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Effect of Temperature on the Biological Aspects and Life Table Parameters of the Mealy Plum Aphid, *Hyalopterus Pruni* Geoffroy. on APRICOT SEEDLINGS

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Abstract

The mealy plum aphid, *Hyalopterus pruni* (Geoffroy) (Hemiptera: Aphididae) is a serious insect pest of apricot trees in Egypt. The impact of aphids as pests is well characterized by their population growth rate, a parameter integrating their age-specific development, survivorship, and fecundity. These population parameters were measured at three constant temperatures on potted apricot seedlings (small trees 2-yr old).

The developmental threshold temperature was greater for the nonlinear model than for the linear model. The greatest proportional survivorship of nymphs occurred at 25 ºC., mean daily fecundity was lowest at 30 ºC and highest at 20 ºC. The adult longevity decreased with temperature. The population growth rates for *H. pruni* were estimated as fecundity and development time and were the highest at 20 ºC. The obtained results were documented the temperature dependence of the life history parameters for *H. pruni* and generate a degree-day model for the prediction of phonological events.

Key Words: *Hyalopterus pruni*, development rate, fecundity, population growth rate, thermal requirements.

Introduction

The mealy plum aphid, *H. pruni* is a serious pest of apricot trees in Egypt. The infestation of aphids causes severe damage, reduces the growth of branches and increases the cracking of fruits with an increase in the infestation level. The all physiological processes of aphids depend to a large extent on many climatic variables that include temperature, **Brodeur *et al*. (2013).** According to **Campbell *et al*. (1974)**, temperature is an important abiotic factor affecting insect biology. The mealy plum aphid *H. pruni* has an almost global distribution **Birol *et al*. (2013)** and is present in Egypt **Ismail *et al*. (1991) and Ibrahim and Afifi. (1994)**. It appears conspicuously on host fruit trees from early summer through late fall **Attia (1983)**. Few experiments have already been performed to evaluate the effect of temperature on the biology of *H. pruni* However, the main objective of this work was to study and visualize the effect of temperature on the biological parameters of *H. pruni* using the mathematical models found in the statistical program of Insect Life Cycle Modeling (ILCYM). **Tonnang *et al.* (2013)**.

Materials and Methods

The experiment was carried out at the laboratory of piercing-sucking insects research department, PPRI, ARC, Dokki, Giza Egypt.

Rearing Technique: the mealy plum aphid, *H. pruni* individuals were collected from apricot gardens located at ' Qalyubia Governorate and left for mass rearing. on apricot (*P. armeniaca* c.v., Amar balady) seedlings (2 yr old, about 1-m. height) grown in 30 cm diameter plastic pots kept inside insect breeding cages, covered with muslin. The apricot seedlings were artificially infested by only one viviparous female, the infested seedlings were kept under laboratory conditions (20 ± 2 °C, 60 ± 5 % R.H. and a 16-8 hr. day light-dark length). To obtain individuals under uniform genetically conditions, apterae viviparous female of *H. pruni* wer collected randomly from the stock culture. After three successive generations of mealy plum aphid rearing, the newly born nymphs of the 3rd generation were used for the experimental purposes.

Biological Studies: To study the effects of temperature regimes on life history, apricots (*Prunus armeniaca*) plants was used in this investigations as food supply. The three constant temperature of 20, 25 and 30 °C., were selected to investigate their effects on the biological characters of the mealy plum aphid, *H. pruni* inside the incubator of controlled day length (16:8 hr. light: dark cycle).

Were used as 12 replicates per each temperature degree treatment the nymphs were inserted in cages and (stayed reared for 3 generations) clip leaf cage describrd by **Mac Gillivary and Anderson (1957).** Experiments were carried out on exterior leaves of apricot trees, 0.75–cm above the ground **Ozg¨okc and Atlıhan (2005)**. The insects were checked every 12 hours and when necessary the insects were gently touched by means of a fine smooth camel's hair brush to withdraw their proboscis, and then the insects carefully transferred by means of hair brush moistened with water to the fresh apricot leaves with their clip leaf cages. Observations were made daily every 12 hr., on deposited newly born until the adult established and each aphid caged was checked daily

under stereoscopic microscope and their survival recorded at the constant temperatures. When the immature nymphs become adults, they were observed daily for reproduction and survival, all new-born nymphs were removed from each aphid cliped on cage after counting and these observations continued until the mature aphid died at tested constant temperature regimes. Developmental times for each nymphal instars, duration of adult pre-parturition, parturition and post-parturition periods, lifetime fecundity and average daily reproduction were calculated.

