



## To study the biology & seasonal incidence of some pesticides in correlation with neem oil against chilli fruit borer, *Helicoverpa armigera* (Hubner), {Lepidoptera: Noctuidae}, under laboratory & field conditions in Rabi season

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### Abstract

The biology of fruit borer was studied under laboratory condition indicate that the metamorphosis is complete. The four development stages of life cycle viz. egg, larvae (caterpillar), pupa and adult were present. It is found in tropical and subtropical areas and the following result reveals that, the mean average eggs hatching period on day 3 after spraying was found T<sub>4</sub> (Untreated) < T<sub>3</sub> Neem Oil (0.03%) < T<sub>1</sub> Malathion (0.04%) < T<sub>2</sub> Methyl Dematon (0.02%) over all replications. Then the average larvae period of *Helicoverpa armigera* (Hubner) in days under lab condition were found that total average of larva period was 21.51 days March – April followed by T<sub>4</sub> (21.05) < T<sub>1</sub> (21.25) < T<sub>3</sub> (21.75) < T<sub>2</sub> (22) and the total average period was 22 April to March. The pupal stage lasted 10 days and data shows that The average period of pupa is 10 days under lab conditions followed by the treatments were T<sub>1</sub> (10.5) & T<sub>3</sub> (10.5) < T<sub>2</sub> (11.5) < T<sub>4</sub> (11.25) found. Harvest crop at bichpuri (Agra) revealed no trace of egg, larvae, or pupal were found in the field which indicated that moth already emerged and have migrated to somewhere else. During April when maximum temperature reached up to 30° C the moth were unable to lay eggs and died within 3 days only few larvae could complete the development up to pupal stage at this temperature. The started infestation of chilli fruit borer in experiment plot from November onward maturity. The Pest population count on randomly selected 5 plants against each treatment in each replication after 7 days of 1st spray were found T<sub>1</sub> (10.4) < T<sub>2</sub> (11) < T<sub>3</sub> (11.6) < T<sub>4</sub> (14.2) after that pest population count on randomly selected 5 Plants against treatment in each replication after 10 days of 1st spray study found that, T<sub>1</sub> (10.8) < T<sub>2</sub> (11.8) < T<sub>3</sub> (12.8) < T<sub>4</sub> (14.8) followed by on 15 days also reveals that, T<sub>1</sub> (10) < T<sub>2</sub> (11.2) < T<sub>3</sub> (12.2) < T<sub>4</sub> (14.4).

**Keywords:** Biology, Fruit borer, Chilli, pest population, *Helicoverpa armigera* (Hubner), Neem oil, lab conditions, Agra

### Introduction

Chilli (*Capsicum annuum* L.) is one of the important commercial spices crop grown in India. It belongs to the family Solanaceae and originated from South and Central America. Chilli being a crop of tropical and subtropical region. It requires a warm humid climate Portuguese trades introduced it to India, Indonesia and other part of Asia around 450-500 year ago (Berke and Shieh, 2000) and since then. It has gained importance as an important spice and vegetable crop. It is cultivated throughout the country in about 7.67 lac hectares with annual production of 12.30 lac tones and average productivity of 1600 kg ha<sup>-1</sup> (Anonymous, 2010). In Rajasthan, it is cultivated in an area of 13,812 hectares with the production of 13,649 tons and productivity of 988 kg/ha (Vital statistics, 2009-10). Its high remunerative return allures the farmers to undertake its extensive cultivation not only in the state, but all over the country. The various factors are responsible for low yield of chilli, among which, insect and mite pests are of prime importance which significantly affects both the quality and production of chilli. The yield losses range from 50-90 per cent due to insect pests of chilli (Nelson and Natrajan, 1994 and Kumar, 1995). *Capsicum* has been cultivated over centuries, producing both pungent and sweet fruits. *Capsicum annuum* L. is characterized by a wide variety of fruit size, shape and with different capsaicinoid content. The

cultivation of chilli has become capital intensive due to many production constrains of which the losses caused by pests in paramount. Nearly 25 insects have been recorded attacking chilli leaves and fruits in India, which includes fruit borer, thrips, aphid, whitefly, cutworm, plant bug and other minor pests. The present investigation was carried out to study the biology of *H. armigera* on chilli which provides information on various life stages through which they pass and behavior shown in the given study.

