



## Life Cycle of *Brevipalpus Deleoni* Pritchard & Baker on Basak (*Adathoda vasica*) at Combination of Different Temperature and RH

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### ABSTRACT

The present paper reports the life cycle of *Brevipalpus deleoni* Pritchard & Baker at three constant temperatures viz  $20 \pm 10C$ ,  $25 \pm 10C$  and  $30 \pm 10C$  along with 3 constant relative humidities like  $50 \pm 3\%$ ,  $70 \pm 3\%$  and  $90 \pm 3\%$  RH. The duration of different developmental stage, total life cycle, pre-oviposition, oviposition, post-oviposition periods, fecundity, viability of eggs etc. at varying temperatures and humidities have been discussed. The total lifecycle depended more on humidity and less on temperature as because the total period increased with increase in humidity. The duration was longest at  $90 \pm 3\%$  RH and lowest at  $50 \pm 3\%$  RH. Highest fecundity was at  $25 \pm 10C$  and  $70 \pm 3\%$  RH.

**KEYWORDS :** *Brevipalpus deleoni*, life cycle, effect of temperatures, RH, *Adathoda vasica*

### Introduction –

Since *Brevipalpus deleoni* Pritchard & Baker was found to infest Vasak, *Adathoda vasica* very frequently producing damage symptoms like development of light brownish patches at the point of feeding and the populations was found almost throughout the year. It was felt necessary to conduct laboratory experiment and accordingly the life cycle of *Brevipalpus deleoni* was carried out on Basak at three temperatures, viz.  $20 \pm 1^\circ C$ ,  $25 \pm 1^\circ C$ ,  $30 \pm 1^\circ C$ , each with three combinations of RH  $50 \pm 3\%$ ,  $70 \pm 3\%$  and  $90 \pm 3\%$

### Material and Methods –

The mite *Brevipalpus deleoni* was collected from Vasak at Ramakrishana Mission Ashrama Narendrapur where it was found regularly infesting. The technique which was followed was leaf disk technique of Helle & Sabelis (1985). The female mites were collected from the field and were released on a leaf bit of *Adathoda vasica*, kept on wet

cotton pad in a Petridish allowing it to lay eggs. As such, five Petridishes were taken and those were kept in BOD incubator maintaining the combination of temperature and RH as mentioned earlier. After the eggs were laid, the females were removed and the eggs were encircled with a pen for subsequent easy locating. The observation towards duration of different developmental stages like larval, protonymphal, deutonymphal, total developmental period, preoviposition, oviposition, post oviposition periods along with % of hatchability and longevity of both females and males were recorded after 24 hrs interval. The data such collected were statistically analyzed and presented in various Tables 1-4.

### Results and Discussion –

The duration of different developmental periods along with preoviposition, oviposition, postoviposition period, fecundity etc. have been presented in Tables 1-4. And those are discussed as below:

**Table1: Developmental period of *Brevipalpus deleoni* at different temperatures and humilities under laboratory condition**

Temperature	RH	Incubation period mean $\pm$ SD	Larval period mean $\pm$ SD	Protonymphal Period mean $\pm$ SD	Deutonymphal period mean $\pm$ SD	Total Developmental period mean $\pm$ SD
$20 \pm 1^\circ C$	$50 \pm 3\%$	$5.33 \pm 2.01$	$8.16 \pm 0.85$	$11.15 \pm 0.85$	$16.53 \pm 0.85$	$36.61 \pm 4.56$
	$70 \pm 3\%$	$5.89 \pm 0.60$	$7.00 \pm 0.60$	$11.00 \pm 0.60$	$17.21 \pm 0.53$	$38.77 \pm 2.33$
	$90 \pm 3\%$	$7.17 \pm 1.12$	$9.98 \pm 1.66$	$12.40 \pm 0.55$	$17.50 \pm 0.54$	$43.18 \pm 3.87$
$25 \pm 1^\circ C$	$50 \pm 3\%$	$5.66 \pm 0.77$	$7.99 \pm 0.60$	$10.83 \pm 0.40$	$17.99 \pm 0.62$	$40.08 \pm 2.39$
	$70 \pm 3\%$	$5.15 \pm 0.57$	$7.19 \pm 0.53$	$10.40 \pm 0.99$	$16.70 \pm 0.63$	$36.72 \pm 2.72$
	$90 \pm 3\%$	$6.98 \pm 0.87$	$8.19 \pm 0.40$	$12.19 \pm 0.40$	$18.80 \pm 0.79$	$43.7 \pm 2.46$
$30 \pm 1^\circ C$	$50 \pm 3\%$	$4.79 \pm 0.40$	$7.13 \pm 0.50$	$10.00 \pm 0.53$	$16.16 \pm 0.85$	$35.8 \pm 2.28$
	$70 \pm 3\%$	$4.56 \pm 0.41$	$6.62 \pm 0.51$	$10.60 \pm 0.54$	$16.23 \pm 0.44$	$36.11 \pm 1.9$
	$90 \pm 3\%$	$6.15 \pm 0.55$	$8.20 \pm 0.53$	$10.80 \pm 0.55$	$17.50 \pm 1.14$	$39.88 \pm 2.77$

