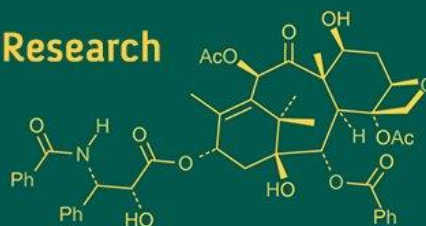
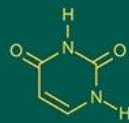


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Studies on the biology and morphology of fruit borer, *Helicoverpa armigera* (Hubner) on chilli as a natural diet under laboratory conditions

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Abstract

The biology of chilli fruit borer *Helicoverpa armigera* (Hubner) was studied in the Entomology laboratory in the Department of Entomology, School of Agriculture Science, Technology and Research, Sardar Patel University, Dongariya, Balaghat, on chilli fruit as a food source. The observations on biology and morphology of fruit borer recorded the average pre-oviposition, oviposition, and post-oviposition on chilli fruit lasted 2.90 ± 0.88 , 7.40 ± 1.17 and 1.50 ± 0.53 , respectively. The fruit borer female lays, on average 608.30 ± 97.34 eggs. The incubation period of eggs were ranges 3.80 ± 0.78 days. The average time duration of first, second, third, fourth, fifth and sixth instars varied 2.90 ± 0.57 , 3.30 ± 0.48 , 3.90 ± 0.74 , 3.62 ± 0.81 , 4.30 ± 0.48 and 4.60 ± 0.84 days, respectively. The average pre-pupal and pupal duration ranged 1.70 ± 0.67 and 12.35 ± 1.86 days, respectively. The average male and female adult period ranged 8.92 ± 0.84 and 10.42 ± 1.14 days, respectively. The average length and breadth of eggs ranged 0.48 ± 0.06 and 0.50 ± 0.05 mm, respectively. The average length of first, second, third, fourth, fifth and sixth instars ranged 1.51 ± 0.23 , 4.36 ± 0.64 , 8.92 ± 0.76 , 12.90 ± 2.58 , 18.86 ± 1.33 and 27.62 ± 1.59 mm, respectively. The average breadth of first, second, third, fourth, fifth and sixth instars was ranged 0.43 ± 0.62 , 0.68 ± 0.89 , 0.90 ± 0.10 , 1.22 ± 0.25 , 2.31 ± 0.23 and 3.08 ± 0.15 millimetres, respectively. The mean length and breadth of pupa was ranged 17.71 ± 2.05 millimetres and 4.65 ± 0.37 millimetres, respectively. The average length of adult male and female ranged 17.13 ± 0.65 , 19.96 ± 1.35 mm and breadth was ranged 34.24 ± 1.18 , 35.27 ± 2.94 mm, respectively. The generation from egg to death of male and female *i.e.* total life cycle was found to be completed within 43 to 55 days with an average of 49.15 ± 3.67 days and 46 to 56 days with an average of 50.79 ± 3.41 days, respectively on chilli.

Keywords: Biology, *Helicoverpa armigera*, length and breadth, morphology, complete metamorphosis, chilli fruit borer

Introduction

Chilli (*Capsicum annuum* L.) is one of the most important commercial spices of India. It is grown almost throughout the country. There are more than 400 different varieties of chillies found all over the world. It is also called as hot pepper, cayenne pepper, sweet pepper, bell pepper, etc. Among the spices consumed per head, dried chilli fruits constitute a major share. Some varieties of chillies are famous for their red colour because of the pigment 'capsanthin' (Baikar and Naik 2016). The most important chilli growing states in India are Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu, which together constitute nearly 75 per cent of the total area. In the Indian subcontinent, chillies are cultivated throughout the year; however, it grows best at 20-30°C. The growth and yield suffer when temperatures exceed 30°C or drop below 15°C for extended periods. The crop can be grown over a wide range of altitudes from sea level upto 2100 meter. Fresh chilli peppers are very rich in vitamin C with 111.0 mg, which makes them very effective as immune system stimulants and healing agents, especially for cellular damage. Many folk remedies recommend chilli pepper in wound cleaning preparations for gangrene and open sores and even as a styptic, though more modern sources generally advise against using chilli on broken skin. While drying, chilli loses most of its vitamin C; it increases the vitamin A content by 100 times. Vitamin A is a powerful antioxidant and anti-inflammatory agent. Chilli preparations have been used as a