### Materials and Methods

The Experiments was carried out under field & Laboratory conditions at the ICAR Research field, Raja Balwant Singh College of Agriculture, Bichpuri, Dr. Bhimrao Ambedkar University, and Agra (U.P.). The study on the biology and seasonal incidences of mentioned pesticides with combination of neem oil against *Helicoverpa armigera* Hub. Shown in Randomized Block Design. There were four replications with 3x 2.5 m meter plot size. The plant spacing between row to row and plants to plant were maintained 60 cm and 40 cm, respectively. The observation of fruit borers was recorded at weekly intervals during morning hours between 6:30 AM to 8:30 AM. The population of fruit borer was counted on five plants in each plot which were selected randomly, tagged and examined carefully with the help of magnifying glass.

**Table 1:** Treatments taken for study showed in

S.NO	Treatment	Name of Insecticide	Concentration of solution used
1	T <sub>1</sub>	Melathion	0.04%
2	T <sub>2</sub>	Methyl Dematon	0.02%
3	T <sub>3</sub>	Neem oil	0.3%
4	T <sub>4</sub>	Untreated	Water Spray

**Details of Layout**

- Design of layout: R.B.D
- Replication: 04
- Treatment: 04
- Total no of plants: 220
- Plot size: 3 x 2.5 M
- Length of experimental field: 10 M
- Width of experimental field: 14 M
- Width of main irrigation channel: 1 M
- Width of sub irrigation channel: 50 cm
- Total plot area: 14 x 10 m = 140 sq.
- Width of bund: 50 cm
- Row to row spacing: 60 cm
- Plant to plant spacing: 40 cm

**Field Experiment techniques**

Methodology regarding observation on the biology of chilli fruit borer (*Helicoverpa armigera*)

**Laboratory trail**

Chilli field was visited in R.B.S. College of agriculture in ICAR Research farm, Bichpuri, Agra as well as farmer field around collage in nearby village and the adult moth (*Helicoverpa armigera*) were collected with the help of conducted the studies on the life cycle in laboratory. To study the various the various metamorphosis stage of chilli fruit borer (*Helicoverpa armigera*, hubner) the required material like wire rearing cage, absolute alcohol, sprit lamp, muslin cloth, rubber bands, hand collection net, stretching board, killing bottle, etc. The required facilities in lab were provided by the department of agriculture Zoology and Entomology R.B.S College of agriculture, Bichpuri Agra. For rearing, the glass jars were thoroughly washed and made disinfected before proceeding for laboratory rearing. These jars were filled ¼ at the bottom by sterilized soil and a piece of blotting paper was placed over the sand layer. The adult moth was collected from the field with the help of hand. Collection net and using the light traps. These adults were released inside the jar and a cotton swab tipped in 5% sugar solution jar and feeding. A paper strip and chilli leaves were placed inside the each jar for egg laying. Two pair of adults was released inside the each jar and the mouth of jar tightly closed by using muslin cloth and rubber band observed the daily time to time noted egg laying date. After the 3<sup>rd</sup> and 5<sup>th</sup> day yellowish or brownish colour eggs were seen on paper. At the time of hatching these eggs turned brownish in colour. Newly hatched caterpillar were taken out and placed in three petri dishes and observation for larvae instar. These instars were feed on fresh leaves. The pupal stages developed during the study were kept separately. The shape and size and colour of the pupa were daily recorded. Total three spray of each treatment were

given the treatment was given at interval of 15 – 20 days. The 1<sup>st</sup> spray 15 FEB 2017. When the crop was in vegetative growth and 2nd spray on 05 MAR 2017 and 3rd spray 25 MAR 2017 when the crop was fully growth with fruit. The each treatment the pest population was count on randomly selected 5 plants in each replication (R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, and R<sup>4</sup>). The pest population on selected plant was count after 7 days, 10 days, and 15 days of treatment. The overall data collected were recorded in table over all analysis or out comes table No.04, 05 and 06 respectively.