**Table 2 : Duration of Preoviposition, Oviposition, Postoviosition Periods of *Brevipalpus deleoni* at different temperatures and humidities under laboratory condition**

Temperature	RH	Preoviposition	Oviposition	Postoviposition
$20 \pm 1^\circ C$	$50 \pm 3\%$	$6.20 \pm 0.35$	$10.00 \pm 1.25$	$12.50 \pm 0.75$
	$70 \pm 3\%$	$9.98 \pm 0.70$	$14.35 \pm 1.85$	$19.00 \pm 1.25$
	$90 \pm 3\%$	$10.25 \pm 1.10$	$12.70 \pm 1.85$	$14.70 \pm 1.35$
$25 \pm 1^\circ C$	$50 \pm 3\%$	$8.35 \pm 1.15$	$10.12 \pm 0.75$	$13.35 \pm 4.45$
	$70 \pm 3\%$	$6.12 \pm 0.65$	$11.70 \pm 0.45$	$14.00 \pm 0.65$
	$90 \pm 3\%$	$8.20 \pm 0.75$	$10.70 \pm 0.45$	$14.00 \pm 4.65$

Temperature	RH	Preoviposition	Oviposition	Postoviposition
30 ± 1°C	50± 3%	10.65 ± 0.50	9.00 ± 0.65	26.80 ± 0.25
	70±3%	8.00 ± 0.75	9.45 ± 1.35	17.80 ± 1.30
	90± 3%	10.50 ± 0.50	9.20 ± 0.44	15.60 ± 0.80

**Table 3 : Duration of Fecundity and Daily rate of egg production of *Brevipalpus deoleoni* at different temperatures and humidities under laboratory condition**

Temperature	RH	No. of eggs
20 ± 1°C	50± 3%	35
	70±3%	42
	90± 3%	35
25 ± 1°C	50± 3%	90
	70±3%	140
	90± 3%	88
30 ± 1°C	50± 3%	48
	70±3%	49
	90± 3%	41

**Table 4: Duration of Viability of eggs of *Brevipalpus deoleoni* at different temperatures and humidities under laboratory condition**

Temperature	RH	No. of eggs examined	No. of eggs hatched	% of viability of eggs
20 ± 1°C	50± 3%	13	9	69.23
	70±3%	10	9	90
	90± 3%	10	7	70
25 ± 1°C	50± 3%	18	14	77.77
	70±3%	16	15	93.75
	90± 3%	22	18	81.81
30 ± 1°C	50± 3%	12	10	83.33
	70±3%	9	8	88.88
	90± 3%	11	8	72.72

**Incubation period –**

The Incubation period took 4.79 ± 0.40 days at 30 ± 1°C and 70 ± 3 % RH. The maximum was 7.17 ± 1.12 days at 20 ± 1°C in combination with 90 ± 3 % RH. In other cases, it ranged between 4.79 ± 0.40 days at 30 ± 1°C and 50 ± 3% RH to 6.98 ± 0.87 days at 25 ± 1°C, 90 ± 3% RH. From these, it appears that so far as this period is concerned, 30°C with 70 ± 3 % RH was most suitable followed by the same temperature with 50 ± 3% RH while 20° with 90 ± 3 % RH was the most unfavorable for this mite.

So far as incubation period is concerned, Gupta( 2012), mentioned 6 days, in case of *Raoiella indica* and as per Sadana and Joshi (1986) it was of 9 days in case of *Brevipalpus californicus*. In case of other tenupalpid mites, the other available data are :- 8 days (in case of *Raoiella indica* at 27 ± 1°C with minimum of 5.07 ± 1.53 days at 30°C and maximum of 9.50 ± 2.72 days), 6.3 ± 0.8 days ( in case of *Brevipalpus obovatus* on *Ipomoea batatas* , 6.0 ± 1.2 days in *Adathoda vesica* and 7.2 ± 1.2 days at 30°C and 54± 1% RH on *Myoporum pictum* (Wahab,1974) and 3.07± 0.7 days in case of *Brevipalpus obovatus* on citrus (Rezk ,1989). From these comparative data it is apparent that the incubation period which was observed in the present study was in conformably with those of earlier workers.