gargle to treat sore throat and laryngitis. Surprisingly, it has been shown that chillies do not aggravate or cause stomach ulcers. In fact, they have a preventative effect, as stomach ulcers are mostly caused by bacteria and their antibacterial action kills such bacteria. In folk medicine, they have also long been used to treat worms. Chilli has a beneficial effect on the circulatory system. Studies have shown that it counteract on cholesterol build up and reduces platelet aggregation, thus reducing the risk of heart attacks and strokes. It also lowers high blood pressure and increases peripheral circulation. (Anonymous, 2009). Chilli is attacked by various major pests like thrips, *Scirtothrips dorsalis* (Hood); aphid, *Aphis gossypii* (Glover) and *Myzus persicae* (Sulzer); fruit borer, *Helicoverpa armigera* and *Spodoptera litura* (Fabricius) and mite, *Polyphagotarsonemus latus* (Bank) from seedling to fruiting stage. The damage caused by *Helicoverpa armigera* during flowering and fruit formation is the most concern. The young larvae of *Helicoverpa armigera* feed on flower buds and young fruits by making a circular hole. Later, the larvae feed on internal contents usually with its head inside the fruit and rest of the body outside.

Chilli is one of the important spice crops and severely infested by fruit borer, *Helicoverpa armigera*. Since few years, considerable research work on biology of fruit borer, *Helicoverpa armigera* infesting chilli has been done in abroad and India, but comparatively less work has been carried out under Balaghat region of Madhya Pradesh. Hence, the present investigation was planned and conducted at the Entomology laboratory, Department of Agricultural Entomology, School of Agriculture Science, Technology and Research, Sardar Patel University, Dongariya, Balaghat (M.P.) at present.

Materials and methods

The experiment was conducted in the Entomology laboratory, Department of Entomology, School of Agriculture Science, Technology and Research, Sardar Patel University, Dongariya, Balaghat (M. P.), in 2025. All techniques used in the experiment are discussed below.

Rearing of *Helicoverpa armigera*

Chilli fruit borer, *Helicoverpa armigera* larvae were collected from the unsprayed chilli field of Student's Research Farm (SRF), School of Agriculture Science, Technology and Research, Sardar Patel University, Dongariya, Balaghat. The collected larvae were reared in the laboratory on fruits of chilli. To protect the larvae of this insect from cannibalism, they were kept individually in plastic tubes with closed lids whose diameter was 4.2 x 5.4 cm. Chilli fruits and plastic tubes were changed daily to maintain sanitation. The larvae kept in all the tubes were taken out for the emergence of its adults, they were kept in separate cages whose length was 30 cm, height was 30 cm and width was 30 cm. All these were kept in Petri dish inside the cage. After the adult male and female came out, they were kept together in a cage for mating. The chilli plant with young fruits were placed inside the cage for egg laying. Absorbent cotton dipped in 10 percent honey solution was served as food for the adults. The freshly laid eggs on fruits were used for further studies.

Larva period

The larvae were raised in separate plastic tubes with soft, fresh fruits as food, and the quantity and length of each larval

instar as well as the overall larval time were recorded. Every morning, the plastic tubes and food were replaced. Cast-off exuvia and larger larvae in future instars were signs that the moulting had occurred. The size, form, and colour of the larvae in each instar were examined. Stage and an ocular micrometre were used to measure the length and width of each larval instar. The quantity of instars, length of each instar, and overall larval time were all noted separately. From the time the egg hatched to the conclusion of the last instar, the total larval duration was determined.

Pre pupal period

For Ten larvae, the amount of time required between the point at which they stop eating and the development of pupa was calculated, yielding the average pre-pupal duration.

Pupal period

To investigate the pupal stage of chilli fruit borer, ten new born pupae were observed in a plastic box until the adult stage emerged and then the average time of all the pupae was examined and the length and width of all these pupae stages were also measured in micrometers scale was measured.