**Number of Spray Application with dates**

**First Spray: 15 FEB 2017**

**Second Spray: 05 MAR 2017**

**Third Spray: 25 MAR 2017**

**Method of observation**

- a. **Vegetative Phase:** Per cent pest populations per plot were worked out.
- b. **Reproductive Phase:** Also percent fruit infestation by following observation from the selecting five plants. Observations were recorded on 7<sup>th</sup>, 10<sup>th</sup> and 15<sup>th</sup> day after spraying (D.A.S.). Form randomly five plants, following observations were recorded.

**Table 2:** Average pupal period of *Helicoverpa armigera* Hubner in days under lab condition.

No. of Replications	Pupa (period in days)			
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
R <sub>1</sub>	9	11	11	09
R <sub>2</sub>	12	10	12	13
R <sub>3</sub>	10	13	10	11
R <sub>4</sub>	11	12	09	12
Total	42	46	42	45
Average	10.5	11.5	10.5	11.25

The average period of pupa = 10 days\*

**Table 3:** Pest population count on randomly selected 5 plants against each treatment in each replication after 7 days of 1<sup>st</sup> spray

Treatments	Replications	Plants				
		P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>
T <sub>1</sub> Malathion (0.04%)	R <sub>1</sub>	2	2	3	2	3
	R <sub>2</sub>	3	3	2	3	2
	R <sub>3</sub>	2	2	3	2	3
	R <sub>4</sub>	3	2	3	3	4
	Total	10	09	11	10	12
T <sub>2</sub> Methyl dematon (0.002%)	R <sub>1</sub>	3	4	3	2	2
	R <sub>2</sub>	4	3	1	2	3
	R <sub>3</sub>	3	2	3	3	2
	R <sub>4</sub>	1	3	4	3	3
	Total	11	12	11	10	11
T <sub>3</sub> Neem oil (0.3%)	R <sub>1</sub>	2	2	3	2	4
	R <sub>2</sub>	2	3	3	3	2
	R <sub>3</sub>	3	4	4	2	3
	R <sub>4</sub>	4	3	3	3	3
	Total	11	12	13	10	12
T <sub>4</sub> Untreated (Water spray)	R <sub>1</sub>	4	4	3	4	3
	R <sub>2</sub>	5	3	3	3	4
	R <sub>3</sub>	4	3	5	4	2
	R <sub>4</sub>	5	4	3	2	3
	Total	18	14	14	13	12

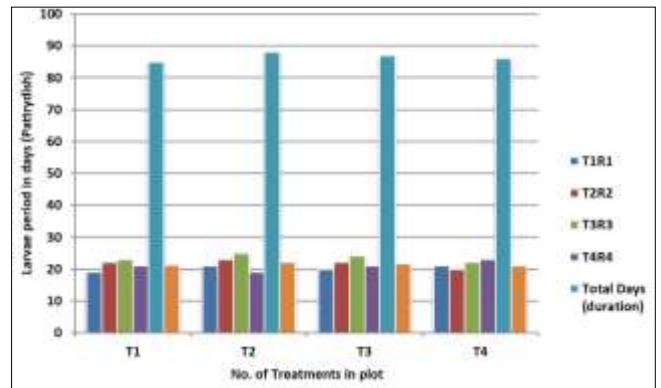
**Table 4:** Pest population count on randomly selected 5 Plants against treatment in each replication after 10 days of 1<sup>st</sup> spray during.

