.34 B	----	31.9±2.73 C	----
	Total	----	100	----	100	----	100

Means followed by the different small letters in a column or capital letters for the annual average number for each year are significantly differences at 5% level of the probability.

The present data tabulated in **Table (3)** show the mortality factors of the black scale *P. ziziphi* on Mandrain trees during the two successive years according to the annually seasons. In respect to the ectoparasitoid *Aphytis spp* recorded the highest average number in Autumn season with 97.4± 7.30 indiv. (33.4%) followed by spring season with 89.6± 4.68 indiv. (30.7%)during the first year. While during the second year was in spring season followed by Autumn season and presented by 97.0±9.81 (32.1%) and 94.1±7.91 (31.2%) indiv., respectively. Statistical analysis revealed that a significant difference between both seasons of each year. Regarding to the predation factor, Autumn season recorded the highest average number of the predation individuals with 59.0±2.60 (32.0%) and 63.7±5.68 (36.2%) during 2021/22 and 2022/23, respectively. On the other hand, spring season came in the second category during the two successive years 2021/22 and 2022/23 with 52.6±4.93indiv. (28.6%)and50.9±4.21 indiv. (28.9%) with significant differences between seasons for each year. According to the unknown mortality, spring season recorded the highest average number in the first year 2021/22 and presented by 44.57±2.56 indiv. (32.9%) and followed by Autumn with 36.57±2.07 indiv. (27.0%). On the other hand, Autumn season recorded the highest average number during the second year with 41.9 ± 2.06 indiv.(32.7%) followed by spring season with 37.0 ± 1.84 (28.4%) with significant differences, respectively. It can be noticed that, the ectoparasitism by *Aphytis spp.* caused the highest average individuales mortality for the black scale, *P. ziziphi* on Mandarin during the two years 2021/22 and 2022/23 and presented by 75.7±4.62 and 78.3±5.41indiv. with significant differences, respectively. While, predation factor came in the second category and presented by 47.7±2.93and 45. 7±3.34 indiv. during the two years , respectively.

Table(3): The seasonal mortality factors and their contribution in population mortality of the black scale, *Parlatoria ziziphi* on mandarin trees during the two years, 2021/22 and 2022/23.

Seasons		Mortality factors					
		Ectoparasitism		Predation		unknown mortality	
		Average±SE	%	Average±SE	%	Average±SE	%
Year 2021/22	Autumn	97.4± 7.30a	33.4	59.0±2.60a	32.0	36.57±2.07ab	27.0
	Winter	61.7± 6.10b	18.1	27.8±5.52b	13.0	25.5±2.69c	16.1
	Spring	89.6± 4.68a	30.7	52.6±4.93a	28.6	44.57±2.56a	32.9
	Summer	52.3± 5.00b	17.9	48.7±2.92a	26.5	32.57±4.57bc	24.0
	Mean±SE	75.7±4.62A	---	47.7±2.93B	---	35.2±1.99C	---
	Total	----	100	----	100	----	100
Year 2022/23	Autumn	94.1±7.91a	31.2	63.7±5.68a	36.2	41.9±2.06 a	32.7
	Winter	46.5±6.87c	13.2	27.2±2.44c	13.2	27.3±3.19 b	18.0
	Spring	97.0±9.81a	32.1	50.9±4.21b	28.9	37.0±1.84 a	28.4
	Summer	71.1±6.59b	23.6	38.3±3.96c	21.7	27.9±1.84 b	21.4
	Mean±SE	78.3±5.41A	---	45. 7±3.34B	---	33.7±1.60C	---
	Total	----	100	----	100	----	100

Means followed by the different small letters in a column or capital letters for the annual average number for each year are significantly differences at 5% level of the probability.