Adult longevity

The sexes of the adults were assigned to different cages, and the adult moths were fed on cotton soaked in a ten percent honey solution. By examining how long it took for ten male and female individuals to emerge and die as adults, the length of their life span was determined. Thus, it has been possible to compute the average lifespan of the male and female moths.

Adult morphometrics

A total of ten adult insects of chilli fruit borer were taken and micrometer scale was used to their measure the length and width of their body and then their body figures were calculated.

Life cycle

The total time required to complete the life cycle of this insect, the chilli fruit borer insect, was calculated based on the duration of larval, pre-pupa, pupa, and adult stages.

Results and discussion

All results about this chilli fruit borer insect are presented and discussed below:

Pre-oviposition, oviposition and post-oviposition periods

The pre-oviposition, oviposition, and post-oviposition periods were recorded, and the results are presented in Table 1.

It was found that the pre-oviposition period was in range of 2 to 4 days with a mean of 2.90 ± 0.88 days. The oviposition period was found to be in between 6 to 9 days with a mean of 7.40 ± 1.17 days. The post-oviposition period was observed only for 1 to 2 days with a mean of 1.50 ± 0.53 days. (Rajak *et al.*, 2026) also reported the It was found that the pre-oviposition period was in range of 2 to 3 days with a mean of 2.40 ± 0.52 days. The oviposition period was found to be in between 4 to 8 days with a mean of 5.6 ± 1.35 days. The post-oviposition period was observed only for 1 to 3 days with a mean of 1.6 ± 0.70 days. (Kumar *et al.*, 2013) also reported the pre -oviposition, oviposition and post oviposition periods ranged from 2.17-3.17, 5.28-6.96 and 1.11-1.32 days,

respectively. (Singh *et al.*, 2023) According to their finding, pre-oviposition, oviposition and post-oviposition period of

fruit borer on tomato lasted for 2.46 ± 0.29 , 6.33 ± 0.14 and 1.67 ± 0.14 days, respectively.

Table 1: Pre-oviposition, oviposition, post-oviposition period and fecundity of *Helicoverpa armigera* on chilli

S. No.	Stage	Developmental period (Days)		Mean $\pm$ SD
		Minimum	Maximum	
1	Pre-oviposition	2	3	2.90 ± 0.88
2	Oviposition	6	9	7.40 ± 1.17
3	Post-oviposition	1	2	1.50 ± 0.53
	Egg laying	No. of eggs	No. of eggs	Mean $\pm$ SD
4	Fecundity	457	789	608.30 ± 97.34

Fecundity

The observed data showed that the total number of eggs a female laid throughout the course of her life time ranged from 457 to 789 with an average of 608.30 ± 97.34 (Table 1). (Rajak *et al.*, 2026) also reported the total number of eggs a female laid throughout the course of her life time ranged from 311 to 674 with an average of 474.4 ± 119.14 . (Kumar *et al.*, 2013) also reported the fecundity/female ranged from 249.15 - 429.51 eggs. (Sharma *et al.*, 2019) according to the finding, fecundity of insect was 490.20 ± 77.87 eggs laid per female.

Eggs, Colour, shape and size

In the current research, the newly laid eggs looked yellowish white in colour, turned to deep yellow after a day and became dark brown prior to hatching. The average length of eggs found to be in range of 0.41 millimetre to 0.61 millimetre with

an average of 0.48 ± 0.06 millimetre. The average breadth of eggs found to be in range of 0.41 mm to 0.56 millimetre with an average of 0.50 ± 0.05 millimetre (Table 2). (Rajak *et al.*, 2026) also reported the average length of eggs found to be in range of 0.42 millimetre to 0.65 millimetre with an average of 0.52 ± 0.08 millimetre. The average breadth of eggs found to be in range of 0.36 mm to 0.56 mm with an average of 0.45 ± 0.07 mm. (Rabari *et al.*, 2017) according to the length and breadth of eggs were recorded maximum (0.52 ± 0.02 and 0.53 ± 0.03 mm) for post *Rabi* season, while minimum for *Rabi* season with 0.47 ± 0.02 and 0.50 ± 0.03 mm, respectively. According to (Singh *et al.*, 2023) average length of eggs found to be in range of 0.43 mm to 0.64 mm with an average of 0.53 ± 0.062 millimetre. The average breadth of eggs found to be in range of 0.36 millimetre to 0.54 millimetre with an average of 0.46 ± 0.063 millimetre.

