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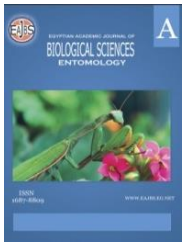

Biological Studies and Estimation Life Table Parameters of Chrysanthemum Aphid, *Macrosiphoniella sanborni* under Different Temperature Conditions

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ABSTRACT

This study was carried out to study the biology and life table parameters of Chrysanthemum aphid, *Macrosiphoniella sanborni* under laboratory conditions throughout three different temperatures degrees (winter, spring, and summer) during the 2018 year. Data obtained showed that the spring season more suitable for *M. sanborni* living (biology) more than winter and summer seasons, respectively. This showed clearly from the life table's parameters, which showed that the nymphal stages of *M. sanborni* in spring season were less than in winter and summer, respectively. Also, the life cycle, mean generation time, life span and longevity duration in spring season were less than in winter and summer seasons respectively. Lastly, the important parameter in the life table, intrinsic rate of increase (rm) in spring season was more than in winter and summer seasons, respectively.

INTRODUCTION

Chrysanthemum flowers consider one of the important cut flowers in Egypt and around all over the world. It is called (The Autumn flower) and sometimes called (The Autumn king). This because its flowers appear during autumn months (October- November- December). It is found from the oldest countries, it became one of the most popular flowers for people all over the world. This is due to their beautiful colors, style of flowers, tolerant of the inferable weather factors and possibility cultivation in different conditions both in open field and under greenhouse conditions.

Chrysanthemum flowers infested with a large scale of insects such as aphids insects and other insects groups. *Macrosiphoniella sanborni* (Gillette) consider one of the most dangerous insects, which infested chrysanthemum flowers both in open field and under glasshouse conditions, Ahmed and El-Deeb (2007). And Sumei, *et al*. (2015) reported that aphids and especially Chrysanthemum aphid *M. sanborni* have caused great damage to chrysanthemum production and affected seriously by the flowers both in quantity and quality under glasshouse conditions. Yanming, *et al.* (2010) found that Chrysanthemum aphid, *M. sanborni* represent the most destructive of chrysanthemum pests to cultivation and caused much damage to the flowers. Wang *et al.* (2016) reported that aphids have caused great damage to chrysanthemum production.

This study was carried out to study the biology and life table parameters of Chrysanthemum aphid, *M. sanborni* under laboratory conditions throughout three different temperatures degrees (winter, spring, and summer) during 2018 year.

MATERIALS AND METHODS

This study was carried out to study the biology and life table parameters of Chrysanthemum aphid, *Macrosiphoniella sanborni* (Gillette) under laboratory conditions throughout three different temperatures degrees (winter, spring, and summer) during 2018 year, and this study was divided into three experiments:

In the first experiment, which was carried out during winter season, the mean daily temperature was 12.35 ± 0.65°C. that ranged from 11.37 to 13.45°C. The mean relative humidity was 55.75 ± 1.25% R.H. which ranged from 50.45 to 60.35 % R.H.

At the second experiment, which was carried out during spring season, the mean daily temperature was 24.45±0.72°C, which ranged from 23.47 to 25.32°C. The mean relative humidity was 65.22 ± 1.75% R.H. which ranged from 60.25 to 70.65% R.H.

In the third experiment, which was carried out through summer season, the mean daily temperature was 33.49 ± 0.74°C, which ranged from 32.65 to 34.45°C. The mean relative humidity was 75.45 ± 1.65 % R.H. which ranged from 70.35 to 80.65% R.H.

In each experiment apterous (mothers) were collected from chrysanthemum plants in the field, then thirty newly-borne progenies (first instar nymphs) resulted from these mothers were transferred separately using a fine hairbrush on discs of filter paper wetted with few water droplets inside thirty clean plastic Petri-dishes. The cover of these plastic Petri-dishes was replaced with muslin cover for good conditions of air and humidity. Fresh flowers of certain chrysanthemum plants were offered daily to each aphid for feeding.

Each group of nymphs was monitored daily until death and the following observations were made:

- Cast skin was removed regularly and periods elapsed between successive moults were recorded.
- The duration of the generation was recorded as time elapsed between birth and first parturition.
- The fraction of progeny reached maturity.
- Sex ratio was considered as one since all progeny developed to females.
- Survival of individuals throughout their developmental duration.

