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## Biology of citrus psyllid, *Diaphorina citri* Kuwayama (Homoptera: Psyllidae)

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**Abstract**

The biology of citrus psyllid, *Diaphorina citri* Kuwayama was conducted at laboratory condition, Department of Entomology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during 2017-18. Study revealed that the total developmental period of male and female was  $38.27 \pm 2.19$  and  $43.87 \pm 2.97$  days, respectively. Eggs laid singly or in clusters or in groups on leaf folds, petioles, young leaves or tender shoots, measured  $0.25 \pm 0.01$  mm in length and  $0.09 \pm 0.01$  mm in width. The egg period was  $3.64 \pm 0.70$  days. The nymph passed through five distinct instars. The total nymphal period was  $13.80 \pm 1.08$  days. Adults were small, brownish coloured sap-sucking insects. Pre-oviposition, oviposition and post-oviposition periods were  $2.93 \pm 0.59$ ,  $20.8 \pm 5.03$  and  $3.47 \pm 0.99$  days, respectively. The fecundity was  $561.44 \pm 34.91$  eggs. Longevity of male and female was  $22.27 \pm 2.19$  and  $28.13 \pm 2.77$  days, respectively.

**Keywords:** Biology, citrus psyllid, morphometric measurement, *Diaphorina citri*

**Introduction**

India ranks sixth in production of citrus fruits in the world. Other major citrus producing countries are Spain, USA, Israel, Morocco, South Africa, Japan, Brazil, Turkey and Cuba. The various types of citrus fruits of commercial importance grown in India are orange, sweet orange and lime/lemon. Lime or acid lime is also commercially known as 'Pati lime' or 'Kagzi lime'. In India, citrus fruits are mainly grown in Maharashtra, Andhra Pradesh, Punjab, Karnataka, Uttarakhand, Bihar, Odisha, Assam and Gujarat. Cultivation of acid lime or *Kagzi* lime is popular in Gujarat state and mostly cultivated in Anand, Kheda, Ahmedabad, Mehsana, Vadodara, Surendranagar and Bhavnagar districts. The genus citrus has 16 species (Swingle, 1943) <sup>[1]</sup>, 162 species recorded by Tanaka (1954) <sup>[2]</sup> and Gmitter and Hu (1990) <sup>[3]</sup>. Citrus is a member of the family rutaceae, sub-family aurantioideae. Citrus crops are grown all over the world. In India, acid lime is cultivated in 2.59 lakh ha with annual production of 27.89 lakh MT. In Gujarat, area under acid lime is about 0.42 lakh ha with annual production of 4.62 MT (Anon., 2017) <sup>[4]</sup>. More than 250 insect species damaging citrus at different stages of crop growth from seedling till the plant exists (Butani, 1979) <sup>[5]</sup>. Out of these, Citrus psyllid is a very serious pest in all the citrus growing regions in India. As a result of increase in cultivation of acid lime in Gujarat state, the citrus psyllid has attained the level of economic importance. It attacks on tender shoots and leaves. It is also a known vector of "Citrus greening" a bacterial disease (Helbert and Manjunath, 2004) <sup>[6]</sup>. It has been observed that infestation of this pest is increasing day by day which adversely affects the economy of farmer. Bassanezi *et al.* (2011) <sup>[7]</sup> recorded 19 per cent yield loss due to incidence of *D. citri*. There is very scanty information available on biology of citrus psyllid in South Gujarat so, the work has been undertaken.

**Materials and Methods**

The experiment based on biology of citrus psyllid was conducted at the P.G. Laboratory of the Department of Entomology, ASPEE College of Horticulture and Forestry, NAU, Navsari during 2017-18. For studying the biology of citrus psyllid, ten pairs of male and female adult psyllids were collected from citrus orchard and reared in wooden cage structure having citrus plants. Leaves showing presence of egg were collected and kept in Petri dish during morning hours on day to day basis. Leaf petiole was covered with wet cotton swab. The subsequent nymphal instars were provided with tender shoots and mass rearing of citrus psyllid was carried out. Observations of each stage of the insect were recorded subsequently. Duration of egg period, nymphal period, adult period, fecundity, Pre-oviposition, oviposition and post-

oviposition period, longevity, total developmental period were recorded. The morphometry of various stages measured with the help stereoscope binocular microscope.