Table 2: Morphometrics of eggs of *Helicoverpa armigera* on chilli

S. No.	Length (mm)	Breadth (mm)
1.	0.42	0.47
2.	0.52	0.43
3.	0.61	0.55
4.	0.47	0.55
5.	0.49	0.52
6.	0.43	0.41
7.	0.51	0.56
8.	0.48	0.45
9.	0.51	0.51
10.	0.41	0.54
Range	(0.41-0.61)	0.41-0.56
Mean $\pm$ SD	0.48 ± 0.06	0.50 ± 0.05

Incubation period

The incubation period was found to be in range of 2 to 5 days with mean of 3.60 ± 0.97 days (Table-3). According to (Gusain *et al.*, 2023) The incubation period ranged from 3 to 6 days, with an average of 4.66 ± 0.88 days. (Singh *et al.*,

2023) according to the finding, incubation period was found to be in range of 2 to 4 days with mean of 3.08 ± 0.32 days. (Chaudhary *et al.*, 2009) reported that the incubation period of egg was 3.37 ± 0.09 days.

Table 3: Life cycle of fruit borer on chilli

S. No.	Stage	Duration (Days)		Mean $\pm$ SD
		Minimum	Maximum	
1	Egg pod	2	5	3.60 ± 0.97
2	Larval period			
	1 st instar	2	4	2.90 ± 0.57
	2 nd instar	3	4	3.30 ± 0.48
	3 rd instar	3	5	3.90 ± 0.74
	4 th instar	3	5	3.62 ± 0.81
	5 th instar	4	5	4.30 ± 0.48
	6 th instar	4	6	4.60 ± 0.84
	Total larval period	19	29	22.62 ± 1.59
3	Pre-pupal period	1	3	1.70 ± 0.67
4	Pupal period	10	15	12.35 ± 1.86
5	Adult longevity with food			

	Male	7	10	8.92 ± 0.84
	Female	9	12	10.42 ± 1.14
	Adult longevity without food			
	Male	1	2	1.6 ± 0.51
	Female	1	3	1.8 ± 0.91
6	Total life cycle with food			
	Male	43	55	49.15 ± 3.67
	Female	46	56	50.79 ± 3.41
	Total life cycle without food			
	Male	30	44	37 ± 9.89
	Female	31	47	39 ± 11.31

Larval development

In recent experiments, it has been found that six larvae of the fruit borer were instar. current result related to larval period and larval instar are given in Table 3. The improvement of larvae was found to be in range of 19 to 29 days with a mean of 22.62 ± 1.59 days. During development, it was found that the larvae moulted for five times. The explanation of each larval instar is given below.

The present observations are in accordance with reports of (Singh *et al.*, 2023) who recorded by period of larvae was found to be in range of 19 to 27 days with a mean of 22.45 ± 0.44 days on tomato. (Baikar and Naik 2016) reported the development period of larvae ranged from 21 to 23 days with an average of 21.8 ± 0.79 days on chilli.

First instar larva

A recent study of this insect has revealed that the time period for first instar larvae ranges from a minimum of 2 and a maximum of 4 days, with an average of 2.90 ± 0.57 days (Table 3). The length of first instar larva varied in between

from 1.19 to 1.84 mm, with a mean of 1.51 ± 0.23) and the breadth from 0.34 to 0.52 mm with a mean (0.43 ± 0.62) (Table 4).

Second instar larva

The study revealed that the time period of second instar larvae was found to be in the range of 3 to 4 days with a mean of 3.30 ± 0.48 days (Table 3). The length of Second instar larva varied in between from 3.39 to 5.13 mm with a mean (4.36 ± 0.64) and the breadth from 0.56 to 0.87 mm with a mean (0.68 ± 0.89) (Table 4).