Data analyses and statistics: The obtained data were subjected to statistical analysis. Data gained in the study are presented as means with standard error values (mean ± SE). The significance of differences between nymphal development times, adult life cycle length, fecundity, and daily reproduction at the three constant temperatures were analyzed using ANOVA and the means comparisons were determined by Least Significant Differences (LSD at 0.05%). The effects of different temperatures on the biology of *H. pruni*. were assessed by constructing a life table, using age-specific survival rates and fecundity for each age interval (x) per day. The intrinsic rate of increase r_m was also calculated adapting **Birch (1948)**. Statistical significance was estimated at $p < 0.05$. Statistical analysis were done using (ILCYM) software **Tonnang *et al*. (2013).**

Results and Discussion

The results presented in Tables (1-4) and illustrated in Figs. (1-2). showed that the duration periods of different *H. pruni* instars reared on apricot cv. Amar variety, were affected by the different tested temperatures (20, 25 and 30 °C).

1- Development and Survival:

a-Developmantal Time: Data in table (1) cleared that the developmental times for the nymphal instars of *H. pruni* reared at the tested temperatures of 20, 25 and 30 °C. were decreased significantly with the increase in temperature ($P < 0.05$). At the tested degrees developmental time was the elapsed for the first, second, third and fourth nymphal instars feed on apricot leaves recorded: 4.44 ± 0.72, 2.44 ± 0.53. 2.67 ± 0.5 & 1.78 ± 0.44 days at 20 °C; 3.5 ± 0.53, 1.88 ± 0.35, 1.38 ± 0.52 &1.25 ± 0.46 days at 25 °C, and 2.29 ± 0.49, 1.29 ± 0.49, 1.0 ± 0.14 & 1.0 ± 0.0 days at 30 °C, respectively.

Statistical analysis of the data showed that the longest time for complete development of the nymphal stage was recorded at the temperature of 20 °C (11.33 ± 0.71 days); mean while the shortest period noticed at 30 °C, being 5.58 ± 1.00 days.

The time required for complete development of *H. pruni*, was decreased with temperature increasing from 20 to 30 °C with shortest time being observed at the latter. The optimum developmental time of *H. pruni* was at 25 °C. these results found in harmony with **Serdar and Raymond (2002)** who recorded that the shortest developmental time of *B. Shwartzi* on peach trees was 6. 9 d. at 25 °C and the longest was 19. 9 d. at 15 °C. However, **Latham and Mills (2011)** they showed that the rates of *H. pruni* evolution increased roughly linear with the temperature reaching a maximum at 26°C before declining at higher temperatures.

Table 1. Developmental Times (days) and developmental rates (1/d) of *H. pruni* nymphal stages at various temperatures (20-25-30 °C) on Apricot leaves.

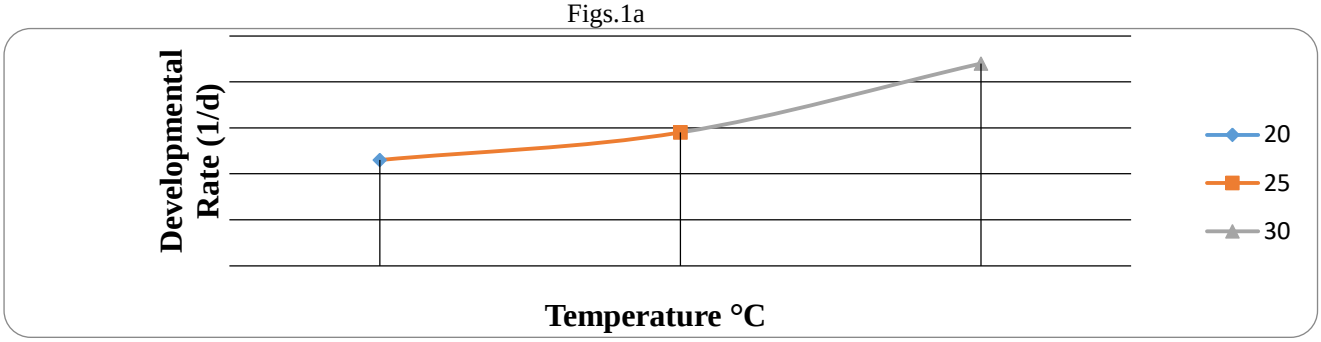
Parameters	Temp. °C	Instar 1	Instar 2	Instar 3	Instar 4	Total nymphal stage
Developmental Time (Day± SE)	**20**	4.44b ± 0.72	2.44c ± 0.53	2.67c ± 0.5	1.78b ± 0.44	11.33c ± 0.71
	25	3.5ab ± 0.53	1.88b ± 0.35	1.38a ± 0.52	1.25a ± 0.46	8b ± 0.53
	30	2.29a ± 0.49	1.29a ± 0.49	1a ± 0.14	1a ± 0	5.58a ± 1.0
LSD (0.05)	**-**	1.37	0.44	0.74	0.46	2.16
Developmental Rate (1/d)	**20**	0.23	0.41	0.37	0.62	0.088
	25	0.29	0.53	0.72	0.8	0.125
	30	0.44	0.78	1	1	0.179

b- Developmental Rates: The developmental rates of all instars and total immature stages of mealy plum aphid, *H. pruni* from birth to adult increased linearly with temperatures from 20° up to 25 °C, then after word reached maximum at 30 °C., (Table, 1 and Figs. 1a-e). Although the increasing rates of all the