## Results and Discussion

The female of psylla laid eggs singly or in clusters or groups on leaf folds, petioles, auxiliary buds, upper and lower surfaces of young leaves and tender shoots (unopened leaf bud) with the help of strong pointed ovipositor and anchored there by means of a short stalk embedded in the plant tissue. Similarly, Patel (2007) [8] recorded eggs laying of *D. citri* on young leaves and tender shoots. Eggs were elongated indicating almost similar site of egg laying. In the present investigation, egg laying by female *D. citri* was individual or in clusters on young leaves which was also observed by Patel (2007) [8] and Husain and Nath (1927) [9]. Similarity of observations based on pattern and site of egg laying in the present investigation with those of earlier reports conformed the results. Egg period of *D. citri* varied from 3 to 5 days ( $3.64 \pm 0.70$ ) indicated in Table-1, result coincide with Khan *et al.* (1989) [10] who recorded egg period of 2 to 4 days, 1.5 to 2.5 days (Nakata, 2006) [11],  $3.5 \pm 0.24$  days (Singh *et al.*, 2018) [12] while, it was of  $2.28 \pm 0.18$  days as per the report of Chhetry *et al.* (2012) [13]. Egg duration in present investigation is almost similar to the earlier reports so it can be concluded that reports of current investigation are said to be in agreement with those of earlier records. Freshly laid eggs were elongated, almond shaped and yellow coloured. Eggs turned bright orange with two distinct red eye spots at maturity. After hatching, the egg shell which was transparent and membranous remained attached to plant tissue. The present investigation indicated similar results as mentioned in the report of Hussain and Nath (1927) [9] who in turn observed almond shaped eggs. Similarly, Patel (2007) [8] observed elongated and almond shaped eggs with a broad basal end tapering toward its distal and curved end. The observations recorded by Patel (2007) [8] and Hussain and Nath (1927) [9] based on shape of eggs were conforms the present results.

Freshly laid eggs of *D. citri* were 0.23 to 0.29 mm ( $0.25 \pm 0.01$ ) in length and 0.08 to 0.11 mm ( $0.09 \pm 0.01$ ) in width (Table-1). Similar results were also reported by Chhetry *et al.* (2012) [13] who observed average length of egg as  $0.28 \pm 0.02$  mm (0.26 to 0.31), width  $0.13 \pm 0.02$  mm (0.12 to 0.14). Singh *et al.* (2018) [12] recorded  $0.28 \pm 0.03$  mm length and  $0.13 \pm 0.01$  mm width of *D. citri* eggs. Morphometric measurements observed by above workers are similar to the trend of current investigation thus, conforms the ongoing discussion. Hatching percentage (Table-1) was recorded in the range of 58 to 74 per cent ( $66 \pm 4.65$ ) similar results recorded by Vaze (1980) [14] who observed hatching percentage in the range of 65 to 68. Which are almost similar to above results thus conform the current investigation.

Nymphs passed through five morphologically distinct instars, when reared on citrus leaves (Table-2). Nymphs continuously secreted copious amount of honeydew from anus and a thread like waxy substance resulted in the growth of black sooty mold on the lower leaves. The present finding indicated that nymphs passed through five instars as mentioned in the report of Pande (1971) [15] and Tsai and Liu (2000) [16]. These results indicate almost similar morphological observations as mentioned in the present investigation thus, confirmed the current results.

First instar nymph survive for 2 to 3 days ( $2.28 \pm 0.46$ ). It was more or less similar with  $2.6 \pm 0.25$  and  $2.6 \pm 0.70$  days in the

