

CHAPTER- IV

4 RESULTS

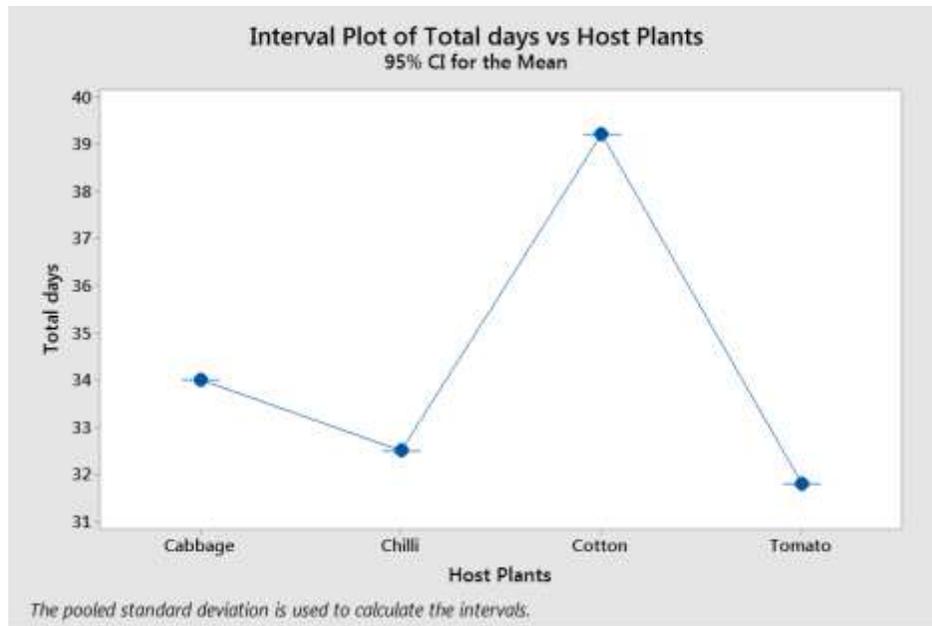
Influence of biotic factors in life cycle of *S. litura*

Spodoptera litura is lepidopteran insect and it undergoes complete metamorphosis & having four stages i.e egg, larvae, pupa and adult. Results indicate that growth and development were influenced by nutrition and rearing conditions. Five larval moults were noted while studying host insect relationship. Larval development from first instar to fifth instar was observed in number of days which indicated in table along with pupal and adult period. The developmental period of *S. litura* was significantly affected by host plant tested. Results pertaining to biology of *S. litura* on different hosts revealed that total life cycle period ranged for about 31.80 to 39.20 days.

Table 1Lifecyle of *Spodoptera litura* on different host plants

Host Plants	Larval period (Days)	Pupal period (Days)	Adult Period (Days)	Total days
Tomato	19.40	6.20	6.20	31.80
Chili	19.80	6.30	6.40	32.50
Cabbage	21.40	6.40	6.20	34.00
Cotton	26.00	6.80	6.40	39.20