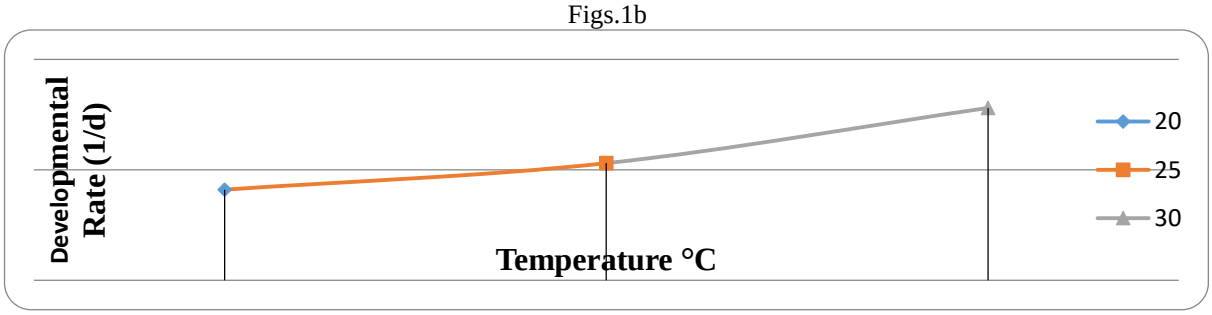
developmental rates parella at 25 and 30 °C slowed slightly toward upper, they were still the maximum development rates (Fig. 1a-e), In the same trend, **Serdar and Raymond (2002)** stated that developmental rate for *B. schwartzi* (Borner) was differed on peach and nectarine (*Prunus persica*) trees in Canada being (r_m 0.286) and for Queen crest peach (r_m 0.283), therefore, these cultivars could be selected as the host plant for the rearing aphid colony. **Mohamed *et al.* (2015)** in Algeria, observed that the development rates *H. pruni* increased with temperature up to an optimum 27 °C. The relationship between development rate and temperature was described by linear and nonlinear models. Developmental threshold based temperature was greater for the nonlinear model than for the linear model.

The results of linear regression analysis for nymphal developmental rates and temperatures within the range of 20–30 °C are shown in (Table 2). The estimated lower developmental thresholds were 1.01, 3.24, 1.13, 1.05 °C and 1.12 °C for the first through fourth instars and total immature stage, respectively.