reports of Singh *et al.* (2018) [12] and Devi and Sharma (2013) [17], respectively. The duration of second nymphal instar ranged from 1 to 2 days ( $1.76 \pm 0.44$ ) It was reported as  $3.0 \pm 0.18$  days by Singh *et al.* (2018) [12],  $2.71 \pm 0.2$  days by Chhetry *et al.* (2012) [13] and  $2.90 \pm 0.79$  days by Devi and Sharma (2013) [17]. The duration of third instar nymph ranged between 2 to 5 days ( $2.68 \pm 0.90$ ). Singh *et al.* (2018) [12] recorded duration of third instar nymphal was  $4.5 \pm 0.21$  days,  $2.50 \pm 0.18$  days (Chhetry *et al.*, 2012) [13] and  $3.2 \pm 0.79$  days (Devi and Sharma, 2013) [17]. The duration of fourth instars nymph ranged from 2 to 3 days ( $2.52 \pm 0.51$ ). The nymphal period of forth instar *D. citri* has been found slightly shorter in the current investigation as compared to the reports of Singh *et al.* 2018) [12] recorded  $4.9 \pm 0.22$  days,  $3.14 \pm 0.32$  days (Chhetry *et al.*, 2012) [13] and  $3.4 \pm 0.52$  (Devi and Sharma, 2013) [17]. Duration of fifth instar nymph ranged from 4 to 5 days ( $4.56 \pm 0.51$ ). Singh *et al.* (2018) [12] recorded duration of fifth nymphal instar was  $4.7 \pm 0.22$  days while and  $4.0 \pm 0.82$  days recorded by Devi and Sharma (2013) [17]. Variation in current investigation which could be due to variation in temperature and humidity prevailed inside the laboratory condition and could also be due to morphological and biochemical differences present in the host plants (Table-2).

The length (Table-3) of first instar nymph varied from 0.25 to 0.32 mm ( $0.28 \pm 0.03$ ) and width varied from 0.15 mm to 0.18 mm ( $0.17 \pm 0.01$ ) which result more or less similar by Tsai and Lui (2000) [16] recorded length and width of nymph as 0.30 and 0.17 mm, respectively. Chhetry *et al.* (2012) [13] mentioned 0.28 to 0.33 mm length and 0.17 mm width. Likewise, average length  $0.36 \pm 0.02$  and width  $0.16 \pm 0.01$  mm was observed by Singh *et al.* (2018) [12]. The second instars nymph measured 0.36 to 0.45 mm ( $0.40 \pm 0.03$ ) length and 0.16 to 0.32 mm ( $0.23 \pm 0.04$ ) width. It was similar report as 0.45 mm length and width of 0.25 mm, 0.43 mm length and 0.24 mm width,  $0.42 \pm 0.06$  mm length and  $0.25 \pm 0.05$  mm width recorded by Tsai and Lui (2000) [16], Chhetry *et al.* (2012) [13] and Singh *et al.* (2018) [12], respectively. The length of third instar nymph varied from 0.71 to 0.95 mm ( $0.81 \pm 0.09$ ), while width varied from 0.35 to 0.45 mm ( $0.40 \pm 0.04$ ). The present findings are in concurrence with Tsai and Lui (2000) [16] found 0.74 mm length and 0.43 mm width and Singh *et al.* (2018) [12] also found  $0.86 \pm 0.01$  mm length and  $0.47 \pm 0.08$  mm width. The length of fourth instar nymph ranged from 0.97 to 1.16 mm ( $1.06 \pm 0.06$ ), while width varied from 0.53 to 0.75 mm ( $0.66 \pm 0.07$ ). Similar results recorded by Tsai and Lui (2000) [16] 1.01 mm length and 0.70 mm width whereas, Chhetry *et al.* (2012) [13] recorded 0.95 mm length and 1.02 mm width. The length and width of fifth instar nymph ranged from 1.43 to 1.83 mm ( $1.60 \pm 0.13$ ) and 0.92 to 1.07 mm ( $0.99 \pm 0.04$ ), respectively. Which concluded more or less similar with Tsai and Lui (2000) [16] recorded length and width 1.60 and 1.02 mm, respectively while, Chhetry *et al.* (2012) [13] recorded 1.82 mm length and width 1.03 mm. The perusal of data revealed total nymphal development period of *D. citri* in the range from 12 to 16 days ( $13.80 \pm 1.08$ ). Earlier, similar report by Tsai and Lui (2000) [16] recorded total nymphal period of *D. citri* as 13.5 days whereas, Singh *et al.* (2018) [12] observed it as 19.7 days. Variation in duration might be due to difference in the laboratory condition and the host range. In the present investigation, total nymphal period was 13.80 days which closely resemble the report (13.5) of Tsai and Lui (2000) [16] and subsequently proves the result of the current

investigation.