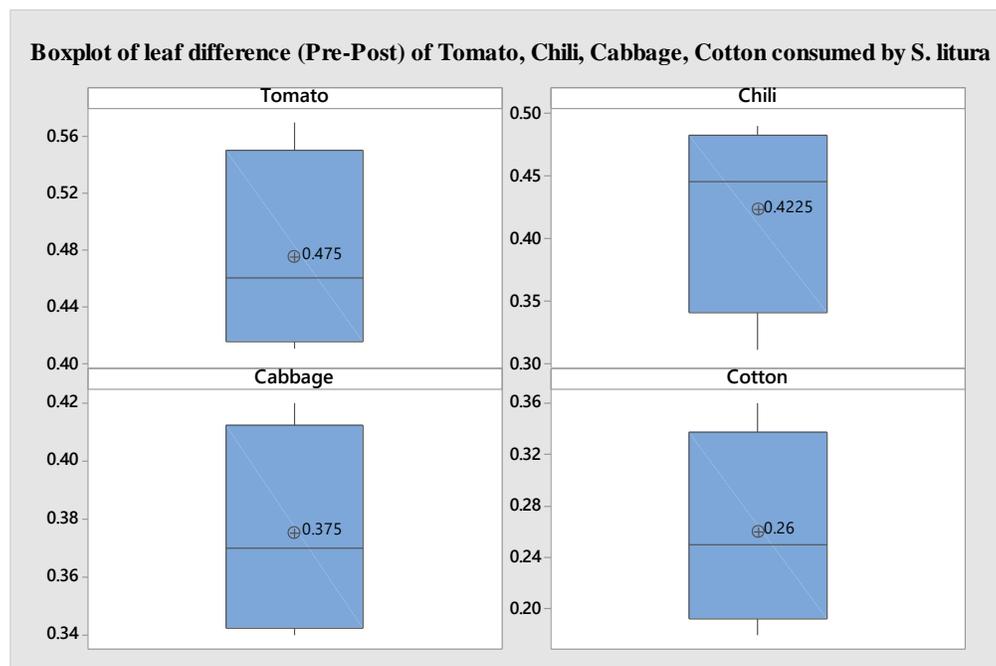
Spodoptera litura takes as much as of 31.80 days when fed with tomato leaves, 32.50 days when fed with chili leaves, 34.00 days if we fed with cabbage leaves and 39.20 days when fed with cotton leaves as seen from the graph 1. Total developmental time from larva to adult of *S. litura* was short when larva fed on tomato leaves, but did not differ significantly with larva fed on chili& cabbage leaves.



Graph 1 Lifecycle of *Spodoptera litura* on different host plants

Feeding preference of *S. litura* on different host plants

Feeding preference was seen by observing feeding behaviour and consumption of leaf of different hosts.

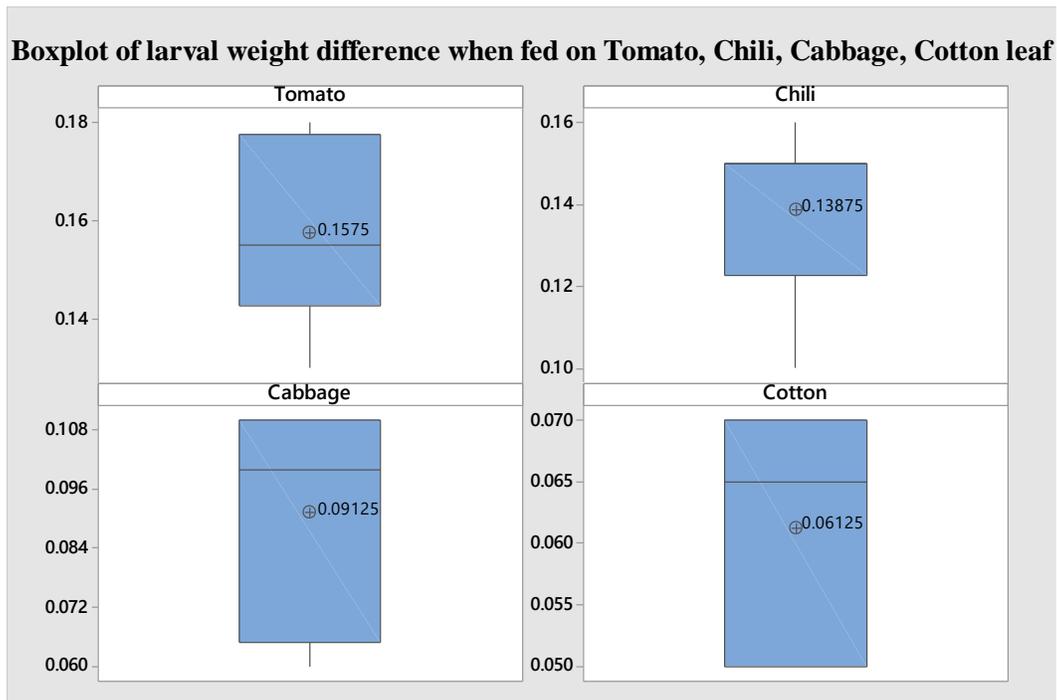


Graph 2 Leaf consumption by *S. litura* on different host plants

Leaf was pre weighed and given to larvae and after 48 hours post weight difference recorded. In case of feeding preference clear response was observed by seeing on consumption of leaf. Highest consumption was observed on tomato leaf i.e. 0.475g followed by Chili leaf 0.423g, cabbage leaf 0.375g and cotton leaf 0.260g.