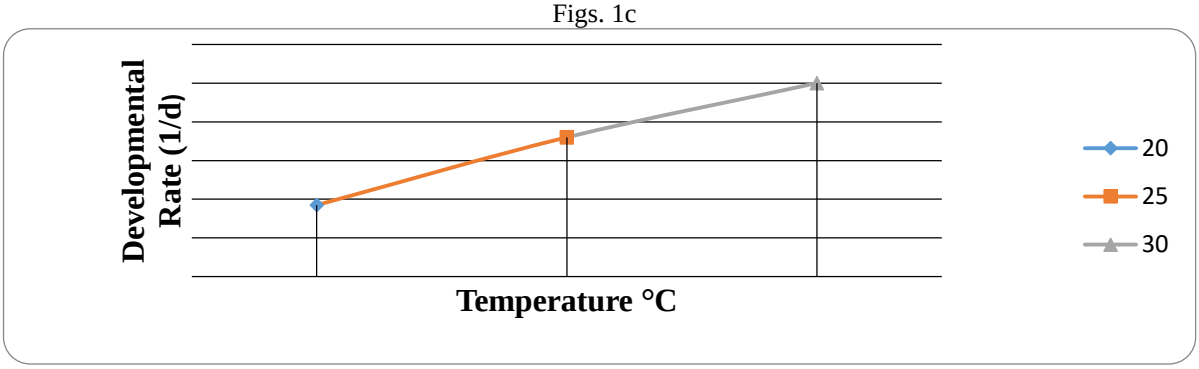
Figs.1a



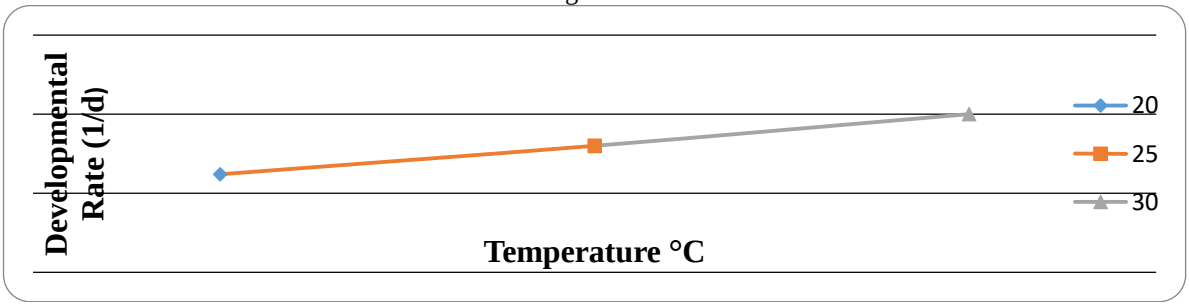
Figs.1b



Figs. 1c



Figs. 1d



Figs. 1e

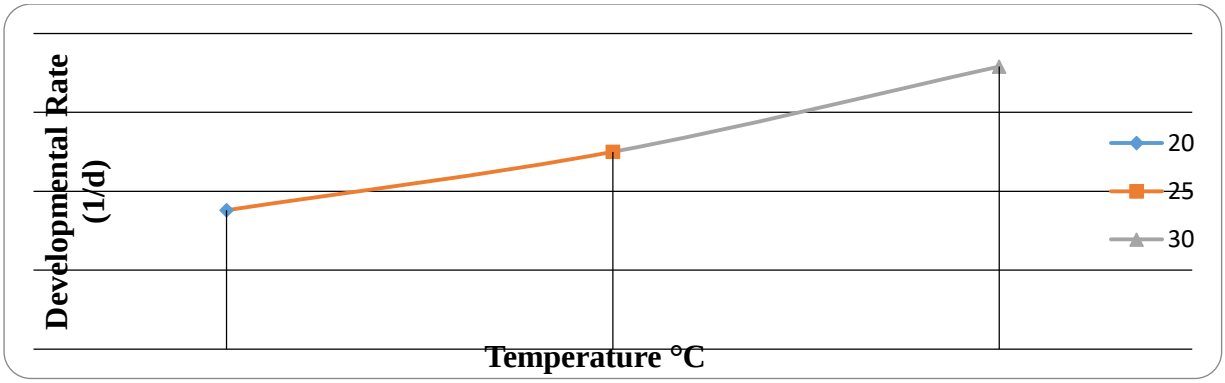


Fig. 1a-e. Observed development rates for immature stages of *H. pruni* on apricot leaves within the range of 20–30 °C, and curves fit to these data by a nonlinear regression.

According to **Campbell *et al.* (1974)** methodology estimates of developmental times in degree-days, decreased from 47.29 DD for first instars to 22.82 DD for fourth instars and the total immature development required 127.54 DD above 1.12 °C (Table, 2). The degree-Day model fit the data well, and adequately predicted the development rates (Table 1 and in Figs. 1a-e).

Table 2. Liner regression analysis for expressing developmental rates of *Hyalopterus pruni* immature instars reared on Apricot leaves at temperature range of 20-30 °C.

Developmental Periods	Regression Values				
	1st. Instar	2nd. Instar	3rd. Instar	4th. Instar	Nymphal stage
Simple Correlation "r"	0.971	0.982	0.998	0.999	0.999
R^2	0.942	0.965	0.995	0.997	0.999
Intercept A	-0.213	-0.341	-0.864	-0.308	-0.069
Regression B	0.021	0.037	0.063	0.044	0.0078
Developmental Time in DD	47.29	27.37	15.988	22.821	127.54
Low Developmental Threshold (°C)	1.01	3.24	1.13	1.05	1.12

Data presented in (Table 2) were used to estimate the developmental threshold (t_o) of the mealy plum aphid. Developmental-temperature relationship expressed as developmental time and as rate of development is shown in Figs. 1a-e.

The present data in table (3) indicated that survivorship rate (%) for immature stages was differed significantly within three constant temperatures on apricots. Higher temperature degree at 30 °C had detrimental effects on the survivorship of immature stages. The highest mortality occurred between 25 and 30 °C, being 33.7 and 42.4 % respectively; when mealy plum aphids feed on leaves of apricot, whereas the lowest mortality percentages were recorded at 20 °C, being 25.3 %. Mortality of nymphs of *H. pruni* under our investigation increased with temperature and all the nymphs died at 35 °C, therefore did not included in our data. **Serdar and Raymond (2002)** indicate the lower threshold for *B. schwartzi* development was 10.04 °C. Also, the data indicate that *B. schwartzi* does better performance on peach or nectarine at cooler temperatures and that early season peach or nectarine varieties and may be susceptible to damage by this aphid. The same result was detected in *H. pruni* by **Özgökçe and Atlihan (2005),** and other aphid species by **Asin and Pons (2001)** for corn aphids.