Adults were small, brown coloured, sap-sucking insects. The forewings were distinctively patterned with mottled brown patches. The abdomen had a pointed shape when viewed from above. Adults had a distinctive feeding posture, with the head down, almost touching the plant surface and the body was observed lifted at 30° angle. The length of adult male varied from 1.92 to 2.15 mm ( $2.02 \pm 0.07$ ) and the width varied from 0.56 to 0.87 mm ( $0.66 \pm 0.09$ ). In case of female, the length varied from 2.83 to 3.11 mm ( $2.92 \pm 0.09$ ) and the width varied from 0.71 to 0.85 mm ( $0.78 \pm 0.04$ ) given in Table-4. Average adult males were 2.7 mm long and 0.8 mm wide and average adult female measured 3.3 mm in length and 1.0 mm in width as recorded by Tsai and Lui (2000) [16]. Singh *et al.* (2018) [12] observed length of adult males as  $2.94 \pm 0.06$  mm and width as  $0.52 \pm 0.05$  mm while, length and width in female insects was measured as  $3.19 \pm 0.08$  mm and  $0.77 \pm 0.04$  mm, respectively. Somewhat variation could be due difference in temperature and humidity prevailed in the laboratory as well as the type of host plants on which the insects were reared.

The pre-oviposition period of the adult female varied from 2 to 4 days ( $2.93 \pm 0.59$ ). Oviposition and post oviposition periods in this investigation varied from 14 to 29 ( $20.8 \pm 5.03$ ) and 2 to 5 days ( $3.47 \pm 0.99$ ) given in Table-5. Similar

results on pre-oviposition and oviposition period were recorded by Shahid and Khan (1976) [18].

The fecundity recorded during the investigation varied from 516 to 629 eggs ( $561.44 \pm 34.91$ ) laid per female on citrus indicated in Table-5. Earlier, similar result obtained by Nava *et al.* (2007) [19] *D. citri* laid 500 to 800 eggs in their lifetime. Singh *et al.* (2018) [12] recorded fecundity of *D. citri* as  $505.2 \pm 26.08$  eggs.

The longevity of male insect ranged from 19 to 27 days ( $22.27 \pm 2.19$ ) while, female insect lived for 24 to 32 days ( $28.13 \pm 2.77$ ) indicated in Table-6. According to Nava *et al.* (2007) [19], adult males lived for 21-25 days and females lived for 31-32 days at 24 °C temperature. Singh *et al.* (2018) [12] recorded longevity of adult male and female as  $28.6 \pm 0.52$  and  $33.20 \pm 0.75$  days, respectively. Longevity of adult male was 22.27 days and female insect was 28.13 days. However, the current results mentioned shorter period than by Singh *et al.* (2018) [12]. This could be due to variation in rearing conditions.

The total developmental period (Table-6) of male insect from egg laying to the death of adult ranged from 36 to 43 days ( $38.27 \pm 2.19$ ) while, it was of 40 to 48 days ( $43.87 \pm 2.97$ ) in the female adult. The observations in the current investigation are more or less similar as observed by Pande (1971) [15] (14-48 days) and Teck *et al.* (2011) [20] (19 days).

**Table 1:** Morphometric observations, egg duration and Hatching percentage of citrus psyllid

Set No.	Egg Period (days)	Egg length (mm)	Egg width (mm)	Hatching percentage
1.	5	0.25	0.08	70
2.	3	0.27	0.10	65
3.	4	0.24	0.08	62
4.	5	0.23	0.09	68
5.	4	0.25	0.10	69
6.	4	0.25	0.11	58
7.	4	0.24	0.09	62
8.	4	0.27	0.08	72
9.	3	0.23	0.08	64
10.	3	0.25	0.10	60
11.	4	0.26	0.09	64
12.	3	0.26	0.09	68
13.	4	0.27	0.08	64
14.	3	0.24	0.10	62
15.	4	0.27	0.10	60
16.	4	0.26	0.08	65
17.	3	0.28	0.10	72
18.	3	0.25	0.09	70
19.	3	0.26	0.10	66
20.	3	0.29	0.08	74
21.	4	0.23	0.08	66
22.	3	0.27	0.10	74
23.	3	0.23	0.08	72
24.	3	0.26	0.08	60
25.	5	0.25	0.08	64
Max.	5	0.29	0.11	74
Min.	3	0.23	0.08	58
Mean $\pm$ S.D.	$3.64 \pm 0.70$	$0.25 \pm 0.01$	$0.09 \pm 0.01$	$66.00 \pm 4.65$