Influence of feeding different host leaf on larval growth

Larval growth in terms of weight gain on different host was observed after 48 hours of feeding. Maximum gain in weight was recorded when larvae fed with tomato leaf followed by Chili, cabbage and cotton leaves.



Graph 3 Larval weight gain when fed with different host plants

As we can see from the graph 2, weight gain was 0.157g, 0.138g, 0.091 and 0.061g when fed with tomato, Chili, cabbage and cotton leaves respectively. Larval growth index in case of tomato, Chili, cabbage & cotton is 5.15, 5.05, 4.67, 3.84 respectively. Pupal growth index in case of tomato, Chili, cabbage & cotton

is 16.12, 15.87, 15.62 & 14.70 respectively. Total developmental index for tomato, Chili, cabbage & cotton is 3.14, 3.07, 2.94 & 2.55 respectively.

Data on larval, pupal and total development were recorded. From these observations, the growth and developmental index were calculated as follows:

Equation 1

$$\text{Larval growth index} = \frac{\% \text{ Pupation}}{\text{Larval period (days)}}$$

Equation 2

$$\text{Pupal growth index} = \frac{\% \text{ Adult emergence}}{\text{Pupal period (Days)}}$$

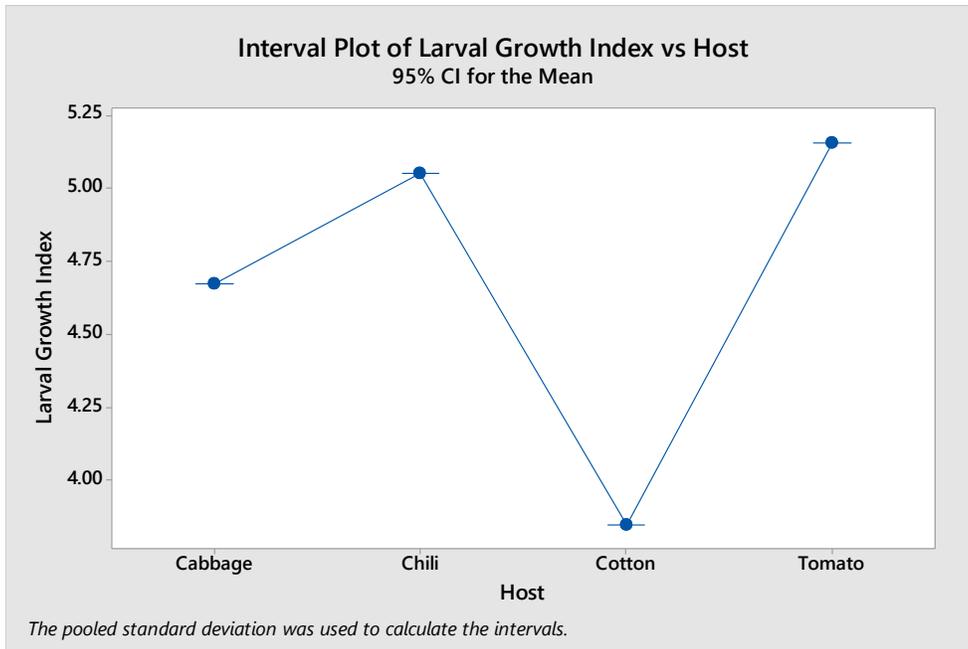
Equation 3

$$\text{Total developmental index} = \frac{\% \text{ Survival}}{\text{Total developmental period (Days)}}$$