**Larval period –**

The highest larval period was 9.98 ± 1.66 days at 20°C and 90 ± 3 % RH followed by 8.20 ± 0.53 days ( 30 °C with 90 ± 3% RH). This period varied between 8.19 ± 0.40 days (25 ± 1°C with 90.3 % RH) and 6.62 ± 0.51 days (30°C with 70 ± 3% RH ). Among the different levels of humidity , it was seen that 70 ± 3% RH recorded the lowest larval period irrespective of temperature and 90 ± 3% RH recorded the longest larval period irrespective of temperature . So far as the effect of temperature was concerned, apparently this period appeared to be longer duration at 20 °C and shorter at 30 °C.

As per Gupta (2012) the larval stage took 9 days in case of *Raoiella indica* and 7-8 days in case of *Brevipalpus californicus* on the same host (Banarjee ,1989), 2.76 ± 0.4 days in case of *Brevipalpus obovatus* on citrus (Rezk ,1998). Therefore , the duration of larval stage found in the present study was higher as compared to duration reported by Rezk (1998) but close to that reported in Gupta (2012).

**Protonymphal period-**

This period was shorter at 30 ± 1°C irrespective of humidity and was longer 20 ± 1°C also irrespective of humidity. So it can be said that at higher temperature the protonymphal period was of shorter duration. Among the three different levels of humidity, 90 ± 3 % RH always registered longer protonymphal period at all the three levels of RH. The maximum duration of this period was 12.40 ± 0.55 at 20 ± 1°C with 90 ± 3% RH followed by 12.19 ± 0.40 (25 ± 1°C and 90 ± 3% RH ). At other levels of temperature and RH , this period varied between 10.40 ± 0.99 (25 ± 1°C and 70 ± 3% RH ) to 11.15 ± 0.85 days ( 20 ± 1°C and 50 ± 3 % RH.)

This period was of 6 days in case of *Roiella indica* (Gupta ,2012) and 7-8 days in case of *Brevipalpus californicus* (Banarjee, 1989) but it was much shorter 1.5 days on *Roiella macfarlanei* (Sobha& Haq ,1995). The other reports indicating duration of this stage were 2.63 ± 1.3 days in case of *Brevipalpus obovatus* on citrus and 3.23 ± 0.7 days on the same mite but on mint (Rezk ,1998).

Considering the above , duration of protonymphal period, as was found, in the present study , was much higher compared to those reported by earlier workers.

**Deutonymphal period –**

In this case also, expecting at 25 ± 1°C with 70 ± 3% RH in all other cases the duration of this period increased with the increase of humidity. So far as influence of temperature of these period is concerned no definite trend was observed. The highest deutonymphal period was 18.80 ± 0.79 days (at 25 ± 1°C with 90 ± 3 % RH) and the minimum was 16.16 ± 0.85 at 30 ± 1°C and 50 ± 3 % RH. It ranged between 16.23 ± 0.44 at 30 ± 1°C with 70 ± 3 % RH at 17.99 ± 0.62 days at 25 ± 1°C and 50 ± 3% RH.

The deutonymphal period was of 10 days (Gupta, 2012) in case of *Roiella indica* and 6-7 days in case of *Brevipalpus californicus* (Banarjee ,1989), 2 days in case of *Roiella macfarlanei* (Sobha & Haq ,1995), 3.21 ± 0.02 days in case of *Brevipalpus obovatus* on citrus and 4.53 ± 0.3 days on Mint (Rezk ,1998). Therefore, as compared to duration of deutonymphal period as was observed earlier, the duration recorded in the present study was much higher.

**Preoviposition period –**

The maximum preoviposition period was 10.65 ± 0.50 days at 30 ± 1°C with 50 ± 3 % Rh which was closely followed by 10.50 ± 0.50 (at 30°C with 90 ± 3 % RH). The lowest preoviposition period was 6.12 ± 0.65 (25 ± 1°C and 70 ± 3 % RH) In other cases this period varied between 6.20 ± 0.35 (20 ± 1°C and 50 ± 3 % RH) and 9.98 ± 0.70 (20 ± 1°C and 70 ± 3 % RH)

From the data it appeared that 20 ± 1°C was the preferred temperature and 30 ± 1°C was the least preferred temperature as preoviposition period was shortest and longest respectively at these temperatures in combination with all three levels of RH.