Generally, aphids reared at the highest tested temperature of 30°C had a detrimental effect on the survivorship of *H. pruni* immature stages; where, it decreased developmental time of nymphs on apricot leaves from 11.33 to 5.58 days, so it developed fastest and had a minimum survival rate about 57.6 %. These result agree with those of **Latham and Mills (2011)** who recorded greatest proportional survivorship of *H. pruni* nymphs on prune trees occurred at 26 °C. Mean daily fecundity was lowest at 14 °C and highest at 22 °C. Similar observation was also reported by **Bayhan *et al.* (2005)** for *Aphis punicae* (Passerini) on Pomegranate, and that of

Shinkichi (1982) for three aphid species, *Toxoptera citricidus*, *Aphis citricola* and *Aphis gossypii* on Citrus.

Table 3. Life Table Parameters of *Hyalopterus pruni* (Geoffroy). on Apricot leaves at temperature range of 20-30 °C.

Parameter	**20 °C**	**25 °C**	**30 °C**
Survival Rate To Maturity %	74.7	66.3	57.6
Mortality % in nymphal stage	25.3	33.7	42.4
Time To 50% Maturity (Days)	36.83	24.88	14.5
Mean Generation Time (Days)	20.11	14.63	10.36
Net Reproductive Rate (R_o) Female	14.92	16.25	9.69
Intrinsic Rate Of Increase (r_m)	0.134	0.191	0.219
Finite Rate Of Increase (exp. $_{rm)}$	1.144	1.21	1.25
Generation Doubling Time (Days)*	5.17	3.63	3.17

*Generation Doubling Time (Days)= Ln (2)/r_m.

2- Adult longevity and Reproduction:

Female adult longevity as pre- parturition, parturition and post-parturition periods was investigated under the three constant temperatures of 20, 25 and 30 °C, Table (4). The statistical analysis of the data revealed that the temperature had a highly significant effect on duration of the adult stage, where The longest durations of the adult stages occurred at 20 °C, (24.89 ± 1.62 days.) and the shortest duration occurred at 30 °C, (10.29 ± 2.29 days).

The obtained results, indicated that different periods of the adult duration decreases with the increase in temperature regime (Table, 4). the Pre- parturition period was ranged 3 ± 1.1 days at 20 °C, to 1.0 ± 0,23 days at 30 °C. The mean parturition period that preduced new born ranged 12.78 ± 1.79 days at 20 °C, to 6.57 ± 1.99 days at 30 °C., and the post-reproductive period ranged from 9.11 ± 1.62 days at 20 °C to 2.71 ± 0.76 days at 30 °C.

The obtained results are found in contrast with that of **Serdar and Raymond (2002)** who recorded that the adult longevity of *B. schwartzi* on peach trees was 38.5 d. at 15 °C and the highest offspring was 46.4 nymphs per female at 20 °C; while it found agreed with **Latham and Mills (2011)** who stated that the adult longevity of *H. pruni* on prune trees decreased with temperature increasing.

Also data indicated that temperature regimes affected significantly on female longevity, total life-span and on their fecundity as shown in (Table 4). The mean insect period of viviparous females of mealy plum aphids was varied from 16.29 ± 1.5 days at 30 °C to 36.22 ± 1.79 days at 20 °C. The average nymph production of *H. pruni* female (offspring per female) reached a maximum of 24.25± 3.88 and 19.89± 2.76 nymphs per female at 25 and 20 °C, respectively while, the lower rates 16.71 ± 5.22 nymphs per female produced at 30 °C. when feed on apricot leaves, respectively under temperature within 20–30 °C, also data obtained exhibited that viviparous female *H. pruni* longevity and fecundity were both statistically significant affected by temperature (LSD at 0.05 being 8.14 and 2.88, respectively).

Table 4. Female specific data of the life cycle at three temperetures.

Mean duration's ± S.E (day)	Temperature (°C)			LSD (0.05)
	20	**25**	**30**	
Pre-parturition	3.0c ± 1.1	1.38b ± 0.52	1.0a ± 0.23	0.48
parturition	12.78b ± 1.79	11.38b ± 1.51	6.57a ± 1.99	2.45
Post-parturition	9.11c ± 1.62	6.13b ± 2.23	2.71a ± 0.76	2.44
generation time	14.33b ± 0.71	9.38a ± 0.74	7.0a ± 1	2.57
Adult stage	24.89c ± 1.62	18.88b ± 3.14	10.29a ± 2.29	4.17
Life span	36.22 ± 1.79	26.88 ± 3.36	16.29 ± 1.5	8.14
fecundity rate (progeny/female)	19.89 ± 2.76	24.25 ± 3.88	16.71 ± 5.22	2.88

Means within the same row sharing the same letter are not significantly different at 0.05 Prob., Duncan multiple range test.