Treatments	Replications	Plants				
		P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>

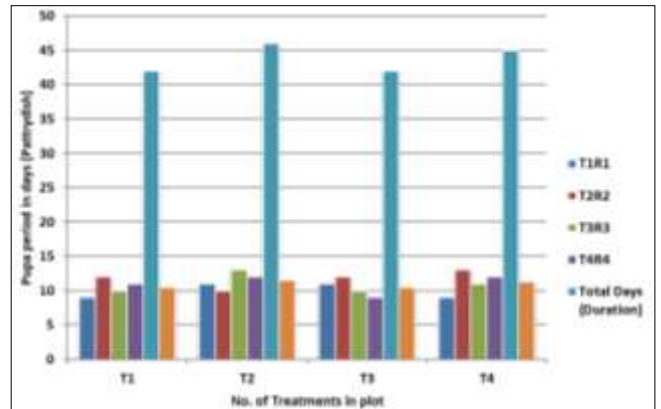
T <sub>1</sub> Malathion (0.04%)	R <sub>1</sub>	3	3	3	4	4
	R <sub>2</sub>	1	2	4	2	3
	R <sub>3</sub>	2	1	0	3	2
	R <sub>4</sub>	3	4	4	3	3
	Total	09	10	11	12	12
T <sub>2</sub> Methal dematon (0.026%)	R <sub>1</sub>	4	2	4	4	2
	R <sub>2</sub>	4	3	2	2	3
	R <sub>3</sub>	3	2	2	3	3
	R <sub>4</sub>	1	4	4	4	3
	Total	12	11	12	13	11
T <sub>3</sub> Neem oil (2 ppm)	R <sub>1</sub>	5	3	1	3	2
	R <sub>2</sub>	2	4	3	4	3
	R <sub>3</sub>	4	3	4	3	4
	R <sub>4</sub>	3	1	5	2	5
	Total	14	11	13	12	14
T <sub>4</sub> Untreted (Water Spray)	R <sub>1</sub>	4	4	6	4	5
	R <sub>2</sub>	2	5	4	3	3
	R <sub>3</sub>	2	2	3	5	4
	R <sub>4</sub>	5	2	3	3	6
	Total	13	13	16	15	17

**Table 5:** Pest population count on randomly selected 5 Plants against treatment in each replication after 15 days of 1<sup>st</sup> spray

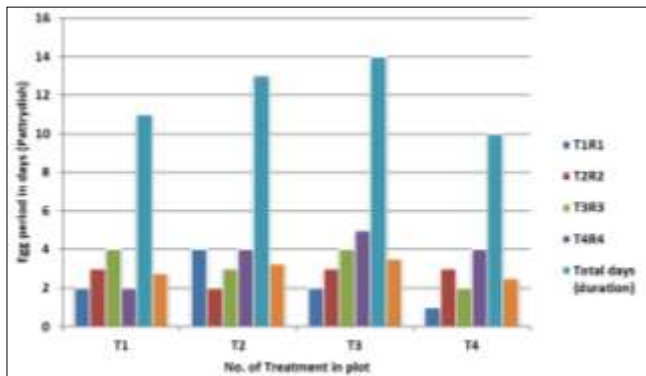
Treatments	Replications	Plants				
		P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>
T <sub>1</sub> Malathion (0.04%)	R <sub>1</sub>	3	2	1	2	2
	R <sub>2</sub>	4	3	2	3	1
	R <sub>3</sub>	2	4	3	4	4
	R <sub>4</sub>	3	1	2	2	3
	Total	12	10	08	11	10
T <sub>2</sub> Methal dematon (0.026%)	R <sub>1</sub>	2	3	2	2	3
	R <sub>2</sub>	3	2	3	3	5
	R <sub>3</sub>	3	4	4	3	2
	R <sub>4</sub>	2	2	3	2	3
	Total	10	11	12	10	13
T <sub>3</sub> Neem oil (2 ppm)	R <sub>1</sub>	4	3	4	3	3
	R <sub>2</sub>	2	3	5	3	4
	R <sub>3</sub>	3	4	2	4	3
	R <sub>4</sub>	2	2	2	1	4
	Total	11	12	13	11	14
T <sub>4</sub> Untreted (Water Spray)	R <sub>1</sub>	4	3	4	3	3
	R <sub>2</sub>	3	4	5	4	4
	R <sub>3</sub>	5	3	3	3	3
	R <sub>4</sub>	4	4	1	4	5
	Total	16	14	13	14	15