Table 2 Different growth indexes when *S. litura* fed with different host plants

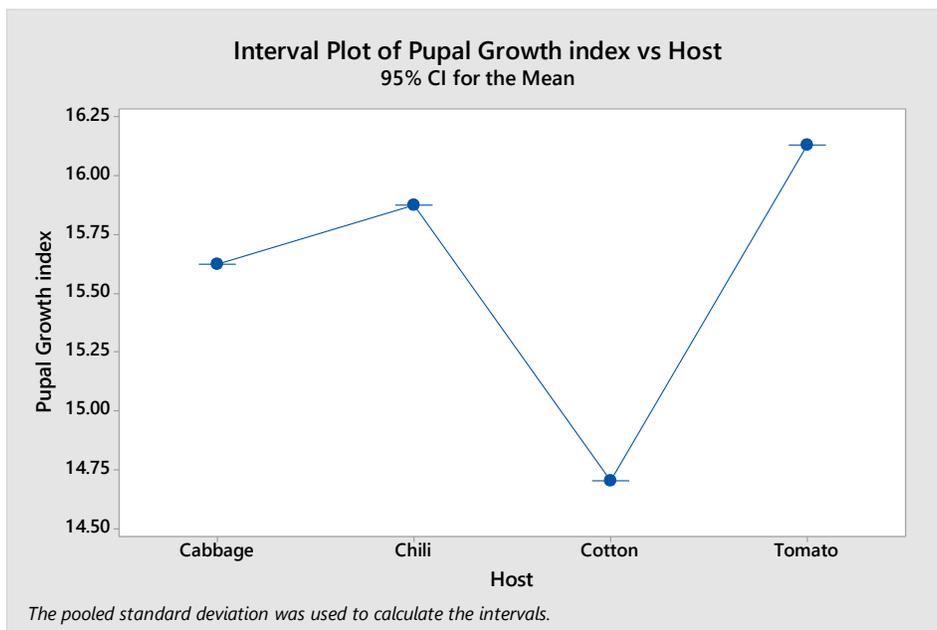
Host	Larval Growth Index	Pupal Growth index	Total Developmental index
Tomato	5.155	16.129	3.145
Chili	5.051	15.873	3.077
Cabbage	4.673	15.625	2.941
Cotton	3.846	14.706	2.551

As seen from the table that highest larval, pupal & total developmental index was found when larvae fed with tomato leaf followed by chili, cabbage and cotton leaves.