Longevity of mealy plum aphid female was 36.22 ± 0.1.79 days at 20 °C, but significantly declined at 30 °C (16.29 ± 1.5 days). The highest value of adult fecundity was about 24.25± 3.88 offspring per female at 25 °C. The lower progeny borne being 19.89 ± 2.76 and 16.71 ± 5.22 nymphs per female at 20 and 30 °C. respectively (Table 4). Neverthsells, at 35 °C, only few nymphs of *H. pruni* less than four individuals survived, but all adults died before

reached reproductive phase with very low numbers not exceeded than one individuals.

Adult fecundity was also adversely affected by the three temperature regimes of 20, 25 and 30 °C, where the reproduction rates were 1.56 ± 0.15; 2.13 ± 0.2 and 2.57 ± 0.37 nymphs /mother/day, for the three tested temperature respectively.

The effective lifetime fecundity (Md) of an aphid is achieved in time, where (d) is the time from first reproduction to females is completely cased **Wyatt & White, (1977)**. There was a significant difference in Md achieved on the different temperature exposure. The maximum effective lifetime fecundity on the *H. pruni* female occurred at 30 °C; meanwhile, minimum lifetime fecundity occurred on the lower temperature of 20 ° C., and comparatively median number of nymphs was born at 25 °C. the lifetime fecundity produced by female mealy plum aphids were: 1.56, 2.13 and 2.54 nymphs, at 20, 25 and 30 °C, respectively. **Zaklad and Skierniewice (1970)**. mentioned that mealy plum aphid, *H. pruni* development was holocyclic, and there were 6-16 generations a year. Fecundity was highest in the fundatrices of the first generation, the females depositing 102-120 (with maximum 172) nymphs each.

3- Population growth statistics:

The obtained results revealed that the values of the intrinsic rate of increase (r_m) was differed significantly among the tested three temperature values of (r_m) which raised as the temperature increasing from 20 to 30 °C being from 0.134, to 0.219 aphids/female/day. (Table 3). Temperature also, significantly affected the respective net reproductive rates (14.92, 16.25 and 9.69 progeny /female), and mean generation times (20.11, 14.63 and 10.36 day).at 20, 25 and 30 °C, respectively. **Serdar and Raymond (2002)** found the intrinsic rate of increase (r_m) of *B. schwartzi* on peach or nectarine rose sharply from 15 °C (0.109 nymphs /d) to a maximum at 25 °C (r_m 0.286), and then fell sharply at 27.5 °C with high mortality at 30 °C and above. Our results found in the same trend of those of **Łucă, et al (2005)** who noted that during the climatic conditions of 2002-2004, *H. pruni* has been developed 4 generations of wingless aphid (2002 and 2004), respectively, and gave 5 generations in 2003. These 4, 5 generations have phased from the second or third decade of April until the second half of July and there has been phased 8-9 generations of winged and wingless form, until September and even October. **Ozg¨okc and Atlıhan (2005)** recorded intrinsic rate of increase, as a good indicator of the growth potential of a population of mealy plum aphid individuals fed on apricot c.v., Tyrinte was significantly greater than that of individuals fed on apricot c.v., Colomer and Bebeco.

Mealy plum aphid reared at 25 °C had the highest net reproductive rate (16.25 offspring female), and at higher temperature of 30 °C had the smallest net reproductive rate (9.69 offspring per female). The generation doubling time (days) decreased from 5.17 to 3.17 days when the temperature was raised from 20 to 30 °C.

Ozg¨okc and Atlıhan (2005) found mean generation times (T_o) of mealy plum aphid populations on different cultivars of apricot were close to each other, the net reproductive rate was the highest (29.45 offspring/aphid/generation) on c.v., Tyrinte and the population doubling time on Tyrinte was18.7 %, 25.2 % and 26.3 % faster than those of individuals on other cultivars tested. Daniel and Nicholas (2011) found several generations *H. pruni* occurs on the primary host e.g., stone fruit trees in the spring and early summer before the host quality decreases and individual migrate to it secondary host, primarily cattails, *Typha latifolia* L., and *stalk vulgaris*, *Phragmites australis* (Cavanilles).

The obtained results partialy agree with those of **Mohamed *et al.* (2015)** mentioned the greatest proportional survivorship of nymphs *H. pruni* occurred at 26 °C. Mean daily fecundity was lowest at 14 °C and highest at 22 °C. Adult longevity decreased with temperature increased. Population growth rates for *H. pruni* were estimated from measurements of fecundity and development time and were highest at 22 °C. Also, **Summers *et al.*, (1984) and Kettunen *et al.* (1988).** and **Zaklad & Skierniewice (1970)** and **Latham & Mills (2011).** indicated that the Temperatures of 30 °C and over had an adverse effect on *H. pruni* development. and added that the *H. pruni* development rates on prune trees increased with temperature up to an optimum. The relationship between development rate and temperature was described by linear and nonlinear models. they also added that population growth rates for *H. pruni* on prune trees were estimated included measurements of fecundity and development time and were proved highest at 22 °C. The changing climate, particularly the temperature increase, can affect both herbivorous insects and plants (**Kettunen *et al.*, 1988)**. An increase in temperature can also indirectly affect aphids by changing the quality of the host plant tissues **(Dampc *et al.* 2021).** The present results of this study demonstrate that different temperatures of summer dominant (20-30 °C) influence population growth rate and fecundity of the mealy plum aphid, *H. pruni*. We can conclude that *H. pruni* has greatest injurious pest potential on apricot under summer season conditions **Attia (1983)** when temperature are most favorable for aphid development in Delta regions of Egypt. In England**, Smith (1937)** found varition in biological charaters beteen populations of the mealy plum aphid, *H. pruni* (Geoff.) on different stone fruit tree plants, i.e, growth rate of aphids and production and may differ with respect to the influence of temperature on development and population growth. **Ozg¨okc and Atlıhan (2005)** found the mealy plum aphid