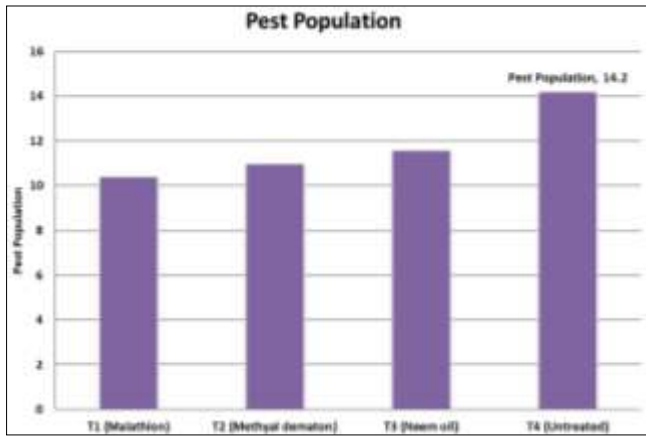
**Fig 2:** The average hatching period of Larvae duration in a day under lab conditions.



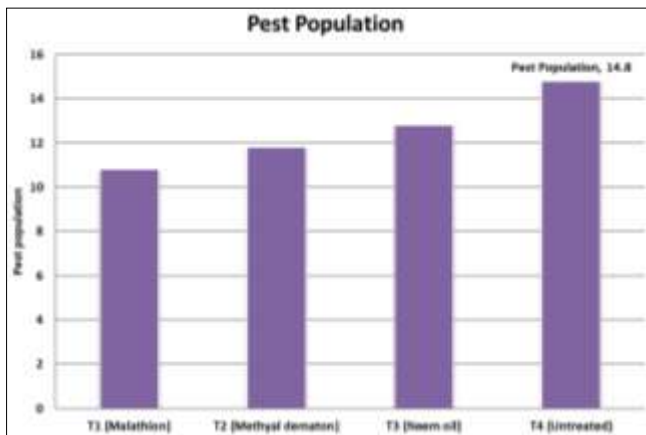
**Fig 3:** The average hatching period of Pupa duration in a day under lab conditions.



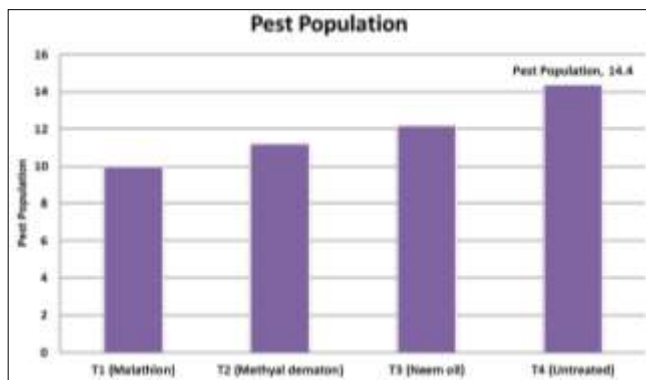
**Fig 1:** The average hatching period of Egg duration in a day under lab conditions.



**Fig 5:** Pest population count on randomly selected 5 plants against each treatment in each replication after 7 days of 1<sup>st</sup> spray



**Fig 6:** Pest population count on randomly selected 5 Plants against treatment in each replication after 10 days of 1<sup>st</sup> spray.



**Fig 7:** Pest population count on randomly selected 5 Plants against treatment in each replication after 15 days of 1<sup>st</sup> spray.

**Results and Discussion**

The observation and result conducted on relative “To study the biology & seasonal incidence of some pesticides in combination with neem oil against chilli fruit borer, *Helicoverpa armigera* (Hubner), {Lepidoptera:Noctuidae}, under laboratory & field conditions in *rabi* season”. The present observations were carried out known the following headlines.

1. The observation on the chilli fruit borer (*Helicoverpa armigera*), Lepidoptera: Noctuidae
2. Weekly count & occurrences of insect population on five randomly selected plants from each replication was done.