**Table 2:** Duration of nymphal instars of *D. citri*

Set. No.	1 <sup>st</sup> instar period (days)	2 <sup>nd</sup> instar period (days)	3 <sup>rd</sup> instar Period (days)	4 <sup>th</sup> instar period (days)	5 <sup>th</sup> instar period (days)	Total nymphal period
1.	2	2	2	3	4	13
2.	3	2	2	2	5	14
3.	3	1	3	3	5	15
4.	2	2	2	3	4	13
5.	2	2	2	2	5	13
6.	2	2	4	3	4	15

7.	2	1	5	2	5	15
8.	2	2	3	2	4	13
9.	3	2	3	2	4	14
10.	2	2	5	3	4	16
11.	2	1	2	2	5	12
12.	2	2	2	3	4	13
13.	2	2	3	3	5	15
14.	2	2	2	2	5	13
15.	3	1	2	3	4	13
16.	2	2	2	3	5	14
17.	2	2	2	2	4	12
18.	3	2	3	2	5	15
19.	2	2	2	3	5	14
20.	2	1	3	3	5	14
21.	2	1	2	2	5	12
22.	3	2	2	2	5	14
23.	2	2	3	3	5	15
24.	3	2	3	2	4	14
25.	2	2	3	3	4	14
Max	3	2	5	3	5	16
Min	2	1	2	2	4	12
Mean $\pm$ S.D.	2.28 $\pm$ 0.46	1.76 $\pm$ 0.44	2.68 $\pm$ 0.90	2.52 $\pm$ 0.51	4.56 $\pm$ 0.51	13.80 $\pm$ 1.08

Table 3: Morphometric measurement of different nymphal instars of *D. citri*

Set. No	1 <sup>st</sup> instar		2 <sup>nd</sup> instar		3 <sup>rd</sup> instar		4 <sup>th</sup> instar		5 <sup>th</sup> instar	
	Length (mm)	Width (mm)	Length (mm)	Width (mm)	Length (mm)	Width (mm)	Length (mm)	Width (mm)	Length (mm)	Width (mm)
1.	0.29	0.18	0.40	0.23	0.91	0.39	1.11	0.59	1.43	0.99
2.	0.29	0.17	0.44	0.27	0.77	0.40	1.09	0.75	1.58	0.94
3.	0.32	0.17	0.38	0.19	0.75	0.44	1.03	0.69	1.49	1.00
4.	0.30	0.17	0.36	0.21	0.94	0.42	1.11	0.63	1.68	0.98
5.	0.31	0.18	0.45	0.27	0.71	0.39	0.97	0.68	1.59	0.92
6.	0.29	0.18	0.38	0.20	0.84	0.43	1.01	0.73	1.6	1.04
7.	0.30	0.18	0.43	0.24	0.84	0.34	1.05	0.70	1.55	0.94
8.	0.32	0.16	0.42	0.20	0.73	0.41	1.14	0.49	1.64	0.88
9.	0.30	0.17	0.36	0.32	0.75	0.42	1.16	0.72	1.71	1.01
10.	0.29	0.15	0.42	0.23	0.79	0.38	1.13	0.74	1.59	1.05
11.	0.25	0.16	0.37	0.23	0.85	0.35	1.05	0.66	1.65	1.00
12.	0.26	0.17	0.42	0.20	0.70	0.47	1.10	0.70	1.50	1.07
13.	0.27	0.16	0.40	0.25	0.94	0.42	1.12	0.68	1.53	1.00
14.	0.27	0.17	0.40	0.27	0.78	0.38	1.10	0.53	1.61	1.01
15.	0.31	0.16	0.42	0.25	0.95	0.45	1.08	0.64	1.83	0.99
16.	0.32	0.17	0.36	0.16	0.95	0.35	1.04	0.59	1.46	0.97
17.	0.26	0.18	0.39	0.27	0.78	0.42	1.12	0.74	1.48	1.05
18.	0.32	0.15	0.38	0.25	0.75	0.44	1.08	0.58	1.69	0.99
19.	0.27	0.17	0.40	0.26	0.71	0.35	0.98	0.64	1.47	1.02
20.	0.25	0.17	0.44	0.25	0.73	0.37	0.98	0.70	1.68	1.05
21.	0.29	0.15	0.42	0.18	0.75	0.40	1.12	0.71	1.80	0.92
22.	0.32	0.18	0.36	0.25	0.83	0.45	1.00	0.75	1.64	0.95
23.	0.30	0.16	0.40	0.20	0.75	0.39	1.02	0.65	1.58	1.05
24.	0.27	0.16	0.42	0.27	0.83	0.35	1.16	0.72	1.47	0.92
25.	0.25	0.17	0.44	0.19	0.78	0.42	0.99	0.66	1.52	0.98
Max	0.32	0.18	0.45	0.32	0.95	0.45	1.16	0.75	1.83	1.07
Min	0.25	0.15	0.36	0.16	0.71	0.35	0.97	0.53	1.43	0.92
Mean $\pm$ S.D.	0.28 $\pm$ 0.03	0.17 $\pm$ 0.01	0.40 $\pm$ 0.03	0.23 $\pm$ 0.04	0.81 $\pm$ 0.09	0.40 $\pm$ 0.04	1.06 $\pm$ 0.06	0.66 $\pm$ 0.07	1.60 $\pm$ 0.13	0.99 $\pm$ 0.04