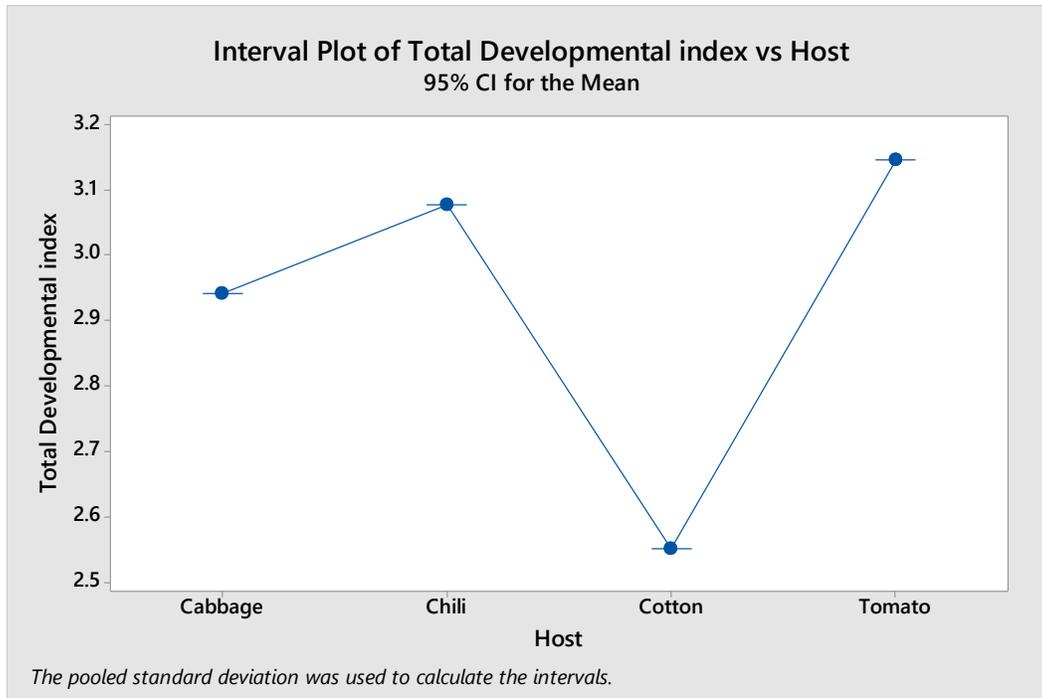


Graph 4 Larval growth index of *S. litura*

As seen from the graph that lowest larval growth index was found in case of cotton leaf fed larvae & at the same time highest larval growth index was found when larvae fed with tomato leaf.



Graph 5 Pupal growth index of *S. litura*



Graph 6 Total growth index of *S. litura*

Both the indexes reveal that highest feeding was observed when larvae fed with tomato leaf followed by chili, cabbage & cotton leaf. Other parameters also calculated like relative growth rate and percent efficiency of conversion of ingested food. For relative growth rate pre weight and post weight of the larvae taken into consideration. For calculating percent efficiency of conversion in ingested food pre weight and post weight of the larvae as well as leaf taken into consideration.

Equation 4 for calculating % efficiency of ingested food

$$\% \text{ efficiency of ingested food} = [(D-C)/(A-B)] \times 100$$

A=Pre weight of the leaf

B=Post weight of the leaf

C=Pre weight of larvae

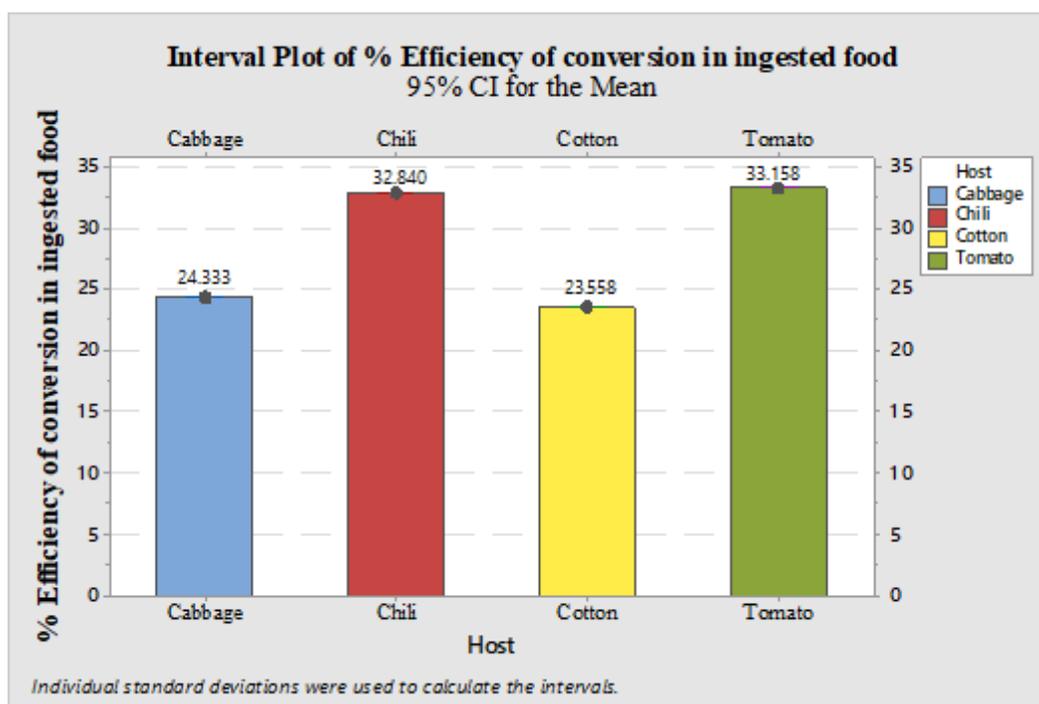
D=Post weight of the larvae

Table 3 Percent efficiency of ingested food on host plants against *S. litura*

Host	% Efficiency of ingested food
Tomato	33.158
Chili	32.840
Cabbage	24.333
Cotton	23.558

As seen from the table that more feeding was observed in case of tomato followed by chili, cabbage and cotton & same will reflect in percent efficiency of ingested food of different host against *S. litura*.