In the biological study trials, the obtained data of life table study was analyzed following Birch, L. (1948) using Life 48 Basic Computer Program (Abou-Setta *et al*., 1986).

RESULTS AND DISCUSSION

The present study was carried out to study the biology and life table parameters of Chrysanthemum aphid, *Macrosiphoniella sanborni* under laboratory conditions throughout three different temperatures degrees (winter, spring, and summer). This study was carried out during 2018 year and this study was divided into three experiments:

The First Experiment (Winter Season):

At the first experiment, which was carried out during winter season, the mean daily temperature was 12.35 ± 0.65°C, which ranged from 11.37 to 13.45°C. The mean relative humidity was 55.75 ± 1.25% R.H. which ranged from 50.45 to 60.35% R.H.

Data tabulated in Table (1) show life table parameters and statically analysis of *M. sanborni* during winter season (2018 year).

Data obtained from Table (1) show that the mean duration of the 1^{st}, 2^{nd}, 3^{rd} and 4^{th} instars were 1.83, 1.86, 1.81 and 1.98 days, respectively, the Life cycle period was 8.39 days, while the mean generation time (T) was 15.23 days. The life span period was 15.35 days; the longevity duration was 10.64 days. The survival rate to maturity reached 67%. The viviparity duration was 6.73 days. The net reproductive rate (R_0) and the intrinsic rate of increase (rm)

were 36.0 and 0.45, respectively. The finite rate of increase (exp. rm) reached to 1.63, while the generation doubling time was 2.80 days.

Table (1): Life table parameters of *M. sanborni* during winter season at 12.35±0.65°C and 55.75±1.25% R.H.

Parameter	Obtained value
First instar (mean±sd) days	1.83±0.65
Second instar (mean±sd) days	1.86±0.59
Third instar (mean±sd) days	1.81±0.45
Fourth instar (mean±sd) days	1.98±0.57
Life cycle	8.39±0.65
Mean generation time (T) (days)	15.23
Life span (days)	15.35±0.85
Longevity duration	10.64±0.53
Survival rate to maturity	67%
Viviparity duration (days)	6.73±0.63
Net reproductive rate (R_0)	36
Intrinsic rate of increase (rm)	0.45
Finite rate of increase (exp. rm)	1.63
Generation doubling time (days)*	2.80
(*) = In 2/rm	

Data are present as mean±sd

Second Experiment (Spring Season):

At the second experiment, which was carried out during spring season, the mean daily temperature was 24.45±0.72°C, which ranged from 23.47 to 25.32°C. The mean relative humidity was 65.22 ± 1.75% R.H. which ranged from 60.25 to 70.65% R.H.

Data tabulated in Table (2) show life table parameters and statically analysis of *A. durantae* during spring season (2018 year).

Table (2): Life table parameters of *M. sanborni* during spring season at 24.45±0.72°C and 65.22±1.75% R.H.

Parameter	Obtained value
First instar (mean±sd) days	1.65±0.45
Second instar (mean±sd) days	1.78±0.47
Third instar (mean±sd) days	1.69±0.42
Fourth instar (mean±sd) days	1.65±0.53
Life cycle	6.77±0.75
Mean generation time (T) (days)	12.52
Life span (days)	14.36±0.84
Longevity duration	9.75±0.40
Survival rate to maturity	75%
Viviparity duration (days)	7.65±0.65
Net reproductive rate (R_0)	38
Intrinsic rate of increase (rm)	0.65
Finite rate of increase (exp. rm)	1.35
Generation doubling time (days)*	2.35
(*) = In 2/rm	

Data are present as mean±sd

Data obtained from Table (2) show that the mean duration of the 1st, 2nd, 3rd and 4th instars were 1.65, 1.78, 1.69 and 1.65 days, respectively, the Life cycle period was 6.77 days, while the mean generation time (T) was 12.52 days. The life span period was 14.36 days; the longevity duration was 9.75 days. The survival rate to maturity reached 75%. The viviparity duration was 7.65 days. The net reproductive rate (R_0) and the intrinsic rate of increase (rm) were 38.0 and 0.65, respectively. The finite rate of increase (exp. rm) reached to 1.35, while the generation doubling time was 2.35 days.

Third Experiment (Summer Season):

In the third experiment, which was carried out through summer season, the mean daily temperature was 33.49 ± 0.74°C, which ranged from 32.65 to 34.45°C. The mean relative humidity was 75.45 ± 1.65 % R.H. which ranged from 70.35 to 80.65% R.H.