Third instar larva

The study revealed that the time period of third instar larvae was found to be in range of 3 to 5 days with a mean of 3.90 ± 0.74 days (Table 3). The length of third instar larva varied in between from 7.49 to 10.59 mm with a mean 8.92 ± 0.76 and the breadth from 0.81 to 1.13 mm with a mean (0.90 ± 0.10) (Table 4).

Table 4: Morphometrics of first to Six instar larva of fruit borer on chilli

Life stages	No. observation	Body Size (mm)	Measurement (mm)		Mean ± S. D.
			Minimum	Maximum	
1 st instar larva	10	Length	1.19	1.84	1.51 ± 0.23
		Breadth	0.34	0.52	0.43 ± 0.62
2 nd instar larva	10	Length	3.39	5.13	4.36 ± 0.64
		Breadth	0.56	0.87	0.68 ± 0.89
3 rd instar larva	10	Length	7.49	10.59	8.92 ± 0.76
		Breadth	0.81	1.13	0.90 ± 0.10
4 th instar larva	10	Length	8.64	15.78	12.90 ± 2.58
		Breadth	0.98	1.89	1.22 ± 0.25
5 th instar larva	10	Length	17.17	21.54	18.86 ± 1.33
		Breadth	1.96	2.62	2.31 ± 0.23
6 th instar larva	10	Length	26.13	30.89	27.62 ± 1.59
		Breadth	2.81	3.26	3.08 ± 0.15

Fourth instar larva

Observed data revealed that the time period of fourth instar larvae was found to be in range of 3 to 5 days with a mean of 3.62 ± 0.81 days (Table 3). The length of fourth instar larva varied in between from 8.64 to 15.78 mm with a mean (12.90 ± 2.58) and the breadth from 0.98 to 1.89 mm with a mean (1.22 ± 0.25) (Table 4).

Fifth instar larva

The study revealed that the time period of fifth instar larvae was found to be in range of 4 to 5 days with a mean of 4.30 ± 0.48 days (Table 3). The length of fifth instar larva varied in between from 17.17 to 21.54 mm with a mean (18.86 ± 1.33) and the breadth from 1.96 to 2.62 mm with a mean (2.31 ± 0.23) (Table 4).

Sixth instar larvae

Observed data revealed that the time period of sixth instar larvae was found to be in range of 4 to 6 days with a mean of 4.60 ± 0.84 days (Table 3). The length of sixth instar larva varied in between from 26.13 to 30.89 mm with a mean (27.62 ± 1.59) and the breadth from 2.81 to 3.26 mm with a mean (3.08 ± 0.15) (Table 4).

Present findings are supporting the findings of (Chakravarty *et al.*, 2018) The average stadial periods for first, second, third, fourth, fifth and sixth instar larvae were 2.28±0.18, 2.46±0.11, 2.72±0.17, 3.18±0.23, 3.86±0.18 and 3.80±0.14 days, respectively. Supporting the finding of (Singh *et al.*, 2023) The first instar larva was very active with body length of 1.54 ± 0.81 mm and body breadth of 0.46 ± 0.05 mm. The larval development completed within 22.45 ± 0.44 days. The duration of each instar on tomato was found to be

2.58 ± 0.26 , 3.50 ± 0.14 , 3.42 ± 0.26 , 3.71 ± 0.28 , 4.38 ± 0.16 and 4.83 ± 0.14 days, respectively. According (Ali *et al.*, 2009) The average duration of first, second, third, fourth, fifth, and sixth instar larvae were respectively: 2.27 ± 0.08 , 2.42 ± 0.08 , 2.67 ± 0.07 , 2.83 ± 0.07 , 3.40 ± 0.10 and 3.37 ± 0.11 days. The length and breadth of corresponding stages were respectively.

Pre-pupal period

When all the stages of the larval insect are completed, then this larval insect stops eating and also stops moving and starts thinning its body. current findings showed that the pre-pupal stage was in range of 1 to 3 days with an average of 1.70 ± 0.67 days (Tabel 3).