Highest value of 33.15% was found in case of tomato followed by 32.84, 24.33 & 23.55 in chili, cabbage & cotton respectively.



Graph 7 Percent efficiency of ingested food by *S. litura* on host plants

As seen from Graph that highest peak was seen in tomato followed by chili, cabbage & cotton leaf. The result indicates that insect host relationship plays very important role in lifecycle of *S. litura*. Also different host influence on growth of the larvae as well as consumption of food also varies in different host which indicates preference in feeding on different host. The study also helps to predict *S. litura* distribution among different host when present at the same time.

Influence of temperature & humidity on life cycle of *S. litura*

As insects are poikilothermic organism so they cannot withstand adverse environmental conditions. The current study focuses on impact of different abiotic factors like temperature and humidity on life cycle of *S. litura*. Influence of these abiotic factors were studied by observing life cycle of *Spodoptera litura* i.e. total number of days were recorded to complete one generation. Total 50 larvae were taken for this study and data shown in the table 1 indicates, days taken to complete one generation. When optimum condition provided than it takes 31-35 days to complete one generation but when we provide decreased temperature it will take 47-49 days to complete one generation. Same with the case when we decrease humidity, it will take 48-50 days to complete one generation. Day wise data were given in table 6 & 7. Normal condition was taken as 27+2°C Temp & 70+5 % RH and 40% humidity & 20°C temperature taken as experimental conditions.

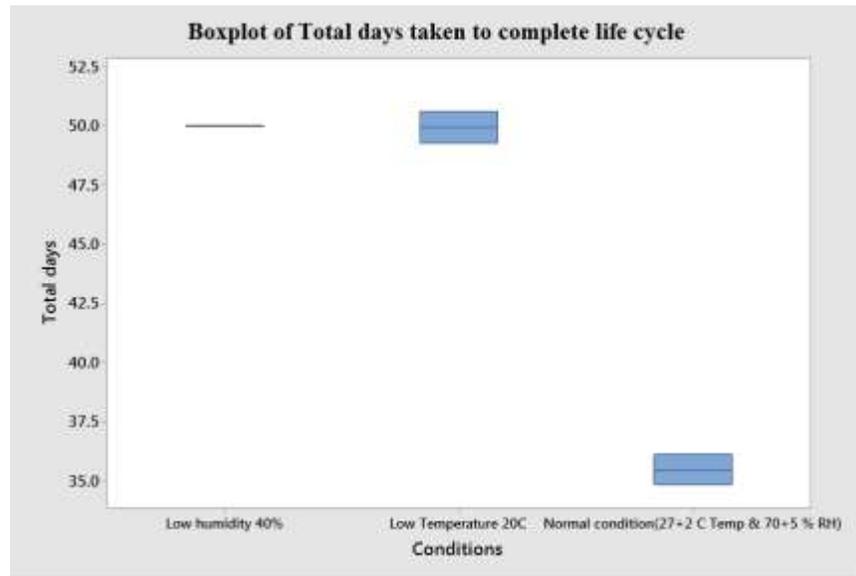
Table 4 Completion of life cycle in Normal & Experimental conditions

Conditions	Eggs (Days)	1st instar (Days)	2nd instar (Days)	3rd instar (Days)	4th instar (Days)	5th instar (Days)
Normal condition	4.5	4.21	4.14	4.11	3.56	3.64
Low humidity 40%	6	6.86	6.69	6.61	5.86	5.74
Low temperature 20°C	7.5	6.3	6.34	6.28	5.66	5.56

Table 5 Completion of life cycle in Normal & Experimental conditions

Conditions	Pupa (Days)	Adult (Days)	Total life cycle (Days)
Normal condition	5.01	6.29	35.46
Low humidity 40%	6.04	6.14	49.94
Low temperature 20°C	6.1	6.17	49.91

The temperature & humidity within the evaluation data point had a large impact on the development times of *S. litura* life stages (Table 6 & 7). There were increases in immature development times were observed in case of both temperature and relative humidity.