Data tabulated in Table (3) show life table parameters and statically analysis of *A. durantae* during summer season (2018 year).

Data obtained from Table (3) show that the mean duration of the 1st, 2nd, 3rd and 4th instars were 2.58, 2.75, 2.35 and 2.75 days, respectively, the Life cycle period was 10.43 days, while the mean generation time (T) was 16.75 days. The life span period was 18.25 days; the longevity duration was 11.75 days. The survival rate to maturity reached 65%. The viviparity duration was 5.75 days. The net reproductive rate (R_0) and the intrinsic rate of increase (rm) were 34.0 and 0.26, respectively. The finite rate of increase (exp. rm) reached to 1.83, while the generation doubling time was 3.75 days.

Comparison between Some Life Table Parameters of *M. Sanborni* at Different Temperatures Degrees (Winter, Spring, and Summer):

Data tabulated in Table (4) and Figures (1), (2), (3), (4), (5) and (6) show comparison between nymphal stages, life cycle, mean generation time, life span, longevity duration and intrinsic rate of increase (rm) in the different temperatures degrees (winter, spring and summer). Obtained data show that the most seasons, which more suitable for *M. sanborni* living or biology was (spring, winter and summer), respectively.

Table (3): Life table parameters of *M. sanborni* during summer season at 33.49±0.74°C and 75.45±1.65% R.H.

Parameter	Obtained value
First instar (mean±sd) days	2.58±0.45
Second instar (mean±sd) days	2.75±0.47
Third instar (mean±sd) days	2.35±0.55
Fourth instar (mean±sd) days	2.75±0.42
Life cycle	10.43±0.65
Mean generation time (T) (days)	16.75
Life span (days)	18.25±0.35
Longevity duration	11.75±0.53
Survival rate to maturity	65%
Viviparity duration (days)	5.75±0.75
Net reproductive rate (R_0)	34
Intrinsic rate of increase (rm)	0.26
Finite rate of increase (exp. rm)	1.83
Generation doubling time (days)*	3.75
(*) = In 2/rm	

Data are present as mean±sd

This shows clearly from Table (4) whereas the nymphal stages period in spring was less than in winter and summer respectively. Also, the life cycle, mean generation time, life span and longevity periods in spring were less than in winter and summer respectively. Lastly, the essential parameter in biology comparison, intrinsic rate of increase (rm) (Birch, 1998) was more in spring season than its value in winter and summer respectively.

The obtained results are in agreement with those obtained by Emam (2009) who found that the nymphal stages (first instar, second instar, third instar and fourth instar) for *Macrosiphum rosae* on rose plants were 1.68, 1.36, 1.31 and 1.55 days, respectively. And life cycle, life span, generation time and longevity duration were 6.90, 15.36, 6.77 and 9.45 days, respectively. Mohamad and Al-Mallah (1987) studied the biology of the rose pest *M. rosae* under laboratory conditions in Mosul, Iraq. They found that generations varied significantly in terms of fecundity, duration of the nymphal stage and adult life span. There were 4 nymphal instars, of which the 1st was the longest and the 2nd the shortest. The intrinsic rate of natural increase (rm) ranged from 0.25 to 0.63. The rm values were similar under laboratory and field conditions. Bisht *et al.* (2010) found that the life cycle and life span period for Rose Aphid, *M. rosae* reached 7.43, 15,35 days, respectively. Kakar and Sood (2012) found on *M. sanborni* that the 4 nympha stages were completed in an average of 12.95 days in March and 12.70 days in November, and survival, adult lifespan and fecundity were higher in March than in November. On the other hand, Bisht *et al.,* (2010) found that the subtropical and temperate climate, enforcing the sexual reproduction in the rose aphid, is favourable for the appearance of sexuales of *M. rosaeiformis.* Finally, Olmez *et al.,* (2003) found that the developmental periods of immature stages ranged from 10.7 days at 17.5°C to 7.95 days at 25 °C. The total percentages of survivorship of immature stages varied from 52.06 and 86% within the temperature range of 17.5-25°C. The average longevity of adult females was 13.92, 10.74, 18.55, and 8.65 days at 17.5, 20, 22.5 and 25°C, respectively. Mohsen and Hatami (2017) studied effect of temperature on some biological parameters of an Iranian population of the Rose Aphid, *M. rosae* and found that the degree 25°C is the most suitable degree for reproduction of it. Lastly, El-Nagar *et al*. (1990) who found that life cycle period for Rose Aphid, *M. rosae* ranged from 7-10 days.