Present findings are supporting the findings of (Chauhan *et al.*, 2018) that the length and width of pre pupa varied from 19.00 to 21.20 (Av. 19.98 ± 0.63) mm and 3.60 to 3.90 (Av. 3.74 ± 0.09) mm, respectively. The prepupal period varied from 1 to 2 (Av. 1.64 ± 0.49) days.

Pupal period

Just this minute formed pupae were yellowish green in colour which became mahogany brown coloured within few hrs of

its formation and further darkened prior to adult moth emergence. They were of obtect type, moving only its posterior most five abdominal segments in a 360° rotation when touched. Male and female pupae were separated on the basis of the position of genital opening, situated mid-ventrally on 8th and 9th abdominal segments, in females and males, respectively. The pupal stage ranged from 10 to 15 days with an average of 12.35 ± 1.86 days (Table 3). The length of pupae was found to be in range of 14.43 to 19.49 mm with a mean of 17.71 ± 2.05 mm and the breadth was in range of 4.11 to 5.15 mm with a mean of 4.65 ± 0.37 mm (Table 5).

Present findings are supporting the findings of (Rabari *et al.*, 2017) The minimum pre pupal (1.93 ± 0.69 days) and pupal periods (8.07 ± 0.98 and 11.17 ± 1.05 days for male and female) were recorded on chickpea host, while maximum (2.27 ± 0.45 days pre pupal and 9.13 ± 0.94 and 12.70 ± 1.26 days male and female pupal periods) on cabbage host. supporting the finding of (Chauhan *et al.*, 2018) The length and width of pupal stage varied from 18.00 to 19.10 (Av. 18.61 ± 0.37) mm and 4.30 to 4.60 (Av. 4.48 ± 0.10) mm, respectively. The pupal duration varied from 10 to 15 (Av. 12.48 ± 1.58) days.



Table 5: Morphometrics of pupae of fruit borer on chilli

S. No.	Length (mm)	Breadth (mm)
1.	18.99	4.71
2.	18.96	4.69
3.	16.91	4.11
4.	19.41	5.12
5.	19.49	4.81
6.	19.35	4.39
7.	15.56	4.96
8.	14.89	5.15
9.	19.12	4.36
10.	14.43	4.19
Range	14.43-19.49	4.11-5.15
Mean $\pm$ SD	17.71 ± 2.05	4.65 ± 0.37

Adult longevity: Adult longevity with food and without food for both sexes of this moth has been studied and observations are given in Table 3. Male moths with food were found to have a shorter life span, with an average life span of 7 to 10 days, with an average of 8.92 ± 0.84 days. while females lived for 9 to 12 days with an average of 10.42 ± 1.14 days. and Male moths without food were found to have a shorter life span, with an average life span of 1 to 2 days, with an average of 1.6 ± 0.51 days. while females lived for 1 to 3 days with an average of 1.8 ± 0.91 days.

According (Kumar *et al.*, 2022) The average male and female length ranged 21.86 ± 0.66 , 22.50 ± 0.67 mm and breadth

ranged 7.06 ± 0.21 , 7.37 ± 0.22 mm, respectively. reported that the (Dwivedi *et al.*, 2020) highest longevity of male and female recorded on chickpea leaf 7.86 and 13.13 days. According to the (Baikar and Naik 2016) without food for 1 to 2 days with an average of 1.5 ± 0.53 days, while females lived without food for 1 to 3 days with an average of 1.8 ± 0.79 days.

Adults stage on chilli fruit borer

The body and thorax of the adult moths of this insect are somewhat thick and the front pair of wings of its male moths are greenish brown in color, but the front pair of wings of its

female adult moths are somewhat brownish orange in color and the edges of its front wings are but there are many small

dots and the second pair of wings is lighter in color and has dark brown wards at its ends.