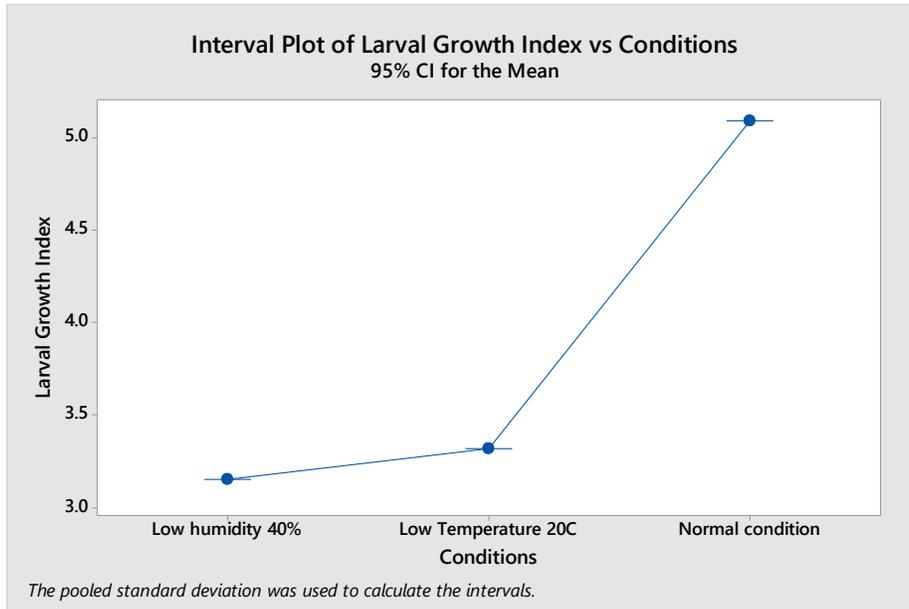
Graph 8 Total days to complete the life cycle of *S. litura*

Different growth index were calculated like larval growth index, pupal growth index and total developmental index by considering developmental period. For Larval growth index percent pupation and total larval development period were considered (Equation 1). Pupal growth index consist of percent adult emergence and total pupal period (Equation 2). For total developmental period percent survived and total developmental period taken into consideration (Equation 3).

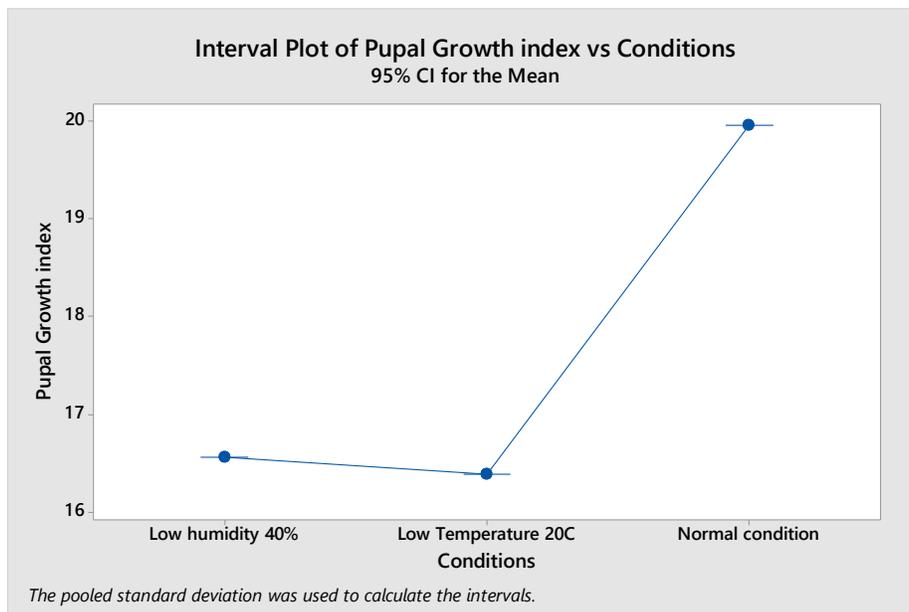
Table 6 Biological attributes recorded on Normal & experimental conditions