Table 4: Measurement of male and female adult of *D. citri*

Set. No.	Male adult		Female adult	
	Length(mm)	Width(mm)	Length(mm)	Width(mm)
1.	2.02	0.87	2.86	0.79
2.	2.04	0.59	2.86	0.77
3.	1.96	0.70	2.84	0.74
4.	2.07	0.78	2.83	0.80
5.	2.04	0.61	3.02	0.71
6.	1.92	0.56	3.11	0.69
7.	1.92	0.72	2.88	0.79
8.	2.06	0.64	3.01	0.75

9.	1.95	0.60	2.71	0.81
10.	2.12	0.80	2.90	0.74
11.	1.91	0.75	2.91	0.85
12.	2.08	0.76	3.01	0.83
13.	2.00	0.65	2.86	0.83
14.	1.99	0.69	2.93	0.73
15.	2.15	0.58	3.03	0.85
Max	2.15	0.87	3.11	0.85
Min	1.92	0.56	2.83	0.71
Mean±S.D.	2.02 ± 0.07	0.66 ± 0.09	2.92 ± 0.09	0.78 ± 0.04

**Table 5:** Pre-oviposition, oviposition and post oviposition periods and fecundity of *D. citri*

Set. No.	Pre-oviposition period (days)	Oviposition period (days)	Post oviposition period (days)	No. of eggs laid per female insect
1.	2	25	3	537
2.	3	22	3	552
3.	2	29	3	584
4.	4	19	4	626
5.	3	15	5	546
6.	3	29	4	584
7.	4	21	4	556
8.	3	20	4	539
9.	3	18	2	555
10.	3	22	3	516
11.	3	18	2	575
12.	3	17	4	606
13.	2	15	5	629
14.	3	28	2	538
15.	3	14	4	527
Max	4	29	5	629
Min	2	14	2	516
Mean ± S.D.	2.93 ± 0.59	20.8 ± 5.03	3.47 ± 0.99	561.44 ± 34.91

**Table 6:** Longevity of adult and total developmental period of *D. citri*

Set. No.	Adult Longevity (days)		Total developmental period (days)	
	Male	Female	Male	Female
1.	23	28	39	44
2.	21	32	37	48
3.	21	25	37	41
4.	21	30	37	46
5.	23	26	39	42
6.	21	27	37	43
7.	21	30	37	46
8.	27	25	43	41
9.	19	32	35	48
10.	21	25	37	41
11.	24	28	40	44
12.	23	24	39	40
13.	26	30	42	46
14.	23	32	39	48
15.	20	28	36	40
Max	27	32	43	48
Min	19	24	36	40
Mean ± S.D.	22.27 ± 2.19	28.13 ± 2.77	38.27 ± 2.19	43.87 ± 2.97

**Conclusion**

Egg and nymphal period of *D. citri* was  $3.64 \pm 0.70$  and  $13.80 \pm 1.08$  days, respectively. Longevity of male and female adults was  $22.27 \pm 2.19$  and  $28.13 \pm 2.77$  days. Total developmental period of male and female was  $38.27 \pm 2.19$  and  $43.87 \pm 2.97$  days, respectively.

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