Table 6: Morphometrics of adults of fruit borer on chilli

S. No.	Male		Female	
	Body Length (mm)	Body Breadth (mm)	Body Length (mm)	Body Breadth (mm)
1.	15.69	32.11	21.54	38.45
2.	17.12	34.23	17.89	37.94
3.	17.52	34.65	19.96	36.82
4.	16.89	32.16	18.36	36.44
5.	16.92	35.45	20.17	30.25
6.	16.91	34.78	19.65	36.69
7.	17.69	34.58	20.73	33.85
8.	18.16	35.36	21.96	31.45
9.	17.44	34.25	20.71	32.86
10.	16.96	34.85	18.58	37.99
Range	15.69-18.16	32.11-35.45	17.89-21.96	30.25-38.45
Mean $\pm$ SD	17.13 $\pm$ 0.65	34.24 $\pm$ 1.18	19.96 $\pm$ 1.35	35.27 $\pm$ 2.94

According to Table 6 data male length range from 15.69 to 18.16 mm with an average of 17.13 ± 0.65 mm. The breadth was in range of 32.11 to 35.45 mm with a mean of 34.24 ± 1.18 mm. the length of female was found to be in range of 17.89 to 21.96 mm with an average of 19.96 ± 1.35 mm and breadth was in range of 30.25 to 38.45 mm an average 35.27 ± 2.94 mm. According to the (Baikar & Naik 2016) the male moth measured 17.84 ± 0.59 mm in length, 36.04 ± 1.24 mm in breadth and the female moth measured 19.34 ± 0.75 mm in length, 40.20 ± 0.84 mm in breadth on chilli. reported the (Singh *et al.*, 2023) the length of females was found to be in range of 18.70 millimetre to 20.60 millimetre with an average of 19.76 ± 0.58 millimetre and breadth was in range of 38.70 millimetre to 41.10 millimetre with a mean of 40.08 ± 0.99 millimetre. the length of males was found to be in range of 17.20 mm to 18.40 millimetre with an average of 17.79 ± 0.41 millimetre and breadth was in range of 34.20 millimetre to 37.00 millimetre (average 35.55 ± 0.92 mm).

Life cycle

The life cycle of with food male and female of this chilli fruit borer insect is completed within 43 to 55 day (Mean 49.15 ± 3.67) and 46 to 56 day (Mean 50.79 ± 3.41), respectively (Table 3). and without food male and female of this chilli fruit borer insect is completed within 30 to 44 day (Mean 37 ± 9.89) and 31 to 47 day (Mean 39 ± 11.31), respectively.

reported that (Sharma *et al.*, 2019) the life cycle of male and female insect was completed in 51 ± 2.97 and 53.76 ± 2.43 day respectively. According to (Baikar and Naik 2016) total life cycle was found to be completed within 42 to 55 days with an average of 47.9 days and 44 to 57 days with an average of 50.0 days, respectively on chilli.

Conclusion

Identification and management of pests are aided by observations of life cycle components. The field population of *Helicoverpa armigera* may be determined with the aid of these research' findings. The current study of the biological characteristics of *Helicoverpa armigera* provides comprehensive knowledge on development, survival, and reproduction/fecundity, which is a necessary precondition for implementing any management measures. This helps us identify the venerable stages of *Helicoverpa armigera* and design chemical, biological, and integrative solutions for managing chillies.

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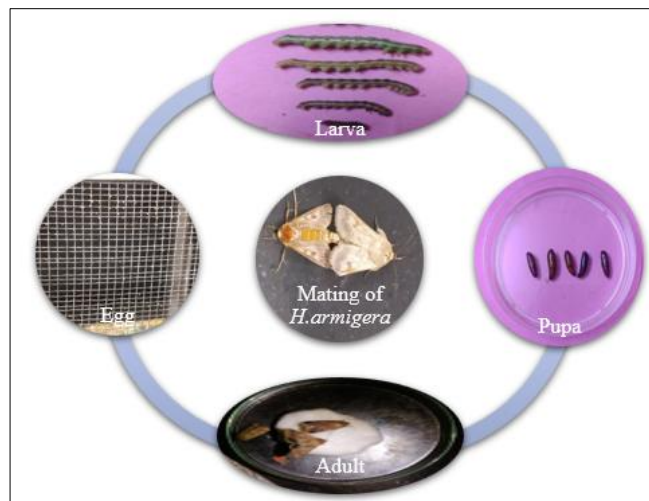


Fig 1: Life cycle Circle of *Helicoverpa armigera*.

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