performed better during early summer and mild climatic condition 27 °C.

Reference

Asin, L. and X. Pons. (2001). Effect of high temperature on the growth and reproduction of corn aphids (Homoptera: Aphididae) and implications for their population dynamics on the Northeastern Iberian Peninsula. Environ. Entomol. 30:1127–1134.

Attia, A.A. (1983). Studies on The Aphid Fauna of Fruit Treess in Egypt.Ph.D. Thesis. Fac. Agric., Ain Shams University.

Bayhan, E.; S. Ölmez-Bayhan; M.R. Ulusoy and J.K. Brown (2005). Effect of Temperature on the Biology of *Aphis punicae* (Passerini) (Homoptera: Aphididae) on Pomogranate, Environ. Entomol., 34: 22-26.

Birch, L.C. (1948). The intrinsic rate of natural increase of an insect population, J Anim Ecol., 17: 15-26.

Birol A.; I. Özdemir; K. Değirmenci and M.S. Başaran (2013). Movement and dispersal of plum pox virus in Turkey. Integrated protection of fruit crops. IOBC-WPRS Bulletin Vol. 91, pp. 329-336.

Brodeur, J. , Boivin, G. , Bourgeois, G. , Cloutier, C. , Doyon, J. , Grenier, P. , & Gagnon, A.-È. (2013). Impact des changements climatiques sur le synchronisme entre les ravageurs et leurs ennemis naturels: conséquences sur la lutte biologique en milieu agricole au Québec. OURANOS: Fond vert Québec. 17–18.

Campbell, A. , Frazer, B. D. , Gilbert, N. , Gutierrez, A. P. , & Mackauer, M. (1974). Temperature requirements of some aphids and their parasites. Journal of Applied Ecology, 11, 431–438. 10.2307/2402197.

Dampc, J.; M. Mołoń; T. Durak and R. Durak (2O21), Changes in Aphid—Plant Interactions under Increased Temperature. Biology 2021, 10(6), 480;

Ibrahim, A.M.A. and A.I. Afifi (1994). *Aphidius colemani* Viereck and *Aphidius picipes* (Nees) as parasitoids on the mealy aphid *Hyalopterus pruni* (Geoffroy) on peach in Egypt. J. Biol. Pest Cont., 4 (1): 45- 56.

Ismail, I. I.; S. El-Nagar and A.A. Attia (1991). The aphid fauna of fruit trees in Egypt. African Journal of Agricultural Sciences, Vol. 13 (1-2), pp.1-7 ref.16.

Kettunen, L.; J. Mukula; V. Pohjonen; O. Rantanen and U. Varjo (1988). The effects of climatic variations on agriculture in Finland, in Parry, M.L., Carter, T.R., and Konijn, N.T. eds, The Impact of Climatic Variations on Agriculture, Volume 1, Assessments in Cool Temperate and Cold Regions, pp.511-614.

Latham, D.R. and N.J. Mills (2011). Effects of Temperature on the Life History Parameters and Population Growth Rates of *Hyalopterus Pruni* (Hemiptera: Aphididae). J. of Econ. Entom., 2011. 104(6): 1864-1869.

Łucă, O.; I.Mitrea and C. Stan (2005). The Biological Cycle of Plum Mealy Aphid (Hyalopterus Pruni Geoffr.) on the Climatic Conditions From S.D. Banu Mărăcine, Cn, 63/2007-Bulletin Usamv Craiova.

Mac Gillivary, M.E. and G.E. Anderson (1957). Three useful insect cages. The candian entomologist, 89: 43-46.

Mohamad, M. A. and N.M. Al-Mallah (1990). Preliminary Field Observations on the Ecology and Biology of the Apricot Leaf Aphid, *Hyalopterus Pruni* G. (Homoptera: Aphididae) In Mosul Region - Iraq. [Arabic]. Arab Journal of Plant Protection; 1990. 8(1): 1-5.