**The Egg**

The adult moths were visible in chilli field during late part of February and early march from over wintering. Two to four copulation female lays light white to yellowish eggs generally on the side of leaves. The egg about 5mm long, brownish at hatching. The female layed several hundred eggs on all part of the plant. Flowers and fruit included. Eggs are brownish at hatching and hatching period is about 3 days at an optimum temperature of 27° C -30° C.

**The larvae**

The newly hatched larvae measure 2-2.5 mm long, light green to brown colour. It has the cremaster bears two long parallel spines. The young beings to feed on the tender portion of the leaves and when formation fruits take place. The full-grown caterpillar is about 35mm in length and very variable colour. The total average period was 22 April to March.

**The pupa**

The larva when full grown drops to the ground and pupate in a shell 8-10 cm. deep in the soil. The pupa is dark brown in colour about 16 mm in length. The cremaster bear two long parallel spines. It remains in the soil during the cold month of January and February. The pupa is red brown in colour and covered with cocoon. The pupal stage lasted 10 days.

**The Adult**

The adult are called moth are nocturnal in habit. The four wings are yellowish to orange in female and greenish-gray in males, with slightly darken transversal band in the distal third. The kidney shaped marking slightly distinct and smoky. Hind wing are pole gray with a broad, darker marginal bond and a small brown marking near the base the filiform antennae in male and bi-pectinate in female. The moths *H.armigera* (hub.) are 20.25 mm in length and the adult measured about 40-50 mm in size across the wing the terminal end of abdomen bear and tuft hairs. The siphoning type mouth parts were present in adult.

**Summary and Conclusion**

The experimental result were summarized as, the observation on the biology of chilli fruit borer (*Helicoverpa armigera*). Indicate the life cycle was completed through variation stage viz Egg, larvae, pupa and Adult. The complete metamorphosis is observed and in details of those life stages are discussed below

**Peak population of *Helicoverpa armigera* Hubner.**

The population of pest was not at the peak level during stage of the plant growth. The peak population of chilli fruit borer was recorded in month of February – April 2017 when the average monthly maximum and minimum temperature and relative humidity were around 28° C to 10° C and 58% humidity respectively. The peak population of the *Helicoverpa armigera* Hubner was reported in 1<sup>st</sup> and week of the month was considerable high during in February – march.

**Conclusion**

In Conclusion the final data says that the pesticides and neem based insecticide is a vast scope for management of chilli fruit borer *Helicoverpa armigera* (Hubner) in the

country and The Pest population count on randomly selected 5 plants against each treatment in each replication after 7 days of 1st spray were found  $T_1 (10.4) < T_2 (11) < T_3 (11.6) < T_4 (14.2)$  after that pest population count on randomly selected 5 Plants against treatment in each replication after 10 days of 1st spray study found that,  $T_1 (10.8) < T_2 (11.8) < T_3 (12.8) < T_4 (14.8)$  followed by on 15 days also reveals that,  $T_1 (10) < T_2 (11.2) < T_3 (12.2) < T_4 (14.4)$  followed by the biology of fruit borer was studied under laboratory condition indicate that the metamorphosis is complete. The four development stages of life cycle viz. egg, larvae (caterpillar), pupa and adult were present. It is found in tropical and subtropical areas and the following result reveals that, the mean average eggs hatching period on day 3 after spraying was found  $T_4$  (Untreated)  $< T_3$  Neem Oil (0.03%)  $< T_1$  Malathion (0.04%)  $< T_2$  Methyl Dematon (0.02%) over all replications. Then the average larvae period of *Helicoverpa armigera* (Hubner) in days under lab condition were found that total average of larva period was 21.51 days March – April followed by  $T_4 (21.05) < T_1 (21.25) < T_3 (21.75) < T_2 (22)$  and the total average period was 22 April to March. The pupal stage lasted 10 days and data shows that The average period of pupa is 10 days under lab conditions followed by the treatments were  $T_1 (10.5) & T_3 (10.5) < T_2 (11.5) < T_4 (11.25)$  found.

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