Condition	Larval growth index	Pupal growth index	Total developmental index
Normal condition	5.08	19.96	2.82
Low humidity	3.14	16.56	2.00
Low temperature	3.32	16.39	2.00

Data on larval, pupal & total development were recorded. From these observations, the growth and developmental index were calculated and shown in table 7.

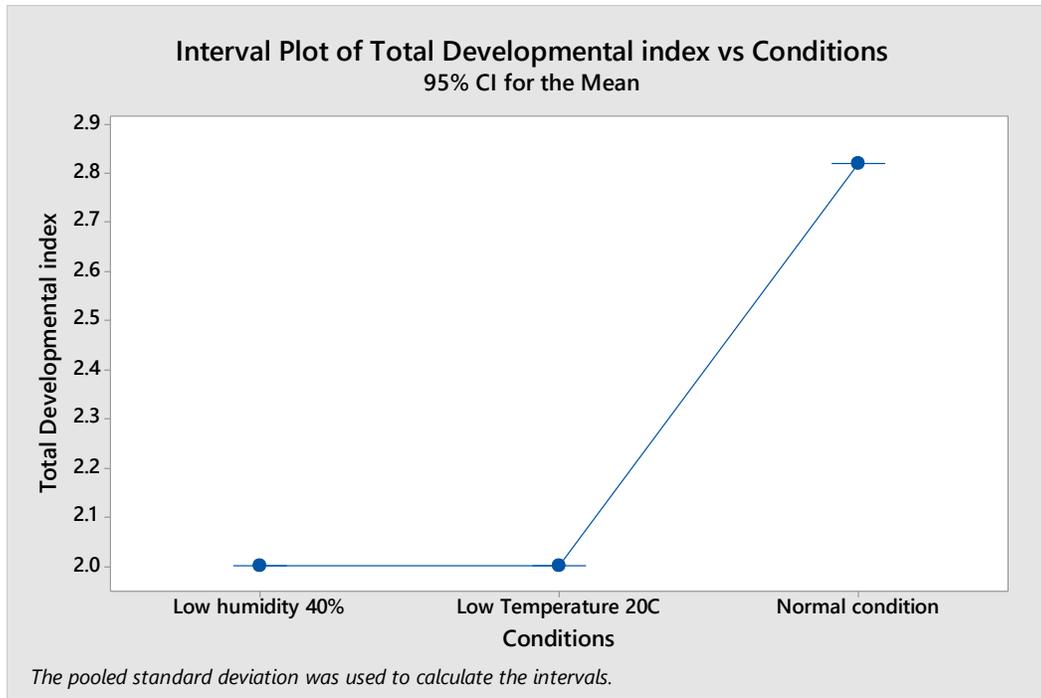


Graph 9 Larval growth index of *S. litura* at different abiotic conditions



Graph 10 Pupal growth index of *S. litura* at different abiotic conditions

At optimum condition (27+2°C Temp & 70+5 % RH), 40% humidity & 20°C temperature larval growth index were 5.08, 3.14 & 3.32 respectively.



Graph 11 Total developmental index of *S. litura* at different abiotic conditions

At optimum condition (27+2°C Temp & 70+5 % RH), 40% humidity & 20°C temperature larval growth index were 5.08, 3.14 & 3.32, pupal growth index were 19.96, 16.56 & 16.39 & total developmental index were 2.82, 2.00 & 2.00 respectively (Table-5). A growth index clearly indicates from the graphs that there was influence of abiotic factors like temperature and humidity on life cycle of *Spodoptera litura* larvae.