Table (4): Comparison between nymphal stages, life cycle, mean generation time, life span, longevity duration and intrinsic rate of increase (rm) in the different seasons: winter, spring and summer during 2018 year

Parameter	Obtained value		
	Winter	**Spring**	**Summer**
First instar (days)	1.83	1.65	2.58
Second instar (days)	1.86	1.78	2.75
Third instar (days)	1.81	1.69	2.35
Fourth instar (days)	1.98	1.65	2.75
Life cycle (days)	8.39	6.77	10.43
Mean generation time (T) (days)	15.23	12.52	16.75
Life span (days)	15.35	14.36	18.25
Longevity duration (days)	10.64	9.75	11.75
Intrinsic rate of increase (rm)	0.45	0.65	0.26

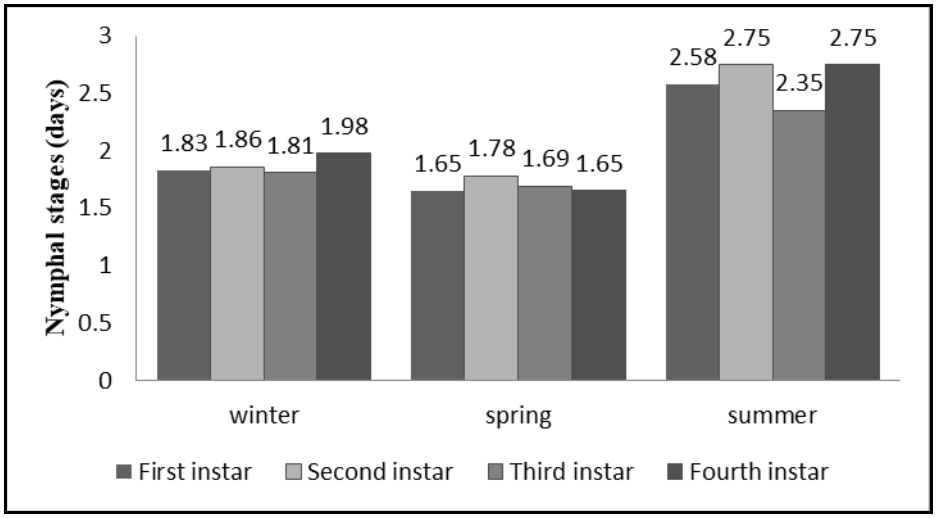

Fig. 1: Comparison between nymphal stages periods at winter, spring, and summer during 2018 year

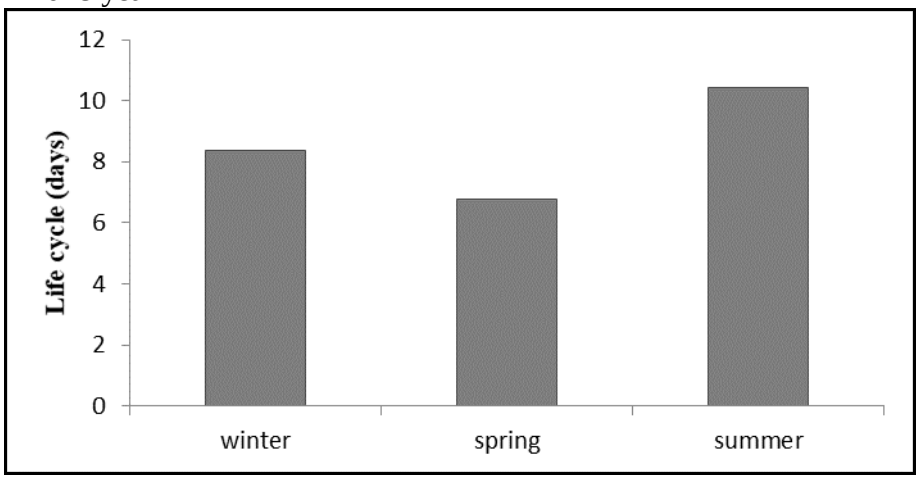

Fig. 2: Comparison between life cycle period in winter, spring and summer during 2018 year