**Oviposition period –**

So far as oviposition period is concerned, it was seen that no trend could be established with regard to the effect of temperature on this period, though of course the effect of humidity could be seen. From the data it appeared that among all the three temperatures , the maximum oviposition period was seen at 70 ± 3 % RH, as it was 14.35 ± 1.85 days at 20 ± 1°C and 11.70 ± 0.45 days at 25 ± 1°C and 9.45 ± 1.35 days at 30 ± 1°C. It was also observed that the duration of this

period decreased with the increasing temperature. The maximum oviposition period was  $14.35 \pm 1.85$  days at  $20 \pm 1^\circ\text{C}$  and lowest being  $9.00 \pm 0.65$  days. This period in other cases varied between  $9.20 \pm 0.44$  days at  $30 \pm 1^\circ\text{C}$  and  $90 \pm 3\%$  RH to  $12.70 \pm 1.85$  days at  $20 \pm 1^\circ\text{C}$  at  $90 \pm 3\%$  RH

According to Santosh & Haq (2010) the oviposition period was 20.42 days in *Dolichotetranychus coccus*, 8.2-12 days in *Brevipalpus californicus* (Sadana & Joshi, 1986), and  $20 \pm 2.3$  days on citrus and  $22.43 \pm 3.1$  days on mint (Rezk 1998). So the oviposition period was observed in the present study was of shorter duration, compared to those reported by earlier workers.

#### Post oviposition period –

In this case no definite trend could be seen either with the effect of temperature or with the effect of RH on duration of this period. As it appeared that the highest postoviposition period was  $26.80 \pm 0.25$  days at  $30 \pm 1^\circ\text{C}$  and  $50 \pm 3\%$  RH, but at  $20 \pm 1^\circ\text{C}$  and  $25 \pm 1^\circ\text{C}$  the highest values were  $9.00 \pm 1.25$  days at  $70 \pm 3\%$  RH and  $14.00 \pm 0.65$  days at the same RH at  $25 \pm 1^\circ\text{C}$ . The lowest duration of this period was  $12.50 \pm 0.75$  days at  $20 \pm 1^\circ\text{C}$  and  $50 \pm 3\%$  RH.

These period was  $15.66 \pm 2.1$  days in case of *Brevipalpus obovatus* on mint as reported by Rezk (1998). Therefore, the present finding conformed the observation made by Rezk (1998).

#### Fecundity-

So far as total number of egg by a female was concerned, the highest was always at  $25 \pm 1^\circ\text{C}$  as compared to other two temperatures. The highest being 140 eggs at  $70 \pm 3\%$  RH. It was also seen that fecundity was always higher at  $70 \pm 3\%$  RH as compared to other two RH as evident from the fact that it was 42 eggs at  $70 \pm 3\%$  RH against 35 and 35 at  $50 \pm 3\%$  RH and  $90 \pm 3\%$  RH respectively, at  $20^\circ\text{C}$ , 140 eggs at  $70 \pm 3\%$  RH against 90 and 88 eggs at  $50 \pm 3\%$  RH and  $90 \pm 3\%$  RH, respectively at  $25 \pm 1^\circ\text{C}$  and 49 eggs at  $70 \pm 3\%$  RH against 48 and 41 eggs at  $50 \pm 3\%$  RH and  $90 \pm 3\%$  RH, respectively at  $30 \pm 1^\circ\text{C}$ .

As regards total fecundity, not much information is available and the

one which is available indicated 16-12 eggs as total fecundity as reported by Santhosh & Haq (2010) in case of *Dolichotetranychus coccus* but the results obtained in the present study indicated the total fecundity varying from 35 (at  $20 \pm 1^\circ\text{C}$  and  $50 \pm 3\%$  RH) to 140 ( $20 \pm 1^\circ\text{C}$  and  $70 \pm 3\%$  RH). Therefore, the total fecundity was much higher in the present study.

#### Total life cycle-

The total life cycle (egg-adult) took 15.42 days in female and 13.93 days in male in case of *Dolichotetranychus coccus* (Santhosh & Haq, 2010) and 33 days in *Roiella indica* (Gupta, 2012) and 5 weeks in *Brevipalpus californicus* (Banarjee, 1989), 21 days-25 days in *Brevipalpus californicus* (Sadana & Joshi, 1986), 15.22 days at  $23 \pm 3^\circ\text{C}$  at 85% RH in *Brevipalpus phonusis* (Gupta 2012). Keeping in view the published information, the duration of the total developmental stage in the present study conformed with those of the earlier reports.

Sadana & Sharma (1989) while studying biology of *Brevipalpus rugulosus* at different temperature reported  $30^\circ\text{C}$  as the best temperature wherein the development took place more rapidly. In the present study, the shortest time taken to complete the life cycle was  $35.8 \pm 2.28$  days at  $30^\circ\text{C}$  and longest was  $43.7 \pm 2.46$  days at  $25 \pm 1^\circ\text{C}$  and  $90 \pm 3\%$  RH. From this, it can be inferred that  $30^\circ\text{C}$  in combination with  $50 \pm 3\%$  RH was the best as was observed by Sadana & Joshi (1989).

#### Viability –

As regards viability of eggs, as mentioned earlier, it ranged between 69.23% (at  $20 \pm 1^\circ\text{C}$ ) to 90% (at same temperature  $70 \pm 3\%$  RH). Since no data was available from other reports, the present result could not be compared with the other published information.

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