Data illustrated in **Table (4)** show the mortality factors of the black scale *P. ziziphi* on balady lemon trees during the two successive years according to the annually seasons. In respect to the ectoparasitoid *Aphytis spp* recorded the highest average number in Autumn season with 95.1±6.91 indiv. (34.2%) and 88.1±3.86 indiv. (33.7%) during 2021/22 and 2022/23, respectively. On other hand, spring season came in the second category during the first year with 76.0±3.69 indiv. (27.3%) and summer season in the second year with 74.1±3.70 indiv. (28.3%) with significant differences between seasons for each year. Regarding to the predation factor, Autumn season recorded the highest average number of the predation individuals with 49.6±5.22 (31.8%) and 49.3±6.98 (34.4%) during 2021/22 and 2022/23, respectively. While, spring season came in the second category during the two successive years 2021/22 and 2022/23 with 46.0±4.14 indiv. (29.5%) and 47.0±5.49 indiv. (32.8%) with significant differences between seasons for each year. According to the unknown mortality, Spring season recorded the highest average number in the first year 2021/22 and presented by 39.0±3.46 indiv. (30.6%) and followed byAutumn with 36.0±2.07 indiv. (28.3 %). While, Autumn season recorded the highest average number in the second year with 41.0±5.29 indiv. (39.6) and followed by spring with 31.3±2.78 indiv.(30.3%) with significant differences, respectively. It can be noticed that, the ectoparasitism by *Aphytis spp.* caused the highest average individuals mortality for the black scale, *P. ziziphi* on balady lemon during the two years 2021/22 and 2022/23 and presented by72.3±4.19 and 67.9±4.27 indiv. with significant differences, respectively. While, predation factor came in the second category and presented by 40.4±2.54and 37.1±3.31B indiv. during the two years, respectively.

The present studies indicated that *P. ziziphi* the one of the most insect pests attacking citrus trees particularly Navel orange, Mandarin and Balady lemon in Egypt. The ectoparasitism by *Aphytis spp.* caused the highest average individuals mortality for the black scale, *P. ziziphi* followed by the predation factor during the two years 2021/22 and 2022/23. These findings are in consistent with **Helmy (2000)** in Egypt, observed that three annual generations of the black scale, *P. ziziphi* on trifoliate orange, mandarin, grapefruit, and baladi orange trees. These generations peaked in the months of April, August, and October. According to **Franco *et. al.* (2006)** *P. ziziphi* detrimental one of the most citrus pests in Tunisia. Similarities: In a number of Mediterranean nations, they were major or occasional pests. Also **Kwaiz (2009)** in Egypt, Found that the population dynamics of the black parlatoria scale, *P. ziziphi* were investigated for two years in succession (2005-2006) at the Qalubyia Governorate. *P. ziziphi* produced three generations annually on sour oranges. According to **Moustafa (2012),** there were seven kinds of scale insects found in Egypt's citrus trees.

Table(4): The seasonal mortality factors and their contribution in population mortality of the black scale, *Parlatoria ziziphi* on balady lemon trees during the two years 2021/22 and 2022/23

Seasons		Mortality factors					
		Ectoparasitism		Predation		unknown mortality	
		Average±SE	%	Average±SE	%	Average±SE	%
Year 2021/22	Autumn	95.1±6.91 a	34.2	49.6±5.22 a	31.8	36.0±2.65 ab	28.3
	Winter	49.5±4.42 c	15.2	28.3±1.89 c	15.6	29.8±1.64 bc	20.1
	Spring	76.0±3.69 b	27.3	46.0±4.14 ab	29.5	39.0±3.46 a	30.6
	Summer	65.3±6.83 bc	23.4	35.9±4.18 bc	23.0	26.9±3.43 c	21.1
	Mean±SE	72.3±4.19A	----	40.4±2.54B	----	33.0±1.69B	----
	Total	----	100	----	100	----	100
Year 2022/23	Autumn	88.1±3.86 a	33.7	49.36.98± a	34.4	5.29 a±41.0	39.6
	Winter	34.3±6.48 c	11.2	22.7±2.67 b	13.6	2.68 b±15.8	13.1
	Spring	70.1±3.02 b	26.8	47.0±5.49a	32.8	2.78 a±31.3	30.3
	Summer	74.1±3.70 b	28.3	3.54 a±27.4	19.2	3.72 b±20.1	19.5
	Mean±SE	67. 9±4.27A	----	37.1±3.31B	----	27.5±2.63B	----
	Total	----	100	----	100	----	100

Means followed by the different small letters in a column or capital letters for the annual average number for each year are significantly differences at 5% level of the probability.