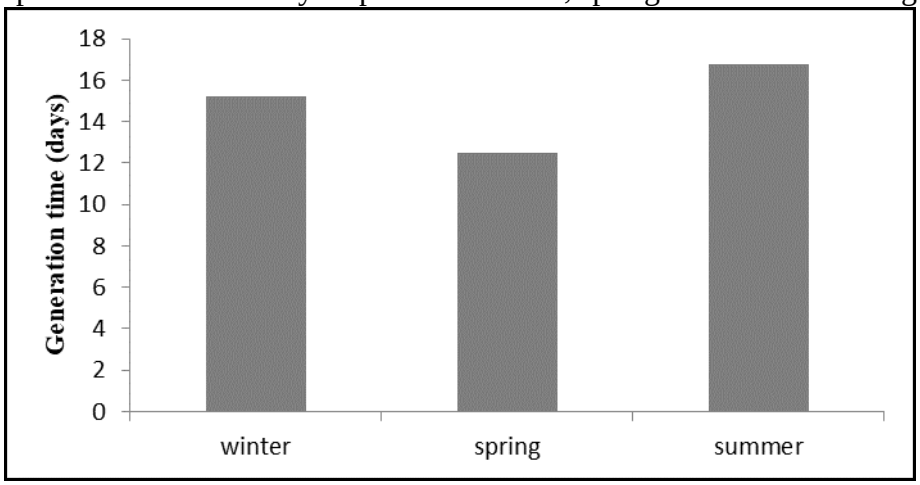

Fig. 3: Comparison between generation time in winter, spring and summer during 2018 year

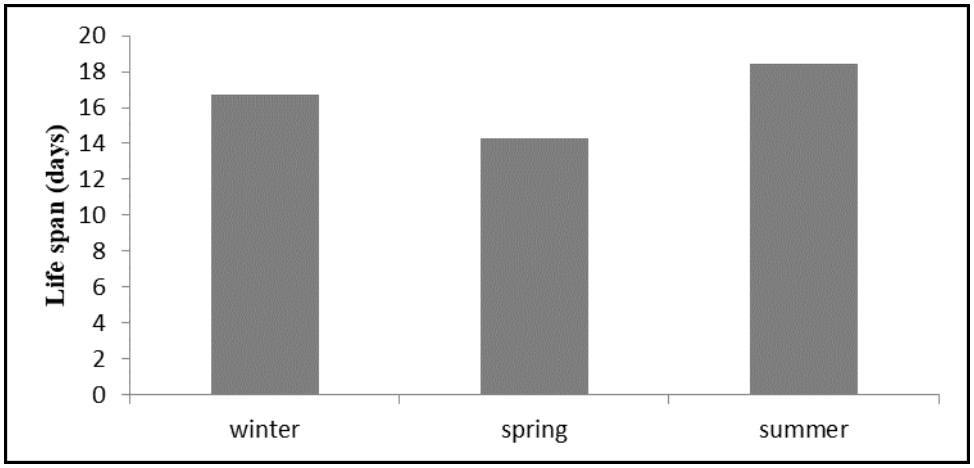

Fig. 4: Comparison between life span period in winter, spring and summer during 2018 year

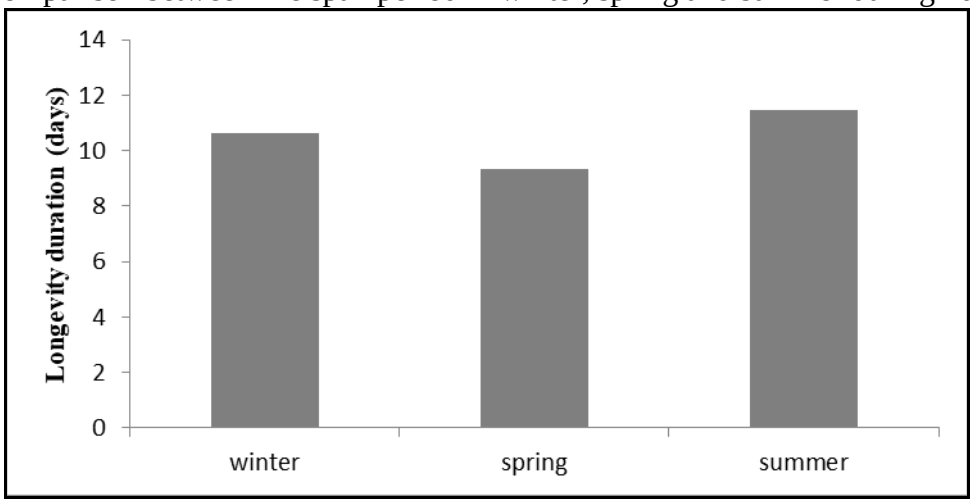

Fig. 5: Comparison between longevity period at winter, spring, and summer during 2018 year