Mohamed El Fodhil, A. 1.; B. D. Mitiche; D. Petit and Z. Djazouli (2015). Temporal Variations in The Life-Cycles of Aphids (Sternorrhyncha: Aphididae) and Their Coccinellid Predators. Eur. J. Entomol. 112.

Ozg¨okc, M.S.; F.I. and R.Atlihan (2005). Biological features and life table parameters of the Mealy plum aphid *Hyalopterus pruni* on different apricot Cultivars. Entomology Phytoparasitica, 33(1): 1-7.

Serdar, S. and Y. Raymond (2002). Effect of Temperature and Host on Development of *Brachycaudus Schwartzi* (Homoptera: Aphididae). Ann. Entomol. Soc. Am. 95(5): 597-602.

Shinkichi, K. (1982). Effect of constant temperatures on population growth of three aphid species, *Toxoptera citricidus* (Kirkaldy), Aphis citricola van der Goot and A. gossypii (Glover), on Citrus. Appl. Ent. Zool., 17 (1): 75-81.

Smith, L.M. (1937). Growth, Repreductions, Feeding and relation to climatic factors. J. Agric. Res. vol.54, 5: 345-364.

Summers, C.G.; R.L. Coviello; A.P. Gutierrez (1984). Influence of constant temperatures on the development and reproduction of *Acyrthosiphum kondoi* (Homoptera: Aphididae). Environ Entomol.,13: 236-242.

Tonnang, E.Z.H., Juarez, H., Carhuapoma, P., Gonzales, J.C., Mendoza, D., Sporleder, M., Simon, R. and Kroschel, J. (2013) ilcym – Insect Life Cycle Modeling. A software package for developing temperature-based insect phenology models with applications for local, regional and global analysis of insect populations and mapping. International Potato Center (CIP), Lima, 193 pp

Wyatt, I.J. and P.F. White. (1977). Simple estimation of intrinsic rate for aphids and tetranychid mites. Journal of Applied Ecology 14: 757–766.

Zaklad, O.; and R. Skierniewice (1970). The Biology of the Mealy Plum Aphid, *Hyalopterus Pruni* (Geoff.) (Homoptera, Aphidodea). Polskie Pismo Entomologiczne, Vol. 40 (2) Pp., 287-328.

تأثير درجة الحرارة علي بعض الظواهر البيولوجية وجداول الحياة لحشرة منْ البرقوق الدقيقى علي أشجار المشمش.

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1- كلية الزراعة – جامعة بنها – مصر

2- معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي – جيزة – مصر

اجريت هى الدراسة في معمل قسم بحوث الحشرات الثاقبة الماصة بمعهد وقاية النباتات بالدقي محافظة الجيزة خلال موسم 2021 حيث تم دراسة تأثير ثلاث درجات حرارة (20 – 25 – 30 درجة مئوية) و رطوبة نسبية 60 % وفترة إضاءة 16 ساعة علي بيولوجى من البرقوق الدقيقي عند تغذيته على اوراق أشجار المشمش. وتم التوصل الي النتائج التالية:

*حشرة منْ البرقوق الدقيقي لها 4 أعمار لطور الحورية. طول فترة هذه الأطوار يتناسب عكسيآ مع درجات الحرارة. ومعدل البقاء علي قيد الحياة حتي النضج كان 75% – 67% – 58% عند درجات حرارة 20 – 25 – 30 درجة مئوية علي التوالي.

*متوسط طول العمر للحشرات الكاملة كان 24,89 – 18,88 – 10,29 يومآ عند درجات الحرارة 20–25–30 درجة مئوية علي التوالي بينما كان متوسط معدل الخصوبة المسجل 19,89 – 24,25 – 16,71 نسل/أنثي عند درجات حرارة 20–25–30 درجة مئوية علي التوالي.

*متوسط مدة الجيل كان 20,11 – 14,63 – 10,36 يومآ عند درجات حرارة 20 –25 –30 درجة مئوية على التوالي.

*صافي معدل التكاثر/انثي كان الاكبر عند 25 درجة مئوية حيث بلغ 16,25 ومعدل الزيادة الطبيعي يزيد مع الزيادة في درجة الحرارة حيث ارتفع من 0,134 عند حرارة 20 درجة مئوية الى ان وصل الى 0,219 عند درجة حرارة 30 درجة مئوية. بينما معدل الزيادة المطلق كان 1,14 – 1,21 – 1,25 عند درجة حرارة 20 –25– 30 درجة مئوية علي التوالي.

*كان الوقت اللازم لمضاعفة الجيل 5,17 – 3,63 – 3,17 يوم عند درجة حرارة 20– 25– 30 درجة مئوية.

–مما سبق يمكن القول بأن درجة الحرارة 25 درجة مئوية تعتبر هي درجة الحرارة الأمثل لحياة وتكاثر حشرة منْ البرقوق الدقيقي علي أشجار المشمش.