Including the black scale *P. ziziphi* , which found two peaks on Cairo's citrus trees. Additionally, one parasitoid, *Aphytis spp.*,was identified. According to **Nabil *et al.* (2018**), there were two activity maxima in the total number of living stages during the first year of 2015–16, which occurred in September and January. However, the overall number of living stages for the second year of 2016–17 indicated that September was the busiest month. Two parasitism maxima occurred in November and May of the first year (2015–2016) when *Aphytis sp.* was identified as a parasitoid of *P. ziziphi*. In contrast, November recorded one peak during the second year. According to **Awadalla *et. al.* (2021) in Egypt,** the populations of the ectoparasitoid, *Aphytis sp.* were in sync with those of the insect and experienced four peaks of abundance annually. While those of *Aphytis* parasitism ranged from 14.6 to 35.4%. The two peaks that *Aphytis sp.* experienced each year nearly coincided with the months of May through August.

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CONFLICTS OF INTEREST:

The authors declare that they have no conflict of interest.

AUTHORS CONTRIBUTION

El-Kady, H.A.; S.S. Awadalla and Mai. Eisa developed the concept of the manuscript. All authors checked and confirmed the final revised manuscript.

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الملخص العربي

ديناميكية التعداد للحشرة القشرية السوداء *Parlatoria ziziphi* على أنواع الموالح المختلفة فى محافظة دمياط , مصر

حافظ عبدالرحمن القاضي* -سمير صالح عوض الله - مي محمد عبدالوهاب عيسي***

* قسم وقاية النبات – كلية الزراعة - جامعة دمياط

** قسم الحشرات الإقتصادية –كلية الزراعة – جامعة المنصورة

أجريت هذه التجارب في بستان للموالح في منطقة كفر البطيخ بمحافظة دمياط بهدف تقدير كثافة التعداد| لحشرة البارلتوريا القشرية السوداء علي أشجار الموالح البرتقال أبو سرة , اليوسفى و الليمون البلدي والنشاط الموسمى للطفيل الخارجي الافيتس خلال العامين المتتالين 22/2021 و 23/2022 . حيث وصلت حشرة البارلتوريا لأعلى ذروة تعداد بالنسبة للأفراد الحية على أشجار البرتقال أبو سرة والليمون البلدي فى 3 من نوفمبر 2021 بمعدل 414 و 321 على التوالى خلال العام الأول 22/2021 . أما فى العام الثاني وصلت لأعلى ذروة تعداد بالنسبة للأفراد الحية على البرتقال أبو سرة فى اليوم 21 من أكتوبر 2022 بمعدل 342 فردا . على الجانب الآخر جاء البرتقال أبو سرة فى المرتبة الأول بمتوسط 162.0 ± 21.06 و 150.6 ± 15.00فردا يليها اليوسفي بمتوسط 150.7 ± 16.22 و 140.3 ± 14.48فردا ثم الليمون البلدى بمعدل 135.6 ± 12.62 و 115.70 ± 10.66 فردا خلال العامين بفروق غير معنوية عند مستوي 5% على التوالى . كما وصل طفيل الافيتس إلى ذروة التعداد على البرتقال أبو سرة بمعدل 143 و 136 ، وعلى اليوسفى بمعدل 129 و 129فردا و على الليمون البلدى 117 و 103فردا خلال العامين 22/2021 و 2022/ 23 على التوالى. الطفيل الخارجي الأفيتس أظهر أنه أعلى عامل للموت لحشرة البارلتوريا القشرية السوداء على أنواع الموالح الثلاثة يليه الإفتراس حيث جاء فى المرتبة الثانية وذلك بوجود إختلافات معنوية خلال عامى الدراسة.