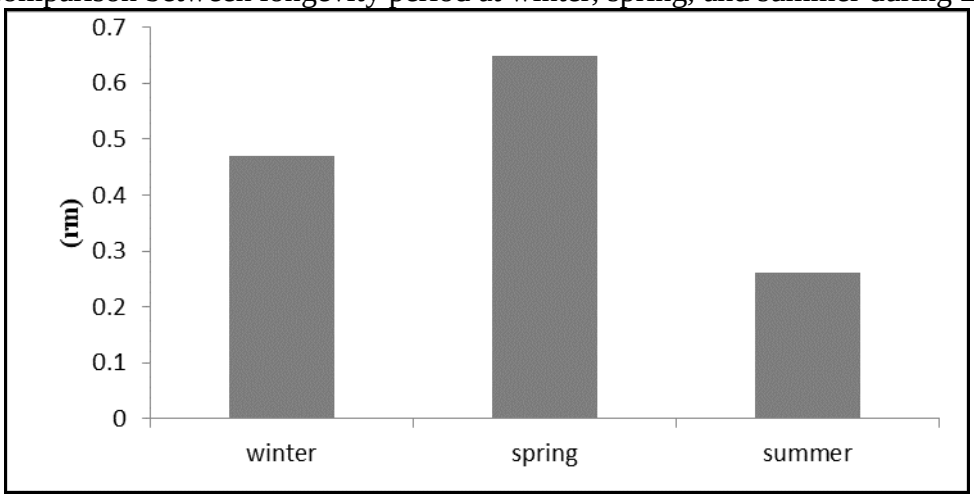

Fig. 6: Comparison between intrinsic rate of increase (rm) at winter, spring and summer during 2018 year

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ARABIC SUMMARY

دراسات بيولوجية وتقدير قياسات جدول الحياة لحشرة من الكريزانثيمم *Macrosiphoniella sanborni* تحت ظروف درجات الحرارة المختلفة

سامية عبد الفتاح يسن

معهد بحوث وقاية النباتات -مركز البحوث الزراعية – الدقى – الجيزة – مصر

أجريت هذه الدراسة بغرض دراسة دورة الحياة (بيولوجية) حشرة من الكريزانثيمم *Macrosiphoniella sanborni* (Gillette) والتى تعتبر أهم الأفات التى تصيب نباتات وزهور الكريزانثيمم . كما إستهدفت الدراسة أيضا تقدير وحساب جدول الحياة Life table للحشرة موضع الدراسة وذلك على ثلاث درجات حرارة مختلفة. لذلك تم إجراء الدراسة فى ثلاثة مواسم (فصول): الشتاء ، الربيع ، الصيف خلال عام 2018 تحت الظروف المعملية .

أوضحت النتائج أن فصل الربيع حيث درجات الحرارة المعتدلة كانت أكثر ملائمة لتكاثر وتوالد حشرة من الكريزانثيمم وذلك بالمقارنة بالموسمين الاخرين، يليه موسم الشتاء ثم أخيرا موسم الصيف . ويتضح ذلك جليا من قياسات جدول الحياة حيث يتضح منها تناقص فترة الأعمار الحورية الأربعة Nymphal stages فى فصل الربيع عنها فى فصلى الشتاء والصيف على الترتيب. كما يتضح ذلك أيضا من تناقص فترة دورة الحياة Life cycle ، و متوسط فترة الجيل Mean generation time (T) ، وفترة حدود الحياة Life span ، وفترة (مدة) البقاء Longevity duration فى موسم الربيع عنها فى موسمى الشتاء والصيف على الترتيب.

و أخيرا يتضح ذلك جليا من أهم مقاييس جدول الحياة وهو معدل الزيادة الأساسى للحشرة Intrinsic rate of increase (rm) حيث يتضح زيادة هذا المعدل فى فصل الربيع وذلك بالمقارنة بالفصلين الاخرين الشتاء والصيف على الترتيب.